

City of
ABERDEEN, IDAHO
WASTEWATER TREATMENT PLANT IMPROVEMENTS
FEBRUARY 2023
PRE-PURCHASE DRAWINGS

30% Design
Review
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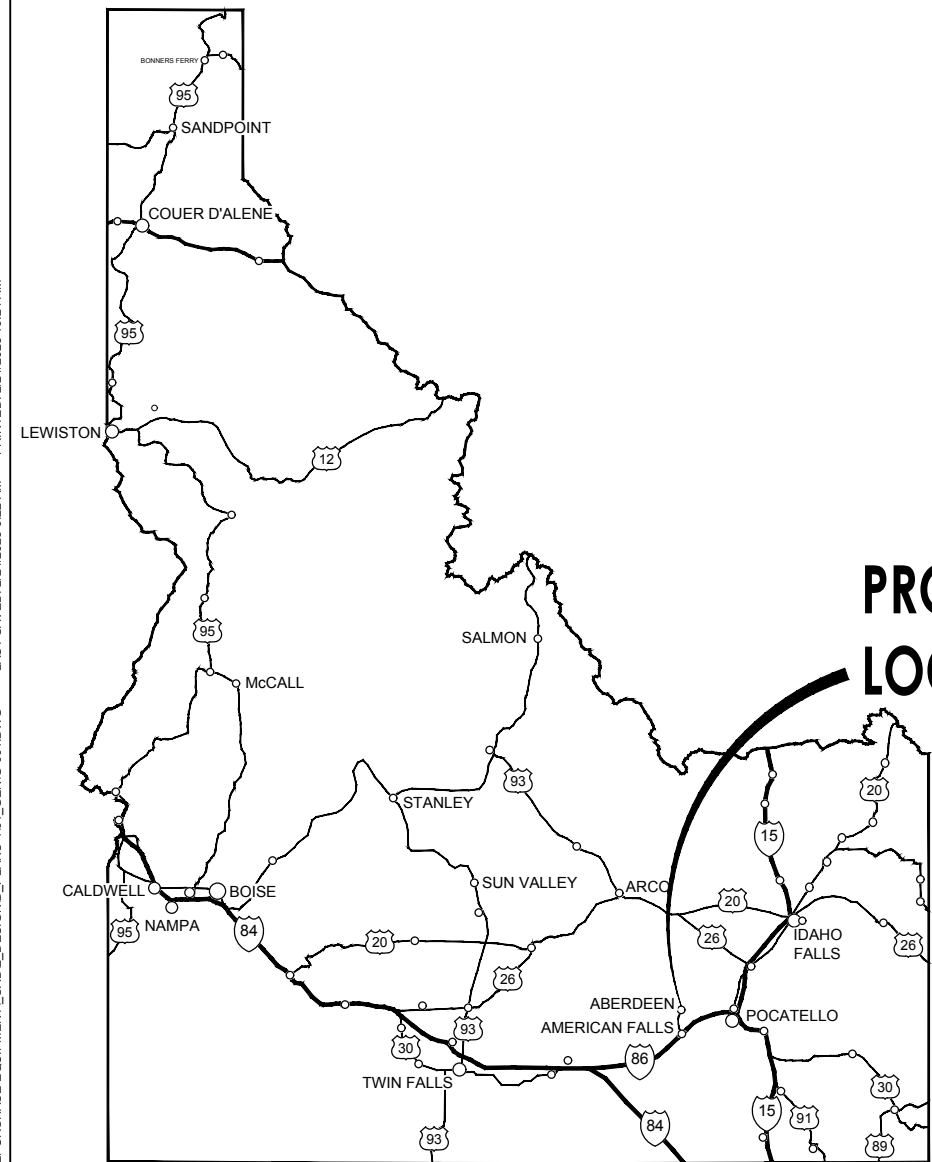
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ABERDEEN WWTP IMPROVEMENTS
COVER SHEET

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PROJECT NO. 222032 PAGE
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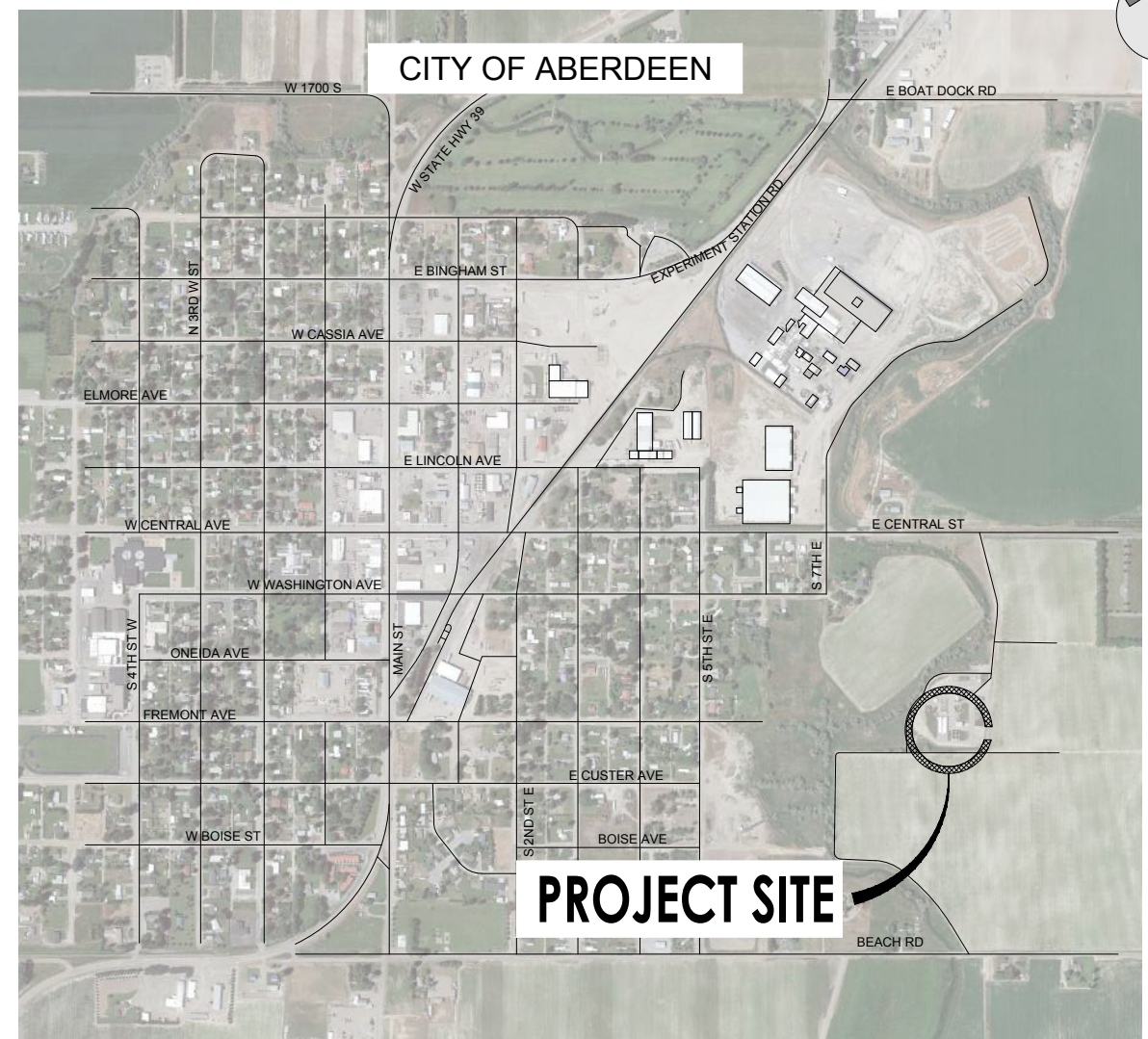
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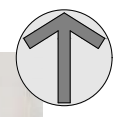
**PROJECT
LOCATION**

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CITY OF ABERDEEN
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PROJECT SITE



A1 LOCATION MAP
N.T.S.

A2 VICINITY MAP
N.T.S.

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LIST OF DRAWINGS

GENERAL

- G-001 - COVER SHEET
- G-002 - SHEET INDEX
- G-006 - ABBREVIATIONS
- G-007 - ABBREVIATIONS CONTINUED
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- EI-005 - HEADWORKS - P&ID
- EI-006 - IFAS TREATMENT - P&ID
- EI-007 - IFAS BLOWERS BUILDING - P&ID
- EI-008 - CLARIFIERS - P&ID
- EI-009 - TERTIARY LIFT STATION - P&ID
- EI-010 - TERTIARY TREATMENT - P&ID
- EI-011 - TERTIARY TREATMENT - P&ID CHEMICAL ADDITION - ALUM
- EI-012 - TERTIARY TREATMENT - P&ID CHEMICAL ADDITION - CAUSTIC
- EI-013 - UV BUILDING - P&ID
- EI-014 - DIGESTERS - P&ID
- EI-015 - DECANT LIFT STATION - P&ID
- EI-016 - DEWATERING BUILDING - P&ID
- EI-017 - AIR GAP SYSTEM
- S-105-B IFAS - EXISTING PLAN FOR VENDOR
- S-401-B IFAS - EXISTING SECTIONS FOR VENDOR

DISCIPLINE DESIGNATORS

- G GENERAL DRAWINGS
- V SURVEY DRAWINGS
- C CIVIL DRAWINGS
- A ARCHITECTURAL DRAWINGS
- S STRUCTURAL DRAWINGS
- MP PLUMBING DRAWINGS
- MH HVAC DRAWINGS
- M MECHANICAL PROCESS DRAWINGS
- E ELECTRICAL DRAWINGS
- EI ELECTRICAL INSTRUMENTATION DRAWINGS

CIVIL SHEET TYPES

- 0XX GENERAL (SYMBOLS LEGEND, NOTES, KEY MAPS, ETC.)
- 1XX SITE (TOPOGRAPHY, DEMOLITION, SITE LAYOUTS, ETC.)
- 2XX GRADING (GRADING, DRAINAGE, EXCAVATION, ETC.)
- 3XX ROADWAY (ROADWAY DESIGN, PLAN & PROFILES, ETC.)
- 4XX UTILITY (PLAN VIEW, PLAN & PROFILES, ETC.)
- 5XX PROJECT DETAILS
- 55X AGENCY DETAILS
- 6XX MISCELLANEOUS

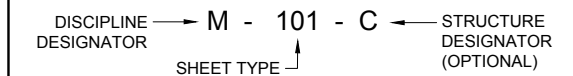
STRUCTURE SHEET TYPES

- 0XX GENERAL (SYMBOLS LEGEND, NOTES, ETC.)
- 1XX PLANS (HORIZONTAL VIEWS)
- 2XX ELEVATIONS (VERTICAL VIEWS)
- 3XX SECTIONS (SECTION VIEWS)
- 4XX LARGE SCALE VIEWS (PLANS, ELEVATIONS OR SECTIONS)
- 5XX PROJECT DETAILS
- 6XX SCHEDULES AND DIAGRAMS
- 7XX USER DEFINED (FOR TYPES WHICH DO NOT FALL IN OTHER CATEGORIES)

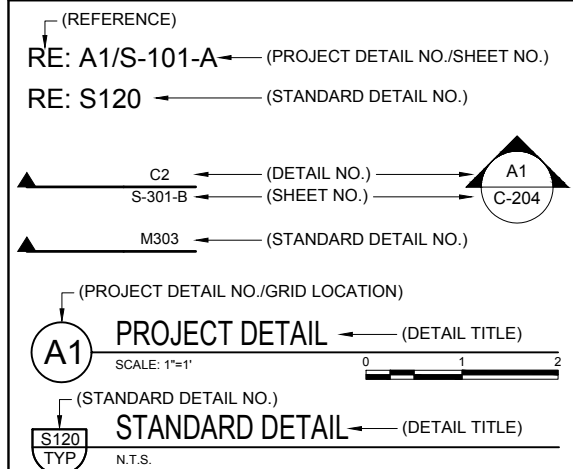
STRUCTURE DESIGNATORS

- A - HEADWORKS (E)
- B - IFAS (E)
- B1 - IFAS SPLITTER BOX (N)
- B2 - IFAS BLOWER BUILDING (N)
- B3 - EBPR TREATMENT (FUTURE)
- C - CLARIFIERS (E)
- D - TERTIARY TREATMENT (N)
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- E - CONTROL & DEWATERING BUILDING (N)
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- G - DIGESTERS (E)
- G1 - DIGESTER BLOWER BUILDING (E)
- G2 - DECANT LIFT STATION (E)
- H - ELECTRICAL BUILDING (E)
- I - SLUDGE DRYING BEDS (E)
- J - MAINTENANCE BUILDING (E)
- K - UV BUILDING (E)

SHEET NUMBERING KEY



DETAIL & SECTION CALLOUT KEY



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ABERDEEN WWTP IMPROVEMENTS

SHEET INDEX

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G-002

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GENERAL ABBREVIATIONS

A	-AMPERE	CL	-CHLORINE LIQUID	F	-FAHRENHEIT	HWR	-HOT WATER RETURN	MTR	-MOTOR
AB	-ANCHOR BOLT		-CHAIN LINK	FA	-FOUL AIR	HWS	-HOT WATER SUPPLY	MV	-MUD VALVE
ABI	-ADDITIVE BID ITEM		-CLEARANCE	FAB	-FABRICATE(D)	HYD	-HYDRAULIC		-MILLIVOLT
AC	-ASPHALTIC CONCRETE	CL2	-CENTERLINE		-FABRICATION	HYDT	-HYDRANT	MX	-MIXER
	-ACOUSTIC	CLG	-CHLORINE	FAI	-FRESH AIR INTAKE	HZ	-HERTZ (CYCLES PER SECOND)		
A/C	-AIR CONDITIONING	CLO	-CEILING	FC	-FAIL CLOSED				
ACC	-AREA CONTROL CENTER	CLR	-CHLORINE	FCA	-FLANGE COUPLING ADAPTER				
ACOU	-ACOUSTIC	CLS	-CLEAR	FCO	-FLOOR CLEAN OUT				
ACP	-ASBESTOS	CMC	-CHLORINE SOLUTION	FCR	-FINE CRUSHED ROCK				
ACT	-ACOUSTICAL CEILING TILE	CML	-CEMENT MORTAR COATED	FCV	-FLOW CONTROL VALVE				
AD	-ANAEROBIC DIGESTER	CMP	-CEMENT MORTAR LINED	FD	-FLOOR DRAIN				
ADD	-ADDITION(AL)	CMU	-CORRUGATED METAL PIPE		-FOUND				
ADF	-AVERAGE DESIGN FLOW (AVERAGE DAY, PEAK MONTH)	CND	-CONCRETE MASONRY UNIT	FE	-FIRE EXTINGUISHER				
ADH	-ADHESIVE	CNTL	-CONDUIT		-FIRE EXTINGUISHER				
ADJ	-ADJUSTABLE	CO	-CONTROL		-FLOW ELEMENT				
ADPT	-ADAPTER	COD	-CLEANOUT	FF	-FINAL EFFLUENT				
AF	-AIR FILTER	COD	-CHEMICAL OXYGEN DEMAND		-FINISH FLOOR				
AFF	-ABOVE FINISHED FLOOR	COL	-COLUMN		-FLAT FACE				
AHU	-AIR HANDLING UNIT	COM	-COMMUNICATOR	FG	-FINISH GATE				
AL	-ALUMINUM, ALUM	CON	-CONVEYOR	FH	-FIRE HYDRANT				
ALP	-AIR LOW PRESSURE	CONC	-CONCRETE	FIN	-FINISH				
ALT	-ALTERNATE	COND	-CONDITION	FIT	-FLOW INDICATOR TOTALIZER				
A/O	-ANOXIC	CONN	-CONNECTION	FL	-FLANGE				
	-OXIC	CONST	-CONSTRUCTION		-FLOORING				
AP	-AIR PROCESS	CONT	-CONTINUOUS		-FLOW LINE				
APPX	-APPROXIMATE(LY)	COTG	-CLEANOUT TO GRADE	FLC	-FLOCCULATOR				
AR	-AIR RETURN	CPLG	-COUPLING	FLEX	-FLEXIBLE				
ARV	-AIR RELEASE VALVE	CPVC	-CHLORINATED POLYVINYL CHLORIDE	FLG	-FLANGE(D)				
ARCH	-ARCHITECTURAL	CR	-CIRCLE	FLR	-FLOOR				
AS	-AIR SUPPLY	CSL	-COMBINED SLUDGE	FLT	-FILTER				
ASME	-AMERICAN SOCIETY OF MECHANICAL ENGINEERS	CT	-CONTACT TIME	FM	-FORCE MAIN				
ASTM	-AMERICAN SOCIETY OF TESTING MATERIALS	CTF	-CENTRIFUGE	FMH	-FLEXIBLE METAL HOSE				
ATM	-ATMOSPHERE	CU	-CUBIC	FMX	-FLASH MIXER				
AUTO	-AUTOMATIC	CV	-CHECK VALVE	FND	-FOUNDATION				
AUX	-AUXILIARY	CV	-CONTROL VALVE	FO	-FAIL OPEN				
AV	-ANGLE VALVE	C/W	-COMPLETE WITH	FPC	-FIBER OPTICS				
AVAR	-AIR VACUUM AND AIR RELEASE	CW	-CULINARY WATER (POTABLE)	FPS	-FEET PER SECOND				
AVE	-AVENUE	CWR	-COOLING WATER RETURN	FRP	-FIBERGLASS REINFORCED PLASTIC				
		CWS	-COOLING WATER SUPPLY	FS	-FAR SIDE				
		CY	-CUBIC YARD		-FLOW SWITCH				
				FT	-FEET				
B	-BOTTOM	DAF/DAFT	-DISSOLVED AIR FLOTATION	FTG	-FOOTING				
B/C	-BOTTOM OF CURB	DB	-DUCT BANK	FUT	-FUTURE				
BAC	-BACTERIOLOGICAL		-DOWEL BAR						
BC	-BEGINNING OF CURVE	DBA	-DEFORMED BAR ANCHOR						
BCR	-BEGINNING OF CURVE CENTER	DBL	-DOUBLE	GA	-GAGE				
BD	-BOARD	DEMO	-DEMOLISH		-GAUGE				
BF	-BLIND FLANGE	DET	-DETAIL	GAL	-GALLON				
BFP	-BACKFLOW PREVENTER	DF	-DRINKING FOUNTAIN	GALV	-GALVANIZED				
BFV	-BUTTERFLY VALVE	DI	-DUCTILE IRON	GAS	-NATURAL GAS				
BHP	-BRAKE HORSEPOWER	DIA	-DIAMETER	GB	-GRADE BREAK				
BKR	-BREAKER	DIAG	-DIAGRAM	GBV	-GLOBE VALVE				
BLDG	-BUILDING	DIFF	-DIFFERENTIAL	GCO	-GROUND CLEAN OUT				
BLK	-BLOCK	DIM	-DIMENSION	GDR	-GRINDER				
BLVD	-BOULEVARD	DIP	-DUCTILE IRON PIPE	GEN	-GENERAL				
BO	-BLOW OFF	DIR	-DIRECTION	GFD	-FLUX UNITS				
BOD	-BIOCHEMICAL OXYGEN DEMAND	DISCH	-DISCHARGE	GFI	-GROUND FAULT INTERRUPTER				
BOD5	-BIOCHEMICAL OXYGEN DEMAND, 5 DAY	DO	-DISSOLVED OXYGEN	GI	-GALVANIZED IRON				
BOP	-BOTTOM OF PIPE	DR	-DRAIN	GL	-GLASS				
	-BACK OF PIPE	DS	-DRUM SCREEN		-GLASS LINED				
BOT	-BOTTOM	DTL	-DETAIL	GND	-GROUND				
BP	-POINT OF BEGINNING	DWF	-DRY WEATHER FLOW	GPD	-GALLONS PER DAY				
BRG	-BEARING	DWG	-DRAWING	GPM	-GALLONS PER MINUTE				
BSN	-BAR SCREEN			GRD	-GRADE				
BTD	-BIOTOWER DRAIN	(E)	-EXISTING	GRDR	-GRINDER				
BTI	-BIOTOWER INFLUENT	E	-EPOXY	GRT	-GROUT				
BTU	-BRITISH THERMAL UNIT	EA	-EACH	GRTG	-GRATING				
BV	-BALL VALVE	ECC	-EXHAUST AIR	GSKT	-GASKET				
BVCE	-BEGIN VERTICAL CURVE ELEVATION	EF	-ECCENTRIC	GSN	-GENERAL STRUCTURAL NOTES				
BVCS	-BEGIN VERTICAL CURVE STATION	EG	-EACH FACE	GTS	-GRAVITY THICKENER SUPERNATANT				
		EFF	-EXHAUST FAN	GV	-GATE VALVE				
		EG	-EFFLUENT	GYP	-GYPSUM				
C	-CELSIUS	EG	-EDGE OF GRAVEL						
	-CONDUIT	EJ	-EXPANSION JOINT	H	-HORIZONTAL				
CAB	-DIRECT BURIAL CABLE	EL	-ELEVATION	H/A	-HAND AUTO				
	-CABINET	ELEV	-ELEVATION	H/B	-HOSE BIBB				
CAF	-COMBUSTION AIR FAN	ELL	-ELBOW	HD	-HEAVY DUTY				
CATV	-CABLE TELEVISION	EMBED	-EMBEDMENT	HOPE	-HIGH DENSITY POLYETHYLENE				
CB	-CATCH BASIN	ENG	-ENGINEERED	HDR	-HEADER				
CBOD5	-CARBONACEOUS BIOCHEMICAL OXYGEN DEMAND, 5 DAY	EOP	-END OF PIPE	HEX	-HEXAGONAL				
C/C	-CENTER TO CENTER	EP	-EDGE OF PAVEMENT	HG	-MERCURY				
CCP	-CONCRETE CYLINDER PIPE	EPDM	-ETHYLENE PROPYLENE DIENE MONOMER	HH	-HANDHOLE				
CCSP	-CONCRETE PINED AND COATED STEEL PIPE	EQ	-EQUAL	HM	-HOLLOW METAL				
CD	-CEILING DIFFUSER	EOR	-ENGINEER OF RECORD	HOA	-HAND-OFF-AUTO				
CDF	-CONTROL DENSITY FILL	EP	-EDGE OF PAVEMENT	HOR	-HORIZONTAL				
CDR	-CONDUCTOR	EQ	-EQUAL	HP	-HORSEPOWER				
CDS	-CHEMICAL DOSING		-EQUALIZATION		-HIGH PRESSURE				
CDU	-CONDENSING UNIT	EVCE	-END VERTICAL CURVE ELEVATION	HR	-HOUR				
CE	-CEILING EXHAUST DIFFUSER	EVCS	-END VERTICAL CURVE STATION	HRT	-HYDRAULIC RETENTION TIME				
CER	-CEILING EXHAUST REGISTER	EW	-EACH WAY	HSA	-HEADED STUD ANCHOR				
CF	-CUBIC FOOT	EWEF	-EACH WAY EACH FACE	HSS	-HOLLOW STRUCTURAL SECTION				
CFM	-CUBIC FEET PER MINUTE	EWS	-EYE WASH STATION	HT	-HEIGHT				
CFR	-CODE OF FEDERAL REGULATIONS	EX	-EXISTING	HTR	-HEATER				
CFS	-CUBIC FEET PER SECOND	EXIST	-EXISTING	H/V	-HEATING AND VENTILATING				
CH	-CHANNEL	EXT	-EXTERIOR	HV	-HAND VALVE				
CI	-CAST IRON			HVAC	-HEATING AND AIR CONDITIONING				
CIP	-CAST IRON PIPE			HWL	-HIGH WATER LEVEL				
CJ	-CONSTRUCTION JOINT			HWP	-HOT WATER PUMP				
	-CONTROL JOINT								
CK	-CHECKER(ED)								
CKPL	-CHECKER PLATE								
CKT	-CIRCUIT								



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ABERDEEN WWTP IMPROVEMENTS

ABBREVIATIONS

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GENERAL ABBREVIATIONS

QCPL	-QUICK COUPLING	TE	-TANK DRAIN	#	-NUMBER
QTY	-QUANTITY		-TERTIARY EFFLUENT		-POUNDS
		TEL	-TOTALLY ENCLOSED	&	-AND
		TEMP	-TELEPHONE	@	-AT
R	R		-TEMPERATURE	Ø	-DIAMETER
	-RADIUS	TERM	-TEMPORARY	Δ	-PHASE
	-RISER	THD'D	-TERMINATE		-ANGLE OF DEFLECTION
RA	-RETURN AIR	THRU	-THREADED		
RAS	-RETURN ACTIVATED SLUDGE	T&G	-THROUGH		
RB	-RUBBER WALL BASE	TK	-TONGUE AND GROOVE		
RCP	-REINFORCED CONCRETE PIPE	TKN	-TANK		
RCR	-RECORDER	TKN	-TOTAL KJELDAHL NITROGEN		
RCY	-RECYCLE	TOC	-TOP OF CONCRETE		
RD	-ROOF DRAIN	TOF	-TOP OF FOOTING		
	-ROAD	TOG	-TOP OF GROUT		
RE:	-REFERENCE	TOP	-TOP OF PIPE		
RECP	-RECEPTACLE	TOM	-TOP OF MASONRY		
RED	-REDUCE(R)	TOW	-TOP OF WALL		
	-REDUCING	TP	-TOTAL PHOSPHORUS		
REF	-REFERENCE	TPD	-TONS PER DAY		
REG	-REGULATOR	TR	-TIMING RELAY		
REINF	-REINFORCEMENT(ING)	TRANS	-TRANSMITTANCE		
REL	-RELAY		-TRANSFORMER		
REQ'D	-REQUIRED	TRM	-TRANSMITTER		
RF	-RAISED FACE	TRN	-TRANSUCER		
RGS	-RIGID GALVANIZED STEEL	TS	-TEMPERATURE SWITCH		
RH	-RIGHT HAND		-TUBE STEEL		
RI	-RAPID INFILTRATION	TSS	-TOTAL SUSPENDED SOLIDS		
RM	-ROOM	TV	-TELEVISION		
RO	-ROUGH OPENING	TYP	-TYPICAL		
RPM	-REVOLUTIONS PER MINUTE				
RR	-RAILROAD	U			
RS	-RECIRCULATED SLUDGE	UG	-UNDERGROUND		
RT	-RIGHT	UGP	-UNDERGROUND POWER		
RV	-RELIEF VALVE	UH	-UNIT HEATER		
R/W	-RIGHT OF WAY	UL	-UNDERWRITERS LABORATORIES		
ROW	-RIGHT OF WAY		-ULTIMATE LOAD		
		UN	-UNION		
S	S	UNO	-UNLESS NOTED OTHERWISE		
	-SOUTH	U/P	-UTILITY POLE		
	-SCUM	UPS	-UNINTERRUPTIBLE POWER SUPPLY		
	-SINK	UV	-ULTRA VIOLET		
	-SECOND	UW	-UTILITY WATER (NONPOTABLE)		
	-SLOPE				
SA	-SAMPLE	V			
	-SUPPLY AIR	V	-VALVE		
SB	-SCUM BAFFLE		-VENT		
SBR	-SEQUENCING BATCH REACTOR		-VOLTS		
SCFM	-STANDARD CUBIC FEET PER MINUTE		-VAULT		
SCH	-SCHEDULE	VAC	-VACUUM		
SCM	-SCUM		-VOLTS ALTERNATING CURRENT		
SCR'D	-SCREWED	VAR	-VARIABLE		
SD	-SMOKE DETECTOR	VB	-VALVE BOX		
	-STORM DRAIN	VCP	-VITRIFIED CLAY PIPE		
SDMH	-STORM DRAIN MANHOLE	VCT	-VINYL COMPOSITE TILE		
SDR	-STORM DRAIN	VDC	-VOLTS DIRECT CURRENT		
SE	-SECONDARY EFFLUENT	VERT	-VERTICAL		
	-SOUTH EAST	VOL	-VOLUME		
SEC	-SECONDARY CLARIFIER EFFLUENT	VSS	-VOLATILE SUSPENDED SOLIDS		
SECT	-SECTION	VTC	-VENT TO CEILING		
SEP	-SEPARATOR	VTR	-VENT THRU ROOF		
SF	-SQUARE FOOT				
SG	-SUPPLY GRILLE	W			
SHT	-SHEET		-POTABLE WATER		
SHT'H'G	-SHEATHING		-WEST		
SIM	-SIMILAR	W/	-WITH		
SO2	-SULFUR DIOXIDE	WAS	-WASTE ACTIVATED SLUDGE		
SOR	-SURFACE OVERFLOW RATE	WC	-WATER COLUMN		
SPEC	-SPECIFICATION SECTION	WCO	-WALL CLEAN OUT		
SP	-SPACES	WEG	-WALL EXHAUST GRILLE		
SPC'G	-SPACING	WER	-WALL EXHAUST REGISTER		
SPL	-SPLICE	WF	-WIDE FLANGE		
SQ	-SQUARE	WG	-WASTE GAS		
SRT	-SOLIDS RETENTION TIME	W/O	-WITHOUT		
SS	-SANITARY SEWER	WOG	-WATER/OIL/GAS WORKING PRESSURE		
	-STAINLESS STEEL	WPR	-WASHER COMPACTOR		
	-SERVICE TANK	WS	-WATER SURFACE		
	-SUSPENDED SOLIDS	WSA	-WELDED STUD ANCHOR		
SSMH	-SANITARY SEWER MANHOLE	WSP	-WELDED STEEL PIPE		
SST	-STAINLESS STEEL TUBING	WSTP	-WATERSTOP		
ST	-START	WT	-WEIGHT		
	-STREET	WWF	-WELDED WIRE FABRIC		
STA	-STATION	WWP	-WATER WORKING PRESSURE		
STD	-STANDARD				
STL	-STEEL	X			
STOR	-STORAGE	XFMR	-POWER TRANSFORMER		
STRUC	-STRUCTURAL	XLP	-CROSS LINKED POLYETHYLENE		
SV	-SOLENOID VALVE	XP	-EXPLOSION PROOF		
SVI	-SLUDGE VOLUME INDEX				
SW	-SOUTHWEST	Y			
	-SOCKET WELD	YCO	-YARD CLEANOUT		
SYM	-SYMMETRICAL	YD	-YARD		
			-YARD DRAIN		
		YR	-YEAR		
T	T	Z			
	-THERMOSTAT		-POSITION SWITCH		
	-TREAD OF STAIR				
	-TANGENT				
	-TOP				
TB	-TERMINAL BOX				
	-TOP AND BOTTOM				
TC	-TOP OF CURB				
T/D	-TELEPHONE/DATA COMMUNICATIONS				
TD	-TIME DELAY RELAY				

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ABERDEEN WWTP IMPROVEMENTS
ABBREVIATIONS CONTINUED

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Description	Units	Value	Comments
Design Flow			
Average Daily Flow	MGD	0.36	2042 AADF
Max Month Flow	MGD	0.50	2042 MMF
Peak Day Flow	MGD	0.67	2042 PDF
Peak Hour Flow	MGD	1.73	2042 PHF
Influent Characteristics			
BOD ₅	MG/L	347	Maximum Month Average
BOD ₂	PPD	1,446	Maximum Month Average
TSS	MG/L	404	Maximum Month Average
TSS	PPD	1,683	Maximum Month Average
TKN	MG/L	26	Maximum Month Average
TKN	PPD	107	Maximum Month Average
TP	MG/L	6	Maximum Month Average
TP	PPD	24	Maximum Month Average
Temperature (Minimum)	°C	7	
Temperature (Maximum)	°C	19	
Effluent Requirements			
BOD ₅	MG/L	30	Average Monthly
BOD ₂	PPD	205	Average Monthly
BOD ₅	% REMOVAL	85	Average Monthly
BOD ₅	MG/L	45	Average Weekly
BOD ₂	PPD	308	Average Weekly
TSS	MG/L	30	Average Monthly
TSS	PPD	205	Average Monthly
TSS	% REMOVAL	85	Average Monthly
TSS	MG/L	45	Average Weekly
TSS	PPD	308	Average Weekly
Total Phosphorus as P	PPD	0.876	Annual Average
Total Phosphorus as P	PPD	1.36	Average Monthly
Total Phosphorus as P	PPD	2.38	Average Weekly
E. Coli	MPN/100 ML	126	Average Monthly Geometric Mean
E. Coli	MPN/100 ML	406	Instantaneous Maximum
pH	S.U.	6.5-9.0	
HEADWORKS			
Influent Flow Meter			
Number	NO.	1	Existing
Capacity	GPM	4,000	Open Channel Area/Velocity with Ultrasonic Level
Screens			
Number	NO.	2	1 New, 1 Existing
New Perforated Plate Screen			
Capacity/Screen	MGD	1.73	2042 PHF
Opening Size	mm	3	
Motor Size	HP	2	
Washer/Compactor			Incorporated into Screen
Existing Bar Screen			
Capacity/Screen	MGD	1.73	2042 PHF
Opening Size	IN	1/4	
Motor Size	HP	2	
Washer/Compactor			Incorporated into Screen
Grit Removal			
No. of Chambers	NO.	1	Existing
Capacity/Chamber	MGD	2.80	Vortex Grit Chamber
Grit Chamber Drive Motor	HP	0.75	Peak Hour Flow
No. of Grit Pumps	NO.	1	Existing
Grit Pump Capacity/Pump	GPM	225	
Grit Pump Motor	HP	10	
Grit Classifier			
Number of Classifiers	NO.	1	Existing
Capacity	GPM	225	Cyclone, Classifier and Washer
Motor Size	HP	0.5	
Headworks Pump Station			
Wetwell Diameter	FT	12	Existing
Number of Pumps	NO.	3	Submersible Wetwell
Capacity/Pump	GPM	1,050	3 Existing Submersible Pumps
TDH/Pump	FT	53	Each Pump, 1 Standby
Pump Motor Size	HP	25	
Drive			Variable Speed

Description	Units	Value	Comments
SECONDARY TREATMENT			
New Floating Media IFAS			
Number of Basins	NO.	2	Basins Existing, New IFAS Process
Max. Basin Volume Combined	GAL	TBD	Two Treatment Trains
Max. Side Water Depth	FT	14.0	
Design MLSS Concentration	MG/L	TBD	
Number of Blowers	NO.	3	2 Duty, 1 Standby
Total Ammonia IFAS Performance	MG/L	1.0	Average Monthly
Secondary Clarifiers			
Number of Clarifiers	NO.	2	Existing
Dimensions (L x W x D)	FT	100 x 20 x 12	Rectangular
Average Overflow Rate	GAL/DAY/FT ²	178	1 Duty, 1 Standby
Max Month Overflow Rate	GAL/DAY/FT ²	250	1 Duty, 1 Standby
RAS/WAS Pumps			
RAS Pump Type			Existing
Number of RAS Pumps	NO.	4	Submersible Non-clog
RAS Pump Capacity/Pump	GPM	430	2 Per Sump, Existing
RAS Pump Motor Size	HP	5	215-430
Scum			
Scum Pipe	NO.	2	Existing
Type			1 Per Clarifier
Flow to Digester			Collector
			Gravity
TERTIARY FILTRATION			
Tertiary Lift Station			
Wetwell Diameter	FT	12	New
Number of Pumps	NO.	3	Submersible Wetwell
Capacity/Pump	GPM	600	3 Submersible Pumps
TDH/Pump	FT	22	Each Pump, 1 Standby
Pump Motor Size	HP	7.5	Each Pump
Drive			Variable Speed
Coagulant Chemical Addition			
Chemical Feed Pumps	NO.	3	New, 48% Aluminum Sulfate
Number of Skids	NO.	1	2 Duty, 1 Standby
Chemical Addition Locations	NO.	2	3 Pumps on 1 Skid
Pump Capacity	GPH	30	Leaving IFAS, Tertiary Filtration
pH Adjustment Chemical Addition			
Chemical Feed Pumps	NO.	2	New, 35% Sodium Hydroxide
Number of Skids	NO.	1	1 Duty, 1 Standby
Chemical Addition Locations	NO.	1	2 Pumps on 1 Skid
Pump Capacity	GPH	30	Tertiary Filtration
Upflow Sand Filters			
Number of Filter Modules	NO.	8	New
Number of Cells	NO.	4	2 Per Cell
Filtration Area Per Cell	FT ²	100	3 Duty, 1 Standby
Peak Hour Hydraulic Loading	GPM/FT ²	5.0	50 FT ² Per Filter Module
Compressor Type			3 Duty, 1 Standby
Number of Compressors	NO.	2	Rotary Screw
Air Consumption at 100 psi	SCFM	12	1 Duty, 1 Standby
Compressor Motor Size	HP	10	All filters operating
TP Filter Performance	MG/L AS P	0.29	Average Monthly
Effluent Flow Meter			
Number	NO.	1	New
Capacity	MGD	3.0	Magnetic Flow Meter
Flow Meter Diameter	IN	18	
DISINFECTION			
UV Disinfection			
UV Type			Existing
No. of Channels	NO.	2	Closed Vessel
Capacity/Channel	MGD	3	1 Duty, 1 Standby
Dosage	MJ/CM ²	35	
UV Transmittance	% TRANS.	55	
Lamp Aging Factor		0.85	
Lamp Fouling Factor		0.90	

Description	Units	Value	Comments
SOLIDS HANDLING			
Aerobic Digesters			
No. of Aerobic Digester Basins	NO.	4	Existing
Max. Basin Volume/Digester	GAL	255,822	Diffused Aeration
Type of Diffusers			Existing Fine Bubble
Number of Diffusers	NO.	39	Existing 9 in Cell 1; Existing 10 in Each Cell 2 to 4
No. of Blowers	NO.	2	Existing Rotary Lobe Blowers
Blower Air Flow	SCFM	1,060	@ 5.0 psig
Blower Motor Size	HP	25	
Polymer System			
No. of Polymer Systems	NO.	1	Existing
No. of Polymer Pump	NO.	1	Existing, Diaphragm
Polymer Pump	GPH	10	
Dilution Water	GPH	1,000	
Dewatering Pump			
No. of Dig. Sludge Pumps	NO.	1	One Existing
Dig. Sludge Pump Motor Size	HP	5	Progressive Cavity
Dig. Sludge Pump Capacity	GPM	36	
Dewatering Pump			
No. of Dig. Sludge Pumps	NO.	1	One New
Dig. Sludge Pump Motor Size	HP	3	Progressive Cavity
Dig. Sludge Pump Capacity	GPM	36	
Sludge Drying Beds			
No. of Sludge Drying Beds		6	Existing
Size (L x W)	FT	60 x 30	
Sludge Dewatering Bags			
No. of Sludge Dewatering Bags		5	Existing
Size (L x W)	FT	60 x 30	
New Polymer System			
No. of Polymer Systems	NO.	1	New
No. of Polymer Pump	NO.	1	Progressive Cavity
New Screw Press			
No. of Screw Presses	NO.	1	New
Hydraulic Capacity	GPM	28	Keep Existing Sludge Dewatering Bags as the Redundancy
Solids Capacity	LB/HR	210	At 1.5% Inlet Solids Concentration
Inlet Solids Concentration	%	1 - 3	8 Hours Per Day, 5 Days Per Week
Minimum Cake Solids	%	18	
Solids Capture Rate	%	95	
Press Motor Size	HP	3	
Average Wash Water Requirement	GPH	62	@ 72.5 psig
MISCELLANEOUS			
Decant Drain Pump Station			
Wetwell Diameter	FT	8	Existing
Number of Pumps	NO.	2	Submersible Wetwell
Capacity/Pump	GPM	350	1 New, 1 Existing
TDH/Pump	FT	13	
Pump Motor Size	HP	3.0	
New Decant Drain Pump Station			
Wetwell Diameter	FT	8	New Pumps in Existing Wetwell
Number of Pumps	NO.	2	Existing Submersible Wetwell
Capacity/Pump	GPM	350	1 Duty, 1 Standby
TDH/Pump	FT	13	
Pump Motor Size	HP	2.0	
EMERGENCY POWER			
Existing Backup Generator			
Engine Type	SC		Existing
Number of Generators	NO.	1	Diesel
Engine Output	KW	400	Auto Transfer Switch Included
Storage Tank Capacity	Gallon	774	
New Backup Generator			
Engine Type			New
Number of Generators	NO.	1	Diesel
Engine Output	KW	750	Auto Transfer Switch Included
Storage Tank Capacity	Gallon	1,200	

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ABERDEEN WWTP IMPROVEMENTS

DESIGN CRITERIA

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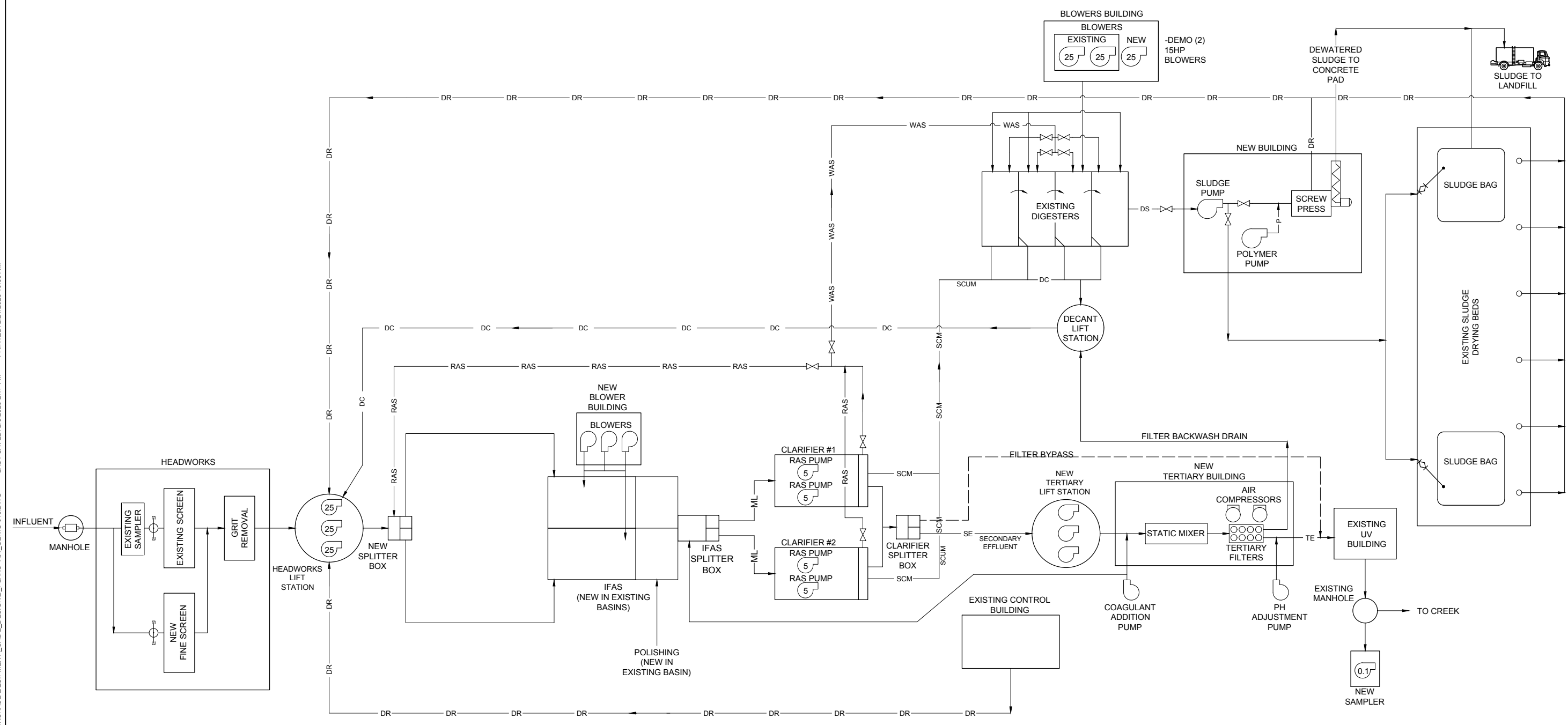
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PROCESS FLOW DIAGRAM

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VERIFY SCALE: Scales based on 22"x34" prints.	
1-1/2 Inches	
PROJECT NO. 222032	PAGE
SHEET NO. G-010	

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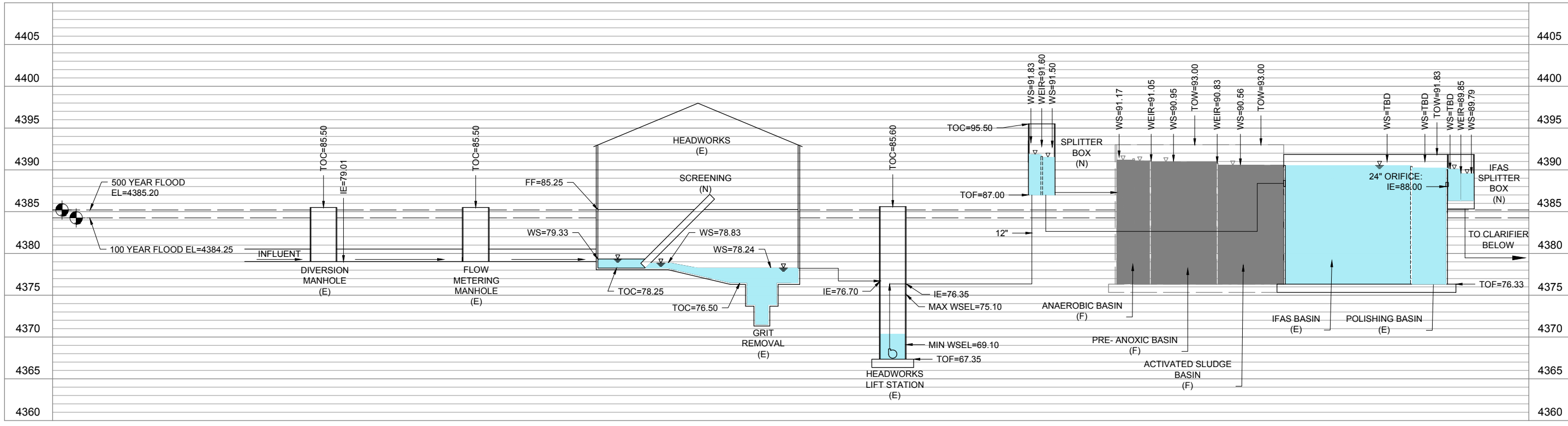


A1 PROCESS FLOW DIAGRAM
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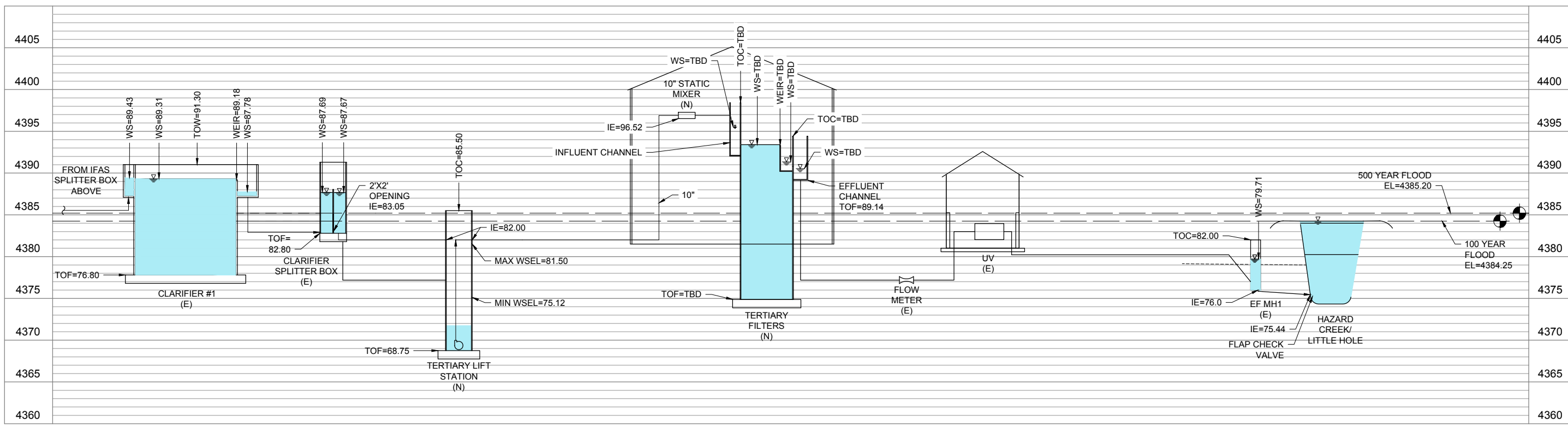
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B1 HYDRAULIC PROFILE
 N.T.S.



A1 HYDRAULIC PROFILE
 N.T.S.

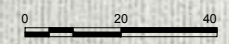
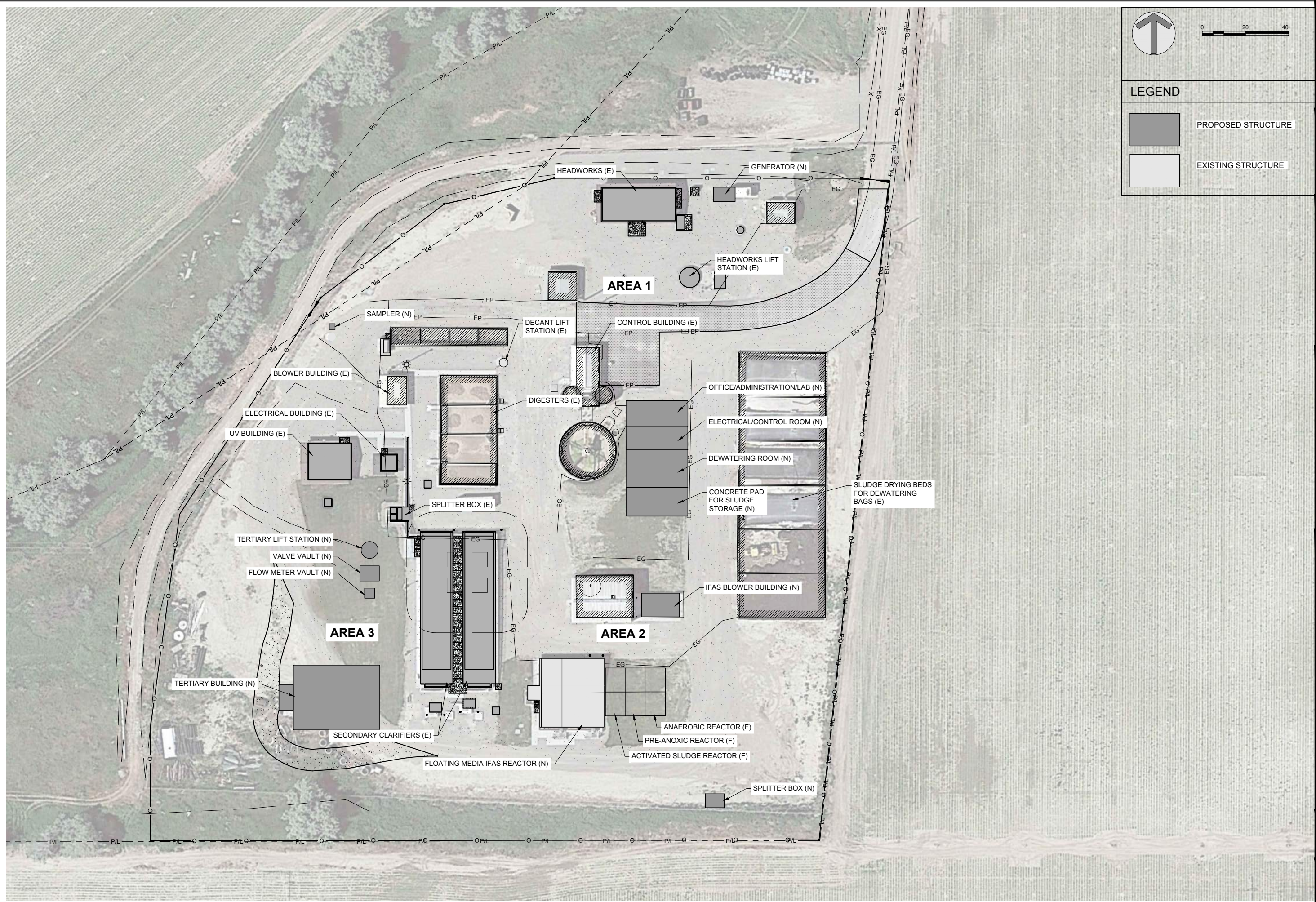
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 HYDRAULIC PROFILE

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LEGEND

- PROPOSED STRUCTURE
- EXISTING STRUCTURE

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ABERDEEN WWTP IMPROVEMENTS
PROJECT OVERVIEW

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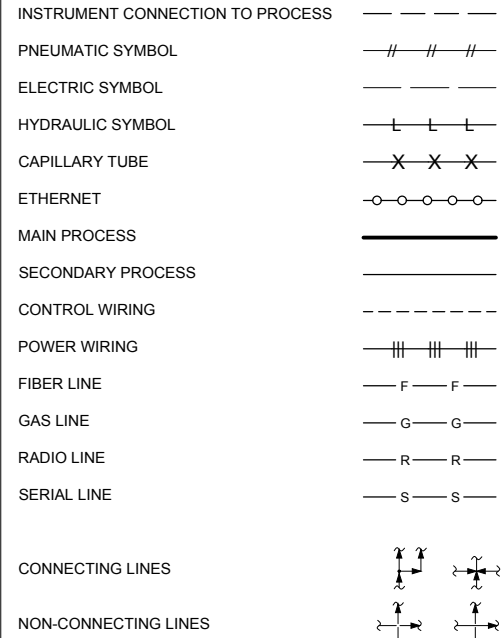
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GENERAL INSTRUMENTATION NOTES

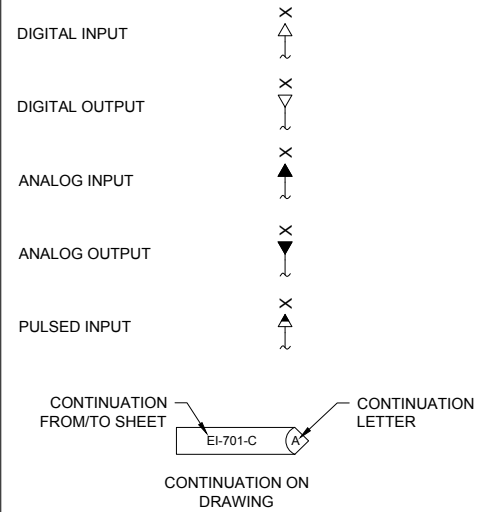


- NOTES:
- DRAWINGS REFER ONLY TO CONNECTIONS FROM FIELD DEVICES TO THE PLANT PLC AND/OR SCADA SYSTEM. REFER TO THE SPECIFICATIONS FOR DETAILS ON ALL FIELD AND PACKAGED SYSTEMS.
 - ALL PANEL INSTRUMENTS SHALL BE FURNISHED UNDER THE SPECIFICATIONS.

INSTRUMENT LINE LEGEND



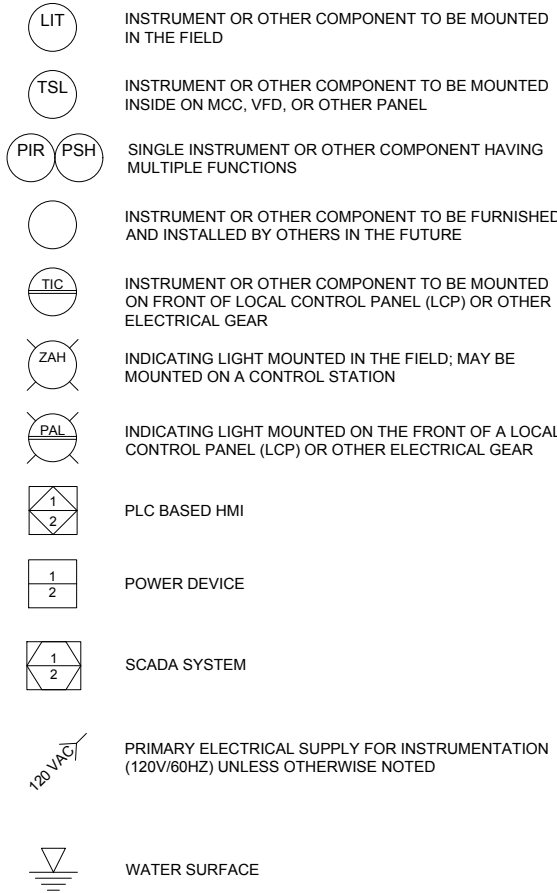
INPUT & OUTPUT SYMBOLS



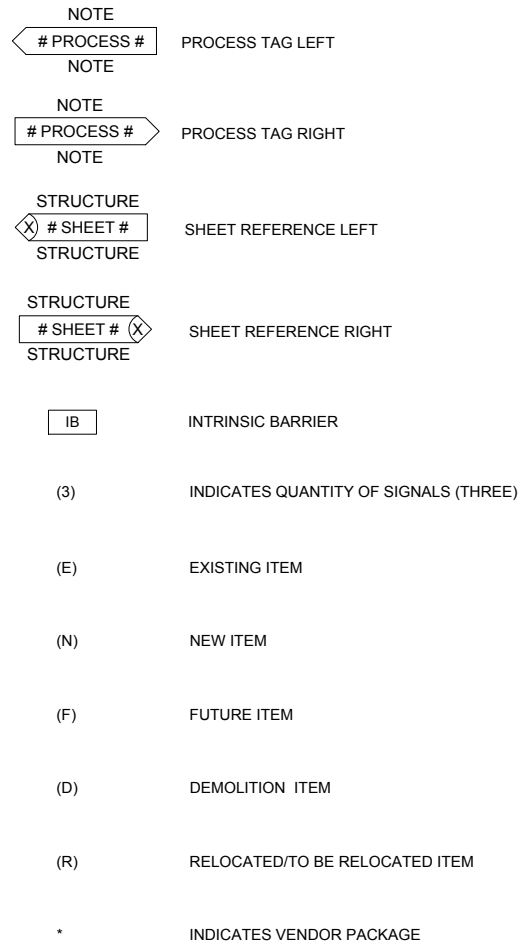
INSTRUMENT TAG IDENTIFICATION LETTERS

MEASURED VARIABLE	INSTRUMENT FUNCTION																										
	ELEMENT	TRANSMITTER	INDICATING TRANSMITTER	CONVERTER TRANSDUCER RELAY, SPECIAL DEVICES	INDICATOR	RECORDER	CONTROLLER	INDICATING CONTROLLER	RECORDING CONTROLLER	SWITCH	SWITCH LOW LOW	SWITCH LOW	SWITCH HIGH	SWITCH HIGH HIGH	SWITCH COMBINATION HIGH LOW	ALARM LOW LOW	ALARM LOW	ALARM HIGH	ALARM HIGH HIGH	TOTALIZE INDICATOR TRANSMITTER	VALVE	GAUGE	LIGHT	SPEED SETTING	FAIL ALARM		
A	ANALYSIS	AE	AT	AIT	AY	AI	AR	AC	AIC	ARC	AS	ASLL	ASL	ASH	ASHH	ASHL	AALL	AAL	AAH	AAHH							
B	BURNER FLAME	BE	BT	BIT	BY	BI	BR	BC	BIC	BRC	BS	BSLL	BSL	BSH	BSHH		BALL	BAL	BAH	BAHH							
C	CONDUCTIVITY	CE	CT	CIT	CY	CI	CR	CC	CIC	CRC	CS	CSLL	CSL	CSH	CSHH	CSHL	CALL	CAL	CAH	CAHH							
D	DENSITY	DE	DT	DIT	DY	DI	DR	CD	DIC	DRC	DS	DSLL	DSL	DSH	DSHH	DSHL	DALL	DAL	DAH	DAHH							
E	VOLTAGE	EE	ET	EIT	EY	EI	ER				ES	ESLL	ESL	ESH	ESHH		EALL	EAL	EAH	EAHH							
F	FLOW	FE	FT	FIT	FY	FI	FR	FC	FIC	FRC	FS	FSLL	FSL	FSH	FSHH	FSHL	FALL	FAL	FAH	FAHH	FQI	FV	FG	FL			
FF	FLOW RATIO				FFY	FFI	FFC	FFIC		FFS																	
G	GAUGING (DIMENSION)																										
H	HAND (MANUAL)							HC			HS											HV		HL	HSS		
I	CURRENT		IT	IIT	IY	II	IR	IC	IIC	IRC	IS	ISLL	ISL	ISH	ISHH		IALL	IAL	IAH	IAHH				IL			
J	POWER																										
K	TIME				KY	KI	KR	KC	KIC	KRC	KS	KSLL	KSL	KSH	KSHH		KALL	KAL	KAH	KAHH				KV	KL		
L	LEVEL	LE		LIT	LY	LI	LR	LC	LIC	LRC	LS	LSLL	LSL	LSH	LSHH	LSHL	LALL	LAL	LAH	LAHH				LV	LG	LL	
M	MOISTURE OR HUMIDITY	ME	MT	MIT	MY	MI	MR	MC	MIC	MRC	MS	MSLL	MSL	MSH	MSHH		MALL	MAL	MAH	MAHH						ML	
N	EMERGENCY SHUTDOWN																										
O																											
P	PRESSURE OR VACUUM		PT	PIT	PY	PI	PR	PC	PIC	PRC	PS	PSLL	PSL	PSH	PSHH	PSHL	PALL	PAL	PAH	PAHH				PV	PL		
PD	DIFFERENTIAL PRESSURE		PDT	PDIT	PDY	PDI	PDR	PDC	PDIC	PDRC	PDS	PDSLL	PDSL	PDSH	PDSHH		PDALL	PDAL	PDAH	PDAHH				PDV	PDL		
Q	QUANTITY	QE	QT	QIT	QY	QI	QR				QS	QSLL	QSL	QSH	QSHH		QALL	QAL	QAH	QAHH							
R	RADIOACTIVITY																										
S	SPEED	SE	ST	SIT	SY	SI	SR	SC	SIC	SRC	SS	SSLL	SSL	SSH	SSHH		SALL	SAL	SAH	SAHH							
T	TEMPERATURE	TE	TT	TIT	TY	TI	TR	TC	TIC	TRC	TS	TSLL	TSL	TSH	TSHH	TSHL	TALL	TAL	TAH	TAHH				TV	TL		
TD	DIFFERENTIAL TEMPERATURE		TDT	TDIT	TDY	TDI	TDR	TDC	TDIC	TDRC	TDS	TDSLL	TDSL	TDSH	TDSHH		TDALL	TDAL	TDAH	TDAHH				TDV	TDL		
U	MULTIVARIABLE					UI	UR	UC	UIC	URC	US														UL		
V	VISCOSITY	VE	VT	VIT	VY	VI	VR	VC	VIC	VRC	VS	VSLL	VSL	VSH	VSHH		VALL	VAL	VAH	VAHH						VL	
W	WEIGHT	WE	WT	WIT	WY	WI	WR				WS	WSLL	WSL	WSH	WSHH		WALL	WAL	WAH	WAHH							
X	UNCLASSIFIED	XE	XT	XIT	XY	XI	XR	XC	XIC	XRC	XS	XSLL	XSL	XSH	XSHH		XALL	XAL	XAH	XAHH				XV	XG	XL	XA
XV	VIBRATION	XVE	XVT		XVY	XVI	XVR				XVS			XVSH	XVSHH				XVAH	XVAHH						XVL	YA
Y	EVENT / STATUS					YI		YC			YS															YL	
Z	POSITION	ZE	ZT	ZIT	ZY	ZI					ZS															ZL	

INSTRUMENT SYMBOLS



INSTRUMENT SYMBOLS



MISCELLANEOUS ABBREVIATIONS

AM	AUTO/MANUAL
CB	CIRCUIT BREAKER
HA	HAND/AUTOMATIC
HOA	HAND/OFF/AUTOMATIC
HOR	HAND/OFF/REMOTE
ID	INCREASE/DECREASE
I/P	CURRENT TO PNEUMATIC
KO	TIMER/OFF
LCP	LOCAL CONTROL PANEL
LOR	LOCAL/OFF/REMOTE
LOS	LOCKOUT STOP
LR	LOCAL/REMOTE
MCC	MOTOR CONTROL CENTER
HIM	HUMAN INTERFACE MODULE
N.C.	NORMALLY CLOSED
N.O.	NORMALLY OPEN
OC	OPEN/CLOSE
OIT	OPERATOR INTERFACE TERMINAL
OL	OVERLOAD
OLH	OFF/LOW/HIGH
OSC	OPEN/STOP/CLOSE
PLC	PROGRAMMABLE LOGIC CONTROLLER
POT	POTENTIOMETER
RSL	RAISE/STOP/LOWER
RTU	REMOTE TERMINAL UNIT
SEL	SELECT
SP	SET POINT
SS	START/STOP
TSP	TWISTED SHIELD PAIR
VFD	VARIABLE FREQUENCY DRIVE



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PUMPS, BLOWERS, & COMPRESSORS	
	AERATOR
	CENTRIFUGAL WET PIT PUMP OR TURBINE PUMP
	CENTRIFUGAL OR TURBINE PUMP, FAN, OR BLOWER
	CHEMICAL FEED PUMP
	BLOWER OR COMPRESSOR
	COMPRESSOR (CENTRIFUGAL) OR TURBINE MOTOR
	DIAPHRAGM PUMP
	EJECTOR
	GEAR PUMP OR BLOWER
	METERING PUMP
	COMPRESSOR (PISTON)
	PISTON PUMP
	PROGRESSIVE CAVITY POSITIVE DISPLACEMENT PUMP
	PROGRESSIVE CAVITY PUMP
	SUBMERSIBLE PUMP
	SUBMERSIBLE SUMP PUMP
	VERTICAL TURBINE PUMP

P&ID GATES	
	BUTTERFLY GATE
	FLAP GATE
	SHEAR GATE
	SLIDE GATE
	SLUICE GATE
	STOP GATE

P&ID VALVES	
	THREE WAY VALVE
	AIR RELEASE VALVE
	ANGLE VALVE
	BALL VALVE
	BUTTERFLY VALVE
	CHECK VALVE
	DAMPER VALVE
	DIAPHRAGM VALVE
	DUPLEX HOSE VALVE
	FLOAT VALVE
	GATE VALVE
	GLOBE VALVE
	HOSE BIBB 1
	HOSE BIBB 2
	HOSE BIBB 3
	IRRIGATION CONTROL VALVE
	KNIFE GATE VALVE
	MUD VALVE
	NEEDLE VALVE
	NON-FREEZE HOSE BIBB

P&ID VALVES	
	TELESCOPING VALVE
	PLUG VALVE
	LUBRICATED PLUG VALVE
	PRESSURE CONTROL VALVE
	PRESSURE RELIEF VALVE
	PRESSURE RELIEF (GLOBE) VALVE
	PRESSURE RELIEF VALVE WITH VENT
	VACUUM RELIEF VALVE
	VEE BALL VALVE
	BALANCED WEIGHT VALVE

P&ID VALVE ACTUATORS	
	AIR ACTUATOR
	DIAPHRAGM ACTUATOR
	DIAPHRAGM WITH ELECTRO-PNEUMATIC CONVERTER
	DUEL CHAMBER HYDRAULIC OR PNEUMATIC CYLINDER ACTUATOR
	MANUAL ACTUATOR
	MOTOR ACTUATOR
	ROTARY MOTOR ACTUATOR
	SOLENOID ACTUATOR
	TEMPERATURE ACTUATOR

P&ID FLOW METERS	
	FLOW TUBE FLOW METER
	INSERTION FLOW METER
	MAGNETIC FLOW METER

P&ID FLOW METERS CONTINUED	
	MASS FLOW METER
	ORIFICE FLOW METER
	PARSHALL FLUME FLOW METER
	PITOT TUBE FLOW METER
	PROPELLER FLOW METER
	ROTAMETER TYPE 1 FLOW METER
	ROTAMETER TYPE 2 FLOW METER
	THERMAL DISPERSION FLOW METER
	ULTRASONIC FLOW METER
	ULTRASONIC (CLAMP ON) FLOW METER
	VARIABLE AREA FLOW METER
	VENTURI FLOW METER
	UV DISINFECTION WITH FM FLOW METER

P&ID GAUGES, SENSORS, & TRANSMITTERS	
	ANNULAR DIAPHRAGM SEAL
	ANNULAR SEAL
	BUBBLER LEVEL CONTROL
	CALIBRATION COLUMN
	DIAPHRAGM SEAL
	FLOW SIGHT GAUGE
	HYDRAULIC WEIGHT TRANSMITTER
	INDUCTIVE RELAY LEVEL SWITCH
	INVERTED COLUMN SWITCH
	LIMIT SWITCH
	FLOW SWITCH

P&ID GAUGES, SENSORS, & TRANSMITTERS	
	PRESSURE
	PRESSURE SWITCH
	PRESSURE SWITCH WITH DIAPHRAGM
	PRESSURE TRANSMITTER
	PRESSURE TRANSMITTER WITH DIAPHRAGM
	ROOM THERMOSTAT
	RUPTURE DISK
	SONIC LEVEL SENSOR
	SUBMERSIBLE PRESSURE LEVEL TRANSMITTER
	SUSPENSION CABLE LEVEL SWITCH
	TEMPERATURE ELEMENT WITH WELL
	TIPPING FLOAT LEVEL SWITCH

P&ID MISCELLANEOUS DEVICES & EQUIPMENT	
	"Y" STRAINER
	ACCUMULATOR
	AIR FILTER
	AIR SET
	AREA DRAIN
	BASKET STRAINER
	CONDENSATE TRAP
	DEMISTER
	EJECTOR - EDUCTOR

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ABERDEEN WWTP IMPROVEMENTS
P&ID SYMBOLS LEGEND

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P&ID MISCELLANEOUS DEVICES & EQUIPMENT

	ELECTRIC MOTOR
	EMERGENCY EYEWASH OR SHOWER
	EXPANSION CHAMBER WITH RUPTURE DISK
	EYE WASH
	FLOOR DRAIN
	FLOOR SINK
	GRINDER
	HEAT EXCHANGER
	HORN
	HOSE RACK
	IN-LINE STATIC MIXER
	IN-LINE MIXER
	MIXER
	MIXER AIR GAS
	PIPE ANCHOR
	PNEUMATIC CYLINDER
	PULSATION DAMPENER
	ROOF DRAIN
	SIGHT GLASS
	SURGE DAMPENER
	THERMOMETER
	TRENCH DRAIN
	WAFER TYPE STATIC MIXER
	TRANSFORMER IRON CORE

P&ID MISCELLANEOUS DEVICES & EQUIPMENT

	DOUBLE POLE
	SINGLE POLE
	PRESSURE SWITCH NORMALLY CLOSED
	PRESSURE SWITCH NORMALLY OPEN
	PUSH BUTTON NORMALLY CLOSED
	PUSH BUTTON NORMALLY OPEN
	ONE WAY SELECTOR
	TWO WAY SELECTOR
	THREE WAY SELECTOR
	HANDS OFF AUTO SELECTOR
	STARTER
	MOTOR STARTER
	MOTOR STARTER DISCONNECT
	TEMPERATURE NORMALLY CLOSED
	TEMPERATURE NORMALLY OPEN
	TIME OPEN TIME CLOSED
	TIMING CLOSED NORMALLY CLOSED
	TIMING CLOSED NORMALLY OPEN
	TIMING OPEN NORMALLY CLOSED
	TIMING OPEN NORMALLY OPEN
	TORQUE SWITCH
	TRANSFER SWITCH
	TRANSFORMER
	TRANSFORMER DIAGRAM

PRIMARY ELEMENT SYMBOLS

	VENTURI FLOWMETER WITH INSTRUMENT TAG
	MAGNETIC FLOWMETER WITH INSTRUMENT TAG
	PITOT TUBE WITH INSTRUMENT TAG
	CLAMP-ON ULTRASONIC FLOWMETER WITH INSTRUMENT TAG
	PARSHALL FLUME WITH INSTRUMENT TAG
	SONIC LEVEL SENSOR WITH INSTRUMENT TAG
	INVERTED COLUMN LEVEL SWITCH WITH INSTRUMENT TAG
	PRESSURE TRANSMITTER WITH DIAPHRAGM SEAL (ALSO APPLIES TO PRESSURE GAUGE AND SWITCH) WITH INSTRUMENT TAG
	SUSPENSION CABLE LEVEL SWITCH WITH INSTRUMENT TAG
	ORIFICE FLOWMETER WITH INSTRUMENT TAG
	PROPELLER FLOWMETER WITH INSTRUMENT TAG
	THERMAL DISPERSION FLOWMETER WITH INSTRUMENT TAG
	TIPPING FLOAT LEVEL SWITCH WITH INSTRUMENT TAG
	TEMPERATURE ELEMENT WITH WELL AND INSTRUMENT TAG
	PRESSURE TRANSMITTER WITH ANNULAR SEAL (ALSO APPLIES TO PRESSURE GAUGE AND SWITCH) WITH INSTRUMENT TAG
	INDUCTIVE RELAY LEVEL SWITCH WITH INSTRUMENT TAG
	SUBMERSIBLE PRESSURE LEVEL TRANSMITTER WITH INSTRUMENT TAG

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ABERDEEN WWTP IMPROVEMENTS
P&ID SYMBOLS LEGEND

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PROJECT NO. 222032	PAGE
SHEET NO.	EI-003

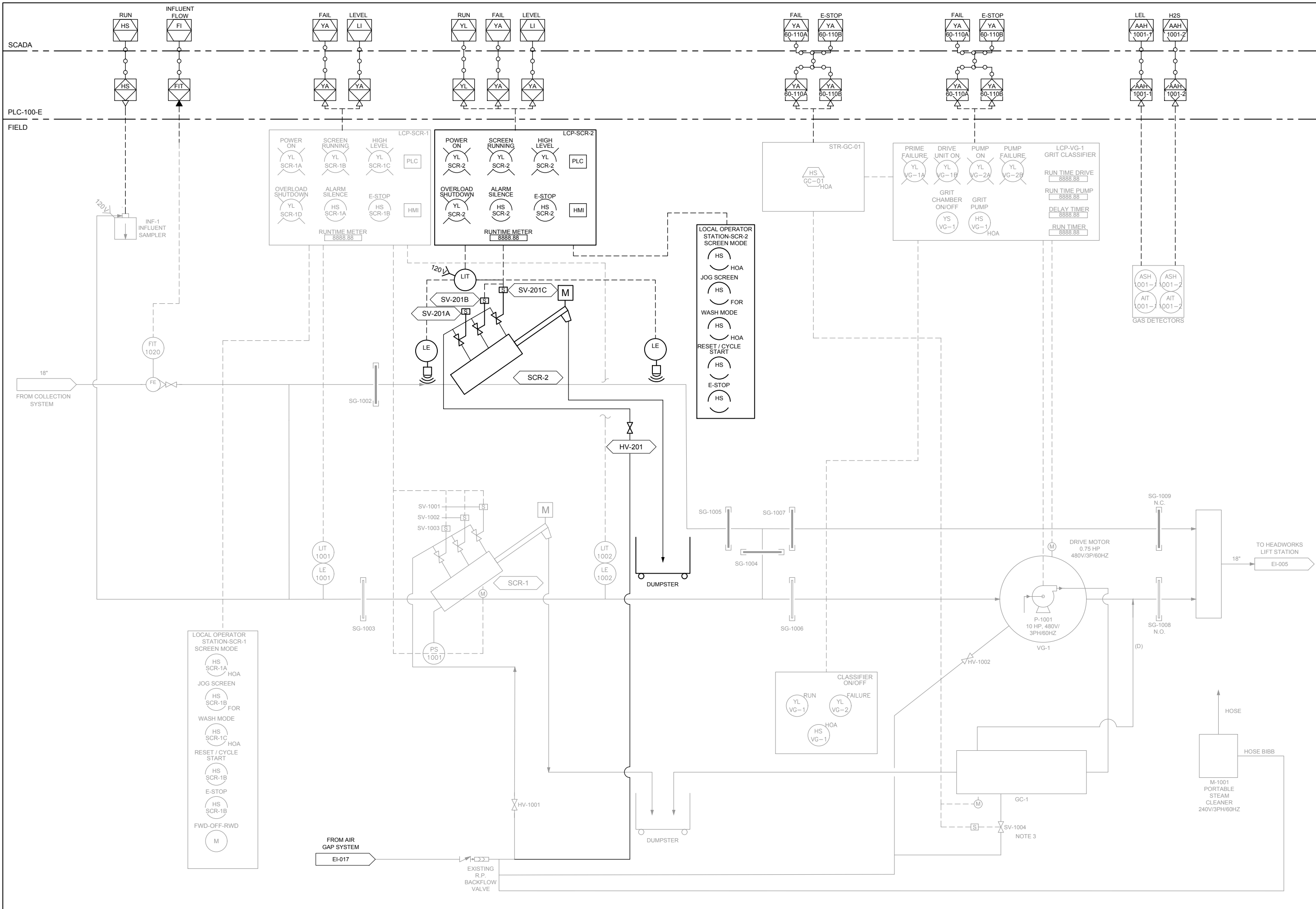
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ABERDEEN WWTP IMPROVEMENTS
HEADWORKS - FINE SCREEN P&ID

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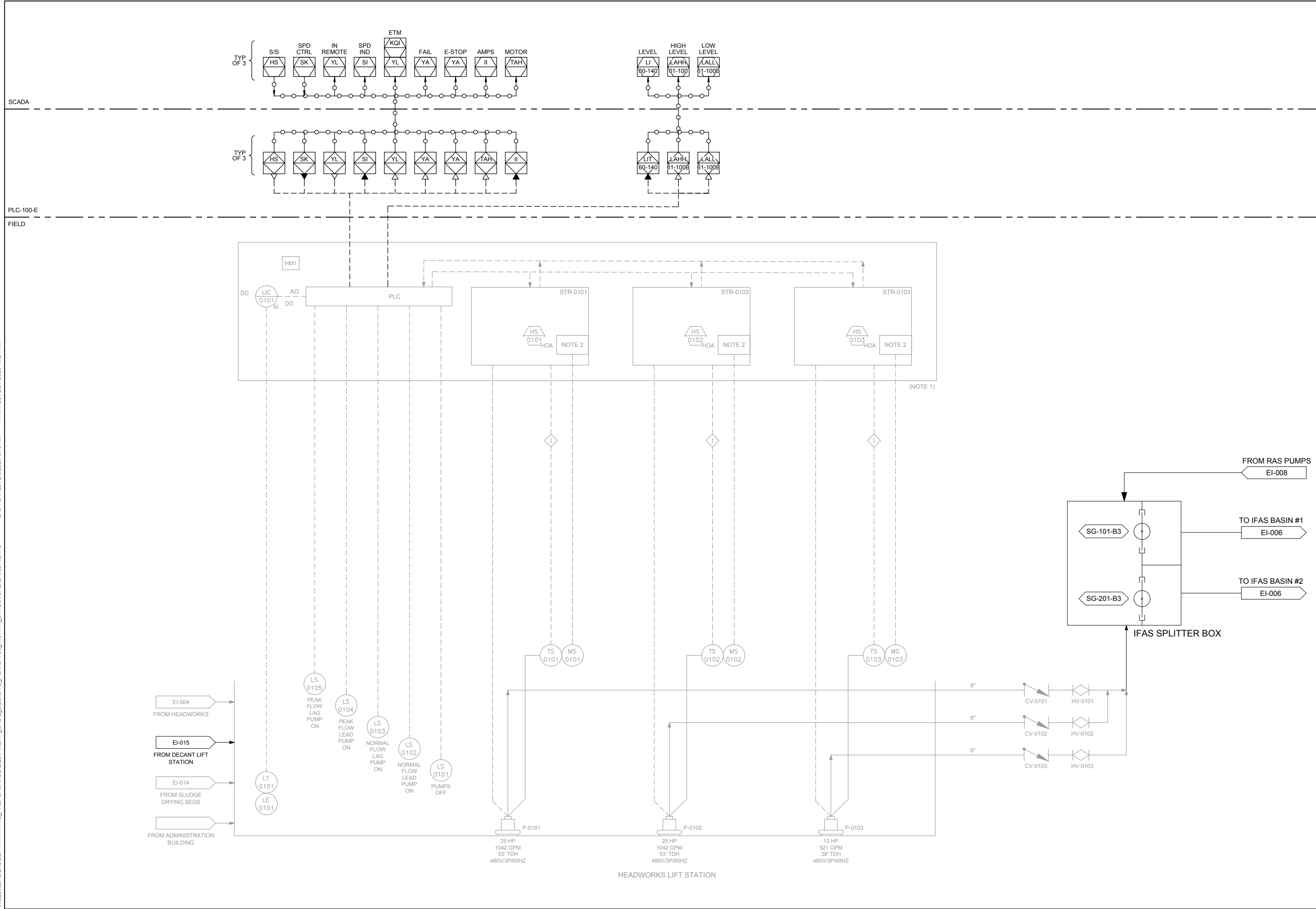
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ABERDEEN WWTP IMPROVEMENTS
HEADWORKS - P&ID

PROJECT NO. 222032	PAGE
SHEET NO. EI-005	



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SCADA

FIELD

KEYNOTES

01 ALL EQUIPMENT, INCLUDING PANELS, INSTRUMENTS, VALVING WITHIN THIS AREA, ARE TO BE PROVIDED BY THE IFAS VENDOR. INTERCONNECTING PIPING AND CABLING TO BE PROVIDED BY CONTRACTOR UNLESS OTHERWISE NOTED.

02 VALVE IS NOT IN VENDOR SCOPE

KELLER ASSOCIATES
 305 North 3rd Ave, Suite A
 Pocatello, Idaho 83201
 (208) 238-2146

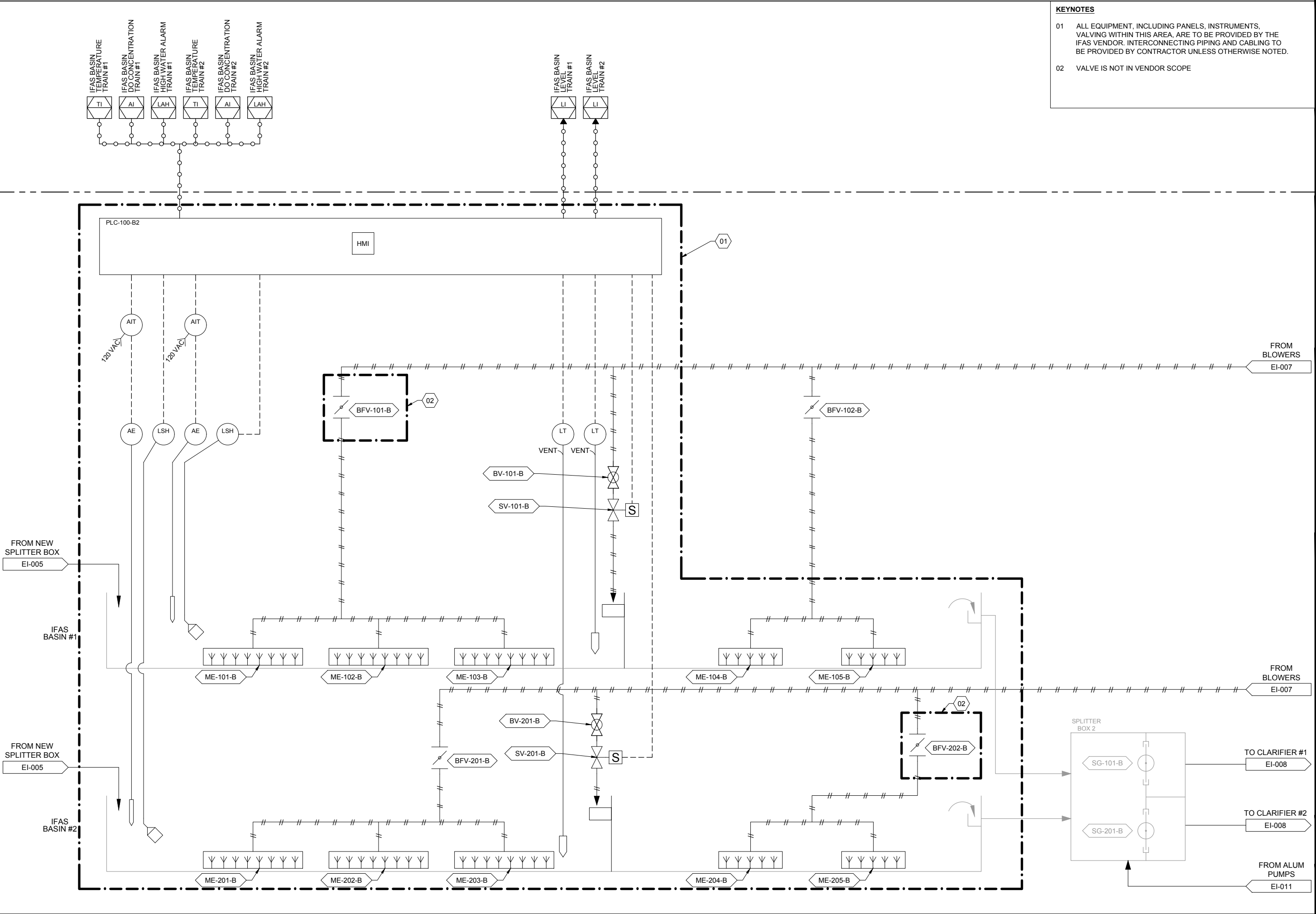
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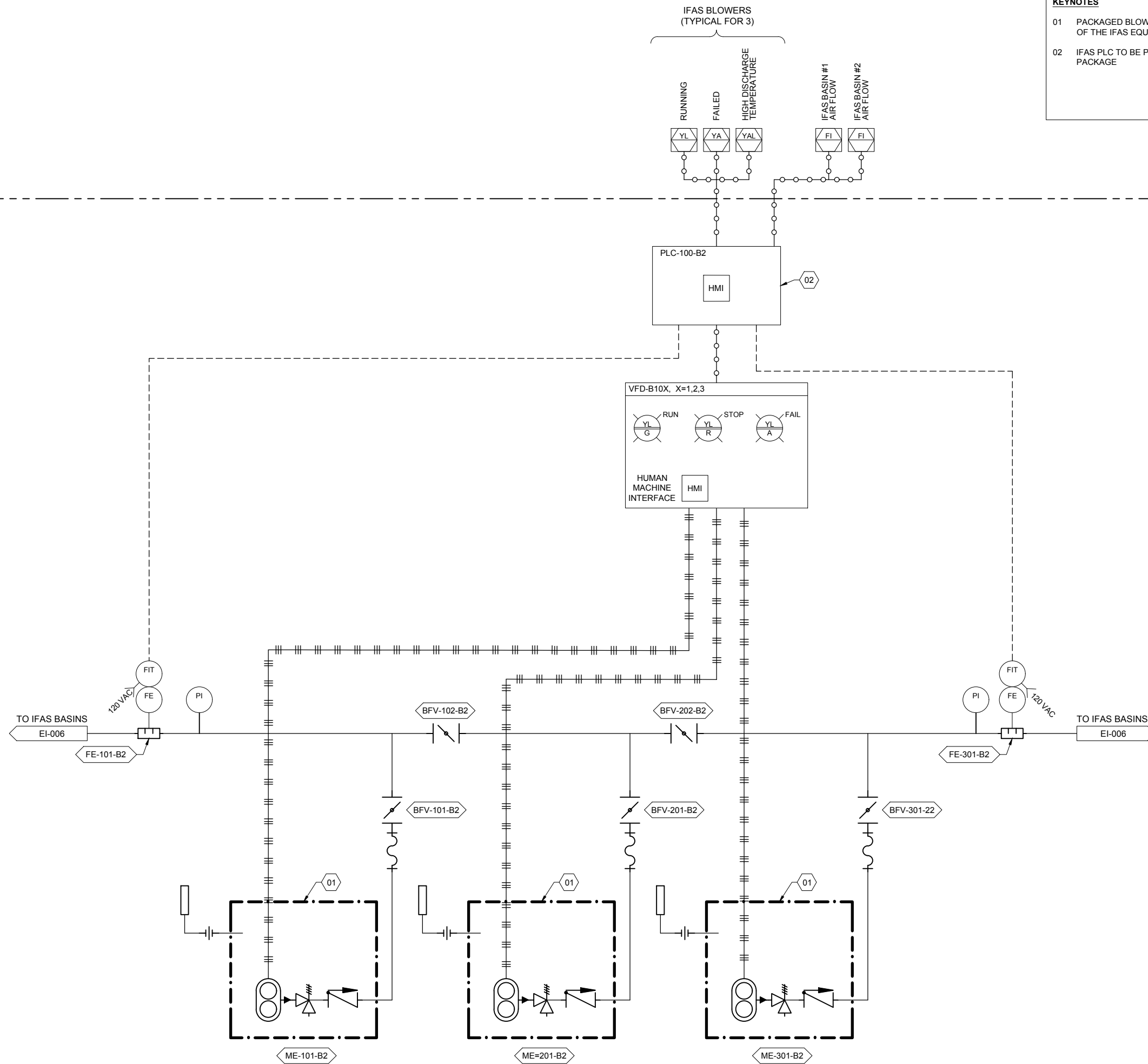


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IFAS TREATMENT - P&ID

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 PROJECT NO. 222032 PAGE
 SHEET NO. EI-006



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KEYNOTES

- 01 PACKAGED BLOWER SYSTEM SHALL BE PROVIDED AS PART OF THE IFAS EQUIPMENT PACKAGE.
- 02 IFAS PLC TO BE PROVIDED AS PART OF IFAS VENDOR PACKAGE

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ABERDEEN WWTP IMPROVEMENTS
IFAS BLOWERS BUILDING - P&ID

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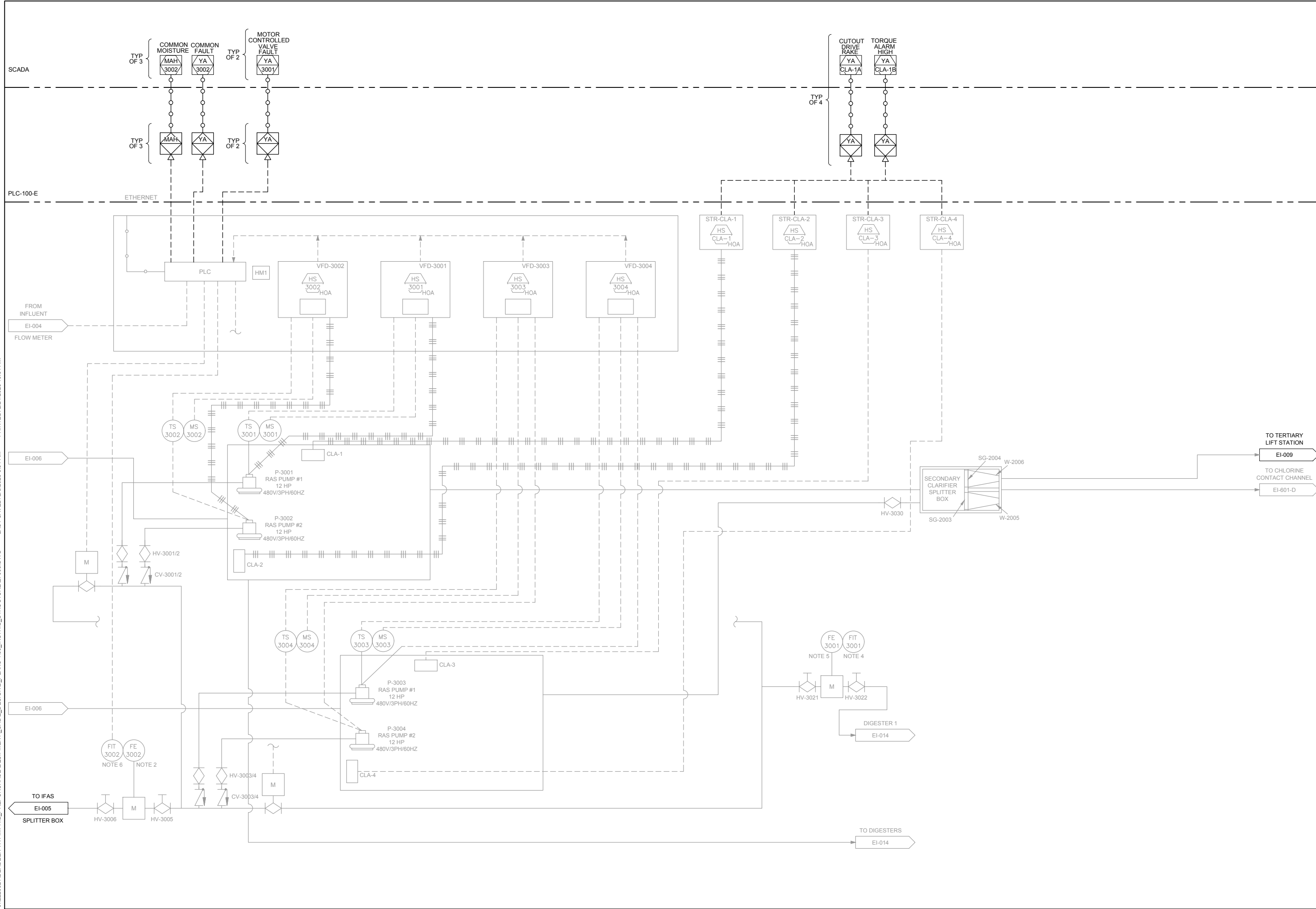
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CLARIFIERS - P&ID

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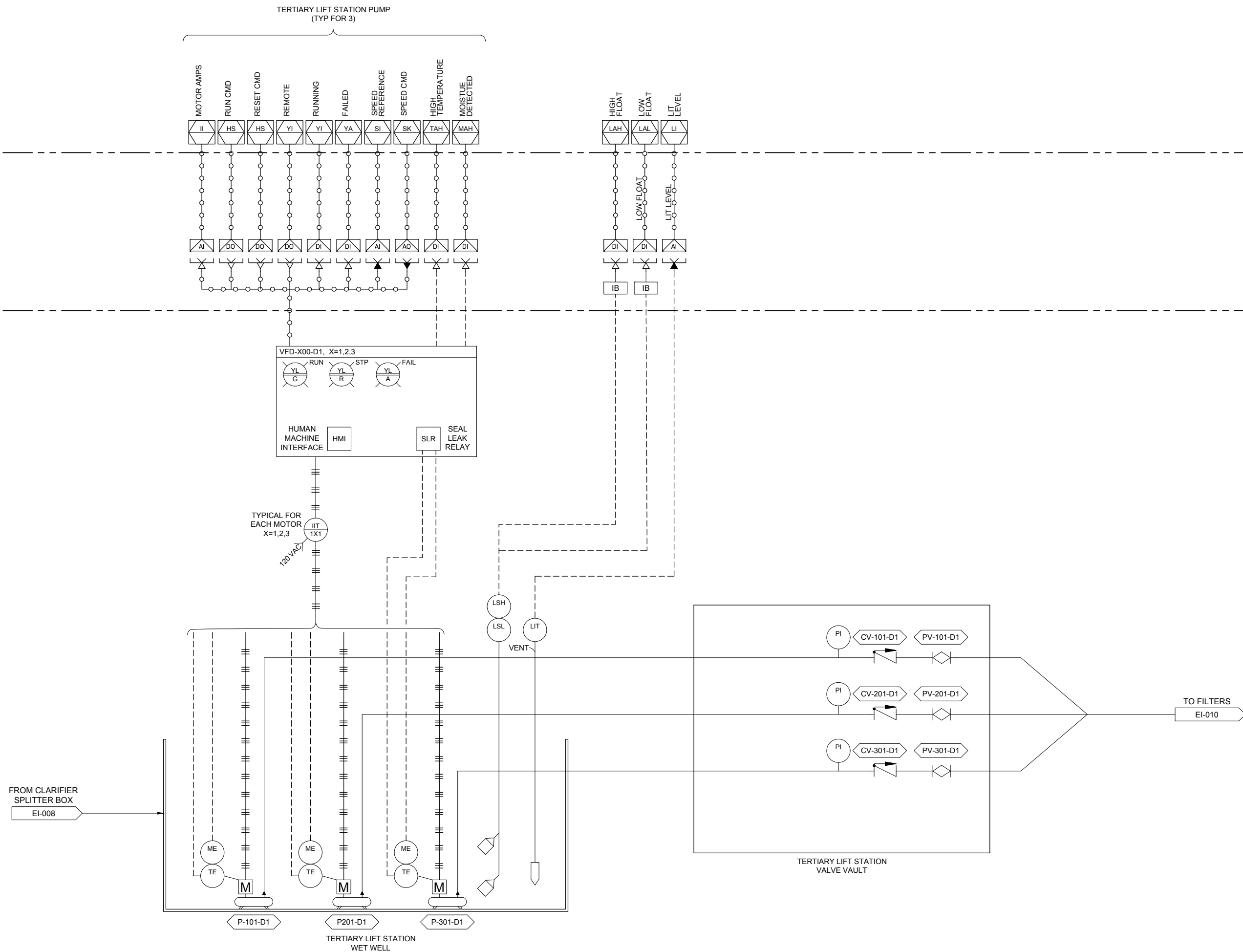
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SCADA

PLC-100-E

FIELD



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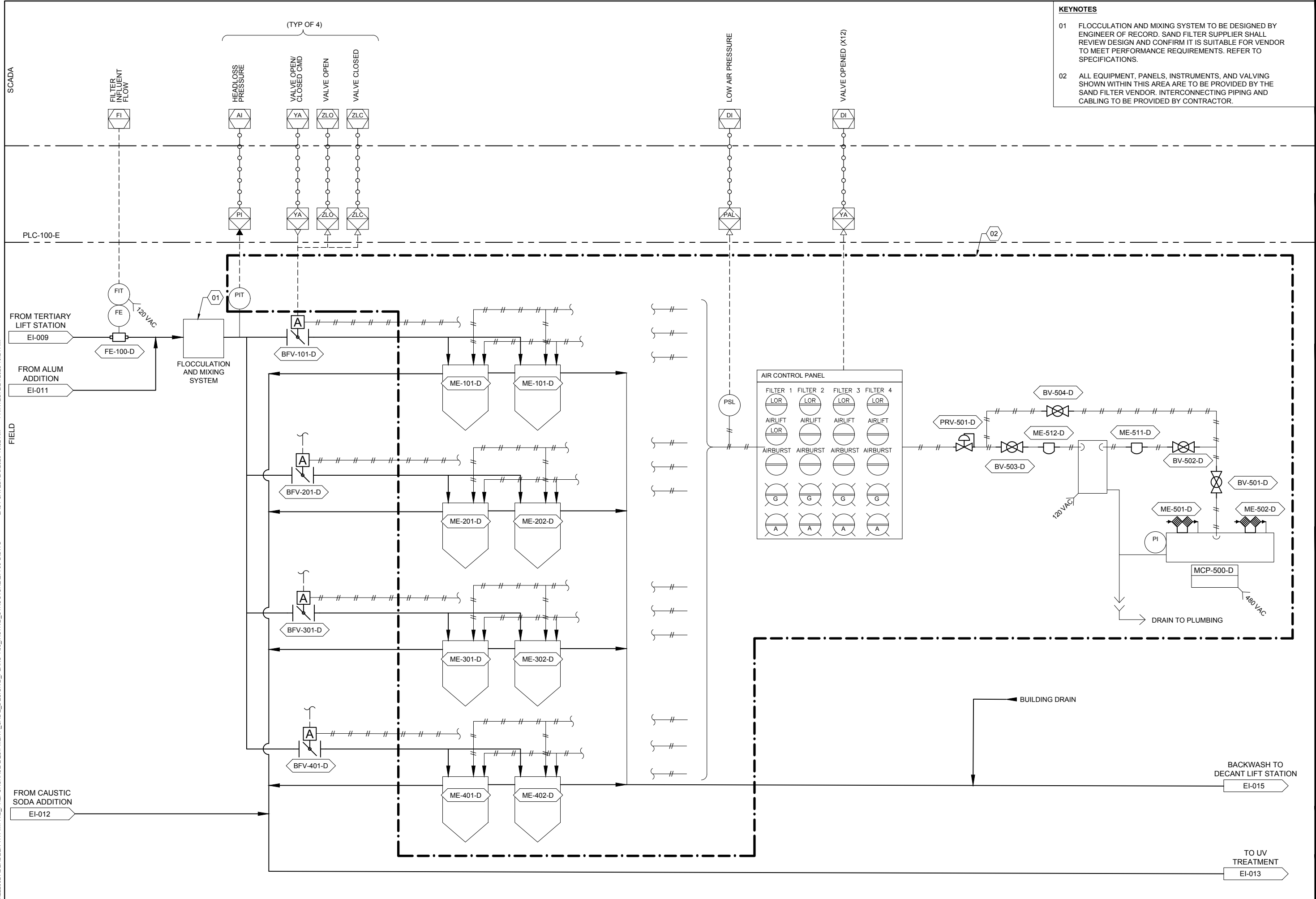
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ABERDEEN WWTP IMPROVEMENTS
TERTIARY LIFT STATION - P&ID

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 PRINTED: 2/24/2023 10:24 AM



KEYNOTES

01 FLOCCULATION AND MIXING SYSTEM TO BE DESIGNED BY ENGINEER OF RECORD. SAND FILTER SUPPLIER SHALL REVIEW DESIGN AND CONFIRM IT IS SUITABLE FOR VENDOR TO MEET PERFORMANCE REQUIREMENTS. REFER TO SPECIFICATIONS.

02 ALL EQUIPMENT, PANELS, INSTRUMENTS, AND VALVING SHOWN WITHIN THIS AREA ARE TO BE PROVIDED BY THE SAND FILTER VENDOR. INTERCONNECTING PIPING AND CABLING TO BE PROVIDED BY CONTRACTOR.

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ABERDEEN WWTP IMPROVEMENTS

TERTIARY TREATMENT - P&ID

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 VERIFY SCALE: Scales based on 22"x34" prints.
 1-1/2 Inches
 PROJECT NO. 222032 PAGE
 SHEET NO. EI-010

BACKWASH TO DECANT LIFT STATION
 EI-015

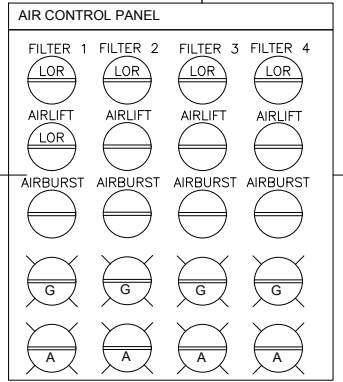
TO UV TREATMENT
 EI-013

BUILDING DRAIN

DRAIN TO PLUMBING

120 VAC

MCP-500-D
 480 VAC



PSL

LOW AIR PRESSURE

VALVE OPENED (X12)

(TYP OF 4)

HEADLOSS PRESSURE
 VALVE OPEN/CLOSED CMD
 VALVE OPEN
 VALVE CLOSED

FILTER INFLUENT FLOW

PLC-100-E

SCADA

FIELD

FROM TERTIARY LIFT STATION
 EI-009

FROM ALUM ADDITION
 EI-011

FROM CAUSTIC SODA ADDITION
 EI-012

FLOCCULATION AND MIXING SYSTEM

01

AI

YA

ZLO

ZLC

PI

YA

ZLO

ZLC

DI

DI

YA

02

BFV-101-D

BFV-201-D

BFV-301-D

BFV-401-D

ME-101-D

ME-101-D

ME-201-D

ME-202-D

ME-301-D

ME-302-D

ME-401-D

ME-402-D

PRV-501-D

BV-504-D

ME-512-D

ME-511-D

BV-502-D

BV-501-D

ME-501-D

ME-502-D

PI

480 VAC

BACKWASH TO DECANT LIFT STATION
 EI-015

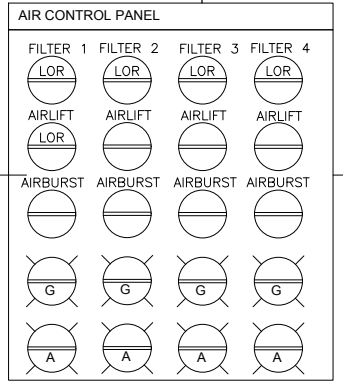
TO UV TREATMENT
 EI-013

BUILDING DRAIN

DRAIN TO PLUMBING

120 VAC

MCP-500-D
 480 VAC



PSL

LOW AIR PRESSURE

VALVE OPENED (X12)

(TYP OF 4)

HEADLOSS PRESSURE
 VALVE OPEN/CLOSED CMD
 VALVE OPEN
 VALVE CLOSED

FILTER INFLUENT FLOW

PLC-100-E

SCADA

FIELD

FROM TERTIARY LIFT STATION
 EI-009

FROM ALUM ADDITION
 EI-011

FROM CAUSTIC SODA ADDITION
 EI-012

FLOCCULATION AND MIXING SYSTEM

01

AI

YA

ZLO

ZLC

PI

YA

ZLO

ZLC

DI

DI

YA

02

BFV-101-D

BFV-201-D

BFV-301-D

BFV-401-D

ME-101-D

ME-101-D

ME-201-D

ME-202-D

ME-301-D

ME-302-D

ME-401-D

ME-402-D

PRV-501-D

BV-504-D

ME-512-D

ME-511-D

BV-502-D

BV-501-D

ME-501-D

ME-502-D

PI

480 VAC

BACKWASH TO DECANT LIFT STATION
 EI-015

TO UV TREATMENT
 EI-013

BUILDING DRAIN

DRAIN TO PLUMBING

120 VAC

MCP-500-D
 480 VAC

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SCADA

PLC-100-E

FIELD

KEYNOTES
01 CHEMICAL PUMPING SYSTEM TO BE PROVIDED AS A PACKAGED SYSTEM BY THE INSTALLING CONTRACTOR.

KELLER ASSOCIATES
305 North 3rd Ave, Suite A
Pocatello, Idaho 83201
(208) 238-2146

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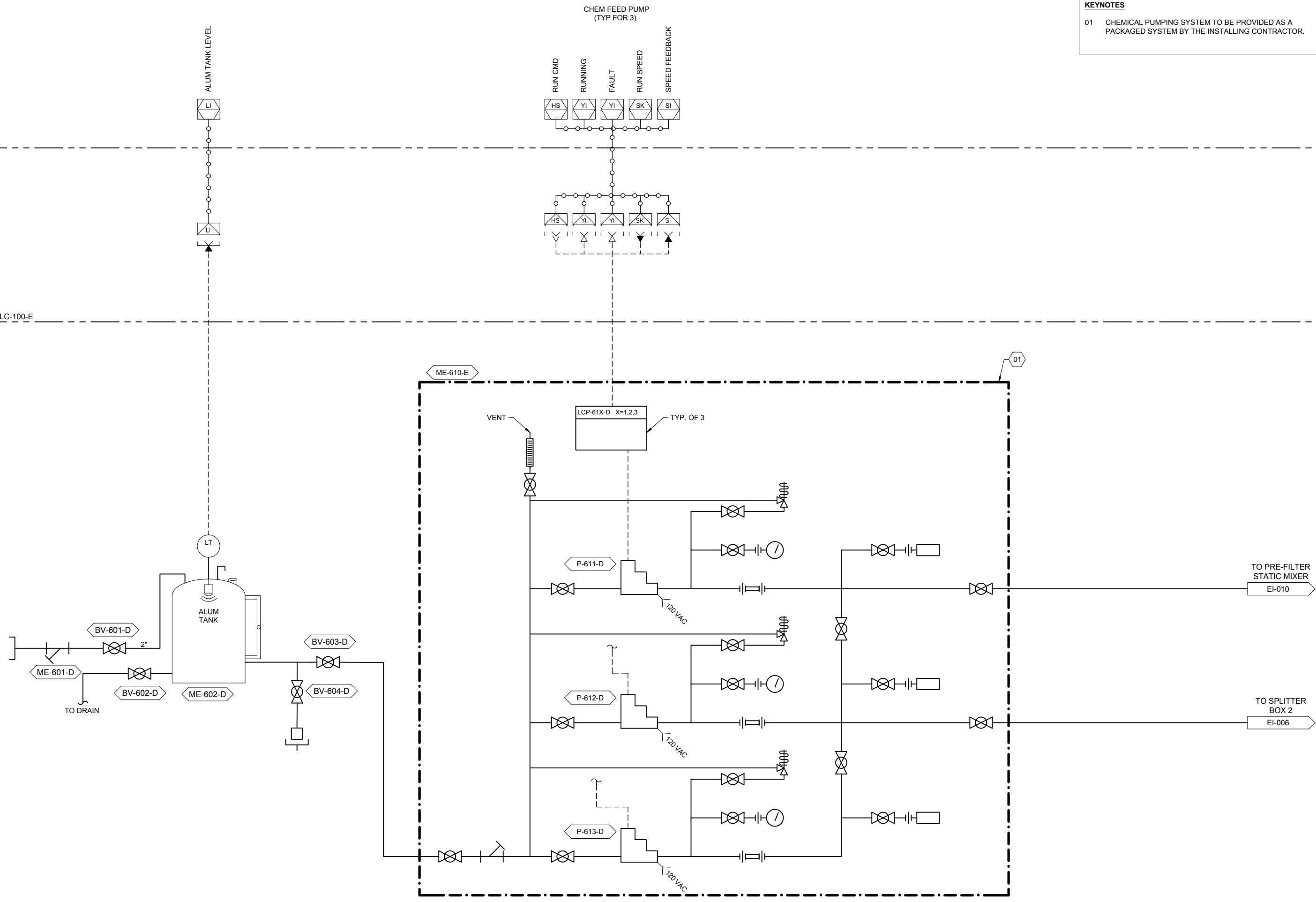
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ABERDEEN WWTP IMPROVEMENTS
TERTIARY TREATMENT - P&ID
CHEMICAL ADDITION - ALUM

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SHEET NO.	EI-011



EI-011

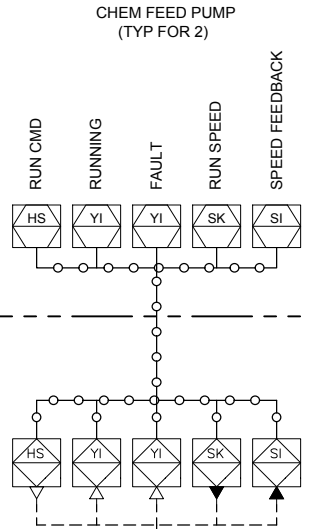
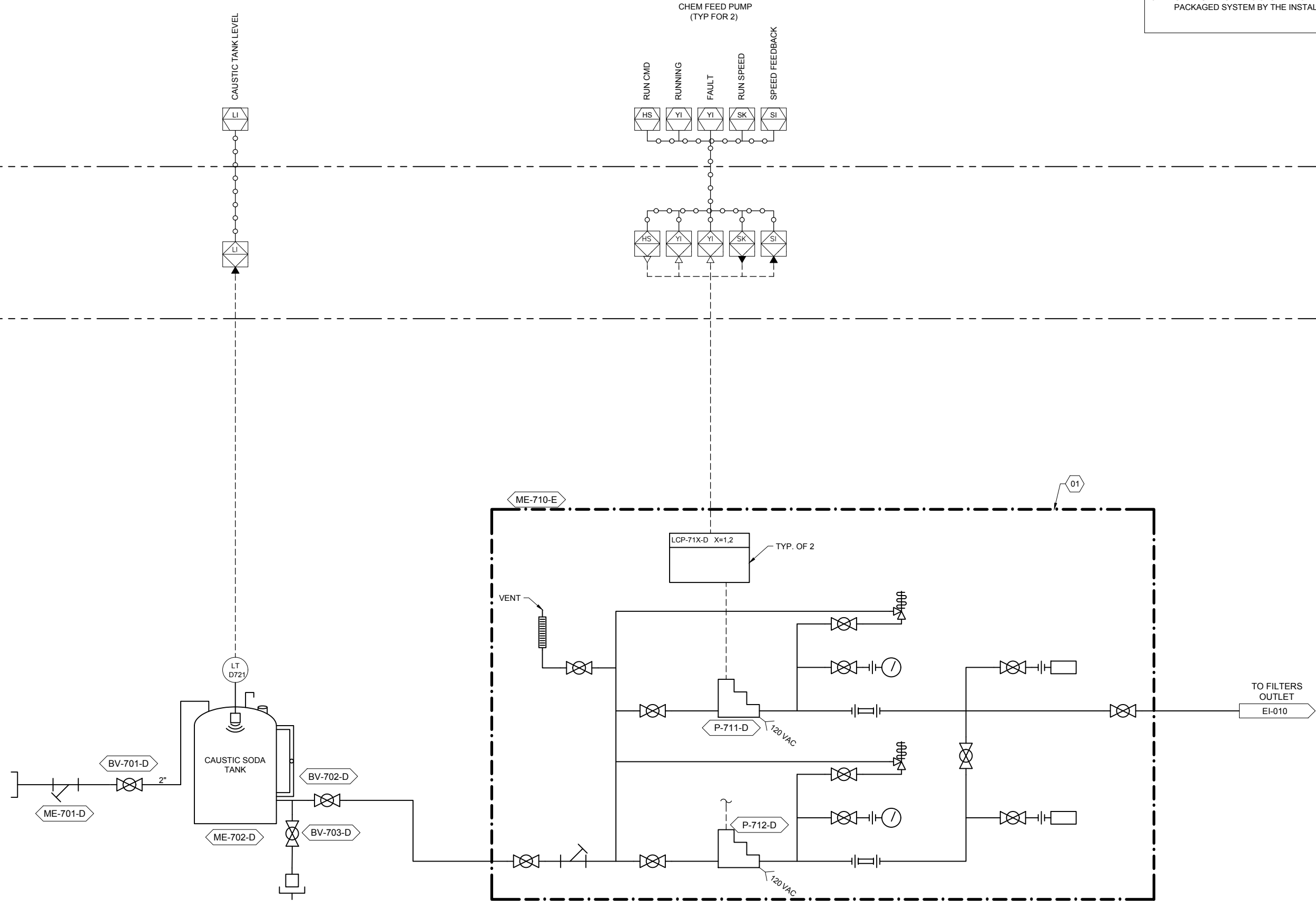
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SCADA

FIELD

PLC-100-E

KEYNOTES
 01 CHEMICAL PUMPING SYSTEM TO BE PROVIDED AS A PACKAGED SYSTEM BY THE INSTALLING CONTRACTOR.



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TERTIARY TREATMENT - P&ID
CHEMICAL ADDITION - CAUSTIC

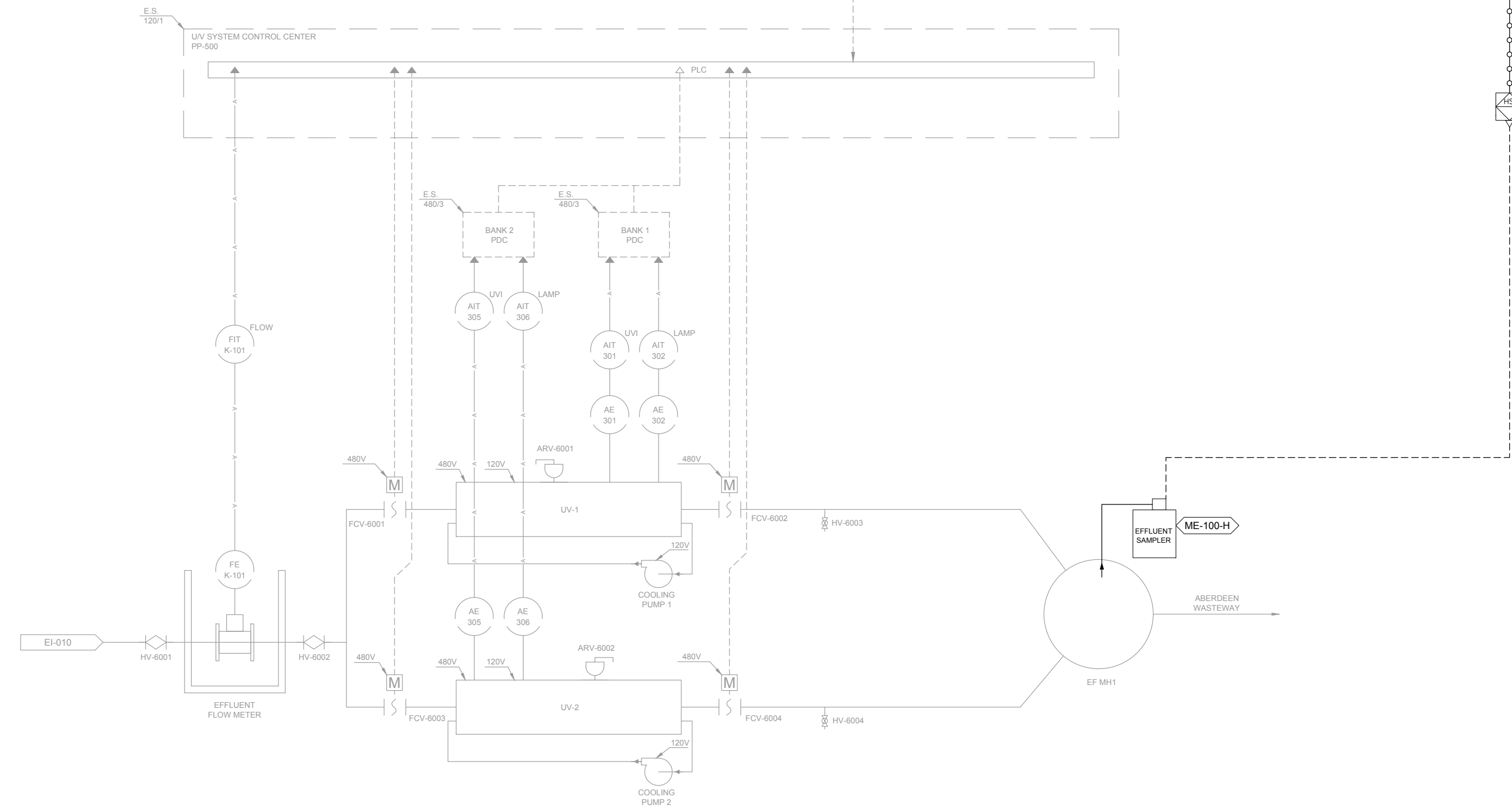
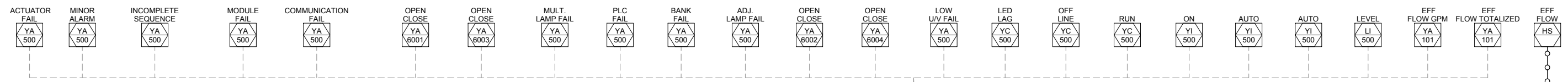
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UV BUILDING - P&ID

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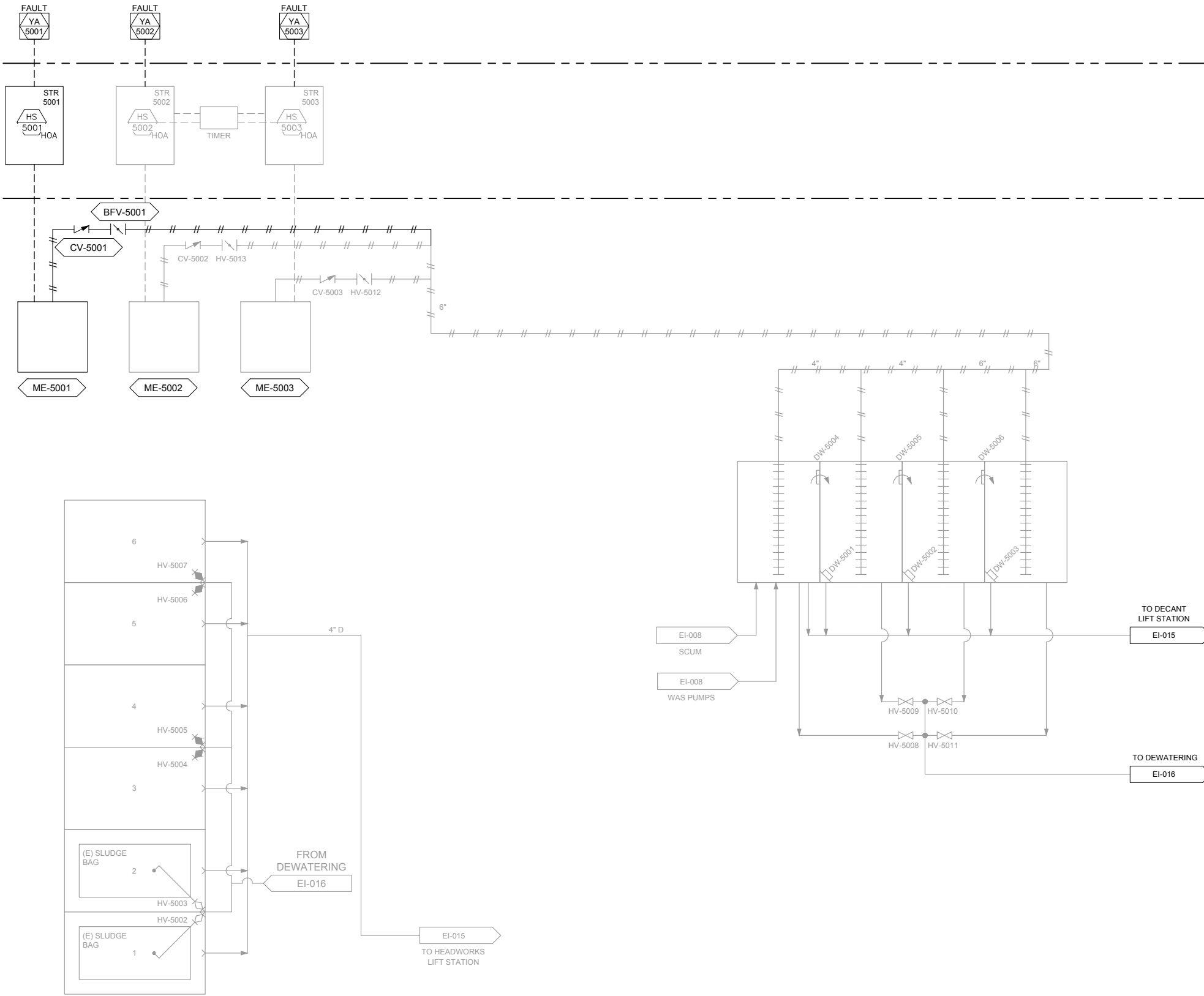
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HEADWORKS ALARM
DIALER

(E) F-MCC-01

FIELD



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DIGESTERS - P&ID

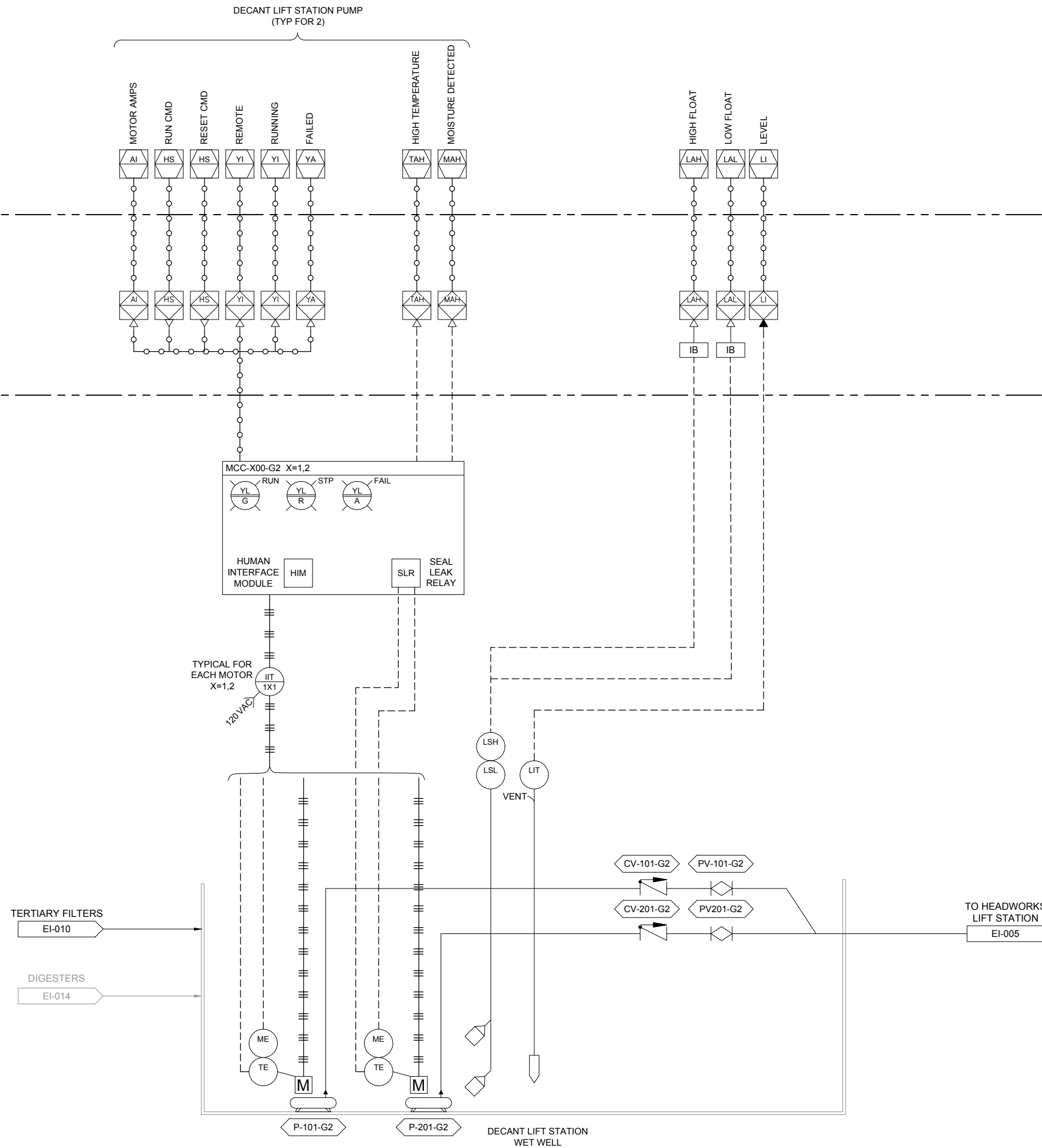
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DECANT LIFT STATION - P&ID

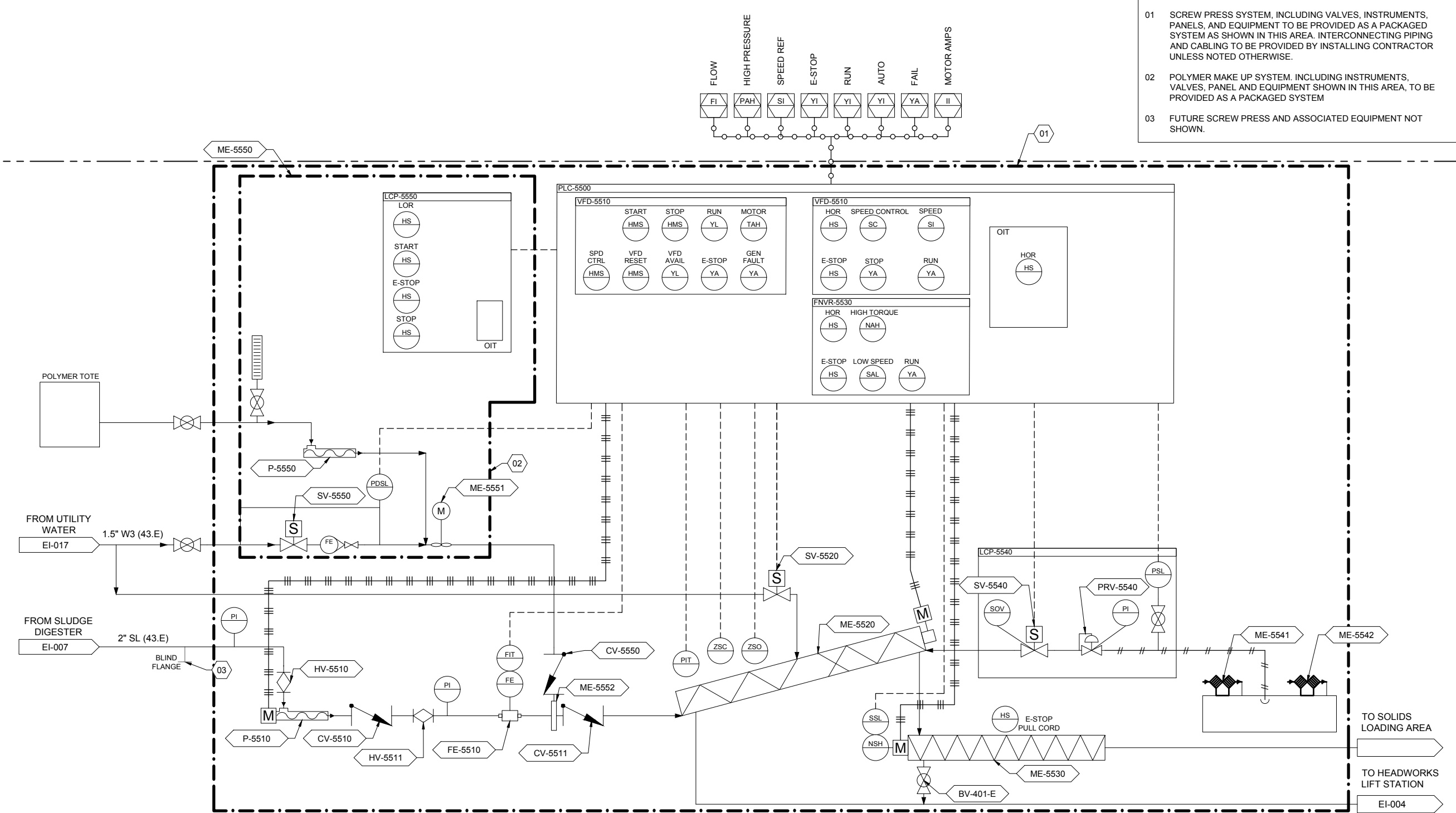
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ABERDEEN WWTP IMPROVEMENTS
DEWATERING BUILDING - P&ID

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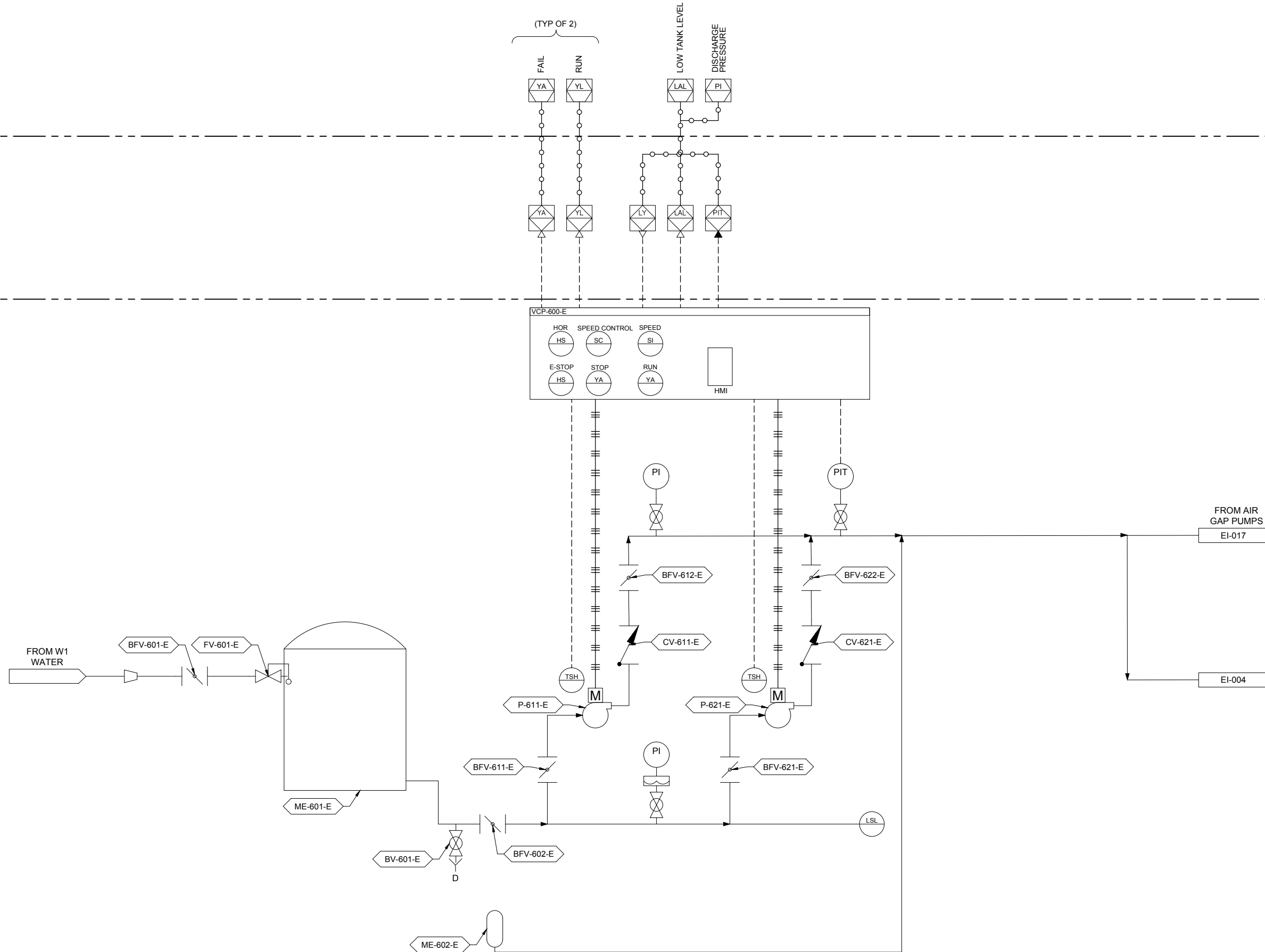
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ABERDEEN WWTP IMPROVEMENTS
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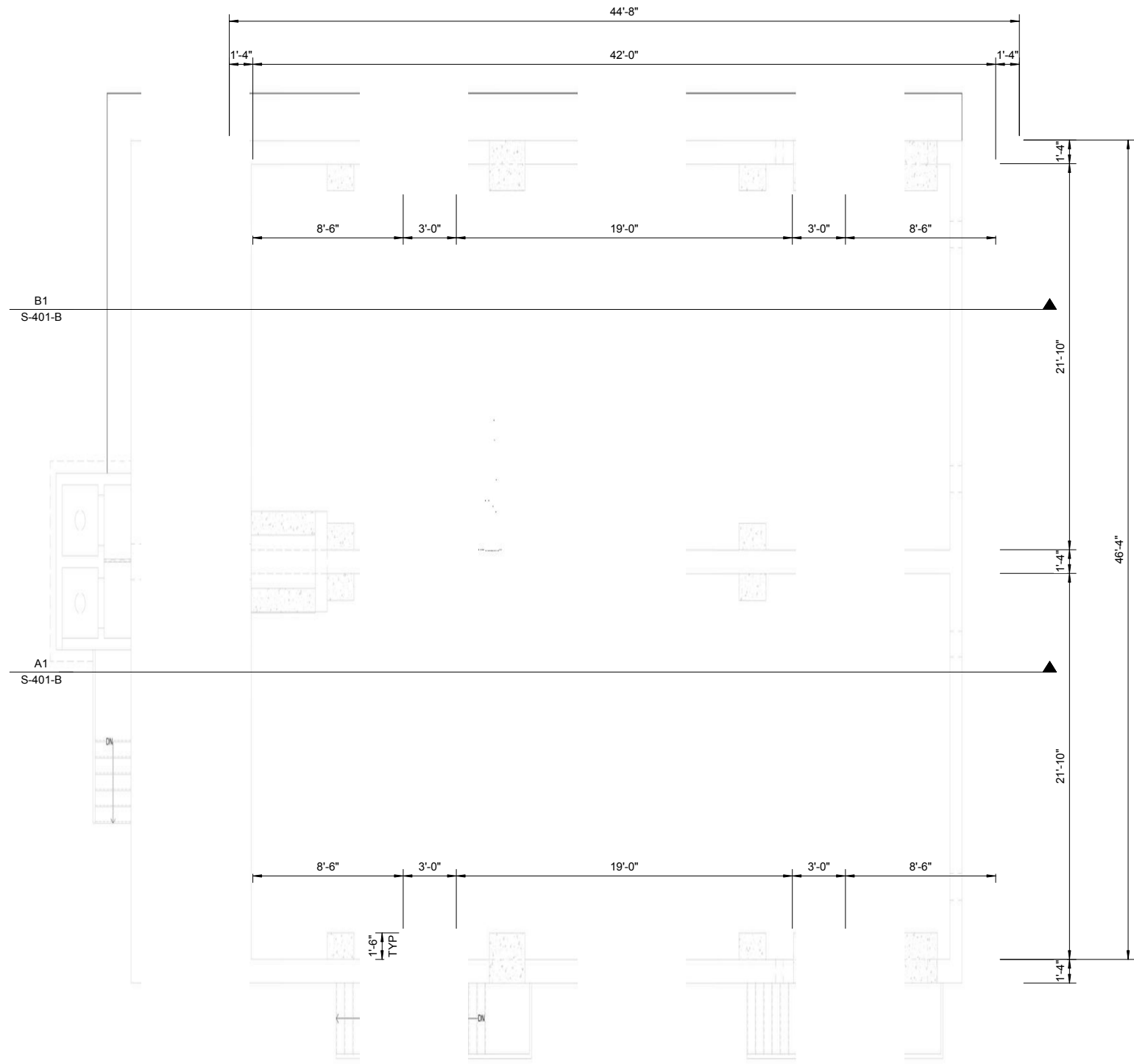
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2/24/2023 10:51:00 AM

A1

EXISTING WALL PLAN

1/4" = 1'-0"



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WASTEWATER TREATMENT PLANT

IFAS - EXISTING PLAN FOR VENDOR

DRAWN: GAI CHECK: -

VERIFY SCALE: Scales based on 22"x34" prints.

1-1/2 Inches

PROJECT NO. 222032 PAGE

SHEET NO.

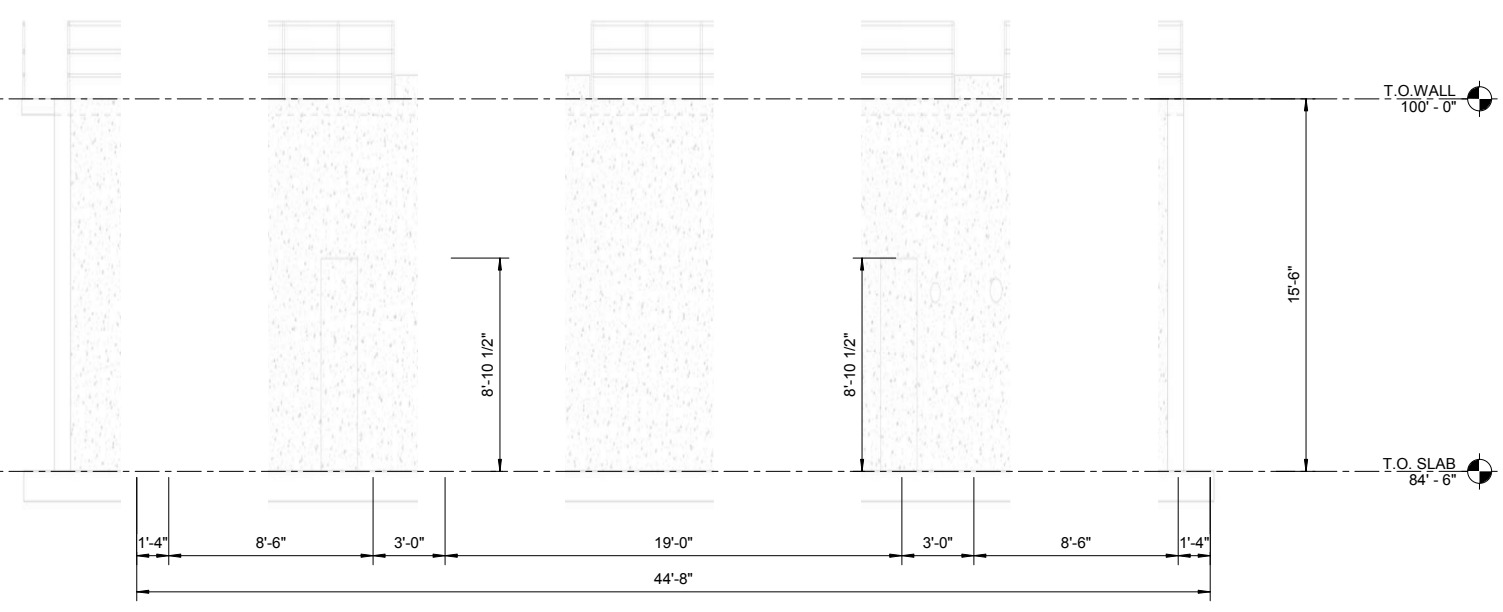
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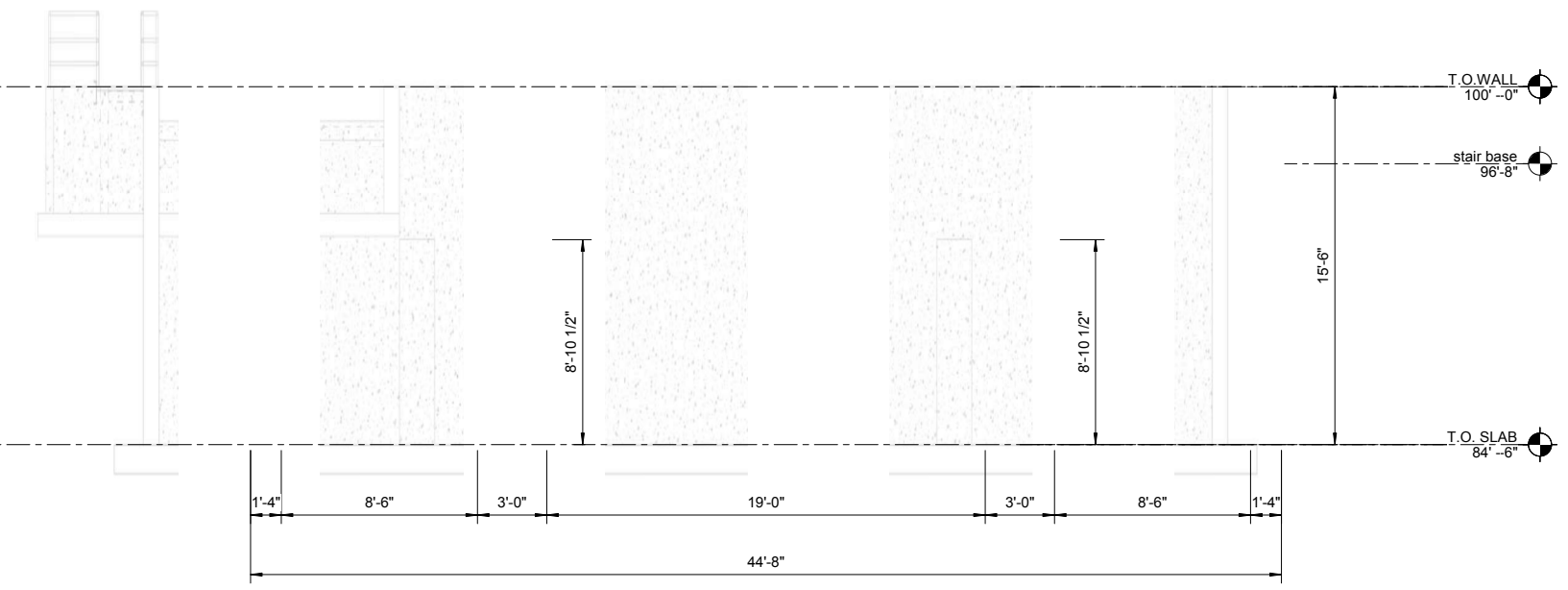
WASTEWATER TREATMENT PLANT
IFAS - EXISTING SECTIONS FOR VENDOR

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VERIFY SCALE: Scales based on 22"x34" prints.	
1-1/2 Inches	
PROJECT NO. 222032	PAGE
SHEET NO. S-401-B	



B1 Section 2
1/4" = 1'-0"

0 2' 4' 8'
1/4"



A1 Section 1
1/4" = 1'-0"

0 2' 4' 8'
1/4"

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APPENDIX C

Tertiary Filters

- C.1 Bid Documents and Contract
- C.2 Equipment Submittal

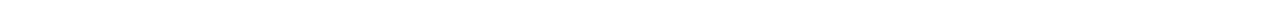


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APPENDIX C.1

Bid Documents and Contract



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BID FORM

PROJECT IDENTIFICATION:

City of Aberdeen - WWTP Equipment Pre-Purchase

ARTICLE 1 - BID RECIPIENT

- 1.01 This Bid is submitted to: **City of Aberdeen, ID**
- 1.02 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into a Contract with Buyer in the form included in the Bidding Documents to furnish the Goods and Special Services as specified or indicated in the Bidding Documents, for the prices and within the times indicated in this Bid, and in accordance with the other terms and conditions of the Bidding Documents.

ARTICLE 2 - BIDDER'S ACKNOWLEDGMENTS

- 2.01 Bidder accepts all of the terms and conditions of the Notice Inviting Bids and Instructions to Bidders, including without limitation those dealing with the deposition of Bid security. This Bid will remain subject to acceptance for 60 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Buyer. Bidder will sign and submit the Agreement with the Bonds and other documents required within 15 days after the date of Owner's Notice of Award herein is received.
- 2.02 Bidder acknowledges that this Contract, if awarded, will be assigned by the Owner to the Installation Contractor, and hereby consents to the assignment under the terms and conditions of the Contract Documents. Bidder accepts that, until the assignment of contract is executed by all parties, the Owner is not obligated to any monetary commitment associated with the Contract beyond that which is associated with Special Engineering Services.

ARTICLE 3 - BIDDER'S REPRESENTATIONS

- 3.01 In submitting this Bid, Bidder represents that:
 - A. Bidder has examined and carefully studied the Bidding Documents, the related data identified in the Bidding Documents, and the following Addenda, receipt of which is hereby acknowledged:

Date	Number	Initials
NA _____	_____	_____
_____	_____	_____
_____	_____	_____

- B. Bidder is familiar with and is satisfied as to all Laws and Regulations in effect as of the date of the Bid that may affect cost, progress, and the furnishing of Goods and Special Services.

- C. Bidder has carefully studied, considered, and correlated the information known to Bidder; information commonly known to sellers of similar goods doing business in the locality of the Point of Destination and the site where the Goods will be installed or where Special Services will be provided; information and observations obtained from Bidder's visits, if any, to the Point of Destination and the site where the Goods will be installed or where Special Services will be provided; and any reports and drawings identified in the Bidding Documents regarding the Point of Destination and the site where the Goods will be installed or where Special Services will be provided, with respect to the effect of such information, observations, and documents on the cost, progress, and performance of Seller's obligations under the Bidding Documents.
- D. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, and discrepancies that Bidder has discovered in the Bidding Documents, and the written resolution (if any) thereof by Engineer is acceptable to Bidder.
- E. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for furnishing the Goods and Special Services for which this Bid is submitted.

ARTICLE 4 - BIDDER'S CERTIFICATIONS

4.01 Bidder certifies that:

- A. This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive agreement or rules of any group, association, organization, or corporation;
- B. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid;
- C. Bidder has not solicited or induced any individual or entity to refrain from bidding; and
- D. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 4.01.D:
 - 1. "corrupt practice" means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process;
 - 2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process to the detriment of Buyer, (b) to establish bid prices at artificial non-competitive levels, or (c) to deprive Buyer of the benefits of free and open competition;
 - 3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Buyer, a purpose of which is to establish bid prices at artificial, non-competitive levels; and

4. “coercive practice” means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process.

ARTICLE 5 - BASIS OF BID

5.01 BID SCHEDULE 1 – BASE BID: WWTP EQUIPMENT. Bidder will furnish the Goods (specifically equipment by vendors listed below) and Special Services in accordance with the Contract Documents for the following price(s). Vendors may provide bids for one or more of the following base bid items. State of Idaho taxes shall not be included (Section P-800 – Supplementary Conditions 5.05.A).

Item No.	Description	Unit	Amount
1A	SUBMITTALS AND SHOP DRAWINGS: As defined in the Agreement, price not to exceed 10% of the Contract price for the work outlined in Item 1B.	LS	\$ 33,675
1B	SAND FILTER SYSTEM consisting of sand filters with all necessary appurtenances and services as described in Section 46 61 27 of the specifications.	LS	\$ 303,075
1A + 1B	TOTAL ITEM PRICE \$ Three hundred thirty-six thousand, seven hundred fifty (In Words)	LS	\$ 336,750

ARTICLE 6 - PRICE ESCALATION

- 6.01 Any selected vendor or vendors will be required to honor their submitted proposal pricing for the Goods and Services for 60 consecutive calendar days from the proposal due date for this RFP.
- 6.02 Where a signed agreement between the City and the manufacturer is not signed within 60 calendar days from the proposal due date, price escalation shall be allowed as follows: Price adjustment will be based on the net change of the ENR Construction Cost Index occurring in the period from 60 consecutive calendar days from the proposal due date to the date when the agreement is signed with the City.

ARTICLE 7 - TIME OF COMPLETION

- 7.01 Bidder agrees that the furnishing of Goods and Special Services will conform to the schedule below. Startup services and training shall be coordinated with the Installation Contractor and Owner but shall not occur more than 21 days after the Vendor has certified the installation of the equipment.

Item	Required Time for Completion (Calendar days from Vendor Bid Award)
Signing of Agreement	30
	Required Time for Completion (Calendar days from completion of Signed Agreement)
Accepted Submittals, including drawings, calculations, and anchor bolt design	75
	Required Time for Completion (Calendar days from Installation Contractor Bid Award)
Assignment of Agreement to Installation Contractor	30
Delivery	212

ARTICLE 8 - ATTACHMENTS TO THIS BID

8.01 The following documents are attached to and made a condition of this Bid:

- A. Information Required of Bidder;
- B. Required Bid Security;
- ~~C. If Bid amount exceeds \$10,000, signed Compliance Statement (RD 400-6). Refer to specific equal opportunity requirements set forth in paragraph 18.10 of the Supplemental Conditions to the agreement with the Contractor who will install the WWTP equipment and to who the City will assign the contract with the Vendor (attached);~~
- ~~D. If Bid amount exceeds \$25,000, signed Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transactions (AD 1048);~~
- ~~E. If Bid amount exceeds \$100,000, signed RD Instruction 1940-Q, Exhibit A01, Certification for Contracts, Grants and Loans.~~

ARTICLE 9 - BID SUBMITTAL

9.01 This Bid submitted by:

If Bidder is:

An Individual

Name (typed or printed): NA

By: _____
(Individual's signature)

Doing business as: _____

Business address: _____

Phone: _____ Facsimile: _____

E-mail address: _____

Partnership

Partnership Name: NA _____ (SEAL)

By: _____
(Signature of general partner - attach evidence of authority to sign)

Name (typed or printed): _____

Business address: _____

Phone: _____ Facsimile: _____


E-mail address: _____

A Corporation

Corporation Name: Nexom (US), Inc.

State of Incorporation: Delaware

Type (General Business, Professional, Service, other): General Business

By: 
(Signature - attach evidence of authority to sign)

Name (typed or printed): Anousch Mathew

Title: General Manager
(CORPORATE SEAL)

Attest _____
(Signature of Corporate Secretary)

Business address: 323 N Spokane Street, Suite 200
Post Falls, ID 83854

Phone: 1-204-949-7500 Facsimile: 1-204-237-0660

E-mail address: anousch.mathew@nexom.com

A Limited Liability Company (LLC)

LLC Name: NA

State in which organized: _____

By: _____
(Signature - attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____

Business address: _____

Phone: _____ Facsimile: _____

E-mail address: _____

A Joint Venture

First Joint Venturer Name: NA (SEAL)

By: _____
(Signature - attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____

Business address: _____

Phone: _____ Facsimile: _____

E-mail address: _____

Second Joint Venturer Name: _____ (SEAL)

By: _____
(Signature - attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____

Business address: _____

Phone: _____ Facsimile: _____

E-mail address: _____

Phone and Facsimile Number, and Address for receipt of official communications to Joint
Venture:

(Each joint venturer must sign. The manner of signing for each individual, partnership, corporation, and limited liability company that is a party to the joint venture should be in the manner indicated above.)

BID BOND

Any singular reference to Bidder, Surety, Owner, or other party shall be considered plural where applicable.

BIDDER (Name and Address): Nexom (US), Inc.
323 North Spokane Street, Suite 200
Post Falls, ID 83854

SURETY (Name, and Address of Principal Place of Business): Liberty Mutual Insurance Company
175 Berkeley Street
Boston, MA 02116

OWNER (Name and Address): City of Aberdeen
33 N. Main Street
Aberdeen, ID 83210

BID

Bid Due Date: May 11, 2023
Description (Project Name— Include Location): Wastewater Treatment Plant Equipment Pre-Purchase
2683 West 1750 South, Aberdeen, ID 83210

BOND

Bond Number: BDTO-480006-023-003
Date: May 3, 2023
Penal sum Five Percent of the Tender Price \$ 5% of the Tender Price
(Words) (Figures)

Surety and Bidder, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Bid Bond to be duly executed by an authorized officer, agent, or representative.

BIDDER Nexom (US), Inc. (Seal) **SURETY** Liberty Mutual Insurance Company (Seal)
Bidder's Name and Corporate Seal Surety's Name and Corporate Seal

By: [Signature]
Signature

By: [Signature]
Signature (Attach Power of Attorney)

ANCUSCH MATHEW
Print Name

Alexandra Derksen
Print Name

GENERAL MANAGER
Title

Attorney-in-Fact
Title

Attest: [Signature]
Signature

Attest: [Signature]
Signature

Title Senior Mechanical Engineer

Title Surety Broker

Note: Addresses are to be used for giving any required notice.
Provide execution by any additional parties, such as joint venturers, if necessary.

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Bidder's and Surety's liability. Recovery of such penal sum under the terms of this Bond shall be Owner's sole and exclusive remedy upon default of Bidder.
2. Default of Bidder shall occur upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.
3. This obligation shall be null and void if:
 - 3.1 Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or
 - 3.2 All Bids are rejected by Owner, or
 - 3.3 Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).
4. Payment under this Bond will be due and payable upon default of Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.
5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions shall not in the aggregate exceed 120 days from the Bid due date without Surety's written consent.
6. No suit or action shall be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety and in no case later than one year after the Bid due date.
7. Any suit or action under this Bond shall be commenced only in a court of competent jurisdiction located in the state in which the Project is located.
8. Notices required hereunder shall be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Registered or Certified Mail, return receipt requested, postage pre-paid, and shall be deemed to be effective upon receipt by the party concerned.
9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.
10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond shall be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute shall govern and the remainder of this Bond that is not in conflict therewith shall continue in full force and effect.
11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.



This Power of Attorney limits the acts of those named herein, and they have no authority to bind the Company except in the manner and to the extent herein stated.

Liberty Mutual Insurance Company

Certificate No: 8206846 - 986100

POWER OF ATTORNEY

KNOWN ALL PERSONS BY THESE PRESENTS: That Liberty Mutual Insurance Company ("the Company") a corporation duly organized under the laws of the State of Massachusetts, USA, pursuant to and by authority herein set forth, does hereby name, constitute and appoint, Alexandra Derksen; Joshua Tytlandsvik; Michael J. Byrne

all of the city of Winnipeg, state/province/territory of MB each individually if there be more than one named, its true and lawful attorney-in-fact to make, execute, seal, acknowledge and deliver, for and on its behalf as surety and as its act and deed, any and all undertakings, bonds, recognizances and other surety obligations, in pursuance of these presents and shall be as binding upon the Company as if they have been duly signed by the president and attested by the secretary of the Company in their own proper persons.

IN WITNESS WHEREOF, this Power of Attorney has been subscribed by an authorized officer or official of the Companies and the corporate seals of the Companies have been affixed thereto this 24th day of November, 2021.



Liberty Mutual Insurance Company

By: David M. Carey, Assistant Secretary

Not valid for mortgage, note, loan, letter of credit, currency rate, interest rate or residual value guarantees.

For bond and/or Power of Attorney (POA) verification inquiries, please call 610-832-8240 or email HOSUR@libertymutual.com.

State of PENNSYLVANIA
County of MONTGOMERY ss

On this 24th day of November, 2021 before me personally appeared David M. Carey, who acknowledged himself to be the Assistant Secretary of Liberty Mutual Insurance Company, and that he, as such, being authorized so to do, execute the foregoing instrument for the purposes therein contained by signing on behalf of the Company by himself as a duly authorized officer.

IN WITNESS WHEREOF, I have hereunto subscribed my name and affixed my notarial seal at King of Prussia, Pennsylvania, on the day and year first above written.



Commonwealth of Pennsylvania - Notary Seal
Teresa Pastella, Notary Public
Montgomery County
My commission expires March 28, 2025
Commission number 1126044
Member, Pennsylvania Association of Notaries

By: Teresa Pastella, Notary Public

This Power of Attorney is made and executed pursuant to and by authority of the following By-laws and Authorizations of Liberty Mutual Insurance Company, which resolutions are now in full force and effect reading as follows:

ARTICLE IV - OFFICERS: Section 12. Power of Attorney.

Any officer or other official of the Corporation authorized for that purpose in writing by the Chairman or the President, and subject to such limitation as the Chairman or the President may prescribe, shall appoint such attorneys-in-fact, as may be necessary to act in behalf of the Corporation to make, execute, seal, acknowledge and deliver as surety any and all undertakings, bonds, recognizances and other surety obligations. Such attorneys-in-fact, subject to the limitations set forth in their respective powers of attorney, shall have full power to bind the Corporation by their signature and execution of any such instruments and to attach thereto the seal of the Corporation. When so executed, such instruments shall be as binding as if signed by the President and attested to by the Secretary. Any power or authority granted to any representative or attorney-in-fact under the provisions of this article may be revoked at any time by the Board, the Chairman, the President or by the officer or officers granting such power or authority.

ARTICLE XIII - Execution of Contracts: Section 5. Surety Bonds and Undertakings.

Any officer of the Company authorized for that purpose in writing by the chairman or the president, and subject to such limitations as the chairman or the president may prescribe, shall appoint such attorneys-in-fact, as may be necessary to act in behalf of the Company to make, execute, seal, acknowledge and deliver as surety any and all undertakings, bonds, recognizances and other surety obligations. Such attorneys-in-fact subject to the limitations set forth in their respective powers of attorney, shall have full power to bind the Company by their signature and execution of any such instruments and to attach thereto the seal of the Company. When so executed such instruments shall be as binding as if signed by the president and attested by the secretary.

Certificate of Designation - The President of the Company, acting pursuant to the Bylaws of the Company, authorizes David M. Carey, Assistant Secretary to appoint such attorneys-in-fact as may be necessary to act on behalf of the Company to make, execute, seal, acknowledge and deliver as surety any and all undertakings, bonds, recognizances and other surety obligations.

Authorization - By unanimous consent of the Company's Board of Directors, the Company consents that facsimile or mechanically reproduced signature of any assistant secretary of the Company, wherever appearing upon a certified copy of any power of attorney issued by the Company in connection with surety bonds, shall be valid and binding upon the Company with the same force and effect as though manually affixed.

I, Renee C. Llewellyn, the undersigned, Assistant Secretary, The Ohio Casualty Insurance Company, Liberty Mutual Insurance Company, and West American Insurance Company do hereby certify that the original power of attorney of which the foregoing is a full, true and correct copy of the Power of Attorney executed by said Companies, is in full force and effect and has not been revoked.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed the seals of said Company this 3rd day of May, 2023.



By: Renee C. Llewellyn, Assistant Secretary



City of Aberdeen WWTP Improvements
Keller Associates Project No. 222032-000
Addenda Reviewed: 0
May 11, 2023



technologies for cleaner water

323 N. Spokane St. Suite 200 · Post Falls ID · 83854
888-710-2583 • www.nexom.com

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Appendix – Drawings, Brochures & Data Sheets

Nexom Regional Manager	Manufacturer’s Representative
Greg Roppelt greg.roppelt@wastewater.com Direct: 239-565-8873 www.nexom.com	Brad Gwinnup W-Cubed INC. bradg@wcubedinc.com Direct 801-821-3770



Value Engineered Cost of Ownership

EXPERIENCE

- Nexom proposes its Blue PRO Reactive Filtration system, validated by decades of operation in dozens of wastewater plants in North America.
- Nexom now has a reference base of over 10,000 filtration, lagoon, and fixed-grid aeration projects. An introduction to Nexom's experience and team is included in this proposal along with filtration data and references. Our filtration technologies have been treating for reuse and nutrients for 25+ years, with 500+ installations.

DESIGN

- The design envelope with required parameters is summarized in this proposal including process metrics, technical specifications and drawings. Drawings illustrate that chemical can be injected in the filter inlet header prior to distribution to filter cells mitigating any flocculation equipment, footprint and associated controls. All other suppliers will be required addition of polymer due to existing intellectual property owned by the University of Idaho, licensed exclusively by Nexom. All royalty fees to the University are included in Nexom's price.

Included Reactive Filtration gives unmatched performance while eliminating the footprint, CAPEX and OPEX of pre-flocculation tanks

- Nexom's filter is shorter than similar upflow sand filters in the industry. Blue PRO filters have higher reactive surface area and shorter media depth for the required performance, saving on facility construction or modification and equipment CAPEX.
- Nexom's AirMaster™ airlift control panel operates the filters autonomously with contacts to customer's plant PLC for headloss and two process alarms.

PERFORMANCE, WARRANTY AND MAINTENANCE

- Nexom includes a **five-year** equipment warranty as part of its base bid.
- Nexom, has staff technicians in Idaho. W-Cubed represents Nexom and has been a manufacturer's service rep in Salt Lake for 30+years. Its team maintains service capabilities and has installed many Nexom & EDI equipment across the USA. W-Cubed is willing, capable and authorized for servicing all Nexom supplied filter equipment.

COST

- No pre-flocculation, polymer storage, polymer preparation, dosing, injection, flocculators, controls/oversight and associated building footprint and CAPEX.
- Reactive filtration design footprint and overall height minimizes civil works and construction costs.

Scope of Work

Nexom Inc. is bidding the scope of work described RFP for Keller Associates Project No. 222032-000 specifically in the SECTION 46 61 27 "UPFLOW MOVING BED FILTER". Addenda Reviewed: 0.

In general, the following major components are included within the scope of supply:

- BluePRO sand filter system
- Air controls and instrumentation.

Included in overall scope of supply:

- System process design, complete with detailed shop drawings
- Process design calculations and full technical submittal
- Installation support for any equipment supplied by Nexom and installed by others
- Operation & Maintenance Manuals complete with as-built drawings.

Design and Supply Only of process equipment for the continuous backwash filtration system.

Sand Filter

- Five (5) pre-fabricated filters CF64-60, each designed for a nominal 60" bed capacity
- Five (5) filters modular cones, CF64, for installation in concrete cells
- Five (5) washboxes with necessary appurtenances
- Five (5) HDPE airlifts
- Five (5) effluent collection boxes, FRP
- One (1) lot, sand media, 40" nominal bed depth, nominal 12-20 sieve
- One (1) headloss sight gauge.

Pneumatic System

- One (1) Gardner Denver compressor system, HR10DF-24; two (2) splash lubricator reciprocating (duplex) compressor heads mounted to an integral 240-gallon receiver
- Refrigerated dryer, RGD35A1FP
- Grade E filtration
- Auto-drain
- Regulator assembly.

Process Instrumentation

- Five (5) filter run level switches, vertical floats, Madison M5600 or equal
- One (1) pressure transmitter E+H PMC21.

Air Control panels

- One (1) AirMaster™ control panel for operation of airlifts, NEMA Type 4X enclosure
 - Headloss indicator
 - Hand-off-auto selector
 - Airburst control
 - Run and alarm status lamp
 - Rotameters for air flow control
 - Pressure regulator and gauges
 - Instrument and alarm status available to SCADA via a terminal strip.

Startup Support

- Up to four (4) trips consisting of up to eight (8) eight-hour days on-site.

Nexom Equipment Documentation

Nexom can provide the following documentation during the project cycle:

- Detailed shop drawings with equipment sizing and general layout for use by installing contractor
- Detailed electrical drawings with panel layouts and small parts BOM's
- P&ID for Nexom supplied equipment
- 3D model of Nexom fabricated major system components (.step/.iges/.x_t)
- Equipment cutsheets for all major off the shelf components
- Digital copy of Nexom's Quality manual
- Recommended spare parts list.

Spare Parts

- One (1) spare Airlift
- One (1) Regulator – Air Control Panel
- One (1) Air Flow Indicator and Control Valve – Air Control Panel
- One (1) Air Filter Element – Air Control Panel
- One (1) Intake Air Filter and one oil change for the air compressor

Exclusions

General

- Receiving/off-loading and secure on-site storage of all equipment and materials.
- Site preparation.
- Building and all civil work required for equipment installation.
- Installation of Nexom supplied equipment.
- All concrete anchors.
- Heat tracing or weather protection as needed.

Equipment

- All piping external to the filter components including effluent piping, influent feed, reject handling and disposal, pneumatic lines and all associated fittings and valves not listed in Nexom scope. Required instrumentation by others is shown on the Nexom P&ID.
- Electrical connections, wiring, and hookup of Nexom provided equipment.
- Dosing equipment external to Nexom supplied skid including; inline chemical injectors (if required), chemical mixing, injection quills, storage and fills.
- Process feed pumps and pump control.
- Flow signal representative of influent feed rate to the filters.

Exceptions

No exceptions taken.

Optional Equipment Scope

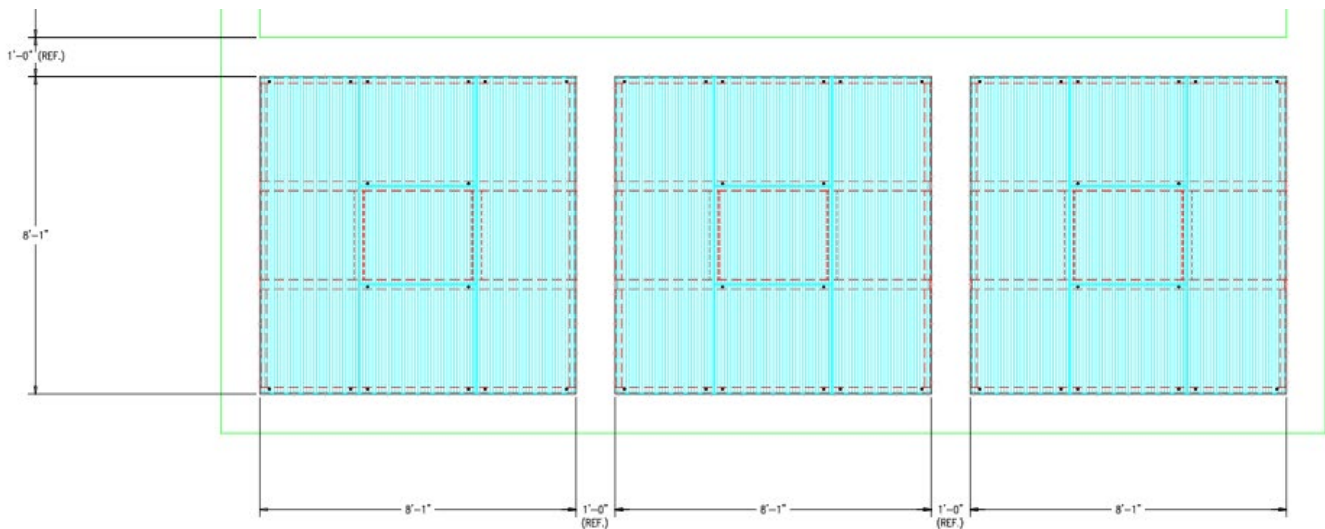
Hydrovane Compressors

Hydrovane compressors are from the same supplier as the reciprocating. The hydrovane has fewer moving parts, operates at a lower dB level and occupies a smaller footprint in comparison. Both have a similar CAPEX.

- One (1) Substitution of VR07PDRHS-1 hydrovane compressor for the reciprocating HR10DF-24 2-stage splash lubricated reciprocating compressor.

Filter Access Covers

- Five (5) Nexom standard aluminum (un-coated) plank covers for filters
 - Aluminum structural members and brackets
 - Includes removable sections for washbox access and service activities
 - A plan view of this standard design is included below (showing 3 of 5):



Chemical Dosing

- One (1) alum dosing system, duty & duty standby peristaltic pump
 - Pre-plumbed on an HDPE back panel with supports
 - PVC schedule 80 plumbing
 - Watson Marlow QDOS60 pump
- One (1) caustic dosing system, duty & duty standby peristaltic pump
 - Pre-plumbed on an HDPE back panel with supports
 - PVC schedule 80 plumbing
 - Watson Marlow QDOS60 pump

- A panel drawing of Nexom dosing system is attached to this bid.

No polymer dosing system is required by Nexom as we are licensed by the University of Idaho to practice reactive filtration.

Inlet Control Valves

- Four (4) single acting pneumatic, spring return control valves for control by Nexom's air control panel, Dezurik BAW,6,F1,CI,EPDN-EPDM,150B,DI-S2*TW-5-PC4.
 - BAW: Style - DeZURIK AWWA C504 3-72"; C516 78" and larger Rubber Seated Butterfly Valve
 - 6: Size - 6 Inch (150mm)
 - F1: End Connection - Flanged, Drilled to ASME B16.1 Class 125/150
 - CI: Body Material - Cast Iron, ASTM A126 Class B
 - EPDN: Packing - EPDM (Terpolymer of Ethylene Propylene and a Diene), Self-Adjusting Multiple V-Ring; -20 to 290°F (-29 to 143°C)
 - EPDM: Seat Material - EPDM (Terpolymer of Ethylene Propylene and a Diene); -20 to 290°F (-29 to 143°C)
 - 150B: Service Class - AWWA Class 150B
 - DI: Disc - Ductile Iron, ASTM A536 Grade 65-45-12 (3" - 24" (80-600mm) Class 150B/250B, 28" - 72" (700-1800mm) Class 25A, 75B & 150B & 28" - 48" (800-1200mm) Class 250B) and Grade 80-55-06 (54" - 72" (1400-1800mm) Class 250B), Type 316 Stainless Steel Seating Edge (3" - 20" (80-500mm) =ASTM A276, 24" and larger (600mm & larger) - ASTM A240)
 - S2: Shaft - 316 Stainless Steel, ASTM A276
 - Coating or Paint: S30SC0 - 8 mils minimum (non-stainless steel parts) of Blue DeZURIK Epoxy (NSF Std. 61) on Interior and Standard (SP10) surface prep AND Blue DeZURIK Epoxy (NSF Std. 61), and on Exterior with Standard (SP10) surface prep TW-5-PC4: Actuator Type - T-Series with Single-acting spring return.
 - Pneumatic Cylinder Operator.

Option Pricing & Delivery

Base Price:	SEE BID FORM
Optional Scope – Hydrovane Compressor Basis	\$0.00
Optional Scope - Filter Access Covers	\$123,400.00
Optional Scope – Chemical Panels	\$21,200.00
Optional Scope – Inlet Control Valves	\$46,052.00

- Includes filtration equipment and documentation as described above.
- Includes freight and services for delivery FOB Jobsite.
- Payments: with PO 10%; Submittal Approval and Notice to Proceed 10%; with Equipment Delivery 75%; Commissioning 5%.
- All pricing excludes applicable taxes. Pricing is valid for 60 days.

Shop drawings / submittals would be completed within 5 weeks after confirmation of order (priority shop drawings provided earlier). Equipment lead times are expected to be 14-18wks from submittal approval. Shipments may be staged as completed by vendor(s). All deliveries to arrive by timeline above.



O&M Cost (20-year Present Worth)

TRAINING

Nexom will provide a certified field technician to complete the Installation Training, the Operator Training, and the Maintenance Training programs for the onsite staff. The trainer will be a Nexom employee with a minimum of 5 years' experience with the filtration products.

Operator Training will consist of one (1) day with the first half being held in a classroom, and the second half completed in the field with the filter system. Classroom sessions will be approximately four hours with a presentation and videos given. Nexom will provide the necessary handouts and literature to the attendees. A suitable space and video recording (if required) is to be provided by the customer. Topics covered will include at a minimum:

- Safety
- Operation
- Troubleshooting
- Preventive and corrective maintenance
- Parts
- Local representatives

Maintenance Schedule

Follow all safety procedures outlined in the Filter O&M section when performing any maintenance.	Daily	Weekly	Bi-Weekly	Monthly	Semi-Annually	Annually
Air Control Panel						
Verify regulator pressure is 40 PSI	•					
Adjust and monitor airflow to the filter(s)	•					
Verify airlift pressure is within proper range for each filter	•					
Replace air coalescing filter element						•
Control Panel						
Verify operation	•					
Monitor for faults	•					
Filter System						
Verify headloss pressure is within proper range for each filter	•					
Verify proper pumping action of sand from the airlift(s)	•					
Adjust the reject weir(s) as needed				•		
Perform bed turnover measurements				•		
Remove and inspect the airlift for wear					•	
Inspect the airlift screen for plugging					•	
Remove and inspect the deflector cap for wear					•	

An annual oil change and service of the pneumatic system is recommended. This can be performed by operators or by a compressor service group (recommended). That service cost would encompass the oil change and air filtration maintenance.

PRESENT WORTH (20-YEAR)

POWER COSTS		*Electrical Rate: 0.1 \$/kW-h						
	Quantity	Power at FLA		Duty kW	Monthly kWh	Monthly cost	Period # months	Annual Cost
		bhp	kW					
Duty compressor motor	1	10	7.5	2.3	1666	\$167	12	\$1,999
Air dryer	1	-	0.21	0.2	153	\$15	12	\$184
PLC and controls	1 lot	-	< 0.25	0.25	183	\$18	12	\$219

ESTIMATED DUTY RUN TIME FOR COMPRESSOR MOTORS

Compressor air capacity FAD, ACFM	34.7
Air required for all filters, ACFM	26.5
Operating demand, all filters	76%
Duty demand, two-filter average	31%

The compressor system uses an alternating dual head compressor, with ancillary equipment described in the P&ID. At max filter air demand, the compressor is under the recommended 80% duty. Nexom has allowed for control of air-actuated filter inlet valves (supplied by the GC). This allows the plant SCADA to duty-cycle filter cells (similar to a pump station) to meet plant flow demands, which leads to significant power savings over time. On average the design flows will demand two filters online to meet treatment

goals. This ability to cycle down to on the required number of filters online automatically will also minimize the backwash produced by the filter system.

The compressor system draws the bulk of the power for the filter system. Other subsystems that draw power to support the completely automated filter operation are detailed above.

The operator labor required to operate the filter system is included the following table:

OPERATOR LABOR

	Annual Hours	Rate \$/h	Annual Cost
Annualized daily 10-minute rounds	60.8	\$75	\$4,563

An annual oil change and service of the pneumatic system is recommended. This can be performed by operators or by a compressor maintenance service group (recommended). That service would encompass the oil change and air filtration maintenance, and the cost of typical service contracts is included in this exercise. Airlifts are the only other consumable filter component. Nexom is proud to include its HDPE airlift design, which has a 10+ year life and is used in other installations in Idaho. Filter media is not a consumable with Nexom’s Blue PRO filter design. Most installations operate 20+ years without changing or adding to the installed media.

PARTS & SERVICE

Maintenance Interval	Pneumatics	Airlifts	-
Part/annual service	\$500	\$1,800	-
Annual	1	-	-
5-year	-	-	-
10-year	-	5	-
20-year	-	-	-
Annualized	\$500	\$450	\$950

Nexom’s AirMaster™ air control panel and PCN to the integrator provides for fully automated filtration system. All typical maintenance tasks will be covered by the average 10-minute daily rounds. Even airlift inspections and replacement take less than 10 minutes as training will demonstrate.

The estimated chemical consumption is presented in the following table:

ESTIMATED CHEMICAL USE PROJECTIONS

Assumes 2:1 Al:P mole ratio	Daily gal	Cost per gal	Monthly Cost	Annual Months	Annual Cost
Alum, 50%, gal/d	24.4	\$1.25	\$914	12	\$10,966

The estimated chemical storage is summarized as follows:

CHEMICAL STORAGE PROJECTIONS

Days of storage required	40
Reserve factor, %	15%
Storage capacity, Alum, 50%, gallons	1,121

Chemical use calculations are based on Nexom’s experience with phosphorus removal projects.

Nexom is also the exclusive licensee of reactive filtration patents, so we can incorporate the efficiencies of direct chemical injection, eliminating the need for upstream flocculation.



Nexom's design allows for in-pipe chemical injection and mixing in the inlet header prior to flow distribution to the filters. Nexom used a 2:1 Al:P mole ratio using alum having a 4.5-5% aluminum concentration. Using a high basicity PAC can reduce chemical volumes and overall costs, including minimizing onsite storage space. Nexom can provide further details in the submittal process.

The projected 20-year present worth is summarized as follows:

20-YEAR LIFE CYCLE COST

Assumed life, n, years	20
Assumed power draw at average conditions, p, kWh	24019
Average Energy Cost, c, \$/kW	0.1
Interest rate, i	3.5%
Assumed annual chemical & maintenance, m, \$	\$16,478
Est. PW Factor	14
CAPEX, delivered	See Bid Form
Estimated Energy Cost	(\$34,137)
Estimated Maintenance Cost	(\$234,193)
Estimated 20-year Life Cycle Cost (+Bid Price)	(\$268,331)

Given
 Calculated Est. PW Factor $\left[\frac{(1+i)^n - 1}{i(1+i)^n} \right]$
Given
Given
 Sum of *Parts & Service, Operator Labor and Estimated Chemical Use*
Given, calculated
 =p x c x 8,760 x Est. PW Factor
 =m x Est. PW Factor
 CAPEX, delivered + Estimated Energy Cost + Estimated Maintenance Cost

Nexom's Experience

New effluent regulations have exposed the limitations of existing technologies, in particular, those related to nutrient removal. Nexom design and supplies the next wave of **proven technologies for cleaner water**, helping engineers and operators confidently meet or exceed those objectives.

Nexom is part of the Axiom Water Platform which is majority owned by the KKR Global Impact fund. The Global Impact fund is committed to ESG (Environmental and Social Governance) around the world.

With the recent acquisitions of Environmental Dynamics International (EDI) and ATAC Solutions (UK), Nexom is now part of a team of more than 300+ employees primarily spread across offices in Canada, United States and the UK. Nexom and affiliated companies have a reference base of greater than 10,000 projects including biological systems, filtration and aeration.

Martin Hildebrand (Nexom founder and CEO) brings 25 years of technical and executive experience to the group.

More than simply an equipment manufacturer, Nexom serves consulting engineers, municipalities, and industrial clients with a focus on moving projects forward smoothly and efficiently.

Our vision is for every drop of wastewater in North America to meet the highest nutrient standards at the lowest possible energy footprint. As Nexom, we ensure all wastewater plant operators sleep easy at night through a relentless commitment to proven innovation, best in class employees and customer service.



Nexom is the exclusive supplier of Blue PRO[®] reactive filtration, **which has served the industry starting with its first installation in 2005**, a simple and powerful tool for meeting low phosphorus or metals limits. The Blue PRO uses a patented reactive filtration process in a continuous-backwash media filter to achieve the industry's lowest phosphorus and metals levels with unmatched efficiency. The Blue PRO process described in this proposal allows you to:

- Meet Total Phosphorus limits
- Reduce plant chemical usage volumes
- Eliminate high-rate media backwashes
- Eliminate replacement/loss of media.

Nexom has a 25-year history of developing wastewater treatment process equipment and performing continuous improvement on existing technologies.

- SAGR[®] process, BioPorts[™] MBBR
- Five generations of optAER[®] lagoon aeration diffusers
- Blue PRO[®] ultra-low phosphorus removal filters
- Cloth Media Filter.

Our team of highly skilled process engineers, project managers and field service personnel is looking forward to working with you and your client to meet its wastewater treatment objectives.



- Our filters have been treating for reuse and nutrients for over 25 years, with 800+ installations
- Our filter team is the main disk filter supplier and integrator for municipal water utilities in the UK
- We have installed nearly 100 cloth media filters in North America for reuse and nutrients and the UK as part of the UK-wide AMP7 phosphorus initiative
- Nexom's facilities in Manitoba and Missouri provide integration, controls, programming and spare parts for all filter projects.
- Nexom manufactures the Mita filter in the Midwest.

Individual Experience: Key Personnel

Key areas of responsibility to ensure a successful project include design, contract administration, project management, shop fabrication, construction, and aftermarket.

Applications Engineering personnel are responsible for the process design concept, process sequence, equipment sizing, process optimization, and process modelling. They are responsible for reviewing client-provided design information and integrating process equipment capabilities and final treatment requirements.

Engineering personnel are responsible for process design and detailed engineering including complete system design, shop drawings, technical material submittals, and technical support for commissioning and field personnel.

Project Management personnel are responsible for project coordination, material management, construction schedule, contracts, bonding and insurance, and commissioning. They act as a liaison between field staff and the general contractor, owner, and consulting engineer, ensuring that key participants work collaboratively towards project objectives and targets.

Applications Engineering

The Applications Engineering team has primary responsibility for design communication between Nexom and the consultant or end user. Led by industry veterans **CJ Strain, P.E.**, Merle Kroeker, P.Eng., Dr. Tanner Devlin, P.Eng. and Dr. Damian Kruk, it is their job to assess the available site data to recommend appropriate technologies to meet the project treatment / reuse goals. With over 100 years of combined experience in wastewater treatment design and implementation, the Applications team helps the end user select a process that is appropriate for the scale, climate, and final effluent quality needs of the site.



Working with a North America-wide network of manufacturer's sales reps and regional sales managers, the Applications team designs and implements treatment solutions for 50+ major projects annually. After projects are completed, our Applications and Aftermarket teams remain available for on-going project analysis and operation support.

Engineering

Nexom's Engineering team is responsible for process design and detailed engineering including complete system design, shop drawings, technical material submittals, and technical support for commissioning and field personnel. Led by Engineering Director **Lionel Ens, P.Eng.**, a twenty-year veteran of Nexom who himself has engineered hundreds of wastewater treatment plant upgrades, our Engineering team is driven to get every detail right to ensure consultants and operators can sleep easy at night knowing the plant will be in compliance.



Project Management

Project Management personnel are responsible for project coordination, material management, construction schedule, contracts, bonding and insurance, and commissioning. They act as a liaison between field staff and the general contractor, owner, and consulting engineer. Leading this crucial team is **Lloyd Vasquez**, Nexom's Manager of Project Operations. Along with his dedicated team, Lloyd brings with him a long track-record of ensuring projects are completed on time and within budget.



Experience Summary

Name	Responsibilities	Department	Experience
CJ Strain, P.E. (ID, OH)	Product Manager	Applications	20+ years
Merle Kroeker, P.Eng.	Process design	Applications	15+ years
Lionel Ens, P.Eng.	Detailed system design	Engineering	20+ years
Dan Kaethler, P.Eng.	Lead mechanical design	Engineering	10+ years
Todd Hansen, PMP	Operations Manager	Project Mgmt	20+ years
Lloyd Vasquez, PMP	Project Operations Manager	Project Mgmt	10+ years

Project Phases and Implementation

Our project development and delivery process is designed by engineers, for engineers.

Basis for Design. Nexom's staff will help walk you through the details we need and help review design information. Our highly experienced team is familiar with hundreds of installations, and we use our experience to your benefit.



Design Support. Engineers receive design support throughout the project life, from feasibility studies to detailed design. Our engineers work with you to identify the solution to your water and wastewater treatment requirements.



Exclusive Technologies. Nexom's exclusive technologies set projects apart, and are delivered to site on time, ensuring the project is on schedule. Nexom personnel commission every installation, assuring clients that our technologies work.



Never Worry About Your Effluent Limits Again. Nexom stands behind every installation, long after the shovels and hardhats have left. Our support team ensures our technologies exceed expectations, and that operators are equipped with the knowledge and tools they need to keep it that way.



Nexom's business model is based on **collaborative project development and delivery** with engineering consultants throughout North America.

Our typical project design process begins with a outlined project scope. As the major technology supplier Nexom can provide end-to-end visibility of project risks and opportunities through the validation phase.

Daily "campfire" group huddles within the Applications and Engineering departments help to align priorities for preliminary design proposals and detailed project document preparation. Weekly project production meetings with representation from Engineering, Project Management, Procurement, and Field Services ensure that projects are delivered smoothly and collaboratively.

Internal Design Collaboration



Nexom personnel from various departments are regularly involved from the beginning of projects to select appropriate technologies and determine feasible construction / installation methods. With an emphasis on Nexom's Core Value of **"No Silos, no Egos"**, we can develop a preliminary plan with accurate cost estimates, firm schedules, and optimized technology by integrating diverse project perspectives.

The integrated approach to project proposals and planning extends to costing and accounting as well. The estimates generated during bid preparation flow directly into our accounting and project management software, to ensure continuity of financial controls as the project is implemented. All the costing and budgeting tools used during the preliminary phases of the project are regularly vetted with actual costs, "closing the loop" from our Project Management and Procurement departments. Firm costs and schedules allow us to manage risk and implement our Core Value of **"Doing What We Say"** – we rarely need to ask for extensions or change orders to achieve project goals.



Once projects proceed to the construction phase, a single Project Manager takes ownership and sees the project through to completion. Any discrepancies that arise during the fabrication and installation phases of the project are brought back to Applications and Engineering for review and correction as the project proceeds. Lessons learned are recorded and incorporated into design standards for future projects. This aligns with our Core Value of **"Relentlessly Doing the Little Things Right"**.

External Collaboration

Together with a wide variety of engineering consultants, Nexom prepares hundreds of treatment system proposals per year. These proposals are developed using the Nexom Core Value of **"Seeing through the Client's Eyes"**. By investing time early in the project development phase to clearly understand the client's priorities and values, Nexom is able to propose the right system for the right client. This collaboration takes place through a variety of means, including face-to-face meetings, telephone / electronic communication, and on-line collaboration tools such as Teams.



Nexom's Philosophy of Quality & Safety

Nexom is committed to delivering quality products, services, and support in all aspects of wastewater treatment projects. In order to accomplish this goal, the company provides essential resources (human, technological, financial) for the implementation and control of quality. Responsibilities and authorities for quality apply and are assigned to all employees, as well as to specific positions and individuals within the existing organization structure. Regulatory authority and other requirements that apply to Nexom are known, understood, and managed.

Customer satisfaction results from the effective application of a quality control plan, including processes for continual improvement and the prevention of non-conformances. Nexom's filters are manufactured in an ISO 9000/9001 facility. Success depends on understanding and satisfying the current and future needs and expectations of customers. Customer satisfaction is monitored by the evaluation of information from the customer as to whether or not the customer's requirements have been met.

The Nexom Safety, Health and Environment Program is designed in the best interests of all personnel, customers, subcontractors and visitors. Nexom believes that hazard identification and control and efficient production go hand in hand. Under no circumstances will safety and health matters be compromised in favor of production. Accordingly, Nexom insists on the dedicated participation of all for its success.

"...Nexom is committed to providing and maintaining a safe, healthy and secure work environment, for all of its employees. Through the use of a comprehensive safety and health program, Nexom's objective is to provide top quality service while taking all reasonable steps necessary to prevent injury to employees, Nexom customers, and the public; and to prevent damage to property and the environment..."

Nexom's quality program has been approved by multinational organizations such as Teck Coal, AECOM, Stantec, B&V, CDM SMITH, Keller, WSP, Brown & Caldwell, and Bechtel among many others.

Research and Development

Nexom's commitment to quality starts with having the right people in required roles. Nexom has a strong team of engineers and scientists, led by some of the most capable professionals in the industry, committed to using state-of-the-art computer aided modeling. Nexom extends options for bench or pilot studies of its filtration products under the supervision of its technical team, supported by Nexom project management and adhering to the commitments of Nexom's Quality Program.

Tanner Devlin PhD, Senior Applications Engineering. Dr Devlin received his Doctor of Philosophy in Civil Engineering (PhD C.E.) from the University of Manitoba, Canada. He has 10+ years' experience in water and wastewater treatment system design and process modeling focusing on MBBR, IFAS and solids separation technology development. Dr Devlin's specific areas of expertise include:



- Detailed design of water and wastewater treatment equipment and processes
- Design tool / process modeling development
- BioWin™ software modeling of water and wastewater treatment equipment.

Damian Kruk, PhD, Senior Applications Engineering. Dr Kruk received his Bachelor's and Master's degrees in environmental engineering from Poznan University in Poland. He received his Doctor of Philosophy in Civil Engineering (PhD C.E.) from the University of Manitoba, Canada. He has 10+ years' experience in engineering and consulting, having most recently worked for AECOM, consulting for the City of Winnipeg and Salt Lake City among others before joining Nexom's team. Dr Kruk's specific areas of focus include:



- Detailed design of water and wastewater treatment equipment and processes
- Design tool / process modeling development

BioWin™ software modeling of water and wastewater treatment equipment.

References

Nexom's first continuously backwashing sand filters date to the mid to late '90s. **The first full-scale reactive filtration installation was a 0.5 MGD R&D facility in Hayden, Idaho**, and it achieved less than 0.01 mg/L TP within its first full year of operation. Since then, the technology has been implemented at **100+ sites through North America**. Multiple references are included in this proposal.

Nexom has commissioned multiple Blue PRO systems that have phosphorus, copper and/or other trace metal requirements in states including Idaho, Montana, and many nearby states.

A **partial installation list** is included in the following pages.

Gooding, ID

- In construction
- Average Daily Flow 0.29 MGD
- Peak Day Flow 0.91 MGD
- Address: 1775 South 1800 East, Gooding, ID 83330
- Contractor: Joeti Klein jklein@gseconstruction.com
- Phone 925-425-9191

Holmen, WI

- 2021 Startup
- Average Daily Flow 0.558 MGD
- Peak Hour Flow 2.14 MGD
- **Single-stage Contracted: < 0.075 mg/L TP**
- Address: 650 Remus Road, Holmen, Wisconsin 54636
- Doug Johnson 608-397-3694



Bloomer, WI

- 2021 Startup
- Average Daily Flow 0.369 MGD
- Peak Daily Flow 1.42 MGD
- **Single-stage Contracted: < 0.075 mg/L TP**
- Address: 2431 Chippewa Road, Bloomer, WI 54724
- Bill Miller 715-568-2424 ext. 1



Beloit, WI, Alliant Energy

- 2020 Startup
- Average Daily Flow 0.6 MGD
- Peak Hour Flow 0.65 MGD
- **Single-stage Contracted: < 0.05 mg/L TP**
- Address: 935 W B R Townline Road, Beloit, WI 53511
- Rob Moline 612-743-3161



Belmont, WI, Lactalis, Corp

- 2013 Startup
- Designed and installed by McMAHON
- Average Daily Flow 0.79 MGD
- Peak Daily Flow 1.12 MGD
- **Contracted: < 0.075 mg/L**
- Address: 218 S. Park St., Belmont, WI 53510
- Operator: Rob Winter 608-642-0608



Burrillville, RI

- 2017 Startup
- Average Daily Flow 1.5 MGD
- Peak Daily Flow 4.5 MGD
- Single-stage Contracted: < 0.07 mg/L TP,
< 8 µg/L Cu
- Address: 141 Clear River Dr, Harrisville, RI 02830
- Superintendent: Michael Emond 401-568-6296



Citronelle, AL

- 2015 Startup
- Average Daily Flow 0.4 MGD
- Peak Daily Flow 0.76 MGD
- Contracted: < 0.022 mg/L TP
- Address: 18820 S 5th Ave, Citronelle, AL 36522
- Operator: Bud Smith 251-331-0341



Liberty Hill, SC - Nosoca Pines Ranch

- 2011 Startup
- Average Daily Flow 0.02 MGD
- Peak Daily Flow 0.04 MGD
- **Contracted: <0.06 mg/L TP**
- Address: 2990 Singleton Creek Road, Liberty Hill, SC, 29074
- Operator: Allen Greaves 803-235-0199



Lincoln, AR

- 2013 startup
- Average Daily Flow 0.5 MGD
- Peak Hour Flow 2.3 MGD
- Single-stage Contracted: < 0.5 mg/L TP
- Address: 1500 N Fox Hunter Rd, Fayetteville, AR 72701
- Operator: Johnny Dement (479) 824-2585

Grangeville, ID

- 2013 Startup
- Average Daily Flow 0.63 MGD
- Peak Daily Flow 1.02 MGD
- Contracted: <0.067 mg/L TP; being achieved single-stage
- Address: 174 Airport Road, Grangeville, ID 83530
- Operator: Mike Tackett (208) 451-4673

International Falls, MN

- 2013 Startup
- Average Daily Flow 3.2 MGD
- Peak Daily Flow 4.7 MGD
- Single-stage Contracted: <0.1 mg/L TP pending; <6 ng/L Hg
- Address: 1412 US-71, International Falls, MN 56649
- Operator: John Harris (218) 244-8255; (218) 283-9388
- Featured in: Beutel et al (2019). Mercury removal from municipal secondary effluent with hydrous ferric oxide reactive filtration. *Water Environment Research* 91: 132–143

Product Support

What Sets Nexom Apart?

Value-driven solutions. Nexom's team of application and design engineers have worked relentlessly to develop reliable, simple to operate, and intensified solutions to nutrient and metals removal, TSS polishing and Class A reuse. Our team takes it one step further and ensures that the configuration of each installation has been optimized to provide value to the end user. Nexom does this by designing each project to satisfy site specific constraints while considering what is important to end users, such as capital and operational costs, footprint, quality of construction, and availability of service.

Responsive service and technologies. Our team strives to make our customers' lives easier by providing responsive service, with design support and drawings that keep projects on track. Nexom's team of professional staff ensures that each project proceeds as planned and suits the unique needs of each client. Our portfolio of proprietary technologies is responsive as well, focused on addressing contaminants and nutrients that regulators are targeting today and in the future.

Research and performance. We only promise what we have proven we can reliably deliver. We can provide years of data from dozens of full-scale installations, have been approved by the most rigorous regulators on the continent, and have the testimony of recognized academic authorities. All this, to give you the confidence that what we supply will work.



Maintenance and Technical Support

Nexom and Axius Water affiliated companies operate from engineering and production facilities in Columbia, Missouri, Winnipeg, Manitoba, and Maidstone, UK, as well as satellite engineering and sales offices. **Design engineers and service personnel are available in all locations year-round for process and equipment questions and troubleshooting.**

Nexom strives to maintain good relationships with the operators of all our project sites. Our design engineers are available for review and analysis of operating data at any time, free of charge.

Field technicians specialize in equipment startup and troubleshooting. On-site consultations can easily be arranged, if required, to assist with process or equipment troubleshooting.

Value-Added Services

Process Optimization

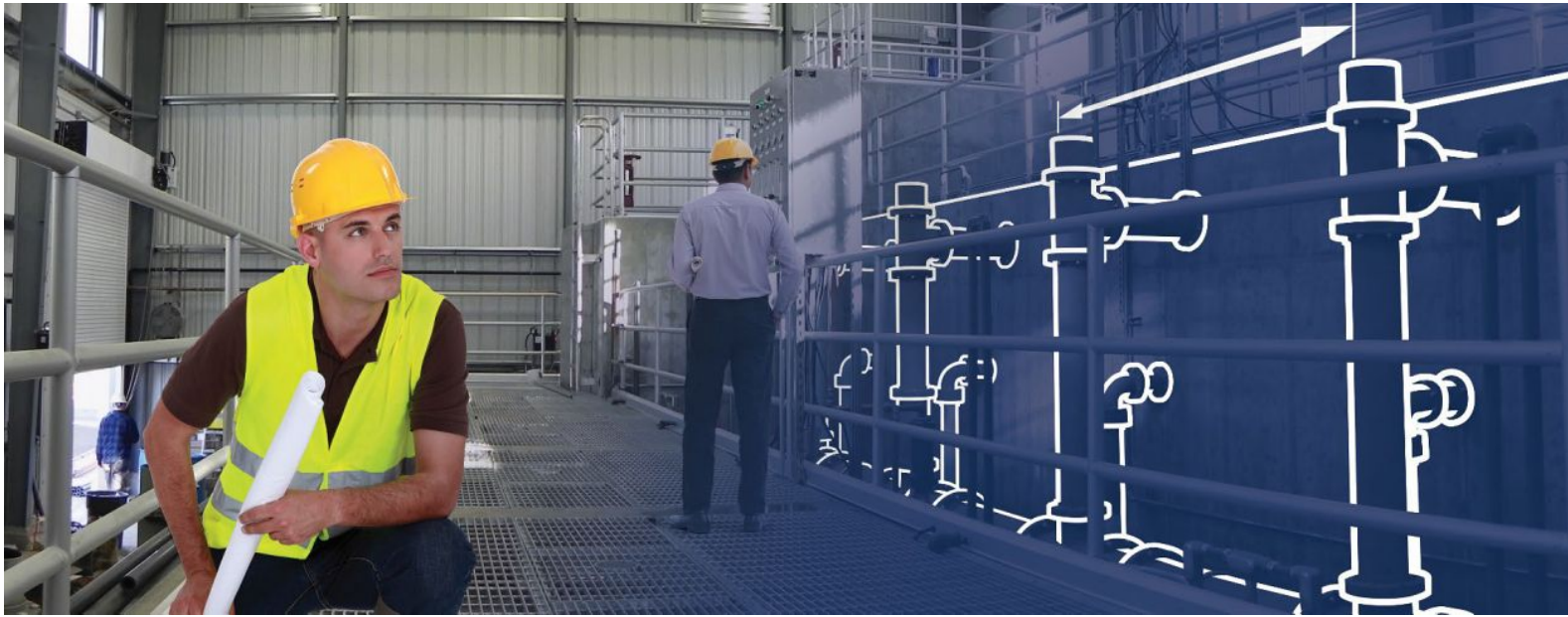
Nexom's Research and Development team, as well as the field technicians, are well-versed in process optimization. Communication between instrumentation and control systems can be assessed, and plant performance can be optimized based on on-line measurements. Nexom can also utilize actual plant performance to validate and forecast plant performance using BioWin™, resulting in optimization of operation.

Training

Nexom will provide a certified field technician to complete the Installation Training, the Operator Training, and the Maintenance Training programs for the onsite staff. The trainer will be a Nexom employee with a minimum of 5 years' experience with the filtration products.

Operator Training will consist of one (1) day with the first half being held in a classroom, and the second half completed in the field with the filter system. Classroom sessions will be approximately four hours with a presentation and videos given. Nexom will provide the necessary handouts and literature to the attendees. A suitable space and video recording (if required) is to be provided by the customer. Topics covered will include at a minimum:

- Safety
- Operation & Troubleshooting
- Preventive and corrective maintenance
- Parts
- **Local representatives and service.**



Warranty & Warranty Period Services

Nexom operates from offices in Post Falls, ID, Columbia, MO and Winnipeg, MB. **Project managers, design engineers and service personnel are available in Idaho year-round for process and equipment questions and troubleshooting.**

Nexom strives to maintain good relationships with the operators at all its project sites. During installation inspections, startup and classroom training, we build relationships with operators that last for the life of the equipment. Our design engineers are available for review and analysis of operating data at any time, **free of charge**. On-site consultations can easily be arranged, if required, to assist with training and process or equipment troubleshooting.

Technicians can be onsite inside of a 3-hour trip. Nexom has service contracts available that can include regular site visits.

- Nexom Project Managers reside in Post Falls, ID.
- **Nexom, has staff technicians in Idaho. W-Cubed represents Nexom and has been a manufacturer's service rep in Salt Lake for 30+years. Its team maintains service capabilities and has installed many Nexom & EDI equipment across the USA. W-Cubed is willing, capable and authorized for servicing all Nexom supplied filter equipment.**
- Standard parts are manufactured and stocked in the Central Time Zone and available for immediate shipping.
- Phone support through our MO service center 24/7.





System Configuration & Operation

Design loads, flow, and effluent objectives are presented in the following table:

	Units	Influent	Effluent
Design Average Daily Flow (ADF)	MGD	0.36	
Max Month Daily Flow (MMF)	MGD	0.50	
Peak Day Flow (PDF)	MGD	0.67	
Peak Hour Flow (PHF)	MGD	1.73	
Alkalinity	mg/L	50 - 100	
pH	S.U.	6 - 9	
Temperature	°C	8-25	
Total suspended solids (TSS)	mg/L	< 30	< 5
Total phosphorus (TP)	mg/L	< 2.0	< 0.29
Non-reactive phosphorus (NRP)	mg/L	< 0.20	< 0.20

Filtration design parameters are presented in the following table:

Configuration	Units	Design Parameter
Filter model		CF64-60
Headloss profile	in	< 48
Total number of filters duty + standby at peak hour flow		4 + 1
Filtration area per filter cell	ft ²	64
¹ Hydraulic loading at MMF, PDF, 2 filters online	gpm/ft ²	2.7, 3.7
¹ Surface solids loading rate (SSLR) at MMF, PDF, 2 filters online	lb/ft ² d	1.4, 1.9
¹ Hydraulic loading at PHF, 4 filters online	gpm/ft ²	< 4.7
¹ Surface solids loading rate (SSLR) at PHF, 4 filters online	lb/ft ² d	< 2.5

1. SSLR includes assumed chemical solids for 3:1 mole ratio of alum to TP; backwash is +11-12 gpm per filter.

Flexibility

Nexom has proposed a continuously backwashing sand filter (CBSF) system with a high degree of flexibility. **It can be integrated as a Reactive Filtration system** as proposed, which has the benefit of eliminating the upstream flocculation footprint, CAPEX and OPEX.

Reactive Filtration branded as the Blue PRO® process utilizes a patented reactive filtration process within Centra-flo® continuous-backwash media filter to accomplish low levels of TSS, phosphorus, and many other trace elements. With the efficiency of reactive filtration, Blue PRO® uses 30% less chemical than comparative technologies for ultra-low phosphorus results, thereby also producing less chemical sludge.



Reactive Filtration is a patented process by the University of Idaho. Nexom pays for the exclusive license to this technology, and has included all licensing costs and royalties in its proposal.

USRE44,570 describes reactive filtration as *adding a metal salt reagent to water in sufficient quantity and concentration to allow precipitation reactions between the metal salt reagent and a dissolved contaminant in the water to go to at least near completion and to leave unreacted metal salt reagent in the water; inducing turbulence in the water; and then flowing the water through a bed of moving filter media, wherein unreacted metal salt reagent in the water reacts with the filter media to generate a reactive metal oxide or hydroxide coating on the filter media...*

It has been established that the University of Idaho's intellectual property requires that alternate CBSF systems *...requires alum and polymer addition with a minimum 5 minute HRT peak-flow, pre-filter flocculation process.*

Simplicity of Operation

Nexom's design approach to Aberdeen's wastewater challenges is to propose a process that is reliable, simple, and cost effective to operate. The system is completely automated, and operators' regular oversight include only daily rounds. There are no mechanical components in the filter, so regular maintenance of the pneumatic system is the only mechanical maintenance requirement.

Total Phosphorus (TP) Removal. Nexom has technologies that are regularly implemented for phosphorus removal across North America. Whereas all its technologies are effective chemical phosphorus removal solutions when applied properly, they use different mechanisms leading to differences in contact efficiency. The proposed Blue PRO® process uses a continuously regenerated adsorptive substrate and is capable of high contact efficiency and achieving residuals as low as 0.01

mg/L TP. The owner has the opportunity to realize chemical OPEX savings while using a proven technology for phosphorus and solids separation when phosphorus requirements are less stringent.

Control Methodology

A complete process flow diagram/P&ID is appended with the general arrangement drawing.

The reactive filtration cycle starts with influent water distributed across the cross-sectional area of the filter at the bottom of the media column. Water flows upward, carrying hydrous metal oxide (HMO) and coating the media with it. Media now covered by HMO coating attracts and reacts with the phosphorus and metals while moving downward by gravity in a countercurrent flow to an airlift pump. The filtered water floods the vessel, activates a level switch and exits over an effluent weir at the top of the filter. The airlift transports the TSS and the phosphorus- or metals-laden media up into the washbox where the discharged HMO coating and adsorbed contaminants are separated from the media. Water velocities in the washbox are carefully designed to carry away the contaminants while allowing the media to fall to the filter bed. The cycle restarts with freshly scrubbed media from the washbox recoated with HMO (regenerated) as the continuous influent flows upward.



The BluePRO® Reactive Filtration process overcomes a critical process obstacle of achieving efficient phosphorus and contaminant removal by providing a very large reactive surface area within the media bed, resulting in guaranteed contact of contaminant with HMO and its high adsorptive capacity.

Waste HMO, phosphorus, and solids are removed from the filter through the backwash or reject stream. Recycling this backwash upstream provides the added benefit of phosphorus pre-treatment in primary or secondary treatment systems, further guaranteeing the achievement of the effluent phosphorus target as well as lowering the overall plant chemical ratio. The phosphorus is

chemically bound, exiting the site with the plant sludge. The integration of the BluePRO® technology does not require a change in the plant's sludge handling system.

Ancillary equipment is minimal. A compressor system is required to provide continuous air flow to the filter airlifts. A chemical pump system is required to dose sufficient chemical to coat the media in the filter. All filters and subsystems are fully automated and controlled by plant SCADA through Nexom's air panel (PCN provided to integrator). A typical process P&ID is included in the appendix.

Operator Attention & Cleaning

Blue PRO filters are reliable and robust tertiary treatment systems requiring very little operator intervention. Daily monitoring includes monitoring the air flows, air pressures and faults.

Monthly and semi-annual maintenance include inspection of filter wear parts, namely the airlifts and deflector caps (10-minute inspection).

Annual maintenance consists in oil changes and maintenance of the pneumatic system.

The system and PCN is designed to allow the SCADA system to automatically duty cycle the filter cells to minimize operator effort and oversight. This allows the standby cell to be maintain run hours consistent to the other filters and available in a wetted and ready state.

Performance and Longevity

A Blue PRO[®] system will waste almost no media in its lifetime, meaning that in a 20-year period, topping up is unlikely to be required, and the media should never need to be replaced.

Nexom's installation and reference lists highlight decades of consistent and reliable operation of Blue PRO systems. The best witnesses to performance, reliability and longevity are data and operator feedback. Nexom enjoys relationships with operators across North America that share performance data with Nexom for analysis and future modeling efforts. These data sets prove the performance and longevity of Blue PRO systems. Two data sets of 12-month, 4-season windows are included for review.

Burrillville, RI (single-stage)

Operator quote:

“Nexom contracted for < 0.07, and I can achieve that at will. We completed a one-week performance study using daily 24-hour composites and averaged 0.039 mg/L TP in October of 2019!”

Single-Stage Filtration System Design Specifications

Startup	Design Average Flow	Design Peak Day	Design Filter Influent Average	Contract* Average	Modules	Season
2017	1.5 MGD 2-4 gpm/ft ²	4.5 MGD 5 gpm/ft ²	< 1 mg/L TP <10.7 µg/L Cu < 15 mg/L TSS	< 0.08 mg/L TP <7.5 µg/L Cu < 15 mg/L TSS	12x CF64	April-October Phosphorus; Annual Copper

*Plant permitted at < 0.1 mg/L TP and 8 µg/L Cu, monthly average

**Operated without automated effluent feedback control; dosing is feedforward by operator input (reactive to lab data).

Operating Monthly Averages From 2017-2018

Parameter	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Max Day Flow, MGD	1.76	1.51	2.18	2.03	3.21	2.45	1.72	1.70	1.89	1.66	1.97	2.12
Avg Day Flow, MGD	0.89	0.87	1.02	1.18	1.34	1.12	0.94	0.80	0.78	0.81	0.92	1.14
Limit TP, mg/L	< 1	< 1	< 1	< 1	< 1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Effluent TP, mg/L	0.056	0.098	0.057	0.054	0.049	0.064	0.049	0.058	0.052	0.047	0.029	0.038
Limit Cu, µg/L	< 8	< 8	< 8	< 8	< 8	< 8	< 8	< 8	< 8	< 8	< 8	< 8
Effluent Cu, µg/L	2.6	3.8	3.1	4.3	3.5	5.5	6.7	6.1	5.7	7.8	5.6	6.2
Effluent TSS, mg/L	1.8	2.6	1.6	1.9	1.7	1.7	1.4	1.3	1.3	1.4	1.2	1.2

Marlborough, MA (Westerly - single-stage)

Operator quote:

“We averaged a 0.044 mg/L TP during CDMSmith’s performance test. We have a 60-day rolling average permit, so I back my chemical off to realize monthly savings!”

Single-Stage Filtration System Design Specifications

Startup	Design Average Flow	Design Peak Day	Design Peak Flow	Design Filter Influent Average	Contract Limit* Average	Modules	Season
2012	4.15 MGD 2.9 gpm/ft ²	7.5 MGD 5 gpm/ft ²	11.62 MGD 8 gpm/ft ²	0.85 mg/L TP < 15 mg/L TSS	< 0.07 mg/L TP < 15 mg/L TSS	24x CF50	April-October

*Guaranteed for a TMDL < 0.07 mg/L TP confirmed by a 30-day performance test and 6 years of history; permit is 60-day rolling average currently at 0.1 mg/L summer; offseason phosphorus limit is < 1 mg/L

**Operated without automated effluent feedback control; dosing is feedforward by operator input (reactive to lab data).

Operating Monthly Averages From 2012

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Max Day Flow, MGD	4.00	3.60	3.60	4.50	3.70	3.40	3.00	3.30	2.90	4.50	4.30	3.80
Average Day Flow, MGD	2.36	2.11	2.10	1.79	2.07	2.06	1.61	1.64	1.48	1.66	1.87	1.78
Limit TP, mg/L	< 1	< 1	< 1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 1	< 1
Effluent TP, mg/L	0.1	0.08	0.1	0.07	0.1	0.1	0.05	0.07	0.05	0.1	0.2	0.1
Effluent TSS, mg/L	2.4	2.1	1.4	1.4	1.5	1.7	2.2	2.3	1.6	1.9	1.6	1.5
Effluent Copper, ug/L	3	5	4	3	10	3	4	8	4	3	6	2

*All are monthly averages unless otherwise noted; offseason is reported in grey text.

Lincoln, AR (single-stage)

Operator quote:

“The Blue PRO equipment contract says < 0.1 mg/L, but I can hit any residual TP that I want to with this system!”

Single-Stage Filtration System Design Specifications

Startup	Design Average Flow	Design Peak Day	Design Peak Flow	Design Filter Influent Average	Contract Limit* Average	Modules	Season
2013	0.5 MGD 1.3 gpm/ft ²	NA	2.3 gpm/ft ² 5.1 gpm/ft ²	4.0 mg/L TP 15 mg/L TSS	< 0.1 mg/L TP < 5 mg/L TSS	6x CF64	Annual

*Plant permit is currently < 1 mg/L, however the process guarantee from Nexom was for future use to < 0.1 mg/L TP

**Operated without automated effluent feedback control; dosing is feedforward by operator input (reactive to lab data).

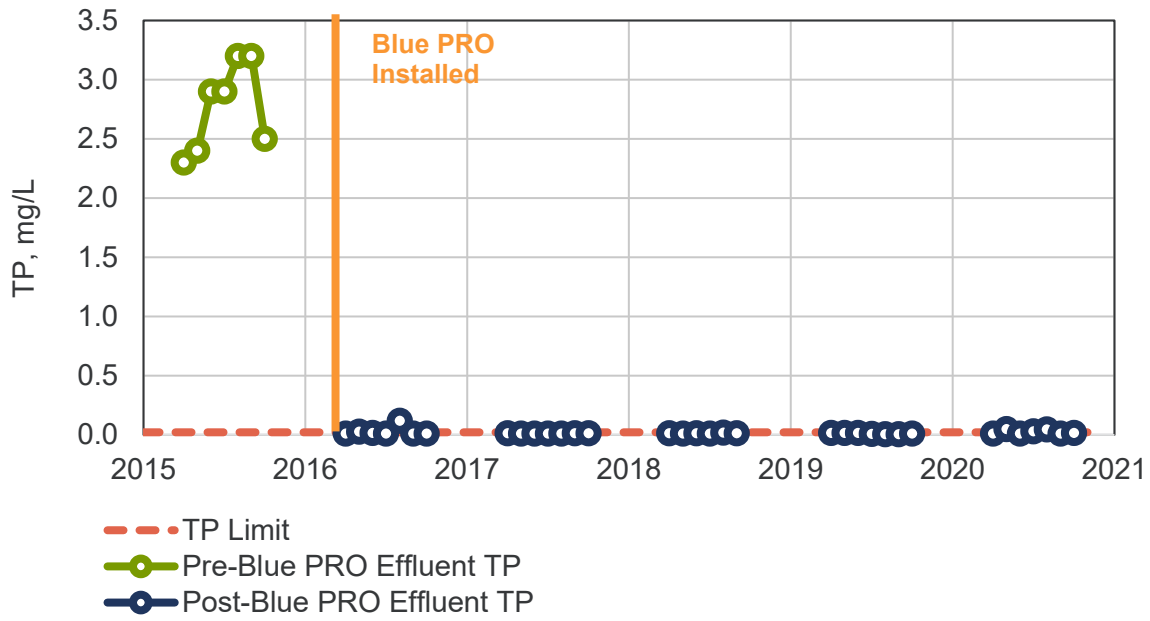
Operating Monthly Averages From 2017

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Max Day Flow, MGD	0.704	0.708	1.453	2.587	1.432	1.880	0.877	1.970	0.191	1.690	0.248	0.935
Average Day Flow, MGD	0.212	0.164	0.385	0.832	0.598	0.430	0.333	0.542	0.155	0.263	0.155	0.222
Limit TP, mg/L	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Effluent TP, mg/L	< 0.070	< 0.050	0.057	< 0.050	< 0.050	< 0.080	< 0.160	< 0.280	0.180	0.370	< 0.058	0.100
Effluent TSS, mg/L	< 1.3	< 1.6	< 1.3	< 1.4	< 2.3	< 1.0	< 1.4	< 1.2	< 1.8	< 1.3	< 1.9	< 2.0

*All are monthly averages unless otherwise noted.

Citronelle, AL (2-stage)

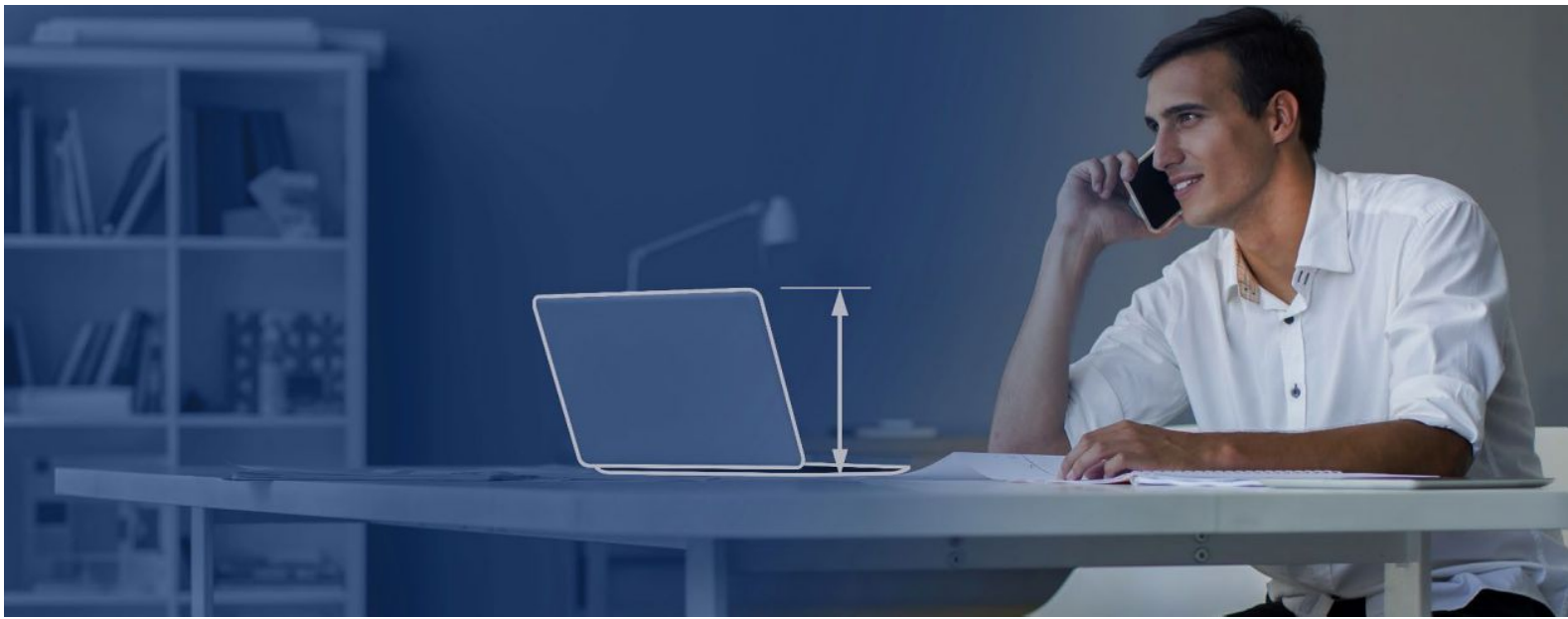
Permitted to < 0.022 mg/L TP May through October. Averaging 0.01 mg/L TP.



Treatment of Residuals

Nexom provides a process design study during submittals with more details of calculations. **Based on similar experience and preliminary calculations**, Nexom anticipates that:

- Backwash flow will constitute approximately 5% of the forward flow.
- Backwash will average approximately < 500 mg/L of TSS (including chemical TSS).
- Backwash should be recycled to the plant headworks or upstream of the secondary splitter box before clarification; the residual chemical reactivity from a Reactive Filtration backwash will have a net positive benefit on phosphorus control and chemical operating costs by reducing the raw phosphorus levels.
- Phosphorus will remain bound to the hydrous metal oxide inside of expected pH ranges (4-10) and will exit the plant through existing sludge management processes.
- Given dilution of phosphorus within the sludge, there will be no issues with disposal.



Five-Year Extended Warranty

Nexom includes a **five-year** extended warranty in its proposal. This supersedes its standard one-year warranty in its T&Cs. All other details of the warranty are summarized in Nexom's standard T&Cs, appended.

Appendix

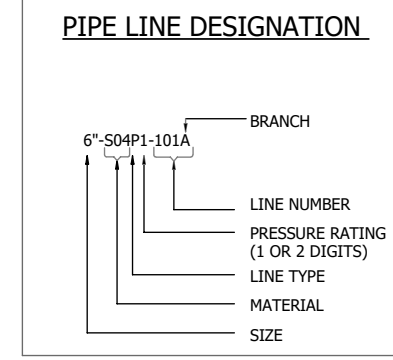
- Nexom Filter Drawings
- Contract Specifications Markup
- Equipment Data Sheets

PIPING SYMBOLS

	PRIMARY PROCESS FLOW PATH
	SECONDARY FLOW PATH
	HEAT TRACE
	INSULATED PIPELINE
	INFLUENT
	EFFLUENT
	REJECT
	SYSTEM EXTENTS

INSTRUMENT LINE SYMBOLS

	PNEUMATIC SIGNAL
	CONTROL LOGIC
	ELECTRIC SIGNAL
	UNDEFINED SIGNAL
	INTERNAL SYSTEM LINK SOFTWARE OR DATA
	CAPILLARY TUBE



VALVE ACTUATOR SYMBOLS

(NO SYMBOL) = MANUAL FOR ON/OFF SERVICE	HANDWHEEL (MANUAL OVERRIDE)	ELECTRIC
SOLENOID (WITHOUT)	DIAPHRAGM AIR TO AIR (WITHOUT)	DIAPHRAGM & SPRING TO OPEN (WITHOUT)
SOLENOID (WITH) =MANUAL OVERRIDE	DIAPHRAGM AIR TO AIR (WITH)=POSITIONER	DIAPHRAGM & SPRING TO CLOSE (WITH)=POSITIONER
DOUBLE-ACTING CYLINDER (WITHOUT)	CYLINDER & SPRING TO OPEN	
DOUBLE-ACTING CYLINDER (WITH)=POSITIONER	CYLINDER & SPRING TO CLOSE	

SYMBOLS FOR VALVE ACTION IN THE EVENT OF ACTUATOR POWER FAILURE

FO = FAIL OPEN
 FC = FAIL CLOSED
 FL = FAIL LOCKED
 FI = FAIL INDETERMINATE (LAST POSITION)
 F = USED WITH 3 WAY & 4 WAY VALVE-ARROWS SHOW PATHS OPEN TO FLOW ON POWER FAILURE.

SYMBOL LOCATED BY VALVE-USED ONLY WHERE NECESSARY TO INCREASE UNDERSTANDING OF THE SYSTEM.

SYMBOLS FOR SELF-ACTUATED REGULATORS

DIFFERENTIAL PRESSURE REDUCING REGULATOR - SHOWN WITH INTERNAL AND EXTERNAL PRESSURE TAPS.		

HEAT EXCHANGER SYMBOLS

MATERIAL DESIGNATION

BRZ - BRASS/BRONZE
 CIR - CAST IRON
 CST - CARBON STEEL
 CPR - COPPER
 FRP - FIBERGLASS
 GCS - GALVANIZED CARBON STEEL
 LCS - LINED CARBON STEEL
 TEF - TEFLON
 PU - POLYURETHANE
 PET - POLYETHYLENE
 POP - POLYPROPYLENE
 PVC - POLYVINYL CHLORIDE
 RUB - RUBBER
 S04 - 304 STAINLESS STEEL
 S4L - 304L STAINLESS STEEL
 S16 - 316 STAINLESS STEEL
 S6L - 316L STAINLESS STEEL
 VIT - VITON
 CVC - CHLORINATED POLYVINYL CHLORIDE

PRIME MOVERS FOR MOTOR DRIVEN EQUIPMENT

ELECTRIC MOTOR	PNEUMATIC ROTARY MOTOR
----------------	------------------------

MOTOR DRIVEN EQUIPMENT

TYPE

D = DUCT
 H = HOSE
 P = PIPE
 T = TUBE

GENERAL NOTES:

1. FOR INSTRUMENTATION SYMBOLS AND LIST OF RELAY FUNCTIONS SEE BLUE WATER DRAWING NO. PID-B.
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PIPING ACCESSORIES & DETAILS

VALVE SYMBOLS

TANK AND ACCESSORIES



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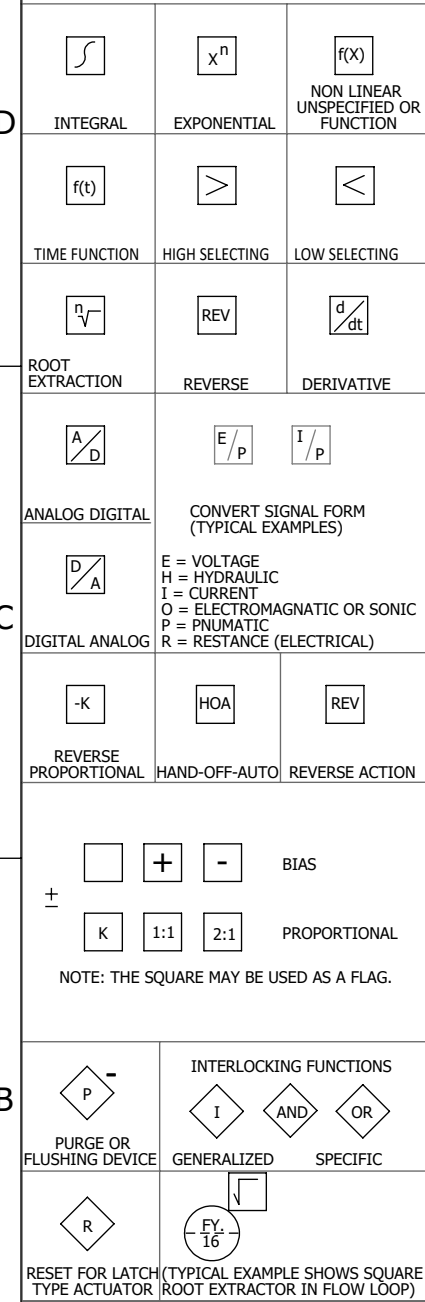
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 ONE DECIMAL ± .125"
 TWO DECIMAL ± .0625"
 ANGULAR ± 2.0°
 THIRD ANGLE PROJECTION

LOCATION: Aberdeen ID		SCALE NTS	
DESCRIPTION: Piping & Instrumentation Diagram, 5x CF64-60BG			
AUTH.		CHKD.	
NUMBER: cd13670		REV.	PAGE 1/4

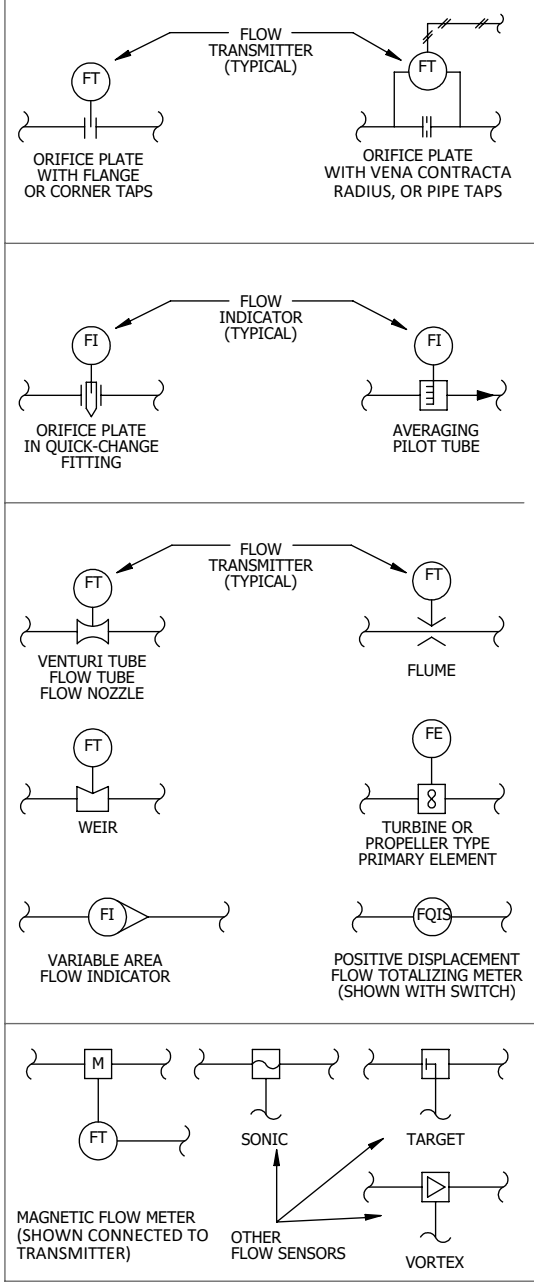
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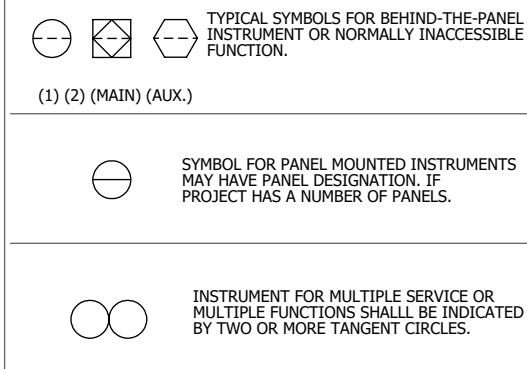
MISCELLANEOUS SYMBOLS



SYMBOLS FOR FLOW MEASUREMENT



SYMBOLS FOR LOGIC CONTROL



INSTRUMENT SYMBOLS

	PRIMARY CONTROL PANEL NORMALLY ACCESSIBLE TO OPERATOR	FIELD MOUNTED	AUXILIARY PANEL OR RACK NORMALLY ACCESSIBLE TO OPERATOR
DISCRETE INSTRUMENTS			
SHARED DISPLAY SHARED CONTROL			
COMPUTER FUNCTION INCLUDING DISTRIB. CNTL. SYS.			
PROGRAMMABLE LOGIC CONTROLLER FUNCTION			

INSTRUMENT IDENTIFICATION LETTERS

FIRST LETTER		SUCCEEDING LETTERS			
MEASURE OR INIATING VARIABLE	MODIFIER	LETTER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A = ANALYSIS		A	ALARM		
B = BURNER, COMBUSTION		B	USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
C = USER'S CHOICE		C		CONTROL	
D = USER'S CHOICE	DIFFERENTIAL	D			
E = VOLTAGE		E	SENSOR (PRIMARY ELEMENT)		
F = FLOW RATE	RATIO (FRACTION)	F			
G = USER'S CHOICE		G	GLASS, VIEWING DEVICE		
H = HAND		H			HIGH
I = CURRENT (ELECTRICAL)		I	INDICATE		
J = POWER	SCAN	J			
K = TIME, TIME SCHEDULE	TIME RATE OF CHANGE	K		CONTROL STATION	
L = LEVEL		L	LIGHT		
M = USER'S CHOICE	MOMENTARY	M			MIDDLE, INTERMEDIATE
N = USER'S CHOICE		N	USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
O = USER'S CHOICE		O	ORIFICE, RESTRICTION		
P = PRESSURE, VACUUM		P	POINT (TEST) CONNECTION		
Q = QUANTITY	INTERGRATE, TOTALIZE	Q			
R = RADIATION		R	RECORD		
S = SPEED, FREQUENCY	SAFETY	S		SWITCH	
T = TEMPERATURE		T		TRANSMIT	
U = MULTIVARIABLE		U	MULTIFUNCTION	MULTIFUNCTION	MULTIFUNCTION
V = VIBRATION, MECH. ANALYSIS		V		VALVE, DAMPER, LOUVER	
W = WEIGHT, FORCE		W	WELL		
X = UNCLASSIFIED	X AXIS	X	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED
Y = EVENT, STATE OR PRESENCE	Y AXIS	Y		RELAY, COMPUTE, CONVERT	
Z = POSITION, DIMENSION	Z AXIS	Z		DRIVE, ACTUATOR, UNCLASSIFIED FINAL CONTROL ELEMENT	

NOTES:

- ANY FIRST LETTER COMBINED WITH MODIFIER REPRESENTS A NEW AND SEPARATE MEASURED VARIABLE. EXAMPLES: PD = DIFFERENTIAL PRESSURE FQ = TOTALIZED OR INTEGRATED FLOW. EXCEPTION IS THE MODIFIER "J" FOR MULTIPOINT SCANNING.
- FOR ANALYSIS NOT IDENTIFIED BY A SPECIFIC LETTER IN THE TABLE, USE THE LETTER "A" NEAR THE INSTRUMENT SYMBOL, SPECIFY THE NATURE OF THE ANALYSIS. EXAMPLE: PH
- MEANING OF A "USER CHOICE" LETTER SHALL BE CONSISTENT THROUGHOUT A PROJECT AND SHALL BE SPECIFIED IN THE DRAWING LEGEND.
- UNCLASSIFIED LETTERS MAY HAVE A FEW DIFFERENT MEANINGS ON A PROJECT, THE MEANING SHALL BE SPECIFIED NEAR EACH INSTRUMENT SYMBOL USING THE UNCLASSIFIED LETTER.
- THE MODIFIER "SCAN" APPLIES TO MULTIPOINT PRINTING INSTRUMENTS, SUCH AS CJRS (MULTIPOINT CONDUCTIVITY RECORDER WITH ALARM SWITCHES).

GENERAL NOTES:

- FOR MECHANICAL SYMBOLS AND ADDITIONAL NOTES, SEE BLUE WATER DRAWING NO. PID-A. THIS DRAWING IS PROVIDED FOR INFORMATION ONLY.



UNLESS OTHERWISE SPECIFIED

TOLERANCES:

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ONE DECIMAL $\pm .125"$

TWO DECIMAL $\pm .0625"$

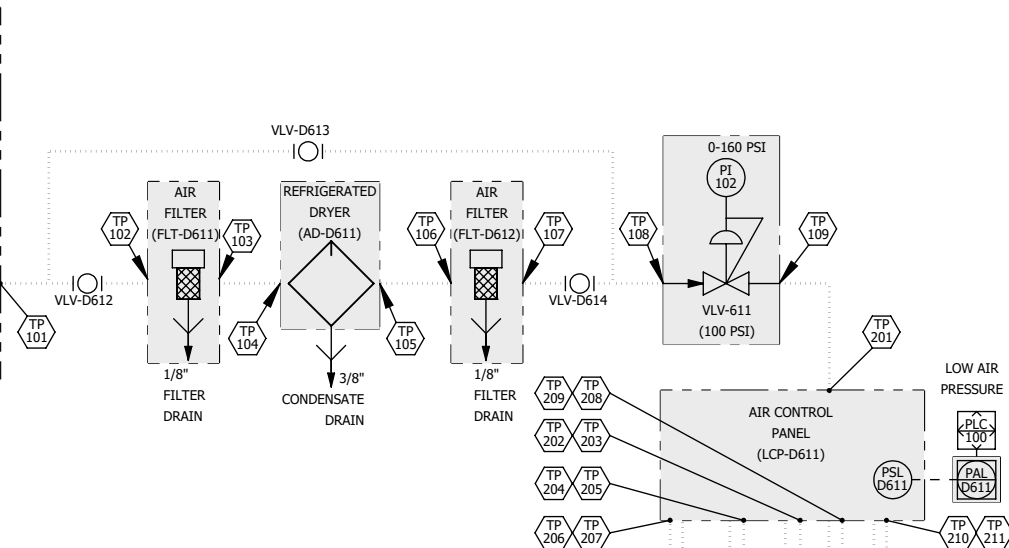
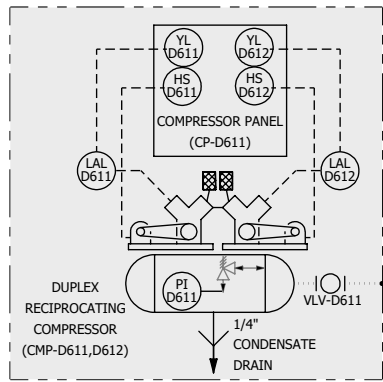
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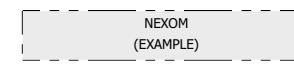
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NUMBER: cd13670 **REV.** **PAGE** 2/4

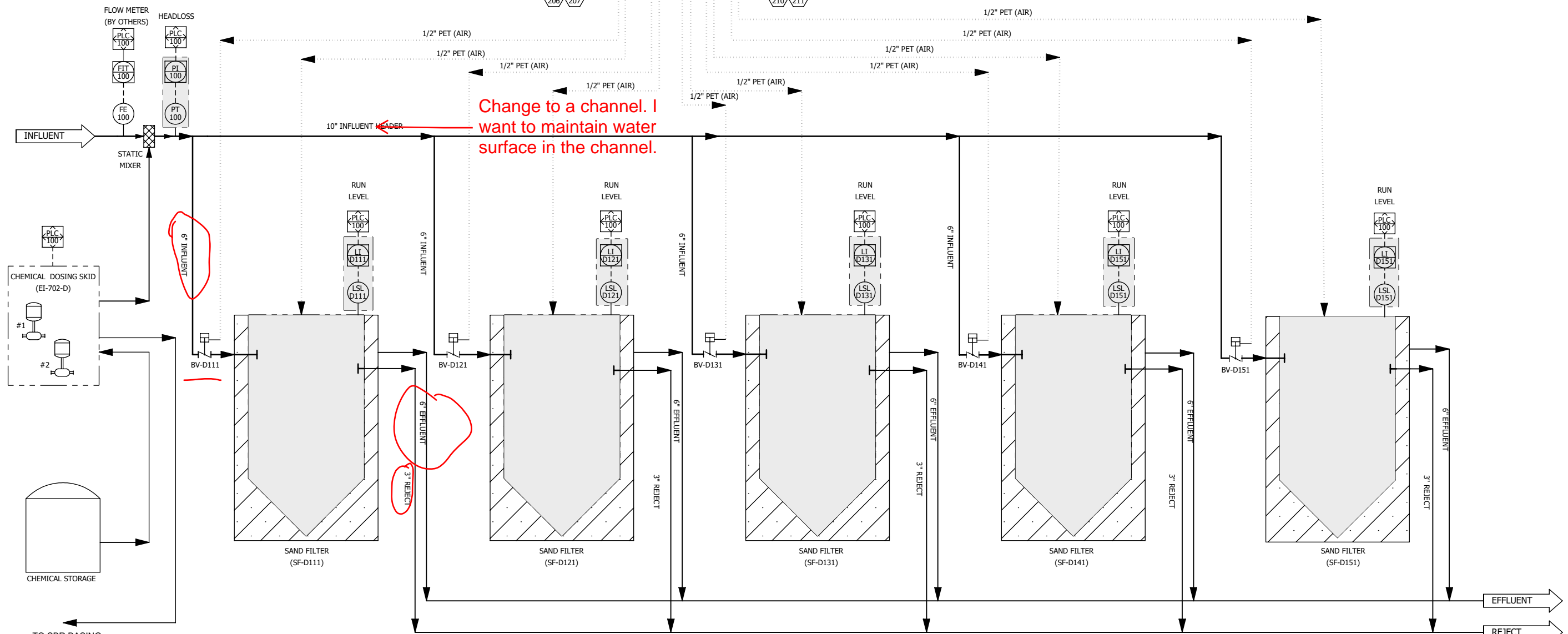
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- NOTES:
- PIPING CONNECTIONS/FLANGES INTERNAL TO FILTER CELL TO BE FLUSH WITH CELL WALL.
 - SHADED AREAS ARE IN NEXOM'S SCOPE OF SUPPLY



TERMINAL POINT TABLE	
TP-101	1/2" FNPT
TP-102	1/2" FNPT
TP-103	1/2" FNPT
TP-104	1/2" FNPT
TP-105	1/2" FNPT
TP-106	1/2" FNPT
TP-107	1/2" FNPT
TP-108	1/2" FNPT
TP-109	1/2" FNPT
TP-201	1/2" FNPT
TP-202	1/2" TUBING
TP-203	1/2" TUBING
TP-204	1/2" TUBING
TP-205	1/2" TUBING
TP-206	1/2" TUBING
TP-207	1/2" TUBING
TP-208	1/2" TUBING
TP-209	1/2" TUBING
TP-210	1/2" TUBING
TP-211	1/2" TUBING
TP-402	6" ANSI FF
TP-403	3" PIPE STUB
TP-405	1" MNPT



Change to a channel. I want to maintain water surface in the channel.



REVISIONS			
REV.	DESCRIPTION	ENGINEER	DATE

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TOLERANCES:
 00.0 OR X/X ± .125"
 00.00 ± .05"
 00.0° ± 2.0°
 THIRD ANGLE PROJECTION

LOCATION: Aberdeen ID		SCALE NTS	
DESCRIPTION: Piping & Instrumentation Diagram, 5x CF64-60BG			
AUTH.		CHKD.	
NUMBER: cd13670		REV.	
			PAGE 3/4

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D

C

B

A

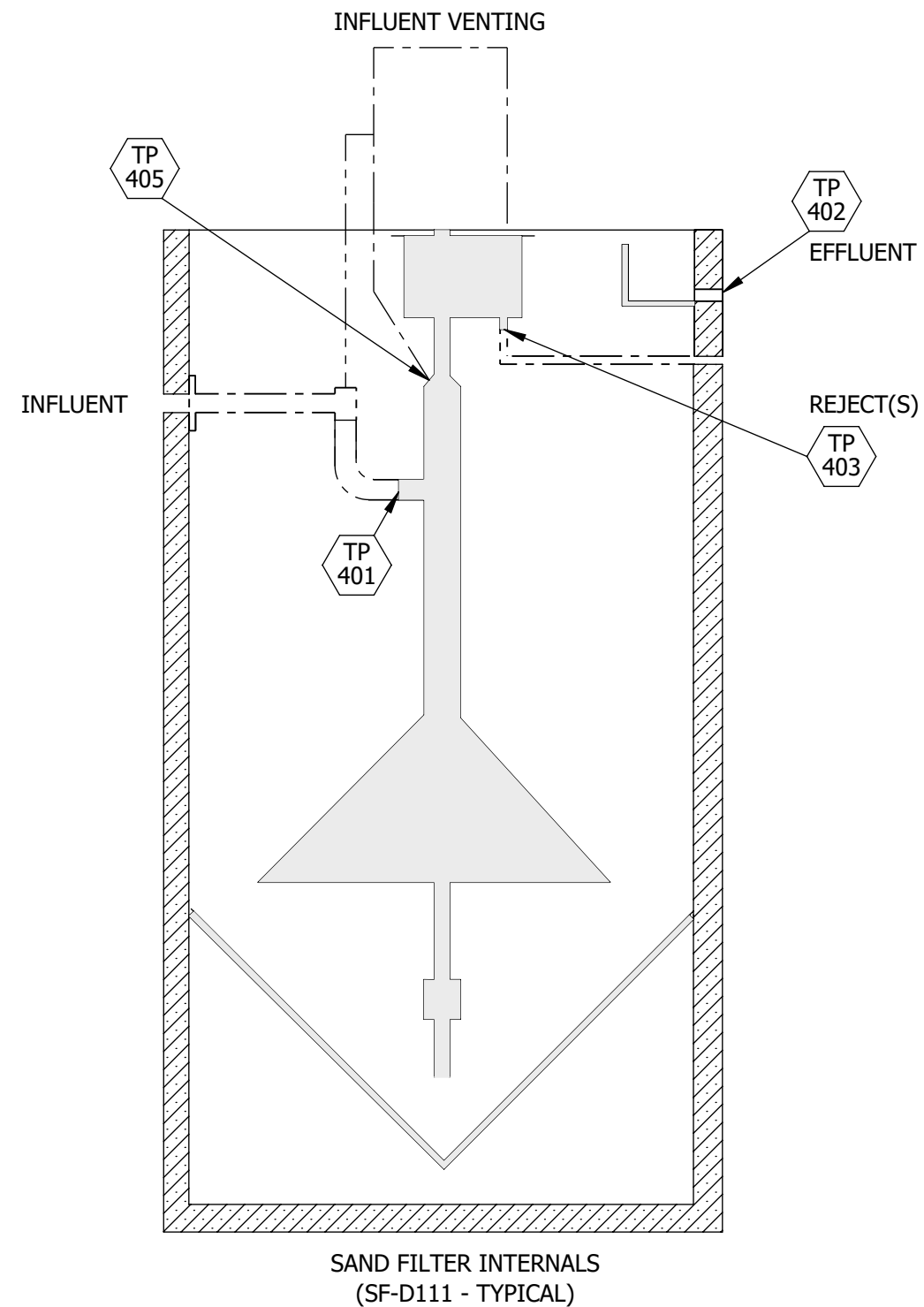
D

C

B

A

TERMINAL POINT TABLE	
TP-101	1/2" FNPT
TP-102	1/2" FNPT
TP-103	1/2" FNPT
TP-104	1/2" FNPT
TP-105	1/2" FNPT
TP-106	1/2" FNPT
TP-107	1/2" FNPT
TP-108	1/2" FNPT
TP-109	1/2" FNPT
TP-201	1/2" FNPT
TP-202	1/2" TUBING
TP-203	1/2" TUBING
TP-204	1/2" TUBING
TP-205	1/2" TUBING
TP-206	1/2" TUBING
TP-207	1/2" TUBING
TP-208	1/2" TUBING
TP-209	1/2" TUBING
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TP-211	1/2" TUBING
TP-402	6" ANSI FF
TP-403	3" PIPE STUB
TP-405	1" MNPT

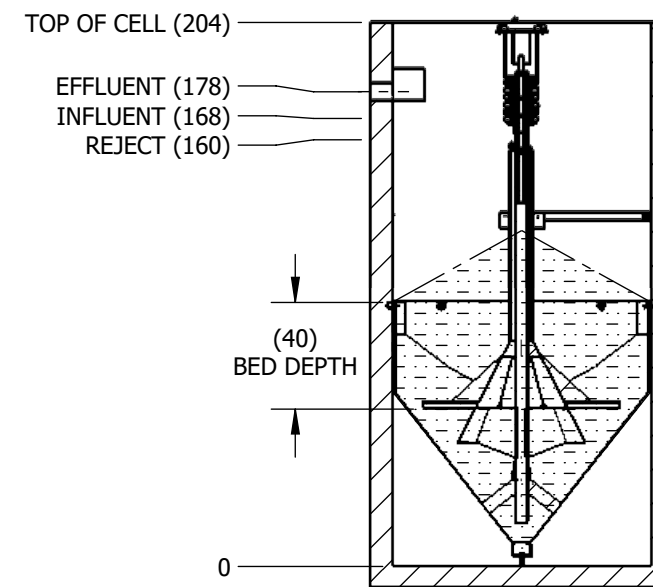
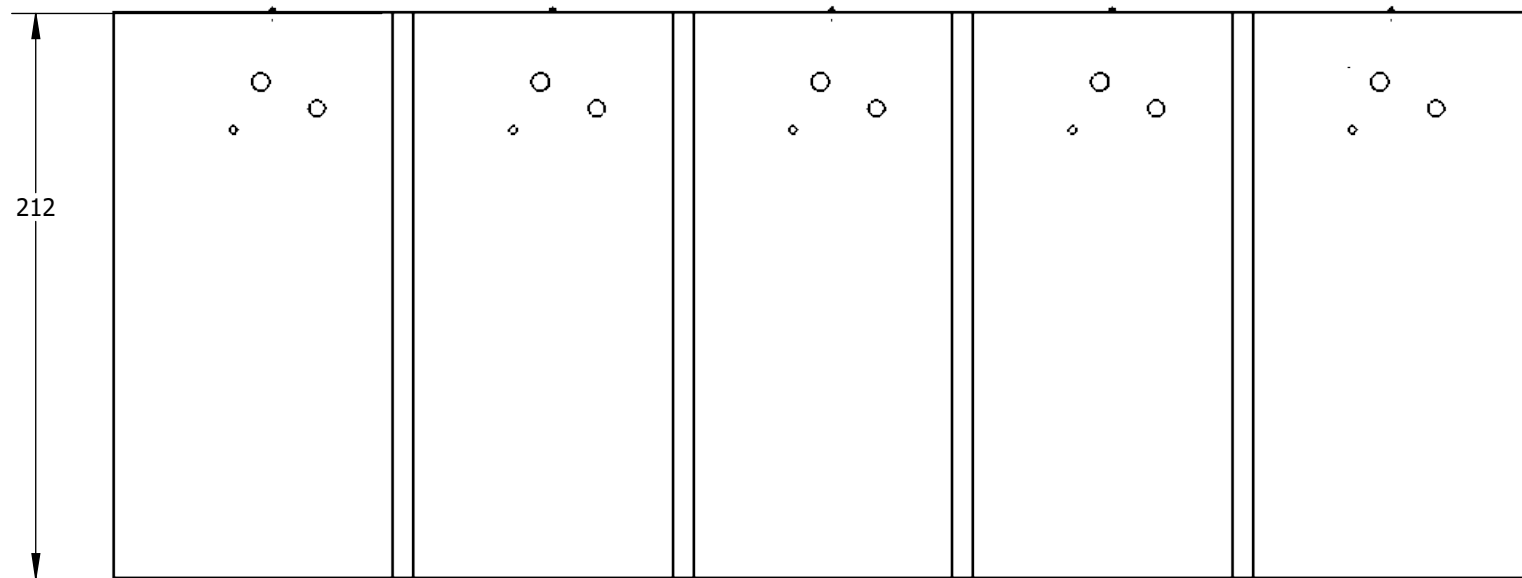
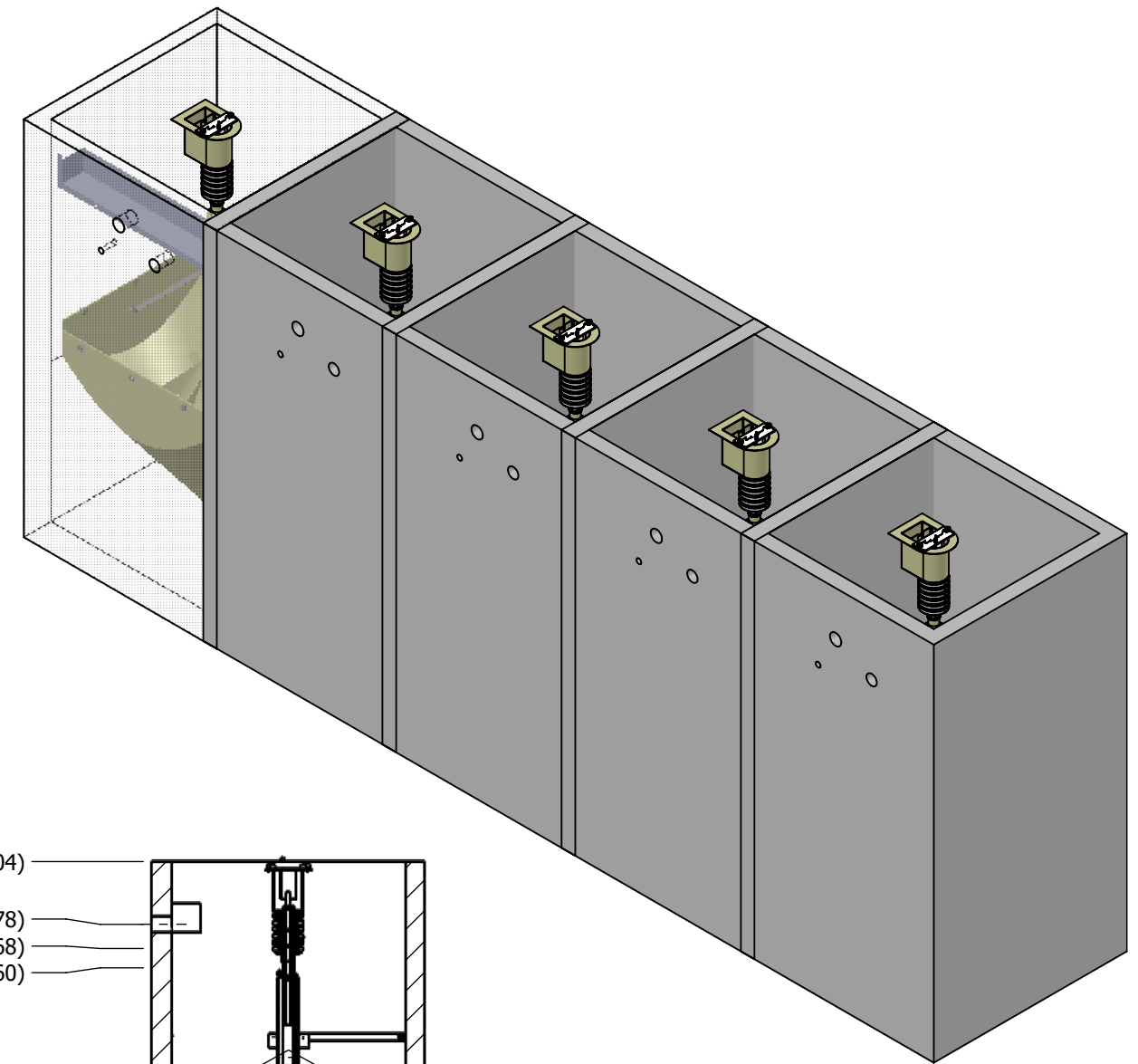
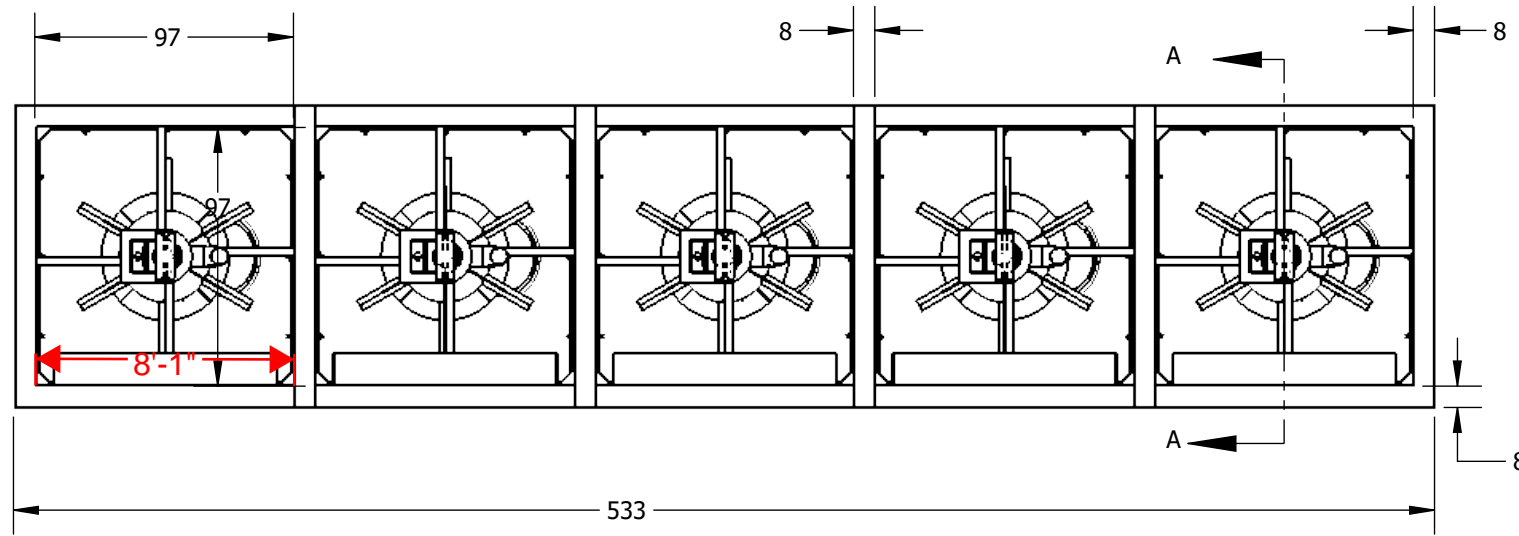


UNLESS OTHERWISE SPECIFIED	
TOLERANCES:	
FRACTIONAL	± 1/16"
ONE DECIMAL	± .125"
TWO DECIMAL	± .0625"
ANGULAR	± 2.0°

LOCATION: Aberdeen ID	SCALE NTS
DESCRIPTION: Piping & Instrumentation Diagram, 5x CF64-60BG	
NUMBER: cd13670	REV.
	PAGE 4/4

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SECTION A-A



REVISIONS			
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TOLERANCES:
 00.0 OR X/X ± .125"
 00.00 ± .05"
 00.0° ± 2.0°
 THIRD ANGLE PROJECTION

LOCATION: Aberdeen, ID		SCALE 1:72	
DESCRIPTION: General Arrangement Drawings, 5x CF64-60BG			
AUTH.		CHKD.	
NUMBER: cd13670		REV.	PAGE 1/1

TEMPLATE LAST MODIFIED: 08.05.19

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SECTION 46 61 27 – UPFLOW MOVING BED FILTER

PART 1 - GENERAL

1.1 SCOPE OF WORK

- ✓ A. Vendor shall furnish and place into satisfactory operating condition a complete filtration system as specified herein. Filters shall be provided with all required equipment, and filtration media. Filters shall be modular and will be installed in concrete basins. The Installation Contractor shall install all structures including any required wall thimbles and external piping.
- ✓ B. The Vendor shall size the filter equipment to meet the performance specifications below. The filter systems shall be designed so that the peak flow can be treated with one unit offline.
- ✓ C. Air compressor: Vendor shall provide a compressed air system sized to deliver sufficient air to each airlift for backwashing, as well as any ancillary air requirements for the system, including pneumatic actuation of valves. The compressed air system shall include a dual air compressor with reservoir, air dryer, compressed air control panel, air panels for the control of air to the air lifts, and valves. The Installation Contractor shall install the air system and provide and install the interconnecting piping.
- ✓ D. Vendor can provide more than one proposal (for different configurations or materials) at the time of bid.
- ✓ E. The Installation Contractor shall provide two chemical dosing systems with associated mixing and flocculation – an alum system for phosphorus coagulation, and a caustic soda system for pH adjustment (downstream of the filters). Where necessary, a polymer dosing system shall also be provided by the contractor. The chemical, mixing and flocculation systems shall meet the Filter Vendor’s requirements subject to the Engineer’s approval.

1.2 DESIGN REQUIREMENTS

- ✓ A. Influent Design Criteria: Clarified secondary effluent will be provided to the sand filter system with the following flow and water quality:

1.	Average Daily Flow:	0.36 MGD
2.	Max Month Flow:	0.50 MGD
3.	Peak Day Flow:	0.67 MGD
4.	Peak Hour Flow:	1.73 MGD
5.	Max Total Suspended Solids (from clarifier effluent):	30 mg/L
6.	Total Phosphorus:	2 mg/L*

*Note that chemical dosing upstream of the clarifiers will be provided to meet the influent concentration noted above to the sand filters.

- ✓ B. Effluent Design Criteria: The sand filter vendor shall meet the following effluent water quality:
 - 1. Total Suspended Solids: 5 mg/L
 - 2. Total Phosphorus: 0.29 mg/L
- ✓ C. The maximum allowable hydraulic loading shall not exceed 5 gpm/ft² at the peak hour flow with one unit offline.
- ✓ D. The headloss through the filter shall not exceed 48" (as measured from the influent to the filter module to the crest of the effluent weir).

1.3 SUBMITTALS

- ✓ A. See Section 01 30 00 – Vendor Submittals, for submittal procedures.
- ✓ B. The Vendor shall submit a copy of the equipment specification section with all addenda and all referenced specification sections. Each paragraph shall be check-marked to indicate specification compliance or marked to indicate deviations from the specification requirements. Check marks shall indicate complete compliance with the paragraph requirements. Deviations from the specification shall be indicated by underlining the deviation and marking the paragraph or line with a number or letter. The remainder of the paragraph not marked as a deviation shall indicate compliance with the requirements of the paragraph. The manufacturer shall prepare a detailed justification for each deviation. Failure to include the required specification sections and justification for deviations will indicate non-compliance and shall be rejected without further consideration.
- ✓ C. Submit to the Engineer for review, filtration calculation, headloss calculations, air flow requirements, complete drawings showing installation details, materials of construction, arrangement details, loadings, elevations, and all items furnished under this Section.
- ✓ D. Complete instructions on installation of the equipment, air compressor, air lift system, controls, and filter media.
- ✓ E. Design calculation for anchor bolts. Design calculations shall include dead, live, and dynamic loadings for normal and seismic conditions (see Drawings for seismic design standards). Design calculations shall be stamped by a professional engineer registered in the State of Idaho.
- ✓ F. Start-up instructions.
- ✓ G. Operation and Maintenance Data: Submit operation and maintenance data and equipment parts list in manual in accordance with Section 01 78 23 – Operation and Maintenance Data.

1.4 QUALITY ASSURANCE

- ✓ A. To ensure that all the equipment required for the installation of the filter modules and air supply is properly coordinated and will function as a unit in accordance with the intent of these Specifications, the Vendor shall provide all the equipment specified under this Section.
- ✓ B. Qualification of Filter Manufacturer: The filter Manufacturer shall have a minimum of 10 years' experience in the manufacture of this type of filter equipment and shall have completed at least 10 successful installations of the same type proposed.

1.5 WARRANTY AND GUARANTEE

- ✓ A. A written manufacturer warranty shall be provided. The warranty shall be for a minimum period of one (1) year from the date of Substantial Completion. Manufacturer shall repair or replace all defects of materials or workmanship in the equipment during the warranty period. Corrections shall be completed within five (5) days after notification.
- ✓ B. Written Guarantee: The Vendor shall guarantee that the filter system shall meet the required effluent limits. The coagulant dosing system will be supplied by the Installation Contractor. If, during the one-year guarantee period, the filter system fails or does not meet any of the specified requirements or test criteria herein, the Vendor shall correct such deficiencies as may be necessary to meet these requirements and criteria at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Parkson
- ✓ B. Nexom
- C. WesTech
- D. Or approved equal

2.2 GENERAL

- ✓ A. All structural steel shall conform to "Standard Specifications for Structural Steel of the A.S.T.M."
- ✓ B. An effluent weir shall be provided to control the water level over the media.
- ✓ C. All equipment shall be designed for continuous, twenty-four hour operation, and all parts of the mechanism shall be amply proportioned for all stresses, which may occur during fabrication, erection, and operation.
- ✓ D. All anchor bolts shall be Type 316 stainless steel and shall be sized by the Vendor. The Installation Contractor shall provide and install the anchor bolts in accordance with the Vendor instructions.

- ✓ E. All filter wetted parts shall be 304 or 316 stainless steel, FRP, or PVC. No carbon steel shall be allowed in the filters. All stainless steel shall be passivated.

2.3 UPFLOW MOVING BED FILTER

- ✓ A. Materials of Construction

- | | | |
|-----|---------------------------------|---------------------------------|
| 1. | Basin | Concrete, FRP, or 304 SS |
| 2. | Filtrate trough (if applicable) | FRP or 304 SS |
| 3. | Bottom hopper cones | FRP or 304 SS |
| 4. | Feed distribution radials | FRP or 304 SS |
| 5. | Reject compartment | FRP or Injection Molded Plastic |
| 6. | Washer rings | PVC or Injection Molded Plastic |
| 7. | Reject weirs | FRP or Injection Molded Plastic |
| 8. | Distribution cones | FRP or 304 SS |
| 9. | Airlift pipes | HDPE or PVC |
| 10. | Airlift housing | FRP or 304 SS |
| 11. | Airlift panel | 304 SS |
| 12. | Nuts, bolts, fasteners | 304 SS |
| 13. | Anchor bolts | 304 SS |

- ✓ B. FILTER TANK

1. Each filter shall be self-contained in an open-top concrete tank sized by Vendor. Vendor shall produce dimensioned layout drawings of the filters with all sections needed to estimate concrete volumes, if applicable.

- ✓ C. AIRLIFT

1. The sand cleaning system shall be capable of continuous or intermittent backwashing and internally redistributing the granular media to the top of the sand bed an average of 4-8 times per 24 hours. The airlift shall be supplied with an external air feed line to supply the pressurized air to the injection point. The feed line shall be protected from the abrasive movement of the media both inside the airlift and outside within the filter bed.

✓ D. COUNTER-CURRENT WASHBOX

1. The filter system shall be furnished with a washbox assembly of fiberglass or injection molded plastic construction with an adjustable weir. The cross-sectional area of the counter-current washbox shall be sized to assure sufficient velocity of up-flowing water to transport separated solids into the wash chamber and over the reject weir and ultimately out through the reject line. The washbox geometry shall be optimized for separation of solids rejected from the filter media.

✓ E. FILTER MEDIA

1. The filter media shall be furnished by the Filter Manufacturer and shall be of high quality silica sand in accordance with the American Water Works Association Standard for Filter Materials AWWA/ANSI B-100 (latest edition). The Filter manufacturer shall deliver the sand to the Site, and the Installation Contractor shall install the filter media per the Filter Manufacturer's instructions.

✓ F. FEED CHAMBER

1. Each filter shall be furnished with a central feed chamber designed to distribute the influent water directly into the media. The feed chamber shall have capacity to distribute the influent at least 60" below the top of the media. The feed chamber shall have a central protector tube to house, support and protect the airlift feed pump and compressed air feed line from damage due to abrasion. This central protector tube shall extend from the top of the filter bed down through the feed chamber to the recessed chamber in the lower cone. The feed chamber shall also incorporate support devices to the side wall, if applicable. The feed chamber shall be permanently attached and centered on the lower end to ensure that the system remains properly located at all times. The feed chamber shall be constructed of fiberglass or 304 SS.

✓ G. HEAD LOSS INSTRUMENTATION

1. The Head Loss Indicator Gauge shall be coupled directly to the influent feed channel of the filter and extend above the top of the filter cell. The Head Loss Indicator Gauge shall be marked with an easily readable clear rule indicating the differential pressure (ΔP).
2. Head Loss shall also be monitored with a pressure transmitter directly to the influent feed of the filter system. Transmitter signal shall land in the Air Control Panel and the signal made available to the plant PLC (by Installation Contractor).

✓ H. AIR CONTROL PANEL WITH AIR BURST SYSTEM

1. The filter system shall be furnished with a NEMA 4X operators control panel equipped with manufacturer's standard equipment, including airflow regulation, flow monitoring/control valves, normal operation and adjustable duration airbursting (where applicable) solenoids and all other controls necessary for operation of the filter's airlift. A signal from the plant SCADA system shall be received to operate the system.

2. All analog and digital signals from flow or level instrumentation in the Air Control Panel shall be available to the plant PLC via terminal contacts.
3. Where filter cells are intended to be operated in a lead/lag type configuration, the Vendor shall provide a control narrative for system integration through the plant PLC. Solenoid valves shall be included in the Vendor's scope, as well as sufficient instrument air in the air compressor system, to operate Installation Contractor-supplied pneumatic control valves to each filter cell.



I. AIR SYSTEM

1. The Filter Manufacturer shall furnish an air compressor unit to pressurize the pneumatic system. The duplex air compressor unit shall be provided with two each, two-stage compressor pumps. The air tank shall be an ASME Code receiver rated at a minimum of 200 psig. The system shall be complete with two (2), 460 V/3P/60 Hz powered, 2-stage compressor pumps; air cooled aftercooler; loadless starting; low oil shutdown switch; pressure gauge; safety valve; intake air filter; pressure switch; manual and automatic receiver blowdown and shut off valves; vibration pads for mounting; and complete startup kits. The Vendor shall size the air compressor.
2. A refrigerated-type air dryer shall be provided and sized by Vendor. Power shall be 115V/1P/60 Hz. The air dryer shall be provided with a pre-filter.
3. The Vendor shall provide a duplex alternating control panel. The panel shall include motor starter for the two compressor motors and thermal overloads. Circuit protection and disconnects shall be by others.



J. SPARE PARTS

1. Filter Equipment: The Filter Manufacturer shall provide the following spare parts for the airlift pumps and control panel (one each):
 - a. Spare airlift
 - b. Regulator - air control panel.
 - c. Air flow indicator and control valve - air control panel.
 - d. Air filter element – air control panel.
 - e. One intake air filter and one oil change for the air compressor.

PART 3 - EXECUTION

3.1 INSTALLATION



- A. General: The Installation Contractor shall install structures, filter equipment, filter media, piping and valves in conformance with the Manufacturer's recommendations.

- ✓ B. The Installation Contractor shall provide and install the chemical feed system including pumps, valves, piping, and controls.

3.2 TESTING AND CORRECTION OF DEFICIENCIES

- ✓ A. General
 - 1. All testing shall be performed under the supervision of the Filter Manufacturer's representative as specified. The Installation Contractor shall conduct all specified tests and shall furnish all power, material, instrumentation, equipment, personnel, etc., for conducting tests as specified herein.
 - 2. The Vendor shall submit three copies of full and complete test reports for all tests, describing the units tested; the type of test; test set-ups, and procedures and instrumentation; and test flow rates, pressures, levels and all other data and results as required to demonstrate that all items tested meet specified requirements.

- ✓ B. Start-Up
 - 1. Equipment Testing
 - a. The Filter Manufacturer's representative shall check and verify that installation of the filter modules is in accordance with Drawings, Specifications, and Filter Manufacturer's installation instructions.
 - b. The Filter Manufacturer's representative shall adjust all reject weir plates and air rates to each airlift.
 - c. The Filter Manufacturer's representative shall instruct plant personnel on operation and maintenance of the filter system.
 - d. The Filter Manufacturer shall include two (2) trips to the site, each one (1) day to advise the Installation Contractor on the installation of the filter equipment and to inspect and approve the installation.
 - e. The Filter manufacturer shall include two (2) trips to the site for four (4) days to start-up the filter system and to train the operators.

- ✓ C. Testing
 - 1. Process System Testing
 - a. The Installation Contractor and Filter Manufacturer shall test the blower/air compressor system for correct operation and certify that the backwash system is operating in conformance with these Specifications.
 - 2. 7-Day Test
 - a. The Owner shall collect inlet and outlet samples (composite) on seven consecutive days and analyze them for total suspended solids (TSS) and total phosphorus (TP) at the Owner's expense. If the outlet concentration averages are less than or equal to the performance requirements, then the filter system shall have passed the initial seven-day test. The Installation

Contractor and Filter Manufacturer shall make the necessary adjustments to the filter system and conduct additional seven-day tests at no cost to the Owner until the system passes.

3.3 OPERATOR TRAINING

- ✔ A. A trained factory representative shall provide a minimum of 4 hours of operation and maintenance training to the Owner's personnel. The Installation Contractor shall video the training session and provide a copy on DVD to the Owner.

END OF SECTION 46 61 27

Headloss Pressure
Transmitter

Technical Information Cerabar PMC11, PMC21, PMP11, PMP21

Process pressure measurement

Pressure transducer with ceramic and metal
sensors

Application

The Cerabar is a pressure transducer for the measurement of absolute and gauge pressure in gases, vapors, liquids and dust. The Cerabar can be used internationally thanks to a wide range of approvals and process connections.

Your benefits

- High reproducibility and long-term stability
- Reference accuracy: up to 0.3%
- Customized measuring ranges
 - Turn down up to 5:1
 - Sensor for measuring ranges up to 400 bar (6 000 psi)
- Housing and process isolating diaphragm made of 316L



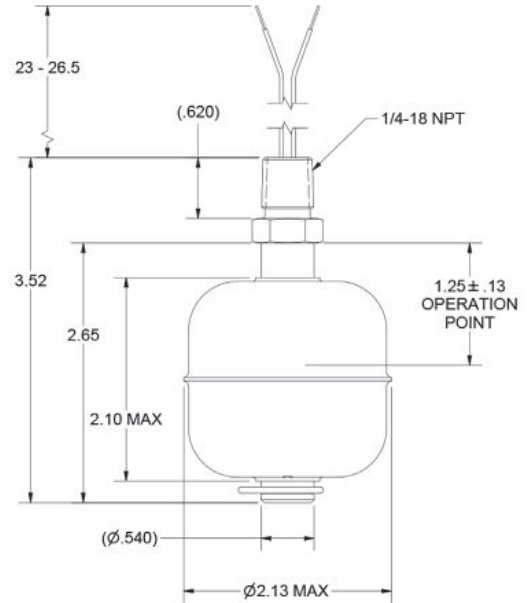
Configuration summary

Mat. no.	Description Order code	Quantity	Unit
71239739	Cerabar PMC21 PMC21-CA1M1FFVXJA+RZ	1	PC

010	Approval:	CA	CSA C/US General Purpose
020	Output:	1	4-20mA
040	Electrical Connection:	M	Plug M12, IP65/67 NEMA Type 4X Encl.
070	Sensor Range:	1F	400mbar/40kPa/6psi gauge, overload: 8bar/800kPA/120psi
090	Calibration; Unit:	F	Sensor range; psi
110	Process Connection:	VXJ	Thread ASME MNPT1/2 FNPT1/4, 316L
190	Seal:	A	FKM
620	>>Accessory Enclosed:	RZ	Plug connector M12 90deg, IP67, 5m cable, union nut Cu Sn/Ni

Madison Home » Point Level Float Switch Series » Float switch, stainless steel, 1/4" NPT, 60 watt

Level Switches



Applications:

- Detects high/low levels in a container
- 316 SS is frequently used in food processing
- Ideal for high-temperature, medical and petrochemical applications, as well as plating processes
- Suitable in applications where superior corrosion resistance is required
- All NPT vertical switches can be extended with pipe to meet custom tank depths

Related Products:



M5600-PR



M5600-SPDT



MS5600



MSB5600

View in-stock products ready to ship today at Madisonco.com/buy

Specifications:

Approvals	CE, UL Haz. Loc., CSA Haz. Loc., NSF
Electrical Ratings	240 VAC, 0.40A; 120 VAC, 0.50A; 120 VDC, 0.20A; 24 VDC, 0.50A
Float Material	316 Stainless Steel
Float SG	0.55
Lead Wires	24", 22 AWG, Teflon Insulated
Max Pressure	200 PSI
Max Temperature	392°F (200°C)
Mounting	1/4" NPT
Note	Electrical Switch Ratings are shown for resistive loads as tested by UL at different voltages. See our Electrical Considerations for typical inductive or capacitive load considerations. The wire clips are made to be removed and replaced up to 10 times, while maintaining a holding force of 3 lb.
Stem Material	316 Stainless Steel
Switch Rating	60 Watt, SPST
Type	Full Size Switch

Ships same day EST (Eastern Standard Time), normal shipping hours apply

View and buy online:

<https://www.madisonco.com/products/m5600-float-switch-stainless-steel-1-4-npt-60-watt>

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Gardner Denver	R Series 7.5HP	Eng. Data Sheet: GD-R4-V1
	Engineering Data Sheet	Date: 2/25/2015
	Air Cooled, 60Hz	Supersedes: NEW

Model Number		VR7F-6	VR7F-8	VR7F-12	HR7F-6	HR7F-8	HR7F-12	HR7DF-12	HR7DF-25	BRF7	BR7	VR7-8	VR7-12	HR7-8	HR7-12	HR7-25	HR7D-12	HR7D-25	
Configurator Number		CASRSA			CADRSA	CABRSA	CASRSA			CADRSA									
Description	Units	Product Data																	
Compressor Pump																			
Pump Model	na	R15B							R30D										
Number of Cylinders	na	2							4										
Bore & Stroke	in.	4-5/8 & 2-1/2 x 3							4-5/8 (2) & 2-1/2 (2) x 3										
Flywheel	OD in.	16.5							18.875										
Pulley 125 PSIG	OD in.	9.35							7.0										
Pulley 175 PSIG	OD in.	9.35							6.2										
Number of Stages	na	2																	
Lubrication	na	Splash Lubricated																	
Oil Capacity	qt.	2							4										
Oil Type	na	AEON AC-HC, ISO 100 Non-Detergent Industrial Lubricant																	
Number of Belt Grooves	na	2																	
Belt Section	na	B																	
Crankcase	na	Cast Iron																	
Bearings	na	Tapered Roller																	
Cylinder	na	Aluminum with Cast Iron Liner																	
Piston 1st Stage	na	Aluminum Alloy																	
Piston 2nd Stage	na	Cast Iron																	
Valves	na	Disc Valves																	
Intake Filter	na	5 Micron																	
Main Drive Motor (1)																			
Drive Motor Nominal Power	hp(kW)	7.5 (5.59)																	
Voltage (2)	na	208/230/460/575																	
Phase	na	1 or 3																	
Drive Motor Speed	rpm	1800																	
Service Factor	na	1.15																	
Motor Insulation Class	na	F																	
Drive Motor Full Load Current - 208/1/60 (3)	amps	44.0																	
Drive Motor Full Load Current - 230/1/60 (3)	amps	40.0																	
Drive Motor Full Load Current - 208/3/60 (3)	amps	24.2																	
Drive Motor Full Load Current - 230/3/60 (3)	amps	22.0																	
Drive Motor Full Load Current - 460/3/60 (3)	amps	11.0																	
Drive Motor Full Load Current - 575/3/60 (3)	amps	9.0																	
Wire Size - 208/1/60 (3,4,5)	awg	6 (2)							6 (2)										
Wire Size - 230/1/60 (3,4,5)	awg	6 (2)							6 (2)										
Wire Size - 208/3/60 (3,4,5)	awg	8 (6)							8 (6)										
Wire Size - 230/3/60 (3,4,5)	awg	10 (6)							10 (6)										
Wire Size - 460/3/60 (3,4,5)	awg	14 (10)							14 (10)										
Wire Size - 575/3/60 (3,4,5)	awg	14 (10)							14 (10)										

- 1) Main Drive Motor performance is based off the standard ODP motor.
- 2) Compressors are voltage specific and must be specified at time of order.
- 3) The amp draws and wire size provided are off general NEC guidelines. For proper breaker and fuses please consult a licensed electrician or electrical contractor.
- 4) Copper wire, 75°C (167°F) maximum temperature rating, 30°C (86°F) ambient temperature
- 5) Values in () is for incoming power line on duplex units.

Gardner Denver	R Series 7.5HP	Eng. Data Sheet: GD-R4-V1
	Engineering Data Sheet	Date: 2/25/2015
	Air Cooled, 60Hz	Supersedes: NEW

Model Number		VR7F-6	VR7F-8	VR7F-12	HR7F-6	HR7F-8	HR7F-12	HR7DF-12	HR7DF-25	BR7F	BR7	VR7-8	VR7-12	HR7-8	HR7-12	HR7-25	HR7D-12	HR7D-25
Configurator Number		CASRSA			CADRSA			CABRSA	CASRSA			CADRSA						
Description	Units	Product Data																
Performance Data (6)																		
CFM Delivery @ 125 PSIG (7)	acfm	23.9			47.8			23.9			30.0			60.0				
CFM Delivery @ 175 PSIG (7)	acfm	23.1			46.2			23.1			25.8			51.6				
CFM Displacement @ 125 PSIG	icfm	28.7			57.4			28.7			39.6			79.2				
CFM Displacement @ 175 PSIG	icfm	28.7			57.4			28.7			33.5			67.0				
Maximum Pressure	psig	175																
Working Pressure Differential	psig	35																
Pump Operating Speed @ 125 PSIG	rpm	990						670										
Pump Operating Speed @ 175 PSIG	rpm	990						575										
Minimum Speed	rpm	400																
Maximum Speed	rpm	1000						1050										
Cooling Air Flow @ 125 PSIG	cfm	1195						975										
Cooling Air Flow @ 175 PSIG	cfm	1195						835										
Heat Rejection	btu/hr	16800																
Noise Level (8)	dB(A)	77			80			77			78							
Aftercooler Approach Temp (9)	°F	45																
Min/Max Operating Temp	°F	32/104																
Dimensions and Weight																		
Tank Size	gal	60	80	120	60	80	120	250	na	80	120	80	120	250	120	250		
Tank Configuration	na	Vertical			Horizontal				na	Vertical			Horizontal					
Tank Capacity @ 125 PSIG	ft³	68.4	91.1	137	68.4	91.1	137	68.4	285	na	91.1	137	91.1	137	284.9	136.7	284.9	
Tank Capacity @ 175 PSIG	ft³	95.7	128	191	95.7	128	191	95.7	399	na	128	191	128	191	398.8	191.4	398.8	
Tank Pumping Time @ 125 PSIG (10)	min	2.85	3.8	5.71	2.85	3.8	2.85	5.94	na	3.03	4.55	3.03	4.55	9.47	2.27	4.74		
Tank Pumping Time @ 175 PSIG (10)	min	4.13	5.51	8.27	4.13	5.51	4.13	8.61	na	4.93	7.4	4.93	7.46	15.42	3.7	7.71		
Package Length	in.	35	35	43	51	66	71.5	75	88.5	38	42.7	42.5	67.3	71.4	88.5	83	88	
Package Width	in.	25	27	30	22.5	22.5	25.5	30	21.3	25	22.5	30	26	26	31	30	33.1	
Package Height	in.	77	75	80.5	49	53	56.5	61.5	29.5	28.5	66.8	81	49.5	52.8	60	56	61.3	
Total Package Weight	lbs.	485	635	765	485	570	765	1150	1485	310	430	665	800	665	860	1275	1305	1675
Pump Length	in.	20						21.13										
Pump Width	in.	16.875						25.42										
Pump Height	in.	23.25						23.563										
Pump Weight	lbs.	109						220										
Discharge Connection (11)	npt "	1/2 F		3/4 F	1/2 F		3/4 F					3/4 F						
Outline Drawing ID	na	336CAS800	313CAS800	326CAS800	335CAS800	320CAS800	325CAS800	308CAD800	309CAD800	302CAB800	303CAB800	330CAS800	329CAS800	328CAS800	327CAS800	323CAS800	303CAD800	306CAD800
Operating/Parts Manual ID	na	GF3231									GF3233							

- 6) All units tested in accordance with CAGI/PNEUROP Acceptance Test Code PN2CPTC2.
- 7) acfm is actual cubic feet per minute at inlet conditions.
- 8) Sound levels are based off estimated dB(A).
- 9) Approach temperature is the temperature above the discharge air and above the ambient air of the aftercooler.
- 10) Tank pumping time is based off 0 PSIG to fully pressurized.
- 11) M = Male connection, F=Female connection

NOTE: Duplex models take quantities of 2 on applicable items such as motors, pump, oil quantity, etc.

Due to Gardner Denver's continuing product development program, specifications and materials are subject to change without notice or obligation.

Refrigerated Global Design

RGD series refrigerated air dryers offer the perfect balance between technology and simplicity to dry compressed air systems to a stable ISO 8573-1 Air Quality, Class 4 to 5 pressure dew point.



Design Features

RGD 25-50 SCFM

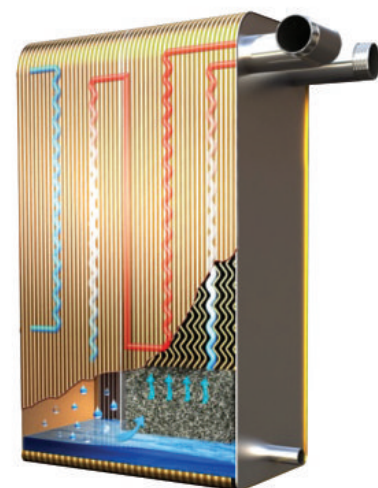
- Smooth bore, copper tube-on-tube heat exchangers
- Centrifugal separator efficiently captures condensate
- Static condenser design provides trouble free, quiet operation
- Electronic drain valve

RGD 75-500 SCFM

- Stainless steel, cross flow heat exchangers optimize heat transfer and service life
- Compact design saves floor space
- Stainless steel inlet/outlet connections to prevent corrosion
- Timed electric condensate drain
- Integral demister/separator



Copper
"Tube-on-Tube"
Heat Exchanger



Stainless Steel
Demister/Separator

RGD SPECIFICATIONS

MODEL	RATED FLOW (SCFM)	AVAILABLE VOLTAGES	INLET/OUTLET CONNECTIONS (IN)	POWER (KW)	REFRIGERANT	DIMENSIONS (IN)			WEIGHT (LBS)
						H	W	D	
RGD25A1	25	115/1/60	¾" NPT	0.41	R134a	22.00	16.00	15.00	88
RGD35A1	35			0.46		22.00	16.00	15.00	92
RGD50A1	50			0.57		22.00	20.00	20.00	101
RGD75A1	75			0.52		23.67	14.28	32.33	123
RGD100A1	100			0.65		23.67	14.28	32.33	129
RGD125A1	125	115/1/60	1" NPT	0.68	R134a	23.67	14.28	32.33	135
RGD150A1	150			1.11		21.00	13.00	30.00	161
RGD150A2	150	230/1/60	2" NPT	0.91	R-407c	23.67	14.28	34.69	152
RGD200A2	200	230/1/60 460/3/60		1.53	R-407c	29.97	17.43	36.66	196
RGD200A4	200		1½" NPT	1.42	R134a	30.00	17.00	36.00	183
RGD250A2	250		2" NPT	1.87	R-407c	29.97	17.43	36.66	181
RGD250A4	250		1½" NPT	1.98	R134a	30.00	17.00	36.00	211
RGD300A2	300		2" NPT	2.09	R-407c	31.94	19.39	43.75	252
RGD300A4	300		1½" NPT	2.05	R134a	30.00	20.00	38.00	219
RGD400A2	400		2" NPT	2.83	R-407c	31.94	19.39	43.75	270
RGD400A4	400			2.50	R134a	30.00	21.00	38.00	232
RGD500A4	500	3.18		R407c	31.94	21.36	47.69	328	

Maximum Inlet Air Temperature: 120°F (49°C) Maximum Operating Pressure: 250 psig (Models RGD25-50), 232 psig (Models RGD75-500). Above conditions tested at 100°F inlet air temperature, 100% saturated inlet air, 100 psig operating pressure and 100°F ambient air temperature.

OPERATING CONDITIONS

MODEL SCFM	MAX INLET AIR PRESSURE		MIN INLET AIR PRESSURE		MAX INLET AIR TEMPERATURE		MIN INLET AIR TEMPERATURE		MAX AMBIENT AIR TEMPERATURE		MIN AMBIENT AIR TEMPERATURE	
	PSIG	BARG	PSIG	BARG	°F	°C	°F	°C	°F	°C	°F	°C
25-50	250	17	30	2	120	49	40	4	110	43	45	7
75-500	232	16	10	1	120	49	40	4	110	43	45	7

CAPACITY CORRECTION FACTORS

To adjust the dryer capacity for non-standard conditions, use the Capacity Correction Factors (multipliers) from the tables below.
Sizing Example: What is the capacity of an RGD100 at 100°F inlet air temperature, 150 psig working pressure and 110°F ambient air temperature?

Answer: 100 scfm (rated flow from RGD specifications table) x 1.08 (correction factor for inlet air temperature, table 1) x 0.94 (correction factor for ambient air temperature, table 2) = 102 scfm

INLET AIR PRESSURE		INLET AIR TEMPERATURE			
PSIG	BARG	90°F/32°C	100°F/38°C	110°F/43°C	120°F/49°C
80	5.6	1.19	0.95	0.77	0.63
100	6.9	1.25	1	0.82	0.68
125	8.6	1.3	1.05	0.86	0.72
150	10.3	1.34	1.08	0.9	0.75
175	12.1	1.37	1.11	0.92	0.78
200	13.8	1.39	1.14	0.95	0.8
250	17.2	1.43	1.17	0.98	0.83

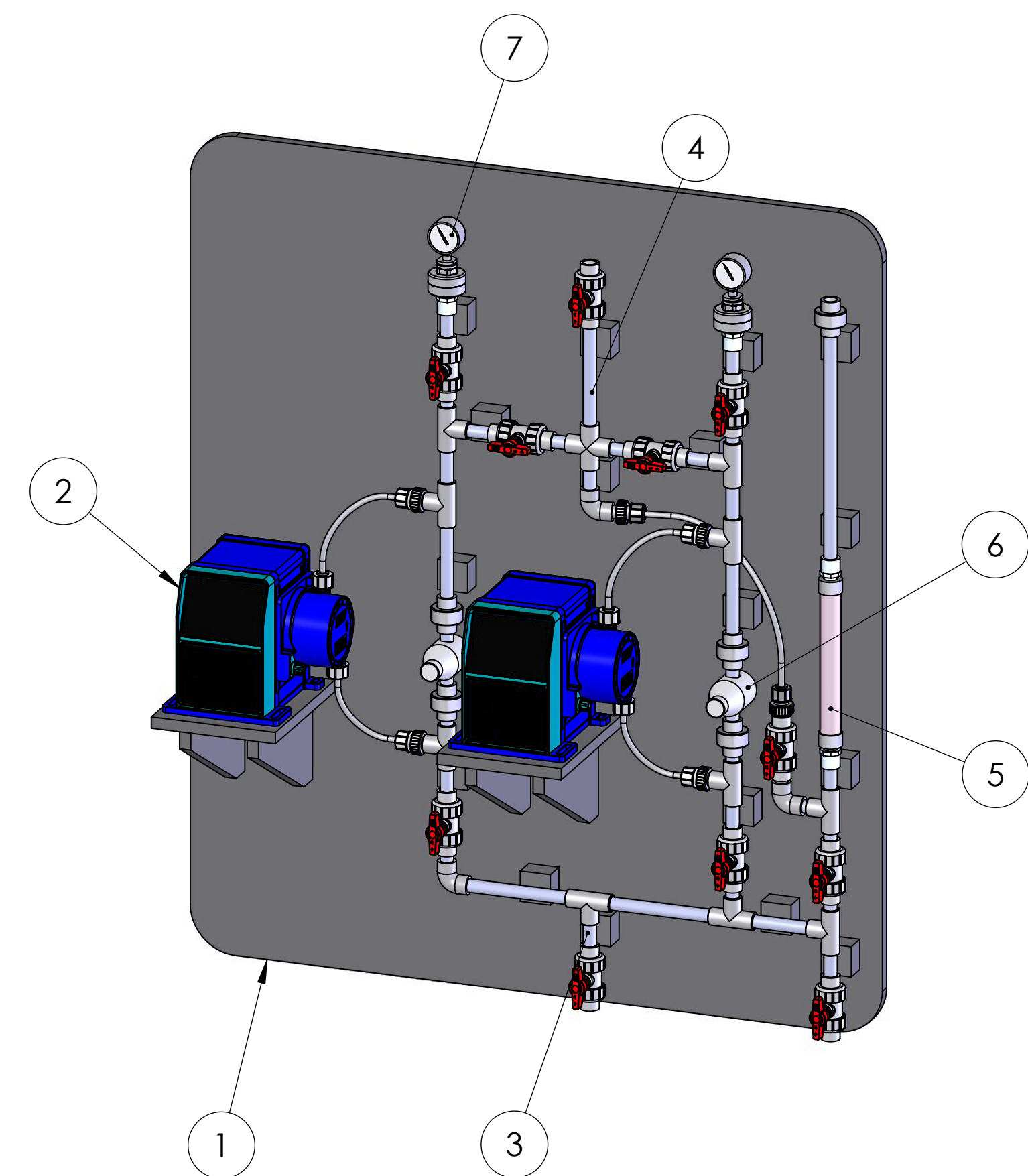
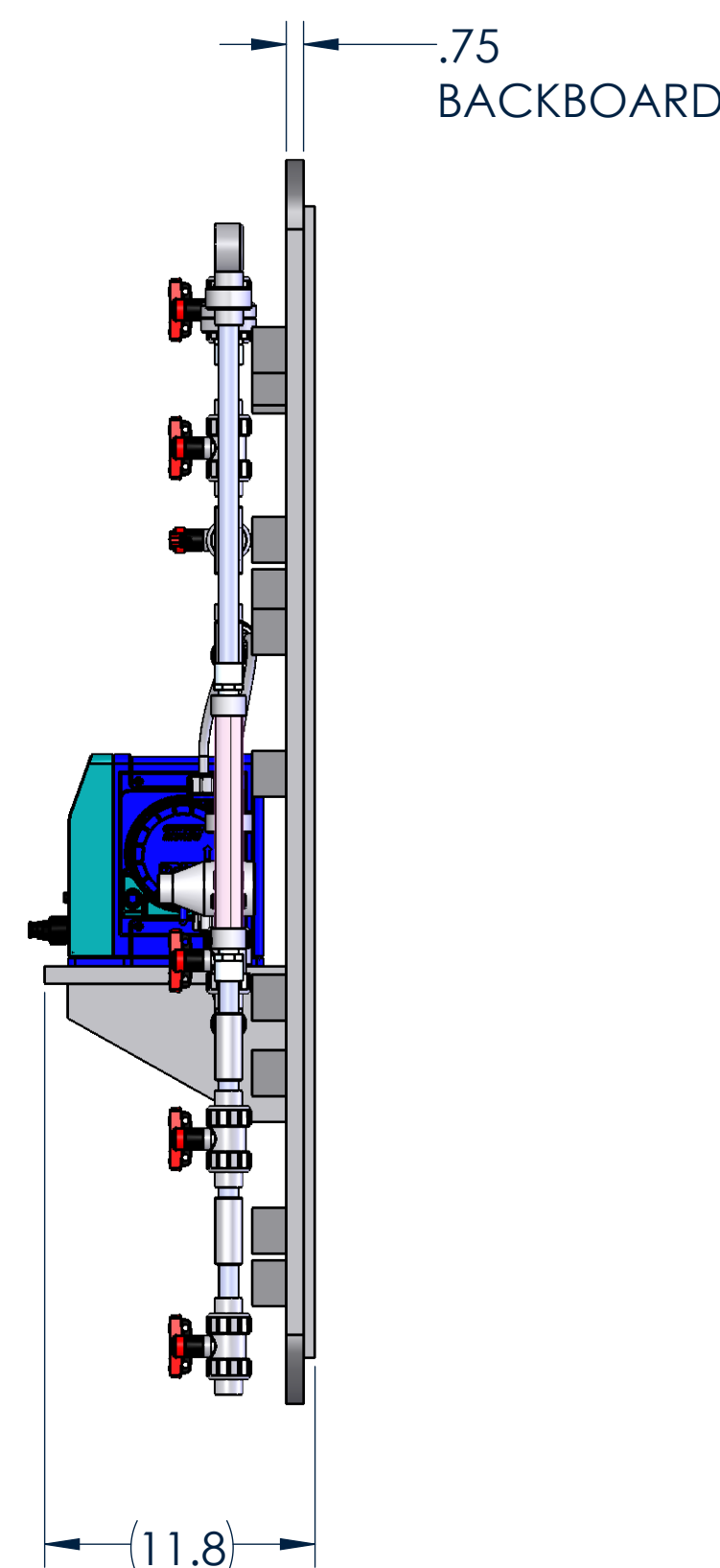
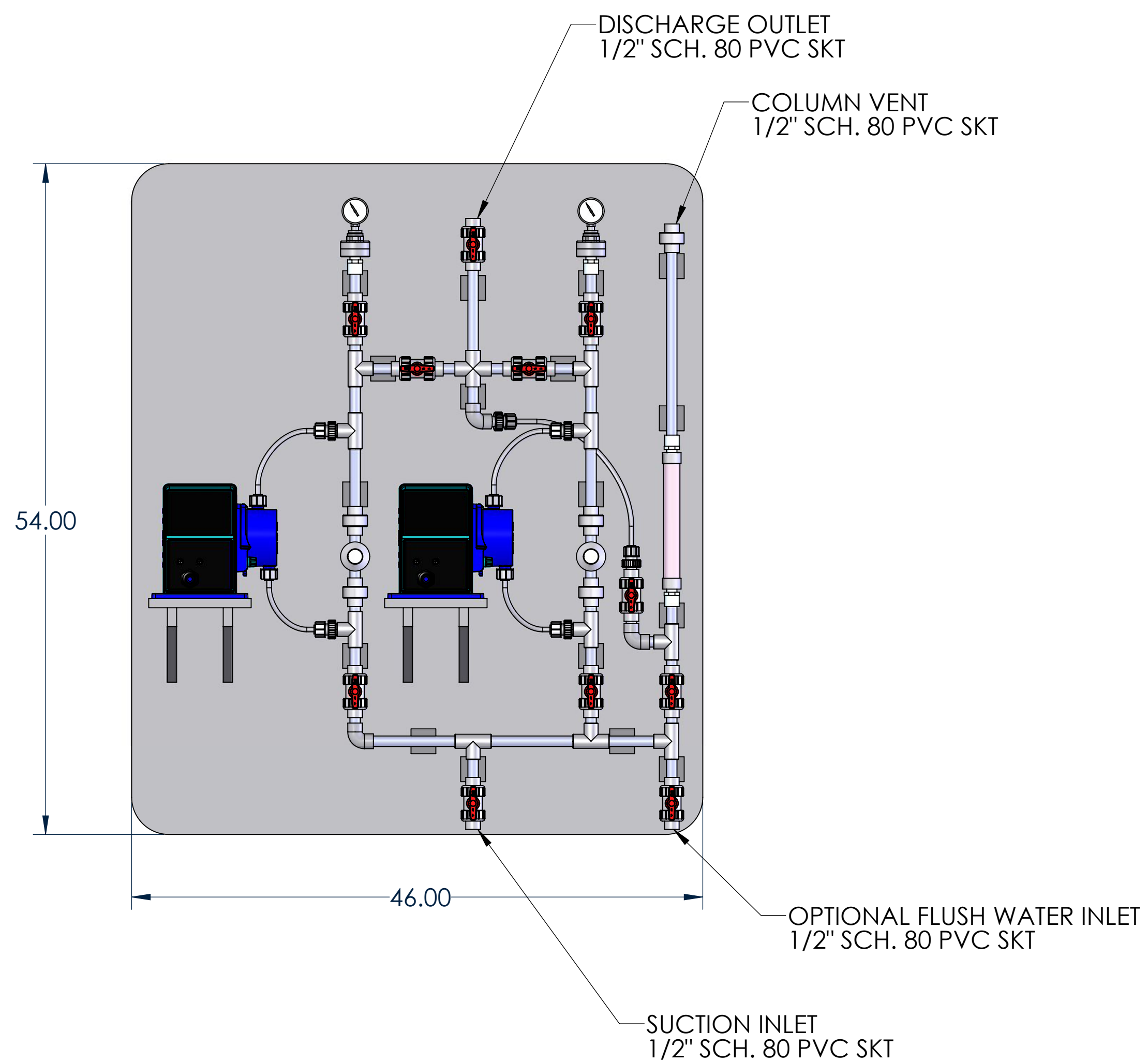
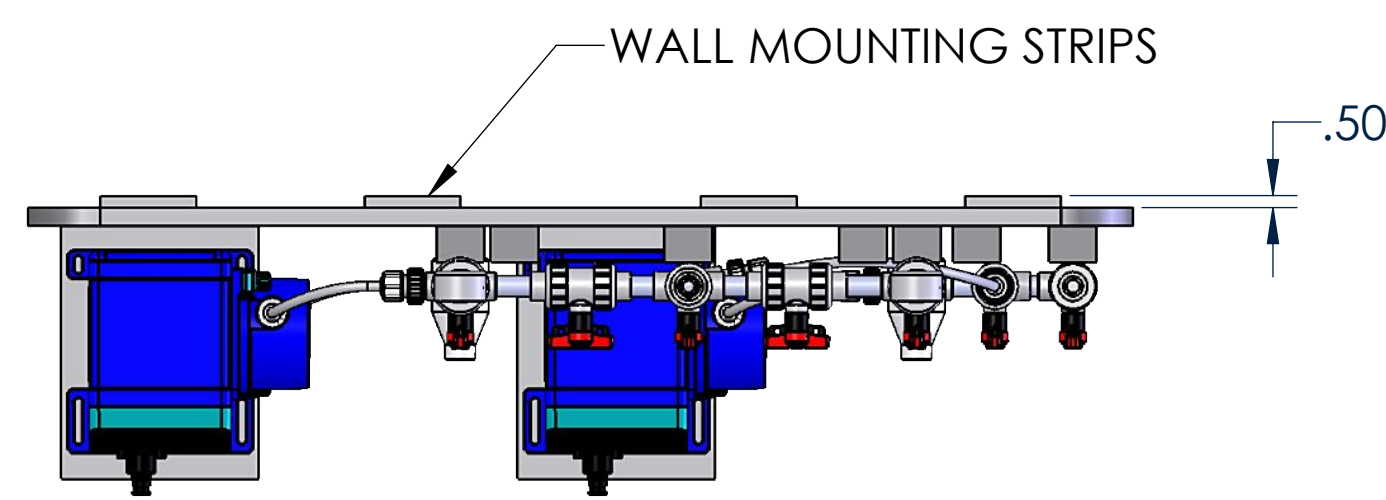
AMBIENT AIR TEMPERATURE	80°F/27°C	90°F/32°C	100°F/38°C	110°F/43°C
Multiplier	1.12	1.06	1	0.94

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REVISIONS				
ZONE	REV.	DESCRIPTION	DATE	APPROVED
	A	CHANGED COLUMN FILL PLUMBING	4/28/2021	BZ

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	DTY-STDY 110	HDPE WALL MOUNT	1
2	S062253150	QDOS 30 PERISTALTIC PUMP	2
3	DTY-STDY 100901	SUCTION PIPING ROUTE	1
4	DTY-STDY 100902	DISCHARGE PIPING ROUTE	1
5	260607	CALIBRATION COLUMN, PVC, 100ml, 1/2" FNPT	1
6	PRM2050-PS	PRESSURE RELIEF VALVE, 1/2" SOCKET, PVC/PTFE, 2 PORT	2
7	GG050P25T	PRESSURE GAUGE AND GUARD, 1/2" FNPT PVC/PTFE, 0-300 PSI, 2" SST CASE	2

Pricing Option
Chemical Dosing Skid:



- NOTES:
1. FRAME MATERIAL: 3/4" THICK THERMAL WELDED BLACK HDPE
 2. PIPING MATERIAL: SCHEDULE 80 PVC, FKM/FPM (VITON) & PTFE (TEFLON) ELASTOMERS
 3. CONNECTIONS: SOCKET, NPT OR TUBING TYPE
 4. SOLVENT CEMENT: WELD-ON 724

PROPRIETARY AND CONFIDENTIAL
THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF NEXOM.
ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF NEXOM IS PROHIBITED.

UNLESS OTHERWISE SPECIFIED:		NAME	DATE
DRAWN	DIMENSIONS ARE IN INCHES	BZ	2018/12/18
CHECKED	TOLERANCES:		
ENG APPR:	FRACTIONAL ±		
MFG APPR:	ANGULAR: MACH ±		
G.A.	BEND ±		
COMMENTS:	TWO PLACE DECIMAL ±		
	THREE PLACE DECIMAL ±		
	INTERPRET GEOMETRIC TOLERANCING PER:		
	MATERIAL		
NEXT ASSY	USED ON		
	FINISH		
APPLICATION			

Nexom

TITLE: 2-PUMP DUTY/STANDBY STD WALL CHEM FEED SYS

SIZE DWG. NO. REV
D DTY-STDY 100 **A**

SCALE: 1:8 WEIGHT: SHEET 1 OF 1

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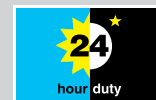
Qdos 30 Universal and Universal+ pumps with 24V relay module

qdos30
Peristaltic Metering

Watson-Marlow Pumps

FEATURES AND BENEFITS

- Flow rates 0.1 ml/min (0.001 USGPH) to 500 ml/min (7.93 USGPH) at 7 bar (100psi) RMS pressure
- ReNu pumphead provides accurate, linear and repeatable flow
- Fluid recovery ensures operator safety and avoids chemical waste
- Flow control 5000:1 with $\pm 1\%$ accuracy
- Manual, analogue or contact mode functionality
- 3.5" (88.9mm) colour TFT display providing pump feedback through colour, icons, graphics and text
- No valves or ancillary equipment required



Watson-Marlow... Innovation in Full Flow

PERFORMANCE

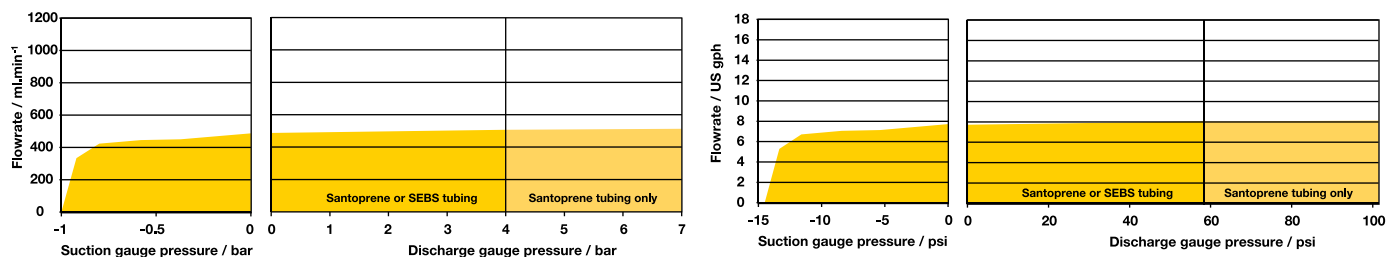
Qdos 30 pump typical flow rates

	Speed (rpm)	Flow (ml/min)*
ReNu Pumphead	0.025-125	0.1-500
	Speed (rpm)	Flow (USGPH)*
ReNu Pumphead	0.016-125	0.001-7.93

*accuracy $\pm 1\%$, repeatability $\pm 0.5\%$

Chemical Pumps:
P-1, P-2

Flow rate with discharge pressure for ReNu pumpheads at different drive speeds



TECHNICAL DATA

Functionality	Qdos 30 Universal	Qdos 30 Universal+
Operational modes		
Manual	•	•
Contact	•	•
4-20mA	•	•
Fluid recovery	•	•
Fault reporting	•	•
Manual control		
Flow rate range 0.1 to 500 ml/min (5000:1)	•	•
Numerical flow display	•	•
Numerical speed display	•	•
Numerical percentage of max speed display	•	•
Fluid level monitor	•	•
Max (prime)	•	•
Auto restart	•	•

Functionality (continued)	Qdos 30 Universal	Qdos 30 Universal+
Fluid recovery and leak detection	•	•
Remote control		
4-20mA input	•	•
4-20mA input two point calibration		•
4-20mA output		•
Contact input (pulse/batch)	•	•
Run stop input (configurable, N/O or N/C)	•	•
Run status output	•	•
Alarm output	•	•
Security		
Keypad lock	•	•
PIN lock to protect set up	•	•

DIMENSIONS



TECHNICAL SPECIFICATION

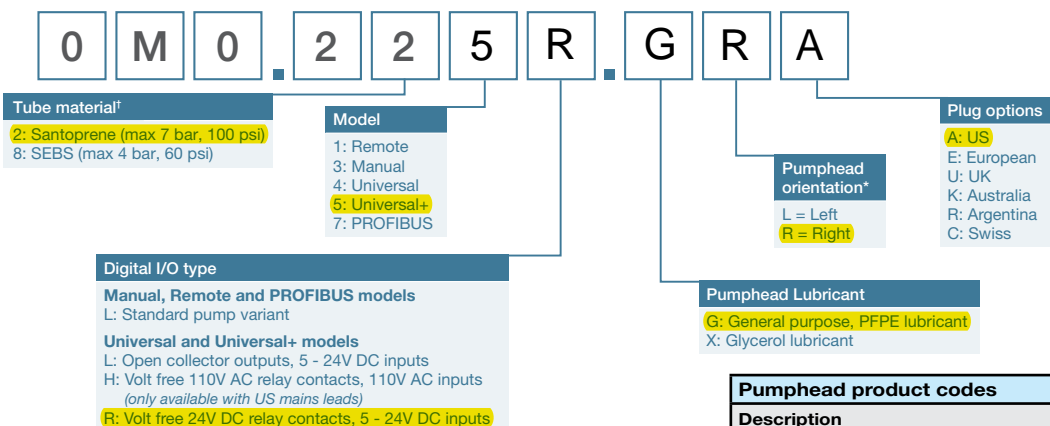
Ingress rating	IP66
Enclosure	Watertight / dustproof
Humidity	Non-condensing 5% to 95%
Temperature	5C to 45C (41F to 113F) Santoprene 5C to 40C (41F to 104F) SEBS
Pump weight	Drive: 4.1kg (9lb 6oz) Pumphead: 0.95kg (2lb 15oz)
Control ratio	5000:1
Noise	< 70dB(A) at 1m
Standard	CE, NSF 61, cETLus
Power supply	Switch mode power supply ~100-240V 50-60Hz 190VA

MATERIALS OF CONSTRUCTION

Component	Material
Keypad	Polyester
Drive casework	20% Glass filled PPE/ PS
Drive shaft	Stainless steel 440C
Pumphead enclosure	40% Glass filled PPS
Rotor	Glass filled nylon
Rotor bearings	Steel
Tube†	Santoprene (max 7 bar, 100 psi) SEBS (max 4 bar, 60 psi)
Hydraulic connectors	Polypropylene
Lubricant*	PFPE based (standard lubricant) Glycerol-based (optional lubricant)

*The ReNu Pumphead contains lubricant. It is the user's responsibility to comply with local health and safety regulations, including ensuring chemical compatibility between the lubricant and the duty fluid before use. The standard lubricant is PFPE. A glycerol/glycol blend lubricant is also available as an option.

ORDER INFORMATION



Pumphead product codes	
Description	Partcode
ReNu pumphead 7 bar (100 psi) PFPE lubricant	0M3.2200.PFP
ReNu pumphead 7 bar (100 psi) glycerol-based-lubricant	0M3.2200.GLY
ReNu pumphead 4 bar (60psi) PFPE-lubricant	0M3.2800.PFP

* The pumphead side location is required when ordering. The left/right perspective assumes the user is looking at the front of the pump. The pump in the dimensions diagram is considered a pumphead located to the left.

All flow rates shown were obtained pumping water at 20C (68F) with zero suction and delivery heads.
Disclaimer: The information contained in this document is believed to be correct but Watson-Marlow Limited accepts no liability for any errors it contains and reserves the right to alter specifications without notice. It is the users responsibility to ensure product suitability for use within their application. Watson-Marlow, Qdos, ReNu, LoadSure, Bioprene, Pumpsil and Marprene are trademarks of Watson-Marlow Limited. STA-PURE PFL® and STA-PURE PCS® are registered trademarks of W.L Gore & Associates Inc. Please state the product code when ordering pumps and tubing.

**WATSON
MARLOW
Pumps**

wmpg.co.uk
info@wmpg.co.uk
+44 (0) 1326 370370

Special Warranty Terms

1. Offer, Governing Provisions and Cancellation. This document is an offer or counter-offer by Nexom ("Seller") to sell the goods and/or services described in it in accordance with these terms and conditions, is not an acceptance of any offer made by buyer, and is expressly conditioned upon buyer's assent to these Terms and Conditions of Sale. Seller objects to any additional or different terms contained in any request for proposal, purchase order, acknowledgement or other communication previously or hereafter provided by buyer to Seller. No such additional or different terms or conditions will be of any force or effect. The terms contained in or incorporated into this document will be the entire agreement between Seller and buyer on the subject of the transaction described herein; there are no conditions to that agreement that are not so contained or incorporated. **THIS OFFER AND THAT AGREEMENT WILL BE GOVERNED BY AND CONSTRUED ACCORDING TO THE LAWS OF THE STATE OR PROVINCE IN WHICH THE OFFICE OF THE SELLER THAT ISSUED THIS OFFER IS LOCATED (WITHOUT REFERENCE TO PRINCIPLES OF CONFLICTS OF LAWS). THE RIGHTS AND OBLIGATIONS OF THE PARTIES HEREUNDER WILL NOT BE GOVERNED BY THE 1980 U.N. CONVENTION ON CONTRACTS FOR THE INTERNATIONAL SALE OF GOODS.**

No accepted offer may be cancelled or altered by buyer except upon terms and conditions accepted by Seller in writing, and no changes to this document will be binding unless set forth in writing and manually signed by Seller. This offer may be revoked by Seller at any time before it is accepted by buyer, and will automatically expire 30 calendar days after its date if buyer has not accepted it before then. Neither buyer's acceptance of this offer nor any conduct by Seller (including but not limited to shipment of goods) will oblige Seller to sell to buyer any quantity of goods in excess of the quantity that buyer has committed to purchase from Seller at the time of such acceptance or conduct.

2. Credit Approval; Payment Terms; Storage. All payment terms set forth in this document are subject to Seller's approval of buyer's credit, in Seller's discretion; if such approval is withheld, payment will be due in advance of Seller's performance. Except as otherwise provided on the face of this document or in the preceding sentence, payment is due upon buyer's receipt of Seller's invoice following shipment. Interest will be charged at the lesser of (i) 18% per year, or (ii) the highest rate permitted by applicable law, on accounts more than 30 calendar days past due. If production or shipment of completed goods, or other Seller performance, is delayed by buyer, Seller may immediately invoice, and buyer will pay, the percentage of the purchase price corresponding to the percentage of completion; in addition, buyer will compensate Seller for storage of completed goods or work in process during any such delay, whether stored at Seller's facility or an independent storage company's facilities.

3. Delivery, Claims and Force Majeure. Unless otherwise provided on the face of this document, goods shall be delivered to buyer F.O.B. Seller's loading dock or, for ultimate destinations outside of the U.S., EXW Seller's loading dock (as the latter shipping term is defined in *Incoterms 2010*). Delivery of products to the carrier will constitute delivery to buyer, and regardless of shipping terms or freight payment, buyer will bear all risk of loss or damage in transit. Seller reserves the right to make delivery in installments, unless otherwise expressly stipulated herein; all such installments to be separately invoiced and paid for when due per invoice, without regard to subsequent deliveries. Delay in delivery of any installment will not relieve buyer of its obligations to accept remaining deliveries.

Claims for shortages or other errors in delivery must be made in writing to Seller within 10 calendar days after receipt of shipment, and failure to give such notice will constitute unqualified acceptance and a waiver of all such claims for such shortages or delivery errors by buyer. Claims for loss of or damage to goods in transit must be made to the carrier, and not to Seller.

All delivery dates are approximate. Seller will not be liable for any losses or damages as a result of any delay or failure to deliver due to any cause beyond Seller's reasonable control, including but not limited to any act of God, act of buyer, embargo or other governmental act, regulation or request, fire, accident, strike, slowdown, war, act of terrorism, riot, delay in transportation, or inability to obtain necessary labor, materials or manufacturing facilities. In the event of any such delay, the date of delivery will be extended for a period equal to the time lost because of the delay. Buyer's exclusive remedy for other delays, and for Seller's inability to deliver for any reason, will be rescission of its agreement to purchase.

4. Warranties. Seller warrants any goods provided hereunder to be free from nonconformity to any attached specifications, and free of defects in materials and workmanship, appearing within twelve (12) months after substantial completion or eighteen (18) months after delivery, whichever occurs first. If within such period any such goods shall be proved to Seller's satisfaction to be defective, the affected part will be repaired or replaced free of charge, F.O.B. Seller's loading dock or, for customers outside of the U.S., EXW Seller's loading dock (as the latter shipping term is defined in *Incoterms 2010*, for purposes of which definition buyer will have the responsibilities of the "seller"), or Seller will refund the purchase price of the affected part. Such repair, replacement or refund (whichever Seller determines, in its discretion, to provide) will be Seller's sole obligation and buyer's exclusive remedy for any deficiency in goods furnished hereunder, and will be conditioned upon buyer's return of such goods to Seller, F.O.B. Seller's loading dock or, for customers outside of the U.S., DDP Seller's loading dock (as the latter shipping term is defined in *Incoterms 2010*, for purposes of which definition buyer will have the responsibilities of the "seller"). Any parts repaired or replaced under this warranty are warranted only for the balance of the warranty period on the part that was repaired or replaced.

This warranty shall not apply to prime movers, starting products, electrical apparatus, parts, material and any other products not manufactured by Seller; such products are sold **AS IS**, except that the warranties, if any, of the respective manufacturers of such products, parts or material shall be assigned by Seller to Buyer. Seller has no liability for products installed by anyone other than it or its authorized agent. Decomposition by chemical action and wear caused by the presence of abrasive materials shall not constitute defects under the foregoing warranty, nor shall Seller have any responsibility hereunder with respect to products which have been repaired or altered by others without Seller's written consent.

Seller warrants that any services it provides hereunder will be performed in a manner consistent with customary practice in its industry. Should a failure to conform to this warranty appear within thirty 30 calendar days after completion of any services, Seller will, if promptly notified thereof in writing, either perform the services again, properly and without charge, or refund the price charged for such services. Such reperformance or refund (whichever Seller determines, in its discretion, to provide) will be the buyer's exclusive remedy and the Seller's sole liability with respect to any deficiency in services furnished hereunder.

THE ABOVE WARRANTIES ARE EXCLUSIVE AND IN LIEU OF ALL OTHER REPRESENTATIONS AND WARRANTIES, EXPRESS OR IMPLIED. SELLER EXPRESSLY DISCLAIMS AND EXCLUDES ANY IMPLIED WARRANTY OF

[See section: Five Year Extended Warranty](#)

MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE, AND ANY WARRANTIES ARISING FROM COURSE OF DEALING OR USAGE OF TRADE.

Any description of the products, whether in writing or made orally by Seller or its agents, specifications, samples, models, bulletins, drawings, diagrams, engineering sheets or similar materials used in connection with Buyer's order are for the sole purpose of identifying the products and shall not be construed as an express warranty. Any suggestions by Seller or Seller's agents regarding use, application or suitability of the products shall not be construed as an express warranty unless confirmed to be such in writing by Seller.

5. Patents, Trademarks and Copyrights. Seller will, at its own expense, defend any suits that may be instituted by anyone against buyer for alleged infringement of any patent, trademark or copyright relating to goods or services provided by Seller, and will pay any final damage award therein, provided buyer has made all payments then due hereunder, will give Seller immediate notice in writing of any such suit, will transmit to Seller immediately upon receipt all processes and papers served upon buyer, and will permit Seller, through its counsel, to defend or settle the same, either in the name of buyer or in the name of Seller, giving Seller all needed information, assistance and authority to enable Seller to do so. Further, if the result of any such suit is a determination or acknowledgement of infringement, Seller will, at Seller's option (a) obtain for buyer the right to continue to use the goods, or the products of the services purchased from Seller, or (b) replace the same with non-infringing goods or services, or (c) modify such goods or services so that they are non-infringing, or (d) remove such goods or products of services and refund to buyer the undepreciated portion of the purchase price, determined on the basis of a five-year useful life.

To the extent that any goods or services that Seller furnishes to buyer are manufactured in accordance with drawings, designs or specifications proposed or furnished by buyer, Seller will not be liable, and buyer will indemnify and hold harmless Seller from and against any and all losses, liabilities, damages, claims and expenses (including but not limited to Seller's reasonable attorneys' fees and other costs of defense) incurred by Seller as a result of any claim of patent, trademark, copyright or trade secret infringement, or infringement or any other proprietary rights of third parties.

6. Consequential Damages and Other Liability. Seller's liability with respect to the goods or services sold hereunder will be limited to the remedy and indemnity provided in sections 4 and 5 of these Terms and Conditions of Sale and, with respect to any other breaches of its contract with buyer, will be limited to the contract price of the affected goods. **SELLER WILL NOT BE SUBJECT TO ANY OTHER OBLIGATIONS OR LIABILITIES, WHETHER ARISING OUT OF BREACH OF CONTRACT, WARRANTY, TORT (INCLUDING NEGLIGENCE AND STRICT LIABILITY), OR UNDER OTHER THEORIES OF LAW OR EQUITY, WITH RESPECT TO GOODS OR SERVICES SOLD BY SELLER, OR ANY UNDERTAKINGS, ACTS OR OMISSIONS RELATING THERETO.** Without limiting the generality of the foregoing, Seller specifically disclaims any liability for property damages, penalties, special or punitive damages, damages for lost profits or revenues, downtime, lost good will, cost of capital, cost of substitute goods or services, or for any other types of economic loss, or for claims of buyer's customers or any third party for any such damages, costs or losses. **SELLER WILL NOT BE LIABLE FOR, AND DISCLAIMS, ALL CONSEQUENTIAL, INCIDENTAL, INDIRECT AND CONTINGENT DAMAGES WHATSOEVER.**

7. Buyer's Indemnity. BUYER WILL INDEMNIFY AND HOLD HARMLESS SELLER FROM AND AGAINST ANY AND ALL LOSSES, LIABILITIES, DAMAGES AND EXPENSES (INCLUDING BUT NOT LIMITED TO ATTORNEYS FEES AND OTHER COSTS OF DEFENSE) THAT SELLER MAY INCUR AS A RESULT OF ANY CLAIM, OTHER THAN A CLAIM FOR THE REMEDIES PROVIDED IN SECTIONS 4 AND 5 OF THESE TERMS AND CONDITIONS OF SALE, BY BUYER OR BUYER'S CUSTOMERS OR BY ANY THIRD PARTY ARISING OUT OF OR RELATING TO THE GOODS OR SERVICES SOLD HEREUNDER, INCLUDING BUT NOT LIMITED TO ANY SUCH CLAIM BASED UPON THE NEGLIGENCE OF SELLER IN DESIGNING, MANUFACTURING, PERFORMING AND/OR SELLING SUCH GOODS OR SERVICES, UNLESS SUCH LOSSES, LIABILITIES, DAMAGES OR EXPENSES ARE ULTIMATELY DETERMINED TO BE ATTRIBUTABLE SOLELY TO THE WILLFUL MISCONDUCT OF SELLER.

8. Taxes and Other Charges. Any manufacturer's tax, occupation tax, use tax, sales tax, excise tax, value added tax, duty, custom, inspection or testing fee, or any other tax, fee, interest or charge of any nature whatsoever imposed by any governmental authority on or measured by the transaction between Seller and buyer will be paid by buyer in addition to the prices quoted or invoiced. In the event Seller is required to pay any such taxes or other charges, buyer will reimburse Seller therefor on demand.

9. Changes. Seller may at any time make such changes in design and construction of products, components or parts as Seller deems appropriate, without notice to buyer. Seller may furnish suitable substitutes for materials unobtainable because of priorities or regulations established by governmental authority, or non-availability of materials from suppliers.

10. Technical Information. Any sketches, models or samples submitted by Seller will remain the property of Seller, and will be treated as confidential information unless Seller has in writing indicated a contrary intent. No use or disclosure of such sketches, models or samples, or any design or production techniques revealed thereby, will be made without the express, prior written consent of Seller.

11. Designs and Tools. Any design work performed by Seller, and any dies, molds, jigs or other tools that Seller manufactures or acquires, in connection with its performance hereunder will be and remain the sole property of Seller, notwithstanding any charges to buyer therefor. Any such charges convey to buyer the right to have the designs, dies, molds, jigs and/or other tools used by Seller for performance hereunder, but do not convey title or right of possession or any other right.

12. Permits. The Buyer shall have full responsibility for securing the requisite permits and compliance with all health and sanitation laws, ordinances and regulations pertaining to the installation of the products involved in a sewage treatment plant or other products sold by Seller.

Please address PO to:

Nexom Inc.
323 N Spokane St. Suite 200
Post Falls ID 83854

Please forward electronic PO to:

Todd Hansen
thansen@nexom.com
(208) 618-2232

BID BOND

Any singular reference to Bidder, Surety, Owner, or other party shall be considered plural where applicable.

BIDDER (Name and Address): Nexom (US), Inc.
323 North Spokane Street, Suite 200
Post Falls, ID 83854

SURETY (Name, and Address of Principal Place of Business): Liberty Mutual Insurance Company
175 Berkeley Street
Boston, MA 02116

OWNER (Name and Address): City of Aberdeen
33 N. Main Street
Aberdeen, ID 83210

BID

Bid Due Date: May 11, 2023
Description (Project Name— Include Location): Wastewater Treatment Plant Equipment Pre-Purchase
2683 West 1750 South, Aberdeen, ID 83210

BOND

Bond Number: BDTO-480006-023-003
Date: May 3, 2023
Penal sum Five Percent of the Tender Price (Words) \$ 5% of the Tender Price (Figures)

Surety and Bidder, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Bid Bond to be duly executed by an authorized officer, agent, or representative.

BIDDER Nexom (US), Inc. (Seal) **SURETY** Liberty Mutual Insurance Company (Seal)
Bidder's Name and Corporate Seal Surety's Name and Corporate Seal

By: [Signature]
Signature

By: [Signature]
Signature (Attach Power of Attorney)

ANCUSCH MATHEW
Print Name

Alexandra Derksen
Print Name

GENERAL MANAGER
Title

Attorney-in-Fact
Title

Attest: [Signature]
Signature

Attest: [Signature]
Signature

Title Senior Mechanical Engineer

Title Surety Broker

Note: Addresses are to be used for giving any required notice.
Provide execution by any additional parties, such as joint venturers, if necessary.

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Bidder's and Surety's liability. Recovery of such penal sum under the terms of this Bond shall be Owner's sole and exclusive remedy upon default of Bidder.
2. Default of Bidder shall occur upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.
3. This obligation shall be null and void if:
 - 3.1 Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or
 - 3.2 All Bids are rejected by Owner, or
 - 3.3 Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).
4. Payment under this Bond will be due and payable upon default of Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.
5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions shall not in the aggregate exceed 120 days from the Bid due date without Surety's written consent.
6. No suit or action shall be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety and in no case later than one year after the Bid due date.
7. Any suit or action under this Bond shall be commenced only in a court of competent jurisdiction located in the state in which the Project is located.
8. Notices required hereunder shall be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Registered or Certified Mail, return receipt requested, postage pre-paid, and shall be deemed to be effective upon receipt by the party concerned.
9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.
10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond shall be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute shall govern and the remainder of this Bond that is not in conflict therewith shall continue in full force and effect.
11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.



This Power of Attorney limits the acts of those named herein, and they have no authority to bind the Company except in the manner and to the extent herein stated.

Liberty Mutual Insurance Company

Certificate No: 8206846 - 986100

POWER OF ATTORNEY

KNOWN ALL PERSONS BY THESE PRESENTS: That Liberty Mutual Insurance Company ("the Company") a corporation duly organized under the laws of the State of Massachusetts, USA, pursuant to and by authority herein set forth, does hereby name, constitute and appoint, Alexandra Derksen; Joshua Tytlandsvik; Michael J. Byrne

all of the city of Winnipeg, state/province/territory of MB each individually if there be more than one named, its true and lawful attorney-in-fact to make, execute, seal, acknowledge and deliver, for and on its behalf as surety and as its act and deed, any and all undertakings, bonds, recognizances and other surety obligations, in pursuance of these presents and shall be as binding upon the Company as if they have been duly signed by the president and attested by the secretary of the Company in their own proper persons.

IN WITNESS WHEREOF, this Power of Attorney has been subscribed by an authorized officer or official of the Companies and the corporate seals of the Companies have been affixed thereto this 24th day of November, 2021.



Liberty Mutual Insurance Company

By: David M. Carey
David M. Carey, Assistant Secretary

Not valid for mortgage, note, loan, letter of credit, currency rate, interest rate or residual value guarantees.

For bond and/or Power of Attorney (POA) verification inquiries, please call 610-832-8240 or email HOSUR@libertymutual.com.

State of PENNSYLVANIA
County of MONTGOMERY ^{SS}

On this 24th day of November, 2021 before me personally appeared David M. Carey, who acknowledged himself to be the Assistant Secretary of Liberty Mutual Insurance Company, and that he, as such, being authorized so to do, execute the foregoing instrument for the purposes therein contained by signing on behalf of the Company by himself as a duly authorized officer.

IN WITNESS WHEREOF, I have hereunto subscribed my name and affixed my notarial seal at King of Prussia, Pennsylvania, on the day and year first above written.



Commonwealth of Pennsylvania - Notary Seal
Teresa Pastella, Notary Public
Montgomery County
My commission expires March 28, 2025
Commission number 1126044
Member, Pennsylvania Association of Notaries

By: Teresa Pastella
Teresa Pastella, Notary Public

This Power of Attorney is made and executed pursuant to and by authority of the following By-laws and Authorizations of Liberty Mutual Insurance Company, which resolutions are now in full force and effect reading as follows:

ARTICLE IV – OFFICERS: Section 12. Power of Attorney.

Any officer or other official of the Corporation authorized for that purpose in writing by the Chairman or the President, and subject to such limitation as the Chairman or the President may prescribe, shall appoint such attorneys-in-fact, as may be necessary to act in behalf of the Corporation to make, execute, seal, acknowledge and deliver as surety any and all undertakings, bonds, recognizances and other surety obligations. Such attorneys-in-fact, subject to the limitations set forth in their respective powers of attorney, shall have full power to bind the Corporation by their signature and execution of any such instruments and to attach thereto the seal of the Corporation. When so executed, such instruments shall be as binding as if signed by the President and attested to by the Secretary. Any power or authority granted to any representative or attorney-in-fact under the provisions of this article may be revoked at any time by the Board, the Chairman, the President or by the officer or officers granting such power or authority.

ARTICLE XIII – Execution of Contracts: Section 5. Surety Bonds and Undertakings.

Any officer of the Company authorized for that purpose in writing by the chairman or the president, and subject to such limitations as the chairman or the president may prescribe, shall appoint such attorneys-in-fact, as may be necessary to act in behalf of the Company to make, execute, seal, acknowledge and deliver as surety any and all undertakings, bonds, recognizances and other surety obligations. Such attorneys-in-fact subject to the limitations set forth in their respective powers of attorney, shall have full power to bind the Company by their signature and execution of any such instruments and to attach thereto the seal of the Company. When so executed such instruments shall be as binding as if signed by the president and attested by the secretary.

Certificate of Designation – The President of the Company, acting pursuant to the Bylaws of the Company, authorizes David M. Carey, Assistant Secretary to appoint such attorneys-in-fact as may be necessary to act on behalf of the Company to make, execute, seal, acknowledge and deliver as surety any and all undertakings, bonds, recognizances and other surety obligations.

Authorization – By unanimous consent of the Company's Board of Directors, the Company consents that facsimile or mechanically reproduced signature of any assistant secretary of the Company, wherever appearing upon a certified copy of any power of attorney issued by the Company in connection with surety bonds, shall be valid and binding upon the Company with the same force and effect as though manually affixed.

I, Renee C. Llewellyn, the undersigned, Assistant Secretary, The Ohio Casualty Insurance Company, Liberty Mutual Insurance Company, and West American Insurance Company do hereby certify that the original power of attorney of which the foregoing is a full, true and correct copy of the Power of Attorney executed by said Companies, is in full force and effect and has not been revoked.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed the seals of said Company this 3rd day of May, 2023.



By: Renee C. Llewellyn
Renee C. Llewellyn, Assistant Secretary

PROCUREMENT AGREEMENT

THIS AGREEMENT is by and between City of Aberdeen, Idaho (“Buyer”) and Nexom (US), Inc. (“Seller”).

Buyer and Seller hereby agree as follows:

ARTICLE 1 – GOODS AND SPECIAL SERVICES

- 1.01 Seller shall furnish the Goods and Special Services as specified or indicated in the Contract Documents.
- 1.02 Seller (Vendor) shall complete the Goods and Services as specified or indicated in the Buyer’s Contract Documents and Specifications titled, “City of Aberdeen WWTP Equipment Pre-Purchase”.
- 1.03 The Project, of which the Goods and Special Services may be the whole or only a part, is described as performing or providing all labor, services, engineering, manufacturing, testing, and documentation necessary for Installation Contractor to install and successfully start-up the WWTP Equipment.
- 1.04 The Goods are generally described as follows:
 - ~~A. **Integrated Fixed Film Activated Sludge (IFAS) System:** A biological treatment system designed to reduce BOD. The system shall include all major equipment components, including diffusers, blowers, control valves, instrumentation, motor controls and control panels as required in Section 46 53 36 and related sections.~~
 - B. **Sand Filter System:** A sand filter system designed to remove phosphorus following a chemical addition and mixing system. The system shall include all major equipment components, such as internal piping and components, media bed, air compressors, instrumentation, motor controls and control panels as required in Section 46 61 27 – Upflow Moving Bed Filter and related sections.
 - ~~C. **Mechanical Dewatering System:** Press system for dewatering of waste activated sludge to meet the minimum performance criteria identified in Section 46 76 27. System shall include all major equipment components including screw press, polymer activation and dosing skid, polymer injection and mixing assembly, instrumentation, motor controls, control panel, and other appurtenances as required in Section 46 76 27 and related sections.~~
- 1.05 The Services are generally described as follows:
 - D. **Submittals:** The Vendor will provide design of the Goods, submittal of the shop drawings, general arrangement drawings of equipment, and a control strategy description; will participate in meetings and assist Engineer during the design; and will make changes to the equipment system as required to coordinate the design with the Engineer during the submittal review process. Submittals shall meet the requirements of Section 01 30 00 – Vendor Submittals.

- E. **Supply and Shipping of Equipment:** The Vendor shall supply all equipment identified in the approved submittals and shall deliver equipment to site. During shipment, Vendor shall assume all responsibility for loss or damage.
- F. **Start-Up Services and Training:** The Vendor shall provide the minimum number of days and trips identified in the equipment specifications and Section 01 75 16 – Startup Procedures.
- G. **Anchoring Calculations:** Design of equipment supports, and anchor bolt design shall be provided by the Vendor, certified by a licensed professional engineering in the state where the equipment is to be installed. Anchor bolts are to be provided by the Installation Contractor.

ARTICLE 2 – ENGINEER

- 2.01 The Contract Documents for the Goods and Special Services have been prepared by Keller Associates, Inc., 305 North 3rd Avenue, Ste. A, Pocatello, ID 83201 (“Engineer”), which is to act as Buyer’s representative, assume all duties and responsibilities, and have the rights and authority assigned to Engineer in the Contract Documents in connection with Seller’s furnishing of Goods and Special Services.

ARTICLE 3 – POINT OF DESTINATION

- 3.01 The point of destination is:

2683 W 1750 S
Aberdeen, ID 83210

ARTICLE 4 – CONTRACT TIMES

- 4.01 *Time of the Essence*
 - A. All time limits for Milestones, if any, including the submittal of Shop Drawings and Samples, the delivery of Goods, and the furnishing of Special Services as stated in the Contract Documents, are of the essence of the Contract.
- 4.02 *Milestones:*
 - A. *Days for Submittal of Shop Drawings and Samples:* Seller shall submit all Shop Drawings and Samples required by the Contract Documents to Buyer for Engineer’s review and approval as noted in the Bid Forms. If more than one resubmittal is necessary for reasons not the fault and beyond the control of Seller, then Seller shall be entitled to seek appropriate relief under Paragraph 7.02.B of the General Conditions.
 - B. *Days to Achieve Delivery of Goods:* It is expected that the Seller shall deliver the Goods to the Point of Destination and ready for Buyer’s receipt of delivery as noted in the Bid Forms. The delivery of the Goods shall be coordinated with the Installation Contractor and provided at the Installation Contractor’s request within their construction contract time. Staged delivery of the equipment shall be acceptable at the Installation Contractor’s request.

- C. *Days for Furnishing Start-Up and Training Services:* The furnishing of start-up services, detailed installation and operation and maintenance manuals, testing services, and operator training shall be coordinated with the Installation Contractor and provided at the Installation Contractor's request within their construction contract time.

4.03 *Buyer's Final Inspection*

- A. *Days to Achieve Final Inspection:* Buyer shall make its final inspection of the Goods pursuant to Paragraph 8.01.C of the General Conditions within 30 days after Buyer's acknowledgement of receipt of delivery of the Goods and Seller's completion of furnishing Start-Up and Training Services. The final inspection shall be requested by the Installation Contractor.

4.04 *Liquidated Damages*

- A. Buyer and Seller recognize that Buyer will suffer financial loss if the Goods are not delivered at the Point of Destination and ready for receipt of delivery by Buyer within the times specified above, plus any extensions thereof allowed in accordance with Article 7 of the General Conditions. The parties also recognize that the timely performance of services by others involved in the Project is materially dependent upon Seller's specific compliance with the requirements of Paragraph 4.02. Further, they recognize the delays, expense, and difficulties involved in proving the actual loss suffered by Buyer if complete acceptable Goods are not delivered on time. Accordingly, instead of requiring such proof, Buyer and Seller agree that as liquidated damages for delay (but not as a penalty) Seller shall pay Buyer \$1,000.00 for each day that expires after the time specified in Paragraph 7.01 of Section C-400 – Bid Form for delivery of acceptable Goods. Other services provided by the Seller, such as start-up services and training, shall be performed per requirements specified in Article 4 herein and at the request of the Installation Contractor to comply with contractual dates for construction.

ARTICLE 5 – CONTRACT PRICE

- 5.01 Buyer shall pay Seller for furnishing the Goods and Special Services in accordance with the Contract Documents.

ARTICLE 6 – PAYMENT PROCEDURES

6.01 *Submittal and Processing of Payment*

- A. Seller shall submit Applications for Payment in accordance with Article 10 of the General Conditions and Section 01 29 76 – Schedule of Payments. Applications for Payment will be processed by Engineer as provided in the General Conditions.

6.02 *Progress Payments; Retainage*

- A. Buyer shall make progress payments on account of the Contract Price on the basis of Section 01 29 76 – Schedule of Payments on or about the 30th day of each month during performance of the Work provided that such Applications for Payment have been submitted in a timely manner and otherwise meet the requirements of the Contract.

1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below, but, in each case, less the aggregate of payments previously made and less such amounts as Buyer may withhold, including but not limited to liquidated damages, in accordance with the Contract.
 - a. 95 percent of Work completed (with the balance being retainage); and
 - b. 95 percent of cost of materials and equipment not incorporated in the Work (with the balance being retainage).
- B. Upon Substantial Completion, Owner shall pay an amount sufficient to increase total payments to Seller to 100 percent of the Work completed, less such amounts set off by Buyer pursuant to Paragraph 10.04 of the General Conditions, and less 200 percent of Engineer's estimate of the value of Work to be completed or corrected as shown on the punch list of items to be completed or corrected prior to final payment.

6.03 *Final Payment*

- A. Upon receipt of the final Application for Payment accompanied by Engineer's recommendation of payment, Buyer shall pay Seller the amount recommended by Engineer, less any sum Buyer is entitled to set off against Engineer's recommendation, including but not limited to liquidated damages.

ARTICLE 7 – INTEREST

7.01 [Reserved.]

ARTICLE 8 – SELLER'S REPRESENTATIONS

- 8.01 In order to induce Buyer to enter into this Agreement, Seller makes the following representations:
 - A. Seller has examined and carefully studied the Contract Documents and the other related data identified in the Bidding Documents, as applicable to Seller's obligations identified in Article 1 above.
 - B. If required by the Bidding Documents to visit the Point of Destination and site where the Goods are to be installed or Special Services will be provided, or if, in Seller's judgment, any local condition may affect cost, progress, or the furnishing of the Goods and Special Services, Seller has visited the Point of Destination and site where the Goods are to be installed or Special Services will be provided and become familiar with and is satisfied as to the observable local conditions that may affect cost, progress, and the furnishing of the Goods and Special Services.
 - C. Seller is familiar with and is satisfied as to all Laws and Regulations that may affect cost, progress, and the furnishing of the Goods and Special Services.
 - D. Seller has carefully studied, considered, and correlated the information known to Seller; information commonly known to sellers of similar goods doing business in the locality of the Point of Destination and the site where the Goods will be installed or where Special

Services will be provided; information and observations obtained from Seller's visits, if any, to the Point of Destination and site where the Goods are to be installed or Services will be provided; and any reports and drawings identified in the Bidding Documents regarding the Point of Destination and the site where the Goods will be installed or where Special Services will be provided, with respect to the effect of such information, observations, and documents on the cost, progress, and performance of Seller's obligations under the Contract Documents.

- E. Seller has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Seller has discovered in the Contract Documents, and the written resolution (if any) thereof by Engineer and Buyer is acceptable to Seller.
- F. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for furnishing Goods and Special Services.

ARTICLE 9 – CONTRACT DOCUMENTS

9.01 *Contents*

- A. The Contract Documents consist of the following:
 - 1. Notice Inviting Bids;
 - 2. Instruction to Bidders;
 - 3. Bid Forms including the Bid, Information required of Bidder, Bid Bond, and all required certificates and affidavits;
 - 4. This Procurement Agreement (EJCDC P-520);
 - 5. Performance Bond;
 - 6. Payment Bond;
 - 7. General Conditions (EJCDC P-700);
 - 8. Revised Supplementary Conditions (EJCDC P-800) (attached);
 - 9. Specifications as listed in the Table of Contents;
 - a. Revised Section 01 29 76 (attached)
 - 10. Addenda (none);
 - 11. Exhibits to this Agreement (enumerated as follows):
 - a. Seller's Bid, solely as to the prices set forth therein;
 - 12. The following, which may be delivered or issued on or after the Effective Date of the Agreement:
 - a. Written Amendments to this Agreement;

- b. Notice to Proceed;
 - c. Change Order(s);
 - d. Work Change Directive(s).
- B. The documents listed in Paragraph 9.01.A are incorporated into this Agreement by reference (except as expressly noted otherwise above).
- C. There are no Contract Documents other than those listed above in this Article 9.
- D. The Contract Documents may only be amended or supplemented as provided in Paragraph 3.04 of the General Conditions.

ARTICLE 10 – MISCELLANEOUS

10.01 *Terms*

- A. Terms used in this Agreement will have the meanings indicated in the General Conditions and the Supplementary Conditions.

10.02 *Successors and Assigns*

- A. Buyer and Seller each binds itself, its partners, successors, assigns, and legal representatives to the other party hereto, its partners, successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.

10.03 *Severability*

- A. Any provision or part of the Contract Documents held to be void or unenforceable by a court of competent jurisdiction under any applicable Law or Regulation shall be deemed stricken, and all remaining provisions shall continue to be valid and binding upon Buyer and Seller. The Contract Documents shall be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

10.04 *Seller's Certifications*

- A. Seller certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or in executing the Contract. For the purposes of this Paragraph 11.04:
1. “corrupt practice” means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process or in the Contract execution;
 2. “fraudulent practice” means an intentional misrepresentation of facts made (a) to influence the bidding process or the execution of the Contract to the detriment of Buyer, (b) to establish Bid or Contract prices at artificial non-competitive levels, or (c) to deprive Buyer of the benefits of free and open competition;

3. “collusive practice” means a scheme or arrangement between two or more Bidders, with or without the knowledge of Buyer, a purpose of which is to establish Bid prices at artificial, non-competitive levels; and
4. “coercive practice” means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

10.05 *Limitations*

- A. Buyer and Seller waive against each other, and against the other’s officers, directors, members, partners, employees, agents, consultants, and subcontractors, any and all claims for or entitlement to incidental, indirect, or consequential damages arising out of, resulting from, or related to the Contract. The terms of this mutual waiver do not apply to or limit any claim by either Buyer or Seller against the other based on any of the following: (a) contribution or indemnification, (b) costs, losses, or damages attributable to personal or bodily injury, sickness, disease, or death, or to injury to or destruction of the tangible property of others, (c) intentional or reckless wrongful conduct, or (d) rights conferred by any bond provided by Seller under this Contract.

10.06 *Insurance*

- A. Prior to the Buyer’s execution of this Procurement Agreement, Seller shall secure, and shall thereafter maintain until completion of the Contract, such public liability and property damage insurance as shall protect Seller from claims for damages for personal injury, including accidental death, as well as from claims for property damage which may arise from or which may concern operations under the Contract, whether such operations be by or on behalf of Seller, any Subvendor or anyone directly or indirectly employed by, connected with or acting for or on behalf of any of them.
- B. All liability insurance shall be issued by an insurance company or companies authorized to transact liability insurance business in the State of Idaho and shall cover comprehensive general and automobile liability for both bodily injury (including death) and property damage, including, but not limited to aggregate products, aggregate operations, aggregate protective and aggregate contractual with the limits as specified in the Supplementary General Conditions.

10.07 *Assignment of Procurement Contract*

- A. The Contract may at the Owner’s discretion be assigned by Owner to Contractor, and Vendor will accept such assignment, pursuant to the Procurement Documents. In the application of the terms and conditions of the Procurement Documents after said assignment, Vendor will function as a subcontractor to the Contractor, and all obligations of the Vendor to Owner will become obligations of the Vendor to Contractor. Notwithstanding this assignment, the guarantees and warranties specified in the Procurement Documents are intended for the benefit of Owner and the Contractor and may be enforced by either party.
- B. Assignment of the Purchase Agreement shall be accomplished on Exhibits A-1 and A-2, copies of which are attached to this Purchase Agreement.

- C. Miscellaneous Assignments. No further assignment by a party hereto of any rights under or interests in the Contract Documents will be binding on another party hereto without the written consent of the party sought to be bound; and specifically but without limitation monies that may become due and monies that are due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract Documents.

IN WITNESS WHEREOF, Buyer and Seller have executed this Agreement and acknowledge that all portions of the Contract Documents have been signed or identified by Buyer and Seller or on their behalf.

This Agreement will be effective on _____ (“Effective Date”).

Buyer: City of Aberdeen

Seller: Nexom (US), Inc.

By: Larry Barrett

By: [Signature]

Date: June 30 2023

Date: June 6, 2023



[Corporate Seal]

[Corporate Seal]

Attest: Romelia Vidales

Attest: Kevin Esau [Signature]

Address for giving notice:
33 N. Main Street
Aberdeen, ID 83210

Address for giving notice:
323 North Spokane Street, Suite 200
Post Falls, ID 83854

(If Buyer is a corporation, attach evidence of authority to sign. If Buyer is a public body, attach evidence of authority to sign and resolution or other documents authorizing execution of Buyer-Seller Agreement.)

Agent for service of process:

(If Seller is a corporation or a partnership, attach evidence of authority to sign.)

Designated Representative:
Name: Larry Barrett
Title: Mayor
Address: 33 N Main Street Aberdeen
Phone: 208-397-4161
Facsimile: 208-397-3431

Designated Representative:
Name: Anousch Mathew
Title: General Manager
Address: 5 Burks Way, Navin, Manitoba, Canada, R5T 0C9
Phone: 204-290-2162
Facsimile: 204-237-0660

**PAYMENT BOND
FOR PROCUREMENT CONTRACTS**

Any singular reference to Seller, Surety, Buyer, or other party shall be considered plural where applicable.

SELLER (Name and Address): Nexom (US), Inc.
Suite 200
323 North Spokane Street
Post Falls, ID 83854

SURETY (Name and Address of Principal
Place of Business): Liberty Mutual Insurance Company
175 Berkeley Street
Boston, MA 02116

BUYER (Name and Address): City of Aberdeen
33 North Main Street
Aberdeen, ID 83210

CONTRACT

Date: May 30, 2023
Amount: \$336,750.00
Description (Name and Location): Wastewater Treatment Plant Equipment Pre-Purchase
2683 West 1750 South, Aberdeen, ID 83210


BOND

Date (Not earlier than Contract Date): June 12, 2023
Bond Number: BDTO-480105-023
Amount: \$336,750.00
Modifications to this Bond Form: NONE

Surety and Seller, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Payment Bond to be duly executed on its behalf by its authorized officer, agent, or representative.


Seller as Principal

Company: Nexom (US), Inc. (Corp. Seal)

Signature: 
Name and Title:
MATTHEW, GENERAL MANAGER

Surety

Company: Liberty Mutual Insurance Company (Corp. Seal)

Signature: 
Name and Title: Alexandra Derksen, Attorney-in-Fact
(Attach Power of Attorney)
Address: 175 Berkeley Street, Boston, MA 02116
Telephone Number: 1-610-832-8240

(Space is provided below for signatures of additional parties, if required.)

Seller as Principal

Company: (Corp. Seal)

Signature:
Name and Title:

Surety

Company: (Corp. Seal)

Signature:
Name and Title:
Address:
Telephone Number:

9. Surety shall not be liable to Buyer, Claimants or others for obligations of Seller that are unrelated to the Contract. Buyer shall not be liable for payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to, give notices on behalf of, or otherwise have obligations to Claimants under this Bond.
10. Surety hereby waives notice of any change, including changes of time, to the Contract or to related subcontracts, purchase orders, and other obligations.
11. No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the location in which the Goods relevant to the claim are located or after the expiration of one year from the date (1) on which the Claimant gave the notice required by Paragraph 4.1 or paragraph 4.2.3, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.
12. Notice to Surety, Buyer or Seller shall be mailed or delivered to the addresses shown on the signature page. Actual receipt of notice by Surety, Buyer or Seller, however accomplished, shall be sufficient compliance as of the date received at the address shown on the signature page.
13. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the Contract was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory Bond and not as a common law bond.
14. Upon request of any person or entity appearing to be a potential beneficiary of this Bond, Seller shall promptly furnish a copy of this Bond or shall permit a copy to be made.
15. Definitions
 - 15.1 *Claimant*: An individual or entity having a direct contract with Seller or with a Subcontractor of Seller to furnish labor, materials or equipment for use in the performance of the Contract. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment used in the Contract, architectural and engineering services required for furnishing the Goods and Special Services by Seller and Seller's Subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials or equipment were furnished.
 - 15.2. *Contract*: The agreement between Buyer and Seller identified on the signature page, including all Contract Documents and changes thereto.
 - 15.3. *Buyer Default*: Failure of Buyer, which has neither been remedied nor waived, to pay Seller as required by the Contract or to perform and complete or comply with the other terms thereof.

**PERFORMANCE BOND
FOR PROCUREMENT CONTRACTS**

Any singular reference to Seller, Surety, Buyer, or other party shall be considered plural where applicable.

SELLER (Name and Address): Nexom (US), Inc.
Suite 200
323 North Spokane Street
Post Falls, ID 83854

**SURETY (Name and Address of Principal
Place of Business):** Liberty Mutual Insurance Company
175 Berkeley Street
Boston, MA 02116

BUYER (Name and Address): City of Aberdeen
33 North Main Street
Aberdeen, ID 83210

CONTRACT

Date: May 30, 2023
Amount: \$336,750.00
Description (Name and Location): Wastewater Treatment Plant Equipment Pre-Purchase
2683 West 1750 South, Aberdeen, ID 83210


BOND

Date (Not earlier than Contract Date): June 12, 2023
Bond Number: BDTO-480105-023
Amount: \$336,750.00
Modifications to this Bond Form: NONE

Surety and Seller, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Performance Bond to be duly executed on its behalf by its authorized officer, agent, or representative.


Seller as Principal

Company: Nexom (US), Inc. (Corp. Seal)
Seal

Signature: 
Name and Title:
ANCUS, MATTHEW, GENERAL MANAGER

Surety

Company: Liberty Mutual Insurance Company (Corp. Seal)

Signature: 
Name and Title: Alexandra Derksen, Attorney-in-Fact
(Attach Power of Attorney)
Address: 175 Berkeley Street, Boston, MA 02116
Telephone Number: 1-610-832-8240

(Space is provided below for signatures of additional parties, if required.)

Seller as Principal

Company: (Corp. Seal)

Signature:
Name and Title:

Surety

Company: (Corp. Seal)

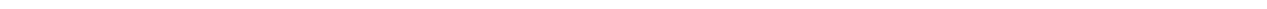
Signature:
Name and Title:
Address:
Telephone Number:

5. If Surety does not proceed as provided in Paragraph 4 with reasonable promptness, Surety shall be deemed to be in default on this Bond 15 days after receipt of an additional written notice from Buyer to Surety demanding that Surety perform its obligations under this Bond, and Buyer shall be entitled to enforce any remedy available to Buyer. If Surety proceeds as provided in paragraph 4.4, and Buyer refuses the payment tendered or Surety has denied liability, in whole or in part, without further notice Buyer shall be entitled to enforce any remedy available to Buyer.
6. After Buyer has terminated Seller's right to complete the Contract, and if Surety elects to act under Paragraph 4.1, 4.2, or 4.3, then the responsibilities of Surety to Buyer shall not be greater than those of Seller under the Contract, and the responsibilities of Buyer to Surety shall not be greater than those of Buyer under the Contract. To a limit of the amount of this Bond, but subject to commitment by Buyer of the Balance of the Contract Price to mitigation of costs and damages on the Contract, Surety is obligated without duplication for:
 - 6.1. the responsibilities of Seller for correction or replacement of defective Goods and Special Services and completion of the Contract;
 - 6.2. additional legal, design professional, and delay costs resulting from Seller's Default, and resulting from the actions of or failure to act of Surety under Paragraph 4; and
 - 6.3. liquidated damages, or if no liquidated damages are specified in the Contract, actual damages caused by delayed performance or non-performance of Seller.
7. Surety shall not be liable to Buyer or others for obligations of Seller that are unrelated to the Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than Buyer or its heirs, executors, administrators, successors, or assigns.
8. Surety hereby waives notice of any change, including changes of time, to the Contract or to related subcontracts, purchase orders and other obligations.
9. Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location of the Point of Destination, and shall be instituted within two years after Seller Default or within two years after Seller ceased working or within two years after Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.
10. Notice to Surety, Buyer or Seller shall be mailed or delivered to the address shown on the signature page.
11. When this Bond has been furnished to comply with a statutory or other legal requirement in the location of the Point of Destination, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted here from and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory bond and not as a common law bond.
12. Definitions.
 - 12.1. *Balance of the Contract Price*: The total amount payable by Buyer to Seller under the Contract after all proper adjustments have been made, including allowance to Seller of any amounts



APPENDIX C.2

Equipment Submittal



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Shop Drawing Review

Owner: City of Aberdeen, Idaho **Date:** 3/19/2024
Project Name: City of Aberdeen WWTP Improvements - Prepurchase **Project No.:** 222032-000
Vendor: Nexom (US), Inc. **Vendor Address:** 323 N. Spokane St., Ste. 200, Post Falls, ID 83854
Attention: Beatrice Benner, Proj. Coord.

Spec Section: 46 61 27
Item of Equipment or Material: Upflow Moving Bed Filter

Subject submittal has been reviewed with review action(s) required as shown below:

Submittal No.	Subject of Shop Drawing or Data	No Exception Taken	Furnish as Corrected	Revise and Resubmit	Record Copy
46 76 27 - R01	Upflow Moving Bed Filter and Air Control Panel	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Comments: None.

Corrections or comments made relative to submittals during this review do not relieve the Contractor from compliance with the requirements of the drawings and specifications. This check is only for review of general conformance with the design concept of the project and general information given in the contract documents. The Contractor is responsible for confirming and correlating all quantities and dimensions; selecting fabrication processes and techniques of construction; coordinating his work with that of other trades, and performing his work in a safe and satisfactory manner.

Keller Associates, Inc.

Engineer

100 E. Bower Street, Suite 110
 Meridian, ID
 (Address)

By (Authorized Signature)

Holly C. Johnson, PE
 (Printed Name)

3/19/2024
 Date

Copies Distributed to: Keller Office (1), Owner (0), Field (0)



123.13670 Full Submittal

Revision 01

This Document Contains:

- Equipment Specifications
- Filter Calculations
- Installation Instructions
- Filter Anchoring
- Warranty
- Nexom's Submittal Drawings

System Specifications

Installation Data	
Number of Modules	5
Airlifts per Cell	1
Module Size	CF64-60RC
Total Filtration Area	320 ft ²

Aberdeen Idaho

Submitted: 11/20/2023

1.4 QUALITY ASSURANCE

- ✓ A. To ensure that all the equipment required for the installation of the filter modules and air supply is properly coordinated and will function as a unit in accordance with the intent of these Specifications, the Vendor shall provide all the equipment specified under this Section.
- ✓ B. Qualification of Filter Manufacturer: The filter Manufacturer shall have a minimum of 10 years' experience in the manufacture of this type of filter equipment and shall have completed at least 10 successful installations of the same type proposed.

1.5 WARRANTY AND GUARANTEE

- ✓ A. A written manufacturer warranty shall be provided. The warranty shall be for a minimum period of one (1) year from the date of Substantial Completion. Manufacturer shall repair or replace all defects of materials or workmanship in the equipment during the warranty period. Corrections shall be completed within five (5) days after notification.
- ✓ B. Written Guarantee: The Vendor shall guarantee that the filter system shall meet the required effluent limits. The coagulant dosing system will be supplied by the Installation Contractor. If, during the one-year guarantee period, the filter system fails or does not meet any of the specified requirements or test criteria herein, the Vendor shall correct such deficiencies as may be necessary to meet these requirements and criteria at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Parkson
- ✓ B. Nexom
- C. WesTech
- D. Or approved equal

2.2 GENERAL

- ✓ A. All structural steel shall conform to "Standard Specifications for Structural Steel of the A.S.T.M."
- ✓ B. An effluent weir shall be provided to control the water level over the media.
- ✓ C. All equipment shall be designed for continuous, twenty-four hour operation, and all parts of the mechanism shall be amply proportioned for all stresses, which may occur during fabrication, erection, and operation.
- ✓ D. All anchor bolts shall be Type 316 stainless steel and shall be sized by the Vendor. The Installation Contractor shall provide and install the anchor bolts in accordance with the Vendor instructions.

- ✓ E. All filter wetted parts shall be 304 or 316 stainless steel, FRP, or PVC. No carbon steel shall be allowed in the filters. All stainless steel shall be passivated.

2.3 UPFLOW MOVING BED FILTER

- ✓ A. Materials of Construction

- | | | |
|-----|---------------------------------|---------------------------------|
| 1. | Basin | Concrete, FRP, or 304 SS |
| 2. | Filtrate trough (if applicable) | FRP or 304 SS |
| 3. | Bottom hopper cones | FRP or 304 SS |
| 4. | Feed distribution radials | FRP or 304 SS |
| 5. | Reject compartment | FRP or Injection Molded Plastic |
| 6. | Washer rings | PVC or Injection Molded Plastic |
| 7. | Reject weirs | FRP or Injection Molded Plastic |
| 8. | Distribution cones | FRP or 304 SS |
| 9. | Airlift pipes | HDPE or PVC |
| 10. | Airlift housing | FRP or 304 SS |
| 11. | Airlift panel | 304 SS |
| 12. | Nuts, bolts, fasteners | 304 SS |
| 13. | Anchor bolts | 304 SS |

- ✓ B. FILTER TANK

1. Each filter shall be self-contained in an open-top concrete tank sized by Vendor. Vendor shall produce dimensioned layout drawings of the filters with all sections needed to estimate concrete volumes, if applicable.

- ✓ C. AIRLIFT

1. The sand cleaning system shall be capable of continuous or intermittent backwashing and internally redistributing the granular media to the top of the sand bed an average of 4-8 times per 24 hours. The airlift shall be supplied with an external air feed line to supply the pressurized air to the injection point. The feed line shall be protected from the abrasive movement of the media both inside the airlift and outside within the filter bed.

- ✓ D. COUNTER-CURRENT WASHBOX
 1. The filter system shall be furnished with a washbox assembly of fiberglass or injection molded plastic construction with an adjustable weir. The cross-sectional area of the counter-current washbox shall be sized to assure sufficient velocity of up-flowing water to transport separated solids into the wash chamber and over the reject weir and ultimately out through the reject line. The washbox geometry shall be optimized for separation of solids rejected from the filter media.

- ✓ E. FILTER MEDIA
 1. The filter media shall be furnished by the Filter Manufacturer and shall be of high quality silica sand in accordance with the American Water Works Association Standard for Filter Materials AWWA/ANSI B-100 (latest edition). The Filter manufacturer shall deliver the sand to the Site, and the Installation Contractor shall install the filter media per the Filter Manufacturer's instructions.

- ✓ F. FEED CHAMBER
 1. Each filter shall be furnished with a central feed chamber designed to distribute the influent water directly into the media. The feed chamber shall have capacity to distribute the influent at least 60" below the top of the media. The feed chamber shall have a central protector tube to house, support and protect the airlift feed pump and compressed air feed line from damage due to abrasion. This central protector tube shall extend from the top of the filter bed down through the feed chamber to the recessed chamber in the lower cone. The feed chamber shall also incorporate support devices to the side wall, if applicable. The feed chamber shall be permanently attached and centered on the lower end to ensure that the system remains properly located at all times. The feed chamber shall be constructed of fiberglass or 304 SS.

- ✓ G. HEAD LOSS INSTRUMENTATION
 1. The Head Loss Indicator Gauge shall be coupled directly to the influent feed channel of the filter and extend above the top of the filter cell. The Head Loss Indicator Gauge shall be marked with an easily readable clear rule indicating the differential pressure (ΔP).
 2. Head Loss shall also be monitored with a pressure transmitter directly to the influent feed of the filter system. Transmitter signal shall land in the Air Control Panel and the signal made available to the plant PLC (by Installation Contractor).

- ✓ H. AIR CONTROL PANEL WITH AIR BURST SYSTEM
 1. The filter system shall be furnished with a NEMA 4X operators control panel equipped with manufacturer's standard equipment, including airflow regulation, flow monitoring/control valves, normal operation and adjustable duration airbursting (where applicable) solenoids and all other controls necessary for operation of the filter's airlift. A signal from the plant SCADA system shall be received to operate the system.

2. All analog and digital signals from flow or level instrumentation in the Air Control Panel shall be available to the plant PLC via terminal contacts.
3. Where filter cells are intended to be operated in a lead/lag type configuration, the Vendor shall provide a control narrative for system integration through the plant PLC. Solenoid valves shall be included in the Vendor's scope, as well as sufficient instrument air in the air compressor system, to operate Installation Contractor-supplied pneumatic control valves to each filter cell.



I. AIR SYSTEM

1. The Filter Manufacturer shall furnish an air compressor unit to pressurize the pneumatic system. The duplex air compressor unit shall be provided with two each, two-stage compressor pumps. The air tank shall be an ASME Code receiver rated at a minimum of 200 psig. The system shall be complete with two (2), 460 V/3P/60 Hz powered, 2-stage compressor pumps; air cooled aftercooler; loadless starting; low oil shutdown switch; pressure gauge; safety valve; intake air filter; pressure switch; manual and automatic receiver blowdown and shut off valves; vibration pads for mounting; and complete startup kits. The Vendor shall size the air compressor.
2. A refrigerated-type air dryer shall be provided and sized by Vendor. Power shall be 115V/1P/60 Hz. The air dryer shall be provided with a pre-filter.
3. The Vendor shall provide a duplex alternating control panel. The panel shall include motor starter for the two compressor motors and thermal overloads. Circuit protection and disconnects shall be by others.



J. SPARE PARTS

1. Filter Equipment: The Filter Manufacturer shall provide the following spare parts for the airlift pumps and control panel (one each):
 - a. Spare airlift
 - b. Regulator - air control panel.
 - c. Air flow indicator and control valve - air control panel.
 - d. Air filter element – air control panel.
 - e. One intake air filter and one oil change for the air compressor.

PART 3 - EXECUTION

3.1 INSTALLATION



- A. General: The Installation Contractor shall install structures, filter equipment, filter media, piping and valves in conformance with the Manufacturer's recommendations.

SECTION 46 61 27 – UPFLOW MOVING BED FILTER

PART 1 - GENERAL

1.1 SCOPE OF WORK

- ✓ A. Vendor shall furnish and place into satisfactory operating condition a complete filtration system as specified herein. Filters shall be provided with all required equipment, and filtration media. Filters shall be modular and will be installed in concrete basins. The Installation Contractor shall install all structures including any required wall thimbles and external piping.
- ✓ B. The Vendor shall size the filter equipment to meet the performance specifications below. The filter systems shall be designed so that the peak flow can be treated with one unit offline.
- ✓ C. Air compressor: Vendor shall provide a compressed air system sized to deliver sufficient air to each airlift for backwashing, as well as any ancillary air requirements for the system, including pneumatic actuation of valves. The compressed air system shall include a dual air compressor with reservoir, air dryer, compressed air control panel, air panels for the control of air to the air lifts, and valves. The Installation Contractor shall install the air system and provide and install the interconnecting piping.
- ✓ D. Vendor can provide more than one proposal (for different configurations or materials) at the time of bid.
- ✓ E. The Installation Contractor shall provide two chemical dosing systems with associated mixing and flocculation – an alum system for phosphorus coagulation, and a caustic soda system for pH adjustment (downstream of the filters). Where necessary, a polymer dosing system shall also be provided by the contractor. The chemical, mixing and flocculation systems shall meet the Filter Vendor’s requirements subject to the Engineer’s approval.

1.2 DESIGN REQUIREMENTS

- ✓ A. Influent Design Criteria: Clarified secondary effluent will be provided to the sand filter system with the following flow and water quality:

1.	Average Daily Flow:	0.36 MGD
2.	Max Month Flow:	0.50 MGD
3.	Peak Day Flow:	0.67 MGD
4.	Peak Hour Flow:	1.73 MGD
5.	Max Total Suspended Solids (from clarifier effluent):	30 mg/L
6.	Total Phosphorus:	2 mg/L*



DESIGN CALCULATIONS ABERDEEN ID

Revision 0 January 16, 2024



technologies for cleaner water

323 N. Spokane St. Suite 200 · Post Falls ID · 83854
888-710-2583 • www.nexom.com



Axiom Water companies

Project Overview

Nexom is pleased to provide a Blue PRO® Reactive Filtration system for Aberdeen, Idaho. The submitted system design includes the following benefits:

- Nexom's Blue PRO Reactive Filtration system, validated by decades of operation in dozens of wastewater plants in North America.
- Minimizes chemical-related CAPEX and OPEX with chemicals injected in the filter inlet header prior to distribution.
- Air-actuated control on filter inlet valves allowing for filter duty cycling that minimizes air, power usage and generated backwash.
- Nexom's system is designed to allow the PLC to automatically duty cycle the filter cells to minimize operator effort and oversight. This allows the standby cell to maintain run hours consistent to the other filters and be available in a wetted and ready state. This automation requires only that the contractor include actuators with his inlet valve for Nexom's control.

Nexom's Blue PRO system will allow Aberdeen to comply with its phosphorus and TSS residual requirements for years to come.



Process Narrative

Flexibility

Reactive Filtration branded as the Blue PRO® process utilizes a patented reactive filtration process within Centra-flo® continuous-backwash media filter to accomplish low levels of TSS, phosphorus, and many other trace elements. With the efficiency of reactive filtration, Blue PRO® uses 30% less chemical than comparative technologies for ultra-low phosphorus results, thereby also producing less chemical sludge.



Reactive Filtration is a patented process where Nexom holds the exclusive license to this technology. USRE44,570 describes reactive filtration as *adding a metal salt reagent to water in sufficient quantity and concentration to allow precipitation reactions between the metal salt reagent and a dissolved contaminant in the water to go to at least near completion and to leave unreacted metal salt reagent in the water; inducing turbulence in the water; and then flowing the water through a bed of moving filter media, wherein unreacted metal salt reagent in the water reacts with the filter media to generate a reactive metal oxide or hydroxide coating on the filter media...*

Nexom's bid included all patent royalties for the proven Reactive Filtration technology.

The filter system has the added capability to be operated in a completely manual mode independent of the PLC in case of maintenance activities. Simple step-by-step instructions are included in the Blue PRO O&M manual.

Complexity of Operation

Nexom's design approach to Aberdeen's wastewater challenges is to provide a process that is reliable, simple, and cost effective to operate. The system is completely automated, and operators' regular oversight include only daily rounds. There are no mechanical components in the filter, so regular maintenance of the pneumatic system is the only mechanical maintenance requirement.

Total Phosphorus (TP) Removal. Nexom has technologies that are regularly implemented for phosphorus removal across North America. Whereas all its technologies are effective chemical phosphorus removal solutions when applied properly, they use different mechanisms leading to differences in contact efficiency. The provided Blue PRO® process uses a continuously regenerated adsorptive substrate and is capable of high contact efficiency and achieving residuals as low as 0.01 mg/L TP. The owner has the opportunity to realize chemical OPEX savings while using a proven technology for phosphorus and solids separation when phosphorus requirements are less stringent.

Control Methodology

A complete process flow diagram/P&ID is included with Nexom submittals and its general arrangement drawings.

The reactive filtration cycle starts with influent water distributed across the cross-sectional area of the filter at the bottom of the media column. Water flows upward, carrying hydrous metal oxide (HMO) and coating the media with it. Media now covered by HMO coating attracts and reacts with the phosphorus and metals while moving downward by gravity in a countercurrent flow to an airlift pump. The filtered water floods the vessel, activates a level switch and exits over an effluent weir at the top of the filter. The airlift transports the TSS and the phosphorus- or metals-laden media up into the washbox where the discharged HMO coating and adsorbed contaminants are separated from the media. Water velocities in the washbox are carefully designed to carry away the contaminants while allowing the media to fall to the filter bed. The cycle restarts with freshly scrubbed media from the washbox recoated with HMO (regenerated) as the continuous influent flows upward.



The BluePRO® Reactive Filtration process overcomes a critical process obstacle of achieving efficient phosphorus and contaminant removal by providing a very large reactive surface area within the media bed, resulting in guaranteed contact of contaminant with HMO and its high adsorptive capacity.

Waste HMO, phosphorus, and solids are removed from the filter through the backwash or reject stream. Recycling this backwash upstream provides the added benefit of phosphorus pre-treatment in primary or secondary treatment systems, further guaranteeing the achievement of the effluent phosphorus

target as well as lowering the overall plant chemical ratio. The phosphorus is chemically bound, exiting the site with the plant sludge. The integration of the BluePRO® technology does not require a change in the plant's sludge handling system.

Ancillary equipment is minimal. A compressor system is required to provide continuous air flow to the filter airlifts. A chemical pump system is required to dose sufficient chemical to coat the media in the filter. All filters and subsystems are fully automated and controlled by a PLC.

Treatment of Residuals

Based on similar experience and preliminary calculations, Nexom anticipates that:

- Backwash flow will constitute approximately 3% to 10% of the forward flow.
- Backwash will contain approximately < 625 mg/L of TSS (including chemical TSS).
- Backwash should be recycled to the plant headworks or upstream of the secondary splitter box before clarification; the residual chemical reactivity from a Reactive Filtration backwash will have a net positive benefit on phosphorus control and chemical operating costs by reducing the raw phosphorus levels.
- Phosphorus will remain bound to the hydrous metal oxide inside of expected pH ranges (4-10) and will exit the plant through existing sludge management processes.
- Given dilution of phosphorus within the sludge, there will be no issues with disposal.



Aberdeen ID Design Parameters

Design loads and effluent objectives are presented in the following table:

	Units	Influent	Effluent
Design Average Daily Flow (ADF)	MGD	0.36	
Peak Day Flow (PDF)	MGD	0.67	
Peak Hour Flow (PHF)	MGD	1.73	
Alkalinity	mg/L	50 – 100	
pH	S.U.	6.5-7.5	
Temperature	°C	8-25	
Total suspended solids (TSS)	mg/L	≤ 30	≤ 5
Total phosphorus (TP)	mg/L	≤ 2.0	≤ 0.29
Non-reactive phosphorus (NRP)	mg/L	< 0.06	< 0.06

Filtration design parameters are presented in the following table:

Configuration	Units	Design Parameter
Filter model		CF64-60RC
Headloss profile (at 8 °C)	in	< 52
Total number of filters duty + standby		4 + 1
Filtration area per filter cell	ft ²	64
Duty filtration area	ft ²	256
Total filtration area	ft ²	320
¹ Hydraulic loading at ADF, PHF	gpm/ft ²	1.0,4.7
¹ Surface solids loading rate (SSLR) at ADF, PHF	lb/ft ² d	≤ 0.5, < 2.5
Average air requirements per filter at 100 PSIG	CFM	≤ 6
² Max system air requirements at 100 PSIG	ACFM	≤ 32.5

1. SSLR includes assumed chemical solids (~13 mg/L); backwash is +11-12 gpm per filter cell; rates summarized are calculated by dividing the flow and solids loading by the available filter surface area.
2. Converted to site elevation.

Process calculations and design assumptions:

1. Design Average Daily Flow (ADF): $0.36 \text{ MGD} \times \frac{694.4 \text{ gpm}}{1 \text{ MGD}} = 250 \text{ gpm}$
2. Peak Day Flow (PDF): $0.67 \text{ MGD} \times \frac{694.4 \text{ gpm}}{1 \text{ MGD}} = 465 \text{ gpm}$
3. Peak Hour Flow (PHF): $1.73 \text{ MGD} \times \frac{694.4 \text{ gpm}}{1 \text{ MGD}} = 1201 \text{ gpm}$
4. Filtration area per filter: 64 ft²
 - a. At ADF, 1 - 2 filters are required on average,
 - b. At PDF, 2 - 3 filters are required on average,
 - c. At PHF, 4 filters are required on average,
5. Duty filtration area:
 - a. 64 – 128 ft²
 - b. 128 – 192 ft²
 - c. 192 – 256 ft²
6. Hydraulic loading rates per duty area:
 - a. ADF: $\frac{250 \text{ gpm}}{128 \text{ ft}^2} = \frac{1.95 \text{ gpm}}{\text{ft}^2}$ to $\frac{250 \text{ gpm}}{64 \text{ ft}^2} = \frac{3.91 \text{ gpm}}{\text{ft}^2}$
 - b. PDF: $\frac{465 \text{ gpm}}{192 \text{ ft}^2} = \frac{2.42 \text{ gpm}}{\text{ft}^2}$ to $\frac{465 \text{ gpm}}{128 \text{ ft}^2} = \frac{3.63 \text{ gpm}}{\text{ft}^2}$
 - c. PHF: $\frac{1201 \text{ gpm}}{256 \text{ ft}^2} = \frac{4.7 \text{ gpm}}{\text{ft}^2}$
7. Pounds formula: [mg/L] x 8.34 x [MGD] = [lb/d]
8. Design inlet TSS from secondary system
 - a. ADF: $\frac{30 \text{ mg}}{\text{L}} \times 8.34 \times 0.36 \text{ MGD} = 90 \frac{\text{lb}}{\text{d}}$
 - b. PDF: $\frac{30 \text{ mg}}{\text{L}} \times 8.34 \times 0.67 \text{ MGD} = 168 \frac{\text{lb}}{\text{d}}$
 - c. PHF: $\frac{30 \text{ mg}}{\text{L}} \times 8.34 \times 1.73 \text{ MGD} = 433 \frac{\text{lb}}{\text{d}}$
9. Chemical TSS is estimated with literature modeling. Nexom assumes a 2:1 Al:P mole ratio with inlet phosphorus of 2.0 mg/L. PAC added over the stoichiometric equivalent required for phosphorus uptake is assumed to form an insoluble metal hydroxide. This leads to approximately 13 mg/L of precipitate composed of aluminum/phosphate complexes.

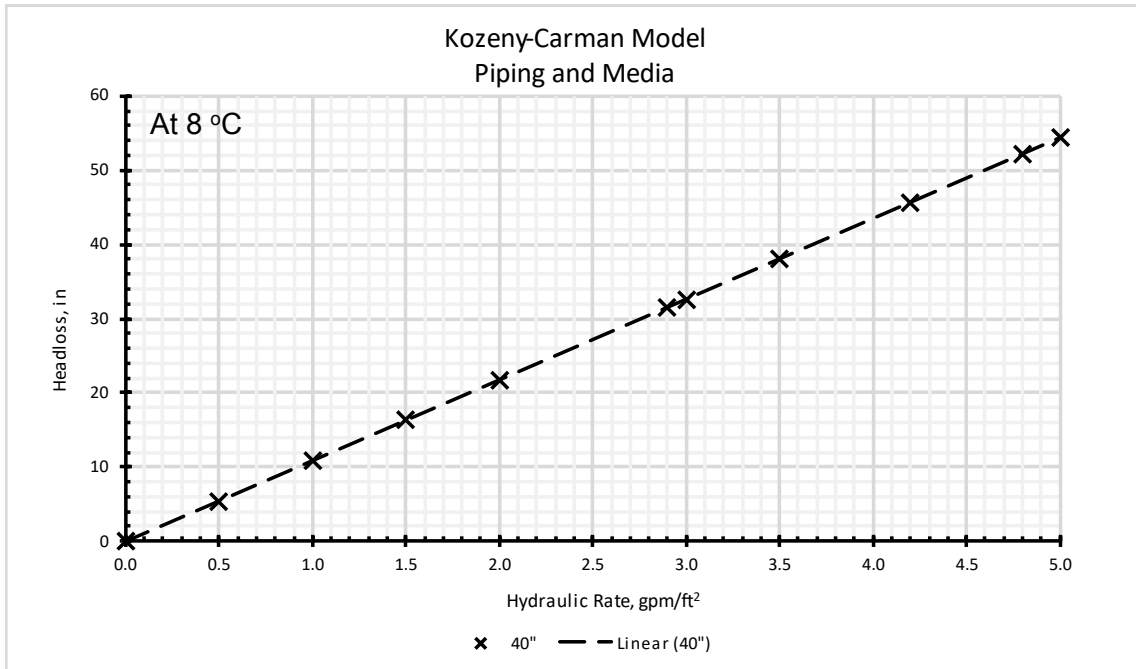
- a. ADF: $\frac{13mg}{L} \times 8.34 \times 0.36MGD = 39 \frac{lb}{d}$
- b. PDF: $\frac{13mg}{L} \times 8.34 \times 0.67MGD = 72 \frac{lb}{d}$
- c. PHF: $\frac{13mg}{L} \times 8.34 \times 1.73MGD = 187 \frac{lb}{d}$

10. Total surface solids loading rates per duty area:

- a. ADF: $\frac{(90+39)lb/d}{128ft^2} = \frac{1.00 lb}{ft^2d}$ to $\frac{(90+39)lb/d}{64ft^2} = \frac{2.01 lb}{ft^2d}$
- b. PDF: $\frac{(168+72)lb/d}{192ft^2} = \frac{1.25 lb}{ft^2d}$ to $\frac{(168+72)lb/d}{128ft^2} = \frac{1.88 lb}{ft^2d}$
- c. PHF: $\frac{(433+187)lb/d}{256ft^2} = \frac{2.42 lb}{ft^2d}$

11. Headloss will be < 52 inches in the design ranges.

- a. Nexom sources a nominal 1.20 mm media, with significant variability depending on the source pit and batch. The nominal 40 inch bed will measure between 40-50 inches at the midpoint of the filter wall.
- b. Many models exist in literature, and many suppliers have proprietary headloss models. Headloss with a constant bed depth and applied inlet solids concentration is essentially linear with respect to changing hydraulics in the designed operating range for Aberdeen.
- c. The variability in media particle size will have nuanced impacts on observed headloss. However, following installation, the bed depth and media size distribution for the system are set. Ongoing variability in observed headloss following installation will be due to hydraulics and TSS.



12. With the cell cycling function of Nexom's PLC, operators can establish target hydraulic loading rate ranges to maximize system performance.



INSTALLATION MANUAL

Sand Filter – Reinforced Concrete Installation

11/15/2023





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Order of Installation

Below-Ground Reinforced Concrete Filter System

The recommended installation order of operations for installation is as follows:

1. Assemble fiberglass cone sections outside of concrete cell.
2. Install assembled fiberglass cone in concrete cell, level, and fasten with anchors.
3. Install drain screen and plumbing (if applicable) to cone(s) and drain wall penetration.
 - This is required prior to grout.
 - Drains are required for every installation, see submittals for project specific detail.
4. Install cone manway cover and grout cones in place in multiple lifts as required.
 - Drain plumbing will be inaccessible after grouting, so ensure screen installed and no leaks exist in plumbing.
5. Assemble top and bottom feed chamber sections.
6. Install feed chamber, confirm plumb, and adjust if required before anchoring it in place.
7. Install Influent plumbing.
8. Install sand media.
 - Sand media installed prior to washbox installation is useful as a bed to stand on during venting, reject plumbing, and washbox/tortuous path.
9. Install washbox with tortuous path, reject weir, and deflector cap.
 - Deflector cap will be removed for airlift installation. Can be installed later.
 - Deflector cap mounts to the washbox.
10. Install platform framing and grating according to drawings.
11. Install venting assembly and route tubing to drain into washbox.
12. Install reject plumbing from washbox(es) to reject wall penetration.
13. Install influent isolation valves (if required).
 - Valves can be installed at any point, but if controlled by the air panel Nexom recommends installing them prior to the air panel.
14. Install filter control panel (PLC).
 - Installing control panel prior to air panel will allow for wiring to air panel when installed.
15. Install air panel to wall and/or support frame, providing air and power connection to panel.
16. Install filter airlift.
17. Install filter instrumentation including level switch and influent pressure transmitter.
 - Instrumentation can be mounted after filter and internals are installed, but at this stage allows for connection to the air panel and prevents damage to sensors during larger equipment installation.

Additional Equipment

- Install compressor system
 - This can be done at any point.
 - Installing compressor prior to airlift installation will allow use of the airlift pumping action to assist installation of the sand bed.
- Install chemical dosing system.
 - This can be done at any point.
 - Chemical injection point should be installed into influent stream prior to introduction of flow.
 - Installation after filter control panel will allow wiring to filter control panel when installed.

General Information

Notes

This system should be operated by trained, authorized personnel and only under the conditions for which it was originally designed. Any modification to the components or materials used may result in an unstable or unsafe condition. Always consult the manufacturer prior to making any changes from the original design configuration.

Safety is to be exercised at all times during installation, operation, and maintenance. Operation of equipment should conform to established plant safety standards. The Department of Labor Occupational Safety and Health Act as printed in 29 Code of Federal Regulations (29 CFR) Part 110 should be followed. Plant areas where the equipment is being tested or adjusted during maintenance should be isolated by barriers (with signs) to prevent accidental entry to the area. A Site Specific Health and Safety Plan should be consulted for detailed safety protocols, personal protection, and emergency procedures.



Example of filter site

Mechanical Installation

During installation of mechanical components, always protect body and limbs from being crushed or pinched during equipment placement. Make sure all equipment is properly affixed to the floor or pad to prevent shifting due to operational vibrations. Vibration pads, if specified, may be installed to minimize vibrations generated by operating equipment. Ensure all mounting/anchoring studs and bolts are tight (which may become loose in shipment). When attaching piping, use proper gaskets rated for the liquids and gases to be transported.

Mechanical Operation

Mechanical equipment such as mixers, pumps, blowers, and electrically actuated valves present hazards to workers. Always observe the following precautions when working with mechanical equipment which can move.

1. Hearing protection should always be worn to prevent hearing damage/loss caused by loud machinery.
2. Mechanical equipment may start abruptly without warning if in the “auto” position or if stopped by an internal thermal breaker.
3. Keep hands away from moving parts and avoid pinch points such as blower belt drives.
4. Proper protective clothing and equipment must be always worn.

Mechanical Maintenance

1. Personnel should protect themselves from mechanical hazards of rotating equipment.
2. Turn off electric power and follow proper “Lock Out/Tag Out” procedures.
3. Ensure all vessels, piping, tubing, and other lines or devices are properly drained and ventilated.
4. Be aware that piping and tubing may contain liquids that are under pressure and/or present a chemical hazard to breathing and/or exposed skin.
5. Equipment designed to handle liquids always presents a potential splash hazard during service periods.

Manway Closures

Manways are used to provide access to the inside of tanks and closed vessels for inspection, cleaning or other purposes. When a vessel is being used the manway is tightly closed. A gasket provides a tight seal between the manway cover and the cone. Note: this does not apply to the filter cone manway.

WARNING! BEFORE OPENING A MANWAY:

1. Be sure that nearby eye wash basins and safety showers are available and working.
2. Shut down the system. Close and tag all valves to the tank (liquid, chemical).
3. Reduce pressure of the vessel to zero.
4. Leave a vent open. Drain all liquids from the vessel. (Some vessels with internal compartments require that the internal compartments be drained first.)
5. Tag the control panel “OUT OF SERVICE”. Be sure that the vessel has in fact been drained. Use the sample lines and valves that are provided for the vessel to confirm.
6. Because gasket seals, which have been under compressive pressure (from vessel pressure or from cover fastening pressure), may securely hold a manway cover, first just loosen the fastenings. Move the cover to separate it from the vessel (tap, bump or pry it, taking care not to damage the tank lining). Check that there is no further internal pressure. Personnel should not be in front of, or below, the manway when the cover is removed because in some cases, the contents may be retained in the manway nozzle. Remove the cover.
7. Secure the manway cover with davit, ropes or chain.

Entering a Confined Space

See the Site-Specific Health and Safety Plan before entering any confined space.

WARNING! Anyone who operates or maintains the equipment must be aware of all the hazards presented by potentially oxygen-poor, asphyxiating, and toxic atmospheres within a reactor vessel or other closed vessels. They should also be aware of common industrial safety hazards and other safety and health hazards that are present in water treatment facilities. Safety precautions appropriate for all these hazards must be taken. Failure to do so may result in serious injury, illness, or death.



Electrical Safety Precautions for Control Panels

WARNING! Electrical equipment and assemblies always contain the possibility of hazards from electrical shock or short circuits. Therefore, proper caution must be observed with the installation, operation, and maintenance of the control panel or control cabinets.

Electrical Installation

Qualified electricians, following the diagrams and Schematic Wiring Diagrams supplied by the manufacturer, shall make electrical connections. If there are questions regarding interpretation of the drawings, Blue Water engineers should be consulted. Before electrical power is turned on to the control panel or cabinet, make sure that the enclosure is properly grounded. Before electrical power is turned on to the control panel or cabinet, the internal connections should be checked for accuracy with the Wiring Diagrams and Schematic Wiring Diagrams supplied.

Electrical Operation

Automatic control circuits have been designed with the intention of properly controlling the process and to provide operating safety for equipment and personnel. Reasonably foreseeable component failures are considered, and interlocks are provided to safeguard against damage caused by such failures. It must be remembered, however, that component failures likely will result in degradation of system performance. Therefore, it is necessary that competent operating personnel who understand the functions of the systems make periodic checks of the system performance (for example: valve and pump operating sequences, instrument readings and calibrations, and chemical tests).

Manual control features are built into most systems that are designed for automatic operation. These make it possible to operate the equipment for maintenance or in case an automatic control has failed. The manual control features also make it possible to make experimental changes in the process sequences without having to reconfigure the automatic controls. When operating with manual override to automatic controls, the operator shall be familiar with the equipment and understand its operation and follow the valve-operating sequence given in the instruction manual.

Electrical Maintenance

The tracing of circuits, removal or replacement of components, or revisions to electrical circuits, should be done by a qualified electrician. All power to any electrical device inside the control panel with which the worker might come in contact is to be turned off. On large control panels, it might be possible to remove voltage from one section while leaving other sections operating. In order to properly shut off the power at the control panel, the following rules must be observed:

1. Adhere to plant specific "LOCK OUT/TAG OUT" procedures.
2. Consult the Schematic Wiring Diagrams to determine which disconnecting switches need to be opened to shut off all of the power at the control panel. Very often it is not sufficient to disconnect the main power source to the control panel. Motor control circuits are usually supplied with power from the motor starters and have to be disconnected by opening the motor circuit switch ahead of the motor starter. Control circuits may be protected by a UPS.
3. Personnel familiar with the plant installation and the location of disconnect switches should be consulted.
4. Shut off all power to the control panel. The switches should be locked or tagged in the OFF position until work inside the control panel is completed. Turn off the UPS (if applicable).
5. After the switches have been turned OFF, but before work is started in the control panel, make voltage checks on the circuits inside the control panel. This is to confirm that the correct switches have been opened and that circuits have no voltage present.
6. NOTE: Sometimes troubleshooting must be performed while the system is in operation and power is ON while checking for the presence or absence of voltage at suitable test points in a control circuit. When checking circuits with the voltage ON, the following rules must be observed:
7. Only a person who understands the operation of electrical controls, and who recognizes electrical terminals and other exposed conducting surfaces that might have voltage present, may perform this work.
8. The area of work must be properly illuminated so that all exposed electrical parts can be readily seen.
9. The person performing the work should have the Wiring Diagrams at hand and shall use them to locate the points where voltage is to be checked to determine circuit continuity and operation.
10. While work is performed in a control panel with voltage present, another person must be available to give assistance in case of accident. The second person should be familiar with the voltage shut-off procedure and be trained in artificial respiration.
11. Make sure that there is adequate clearance around the work area to prevent working in a cramped position.
12. It is recommended that soft, thin dry leather gloves, or meterman's gloves, safety glasses and rubber soled shoes be used.
13. Rubber floor mats should be provided around the area.

Chemical Safety

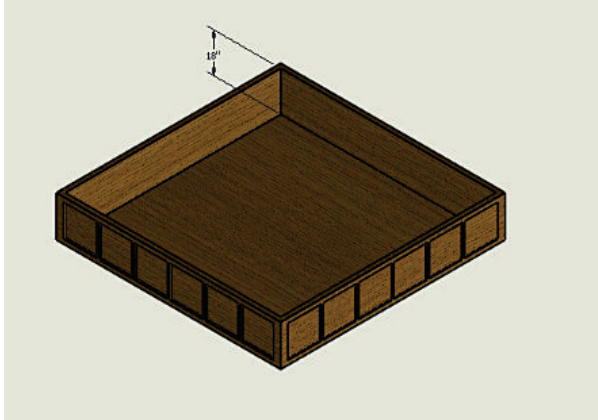
See the Site-Specific Health and Safety Plan for chemical hazards and handling procedures.

1. Consult Material Safety Data Sheets found in Appendix B for chemicals supplied by Blue Water prior to potential exposure to specific chemicals used with the operation of the system. Any other chemicals, please consult the site's chemical supplier.
2. Proper protective clothing and equipment must be always worn.
3. Be aware that piping and tubing may contain liquids that are under pressure and/or present a chemical hazard to breathing and/or exposed skin.
4. Equipment designed to handle liquids always presents a potential splash hazard during service periods.

Pre-Installation Procedures

Cone Assembly Fixture

A base fixture must be fabricated to assemble the bottom cone sections.



Components and Assembled wooden fixture.

Internal Square dimensions: CF50 Filters need to be 84.5" X 84.5", CF64 Filters need to be 86.5" X 86.5"

Cone Assembly

This section describes assemble instructions and methodology of the fiberglass cone.

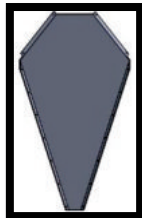
Use anti-seize for all fasteners.

Cone Assembly Instructions

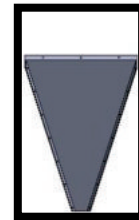
Hardware:

- Clamps (By Others)
- Bolts (7/16")
- Nuts (7/16")
- Washer (7/16")

1. Separate and stack corner and center pieces into piles.

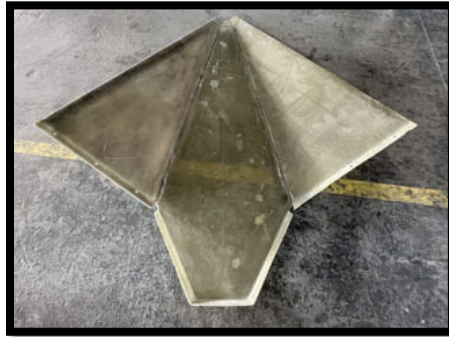


Cone Corner Pieces

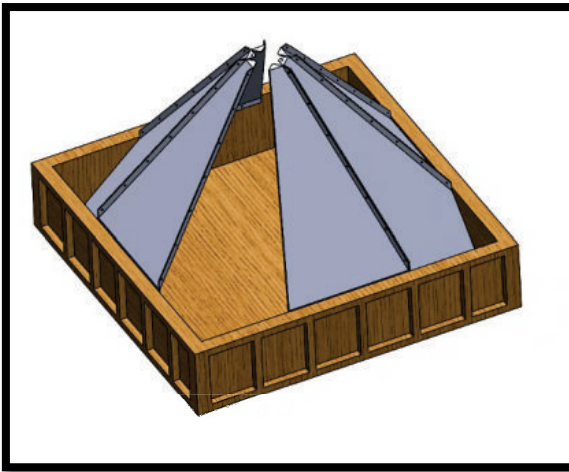


Cone Center Pieces

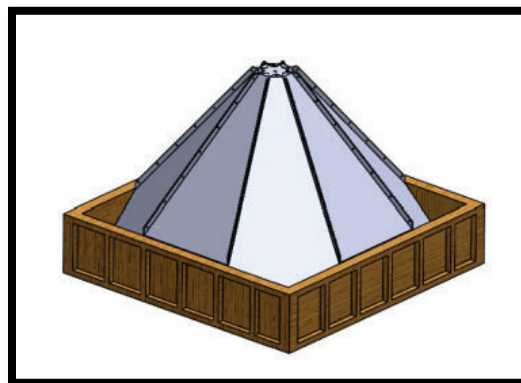
2. Take corner piece and attach two center pieces as show below. Make two of such sections.



3. Bring two sections in the box and clamp them in place. To apply clamps cut holes through box as required.



4. Bolt remaining corner pieces to complete full cone.

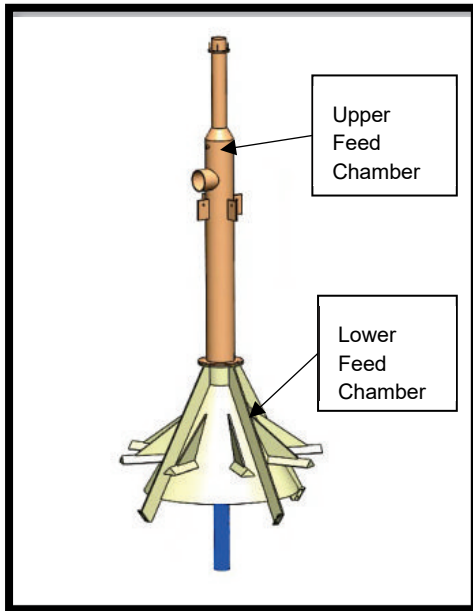


5. Once cone assembly is complete, remove the cone assembly from the box and set it aside.

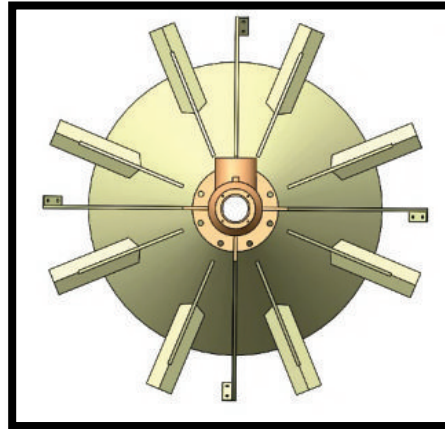
Assembly of Feed Chamber

Hardware:

- 8X Hex Bolt (3/4")
 - 8X Nut (3/4")
 - 8X Lock Washer (3/4)
 - 16X Washer (3/4")
 - 1X Rubber flexible coupling
- 12X Hex Bolt (3/8")
 - 12X Nut (3/8")
 - 12X Lock Washer (3/8")
 - 24X Washer (3/8")
1. Connect upper feed chamber and lower feed chamber using the supplied 3/4" hardware. Make sure the Influent inlet is aligned with one of the gusset arms as shown below.

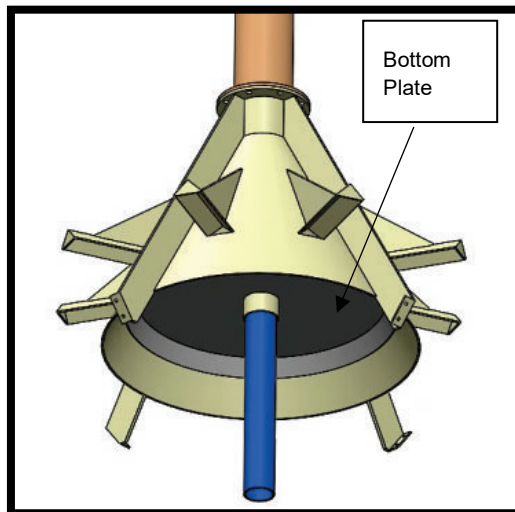


Upper and Lower Feed Chamber

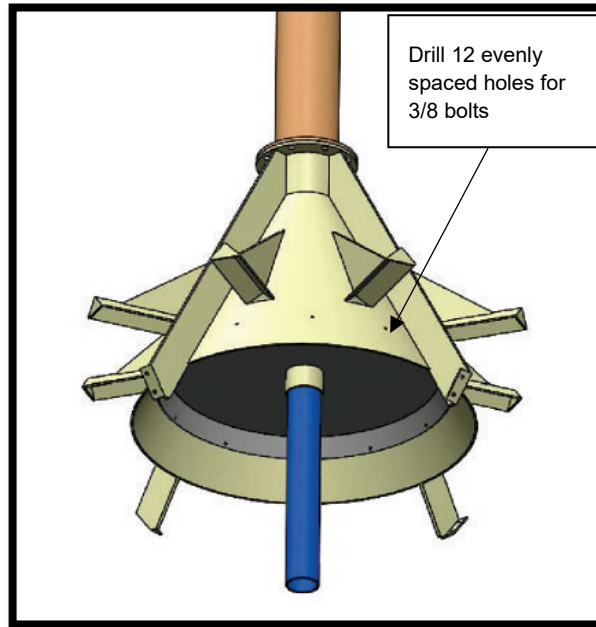


Top view of Feed Chamber

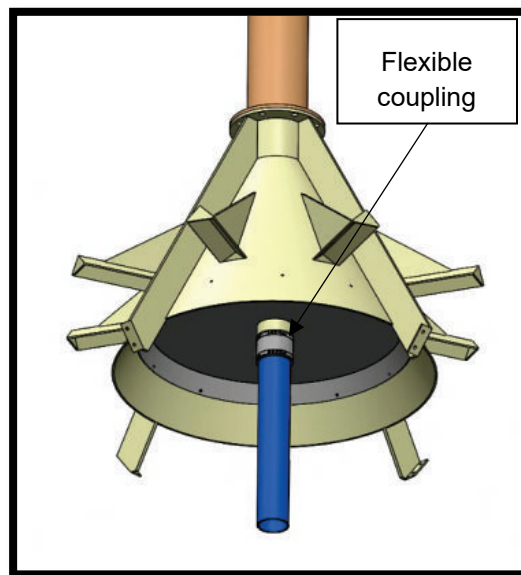
2. Insert bottom plate into lower feed chamber until contact is made at inner surface of lower feed chamber. Make sure bottom plate does not overlap distribution arms.



3. Drill holes through bottom plate and feed chamber skirt (hot coat must be applied for any drilled hole). Drill 3 equally spaced holes per quadrant for total of 12 holes.



4. Fasten bottom plate to feed chamber using supplied 3/8" hardware.
5. Add silicon seal to fill in gaps at skirt and pipe as required.
6. Install Flexible coupling fitting at the feed chamber pipe and bottom plate.
7. For venting purposes, drill 1/4 "holes in each quadrant 1" below the lip of bottom plate.



Equipment Installation

NOTE: TAKE CARE TO KEEP DEBRIS FROM GETTING IN THE BOTTOM OF THE FILTER. ALL DEBRIS MUST BE REMOVED FROM BELOW THE FEED CHAMBER BEFORE SAND INSTALLATION.

The following are some normal precautions to prevent damage to the cone and feed chamber.

1. Operators of hoist equipment should always follow proper rigging procedures. Care should be taken to prevent the FRP equipment from swinging out of control.
2. Always lift – Never roll or slide FRP equipment
3. When moving FRP equipment, do not drop or allow hard impact.
4. Never let tools strike or drop on either the inside or outside of the cone or feed chamber.
5. Never use cables or chains around the FRP equipment.
6. Cone sections and feed chamber bases will be stacked on pallets and may be unloaded with a forklift.
7. Use slings around the feed chamber pipes to avoid damage to the FRP. Woven, fabric slings of 3-inch minimum width are recommended.
8. If storing cone or feed chamber prior to installation, tie down securely. FRP equipment should be placed only on firm level surfaces which are clear of debris that may create high stress points. When stored outdoors, FRP equipment should be adequately secured to prevent movement due to wind or water flotation as well as covered to prevent UV damage. Do not allow cables, hooks, or spreader bar to swing against the FRP components.

Moving the Fiberglass Equipment

Appropriate lines, straps, or a clevis and lines, shall be used to move and locate fiberglass equipment. Workmen should keep control over the fiberglass equipment with guidelines to ensure they are gently brought to rest in their final position.

Use lines, straps, or clevis lines to appropriate lift points to move fiberglass equipment when in an upright position. Ensure size of lifting equipment, lines, and clevis pins are capable of handling weight of fiberglass equipment.

Cone Installation

The concrete cell will be designed per the contract drawings and will allow for a small gap around the cone when installed. When located, the weight of the cone will temporarily be placed on the bottom flanges until anchors and grout are installed.

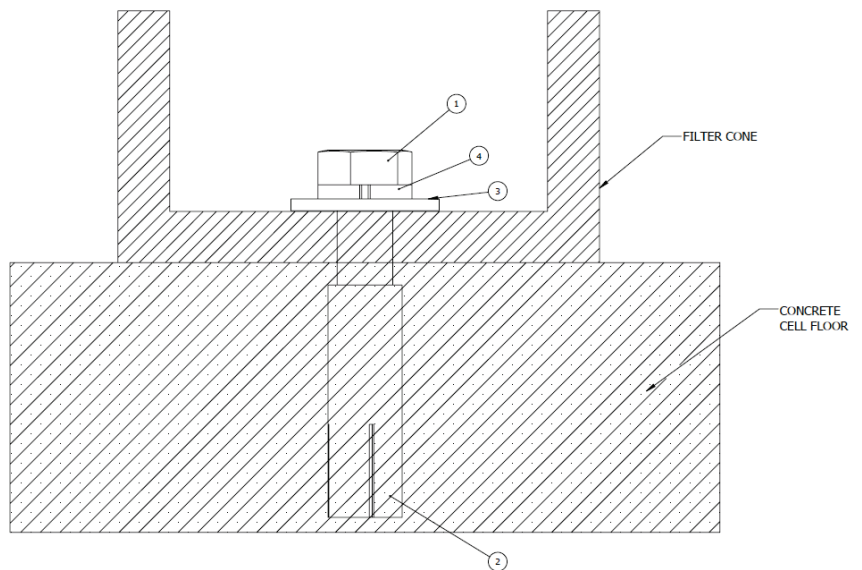
Ensure the cone is level, as it will support the feed chamber vertically.

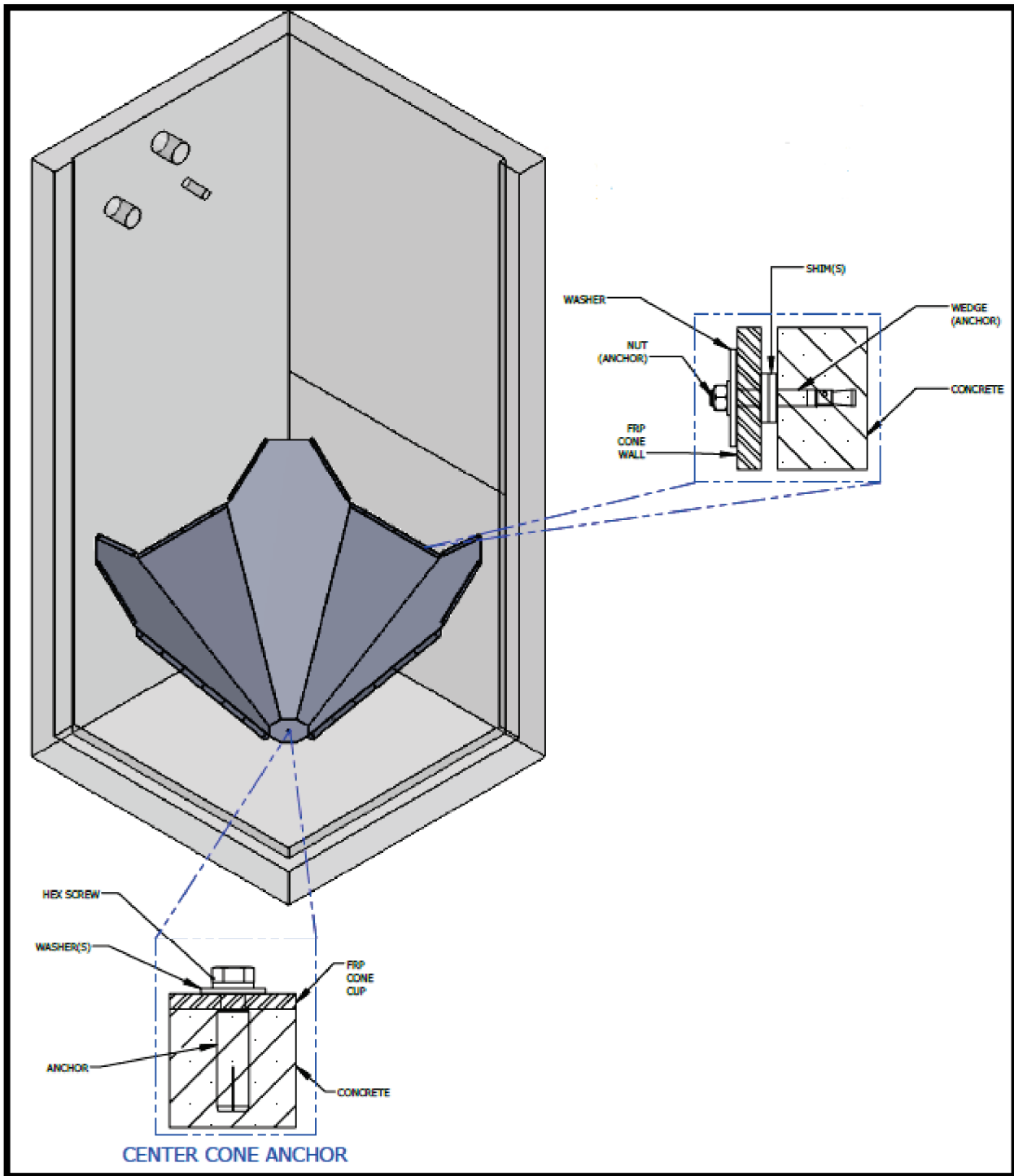
Anchoring

Anchor the bottom of the fiberglass cone to the concrete cell with a single vertical anchor through the anchor plate. The anchor plate is a separate octagonal part that fits in the bottom of the assembled cone to hold it in place. Horizontal anchors attach the upper flange of the cone pieces to the cell walls, holding the cone in place.

Center Cone Anchor Bill of Materials

1. Hex Head Cap Screw
2. Anchor, Drop-In
3. Washer
4. Lock Washer





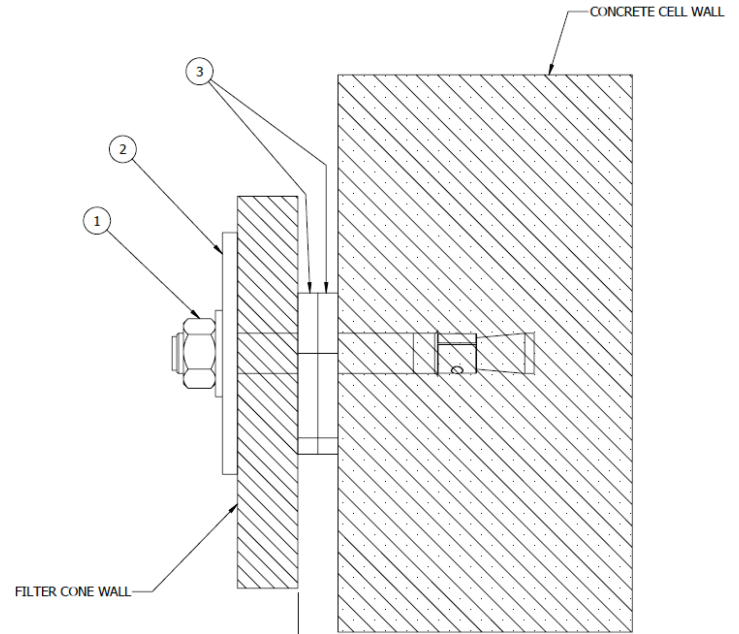
Model of anchoring locations of both cone-to-cone & cone-to-concrete

Cone-to-Wall Anchor Bill of Materials

1. Anchor
2. Washer
3. Spacers

Installation Instructions

1. Ensure each cone assembly is plumb in filter cell, using temporary shims as required.
2. Match drill and anchor the existing holes along each cone top flange. Use spacers as required to locate cone.



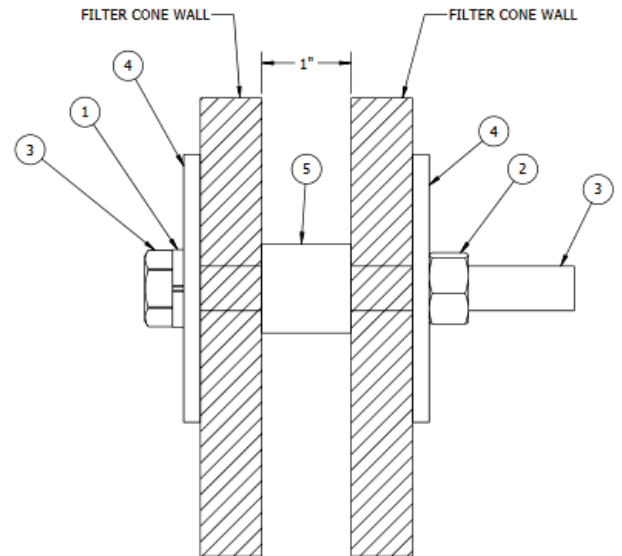
Example of anchoring cone-to-wall

Cone-to-Cone Fasteners Bill of Materials (For Multi Cone Cells)

1. Lock Washer
2. Nut
3. Hex Head Cap Screw
4. Large Washer
5. Spacer

Installation Instructions

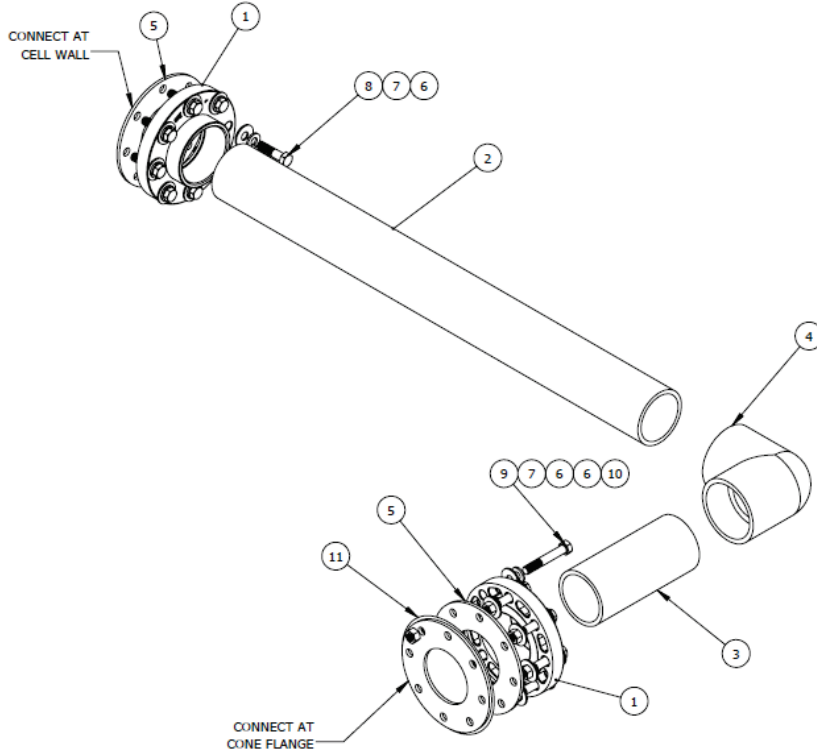
1. Ensure each cone is plumb in filter cell, using temporary shims as required.
2. Locate and fasten the holes along each cone top flange. Use spacers as required to locate cone to each other.



Example of anchoring cone-to-cone

Drain Plumbing (if applicable)

NOTE: Multiple cones in a single cell have a single drain plumbing assembly that ties all drain connections to a single exit point. The assembly example below is for a single cone cell only, configuration may differ from what is shown below. Refer to drawings for project specific layout.



Drawing representation of drain plumbing



Inspection of drain screen installation with gaskets

Bill of Materials (Typical)

- | | |
|--------------------|---------------------------|
| 1. PVC Flange | 7. Lock Washer |
| 2. PVC Pipe Length | 8. Hex Bolt |
| 3. PVC Pipe Length | 9. Hex Bolt |
| 4. PVC Elbow | 10. Hex Nut |
| 5. Rubber Gasket | 11. Stainless Mesh Screen |
| 6. Washer | |

Installation Instruction

1. Cut pipe to length as required.
2. Assemble per bill of materials using Teflon tape/paste on all threaded connections and PVC primer and cement on all socket connections.
3. Ensure screen has been installed between gaskets to maintain seal.
4. Provide supports if required to pipe section(s). Note that assembly will be encased in grout.

Cone Grouting

Once anchored and the drain plumbing has been installed and inspected, the FRP cone(s) must be grouted in place. To prevent lifting and for ease of installation it is recommended to fill in multiple lifts.

Installation Instruction

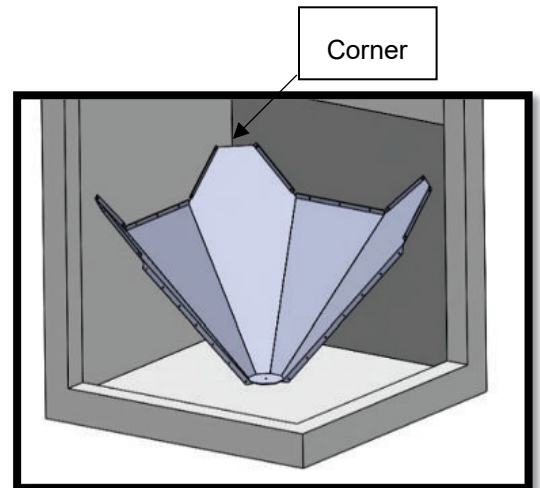
1. Ensure drain plumbing, drain screen, and cone anchors are installed.
2. Grout under the cone up to the bottom of the access hatch in the side of the cone.
3. Secure the manway cover on the access hatch with lag screws.
4. Grout the remaining area under the cone up to the upper lip/flange on the cone. The corners of the cones provide access for hoses.

Installation Instruction without access hatch and drain

1. Use empty space between corners to insert the hose for grouting.
2. Grout the area under the cone up to the upper lip/flange on the cone.



Initial grout lift utilizing the access hatch. Cup plugged to prevent spills in the bottom cup.



Grouting for Cones without access hatch

NOTES

1. Do not allow concrete into the bottom of the cone as it can blind the drain screen.

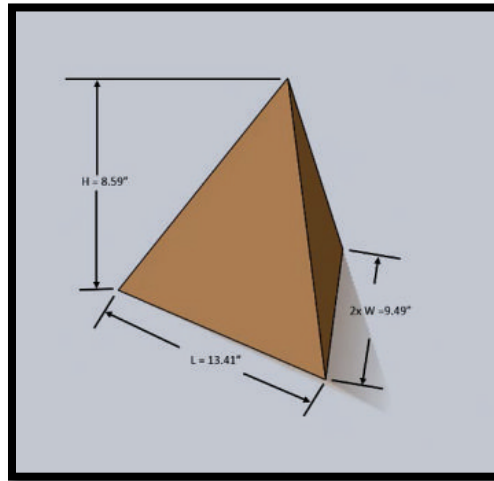


Grouting underneath multiple cones.

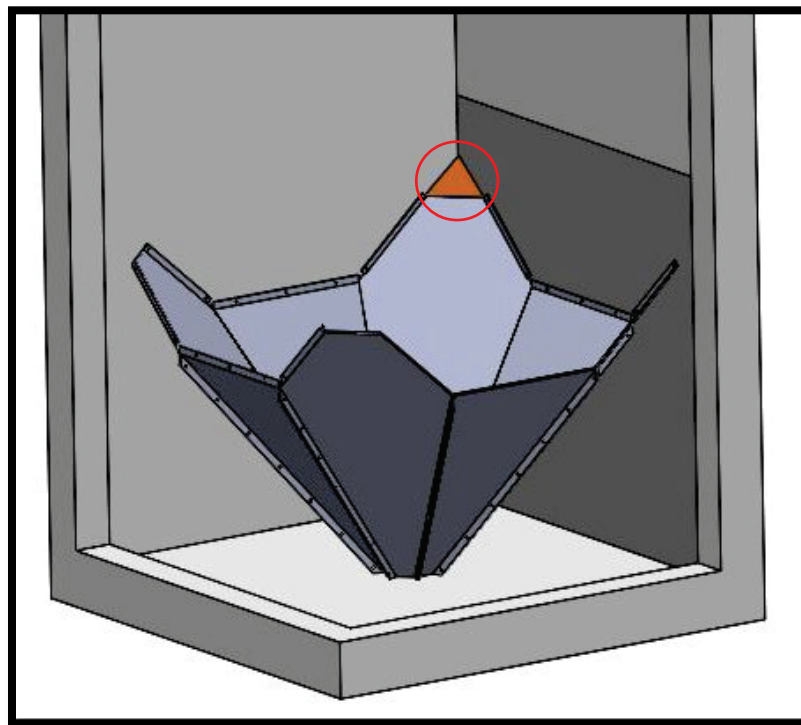
Fabricating Grout Corner Piece

When the fiberglass cone is installed in the concrete cell, anchored, and grouted underneath there will be a vacant area in the corners of the cell. Thus a corner piece will need to be made for all 4 corner and installed after anchoring of fiberglass cone.

The component will be made from grout material and shaped according to the Figure 11 below.



Grout corner dimensions

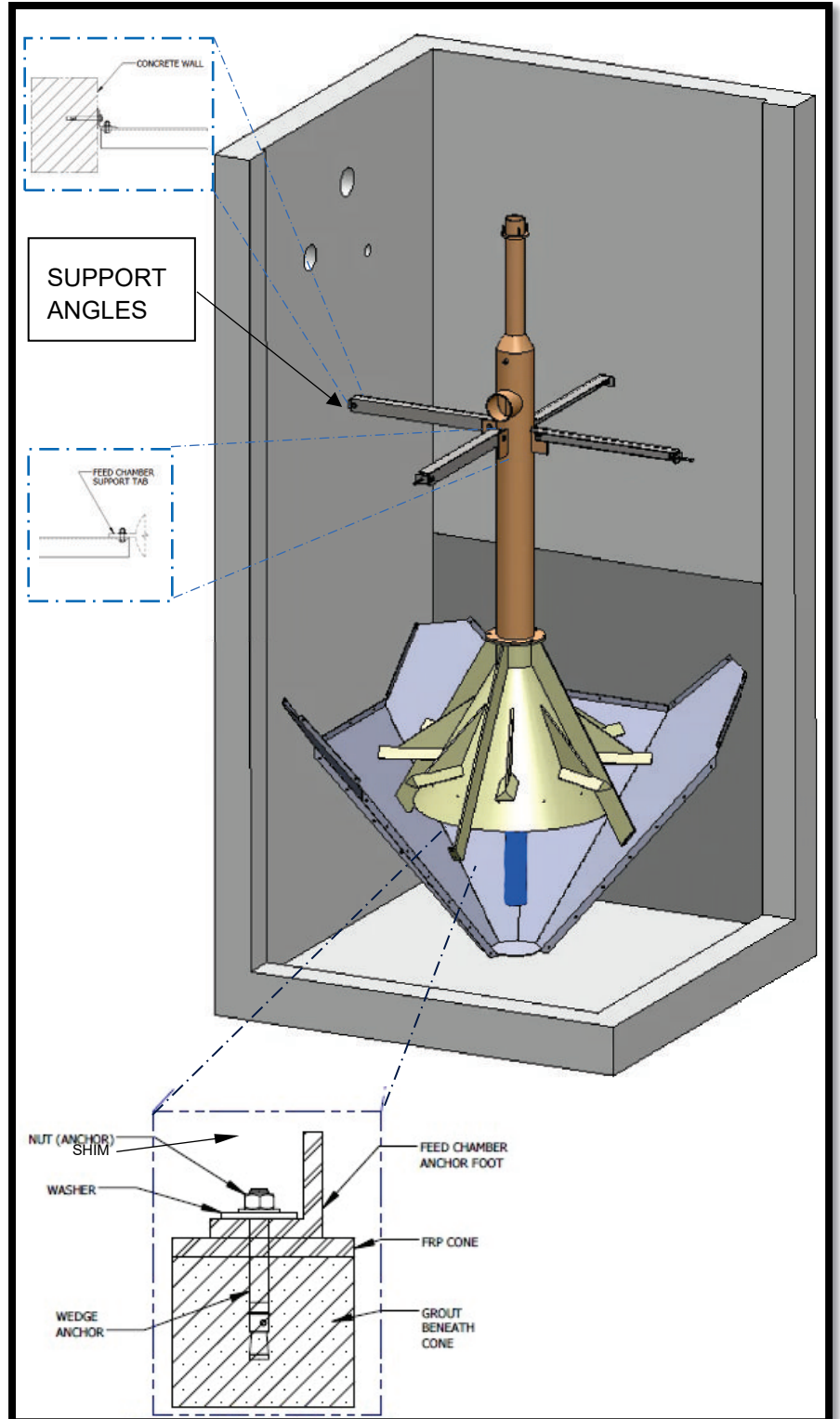


Installation location example

2. Feed Chamber Installation

Note: Apply hot coat to any drilled holes in fiberglass.

1. Clean out bottom of cone before installing feed chamber assembly. After this point, cleaning of filter will be difficult.
2. Utilize proper lifting techniques to lower feed chamber into cell in order to prevent damage.
3. Orient influent pipe section of feed chamber as instructed in general arrangement drawings.
4. Use the supplied support angles to hold the feed chamber in plumb position. Follow instructions in next section of Plumb Feed Chamber.
5. Add shims as required between feed chamber and cone.
6. Anchor feed chamber feet to cone.

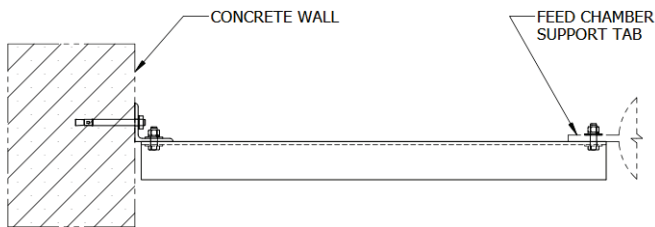


Plumb Feed Chamber

Once in place, ensure that the feed chamber is plumb to within 1/8" over 4ft measured from a smooth surface. Adjustments to the feed chamber can be made by loosening the feed chamber support brackets, adjusting position, and tightening the supports again.

Installation Instructions – Feed Chamber-to-Wall

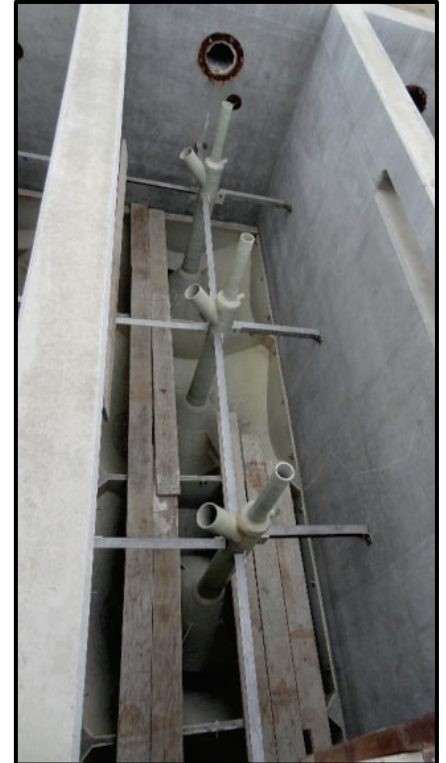
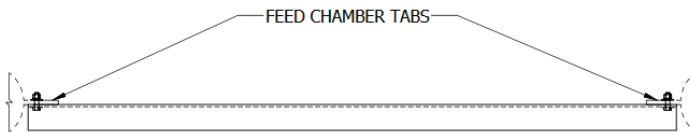
1. Ensure feed chamber is plumb.
2. Locate, drill and anchor wall side bracket as shown. Orient parallel to feed chamber support tabs.
3. Use supplied fasteners to fasten support between bracket and feed chamber support tab. Repeat as required.



Installation Instructions – Feed Chamber-to-Feed Chamber

Cells with single filters will not require these supports.

1. Ensure feed chamber is plumb.
2. Use fastener stack-up to fasten support between feed chamber support tabs. Repeated as required.



Feed chambers connected and secured with steel angle supports.

Platform and Access Installation

Platform System

The platform system will cover each concrete filter cell, typically flush with the top of the wall. Primary support for the platform comes from the support beam(s) spanning the cell and anchored ledgers along the cell wall. Additional access and handrails may be provided. Refer to platform drawings for assembly instructions.



Example of platform area

Access Hatch

A removable section of planking is provided as an access hatch to the filter internals, centered over each vessel.

The hatch is sized to allow for removal of the washbox while providing access to the media bed for maintenance and observation. This hatch may be removable by hand or fastened in place.



Top view of access hatch over washbox.

Air Panel Supports

Air control panels are typically mounted to the influent trough adjacent to each filter so that operators can easily access the filter controls.

The air panel will be located according to system drawings and require anchoring/mounting the panel mounting tabs to the concrete wall. The panel should be located to provide clearance for the panel door to open as well as for the power and air connections typically located on the sides/bottom of the panel. See air panel installation section later in this manual.



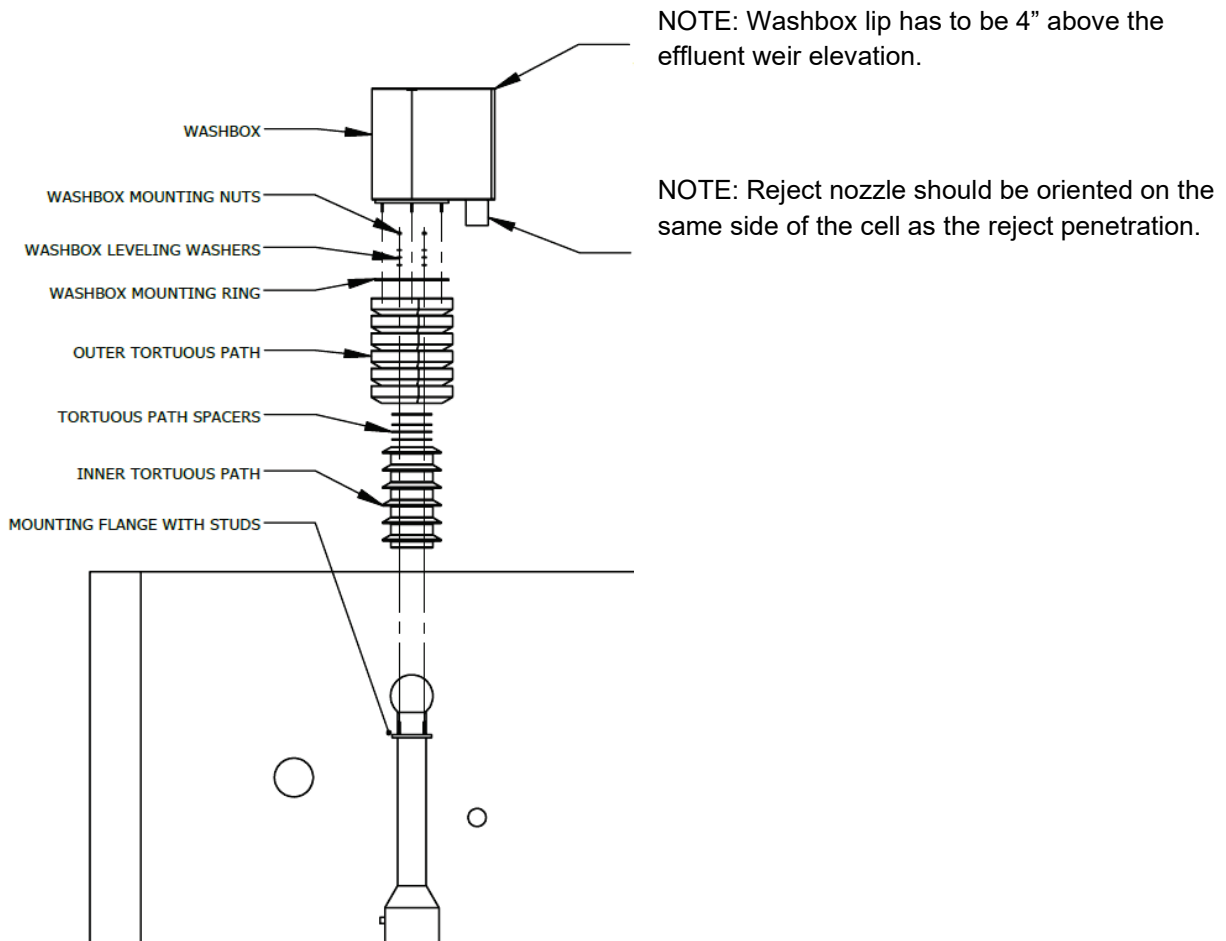
Example of air panel installed.

Filter Internals Installation

The washbox is the central component in the media washing assembly. The washbox itself has an outlet for media washing that is centered over the feed chamber pipe, with an additional outlet for reject flow.

Tortuous Path Installation

Locate the washbox and fasteners that secure it. The tortuous path assembly will install to the bottom of the washbox, and to the central feed chamber pipe.



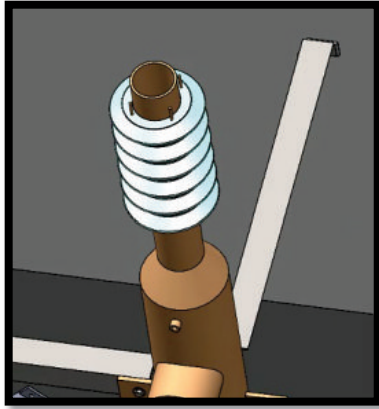
Drawing representation of feed chamber, tortuous path, and washbox

Bill of Materials (Typical)

- | | | |
|------------------------|--------------------------|--------------------------|
| 1. Inner Tortuous Path | 3. Tortuous Path Spacers | 5. Washbox Mounting Ring |
| 2. Outer Tortuous Path | 4. Hex Nut | |

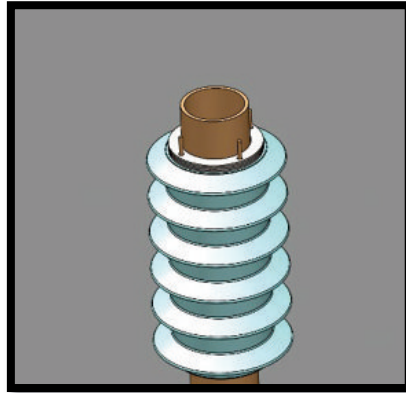
Tortuous Path Installation Instruction

1. Place the inner tortuous path over the feed chamber pipe as shown below.

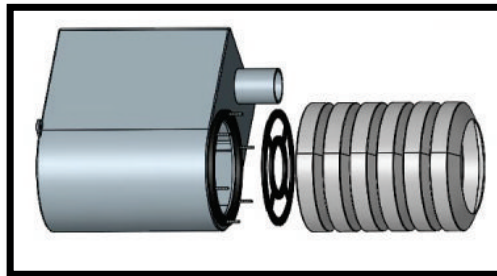


Inner tortuous path placed on feed chamber pipe.

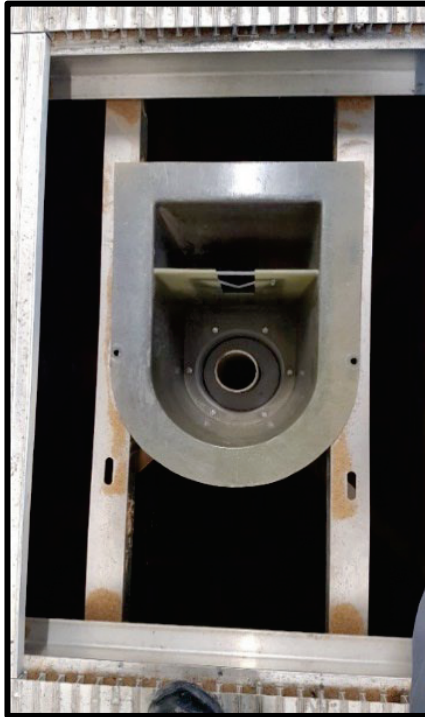
2. Place 4X Custom Steel plates as shown.



3. Secure outer tortuous path to the bottom of the washbox with the washbox mount and provided hardware.

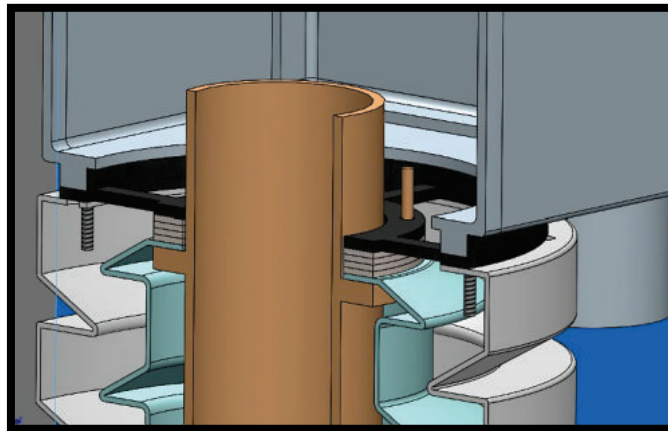


- Slide the washbox and outer tortuous path assembly over the inner tortuous path and feed chamber. Ensure reject outlet is aligned per general arrangement drawings.



Washbox centered over feed chamber pipe.

- Align the holes of washbox mount with the feedchamber pipe and secure them with hardware provided.



Reject Weir Location

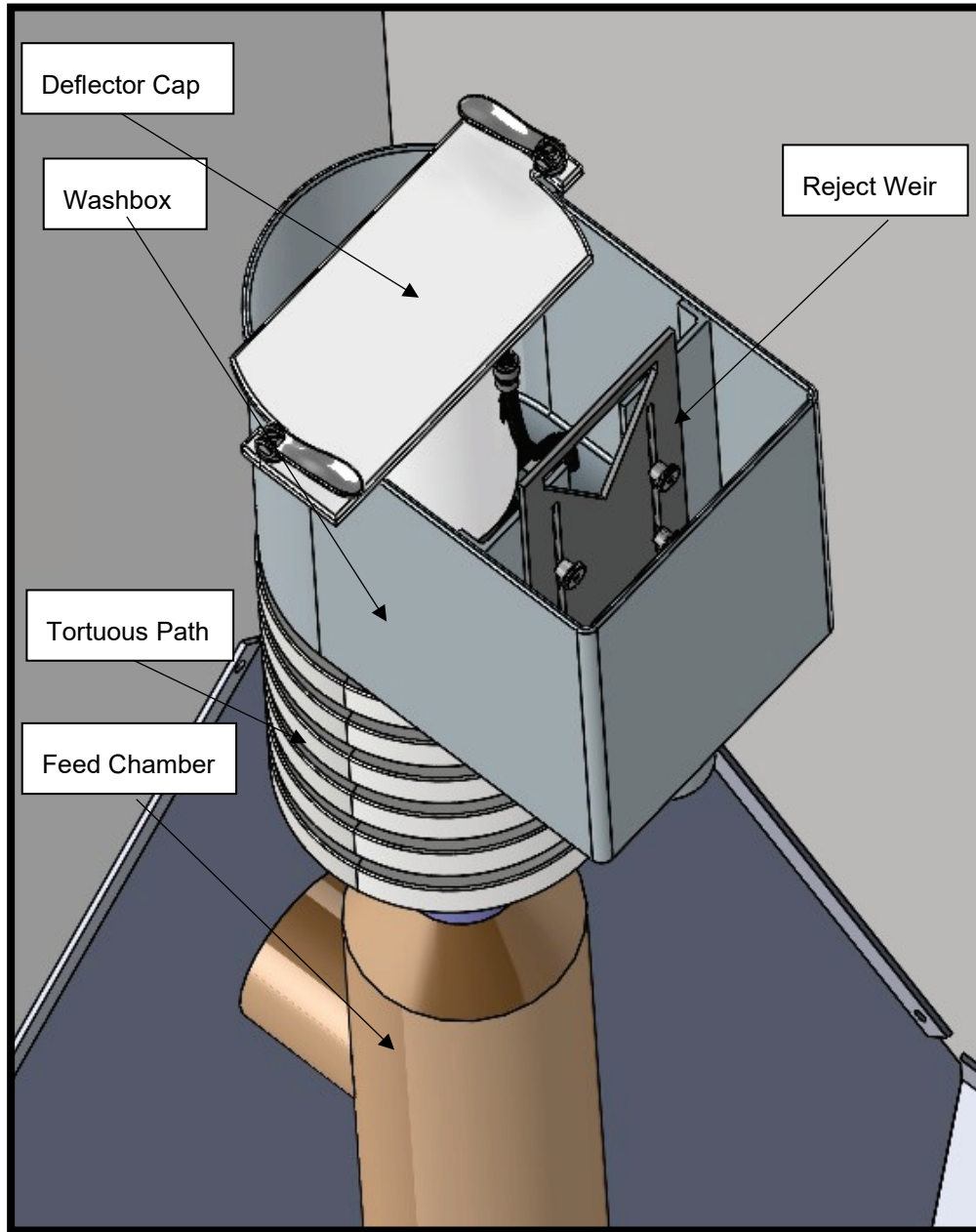
A reject weir plate is attached to the washbox to regulate the reject flow through the washbox.

Reject Weir Bill of Materials (Typical)

- FRP Reject Weir Plate
- Knurled Nut
- Silicone & Applicator

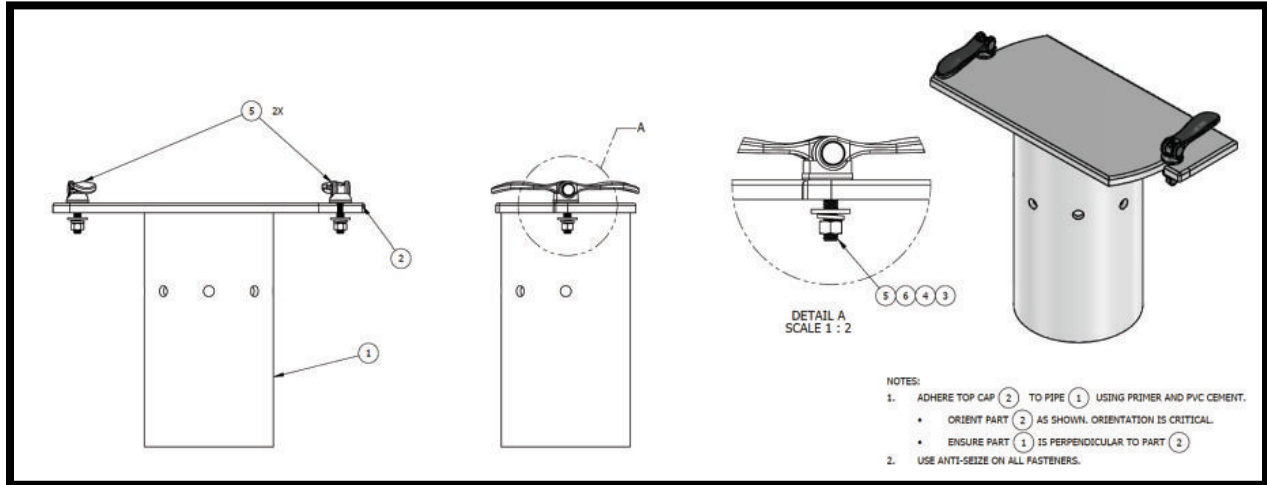
Installation Instruction

1. Add a bead of silicone along the bottom edge, LH and RH edges of the plate. Allow to partially dry to create a gasket.
2. Before silicone dries, fasten weir plate to reject side of washbox using supplied studs.
3. Height of reject weir will be set by Nexom personnel.



Annotated assembly of feed chamber to washbox

Deflector Cap Installation



Drawing schematic of deflector cap

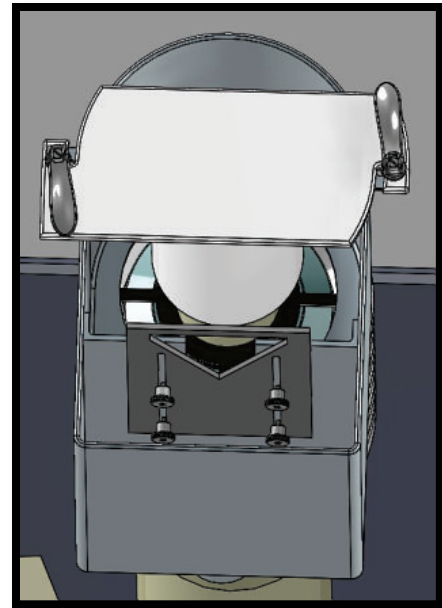
Installed in the filter washbox, the deflector cap is designed to prevent the turbulent water and sand expelled by the airlift from exiting the washbox. Centered over the feed chamber pipe and airlift, the deflector cap can be removed by hand to access the airlift.

Bill of Materials (Typical)

- PVC Deflector Cap
- Flat Washer
- Split Washer
- Clamping Handle with Threaded Stud
- Hex Nut

Installation Instruction

- Place deflector cap PVC assembly over the feed chamber pipe in the washbox.
- After locating, mount the deflector cap using the cam handle assembly through the washbox mounting tab.



Top view of washbox with deflector cap

Plumbing and Venting

Installation of the filter internal plumbing will require entering the filter cell which may be considered a confined space. Plumbing assemblies consist mainly of PVC pipe and fittings for routing of influent, reject, and drain process flows. Generally, plumbing assemblies will be self-supporting from internal flange/stub connections, but additional supports may be required.

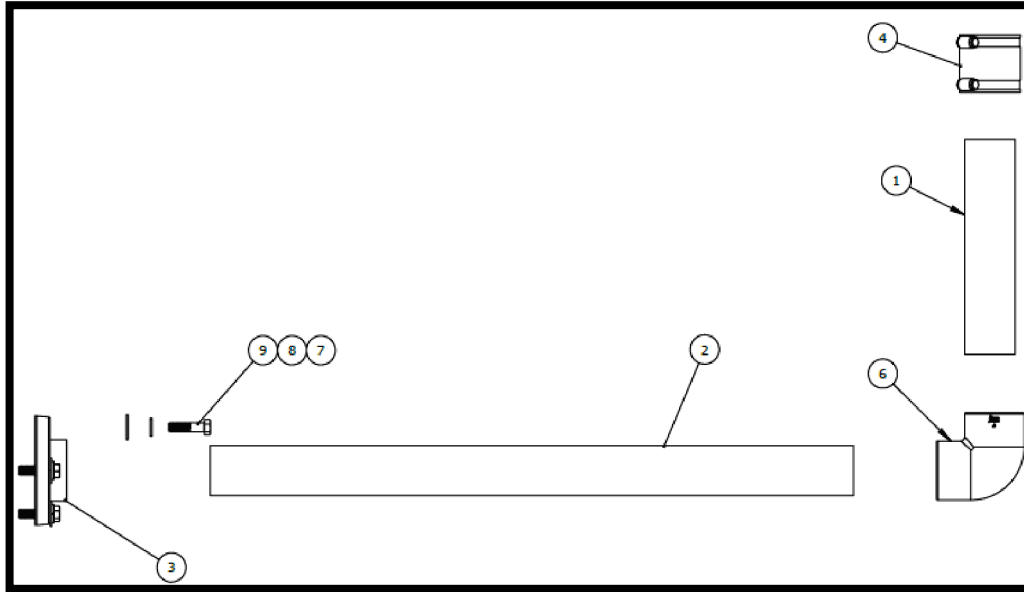
TOOLS REQUIRED

- PVC Primer (IPS WELD-ON P70)
- PVC Cement (IPS WELD-ON 705PC)
- Adjustable Pliers, Wrench, or Vice Grip
- Teflon Tape/Paste
- Power Drill/Screw Gun

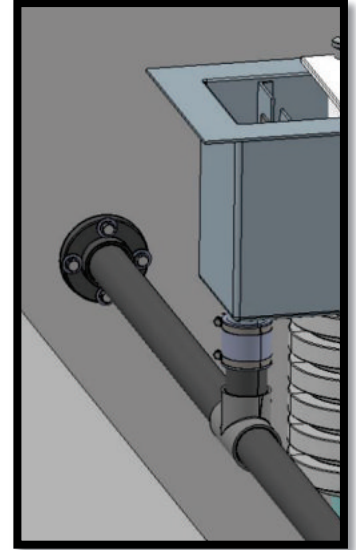


Reject Plumbing

This plumbing connects the reject pipe stub on the bottom of each washbox to the reject outlet connection. Refer to drawings for project specific layout.



Reject plumbing drawing schematic for single filter in a cell.



Model of reject plumbing for multiple filters in a cell.

NOTE: Multiple cones in a single cell have a single reject plumbing assembly that ties all reject connections to a single exit point.

Bill of Materials (Typical)

- | | | |
|--------------------|--------------------------|----------------|
| 1. PVC Pipe Length | 4. Rubber Fernco Fitting | 7. Hex Bolt |
| 2. PVC Pipe Length | 5. Gasket | 8. Lock Washer |
| 3. PVC Flange | 6. PVC Elbow | 9. Washer |

Installation Instruction

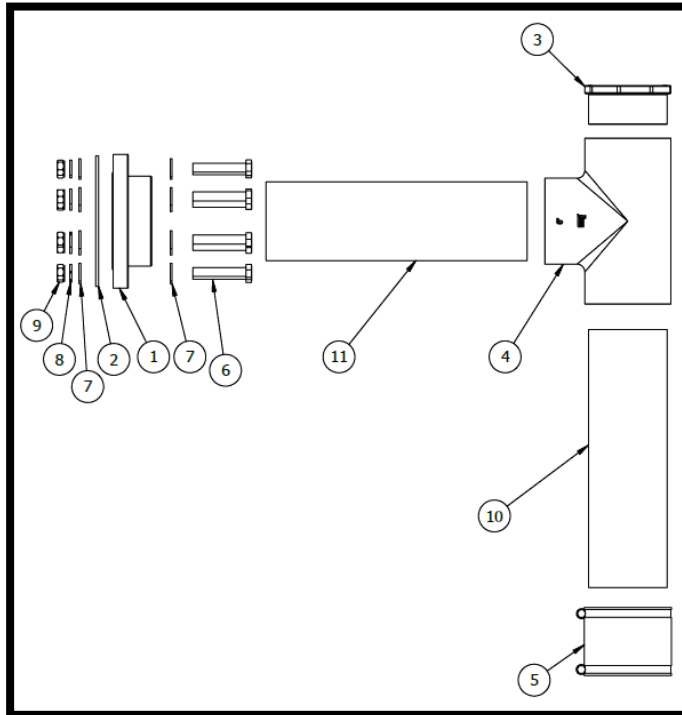
1. Cut pipe to length as required and dry fit per bill of materials. Repeat as required.
2. Complete final assembly using Teflon tape/paste on all threaded connections and PVC primer and cement on all socket connections.
3. Tighten clamps on Fernco fittings to connect piping to the pipe stub on the bottom of the washbox.
4. Connect reject piping flange to the reject flange on inside of the cell per Nexom drawings.

NOTES

1. Ensure there are no low points in the reject line for solids to settle and accumulate.

Influent Plumbing – Single Filter

NOTE: Multiple cones in a single cell have a single influent plumbing assembly that ties all influent connections to a single entry point. The assembly example below is for a single filter only. Refer to drawings for project specific layout.



Influent plumbing assembly drawing



Influent plumbing connected to cell wall and feed chamber inlet pipe stub.

Bill of Materials (Typical)

- | | | |
|------------------------|--------------------------|---------------------|
| 1. PVC Flange | 5. Rubber Fernco Fitting | 9. Hex Nut |
| 2. Gasket | 6. Hex Bolt | 10. PVC Pipe Length |
| 3. PVC Bushing Reducer | 7. Washer | 11. PVC Pipe Length |
| 4. PVC Tee | 8. Lock Washer | |

Installation Instruction

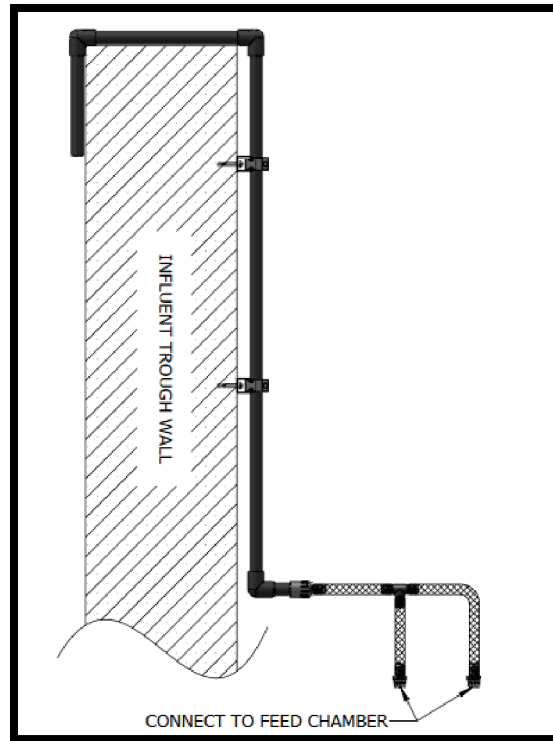
1. Cut pipe to length as required.
2. Assemble per bill of materials using Teflon tape/paste on all threaded connections and PVC primer and cement on all socket connections.
3. Tighten clamps on Fernco fittings to connect piping to the pipe stub on the feed chamber.
4. Connect piping flange to the influent flange on the inside of the cell.

NOTES

1. Influent piping should remain above the sand media bed.
2. Some installations will include an influent isolation valve in the influent plumbing assembly. Ensure proper seals are installed on mating surfaces, and piping/valve is supported.

Venting Assembly

The influent venting assembly is designed to provide an outlet for built-up air in the influent plumbing. A suitable installation routes the venting such that the highest point is at least 48" above the effluent weir to prevent short-circuiting of the influent. The assembly can be handrail or wall mounted, and flexible hose is used to connect to the vented connections. Optionally the venting can drain back to the influent trough. The example below is for two filters per cell. Refer to General Arrangement drawings for project specific layout.



*Influent Trough Venting example.
See General Arrangement Drawing.*

Installation Instruction

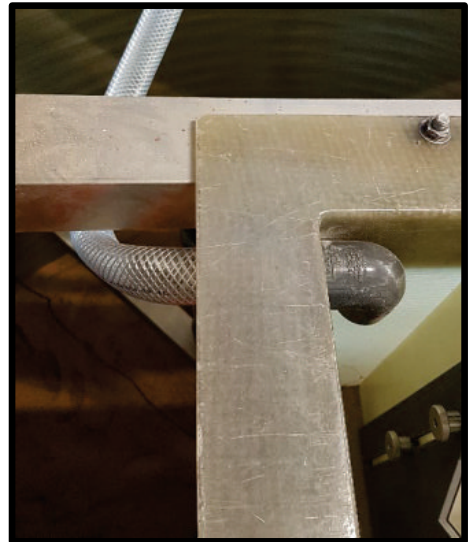
1. PVC components will ship unassembled to be field measured and fit.
2. Measure and assemble the PVC pipe lengths and elbow to route the venting over the influent trough.
3. Using the strut and clamps, secure the assembly to either a wall (or handrail system) ensuring adequate height above the effluent weir (48" minimum).
4. Install the feed chamber barb fitting in the feed chamber vent port using Teflon tape on threaded connections.
5. Install the influent plumbing reducer and barb fitting on the influent plumbing assembly using Teflon tape and glue for each filter as required.
6. Connect the hoses to all barbed fittings. Measure and cut hoses to length, securing as required to prevent any low points in the plumbing.



Venting hose connected to influent plumbing assembly and feed chamber.



Venting installed on concrete cell, draining to influent trough.



Venting drain routed through washbox on reject side (Option).

Media Loading & Washing

Filter sand media is installed to a specific height in the filter based on a calculated media volume. Referring to the submitted project documents, the volume of media for each filter is typically defined by the quantity of (3000 lb.) super sacs. If partial sacs are required for a filter, it is generally easier to segregate this volume by hand than try to close the super sac halfway through the process of draining.



Sand Media on-site

IMPORTANT:

BEFORE FILLING WITH WATER OR SAND, CHECK THAT THE FILTER IS COMPLETELY FREE OF FOREIGN OBJECTS. CONFIRM THAT ALL FRP MOLD RELEASE AGENTS HAVE BEEN REMOVED. ONCE THE FILTER CONTAINS WATER, SAND ADDITION MAY COMMENCE BY ADDING EVENLY AROUND THE TOP OF THE FILTER AT A SLOW RATE. ONCE THE FILTER CONTAINS SAND, ANY FOREIGN OBJECT DROPPED INTO THE FILTER WILL CAUSE BLOCKAGE OF THE AIRLIFT AND MUST BE REMOVED IMMEDIATELY. STOP THE AIRLIFT (IF RUNNING) AND REMOVE OBJECT FROM TOP OF SAND BED.



Media raised into place

1. Check to see that the unit is free of all foreign material. Take special care to inspect the lower recessed chamber in the very bottom of the filter's lower cone section. This is the suction point for the airlift, and it **MUST** be clear of ALL foreign objects such as rocks, plastic bags, and bolts. A wet/dry vacuum works extremely well and is recommended for cleaning each filter.
2. Check all piping connections and ensure all filter components are in place.
3. Fill cell with clean water **FROM THE TOP** or through the central feed chamber at a low rate. Fill cell with water, (about 1/3), to (1) minimize dust production, (2) protect the internal components and (3) help spread out the sand.
4. Place a coarse screen (1/4" mesh) over the filter so that no foreign objects can enter with sand. If sand delivery is by pneumatic truck, a simple cover may be used to control the large amount of dust created or use a "dust arrestor" device.



Custom box with mesh for screening the media



IN COMPLIANCE WITH OSHA STANDARD 1910.134, A DUST RESPIRATOR MUST BE WORN BY ALL PERSONNEL ASSOCIATED WITH SAND LOADING.

5. Be sure to cover washbox with a sturdy cover (3/4" plywood) before adding sand from bulk bags. Add sand at a slow rate and distribute evenly across the filter. Adding sand at a high rate and failing to distribute it evenly across the filter can cause shifting of the internal filter components. Sand in 50 pound bags can be loaded by hand from a forklift truck. 3,000 pound bulk bags will require a crane or hoist. Pneumatic truck delivery requires close enough access from the short delivery hose.
6. Load the correct number of sacs of sand media into each filter cell per the Nexom submittal and/or scope of supply. There may be excess media for spare.
7. Drain the filter basins after sand addition if start-up is not to take place immediately.

Filling and Draining the Filters

WARNING:

If water is allowed to flow backwards through a filter, sand can be sucked from the sand bed into the central feed chamber and feed pipe. Backflow must be avoided at all times. Avoid the following actions which could cause backflow:

1. Do not open any feed bypass valve or break the feed line when a filter feed valve is open.
2. If the water level in one filter is lower than in the other after partial or complete draining, opening the filter feed valve could allow water to backflow from the full filter to the empty one. To refill a partly or completely drained filter, run a hose into the top at flow detailed on the Specifications Page (Appendix A). Faster flows into the top of an empty unit can cause backflow.

Removal of Sand from Feed Chamber and Feed Lines

1. Allow water to feed to the filter with the maximum head available.
2. Turn on the airlift pump and set the rotameter to the maximum listed on the Specifications Page (Appendix A).
3. Frequently check to make sure the washbox does not plug.
4. Give the system some time to evacuate the sand from the feed chamber. Keep in mind that all the sand in the feed chamber has to have a place to go, meaning that the airlift must be running.

Sand Removal and Replacement

Sand can most easily be removed from the filter, by letting the airlift pump do the work. The filter should be kept full of water by running a hose into the top. A flexible PVC pipe assembly should be made up, one end of which will fit onto the top of the airlift. Use this pipe to distribute the sand to super sacks, containers, or an adjacent filter.

To use a super sack/tote method, cut the top off a large plastic tote and place an empty super sack inside. Pump sand into the super sack. Attach a hose to the valve at the bottom of the tote. Water will pass through the super sack and can be drained through the hose to the proper location.

If the sand will be put back into the unit, pump it into bags or drums that can be brought up to the top of the filter to refill it. Remember that the airlift pump cannot pump very much higher than the surface of the water, so keep the pipe assembly low and the filter full of water.

Air Control Panel Installation

Air control panels contain solenoids and air filtration equipment required for operating filter airlifts and air-operated influent valves. Additionally, filter sensors and instrumentation are routed through the air panel to the main control panel (when supplied). Air control panels are rated for outdoor installation, and typically installed close to the filter(s) they control for operator access and monitoring.

TOOLS REQUIRED

- Adjustable Pliers, Wrench, or Vice Grip
- Power Drill/Screw Gun
- Sharpie Marker
- Tubing Cutting Tool
- Measuring Tape
- Safety Gloves and Glasses
- Electrical Installation Tools



Air control panel connections: power, air supply, and filter air.

Installation Instruction

1. Air panel will be supplied with enclosure mounting brackets to prevent fasteners penetrating the enclosure. These brackets should be attached to the four corners of the enclosure per the manufacturer's instructions.
2. Air panel should be mounted to wall supports or air panel support weldment/assembly as required. Panel needs to be located for visual access to the front of the panel, clearance to open the enclosure door, and for the electrical and pneumatic connections on the bottom of the panel.
3. Land power and signal wiring (as required) to the panel per the electrical schematic provided.
4. Connect the air supply to the air inlet port on the panel (ball valve) to provide the system with dry, filtered compressed air. Valve is shipped loose and should be installed with Teflon tape.
5. Wire any instrumentation to the panel per the electrical schematic provided.
6. The drain connection for the air filter should be routed to a drain location if required.

NOTES

1. Assuming airlifts and pneumatic system are installed, the air panels can be tested for basic operation by ensuring the following:
 - a. Rotameter(s) function and provide flow adjustment
 - b. Pressure gauge(s) function when airflow is provided
 - c. Airburst button sends high pressure air to airlift when pressed
2. Final air panel operational check will be carried out by Nexom personnel during startup.



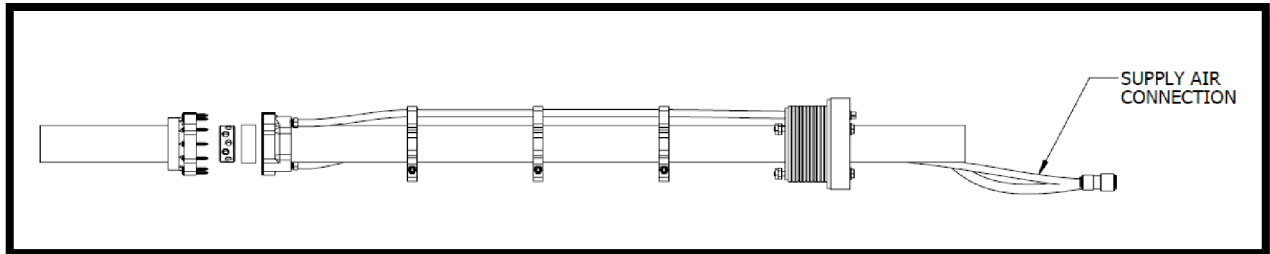
Wall mounted air panel



Handrail mounted air panel

Airlift Installation

The airlift is a plastic pipe assembly that utilizes compressed air to cycle sand media and water up through the feed chamber to the washbox assembly for cleaning.



Airlift example drawing

Installation Instruction

1. Feed the lower end of the airlift down the feed chamber until it becomes difficult to do so. The HDPE pipe can flex to accommodate low clearances, but adequate head space (5 ft) above the filter is required.
2. Connect the tube coupling at the top of the airlift to the air supply connection at the air panel with provided tubing. Route and secure the supplied tubing to the air panel to limit low points.
3. Turn on air flow to the airlift. The top of the airlift will be ejecting media and water so cover the end with a flexible hose to route back to the filter.
4. With the air on, slowly lower the airlift into the feed chamber until the pipe plug assembly comes to a rest on the top of the feed chamber. The rubber plug should fit snugly in the top of the feed chamber pipe.
5. Turn off the air flow to the airlift.
6. Tighten the three (3) bolts on top of the pipe plug assembly to secure the airlift in place. The airlift should remain in place and not be removable by hand.



Airlift installed in washbox with temporary air supply tubing

Filter Control Panel Installation

The filter control panel contains the PLC program for operating the system as well as an HMI for operator interaction. Air panel power and instrumentation signals are sent to the filter control panel and system outputs can be provided to plant SCADA for monitoring and/or control. The filter control panel is installed indoors protected from the elements.

TOOLS REQUIRED

- Adjustable Pliers, Wrench
- Power Drill/Screw Gun
- Measuring Tape
- Safety Gloves and Glasses
- Electrical Installation Tools

Installation Instruction

1. Filter control panel will be supplied with enclosure mounting brackets to prevent fasteners penetrating the enclosure. These brackets should be attached to the four corners of the enclosure per the manufacturer's instructions.
2. Filter control panel should be mounted to wall supports and located for visual access to the front of the panel, clearance to open the enclosure door, and for the electrical connections on the bottom of the panel.
3. Land power and signal wiring (as required) to the panel per the electrical schematic provided.

NOTES

1. Once the air panels and instrumentation are installed and connected to the filter control panel, testing for basic operation and/or alarms can be done for the following:
 - a. Flow meter signal
 - b. Headloss level signal
 - c. Filter level switch signal
 - d. Sand Monitoring (SAM) sensor signal
 - e. Low air pressure switch signal
2. Final filter control panel operational check and setpoint calibration will be carried out by Nexom personnel during startup.



Wall mounted filter control panel during system installation.

Instrumentation Installation

Influent Pressure Transmitter

The headloss through the filter system can be measured at the influent stream of the filter by two types of sensors.

If the filter is fed solely by pipe from the influent stream, then an in-line pressure transmitter will be mounted via saddle tap (or similar) to measure pressure in the influent header. The installation location is determined by engineer, but the relative height from the sensor to the effluent weir of the filter will be an input value in the PLC program. If there is a separate feed line for each filter, a sensor will be installed on each line and provide an individual headloss for each filter. If there is a common header, a single sensor is used, and the filters share a common headloss value. Refer to P&ID for filter arrangement.

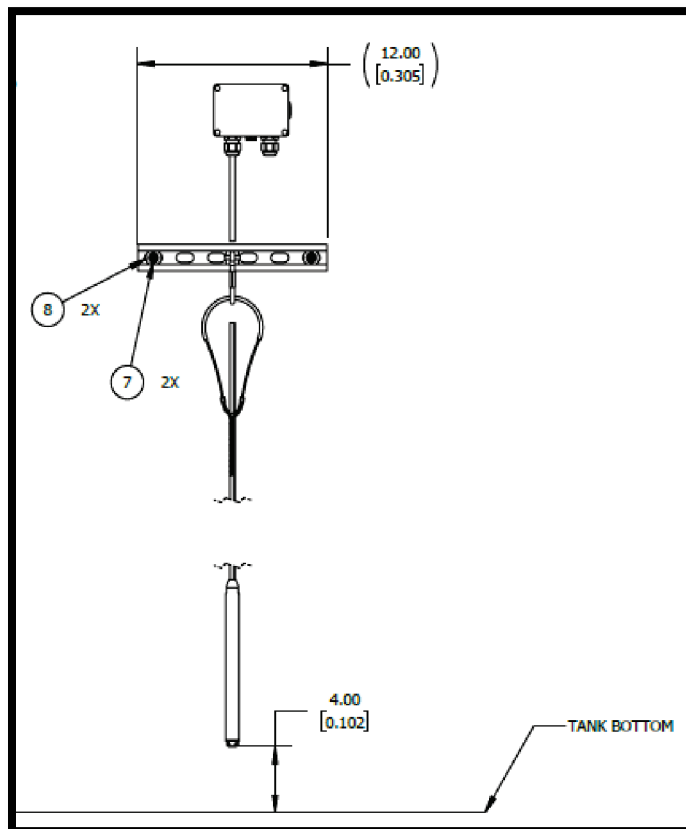
If the filter is fed by an open influent trough, typical of concrete cell filters, then a submersible sensor may be used. This submersible pressure transmitter is lowered to a fixed point in the trough, and the relative height from the sensor to the effluent weir of the filter will be an input value in the PLC program. If the trough feeds several filters, they will all read the same headloss value.

Installation Instruction – In-Line Sensor

1. Locate source for installation in influent line. A saddle tap on the influent pipe may be required.
2. Thread sensor into fitting and secure.
3. Attach sensor cable and connect to panel.
4. Measure and note offset from sensor position to effluent weir.

Installation Instruction – Submersible Sensor

1. Locate position for mounting bracket in trough away from turbulent areas.
2. Mount bracket and suspend transmitter into trough as far down as possible without touching bottom. Refer to specific instrumentation manual.
3. Measure and note offset from sensor position to effluent weir.



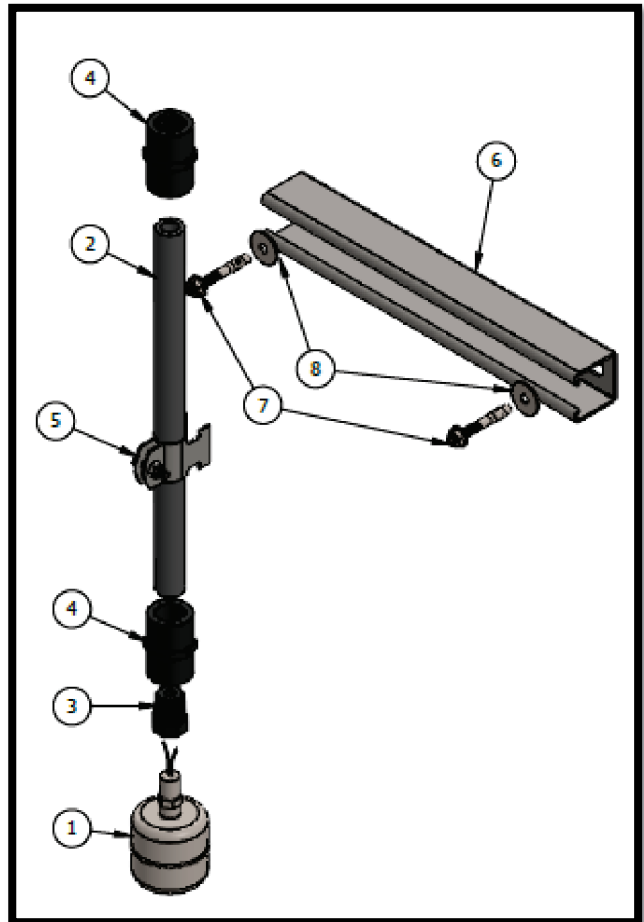
Drawing of Submersible Sensor

Filter Run Level Switch

Each filter utilizes a run level switch for monitoring the water level in the filter. When the level reaches the point where water will flow over the effluent weir, the level switch signals to the system that the filter can operate. The level switch location is adjustable through use of the mounting bracket which is located along the outside wall of the filter cell.

Installation Instruction

1. Determine a point cell wall near the air panel that provides access for the sensor. If the cell platform/cover provides an access point for the sensor, locate it there.
2. Locate the filter bracket on the wall so the center of the bracket is at the effluent weir, allowing for the sensor to be adjusted up or down relative to the weir.
3. Match drill mounting holes in the concrete wall and secure the bracket to the wall with the supplied hardware and anchors as required.
4. Assemble the sensor mount assembly per bill of materials using Teflon tape/paste on all threaded connections and PVC primer and cement on all socket connections.
5. Fasten the sensor and mount assembly.
6. Attach the sensor cable to the sensor, routing to minimize risk of damage to the cable.
7. Locate the assembly such that the measuring point on the sensor is at the effluent weir.

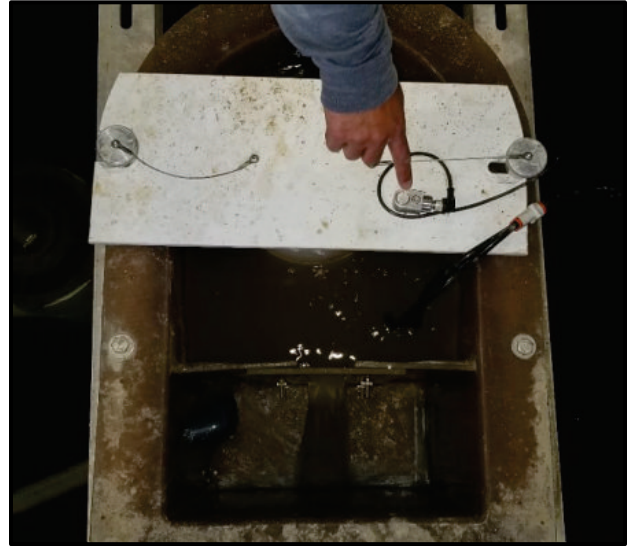


Drawing of Run Level Switch

Sand Monitoring (SAM) Sensor

Each washbox is fitted with a SAM sensor for monitoring fluctuations and trends in the washbox water level. The vibrations given off by these changes in water level are detected by a vibration sensor mounted to the washbox assembly. Specifically, the sensor is threaded to a tapped hole in the deflector cap drilled and located by Nexom.

1. Locate the tapped hole on the top of the deflector cap assembly.
2. Orient the SAM sensor to prevent damage to the cable
3. Attach the M12 cable connector and wire to the air/filter control panel, securing as required.



SAM Sensor Installation

ADDITIONAL SENSORS

The sand filter system may be provided with additional instrumentation for pH monitoring, temperature, flow, outlet parameters, etc. This instrumentation will be installed and wired to the control system per the manufacturer's instructions.

Pneumatic System Installation

The sand filters continuously recirculate the sand media for cleaning through use of the airlift that runs down through the feed chamber of each filter. This airlift operates with compressed air, regulated and controlled by the air panel for that filter. The pneumatic system which provides compressed air to the air panels is installed indoors and typically consists of a compressor (often with redundancy), air dryer, and filtration.

Specific installation instructions should be referenced from the manuals for the equipment supplied. However, several items below are common to all installations.



Example of an air compressor on site

All Equipment

- Install isolation valves and plumbing to allow bypass of equipment for maintenance.
- Allow adequate space around equipment for removal and/or maintenance access.
- The air lines should be blown out to remove scale or debris before installing.
- Install indoors and away from corrosive chemicals, gases, or high ambient temperatures.
- Follow standard mechanical and electrical installation guidelines.
- Lift equipment from mounts, supports, lifting points and not motors, control boxes, or piping.

Compressor

- Mount on a level solid surface with vibration isolation pads.

Filtration

- Orient filter based on marked "Flow Direction" on the filter.
- Drains from filters should be properly routed with no low points for moisture buildup.

Refrigerated/Desiccant Dryer

- Mount dryer on a level solid surface. Mounting holes are provided.
- Confirm dryer has been adjusted at the factory for installation altitude
- Remove power to the dryer before installing.
- Do not remove components while the dryer is under pressure.
- Ensure NEMA rating on control box matches installation.

Dosing System Installation

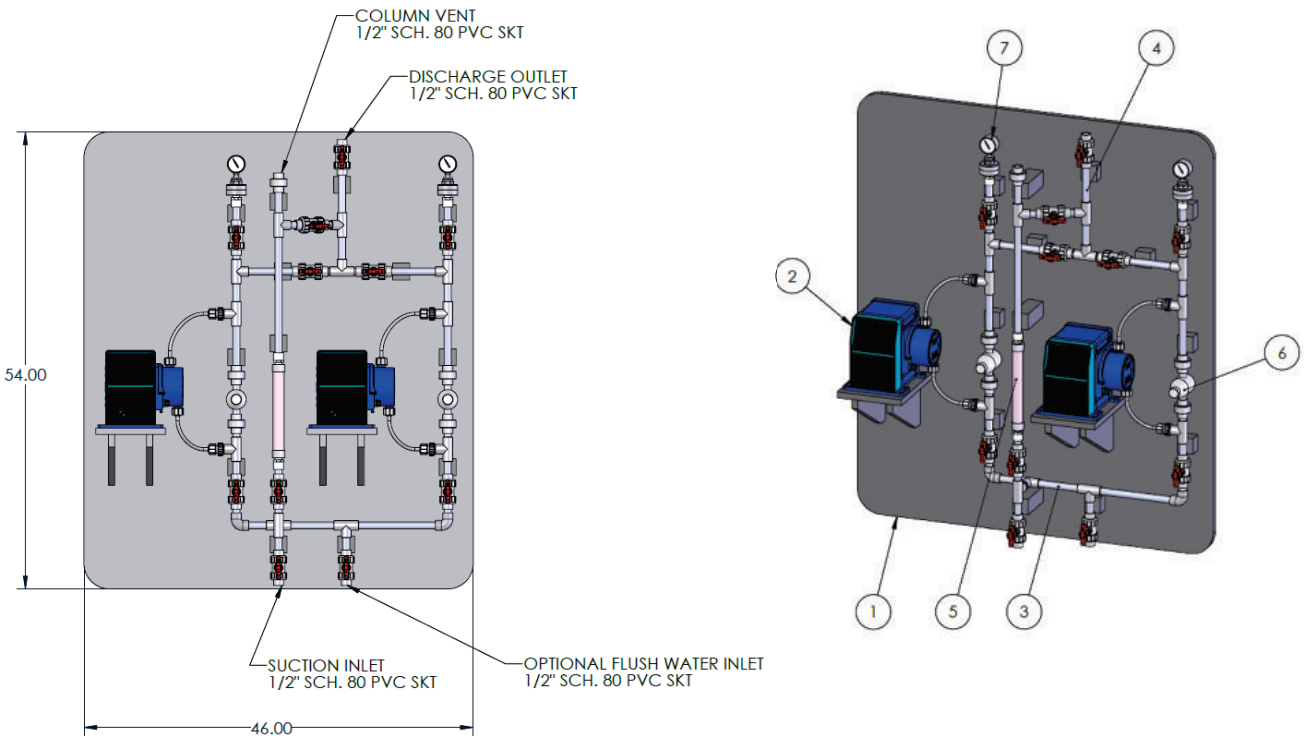
Dosing Panel

For dosing of chemical to the filter system influent stream, a dosing pump skid is provided for each chemical. Layouts for these skids varies depending on pump requirements and installation location, determined by the engineer. Dosing pumps should be made accessible to the operator for adjustment, maintenance, and calibration. A typical dosing skid will contain the following:

- Panel mounted components to be installed either on a wall, or self-supporting (skid)
- An inlet port for connection to the bulk chemical storage
- An outlet port for connection to the filter system influent dosing point
- One or more peristaltic metering pumps operating in various duty/standby modes
- Plumbing and instrumentation required for calibrating of chemical dose rates
- Power and signal connections to the PLC panel for chemical dose rate, alarms, etc.

EXAMPLE PUMP LAYOUT

The dosing panel shown on this page is a 2-pump system operating duty/standby.



Notable Equipment

- | | |
|---|--|
| 1. Back panel mounted equipment | 5. Shared calibration column |
| 2. Dosing pump, shelf mounted | 6. Pressure relief valve(s) for protection |
| 3. Single inlet point for both pumps | 7. Pressure gauge for system monitoring |
| 4. Single outlet point from active pump | |

Filter Tools

Operation and maintenance of Nexom sand filter systems requires the use of several specific tools. The following will be provided with each system and should be located near the filters for easy access by system operators. Further instructions are provided in the O&M manual for the filter system.

TOOLS REQUIRED

- Reject Plumbing Tool
- Air Lance
- Bed Turnover Rods (4x)

Reject Plumbing Tool

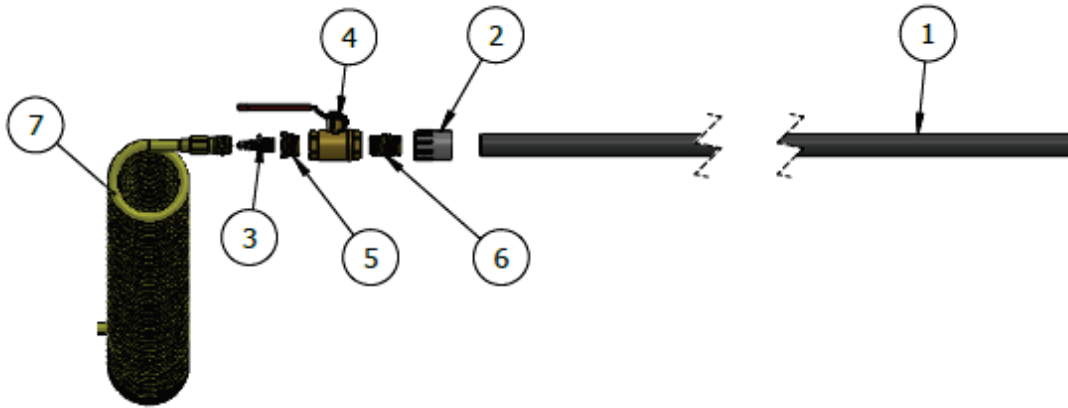
This assembly is used to test the reject rate for a filter washbox. The plug end of the reject tool is used to cover the reject outlet in the washbox and allow for measuring the fill rate for the washbox. The adjustable height of the reject weir located in the washbox changes this rate and is changed for proper filter operation.



Example of Reject Plumbing Tool

Air Lance

This assembly is connected to compressed air, typically via a tee in the air panel supply line. The air lance is plunged into the filter to break up a plugged media bed. This operation is only used when the filter is plugging and is not part of normal operation.



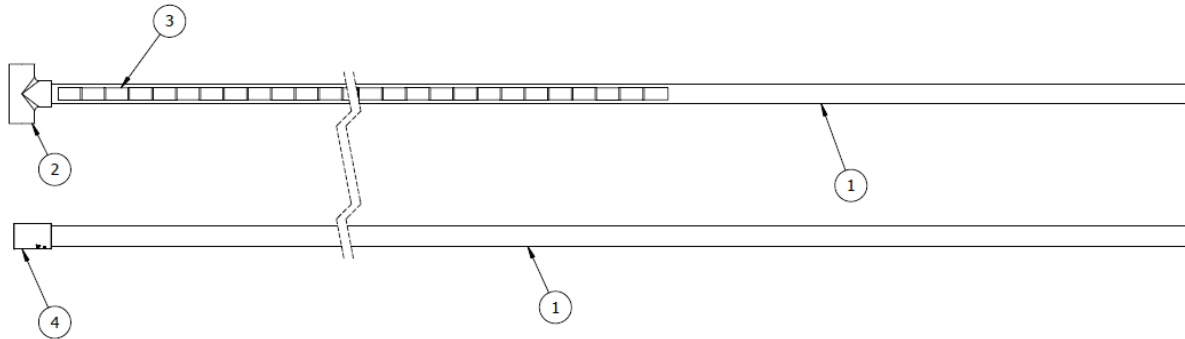
Drawing Representation of Air Lance

NOTES

1. When plumbing the air supply connection for the air panel(s), it is recommended to include a tee and ball valve with an adapter for the 1/2" tubing supplied with the air lance. This eliminates the need to provide an external source for the compressed air.

Bed Turnover Rods (4X)

These four rods are placed in the four quadrants of the sand filter and serve as a measuring tool. As the filter operates. The media bed is cycled for cleaning, and the rods provide a point of reference to determine the rate and consistency of media turnover across the entire media bed. This is a part of normal operation.

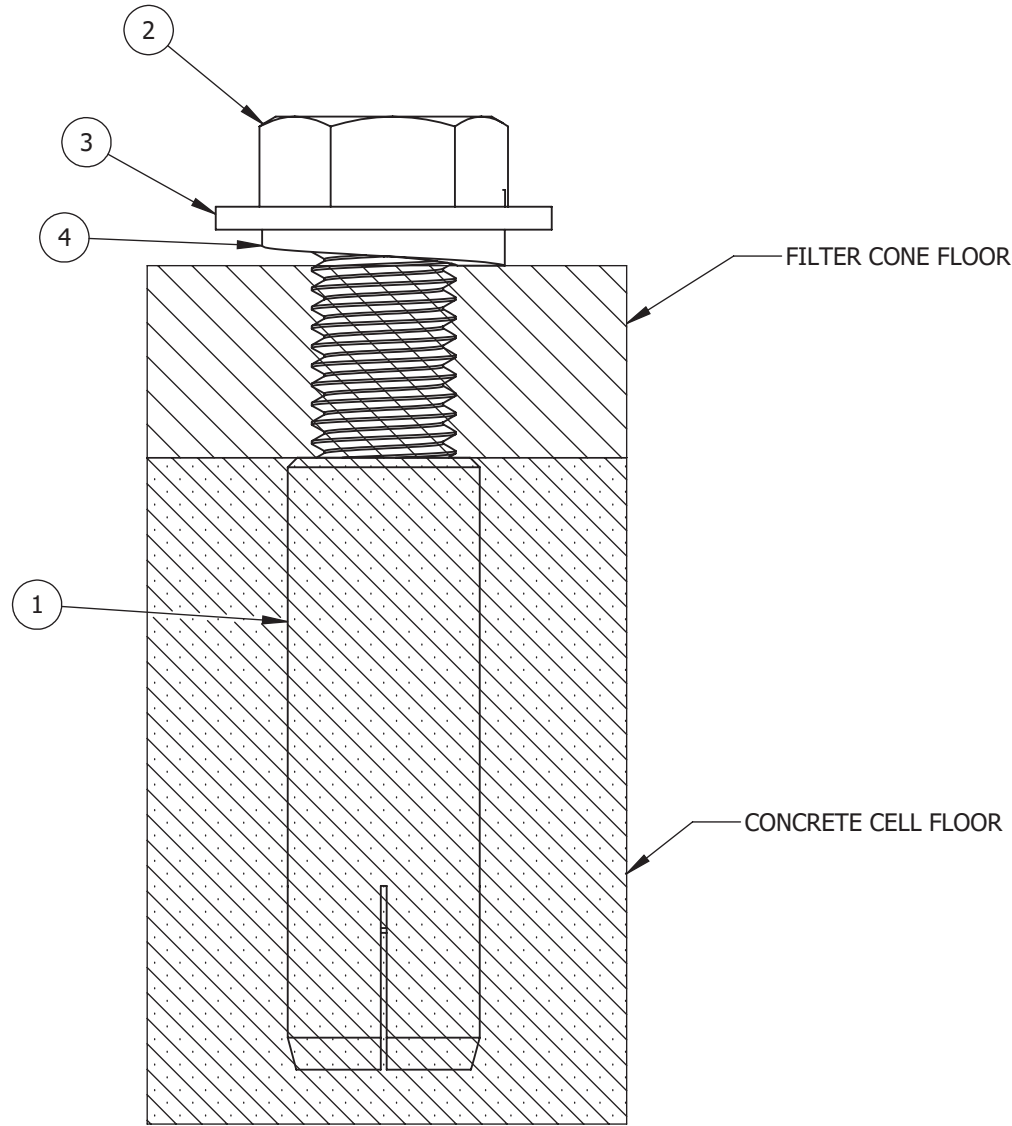


Drawing of Bed Turnover Rod

NOTES

1. It is recommended to keep the rods accessible to the filter for quick maintenance.

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	MCM 97082A046	304 Stainless Steel Female-Threaded Anchor for Concrete 3/4"-10 Thread Size	1
2	MCM 92240A843	304 Stainless Steel Hex Head Screw 3/4"-10 Thread Size, 2-1/4" Long	1
3	MCM 92141A056	304 Stainless Steel Washer for 3/4" Screw Size, 0.812" ID, 1.75" OD	1
4	MCM 92146A036	304 Stainless Steel Split Lock Washer for 3/4" Screw Size, 0.766" ID, 1.265" OD	1



NOTES:

1. USE ANTI-SEIZE ON ALL FASTENERS.



REVISIONS			
REV.	DESCRIPTION	ENGINEER	DATE
01	INITIAL RELEASE	MS	2021-04-14

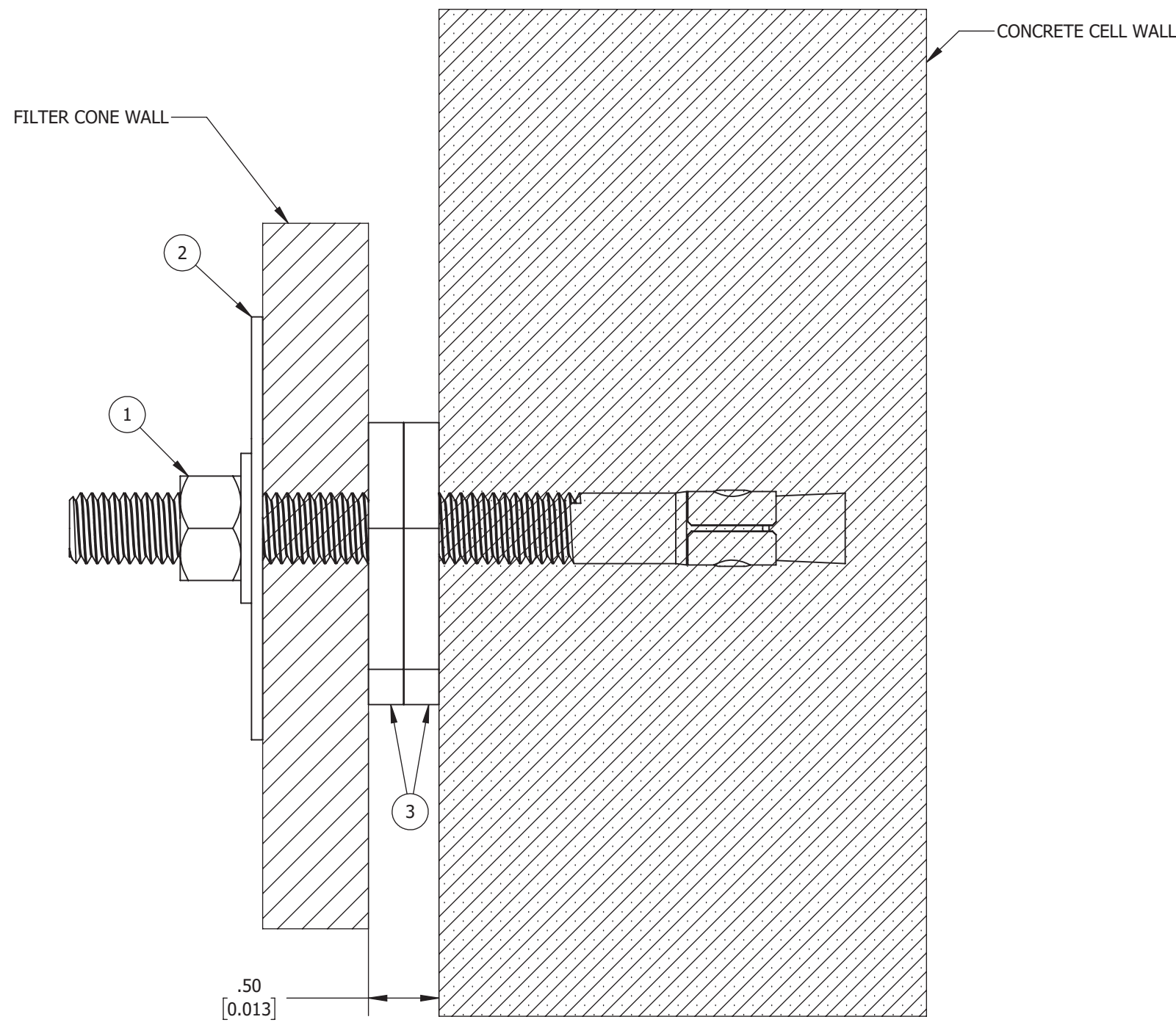
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UNLESS OTHERWISE SPECIFIED
 DIMENSIONS ARE IN INCHES [m]
 TOLERANCES:
 00.0 OR X/X ± .125" [N/A]
 00.00 ± .05" [.01m]
 00.000 ± N/A [.001m]
 00.0° ± 2.0° [2.0°]
 THIRD ANGLE PROJECTION

LOCATION: Nexom Assemblies		SCALE 1:1	
DESCRIPTION: Cone to Floor Hardware Kit, BG Filter			
AUTH.	MS, 2021-04-14	CHKD.	N/A, 2021-04-14
NUMBER: S00K.01		REV. 01	PAGE 1/1

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ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	MCM 92188A302	304 Stainless Steel Stud Anchor for Concrete 1/2" Diameter, 5-1/2" Long	1
2	MCM 90313A351	304 Stainless Steel Oversized Washer for 1/2" Screw, 0.531" ID, 3" OD, 0.051"-0.080" Thick	1
3	MCM 9731K31	Black Plastic Horseshoe Shims, 0.25" Thick, 2" Long	2



Same anchors may be used for anchoring Feed Chamber

NOTES:
1. USE ANTI-SEIZE ON ALL FASTENERS.



REVISIONS			
REV.	DESCRIPTION	ENGINEER	DATE
01	INITIAL RELEASE	MS	2021-04-14

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00.000 ± N/A [.001m]
00.0° ± 2.0° [2.0°]
THIRD ANGLE PROJECTION

LOCATION: Nexom Assemblies		SCALE 1:1	
DESCRIPTION: Cone to Wall Hardware Kit, BG Filter			
AUTH.	MS, 2021-04-14	CHKD.	N/A, 2021-04-14
NUMBER: S00K.02		REV. 01	PAGE 1/1

TEMPLATE LAST MODIFIED: 08.05.19

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November 15, 2023

Keller Associates
Rock XU
Pocatello, ID

WARRANTY CERTIFICATE

Aberdeen, ID

Nexom Project No: 123.13670

WARRANTY AND WARRANTY PERIOD SERVICES

In accordance with the contract documents, Nexom warrants the Sand Filter system free from defects in workmanship and materials as outlined below.

Description	Period	Start Date	End Date
Sand Filter - Material and Workmanship	60 months	(Substantial Completion)	

PERFORMANCE, WARRANTY AND MAINTENANCE:

- Nexom includes a five-year equipment warranty as part of its base bid.
- Nexom, has staff technicians in Idaho. W-Cubed represents Nexom and has been a manufacturer's service rep in Salt Lake for 30+ years. Its team maintains service capabilities and has installed many Nexom and EDI equipment across the USA. W-Cubed is willing, capable, and authorized for serving all Nexom supplied filter equipment.

PROJECT WARRANTY CONDITIONS:

Warranty is subject to the following provisions, in addition to the General Warranty Terms and Conditions included below:

1. The warranty shall be for a minimum period of one (1) year from the date of substantial completion or eighteen (18) months after delivery. The manufacturer shall repair or replace all defects of materials of workmanship in the equipment during the warranty period. Corrections shall be completed within five (5) days of notification.
 - a. Nexom includes a five (5) -year extended warranty in its proposal. This supersedes its standard one-year warranty in its Terms & Conditions. All other details of the warranty or summarized in Nexom's Standard Terms & conditions, appended.
2. Nexom will repair or replace defective parts at their sole discretion. Costs for removal and re-installation of components are covered by this warranty only if Nexom supplied and installed the affected components.
3. Operation and maintenance of the equipment must be in accordance with operation and maintenance schedules and manuals provided for the warranty to remain in effect.
4. The warranty is expressly limited to the supply of manufactured materials as set out above and/or workmanship specifically procured by Nexom, its employees and authorized representatives. This warranty expressly excludes any defects in workmanship, neglect, omissions, or failures of any third party or buyer who may have installed, worked on, or worked in connection with any of the materials supplied and/or installed by Nexom.
5. Warranty does not apply to any cessation of function, malfunctions or system errors of any nature or kind whatsoever that are caused by, or materially attributable to any act, omission, or neglect of any third party or buyer who has supplied materials or services associated with the system.
6. Nexom must be copied on all water quality results received from third-party testing laboratories.
7. System service and operation records including are to be submitted quarterly to Nexom to maintain full warranty coverage.
8. The owner shall give prompt written notice of any observed defects to Nexom.

SYSTEM PERFORMANCE “MAKE GOOD” GUARANTEE.

If the treatment system is operated within the specified design parameters and fails to meet the specified treatment performance goals within the warranty period, Nexom will, at their own cost, adjust the system to bring it back into compliance. See Nexom O&M Manual for detailed coverage and conditions.

Written Guarantee: the Vendor shall guarantee that the filter system shall meet the required effluent limits. The coagulant dosing system will be supplied by the Installation Contractor. If during the one-year guarantee period, the filter system fails or does not meet any of the specified requirements or test criteria herein, the Vendor shall correct such deficiencies as may be necessary to meet these requirements and criteria at no additional cost to the owner.

Description	Period	Start Date	End Date
Sand Filter – Effluent Performance	12 months	(Substantial Completion)	

NEXOM STANDARD WARRANTY TERMS AND CONDITIONS

Seller warrants any goods provided hereunder to be free from nonconformity to any attached specifications, and free of defects in materials and workmanship appearing within the periods outlined above. If within such period any such goods shall be proved to Seller's satisfaction to be defective, the affected part will be repaired or replaced free of charge, F.O.B. Seller's loading dock, or Seller will refund the purchase price of the affected part. Such repair, replacement, or refund (whichever Seller determines, in its discretion, to provide) will be Seller's sole obligation and buyer's exclusive remedy for any deficiency in goods furnished hereunder, and will be conditioned upon buyer's return of such goods to Seller, F.O.B. Seller's loading dock. Any parts repaired or replaced under this warranty are warranted only for the balance of the warranty period on the part that was repaired or replaced.

This warranty shall not apply to prime movers, starting products, electrical apparatus, parts, material and any other products not manufactured by Seller; such products are sold AS IS, except that the warranties, if any, of the respective manufacturers of such products, parts or material shall be assigned by Seller to Buyer. The seller has no liability for products installed by anyone other than it or its authorized agent. Decomposition by chemical action and wear caused by the presence of abrasive materials shall not constitute defects under the foregoing warranty, nor shall Seller have any responsibility hereunder with respect to products which have been repaired or altered by others without Seller's written consent.

The seller warrants that any services it provides hereunder will be performed in a manner consistent with customary practice in its industry. Should a failure to conform to this warranty appear within thirty 30 calendar days after completion of any services, Seller will, if promptly notified thereof in writing, either perform the services again, properly and without charge, or refund the price charged for such services. Such reperformance or refund (whichever Seller determines, in its discretion, to provide) will be the buyer's exclusive remedy and the Seller's sole liability with respect to any deficiency in services furnished hereunder.

THE ABOVE WARRANTIES ARE EXCLUSIVE AND IN LIEU OF ALL OTHER REPRESENTATIONS AND WARRANTIES, EXPRESS OR IMPLIED. SELLER EXPRESSLY DISCLAIMS AND EXCLUDES ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE, AND ANY WARRANTIES ARISING FROM COURSE OF DEALING OR USAGE OF TRADE.

Any description of the products, whether in writing or made orally by Seller or its agents, specifications, samples, models, bulletins, drawings, diagrams, engineering sheets or similar materials used in connection with Buyer's order are for the sole purpose of identifying the products and shall not be construed as an express warranty. Any suggestions by Seller or Seller's agents regarding use, application or suitability of the products shall not be construed as an express warranty unless confirmed to be such in writing by Seller.

Consequential Damages and Other Liability. Seller's liability with respect to the goods or services sold hereunder will be limited to the remedy and indemnity provided above and, with respect to any other breaches of its contract with buyer, will be limited to the contract price of the affected goods. SELLER WILL NOT BE SUBJECT TO ANY OTHER OBLIGATIONS OR LIABILITIES, WHETHER ARISING OUT OF BREACH OF CONTRACT, WARRANTY, TORT (INCLUDING NEGLIGENCE AND STRICT LIABILITY), OR UNDER OTHER THEORIES OF LAW OR EQUITY, WITH RESPECT TO GOODS OR SERVICES SOLD BY SELLER, OR ANY UNDERTAKINGS, ACTS OR OMISSIONS RELATING THERETO. Without limiting the generality of the foregoing, Seller specifically disclaims any liability for property damages, penalties, special or punitive damages, damages for lost profits or revenues, down-time, lost good will, cost of capital, cost of substitute goods or services, or for any other types of economic loss, or for claims of buyer's customers or any third party for any such damages, costs or losses. SELLER WILL NOT BE LIABLE FOR, AND DISCLAIMS, ALL CONSEQUENTIAL, INCIDENTAL, INDIRECT AND CONTINGENT DAMAGES WHATSOEVER.

Nexom Inc.

5 Burks Way

Winnipeg, MB

R2J 3R8

info@nexom.com

888-426-8180

Special Warranty Terms

1. Offer, Governing Provisions and Cancellation. This document is an offer or counter-offer by Nexom ("Seller") to sell the goods and/or services described in it in accordance with these terms and conditions, is not an acceptance of any offer made by buyer, and is expressly conditioned upon buyer's assent to these Terms and Conditions of Sale. Seller objects to any additional or different terms contained in any request for proposal, purchase order, acknowledgement or other communication previously or hereafter provided by buyer to Seller. No such additional or different terms or conditions will be of any force or effect. The terms contained in or incorporated into this document will be the entire agreement between Seller and buyer on the subject of the transaction described herein; there are no conditions to that agreement that are not so contained or incorporated. **THIS OFFER AND THAT AGREEMENT WILL BE GOVERNED BY AND CONSTRUED ACCORDING TO THE LAWS OF THE STATE OR PROVINCE IN WHICH THE OFFICE OF THE SELLER THAT ISSUED THIS OFFER IS LOCATED (WITHOUT REFERENCE TO PRINCIPLES OF CONFLICTS OF LAWS). THE RIGHTS AND OBLIGATIONS OF THE PARTIES HEREUNDER WILL NOT BE GOVERNED BY THE 1980 U.N. CONVENTION ON CONTRACTS FOR THE INTERNATIONAL SALE OF GOODS.**

No accepted offer may be cancelled or altered by buyer except upon terms and conditions accepted by Seller in writing, and no changes to this document will be binding unless set forth in writing and manually signed by Seller. This offer may be revoked by Seller at any time before it is accepted by buyer, and will automatically expire 30 calendar days after its date if buyer has not accepted it before then. Neither buyer's acceptance of this offer nor any conduct by Seller (including but not limited to shipment of goods) will oblige Seller to sell to buyer any quantity of goods in excess of the quantity that buyer has committed to purchase from Seller at the time of such acceptance or conduct.

2. Credit Approval; Payment Terms; Storage. All payment terms set forth in this document are subject to Seller's approval of buyer's credit, in Seller's discretion; if such approval is withheld, payment will be due in advance of Seller's performance. Except as otherwise provided on the face of this document or in the preceding sentence, payment is due upon buyer's receipt of Seller's invoice following shipment. Interest will be charged at the lesser of (i) 18% per year, or (ii) the highest rate permitted by applicable law, on accounts more than 30 calendar days past due. If production or shipment of completed goods, or other Seller performance, is delayed by buyer, Seller may immediately invoice, and buyer will pay, the percentage of the purchase price corresponding to the percentage of completion; in addition, buyer will compensate Seller for storage of completed goods or work in process during any such delay, whether stored at Seller's facility or an independent storage company's facilities.

3. Delivery, Claims and Force Majeure. Unless otherwise provided on the face of this document, goods shall be delivered to buyer F.O.B. Seller's loading dock or, for ultimate destinations outside of the U.S., EXW Seller's loading dock (as the latter shipping term is defined in *Incoterms 2010*). Delivery of products to the carrier will constitute delivery to buyer, and regardless of shipping terms or freight payment, buyer will bear all risk of loss or damage in transit. Seller reserves the right to make delivery in installments, unless otherwise expressly stipulated herein; all such installments to be separately invoiced and paid for when due per invoice, without regard to subsequent deliveries. Delay in delivery of any installment will not relieve buyer of its obligations to accept remaining deliveries.

Claims for shortages or other errors in delivery must be made in writing to Seller within 10 calendar days after receipt of shipment, and failure to give such notice will constitute unqualified acceptance and a waiver of all such claims for such shortages or delivery errors by buyer. Claims for loss of or damage to goods in transit must be made to the carrier, and not to Seller.

All delivery dates are approximate. Seller will not be liable for any losses or damages as a result of any delay or failure to deliver due to any cause beyond Seller's reasonable control, including but not limited to any act of God, act of buyer, embargo or other governmental act, regulation or request, fire, accident, strike, slowdown, war, act of terrorism, riot, delay in transportation, or inability to obtain necessary labor, materials or manufacturing facilities. In the event of any such delay, the date of delivery will be extended for a period equal to the time lost because of the delay. Buyer's exclusive remedy for other delays, and for Seller's inability to deliver for any reason, will be rescission of its agreement to purchase.

4. Warranties. Seller warrants any goods provided hereunder to be free from nonconformity to any attached specifications, and free of defects in materials and workmanship, appearing within twelve (12) months after substantial completion or eighteen (18) months after delivery, whichever occurs first. If within such period any such goods shall be proved to Seller's satisfaction to be defective, the affected part will be repaired or replaced free of charge, F.O.B. Seller's loading dock or, for customers outside of the U.S., EXW Seller's loading dock (as the latter shipping term is defined in *Incoterms 2010*, for purposes of which definition buyer will have the responsibilities of the "seller"), or Seller will refund the purchase price of the affected part. Such repair, replacement or refund (whichever Seller determines, in its discretion, to provide) will be Seller's sole obligation and buyer's exclusive remedy for any deficiency in goods furnished hereunder, and will be conditioned upon buyer's return of such goods to Seller, F.O.B. Seller's loading dock or, for customers outside of the U.S., DDP Seller's loading dock (as the latter shipping term is defined in *Incoterms 2010*, for purposes of which definition buyer will have the responsibilities of the "seller"). Any parts repaired or replaced under this warranty are warranted only for the balance of the warranty period on the part that was repaired or replaced.

This warranty shall not apply to prime movers, starting products, electrical apparatus, parts, material and any other products not manufactured by Seller; such products are sold **AS IS**, except that the warranties, if any, of the respective manufacturers of such products, parts or material shall be assigned by Seller to Buyer. Seller has no liability for products installed by anyone other than it or its authorized agent. Decomposition by chemical action and wear caused by the presence of abrasive materials shall not constitute defects under the foregoing warranty, nor shall Seller have any responsibility hereunder with respect to products which have been repaired or altered by others without Seller's written consent.

Seller warrants that any services it provides hereunder will be performed in a manner consistent with customary practice in its industry. Should a failure to conform to this warranty appear within thirty 30 calendar days after completion of any services, Seller will, if promptly notified thereof in writing, either perform the services again, properly and without charge, or refund the price charged for such services. Such reperformance or refund (whichever Seller determines, in its discretion, to provide) will be the buyer's exclusive remedy and the Seller's sole liability with respect to any deficiency in services furnished hereunder.

THE ABOVE WARRANTIES ARE EXCLUSIVE AND IN LIEU OF ALL OTHER REPRESENTATIONS AND WARRANTIES, EXPRESS OR IMPLIED. SELLER EXPRESSLY DISCLAIMS AND EXCLUDES ANY IMPLIED WARRANTY OF

MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE, AND ANY WARRANTIES ARISING FROM COURSE OF DEALING OR USAGE OF TRADE.

Any description of the products, whether in writing or made orally by Seller or its agents, specifications, samples, models, bulletins, drawings, diagrams, engineering sheets or similar materials used in connection with Buyer's order are for the sole purpose of identifying the products and shall not be construed as an express warranty. Any suggestions by Seller or Seller's agents regarding use, application or suitability of the products shall not be construed as an express warranty unless confirmed to be such in writing by Seller.

5. Patents, Trademarks and Copyrights. Seller will, at its own expense, defend any suits that may be instituted by anyone against buyer for alleged infringement of any patent, trademark or copyright relating to goods or services provided by Seller, and will pay any final damage award therein, provided buyer has made all payments then due hereunder, will give Seller immediate notice in writing of any such suit, will transmit to Seller immediately upon receipt all processes and papers served upon buyer, and will permit Seller, through its counsel, to defend or settle the same, either in the name of buyer or in the name of Seller, giving Seller all needed information, assistance and authority to enable Seller to do so. Further, if the result of any such suit is a determination or acknowledgement of infringement, Seller will, at Seller's option (a) obtain for buyer the right to continue to use the goods, or the products of the services purchased from Seller, or (b) replace the same with non-infringing goods or services, or (c) modify such goods or services so that they are non-infringing, or (d) remove such goods or products of services and refund to buyer the undepreciated portion of the purchase price, determined on the basis of a five-year useful life.

To the extent that any goods or services that Seller furnishes to buyer are manufactured in accordance with drawings, designs or specifications proposed or furnished by buyer, Seller will not be liable, and buyer will indemnify and hold harmless Seller from and against any and all losses, liabilities, damages, claims and expenses (including but not limited to Seller's reasonable attorneys' fees and other costs of defense) incurred by Seller as a result of any claim of patent, trademark, copyright or trade secret infringement, or infringement or any other proprietary rights of third parties.

6. Consequential Damages and Other Liability. Seller's liability with respect to the goods or services sold hereunder will be limited to the remedy and indemnity provided in sections 4 and 5 of these Terms and Conditions of Sale and, with respect to any other breaches of its contract with buyer, will be limited to the contract price of the affected goods. **SELLER WILL NOT BE SUBJECT TO ANY OTHER OBLIGATIONS OR LIABILITIES, WHETHER ARISING OUT OF BREACH OF CONTRACT, WARRANTY, TORT (INCLUDING NEGLIGENCE AND STRICT LIABILITY), OR UNDER OTHER THEORIES OF LAW OR EQUITY, WITH RESPECT TO GOODS OR SERVICES SOLD BY SELLER, OR ANY UNDERTAKINGS, ACTS OR OMISSIONS RELATING THERETO.** Without limiting the generality of the foregoing, Seller specifically disclaims any liability for property damages, penalties, special or punitive damages, damages for lost profits or revenues, downtime, lost good will, cost of capital, cost of substitute goods or services, or for any other types of economic loss, or for claims of buyer's customers or any third party for any such damages, costs or losses. **SELLER WILL NOT BE LIABLE FOR, AND DISCLAIMS, ALL CONSEQUENTIAL, INCIDENTAL, INDIRECT AND CONTINGENT DAMAGES WHATSOEVER.**

7. Buyer's Indemnity. **BUYER WILL INDEMNIFY AND HOLD HARMLESS SELLER FROM AND AGAINST ANY AND ALL LOSSES, LIABILITIES, DAMAGES AND EXPENSES (INCLUDING BUT NOT LIMITED TO ATTORNEYS FEES AND OTHER COSTS OF DEFENSE) THAT SELLER MAY INCUR AS A RESULT OF ANY CLAIM, OTHER THAN A CLAIM FOR THE REMEDIES PROVIDED IN SECTIONS 4 AND 5 OF THESE TERMS AND CONDITIONS OF SALE, BY BUYER OR BUYER'S CUSTOMERS OR BY ANY THIRD PARTY ARISING OUT OF OR RELATING TO THE GOODS OR SERVICES SOLD HEREUNDER, INCLUDING BUT NOT LIMITED TO ANY SUCH CLAIM BASED UPON THE NEGLIGENCE OF SELLER IN DESIGNING, MANUFACTURING, PERFORMING AND/OR SELLING SUCH GOODS OR SERVICES, UNLESS SUCH LOSSES, LIABILITIES, DAMAGES OR EXPENSES ARE ULTIMATELY DETERMINED TO BE ATTRIBUTABLE SOLELY TO THE WILLFUL MISCONDUCT OF SELLER.**

8. Taxes and Other Charges. Any manufacturer's tax, occupation tax, use tax, sales tax, excise tax, value added tax, duty, custom, inspection or testing fee, or any other tax, fee, interest or charge of any nature whatsoever imposed by any governmental authority on or measured by the transaction between Seller and buyer will be paid by buyer in addition to the prices quoted or invoiced. In the event Seller is required to pay any such taxes or other charges, buyer will reimburse Seller therefor on demand.

9. Changes. Seller may at any time make such changes in design and construction of products, components or parts as Seller deems appropriate, without notice to buyer. Seller may furnish suitable substitutes for materials unobtainable because of priorities or regulations established by governmental authority, or non-availability of materials from suppliers.

10. Technical Information. Any sketches, models or samples submitted by Seller will remain the property of Seller, and will be treated as confidential information unless Seller has in writing indicated a contrary intent. No use or disclosure of such sketches, models or samples, or any design or production techniques revealed thereby, will be made without the express, prior written consent of Seller.

11. Designs and Tools. Any design work performed by Seller, and any dies, molds, jigs or other tools that Seller manufactures or acquires, in connection with its performance hereunder will be and remain the sole property of Seller, notwithstanding any charges to buyer therefor. Any such charges convey to buyer the right to have the designs, dies, molds, jigs and/or other tools used by Seller for performance hereunder, but do not convey title or right of possession or any other right.

12. Permits. The Buyer shall have full responsibility for securing the requisite permits and compliance with all health and sanitation laws, ordinances and regulations pertaining to the installation of the products involved in a sewage treatment plant or other products sold by Seller.

Please address PO to:

Nexom Inc.
323 N Spokane St. Suite 200
Post Falls ID 83854

Please forward electronic PO to:

Todd Hansen
thansen@nexom.com
(208) 618-2232

Top Level Drawings

Revision 02

This Document Contains:

- Piping & Instrumentation Diagram – 123.13670-PID
- Tag List
- Filter General Arrangement – 123.13670-GA

System Specifications

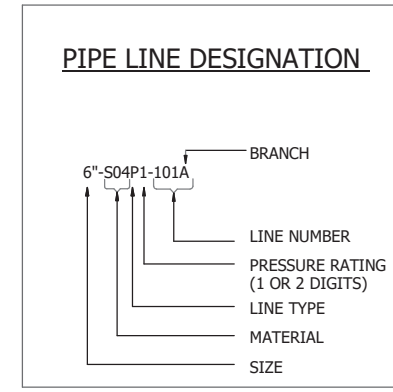
Installation Data	
Number of Modules	5
Airlifts per Cell	1
Module Size	CF64-60RC
Total Filtration Area	320 ft ²

PIPING SYMBOLS

	PRIMARY PROCESS FLOW PATH
	SECONDARY FLOW PATH
	HEAT TRACE
	INSULATED PIPELINE
	INFLUENT
	EFFLUENT
	REJECT
	SYSTEM EXTENTS

INSTRUMENT LINE SYMBOLS

	PNEUMATIC SIGNAL
	CONTROL LOGIC
	ELECTRIC SIGNAL
	UNDEFINED SIGNAL
	INTERNAL SYSTEM LINK SOFTWARE OR DATA
	CAPILLARY TUBE



VALVE ACTUATOR SYMBOLS

(NO SYMBOL) = MANUAL FOR ON/OFF SERVICE	T HANDWHEEL (MANUAL OVERRIDE)	 ELECTRIC
 SOLENOID (WITHOUT)	 DIAPHRAGM AIR TO AIR (WITHOUT)	 DIAPHRAGM & SPRING TO OPEN (WITHOUT)
 SOLENOID (WITH) =MANUAL OVERRIDE	 DIAPHRAGM AIR TO AIR (WITH)=POSITIONER	 DIAPHRAGM & SPRING TO CLOSE (WITH)=POSITIONER
 DOUBLE-ACTING CYLINDER (WITHOUT)	 CYLINDER & SPRING TO OPEN	
 DOUBLE-ACTING CYLINDER (WITH)=POSITIONER	 CYLINDER & SPRING TO CLOSE	

SYMBOLS FOR VALVE ACTION IN THE EVENT OF ACTUATOR POWER FAILURE

FO = FAIL OPEN
 FC = FAIL CLOSED
 FL = FAIL LOCKED
 FI = FAIL INDETERMINATE (LAST POSITION)
 F = USED WITH 3 WAY & 4 WAY VALVE- ARROWS SHOW PATHS OPEN TO FLOW ON POWER FAILURE.

SYMBOL LOCATED BY VALVE- USED ONLY WHERE NECESSARY TO INCREASE UNDERSTANDING OF THE SYSTEM.

SYMBOLS FOR SELF-ACTUATED REGULATORS

 PRESSURE REDUCING REGULATOR SELF CONTAINED	 BACK PRESSURE REGULATOR SELF CONTAINED	 RUPTURE DISC OR SAFETY HEAD PRESSURE RELIEF
 PRESSURE REDUCING REGULATOR EXTERNAL TAP	 BACK PRESSURE REGULATOR EXTERNAL TAP	 RUPTURE DISC OR SAFETY HEAD VACUUM RELIEF
 PRESSURE RELIEF ANGLE	 VACUUM RELIEF ANGLE	 PRESSURE VACUUM RELIEF
 PRESSURE RELIEF STRAIGHT	 VACUUM RELIEF STRAIGHT WITH WELL	 TEMPERATURE REGULATOR FILLED SYSTEM
 LEVEL REGULATOR FLOAT OPERATED MECHANICAL LINKAGE	 TRAP CONTINUOUS DRAINER BALL FLOAT TYPE	 TRAP WITH EQUALIZING CONNECTION

DIFFERENTIAL PRESSURE REDUCING REGULATOR - SHOWN WITH INTERNAL AND EXTERNAL PRESSURE TAPS.

HEAT EXCHANGER SYMBOLS

 SHELL & TUBE HEAT EXCHANGER	 ELECTRICAL HEATING ELEMENT
 AIR COOLED HEAT EXCHANGER	 GENERAL HEAT EXCHANGER
 DIRECT CONTACT JET MIXER	

MATERIAL DESIGNATION

BRZ - BRASS/BRONZE
 CIR - CAST IRON
 CST - CARBON STEEL
 CPR - COPPER
 FRP - FIBERGLASS
 GCS - GALVANIZED CARBON STEEL
 LCS - LINED CARBON STEEL
 TEF - TEFLON
 PU - POLYURETHANE
 PET - POLYETHYLENE
 POP - POLYPROPYLENE
 PVC - POLYVINYL CHLORIDE
 RUB - RUBBER
 S04 - 304 STAINLESS STEEL
 S4L - 304L STAINLESS STEEL
 S16 - 316 STAINLESS STEEL
 S6L - 316L STAINLESS STEEL
 VIT - VITON
 CVC - CHLORINATED POLYVINYL CHLORIDE

PRIME MOVERS FOR MOTOR DRIVEN EQUIPMENT

 ELECTRIC MOTOR	 PNEUMATIC ROTARY MOTOR
--------------------	-------------------------------

MOTOR DRIVEN EQUIPMENT

 CENTRIFUGAL PUMP	 ROTARY BLOWER OR COMPRESSOR	 FAN / BLOWER
 VERTICAL CENTRIFUGAL PUMP	 SUBMERSIBLE PUMP	 CHEMICAL FEED PUMP
 VERTICAL TURBINE	 PERISTALTIC PUMP	 PROGRESSIVE CAVITY PUMP
 DIAPHRAGM CHEMICAL FEED PUMP W/ INTERNAL RELIEF VALVE	 LIQUID RING VACUUM PUMP	
 VENT FAN	 AGITATOR OR MIXER	 DIAPHRAGM PUMP (PNEUMATIC OPER.)
 AIR COMPRESSOR	 DUPLIX AIR COMPRESSOR	

TYPE

D = DUCT
 H = HOSE
 P = PIPE
 T = TUBE

GENERAL NOTES:

1. FOR INSTRUMENTATION SYMBOLS AND LIST OF RELAY FUNCTIONS SEE BLUE WATER DRAWING NO. PID-B.
 THIS DRAWING IS PROVIDED FOR INFORMATION ONLY.

PIPING ACCESSORIES & DETAILS

 Y STRAINER	 CONE STRAINER	 SCREEN STRAINER OR STATIC MIXER
 MIXING SECTION	 EJECTOR	 BACKFLOW PREVENTER
 SPRAY NOZZLE OR SPARGER	 CHEMICAL SEAL	 EXPANSION JOINT
 FLEX HOSE	 STRAIGHTENING VANES	
 FILTER	 SCOPE LIMITS	 THERMOWELL
 SIMPLEX BASKET STRAINER	 DUPLIX BASKET STRAINER	 AIR FILTER
 AIR DRYER	 MIST ELIMINATOR	 PULSATION DAMPER
 SIGHT GLASS	 RESTRICTION ORIFICE	 DU INSULATED FLANGE OR DIELECTRIC UNION
 QUICK DISCONNECT ASSEMBLY	 SUMP/DRAIN	 CALIBRATION COLUMN
 VARIABLE AREA FLOW INDICATOR WITH INTEGRAL NEEDLE VALVE	 ORIFICE FLANGE	 CONCENTRIC REDUCER
 ECCENTRIC REDUCER FLAT ON TOP	 ECCENTRIC REDUCER FLAT ON BOTTOM	

VALVE SYMBOLS

 GATE	 GLOBE	 BALL
 PLUG	 3 WAY PLUG	 BUTTERFLY
 CHECK	 DIAPHRAGM	 PINCH
 NEEDLE	 3 WAY	 4 WAY
 ANGLE	 KNIFE GATE	 WEIGHTED RELIEF
 VALVE (UNDEFINED TYPE)	 V-PORT BALL VALVE	 AIR RELEASE

TANK AND ACCESSORIES

 MANHOLE/ACCESS	 COUPLING (HALF OR FULL)	 FLANGED NOZZLE
 RECEIVER TANK	 INSULATION	



NEXOM CONFIDENTIALITY

ALL INFORMATION CONTAINED ON THIS DOCUMENT IS THE PROPERTY OF NEXOM, INC. (AND/OR ITS AFFILIATES). THE DESIGN CONCEPTS AND INFORMATION CONTAINED HEREIN ARE PROPRIETARY TO NEXOM AND ARE SUBMITTED IN CONFIDENCE. THEY ARE NOT TRANSFERABLE AND MUST BE USED ONLY FOR THE PURPOSE FOR WHICH THE DOCUMENT IS EXPRESSLY SUBMITTED. THEY MUST NOT BE DISCLOSED, REPRODUCED, LOANED, OR USED IN ANY OTHER MANNER WITHOUT THE EXPRESS WRITTEN CONSENT OF NEXOM. NEXOM ASSUMES NO RESPONSIBILITY OR LIABILITY FOR THE USE OF THIS DOCUMENT OR THE DESIGN CONCEPTS AND INFORMATION CONTAINED HEREIN FOR ANOTHER PROJECT, OR IN A MANNER THAT DOES NOT RELATE TO THE FITNESS OR PURPOSE OF THIS DOCUMENT. IN NO EVENT SHALL THIS DOCUMENT OR THE DESIGN CONCEPTS AND INFORMATION CONTAINED HEREIN BE USED IN ANY MANNER DETRIMENTAL TO THE INTEREST OF NEXOM. ALL PATENT RIGHTS ARE RESERVED. ACCEPTANCE OF THE DELIVERY OF THIS DOCUMENT CONSTITUTES AGREEMENT TO THESE TERMS AND CONDITIONS.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

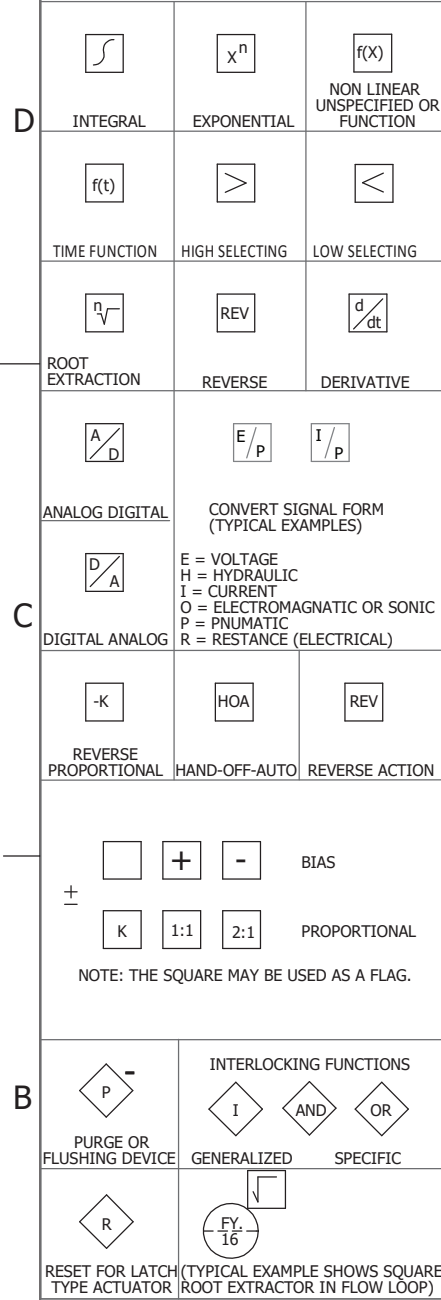
TOLERANCES:
 FRACTIONAL ± 1/16"
 ONE DECIMAL ± .125"
 TWO DECIMAL ± .0625"
 ANGULAR ± 2.0°
THIRD ANGLE PROJECTION

LOCATION: Aberdeen ID		SCALE NTS	
DESCRIPTION: Piping & Instrumentation Diagram, 5x CF64-60BG			
AUTH.	ME, 2023-07-26	CHKD.	N/A, 2023-07-26
NUMBER: 123.13670 PID		REV. 01	PAGE 1/4

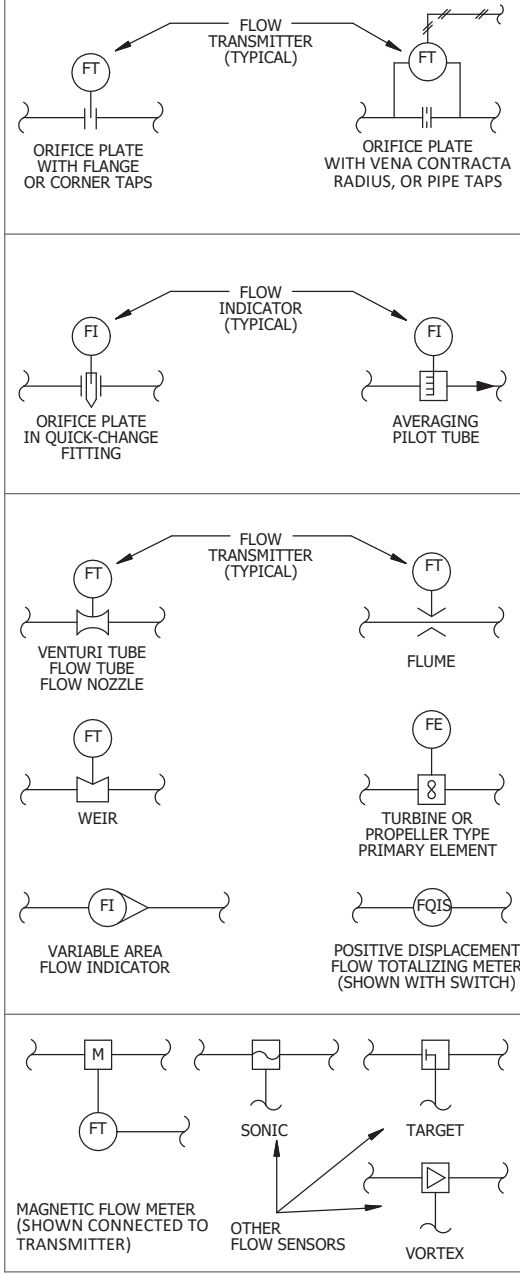
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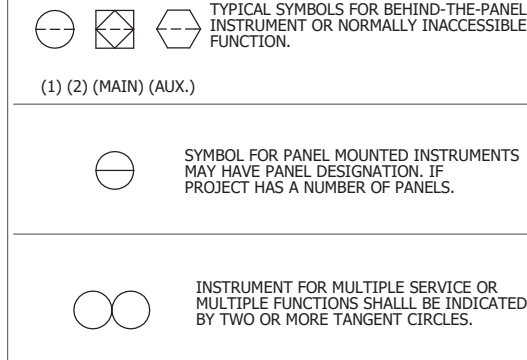
MISCELLANEOUS SYMBOLS



SYMBOLS FOR FLOW MEASUREMENT



SYMBOLS FOR LOGIC CONTROL



INSTRUMENT SYMBOLS

	PRIMARY CONTROL PANEL NORMALLY ACCESSIBLE TO OPERATOR	FIELD MOUNTED	AUXILIARY PANEL OR RACK NORMALLY ACCESSIBLE TO OPERATOR
DISCRETE INSTRUMENTS			
SHARED DISPLAY SHARED CONTROL			
COMPUTER FUNCTION INCLUDING DISTRIB. CNTL. SYS.			
PROGRAMMABLE LOGIC CONTROLLER FUNCTION			

INSTRUMENT IDENTIFICATION LETTERS

FIRST LETTER		SUCCEEDING LETTERS			
MEASURE OR INIATING VARIABLE	MODIFIER	LETTER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A = ANALYSIS		A	ALARM		
B = BURNER, COMBUSTION		B	USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
C = USER'S CHOICE		C		CONTROL	
D = USER'S CHOICE	DIFFERENTIAL	D			
E = VOLTAGE		E	SENSOR (PRIMARY ELEMENT)		
F = FLOW RATE	RATIO (FRACTION)	F			
G = USER'S CHOICE		G	GLASS, VIEWING DEVICE		
H = HAND		H			HIGH
I = CURRENT (ELECTRICAL)		I	INDICATE		
J = POWER	SCAN	J			
K = TIME, TIME SCHEDULE	TIME RATE OF CHANGE	K		CONTROL STATION	
L = LEVEL		L	LIGHT		
M = USER'S CHOICE	MOMENTARY	M			MIDDLE, INTERMEDIATE
N = USER'S CHOICE		N	USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
O = USER'S CHOICE		O	ORIFICE, RESTRICTION		
P = PRESSURE, VACUUM		P	POINT (TEST) CONNECTION		
Q = QUANTITY	INTERGRATE, TOTALIZE	Q			
R = RADIATION		R	RECORD		
S = SPEED, FREQUENCY	SAFETY	S		SWITCH	
T = TEMPERATURE		T		TRANSMIT	
U = MULTIVARIABLE		U	MULTIFUNCTION	MULTIFUNCTION	MULTIFUNCTION
V = VIBRATION, MECH. ANALYSIS		V		VALVE, DAMPER, LOUVER	
W = WEIGHT, FORCE		W	WELL		
X = UNCLASSIFIED	X AXIS	X	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED
Y = EVENT, STATE OR PRESENCE	Y AXIS	Y		RELAY, COMPUTE, CONVERT	
Z = POSITION, DIMENSION	Z AXIS	Z		DRIVE, ACTUATOR, UNCLASSIFIED FINAL CONTROL ELEMENT	

NOTES:

- ANY FIRST LETTER COMBINED WITH MODIFIER REPRESENTS A NEW AND SEPARATE MEASURED VARIABLE. EXAMPLES: PD = DIFFERENTIAL PRESSURE FQ = TOTALIZED OR INTEGRATED FLOW. EXCEPTION IS THE MODIFIER "J" FOR MULTIPOINT SCANNING.
- FOR ANALYSIS NOT IDENTIFIED BY A SPECIFIC LETTER IN THE TABLE, USE THE LETTER "A" NEAR THE INSTRUMENT SYMBOL, SPECIFY THE NATURE OF THE ANALYSIS. EXAMPLE: PH
- MEANING OF A "USER CHOICE" LETTER SHALL BE CONSISTENT THROUGHOUT A PROJECT AND SHALL BE SPECIFIED IN THE DRAWING LEGEND.
- UNCLASSIFIED LETTERS MAY HAVE A FEW DIFFERENT MEANINGS ON A PROJECT, THE MEANING SHALL BE SPECIFIED NEAR EACH INSTRUMENT SYMBOL USING THE UNCLASSIFIED LETTER.
- THE MODIFIER "SCAN" APPLIES TO MULTIPOINT PRINTING INSTRUMENTS, SUCH AS CJRS (MULTIPOINT CONDUCTIVITY RECORDER WITH ALARM SWITCHCES).

GENERAL NOTES:

- FOR MECHANICAL SYMBOLS AND ADDITIONAL NOTES, SEE BLUE WATER DRAWING NO. PID-A. THIS DRAWING IS PROVIDED FOR INFORMATION ONLY.



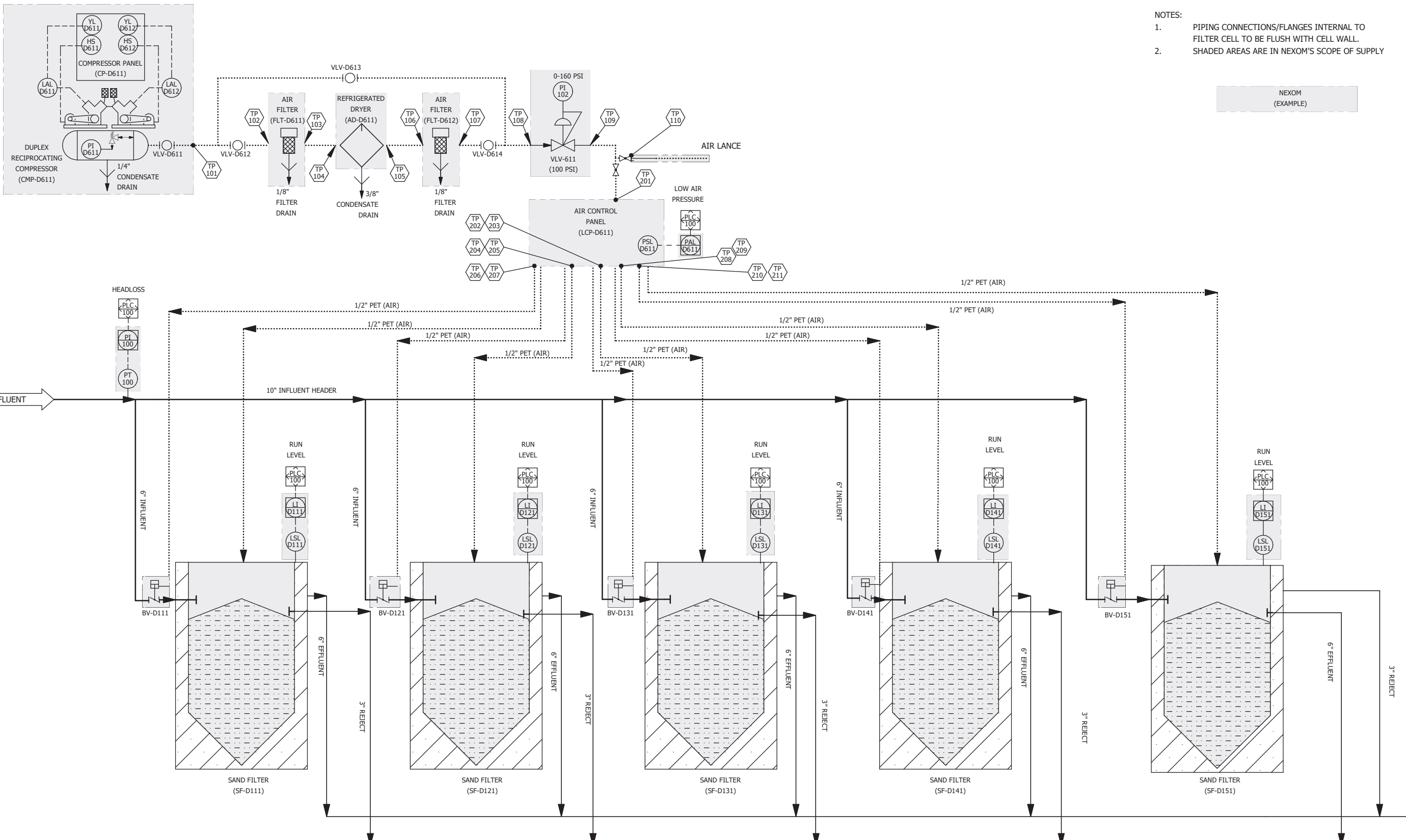
UNLESS OTHERWISE SPECIFIED

TOLERANCES:

FRACTIONAL	± 1/16"
ONE DECIMAL	± .125"
TWO DECIMAL	± .0625"
ANGULAR	± 2.0°

LOCATION: Aberdeen ID	SCALE NTS
DESCRIPTION: Piping & Instrumentation Diagram, 5x CF64-60BG	
NUMBER: 123.13670 PID	REV. 01
PAGE 2/4	

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- NOTES:
- PIPING CONNECTIONS/FLANGES INTERNAL TO FILTER CELL TO BE FLUSH WITH CELL WALL.
 - SHADED AREAS ARE IN NEXOM'S SCOPE OF SUPPLY

TERMINAL POINT TABLE	
TP-101	3/4" FNPT
TP-102	3/4" FNPT
TP-103	3/4" FNPT
TP-104	3/4" FNPT
TP-105	3/4" FNPT
TP-106	3/4" FNPT
TP-107	3/4" FNPT
TP-108	1/2" FNPT
TP-109	1/2" FNPT
TP-110	1/4" QUICK CONNET
TP-201	1/2" FNPT
TP-202	1/2" TUBING
TP-203	1/2" TUBING
TP-204	1/2" TUBING
TP-205	1/2" TUBING
TP-206	1/2" TUBING
TP-207	1/2" TUBING
TP-208	1/2" TUBING
TP-209	1/2" TUBING
TP-210	1/2" TUBING
TP-211	1/2" TUBING
TP-401	6" PIPE STUB
TP-402	6" ANSI FF
TP-403	3" PIPE STUB
TP-405	1" MNPT



REVISIONS			
REV.	DESCRIPTION	ENGINEER	DATE
01	Initial Release	ME	2023-07-26

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 DIMENSIONS ARE IN INCHES
 TOLERANCES:
 00.0 OR X/X ± .125"
 00.00 ± .05"
 00.0° ± 2.0°
THIRD ANGLE PROJECTION

LOCATION: Aberdeen ID		SCALE NTS	
DESCRIPTION: Piping & Instrumentation Diagram, 5x CF64-60BG			
AUTH.	ME, 2023-07-26	CHKD.	N/A, 2023-07-26
NUMBER: 123.13670 PID		REV. 01	PAGE 3/4

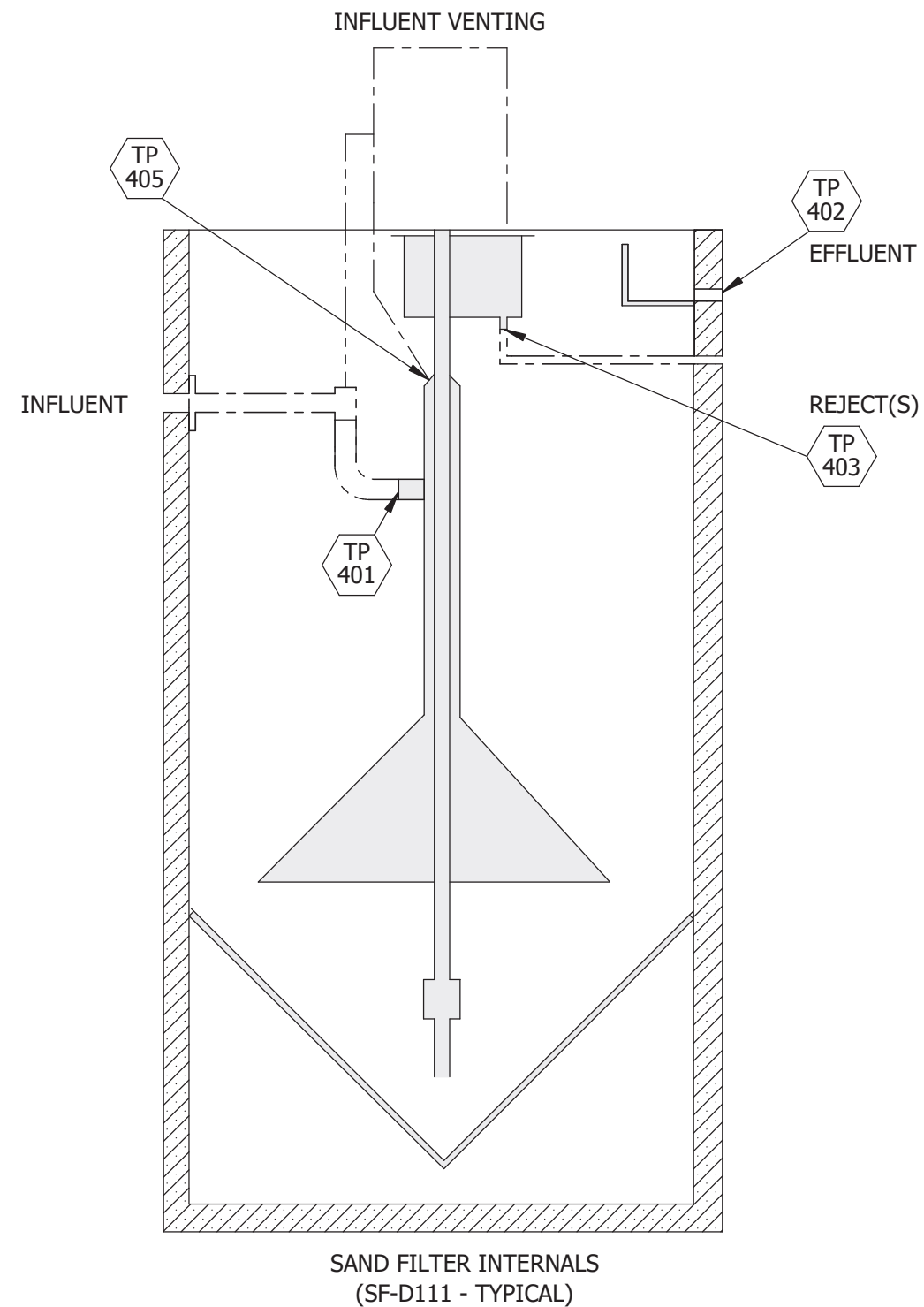
TEMPLATE LAST MODIFIED: 08.05.19

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TERMINAL POINT TABLE	
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TP-102	1/2" FNPT
TP-103	1/2" FNPT
TP-104	1/2" FNPT
TP-105	1/2" FNPT
TP-106	1/2" FNPT
TP-107	1/2" FNPT
TP-108	1/2" FNPT
TP-109	1/2" FNPT
TP-201	1/2" FNPT
TP-202	1/2" TUBING
TP-203	1/2" TUBING
TP-204	1/2" TUBING
TP-205	1/2" TUBING
TP-206	1/2" TUBING
TP-207	1/2" TUBING
TP-208	1/2" TUBING
TP-209	1/2" TUBING
TP-401	6" PIPE STUB
TP-402	6" ANSI FF
TP-403	3" PIPE STUB
TP-405	1" MNPT

D
C
B
A

D
C
B
A



SAND FILTER INTERNALS
(SF-D111 - TYPICAL)



UNLESS OTHERWISE SPECIFIED	
TOLERANCES:	
FRACTIONAL	± 1/16"
ONE DECIMAL	± .125"
TWO DECIMAL	± .0625"
ANGULAR	± 2.0°

LOCATION: Aberdeen ID	SCALE NTS
DESCRIPTION: Piping & Instrumentation Diagram, 5x CF64-60BG	
NUMBER: 123.13670 PID	REV. 01
	PAGE 4/4

TEMPLATE LAST MODIFIED: 08.05.19

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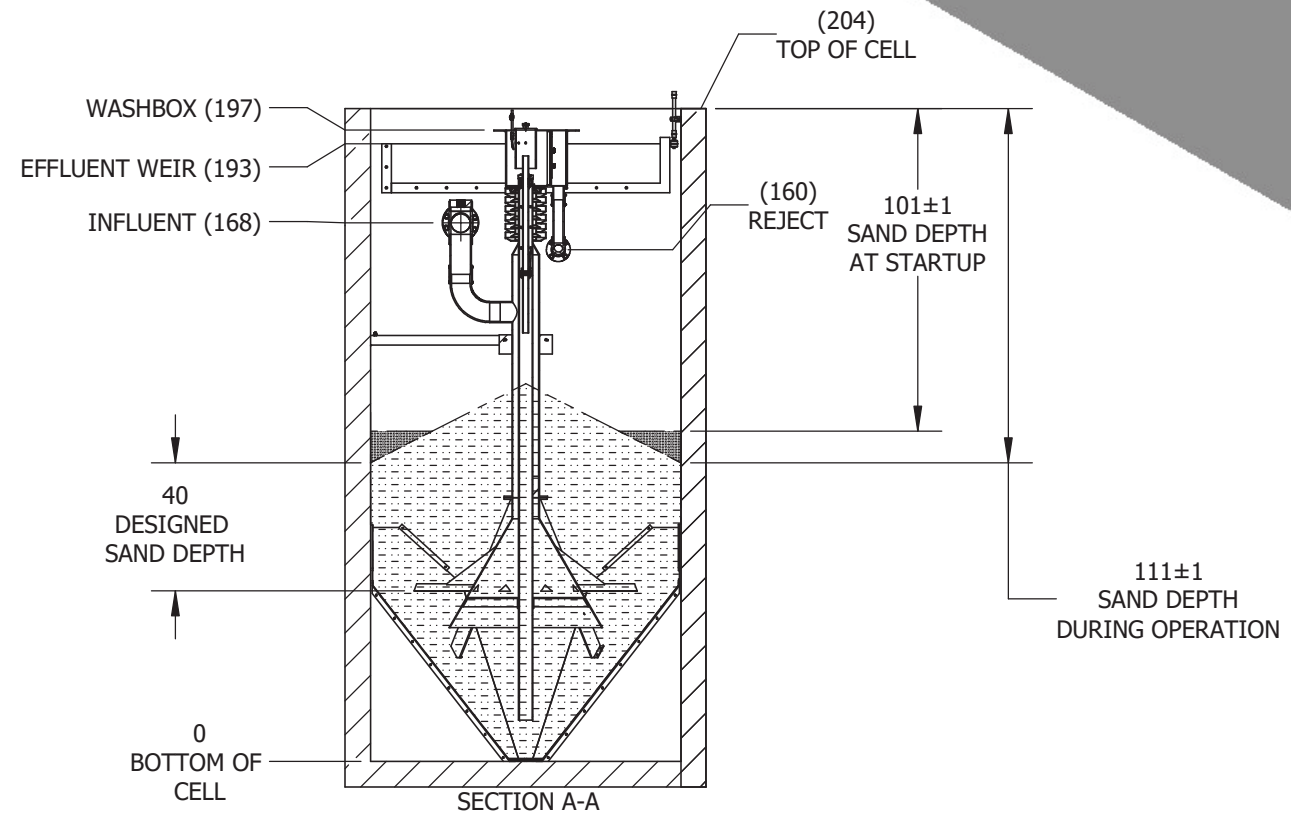
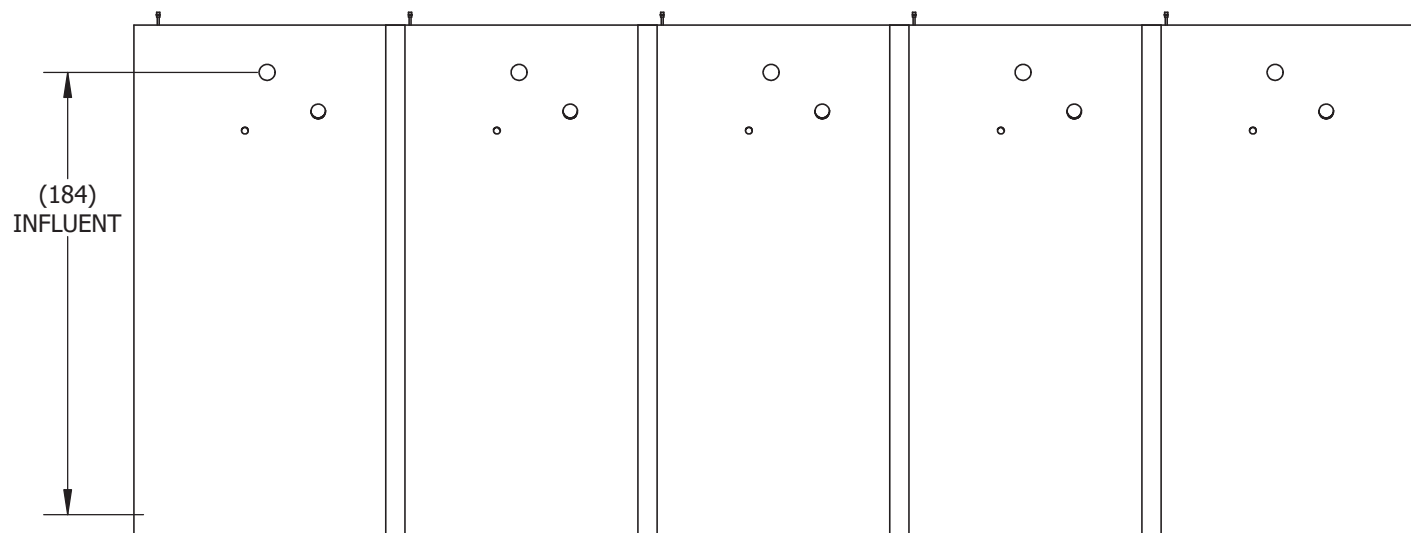
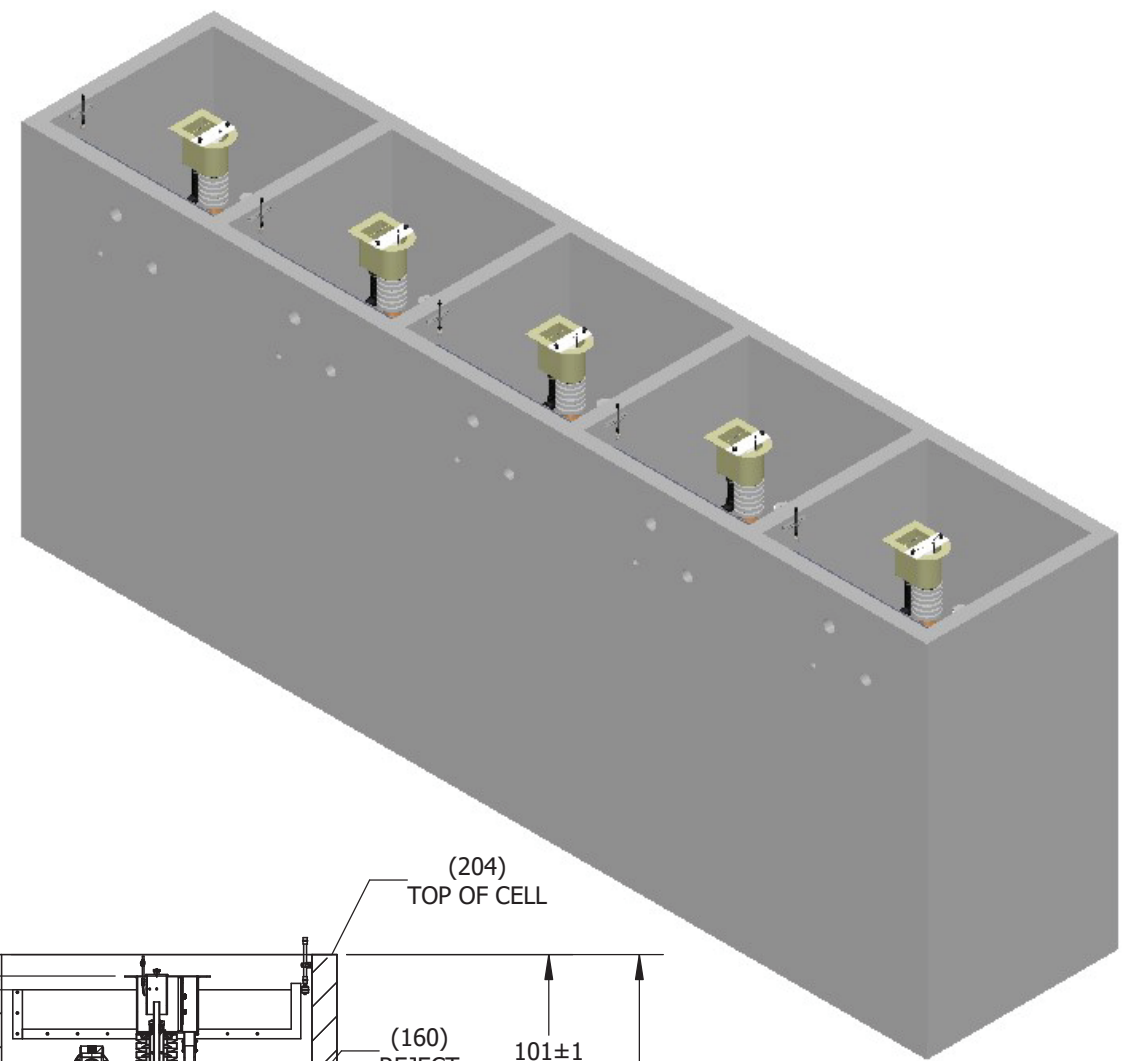
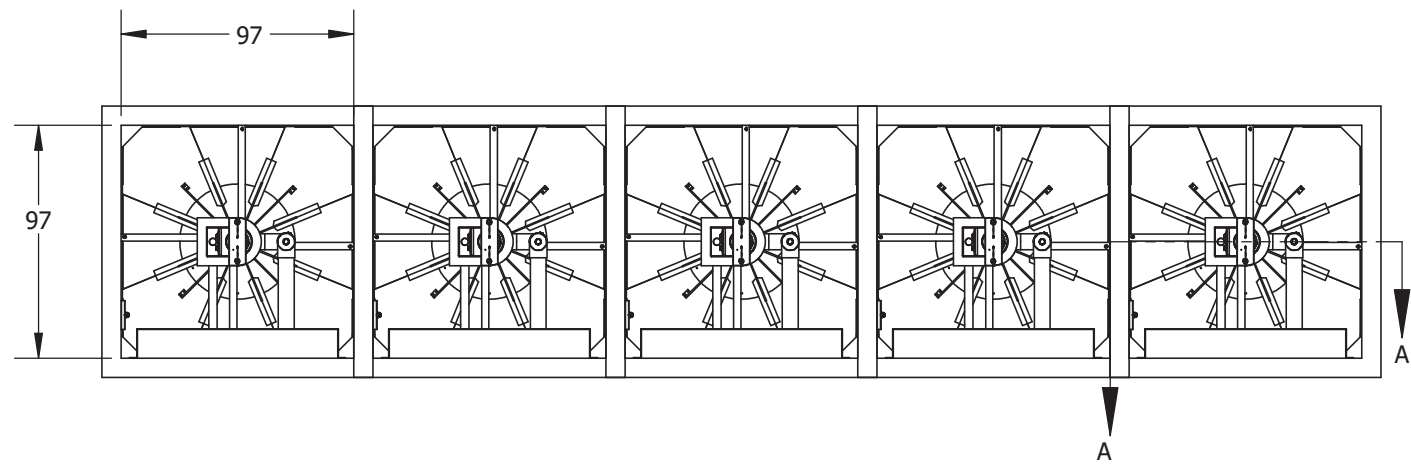
Tag List

Pneumatics			
Tag Number	Mfg.	Description	Mfg. Part Number
CMP-D611	Gardner Denver	Compressor, Dual Head Reciprocating	HR10DF-24
AD-D611	Gardner Denver	Refrigerated Air Dryer w/filtration	RGD35A1FP
VLV-611	Gardner Denver	Pressure/Flow Control Valve	XMX75-LR
FLT-D611, FLT-D612	Gardner Denver	Air Filter	

Control Panel			
Tag Number	Mfg.	Description	Mfg. Part Number
LCP-D611	Nexom	Air Control Panel	

Sand Filter System			
Tag Number	Mfg.	Description	Mfg. Part Number
SF-D111, SF-D121, SF-D131, SF-D141, SF-D151	Nexom	Continuous Backwash Sand Filters	CF64-60RC
PT-100	Endress + Hauser	Pressure Transmitter	E+H PMC21
LSL-D111, LSL-D121, LSL-D131, LSL-D141, LSL-D151	Madison	Filter Run Level Float Switch	M5600
BV-D111, BV-D121, BV-D131, BV-D141, BV-D151	DEZURIK	INFLUENT CONTROL VALVE	PR_-R1_-SC6-R-60

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REVISIONS			
REV.	DESCRIPTION	ENGINEER	DATE
01	New FRP arrangement	ME	2023-11-06
02	ADDED RUN LEVEL	ME	2023-11-14

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 00.00 ± .05"
 00.0° ± 2.0°
THIRD ANGLE PROJECTION

LOCATION: Aberdeen, ID		SCALE 1:80	
DESCRIPTION: GENERAL ARRANGEMENT DRAWING, 5X CF64-60RC			
AUTH.	ME, 2023-11-14	CHKD.	N/A, 2023-11-14
NUMBER: 123.13670 New Style GA		REV. 02	PAGE 1/7

TEMPLATE LAST MODIFIED: 08.05.15

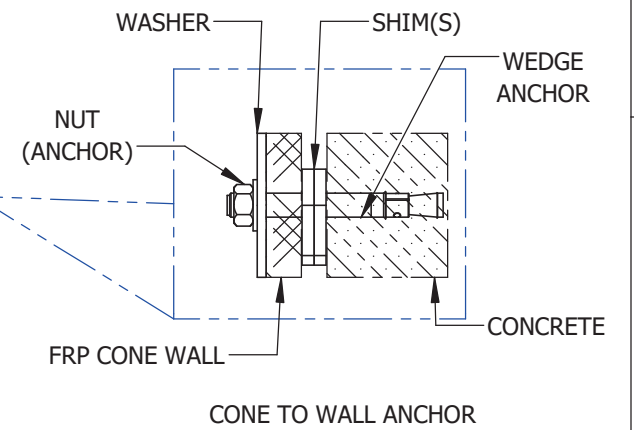
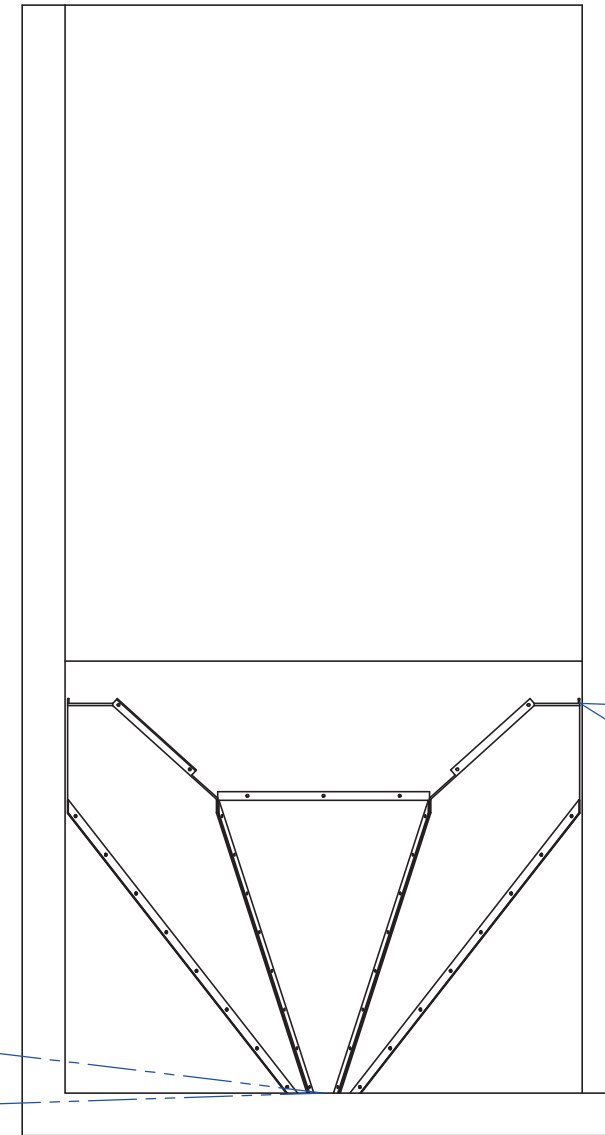
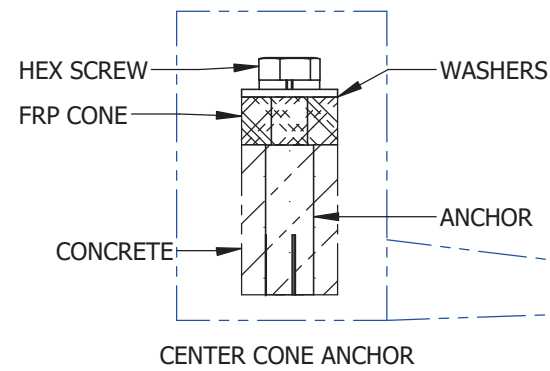
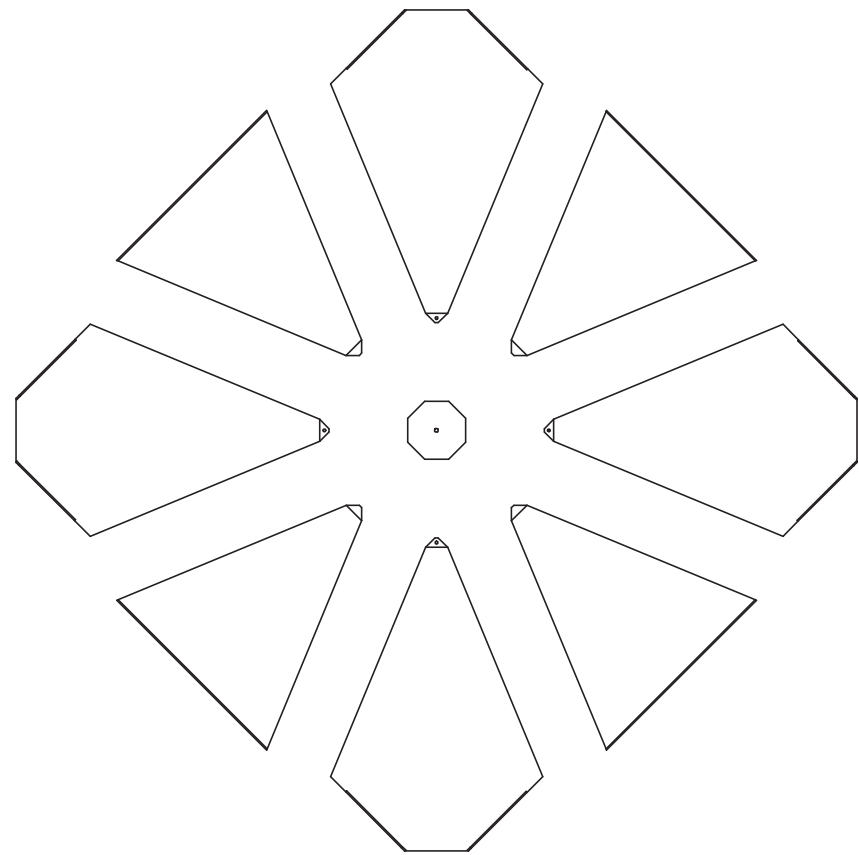
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STEP 1:

- ASSEMBLE CONE OUTSIDE OF CONCRETE
- SEE CONE DRAWINGS FOR REFERENCE
- SEE BELOW GROUND INSTALLATION DOCUMENT

STEP 2:

- INSTALL CONE USING SHOWN FASTENERS TO ANCHOR CONES TO WALL & FLOOR
- FILL EMPTY SPACE BELOW CONE WITH GROUT. SEE BELOW GROUND INSTALLATION DOCUMENT



UNLESS OTHERWISE SPECIFIED
 TOLERANCES:
 00.0 OR X/X ± .125"
 00.00 ± .05"
 00.0° ± 2.0°

LOCATION: Aberdeen, ID	SCALE 1:36
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NUMBER: 123.13670 New Style GA	REV. 02
PAGE 2/7	

TEMPLATE LAST MODIFIED: 08/05/19

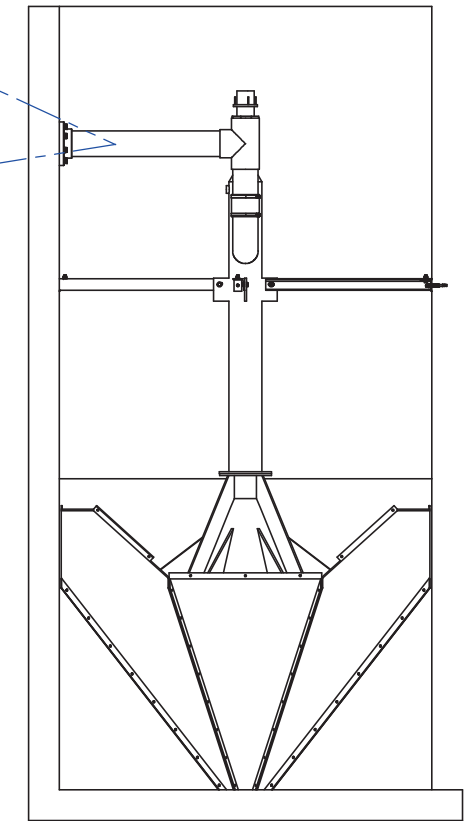
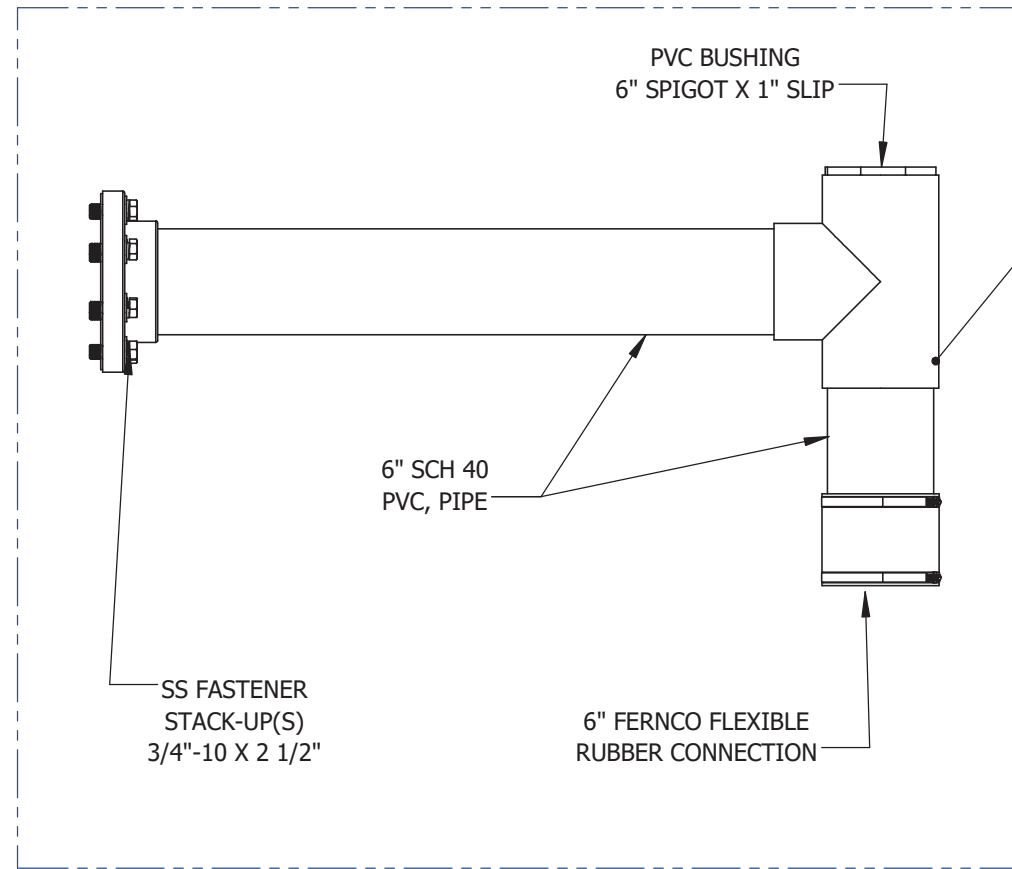
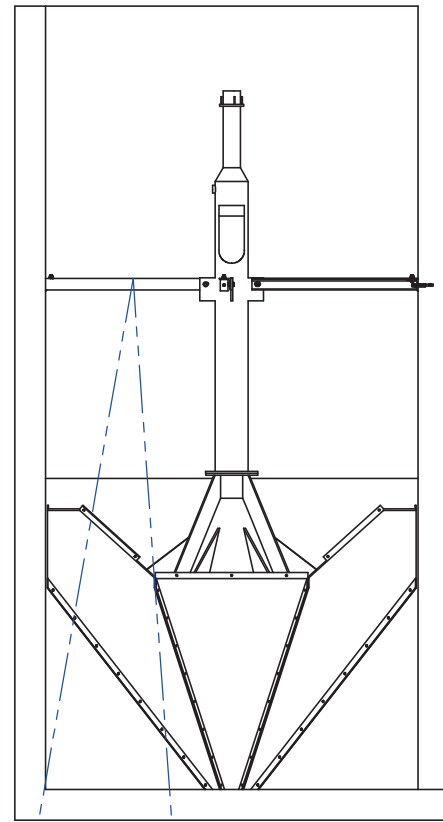
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STEP 3:

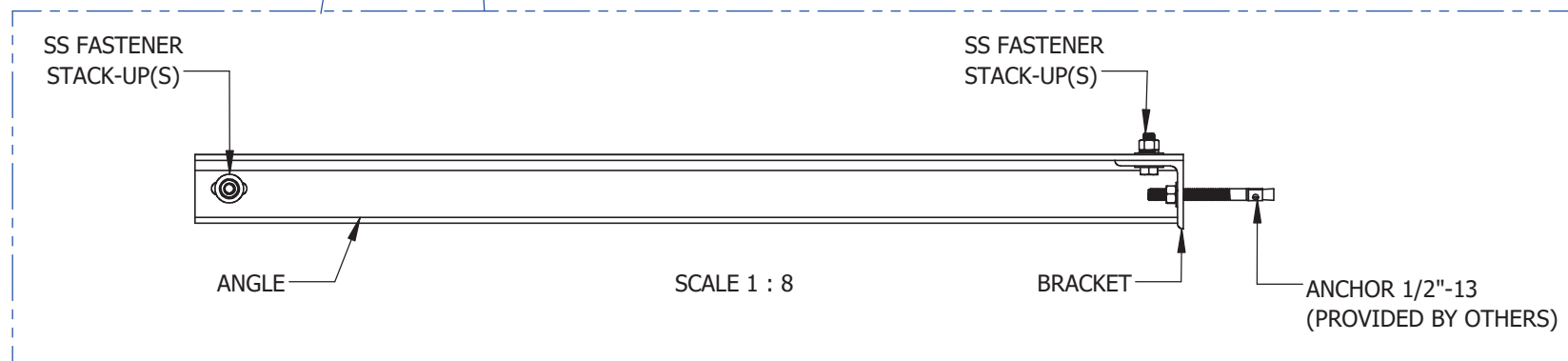
- PLACE FEED CHAMBER
- ENSURE FEED CHAMBER IS PLUMB TO WITHIN 1/8" OVER 4" BEFORE ADDING SAND
- ANCHOR FEED CHAMBERS TO WALL USING SUPPLIED ANGLES AND FASTENERS
- USE ANTI-SEIZE ON ALL FASTENERS

STEP 4:

- INSTALL INFLUENT PLUMBING SIMILAR AS SHOWN
- USE ANTI-SEIZE ON ALL FASTENERS
- USE PVC PRIMER AND CEMENT FOR ALL SLIP CONNECTIONS
- INFLUENT VALVE PROVIDED BY NEXOM, INFLUENT PLUMBING PROVIDED BY OTHERS



INFLUENT PLUMBING (BY OTHERS)
1 PER FILTER, 5 TOTAL



FEED CHAMBER SUPPORT
4 PER FILTER, 20 TOTAL



UNLESS OTHERWISE SPECIFIED

TOLERANCES:	
00.0 OR X/X	± .125"
00.00	± .05"
00.0°	± 2.0°

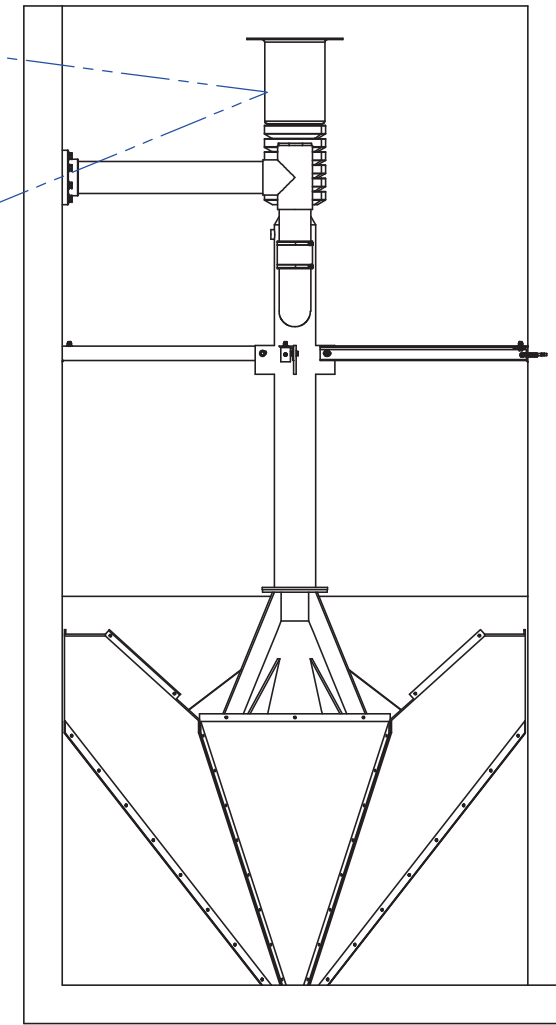
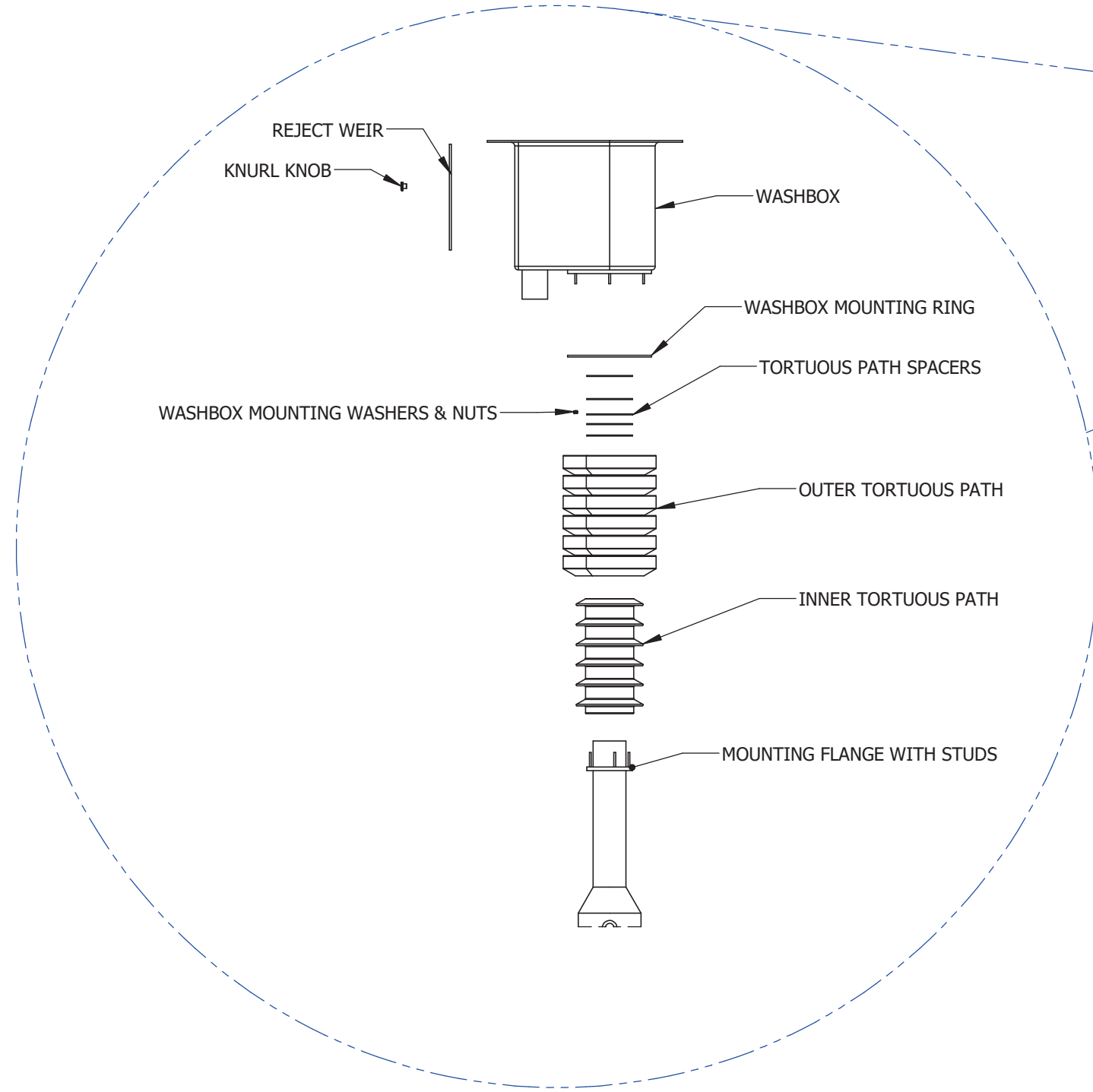
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DESCRIPTION: GENERAL ARRANGEMENT DRAWING, 5X CF64-60RC	
NUMBER: 123.13670 New Style GA	REV. 02
PAGE 3/7	

TEMPLATE LAST MODIFIED: 08.05.19

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STEP 5:

- INSTALL WASHBOX AND TORTUOUS PATH AS SHOWN
- LEVEL WASHBOX USING THE WASHBOX LEVELING WASHERS AS NEEDED



UNLESS OTHERWISE SPECIFIED	
TOLERANCES:	
00.0 OR X/X	± .125"
00.00	± .05"
00.0°	± 2.0°

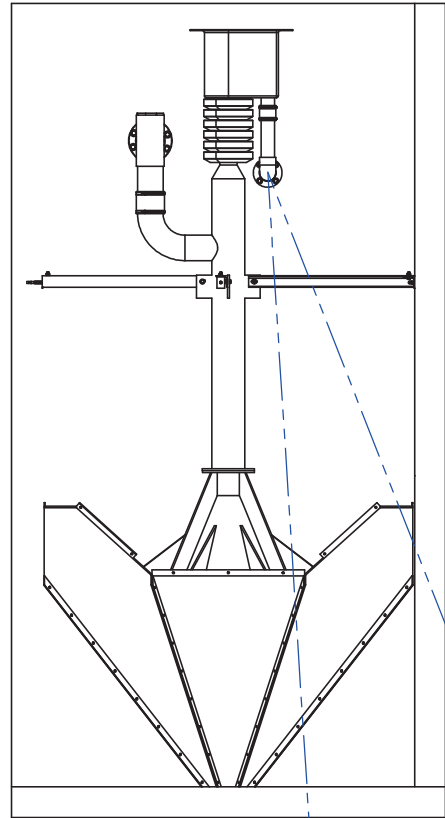
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NUMBER: 123.13670 New Style GA	REV. 02
PAGE 4/7	

TEMPLATE LAST MODIFIED: 08/05/19

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STEP 6:

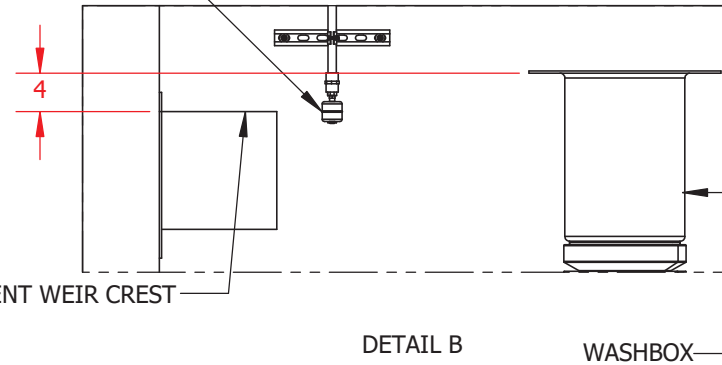
- INSTALL REJECT PLUMBING SIMILAR AS SHOWN
- USE ANTI-SEIZE ON ALL FASTENERS
- USE PVC PRIMER AND CEMENT ON ALL SLIP CONNECTIONS



STEP 7:

- INSTALL EFFLUENT WEIR BOX
- ENSURE WEIR BOX IS CENTERED HORIZONTALLY IN TANK
- INSTALL RUN LEVEL SWITCH. ENSURE CENTER OF SWITCH IS ALIGNED WITH EFFLUENT WEIR CREST
- CONTRACTOR CAN PLACE RUN LEVEL SWITCH ANYWHERE IN THE CELL EXCEPT OVER EFFLUENT WEIR BOX
- ENSURE WEIR BOX CREST IS 4" BELOW THE BOTTOM LIP OF THE WASHBOX AS SHOWN.

ALIGN WITH
EFFLUENT WEIR CREST



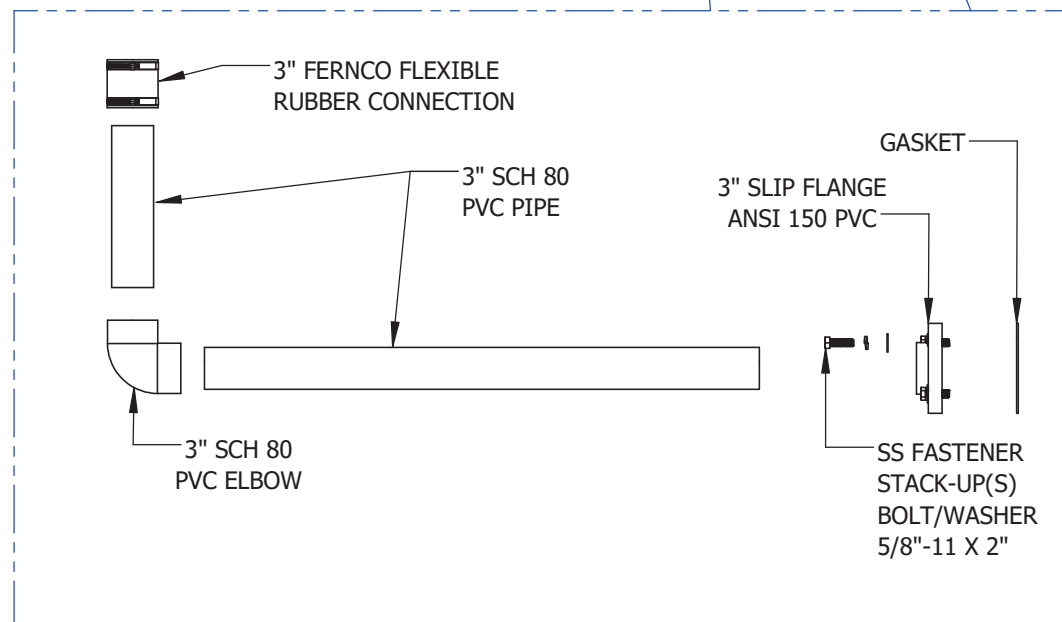
RUN LEVEL SWITCH

204
193

B

197

0



REJECT PLUMBING (BY OTHERS)
1 PER FILTER, 5 TOTAL



UNLESS OTHERWISE SPECIFIED TOLERANCES:	
00.0 OR X/X	± .125"
00.00	± .05"
00.0°	± 2.0°

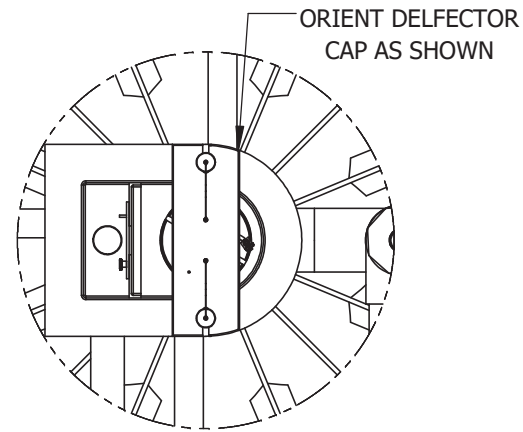
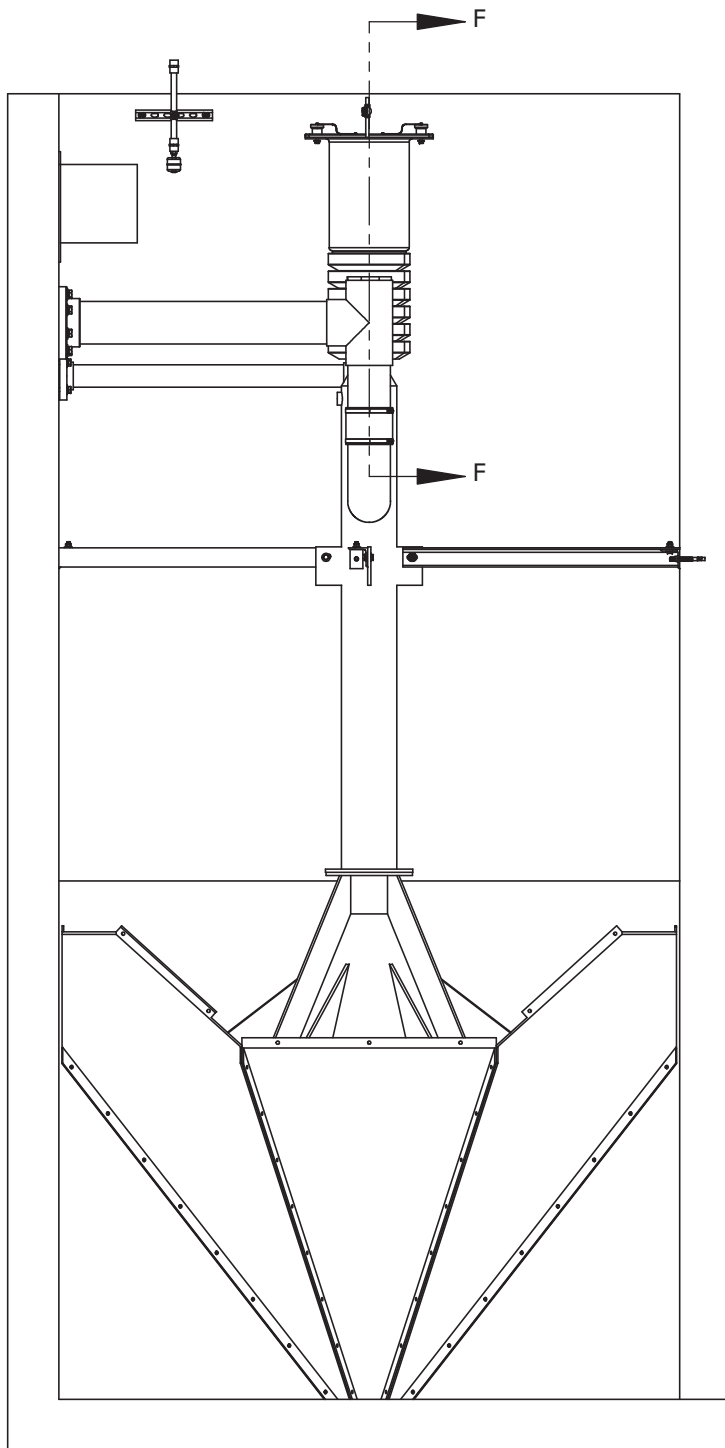
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NUMBER: 123.13670 New Style GA	REV. 02
PAGE 5/7	

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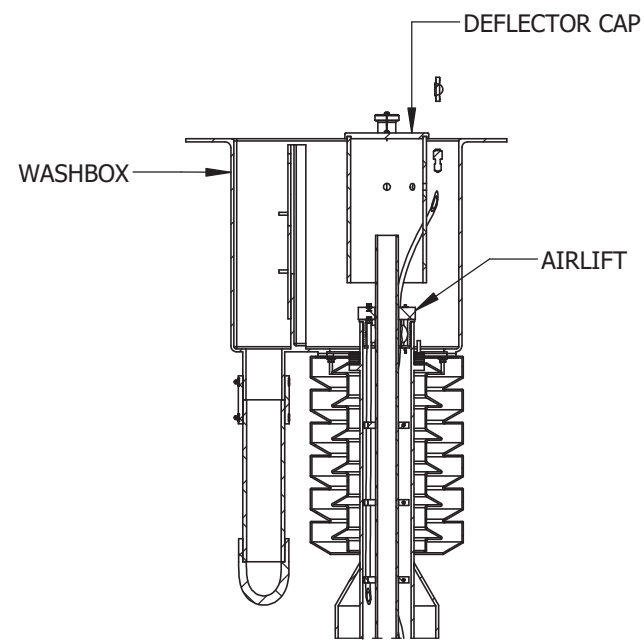
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STEP 8

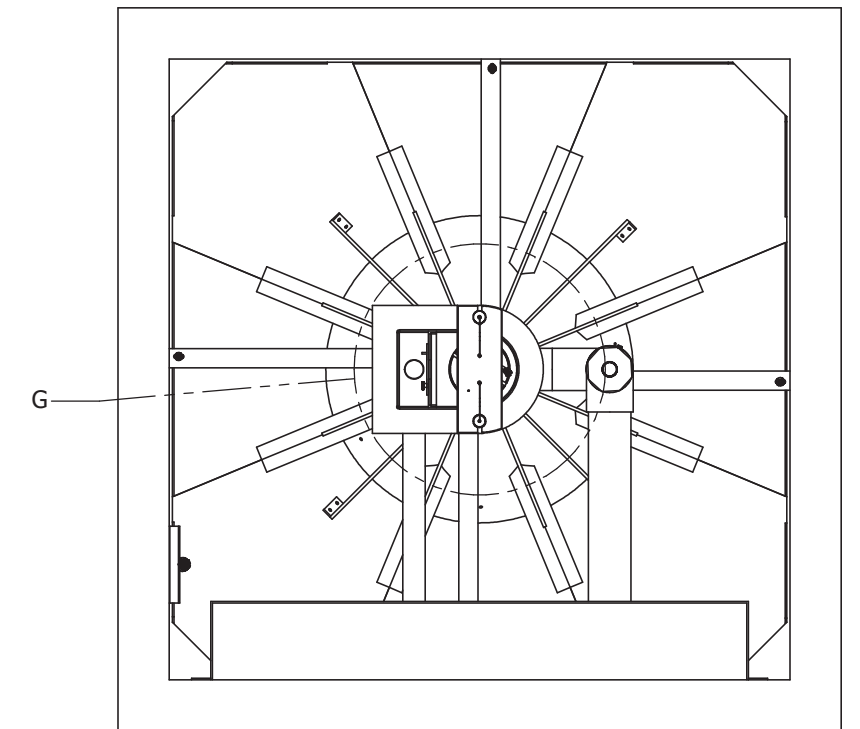
- INSTALL WASHBOX PARTS-PER INSTALLATION INSTRUCTIONS
 - AIRLIFT
 - DEFLECTOR CAP
- USE ANTI-SEIZE ON ALL FASTENERS



DETAIL G



SECTION F-F



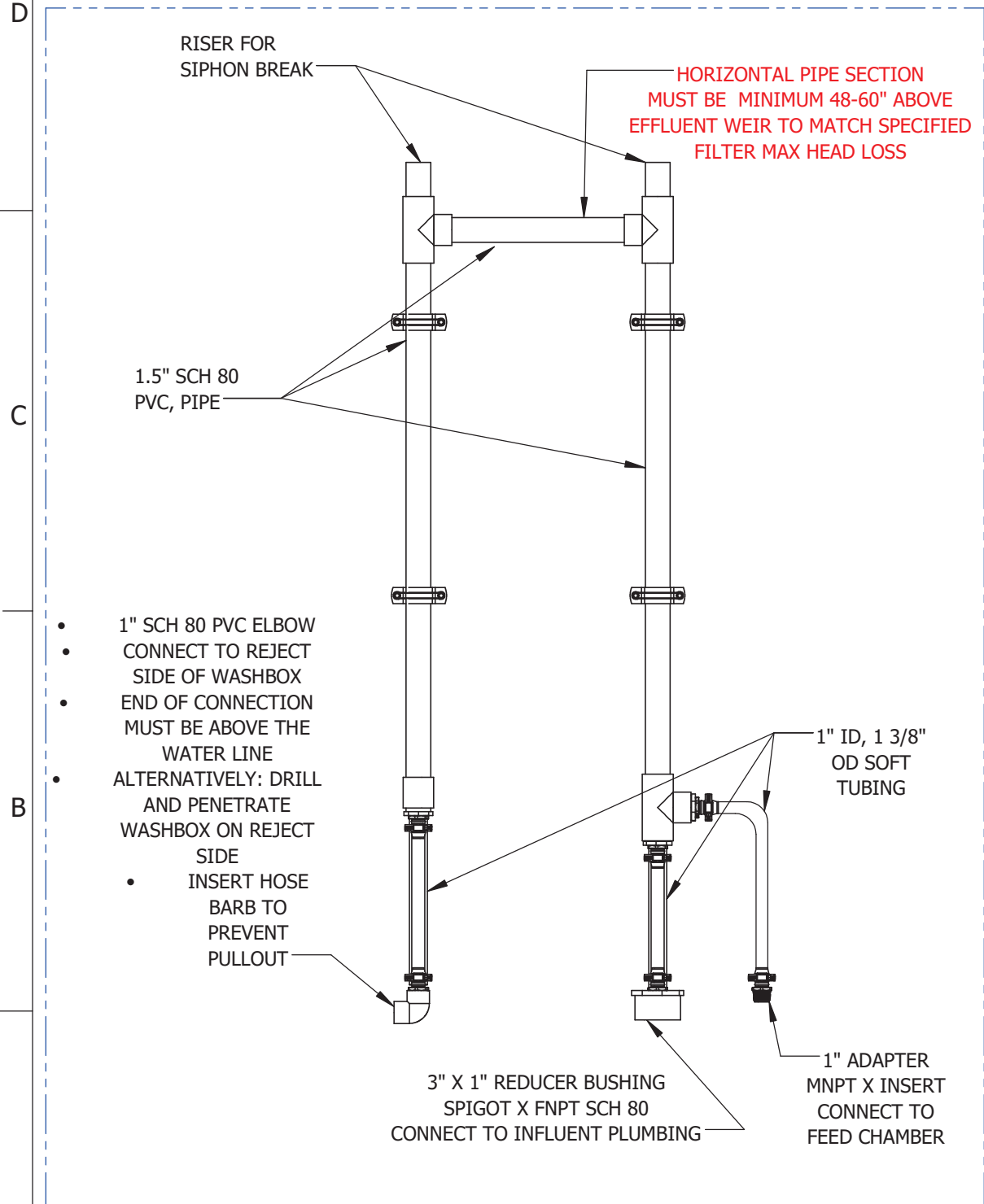
UNLESS OTHERWISE SPECIFIED	
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00.00	± .05"
00.0°	± 2.0°

LOCATION: Aberdeen, ID	SCALE 1:30
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NUMBER:123.13670 New Style GA	REV. 02
PAGE 6/7	

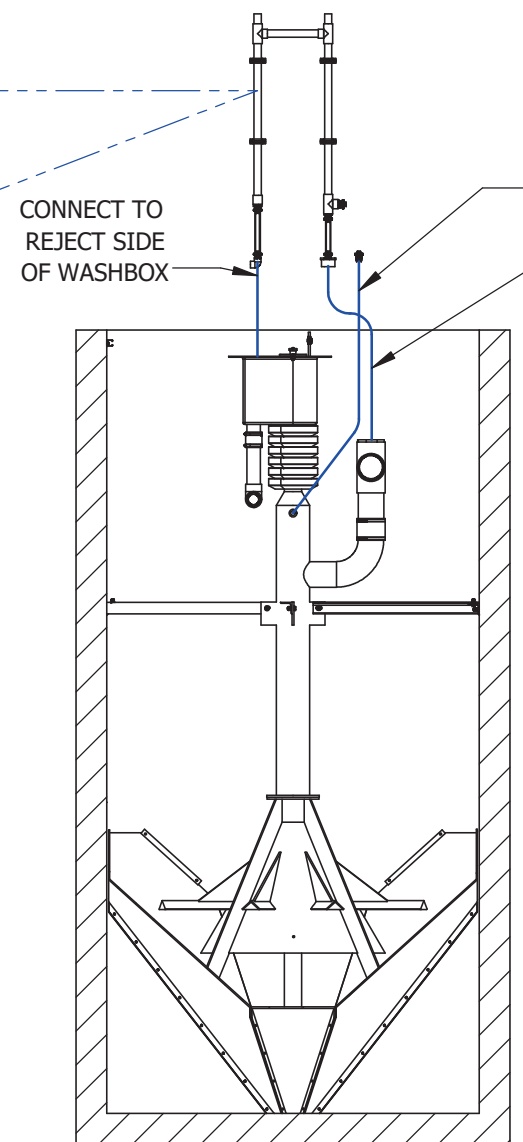
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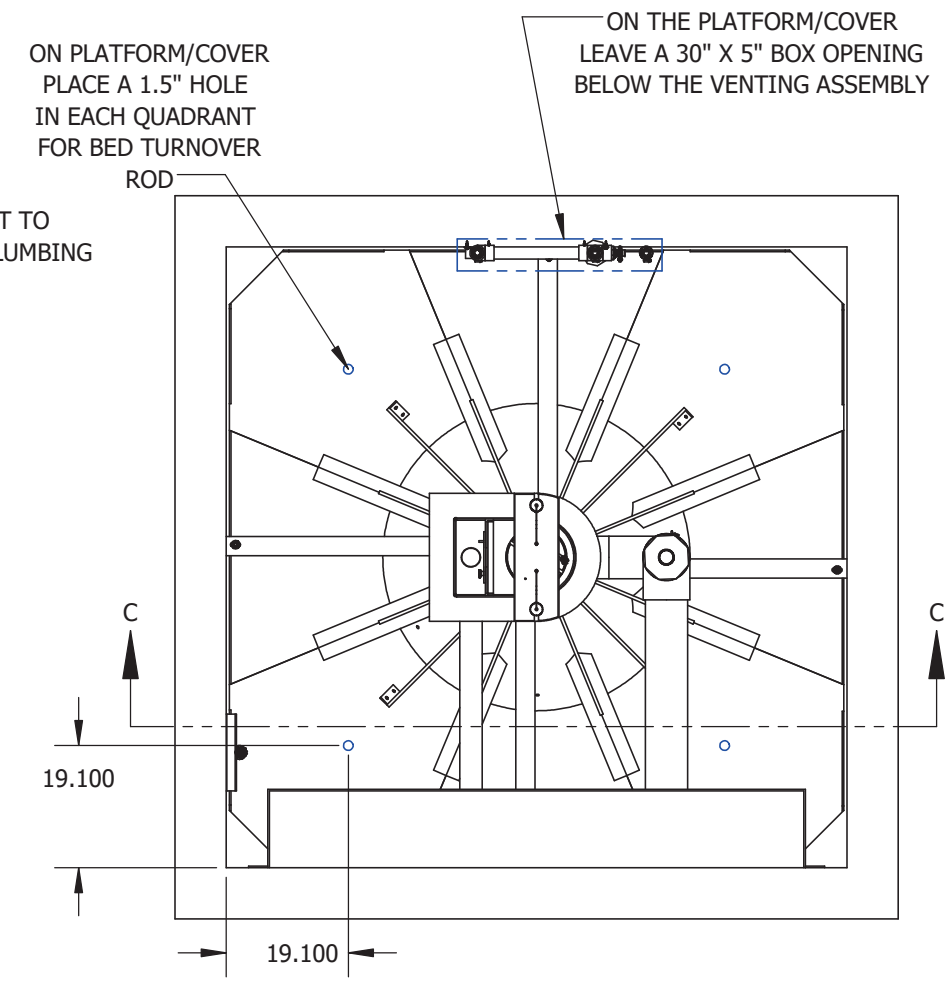
- STEP 9:
- INSTALL VENTING FOR INFLUENT PLUMBING AND FEED CHAMBER
 - USE PVC PRIMER AND CEMENT FOR ALL SLIP CONNECTIONS
 - USE TEFLON TAPE FOR ALL NPT CONNECTIONS
 - ALL HOSE RUNS MUST BE FREE DRAINING. ANY COLLECTING POINTS WILL LIMIT FUNCTIONALITY
 - FINAL LOCATION OF VENTING TO BE DETERMINED BY CONTRACTOR



HORIZONTAL PIPE SECTION MUST BE MINIMUM 48-60" ABOVE EFFLUENT WEIR TO MATCH SPECIFIED FILTER MAX HEAD LOSS



SECTION C-C



19.100

19.100



UNLESS OTHERWISE SPECIFIED

TOLERANCES:

00.0 OR X/X	± .125"
00.00	± .05"
00.0°	± 2.0°

LOCATION: Aberdeen, ID	SCALE 1:30
DESCRIPTION: GENERAL ARRANGEMENT DRAWING, 5X CF64-60RC	
NUMBER: 123.13670 New Style GA	REV. 02
PAGE 7/7	

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Fiberglass Components

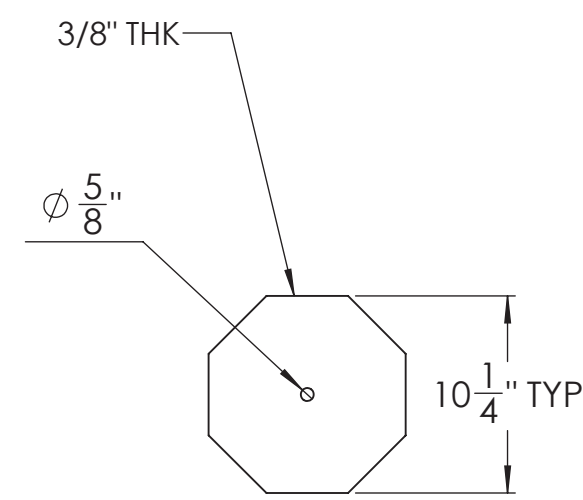
Revision 01

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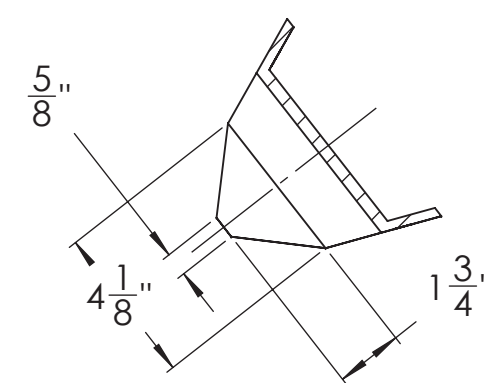
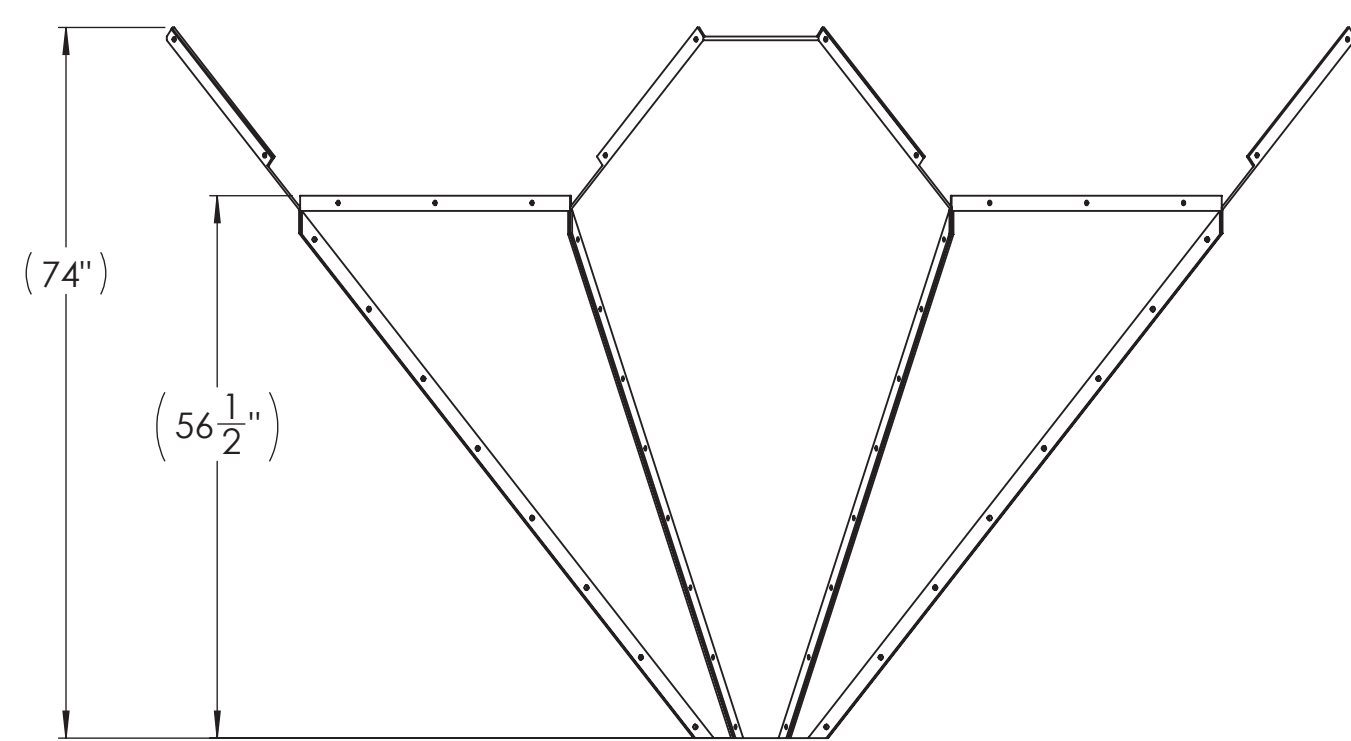
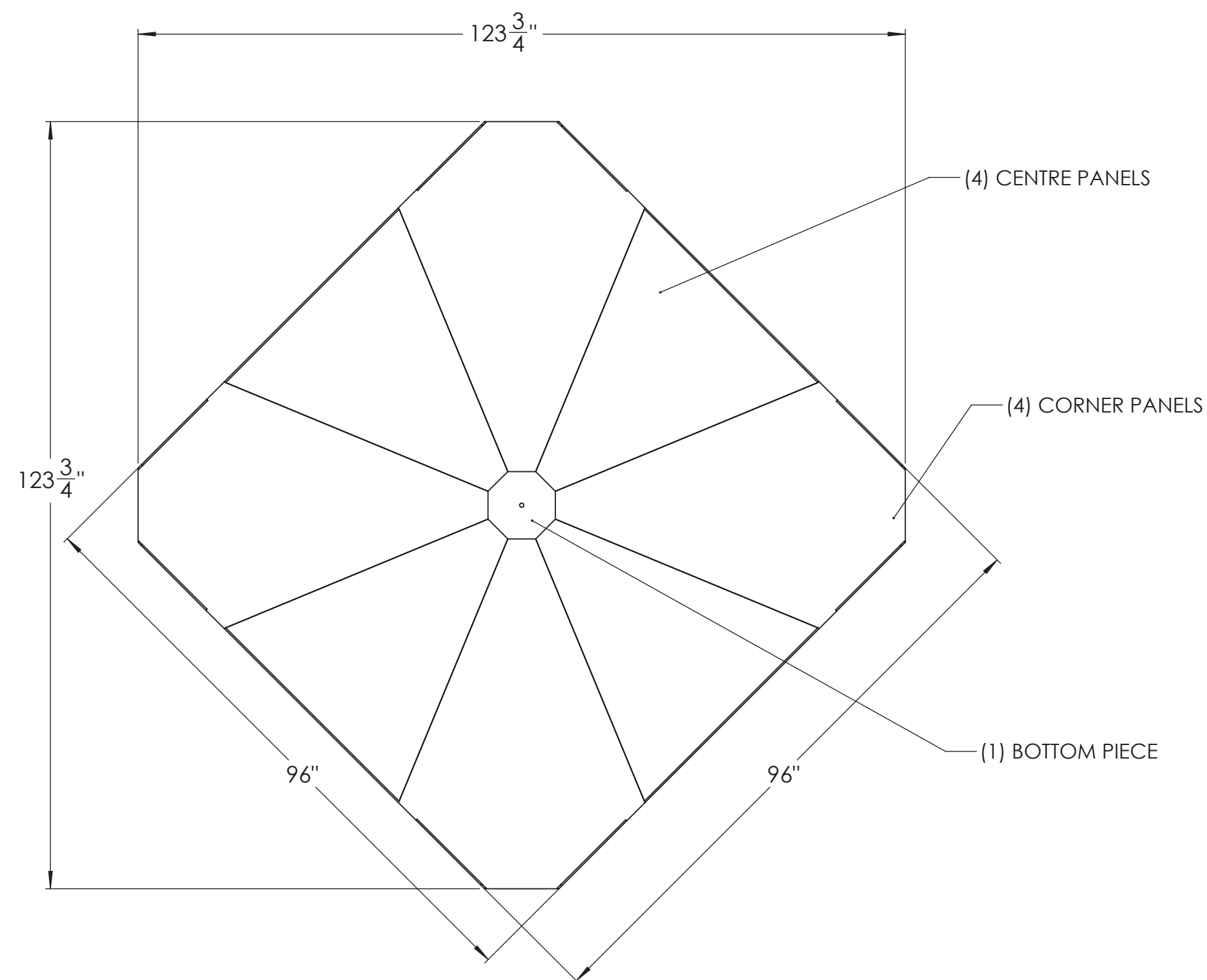
- Filter Vessel Drawing
- Washbox Drawing

Equipment Data	
Shipping Dimensions	Ø9'6" x 16"8"
Dry Weight	4640 lbs
Operating Weight	70831.2 lbs

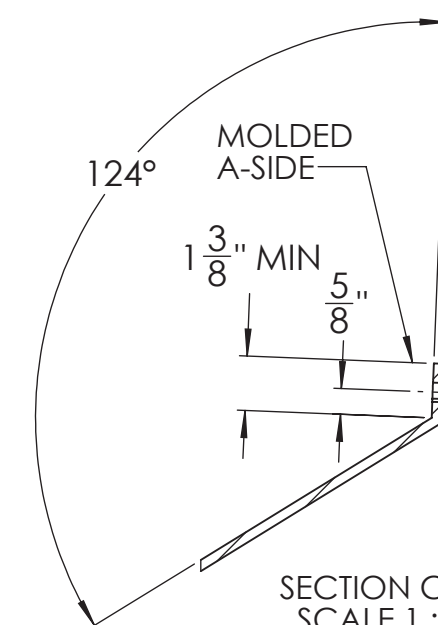
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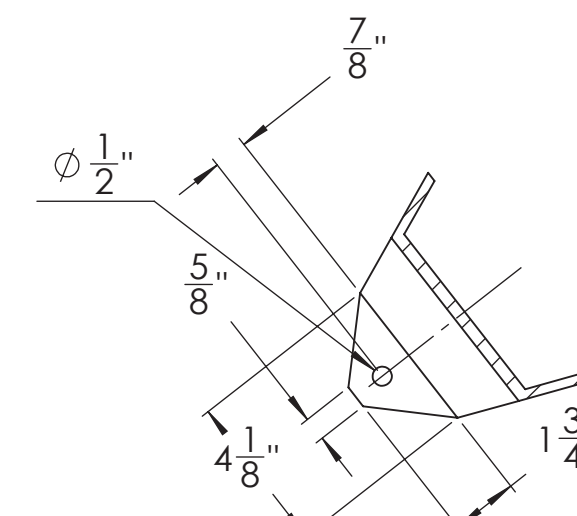
BOTTOM PLATE



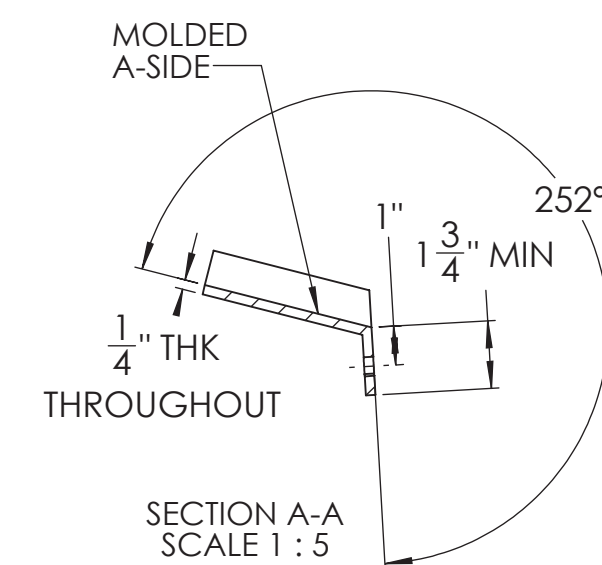
SECTION D-D
SCALE 1 : 5



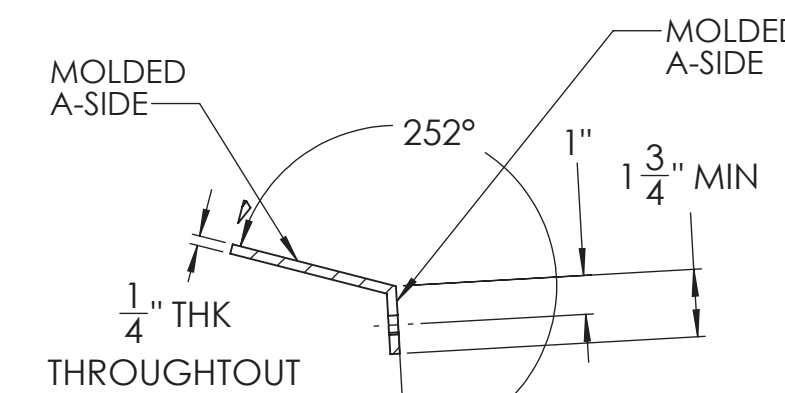
SECTION C-C
SCALE 1 : 5



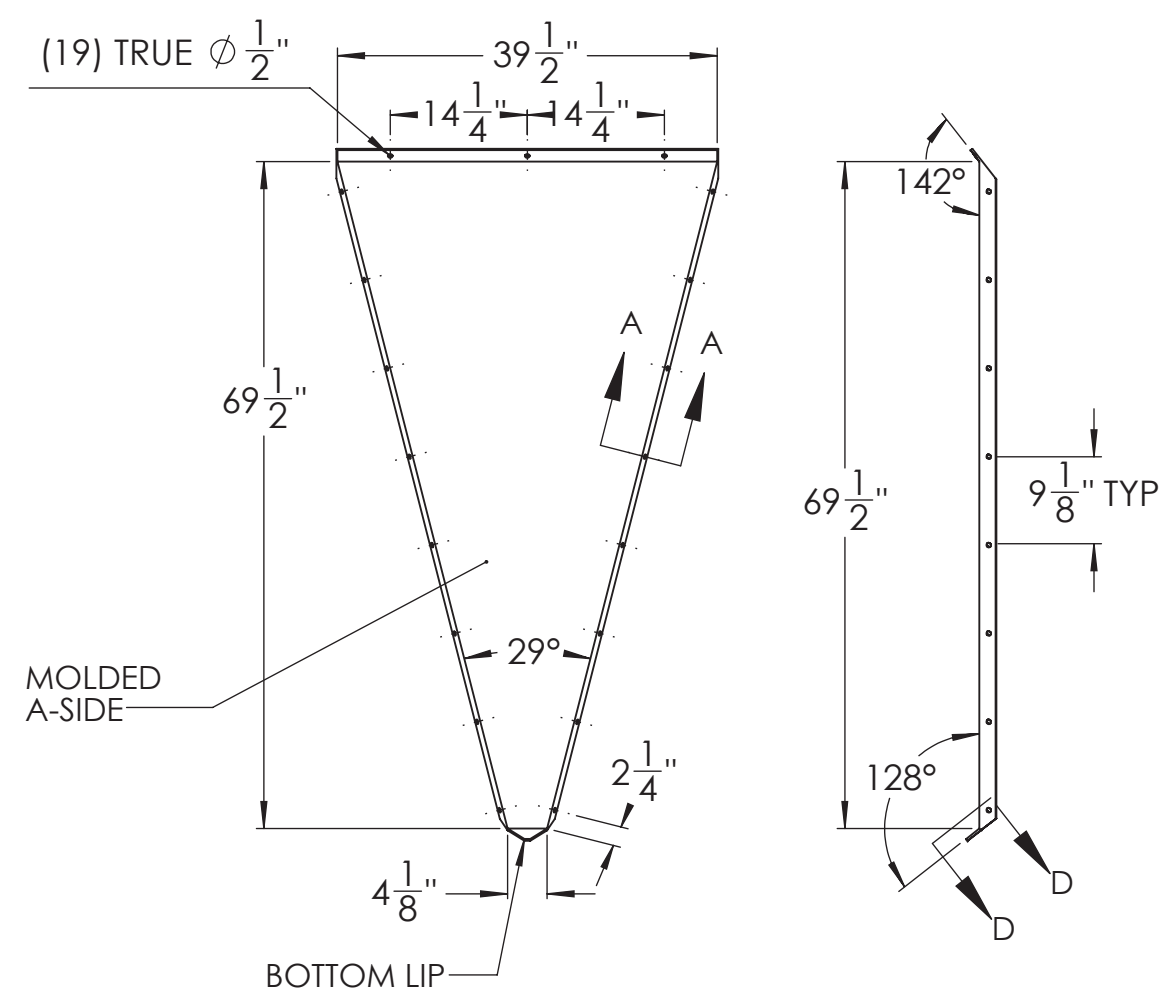
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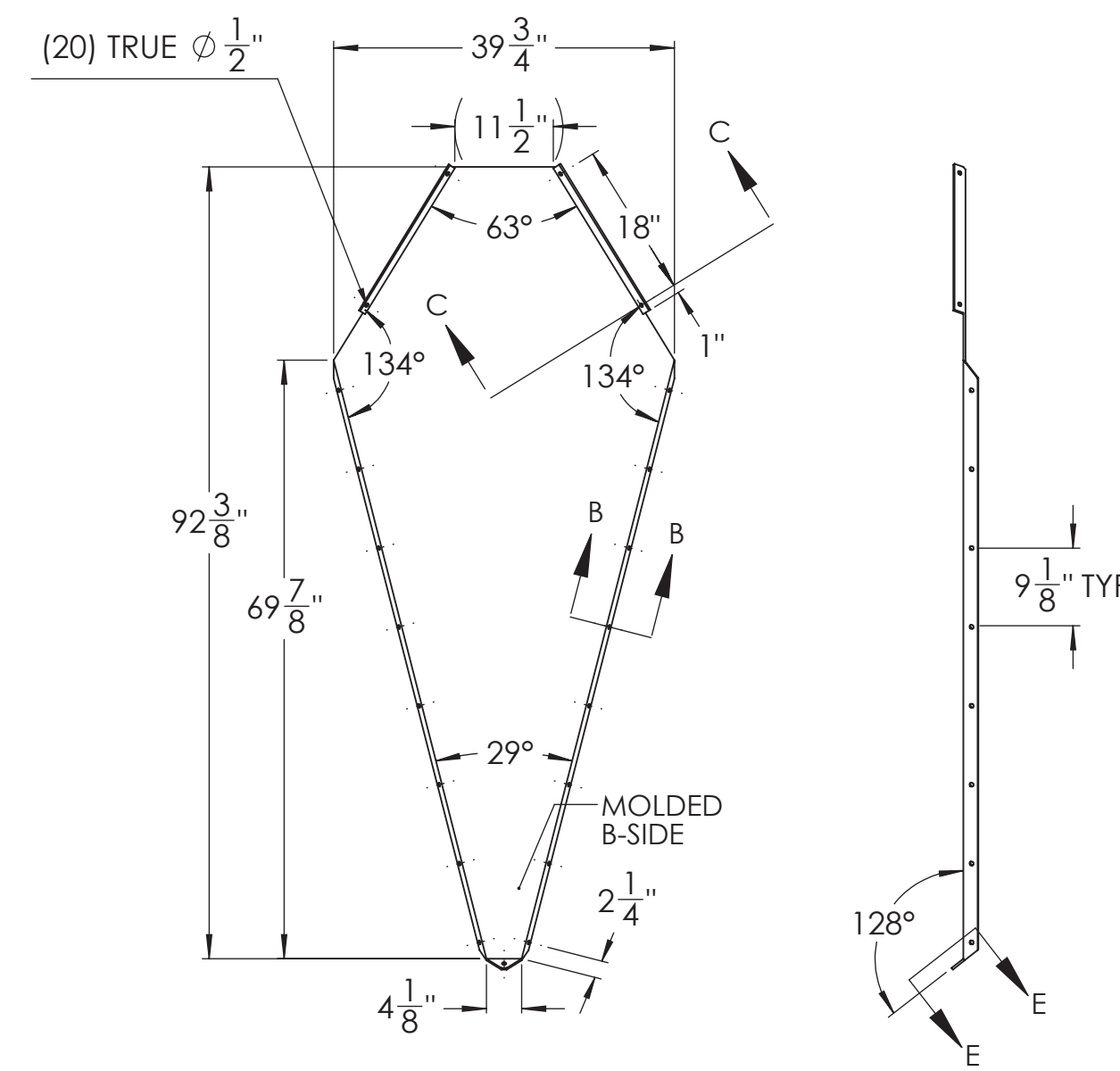
SECTION A-A
SCALE 1 : 5



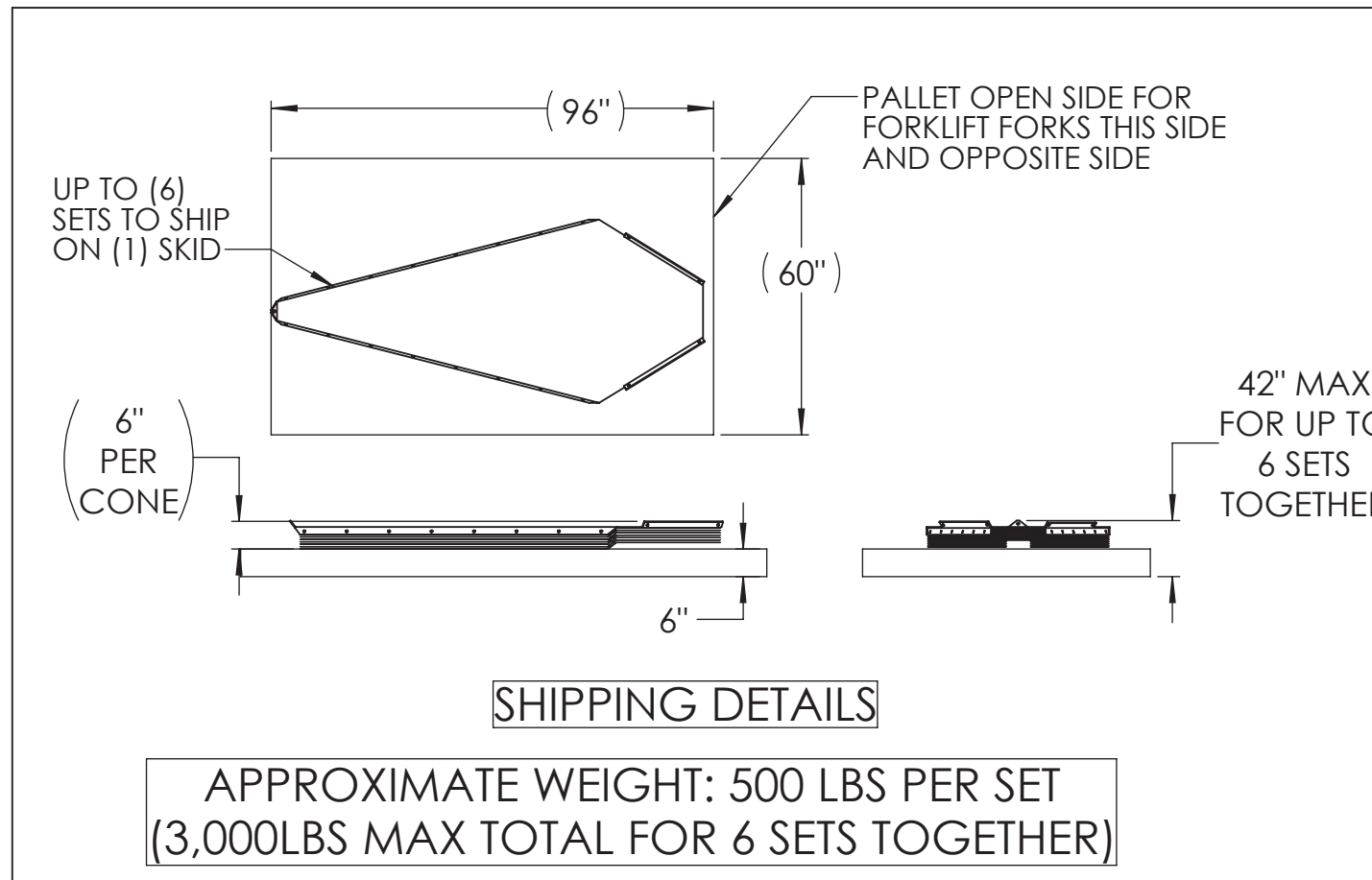
SECTION B-B
SCALE 1 : 5



CENTRE PANEL



CORNER PANEL



SHIPPING DETAILS

APPROXIMATE WEIGHT: 500 LBS PER SET
(3,000LBS MAX TOTAL FOR 6 SETS TOGETHER)

NOZZLE SCHEDULE								
MARK	DESCRIPTION	ID (")	PRESSURE (psi)	MATERIAL	TYPE	GUSSETS	GASKET	BLIND FLANGE /COVER
-	-	-	-	-	-	-	-	-
CONSTRUCTION DETAILS & REQUIREMENTS						LIFTING LUGS	-	-
CORROSION LINER			V+2M		HOLD DOWN LUGS	-	-	
RESIN	LINER	COR75	COLOR	CLEAR	POST CURE		NO	
	STRUCTURAL	COR75	COLOR	CLEAR	HYDROTEST		NO	
TOP COAT COLOUR			CLEAR		BPO/DMA (Corrosion Liner Only)		NO	

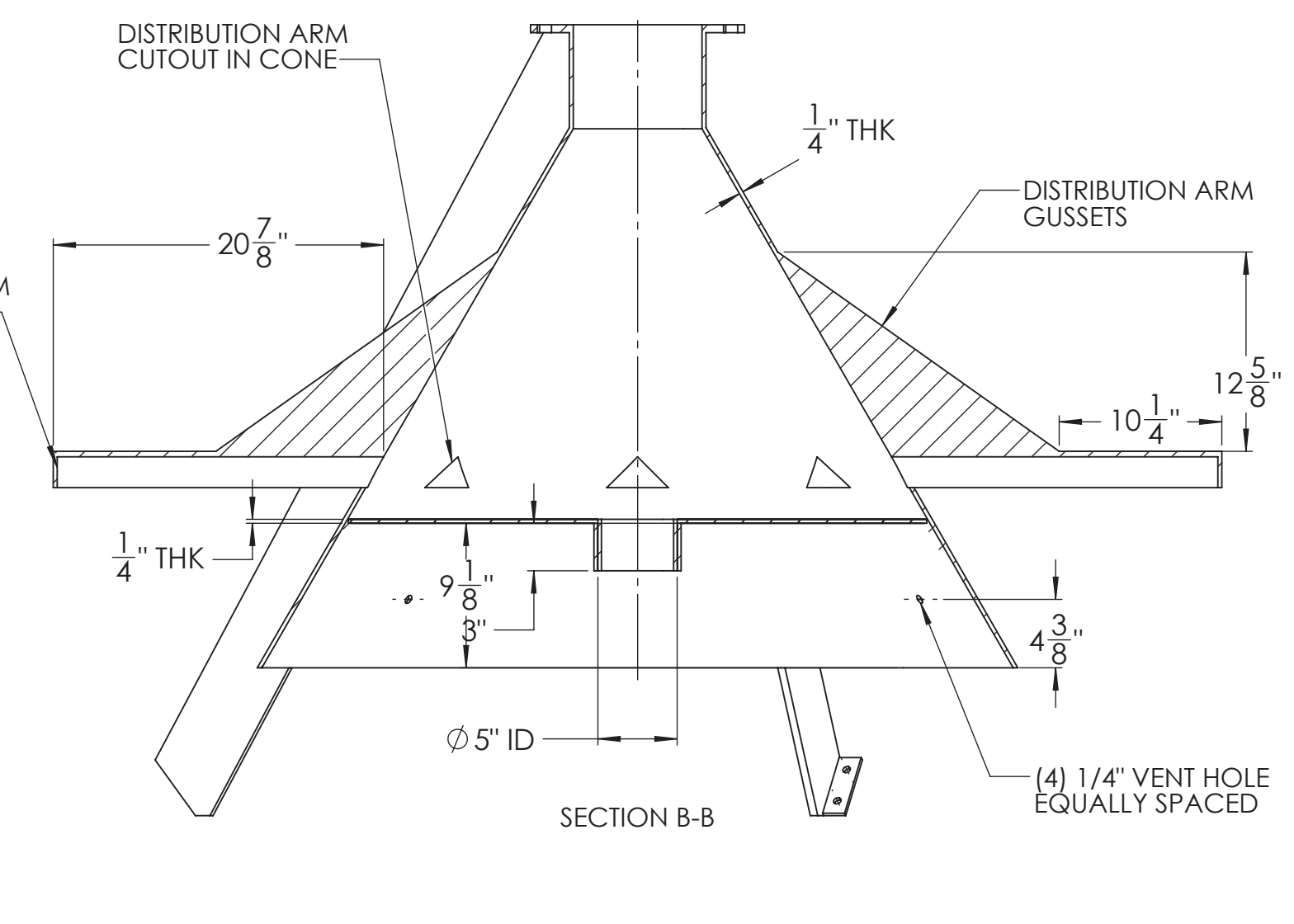
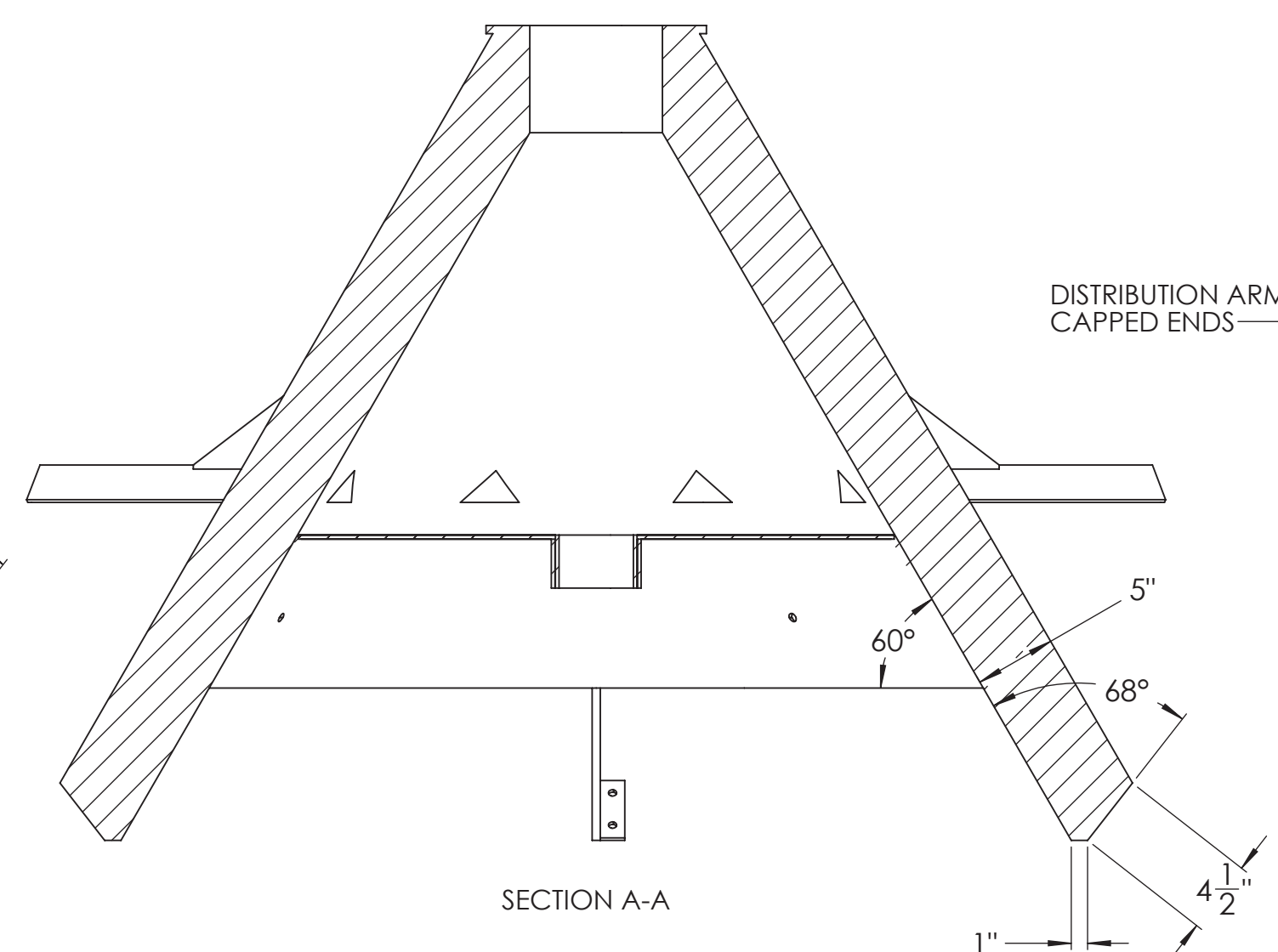
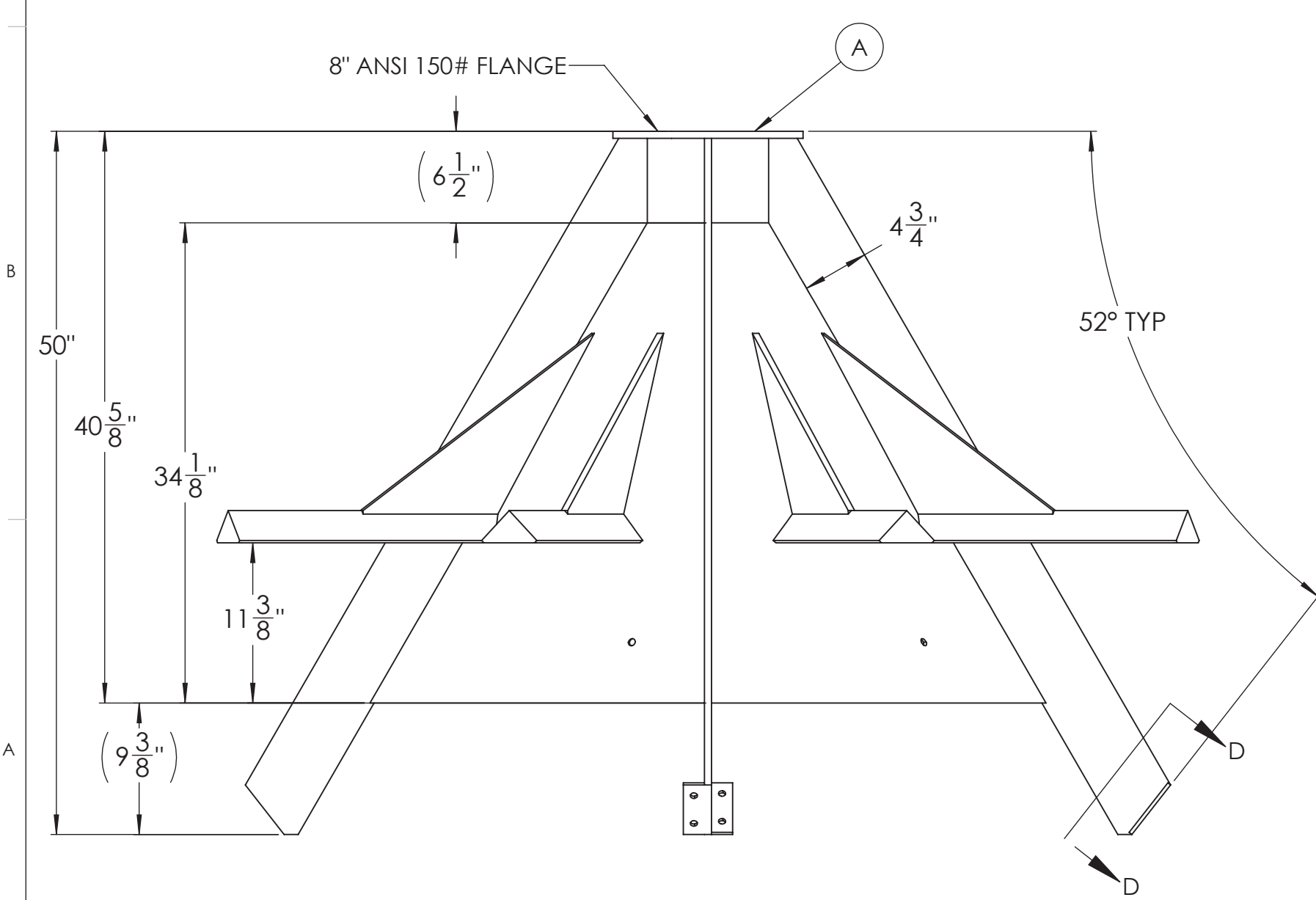
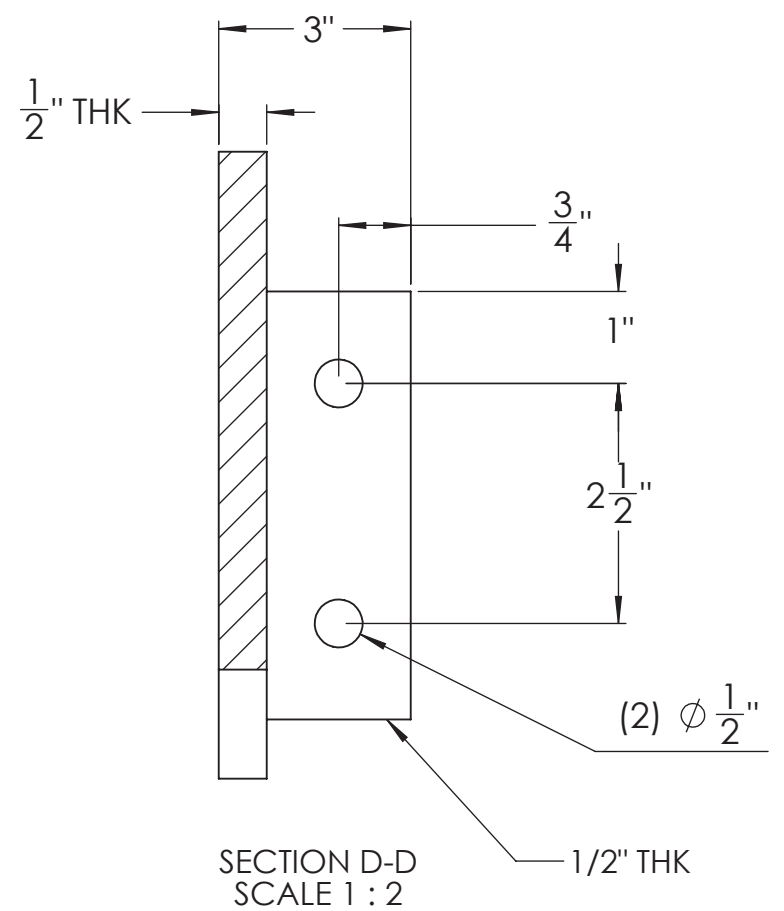
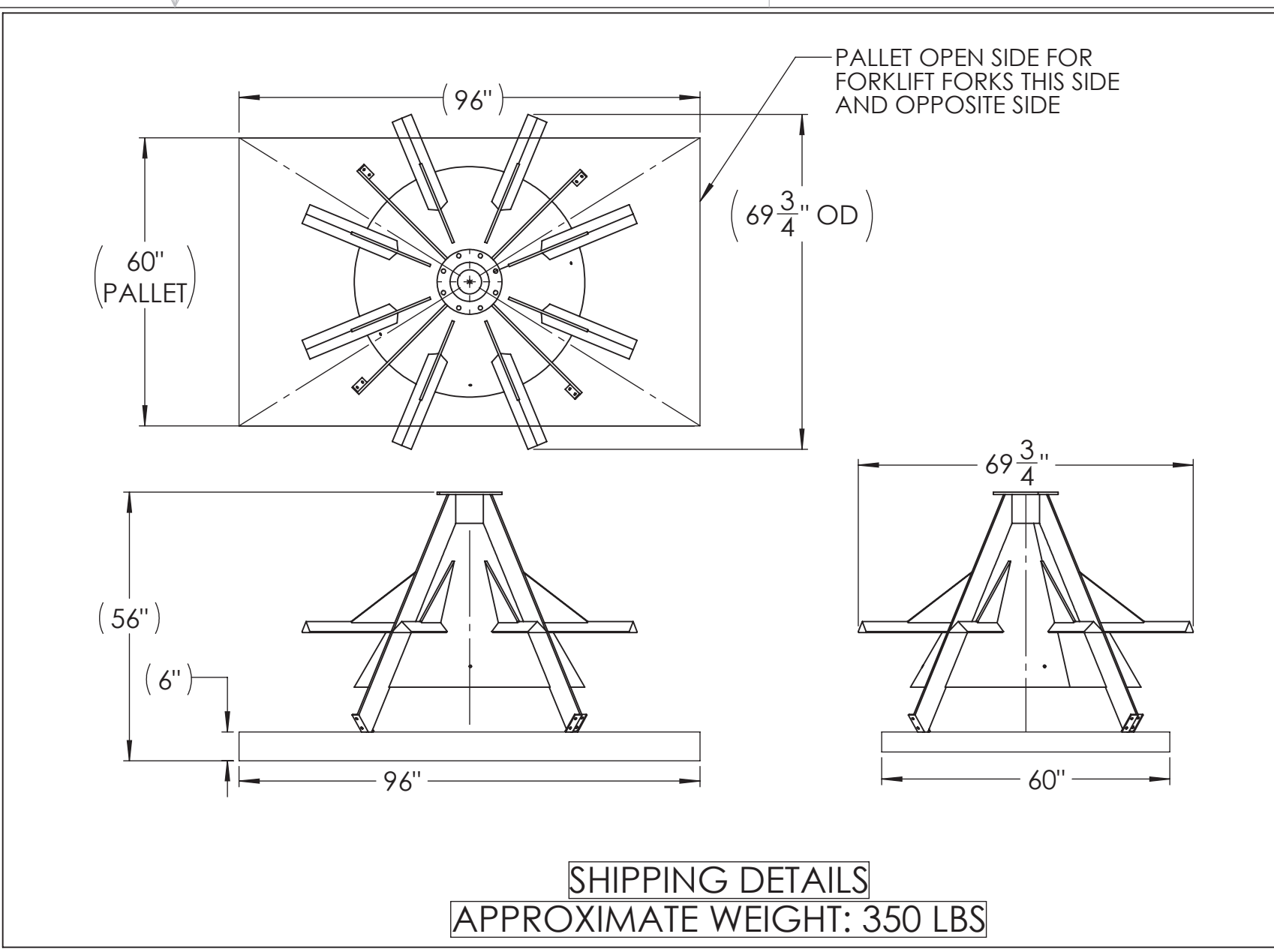
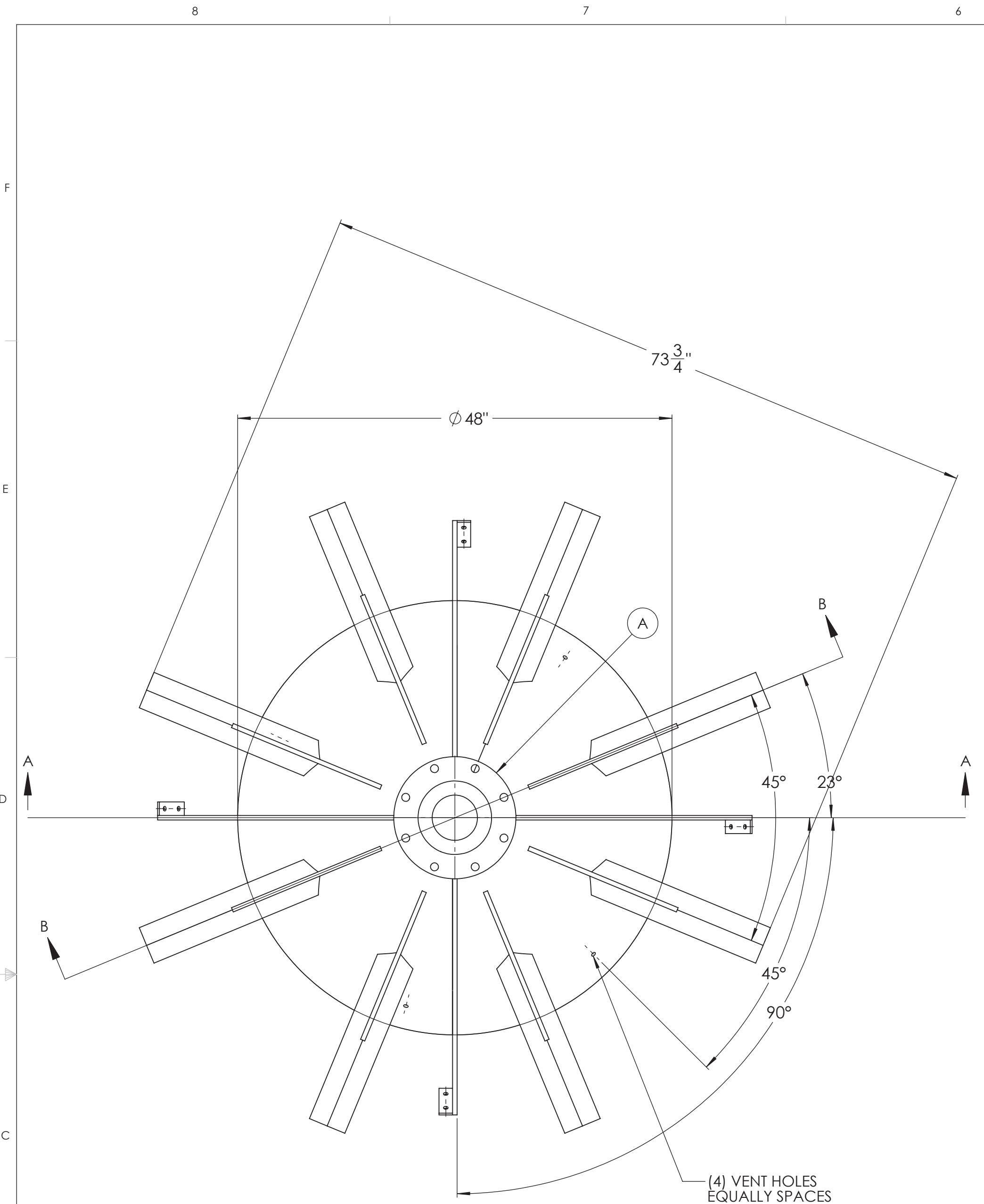
- NOTES:**
- BOLT HOLES IN DRILLED FLANGES TO STRADDLE NATURAL CENTRELINES
 - ALL BOLTING HARDWARE TO BE STAINLESS STEEL
 - DIMENSIONS IN () TO BE CRITICAL. PRODUCTION TO HOLD UNTIL QC VARIFIES
 - ALL CUT EDGES TO BE HOT COATED TO COVER EXPOSED GLASS FIBERS
 - ALL THICKNESSES SHOWN ARE STRUCTURAL AND DO NOT INCLUDE CORROSION LINER
 - ALL COUPLINGS TO BE FULL COUPLINGS, INSTALLED HALF WAY THROUGH TANK BODY UNLESS OTHERWISE SPECIFIED

- DESIGN CONDITIONS:**
- PART THICKNESS AS PER NEXOM

REVISIONS				
REV.	DESCRIPTION	DATE	BY	CHK.
0	RELEASED FOR CUSTOMER APPROVAL	2023-11-10	VBG	

UNLESS OTHERWISE SPECIFIED:		FILAMAT COMPOSITES INC. 880 RANGEVIEW RD. MISSISSAUGA ONTARIO L5E 1G9 CANADA	
DIMENSIONS ARE IN INCHES TOLERANCES: LENGTH: ±1/2" EVERY 10" INCREMENTS DIAMETER ≤ Ø 36": ±1/4", > Ø 36": ±3/4" THICKNESS: ±1/8" ANGLE: ≤ Ø 36": ±2", > Ø 36": ±4"		THE INFORMATION AND KNOW HOW ON THIS DRAWING ARE CONFIDENTIAL AND MAY NOT BE USED OR REPRODUCED WITHOUT WRITTEN PERMISSION OF FILAMAT COMPOSITES INC.	
TITLE		8FT OCTAGONAL BG CONE	
CUSTOMER:		NEXOM	
SIZE	SCALE	SHEET	
D	1:20	1 OF 1	
CUSTOMER REFERENCE DWG:	QUOTE NO.	PURCHASE ORDER NO.	WORK ORDER NO.
-	Q23-01241	238	FIL14687
DWG. NO.	23-6491-C	REV	
-	-	0	

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NOZZLE SCHEDULE							
MARK	DESCRIPTION	ID (")	PRESSURE (psi)	MATERIAL	TYPE	GUSSETS	BLIND FLANGE /COVER
A	CONNECTION	8	150	FRP	FLNG	-	-
CONSTRUCTION DETAILS & REQUIREMENTS						LIFTING LUGS	-
CORROSION LINER						HOLD DOWN LUGS	-
RESIN	LINER	COR75	COLOR	CLEAR	POST CURE		NO
	STRUCTURAL	COR75	COLOR	CLEAR	HYDROTEST		NO
TOP COAT COLOUR						BPO/DMA (Corrosion Liner Only)	NO

- NOTES:**
- BOLT HOLES IN DRILLED FLANGES TO STRADDLE NATURAL CENTRELINES
 - ALL BOLTING HARDWARE TO BE STAINLESS STEEL
 - DIMENSIONS IN () TO BE CRITICAL. PRODUCTION TO HOLD UNTIL QC VARIFIES
 - ALL CUT EDGES TO BE HOT COATED TO COVER EXPOSED GLASS FIBERS
 - ALL THICKNESSES SHOWN ARE STRUCTURAL AND DO NOT INCLUDE CORROSION LINER
 - ALL COUPLINGS TO BE FULL COUPLINGS, INSTALLED HALF WAY THROUGH TANK BODY UNLESS OTHERWISE SPECIFIED

- DESIGN CONDITIONS:**
- PART THICKNESS AS PER NEXOM DESIGN

REVISIONS				
REV.	DESCRIPTION	DATE	BY	CHK.
0	RELEASED FOR CUSTOMER APPROVAL	2023-11-10	VBG	

UNLESS OTHERWISE SPECIFIED:
 DIMENSIONS ARE IN INCHES
 TOLERANCES:
 LENGTH: ±1/2" EVERY 10" INCREMENTS
 DIAMETER ≤ Ø 36": ±1/4", > Ø 36": ±3/4"
 THICKNESS: ±1/8"
 ANGLE: ≤ Ø 36": ±2', > Ø 36": ±4'

FILAMAT COMPOSITES INC.
 880 RANGEVIEW RD.
 MISSISSAUGA ONTARIO
 L5E 1G8 CANADA

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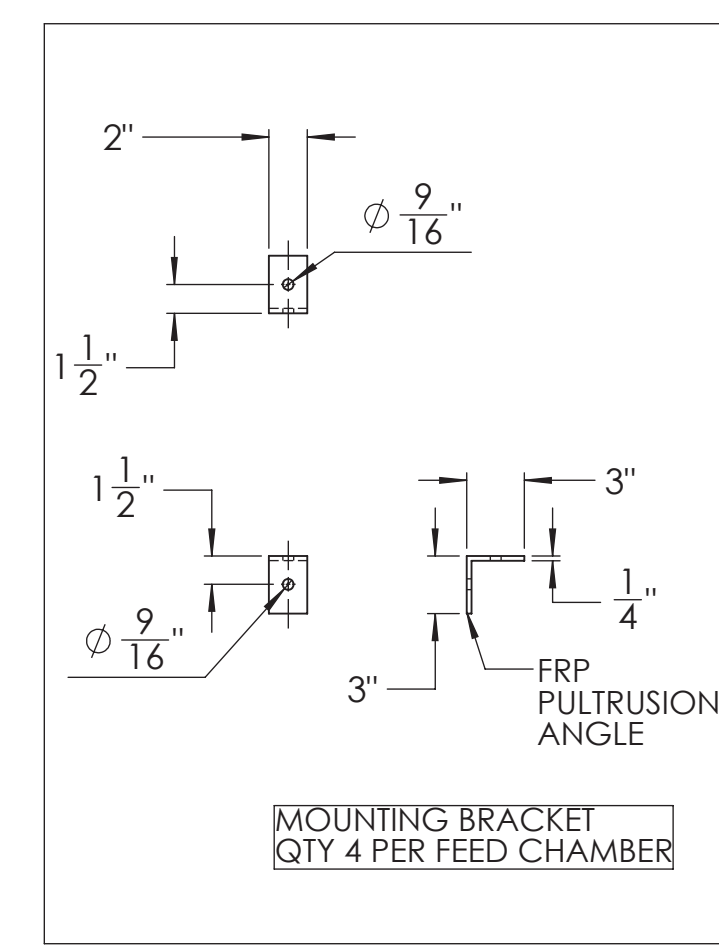
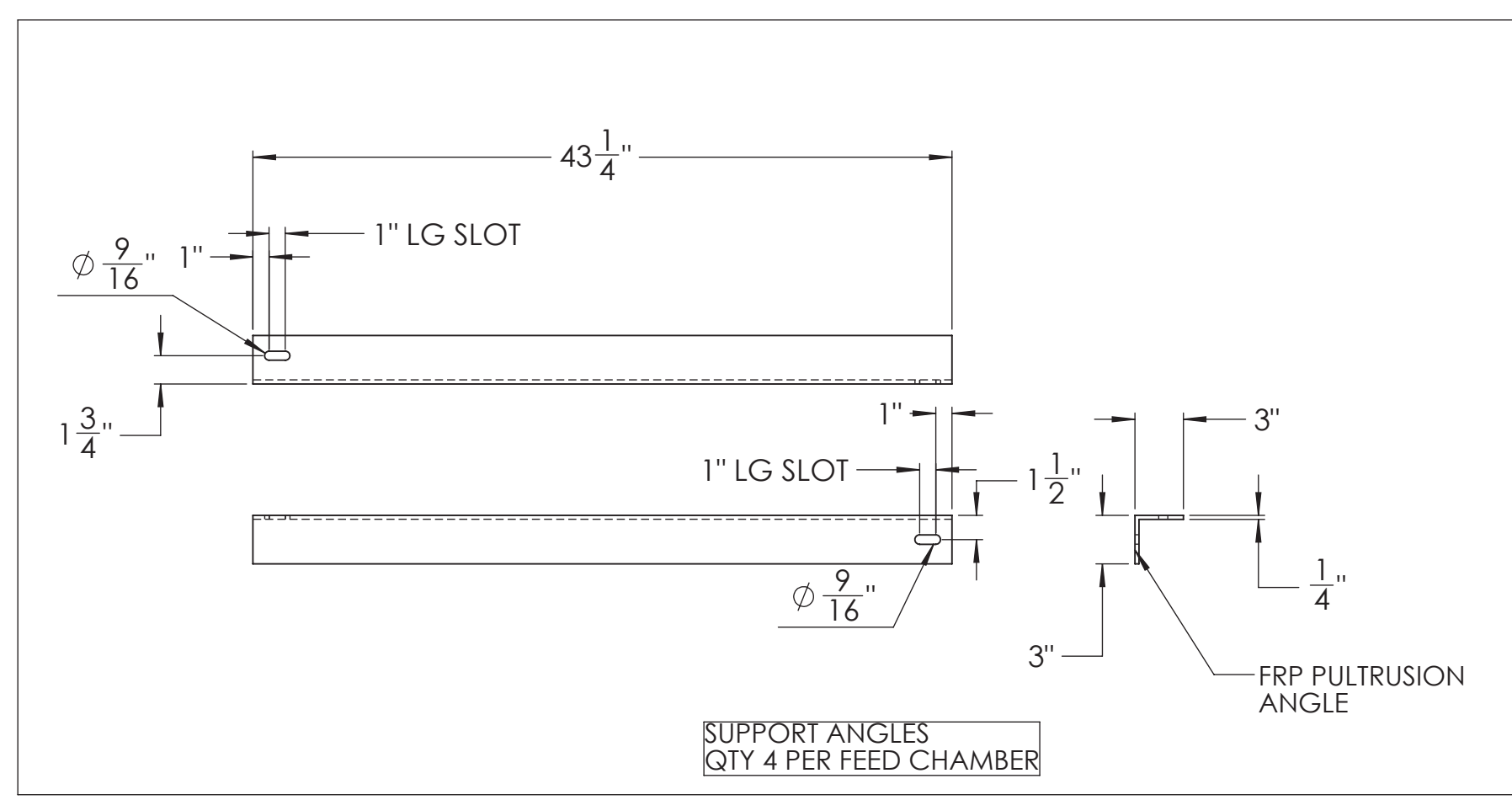
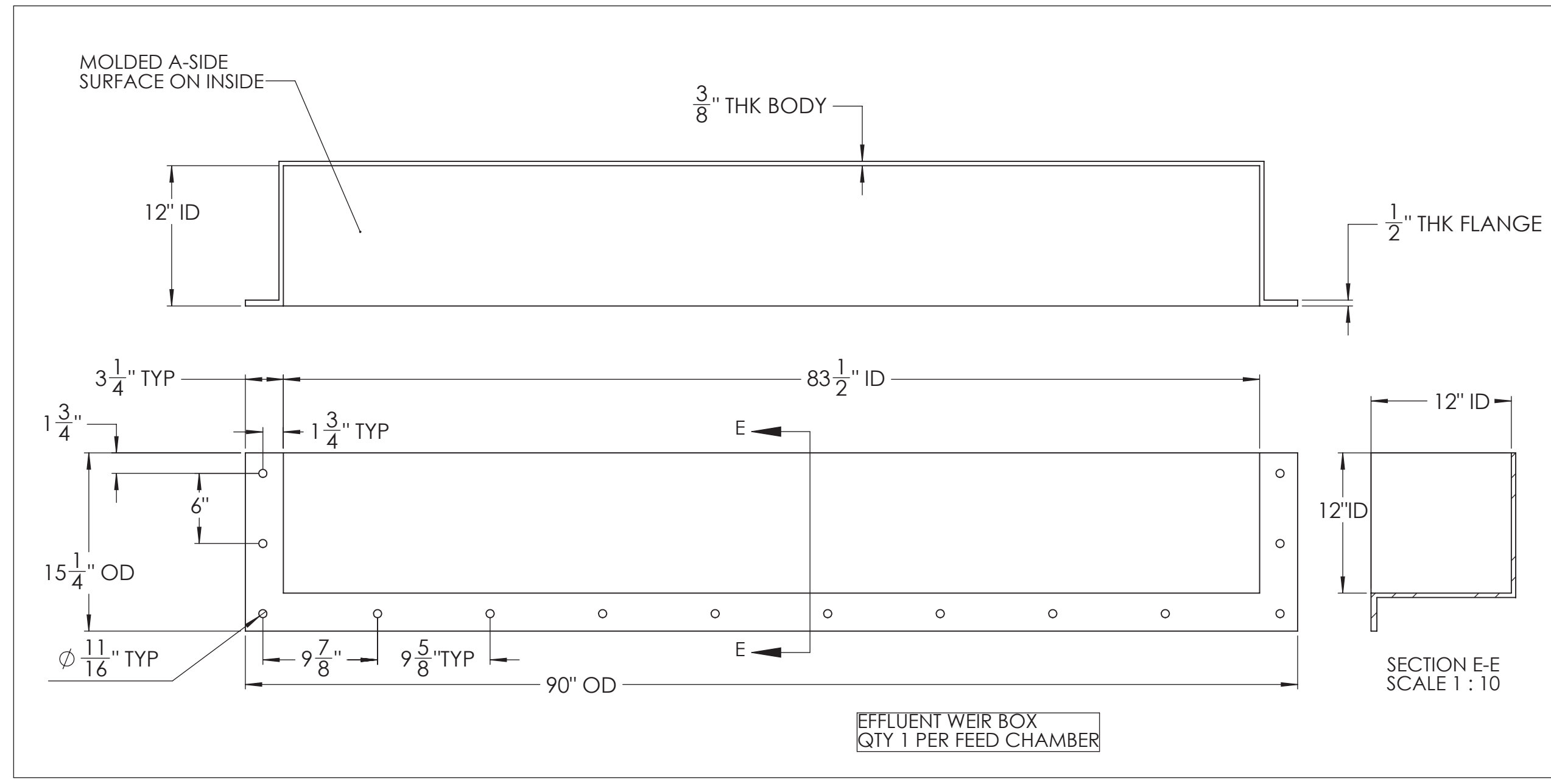
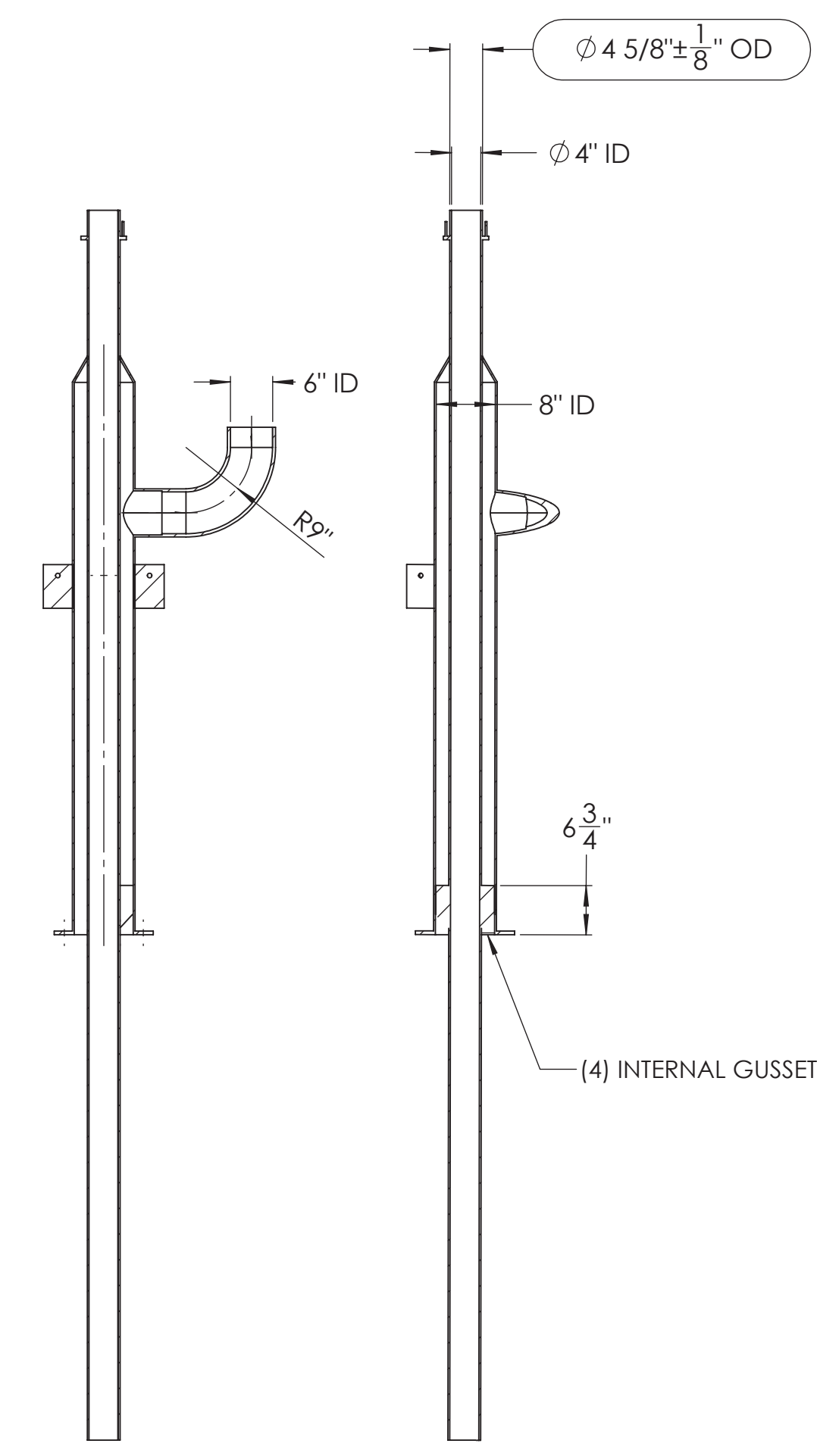
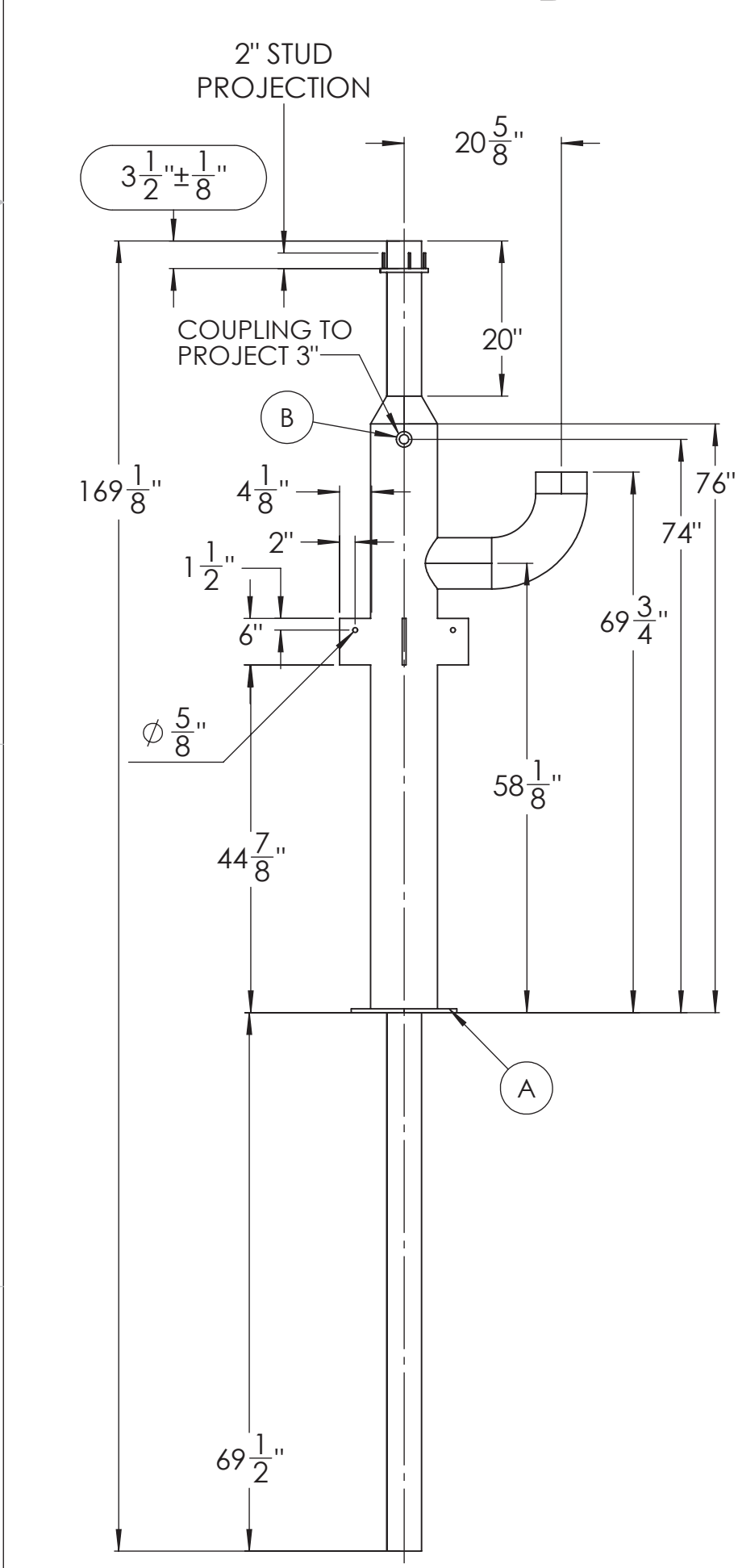
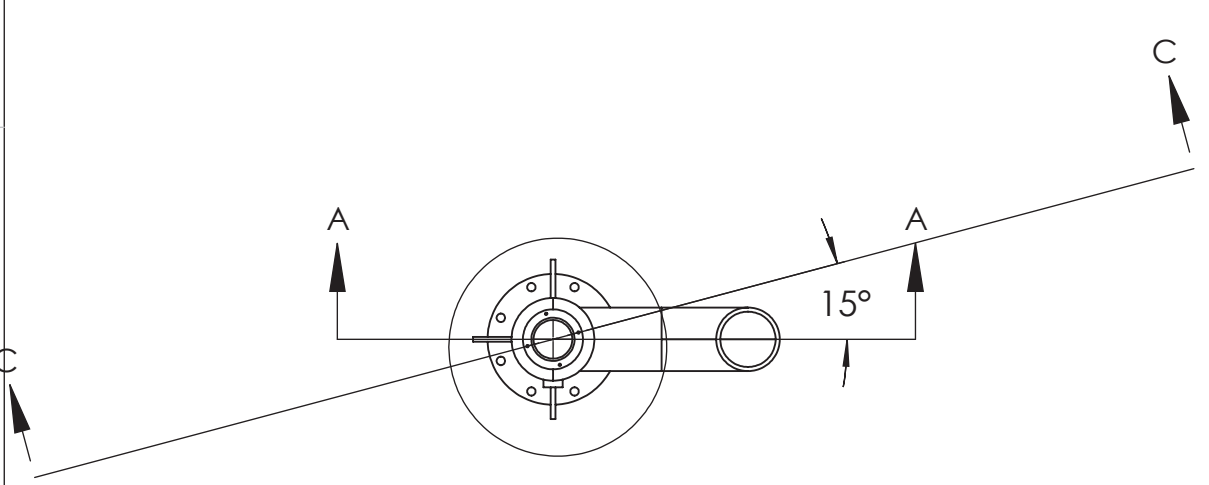
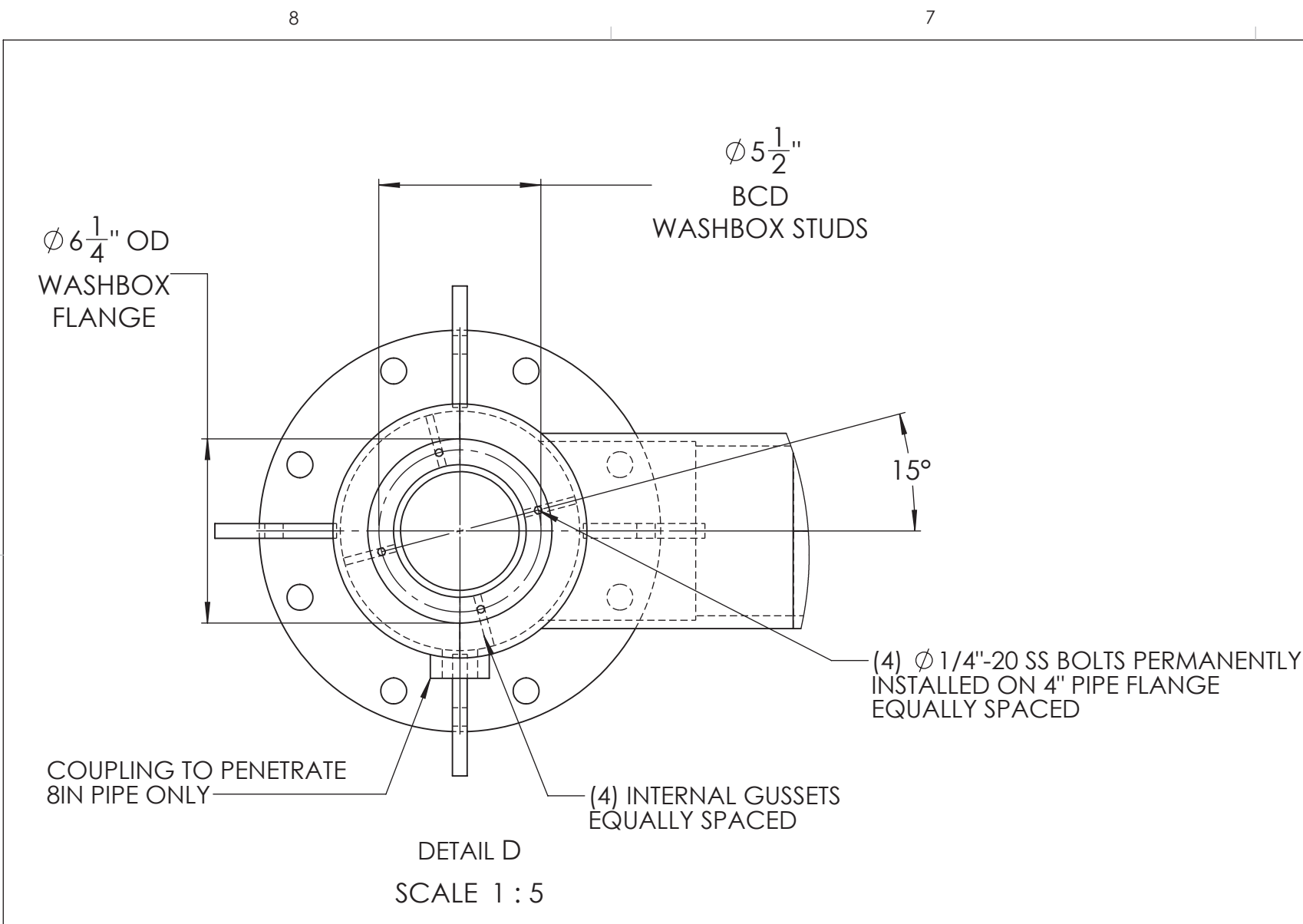
TITLE: **8FT FEED CHAMBER BASE OCTOGONAL DESIGN**

CUSTOMER: **NEXOM**

SIZE	SCALE	SHEET
D	1:10	1 OF 1

CUSTOMER REFERENCE DWG:	QUOTE NO.	PURCHASE ORDER NO.	WORK ORDER NO.	DWG. NO.	REV
-	Q23-01241	238	FIL14687	23-6492-C	0

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NOZZLE SCHEDULE									
MARK	DESCRIPTION	ID (")	PRESSURE (psf)	MATERIAL	TYPE	GUSSETS	GASKET	BLIND FLANGE /COVER	
A	CONNECTION	8	150	FRP	FLNG	-	-	-	
B	FEED CHAMBER (FNPT)	1	150	FRP	CPLG	-	-	-	
			150	FRP	FLNG	-	-	-	

CONSTRUCTION DETAILS & REQUIREMENTS						LIFTING LUGS	GASKET	BLIND FLANGE /COVER
CORROSION LINER						V+2M		
RESIN	LINER	COR75	COLOR	CLEAR	POST CURE			NO
	STRUCTURAL	COR75	COLOR	CLEAR	HYDROTEST			NO
TOP COAT COLOUR						CLEAR	BPO/DMA (Corrosion Liner Only)	NO

- NOTES:**
- BOLT HOLES IN DRILLED FLANGES TO STRADDLE NATURAL CENTRELINES
 - ALL BOLTING HARDWARE TO BE STAINLESS STEEL
 - DIMENSIONS IN \square TO BE CRITICAL. PRODUCTION TO HOLD UNTIL QC VARIFIES
 - ALL CUT EDGES TO BE HOT COATED TO COVER EXPOSED GLASS FIBERS
 - ALL THICKNESSES SHOWN ARE STRUCTURAL AND DO NOT INCLUDE CORROSION LINER
 - EFFLUENT WEIR BOX WEIGHT APPROXIMATELY 80 LBS
 - FEED CHAMBER PIPE WEIGHT APPROXIMATELY 100 LBS
 - SUPPORT ANGLES AND BRACKETS WEIGHT APPROXIMATELY 20 LBS
 - PACKAGING DIMENSIONS TO BE DETERMINED AT TIME OF SHIPPING

- DESIGN CONDITIONS:**
- AS PER NEXOM DESIGN

REVISIONS				
REV.	DESCRIPTION	DATE	BY	CHK.
0	RELEASED FOR CUSTOMER APPROVAL	2023-11-10	VBG	

UNLESS OTHERWISE SPECIFIED:
 DIMENSIONS ARE IN INCHES
 TOLERANCES:
 LENGTH: $\pm 1/2$ " EVERY 10" INCREMENTS
 DIAMETER: $\leq \phi 36$: $\pm 1/4$ ", $> \phi 36$: $\pm 3/4$ "
 THICKNESS: $\pm 1/8$ "
 ANGLE: $\leq \phi 36$: ± 2 ", $> \phi 36$: ± 4 "

FILAMAT COMPOSITES INC.
 880 RANGEVIEW RD.
 MISSISSAUGA ONTARIO
 L5E 1G8 CANADA

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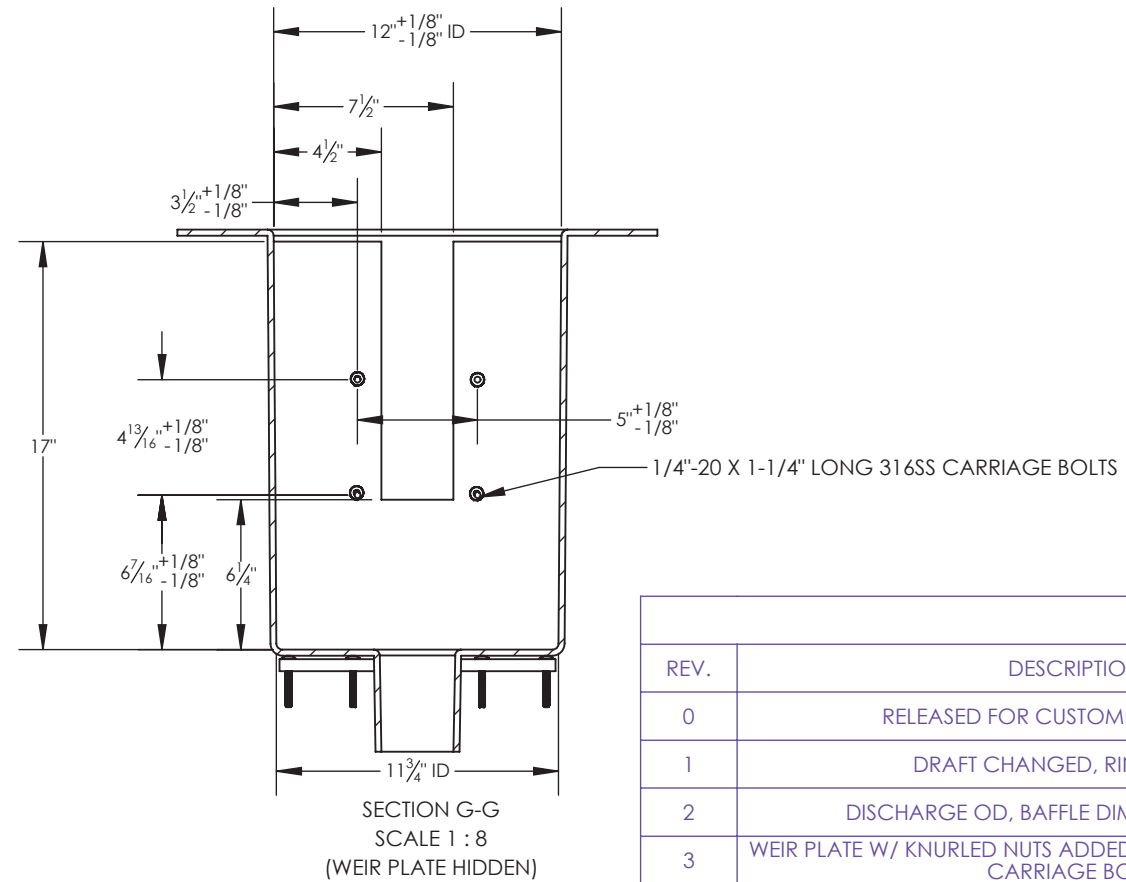
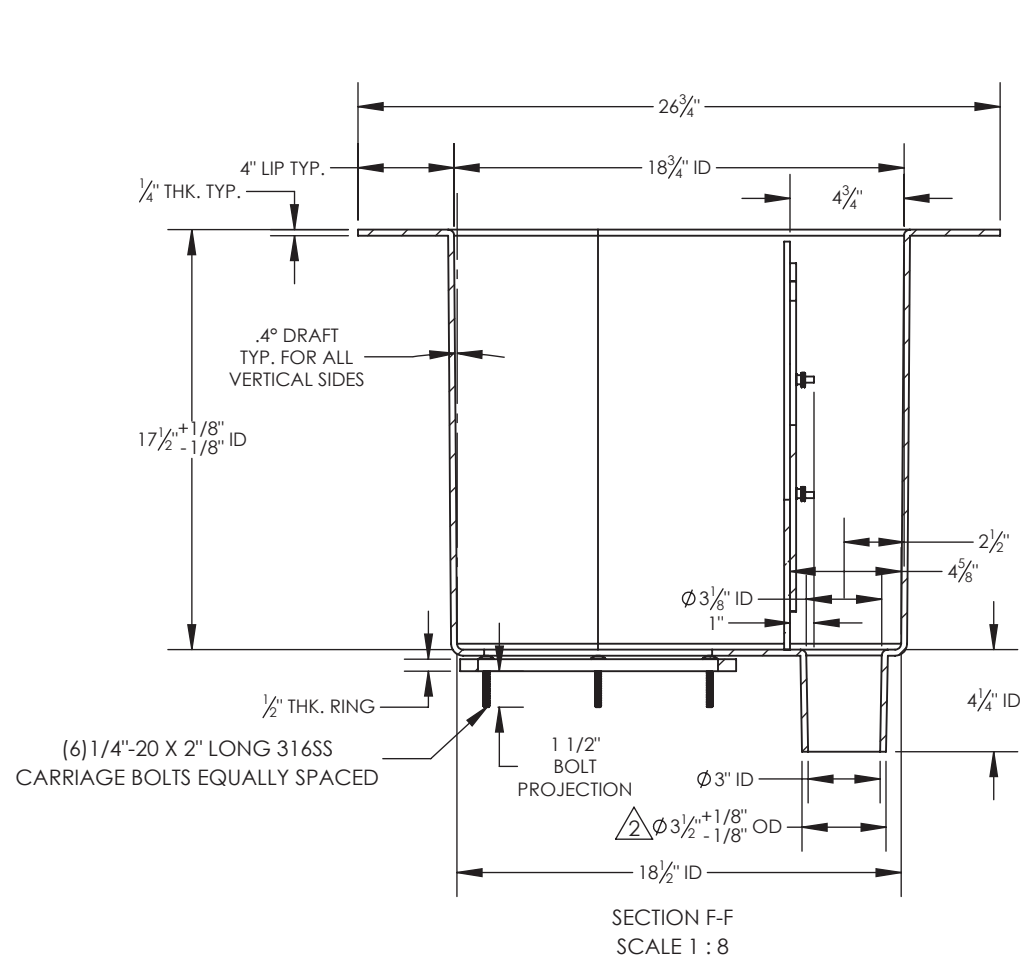
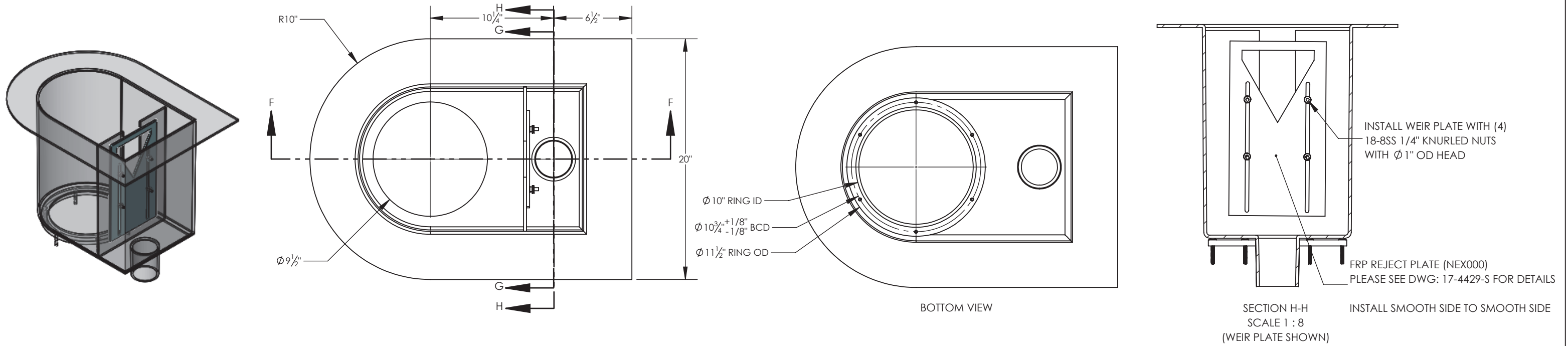
TITLE
CUSTOM TANK

CUSTOMER:
NEXOM

SIZE	SCALE	SHEET
D	1:20	1 OF 1

CUSTOMER REFERENCE DWG:	QUOTE NO.	PURCHASE ORDER NO.	WORK ORDER NO.	DWG. NO.	REV
-	Q23-01241	238	FIL14687	23-6493 -C	0

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REVISIONS				
REV.	DESCRIPTION	DATE	BY	CHK
0	RELEASED FOR CUSTOMER APPROVAL	8/11/2017	VBG	AL
1	DRAFT CHANGED, RING ADDED	8/16/2017	VBG	PM
2	DISCHARGE OD, BAFFLE DIMENSIONS ADDED	8/31/2017	VBG	PM
3	WEIR PLATE W/ KNURLED NUTS ADDED AND CHANGED STUDS TO CARRIAGE BOLTS	1/19/2018	TL	VBG
4	ADDED APPROXIMATE WEIGHT IN NOTES	9/28/2022	PM	VBG
5	KNURLED NUTS UPDATED AS PER NEXOM, BOLT LENGTH UPDATED	2023-10-27	VBG	PM

NOTES:

1. RESIN TO BE SAME AS TANK CORROSION LINER - USE SAME RESIN THROUGHOUT
2. THICKNESS TO BE 1/4" THROUGHOUT
3. WEIGHT TO BE APPROXIMATELY 30 LBS

	UNLESS OTHERWISE SPECIFIED UNITS ARE IN: INCHES		DWG. TITLE:		
	TOLERANCES:		12" WASHBOX (04902)		
	DIAMETER:	(+) 1/4" (-) 1/4"	SIZE	PAGE TITLE:	
	THICKNESS:	(+) 1/8" (-) 1/8"			
LENGTH:	(+) 1/4" (-) 1/4"	B			
		SCALE: 1:14	SHEET: 1 OF 1	DWG #: 17-3951-C	REV. 5

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Filter Ancillaries

Revision 00

This Document Contains:

- Airlift Drawing – S00C.09
- Tortuous Path Drawing- S00D.09
- Deflector Cap Drawing -S00D.04
- Air Lance Drawing – S00F.04
- Reject Plug – S00F.01
- Bed Turnover Rods – S00F.03
- Filter Drain Assembly Drawing – S00E.10

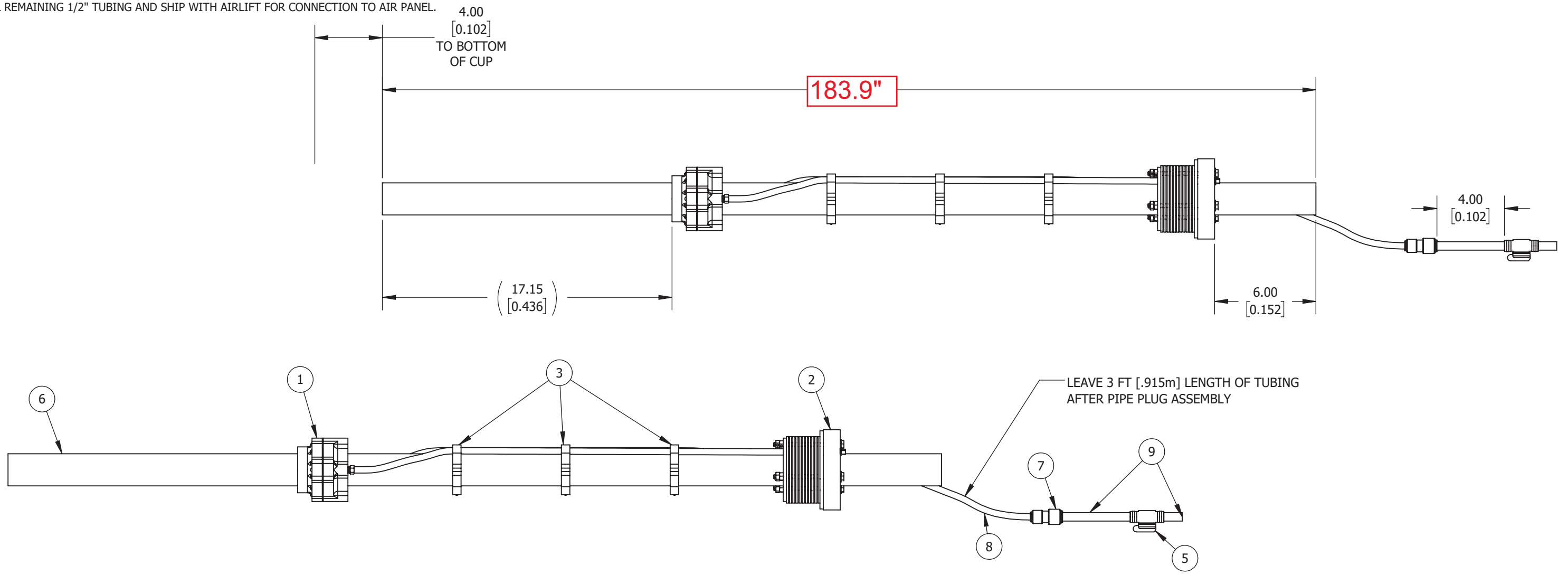
Equipment Data			
Item	Installed	Loose Contractor Install	Loose Nexom Install
Airlift		X	
Tortuous Path		X	
Deflector Cap		X	
Air Lance			
Reject Plug			
Bed Turnover Rods			
Filter Drain Assembly	X		

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NOTES:

- ASSEMBLE AS SHOWN.
 - SAND MATING SURFACES OF UPPER/LOWER AIR INJECTION CHAMBER BODIES.
 - CUT 18" [.457m] LENGTH FROM END OF A FULL STICK OF PIPE.
 - WELD THE 18" [.457m] LENGTH TO THE LOWER AIR INJECTION CHAMBER BODY.
 - WELD THE REMAINING PIPE LENGTH TO THE UPPER AIR INJECTION CHAMBER BODY.
 - ASSEMBLY UPPER/LOWER AIR INJECTION CHAMBER WITH GASKET, AIRLIFT SCREEN, AND AIRLIFT SCREEN SUPPORT.
 - INSTALL ADAPTER(S) IN AIR INJECTION CHAMBER.
 - TRIM AIRLIFT TO FINAL OVERALL LENGTH (OAL).
 - INSTALL CENTERING RINGS, COMPRESSION PALTE, AND COMPRESSION PLUG ON UPPER LENGTH OF AIRLIFT.
 - LOCATE AND WELD PIPE PLUG CAP IN PLACE.
 - FASTEN PIPE PLUG ASSEMBLY COMPONENTS AND INSTALL ADAPTER(S).
 - EVENLY SPACE CENTERING RINGS.
 - ADD TUBING RUNS AND REMAINING FITTINGS. SECURE CENTERING RINGS.
 - TEST PER QA/QC PROCEDURES.
- USE ANTI SEIZE ON ALL STAINLESS TO STAINLESS FASTENERS.
- SCRAP EXCESS PIPE.
- COIL REMAINING 1/2" TUBING AND SHIP WITH AIRLIFT FOR CONNECTION TO AIR PANEL.

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	S00C.06	Airlift Air Injection Assembly, 1.5", HDPE	1
2	S00C.07	Airlift Pipe Plug Assembly, 1.5", HDPE	1
3	S00C.08	Airlift Centering Ring Assembly, 1.5" Airlift, HDPE	3
5	JGT PISV0416S	1/2" VALVE SHUT OFF, INSERT X INSERT	1
6	PIPE 0150DR11HDPE	Pipe, 1.5", HPDE, DR11, Black	20' [6.10m]
7	MCM 51055K99	Push-to-Connect Fitting for Drinking Water Straight Reducer, for 1/2" x 3/8" Tube OD	1
8	MCM 5648K26	Firm Polyurethane Tubing for Air and Water 1/4" ID, 3/8" OD, Opaque	60' [18.30m]
9	MCM 5648K33	Firm Polyurethane Tubing for Air and Water 21/64" ID, 1/2" OD, Opaque	40.5' [12.35m]



REVISIONS			
REV.	DESCRIPTION	ENGINEER	DATE
04	NEW DUAL DIMENSIONS	MS	2021-03-24
05	ADDED DUAL DIMENSIONS TO NOTES	MS	2021-03-25
06	ADDED SHUT OFF VALVE	MS	2021-05-17

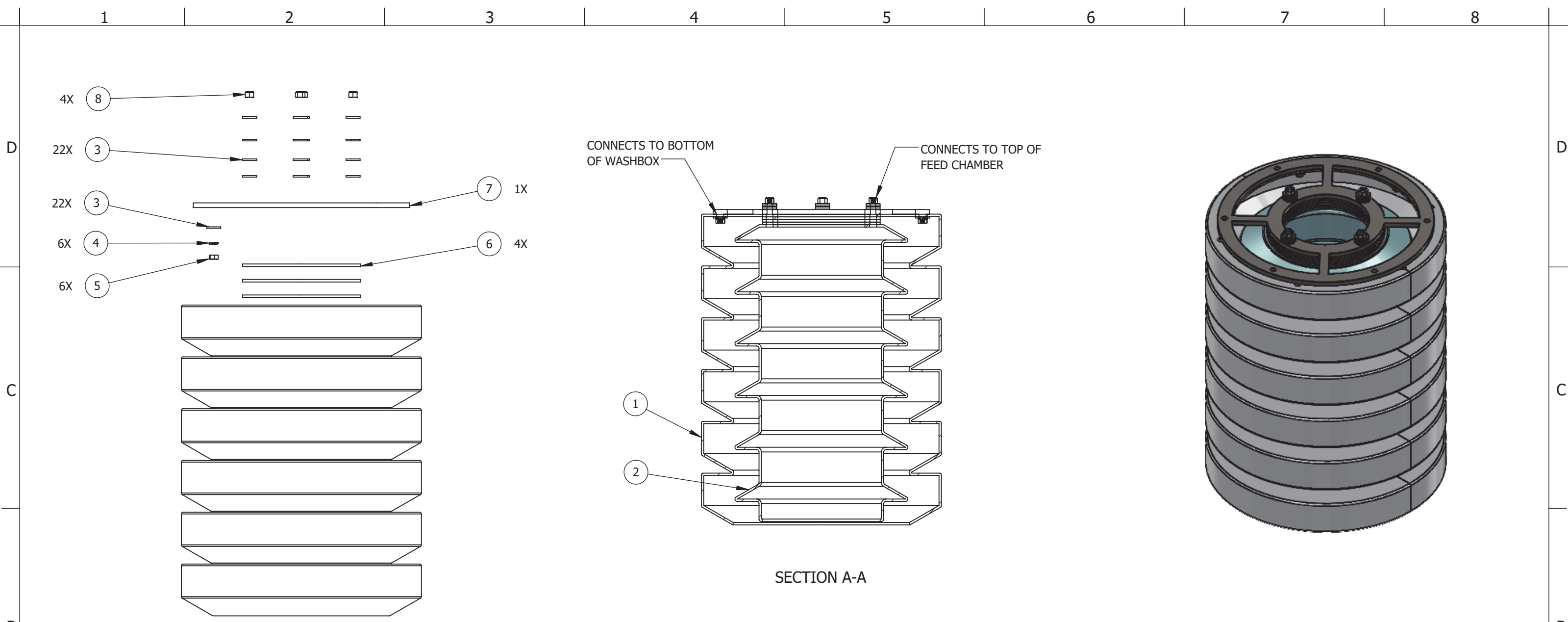
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 DIMENSIONS ARE IN INCHES [m]
 TOLERANCES:
 00.0 OR X/X ± .125" [N/A]
 00.00 ± .05" [.01m]
 00.000 ± N/A [.001m]
 00.0° ± 2.0° [2.0°]
 THIRD ANGLE PROJECTION

LOCATION: ID Std. Drawings		SCALE 1:6	
DESCRIPTION: Airlift Assembly, 1.5", Standard, HDPE			
AUTH.	MS, 2021-05-17	CHKD.	N/A, 2021-05-17
NUMBER: S00C.09		REV. 06	PAGE 1/8

TEMPLATE LAST MODIFIED: 08.05.19

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CONNECTS TO BOTTOM OF WASHBOX

CONNECTS TO TOP OF FEED CHAMBER

SECTION A-A

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	S00D.008	12-6 Tortuous Path, Outer Sub-Assembly, Rotomold	1
2	S00D.009	12-6 Tortuous Path, Inner Sub-Assembly, Rotomold	1
3	MCM 93852A102	USS Washer 304 Stainless Steel, 1/4" Screw Size, 0.312" ID, 0.75" OD	1
4	MCM 92146A029	304 Stainless Steel Split Lock Washer for 1/4" Screw Size, 0.26" ID, 0.487" OD	1
5	MCM 91845A029	304 Stainless Steel Hex Nut 1/4"-20 Thread Size	6
6	4247-TP Spacer	304 Stainless Steel Custom Spacer, .14" Thick	6
7	4147 Washbox Mount	304SS Custom Washbox Mount Ring, 1/4" Thick	1
8	MCM 91831A029	304 Stainless Steel NyLock Nut, 1/4"-20 Thread Size	4

- NOTES:
- SUB-ASSEMBLIES TO BE FIELD FIT/ADJUSTED AS SHOWN
 - OUTER SUB-ASSEMBLY FASTENS TO WASHBOX
 - INNER SUB-ASSEMBLY FASTENS TO FEED CHAMBER
 - PARTS TO BE BAGGED AND LABELED FOR INSTALLATION IN THE FIELD
 - USE ANTI-SEIZE ON ALL FASTENERS



REVISIONS			
REV.	DESCRIPTION	ENGINEER	DATE
01	INITIAL RELEASE	MS	2020-12-21
02	NEW DUAL DIMENSIONS	MS	2021-03-24
03	Updated for New Washbox Design	LBP	10/1/2021

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DIMENSIONS ARE IN INCHES [m]

TOLERANCES:

00.0 OR X/X ± .125" [N/A]

00.00 ± .05" [.01m]

00.000 ± N/A [.001m]

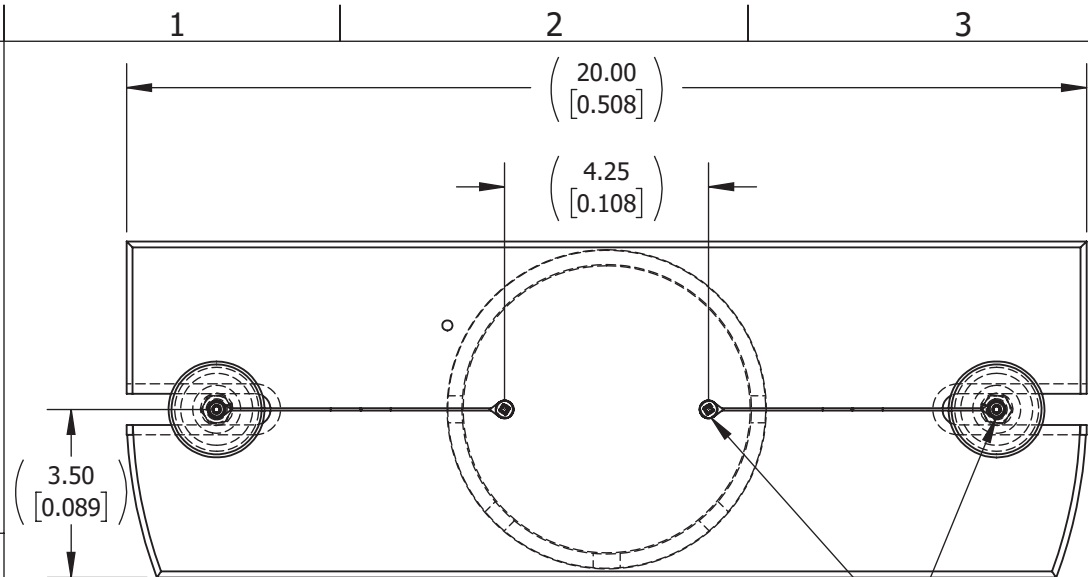
00.0° ± 2.0° [2.0°]

THIRD ANGLE PROJECTION

LOCATION: Nexom Assemblies		SCALE 1:5	
DESCRIPTION: Tortuous Path Assembly, 12-6, Rotomold			
AUTH.	MS, 2021-03-24	CHKD.	N/A, 2021-03-24
NUMBER: S00D.09		REV. 03	PAGE 1/1

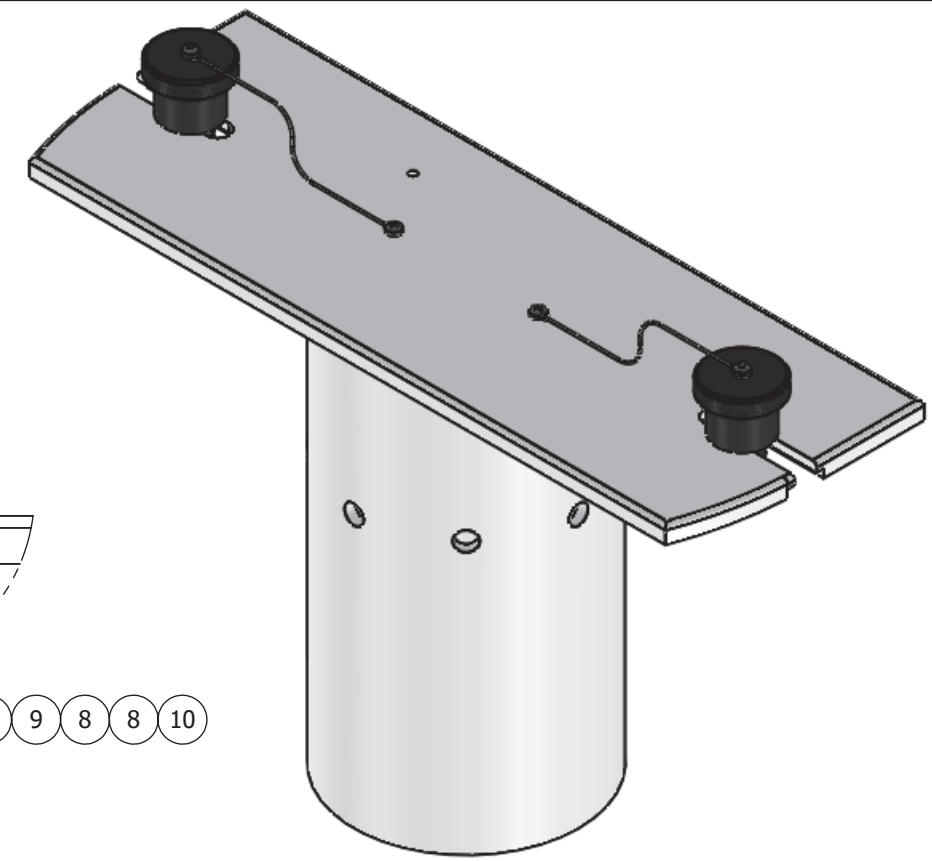
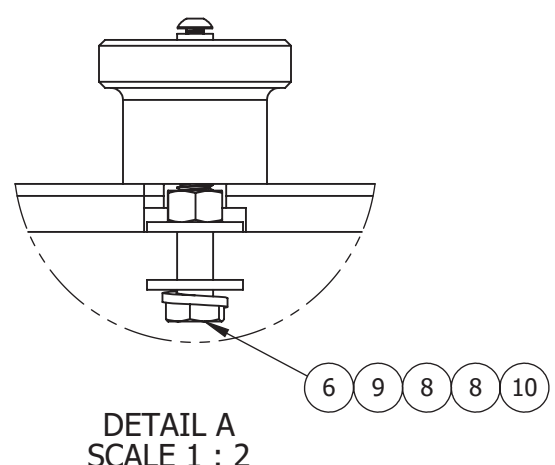
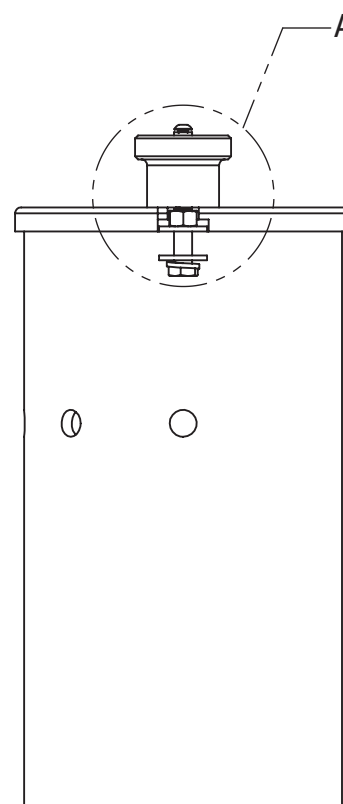
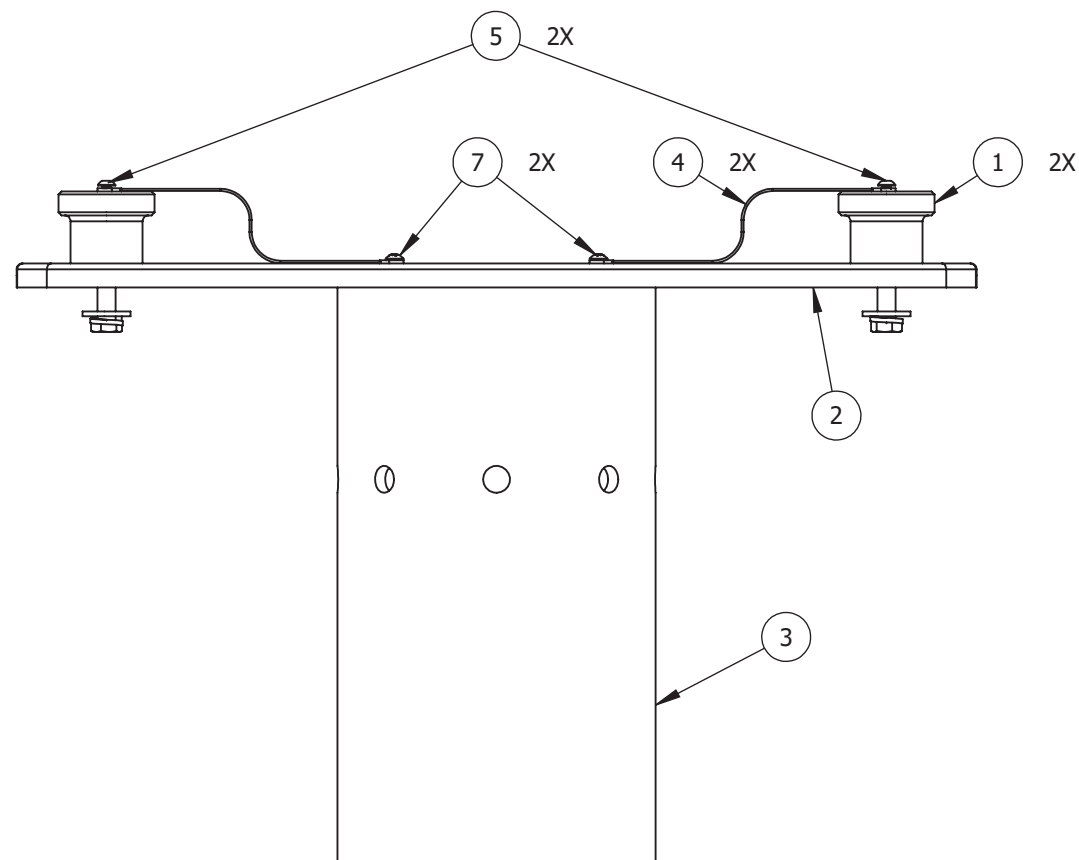
TEMPLATE LAST MODIFIED: 08.05.19

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ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	S00D.002	Knob, Deflector Cap, PVC, Dark Grey	2
2	S00D.003	Deflector Cap Top Plate, 12" Washbox	1
3	S00D.03	Deflector Cap Chamber, 11" & 12" Washbox	1
4	MCM 30345T565	304 Stainless Steel Lanyard - Not for Lifting Eye-to-Eye, 3/64" Rope Diameter, 8" Long, Nylon	2
5	MCM 92949A265	304 Stainless Steel Button Head Hex Drive Screw 10-32 Thread Size, 1/2" Long	2
6	MCM 92198A630	304 Stainless Steel Hex Head Screw 3/8"-16 Thread Size, 1-3/4" Long, Partially Threaded	2
7	MCM 92470A244	Phillips Rounded Head Screws for Sheet Metal 304 Stainless Steel, Number 10 Size, 5/8" Long	2
8	MCM 93852A104	USS Washer 304 Stainless Steel, 3/8" Screw Size, 0.438" ID, 1" OD	4
9	MCM 92146A031	304 Stainless Steel Split Lock Washer for 3/8" Screw Size, 0.385" ID, 0.68" OD	2
10	MCM 91845A031	304 Stainless Steel Hex Nut 3/8"-16 Thread Size	2

LEAVE SCREWS LOOSE
TYP



- NOTES:
- ADHERE TOP CAP (2) TO PIPE (3) USING PRIMER AND PVC CEMENT.
 - ORIENT PART (2) AS SHOWN. ORIENTATION IS CRITICAL.
 - ENSURE PART (3) IS PERPENDICULAR TO PART (2)
 - USE ANTI-SEIZE ON ALL FASTENERS.



REVISIONS			
REV.	DESCRIPTION	ENGINEER	DATE
05	NO CHANGES	MS	2021-03-24
06	ADDED DUAL DIMENSIONS	MS	2021-03-24
07	NEW DUAL DIMENSIONS	MS	2021-03-24

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DIMENSIONS ARE IN INCHES [m]
TOLERANCES:
00.0 OR X/X ± .125" [N/A]
00.00 ± .05" [.01m]
00.000 ± N/A [.001m]
00.0° ± 2.0° [2.0°]
THIRD ANGLE PROJECTION

LOCATION: Nexom Assemblies		SCALE 1:4	
DESCRIPTION: Deflector Cap Assy for 12" Washbox			
AUTH.	MS, 2021-03-24	CHKD.	N/A, 2021-03-24
NUMBER: S00D.04		REV. 07	PAGE 1/1

TEMPLATE LAST MODIFIED: 08.05.19

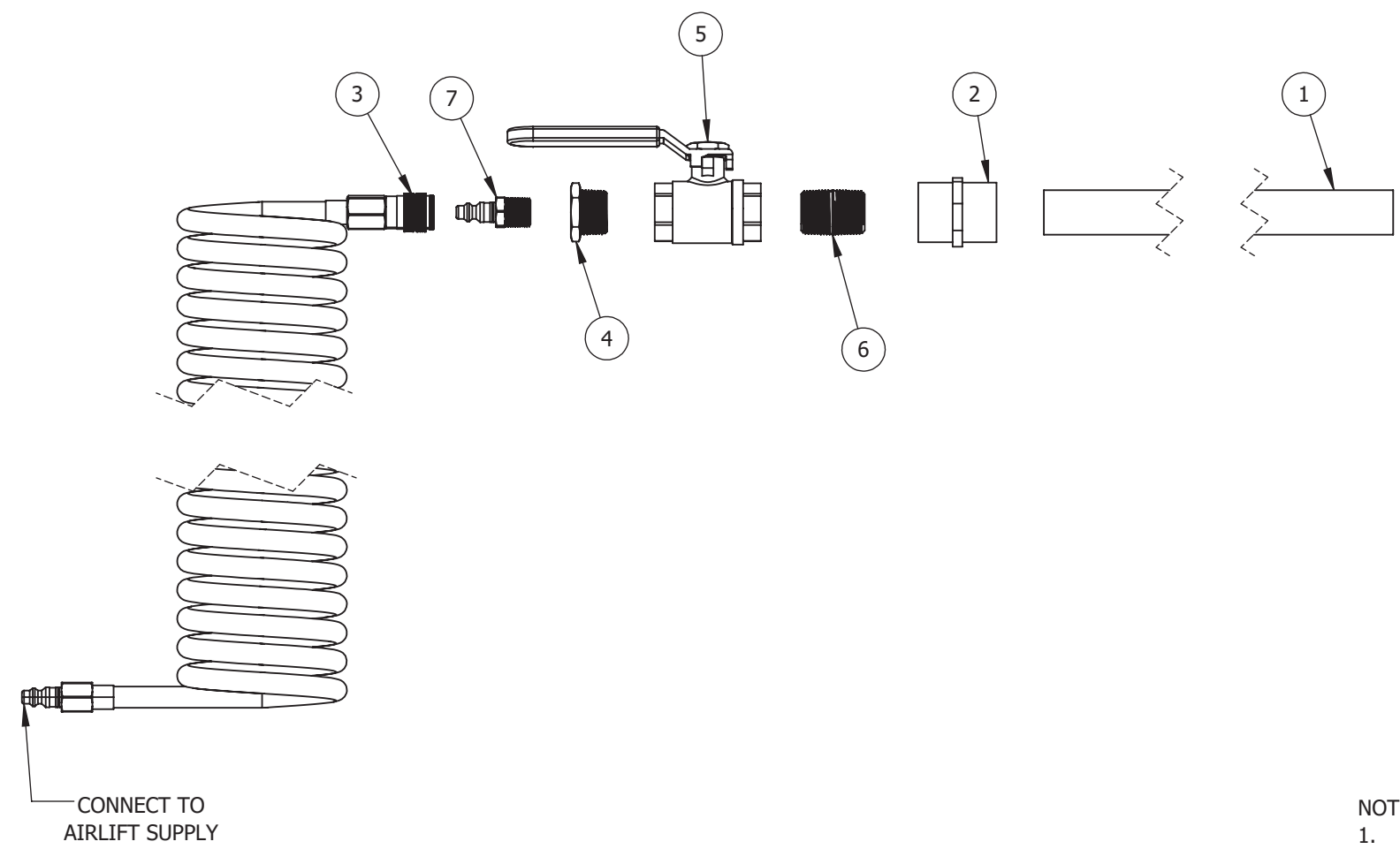
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ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	PIPE 0075S80PVC	Pipe, 3/4", PVC, SCH80	20 FT [6.10m]
2	SPR 835-007	3/4" Adapter, Socket X FNPT, PVC, SCH80	1
3	MCM 5138K14	Air Hose Brass 1/4 Industrial Quick-Disconnect Socket x Steel 1/4 Plug, 200 PSI	1
4	MCM 2725K58	Low-Pressure Brass Pipe Fitting with Sealant Bushing Adapter, 3/4 NPT Male x 3/8 NPT Female	1
5	MCM 47865K24	Brass On/Off Valve with Lever Handle, 3/4 NPT Female	1
6	MCM 4568K199	Standard-Wall Brass Pipe Nipple Threaded on Both Ends, 3/4 NPT, 1-1/2" Long	1
7	MCM 1077T18	Brass Industrial Quick-Disconnect Hose Coupling for Air Plug, 1/4 Coupling Size, 3/8 NPTF Male	1

C

B

A



NOTES:

1. USE TEFLON TAPE/PASTE ON ALL NPT CONNECTIONS
2. USE PVC PRIMER AND CEMENT FOR ALL SLIP CONNECTIONS
3. FIELD TRIM AIRLANCE AS REQUIRED. AIRLANCE SHOULD BE ABLE TO REACH THE BOTTOM OF THE FILTER CONE
4. 100 PSI SUPPLY PRESSURE RECOMMENDED



REVISIONS			
REV.	DESCRIPTION	ENGINEER	DATE
01	Initial review.	MS	2021-01-07
02	INITIAL RELEASE	MS	2021-01-07
03	NEW DUAL DIMENSIONS	MS	2021-03-24

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UNLESS OTHERWISE SPECIFIED
 DIMENSIONS ARE IN INCHES [m]
 TOLERANCES:
 00.0 OR X/X ± .125" [N/A]
 00.00 ± .05" [.01m]
 00.000 ± N/A [.001m]
 00.0° ± 2.0° [2.0°]
 THIRD ANGLE PROJECTION

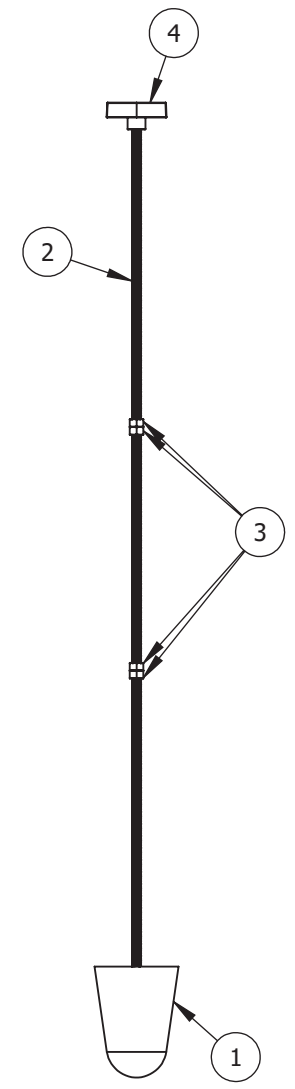
LOCATION: Nexom Assemblies		SCALE 1:4	
DESCRIPTION: Air Lance Kit, 3/4" Sch. 80 PVC			
AUTH.	MS, 2021-03-24	CHKD.	N/A, 2021-03-24
NUMBER: S00F.04		REV. 03	PAGE 1/1

TEMPLATE LAST MODIFIED: 08.05.19

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ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	GBI 2114	Ultra-Drain Plug, 3"	1
2	MCM 98847A031	304 Stainless Steel Threaded Rod 3/8"-16 Thread Size, 3 Feet Long	1
3	MCM 91845A031	304 Stainless Steel Hex Nut 3/8"-16 Thread Size	4
4	MCM 65035K63	Two Arm Knob Polypropylene, 3/8"-16 Threaded Hole, 2-1/2" Wide Head	1

NOTES:
 1. USE ANTI-SEIZE ON ALL FASTENERS
 2. ASSEMBLE AS SHOWN



REVISIONS			
REV.	DESCRIPTION	ENGINEER	DATE
01	INITIAL RELEASE	MS	2021-02-17

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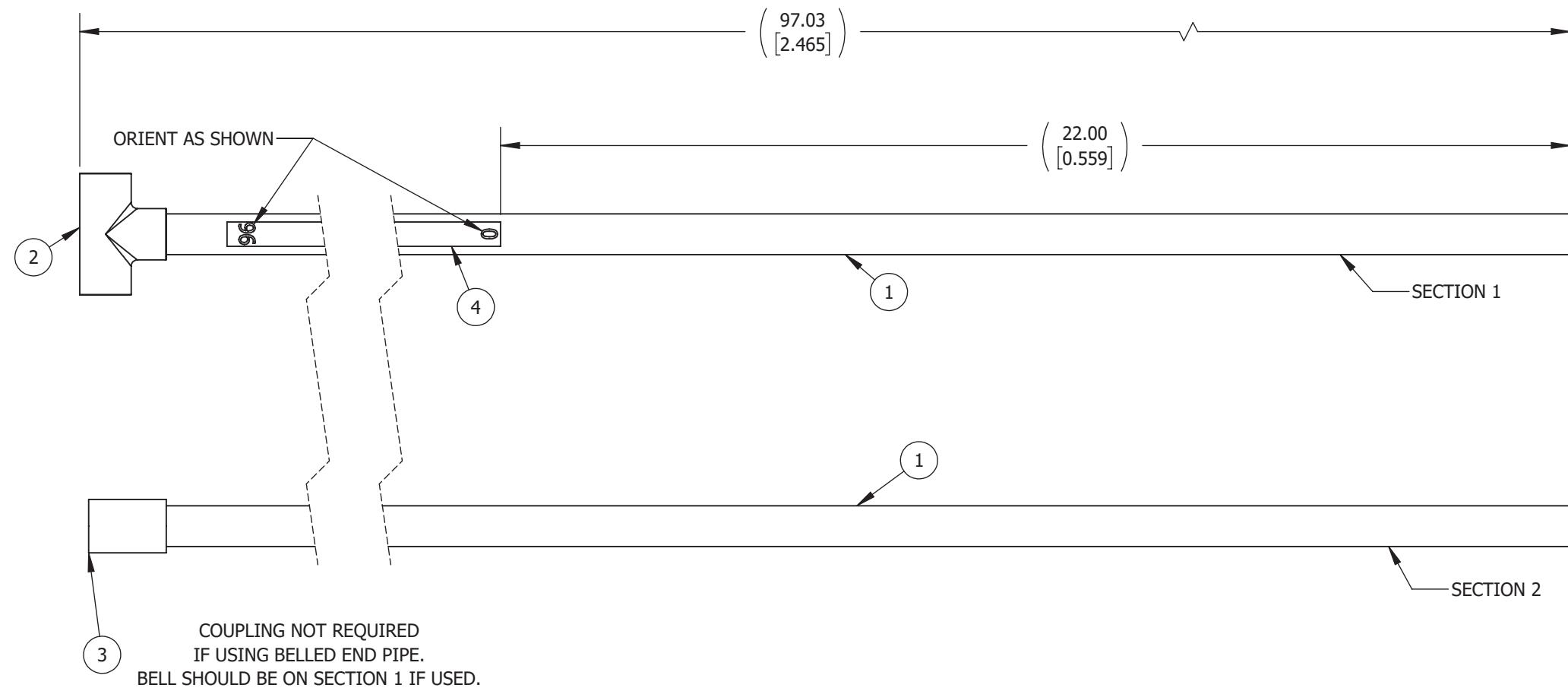
UNLESS OTHERWISE SPECIFIED
 DIMENSIONS ARE IN INCHES
 TOLERANCES:
 FRACTIONAL ± 1/16"
 ONE DECIMAL ± .125"
 TWO DECIMAL ± .0625"
 ANGULAR ± 2.0°
 THIRD ANGLE PROJECTION

LOCATION: Nexom Assemblies		SCALE 1:8	
DESCRIPTION: Reject Measurement Plug, 3"			
AUTH.	MS, 2021-02-17	CHKD.	N/A, 2021-02-17
NUMBER: S00F.01		REV. 01	PAGE 1/1

TEMPLATE LAST MODIFIED: 08.05.19

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ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	PIPE 0050S40PVC	Pipe, 0.5", PVC, SCH40	16 FT [4.90m]
2	SPR 401-005	1/2" Tee, Socket X Socket X Socket, PVC, SCH40	1
3	SPR 429-005	1/2" Coupling, Socket X Socket, PVC, SCH40	1
4	MCM 19395A23	Adhesive-Back Plastic Vertical Ruler Reads Bottom to Top, 6' Length, 16ths Graduation Marks, 1/2" Width	1



- NOTES:
- BREAK ALL SHARP EDGES, CORNERS, AND BURRS
 - USE PVC PRIMER AND CEMENT FOR ALL SLIP CONNECTIONS
 - SHIP SECTION 1 & 2 LOOSE



REVISIONS			
REV.	DESCRIPTION	ENGINEER	DATE
01	INITIAL RELEASE	MS	2021-01-07
02	NEW DUAL DIMENSIONS	MS	2021-03-24

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 TOLERANCES:
 00.0 OR X/X ± .125" [N/A]
 00.00 ± .05" [.01m]
 00.000 ± N/A [.001m]
 00.0° ± 2.0° [2.0°]
 THIRD ANGLE PROJECTION

LOCATION: Nexom Assemblies		SCALE 1:3	
DESCRIPTION: 8' Bed Turn Over Rod			
AUTH.	MS, 2021-03-24	CHKD.	N/A, 2021-03-24
NUMBER: S00F.03		REV. 02	PAGE 1/1

TEMPLATE LAST MODIFIED: 08.05.19

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Air Control Panel(s)

Revision 00

This Document Contains:

- Air Control Panel Drawings
- Air Control Panel Cutsheets

Air Control Panel Data	
Power Supply (from Control Panel)	24 VDC
Rating	NEMA Type 4X
Enclosure Size	36" x 30" x 12"
Contractor Installed	Yes

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J14280-R2	2
CP3630 DATASHEET	14
CSD363012SS DATASHEET	15
FlowMeter_KingDataSheet_7530	18
MDL-2-R FUSES DATASHEET	19
PK7GTA DATASHEET	21
SMC ISE35 PressureSwitch DATASHEET	23
SMC KQ2 Fittings	27
SMC Shuttlevalve VR1220F-11 DATASHEET	29
SMC-SY7000Series	31
Wika_PressureGauges_PM23X_53	33
700-HLT12 DATASHEET	41
800FP PUSH BUTTONS DATASHEET	45
800FP-SELECTOR SWITCH DATASHEET	55
1489-M1C100 DATASHEET	65
1492-H4 DATASHEET	77
1492-J3 DATASHEET	78
1492-JG3 DATASHEET	79
1492-SPM DATASHEET	80
2080-LC10 DATASHEET	93
2080-LCD DATASHEET	109
AB 1606-XLB90E DATASHEET	117
AB-800FP PILOT LIGHTS	119
APM-PROC-APO DATASHEET	128
CMFKSS DATASHEET	131

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NEXOM FILTER SYSTEM AIR CONTROL PANEL ABERDEEN, ID

AUGUST 2023
REVISION: 2

SH	FILENAME	DWGDESC
1	J14280-01	ELECTRICAL WIRING
2	J14280-02	AIRLIFT 1 ELECTRICAL
3	J14280-03	AIRLIFT 2 ELECTRICAL
4	J14280-04	AIRLIFT 3 ELECTRICAL
5	J14280-05	AIRLIFT 4 ELECTRICAL
6	J14280-06	AIRLIFT 5 ELECTRICAL
7	J14280-07	PNEUMATIC CIRCUIT
8	J14280-08	PNEUMATIC CIRCUIT (CONTINUED)
9	J14280-09	ENCLOSURE LAYOUT
10	J14280-10	SUBPANEL LAYOUT
11	J14280-11	BILL OF MATERIAL

DEFINITIONS

	WIRE GAP (WIRE NOT CONNECTED)
	TIE POINT (WIRE CONNECTED)
	FIELD WIRING
	TERMINAL - PRIMARY PANEL
	TERMINAL - SECONDARY PANEL
	TERMINAL - TERTIARY PANEL
	TERMINAL - QUATERNARY PANEL
1-23	NORMALLY OPEN CROSS REFERENCE
<u>1-23</u>	NORMALLY CLOSED CROSS REFERENCE

SOURCE/DESTINATION REFERENCING

	VOLTAGE/TYPE
	WIRE BELOW
	WIRE RIGHT
	WIRE LEFT
	WIRE ABOVE

CONTROL CABINET INTERIOR WIRE DETAILS: (UNLESS OTHERWISE NOTED IN SCHEMATICS)

3-PHASE POWER		
PHASE A (1)	BLACK	#14AWG MINIMUM MTW/THHN
PHASE B (2)	BLACK	#14AWG MINIMUM MTW/THHN
PHASE C (3)	BLACK	#14AWG MINIMUM MTW/THHN
SINGLE PHASE CONTROL		
CONTROL	RED	#16AWG MINIMUM MTW/THHN
NEUTRAL	WHT	#16AWG MINIMUM MTW/THHN
FOREIGN VOLTAGE		
ALL	ORANGE	#16AWG MINIMUM MTW/THHN
DC POWER & CONTROL		
24VDC	BLUE	#16AWG MINIMUM MTW/THHN
0V (UNGROUNDING)	BLUE	#16AWG MINIMUM MTW/THHN
0V (GROUNDING)	WHITE WITH BLUE STRIPE	#16AWG MINIMUM MTW/THHN
GROUND	GREEN WITH YELLOW STRIPE	#14AWG MINIMUM MTW/THHN

WIRE LABEL TYPE: BRADY THT-95-498-5

- NOTES:**
- COLORED ELECTRICAL TAPE OR SHRINK TUBING SHALL BE WRAPPED OVER THE INSULATION ON THE ENDS OF EACH CONDUCTOR THAT DOES NOT COMPLY TO THE COLOR SCHEME ABOVE
 - GROUND WIRES MUST BE CONTINUOUS COLOR FROM END TO END
 - VFD OUTPUT WIRES MUST BE MTW OR XLPE TYPE - DO NOT USE THHN AT VFD MOTOR OUTPUTS

PREPARED FOR:



NEXOM FILTER SYSTEM
AIR CONTROL PANEL
ABERDEEN, ID

CHG#	DATE	BY	REVISIONS
1	02AUG23	EK	INFLUENT VALVES ADDED
2	10AUG23	EK	5 HOA SWITCHES ADDED

TITLE:	ELECTRICAL COVER SHEET
SCALE	NTS
DATE	03 AUG 2023
DRN BY	EK
CHKD BY	BW
DRAWING NUMBER	J14280-R2
SHEET NO.	00F 0

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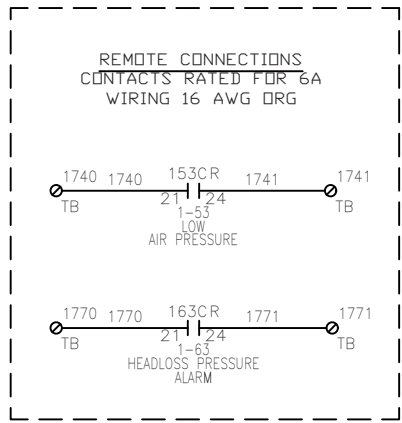
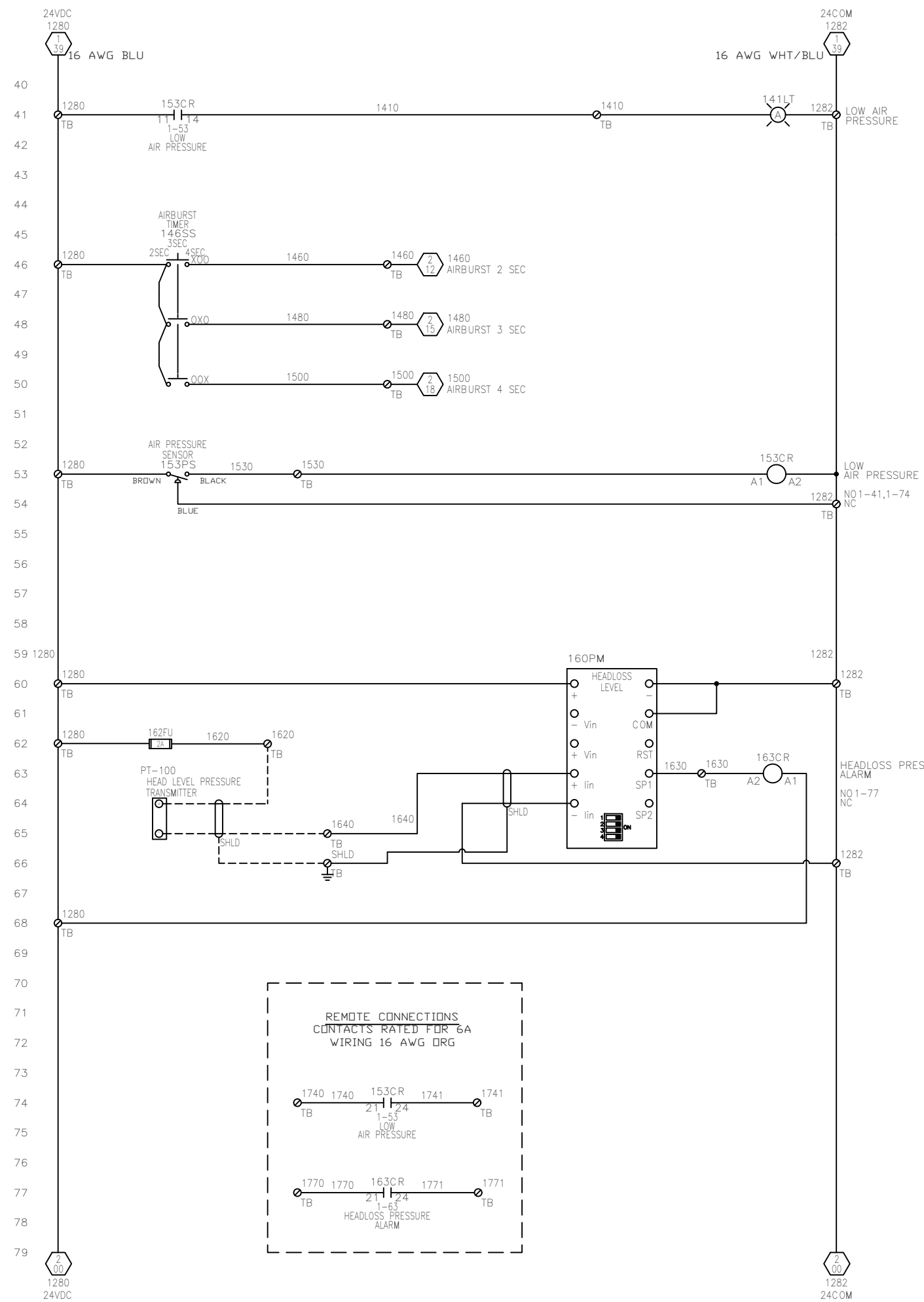
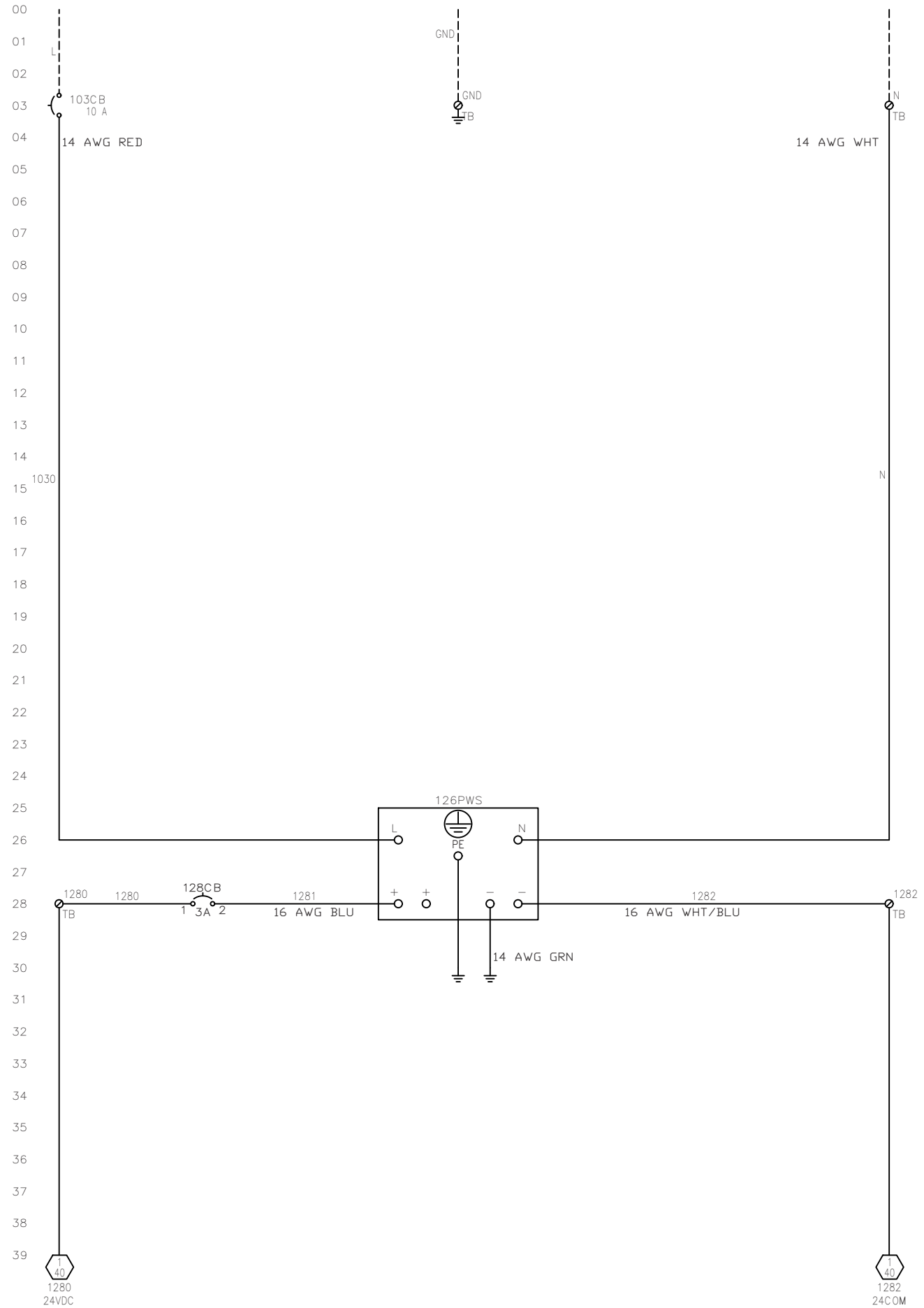
JOB#: J14280
FILE: J14280-00.dwg

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INCOMING POWER SUPPLY
120V 1φ 60Hz
RATED FOR 8A MAX
BRANCH PROTECTION BY OTHERS
NOT LESS THAN 75' 12 AWG WIRE

SHORT CIRCUIT CURRENT RATING:
5KVA RMS SYMMETRICAL, 120V MAXIMUM
UL 508A LISTED



NEXOM FILTER SYSTEM
AIR CONTROL PANEL
ABERDEEN, ID

DATE	BY	REVISIONS
10AUG23	EK	5 HDA SWITCHES ADDED
02AUG23	EK	1 INFLEUENT VALVES ADDED

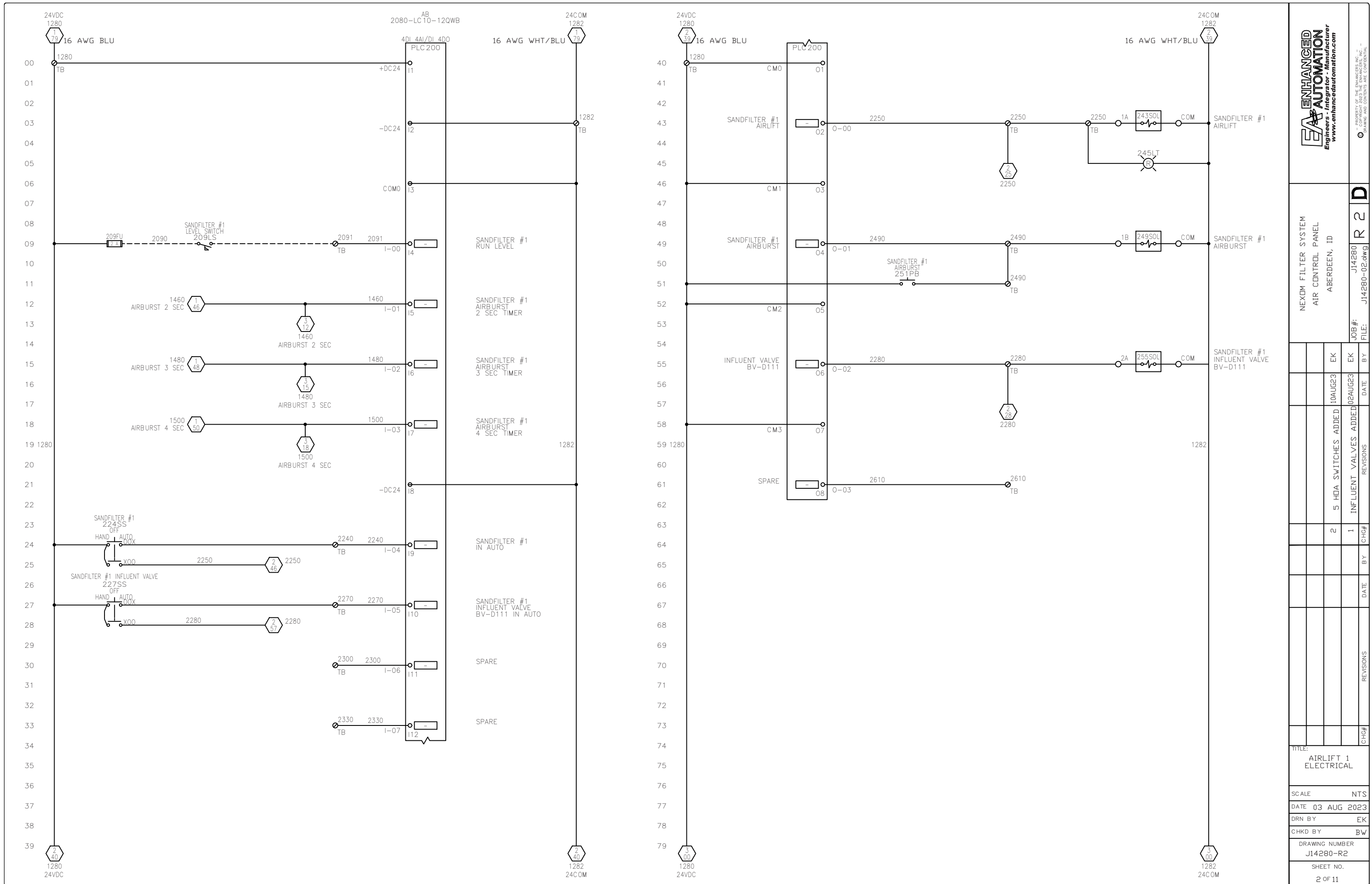
DATE	BY	REVISIONS

DATE	BY	REVISIONS

TITLE:	ELECTRICAL WIRING
SCALE	NTS
DATE	03 AUG 2023
DRN BY	EK
CHKD BY	BW
DRAWING NUMBER	J14280-R2
SHEET NO.	1 OF 11

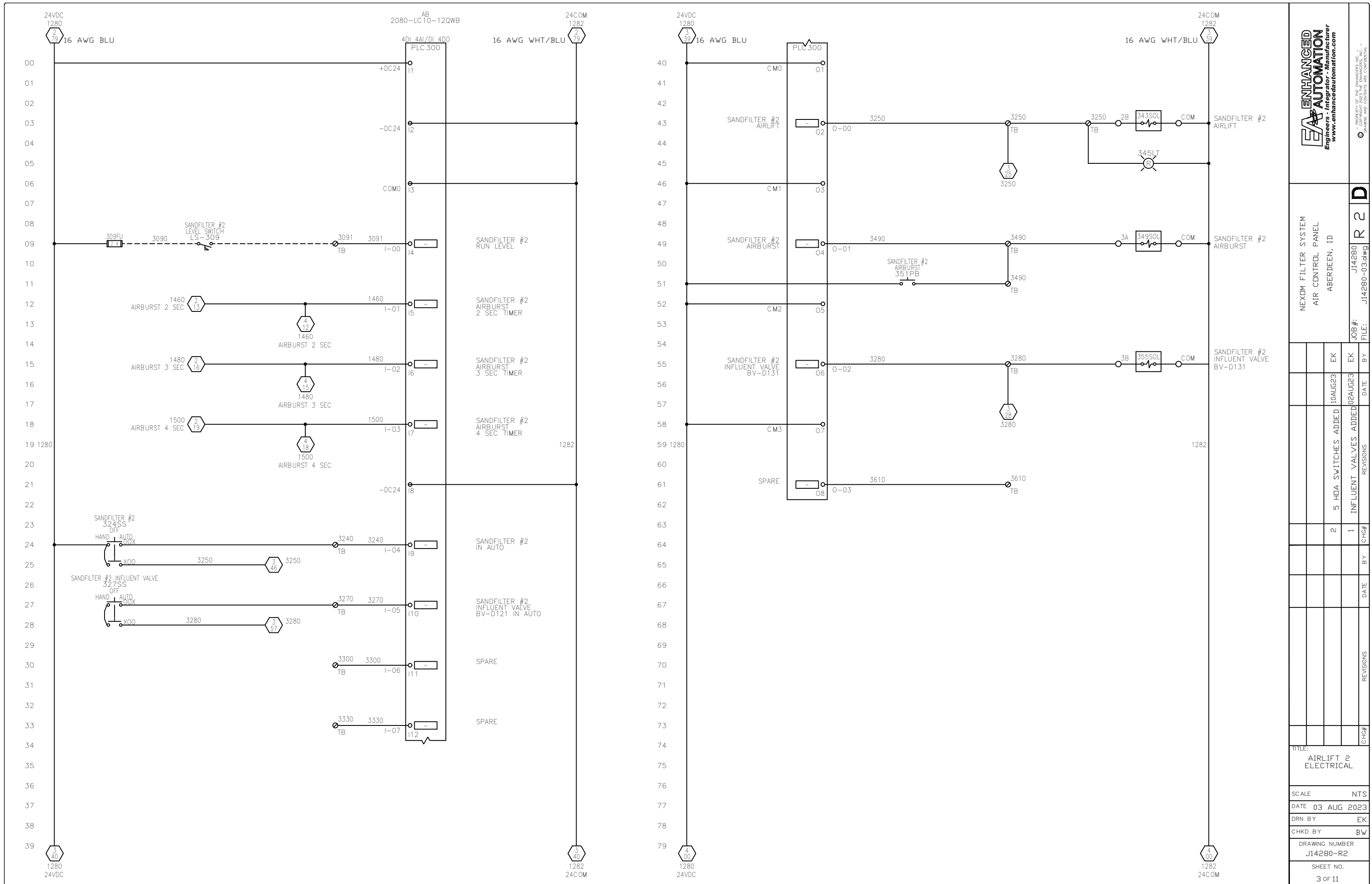
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NO.	DATE	BY	REVISIONS
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2	10AUG23	EK	5 HDA SWITCHES ADDED

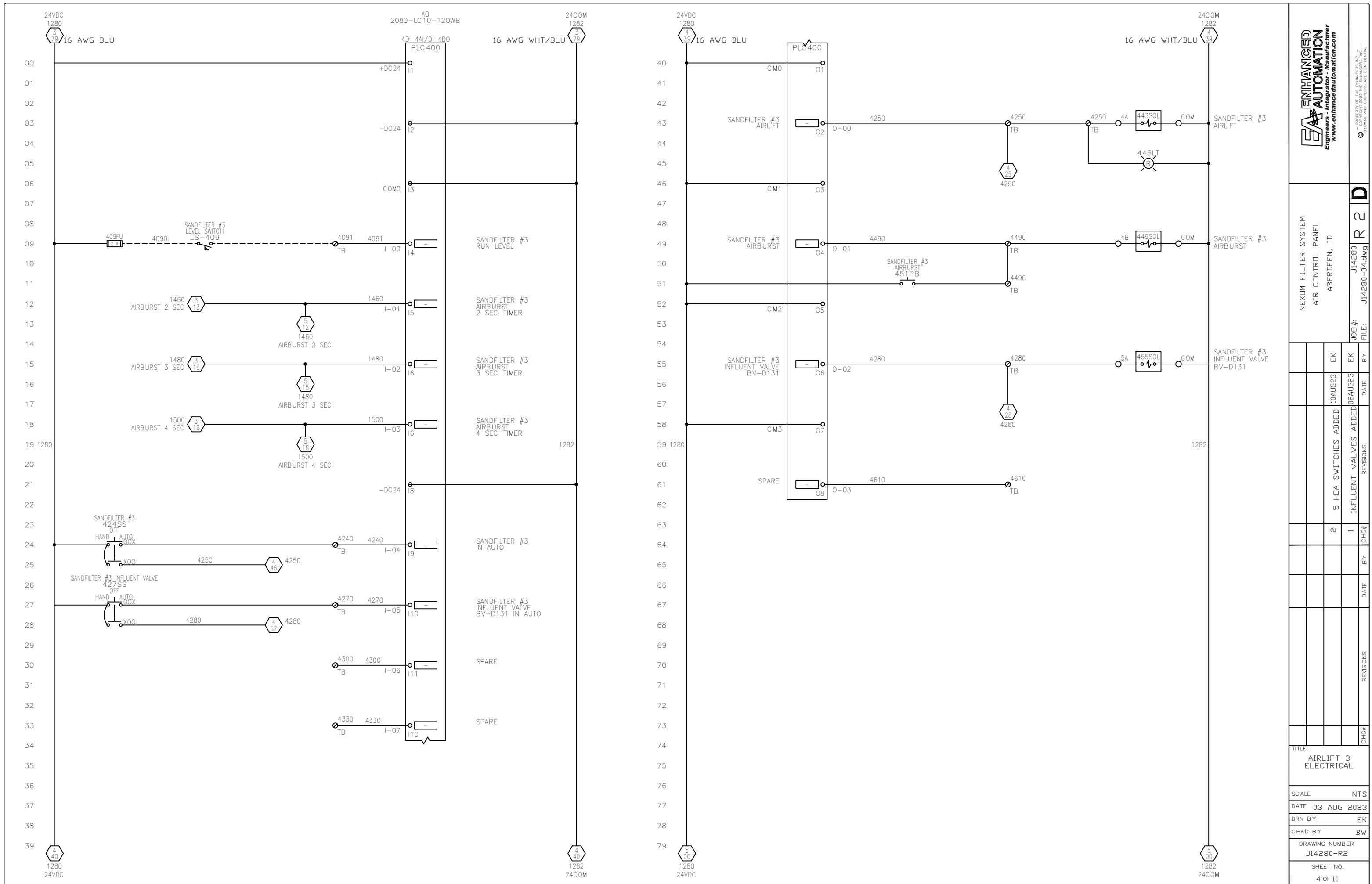
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DATE	BY	REVISIONS
10AUG23	EK	5 HDA SWITCHES ADDED
02AUG23	EK	1 INFLUENT VALVES ADDED

DATE	BY	CHG#	REVISIONS
		2	1

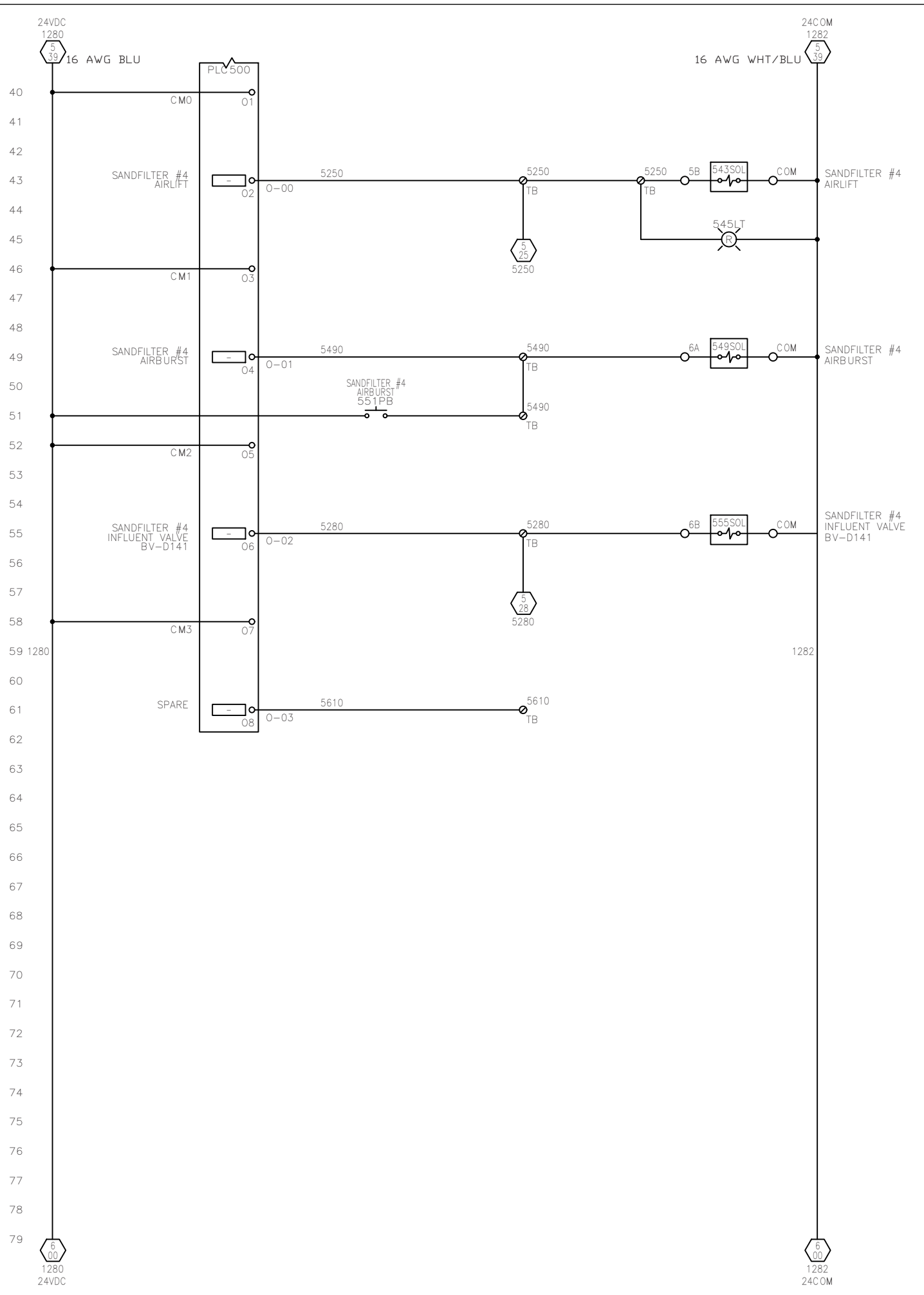
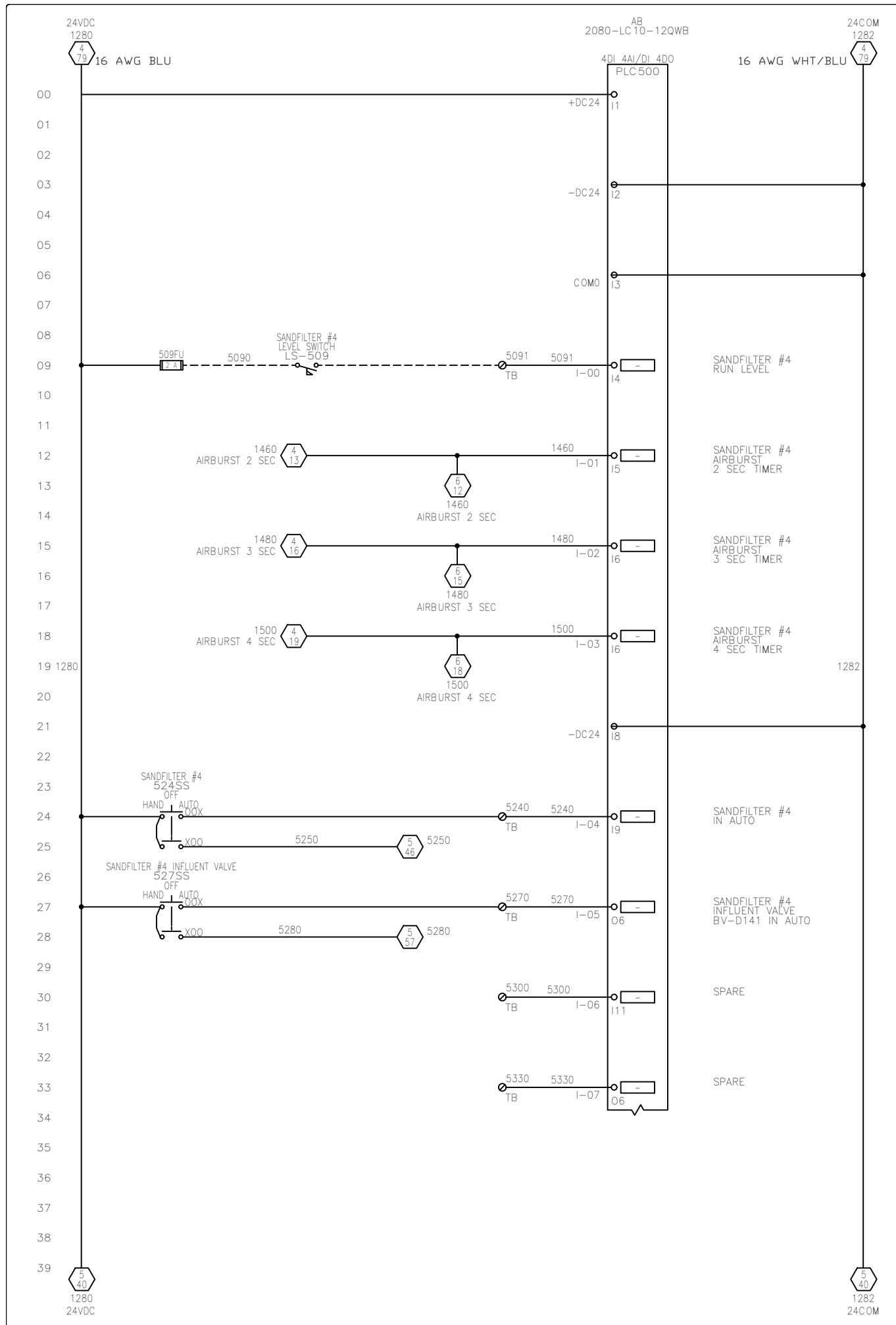
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NO.	DATE	BY	REVISIONS
1	02AUG23	EK	INFLUENT VALVES ADDED
2	10AUG23	EK	5 HOA SWITCHES ADDED

NO.	DATE	BY	REVISIONS
1	02AUG23	EK	INFLUENT VALVES ADDED
2	10AUG23	EK	5 HOA SWITCHES ADDED

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 Engineers - Integrator - Manufacturer
 www.enhancedautomation.com

NEXOM FILTER SYSTEM
 AIR CONTROL PANEL
 ABERDEEN, ID

JOB#: J14280
 FILE: J14280-05.dwg

REVISIONS	DATE	BY	CHG#
5	10AUG23	EK	1
2	02AUG23	EK	1

TITLE: AIRLIFT 4 ELECTRICAL

SCALE: NTS

DATE: 03 AUG 2023

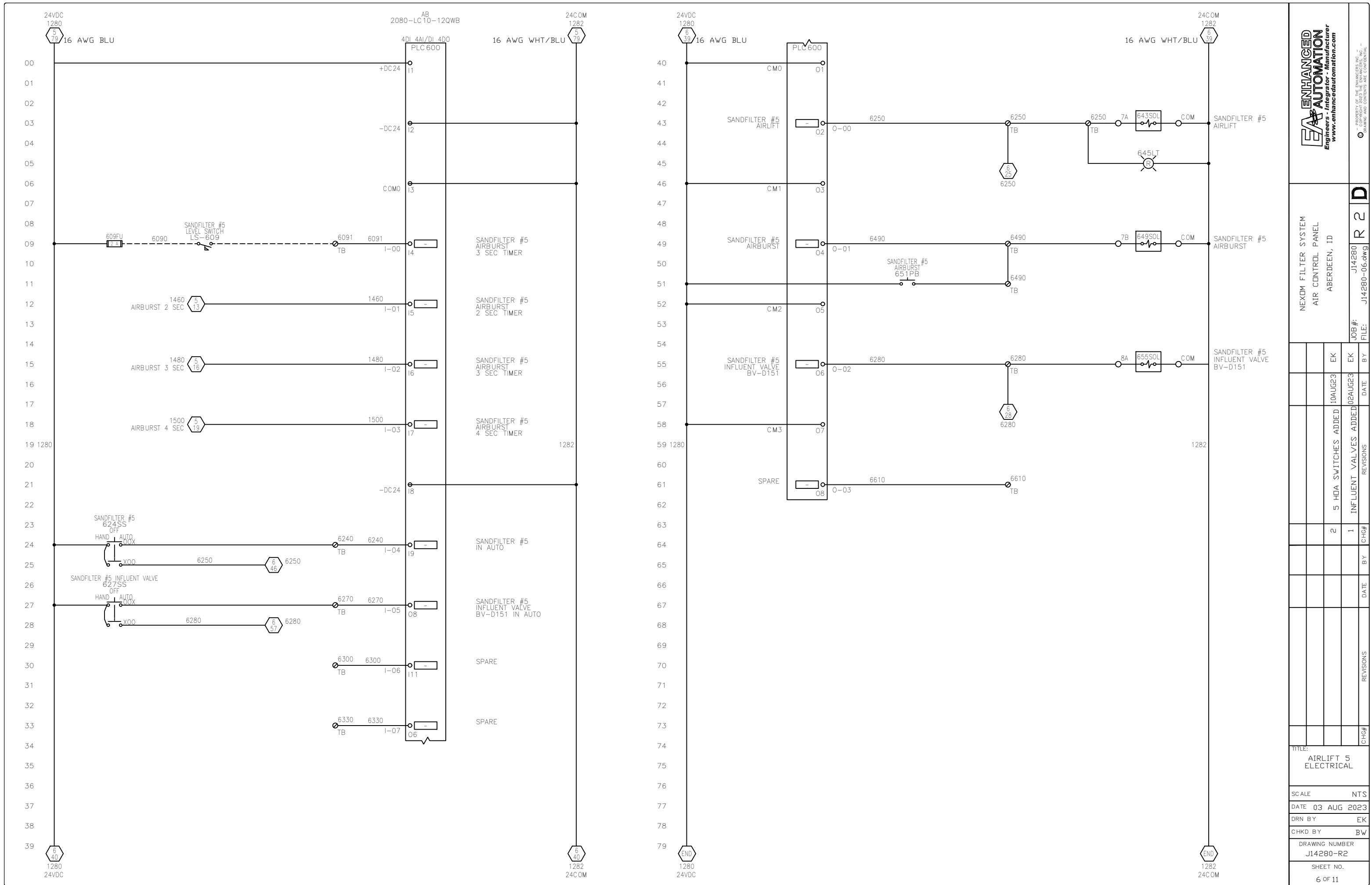
DRN BY: EK

CHKD BY: BW

DRAWING NUMBER: J14280-R2

SHEET NO.: 5 OF 11

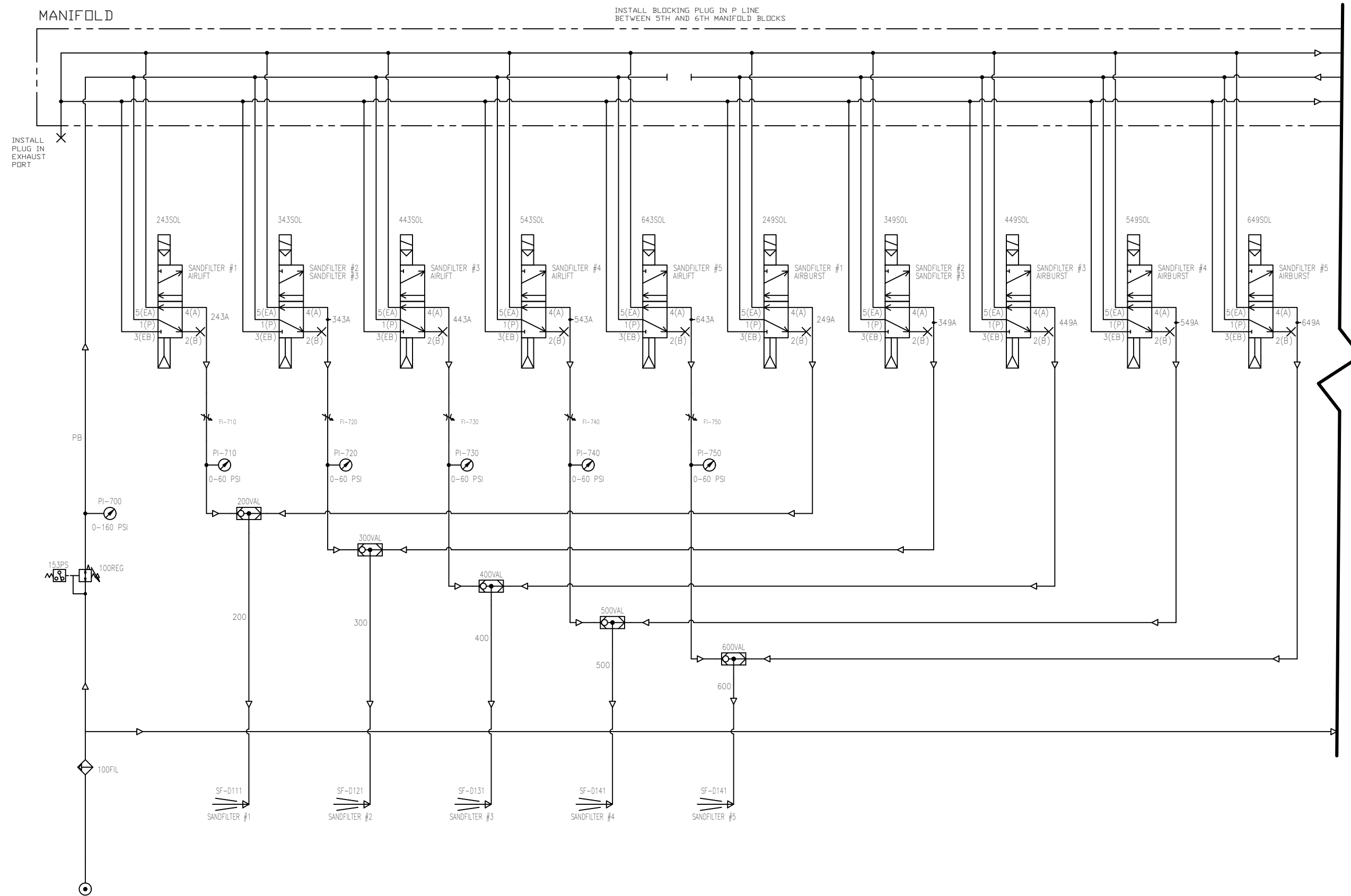
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DATE	BY	REVISIONS
10AUG23	EK	5 HOA SWITCHES ADDED
02AUG23	EK	1 INFLUENT VALVES ADDED

DATE	BY	CHG#	REVISIONS
		1	
		2	

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CHG#	DATE	BY	REVISIONS
2	10AUG23	EK	5 HDA SWITCHES ADDED
1	02AUG23	EK	INFLUENT VALVES ADDED

TITLE: PNEUMATIC CIRCUIT

SCALE: NTS

DATE: 03 AUG 2023

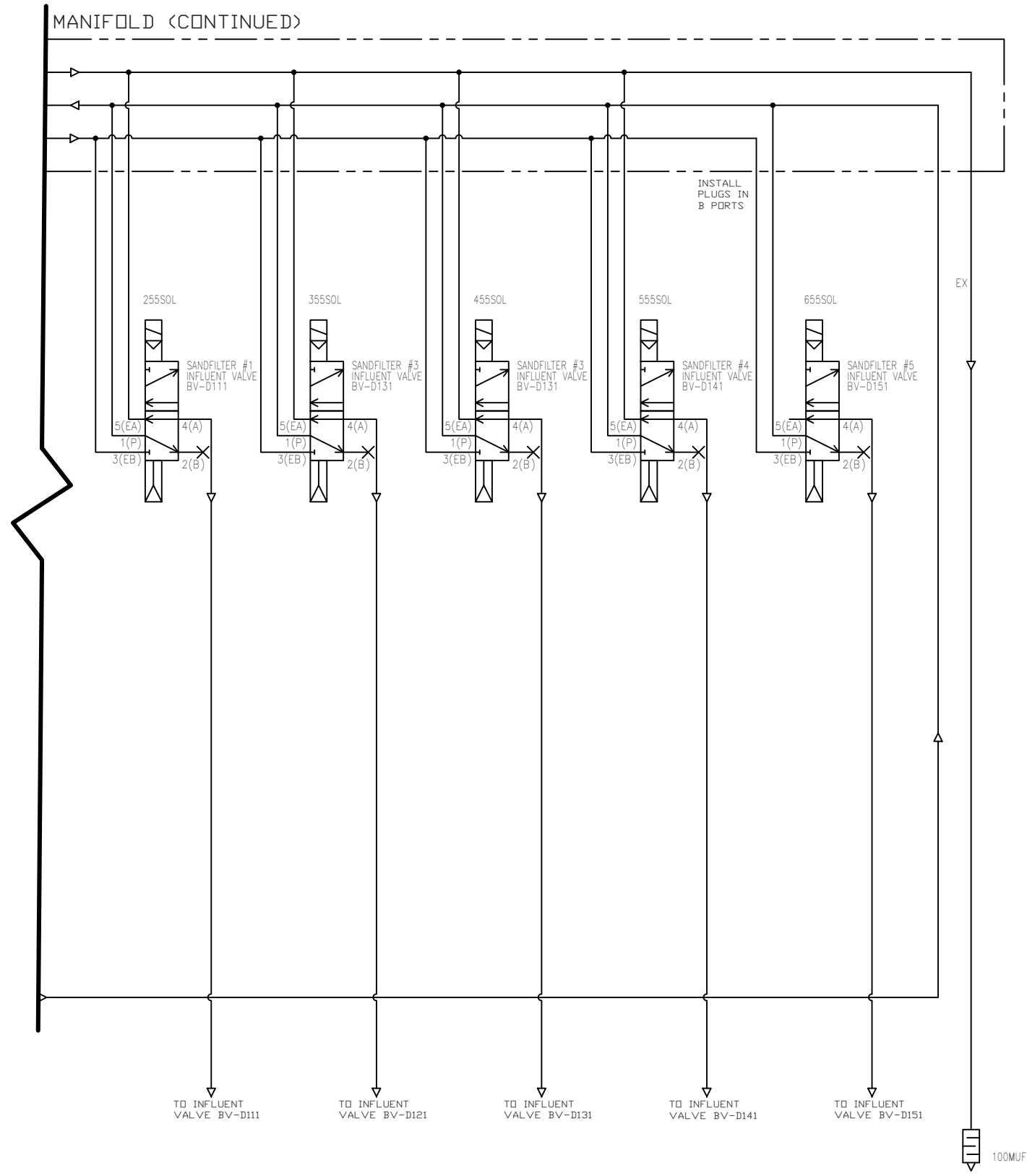
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DRAWING NUMBER: J14280-R2

SHEET NO.: 7 OF 11

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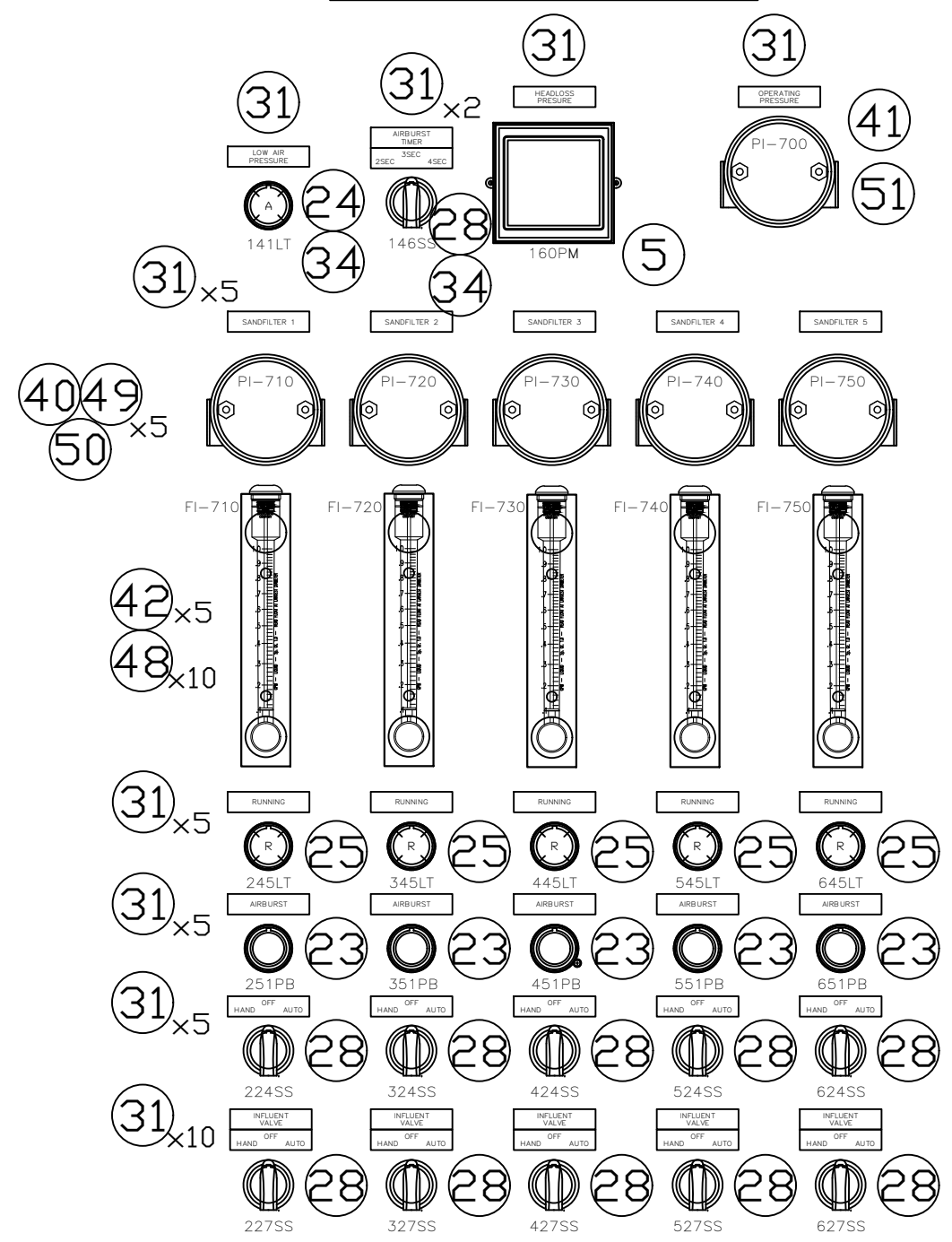
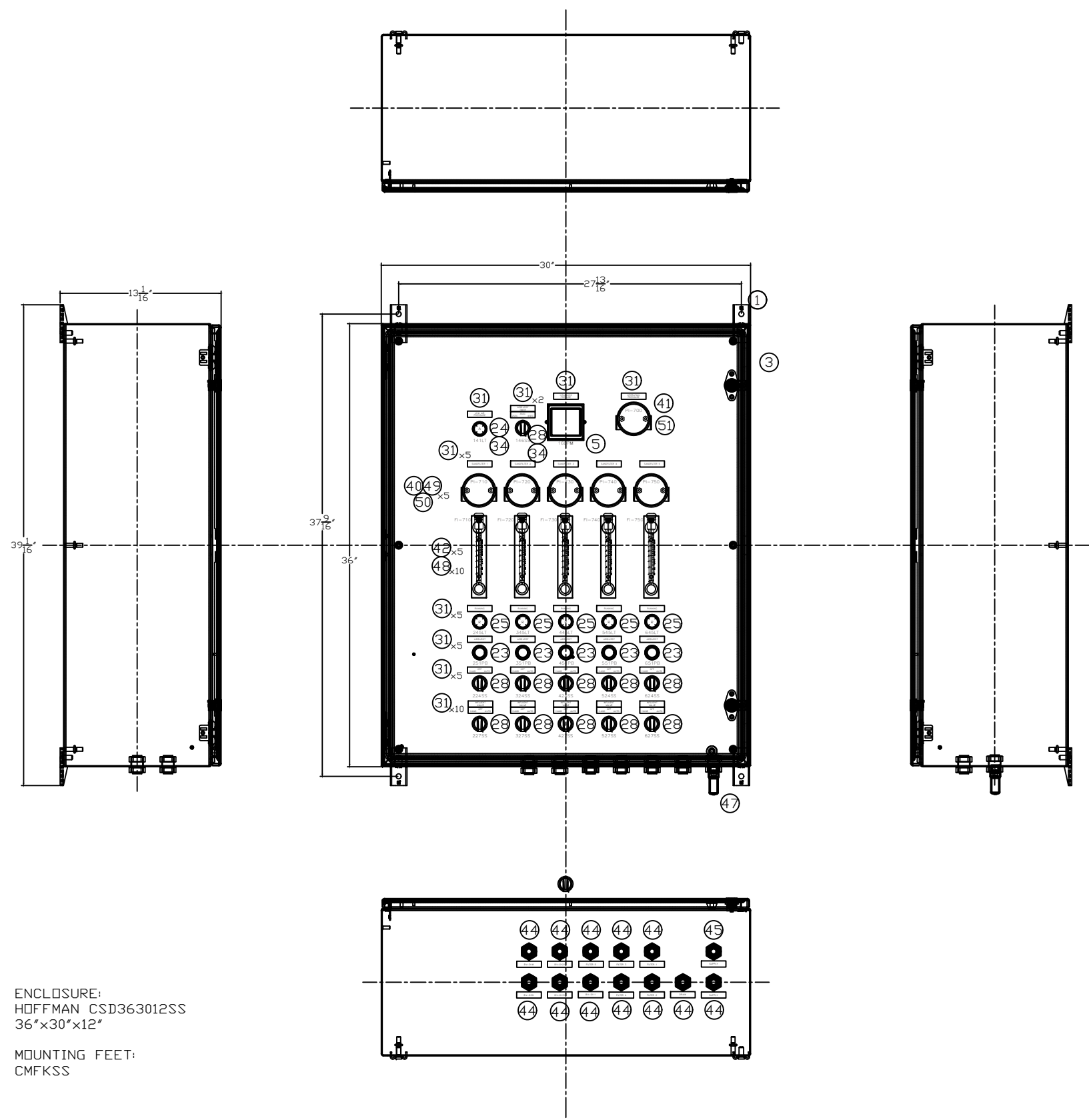


CHG#	DATE	BY	REVISIONS
2	10AUG23	EK	5 HDA SWITCHES ADDED
1	02AUG23	EK	INFLUENT VALVES ADDED

TITLE:	PNEUMATIC CIRCUIT (CONTINUED)
SCALE:	NTS
DATE:	03 AUG 2023
DRN BY:	EK
CHKD BY:	BW
DRAWING NUMBER:	J14280-R2
SHEET NO.:	8 OF 11

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OPERATOR DETAIL



NEXDM FILTER SYSTEM
 AIR CONTROL PANEL
 ABERDEEN, ID

JOB#: J14280
 FILE: J14280-09.dwg

REVISIONS	DATE	BY
1	02AUG23	EK
2	10AUG23	EK

TITLE:	ENCLOSURE LAYOUT
SCALE:	NTS
DATE:	03 AUG 2023
DRN BY:	EK
CHKD BY:	BW
DRAWING NUMBER:	J14280-R2
SHEET NO.:	9 OF 11

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ITEM	QTY	SUB	CATALOG	MFG	DESCRIPTION	TAGS
1	1		CMFKSS	HOFFMAN	MOUNTING FEET, SS	
2	1		CP3630	HOFFMAN	SUBPANEL, 34.5x28.2, WHITE, STEEL	
3	1		CSD363012SS	HOFFMAN	ENCLOSURE, SINGLE DOOR, 36.00x30.00x12.00, METALLIC, STAINLESS STEEL, TYPE 4X	
4	1		CUSTOM	UL	UL TAG	
5	1		APM-PROC-APD	TRUMETER	PANEL DISPLAY, APM PROCESS METER, 0 TO +/-10VDC, 0-50mA IN, 4-20mA OUT, 12-24 AC/DC POWER	160PM
6	1		1489-MIC100	AB	CIRCUIT BREAKER, 1 POLE , TRIP CURVE C, 10A	103CB
7	10		1492-CJLJ5-2	AB	JUMPER, 2 POLE, J3 TERMINALS	TB
8	1		1492-CJLJ5-6	AB	JUMPER, 6 POLE, J3 TERMINALS	TB
9	1		1492-CJLJ5-8	AB	JUMPER, 8 POLE, J3 TERMINALS	TB
10	1		1492-DR6	AB	ALUMINUM RAISED DIN RAIL (35mm x 7.5mm x 57.4mm HIGH)	
11	5		1492-EAJ35	AB	TB, END ANCHOR	
12	2		1492-EBJ3	AB	TB, END BARRIER	
13	6		1492-H4	AB	FUSE HOLDER, DIN, NEON INDICATOR	162FU,209FU,309FU,409FU,509FU,609FU
14	95		1492-J3	AB	TB, SINGLE, 30-12AWG, 25A, 600V, GRAY	TB
15	2		1492-JG3	AB	TB, GROUND BLOCK 30-12AWG	TB
16	1		1492-N37	AB	END BARRIER, 1492-H..	
17	1		1492-SPM1C030	AB	CIRCUIT BREAKER, SUPPLEMENTAL, 1POLE , TRIP CURVE C, 3A	128CB
18	1		1606-XLB90E	AB	POWER SUPPLY, 1-PHASE, 100...240V AC IN, 90 W, 24...28V DC OUT	126PWS
19	1		199-DR1	AB	ZINC/STEEL DIN RAIL EN 50022 (35mm x 7.5mm)	
20	5		2080-LC10-12QWB	AB	MICROLOGIX 810 PLC, 24V DC POWER, 8 24VDC DIGITAL INPUTS, 4 RELAY OUTPUTS	PLC200,PLC300,PLC400,PLC500,PLC600
21	5		2080-LCD	AB	MICRO810 LCD MODULE	
22	2		700-HLT12U24	AB	CONTROL RELAY, SLIM, DPDT, 24VDC COIL,24VAC/DC	153CR,163CR
23	5		800FP-F2PX10	AB	PUSH BUTTON ASSEMBLY, 22MM, BLACK, 1 NO	251PB,351PB,451PB,551PB,651PB
24	1		800FP-P0PN3W	AB	PILOT LIGHT ASSEMBLY, 22MM, 24V, AMBER	141LT
25	5		800FP-P4PN3R	AB	PILOT LIGHT ASSEMBLY, 22MM, 24V, RED	245LT,345LT,445LT,545LT,645LT
26	15		SY7100-5U1	SMC	2 POS, SINGLE ACTING, DIRECTIONAL CONTROL VALVE, PNEUMATIC, 24VDC	243SOL, 249SOL, 255SOL, 343SOL, 349SOL, 355SOL, 443SOL, 449SOL, 455SOL, 543SOL, 549SOL, 555SOL, 643SOL, 649SOL, 655SOL
27	1		ISE35-R-65-PLA	SMC	PRESSURE SWITCH, 145psi, REGULATOR MOUNT	153PS
28	12		800FP-SM32PX20	AB	SELECTOR SWITCH ASSEMBLY, 3-POS, 22MM, 2 NO	146SS,224SS,324SS,424SS,524SS,624SS
29	6		MDL-2-R	BUSSMANN	FUSE, MINIATURE, TIME DELAY, SUPPLEMENTAL, 250V, 2 AMP	609FU
30	1		PK7GTA	SQD	GROUND BAR, 7-POINT	
31	35		CUSTOM	EA	LAMACOID	
32	3	*1	G1X4WH6	PANDUIT	WIRING DUCT, SLOTTED,WHITE, 1X4 IN	
		*1	C1WH6	PANDUIT	WIRING DUCT, COVER, WHITE, 1 IN	
33	3	*1	G2X4WH6	PANDUIT	WIRING DUCT, SLOTTED,WHITE, 2X4 IN	
		*1	C2WH6	PANDUIT	WIRING DUCT, COVER, WHITE, 2 IN	
34	1		800F-X10	AB	CONTACT BLOCK, NORMALLY OPEN	146SS
40	5		9768335	WIKA	PRESSURE GAUGE, 60psi, 1/4"NPT CENTER, 2.5"	PI-210, PI-220, PI-230, PI-240, PI-250
41	1		9768319	WIKA	PRESSURE GAUGE, 160psi, 1/4"NPT CENTER, 2.5"	PI-200
42	5		7530-2-1-1-5C02	KING	AIR FLOW METER, 15SCFM	FL-210, FL-220, FL-230, FL-240, FL-250
44	13		KQ2E13-00A	SMC	BULKHEAD CONNECTOR, 1/2" TUBE	
45	1		KQ2E13-37A	SMC	BULKHEAD CONNECTOR, 1/2" TUBE TO 1/2" NPT FEMALE	
47	1		AN30-N03	SMC	SILENCER, 3/8" NPT MALE	
48	10		KQ2LF11-37A	SMC	90 DEGREE PUSH TO CONNECT FITTING, 3/8" TUBE TO 1/2"NPT FEMALE	
49	5		KQ2T11-35AS	SMC	T-PUSH TO CONNECT FITTING, 3/8" TUBE TO 1/4"NPT MALE	
50	5		4464K352	MCMMASTER	1/4" NPT COUPLING, STAINLESS	
51	1		KQ2LF11-35A	SMC	90 DEGREE PUSH TO CONNECT FITTING, 3/8" TUBE TO 1/4"NPT FEMALE	
53	5		VR1220F-11	SMC	SHUTTLE VALVE, 3/8" PUSH TO CONNECT	
54	10		KQ2N11-13	SMC	PUSH TO CONNECT REDUCER TUBE, 1/2" TO 3/8" TUBE	
55	1		KQ2V11-36AS	SMC	90 DEGREE PUSH TO CONNECT FITTING 3/8" TUBE TO 3/8"NPT MALE, SEALENT	
56	1		KQ2VD11-36AS	SMC	DOUBLE 90 DEGREE PUSH TO CONNECT FITTING 3/8" TUBE TO 3/8"NPT MALE	
57	1		AF40-N03C-RZ-A	SMC	PNEUMATIC FILTER WITH NC AUTO DRAIN, SIZE 40 3/8"NPT, RIGHT TO LEFT FLOW	
58	1		AR40-N03-RZ-A	SMC	PRESSURE REGULATOR, AR40, 3/8"NPT, RIGHT TO LEFT FLOW	
59	1		KQ2H11-36AS	SMC	PUSH TO CONNECT 3/8" TUBE, 3/8" MALE NPT, SEALENT	
60	1		Y400T-A	SMC	AC-B Y000 - SPACER WITH BRACKET	
61	1		Y400-A	SMC	AC-B Y0000 - SPACING ADAPTER	
62	1		SY70M-3-1A-N13-D0	SMC	SY70M-3, SUP/EXH END BLOCK ASSEMBLY, 1/2"PORT, U SIDE	
63	3		KQ2R11-13A	SMC	REDUCER, 1/2" TUBE TO 3/8" TUBE	
64	15		SY70M-2-1SA-N11	SMC	SMC SY7 MANIFOLD BASE, SINGLE WIRE, 2 PORTS, 3/8" FITTING	
65	1		SYM70M-1-1A-N13-D0	SMC	SY70M-3, SUP/EXH END BLOCK ASSEMBLY, 1/2"PORT, D SIDE	
66	1		SY30M-130-1A	SMC	MANIFOLD TERMINAL BLOCK, FOR SY3000, SY5000, SY7000	
67	1		KQ2P-13	SMC	PUSH TO CONNECT 1/2" PLUG	
68	10		KQ2P-11	SMC	PUSH TO CONNECT 3/8" PLUG	
69	1		Y410-N03-A	SMC	AC-A T, T-SPACER, 3/8"NPT	
70	1		SY70M-40-1A	SMC	SUPPLY BLOCKING PLUG	
71	1		SY70M-49-15	SMC	TIE-ROD KIT	
72	A/R		5648K71-CLEAR	MCMMASTER	3/ 8" POLYURETHANE TUBING	



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NEXOM FILTER SYSTEM
AIR CONTROL PANEL
ABERDEEN, ID

J14280
R 2
D
JOB#: J14280-11.dwg
FILE:

CHG#	BY	DATE	REVISIONS
2	EK	10AUG23	5 HOA SWITCHES ADDED
1	EK	02AUG23	INFLUENT VALVES ADDED

TITLE: BILL OF MATERIAL

SCALE: NTS

DATE: 03 AUG 2023

DRN BY: EK

CHKD BY: BW

DRAWING NUMBER: J14280-R2

SHEET NO.: 11 OF 11

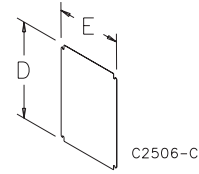
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CONCEPT PANELS

These panels are taller and wider than corresponding NEMA-size panels. Panels are 14 or 12 gauge steel and painted white or have a conductive finish.

Panels have a formed flange along any side that is longer than 22.20 in. (564 mm).

BULLETIN: CWP, CWY, DWDH2



Catalog Number	Panel Type	Panel Size D x E (in.)	Panel Size D x E (mm)	Gauge
CP1210	Painted steel	10.20 x 8.20	259 x 208	14
CP1210G	Conductive	10.20 x 8.20	259 x 208	14
CP1212	Painted steel	10.20 x 10.20	259 x 259	12
CP1212G	Conductive	10.20 x 10.20	259 x 259	12
CP1612	Painted steel	14.20 x 10.20	361 x 259	12
CP1612G	Conductive	14.20 x 10.20	361 x 259	12
CP1616	Painted steel	14.20 x 14.20	361 x 361	12
CP1616G	Conductive	14.20 x 14.20	361 x 361	12
CP2012	Painted steel	18.20 x 10.20	462 x 259	12
CP2012G	Conductive	18.20 x 10.20	462 x 259	12
CP2014	Painted steel	18.20 x 12.20	462 x 310	12
CP2014G	Conductive	18.20 x 12.20	462 x 310	12
CP2016	Painted steel	18.20 x 14.20	462 x 361	12
CP2016G	Conductive	18.20 x 14.20	462 x 361	12
CP2020	Painted steel	18.20 x 18.20	462 x 462	12
CP2020G	Conductive	18.20 x 18.20	462 x 462	12
CP2412	Painted steel	22.20 x 10.20	564 x 259	12
CP2412G	Conductive	22.20 x 10.20	564 x 259	12
CP2416	Painted steel	22.20 x 14.20	564 x 361	12
CP2416G	Conductive	22.20 x 14.20	564 x 361	12
CP2420	Painted steel	22.20 x 18.20	564 x 462	12
CP2420G	Conductive	22.20 x 18.20	564 x 462	12
CP2424	Painted steel	22.20 x 22.20	564 x 564	12
CP2424G	Conductive	22.20 x 22.20	564 x 564	12
CP2442	Painted steel	22.20 x 40.20	564 x 1021	12
CP2442G	Conductive	22.20 x 40.20	564 x 1021	12
CP3012	Painted steel	28.20 x 10.20	716 x 259	12
CP3012G	Conductive	28.20 x 10.20	716 x 259	12
CP3016	Painted steel	28.20 x 14.20	716 x 361	12
CP3016G	Conductive	28.20 x 14.20	716 x 361	12
CP3020	Painted steel	28.20 x 18.20	716 x 462	12
CP3020G	Conductive	28.20 x 18.20	716 x 462	12
CP3024	Painted steel	28.20 x 22.20	716 x 564	12
CP3024G	Conductive	28.20 x 22.20	716 x 564	12
CP3030	Painted steel	28.20 x 28.20	716 x 716	12
CP3030G	Conductive	28.20 x 28.20	716 x 716	12
CP3048	Painted steel	28.20 x 46.20	716 x 1173	12
CP3048G	Conductive	28.20 x 46.20	716 x 1173	12
CP3060	Painted steel	28.20 x 58.20	716 x 1478	12
CP3060G	Conductive	28.20 x 58.20	716 x 1478	12
CP3220	Painted steel	30.20 x 18.20	762 x 462	12
CP3624	Painted steel	34.20 x 22.20	869 x 564	12
CP3624G	Conductive	34.20 x 22.20	869 x 564	12
CP3630	Painted steel	34.20 x 28.20	869 x 716	12
CP3630G	Conductive	34.20 x 28.20	869 x 716	12
CP3636	Painted steel	34.20 x 34.20	869 x 869	12
CP3636G	Conductive	34.20 x 34.20	869 x 869	12
CP4230	Painted steel	40.20 x 28.20	1021 x 716	12
CP4230G	Conductive	40.20 x 28.20	1021 x 716	12
CP4236	Painted steel	40.20 x 34.20	1021 x 869	12
CP4236G	Conductive	40.20 x 34.20	1021 x 869	12
CP4242	Painted steel	40.20 x 40.20	1021 x 1021	12
CP4242G	Conductive	40.20 x 40.20	1021 x 1021	12
CP4260	Painted steel	40.20 x 58.20	1021 x 1478	12
CP4260G	Conductive	40.20 x 58.20	1021 x 1478	12
CP4420	Painted steel	42.20 x 18.20	1072 x 462	12
CP4824	Painted steel	46.20 x 22.20	1173 x 564	12
CP4824G	Conductive	46.20 x 22.20	1173 x 564	12
CP4836	Painted steel	46.20 x 34.20	1173 x 869	12
CP4836G	Conductive	46.20 x 34.20	1173 x 869	12
CP4848	Painted steel	46.20 x 46.20	1173 x 1173	12
CP4848G	Conductive	46.20 x 46.20	1173 x 1173	12
CP5620	Painted steel	53.20 x 18.20	1351 x 462	12
CP6036	Painted steel	58.20 x 34.20	1478 x 869	12
CP6036G	Conductive	58.20 x 34.20	1478 x 869	12
CP7230	Painted steel	70.20 x 28.20	1783 x 716	12
CP7230G	Conductive	70.20 x 28.20	1783 x 716	12
CP7236	Painted steel	70.20 x 34.20	1783 x 869	12

Catalog number CP4230 is used on CONCEPT disconnect enclosures.

CONCEPT, TYPE 4X



INDUSTRY STANDARDS

Mounting brackets required to meet UL/CSA external mounting requirements.

UL 508A Listed; Type 3R, 4, 4X, 12; File No. E61997
 cUL Listed per CSA C22.2 No 94; Type 3R, 4, 4X, 12; File No. E61997

NEMA/EEMAC Type 3R, 4, 4X, 12, 13
 CSA File No. 42186: Type 4, 4X, 12
 VDE IP66
 IEC 60529, IP66
 Meets NEMA Type 3RX requirements

APPLICATION

For indoor or outdoor applications that require corrosion protection from chemicals and water. Concept Enclosures feature streamlined styling with an attractive stroked finish and flush quarter-turn latches for secure closure. Available in solid- and window-door models.

SPECIFICATIONS

- Manufactured from Type 304 or Type 316L stainless steel
- Minimum-width body flange provides maximum body opening
- External formed 90-degree body flange
- Panel mounting studs fit optional Concept panels and other accessories
- Mounting holes in back of body for direct mounting or for optional external mounting brackets
- Type 316 stainless steel hidden hinges promote clean aesthetic appearance
- Corner formed doors are interchangeable and easily removed by pulling clip-style hinge pins
- Provision on door (except window-door style and when B = 12 in.) for thermoplastic data pocket
- Provision on door (except window-door style and when B = 12 in.) for optional doorstop kit
- Quarter-turn latches furnished with flush slotted insert
- Seamless foam-in-place gasket
- Self-grounding latch system with double seal
- Bonding provision on door; grounding stud on body
- Furnished hardware kit consists of panel-mounting nuts, panel-grounding hardware and sealing washers for wall-mounting holes
- Installation instructions
- Window doors have a clear polycarbonate window

FINISH

Door and body have smooth #4 brushed finish.

ACCESSORIES

- Type 316 Stainless Steel Door Stop Kit
- Concept panels
- H2Omit Vent Drains, Type 4X
- H2Omit Thermoelectric Dehumidifier
- Handles
- Lock Inserts
- HF Side-Mount Filter Fans
- Steel, Stainless Steel and Non-Metallic Window Kits
- PaneLite Enclosure Lights
- Hol-Sealers Hole Seals

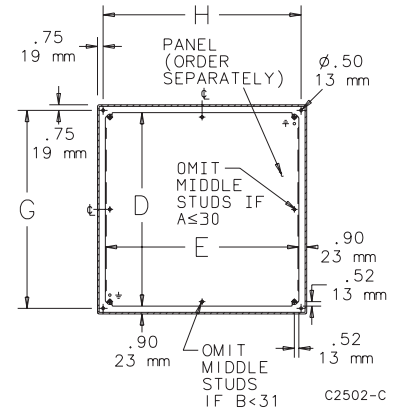
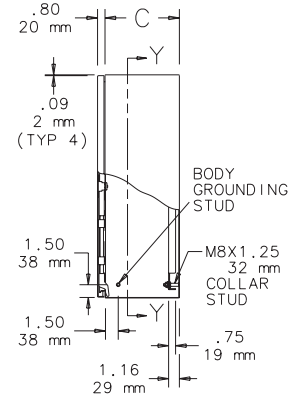
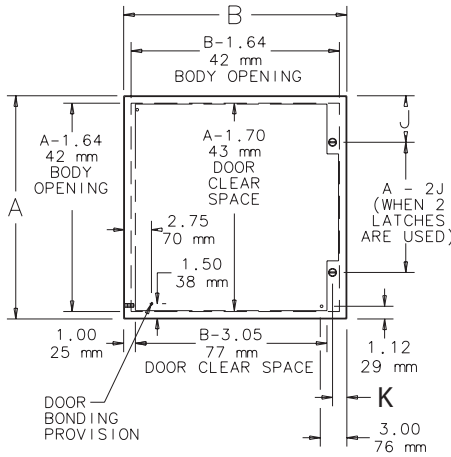
MODIFICATION AND CUSTOMIZATION

nVent HOFFMAN excels at modifying and customizing products to your specifications. Contact your local nVent HOFFMAN sales office or distributor for complete information.

BULLETIN: CWS

Standard Product One-Door

Catalog Number	AxBxC in.	AxBxC mm	Door Gauge	Body Gauge	Panel	Conductive Panel	Panel Size D x E (in.)	Panel Size D x E (mm)	Mounting G x H (in.)	Mounting G x H (mm)	Latches Qty.	Style	J (in.)	J (mm)
CSD12126SS	12.00 x 12.00 x 6.00	305 x 305 x 152	16	16	CP1212	CP1212G	10.20 x 10.20	259 x 259	10.50 x 10.50	267 x 267	1	Quarter-turn	6.00	152
CSD12126SS6	12.00 x 12.00 x 6.00	305 x 305 x 152	16	16	CP1212	CP1212G	10.20 x 10.20	259 x 259	10.50 x 10.50	267 x 267	1	Quarter-turn	6.00	152
CSD12246SS	12.00 x 24.00 x 6.00	305 x 610 x 152	16	16	CP2412	CP2412G	22.20 x 10.20	564 x 259	10.50 x 22.50	268 x 572	1	Quarter-turn	6.00	152
CSD12246SS6	12.00 x 24.00 x 6.00	305 x 610 x 152	16	16	CP2412	CP2412G	22.20 x 10.20	564 x 259	10.50 x 22.50	268 x 572	1	Quarter-turn	6.00	152
CSD16126SS	16.00 x 12.00 x 6.00	406 x 305 x 152	16	16	CP1612	CP1612G	14.20 x 10.20	361 x 259	14.50 x 10.50	368 x 267	1	Quarter-turn	8.00	203
CSD16126SS6	16.00 x 12.00 x 6.00	406 x 305 x 152	16	16	CP1612	CP1612G	14.20 x 10.20	361 x 259	14.50 x 10.50	368 x 267	1	Quarter-turn	8.00	203
CSD16166SS	16.00 x 16.00 x 6.00	406 x 406 x 152	16	16	CP1616	CP1616G	14.20 x 14.20	361 x 361	14.50 x 14.50	368 x 368	1	Quarter-turn	8.00	203
CSD16166SS6	16.00 x 16.00 x 6.00	406 x 406 x 152	16	16	CP1616	CP1616G	14.20 x 14.20	361 x 361	14.50 x 14.50	368 x 368	1	Quarter-turn	8.00	203
CSD20166SS	20.00 x 16.00 x 6.00	508 x 406 x 152	16	16	CP2016	CP2016G	18.20 x 14.20	462 x 361	18.50 x 14.50	470 x 368	1	Quarter-turn	10.00	254
CSD20166SS6	20.00 x 16.00 x 6.00	508 x 406 x 152	16	16	CP2016	CP2016G	18.20 x 14.20	462 x 361	18.50 x 14.50	470 x 368	1	Quarter-turn	10.00	254
CSD20206SS	20.00 x 20.00 x 6.00	508 x 508 x 152	16	16	CP2020	CP2020G	18.20 x 18.20	462 x 462	18.50 x 18.50	470 x 470	1	Quarter-turn	10.00	254
CSD20206SS6	20.00 x 20.00 x 6.00	508 x 508 x 152	16	16	CP2020	CP2020G	18.20 x 18.20	462 x 462	18.50 x 18.50	470 x 470	1	Quarter-turn	10.00	254
CSD24206SS	24.00 x 20.00 x 6.00	610 x 508 x 152	16	16	CP2420	CP2420G	22.20 x 18.20	564 x 462	22.50 x 18.50	572 x 470	1	Quarter-turn	12.00	305
CSD24206SS6	24.00 x 20.00 x 6.00	610 x 508 x 152	16	16	CP2420	CP2420G	22.20 x 18.20	564 x 462	22.50 x 18.50	572 x 470	1	Quarter-turn	12.00	305
CSD30166SS	30.00 x 16.00 x 6.00	762 x 406 x 152	16	16	CP3016	CP3016G	28.20 x 14.20	716 x 361	28.50 x 14.50	724 x 368	2	Quarter-turn	5.00	127
CSD30166SS6	30.00 x 16.00 x 6.00	762 x 406 x 152	16	16	CP3016	CP3016G	28.20 x 14.20	716 x 361	28.50 x 14.50	724 x 368	2	Quarter-turn	5.00	127
CSD16128SS	16.00 x 12.00 x 8.00	406 x 305 x 203	16	16	CP1612	CP1612G	14.20 x 10.20	361 x 259	14.50 x 10.50	368 x 267	1	Quarter-turn	8.00	203
CSD16128SS6	16.00 x 12.00 x 8.00	406 x 305 x 203	16	16	CP1612	CP1612G	14.20 x 10.20	361 x 259	14.50 x 10.50	368 x 267	1	Quarter-turn	8.00	203
CSD16168SS	16.00 x 16.00 x 8.00	406 x 406 x 203	16	16	CP1616	CP1616G	14.20 x 14.20	361 x 361	14.50 x 14.50	368 x 368	1	Quarter-turn	8.00	203
CSD16168SS6	16.00 x 16.00 x 8.00	406 x 406 x 203	16	16	CP1616	CP1616G	14.20 x 14.20	361 x 361	14.50 x 14.50	368 x 368	1	Quarter-turn	8.00	203
CSD16208SS	16.00 x 20.00 x 8.00	406 x 508 x 203	16	16	CP2016	CP2016G	18.20 x 14.20	462 x 361	18.50 x 18.50	470 x 470	1	Quarter-turn	8.00	203
CSD16208SS6	16.00 x 20.00 x 8.00	406 x 508 x 203	16	16	CP2016	CP2016G	18.20 x 14.20	462 x 361	18.50 x 18.50	470 x 470	1	Quarter-turn	8.00	203
CSD20168SS	20.00 x 16.00 x 8.00	508 x 406 x 203	16	16	CP2016	CP2016G	18.20 x 14.20	462 x 361	18.50 x 14.50	470 x 368	1	Quarter-turn	10.00	254
CSD20168SS6	20.00 x 16.00 x 8.00	508 x 406 x 203	16	16	CP2016	CP2016G	18.20 x 14.20	462 x 361	18.50 x 14.50	470 x 368	1	Quarter-turn	10.00	254
CSD20208SS	20.00 x 20.00 x 8.00	508 x 508 x 203	16	16	CP2020	CP2020G	18.20 x 18.20	462 x 462	18.50 x 18.50	470 x 470	1	Quarter-turn	10.00	254
CSD20208SS6	20.00 x 20.00 x 8.00	508 x 508 x 203	16	16	CP2020	CP2020G	18.20 x 18.20	462 x 462	18.50 x 18.50	470 x 470	1	Quarter-turn	10.00	254
CSD20248SS	20.00 x 24.00 x 8.00	508 x 610 x 203	16	16	CP2420	CP2420G	22.20 x 18.20	564 x 462	18.50 x 22.50	470 x 572	1	Quarter-turn	10.00	254
CSD20248SS6	20.00 x 24.00 x 8.00	508 x 610 x 203	16	16	CP2420	CP2420G	22.20 x 18.20	564 x 462	18.50 x 22.50	470 x 572	1	Quarter-turn	10.00	254
CSD24168SS	24.00 x 16.00 x 8.00	610 x 406 x 203	16	16	CP2416	CP2416G	22.20 x 14.20	564 x 361	22.50 x 14.50	572 x 368	1	Quarter-turn	12.00	305



SECTION Y-Y
(WITH PANEL INSTALLED)

Standard Product One-Door with Window

Catalog Number	AxBxC in.	AxBxC mm	Door Ga.	Body Ga.	Panel	Panel Size D x E (in.)	Panel Size D x E (mm)	Mounting G x H (in.)	Mounting G x H (mm)	Window Size M x N (in.)	Window Size M x N (mm)	Latch Qty.	Style	J (in.)	J (mm)
CSD12126WSS	12.00 x 12.00 x 6.00	305 x 305 x 152	16	16	CP1212	10.20 x 10.20	259 x 259	10.50 x 10.50	267 x 267	8.74 x 7.10	222 x 180	1	Quarter-turn	6.00	152
CSD16126WSS	16.00 x 12.00 x 6.00	406 x 305 x 152	16	16	CP1612	14.20 x 10.20	361 x 259	14.50 x 10.50	368 x 267	12.74 x 7.10	324 x 180	1	Quarter-turn	8.00	203
CSD20166WSS	20.00 x 16.00 x 6.00	508 x 406 x 152	16	16	CP2016	18.20 x 14.20	462 x 361	18.50 x 14.50	470 x 368	16.74 x 11.10	425 x 282	1	Quarter-turn	10.00	254
CSD20206WSS	20.00 x 20.00 x 6.00	508 x 508 x 152	16	16	CP2020	18.20 x 18.20	462 x 462	18.50 x 18.50	470 x 470	16.74 x 15.10	425 x 384	1	Quarter-turn	10.00	254
CSD20168WSS	20.00 x 16.00 x 8.00	508 x 406 x 203	16	16	CP2016	18.20 x 14.20	462 x 361	18.50 x 14.50	470 x 368	16.74 x 11.10	425 x 282	1	Quarter-turn	10.00	254
CSD20208WSS	20.00 x 20.00 x 8.00	508 x 508 x 203	16	16	CP2020	18.20 x 18.20	462 x 462	18.50 x 18.50	470 x 470	16.74 x 15.10	425 x 384	1	Quarter-turn	10.00	254
CSD24208WSS	24.00 x 20.00 x 8.00	610 x 508 x 203	16	16	CP2420	22.20 x 18.20	564 x 462	22.50 x 18.50	572 x 470	20.74 x 15.10	527 x 384	1	Quarter-turn	12.00	305
CSD24248WSS	24.00 x 24.00 x 8.00	610 x 610 x 203	14	16	CP2424	22.20 x 22.20	564 x 564	22.50 x 22.50	572 x 572	20.74 x 17.68	527 x 449	2	Quarter-turn	5.00	127
CSD30248WSS	30.00 x 24.00 x 8.00	762 x 610 x 203	14	16	CP3024	28.20 x 22.20	716 x 564	28.50 x 22.50	724 x 572	26.74 x 17.68	679 x 449	2	Quarter-turn	5.00	127
CSD161210WSS	16.00 x 12.00 x 10.00	406 x 305 x 254	16	16	CP1612	14.20 x 10.20	361 x 259	14.50 x 10.50	368 x 267	12.74 x 7.10	324 x 180	1	Quarter-turn	8.00	203
CSD201610WSS	20.00 x 16.00 x 10.00	508 x 406 x 254	16	16	CP2016	18.20 x 14.20	462 x 361	18.50 x 14.50	470 x 368	16.74 x 11.10	425 x 282	1	Quarter-turn	10.00	254
CSD202010WSS	20.00 x 20.00 x 10.00	508 x 508 x 254	16	16	CP2020	18.20 x 18.20	462 x 462	18.50 x 18.50	470 x 470	16.74 x 15.10	425 x 384	1	Quarter-turn	10.00	254
CSD242010WSS	24.00 x 20.00 x 10.00	610 x 508 x 254	16	16	CP2420	22.20 x 18.20	564 x 462	22.50 x 18.50	572 x 470	20.74 x 15.10	527 x 384	1	Quarter-turn	12.00	305
CSD242410WSS	24.00 x 24.00 x 10.00	610 x 610 x 254	14	16	CP2424	22.20 x 22.20	564 x 564	22.50 x 22.50	572 x 572	20.74 x 17.68	527 x 449	2	Quarter-turn	5.00	127
CSD302410WSS	30.00 x 24.00 x 10.00	762 x 610 x 254	14	16	CP3024	28.20 x 22.20	716 x 564	28.50 x 22.50	724 x 572	26.74 x 17.68	679 x 449	2	Quarter-turn	5.00	127
CSD202012WSS	20.00 x 20.00 x 12.00	508 x 508 x 305	14	16	CP2020	18.20 x 18.20	462 x 462	18.50 x 18.50	470 x 470	16.74 x 15.10	425 x 384	1	Quarter-turn	10.00	254
CSD302412WSS	30.00 x 24.00 x 12.00	762 x 610 x 305	14	16	CP3024	28.20 x 22.20	716 x 564	28.50 x 22.50	724 x 572	26.74 x 17.68	679 x 449	2	Quarter-turn	5.00	127

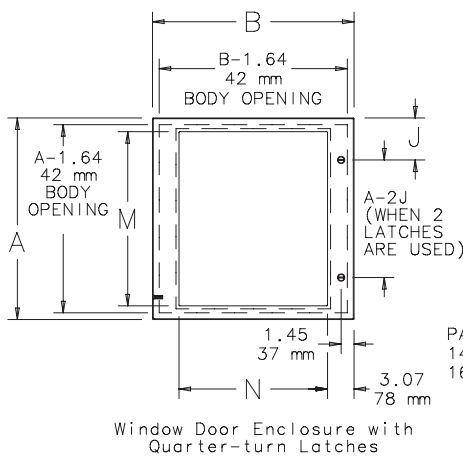
Purchase panels separately.

Optional NEMA style steel and stainless steel panels require conversion kit catalog number CCPM4.

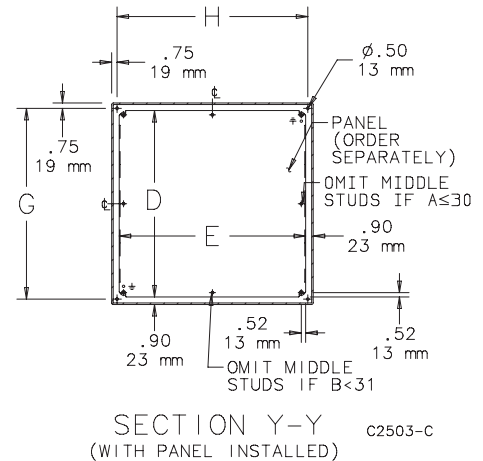
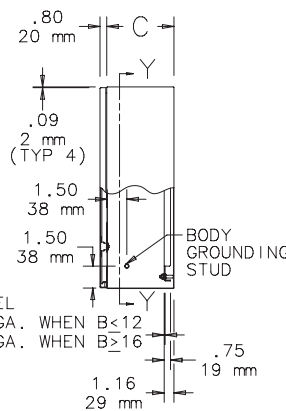
Material is stainless steel Type 304.

For Conductive Panels, add a "C" to the panel catalog number.

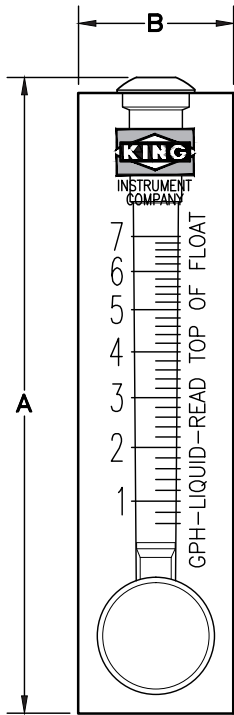
CONCEPT Single-Door Wall-Mounted Enclosures with Windows



Window Door Enclosure with Quarter-turn Latches



SECTION Y-Y
(WITH PANEL INSTALLED)



Economical machined cast acrylic block construction makes these meters great for OEM use.
Optional inlet metering valve available

DESCRIPTION

- Metering Tube**
Machined cast acrylic
- Internal Components**
316L SS
- Fitting Material**
Standard: PVC
(brass for 2C block size)
Optional: 316L SS or brass
- Inlet/Outlet Fittings**
NPT, horizontal
Control valve optional
- O-Ring**
Standard: EPR
Optional: Buna N, Viton®, and Kalrez®

PERFORMANCE

- Capacities**
Water 7 GPH to 20 GPM
Air 2.6 SCFH to 60 SCFM
- Scale**
50mm, 75mm, 100mm, 127mm, 250mm
direct reading
- Accuracy**
± 6% of full scale flow, 50 mm scale
± 4% of full scale flow, 75 mm scale
± 4% of full scale flow, 100 mm scale
± 7% of full scale flow, 6C-04, 6C-06
± 3% of full scale flow, 127 mm scale
± 2% of full scale flow, 250 mm scale
- Turndown**
10:1
- Repeatability**
3%, 50 mm scale
2%, 75 mm scale
2%, 100 mm scale
4%, 6C-04, 6C-06
2%, 127 mm scale
0.5%, 250 mm scale

- Maximum Temperature**
Liquid 130° F (54° C)
Gases 100° F (38° C)

- Maximum Pressure**
Water 125 psig
Air 100 psig

- Ambient Temperature**
33° F to 125° F (1° C to 52° C)

OPTIONS

- Certified Calibrations**
Conform to ISA RP 16.6

- Scales**
Any volumetric unit

CAUTION: Meters used in gas service are designed to operate at 14.7 psia. Meters used in pressure gas service must be shielded using 3/8" polycarbonate to protect personnel and equipment in the event of tube failure.

SPECIFICATIONS:

Order Number	Flow Water	Order Number	Flow Air	Float	Dimensions (Inches)	
Block #2C, 50mm (2 Inch) Scale						
A						
B						
-	-	2C-01*	2.6 SCFH	BL	4.125	1
-	-	2C-03**	5 SCFH	BL	4.125	1
-	-	2C-05*	10 SCFH	BL	4.125	1
-	-	2C-07*	20 SCFH	BL	4.125	1
2C-02	7 GPH	2C-09**	30 SCFH	BL	4.125	1
2C-04	12 GPH	2C-11	60 SCFH	SL	4.125	1
2C-06	22 GPH	2C-13	100 SCFH	SL	4.125	1
2C-08	44 GPH	2C-15	180 SCFH	SL	4.125	1
2C-10	60 GPH	2C-17	4 SCFM	SL	4.125	1
2C-12	75 GPH	-	-	SL	4.125	1

*These meters have glass ball floats

**These meters have stainless steel ball floats

Order Number	Flow Water	Order Number	Flow Air	Float	Dimensions (Inches)	
Block #3C, 75mm (3 Inch) Scale						
A						
B						
3C-02	1 GPM	3C-01	4 SCFM	GV	6.875	1.20
3C-04	2 GPM	3C-03	8 SCFM	GV	6.875	1.20
3C-06	3.5 GPM	3C-05	15 SCFM	SL	6.875	1.20
3C-08	5 GPM	3C-07	23 SCFM	SL	6.875	1.20
Block #5C, 127mm (5 Inch) Scale						
5C-10	10 GPH	5C-11	42 SCFH	GV	8.45	1.20
5C-12	20 GPH	5C-13	100 SCFH	SL	8.45	1.20
5C-14	40 GPH	5C-15	175 SCFH	SL	8.45	1.20
5C-02	1 GPM	5C-01	4 SCFM	GV	8.45	1.20
5C-04	100 GPH	5C-03	6.8 SCFM	GV	8.45	1.20
5C-06	2 GPM	5C-05	8.2 SCFM	GV	8.45	1.20
5C-08	5 GPM	5C-07	22 SCFM	SL	8.45	1.20
Block #6C, 100mm (4 Inch) Scale						
6C-02	10 GPM	6C-01	40 SCFM	SL	9.125	1.78
6C-04	15 GPM	6C-03	60 SCFM	SL	9.125	1.78
6C-06	20 GPM	-	-	SL	9.125	1.78
Block #7C, 250mm (10 Inch) Scale						
7C-02	2 GPM	7C-01	8 SCFM	GV	14.50	1.78
7C-04	3.5 GPM	7C-03	14.4 SCFM	GV	14.50	1.78
7C-06	5 GPM	7C-05	20 SCFM	GS	14.50	1.78
7C-08	10 GPM	7C-07	42 SCFM	SL	14.50	1.78

Blocks 3C, 5C, 6C and 7C have mounting studs depicted in dimension "H" and thread "J". (Mounting nuts not supplied)

CONNECTIONS & MOUNTING

Block Number	Connection Size
2C	1/4" FNPT

Block 2C is supplied with .875" hex mounting nuts on plumbing connections.

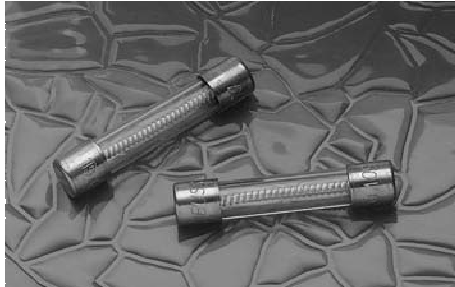
ORDERING:

Use the following guide to determine the specific product number you require.

Meter Series	Fitting Material	O-Ring Material	Valve Material	Order Number
7520 No valve	Brass - 1	EPR - 1	Brass - 1	See Specifications
7530 With valve	316L SS - 3	Buna-N - 2 Viton® - 3	316L SS - 2 Without Valve - 0	Table

MDL

1/4" x 1 1/4" Time-delay glass tube fuses



Product features

- Time-delay
- Optional axial leads available
- 1/4 x 1 1/4 (6.4 x 31.7mm) physical size
- Glass tube, nickel-plated brass endcap construction
- UL Listed product meets standard 248-14

Environmental data

- Shock: 1A thru 30A – MIL-STD-202, Method 207, (HI Shock)
- Vibration: 1/4A thru 30A – MIL-STD-202, Method 204, Test Condition C (Except 5g, 500HZ)

Agency information

- UL Listed Card: MDL 1/16 - 8A (Guide JDYX, File E19180)
- UL Recognized Card: MDL 9 - 30A (Guide JDYX2, File E19180)
- CSA Certification Card: MDL 1/16 - 8A (Class No. 1422-01)
- CSA Component Acceptance: MDL 9-30A (Class No. 1422-30)
- CE

Ordering

- Specify packaging code
- Insert packaging code prefix before part number. E.g., BK (or BK1)-MDL-5-R
- Specify option codes if desired
- For axial leads, insert "V" between catalog series and amp rating. E.g., BK-MDL-V-5-R
- For board washable, insert "B" between catalog series and amp rating. E.g., BK-MDL-B-5-R
- For axial leads and board washable, insert "B" then "V" between catalog series and amp rating. E.g., BK-MDL-BV-5-R

Part Number	Voltage Rating Vac	Specifications			Typical DC Cold Resistance** (Ω)	Typical Melting I ² t† AC	Typical Voltage Drop‡
		AC Interrupting Rating* (amps)@					
		250Vac	125Vac	32Vac			
MDL-1/16-R	250	35	10000	-	45.6	0.0046	2.79
MDL-1/10-R	250	35	10000	-	15.68	0.0420	1.95
MDL-1/8-R	250	35	10000	-	12.238	0.0422	1.52
MDL-3/16-R	250	35	10000	-	4.81	0.116	1.05
MDL-2/10-R	250	35	10000	-	5.234	0.314	0.972
MDL-1/4-R	250	35	10000	-	3.208	0.447	0.965
MDL-3/10-R	250	35	10000	-	2.046	0.412	0.808
MDL-3/8-R	250	35	10000	-	1.567	0.982	1.46
MDL-1/2-R	250	35	10000	-	0.943	1.656	1.27
MDL-3/4-R	250	35	10000	-	0.397	4.343	1.01
MDL-1-R	250	35	10000	-	0.273	11.498	0.995
MDL-1-1/4-R	250	100	10000	-	0.205	86.2	0.722
MDL-1-1/2-R	250	100	10000	-	0.156	22.7	0.721
MDL-2-R	250	100	10000	-	0.116	62.3	0.644
MDL-2-1/4-R	250	100	10000	-	0.096	49.6	0.535
MDL-2-1/2-R	250	100	10000	-	0.081	63.1	0.410
MDL-3-R	250	100	10000	-	0.057	67.5	0.345
MDL-4-R	250	200	10000	-	0.038	19.3	0.187
MDL-5-R	250	200	10000	-	0.025	32.0	0.160
MDL-6-R	250	200	10000	-	0.022	37.4	0.155
MDL-6-1/4-R	250	200	10000	-	0.02	38.7	0.152
MDL-7-R	250	200	10000	-	0.018	42.7	0.140
MDL-8-R	250	200	10000	-	0.015	47.8	0.119
MDL-9-R	32	-	-	1000	0.012	51.5	0.124
MDL-10-R	32	-	-	1000	0.01	64.4	0.114
MDL-15-R	32	-	-	1000	0.005	354.0	0.130
MDL-20-R	32	-	-	1000	0.004	2914.0	0.530
MDL-25††	32	-	-	1000	0.01225	15221.0	0.30
MDL-30††	32	-	-	1000	0.0011	15581.0	0.40

* Interrupting Ratings (Interrupting ratings were measured at 70% - 80% power factor on AC)

** DC Cold Resistance (Measured at ≤10% of rated current)

† Typical Melting I²t (A²Sec) (I²t was measured at listed interrupting rating and rated voltage.)

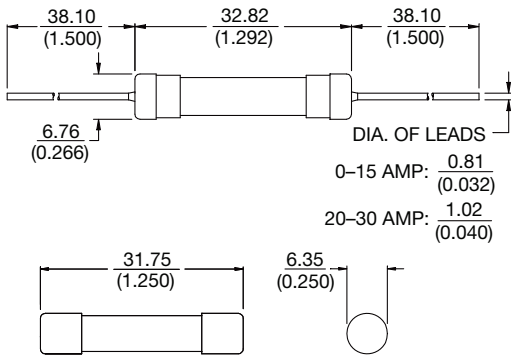
‡ Typical Voltage Drop (Voltage drop was measured at 25°C±3°C ambient temperature at rated current)

†† MDL-25 & MDL-30 not available in RoHS compliant construction.

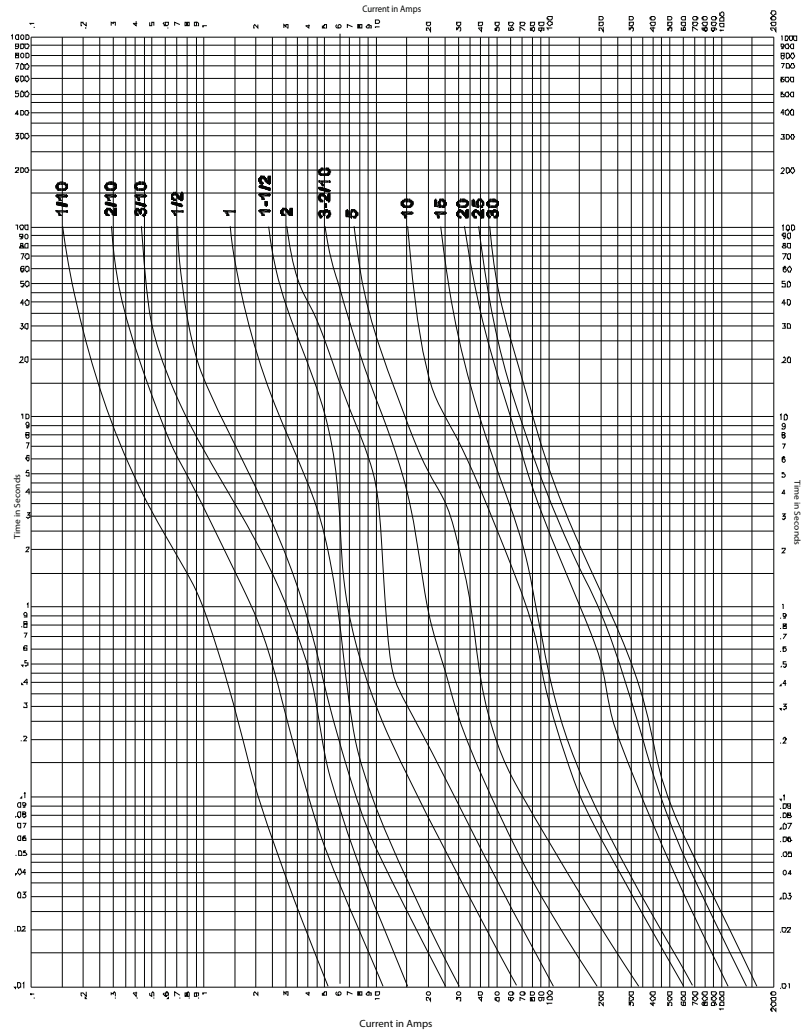


Powering Business Worldwide

Dimensions - mm (in)
Drawing Not to Scale



Time-Current Curve



Packaging Code	
Packaging Code	Description
BK	100 fuses packed into a cardboard carton

Option Code	
Option Code	Description
B	Sealed to withstand aqueous cleaning (Board Washable)
V	Axial leads - copper tinned wire with nickel plated brass overcaps

Life Support Policy: Eaton does not authorize the use of any of its products for use in life support devices or systems without the express written approval of an officer of the Company. Life support systems are devices which support or sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in significant injury to the user.

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June 2017

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Main

Product line	QO
Product type	Bar

Complementary

Number of connectors	7
Wire size	AWG 14...AWG 4 copper AWG 12...AWG 4 aluminium
Provided equipment	2 screw
Bar length	2.87 in (73 mm)
Maximum length of segment	1.26 in (32 mm)
Device mounting	Direct mounting back of enclosure
Height	0.437 in (11.10 mm)
Depth	0.312 in (7.92 mm)
Tightening torque	30 lb.in Mounting screw 30 lb.in 20 lb.in, AWG 14...AWG 10, copper 20 lb.in, AWG 12...AWG 10, aluminium 35 lb.in, AWG 6...AWG 4 25 lb.in, AWG 8 25 lb.in, AWG 14...AWG 12, copper 25 lb.in, AWG 12...AWG 10, aluminium

Ordering and shipping details

Category	00102-QO LC ACCESSORIES
Discount Schedule	DE3A
GTIN	785901026372
Nbr. of units in pkg.	1
Package weight(Lbs)	1.60 oz (45.359 g)
Returnability	Yes
Country of origin	US

Packing Units

Unit Type of Package 1	PCE
Package 1 Height	0.40 in (1.016 cm)
Package 1 width	1.20 in (3.048 cm)
Package 1 Length	5.00 in (12.7 cm)
Unit Type of Package 2	PAL
Number of Units in Package 2	2160
Package 2 Weight	260.00 lb(US) (117.934 kg)
Package 2 Height	26.50 in (67.31 cm)

Package 2 width	40.00 in (101.6 cm)
Package 2 Length	48.00 in (121.92 cm)

Offer Sustainability

Sustainable offer status	Green Premium product
California proposition 65	WARNING: Cancer and Reproductive Harm - www.P65Warnings.ca.gov
REACH Regulation	REACH Declaration
REACH free of SVHC	Yes
EU RoHS Directive	Pro-active compliance (Product out of EU RoHS legal scope) EU RoHS Declaration
Toxic heavy metal free	Yes
Mercury free	Yes
RoHS exemption information	Yes
China RoHS Regulation	China RoHS Declaration

Contractual warranty

Warranty	18 months
----------	-----------

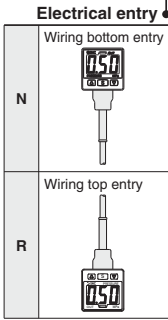
Digital Pressure Switch (Built-in Regulator Type)

ISE35 Series



How to Order

ISE35 - **N** - **25** - **M** **L** -



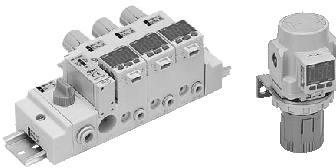
Output specifications

25	NPN output
65	PNP output

Unit specifications

Nii	With unit conversion function <small>Note 1)</small>
M	Fixed SI unit <small>Note 2)</small>
P	Pressure unit: psi (Initial value), with unit conversion function <small>Note 1)</small>

Note 1) Under the New Measurement Law, sales of switches with the unit switching function have not been allowed for use in Japan.
Note 2) Fixed unit: MPa



Made to Order (p. 128-1)

Symbol	Specifications
X523	AR/AW-D Series Mounting kit is included

* Only applicable to Option 2 (A)

Option 2

	None
A	<p>AR/AW series mounting kit</p>
B	<p>ARM10/11 series mounting kit</p>

Option 1

	None
L	<p>Lead wire with connector (Length: 2 m)</p>

Applicable series

Product series that this product can be installed in.

Product series	Model
F.R.L. combination	AC20/AC25/AC30/AC50/AC55/AC60
	AC20A/AC30A/AC40A/AC50A/AC60A
	AC20B/AC25B/AC30B/AC50B/AC55B/AC60B
	AC20C/AC25C/AC30C/AC40C
Regulator	AC20D/AC30D/AC40D
	AR20 (K) /AR25 (K) /AR30 (K) /AR40 (K) /AR50 (K) /AR55 (K) /AR60 (K)
Filter regulator	AW20 (K) /AW30 (K) /AW40 (K) /AW60 (K)
Mist separator regulator	AWM20/AWM30/AWM40
Micro mist separator regulator	AWD20/AWD30/AWD40
Compact manifold regulator	ARM10/ARM11
Direct precision operated regulator	ARP20 (K) /ARP30 (K) /ARP40 (P)

Option/Part No.

When optional parts are required separately, use the following part numbers to place an order.

Name	Part No.	Note
Lead wire with connector	ZS-32-A	Length: 2 m (With rubber cover)
Mounting kit	ZS-32-C	For ISE35-□-A (AR/AW series) Mounting thread (3 x 7L, 2 pcs.), adapter, lock pin, O-ring are attached
	ZS-32-D	For ISE35-□-B (ARM10/11 series) Mounting thread (M3 x 13, 2 pcs.), adapter, lock pin, O-ring are attached
	ZS-32-C-X473	For ISE35-□-A-X523 (AR/AW-D series) Mounting thread (3 x 8L, 2 pcs.), adapter, lock pin, O-ring are attached

Refer to pages 11 and 12 for Pressure Switch Precautions. For details about the Specific Product Precautions, refer to the Operation Manual on the SMC website, <http://www.smcworld.com> Click [here](#) for details.

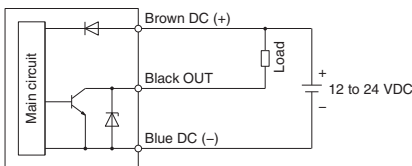
Specifications

Model		ISE35
Rated pressure range		0 to 1 MPa
Display/setting pressure range		-0.1 to 1 MPa
Withstand pressure		1.5 MPa
Minimum display/setting unit		0.01 MPa
Applicable fluid		Air, Non-corrosive gas, Non-flammable gas
Power supply voltage		12 to 24 VDC $\pm 10\%$, Ripple (p-p) 10% or less (With power supply polarity protection)
Current consumption		55 mA or less (at no load)
Switch output		NPN or PNP open collector output: 1 output
	Max. load current	80 mA
	Max. applied voltage	30 V (With NPN output)
	Residual voltage	1 V or less (With load current of 80 mA)
	Response time	1 s (0.25, 0.5, 2, 3s selections)
Short circuit protection		Yes
Repeatability		$\pm 1\%$ F.S.
Hysteresis	Hysteresis mode	Adjustable (can be set from 0)
	Window comparator mode	
Display		3-digit, 7-segment indicator, 2-color display (Red/Green) A switch can be operated simultaneously.
Display accuracy		$\pm 2\%$ F.S. ± 1 digit (at 25°C $\pm 3^\circ\text{C}$ ambient temperature)
Indicator light		Lights up when output is turned ON. (Green)
Environment	Enclosure	IP40
	Operating temperature range	-5 to 50°C (No freezing or condensation)
Lead wire with connector (Option: L)		Oil resistance vinyl cabtyre cable 3 core $\phi 3.4$ 2 m Sectional area of conductor: 0.2 mm ² (AWG25) Outside diameter of insulator: 1.16 mm
Weight		Approx. 14 g (Body only) Approx. 38 g (Including lead wire with connector)
Standard		CE/UKCA marking, UL/CSA (E216656)

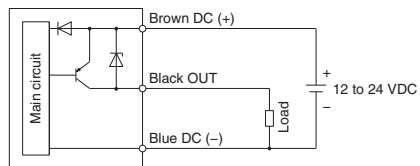
ZSE20
ISE20
ZSE30
ISE30
ZSE40
ISE40
ZSE10
ISE10
ISE70
ZSE80
ISE80
PS
ISA3
ISA2
ISE35
PSE
IS
ISG
ZSM1

Internal Circuits and Wiring Examples

-25 NPN (1 output)

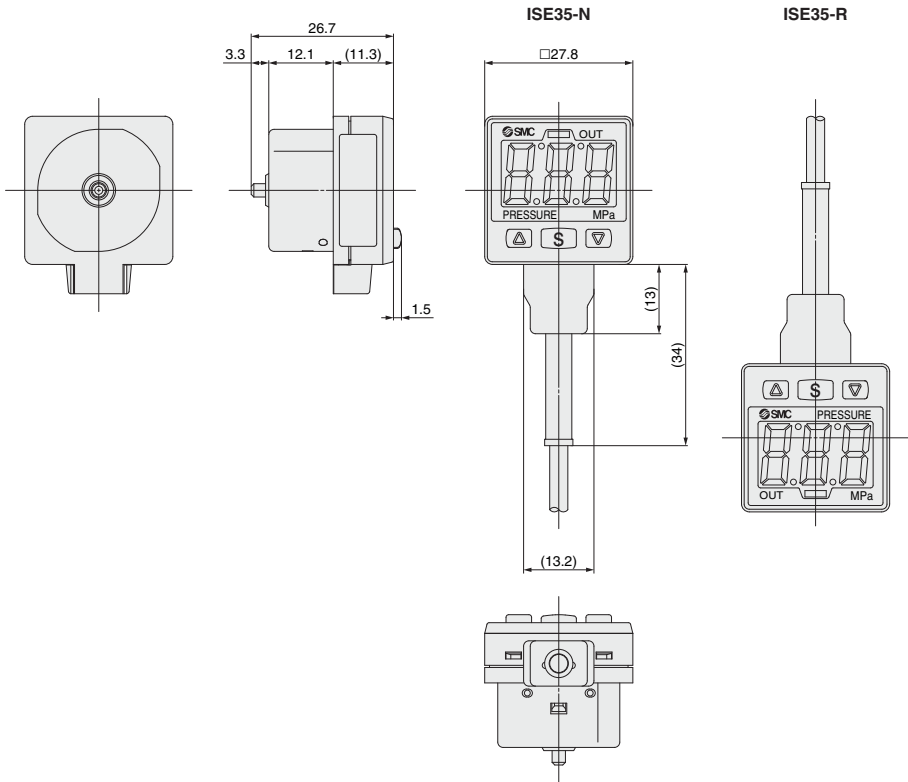


-65 PNP (1 output)

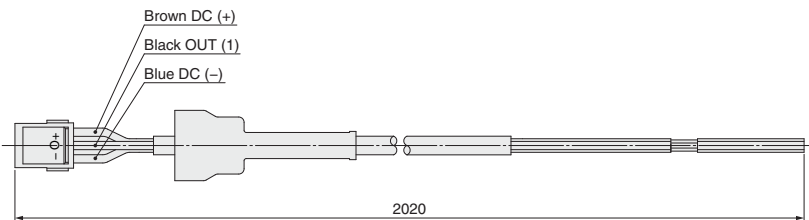


ISE35 Series

Dimensions



Lead wire with connector ZS-32-A



ISE35 Series

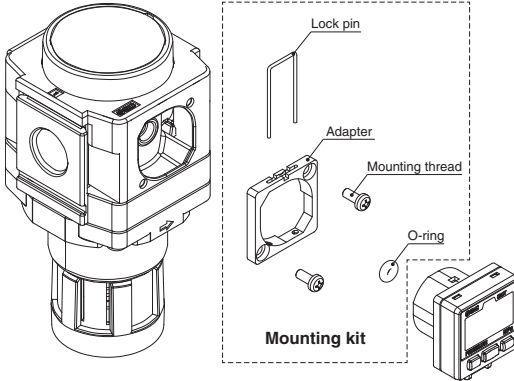
Made to Order

Please contact SMC for detailed dimensions, specifications and lead times.



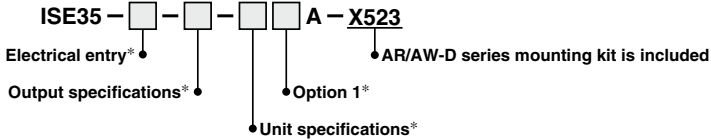
1 AR/AW-D Series Mounting Kit is Included

Mounting screws, an adapter, a lock pin, and an O-ring are shipped together with the product.



How to Order

* Refer to "How to Order" on page 126 for standard specifications.



Option/Part No.

Name	Part No.	Note
Mounting kit	ZS-32-C-X473	For ISE35-□-A-X523 (AR/AW-D series) Mounting thread (3 x 8L, 2 pcs.), adapter, lock pin, O-ring are attached

ZSE20
ISE20
ZSE30
ISE30
ZSE40
ISE40
ZSE10
ISE10
ISE70
ZSE80
ISE80
PS
ISA3
ISA2
ISE35
PSE
IS
ISG
ZSM1



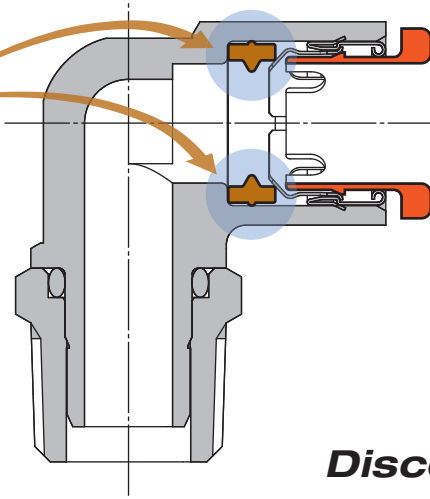
One-Touch Fittings

Manufacturing Pneumatics Worldwide



Reinventing One Touch

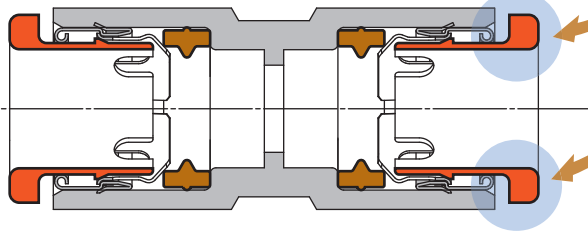
New Engineered Anchor Grip Seal



Easy Insertion

Quick Disconnect

Easy Insertion

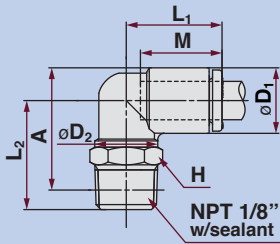


Same Strong Hold

Compact Low Profile

KQ2L07-34AS

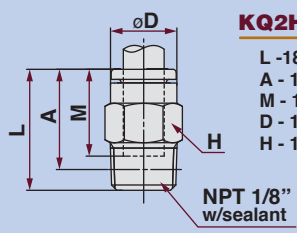
- L₂ - 17.7 mm
- A - 20.1 mm
- D₂ - 10 mm
- L₁ - 15.6 mm
- M - 13.3 mm
- H - 11.1 mm
- D₁ - 11.1 mm



NPT 1/8" w/sealant

KQ2H07-34AS

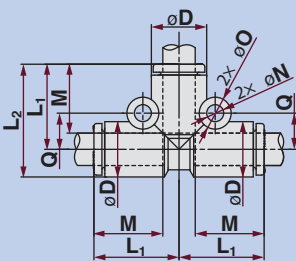
- L - 18 mm
- A - 14.8 mm
- M - 13.3 mm
- D - 10 mm
- H - 11.1 mm



NPT 1/8" w/sealant

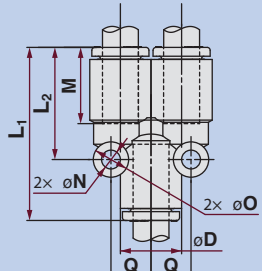
KQ2T07-00A

- L₂ - 22.1 mm
- L₁ - 16.5 mm
- Q - 7.2 mm
- M - 13.3 mm
- D - 11.1 mm
- O - 6 mm
- N - 3.2 mm



KQ2U07-00A

- L₁ - 30.3 mm
- L₂ - 20.2 mm
- M - 13.3 mm
- P - 11.1 mm
- Q - 7.6 mm
- D - 11.1 mm
- O - 8 mm
- N - 4 mm



Move Forward with **EXPERIENCE**

Move Forward with **EASE**

Move Forward with



NF225-A

Simple Part Number

Full Part Number Listings (including metric) available at www.smcusa.com/newkq2

Series KQ2

COMING
SOON



FACE
SEAL

**FASTER
INSTALLATION**

**EASIER
MAINTENANCE**

**DURABLE...
USE, REUSE**

NICKEL
PLATED
BRASS



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www.smcusa.com

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(800 - 762 - 7621)

SMC Pneumatics (Canada) Ltd.
www.smc Pneumatics.ca

e-mail: sales@smcusa.com
For International inquires:
www.smcworld.com

All reasonable efforts to ensure the accuracy of the information detailed in this flyer were made at the time of publishing. However, SMC can in no way warrant the information herein contained as specifications are subject to change without notice.

How to Order

Threaded Type

KQ2 H 07 - 34 A S

Model

H	Male Connector
S	Hexagon Socket Head Male Connector
F	Female Union
L	Male Elbow
K	45 Degree Male Elbow
V	Universal Male
VS	Hexagon Socket Head Universal Male Elbow
VF	Universal Female Elbow
LF	Female Elbow
VD	Double Universal Male Elbow
VT	Triple Universal Male Elbow
Z	Branch Universal Male Elbow
ZD	Double Branch Universal Male Elbow
ZT	Triple Branch Universal Male Elbow
W	Extended Male Elbow
T	Male Branch Tee
Y	Male Run Tee
U	Branch "Y"
X	Different Diameter Plug In "Y"
E	Bulkhead Union
	Bulkhead Connector
LE	Bulkhead Union Elbow
N	Reducer Nipple

Tube O.D.

01	1/8"
03	5/32"
05	3/16"
07	1/4"
09	5/16"
11	3/8"
13	1/2"

Applicable Thread Type

32	10-32UNF
33	NPT 1/16
34	NPT 1/8
35	NPT 1/4
36	NPT 3/8
37	NPT 1/2
*00	Same Diameter Tubing

*Only for "Bulkhead union" and "Bulkhead union elbow"

Thread Sealing Method

S	With Thread Sealant
---	---------------------

Thread Material/Plating

A	Brass
N	Electroless Nickel Plated Brass
<input type="checkbox"/> J	Interchangeable with KJE



Tube - Tube Type

KQ2 H 05 - 00 A

Model

H	Straight Union
	Different Diameter Straight
	Elbow
L	Plug-in Elbow
	Reducer Elbow
R	Plug-in Reducer
T	Union Tee
	Different Diameter Tee
TW	Cross Union
	Union "Y"
U	Plug in "Y"
	Different Diameter Union "Y"

Tube O.D.

01	1/8"
03	5/32"
05	3/16"
07	1/4"
09	5/16"
11	3/8"
13	1/2"

Applicable Tubing O.D.

00	Same Diameter Tubing
99	Same Diameter Rod
01	ø1/8"
03	ø5/32"
05	ø3/16"
07	ø1/4"
09	ø5/16"
11	ø3/8"
13	ø1/2"

Accessories

KQ2N	Nipple
	Reducer Nipple
KQ2C	Tube Cap
KQ2P	Plug

Transmitters: Shuttle Valve with One-touch Fittings VR1210F/1220F Series



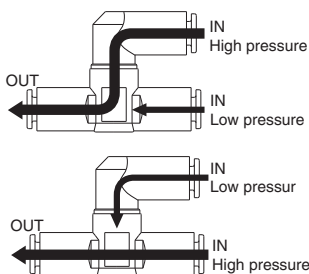
Relay valves for controlling pneumatic signal lines



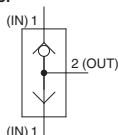
Related Products



When the difference in input air pressure between two IN sides is 0.05 MPa or more, the air with higher pressure constantly flows to the OUT side.



Symbol



Model

Model	Applicable tubing O.D.									
	Metric size					Inch size				
	3.2	4	6	8	10	1/8"	5/32"	1/4"	5/16"	3/8"
VR1210F	●	●	●	●	●	●	●	●	●	●
VR1220F			●	●	●			●	●	●

Specifications

Proof pressure	1.5 MPa
Max. operating pressure	1.0 MPa
Min. operating pressure	0.05 MPa
Ambient and fluid temperature	-5 to 60°C (No freezing)
Applicable tubing material ⁽¹⁾	Nylon, Soft nylon, Polyurethane

Note 1) Use caution about the maximum operating pressure when soft nylon and polyurethane is used. (Refer to the [Web Catalog](#).)

Note 2) Brass components are all electroless nickel plated as standard. (Copper-free and fluorine-free)

Flow rate characteristics

Applicable tubing O.D.	Model	VR1210F				VR1220F			
	Metric size	ø3.2	ø4	ø6	ø8	ø6	ø8	ø10	
	Inch size	ø1/8"	ø5/32"	ø1/4"	ø5/16"	ø1/4"	ø5/16"	ø3/8"	
Flow rate characteristics	C[dm ³ /(s·bar)]	0.5	0.7	1.3	1.5	1.4	2.1	3.1	
	b	0.25	0.25	0.25	0.25	0.25	0.25	0.25	

How to Order

VR 12 1 0 F - 06

Body size

1	1/8 standard
2	1/4 standard

Shuttle valve

With One-touch fittings

Applicable tubing O.D.

Metric size		Inch size	
23	ø3.2*	01	ø1/8"
04	ø4	03	ø5/32"
06	ø6	07	ø1/4"
08	ø8	09	ø5/16"
10	ø10	11	ø3/8"

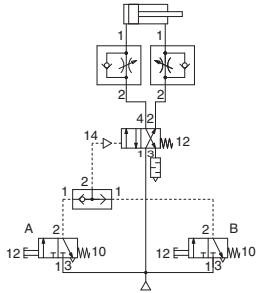
* For ø3.2, use ø1/8" tubing.

Transmitters: Shuttle Valve with One-touch Fittings **VR1210F/1220F Series**

Example of Operating Circuit

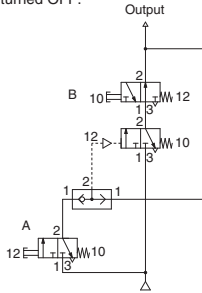
OR circuit

- If either A or B is turned ON, cylinder is actuated.



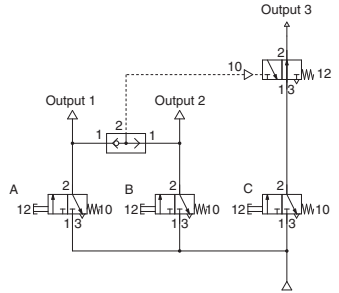
Self-hold circuit

1. If A is turned ON, the output turns ON.
2. Even though A is turned OFF, the output remains in ON state.
3. If B is turned ON in 2. state, the output is turned OFF.

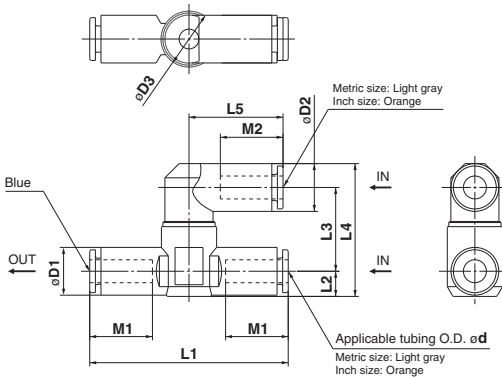


Interlock circuit

- When either A or B is turned ON, even though C turns ON, the output 3 will not be turned ON.
- Only when both A and B are in OFF state, if C turns ON, the output 3 is turned ON.



Dimensions



Metric Size

Model	d	D1	D2	D3	L1	L2	L3	L4	L5	M1	M2	Weight (g)	Compatible holder <small>(Note)</small>
VR1210F-23	3.2	11.4	8.4	14.8	52	6.2	19.4	29.8	17.5	12.7	12.9	21.4	TMH-06J
VR1210F-04	4	11	10.4		53	6	20.3	31.5	21.9	16.5	15.8	15.6	—
VR1210F-06	6	12.8	12.8		53.2	6.7	22.5	35.6	25.2	16.8	16.8	23.0	TMH-06
VR1210F-08	8	15.2	15.2		60.4	8		38.2	28.2	18.7	18.7	24.0	TMH-08
VR1220F-06	6	12.8	12.8	19.8	59	7.4	23.9	37.7	25.2	16.8	16.8	27.2	TMH-06
VR1220F-08	8	15.2	15.2		65	8.2		39.7	28.2	18.7	18.7	31.9	TMH-08
VR1220F-10	10	18.5	18.5		71.6	9.8	25.8	44.8	31	20.8	20.8	43.2	TMH-10

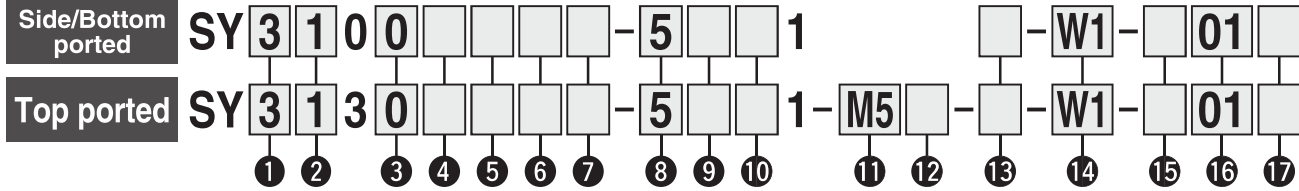
Inch Size

Model	d	D1	D2	D3	L1	L2	L3	L4	L5	M1	M2	Weight (g)	Compatible holder <small>(Note)</small>
VR1210F-01	1/8"	11.4	8.4	14.8	52	6.2	19.4	29.8	17.5	12.7	12.9	21.4	TMH-06J
VR1210F-03	5/32"	11	10.4		53	6	20.3	31.5	21.9	16.5	15.8	15.6	—
VR1210F-07	1/4"	13.2	13.2		54.4	7	22.5	36.2	25.6	16.8	16.8	23.5	TMH-07
VR1210F-09	5/16"	15.2	15.2		60.4	8		38.2	28.2	18.7	18.7	24.0	TMH-09
VR1220F-07	1/4"	13.2	13.2	19.8	59	7.4	23.9	37.9	25.6	16.8	16.8	31.4	TMH-07
VR1220F-09	5/16"	15.2	15.2		65	8.2		39.7	28.2	18.7	18.7	31.9	TMH-09
VR1220F-11	3/8"	17.9	18.5		69.8	9.4	25.8	44.5	31	20.8	20.8	53.0	—

Note) It is possible to use a TMH series holder to secure the VR12. The compatible models and holder models are shown above.

How to Order

In the case of (Valve) + (Sub-plate) (Built-in valve type part no.)



1 Series

3	SY3000
5	SY5000
7	SY7000

2 Type of actuation

1	2-position	Single
2		Double
3	3-position	Closed center
4		Exhaust center
5		Pressure center
A*1	4-position dual 3-port	N.C./N.C.
B*1		N.O./N.O.
C*1		N.C./N.O.

*1 Only the rubber seal type is available for the 4-position dual 3-port valve.

3 Seal type

0	Rubber seal
1	Metal seal

4 Pilot type

Nil	Internal pilot
R	External pilot

5 Back pressure check valve (Built-in valve type)

Nil	None
H	Built-in

* Only the rubber seal type is available.
* The built-in valve type back pressure check valve is not available for the 3-position type or the SY7000.

6 Pilot valve option

Nil	Standard (0.7 MPa)
B	Quick response type (0.7 MPa)
K*1	High pressure type (1.0 MPa)

*1 Only the metal seal type is available for the high pressure type.

7 Coil type

Nil	Standard
T	With power saving circuit (Continuous duty type)

* Be sure to select the power saving circuit type if the valve is to be continuously energized for long periods of time.
* Be careful of the energizing time when the power saving circuit is selected. Refer to page 292 for details.

8 Rated voltage

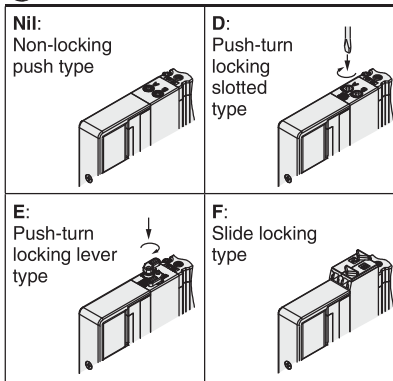
5	24 VDC
6	12 VDC

9 Light/surge voltage suppressor and common specification

Symbol	With light	Surge voltage suppressor	Common specification
Nil	—	—	Non-polar
R	—	—	
U	●	—	
S	—	●	Positive common
Z	●	—	Negative common
NS	—	—	
NZ	●	—	

* For the non-polar type, be careful of surge voltage intrusion. Refer to page 293 for details.
* Only "Z" and "NZ" types are available with a power saving circuit.

10 Manual override



* Refer to page 34 for the safety slide locking manual override.

11 A, B port size (* Top ported valve only)

Symbol	Port size	Applicable series
M5	M5 x 0.8	SY3000
01	1/8	SY5000
02	1/4	SY7000

Metric size (One-touch fitting)

Symbol	A, B port	SY3000	SY5000	SY7000
C2	ø2	●	—	—
C3	ø3.2	●	—	—
C4	ø4	●	●	—
C6	ø6	●	●	●
C8	ø8	—	●	●
C10	ø10	—	—	●
C12	ø12	—	—	●

Inch size (One-touch fitting)

Symbol	A, B port	SY3000	SY5000	SY7000
N1	ø1/8"	●	—	—
N3	ø5/32"	●	●	—
N7	ø1/4"	●	●	●
N9	ø5/16"	—	●	●
N11	ø3/8"	—	—	●

12 A, B port thread type (Thread piping)

Nil	Rc
F	G
N	NPT
T	NPTF

* Only Nil is available for M5.

13 Type of mounting screw

Nil	Round head combination screw
B	Hexagon socket head cap screw
K	Round head combination screw (Drop prevention type)
H	Hexagon socket head cap screw (Drop prevention type)

* For "K" and "H," the valve body cover has a drop prevention construction to stop the mounting screws from falling out when the valve is removed for maintenance, etc.
* Refer to page 283 when the base gaskets and mounting screws are required for maintenance.
* When using an optional spacer assembly, "B" and "H" cannot be selected.

14 Wiring specifications (Sub-plate)

WO	Without M12 connector cable
W1	With M12 connector cable (300 mm)
W2	With M12 connector cable (500 mm)
W3	With M12 connector cable (1000 mm)
W4	With M12 connector cable (2000 mm)
W7	With M12 connector cable (5000 mm)

* When ordering a product with M12 connector cable, the connector cable is included.

15 Port location (Sub-plate)

Nil	Side ported
B	Bottom ported
V*1	Top ported (1P, 5EA, 3EB port: Side ported)

*1 Only available for the valve piping type "3" top ported

16 Port size (Sub-plate)

Symbol	Port size	Applicable series
01	1/8	SY3000
02	1/4	SY5000
03	3/8	SY7000

17 Thread type (Sub-plate)

Nil	Rc
F	G
N	NPT
T	NPTF

* When mounting a special order (including Made-to-Order specification) valve or manifold option (spacer, etc.) on the sub-plate, add the valve part number or spacer part number under the sub-plate part number to place an order. For details, refer to the ordering example on page 283.

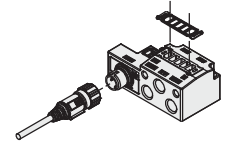
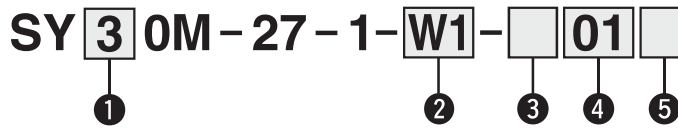
* When selecting a product with residual pressure release valve or vacuum release valve with restrictor, after selecting a model from page 24 or 26, make selections for items 15 to 18 above.

SY3000/5000/7000 Series

How to Order

In the case of **(Sub-plate)** (Sub-plate single unit part no.)

* Without valve



* Base gasket is included.
* Valve mounting screws are not included.

1 Series

3	SY3000
5	SY5000
7	SY7000

2 Wiring specifications

WO	Without M12 connector cable
W1	With M12 connector cable (300 mm)
W2	With M12 connector cable (500 mm)
W3	With M12 connector cable (1000 mm)
W4	With M12 connector cable (2000 mm)
W7	With M12 connector cable (5000 mm)

- * Refer to the table below for connector cable part numbers.
- * When ordering a product with M12 connector cable, the connector cable is included.

3 Port location (Sub-plate)

Nil	Side ported
B	Bottom ported
V	Top ported [1(P), 5(EA), 3(EB) port: Side ported]

4 Port size

Symbol	Port size	Applicable series
01	1/8	SY3000
02	1/4	SY5000
03	3/8	SY7000

5 Sub-plate thread type

Nil	Rc
F	G
N	NPT
T	NPTF

How to Order when mounting a special order (including Made-to-Order specification) valve on the sub-plate (Ordering example: X90)

- *SY30M-27-1-W1-01 1 set (Sub-plate single unit part no.)
- *SY3200-5U1-X90 1 set (2-position double part no./Main valve fluororubber specification)

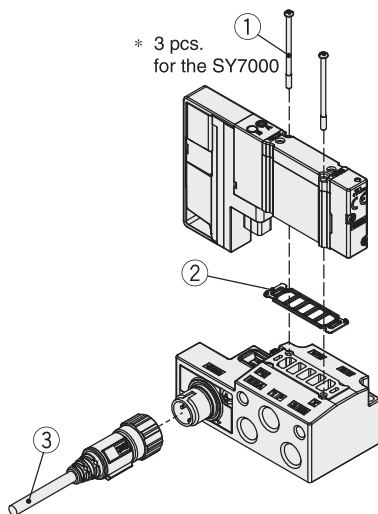
Ordering example when mounting a manifold option (spacer, etc.)

- *SY30M-27-1-W1-01 1 set (Sub-plate single unit part no.)
- *SY3400-5U1 1 set (3-position exhaust center part no.)
- *SY30M-60-1A 1 set (Part no. for double check spacer with residual pressure release valve)

⚠ Caution

Due to the properties of the double check spacer, assembly carried out by the customer is not recommended. If a double check spacer is to be used, be sure to order the type that is built in to the sub-plate as shown in the ordering example above.

Sub-plate Parts Nos.



No.	Description	Part no.			Note	
		SY3000	SY5000	SY7000		
①	Valve mounting screw	Round head combination screw (M2 x 32)	SY3000-23-24A (M2 x 32)	SY5000-221-1A (M3 x 32.5)	SY7000-221-1A (M3 x 36.5)	Part numbers shown on the left are for 10 valves (20 pcs.). (30 pcs. for the SY7000)
		Hexagon socket head cap screw (M2 x 32)	SY3000-222-1A (M2 x 32)	SY5000-222-1A (M3 x 32.5)	SY7000-222-1A (M3 x 36.5)	
②	Base gasket (for sub-plate)	SY30M-11-1A	SY50M-11-1A	SY70M-11-1A	Part numbers shown on the left are for 10 valves (10 pcs.).	
③	M12 waterproof connector cable	ZS-37-L			Cable length: 300 mm Cable weight: Approx. 18 g	
		ZS-37-M			Cable length: 500 mm Cable weight: Approx. 23 g	
		ZS-37-N			Cable length: 1000 mm Cable weight: Approx. 36 g	
		ZS-37-P			Cable length: 2000 mm Cable weight: Approx. 62 g	
		ZS-37-C			Cable length: 5000 mm Cable weight: Approx. 140 g	

⚠ Caution

Tightening torque

- M2: 0.16 N·m (SY3000)
- M3: 0.8 N·m (SY5000/7000)

Bourdon Tube Pressure Gauges Stainless Steel Series Type 232.53 - Dry Case Type 233.53 - Liquid-filled Case

WIKA Datasheet 23X.53

Applications

- With liquid filled case for applications with high dynamic pressure pulsations or vibration
- Suitable for corrosive environments and gaseous or liquid media that will not obstruct the pressure system
- Process industry: chemical/petrochemical, power stations, mining, on and offshore, environmental technology, mechanical engineering and plant construction

Product features

- Excellent load-cycle stability and shock resistance
- All stainless steel construction
- Positive pressure ranges to 15,000 psi (1,000 bar)
- FlexWindow™ option with integrated pressure compensation and 100% case fill*

Specifications

Design

ASME B40.100 & EN 837-1

Sizes

2", 2½" & 4" (50, 63 and 100 mm)

Accuracy class

2" & 2½": ± 2/1/2% of span (ASME B40.100 Grade A)
4": ± 1.0% of span (ASME B40.100 Grade 1A)

Ranges

Vacuum / compound to 200 psi (16 bar)
Pressure from 15 psi (1 bar) to 15,000 psi (1,000 bar) or other equivalent units of pressure or vacuum

Working pressure

2" & 2½":	Steady:	3/4 scale value
	Fluctuating:	2/3 full scale value
	Short time:	full scale value
4":	Steady:	full scale value
	Fluctuating:	0.9 x full scale value
	Short time:	1.3 x full scale value

Operating temperature

Ambient: -40°F to +140°F (-40°C to +60°C) - dry
-4°F to +140°F (-20°C to +60°C) - glycerine filled
-40°F to +140°F (-40°C to +60°C) - silicone filled
Medium: +212°F (+100°C) maximum



Bourdon Tube Pressure Gauge Model 232.53 – 2-1/2" » with FlexWindow™ option

Temperature error

Additional error when temperature changes from reference temperature of 68°F (20°C) ±0.4% of span for every 18°F (10°K) rising or falling.

Ingress protection

IP 65 per EN 60529 / IEC 60259
IP66 (NEMA 4) with FlexWindow™ option (2-1/2" only)

Pressure connection

Material: 316 stainless steel
Lower mount (LM) or center back mount (CBM)
Lower back mount (LBM) for 4" size
1/8" NPT, 1/4" NPT or 1/2" NPT limited to wrench flat area

Bourdon tube

Material: 316 stainless steel
≤ 1,500 psi (100 bar): C-shape,
> 1,500 psi (100 bar): Helical type

Movement

Stainless steel

Dial

White aluminum with black lettering, 2" and 2½" with stop pin

Pointer

Black aluminum

(*) EN837-1 does not apply to FlexWindow™.

Case

304 stainless steel with vent plug for ranges ≤ 300 psi (FlexWindow™ option without vent plug) and stainless steel crimp ring.

Window

Polycarbonate (standard)

Laminated Safety Glass

FlexWindow™ (Clear liquid silicone rubber)

Case fill

Model 233.53 – Glycerin, Glycerin/Water

100% Case fill with integrated pressure compensation with FlexWindow™ option (only available in 2-1/2")

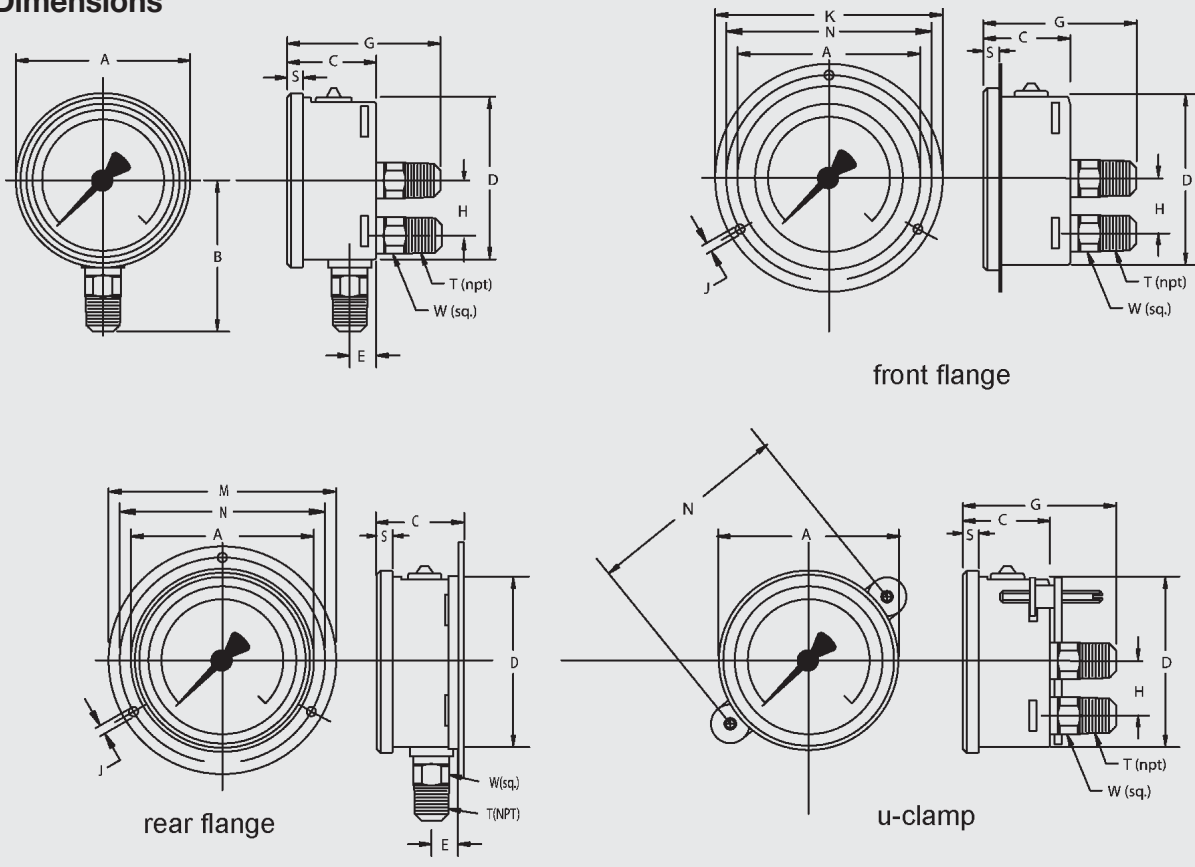
Approvals

NGV 3.1 Approval (not available with FlexWindow™)

Optional extras

- SS restrictor
- SS front flange
- SS rear flange (2½" and 4" only)
- Zinc-plated steel or SS u-clamp bracket (field installable - see note)
- Cleaned for oxygen service (not available with FlexWindow™)
- Red drag pointer or mark pointer (2½" and 4" only) (not available with FlexWindow™)
- External zero adjustment (4" size only)
- Other pressure connections
- Silicone or Halocarbon Oil case filling (not available with FlexWindow™)
- Other pressure scales available:

Dimensions



Size		A	B	C	D	E	G	H	J	K	M	N	S	T	W	Weight
2"	mm	55	48	30	50	12	53	-	3.6	71	71	60	5.5		14	0.27 lb. dry
	in	2.17	1.89	1.18	1.97	0.47	2.09	-	0.14	2.80	2.80	2.36	0.22	1/4"	0.55	0.33 lb. filled
2.5"	mm	69	54	32	62	13	54	-	3.6	85	88.1	75	6.5		14	0.36 lb. dry
	in	2.69	2.13	1.26	2.45	0.51	2.13	-	0.14	3.35	3.47	2.95	0.26	1/4"	0.55	0.44 lb. filled
4"	mm	107	87	48	100	15.5	79.5	30	4.8	132	132	116	8		22	1.10 lb. dry
	in	4.21	3.43	1.89	3.91	0.61	3.13	1.18	0.19	5.20	5.20	4.57	0.31	1/2"	0.87	1.76 lb. filled

Recommended panel cutout is dimension D + 3 mm

Standard Order Code - 23X.53 2"

		Measuring System	
1	<input type="text"/>	3	Stainless Steel
		Case filling	
		2	without
2	<input type="text"/>	3	with
		Case	
3	<input type="text"/>	53	Non-removable crimp ring
		Unit of outer Scale	
		P	psi / -inHg
		B	bar
		L	kPa
		E	MPa
4	<input type="text"/>	K	kg/cm2
		Measuring range	
		G	gauge pressure range
5	<input type="text"/>	V	vacuum- or compound-range
		Scale range	
		310	0/15 psi (-30"Hg/0)
		321	0/30 psi (-30"Hg/15 psi)
		341	0/60 psi
		369	0/100 psi
		411	0/160 psi
		414	0/200 psi
		421	0/300 psi
		428	0/400 psi
		441	0/600 psi
		455	0/800 psi
		469	0/1000 psi
		510	0/1500 psi
		514	0/2000 psi
		521	0/3000 psi
		528	0/4000 psi
		534	0/5000 psi
		541	0/6000 psi
		552	0/7500 psi
		569	0/10000 psi
		610	0/15000 psi
		331	-30 inHg/30 psi
		352	-30 inHg/60 psi
		379	-30 inHg/100 psi
		412	-30 inHg/160 psi
		415	-30 inHg/200 psi
6	<input type="text"/>	422	-30 inHg/300 psi

		2nd Scale / Special Scale	
		Z	without
		B	2nd scale bar
		P	2nd scale psi
		L	2nd scale kPa
		E	2nd scale MPa
7	<input type="text"/>	K	2nd scale kg/cm2
		Process Connection	
		NB	1/4 NPT
		GB	G 1/4 B
8	<input type="text"/>	NH	1/8 NPT
		Connector location	
		U	lower mount
		B	center back mount
		E	3 o'clock
		G	9 o'clock
9	<input type="text"/>	D	12 o'clock
		Mounting Flange/Bracket	
		Z	Without (Standard)
		F	front flange, polished SS
10	<input type="text"/>	G	panel mount with zinc plated mounting bracket
		Restrictor	
		Z	Without (Standard)
		Q	stainless steel, D 0.6
11	<input type="text"/>	R	Stainless Steel, Orifice 0.3mm(0.012 inches)
		Special design features	
		Z	without (Standard)
		G	for Oxygen, Cleanliness ASME B40.1 Level IV
12	<input type="text"/>	D	Cleanliness ASME B40.1 Level IV
		Certificates	
		Z	without (Standard)
13	<input type="text"/>	1	quality certificates
		Approvals	
14	<input type="text"/>	Z	without (Standard)
		Additional ordering information	
		Z	Without (Standard)
15	<input type="text"/>	T	Additional text

Modelcode: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
2 3 .53 .050 - - - - - Z

Additional Text:

Additional scale ranges and options are available. Please contact the factory or access the product configurator for model 23X.53 on the WIKA US website.

Quick Order Guide/Standard Items - 23X.53 2½”





Specifications according to data sheet
Nominal size

23X.53 and 23X.54
2.5"

Standard features

Measuring System Stainless Steel
Process Connection 1/4 NPT
Accuracy Class +/- 2/1/2% (ASME B40.100 Grade A)
Case material Stainless steel 1.4301 (standard)

Ordering information

Case		Non-removable crimp ring					
Case filling		without			with		
Connector location							
Unit of outer Scale		psi / -inHg		psi / -inHg		psi / -inHg	psi / -inHg
Scale range	2nd Scale / Special Scale	without	without	2nd scale bar	2nd scale kPa	without	without
0/15 psi		9768734	9768351	50603515	7310315	9833604	9833272
0/30 psi		9768726	9768343	4335911	7310366	9833590	9833264
0/60 psi		9768718	9768335	8992848	8993089	9833582	9833255
0/100 psi		9768700	9768327	8992856	8993097	9833574	9833247
0/160 psi		9768696	9768319	8992865	8993101	9833565	9833239
0/200 psi		9768688	9768300	8992873	8993119	9833557	9833221
0/300 psi		9768670	9768297	8992881	8993127	9833549	9833213
0/400 psi		9768661	9768289	50982274	7310439	9833531	9833205
0/600 psi		9768653	9768270	9779685	9779693	9833523	9833191
0/1000 psi		9768645	9768262	8992899	8993135	9833515	9833183
0/1500 psi		9768637	9768254	8992903	7310499	9833506	9833175
0/2000 psi		9768629	9768246	8992911	8993152	9833493	9833166
0/3000 psi		9768610	9768238	8992929	52906341	9833485	9833158
0/5000 psi		9768602	9768220	8992937	8993178	9833476	9833140
0/10000 psi		9768599	9768211	8992954	8993195	9833468	9833132
0/15000 psi		50401581	9779715	9776715	9779723	50987764	9779715-0003
-30 inHg/0 psi		9768777	9768394	52875470	7309661	9833646	9833310
-30 inHg/15 psi		4386189	4259029	52875471	52812065	4210194	4257905
-30 inHg/30 psi		9768769	9768386	52875472	52428486	9833638	9833302
-30 inHg/60 psi		9768750	9768378	52875473	7310269	9833620	9833298
-30 inHg/100 psi		4382621	50771990	52620174	7310277	4382621-0001	50164619
-30 inHg/160 psi		9768742	9768360	52875474	52875476	9833612	9833280
-30 inHg/200 psi		50590324	52875469	52875475	52875477	50091905	52912385

	available on stock
	available after production
-	not available

Standard Order Code - 23X.53 2½”

		Measuring System				2nd Scale / Special Scale	
1	<input type="checkbox"/>	3	Stainless Steel		<input type="checkbox"/>	Z	without
		Case filling				B	2nd scale bar
	<input type="checkbox"/>	2	without		<input type="checkbox"/>	P	2nd scale psi
2	<input type="checkbox"/>	3	with		<input type="checkbox"/>	L	2nd scale kPa
		Case				E	2nd scale MPa
3	<input type="checkbox"/>	53	Non-removable crimp ring	7	<input type="checkbox"/>	K	2nd scale kg/cm2
		Unit of outer Scale				Process Connection	
	<input type="checkbox"/>	P	psi / -inHg		<input type="checkbox"/>	NB	1/4 NPT
	<input type="checkbox"/>	B	bar		<input type="checkbox"/>	GA	G 1/8 B
	<input type="checkbox"/>	L	kPa		<input type="checkbox"/>	GB	G 1/4 B
	<input type="checkbox"/>	E	MPa	8	<input type="checkbox"/>	NH	1/8 NPT
4	<input type="checkbox"/>	K	kg/cm2			Connector location	
		Measuring range			<input type="checkbox"/>	U	lower mount
	<input type="checkbox"/>	G	gauge pressure range		<input type="checkbox"/>	B	center back mount
5	<input type="checkbox"/>	V	vacuum- or compound-range		<input type="checkbox"/>	E	3 o'clock
		Scale range			<input type="checkbox"/>	G	9 o'clock
	<input type="checkbox"/>	310	0/15 psi (-30"Hg/0)	9	<input type="checkbox"/>	D	12 o'clock
	<input type="checkbox"/>	321	0/30 psi (-30"Hg/15 psi)			Mounting Flange/Bracket	
	<input type="checkbox"/>	341	0/60 psi		<input type="checkbox"/>	Z	Without (Standard)
	<input type="checkbox"/>	369	0/100 psi		<input type="checkbox"/>	F	front flange, polished SS
	<input type="checkbox"/>	411	0/160 psi		<input type="checkbox"/>	C	Rear Flange, Stainless Steel
	<input type="checkbox"/>	414	0/200 psi	10	<input type="checkbox"/>	K	Panel mount with Stainless steel U-clamp
	<input type="checkbox"/>	421	0/300 psi			Restrictor	
	<input type="checkbox"/>	428	0/400 psi		<input type="checkbox"/>	Z	Without (Standard)
	<input type="checkbox"/>	441	0/600 psi		<input type="checkbox"/>	Q	stainless steel, D 0.6
	<input type="checkbox"/>	455	0/800 psi	11	<input type="checkbox"/>	R	Stainless Steel, Orifice 0.3mm(0.012 inches)
	<input type="checkbox"/>	469	0/1000 psi			Special design features	
	<input type="checkbox"/>	510	0/1500 psi		<input type="checkbox"/>	Z	without (Standard)
	<input type="checkbox"/>	514	0/2000 psi		<input type="checkbox"/>	G	for Oxygen, Cleanliness ASME B40.1 Level IV
	<input type="checkbox"/>	521	0/3000 psi		<input type="checkbox"/>	D	Cleanliness ASME B40.1 Level IV
	<input type="checkbox"/>	528	0/4000 psi	12	<input type="checkbox"/>	N	NACE Sour Gas Service
	<input type="checkbox"/>	534	0/5000 psi			Certificates	
	<input type="checkbox"/>	541	0/6000 psi		<input type="checkbox"/>	Z	without (Standard)
	<input type="checkbox"/>	552	0/7500 psi	13	<input type="checkbox"/>	1	quality certificates
	<input type="checkbox"/>	569	0/10000 psi			Approvals	
	<input type="checkbox"/>	610	0/15000 psi	14	<input type="checkbox"/>	Z	without (Standard)
		Scale range				Additional ordering information	
	<input type="checkbox"/>	331	-30 inHg/30 psi		<input type="checkbox"/>	Z	Without (Standard)
	<input type="checkbox"/>	352	-30 inHg/60 psi	15	<input type="checkbox"/>	T	Additional text
	<input type="checkbox"/>	379	-30 inHg/100 psi				
	<input type="checkbox"/>	412	-30 inHg/160 psi				
	<input type="checkbox"/>	415	-30 inHg/200 psi				
6	<input type="checkbox"/>	422	-30 inHg/300 psi				

Modelcode: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
 2 3 . 53 .063 - - - - - Z

Additional Text: _____
 Additional scale ranges and options are available. Please contact the factory or access the product configurator for model 23X.53 on the WIKA US website.

Quick Order Guide/Standard Items - 23X.53 4''

Specifications according to data sheet
Nominal size





23X.53 and 23X.54
100 mm




Standard features

Measuring System
2nd Scale / Special Scale
Accuracy Class
Material pressure element

Stainless Steel
without
+/- 1% (ASME B40.100 Grade 1A)
Measuring System 316L

Ordering information

Case		Non-removable crimp ring					
Case filling		without			with		
Connector location							
Unit of outer Scale		psi / -inHg		psi / -inHg	psi / -inHg		psi / -inHg
Scale range	Process Connection	1/2 NPT	1/4 NPT	1/2 NPT	1/2 NPT	1/4 NPT	1/2 NPT
0/15 psi		9768513	9767428	9737120	9833387	9833026	9831571
0/30 psi		9768521	9767436	9737138	9833395	9833035	9831589
0/60 psi		9768530	9767444	9737146	9833409	9833043	9831597
0/100 psi		9768548	9767452	9737154	9833417	9833051	9831601
0/160 psi		9768556	9767460	9737162	9833425	9833069	9831619
0/200 psi		9768564	9767479	9737170	9833434	9833077	9831627
0/300 psi		9768572	9767487	9737189	9833442	9833085	9831635
0/400 psi		9768580	9767495	9737197	9833450	9833094	9831644
0/600 psi		9768963	9767509	9737200	9833727	9833107	9831652
0/1000 psi		9768858	9767517	9737227	9833697	9833115	9831678
0/1500 psi		9768866	4382613	9737235	9833701	50417754	9831686
0/2000 psi		9768807	50025708	9737243	9833655	50570838	9831695
0/3000 psi		9768874	50576151	9737251	9833719	50563181	9831708
0/5000 psi		9768823	4232724	9737260	9833663	4267927	9831716
0/10000 psi		9768831	52806638	9737278	9833671	4267935	9831725
0/15000 psi		9768840	52873915	9737286	9833689	52142809	9831733
-30 inHg/0 psi		9768459	9767576	9737057	9833328	9833124	9831504
-30 inHg/15 psi		9768467	9737910	9737065	9833336	9831775	9831512
-30 inHg/30 psi		9768475	9767398	9737073	9833345	9832993	9831520
-30 inHg/60 psi		9768483	9767401	52912433	9833353	9833000	9831538
-30 inHg/100 psi		9737880	9737898	9737090	9831741	9831759	9831546
-30 inHg/160 psi		9768491	9767410	9737103	9833361	9833018	9831555
-30 inHg/200 psi		9768505	9737901	9737111	9833379	9831767	9831563

	available on stock
	available after production
	not available

Standard Order Code - 23X.53 4"

		Measuring System				2nd Scale / Special Scale	
1	<input type="checkbox"/>	3	Stainless Steel			B	2nd scale bar
		Case filling				P	2nd scale psi
		2	without			L	2nd scale kPa
2	<input type="checkbox"/>	3	with			E	2nd scale MPa
		Case		7	<input type="checkbox"/>	K	2nd scale kg/cm2
3	<input type="checkbox"/>	53	Non-removable crimp ring			Process Connection	
		Unit of outer Scale				ND	1/2 NPT
		P	psi/ -inHg			NB	1/4 NPT
		B	bar			GD	G 1/2 B
		L	kPa	8	<input type="checkbox"/>	GB	G 1/4 B
		E	MPa			Connector location	
4	<input type="checkbox"/>	K	kg/cm2			U	lower mount
		Measuring range				3	lower back mount
		G	gauge pressure range			E	3 o'clock
5	<input type="checkbox"/>	V	vacuum- or compound-range			G	9 o'clock
		Scale range		9	<input type="checkbox"/>	D	12 o'clock
		310	0/15 psi (-30"Hg/0)			Mounting Flange/Bracket	
		321	0/30 psi (-30"Hg/15 psi)			Z	Without (Standard)
		341	0/60 psi			F	front flange, polished SS
		369	0/100 psi			C	Rear Flange, Stainless Steel
		411	0/160 psi	10	<input type="checkbox"/>	K	Panel mount with Stainless steel U-clamp
		414	0/200 psi			Restrictor	
		421	0/300 psi			Z	Without (Standard)
		428	0/400 psi			Q	stainless steel, D 0.6
		441	0/600 psi	11	<input type="checkbox"/>	R	Stainless Steel, Orifice 0.3mm(0.012 inches)
		455	0/800 psi			Special design features	
		469	0/1000 psi			Z	without (Standard)
		510	0/1500 psi			G	for Oxygen, Cleanliness ASME B40.1 Level IV
		514	0/2000 psi			D	Cleanliness ASME B40.1 Level IV
		521	0/3000 psi	12	<input type="checkbox"/>	N	NACE Sour Gas Service
		528	0/4000 psi			Certificates	
		534	0/5000 psi			Z	without (Standard)
		541	0/6000 psi	13	<input type="checkbox"/>	1	quality certificates
		552	0/7500 psi			Approvals	
		569	0/10000 psi			Z	without (Standard)
		610	0/15000 psi	14	<input type="checkbox"/>	Additional ordering information	
		331	-30 inHg/30 psi			Z	Without (Standard)
		352	-30 inHg/60 psi			Additional ordering information	
		379	-30 inHg/100 psi	15	<input type="checkbox"/>	T	Additional text
		412	-30 inHg/160 psi			Additional ordering information	
		415	-30 inHg/200 psi			Additional ordering information	
6	<input type="checkbox"/>	422	-30 inHg/300 psi			Additional ordering information	

Modelcode: 2 3 . 53 .100 - - - - - Z

Additional Text:

Additional scale ranges and options are available. Please contact the factory or access the product configurator for model 23X.53 on the WIKA US website.



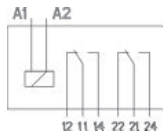


Relay and Timer Specifications

Bulletin 700

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700-HL 2-pole Terminal Block Relay




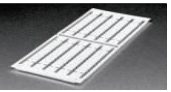
- Relay and socket assembled interface modules for high density interposing or isolation applications
- Screw terminal and spring-clamp bases
- 10 A relay, choice of silver or gold contacts
- DPDT (relay)
- Built-in retainer clip and snap-in marker lever
- Standard LED, reverse polarity protection, and surge protection
- Externally replaceable relay modules

		
Output Type	DPDT (2 C/O); $I_{th} = 10\text{ A}$	
Recommended Tightening Torque	0.6 N·m max. (5.3 lb·in.)	
Wire Range	Screw Terminal: 0.2...2.5 mm ² (#24...14 AWG), Spring Terminal: 0.2...2.5 mm ² (#24...14 AWG)	
Approvals	cULus, cURus, CE	

Input Voltages	Pkg. Quantity	Cat. No. ⁽¹⁾ (Screw Terminals)	Cat. No. (Spring Clamp Terminals)
12V DC	10	700-HLT12Z12	700-HLT22Z12
24V DC	10	700-HLT12Z24	700-HLT22Z24
48V DC	10	700-HLT12Z48	700-HLT22Z48
24V AC/DC	10	700-HLT12U24	700-HLT22U24
110/125V AC/DC	10	700-HLT12U1	700-HLT22U1
220...240V AC/DC	10	700-HLT12U2	700-HLT22U2

(1) For Gold-plated contacts: Add the letter "X" at the end of the catalog number. Example: Cat. No. 700-HLT12Z24 with gold plated contacts is Cat. No. 700-HLT12Z24X. The following relays are available with the gold-plated contact option: 700-HLT_2Z24, 700-HLT_2U24, 700-HLT_2U1, and 700-HLT_2U2. Not available on 12V and 48V DC products.

Accessories - 700-HL Relays (2- pole)

Photo	Description	Pkg. Qty.	Socket Input Voltage/Color	Cat. No.
	Replacement Relays Order must be for 20 relays or multiples of 20.	20	12V DC	700-TBR212
			24V AC/DC	700-TBR224
			48V DC	700-TBR248
			110/125V AC/DC, 220...240V AC/DC	700-TBR2110
	8-Way Jumper Can be cut to required length. $I_{th} = 10\text{ A}$ max per 8-way jumper.	1	Red	700-TBJ08R
			Grey	700-TBJ08G
			Blue	700-TBJ08B
	End Barrier Used for visual inspection of groups, safe separation of neighboring 700-HL modules that end with jumpers.	10	Black	700-HN177
	Snap-in Marker⁽¹⁾ These snap-in markers have a 6 x 12 mm surface and snap into the ejection lever for the relay.	100	Blank	1492-MS6X12

(1) For custom markers, contact your local Rockwell Automation sales office or Allen-Bradley distributor for more information.

Specifications - 700-HL Relays (2-Pole)

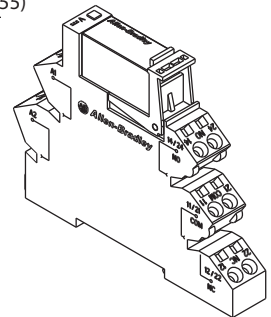
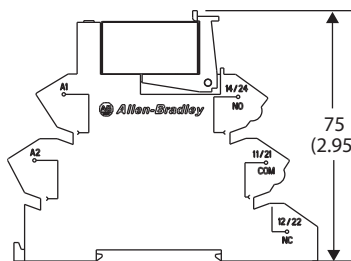
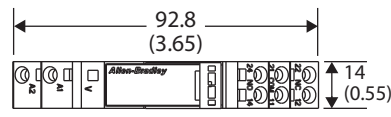
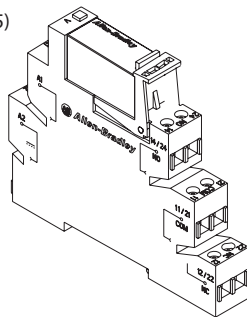
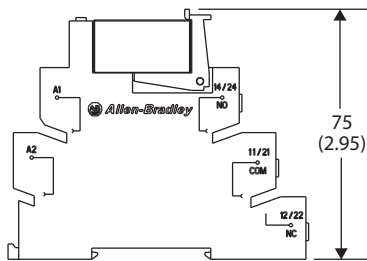
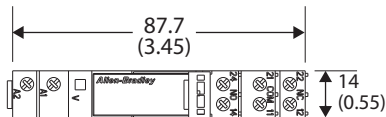
Cat. No. 700-HLT...2-Pole (Relay Output)							
Electrical Ratings							
Pilot Duty Rating		B 300, R 300					
Rated Thermal Current (I_{th})		2-Pole — 10 A					
Rated Insulation Voltage (U_i)		250V IEC, 300V UL/CSA					
Contacts	Inductive V AC UL	120VAC	AC-15, 3.0A B 300, 3.0 A			1/4 HP (186 W), 1-phase	
		240VAC	AC-15, 3.0 A B 300, 1.5 A			1/2 HP (373 W), 1-phase	
	Inductive V DC	24VDC	DC-13, 2.0 A				
		125VDC	DC-13, 0.3 A				
		250VDC	DC-13, 0.2 A				
	Resistive Make, Break, and Continuous	250VAC	10 A				
		24VDC	10 A				
		250VDC	0.28 A				
	Min. Permissible Contact Ratings		12V, 10 mA (120 mW) for Silver Contacts, 5V, 1 mA (50 mW) for Gold Contacts				
Permissible Coil Voltage Variation		Pickup: 85...110% of Nominal Voltage at 50 Hz 85...110% of Nominal Voltage at 60 Hz 80...110% of Nominal Voltage at DC			Must Dropout Voltage: 10% of Nominal Voltage at AC 5% of Nominal Voltage at DC		
Design Specification/Test Requirements							
Dielectric Withstand Voltage		Pole to Pole (VRMS)	1000V				
		Contact to Coil (VRMS)	5000V				
		Adjacent Contacts (VRMS)	2500V				
Input Voltage		12V AC/DC	24V AC/DC	48VDC	120V AC/DC	240V AC/DC	
Impedance (Ohms)		1 K	2 K	3 K	34 K	72 K	
Power Consumption $\pm 10\%$		AC	N/A	0.5VA	N/A	0.4VA	0.8VA
		DC	0.4 W	0.5 W	0.8 W	0.5 W	0.7 W
Mechanical							
Degree of Protection		IP20					
Mechanical Life Operations		3×10^7					
Electrical Life Operations		250V AC/24V DC, 8 A Resistive: 100 000 min. 24V DC, 10 A Resistive: 6000 min. 250V DC, 0.28 A Resistive: 6000 min. 250V AC, 10 A Resistive: 30 000 min.					
Switching Frequency Operations (no-load)		1200 cycles/sec					
Coil Voltages		See Overview/Product Selection					
Operating Time at Nominal Voltage at 20 °C (ms)		Pickup	typical 10 ms				
		Dropout	typical 10 ms				
Maximum Operating Rate (full load = 6 A)		6 cycles/min.					

Cat. No. 700-HLT...2-Pole (Relay Output)

Environmental		
Temperature	Operating	-40...+60 °C
	Storage	-40...+100 °C
Altitude	2000 m (6560 ft)	
Construction		
Insulating Material	Molded High-Dielectric Material	
Enclosure	Relay RT II — flux-proof, pollution degree 2 installation environment	
Contact Material	AgNi 90/10 or AgNi 90/10 + Au	
Terminal Markings on Socket	In accordance with EN50 0005	
Certifications	cULus Listed (File No. E3125, Guide NRNT/NRNT7), CE Marked	
Standards	UL 508, CSA C22.2 No. 14, EN 61810-1	

Dimensions - 700-HL (2-pole)

Approximate dimensions are shown in millimeters (inches). Dimensions are not intended for manufacturing purposes.



Bulletin 700-HL Screw Terminal Design

Single Wire: 0.14 mm²...2.5 mm² (#26 AWG...14 AWG)

Double Wire: 2 x 0.14 mm²...2 x 1.5 mm² (2 x #26 AWG...2 x 16 AWG)

Wire Type: Solid or stranded, copper only

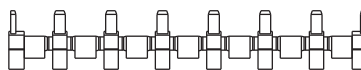
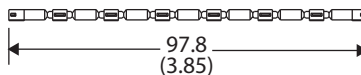
Strip Length: 9 mm (11/32 in). Torque: 0.5 N·m (4.4 lb·in)

Bulletin 700-HL Spring Terminal Design

Single Wire: 0.2 mm²...2.5 mm² (#24 AWG...#14 AWG)

Wire Type: Solid or stranded, copper only

Strip Length: 9 mm (11/32 in)



Bulletin 700-TBJ08_ 8-Way Jumper



22 mm Push Button Specifications

Bulletin Numbers 598, 800B, 800F, 800FC, 800FD, 800MB, 800MR

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Our Bulletin 800F 22 mm round operator family meets demanding performance specifications. We use state-of-the-art solid modeling techniques and finite element analysis to optimize the durability and performance of our push buttons.

800FP Plastic Operators

- IP69K
- IP65/66, Type 4/4X/13
- Engineering grade thermoplastics
- Chemical-resistant for harsh environments



800FM Metal Operators

- IP65/66, Type 4/13
- Die-cast metal construction
- Chrome-plated



3-across x 2-deep Back-of-panel (6 Circuits Max)

- Rugged snap-fit design for plastic or metal latch
- Stackable contact blocks
- Rotating collar for easy one-hand latch removal
- Color-coded contact block plungers for contact identification

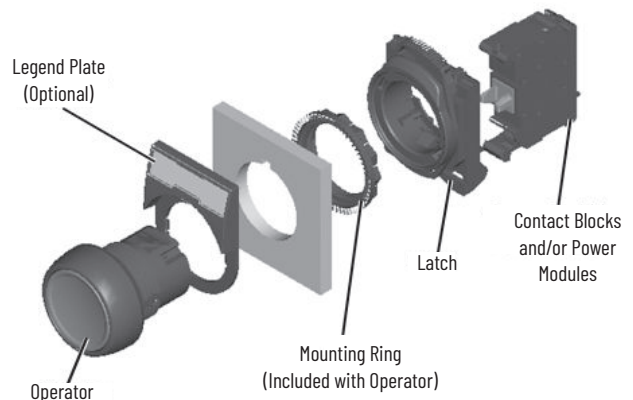


Plastic Latch with Contact Block



Metal Latch with Contact Block

Assembly Overview



Specifications

Product Certifications

Attribute	Plastic (Bulletin 800FP) and Metal (Bulletin 800FM)
Certifications	UR/UL, CSA, CCC, CE
Standards Compliance – CE Marked	NEMA ICS-5; UL 508, EN ISO 13850, EN 60947-1, EN 60947-5-1, EN 60947-5-5
Terminal Identification	EN/IEC 60947-1
Shipping Approvals	ABS
RoHS	Yes

Front-of-Panel (Operators)

IMPORTANT Performance Data – Performance data that is given in this publication is provided only as a guide for you to determine suitability and does not constitute a performance warranty of any kind. Such data can represent the results of accelerated testing at elevated stress levels, and you are responsible for correlating the data to actual application requirements. ALL WARRANTIES AS TO ACTUAL PERFORMANCE, WHETHER EXPRESS OR IMPLIED, ARE EXPRESSLY DISCLAIMED.

Table 1 - Mechanical Ratings – Operators

Attribute		Plastic (Bulletin 800FP)	Metal (Bulletin 800FM)
Vibration (assembled to panel)		Tested at 10...2000 Hz, 1.52 mm (0.06 in.) displacement (peak-to-peak) max./10 G max. for 3 hr duration, no damage	
Shock		Tested at 1/2 cycle sine wave for 11 ms; no damage at 100 G	
Degree of protection ⁽¹⁾ ⁽²⁾		IP69K ⁽³⁾ and IP65/66 (Type 3/3R/4/4X/12/13)	IP65/66 (Type 3/3R/4/12/13)
Mechanical durability per EN 60947-5-1 (Annex C)	10,000,000 Cycles	Momentary push buttons, momentary mushroom	
	1,000,000 Cycles	Multi-function, selector switch, key selector switch, selector jog, SensEject™ key selector switch	
	500,000 Cycles	Non-illuminated push-pull E-stop ⁽⁴⁾	
	300,000 Cycles	Twist-to-release E-stop, illuminated push-pull E-stop ⁽⁴⁾ , alternate action push buttons	
	100,000 Cycles	Potentiometer, toggle switch	
Operating forces (typical with one contact block)		Flush/extended = 5 N, E-stop = 36 N Mushroom = 9 N	
Operating torque (typical application with one contact block)		Selector switch = 0.25 N•m (2.2 lb•in)	
Mounting torque	Plastic	1.7 N•m (15 lb•in)	
	Metal	4.4 N•m (40 lb•in)	

(1) Momentary mushroom operators are IP65. Plastic keyed operators are IP66, Type 4/13; not Type 4X.

(2) IP65/66 products are compliant to IEC 60529.

(3) IP69K products listed in [Table 2](#) are compliant to ISO 20653 (replaces DIN 40050 Part 9) for IP69K and IEC 60529 for all other IP ratings.

(4) Limit of four contact blocks max for these devices.

Table 2 - IP69K Operators and Assembled Stations

IP69K Rated Operators		IP69K Rated Assembled Stations
<ul style="list-style-type: none"> • 800FD-MT44* • 800FP-F* • 800FP-F* and 800F-AB7 • 800FP-LF* • 800FP-E* • 800FP-E* and 800F-ABE7 • 800FP-LE* • 800FP-FA* • 800FP-LFA* • 800FP-G* • 800FP-P* • 800FP-MT3* • 800FP-MT4* • 800FP-LMT4* • 800FP-MT6* 	<ul style="list-style-type: none"> • 800FP-LMT6* • 800FP-LMP3* • 800FP-MP4* • 800FP-LMP4* • 800FP-MM4* • 800FP-LMM4* • 800FP-MM6* • 800FP-LMP6* • 800FP-MP9* • 800FP-LMP9* • 800FP-U2* • 800FP-LU2* • 800FP-U3* • 800FP-MM9* • 800FP-POT* 	<ul style="list-style-type: none"> • 800F-1YP1 • 800F-1YP2 • 800F-1YP3 • 800F-1YP7 • 800F-1YP8 • 800F-1YM1 • 800F-1YM2 • 800F-1YM3 • 800F-1YM7 • 800F-1YM8 • 800F-1YML1 • 800F-1YML2 • 800F-1YML3 • 800F-1YMD51 • 800F-1YMD52 • 800F-1YMD81
<ul style="list-style-type: none"> • 800F-1YMD and 800F-ALC2 (1 pc) and IP69K rated operators • 800F-2PM and 800F-ALC2 (2 pcs) and IP69K rated operators • 800F-3PM and 800F-ALC2 (3 pcs) and IP69K rated operators • 800F-4PM and 800F-ALC2 (4 pcs) and IP69K rated operators • 800F-6PM and 800F-ALC2 (6 pcs) and IP69K rated operators • 800F-AHA1 • 800F-1YMD51, 800F-1YMD52, and 800F-1YMD81 		

Table 3 - Environmental – Operators

Attribute		Plastic (Bulletin 800FP)	Metal (Bulletin 800FM)
Temperature Range	Operating	-25...+70 °C (-13...+158 °F) ⁽¹⁾	
	Short-term Storage	-40...+85 °C (-40...+185 °F)	
Humidity		≤95% RH from 25...60 °C (77...140 °F)	

(1) Operating temperatures below 0 °C (32 °F) are based on the absence of freezing moisture and liquids, UL Recognized to 55 °C (131 °F) - Incandescent module max. 40 °C (104 °F).

Back-of-panel Components

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Table 4 - Electrical Ratings – Back-of-panel Components

Attribute	Screw Termination	Spring Clamp Termination			
Standard Contact Block Ratings	A600, Q600 600V AC	A300, Q300 300V AC			
	AC 15, DC 13 to IEC/EN 60947-5-1 and UL 508, 17V, 5 mA min.				
Low-voltage Contact Block Ratings ⁽¹⁾	5V, 1 mA DC min. C300, R150, AC 15, DC 13 to EN 60947-5-1 and UL 508				
	Lamp Voltage	Voltage Range	Current, Typical	Leakage Current	Frequency
Light-emitting diode (LED) Module Ratings	Universal	24...120V AC/DC	15 mA (AC), 12 mA (DC)	3 mA	50/60 Hz, DC
	24V AC	10...29V AC	31 mA	3 mA	50/60 Hz
	24V DC	10...30V DC	24 mA	3 mA	DC
	120V AC	102...132V DC	6 mA	3 mA	50/60 Hz
	240V AC	204...264V AC	6 mA	3 mA	50/60 Hz
Thermal Current	10 A max. enclosed (40 °C [104 °F] ambient) to UL508, EN 60947-5-1 @ A600				
Insulation Voltage (U _i)	Screw terminal = 690V, spring-clamp = 300V				
Wire Capacity	Screw Terminal ⁽²⁾	#18...12 AWG (0.75...2.5 mm ²); Max. (2) #14 AWG or (1) #12 AWG			
	Spring-clamp terminal	#18...14 AWG (0.75...1.5 mm ²) One per spring clamp, two spring clamps per terminal			
Recommended Tightening Torque on Screw Terminals	0.7...0.9 N•m (6...8 lb•in)				
Dielectric Strength (Minimum)	2500V for 1 minute				
External Short Circuit Protection	Standard blocks	10 A type gL/gG cartridge fuse to EN 60269-2-1 or gN (Class J to UL 248-8 or Class C to UL 248-4)			
	Low-voltage contact blocks	6 A type gL/gG cartridge fuse to EN 60269-2-1 or gN (Class J to UL 248-8 or Class C to UL 248-4)			
Electrical shock protection	Fingersafe conforming to IP2X				

(1) Low-voltage contacts are recommended for applications below 17V, 5 mA.

(2) Wires less than #18 AWG (0.75 mm²) may not hold in terminal securely.

Table 5 - Mechanical Ratings – Back-of-panel Components

Attribute	Value	
Vibration (assembled to panel)	Tested at 10...2000 Hz, 1.52 mm displacement (peak-to-peak) max./10 G max. 6 hr	
Shock	Tested at 1/2 cycle sine wave for 11 ms and no damage at 100 G max.	
Contact durability per EN 60947-5-1 (Annex C)	10,000,000 cycles	
Contact operation	N.O.	Slow double make and break
	N.C. & S.M.C.B.	Slow double make and break – positive opening ⊙
	N.O.E.M.	Double break / double make, early make
	N.C.L.B.	Double break / double make, late break – positive opening ⊙
	N.C.E.B.	Double break / double make, early break – positive opening ⊙
Push button travel to change electrical state	N.C. and N.O.E.M.	1.5 mm (0.060 in.)
	N.O. and N.C.L.B.	2.5 mm (0.1 in.)
Operating forces (typical)	Single-circuit contact block	3.4 N
	Dual-circuit contact block	5...6.5 N

Table 6 - Illumination – Back-of-panel Components

Attribute	Green	Red	White
LED Dominant Wavelength	525 nm	629 nm	–
LED Luminous Intensity	780 mcd	780 mcd	360 mcd
Incandescent maximum wattage	2.6 W		

Table 7 - Materials – Back-of-panel Components

Attribute	Value	
Springs	Stainless steel and zinc coated music wire	
Electrical contacts	Standard	Silver-nickel
	Low-voltage	Gold-plated over silver
Terminals	Screw	Brass
	Spring-clamp	Silver-plated brass

Material Listing

Component	For Use with	Material Used
Panel gasket	All operators	Nitrile, TPE
Diaphragm seal	Illuminated push button, non-illuminated push button	Automotive industry acceptable silicone
K-seal	Selector switch, key selector switch, push/twist-to-release E-stop, key E-stop, push/pull mushroom	Nitrile
Diaphragm retainer, return spring I	Illuminated push button, non-illuminated push button, momentary mushroom	Stainless steel
Return spring II	Reset, selector switch, key selector switch, alternate action, push/twist-to-release E-stop, key E-stop, push/pull mushroom	Zinc-coated music wire
Button cap/mushroom head	Non-illuminated push button, momentary mushroom, reset, push/twist-to-release E-stop, key E-stop, push/pull mushroom, multi-function	PBT/polycarbonate blend
2-color molded button cap	Non-illuminated push button	PBT/polycarbonate blend
Lens	Multi-function	Acetal
Lens, knob	Illuminated push button, illuminated momentary mushroom, illuminated selector switch	Polyamide
Knob	Non-illuminated selector switch	Glass-filled polyamide
Plastic bezel/bushing I	Non-illuminated push button, illuminated push button, momentary mushroom, selector switch, key selector switch, push/twist-to-release E-stop, key E-stop, push/pull mushroom, multi-function, reset	Glass-filled polyamide
Plastic bezel/bushing II, jam nut	Pilot light, reset jam nut, reset pushers	Glass-filled PBT
Metal bezel/bushing	All metal operators	Zinc
Diffuser	Illuminated push button, pilot light	Polycarbonate
Legend frames	–	Glass-filled polyamide
Plastic mounting ring	All plastic operators	Glass-filled polyamide
Metal mounting ring	All metal operators	Chromated zinc
Plastic latch	–	Glass-filled polyamide
Metal latch	–	Chromated zinc + stainless steel
Plastic enclosure	–	PBT/polycarbonate blend
Metal enclosure	–	Aluminum
Terminal screws	LED module, incandescent module, contact blocks	Zinc-plated steel with chromate
Terminals	LED module, incandescent module, contact blocks	Brass with silver-nickel contacts
Spring clamps	LED module, incandescent module, contact blocks	Stainless steel
Lamp socket	Incandescent module	Brass
Housing	Incandescent module, LED module	Glass-filled polyamide
Low-voltage terminals	Contact blocks	Gold-plated silver-nickel contacts
Low-voltage spanner	Contact blocks	Gold-plated silver-nickel contacts
Spanner	Contact blocks	Brass with silver-nickel contacts
Boot	Toggle Switch, illuminated push button, non-illuminated push button, multi-function illuminated and non-illuminated	Automotive industry acceptable silicone

Momentary Push Button Operators

Non-illuminated – Flush, Extended, Guarded



Flush Operator
Cat. No. 800FP-F3



Extended Operator
Cat. No. 800FM-E4



Guarded Operator
Cat. No. 800FP-G6

Color	Package Quantity	Flush		Extended	
		Plastic	Metal	Plastic	Metal
		Cat. No.	Cat. No.	Cat. No.	Cat. No.
Black	1	800FP-F2	800FM-F2	800FP-E2	800FM-E2
Green		800FP-F3	800FM-F3	800FP-E3	800FM-E3
Red		800FP-F4	800FM-F4	800FP-E4	800FM-E4

800F $\frac{P}{a}$ - $\frac{F}{b}$ $\frac{3}{c}$ - $\frac{\quad}{d}$

a	
Operator Construction	
Code	Description
P	Round plastic operator (IP69K; IP66, Type 4/4X/13)
M	Round metal operator (IP66, Type 4/13)

b	
Operator Type	
Code	Description
F	Flush
E	Extended
G	Guarded

c	
Color Cap	
Code	Description
0	Orange
1	White
2	Black
3	Green
4	Red
5	Yellow
6	Blue
8	Gray ⁽¹⁾
9	No cap
X	Assortment pack ⁽²⁾

d	
Packaging	
Code	Description
Blank	1 per package
BP	10 per package ⁽³⁾

- (1) Available in flush only.
- (2) Assortment pack contains one cap of each color, not available in BP packaging.
- (3) Only available with no color cap (option 9 from Table c).

Illuminated – Flush, Extended, Guarded



Flush Operator
Cat. No. 800FM-LF4



Extended Operator
Cat. No. 800FP-LE3



Guarded Operator
Cat. No. 800FP-LG3

Color	Package Quantity	Flush		Extended	
		Plastic	Metal	Plastic	Metal
		Cat. No.	Cat. No.	Cat. No.	Cat. No.
Green	1	800FP-LF3	800FM-LF3	800FP-LE3	800FM-LE3
Red		800FP-LF4	800FM-LF4	800FP-LE4	800FM-LE4
Yellow		800FP-LF5	800FM-LF5	800FP-LE5	800FM-LE5
Clear		800FP-LF7	800FM-LF7	800FP-LE7	800FM-LE7

800F $\frac{P}{a}$ - $\frac{LE}{b}$ $\frac{3}{c}$ - $\frac{\quad}{d}$

a Operator Construction	
Code	Description
P	Round plastic operator (IP69K; IP66, Type 4/4X/13)
M	Round metal operator (IP66, Type 4/13)

b Operator Type	
Code	Description
F	Flush
E	Extended
G	Guarded

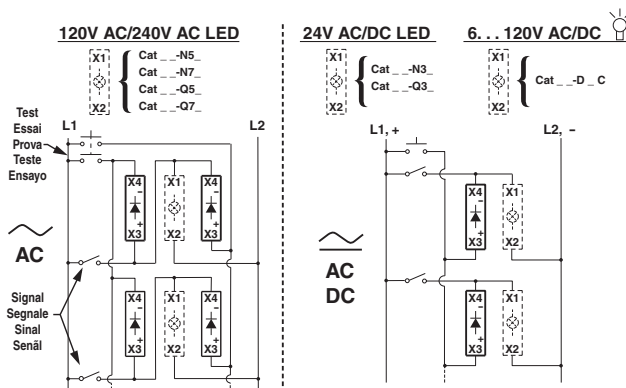
c Color Cap ⁽¹⁾	
Code	Description
0	Amber ⁽²⁾
3	Green
4	Red
5	Yellow ⁽²⁾
6	Blue ⁽²⁾
7	Clear
9	No cap

d Packaging	
Code	Description
Blank	1 per package
BP	10 per package ⁽³⁾

- (1) For custom laser-engraved operator, consult your local Rockwell Automation sales office or Allen-Bradley distributor.
- (2) When using LED for illumination, a white LED is recommended.
- (3) Only available with no color cap (9 from Table c).

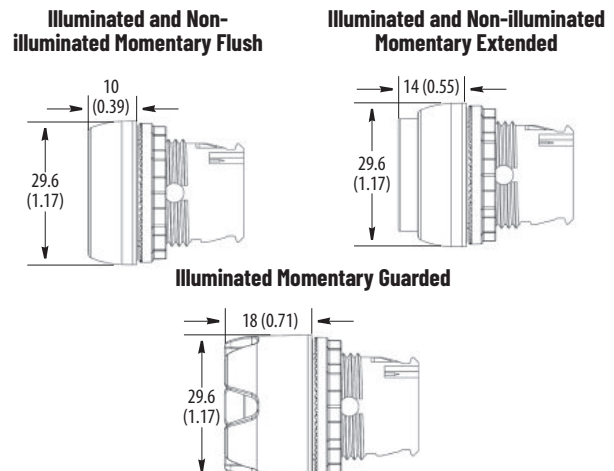
Push-to-test Push Button Device Schematic

Illuminated push buttons can be wired as a push-to-test device by using the following schematic and a catalog number 800F-XD7 diode module (see [page 52](#)).



Approximate Dimensions – Momentary Operators

Dimensions in millimeters (inches). Dimensions are not intended to be used for manufacturing purposes.



Power Modules with Contact Blocks and Latch – Composite

800F - P N 5 R X 1 0 E
a b c d e f g h

a	
Style	
Code	Description
P	Plastic latch
M	Metal latch

b	
Power Module Type ^{(1) (2)}	
Code	Description
D	Incandescent module, screw termination
N	Integrated LED module, screw termination
Q	Integrated LED module, spring-clamp termination

c	
Voltage	
Code	Description
0	No bulb ⁽³⁾
1	6V AC/DC ⁽³⁾
2	12V AC/DC ⁽³⁾
3	10...29V AC 10...30V DC
4	48V AC/DC ⁽³⁾
5	120V AC
7	240V AC ⁽⁴⁾

d	
Lamp Color ⁽⁵⁾	
Code	Description
C	Incandescent
R	Red LED
G	Green LED
W	White LED

e	
Contact Block Termination Style	
Code	Description
X	Screw termination
Q	Spring-clamp termination

f	
N.O. (Normally Open) Circuits	
Code	Description
0	No contact
1	1 N.O.
2	2 N.O.
3	3 N.O.
4	4 N.O.

g	
N.C. (Normally Closed) Circuits	
Code	Description
0	No contact
1	1 N.C.
2	2 N.C.
3	3 N.C.
4	4 N.C.

h	
Specialty Contact Block	
Code	Description
Blank	Standard blocks
V	Low-voltage – QuadConnect™
E	N.O. early make
L	N.C. late break
B	N.C. early break
S	N.C. self-monitoring

- (1) Four circuits maximum allowable when power module is used. Contact blocks cannot be stacked on power module.
(2) LED modules for use with all illuminated operators. Incandescent module for use with pilot lights, push buttons, and momentary mushroom operators only.
(3) Only available for incandescent module.
(4) Only available for integrated LED module.
(5) For best illuminated results, LED should match lens color. For yellow, blue, or amber operator, select a white LED.

Other Back-of-panel Components

Table 24 - Latches






	Description	Pkg. Qty.	Cat. No.
 Cat. No. 800F-ALM	Metal Mounting Latch Zinc-plated, metal die cast mounting latches. Sold only in multiples of 10. Order (quantity of) 10 to receive one package of 10 pieces.	10	800F-ALM
	Note: Sold only in multiples of 100. Order (quantity of) 100 to receive one package of 100 pieces.	100	800F-ALM-BP
 Cat. No. 800F-ALP	Plastic Mounting Latch Note: Sold only in multiples of 10. Order (quantity of) 10 to receive one package of 10 pieces.	10	800F-ALP
	Note: Sold only in multiples of 100. Order (quantity of) 100 to receive one package of 100 pieces.	100	800F-ALP-BP

Table 25 - Contact Blocks

	Description	Contact Type	Pkg. Qty.	Cat. No.
 <p>Cat. No. 800F-X10</p>	<p>Contact Block Note: Sold only in multiples of 10. Order (quantity of) 10 to receive one package of 10 pieces. Latch not included.</p>	N.O.	10	800F-X10
		N.C.		800F-X01
		N.O. low-voltage — QuadConnect		800F-X10V
		N.C. low-voltage — QuadConnect		800F-X01V
		N.O.L.M.		800F-X10N ⁽¹⁾
		N.O.E.M.		800F-X10E
		N.O.E.E.M.		800F-X10M ⁽²⁾
		N.C.L.B.		800F-X01L
		N.C.E.B.		800F-X01B ⁽³⁾
		Self-Monitoring		800F-X01S ⁽⁴⁾
		Dual-circuit of 2 N.O.		800F-X20D ⁽⁴⁾
		Dual-circuit of 2 N.C.		800F-X02D ⁽⁴⁾
		Dual-circuit of 1 N.O.-1 N.C.		800F-X11D ⁽⁴⁾
		N.O. spring-clamp		800F-Q10
		N.C. spring-clamp		800F-Q01
Ring lug N.O.	800F-R10 ^{(5) (6)}			
Ring lug N.C.	800F-R01 ^{(5) (6)}			
<p>Note: Sold only in multiples of 100. Order (quantity of) 100 to receive one package of 100 pieces. Latch not included.</p>	N.O.	100	800F-X10-BP	
	N.C.		800F-X01-BP	
 <p>Cat. No. 800F-BX01</p>	<p>Base-mounted Contact Block Base-mounted contact blocks can be used in plastic or metal enclosures. Note: Sold only in multiples of 10. Order (quantity of) 10 to receive one package of 10 pieces. Latch not included.</p>	N.O.	10	800F-BX10
		N.C.		800F-BX01

- (1) For use with Cat. No. 800FP-CB_ and Cat. No. 800FP-CC_ operators.
- (2) For use with Cat. No. 800FP-CC_ operators.
- (3) Only for use with 4-position selector switch, 4-position toggle switch, or 3-position push-pull operator.
- (4) Cannot stack.
- (5) Cannot be used in a composite catalog number.
- (6) Replacement screws are available (Cat. No. 800F-ARS1)

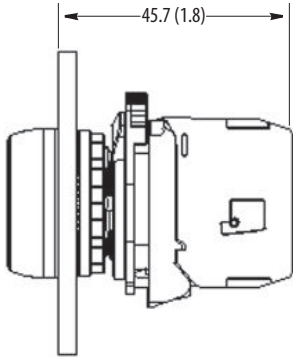
Table 26 - Power Modules

	Description	Voltage	Pkg. Qty.	Cat. No.
 <p>Cat. No. 800F-D3C</p>	<p>Incandescent Module For use with pilot lights, push buttons, and momentary mushroom operators. Note: Sold in multiples of 10. Order (quantity of) 10 to receive one package of 10 pieces. Latch not included.</p>	No bulb	10	800F-D0C
		6V AC/DC		800F-D1C
		12V AC/DC		800F-D2C
		24V AC/DC		800F-D3C
		48V AC/DC		800F-D4C
		120V AC/DC		800F-D5C

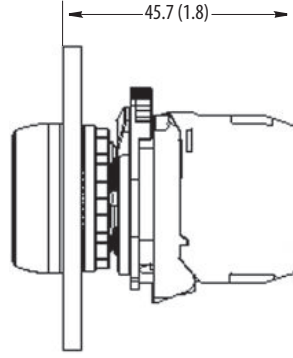
Approximate Dimensions – Back-of-panel Components

Dimensions in millimeters (inches). Dimensions are not intended to be used for manufacturing purposes.

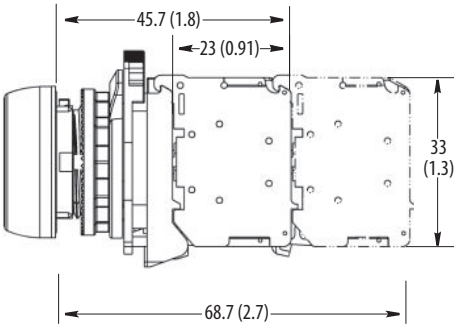
Incandescent Module with Latch



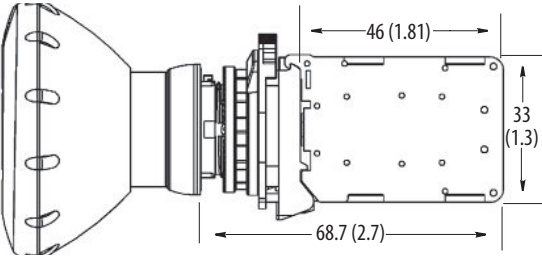
LED Module with Latch



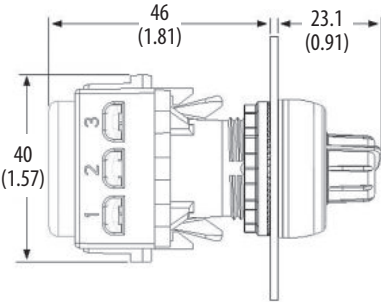
Contact Cartridges with Latch



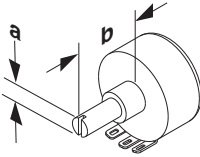
Dual-circuit Contact Block or Self-monitoring Contact Block (1 Deep, Max)



Potentiometer with Resistive Element



Customer Supplied Resistive Element



	Max.		Min.
a (Dia.)	6.4 (0.252)	5.9 (0.232)	5.7 (0.224)
b (Length)	24 (0.945)	32 (1.26)	14 (0.551)



22 mm Push Button Specifications

Bulletin Numbers 598, 800B, 800F, 800FC, 800FD, 800MB, 800MR

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Our Bulletin 800F 22 mm round operator family meets demanding performance specifications. We use state-of-the-art solid modeling techniques and finite element analysis to optimize the durability and performance of our push buttons.

800FP Plastic Operators

- IP69K
- IP65/66, Type 4/4X/13
- Engineering grade thermoplastics
- Chemical-resistant for harsh environments



800FM Metal Operators

- IP65/66, Type 4/13
- Die-cast metal construction
- Chrome-plated



3-across x 2-deep Back-of-panel (6 Circuits Max)

- Rugged snap-fit design for plastic or metal latch
- Stackable contact blocks
- Rotating collar for easy one-hand latch removal
- Color-coded contact block plungers for contact identification

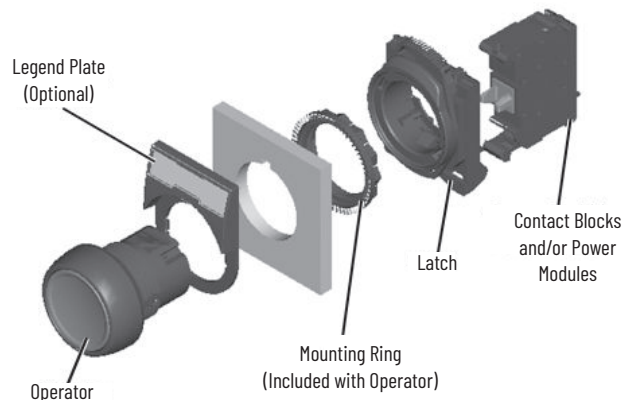


Plastic Latch with Contact Block



Metal Latch with Contact Block

Assembly Overview



Specifications

Product Certifications

Attribute	Plastic (Bulletin 800FP) and Metal (Bulletin 800FM)
Certifications	UR/UL, CSA, CCC, CE
Standards Compliance – CE Marked	NEMA ICS-5; UL 508, EN ISO 13850, EN 60947-1, EN 60947-5-1, EN 60947-5-5
Terminal Identification	EN/IEC 60947-1
Shipping Approvals	ABS
RoHS	Yes

Front-of-Panel (Operators)

IMPORTANT Performance Data – Performance data that is given in this publication is provided only as a guide for you to determine suitability and does not constitute a performance warranty of any kind. Such data can represent the results of accelerated testing at elevated stress levels, and you are responsible for correlating the data to actual application requirements. ALL WARRANTIES AS TO ACTUAL PERFORMANCE, WHETHER EXPRESS OR IMPLIED, ARE EXPRESSLY DISCLAIMED.

Table 1 - Mechanical Ratings – Operators

Attribute		Plastic (Bulletin 800FP)	Metal (Bulletin 800FM)
Vibration (assembled to panel)		Tested at 10...2000 Hz, 1.52 mm (0.06 in.) displacement (peak-to-peak) max./10 G max. for 3 hr duration, no damage	
Shock		Tested at 1/2 cycle sine wave for 11 ms; no damage at 100 G	
Degree of protection ⁽¹⁾ ⁽²⁾		IP69K ⁽³⁾ and IP65/66 (Type 3/3R/4/4X/12/13)	IP65/66 (Type 3/3R/4/12/13)
Mechanical durability per EN 60947-5-1 (Annex C)	10,000,000 Cycles	Momentary push buttons, momentary mushroom	
	1,000,000 Cycles	Multi-function, selector switch, key selector switch, selector jog, SensEject™ key selector switch	
	500,000 Cycles	Non-illuminated push-pull E-stop ⁽⁴⁾	
	300,000 Cycles	Twist-to-release E-stop, illuminated push-pull E-stop ⁽⁴⁾ , alternate action push buttons	
	100,000 Cycles	Potentiometer, toggle switch	
Operating forces (typical with one contact block)		Flush/extended = 5 N, E-stop = 36 N Mushroom = 9 N	
Operating torque (typical application with one contact block)		Selector switch = 0.25 N•m (2.2 lb•in)	
Mounting torque	Plastic	1.7 N•m (15 lb•in)	
	Metal	4.4 N•m (40 lb•in)	

(1) Momentary mushroom operators are IP65. Plastic keyed operators are IP66, Type 4/13; not Type 4X.

(2) IP65/66 products are compliant to IEC 60529.

(3) IP69K products listed in [Table 2](#) are compliant to ISO 20653 (replaces DIN 40050 Part 9) for IP69K and IEC 60529 for all other IP ratings.

(4) Limit of four contact blocks max for these devices.

Table 2 - IP69K Operators and Assembled Stations

IP69K Rated Operators		IP69K Rated Assembled Stations
<ul style="list-style-type: none"> • 800FD-MT44* • 800FP-F* • 800FP-F* and 800F-AB7 • 800FP-LF* • 800FP-E* • 800FP-E* and 800F-ABE7 • 800FP-LE* • 800FP-FA* • 800FP-LFA* • 800FP-G* • 800FP-P* • 800FP-MT3* • 800FP-MT4* • 800FP-LMT4* • 800FP-MT6* 	<ul style="list-style-type: none"> • 800FP-LMT6* • 800FP-LMP3* • 800FP-MP4* • 800FP-LMP4* • 800FP-MM4* • 800FP-LMM4* • 800FP-MM6* • 800FP-LMP6* • 800FP-MP9* • 800FP-LMP9* • 800FP-U2* • 800FP-LU2* • 800FP-U3* • 800FP-MM9* • 800FP-POT* 	<ul style="list-style-type: none"> • 800F-1YP1 • 800F-1YP2 • 800F-1YP3 • 800F-1YP7 • 800F-1YP8 • 800F-1YM1 • 800F-1YM2 • 800F-1YM3 • 800F-1YM7 • 800F-1YM8 • 800F-1YML1 • 800F-1YML2 • 800F-1YML3 • 800F-1YMD51 • 800F-1YMD52 • 800F-1YMD81
<ul style="list-style-type: none"> • 800F-1YMD and 800F-ALC2 (1 pc) and IP69K rated operators • 800F-2PM and 800F-ALC2 (2 pcs) and IP69K rated operators • 800F-3PM and 800F-ALC2 (3 pcs) and IP69K rated operators • 800F-4PM and 800F-ALC2 (4 pcs) and IP69K rated operators • 800F-6PM and 800F-ALC2 (6 pcs) and IP69K rated operators • 800F-AHA1 • 800F-1YMD51, 800F-1YMD52, and 800F-1YMD81 		

Table 3 - Environmental – Operators

Attribute		Plastic (Bulletin 800FP)	Metal (Bulletin 800FM)
Temperature Range	Operating	-25...+70 °C (-13...+158 °F) ⁽¹⁾	
	Short-term Storage	-40...+85 °C (-40...+185 °F)	
Humidity		≤95% RH from 25...60 °C (77...140 °F)	

(1) Operating temperatures below 0 °C (32 °F) are based on the absence of freezing moisture and liquids, UL Recognized to 55 °C (131 °F) - Incandescent module max. 40 °C (104 °F).

Back-of-panel Components

IMPORTANT Performance Data — Performance data that is given in this publication is provided only as a guide for you to determine suitability and does not constitute a performance warranty of any kind. Such data can represent the results of accelerated testing at elevated stress levels, and you are responsible for correlating the data to actual application requirements. ALL WARRANTIES AS TO ACTUAL PERFORMANCE, WHETHER EXPRESS OR IMPLIED, ARE EXPRESSLY DISCLAIMED.

Table 4 - Electrical Ratings – Back-of-panel Components

Attribute	Screw Termination	Spring Clamp Termination			
Standard Contact Block Ratings	A600, Q600 600V AC	A300, Q300 300V AC			
	AC 15, DC 13 to IEC/EN 60947-5-1 and UL 508, 17V, 5 mA min.				
Low-voltage Contact Block Ratings ⁽¹⁾	5V, 1 mA DC min. C300, R150, AC 15, DC 13 to EN 60947-5-1 and UL 508				
	Lamp Voltage	Voltage Range	Current, Typical	Leakage Current	Frequency
Light-emitting diode (LED) Module Ratings	Universal	24...120V AC/DC	15 mA (AC), 12 mA (DC)	3 mA	50/60 Hz, DC
	24V AC	10...29V AC	31 mA	3 mA	50/60 Hz
	24V DC	10...30V DC	24 mA	3 mA	DC
	120V AC	102...132V DC	6 mA	3 mA	50/60 Hz
	240V AC	204...264V AC	6 mA	3 mA	50/60 Hz
Thermal Current	10 A max. enclosed (40 °C [104 °F] ambient) to UL508, EN 60947-5-1 @ A600				
Insulation Voltage (U _i)	Screw terminal = 690V, spring-clamp = 300V				
Wire Capacity	Screw Terminal ⁽²⁾	#18...12 AWG (0.75...2.5 mm ²); Max. (2) #14 AWG or (1) #12 AWG			
	Spring-clamp terminal	#18...14 AWG (0.75...1.5 mm ²) One per spring clamp, two spring clamps per terminal			
Recommended Tightening Torque on Screw Terminals	0.7...0.9 N•m (6...8 lb•in)				
Dielectric Strength (Minimum)	2500V for 1 minute				
External Short Circuit Protection	Standard blocks	10 A type gL/gG cartridge fuse to EN 60269-2-1 or gN (Class J to UL 248-8 or Class C to UL 248-4)			
	Low-voltage contact blocks	6 A type gL/gG cartridge fuse to EN 60269-2-1 or gN (Class J to UL 248-8 or Class C to UL 248-4)			
Electrical shock protection	Fingersafe conforming to IP2X				

(1) Low-voltage contacts are recommended for applications below 17V, 5 mA.

(2) Wires less than #18 AWG (0.75 mm²) may not hold in terminal securely.

Table 5 - Mechanical Ratings – Back-of-panel Components

Attribute	Value	
Vibration (assembled to panel)	Tested at 10...2000 Hz, 1.52 mm displacement (peak-to-peak) max./10 G max. 6 hr	
Shock	Tested at 1/2 cycle sine wave for 11 ms and no damage at 100 G max.	
Contact durability per EN 60947-5-1 (Annex C)	10,000,000 cycles	
Contact operation	N.O.	Slow double make and break
	N.C. & S.M.C.B.	Slow double make and break – positive opening ⊙
	N.O.E.M.	Double break / double make, early make
	N.C.L.B.	Double break / double make, late break – positive opening ⊙
	N.C.E.B.	Double break / double make, early break – positive opening ⊙
Push button travel to change electrical state	N.C. and N.O.E.M.	1.5 mm (0.060 in.)
	N.O. and N.C.L.B.	2.5 mm (0.1 in.)
Operating forces (typical)	Single-circuit contact block	3.4 N
	Dual-circuit contact block	5...6.5 N

Table 6 - Illumination – Back-of-panel Components

Attribute	Green	Red	White
LED Dominant Wavelength	525 nm	629 nm	–
LED Luminous Intensity	780 mcd	780 mcd	360 mcd
Incandescent maximum wattage	2.6 W		

Table 7 - Materials – Back-of-panel Components

Attribute	Value	
Springs	Stainless steel and zinc coated music wire	
Electrical contacts	Standard	Silver-nickel
	Low-voltage	Gold-plated over silver
Terminals	Screw	Brass
	Spring-clamp	Silver-plated brass

Material Listing

Component	For Use with	Material Used
Panel gasket	All operators	Nitrile, TPE
Diaphragm seal	Illuminated push button, non-illuminated push button	Automotive industry acceptable silicone
K-seal	Selector switch, key selector switch, push/twist-to-release E-stop, key E-stop, push/pull mushroom	Nitrile
Diaphragm retainer, return spring I	Illuminated push button, non-illuminated push button, momentary mushroom	Stainless steel
Return spring II	Reset, selector switch, key selector switch, alternate action, push/twist-to-release E-stop, key E-stop, push/pull mushroom	Zinc-coated music wire
Button cap/mushroom head	Non-illuminated push button, momentary mushroom, reset, push/twist-to-release E-stop, key E-stop, push/pull mushroom, multi-function	PBT/polycarbonate blend
2-color molded button cap	Non-illuminated push button	PBT/polycarbonate blend
Lens	Multi-function	Acetal
Lens, knob	Illuminated push button, illuminated momentary mushroom, illuminated selector switch	Polyamide
Knob	Non-illuminated selector switch	Glass-filled polyamide
Plastic bezel/bushing I	Non-illuminated push button, illuminated push button, momentary mushroom, selector switch, key selector switch, push/twist-to-release E-stop, key E-stop, push/pull mushroom, multi-function, reset	Glass-filled polyamide
Plastic bezel/bushing II, jam nut	Pilot light, reset jam nut, reset pushers	Glass-filled PBT
Metal bezel/bushing	All metal operators	Zinc
Diffuser	Illuminated push button, pilot light	Polycarbonate
Legend frames	–	Glass-filled polyamide
Plastic mounting ring	All plastic operators	Glass-filled polyamide
Metal mounting ring	All metal operators	Chromated zinc
Plastic latch	–	Glass-filled polyamide
Metal latch	–	Chromated zinc + stainless steel
Plastic enclosure	–	PBT/polycarbonate blend
Metal enclosure	–	Aluminum
Terminal screws	LED module, incandescent module, contact blocks	Zinc-plated steel with chromate
Terminals	LED module, incandescent module, contact blocks	Brass with silver-nickel contacts
Spring clamps	LED module, incandescent module, contact blocks	Stainless steel
Lamp socket	Incandescent module	Brass
Housing	Incandescent module, LED module	Glass-filled polyamide
Low-voltage terminals	Contact blocks	Gold-plated silver-nickel contacts
Low-voltage spanner	Contact blocks	Gold-plated silver-nickel contacts
Spanner	Contact blocks	Brass with silver-nickel contacts
Boot	Toggle Switch, illuminated push button, non-illuminated push button, multi-function illuminated and non-illuminated	Automotive industry acceptable silicone

3-position, Non-illuminated



Standard Knob
Cat. No. 800FP-SM32

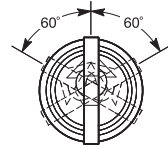


Knob Lever
Cat. No. 800FM-HM32

Switching Angle

Table 11 - Target Table and Operator Position (60° Switching Angle)

Contact Type ⁽¹⁾	Position on Mounting Latch			
N.O.	Left	X	0	0
	Right	0	0	X
	Center	X	0	X
	Center CL ⁽²⁾	X	0	0
	Center CR ⁽²⁾	0	0	X
N.C.	Left	0	X	X
	Right	X	X	0
	Center	0	X	0
	Center CL ⁽²⁾	0	X	X
	Center CR ⁽²⁾	X	X	0



- (1) Contact selection is limited to the following options, consult your local Rockwell Automation sales office or Allen-Bradley distributor for other options.
 (2) The center contact block can have the same target output as the left or right contact block, by specifying center left (CL) or center right (CR) option.
Note: X = Closed / 0 = Open

Color	Operator Type			Package Quantity	Standard Knob		Knob Lever	
					Plastic	Metal	Plastic	Metal
	Cat. No.	Cat. No.	Cat. No.		Cat. No.	Cat. No.	Cat. No.	Cat. No.
Black with White Insert	Maintained			1	800FP-SM32	800FM-SM32	800FP-HM32	800FM-HM32
	Spring return from left and right				800FP-SB32	800FM-SB32	800FP-HB32	800FM-HB32

800F P - S M3 2 _____
 a b c d e f

a	
Operator Construction	
Code	Description
P	Round plastic operator (IP66, Type 4/4X/13)
M	Round metal operator (IP66, Type 4/13)

b	
Operator Type	
Code	Description
S	Standard knob
H	Knob lever ⁽¹⁾

c	
Operator Function	
Code	Type
M3	Maintained
L3	Spring return from left
R3	Spring return from right
B3	Spring return from left and right

d		
Knob/Insert Color		
Code	Knob Color	Insert Color
2	Black	White

e	
Orientation	
Code	Description
Blank	Standard
N	90° offset ⁽²⁾

f	
Operation	
Code	Description
Blank	Standard
CL	Center left ⁽³⁾
CR	Center right ⁽³⁾

- (1) 30 mm hole spacing does not work if knob lever is used. See [page 47](#) for recommended operator panel spacing.
 (2) For use in vertical mount Bulletin 800F enclosures.
 (3) The center contact block can have the same target output as the left or right contact block, by specifying center left (CL) or center right (CR) option.

4-position, Non-illuminated



Standard Knob
Cat. No. 800FP-SM42

Table 13 - Target Table and Operator Position (45° Switching Angle) ⁽¹⁾

Contact Type ⁽²⁾	Position on Mounting Latch				
N.O.	Left	0	0	X	0
	Right	X	0	0	0
	Center	X	0	X	0
	Center CL	0	0	X	0
	Center CR	X	0	0	0
N.C.E.B.	Left	0	0	0	X
	Right	0	X	0	0
	Center CL	0	0	0	X
	Center CR	0	X	0	0
N.C.L.B.	Left	X	X	0	X
	Right	0	X	X	X
	Center	0	X	0	X
	Center CL	X	X	0	X
	Center CR	0	X	X	X

(1) Must use N.O., N.C.E.B., or N.C.L.B. contact blocks only. Cannot use N.C. or N.O.E.M. contact blocks with 4-position selector switch.

(2) Contact selection is limited to the following options, consult your local Rockwell Automation sales office or Allen-Bradley distributor for other options.

Note: X = Closed / 0 = Open

Color	Pkg. Quantity	Standard Knob – Maintained	
		Plastic	Metal
		Cat. No.	Cat. No.
Black with White Insert	1	800FP-SM42	800FM-SM42

800F P - S M4 2

 a b c d e f

a		b		c	
Operator Construction		Operator Type		Operator Function	
Code	Description		Description	Code	Type
P	Round plastic operator (IP66, Type 4/4X/13)		Standard knob	M4	Maintained (45° switching angle)
M	Round metal operator (IP66, Type 4/13)		Knob lever		

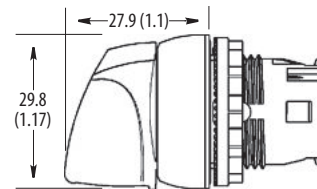
d			e		f	
Knob/Insert Color			Orientation		Operation	
Code	Knob Color	Insert Color	Code	Description	Code	Description
2	Black	White	Blank	Standard	Blank	Standard
			N	90° offset ⁽¹⁾	CL	Center left ⁽²⁾
					CR	Center right ⁽²⁾

(1) For use in vertical mount enclosures.

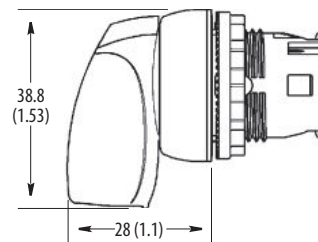
(2) The center contact block can have the same target output as the left or right contact block, by specifying center left (CL) or center right (CR) option.

Approximate Dimensions – Selector Switch Operators

Illuminated and Non-illuminated Knob Selector Switch Operators



Non-illuminated Knob Lever Selector Switch Operators



Power Modules with Contact Blocks and Latch – Composite

800F - P N 5 R X 1 0 E
a b c d e f g h

a	
Style	
Code	Description
P	Plastic latch
M	Metal latch

b	
Power Module Type ^{(1) (2)}	
Code	Description
D	Incandescent module, screw termination
N	Integrated LED module, screw termination
Q	Integrated LED module, spring-clamp termination

c	
Voltage	
Code	Description
0	No bulb ⁽³⁾
1	6V AC/DC ⁽³⁾
2	12V AC/DC ⁽³⁾
3	10...29V AC 10...30V DC
4	48V AC/DC ⁽³⁾
5	120V AC
7	240V AC ⁽⁴⁾

d	
Lamp Color ⁽⁵⁾	
Code	Description
C	Incandescent
R	Red LED
G	Green LED
W	White LED

e	
Contact Block Termination Style	
Code	Description
X	Screw termination
Q	Spring-clamp termination

f	
N.O. (Normally Open) Circuits	
Code	Description
0	No contact
1	1 N.O.
2	2 N.O.
3	3 N.O.
4	4 N.O.

g	
N.C. (Normally Closed) Circuits	
Code	Description
0	No contact
1	1 N.C.
2	2 N.C.
3	3 N.C.
4	4 N.C.

h	
Specialty Contact Block	
Code	Description
Blank	Standard blocks
V	Low-voltage – QuadConnect™
E	N.O. early make
L	N.C. late break
B	N.C. early break
S	N.C. self-monitoring

- (1) Four circuits maximum allowable when power module is used. Contact blocks cannot be stacked on power module.
(2) LED modules for use with all illuminated operators. Incandescent module for use with pilot lights, push buttons, and momentary mushroom operators only.
(3) Only available for incandescent module.
(4) Only available for integrated LED module.
(5) For best illuminated results, LED should match lens color. For yellow, blue, or amber operator, select a white LED.

Other Back-of-panel Components

Table 24 - Latches






	Description	Pkg. Qty.	Cat. No.
 Cat. No. 800F-ALM	Metal Mounting Latch Zinc-plated, metal die cast mounting latches. Sold only in multiples of 10. Order (quantity of) 10 to receive one package of 10 pieces.	10	800F-ALM
	Note: Sold only in multiples of 100. Order (quantity of) 100 to receive one package of 100 pieces.	100	800F-ALM-BP
 Cat. No. 800F-ALP	Plastic Mounting Latch Note: Sold only in multiples of 10. Order (quantity of) 10 to receive one package of 10 pieces.	10	800F-ALP
	Note: Sold only in multiples of 100. Order (quantity of) 100 to receive one package of 100 pieces.	100	800F-ALP-BP

Table 25 - Contact Blocks

	Description	Contact Type	Pkg. Qty.	Cat. No.
 <p>Cat. No. 800F-X10</p>	<p>Contact Block Note: Sold only in multiples of 10. Order (quantity of) 10 to receive one package of 10 pieces. Latch not included.</p>	N.O.	10	800F-X10
		N.C.		800F-X01
		N.O. low-voltage — QuadConnect		800F-X10V
		N.C. low-voltage — QuadConnect		800F-X01V
		N.O.L.M.		800F-X10N ⁽¹⁾
		N.O.E.M.		800F-X10E
		N.O.E.E.M.		800F-X10M ⁽²⁾
		N.C.L.B.		800F-X01L
		N.C.E.B.		800F-X01B ⁽³⁾
		Self-Monitoring		800F-X01S ⁽⁴⁾
		Dual-circuit of 2 N.O.		800F-X20D ⁽⁴⁾
		Dual-circuit of 2 N.C.		800F-X02D ⁽⁴⁾
		Dual-circuit of 1 N.O.-1 N.C.		800F-X11D ⁽⁴⁾
		N.O. spring-clamp		800F-Q10
		N.C. spring-clamp		800F-Q01
Ring lug N.O.	800F-R10 ^{(5) (6)}			
Ring lug N.C.	800F-R01 ^{(5) (6)}			
<p>Note: Sold only in multiples of 100. Order (quantity of) 100 to receive one package of 100 pieces. Latch not included.</p>	N.O.	100	800F-X10-BP	
	N.C.		800F-X01-BP	
 <p>Cat. No. 800F-BX01</p>	<p>Base-mounted Contact Block Base-mounted contact blocks can be used in plastic or metal enclosures. Note: Sold only in multiples of 10. Order (quantity of) 10 to receive one package of 10 pieces. Latch not included.</p>	N.O.	10	800F-BX10
		N.C.		800F-BX01

- (1) For use with Cat. No. 800FP-CB_ and Cat. No. 800FP-CC_ operators.
- (2) For use with Cat. No. 800FP-CC_ operators.
- (3) Only for use with 4-position selector switch, 4-position toggle switch, or 3-position push-pull operator.
- (4) Cannot stack.
- (5) Cannot be used in a composite catalog number.
- (6) Replacement screws are available (Cat. No. 800F-ARS1)

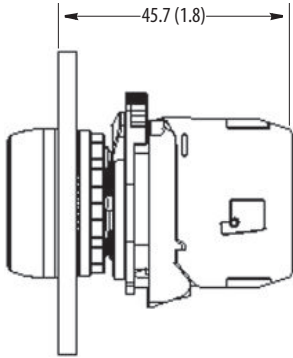
Table 26 - Power Modules

	Description	Voltage	Pkg. Qty.	Cat. No.
 <p>Cat. No. 800F-D3C</p>	<p>Incandescent Module For use with pilot lights, push buttons, and momentary mushroom operators. Note: Sold in multiples of 10. Order (quantity of) 10 to receive one package of 10 pieces. Latch not included.</p>	No bulb	10	800F-D0C
		6V AC/DC		800F-D1C
		12V AC/DC		800F-D2C
		24V AC/DC		800F-D3C
		48V AC/DC		800F-D4C
		120V AC/DC		800F-D5C

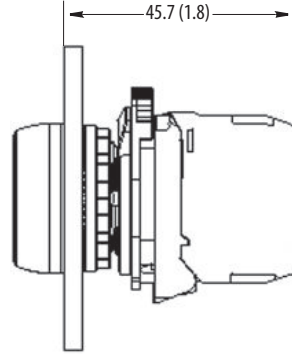
Approximate Dimensions – Back-of-panel Components

Dimensions in millimeters (inches). Dimensions are not intended to be used for manufacturing purposes.

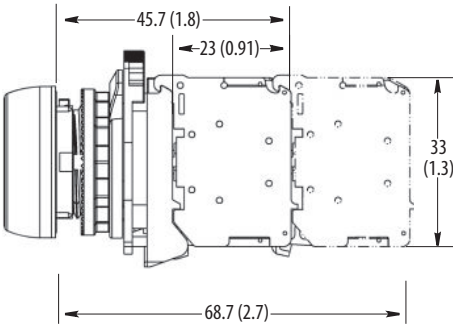
Incandescent Module with Latch



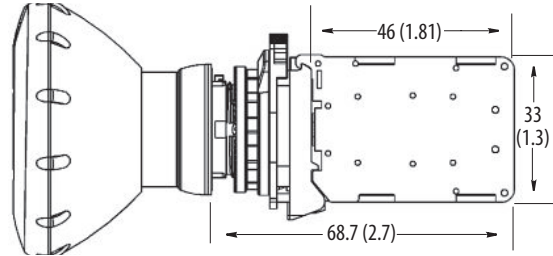
LED Module with Latch



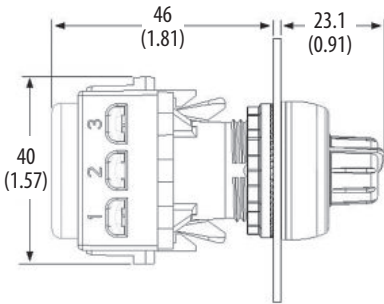
Contact Cartridges with Latch



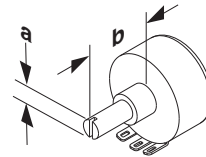
Dual-circuit Contact Block or Self-monitoring Contact Block (1 Deep, Max)



Potentiometer with Resistive Element



Customer Supplied Resistive Element



	Max.		Min.
a (Dia.)	6.4 (0.252)	5.9 (0.232)	5.7 (0.224)
b (Length)	24 (0.945)	32 (1.26)	14 (0.551)



Control Circuit and Load Protection

Bulletin Numbers 188, 1489, 1492, 1694



Allen-Bradley

by ROCKWELL AUTOMATION

Selection Guide

Original Instructions

What's Inside

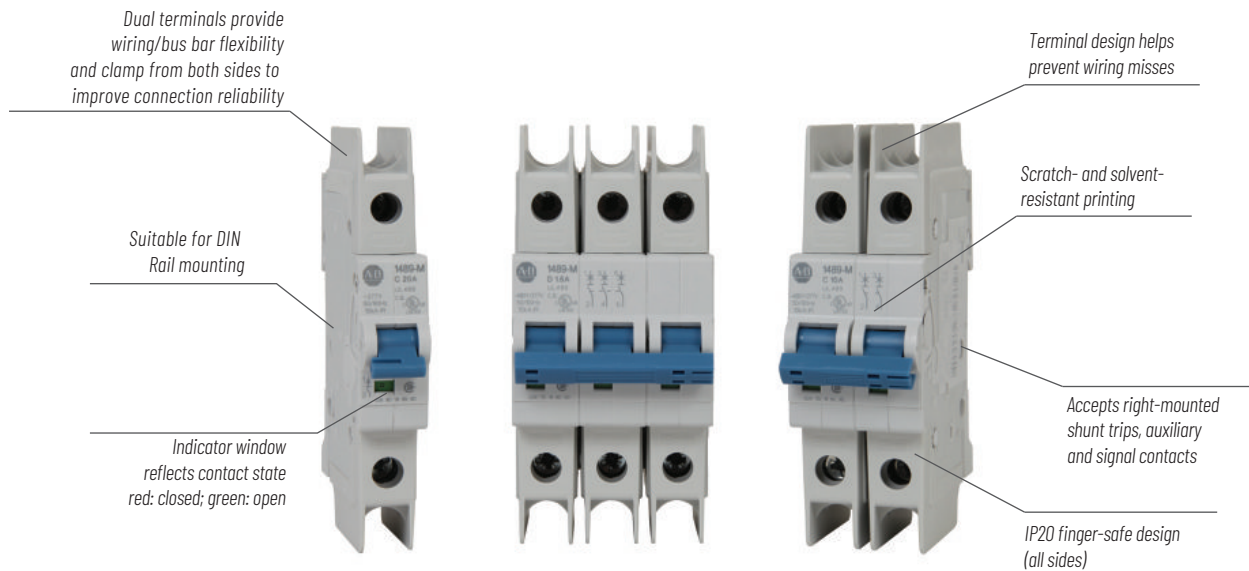
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What's New

This publication contains the following new or updated information. This list includes substantive updates only and is not intended to reflect all changes.

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1489-M Circuit Breakers



Bulletin 1489-M thermal-magnetic Circuit Breakers are approved for branch circuit protection in the United States and Canada, and are certified as Miniature Circuit Breakers for IEC applications.

These branch protectors are compatible with many accessories to meet diverse application needs, including UL 508 Listed bus bars for convenience in panel assembly, auxiliary contacts, signal contacts and shunt trips for versatility, and lockout attachments for safety during maintenance.

- Current limiting
- Fast breaking time
- High rated voltage
- Dual terminals provide a more secure connection of up to four wires, or two wires and a bus bar
- Superior shock and vibration resistance to help prevent nuisance tripping
- Terminal design helps prevent wiring misses by directing wires into the terminal openings, even while tightening
- Reversible line and load connections
- Single and multi-pole toggle mount lock out attachments available for Lockout/Tagout (LOTO)
- RoHS compliant and fully recyclable device
- Suitable for extreme ambient conditions

1489-M Circuit Breakers	
Rated Voltage	UL/CSA: Max. 480Y/277V AC IEC: U_e 230/400V AC
Interrupting Capacity	UL/CSA: 10 kA IEC: 15 kA
Current Ratings	0.5...63 A
Poles	1, 2, 3
Trip Curves	C, D
Standards Compliance	UL 489 CSA C22.2 No. 5.1 EN 60947-2 GB 14048.2
Certifications	UL Listed, File No. E197878 CSA Certified, File No. 259391 CE Marked VDE Certified CCC Certified RoHS Compliant

Catalog Number Explanation

Examples given in this section are for reference purposes. This basic explanation should not be used for product selection; some combinations may not produce a valid catalog number.

1489 - **M** **1** **C** **005**
 a b c d

a

Voltage Type	
Code	Description
M	AC Circuit Breaker

b

Poles	
Code	Description
1	1-Pole
2	2-Pole
3	3-Pole

c


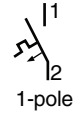
Trip Curve	
Code	Description
C	Trip Curve C
D	Trip Curve D

d

Rated Current (I_n)	
Code	Current [A]
005	0.5
010	1
016	1.6
020	2
030	3
040	4
050	5
060	6
070	7
080	8
100	10
130	13
150	15
160	16
200	20
250	25
300	30
320	32
350	35
400	40
500	50
600	60
630	63

Product Selection

1-Pole Circuit Breakers

Photo/ Wiring Diagram	UL/CSA Max. Voltage	IEC/EN Max. Voltage	Continuous Current Rating (I_n)	Trip Curve C Inductive 5...10 I_n	Trip Curve D Highly Inductive 10...20 I_n
			[A]	Cat. No.	Cat. No.
 	277V AC, 48V DC	230V AC	0.5	1489-M1C005	1489-M1D005
			1	1489-M1C010	1489-M1D010
			1.6	1489-M1C016	1489-M1D016
			2	1489-M1C020	1489-M1D020
			3	1489-M1C030	1489-M1D030
			4	1489-M1C040	1489-M1D040
			5	1489-M1C050	1489-M1D050
			6	1489-M1C060	1489-M1D060
			7	1489-M1C070	1489-M1D070
			8	1489-M1C080	1489-M1D080
			10	1489-M1C100	1489-M1D100
			13	1489-M1C130	1489-M1D130
			15	1489-M1C150	1489-M1D150
			16	1489-M1C160	1489-M1D160
			20	1489-M1C200	1489-M1D200
			25	1489-M1C250	1489-M1D250
			30	1489-M1C300	1489-M1D300
			32	1489-M1C320	1489-M1D320
			35	1489-M1C350	1489-M1D350
		C Curve: 277V AC, 48V DC D Curve: 240V AC, 48V DC		40	1489-M1C400
	240V AC, 48V DC		50	1489-M1C500	1489-M1D500
			60	1489-M1C600	1489-M1D600
			63	1489-M1C630	1489-M1D630

Specifications

Electrical Ratings					
Poles	1, 2, 3				
Tripping characteristics	C, D				
Rated current (I_n)	0.5...63 A				
Rated frequency [f]	50/60 Hz				
Rated insulation voltage U_i per IEC/EN 60664-1	250V AC (phase to ground) 440V AC (phase to phase)				
Overtoltage category	III				
Pollution degree	3				
Data per UL/CSA					
Rated voltage	AC	1-pole	C Curve	0.5...40 A	277V AC
				50...63 A	240V AC
		D Curve		0.5...35 A	277V AC
				40...63 A	240V AC
	2-, 3-pole	C Curve		0.5...40 A	480Y/277V AC
				50...63 A	240V AC
		D Curve		0.5...35 A	480Y/277V AC
				40...63 A	240V AC
	DC	1-pole			48V DC
		2-pole			96V DC (2-pole in series)
Rated interrupting capacity per UL 489				10 kA	
Reference temperature for tripping characteristics				40 °C	
Electrical endurance				6,000 operations (AC and DC); 1 cycle (1s - ON, 9s - OFF)	
Data per IEC/EN 60947-2					
Rated operational voltage (U_o)	1-pole		230V AC		
	2-, 3-pole		400 V AC		
Highest supply or utilization voltage (U_{max})	AC	1-pole	253/440V AC		
		2-, 3-pole	440V AC		
	DC (1)	1-pole	48V DC		
		2-pole	96V DC		
Min. operating voltage				12V AC, 12V DC	
Rated ultimate short-circuit breaking capacity (I_{cu})				15 kA	
Rated service short-circuit breaking capacity (I_{cs})				≤ 40 A: 11.25 kA > 40 A: 7.5 kA	
Rated impulse withstand voltage U_{imp} . (1.2/50μs)				4 kV (test voltage 6.2 kV at sea level, 5 kV at 2,000 m)	
Dielectric test voltage				2 kV (50/60Hz, 1 min.)	
Reference temperature for tripping characteristics				30 °C	
Electrical endurance				$I_n < 30$ A: 20,000 ops. (AC) 1 cycle (2s - ON, 13s - OFF, $I_n \leq 32$ A), $I_n \geq 30$ A: 10,000 ops. (AC) 1 cycle (2s - ON, 28s - OFF, $I_n > 32$ A) 1,000 ops. (DC)	

(1) Self-declared IEC DC ratings.

Mechanical Data		
Housing	Insulation group II, RAL 7035	
Indicator window	red ON/green OFF	
Protection degree per EN 60529	IP20, IP40 in enclosure with cover	
Mechanical endurance	20,000 operations	
Shock resistance per IEC/EN 60068-2-27	25 g - 2 shocks - 13 ms	
Vibration resistance per IEC/EN 60068-2-6	5g - 20 cycles at 5...150...5 Hz with load 0.8 I_n	
Environmental		
Environmental conditions (damp heat) per IEC/EN 60068-2-30	28 cycles with 55°C/90-96% and 25°C/95-100%	
Ambient temperature (2)	-25...+55 °C (-13...+131 °F)	
Storage temperature	-40...+70 °C (-40...+158 °F)	
Installation		
Terminal	Dual terminal	
Cross-section of wire (3) - solid, stranded (front/back terminal slot)		35/35 mm ²
		18...4/18...10 AWG
Cross-section of wire - flexible (front/back terminal slot)		25/10 mm ²
		1 wire, 18...4 AWG
Multi-wire rating per UL, CSA		2-4 wires (4), 18...10 AWG
Cross-section of bus bars (back terminal slot)		10 mm ²
Tightening torque	IEC	2.8 N•m
	UL/CSA	AWG 18...16: 13.3 in•lb, AWG 14...10: 17.7 in•lb, AWG 8...4: 39.8 in•lb
Screwdriver		No. 2 Pozidriv
Mounting		DIN Rail (EN 60715, 35 mm) with fast clip
Mounting position		Any
Supply		Optional
Approximate Dimensions and Weight		
Pole dimension (H x D x W)		111 x 69 x 17.5 mm (4.37 x 2.72 x 0.69")
Pole weight		125 g (4.4 oz.)
Combination with Auxiliary Elements		
Auxiliary contact		Yes
Signal contact		Yes
Shunt trip		Yes

(2) Refer to the ambient temperature derating tables.

(3) 35 mm self-declared, not included in IEC/EN approval.

(4) Wires must be of like size and stranding. Up to two wires per terminal slot.

Power Loss Due to Current

Rated Current [A]	Power Loss Per Pole [W]	Rated Current [A]	Power Loss Per Pole [W]
0.5	1.4	15	2.4
1	1.4	16	2.5
1.6	1.8	20	2.5
2	1.8	25	3.2
3	1.6	30	3.5
4	1.8	32	3.7
5	1.9	35	4.1
6	2.0	40	4.5
7	1.1	50	4.5
8	1.5	60	4.9
10	2.1	63	5.4
13	2.3	—	—

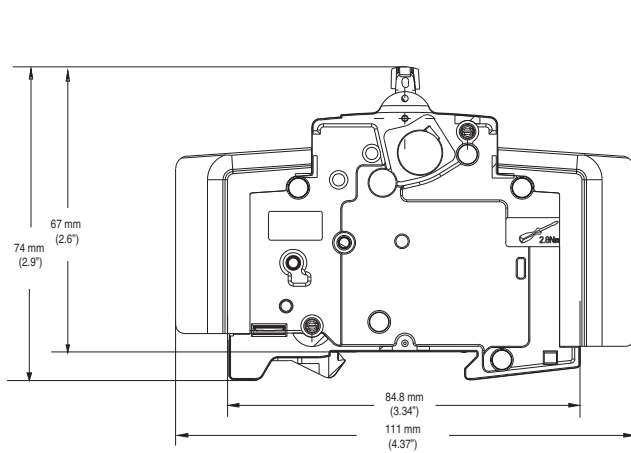
Zero-stack Derating

The installation of several miniature circuit breaker side by side with rated current on all poles requires a correction factor to the rated current (not required if spacers are used).

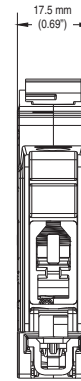
No. of Adjacent Devices	Factor
1	1
2,3	0.9
4,5	0.8
≥ 6	0.75

Approximate Dimensions

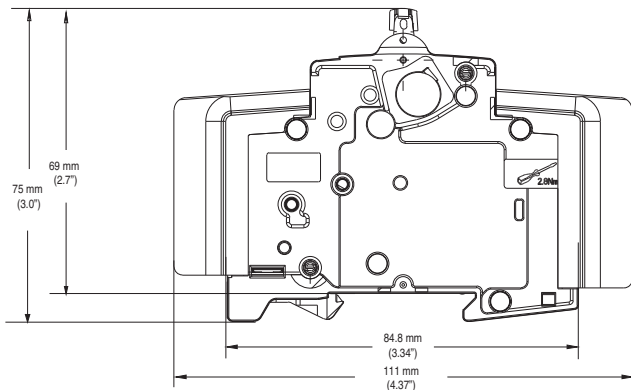
Dimensions are shown in millimeters (inches). Dimensions are not intended for manufacturing purposes.



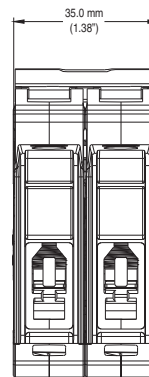
1 Pole



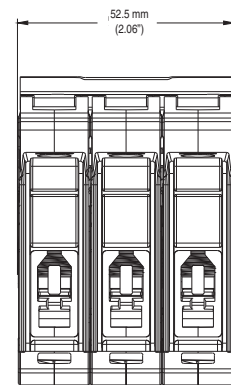
1 Pole



2-, 3 Pole



2-Pole



3-Pole

Application Information

Circuit Voltage

The Bulletin 1489-M circuit breakers are rated by voltage class. Applications should not exceed the listed voltage and current range.

Circuit Frequency

The Bulletin 1489-M circuit breakers may be applied to frequencies of 50 Hz and 60 Hz without derating. For applications above 60 Hz, contact Rockwell Automation with specific application information for the derating of the circuit breakers.

Available Short Circuit Current

The Bulletin 1489-M circuit breakers should only be applied in those applications in which the available short-circuit (or fault) current is less than or equal to 10 kA (US/Canada) and 15 kA (IEC).

Tripping Characteristics

The trip curve characteristics are shown on the following pages. The trip bands shown for each breaker represent current tripping limits for a circuit breaker and are within the limits established by UL.

The standard tripping characteristic for Bulletin 1489-M is Type C. Type C has a magnetic trip activated at 5-10 times the rated current of the circuit breaker. The reference temperature for the thermal tripping characteristics is 30 °C. The Type C characteristic will suit most applications.

In rare occurrences when the Type C characteristic does not fully meet the application, Type D magnetic trip characteristic is available, allowing for transients approximately twice as high as the standard Type C.

For a specific current at 30 °C, a circuit breaker will open ("clear the circuit") automatically at some total time that will be within the minimum and maximum time shown on the curves. For example, a one-pole, 15 A, Bulletin 1489-M circuit breaker trips in not less than 1 s and not more than 200 s on a 30 A current. Because the UL standard defines this time spread, users should not specify exact tripping time. The lower current portion of the curves (upper left) depicts the time to trip due to thermal action and reflect overload protection of the wire and connect load. The higher current portion of the curves (lower right) depicts the trip due to magnetic action of the circuit breaker and reflects protection due to short circuit level currents.

Application Considerations

The following is a discussion of application considerations related to North American applications. When applying product to IEC regional requirements, follow IEC practices and guidelines.

The selection of a specific ampere rating for a specific application is dependent on the type of load and duty cycle and is governed by the National Electrical Code (Canadian Electrical Code) and UL/CSA. In general, the codes require that overcurrent protection is at the current supply and at points where wire sizes are reduced. In addition, the codes state that conductors be protected according to their current carrying capacity. There are specific situations that require application consideration, such as motor circuit, and guidelines for the selection for transformer protection.

The Bulletin 1489-M circuit breakers are "non-100% rated" as defined by UL 489, para 7.1.4.2. As such, the circuit breaker's rating should be loaded to no more than 80% if used with continuous loads.

Line and load may be reversed. The Bulletin 1489-M circuit breaker may be bottom fed.

Branch Circuits

Bulletin 1489-M circuit breakers may be used to protect branch circuits. A branch circuit is the wiring portion of a system extending beyond the final overcurrent device protecting the circuit. Guidelines established in NEC, CEC, UL, and CSA should be used to determine the specific device. For example:

Motor Branch Circuit

Bulletin 1489-M circuit breakers are not horsepower rated because they are able to safely interrupt currents far in excess of the locked rotor value for a selected motor. This ability is recognized in the codes and standards and is also established by the UL and CSA tests described in UL 489 and CSA C22.2 No. 5 standards.

The size of a Bulletin 1489-M circuit breaker should be determined following the guidelines for an Inverse Time Circuit Breaker.

References: NEC 430.51 and UL 489. Also see CEC and appropriate Canadian Standards.

Transformer Protection

Bulletin 1489-M circuit breakers may be used for transformer protection following the guidelines established.

References: NEC 450 and UL 489. Also see CEC and appropriate Canadian Standards.

Heater Load, Lighting, and Other Load Protection Bulletin 1489-M circuit breakers may be used for protection of heater loads, lighting loads, and other loads following the guidelines established.

References: NEC Article 31 and UL 508A. Also see CEC and appropriate Canadian Standards.

SWD Rating

The Bulletin 1489-M breakers (0.5 ... 20 A) are rated as Switch Duty (SWD) and as such may be applied to switch fluorescent lighting loads up to their current and voltage maximum.

Coordinated Overcurrent Protection

Where an orderly shutdown is required to minimize the hazards to personnel and equipment, a system of coordination based upon the faulted or overloaded circuit is isolated by selective operation of only the overcurrent protective device closest to the overcurrent condition. The user should select devices that meet this requirement. *References: NEC 240.12. Also see CEC.*

HACR Rating

Bulletin 1489-M Circuit Breakers are rated as Heating, Air Conditioning and Refrigeration circuit breakers as defined by UL 489, paragraph 6.7 and may be used in this type of application.

Current Limiting

Bulletin 1489-M Circuit Breakers are rated as current limiting circuit breakers as defined by UL 489, paragraph 8.6.

The Bulletin 1489-M line features the ability to achieve short circuit interruptions far more effectively than conventional breakers. In conventional circuit breakers, the short circuit interruption time required is approximately one or two half cycles of an AC sine wave. When the contacts open, the resulting arc continues to burn until the current level passes through zero. The arc may re-ignite because of the insufficient width of the contact gap. The current that flows until the arc is extinguished produces a heating effect proportional to the I^2t value (let-through-energy) of the fault current.

The Bulletin 1489-M device is designed to substantially reduce the amount of let-through-current and the resulting let-through-energy that can damage protected components. The Bulletin 1489-M has the ability to interrupt short circuit current within the first half cycle of the fault. Limiting let-through current and energy will protect against the harmful effects of overcurrent and is focused primarily on avoiding excessive heat and mechanical damage.

Both of these factors are proportional to the square of the current. Thermal energy is proportional to the square of the RMS value and magnetic forces are proportional to the square of the peak value. The most effective way to provide protection is to substantially limit let-through-energy. This provides the following advantages:

- Far less damage at the location of the short circuit.
- Fast electric separation of a faulty unit from the system, especially power supplies connected in parallel that are switched off when the voltage of the power bus drops below a certain level.
- Far less wear on the miniature circuit breaker itself. This means more safe interruptions.
- Better protection of all components in the short circuit path.
- Far wider range of selective action when used with an upstream protective device. (No nuisance shut downs from feeder line interruptions, causing a blackout in all connected branches.)

Ambient Temperature Derating

- The Bulletin 1489-M circuit breakers are rated in RMS amperes at a 40 °C (104 °F) ambient temperature per UL 489/CSA C22.2 No. 5. This temperature is used as the ambient temperature external to an industrial enclosure.
- If a circuit breaker is applied in a temperature that exceeds the 40 °C (104 °F) ambient rating, then the circuit breaker should be derated using the table below. For IEC 60947-2 standard, the products carry an ambient rating of 30 °C.
- Follow standard IEC application considerations for temperature rating in different ambient temperatures.
- Application below 0° C is for non-condensing atmosphere. Care should be taken for applications below 0 °C. These devices are not certified to operate correctly in the presence of ice.

Bulletin 1489-M
Temperature Derating, UL
Reference temperature = 40 °C

Current Rating (A)	Ambient temperature (°C)									
	-25	-20	-10	0	10	20	30	40	50	55
0.5	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5
1	1.2	1.2	1.2	1.1	1.1	1.1	1.0	1	1.0	0.9
1.6	2.0	2.0	1.9	1.8	1.8	1.7	1.7	1.6	1.5	1.5
2	2.5	2.4	2.4	2.3	2.2	2.1	2.1	2	1.9	1.9
3	3.7	3.7	3.6	3.4	3.3	3.2	3.1	3	2.9	2.8
4	5.0	4.9	4.7	4.6	4.4	4.3	4.1	4	3.9	3.8
5	6.2	6.1	5.9	5.7	5.6	5.4	5.2	5	4.8	4.7
6	7.4	7.3	7.1	6.9	6.7	6.4	6.2	6	5.8	5.7
7	8.7	8.6	8.3	8.0	7.8	7.5	7.3	7	6.7	6.6
8	9.9	9.8	9.5	9.2	8.9	8.6	8.3	8	7.7	7.6
10	12.4	12.2	11.9	11.5	11.1	10.7	10.4	10	9.6	9.4
13	16.1	15.9	15.4	14.9	14.4	14.0	13.5	13	12.5	12.3
15	18.6	18.3	17.8	17.2	16.7	16.1	15.6	15	14.4	14.2
16	19.8	19.6	19.0	18.4	17.8	17.2	16.6	16	15.4	15.1
20	24.8	24.4	23.7	23.0	22.2	21.5	20.7	20	19.3	18.9
25	31.0	30.6	29.6	28.7	27.8	26.9	25.9	25	24.1	23.6
30	37.2	36.7	35.6	34.4	33.3	32.2	31.1	30	28.9	28.3
32	39.7	39.1	37.9	36.7	35.6	34.4	33.2	32	30.8	30.2
35	43.4	42.8	41.5	40.2	38.9	37.6	36.3	35	33.7	33.1
40	49.6	48.9	47.4	45.9	44.4	43.0	41.5	40	38.5	37.8
50	62.0	61.1	59.3	57.4	55.6	53.7	51.9	50	48.2	47.2
60	74.4	73.3	71.1	68.9	66.7	64.4	62.2	60	57.8	56.7
63	78.2	77.0	74.7	72.3	70.0	67.7	65.3	63	60.7	59.5

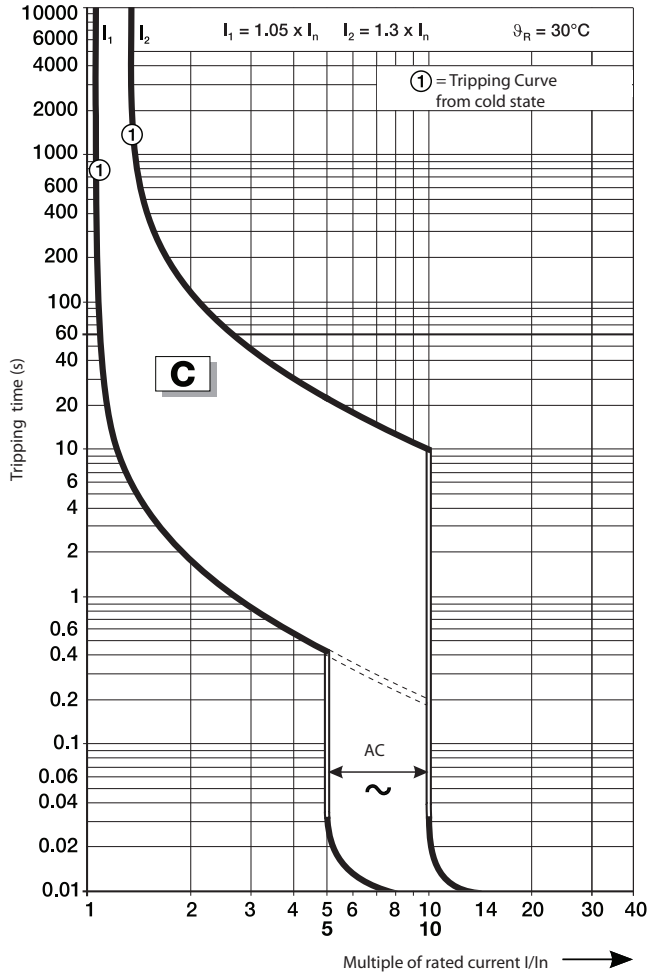
Bulletin 1489-M
Temperature Derating, IEC
Reference temperature = 30 °C

Current Rating (A)	Ambient temperature (°C)									
	-25	-20	-10	0	10	20	30	40	50	55
0.5	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.5
1	1.2	1.2	1.1	1.1	1.1	1.0	1	1.0	0.9	0.9
1.6	1.9	1.9	1.8	1.8	1.7	1.7	1.6	1.5	1.5	1.5
2	2.4	2.4	2.3	2.2	2.1	2.1	2	1.9	1.9	1.8
3	3.6	3.6	3.4	3.3	3.2	3.1	3	2.9	2.8	2.7
4	4.8	4.7	4.6	4.4	4.3	4.1	4	3.9	3.7	3.6
5	6.0	5.9	5.7	5.6	5.4	5.2	5	4.8	4.6	4.5
6	7.2	7.1	6.9	6.7	6.4	6.2	6	5.8	5.6	5.4
7	8.4	8.3	8.0	7.8	7.5	7.3	7	6.7	6.5	6.4
8	9.6	9.5	9.2	8.9	8.6	8.3	8	7.7	7.4	7.3
10	12.0	11.9	11.5	11.1	10.7	10.4	10	9.6	9.3	9.1
13	15.6	15.4	14.9	14.4	14.0	13.5	13	12.5	12.0	11.8
15	18.1	17.8	17.2	16.7	16.1	15.6	15	14.4	13.9	13.6
16	19.3	19.0	18.4	17.8	17.2	16.6	16	15.4	14.8	14.5
20	24.1	23.7	23.0	22.2	21.5	20.7	20	19.3	18.5	18.2
25	30.1	29.6	28.7	27.8	26.9	25.9	25	24.1	23.2	22.7
30	36.1	35.6	34.4	33.3	32.2	31.1	30	28.9	27.8	27.2
32	38.5	37.9	36.7	35.6	34.4	33.2	32	30.8	29.6	29.0
35	42.1	41.5	40.2	38.9	37.6	36.3	35	33.7	32.4	31.8
40	48.1	47.4	45.9	44.4	43.0	41.5	40	38.5	37.0	36.3
50	60.2	59.3	57.4	55.6	53.7	51.9	50	48.2	46.3	45.4
60	72.2	71.1	68.9	66.7	64.4	62.2	60	57.8	55.6	54.5
63	75.8	74.7	72.3	70.0	67.7	65.3	63	60.7	58.3	57.2

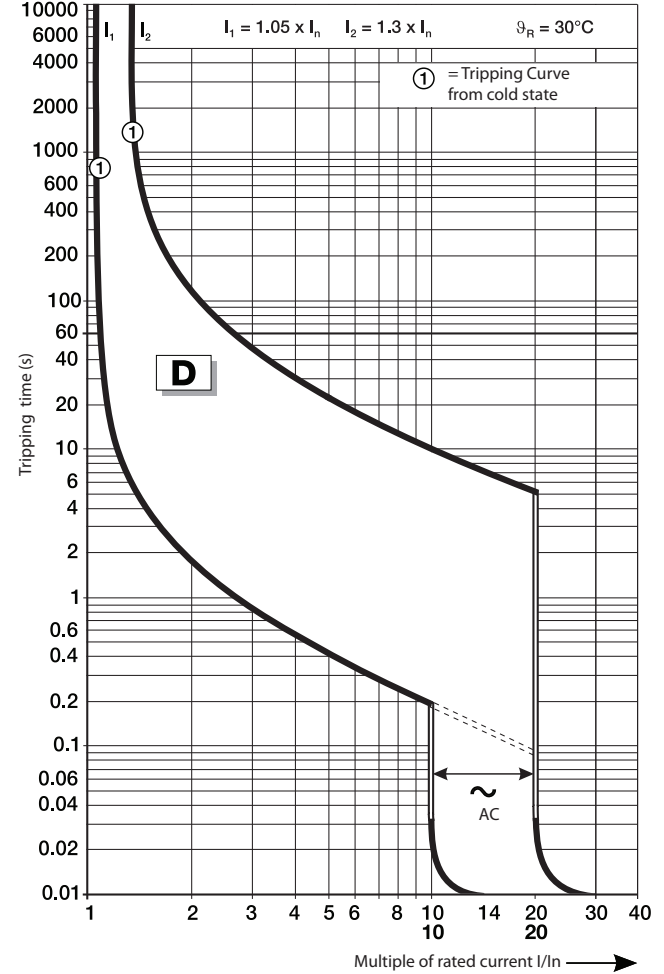
Tripping Characteristics

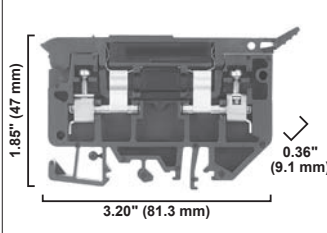







- DC trip curves - When using 1489-M_ on DC applications or DC loads, please refer to AC trip curves and times and use a factor of 1.5 for the magnetic instantaneous trip times the continuous current rating (I_n).
- For C trip curve = 7.5 to 15 multiple of the rated current (I / I_n).
- For D trip curve = 15 to 30 multiple of the rated current (I / I_n).
- The thermal trip times remain the same for both AC and DC applications.

C Curve



D Curve



	1492-H...	1492-WFB4...		
Dimensions are not intended to be used for manufacturing purposes. Note: Height dimension is measured from top of rail to top of terminal block.				
Specifications	Single-circuit fusible terminal block with or without fuse indication.	Single-circuit fuse block with or without fuse indication.		
Certifications	  	  		
Voltage Rating	H6/WFB4: 300V AC/DC H5/WFB424: 10...57V AC/DC H4/WFB4250: 100...300V AC	H6/WFB4: 300V AC/DC H5/WFB424: 10...57V AC/DC H4/WFB4250: 85...264V AC		
Maximum Current	15 A	15 A		
Wire Range (Rated Cross Section)	#30...12 AWG 0.5...4 mm ²	#30...12 AWG 0.5...4 mm ²		
Wire Strip Length	0.38 in. (9.7 mm)	0.31 in. (8 mm)		
Recommended Tightening Torque	7.1 lb•in. (0.8 N•m)	2.65...5.3 lb•in. (0.3...0.6 N•m)		
Density	33 pcs/ft (109pcs/m)	38 pcs/ft (125 pcs/m)		
Housing Temperature Range	-40...+195 °F (-40...+90 °C)	-40...+195 °F (-40...+90 °C)		
Indicator Type				
H6/WFB4	Non-Indicating	Non-Indicating		
H5/WFB424	Red LED	Red LED		
H4/WFB4250	Neon	Neon		
Leakage Current				
H6/WFB4	—	—		
H5/WFB424	2 mA @ 24V	2 mA @ 24V		
H4/WFB4250	2 mA @ 300V	2 mA @ 300V		
Fuse Size (Not Supplied)	1/4 x 1-1/4 in.	5 x 20 mm		
Short-Circuit Current Rating	See page 12-43			
Terminal Blocks	Cat. No.	Pkg Qty.	Cat. No.	Pkg Qty.
Color: Black No-indication	1492-H6	25	1492-WFB4	50
Black w/LED	1492-H5	25	1492-WFB424	50
Black w/Neon	1492-H4	25	1492-WFB4250	50
Accessories	Cat. No.	Pkg Qty.	Cat. No.	Pkg Qty.
Mounting Rails:				
1 m Symmetrical DIN (Steel)	199-DR1	10	199-DR1	10
1 m Symmetrical DIN (Aluminum)	1492-DR5	10	1492-DR5	10
1 m Hi-Rise Sym. DIN (Aluminum)	1492-DR6	2	1492-DR6	2
1 m Angled Hi-Rise Sym. DIN (Steel)	1492-DR7	2	1492-DR7	2
3 ft Scored A-B Rail	1492-N1	20	—	—
3 ft Rigid A-B Rail	1492-N22	20	—	—
3 ft High Rise A-B Rail	1492-N44	2	—	—
Standoff Brackets (Use Every 12 in.)	1492-N25	2	—	—
End Barrier	1492-N37	50	Not Required	—
End Anchors and Retainers:				
Screwless End Retainer	1492-ERL35	20	1492-ERL35	20
DIN Rail — Normal Duty	1492-EAJ35	100	1492-EAJ35	100
DIN Rail — Heavy Duty	1492-EAHJ35	50	1492-EAHJ35	50
A-B Rail — Heavy Duty	1492-N23	10	—	—
Uninsulated 10-Pole Side Jumper	1492-N49	10	1492-SJFB8-10	10
Side Jumper Insulating Sleeve	1492-SJS	10	—	—
Other Accessories:				
Partition Plate	—	—	1492-PPSL3	50
Group Marking Carrier	1492-GM35	25	1492-GM35	25
Marking Systems:				
Snap-In Marker Card — For Base Block	1492-MS8X12 (56/card)	5	1492-MS8X12 (56/card)	5
For Handle	1492-MS8X9 (56/card)	5	1492-MS8X9 (56/card)	5
Adhesive Labels	1492-ALHFB (50/sheet)	1	1492-ALHFB (50/card)	1

* IEC standards for 5 x 20 mm fuses do not include ratings above 6.3 A.

Screw Connection Terminal Blocks

Standard Feed-Through Blocks

	1492-J3				1492-J4				1492-J6			
Dimensions are not intended to be used for manufacturing purposes. Note: Height dimension is measured from top of rail to top of terminal block.												
Specifications	<i>Feed-through terminal block</i>				<i>Feed-through terminal block</i>				<i>Feed-through terminal block</i>			
Certifications		CSA	IEC	ATEX		CSA	IEC	ATEX		CSA	IEC	ATEX
Voltage Rating	600V AC/DC		800V AC/DC	550V AC/DC	600V AC/DC		800V AC/DC	690V AC/DC	600V AC/DC		800V AC/DC	550V AC/DC
Maximum Current	25 A	20 A	24 A	21 A	35 A	25 A	32 A	28 A	50 A	41 A	36 A	
Wire Range (Rated Cross Section)	#22...12 AWG	#26...12 AWG	2.5 mm ²	2.5 mm ² (#20...14 AWG)	#22...10 AWG	#26...10 AWG	4 mm ²	4 mm ² (#20...12 AWG)	#22...8 AWG	6 mm ²	6 mm ² (#20...10 AWG)	
Wire Strip Length	0.39 in. (10 mm)				0.39 in. (10 mm)				0.47 in. (12 mm)			
Recommended Tightening Torque	4.5...7.1 lb•in (0.5...0.8 N•m)				9.0 lb•in (1.0 N•m)				14.2 lb•in (1.6 N•m)			
Density	59 pcs/ft (196 pcs/m)				49 pcs/ft (163 pcs/m)				37 pcs/ft (123 pcs/m)			
Housing Temperature Range	-58...+248 °F (-50...+120 °C)				-58...+248 °F (-50...+120 °C)				-58...+248 °F (-50...+120 °C)			
Short-Circuit Current Rating	See page 12-42											
Terminal Blocks		Cat. No.	Pkg Qty.		Cat. No.	Pkg Qty.		Cat. No.	Pkg Qty.		Cat. No.	Pkg Qty.
Color:	Grey	1492-J3	100		1492-J4	100		1492-J6	100		1492-J6	100
	Red	1492-J3-RE	100		1492-J4-RE	100		1492-J6-RE	100		1492-J6-RE	100
	Blue	1492-J3-B	100		1492-J4-B	100		1492-J6-B	100		1492-J6-B	100
	Black	1492-J3-BL	100		1492-J4-BL	100		1492-J6-BL	100		1492-J6-BL	100
	Green	1492-J3-G	100		1492-J4-G	100		1492-J6-G	100		1492-J6-G	100
	Yellow	1492-J3-Y	100		1492-J4-Y	100		1492-J6-Y	100		1492-J6-Y	100
	Orange	1492-J3-OR	100		1492-J4-OR	100		1492-J6-OR	100		1492-J6-OR	100
	Brown	1492-J3-BR	100		1492-J4-BR	100		1492-J6-BR	100		1492-J6-BR	100
	White	1492-J3-W	100		1492-J4-W	100		1492-J6-W	100		1492-J6-W	100
	Violet	1492-J3-V	100		1492-J4-V	100		—	—		—	—
Mounting Rails:												
1 m Symmetrical DIN (Steel)		199-DR1	10		199-DR1	10		199-DR1	10		199-DR1	10
1 m Symmetrical DIN (Aluminum)		1492-DR5	10		1492-DR5	10		1492-DR5	10		1492-DR5	10
1 m Hi-Rise Sym. DIN (Aluminum)		1492-DR6	2		1492-DR6	2		1492-DR6	2		1492-DR6	2
1 m Angled Hi-Rise Sym. DIN (Steel)		1492-DR7	2		1492-DR7	2		1492-DR7	2		1492-DR7	2
End Barriers	Grey	1492-EBJ3	50		1492-EBJ3	50		1492-EBJ3	50		1492-EBJ3	50
	Blue	1492-EBJ3-B	50		1492-EBJ3-B	50		1492-EBJ3-B	50		1492-EBJ3-B	50
	Yellow	1492-EBJ3-Y	50		1492-EBJ3-Y	50		1492-EBJ3-Y	50		1492-EBJ3-Y	50
End Anchors and Retainers:												
DIN Rail — Normal Duty		1492-EAJ35	100		1492-EAJ35	100		1492-EAJ35	100		1492-EAJ35	100
DIN Rail — Heavy Duty		1492-EAHJ35	50		1492-EAHJ35	50		1492-EAHJ35	50		1492-EAHJ35	50
Screwless End Retainer		1492-ERL35	20		1492-ERL35	20		1492-ERL35	20		1492-ERL35	20
Jumpers: *												
Screw Center Jumper — 10-pole		1492-CJJ5-10	20		1492-CJJ6-10	20		1492-CJJ8-10	20		1492-CJJ8-10	20
Screw Center Jumper — 4-pole		1492-CJJ5-4	50		1492-CJJ6-4	50		1492-CJJ8-4	50		1492-CJJ8-4	50
Screw Center Jumper — 3-pole		1492-CJJ5-3	50		1492-CJJ6-3	50		1492-CJJ8-3	50		1492-CJJ8-3	50
Screw Center Jumper — 2-pole		1492-CJJ5-2	50		1492-CJJ6-2	50		1492-CJJ8-2	50		1492-CJJ8-2	50
Plug-in Center Jumper — 50-Pole		1492-CJLJ5-50	10		1492-CJLJ6-41 (41-pole)	10		—	—		—	—
Plug-in Center Jumper — 10-Pole		1492-CJLJ5-10	20		1492-CJLJ6-10	20		—	—		—	—
Plug-in Center Jumper — 9-Pole		1492-CJLJ5-9	20		—	—		—	—		—	—
Plug-in Center Jumper — 8-Pole		1492-CJLJ5-8	20		—	—		—	—		—	—
Plug-in Center Jumper — 7-Pole		1492-CJLJ5-7	20		—	—		—	—		—	—
Plug-in Center Jumper — 6-Pole		1492-CJLJ5-6	20		—	—		—	—		—	—
Plug-in Center Jumper — 5-Pole		1492-CJLJ5-5	20		—	—		—	—		—	—
Plug-in Center Jumper — 4-Pole		1492-CJLJ5-4	60		1492-CJLJ6-4	60		—	—		—	—
Plug-in Center Jumper — 3-Pole		1492-CJLJ5-3	60		1492-CJLJ6-3	60		—	—		—	—
Plug-in Center Jumper — 2-Pole		1492-CJLJ5-2	60		1492-CJLJ6-2	60		—	—		—	—
Insulated Side Jumper — 24-Pole		1492-SJ5B-24	50		—	—		—	—		—	—
Insulated Side Jumper — 10-Pole		1492-SJ5B-10	50		—	—		—	—		—	—
Screw Type Jumper Notching Tool		1492-T1	1		1492-T1	1		1492-T1	1		1492-T1	1
Other Accessories:												
Partition Plate		1492-EBJ16	20		1492-EBJ16	20		1492-EBJ16	20		1492-EBJ16	20
Test Plug Socket		1492-TPS23	20		1492-TPS23L	50		1492-TPS23L	50		1492-TPS23L	50
Test Plug		1492-TP23	20		1492-TP23	20		1492-TP23	20		1492-TP23	20
Test Plug (Stackable)		1492-TPJ5	25		1492-TPJ6	25		—	—		—	—
Electrical Warning Plate		1492-EWPJ5	25		1492-EWPJ5	25		1492-EWPJ8	50		1492-EWPJ8	50
Marking Systems:												
Snap-in Marker Cards		1492-M5X12 (144/card)	5		1492-M6X12 (120/card)	5		1492-MR8X12 (84/card)	5		1492-M8X5 (160/card)	5
		1492-M5X5 (200/card)	5		1492-M6X5 (200/card)	5		1492-M8X5 (160/card)	5		1492-M8X5 (160/card)	5

* Use of center jumpers may affect spacings, requiring derating of terminal blocks. See page 12-83 for details.

Screw Connection Terminal Blocks

Grounding Blocks

	1492-JG2Q	1492-JG3	1492-JG3TW
Dimensions are not intended to be used for manufacturing purposes. Note: Height dimension is measured from top of rail to top of terminal block.			
Specifications	Feed-through grounding terminal block with 2 connection points on each side		Feed-through grounding terminal block with 3 connection points, 2 on one side
Certifications			
Voltage Rating	—	—	—
Maximum Current	Grounding		Grounding
Wire Range (Rated Cross Section)	#22...14 AWG	1.5 mm ²	#22...12 AWG
			2.5 mm ²
			2.5 mm ² (#20...14 AWG)
			Single Side: #22...12 AWG
			2.5 mm ²
			Twin Side: #26...12 AWG
			1.5 mm ² (#20...16 AWG)
Wire Strip Length	0.28 in. (7 mm)		0.39 in. (10 mm)
			Single Side: 0.39 in. (10 mm)
			Twin Side: 0.28 in. (7 mm)
Recommended Tightening Torque	5.0 lb•in (0.6 N•m)		7.1 lb•in (0.8 N•m)
Mounting Torque — Center Screw	3.5...5.3 lb•in (0.4...0.6 N•m)		3.5...6.2 lb•in (0.4...0.6 N•m)
Density	59 pcs/ft (196 pcs/m)		59 pcs/ft (196 pcs/m)
Housing Temperature Range	-58...+248 °F (-50...+120 °C)		-58...+248 °F (-50...+120 °C)
Short-Circuit Current Rating	See page 12-42		
Terminal Blocks	Cat. No.	Pkg Qty.	Cat. No.
Color: Green/Yellow	1492-JG2Q	100	1492-JG3
			1492-JG3TW
			100
Accessories	Cat. No.	Pkg Qty.	Cat. No.
Mounting Rails:			
1 m Symmetrical DIN (Steel)	199-DR1	10	199-DR1
1 m Symmetrical DIN (Aluminum)	1492-DR5	10	1492-DR5
1 m Hi-Rise Sym. DIN (Aluminum)	1492-DR6	2	1492-DR6
1 m Angled Hi-Rise Sym. DIN (Steel)	1492-DR7	2	1492-DR7
End Barrier Yellow	1492-EBJ3-Y	50	1492-EBJ3-Y
End Anchors and End Retainers:			
Screwless End Retainer	1492-ERL35	20	1492-ERL35
DIN Rail — Normal Duty	1492-EAJ35	100	1492-EAJ35
DIN Rail — Heavy Duty	1492-EAHJ35	50	1492-EAHJ35
Marking Systems:			
Snap-in marker cards	1492-M5X12 (144/card)	5	1492-M5X12 (144/card)
Snap-in marker cards	1492-M5X5 (200/card)	5	1492-M5X5 (200/card)



Control Circuit and Load Protection

Bulletin Numbers 188, 1489, 1492, 1694



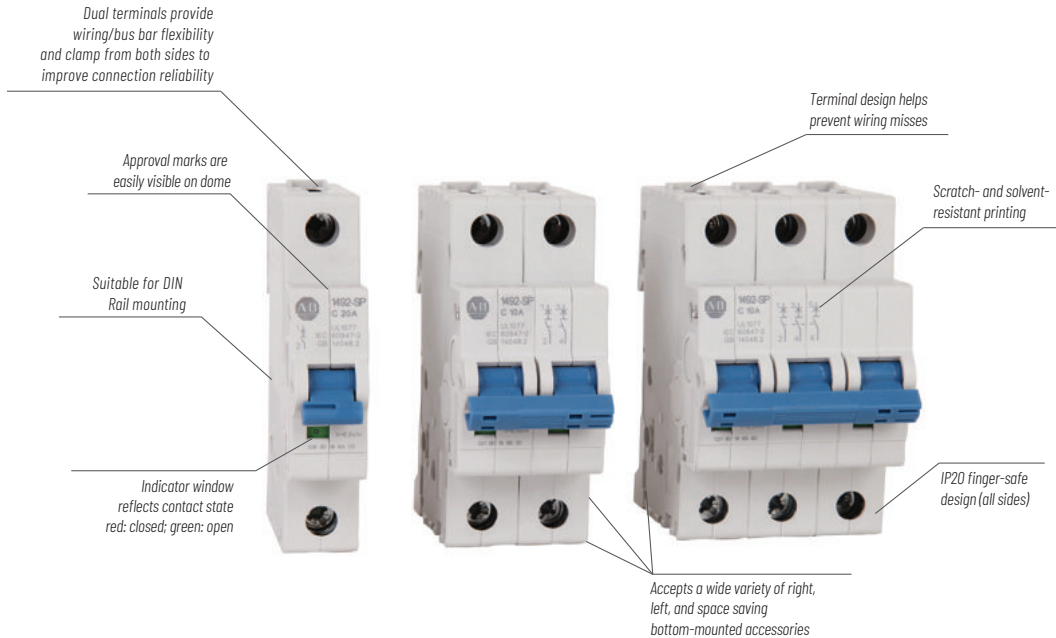
Allen-Bradley

by ROCKWELL AUTOMATION

Selection Guide

Original Instructions

1492-SP Supplementary Protectors



Bulletin 1492-SP thermal magnetic Supplementary Protectors provide overcurrent protection for equipment where branch circuit protection is already provided, or is not required. These devices are also Miniature Circuit Breakers as defined by IEC Standards.

These supplementary protectors are offered as a broad portfolio of pole variants, current ratings, and trip curves to match the appropriate level of protection for your application. They may be used with UL 508 Listed bus bars for convenience in panel assembly, a wide range of left-, right- and space saving bottom-mount accessories, and lock out attachments for safety during maintenance.

- Current limiting
- Fast breaking time
- Existing installations can be easily upgraded to include an auxiliary using the bottom mounted auxiliary contact options, which require no DIN Rail space
- 40 °C calibration temperature (UL/CSA) eliminates need to derate for 508A industrial control panel installations
- Installation of up to six accessories on the same circuit breaker
- Dual terminals provide a more secure connection of up to four wires, or two wires and a bus bar
- Superior shock and vibration resistance to prevent nuisance tripping
- Terminal design helps prevent wiring misses by directing wires into the terminal openings, even while tightening
- Reversible line and load connections
- Single and multi-pole toggle mount lock out attachments available for Lockout/Tagout (LOTO)
- RoHS compliant and fully-recyclable device
- Suitable for extreme ambient conditions

1492-SP Supplementary Protectors	
Rated Voltage	UL/CSA: Max. 480Y/277V AC IEC: U_e 230/400V AC
Interrupting Capacity	UL/CSA: 5...10 kA IEC: 15 kA
Current Ratings	0.5...63 A
Poles	1, 2, 3, 1+N, 3+N
Trip Curves	B, C, D
Standards Compliance	UL 1077 CSA C22.2 No. 235 EN 60947-2 GB 14048.2
Certifications	UL Recognized, File No. E65138 ⁽¹⁾ CSA Certified, File No. 259391 ⁽¹⁾ DNV GL Type Approval CE Marked CCC Certified VDE Certified RoHS Compliant
⁽¹⁾ 1+N and 3+N devices are not UL recognized or CSA certified.	

Catalog Number Explanation

Examples given in this section are for reference purposes. This basic explanation should not be used for product selection; some combinations may not produce a valid catalog number.

1492 - **SPM** **1** **C** **010** **N**
 a b c d e

a

Voltage Type	
Code	Description
SPM	AC Supplementary Protector

c

Trip Curve	
Code	Description
B	Trip Curve B
C	Trip Curve C
D	Trip Curve D

b

Poles	
Code	Description
1	1-Pole
2	2-Pole
3	3-Pole

d


Rated Current (I_n)	
Code	Current [A]
005	0.5
010	1
020	2
030	3
040	4
050	5
060	6
070	7
080	8
100	10
130	13
150	15
160	16
200	20
250	25
300	30
320	32
400	40
500	50
630	63

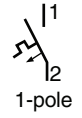
e

+ Neutral (available for 1+N and 3+N configurations)	
Code	Description
	Can be left blank
N	+ Neutral


Product Selection

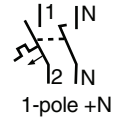
1-Pole Supplementary Protectors

Photo/Wiring Diagram	Continuous Current Rating (I_n)	Trip Curve B Resistive or Slightly Inductive 3...5 I_n	Trip Curve C Inductive 5...10 I_n	Trip Curve D Highly Inductive 10...20 I_n
	[A]	Cat. No.	Cat. No.	Cat. No.
	0.5	1492-SPM1B005	1492-SPM1C005	1492-SPM1D005
	1	1492-SPM1B010	1492-SPM1C010	1492-SPM1D010
	2	1492-SPM1B020	1492-SPM1C020	1492-SPM1D020
	3	1492-SPM1B030	1492-SPM1C030	1492-SPM1D030
	4	1492-SPM1B040	1492-SPM1C040	1492-SPM1D040
	5	1492-SPM1B050	1492-SPM1C050	1492-SPM1D050
	6	1492-SPM1B060	1492-SPM1C060	1492-SPM1D060
	7	1492-SPM1B070	1492-SPM1C070	1492-SPM1D070
	8	1492-SPM1B080	1492-SPM1C080	1492-SPM1D080
	10	1492-SPM1B100	1492-SPM1C100	1492-SPM1D100
	13	1492-SPM1B130	1492-SPM1C130	1492-SPM1D130
	15	1492-SPM1B150	1492-SPM1C150	1492-SPM1D150
	16	1492-SPM1B160	1492-SPM1C160	1492-SPM1D160
	20	1492-SPM1B200	1492-SPM1C200	1492-SPM1D200
	25	1492-SPM1B250	1492-SPM1C250	1492-SPM1D250
	30	1492-SPM1B300	1492-SPM1C300	1492-SPM1D300
	32	1492-SPM1B320	1492-SPM1C320	1492-SPM1D320
	40	1492-SPM1B400	1492-SPM1C400	1492-SPM1D400
	50	1492-SPM1B500	1492-SPM1C500	1492-SPM1D500
63	1492-SPM1B630	1492-SPM1C630	1492-SPM1D630	




1-Pole + Neutral Supplementary Protectors⁽¹⁾

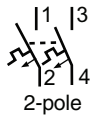
Photo/Wiring Diagram	Continuous Current Rating (I_n)	Trip Curve B Resistive or Slightly Inductive 3...5 I_n	Trip Curve C Inductive 5...10 I_n	Trip Curve D Highly Inductive 10...20 I_n
	[A]	Cat. No.	Cat. No.	Cat. No.
	0.5	1492-SPM1B005-N	1492-SPM1C005-N	1492-SPM1D005-N
	1	1492-SPM1B010-N	1492-SPM1C010-N	1492-SPM1D010-N
	2	1492-SPM1B020-N	1492-SPM1C020-N	1492-SPM1D020-N
	3	1492-SPM1B030-N	1492-SPM1C030-N	1492-SPM1D030-N
	4	1492-SPM1B040-N	1492-SPM1C040-N	1492-SPM1D040-N
	5	1492-SPM1B050-N	1492-SPM1C050-N	1492-SPM1D050-N
	6	1492-SPM1B060-N	1492-SPM1C060-N	1492-SPM1D060-N
	7	1492-SPM1B070-N	1492-SPM1C070-N	1492-SPM1D070-N
	8	1492-SPM1B080-N	1492-SPM1C080-N	1492-SPM1D080-N
	10	1492-SPM1B100-N	1492-SPM1C100-N	1492-SPM1D100-N
	13	1492-SPM1B130-N	1492-SPM1C130-N	1492-SPM1D130-N
	15	1492-SPM1B150-N	1492-SPM1C150-N	1492-SPM1D150-N
	16	1492-SPM1B160-N	1492-SPM1C160-N	1492-SPM1D160-N
	20	1492-SPM1B200-N	1492-SPM1C200-N	1492-SPM1D200-N
	25	1492-SPM1B250-N	1492-SPM1C250-N	1492-SPM1D250-N
	30	1492-SPM1B300-N	1492-SPM1C300-N	1492-SPM1D300-N
	32	1492-SPM1B320-N	1492-SPM1C320-N	1492-SPM1D320-N
	40	1492-SPM1B400-N	1492-SPM1C400-N	1492-SPM1D400-N
	50	1492-SPM1B500-N	1492-SPM1C500-N	1492-SPM1D500-N
63	1492-SPM1B630-N	1492-SPM1C630-N	1492-SPM1D630-N	




(1) 1+N configurations are not UL or CSA certified.

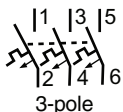
2-Pole Supplementary Protectors

Photo/Wiring Diagram	Continuous Current Rating (I_n)	Trip Curve B Resistive or Slightly Inductive 3...5 I_n	Trip Curve C Inductive 5...10 I_n	Trip Curve D Highly Inductive 10...20 I_n
	[A]	Cat. No.	Cat. No.	Cat. No.
	0.5	1492-SPM2B005	1492-SPM2C005	1492-SPM2D005
	1	1492-SPM2B010	1492-SPM2C010	1492-SPM2D010
	2	1492-SPM2B020	1492-SPM2C020	1492-SPM2D020
	3	1492-SPM2B030	1492-SPM2C030	1492-SPM2D030
	4	1492-SPM2B040	1492-SPM2C040	1492-SPM2D040
	5	1492-SPM2B050	1492-SPM2C050	1492-SPM2D050
	6	1492-SPM2B060	1492-SPM2C060	1492-SPM2D060
	7	1492-SPM2B070	1492-SPM2C070	1492-SPM2D070
	8	1492-SPM2B080	1492-SPM2C080	1492-SPM2D080
	10	1492-SPM2B100	1492-SPM2C100	1492-SPM2D100
	13	1492-SPM2B130	1492-SPM2C130	1492-SPM2D130
	15	1492-SPM2B150	1492-SPM2C150	1492-SPM2D150
	16	1492-SPM2B160	1492-SPM2C160	1492-SPM2D160
	20	1492-SPM2B200	1492-SPM2C200	1492-SPM2D200
	25	1492-SPM2B250	1492-SPM2C250	1492-SPM2D250
	30	1492-SPM2B300	1492-SPM2C300	1492-SPM2D300
	32	1492-SPM2B320	1492-SPM2C320	1492-SPM2D320
40	1492-SPM2B400	1492-SPM2C400	1492-SPM2D400	
50	1492-SPM2B500	1492-SPM2C500	1492-SPM2D500	
63	1492-SPM2B630	1492-SPM2C630	1492-SPM2D630	




3-Pole Supplementary Protectors

Photo/Wiring Diagram	Continuous Current Rating (I_n)	Trip Curve B Resistive or Slightly Inductive 3...5 I_n	Trip Curve C Inductive 5...10 I_n	Trip Curve D Highly Inductive 10...20 I_n
	[A]	Cat. No.	Cat. No.	Cat. No.
	0.5	1492-SPM3B005	1492-SPM3C005	1492-SPM3D005
	1	1492-SPM3B010	1492-SPM3C010	1492-SPM3D010
	2	1492-SPM3B020	1492-SPM3C020	1492-SPM3D020
	3	1492-SPM3B030	1492-SPM3C030	1492-SPM3D030
	4	1492-SPM3B040	1492-SPM3C040	1492-SPM3D040
	5	1492-SPM3B050	1492-SPM3C050	1492-SPM3D050
	6	1492-SPM3B060	1492-SPM3C060	1492-SPM3D060
	7	1492-SPM3B070	1492-SPM3C070	1492-SPM3D070
	8	1492-SPM3B080	1492-SPM3C080	1492-SPM3D080
	10	1492-SPM3B100	1492-SPM3C100	1492-SPM3D100
	13	1492-SPM3B130	1492-SPM3C130	1492-SPM3D130
	15	1492-SPM3B150	1492-SPM3C150	1492-SPM3D150
	16	1492-SPM3B160	1492-SPM3C160	1492-SPM3D160
	20	1492-SPM3B200	1492-SPM3C200	1492-SPM3D200
	25	1492-SPM3B250	1492-SPM3C250	1492-SPM3D250
	30	1492-SPM3B300	1492-SPM3C300	1492-SPM3D300
	32	1492-SPM3B320	1492-SPM3C320	1492-SPM3D320
40	1492-SPM3B400	1492-SPM3C400	1492-SPM3D400	
50	1492-SPM3B500	1492-SPM3C500	1492-SPM3D500	
63	1492-SPM3B630	1492-SPM3C630	1492-SPM3D630	



3-Pole + Neutral Supplementary Protectors⁽¹⁾

Photo/Wiring Diagram	Continuous Current Rating (I_n)	Trip Curve B Resistive or Slightly Inductive 3...5 I_n	Trip Curve C Inductive 5...10 I_n	Trip Curve D Highly Inductive 10...20 I_n
	[A]	Cat. No.	Cat. No.	Cat. No.
 <p>11 13 15 N 12 14 16 N 3-pole + N</p>	0.5	1492-SPM3B005-N	1492-SPM3C005-N	1492-SPM3D005-N
	1	1492-SPM3B010-N	1492-SPM3C010-N	1492-SPM3D010-N
	2	1492-SPM3B020-N	1492-SPM3C020-N	1492-SPM3D020-N
	3	1492-SPM3B030-N	1492-SPM3C030-N	1492-SPM3D030-N
	4	1492-SPM3B040-N	1492-SPM3C040-N	1492-SPM3D040-N
	5	1492-SPM3B050-N	1492-SPM3C050-N	1492-SPM3D050-N
	6	1492-SPM3B060-N	1492-SPM3C060-N	1492-SPM3D060-N
	7	1492-SPM3B070-N	1492-SPM3C070-N	1492-SPM3D070-N
	8	1492-SPM3B080-N	1492-SPM3C080-N	1492-SPM3D080-N
	10	1492-SPM3B100-N	1492-SPM3C100-N	1492-SPM3D100-N
	13	1492-SPM3B130-N	1492-SPM3C130-N	1492-SPM3D130-N
	15	1492-SPM3B150-N	1492-SPM3C150-N	1492-SPM3D150-N
	16	1492-SPM3B160-N	1492-SPM3C160-N	1492-SPM3D160-N
	20	1492-SPM3B200-N	1492-SPM3C200-N	1492-SPM3D200-N
	25	1492-SPM3B250-N	1492-SPM3C250-N	1492-SPM3D250-N
	30	1492-SPM3B300-N	1492-SPM3C300-N	1492-SPM3D300-N
	32	1492-SPM3B320-N	1492-SPM3C320-N	1492-SPM3D320-N
40	1492-SPM3B400-N	1492-SPM3C400-N	1492-SPM3D400-N	
50	1492-SPM3B500-N	1492-SPM3C500-N	1492-SPM3D500-N	
63	1492-SPM3B630-N	1492-SPM3C630-N	1492-SPM3D630-N	

(1) 3+N configurations are not UL or CSA certified.

Specifications

Electrical Ratings			
Poles	1, 2, 3, 1+N, 3+N		
Tripping characteristics	B, C, D		
Rated current (I_n)	0.5...63 A		
Rated frequency (f)	50/60 Hz		
Rated insulation voltage U_i per IEC/EN 60664-1	250 V AC (phase to ground), 440V AC (phase to phase)		
Overvoltage category	III		
Pollution degree	3		
Data per UL/CSA			
Rated voltage	1-pole	AC 277V AC DC 48V DC	
	2-pole	AC 480Y/277V AC DC 96V DC	
	3-pole	AC 480Y/277V AC	
Rated interrupting capacity per UL 1077	≤ 32 A: 10 kA (AC); > 32 A: 5 kA (AC); 0.5...63 A: 10 kA (DC)		
Application Supplementary ⁽¹⁾ protector for general use; application codes: TC1: [1P] OLO 277V AC, [2P, 3P] OLO 480Y/277V AC; SC: 10 kA (0.5...32 A), 5 kA (35...63 A), U2 480Y/277V AC; FW3			
Ref. temperature for tripping characteristics	40 °C		
Electrical endurance	6,000 ops (AC), 6,000 ops. (DC) 1 cycle (1s - ON, 9s - OFF)		
Data per IEC/EN 60947-2			
Rated operational voltage (U_e)	1-pole, 1+N	230V AC	
	2-pole, 3-pole, 3+N	400V AC	
Highest supply or utilization voltage (U_{max})	AC	1-pole, 1+N	253V AC
		2-pole, 3-pole, 3+N	440V AC
	DC ⁽²⁾	1-pole	48V DC
		2-pole	96V DC
Min. operating voltage	12V AC, 12V DC		
Rated ultimate short-circuit breaking capacity (I_{cu})	15 kA		
Rated service short-circuit breaking capacity (I_{cs})	≤ 40 A: 11.25 kA > 40 A: 7.5 kA		
Rated impulse withstand voltage U_{imp} . (1./2./50 μ s)	4 kV (test voltage 6.2 kV at sea level, 5 kV at 2,000 m)		
Dielectric test voltage	2 kV (50/60Hz, 1 min.)		
Reference temperature for tripping characteristics	30 °C		
Electrical endurance 1 cycle (2s - ON, 13s - OFF, $I_n \leq 32$ A), 1 cycle (2s - ON, 28s - OFF, $I_n > 32$ A)	$I_n < 30$ A: 20,000 ops (AC) $I_n \geq 30$ A: 10,000 ops. (AC) 1,000 ops. (DC)		

(1) 2-pole/3-pole single pole load: TC2.

(2) IEC DC ratings self-declared.

Mechanical Data		
Housing	Insulation group II, RAL 7035	
Indicator window	red ON / green OFF	
Protection degree per EN 60529	IP20, IP40 in enclosure with cover	
Mechanical endurance	20,000 operations	
Shock resistance per IEC/EN 60068-2-27	25 g - 2 shocks - 13 ms	
Vibration resistance per IEC/EN 60068-2-6	5g - 20 cycles at 5...150...5 Hz with load 0.8 I_n	
Environmental		
Environmental conditions (damp heat) per IEC/EN 60068-2-30	28 cycles with 55°C (131 °F)/ 90-96% and 25°C (77 °F)/ 95-100%	
Ambient temperature ⁽¹⁾	-25...+55 °C (-13...+131 °F)	
Storage temperature	-40...+70 °C (-40...+158 °F)	
Installation		
Terminal	Dual terminal	
Cross-section of wire ⁽²⁾ - solid, stranded (front / back terminal slot)	35 / 35 mm ²	
	18...4 / 18...10 AWG	
Cross-section of wire - flexible (front / back terminal slot)	25 / 10 mm ²	
	1 wire, 18...4 AWG	
Multi-wire rating per UL, CSA	2-4 wires ⁽³⁾ , 18...10 AWG	
	10 mm ²	
Cross-section of bus bars (back terminal slot)	10 mm ²	
	2.8 N•m	
Tightening torque	IEC	2.8 N•m
	UL/CSA	AWG 18...16: 13.3 in•lb. AWG 14...10: 17.7 in•lb. AWG 8...4: 39.8 in•lb.
Screwdriver	No. 2 Pozidriv	
Mounting	DIN rail (EN 60715, 35mm) with fast clip	
Mounting position	Any	
Supply	Optional	
Approximate Dimensions and Weight		
Pole dimension (H x D x W)	88 x 69 x 17.5 mm	
Pole weight	115 g (4.1 oz.)	
Combination with Auxiliary Elements		
Auxiliary contact	Yes	
Signal contact	Yes	
Shunt trip	Yes	

(1) Refer to the ambient temperature derating tables.

(2) 35 mm² self-declared, not included in IEC/EN approval.

(3) Wires must be of like size and stranding. Up to two wires per terminal slot.

Power Loss Due to Current

Rated Current	Power Loss Per Pole	Rated Current	Power Loss Per Pole
[A]	[W]	[A]	[W]
0.5	1.4	13	2.3
1	1.4	15	2.4
2	1.8	16	2.5
3	1.6	20	2.5
4	1.8	25	3.2
5	1.9	30	3.5
6	2.0	32	3.7
7	1.1	40	4.5
8	1.5	50	4.5
10	2.1	63	5.4

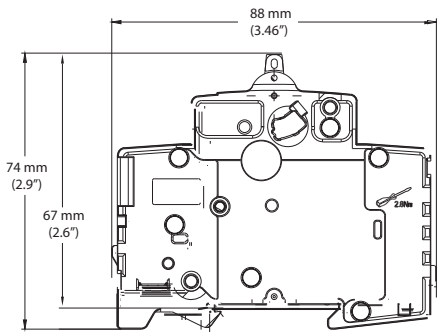
Zero-stack Derating

The installation of several miniature circuit breaker side by side with rated current on all poles requires a correction factor to the rated current (not required if spacers are used).

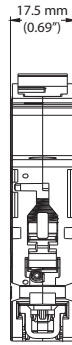
No. of Adjacent Devices	Factor
1	1
2.3	0.9
4.5	0.8
≥ 6	0.75

Approximate Dimensions

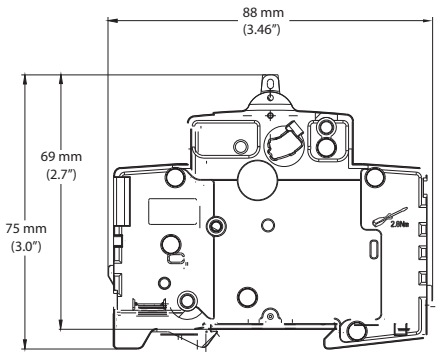
Dimensions are shown in millimeters (inches). Dimensions are not intended for manufacturing purposes.



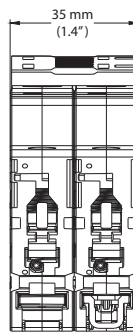
1 Pole



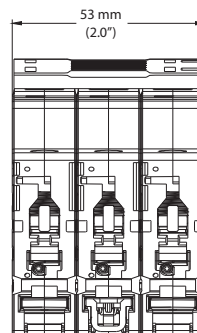
1 Pole



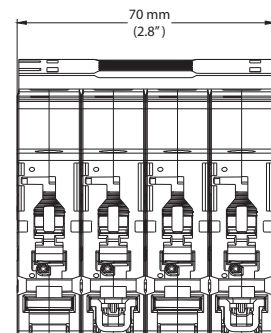
1 Pole + N, 2-, 3-, 3 Pole + N



1 Pole + N, 2-Pole



3-Pole



3-Pole + N

Ambient Temperature Derating

Application below 0 °C is for non-condensing atmosphere. Care should be taken for applications below 0 °C. These devices are not certified to operate correctly in the presence of ice.

Bulletin 1492-SP
 Temperature Derating, UL
 Reference temperature = 40 °C

Current Rating (A)	Ambient temperature (°C)									
	-25	-20	-10	0	10	20	30	40	50	55
0.5	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5
1	1.2	1.2	1.2	1.1	1.1	1.1	1.0	1	1.0	0.9
2	2.5	2.4	2.4	2.3	2.2	2.1	2.1	2	1.9	1.9
3	3.7	3.7	3.6	3.4	3.3	3.2	3.1	3	2.9	2.8
4	5.0	4.9	4.7	4.6	4.4	4.3	4.1	4	3.9	3.8
5	6.2	6.1	5.9	5.7	5.6	5.4	5.2	5	4.8	4.7
6	7.4	7.3	7.1	6.9	6.7	6.4	6.2	6	5.8	5.7
7	8.7	8.6	8.3	8.0	7.8	7.5	7.3	7	6.7	6.6
8	9.9	9.8	9.5	9.2	8.9	8.6	8.3	8	7.7	7.6
10	12.4	12.2	11.9	11.5	11.1	10.7	10.4	10	9.6	9.4
13	16.1	15.9	15.4	14.9	14.4	14.0	13.5	13	12.5	12.3
15	18.6	18.3	17.8	17.2	16.7	16.1	15.6	15	14.4	14.2
16	19.8	19.6	19.0	18.4	17.8	17.2	16.6	16	15.4	15.1
20	24.8	24.4	23.7	23.0	22.2	21.5	20.7	20	19.3	18.9
25	31.0	30.6	29.6	28.7	27.8	26.9	25.9	25	24.1	23.6
30	37.2	36.7	35.6	34.4	33.3	32.2	31.1	30	28.9	28.3
32	39.7	39.1	37.9	36.7	35.6	34.4	33.2	32	30.8	30.2
40	49.6	48.9	47.4	45.9	44.4	43.0	41.5	40	38.5	37.8
50	62.0	61.1	59.3	57.4	55.6	53.7	51.9	50	48.2	47.2
63	78.2	77.0	74.7	72.3	70.0	67.7	65.3	63	60.7	59.5

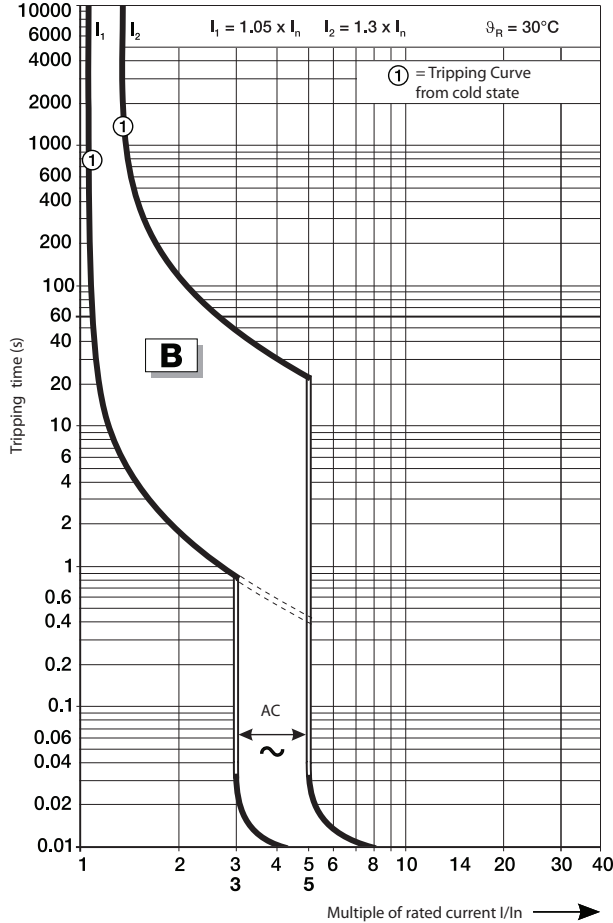
Bulletin 1492-SP
 Temperature Derating, IEC
 Reference temperature = 30 °C

Current Rating (A)	Ambient temperature (°C)									
	-25	-20	-10	0	10	20	30	40	50	55
0.5	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.5
1	1.2	1.2	1.1	1.1	1.1	1.0	1	1.0	0.9	0.9
2	2.4	2.4	2.3	2.2	2.1	2.1	2	1.9	1.9	1.8
3	3.6	3.6	3.4	3.3	3.2	3.1	3	2.9	2.8	2.7
4	4.8	4.7	4.6	4.4	4.3	4.1	4	3.9	3.7	3.6
5	6.0	5.9	5.7	5.6	5.4	5.2	5	4.8	4.6	4.5
6	7.2	7.1	6.9	6.7	6.4	6.2	6	5.8	5.6	5.4
7	8.4	8.3	8.0	7.8	7.5	7.3	7	6.7	6.5	6.4
8	9.6	9.5	9.2	8.9	8.6	8.3	8	7.7	7.4	7.3
10	12.0	11.9	11.5	11.1	10.7	10.4	10	9.6	9.3	9.1
13	15.6	15.4	14.9	14.4	14.0	13.5	13	12.5	12.0	11.8
15	18.1	17.8	17.2	16.7	16.1	15.6	15	14.4	13.9	13.6
16	19.3	19.0	18.4	17.8	17.2	16.6	16	15.4	14.8	14.5
20	24.1	23.7	23.0	22.2	21.5	20.7	20	19.3	18.5	18.2
25	30.1	29.6	28.7	27.8	26.9	25.9	25	24.1	23.2	22.7
30	36.1	35.6	34.4	33.3	32.2	31.1	30	28.9	27.8	27.2
32	38.5	37.9	36.7	35.6	34.4	33.2	32	30.8	29.6	29.0
40	48.1	47.4	45.9	44.4	43.0	41.5	40	38.5	37.0	36.3
50	60.2	59.3	57.4	55.6	53.7	51.9	50	48.2	46.3	45.4
63	75.8	74.7	72.3	70.0	67.7	65.3	63	60.7	58.3	57.2

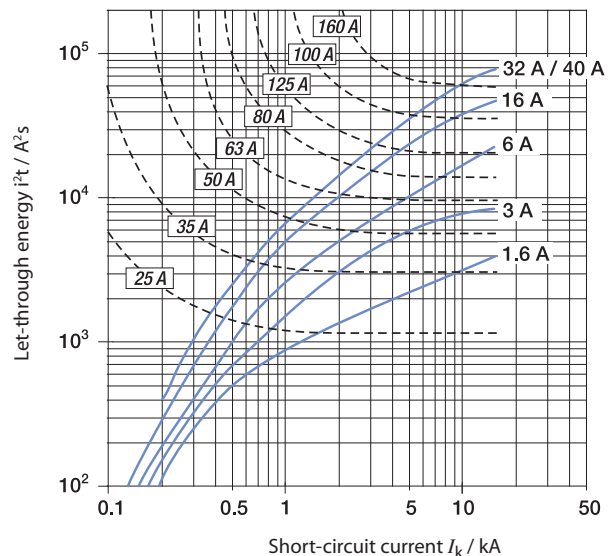
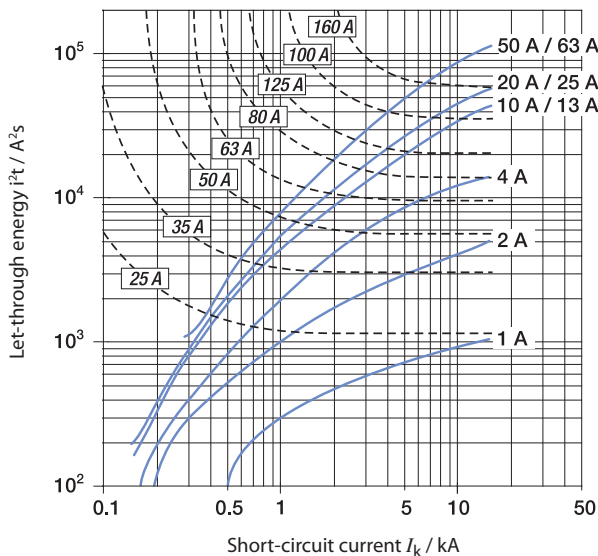
Tripping Characteristics

- DC trip curves - When using 1492-SPM_ on DC applications or DC loads, please refer to AC trip curves and times and use a factor of 1.5 for the magnetic instantaneous trip times the continuous current rating (I_n).
- For B trip curve = 4.5 to 7.5 multiple of the rated current (I / I_n).
- The thermal trip times remain the same for both AC and DC applications.

B Curve

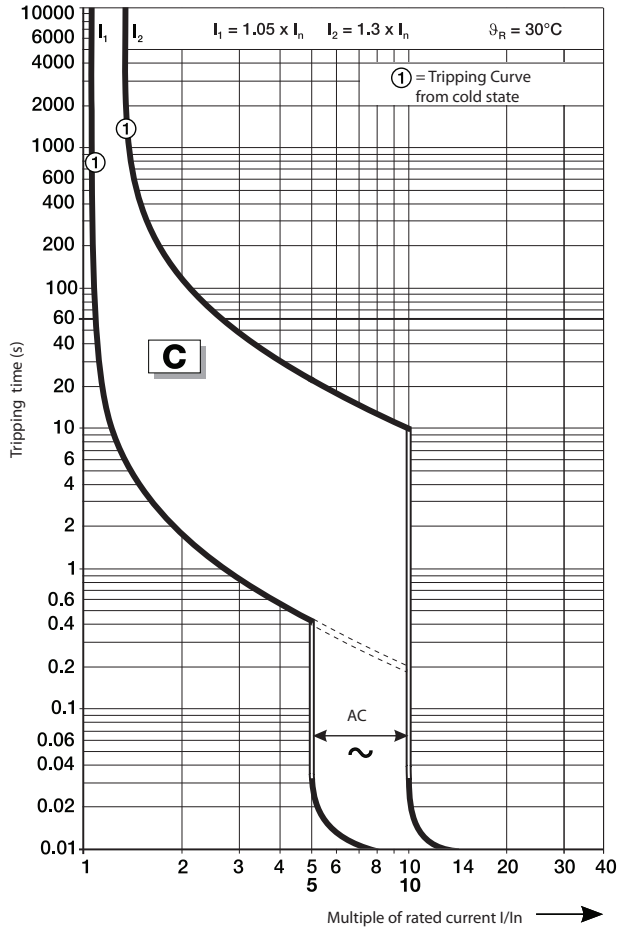


B and C Curve - 230/400V AC Let-through Energy

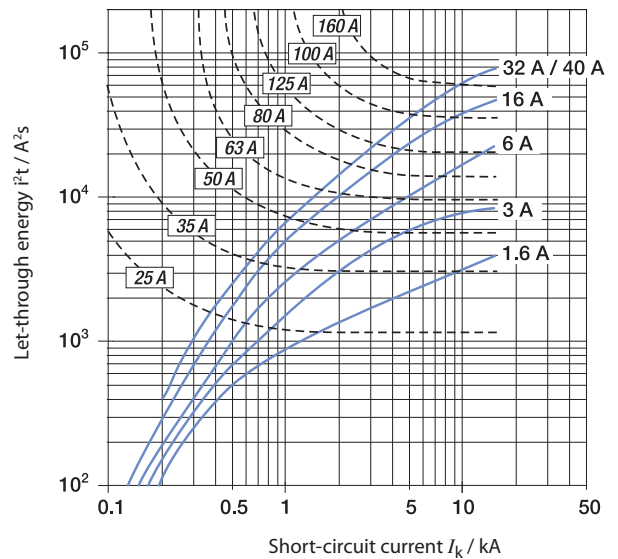
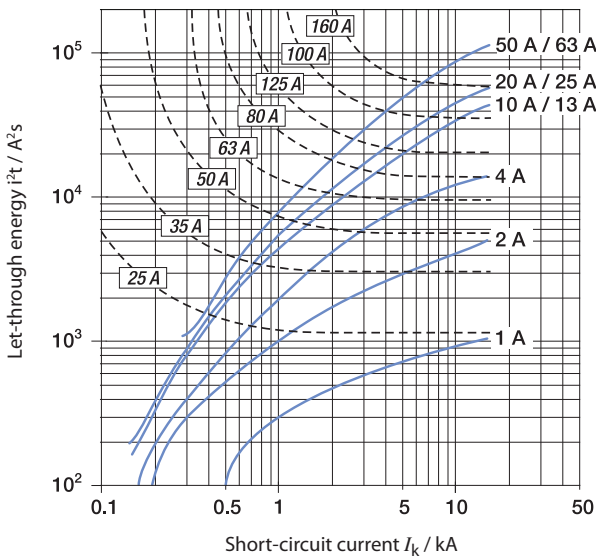


- DC trip curves - When using 1492-SPM_ on DC applications or DC loads, please refer to AC trip curves and times and use a factor of 1.5 for the magnetic instantaneous trip times the continuous current rating (I_n).
- For C trip curve = 7.5 to 15 multiple of the rated current (I / I_n).
- The thermal trip times remain the same for both AC and DC applications.

C Curve

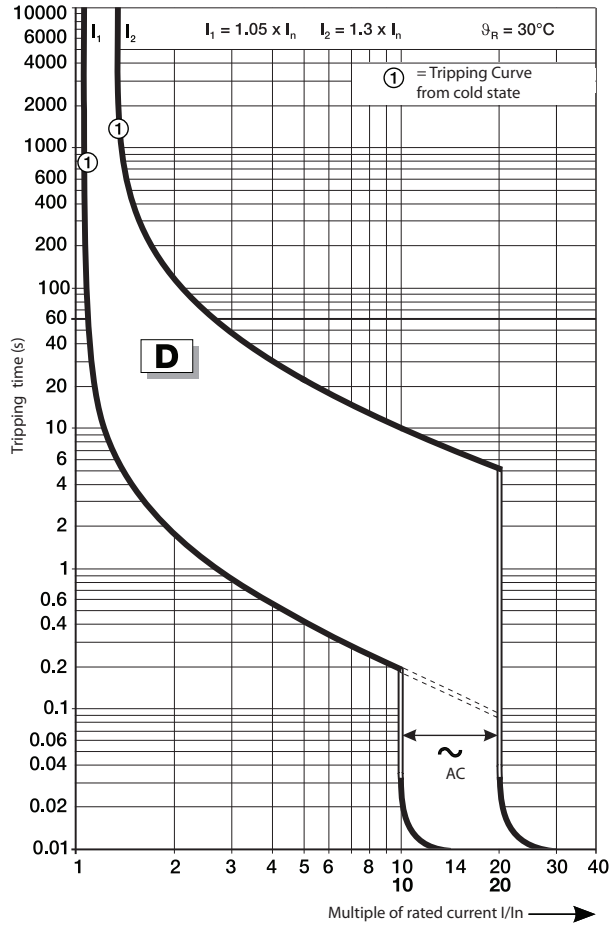


B and C Curve - 230/400V AC Let-through Energy

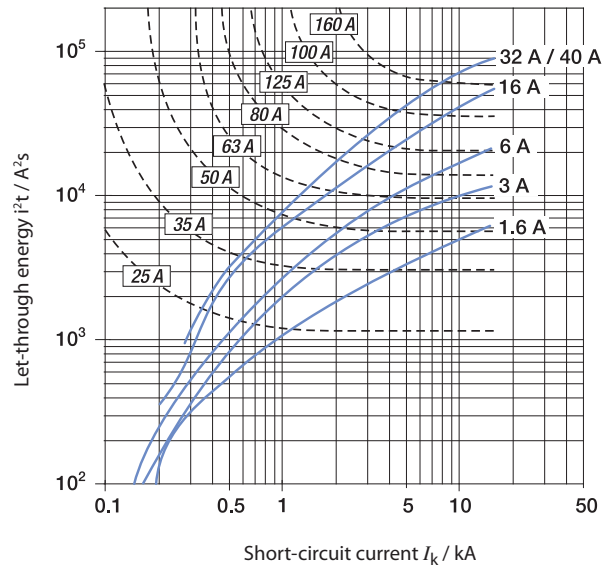
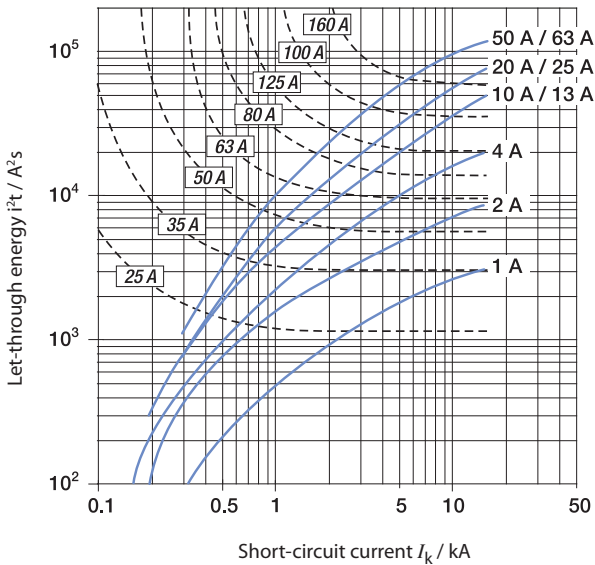


- DC trip curves - When using 1492-SPM.. on DC applications or DC loads, please refer to AC trip curves and times and use a factor of 1.5 for the magnetic instantaneous trip times the continuous current rating (I_n).
- For D trip curve = 15 to 30 multiple of the rated current (I / I_n).
- The thermal trip times remain the same for both AC and DC applications.

D Curve



D Curve - 230/400V AC Let-through Energy



Micro810 12 Point Programmable Controllers

Catalog Numbers 2080-LC10-12AWA, 2080-LC10-12QWB,
2080-LC10-12QBB, 2080-LC10-12DWD

http://literature.rockwellautomation.com/idc/groups/literature/documents/in/2080-in006_-mu-p.pdf

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Important User Information

Solid state equipment has operational characteristics differing from those of electromechanical equipment. Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls (Publication [SGI-1.1](#) available from your local Rockwell Automation sales office or online at

<http://literature.rockwellautomation.com>) describes some important differences between solid state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.





In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

No patent liability is assumed by Rockwell Automation, Inc. with respect to use of information, circuits, equipment, or software described in this manual.

Reproduction of the contents of this manual, in whole or in part, without written permission of Rockwell Automation, Inc., is prohibited.

Throughout this manual, when necessary, we use notes to make you aware of safety considerations.

<p>WARNING</p> 	<p>Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.</p>
<p>IMPORTANT</p>	<p>Identifies information that is critical for successful application and understanding of the product.</p>
<p>ATTENTION</p> 	<p>Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard and recognize the consequences.</p>
<p>SHOCK HAZARD</p> 	<p>Labels may be on or inside the equipment (for example, drive or motor) to alert people that dangerous voltage may be present.</p>
<p>BURN HAZARD</p> 	<p>Labels may be on or inside the equipment (for example, drive or motor) to alert people that surfaces may reach dangerous temperatures.</p>

Environment and Enclosure

ATTENTION

This equipment is intended for use in a Pollution Degree 2 industrial environment, in overvoltage Category II applications (as defined in IEC 60664-1), at altitudes up to 2000 m (6562 ft) without derating.

This equipment is considered Group 1, Class A industrial equipment according to IEC/CISPR 11. Without appropriate precautions, there may be difficulties with electromagnetic compatibility in residential and other environments due to conducted and radiated disturbances.

This equipment is supplied as open-type equipment. It must be mounted within an enclosure that is suitably designed for those specific environmental conditions that will be present and appropriately designed to prevent personal injury resulting from accessibility to live parts. The enclosure must have suitable flame-retardant properties to prevent or minimize the spread of flame, complying with a flame spread rating of 5VA, V2, V1, V0 (or equivalent) if non-metallic. The interior of the enclosure must be accessible only by the use of a tool. Subsequent sections of this publication may contain additional information regarding specific enclosure type ratings that are required to comply with certain product safety certifications.

In addition to this publication, see:

- Industrial Automation Wiring and Grounding Guidelines, Rockwell Automation publication [1770-4.1](#), for additional installation requirements.
- NEMA Standard 250 and IEC 60529, as applicable, for explanations of the degrees of protection provided by different types of enclosure.

Preventing Electrostatic Discharge



ATTENTION

This equipment is sensitive to electrostatic discharge, which can cause internal damage and affect normal operation. Follow these guidelines when you handle this equipment:

- Touch a grounded object to discharge potential static.
 - Wear an approved grounding wriststrap.
 - Do not touch connectors or pins on component boards.
 - Do not touch circuit components inside the equipment.
 - Use a static-safe workstation, if available.
 - Store the equipment in appropriate static-safe packaging when not in use.
-

North American Hazardous Location Approval

The following modules are North American Hazardous Location approved:
 2080-LC10-12AWA, 2080-LC10-12QWB, 2080-LC10-12QBB, 2080-LC10-12DWD

<p>The following information applies when operating this equipment in hazardous locations:</p> <p>Products marked "CL I, DIV 2, GP A, B, C, D" are suitable for use in Class I Division 2 Groups A, B, C, D, Hazardous Locations and nonhazardous locations only. Each product is supplied with markings on the rating nameplate indicating the hazardous location temperature code. When combining products within a system, the most adverse temperature code (lowest "T" number) may be used to help determine the overall temperature code of the system. Combinations of equipment in your system are subject to investigation by the local Authority Having Jurisdiction at the time of installation.</p>		<p>Informations sur l'utilisation de cet équipement en environnements dangereux:</p> <p>Les produits marqués "CL I, DIV 2, GP A, B, C, D" ne conviennent qu'à une utilisation en environnements de Classe I Division 2 Groupes A, B, C, D dangereux et non dangereux. Chaque produit est livré avec des marquages sur sa plaque d'identification qui indiquent le code de température pour les environnements dangereux. Lorsque plusieurs produits sont combinés dans un système, le code de température le plus défavorable (code de température le plus faible) peut être utilisé pour déterminer le code de température global du système. Les combinaisons d'équipements dans le système sont sujettes à inspection par les autorités locales qualifiées au moment de l'installation.</p>	
<p>WARNING</p> 	<p>EXPLOSION HAZARD</p> <ul style="list-style-type: none"> Do not disconnect equipment unless power has been removed or the area is known to be nonhazardous. Do not disconnect connections to this equipment unless power has been removed or the area is known to be nonhazardous. Secure any external connections that mate to this equipment by using screws, sliding latches, threaded connectors, or other means provided with this product. Substitution of any component may impair suitability for Class I, Division 2. If this product contains batteries, they must only be changed in an area known to be nonhazardous. 	<p>AVERTISSEMENT</p> 	<p>RISQUE D'EXPLOSION</p> <ul style="list-style-type: none"> Couper le courant ou s'assurer que l'environnement est classé non dangereux avant de débrancher l'équipement. Couper le courant ou s'assurer que l'environnement est classé non dangereux avant de débrancher les connecteurs. Fixer tous les connecteurs externes reliés à cet équipement à l'aide de vis, loquets coulissants, connecteurs filetés ou autres moyens fournis avec ce produit. La substitution de tout composant peut rendre cet équipement inadapté à une utilisation en environnement de Classe I, Division 2. S'assurer que l'environnement est classé non dangereux avant de changer les piles.

WARNING

- If you insert or remove the module while power is on, an electrical arc can occur. This could cause an explosion in hazardous location installations. Be sure that power is removed or the area is nonhazardous before proceeding.
- The local programming terminal port is intended for temporary use only and must not be connected or disconnected unless the area is assured to be nonhazardous.
- When used in a Class I, Division 2, hazardous location, this equipment must be mounted in a suitable enclosure with proper wiring method that complies with the governing electrical codes.
- If you connect or disconnect wiring while the field-side power is on, an electrical arc can occur. This could cause an explosion in hazardous location installations. Be sure that power is removed or the area is nonhazardous before proceeding.
- The USB port is intended for temporary local programming purposes only and not intended for permanent connection. If you connect or disconnect the USB cable with power applied to this module or any device on the USB network, an electrical arc can occur. This could cause an explosion in hazardous location installations.
Be sure that power is removed or the area is nonhazardous before proceeding. The USB port is a nonincendive field wiring connection for Class I, Division 2 Groups A, B, C and D.
- Exposure to some chemicals may degrade the sealing properties of materials used in the Relays. It is recommended that the User periodically inspect these devices for any degradation of properties and replace the module if degradation is found.

ATTENTION

- To comply with the CE Low Voltage Directive (LVD), this equipment must be powered from a source compliant with the following:
Safety Extra Low Voltage (SELV) or Protected Extra Low Voltage (PELV).
- To comply with UL restrictions, this equipment must be powered from a source compliant with the following:
Class 2 or Limited Voltage/Current.
- Do not wire more than 2 conductors on any single terminal.
- Be careful when stripping wires. Wire fragments that fall into the controller could cause damage. Once wiring is complete, make sure the controller is free of all metal fragments.

ATTENTION



- Do not remove the protective debris strips until after the controller and all other equipment in the panel near the module are mounted and wired. Remove strips before operating the controller. Failure to remove strips before operating can cause overheating.
 - Electrostatic discharge can damage semiconductor devices inside the module. Do not touch the connector pins or other sensitive areas.
 - This product is intended to be mounted to a well-grounded mounting surface such as a metal panel. Additional grounding connections from the power supply's mounting tabs or DIN rail (if used) are not required unless the mounting surface cannot be grounded. Refer to Industrial Automation Wiring and Grounding Guidelines, Allen-Bradley publication [1770-4.1](#), for additional information.
 - The USB cable is not to exceed 3.0 m (9.84 ft).
-

Additional Resources

Resource	Description
Micro810 Programmable Controllers User Manual, publication 2080-UJM001	A more detailed description of how to install and use your Micro810 programmable controller and expansion I/O system.
Micro810 AC Power Supply Installation Instruction, publication 2080-IN001	Information on wiring and installing the optional AC power supply.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	More information on proper wiring and grounding techniques.

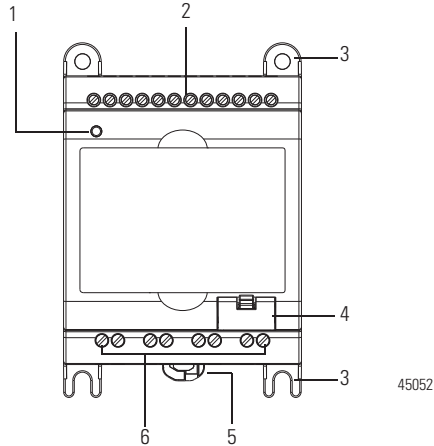
If you would like a manual, you can:

- download a free electronic version from the Internet:
<http://literature.rockwellautomation.com>
- purchase a printed manual by contacting your local Allen-Bradley distributor or Rockwell Automation representative

Overview

The Micro810 12 Point controller is an economical brick-style controller with embedded inputs and outputs. It can accommodate a USB adapter, and an LCD module. It can also accommodate any 24V DC output power supply that meets minimum specifications such as the optional Micro800 power supply.

Controller Overview



Controller Description

	Description		Description
1	Status indicator	4	USB port (for use with USB Adapter only)
2	Input terminal block	5	DIN rail mounting latch
3	Mounting screw hole/ mounting foot	6	Output connectors

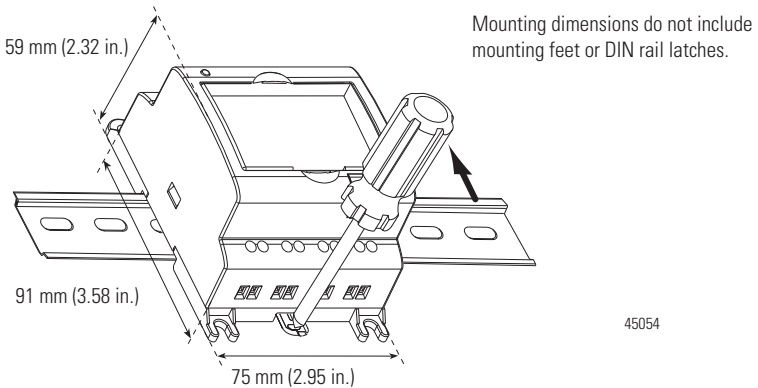
Status Indicator

State	During Normal Operation	During Firmware Update or Program/Data Transfer
Off	No power applied to device, or in Fault mode	No power applied to device, or in Fault mode
Solid green	Device operating normally	Program transfer successful
Flashing green	Operating System error	Firmware update in progress

Mount the Module

Most applications require installation in an industrial enclosure to reduce the effects of electrical interference and environmental exposure. Locate your controller as far as possible from power lines, load lines, and other sources of electrical noise such as hard-contact switches, relays, and AC motor drives. For more information on proper grounding guidelines, see the Industrial Automation Wiring and Grounding Guidelines, publication [1770-4.1](#).

Mounting Dimensions and DIN Rail Mounting



Module Spacing

Maintain spacing from objects such as enclosure walls, wireways and adjacent equipment. Allow 50.8 mm (2 in.) of space on all sides for adequate ventilation.

DIN Rail Mounting

The module can be mounted using the following DIN rails: 35 x 7.5 x 1 mm (EN 50 022 - 35 x 7.5) .

Before mounting the module on a DIN rail, use a flat-blade screwdriver in the DIN rail latch and pry it downwards until it is in the unlatched position.

1. Hook the top of the DIN rail mounting area of the controller onto the DIN rail, and then press the bottom until the controller snaps onto the DIN rail.
2. Push the DIN rail latch back into the latched position.
Use DIN rail end anchors (Allen-Bradley part number 1492-EA35 or 1492-EAHJ35) for vibration or shock environments.

To remove your controller from the DIN rail, pry the DIN rail latch downwards until it is in the unlatched position.

TIP

For environments with greater vibration and shock concerns, use the panel mounting method, instead of DIN rail mounting.

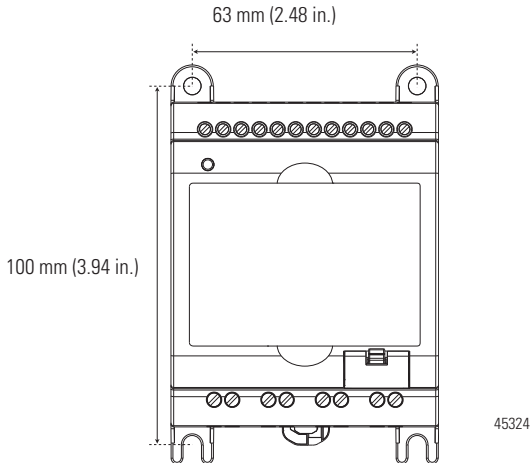
Panel Mounting

The preferred mounting method is to use four M4 (#8) screws per module. Hole spacing tolerance: ± 0.4 mm (0.016 in.).

Follow these steps to install your controller using mounting screws.

1. Place the controller against the panel where you are mounting it. Make sure the controller is spaced properly.
2. Mark drilling holes through the mounting screw holes and mounting feet then remove the controller.
3. Drill the holes at the markings, then replace the controller and mount it. Leave the protective debris strip in place until you are finished wiring the controller and any other devices.

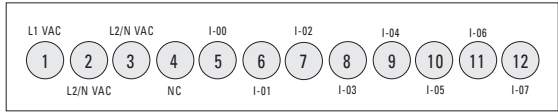
Panel Mounting Dimensions



Wire the Controller

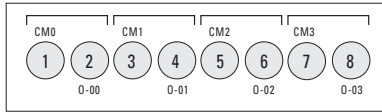
2080-LC10-12AWA

Input Terminal Block



45055

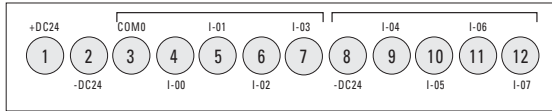
Output Terminal Block



45059

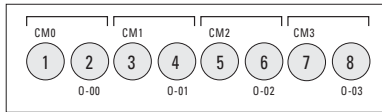
2080-LC10-12QWB

Input Terminal Block



45056

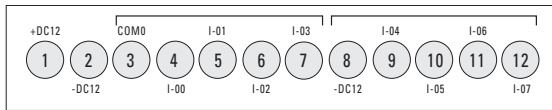
Output Terminal Block



45059

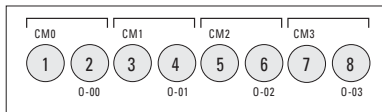
2080-LC10-12DWD

Input Terminal Block



45057

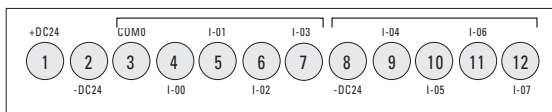
Output Terminal Block



45059

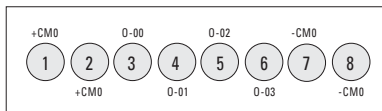
2080-LC10-12QBB

Input Terminal Block



45056

Output Terminal Block



45058

Specifications

General (2080-LC10-12AWA, 2080-LC10-12QWB, 2080-LC10-12QBB, 2080-LC10-12DWD)

Attribute	2080-LC10-12AWA	2080-LC10-12QWB	2080-LC1012DWD	2080-LC10-12QBB
Number of I/O	8 Input (4 digital, 4 analog/digital, configurable) 4 Output			
Dimensions HxWxD	91 x 75 x 59 mm (3.58 x 2.95 x 2.32 in.)			
Supply voltage range	85V...263V	20.4...26.4V DC	10.8V...13.2V DC	11.4V...26.4V DC
Supply frequency range (AC supply)	47...63 Hz	N.A.		
Voltage range	100...240V AC, 50/60 Hz	24V DC Class 2	12V DC Class 2	12/24V DC Class 2
Power consumption	5V A	5 W		
I/O rating	Input: 120...240V AC, 8.4V A Output: C300 R150, 8A 250V AC General Use	Input: 24V DC, 8 mA Output: C300 R150, 8A 250V AC General Use	Input: 12V DC, 8 mA Output: C300 R150, 8A 250V AC General Use	Input: 24V DC, 8 mA Output: 24V DC 1A, 25 °C, 24V DC 0.5A 55°C
Shipping weight, approx.	0.203 kg (0.448 lb)			
Wire size	0.32... 2.1 mm ² (22...14 AWG) solid copper wire or 0.32... 1.3 mm ² (22...16 AWG) stranded copper wire rated at 90 °C (194 °F) insulation max.			
Wiring category ⁽¹⁾	2 - on signal ports 2 - on power ports			
Wiring torque	1.085 Nm (8 in-lb)			
Wire type	use Copper Conductors only			
Fuse, type	Rated 250V 3.15 A-RADIAL			
Enclosure type rating	None (open-style)			
North American temp code	T5			
Insulation stripping length	7 mm (0.28 in)			

General (2080-LC10-12AWA, 2080-LC10-12QWB, 2080-LC10-12QBB, 2080-LC10-12DWD)

Attribute	2080-LC10-12AWA	2080-LC10-12QWB	2080-LC1012DWD	2080-LC10-12QBB
Isolation voltage	250V (continuous), Reinforced Insulation Type, I/O to Aux and Network, Inputs to Outputs. Type tested for 60 s 3250V DC, I/O to Aux and Network, Inputs to Outputs	250V (continuous), Reinforced Insulation Type, I/O to Aux and Network, Inputs to Outputs Type tested for 60 s at 720V DC, Inputs to Aux and Network, 3250V DC Outputs to Aux and Network, Inputs to Outputs		50V (continuous), Reinforced Insulation Type, I/O to Aux and Network, Inputs to Outputs Type tested for 60 s at 720V DC, I/O to Aux and Network, Inputs to Outputs

⁽¹⁾ Use this Conductor Category information for planning conductor routing. Refer to Industrial Automation Wiring and Grounding Guidelines, publication [1770-4.1](#).

Non-isolated AC Inputs (2080-LC10-12AWA)

Attribute	Value
On-state voltage, nom	120/240 V AC
On-state voltage, min	79 V AC
On-state voltage, max	265 V AC
Off-state voltage, max	40 V AC
Operating frequency, nom	50/60 Hz
Input impedance	423.7 kΩ
Operating frequency	47...63 Hz

DC Inputs (2080-LC10-12QWB, -12QBB, -12DWD) (Inputs 0 through 3)

Attribute	Non-isolated, shared with analog inputs	Isolated
Voltage category	24V DC sink/source	
On-state voltage, nom	12/24V DC	
On-state voltage, min	9.8V DC	
On-state voltage, max	28.8V AC	
Off-state voltage, max	5V DC	
Off-state current, max	0.5 mA	1.5 mA
On-state current, min	0.75 mA @ 10.8V DC 1.0 mA @ 15 V DC	1.8 mA @ 10.8V DC 2.7 mA @ 15 V DC
On-state current, nom	1.7 mA @ 24V DC	6 mA @ 24V DC
On-state current, max	2.1 mA @ 28.8 V DC	7.5 mA @ 28.8 V DC

DC Inputs (2080-LC10-12QWB, -12QBB, -12DWD) (Inputs 0 through 3)

Attribute	Non-isolated, shared with analog inputs	Isolated
Nominal impedance	14.1 k Ω	3.74 k Ω (isolated)
IEC input compatibility	Type 1	Type 3

Analog Inputs (2080-LC10-12QWB, -12QBB, -12DWD) (Inputs 4 through 7)

Attribute	Value
Input type	DC voltage
Input voltage range	0...10V DC
Input voltage, max	26.4V DC
Value of LSB	2.5 mV
Input resolution	10-bit
Smoothing	None, smoothing
Overall accuracy	5% of full-scale (2% with calibration) (25...55 °C) (77...131 °F)
Noise rejection	50/60 Hz
Common mode rejection	40 dB, DC to 60 Hz with Smoothing filter
Nominal impedance	14.1 k Ω (non-isolated)

DC Output (2080-LC10-12QBB)

Attribute	Value
User supply voltage, min	10 V DC
User supply voltage, max	26.4V DC
On-state voltage drop	1V @ max load current 2.5V @ max surge current
Current ratings	0.5A @ 55 °C max 1.0A @ 30 °C max 1.0 mA min
Surge current, peak	4.0 A
Surge current, max duration	10 ms
Turn-on- time, max	0.1 ms
Turn-off time, max	0.1 ms

Relay Outputs (2080-LC10-12AWA, -12QWB, -12DWD)

Attribute	Value
Output rating	Relay 00 & 01: 8 A @ 240V AC, 5A @ 24V DC, B300 Relay 02 & 03: 4 A @ 240V AC, 2A @ 24V DC, C300, R150

For more specifications, refer to the Micro810 Programmable Controllers User Manual, publication [2080-UM001](#).

Environmental Specifications

Attribute	Value
Temperature, operating	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): -20...55 °C (-4...131 °F)
Temperature, surrounding air, max	55 °C (131 °F)
Temperature, storage	IEC 60068-2-1 (Test Ab, Unpackaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Unpackaged Non-operating Thermal Shock): -40...85 °C (-40...185 °F)
Relative humidity	IEC 60068-2-30 (Test Db, Unpackaged Damp Heat): 5...95% non-condensing
Vibration	IEC 60068-2-6 (Test Fc, Operating): 2 g @ 10...500 Hz
Shock, operating	IEC 60068-2-27 (Test Ea, Unpackaged Shock): 30 g
Shock, nonoperating	IEC 60068-2-27 (Test Ea, Unpackaged Shock): 30 g (DIN Rail Mounted) 30 g (Panel Mounted)
Emissions	CISPR 11 Group 1, Class A
ESD immunity	IEC 61000-4-2: 4 kV contact discharges 8 kV air discharges
Radiated RF immunity	IEC 61000-4-3: 10V/m with 1 kHz sine-wave 80% AM from 80...2000 MHz 10V/m with 200 Hz 50% Pulse 100% AM at 900 MHz 10V/m with 200 Hz 50% Pulse 100% AM at 1890 MHz 3V/m with 1 kHz sine-wave 80% AM from 2000...2700 MHz
EFT/B immunity	IEC 61000-4-4: ±2 kV at 5 kHz on power ports ±2 kV at 5 kHz on signal ports

Environmental Specifications

Attribute	Value
Surge transient immunity	IEC 61000-4-5: ±1 kV line-line(DM) and ±2 kV line-earth(CM) on power ports ±1 kV line-line(DM) and ±2 kV line-earth(CM) on signal ports ±2 kV line-earth(CM) on shielded ports
Conducted RF immunity	IEC 61000-4-6: 10V rms with 1 kHz sine-wave 80% AM from 150 kHz...80 MHz
Voltage variation	IEC 61000-4-11: 60% dip for 5 and 50 periods on AC supply ports 30% dip for 0.5 period at 0° and 180° on AC supply ports 100% dip for 0.5 period at 0° and 180° on AC supply ports ±10% fluctuations for 15 min on AC supply ports >95% interruptions for 250 periods on AC supply ports

Certifications

Certification (when product is marked) ⁽¹⁾	Value
c-UL-us	UL Listed Industrial Control Equipment, certified for US and Canada. See UL File E322657. UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada. See UL File E334470.
CE	European Union 2004/108/EC EMC Directive, compliant with: EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions EN 61131-2; Programmable Controllers (Clause 8, Zone A & B) EN 61131-2; Programmable Controllers (Clause 11)
C-Tick	Australian Radiocommunications Act, compliant with: AS/NZS CISPR 11; Industrial Emissions

⁽¹⁾ See the Product Certification link at <http://www.ab.com> for Declaration of Conformity, Certificates, and other certification details.

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Asia Pacific: Rockwell Automation, Level 14, Core E, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

Publication 2080-IN006A-EN-P - September 2010

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Wiring Diagrams

Micro800™ 1.5" LCD Display and Keypad Module

Catalog Number 2080-LCD

<http://literature.rockwellautomation.com>

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Environment and Enclosure

ATTENTION

This equipment is intended for use in a Pollution Degree 2 industrial environment, in overvoltage Category II applications (as defined in IEC 60664-1), at altitudes up to 2000 m (6562 ft) without derating. This equipment is considered Group 1, Class A industrial equipment according to IEC/CISPR 11. Without appropriate precautions, there may be difficulties with electromagnetic compatibility in residential and other environments due to conducted and radiated disturbances.

This equipment is supplied as open-type equipment. It must be mounted within an enclosure that is suitably designed for those specific environmental conditions that will be present and appropriately designed to prevent personal injury resulting from accessibility to live parts. The enclosure must have suitable flame-retardant properties to prevent or minimize the spread of flame, complying with a flame spread rating of 5V A, V2, V1, V0 (or equivalent) if non-metallic. The interior of the enclosure must be accessible only by the use of a tool. Subsequent sections of this publication may contain additional information regarding specific enclosure type ratings that are required to comply with certain product safety certifications.

In addition to this publication, see:

- Industrial Automation Wiring and Grounding Guidelines, Rockwell Automation publication [1770-4.1](#), for additional installation requirements.
- NEMA Standard 250 and IEC 60529, as applicable, for explanations of the degrees of protection provided by different types of enclosure.

Preventing Electrostatic Discharge



ATTENTION

This equipment is sensitive to electrostatic discharge, which can cause internal damage and affect normal operation. Follow these guidelines when you handle this equipment:

- Touch a grounded object to discharge potential static.
- Wear an approved grounding wriststrap.
- Do not touch connectors or pins on component boards.
- Do not touch circuit components inside the equipment.
- Use a static-safe workstation, if available.
- Store the equipment in appropriate static-safe packaging when not in use.

North American Hazardous Location Approval

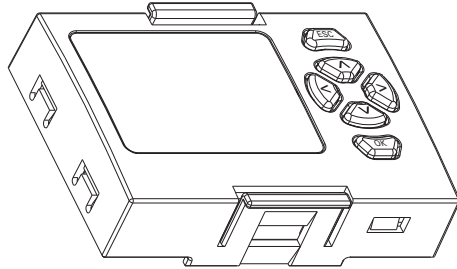
The following modules are North American Hazardous Location approved:
2080-LCD

<p>The following information applies when operating this equipment in hazardous locations:</p> <p>Products marked "CL I, DIV 2, GP A, B, C, D" are suitable for use in Class I Division 2 Groups A, B, C, D, Hazardous Locations and nonhazardous locations only. Each product is supplied with markings on the rating nameplate indicating the hazardous location temperature code. When combining products within a system, the most adverse temperature code (lowest "T" number) may be used to help determine the overall temperature code of the system. Combinations of equipment in your system are subject to investigation by the local Authority Having Jurisdiction at the time of installation.</p>		<p>Informations sur l'utilisation de cet équipement en environnements dangereux:</p> <p>Les produits marqués "CL I, DIV 2, GP A, B, C, D" ne conviennent qu'à une utilisation en environnements de Classe I Division 2 Groupes A, B, C, D dangereux et non dangereux. Chaque produit est livré avec des marquages sur sa plaque d'identification qui indiquent le code de température pour les environnements dangereux. Lorsque plusieurs produits sont combinés dans un système, le code de température le plus défavorable (code de température le plus faible) peut être utilisé pour déterminer le code de température global du système. Les combinaisons d'équipements dans le système sont sujettes à inspection par les autorités locales qualifiées au moment de l'installation.</p>	
<p>WARNING</p> 	<p>EXPLOSION HAZARD</p> <ul style="list-style-type: none"> Do not disconnect equipment unless power has been removed or the area is known to be nonhazardous. Do not disconnect connections to this equipment unless power has been removed or the area is known to be nonhazardous. Secure any external connections that mate to this equipment by using screws, sliding latches, threaded connectors, or other means provided with this product. Substitution of any component may impair suitability for Class I, Division 2. If this product contains batteries, they must only be changed in an area known to be nonhazardous. 	<p>AVERTISSEMENT</p> 	<p>RISQUE D'EXPLOSION</p> <ul style="list-style-type: none"> Couper le courant ou s'assurer que l'environnement est classé non dangereux avant de débrancher l'équipement. Couper le courant ou s'assurer que l'environnement est classé non dangereux avant de débrancher les connecteurs. Fixer tous les connecteurs externes reliés à cet équipement à l'aide de vis, loquets coulissants, connecteurs filetés ou autres moyens fournis avec ce produit. La substitution de tout composant peut rendre cet équipement inadapté à une utilisation en environnement de Classe I, Division 2. S'assurer que l'environnement est classé non dangereux avant de changer les piles.

4 Micro800™ 1.5" LCD Display and Keypad Module

Parts List

Your package contains one LCD module.



45071

WARNING



- If you insert or remove the module while power is on, an electrical arc can occur. This could cause an explosion in hazardous location installations. Be sure that power is removed or the area is nonhazardous before proceeding.
- When used in a Class I, Division 2, hazardous location, this equipment must be mounted in a suitable enclosure with proper wiring method that complies with the governing electrical codes.

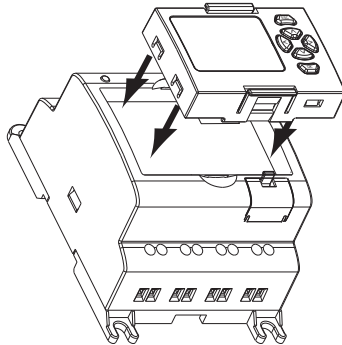
ATTENTION



- This equipment is considered Group 1, Class A industrial equipment according to IEC/CISPR 11. Without appropriate precautions, there may be difficulties with electromagnetic compatibility in residential and other environments due to conducted and radiated disturbance.
-

Insert Module into Controller

Follow the instructions to insert and secure the module to the controller.



45072

1. Remove the dust cover from the controller by pressing both latches toward each other and pulling the dust cover out.
2. Position the LCD module as shown.
3. Snap the module into the LCD module bay.

ATTENTION

You can insert or remove the module while power is applied, but only in nonhazardous locations.

Access the Main Menu

Press the ESC and OK buttons at the same time to access the Main Menu screen.

Specifications

General and Environmental Specifications

Attribute	Value
Temperature, operating	IEC60068-2-1 (Test Ad, Operating Cold), IEC60068-2-2, (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): -20..55 °C (-4...131 °F)
Temperature, surrounding air, max	55 °C (131 °F)
Temperature, non-operating	IEC60068-2-1 (Test Ad, Operating Cold), IEC60068-2-2, (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): -40...85 °C (-40...185 °F)
North American temp code	T5

Certifications

Certification (when product is marked) ⁽¹⁾	Value
c-UL-us	UL Listed Industrial Control Equipment, certified for US and Canada. See UL File E322657. UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada. See UL File E334470.
CE	European Union 2004/108/EC EMC Directive, compliant with: EN 61326-1; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions EN 61131-2; Programmable Controllers (Clause 8, Zone A & B) European Union 2006/95/EC LVD, compliant with: EN 61131-2; Programmable Controllers (Clause 11)
C-Tick	Australian Radiocommunications Act, compliant with: AS/NZS CISPR 11; Industrial Emissions

⁽¹⁾ See the Product Certification link at <http://www.ab.com> for Declarations of Conformity, Certificates, and other certification details.

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953203-36(01)

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Bulletin 1606-XLB Basic Power Supply



Cost-Effective, Efficient Power for Control Circuits

Features and Benefits

- Available in 1.5A (36 Watts), 2.5A (60 Watts), 3.75A (90 Watts), 5A (120 Watts), 10A (240 Watts) and 20A (480 Watts) sizes
- Designed for extended mean time between failure for longer service – at a significant price advantage
- Clever single-board design enables up to 95.2% efficiency, reducing heat output which can putting less thermal stress on other components in the enclosure
- DC-OK signal allows monitoring of unit's output voltage
- Clicks smoothly onto any standard DIN rail and features large-sized terminals, making wiring easier



1606-XLB36EH 1.5A (36 W)
Push-in Terminals



1606-XLB90EH 3.8A (90 W)
Push-in Terminals



1606-XLB90EQ 3.8A (90 W)
NEC Class 2
Screw Terminals



1606-XLB480E 20A (480 W)
Screw terminals

Introducing new 1606-XLB family of power supplies with high efficiency and life expectancy

Basic DIN Rail Mounted Power Supplies

Bulletin 1606-XLB offers reliability and efficiency usually available only in more expensive power supplies.

These power supplies are rated up to 1.37 million hours mean time between failure (MTBF) and the minimum service life-time is typically 47,000 hours. Efficiency figures range from 90.7% up to 95.2%. Furthermore, the XLB family offers a DC "OK" signal that can be used to monitor the unit's output voltage.

Robust enough for demanding applications, these convection cooled units can operate from -10 °C (some units -25 °C) up to 70 °C. Typically, power derating is only required above 55 °C. The XLB family is easy to mount on any standard DIN rail and features large-sized terminals for east wiring. The 240 W version is only 49 mm wide, an industry leading space saving benefit of XLB.

The new 1606-XLB product family is cost-effective without compromising reliability, efficiency and ease of application.



	36W	60W		90W		120W	240W	480W
	XLB36EH	XLB60BH	XLB60EH XLB60E	XLB90EH	XLB90E XLB90EQ ²	XLB120E	XLB240E	XLB480E
Output								
Output current, nominal	1.5A	5A	2.5A	3.8A	3.8A	5A	10A	20A
Output voltage, nominal DC	24V	12V	24V	24V	24V	24V	24V	24V
output voltage range	24-28V	12-15V	24-28V	24-28V	24-28V	24-28V	24-28V	24-28V
Hold-up time, typ. at 230V _{ac}	161ms	114ms	113ms	119ms	119ms	50ms	32ms	27ms
Input								
AC input voltage, nominal	100-240V	100-240V	100-240V	100-240V	100-240V	100-120V ⁽¹⁾ 200-240V ⁽¹⁾	100-240V	100-240V
AC input voltage range	90-264V	90-264V	90-264V	90-264V	90-264V	90-132V ⁽¹⁾ 180-264V ⁽¹⁾	90-264V	90-264V
Power factor, typ.	0.46	0.49	0.47	0.45	0.45	0.54	0.93	0.97
Input inrush current, typ. AC (+40°C)	TBD	31A	35A	40A	40A	33A	26A	35A
Operational temperature range	-10°C to +70°C	-10°C to +70°C	-10°C to +70°C	-10°C to +70°C	-10°C to +70°C	-10°C to +70°C	-25°C to +70°C	-25°C to +70°C
Efficiency	> 90%	90.7%	91.8%	93.8%	93.8%	92.3%	95.2%	95.3%
MTBF SN 29500, IEC61709 at +40°C	TBD	TBD	TBD	TBD	TBD	1379kh	822kh	704 kh
Minimum lifetime expectancy at +40°C and 100% load	115 kh 100Vac	89 kh 100Vac	115 kh 100Vac	102 kh 100Vac	102 kh 100Vac	83kh	74kh	102kh
Mechanical data								
Dimensions WxHxD	22.5x90x91mm	36x90x91mm	36x90x91mm	36x90x91mm	36x90x91mm	39x124x124mm	49x124x124mm	59x124x127mm
Weight	138g	225g	220g	270g	270g	370g	540g	810g
DC-OK relay contact	-	-	-	-	-	yes	yes	yes
Connection terminals	push-in	push-in	XLB60EH : push-in XLB60E: screw	push-in	screw	screw	screw	screw

Standards and approvals







Annotations

1) Auto-select 2) NEC Class 2 version
 3) 1606-XLB36EH, 1606-XLB60BH, 1606-XLB60EH / 1606-XLB60E,
 1606-XLB90EH / 1606-XLB90E / 1606-XLB90EQ, 1606-XLB480E,

All values are valid at 230 Vac, 50Hz, +25°C ambient temperature after a warm-up time of 5 minutes, unless stated otherwise. All technical data is subject to change without notice.

General data for all versions:

Power reduction 2.5%/°C from +55°C (PIC480.241C: 1.7%/°C) 5% to
 Humidity 95% r.h.
 Installation height (with derating) 0 to 2,000m (up to 5,000m)
 Shock test 30g 6ms, 20g 11ms in accordance with IEC60068-2-27

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22 mm Push Button Specifications

Bulletin Numbers 598, 800B, 800F, 800FC, 800FD, 800MB, 800MR

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Our Bulletin 800F 22 mm round operator family meets demanding performance specifications. We use state-of-the-art solid modeling techniques and finite element analysis to optimize the durability and performance of our push buttons.

800FP Plastic Operators

- IP69K
- IP65/66, Type 4/4X/13
- Engineering grade thermoplastics
- Chemical-resistant for harsh environments



800FM Metal Operators

- IP65/66, Type 4/13
- Die-cast metal construction
- Chrome-plated



3-across x 2-deep Back-of-panel (6 Circuits Max)

- Rugged snap-fit design for plastic or metal latch
- Stackable contact blocks
- Rotating collar for easy one-hand latch removal
- Color-coded contact block plungers for contact identification

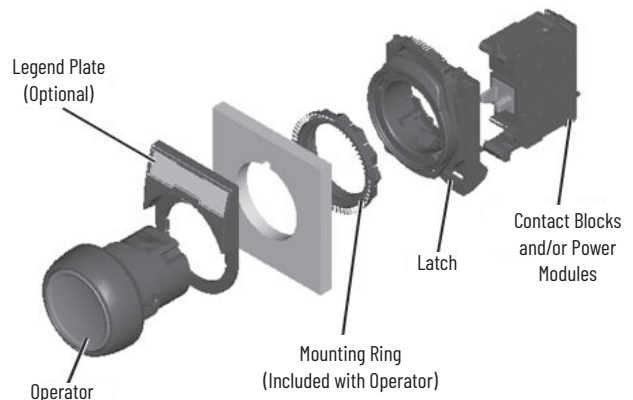


Plastic Latch with Contact Block



Metal Latch with Contact Block

Assembly Overview



Specifications

Product Certifications

Attribute	Plastic (Bulletin 800FP) and Metal (Bulletin 800FM)
Certifications	UR/UL, CSA, CCC, CE
Standards Compliance – CE Marked	NEMA ICS-5; UL 508, EN ISO 13850, EN 60947-1, EN 60947-5-1, EN 60947-5-5
Terminal Identification	EN/IEC 60947-1
Shipping Approvals	ABS
RoHS	Yes

Front-of-Panel (Operators)

IMPORTANT Performance Data — Performance data that is given in this publication is provided only as a guide for you to determine suitability and does not constitute a performance warranty of any kind. Such data can represent the results of accelerated testing at elevated stress levels, and you are responsible for correlating the data to actual application requirements. ALL WARRANTIES AS TO ACTUAL PERFORMANCE, WHETHER EXPRESS OR IMPLIED, ARE EXPRESSLY DISCLAIMED.

Table 1 - Mechanical Ratings – Operators

Attribute		Plastic (Bulletin 800FP)	Metal (Bulletin 800FM)
Vibration (assembled to panel)		Tested at 10...2000 Hz, 1.52 mm (0.06 in.) displacement (peak-to-peak) max./10 G max. for 3 hr duration, no damage	
Shock		Tested at 1/2 cycle sine wave for 11 ms; no damage at 100 G	
Degree of protection ⁽¹⁾ ⁽²⁾		IP69K ⁽³⁾ and IP65/66 (Type 3/3R/4/4X/12/13)	IP65/66 (Type 3/3R/4/12/13)
Mechanical durability per EN 60947-5-1 (Annex C)	10,000,000 Cycles	Momentary push buttons, momentary mushroom	
	1,000,000 Cycles	Multi-function, selector switch, key selector switch, selector jog, SensEject™ key selector switch	
	500,000 Cycles	Non-illuminated push-pull E-stop ⁽⁴⁾	
	300,000 Cycles	Twist-to-release E-stop, illuminated push-pull E-stop ⁽⁴⁾ , alternate action push buttons	
	100,000 Cycles	Potentiometer, toggle switch	
Operating forces (typical with one contact block)		Flush/extended = 5 N, E-stop = 36 N Mushroom = 9 N	
Operating torque (typical application with one contact block)		Selector switch = 0.25 N•m (2.2 lb•in)	
Mounting torque	Plastic	1.7 N•m (15 lb•in)	
	Metal	4.4 N•m (40 lb•in)	

(1) Momentary mushroom operators are IP65. Plastic keyed operators are IP66, Type 4/13; not Type 4X.

(2) IP65/66 products are compliant to IEC 60529.

(3) IP69K products listed in [Table 2](#) are compliant to ISO 20653 (replaces DIN 40050 Part 9) for IP69K and IEC 60529 for all other IP ratings.

(4) Limit of four contact blocks max for these devices.

Table 2 - IP69K Operators and Assembled Stations

IP69K Rated Operators		IP69K Rated Assembled Stations
<ul style="list-style-type: none"> • 800FD-MT44* • 800FP-F* • 800FP-F* and 800F-AB7 • 800FP-LF* • 800FP-E* • 800FP-E* and 800F-ABE7 • 800FP-LE* • 800FP-FA* • 800FP-LFA* • 800FP-G* • 800FP-P* • 800FP-MT3* • 800FP-MT4* • 800FP-LMT4* • 800FP-MT6* 	<ul style="list-style-type: none"> • 800FP-LMT6* • 800FP-LMP3* • 800FP-MP4* • 800FP-LMP4* • 800FP-MM4* • 800FP-LMM4* • 800FP-MM6* • 800FP-LMP6* • 800FP-MP9* • 800FP-LMP9* • 800FP-U2* • 800FP-LU2* • 800FP-U3* • 800FP-MM9* • 800FP-POT* 	<ul style="list-style-type: none"> • 800F-1YP1 • 800F-1YP2 • 800F-1YP3 • 800F-1YP7 • 800F-1YP8 • 800F-1YM1 • 800F-1YM2 • 800F-1YM3 • 800F-1YM7 • 800F-1YM8 • 800F-1YML1 • 800F-1YML2 • 800F-1YML3 • 800F-1YMD51 • 800F-1YMD52 • 800F-1YMD81
<ul style="list-style-type: none"> • 800F-1YMD and 800F-ALC2 (1 pc) and IP69K rated operators • 800F-2PM and 800F-ALC2 (2 pcs) and IP69K rated operators • 800F-3PM and 800F-ALC2 (3 pcs) and IP69K rated operators • 800F-4PM and 800F-ALC2 (4 pcs) and IP69K rated operators • 800F-6PM and 800F-ALC2 (6 pcs) and IP69K rated operators • 800F-AHA1 • 800F-1YMD51, 800F-1YMD52, and 800F-1YMD81 		

Table 3 - Environmental – Operators

Attribute		Plastic (Bulletin 800FP)	Metal (Bulletin 800FM)
Temperature Range	Operating	-25...+70 °C (-13...+158 °F) ⁽¹⁾	
	Short-term Storage	-40...+85 °C (-40...+185 °F)	
Humidity		≤95% RH from 25...60 °C (77...140 °F)	

(1) Operating temperatures below 0 °C (32 °F) are based on the absence of freezing moisture and liquids, UL Recognized to 55 °C (131 °F) - Incandescent module max. 40 °C (104 °F).



Instrumentation

Revision 00

This Document Contains:

- Run Level Switch Drawing – S00B.005
- Run Level Switch Cutsheet
- Run Level Switch Manual
- Headloss Pressure Transmitter Cutsheet
- Headlong Pressure Transmitter Manual
- Influent Valve Cutsheet

Equipment Data					
Item	Installed	Loose Contractor Install	Loose Nexom Install	Signal Type	Manufacturer
Run Level Switch		X		NC/NO	Madison Inc.
Headloss Pressure Transmitter		X		4-20 mah	Endress + Hauser
Influent Valve		x		Spring To Close	DeZurik

Configuration summary

Mat. no.	Description Order code	Quantity	Unit
71239739	Cerabar PMC21 PMC21-CA1M1FFVXJA+RZ	1	PC

010	Approval:	CA	CSA C/US General Purpose
020	Output:	1	4-20mA
040	Electrical Connection:	M	Plug M12, IP65/67 NEMA Type 4X Encl.
070	Sensor Range:	1F	400mbar/40kPa/6psi gauge, overload: 8bar/800kPA/120psi
090	Calibration; Unit:	F	Sensor range; psi
110	Process Connection:	VXJ	Thread ASME MNPT1/2 FNPT1/4, 316L
190	Seal:	A	FKM
620	>>Accessory Enclosed:	RZ	Plug connector M12 90deg, IP67, 5m cable, union nut Cu Sn/Ni

Headloss Pressure
Transmitter:
PT-100

Technical Information Cerabar PMC11, PMC21, PMP11, PMP21

Process pressure measurement

Pressure transducer with ceramic and metal
sensors

Application

The Cerabar is a pressure transducer for the measurement of absolute and gauge pressure in gases, vapors, liquids and dust. The Cerabar can be used internationally thanks to a wide range of approvals and process connections.

Your benefits

- High reproducibility and long-term stability
- Reference accuracy: up to 0.3%
- Customized measuring ranges
 - Turn down up to 5:1
 - Sensor for measuring ranges up to 400 bar (6 000 psi)
- Housing and process isolating diaphragm made of 316L



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Document information



Document function	The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device.
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Symbols used








Safety symbols

Symbol	Meaning
	DANGER! This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.
	WARNING! This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
	CAUTION! This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.
	NOTICE! This symbol contains information on procedures and other facts which do not result in personal injury.

Electrical symbols

Symbol	Meaning	Symbol	Meaning
	Protective ground connection A terminal which must be connected to ground prior to establishing any other connections.		Ground connection A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.

Symbols for certain types of information

Symbol	Meaning
	Permitted Procedures, processes or actions that are permitted.
	Forbidden Procedures, processes or actions that are forbidden.
	Tip Indicates additional information.
	Reference to documentation
	Reference to page
	Reference to graphic
	Visual inspection

Symbols in graphics

Symbol	Meaning
1, 2, 3 ...	Item numbers
1. 2. 3. ...	Series of steps
A, B, C, ...	Views

Documentation



The document types listed are available:
 In the Download Area of the Endress+Hauser Internet site: www.endress.com → Download

Brief Operating Instructions (KA): getting the 1st measured value quickly

These instructions contain all the essential information from incoming acceptance to initial commissioning.

Operating Instructions (BA): your comprehensive reference

These Operating Instructions contain all the information that is required in various phases of the life cycle of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning through to troubleshooting, maintenance and disposal.

Safety Instructions (XA)

Depending on the approval, the following Safety Instructions (XA) are supplied with the device. They are an integral part of the Operating Instructions.

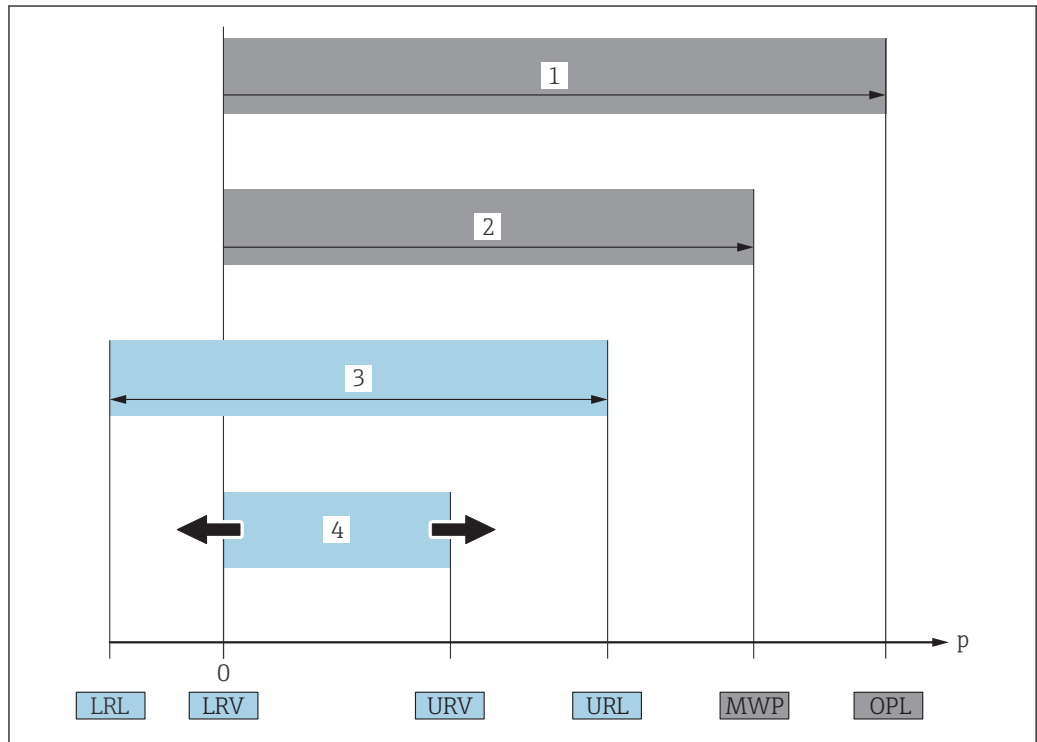
Device	Directive	Documentation	Option ¹⁾
PMP21	ATEX II 1/2G Ex ia IIC T4 Ga/Gb	XA01271P	BA
PMC21	ATEX II 2G Ex ia IIC T4 Gb	XA01271P	BB
PMC21 PMP21	ATEX II 3G Ex ec IIC T4 Gc	XA01533P	BC
PMC21 PMP21	FM IS Cl. I, Div.1 Gr. A-D T4	XA01321P	FA
PMC21 PMP21	CSA C/US IS Cl. I Div. 1 Gr. A-D	XA01322P	CB
PMC21 PMP21	EAC Ex ia IIC T4 Ga/Gb	XA01540P	GA
PMC21 PMP21	IEC Ex ia IIC T4 Ga/Gb	XA01271P	IA
PMC21 PMP21	NEPSI Ex ia IIC T4	XA01363P	NA
PMC21 PMP21	TIIS Ex ia IIC T4	In preparation	TA

1) Product Configurator order code for "Approval"



The nameplate indicates the Safety Instructions (XA) that are relevant to the device.

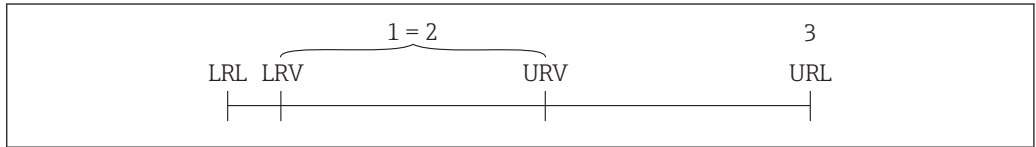
Terms and abbreviations



A0029505

Item	Term/ abbreviation	Explanation
1	OPL	The OPL (over pressure limit = sensor overload limit) for the measuring device depends on the lowest-rated element, with regard to pressure, of the selected components, i.e. the process connection has to be taken into consideration in addition to the measuring cell. Also observe pressure-temperature dependency. For the relevant standards and additional notes, see the "Pressure specifications" section → 28 . The OPL may only be applied for a limited period of time.
2	MWP	The MWP (maximum working pressure) for the sensors depends on the lowest-rated element, with regard to pressure, of the selected components, i.e. the process connection has to be taken into consideration in addition to the measuring cell. Also observe pressure-temperature dependency. For the relevant standards and additional notes, see the "Pressure specifications" section → 28 . The MWP may be applied at the device for an unlimited period. The MWP can also be found on the nameplate.
3	Maximum sensor measuring range	Span between LRL and URL This sensor measuring range is equivalent to the maximum calibratable/adjustable span.
4	Calibrated/ adjusted span	Span between LRV and URV Factory setting: 0 to URL Other calibrated spans can be ordered as customized spans.
p	-	Pressure
-	LRL	Lower range limit
-	URL	Upper range limit
-	LRV	Lower range value
-	URV	Upper range value
-	TD (turn down)	Turn down The turn down is preset at the factory and cannot be changed. Example - see the following section.

Turn down calculation



A0029545

- 1 *Calibrated/adjusted span*
- 2 *Zero point-based span*
- 3 *URL sensor*

Example

- Sensor: 10 bar (150 psi)
- Upper range value (URL) = 10 bar (150 psi)
- Lower range value (LRV) = 0 bar (0 psi)
- Upper range value (URV) = 5 bar (75 psi)
- Calibrated/adjusted span: 0 to 5 bar (0 to 75 psi)

Turn down (TD):

$$TD = \frac{URL}{|URV - LRV|}$$

$$TD = \frac{10 \text{ bar (150 psi)}}{|5 \text{ bar (75 psi)} - 0 \text{ bar (0 psi)}|} = 2$$

In this example, the TD is 2:1.
This span is based on the zero point.

Function and system design

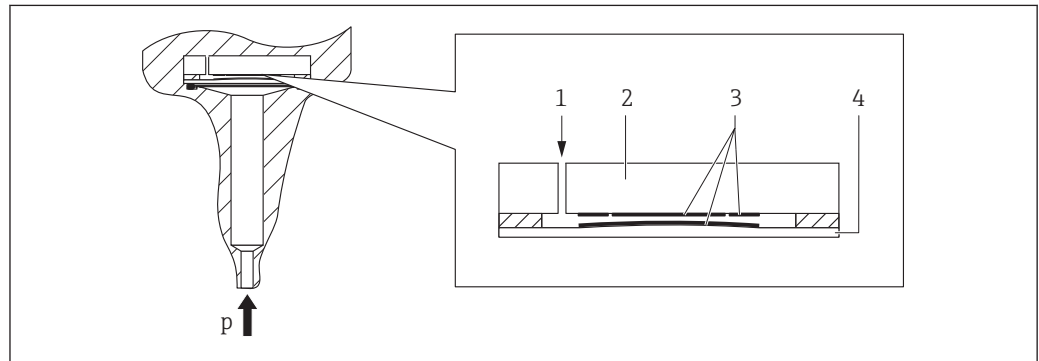
Measuring principle - process pressure measurement

Devices with ceramic process isolating diaphragm (Ceraphire®)

The ceramic sensor is an oil-free sensor, i.e. the process pressure acts directly on the robust ceramic process isolating diaphragm and causes it to deflect. A pressure-dependent change in capacitance is measured at the electrodes of the ceramic substrate and the process isolating diaphragm. The measuring range is determined by the thickness of the ceramic process isolating diaphragm.

Advantages:

- Guaranteed overload resistance up to 40 times the nominal pressure
- The ultrapure 99.9% ceramic (Ceraphire®, see also "www.endress.com/ceraphire") ensures:
 - Extremely high chemical durability
 - High mechanical durability
- Can be used in absolute vacuum
- Small measuring ranges



A0020465

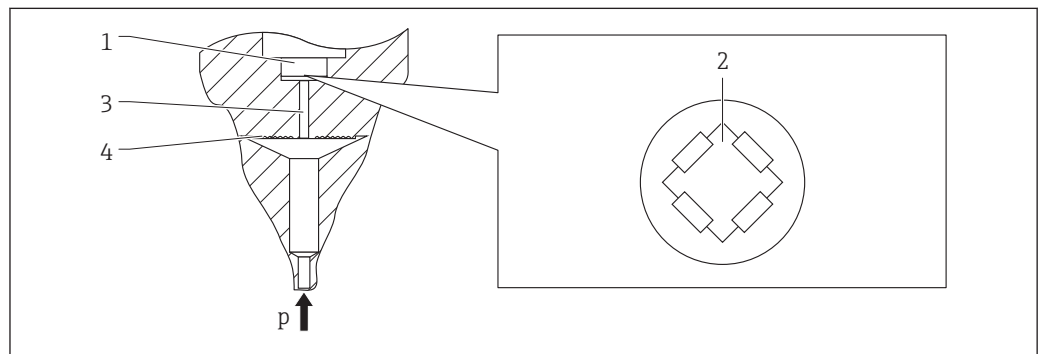
- 1 Air pressure (gauge pressure sensors)
- 2 Ceramic substrate
- 3 Electrodes
- 4 Ceramic process isolating diaphragm

Devices with metallic process isolating diaphragm

The process pressure deflects the metal process isolating diaphragm of the sensor and a fill fluid transfers the pressure to a Wheatstone bridge (semiconductor technology). The pressure-dependent change in the bridge output voltage is measured and evaluated.

Advantages:

- Can be used for high process pressures
- Fully welded sensor
- Slim, flush-mounted process connections available

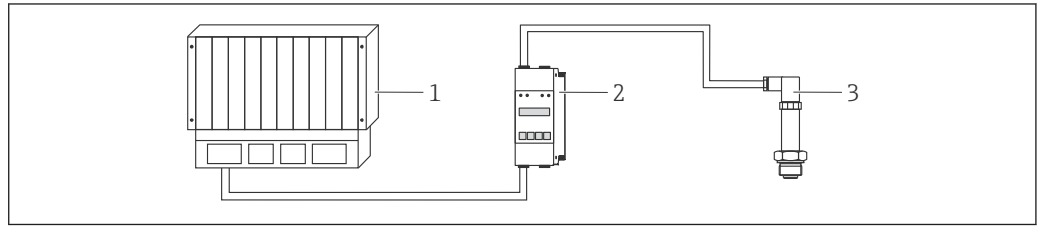


A0016448

- 1 Silicon measuring element, substrate
- 2 Wheatstone bridge
- 3 Channel with fill fluid
- 4 Metal process isolating diaphragm

Measuring system

A complete measuring system comprises:



A0021926

- 1 PLC (programmable logic control)
 2 e.g. RN221N / RMA42 (if required)
 3 Pressure transducer

Device features

Field of application

- PMC11: Gauge pressure
- PMP11: Gauge pressure
- PMC21: Gauge and absolute pressure
- PMP21: Gauge and absolute pressure

Process connections

PMC11:

- Thread ISO 228
- Thread ASME
- DIN 13

PMP11:

- Thread ISO 228, also flush-mount
- Thread ASME
- DIN 13

PMC21:

- Thread ISO 228
- Thread DIN 13
- Thread ASME
- Thread JIS

PMP21:

- Thread ISO 228, also flush-mount
- Thread DIN 13
- Thread ASME
- Thread JIS

Measuring ranges

- PMC11: from -400 to +400 mbar (-6 to +6 psi) to -1 to +40 bar (-15 to +600 psi).
- PMP11: from -400 to +400 mbar (-6 to +6 psi) to -1 to +40 bar (-15 to +600 psi).
- PMC21: from -100 to +100 mbar (-1.5 to +1.5 psi) to -1 to +40 bar (-15 to +600 psi).
- PMP21: from -400 to +400 mbar (-6 to +6 psi) to -1 to +400 bar (-15 to +6 000 psi).

OPL (depends on the measuring range)

- PMC11: max. 0 to +60 bar (0 to +900 psi)
- PMP11: max. 0 to +160 bar (0 to +2 400 psi)
- PMC21: max. 0 to +60 bar (0 to +900 psi)
- PMP21: max. 0 to +600 bar (0 to +9 000 psi)

MWP

- PMC11: max. 0 to +60 bar (0 to +900 psi)
- PMP11: max. 0 to +160 bar (0 to +2 400 psi)
- PMP21: max. 0 to +600 bar (0 to +9 000 psi)
- PMC21: max. 0 to +60 bar (0 to +900 psi)

Process temperature range (temperature at process connection)

- PMC11: -25 to +85 °C (-13 to +185 °F)
- PMP11: -25 to +85 °C (-13 to +185 °F)
- PMC21: -25 to +100 °C (-13 to +212 °F)
- PMP21: -40 to +100 °C (-40 to +212 °F)

Ambient temperature range

PMC11: -40 to +70 °C (-40 to +158 °F)

PMP11: -40 to +70 °C (-40 to +158 °F)

PMC21:

- -40 to +85 °C (-40 to +185 °F)

- Devices for hazardous areas: -40 to +70 °C (-40 to +158 °F)

PMP21:

-40 to +85 °C (-40 to +185 °F)

Reference accuracy

- PMC11: up to 0.5 %, TD 5:1, for details, see "Reference accuracy" section.

- PMP11: up to 0.5 %, TD 5:1, for details, see "Reference accuracy" section.

- PMC21: up to 0.3 %, TD 5:1, for details, see "Reference accuracy" section.

- PMP21: up to 0.3 %, TD 5:1, for details, see "Reference accuracy" section.

Supply voltage

PMC11:

- 4 to 20 mA output: 10 to 30V DC

- 0 to 10 V output: 12 to 30V DC

PMP11:

- 4 to 20 mA output: 10 to 30V DC

- 0 to 10 V output: 12 to 30V DC

PMC21:

10 to 30 V DC

PMP21:

10 to 30 V DC

Output

PMC11:

- 4 to 20 mA

- 0 to 10 V

PMP11:

- 4 to 20 mA

- 0 to 10 V

PMC21:

4 to 20 mA

PMP21:

4 to 20 mA

Material

PMC11:

- Housing made from 316L (1.4404)

- Process connections made from 316L

- Process isolating diaphragm made from Al₂O₃ aluminum oxide ceramic, (Ceraphire®), ultrapure 99.9 %

PMP11:

- Housing made from 316L (1.4404)

- Process connections made from 316L (1.4404)

- Process isolating diaphragm made from 316L (1.4435)

PMC21:

- Housing made from 316L (1.4404)

- Process connections made from 316L

- Process isolating diaphragm made from Al₂O₃ aluminum-oxide ceramic, (Ceraphire®), ultrapure 99.9 %

PMP21:

- Housing made from 316L (1.4404)

- Process connections made from 316L (1.4404)

- Process isolating diaphragm made from 316L (1.4435)

Options

PMC11:

- Certificate of calibration
- Cleaned from oil+grease

PMP11:

- Certificate of calibration
- Cleaned from oil+grease

PMC21:

- Ex approvals
- Marine certificate
- Min. alarm current setting
- 3.1 Material certificates
- Certificate of calibration
- Cleaned from oil+grease
- Cleaned for O₂ service

PMP21:

- Ex approvals
- Marine certificate
- Min. alarm current setting
- 3.1 Material certificates
- Certificate of calibration
- Cleaned from oil+grease

Product design

Overview	Position	Description
	A	Valve plug
	B	Cable
	C- 1	M12 plug Housing cap made of plastic
	C- 2	M12 plug For Ex ec and IP69: metal housing cap
	D E	Housing Process connection (sample illustration)

System integration

The device can be given a tag name (max. 32 alphanumeric characters).

Designation	Option ¹⁾
Measuring point (TAG), see additional specifications	Z1

1) Product Configurator order code for "Marking"

Input

Measured variable	Measured process variable
	<ul style="list-style-type: none"> ■ PMC11: Gauge pressure ■ PMP11: Gauge pressure → ■ PMC21: Gauge pressure or absolute pressure ■ PMP21: Gauge pressure or absolute pressure
	Calculated process variable
	Pressure

Measuring range **Ceramic process isolating diaphragm**

Sensor	Device	Maximum Sensor measuring range		Lowest calibratable span ¹⁾	MWP	OPL	Factory settings ²⁾	Option ³⁾
		lower (LRL)	upper (URL)					
		[bar (psi)]	[bar (psi)]					
Devices for gauge pressure measurement								
100 mbar (1.5 psi) ⁴⁾	PMC21	-0.1 (-1.5)	+0.1 (+1.5)	0.02 (0.3)	2.7 (40.5)	4 (60)	0 to 100 mbar (0 to 1.5 psi)	1C
250 mbar (4 psi) ⁵⁾	PMC21	-0.25 (-4)	+0.25 (+4)	0.05 (1)	3.3 (49.5)	5 (75)	0 to 250 mbar (0 to 4 psi)	1E
400 mbar (6 psi) ⁶⁾	PMC11 PMC21	-0.4 (-6)	+0.4 (+6)	0.08 (1.2)	5.3 (79.5)	8 (120)	0 to 400 mbar (0 to 6 psi)	1F
1 bar (15 psi) ⁶⁾	PMC11 PMC21	-1 (-15)	+1 (+15)	0.2 (3)	6.7 (100.5)	10 (150)	0 to 1 bar (0 to 15 psi)	1H
2 bar (30 psi) ⁶⁾	PMC11 PMC21	-1 (-15)	+2 (+30)	0.4 (6)	12 (180)	18 (270)	0 to 2 bar (0 to 30 psi)	1K
4 bar (60 psi) ⁶⁾	PMC11 PMC21	-1 (-15)	+4 (+60)	0.8 (12)	16.7 (250.5)	25 (375)	0 to 4 bar (0 to 60 psi)	1M
6 bar (90 psi) ⁶⁾	PMC11 PMC21	-1 (-15)	+6 (+90)	2.4 (36)	26.7 (400.5)	40 (600)	0 to 6 bar (0 to 90 psi)	1N
10 bar (150 psi) ⁶⁾	PMC11 PMC21	-1 (-15)	+10 (+150)	2 (30)	26.7 (400.5)	40 (600)	0 to 10 bar (0 to 150 psi)	1P
16 bar (240 psi) ⁶⁾	PMC11 PMC21	-1 (-15)	+16 (+240)	6.4 (96)	40 (600)	60 (900)	0 to 16 bar (0 to 240 psi)	1Q
25 bar (375 psi) ⁶⁾	PMC11 PMC21	-1 (-15)	+25 (+375)	10 (150)	40 (600)	60 (900)	0 to 25 bar (0 to 375 psi)	1R
40 bar (600 psi) ⁶⁾	PMC11 PMC21	-1 (-15)	+40 (+600)	8 (120)	40 (600)	60 (900)	0 to 40 bar (0 to 600 psi)	1S

Sensor	Device	Maximum Sensor measuring range		Lowest calibratable span ¹⁾	MWP	OPL	Factory settings ²⁾	Option ³⁾
		lower (LRL)	upper (URL)					
		[bar (psi)]	[bar (psi)]					
Devices for absolute pressure measurement								
100 mbar (1.5 psi) ⁶⁾	PMC21	0	+0.1 (+1.5)	0.1 (1.5)	2.7 (40.5)	4 (60)	0 to 100 mbar (0 to 1.5 psi)	2C
250 mbar (4 psi) ⁶⁾	PMC21	0	+0.25 (+4)	0.25 (4)	3.3 (49.5)	5 (75)	0 to 250 mbar (0 to 4 psi)	2E
400 mbar (6 psi) ⁶⁾	PMC21	0	+0.4 (+6)	0.4 (6)	5.3 (79.5)	8 (120)	0 to 400 mbar (0 to 6 psi)	2F
1 bar (15 psi) ⁶⁾	PMC21	0	+1 (+15)	0.4 (6)	6.7 (100.5)	10 (150)	0 to 1 bar (0 to 15 psi)	2H
2 bar (30 psi) ⁶⁾	PMC21	0	+2 (+30)	0.4 (6)	12 (180)	18 (270)	0 to 2 bar (0 to 30 psi)	2K
4 bar (60 psi) ⁶⁾	PMC21	0	+4 (+60)	0.8 (12)	16.7 (250.5)	25 (375)	0 to 4 bar (0 to 60 psi)	2M
10 bar (150 psi) ⁶⁾	PMC21	0	+10 (+150)	2 (30)	26.7 (400.5)	40 (600)	0 to 10 bar (0 to 150 psi)	2P
40 bar (600 psi) ⁶⁾	PMC21	0	+40 (+600)	8 (120)	40 (600)	60 (900)	0 to 40 bar (0 to 600 psi)	2S

- 1) Highest turn down that can be set at the factory: 5:1. The turn down is preset and cannot be changed.
- 2) Other measuring ranges (e.g. -1 to +5 bar (-15 to 75 psi)) can be ordered with customer-specific settings (see the Product Configurator, order code for "Calibration; Unit" option "J"). It is possible to invert the output signal (LRV = 20 mA; URV = 4 mA). Prerequisite: URV < LRV
- 3) Product Configurator, order code for "Sensor range"
- 4) Vacuum resistance: 0.7 bar (10.5 psi) abs
- 5) Vacuum resistance: 0.5 bar (7.5 psi) abs
- 6) Vacuum resistance: 0 bar (0 psi) abs

Maximum turn down which can be ordered for absolute pressure and gauge pressure sensors

Devices for gauge pressure measurement

- 6 bar (90 psi), 16 bar (240 psi), 25 bar (375 psi): TD 1:1 to TD 2.5:1
- All other measuring ranges: TD 1:1 to TD 5:1

Devices for absolute pressure measurement

- 100 mbar (1.5 psi), 250 mbar (4 psi), 400 mbar (6 psi): TD 1:1
- 1 bar (15 psi): TD 1:1 to TD 2.5:1
- All other measuring ranges: TD 1:1 to TD 5:1

Metal process isolating diaphragm

Sensor	Device	Maximum Sensor measuring range		Lowest calibratable span ¹⁾	MWP	OPL	Factory settings ²⁾	Option ³⁾
		lower (LRL)	upper (URL)					
		[bar (psi)]	[bar (psi)]					
Devices for gauge pressure measurement								
400 mbar (6 psi) ⁴⁾	PMP11 PMP21	-0.4 (-6)	+0.4 (+6)	0.4 (6)	1 (15)	1.6 (24)	0 to 400 mbar (0 to 6 psi)	1F
1 bar (15 psi) ⁴⁾	PMP11 PMP21	-1 (-15)	+1 (+15)	0.4 (6)	2.7 (40.5)	4 (60)	0 to 1 bar (0 to 15 psi)	1H
2 bar (30 psi) ⁴⁾	PMP11 PMP21	-1 (-15)	+2 (+30)	0.4 (6)	6.7 (100.5)	10 (150)	0 to 2 bar (0 to 30 psi)	1K
4 bar (60 psi) ⁴⁾	PMP11 PMP21	-1 (-15)	+4 (+60)	0.8 (12)	10.7 (160.5)	16 (240)	0 to 4 bar (0 to 60 psi)	1M
6 bar (90 psi) ⁴⁾	PMP11 PMP21	-1 (-15)	+6 (+90)	2.4 (36)	16 (240)	24 (360)	0 to 6 bar (0 to 90 psi)	1N
10 bar (150 psi) ⁴⁾	PMP11 PMP21	-1 (-15)	+10 (+150)	2 (30)	25 (375)	40 (600)	0 to 10 bar (0 to 150 psi)	1P
16 bar (240 psi) ⁴⁾	PMP11 PMP21	-1 (-15)	+16 (+240)	5 (75)	25 (375)	64 (960)	0 to 16 bar (0 to 240 psi)	1Q
25 bar (375 psi) ⁴⁾	PMP11 PMP21	-1 (-15)	+25 (+375)	5 (75)	25 (375)	100 (1500)	0 to 25 bar (0 to 375 psi)	1R
40 bar (600 psi) ⁴⁾	PMP11 PMP21	-1 (-15)	+40 (+600)	8 (120)	100 (1500)	160 (2400)	0 to 40 bar (0 to 600 psi)	1S
100 bar (1500 psi) ⁴⁾	PMP21	-1 (-15)	+100 (+1500)	20 (300)	100 (1500)	160 (2400)	0 to 100 bar (0 to 1500 psi)	1U
400 bar (6000 psi) ⁴⁾	PMP21	-1 (-15)	+400 (+6000)	80 (1200)	400 (6000)	600 (9000)	0 to 400 bar (0 to 6000 psi)	1W
Devices for absolute pressure measurement								
400 mbar (6 psi) ⁴⁾	PMP21	0 (0)	0.4 (+6)	0.4 (6)	1 (15)	1.6 (24)	0 to 400 mbar (0 to 6 psi)	2F
1 bar (15 psi) ⁴⁾	PMP21	0 (0)	1 (+15)	0.4 (6)	2.7 (40.5)	4 (60)	0 to 1 bar (0 to 15 psi)	2H
2 bar (30 psi) ⁴⁾	PMP21	0 (0)	2 (+30)	0.4 (6)	6.7 (100.5)	10 (150)	0 to 2 bar (0 to 30 psi)	2K
4 bar (60 psi) ⁴⁾	PMP21	0 (0)	4 (+60)	0.8 (12)	10.7 (160.5)	16 (240)	0 to 4 bar (0 to 60 psi)	2M
10 bar (150 psi) ⁴⁾	PMP21	0 (0)	10 (+150)	2 (30)	25 (375)	40 (600)	0 to 10 bar (0 to 150 psi)	2P
40 bar (600 psi) ⁴⁾	PMP21	0 (0)	+40 (+600)	8 (120)	100 (1500)	160 (2400)	0 to 40 bar (0 to 600 psi)	2S
100 bar (1500 psi) ⁴⁾	PMP21	0 (0)	+100 (+1500)	20 (300)	100 (1500)	160 (2400)	0 to 100 bar (0 to 1500 psi)	2U
400 bar (6000 psi) ⁴⁾	PMP21	0 (0)	+400 (+6000)	80 (1200)	400 (6000)	600 (9000)	0 to 400 bar (0 to 6000 psi)	2W

- 1) Highest turn down that can be set at the factory: 5:1. The turn down is preset and cannot be changed.
- 2) Other measuring ranges (e.g. -1 to +5 bar (-15 to 75 psi)) can be ordered with customer-specific settings (see the Product Configurator, order code for "Calibration; Unit" option "J"). It is possible to invert the output signal (LRV = 20 mA; URV = 4 mA). Prerequisite: URV < LRV
- 3) Product Configurator, order code for "Sensor range"
- 4) Vacuum resistance: 0.01 bar (0.145 psi) abs

Maximum turn down which can be ordered for absolute pressure and gauge pressure sensors

Device	Range	400 mbar (6 psi)	1 bar (15 psi) 6 bar (90 psi) 16 bar (240 psi)	2 bar (30 psi) 4 bar (60 psi) 10 bar (150 psi) 25 to 400 bar (375 to 6000 psi)
PMP11	0.5%	TD 1:1	TD 1:1 to TD 2.5:1	TD 1:1 to TD 5:1
PMP21	0.3%	TD 1:1	TD 1:1 to TD 2.5:1	TD 1:1 to TD 5:1

Output

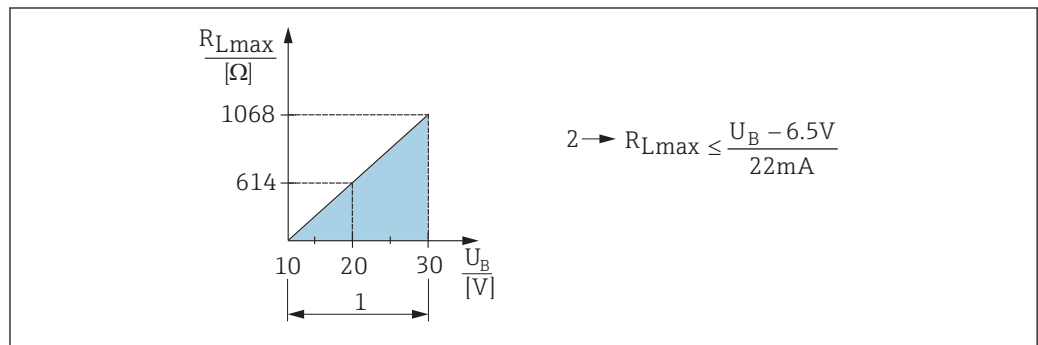
Output signal	Designation	Option ¹⁾
	4 to 20 mA (2-wire)	1
	PMC11: 0 to 10 V output (3-wire) PMP11: 0 to 10 V output (3-wire)	2

1) Product Configurator, order code for "Output"

Signal range 4 to 20 mA 3.8 mA to 20.5 mA

Load (for 4 to 20 mA devices)

In order to guarantee sufficient terminal voltage in two-wire devices, a maximum load resistance R_L (including line resistance) must not be exceeded depending on the supply voltage U_B of the supply unit.



A0029452

- 1 Power supply 10 to 30 V DC
- 2 R_{Lmax} Maximum load resistance
- U_B Supply voltage

Load resistance (for 0 to 10 V devices) The load resistance must be ≥ 5 [kΩ].

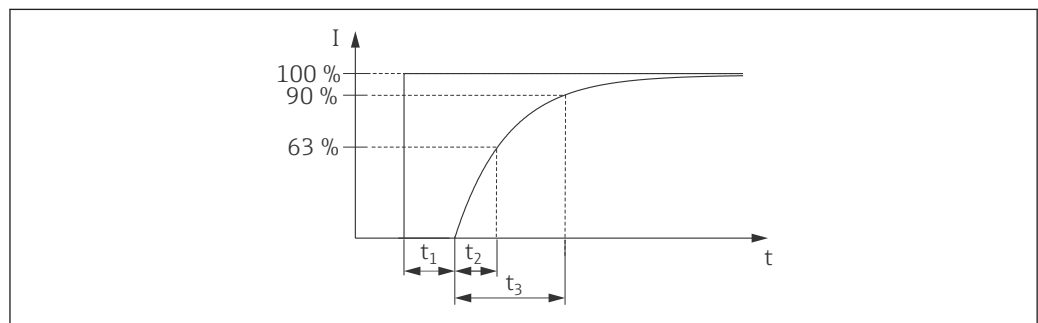
Signal on alarm 4 to 20 mA The response of the output to error is regulated in accordance with NAMUR NE43.
Factory setting MAX alarm: >21 mA

alarm current

Device	Description	Option
PMC21 PMP21	Adjusted min. alarm current	IA ¹⁾

1) Product Configurator order code for "Service"

Dead time, time constant Presentation of the dead time and the time constant:



A0019786

Dynamic behavior

Dead time (t_1) [ms]	Time constant (T63), t_2 [ms]	Time constant (T90), t_3 [ms]
6 ms	10 ms	15 ms

Power supply

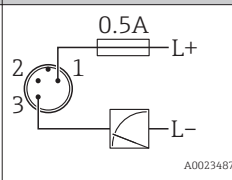
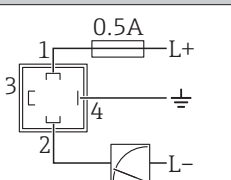
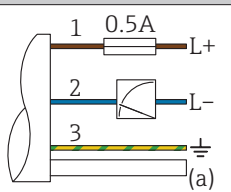
⚠ WARNING

Limitation of electrical safety due to incorrect connection!

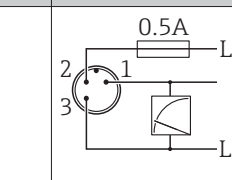
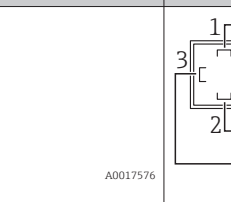
- ▶ In accordance with IEC/EN61010 a separate circuit breaker must be provided for the device .
- ▶ When using the measuring device in hazardous areas, installation must comply with the corresponding national standards and regulations and the Safety Instructions or Installation or Control Drawings.
- ▶ All explosion protection data are given in separate documentation which is available upon request. The Ex documentation is supplied as standard with all devices approved for use in explosion hazardous areas.
- ▶ Protective circuits against reverse polarity, HF influences and overvoltage peaks are integrated.
- ▶ The device must be operated with a 500 mA fine-wire fuse (slow-blow).

Terminal assignment

4 to 20 mA output

Device	M12 plug	Valve plug	Cable
PMC11 PMP11 PMC21 PMP21	 A0023487	 A0022823	 A0023783 1 brown = L+ 2 blue = L- 3 green/yellow = ground connection (a) reference air hose

0 to 10 V output

Device	M12 plug	Valve plug	Cable
PMC11 PMP11	 A0017576	 A0022822	-

Supply voltage

Electronic version	Device	Supply voltage
4 to 20 mA output	PMC11 PMP11 PMC21 PMP21	10 to 30 V DC
0 to 10 V output	PMC11 PMP11	12 to 30 V DC

Current consumption and alarm signal

Number of wires	Device	Normal operation	Alarm signal ¹⁾
2	PMC11 PMP11 PMC21 PMP21	≤ 26 mA	> 21 mA
3	PMC11 PMP11	< 12 mA	11 V

1) For MAX alarm (factory setting)

Power supply fault

- Behavior in the event of overvoltage (>30 V):
The device works continuously up to 34 V DC without damage. If the supply voltage is exceeded, the specified characteristics are no longer guaranteed.
- Behavior in the event of undervoltage:
If the supply voltage falls below the minimum value, the device switches off in a defined manner (status same as for no power supply).

Electrical connection

Degree of protection

Device	Connection	Degree of protection	Option ¹⁾
PMP21 PMP21	Cable 5 m (16 ft)	IP66/68 ²⁾ NEMA type 4X/6P enclosure	A
PMP21 PMP21	Cable 10 m (33 ft)	IP66/68 ²⁾ NEMA type 4X/6P enclosure	B
PMP21 PMP21	Cable 25 m (82 ft)	IP66/68 ²⁾ NEMA type 4X/6P enclosure	C
PMC11 PMP11	M12 plug	IP65 NEMA type 4X enclosure	L
PMC21 PMP21	M12 plug	IP65/67 NEMA type 4X enclosure	M
PMC11 PMP11 PMC21 PMP21	Valve plug ISO4400 M16	IP65 NEMA type 4X enclosure	U
PMC11 PMP11 PMC21 PMP21	Valve plug ISO4400 NPT ½	IP65 NEMA type 4X enclosure	V

- 1) Product Configurator order code for "Electrical connection"
 2) IP 68 (1.83m H2O for 24 h)

Cable specification

For valve plug: < 1.5 mm² (16 AWG) and Ø4.5 to 10 mm (0.18 to 0.39 in)

Residual ripple

The device operates within the reference accuracy up to ±5 % of the residual ripple of the supply voltage, within the permitted voltage range.

Influence of power supply

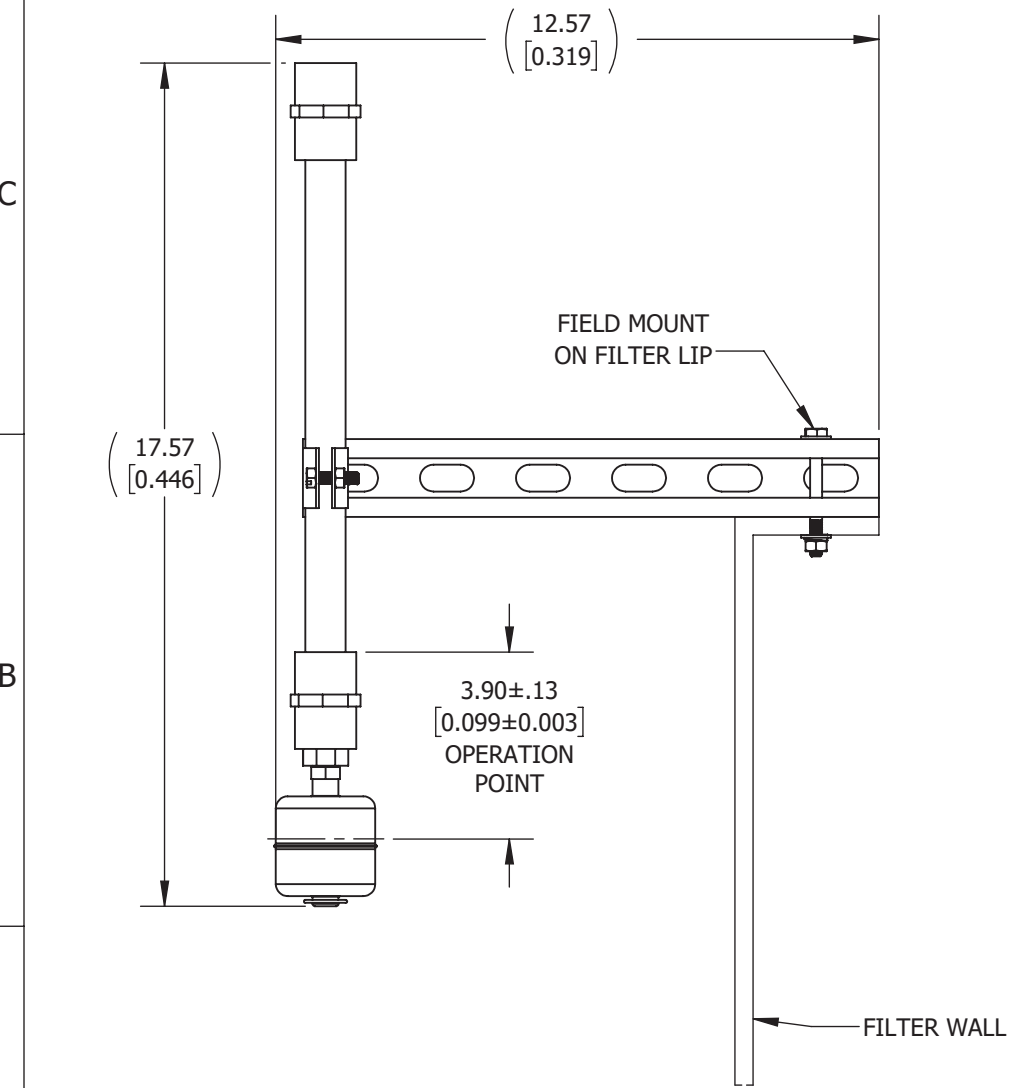
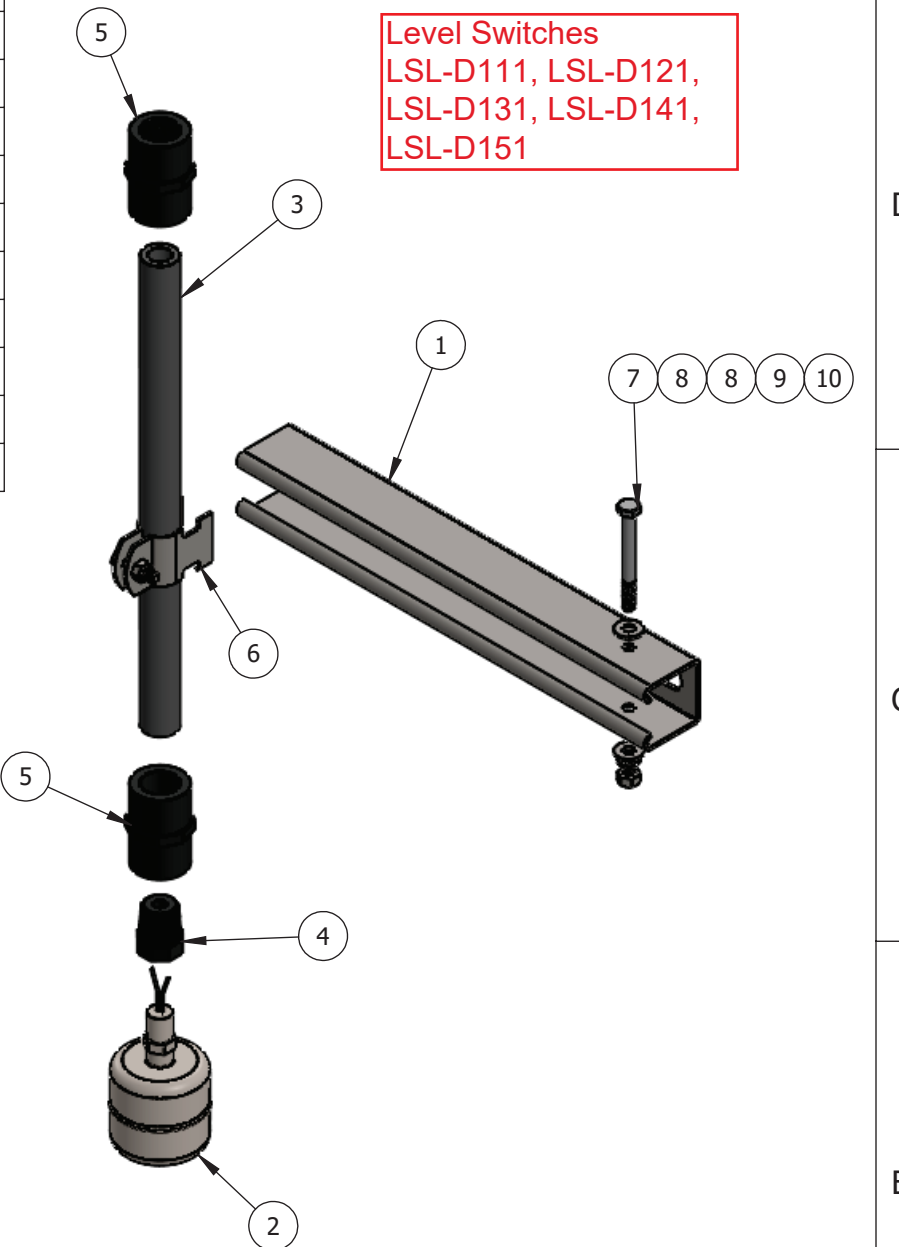
≤0.005 % of the URL/1 V

Overvoltage protection

The device does not contain any special elements to protect against overvoltage ("wire to ground"). Nevertheless the requirements of the applicable EMC standard EN 61000-4-5 (testing voltage 1kV EMC wire/ground) are met.

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ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	S00B.03	Unistrut AG, 1.625", 304SS	1
2	MAD M5600	Float switch, stainless steel, 1/4" NPT, 60 watt	1
3	Pipe, 0.5", PVC, SCH80	Pipe, 0.5", PVC, SCH80	12" [.31m]
4	MCM 4596K402	Thick-Wall Plastic Pipe Fitting for Water Bushing Reducer Adapter, 1/2 NPT Male x 1/4 NPT Female	1
5	MCM 4596K844	Thick-Wall Plastic Pipe Fitting for Water Adapter, 1/2 Socket-Connect Female x 1/2 NPT Female	2
6	MCM 3115T42	Strut-Mount Metal Routing Clamp 304 Stainless Steel, 13/16" ID, 1/16" Thick	1
7	MCM 92198A552	304 Stainless Steel Hex Head Screw 1/4"-20 Thread Size, 2-1/2" Long, Partially Threaded	1
8	MCM 92141A029	304 Stainless Steel Washer for 1/4" Screw Size, 0.281" ID, 0.625" OD	2
9	MCM 92146A029	304 Stainless Steel Split Lock Washer for 1/4" Screw Size, 0.26" ID, 0.487" OD	1
10	MCM 91845A029	304 Stainless Steel Hex Nut 1/4"-20 Thread Size	1



- NOTES:
1. USE ANTI-SEIZE ON ALL FASTENERS
 2. BREAK ALL SHARP EDGES, CORNERS, AND BURRS
 3. USE TEFLON TAPE/PASTE ON ALL NPT CONNECTIONS
 4. USE PVC PRIMER AND CEMENT FOR ALL SLIP CONNECTIONS



REVISIONS			
REV.	DESCRIPTION	ENGINEER	DATE
01	INITIAL RELEASE	MS	2020-12-14
02	ADDED DUAL DIMENSIONS	MS	2021-03-23
03	NEW DUAL DIMENSIONS	MS	2021-03-24

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UNLESS OTHERWISE SPECIFIED
 DIMENSIONS ARE IN INCHES [m]
 TOLERANCES:
 00.0 OR X/X ± .125" [N/A]
 00.00 ± .05" [.01m]
 00.000 ± N/A [.001m]
 00.0° ± 2.0° [2.0°]
 THIRD ANGLE PROJECTION

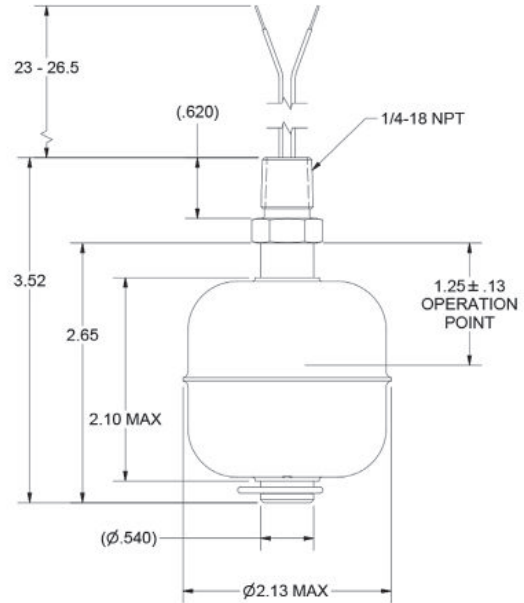
LOCATION: ID Std. Drawings		SCALE 1:4	
DESCRIPTION: Level Switch, AG			
AUTH.	MS, 2021-03-24	CHKD.	N/A, 2021-03-24
NUMBER: S00B.01		REV. 03	PAGE 1/1

TEMPLATE LAST MODIFIED: 08.05.19

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Madison Home » Point Level Float Switch Series » Float switch, stainless steel, 1/4" NPT, 60 watt

Level Switches:
LSL-D111, LSL-D121,
LSL-D131, LSL-D141,
LSL-D151



Applications:

- Detects high/low levels in a container
- 316 SS is frequently used in food processing
- Ideal for high-temperature, medical and petrochemical applications, as well as plating processes
- Suitable in applications where superior corrosion resistance is required
- All NPT vertical switches can be extended with pipe to meet custom tank depths

Related Products:



M5600-PR



M5600-SPDT



MS5600



MSB5600

View in-stock products ready to ship today at Madisonco.com/buy

Specifications:

Approvals	CE, UL Haz. Loc., CSA Haz. Loc., NSF
Electrical Ratings	240 VAC, 0.40A; 120 VAC, 0.50A; 120 VDC, 0.20A; 24 VDC, 0.50A
Float Material	316 Stainless Steel
Float SG	0.55
Lead Wires	24", 22 AWG, Teflon Insulated
Max Pressure	200 PSI
Max Temperature	392°F (200°C)
Mounting	1/4" NPT
Note	Electrical Switch Ratings are shown for resistive loads as tested by UL at different voltages. See our Electrical Considerations for typical inductive or capacitive load considerations. The wire clips are made to be removed and replaced up to 10 times, while maintaining a holding force of 3 lb.
Stem Material	316 Stainless Steel
Switch Rating	60 Watt, SPST
Type	Full Size Switch

Ships same day EST (Eastern Standard Time), normal shipping hours apply

View and buy online:

<https://www.madisonco.com/products/m5600-float-switch-stainless-steel-1-4-npt-60-watt>

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BV-D111, BV-D121, BV-D131,
BV-D141, BV-D151



Submittal Data Sheet

Date: 07/25/2023

Nexom (US) Inc.
Attn: MIKE ENGLE
CAN

QUOTE NUMBER 299849-01
REV

PROJ. Aberdeen ID - Butterfly Valves

Fact. ITEM	Cust. ITEM	QTY	DESCRIPTION
1		5	BAW,6,F1,CI,EPDN-EPDM,150B,DI-S2*DXX872
Style		BAW	DeZURIK AWWA C504 3-72"; C516 78" and larger Rubber Seated Butterfly Valve
Size		6	6 Inch (150mm)
End Connection		F1	Flanged, Drilled to ASME B16.1 Class 125/150
Body Material		CI	Cast Iron, ASTM A126 Class B
Packing		EPDN	EPDM (Terpolymer of Ethylene Propylene and a Diene), Self-Adjusting Multiple V-Ring; -20 to 290°F (-29 to 143°C)
Seat Material		EPDM	EPDM (Terpolymer of Ethylene Propylene and a Diene); -20 to 290°F (-29 to 143°C)
Service Class		150B	AWWA Class 150B
Disc		DI	Ductile Iron, ASTM A536 Grade 65-45-12 (3" - 24" (80-600mm) Class 150B/250B, 28" - 72" (700-1800mm) Class 25A, 75B & 150B & 28" - 48" (800-1200mm) Class 250B) and Grade 80-55-06 (54" - 72" (1400-1800mm) Class 250B), Type 316 Stainless Steel Seating Edge (3" - 20" (80-500mm) =ASTM A276, 24" and larger (600mm & larger) - ASTM A240)
Shaft		S2	316 Stainless Steel, ASTM A276
Coating or Paint		S30SC0	8 mils minimum (non-stainless steel parts) of Blue DeZURIK Epoxy (NSF Std. 61) on Interior and Standard (SP10) surface prep AND Blue DeZURIK Epoxy (NSF Std. 61), and on Exterior with Standard (SP10) surface prep
Modification		DXX872	PR-R1A-SC6-R-60 POWERRAC SPRING TO CLOSE CYLINDER ACTUATOR

VALVE SIZE	DIMENSIONS										
	INCHES						MILLIMETERS				
	A	B	C	D	E	F	G	H	J	K	L
3	5.00 127	.81 21	4.00 102	4.81 122	6.00 152	.75 19	4	N/A	N/A	N/A	7.50 191
4	5.00 127	1.00 25	4.75 121	5.56 141	7.50 191	.75 19	4	5/8-11 UNC	4	1.06 27	9.00 229
6	5.00 127	1.06 27	6.03 153	7.00 178	9.50 241	.88 22	4	3/4-10 UNC	4	1.28 33	11.00 279
8	6.00 152	1.19 30	7.16 182	8.31 211	11.75 298	.88 22	8	N/A	N/A	N/A	13.50 343

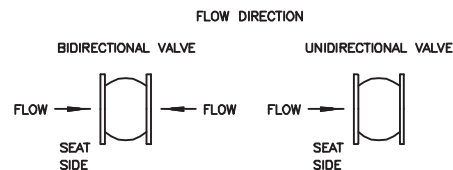
ACTUATOR NUMBER	DIMENSIONS				
	INCHES MILLIMETERS				
	M	N	P	R	S
PR_-R1_-SC4-R-60	3.88 99	4.50 114	12.12 308	21.00 533	3.50 89
PR_-R1_-SC6-R-60	4.94 125	6.62 168	12.62 321	21.88 556	3.50 89

ACTUATOR SIZING IS DEPENDENT ON SHUT OFF PRESSURE DROP

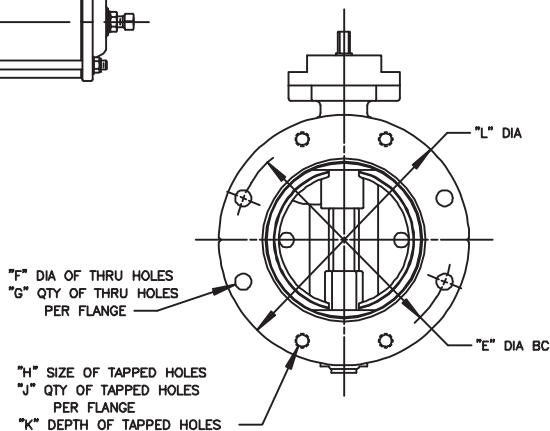
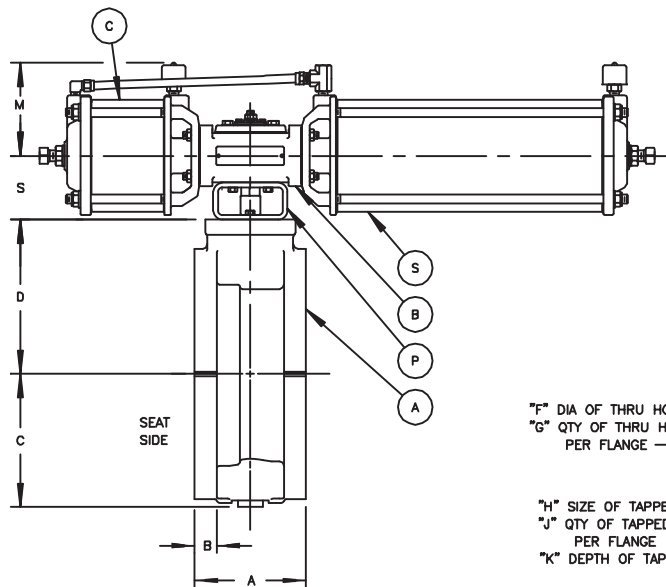
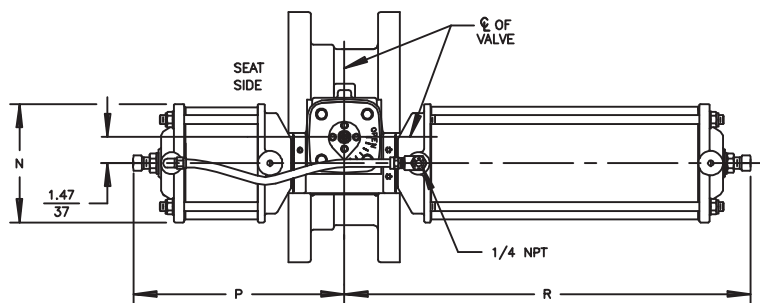
A	VALVE
B	ACTUATOR
C	CYLINDER
P	CONNECTING PARTS
S	SPRING CYLINDER

NOTE:

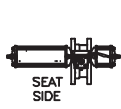
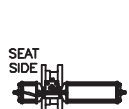
1. FLANGES ARE FLAT FACED WITH DIMENSIONS AND DRILLING TO ANSI B16.1 CLASS 125 EXCEPT FOR TAPPED HOLES AS INDICATED. SEE A-26506 FOR NON-ANSI FLANGE DATA.



NOTICE
THIS DRAWING DOES NOT SHOW ACTUATOR ACCESSORIES. IF ACCESSORIES ARE REQUIRED, REFER TO THE APPROPRIATE ACCESSORY INSTALLATION DRAWING FOR DIMENSIONS AND OTHER RELATED INFORMATION.



ACTUATOR MOUNTING POSITIONS



STANDARD POSITION SHOWN ON THIS DRAWING

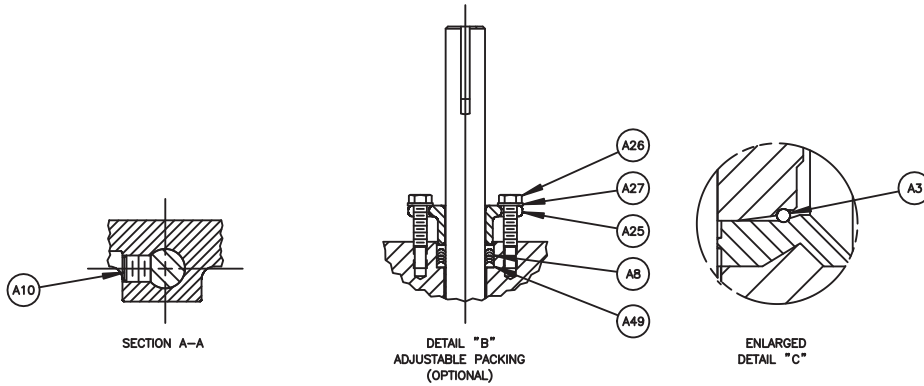
Q	L	M	D	C	B	A
50312	09/20/15	01/30	05/14/07			

DeZURIK
Sartell, MN USA 56377
www.dezurik.com

DOCT. CODE	DRAWN	APPROVED
C1	CHECKED	DATE
	CMW	GK
	GK	10/09/97

J51455

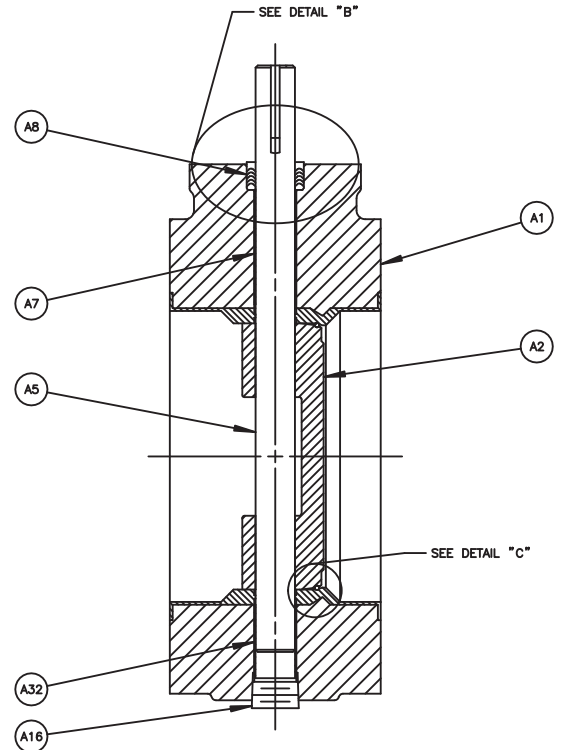
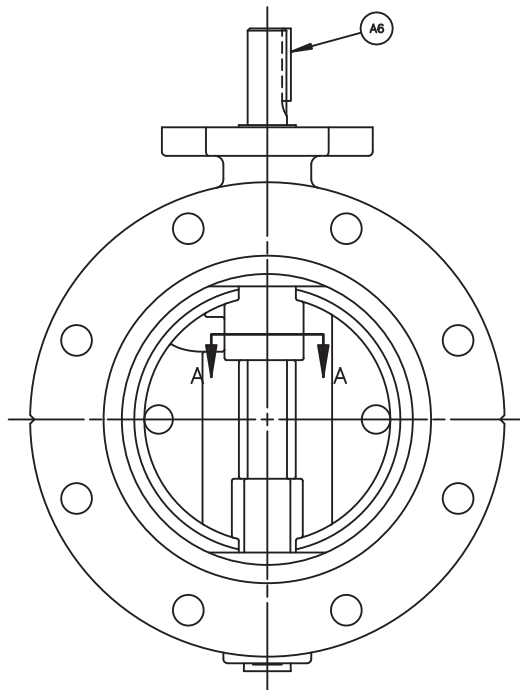
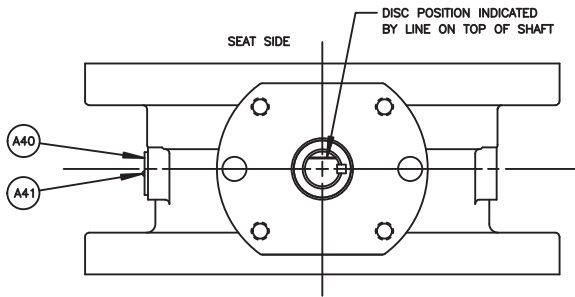
BAW BUTTERFLY VALVES SIZE 3 - 8 FLANGED
POWERACC PR_-R1_-SC_-R-60 SPRING RETURN CYL ACT'R,
REVERSE ACTING (SPRING-TO-CLOSE)



NO	PART NAME	QTY
A1	BODY	1
A2	DISC	1
A3	SEAT RING	1
A4		
A5	SHAFT	1
A6	KEY	1
A7	BEARING (UPPER JOURNAL)	1
A8	PACKING	-
A9		
A10	TORQUE PLUG	1
A11		
A12		
A13		
A14		
A15		
A16	PLUG	1
A25	GLAND	1
A26	SCREW	2
A27	WASHER	2
A32	BEARING (LOWER JOURNAL)	1
A40	VALVE CLASSIFICATION PLATE (WHEN REQ'D)	1
A41	DRIVE SCREW (USED WITH A40)	2
A49	SUPPORT RING (PTFE PACKING ONLY)	1

NOTE:

1. WHEN ORDERING PARTS, INCLUDE VALVE SIZE AND PART NUMBER FROM DATA PLATE. ALSO INCLUDE THIS DRAWING NUMBER WITH PART NAME, NUMBER AND QUANTITY.
2. REPLACEABLE WEAR PARTS ARE ITEMS NO A7, A8 AND A32.



F	7/28/02	07/14/02
E	01/08/02	01/07/04
D	02/25/02	12/14/02
C	01/26/02	07/14/02
B	01/19/02	02/13/04
A	09/15/02	02/20/02



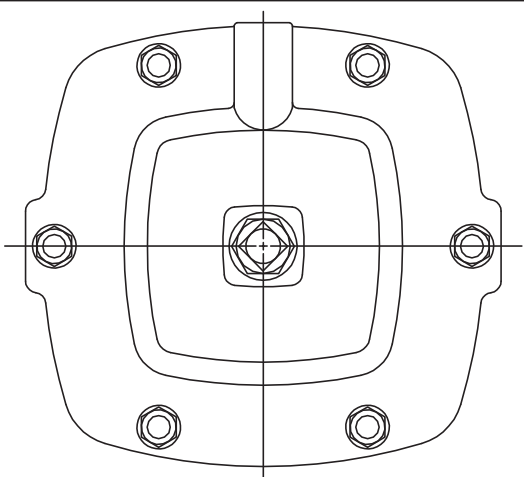
www.dezurik.com

BAW BUTTERFLY VALVES SIZE 3 - 12
FLANGED VALVE ASSEMBLY

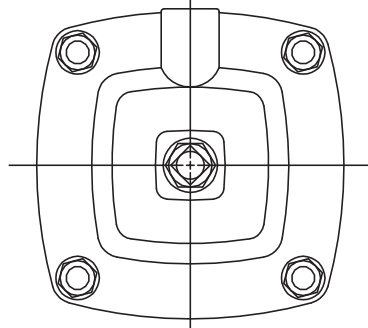
DCCT. CODE	DRAWN	APPROVED	WCB
C1	CHECKED	DATE	09/11/96

A47525

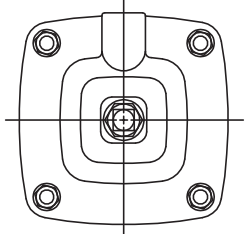
NO	PART NAME	QTY
S1	CYLINDER HEAD	1
S2	BEARING	1
S3	ROD SEAL (1 SEAL & 2 BACKUP RINGS)	1
S4	PISTON ROD	1
S5	O-RING (CYLINDER TUBE)	2
S6	TUBE	1
S7	PISTON	1
S8	O-RING (PISTON)	1
S9	SEAL (PISTON)	1
S10	NUT	1
S11	CYLINDER CAP	1
S12	TIE ROD (SC4, SC4A, SC6 & SC6_ CYL)	4
S12	TIE ROD (SC8 CYL)	6
S13	WASHER (SC4, SC4A, SC6 & SC6_ CYL)	4
S13	WASHER (SC8 CYL)	6
S14	O-RING (PISTON ROD)	1
S15	LOCK NUT (SC4, SC4A, SC6 & SC6_ CYL)	4
S15	LOCK NUT (SC8 CYL)	6
S16	THREAD SEAL (CYLINDER CAP)	-
S17	JAM NUT	1
S18	STOP SCREW	1
S19	SPRING ASSEMBLY	1
S21	BREATHER	1
S22	IDENTIFICATION TAG (EXCEPT SC4A & SC6_)	1
S23	WARNING TAG	1



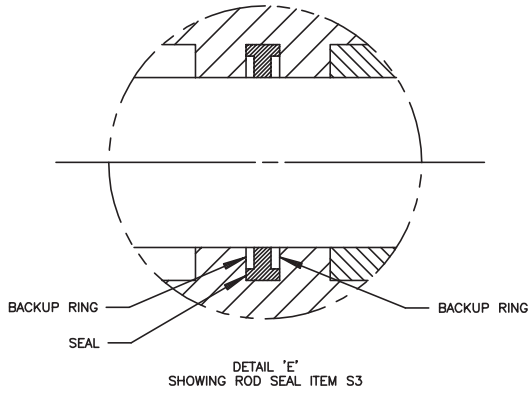
SC8 CYLINDER
VIEW B - B



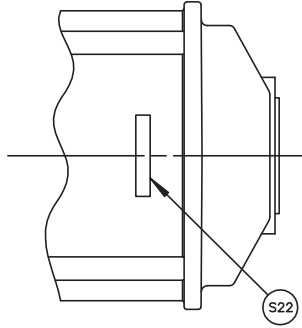
SC6 & SC6_ CYLINDER
VIEW B - B



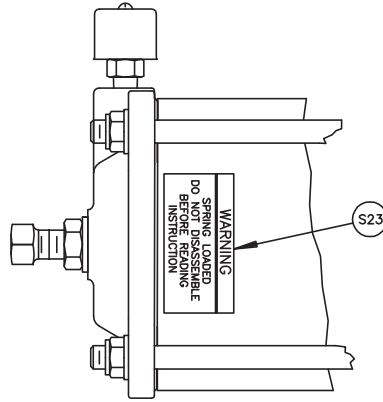
SC4 & SC4A CYLINDER
VIEW B - B



DETAIL 'E'
SHOWING ROD SEAL ITEM S3



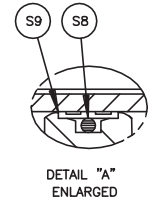
VIEW C - C



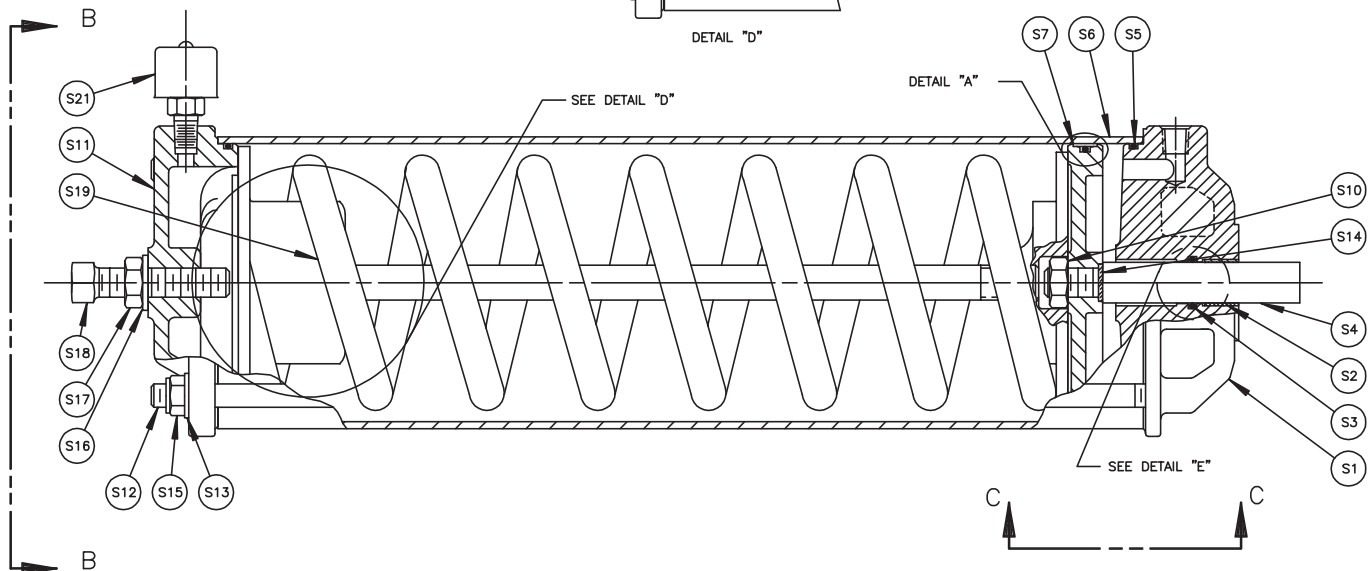
DETAIL 'D'

NOTE:

1. WHEN ORDERING PARTS, INCLUDE VALVE SIZE AND PART NUMBER FROM DATA PLATE. ALSO INCLUDE THIS DRAWING NUMBER WITH PART NAME, NUMBER AND QUANTITY.
2. RECOMMENDED SPARE PARTS ARE ITEMS NO S3, S5, S8, S9, S14 AND S16.



DETAIL 'A'
ENLARGED



G	63158	06/17/18
F	61100	08/28/09
E	54529	09/22/08
D	52386	05/18/03
C	51949	06/17/92
B	51903	03/27/92
A	50032	10/22/91

DeZURIK
Sartell, MN USA 56377
www.dezurik.com

SC4, SC4A, SC6, SC6_ & SC8 SPRING RETURN CYLINDER ASSEMBLY FOR USE WITH POWER RAC SPRING RETURN CYLINDER ACTUATORS			
DOCT. CODE	DRAWN	APPROVED	DT
C1	CHECKED	DATE	09-04-91
	TNB		A39532



RECOMMENDED LONG & SHORT TERM STORAGE PROCEDURES

LONG TERM STORAGE (6 MONTHS +)

1. All valves shall be stored in the position in which they were shipped.
2. Valves shall be stored fully enclosed in a crate or on a skid. It is acceptable to store the valves uncrated but protected from any dirt, debris or UV exposure as long as the environmental conditions as described in item 3 are met. Any desiccant packages received with the original shipment should be replaced before putting valves into long term storage. Please follow your desiccant manufacturer's recommended usage of any desiccant based on the volume of the enclosed area.
3. Valves shall be stored in a well ventilated, clean, dry indoor facility on skids or raised racks with temperatures ranging from 35°F to 95°F (2°C to 35°C) with humidity levels not exceeding 50%.
4. If the above conditions cannot be met, valves shall be separately packaged inside sealed heavy duty plastic sheeting and a weather resistant enclosure, or a standard crate lined with moisture proof paper, to protect the valves from dirt, debris and UV exposure. Desiccant packages shall be used to control moisture both inside the enclosure and the sealed heavy duty plastic covering. Please follow your desiccant manufacturer's recommended usage of any desiccant based on the volume of the enclosed area.
5. Do not store valves next to operating electric motors or equipment which may emit ozone, which can cause deterioration of valve elastomers. Store in an environment with less than 0.1 ppm concentration, at least 25 feet from ozone emitting devices, with ventilation.
6. Valves with cylinder actuators and control valves which are stored for extended periods may be subject to cylinder blow-by caused by permanent distortion of any of the seals. Valves should be operated prior to installation and damaged seals replaced. If possible, it is recommended that cylinders be cycled every 4-6 months to maintain seals.
7. Valves with electric motor operators shall be stored in accordance with the individual motor manufacturer's recommended long term storage procedures.
8. All electrical components shall be visually inspected prior to valve installation.

SHORT TERM STORAGE (LESS THAN 6 MONTHS)

1. All valves shall be stored in the position in which they were shipped.
2. Valves shall be protected from dirt, debris, excessive moisture and UV exposure. Store at temperatures ranging from 35°F to 95°F (2°C to 35°C) with humidity levels not exceeding 50%.



Pneumatic System

Revision 00

This Document Contains:

- Compressor Cutsheet
- Filtration Cutsheet
- Refrigerated Dryer Cutsheet
- Regulator Cutsheet

Equipment Data					
Item	Power Supply	Rating (CFM)	Size	Weight	Manufacturer
Compressor	460VAC	34.7	71X32X55	895 lbs	Gardner-Denver
Filtration	N/A	35	11.05x4.13	8.3 lbs	Gardner-Denver
Dryer	115/1/60	42	38X32X20	251 lbs	Gardner-Denver

CMP-D611

Gardner Denver

2-30 HP | RECIPROCATING AIR COMPRESSORS

R-Series





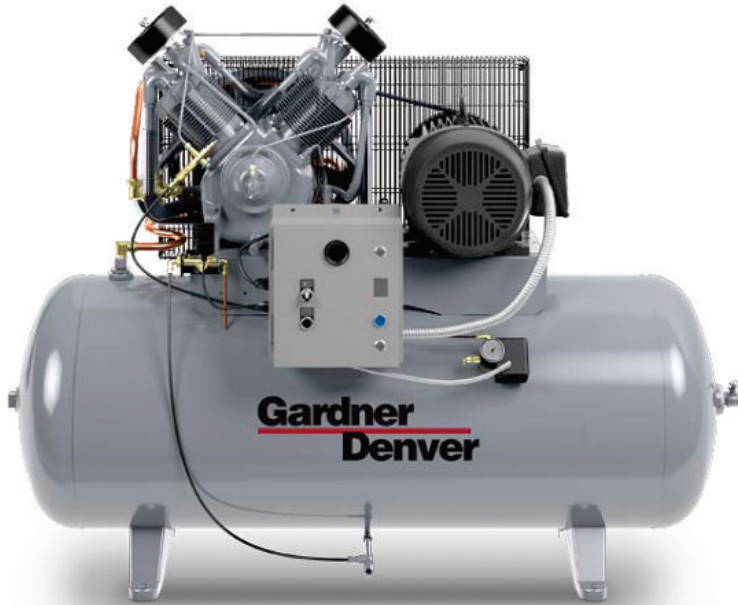
Customized **Solutions**, Unparalleled Performance

A Winning Combination

Gardner Denver compressors are proven units, known for their reliability over decades of use. We know our products and understand how they operate in many different applications and environments. No matter the application, Gardner Denver gets the job done.

The Solution to Your Application

Gardner Denver R-Series Compressors have a time-tested, proven design. Rugged standard features, a wide selection of configurations, and premium quality available options make the R-Series compressors the solution to your application. Delivering high performance, long life and tremendous value—Gardner Denver compressors are the proven choice!



Units Shown with Optional Accessories

- Air-Cooled Aftercooler
- Electric Tank Drain
- Hour Meter
- Test/Off/Auto Switch
- High Temp Switch
- Dual Control
- Low Oil Stop Control
- Mounted Dryer—AirStation



Splash-Lubricated R-Series

Multi-Finned Cylinders

Cooler operating temperatures result in longer life and consistent performance over time.

Integral Cylinder/Head

Gasketless design eliminates the possibility of blown head gaskets for trouble-free operation.

Balanced Pistons

Aluminum alloy first-stage piston and cast iron second-stage piston ensure proper balance.

Piston Rings

Two high efficient lap joint compression rings with bi-directional seal provide the most efficient air delivery.

Lightweight Connecting Rods

High-density, die-cast aluminum alloy rods minimize reciprocating weight. An integral, precision-bored crankpin bearing and needle bearing for the wrist pin minimize friction and properly distribute loads for extremely long life.

Pressure Relief Valves

Located in interstage and discharge.

Large Capacity Crankcase

Rugged cast iron oil reservoir has convenient sight gauge glass, corner oil fill boss and large oil drain.

Intercoolers

Large diameter finned tubing is positioned to obtain the greatest cooling effect between stages for maximum compressor efficiency.

Optimized Cooling Fan/Flywheel

Precision balanced flywheel has fan blades for optimum compressor cooling and life.

Reliable, High-Flow Disc Valves

Single-unit, disc-type valves provide low lift and long life. Discs are made of corrosion resistant steel, valves are easily serviced by removing the manifolds.

Oversized Main Bearings

Tapered roller-type main bearings provide full contact and support of the crankshaft plus deliver the longest possible life.

Balanced Crankshaft

Constructed of rugged ductile iron with large diameter throws for minimum bearing loads and large counterweights to minimize vibration.

Loadless Starting

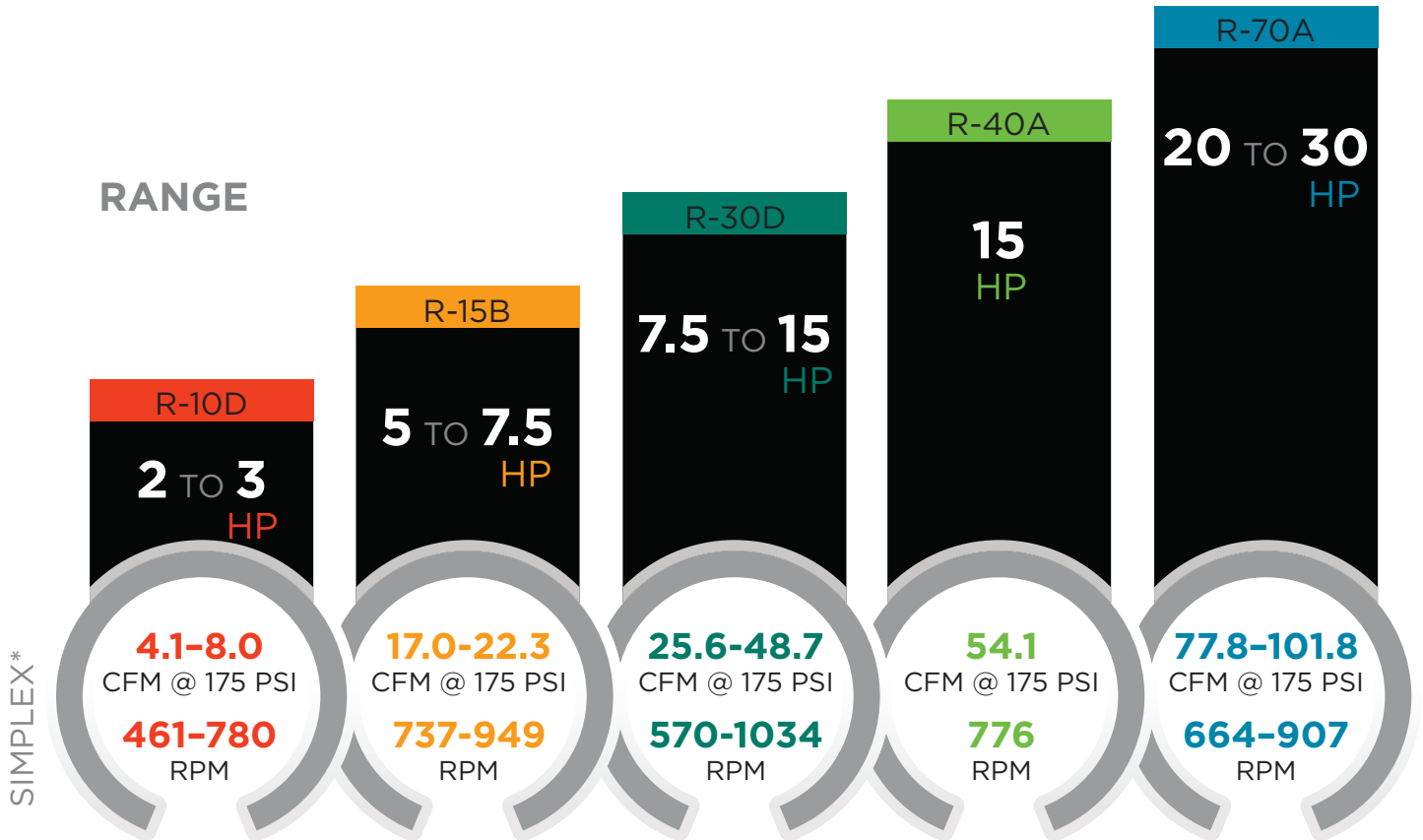
Mechanical governor-type centrifugal unloader assures longer motor life by allowing the compressor to start unloaded every time.

Loaded with rugged features, the R-Series splash-lubricated compressors deliver high performance, long life, and tremendous value.

It's All in the Details



A Complete RANGE



*Double CFM values for Duplex Units.



R-40A



R-70A



R-15B



R-10D



R-30D

AirStation & Lower Pressure Options

Gardner Denver has expanded on its already cutting-edge technology to provide the first reciprocating air compressor AirStation to the marketplace.

What does this mean?

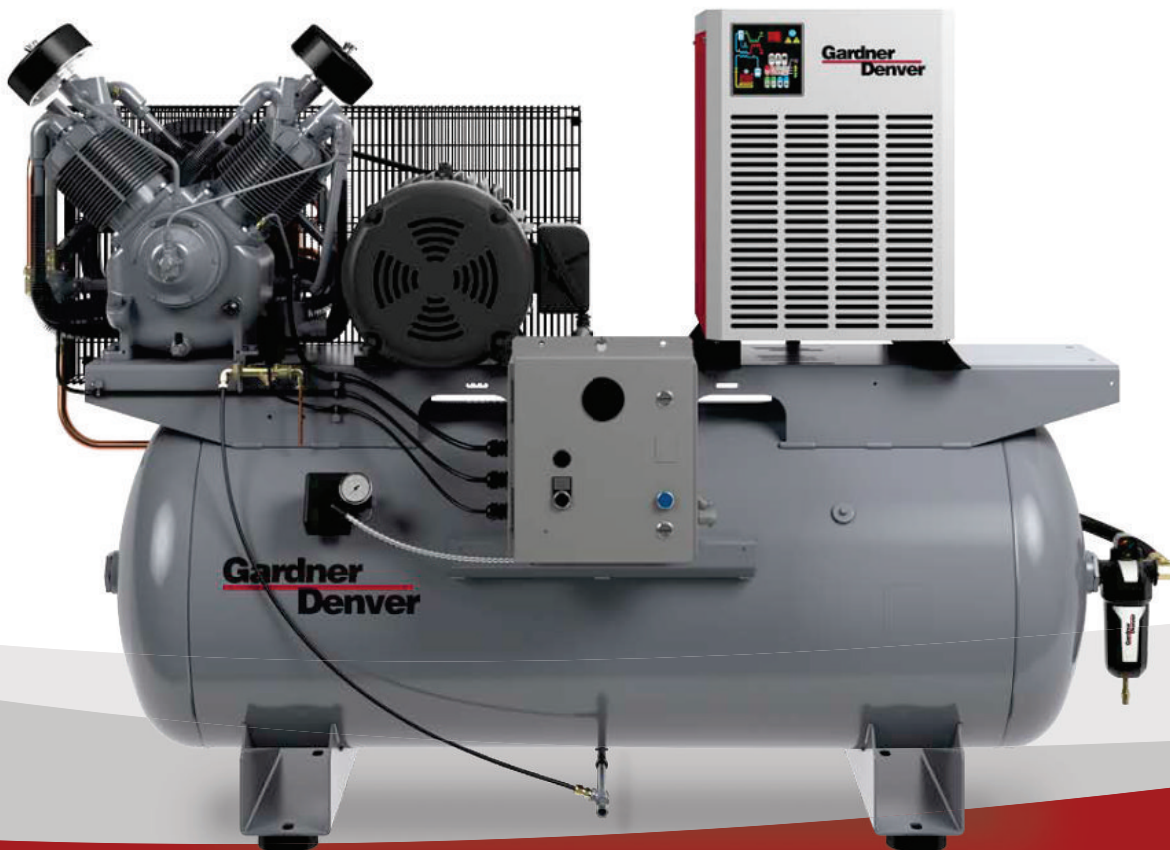
What this means is that a select number of R-Series simplex packages will have the option to have a Gardner Denver Refrigerated XGNC Series dryer mounted to the package, which is referred to as an AirStation.

Benefits to the R-Series AirStation

- Complete plug-and-play system
- Compact design and footprint—less space needed for a complete system
- Less plumbing needed due to the removal of needing a standalone dryer
- All the above = more money saved!
- 3-way bypass valve and X-Series GP filter included with the dryer

AIR STATION MODELS (Models with mounted dryer option)

2-5 HP	7.5 HP	10-15 HP
HR2-8	HR7F-8	HR10-12
HR3F-8	HR7F-12	HR10-24
HR3F-12	HR7-12	HR15F-12
HR5-8	HR7-24	HR15F-24
HR5-12		



XGNC SERIES | NON-CYCLING REFRIGERATED DRYER

MODEL	INLET FLOW		PRESSURE DROP PSI	VOLTAGE**	IN/OUT CONNECTIONS	POWER CONSUMPTION KW	REFRIGERANT	DIMENSIONS H x W x D		WEIGHT	
	SCFM	NM ³ /H						INCHES	MM	LBS	KG
XGNC11	11	19	C/F	115/1/60	3/8" FNPT	0.22	R-134A	16 x 12 x 16	406 x 305 x 406	40	18
XGNC25	25	43	C/F	115/1/60	1/2" FNPT	0.27	R-134A	18 x 16 x 18	457 x 406 x 457	60	27
XGNC32	32	54	C/F	115/1/60	1/2" FNPT	0.49	R-134A	18 x 16 x 18	457 x 406 x 457	62	28
XGNC42	42	71	C/F	115/1/60	1/2" FNPT	0.53	R-134A	18 x 16 x 18	457 x 406 x 457	62	28
XGNC64	64	109	C/F	115/1/60	3/4" FNPT	0.66	R-134A	22.5 x 16.5 x 21.5	572 x 419 x 546	77	35

Performance data presented in accordance with ISO 7183 (Option A2) conditions: 100°F inlet temperature, 100°F ambient temperature and 100 psig conditions.

Overall dimensions include base, threaded conn., elec enclosure protrusions.

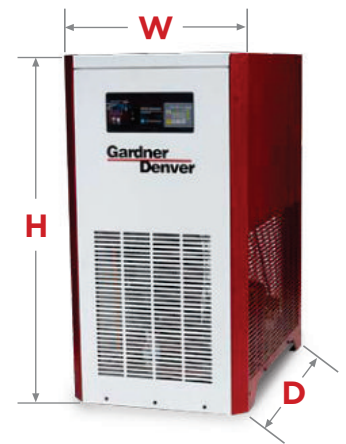
**See pricebook for other voltages.

About the Dryer

Gardner Denver Refrigerated XGNC Series Dryers make providing continuous dry air as easy as piping a self-contained unit into your compressed air supply line. Corrosion-resistant heat exchangers, an enhanced control-system and high-efficiency moisture-separation ensure a steady long-term supply of dry air. This virtually eliminates cost due to ruined product finishes, scrapped materials or replacement of pneumatic tools and manufacturing equipment destroyed by wet air.

Lower Pressure Options

Gardner Denver also offers an 80 PSI setting for all of our R-Series packages, regardless of if a mounted dryer is selected or not. This 80 PSI option is perfect for Climate Control applications.



Meeting your Needs,
Exceeding your
Highest **Expectations**



Customized to Fit Your Application

With multiple unit configurations, tank sizes and variations—along with available options and accessories, Gardner Denver R-Series are built specifically to satisfy your demanding application.

Standard Features

- Load-less starting (via centrifugal unloader) for lower energy costs and less wear on drive motor
- ASME inter-stage pressure relief valve for protection
- ODP NEMA 1760 RPM electric motor
- 10 Micron industrial grade intake filter
- ASME / NB certified receivers
- 0-300 PSIG air pressure gauge on tank
- Available voltages
 - Single phase—115/208-230
 - Three phase—208/230/460/575

Available Options

- Multiple tank sizes and variations
- Electric or engine driven
- NEMA 4 full-voltage starter upgrade
- TEFC motor upgrades
- Control panel upgrades
 - Test/Off/Auto switch
 - Hour Meter
- Air-cooled aftercooler
- Low oil-stop control (NEMA 1/4)
- AirStation on select simplex units (R-10, R-15, R-30)
- Dual control
- Vibration isolators
- Food grade lubricant
- High temperature switch (NEMA 1 or 4)
- Automatic electric tank drain



BARE
COMPRESSOR
PUMP



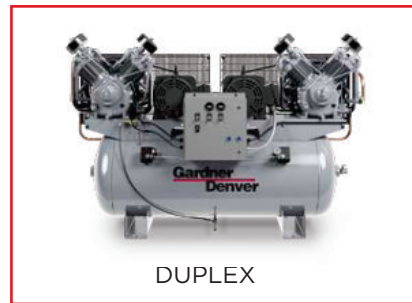
BASE MOUNT



HORIZONTAL



VERTICAL



DUPLEX



AIRSTATION



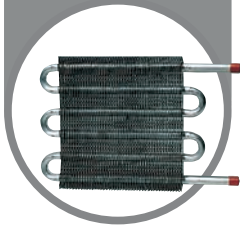
ENGINE DRIVEN

Features and options vary between product configurations as items that may be available on a duplex that are not available for a simplex.



Control Panel

Provides thermal overload protection, and transformer provides reliable low voltage output to the auxiliary components. May be mounted or unmounted.



Air-Cooled Aftercooler

The factory mounted, heavy duty, air-cooled aftercooler effectively reduces up to 65% of the moisture from discharged compressed air.



Automatic Tank Drain

An adjustable electric timed drain automatically discharges moisture from receiver.



Vibration Isolators

Isolates the compressor unit from the foundation or floor. Reduces noise and protects the unit from vibrations that could cause damage.

Other Options

- Dual control will allow the compressor to run either in start/stop or constant speed mode
- NEMA 4 rated parts available
- Alternate voltages and TEFC electric motors

Complete Your Package with **Quality Accessories**

Many options are available to help you develop a Gardner Denver compressor package that exactly matches your specific operating requirements.

Low Oil-Stop Control

Low oil-stop control shuts down the unit when oil levels are below an adequate level. Prevents the unit from restarting until oil level has been restored.



Refrigerated Air Dryer

Cools compressed air to a 33-39° dew point, eliminating additional downstream condensation in the air line. Normally, a dryer should be used in conjunction with an aftercooler. Other refrigerated and desiccant dryer types are available.



Gardner Denver Compressor Lubricants

AEON lubricants are blended specifically for Gardner Denver compressors for use in harsh compressor environments. They are sourced from extremely stable base stocks and enhanced with carefully selected additive packages to provide long life and superior protection. AEON lubricants are suitable for a variety of applications and are available as a mineral, synthetic or food-grade, and come in 55 gallon drums, 5 gallon pails, 1 gallon bottles and 1 quart bottles.



Sales & Service **Distributors** Across America

An Extensive Network

By leveraging the extensive network of Gardner Denver factory-trained authorized local distributors, your sales, service and technical support needs can be handled quickly and easily.



To find a distributor visit:
www.gardnerdenver.com

Convenience & Peace of Mind

Standard Warranty

The standard warranty covers parts and labor on the package components for one year and three years on the compressor pump.

The Gardner Denver philosophy ensures long-lasting, reliable equipment. Our warranty program demonstrates our confidence in our products.

Each new Gardner Denver assembled unit has a 3-year warranty on the compressor pump against defects in materials of workmanship under normal use and service.

*See standard warranty form BU-51 for complete standard warranty details.



Premium Extended Warranty

Purchase a Premium Warranty Kit at the same time as your new Gardner Denver compressor package to receive extended warranty protection. This offer will double the coverage with an additional 3 years of warranty on the compressor pump (parts & labor) providing 6 YEARS of worry free coverage. The Premium Extended Warranty also provides an extra 12 months coverage on the package for a total of 24 months. See Premium Warranty form BU-60 for complete extended warranty details.

- * Premium Warranty kit has all necessary service items (oil & filters) for 6 years of annual maintenance.
- * The use of approved Gardner Denver lubricants are required to maintain the extended warranty period.
- * Duplex machines require two kits, one for each pump.



Pump Model R-10D

R-SERIES | 2-3 HP RECIPROCATING COMPRESSORS

MOTOR HP	TANK CAPACITY GAL	HORIZONTAL PACKAGES			VERTICAL PACKAGES			80 PSI RATING		125 PSI RATING		175 PSI RATING	
		R-SERIES MODEL	UNIT DIMENSIONS L x W x H INCHES	APPROX. SHIP WEIGHT LBS.	R-SERIES R2-30A	UNIT DIMENSIONS L x W x H INCHES	APPROX. SHIP WEIGHT LBS.	RPM	CFM DEL'Y	RPM	CFM DEL'Y	RPM	CFM DEL'Y
2	-	BR2	38 x 25 x 30	220	-	-	-	546	5.6	546	5.5	461	4.1
2	30	HR2-3	43 x 32 x 44	406	-	-	-	546	5.6	546	5.5	461	4.1
2	60	HR2-6	52 x 32 x 49	499	VR2-6	35 x 33 x 77	499	546	5.6	546	5.5	461	4.1
2	80	HR2-8	67 x 32 x 49	564	VR2-8	35 x 27 x 75	564	546	5.6	546	5.5	461	4.1
2 (x2)	80	HR2D-8	75 x 32 x 50	715	-	-	-	546	11.2	546	11.0	461	8.2
2 (x2)	120	HR2D-12	75 x 33 x 57	940	-	-	-	546	11.2	546	11.0	461	8.2
3	-	BR3F	38 x 25 x 30	230	-	-	-	822	9.4	822	9.0	780	8.0
3	30	HR3F-3	43 x 32 x 44	416	-	-	-	822	9.4	822	9.0	780	8.0
3	60	HR3F-6	52 x 32 x 49	509	VR3F-6	35 x 33 x 77	509	822	9.4	822	9.0	780	8.0
3	80	HR3F-8	67 x 32 x 49	574	VR3F-8	35 x 27 x 75	574	822	9.4	822	9.0	780	8.0
3	120	HR3F-12	71 x 32 x 55	746	VR3F-12	43 x 31 x 79	746	822	9.4	822	9.0	780	8.0
3 (x2)	80	HR3DF-8	75 x 32 x 50	725	-	-	-	822	18.8	822	18.0	780	16.0
3 (x2)	120	HR3DF-12	75 x 33 x 54	950	-	-	-	822	18.8	822	18.0	780	16.0

Pump Model R-15B

R-SERIES | 5-7.5 HP RECIPROCATING COMPRESSORS

MOTOR HP	TANK CAPACITY GAL	HORIZONTAL PACKAGES			VERTICAL PACKAGES			80 PSI RATING		125 PSI RATING		175 PSI RATING	
		R-SERIES MODEL	UNIT DIMENSIONS L x W x H INCHES	APPROX. SHIP WEIGHT LBS.	R-SERIES R2-30A	UNIT DIMENSIONS L x W x H INCHES	APPROX. SHIP WEIGHT LBS.	RPM	CFM DEL'Y	RPM	CFM DEL'Y	RPM	CFM DEL'Y
5	-	BR5	38 x 25 x 30	280	-	-	-	780	21.6	780	21.0	737	17.0
5	30	HR5-3	43 x 32 x 44	432	-	-	-	780	21.6	780	21.0	737	17.0
5	60	HR5-6	52 x 32 x 49	525	VR5-6	35 x 33 x 77	525	780	21.6	780	21.0	737	17.0
5	80	HR5-8	67 x 32 x 49	590	VR5-8	35 x 27 x 75	590	780	21.6	780	21.0	737	17.0
5	120	HR5-12	71 x 32 x 55	762	VR5-12	43 x 31 x 79	762	780	21.6	780	21.0	737	17.0
5 (x2)	80	HR5D-8	75 x 32 x 50	755	-	-	-	780	43.2	780	42.0	737	34.0
5 (x2)	120	HR5D-12	75 x 33 x 54	980	-	-	-	780	43.2	780	42.0	737	34.0
7.5	-	BR7F	38 x 25 x 30	310	-	-	-	980	23.7	949	23.0	949	22.3
7.5	60	HR7F-6	52 x 32 x 49	565	VR7F-6	35 x 33 x 77	565	980	23.7	949	23.0	949	22.3
7.5	80	HR7F-8	67 x 32 x 49	630	VR7F-8	31 x 24 x 75	630	980	23.7	949	23.0	949	22.3
7.5	120	HR7F-12	71 x 32 x 55	802	VR7F-12	43 x 31 x 79	802	980	23.7	949	23.0	949	22.3
7.5 (x2)	120	HR7DF-12	75 x 33 x 54	1150	-	-	-	980	47.7	949	46.0	949	44.6
7.5 (x2)	240	HR7DF-24	88 x 38 x 61	1485	-	-	-	980	47.7	949	46.0	949	44.6

Pump Model R-30D

R-SERIES | 7.5-15 HP RECIPROCATING COMPRESSORS

MOTOR HP	TANK CAPACITY GAL	HORIZONTAL PACKAGES			VERTICAL PACKAGES			80 PSI RATING		125 PSI RATING		175 PSI RATING	
		R-SERIES MODEL	UNIT DIMENSIONS L x W x H INCHES	APPROX. SHIP WEIGHT LBS.	R-SERIES R2-30A	UNIT DIMENSIONS L x W x H INCHES	APPROX. SHIP WEIGHT LBS.	RPM	CFM DEL'Y	RPM	CFM DEL'Y	RPM	CFM DEL'Y
7.5	-	BR7	43 x 23 x 29	430	-	-	-	649	31.9	649	28.7	570	25.6
7.5	80	HR7-8	67 x 32 x 49	763	VR7-8	40 x 35 x 77	710	649	31.9	649	28.7	570	25.6
7.5	80S*	-	-	-	VR7-8S*	43 x 38 x 64	753	649	31.9	649	28.7	570	25.6
7.5	120	HR7-12	71 x 32 x 55	882	VR7-12	43 x 30 x 81	882	649	31.9	649	28.7	570	25.6
7.5	240	HR7-24	88 x 33 x 61	1236	-	-	-	649	31.9	649	28.7	570	25.6
7.5 (x2)	120	HR7D-12	83 x 34 x 56	1305	-	-	-	649	63.8	649	57.4	570	51.2
7.5 (x2)	240	HR7D-24	88 x 38 x 61	1675	-	-	-	649	63.8	649	57.4	570	51.2
10	-	BR10	43 x 23 x 29	540	-	-	-	774	35.7	774	34.7	718	33.8
10	80	HR10-8	67 x 32 x 49	776	VR10-8	40 x 35 x 77	723	774	35.7	774	34.7	718	33.8
10	80S*	-	-	-	VR10-8S*	43 x 38 x 64	766	774	35.7	774	34.7	718	33.8
10	120	HR10-12	71 x 32 x 55	895	VR10-12	43 x 30 x 81	895	774	35.7	774	34.7	718	33.8
10	240	HR10-24	88 x 33 x 61	1249	-	-	-	774	35.7	774	34.7	718	33.8
10 (x2)	120	HR10D-12	83 x 34 x 54	1725	-	-	-	774	71.4	774	69.4	718	67.6
10 (x2)	240	HR10D-24	88 x 33 x 61	2325	-	-	-	774	71.4	774	69.4	718	67.6
15	-	BR15F	43 x 23 x 29	550	-	-	-	1029	50.3	1034	49.9	1034	48.7
15	80	HR15F-8	67 x 32 x 49	898	-	-	-	1029	50.3	1034	49.9	1034	48.7
15	120	HR15F-12	71 x 32 x 55	1017	VR15F-12	43 x 30 x 81	1017	1029	50.3	1034	49.9	1034	48.7
15	240	HR15F-24	88 x 33 x 61	1371	-	-	-	1029	50.3	1034	49.9	1034	48.7
15 (x2)	120	HR15DF-12	82 x 34 x 54	1860	-	-	-	1029	100.6	1034	99.8	1034	97.4
15 (x2)	240	HR15DF-24	88 x 38 x 61	2460	-	-	-	1029	100.6	1034	99.8	1034	97.4

Pump Model R-40A

R-SERIES | 15 HP RECIPROCATING COMPRESSORS

MOTOR HP	TANK CAPACITY GAL.	R-SERIES MODEL	DIMENSIONS L x W x H INCHES	APPROX. SHIP WEIGHT LBS.	80 PSI RATING		125 PSI RATING		175 PSI RATING	
					RPM	CFM DEL'Y	RPM	CFM DEL'Y	RPM	CFM DEL'Y
15	-	BR15	50 x 28 x 38	730	903	61.6	903	59.9	776	54.1
15	120	HR15-12	73 x 36 x 62	1210	903	61.6	903	59.9	776	54.1
15	240	HR15-24	90 x 36 x 69	1564	903	61.6	903	59.9	776	54.1
15 (x2)	240	HR15D-24	90 x 54 x 73	2460	903	123.2	903	119.8	776	108.2

Pump Model R-70A

R-SERIES | 20-30 HP RECIPROCATING COMPRESSORS

MOTOR HP	TANK CAPACITY GAL.	R-SERIES MODEL	DIMENSIONS L x W x H INCHES	APPROX. SHIP WEIGHT LBS.	80 PSI RATING		125 PSI RATING		175 PSI RATING	
					RPM	CFM DEL'Y	RPM	CFM DEL'Y	RPM	CFM DEL'Y
20	-	BR20	57 x 44 x 40	1000	712	88.5	712	84.9	664	77.8
20	120	HR20-12	74 x 36 x 65	1517	712	88.5	712	84.9	664	77.8
20	240	HR20-24	90 x 36 x 71	1871	712	88.5	712	84.9	664	77.8
20 (x2)	240	HR20D-24	90 x 67 x 76	2845	712	177.0	712	169.8	664	155.6
25	-	BR25	57 x 44 x 40	1020	907	105.2	907	102.9	776	90.7
25	120	HR25-12	74 x 36 x 65	1557	907	105.2	907	102.9	776	90.7
25	240	HR25-24	90 x 36 x 71	1911	907	105.2	907	102.9	776	90.7
25 (x2)	240	HR25D-24	90 x 67 x 76	2940	907	210.4	907	205.8	776	181.4
30	-	BR30	57 x 44 x 40	1060	907	105.2	907	102.9	907	101.8
30	120	HR30-12	74 x 36 x 65	1597	907	105.2	907	102.9	907	101.8
30	240	HR30-24	90 x 36 x 71	1951	907	105.2	907	102.9	907	101.8
30 (x2)	240	HR30D-24	90 x 67 x 76	3018	907	210.4	907	205.8	907	203.6



AirStations

R-10D: R-SERIES | 2-3 HP AIRSTATION

MOTOR HP	TANK CAPACITY GAL	HORIZONTAL PACKAGES			80 PSI RATING		125 PSI RATING		175 PSI RATING	
		R-SERIES MODEL	UNIT DIMENSIONS L x W x H INCHES	APPROX. SHIP WEIGHT LBS.	RPM	CFM DEL'Y	RPM	CFM DEL'Y	RPM	CFM DEL'Y
2	80	HR2-8	75 x 35 x 50	745	546	5.4	546	5.5	461	4.1
3	80	HR3F-8	75 x 35 x 50	770	822	9.4	822	9.0	780	8.0
3	120	HR3F-12	77 x 36 x 54	879	822	9.4	822	9.0	780	8.0

R-15B: R-SERIES | 5-7.5 HP AIRSTATION

MOTOR HP	TANK CAPACITY GAL	HORIZONTAL PACKAGES			80 PSI RATING		125 PSI RATING		175 PSI RATING	
		R-SERIES MODEL	UNIT DIMENSIONS L x W x H INCHES	APPROX. SHIP WEIGHT LBS.	RPM	CFM DEL'Y	RPM	CFM DEL'Y	RPM	CFM DEL'Y
5	80	HR5-8	75 x 35 x 50	780	780	19.1	780	21.0	737	17.0
5	120	HR5-12	77 x 36 x 54	889	780	19.1	780	21.0	737	17.0
7.5	80	HR7F-8	75 x 35 x 50	855	980	22.8	949	23.0	949	22.3
7.5	120	HR7F-12	77 x 36 x 54	964	980	22.8	949	23.0	949	22.3

R-30D: R-SERIES | 7.5-15 HP AIRSTATION

MOTOR HP	TANK CAPACITY GAL	HORIZONTAL PACKAGES			80 PSI RATING		125 PSI RATING		175 PSI RATING	
		R-SERIES MODEL	UNIT DIMENSIONS L x W x H INCHES	APPROX. SHIP WEIGHT LBS.	RPM	CFM DEL'Y	RPM	CFM DEL'Y	RPM	CFM DEL'Y
7.5	120	HR7-12	83 x 36 x 55	1080	649	31.9	649	28.7	570	25.6
7.5	240	HR7-24	92 x 36 x 62	1230	649	31.9	649	28.7	570	25.6
10	120	HR10-12	83 x 36 x 55	1071	774	38.7	774	34.7	718	33.8
10	240	HR10-24	92 x 36 x 62	1221	774	38.7	774	34.7	718	33.8
15	120	HR15F-12	83 x 36 x 55	1178	1029	50.3	1034	49.9	1034	48.7
15	240	HR15F-24	92 x 36 x 62	1328	1029	50.3	1034	49.9	1034	48.7

Bare Pumps

R-SERIES RECIPROCATING COMPRESSOR

MODEL	# OF CYLINDERS	BORE DIA. INCHES	STROKE INCHES	OIL CAPACITY QUARTS	UNIT DIMENSIONS L x W x H INCHES	APPROX. SHIP WEIGHT LBS.	MINIMUM RPM	MAXIMUM RPM
R-10D	2	4.63 & 2.5	2.5	2	20 x 17 x 24	135	400	1050
R-15B	2	4.63 & 2.5	3	2	20 x 17 x 24	135	400	1050
R-30D	4	4.63 & 2.5	3	4	22 x 24 x 24	240	400	1050
R-40A	2	6.25 & 3.25	4.5	4	26 x 26 x 32	460	425	1000
R-70A	4	6.25 & 3.25	4.5	6.5	27 x 33 x 34	590	425	1000

The leader in every market we serve
by continuously improving all business processes
with a focus on innovation and velocity

**Gardner
Denver**[®]

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GR-R-SERIES 4th Ed. 9/22



FLT-D611, FLT-D612

**Gardner
Denver**

20-21,250 SCFM | GLOBAL AIR TREATMENT

FIL Series



World Class Filtration

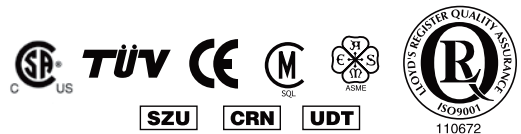
FIL Series Filters provide your compressed air system with premium quality filtration for the three typical contaminant types

- Solid particles come from ambient air contaminants like dust and from rusted, oxidized pipework. They will cause pneumatic equipment to malfunction, cause instrument and control failures, and contaminate end products.
- Condensed water droplets come from the humidity in ambient air. Water will oxidize pipework and pneumatic equipment, ruin paint finishes and end products.
- Liquid oil and oil vapors are introduced by compressor lubricants and by hydrocarbon vapors present in ambient air. Oil-free compressed air is particularly important in food and pharmaceutical processes.



Comply with Pressure Vessel Directives Worldwide

FIL Series Filters utilize housings which conform to most major pressure vessel directives in the Americas, Europe, and Asia.



Innovative Features

An Innovative Design for all Applications

- 1 Slide Indicator**
 - Standard on 20–60 scfm models
 - Changes color based on differential pressure
- 2 Gauge**
 - Standard on 100–21,250 scfm models
 - Dual gauge face allows housings to be mounted in any flow direction
 - Indicates element change-out based on differential pressure
 - Large easy-to-read gauge face
 - Remote mounting possible
- 3 Simple Maintenance**
 - 1/8" turn, self-locking bayonet head to bowl connection (up through 1" connection sizes)
 - Audible warning by escaping air if housing is not depressurized before disassembly
 - Ribbed bowls allow use of C-spanner
 - Color-coded elements for easy identification
- 4 Modular Housings Save Space and Time**
 - Standard on 20–780 scfm models
 - Large flow paths reduce pressure drop
 - Chromated and epoxy powder painted (interior and exterior) add durability and corrosion resistance
 - MWP 300 psig (21 bar)
 - Can be mounted for left or right entry
 - High-quality aluminum, zinc, and steel materials
- 5 Internal Automatic Drains**
 - Reliable discharge of condensate
 - Pilot operated, pneumatically actuated, particulate-resistant mechanism
 - Viton seals and inlet screen for additional protection
- 6 Element Grades Offer Superior Filtration**
 - Large effective surface areas ensure high capture rates
 - Large open areas minimize pressure drop
 - Silicone-free, withstand temperatures to 150° F (66° C)
 - Push-on elements for quick replacement
 - Corrosion resistant, stainless steel cores

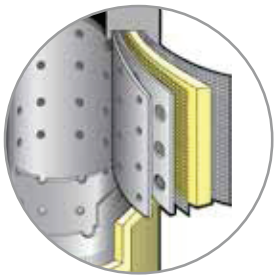


Filter Element Grades

Filter Elements for all Grades of Filtration

Compressed air systems continually challenge filtration with moisture, solid particulates, and liquid oil or oil vapors. FIL Series filter elements represent state-of-the-art filter designs which allow for custom filtration at every installation.

- Inside-to-out air flow maximizes filtration efficiency
- Two-stage filtration ensures long element life
- Stainless steel inner and outer cores add structural integrity
- Uniquely blended coalescing fiber media design
- Coated foam sleeves provide protection against chemical attack
- 100% silicone free, withstand temperatures to 150°F (66°C)

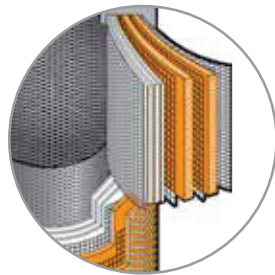


Grade A - Water Separator

Installation: after an air compressors' (or a stand-alone) aftercooler.

Design: One-stage filtration with two stainless steel orifice tubes. Labyrinth style air flow path removes liquid water by forcing abrupt directional changes.

Performance*: Handles bulk liquid inlet loads to 30,000 ppm w/w and provides 10 micron solid particulate separation. Efficient to flows as low as 5% of rated flow.

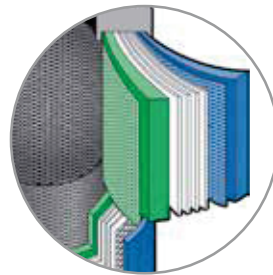


Grade B - Separator/Filter

Installation: after an air compressors' (or a stand-alone) aftercooler or as a prefilter to a refrigerated dryer.

Design: Two-stage filtration with first stage of two stainless steel orifice tubes which remove bulk liquids and solid particulates to 10 micron. Second stage has in-depth coalescing fiber media which captures solid particulates to 3 micron.

Performance*: Handles bulk liquid inlet loads to 25,000 ppm w/w and provides 3 micron solid particulate filtration.



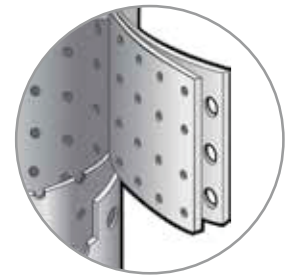
Grade C - General Purpose Filter

Installation: 1 micron particulate prefilter for refrigerated dryers and high efficiency oil removal filters.

Design: Two-stage filtration with a first stage of multiple layers of fiber media which pre-filter the air.

Second stage has in-depth coalescing fiber media which coalesces oil aerosols and removes finer particulates to 1 micron.

Performance*: Handles bulk liquid inlet loads to 2,000 ppm w/w, provides 1 micron solid particulate filtration and oil removal to 1 ppm.



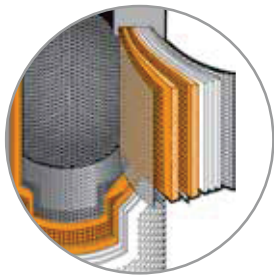
Grade D - Dry Particulate Filter

Installation: Dry, solid particulate afterfilter for heatless desiccant dryers

Design: Two-stage filtration with life-prolonging outside/in air flow with first stage of alternate layers of fiber media and a media screen capturing large particulates.

Second stage captures finer particulates. Not designed for any liquid loading.

Performance*: Provides 1 micron solid particulate filtration of desiccant dust.

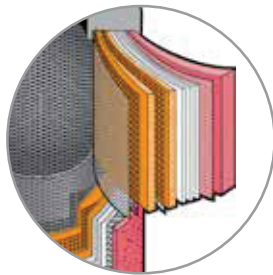


Grade E - High Efficiency Oil Removal Filter

Installation: Prefilter to desiccant and membrane dryers, afterfilter to refrigerated dryers and stand-alone oil removal at the point-of-use of compressed air.

Design: Two-stage filtration with a first stage of multiple layers of fiber media which prefilter the air. Second stage has in-depth coalescing fiber media which coalesces oil aerosols. Includes an outer-coated, closed cell foam sleeve.

Performance*: Handles bulk liquid water inlet loads to 1,000 ppm w/w and provides 0.008 ppm oil aerosol removal and 0.01 micron solid particulate separation.

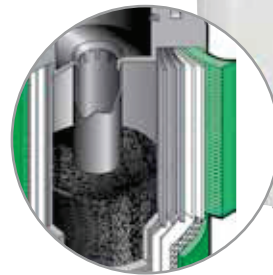


Grade F - Maximum Efficiency Oil Removal Filter

Installation: Prefilter to desiccant and membrane dryers with a Grade C prefilter, oil-free air applications.

Design: Two-stage filtration with a first stage of a coated, closed-cell foam sleeve which acts as a prefilter and flow disperser. Second stage has in-depth coalescing fiber media which coalesces fine oil aerosols. Includes an outer-coated, closed cell foam sleeve.

Performance*: Handles bulk liquid water inlet loads to 100 ppm w/w and provides 0.0008 ppm oil aerosol removal and 0.01 micron solid particulate separation.



Grade G - Oil Vapor Removal Filter

Installation: Afterfilter to high efficiency liquid oil removal filters for true oil-free applications.

Design: Two-stage filtration with a generously-sized first stage of a stabilized bed of carbon particles which remove the majority of the oil vapor. Second stage has multiple layers of fiber media with bonded microfine carbon particles which remove the remaining oil vapors. Includes an outer-coated, closed cell foam sleeve which prevents fiber migration.



Performance**: No liquid should be present at filter inlet. Provides 0.003 ppm w/w oil (as a vapor) removal and 0.01 micron solid particulate separation.

* Filter efficiencies have been established in accordance with CAGI standard ADF400 and are based on 100° F (38° C) inlet temperature

** Filter efficiency has been established in accordance with CAGI standard ADF500 and is based on 100° F (38° C) inlet temperature

ISO 8573.1 Quality Classes

ISO 8573.1 was developed in 1992 by ISO (International Organization for Standardization) to help plant engineers specify desired compressed air quality globally by providing “Quality Classes” for solid particulates, humidity and oil. Quality classes provide engineers with an internationally accepted unit of measure. A typical pharmaceutical plant, for example, would have a compressed air specification of ISO Quality Classes 1.2.1. This is equivalent to 0.1 micron solid contaminants, -40°F (-40°C) dew point, and 0.008 ppm (0.01 mg/m³) oil content filtration.

No matter what language is spoken and what unit of measure is used, using ISO 8573.1 Air Quality Classes ensures that your factory will get the compressed air quality you specified.



QUALITY CLASSES	SOLID CONTAMINANTS (MAX. PARTICLE SIZE) MICRONS	MAXIMUM PRESSURE DEW POINTS °F (°C)	MAXIMUM OIL CONTENT (DROPLETS, AEROSOLS, VAPOR) PPM W/W (MG/M ³)
1	0.1	-94 (-70)	0.008 (0,01)
2	1	-40 (-40)	0.08 (0,1)
3	5	-4 (-20)	0.8 (1)
4	15	38 (3)	4 (5)
5	40	45 (7)	21 (25)
6	-	50 (10)	-

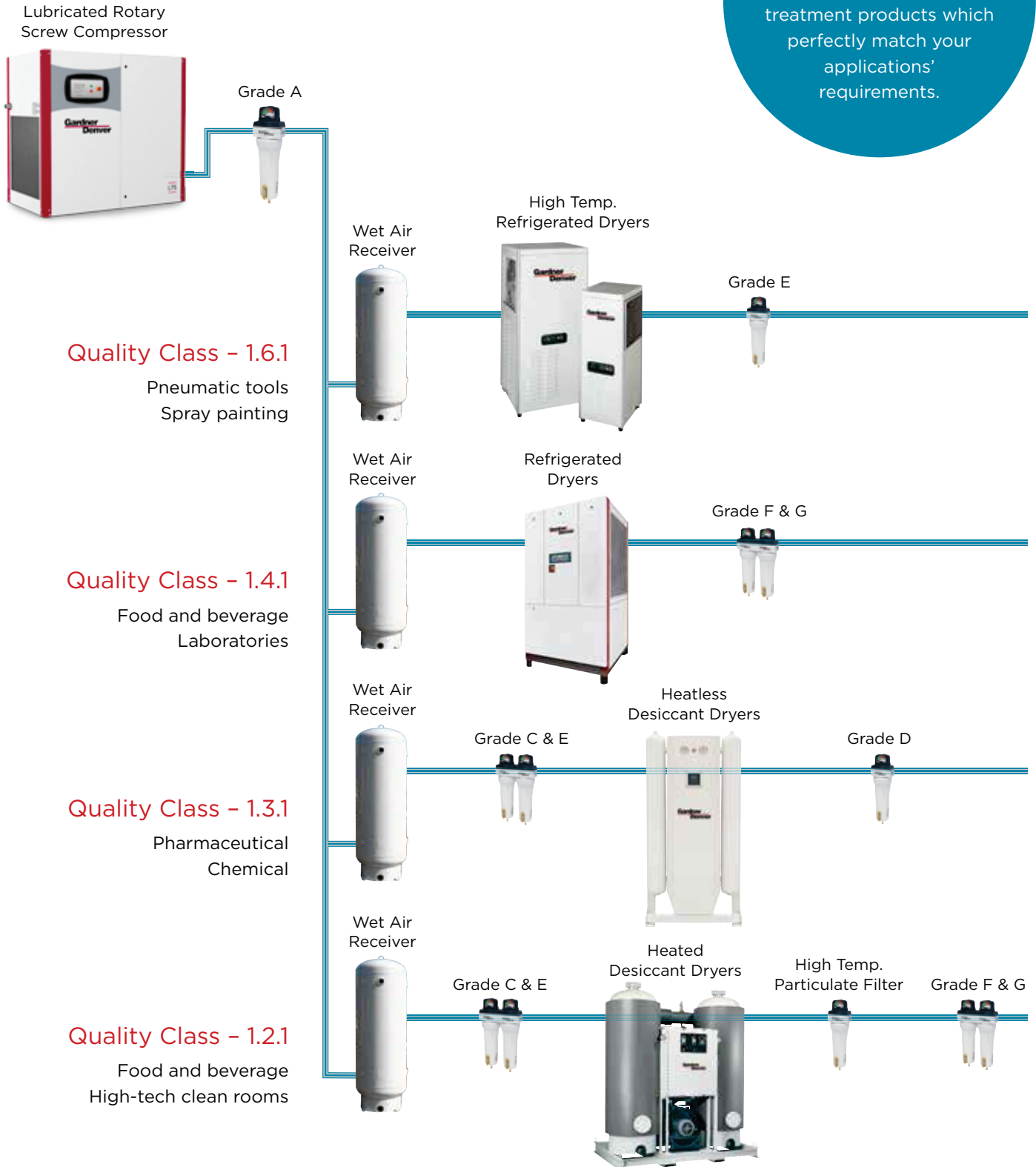
SEVEN FILTRATION GRADES PROVIDE ISO 8573.1 STANDARD AIR QUALITY

FILTER GRADE	DESCRIPTION	FILTRATION ¹			ISO 8573.1 QUALITY CLASSES	
		WATER DROPLETS ² PPM W/W	SOLID PARTICULATES MICRON	OIL REMOVAL PPM W/W	SOLIDS	OIL
A	Water Separator	30,000	-	-	-	-
B	Separator/Filter	25,000	5	5	3	5
C	General Purpose	2,000	1	1	2	4
D	Dry Particulate	-	1	-	2	-
E	High Efficiency Oil Removal	1,000	0.01	0.008	1	1
F	Maximum Efficiency Oil Removal	100	0.01	0.0008	1	1
G	Oil Vapor Removal	-	0.01	0.003	1	1

1) Tested to CAGI ADF400 & ADF500. 2) Maximum inlet liquid load.

Create a Custom Air Treatment System

Maximize system air quality by choosing the combination of Gardner Denver air treatment products which perfectly match your applications' requirements.



REPLACEMENT MODEL GRADE-FEATURES	CAPACITY		CONNECTIONS NPT/ANSI FLG.	STANDARD FEATURES					MAX PRESSURE PSIG [KGF/CM ²] & TEMP °F (°C)		DIMENSIONS						ELEMENT		
	SCFM	M ³ /MIN		A	B	C,E,F	D	G	MANUAL DRAIN	WITH D OR L	HEIGHT IN	MM	WIDTH IN	MM	WEIGHT LB	KG	MODEL-GRADE	QTY	
MODULAR TYPE HOUSINGS	FIL12-11	20	0.57	¾" NPTF	A	A P	A P	P	NONE	300 psig 21 kgf/cm ² 150°F 66°C	250 psig 17.6 kgf/cm ² 150°F 66°C	8.15	207	4.13	105	4.2	1.9	FIL12-E	1
	FIL14-13	35	1.00	½" NPTF								11.05	281	4.13	105	8.1	3.7	FIL14-E	
	FIL16-13	60	1.72	½" NPTF								13.4	340	4.13	105	8.5	3.9	FIL16-E	
	FIL18-15	100	2.9	¾" NPTF	A	A G	A G	G				15.32	389	5.25	133	6.3	2.9	FIL18-E	
	FIL20-17	170	4.9	1" NPTF								19.57	497	5.25	133	6.9	3.1	FIL20-E	
	FIL22-21	250	7.2	1½" NPTF	G			G				22.8	579	6.44	164	10.2	4.6	FIL22-E	
	FIL24-21	375	11	1½" NPTF	(1)	(1)	27.29					693	6.44	164	11.3	5.1	FIL24-E		
	FIL26-23	485	14	2" NPTF	(1)	G (1)	A G	G				31.08	789	7.63	194	28	12.7	FIL26-E	
	FIL28-25	625	18	2½" NPTF								36.83	935	7.63	194	33	15.0	FIL28-E	
	FIL30-25	780	22	2½" NPTF								42.96	1091	7.63	194	38	17.2	FIL30-E	
FIL32-27	625	18	3" NPTM	A	A G	A G	NONE (1)	300 psig 21 kgf/cm ² 150°F 66°C	300 psig 21 kgf/cm ² 150°F 66°C	40.88	1038	10.25	260	36	16.3	FIL32-E	1		
FIL34-27	1,000	29	3" NPTM	(1)	G (1)	G (1)		G	225 psig 15.8 kgf/cm ² 150°F 66°C	225 psig 15.8 kgf/cm ² 150°F 66°C	48.00	1219	16.00	406	91	41.3	FIL34-E	2	
FIL36-27	1,250	36	3" NPTM								48.00	1219	16.00	406	91	41.3	FIL32-E		
FIL38-27	1,875	54	3" NPTM								49.00	1245	16.25	413	120	54.4	FIL32-E	3	
FIL40-29	2,500	72	4" FLG.								52.25	1327	20.00	508	179	81.2	FIL32-E	4	
FIL42-29	3,125	89	4" FLG.								52.25	1327	20.00	508	182	82.6	FIL32-E	5	
FIL44-31	5,000	143	6" FLG.								54.63	1387	24.00	610	271	123	FIL32-E	8	
FIL46-31	6,875	197	6" FLG.								62.56	1589	28.00	711	518	235	FIL32-E	11	
FIL48-31	8,750	250	6" FLG.								62.56	1589	28.00	711	527	239	FIL32-E	14	
FIL50-33	11,875	340	8" FLG.								69.13	1756	33.00	838	709	322	FIL32-E	19	
FIL52-33	16,250	465	8" FLG.				67.94				1726	39.00	991	918	416	FIL32-E	26		
FIL54-35	21,250	608	10" FLG.	70.94	1802	45.88	1165	1412	640	FIL32-E	34								

(1) Drain plugs standard. Externally mounted automatic drains are available.

A - Internal Automatic Drain; E - Electronic Demand Drain; P - Differential Pressure Slide; G - Differential Pressure Gauge; L - Liquid Level Indicator

Sizing Correction Factors

To find the maximum flow at pressures other than 100 psig [7 kgf/cm²], multiply the flow by the Correction Factor corresponding to the minimum pressure at the inlet of the filter. Do not select filters by pipe size; use flow rate and operating pressure.

PSIG	20	30	40	60	80	100	125	150	175	200	250	300
KGF/CM ²	1.4	2.1	2.8	4.2	5.6	7.0	8.8	10.6	12.3	14.1	17.6	21.1
CORRECTION FACTOR	0.30	0.39	0.48	0.65	0.82	1	1.22	1.43	1.65	1.87	2.31	2.74

Gardner Denver®

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GA-FIL 1st Ed. 7/16

Supersedes GA-FIL-100 2nd Ed. 9/15

Please recycle after use.

AD-D611

Gardner Denver

10-1200 SCFM | NON-CYCLING DRYER

RGD Series



Refrigerated Global Design

RGD series refrigerated air dryers offer the perfect balance between technology and simplicity to dry compressed air systems to a stable ISO 8573-1 Air Quality, Class 4 to 5 pressure dew point.



Design Features

RGD 10-50 SCFM

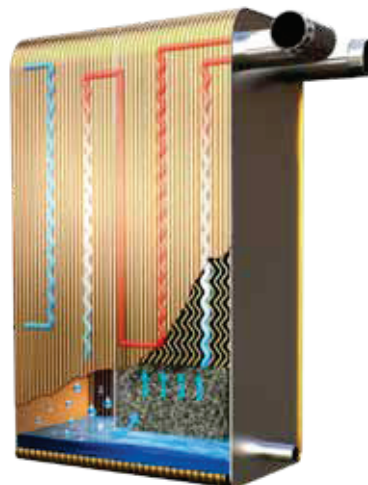
- Smooth bore, copper tube-on-tube heat exchangers
- Centrifugal separator efficiently captures condensate
- Static condenser design provides trouble free, quiet operation
- Electronic drain valve

RGD 75-1200 SCFM

- Stainless steel, cross flow heat exchangers optimize heat transfer and service life
- Compact design saves floor space
- Stainless steel inlet/outlet connections to prevent corrosion
- Timed electric condensate drain
- Integral demister/separator



Copper
"Tube-on-Tube"
Heat Exchanger

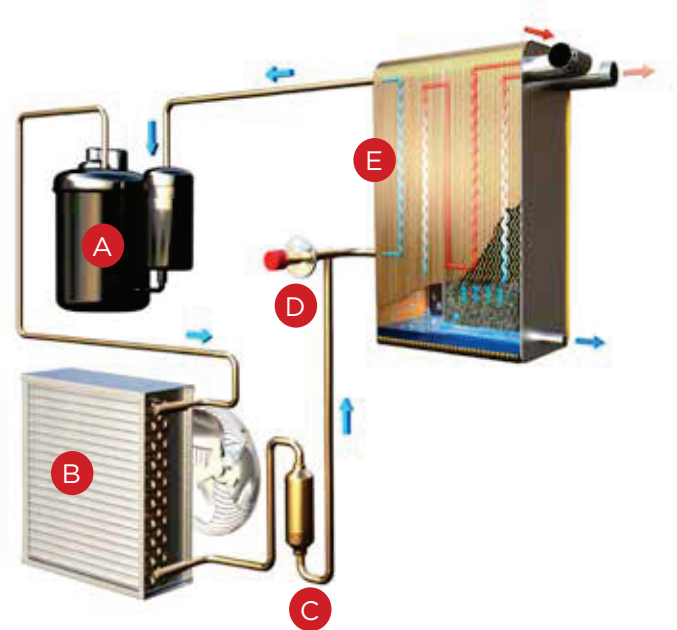


Stainless Steel
Demister/Separator

How it Works

Refrigeration Circuit

A hermetically sealed refrigerant compressor (A) takes in evaporated refrigerant and compresses it to a higher pressure. The air cooled condenser (B) turns the high pressure gas into a high pressure refrigerant. An in-line filter dryer (C) removes contaminants from the high pressure refrigerant gas. A constant pressure valve (D) reduces the pressure and regulates the flow of refrigerant into the heat exchanger (E).

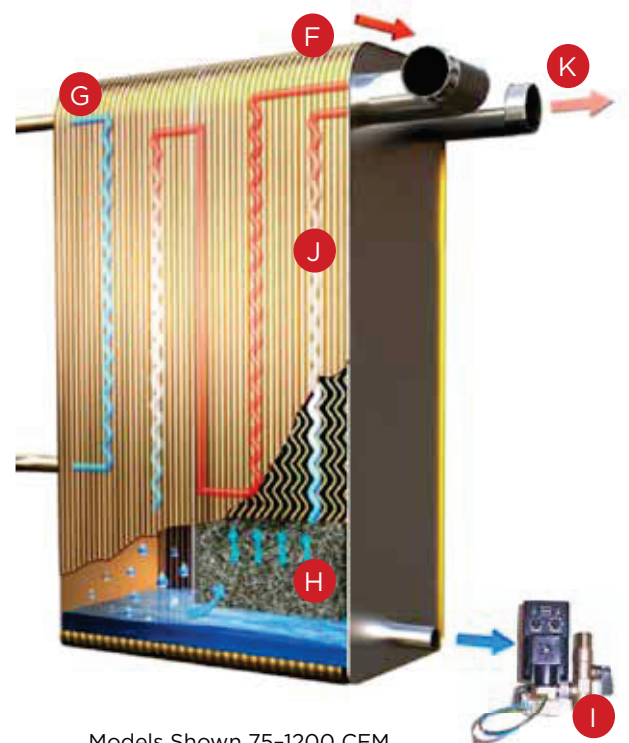


Models Shown 75-1200 CFM

Refrigerant is continuously circulated through the system

Air Circuit

Warm, saturated compressed air enters the air to air heat exchanger (F) and is cooled by the exiting air. The precooled air (G) then enters the air to refrigerant heat exchangers and is further chilled causing water vapor to condense. Condensed moisture is collected from the air stream by an integral separator (H) with stainless steel demister. Liquid condensate is removed from the separator by a (I) high performance drain. Cold air is then reheated in the air-to-air heat exchanger (J) to eliminate pipe line sweat. Clean dry air exits (K) the dryer and is now conditioned for use.



Models Shown 75-1200 CFM

Value at its Best

Efficient Condensate Management

- Increased calming zone and integral demister/separator captures liquid condensate and solid particles
 - Effectively removes condensate from 0-100% flow conditions without moisture carry-over
- Furnished with condensate drain
 - Electronic or timed electric (dependent on scfm range)

Safety First – Environmentally Friendly

- Models 10-125 scfm CFC free R134A refrigerant
- Models 150-1200 scfm R407C refrigerant
- CSA approved

Warranty Protection

- 2-Year Standard Warranty
- 3-Year Extended Warranty

- 1 Fan motor and blade assembly
- 2 Rugged, epoxy coated cabinet
- 3 Timed electric drain
- 4 Controls—models shown are 200-500 scfm
- 5 Stainless steel heat exchanger with integral demister separator
- 6 Refrigerant compressor
- 7 Constant expansion valve
- 8 Air-cooled condenser core



Take Control

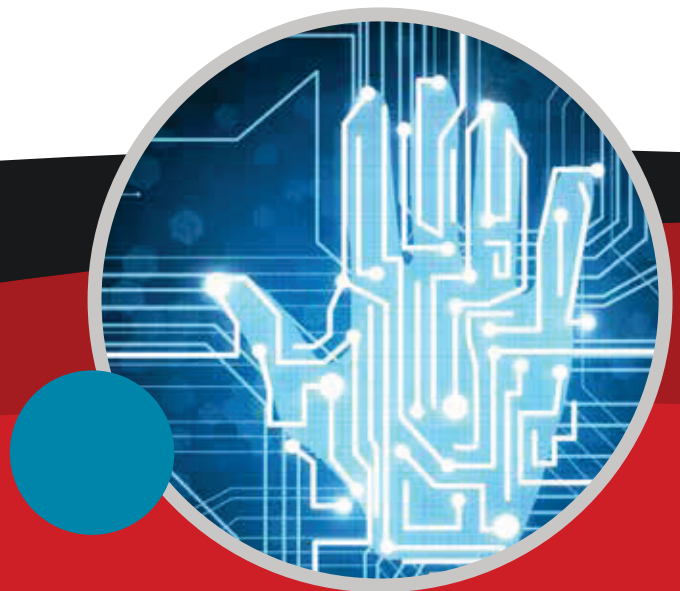
Models 10-150 SCFM

- Illuminated on/off switch
- Dew point temperature display to monitor inlet load conditions



Models 200-1200 SCFM

- Illuminated on/off switch
- LED dew point temperature display
- EDV control
- Dry alarm contact
- Equipped with panel mounted drain timer control



International Air Quality Class Standards

ISO 8573-1, the international standard for compressed air quality, defines the amount of contamination permissible in compressed air. The ISO standard identifies three primary forms of contamination: solid particles, water and oil contaminants. These forms are classified and assigned to a quality class, ranging from Class 0 being the highest purity level to a Class 6, which is the most relaxed level.

Gardner Denver's RGD series refrigerated air dryers provide dry compressed air at a stable ISO 8573-1 Air Quality Class 4 to 5 pressure dew point.



Pre-Filtration Option

FIL Series—Grade C Filtration removes solids and oil contaminants from the air stream before entering the dryer.

ISO Air Quality Class

- Solids - Class 2
- Remaining Oil - Class 4
- Removes solids 1.0 micron & larger
- Remaining oil content 2.0 mg/m³

After-Filtration Option

FIL Series—Grade E Filtration provides high efficiency oil removal protecting downstream equipment.

ISO Air Quality Class

- Solids - Class 1
- Remaining Oil - Class 1
- Removes 99.999+% of solids \geq 0.01 micron
- Remaining oil content < 0.01 mg/m³



RGD SPECIFICATIONS

MODEL	INLET FLOW		PRESSURE DROP	VOLTAGE	DIMENSIONS						REFRIGERANT	IN/OUT CONNECTIONS	POWER CONSUMPTION	WEIGHT
	SCFM	NM ³ /H			PSI	HEIGHT		WIDTH		DEPTH				
			IN			MM	IN	MM	IN	MM		NPT	KW	
RGD10A1	10	16	2.3		15	381	13	330	13	330		3/8" OD	0.21	64
RGD15A1	15	25	2.5		15	381	13	330	13	330		3/8" OD	0.24	69
RGD25A1	25	42	2.7		22	558	16	406	15	381		3/4"	0.47	88
RGD35A1	35	59	2.9		22	558	16	406	15	381		3/4"	0.47	92
RGD50A1	50	84	2.9	115/1/60	22	558	20	508	20	508	R 134a	3/4"	0.63	101
RGD75A1	75	127	2.5		24	609	15	381	33	838		1"	0.52	123
RGD100A1	100	170	3.3		24	609	15	381	33	838		1"	0.65	129
RGD125A1	125	212	3.7		24	609	15	381	33	838		1"	0.68	135
RGD150A1	150	255	3.0		21	533	13	330	30	762		1"	1.11	161
RGD200A4	200	340	2.6	460/3/60	30	762	20	493	37	932	R 134a	1 1/2"	1.42	183
RGD250A4	250	424	2.8	460/3/60	30	762	20	493	37	932	R 134a	1 1/2"	1.98	211
RGD300A4	300	509	3.1	460/3/60	32	812	20	493	44	1112	R 134a	1 1/2"	2.05	219
RGD400A4	400	680	2.5		30	762	21	787	38	965	R 134a	2"	2.5	232
RGD500A4	500	849	3.0		32	812	22	558	48	1218		2"	3.18	328
RGD600A4	600	1019	3.7		32	812	22	558	50	1270		2"	3.8	353
RGD600W4	600	1019	3.7		32	812	22	558	50	1270		2"	3.8	353
RGD800A4	800	1359	2.8		59	1450	30	762	42	1067		3" FLG	5.4	687
RGD800W4	800	1359	2.8	460/3/60	59	1450	30	762	42	1067	R 407c	3" FLG	5.4	687
RGD1000A4	1000	1699	2.9		64	1626	29	737	45	1143		4" FLG	6.6	786
RGD1000W4	1000	1699	2.9		64	1626	29	737	45	1143		4" FLG	6.6	786
RGD1200A4	1200	2038	3.9		64	1626	29	737	45	1143		4" FLG	8.66	810
RGD1200W4	1200	2038	3.9		64	1626	29	737	45	1143		4" FLG	8.66	810

Maximum Inlet Air Temperature: 120°F (49°C) Maximum Operating Pressure: 250 psig (Models RGD25-50), 232 psig (Models RGD75-500).
Above conditions tested at 100°F inlet air temperature, 100% saturated inlet air, 100 psig operating pressure and 100°F ambient air temperature.

OPERATING CONDITIONS

MODEL	MAX INLET AIR PRESSURE		MIN INLET AIR PRESSURE		MAX INLET AIR TEMPERATURE		MIN INLET AIR TEMPERATURE		MAX AMBIENT AIR TEMPERATURE		MIN AMBIENT AIR TEMPERATURE	
	PSIG	BARG	PSIG	BARG	°F	°C	°F	°C	°F	°C	°F	°C
5-10 to 50	250	17	30	2	120	49	40	4	110	43	45	7
75-500	232	16	10	1	120	49	40	4	110	43	45	7
600-1200	232	16	43	3	120	49	45	7	110	43	34	1

CAPACITY CORRECTION FACTORS

To adjust the dryer capacity for non-standard conditions, use the Capacity Correction Factors (multipliers) from the tables below. **Sizing Example:** What is the capacity of an RGD100 at 100°F inlet air temperature, 150 psig working pressure and 110°F ambient air temperature? **Answer:** 100 scfm (rated flow from RGD specifications table) × 1.08 (correction factor for inlet air temperature, table 1) × 0.94 (correction factor for ambient air temperature, table 2) = 102 scfm

INLET AIR PRESSURE		INLET AIR TEMPERATURE			
PSIG	BARG	90°F/32°C	100°F/38°C	110°F/43°C	120°F/49°C
80	5.6	1.19	0.95	0.77	0.63
100	6.9	1.25	1	0.82	0.68
125	8.6	1.3	1.05	0.86	0.72
150	10.3	1.34	1.08	0.9	0.75
175	12.1	1.37	1.11	0.92	0.78
200	13.8	1.39	1.14	0.95	0.8
250	17.2	1.43	1.17	0.98	0.83

AMBIENT AIR TEMPERATURE	80°F/27°C	90°F/32°C	100°F/38°C	110°F/43°C
Multiplier	1.12	1.06	1	0.94

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by continuously improving all business processes
with a focus on innovation and velocity

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 Please recycle after use.

VLV-611

XMx Series

75 - 1,000 scfm
System Flow Controllers



Experience Proven Results™

Stop Wasting Air

- ▶ Reduce Energy Consumption
- ▶ Improve Productivity
- ▶ Enhance Air Compressor Life
- ▶ Minimize Maintenance Costs



Source: US Dept of Energy/Compressed Air Challenge

XMX Savings Example – The 10/7 Equation

Reducing plant pressure by 10 psi results in a 7% energy consumption reduction. Installing an XMX Controller, along with adequate compressed air storage, allows compressed air to be stored at a higher pressure while delivering consistent, low-pressure air to an application.

A 15 HP compressor running 3,000 hours per year at \$0.10 per kW = \$3,300 annual power consumption.

What is the XMX System Flow Controller?

The XMX Series is a balanced flow controller which provides an economical and reliable single point of control when it comes to controlling the air pressure delivered to your operation. As opposed to a simple regulator that cannot deliver air volume above its set point, the XMX Series is designed to recognize and react to increases in flow demand.

Why Use an XMX System Flow Controller?

Regardless of the care that is taken when an air system is designed and installed, it is still going to have leaks and waste. When the working pressure delivered to that system is reduced, the volume of air lost to those leaks and waste is dramatically reduced. Reducing the amount of lost air results in less run time for an air compressor. The lower power consumption and decreased maintenance costs associated with less air compressor run time are direct improvement to the bottom line.

	POWER CONSUMPTION REDUCTION	SAVINGS
psi Reduction 20	14%	\$462
psi Reduction 40	28%	\$924
psi Reduction 70	49%	\$1,617

Features & Benefits

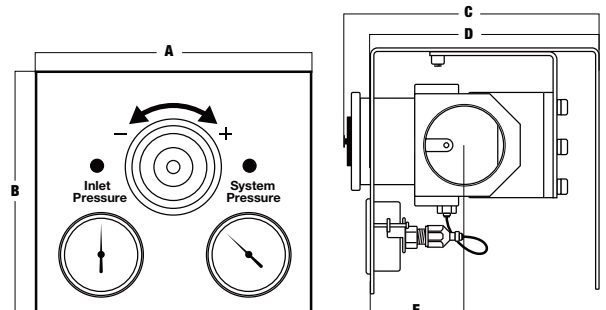
- Unit can be ordered for left to right or right to left flow to meet the needs of the installation
- Balanced valve design provides immediate response to changes in air demand
- NPT thread allows unit to connect easily into new or existing piping systems
- Nitrite seals for high level of chemical resistance
- Dual stainless steel gauges allow easy reference to both inlet and outlet pressures
- Tamper proof dial is centrally located for quick adjustment and easy calibration



Technical Data

Part Number	Flow Direction	Max Flow scfm	Max Inlet Pressure psig	Control Range psig	Max Operating Temp. Range	Connection Size (Female)	Sensitivity	Repeatability
XMx75-RL	Right to Left	75				1/2" NPT		
XMx75-LR	Left to Right	75				1/2" NPT		
XMx200-RL	Right to Left	200	300	0 - 160	-4° F to 176° F -20° C to 80° C	1" NPT	0.2% of full span	± 0.5% of full span
XMx200-LR	Left to Right	200				1" NPT		
XMx1000-RL	Right to Left	1000				2" NPT		
XMx1000-LR	Left to Right	1000				2" NPT		

Part Number	A	B	C	D	E	Weight
XMx75-RL					1.89"	8.40 lbs.
XMx75-LR					1.89"	8.40 lbs.
XMx200-RL	8.11"	7.28"	8.57"	7.36"	2.21"	10.45 lbs.
XMx200-LR					2.21"	10.45 lbs.
XMx1000-RL					2.78"	14.65 lbs.
XMx1000-LR					2.78"	14.65 lbs.



Other Innovative Products



FIL Series High Efficiency Filters

A full range of filters 20–21,250 cfm; coalescing, particulate, and activated carbon for the removal of water, oil, and particulates from compressed air.



DS2 Series Evacuator Drain Valves

A full family of zero air loss, energy efficient demand drains. Ruggedly designed to effectively and reliably prevent moisture damage to dryers, air tools, gauges, and other critical components.



RNC Series Refrigerated Dryers

A full line of high quality refrigerated dryers with features and benefits unmatched by the competition. Designed to produce dew points as low as 38° F in compressed air.



DGH Series Desiccant Dryers

A complete line of desiccant dryers for the removal of water vapor in compressed air to dew points as low as -100° F.


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 Please recycle after use.

Media

Revision 00

This Document Contains:

- Filter Media Safety Data Sheet
- Media Specification

Media Data	
Filtration Bed Depth	40 in
Particle Size	0.033" -0.066"
Sand Dry Weight	154320 lbs
Delivery Method	Super Sacks
Sand Mix	100% 12-20

SAFETY DATA SHEET

Product Name: Silica Sand, Silica Flour, or Quartz

Product Description: Crystalline Silica

1. IDENTIFICATION OF THE SUBSTANCE/MIXTURE, AND OF THE COMPANY/UNDERTAKING

1.1 Identification of the substance or preparation

Product identifiers: Silica Sand, Quartz, Novaculite, Silicon Dioxide, Silica Flour.

1.2 Other means of identification

Odorless, abrasive (hard), white, gray, or tan granular powder.

1.3 Recommended use and restrictions on use

Main applications of silica (non-exhaustive list): glass Ingredient, silica chemical processing, foundry sand, refractory ingredient, filler for resins, composites, artificial stone, textured coatings, glues and mortars.

DO NOT USE THIS PRODUCT FOR SANDBLASTING.

1.4 Supplier

Company Name:	AGSCO Corporation	Emergency number: 847-520-4455
Address:	160 West Hintz Road	Information number: 847-520-4455
	Wheeling Illinois 60090	Prepared: February 2015

2. HAZARDS IDENTIFICATION

2.1 Classification in accordance with 29 CFR §1910.1200(d)

STOT RE 1; Carcinogen 1A

2.2 Signal word, hazard statements, symbol and precautionary statements

Danger Causes damage to lungs, kidneys, through prolonged or repeated exposure. May cause cancer by prolonged or repeated inhalation.



Do not breathe dust. Wash hands thoroughly after handling. Do not eat, drink or smoke when using this product. Obtain special instructions before use. Do not handle until all safety instructions have been read and understood. Wear eye and respiratory protection. If exposed or concerned: Get medical attention. Store locked up. Dispose of contents in accordance with local, regional and national regulations.

2.3 Hazards not otherwise classified

Increased risk of systemic autoimmune disease (scleroderma, rheumatoid arthritis, and systemic lupus erythematosus) through prolonged or repeated inhalation. Increased risk of tuberculosis through prolonged or repeated inhalation. Smoking increases the risk of lung function impairment and chronic obstructive pulmonary disease COPD through prolonged or repeated inhalation.

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Chemical name and composition

Component	CAS Number	EINECS Number	Percent
Silicon dioxide (quartz)	14808-60-7	238-878-4	98.7 - 99.9
Aluminum Oxide	1344-28-1	215-691-6	<1.1
Iron Oxide	1309-37-1	215-168-2	<0.1
Titanium Oxide	13463-67-7	236-675-5	<0.1

SAFETY DATA SHEET

3.2 Common name and synonyms

Silica, SiO₂, quartz, crystalline silica, Novaculite, cryptocrystalline quartz, microcrystalline quartz, sand, chert, flint, tripoli.

3.3 Impurities which are themselves classified and which contribute to the classification of the product

Contains 1% or greater respirable crystalline silica which is classified as STOT RE 1

4. FIRST AID MEASURES

4.1 Eye Exposure

Not classified as an eye irritant. May cause physical abrasion if it gets in eyes. If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

4.2 Skin Exposure

Not applicable.

4.3 Inhalation

If exposed or concerned: Get medical attention.

4.4 Ingestion

Not applicable.

4.5 Most important symptoms/effects, acute and delayed

Dry chronic cough, sputum production, shortness of breath, wheezing, and reduced pulmonary function.

4.6 Indication of immediate medical attention and special treatment needed.

Symptoms of pulmonary impairment, such as shortness of breath, coughing, and wheezing.

5. FIRE-FIGHTING MEASURES

5.1 Suitable extinguishing media

Noncombustible and compatible with all extinguishing media.

5.2 Specific hazards arising from the chemical

Noncombustible. Thermal decomposition will not occur.

5.3 Special protective equipment and precautions for fire-fighters

Wear respiratory protection where airborne dust occurs.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment, and emergency procedures

Avoid generating airborne dust. Wear respiratory protection where airborne dust occurs. Keep unnecessary people away; isolate hazard area and deny entry.

6.2 Methods and materials for containment and cleaning up.

Do not dry sweep or use compressed air. Use water spraying, or a ventilated or HEPA filtered vacuum cleaning system.

7. HANDLING AND STORAGE

7.1 Precautions for safe Handling

Do not breathe dust. Obtain special instructions before use. Do not handle until all safety instructions have been read and understood. Wear eye and respiratory protection. Avoid airborne dust generation.

SAFETY DATA SHEET

Use appropriate exhaust ventilation at places where airborne dust is generated, including during loading and unloading. Do not rely on your sight to determine if dust is in the air. Respirable crystalline silica dust may be invisible in the air. Handle packaged products carefully to prevent accidental bursting. Maintain and test ventilation and dust collection equipment. Use all available work practices to control dust exposures, such as water sprays. Practice good housekeeping. Do not permit dust to collect on walls, floors, sills, ledges, machinery, or equipment. Exposures to respirable crystalline silica can occur when cutting, sawing, grinding, drilling, and crushing this material or articles that contain this material.

7.2 Conditions for safe storage

Keep containers closed and store to avoid accidental tearing, breaking, or bursting. Inert and unreactive with most chemicals. Contact with powerful oxidizing agents such as fluorine, chlorine trifluoride, and oxygen difluoride may cause fires.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

8.1 Exposure limits

OSHA PEL 8-hour time weighted average for respirable quartz expressed as millions of particles per cubic foot of air, based on impinger samples counted by light-field techniques:

250
(%SiO₂+5)

The percentage of crystalline silica in the formula is the amount determined from airborne samples, except in those instances in which other methods have been shown to be applicable. OSHA PEL 8-hour time weighted average for respirable quartz expressed as milligrams per cubic meter:

10 mg/m³
(%SiO₂+2)

Both concentration and percent quartz for the application of this limit are to be determined from the fraction passing a size-selector with the following characteristics:

Aerodynamic diameter (unit density sphere)	Percent passing selector
2	90
2.5	75
3.5	50
5	25
10	0

OSHA PEL 8-hour time weighted average for Quartz total dust expressed as milligrams per cubic meter
30 mg/m³
(%SiO₂+2)

On September 12, 2013, OSHA published a preliminary quantitative risk assessment concluding that the available evidence indicates that employees exposed to respirable crystalline silica well below the current PELs are at increased risk of lung cancer mortality and silicosis.

CAL OSHA PEL 8-hour time weighted average for respirable quartz 0.1 mg/m³
CAL OSHA PEL 8-hour time weighted average for quartz total dust 0.3 mg/m³

ACGIH TLV 8-hour time weighted average for respirable α-quartz and cristobalite 0.025 mg/m³
NIOSH REL up to 10 -hour time weighted average for respirable quartz ca 0.05 mg/m³

SAFETY DATA SHEET

8.2 Appropriate engineering controls

Avoid airborne dust generation. Use process enclosures and appropriate exhaust ventilation at places where airborne dust is generated, including during loading and unloading. Apply organizational measures, e.g. by isolating personnel from dusty areas. Remove and wash soiled clothing.

8.3 Individual protection measures, such as personal protective equipment

8.3.1 Eye / Face Protection

Wear appropriate safety glasses with side shields or chemical goggles.

8.3.2 Skin Protection

Wear body-covering clothing. Appropriate hand protection (e.g. gloves, barrier cream) is recommended for workers who suffer from dermatitis or sensitive skin. Wash hands at the end of each work session. Remove and wash soiled clothing.

8.3.3 Respiratory Protection

When engineering and work practice controls are not feasible, while they are being implemented, or when they do not reduce silica levels below OSHA PELs, employers must provide workers with respirators. Whenever respirators are used, the employer must have a respiratory protection program that meets the requirements of OSHA's Respiratory Protection standard (29 CFR 1910.134). This program must include proper respirator selection, fit testing, medical evaluations, and training. See, OSHA's Respiratory Protection eTool, available at www.osha.gov/SLTC/etools/respiratory/index.html

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	White, gray, or tan granular powder
Odor	Odorless
Odor Threshold	Not applicable
pH:	Water dispersions are neutral; pH 6 - 8
Specific Gravity:	2.65 g/cc
Melting Point:	3110°F/1710°C
Freezing Point:	Not applicable
Boiling Point:	4046°F/2230°C
Flashpoint:	Not applicable
Flammability:	Noncombustible
Flammable or Explosive Limits:	Not applicable
Vapor Pressure:	Not detectable
Vapor density:	Not applicable
Relative Density:	Not applicable
Solubility:	Dissolves in hydrofluoric acid and produces a corrosive gas, silicon tetrafluoride
Water Solubility:	Negligible
Partition Coefficient n-octanol/water:	Not applicable
Autoignition Temperature:	Not applicable
Decomposition Temperature:	Will not decompose
Viscosity:	Not applicable

SAFETY DATA SHEET

10. STABILITY AND REACTIVITY

10.1 Reactivity

Stable and inert.

10.2 Chemical Stability

Will not decompose or react with containers or environmental materials

10.3 Possibility of hazardous reactions

Reacts only with powerful oxidizing agents such as fluorine, chlorine trifluoride, and oxygen difluoride which may cause fires. If crystalline silica (quartz) is heated to more than 870°C, it can change to tridymite crystalline silica; and if crystalline silica (quartz) is heated to more than 1470°C, it can change to cristobalite crystalline. The OSHA PEL for respirable tridymite and cristobalite is one-half of the OSHA PEL for crystalline silica (quartz).

10.4 Conditions to avoid

None.

10.5 Incompatible materials

Contact with powerful oxidizing agents such as fluorine, chlorine trifluoride and oxygen difluoride, which may cause fires.

10.6 Hazardous Decomposition Products

None. Will not decompose.

11. TOXICOLOGICAL INFORMATION

11.1 Likely routes of exposure

The relevant route for occupational exposure is by inhalation.

11.2 Symptoms related to the physical, chemical and toxicological characteristics

Dry chronic cough, sputum production, shortness of breath, wheezing, and reduced pulmonary function.

11.3 Delayed and immediate effects and also chronic effects from short- and long-term exposure

11.3.1 Short-term exposure

Acute silicosis can occur within a few weeks to months after inhalation exposure to extremely high levels of respirable crystalline silica. Acute silicosis causes decreased lung function and can result in heart disease secondary to the lung disease: heart failure and cor pulmonale. Death from acute silicosis can occur within months to a few years of disease onset, and persons with acute silicosis are at high risk of contracting other lung diseases including tuberculosis, atypical mycobacterial infections, and fungal superinfections. Quantitative information on the level of exposure that causes acute silicosis is not available, but available information indicates those levels are far in excess of permissible exposure limits. Animal studies also suggest that pulmonary reactions of rats to short-duration exposure to freshly fractured silica mimic those seen in acute silicosis in humans.

Accelerated silicosis results from exposure to high levels of airborne respirable crystalline silica, and usually occurs within 2 to 10 years of initial exposure. Accelerated silicosis causes decreased lung function and can result in heart disease secondary to the lung disease. Accelerated silicosis has a rapid, severe course and persons with this condition are at high risk of contracting other lung diseases including tuberculosis, atypical mycobacterial infections, fungal superinfections, and lung cancer. Quantitative information on the level of exposure that causes accelerated silicosis is not available, but available information indicates those levels are substantially in excess of permissible exposure limits.

SAFETY DATA SHEET

11.3.2 Long term exposure

Chronic silicosis generally occurs after 10 years or more of inhalation exposure to respirable crystalline silica at levels below those associated with acute and accelerated silicosis. Chronic silicosis in most cases is a slowly progressive disease resulting in decreased lung function and can result in heart disease secondary to the lung disease. Its effects are disabling and may lead to death. Persons with chronic silicosis are at high risk of contracting other lung diseases including tuberculosis, atypical mycobacterial infections, fungal superinfections, and lung cancer. On September 12, 2013, OSHA published a preliminary quantitative risk assessment concluding that the available evidence indicates that employees exposed to respirable crystalline silica well below the current PELs are at increased risk of lung cancer mortality and silicosis.

Chronic obstructive pulmonary disease, COPD, including chronic bronchitis and emphysema, occurs in silica-exposed workers, including those who do not develop silicosis. Respirable crystalline silica exposure and smoking may be synergistic for COPD, that is, there is evidence that the combined effect of exposure to respirable crystalline silica and smoking may be greater than additive.

Respirable crystalline silica is recognized by OSHA, NTP and IARC as a cause of lung cancer. Respirable crystalline silica is an independent risk factor from smoking for lung cancer. Respirable crystalline silica exposure and smoking may be synergistic for lung cancer, that is, there is some evidence that the combined effect of exposure to respirable crystalline silica and smoking may be greater than additive.

There is substantial evidence suggesting an association between exposure to inhaled respirable crystalline silica and increased risks of renal (kidney) and systemic autoimmune disease (scleroderma, rheumatoid arthritis, and systemic lupus erythematosus).

11.4 Numerical measures of toxicity (such as acute toxicity estimates)

Crystalline silica is not acutely toxic. Reliable numerical measures of chronic toxicity do not exist.

12. ECOLOGICAL INFORMATION

12.1 Ecotoxicity (aquatic and terrestrial, where available)

Crystalline silica (quartz) is ubiquitous in the natural environment. It is not ecotoxic; i.e., no data exists that demonstrate or suggests that crystalline silica (quartz) is toxic to animals, microorganisms, or plants.

12.2 Persistence and degradability

Because of its low solubility and slow rate of solution, crystalline silica (quartz) is persistent except on a geologic time-scale.

12.3 Bioaccumulative potential

Does not bioaccumulate. Some plants, such as graminaceae (grasses) and animals such as Demospongiae (siliceous sponges) bioaccumulate silica, but this occurs by absorption of dissolved silica from natural waters.

12.4 Mobility in soil

Immobile in soil.

12.5 Other adverse effects

None.

SAFETY DATA SHEET

13. DISPOSAL CONSIDERATIONS

13.1 Waste Disposal Method

Disposed material is not a hazardous waste. Where possible, recycling is preferable to disposal. Dispose in accordance with local, regional and national regulations.

13.2 Container Handling and Disposal

Avoid airborne dust generation from residues in packaging, and use suitable engineering controls and personal protection measures. Store used packaging in enclosed receptacles. Dispose of containers, residues and unused contents accordance with local, regional and national regulations

14. TRANSPORTATION INFORMATION

14.1 UN number

None. Not a regulated material for transportation purposes.

14.2 UN proper shipping name

None. Not a regulated material for transportation purposes.

14.3 Transport hazard class(es)

None. Not a regulated material for transportation purposes.

14.4 Packing group, if applicable

Not applicable.

14.5 Environmental hazards

None.

14.6 Transport in bulk (according to Annex II of MARPOL 73/78 and the IBC Code)

Not applicable.

14.7 Special precautions

Do not breathe dust. Wash thoroughly after handling.. Do not eat, drink or smoke when using this product. Avoid generating airborne dust during loading and unloading. Use suitable engineering controls and personal protection measures. Handle packaged products carefully to prevent accidental bursting.

15. REGULATORY INFORMATION

15.1 Toxic Substances Control Act (TSCA) status

Crystalline silica (quartz) is listed on the EPA TSCA inventory under the CAS No 14808-60-7.

15.2 Resource Conservation and Recovery Act (RCRA) status

Disposed product is not a hazardous waste under RCRA.

15.3 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) status

No CERCLA Reportable Quantity has been established for any ingredient in this product.

15.4 Emergency Planning and Community Right to Know Act (SARA Title III) status

Not an Extremely Hazardous Substance under §302. Not a Toxic Chemical under §313. Hazard Categories under §§311/312: Acute.

15.5 Clean Air Act status

This product is not processed with nor does it contain any Class I or Class II ozone depleting substances.

SAFETY DATA SHEET

15.6 California Proposition 65 status

Crystalline silica (airborne particles of respirable size) is classified as a substance known to the State of California to be a carcinogen.

15.7 Massachusetts Toxic Use Reduction Act status

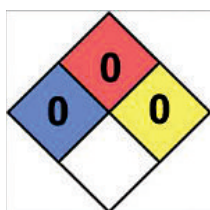
Silica, crystalline (respirable size, <10 microns) is "toxic" for purposes of the Massachusetts Toxic Use Reduction Act.

15.8 Pennsylvania Worker and Community Right to Know Act status


Quartz is a hazardous substance, but it is not a special hazardous substance or an environmental hazardous substance under the Pennsylvania Worker and Community Right to Know Act.

16. OTHER INFORMATION

16.1 NFPA 704: Standard System for the Identification of the Hazards of Materials for Emergency Response (Fire Diamond)



THE INFORMATION ON THIS SAFETY DATA SHEET IS BELIEVED TO BE ACCURATE AND IT IS THE BEST INFORMATION AVAILABLE TO AGSCO CORPORATION. THIS DOCUMENT IS INTENDED ONLY AS A GUIDE TO THE APPROPRIATE PRECAUTIONS FOR HANDLING A HAZARDOUS SUBSTANCE BY PERSON TRAINED IN HAZARDOUS SUBSTANCE HANDLING. AGSCO CORPORATION MAKES NO WARRANTY OF MERCHANTABILITY OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED, WITH RESPECT TO SUCH INFORMATION OR THE PRODUCT TO WHICH IT RELATES, AND WE ASSUME NO LIABILITY RESULTING FROM THE USE OR HANDLING OF THE PRODUCT TO WHICH THIS SAFETY DATA SHEET RELATES. USERS AND HANDLERS OF THIS PRODUCT SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION PROVIDED HEREIN FOR THEIR OWN PURPOSES.

	Document Title:	Media Specification, Centra-flo® Sand Filters
	Document Number:	OP-REF-001

1.01 PURPOSE:

- A. To define the requirements of purchased granular filter media used in Nexom upflow sand filters.

1.02 SCOPE:

- A. This specification applies to granular filter media purchased by Nexom from any vendor.

1.03 FILTER SAND SPECIFICATION

- A. Material must meet or surpass all requirements for silica sand per AWWA B100-16 Section 4.1.1.2 and the additional or more stringent requirements below:

1. Grain Shape: Spherical to sub-angular.
2. Chemical Analysis:
 - a. Loss on Ignition: 0.3% Maximum*
*Per ASTM C114-09 Part 16, using 20g mass and 8 hours at 750°C.
3. Size and distribution (Per the sieve size range #XX-XX identified on the purchase order)

- a. #12-20 (Applies to Nexom part numbers beginning with 02419-)
Particle size distribution % by weight:
Maximum 4% material is smaller than size #20 (0.84mm or 0.033")
Maximum 4% material is larger than size #12 (1.68mm or 0.066")
- b. #10-16 (Applies to Nexom part numbers beginning with 02642-)
Particle size distribution % by weight:
Maximum 4% material is smaller than size #16 (1.19mm or 0.047")
Maximum 4% material is larger than size #10 (2.00mm or 0.079")
- c. #10-20 (Applies to Nexom part numbers beginning with 05872-)
Particle size distribution % by weight:
Maximum 4% material is smaller than size #20 (0.84mm or 0.033")
Maximum 4% material is larger than size #10 (2.00mm or 0.079")

1.04 DOCUMENTATION

- A. A Sieve Analysis showing the % retained for every even sieve size in the appropriate size range specified above and the % beyond the upper and lower size range is required for each shipment.


1.05 REVISION HISTORY

Revision	Date	Author	Description of Change
01	11.01.2016	D. Goldgrabe	Initial Release
02	01.25.2017	D. Goldgrabe	Added #10-20 sand, corrected sand mm and inch sizes

1.06 APPROVAL

Approval Routing	Signature	Date:
Department Head		

CONTROLLED
Uncontrolled if Printed on Paper

	Document Title:	Form Approval Sheet
	Document Number:	QT-SOP-001-F5

1.01 PURPOSE:

To provide a mechanism to approve the pdf version of forms.

1.02 SCOPE:

All procedural forms created at Blue Water Technologies, Inc.

1.03 RESPONSIBILITIES:

All personnel involved in the document release process within Blue Water Technologies, Inc.

1.04 REFERENCES:

List all process documents which are inputs or outputs to process. Include document number and name.

1. QT-SOP-001 Document Control
2. QT-SOP-001-F2 Form Template
3. QT-SOP-001-F2 Form Template MS Excel

1.05 PROCEDURE:

Populate this sheet with relevant document revision and Approval information and add this sheet to the pdf of a form for approval.

Route appropriately for approval.

Once approved the complete pdf file can be moved to the appropriate "Approved" folder, along with the editable form template.

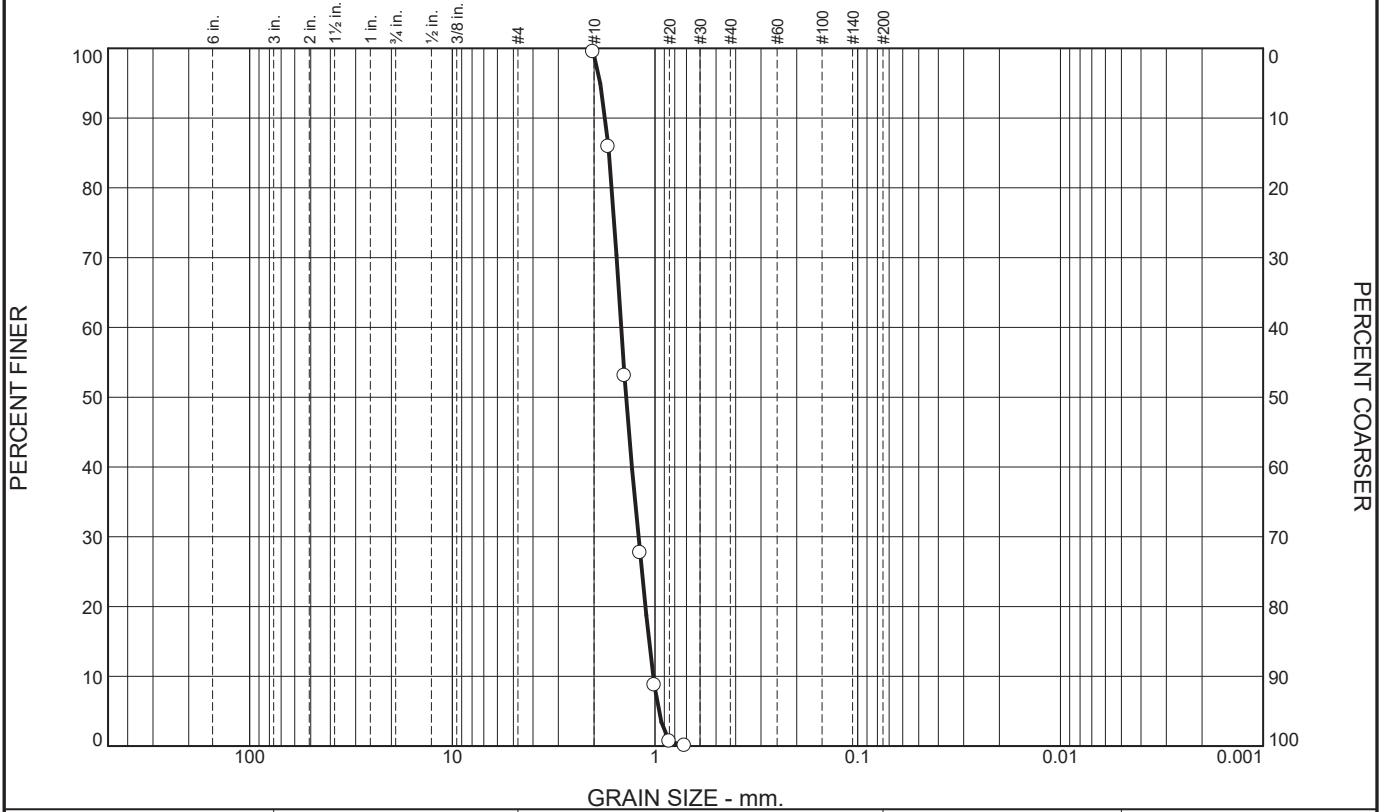
1.06 REVISION HISTORY

Revision	Date	Author	Description of Change
01	11.20.16	Name	Initial Release

1.07 APPROVAL

Approval Routing	Signature	Date:
Process Owner		
Department Head		

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
-------	----------	--------	--------	--------

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	99.5		
#12	85.9		
#14	53.1		
#16	27.7		
#18	8.7		
#20	0.7		
#25	0.1		

Material Description

0.80-1.20mm Silica Sand
UC < 1.6

Atterberg Limits

PL= LL= PI=

Coefficients

D₉₀= 1.7580 D₈₅= 1.6881 D₆₀= 1.4695
D₅₀= 1.3897 D₃₀= 1.2054 D₁₅= 1.0710
D₁₀= 1.0220 C_u= 1.44 C_c= 0.97

Classification

USCS= AASHTO=

Remarks

Typical Sieve Analysis

* (no specification envelope)

Location: Cleveland, Texas Origin

Date:

<p>RED FLINT SAND & GRAVEL, LLC. Eau Claire, Wisconsin</p>	<p>Client: Project: Project No:</p>
<p>Figure</p>	

Checked By: _____



APPENDIX D

IFAS Process

- D.1 Bid Documents and Contract
- D.2 Equipment Submittal



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APPENDIX D.1

Bid Documents and Contract



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BID FORM

PROJECT IDENTIFICATION:

City of Aberdeen - WWTP Equipment Pre-Purchase

ARTICLE 1 - BID RECIPIENT



- 1.01 This Bid is submitted to: **City of Aberdeen, ID**
- 1.02 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into a Contract with Buyer in the form included in the Bidding Documents to furnish the Goods and Special Services as specified or indicated in the Bidding Documents, for the prices and within the times indicated in this Bid, and in accordance with the other terms and conditions of the Bidding Documents. **

ARTICLE 2 - BIDDER'S ACKNOWLEDGMENTS

- 2.01 Bidder accepts all of the terms and conditions of the Notice Inviting Bids and Instructions to Bidders, including without limitation those dealing with the deposition of Bid security. This Bid will remain subject to acceptance for 60 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Buyer. Bidder will sign and submit the Agreement with the Bonds and other documents required within 15 days after the date of Owner's Notice of Award herein is received. **
- 2.02 Bidder acknowledges that this Contract, if awarded, will be assigned by the Owner to the Installation Contractor, and hereby consents to the assignment under the terms and conditions of the Contract Documents. Bidder accepts that, until the assignment of contract is executed by all parties, the Owner is not obligated to any monetary commitment associated with the Contract beyond that which is associated with Special Engineering Services. **

ARTICLE 3 - BIDDER'S REPRESENTATIONS

- 3.01 In submitting this Bid, Bidder represents that:
 - A. Bidder has examined and carefully studied the Bidding Documents, the related data identified in the Bidding Documents, and the following Addenda, receipt of which is hereby acknowledged:

Date	Number	Initials
March 14, 2023	1	
March 20, 2023	2	
_____	_____	_____

- B. Bidder is familiar with and is satisfied as to all Laws and Regulations in effect as of the date of the Bid that may affect cost, progress, and the furnishing of Goods and Special Services.

**Please refer to verbiage on page 8 of this Bid Form

- C. Bidder has carefully studied, considered, and correlated the information known to Bidder; information commonly known to sellers of similar goods doing business in the locality of the Point of Destination and the site where the Goods will be installed or where Special Services will be provided; information and observations obtained from Bidder's visits, if any, to the Point of Destination and the site where the Goods will be installed or where Special Services will be provided; and any reports and drawings identified in the Bidding Documents regarding the Point of Destination and the site where the Goods will be installed or where Special Services will be provided, with respect to the effect of such information, observations, and documents on the cost, progress, and performance of Seller's obligations under the Bidding Documents.
- D. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, and discrepancies that Bidder has discovered in the Bidding Documents, and the written resolution (if any) thereof by Engineer is acceptable to Bidder.
- E. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for furnishing the Goods and Special Services for which this Bid is submitted. **

ARTICLE 4 - BIDDER'S CERTIFICATIONS

4.01 Bidder certifies that:

- A. This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive agreement or rules of any group, association, organization, or corporation;
- B. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid;
- C. Bidder has not solicited or induced any individual or entity to refrain from bidding; and
- D. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 4.01.D:
 - 1. "corrupt practice" means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process;
 - 2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process to the detriment of Buyer, (b) to establish bid prices at artificial non-competitive levels, or (c) to deprive Buyer of the benefits of free and open competition;
 - 3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Buyer, a purpose of which is to establish bid prices at artificial, non-competitive levels; and

**Please refer to verbiage on page 8 of this Bid Form

4. “coercive practice” means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process.

ARTICLE 5 - BASIS OF BID**

5.01 BID SCHEDULE 1 – BASE BID: WWTP EQUIPMENT. Bidder will furnish the Goods (specifically equipment by vendors listed below) and Special Services in accordance with the Contract Documents for the following price(s). Vendors may provide bids for one or more of the following base bid items. State of Idaho taxes shall not be included (Section P-800 – Supplementary Conditions 5.05.A).

Item No.	Description	Unit	Amount
1A	SUBMITTALS AND SHOP DRAWINGS: As defined in the Agreement, price not to exceed 10% of the Contract price for the work outlined in Item 1B.	LS	\$ <u>109,900</u>
1B	INTEGRATED FIXED FILM ACTIVATED SLUDGE SYSTEM consisting of (1) IFAS system and all necessary appurtenances and services as described in Section 46 21 35 of the specifications.	LS	\$ <u>988,300</u>
1A + 1B	TOTAL ITEM PRICE \$ <u>One Million, One-Hundred Thousand, Seven-Hundred</u> (In Words)	LS	\$ <u>1,098,200</u>

Item No.	Description	Unit	Amount
2A	SUBMITTALS AND SHOP DRAWINGS: As defined in the Agreement, price not to exceed 10% of the Contract price for the work outlined in Item 2B.	LS	Not Applicable \$
2B	SAND FILTER SYSTEM consisting of sand filters with all necessary appurtenances and services as described in Section 46 61 27 of the specifications.	LS	Not Applicable \$
2A + 2B	TOTAL ITEM PRICE \$ Not Applicable _____ (In Words)	LS	Not Applicable \$

**Please refer to verbiage on page 8 of this Bid Form

Item No.	Description	Unit	Amount
3A	SUBMITTALS AND SHOP DRAWINGS: As defined in the Agreement, price not to exceed 10% of the Contract price for the work outlined in Item 3B.	LS	Not Applicable \$
3B	MECHANICAL DEWATERING SYSTEM consisting of mechanical screw press equipment and all necessary appurtenances and services as described in Section 46 66 16 of the specifications.	LS	Not Applicable \$
3A + 3B	TOTAL ITEM PRICE \$ Not Applicable <hr style="width: 50%; margin-left: 0;"/> (In Words)	LS	Not Applicable \$

ARTICLE 6 - PRICE ESCALATION**

- 6.01 Any selected vendor or vendors will be required to honor their submitted proposal pricing for the Goods and Services for 60 consecutive calendar days from the proposal due date for this RFP.
- 6.02 Where a signed agreement between the City and the manufacturer is not signed within 60 calendar days from the proposal due date, price escalation shall be allowed as follows: Price adjustment will be based on the net change of the ENR Construction Cost Index occurring in the period from 60 consecutive calendar days from the proposal due date to the date when the agreement is signed with the City.

ARTICLE 7 - TIME OF COMPLETION**

- 7.01 Bidder agrees that the furnishing of Goods and Special Services will conform to the schedule below. Startup services and training shall be coordinated with the Installation Contractor and Owner but shall not occur more than 21 days after the Vendor has certified the installation of the equipment.

Item	Required Time for Completion (Calendar days from Vendor Bid Award)
Signing of Agreement	30
	Required Time for Completion (Calendar days from completion of Signed Agreement)
Accepted Submittals, including drawings, calculations, and anchor bolt design	75
	Required Time for Completion (Calendar days from Installation Contractor Bid Award)

**Please refer to verbiage on page 8 of this Bid Form

Assignment of Agreement to Installation Contractor	30
Delivery	212

ARTICLE 8 - ATTACHMENTS TO THIS BID

8.01 The following documents are attached to and made a condition of this Bid:

- A. Information Required of Bidder;
- B. Required Bid Security;^{**}
- ~~C. If Bid amount exceeds \$10,000, signed Compliance Statement (RD 400-6). Refer to specific equal opportunity requirements set forth in paragraph 18.10 of the Supplemental Conditions to the agreement with the Contractor who will install the WWTP equipment and to who the City will assign the contract with the Vendor (attached);~~
- ~~D. If Bid amount exceeds \$25,000, signed Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transactions (AD-1048);~~
- ~~E. If Bid amount exceeds \$100,000, signed RD Instruction 1940 Q, Exhibit A01, Certification for Contracts, Grants and Loans.~~

****Please refer to verbiage on page 8 of this Bid Form**

ARTICLE 9 - BID SUBMITTAL

9.01 This Bid submitted by:

If Bidder is:

An Individual

Name (typed or printed): _____

By: _____
(Individual's signature)

Doing business as: _____

Business address: _____

Phone: _____ Facsimile: _____

E-mail address: _____

Partnership

Partnership Name: _____ (SEAL)

By: _____
(Signature of general partner - attach evidence of authority to sign)

Name (typed or printed): _____

Business address: _____

Phone: _____ Facsimile: _____

E-mail address: _____

A Corporation

Corporation Name: Veolia Water Technologies, Inc.

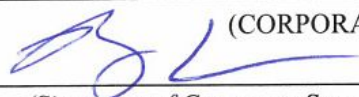
State of Incorporation: Delaware

Type (General Business, Professional, Service, other): General Business

By:  **
(Signature - attach evidence of authority to sign)

Name (typed or printed): Michael Gutshall

Title: Vice President

Attest  (CORPORATE SEAL)
(Signature of Corporate Secretary)



Business address: 4001 Weston Parkway
Cary, NC 27513

Phone: 919-677-8310 Facsimile: 919-677-0082

E-mail address: rodrigo.lara@veolia.com

A Limited Liability Company (LLC)

LLC Name: _____

State in which organized: _____

By: _____
(Signature - attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____

Business address: _____

Phone: _____ Facsimile: _____

E-mail address: _____

**Please refer to verbiage on page 8 of this Bid Form

A Joint Venture

First Joint Venturer Name: _____ (SEAL)

By: _____
(Signature - attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____

Business address: _____

Phone: _____ Facsimile: _____

E-mail address: _____

Second Joint Venturer Name: _____ (SEAL)

By: _____
(Signature - attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____

Business address: _____

Phone: _____ Facsimile: _____

E-mail address: _____

Phone and Facsimile Number, and Address for receipt of official communications to Joint
Venture:

(Each joint venturer must sign. The manner of signing for each individual, partnership, corporation, and limited liability company that is a party to the joint venture should be in the manner indicated above.)

**Veolia Water Technologies, Inc. dba Kruger's Bid Submittal, including disposition of its bid security, is expressly conditioned on parties reaching mutually acceptable terms and conditions for the contract post-award. Kruger's Bid Submittal, is provided per the scope of work as detailed in this Bid Submittal, including pricing, Comments to the Bid Documents, Process Guarantee, and terms and conditions, contained therein.

Veolia Water Technologies, Inc.
Unanimous Written Consent of the Directors
November 17, 2021

The undersigned, being all of the directors of Veolia Water Technologies, Inc., a Delaware corporation (the "Corporation"), hereby adopt the following resolutions and preambles removing an officer of the Corporation without the necessity of a meeting, in accordance with the Delaware General Corporation Law and the Bylaws of the Corporation:


RESOLVED, that Richard Dimassimo, the former Vice President (Engineering Only) resigned his position on September 30, 2021.

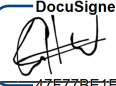
RESOLVED, that the following individuals are hereby elected to the respective offices of the Corporation indicated below to serve in such offices in accordance with the Bylaws of the Corporation until the next annual election of officers and until their successors are duly elected and qualified, or until their earlier death, resignation, retirement, disqualification or removal from office:


Jim Brown	President and CEO
John M. Santelli	Vice President, Secretary and Treasurer
Michael Gutshall	Vice President
Mark Boone	Senior Vice President
Laurent Cuny	Vice President
Jack Kuhar	Vice President (Engineering Only)
John Dimonte	Vice President (Engineering Only)
Frederic Pfau	Assistant Secretary
Brittany Tuck	Assistant Secretary
Martin Vosburg	Assistant Treasurer

IT IS FURTHER RESOLVED, that Jack Kuhar and John Dimonte shall continue to serve as Vice Presidents for the limited purpose of supervising engineering work to enable the Corporation to obtain and maintain certain professional engineering licenses and certificates of authority and to perform all tasks incidental thereto.

WITNESS the due execution hereof as of the date first above written.

DocuSigned by:

1E1D249A9E5D444...
James T. Brown

DocuSigned by:

47F77BE1F0564D9...
Vincent Caillaud

DocuSigned by:

FD730AD203AC4CA...
Claire Béchaux

BID BOND

Any singular reference to Bidder, Surety, Owner, or other party shall be considered plural where applicable.

BIDDER (Name and Address):

Veolia Water Technologies, Inc.
4001 Weston Parkway
Cary, NC 27513

SURETY (Name, and Address of Principal Place of Business):

Federal Insurance Company
202B Halls Mill Road
Whitehouse Station, NJ 08889-3454

OWNER (Name and Address):

City of Aberdeen
33 N. Main St.
Aberdeen, ID 83210

BID

Bid Due Date: April 4, 2023

Description (Project Name— Include Location): City of Aberdeen's Wastewater Treatment Plant Equipment Pre-Purchase
IFAS System Equipment Supply

BOND

Bond Number: 36813-CHU-23-1

Date: March 22, 2023

Penal sum	<u>Five Percent of Amount Bid</u>	\$ <u>5% of Amount Bid</u>
	(Words)	(Figures)

Surety and Bidder, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Bid Bond to be duly executed by an authorized officer, agent, or representative.

BIDDER	SURETY
Veolia Water Technologies, Inc. (Seal)	Federal Insurance Company (Seal)
Bidder's Name and Corporate Seal	Surety's Name and Corporate Seal


By: 
Signature

Michael Gutsch II
Print Name

Vice-President
Title


Attest: 
Signature

Title Assistant Secretary

By: 
Signature (Attach Power of Attorney)

Kristin S. Bender
Print Name

Attorney-in-Fact
Title

Attest: 
Signature Annette Audinot

Title Witness as to Surety

Note: Addresses are to be used for giving any required notice.
Provide execution by any additional parties, such as joint venturers, if necessary.

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Bidder's and Surety's liability. Recovery of such penal sum under the terms of this Bond shall be Owner's sole and exclusive remedy upon default of Bidder.
2. Default of Bidder shall occur upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.
3. This obligation shall be null and void if:
 - 3.1 Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or
 - 3.2 All Bids are rejected by Owner, or
 - 3.3 Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).
4. Payment under this Bond will be due and payable upon default of Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.
5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions shall not in the aggregate exceed 120 days from the Bid due date without Surety's written consent.
6. No suit or action shall be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety and in no case later than one year after the Bid due date.
7. Any suit or action under this Bond shall be commenced only in a court of competent jurisdiction located in the state in which the Project is located.
8. Notices required hereunder shall be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Registered or Certified Mail, return receipt requested, postage pre-paid, and shall be deemed to be effective upon receipt by the party concerned.
9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.
10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond shall be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute shall govern and the remainder of this Bond that is not in conflict therewith shall continue in full force and effect.
11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

Power of Attorney

Federal Insurance Company | Vigilant Insurance Company | Pacific Indemnity Company
Westchester Fire Insurance Company | ACE American Insurance Company

Know All by These Presents, that FEDERAL INSURANCE COMPANY, an Indiana corporation, VIGILANT INSURANCE COMPANY, a New York corporation, PACIFIC INDEMNITY COMPANY, a Wisconsin corporation, WESTCHESTER FIRE INSURANCE COMPANY and ACE AMERICAN INSURANCE COMPANY corporations of the Commonwealth of Pennsylvania, do each hereby constitute and appoint

Kristin S. Bender

each as their true and lawful Attorney-in-Fact to execute under such designation in their names and to affix their corporate seals to and deliver for and on their behalf as surety thereon or otherwise, bonds and undertakings and other writings obligatory in the nature thereof (other than bail bonds) given or executed in the course of business, and any instruments amending or altering the same, and consents to the modification or alteration of any instrument referred to in said bonds or obligations.

In Witness Whereof, said FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, PACIFIC INDEMNITY COMPANY, WESTCHESTER FIRE INSURANCE COMPANY and ACE AMERICAN INSURANCE COMPANY have each executed and attested these presents and affixed their corporate seals on this 10th day of March, 2020.

Dawn M. Chloros

Dawn M. Chloros, Assistant Secretary

Stephen M. Haney

Stephen M. Haney, Vice President



STATE OF NEW JERSEY
County of Hunterdon

ss.

On this 10th day of March, 2020 before me, a Notary Public of New Jersey, personally came Dawn M. Chloros and Stephen M. Haney, to me known to be Assistant Secretary and Vice President, respectively, of FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, PACIFIC INDEMNITY COMPANY, WESTCHESTER FIRE INSURANCE COMPANY and ACE AMERICAN INSURANCE COMPANY, the companies which executed the foregoing Power of Attorney, and the said Dawn M. Chloros and Stephen M. Haney, being by me duly sworn, severally and each for herself and himself did depose and say that they are Assistant Secretary and Vice President, respectively, of FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, PACIFIC INDEMNITY COMPANY, WESTCHESTER FIRE INSURANCE COMPANY and ACE AMERICAN INSURANCE COMPANY and know the corporate seals thereof, that the seals affixed to the foregoing Power of Attorney are such corporate seals and were thereto affixed by authority of said Companies; and that their signatures as such officers were duly affixed and subscribed by like authority.

Notarial Seal



KATHERINE J. ADELAAR
NOTARY PUBLIC OF NEW JERSEY
No. 2316685
Commission Expires July 16, 2024

Katherine J. Adelaar

Notary Public

CERTIFICATION

Resolutions adopted by the Boards of Directors of FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, and PACIFIC INDEMNITY COMPANY on August 30, 2016; WESTCHESTER FIRE INSURANCE COMPANY on December 11, 2006; and ACE AMERICAN INSURANCE COMPANY on March 20, 2009:

"RESOLVED, that the following authorizations relate to the execution, for and on behalf of the Company, of bonds, undertakings, recognizances, contracts and other written commitments of the Company entered into in the ordinary course of business (each a "Written Commitment"):

- (1) Each of the Chairman, the President and the Vice Presidents of the Company is hereby authorized to execute any Written Commitment for and on behalf of the Company, under the seal of the Company or otherwise.
(2) Each duly appointed attorney-in-fact of the Company is hereby authorized to execute any Written Commitment for and on behalf of the Company, under the seal of the Company or otherwise, to the extent that such action is authorized by the grant of powers provided for in such person's written appointment as such attorney-in-fact.
(3) Each of the Chairman, the President and the Vice Presidents of the Company is hereby authorized, for and on behalf of the Company, to appoint in writing any person the attorney-in-fact of the Company with full power and authority to execute, for and on behalf of the Company, under the seal of the Company or otherwise, such Written Commitments of the Company as may be specified in such written appointment, which specification may be by general type or class of Written Commitments or by specification of one or more particular Written Commitments.
(4) Each of the Chairman, the President and the Vice Presidents of the Company is hereby authorized, for and on behalf of the Company, to delegate in writing to any other officer of the Company the authority to execute, for and on behalf of the Company, under the Company's seal or otherwise, such Written Commitments of the Company as are specified in such written delegation, which specification may be by general type or class of Written Commitments or by specification of one or more particular Written Commitments.
(5) The signature of any officer or other person executing any Written Commitment or appointment or delegation pursuant to this Resolution, and the seal of the Company, may be affixed by facsimile on such Written Commitment or written appointment or delegation.

FURTHER RESOLVED, that the foregoing Resolution shall not be deemed to be an exclusive statement of the powers and authority of officers, employees and other persons to act for and on behalf of the Company, and such Resolution shall not limit or otherwise affect the exercise of any such power or authority otherwise validly granted or vested."

I, Dawn M. Chloros, Assistant Secretary of FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, PACIFIC INDEMNITY COMPANY, WESTCHESTER FIRE INSURANCE COMPANY and ACE AMERICAN INSURANCE COMPANY (the "Companies") do hereby certify that

- (i) the foregoing Resolutions adopted by the Board of Directors of the Companies are true, correct and in full force and effect,
(ii) the foregoing Power of Attorney is true, correct and in full force and effect.

Given under my hand and seals of said Companies at Whitehouse Station, NJ, this March 22, 2023



Dawn M. Chloros

Dawn M. Chloros, Assistant Secretary

IN THE EVENT YOU WISH TO VERIFY THE AUTHENTICITY OF THIS BOND OR NOTIFY US OF ANY OTHER MATTER, PLEASE CONTACT US AT:
Telephone (908) 903-3493 Fax (908) 903-3656 e-mail: surety@chubb.com

Kruger Bid Submittal
City of Aberdeen, ID
AnoxKaldnes IFAS

CITY OF ABERDEEN WWTP IMPROVEMENTS PRE-PURCHASE

Section 46 53 36 Integrated Fixed Film Activated Sludge System

Kruger Project No. 5700112106

Bid Date: April 04, 2023 (2PM MST)

***This document is confidential and may contain proprietary information
It is not to be disclosed to a third party without the written consent of Veolia Water Technologies***



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April 04, 2023

City of Aberdeen &
Keller Associates, Inc

**Re: City Of Aberdeen Wwtp Improvements Pre-Purchase
Section 46 53 36 Integrated Fixed Film Activated Sludge System**

To Whom it May Concern:

Veolia Water Technologies, Inc (Veolia, dba Kruger) appreciates the opportunity to provide you with our bid proposal for this important IFAS project. As the inventor and pioneer of the IFAS technology, Veolia/AnoxKaldnes designed and installed the first IFAS system in the world at **Broomfield, CO** in 2002. The system is still performing today with its original equipment, helping the plant achieve biological nutrient removal of both total nitrogen and phosphorus. Since then, Veolia has designed and delivered more than 35 IFAS systems in the US and more than 75 systems worldwide (not including more than 1,200 MBBR installations).

The IFAS system design and proposal for this project are based on a thorough understanding of the design intent, performance requirements and limitations of the project. It incorporates comprehensive considerations of the City's overall facilities, technical discussions on influent characteristics and design constraints with Keller Associates, and Veolia/Kruger's 20 plus years of IFAS design/modeling knowledge and vast experience in delivering more 75 successful IFAS installations.

The Veolia/AnoxKaldnes team provides the highest dependability and reliability with the best value: originating from the inventor and leading innovator of the IFAS technology, being engineered as a complete system, and being the beneficiary of decades of wisdom earned from the largest install base, Kruger's AnoxKaldnes Hybas IFAS technology has earned the trust of numerous customers. We certainly hope we can win yours as well.

We hope that you find the information we provided in this proposal helpful and convincing in understanding the advantages and benefits of our design and system, and the value and experience that our team can provide. We also hope that our superior product quality, financial capabilities and excellent customer services offer Keller and the City an extra measure of assurance in delivering a successful project with low risks.

Thank you for this opportunity to offer our proposal. We look forward to discussing our technology and proposal further with you if you have any questions. Please feel free to contact us at your earliest convenience.

Sincerely,

Rodrigo Lara





PROPOSAL CHECKLIST (IN RESPONSE TO SECTION 00 40 00 – VENDOR PERFORMANCE QUESTIONNAIRE)

I. Submittal Requirements

- A. Identification of Vendor, name of project, name of Owner, and date of submittal.
 - a. **Veolia:** Please see the proposal cover page and cover letter for the information.
- B. Responses to all questions listed in Parts below including: Product Support Services, Experience and References, Product Design, and pertinent licensing agreements.
 - a. **Veolia:** Veolia has provided responses to all questions. Please see below and the various sections in the proposal. If any additional information is required please contact us.
- C. Provide a complete description of proposed equipment including layout and installation details. Power requirements shall be provided. Description of motors, if any, shall be provided. For blowers, a blower curve shall be provided. For pumps, a pump curve shall be provided.
 - a. **Veolia:** Description of proposed equipment is provided Section 4 of the proposal. Description of motors is provided in the same section. A Blower curve is provided in this Appendix D.
- D. Provide a complete description of equipment operating and maintenance costs for power, materials, and labor hours. Provide a summary of annual maintenance, 5- year maintenance, 10-year maintenance, and 20-year maintenance activities and include estimated labor hours and materials cost for each item of maintenance to help Owner properly evaluate life cycle costs.
 - a. **Veolia:** The main system components of Veolia's Hybas IFAS system, i.e. media, aeration grids and media retention screens are designed to be maintenance-free throughout the lifetime of the system. This helps the City keep the maintenance cost down. The rest of the system equipment such as blowers will require typical maintenance like any other blowers. Please see Section 3.2 for more details on the estimated O&M costs information.
- E. Indicate and list any and all advantages that Vendor's equipment might have over a competitor's equipment. Include information on any extended equipment or media warranties offered beyond the specified warranty period.
 - a. **Veolia:** Veolia's Hybas IFAS system equipment are field proven over years of operations and dozens of installations. The US-made quality, unique design, structural integrity, high surface area and therefore high performance of the AnoxK 5 media has made it a target for copying by competition over the last decades. Many competitors are replacing their low quality, low surface area, prone to breakage media with something similar to the K5 media. However, it will take them a long time or many installations to prove and validate the quality and performance of their new media. In the meantime, they add major risks to the projects they do with the media. Please see Section 3.3 and 3.4 for additional information for the advantages that our design system offers.



- b. For warranty, Veolia has included 30 months from delivery and 24 months from substantial completion of Kruger's equipment, which is one year more than the warranty required in the specification. Veolia can also provide additional warranty coverage beyond what's in the scope at a very small cost.
- F. Any other information deemed appropriate by Vendor to assist Owner and Engineer in determining Vendor qualifications including company brochures, product data sheets, etc.
 - a. Veolia: Please see Appendix A through F for company brochures, product data etc. We have included two WEFTEC papers to highlight our team's knowledge and experience in designing, delivering and guaranteeing the performance of the World's largest IFAS system in one paper and also achieving the lowest TN limit of 3 mg/L in an IFAS systems in the other.
- G. Proposal to be organized with table of contents at the front and tabbed dividers between sections.
 - a. Veolia: We have organized our proposal with a table of contents.

II. Product Support Services

- A. Provide examples or document past experience.
 - a. Veolia: Please see Appendices A, B, C and E and information throughout this Checklist and the proposal for examples and documents.
- B. List of office locations of the WWTP Equipment Manufacturer in North America. Provide location where the equipment is manufactured.
 - a. Veolia: Veolia's media is made in the US and manufactured in Baraboo Wisconsin; Airgrids and media retention screens are manufactured in Toledo Ohio; Blowers are shipped from Coatesville PA; Instrumentation and controls will be from various US suppliers such as Allen Bradley and Saginaw etc.
- C. List all service/maintenance locations in the United States for the WWTP equipment to be provided. Provide the following for each location:
 - 1. Name: Veolia Water Technologies, Inc (Kruger)
 - a. Location: Raleigh NC.
 - b. Type of support services provided: Engineering design; submittal preparation and submission; project management and delivery; system startup and training; aftermarket customer services and spare parts.
 - c. Description of Service Provided by Manufacturer or Subcontractor: Veolia provides onsite technical services for equipment/system installation inspection, equipment and/or system startup, dry and wet testing, performance testing, onsite operator training; Veolia also provides remote services through virtual conference meetings and phone calls to the operators; Veolia also provides a cloud based remote process monitoring and/or control system, i.e. Hubgrade to help the plant monitor and/or control the IFAS process. There are many different levels for the Hubgrade platform. Please refer to the proposal for the services included for the current project.

- d. Response Time for Technician to be in Aberdeen: Preferably one to two weeks but depending on the urgency of the requests, technician and flight availability, the response time can be shorter.
2. Name: Coombs Hopkins Company (Veolia's manufacturer representative)
- e. Location: Sandy UT.
 - f. Type of support services provided: Onsite sales support; Onsite visits and meetings.
 - g. Description of Service Provided by Manufacturer or Subcontractor: Onsite sales support; Onsite visits and meetings; Certain spare parts services.
 - h. Response Time for Technician to be in Aberdeen: Depending on the urgency of the requests but our sales representatives can be in Aberdeen within a few hours.
- D. Describe the system start-up and operator training capabilities of the Equipment Manufacturer. In addition, provide a resume for installation supervision and start-up personnel.
- a. Veolia/Kruger has a core group of more than 10 process experts who have designed and started up more than 35 IFAS systems (more than all competitor installations combined) in the US in the past 20 years, are well published on the technology, and have a collective design experience of over 250 years. Our process team has trained the operators of every plant we designed. We have a complete set of training slides that cover all aspects of the IFAS system, from equipment operation to process control and troubleshooting. They will share all the operating experience learned from our installations in the US and those from overseas. Working with the Veolia process team will ensure the design team and the City have the best expertise and strongest design support for this project to be successful and trouble free. A summary of Veolia's design team and selected resumes have been attached for our process engineers/experts who may be working on this project during installation and startup. Please see Appendix A for more information.
 - b. Our project delivery team is also the most experienced team in delivering IFAS systems. The knowledge they have accumulated over the past 20 years since the world's first Hybas system at Broomfield CO will help the project stay on schedule and avoid any potential delivery issues.
- E. Describe facilities, programs and methods, which the Equipment Manufacturer provides to Owners/operators for ongoing maintenance and troubleshooting.
- a. For facilities, please see Item C above.
 - b. For programs and methods, please see Section 5.4 and the attached Hubgrade Brochure for more information. We have included a blended service program to help the owner/operators for ongoing maintenance and troubleshooting. From a maintenance standpoint, the following Veolia's system components, media, SS airgrids and SS retention screens are designed to require no maintenance during the lifetime of the system. Typical maintenance is required on other equipment such as blowers and instrumentation.

- c. Our cloud based Hubgrade remote operating or monitoring system, if adopted at the right level, can greatly benefit the City in helping operate, optimize and/or monitor the system after commissioning. It can also help the operators troubleshoot the system and/or remind the operators of any maintenance or chemical needs.
- F. Provide description of available 24/7 telephone support services, additional operator training after start-up including conferences, available support groups and quarterly site visits.
 - a. Twenty hours of 24/7 telephone support services and quarterly wellness calls have been included in the one year post-commissioning services in our scope (Section 5.4). In addition, one trip including a total of four workdays six months after substantial completion has been included in our scope per the specification requirement. Once all these services have been provided, Veolia’s technical sales team can work with the plant operating staff to set up virtual conferences based on the plant’s needs to discuss system performance and other system related topics. The technical sales team will also make an effort to stop by the plant whenever it’s on trips to the Aberdeen area, something we do with all our IFAS plants. Different levels of service packages can be offered to the plant to cover any additional support needs including dedicated onsite visits by our process team. Working with Veolia will enable the plant to enjoy all these services plus have access to our Veolia IFAS user family to share experience and discuss performance optimization possibilities.

III. Manufacturer’s Experiences and References

- A. Attach to this bid, a list of all municipal contracts completed (and private contracts if allowed) by the Bidder during the last 5 years involving applications for wastewater treatment and of comparable value in North America, please limit to 5 projects. The list shall include the following information as a minimum.
 - a. Names, address, and telephone number of Plant operator.
 - b. Name of project.
 - c. Location of project.
 - d. Brief description of the work involved.

The following is a list of selected municipal Hybas™ IFAS contracts completed during the **last 5 years**.

<u>Year</u>	<u>IFAS Plant Name</u>	<u>Address</u>	<u>Contact</u>	<u>Telephone</u>	<u>Brief Description of Work</u>
2023 (Startup ongoing)	Gatlinburg TN	1025 Banner Road Gatlinburg, TN 37738	Wes Carpenter	865-389-1 701	Retrofit of an existing AS plant to IFAS system for more BOD and nitrification capacity. Very similar scope as Aberdeen as it’s all aerobic.
2022	Erie North, CO	501 State Highway 52 Erie, CO 80516	John Coyle	(303) 434-1334	Retrofitting existing IFAS system from 2011 to include



					BNR and adding an additional IFAS train to a total of 3 trains. Same basic IFAS equipment as Aberdeen plus mixers in anoxic zones and IMLR pumps.
2022	South Beloit, IL	100 Perry Avenue South Beloit, IL 61080	Mike Jones	(815) 389-3070	IFAS A2O process to achieve low TN limits of 6 in summer and 10 in winter. Same basic IFAS equipment as Aberdeen plus mixers in anoxic zones and IMLR pumps.
2021	Security, CO	6510 Southmoor Drive Fountain, CO	Nick Sipe	(719) 492 0255	Four stage IFAS AX-AE-AX-AE process to achieve TN less than 10. Similar scope as Aberdeen but larger with more equipment items.
2018	Massillon OH	151 Lincoln Way East, Massillon, OH 44646	Tony Ulrich; Plant Manager,	(330) 833-3304	Retrofit existing TF/AS plant into an IFAS A2O process to achieve low ammonia, TN and P limits. A bit more scope of work than Aberdeen and larger.

- B. Identify the year that the Equipment Manufacturer first began manufacturing WWTP Equipment for the treatment of municipal wastewater.
- a. Veolia is a company with more than 160 years of history. It started manufacturing WWTP equipment for treatment of municipal wastewater in 1933. As a pioneer/inventor of the MBBR and IFAS technologies, It manufactured world's first IFAS system equipment in 2002 for the Broomfield municipal WWTP in Colorado. On the other hand, it manufactured its first MBBR system equipment in 1990 for the Steinsholt municipal WWTP in Norway. As of today, Veolia has manufactured and delivered more than 1,200 MBBR systems and 75 IFAS systems. Many of the installations from the 1990s are still in operation and have their original equipment.
- C. Furnish a list of North American Equipment installations for the treatment of municipal wastewater. The following information shall all be provided with each listing:
- a. Location
 - b. Equipment rated capacity in mgd
 - c. Identify system by model or type
 - d. First year of operation (or identify as under construction)

Veolia: Please see Attachment B for Veolia's US IFAS installations. MBBR installations have not been provided as MBBRs are different from IFAS from a process standpoint and therefore



should not count as references for this project. Otherwise, Veolia has more MBBRs references that we can provide.

- D. Identify which of the North American installations utilize the manufacturer's same model/type anticipated for City of Aberdeen.

Veolia: A column has been provided in Appendix B to indicate which US installations utilize the same model/type for the City of Aberdeen.

IV. Vendor Licensing Agreement

- A. Attach to this bid, a copy of the manufacturer's licensing agreement for the WWTP equipment technology, if existing, listing commencement and termination dates and all existing contractual arrangements related to the licensing agreement.

Veolia: The IFAS technology is wholly owned by Veolia.



SECTION 1: PRICING AND SCHEDULE

1.1 DESCRIPTION OF WORK

Kruger, an equipment supplier, proposes and agrees to furnish all labor services, materials, equipment, and all other items and facilities necessary to supply and deliver the equipment items as specified in these Proposal Documents and conditions stated herein.

1.2 PROPOSAL PRICE

Price includes IFAS equipment, as well as instrumentation and controls as detailed herein. Kruger's Bid Submittal, including disposition of its bid security, is expressly conditioned on parties reaching mutually acceptable terms and conditions for the contract post-award. Kruger's Bid Submittal is provided per the scope of work as detailed in this Bid Submittal, including pricing, comments and clarifications to the RFP Documents, and terms and conditions as contained herein. Kruger proposes and agrees to negotiate in good faith with the Owner to reach mutually agreeable terms and conditions for the resulting Purchase Order. Kruger's standard Terms of Sale are included herein.

The price excludes sales and/or use taxes. Buyer agrees to provide the necessary tax-exempt certification or Reseller documentation for sales taxes exemption within thirty (30) days after receipt of a purchase agreement executed by all parties. Furthermore, Buyer accepts responsibility for all applicable state and local sales taxes.

Kruger shall furnish and deliver (DDP Jobsite; Freight Estimated) IFAS Equipment as well as instrumentation and controls, including submittals, start-up and other services, in conformance to the requirements set forth in this document for the Lump Sum price of:

SEE BID FORM

The price is valid for 60 days from the date of this Proposal.

The proposed goods may be affected by the ongoing market fluctuations impacting material and shipping costs. Kruger reserves the right to re-evaluate the Proposal price after 60 days from the date of this proposal to the date the purchase agreement is assigned to the contractor. The price shall be subject to escalation based on the following: Price adjustment will be based on the net change of the ENR Construction Cost Index occurring in the period from 60 consecutive calendar days from the proposal date to the date when the agreement is assigned to the contractor. Kruger's price shall not be subject to decrease based on any decrease in the Index. If at the time of the agreement assignment Kruger finds that the percent increase in the Index is insufficient given then existing market conditions (including but not limited to an increase in the cost of materials, labor, fabrication, freight, tariffs or other relevant taxes or fees) Kruger shall submit evidence in support of its claim for an increase in price above the Index to the Engineer/Owner for approval. Said approval shall not be unreasonably withheld or delayed.

The price above includes \$29,000 as an estimate for shipping and freight costs. Please note that shipping will be billed based on actual price at time of delivery.

1.3 LIQUIDATED DAMAGES

Kruger agrees to negotiate mutually acceptable terms for Liquidated Damages with the Owner in the event of Kruger's failure to deliver Equipment in accordance with the mutually agreed upon delivery schedule.

1.4 TERMS OF PAYMENT AND CONDITION OF SALE

The terms of payment are 10% upon receipt of a fully executed contract, 15% upon delivery of submittal of shop drawings, and 75% upon delivery of equipment to the site.

Payment shall not be contingent upon receipt of funds by the Contractor from the Owner and there shall be no retention in payments due to Kruger. All payment terms are net 30 days from date of invoice. Final payment shall not exceed 120 days from delivery of equipment.

All other payment terms as defined in Kruger's Standard Terms of Sale.

1.5 BONDS

Kruger's Bid Submittal includes the cost for a bid bond per the requirements of the bid.

Kruger's Bid Submittal also includes the cost for Performance and Payment Bonds per the bid requirement. A letter from our Surety evidencing Kruger's bonding capacity has been attached.

Kruger proposes to provide Performance and Payment Bonds equal to 100% of the Contract Price upon the assignment of the Contract to the Owner's selected general contractor. The Performance and Payment Bonds shall be released upon completion of the warranty period, however the Performance and Payment Bonds shall not be outstanding for longer than 48 months.

Please see Section 9 of this proposal for more bond information.

1.6 ESTIMATED DELIVERY SCHEDULE

The following delivery schedule is estimated based on current availability of materials and market conditions. Actual equipment delivery lead times may vary at time of order. Veolia will work with the Buyer to update lead times at time or order.

Deliverables	Estimated Delivery
Submittal of Approval Drawings	4 – 8 weeks *
Delivery of Mechanical Equipment	16 – 24 weeks **
Delivery of IFAS Carrier Media	12 – 20 weeks **
Delivery of Instrumentation	18 – 30 weeks **
Delivery of Installation Manuals	Upon delivery of equipment
Delivery of Operation and Maintenance Manuals	90 days**
<ul style="list-style-type: none"> - Aeration system, media, and screens will be shipped via exclusive/dedicated freight. - If Kruger is able to ship equipment sooner than the above schedule, contractor shall accept deliveries and provide adequate storage on-site for such equipment. 	
* after receipt of a fully executed purchase order	
** after receipt of written approval of submittal drawings and release to manufacturer	

1.7 PRIMARY CONTACTS

If any you have any questions or concerns, please contact the following:

	Kruger Contact	Representative
Name	Rodrigo Lara	Scott Forsling, PE
Company	Kruger / Veolia	Coombs Hopkins Company
Address	4001 Weston Parkway Cary, NC 27513	8706 South 700 East Suite 201 Sandy, UT 84070
Phone	503-380-3995	435-659-7199
Email	rodrigo.lara@veolia.com	scott@chcwater.com

1.8 PROPRIETARY INFORMATION

The information or data contained in this proposal is proprietary to Kruger and should not be copied, reproduced, duplicated, or disclosed to any third party, in whole or part, without the prior written consent of Kruger. This restriction will not apply to any information or data that is available to the public generally.

1.9 STATEMENT REGARDING COVID-19

Veolia shall not be held liable in the event of a non-compliance with its obligations set forth herein to the extent such non-compliance is due to the consequences of the Covid-19 pandemic including without

limitation (i) obligation to comply with the legislation enacted or measures taken by the authorities to address the Covid-19 pandemic (including mandatory closures, requisitions, transport limitations, social distancing requirements), (ii) observance of hygiene and security rules and recommendations resulting from the Covid-19 pandemic, (iii) inability to supply or distribute to relevant personnel appropriate personal protective equipment for the tasks to be performed, as a result of shortages of supply resulting from the Covid-19 pandemic, (iv) inability of a Veolia subcontractor or supplier to comply with its obligations for the reasons mentioned above; and to the extent the resulting impediments cannot be reasonably overcome.

In the event such consequences of the Covid-19 pandemic render Veolia's performance hereunder more onerous than could have been anticipated at the date hereof the parties shall negotiate alternative contractual terms, including for delivery/performance dates or service levels, which reasonably allow for the impact of the consequences of the Covid-19 pandemic referred to here above.

1.11 CONTRACT PRICE

Veolia shall be entitled to an adjustment of the Contract Price and/or time of performance in connection with exceptional circumstances beyond Veolia's control such as, without limitation, raw materials shortages, sudden fluctuations of raw material pricing, extension, suspension or delay of the the project schedule, sudden disruption on production of Goods and/or spare parts required for the Project, delay of carriers, which may affect the execution of Veolia's timely performance of the Work or affect it financially. Veolia shall notify the Owner accordingly within ten (10) days from the actual knowledge of such circumstances. Following submission of such notice, Veolia shall provide relevant justification reasonably satisfactory to the Owner to proceed to the necessary adjustments to the Contract Price and/or time of performance under the Contract.

SECTION 2: KRUGER STANDARD TERMS OF SALE

1. **Applicable Terms.** These terms govern the purchase and sale of the equipment and related services, if any (collectively, "Equipment"), referred to in Seller's purchase order, quotation, proposal or acknowledgment, as the case may be ("Seller's Documentation"). Whether these terms are included in an offer or an acceptance by Seller, such offer or acceptance is conditioned on Buyer's assent to these terms. Seller rejects all additional or different terms in any of Buyer's forms or documents.
2. **Payment.** Buyer shall pay Seller the full purchase price as set forth in Seller's Documentation. Unless Seller's Documentation provides otherwise, freight, storage, insurance and all taxes, duties or other governmental charges relating to the Equipment shall be paid by Buyer. If Seller is required to pay any such charges, Buyer shall immediately reimburse Seller. All payments are due within 30 days after receipt of invoice. Buyer shall be charged the lower of 1 ½% interest per month or the maximum legal rate on all amounts not received by the due date and shall pay all of Seller's reasonable costs (including attorneys' fees) of collecting amounts due but unpaid. All orders are subject to credit approval.
3. **Delivery.** Delivery of the Equipment shall be in material compliance with the schedule in Seller's Documentation. Unless Seller's Documentation provides otherwise, Delivery terms are DDP Jobsite.
4. **Ownership of Materials.** All devices, designs (including drawings, plans and specifications), estimates, prices, notes, electronic data and other documents or information prepared or disclosed by Seller, and all related intellectual property rights, shall remain Seller's property. Seller grants Buyer a non-exclusive, non-transferable license to use any such material solely for Buyer's use of the Equipment. Buyer shall not disclose any such material to third parties without Seller's prior written consent.
5. **Changes.** Seller shall not implement any changes in the scope of work described in Seller's Documentation unless Buyer and Seller agree in writing to the details of the change and any resulting price, schedule or other contractual modifications. This includes any changes necessitated by a change in applicable law occurring after the effective date of any contract including these terms.
6. **Warranty.** Subject to the following sentence, Seller warrants to Buyer that the Equipment shall materially conform to the description in Seller's Documentation and shall be free from defects in material and workmanship. The foregoing warranty shall not apply to any Equipment that is specified or otherwise demanded by Buyer and is not manufactured or selected by Seller, as to which (i) Seller hereby assigns to Buyer, to the extent assignable, any warranties made to Seller and (ii) Seller shall have no other liability to Buyer under warranty, tort or any other legal theory. If Buyer gives Seller prompt written notice of breach of this warranty within 30 months from delivery or 24 months from substantial completion of Kruger's equipment, whichever occurs first (the "Warranty Period"), Seller shall, at its sole option and as Buyer's sole remedy, repair or replace the subject parts or refund the purchase price therefore. If Seller determines that any claimed breach is not, in fact, covered by this warranty, Buyer shall pay Seller its then customary charges for any repair or replacement made by Seller. Seller's warranty is conditioned on Buyer's (a) operating and maintaining the Equipment in accordance with Seller's instructions, (b) not making any unauthorized repairs or alterations, and (c) not being in default of any payment obligation to Seller. Seller's warranty does not cover damage caused by chemical action or abrasive material, misuse or improper installation (unless installed by Seller). **THE WARRANTIES SET FORTH IN THIS SECTION ARE SELLER'S SOLE AND EXCLUSIVE WARRANTIES AND ARE SUBJECT TO SECTION 10 BELOW. SELLER MAKES NO OTHER WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR PURPOSE.**
7. **Indemnity.** Seller shall indemnify, defend and hold Buyer harmless from any claim, cause of action or liability incurred by Buyer as a result of third party claims for personal injury, death or damage to tangible property, to the extent caused by Seller's negligence. Seller shall have the sole authority to direct the defense of and settle any indemnified claim. Seller's indemnification is conditioned on Buyer (a) promptly, within the Warranty Period, notifying Seller of any claim, and (b) providing reasonable cooperation in the defense of any claim.
8. **Force Majeure.** Neither Seller nor Buyer shall have any liability for any breach (except for breach of payment obligations) caused by extreme weather or other act of God, strike or other labor shortage or disturbance, fire, accident, war or civil disturbance, delay of carriers, failure of normal sources of supply, act of government or any other cause beyond such party's reasonable control.
9. **Cancellation.** If Buyer cancels or suspends its order for any reason other than Seller's breach, Buyer shall promptly pay Seller for work performed prior to cancellation or suspension and any other direct costs incurred by Seller as a result of such cancellation or suspension.
10. **LIMITATION OF LIABILITY.** NOTWITHSTANDING ANYTHING ELSE TO THE CONTRARY, SELLER SHALL NOT BE LIABLE FOR ANY CONSEQUENTIAL, INCIDENTAL, SPECIAL, PUNITIVE OR OTHER INDIRECT DAMAGES, AND SELLER'S TOTAL LIABILITY ARISING AT ANY TIME FROM THE SALE OR USE OF THE EQUIPMENT SHALL NOT EXCEED THE PURCHASE PRICE PAID FOR THE EQUIPMENT. THESE LIMITATIONS APPLY WHETHER THE LIABILITY IS BASED ON CONTRACT, TORT, STRICT LIABILITY OR ANY OTHER THEORY.
11. **Miscellaneous.** If these terms are issued in connection with a government contract, they shall be deemed to include those federal acquisition regulations that are required by law to be included. These terms, together with any quotation, purchase order or acknowledgement issued or signed by the Seller, comprise the complete and exclusive statement of the agreement between the parties (the "Agreement") and supersede any terms contained in Buyer's documents, unless separately signed by Seller. No part of the Agreement may be changed or canceled except by a written document signed by Seller and Buyer. No course of dealing or performance, usage of trade or failure to enforce any term shall be used to modify the Agreement. If any of these terms is unenforceable, such term shall be limited only to the extent necessary to make it enforceable, and all other terms shall remain in full force and effect. Buyer may not assign or permit any other transfer of the Agreement without Seller's prior written consent. The Agreement shall be governed by the laws of the State of North Carolina without regard to its conflict of laws provisions.



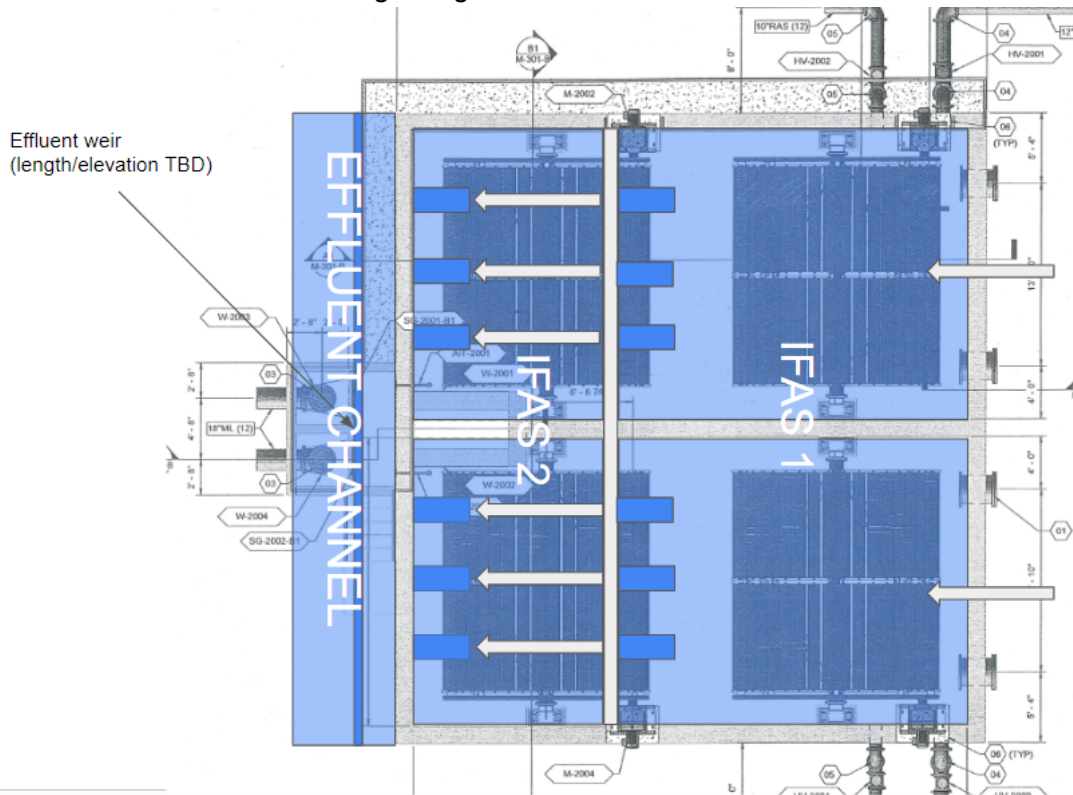
SECTION 3: DESIGN SUMMARY

3.1 DESIGN SUMMARY

The proposed IFAS system is designed per Section 3.5 Performance Guarantee below, and includes the following unique considerations. The Veolia process design team would like to discuss these design considerations at the detailed design stage.

- This design is based on the maximum monthly loads/concentrations at the minimum temperature of 7°C and targets the Maximum Month effluent values.
- The O&M calculations are based on Maximum Month concentrations applied to the annual average flows.
- This design assumes a diurnal peak loading factor of 2.0, typical for smaller plants such as Aberdeen. Blowers and air grids are sized for a 1.3 peaking factor in order to accommodate these daily diurnal peaking loads in addition to the maximum day loads. The system was modeled using both Veolia's proprietary IFAS design tool (calibrated to AnoxKaldnes media and long term empirical experience) and the commercially available BioWin software. When using BioWin or other simulators, it is important to include modeling of **dynamic conditions**. The influent to a municipal wastewater plant is rarely constant in flow or strength. This dynamic modeling provides insight on how the varying loads affect an effluent daily composite sample. These variations can have significant negative impact on ammonia effluent values in BNR systems that are operating under challenging conditions, such as the low design temperature and high peaking factors for Aberdeen.
- Due to the higher BOD and TSS loads, Biowin modeling shows that the suspended SRT is less than 3 days at a normal MLSS of 3,500 mg/L. Furthermore, the small plant size (with higher flow variation) makes the system more susceptible to MLSS washout. Therefore, as noted in the process guarantee, meeting the total BOD limit is contingent on the ability of the clarifiers to achieve a stable secondary effluent TSS of ≤ 30 mg/L at a minimum design MLSS of 3,500 mg/L.
- Given the low temperature, short SRT, and small plant size, and based on the dynamic modeling results and our experience with designing many similar IFAS installations, two IFAS zones are shown to be required to achieve the low ammonia concentration required by the specification, as one IFAS zone is insufficient to expect stable performance at these challenging constraints. The model results show a minimum total protected surface area of 1,946,115 ft² is required for the system to meet the required effluent ammonia limit at a 7 degree C design temperature and shorter than typical suspended SRT. Anything less than this minimum surface area will result in a high risk design that will potentially violate the ammonia limit.
- Veolia performed preliminary hydraulic calculations to evaluate the hydraulic profile of the system. The hydraulic calculations are based on the hydraulic redundancy requirements, head loss through the IFAS zones, and maximum pump capacity of the headworks lift station. Our initial calculations indicated that the current effluent weir, splitter box configuration and freeboard allowance would not satisfy the anticipated hydraulic redundancy requirements (i.e. passing peak flow through one train with the other train offline). To solve this hydraulic issue, Veolia has proposed an effluent channel with a freefall weir in the middle to allow for additional freeboard plus a means for scum to exit the system. The design of this effluent channel and how it should

be connected to the existing effluent split box and/or the downstream clarifiers should be further discussed at the detailed design stage.



Possible IFAS arrangement in existing basin

- To maximize media surface removal rate the tank volume is split with approximately 65% of the volume partitioned for IFAS Zone 1 and 35% for IFAS Zone 2. The media fill percentage is the same in both zones. However, The media volume in IFAS Zone 1 is more than in IFAS Zone 2 due to the larger volume of the first zone.
- The use of AnoxKaldnes AnoxK™5 biofilm carrier, with its high protected surface area, provides the required surface area while keeping the required fill fraction at levels that allow for additional media addition.

Process Design Summary

Parameter	Units	Total
Number of Process Trains	-	2
Number of IFAS Reactors per Train	-	2
IFAS 1 Reactor		
Dimensions (L x W x SWD)	ft	27 x 21.8 x 13.5
Volume	ft ³	7,946
Total Volume	ft ³	15,892
Media Type:	-	AnoxK5
Fill of Biofilm Carriers	%	33
Media Volume	ft ³	5,226
Aeration System Type	-	Medium Bubble
Residual DO, Max Month (Winter/Summer)	mg/L	5 / 3
Total Air Requirement, Max Month (process driven)	SCFM	1,029
Total Air Requirement, Peak	SCFM	1,338
Pressure at Top of Drop Pipe	psi	5.7
IFAS 2 Reactor		
Dimensions (L x W x SWD)	ft	14 x 21.8 x 13.5
Volume	ft ³	4,120
Total Volume	ft ³	8,240
Media Type:	-	AnoxK5
Fill of Biofilm Carriers	%	33
Media Volume	ft ³	2,754
Aeration System Type	-	Medium Bubble
Residual DO, Max Month (Winter/Summer)	mg/L	5 / 3
Total Air Requirement, Max Month (mixing driven)	SCFM	336
Total Air Requirement, Peak	SCFM	386
Pressure at Top of Drop Pipe	psi	5.7
Min MLSS, Max. Month	mg/L	~3,500
RAS, Max. Month	%	50-100
*Estimated maximum alum consumption for P removal (not part of process guarantee)	lb/day	90
Estimated Sludge Production, Max. Month	lb/day	~1,658
Air Requirement for Blowers, Peak (All trains)	SCFM	~1,980

*Alum addition exceeding this amount may affect sludge characteristics and quantity and therefore the biological process performance.



3.2 ESTIMATED O&M COSTS BASED ON AVERAGE ANNUAL FLOWS

To help the Owner and Engineer properly evaluate the life cycle costs of the proposed IFAS system by Kruger, we have prepared the following tables with some preliminary costs information. The first table has information on the recommended maintenance schedules for various tasks/equipment and estimated total hours/man-days to operate and maintain the proposed IFAS system. The second table contains estimated costs for the blower power consumption, labor hours for the operation and maintenance of the system, and parts replacement and materials for the blowers. The costs are presented as annual, 5- year, 10-year, and 20-year present worth values. Installation costs, energy & chemical costs outside Kruger’s scope of supply have not been included.

Equipment	Quantity	Preventive Maintenance Requirement	Maintenance Interval	Persons Required to Perform Task	Time Required to Perform Task	Averaged Man-hours per year
General operations and sampling		Walk through, review setpoints, any necessary sample collection	Weekly	1	60 min	52.0
Blowers, general prevention	3	Check filters, V-belts, Oil level, etc	Weekly	1	10 min	26.0
Blowers, maintenance	3	Filter replacement	Once per year	1	10 min	0.5
	3	V-belt replacement	Once every two years	1	120 min	6.0
	3	Oil replacement	Once every two years	1	120 min	6.0
	3	Motor replacement	Once every five years	1	480 min	24.0
DO Probes	2	Clean and calibrate	Weekly	1	10 min	16
					TOTAL	130.5 hrs
						16.3
						Man-Days

	1 year	5 year	10 year	20 year
Total Blower Energy Cost Based on an Est. 397,688 kwh/yr Total Power Consumption (Present Value)	\$39,769	\$179,558	\$330,742	\$565,211
Blower Maintenance Schedule and Costs (Present value)				
Filter replacement cost (includes standby blower)	\$660	\$2,980	\$5,489	\$9,380
V-belt replacement cost, every 2 years (includes standby blower)	\$693	\$3,128	\$5,762	\$9,847
Oil replacement cost, every 2 years (includes standby blower)	\$221	\$998	\$1,839	\$3,143
Motor replacement cost, every 5 years (includes standby blower)	\$3,413	\$15,408	\$28,381	\$48,501
Bearing replacement cost, every 10 years (includes standby blower)	\$1,279	\$5,773	\$10,634	\$18,172
Total maintenance cost	\$6,265	\$28,288	\$52,105	\$89,044
Labor Costs (Present value)				
Annual labor hours for system O&M, hrs	130.5 hrs			
Cost of labor, \$/hr	75			
Labor Cost, \$	\$9,788	\$44,191	\$81,399	\$139,104



3.3 KRUGER DESIGN BENEFITS

The proposed design with two IFAS zones in each train will have the following benefits to the owner.

1. It ensures that the system meets limits (especially the low ammonia limit) under the low design temperature and short sludge retention time while being able to fit within the existing tank volume.
2. It provides flexibility and potential for more treatment capacity if flow and/or load further increase in the future. The current design has 33% of fill in each zone. If flow and/or load further increase in the future, more media up to 55% fill can simply be added to handle the capacity increase needs. This would not be possible with just one IFAS zone especially if the media fill % in the one zone is already close to a maximum fill %.
3. Washout of MLSS or lower than design MLSS concentrations can occur during the lifetime of the system for certain reasons. For instance, clarifiers do not perform as expected. Or industrial components in the influent stimulate excessive filamentous growth, which makes the sludge settleability (ie SVI) deteriorate and the system not be able to keep enough MLSS in the system. Under these conditions, having media in all reactors can compensate for the MLSS loss and provide more treatment capacity than a design with media in only some reactors.
4. It provides a potential for optimizing system performance by moving media around between the two zones. Currently, the media fill is 33% in each zone. Depending on system performance, adjustment in media fill between the two zones may be beneficial and can be done with the two zones both set up to receive media.
5. It provides flexibility in handling media to the plant. Kruger's IFAS systems are set up to not require draining of the tank under normal operation because all the components under water are designed to require no maintenance during the lifetime of the system. Most of our earlier plants installed 10 to 20 years ago did not have to drain tanks during their long term operation. However, if for whatever reason the plant needs to empty and get in the tanks, they can move media from one zone to the other for storage purposes.
6. The proposed effluent channel design will help improve the overall hydraulics of the system, reducing head loss and providing more freeboard to the IFAS system. More freeboard in the IFAS zones helps reduce media escaping potential during high flow events.
7. Kruger has included scum/foam screens in our proposal to help control scum/foami. Scum/foam can be a big issue for IFAS systems. Kruger has seen multiple installations where scum/foam control mechanisms were not provided or not well managed. Scum/foam accumulated in the IFAS tanks and eventually came out of the tank and was blown to places within those plants, causing health and hygiene concerns. It is best practice to include these mechanisms during the IFAS retrofit as it becomes more difficult to add them later on when the IFAS is put in operation.

3.4 KRUGER SYSTEM BENEFITS

Kruger's Hybas IFAS system is proven to be reliable and robust through 20 plus years of experience and more than 75 worldwide installations. Our system has the following unique system benefits.

1. The proposed system utilizes the AnoxKaldnes AnoxK™5 media with a protected (effective) specific surface area (SSA) of 800 m²/m³ (243 ft²/ft³) that is greater than the SSA of most other media carries, enabling the plant to fit the process into the existing reactors while meeting the maximum 40% fill requirement.
2. The media model to be used in this project has been successfully used in more than one hundred (100) municipal and industrial wastewater treatment plants and is field proven. This eliminates the risks of using an unproven media that may result in much lesser performance and potential media breakage and/or snail problems.
3. The high protected surface area enables a lower fill percentage for the current design (ie. 33%) and allows more media to be added to the reactors for future plant capacity or flow increase.
4. The short media depth of the AnoxK5™ media ensures better mixing and scouring of the biofilm, providing better mass and oxygen transfer and therefore better treatment performance. It also helps prevent high life forms such as snails and worms from brooding and growing in the media.
5. To ensure best media quality, the media used for this project will be virgin HDPE manufactured in the USA. The media has a long life expectancy of more than 20 years. Media made overseas could have quality and/or delivery issues. In addition, media made of recycled materials could result in premature failure and frequent replacements.
6. The Hybas system consists of stainless steel air diffusers that are designed to be robust, non-clogging and maintenance free throughout the lifetime of the system.
7. The system employs stainless steel maintenance-free cylindrical perforated plate screens at the reactor effluent wall to retain media, while allowing treated water to pass through. The current perforated plate screen design is a significant improvement over the previous wedge-wire screen design in terms of screen clogging potential. The wedge wire screen design is prone to clogging by stringy materials that can easily get caught on the wire and are hard to remove, which could result in higher head loss and/or worm issues and therefore demand more maintenance.

3.5 PROCESS GUARANTEE

ANOXKALDNES™ HYBAS™ INTEGRATED FIXED FILM ACTIVATED SLUDGE (IFAS) PROCESS PERFORMANCE SPECIFICATION

I. Definitions

- A. Supplier: Veolia Water Technologies, Inc. dba Kruger
- B. Purchaser: Shall mean the party that has or will enter into a Contract or Purchase Order with Supplier for the purchase of the Equipment.
- C. System Stability: Is achieved when the Basis of Design conditions being met, the system appears to be acclimated to the water, wastewater, or biosolids that it is intended to treat, the System's unit operations are treating the load being provided and appear to be functioning at acceptable operating conditions, and the System is being operated with proper pre-treatment, pre-conditioning, or chemical conditioning as instructed by Supplier.
- D. System: The facility at which the Supplier's Equipment is to be installed inclusive of upstream and downstream Equipment and appurtenances.
- E. Equipment: Equipment provided by the Supplier upon which the Process Guarantee applies.

II. Basis of Design

- A. Purchaser hereby agrees to and certifies the Basis of Design is as provided in Annex A.

III. Process Guarantee

- A. The Process Guarantee as defined in Annex B shall be conclusively and finally demonstrated through the successful completion of the Performance Test as described herein.
- B. Supplier's obligation to comply with the Process Guarantee is strictly subject to and conditioned on the following criteria in effect during start up, operation and Performance Test periods:
 - 1. The influent is in compliance with the Basis of Design in accordance with Annex A ("Compliant Influent").
 - 2. The operation of the System is in accordance with Supplier's Operation and Maintenance manual and/or Supplier's direction.
 - 3. Purchaser allowing Supplier access to the site and any and all data deemed relevant by Supplier and documentation for the facility and its operation.
 - 4. Remote access monitoring at Supplier's discretion.
 - 5. All existing equipment and facilities of Purchaser are in good condition and free of defects.
 - 6. System Stability is achieved as deemed by Supplier.
- C. A Performance Test Protocol shall be provided by Supplier at least 30 days before the official start of the Performance Test.

IV. Performance Test:

A. Activities and responsibilities

1. During start-up, operation and Performance Test periods, the Purchaser shall be responsible to provide trained, competent operators who will operate the facility in accordance with Section III(B)(2) above.
2. Purchaser shall be responsible and bear all costs for collecting all samples, carrying out all laboratory analysis or other tests, and furnishing all necessary labor, laboratory equipment, and supplies.
3. The Performance Test shall commence no later than 14 days after Supplier's written notice to Purchaser that System Stability has been reached.
4. The Performance test shall consist of one, 30-day performance test.
5. This Performance Guarantee will be considered fully satisfied upon completion of the Performance Test demonstrating that the Equipment has delivered effluent as defined in Annex B.
6. During the Performance Test, if operations are interrupted for the maintenance, repair or replacement of Equipment necessary to the Performance Test, the Equipment shall be repaired or replaced (at the cost of the party who is responsible for the damage) and only the remaining portion of the Performance Test will be completed.
7. Upon successful completion of the Performance Test, Supplier shall execute and submit a performance test report and the Certificate of Performance Test Acceptance provided in Annex C to the Purchaser. The effective date for acceptance shall be the date the Performance Test was completed.

B. Unavailability of compliant Influent or other obstacles to the Performance Test

1. Non-Compliant Influent. Any change in the Basis of Design conditions provided in Annex A may have a negative impact on the performance of Supplier's Equipment. It is therefore agreed by the Parties that:
(i) the Purchaser shall inform Supplier of any such changes in a timely manner in order to allow the Parties to assess any impact on the Basis of Design and/or the performance of Supplier's Equipment;
(ii) Supplier shall assess the consequences of such changes on the Performance Guarantee and/or Performance Test; and
(iii) the parties shall meet to try to agree on any required revisions to the Performance Guarantee and/or Contract.
2. If, after the commencement of the Performance Test, the Purchaser is unable to deliver Compliant Influent to the Equipment, the Supplier shall attempt to be treated Non-Compliant Influent, while Purchaser makes every effort to bring the Influent into compliance. Supplier shall assist Purchaser and use commercially reasonable efforts to adjust Equipment and/or operating and maintenance guidelines to optimize performance of the Equipment under the prevailing conditions.
3. Despite the efforts described above, if after the commencement of the Performance Test, any daily Influent composite samples taken during such Test are Non-Compliant Influent, then that day's results and any following days impacted will be excluded from the Performance Test's final results and that day(s) will be considered passed.
4. Disagreement over Compliant Influent. Should the Parties disagree on whether the Influent is Compliant Influent or not, Supplier may take additional Influent and Effluent samples and conduct laboratory testing at a mutually agreed upon 3rd party laboratory, and as applicable, either the Performance Test will be delayed (if not yet commenced) or the Performance Test will be rescheduled.

The Contract Schedule and date of the Performance Test will be adjusted accordingly as provided in the applicable section of the Contract, until the results of such laboratory tests are issued. If the laboratory testing confirms the Influent is non-Compliant Influent, Purchaser shall reimburse Supplier for its costs and expenses.

5. Should the Performance Test fail due to reasons not attributable to Supplier (other than non-compliant influent), at Purchaser's request, cost and expense, Supplier may agree to conduct a subsequent Performance Test.
6. Should the Purchaser be unable or unwilling to conduct the Performance Test within 12 months from delivery of Supplier's Equipment, the requirement to conduct a Performance Test and the Process Guarantee will be deemed met and Purchaser will execute the Certificate of Acceptance. At Purchaser's request, cost and expense, Supplier may agree to extend the time period to conduct the Performance Test.

C. Failure of the Performance Test due to Supplier

1. Should the Performance Test fail due to reasons attributable to Supplier, Supplier will be given the opportunity and a reasonable time to adjust or modify the System in accordance with Supplier's scope of supply, or to modify the operating protocols of the System, provided such operating protocols are in accordance with good engineering practices. Supplier shall be granted two (2) additional opportunities to successfully complete a Subsequent Performance Test. All such adjustments, modifications and additional testing shall be done at Supplier's expense.
2. In the event that the Equipment fails to meet the Process Guarantee following Supplier's efforts as described in the preceding paragraph, Supplier's sole obligation and Purchaser's sole remedy shall be to replace or modify the Equipment, as Supplier deems appropriate to enable the Equipment to meet the Process Guarantee, subject to the limitation of liability set forth in the Contract.

V. Test Methods and Sampling Requirements

- A. The following Sampling and Analytical Parameters table provides the minimum parameters for sampling and analysis. Supplier reserves the right to witness the sampling and testing and to take portions of the samples for analysis in its own laboratories.
- B. The publication, Standard Methods for Examination of Water and Wastewater, most recent edition, shall be used as the primary laboratory and analytical procedure source, unless otherwise agreed to by Supplier. All other analyses, data reduction or tests not specified in that publication or otherwise specified shall be carried out using procedures furnished or approved by Supplier.
- C. In the case of continuous reading instrumentation, OWNER/CONTRACTOR shall calibrate instrumentation at least once per week during the entire test period. Calibration reports shall be available if requested by Supplier.

Sampling and Analytical Parameters		
Parameter	Sample Type	Frequency
Plant Flow, Influent/Effluent, gpd	Continuous	Daily
TSS, Influent/Effluent, mg/L	24 hr Composite	3 times per week
cBOD ₅ , Influent/Effluent, mg/L	24 hr Composite	3 times per week
Total Kjeldahl Nitrogen (TKN), Influent, mg/L	24 hr Composite	3 times per week
NH ₃ -N, Influent/Effluent, mg/L	24 hr Composite	3 times per week
Total Phosphorus, Influent/Effluent mg/L	24 hr Composite	3 times per week
pH, Influent/Effluent, SU	24 hr Composite	3 times per week
Alkalinity, Influent, mg/L as CaCO ₃	24 hr Composite	3 times per week
Temperature, Influent/Effluent, °C	Continuous	Daily



ANNEX A – BASIS OF DESIGN

Purchaser hereby agrees to the Basis of Design as defined herein, confirms its accuracy and completeness, and agrees that it shall serve as the basis for the Process Guarantee as provided in Annex B.

I. Compliant Influent Composition:

Parameter	Units	Values
Flow, Design Flow Rate	MGD	0.50
Flow, Maximum Day	MGD	0.67
Flow, Peak Hourly	MGD	1.73
BOD ₅ , Design Flow	mg/L	360
TSS, Design Flow	mg/L	481
TKN, Design Flow	mg/L	29
TP	mg/L	9.6
Elevation	ft	4,400
Min/Max Temperature	°C	7/19

A. Conditions and Clarifications:

1. The wastewater shall contain sufficient alkalinity, either present in the wastewater or by means of chemical addition by the Purchaser, to maintain a pH in the range of 6.5 - 8.0 in the process tanks.
2. The wastewater is biodegradable and does not contain any substance or element whose presence or concentration causes interference or inhibition, defined as: a substance that hinders the mechanisms of treatment; or whose treatment byproduct (sludge, dewatered liquor, etc.) is hazardous or otherwise requires additional cost for disposal; or may result in gases or vapors that pose a risk to system performance or human health; or that is corrosive, erosive, or abrasive; or which contains pollutants that obstruct the flow in the system. Examples include solvents, lubricants, preservatives, quaternary ammonium compounds, fugitive polymers, oils, etc.
3. With the exception of temperature, all values listed in the Basis of Design are maximum values, including all recycle streams. The minimum and maximum temperatures in the Basis of Design are based upon a seven (7) day average.
4. The running 7-day average reactor temperature shall not be lower than the minimum design temperature, and any daily temperature shall not be less than 7°C.
5. The 7-day average applied loads shall not exceed the design loadings by more than 10%.
6. The influent BOD/TKN ratio to the activated sludge system shall be equal to or greater than 10.
7. The influent BOD/TP ratio to the activated sludge system shall be equal to or greater than 30.



ANNEX B – PROCESS GUARANTEE

Supplier warrants and represents that during the Performance Test, the Equipment will produce effluent meeting the objectives listed in the table below:

I. Compliant Effluent Composition:**Table 2: IFAS Effluent Objectives**

Parameter	Units	Value
cBOD ₅ *	mg/L	30 (30-day) 45 (7-day)
NH ₃ -N	mg/L	1 (30-day) 2.6 (Max day)

*Clarifiers must be capable of achieving a stable effluent TSS \leq 30 mg/L at a minimum design MLSS of 3,500 mg/L. If this cannot be met, design and guaranteed parameters will need to be adjusted. Veolia would like to discuss this with the Engineer at the detailed design stage.



ANNEX C – CERTIFICATE OF PERFORMANCE TEST ACCEPTANCE

The undersigned representative of Veolia Water Technologies Inc (dba Kruger) hereby certifies that the Equipment has successfully completed the Performance Test on:

_____ and as required by the Contract between Kruger and

_____ for the named project.

System: Hybas
Project:Aberdeen ID IFA

Veolia Water Technologies Inc, dba Kruger
Signed:

Printed or Typed Name:

Title:

Date:

ACCEPTANCE:

Purchaser hereby agrees that the Equipment has successfully completed the Performance Test and the Process Guarantee is discharged as of the completion date shown.

[PURCHASER]

Signed: _____

Printed or Typed Name:

Title:

Date:

END OF SECTION



SECTION 4: EQUIPMENT SCOPE OF SUPPLY

4.1 GENERAL

Kruger will provide the equipment and field services as described in the original specification, and as detailed herein.

Kruger will supply the following equipment as described below:

1. IFAS

- a. Biofilm Carrier Elements
- b. Media retention screens with air sparge system & sparge valves
- c. Scum screens
- d. Medium Bubble Aeration System in IFAS Reactors
- e. Blowers
- f. Air grid drop pipe valves

2. System Instrumentation

- a. Control panel with PLC
- b. Associated IFAS instrumentation

4.2 ANOXKALDNES IFAS EQUIPMENT SYSTEM – LIMITED TO IN-BASIN EQUIPMENT ONLY

Process and Mechanical Equipment Items	Qty	Description
AnoxKaldnes K5 Media, (ft ³)	7,980	<ul style="list-style-type: none"> • AnoxKaldnes K5 carrier elements, providing 1,946,115 ft² of effective surface area for biological growth. • Carrier elements will be delivered, DDP Jobsite, freight estimated in this scope of supply, to Aberdeen, ID • Media will be delivered in a total of three (3) covered box trailers, each containing 78 bags. If alternate shipping methods are requested by the Buyer, additional charges may apply. • For reference, Contractors at other projects have typically installed three (3) trailers per day with a crane and a crew of 3-5 people. The fastest installation rate observed was five (5) trucks per day per crew. • Each bag is approximately 3.5 ft x 3.5 ft x 3.0 ft, or 35 ft³ per bag (1.0 m³) and has at least two (2) handles on the top side, which can be used to remove the bags from the trailers. Bags weigh approximately 280 lbs each. • Media bags will be shipped individually or shrink-wrapped 2-3 to a pallet. • The bags will require removal from trailers and field placement or storage by the Contractor. The Contractor will have 2 hours to unload each container, after it arrives on site, before demurrage charges are



		<p>assessed. The Contractor shall be responsible for any demurrage charges.</p> <p>Storage:</p> <ul style="list-style-type: none"> • The media bags can be stored outside for long periods of time however they need to be covered to minimize any degradation of the bag itself due to sunlight. • The media bags can be stored in a pyramid style using 3 - 4 bags as the height of the pyramid. UV-reflective tarps shall be used to cover the bags of media until such time they are loaded into the reactor. • The Contractor shall be responsible for supply, installation, maintenance, and repair of protective tarps or covers.
<p>AnoxKaldnes IFAS Aeration System</p>	<p>4 Reactors</p>	<ul style="list-style-type: none"> • Aeration Systems for two (2) reactors per train for a total of four (4) reactors. The following are provided for the noted reactors: <ul style="list-style-type: none"> o IFAS Reactor 1 <ul style="list-style-type: none"> ▪ Two (2) grids: 4" diameter Schedule 10s drop pipe, 4" diameter Schedule 10s central manifold, and nine (9) diffuser laterals of 1-1/4" diameter and Schedule 5s. o IFAS Reactor 2 <ul style="list-style-type: none"> ▪ Two (2) grids: 3" diameter Schedule 10s drop pipe, 3" diameter Schedule 10s central manifold, and six (6) diffuser laterals of 1" diameter and Schedule 5s. • Laterals with 4 mm holes drilled at equally spaced intervals are designed for a turndown of 50% of the design airflow without loss of equal distribution of air to each lateral • All piping and supports will be of 304 or 304L stainless steel. • All interconnecting hardware provided by Kruger, with the exceptions listed below. Hardware will be of 304 stainless steel. • The aeration system & supports will require unloading & field erection by others. • All drop pipes supplied by Kruger will be terminating 3ft above SWD with a Straub coupling for field piping connection • Kruger shall provide all anchor bolts, nuts and washers. Contractor shall provide epoxy anchor chemicals and applicators. All hardware shall be 304 stainless. Kruger recommends Hilti HY-200 MAX SD adhesive or similar epoxy anchor product.
<p>Cylindrical Screen Assemblies</p>	<p>12</p>	<ul style="list-style-type: none"> • An installed total of twelve (12) screen assemblies, each 5 feet long, 23 inch diameter. Three (3) screens shall be installed in each IFAS reactor. • Minimum of 50% open area in screens. • The cylindrical screen shall be constructed of a minimum 14 ga perforated plate. • Maintain a maximum headloss of 3 inches through each reactor at peak hydraulic flows. • The screens and supports will require unloading & field erection by others. • Kruger shall provide all anchor bolts, nuts, and washers. Contractor shall provide epoxy anchor chemicals and applicators. Kruger



		<p>recommends Hilti HY-200 MAX SD adhesive or similar epoxy anchor product.</p> <ul style="list-style-type: none"> • Wall inserts are not necessary and shall not be provided. • All hardware will be 18-8 stainless.
Scum Screens	8	Two (2) 24" x 48" screens, 304 SS, for each IFAS reactor for scum ports – for a total of four (4) per train
Nozzle Spray Assembly	8	One (1) spray bar with nozzles per scum screen. Piping by others.
Air Scour System	4	An air sparging system in 304L SS will be provided to scour the cylindrical screens in each reactor.
Air Scour Solenoid Valve	4	<ul style="list-style-type: none"> • One (1) shutter valve with on-off actuator for each Sparging Air Header. • For Contractor installation downstream of Air Scour Ball Valve
Air Scour Ball Valve	4	<ul style="list-style-type: none"> • One (1) manual ball valve for each Sparging Air header • For Contractor Installation upstream of Air Scour Shutter Valve
Air Grid Drop Pipe Isolation Valves – IFAS 1 Reactors	4	One (1) 3" Manual Butterfly Valve per air drop pipe – for a total of two (2) per train.
Air Grid Drop Pipe Isolation Valves – IFAS 2 Reactors	4	One (1) 2.5" Manual Butterfly Valve per air drop pipe – for a total of two (2) per train
Positive Displacement Lobe Blowers	2 + 1	<ul style="list-style-type: none"> • Two (2) duty + One (1) stand-by blowers for process air • Motor 75 HP or lower, 2-pole, NEMA, TEFC, 208-230/460V/60HZ, NEMA Premium Efficiency, thermostats, shaft ground ring • V-belt drive, inlet filter-silencer, discharge silencer, pressure relief valve, check valve, misc • MCC starter, VFDs, external controls, isolation valves by others • Aerzen or Gardner Denver

Blower Spare Parts included	Qty
Air Filter(s)	3
Belt Set(s)	3
Delta Lube 06-1 gallon(s)	3



4.3 INSTRUMENTATION & CONTROLS

Kruger shall supply the following equipment as described below.

PLC Based Control Panel

One (1) PLC Based Control panel will be supplied, as specified below, to control the IFAS process based on Operator setpoints. All field wiring and field terminations are by others. The Control Panel will be completely assembled, tested, and programmed for the required functionality. U. L. labeled Panel will be comprised of the following:

IFA System Controls	Quantity (Details)
Control Panels	
NEMA 12 Painted Steel (for indoor use only) Panel, Free Standing Enclosure. *For use in a non-classified environment only.	1
Back Panel for Control Panel - SAGINAW	1
Panelview Plus 7 10" Color Touchscreen Operator Interface w/Ethernet – ALLEN BRADLEY	1
CompactLogix PLC Processor – ALLEN BRADLEY	1
UPS 850VA 120VAC Input/ 120VAC Output – SOLA	1
PLC Control Panel I/O + 20% "LIVE" spare wired signals for additional signal interface - KRUGER	1
Complete Set of Control Panel Internals per Kruger Standard Scope - KRUGER	1
PLC and Operator Interface Programming – KRUGER	1
PLC site Start-Up and Testing – KRUGER	1

Additional notes:

- Each PLC Control Panel will include the necessary input/output plus twenty percent (20%) "Live" spare wired signals for future or additional signal interface.
- All PLC and Operator Interface programming is based on Kruger's standards. Any requests or requirements that would deviate from this standard will result in additional costs. Kruger shall provide the PLC/Operator Interface programming for the Kruger supplied PLC Control Panel.
- The PLC Program and Operator Interface Program and its associated Graphic screens developed by Kruger are for use on the Kruger supplied PLC and Operator Interface.
- Kruger shall use Allen Bradley development software for PLC Programming and Operator Interface Programming; the development software is licensed to Kruger and shall not be provided as part of this scope. Kruger shall not provide any PLC, Network, Operator Interface, SCADA, or Alarm Notification software.



- Kruger shall supply copies of the completed PLC and Operator Interface programs at job completion. Prior to supplying completed PLC and Operator Interface programs, Kruger requests that a non-disclosure agreement be signed and returned.
- Factory testing of the Kruger PLC Control Panel shall be conducted by Kruger personnel at a Kruger selected Panel Facility. Kruger has an established Panel testing criteria and will conduct all Panel and Software testing. When said Panel/Software testing is complete, a Test Report shall be generated. Other parties are welcome to witness panel testing at their expense.

No other Instruments, Control Panel Components (PLC or other components) will be supplied unless they are explicitly listed in this Scope of Supply. Field wiring and field terminations by others.

IFAS Field Instruments		
Description	Manufacturer	Quantity
Thermal Mass Flowmeter w/Transmitter. One (1) per IFAS Train	FCI	2
Dissolved Oxygen Sensor. One (1) per IFAS reactor	Hach	2
SC4500 Transmitters for Dissolved Oxygen Probes.	Hach	2
Level Float Switch. One (1) per aeration train	Anchor Scientific	2
Submersible Level Transducer. One (1) per aeration train		2
Pressure gauge. One (1) per train		2

Kruger shall calibrate and start-up Instruments supplied.



SECTION 5: SCOPE OF WORK

5.1 SCOPE OF WORK

Kruger is responsible for process design and equipment procurement required for the IFAS process and associated equipment. Kruger's scope of work does not include any equipment, materials or other services not specifically defined in this proposal.

5.2 PROCESS DESIGN AND ENGINEERING

Kruger will perform engineering in accordance with the applicable national codes, standards, and/or regulations (except where otherwise noted) in effect at the time of this proposal. Additionally, Kruger will provide all necessary design, installation, and operating information for equipment within its stated scope of supply. Kruger is not responsible for the design, selection, installation, operation, or maintenance of any material, equipment, or services provided by others.

Kruger will provide process engineering and design support for the system as follows:

1. Equipment specification for all equipment supplied by Kruger
2. Technical instruction for operation and start-up of the system
3. Equipment layout drawings
4. Equipment installation instructions
5. O&M manuals

5.3 FIELD SERVICE

Kruger shall supply the following services of one (1) system-trained representative as detailed in Specification SECTION 46 53 36 3.1 – Onsite Services, and as detailed herein:

- Four (4) trips with a total of Eight (8) days
- One (1) trip of four (4) days six months after substantial completion

In addition to the onsite services required by the specification Section 46 53 36, Kruger will provide the following services of an I&C engineer to help inspect, test and startup the control system under Kruger's scope:

- Three (3) trips with a total of twelve (12) days.

NOTES:

- Days are eight hour days Monday through Friday that include travel time.

- Days and/or trips required beyond those indicated above will be billed at Kruger’s published standard rates at time of service, plus travel and lodging costs. Such additional days could become necessary for correction of improperly installed equipment or instrumentation, prolonged construction time, or Contractor’s failure to properly coordinate start-up and training.

5.4 POST-COMMISSIONING SERVICES

Kruger provides remote performance support for one (1) year following system commissioning as a standard service for our customers, consisting of both incoming and outbound call support and regular reports to summarize performance observations and recommendations. This support is provided with the Hubgrade digital service of Veolia, which includes various web-based dashboards for displaying Key Performance Indicators and access to remote Augmented Reality tools through Veolia’s partnership with Help Lightning. Support directly tied to warranty claims will not draw upon the Hubgrade support services.

- | | |
|---|-----------|
| a. Treatment Performance Summary Report: | Quarterly |
| b. Outbound Wellness Call: | Quarterly |
| c. Process/Automation Support Bank (Inbound Calls, 24/7): | 20 hrs |

If a higher level of post-commissioning support is desired, there are many options available. Some examples include:

- Kruger’s expert support can be expanded with an increased number of hrs for call support or more frequent proactive data reviews/reports (e.g. monthly).
- Operator refresher training is commonly provided near the end of the warranty period, or in the event the staff has experienced a high turnover rate. This refresher training is typically done via remote webinar and thus may draw on the Support Bank hours included in the standard post-commissioning service. If a more hands-on approach via a dedicated onsite training session is desired, Kruger can add such a training visit for an additional charge.
- The Hubgrade plan can be upgraded to include Hubgrade Performance Plant, allowing for state-of-the-art real-time performance optimization based on Digital Twin principles and Kruger’s extensive process expertise.



SECTION 6: SCOPE OF WORK BY OTHERS

6.1 SCOPE OF WORK BY OTHERS

Unless otherwise indicated in this Scope of Supply document, the Contractor shall furnish the following items. The Contractor's scope is not necessarily limited to this list:

1. Others shall provide access to the basins and facilities for Kruger field personnel to inspect the installed Kruger equipment. This access shall include, but not be limited to, the following:
 - a. Safe ingress and egress at the basins.
 - b. Equipment, personnel, assistance, training and permitting for confined space entry, if applicable.
 - c. Tank dewatering and sludge removal, if necessary.
 - d. Provisions, such as scaffolding or lifting devices, to allow the Kruger inspector to gain close access to installed equipment for a complete and proper inspection.
 - e. Sufficient lighting for safety and inspection visibility purposes.
 - f. Provisions for atmospheric monitoring and ventilation, if necessary.
 - g. Personnel available to provide remedy for items that can be corrected during or just after the inspection.
2. Receiving (preparation of receiving reports), unloading, storage, maintenance preservation and protection of all equipment, and materials provided by Kruger.
3. Installation of all equipment and materials provided by Kruger.
4. Supply, fabrication, installation, cleaning, pickling, and/or passivation of all stainless steel piping components not provided by Kruger.
5. Supply and installation of all flange gaskets and bolts for all piping components not supplied by Kruger.
6. Supply and installation of all pipe supports not supplied by Kruger.
7. Install and test all level floats, level transmitters, level alarms, and alarm communication devices prior to filling a process tank with media and water.
8. Provide all motor control centers, motor starters, panels, transformers, and VFD's other than supplied by Kruger.
9. Install and terminate all motor control centers, motor starters, panels, transformers, and VFD's.

10. Supply and install all electrical power and control wiring and conduit to the equipment served plus interconnection between Kruger's furnished equipment as required, including wire, cable, junction boxes, fittings, conduit, etc.
11. Provide all anchor bolts and mounting hardware not provided by Kruger.
12. Provide and install all piping required to interconnect to the Supplier's equipment.
13. Provide all nameplates, safety signs and labels.
14. The Contractor shall coordinate the installation and timing of interface points such as piping and electrical with the Supplier.
15. Video recording of any training activities.
16. Supply and install all sunshields and/or additional enclosures as needed when installing equipment and instrumentation outdoors.
17. Collecting of samples from the process (including necessary labor, composite samplers, etc).
18. Laboratory testing of process samples.
19. Good, quality workmanship on concrete work for the process reactors to eliminate large holes, excessive form marks, large pockets, and excessively rough areas. Particular attention must be paid to eliminate the potential for annular space around media retention screens. Concrete finish shall meet Kruger's requirements.
20. Installation, testing, and operation of level detection and level communication systems in the process reactors prior to the filling of process tanks with water and media.
21. Field verification of elevations and dimensions etc.
22. chemical feed systems.
23. Spare parts not specifically included in Kruger's equipment scope.
24. Witnessed FAT tests.
25. Class 1, Div 2 equipment.
26. All other necessary equipment, materials, chemicals and services not otherwise listed as specifically supplied by Kruger.



SECTION 7: COMMENTS TO BID DOCUMENTS

Kruger reviewed the RFP documents pertaining to the terms and conditions, and equipment to be supplied as detailed in the Contract Documents and Technical Specifications, Addendum 1, and Addendum 2 and have the following clarifications and exceptions as shown in the Sections below. Kruger will work with the Engineer and Owner to resolve all technical comments/clarifications. Kruger will also negotiate with the Owner/Engineer in good faith and come to mutually agreeable terms. Kruger deems this comment approach in a table/summary format at a central location is easier. But if the Engineer/Owner prefers redlines and check marks/comments on the specification files, Kruger can provide them upon request.

7.1 COMMENTS TO BID DOCUMENTS

Comment No.	Specification Section/ Drawing	Referenced Documentation	Comments/Clarifications
1	46 53 36 1.7 C 3 e	The effluent quality shall meet the requirements specified for 30 consecutive days based on 24-hour composite sample results.	Veolia understands this requirement requires the process to meet the specified limits on average over the 30 day testing period and not on a day to day basis.
2	46 53 36 1.1 A	The system shall consist of two trains, each with an IFAS zone with media, and a polishing/IMLR pump zone	Due to the low temperature and a much shorter than typical SRT for the current system, Veolia, based on our steady state and dynamic modeling results, has designed two IFAS zones to achieve the low ammonia concentration as required by the specification. One IFAS zone is not going to be adequate, especially when the clarifiers are stressed under high hydraulic/solids loadings. Plus, having two IFAS zones provides many benefits to the system as discussed in the proposal.
3	46 53 36 1.2 C.4	Treatment calculations for maximum monthly loadings, tank volumes required, aeration required and provided, and expected effluent quality. The submitted calculations must show the entire range of operation, (from average to peak hour design flows). Hydraulic calculations must include operation with one unit out of service. Treatment calculations should demonstrate that the system meets redundancy requirements.	Veolia's initial hydraulic calculations are based on the head loss through the IFAS zones and maximum pump capacity of the headworks lift station. These calculations indicated that the current effluent weir, splitter box configuration and freeboard allowance would not satisfy the anticipated hydraulic redundancy requirements (i.e. passing peak flow through one train with the other train offline). To solve this hydraulic issue, Veolia has proposed an effluent channel with a freefall weir in the middle to allow for additional freeboard plus a means for scum to exit the system. The design of this effluent channel and how it should be

			connected to the existing effluent split box and/or the downstream clarifiers should be further discussed at the detailed design stage.
4	DWG M-301-B	IFAS - Mechanical Sections	Veolia has proposed mechanisms for floating scum removal as scum can accumulate in the tanks and become a nuisance without proper exit ports, especially given the higher BOD loading and potential for filamentous growth caused by industrial contribution to the wastewater. Details can be discussed during the detailed design stage.
5	46 53 36 1.7	Process performance requirements	Veolia's proposal is conditioned on reaching mutually agreeable language for the Performance Guarantee. Veolia's standard specification is provided herein for reference.
6	46 53 36:1.2.C.16	The Vendor shall provide anchor bolt calculations made and signed by a civil or structural engineer currently registered in the State of Idaho.	Anchorage calculations are not included in Veolia's design. Support and anchorage is a standard design. Seismic calculations can be provided for an additional charge if required.
7	46 53 36:2.1.B	B. Fabrication: All welded connections shall develop the full strength of the connected elements and all joined or lapped surfaces shall be completely seal welded with a minimum 3/16-inch fillet weld. Intermittent welding shall not be allowed.	Due to material thicknesses of some fabricated items not all welds are seal welded or utilize a 3/16" fillet weld.
8	46 53 36:1.2.C.2	Certified general arrangement drawings showing the layout, all important details and materials of construction, dimensions, loads on supporting structures and anchorage locations.	Equipment weights and sizes will be included. Operating loads will not be provided for support structures and anchorage.
9	46 53 36:2.5.B.3	2-inch diameter 304/304L stainless steel air scour piping will be provided for each cylindrical screen. The air scour piping shall be tapped from the main air line inclusive of manual isolation valves.	Air sparge piping is 1.5" in diameter
10	43 11 33; 2.2.B.	The blower noise shall not exceed 85 dBA at 3 feet per ISO Standard 2151. The blower manufacturer shall perform open field noise test as specified in paragraph 1.2 of this Section meeting the above condition. A sound attenuating enclosure shall be provided to meet the noise limitations.	Blower supplier is guaranteeing a free field sound level based on ISO-2151 empirical data.
11	43 11 33; 2.2.B.2.	The sound attenuating enclosure shall accommodate HVAC ductwork to	Blower sound enclosure will house blower equipment only and will not include ductwork.



		separately vent the blower from the rest of the building.	
12	43 11 33; 2.3.D.2.	Two lobe involute type, straight, and operate without rubbing.	Blower supplier provides rotors of the straight, three-lobe type, and shall operate without rubbing or liquid seals or lubrication.
13	43 11 33; 2.4.A.	Inlet Filter: The inlet filter shall be of heavy-duty construction. The removal efficiency shall be 99.5 percent on 2-micron particles and 97 percent on 1-micron particles. The maximum initial pressure drop across the filter at the rated flow shall not exceed 2.5 inches W.C.	Blower supplier's filter meets the requirements of ASHRAE 52.2 MERV7 50-70% @3-10 microns corresponding to EN779 G4. This filter is designed to provide adequate filtration while maximizing efficiency.
14	43 11 33; 2.4.C.	Valves: A weight-loaded type pressure relief valve shall be provided on the blower discharge. The relief valve shall be sized to discharge 100 percent of the blower capacity and shall be set 0.5 psig above maximum blower discharge pressure.	The blower supplied PRV is field adjustable, however the factory setting is protected with a tamper resistant cover to avoid field adjustment beyond a safe level of operation. If a secondary weighted type valve is required, this valve must ship loose and be installed outside of the blower package by the contractor.
15	43 11 33; 2.6.	SPARE PARTS	Blower supplier only recommends spare inlet filters, V-belts and enough oil for two years of operation.

7.2 OTHER COMMENTS ON GENERAL AND SUPPLEMENTAL TERMS AND CONDITIONS

Kruger proposes and agrees, if selected, to negotiate in good faith with the Owner to reach mutually agreeable terms for the Procurement Agreement, starting from the Procurement Agreement documents included in the Bidding Documents. Upon request, Kruger can provide specific redlines to the Procurement Agreement. The following is a list of the key conceptual terms and conditions to be addressed in the Agreement:

- Limitation of Liability to 100% of the contract value and mutually agreeable exceptions to the mutual waiver of consequential and indirect damages.
- Kruger will agree to proportionate, fault based indemnification for third party claims of personal injury, death, and damage to tangible property and to indemnify Owner against intellectual property infringement.
- A mutually agreeable schedule for submission and review of submittals of shop drawings and equipment delivery, subject to Kruger's lead times set forth in its Bid Submittal and acts of force majeure/excusable delay.
- A mutually agreeable payment schedule.
- A defined scope of work/supply and testing protocol for equipment/services provided by Kruger which includes or addresses Kruger's comments to the technical specifications.
- Kruger's understanding is that the design will be finalized by the Engineer and Kruger during the submittal process. Kruger's Bid Submittal price is based on the scope of work contained in its Bid Submittal. At the conclusion of the submittal process, Kruger shall be entitled to a Change Order to account for the finalized design including changes to scope, price, time and terms as needed. All Change Orders shall be in writing and mutually agreed upon.
- Mutually agreeable provision for adjustment of Kruger's price due to escalation, freight increases or conditions beyond Kruger's control occurring between Execution of Agreement with the Owner and assignment Mutually agreeable terms for the mechanical warranty provided with Kruger's equipment.
- Kruger does not agree to "time is of the essence" language. Either party may terminate the contract for the other party's material breach after a reasonable time to cure.
- Mutually agreeable terms for insurance and policies/limits required to be evidenced by Kruger, proportionate to Kruger's scope of work.
- Liquidated damages must be reasonable in amount, tied to the delivery of equipment in accordance with the mutually agreed upon delivery schedule (subject to excusable delays beyond the control of Kruger), capped in the aggregate at a reasonable amount or percent of the contract value, and be the sole and exclusive remedy for Kruger's failure to deliver equipment on time.
- Mutually agreeable terms and conditions for required bonds, including the delivery and duration of such bonds. (Please see Section 1.5 of Kruger's Bid Submittal for its current bond offering).
- Excusable Delays shall include the existing but evolving COVID-19 pandemic and any variants thereof, the Ukraine/Russia war, government acts, riots.



SECTION 8: BID FORM

BID FORM

PROJECT IDENTIFICATION:

City of Aberdeen - WWTP Equipment Pre-Purchase

ARTICLE 1 - BID RECIPIENT



- 1.01 This Bid is submitted to: **City of Aberdeen, ID**
- 1.02 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into a Contract with Buyer in the form included in the Bidding Documents to furnish the Goods and Special Services as specified or indicated in the Bidding Documents, for the prices and within the times indicated in this Bid, and in accordance with the other terms and conditions of the Bidding Documents. **

ARTICLE 2 - BIDDER'S ACKNOWLEDGMENTS

- 2.01 Bidder accepts all of the terms and conditions of the Notice Inviting Bids and Instructions to Bidders, including without limitation those dealing with the deposition of Bid security. This Bid will remain subject to acceptance for 60 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Buyer. Bidder will sign and submit the Agreement with the Bonds and other documents required within 15 days after the date of Owner's Notice of Award herein is received. **
- 2.02 Bidder acknowledges that this Contract, if awarded, will be assigned by the Owner to the Installation Contractor, and hereby consents to the assignment under the terms and conditions of the Contract Documents. Bidder accepts that, until the assignment of contract is executed by all parties, the Owner is not obligated to any monetary commitment associated with the Contract beyond that which is associated with Special Engineering Services. **

ARTICLE 3 - BIDDER'S REPRESENTATIONS

- 3.01 In submitting this Bid, Bidder represents that:
 - A. Bidder has examined and carefully studied the Bidding Documents, the related data identified in the Bidding Documents, and the following Addenda, receipt of which is hereby acknowledged:

Date	Number	Initials
<u>March 14, 2023</u>	<u>1</u>	<u></u>
<u>March 20, 2023</u>	<u>2</u>	<u></u>
_____	_____	_____

- B. Bidder is familiar with and is satisfied as to all Laws and Regulations in effect as of the date of the Bid that may affect cost, progress, and the furnishing of Goods and Special Services.

**Please refer to verbiage on page 8 of this Bid Form

- C. Bidder has carefully studied, considered, and correlated the information known to Bidder; information commonly known to sellers of similar goods doing business in the locality of the Point of Destination and the site where the Goods will be installed or where Special Services will be provided; information and observations obtained from Bidder's visits, if any, to the Point of Destination and the site where the Goods will be installed or where Special Services will be provided; and any reports and drawings identified in the Bidding Documents regarding the Point of Destination and the site where the Goods will be installed or where Special Services will be provided, with respect to the effect of such information, observations, and documents on the cost, progress, and performance of Seller's obligations under the Bidding Documents.
- D. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, and discrepancies that Bidder has discovered in the Bidding Documents, and the written resolution (if any) thereof by Engineer is acceptable to Bidder.
- E. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for furnishing the Goods and Special Services for which this Bid is submitted. **

ARTICLE 4 - BIDDER'S CERTIFICATIONS

4.01 Bidder certifies that:

- A. This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive agreement or rules of any group, association, organization, or corporation;
- B. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid;
- C. Bidder has not solicited or induced any individual or entity to refrain from bidding; and
- D. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 4.01.D:
 - 1. "corrupt practice" means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process;
 - 2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process to the detriment of Buyer, (b) to establish bid prices at artificial non-competitive levels, or (c) to deprive Buyer of the benefits of free and open competition;
 - 3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Buyer, a purpose of which is to establish bid prices at artificial, non-competitive levels; and

**Please refer to verbiage on page 8 of this Bid Form

4. “coercive practice” means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process.

ARTICLE 5 - BASIS OF BID**

5.01 BID SCHEDULE 1 – BASE BID: WWTP EQUIPMENT. Bidder will furnish the Goods (specifically equipment by vendors listed below) and Special Services in accordance with the Contract Documents for the following price(s). Vendors may provide bids for one or more of the following base bid items. State of Idaho taxes shall not be included (Section P-800 – Supplementary Conditions 5.05.A).

Item No.	Description	Unit	Amount
1A	SUBMITTALS AND SHOP DRAWINGS: As defined in the Agreement, price not to exceed 10% of the Contract price for the work outlined in Item 1B.	LS	\$ <u>109,900</u>
1B	INTEGRATED FIXED FILM ACTIVATED SLUDGE SYSTEM consisting of (1) IFAS system and all necessary appurtenances and services as described in Section 46 21 35 of the specifications.	LS	\$ <u>988,300</u>
1A + 1B	TOTAL ITEM PRICE \$ <u>One Million, One-Hundred Thousand, Seven-Hundred</u> (In Words)	LS	\$ <u>1,098,200</u>

Item No.	Description	Unit	Amount
2A	SUBMITTALS AND SHOP DRAWINGS: As defined in the Agreement, price not to exceed 10% of the Contract price for the work outlined in Item 2B.	LS	Not Applicable \$
2B	SAND FILTER SYSTEM consisting of sand filters with all necessary appurtenances and services as described in Section 46 61 27 of the specifications.	LS	Not Applicable \$
2A + 2B	TOTAL ITEM PRICE \$ Not Applicable (In Words)	LS	Not Applicable \$

**Please refer to verbiage on page 8 of this Bid Form

Item No.	Description	Unit	Amount
3A	SUBMITTALS AND SHOP DRAWINGS: As defined in the Agreement, price not to exceed 10% of the Contract price for the work outlined in Item 3B.	LS	Not Applicable \$
3B	MECHANICAL DEWATERING SYSTEM consisting of mechanical screw press equipment and all necessary appurtenances and services as described in Section 46 66 16 of the specifications.	LS	Not Applicable \$
3A + 3B	TOTAL ITEM PRICE \$ Not Applicable <hr style="width: 50%; margin-left: 0;"/> (In Words)	LS	Not Applicable \$

ARTICLE 6 - PRICE ESCALATION**

- 6.01 Any selected vendor or vendors will be required to honor their submitted proposal pricing for the Goods and Services for 60 consecutive calendar days from the proposal due date for this RFP.
- 6.02 Where a signed agreement between the City and the manufacturer is not signed within 60 calendar days from the proposal due date, price escalation shall be allowed as follows: Price adjustment will be based on the net change of the ENR Construction Cost Index occurring in the period from 60 consecutive calendar days from the proposal due date to the date when the agreement is signed with the City.

ARTICLE 7 - TIME OF COMPLETION**

- 7.01 Bidder agrees that the furnishing of Goods and Special Services will conform to the schedule below. Startup services and training shall be coordinated with the Installation Contractor and Owner but shall not occur more than 21 days after the Vendor has certified the installation of the equipment.

Item	Required Time for Completion (Calendar days from Vendor Bid Award)
Signing of Agreement	30
	Required Time for Completion (Calendar days from completion of Signed Agreement)
Accepted Submittals, including drawings, calculations, and anchor bolt design	75
	Required Time for Completion (Calendar days from Installation Contractor Bid Award)

**Please refer to verbiage on page 8 of this Bid Form

Assignment of Agreement to Installation Contractor	30
Delivery	212

ARTICLE 8 - ATTACHMENTS TO THIS BID

8.01 The following documents are attached to and made a condition of this Bid:

- A. Information Required of Bidder;
- B. Required Bid Security;^{**}
- ~~C. If Bid amount exceeds \$10,000, signed Compliance Statement (RD 400-6). Refer to specific equal opportunity requirements set forth in paragraph 18.10 of the Supplemental Conditions to the agreement with the Contractor who will install the WWTP equipment and to who the City will assign the contract with the Vendor (attached);~~
- ~~D. If Bid amount exceeds \$25,000, signed Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transactions (AD-1048);~~
- ~~E. If Bid amount exceeds \$100,000, signed RD Instruction 1940 Q, Exhibit A01, Certification for Contracts, Grants and Loans.~~

****Please refer to verbiage on page 8 of this Bid Form**

ARTICLE 9 - BID SUBMITTAL

9.01 This Bid submitted by:

If Bidder is:

An Individual

Name (typed or printed): _____

By: _____
(Individual's signature)

Doing business as: _____

Business address: _____

Phone: _____ Facsimile: _____

E-mail address: _____

Partnership

Partnership Name: _____ (SEAL)

By: _____
(Signature of general partner - attach evidence of authority to sign)

Name (typed or printed): _____

Business address: _____

Phone: _____ Facsimile: _____

E-mail address: _____

A Corporation

Corporation Name: Veolia Water Technologies, Inc.

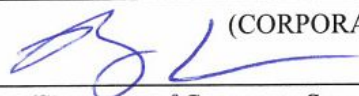
State of Incorporation: Delaware

Type (General Business, Professional, Service, other): General Business

By:  **
(Signature - attach evidence of authority to sign)

Name (typed or printed): Michael Gutshall

Title: Vice President

Attest  (CORPORATE SEAL)
(Signature of Corporate Secretary)



Business address: 4001 Weston Parkway
Cary, NC 27513

Phone: 919-677-8310 Facsimile: 919-677-0082

E-mail address: rodrigo.lara@veolia.com

A Limited Liability Company (LLC)

LLC Name: _____

State in which organized: _____

By: _____
(Signature - attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____

Business address: _____

Phone: _____ Facsimile: _____

E-mail address: _____

**Please refer to verbiage on page 8 of this Bid Form

A Joint Venture

First Joint Venturer Name: _____ (SEAL)

By: _____
(Signature - attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____

Business address: _____

Phone: _____ Facsimile: _____

E-mail address: _____

Second Joint Venturer Name: _____ (SEAL)

By: _____
(Signature - attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____

Business address: _____

Phone: _____ Facsimile: _____

E-mail address: _____

Phone and Facsimile Number, and Address for receipt of official communications to Joint
Venture:

(Each joint venturer must sign. The manner of signing for each individual, partnership, corporation, and limited liability company that is a party to the joint venture should be in the manner indicated above.)

**Veolia Water Technologies, Inc. dba Kruger's Bid Submittal, including disposition of its bid security, is expressly conditioned on parties reaching mutually acceptable terms and conditions for the contract post-award. Kruger's Bid Submittal, is provided per the scope of work as detailed in this Bid Submittal, including pricing, Comments to the Bid Documents, Process Guarantee, and terms and conditions, contained therein.

Veolia Water Technologies, Inc.
Unanimous Written Consent of the Directors
November 17, 2021

The undersigned, being all of the directors of Veolia Water Technologies, Inc., a Delaware corporation (the "Corporation"), hereby adopt the following resolutions and preambles removing an officer of the Corporation without the necessity of a meeting, in accordance with the Delaware General Corporation Law and the Bylaws of the Corporation:


RESOLVED, that Richard Dimassimo, the former Vice President (Engineering Only) resigned his position on September 30, 2021.

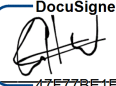
RESOLVED, that the following individuals are hereby elected to the respective offices of the Corporation indicated below to serve in such offices in accordance with the Bylaws of the Corporation until the next annual election of officers and until their successors are duly elected and qualified, or until their earlier death, resignation, retirement, disqualification or removal from office:

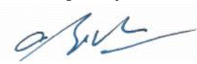
Jim Brown	President and CEO
John M. Santelli	Vice President, Secretary and Treasurer
Michael Gutshall	Vice President
Mark Boone	Senior Vice President
Laurent Cuny	Vice President
Jack Kuhar	Vice President (Engineering Only)
John Dimonte	Vice President (Engineering Only)
Frederic Pfau	Assistant Secretary
Brittany Tuck	Assistant Secretary
Martin Vosburg	Assistant Treasurer

IT IS FURTHER RESOLVED, that Jack Kuhar and John Dimonte shall continue to serve as Vice Presidents for the limited purpose of supervising engineering work to enable the Corporation to obtain and maintain certain professional engineering licenses and certificates of authority and to perform all tasks incidental thereto.

WITNESS the due execution hereof as of the date first above written.

DocuSigned by:

1E1D249A9E5D444...
James T. Brown

DocuSigned by:

47F77BE1F0564D9...
Vincent Caillaud

DocuSigned by:

FD730AD203AC4CA...
Claire Béchaux



SECTION 9: BID BOND

BID BOND

Any singular reference to Bidder, Surety, Owner, or other party shall be considered plural where applicable.

BIDDER (Name and Address):

Veolia Water Technologies, Inc.
4001 Weston Parkway
Cary, NC 27513

SURETY (Name, and Address of Principal Place of Business):

Federal Insurance Company
202B Halls Mill Road
Whitehouse Station, NJ 08889-3454

OWNER (Name and Address):

City of Aberdeen
33 N. Main St.
Aberdeen, ID 83210

BID

Bid Due Date: April 4, 2023

Description (Project Name— Include Location): City of Aberdeen's Wastewater Treatment Plant Equipment Pre-Purchase IFAS System Equipment Supply

BOND

Bond Number: 36813-CHU-23-1

Date: March 22, 2023

Penal sum	<u>Five Percent of Amount Bid</u>	\$	<u>5% of Amount Bid</u>
	(Words)		(Figures)


Surety and Bidder, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Bid Bond to be duly executed by an authorized officer, agent, or representative.

BIDDER	SURETY
Veolia Water Technologies, Inc. (Seal)	Federal Insurance Company (Seal)
Bidder's Name and Corporate Seal	Surety's Name and Corporate Seal


By: 
Signature

Michael Gutsch II
Print Name

Vice-President
Title


Attest: 
Signature

Title Assistant Secretary

By: 
Signature (Attach Power of Attorney)

Kristin S. Bender
Print Name

Attorney-in-Fact
Title

Attest: 
Signature Annette Audinot

Title Witness as to Surety

Note: Addresses are to be used for giving any required notice.
Provide execution by any additional parties, such as joint venturers, if necessary.

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Bidder's and Surety's liability. Recovery of such penal sum under the terms of this Bond shall be Owner's sole and exclusive remedy upon default of Bidder.
2. Default of Bidder shall occur upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.
3. This obligation shall be null and void if:
 - 3.1 Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or
 - 3.2 All Bids are rejected by Owner, or
 - 3.3 Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).
4. Payment under this Bond will be due and payable upon default of Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.
5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions shall not in the aggregate exceed 120 days from the Bid due date without Surety's written consent.
6. No suit or action shall be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety and in no case later than one year after the Bid due date.
7. Any suit or action under this Bond shall be commenced only in a court of competent jurisdiction located in the state in which the Project is located.
8. Notices required hereunder shall be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Registered or Certified Mail, return receipt requested, postage pre-paid, and shall be deemed to be effective upon receipt by the party concerned.
9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.
10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond shall be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute shall govern and the remainder of this Bond that is not in conflict therewith shall continue in full force and effect.
11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

Power of Attorney

Federal Insurance Company | Vigilant Insurance Company | Pacific Indemnity Company
Westchester Fire Insurance Company | ACE American Insurance Company

Know All by These Presents, that FEDERAL INSURANCE COMPANY, an Indiana corporation, VIGILANT INSURANCE COMPANY, a New York corporation, PACIFIC INDEMNITY COMPANY, a Wisconsin corporation, WESTCHESTER FIRE INSURANCE COMPANY and ACE AMERICAN INSURANCE COMPANY corporations of the Commonwealth of Pennsylvania, do each hereby constitute and appoint

Kristin S. Bender

each as their true and lawful Attorney-in-Fact to execute under such designation in their names and to affix their corporate seals to and deliver for and on their behalf as surety thereon or otherwise, bonds and undertakings and other writings obligatory in the nature thereof (other than bail bonds) given or executed in the course of business, and any instruments amending or altering the same, and consents to the modification or alteration of any instrument referred to in said bonds or obligations.

In Witness Whereof, said FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, PACIFIC INDEMNITY COMPANY, WESTCHESTER FIRE INSURANCE COMPANY and ACE AMERICAN INSURANCE COMPANY have each executed and attested these presents and affixed their corporate seals on this 10th day of March, 2020.

Dawn M. Chloros

Dawn M. Chloros, Assistant Secretary

Stephen M. Haney

Stephen M. Haney, Vice President



STATE OF NEW JERSEY
County of Hunterdon

ss.

On this 10th day of March, 2020 before me, a Notary Public of New Jersey, personally came Dawn M. Chloros and Stephen M. Haney, to me known to be Assistant Secretary and Vice President, respectively, of FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, PACIFIC INDEMNITY COMPANY, WESTCHESTER FIRE INSURANCE COMPANY and ACE AMERICAN INSURANCE COMPANY, the companies which executed the foregoing Power of Attorney, and the said Dawn M. Chloros and Stephen M. Haney, being by me duly sworn, severally and each for herself and himself did depose and say that they are Assistant Secretary and Vice President, respectively, of FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, PACIFIC INDEMNITY COMPANY, WESTCHESTER FIRE INSURANCE COMPANY and ACE AMERICAN INSURANCE COMPANY and know the corporate seals thereof, that the seals affixed to the foregoing Power of Attorney are such corporate seals and were thereto affixed by authority of said Companies; and that their signatures as such officers were duly affixed and subscribed by like authority.

Notarial Seal



KATHERINE J. ADELAAR
NOTARY PUBLIC OF NEW JERSEY
No. 2316685
Commission Expires July 16, 2024

Katherine J. Adelaar
Notary Public

CERTIFICATION

Resolutions adopted by the Boards of Directors of FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, and PACIFIC INDEMNITY COMPANY on August 30, 2016; WESTCHESTER FIRE INSURANCE COMPANY on December 11, 2006; and ACE AMERICAN INSURANCE COMPANY on March 20, 2009:

"RESOLVED, that the following authorizations relate to the execution, for and on behalf of the Company, of bonds, undertakings, recognizances, contracts and other written commitments of the Company entered into in the ordinary course of business (each a "Written Commitment"):

- (1) Each of the Chairman, the President and the Vice Presidents of the Company is hereby authorized to execute any Written Commitment for and on behalf of the Company, under the seal of the Company or otherwise.
(2) Each duly appointed attorney-in-fact of the Company is hereby authorized to execute any Written Commitment for and on behalf of the Company, under the seal of the Company or otherwise, to the extent that such action is authorized by the grant of powers provided for in such person's written appointment as such attorney-in-fact.
(3) Each of the Chairman, the President and the Vice Presidents of the Company is hereby authorized, for and on behalf of the Company, to appoint in writing any person the attorney-in-fact of the Company with full power and authority to execute, for and on behalf of the Company, under the seal of the Company or otherwise, such Written Commitments of the Company as may be specified in such written appointment, which specification may be by general type or class of Written Commitments or by specification of one or more particular Written Commitments.
(4) Each of the Chairman, the President and the Vice Presidents of the Company is hereby authorized, for and on behalf of the Company, to delegate in writing to any other officer of the Company the authority to execute, for and on behalf of the Company, under the Company's seal or otherwise, such Written Commitments of the Company as are specified in such written delegation, which specification may be by general type or class of Written Commitments or by specification of one or more particular Written Commitments.
(5) The signature of any officer or other person executing any Written Commitment or appointment or delegation pursuant to this Resolution, and the seal of the Company, may be affixed by facsimile on such Written Commitment or written appointment or delegation.

FURTHER RESOLVED, that the foregoing Resolution shall not be deemed to be an exclusive statement of the powers and authority of officers, employees and other persons to act for and on behalf of the Company, and such Resolution shall not limit or otherwise affect the exercise of any such power or authority otherwise validly granted or vested."

I, Dawn M. Chloros, Assistant Secretary of FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, PACIFIC INDEMNITY COMPANY, WESTCHESTER FIRE INSURANCE COMPANY and ACE AMERICAN INSURANCE COMPANY (the "Companies") do hereby certify that

- (i) the foregoing Resolutions adopted by the Board of Directors of the Companies are true, correct and in full force and effect,
(ii) the foregoing Power of Attorney is true, correct and in full force and effect.

Given under my hand and seals of said Companies at Whitehouse Station, NJ, this March 22, 2023



Dawn M. Chloros

Dawn M. Chloros, Assistant Secretary

IN THE EVENT YOU WISH TO VERIFY THE AUTHENTICITY OF THIS BOND OR NOTIFY US OF ANY OTHER MATTER, PLEASE CONTACT US AT:
Telephone (908) 903-3493 Fax (908) 903-3656 e-mail: surety@chubb.com



SECTION 10: SAMPLE INSURANCE CERTIFICATE



CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY)
12/23/2021

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must have ADDITIONAL INSURED provisions or be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER Marsh USA, Inc. 540 W. Madison Street Chicago, IL 60661 Attn: Veolia.CertRequest@marsh.com Fax: 212-948-5053 VWT Cary	CONTACT NAME _____	
	PHONE (A/C, No. Ext): _____	FAX (A/C, No): _____
E-MAIL ADDRESS: _____		
INSURER(S) AFFORDING COVERAGE		NAIC #
INSURER A : National Union Fire Insurance Company Of Pittsburgh		19445
INSURER B : AIU Insurance Co		19399
INSURER C : N/A		N/A
INSURER D : Berkshire Hathaway Specialty Insurance		22276
INSURER E : AIG Specialty Insurance Company		26883
INSURER F :		

COVERAGES **CERTIFICATE NUMBER:** CHI-009773857-19 **REVISION NUMBER:** 8

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSR	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS
A	<input checked="" type="checkbox"/> COMMERCIAL GENERAL LIABILITY <input type="checkbox"/> CLAIMS-MADE <input checked="" type="checkbox"/> OCCUR GEN'L AGGREGATE LIMIT APPLIES PER: <input checked="" type="checkbox"/> POLICY <input type="checkbox"/> PRO-JECT <input type="checkbox"/> LOC <input type="checkbox"/> OTHER: _____			GL5425835	01/01/2022	01/01/2023	EACH OCCURRENCE \$ 5,000,000 DAMAGE TO RENTED PREMISES (Ea occurrence) \$ 1,000,000 MED EXP (Any one person) \$ 10,000 PERSONAL & ADV INJURY \$ 5,000,000 GENERAL AGGREGATE \$ 5,000,000 PRODUCTS - COMP/OP AGG \$ 5,000,000 _____ \$ _____
A	<input checked="" type="checkbox"/> AUTOMOBILE LIABILITY <input checked="" type="checkbox"/> ANY AUTO <input type="checkbox"/> OWNED AUTOS ONLY <input type="checkbox"/> SCHEDULED AUTOS <input type="checkbox"/> HIRED AUTOS ONLY <input type="checkbox"/> NON-OWNED AUTOS ONLY			CA9767418 (AO5) CA9767419 (MA) CA9767420 (VA)	01/01/2022 01/01/2022 01/01/2022	01/01/2023 01/01/2023 01/01/2023	COMBINED SINGLE LIMIT (Ea accident) \$ 5,000,000 BODILY INJURY (Per person) \$ _____ BODILY INJURY (Per accident) \$ _____ PROPERTY DAMAGE (Per accident) \$ _____ _____ \$ _____
	<input type="checkbox"/> UMBRELLA LIAB <input type="checkbox"/> OCCUR <input type="checkbox"/> EXCESS LIAB <input type="checkbox"/> CLAIMS-MADE DED: _____ RETENTION \$: _____						EACH OCCURRENCE \$ _____ AGGREGATE \$ _____ _____ \$ _____
B	<input checked="" type="checkbox"/> WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? (Mandatory in NH) If yes, describe under DESCRIPTION OF OPERATIONS below		N/A	WC 058240107 (AO5) WC 058240110 (CA) WC 058240109 (WJ) WC 065885979 (NY)	01/01/2022 01/01/2022 01/01/2022 01/01/2022	01/01/2023 01/01/2023 01/01/2023 01/01/2023	<input checked="" type="checkbox"/> PER STATUTE <input type="checkbox"/> OTHER E.L. EACH ACCIDENT \$ 1,000,000 E.L. DISEASE - EA EMPLOYEE \$ 1,000,000 E.L. DISEASE - POLICY LIMIT \$ 1,000,000
E	CPL - SIR: \$500,000			CPO29329661	01/01/2022	01/01/2023	Occurrence/Aggregate \$ 5,000,000
D	E&O - SIR: \$10,000,000			42-CNP-313450-02	01/01/2022	01/01/2023	Per Claim/Aggregate \$ 5,000,000

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)

CERTIFICATE HOLDER Veolia Water Technologies, Inc. 4001 Weston Parkway Cary, NC 27513	CANCELLATION SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS. AUTHORIZED REPRESENTATIVE <i>Marsh USA Inc.</i>
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APPENDIX A: VEOLIA IFAS DESIGN TEAM EXPERIENCE





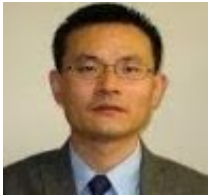
Veolia/Kruger Process Design Team & Experience


Veolia/Kruger leads the industry in the development, piloting, design and optimization of the IFAS technology in the United States. We will leverage this experience to deliver a holistic solution to meet your teams' unique drivers and interests.

- Unmatched U.S. Expertise and Support:
 - Kruger's U.S. experts, engineers, and designers have been with Kruger for decades and have a collective design experience of more than 300 years.
 - Kruger's U.S. team of engineers will provide your team with invaluable first-hand experience gained through the design, implementation, startup, troubleshooting and/or operation of more than 35 U.S. IFAS and other biological installations over the past 30 years.
 - Having numerous U.S. experts available ensures that our team will be able to consistently and steadily support and follow the project from start to finish and in a timely manner.
 - Kruger process engineers have been closely involved with the design of IFAS and MBBR applications. Such applications include treatment of both municipal, industrial and commercial wastewaters.
- Development and Ownership of Technology:
 - Veolia developed and owns the IFAS / MBBR technologies. This means there is no risk of losing the license and thus ability to support your team from the start of the project to the distant future.
- Resumes
 - Attached are resumes from a few of our process engineers/experts who may be onsite during the start up to assist with installation, startup, training and process testing.

Name	Place of Work	Years with Veolia	Total Years of Experience	Project Responsibilities	Photo
Kim Sorensen, <i>Senior Process and Technology Expert</i>	France, Veolia	25	38	IFAS / MBBR and biological technology validation, risk evaluation and control, process modeling, overall project supervision and advice	
Jeff Moccock <i>VP Engineering</i>	Cary, NC	20	20	IFAS / MBBR and biological technology validation, risk evaluation and control, pilot asset management, overall project supervision and advice	
Rich DiMassimo, P.E. <i>Consulting Engineering (Former VP Engineering)</i>	Cary, NC	23	27	IFAS / MBBR and biological process design, modeling, specifications/drawings and proposal preparation, technical communication and customer service; project commissioning, trouble-shooting; operator training; process manager and supervision.	
Glenn Thesing, P.E., MSEE <i>Process Manager</i>	Cary, NC	23	27	IFAS / MBBR and biological process design, modeling, specifications/drawings and proposal preparation, technical communication and customer service; project commissioning, trouble-shooting; operator training; process manager and supervision.	
Luke Wood, PE <i>Senior Principal Engineer</i>	Cary, NC	23	30	IFAS / MBBR and biological process design, modeling, specifications/drawings and proposal preparation, technical communication and customer service; project commissioning, trouble-shooting; operator training; process manager and supervision.	

<p>Hong Zhao, Ph.D., P.E. <i>Process & Technology Leader</i></p>	<p>Cary, NC</p>	<p>22</p>	<p>22</p>	<p>IFAS / MBBR and biological process design modeling tool development; expert comprehensive process design oversight; technology research/development and validation; technology leader.</p>	
<p>Joseph Ma <i>Process Engineer</i></p>	<p>Cary, NC</p>	<p>2</p>	<p>16</p>	<p>IFAS / MBBR and biological process design and modeling; specification/drawings and proposal preparation; technical communication and customer service; project commissioning, trouble-shooting, operators training. Process engineer.</p>	
<p>Meg Hollowed, PE <i>Principal Process Engineer</i></p>	<p>Cary, NC</p>	<p>8</p>	<p>12</p>	<p>IFAS / MBBR and biological process design and modeling; specification/drawings and proposal preparation; technical communication and customer service; project commissioning, trouble-shooting, operators training. Process engineer.</p>	
<p>Michael Johns <i>Senior Process Engineer</i></p>	<p>Providence, RI</p>	<p>17</p>	<p>20</p>	<p>IFAS / MBBR and biological process design design, modeling, specifications/drawings and proposal preparation, technical communication and customer service; project commissioning, trouble-shooting; operators training; process manager and supervision..</p>	
<p>Mike Baker <i>I&C Department Manager</i></p>	<p>Cary, NC</p>	<p>19</p>	<p>23</p>	<p>Instrumentation and Controls; PLC, SCADA</p>	
<p>Tim Platt, PMP <i>Projects Department Manager</i></p>	<p>Cary, NC</p>	<p>22</p>	<p>22</p>	<p>Project management and delivery; scheduling; internal communication with Veolia functional groups and external communication with contractor, engineer and owner;</p>	

<p>Pia Prohaska Senior Process Engineer</p>	<p>Cary, NC</p>	<p>35</p>	<p>35</p>	<p>IFAS / MBBR and biological process design and modeling; specification/drawings and proposal preparation; technical communication and customer service; project commissioning, trouble-shooting, operators training. Process engineer.</p>	
<p>Ashley Waples</p>	<p>Cary, NC</p>	<p>15</p>	<p>15</p>	<p>IFAS / MBBR and biological process design and modeling; specification/drawings and proposal preparation; technical communication and customer service; project commissioning, trouble-shooting, operators training. Process engineer.</p>	
<p>Todd Casey <i>Project Manager</i></p>	<p>Cary, NC</p>	<p>24</p>	<p>32</p>	<p>Instrumentation and Controls; PLC, SCADA;</p>	
<p>Hans Hoffman <i>Mechanical Design Group Manager</i></p>	<p>Cary, NC</p>	<p>9</p>	<p>21</p>	<p>Mechanical design, fabrication and installation; CAD drawings; Equipment inspection and certification; Specifications.</p>	
<p>Larry Li <i>AnoxKaldnes PM</i></p>	<p>Cary, NC</p>	<p>5</p>	<p>20</p>	<p>AnoxKaldnes product development and coordination, proposal and technical support.</p>	
<p>Jenna Young Process Engineer</p>	<p>Cary, NC</p>	<p>3</p>	<p>8</p>	<p>IFAS / MBBR and biological process design and modeling; specification/drawings and proposal preparation; technical communication and customer service; project commissioning, trouble-shooting, operators training. Process engineer.</p>	

Rodrigo Lara <i>Regional Manager</i>	Portland, OR	2	16	Proposal preparation, commercial, contracting, customer support.	
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PROCESS MANAGER

Glenn Thesing, P.E., MSEE
Veolia Water Technologies, Inc.
4001 Weston Parkway
Cary, NC 27513
Office: +1 919-653-4555
Cell: +1 919-523-1154
glenn.thesing@veolia.com

PROJECT HIGHLIGHTS

Binghamton-Johnson City Joint Sewage Treatment Plant, Binghamton, NY

- Application: Wastewater
- Technologies: BIOSTYR Duo and ACTIFLO
- Role: Process Design Manager. Provided process and hydraulic design support to Consultant during final design of 35 MGD ADF BIOSTYR DUO consisting of 14 cells for BOD and NH₃ removal and 4 denitrification cells. Startup planned in 2019.

Peirce Island WWTP, Portsmouth, NH

- Application: Wastewater
- Technologies: BIOSTYR
- Role: Process Design Manager. Provided process and hydraulic design support to Consultant during final design of 11 MGD ADF BIOSTYR consisting of 6 cells for removal of BOD and NH₃ and 6 denitrification cells. Startup planned in 2019.

Metropolitan Water Reclamation District of Greater Chicago, IL

- Application: Digester centrate
- Technologies: ANITA Mox system for deammonification
- Role: Process Design Manager. Provided process design support during pilot testing, final design, and startup of an ANITA Mox MBBR for removal of NH₃ by the deammonification process. System started in 2016.

City of Durham South WRF, Durham, NC

- Application: Digester filtrate
- Technologies: ANITA Mox system for deammonification
- Role: Process Design Manager. Provided process design support to Consultant during final design and startup of an ANITA Mox MBBR for removal of NH₃ by the deammonification process. System started in 2015.

Tahoe-Truckee Sanitation Agency, Truckee, CA

- Application: Wastewater
- Technologies: BIOSTYR
- Role: Process Design Lead. Provided support during process design, installation, commissioning, and performance testing phases for successful completion of 10 MGD ADF BIOSTYR. System follows high-purity oxygen system and consists of 8 nitrification cells and 4 denitrification cells. BIOSTYR system started in 2009.



EXPERIENCE

15+ Years of Experience with Wastewater Process Engineering

2012 – Present **Process Manager for BIOSTYR, ANITA Mox, IFAS
Veolia Water Technologies, Inc.; Cary, NC**

- Responsible for supervision of process engineering activities for wastewater biological treatment projects involving BIOSTYR, AnoxKaldnes IFAS and ANITA Mox.
- Supervise direct reports, assign daily tasks, review and approve design work.
- Perform commissioning for wastewater plants including operator training, optimization, and performance testing.
- Present technologies to consulting engineers and municipalities.
- Support sales and project management throughout the life of a project.

2008 – 2012 **Product Manager for AnoxKaldnes Technologies
Veolia Water Technologies, Inc.; Cary, NC**

- Oversee product marketing, development and improvement for line of AnoxKaldnes technologies (IFAS, MBBR, and ANITA Mox). Functions include:
 - Support Veolia sales staff and local representatives from initial development of opportunities through bid preparation and contract negotiation.
 - Guide applications and process engineers in design activities.
 - Direct marketing personnel in development of digital and print marketing.
 - Work with global Veolia experts in advancing technologies for implementation within the US municipal market.

1998 – 2008 **Lead Process Engineer for BIOSTYR
Veolia Water Technologies, Inc.; Cary, NC**

- Preparation of process designs, proposals, and bid packages for municipal applications, coordinate with Consultants and equipment suppliers,
- Preparation of process control strategies and collaboration with controls engineers to implement controls sequencing
- Review of engineering plans and bid specifications prior to bid,
- Field start up services including mechanical checkout, process optimization, and operator training

EDUCATION

Bachelor of Science, Civil Engineering, University of Notre Dame

Master of Science, Environmental Engineering, University of North Carolina at Chapel Hill

CERTIFICATIONS and AFFILIATIONS

Professional Engineering License # 022615, State of North Carolina

WEF Member

North Carolina AWWA-WEA Member



EDUCATION:

B.S., Agricultural Engineering, North Carolina State University, 1987

M.S., Agricultural Engineering, Virginia Polytechnic Institute and State University, 1991

PROFESSIONAL REGISTRATION

Professional Engineer,
North Carolina - 1994

PUBLICATIONS / PRESENTATIONS / PATENTS

“Struvite Harvesting: Creating Value from Wastewater?” NCWEA/AWWA Annual Conference 2017, Raleigh, NC, November 2017

“Improving Effluent Total Nitrogen With Dynamic Control of Aerobic/Anoxic Phasing”, WEFTEC Annual Conference 2011, Los Angeles, CA, October 2011

“Improving Nitrogen Removal by RAS addition to the Secondary Anoxic Zone: Results of Full-Scale Implementation”, WEFTEC Annual Conference 2007, San Francisco, CA, October 16, 2007

“Assessment of Biological Phosphorus Removal in an Oxidation Ditch”, Nutrient Removal 2007, WEF Specialty Conference, Baltimore, MD, March 4, 2007

“Dynamic Phase Control For Increased Nitrogen Removal using On-line Nutrient Analyzers”, 60th Annual KWEA Conference, Topeka, KS, April 13, 2005

“Microsand Ballasted Flocculation and Clarification: Effects on Removal of TSS, Oil & Grease, and Metals from a Steel Mill Waste Stream”, WEFTEC Annual Conference 2002,

“Use of Phased Isolation Ditch Technology to Minimize Secondary Clarifier Solids Loading During Peak Hydraulic Flows”, Indiana Water Pollution Control Association 63rd Annual Conference. November 15, 1999

“Modeling Gas Transfer and Biological Respiration in a Recirculating Aquaculture System”, Aquacultural Engineering, Vol. 15, No. 5, 1996

US Patent, Method and System for Nitrifying and Denitrifying Wastewater, Process uses Oxidic/Anoxic Phasing coupled with Membrane Treatment

US Patent, Rotary Discfilter with Integrated Backwash and Chemical Cleaning System, System integrates an automated chemical cleaning system within normal filtering operations without the need to remove the filter from service.

EXPERIENCE

Biological Process Department Manager, Kruger **2015-Present**

- Managing process Biological Process/Engineering Department consisting of two Process groups of staff engineers and their Group Managers. These groups are responsible for project design, commissioning, and technical support for all of Kruger's biological treatment processes: Biosytr[®], Anitamox[™], MBR, IFAS/MBBR, and conventional activated sludge.

Process Group Manager, Kruger **2002- 2015**

- Managed process engineering group responsible for project design, commissioning, and technical support for IFAS/MBBR, conventional activated sludge, tertiary phosphorous removal. Likewise responsible for project assignment, completion and delivery, QA/QC reviews.
- Process Lead and/or oversight of others in process lead role responsible for design, facility start-up, process troubleshooting, operator training, etc.
 - Mamaroneck, NY, 23 MGD IFAS Process
 - James River, VA, 20 MGD IFAS Process
 - Lancaster, PA, 32 MGD Pure Oxygen Process
 - Durham, NC, 12-MGD A2/O EBNR Process (TN < 2.8, TP < 0.28)
 - Cary, NC, 12 MGD BioDenipho Process
- Process for tertiary phosphorus removal applications to low concentrations (<0.1 mg/l) with cloth media filters and <0.07 mg/L with ballasted coagulation/flocculation.

Senior Process Engineer- ACTIFLO Process, Kruger **2000 - 2002**

- QA/QC reviews and Technical Support on Projects, Process design and engineering on special projects, start-up of water treatment facilities, troubleshooting, Operator training
- Bethlehem Steel, MD: 116-MGD Wastewater Treatment Facility, Principal Process Design Engineer:
- Hillsborough-Tampa, FL: 40-MGD ACTIFLO Water Treatment Process, Startup and Operator Training, Troubleshooting
- Fort Worth, TX: 58-MGD CSO Treatment Facility, Process Design Engineer
- Process Design/Startup for ACTIFLO Projects in CA, MO, TX, OR, KY, KS

Process Engineer, Biological Systems, Kruger **1998 - 2000**

- Process design, Start-up, Operator training for Aerobic Thermophillic Digestion (ATAD) Systems and Biosolids Pasturization
- Process design, start-up, and operator training for Biological Nutrient Removal Systems

Consulting Engineer, Triangle Environmental, Inc. **1991 - 1998**

- Project Engineer and Staff Engineering Support: Industrial Wastewater Projects, Groundwater treatment, Land Application of Sludge
- Permitting and Regulatory Assessment. NPDES Permit Applications, Pretreatment Permits, Title 5 Air Quality Permit Preparations, Air Emissions Inventories, Hazardous Waste Reporting, Storm water Prevention Plans, SPCC Plans

Education:

PH.D., Technical University of Denmark, 1990

Bachelor of Engineering, Chemical Engineering, Technical University of Denmark, 1986

Publications:

Authored or co-authored several technical publications covering various water and wastewater treatment disciplines, including:

- Production of Internal Carbon for Optimization of BNR Process
- Fermentation of Primary Sludge for production of Internal Carbon for Optimization of BNR processes
- Online Optimization of BNR Processes

Background:

Ms. Prohaska is a Process Engineer with Veolia Water Technologies. (Veolia). In her role, she has been responsible for design, start-up and operational support for various treatment technologies, including biological, liquid stream treatment and tertiary treatment technologies.

Ms. Prohaska has over 30 years of experience in environmental engineering. She has been involved in various aspects of the water and wastewater industry and served in roles including research assistant, pilot engineer, project and process engineer.

Key Experience:

2009 to 2019 – Senior Process Engineer, Biological Treatment, VEOLIA, Cary, NC

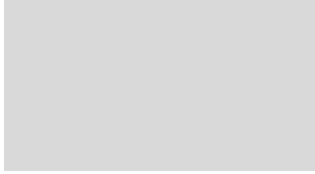
- Core activities include design and commissioning support from preliminary proposals through performance testing.
- Design work includes technology sizing, media selection and sizing, risk evaluation in meeting effluent requirements, operating cost evaluations to support competitive tenders and review of consultant's design/bidding documents for consistency with Veolia's proposed process requirements.
- Field work includes process training, process startup, troubleshooting, and assistance during performance testing.
- Key Projects: South Beloit WWTP (IL) IFAS design, Brevard WWTP (FL) IFAS Design/Startup, Volusia WRF (FL) BNR design/startup, Midwest WWTP (IN) BNR design/Startup, Elkton WWTP, VA BNR Design, Boxelder WWTP, CO BNR Design/start-up

1997 to 2007 – Process Engineer, Kruger AS, Denmark

- Preparation of specifications and drawings to be used for project bidding.
- Development of preliminary and final design reports related to various equipment upgrades or operational modifications to existing wastewater treatment facilities
- Designing and incorporating of online optimization systems using nutrient analyzers on multiple municipal wastewater treatment plants.
- Technical support for Sales.
- Design and startup of multiple BNR plants in Europe.

1990 to 1997 – Research Engineer, Kruger AS, Denmark

- Main activities included operating and maintaining laboratory and pilot-scale research systems related to biological treatment of municipal wastewater, including data analysis, system evaluation and maintaining various online process instruments.



1987 to 1990 – Ph.D , Technical University of Denmark/Kruger AS,
Denmark

- Fermentation of Primary Sludge for production of Internal Carbon for Optimization of BNR processes.

Michael R. Johns

EDUCATION

Bachelor of Science in Chemical Engineering, Pontificia Universidade Catolica of Rio de Janeiro, Brazil

Masters of Business Administration, Universidade Estadual of Rio de Janeiro, Brazil

BACKGROUND

Mr. Johns is a chemical engineer with extensive understanding of wastewater treatment, specifically, with over 20 years of experience with the popular Moving Bed Biofilm Reactor wastewater technology. Now as part of Veolia Water, Mr. Johns' considerable expertise is a valuable asset to the continued success of the Moving Bed Biofilm Technology within the company. Fluent in Portuguese and Spanish, Mr. Johns provides technical support to Veolia business units throughout North and South America.

EXPERIENCE

PROJECT ENGINEER, VEOLIA WATER (2010-PRESENT)

- Provides process and technical guidance with regards to all AnoxKaldnes biological wastewater treatment products including process and associated equipment design, start-up and training

PROJECT MANAGER, ANOXKALDNES, INC. (2007-2009)

- Acted as the point of contact and liaison between the company and its clients
- Prepared submittal documents, monitored the project scope, tracked budgets and schedules
- Responsible for timely delivery for all project documents, equipment and services
- Provided field inspections and training
- Reviewed all engineering work products prior to delivery to the client

DIRECTOR OF SALES, HYDROXYL SYSTEMS, INC. (2004-2007)

- Responsible for directing the company's sales strategies in addition to managing companywide process engineering
- Responsible for preparing process designs, cost estimates and all proposals

Michael R. Johns

- Played a key role in communicating with the client and representing the company prior to a sale
- Identified new products, processes and procedures to improve the company's competitive edge

PROCESS ENGINEERING MANAGER, HYDROXYL SYSTEMS INC. (1999-2004)

- Responsible for preparation of all process designs, cost estimates, pricing and proposals and ensure that a quality bid was delivered on time and according to specifications
- Provided guidance on R&D activities
- Kept abreast of marketing trends, new competitors, old competitors and their impact on the company

Education:

Master of Science,
Environmental
Engineering, Duke
University, 2017

Bachelor of Science,
Chemical Engineering,
University of Arizona,
2013

Presentations:

Technical presentations covering various Environmental Engineering disciplines, include:

- Cost comparisons of novel membrane separation processes for applications in rare earth separation
- Assessment of polar organic contaminants, nonionic surfactants, and microbial communities in ballast water

Professional Registrations:

Registered Engineer Intern (EI) in Environmental Engineering (NC), 2019

Background:

Ms. Young is a Process Engineer with Veolia Water Technologies (Veolia). In her role, she is responsible for design, start-up, training and operational support for various biological and liquid sidestream treatment technologies.

Ms. Young has over 7 years of work experience in environmental engineering. She has been involved in various aspects of the water and wastewater industry and served in roles including research assistant, account manager, and process engineer.

Key Experience:

2019 to Present - Process Engineer, Biological Processes, VEOLIA, Cary, NC

- Core activities include design and support from preliminary proposals & pilot studies through performance testing.
- Design work includes technology sizing, equipment selection and sizing, risk evaluation in meeting performance requirements, operating cost evaluations to support competitive tenders and review of consultant's design/bidding documents for consistency with Veolia's proposed process requirements.
- Fieldwork includes process training, process startup, troubleshooting, and assistance during performance testing.
- Key Projects:
 - Tomahawk Creek WWTF (KS) ANITA Mox commissioning
 - Fresno-Clovis WRF (CA) ANITA Mox pilot study/design
 - Trafalgar (IN) Ditch design/commissioning (Summer 2023)
 - North Durham WRF (NC) ANITA Mox commissioning (Summer 2023)
 - Crested Butte WRF (CO) IFAS commissioning (Fall 2023)

2017 to 2018 - Associate Account Manager, Hoganas Environment Solutions Cary, NC

- Sold patented Zero Valent Iron media for groundwater treatment
- Presented technical product information to prospective customers during onsite visits
- Managed team CRM database; developed dashboards and assigned leads to optimize operational efficiency

2014 to 2017 - Research Assistant, Duke University, Durham, NC

- Developed predictive models to analyze operating costs of novel membrane processes
- Interpreted membrane cost and performance data to recommend process improvements
- Authored proposals of cutting-edge technologies for niche market applications



APPENDIX B: VEOLIA U.S. IFAS SYSTEM REFERENCE LIST

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Veolia AnoxKaldnes US Municipal IFAS Installation List

Number	Name	First Year of Operation (Approx.)	Country	State	Plant Address	Design Flow (mgd)	Media Type	IFAS OR MBBR	Same Media Model and Technology as Aberdeen?
1	Broomfield, Colorado Phase I	2002	USA	CO	2985 W. 124th Ave Broomfield, CO 80020	8	K1	IFAS	--
2	Taos, NM WWTP	2006	USA	NM	38 Ocean Boulevard Taos Ski Valley, NM 87525	0.2	K1	IFAS	--
3	Cheyenne - Dry Creek, Wyoming	2006	USA	WY	8911 Campstool Rd. Cheyenne, WY 82007	9.5	K1	IFAS	--
4	Yucaipa WWTP	2008	USA	CA	12770 Second Street Yucaipa, CA 92399	8	K3	IFAS	--
5	Cascade Shores, CA	2009	USA	CA	950 Maidu Avenue Nevada City, CA 95959	0.026	K1	IFAS	--
6	Fairplay WWTP, CO	2009	USA	CO	1243 County Road 16 Fairplay, CO 80440	0.3	K1	IFAS	--
7	TZ Osborne WWTP Greensboro, NC	2009	USA	NC	2350 Huffine Mill Rd McLeansville, NC 27301	3.4	K3	IFAS	--
8	Wildcat Hill WWTP Flagstaff, AZ	2009	USA	AZ	2800 N. El Paso Rd. Flagstaff, AZ 86001	6	K3	IFAS	--
9	New Castle, CO	2010	USA	CO	202 Kamm Avenue New Castle, CO 81647	0.6	K3	IFAS	--
10	Broomfield, Colorado Phase II	2010	USA	CO	2985 W. 124th Ave Broomfield, CO 80020	12	K3	IFAS	--
11	Crested Butte, Colorado	2011	USA	CO	280 Cement Creek Rd. Crested Butte, CO 81224	0.125	K3	IFAS	--
12	Georgetown, CO	2011	USA	CO	2900 Argentine St. Georgetown, CO 80444	0.48	K3	IFAS	--
13	Lubbock WWTP, TX	2011	USA	TX	3603 Guava Avenue Lubbock, TX 79404	18	K1	IFAS	--
14	Hooksett, New Hampshire	2011	USA	NH	1 Egawes Dr Hooksett, NH 03106	2.2	Chip M	IFAS	--
15	Shepherdsville, Kentucky	2011	USA	KY	485 Old Ford Road Shepherdsville, KY 40165	3.75	K3	IFAS	--
16	Erie, CO	2012	USA	CO	501 State Highway 52 Erie, CO 80516	2.8	K3	IFAS	--
17	Grand Chute, Wisconsin	2012	USA	WI	1965 W. Butte Des Morts Beach Rd Neenah, WI 54956	7.4	K3	IFAS	--
18	Mamaroneck, New York	2012	USA	NY	119 W Boston Post Rd Mamaroneck, NY 10543	27.5	K3	IFAS	--
19	Springettsbury, Pennsylvania	2012	USA	PA	3501 North Sherman St. York, PA 17406	15.5	Chip P	IFAS	--
20	Cocoa Beach, Florida	2013	USA	FL	1600 Minutemen Causeway Cocoa Beach, FL 32931	6	K5	IFAS	YES
21	James River WWTP, VA	2013	USA	VA	111 City Farm Rd Newport News, VA 23602	15.9	K3	IFAS	--
22	Fields Point WWTP, RI	2013	USA	RI	One Service Road Providence, RI 02905	77	K3	IFAS	--
23	Salida, Colorado	2013	USA	CO	6608 Co Rd 102 Salida, CO 81201	2.1	K3	IFAS	--

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Veolia AnoxKaldnes US Municipal IFAS Installation List

Number	Name	First Year of Operation (Approx.)	Country	State	Plant Address	Design Flow (mgd)	Media Type	IFAS OR MBBR	Same Media Model and Technology as Aberdeen?
24	Lickdale WWTP - Union Township, Pennsylvania	2014	USA	PA	5 Everest Ln Jonestown, PA 17038	0.21	K5	IFAS	YES
25	Mahomet, Illinois	2015	USA	IL	806 S Center St Mahomet, IL 61853	0.9	K5	IFAS	YES
26	Bend, Oregon	2015	USA	OR	22395 McGrath Road Bend, OR 97709	12.15	K5	IFAS	YES
27	Franklin Township, PA	2015	USA	PA	340 Jefferson Rd Waynesburg, PA	1.74	K5	IFAS	YES
28	Twin Falls, ID	2016	USA	ID	321 2nd Ave. East Twin Falls, ID 83301	16.5	K5	IFAS	YES
29	Dickinson, North Dakota	2016	USA	ND	38th Street SW Dickinson, ND 58601	3.65	K5	IFAS	YES
30	South Adams County, CO	2016	USA	CO	9702 Monaco Commerce City, CO 80037	8	K1	IFAS	--
31	Sanford Florida	2017	USA	FL	300 N. Park Ave. Sanford, FL 3277	7.3	K5	IFAS	YES
32	Brevard County, FL	2017	USA	FL	10001 N Wickham Rd Melbourne, FL 32940	6	K5	IFAS	YES
33	Massillon, OH	2018	USA	OH	151 Lincoln Way East Massillon, OH 44646	17.9	K5	IFAS	YES
34	South Beloit, WI	2022	USA	WI	100 Perry Ave South Beloit, IL 61080	3	K3	IFAS	--
35	Vernon, CT	Under Construction	USA	CT	100 Windorville Road Vernon, CT 06066	5	K5	IFAS	YES
36	Security, Colorado	2021	USA	CO	6510 Southmoor Drive Fountain, CO 80817	1.95	K5	IFAS	YES
37	Fargo ND IFAS	Under Construction	USA	ND	3400 N Broadway Dr Fargo, ND 58102	15.2	K5	IFAS	YES
38	Erie North	2022	USA	CO	501 State Highway 52 Erie, CO 80516	1.94	K3	IFAS	--
39	Gatlinburg	2023 (Startup ongoing)	USA	TN	1025 Banner Road Gatlinburg, TN 37738	2.7	K5	IFAS	YES

Note: This list lists only Veolia's IFAS systems in the US and doesn't include MBBR systems as MBBR technology is not the same technology as the IFAS technology for Aberdeen. Veolia believes MBBR installations shall not count and shall be disregarded if others provide them to inflate their number of relevant references. Otherwise, Veolia has more MBBR references than others and can provide an additional list.

Confidential: This list shall not be shared with any third party without Veolia's written consent.

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**APPENDIX C: BROCHURE FOR HUBGRADE: VEOLIA'S DIGITAL TOOL FOR REMOTE
OPERATION, OPTIMIZATION AND MONITORING**

Hubgrade





MEETING CUSTOMER CHALLENGES IN THE WATER INDUSTRY

Hubgrade makes your resources smarter!

We're experiencing unprecedented changes in our climate on a global scale. Now we are facing new challenges, such as health crises that separates us from the places we need to be. For water technologies, we need to anticipate disturbances, prepare for them and respond quickly to ensure the resiliency of operations.

With Hubgrade, water and wastewater operations can be safely and sustainably managed no matter the crisis or location.

Hubgrade is the combination of digital tools and the knowledge of Veolia experts to deliver operational and environmental efficiency. Its

specificity? Capitalizing on human competency and digital power to process data and provide you with a continuous supply of optimized solutions adapted to your priorities: compliance, operational excellence, and sustainability.

Hubgrade enables our customers to consider and implement operational solutions in line with day-to-day concerns encountered by the operators and managers.

With Hubgrade, Veolia Water Technologies addresses the water optimization needs of municipalities and industries to respond to customer challenges throughout the water cycle.

VEOLIA WATER TECHNOLOGIES DELIVERS THREE INNOVATIVE SERVICES:

Hubgrade

ASSIST

ACCOMPANY CLIENTS IN THEIR PROGRESS PLANS AND REMOTELY ADVISE IN THE PILOTAGE OF THEIR FACILITIES

#SUPPORT

Hubgrade

PERFORMANCE

MEASURE AND IMPROVE PERFORMANCE AND GUARANTEE A QUALITY LEVEL OF SERVICE

#IMPROVE

Hubgrade

ESSENTIAL

EVALUATE AND CONTINUOUSLY FOLLOW THE QUALITY OF THE SERVICE AND COMMUNICATE WITH TRANSPARENCY

#CONNECT

Hubgrade

Powered by  VEOLIA



Veolia's global digital offer



A wide and flexible range of digital solutions responding to operator and manager challenges



Fast access to a global network of Veolia experts



Digital platform that relies on multi-source data, advanced analytics and VWT lifelong water-treatment expertise



Proven solutions already deployed worldwide with excellent customer feedback!

● Main functionalities:

- ✓ 24/7 private and secure access.
- ✓ Mobile, user-friendly interface.
- ✓ Customizable interface by user personas.
- ✓ Multiple sources of data and versatile data collection (manual and automatic).
- ✓ Best-in-class algorithms to ensure the reliability of data.
- ✓ Equipment agnostic (Veolia and non-Veolia equipment).
- ✓ Applicable to a standalone technology, a range of equipment and entire water and wastewater plants.

● For your water systems, this means:

- ✓ Ensuring a high level of water quality to comply with stringent regulations.
- ✓ Reduction of operating costs.
- ✓ Avoiding investments.
- ✓ An increase in productive uptime.
- ✓ Sustainable development goals are achieved.



STANDARD PRODUCTS



PACKAGES SOLUTIONS



WATER AND WASTEWATER TREATMENT PLANTS



The Hubgrade Digital Trust targets four sections of your digital landscape:



PHYSICAL SECURITY
Data acquisition



NETWORK SECURITY
Data transfer



CLOUD SECURITY
Data aggregation and data analysis



DATA SECURITY
Data protection

HUBGRADE RUNS ON TODAY'S MOST SECURE CLOUD-BASED SYSTEMS

Offering products with first-class digital security and compliance is our number one priority.

We guarantee a high level of cybersecurity, from the connectivity solution to your industrial control systems up to isolation at the application and data layers, with end-to-end encryption.

We constantly ensure that you are protected against cybersecurity threats.

To ensure this, we rely on certified partners and highly-resilient cloud-based systems.

Hubgrade also strictly follows guidelines from leading security standards such as ISO/IEC 27001:2013, ISO/IEC 27017:2015, NIST SP 800-210, and the NIST cybersecurity framework 1.1, in addition to best practices issued by industry 4.0 standards.

RECOVERY

Recovery planning, continuous improvement, advancement of tooling.

RESPONSE AND ACTION

Efficient analysis, rapid issue response, mitigation of risk with proper communication plus improvements.

DETECTION MONITORING

Security event detection, advanced tooling for monitoring, procedures to detect anomalies, automated process.

PROTECTION STRATEGY

Better access management data security, standard processes and practices.

CYBERSECURITY MODEL

Governance, business IT security environment, asset / fleet management, risk assessment strategy.



CYBERSECURITY

Hubgrade digital solutions are designed to ensure a high level of end-to-end cybersecurity

At Veolia Water Technologies, Hubgrade stands for secure, optimized and sustainable water and wastewater processes for municipalities and industries.

We are mindful of the critical nature of your water facilities and the emerging threats of cyberattacks. For this, we have designed our digital solutions with the highest level of end-to-end cyber security and in line with international security standards to ensure that your business is fully resilient.

We apply globally recognized standards from the International Organization for Standardization (ISO), the International Electrotechnical Commission (IEC) and the National Institute of Standards and Technologies (NIST) such as ISO/IEC 27001:2013, NIST cybersecurity framework. We also follow guidelines of the Open Web Application Security Project (OWASP) and as well as the industry 4.0 best practices.



Cloud Security Alliance Controls



Audit Controls Report



Security, Availability & Confidentiality Report



Protected Health Information



1

Industrial Internet of Things (IIoT): The choice of certified partners

To protect sensors, software and other technologies that connect and exchange data with other devices and systems over the internet, we carefully select our suppliers and ensure that they comply with the international industrial security standards.

Our partners are regularly evaluated and are well recognized in the IIoT market.

2

Connectivity: encryption of data

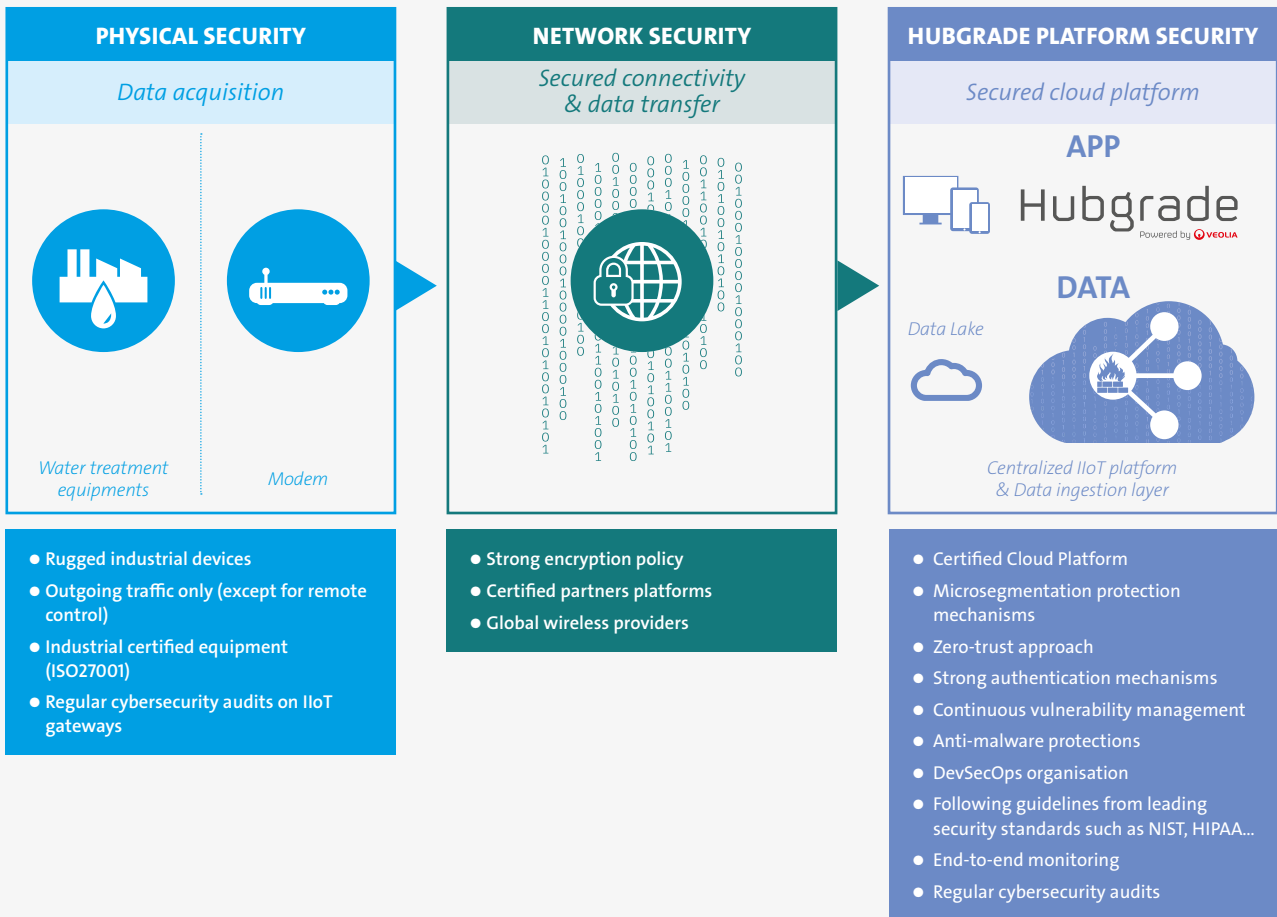
To ensure confidentiality and integrity of data through Internet communications, we rely on the highest level of cryptography protocols.

3

Digital cybersecurity: highly resilient cloud-based systems

Data is hosted on today's most secure cloud-based systems to guarantee its highest availability. Our cloud supplier supports security standards and compliance certifications to satisfy requirements for virtually every regulatory agency around the globe.

The security is ensured at all stages from the data acquisition process up to the processing of this data:



We recognize the risks associated with cyberattacks and we take the necessary measures to protect the integrity and confidentiality of the data and to ensure its availability anytime, anywhere.

Veolia Water Technologies
L'Aquarène • 1 place Montgolfier
94417 Saint-Maurice Cedex • France

LinkedIn Veolia Water Technologies

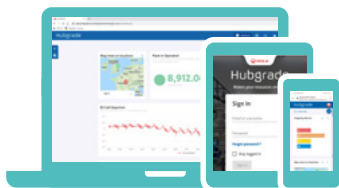
www.veoliawatertechnologies.com/hubgrade

HUBGRADE ESSENTIAL

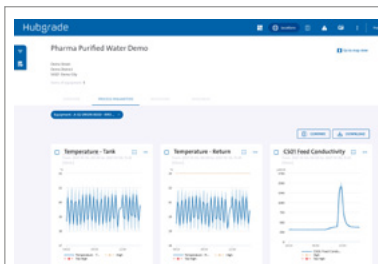
Hubgrade makes your resources smarter!

Hubgrade Essential enables you to be more informed to make faster and better decisions related to your water treatment facility and equipment for your business.

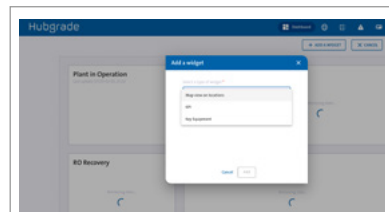
Hubgrade enhances Veolia and non-Veolia technology, a range of equipment, and existing or new industrial and municipal water treatment plants for all applications: drinking, waste and process water and all markets: municipal, pharma, lab water, etc.



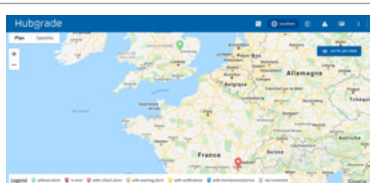
- ✓ Connect to your plant anywhere, at anytime, using your mobile or desktop device



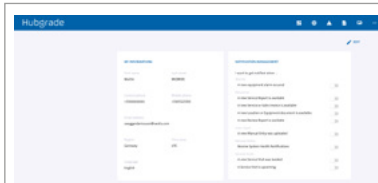
- ✓ Monitor all your process parameters as well as events such as alarms and warnings in real-time



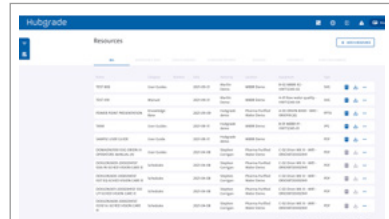
- ✓ Customize your dashboard to your needs with quick links to your most important features
- ✓ User friendly dashboards



- ✓ Access all your locations from one single point of entry



- ✓ Receive notification by email or text to intervene early and avoid shutdown



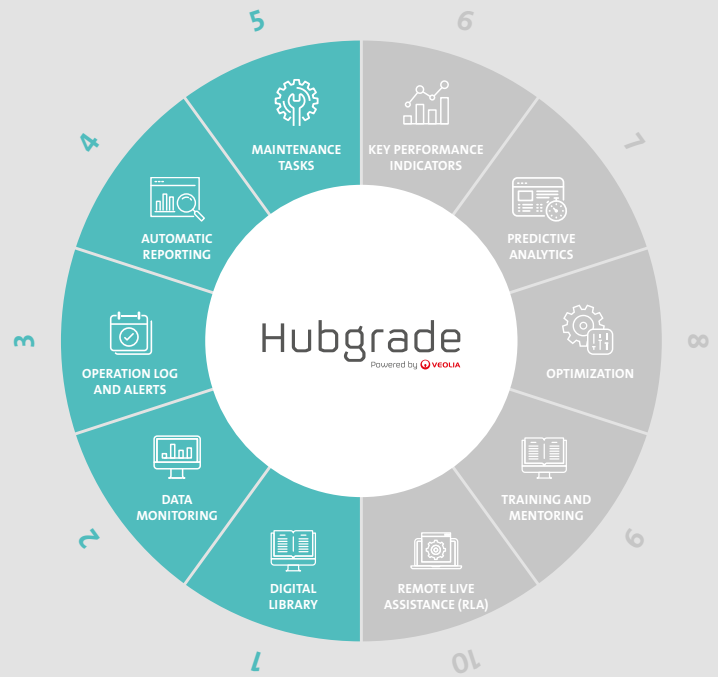
Resource Name	Location	Status	Last Update	Alerts
Plant A	Paris	Operational	2023-10-27 10:00	1
Plant B	Lyon	Operational	2023-10-27 09:30	0
Plant C	Marseille	Operational	2023-10-27 11:15	2
Plant D	Nice	Operational	2023-10-27 08:45	0
Plant E	Toulouse	Operational	2023-10-27 10:30	1

- ✓ Find all resources linked to your plant in one single space

5

FEATURES

which enable access to all relevant process data and plant documentation as a foundation for informed decision making.



DIGITAL LIBRARY

Comfort of having all relevant documents and orders in one place, accessible from anywhere, at any time.



DATA MONITORING

Access to the plant's process and equipment status data in real-time.



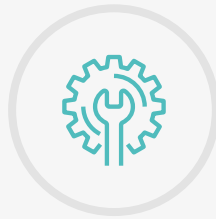
OPERATION LOG AND ALERTS

Notifies the client by email or by SMS if a parameter exceeds a threshold. It provides the client the ability to enter comments or tasks for alarm resolutions.



AUTOMATIC REPORTING

Generates standardized and consistent pre-defined reports; specific to your equipment and/or locations with definition of the scope for certain parameters along with events information.



MAINTENANCE TASKS

Overview of maintenance tasks per equipment (open and completed), with the possibility to assign tasks to users, add information such as photos or comments.



DATA UPLOAD AND AUTOMATIC DATA COLLECTION

"We are very happy with the results of the trial. So happy that we want to extend it to the distribution systems as well."

Client, Pharmaceutical, Manufacturing Manager, May 2020





HUBGRADE PERFORMANCE

Hubgrade makes your resources smarter!

Hubgrade Performance aggregates real-time data and applies analytics and algorithms, developed and based on Veolia's experience in designing and operating water and wastewater treatment plants worldwide, to continuously benchmark and optimize your plant's performance.

The Plant module of Hubgrade Performance is an online digital twin of the wastewater treatment plant and/or sewer network. It creates a digital representation of the customers' assets which

uses predictive analysis in real-time to provide optimized setpoints to the PLC control and deliver insight to the operators, process engineers and management.

The Plant module is an intelligent software, with a suite of powerful algorithms and holistic solutions offering state-of-the-art automated real-time performance optimization and capacity enhancement.



HUBGRADE™ PERFORMANCE PLANT

60+ Features: Standard - Modular - Scalable - Proven

Everywhere

- Digital lab



Anaerobic Pre-treatment, Industries



- UASB
 - Performance / Load / Recirculation
- Capacity
- Emergency Tank
- OPEX

Sewer System



- SeverView
- SewerFlex
- Stormwater Forecast

Preliminary Treatment



- Max. Flow
- Equalization Tank
- Grit Chamber Aeration

Hubgrade

PERFORMANCE



Primary Treatment



- Carbon Management
- By pass, Primary
- Pre-precipitation
- Primary Sludge Outtake

Biosolids



- Anaerobic Digester
 - Performance / Load
- Anammox - ANITA™ Mox
 - StartUp / DO / Load

Tertiary Treatment



- P-precipitation
- Predifloc

Secondary Treatment



- Stand-by
- First Flush
- DO & COD-removal
- DO & N Removal
- N₂O reduction
- Bio-P
- Mixer
- Air Supply
- P-precipitation
- NO₃-recirculation
- Return Activated Sludge
- Solids Retention Time
- Flow Distribution
- Carbon Management
- External Carbon Dosage
- External Nutrient Dosage
- Max. Flow
- Stormwater Mode

Hubgrade Performance Plant

DO & Nitrogen Removal with N₂O Removal



DO & Nitrogen Removal with N₂O Removal

WHY

- Ensure compliance
 - Reduce OPEX
 - Reduce energy use
 - Reduce CO₂ emissions
 - Reduce N₂O emissions
- by 70 to 90%**



HOW

- Avoid over-aeration & enhance the usage of COD for NO₃ removal.
- Enhance balancing of N/DN processes according to load variations.
- Abort nitrification phases when N₂O is being produced



WHAT

- Two patented optimized controls:
- regulating the DO set point
 - regulating N/DN switching phases.
- Providing set points for intermittent aeration and oxygen based on real-time measurements of NO₃ and NH₄ in the aeration tanks.

Hubgrade

OVERVIEW KPI PROCESS CONTROL OPERATIONS ...



Controls

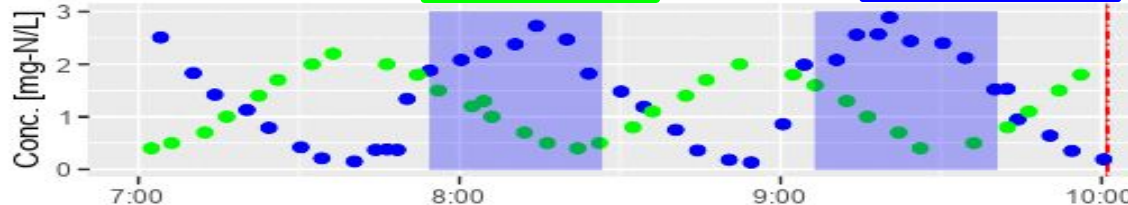
- Carbon Management
- DO/N removal
- P-precipitation
- Return Activated Sludge
- Solids Retention Time
- Stormwater Mode
- DNA Fantastic
- Process Precision
- Data quality
- Compare

DO/N removal: General

Period 2 curves Export 3H ...

NH₄ (mg/L)

NO₃ (mg/L)



Graphs Settings Status Output

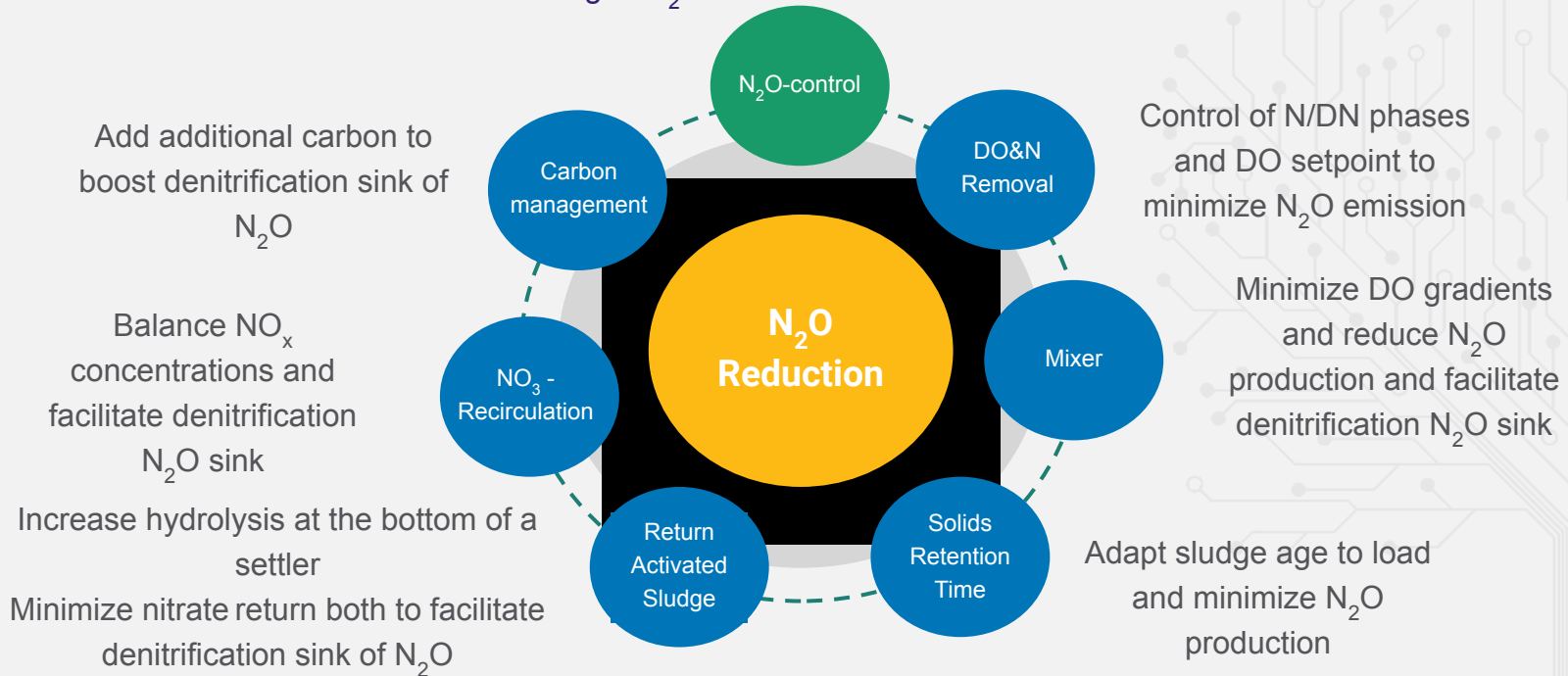
Parameter History

Data quality 1 of 26 sensors has bad quality

DO & Nitrogen Removal

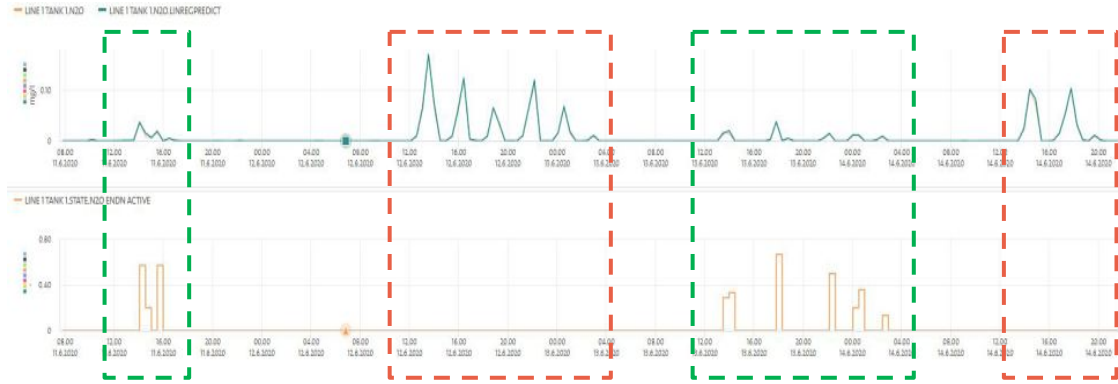
Optimization in action

Abort aeration and enforce denitrification sink of N_2O according to N_2O threshold measurements online





Hubgrade™ Performance Plant - Climate Impact Ecological Transformation - N₂O Reduction



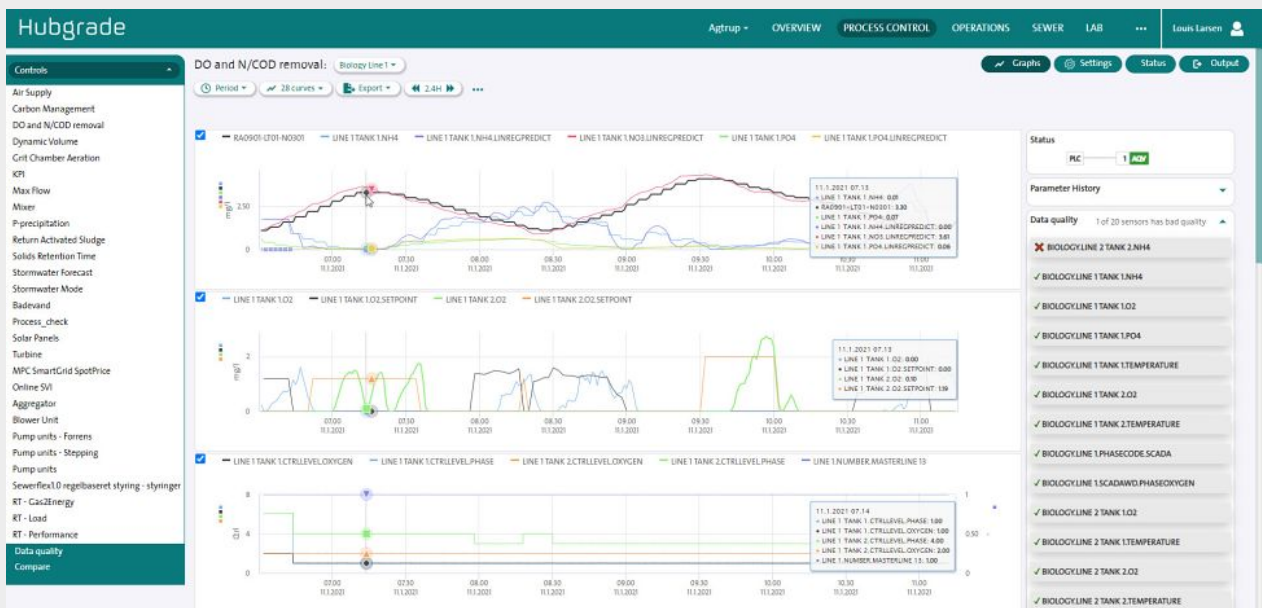
N₂O emissions

HPP N₂O feature activity

Day with HPP control ON

Day without HPP control OFF

70-90% Reduction of N₂O emissions



The Plant module is already installed at over 100 wastewater treatment plants and installations worldwide. The results experienced on those plants show up to:

- ✓ 40% higher biological capacity;
- ✓ 100% increase in hydraulic capacity;
- ✓ 25% energy reduction for aeration;
- ✓ 75% energy reduction for grit chamber aeration;
- ✓ 75% reduction in energy use for internal nitrate recirculation;
- ✓ 100% reduction in chemicals for denitrification and for phosphorus precipitation;
- ✓ 20-30% in overall OPEX savings.

“Hubgrade Performance boosts our performance by increasing the hydraulic capacity during wet weather. It is a smart solution with a high effect.”

Andrea Aliscioni, COO Milan Water Service



HUBGRADE ASSIST

Digitally empowered process expertise for best-in-class operation of equipment, processes and facilities

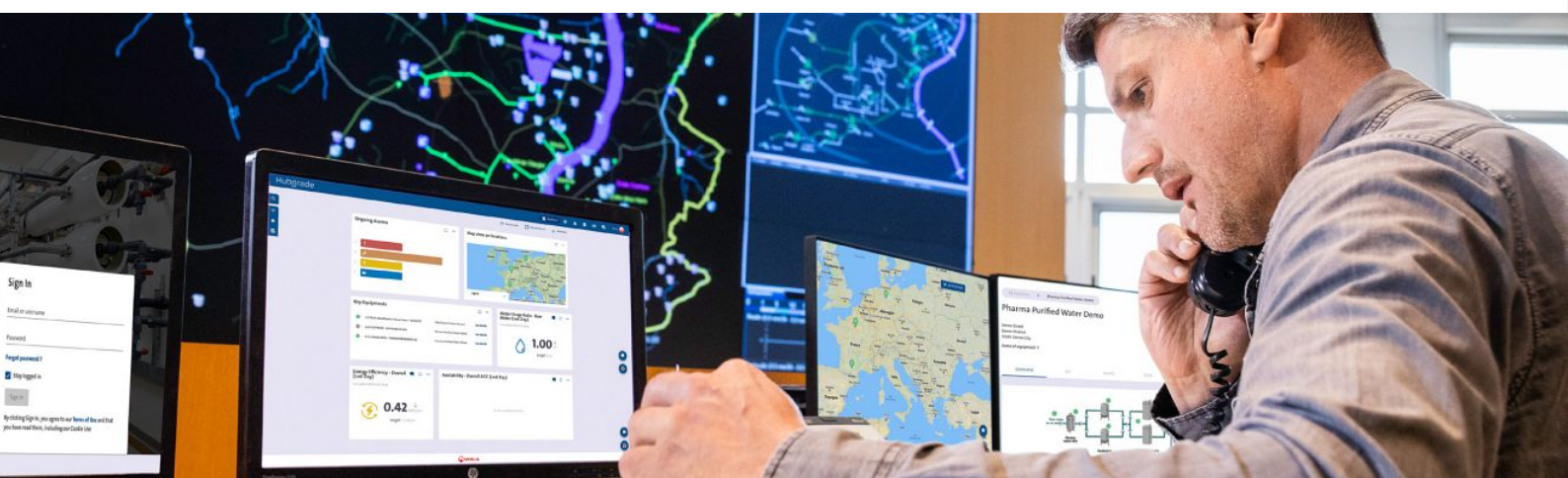
The essence of Hubgrade Assist is providing access to Veolia long-term experience and expertise in water treatment, combined with digital tools for global assets as well as specific local ones.

Veolia process & technology experts proactively support and advise our customers throughout the whole operational life cycle of their equipment and assets.

✓ Hubgrade Assist supports operators in their daily monitoring with proactive data driven service and site support that includes troubleshooting and long term drifts resolution;

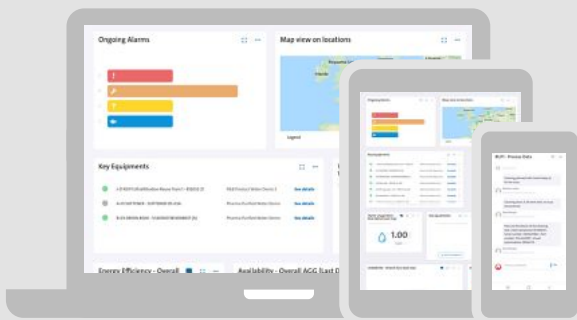
- ✓ It supports process and asset management engineers by sending instantaneous notifications alerting of potential operational issues, exploring optimization potential and producing technical reports;
- ✓ And it also helps plant managers and headquarter teams by providing a high level rationalized overview of operations and proposing actions to optimize operational costs.

Hubgrade Assist is the ideal “Expert Companion” to offer peace of mind for safe, reliable and effective operations at any time, and it is ideally bundled with other Hubgrade offers (Essential, Insight or Plant) to boost their benefits.





Hubgrade **ASSIST** + Hubgrade **ESSENTIAL**

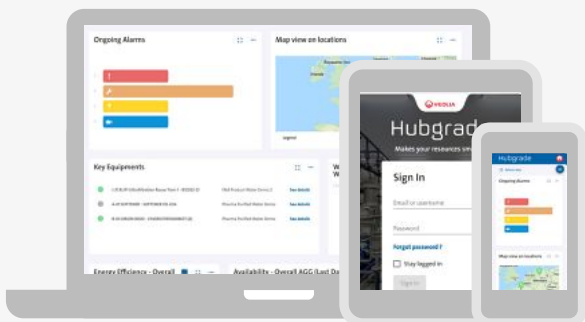


- **Expert-driven, single point of entry to manage your water processes**
 - ✓ Instant access to Veolia's water treatment experts
 - ✓ Proactive, data-driven service
 - ✓ Alarms access and trouble-shooting

"Hubgrade Essential, combined with Hubgrade Assist, helps us optimize the operation of our new water treatment plant to control costs, manage maintenance, and document regulatory compliance."

General Manager, water and sanitation district

Hubgrade **ASSIST** + Hubgrade **ESSENTIAL** + Hubgrade **PERFORMANCE**



- **Combine advanced data analytics with our expertise**
 - ✓ Be more proactive and mitigate risks with predictive analytics
 - ✓ We interpret the predictive trends to translate them into real action plans

"This really is a high value service which helps us to reduce operational costs and improve the reliability of our water treatment plant. Veolia's digitalization strategy is the right step to differentiate its services further from competition."

Engineering Director, food and beverage client

Resourcing the world

Veolia Water Technologies

L'Aquarène • 1 place Montgolfier • 94417 Saint-Maurice Cedex • France
tel. +(33) 0 1 45 11 55 55

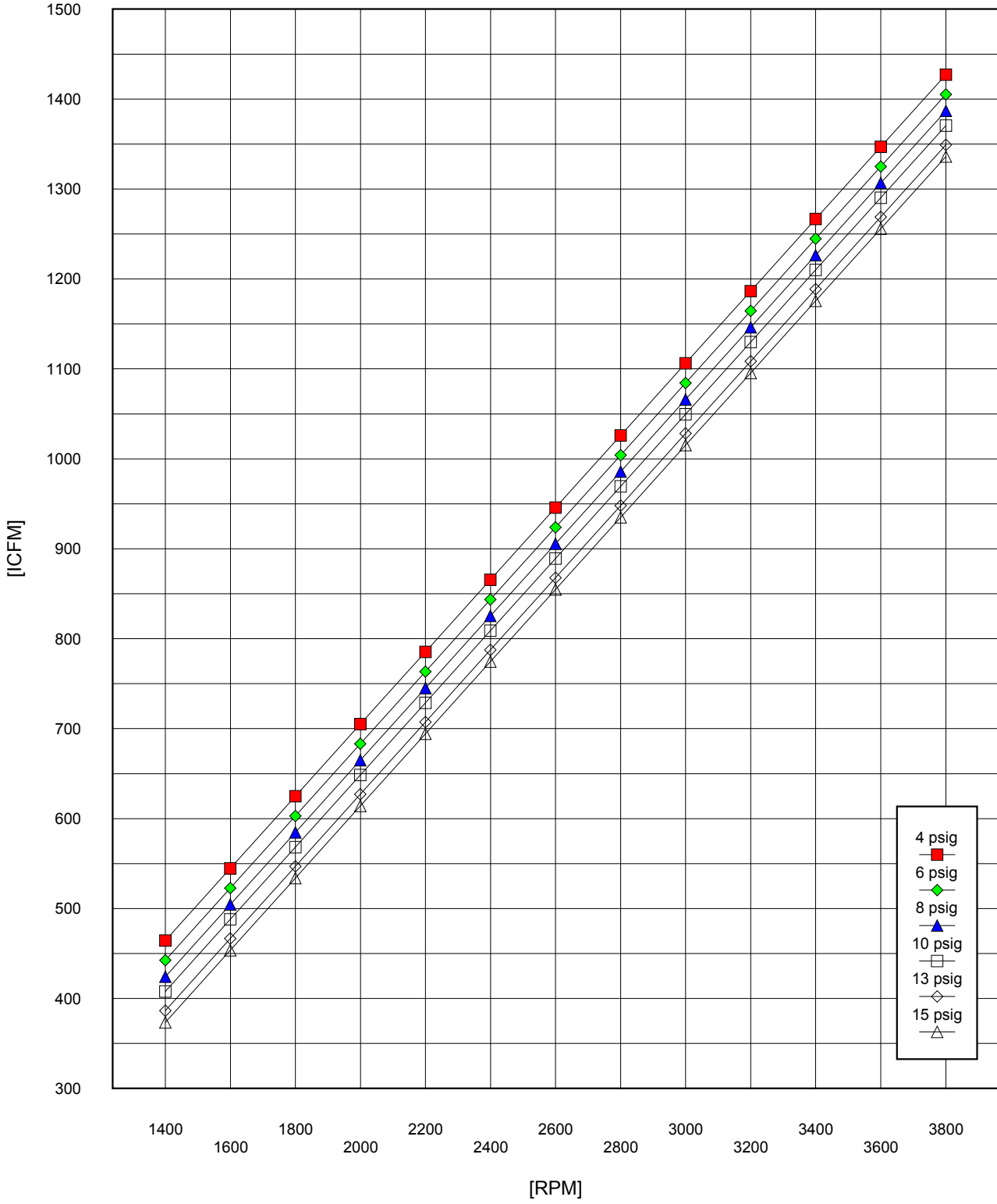
www.veoliawatertechnologies.com/hubgrade



APPENDIX D: SELECTED EQUIPMENT INFORMATION

AERZEN GM 35S DELTA PACKAGE, PRESSURE

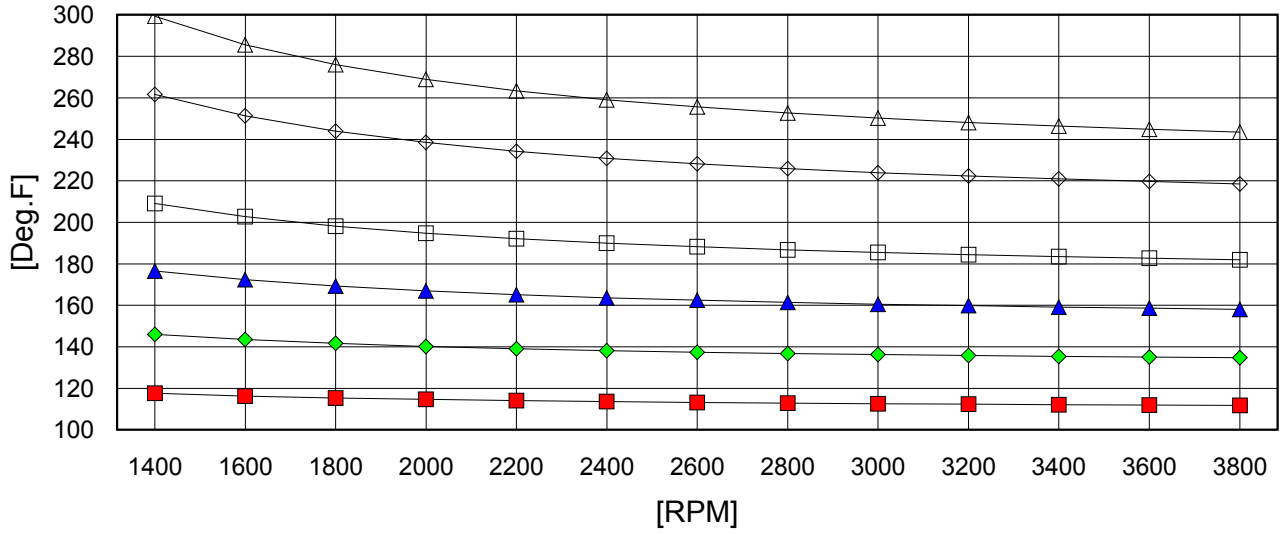
INLET FLOW



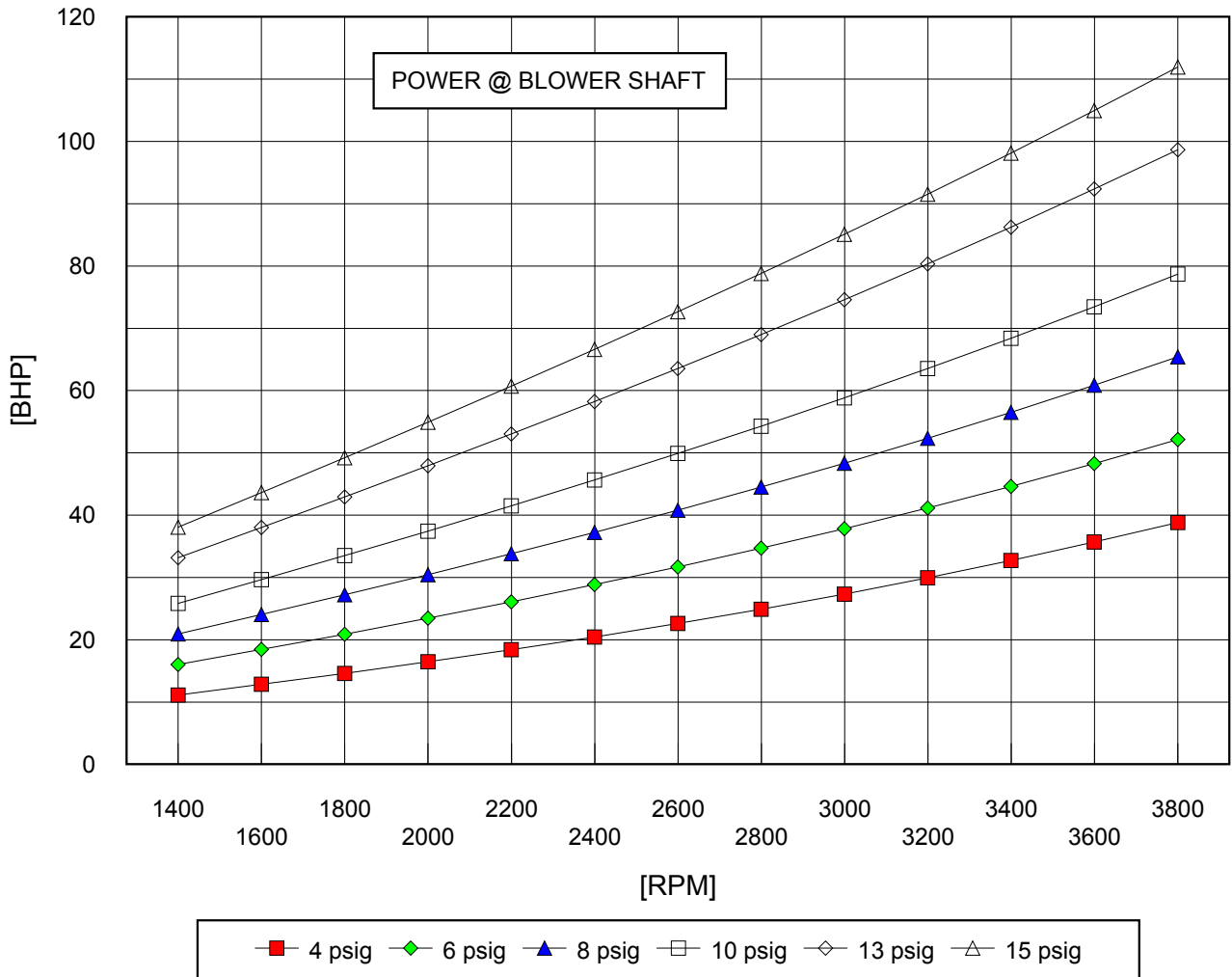
Performance data based on air @ 68 deg.F/ 14.7 psia inlet.

See temperature chart on second sheet for allowable operating range.

AERZEN GM 35S DELTA PACKAGE, PRESSURE DISCHARGE TEMPERATURE



MAXIMUM ALLOWABLE DISCHARGE TEMPERATURE: 285 deg.F
Performance data based on air @ 68 deg.F/ 14.7 psia inlet.





APPENDIX E: BROCHURES AND PAPERS FOR VEOLIA'S HYBAS IFAS SYSTEM



AnoxKaldnes™

Moving Bed Biofilm Reactor (MBBR)

Integrated Fixed-Film Activated Sludge (IFAS)

and ANITA™ Mox Deammonification

WATER TECHNOLOGIES

AnoxKaldnes™ MBBR and Hybas™ Processes

AnoxKaldnes™ MBBR

(Moving Bed Biofilm Reactor) is a biological wastewater treatment process that utilizes specialized polyethylene carriers (media) to create a large protected surface on which biofilm can attach. The media is mixed in the reactor, and the large surface area provides more treatment capacity in a smaller volume compared to activated sludge.

AnoxKaldnes Hybas™

(Hybrid Biofilm Activated Sludge) technology is an application of the IFAS process in which moving media is mixed into an activated sludge environment. The result is both fixed-film and suspended growth biomass working together and lending the strengths of each to the hybrid process. The Hybas process is excellent for retrofitting existing activated sludge plants to improve ammonia and nitrogen removal.

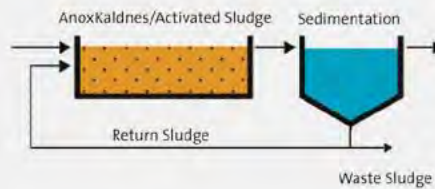
AnoxKaldnes Hybas™ for SBR

AnoxKaldnes Hybas™ systems can be retrofitted into a sequencing batch reactor (SBR) system. The AnoxKaldnes Hybas can increase the capacity of a SBR wastewater treatment process in the same footprint as a conventional SBR without the need for new tankage. The AnoxKaldnes Hybas for SBR uses engineered moving bed media to grow and foster nitrifying bacteria, even at low SRT's and low reactor temperatures. The process allows for greater BOD, NH₃-N, and TN removal.

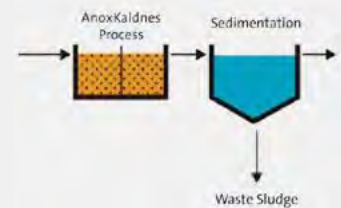
Advantages

- Simple and reliable operation
- Excellent for ammonia and total nitrogen limits (NH₃-N < 1 mg/L, NO₃-N < 1 mg/L)
- Smaller footprint than activated sludge
- Increase plant capacity for nitrification and/or denitrification
- Effective in cold water
- Accommodates a wide range of flow and load fluctuations
- Non-clogging media with a long lifespan
- Flexible design for almost any tank configuration

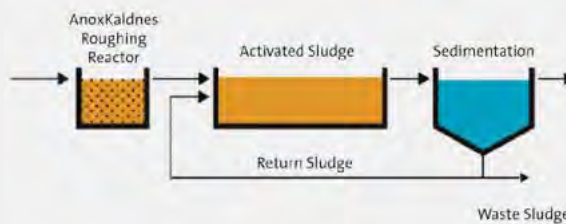
Hybas™ Technology



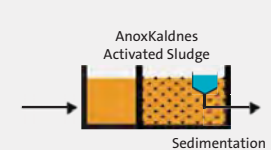
MBBR



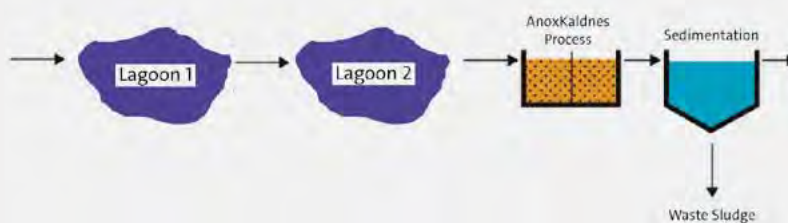
Biofilm Activated Sludge



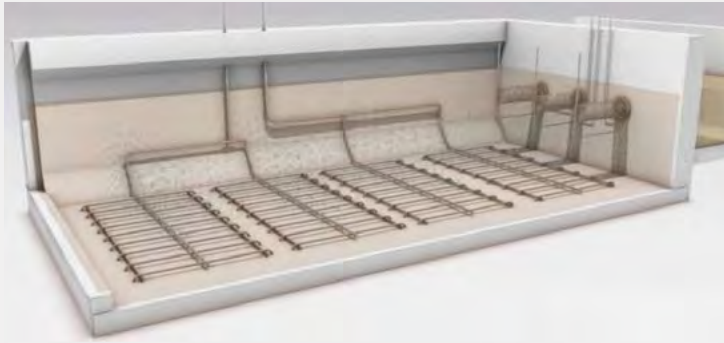
Hybas™ for SBR



LagoonGuard® MBBR



Air Grids and Media Retention Screens



Aerobic Applications

- AnoxKaldnes stainless steel air diffuser system is robust, non-clogging and maintenance free
- Diffusers provide oxygen for process needs and media mixing for optimal biological performance
- Cylindrical screens at reactor's effluent wall retain media while allowing treated water and suspended solids to pass through

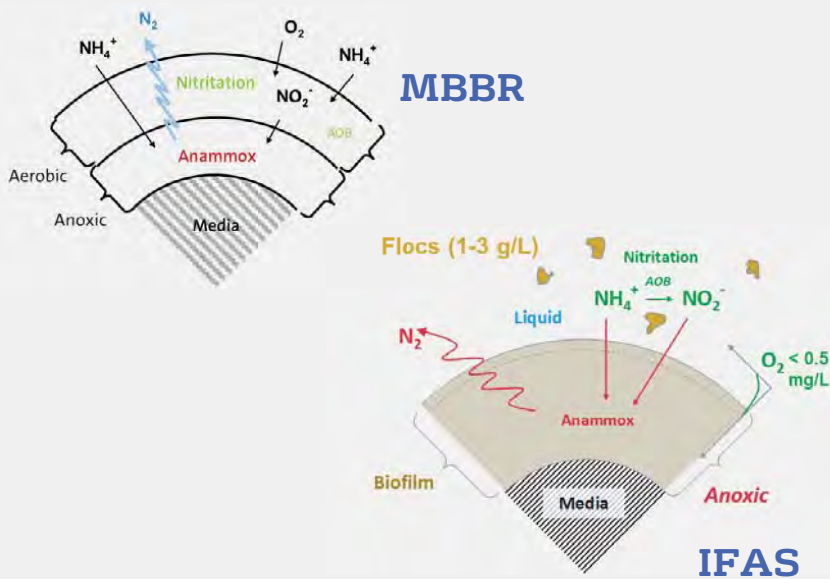
Mixers and Flat Screens



Anoxic Applications

- AnoxKaldnes stainless steel air diffuser system is robust, non-clogging and maintenance free
- Diffusers provide oxygen for process needs and media mixing for optimal biological performance
- Flat screens at reactor's effluent wall retain media while allowing treated water and suspended solids to pass through

ANITA™ Mox Deammonification



System Supplier Scope of Supply

- Complete process design with effluent guarantees
- Process equipment including media, screens, air grids, blowers, pumps, mixers and valves
- Field instruments and process control
- Customized SCADA for the highest level of operations monitoring and control

The ANITA Mox process combines aerobic nitritation and anammox reactions simultaneously in a single reactor. With MBBR, the reactions take place in different layers of biofilm on the AnoxKaldnes media. With IFAS ANITA Mox, most of the nitritation reaction occurs in the suspended biomass, while the anammox reaction takes place on the carrier media. The MBBR and IFAS ANITA Mox platforms both provide a robust, stable process with simple operation, energy and chemical savings, and efficient ammonia removal.

AnoxKaldnes Technology Can Benefit A Wide Range of Plant Sizes



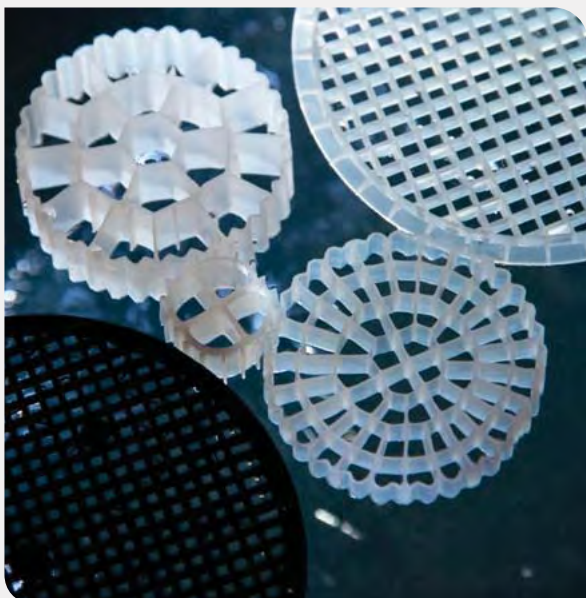
Cheyenne, WY **AnoxKaldnes MBBR**

- In 2005, MBBR replaced trickling filters and was chosen because it is a biofilm process that is compatible with the existing clarifiers.
- Consists of two trains of two pre-anoxic and four aerobic reactors in series to treat 6.5 MGD and achieve BOD <10 mg/L and ammonia <2 mg/L, NO_x-N <9 mg/L.



Providence, RI **AnoxKaldnes Hybas Technology**

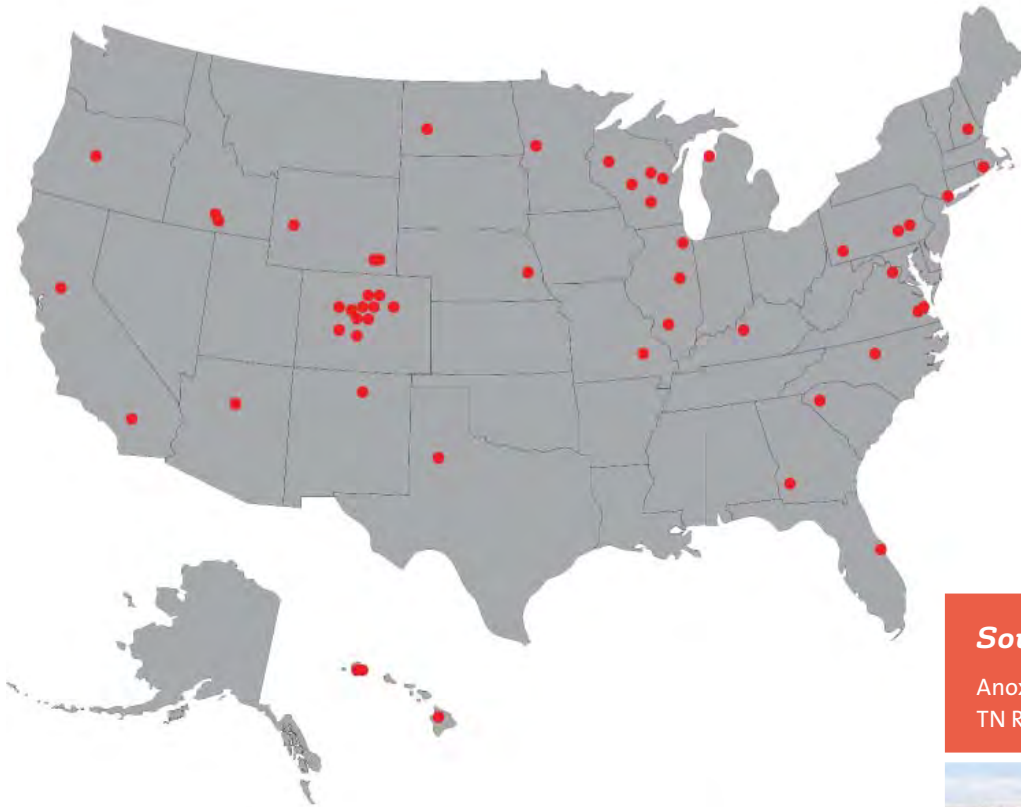
- Ten parallel process trains with a treatment capacity of 77 MGD
- Existing aeration basins converted to a 4 stage process with one IFAS zone per train
- Pre-anoxic stage for denitrification using the influent BOD as a carbon source
- Aerobic Nitrification stage for BOD and Nitrification – IFAS Zone. 52% fill using AnoxKaldnes K3 media type. Total media surface area of 36.3 million square feet
- Post-anoxic stage for additional denitrification using an external carbon source
- Clarification stage for solids separation and collection



Winning Combinations

- *High rate clarification with ACTIFLO®*
- *Primary clarification with MULTIFLO*
- *Filtration with Hydrotech Discfilter*

AnoxKaldnes Technologies Support Municipal Plants in Cities Across the Country



With more than 350 MGD of cumulative capacity at municipal plants based on design flows, there are more US AnoxKaldnes installations for more types of applications than any other MBBR/IFAS technology.

South Adams County, CO

AnoxKaldnes™ MBBR for
TN Removal 5.5 MGD



Cocoa Beach, FL

AnoxKaldnes™ IFAS for
TN Removal 6 MGD



Fairfax Co, VA

AnoxKaldnes™ MBBR for
Tertiary DN 78 MGD



Chicago, IL

ANITA™ Mox for
Deammonification 0.23 MGD

AnoxKaldnes™ Expertise

Rocky Mountain Region | MBBR and Hybas™

With over 600 full-scale installations worldwide, the AnoxKaldnes technology is backed by unparalleled experience and expertise.

The AnoxKaldnes™ MBBR (Moving Bed Biofilm Reactor) process is a biological wastewater treatment process that utilizes specialized plastic carriers to create a surface on which a biofilm can attach. The carriers are mixed in the reactor, and their large surface provides capacity for a large biomass inventory, reducing the volume required for treatment. In the AnoxKaldnes MBBR process, most of the biomass resides in the biofilm on the carriers.

The AnoxKaldnes™ Hybas™ technology is an application of the IFAS process – Integrated Fixed-Film Activated Sludge. The same AnoxKaldnes MBBR media are used in the Hybas process, the difference being the carriers are used in an activated sludge environment. The suspended-growth biomass of the activated sludge and the biofilm on the carriers work together to provide higher treatment capacity in a smaller volume than that required for activated sludge alone.

Erie, CO - Hybas™

Started in 2011 with a design flow of 1.75 MGD and a peak flow of 4.2 MGD, this plant meets effluent criteria for ammonia <1 mg/L, NOx <9 mg/L and TP <1 mg/L. It is designed with biological phosphorous removal and pre-anoxic zones ahead of two aerobic Hybas zones with K3 media. In addition, a Kruger Discfilter provides tertiary filtration for water reuse.



Broomfield, CO - Hybas™



This system was installed in 2002 and is the first full-scale Hybas in the World. This plant is designed with biological phosphorous removal and pre-anoxic zones to achieve a TP of <1 mg/L, TN of 8 mg/L, and ammonia <1 mg/L. The Hybas process enabled expansion from 4 MGD to 8 MGD without additional aerobic reactor volume. The City has subsequently added an additional 4 MGD train to the plant.

Cheyenne, WY - Hybas™

The Dry Creek Hybas system was installed in 2005 and designed for 8 MGD, with effluent ammonia <2 mg/l and TN <12 mg/l. This plant was a partial retrofit of an existing circular aeration basin along with one new rectangular train to complete the upgrade.



Cheyenne, WY - MBBR

The Crow Creek MBBR was installed in 2005. The plant previously used a trickling filter. The city chose MBBR because it is also a biofilm process that would be compatible with the existing clarifiers. The MBBR has two trains of 4 aerobic reactors in series to treat 5 MGD and achieve BOD <10 mg/L and ammonia <2 mg/L. In 2010, the plant added two pre-anoxic MBBR reactors to target a TN of 10 mg/l.



Johnstown, CO - MBBR After Lagoons



The original plant consisted of 3 lagoons. The City required an upgrade in order to increase treatment capacity and meet lower ammonia limits. The MBBR system has a design flow of 0.75 MGD with a media fill of

26%. A future, construction-free expansion to 1.5 MGD can be achieved by simply adding media to the MBBR reactors.

Fairplay, CO - Hybas™

This plant formerly consisted of a lagoon system. The Fairplay Sanitation District was challenged in meeting their ammonia permit limits and wanted a process that would produce a stable effluent in a small footprint. The District replaced the lagoons with a new Hybas system in 2008. The plant design temperature is 4.5°C at 10,000 ft of elevation and a flow of 0.3 MGD. The effluent limits are 1 mg/L ammonia, 10 mg/L BOD and 10 mg/L TN. In order to achieve these limits, the plant was designed with pre-anoxic reactors and aerobic Hybas reactors.



South Adams County, CO - MBBR

This MBBR system was completed in 2003 and was designed with pre-anoxic and aerobic zones to achieve TN <11 mg/L. The MBBR was selected due to the City's desire to operate a fixed film system and reuse the existing clarifiers.



Crested Butte, CO - Hybas™



Crested Butte is designed for 0.125 MGD with a peak of 0.5 MGD. The plant includes pre-anoxic and aerobic Hybas reactors containing K3 media to achieve BOD <10 mg/L, ammonia <1 mg/L

and TN < 12 mg/L. By choosing Hybas, the City was able to add one new train of treatment capacity while planning for future retrofit of the existing activated sludge plant to Hybas.

Georgetown, CO - Hybas™

This plant is designed for 0.4 MGD with a peak of 0.8 MGD. It has pre-anoxic reactors, one Hybas zone with K3 media, and one aerobic zone with MLSS (no media) to achieve BOD <10 mg/L, ammonia <2 mg/L and TIN <10 mg/L. The MLSS zone is designed to be retrofitted with media for future growth.



Veolia Water Technologies

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LagoonGuard™ 0°C

Lead-Lag Biofilm Reactor (LLBR)

WATER TECHNOLOGIES

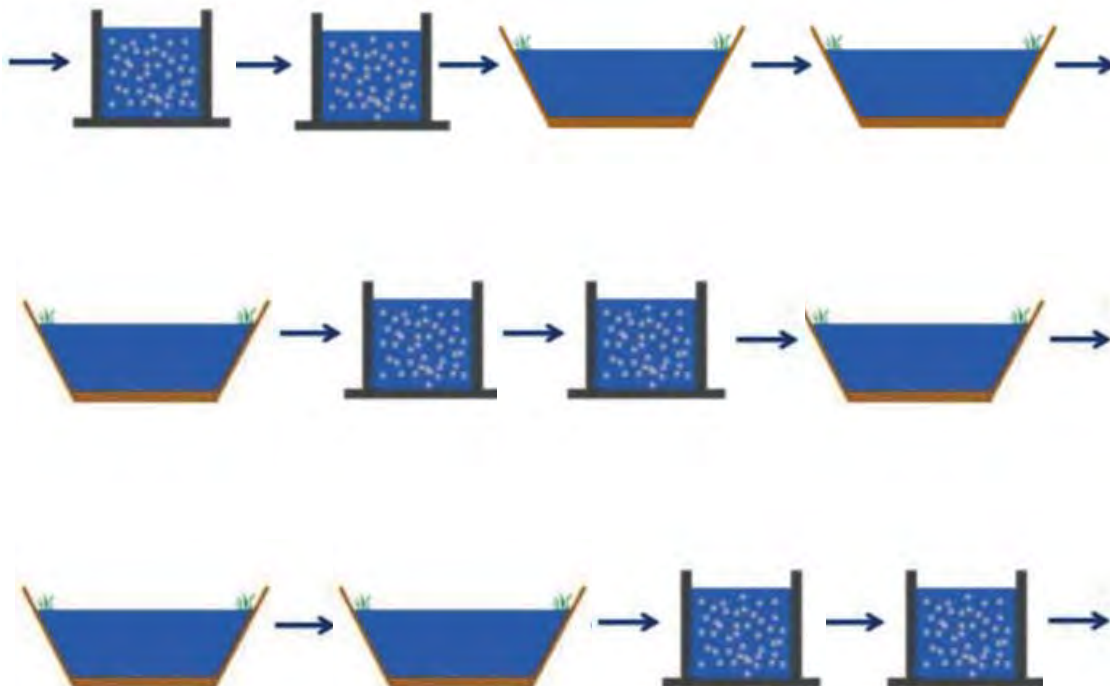
LagoonGuard™ 0°C - LLBR Benefits

AnoxKaldnes LagoonGuard™ 0°C LLBR

Today's municipalities and operators using facultative or aerobic wastewater treatment lagoons are facing the challenge of increasingly stringent effluent ammonia regulations under extremely low temperatures posing both space and financial challenges. To solve the challenges, Veolia revolutionized its LagoonGuard™ technology with an innovative lead-lag design to maximize biofilm growth and biomass inventory on media carriers to ensure efficient treatment performance under low temperatures with the smallest footprint and lowest capital costs. The lead-lag biofilm reactors (LLBR) have the following characteristics: 1. two reactors in series, each reactor periodically takes lead in receiving flows; 2. flow through system without recycle; 3. moving bed media carriers with high protected surface area; 4. stainless steel medium bubble aeration diffusers and media retaining screens. The LagoonGuard™ 0°C LLBR has the following advantages:

- Guaranteed performance at a temperature as low as 0.5°C
- Innovative and patented lead-lag reactor design
- Significantly smaller footprint than other technologies
- Lower construction and capital costs
- Easy to maintain and operate
- Lower energy costs due to use of medium bubble diffusers with increased oxygen transfer efficiency
- Single system supplier for all process equipment including media, screens, air grids, controls, instrumentation, blowers, valves and if required, headworks screens and discfilters

LagoonGuard™ 0°C LLBR Configurations



LagoonGuard™ 0°C - LLBR Components

AnoxKaldnes AnoxK™ 5 Media

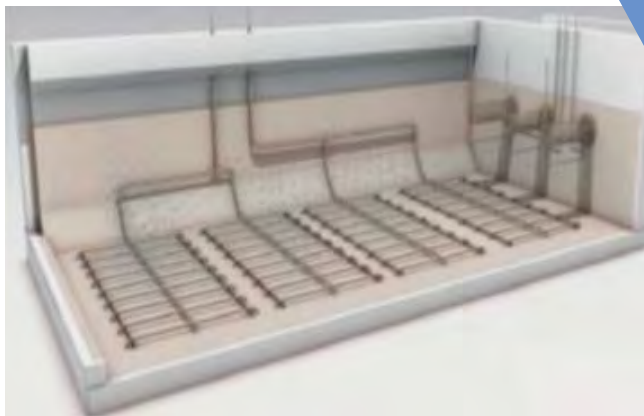
AnoxK™5 media provides the guardian structure for biofilm growth found in the LagoonGuard™. The media offers 800 m²/m³ of protected surface area for the biofilm. The incredible amount of surface area provides a large biomass inventory that remains fixed in the reactor. This eliminates the risk of biomass washout (especially nitrifiers) and significantly reduces the retention time, and therefore the footprint in the system. The hydraulic retention time in the LagoonGuard is within hours as compared to days in earthen or rock basins.

Media volume can be up to 55% the reactor volume. Typical designs allow for significant expansion of the treatment capacity simply by adding media.

The AnoxK™ series are made of virgin, high density polyethylene. This media is built to last and has proven the ability to be in long-term operation without degradation or media replacement.



LagoonGuard™ Reactor Cell



- LagoonGuard stainless steel air diffuser system is robust, non-clogging and maintenance free.
- Medium bubble air grids provide the oxygen and mixing needs for optimal biological performance. Diffusion through MBBR media results in increased oxygen transfer, saving more energy than coarse bubble systems.
- Cylindrical screens at the reactors effluent wall retain media, while allowing treated water to pass through.
- Reactors are sized to allow for media addition, increasing the treatment capacity within existing cells.

LagoonGuard™ 0°C LLBR Systems Include

- Complete process design with equipment warranty and effluent guarantee
- Equipment: media, air grid, blowers, screens, pumps, valves, meters and analyzers
- Controls: Veolia standard (A-B) or customized Control panel, PLC and HMI



LagoonGuard™ 0 °C - LLBR Complete Solution

TSS & Phosphorus Removal

Veolia is able to support the entire process train with in-house expertise and a complete line of technologies.

Hydrotech™ Discfilters

Similar to the new lower limits for ammonia, TSS and Total Phosphorus, effluent limits are becoming more stringent. Thus, a TSS and/or phosphorus removal stage may be required after the LagoonGuard™ process. Veolia's Hydrotech™ Discfilter is an operator friendly and low maintenance equipment for removal of TSS and phosphorus to low levels. For TSS polishing only, the Hydrotech Discfilter can typically achieve the regulation without chemicals. When the Hydrotech Discfilter is also used for achieving low effluent phosphorus concentrations, coagulant and polymer may be required. The Hydrotech Discfilter can achieve $TP \leq 0.1 \text{ mg/L}$ in the effluent with a Veolia chemical coagulation/flocculation process that will optimize chemical usage.

HYDROTECH™ series 2200 & 2600

Flow rates per unit	2200 series up to 9 MGD 2600 series up to 15 MGD
Process	Inside out filtration
Backwash Reject	~1-2% of treated flow
Effluent	TSS $\leq 5 \text{ mg/L}$, TP $\leq 0.1 \text{ mg/L}$



Influent Screening

If the LagoonGuard reactor is placed in front of the lagoons or to eliminate large solids and debris from entering the reactor, Veolia offers a full line of headworks equipment such as the ROTARC screen that can be installed in a channel or a tank. In typical lagoon applications, the screened solids are removed once per week from the wastewater treatment plant site and hauled off for disposal.

LagoonGuard™ - Performance Data



Neepawa, MB Commercial Demonstration

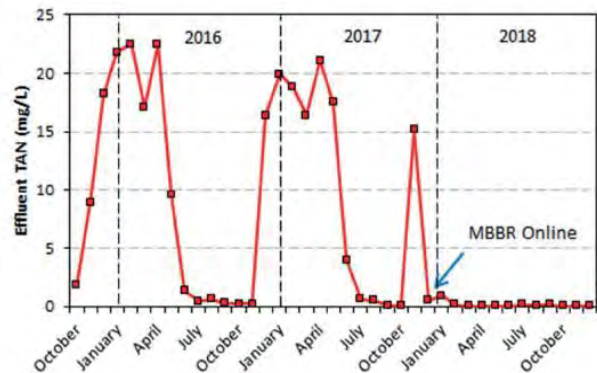
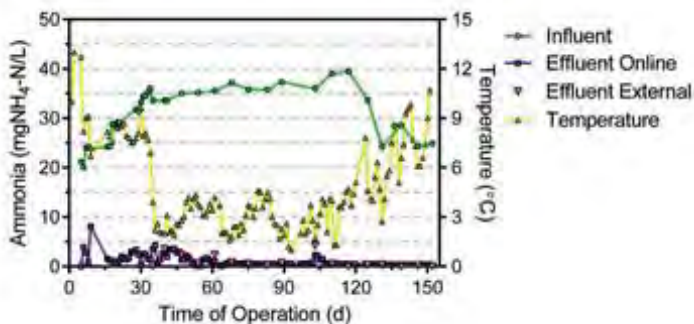
Operational Time: Dec 2016 to April 2017
 Application: Post-Lagoon Nitrification
 Discharge: Continuous
 Effluent Ammonia Objective: < 5 mgNH₄-N and non-acutely lethal to rainbow trout

- Minimum WW temperature 0.6°C
- Effluent ammonia objective met
- Effluent passed acute lethality testing 0% mortality
- Process robust to changing conditions
- LagoonGuard™ preselected for upgrade

Wray, CO Municipal Installation

Operational: Since 2017
 Design: Hybrid MBBR/Discfilter solution operating with or without lagoon with simple flow through process in a small footprint

- Doubled the wastewater treatment capacity (0.25 MGD to 0.5 MGD)
- Lowered the amount of organic and inorganic material without clarifiers
 - BOD < 10 mg/L
 - NH₃-N < 1 mg/L
 - TSS < 10 mg/L



Resourcing the world

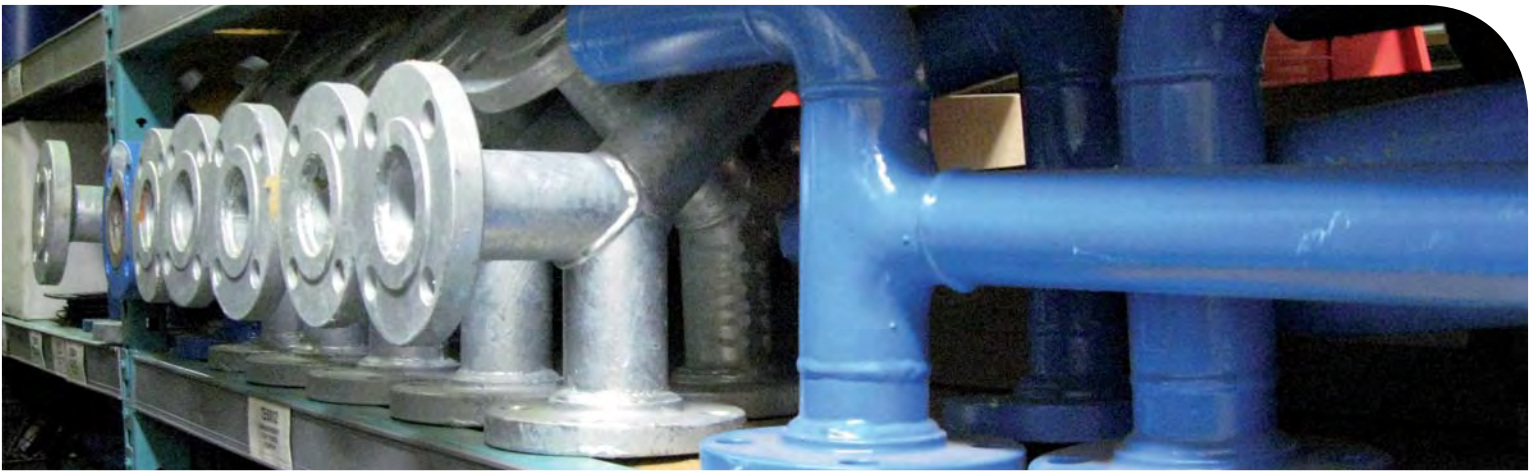
Veolia Water Technologies

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usmunicipal@veolia.com • www.veoliawatertech.com



US Municipal Customer Support

WATER TECHNOLOGIES



OEM Products & Replacement Parts

Kruger Customer Support is able to support all your repair and upgrade needs by providing Original Equipment Manufacturer Products and Replacement Parts. We maintain an extensive inventory and competitive pricing agreements with manufacturers for all parts needed to support:

Kruger Technologies

- > ACTIFLO®
- > Discfilter
- > Drumfilter
- > Oxidation Ditch
- > BIOSTYR®
- > MBBR/Hybas™
- > NEOSEP®/MBR
- > BioCon®
- > OASES®
- > Xtream™ and KCM Membranes
- > OdoWatch®

Conventional Technologies

- > Bar Screens
- > Pump Stations
- > Clarifiers
- > Aeration Basins
- > Digesters
- > Wet Wells
- > Thickeners

Services

Kruger Customer Support offers Service programs designed to reduce your overall operating cost, minimize downtime, increase the life expectancy of your equipment, and expand the operational knowledge of your staff. We have certified service experts throughout the US ready to provide:

- > Mechanical Repairs (In-House & Local Repairs Available)
- > Operator Training (Hand-On, Classroom, & Webinar Training Available)
- > Process Optimization
- > Discfilter Media Restoration
- > Automation & Control Support
- > Preventative Maintenance
- > Performance Audits
- > Lab Treatability Tests



Chemicals

Kruger Customer Support is able to supply certified chemicals intended to provide the best results for your treatment process. Our chemical formulations are developed specifically for our treatment technologies to optimize chemical consumption and improve performance. We have distribution centers throughout the US that are ready to supply:

- > Polymers
- > Coagulants
- > Dewatering Polymers
- > Microsand
- > Media and Membrane Cleaners
- > Micro C
- > Odor Control Agents
- > Acids
- > Bases
- > Oxidants
- > Defoamers



Instrumentation, Automation, & Lab Supplies

Kruger Customer Support is able to offer instrumentation and lab supplies needed to monitor the quality of your water. We are a preferred supplier of HACH and Endress+Hauser. Our I&C experts are prepared to provide you discounted pricing on:

- > Online Instrumentation
- > Portable Laboratory Equipment
- > Reagents
- > Flow Meters
- > Odor Monitoring
- > Automated Microbiology
- > AC & DC Drives
- > Panel Boxes & Electrical Components
- > HMIs
- > PLCs
- > Jar Testing Kits
- > Gauges
- > Transformers



Mobile Services

Kruger Customer Support offers Mobile Water Services to provide modular treatment plants for your short, mid, or long term water treatment needs. Our large fleet of mobile treatment units may be deployed as stand-alone units or combined to form complete water treatment systems. These mobile solutions are available for emergency rental, planned temporary hire, or long term contract to cover your needs:

- > Equipment Breakdown
- > Plant Commissioning
- > Delayed delivery of new plant
- > Plant downtime for maintenance purposes
- > Process trial validation
- > Peak demand
- > Raw water changes



Resourcing the world

Veolia Water Technologies

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Design and Operational Insights of the World's Largest Integrated Fixed Film Activated Sludge (IFAS) Process for Low Nitrogen Limits

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ABSTRACT

The Narragansett Bay Commission (NBC) is in the initial stages of startup of integrated fixed film activated sludge (IFAS) process to achieve a monthly seasonal 5 mg/l total nitrogen effluent permit limit for their 291 MLD (77 mgd) Field's Point Wastewater Treatment Plant. The upgrades included new fine screens, supplemental alkalinity addition, supplemental carbon addition and conversion of the complete mix activated sludge reactors into plug flow IFAS reactors. Six (6) of the ten (10) reactors are currently converted for IFAS operation. The design was completed in 2008 following a comprehensive procurement process which included a system guarantee from the IFAS system supplier. When completed in 2014, it is expected to be the largest IFAS facility in the world. The initial results of the nitrogen removal performance prior to any system optimization or supplemental alkalinity and carbon addition indicated that effluent total nitrogen ranged from 8 to 12 mg/l total nitrogen (TN). Additionally the sludge volume index (SVI) at the 95 percent occurrence level has been reduced from 300 ml/g pre-IFAS condition to 150 ml/g post-IFAS condition. This paper will present a summary of the system procurement, design and nitrogen performance and operational insight of the new facility.

Key words: integrated fixed film activated sludge, conventional activated sludge, complete mix conversion, design, operational insights, nitrification, nitrification rates, biological nitrogen removal, clean water oxygen transfer test, system procurement.

INTRODUCTION

Installations of integrated fixed film activated sludge (IFAS) processes have increased and designs have matured over the past decade. The design described in this paper is exclusively for free-moving plastic biofilm carriers. Biofilm accumulated on the free-moving plastic carriers, plus the suspended biomass, combine to form the biological wastewater treatment process. Increasingly, IFAS is being considered as an upgrade option to achieve consistent year round nitrification in activated sludge systems that nitrify on a seasonal basis, or do not nitrify at all, due to limited aeration basin and/or clarifier capacity¹. In cases of physical space limitations and/or high cost associated with the construction of additional tanks, the designer may find that IFAS is a more economical and attractive alternative than conventional activated sludge (CAS) upgrade approaches. An advantage of the IFAS process

is a flexible array of design choices, including bioreactor configuration, locations where free-moving plastic biofilm carriers are placed in the bioreactor, and the volume of free-moving plastic biofilm carriers. Adequate design of the IFAS process mechanical components including aeration systems and carrier retention screens creates a platform for capacity expansion without new reactor construction by increasing the free-moving plastic biofilm carrier volume. This flexibility can also be a barrier to the application of IFAS process technology, as reliable and robust design approaches are still evolving as newer and larger designs move forward. This paper describes the physical limitations, process configuration and initial operational insights in currently the largest IFAS treatment process in the world.

BACKGROUND

The NBC was initially interested in IFAS as a nitrogen removal technology starting in 2004 due to the ability for IFAS to provide an environment and active sites for a fully nitrifying biofilm which increased the capacity of the plant without the addition of new aeration basins. Figure 1 highlights the size of the aeration basins and the site physical limitations for expansion.



Figure 1 – Field’s Point WWTP Project Site

PROCESS DESIGN CRITERIA AND DISCUSSION

The process design was based on achieving complete nitrification and virtually complete denitrification on a seasonal basis, from May through October, while reducing effluent total inorganic nitrogen and ammonia to the design criteria as provided in Tables 1 through 4 below. The average dry weather flow to the plant is 189 MLD (50 mgd) however during wet weather events, influent flow to the secondary treatment process consists of both storm water flow and wastewater flow up to a maximum flowrate of 291 MLD (77 mgd). The NBC’s Combined Sewer Overflow (CSO) conveyance system includes a 235 ML (62-million gallon) deep rock CSO storage tunnel and tunnel pump station that allows flows in excess of 291 MLD (77 mgd) to be captured and stored. After the storm event and as plant capacity becomes available, the stored storm water in the tunnel is pumped at a sustained rate of up to 189 MLD (50 mgd) and mixed with the municipal influent wastewater up to the maximum

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flow to secondary. The combination of municipal wastewater flows and pumped flow from the deep rock tunnel can result in extended periods of dilute wastewater flow at 291 MLD (77 mgd) to the biological treatment process. The IFAS process was chosen for Fields Point WWTF due to the ability of the plastic carrier media in an activated sludge reactor to provide additional growth sites for ammonia oxidizing bacteria (AOB) and increase biomass due to the combination of the attached growth biofilm on the carriers and the biomass in the mixed liquor suspended solids. This increased biomass substantially improves nitrification performance in cold temperature conditions^{2,3,4}.

Table 1- IFAS System Design Flow Conditions

Average Daily Flow (ADF)	189 MLD (50 mgd)
Maximum Month Average Daily Flow (MMADF)	291 MLD (77 mgd)

The primary effluent (aeration basin influent) pollutant load conditions are summarized in Table 2 below⁵.

Table 2 – IFAS System Design Pollutant Load Conditions

BOD⁽¹⁾	
Average	19,833 kg/d (43,726 lb/day)
Maximum Month	21,424 kg/d (47,234 lb/day)
Maximum Week	26307 kg/d (57,997 lb/day)
TSS	
Average	11,928 kg/d (26,297 lb/day)
Maximum Month	14,523 kg/d (32,018 lb/day)
Maximum Week	29,627 kg/d (65,317 lb/day)
Total Nitrogen⁽²⁾	
Average	3430 kg/d (7,562 lb-N/day)
Maximum Average Month	4432 kg/d (9,772 lb-N/day)
Maximum Average Week	5064 kg/d (11,166 lb-N/day)

Nitrates ⁽³⁾	
Average	172 kg/d (381 lb-N/day)
Maximum Average Month	346 kg/d (765 lb-N/day)
Maximum Average Week	419 kg/d (925 lb-N/day)
<p>⁽¹⁾ SBOD:BOD ratio is 0.65 +/- 0.1.</p> <p>⁽²⁾ TKN plus nitrites plus nitrates. NH₃:TKN ratio is 0.6 +/- 0.1</p> <p>⁽³⁾ Sum of nitrite and nitrate nitrogen loads. Nitrate expressed as N.</p>	

DESIGN OPERATING CONDITIONS

The design was based on the operating conditions summarized in Table 3 below and includes a maximum firm return sludge pumping capacity of 246 MLD (65 mgd).

Table 3 – IFAS System Design Operating Conditions

Mixed Liquor Temperature	
Minimum ⁽¹⁾	14 C
Average	17 C
Maximum ⁽¹⁾	21 C
Primary Effluent Total Alkalinity ⁽²⁾	
Minimum	80 mg/L as CaCO ₃
Average	110 mg/L as CaCO ₃
Primary Effluent Dissolved Oxygen (D.O.)	
Average	4 mg/L
Maximum	5 mg/L
Mixed Liquor Concentration (MLSS)	
Minimum	1,800 mg/L
Average	2,000 mg/L
Maximum	2,500 mg/L
Return Sludge Pumping Capacity (Firm)	246 MLD (65 mgd)

- (1) Sustained temperature for greater than seven days.
- (2) A sodium hydroxide system will be installed at the plant to maintain a total alkalinity of 100 mg/L as CaCO₃.

The process design was based on meeting the monthly seasonal effluent limits summarized in Table 4 below and is predicated on a system guarantee for effluent total inorganic nitrogen (TIN), ammonia nitrogen (NH₃-N) and carbonaceous biochemical oxygen demand (CBOD₅). Additionally the process design was required to fit within the existing hydraulic profile of the treatment plant with a design head loss at peak hydraulic flow including recirculation of no more than 50 mm (2-inches) per reactor basin.

Table 4 – Field’s Point WWTF Effluent Quality Requirements¹ and Guaranteed System Performance, 30 Day Averages (Filtered Samples)

Total Nitrogen ⁽²⁾ Monthly Average (5/1-10/31) Monthly Average (5/1-10/31)	5.0 mg-N/L 1229 kg/d (2,711 lb/day)
BOD and TSS Monthly Average Weekly Average	30 mg/L 45 mg/L
Total Inorganic Nitrogen (TIN) Enforced period (1 May through 31 October)	3.0 mg/L
Ammonia Nitrogen Enforced period (1 May through 31 October)	1.0 mg/L
CBOD ₅ Enforced Period (year round)	10 mg/L
⁽¹⁾ Settled Effluent.	
⁽²⁾ Sum of TKN, plus nitrite, plus nitrate.	

REACTOR PHYSICAL CHARACTERISTICS

The existing ten (10) complete mix activated sludge treatment reactors are being converted to ten (10), seven (7) cell IFAS reactors. Each reactor includes a first stage anoxic zone (two cells), an aerobic cell with biofilm carrier media, a nitrified mixed liquor return cell, a two cell second stage anoxic zone and a re-aeration cell⁶. Table 5 provides the physical characteristics of the cells. Figure 2 depicts the flow pattern and layout of the reactor and cells. Figure 3 depicts the flow pattern and section across the typical basin.

Table 5- Integrated Fixed-Film Activated Sludge Reactor Physical Characteristics

Parameter	Value
Reactors/Cells per reactor	10/7
Suspended biomass solids residence time	4 days
Total volume	36 ML (9.6 MG)
Total hydraulic retention time	3.0 hours
Side water depth	5.25 m (17.25 ft)
Reactor width	23.5 m (77 ft)
Cells 1 and 2 physical characteristics (each)	
Operating mode	Pre-anoxic
Volume	3.4 ML (0.9 MG)
Hydraulic retention time	0.3 hour
Cell 3 physical characteristics	
Operating mode	IFAS
Empty bed volume	15 ML (4.0 MG)
Bulk-liquid volume	13.6 ML (3.6 MG)
Hydraulic retention time	1.2 hours
Media fill fraction (empty bed volume%)	45%
Media Type	K3
Dissolved oxygen concentration	4 mg/L
Cell 4 physical characteristics	
Operating mode	Internal mixed liquor recycle
Volume	1.5 ML (0.4 MG)
Hydraulic retention time	0.1 hour
Cell 5 physical characteristics	
Operating mode	post-anoxic
Volume	5.6 ML (1.5 mg)
Hydraulic retention time	0.5 hour
Methanol feed	3 m ³ /d (800 gpd)
Methanol feed concentration	8 mg/L
Cell 6 physical characteristics	
Operating mode	post-anoxic
Volume	3.4 ML (0.9 MG)
Hydraulic retention time	0.3 hour
Cell 7 physical characteristics	
Operating mode	reaeration
Volume	1.5 ML (0.4 MG)
Hydraulic retention time	0.1 hour
Dissolved oxygen concentration	2 mg/L

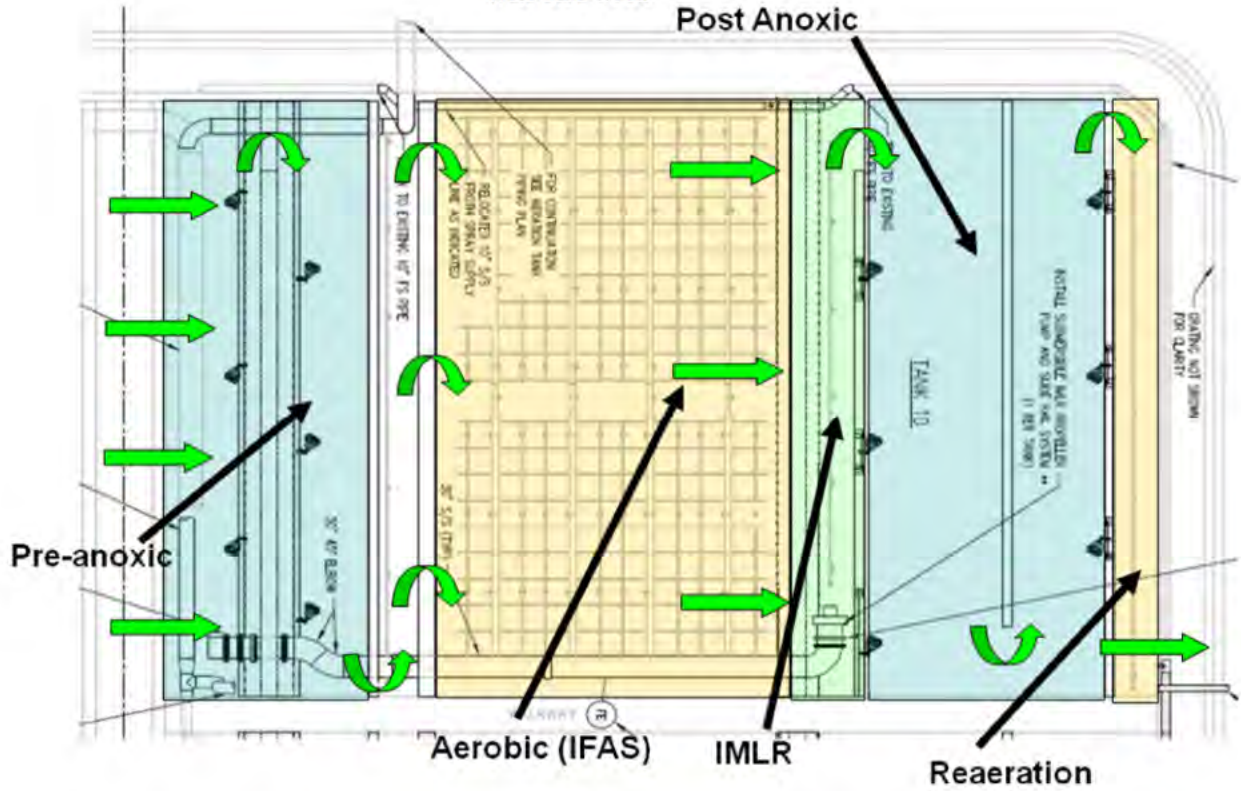


Figure 2- IFAS Reactor Flow Pattern and Plan View Layout

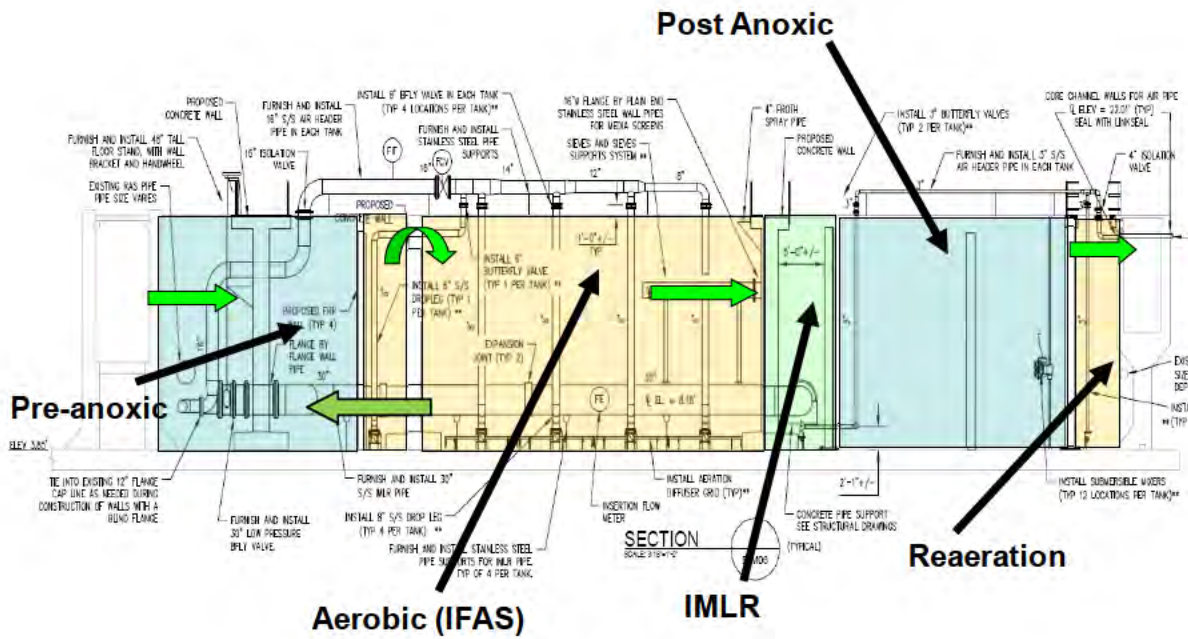


Figure 3- IFAS Reactor Flow Pattern and Section

REACTOR KINETIC RATES AND REQUIRED PERFORMANCE

The temperature range for design is based on 14 C to 21 C and is of particular interest in the reactor design since full nitrification is not required until May 1st each year. Since tank operation is required to be flexible across a wide range of temperatures, flows, and biological conditions, nitrifier growth kinetics will transition between the suspended growth phase and to the biofilm carrier media based on bulk liquid ammonia concentration. The design is based on an increase in flux rate as ammonia penetrates the biofilm surface such that biofilm growth is in response to the concentration of available carbon in the mixed liquor and ammonia concentration reaching the surface of the biofilm. This activity transition from the suspended phase to the biofilm carriers is anticipated to occur as the minimum aerobic SRT for nitrification decreases in response to the increase in wastewater temperature. The ammonia gradient through the mixed liquor is important in driving the flux and overall nitrification performance. Denitrification on the other hand is limited by the bulk dissolved oxygen carryover in the nitrified mixed liquor to the extent that the recirculation rate can outstrip the ability of denitrification to meet the target effluent nitrate levels. Table 6 summarizes the required performance for nitrification and de-nitrification in each reactor.

Table 6- Design Nitrification and De-nitrification Rates Per Reactor

<p>Design IFAS Reactor Influent Conditions (Maximum Month)</p>	<p>Flow = 29,147 m³/d (7.7 mgd/reactor) Ammonia to be nitrified = 320 kg/day/reactor Nitrate = 35 kg/day/reactor NRCY = 218% RAS = 30% Maximum MLSS = 2,500 mg/L Temperature = 14 C Design</p>
<p>Nitrification Rate</p>	<p>320 kg/day(320,000 g/d) Ignoring nitrification from suspended growth Allow for 2mg/L ammonia in IFAS reactor effluent (58 kg/day/tank or 58,300 g/d) Oxygen limited conditions at 4 g-O₂/m³ Rate first-order as function of ammonia concentration to 2 mg-NH₃-N/L Design has 674 m³ at 500 m² per m³ = 337,000 m² per IFAS reactor Reactor loading rate = 320,000 g/337,000 m²/day = 0.95 g/m²/day Required Removal rate = (320,000-58,300) g/337,000 m²/day = 0.78 g/m²/day</p>
<p>Pre-Denitrification Credit</p>	<p>Nitrate = 35 kg/day (influent) + 262 kg/day</p>

	<p>(nitrified) = 297 kg/day</p> <p>Plus, oxygen in recycle,</p> $(2.18 \times 29,147 \text{ m}^3/\text{d} \times 4\text{g}/\text{m}^3)/2.86 = 89 \text{ kg/day NO}_3\text{-Neq}$ <p>Design rate used by IFAS Design for Fields Point = 5.5 g-NO₃-Neq/kg-MLSS/hr</p> <p>Total = 297 kg/day + 89 kg/day = 386 kg/d (16 kg/hr)</p> <p>Anoxic Volume in Fields Point Design (Pre-AX 1 + Pre-AX2 + Swing) = 820 m³/reactor (216,652 gal/reactor), so</p> $820 \text{ m}^3 \times 2.5 \text{ kg-MLSS}/\text{m}^3 \times 5.5 \text{ g-NO}_3\text{-Neq}/\text{kg-MLSS}/\text{hr} = 11.3 \text{ kg/hr}$ <p>16 kg/hr - 11.3 kg/hr = 4.7 kg/hr of NO₃-N moves on to the post-anoxic zone.</p>
<p>Post-De-nitrification Rate</p>	<p>Loading = 4.7 kg/hr NO₃-N,</p> <p>Plus oxygen in forward flow assuming no reduction in pump zone,</p> $[(29,147 \text{ m}^3/\text{d} + 0.3 \times 29,147 \text{ m}^3/\text{day}) \times 4 \text{ gO}_2/\text{m}^3]/(2.86 \times 24) = 6.3 \text{ kg/hr}$ <p>Total loading = 4.7 + 6.3 = 11 kg/hr</p> <p>Post-Anoxic Volume in Fields Point Design = 232,367 gal. = 880 m³/reactor</p> <p>Allow for 2g-NO₃-N/m³ in effluent (3.1 kg/hr)</p> <p>Rate needed to reach effluent goal of 2g-NO₃-N/m³.</p> $(11,000 \text{ g/hr} - 3,100 \text{ g/hr})/(2.5 \text{ g-MLSS}/\text{m}^3 \times 880 \text{ m}^3) = 3.6 \text{ g-NO}_3\text{-Neq}/\text{kg-MLSS}/\text{hr}$

BULK DISSOLVED OXYGEN AND AERATION SYSTEM CAPACITY

Additional aeration capacity was required to obtain 4 mg/l average and 6 mg/l peak bulk dissolved oxygen (DO) levels based on experience at other full scale IFAS facilities. Table 7 provides the summary of the actual oxygen required (AOR) and calculated aeration rate for the bulk DO of 6 mg/l at Peak Week, Maximum Month and Average Day including 2.8 std. m³/min (100 scfm) for mixing in the IMLR pump zone and 2.8 std. m³/min (100 scfm) in the re-aeration zone. An evaluation of converting from existing centrifugal blower technology to high speed turbo blower technology determined that the net present value payback was approximately five (5) years for this facility. Therefore high speed turbo blowers were chosen for the plant upgrades. Nine (9) high speed, 188 std. m³/min (6,650 scfm), 225 kW

(300 horsepower) turbo blowers will be required to meet the air requirements. The new turbo blowers were installed within the existing aeration building air filter room.

Table 7- IFAS Design Air Demands

Condition	Actual Oxygen Requirement (Total 10 Reactors)	Aeration Rate (Total)
Peak Week	41,415 kgs O ₂ /day (91,300 lbs O ₂ /day)	1,670 std. m ³ /min (59,600 scfm)
Max Month	35,470 kgs O ₂ /day (78,200 lbs O ₂ /day)	1,400 std. m ³ /min (49,400 scfm)
Average Week	28,760 kgs O ₂ /day (63,400 lbs O ₂ /day)	1,100 std. m ³ /min (38,900 scfm)

SCHEDULE AND INITIAL OPERATIONS PLAN

The following timeline in Figure 4 depicts several events in the conversion of the aeration system and complete mix reactors into integrated fixed film reactors. Currently, in July 2012, six (6) of the ten (10) complete mix reactors are converted to IFAS reactors. All centrifugal blowers have been converted to turbo-blowers. The construction of the supplemental alkalinity building and carbon building is underway and anticipated to be completed in the late fall 2012. Sludge removal mechanisms of the four (4) primary clarifiers and six (6) of the nine (9) secondary clarifiers were replaced with new trusses, bridges and center wells. The primary clarifiers are plow type and the secondary clarifiers are rapid sludge riser (RSR) type mechanisms.

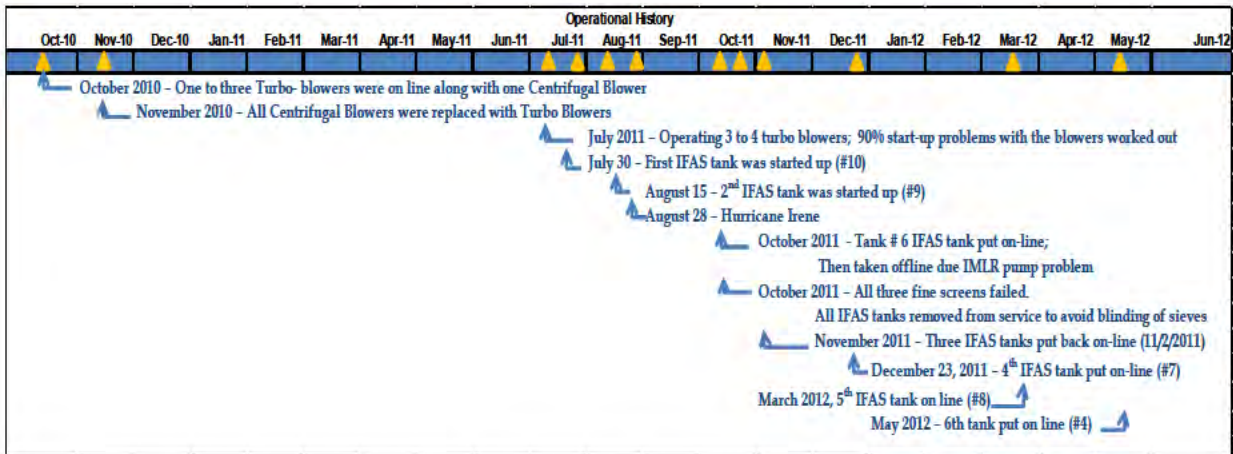


Figure 4- IFAS Reactor and Aeration System Conversion Timeline

The remainder of the construction on the project is planned to take place in several phases. By early July 2012, the plant will be running exclusively on seven (7) IFAS reactors. The three (3) remaining complete mix activated sludge reactors will be converted to IFAS reactors in stages. This work is scheduled to be completed in October 2012. At that time the instrumentation and control system will be tested and accepted. The IFAS acceptance test is planned to be completed in late fall 2012 to very early spring 2013. This testing will be completed when the mixed liquor temperature is approximately 14 degrees C on a two week moving average during the test period. Currently, the effluent weirs at the end of the re-aeration zone have not been installed on the IFAS reactors. This will be done when the eighth

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IFAS reactor comes on line which is planned for August 2012. Following the installation of the weirs the plan is to monitor hydraulic losses and foam in the tanks. The effect of the CSO pump back on the process will be monitored. The hypothesis is that CSO pump back from the tunnel will have an impact on the MLSS temperature as it should tend to warm the mixed liquor in the winter and slightly reduce the mixed liquor temperature in the summer. Currently there has been no attempt to vary the IMLR flows. The plan is to start a sampling program when the IMLR flow rates are varied. The plan is to begin adding caustic for alkalinity/pH control and a carbon source just before the first permit season in the spring of 2014.

FULL SCALE OXYGEN TRANSFER TEST (OTE)

A full-scale clean water oxygen transfer test was performed on July 7th, 2011 using the Anox-Kaldnes^R Aeration System installed at the plant. Clean water testing was performed on the aeration grids installed in the IFAS Cell of Reactor No. 10 and were completed with testing apparatus supplied by the system supplier. The procedure for the testing included; Reactor No. 10 was cleaned, sieve penetrations were blocked, the weir wall at the IFAS cell was extended, the basin overflow weir was blocked, and the basin was filled with potable water. A cobalt chloride catalyst was added on the morning of the test and was followed by dosing with sodium sulfite. Five (5) recording dissolved oxygen probes were located along the tank wall and data was collected electronically every fifteen (15) seconds. Dissolved oxygen response curves were developed from the data obtained. The DO monitors were left on for the duration of the tests and each test was deemed concluded after the near saturated DO concentration was achieved typically after at least 35 minutes. A sample of the test water was collected before Test No. 1 and after the last test to determine the total dissolved solids (TDS) and adjust the test results. The tests were conducted under the following operating conditions:

- Five (5) main blowers were functional with a total output of approx 27,000 scfm to seven (7) basins.
- Air flow to the test basin was throttled to approx 3764 scfm

Figure 4 depicts the full scale clean water oxygen transfer test in the IFAS Zone of Reactor # 10. The oxygen transfer efficiency of coarse bubble system typically found IFAS systems is less efficient than fine bubble systems⁷. The influent to the IFAS zone is to the right in the photograph. The bubble pattern was very uniform throughout each of the three (3) tests. Figure 5 shows the standard oxygen transfer rate for each of the five (5) D.O. probes and the target rate of 672 lbs/hr. Figure 6 depicts the target airflow rate of 3762 scfm and the oxygen transfer results. The clean water oxygen transfer test achieved the required design criteria and met specified test goals.



Figure 4 – IFAS Reactor in Full Scale Clean Water Oxygen Transfer Test

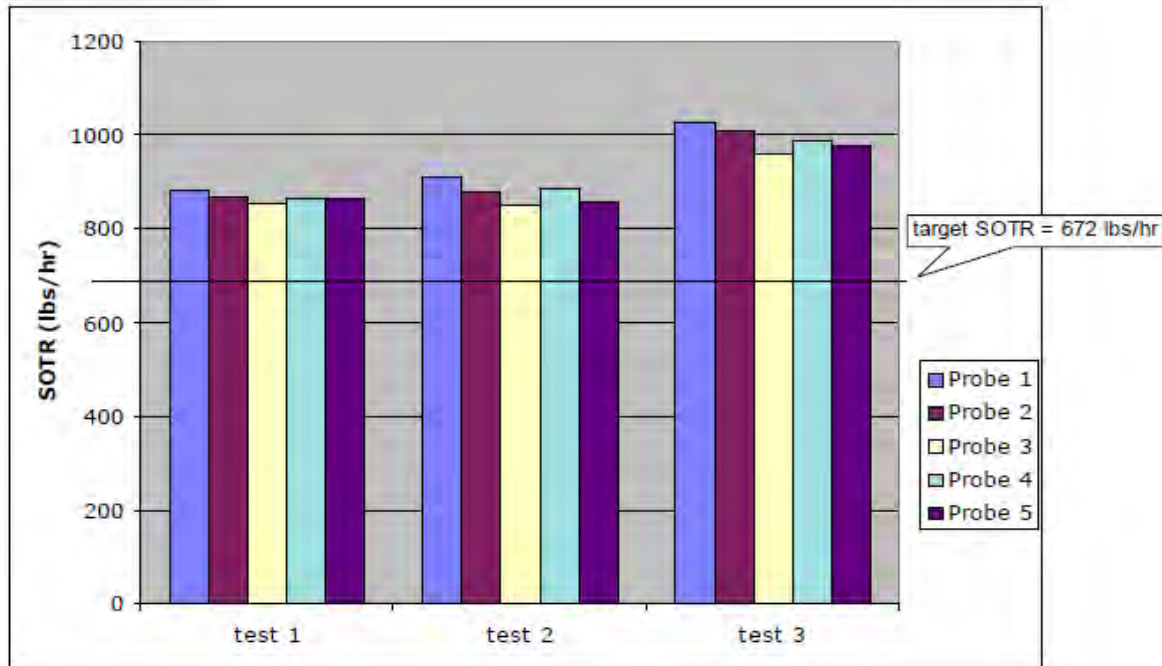


Figure 5- Oxygen Transfer Tests and Target Oxygen Transfer Rate

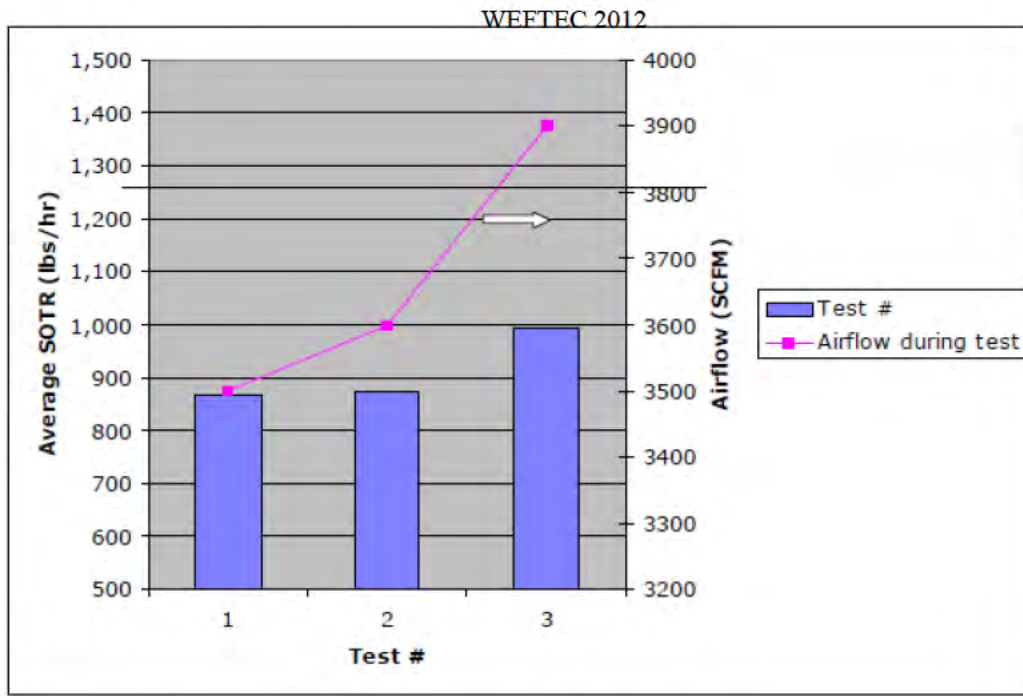


Figure 6- Oxygen Transfer Test and Target Airflow Rate

OPERATIONAL INSIGHTS

Figure 7 depicts the quiescent pre-anoxic zone (Cells 1 and 2) and fiberglass baffle walls in IFAS Tank # 7 in May 2012. Flow enters from the left and flows to the right in Figure 7. Mixed liquor has been absent of foaming in the pre-anoxic zone. The mixed liquor flocculates well with the return activated sludge (RAS) and IMLR entering Cell 1. Figure 8 depicts the post-anoxic zone and Cells 5 and 6 in IFAS Reactor #7. Foam that accumulates in the post-anoxic zone flows around the baffle walls and exits the tank over the weir in the re-aeration zone in Cell 7. Flow enters from the right to the left in Figure 8.



Figure 7 –View of Quiescent Pre-Anoxic Zone in a Tank; Mixer Mast in Foreground



Figure 8 – View of Post Anoxic Zone Cell 5 & 6; Fiberglass Baffle Walls

The IFAS Reactors include several field instruments within each cell to monitor the performance of each reactor. Figure 9 depicts the operating data for IFAS Reactor #10 over approximately sixteen (16) days. The graphic shows the relationship and variation of DO in the IFAS cell, Post Anoxic pH, Pre-Anoxic Nitrate and Post Aeration Nitrate. As may be seen the dissolved oxygen in the IFAS cell varies diurnally between 2.5 – 7 mg/L and peaks with post aeration nitrate. The pre-anoxic nitrate typically varies between 1 – 3 mg/L NO₃ and re-aeration nitrate varies between 1-6.5 mg/L NO₃. pH is relatively stable but can vary between 5.5 – 6.2 S.U. This pH variation may be pointing to an alkalinity deficiency during peak ammonia loading periods and may be limiting nitrification. However supplemental alkalinity will not be added until the Spring 2014.

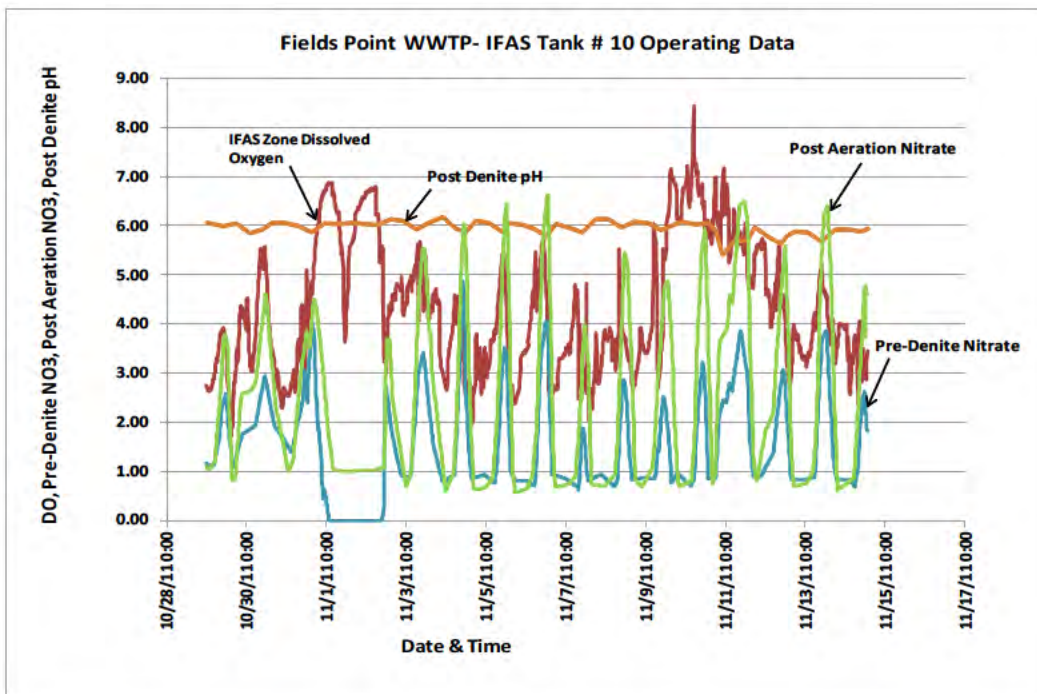


Figure 9 – Operating Data in IFAS Reactor # 10; Pre-Anoxic and Re-Aeration Nitrate

Over the course of the last eleven (11) months plant operations staff has taken numerous photomicrographs of the mixed liquor to characterize the flocculated particles and microorganisms. Figure 10 and 11 below depict 200X phase contrast micrographs from early July 2012. Figure 10 depicts a fungus filament although found in low amounts the growth of these microorganisms usually indicates a low pH. Figure 11 depicts a number of smaller floc particles with numerous bacterial filaments on the edges of these particles. The ratings for *Nitrosomonas* and *Nitrobacter* have been increasing in the mixed liquor.



Figure 10 – Mixed Liquor 200X Phase Contrast Micrograph of Fungus Filament

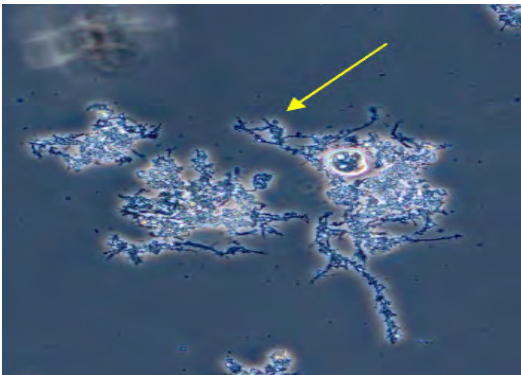


Figure 11 – Mixed Liquor 200X Micrograph of Floc Particles with Bacterial Filaments

Figure 12 shows the nitrogen performance based on the number of IFAS Reactors in service. It depicts plant nitrogen removal performance with six (6) of the ten (10) reactors in service. Plant nitrification performance has been limited to approximately 8 to 12 mg/L total nitrogen in the plant effluent which is approximately a 70 percent reduction from influent total nitrogen concentrations. As may be seen in Figure 12 the effluent ammonia concentration dipped to 3-4 mg/L NH₃ in September 2011 and has steadily climbed to 8-9 mg/L effluent NH₃ in May 2012. This indicates that the existing IFAS zones are not fully nitrifying. Several factors may be affecting the nitrification performance including alkalinity deficiency, all IMLR pumps not fully functional for flow pacing and operating at a constant and stable RAS flow rate until all basins are converted to IFAS reactors. The IMLR pumps are currently run at about 50 percent of the feed forward flow with sieve approach velocities approximately 16-22 m/hr.

Figure 13 shows the relationship between suspended growth SRT, mixed liquor temperature, effluent nitrate and ammonia concentrations. The suspended growth SRT has ranged between 5-10 days, however biofilm carrier SRT is not anticipated to be included in operations monitoring until late Fall 2012. Effluent nitrate concentrations initially went up to about 25

mg/l during the initial IFAS conversion in July 2011 and then dropped to about 2-3 mg/L NO₃ by November 2011 and performance continued to fall to 1-2 mg/l NO₃ in May 2012 due to reduced nitrification.

The biofilm carrier approach velocity is an important design parameter to minimize hydraulic bulking, buildup of carrier media at the sieves and the possibility of structural failure of the sieves or overflowing the reactor. The plant's design approach velocity with peak hydraulic flow is 30 m/hr. Recommended design peak rates are between 30-35 m/hr for feed forward flow and less than 50 m/hr for all feed forward and recirculation flows⁸. Figure 14 depicts the typical approach velocity for a reactor is between 16 – 22 m/hr over a range of influent flows from 5- 9 mgd and IMLR recirculation rates of 5-7 mgd per reactor. This is a conservative design criterion that has minimized the buildup of carrier media and headloss across the sieves to date.

Figure 15 depicts an important and positive change in the sludge volume index (SVI) from the pre-IFAS period to the post-IFAS period. The graphic shows a large reduction in SVI which in turn should increase secondary clarifier capacity. Two data sets were compared; one from 2000-2001 and the second from 2011. At the 95 percent occurrence level the difference in SVI is 50 percent. This confirms that the design SVI of 150 ml/g is a reasonable criterion.

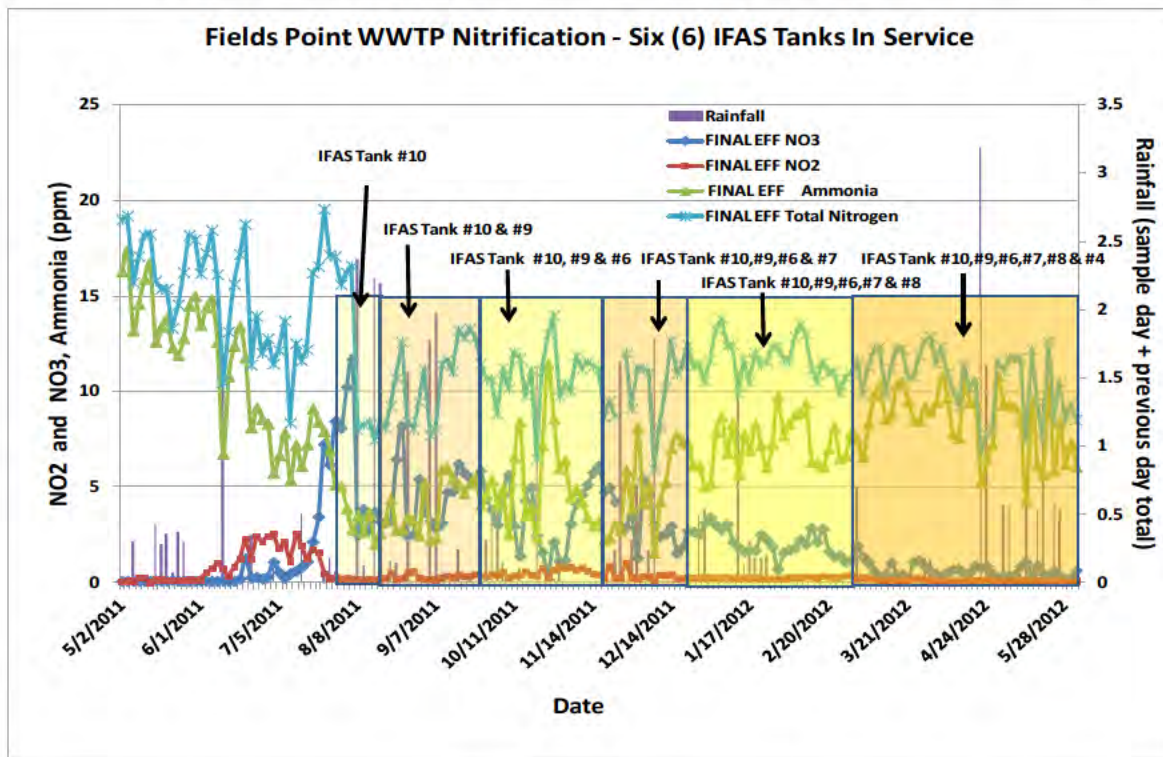


Figure 12 - Nitrogen Performance Based on Number of IFAS Reactors in Service

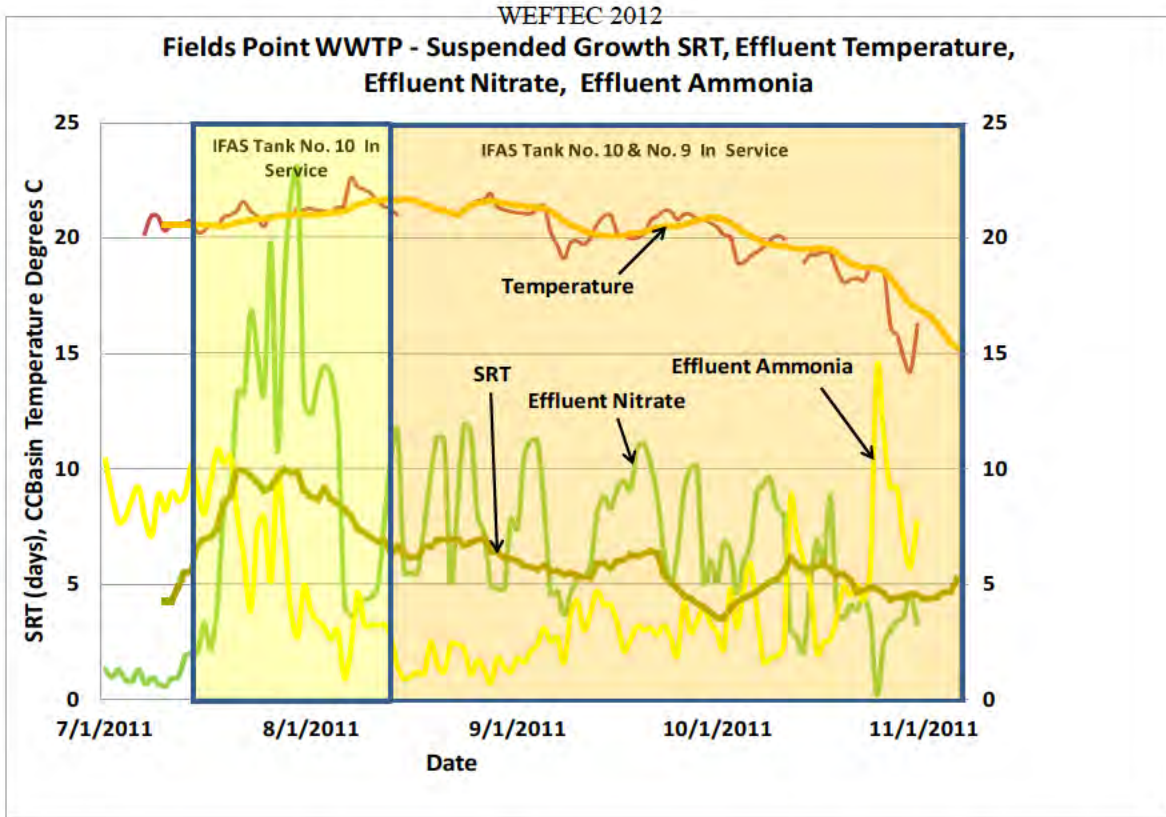


Figure 13 – Suspended Growth SRT, Temperature, Effluent Nitrate & Ammonia

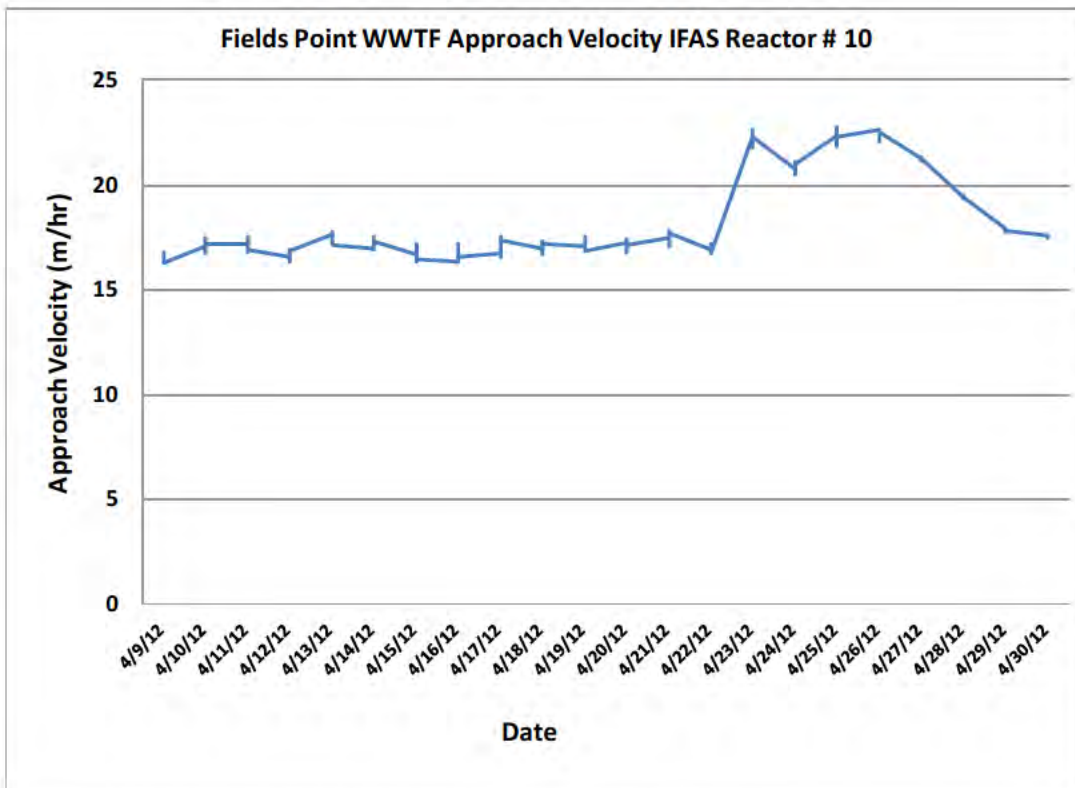


Figure 14 – Typical IFAS Reactor Approach Velocity

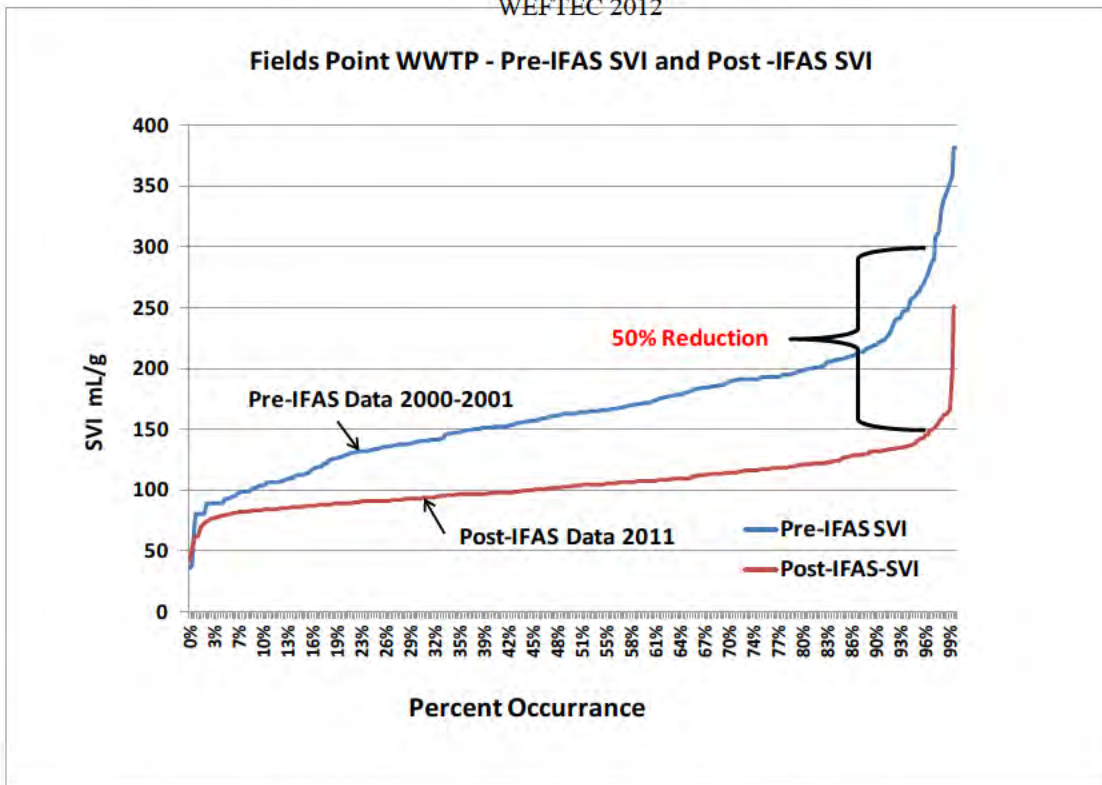


Figure 15- Pre-IFAS and Post-IFAS Sludge Volume Index (SVI)

SUMMARY

The conversion of the Fields Point WWTP complete mix aeration basins to ten (10) IFAS Reactors has been a challenging and rewarding experience. The NBC was challenged initially with a technology that had not matured to the extent required to apply it to a facility the size of Field’s Point yet the challenge was overcome with successful applications of larger and more complex IFAS conversions since 2000. The design details and phased construction approach of the biological nitrogen removal system has been very important for IFAS technology and is significant since the facility will have a monthly seasonal 5 mg/L total nitrogen limit (3 mg/L total inorganic nitrogen limit (TIN)). There have been several insights gained from the operation of the facility to date. They include; physical limitation of converting a complete mix rectangular tank with a length to width ratio of 1.25: 1 into a plug flow reactor with multiple cells or zones, integrating the new baffle and structural walls into the hydraulic grade-line, incorporating process flexibility, supplemental alkalinity and carbon facilities. The process has the advantage of allowing the pump back of significant CSO flows from the tunnel while maintaining a nitrifying biomass and eliminating the need to construct new aeration basins on a constrained plant site. Nitrogen removal performance of the plant has ranged from 8-12 mg/l TN without system optimization, supplemental alkalinity or carbon addition with six (6) of the ten (10) Reactors converted to IFAS. Finally the sludge volume index 50 percent reduction following IFAS conversion will allow an increased secondary clarifier capacity and more flexibility with the operation of secondary treatment.

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Achieving Extremely Low Effluent Total Nitrogen and Total Phosphorous Concentration at Very Low Solids Retention Times Using IFAS Technology

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ABSTRACT

The paper presents results from eighteen-month long testing at the Cocoa Beach, FL Integrated Fixed Film Activated Sludge (IFAS) plant, which was conducted to investigate the ability of IFAS processes with extremely short SRTs to remove total nitrogen (TN), the effect of process designs and operations on meeting extremely low effluent TN concentrations, and reliability of performance. The paper also reports the ability of development of a large population of phosphorous-accumulating organisms (PAOs) within the sludge blanket when the sludge blanket depth is carefully controlled in the secondary clarifiers. Last but not least, the paper summarizes the evolving understanding of the possible biological phosphorous removal mechanism within the sludge blanket, the effect of process operation conditions on meeting low total phosphorous (TP) concentration, and reliability of performance.

KEYWORDS

IFAS, Plastic Media, Sludge Blanket, Hydrolysis, Fermentation, Biomass Decay, POM, PAOs, TN, TP, and rbCOD

INTRODUCTION

IFAS is an increasingly popular technology for upgrading existing Conventional Activated Sludge (CAS) system within the existing tankage for either maintaining nitrification at new higher flow rates or loads or upgrading a plant to meet new nitrification or nitrification and denitrification requirements. It is accomplished by adding the solid media directly into the activated sludge reactors to enhance the growth of the autotrophic bacteria by providing attachment surface areas for autotrophic bacteria growth, which increases total autotrophic microbial concentrations without physically expanding either existing bioreactor volume or increasing suspended mixed liquor solids (MLSS). While IFAS process has been successfully in use for at least a decade for improvement of nitrification at low solid retention times (SRTs) and short hydraulic retention times (HRTs), the typical suspended SRTs of 5 to 7 days for partial nitrogen removal and between 8 and 12 days for complete nitrogen and phosphorous removal are

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still required depending on the minimum design temperatures and the degree of nutrients removal required. Design, upgrade, and successful operation of a complete Biological Nutrients (N + P) Removal (BNR) IFAS system with less than 5 days of SRTs has not been demonstrated in the field yet. The main objective of the paper is to show that IFAS technology has demonstrated that extremely low effluent concentrations of both total nitrogen (TN) (less than 3 mg/L) and total phosphorous (TP) (less than 1.5 mg/L) can be consistently achieved without the help of chemicals at very short SRTs (less than 5 days).

METHODOLOGY

Process Description

The Cocoa Beach, FL plant is faced with extremely stringent effluent limits on nitrogen and phosphorous (TBOD less than 5 mg/L; NH₃-N less than 1 mg/L; TN less than 3 mg/L; and TP less than 1 mg/L), so the Five-Stage Bardenpho process with one anaerobic stage, two-stage anoxic (pre- and post-anoxic), two tank-in-series aerobic stage, and one small re-aeration stage was preferred. However, due to physical limitations and high cost associated with construction of additional tanks, there is no room for the anaerobic stage. Furthermore, wastewater is very warm (18 °C - 24 °C) with very low concentration of BOD₅ ratio, which creates additional challenges for enhanced biological phosphorous removal (EBPR) process. For these reasons, the plant was designed as a four stage Bardenpho process without an anaerobic stage or “biological anaerobic selector”, which allows the development or selection of large population of Phosphorous Accumulating Organisms (PAOs) which can take up soluble carbon substrate in this zone before non-phosphorous-accumulating organisms can in the aerobic stage in all mainstream EBPR processes.

Biological Phosphorous Removal

The design and operation of EBPR processes is traditionally viewed as well-known configurations such as the five-stage Bardenpho, A/O, A²O, UCT, VIP, and Pho-strip processes with a dedicated anaerobic zone where readily biodegradable COD (rbCOD) in influent can be uptake and stored as poly hydroxyl acetate (PHA) or poly hydroxyl butyrate (PHB) by releasing orth-P. As a result, EBPR is usually deemed as impossible if a design not to include a dedicated anaerobic zone or in case where influent characteristics are undesirable (low rbCOD/P ratio). The effect of decay, hydrolysis and fermentation of particulate organic matter (POM) and activated sludge on EBPR has also not been taken into consideration in EBPR process design and operation.

Literature review, however, indicates that Fuhs and Chen (1975), while studying the Pho-strip process, found that phosphorous removal is enhanced by fermenting some of RAS. Bardard (1975) also reported that very good phosphorous removal can induced in systems where VFA is generated from decay, hydrolysis and fermentation of activated sludge in the CAS system. Full-scale applications in Denmark (Vollertsen et al., 2006) and the U.K. (Vale et al., 2009) have demonstrated a very good phosphorous removal can be achieved by fermenting activated sludge in sidestream. Fermentation of a portion of MLSS from an anaerobic zone was also demonstrated in Huntersville, North Carolina, in U.S.A. However, all hydrolysis and fermentation of activated

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sludge technologies so far requires a sidestream reactor or mainline unaerated reactor with mixers so that activated sludge can undergo decay, hydrolysis and fermentation. But the simplest approach to implement fermentation of activated sludge is to allow solids to accumulate in the secondary clarifiers and increase solid retention time for activated sludge decay, hydrolysis and fermentation and provides rbCOD for PAOs.

Without being a part of initial design, accidental phosphorous removal was observed when a sludge blanket that maintains the MLSS within the secondary clarifiers under anaerobic condition with an average solids residence time of 12 - 24 hours is carefully controlled. Because PAOs can only grow when biomass are subjected to alternating anaerobic and aerobic conditions by being recycled biomass between anaerobic and aerobic basins, the only explanation for accidental phosphorous release is that sludge blanket in the secondary clarifiers under anaerobic condition are similar to the Stripper in Pho-strip process or RAS/WAS Fermenter in sludge fermentation technology, a side stream EBPR process where ortho-phosphorous (ortho-P) release occurs in the sludge blanket under anaerobic conditions by utilizing rbCOD generated from decay, hydrolysis and fermentation of activated sludge. However unlike the Stripper in Pho-strip process or RAS/WAS Fermenter in sludge fermentation technology, there is no mixing in the secondary clarifiers, so activated sludge settling to the floor results in decay, hydrolysis and fermentation and provides rbCOD for phosphate releasing. Anaerobic hydrolysis and fermentation of activated sludge, thereby providing a VFA source for PAOs has been schematically shown in Figure 1. The concept of fermentation of sludge in the secondary clarifiers is schematically shown in Figure 2.

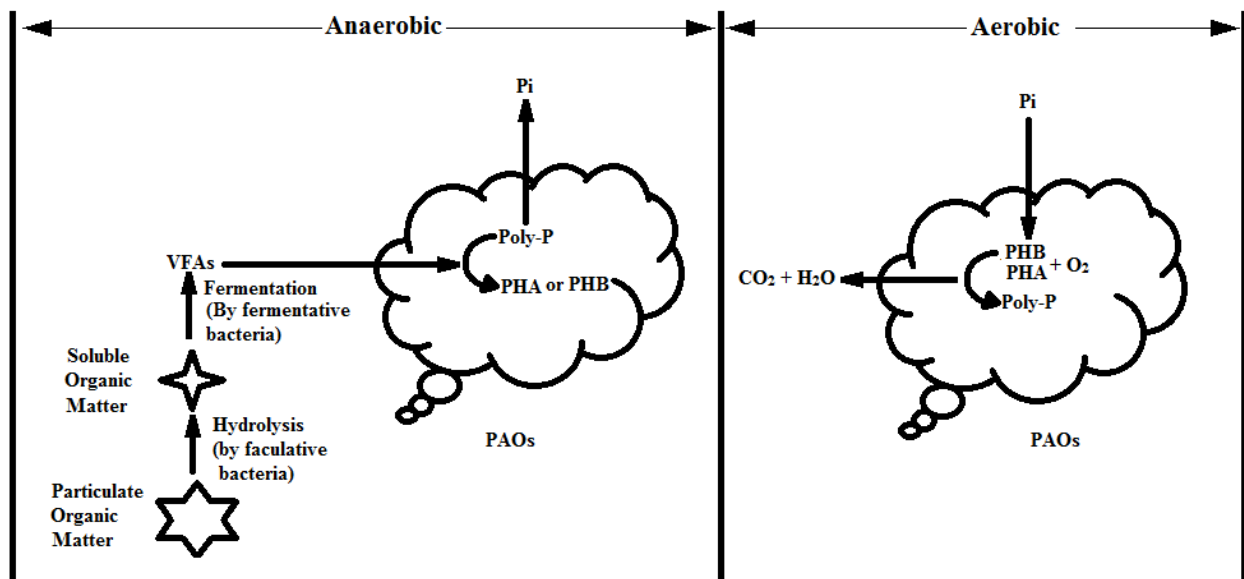


Figure 1. VFAs Production Mechanism through Hydrolysis and Fermentation of Particulate Organic Matter and VFAs Uptake and ortho-P release Model

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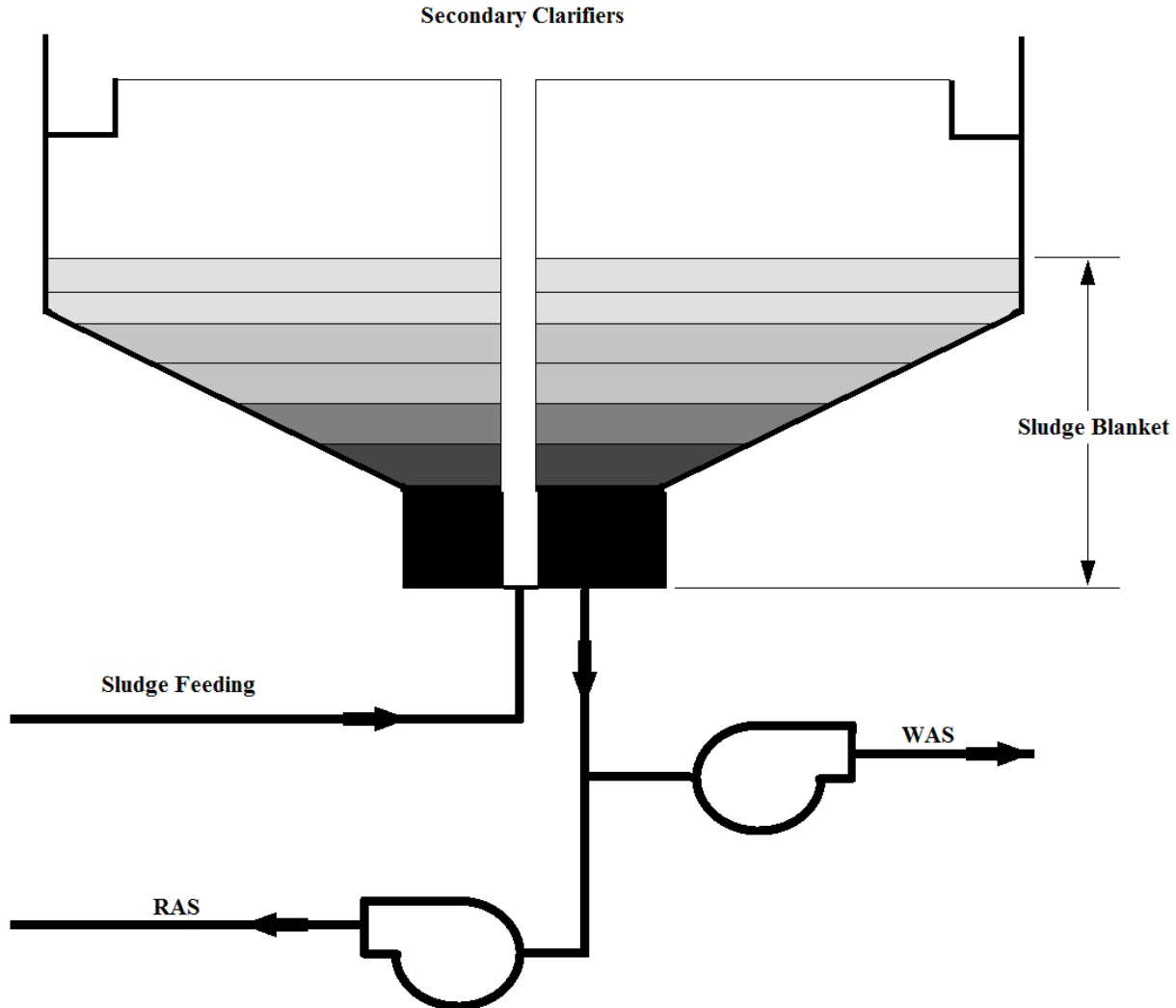


Figure 2. Hydrolysis and Fermentation Process in Secondary Clarifiers

Because the average solids time is only 12 - 24 hrs in the secondary clarifiers, only a portion of the biodegradable POM in the sludge blanket is converted to rbCOD. The yield of fermentation of activated sludge is expected to vary based on how much of POM entrapped in MLSS and VSS concentrations. Lab studies (Daton and Wallergard, 2003; Vollertsen, et al., 2006) and full-scale experience (Andreasen et al., 1997) indicate that the yield of activated sludge hydrolysis is significantly lower than the yield of primary-sludge hydrolysis. The typical VFA yield of activated sludge hydrolysis is reported between 0.1 - 0.14 kg VFA per kg rbCOD applied.

Since all bio-chemical reactions in the activated sludge system have been well studied so all kinetic data and parameters can be easily found in all published Activated Sludge Models (ASMs) or elsewhere (Grady et al, 1999; Rittmann and McCarty, 2001), it is a simple matter to calculate rbCOD production rate and calculate rbCOD yield in terms rbCOD conversion rate over total COD or applied slowly biodegradable COD in the sludge blanket. The theoretical rbCOD conversion rate from POM COD and activated sludge decay are shown as follows:

$$\text{COD}_{\text{Production}} = r_{\text{SO}} \times V + [(1-f_d) \times b_H \times X_H + (1-f_d) \times b_A \times X_A] \times V \div Q \quad (1)$$

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Where:

r_{SO} = hydrolysis rate ($M.L^3T^{-1}$)

V = Sludge blanket Volume (L^3)

Q = Influent Flow (L^3)

b_H = Decay coefficient for heterotrophs (T^{-1})

b_A = Decay coefficient for nitrifiers (T^{-1})

f_d = Fraction of active biomass contributing to biomass debris, traditional approach

X_H = heterotrophic biomass concentration ($M.L^{-3}$)

X_A = Nitrifier biomass concentration ($M.L^{-3}$)

If an assumption is made that X_A is negligible with respect to X_H and let X_A approach zero, which will generally be the case, then rbCOD production from decay process can be expressed as:

$$COD_{SO,Production} = r_{SO} \times V + [(1-f_d) \times b_H \times X_H] \times HRT \quad (2)$$

Anaerobic hydrolysis rate can be expressed as following (ASM3):

$$r_{SO} = K_H \times \eta_{fe} \times \frac{K_{O_2}}{K_{O_2} + S_{O_2}} \times \frac{K_{NO_3}}{K_{NO_3} + S_{NO_3}} \times \frac{X_S/X_H}{K_X + X_S/X_H} \times X_H \quad (3)$$

Where:

η_{fe} = Anaerobic hydrolysis reduction factor ($M.L^{-3}$)

K_{O_2} = Saturation/inhibition coefficient for oxygen ($M.L^{-3}$)

K_{NO_3} = Saturation inhibition coefficient for nitrate ($M.L^{-3}$)

K_H = Hydrolysis rate constant (T^{-1})

K_X = Saturation coefficient for particulate COD, X_S ($M.L^{-3}$)

X_S = Slowly biodegradable substrate ($M.L^{-3}$)

X_H = Heterotrophic biomass concentration ($M.L^{-3}$)

Because DO concentration is zero in the sludge blanket, Eq. 3 can be reduced to:

$$r_{SO} = K_H \times \eta_{fe} \times \frac{K_{NO_3}}{K_{NO_3} + S_{NO_3}} \times \frac{X_S/X_H}{K_X + X_S/X_H} \times X_H \quad (4)$$

One of the important advantages of using a secondary clarifier as an “anaerobic selector” is it does not impact the selection of the total SRT or food-to-microorganism (F/M) ratio for the mainstream IFAS system design, as the SRT in secondary clarifiers is considering not usable and it is not included in process design. Using a secondary clarifier as an anaerobic selector is just an extra bonus we could get from a secondary clarifier operation besides solid and liquid separation.

Nitrification

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Because the total aerobic SRT is only 2.5 days at design flows and loads, the solid media were directly added into the aerobic activated sludge reactors to enhance the growth of the nitrifiers on solid media surface. The effect of the presence of plastic media in the aerobic activated sludge reactors can be seen as externally adding nitrifiers into influent or activated sludge reactors. As discussed in Section Introduction, it is accomplished by providing attachment surface areas for autotrophic bacteria growth, which increases total autotrophic microbial concentrations without physically expanding either existing bioreactor volume or MLSS. The mass balance calculation for nitrifiers across a Completely Stirred Tank Reactor (CSTR) gives the following expression for nitrifier growth in the aerobic reactor with nitrifier growth on solid media surface (Grady et al, 1999):

$$\mu_A = \frac{1}{\text{SRT}} + b_A - \frac{X_{A, \text{Media Surface}}}{\text{HRT} \times X_{A, \text{Suspended}}} \quad (5)$$

Where:

b_A = Decay coefficient for Nitrifiers (T^{-1})

$X_{A, \text{Media Surface}}$ = Nitrifier concentration on media surface ($M.L^{-3}$)

$X_{A, \text{Suspended}}$ = Suspended nitrifier concentration in aerobic reactors ($M.L^{-3}$)

μ_A = Nitrifier growth rate (T^{-1})

Because the only active nitrifiers in the system are from growth due to NH_3-N utilization and its concentration can be calculated from the mass balance on substrate, active nitrifier concentration in aerobic reactor can be expressed as following (Grady et al., 1999):

$$X_A = \frac{Y_A \times (N_{IN} - N_{OUT})}{\mu_A \times \text{HRT}} \quad (6)$$

Where:

Y_A = Nitrifier True Yield in mg COD/mg N

N_{IN} = NH_3-N concentration in influent ($M.L^{-3}$)

N_{OUT} = NH_3-N in effluent ($M.L^{-3}$)

Substituting Eq. 5 into Eq. 6 gives:

$$X_A = \left(\frac{\text{SRT}}{\text{HRT}} \right) \times \left[\frac{X_{A, \text{Media Surface}}}{1 + b_A \times \text{SRT}} + \frac{Y_A \times (N_{IN} - N_{OUT})}{1 + b_A \times \text{SRT}} \right] \quad (7)$$

When $X_{A, \text{Media Surface}}$ is zero, Eq. 7 reduces to following expression:

$$X_A = \frac{\text{SRT}}{\text{HRT}} \times \frac{Y_H \times (N_{IN} - N_{OUT})}{1 + b_H \times \text{SRT}} \quad (8)$$

Examination of Eq. 7 and comparison of Eq.7 with Eq. 8 reveals there are two separate components in the brackets of Eq. 7. The one on the right is nitrifier growth from bulk liquid

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whereas the one on the left is nitrifier growth from media surface. In other words, the active nitrifier concentration in a bioreactor with nitrifier growth on media surface is higher than in a bioreactor without nitrifier growth on media surface. This means that if two bioreactors have the same HRT and SRT, but one with nitrifier growth on media surface and the other one without nitrifier growth on media surface, the one with nitrifier growth on media surface will produce an effluent with a lower NH₃-N concentration. This can be further proved by calculating minimum NH₃-N concentration. Insertion of Eq. 6 into Eq. 8, with subsequent substitution of Monod equation yields the following quadratic equation for NH₃-N concentration (Grady et al, 1999).

$$\mu_A + \left(\frac{1}{\text{SRT}} + b_A\right) \cdot N_{\text{OUT}}^2 - \mu_A \cdot \left(\frac{X_{A, \text{Media Surface}}}{Y_A} + N_{\text{IN}}\right) + (K_S - N_{\text{IN}}) \cdot \left(\frac{1}{\text{SRT}} + b_A\right) + N_{\text{IN}} \cdot K_S \cdot \frac{1}{\text{SRT}} + b_A = 0 \quad (9)$$

Where:

K_S = the Monod half-saturation coefficient for the aerobic growth of nitrifiers (M.L⁻³)

If an assumption is made that N_{OUT} is negligible with respect to N_{IN} and let $1/\text{SRT}$ approach zero, which will generally be the case, then N_{OUT} can be expressed as:

$$N_{\text{OUT}} = \frac{K_S \times b_A}{\mu_A \times \left(1 + \frac{X_{A, \text{Media Surface}}}{Y_A \times N_{\text{IN}}}\right) - b_A} \quad (10)$$

When $X_{A, \text{Media Surface}}$ is zero, Eq. 10 reduces to following expression:

$$N_{\text{OUT}} = \frac{K_S \times b_A}{\mu_A - b_A} \quad (11)$$

Examination of Eq. 10 and comparison of Eq.10 with Eq. 11 clearly reveals N_{OUT} is smaller when a bioreactor has nitrifier growth on media surface. The degree of reduction in N_{OUT} will depend on the magnitude of the nitrifier concentration on media surface, the larger the nitrifier concentrations on media surface, the lower N_{OUT} values will be. This clearly suggests that one way to meet a desired effluent NH₃-N limit when a normal CAS cannot is to add solid media into bioreactor to provide surface area for nitrifier growth. NH₃-N removal can even be achieved when the SRT is so small that nitrifiers get washed out in the bulk liquid. As a matter of fact, having biomass on media surface will prevent nitrifiers washout, because media contain nitrifiers, no matter how small the SRT is. Thus, a minimum SRT can no longer be defined in the same way that it was defined for a CAS without nitrifiers on media surface. In other words, nitrifiers SRT is no longer same as heterotrophs SRTs, due to presence of nitrifiers on media surface. Nitrifier SRTs in a bioreactor with media could be much higher than in a bioreactor without media. However, degree of increasing nitrifier SRTs will depend on nitrifier concentrations on media surface.

Anoxic Endogenous Respiration Denitrification

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A second anoxic zone, also as known as the post-anoxic zone, such as in the four-stage Bardenpho process must be used to further reduce NO₃-N below that which cannot be achieved using a pre-denitrification (MLE) configuration. However, because all of the readily biodegradable organic matter have been oxidized in the pre-anoxic and aerobic zones, a supplemental carbon with readily biodegradable COD (e.g., methanol, ethanol, acetate, and biodiesel byproducts) is required. If the supplemental carbon source is not available, the primary source of electrons for denitrification in post-anoxic zone is particulate organic matter hydrolysis and biomass decay. However, since biomass decay and POM hydrolysis are very slow processes, particularly under anoxic condition, the denitrification rate using POM hydrolysis and anoxic endogenous respiration is very low, requiring very large post-anoxic reactors.

Because the total SRT in post-anoxic reactors is only 0.6 days at design flows and loads, provisions were included in process design for feeding a supplemental carbon source (Micro-C) for denitrification. However, accidental denitrification was observed when a sludge blanket that maintains the MLSS in the secondary clarifiers under anaerobic condition is carefully controlled. It was further observed that addition of supplemental carbon was unnecessary to achieve less than 1 mg/L NO₃-N for the past 18 months of operation. Without the help of supplemental carbon source, the only sources of electron donors is rbCOD generated from hydrolysis of POM entrapped in the MLSS and biomass decay within the sludge blanket.

The rate of NO₃-N (electron acceptor) utilization (denitrification) associated with biomass decay can be calculated by following expression (Grady et al., 1999):

$$\text{COD}_{\text{SO, Decay}} = (1-f_D) \times b_H \times X_H \times \text{HRT} \quad (12)$$

Anaerobic/Anoxic hydrolysis rate can also be determined by Eq. 13 (ASM 3):

$$\text{COD}_{\text{so, Hydrolysis}} = K_H \times \eta_{fe} \times \frac{K_{\text{NO}_3}}{K_{\text{NO}_3} + S_{\text{NO}_3}} \times \frac{X_s / X_H}{K_X + X_s / X_H} \times X_H \times V \quad (13)$$

Where:

V = Post-anoxic Volume + Sludge Blanket Volume in Secondary Clarifier (L³)

Once rbCOD production rates from hydrolysis of POM and biomass decay are known, denitrification potential due to POM hydrolysis and biomass decay then can be easily determined by following expression:

$$\text{DN Potential} = \frac{\text{COD}_{\text{so, Hydrolysis}}}{2.86 / (1 - Y_{\text{ANX}})} + \frac{\text{COD}_{\text{SO, Decay}}}{2.86} \quad (14)$$

Where:

Y_{ANX} = Anoxic Heterotroph Observed Yield

RESULTS AND DISCUSSION

Phosphorous Release Activity

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The plant operation data from Cocoa Beach IFAS Plant shows there is significant phosphorous release and soluble BOD₅ production in the sludge blanket in secondary clarifiers when sludge blanket is carefully controlled. The ortho-P concentration gradient along the secondary clarifiers is illustrated in Figure 3. Since there is no external rbCOD addition in secondary clarifiers, the release of ortho-P in the sludge blanket can only be caused by the following mechanisms: (1) release of ortho-P from PAOs by taking up soluble substrate from hydrolysis and fermentation of biodegradable POM; and (2) release of ortho-P from biomass decay process in sludge blanket.

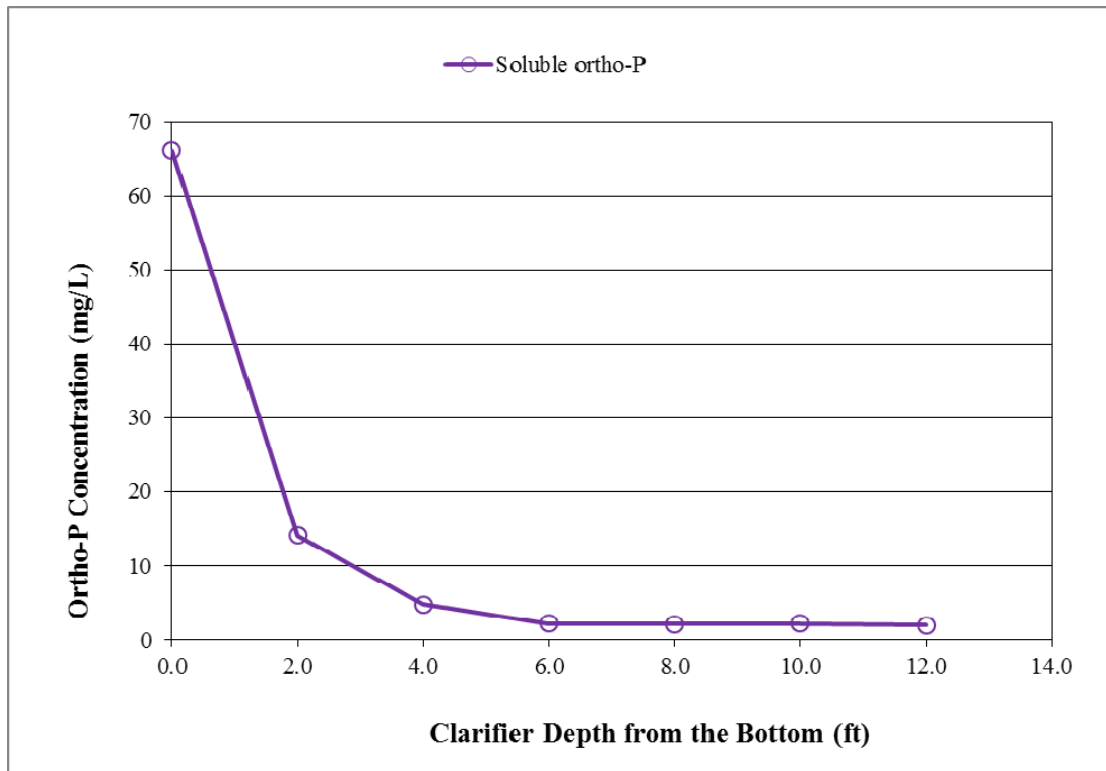


Figure 4. Ortho-P Concentration Profile in Secondary Clarifiers

The sources of soluble substrate or VFAs for PAOs growth in the sludge blanket is thought to be caused by following mechanisms: (1) hydrolysis and fermentation of POM entrapped in the MLSS; and (2) endogenous respiration of biomass in the sludge blanket. The soluble BOD₅ concentration gradient along the secondary clarifier depth is shown in Figure 5. As illustrated in Figure 5, the soluble ortho-P is “washing” out the secondary clarifiers by continuous RAS flow and majority ortho-P released within sludge blanket was returned back to the mainstream system for phosphorous uptake in oxic stage.

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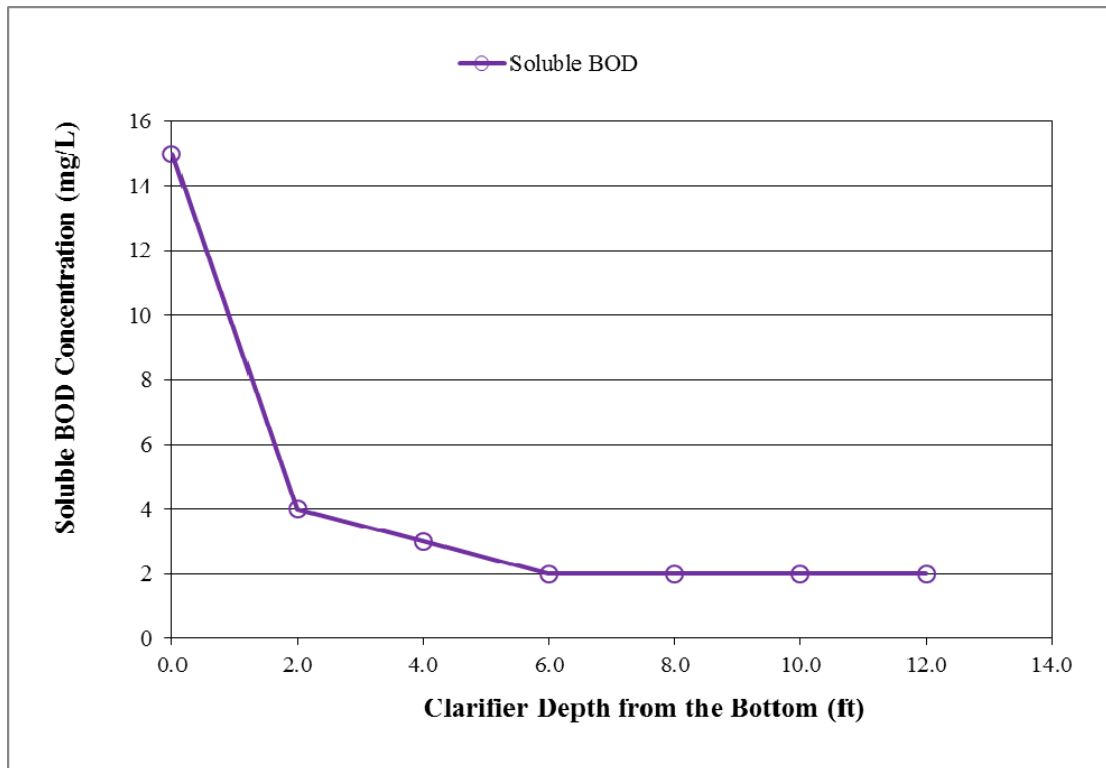


Figure 3. Soluble BOD₅ Concentration Profile within the Secondary Clarifiers

Phosphorous removal was excellent. As illustrated in Figure 5, the plant has been consistently achieving less than 1.0 mg/L TP in effluent without the help of chemical trimming year around. However, during the summer when water temperatures are greater than 20 °C, to meet less than 1 mg/L TP in effluent is not always an achievable goal. This is because PAOs are psychrophilic bacteria that proliferation of PAOs is actually enhanced at low water temperatures (5 - 15 °C). Sell et al. (1982) and Hong et al. (1982) reported that the phosphorous removal capacity at low water temperature ranges (5 - 15 °C) was greater than that at higher temperature ranges (greater than 20 °C). Warm water temperatures have been an additional challenge for this plant to meet the target TP concentrations in effluent.

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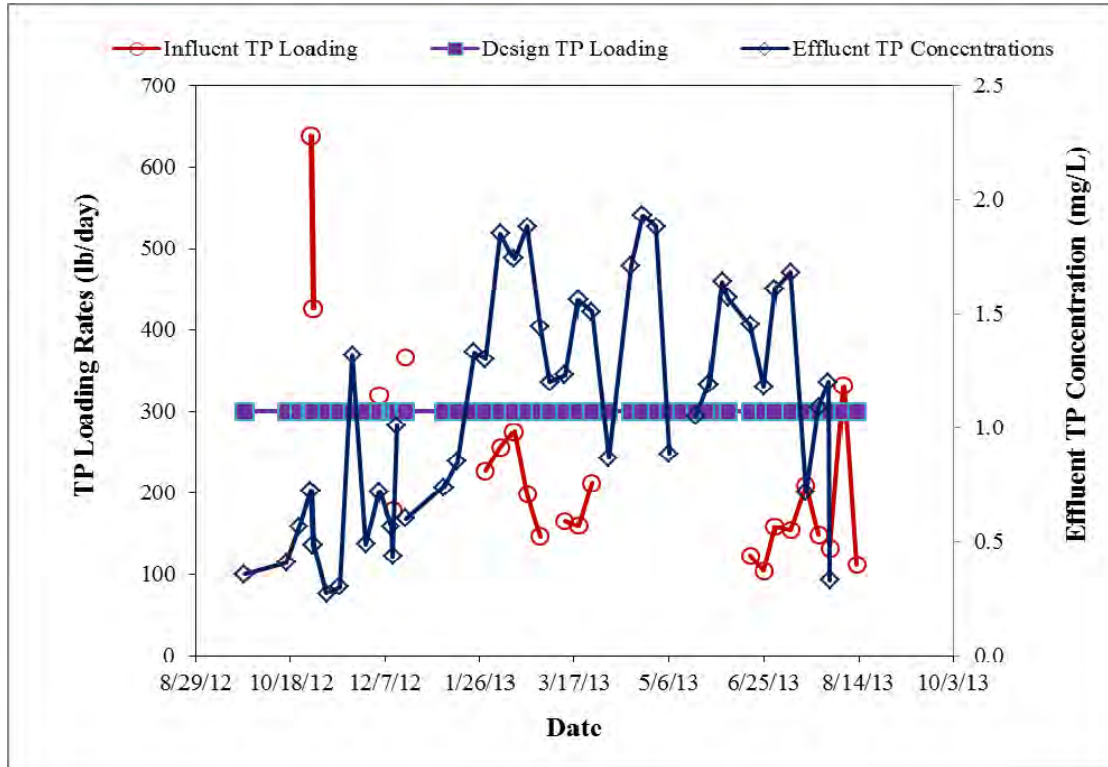


Figure 5. Influent and Design TP loadings vs Weekly Average TP Concentrations in Effluent

Nitrification

Nitrification has not been an issue ever since the plant has been put in service in August 2012. Year around complete nitrification has easily been achieved ($\text{NH}_3\text{-N}$ less than 0.5 mg/L). Figure 6 illustrates weekly average influent and effluent $\text{NH}_3\text{-N}$ loadings vs weekly average $\text{NH}_3\text{-N}$ concentrations in effluent. As indicated in Figure 6, the plant performed significantly better than what was required to meet the guaranteed effluent $\text{NH}_3\text{-N}$ limit, even though the $\text{NH}_3\text{-N}$ loading rate in the first six month plant operation is higher than expected.

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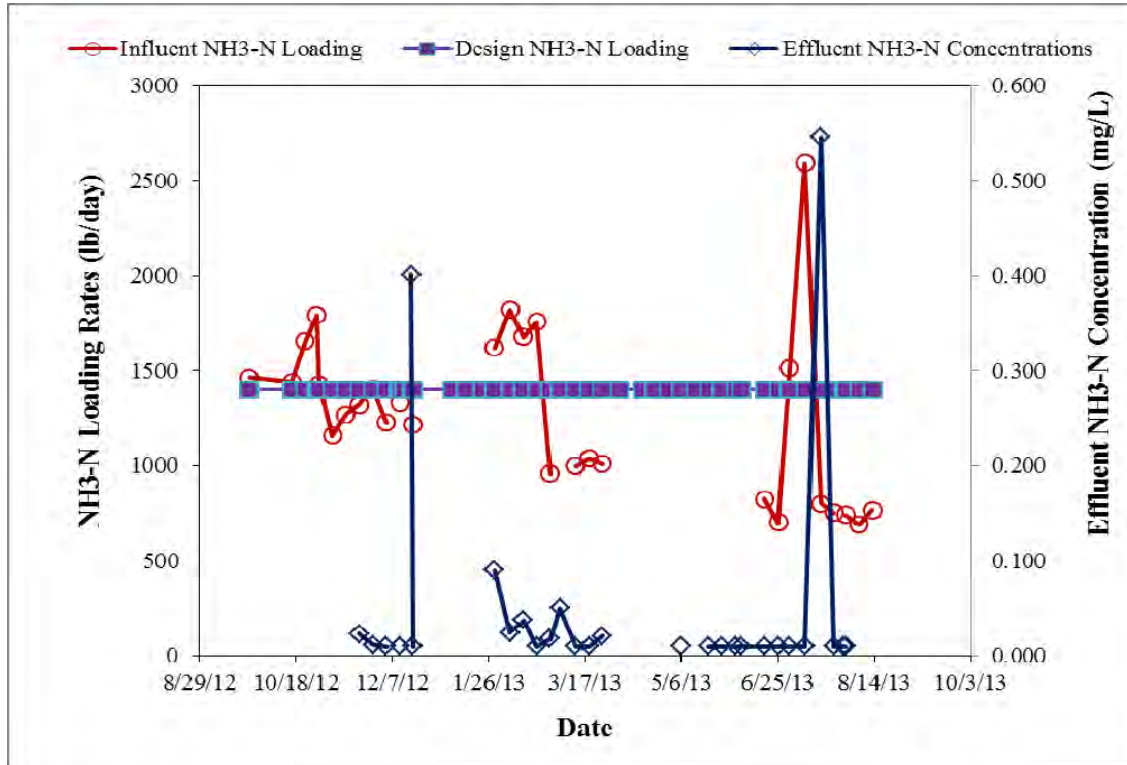


Figure 6. Weekly Average Influent and Effluent NH₃-N loadings vs Weekly Average NH₃-N Concentration in Effluent

Denitrification

The excellent pre-denitrification performance has also been consistently achieved. Pre-denitrification alone reduced NO₃-N concentration to around 3.5 mg/L. Post-Anoxic process and denitrification in sludge blanket under anaerobic condition in secondary clarifiers further reduced NO₃-N less than 1 mg/L without the help of any external carbon source. As a result, the operating costs (energy and chemicals) for the plant were way below the operating costs stated in the specs. The average NO₃-N vs target NO₃-N in effluent was shown in Figure 7. The average TN vs target TN in effluent was shown in Figure 8. As indicated in Figures 7 and 8, the complete denitrification has not be an issue year around and the plant has been consistently meeting NO₃-N less than 1 mg/L and TN less than 3 mg/L without help of external carbon source.

In addition to phosphorous release, the testing results indicated that the sludge blanket in the secondary clarifiers are capable of: (1) achieving less than 3 mg/L effluent total nitrogen (TN) by endogenous respiration denitrification; (2) producing 10 - 15 mg/L of residual soluble BOD₅ in RAS stream, which is a valuable carbon source for pre-denitrification process in pre-anoxic reactor in the main stream system.

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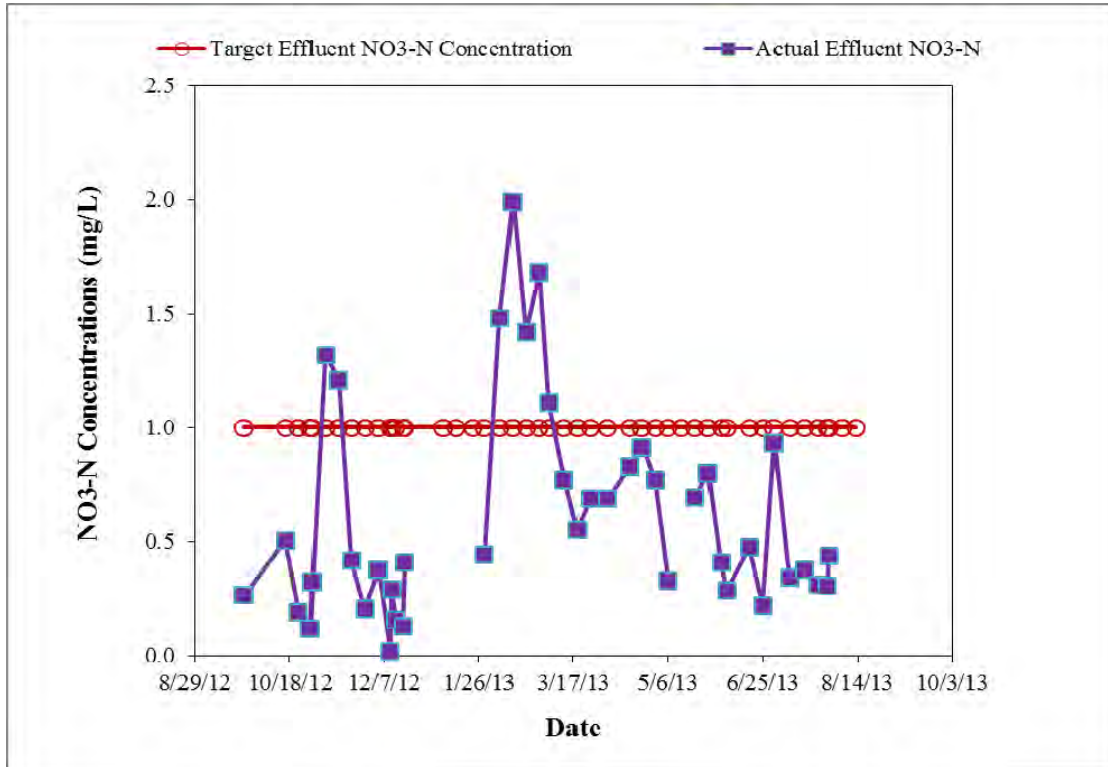


Figure 7. Weekly Average NO₃-N vs Target NO₃-N Concentrations in Effluent

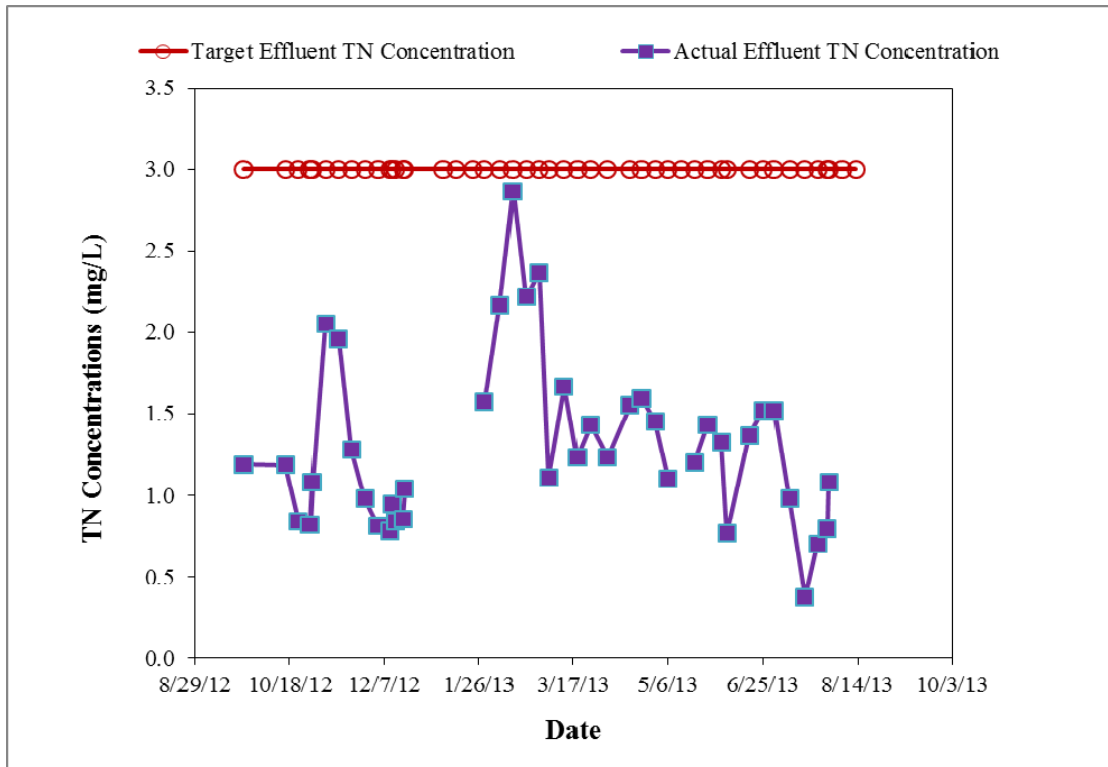


Figure 8. Weekly Average TN vs Target TN Concentrations in Effluent

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CONCLUSIONS

- The experience with the operation of Cocoa Beach, FL IFAS plant supports the conclusion that IFAS is an excellent technology for upgrading existing CAS systems within the existing tankage for either maintaining nitrification at higher flow rates/loads or upgrading a CAS plant to meet new nitrification or total nitrogen removal requirements.
- The experience from the operation of Cocoa Beach, FL IFAS plant also supports the conclusion that IFAS technology could achieve extremely low $\text{NH}_3\text{-N}$ and $\text{NO}_3\text{-N}$ concentrations in secondary effluent. A total of 0.5 mg/L of total inorganic nitrogen (TIN) is achievable for IFAS technology.
- The experience with the operation of Cocoa Beach, FL IFAS plant shows the following: (1) the sludge blanket control strategy in the secondary clarifiers is able to achieve TN and TP less than 3 mg/L and 1 mg/L in effluent in most cases if the sludge blanket is carefully controlled; (2) this process is not as sensitive to TBOD_5/TP ratio in plant influent wastewater as the other EBPR processes; (3) this process does not impact the total process SRT selection.

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WEFTEC 2014 Paper Manuscript

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APPENDIX F: VEOLIA COMPANY INFORMATION



Corporate Description

Company Overview

Veolia Water Technologies, Inc. (dba Kruger) is a water and wastewater solutions provider specializing in advanced and differentiating technologies. Kruger provides complete processes and systems ranging from biological nutrient removal to mobile surface water treatment. The ACTIFLO® Microsand Ballasted Clarifier, ANITA Mox Deammonification Process, BioCon® Dryer, BIOSTYR® Biological Aerated Filter (BAF), NEOSEP™ MBR and HYDROTECH Discfilters are just a few of the innovative technologies offered by Kruger. Kruger is a subsidiary of Veolia Water Technologies, a world leader in engineering and technological solutions in water treatment for industrial companies and municipal authorities.

Veolia, present throughout the world, develops a global approach responding to specific needs of customers at each of their production facilities. This has allowed Veolia to become the world leader in design, project management and execution of projects for water and wastewater treatment plants. The company also creates dedicated technology solutions to meet its customer’s needs. Its unique portfolio of differentiating technologies, developed by the group’s R&D centers, ensures unsurpassed innovation and control of each treatment line for public organizations and industries. Furthermore, a whole range of associated services is offered on each site to guarantee the technical efficiency and life expectancy of the installed solutions. Veolia continually extends and enriches its offer, to guarantee expertise and competence at every step of the projects it undertakes.



Kruger prides itself for being a customer-focused organization that provides solutions to challenges faced by municipalities and not just another equipment supplier. To achieve this, Kruger has gathered a force of process experts, trained sales staff, and project managers that share our vision and priorities. Please see the attached information describing the experience and expertise of Our People. We are proud of our staff and know that they are the most qualified team in the market to provide your project the right solution to meet the plant’s needs and future goals.

Location and Addresses of Corporate and Regional Offices

Kruger’s corporate office is located in the Raleigh, NC area.

Kruger	Customer Support Center
4001 Weston Parkway	1500 Garner Road, Suite C
Cary, NC 27513	Raleigh, NC 27610

In addition, Veolia hosts multiple regional offices across North America in support of our clients, including the Customer Support Center (i.e. aftermarket services and equipment spare parts),





within 20 minutes from Veolia's corporate office. See the Summary of Support Services section below for more details.

Name of Individual Representing Company

Please contact the following person for any questions or concerns relating to the project.

Rodrigo Lara
Regional Sales Manager, Kruger
Biological Biosolids and Bioenergy
Cell : +1 503-380-3995
Kruger / 4001 Weston Pkwy / Cary, NC 27513 / USA
rodrigo.lara@Veolia.com

Date and State of Incorporation

Veolia celebrates 160 years of service to cities, regions and local communities. Established in 1853, Veolia's long history proves our stability and financial strength. Veolia Water Technologies, Inc. (dba Kruger) was incorporated on May 27, 2004 and is incorporated in Delaware. Kruger further builds on Veolia's expertise, offering more than 25 years of experience servicing the US municipal market.

Bonding Qualifications

Veolia Water Technologies, Inc. (dba Kruger) has sufficient financial stability and capacity to provide the performance bonds as required by the specifications.



Corporate and Financial Stability

The Veolia companies in North America, including Veolia Water Technologies, Inc. dba Kruger (Kruger), are part of Veolia Environnement, S.A. (Veolia). Veolia traces its history to the establishment of Compagnie Générale des Eaux (CGE) on December 14, 1853. Since that time and over 160 years, Veolia has continued to focus on new frontiers of environmental business and its traditional markets, in emerging and developed countries. In support of this progress and in line with our commitments, Veolia has strengthened its operating and financial performance.

Veolia is the global leader in optimized resource management. With nearly 171,000 employees worldwide, Veolia designs and provides water, waste and energy management solutions that contribute to the sustainable development of communities and industries. Through its three complementary business activities, Veolia helps to develop access to resources, preserve available resources and replenish them.

In 2018, the Veolia group supplied 95 million people with drinking water and 63 million people with wastewater service, produced nearly 56 million megawatt hours of energy and converted 49 million metric tons of waste into new materials and energy. Veolia Environnement, operating in five continents, realized \$30.1 billion (€25.91 billion) in revenue for 2018.

Kruger, as part of the Veolia family of companies, provides financial strength and stability to our customers. Veolia offers the support structure desired by municipal authorities, assuring project stakeholders of Kruger's commitment to meeting performance guarantees, extended project schedules and ongoing warranties. Veolia has been in business for over 160 years, providing the comfort to our customers that Kruger will remain supportive for the life of the project and beyond.

Veolia's 2018 financial statement is available online. Please see the following website for more information.

<https://www.veolia.com/en/veolia-group/finance>



Corporate Sustainability

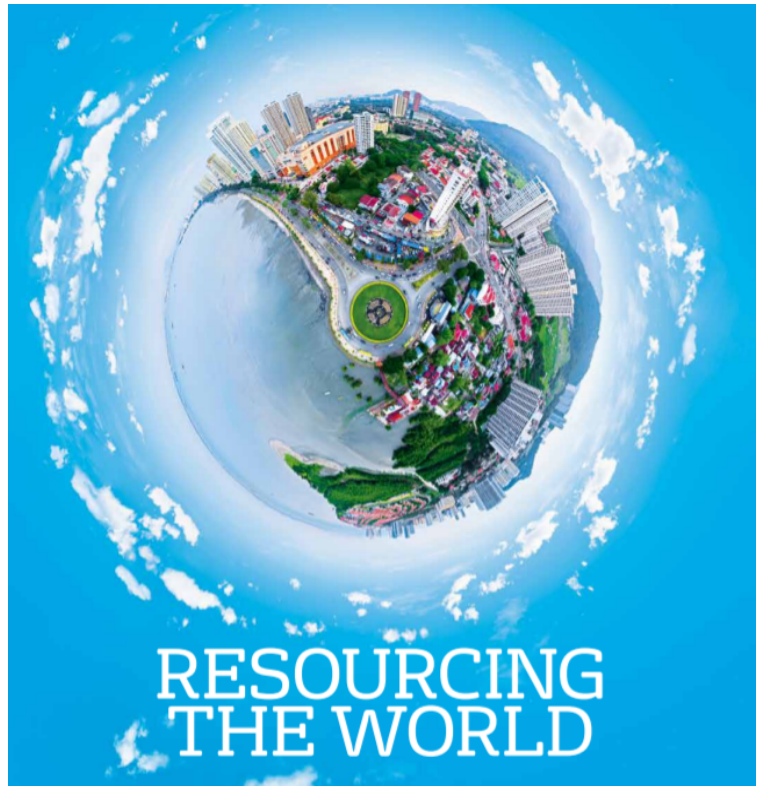
Veolia's 'Resourcing the world' mission is based on a vision of our environment that is shared by our employees, including those at Kruger: the world as it should be. In this world, fewer resources are wasted and they are shared fairly; waste has a value and uses are found for wastewater; and energy is efficiently managed and reused. In this world, companies as well as government bodies play a central role in anticipating and supporting major global transitions. In this world, companies voluntarily ask themselves what is their purpose and their use. This vision both drives and commits us. Our goal is not only to be the world leader but also the standard setter for environmental businesses: *the company that resolves, prepares the ground and invents, inspires and shows the way.*

Resourcing the World

The world has to rethink its relationship with resources and come up with new social and economic growth models that are more efficient, better balanced and more sustainable.

With 160 years of expertise in the areas of water, energy and waste, Veolia applies its capacity for innovation to pursue human progress and wellbeing, and improving the performance of businesses and regions.

To make the switch from a resource consumption rationale to a use-and-recover approach in today's circular economy, Veolia designs and implements solutions aimed at improving access to resources while at the same time protecting and renewing those same resources.



This is how Veolia and its employees contribute each and every day to resourcing the world.

<https://www.livingcircular.veolia.com/en>

PROCUREMENT AGREEMENT

THIS AGREEMENT is by and between City of Aberdeen, Idaho (“Buyer”) and Veolia Water Technologies, Inc. (“Seller”).

Buyer and Seller hereby agree as follows:

ARTICLE 1 – GOODS AND SPECIAL SERVICES

- 1.01 Seller shall furnish the Goods and Special Services as specified or indicated in the Contract Documents.
- 1.02 Seller (Vendor) shall complete the Goods and Services as specified or indicated in the Buyer’s Contract Documents and Specifications titled, “City of Aberdeen WWTP Equipment Pre-Purchase”.
- 1.03 The Project, of which the Goods and Special Services may be the whole or only a part, is described as performing or providing all services, equipment, testing, and documentation necessary for Installation Contractor to install and successfully start-up the Goods.
- 1.04 The Goods are generally described as follows:
 - A. **Integrated Fixed Film Activated Sludge (IFAS) System:** A biological treatment system designed to reduce BOD. The system shall include all major equipment components, including diffusers, blowers, control valves, instrumentation, motor controls and control panels as required in Section 46 53 36 and related sections, and as further detailed in Seller’s Bid Submittal, including comments to specifications.
 - ~~B. **Sand Filter System:** A sand filter system designed to remove phosphorus following a chemical addition and mixing system. The system shall include all major equipment components, such as internal piping and components, media bed, air compressors, instrumentation, motor controls and control panels as required in Section 46 61 27 – Upflow Moving Bed Filter and related sections.~~
 - ~~C. **Mechanical Dewatering System:** Press system for dewatering of waste activated sludge to meet the minimum performance criteria identified in Section 46 76 27. System shall include all major equipment components including screw press, polymer activation and dosing skid, polymer injection and mixing assembly, instrumentation, motor controls, control panel, and other appurtenances as required in Section 46 76 27 and related sections.~~
- 1.05 The Services are generally described as follows:
 - D. **Submittals:** The Vendor will provide design of the Goods, submittal of the shop drawings, general arrangement drawings of equipment, and a control strategy description; will participate in meetings and assist Engineer during the design; and will make changes to the equipment system as required to coordinate the design with the Engineer during the submittal review process. Submittals shall meet the requirements of Section 01 30 00 – Vendor Submittals.

- E. **Supply and Shipping of Equipment:** The Vendor shall supply all equipment identified in the approved submittals and shall deliver equipment to site. During shipment, Vendor shall assume all responsibility for loss or damage.
- F. **Start-Up Services and Training:** The Vendor shall provide the minimum number of days and trips identified in the equipment specifications and Section 01 75 16 – Startup Procedures.
- G. **Anchoring Calculations:** Design of equipment supports, and anchor bolt design shall be provided by the Installation Contractor. Vendor to provide reactions and loads for Goods as part of Submittals. Anchor bolts are to be provided by the Installation Contractor.

ARTICLE 2 – ENGINEER

- 2.01 The Contract Documents for the Goods and Special Services have been prepared by Keller Associates, Inc., 305 North 3rd Avenue, Ste. A, Pocatello, ID 83201 ("Engineer"), which is to act as Buyer's representative, assume all duties and responsibilities, and have the rights and authority assigned to Engineer in the Contract Documents in connection with Seller's furnishing of Goods and Special Services.

ARTICLE 3 – POINT OF DESTINATION

- 3.01 The point of destination is:

2683 W 1750 S
Aberdeen, ID 83210

ARTICLE 4 – CONTRACT TIMES

- 4.01 *Time of Critical Importance*
 - A. All time limits for Milestones, if any, including the submittal of Shop Drawings and Samples, the delivery of Goods, and the furnishing of Special Services as stated in the Contract Documents, are of critical importance to the Contract.
- 4.02 *Milestones:*
 - A. *Days for Submittal of Shop Drawings and Samples:* Seller shall submit all Shop Drawings required by the Contract Documents for Seller's Goods to Buyer for Engineer's review and approval within 4-8 weeks of the execution of the Procurement Agreement. Resubmittals, if needed, shall be made within 2-4 weeks of Seller's receipt of comments from Engineer.
 - B. *Days to Achieve Delivery of Goods:* It is expected that the Seller shall deliver the Goods to the Point of Destination and ready for Buyer's receipt of delivery as noted in Section 1.6 of Seller's Bid Submittal. Staged delivery of the equipment shall be acceptable at the Installation Contractor's request.
 - C. *Days for Furnishing Start-Up and Training Services:* The furnishing of start-up services, detailed installation and operation and maintenance manuals, testing services, and operator training shall be coordinated with the Installation Contractor and provided at the Installation

Contractor's request, provided that Seller shall be given a minimum of 3 weeks' notice before Seller's presence is needed on site for services and training.

4.03 *Buyer's Final Inspection*

- A. Days to Achieve Final Inspection: Buyer shall make its final inspection of the Goods pursuant to Paragraph 8.01.C of the General Conditions within 30 days after Buyer's acknowledgement of receipt of delivery of the Goods and Seller's completion of furnishing Start-Up and Training Services. The final inspection shall be requested by the Installation Contractor.

4.04 *Liquidated Damages*

- A. Buyer and Seller recognize that Buyer will suffer financial loss if the Goods are not delivered at the Point of Destination within the times specified above, plus any extensions thereof allowed in accordance with the General Conditions and any Supplementary Conditions. The parties also recognize that the timely performance of services by others involved in the Project is materially dependent upon Seller's specific compliance with the requirements of Paragraph 4.02.B. Further, they recognize the delays, expense, and difficulties involved in proving the actual loss suffered by Buyer if complete acceptable Goods are not delivered on time. Accordingly, instead of requiring such proof, Buyer and Seller agree that as liquidated damages for delay (but not as a penalty) Seller shall pay Buyer \$500.00 for each day that expires after the time specified in Paragraph 4.02.B for the delivery of conforming Goods. Such liquidated damages shall be Buyer's sole and exclusive remedy for Seller's failure to delivery Goods in accordance with the delivery schedule set forth in Paragraph 4.02.B, and are limited, in the aggregate, to 10% of the total value of the agreement.
- B. Price for Goods and Special Services is as set forth in Seller's Bid Submittal. Pricing is contingent upon Buyer/Engineer releasing Seller to fabricate Goods by October 24, 2023 and Buyer accepting delivery of goods in accordance with timelines set forth in 4.02 B. In the event of a delay of release to fabricate, where such delay is not the fault of the Seller, Seller shall be entitled to an extension of time to complete delivery equivalent to the delay in the release to fabricate.

ARTICLE 5 – CONTRACT PRICE

- 5.01 Buyer shall pay Seller for furnishing the Goods and Special Services in accordance with the price for Goods and Special Services set forth in Seller's Bid Submittal. Pricing is contingent upon Buyer releasing Seller to fabricate Goods by October 24, 2023 and Buyer accepting delivery of goods when Seller is ready to ship. In the event of a delay of release to fabricate, where such delay is not the fault of the Seller, Seller shall be entitled to adjust its price for Goods and Services. Pricing does not include storage. In the event that Buyer would like Seller to store materials or Goods or delay delivery beyond the timelines set forth

above, the parties shall execute a Change Order to update pricing, payment terms, delivery timelines and associated terms and conditions accordingly.

ARTICLE 6 – PAYMENT PROCEDURES

6.01 Submittal and Processing of Payment

- A. Seller shall submit Applications for Payment in accordance with Article 10 of the General Conditions and Section 01 29 76 - Schedule of Payments. Applications for Payment will be processed by Engineer as provided in the General Conditions.

6.02 Progress Payments; Retainage

- A. Buyer shall make progress payments in accordance with the milestones set forth in Section 01 26 76 – Schedule of Payments attached hereto.

6.03 Final Payment

- A. Upon receipt of the final Application for Payment accompanied by Engineer's recommendation of payment, Buyer shall pay Seller the amount recommended by Engineer, less any sum Buyer is entitled to set off against Engineer's recommendation, including but not limited to liquidated damages. In no event shall final payment of all amounts due to Seller exceed 120 days from the Installation Check-out of Seller's Goods.

ARTICLE 7 – INTEREST

- 7.01 [Reserved.]

ARTICLE 8 – SELLER'S REPRESENTATIONS

- 8.01 In order to induce Buyer to enter into this Agreement, Seller makes the following representations:
 - A. Seller has examined and carefully studied the Contract Documents and the other related data identified in the Bidding Documents, as applicable to Seller's obligations identified in Article 1 above.
 - B. If required by the Bidding Documents to visit the Point of Destination and site where the Goods are to be installed or Special Services will be provided, or if, in Seller's judgment, any local condition may affect cost, progress, or the furnishing of the Goods and Special Services, Seller has visited the Point of Destination and site where the Goods are to be installed or Special Services will be provided and become familiar with and is satisfied as to the observable local conditions that may affect cost, progress, and the furnishing of the Goods and Special Services.
 - C. Seller is familiar with and is satisfied as to all Laws and Regulations that may affect cost, progress, and the furnishing of the Goods and Special Services.
 - D. Seller has carefully studied, considered, and correlated the information disclosed to Seller;

- E. Seller has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Seller has discovered in the Contract Documents, which are applicable to Seller's scope of work.
- F. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for furnishing Goods and Special Services.

ARTICLE 9 – CONTRACT DOCUMENTS

9.01 Contents

- A. The Contract Documents consist of the following, in order of precedence:
 - 1. Executed Change Orders and/or written modifications to this Procurement Agreement which are mutually executed by the Buyer and Seller; This Procurement Agreement (EJCDC P-520);
 - 2. Performance Bond;
 - 3. Payment Bond;
 - 4. Supplementary Conditions (EJCDC P-800);
 - 5. General Conditions (EJCDC P-700)
 - 6. Specification Section 46 53 36 and others listed in the Table of Contents, only to the extent they are applicable to Seller's scope of supply for Section 46 53 36 and subject comments in Seller's Bid Submittal and the revisions below;
 - a. Revised Section 01 29 76 (attached which shall replace Section 01 29 76 in the bidding Specifications)
 - b. Revised Section 46 53 36 (attached which shall replace Section 46 53 36 in the bidding Specifications)
 - 7. Addenda (Numbers 1 to 2 , inclusive);
 - 8. Exhibits to this Agreement (enumerated as follows):
 - a. Seller's Bid Submittal, including signed Bid Form and comments;
- B. The documents listed in Paragraph 9.01.A are incorporated into this Agreement by reference (except as expressly noted otherwise above).
- C. There are no Contract Documents other than those listed above in this Article 9.
- D. The Contract Documents may only be amended or supplemented as provided in Paragraph 3.04 of the General Conditions.

ARTICLE 10 – MISCELLANEOUS

10.01 *Terms*

- A. Terms used in this Agreement will have the meanings indicated in the General Conditions and the Supplementary Conditions.

10.02 *Successors and Assigns*

- A. Buyer and Seller each binds itself, its partners, successors, assigns, and legal representatives to the other party hereto, its partners, successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.

10.03 *Severability*

- A. Any provision or part of the Contract Documents held to be void or unenforceable by a court of competent jurisdiction under any applicable Law or Regulation shall be deemed stricken, and all remaining provisions shall continue to be valid and binding upon Buyer and Seller. The Contract Documents shall be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

10.04 *Seller's Certifications*

- A. Seller certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or in executing the Contract. For the purposes of this Paragraph 11.04:
1. "corrupt practice" means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process or in the Contract execution;
 2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process or the execution of the Contract to the detriment of Buyer, (b) to establish Bid or Contract prices at artificial non-competitive levels, or (c) to deprive Buyer of the benefits of free and open competition;
 3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Buyer, a purpose of which is to establish Bid prices at artificial, non-competitive levels; and
 4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

10.05 *Limitations*

- A. Buyer and Seller waive against each other, and against the other's officers, directors, members, partners, employees, agents, consultants, and subcontractors, any and all claims for or entitlement to incidental, indirect, punitive, or consequential damages arising out of, resulting from, or related to the Contract. The terms of this mutual waiver do not apply to or limit any claim by either Buyer or Seller against the other based on any of the following:

(a) third party indemnified claims, (b) costs, losses, or damages attributable to personal or bodily injury, sickness, disease, or death, or to injury to or destruction of the tangible property of third parties, (c) intentional or wrongful conduct, or (d) rights conferred by any bond provided by Seller under this Contract.

- B. With the exception of third party indemnified claims for personal injury or death, Buyer and Seller agree that the aggregate liability (inclusive of any liquidated damages) of Seller to Buyer for damages, claims, demands, suites causes of actions, losses, cost, expenses and/or liability arising out of the Procurement Agreement shall not exceed the amount paid to Seller under the Procurement Agreement, regardless of whether such liability arises out of breach of contract, any guarantee or warranty hereunder, tort, product liability, contribution, strict liability, or any other legal theory.
- C. For avoidance of doubt, upon assignment of the Procurement Contract to the Contractor, the City of Aberdeen shall be considered a third party for the purposes of Article 10.5.

10.06 *Insurance*

- A. Prior to the Buyer's execution of this Procurement Agreement, Seller shall secure, and shall thereafter maintain until completion of the Contract, such public liability and property damage insurance as set forth in the Supplementary and General Conditions.
- B. All liability insurance shall be issued by an insurance company or companies authorized to transact liability insurance business in the State of Idaho and shall cover comprehensive general and automobile liability for both bodily injury (including death) and property damage, including, but not limited to aggregate products, aggregate operations, aggregate protective and aggregate contractual with the limits as specified in the Supplementary General Conditions.

10.07 *Assignment of Procurement Contract*

- A. The Contract may at the Owner's discretion be assigned by Owner to Contractor, and Vendor will accept such assignment, pursuant to the Procurement Documents. In the application of the terms and conditions of the Procurement Documents after said assignment, Vendor will function as a subcontractor to the Contractor, and all obligations of the Vendor to Owner will become obligations of the Vendor to Contractor. Notwithstanding this assignment, the guarantees and warranties specified in the Procurement Documents are intended for the benefit of Owner and the Contractor and may be enforced by either party.
- B. Assignment of the Purchase Agreement shall be accomplished on Exhibits A-1 and A-2, copies of which are attached to this Purchase Agreement.
- C. Miscellaneous Assignments. No further assignment by a party hereto of any rights under or interests in the Contract Documents will be binding on another party hereto without the written consent of the party sought to be bound; and specifically but without limitation monies that may become due and monies that are due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract Documents.

IN WITNESS WHEREOF, Buyer and Seller have executed this Agreement and acknowledge that all portions of the Contract Documents have been signed or identified by Buyer and Seller or on their behalf.

This Agreement will be effective on _____ (“Effective Date”).

Buyer: City of Aberdeen

Seller: Veolia Water Technologies, Inc.

By: Larry Barrett

By: [Signature]

Date: 8-29-23

Date: 8/24/23



[Corporate Seal]



[Corporate Seal]

Attest: Stephanie Wallad

Attest: [Signature]

Address for giving notice:

PO Box 190
33 N. Main Street
Aberdeen ID 83210

Address for giving notice:

4001 Western Parkway
Cary, NC 27513

(If Buyer is a corporation, attach evidence of authority to sign. If Buyer is a public body, attach evidence of authority to sign and resolution or other documents authorizing execution of Buyer-Seller Agreement.)

Agent for service of process:
CT Corporation System
1555 W. Shoreline Dr.
Suite 100
Boise, ID 83702

Copy to: Br. Henry Tuck
4001 Western Parkway, Cary, NC 27513

(If Seller is a corporation or a partnership, attach evidence of authority to sign.)

Designated Representative:

Name: Larry Barrett

Title: Mayor

Address: PO Box 190 33 N Main St

Phone: (208) 397-4161 Aberdeen ID 83210

Facsimile: (208) 397-3431

Designated Representative:

Name: Chris Baucum

Title: Sr. Project Manager

Address: 4001 Western Parkway, Cary, NC 27513

Phone: 919-653-4513

Facsimile: 919-677-0082

chris.baucum@veolia.com

**PERFORMANCE BOND
FOR PROCUREMENT CONTRACTS**

Any singular reference to Seller, Surety, Buyer, or other party shall be considered plural where applicable.

SELLER (Name and Address):

Veolia Water Technologies, Inc.
4001 Weston Parkway
Cary, NC 27513

SURETY (Name and Address of Principal

Place of Business):

Federal Insurance Company
202B Halls Mill Road
Whitehouse Station, NJ 08889-3454

BUYER (Name and Address):

City of Aberdeen
P.O. Box 170, 33 N. Main
Aberdeen, ID 83210

CONTRACT

Date: August 29, 2023

Amount: \$1,143,200.00

Description (Name and Location): WWTP Improvements Equipment Pre-Purchase – IFAS Equipment

BOND

Date (Not earlier than Contract Date): September 11, 2023

Bond Number: K41612630

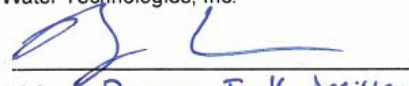
Amount: \$1,143,200.00

Modifications to this Bond Form: none

Surety and Seller, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Performance Bond to be duly executed on its behalf by its authorized officer, agent, or representative.

Seller as Principal

Company: _____ (Corp. Seal)
Seal) Veolia Water Technologies, Inc.

Signature: 
Name and Title: Brittany Tuck, Assistant Secretary

Surety

Company: _____ (Corp.
Federal Insurance Company

Signature: 
Name and Title: Kristin S. Bender

(Attach Power of Attorney)
Address: Marsh USA LLC
445 South Street
Morristown, NJ 07962
Telephone Number: 973-401-5000

(Space is provided below for signatures of additional parties, if required.)

Seller as Principal

Company: _____ (Corp. Seal)

Signature:
Name and Title:

Surety

Company: _____ (Corp. Seal)

Signature:
Name and Title:
Address:
Telephone Number:

1. Seller and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to Buyer for the performance of the Contract, which is incorporated herein by reference. For purposes of this bond, Buyer means Buyer's assigns, if and when Buyer has assigned the Contract.
2. If Seller performs the Contract, Surety and Seller have no obligation under this Bond, except to participate in conferences as provided in Paragraph 3.1.
3. If there is no Buyer Default, Surety's obligation under this Bond shall arise after:
 - 3.1. Buyer has notified Seller and Surety pursuant to Paragraph 10 that Buyer is considering declaring a Seller Default and has requested and attempted to arrange a conference with Seller and Surety to be held not later than 15 days after receipt of such notice to discuss methods of performing the Contract. (If Buyer, Seller, and Surety agree, Seller shall be allowed a reasonable time to perform the Contract, but such an agreement shall not waive Buyer's right, if any, subsequently to declare a Seller Default); and
 - 3.2. Buyer has declared a Seller Default and formally terminated Seller's right to complete the Contract. Such Seller Default shall not be declared earlier than 20 days after Seller and Surety have received notice as provided in Paragraph 3.1; and
 - 3.3. Buyer has agreed to pay the Balance of the Contract Price to:
 - a. Surety in accordance with the terms of the Contract;
 - b. Another seller selected pursuant to Paragraph 4.3 to perform the Contract.
4. When Buyer has satisfied the conditions of Paragraph 3, Surety shall promptly and at Surety's expense take one of the following actions:
 - 4.1. Arrange for Seller, with consent of Buyer, to perform and complete the Contract; or
 - 4.2. Undertake to perform and complete the Contract itself, through its agents or through independent contractors; or
 - 4.3. Obtain bids or negotiated proposals from qualified sellers acceptable to Buyer for a contract for performance and completion of the Contract, arrange for a contract to be prepared for execution by Buyer and a seller selected with Buyer's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the Bonds issued on the Contract, and pay to Buyer the amount of damages as described in Paragraph 6 in excess of the Balance of the Contract Price incurred by Buyer resulting from Seller Default; or
 - 4.4. Waive its right to perform and complete, arrange for completion, or obtain a new seller, and with reasonable promptness under the circumstances, either:
 - a. determine the amount for which it may be liable to Buyer and, as soon as practicable after the amount is determined, tender payment therefore to Buyer; or
 - b. deny liability in whole or in part and notify Buyer citing reasons therefore.

5. If Surety does not proceed as provided in Paragraph 4 with reasonable promptness, Surety shall be deemed to be in default on this Bond 15 days after receipt of an additional written notice from Buyer to Surety demanding that Surety perform its obligations under this Bond, and Buyer shall be entitled to enforce any remedy available to Buyer. If Surety proceeds as provided in paragraph 4.4, and Buyer refuses the payment tendered or Surety has denied liability, in whole or in part, without further notice Buyer shall be entitled to enforce any remedy available to Buyer.
6. After Buyer has terminated Seller's right to complete the Contract, and if Surety elects to act under Paragraph 4.1, 4.2, or 4.3, then the responsibilities of Surety to Buyer shall not be greater than those of Seller under the Contract, and the responsibilities of Buyer to Surety shall not be greater than those of Buyer under the Contract. To a limit of the amount of this Bond, but subject to commitment by Buyer of the Balance of the Contract Price to mitigation of costs and damages on the Contract, Surety is obligated without duplication for:
 - 6.1. the responsibilities of Seller for correction or replacement of defective Goods and Special Services and completion of the Contract;
 - 6.2. additional legal, design professional, and delay costs resulting from Seller's Default, and resulting from the actions of or failure to act of Surety under Paragraph 4; and
 - 6.3. liquidated damages, or if no liquidated damages are specified in the Contract, actual damages caused by delayed performance or non-performance of Seller.
7. Surety shall not be liable to Buyer or others for obligations of Seller that are unrelated to the Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than Buyer or its heirs, executors, administrators, successors, or assigns.
8. Surety hereby waives notice of any change, including changes of time, to the Contract or to related subcontracts, purchase orders and other obligations.
9. Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location of the Point of Destination, and shall be instituted within two years after Seller Default or within two years after Seller ceased working or within two years after Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.
10. Notice to Surety, Buyer or Seller shall be mailed or delivered to the address shown on the signature page.
11. When this Bond has been furnished to comply with a statutory or other legal requirement in the location of the Point of Destination, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted here from and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory bond and not as a common law bond.
12. Definitions.
 - 12.1. *Balance of the Contract Price*: The total amount payable by Buyer to Seller under the Contract after all proper adjustments have been made, including allowance to Seller of any amounts

received or to be received by Buyer in settlement of insurance or other Claims for damages to which Seller is entitled, reduced by all valid and proper payments made to or on behalf of Seller under the Contract.

- 12.2. *Contract*: The agreement between Buyer and Seller identified on the signature page, including all Contract Documents and changes thereto.
- 12.3. *Seller Default*: Failure of Seller, which has neither been remedied nor waived, to perform or otherwise to comply with the terms of the Contract.
- 12.4. *Buyer Default*: Failure of Buyer, which has neither been remedied nor waived, to pay Seller as required by the Contract or to perform and complete or comply with the other terms thereof.

**PAYMENT BOND
FOR PROCUREMENT CONTRACTS**

Any singular reference to Seller, Surety, Buyer, or other party shall be considered plural where applicable.

SELLER (Name and Address):

Veolia Water Technologies, Inc.
4001 Weston Parkway
Cary, NC 27513

SURETY (Name and Address of Principal

Place of Business):

Federal Insurance Company
202B Halls Mill Road
Whitehouse Station, NJ 08889-3454

BUYER (Name and Address):

City of Aberdeen
P.O. Box 170, 33 N. Main
Aberdeen, ID 83210

CONTRACT

Date: August 29, 2023

Amount: \$1,143,200.00

Description (Name and Location): WWTP Improvements Equipment Pre-Purchase – IFAS Equipment

BOND

Date (Not earlier than Contract Date): September 11, 2023

Bond Number: K41612630

Amount: \$1,143,200.00

Modifications to this Bond Form: none

Surety and Seller, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Payment Bond to be duly executed on its behalf by its authorized officer, agent, or representative.

Seller as Principal

Company: _____ (Corp. Seal)

Veolia Water Technologies, Inc.

Signature: 

Name and Title: *Brittany Tuck, Assistant Secretary*

Surety

Company: _____ (Corp. Seal)

Federal Insurance Company

Signature: 

Name and Title: Kristin S. Bender, Attorney-in-Fact
(Attach Power of Attorney)

Address: 445 South Street, Morristown, NJ 07962

Telephone Number: 973-401-5000

(Space is provided below for signatures of additional parties, if required.)

Seller as Principal

Company: _____ (Corp. Seal)

Signature:

Name and Title:

Surety

Company: _____ (Corp. Seal)

Signature:

Name and Title:

Address:

Telephone Number:

1. Seller and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to Buyer to pay for labor, materials and equipment furnished for use in the performance of the Contract, which is incorporated herein by reference. For purposes of this bond, Buyer means Buyer's assigns, if and when Buyer has assigned the Contract.
2. With respect to Buyer, this obligation shall be null and void if Seller:
 - 2.1. Promptly makes payment, directly or indirectly, for all sums due Claimants, and
 - 2.2. Defends, indemnifies and holds harmless Buyer from all claims, demands, liens or suits by any person or entity who furnished labor, materials or equipment for use in the performance of the Contract, provided Buyer has promptly notified Seller and Surety (at the addresses described in Paragraph 12) of any claims, demands, liens or suits and tendered defense of such claims, demands, liens or suits to Seller and Surety, and provided there is no Buyer Default.
3. With respect to Claimants, this obligation shall be null and void if Seller promptly makes payment, directly or indirectly, for all sums due.
4. Surety shall have no obligation to Claimants under this Bond until:
 - 4.1. Claimants who are employed by or have a direct contract with Seller have given notice to Surety (at the address described in Paragraph 12) and sent a copy, or notice thereof, to Buyer stating that a claim is being made under this Bond and, with substantial accuracy, the amount of the claim.
 - 4.2. Claimants who do not have a direct contract with Seller:
 - a. have furnished written notice to Seller and sent a copy, or notice thereof, to Buyer, within 90 days after having last performed labor or last furnished materials or equipment included in the claim stating, with substantial accuracy, the amount of the claim and the name of the party to whom the materials were furnished or supplied or for whom the labor was done or performed; and
 - b. have either received a rejection in whole or in part from Seller or not received within 30 days of furnishing the above notice any communication from Seller by which Seller had indicated the claim will be paid directly or indirectly; and
 - c. not having been paid within the above 30 days, have sent a written notice to Surety (at the address described in Paragraph 12) and sent a copy, or notice thereof, to Buyer stating that a claim is being made under this Bond and enclosing a copy of the previous written notice furnished to Seller.
5. If a notice required by Paragraph 4 is given by Buyer to Seller or to Surety, that is sufficient compliance.
6. Reserved.
7. Surety's total obligation shall not exceed the amount of this Bond, and the amount of this bond shall be credited for any payments made in good faith by Surety.
8. Amounts owed by Buyer to Seller under the Contract shall be used for the performance of the Contract and to satisfy claims, if any, under any Performance Bond. By Seller furnishing and Buyer accepting this Bond, they agree that all funds earned by Seller in the performance of the Contract are dedicated to satisfy obligations of Seller and Surety under this Bond, subject to Buyer's priority to use the funds for the completion of the furnishing the Goods and Special Services.

9. Surety shall not be liable to Buyer, Claimants or others for obligations of Seller that are unrelated to the Contract. Buyer shall not be liable for payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to, give notices on behalf of, or otherwise have obligations to Claimants under this Bond.
10. Surety hereby waives notice of any change, including changes of time, to the Contract or to related subcontracts, purchase orders, and other obligations.
11. No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the location in which the Goods relevant to the claim are located or after the expiration of one year from the date (1) on which the Claimant gave the notice required by Paragraph 4.1 or paragraph 4.2.3, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.
12. Notice to Surety, Buyer or Seller shall be mailed or delivered to the addresses shown on the signature page. Actual receipt of notice by Surety, Buyer or Seller, however accomplished, shall be sufficient compliance as of the date received at the address shown on the signature page.
13. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the Contract was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory Bond and not as a common law bond.
14. Upon request of any person or entity appearing to be a potential beneficiary of this Bond, Seller shall promptly furnish a copy of this Bond or shall permit a copy to be made.
15. Definitions
 - 15.1 *Claimant*: An individual or entity having a direct contract with Seller or with a Subcontractor of Seller to furnish labor, materials or equipment for use in the performance of the Contract. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment used in the Contract, architectural and engineering services required for furnishing the Goods and Special Services by Seller and Seller's Subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials or equipment were furnished.
 - 15.2. *Contract*: The agreement between Buyer and Seller identified on the signature page, including all Contract Documents and changes thereto.
 - 15.3. *Buyer Default*: Failure of Buyer, which has neither been remedied nor waived, to pay Seller as required by the Contract or to perform and complete or comply with the other terms thereof.

CHUBB
Power of Attorney

Federal Insurance Company | Vigilant Insurance Company | Pacific Indemnity Company
Westchester Fire Insurance Company | ACE American Insurance Company

Know All by These Presents, that FEDERAL INSURANCE COMPANY, an Indiana corporation, VIGILANT INSURANCE COMPANY, a New York corporation, PACIFIC INDEMNITY COMPANY, a Wisconsin corporation, WESTCHESTER FIRE INSURANCE COMPANY and ACE AMERICAN INSURANCE COMPANY corporations of the Commonwealth of Pennsylvania, do each hereby constitute and appoint

Kristin S. Bender

each as their true and lawful Attorney-in-Fact to execute under such designation in their names and to affix their corporate seals to and deliver for and on their behalf as surety thereon or otherwise, bonds and undertakings and other writings obligatory in the nature thereof (other than bail bonds) given or executed in the course of business, and any instruments amending or altering the same, and consents to the modification or alteration of any instrument referred to in said bonds or obligations.

In Witness Whereof, said FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, PACIFIC INDEMNITY COMPANY, WESTCHESTER FIRE INSURANCE COMPANY and ACE AMERICAN INSURANCE COMPANY have each executed and attested these presents and affixed their corporate seals on this 10th day of March, 2020.

Dawn M. Chloros

Dawn M. Chloros, Assistant Secretary

Stephen M. Haney

Stephen M. Haney, Vice President



STATE OF NEW JERSEY
County of Hunterdon

ss.

On this 10th day of March, 2020 before me, a Notary Public of New Jersey, personally came Dawn M. Chloros and Stephen M. Haney, to me known to be Assistant Secretary and Vice President, respectively, of FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, PACIFIC INDEMNITY COMPANY, WESTCHESTER FIRE INSURANCE COMPANY and ACE AMERICAN INSURANCE COMPANY, the companies which executed the foregoing Power of Attorney, and the said Dawn M. Chloros and Stephen M. Haney, being by me duly sworn, severally and each for herself and himself did depose and say that they are Assistant Secretary and Vice President, respectively, of FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, PACIFIC INDEMNITY COMPANY, WESTCHESTER FIRE INSURANCE COMPANY and ACE AMERICAN INSURANCE COMPANY and know the corporate seals thereof, that the seals affixed to the foregoing Power of Attorney are such corporate seals and were thereto affixed by authority of said Companies; and that their signatures as such officers were duly affixed and subscribed by like authority.

Notarial Seal



KATHERINE J. ADELAAR
NOTARY PUBLIC OF NEW JERSEY
No. 2316685
Commission Expires July 16, 2024

Katherine J. Adelaar

Notary Public

CERTIFICATION

Resolutions adopted by the Boards of Directors of FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, and PACIFIC INDEMNITY COMPANY on August 30, 2016; WESTCHESTER FIRE INSURANCE COMPANY on December 11, 2006; and ACE AMERICAN INSURANCE COMPANY on March 20, 2009:

"RESOLVED, that the following authorizations relate to the execution, for and on behalf of the Company, of bonds, undertakings, recognizances, contracts and other written commitments of the Company entered into in the ordinary course of business (each a "Written Commitment"):

- (1) Each of the Chairman, the President and the Vice Presidents of the Company is hereby authorized to execute any Written Commitment for and on behalf of the Company, under the seal of the Company or otherwise.
- (2) Each duly appointed attorney-in-fact of the Company is hereby authorized to execute any Written Commitment for and on behalf of the Company, under the seal of the Company or otherwise, to the extent that such action is authorized by the grant of powers provided for in such person's written appointment as such attorney-in-fact.
- (3) Each of the Chairman, the President and the Vice Presidents of the Company is hereby authorized, for and on behalf of the Company, to appoint in writing any person the attorney-in-fact of the Company with full power and authority to execute, for and on behalf of the Company, under the seal of the Company or otherwise, such Written Commitments of the Company as may be specified in such written appointment, which specification may be by general type or class of Written Commitments or by specification of one or more particular Written Commitments.
- (4) Each of the Chairman, the President and the Vice Presidents of the Company is hereby authorized, for and on behalf of the Company, to delegate in writing to any other officer of the Company the authority to execute, for and on behalf of the Company, under the Company's seal or otherwise, such Written Commitments of the Company as are specified in such written delegation, which specification may be by general type or class of Written Commitments or by specification of one or more particular Written Commitments.
- (5) The signature of any officer or other person executing any Written Commitment or appointment or delegation pursuant to this Resolution, and the seal of the Company, may be affixed by facsimile on such Written Commitment or written appointment or delegation.

FURTHER RESOLVED, that the foregoing Resolution shall not be deemed to be an exclusive statement of the powers and authority of officers, employees and other persons to act for and on behalf of the Company, and such Resolution shall not limit or otherwise affect the exercise of any such power or authority otherwise validly granted or vested."

I, Dawn M. Chloros, Assistant Secretary of FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, PACIFIC INDEMNITY COMPANY, WESTCHESTER FIRE INSURANCE COMPANY and ACE AMERICAN INSURANCE COMPANY (the "Companies") do hereby certify that

- (i) the foregoing Resolutions adopted by the Board of Directors of the Companies are true, correct and in full force and effect,
- (ii) the foregoing Power of Attorney is true, correct and in full force and effect.

Given under my hand and seals of said Companies at Whitehouse Station, NJ, this September 11, 2023



Dawn M. Chloros

Dawn M. Chloros, Assistant Secretary

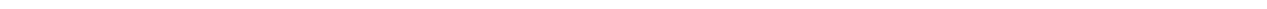
IN THE EVENT YOU WISH TO VERIFY THE AUTHENTICITY OF THIS BOND OR NOTIFY US OF ANY OTHER MATTER, PLEASE CONTACT US AT:
Telephone (908) 903-3493 Fax (908) 903-3656 e-mail: surety@chubb.com

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APPENDIX D.2

Equipment Submittal



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Veolia Water Technologies, Inc. Tel: 919-677-8310
 d/b/a Kruger Fax: 919-677-0082
 4001 Weston Parkway
 Cary, NC 27513

Transmittal Letter

Date: October 10, 2023	Transmittal # 5703212001-001
To: Keller Associates, Inc. C/O Aberdeen, ID IFAS 305 North 3rd Ave, Ste. A Pocatello, ID 83201	Page: 1 of 1 Sent Via: FTP - Download Site Project Name: Aberdeen, ID IFAs Installation Location: Aberdeen, ID Customer PO No.:
Attn: Holly C Johnson, PE	Project No.: 222032-001
Phone: 208-813-7574	Kruger Job No.: 5703212001

We are sending you Attached, Under separate cover, Via FTP Download Site

Drawings Schedule O&M Manuals Installation Manual Change Order

Product Data Sheets Disk Specifications Plans Sketches

Copy of Letter Brochures Contracts Other

QTY	Type (Note 1)	DWG/ DOC #	Description	Transmittal Code (Note 2)	Required Return Date
1	PDF	Rev. 0	5703212001 Aberdeen, ID IFAS Submittal_Rev.0.pdf	FA	10/19/2023

RECIPIENT IS RESPONSIBLE FOR DESTROYING OR RETURNING SUPERSEDED DOCUMENTS

Note 1: Type: OR = Original, HC = Hardcopy, EXL = MS Excel (.xls, .xlsx), WRD = MS Word (.doc, .docx), PDF=Portable Document Format

Note 2: Transmittal Code:

FA= For Approval	RFC = Release For Construction	A = Approved As Submitted
FI = For Your Information And Use	RFD = Release For Design	AP = Approved For Production
FC = For Review and Comment	AN = Approved As Noted	RFQ = For Quote Due
FR = For Record	RA = Resubmit	O =
AR = As Requested	RR = Resubmit	

Remarks:

Signed: Chris Baucom **cc:** _____

Chris Baucom, PE
 Senior Project Manager



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- 6.0 SHIPPING, HANDLING, & STORAGE INSTRUCTIONS**
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1.0 STATEMENT OF CONFIDENTIALITY

Statement of Confidentiality

This document and all information contained herein are the property of Veolia Water Technologies, Inc. (dba Kruger) and/or its affiliates. The design concepts and information contained herein are proprietary to Veolia Water Technologies and are submitted in confidence. They are not transferable and must be used only for the purpose for which the document is expressly loaned. They must not be disclosed, reproduced, loaned or used in any other manner without the express written consent of Veolia Water Technologies. In no event shall they be used in any manner detrimental to the interest of Veolia Water Technologies. All patent rights are reserved. Acceptance of the delivery of this document constitutes agreement to these terms and conditions.

2.0 SCOPE OF SUPPLY

EQUIPMENT SCOPE OF SUPPLY

GENERAL

Kruger will provide the equipment and field services as described in the original specification, and as detailed herein.

Kruger will supply the following equipment as described below:

1. IFAS

- a. Biofilm Carrier Elements
- b. Media retention screens with air sparge system & sparge valves
- c. Scum screens
- d. Medium Bubble Aeration System in IFAS Reactors
- e. Blowers
- f. Air grid drop pipe valves

2. System Instrumentation

- a. Control panel with PLC
- b. Associated IFAS instrumentation

ANOXKALDNES IFAS EQUIPMENT SYSTEM – LIMITED TO IN-BASIN EQUIPMENT ONLY

Process and Mechanical Equipment Items	Qty	Description
AnoxKaldnes K5 Media, (ft ³)	7,980	<ul style="list-style-type: none"> • AnoxKaldnes K5 carrier elements, providing 1,946,115 ft² of effective surface area for biological growth. • Carrier elements will be delivered, DDP Jobsite, freight estimated in this scope of supply, to Aberdeen, ID • Media will be delivered in a total of three (3) covered box trailers, each containing 78 bags. If alternate shipping methods are requested by the Buyer, additional charges may apply. • For reference, Contractors at other projects have typically installed three (3) trailers per day with a crane and a crew of 3-5 people. The fastest installation rate observed was five (5) trucks per day per crew. • Each bag is approximately 3.5 ft x 3.5 ft x 3.0 ft, or 35 ft³ per bag (1.0 m³) and has at least two (2) handles on the top side, which can be used to remove the bags from the trailers. Bags weigh approximately 280 lbs each. • Media bags will be shipped individually or shrink-wrapped 2-3 to a pallet. • The bags will require removal from trailers and field placement or storage by the Contractor. The Contractor will have 2 hours to unload each container, after it arrives on site, before demurrage charges are

		<p>assessed. The Contractor shall be responsible for any demurrage charges.</p> <p>Storage:</p> <ul style="list-style-type: none"> • The media bags can be stored outside for long periods of time however they need to be covered to minimize any degradation of the bag itself due to sunlight. • The media bags can be stored in a pyramid style using 3 - 4 bags as the height of the pyramid. UV-reflective tarps shall be used to cover the bags of media until such time they are loaded into the reactor. • The Contractor shall be responsible for supply, installation, maintenance, and repair of protective tarps or covers.
<p>AnoxKaldnes IFAS Aeration System</p>	<p>4 Reactors</p>	<ul style="list-style-type: none"> • Aeration Systems for two (2) reactors per train for a total of four (4) reactors. The following are provided for the noted reactors: <ul style="list-style-type: none"> o IFAS Reactor 1 <ul style="list-style-type: none"> ▪ Two (2) grids: 4" diameter Schedule 10s drop pipe, 4" diameter Schedule 10s central manifold, and nine (9) diffuser laterals of 1-1/4" diameter and Schedule 5s. o IFAS Reactor 2 <ul style="list-style-type: none"> ▪ Two (2) grids: 3" diameter Schedule 10s drop pipe, 3" diameter Schedule 10s central manifold, and six (6) diffuser laterals of 1" diameter and Schedule 5s. • Laterals with 4 mm holes drilled at equally spaced intervals are designed for a turndown of 50% of the design airflow without loss of equal distribution of air to each lateral • All piping and supports will be of 304 or 304L stainless steel. • All interconnecting hardware provided by Kruger, with the exceptions listed below. Hardware will be of 304 stainless steel. • The aeration system & supports will require unloading & field erection by others. • All drop pipes supplied by Kruger will be terminating 3ft above SWD with a Straub coupling for field piping connection • Kruger shall provide all anchor bolts, nuts and washers. Contractor shall provide epoxy anchor chemicals and applicators. All hardware shall be 304 stainless. Kruger recommends Hilti HY-200 MAX SD adhesive or similar epoxy anchor product.
<p>Cylindrical Screen Assemblies</p>	<p>12</p>	<ul style="list-style-type: none"> • An installed total of twelve (12) screen assemblies, each 5 feet long, 23 inch diameter. Three (3) screens shall be installed in each IFAS reactor. • Minimum of 50% open area in screens. • The cylindrical screen shall be constructed of a minimum 14 ga perforated plate. • Maintain a maximum headloss of 3 inches through each reactor at peak hydraulic flows. • The screens and supports will require unloading & field erection by others. • Kruger shall provide all anchor bolts, nuts, and washers. Contractor shall provide epoxy anchor chemicals and applicators. Kruger

		<p>recommends Hilti HY-200 MAX SD adhesive or similar epoxy anchor product.</p> <ul style="list-style-type: none"> • Wall inserts are not necessary and shall not be provided. • All hardware will be 18-8 stainless.
Scum Screens	8	Two (2) 24" x 48" screens, 304 SS, for each IFAS reactor for scum ports – for a total of four (4) per train
Nozzle Spray Assembly	8	One (1) spray bar with nozzles per scum screen. Piping by others.
Air Scour System	4	An air sparging system in 304L SS will be provided to scour the cylindrical screens in each reactor.
Air Scour Solenoid Valve	4	<ul style="list-style-type: none"> • One (1) shutter valve with on-off actuator for each Sparging Air Header. • For Contractor installation downstream of Air Scour Ball Valve
Air Scour Ball Valve	4	<ul style="list-style-type: none"> • One (1) manual ball valve for each Sparging Air header • For Contractor Installation upstream of Air Scour Shutter Valve
Air Grid Drop Pipe Isolation Valves – IFAS 1 Reactors	4	One (1) 3" Manual Butterfly Valve per air drop pipe – for a total of two (2) per train.
Air Grid Drop Pipe Isolation Valves – IFAS 2 Reactors	4	One (1) 2.5" Manual Butterfly Valve per air drop pipe – for a total of two (2) per train
Positive Displacement Lobe Blowers	2 + 1	<ul style="list-style-type: none"> • Two (2) duty + One (1) stand-by blowers for process air • Motor 75 HP or lower, 2-pole, NEMA, TEFC, 208-230/460V/60HZ, NEMA Premium Efficiency, thermostats, shaft ground ring • V-belt drive, inlet filter-silencer, discharge silencer, pressure relief valve, check valve, misc • MCC starter, VFDs, external controls, isolation valves by others • Aerzen or Gardner Denver

Blower Spare Parts included	Qty
Air Filter(s)	3
Belt Set(s)	3
Delta Lube 06-1 gallon(s)	3

INSTRUMENTATION & CONTROLS

Kruger shall supply the following equipment as described below.

PLC Based Control Panel

One (1) PLC Based Control panel will be supplied, as specified below, to control the IFAS process based on Operator setpoints. All field wiring and field terminations are by others. The Control Panel will be completely assembled, tested, and programmed for the required functionality. U. L. labeled Panel will be comprised of the following:

IFA System Controls	Quantity (Details)
Control Panels	
NEMA 12 Painted Steel (for indoor use only) Panel, Free Standing Enclosure. *For use in a non-classified environment only.	1
Back Panel for Control Panel - SAGINAW	1
Panelview Plus 7 10" Color Touchscreen Operator Interface w/Ethernet – ALLEN BRADLEY	1
CompactLogix PLC Processor – ALLEN BRADLEY	1
UPS 850VA 120VAC Input/ 120VAC Output – SOLA	1
PLC Control Panel I/O + 20% "LIVE" spare wired signals for additional signal interface - KRUGER	1
Complete Set of Control Panel Internals per Kruger Standard Scope - KRUGER	1
PLC and Operator Interface Programming – KRUGER	1
PLC site Start-Up and Testing – KRUGER	1

Additional notes:

- Each PLC Control Panel will include the necessary input/output plus twenty percent (20%) "Live" spare wired signals for future or additional signal interface.
- All PLC and Operator Interface programming is based on Kruger's standards. Any requests or requirements that would deviate from this standard will result in additional costs. Kruger shall provide the PLC/Operator Interface programming for the Kruger supplied PLC Control Panel.
- The PLC Program and Operator Interface Program and its associated Graphic screens developed by Kruger are for use on the Kruger supplied PLC and Operator Interface.
- Kruger shall use Allen Bradley development software for PLC Programming and Operator Interface Programming; the development software is licensed to Kruger and shall not be provided as part of this scope. Kruger shall not provide any PLC, Network, Operator Interface, SCADA, or Alarm Notification software.

- Kruger shall supply copies of the completed PLC and Operator Interface programs at job completion. Prior to supplying completed PLC and Operator Interface programs, Kruger requests that a non-disclosure agreement be signed and returned.
- Factory testing of the Kruger PLC Control Panel shall be conducted by Kruger personnel at a Kruger selected Panel Facility. Kruger has an established Panel testing criteria and will conduct all Panel and Software testing. When said Panel/Software testing is complete, a Test Report shall be generated. Other parties are welcome to witness panel testing at their expense.

No other Instruments, Control Panel Components (PLC or other components) will be supplied unless they are explicitly listed in this Scope of Supply. Field wiring and field terminations by others.

IFAS Field Instruments		
Description	Manufacturer	Quantity
Thermal Mass Flowmeter w/Transmitter. One (1) per IFAS Train	FCI	2
Dissolved Oxygen Sensor. One (1) per IFAS reactor	Hach	2
SC4500 Transmitters for Dissolved Oxygen Probes.	Hach	2
Level Float Switch. One (1) per aeration train	Anchor Scientific	2
Submersible Level Transducer. One (1) per aeration train		2
Pressure gauge. One (1) per train		2

Kruger shall calibrate and start-up Instruments supplied.

3.0 COMMENTS AND CLARIFICATIONS

Comments and Clarifications

Specification Section or Drawing Number	Original Specification Verbiage Please copy the specification section that is not standard and copy it into this column	Comment Verbiage
46 53 36 1.6	The warranty shall be for a minimum period of one (1) year from the date of Substantial Completion.	Substantial completion is a milestone that is out of Veolia's control. Veolia can provide a warranty with a set number of years from equipment delivery or beneficial use and meet the owner/engineer warranty coverage need. Veolia can discuss the warranty period at detailed design period.
46 53 36 1.7 C 3 e	The effluent quality shall meet the requirements specified for 30 consecutive days based on 24-hour composite sample results.	Veolia understands this requirement requires the process to meet the specified limits on average over the 30 day testing period and not on an every single day basis.
DWG M-301-B	IFAS - Mechanical Sections	Veolia has proposed mechanisms for floating scum removal as scum can accumulate in the tanks and become a nuisance without proper exit ports, especially given the higher BOD loading and potential for filamentous growth caused by industrial contribution to the wastewater. Details can be discussed during the detailed design stage.
46 53 36:1.2.C.16	16. The Vendor shall provide anchor bolt calculations made and signed by a civil or structural engineer currently registered in the State of Idaho.	Anchorage calculations are not included in Veolia's design. Support and anchorage is a standard design. Seismic calculations can be provided for an additional charge if required.
46 53 36:2.1.B	B. Fabrication: All welded connections shall develop the full strength of the connected elements and all joined or lapped surfaces shall be completely seal welded with a minimum 3/16-inch fillet weld. Intermittent welding shall not be allowed.	Due to material thicknesses of some fabricated items not all welds are seal welded or utilize a 3/16" fillet weld.
46 53 36:1.2.C.2	Certified general arrangement drawings showing the layout, all important details and materials of construction, dimensions, loads on supporting structures and anchorage locations.	Equipment weights and sizes will be included. Operating loads will not be provided for support structures and anchorage.
46 53 36:2.5.B.3	2-inch diameter 304/304L stainless steel air scour piping will be provided for each cylindrical screen. The air scour piping shall be tapped from the main air line inclusive of manual isolation valves.	Air sparge piping is 1.5" in diameter

4.0 IFAS EQUIPMENT

4.1 Anox K5™ Media

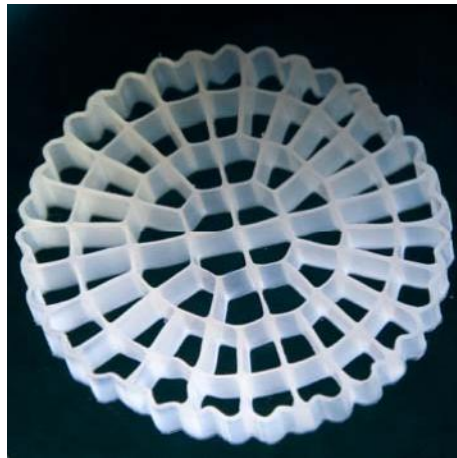
4.2 Blowers

4.3 Valves

4.4 Drawings

4.1 Anox K5™ MEDIA

AnoxKaldnes™ Carrier Media Type Anox K5 ~~and K5 Heavy~~ Product Specification



Use

Carrier media for biofilm in biological wastewater treatment. For use in aerated reactors, with tank and reactor equipment designed for carrier media.

Production

Extrusion. The carriers are produced in several extrusion machines and with several molds. A combination of phenolic antioxidant and phosphite may be added to the material to improve stabilization for the extruding process. Minor differences can be seen between individual pieces but this does not influence performance.

Form and size

4 concentric tubes with internal spacing walls and external corrugated surface, with a nominal length of 3.5-4 mm and a nominal diameter of 25 mm.

Protected surface area for biofilm growth

Approximately $800 \text{ m}^2/\text{m}^3 \pm 1 \%$.

Number per m^3

Approximately 331,000.

KRÜGER

Composition

High-density polyethylene. Virgin polymers are used.

Density

Adjustable. For most applications the carrier exists in density 0.95. ~~K5 Heavy density is 0.98.~~ The density tolerance is ± 0.02 kg/dm³.

Weight per m3

118 kg at a density of 0.95 kg/dm³.

Handling

The carriers are packed and shipped in bags containing 1.0 m³ of carriers in bulk volume.

When the carriers are emptied into the reactor, the reactor must already be filled with water and the aeration or mixing system must be running in order to minimize any impact damage to the carriers. Impact damages can be caused by a free fall of 5 feet or more and collisions with hard surfaces or other carriers. When filling, the suspended bags are usually cut open from the bottom with a utility knife.

If on-site storage is needed prior to installing the carriers in the basins, the carriers should be stored in the bags, and the bags should be protected from UV light to prevent their degradation and subsequent rupture. Bags of 1.0 m³ can be stacked pyramid style up to three or four bags high. The base underneath the bags must be smooth and free from any debris or items that could puncture or rip the bags.

The carriers can be moved from one reactor to another using a solids handling pump, air lift pump, or conveyor belt.

4.2 BLOWERS



AERZEN USA CORPORATION
108 Independence Way * Coatesville, PA 19320
Main Phone: 610-380-0244 * Fax: 610-380-0278

Letter of Transmittal

Company: Veolia Water Solutions 4001 Weston Parkway Cary, NC 27513 USA	Transmittal #: Sub-001
	Date: 10/2/23
Attn: Chris Baucom	PO #: 23000594 HD 05700
Subject: Aberdeen, IA	Job #: SO-23-00316

WE ARE SENDNG YOU

Letter Purchase Order Submittal O&M Manual Other

DOCUMENT TYPE:
OF COPIES: 1 PDF

TRANSMITTED as checked below:

- For Approval
 For Your Use
 As Requested
 For Record
 Action Specified Below

Remarks: Original submission for SO-23-00316.

Copy To:

PROJECT MANAGER:

James Holos
Tel: 484-798-2472 Cell
Fax: 610-380-0278
Email: james.holos@aerzen.com

Signed: *James Holos*



AERZEN

Submittal

Veolia Water Solutions
Aberdeen, IA

Positive Displacement Blowers GM35s

Buyer

Veolia Water Solutions
4001 Weston Parkway
Cary, NC 27513 USA
Tel: 919-677-8310
Fax: 919-677-0082
www.veoliawatertech.com

Local Representative

Coombs-Hopkins
2460 W. 26th Avenue
Suite 215-C
Denver, CO 80221

Manufacturer/Service/ Parts

Aerzen USA Corp.
108 Independence Way
Coatesville, PA 19320
800-444-1692 (tel)
610-380-0278 (fax)
www.aerzen.com/en-us



Aerzen USA Project:
SO-23-00316

Customer:
Veolia Water Solutions

Purchase Order No.
23000594 HD 05700

Project:
5703212001
Aberdeen, IA

SECTION 1

Aerzen Blower Model GM 35s
Performance Data
Bill of Material
General Arrangement Drawing
Pressure Curves

SECTION 2

Blower Description

SECTION 3

Accessory Data

SECTION 4

Instrumentation and/or Controls

SECTION 5

Motor Data Package

SECTION 6

Paint Spec

SECTION 7

Factory Testing

SECTION 8

Startup Report

SECTION 1

**AERZEN**

Aerzen USA Corporation
 108 Independence Way, Coatesville, PA 19320
 Tel: (610) 380-0244 Fax: (610) 380-0278
 website www.USA-Inquiries@aerzen.com

Job Specific Data Package

DATE	Aerzen Job #	Page
25-Sep-23	SO-23-00316	1 of 3
Revision Letter		-

CUSTOMER INFORMATION

CUSTOMER	Veolia Water Technologies, Inc.
CUSTOMER PO #	23000594 HD 05700
PROJECT NAME	Aberdeen, ID

PACKAGE DESCRIPTION

EQUIPMENT IDENTIFICATION	PD Blowers	SERIAL NUMBERS
BLOWER MODEL #	GM 035S-00 QTY. (3)	
PACKAGE DESCRIPTION	Pressure Unit w/ Enclosure	
DISCHARGE CONNECTION TYPE	150# ANSI Discharge Connection	
INLET CONNECTION TYPE	No Inlet Connection	
MOTOR CONDUIT LOCATION	F3 Conduit Box	
TOTAL PACKAGE WEIGHT	3241 lbs	

DOCUMENTATION

GENERAL ARRANGEMENT DRAWING	GB-006954-P2031000
MOTOR CABLE ROUTING	IA-004545
OPERATIONS & MAINTENANCE MANUAL	G4-006
WARRANTY TERMS & CONDITIONS	A2-001-USA

PERFORMANCE DATA

MEDIUM		AIR		
INLET CAPACITY	<i>ICFM</i>	1295	904	213
INLET CAPACITY	<i>SCFM</i>	960	670	157
INLET PRESSURE	<i>PSIA</i>	12.5	12.5	12.5
DISCHARGE PRESSURE	<i>PSI</i>	7.3	7.3	7.3
INLET TEMPERATURE	<i>°F</i>	106	106	106
DISCHARGE TEMPERATURE	<i>°F</i>	210	216	264
NOMINAL BLOWER SPEED	<i>RPM</i>	3616	2633	905
POWER @ BLOWER SHAFT	<i>BHP</i>	55.4	37.5	12
MOTOR RATING	<i>HP</i>	75	75	75
MOTOR SPEED	<i>RPM</i>	3600	2621	901
SOUND PRESSURE LEVEL *	<i>dB(A)</i>	74	74	74
MOTOR/VFD SPEED	<i>Hz</i>	60	44	15

* measured in free field at 3 foot distance from the outline of the unit (tol. +/- 2 dB(A))

Tolerance on Power & Flow is +/- 5%



AERZEN

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108 Independence Way, Coatesville, PA 19320
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website www.USA-Inquiries@aerzen.com

Job Specific Data Package

DATE	Aerzen Job #	Page
25-Sep-23	SO-23-00316	2 of 3
Revision Letter		-

CRITICAL INFORMATION / NOTES

- 1 PRIOR TO SHIPMENT - AERZEN DOES THE FOLLOWING
Removes V-Belts from the motor sheave and wraps them around the blower sheave
Locks the motor hinge plate
Always refer to the operations manual for determining the most suitable lubricant.
Operating and ambient conditions may impact which lubricant to use.

- 2 UPON ARRIVAL
Immediately remove stretch wrap from package when stored outdoors

- 3 LIFTING PACKAGE
Without Sound Enclosure: lifting eye holes in the corner of the base frame
With Sound Enclosure: lifting through slots in base with fork lift

- 4 READ OPERATION MANUAL FOR INSTALLATION INSTRUCTIONS
Call Aerzen After-Sales / Service if you have any questions

- 5 AT COMMISSIONING - CUSTOMER / CONTRACTOR IS TO
Check oil level (refer to operations manual) - and adjust if necessary
Anchor the base or sound enclosure
Make grounding connections
Connect motor cable per Aerzen Drawing IA-004545
Verify correct rotation of motor (counter-clockwise, looking at drive shaft)
Remove locking device from motor pivot plate
Reinstall V-belts
Apply the oil sight glass Sticker

- 6 **ALL CUSTOMER PIPING TO BE INDEPENDENTLY SUPPORTED**

- 7 Recommended MINIMUM clearance at front and rear of package for "normal"
(i.e. inspect machine, change oil, replace belts, etc.) maintenance is 32 inches.



AERZEN

Aerzen USA Corporation

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Job Specific Data Package

Date	Aerzen Job #	Page
25-Sep-23	SO-23-00316	3 of 3
Revision Letter		-

BILL OF MATERIAL for GB-006954-P2031000

ITEM #	QTY	DESCRIPTION	PART #
1	1	Delta Blower Stage	GM 035S-00
2	1	Electric Motor 75 HP, 2-pole, NEMA, TEFC, 208-230/460 V / 60 Hz, NEMA Premium Efficiency,365TS,T-stats,Aegis	21-MTR-TS2-075AD304
3	1	Combination Base Frame / Silencer DN-150	2000012590
4	1	Sound Enclosure (S.E.) w/ Dial Gauges	180740
5	1	Inlet Filter / Silencer Assembly	182116
6	1	Discharge Connection Housing	178666
10	1	Filter Element	* 2000049287
20	3	Drive Belts	* 156315000
30	1	One-way Valve EPDM Flap	** 178655
40	1	Expansion Joint - Discharge 6" 150# ANSI Flange	** 21-003168-06x06EG
50	2	Clamps for Discharge Connection for Rubber Exp. Joint	21-000910_187-200
90	1	Safety Relief Valve DN-125, set @ 750 mbar	** 167374
100	-	Instrumentation	21-G5-IM-PS05-4000
	1	Filter Maintenance Indicator	21-006757
	1	Discharge Pressure Gauge	21-006758
	1	Discharge Temperture Gauge/Switch set @ 285°F	21-006756
140	-	Unloading Valve (optional)	Not Installed
150	1	S.E. - Ventilation Fan 900-3800 rpm	158236
170	1	Motor Sheave Bushing	165686000
180	1	Motor Sheave 170 mm	166313000
190	1	Blower Sheave Bushing	156246000
200	1	Blower Sheave 170 mm	166313000
250	4	Vibration Isolators	184820
260	1	Safety Relief Valve Hose	184096
270	3	Safety Relief Valve Hose Clamps	162923
	1	Oil Drain Valve	185388
	1	Seal Ring for Drain Valve	119086
	1	Oil Drain Hose	2000023662
Spares / Shipped Loose Items (Total for Order)			
	3	Filter Element	2000049287
	3	Sets of v-belts (3 belts per set)	156315000
	3	Delta Lube 06 - 1gal.	21-004391
	3	6" Butterfly Valve,Wafer Style,EPDM seat,Hand lever (Installed by others)	21-009456-06-02

RECOMMENDED SPARE PARTS

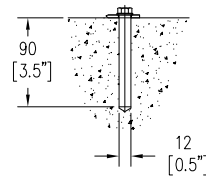
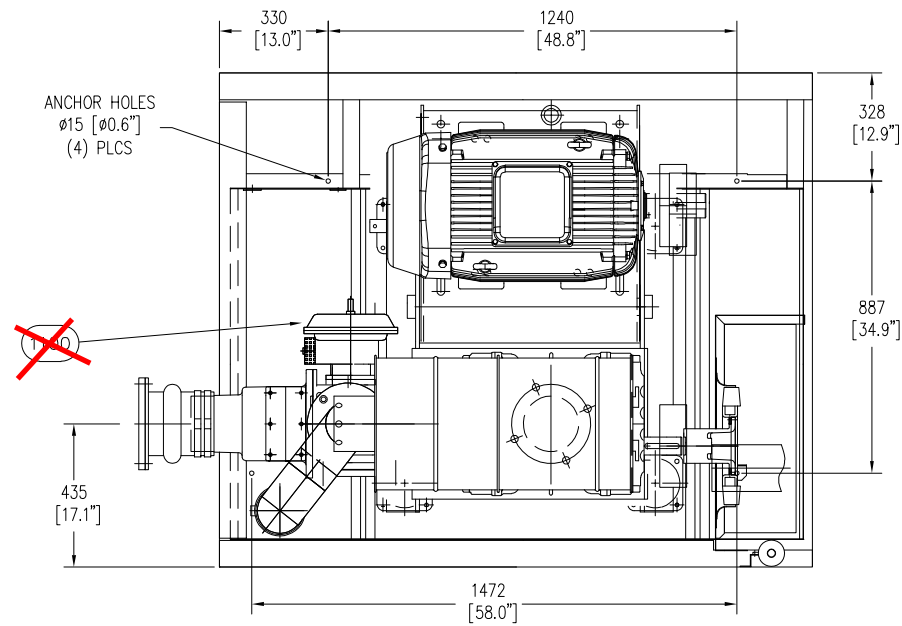
* on hand items

** 2-5 year recommended items

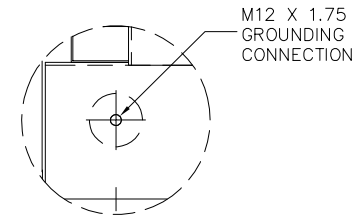
NOTE(S): Always reference the blower s/n & the Aerzen Job # (if known) when ordering spare parts

ITEM	QTY	DESCRIPTION	DESCRIPTION 2
100	1	BLOWER TORSO	GM35S, DN150
110	1	PRESSURE RELIEF VALVE	
200	1	SOUND ENCLOSURE	
300	1	ELECTRIC MOTOR	SHOWN WITH A 400 NEMA MOTOR
310	1	MOTOR MOUNTING	
320	1	BELT DRIVE	
400	1	BELT GUARD	
500	1	COOLING FAN	
600	1	DISCHARGE CONNECTION	6"-150# ANSI
800	1	INSTRUMENTATION	
1100	1	UNLOADING VALVE	(OPTIONAL)

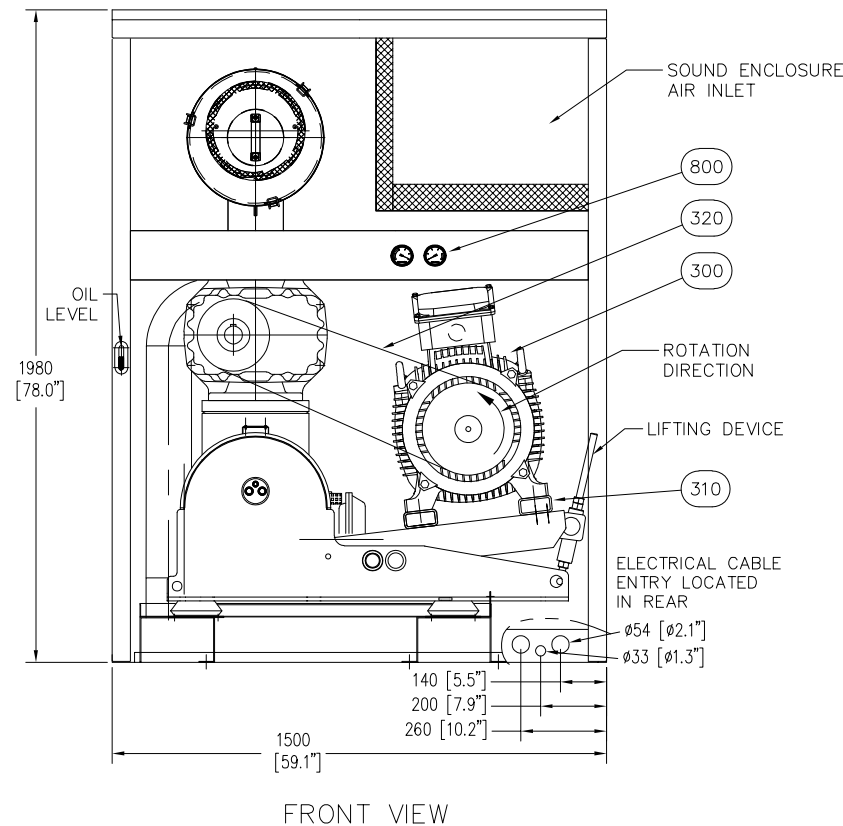
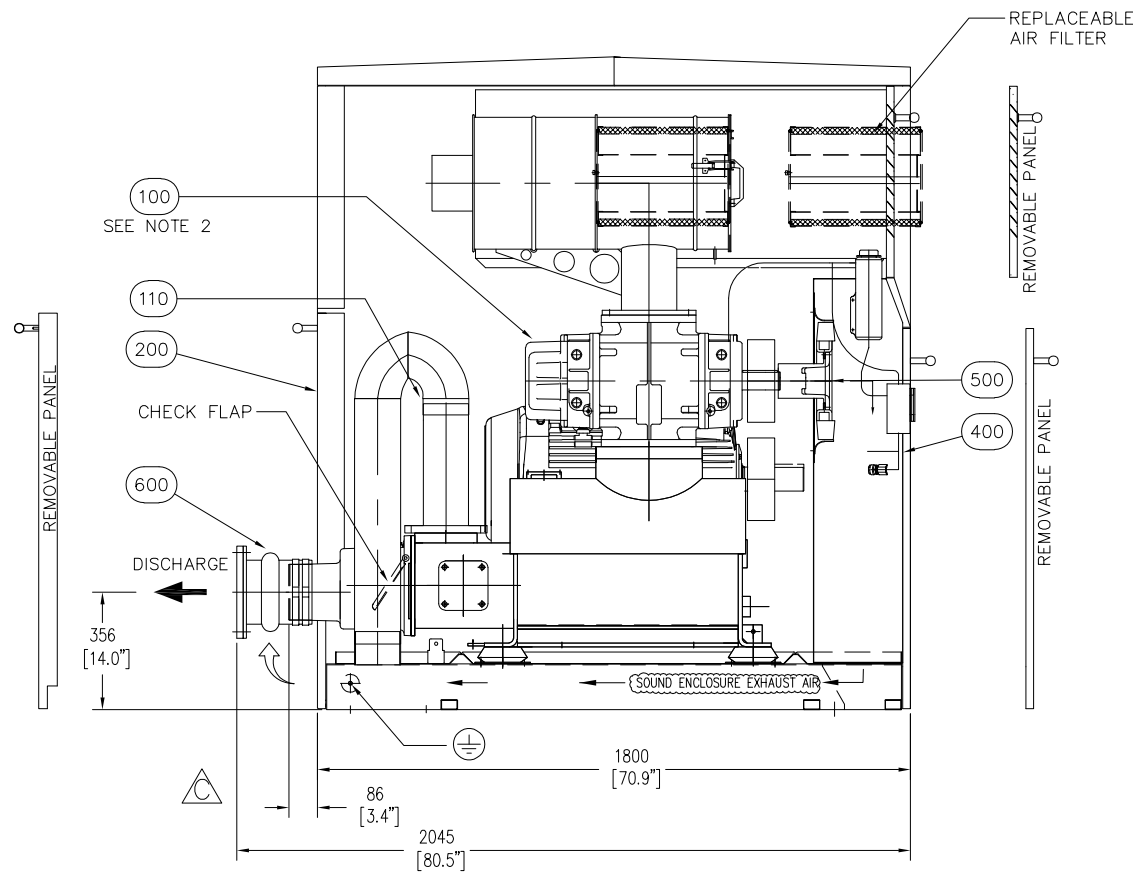
PLAN VIEW



SOUND ENCLOSURE ANCHOR
 RECOMMENDATION
 SHOW WITH OPTIONAL ANCHOR
 AERZEN PART NO. 2000053552
 3X SCALE



EARTH GROUND
 MATL: 304 SS
 3X SCALE



FRONT VIEW

NOTES: \triangle

- TOLERANCE ON DIMENSIONS = $\pm 12\text{mm}$ [0.5"]
- ITEM 100 (BLOWER TORSO) INCLUDES BLOWER STAGE, INLET SILENCER, BASE FRAME/DISCHARGE SILENCER, VIBRATION ISOLATORS, & CONNECTION HOUSING WITH CHECK FLAP
- CUSTOMER PIPING TO BE INDEPENDENTLY SUPPORTED
- LIFT PACKAGE FROM BLOWER SIDE THROUGH FORK LIFT POCKETS IN BASE
- SEE JOB DATA SHEETS FOR PERFORMANCE DATA, PART NUMBERS, TOTAL PACKAGE WEIGHT, INSTRUMENTATION, ANY OTHER OPTIONAL EQUIPMENT & OWNERS MANUAL
- REGARDLESS OF THE OPERATING CONDITION, NO FORCES AND TORQUES MAY ACT ON THE MACHINE THROUGH THE CONNECTED SYSTEM PIPING. ALL CUSTOMER PIPING CONNECTIONS MUST BE DESIGNED AS FIXED POINTS AT THE AERZEN MACHINE LIMIT

WEIGHT

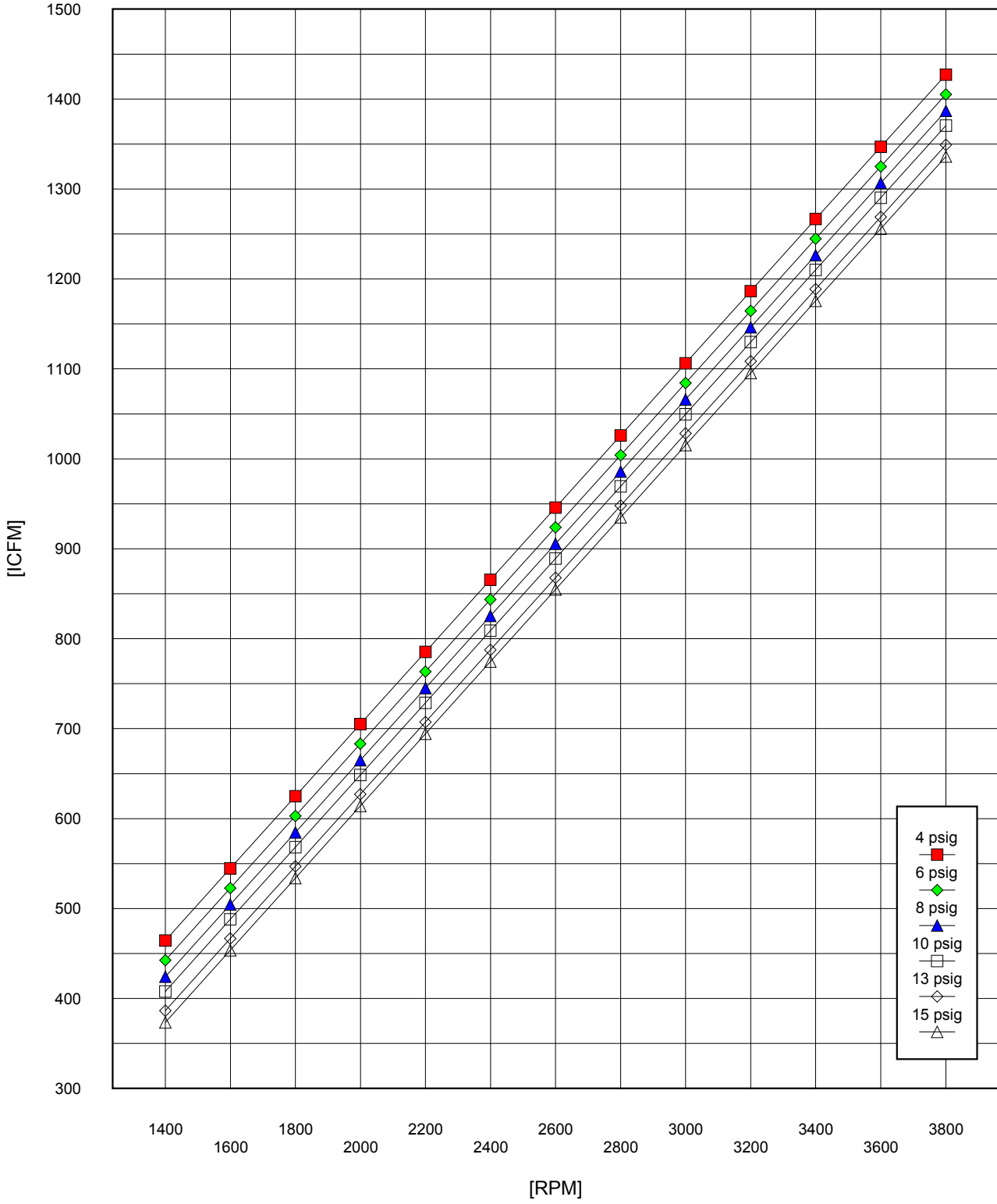
BLOWER PACKAGE (LESS MOTOR)	1068 kg	2354 lbs
ELECTRIC MOTOR (ITEM 300)	-	887 lbs
TOTAL (WET WEIGHT)		3241 lbs

	AERZEN USA CORPORATION 108 INDEPENDENCE WAY, COATESVILLE, PA. PH: (610) 380-0244 FX: (610) 380-0278 WWW.AERZEN.COM		CLASS I 	
	DRAWN BY: JRH CHECKED BY: RJP APPROVED BY: - DRAWING NO: GB-006954-P2031000 REVISION PR: -	DATE: 3.5.2019 DATE: 3.5.2019 DATE: -	TITLE: GA DRAWING GM35S, DN150, G5 F3 SOUND ENCL. 6"-150# ANSI (OUT) PRESSURE	SCALE: - SHEET: 1/ 1

NOTICE: THIS DRAWING AND ALL INFORMATION HEREIN IS THE PROPERTY OF AERZEN USA INC. AND ITS SUBSIDIARIES AND SHALL NOT BE REPRODUCED BY ANY MEANS IN WHOLE OR IN PART USED AS THE BASIS FOR MANUFACTURE WITHOUT WRITTEN PERMISSION

AERZEN GM 35S DELTA PACKAGE, PRESSURE

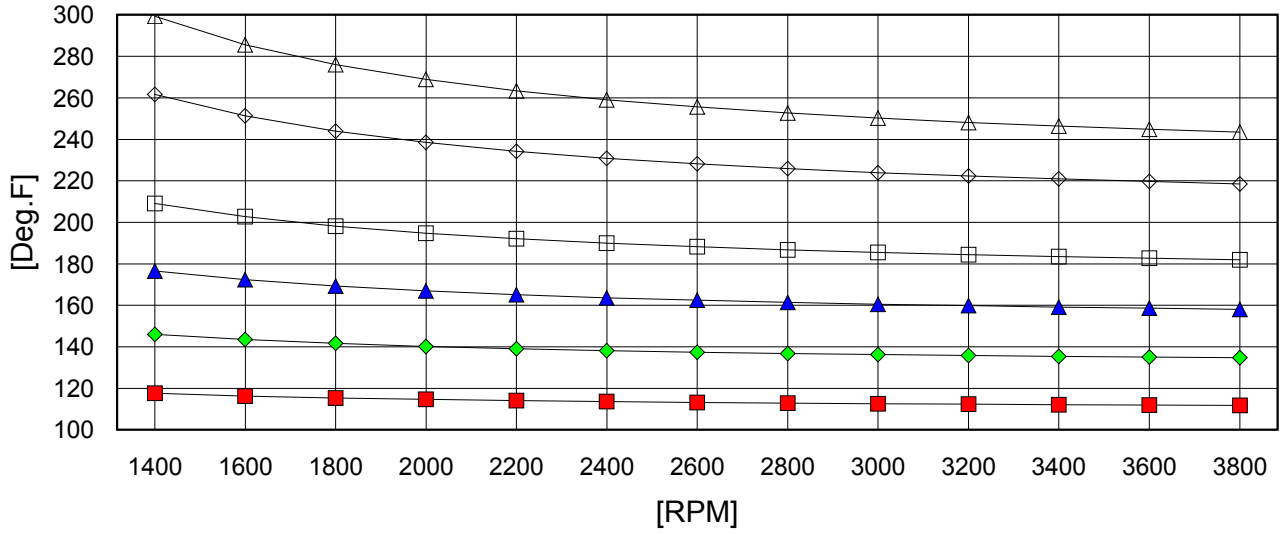
INLET FLOW



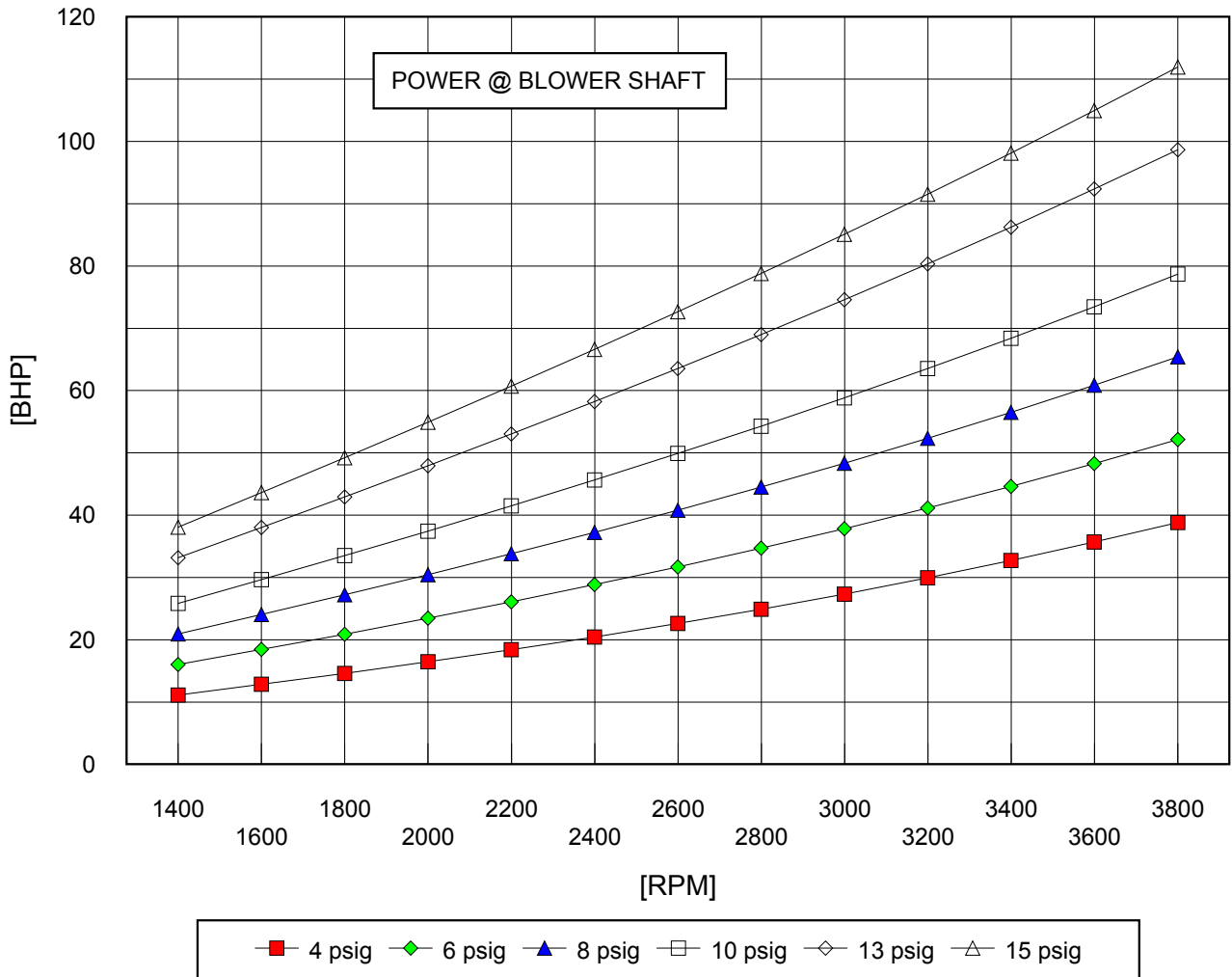
Performance data based on air @ 68 deg.F/ 14.7 psia inlet.

See temperature chart on second sheet for allowable operating range.

AERZEN GM 35S DELTA PACKAGE, PRESSURE DISCHARGE TEMPERATURE



MAXIMUM ALLOWABLE DISCHARGE TEMPERATURE: 285 deg.F
Performance data based on air @ 68 deg.F/ 14.7 psia inlet.



SAMPLE – FOR REFERENCE ONLY

Aerzen USA Corporation

108 Independence Way
Coatesville, PA 19320
(610) 380-0244 ph
(610) 380-0244 fax



Aerzener Maschinenfabrik GmbH

Since 1864
Reherweg 28 - D31855 Aerzen
Telefon: 0 51 54 / 810
Telefax: 0 51 54 / 811 91

Certified Test Report

evaluated date: 1-Aug-19
evaluated by: Rzepka
certified by: Jarow

Customer De Nora Water Technologies, Inc.
Customer PO# 23007-T019266

Aerzen reference # SO-18-01343

Performance & Order Data

Blower Model GM 90S

Serial # 1619621

- 1) Inlet flow Q_1
- 2) differential pressure Δp
- 3) Shaft Power kW
- 4) Blower Speed rpm

Metric units

56.19 m³/min
724 mbar
85.15 kW
1622 rpm

US units

1984.51 lcfm
10.5 psig.
114.30 Bhp
1622 rpm

Test Result

5) Volumetric Efficiency	$\eta_{vol, um}$
6) Actual Slip	$V_{verl, um}$
7) Theoretical Volume	V_0, um
8) Actual Volume	V_1, um
9) Flow Variance	V_t, um
10) Actual Power	$P_{KU, um}$
11) Power Variance	$P_{KU, um}$

Metric units

80%	
13.27	m ³ /min
67.35	m ³ /min
54.15	m ³ /min
-3.62%	
85.09	kW
-0.08%	

US units

80%	
468.49	cfm
2,378.28	cfm
1,912.39	cfm
-3.62%	
114.10	Bhp
-0.08%	

Explanation and Summary

Lines 1), 2), 3). 4) above show required performance data (what was ordered).
Lines 5) through 11) show data that resulted from the performance test on the actual blower.
Line 9) shows a variance of 3.62% in the flow capacity of this unit.
Line 11) shows a variance of 0.08% in the power consumption of this unit.

Standard accepted tolerance is +/- 5%. The unit would be acceptable if the flow was no more than 5% below the expected flow and the power was no more than 5% of expected power.

For this specific case the flow is -3.62% **less than expected.**
For this specific case the power is -0.08% **less than expected.**

Serial number 1619621

Model number GM 90S meets and exceeds the standard tolerance.



Aerzen USA Corporation
108 Independence Way – Coatesville, PA 19320
Tel: (610) 380-0244 Fax: (610) 380-0278
Service Hotline (800) 444-1692
e-mail: USA-Inquiries@Aerzen.com website www.aerzen.com/en-us

Test Report AMUSA based on AMD Report

DATE	Document #
5-Sep-19	B-6-0202 rev "F"

Blower Test Report will be provided in the project O&M Manual.



EC Declaration of Conformity

according to the Machinery Directive 2006/42/EC, Annex II, No.1 A

Company Name : Aerzener Maschinenfabrik GmbH
Reherweg 28
31855 Aerzen
Germany

Product Details :

**The Declaration of Conformity for this piston engine is supplemented by the technical details in the chapter entitled "Performance Data".
The details provided therein identify the product and must be applied together with this Declaration of Conformity.**

Appointed agent for the
compilation

of the technical documentation : Mr. Irtel, Managing Director
Aerzener Maschinenfabrik GmbH
Reherweg 28
31855 Aerzen
Germany

We hereby declare that the aforementioned product complies with all relevant provisions of Machinery Directive 2006/42/EC for the conveyance and compression of gaseous media.

The aforementioned product also fulfils all provisions of the following relevant EC-directives:

- EMC / Electromagnetic Compatibility 2004/108/EC
 - Pressure Equipment Directive 97/23/EC
 - The protection targets of the Low Voltage Directive 2006/95/EC
- have been fulfilled in accordance with Annex I, No. 1.5.1 of the Machinery Directive.

The following harmonised standards were applied:

- DIN EN ISO 12100 03-2011 Safety of Machines - General Design Principles
Risk Assessment and Risk Reduction
- DIN EN 1012-1 02-2011 Compressors and Vacuum Pumps - Safety Requirements
- Part 1: Compressors

This Declaration of Conformity applies to the product in its original state as placed on the market by the manufacturer. Any retrospective changes and/or retrospective work undertaken shall void this Declaration of Conformity.

Aerzen, 09-01-2012
Place, Date of issue

Mr. Björn Irtel, Managing Director-
Details of the Undersigned

SECTION 2

ROTARY LOBE BLOWER PACKAGES

DELTA BLOWER GENERATION 5

Intake volume flow from 20 cfm to 8,800 cfm

Quiet, Compact, Energy Efficient



Delta Blower 5
Generation



AERZEN

aerzenusa.com

Aerzen's Generation 5 Delta Blower

The 5th generation of Aerzen modular compact packages combines tradition and innovation.

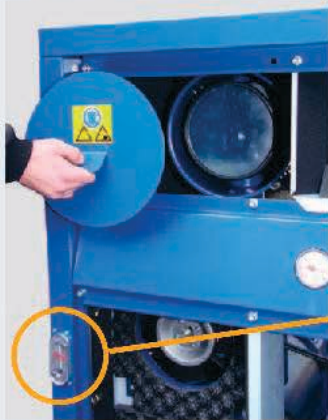
- 1** Easy installation with forklift or pallet jack for placement



- 2** Room-saving, compact, side-by-side installation



- 3** Easy access to all components with one oil drain/oil fill point



- 4** Oil level can be observed from the outside



- 5** Automatic belt tension—No adjustment required



- 6** Typical machinery noise average SPL 75-80 dB(A) with acoustic hood



Aerzen Delta G5 Blower Stage

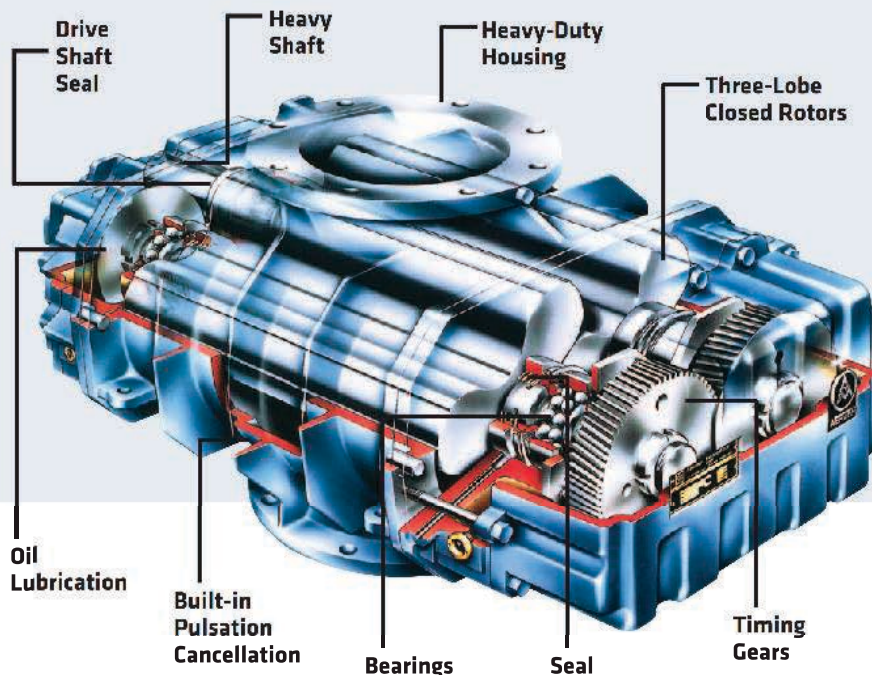
The details that set Aerzen Blowers apart.

Pulse Cancellation Built In, Active Noise Cancellation Built In

- 7** No need for additional electric motor and interlocks with shaft-mounted cooling fan for forced ventilation of the enclosure



- 8** Reactive discharge silencer without internal absorption material



For more information, visit www.aerzenusa.com

The accessories that make the difference.

Inlet Filter/Silencer

Easily replaceable filter element is downstream of the silencer for cleanliness.

Instrumentation

Standard filter maintenance indicator and p2 gauge

Belt Guard

Designed for easy access to the drive. OSHA standard.

**NEMA F3
Premium Efficiency
TEFC Motor**

Hinged Motor Plate

Steady alignment and consistent tension provided by the motor weight. No springs needed. Constant high efficiency.

Reactive Discharge Silencer & Blower Base

Machined support surface for blower. Stiff for installation on vibration isolating mounts. Low pressure drop design. No absorption packing material. ATEX spark arrester.*

Vibration Isolating Mounts

Rubber-type. Located under the supporting base. No special foundation required.

Pressure Safety Valve

Spring-loaded. Specifically designed for low pressure applications. Mounted vertically downstream of the silencer for longevity.*

Aeromat Start Unloading Valve (Optional)

Allows startup of the main motor with no load. The valve is completely self activating and does not need any auxiliary electrical or pneumatic power source.

Discharge Manifold*

With integral full bore check valve for low pressure drop. The check valve can be inspected without disconnecting the piping. Non-chatter check valve suitable for adjustable speed operation.

Discharge Flexible Connector

Reinforced rubber. Downstream of discharge silencer to reduce transmission of structure-borne noise.



Instrumentation package:

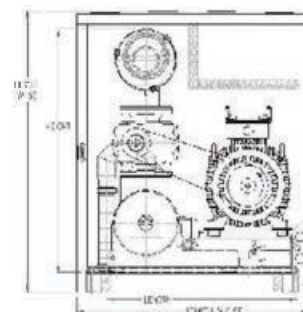
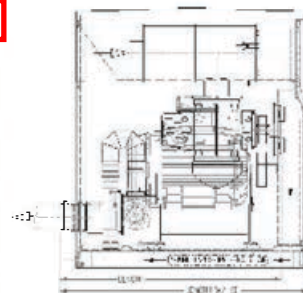
AERtronic Control System includes pressure transmitters for intake, discharge and oil pressure, as well as resistance temperature detectors (RTD) discharge and oil temperature and operator interface.

*PED compliant pressure vessel

G5 Blower Dimensions								
Aerzen Blower Model	Length (inches)	Width (inches)	Height (inches)	Weight (lbs)	Nominal Nozzle Size	Nominal Discharge Pipe Diam. (inches)	Max. Flow (icfm) at 10 psi rise	Pressure (psi)
GM 35	31	33	43	485	DN-50	2	131	15
GM 45	48	36	52	695	DN-80	3	184	15
GM 7L	48	36	52	706	DN-80	3	270	10
GM 10S	48	36	52	759	DN-80	3	339	15
GM 10S	55	51	61	1120	DN-100	4	385	15
GM 15L	55	51	61	1153	DN-100	4	576	10
GM 25S	59	55	61	1279	DN-125	5	823	15
GM 30L	80	73	78	2161	DN-150	6	1186	10
GM 35S	80	73	78	2293	DN-150	6	1370	15
GM 50L	80	73	78	2492	DN-150	6	1494	10
GM 50L	78	84	86	2889	DN-200	8	1896	10
GM 60S	78	84	86	3219	DN-200	8	2020	15
GM 80L	99	90	94	7872	DN-250	10	2828	10
GM 90S	99	90	94	8004	DN-250	10	3090	15
GM 130L	126	116	96	7111	DN-300	12	4449	9
GM 150S	126	116	96	7651	DN-300	12	5120	15
GM 240S	(depends on motor size)				DN-400	16	8800	12

Notes

1. For informational use only. Dimensions shown are close estimates and are subject to change without notice. Contact Aerzen USA if certified dimensions are required. Dimensions are in inches, weights are in lbs.
2. Weight notes: motor not included.
3. Oversize/overweight motors may require hinge plate support; dimensions and weights may vary. Consult Aerzen USA with specific application.
4. Packages available w/o sound enclosure. Consult Aerzen USA.



Aerzen means trouble-free compression.

Aerzen's modular blower packages have been offered since the 1960s. Aerzen Delta Blower packages have been in successful operation since the 1990s. They are just one of the offerings in our single stage positive displacement program. Whatever your application and installation requirements, be sure to consider Aerzen.

Delta Care Maintenance Agreement

Warranty: 5 years optional with our Care Maintenance Agreement

For Pressure

- Up to 15 psi: G5 Blower packages
- Delta Hybrid up to 22 psi
- 10 to 51 psi: Oil-free and air-cooled VM and VML screw compressors

For Vacuum (Dry)

- Up to 15" Hg: G5 Blower packages
- Hybrid up to 20" Hg
- Up to 25" Hg: G5 Blower packages with pre-inlet cooling
- Up to 25.5" Hg: Oil-free and air-cooled VM screw compressors at same flow (30% more efficient than PD blowers)
- Vacuum boosters to 10-3 mbar absolute

For Extended Pressure/Vacuum

- Up to 40,000 cfm available
- For other gases, higher pressure/vacuum consult factory

Aerzen USA

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AERZEN
 EXPECT PERFORMANCE

AERZEN DELTA BLOWER GENERATION 5

North American Standard

Positive Pressure

Standard range

Blower sizes: GM 3S to GM 150S
 Package nominal sizes: 2" (DN 50) to 12" (DN 300)
 Medium: Air
 Flow range: 35 to 5297 icfm (1.0 to 150 m³/min)
 Differential pressure: 15 psi (1000 mbar) for "S" and 10 psi (700 mbar) for "L" machines
 Maximum operating temperature: 285°F (140°C)
 Drive: V-belt drive with totally automatic belt tension adjustment

Introduction

The Aerzen Blower is renowned for its performance and its reliability. There is no secret: From the blower-stage through the accessories, Aerzen enhances key features of each component by applying sound engineering, precision machining, and superior workmanship.

The Delta Blower Generation 5 (G5 for short) is the synthesis of four previous Aerzen blower package generations combined with an array of new technical innovations to provide five key advantages to our customers:

- The machinery noise level has been lowered yet another 6-8dBa¹ on average compared to the previous Delta Blower
- The blower package is even more user friendly especially in transport, installation, operation, and maintenance
- The oil level is visible from the outside of the package, so the blower does not need to be shut down
- No absorption material is used in the discharge combination silencer; this eliminates the possibility of foreign objects contaminating the air or gas stream
- Use of a shaft mounted cooling fan, which reduces installation and operating costs by eliminating extra wiring, motor starters, and its interlocking with the main blower motor
- The compact footprint allows units equipped with sound enclosure to be mounted side-by-side since there is only one main maintenance access side

¹ Measured in 1m free-field conditions



Aerzen USA Corporation

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Sales Description – G5 Delta Blower - Pressure

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Aerzen Delta Blower Generation 5 are pre-engineered modular compact packages, which offer a wide range of options from proven and standardized components at reasonable costs and short delivery times.

Shipped completely assembled, the Aerzen Delta Blower Generation 5 is indoor and outdoor rated. There is no extensive installation work - neither grouting nor special anchoring is required, just simply level it and bolt it to any standard industrial flooring or surface.

Scope of supply: basic configuration

- Aerzen Rotary Lobe Blower stage
- Combination Base Frame / Silencer combined with hinged motor plate for automatic belt tensioning – with 2 ½” diameter discharge pressure gauge
- Making belt changes as easy as possible a motor hinge plate lifting and locking mechanism is included with DN100-300 units and a hydraulic bottle jack is supplied with DN50 and 80 units.
- Set of vibration isolating mounts under the entire blower package
- Inlet silencer – filter with filter maintenance indicator
- Narrow V-belt drive and protection guard
- Pressure safety valve
- Discharge manifold with integral check valve and flexible pipe connector
- Standard paint system
- NEMA electric motor TEFC, Premium efficiency, VFD duty, with conduit box on top
- First oil fill and “Service kit”
- Packaging for domestic trucking
- Standard documentation in electronic format: English language, drawings with US-customary and metric units of measure

Standard options include (not limited to)

- Inlet pipe connection kit
- Sound enclosure with skid / oil-drip pan and forced ventilation
- Start-unloading valve Aeromat, with or without solenoid valve
- Pressure modulating valve Aeropress or Aeropress10S, pilot operated
- Other motors, e.g. misc vendors Premium Efficiency with conduit box on top
- Instrumentation & controls, e.g. AERtronic Aerzen blower controller



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Description of the main components

The combination of key components marked with a * in the description below significantly contribute to the reliability and performance of the Aerzen Blower:

At the heart of the package: The Aerzen Rotary Lobe Blower

Low vibration and low pulsations - a key feature:



Internal pulsation interference channels in conjunction with 3-lobe rotors reduce the pulse in the discharge air stream by as much as 90% or 20 dB at the lobe-passing frequency. This significant attenuation contributes strongly to reducing vibrations in the entire package and lowering the noise emitted by the downstream piping.

Positive displacement characteristic:

- The blower moves a fixed volume of gas with each shaft rotation, nearly independently from the operating pressure.
- At constant differential pressure, the load torque remains constant.
- For a given pressure, the power is directly proportional to the speed.

Flow across the blower stage:

- Vertical from top to bottom

Drive shaft location:

- On the left when facing the blower shaft

Rotation:

- Counterclockwise when facing the blower shaft

Housing:



- The central section, “the cylinder” and the two side-plates house the rotors, while a gear case and a drive end cover contain the lubricating oil for bearings and gears. Individual side plates allow for optimal setting of the radial rotor clearances: a valuable feature on blowers with the gas flowing perpendicular to the rotors.
- Connections: full-size, flat-faced flanges
- Maintaining internal alignment under all operating conditions is paramount for the reliability of any rotating equipment. The housing is, for this purpose, designed to support the entire blower stage on its outlet flange only; no need to worry about a “soft foot” or uneven base support
- Materials: Gray cast iron EN-GJL-200 equivalent to ASTM A48 Cl.30 AISI A278 Cl. 30



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Rotors:



- Up to and including the model GM 80L, rotors and shafts are made of a single, drop forged steel piece made from C45 steel equivalent to AISI Type 1045. Models GM35S, 50L, 90S, and 130L are made from a single piece of EN-GJS-500-7 nodular cast iron equivalent to ASTM A 536. Model GM150S rotors are comprised of a through shaft made from C45 steel equivalent to AISI Type 1045 and a rotor made from EN-GJS-400-15 nodular cast iron equivalent to ASTM A536 Gr. 60-40-18. Solid or dust-tight rotors do not have any open cavities that can trap contaminants. This is particularly important in food applications and applications requiring high purity. Moreover, rotor balance is maintained, and vibration is therefore minimized.
- Stiff rotor design: the rotors' first critical speed is always at least 10% above the maximum operating speed.
- The rotors meet or exceed the ISO 1940 / ANSI S2.19 G6.3 criteria of dynamic balancing

Timing gears:



- Helical gears with hardened and ground teeth to meet AGMA 12 quality standard with an AGMA service factor of 1.70.
- To maintain the advantage of high-quality gears, the gear wheels are secured onto the shafts by means of a tapered interference fit. Optimum concentricity is achieved and neither gear hub nor shaft keys are used. To prevent damaging the seats, gear installation and removal are carried out using hydraulic pressure to expand the gear wheels within their elastic limit.

Bearings:

- The rotors are supported by anti-friction bearings
- The bearings are housed in the side-plates and are sized for an expected 5 years between overhauls.
- The drive-shaft bearing is a cylindrical roller bearing whereas the other bearings are selected to achieve the proper clearances between rotors and housing, axial loads from the helical bearings: smaller machines up to GM 50L feature double angular ball bearings.

Lubrication:

- Oil splash lubrication of all bearings and gears through oil spray disks on both blower ends
- An oil sight glass is provided on each oil sump.
- An oil drain valve is provided on each oil sump (units without sound enclosure). The oil drain valves are directly mounted to the oil sump covers for clean, easy and fast oil change.
- Units with sound enclosure are plumbed together to an oil reservoir that serves as oil fill and drain device, and its oil sight glass is visibly mounted to the maintenance side of the enclosure.
- Aerzen USA provides the first oil fill with a lubricant as recommended in the operating manual as well as a service-kit containing oil fill funnel, and oil drain hose.

Seals at the rotor chamber:



- The rotor chamber is sealed from the oil chambers by four, all metal, non-rubbing seals, each consisting of the following components and in that sequence:
 - Oil slinger ring
 - Two restrictive piston-rings in a labyrinth
 - "Neutral chamber" located between the piston rings used for venting the seal
 - Two restrictive piston-rings in a grooved labyrinth bushing

Seal at the drive shaft:

- Double, permanently lubricated Viton seal ring
- Shaft sleeve: replaceable, hardened steel



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Testing

- Each blower stage is subject to a full-load test to verify the volumetric flow and power values.
- * — Acceptance criteria are +5% on power and –5% on flow for all machine sizes.
- Orifice flow measurement and conversion of results to the operating conditions in accordance with ISO 1217, simplified

The package component Aerzen Rotary Lobe Blower

Intake air silencer & filter

- * — Absorption-type silencer upstream of the air filter element. For reasons of cleanliness, there is no silencing material between the filter and the inlet blower flange.
- The carbon steel housing is powder coated. Quick-release latches for quick access to the filter element
- Filter performance: G4 per EN 779 (greater than 90% of synthetic dust particles), equivalent to ASHRAE 52.2 MERV 7 (50-70% @3-10 microns)
- Progressively compressed, thermally bound polyester fibers, free of PVC, smoothed and compressed on the clean airside for highest dust separation and retention capacity. The filter media is made of a single, 30 mm thick continuous mat that is white in color and is food safe. Filter element mounts with a quick release turn and lock arrangement.
- Included is a filter maintenance indicator. If the sound enclosure option is selected, the filter maintenance indicator is mounted to the enclosure wall.

Base with integral discharge silencer:

- In addition to the blower's internal pulsation cancellation feature, the combination discharge, three-chamber reactive silencer is used to further reduce the noise and residual pulsation in the air stream across a wide range of operating speeds. The residual pulsation downstream of the silencer meets or exceeds the API 619 recommended 2% peak-to-peak of the absolute line pressure.
- * — The discharge silencer is combined with the support base into one compact rugged unit. It is made from pressure vessel steel it forms a torsion resistant cylindrical vessel supporting the blower stage and other components.
- * — The mounting surface for the blower is a full-size steel flange machined and continuously welded to the base with the full number of tapped holes for the studs to fasten the blower to the base - no need to align blower feet or to worry about a soft-foot condition. A surface sealant is used instead of a gasket.
- * — Maximum operating pressure: 1.1 bar gauge (16 psig) and 150°C (300°F), built and certified to the latest European Pressure Vessel Code, PED. Test pressure: 1.9 bar g. (27.6 psig)
- The base is mounted on a set of vibration-isolating mounts



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Belt drive



- Narrow, anti-static V-belts
- Selected for a minimum service factor of 1.4 times operating power (BHP), or 1.1 times the motor nominal power (nameplate HP), whichever is greater.²
- The Aerzen Delta Blower Generation 5 package provides entirely automatic tensioning of the belts. Thanks to the package configuration, the drive geometry is such that the motor hinges parallel to the motor shaft centerline, using only the motor mass to maintain this tension without need for adjustments or springs. This not only reduces maintenance; it also reduces the potential for operating with too little (slipping belts) or excessive belt tension (excessive bearing and shaft load).
- DN100-300 blower packages feature a multipurpose lifting device for the motor swing plate. In its most basic function, it serves as shipping locking device preventing the motor from unwanted movement. It also serves as the lifting mechanism for changing out the drive belts. Another additional purpose is limiting the belt tension when oversized motors are used. Finally, the device can be configured to aid limited movement for seismic or mobile blower package service. The maintenance kit provided by Aerzen USA also includes a ratchet wrench used for lifting the motor to change V belts.
- DN50 & DN80 blower packages have a simple to use bracket and hydraulic jack included in the maintenance kit to lift the motor and change or install the belts.
- Sheaves and bushings are dynamically balanced to ISO 1940 / ANSI S2.19 G6.3. For linear tip speeds > 6500 ft/min (33 m/s), nodular cast-iron, ventilated sheaves are used.

Belt guard

- OSHA compliant personnel guard, made of galvanized steel: either perforated steel or solid sheets with vents, depending upon the model.
- Units with sound enclosure feature hand protection fan and belt guards, and the enclosure itself serves as the ultimate protection device. The removable maintenance panels comprise lockable latches that help facilitate OSHA prescribed tag-out-lock-out procedures.

Vibration isolating mounts

- A set of vibration isolating mounts are located under the blower package to hinder the transmission of structure borne noise from the blower and the discharge silencer into any structure the package is installed on, such as a mounting skid if supplied with acoustic enclosure.

Discharge manifold

- Flange-mounted to the discharge silencer, the discharge manifold serves for mounting the pressure safety valve, an optional start-unloading valve and for connecting the blower package to the discharge piping.
- Materials of construction: Gray Cast Iron EN-GJL-250 equivalent to ASTM A48 (Aluminum stub pipe for DN50)
- The discharge manifold houses the discharge check-valve

Pressure safety valve

- DN100-300 blower packages have a vertically mounted, spring loaded, safety pressure valve sized for the full flow of the blower. DN50 and DN80 blower packages feature horizontally mounted safety relief valves.

² Higher values are not necessarily better as they could lead to belt slippage due to excessive stiffness, and also shaft damage (deflection) caused by higher tension values required by over sized v-belt drives.



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- * — The valve's characteristic is nearly proportional. It not only opens, but also closes at the set pressure
- * — The valve has a built-in dampener that allows the valve to actuate smoothly, which prevents the "pop-off" effect commercially available valves exhibit.
 - Pressure rise up to 10% at full flow. Certification of conformity to PED
 - Being an all-metal valve, it is not suitable as a pressure modulating valve. If this function is needed use an Aerzen pilot operated Aeropress or Aeropress10S pressure modulating valve.
 - Materials: seat of gray cast iron and, depending on the size, a brass or anodized aluminum bell and piston, galvanized spring, steel spring rod, and an aluminum or fabricated external steel cylinder.
 - Standard set points are 15.2 psig (1050 mbar) for "S" model blowers operating above 10 psi (700 mbar), and 10.9 psig (750 mbar) for all machines operating under 10 psi (700 mbar), including all "L" model blowers³.
 - The valve protects the blower stage against line surges, and spikes. It does not protect against prolonged overloads or excessive discharge temperature. Therefore, it is not an absolute protection device, nor is it "bubble tight".

Discharge check valve

- * — A full-bore check valve that can be easily removed for inspection and maintenance without disconnecting the discharge piping⁴
 - With its horizontal top-located steel shaft⁵, the check valve naturally closes by gravity at no-flow.
 - Without any springs, the check valve will not chatter, even at low flow conditions (for example in adjustable speed applications)
 - Flap material: EPDM on steel for operating temperatures up to the blower limit
 - Optional check valve flap material: Silicone rubber

Discharge flexible connector

- * — A reinforced silicone-rubber discharge flexible connector with heavy-duty clamps connects to the discharge piping.
 - It prevents the transmission of structure-borne noise from the blower and its discharge silencer to the discharge piping.
- * — Located downstream of the silencer and with only a small gap (~1/2") between the package and the pipe, the noise sent to the outside is maintained at a minimum.
 - The sleeves are sized for standard, schedule 40 pipe diameters.

Discharge pressure gauge

- Liquid filled, 2 1/2 "dial. Units: mbar and psi
- If the sound enclosure option is selected, the discharge pressure gauge is mounted to the sound enclosure wall.

³ The valves are adjustable, and different springs are available for other set points depending upon operating conditions, motor limitations, or customer's requests.

⁴ Except DN50

⁵ Except DN50



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Optional sound enclosure

- Covering the entire blower package with the drive motor, the enclosure provides suitable protection for outdoor installation up to 50 mph winds and 25 lb/ft² snow load and rain at a 45° angle
- * — The enclosure and the blower package are both mounted on a skid / oil-drip pan, designed for meeting environmental protection standards as well as for easy transportation and installation.
- * — The unique Aerzen package design makes it possible to mount multiple blowers side-by-side without hindering access to the maintenance side (front). All pipe and wiring connections are made from the backside. This offers the best use of available floor space.
- * — All maintenance activities can be carried out from the front of the package, e.g. air filter, belts, and oil maintenance. The oil level is visible from the outside and eliminates any guesswork. Oil can be filled and drained from a common reservoir that also houses the oil level gauge.⁶ The oil level check can be done with the blower in operation.
- The enclosure reduces the package noise level to less than 80 dB(A) – 75dB(A) in most cases- at 1 m, free field, per DIN 45635.
- Quick release panels, each less than 50 lb (as mandated by MSHA) provide quick and easy access to the blower and the package components for routine maintenance.
- * — Blower packages are fitted with a shaft-mounted cooling fan for sufficient heat removal. There is no need for a separate electric driven fan and required interlock and controls.
- Aerzen mounts the blower package in the sound enclosure at our factory prior to shipment.
- * — Panels are made of galvanized steel sheet, with self-extinguishing, non-dripping high-density polyester foam as absorption material.
- The enclosure is powder coated in a UV resistant Aerzen Royal Blue color, accented with light gray maintenance panels

⁶ Except DN50



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Hebevorrichtung für Motorwippe

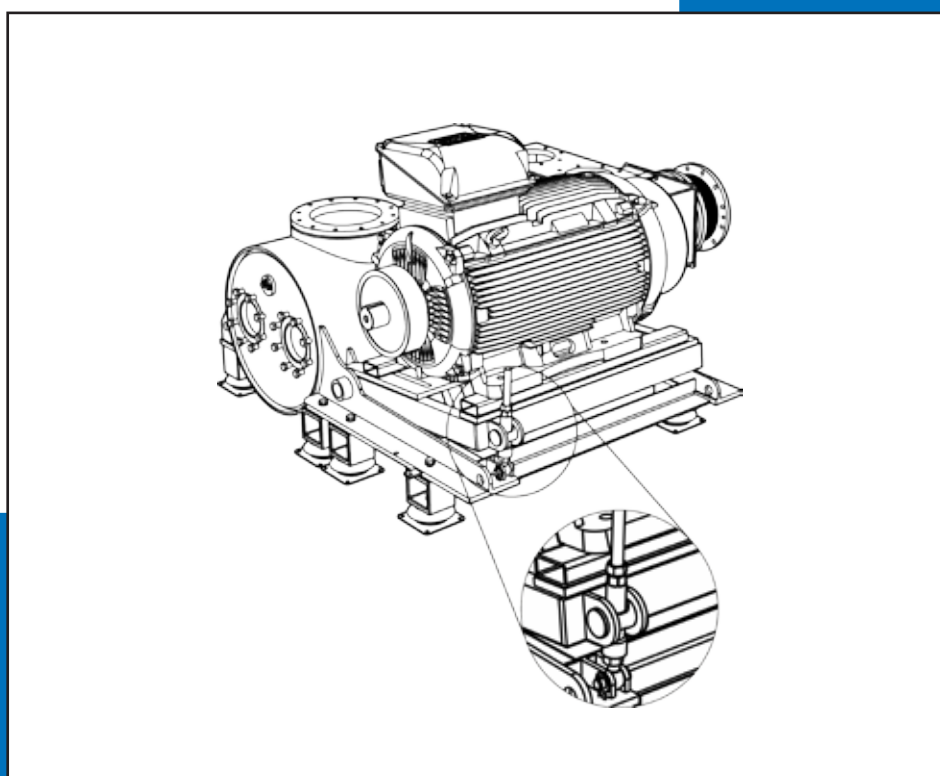
Lifting device for motor base

Dispositif de levage pour moto-interrupteur à bascule

Hijsinrichting voor motorwip

Mecanismo de elevación para base de motor

**Dispositivo di sollevamento per basamento oscillante
del motore**



**AERZENER MASCHINENFABRIK
GMBH**

G4-079 B XT

... .. 03-2014

DEUTSCH

ENGLISH

FRANÇAIS

NEDERLANDS

ESPAÑOL

ITALIANO



	Typ / type Delta Hybrid Delta Blower Generation 5 Delta Screw Generation 5		
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1. General notes

- This description serves as guide for the operation of the hinged motor lifting device.
- Usage requires special knowledge in using and handling this kind of machine.
- For correct operation of the hinged motor in the Delta unit, qualified and trained specialists are required.
- Only use envisaged and suitable tools for adjusting the hinged motor.

Every person involved in the adjustment of the hinged motor should read and understand this description and the corresponding operating instructions and especially the safety instructions!

WARNING!

Danger of injury if insufficiently qualified!

Incorrect use can lead to considerable personal injury and property damage.

- All actions should therefore only be carried out by adequately qualified specialists.

Specialists

are due to their technical training, knowledge and experience as well as knowledge of the relevant provisions able to carry out all work assigned to them and to recognise and avoid possible dangers.

Only personnel are allowed to work whom it can be expected to carry out the work in a reliable manner.

Persons whose responsiveness is influenced due to drugs, alcohol or medication are not allowed.

Age and job-specific regulations should be taken into consideration with the choice of personnel.

MOUNTING



Typ / type

Delta Hybrid
Delta Blower Generation 5
Delta Screw Generation 5

2. Safety information

The hinged motor should only be set or adjusted when the machine is not in operation and secured against reactivation!

Securing against reactivation

The machine should be secured against reactivation for all actions that require the machine to be in a non moving condition (e.g. work or fault rectification).

WARNING!

Lethal danger due to unauthorised, uncontrolled or impermissible reactivation!

Unauthorised or uncontrolled reactivation of the machine can lead to serious injuries or death!

Persons could be in the hazardous area.

Applying power can lethally injure these persons.

- Secure the main switch and lock.
- Signs should be placed on the main switch and users informed of the possible dangers.
- Before reactivation ensure that all safety equipment is assembled and fully functional and that there are no dangers existing to persons.
- Always adhere to the following procedure for securing against reactivation.

1. Switch off energy supply.
2. Secure the main switch using a lock which should be locked and a relevant sign should be placed on the main switch.
3. The key should be kept safe with a responsible person.
4. If the main switch cannot be secured, relevant signs should be placed indicating the dangers.
5. After all work is completed check that there are no persons in the hazardous area.
6. Make sure that all protection devices are installed and fully functional.
7. Unlock the main switch and remove the signs.



MOUNTING



Typ / type

Delta Hybrid
Delta Blower Generation 5
Delta Screw Generation 5

CAUTION!

Danger of injury due to sharp edges and pointed corners!

Sharp edges and pointed corners can cause abrasions and cuts to the skin.

- Proceed carefully when working near sharp edges and pointed corners.
- If in doubt wear protection gloves.

WARNING!

Danger of injury due to moving and rotating components!

Moving and rotating components can cause serious injuries.

- Correctly take the machine out of operation and secure against reactivation before adjusting the hinged motor.
- During the adjustment of the hinged motor do not touch or grasp any moving components.
- Wear close fitting protective clothing with a low tear resistance when in the hazardous area.

WARNING!

Shear and crushing danger due to moving parts!

Moving components can cause shear and crushing injuries.

- Do not grasp between any moving components when working on the hinged motor.
- Never enter the swivel range of the hinged motor.



MOUNTING



Typ / type

Delta Hybrid
Delta Blower Generation 5
Delta Screw Generation 5

- Only use the ratchet spanner and the original mounting material that were delivered to adjust the hinged motor!

- The hinged motor should not rest on the guide bushing when in the operating position.
Exception: Hinged motor support for motors with increased weight.

Otherwise the belts slip and wear out sooner.
Danger of property damage!

The hinged motor should also have sufficient space to place the guide bushing after the belt has stretched.

Design with acoustic hood

- After adjusting the hinged motor correctly close the acoustic hood.

MOUNTING

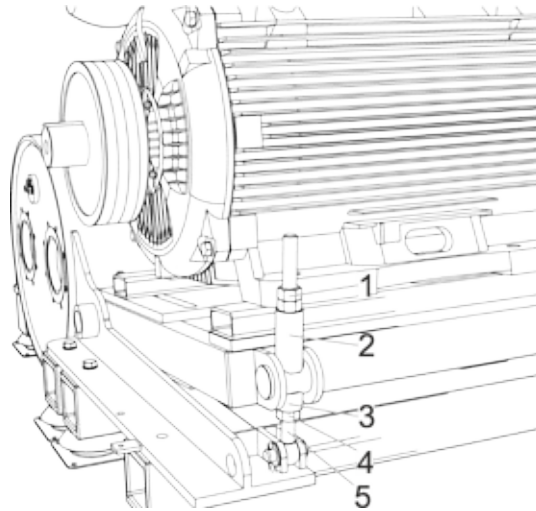


Typ / type

Delta Hybrid
Delta Blower Generation 5
Delta Screw Generation 5

3. Delivery condition

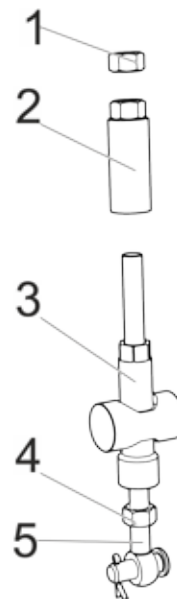
Factory delivery condition / without drive belts.



Fixed hinged motor / transportation lock

4. Assembly overview

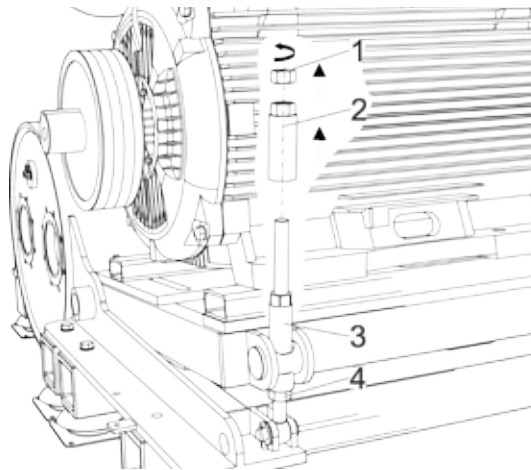
Pos.	designation
1	Locking nut 1
2	Locking sleeve
3	Guide bushing
4	Locking nut 2
5	Eyebolt



**Typ / type**

Delta Hybrid
Delta Blower Generation 5
Delta Screw Generation 5

5. Adjusting the hinged motor before commissioning



- Disassemble locking nut (1) and locking sleeve (2).

Check to direction of rotation

Observe the red direction of rotation label on the unit.
Briefly start the drive motor. (approx. 1 - 2 seconds)

Important: WITHOUT belt on the motor disc!

Incorrect direction will destroy the unit!

Direction of the drive motor and the unit must be the same.

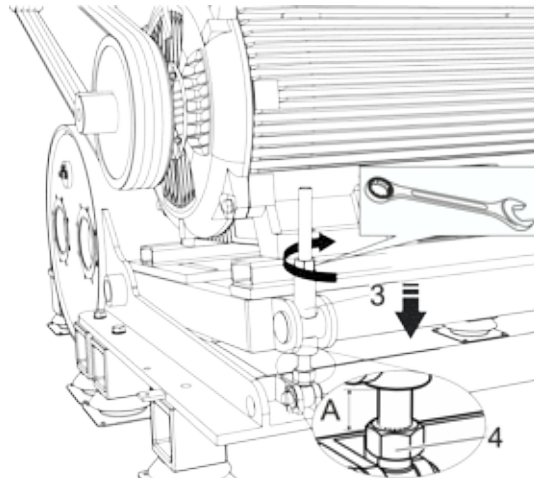
- Mount the belt.

MOUNTING



Typ / type

Delta Hybrid
Delta Blower Generation 5
Delta Screw Generation 5



Pre tension the belt

- Screw down the guide bushing (3) with the ratchet spanner.
- The hinged motor is still slightly on the guide bushing (3).

Adjust dimension A

- Adjust the locking nut (4) to dimension A.
- Turn the guide bushing (3) onto the locking nut (4) with the ratchet spanner.

Delta Blower

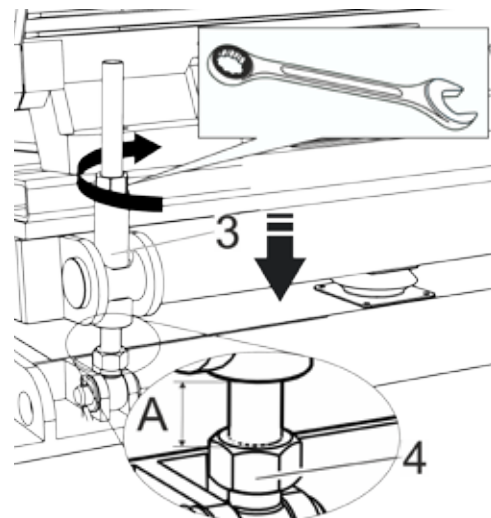
DN dimension A in mm

80	20
100	25
125	30
150	35
200	40
250	45
300	50

Delta Hybrid

DN dimensions A in mm

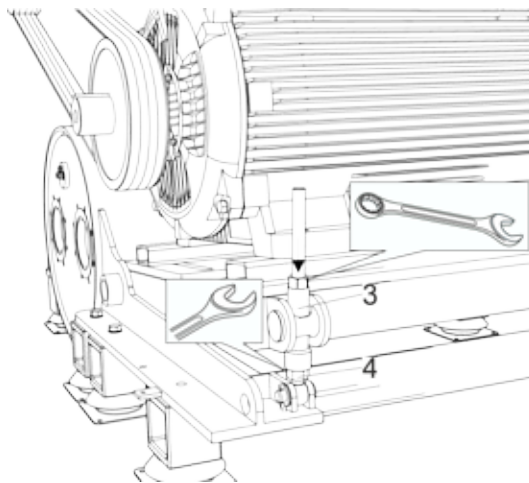
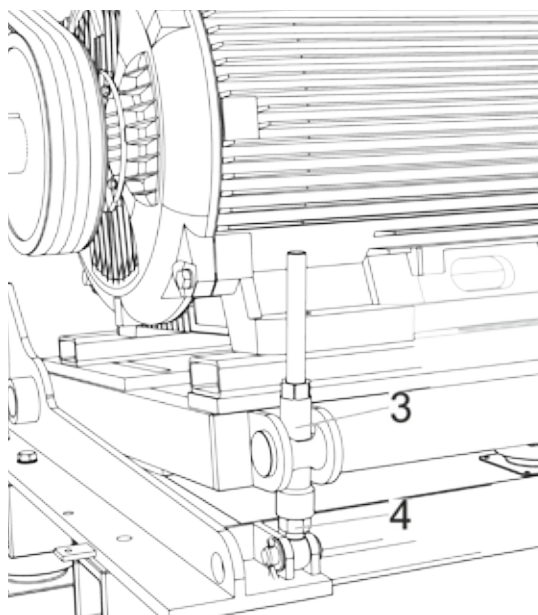
100	25
125	25
150	30
200	35
250	40
300	45



**Typ / type**

Delta Hybrid
Delta Blower Generation 5
Delta Screw Generation 5

- Lock the guide bushing (3) against the locking nut (4).
- The hinged motor is completely held into place by the belt drive.

**6. Operating condition, normal use**

**Typ / type**

Delta Hybrid
Delta Blower Generation 5
Delta Screw Generation 5

7. Adjustment of the hinged motor for truck, ship and earthquake preparation

Prepare the lifting device as with the standard application and set dimension A.

Rocker limit set to the upper position.

- Screw and tighten the locking sleeve (2) completely onto the eyebolt (5),
- Adjust the locking nut (1) to dimension B.

Delta Blower

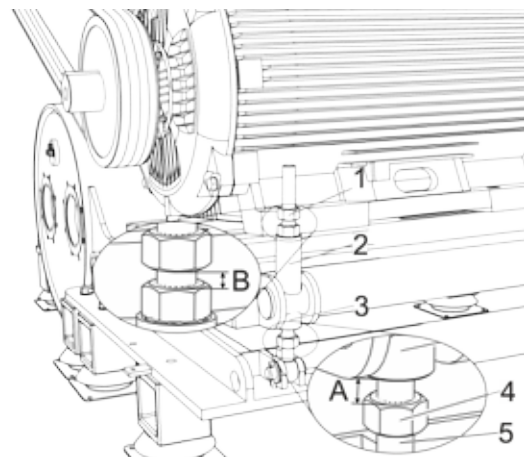
DN Size B in mm

80	5
100	5
125	5
150	10
200	10
250	10
300	10

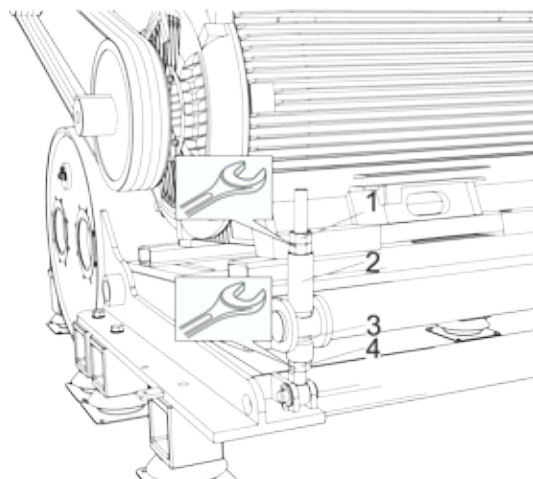
Delta Hybrid

DN Size B in mm

100	5
125	5
150	5
200	5
250	5
300	5



- Loosen the locking sleeve (2) turn upwards and lock with the locking nut (1).



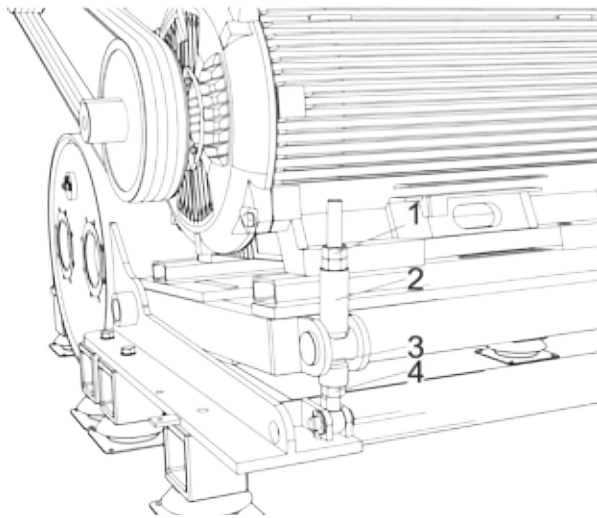
MOUNTING



Typ / type

Delta Hybrid
Delta Blower Generation 5
Delta Screw Generation 5

**8. Operating condition
Truck, ship and earthquake preparation**



**Typ / type**

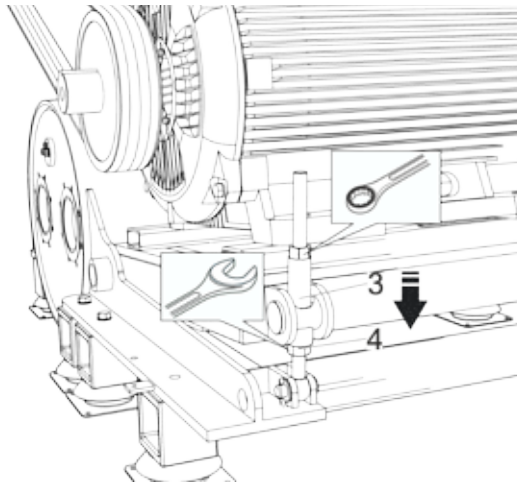
Delta Hybrid
Delta Blower Generation 5
Delta Screw Generation 5

9. Adjustment of the hinged motor for rocker support

Prepare the lifting device as with normal use.

Lower the hinged motor until the belt is tensioned.

- Check the belt tension.
- If the belt tension is incorrect, lock the guide bushing (3) and the locking nut (2).
- Check the belt tension after the following intervals and adjust if necessary:
after 24 op. hrs. after 500 op. hrs after 4000 op. hrs



**Typ / type**

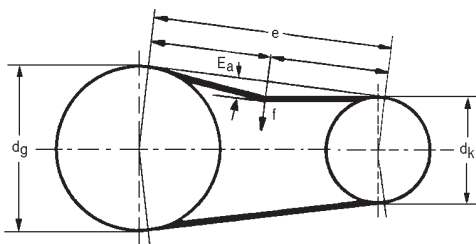
Delta Hybrid
Delta Blower Generation 5
Delta Screw Generation 5

Belt tensioning

1. Set the testing force via the profile type.
2. Determine the disc diameter **dk** on the drive and derive from this the indentation depth **E**.
3. Calculate the indentation depth **Ea** with the existing axial distance **e**.
4. The testing force **f** is to be asserted in the middle of the axial distance **e** on the drive belt. The testing force should be exerted vertically on the strand!
Pretension the drive to the calculated indentation depth **Ea**.

Pretension example: **Profile** = SPZ; **dk** = 100 mm; **e** = 380 mm;
f = 2.5 daN; **E** = 2.00 mm; **Ea** = 7.6 mm

The drive belts should be re-tensioned after 30 min. of operation and be checked if possible after 24 hours.



e = axial distance
E = indentation depth every 100 mm axial distance
 E_a = indentation depth of the strand
f = testing force

$$E_a = \frac{E \cdot e}{100}$$

Profile	Testing force f for each drive belt (daN)	Diameter d_k (mm)	indentation depth E (mm) each 100 mm Strand length with initial assembly	indentation depth E (mm) each 100 mm Strand length in operation after running in.
SPZ/3V XPZ/3VX	2.5	≥ 56 - 71	2.20	2.45
		> 71 - 90	1.95	2.20
		> 90 - 125	1.50	2.00
		> 125	1.20	1.70
SPA XPA	5.0	≥ 71 - 100	2.80	3.20
		> 100 - 140	2.50	2.85
		> 140 - 200	2.20	2.55
		> 200	2.15	2.40
SPB/5V XPB/5VX	7.5	≥ 112 - 160	2.40	3.00
		> 160 - 224	2.10	2.65
		> 224 - 355	1.70	2.22
		> 355	1.40	1.90
SPC XPC	12.5	≥ 180 - 250	2.30	2.65
		> 250 - 355	1.90	2.30
		> 355 - 560	1.65	1.90
		> 560	1.60	1.70



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**Aerzen im
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SECTION 3

G-5 Combination Base - Discharge Silencer

Description: Combination base - discharge silencer

Base/discharge silencer includes three-chamber reactive silencer built as a pressure vessel, blower mounting-flange with studs, discharge connection with integrated check valve, hinged motor plate, entirely supported on vibration isolating feet.

Materials of construction:

Silencer: Pressure vessel quality carbon steel S 235 JR (St 37-2) equivalent to ASTM A 283 Grade B
Pressure vessel code: PED (European directive) PED – AD 2000, DGRL 97/23/EG with consideration given to static and dynamic stress (fatigue resistance)

Maximum operating data: 150 °C (300 °F) and 1.1 bar gauge (16 psig)

Test pressure: 1.9 bar gauge (27.5 psig)

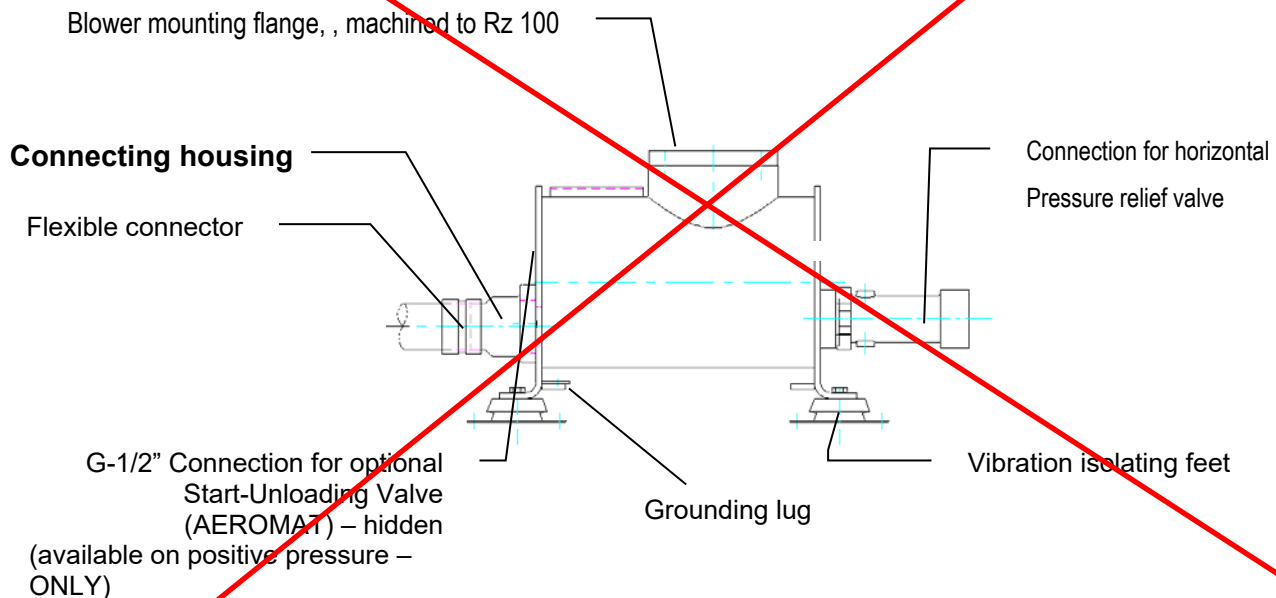
Shell wall thickness: depending on size: 6mm (1/4") for DN-50 → 15mm (5/8") for DN-300

Performance:

Pulsations in the air stream are reduced below the API 619 standard of 2% peak-to-peak of the mean line pressure.

Pressure drop of the entire Base-Silencer with connecting housing and check valve, at the maximum allowable flow: 35 mbar (0.5 psi); included in the power calculations of the Delta Blower package

~~Combination Base - Discharge Silencer DN50~~



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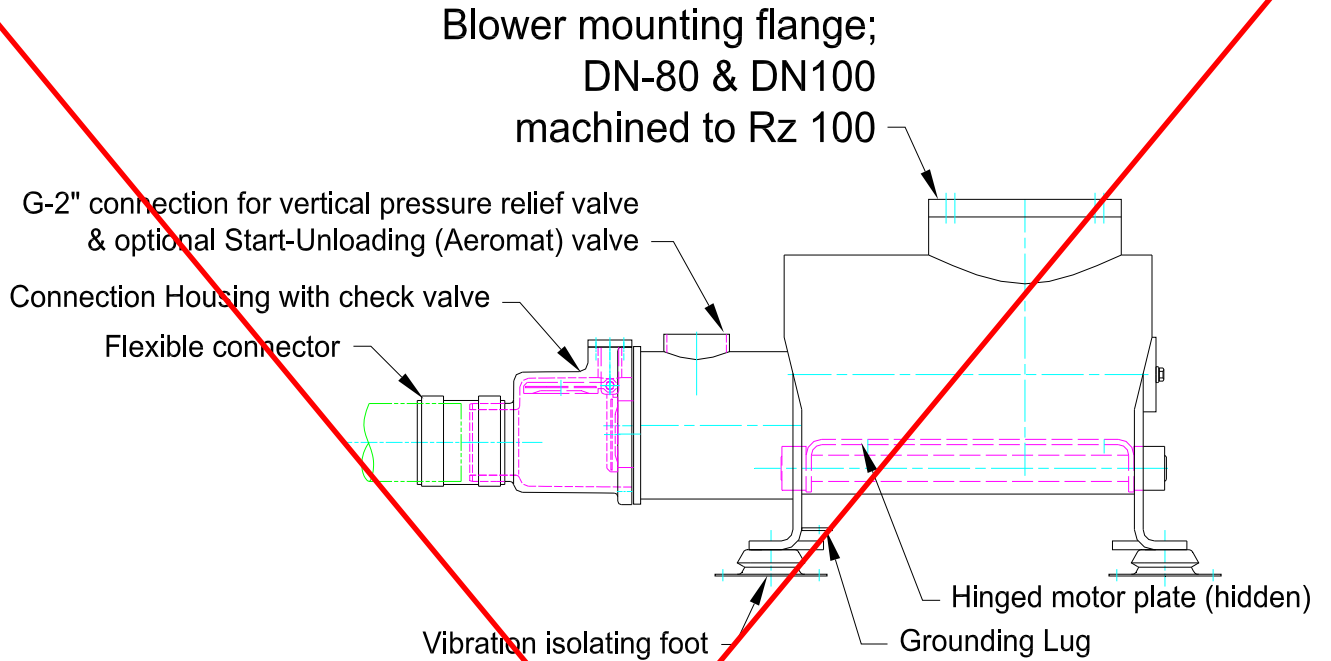
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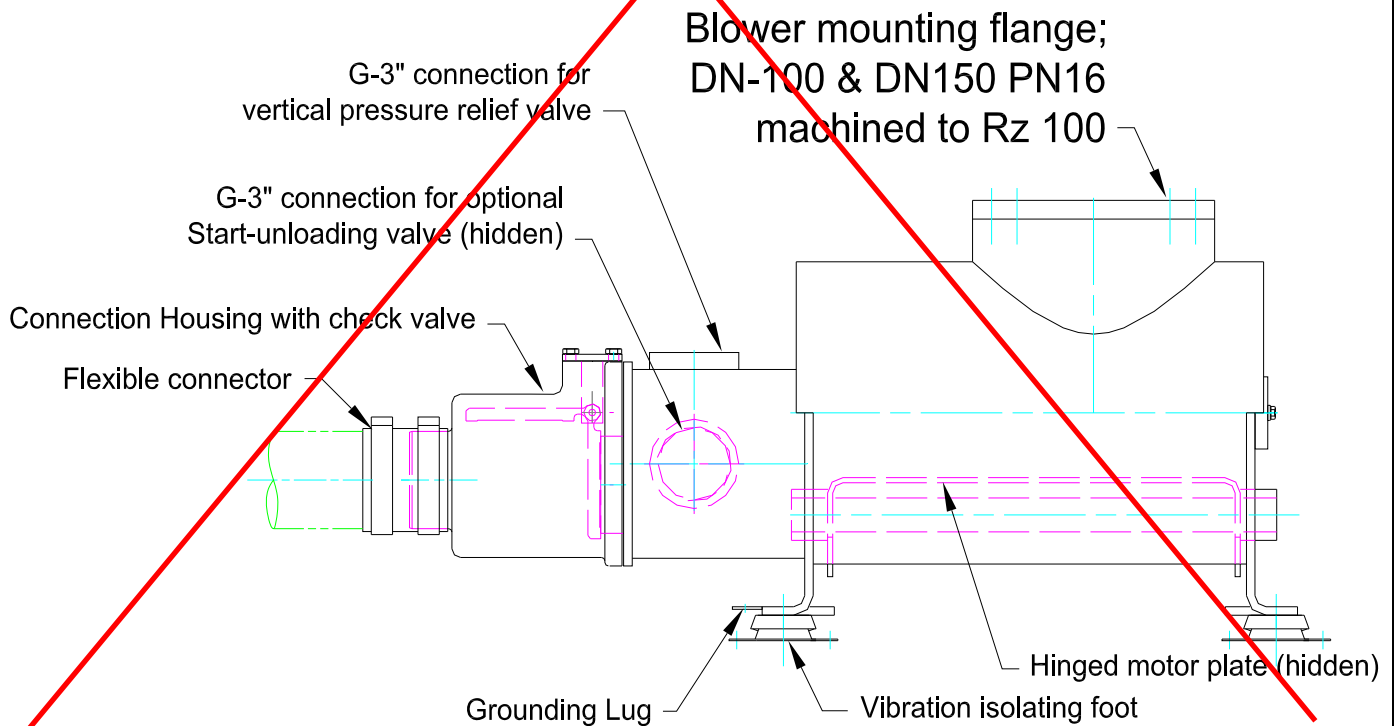
Combination Base Frame – Silencer Delta Blower Generation 5

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Combination Base - Discharge Silencer DN80



Combination Base - Discharge Silencer DN100/125



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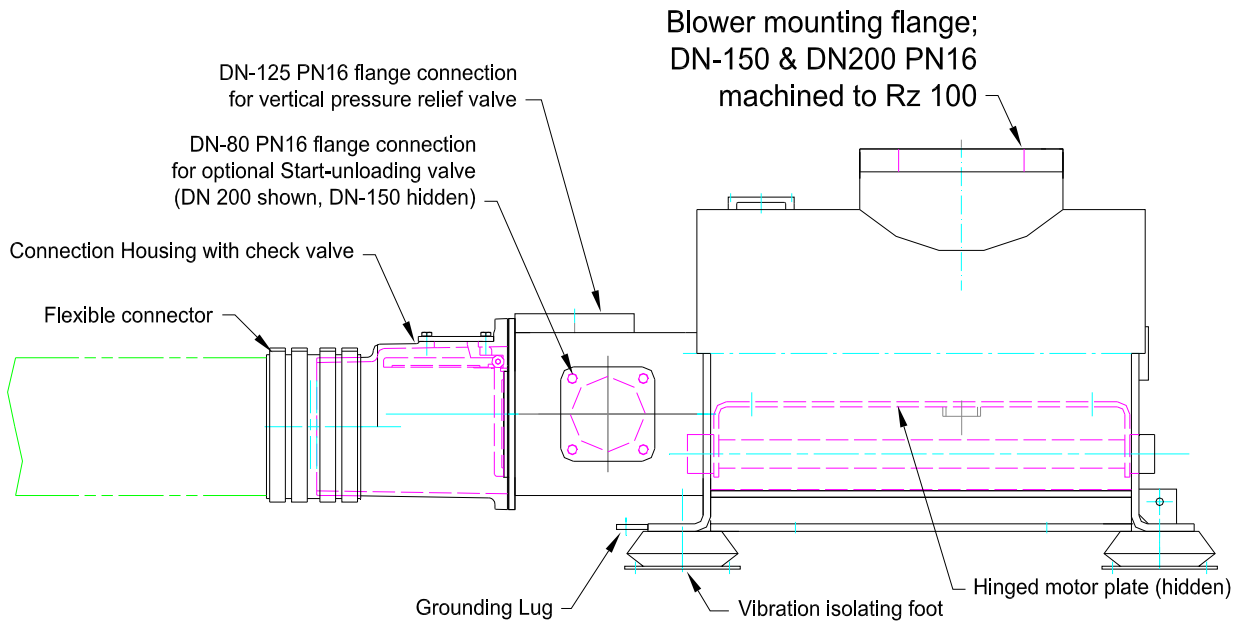
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Combination Base Frame - Silencer Delta Blower Generation 5

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Combination Base - Discharge Silencer DN150 & DN-200



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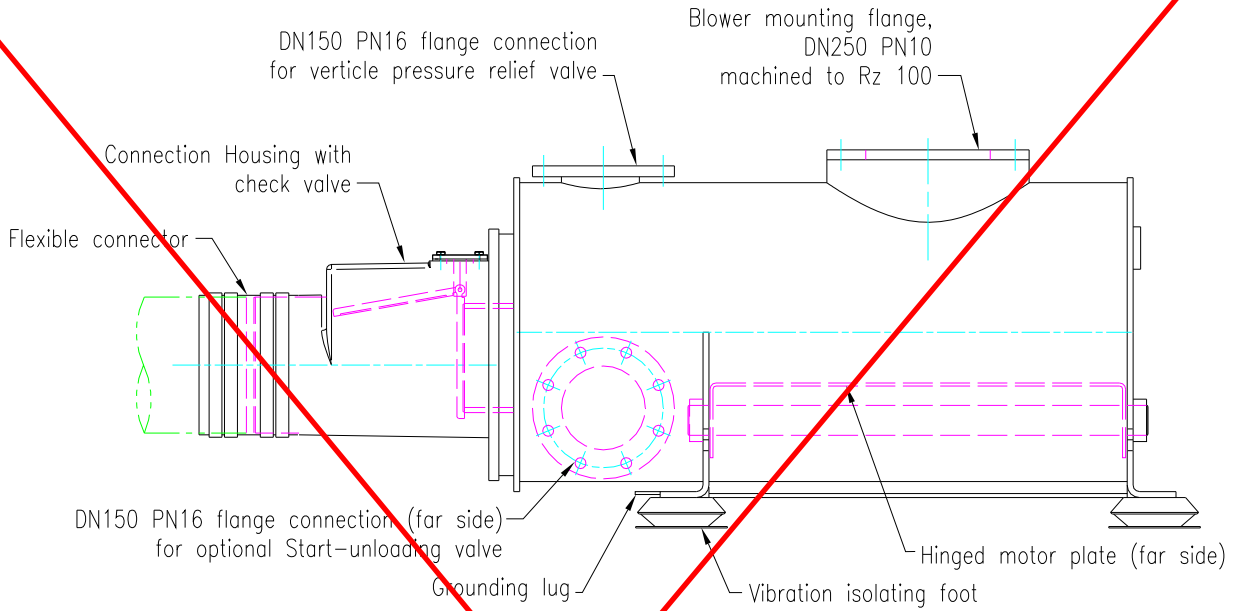
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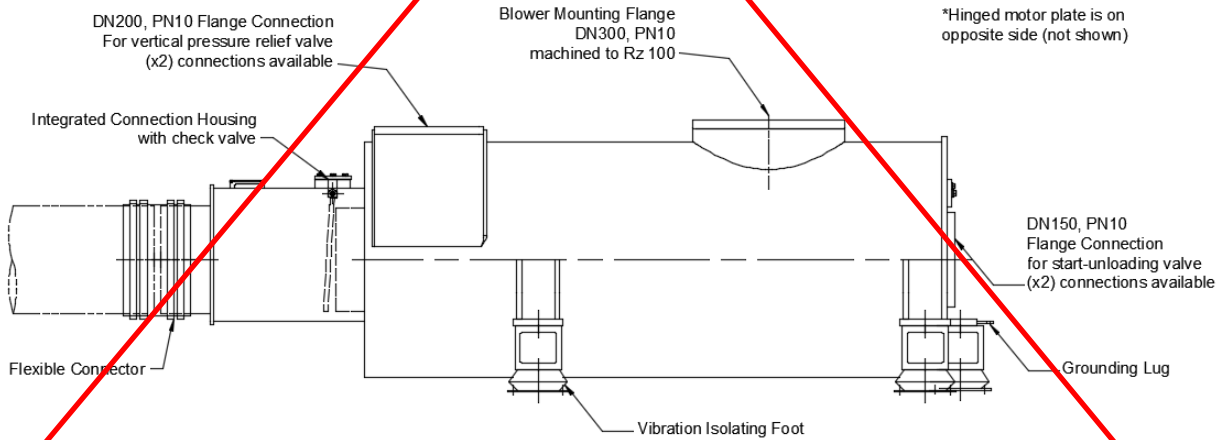
Combination Base Frame – Silencer Delta Blower Generation 5

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Combination Base-Discharge Silencer DN-250



Combination Base-Discharge Silencer DN-300



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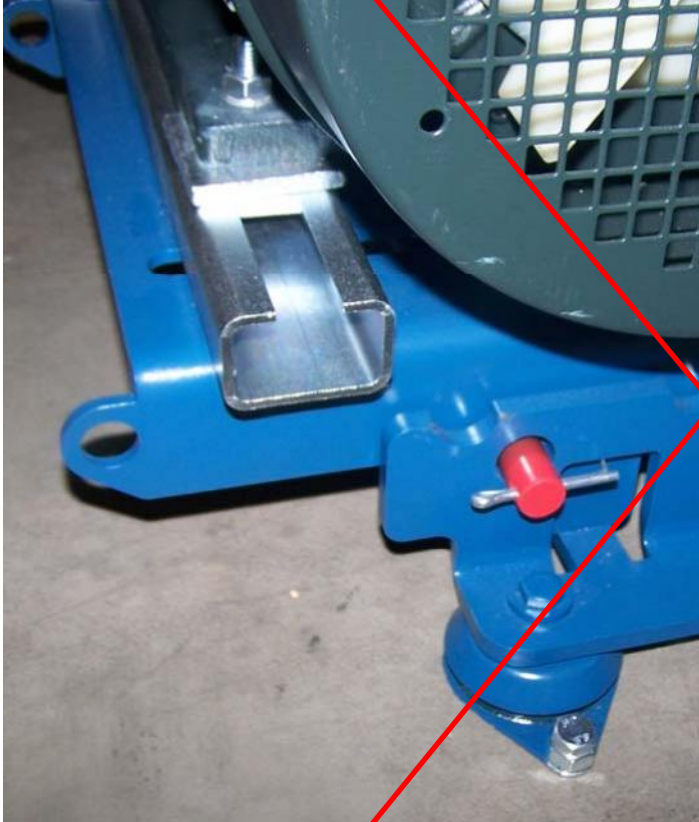
Combination Base Frame – Silencer Delta Blower Generation 5

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Combination Base - Discharge Silencer

Hinged Motor Plate DN50 –DN80

The hinged motor plate of the base frame in sizes DN50 and DN80 allows the motor mass to properly tension the drive belts during normal operation. The motor is mounted and aligned before leaving the factory. The hinged motor plate is then locked in place for shipment. (see photo on the left below) Remove the red locking bar and use the Aerzen supplied bracket and hydraulic jack to raise the hinged motor plate for installation or maintenance of the drive belts. (see photo on the right below) Refer to the Operations Manual for commissioning and maintenance of the blower.



Hinge Plate with Locking Pin on Arrival

The red locking pin serves to keep the motor swing plate stable during shipping. Remove before attempting to raise the motor hinge plate.



Raising the Hinged Motor Plate

Use the Aerzen supplied bracket and jack to raise the hinged motor plate when installing or maintaining the belts.



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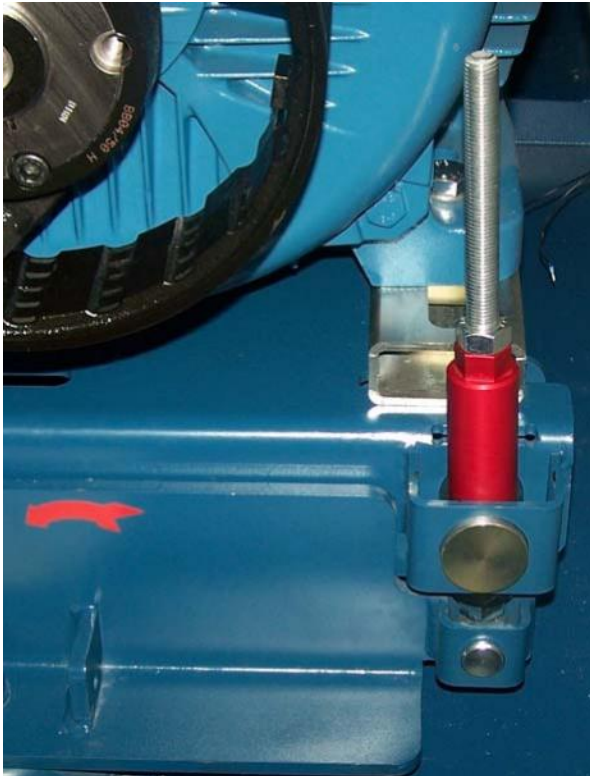
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Combination Base Frame – Silencer Delta Blower Generation 5

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Combination Base - Discharge Silencer Hinged Motor Plate DN100 –DN300

The hinged motor plate for sizes DN100 through DN250 features a multipurpose lifting device. In its most basic function it serves as shipping locking device (red part) preventing the motor from unwanted movement. It also serves as the lifting mechanism (black part) for changing the drive belts. During normal operation the motor mass tensions the drive belts in the tried and true Aerzen way. The motor swing plate does not rest on the lifting mechanism (see photo on the right below). No special adjustments are necessary during normal operation of the blower package. Another additional purpose is limiting the belt tension when oversized motors are used. Finally, the device can be configured to aid limited movement for seismic or mobile blower package service. Refer to G4-079 B XT for operation of Multipurpose Lifting Device. Depending on motor weight, DN300 units can have (1) or (2) lifting devices.



Lifting Device on Arrival

The red locking sleeve serves to keep the motor swing plate stable during shipping. It may also be used in seismic and mobile applications as a motor swing stop



Lifting Device in Normal Operation

The black guide bushing serves as a belt installation aid. Using an Aerzen supplied ratchet wrench, it helps lift the motor swing plate during belt installation and maintenance. Once new belts are installed it is backed down to the lock nut. **The motor hinge plate does not rest on the guide bushing during normal operation.** The guide bushing may also be used as tension limiter for use with overweight motors.



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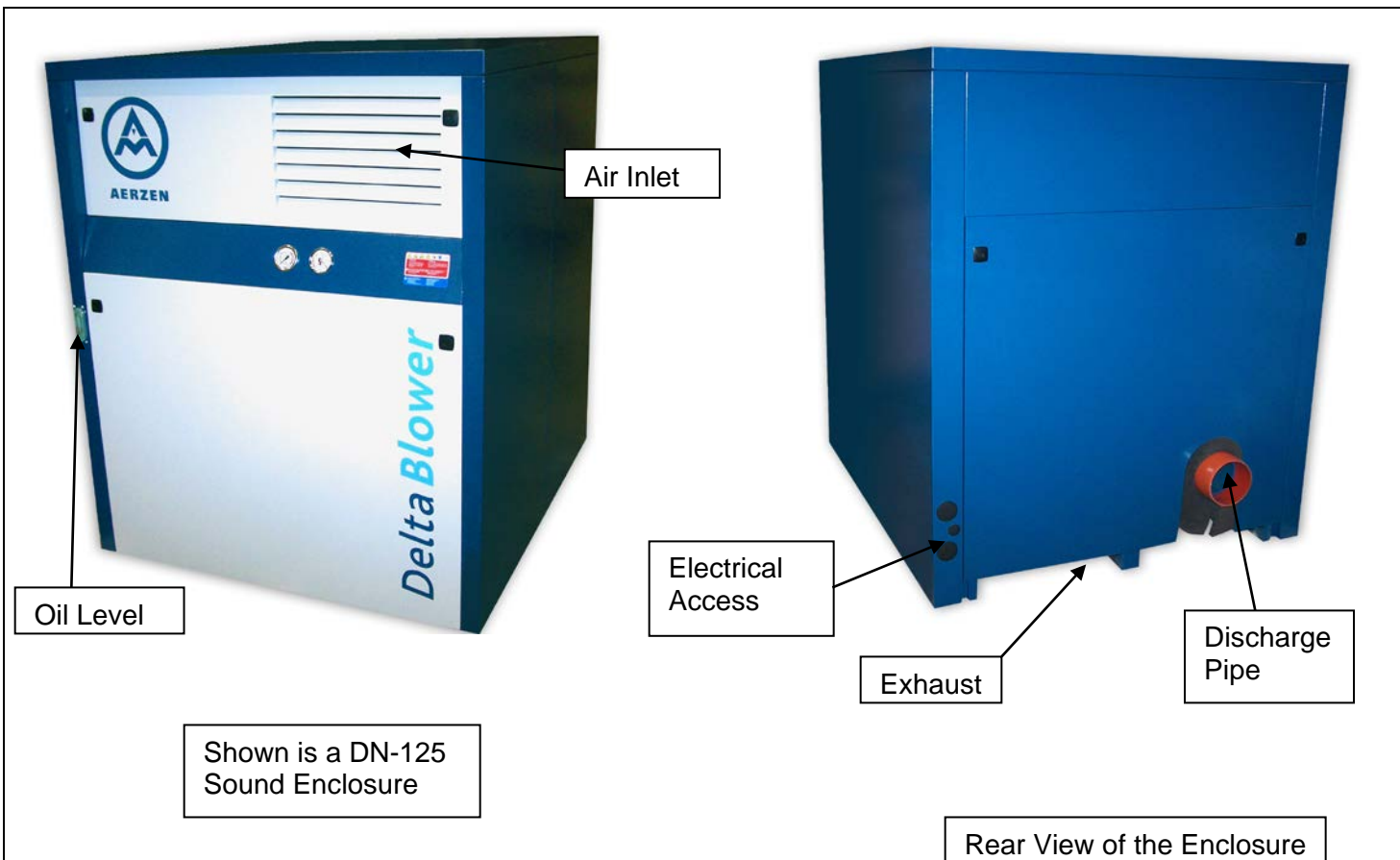
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Combination Base Frame – Silencer Delta Blower Generation 5

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Description: The sound enclosure surrounds the entire blower package to reduce noise and protect the machine from the weather while allowing easy access for maintenance. The base of the enclosure supports the entire blower package and contains an oil drip pan for environmental protection. Aerzen mounts the entire blower package within the sound enclosure at the factory prior to shipment. Transportation and installation are simplified by having the entire package supported and contained within the enclosure. The unit may be moved with a pallet jack or forklift.

The sound enclosure is designed with strategic consideration for airflow through the unit. A fan is mounted on the end of the blower shaft, so there is no need for a separate electric motor driven fan. From the cool, front side of the blower, air is drawn in through a sound trap. The air then passes over the motor and blower housings and finally is exhausted through the floor at the rear of the unit.

Quick release panels, each less than 45 lbs., provide access for routine maintenance of the blower and the package components. All maintenance and connections are located in the front and rear, allowing multiple machines to be placed side-by-side.

The oil level gauge is visible from the outside of the sound enclosure in sizes GM 4S DN-80 through GM 150 S DN-300 with the oil fill port and drain mounted to the enclosure just inside a removable panel.



The smallest size, GM 3S DN-50, has an easily removable roof to facilitate maintenance.

Materials:

Base pan – Polyester based powder coated steel weldment, 3 to 5 mm thick

Exterior panels - Polyester based powder coated galvanized steel

Sound insulation -Self-extinguishing, non-dripping high-density polyester foam

Technical:

Package noise level reduced to 80 dB, or less, at 1 m, free field, per DIN 45635.

Snow Load – 122 kg / m² (25 lbs / ft²)

Wind Load – 80.4 km / hr (50 mph)

Suitable for indoor or outdoor installation

Part Numbers:

Size	Part No.
DN-050	180723
DN-080	180724
DN-100	180725
DN-125	
DN-150	180740
DN-200	180741
DN-250	181753
DN-300	184737



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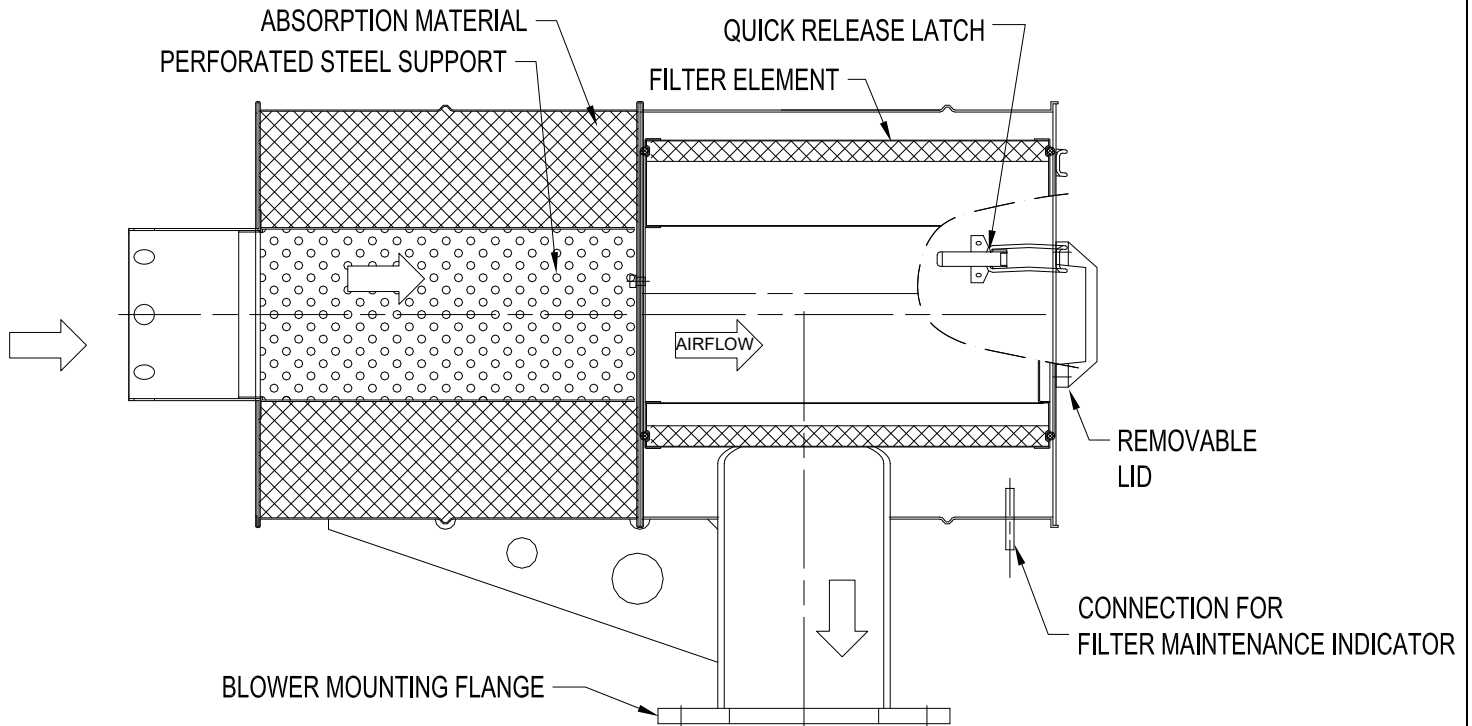
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**DELTA Blower – Generation 5
Sound Enclosure, DN50 to DN300**

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G5 Pressure Inlet Filter/ Silencer DN 50 - DN 300



Description: Combination dry air intake filter and absorption type silencer with filter (or strainer) element located downstream from the silencer chamber

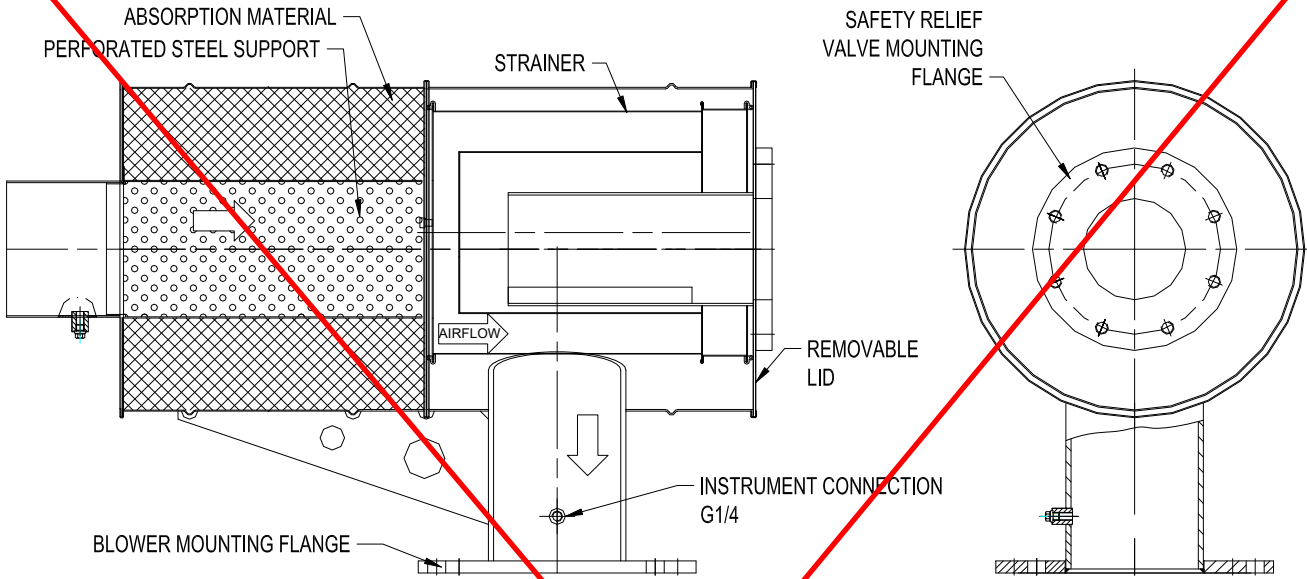
Materials of construction:

- Casing:** Powder coated (RAL# 5001) Carbon Steel
 Maximum operating data: 60 °C (140 °F) and – 70 mbar (-2.07"Hg)
 Removable maintenance lid is held in place with quick release clamps
- Absorption material:** Flame retardant, polyester based urethane foam, grey in color, secured in place with perforated steel
- Filter element:** Thermally bound, food safe, polyester fibers, free of PVC, white in color
 Filter element mounts with a quick release turn and lock arrangement.

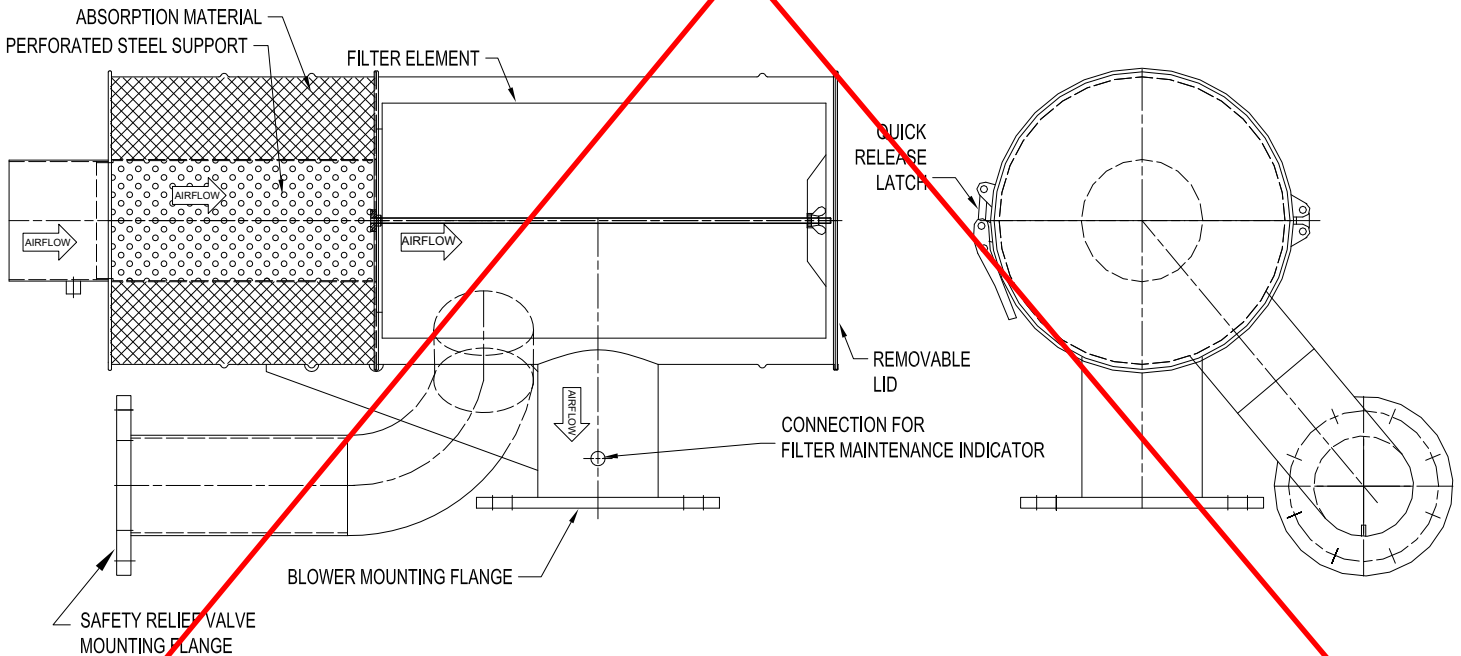
Performance:

- Filtration class: G4 per EN 779 (greater than 90% of synthetic dust particles), equivalent to ASHRAE 52.2 MERV 7 (50-70% @3-10 microns)
- Pressure-drop of the entire silencer and clean filter at the maximum allowable flow: 10 mbar (0.15 psi)
- Pressure drop filter element: 5 mbar (2" WC) clean, or replace at 45 mbar max. (18" WC)
- Noise reduction: 10-15 dB mean noise reduction across audible octave bands

G5 Vacuum Inlet Silencer w/ Internal Strainer (No Filter)
DN 80 - DN 200



G5 Vacuum Inlet Filter/ Silencer
DN 80 - DN 200



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**Delta Blower Generation 5
 Inlet Silencer DN-50 to DN-300**

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G5-WA Inlet Silencer Part Numbers

Filter nominal size	DN-50	DN-80		DN-100	DN-125	DN-150		DN-200	DN-250	DN-300
Blower size	GM 3S	GM 4S GM 7L	GM 10S	GM 10S GM 15L	GM 25S	GM 30L GM 35S	GM 50L	GM 50L GM 60S	GM 80L GM 90S GM 100S	GM 130L/ GM 150S
Pressure Filter / Silencer Assembly	182111	182112	182113	182114	182115	182116	182117		183114	184444/ 184443
Pressure Replacement Filter Element	2000049284	2000049285		2000049286		2000049287	2000049288		2000049289	2000049289 (x2)
Vacuum Inlet Silencer Assembly (No Filter)	182119	182120	182121	182122	182123	182124		182125	N/A	
Vacuum Filter / Silencer Assembly	N/A	184238001	184239001	184234001	184235001	186234000		184252001	N/A	
Vacuum Replacement Filter Element	N/A	2000008104		2000008109		185662		2000008113	N/A	

G5 (Original) Inlet Silencer Part Numbers

Filter nominal size	DN-50	DN-80		DN-100	DN-125	DN-150		DN-200	DN-250	DN-300
Blower size	GM 3S	GM 4S GM 7L	GM 10S	GM 10S GM 15L	GM 25S	GM 30L GM 35S	GM 50L	GM 50L GM 60S	GM 80L GM 90S GM 100S	GM 130L GM 150S
Filter / Silencer Assembly	175018	178810	173924	173882	173883	174143	173925		176294	N/A
Replacement Filter Element	2000049284	2000049285		2000049286		2000049287	2000049288		2000049289	2000049289 (x2)



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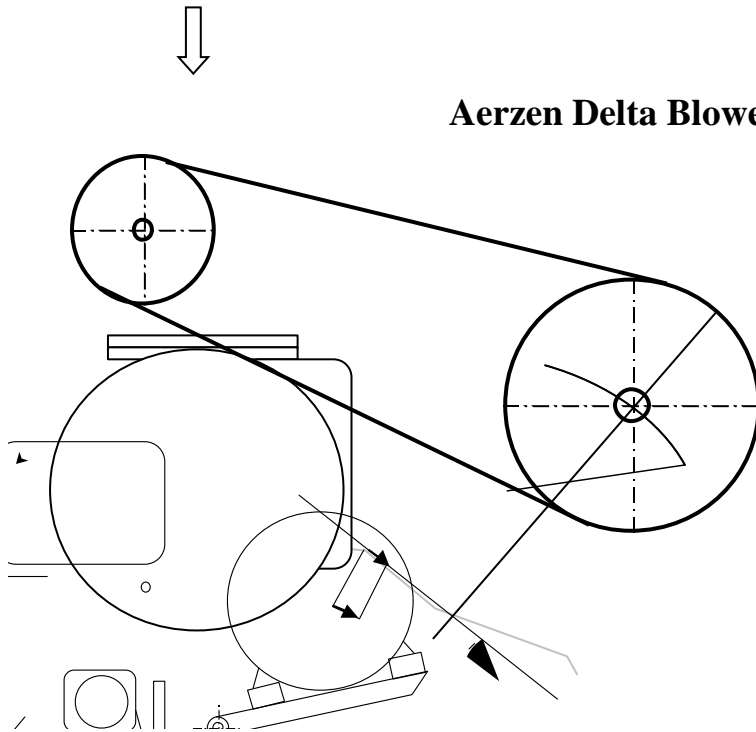
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Delta Blower Generation 5 Inlet Silencer DN-50 to DN-300

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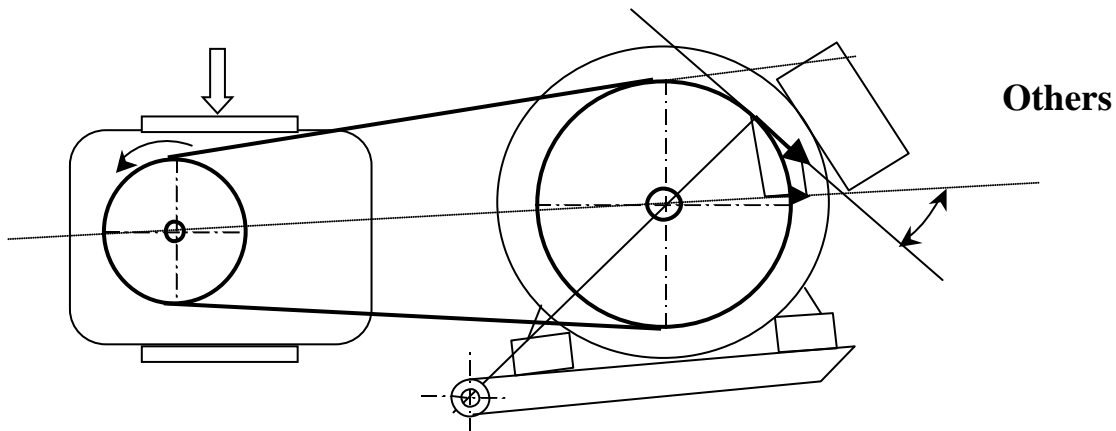
Aerzen Delta Blower + G5



The drive configuration of the Aerzen Delta Blower is such that any change in the belt length (due to belt stretching) results in a nearly proportional displacement of the motor. Therefore, the motor weight alone can be used reliably for automatic belt tension adjustment.

This, however, is not achievable with a different geometry, such as shown below: In such cases, a slight change in the belt length requires a much greater displacement of the motor making a manual adjustment necessary. Improper adjustment leads to belt failure and other, more significant damages can follow.

Our belt tensioning principle offer two more benefits to the user, which are superior to any other system offered: We do not need any other tensioning mechanisms to tension the belts. This eliminates further wear and tear items that the user does not have to maintain or even check up on. Secondly, we have eliminated the need for re-aligning the motor upon changing belts. The motor stays put and is merely pivoted up and down during a belt change.



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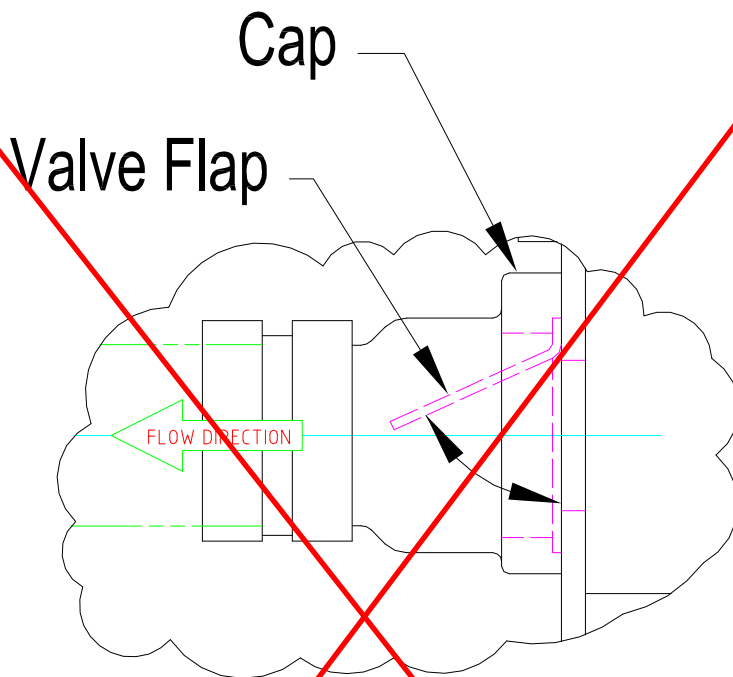
V-Belt Tensioning Principle - Delta Blower

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DN-50 Check Valve

Description: The DN-50 check valve is a full-bore, cast aluminum housing with an embedded Viton flap sandwiched between the connection housing and the baseframe. The hinge is integrated to the rubber and closes naturally by gravity without use of a spring. Operating range is up to 150°C or 302°F.

Check Valve Assembly w/ Viton flap P/N: **146756**



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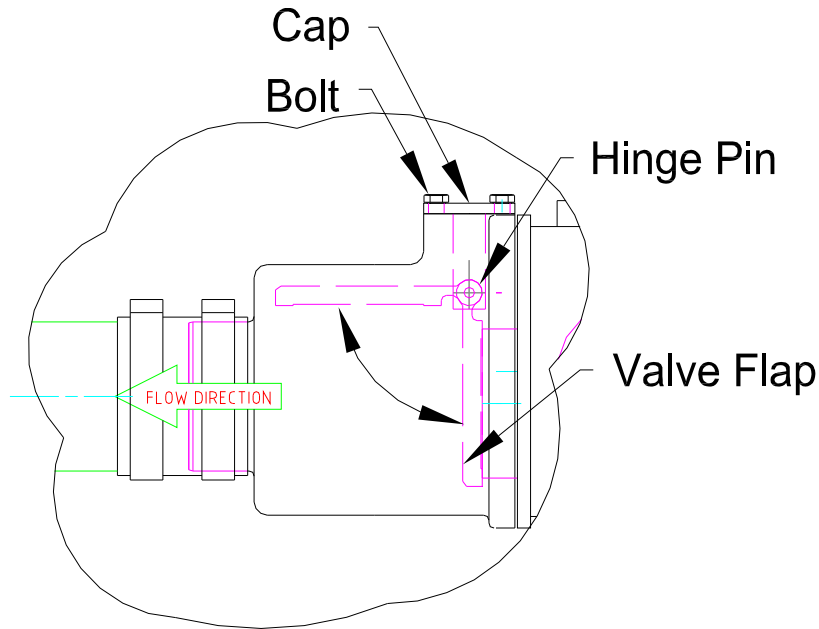
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Delta Blower Generation 5 – Check Valve

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Check Valve - DN-80 Through DN-300

Description: Housed in the connecting housing is a full-bore, steel embedded in rubber check-valve that closes naturally by gravity without use of spring. The check-valve flap can easily be pulled out for inspection, maintenance or replacement without disconnecting the piping: removing the bolts and lifting the cap.



Materials of construction:

Temperature	Flap Sealing Material
Up to 149 °C (300 °F)	EPDM (standard)*
Up to 200 °C (392 °F)	Silicon*

*DN-250 & DN-300 units: Stainless steel plate with outer ring made of the sealing material

**DN-200 and smaller units: Steel plate fully embedded in the sealing material

Part Numbers:

Size DN	EPDM Check Valve Assembly P/N	EPDM Flap Only P/N	Silicone Check Valve Assembly P/N	Silicone Flap Only P/N
80	178653	178647	180877	N/A
100	178654	178648	180878	178651
125	178654	178648	180878	178651
150	178655	178649	180879	178652
200	178655	178649	180879	178652
250	168705	N/A	168711	N/A
300	158608	N/A	178266	N/A



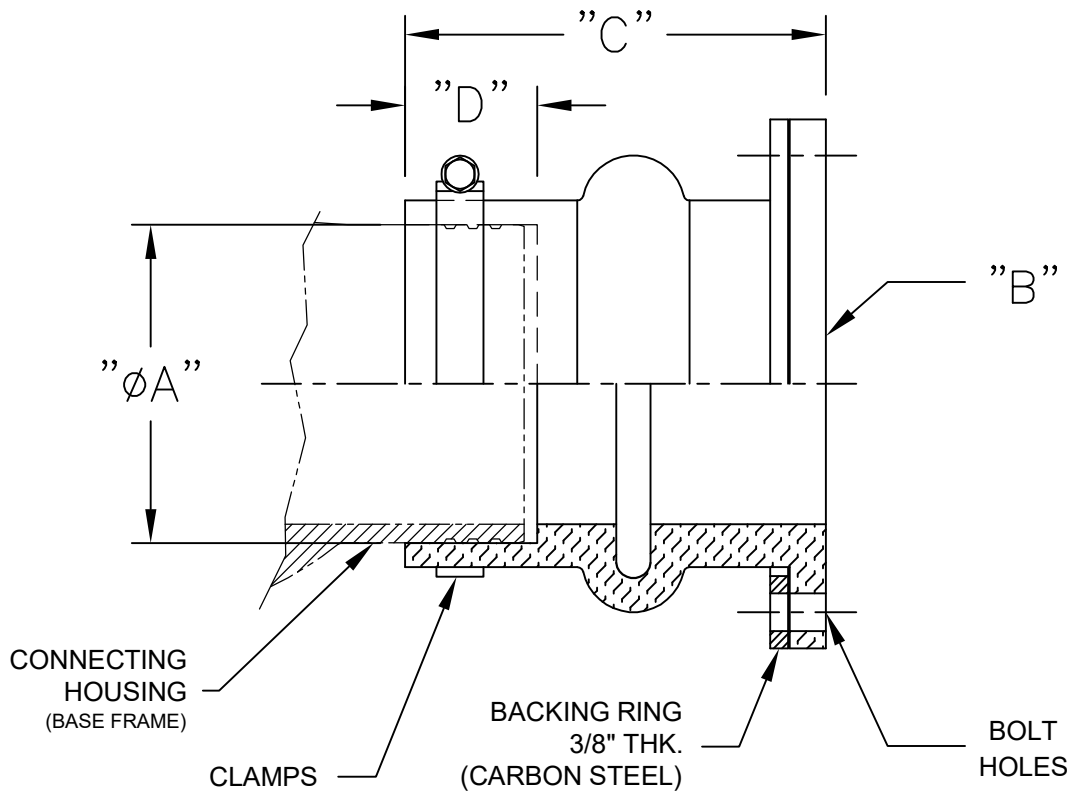
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Delta Blower Generation 5 – Check Valve

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MEDIA BEING CONVEYED = AIR OR NITROGEN

BACKING RING INCLUDED WITH JOINT

MATERIALS OF CONSTRUCTION: EPDM

MATERIAL	MAX. TEMP.	DESIGN PRESSURE
EPDM	300°F	-15 ⁿ Hg to 25 psig

PACKAGE SIZE	Ø A (Sleeve ID)	B (150# ANSI Flange size)	C (Length)	D (Pipe Engagement)	PART No. 21-003168-_____	EXPANSION JOINT SPECIFICATIONS				CLAMPS	
					MATERIAL EPDM	AXIAL COMPRESSION	AXIAL EXTENSION	LATERAL OFFSET	ANGULAR ROTATION	QTY	PART No. 21-000910-_____
DN-050	2 ³ / ₈	2	8.00	2.31	-02X02EG	0.50	0.25	0.50	2°	1	_079-085
DN-080	3 ¹ / ₂	3	8.00	2.31	-03X03EG	0.50	0.25	0.50	2°	1	_104-112
DN-080	3 ¹ / ₂	4	8.00	2.31	-03X04EG	0.50	0.25	0.50	2°	1	_104-112
DN-100	4 ¹ / ₂	4	8.00	2.31	-04X04EG	0.50	0.25	0.50	2°	1	_130-140
DN-125	5 ⁹ / ₁₆	5	9.00	2.5	-05X05EG	0.50	0.25	0.50	2°	2	_150-162
DN-125	5 ¹ / ₂	5	9.00	2.5	-05X05EG-A1	0.50	0.25	0.50	2°	2	_150-162
DN-125	5 ⁹ / ₁₆	6	9.00	2.5	-05X06EG	0.50	0.25	0.50	2°	2	_150-162
DN-125	5 ¹ / ₂	6	9.00	2.5	-05X06EG-A1	0.50	0.25	0.50	2°	2	_150-162
DN-150	6 ⁵ / ₈	6	9.00	2.5	-06X06EG	0.50	0.25	0.50	2°	2	_187-200
DN-150	6 ⁵ / ₈	8	10.00	2.5	-06X08EG	0.50	0.25	0.50	2°	2	_187-200
DN-200	8 ⁵ / ₈	8	10.00	2.75	-08X08EG	0.75	0.25	0.50	2°	2	117191 (AMD)
DN-200	8 ⁵ / ₈	10	10.00	2.75	-08X10EG	0.75	0.25	0.50	2°	2	117191 (AMD)
DN-250	10 ³ / ₄	10	10.00	2.75	-10X10EG	0.75	0.25	0.50	2°	2	_290-305
DN-250	10 ³ / ₄	12	10.00	2.75	-10X12EG	0.75	0.25	0.50	2°	2	_290-305
DN-300	12 ³ / ₄	12	10.00	2.75	-12X12EG	0.75	0.25	0.50	2°	2	160404000

* Dimension in INCHES



Aerzen USA Corp.

108 Independence Way, Coatesville PA, 19320
 (610) 380-0244 PH, (610) 380-0278 FX
 www.aerzenusa.com

EPDM EXPANSION JOINT WITH CLAMPS
 PIPE SLEEVE TO ANSI FLANGE

DATE
7/29/2013

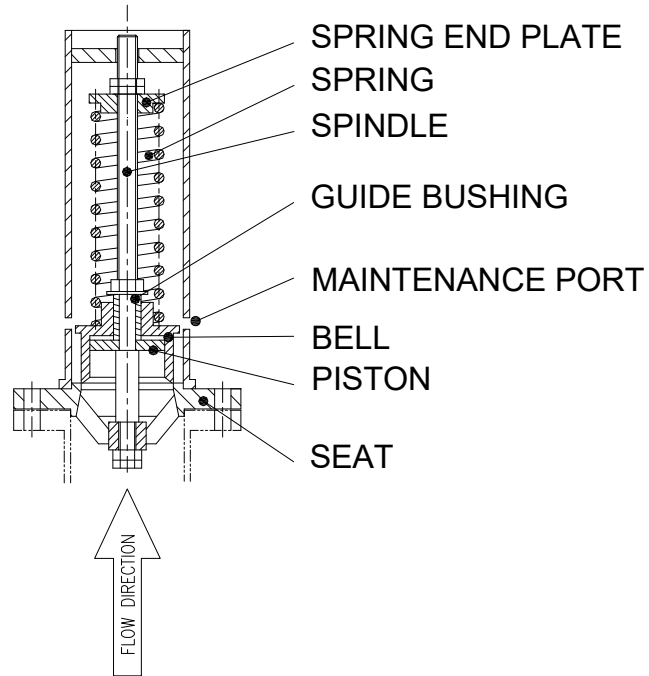
DOCUMENT NO.
XA-005207_EG

REVISION
B

SHEET
1 of 1

Description:

The Pressure Relief Valve is designed for use with air or inert gases to protect the blower and its accessories from damage in the event of excessive pressure. It is not to be used as a pressure regulating device. It contains a spring-loaded valve guided by a spindle and surrounded by a protective sheath that is capable of venting the entire volume flow of the blower. In positive pressure machines, it is installed downstream from the positive displacement blower and before the check valve or any shut-off valve. In vacuum applications, it is installed on the intake side of the blower.



QTY	DESCRIPTION	MATERIAL
1	Connection Flange or Thread with Valve Seat	Grey Cast Iron
1	Valve Spindle	Carbon Steel
1	Bell	Brass
1	Spring End Plate	Carbon Steel
2	Hex Nut	Carbon Steel

QTY	DESCRIPTION	MATERIAL
2	Guide Nut	Carbon Steel
1	Spring	Spring Steel
1	Valve Disc / Piston	Brass
1	Valve Guide / Bushing	Brass
1	Cover	Aluminum

Technical Data:

Maximum Temperature: 150° C (302° F)
 Conforms to PED 97 / 23 / EG
 Maximum Pressure: 1.1 Bar (15.9 PSIG)
 Valve Characteristic: Proportional
 Pressure Rise: 10%



Aerzen USA Corporation

108 Independence Way – Coatesville, PA 19320

Tel: (610) 380-0244 Fax: (610) 380-0278

www.aerzen.com/en-us

G5 Blower – Pressure Relief Valve

Date	Doc #	Page
10/28/2020	B-6-0238 revision "D"	1 of 2

Relief Valves

Nominal Package Size	Blower Designation	Valve Size	Positive Pressure Valve Connection	Vacuum Valve Connection
DN-50	GM 3S	DN -50	G-2" External	DN-50 PN 16 Flange
DN-80	GM 4S			
	GM 7L			
	GM 10S			
DN-100	GM 10S	DN-80	G-3" External	DN-80 PN 16 Flange
DN-125	GM 15L			
	GM 25S			
DN-150	GM 30L	DN-125	DN-125, PN16 Flange	DN-125, PN16 Flange
	GM 35S			
	GM 50L			
DN-200	GM 50L			
	GM 60S			
DN-250	GM 80L			
	GM 90S			
	GM100S			
DN-300	GM 130L	DN-150	DN-150, PN16 Flange	DN-150, PN16 Flange
	GM 150S			

Maintenance:

Periodically inspect for free movement of the valve. While the machine is stopped and the motor locked out, insert flat blade screw drivers into both maintenance ports and lift the valve. Remove the screw drivers and visibly ensure the valve is properly seated. When operated in clean environments, inspect valve either every six months or 1000 run hours, whichever occurs sooner. In dusty conditions, inspect every month. Refer to document G4-002 for complete operating instructions.



Aerzen USA Corporation

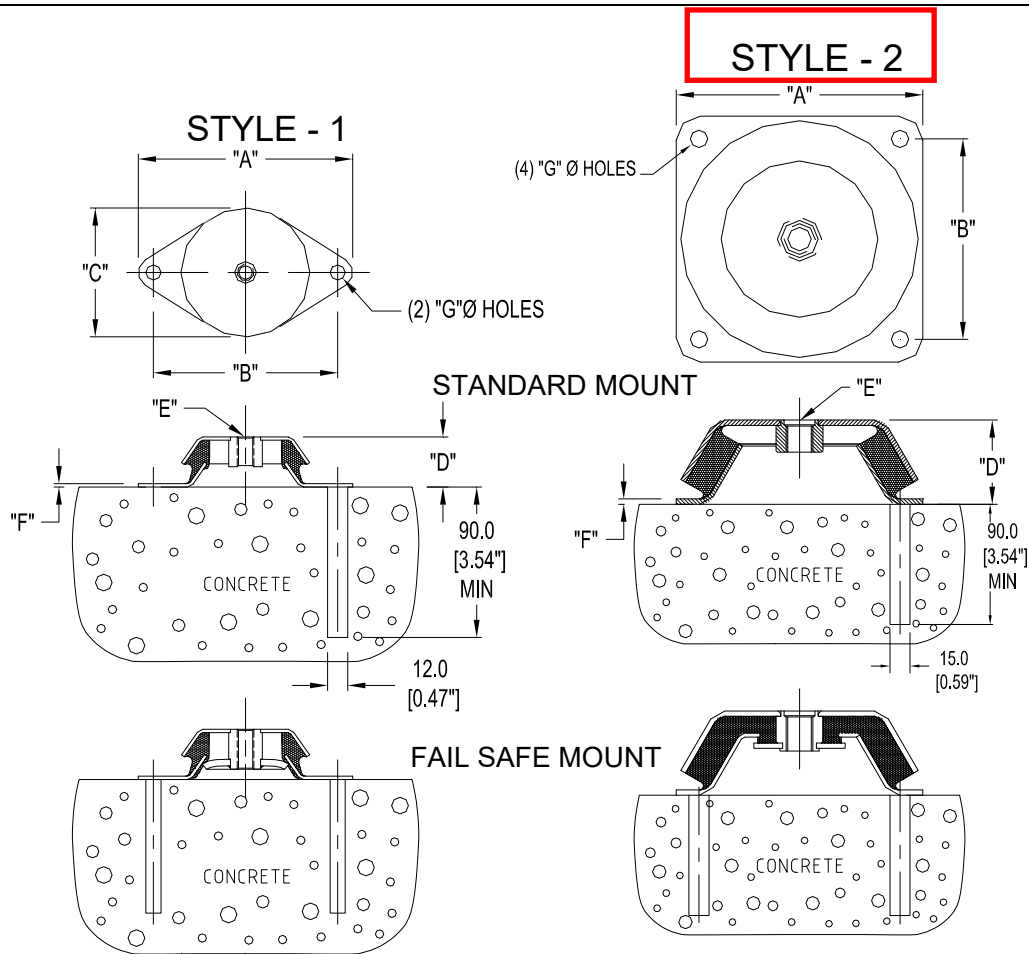
108 Independence Way – Coatesville, PA 19320

Tel: (610) 380-0244 Fax: (610) 380-0278

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G5 Blower – Pressure Relief Valve

Date	Doc #	Page
10/28/2020	B-6-0238 revison "D"	2 of 2



Only (1) anchor per foot is required for Standard mounts, anchor each hole ("G") for Fail-safe mounts.

Standard mounts are not recommended for use where negative loads occur, (marine or earthquake zones) use Fail-safe mounts or contact Aerzen for alternates.

All vibrations isolators have a natural frequency that will not interfere with the fundamental blower package frequencies.

Baseframe	Standard P/N	Fail Safe P/N	Style	A (mm)	B (mm)	C (mm)	D (mm)	E	F (mm)	G (mm)	Maximum Load Per Foot		Recommended Anchor Aerzen P/N
											KN	Lbf	
DN-50	134818	184818	1	127	110	77	30	M10	2	9	1,4	315	200053552
DN-80	176394	184819	1	127	110	77	30	M10	2	9	2	450	200053552
DN-100													
DN-125													
DN-150	177128	184820	2	168	132	-	50	M16	4	13	4	899	120835000
DN-200	184821	184821	2	184	150	-	60	M20	4.5	13	9	2023	120835000
DN-250			2	184	150	-	60	M20	4.5	13	9	2023	120835000
DN-300			2	184	150	-	60	M20	4.5	13	9	2023	120835000



Aerzen USA Corporation

108 Independence Way – Coatesville, PA 19320

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Vibration Isolators – G5 Blowers

Date

9/5/2019

Doc #

B-6-0194 revision "K"

Page

Page 1 of 1



A-T Controls, Inc.



Manual and Automated Resilient Seated Butterfly Valves



Featuring the KE Series actuator for electric automation on butterfly valves up to 4"



ES Series: Wafer and Lug Style, Class 150 Resilient Seated Butterfly Valves | pg 2

AS Series: Lined Butterfly Valves | pg 14

NS Series: NSF/ANSI 61 & 372 Certified and Dead-End Service Butterfly Valves | pg 20



Canada Registration Numbers (CRN)



VALVE NSF/ANSI 61 ALSO CERTIFIED TO NSF/ANSI 372 <SDZU>



Featuring **TRIAO** CONTROLS Actuators and Accessories

Series ES General Purpose

Manual and Automated Butterfly Valves
Lug or Wafer body ANSI 125/150 flanges

- Bi-directional, bubble tight shutoff for full pressure differential
- Cartridge rubber seat design
- ASTM A395 DI & A351 CF8M body materials
- Multiple seat and disc materials available
- Square stems and ISO 5211 mounting pad for direct mounting
- Cover a wide range of industries from General Purpose to Chemical, Food and Beverage, Pulp and Paper, Waste Water applications and more.

STANDARDS

DESIGN	API 609, ASME B16.34, ASME B16.42, MSS SP-67
PRESSURE TESTING	API 598
END CONNECTION	ASME B16.5 Class 150, EN1092-2, PN 10/16, JIS B2220 10K, ASME B16.47 Series A Class 150
FACE TO FACE	API 609 (EN558-1 for sizes not provided in API 609)
MOUNTING	ISO 5211
MATERIAL CERTIFICATION	EN 10204-3.1 MTR
QUALITY ASSURANCE	ISO 9001:2015
MARKINGS	API 609, ASME B16.34, MSS SP-25

CERTIFICATIONS

CANADA REGISTRATION	CRN OC22405.5
ABS TYPE APPROVAL	



Page Reference: ES Series Resilient Butterfly Valves

Page 2.....Product Details and Standards

Page 3-5.....Bill of Materials 1-1/2"-14", 16"-24", and 28"-48"

Page 6-7.....Cv Values, Operating Torques and Pressure & Temperature Ratings

Page 8-9.....Dimensions 1-1/2"-48"

Page 10.....Automated Pneumatic ES Series Sizing

Page 11.....Automated Electric ES Series Sizing

Page 12.....Handles and Gear Operator Sizing

Page 13.....How To Order: ES Series Part Number Matrix

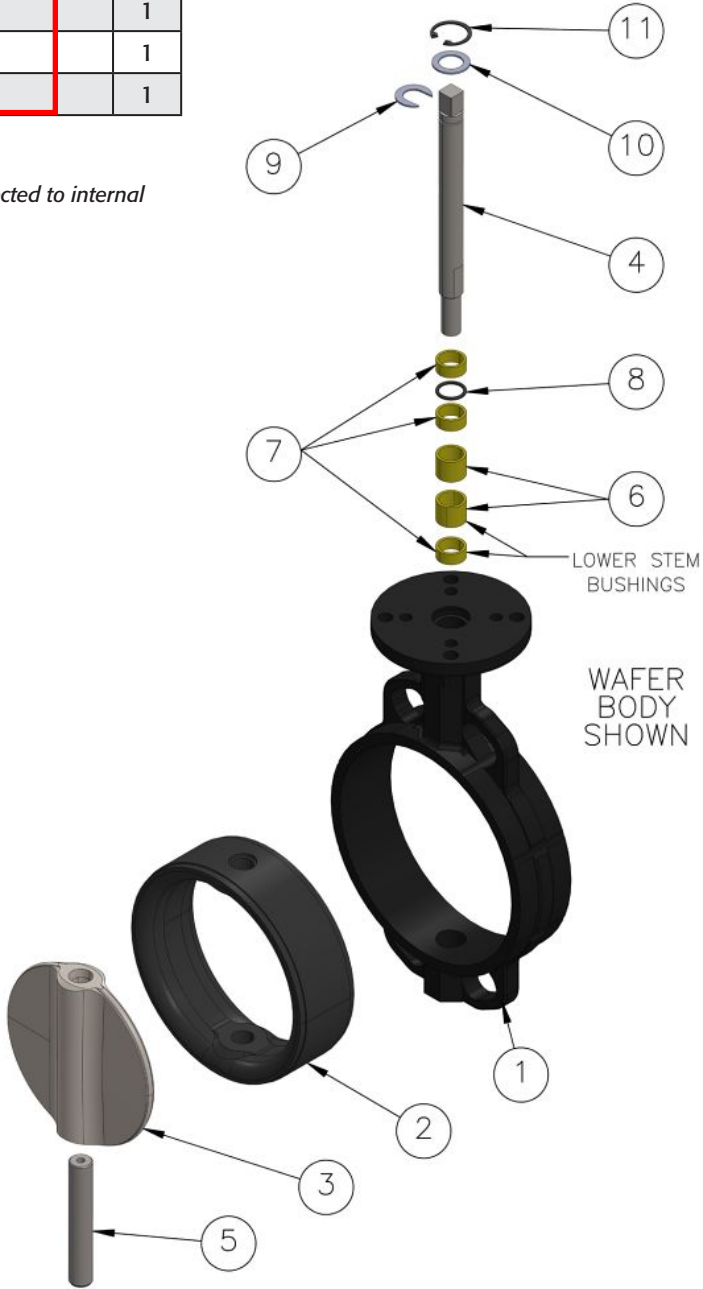
Bill of Materials (1-1/2"-14")

ITEM	DESCRIPTION	MATERIAL	QTY.
1	Body	ASTM A395 / A351 CF8M	1
2	Seat	EPDM / Buna-N / (FKM / Viton®) / PTFE over EPDM / White Food Grade EPDM (up to 12" only)	1
3	Disc	A351 CF8M / Nylon Coated DI / Aluminum Bronze / Nickel Plated DI	1
4	Upper Stem*	ASTM A276 431 / 17-4 PH®	1
5	Lower Stem*	ASTM A276 431 / 17-4 PH®	1
6	Long Bushing	FRP #	2
7	Short Bushing	FRP #	3**
8	O-Ring	Buna-N #	1
9	Stem Retainer	ASTM A276 304	1
10	Thrust Washer	ASTM A276 304	1
11	Snap Ring	SK7 Steel	1

* 1-1/2"-3" valves have a one-piece stem.

**1-1/2" & 10" valves only have qty 2 (not in lower stem area).

Under normal operation, the O-Ring and bushings are not subjected to internal media & pressure.



Series ES RESILIENT SEATED BUTTERFLY

ES Series Bill of Materials 16"-24"

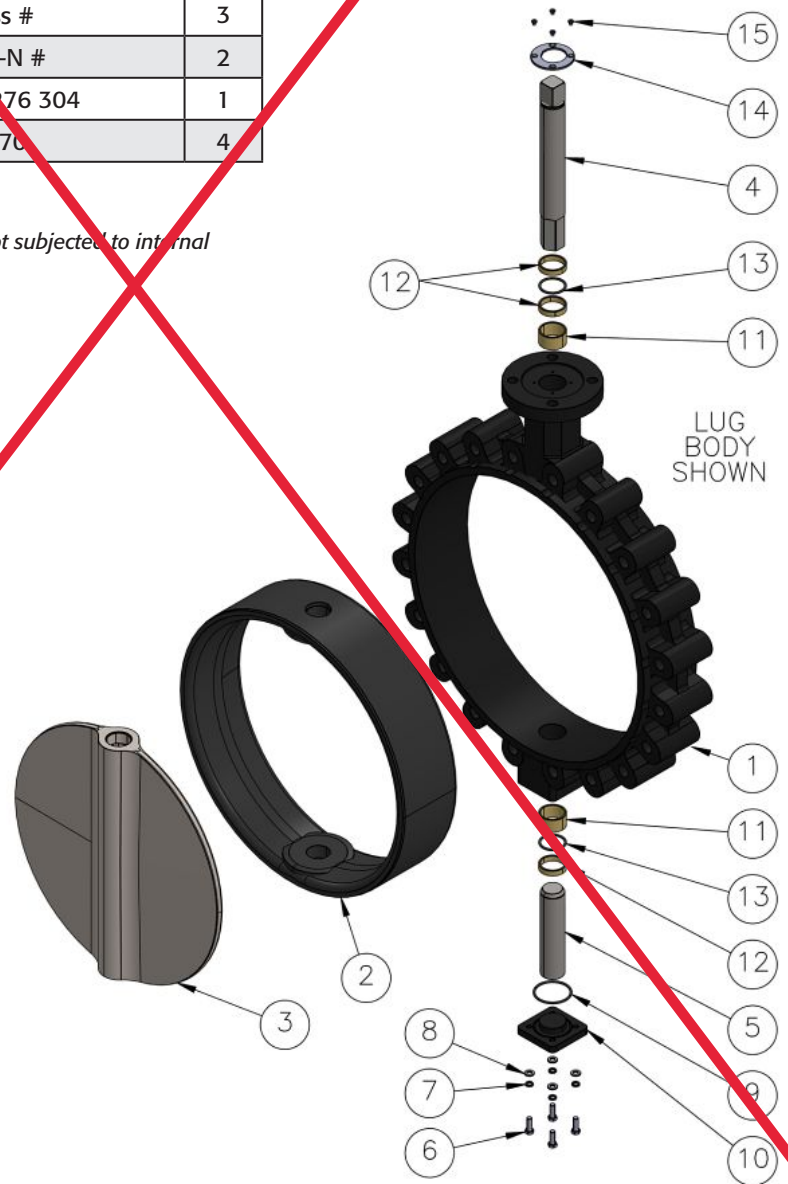
Bill of Materials (16"-24")

ITEM	DESCRIPTION	MATERIAL	QTY.
1	Body	ASTM A395 / A351 CF8M	1
2	Seat	EPDM / Buna-N / (FKM / Viton®) / PTFE over EPDM	1
3	Disc	A351 CF8M / Nylon Coated DI / Aluminum Bronze / Nickel Plated DI	1
4	Upper Stem	ASTM A276 431 / 17-4 PH®	1
5	Lower Stem	ASTM A276 431 / 17-4 PH®	1
6	Bottom Cover Bolt	A2-70	2/4*
7	Bottom Cover Lock Washer	ASTM A276 304	2/4*
8	Bottom Cover Flat Washer	ASTM A276 304	2/4*
9	Bottom Cover O-Ring	Buna-N #	1
10	Bottom Cover	ASTM A395 / A351 CF8M	1
11	Long Bushing	Brass #	2
12	Short Bushing	Brass #	3
13	O-Ring	Buna-N #	2
14	Stem Retainer	ASTM A276 304	1
15	Stem Retainer Bolt	A2-70	4

* Wafer: 16"-18" - qty 2, 20"-24" - qty 4.

* Lug: 16"-24" - qty 4.

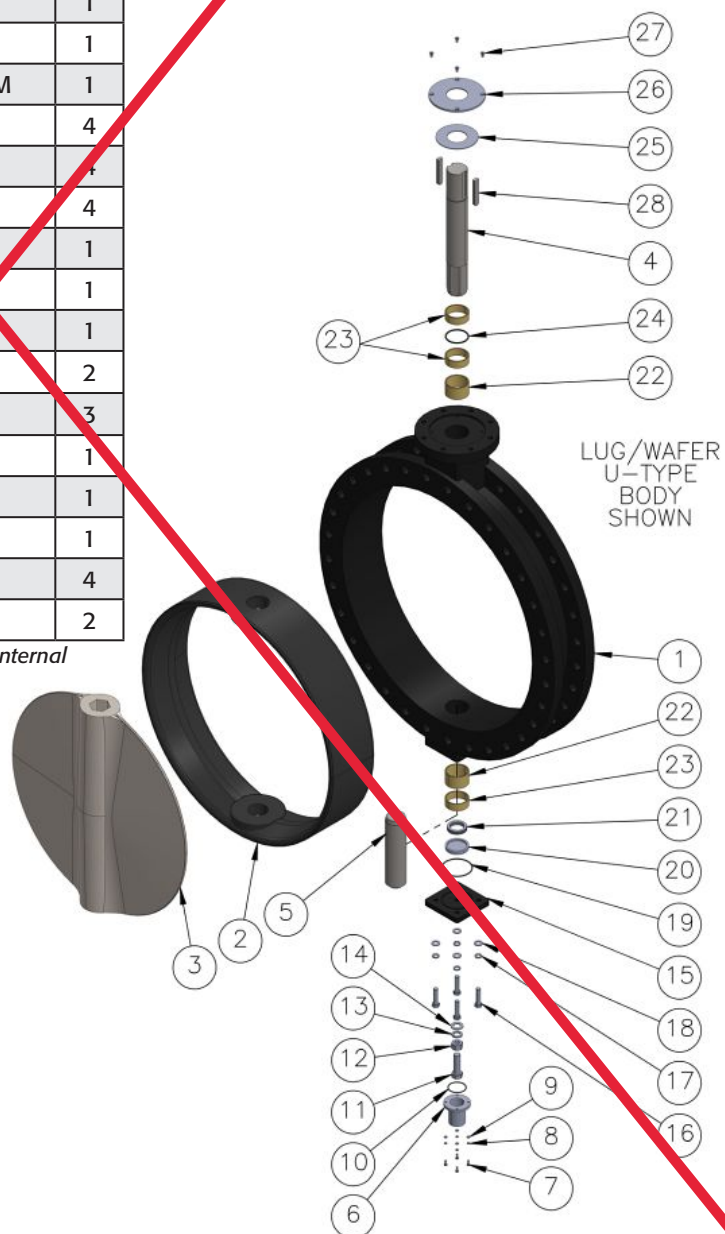
Under normal operation, the O-Ring and bushings are not subjected to internal media & pressure.



Bill of Materials (28"-48")

ITEM	DESCRIPTION	MATERIAL	QTY.
1	Body	ASTM A395 / A351 CF8M	1
2	Seat	EPDM / Buna-N / (FKM / Viton®)	1
3	Disc	A351 CF8M / Nylon Coated DI / Aluminum Bronze / Nickel Plated DI	1
4	Upper Stem	ASTM A276 431 / 17-4 PH®	1
5	Lower Stem	ASTM A276 431 / 17-4 PH®	1
6	Adjust Bolt Cap	ASTM A276 304	1
7	Adjust Bolt Cap Bolt	A2-70	4
8	Adjust Bolt Cap Lock Washer	ASTM A276 304	4
9	Adjust Bolt Cap Flat Washer	ASTM A276 304	4
10	Adjust Bolt Cap O-Ring	Buna-N #	1
11	Adjust Bolt	A2-70	1
12	Adjust Bolt Nut	A2-70	1
13	Adjust Bolt Lock Washer	ASTM A276 304	1
14	Adjust Bolt Flat Washer	ASTM A276 304	1
15	Bottom Cover	ASTM A395 / A351 CF8M	1
16	Bottom Cover Bolt	A2-70	4
17	Bottom Cover Lock Washer	ASTM A276 304	4
18	Bottom Cover Flat Washer	ASTM A276 304	4
19	Bottom Cover O-Ring	Buna-N #	1
20	Adjust Bearing Housing	ASTM A276 304	1
21	Thrust Bearing	ASTM A295 E52100	1
22	Long Bushing	Brass #	2
23	Short Bushing	Brass #	3
24	O-Ring	Buna-N #	1
25	Stem Retainer	ASTM A276 304	1
26	Gland	ASTM A276 304	1
27	Gland Bolt	A2-70	4
28	Key	ASTM A29 1045	2

Under normal operation, the O-Ring and bushings are not subjected to internal media & pressure.



Series ES RESILIENT SEATED BUTTERFLY

ES Series Butterfly Valve Cv Values (US-GPM @ 1 Δ P) - Rated Flow Coefficients

Disc Angle

Valve Size	10°	20°	30°	40°	50°	60°	70°	80°	90°
1-1/2"	0.05	3	7	11	19	29	44	57	70
2"	0.1	5	12	24	45	64	90	125	135
2-1/2"	1	8	20	37	65	98	144	204	220
3"	2	12	22	39	70	116	183	275	302
4"	3	17	36	78	139	230	364	546	600
5"	5	29	61	133	237	392	620	930	1,022
6"	8	45	95	205	366	605	958	1,437	1,579
8"	13	89	188	408	727	1,202	1,903	2,854	3,136
10"	21	151	320	694	1,237	2,047	3,240	4,859	5,340
12"	30	234	495	1,072	1,911	3,162	5,005	7,507	8,250
14"	40	338	715	1,549	2,761	4,568	7,230	10,844	11,917
16"	50	464	983	2,130	3,797	6,282	9,942	14,913	16,388
18"	72	615	1,302	2,822	5,028	8,320	13,168	19,752	21,705
20"	86	971	1,674	3,628	6,465	10,698	16,931	25,396	27,908
24"	256	1,222	2,587	5,605	9,989	16,528	26,157	39,236	43,116
28"	289	1,633	3,522	7,630	12,599	20,036	30,482	46,899	58,696
30"	325	2,086	4,559	8,415	13,159	20,289	31,250	44,520	65,150
32"	365	2,387	4,791	8,736	13,786	20,613	31,395	48,117	68,250
36"	450	3,021	6,063	11,055	17,449	26,086	39,731	60,895	86,375
40"	512	4,183	8,395	15,307	24,159	36,166	55,084	84,425	119,750
48"	598	4,651	10,365	17,010	27,242	43,853	70,431	108,968	132,888
F _L	0.79	0.81	0.79	0.79	0.75	0.71	0.66	0.6	0.53
x _T	0.5	0.53	0.52	0.49	0.46	0.4	0.34	0.27	0.23
F _d	0.09	0.17	0.26	0.34	0.42	0.49	0.57	0.64	0.7

Approximate Operating Torque (In·lbs)

Valve Size	50 PSID			100 PSID			150 PSID			225 PSID	
	WET	DRY	PTFE Seat	WET	DRY	PTFE Seat	WET	DRY	PTFE Seat	WET	DRY
1-1/2"	90	146	190	95	153	199	106	165	215	116	170
2"	105	175	228	115	184	239	126	198	257	140	205
2-1/2"	112	219	285	134	235	306	138	265	345	154	285
3"	170	333	433	176	363	472	201	365	475	221	387
4"	275	506	658	303	585	761	345	610	793	365	635
5"	433	755	982	482	830	1,079	532	889	1,156	556	899
6"	680	1,189	1,546	754	1,317	1,712	886	1,465	1,905	1,065	1,512
8"	1,215	2,089	2,716	1,365	2,398	3,117	1,592	2,636	3,427	1,947	2,730
10"	1,903	3,263	4,242	2,204	3,864	5,023	2,532	4,312	5,606	2,920	4,642
12"	2,784	4,535	5,896	3,285	5,454	7,090	3,813	6,185	8,041	4,602	6,480
14"	3,658	5,366	6,976	4,212	6,218	8,083	4,872	7,409	9,632	-	-
16"	4,516	6,655	8,652	5,914	8,390	10,907	6,855	10,120	13,156	-	-
18"	5,832	8,679	11,283	7,758	11,215	14,580	9,524	13,450	17,485	-	-
20"	7,632	11,226	14,594	10,620	14,890	19,357	13,650	18,560	24,128	-	-
24"	12,340	17,980	23,374	15,340	22,290	28,977	19,870	28,160	36,608	-	-
28"	20,745	31,117	-	29,636	44,454	-	32,818	49,227	-	-	-
30"	21,636	32,454	-	30,909	46,363	-	33,920	50,880	-	-	-
32"	26,090	39,135	-	37,272	55,908	-	49,090	73,635	-	-	-
36"	42,000	63,000	-	60,000	90,000	-	68,181	102,271	-	-	-
40"	51,545	77,317	-	73,636	110,454	-	89,090	133,635	-	-	-
48"	89,090	133,635	-	127,272	190,908	-	145,454	218,181	-	-	-

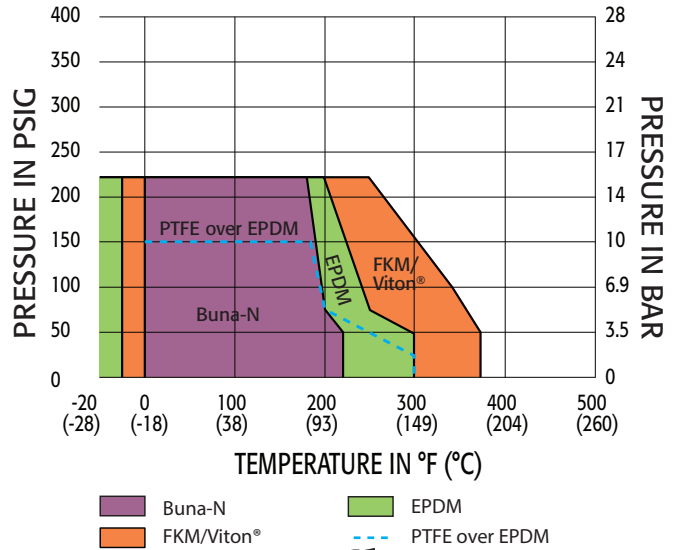
Cv Values & Torques: ES Series

Seat Temperature Ratings

Seat	Temperature °F	1-1/2" - 12" Pressure (PSIG)	14" - 48" Pressure (PSIG)
EPDM	-20	225	150
	100	225	150
	200	225	150
	250	75	75
	300	50	50
Buna-N	0	225	150
	100	225	150
	180	225	150
	200	75	75
	220	50	50
FKM / Viton®	-10	225	150
	100	225	150
	250	225	150
	325	100	100
	360	50	50
PTFE over EPDM*	0	150	90
	75	150	90
	185	150	90
	200	75	75
	300	25	25
Food Grade EPDM	20	225	-
	100	225	-
	200	225	-
	250	75	-

ES Butterfly Series

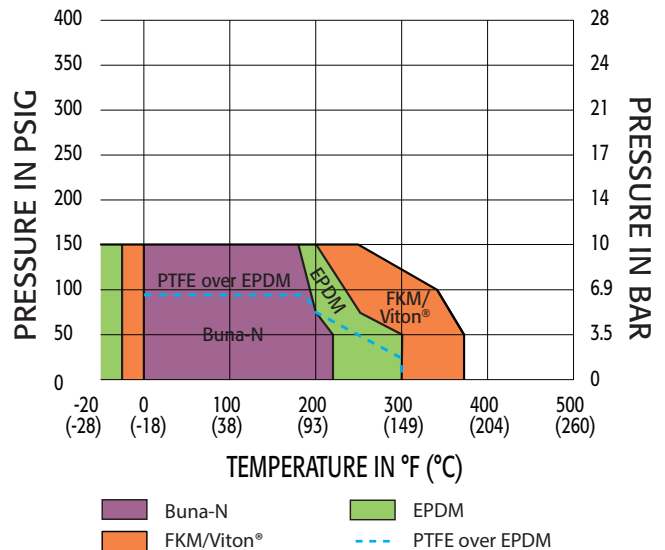
Pressure vs. Temperature Chart for ES Butterfly Valves 1-1/2" to 12"



Note: Food Grade EPDM follows the EPDM curve but stops at 275°F

ES Butterfly Series

Pressure vs. Temperature Chart for ES Butterfly Valves 14" to 48"



Butterfly Series

Pressure vs. Temperature Chart for ES Butterfly Valves 1-1/2" to 12"

PTFE over EPDM limited to 275°F
Nylon Coated DI disc limited to 300°F.

Torque (In-Lbs) - Undercut Disc

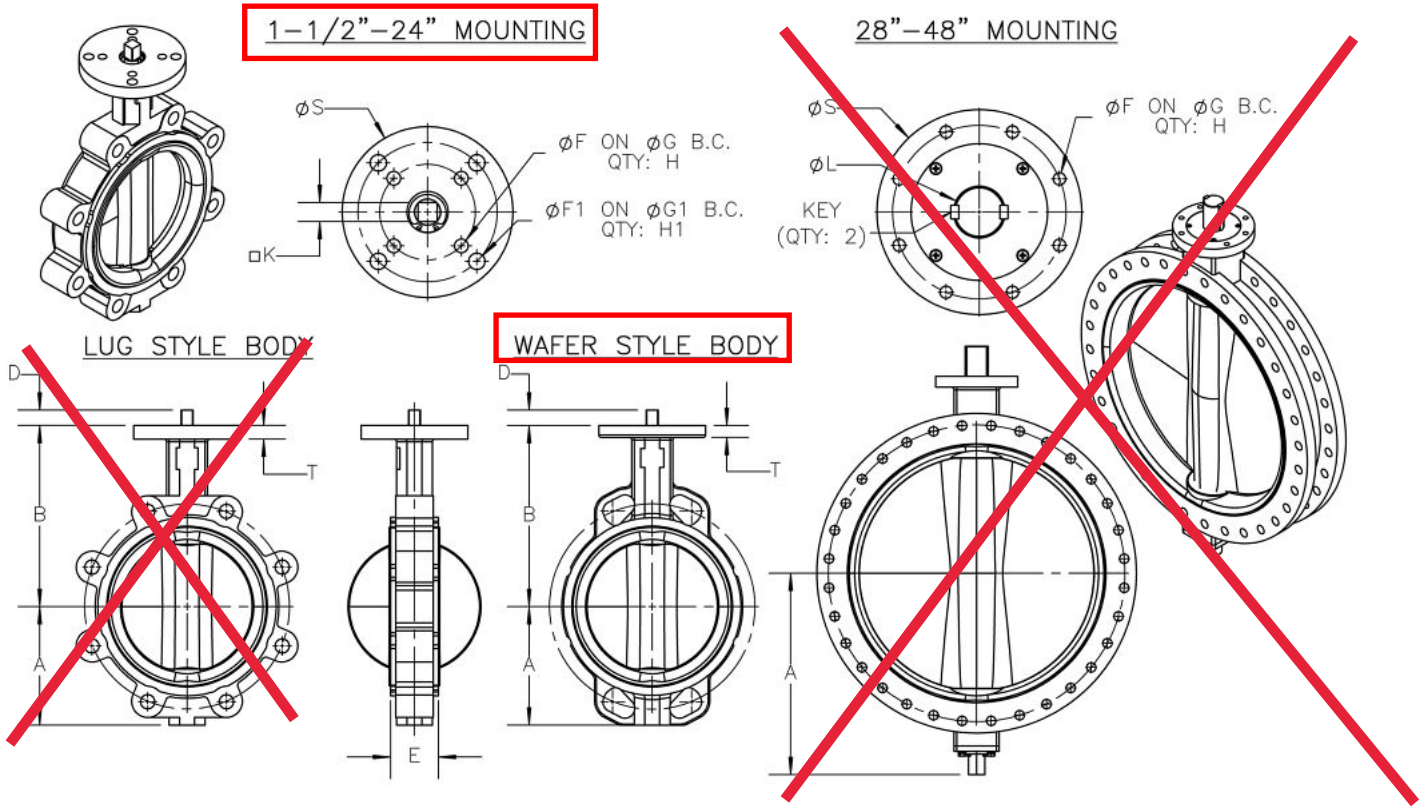
Valve Size	75 PSID		
	WET	DRY	PTFE Seat
6"	426	749	974
8"	772	1,328	1,726
10"	1,231	2,092	2,720
12"	1,820	2,966	3,856
14"	2,699	4,588	5,964
16"	3,938	6,100	7,930
18"	5,480	8,460	10,998
20"	7,250	10,500	13,650
24"	11,327	16,990	22,087

Pressure Vs. Temperature & Undercut Torques: ES Series

Series ES RESILIENT SEATED BUTTERFLY

Dimensions | 1-1/2"-48"

Dimensions: ES Series



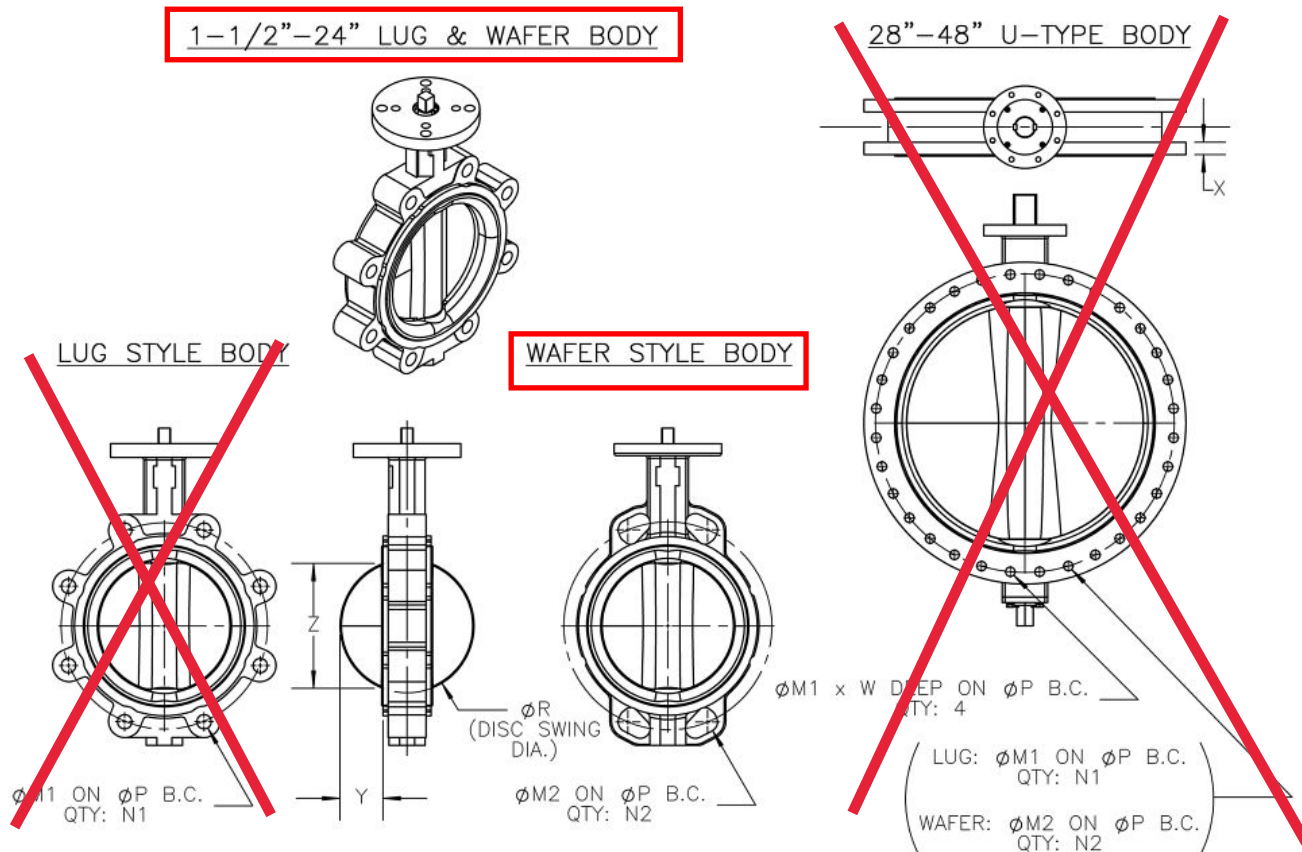
Valve Overall & Mounting Pad Dimensions

Valve Size	A	B	D	E	ØF	ØG	H	ØF1	ØG1	H1	K	ØL	Key (mm)	ØS	T	Lug (lbs)	Wafer (lbs)
1-1/2"	2.56	4.72	0.63	1.30	0.39	2.756 (F07)	4	-	-	-	0.354	-	-	3.54	0.47	4	4
2"	3.15	5.51	0.63	1.69	0.39	2.756 (F07)	4	-	-	-	0.354	-	-	3.54	0.55	7	6
2-1/2"	3.50	5.91	0.63	1.81	0.39	2.756 (F07)	4	-	-	-	0.354	-	-	3.54	0.55	7	7
3"	3.74	6.22	0.63	1.81	0.39	2.756 (F07)	4	-	-	-	0.354	-	-	3.54	0.55	9	7
4"	4.49	6.93	0.63	2.05	0.39	2.756 (F07)	4	-	-	-	0.433	-	-	3.54	0.55	16	10
5"	5.00	7.48	0.71	2.20	0.39	2.756 (F07)	4	-	-	-	0.551	-	-	3.54	0.55	21	14
6"	5.47	8.35	0.71	2.20	0.39	2.756 (F07)	4	0.47	4.016 (F10)	4	0.551	-	-	4.92	0.55	25	17
8"	6.85	9.29	0.71	2.36	0.47	4.016 (F10)	4	0.71	5.512 (F14)	4	0.669	-	-	6.89	0.59	36	27
10"	7.99	10.43	0.94	2.68	0.47	4.016 (F10)	4	0.71	5.512 (F14)	4	0.866	-	-	6.89	0.67	57	40
12"	9.53	12.01	0.94	3.07	0.47	4.016 (F10)	4	0.71	5.512 (F14)	4	0.866	-	-	6.89	0.67	88	62
14"	10.51	14.49	0.94	3.07	0.47	4.016 (F10)	4	0.71	5.512 (F14)	4	0.866	-	-	6.89	0.79	146	79
16"	13.20	15.75	1.42	4.02	0.71	5.512 (F14)	4	0.87	6.496 (F16)	4	1.063	-	-	8.27	0.87	216	137
18"	14.42	16.61	1.42	4.49	0.71	5.512 (F14)	4	0.87	6.496 (F16)	4	1.063	-	-	8.27	0.98	304	166
20"	15.28	17.91 #	1.42	5.00	0.71	5.512 (F14)	4	0.87	6.496 (F16)	4	1.417	-	-	8.27	1.06	353	220
24"	18.83	22.24	1.81	6.06	0.87	6.496 (F16)	4	-	-	-	1.417	-	-	8.27	1.26	507	414
28"	24.25	24.57	4.33	6.50	0.71	10.000 (F25)	8	-	-	-	-	2.494	18x11	11.81	1.38	728	728
30"	25.39	25.59	4.33	6.50	0.71	10.000 (F25)	8	-	-	-	-	2.494	18x11	11.81	1.38	860	860
32"	26.97	26.38	4.33	7.48	0.71	10.000 (F25)	8	-	-	-	-	2.494	18x11	11.81	1.38	902	902
36"	29.13	28.35	4.33	7.87	0.71	10.000 (F25)	8	-	-	-	-	2.953	20x12	11.81	1.77	1082	1082
40"	32.28	31.69	4.33	8.50	0.71	10.000 (F25)	8	-	-	-	-	3.346	22x14	11.81	1.77	1642	1642
48"	38.54	37.40	5.12	10.87	0.87	11.732 (F30)	8	-	-	-	-	4.134	28x16	13.78	1.77	2571	2571

Note:
 • Unless otherwise specified, all dimensions are in inches.
 • # 20" Wafer: B - 17.32 (dimension in table applies to 20" lug valve).
 • Face-To-Face dimensions (E) are across the body flats (metal-to-metal). Approximately 1/16" to 1/8" of the rubber seat protrudes from each side for flange sealing.

Dimensions | 1-1/2"-48"

Dimensions: ES Series



Valve End Connection & Additional Dimensions

Valve Size	ØM1	N1	Class 150	ØM2			Class 150	N2			ØP			ØR	W	X	Y	Z	
				PN 10 (mm)	PN 16 (mm)	JIS 10K (mm)		PN 10	PN 16	JIS 10K	Class 150	PN 10 (mm)	PN 16 (mm)						JIS 10K (mm)
1-1/2"	1/2 - 13	4	0.63	19	19	19	4	4	4	4	3.87	110	110	105	1.69	-	-	0.20	1.09
2"	5/8 - 11	4	0.79	19	19	19	4	4	4	4	4.75	125	125	120	2.08	-	-	0.19	1.21
2-1/2"	5/8 - 11	4	0.79	19	19	19	4	4	4	4	5.50	145	145	140	2.54	-	-	0.36	1.78
3"	5/8 - 11	4	0.79	19	19	19	4	4	4	4	6.00	160	160	150	3.11	-	-	0.65	2.53
4"	5/8 - 11	8	0.79	19	19	19	4	4	4	4	7.50	180	180	175	4.11	-	-	1.03	3.56
5"	3/4 - 10	8	0.91	19	19	23	4	4	4	4	8.50	210	210	210	4.87	-	-	1.33	4.35
6"	3/4 - 10	8	0.91	23	23	23	4	4	4	4	9.50	240	240	240	6.14	-	-	1.97	5.73
8"	3/4 - 10	8	0.91	23	23	23	4	4	4	4	11.75	295	295	290	7.98	-	-	2.81	7.63
10"	7/8 - 9	12	1.02	23	28	25	4	4	4	4	14.25	350	355	355	9.87	-	-	3.60	9.50
12"	7/8 - 9	12	1.02	23	28	25	4	4	4	4	17.00	400	410	400	11.88	-	-	4.41	11.48
14"	1 - 8	12	1.14	-	-	-	4	-	-	-	18.75	-	-	-	13.15	-	-	5.04	12.79
16"	1 - 8	16	1.14	-	-	-	4	-	-	-	21.25	-	-	-	15.39	-	-	5.69	14.86
18"	1-1/8 - 7	16	1.26	-	-	-	4	-	-	-	22.75	-	-	-	17.36	-	-	6.44	16.77
20"	1-1/8 - 7	20	1.26	-	-	-	4	-	-	-	25.00	-	-	-	19.41	-	-	7.20	18.75
24"	1-1/4 - 7	20	1.38	-	-	-	20	-	-	-	29.50	-	-	-	23.39	-	-	8.66	22.59
28"	1-1/4 - 7	28**	1.38	-	-	-	24*	-	-	-	34.00	-	-	-	27.36	1.26	1.44	10.43	26.58
30"	1-1/4 - 7	28**	1.38	-	-	-	24*	-	-	-	36.00	-	-	-	29.33	1.26	1.44	11.42	28.60
32"	1-1/2 - 6	28**	1.65	-	-	-	24*	-	-	-	38.50	-	-	-	31.34	1.54	1.57	11.93	30.43
36"	1-1/2 - 6	32**	1.65	-	-	-	28*	-	-	-	42.75	-	-	-	34.06	1.54	1.71	13.09	33.13
40"	1-1/2 - 6	36**	1.65	-	-	-	32*	-	-	-	47.25	-	-	-	37.99	1.54	1.85	14.74	37.03
48"	1-1/2 - 6	44**	1.65	-	-	-	40*	-	-	-	56.00	-	-	-	45.67	1.54	2.13	17.40	44.36

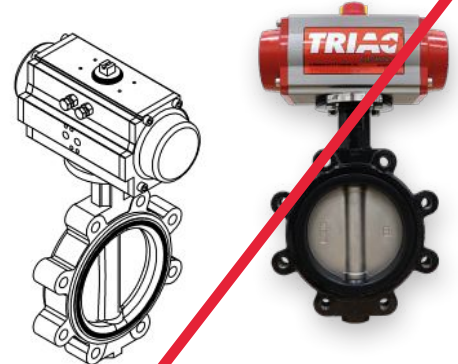
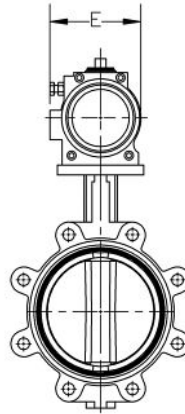
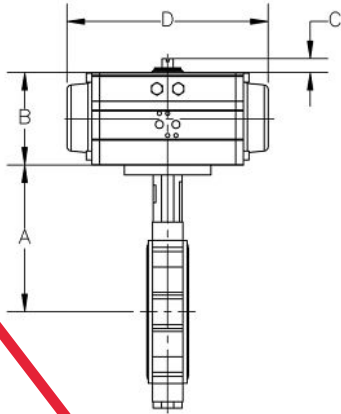
Note:
 • Unless otherwise specified, all dimensions are in inches.
 • Nominal radial clearances given in Table D.1 in Annex D of API 609 Eighth Edition, February 2016 shall be followed for proper installation (disc chord length dimension Z and disc projection dimension Y).
 End Connections
 Wafer: • 1-1/2" - 12" conform to ASME B16.5 Class 150, EN1092-2 PN10/16, and JIS B2220 10K. • 14" - 24" conform to ASME B16.5 Class 150. • 28"-48" conform to ASME B16.47 Series A Class 150.
 Lug: • 1-1/2" - 24" conform to ASME B16.5 Class 150. • 28"-48" conform to ASME B16.47 Series A Class 150.
 • *28" - 48" Wafer valves have 4 additional ØM1 x W deep threaded holes at the top and bottom, all others are clearance holes all the way through the u-type flange. N2 represents the clearance hole quantity (quantity 4 threaded holes not included).
 • ** 28" - 48" Lug valves have 4 ØM1 x W deep threaded holes at the top and bottom, all others are threaded all the way through the u-type flange. N1 represents the total hole quantity.
 A-T Controls reserves the right to change product designs and technical/dimensional specifications without notice. See website for updates.

Series ES RESILIENT SEATED BUTTERFLY

Pneumatic Actuator Sizing: ES Series

Valve Dimensions

Valve Size	A
1-1/2"	4.72
2"	5.51
2-1/2"	5.91
3"	6.22
4"	6.97
5"	7.48
6"	8.35
8"	9.29
10"	10.43
12"	12.01



Dimensions Double Acting Actuator

Actuator Size	B	C	D	E
3R40DA	3.47	0.787	7.60	3.35
3R80DA	4.30	0.787	9.29	4.18
3R130DA	4.61	0.787	11.02	4.27
3R200DA	5.28	0.787	11.50	4.78
3R300DA	6.14	0.787	13.39	5.59
3R500DA	6.81	1.181	15.35	5.98
3R700DA	7.36	1.181	16.89	6.38
3R850DA	7.82	1.181	19.37	6.85
3R1200DA	9.06	1.181	22.36	8.11

For more actuator information, please see the complete actuator catalog.

Dimensions Spring Return Actuator

Actuator Size	B	C	D	E
3R40SR	3.47	0.787	7.60	3.35
3R80SR	4.30	0.787	9.29	4.18
3R130SR	4.61	0.787	11.02	4.27
3R200SR	5.28	0.787	11.50	4.78
3R300SR	6.14	0.787	13.39	5.59
3R500SR	6.81	1.181	15.35	5.98
3R700SR	7.36	1.181	16.89	6.38
3R850SR	7.82	1.181	19.37	6.85
3R1200SR	9.06	1.181	22.36	8.11
3R1750SR	10.08	1.181	23.54	8.90
3R2400SR	11.46	1.181	24.80	10.24

For more actuator information, please see the complete actuator catalog.

Pneumatic Double Acting Actuator Sizing

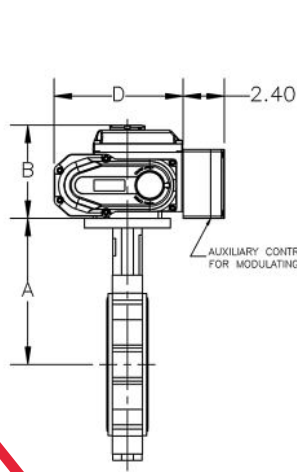
ES Valve Size	WET				DRY			
	50 PSID	100 PSID	150 PSID	225 PSID	50 PSID	100 PSID	150 PSID	225 PSID
1-1/2"	3R40DA	3R40DA	3R40DA	3R40DA	3R40DA	3R40DA	3R40DA	3R40DA
2"	3R40DA	3R40DA	3R40DA	3R40DA	3R40DA	3R40DA	3R40DA	3R40DA
2-1/2"	3R40DA	3R40DA	3R40DA	3R40DA	3R40DA	3R40DA	3R40DA	3R40DA
3"	3R40DA	3R40DA	3R40DA	3R40DA	3R80DA	3R80DA	3R80DA	3R80DA
4"	3R40DA	3R80DA	3R80DA	3R80DA	3R80DA	3R80DA	3R80DA	3R80DA
5"	3R80DA	3R80DA	3R80DA	3R80DA	3R130DA	3R130DA	3R130DA	3R130DA
6"	3R130DA	3R130DA	3R130DA	3R200DA	3R200DA	3R200DA	3R300DA	3R300DA
8"	3R200DA	3R300DA	3R300DA	3R300DA	3R300DA	3R500DA	3R500DA	3R500DA
10"	3R300DA	3R500DA	3R500DA	3R500DA	3R500DA	3R700DA	3R850DA	3R850DA
12"	3R500DA	3R500DA	3R700DA	3R850DA	3R850DA	3R850DA	3R1200DA	3R1200DA

Pneumatic Double Acting actuators above are sized with 10 PSIG supply. Consult factory for actuator sizing on valves larger than 2". Automated sizing is not applicable to PTFE seats. Please see the PTFE seat torques in the catalog torque table.

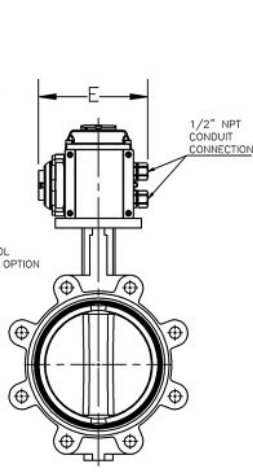
Pneumatic Spring Return Actuator Sizing

ES Valve Size	WET				DRY			
	50 PSID	100 PSID	150 PSID	225 PSID	50 PSID	100 PSID	150 PSID	225 PSID
1-1/2"	3R40SR	3R40SR	3R80SR	3R80SR	3R80SR	3R80SR	3R80SR	3R80SR
2"	3R80SR	3R80SR	3R80SR	3R80SR	3R80SR	3R80SR	3R80SR	3R80SR
2-1/2"	3R80SR	3R80SR	3R80SR	3R80SR	3R80SR	3R130SR	3R130SR	3R130SR
3"	3R80SR	3R80SR	3R80SR	3R80SR	3R200SR	3R200SR	3R200SR	3R200SR
4"	3R130SR	3R130SR	3R200SR	3R200SR	3R300SR	3R300SR	3R300SR	3R300SR
5"	3R200SR	3R300SR	3R300SR	3R300SR	3R300SR	3R300SR	3R500SR **	3R500SR **
6"	3R300SR	3R300SR	3R500SR	3R500SR	3R500SR	3R700SR	3R700SR	3R700SR
8"	3R500SR	3R700SR	3R850SR	3R850SR	3R1200SR	3R1200SR	3R1200SR	3R1200SR
10"	3R850SR	3R1200SR	3R1200SR	3R1750SR	3R1750SR	3R2400SR **	3R2400SR **	3R2400SR **
12"	3R1200SR	3R1750SR	3R1750SR	3R2400SR **	3R2400SR **	3R2400SR **	3R2400SR **	3R2400SR **

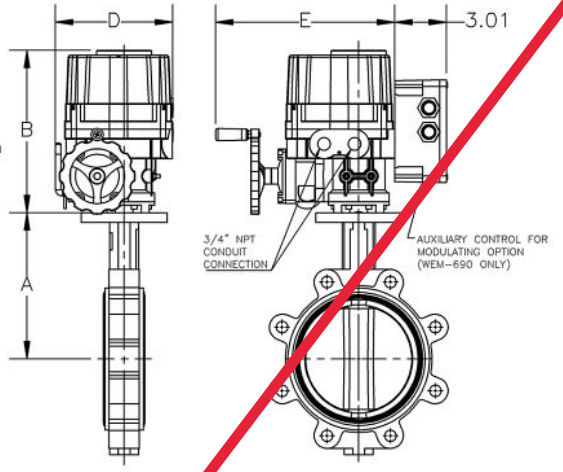
** Not a direct mount. The assembly uses a bracket & coupler. Pneumatic Spring Return Actuators above are sized with 5 springs per side, fail-close. Consult Factory for actuator sizing on valves larger than 12". Automated sizing is not applicable to PTFE seats. Please see the PTFE seat torques in the catalog torque table.



KE SERIES ELECTRIC



WE SERIES ELECTRIC



Valve Dimensions

Valve Size	A
1-1/2"	4.72
2"	5.51
2-1/2"	5.91
3"	6.2
4"	6.93
5"	7.48
6"	8.35
8"	9.29
10"	10.43
12"	12.01

Dimensions Electric Actuator

Actuator Size	B	D	E
KE-440	5.14	6.74	5.44
KE-880	5.31	7.69	6.24
WE-690	9.25	6.69	10.16
WE-1350	10.55	9.02	13.31
WE-1700	10.55	9.02	13.31
WE-2640	11.42	10.2	14.49
WE-4400	11.97	10.2	14.49
WE-5200	11.97	10.2	14.49
WE-6900	12.99	11.69	16.14
WE-10500	12.99	11.69	16.14

For more actuator information, please see the complete actuator catalog

Electric (On/Off) Actuator Sizing

ES Valve Size	WET				DRY			
	50 PSID	100 PSID	150 PSID	225 PSID	50 PSID	100 PSID	150 PSID	225 PSID
1-1/2"	KE-440	KE-440	KE-440	KE-440	KE-440	KE-440	KE-440	KE-440
2"	KE-440	KE-440	KE-440	KE-440	KE-440	KE-440	KE-440	KE-440
2-1/2"	KE-440	KE-440	KE-440	KE-440	KE-440	KE-440	KE-440	KE-440
3"	KE-440	KE-440	KE-440	KE-440	KE-440	KE-440	KE-440	KE-440
4"	KE-440	KE-440	KE-440	KE-440	KE-880	KE-880	KE-880	KE-880
5"	WE-690	WE-690	WE-690	WE-690	WE-1350	WE-1350	WE-1350	WE-1350
6"	WE-1350	WE-1350	WE-1350	WE-1350	WE-1350	WE-1700	WE-1700	WE-1700
8"	WE-1350	WE-1700	WE-1700	WE-2640	WE-2640	WE-2640	WE-4400	WE-4400
10"	WE-2640	WE-2640	WE-4400	WE-4400	WE-4400	WE-4400	WE-5200	WE-5200
12"	WE-4400	WE-4400	WE-4400	WE-5200	WE-5200	WE-6900	WE-6900	WE-6900

Consult Factory for actuator sizing on valves larger than 12". Automated sizing is not applicable to PTFE seats. Please see the PTFE seat torques in the catalog torque table.

Electric (Modulating) Actuator Sizing

ES Valve Size	WET				DRY			
	50 PSID	100 PSID	150 PSID	225 PSID	50 PSID	100 PSID	150 PSID	225 PSID
1-1/2"	KEM-440	KEM-440	KEM-440	KEM-440	KEM-440	KEM-440	KEM-440	KEM-440
2"	KEM-440	KEM-440	KEM-440	KEM-440	KEM-440	KEM-440	KEM-440	KEM-440
2-1/2"	KEM-440	KEM-440	KEM-440	KEM-440	KEM-440	KEM-440	KEM-440	KEM-440
3"	KEM-440	KEM-440	KEM-440	KEM-440	KEM-440	KEM-880	KEM-880	KEM-880
4"	KEM-440	KEM-440	KEM-440	KEM-880	KEM-880	KEM-880	KEM-880	KEM-880
5"	WEM-690	WEM-690	WEM-690	WEM-1350	WEM-1350	WEM-1350	WEM-1350	WEM-1350
6"	WEM-1350	WEM-1350	WEM-1350	WEM-1350	WEM-1700	WEM-1700	WEM-2640	WEM-2640
8"	WEM-1700	WEM-2640	WEM-2640	WEM-2640	WEM-2640	WEM-4400	WEM-4400	WEM-4400
10"	WEM-2640	WEM-4400	WEM-4400	WEM-4400	WEM-4400	WEM-5200	WEM-6900	WEM-6900
12"	WEM-4400	WEM-4400	WEM-5200	WEM-6900	WEM-6900	WEM-6900	WEM-10500	WEM-10500

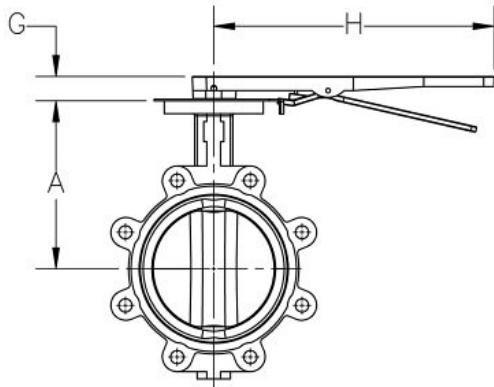
Consult Factory for actuator sizing on valves larger than 12". Automated sizing is not applicable to PTFE seats. Please see the PTFE seat torques in the catalog torque table.

Series ES RESILIENT SEATED BUTTERFLY

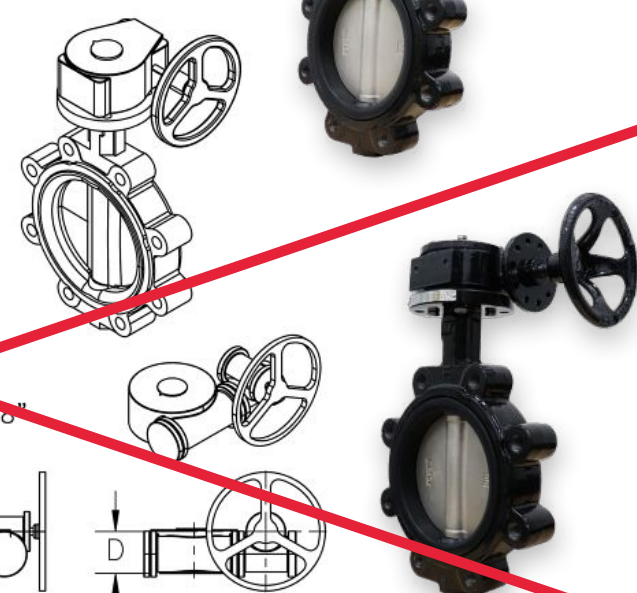
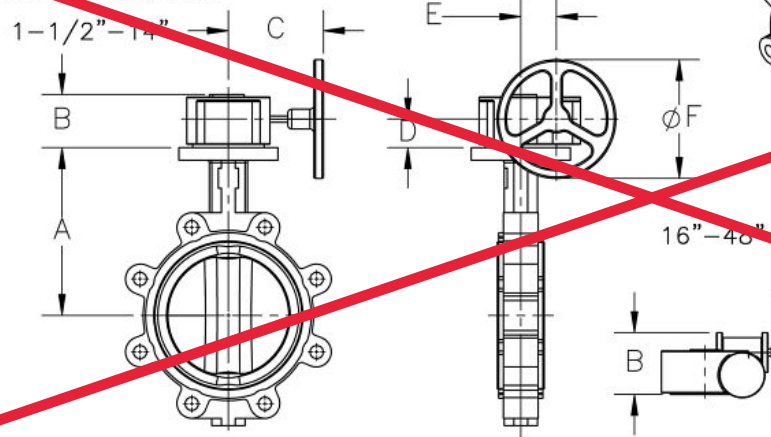
Handle and Gear Operator Sizing: ES Series

Handle and Gear Operator Sizing

HANDLE (UP TO 12")



GEAR OPERATOR



Gear and Handle Dimensions

Valve Size	A	GEAR OPERATOR					HANDLE	
		B	C	D	E	ØF	G	H
1-1/2"	4.72	2.64	4.74	1.42	1.78	6.00	1.05	10.24
2"	5.51							
2-1/2"	5.91							
3"	6.22							
4"	6.93							
5"	7.48	3.27	7.09	1.81	2.48	12.00	1.50	22.00
6"	8.35							
8"	9.29							
10"	10.43							
12"	12.01							
14"	14.49							
16"	15.75							
18"	16.61							
20"	17.91 #							
24"	22.24							
28"	24.57							
30"	25.59							
32"	26.38							
36"	28.35							
40"	31.69							
48"	37.40							

20" Wafer: A - 17.32 (dimension in table applies to 20" lug valve).

Part Number Matrix for

A-T Controls **ES Series Resilient Seated** Butterfly Valves

1 Valve Series	
ES	A-T Cartridge Seat Butterfly Valve

2 Body Material	
Blank	A351 CF8M (No Designation)
P	A395 Ductile Iron (Standard)

3 End Connection	
L1	125/150# Lug
W1	125/150# Wafer
Note: 28"-48" utilize a u-type body. See valve drawings & dimensions for more information.	

4 Valve Size			
0150	1-1/2"	1600	16"
0200	2"	1800	18"
0250	2-1/2"	2000	20"
0300	3"	2400	24"
0400	4"	2800	28"
0500	5"	3000	30"
0600	6"	3200	32"
0800	8"	3600	36"
1000	10"	4000	40"
1200	12"	4800	48"
1400	14"		

5 Seat Material/Style	
B	Buna-N
E	EPDM
V	FKM / Viton®
P	PTFE over EPDM (up to 24" only)
F	White Food Grade (FDA compliant) EPDM (up to 12" only)

6 Disc Material/Style	
N	Nylon Coated Ductile Iron
S	A351 CF8M
B	Aluminum Bronze
D	Nickel Plated Ductile Iron
W	Polished A351 CF8M
U	Undercut Aluminum Bronze (6"-24")
Y	Undercut Polished A351 CF8M (6"-24")
Z	Undercut A351 CF8M (6"-24")

7 Stem Bushing	
F	FRP (Standard up to 14")
B	Brass (Standard 16" & Larger)

8 Operator Designation	
X	Bare Stem
S	Stainless Steel 10 Point Handle (up to 12")
L	Locking Handle -10 Position (up to 12")
I	Infinite Adjustment Handle (up to 12")
G	Gear Operator

9 Stem	
F	431 SST (standard)
A	17-4 PH®

How To ORDER MANUAL RESILIENT SEATED BUTTERFLY VALVES								
1	2	-	3	-	4	-	5 6 7	- 8 9
↓	↓		↓		↓		↓	↓
ESP	-	L1	-	0400	-	E S F	-	X F

How To ORDER AUTOMATED RESILIENT SEATED BUTTERFLY VALVES									
1	2	-	3	-	4	-	5 6 7	-	89 / actuator size - options
↓	↓		↓		↓		↓	↓	↓
ES P	-	W1	-	0400	-	B N F	-	X F /	3RJS - XX
(see Actuator Size Legend)									

EXAMPLE:

ES-L1-0400-ESF-XF

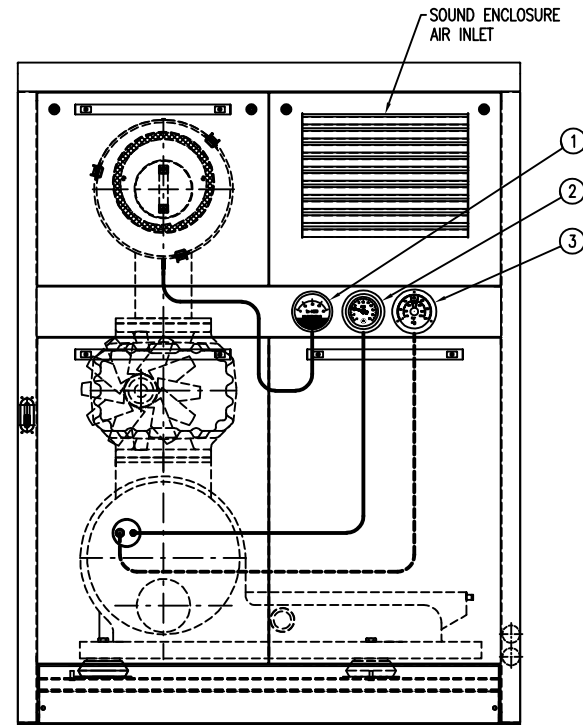
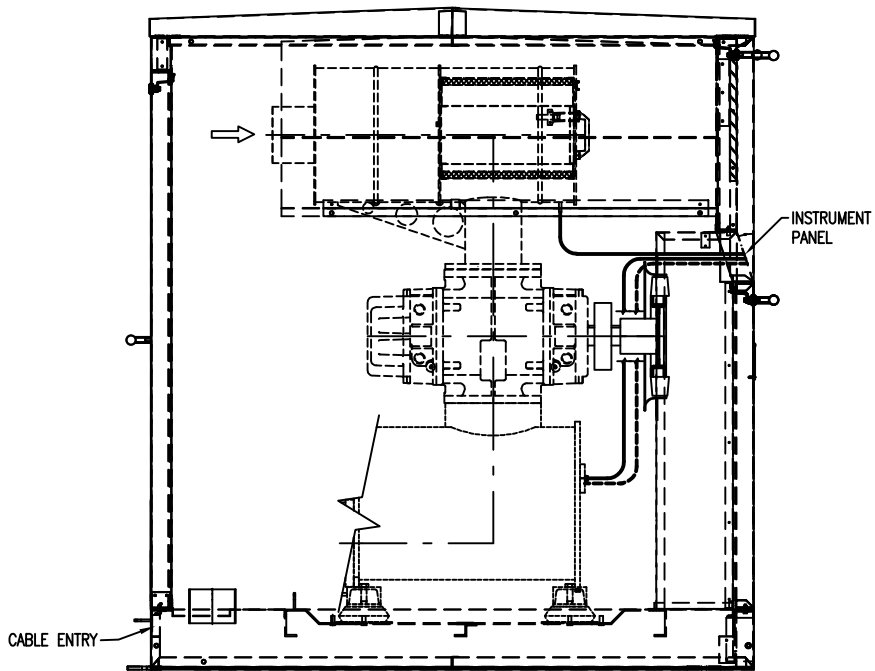
4" ES Series RSBFV, Class 125/150 Lug Style, A351 CF8M Body, EPDM Seat, A351 CF8M Disc, FRP Stem Bushing, 431 SST Stem, Bare Stem.

ESP-W1-0400-BNF-LF

4" ES Series RSBFV, Class 125/150 Wafer Style, A395 Ductile Iron Body, Buna-N Seat, Nylon Coated Ductile Iron Disc, FRP Stem Bushings, 431 SST Stem, Locking Handle -10 Position.



SECTION 4



FRONT PANEL

NOTES:

1. ALL PRESSURE GAUGES & SWITCHES ARE INSTALLED WITH PULSATION DAMPERS. (EXCEPT IF GAUGE HAS A LIQUID FILL)

MAIN COMPONENTS

ITEM	DESCRIPTION	PART NO.
1	GAUGE, FILTER MAINTENANCE INDICATOR	21-006757
2	GAUGE, DISCHARGE PRESSURE	21-006758
3	GAUGE/SWITCH, DISCHARGE TEMPERATURE	21-006756

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AERZEN USA CORP.

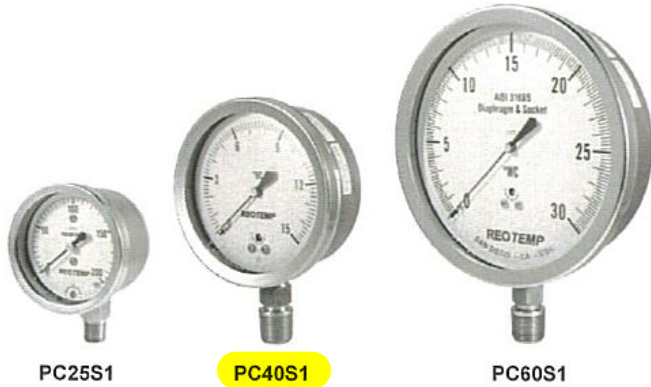
108 Independence Way, COATESVILLE PA 19320
(610) 380-0244 PH, (610) 380-0278 FX

TITLE				
G-5 BLOWER - INSTR. (S.E.)				
FILTER MAINTENANCE INDICATOR				
DISCHARGE PRESSURE GAUGE				
DISCHARGE TEMPERATURE GAUGE/SWITCH				
DATE	DRAWN BY:	CHECKED BY:	P.M. APPROVAL :	SCALE:
07/11/2017	RJP	DLM	-	MSPACE 1 :1
DRAWING NO:			REVISION NO:	SHEET:
G5-IM-PS05-4000-00			D	1/1

ALL STAINLESS STEEL LOW PRESSURE GAUGE

PRESSURE GAUGES

REOTEMP's Series PC low pressure gauges offer accurate and reliable measurements of gaseous media. Offered with stainless steel internals, the Series PC is designed to withstand corrosive media and ensure a long-lasting instrument.



Dials



Custom Logo



Diaphragm Seal
Compatible

FEATURES / BENEFITS

- Sensitive Diaphragm/Capsule Mechanism
- All-Welded 316 Stainless Steel Capsule and Socket
- Easy-Access Zero Reset Screw on Dial



SPECIFICATIONS

Construction Materials:

Non Wetted

Case: 304SS

Ring: 304SS, Bayonet Twist-Off

Dial: White Aluminum, Black Letters

Wetted

Capsule: 316LSS

Socket: 316SS

Case-to-Socket

Screw Connection

Vented Case

Lens

Tempered Safety Glass (Standard), Plastic, or Laminated Safety Glass

Temperature Limits:

Ambient

-40°F ————— 150°F

Process

-40°F ————— 200°F

Process Temperature Limits When Assembled with a Diaphragm Seal

-60°F ————— 350°F

Direct Mount

-100°F ————— 750°F

Remote Mount or Cooling Tower

*Exact temperature limits will depend on diaphragm seal & fill fluid.

Accuracy: 2-1.6-2%

Fillable: No

Restrictor Screw: Yes

Weight: 2.5" = 0.5 lbs

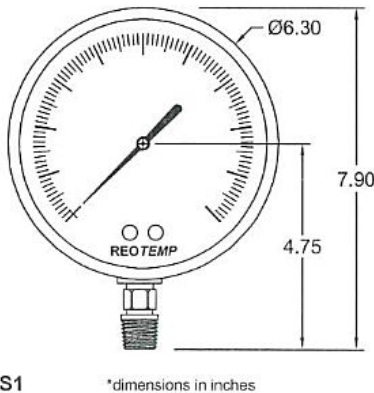
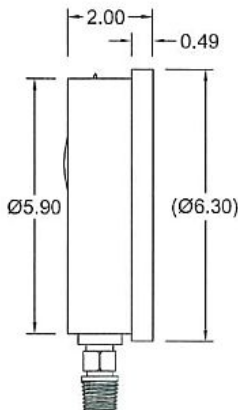
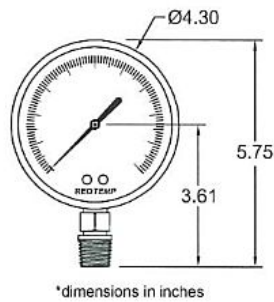
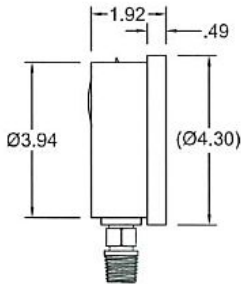
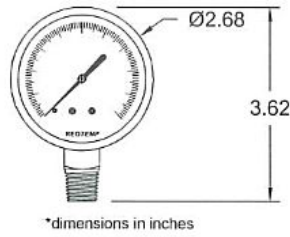
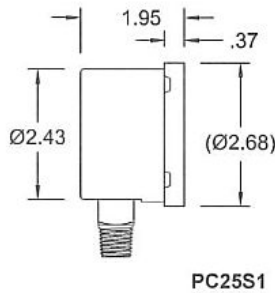
4" = 1.1 lbs

6" = 2.1 lbs

Maximum Working Pressure:

Stable = 100%

Momentary = 130% of scale



ALL STAINLESS STEEL LOW PRESSURE GAUGE



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PRESSURE GAUGES

HOW TO ORDER: Choose options to build a part number. For example: PC40S1A2P52-D-T-HV

PC40	S	1	A	2	P52	-D	-T	-HV
DIAL SIZE	CASE TYPE	CAPSULE & SOCKET	MOUNT TYPE	CONNECTION	RANGE CODE	CASE FILL	LENS	OPTIONS
PC25 = 2.5" PC40 = 4" PC60 = 6"	S = 304SS Case & Bezel w/ Removable Bayonet, Zero Correction on Dial C = crimped ring 304SS	1 = 316SS 2 = copper alloy	A = Bottom B = Bottom/Rear Flange *C = Center Back *D = Center Back "U" Clamp *E = Center Back/Front Flange	4 = 1/4" NPT	See Master Range Code Sheet on Page 46 Common Ranges P50 = 0-10 in H ₂ O P51 = 0-15 in H ₂ O P52 = 0-30 in H ₂ O P53 = 0-60 in H ₂ O P54 = 0-100 in H ₂ O P55 = 0-160 in H ₂ O P56 = 0-200 in H ₂ O Available Ranges ■ 10" to 300" Water Column ■ Gauge Pressure, Vacuum, or Compound Standard Units ■ in H ₂ O Available Units ■ kPa ■ inHg ■ mbar ■ mmHg ■ psi ■ oz/in ² ■ mmH ₂ O ■ & more	Case is Not Fillable -D = Dry	-T = Tempered Safety Glass (std) -P = Plastic -S = Laminated Safety Glass	-HV = Hi-Vis™ Dial -OX = Cleaned for O ₂ Service -C3 = 3 pt. Calibration Certificate -TS = Stainless Steel Tag -NC = NACE Compliance Certificate -PM = Positive Material Identification Certification -R5 = 1.5% Full Scale Accuracy (Not Available on Compound Ranges)
			A = Bottom B = Bottom/Rear Flange *C = Lower Back *E = Lower Back/Front Flange	4 = 1/4" NPT 2 = 1/2" NPT				P905 = -40..0 "H2O

*Non-standard configuration

Diaphragm Seal Suitability Guide

Low pressure capsule gauges are very sensitive and require diaphragm seals with high fluid displacement. If a diaphragm seal is required to isolate the process fluid from the pressure gauge, the following seal model types are available for the Series PC.

Diaphragm Seal Model
High Displacement



Model	Total Gauge Span* (in H ₂ O)									
	10"	15"	20"	30"	40"	60"	100"	160"	200"	300"
W6	X	X	X	X	X	X	S	S	T	T
W7	X	X	X	S	S	T	T	T		
V5	X	S	S	T	T	T	T	T		
T6	X	X	X	X	X	S	S	S	S	S

*Total gauge span is additive of negative and positive pressures.

Example: -15 - 0 - 30 psi = 45 psi span

- Assembly will function correctly with minimal accuracy degradation.
- T Assembly will function correctly given stable temperature.
- S Assembly is highly sensitive to orientation and temperature variance. REOTEMP cannot guarantee a stated accuracy.
- X Assembly will not work. The diaphragm does not displace enough fill fluid to drive the pressure gauge.

OEM CODE **TBD**

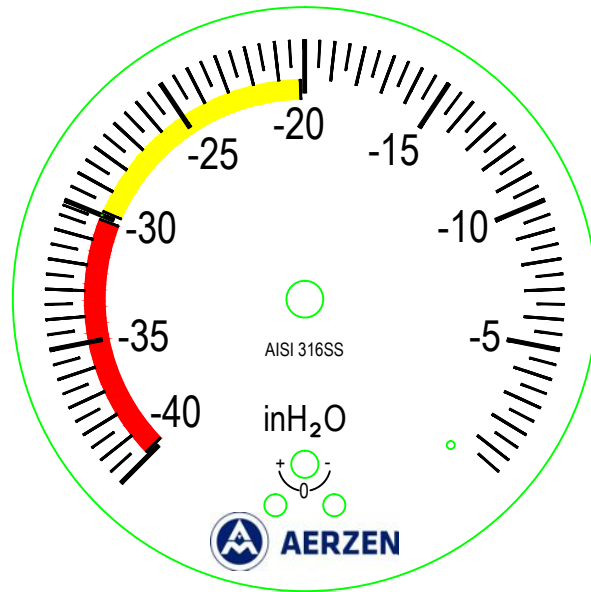
PART NAME


DIAL MARKING DIAL

LOGO: AERZEN

RANGE: -40/0 inH₂O

SIZE: PC40



REOTEMP Instrument Corporation		DATE	
 10656 Roselle Street San Diego, CA 92121 USA Phone: (858) 784-0710 Fax: (858) 784-0720		1/25/19	
		DRAWN BY ML	
		APPROVED	
SIZE	CAGE CODE: 24793	DWG NO.	REV A
SCALE: NTS		FILE NAME:	SHEET 1 OF 1

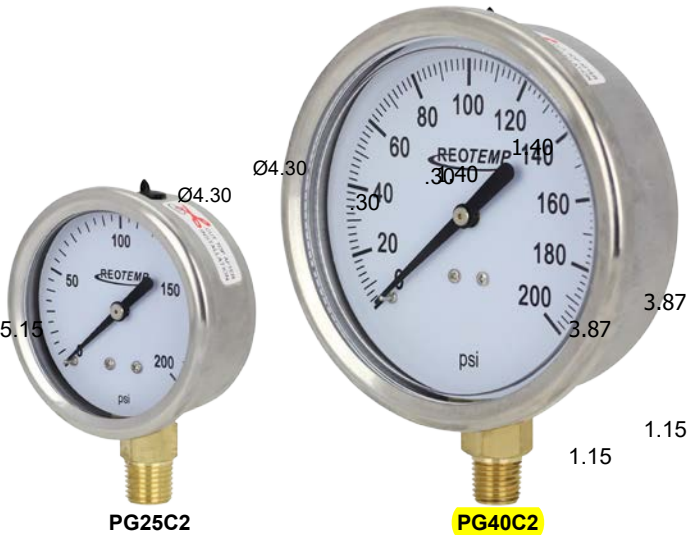
INDUSTRIAL STAINLESS/BRASS GAUGE

PRESSURE GAUGES

REOTEMP's Series PG gauges are an economical choice where ambient corrosion and vibration are of concern. The stainless steel case and ring offer excellent corrosion resistance, and is fillable for applications with vibration. It is suitable for all fluids compatible with copper alloys.



Fillable Custom Logo



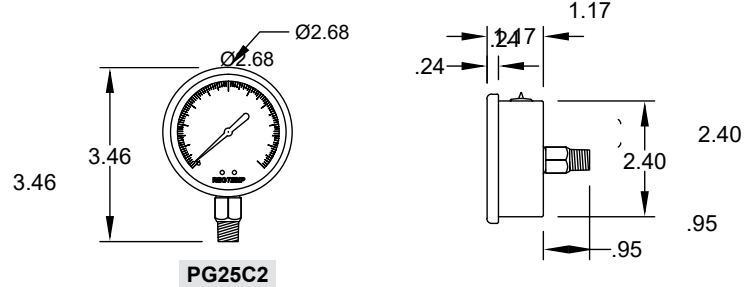
FEATURES / BENEFITS

- Stainless Steel Case
- Copper Alloy Wetted Parts
- Field Fillable Case
- Convenient Panel Mounting Adapters

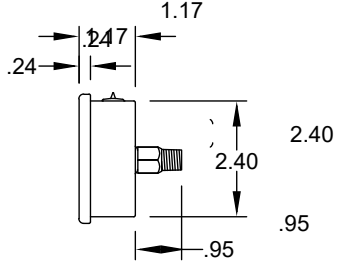


SPECIFICATIONS

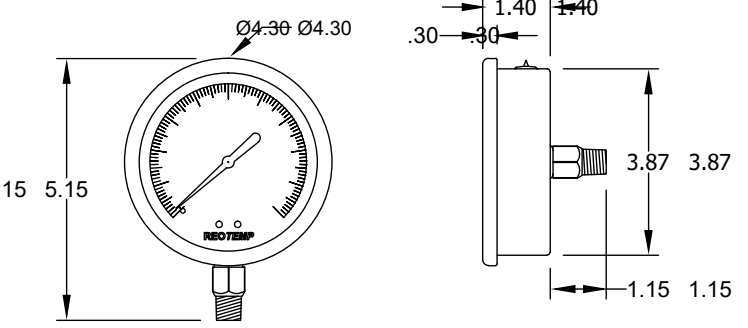
Accuracy	2.5" = 3 - 2 - 3%, ASME Grade B 4" = 2 - 1 - 2%, ASME Grade A
Ambient Limits	-40°F/140°F
Process Limits	-40°F/140°F
Process Limits with Diaphragm Seal	Cannot be mounted to a diaphragm seal.
Wetted Materials	Tube: Copper Alloy Socket: Copper Alloy
Lens	Plastic (Standard) or Glass
Other Materials	Case: 304SS Ring: 304SS Dial: White Aluminum, Black Letters Case-to-Socket: Screw Connection
Fillable	Yes
Restrictor Screw	Built-in, Non-Removable
Maximum Working Pressure	Stable = 100% Momentary = 110% of scale
Environmental Protection	NEMA 4X/IP65
Weight	2.5" = 0.25 lbs (0.4 lbs filled) 4" = 0.6 lbs (1.2 lbs filled)



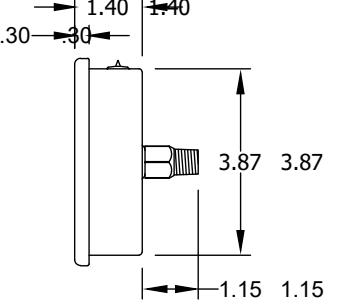
PG25C2



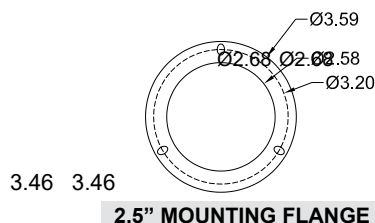
*dimensions in inches



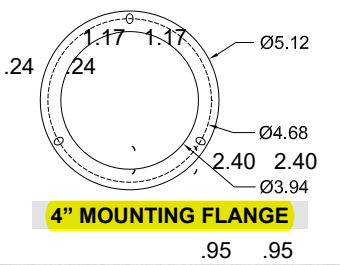
PG40C2



*dimensions in inches



2.5" MOUNTING FLANGE



4" MOUNTING FLANGE

INDUSTRIAL STAINLESS/BRASS GAUGE



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HOW TO ORDER: Choose options to build a part number. For example: PG25C2A4P18-D-P-TS

PG25	C	2	A	4	P18	-D	-P	-TS
DIAL SIZE	CASE TYPE	TUBE & SOCKET	MOUNT TYPE	CONNECTION	RANGE CODE	CASE FILL	LENS	OPTIONS
PG25 = 2.5" PG40 = 4"	C = 304SS Crimped Ring	2 = Copper Alloy	A = Bottom B = Bottom/Rear Flange C = Center Back D = Center Back "U" Clamp E = Center Back/Front Flange	4 = 1/4" NPT *2 = 1/2" NPT	Common Ranges P16 = 0-30 psi P17 = 0-60 psi P18 = 0-100 psi P19 = 0-160 psi P20 = 0-200 psi P21 = 0-300 psi P23 = 0-600 psi P25 = 0-1,000 psi Available Ranges ■ Gauge Pressure, Vacuum, or Compound ■ Vac to 6,000 psi For Additional Range Codes See Page 45 P15B = 0-20 psi	-D = Dry -G = Glycerin -W = Glycerin/Water (65/35) Note: This model cannot be filled with silicone.	-P = Plastic *G = Glass	-TS = Stainless Steel Tag

*Non-standard configuration

OEM CODE **TBD**

PART NAME


DIAL MARKING DIAL

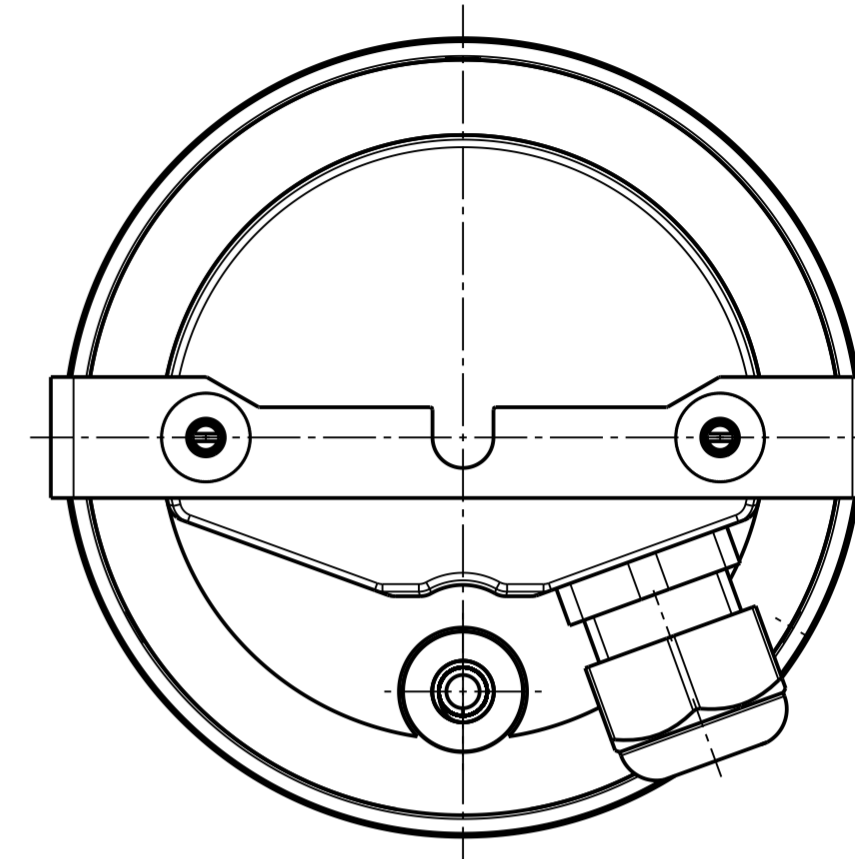
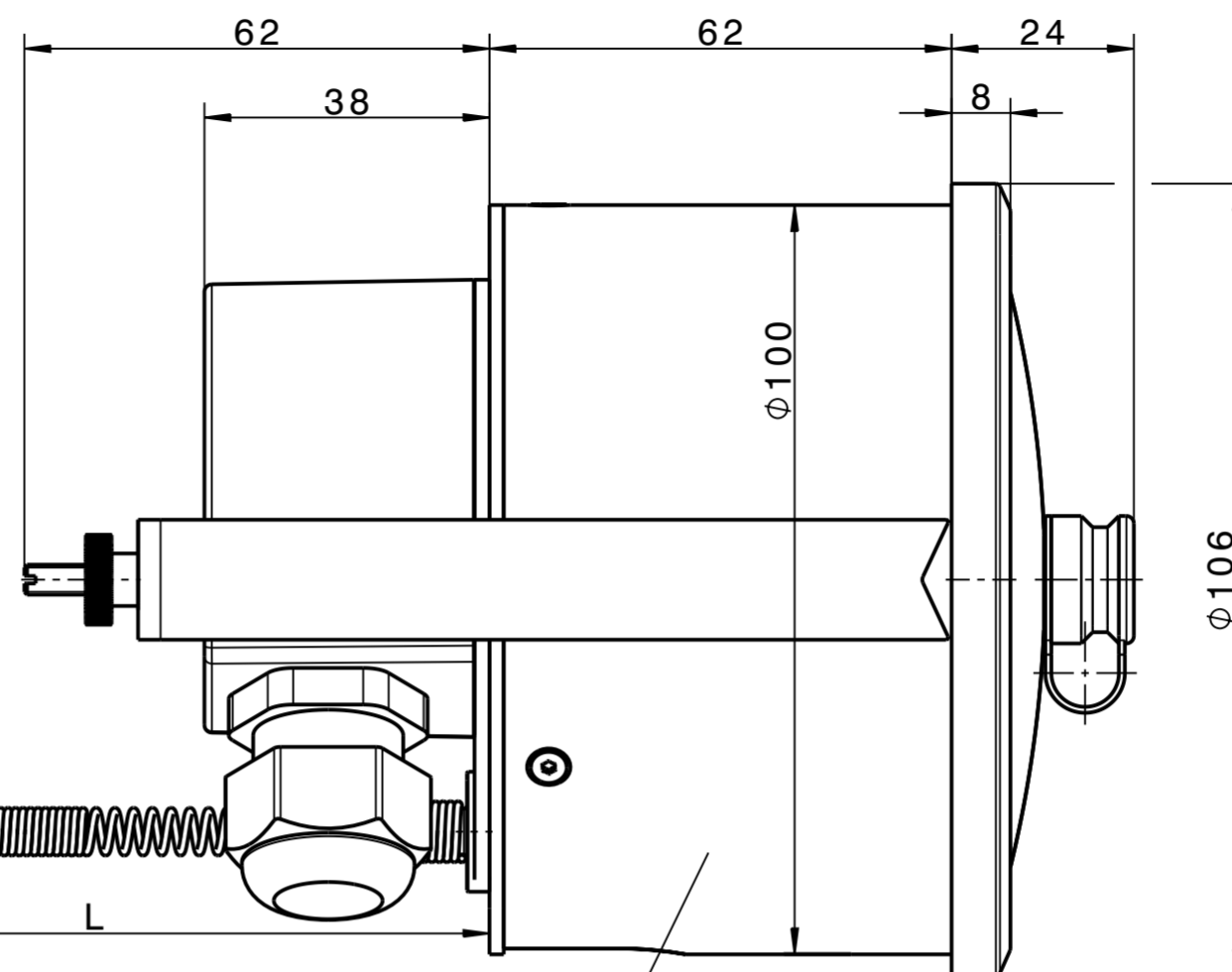
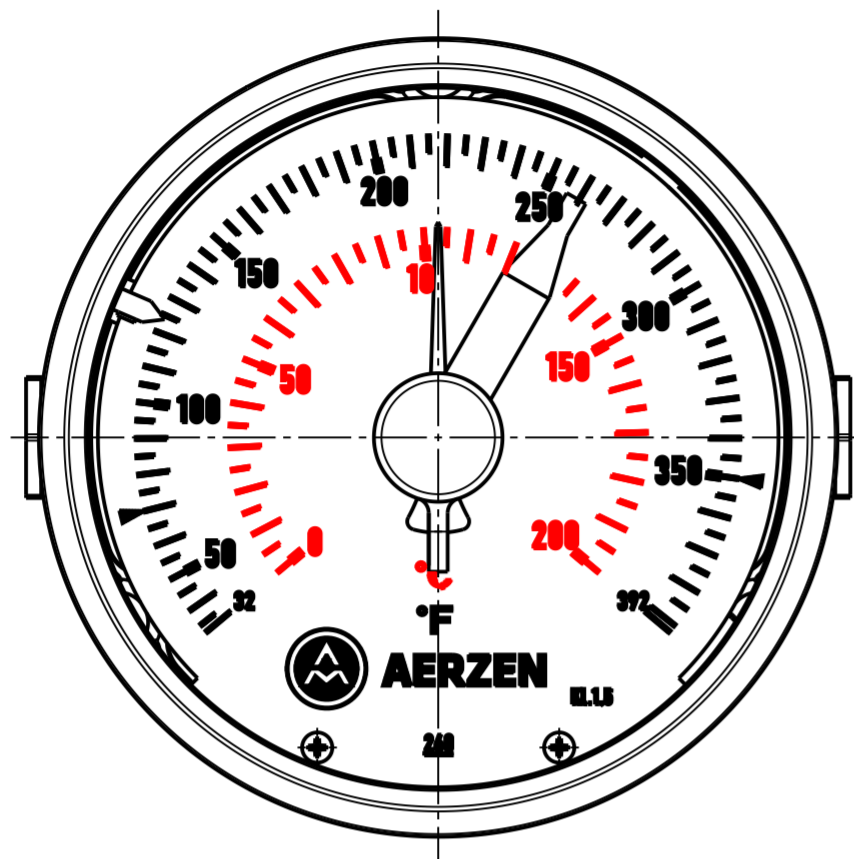
LOGO: AERZEN

RANGE: 0/20 psi

SIZE: PG40

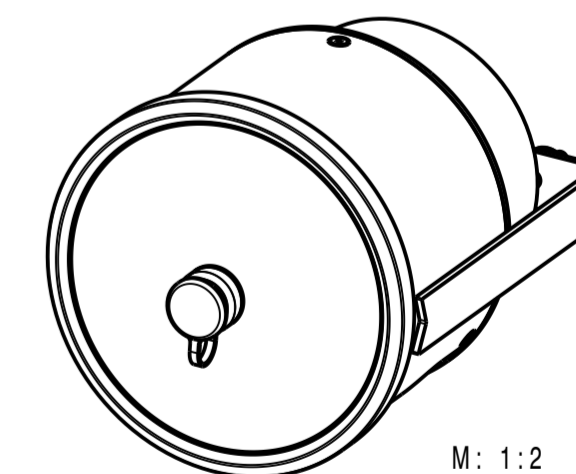
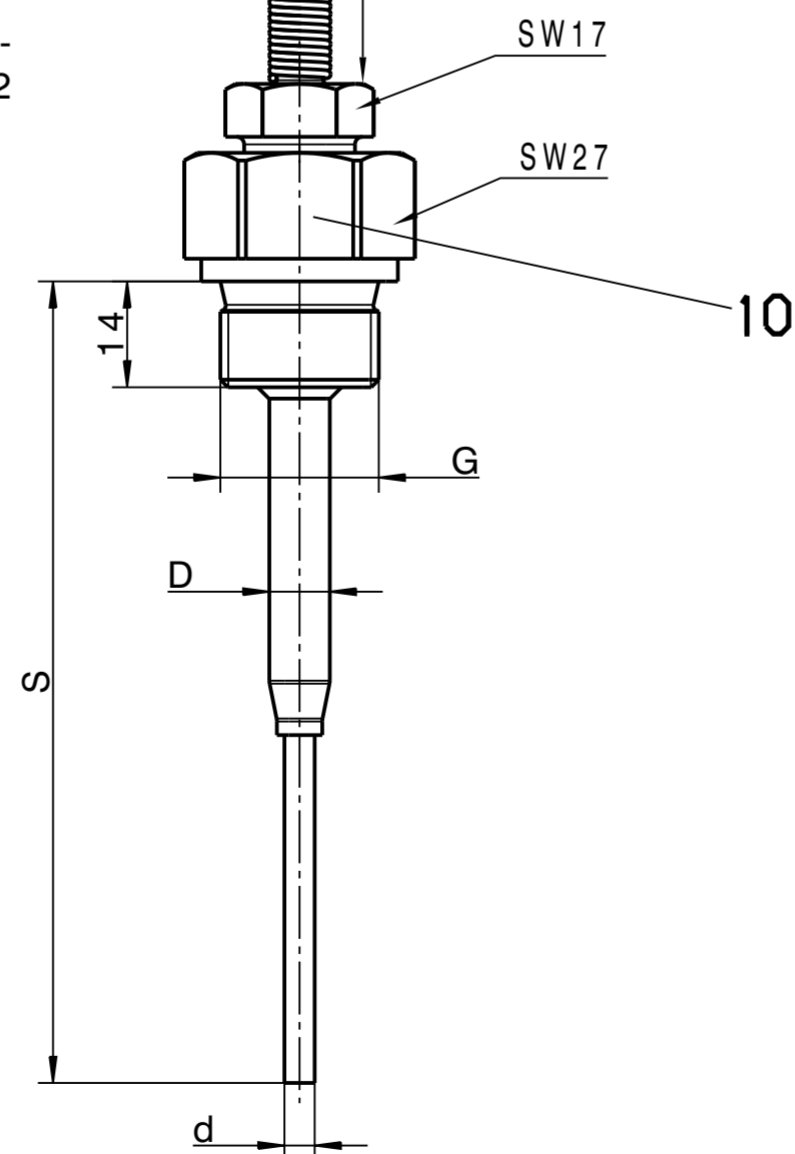


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		DRAWN BY ML	
		APPROVED	
SIZE	CAGE CODE: 24793	DWG NO.	REV A
SCALE: NTS		FILE NAME:	SHEET 1 OF 1



Typenschlüssel/ type code: 608520/2110-832-23-4000-876-8-104-26-46-106-20/426,430,477,522

Pos.	Pos.	001
Typ	type	2110
AB [°C]	display range	0...+200
AB-Einheit	display range oneness	°F/°C
FI Typ	capillary typ	-
Werkst. Fühler	material bulb	CrNi
L [mm]	L	4000
L ₂ [mm]	L ₂	-
Anschluß	connection	SH 10
G Gewinde	treath	G1/2
Werkst. Anschluß	material connection	CuZn
d [mm]	d	4
D [mm]	D	8
S [mm]	S	106
Schaltausgang	switching output	SA20
TZ	extra code	426,430,477,522
Laser Nr	laser No.	2463
Weitere Angaben n. Typenblatt	more information at datasheet	60.8520
Bedienungsanleitung	user manual	B60.8520
Grundtyp	type	85.364.00.00
TN	partnumber	00717805



Weitere technische Daten nach Typenblatt 60.8520
Further technical details as per data sheet 60.8520

Halbzeug/ Semi-finished part		Werkstoff-Nr./ Material-no.	DIN-Kurzbezeichnung/ DIN-code	Oberfläche/ Surface	
Bearb./ Edited	08.02.2019	Riedel	Zeigerkontakt- thermometer		02
Gepr./ Verified	08.02.2019	Kress	60852000A00Z001		01
EW-Stockl.-Nr./BOM-no.:		60852000A53Z000K015		00	
Zeichnungs-Nr./Drawing-no.		K015		00	
Ersatz für Nr./ Replace		Vers. Änderung/ Rev. Modification		Datum/ Date	
GmbH & Co. KG Fulda Germany		Maße ohne Toleranzangabe/ Tol. unless otherwise specified DIN ISO 2768-m		Maßstab/Scale 1:1	
Teile-Nr./Part-no.		Name		Größe/ Size A2	
Blatt/ Sheet 01/01					

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 Internet: www.jumousa.com



Contact dial thermometer

Particularities

- Temperature controller with actual value display as panel-mounting or add-on device
- Stainless steel case with bayonet lock
- Class 1.5
- Protection class IP 53
- Case sizes Ø: 60 mm, 80 mm and 100 mm
 Front frame: 72x72 mm and 96x96 mm

Brief description

Contact dial thermometer are devices with actual value display for temperature measurement, control and monitoring and can be used universally.

The temperature depending volume change in a measuring system filled with liquid or the temperature depending pressure change in a measuring system filled with gas is converted to a rotational movement of the actual value indicator by a bourdon tube, no transmission gear is required. The microswitch is actuated by the rotational movement of the indicator shaft via a tap system.



Technical Data

Case and front frame	Stainless steel (1.4301)
Cover cap	Plastic (PA6), gray, UV stabilized
Protection type	IP 51 as per DIN EN 60529 (IP 53 with extra code 401)
Front pane	Acryl glass (PMMA)
Chassis	Aluminum (3.2582.05)
Scale	white, labeled in black
Display	Class 1.5 similar to DIN EN 13190
Anti-kink spring	for devices with capillary on the case and the temperature probe
Set point value setting	by set point controller in the front window
Display correction	on the rear
Limit value temperatures	for transport and storage -30°C...+70°C (for display range -40...+40°C up to max. 50°C; -30...+50°C up to max. 60°C)
Rated position	any

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Technical Data

Display range (AB)	Display range in °C	Measuring range in °C	Tolerance in °C
469	-40...+40	-30...+30	1.5
643	-20...+120	-20...+120	3.0
807	0...+60	+10...+50	1.5
814	0...+100	+10...+90	1.5
818	0...+120	+20...+100	3.0
832	0...+200	+20...+180	3.0
840	0...+300	+30...+270	6.0
848	0...+400	+50...+350	6.0
854	0...+500	+50...+450	8.0
848	0...+600	+100...+500	10.0

	Liquid filling	Gas filling
Measuring system	Display range (AB) ≤ 350°C	Display range (AB) ÷ 400°C
Time behavior	approx. 12 s, measured in water, with a probe Ø of 6 mm made of Cu.	approx. 4 s, measured in oil, with a probe Ø of 10 mm made of stainless steel.
Ambient temperature influence effect	In % of the display range (referring to the deviation from the reference value +23°C)	
on case	0.15% of the display range per K ambient temperature change	0.05% of the display range per K ambient temperature change
on capillary (per m)	0.03% of the display range per K ambient temperature change	no influence
	Higher ambient temperature – higher temperature display – lower switching point	
Anti-kink spring	for devices with capillary on the case and the temperature probe	
Set point value setting	by set point controller in the front window	
Display correction	on the rear	
Limit value temperatures	for transport and storage -30°C...+70°C (for display range -40...+40°C up to max. 50°C; -30...+50°C up to max. 60°C)	
Rated position	any	

	standard	Extra code (TZ) 650
Electric contact	Single-pole microswitch with mechanically actuate change-over contact	
Type of contact		
Contact rating	AC 230V, +10/-15%, 48...63Hz, cos φ = 1 (0.6)	
	5 (1.5) A	10 (3) A
Hysteresis	approx. 1.5% of the display range	
Switching point accuracy	± 0.5% of the display range referring to the switch-off point with rising temperature	
Switching reliability	To ensure a high switching reliability, we recommend a minimum voltage of 24 V and a minimum current of 100 mA	

	standard	Design 02 and 22	Design 10, 23 and TZ 426	Case Ø 60 mm
Electrical connection	Screw-type terminals, connection cross section up to 2.5 mm ²	Connection cable 0.5 m with screw-type terminals	Cover cap with cable screw-connection, suitable for cable Ø from 6.5 to 13 mm	Cover cap with cable screw-connection, suitable for cable Ø from 8 to 10 mm

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Note:

Physical and toxic features of the expansion means, which could emerge in the event of a measuring system break.

Control range with scale limit value	Hazardous reactions	Fire and explosion hazard		hazardous to waters	Information about toxicology		
		Ignition temperature	Explosion limit		irritant	dangerous to health	toxic
< +200°C	no	+ 355°C	0.6 - 8 V%	yes	yes	a	no
≥ 200°C ≤ +350°C		+ 490°C	- -	yes	yes	a	
> 350°C ≤ +500°C		no	no	no	no	no	

^a There is currently no statement by the health authority concerning hazards to health in the event of short-term exposure and low concentration, e.g. measuring system break.

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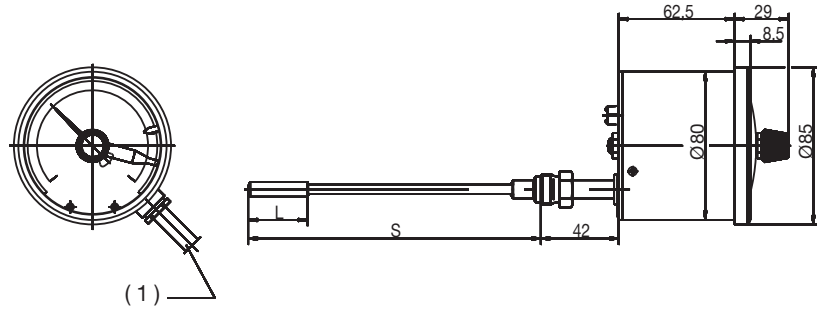
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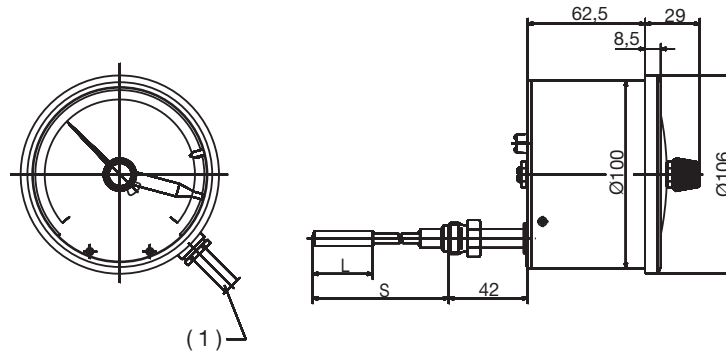
Dimensions

Type:
 608520/0280



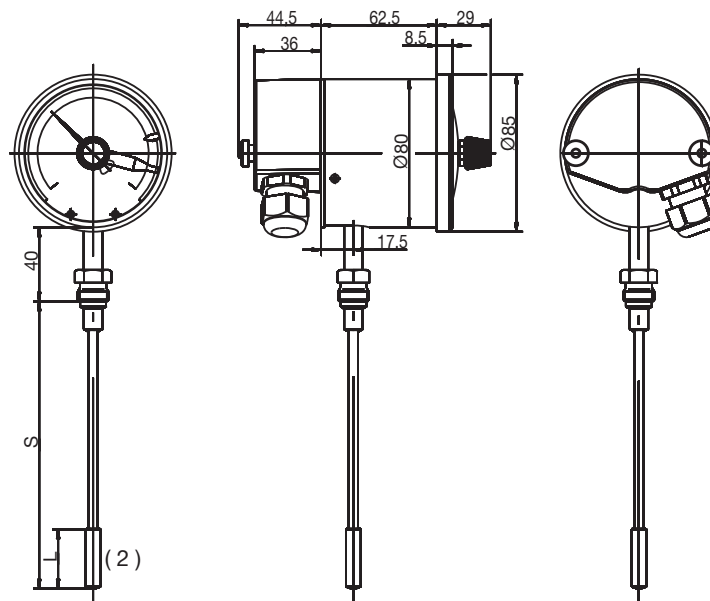
(1) Connection line 0.6 m long with screw terminal

Type:
 608520/0210



(1) Connection line 0.6 m long with screw terminal

Type:
 608520/1080



(2) active probe dimension

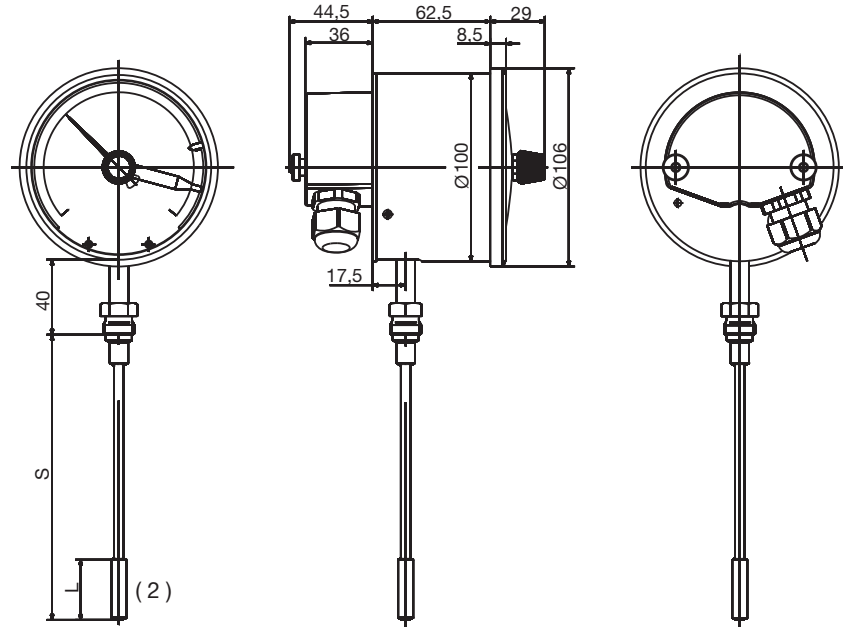
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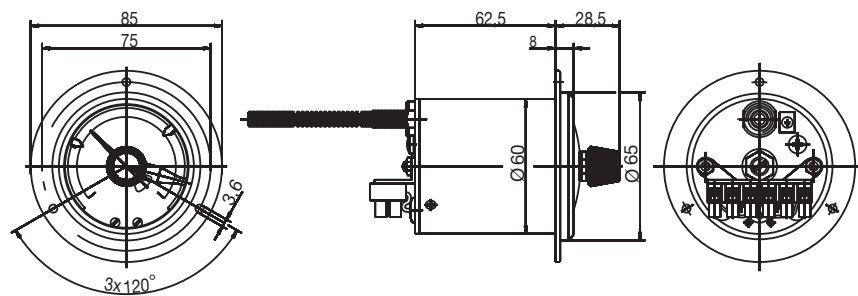


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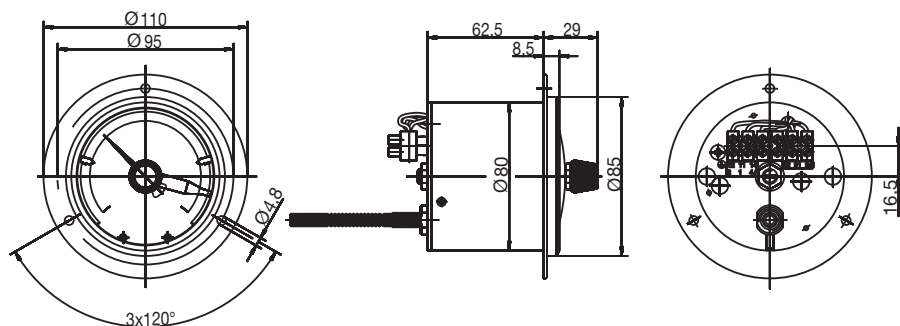
(2) active probe dimension

Type:
 608520/2060



Panel cut-out for case
 $\varnothing 60 \text{ mm} = 62^{+0.5} \text{ mm}$

Type:
 608520/2080



Panel cut-out for case
 $\varnothing 80 \text{ mm} = 62^{+0.5} \text{ mm}$

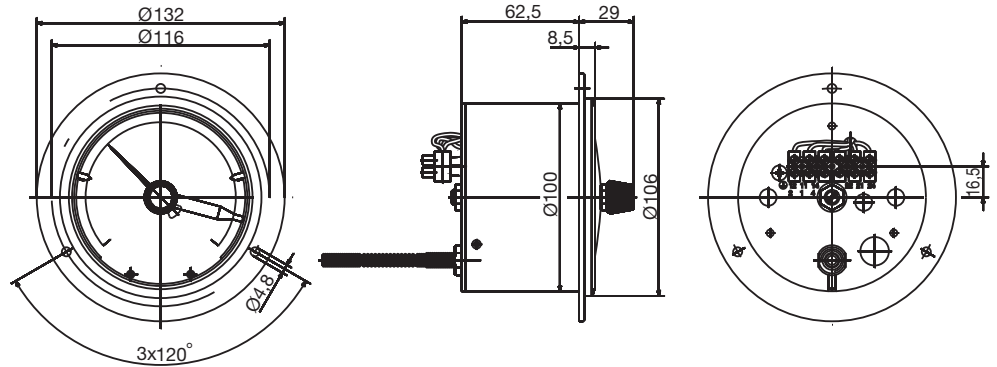
JUMO GmbH & Co. KG
 Delivery address: Mackenrodtstraße 14
 36039 Fulda, Germany
 Postal address: 36035 Fulda, Germany
 Phone: +49 661 6003-0
 Fax: +49 661 6003-607
 E-mail: mail@jumo.net
 Internet: www.jumo.net

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 Harlow, Essex CM20 2DY, UK
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 Fax: +44 1279 635262
 E-mail: sales@jumo.co.uk
 Internet: www.jumo.co.uk

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 1-800-554-5866
 Fax: 315-437-5860
 E-mail: info.us@jumo.net
 Internet: www.jumousa.com

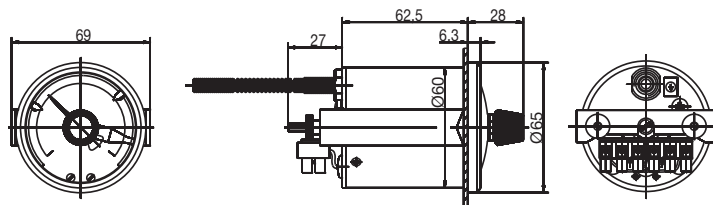


Type:
 608520/2010



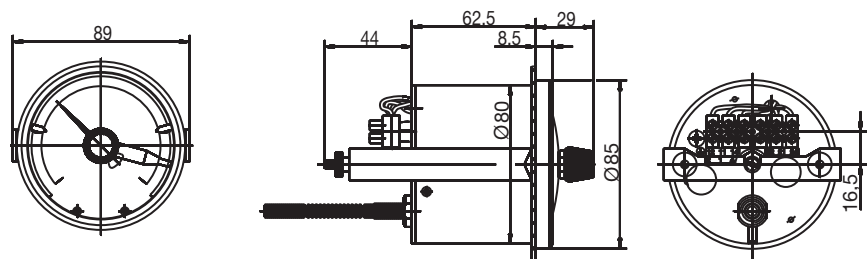
Panel cut-out for case
 $\varnothing 100 \text{ mm} = 100^{+0.5} \text{ mm}$

Type:
 608520/2160



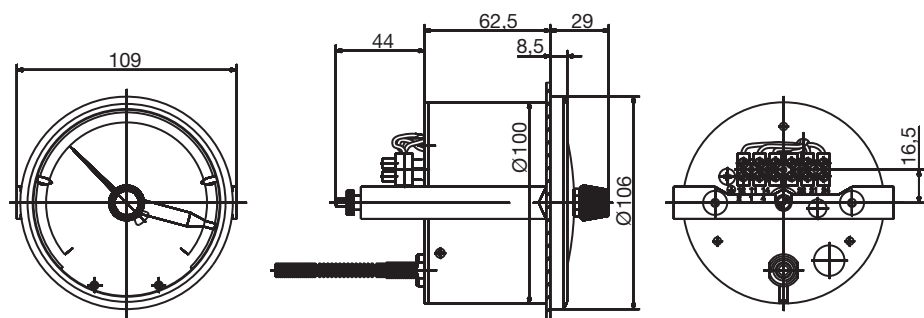
Panel cut-out for case
 $\varnothing 60 \text{ mm} = 62^{+0.5} \text{ mm}$

Type:
 608520/2180



Panel cut-out for case
 $\varnothing 80 \text{ mm} = 82^{+0.5} \text{ mm}$

Type:
 608520/2110



Panel cut-out for case
 $\varnothing 100 \text{ mm} = 100^{+0.5} \text{ mm}$

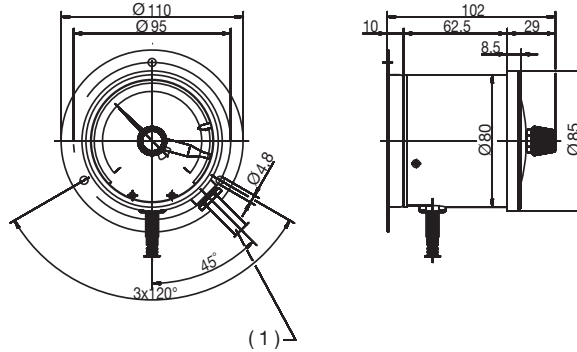
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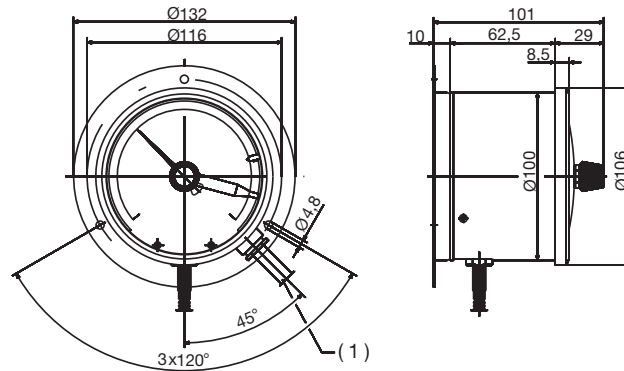


Type:
 608520/2280



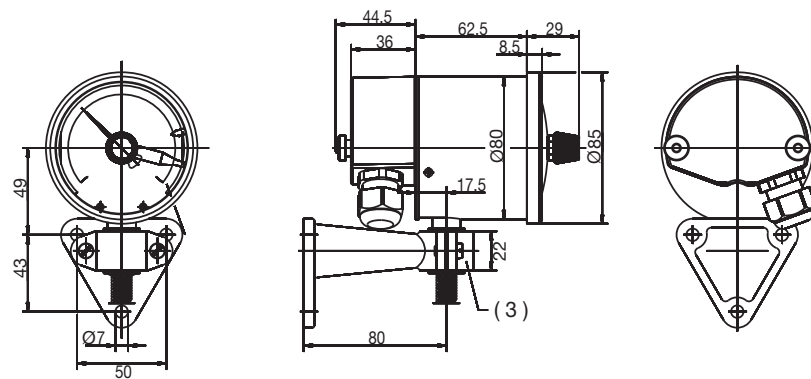
(1) Connection line 0.6 m long with screw terminal

Type:
 608520/2210



(1) Connection line 0.6 m long with screw terminal

Type:
 608520/2380



(3) Spigot \varnothing 20 mm

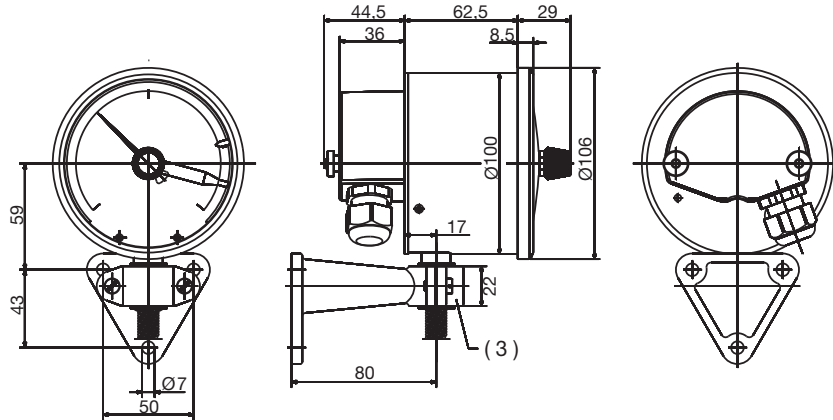
JUMO GmbH & Co. KG
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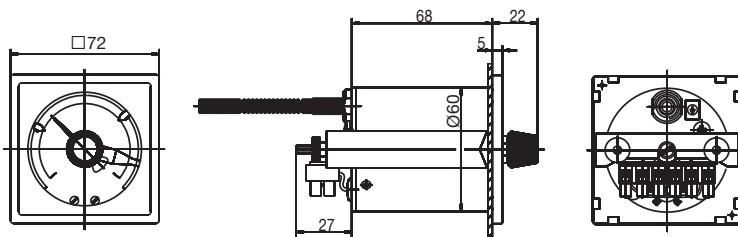


Type:
 608520/2310



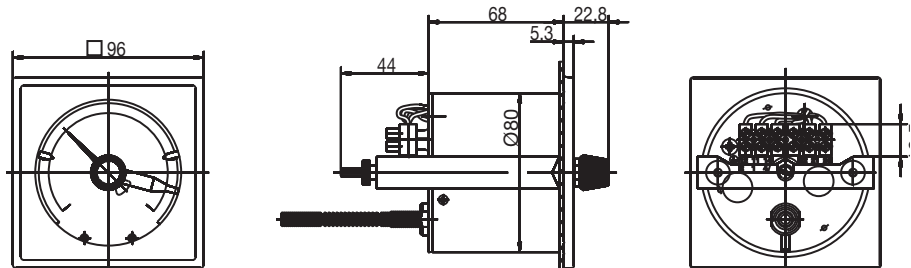
(3) Spigot Ø 20 mm

Type:
 608520/2572



Panel cut-out for front frame
 72 x 72 mm = Ø 62^{+0,5} mm

Type:
 608520/2596



Panel cut-out for front frame
 96 x 96 mm = Ø 82^{+0,5} mm oder
 96 x 96 mm = 92 x 92^{+0,5} mm (TZ 460)

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Order details

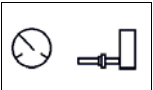
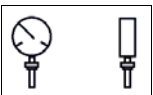
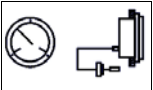
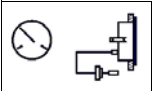
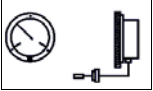

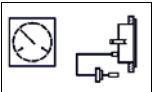
Order code

(1) Basic type

608520	Mechanical Contact dial thermometer, class 1.5
608550	Mechanical Contact dial thermometer, class 1.5, Transformer version (only basic type extension 1080)

(2) Basic type extensions

Case size Ø

0280	Design 02		80 mm
0210			100 mm
1080	Design 10		80 mm
1010			100 mm
2060	Design 20		60 mm
2080			80 mm
2010			100 mm
2160	Design 21		60 mm
2180			80 mm
2110			100 mm
2280	Design 22		80 mm
2210			100 mm
2380	Design 23		80 mm
2310			100 mm
2572	Design 25		Case size □
2596			72 x 72 mm
			96 x 96 mm

(3) Display range in °C

469	-40...+40
643	-20...+120
807	0...+60
814	0...+100
818	0...+120
832	0...+200
840	0...+300
848	0...+400
854	0...+500
858	0...+600

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Order code


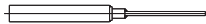
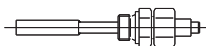





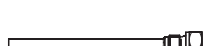





(4) Capillary type (FL) ^a

- 00 Without (with rigid connection)
- 02 FL 02 Cu capillary with Cu textile braiding, approx. Ø 2.5 mm (up to AB limit value +300°C)
- 11 FL 11 Cu capillary with PE jacketing, approx. Ø 3.5 mm (up to AB limit value +120°C)
- 17 FL 17 Stainless steel capillary, approx. Ø 1.5 mm
- 21 FL 21 Cu capillary, approx. Ø 1.0 mm (up to AB limit value +300°C)

(5) Capillary ^b

- 0 Without (with rigid connection)
- 1000 1000 mm
- 2000 2000 mm
- 3000 3000 mm
- 4000 4000 mm**
- 5000 5000 mm
- ... Special length (specifications in plain text: 1000 mm steps, maximum length 6000 mm), further lengths on request

(6) Process connection (PA) ^a

- | | | | |
|------------|--------------|---|---|
| 750 | TF 01 | Temperature probe with stepped support tube |  |
| 752 | TF 11 | Temperature probe without support tube |  |
| 843 | TA 02 | Immersion tube with union nut and loose screw-connection ^b |  |
| 161 | TA 03 | Immersion tube with loose screw-connection |  |
| 847 | TA 06 | Immersion tube with displaceable clamping screw-connection on support tube ^b |  |
| 311 | TA 20 | Immersion tube with loose screw-connection and connection collar ^b |  |
| 872 | TA 21 | Immersion tube with loose screw-connection and sealing cone (only G 3/8 possible) |  |
| 873 | TA 22 | Immersion tube with loose pressure screw, sealing cone and loose screw-connection ^b |  |
| 874 | TA 24 | immersion tube with screw fitting, O ring seal and clamping screw ^{a b} |  |
| 401 | TA 23 | Immersion tube with pressure screw and contact pressure spring (only M 10x1 possible) |  |
| 913 | SH 07 | Screw-in sheath, multi-part, with clamping piece and locking screw (suitable for TF 01 and TF 11) |  |
| 820 | SH 09 | Weld-in sheath, multi-part, with clamping piece and locking screw ^b (not for FL 21 - welding collar with steel 1.4515) |  |
| 876 | SH 10 | Screw-in sheath, multi-part ^b (suitable for TA 21) |  |
| 871 | SH 11 | Screw-in sheath, multi-part ^b (suitable for TA 23) |  |

^a For the description and particularities refer to data sheet 608730.

^b Screw-in spigot as per DIN 3852, form A.

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**Order code (7) Ø Process connection (PC) ^a**

6	6 mm
8	8 mm
10	10 mm
11	11 mm
12	12 mm

(8) Thread type of process connection (PA) ^a

000	Without thread (for TA 01 and TF 11)
103	Screw connection G 3/8
104	Screw-connection G 1/2
105	Screw-connection G 3/4
114	Screw-connection M 10 x 1 (only for TA 23)

(9) Material, probe / support tube ^a

26	Stainless steel (CrNi, 1.4571)
96	Copper (Cu) / Brass (CuZn) (up to 200°C)
95	Stainless steel (CrNi, 1.4571) - probe / Brass (CuZn) - support tube from 250°C)

(10) Material of process connection (PA) ^a

00	Without (only TF 01 and TF 11)
26	Stainless steel (CrNi, 1.4571)
46	Brass (CuZn)

(11) Fitting length, process connection (PA) ^a (dimension "EL" or "S")

0	Minimum fitting length TF 11 (active probe dimension)
50	50 mm
100	100 mm
150	150 mm
200	200 mm
...	Special length (specifications in plain text - 50 mm steps)

106	106 mm
-----	--------

For the description and particularities refer to data sheet 608730.

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Order code (12) Switching output (SA)

20	SA 20	One contact	
21	SA 21	Two contacts	
22	SA 22	Two contacts - Sequence switch	

(13) Extra codes (TZ)

000	Without extra codes
430	Fly back (includes TZ 477)
426	Cover cap to protect the screw terminals against access and splashing water (standard for design 10 and 23; not for design 22; not in connection with TZ 460)
650	Microswitch 10 (3) A (AC/DC 230 V, +10/-15%, 48...63 Hz, cos φ = 1 (0.6))
518	Stop for Min. — or Max. — set point value limitation, factory set
460	Device centering for panel cut-out 92 x 92 mm (only for basic type extension 2596)
477	Set point adjustment protected by the bolted cover. Adjustment with screwdriver.
401	Protection class IP 53 as per EN 60529, includes TZ 426 and TZ 477 (not for case Ø = 60 mm and front frame 72 x 72 mm; not for design 02 and 22)
522	Customized scale

Special versions on request !

Order code

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
608520	/	-	...	-	..	-	...	-	...	-	...

Order example

608520 / 2010 - 818 - 21 - 2000 - 104 - 10 - 000 - 26 - 00 - 100 - 20 / 650^a , ...

^a State extra codes one after another, separated by commas.

Stock versions

Part no.	Type	Display range °C	Switching output	Temperature probe, process connection	Immersion tube mm
00455918	608550/0180-643-874-8-106-50-150-20/434-522 with fly back	-20...+120	20 (1 contact)	TF 05 d = 8 mm TA 24, G 1", CuZn	150
00455919	608550/0180-643-874-8-106-50-150-21/434-522 with fly back		21 (2 contacts)		

Delivery within 3 working days after receipt of order

SECTION 5

TOSHIBA

Leading Innovation >>>



Efficiency, Quality, & Performance (EQP) — The EQP Global™ SD is Toshiba's next-generation NEMA Premium® efficiency motor series.

This cutting-edge motor product line is designed to meet or exceed the competitive demands of the global market as well as the requirements of the Energy Independence & Security Act of 2007 (EISA), while maintaining the high reliability and quality expected from Toshiba.

The EQP Global SD motor series is designed for severe duty applications. Building on over 20 years of success with our EQPIII motor series, the EQP Global SD features multiple new design enhancements that make it one of the lowest cost of ownership products in the industry.

Our EQP philosophy extends beyond great products. We provide Extended Warranties and Global Supply Chain Management Systems (GSCMS) to meet the evolving needs of our global customers.

- NEMA Premium® Efficiency (1 through 500 HP)
- Meets or Exceeds Energy Independence & Security Act of 2007 (EISA)
- Addresses Global Motor Specifications Including CE, NEMA, & IEC
- Dual-Frequency 50/60 Hz Design (50/60 Hz Listed on Nameplate on 1 through 75 HP)
- Inverter-Duty Rated
- Multi-Mount on 140 Through 445 & N449 Frames
- Cast Iron Conduit Box as Standard



Horsepower	¼ to 700 HP
Speed (60 Hz) (50 Hz)*	3600, 1800, or 1200 RPM 3000, 1500, or 1000 RPM
Voltage (60 Hz) (50 Hz)*	230/460, 460, or 575 V 190/380 or 380 V
Enclosure	Totally Enclosed Fan Cooled
Frame Size	143T through 5810U
Protection	IP54
Construction	Cast Iron (Frame, Brackets, & Conduit Box)
Insulation	Class F, Exceeds NEMA MG1 Part 31 (Inverter Duty)
Vibration	Typically 0.08 Inches/Second or Less (Unfiltered)
Mounting	Motors Suitable for Horizontal & Vertical Mounting; Motors also Available with C-Face Mounting
Environment	Severe Duty, Suitable for Use in Division 2 Hazardous Locations

*50/60 Hz Listed on Nameplate on 1 through 75 HP



EQP Global SD

LOW VOLTAGE MOTOR
SEVERE DUTY

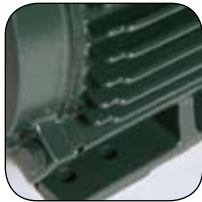


EQP GLOBAL - BUILT FOR SEVERE DUTY APPLICATIONS



Nameplate

- Stainless Steel
- NEMA Premium® Design
- Etched Lettering
- Dual-Frequency 50/60 Hz on Nameplate
- Inverter Duty Rating on Nameplate (1 to 200 HP, 4- & 6-Pole)



Construction

- Cast Iron Frame & Bearing Brackets
- Shaft Slinger Protection
- Multi-Mount on 140 Through 445 & N449 Frames
- Gasket Provided Between Motor Frame & Conduit Box
- Typical Unfiltered Vibration Levels of 0.08 Inches/Second or Less
- IP54 Protection
- Multiple Drain Provisions for Horizontal & Vertical Mounting



Conduit Box

- Gasketed Cast Iron Construction
- Provision for Grounding
- Terminal Lugs on 280 Frame & Larger
- Rotatable (90°)
- NPT Drill & Tap Conduit Opening



Bearing System

- Oversized 300 Series Bearings on All Frames (DE & ODE)
- Regreasable 280 Frame and Larger
- Locked Drive-End Bearing 210 Frame & Larger
- Low Temperature-Rise for Extended Life
- L-10 Life of 150,000 Hours for Direct-Coupled Applications
- L-10 Life of 40,000 Hours for Belted Applications



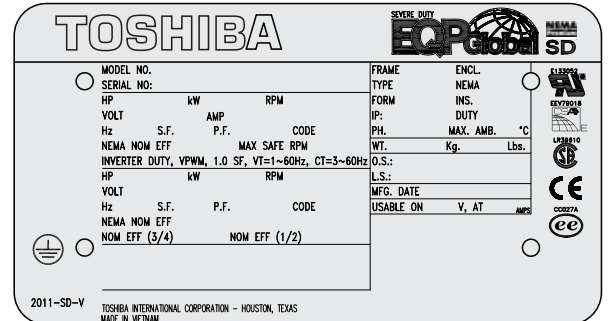
Insulation System

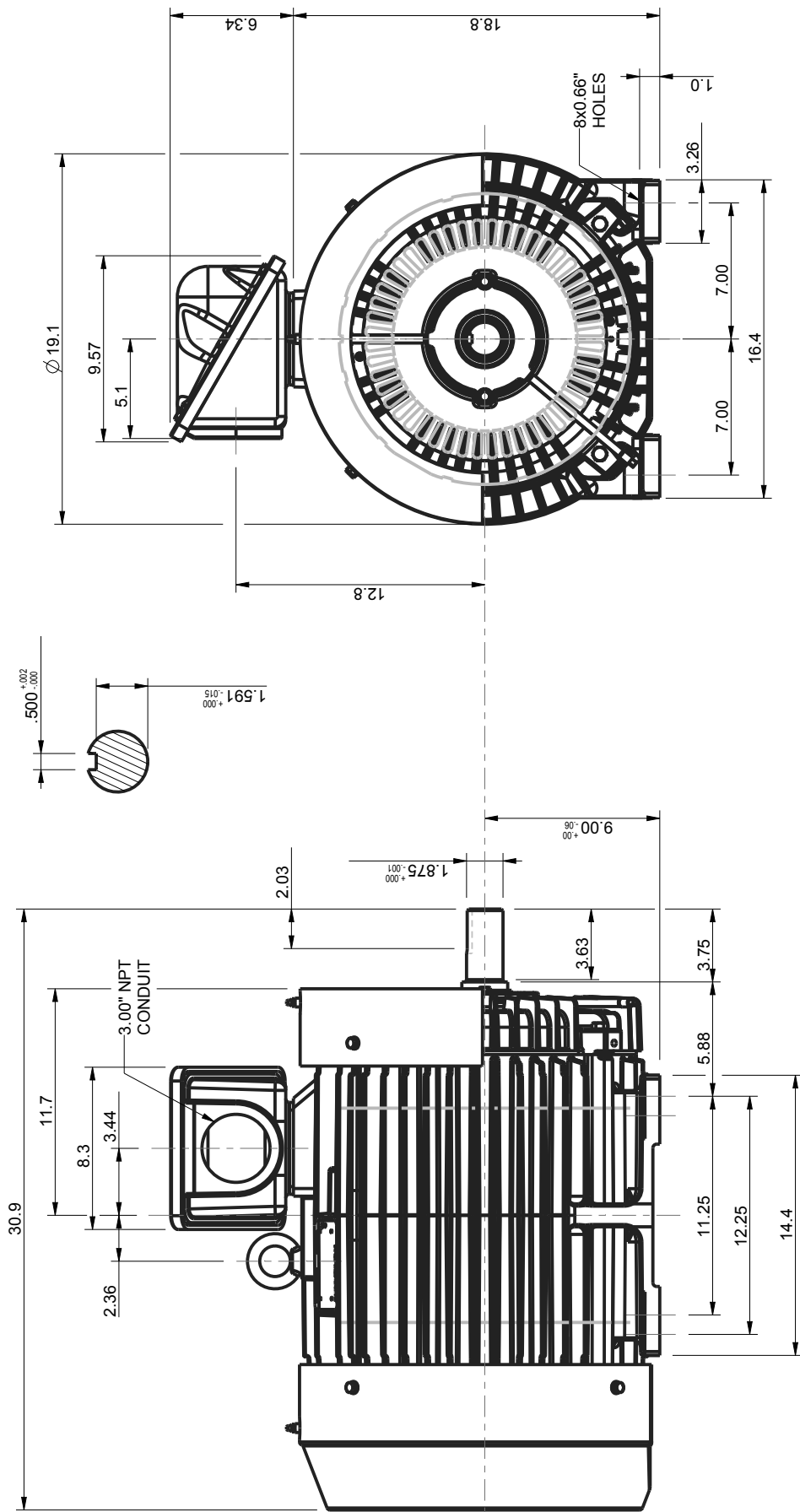
- Major Components Made from Class H Rated Materials
- Low-Loss Electrical Steel
- Exceeds NEMA MG1 Part 31
- 20:1 Constant Torque & 60:1 Variable Torque (1 to 200 HP, 4- & 6-Pole)
- Voltage Withstand Capability of 2000 V in 0.1 μ s
- Large Thermal Margins for Extended Life & Reliability
- Phase Paper & Coil Bracing on Both Ends on All Motor Ratings



Testing

- 100% No-Load Commercial Test per IEEE 112 on All Motors
- On 440 Frame & Larger:
- Commercial Test & Vibration Test
- 100% of Bearings are Ball-Pass Frequency Tested





- NOTES:
1. MAIN CONDUIT BOX MAY BE ROTATED IN 90° INCREMENTS
 2. STANDARD PRODUCT USE BIDIRECTIONAL FAN; OPPOSITE ROTATION AVAILABLE ONLY BY CONNECTION CHANGE.
 3. KEY DIMENSIONS EQUAL 0.500" x 0.500" x 2.00" (MOTOR SUPPLIED WITH KEY)

UNITS: INCHES

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360TS TEFC FRAME
F3 ASSEMBLY

MDSL V020-07

TOSHIBA
TOSHIBA INTERNATIONAL CORPORATION



DRAWN BY: M. O'DOWD
CHECK BY: J. RUSSELL
APPROVED BY:

www.toshiba.com/ind

TOLERANCES	NO	REVISION	DATE	CHECK
X .1				
.XX .03				
.XXX .005				
.XXXX .0005				
MAXIMUM MOTOR WEIGHT				
893 lbs.	0	FIRST ISSUE	02/04/14	JR
405 kgs.	NO			

M. O'DOWD
DRAWN BY

02/04/14
DATE

JR
CHECK



Issued Date	9/24/2019	Transmit #	
Issued By	dschoeck	Issued Rev	

TYPICAL MOTOR PERFORMANCE DATA

Model: 0752SDSR41B-P3

HP 75	kW 55	Pole 2	FL RPM 3550	Frame 365TS	Voltage 230/460	Hz 60	Phase 3	FL Amps 172/86
Enclosure	IP	Ins. Class	S.F.	Duty	NEMA Nom. Eff.	NEMA Design	kVA Code	Ambient (°C)
TEFC	55	F	1.15	CONT	93.6	B	G	40 C

Load	HP	kW	Amperes	Efficiency (%)	Power Factor (%)
Full Load	75	55.9	86.0	93.6	89.3
¾ Load	56.25	41.9	64.7	93.2	88.6
½ Load	37.50	28.0	45.7	91.6	84.7
¼ Load	18.75	14.0	28.9	86.6	70.1
No Load			21.0		7.3
Locked Rotor			542		36.3

Torque				Rotor wk ² Inertia (lb-ft ²)
Full Load (lb-ft)	Locked Rotor (% FLT)	Pull Up (% FLT)	Break Down (% FLT)	
111	215	185	270	12.57

Safe Stall Time(s)		Sound Pressure dB(A) @ 1M	Bearings*		Approx. Motor Weight (lbs)
Cold	Hot		DE	NDE	
35	15	-	6312ZC3	6312ZC3	887

*Bearings are the only recommended spare part(s).

Motor Options:
Product Family:EQP Global SD
Mounting:Footed,Shaft:TS Shaft

Customer	
Customer PO	
Sales Order	
Project #	

Tag:

All characteristics are average expected values.

TOSHIBA INTERNATIONAL CORPORATION · HOUSTON, TEXAS U.S.A.

Engineering	aacosta	Doc. Written By	D. Suarez	Doc.# / Rev	MPCF-1119 / 1
Engr. Date	4/19/2012	Doc. Approved By	M. Campbell	Doc. Issued	9/20/2019



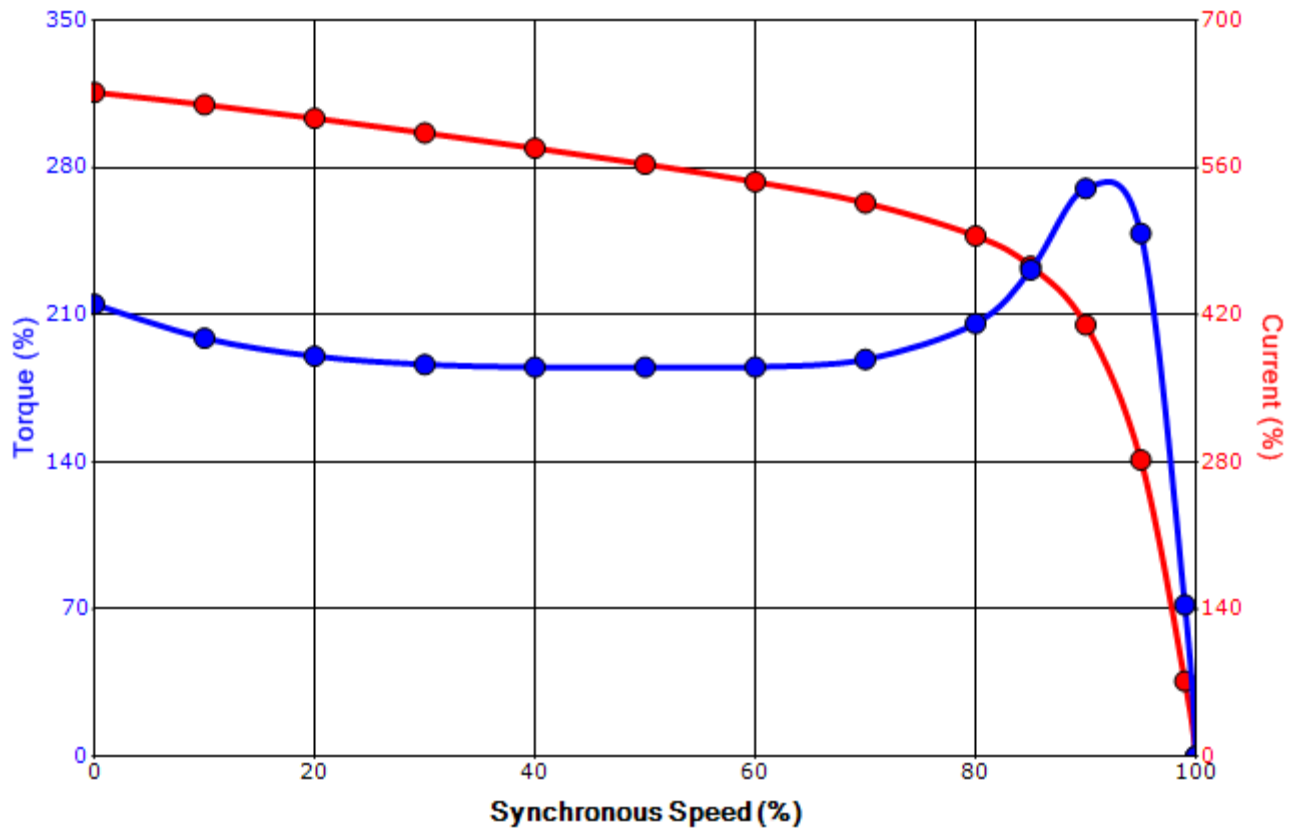
Issued Date	9/24/2019	Transmit #	
Issued By	dschoeck	Issued Rev	

SPEED TORQUE/CURRENT CURVE

Model: 0752SDSR41B-P3

HP	kW	Pole	FL RPM	Frame	Voltage	Hz	Phase	FL Amps
75	55	2	3550	365TS	230/460	60	3	172/86
Enclosure	IP	Ins. Class	S.F.	Duty	NEMA Nom. Eff.	NEMA Design	kVA Code	Ambient (°C)
TEFC	55	F	1.15	CONT	93.6	B	G	40 C
Locked Rotor Amps	Rotor wk ² Inertia (lb-ft ²)	Torque				Pull Up (%)	Break Down (%)	
		Full Load (lb-ft)	Locked Rotor (%)					
542	12.57	111	215		185	270		

Design Values



Customer		wk ² Load Inertia (lb-ft ²)	-
Customer PO		Load Type	-
Sales Order		Voltage (%)	100
Project #		Accel. Time	-

Tag:

All characteristics are average expected values.

TOSHIBA INTERNATIONAL CORPORATION · HOUSTON, TEXAS U.S.A.

Engineering	aacosta	Doc. Written By	D. Suarez	Doc.# / Rev	MPCF-1121/1
Engr. Date	4/19/2012	Doc. Approved By	M. Campbell	Doc. Issued	9/20/2019

Motor Connection Diagrams
12 Leads

Across-the-Line Starting / Running Connections

Low Voltage Delta



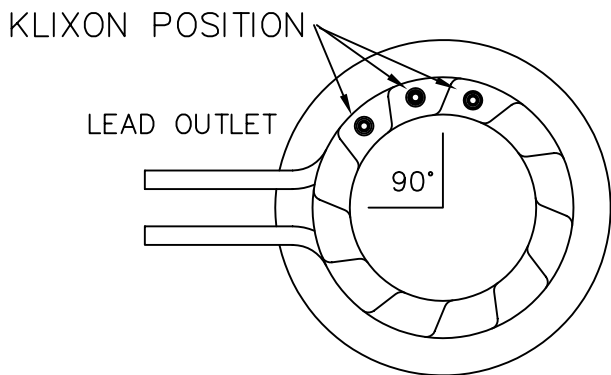
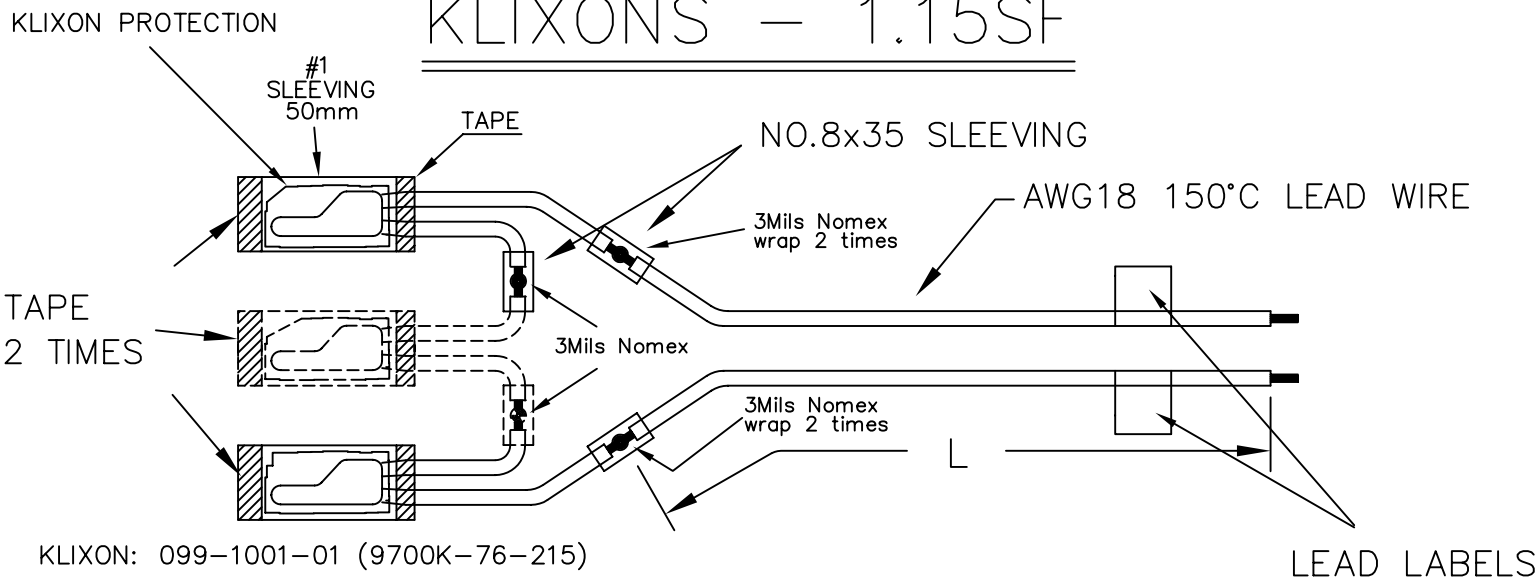
High Voltage Delta



Switch L1 and L2 to reverse rotation

Suitable for Wye-Delta Starting and Limited Part-Winding-Starting.
Please Contact Toshiba International for specific connections.

KLIXONS - 1.15SF



- ONE WINDING MOTOR
LABEL LEADS: P1 & P2
- TWO WINDING MOTOR
TWO SETS PER MOTOR
LABEL LEADS: P1 & P2 (1st WINDING
INSERTED HIGH SPD)
P3 & P4 (2nd WINDING
INSERTED LOW SPD)

LIMITING TEMPERATURE 145°C

VIEW FROM CONNECTION END

P.NO.	FRAME	L	QTY.	SP-T
1	140/180/210 TEFC,ODP	420	A	AT WINDING
2	250 TEFC,ODP	470	A	
3	280 TEFC,ODP	540	B	
4	320 TEFC,ODP	580	B	
5	360 TEFC,ODP	690	B	AFTER ASSY.
6	400 TEFC,ODP	740	B	
7	440 TEFC,ODP	950	B	
8	500 TEFC,ODP	1100	B	
9	580 TEFC	1400	B	

ABM	TIC. NO.	DESC.	QTY.A	QTY.B
KLIXONS	099-1001-01	9700K-76-215	2	3
LEAD WIRE	045-0021-150	AWG18	SEE TABLE	SEE TABLE
SLEEVING	028-1007	NO.8X35	3	4
3 MILS NOMEX TAPE	030-0001	—	—	—
SLEEVING	028-0005	NO.1X50	2	3
TAPE	029-0009	3M#69 TAPE	4	6

FILE: DOC00080

6	ADD PART #'S 1 & 2	JMF	092399	DATE: 010389	KLIXONS - 1.15SF
5	CHG LEAD WIRE FROM STD	JM	101598	BY: KEN M	
4	REMOVE P.NO. 1 AND 2	AT	050698	CHK: <i>Jay B.</i>	TIC: 139-0009
3	UPDATE DRAWING	CA	030298		
2	ADD TWO WINDING NOTE	SAM	113092	SCALE:	QTY PROJECT:
1	ADD LEAD LABELS	KM	082490	MATL:	
NO	REVISION	BY	DATE		

TEXAS INSTRUMENTS

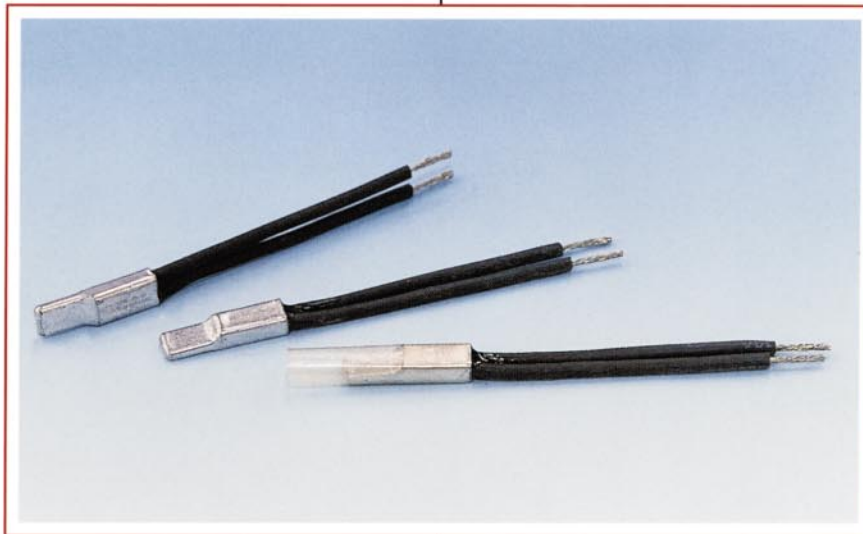
9700 ON-WINDING MOTOR PROTECTOR

As a world market leader in appliance motor protection Texas Instruments builds the 9700 to meet almost any application in this market. This compact motor protector provides locked rotor and overload protection in a wide range of industrial and domestic appliances.

Design and operating principles

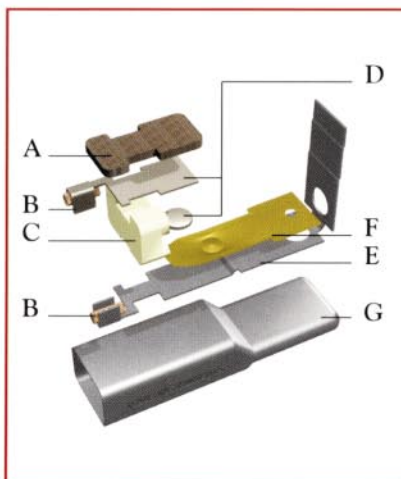
The 9700 design consists of a sealed tin-plated steel can that holds and protects the inner components against penetration of dirt and varnish as well as mechanical forces. The standard 9700 model is supplied with two insulated leads and with shrinkable sleeves as an option. The steel terminal inside the can contains the calibrated Klixon® disc, carrying a contact of fine silver. Another contact is placed on the opposite side, separated from the terminal by an insulator.

The operating principle of the 9700 is both simple and effective. A current flows through the resistive Klixon® bimetal disc. When a fault condition occurs, the increased current and ambient temperature cause the bimetal disc to snap open the contacts. The contacts close again automatically as the device cools down to a safe running temperature.



Applications

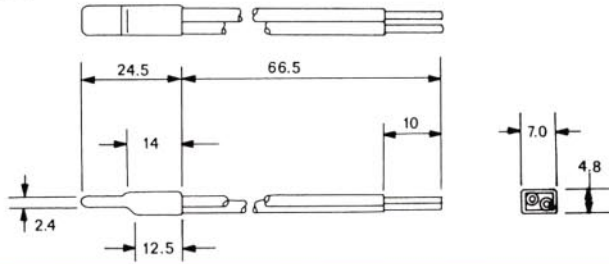
The 9700 operates as a sensitive power cut-out for applications like single and three-phase motors, choke coils, solenoid valves and transformers. In single-phase motors, it can be mounted directly in the main circuit to serve as an on-winding protector. Its compact size assures ease of installation, even in small spaces. At this time there is practically no motor the 9700 cannot protect against overheating and overloading. Texas Instruments' 9700 provides you with a cost-effective solution in terms of maximum quality and reliability.



- A: Insulator
- B: Crimp terminals for insulated leads
- C: Insulator
- D: Contacts
- E: Steel terminal
- F: Calibrated Klixon® snap action disc
- G: Tin plated steel can



Dimensions (mm)



Numbering system

9700		H	2	06	777	A
Contact Type/Rating		Temperature Tolerance		Temp. & Disc Reference	Wire	Sleeve
H	High cap. Fine silver	code	Tol.		Assigned at factory	A standard
K	High cap. AgCdO	0	±5 K			C No sleeve
L	Low cap. Fine silver	1	±5 K			
		2	±8 K			
		3	±8 K			

Specifications

Standard temperature range	75°C - 150°C
Max. ambient temperature	175°C
Tolerance on open temperature	+/- 5°C, +/- 8°C

Certifications

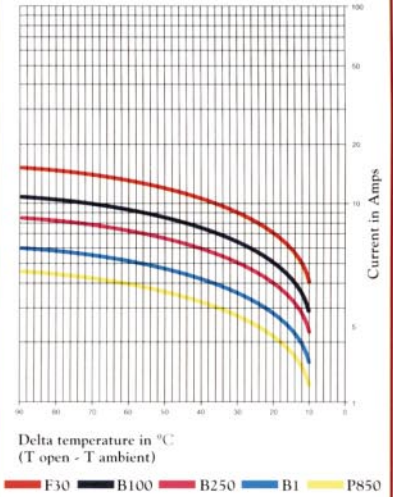
Agency	File number
UL (9700K only)	E34618 & E15962
CSA (9700K only)	LR11372-15C & 0400-192
BEAB (9700K only)	CAT.0212
VDE	4464.9-4510-1001
SEMKO (9700K only)	8733170

Maximum contact rating (10,000 cycles)

Type	AMPS				
	24VDC	115VAC	230VAC	250VAC	400VAC
9700H	18	18	-	13	9
9700K	18	18	12	-	-

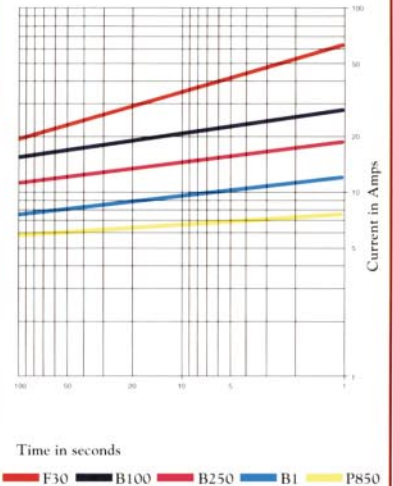
Ultimate trip current vs ambient temperature

Approx., to be used only for selecting samples for verification tests



Average first cycle tripping time vs current 25°C. ambient

Approx., to be used only for selecting samples for verification tests



Note

Texas Instruments provides customer assistance in a variety of technical areas. However, since TI does not have full access to the data concerning all of the uses and applications of customers' products, TI does not assume any responsibility for customer product design or for any infringements of patents or rights of others which may result from TI's assistance.



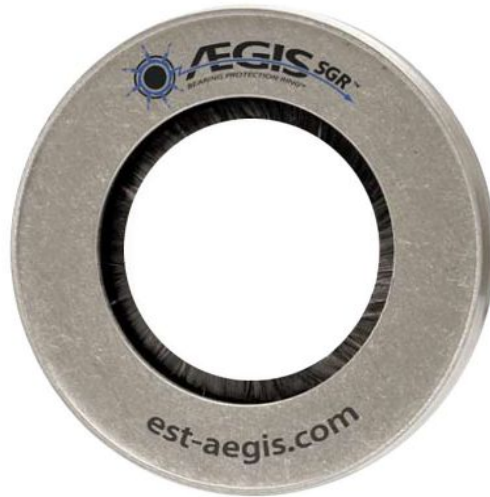
This product is manufactured in:

MALAYSIA

Texas Instruments Malaysia Sdn Bhd
1, Lorong Enggang 33
Ampang / Ulu Klang
54200 KUALA LUMPUR
Tel.: 03-45.02296 Fax: 03-45.60214



*Sustainable Technology
for
True Inverter Duty Motors*



WEG uses the standard SGR from the AEGIS catalog that is sized based on the motor min/max shaft diameter. They use the type with the mounting brackets which are designed to fit over the shaft shoulder on the motor end-shield.

Bearing Protection For Life!

2009





BEARING PROTECTION RING™



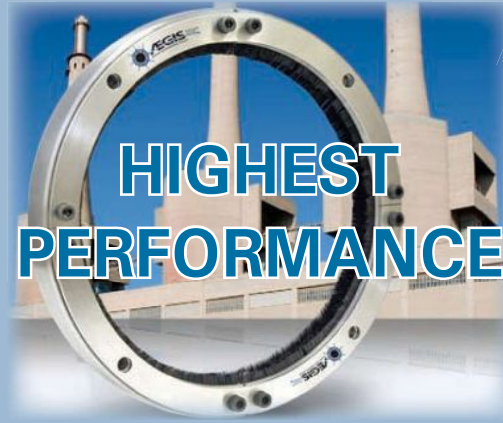
SUSTAINABLE



PROTECTION



RELIABILITY



**HIGHEST
PERFORMANCE**

“The only bearing protection system guaranteed to eliminate harmful shaft currents preventing premature motor failure - for life.”



Guarantee

Electro Static Technology guarantees any new motor up to 100hp/75kW will not fail from electrical bearing fluting damage for the life of the motor when the AEGIS SGR™ Bearing Protection Ring™ is installed in accordance with manufacturer's installation instructions. If electrically induced fluting damage occurs, Electro Static Technology will replace motor bearings. Guarantee is subject to the terms and conditions of the AEGIS SGR™ Guarantee Program.

For program details, visit: www.est-aegis.com

*Don't let
this happen
to your
bearings!*



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Sustainable Motor Design - Prevent Bearing Failure

AEGIS Bearing Protection Ring™ - protects motor bearings for life. Variable frequency drives (VFD) induce electrical voltages onto the shaft of AC and DC motors. With AEGIS SGR Bearing Protection Ring installed on the motor, you benefit from sustainability, system up-time, production improvement, and higher reliability.

PROBLEM:

VFD Induced Shaft Voltages Damage Bearings



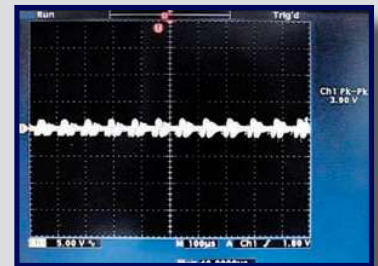
Shaft voltage reading with no protection

Variable frequency drives (VFD) on AC and DC motors induce harmful electrical voltages on the motor shaft. Once these voltages exceed the resistance of the bearing lubricant, they discharge through the motor's bearings causing fusion craters, severe pitting, fluting damage, excessive bearing noise and eventually bearing failure.

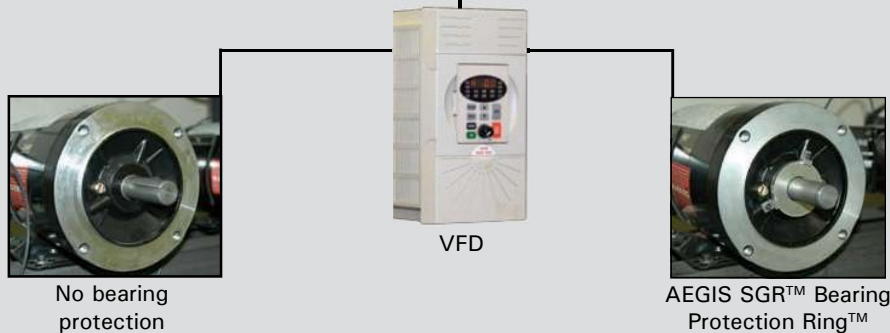
SOLUTION:

AEGIS SGR™ - Electrical Bearing Damage Protection

The new AEGIS SGR™ Bearing Protection Ring™ prevents electrical bearing damage by safely channeling harmful shaft voltages away from the bearings to ground. Using proprietary Electron Transport Technology™, the conductive micro fibers inside the AEGIS SGR™ provide the path of least resistance and dramatically extend motor life.



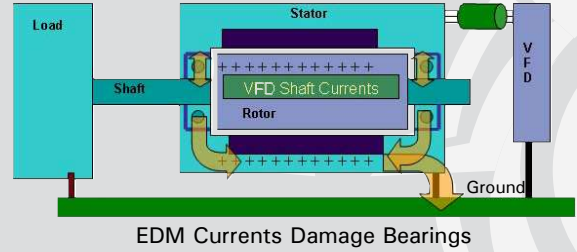
Shaft voltage reading with AEGIS SGR



About Shaft Voltages and Bearing Currents

VFD Induced Shaft Voltages - All Motors

Damaging voltages are induced on the shafts of AC and DC motors controlled by variable frequency drives (VFD). The extremely high on/off switching speeds of the pulse width modulation (PWM), generated by the insulated gate bipolar transistors (IGBT), induce damaging voltages onto the motor shaft through parasitic capacitive coupling between the stator and rotor. This common mode shaft voltage seeks a path to ground, usually through the motor's bearings.



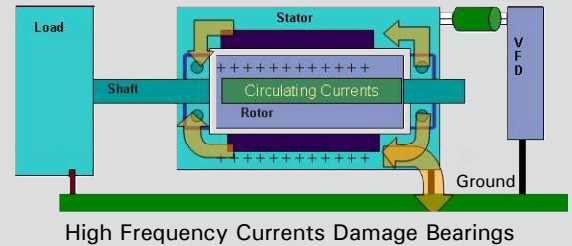
Bearing fluting, "washboard" pattern on bearing race

Electrical Damage in the Bearings (EDM) - Pitting, Fluting, Failure

Damaging currents arc through the dielectric oil film between the rolling elements and the bearing race. This is known as electrical discharge machining (EDM) effect. EDM causes fusion craters, severe pitting, and eventually bearing fluting (a washboard-like pattern in the bearing race) which results in premature bearing failure.

High Frequency Circulating Currents in Large AC and DC Motors

In addition to potential bearing failures in motors from VFD induced EDM currents, AC and DC motors above 100 hp (75 kW) may also experience bearing failures caused by high frequency circulating currents. VFD induced high frequency circulating currents are in the kilohertz or even megahertz range and circulate through the motor's bearings because of magnetic flux imbalances in the stator. This type of VFD induced current becomes the more dominant destructive current in higher hp/kW motors.



AEGIS SGR™ Bearing Protection Ring™ is the most effective solution to protect bearings in motors and attached equipment from EDM currents and VFD induced shaft voltages.

Technology Comparison

	AEGIS SGR™	Insulating sleeve	Ceramic/Hybrid Bearing	Copper or Bronze Metal Brush	Carbon Block Brush	Conductive Grease
Protects Motor and Attached Equipment	Yes	No	No	No	No	No
Long-term Effectiveness	Yes	No	No	No	No	No
Easy to install	Yes	No	No	No	No	No
Contamination Proof	Yes	N/A	N/A	No	No	N/A
Low Lifetime Cost High return on Investment	Yes	No	No	No	No	No
Effective at any RPM	Yes	Yes	Yes	No	No	No
Maintenance Free Operation	Yes	Yes	Yes	No	No	No

Application Notes for AEGIS Bearing Protection Ring™

Improve System Reliability and Production with Sustainable Motor Design

Motors up to 100 HP (75 kW)

Any motor controlled by a variable frequency drive (VFD) requires bearing protection. Motors of 100 hp down to fractional hp motors will experience bearing failures when operated on a PWM drive. AEGIS SGR™ Bearing Protection Ring™ guarantees that bearings will not fail in these motors from fluting damage for the service life of the motor.




Install one AEGIS SGR™ Bearing Protection Ring™ on either the drive end or the non-drive end of the motor. The simplest installation is to slide the AEGIS SGR™ over the drive end and fasten it to the motor end bell with the easy to install mounting hardware included with each AEGIS SGR™

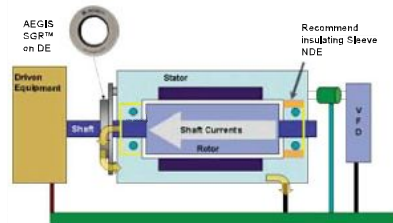
★ Recommend Colloidal Silver Shaft Coating PN CS015

Motors 100 HP to 1000 HP (75 kW to 750 kW)

Large motors above 100 hp may have VFD induced EDM currents as well as high frequency circulating currents when they are controlled by VFDs. To protect the bearings, insulate the bearing on one end and install an AEGIS SGR™ on the other end.

Insulation on one end (usually NDE) and AEGIS SGR™ on opposite end

- This method offers the most reliable protection
- Motor frame must be well grounded
- Non-Drive End: Bearing journal should be insulated or Insulated/ Ceramic Bearing installed to disrupt circulating currents
- Install AEGIS SGR™ Bearing Protection Ring™ on opposite end of insulation and Insulated/Ceramic Bearing (usually DE)
- Protects bearings in attached equipment (gear box, pillow block, encoder etc.)



★ Recommend Colloidal Silver Shaft Coating PN CS015

BEARING PROTECTION FACTS:

Bearing protection for motors and attached equipment: Only AEGIS SGR™ will protect both motor bearings and the bearings in attached equipment. VFD induced currents on the shaft can discharge through motor bearings or coupled equipment like gear boxes, pumps, fan bearings, pillow blocks, encoders, brake motors, etc. AEGIS SGR™ addresses the root of the problem and channels harmful currents to ground.

Maintenance free bearing protection for life: Hundreds of thousands of conductive micro fibers have virtually zero wear during operation, even at high RPM and high surface rates. Unlike carbon block brushes, there is no spring pressure on fibers. AEGIS SGR™ Bearing Protection Ring™ will last for the service life of the motor.

AEGIS SGR™ is effective in grease, oil, dirt or dust: Lab and field tested. The conductive micro fibers “sweep” away contaminants from the shaft surface and maintain a conductive path even when oil, grease, dirt or dust get on the shaft.

Operation in harsh environments where fibers are exposed to excessive debris: To prevent particles from damaging the fibers, install a slinger or O-ring against the AEGIS SGR™.

★ COLLOIDAL SILVER SHAFT COATING: NEW TECHNOLOGY

Improving the conductivity of the steel shaft surface enhances the shaft voltage discharge capability in AEGIS shaft grounding applications. Maintaining a highly conductive shaft surface is especially important in critical applications or in applications where the conductive shaft surface of steel could become compromised. Environmental elements could create a potential for decreased conductivity on the shaft of the motor.



Apply AEGIS CS015 Colloidal Silver Shaft Coating to any VFD driven motor shaft prior to installing AEGIS Bearing Protection Ring™.

BEARING PROTECTION FACTS:

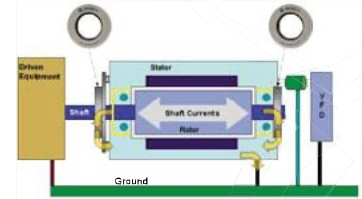
AEGIS SGR™ Bearing Protection Ring™ current handling capability: AEGIS SGR™ is rated to discharge high frequency current. Variable frequency drives (VFD) induce high frequency EDM currents of up to 2 amps in 50 billionths of a second. AEGIS SGR™ protects the bearing by safely channeling the energy away from the motor bearings to ground.

AEGIS Bearing Protection Ring™ - the most reliable bearing protection: Production up-time and reliability improve when AEGIS SGR™ is installed. The patented ring of hundreds of thousands of conductive micro fibers provide protection for the service life of the motor. The fibers will always surround the shaft with a conductive path for destructive shaft currents while the motor is running.

Vertical Motors: Insulate top bearing or shaft with non conductive coating. For bottom bearing, coat shaft with Colloidal Silver Shaft Coating and install AEGIS Bearing Protection Ring.

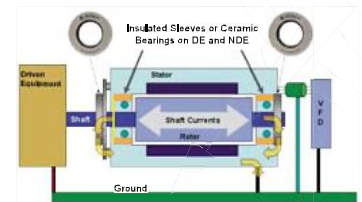
If insulation is not possible, the next best protection is to install AEGIS SGR™ on both ends of the motor

- Motor frame must be well grounded
- Install AEGIS SGR™ Bearing Protection Ring™ on drive and non-drive end to provide path of least resistance for circulating currents and to channel VFD currents to ground.
- Protects bearings in attached equipment
- **NOT SUITABLE FOR CYLINDRICAL ROLLER BEARING**
- ★ Coat shaft with Colloidal Silver Shaft Coating



Critical Applications: Insulate both ends and add AEGIS SGR™ Bearing Protection Ring™ on both ends

- Motor frame must be well grounded
- Drive and Non-Drive end: Bearing journals should be insulated or Insulated/Ceramic Bearing installed to disrupt circulating currents
- Install AEGIS SGR™ Bearing Protection Ring™ on drive and non-drive end to provide path of least resistance for shaft voltages and to channel VFD induced currents to ground.
- AEGIS SGR™ required to protect bearings in attached equipment (gear box, pillow block, encoder, etc.)
- ★ Coat shaft with Colloidal Silver Shaft Coating



Medium Voltage Motors

Large Motors and Generators over 1000 HP (750 kW)

Power Generators over 750kW

AEGIS iPRO™ Bearing Protection Ring™

Large motors and generators often have much higher induced shaft voltages and bearing currents which require a high current capable Bearing Protection Ring™. High frequency circulating currents induced by variable frequency drives (VFD) will cause bearing fluting and catastrophic failure in these motors. Generators experience current surges which can cause electrical arcing in bearings and equipment.

- One end of the motor should be insulated. Install AEGIS iPRO™ on opposite end of insulation to protect the non-insulated bearing.
- Install AEGIS iPRO™ on both ends of motor or generator if bearing cannot be insulated.
- ★ Coat shaft with Colloidal Silver Shaft Coating



AEGIS iPRO™ High Current Bearing Protection Ring™

MOTORS WITH CERAMIC BEARINGS

Insulating both bearing journals or using ceramic coated bearings in the motor **does not prevent VFD induced currents** from discharging through the bearings on attached equipment and may present a voltage hazard.

Whenever ceramic bearings are used in a motor, *AEGIS SGR™ is required* to protect attached equipment and reduce potentially dangerous shaft voltages.

Purpose of Application Notes: Application notes are intended as general guidance to assist with proper application of AEGIS SGR™ Bearing Protection Ring™ to protect motor bearings. All statements and technical information contained in the application notes are rendered in good faith. User must assume responsibility to determine suitability of the product for its intended use.

AEGIS SVP™ Shaft Voltage Probe

Conductive Microfiber Probe for use with Fluke 199C ScopeMeter

Measuring VFD Induced Shaft Voltages



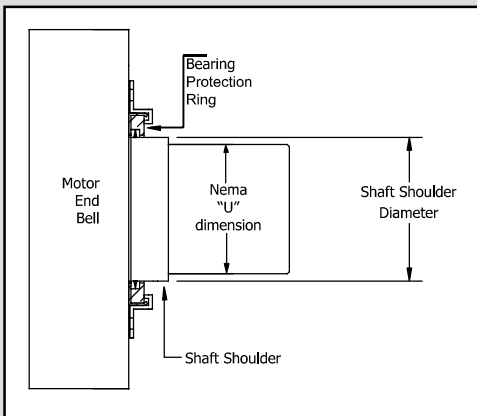
For the first time you can easily and more accurately measure the voltage on a rotating shaft. The AEGIS SVP™ Shaft Voltage Probe's unique design of high density conductive microfibers ensures continuous contact with the rotating shaft. Used with the Fluke 199C ScopeMeter, you can determine if your motor is subject to potentially damaging bearing currents.

Catalog Number	Includes:
SVP-KIT-F199C	3 SVP tips, probe holder with two piece extension rod (fits 3/8" magnetic base)
SVP-TIP-F199C	3 SVP tips

Selecting The Right Size Bearing Protection Ring For Your Motor



Mounting Options shown on page 8

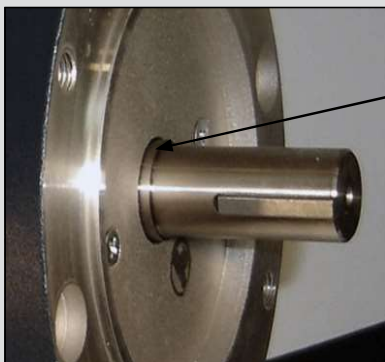


1. Measure shaft diameter at a point 0.125" from motor end bell.
2. Refer to the part lists to locate the correct SGR part number.

Example shaft measurement
0.425"

Note: If you have a slinger or a shaft shoulder that is less than 0.375", you will need the NEMA/IEC kit. See page 13 for more information.

Catalog Number	Min. shaft diameter	Max. shaft diameter	Outside diameter	Thickness Max
SGR-6.9-1	0.311	0.355	1.60	0.295
SGR-8.0-1	0.356	0.395	1.60	0.295
SGR-9.0-1	0.396	0.435	1.60	0.295
SGR-10.1-1	0.436	0.480	1.60	0.295
SGR-11.2-1	0.481	0.520	1.60	0.295



Shaft shoulder: The SGR can be mounted to the shaft shoulder but the shoulder should be at least 0.375" in length so that all of the fibers are in contact with the rotating shaft. Measure the diameter of the shaft shoulder then locate the correct SGR on the part lists.

AEGIS SGR™ Bearing Protection Ring™ Options



NEW PRODUCT!



pg. 9

Conductive Epoxy Mounting

Shaft diameters: 0.311" to 6.02"

Solid and Split Ring

Quick and easy installation to metal motor frame

Conductive Epoxy Included



pg.10-11

Standard Mounting Brackets

Shaft diameters: 0.311" to 6.02"

Ships with mounting brackets, 6-32 screws and washers

Quick and easy installation to most surfaces



pg. 10-11

Split Ring

Shaft diameter: 0.311" to 6.02"

4 to 6 mounting brackets, M3 screws and washers

Installs without decoupling motor



pg. 10-11

Belt Through Mounting

Shaft diameters: 0.311" to 6.02"

M3 x 14 socket head cap screws and lock washers

2 mounting holes up to shaft size 3.895"

4 mounting holes for larger sizes



pg. 12

Press Fit Mounting

Shaft diameters: 0.311" to 6.02"

Clean dry 0.004" press fit

Custom sizes available



pg. 13

NEMA-IEC Mounting Kits

Shaft diameter: see chart for standard kits

Custom kits available for other shaft diameters

Clears any slinger, shaft shoulder or protrusion



pg. 14

WTG

Long term reliable performance

Maintenance free system

Solid and Split Ring configurations



pg. 14

iPRO

Long term reliable performance

Maintenance free system

Solid and Split Ring configurations

Available in sizes up to 30" shaft diameter

Parts List



Dimensions in inches

Standard SGR Catalog Number	Split Ring* Catalog Number	Bolt Through* Catalog Number	Min. shaft diameter	Max. shaft diameter	Outside diameter	Thickness Max
SGR-6.9-1	SGR-6.9-2A4	SGR-6.9-3	0.311	0.355	1.60	0.295
SGR-8.0-1	SGR-8.0-2A4	SGR-8.0-3	0.356	0.395	1.60	0.295
SGR-9.0-1	SGR-9.0-2A4	SGR-9.0-3	0.396	0.435	1.60	0.295
SGR-10.1-1	SGR-10.1-2A4	SGR-10.1-3	0.436	0.480	1.60	0.295
SGR-11.2-1	SGR-11.2-2A4	SGR-11.2-3	0.481	0.520	1.60	0.295
SGR-12.2-1	SGR-12.2-2A4	SGR-12.2-3	0.521	0.560	1.60	0.295
SGR-13.2-1	SGR-13.2-2A4	SGR-13.2-3	0.561	0.605	1.60	0.295
SGR-14.4-1	SGR-14.4-2A4	SGR-14.4-3	0.606	0.645	1.60	0.295
SGR-15.4-1	SGR-15.4-2A4	SGR-15.4-3	0.646	0.685	2.10	0.295
SGR-16.4-1	SGR-16.4-2A4	SGR-16.4-3	0.686	0.730	2.10	0.295
SGR-17.6-1	SGR-17.6-2A4	SGR-17.6-3	0.731	0.774	2.10	0.295
SGR-18.7-1	SGR-18.7-2A4	SGR-18.7-3	0.775	0.815	2.10	0.295
SGR-19.7-1	SGR-19.7-2A4	SGR-19.7-3	0.816	0.855	2.10	0.295
SGR-20.7-1	SGR-20.7-2A4	SGR-20.7-3	0.856	0.895	2.10	0.295
SGR-21.7-1	SGR-21.7-2A4	SGR-21.7-3	0.896	0.935	2.10	0.295
SGR-22.8-1	SGR-22.8-2A4	SGR-22.8-3	0.936	0.980	2.10	0.295
SGR-23.9-1	SGR-23.9-2A4	SGR-23.9-3	0.981	1.020	2.10	0.295
SGR-24.9-1	SGR-24.9-2A4	SGR-24.9-3	1.021	1.060	2.10	0.295
SGR-25.9-1	SGR-25.9-2A4	SGR-25.9-3	1.061	1.105	2.10	0.295
SGR-27.1-1	SGR-27.1-2A4	SGR-27.1-3	1.106	1.145	2.10	0.295
SGR-28.1-1	SGR-28.1-2A4	SGR-28.1-3	1.146	1.185	2.10	0.295
SGR-29.1-1	SGR-29.1-2A4	SGR-29.1-3	1.186	1.230	2.10	0.295
SGR-30.3-1	SGR-30.3-2A4	SGR-30.3-3	1.231	1.270	2.10	0.295
SGR-31.3-1	SGR-31.3-2A4	SGR-31.3-3	1.271	1.310	2.10	0.295
SGR-32.3-1	SGR-32.3-2A4	SGR-32.3-3	1.311	1.355	2.10	0.295
SGR-33.4-1	SGR-33.4-2A4	SGR-33.4-3	1.356	1.395	2.10	0.295
SGR-34.4-1	SGR-34.4-2A4	SGR-34.4-3	1.396	1.435	2.68	0.295
SGR-35.5-1	SGR-35.5-2A4	SGR-35.5-3	1.436	1.480	2.68	0.295
SGR-36.6-1	SGR-36.6-2A4	SGR-36.6-3	1.481	1.520	2.68	0.295
SGR-37.6-1	SGR-37.6-2A4	SGR-37.6-3	1.521	1.560	2.68	0.295
SGR-38.6-1	SGR-38.6-2A4	SGR-38.6-3	1.561	1.605	2.68	0.295
SGR-39.8-1	SGR-39.8-2A4	SGR-39.8-3	1.606	1.645	2.68	0.295
SGR-40.8-1	SGR-40.8-2A4	SGR-40.8-3	1.646	1.685	2.68	0.295
SGR-41.8-1	SGR-41.8-2A4	SGR-41.8-3	1.686	1.730	2.68	0.295
SGR-43.0-1	SGR-43.0-2A4	SGR-43.0-3	1.731	1.770	2.68	0.295
SGR-44.0-1	SGR-44.0-2A4	SGR-44.0-3	1.771	1.810	2.68	0.295
SGR-45.0-1	SGR-45.0-2A4	SGR-45.0-3	1.811	1.855	2.68	0.295
SGR-46.1-1	SGR-46.1-2A4	SGR-46.1-3	1.856	1.895	2.68	0.295
SGR-47.1-1	SGR-47.1-2A4	SGR-47.1-3	1.896	1.935	2.68	0.295
SGR-48.2-1	SGR-48.2-2A4	SGR-48.2-3	1.936	1.980	2.68	0.295
SGR-49.3-1	SGR-49.3-2A4	SGR-49.3-3	1.981	2.020	2.68	0.295
SGR-50.3-1	SGR-50.3-2A4	SGR-50.3-3	2.021	2.060	3.10	0.295
SGR-51.3-1	SGR-51.3-2A4	SGR-51.3-3	2.061	2.105	3.10	0.295
SGR-52.5-1	SGR-52.5-2A4	SGR-52.5-3	2.106	2.145	3.10	0.295
SGR-53.5-1	SGR-53.5-2A4	SGR-53.5-3	2.146	2.185	3.10	0.295
SGR-54.5-1	SGR-54.5-2A4	SGR-54.5-3	2.186	2.230	3.10	0.295
SGR-55.7-1	SGR-55.7-2A4	SGR-55.7-3	2.231	2.270	3.10	0.295
SGR-56.7-1	SGR-56.7-2A4	SGR-56.7-3	2.271	2.310	3.10	0.295
SGR-57.7-1	SGR-57.7-2A4	SGR-57.7-3	2.311	2.355	3.10	0.295
SGR-58.8-1	SGR-58.8-2A4	SGR-58.8-3	2.356	2.395	3.10	0.295
SGR-59.8-1	SGR-59.8-2A4	SGR-59.8-3	2.396	2.435	3.60	0.295
SGR-60.9-1	SGR-60.9-2A4	SGR-60.9-3	2.436	2.480	3.60	0.295
SGR-62.0-1	SGR-62.0-2A4	SGR-62.0-3	2.481	2.520	3.60	0.295
SGR-63.0-1	SGR-63.0-2A4	SGR-63.0-3	2.521	2.560	3.60	0.295
SGR-64.0-1	SGR-64.0-2A4	SGR-64.0-3	2.561	2.605	3.60	0.295
SGR-65.2-1	SGR-65.2-2A4	SGR-65.2-3	2.606	2.645	3.60	0.295
SGR-66.2-1	SGR-66.2-2A4	SGR-66.2-3	2.646	2.685	3.60	0.295
SGR-67.2-1	SGR-67.2-2A4	SGR-67.2-3	2.686	2.730	3.60	0.295
SGR-68.4-1	SGR-68.4-2A4	SGR-68.4-3	2.731	2.770	3.60	0.295
SGR-69.4-1	SGR-69.4-2A4	SGR-69.4-3	2.771	2.810	3.60	0.295
SGR-70.4-1	SGR-70.4-2A4	SGR-70.4-3	2.811	2.855	3.60	0.295
SGR-71.5-1	SGR-71.5-2A4	SGR-71.5-3	2.856	2.895	3.60	0.295
SGR-72.5-1	SGR-72.5-2A4	SGR-72.5-3	2.896	2.935	4.10	0.295
SGR-73.6-1	SGR-73.6-2A4	SGR-73.6-3	2.936	2.980	4.10	0.295
SGR-74.7-1	SGR-74.7-2A4	SGR-74.7-3	2.981	3.020	4.10	0.295
SGR-75.7-1	SGR-75.7-2A4	SGR-75.7-3	3.021	3.060	4.10	0.295
SGR-76.7-1	SGR-76.7-2A4	SGR-76.7-3	3.061	3.105	4.10	0.295
SGR-77.9-1	SGR-77.9-2A4	SGR-77.9-3	3.106	3.145	4.10	0.295
SGR-78.9-1	SGR-78.9-2A4	SGR-78.9-3	3.146	3.185	4.10	0.295

*Custom Part - No Returns

Parts List



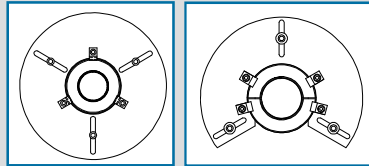
Dimensions in inches

Standard SGR Catalog Number	Split Ring* Catalog Number	Bolt Through* Catalog Number	Min. shaft diameter	Max. shaft diameter	Outside diameter	Thickness Max
SGR-79.9-1	SGR-79.9-2A4	SGR-79.9-3	3.186	3.230	4.10	0.295
SGR-81.1-1	SGR-81.1-2A4	SGR-81.1-3	3.231	3.270	4.10	0.295
SGR-82.1-1	SGR-82.1-2A4	SGR-82.1-3	3.271	3.310	4.10	0.295
SGR-83.1-1	SGR-83.1-2A4	SGR-83.1-3	3.311	3.355	4.10	0.295
SGR-84.2-1	SGR-84.2-2A4	SGR-84.2-3	3.356	3.395	4.10	0.295
SGR-85.2-1	SGR-85.2-2A4	SGR-85.2-3	3.396	3.435	4.60	0.295
SGR-86.3-1	SGR-86.3-2A4	SGR-86.3-3	3.436	3.480	4.60	0.295
SGR-87.4-1	SGR-87.4-2A4	SGR-87.4-3	3.481	3.520	4.60	0.295
SGR-88.4-1	SGR-88.4-2A4	SGR-88.4-3	3.521	3.560	4.60	0.295
SGR-89.4-1	SGR-89.4-2A4	SGR-89.4-3	3.561	3.605	4.60	0.295
SGR-90.6-1	SGR-90.6-2A4	SGR-90.6-3	3.606	3.645	4.60	0.295
SGR-91.6-1	SGR-91.6-2A4	SGR-91.6-3	3.646	3.685	4.60	0.295
SGR-92.6-1	SGR-92.6-2A4	SGR-92.6-3	3.686	3.730	4.60	0.295
SGR-93.8-1	SGR-93.8-2A4	SGR-93.8-3	3.731	3.770	4.60	0.295
SGR-94.8-1	SGR-94.8-2A4	SGR-94.8-3	3.771	3.810	4.60	0.295
SGR-95.8-1	SGR-95.8-2A4	SGR-95.8-3	3.811	3.855	4.60	0.295
SGR-96.9-1	SGR-96.9-2A4	SGR-96.9-3	3.856	3.895	4.60	0.295
SGR-97.9-1	SGR-97.9-2A4	SGR-97.9-3	3.896	3.935	5.10	0.295
SGR-99.0-1	SGR-99.0-2A4	SGR-99.0-3	3.936	3.980	5.10	0.295
SGR-100.1-1	SGR-100.1-2A4	SGR-100.1-3	3.981	4.020	5.10	0.295
SGR-101.1-1	SGR-101.1-2A4	SGR-101.1-3	4.021	4.060	5.10	0.295
SGR-102.1-1	SGR-102.1-2A4	SGR-102.1-3	4.061	4.105	5.10	0.295
SGR-103.3-1	SGR-103.3-2A4	SGR-103.3-3	4.106	4.145	5.10	0.295
SGR-104.3-1	SGR-104.3-2A4	SGR-104.3-3	4.146	4.185	5.10	0.295
SGR-105.3-1	SGR-105.3-2A4	SGR-105.3-3	4.186	4.230	5.10	0.295
SGR-106.5-1	SGR-106.5-2A4	SGR-106.5-3	4.231	4.270	5.10	0.295
SGR-107.5-1	SGR-107.5-2A4	SGR-107.5-3	4.271	4.310	5.10	0.295
SGR-108.5-1	SGR-108.5-2A4	SGR-108.5-3	4.311	4.355	5.10	0.295
SGR-109.6-1	SGR-109.6-2A4	SGR-109.6-3	4.356	4.395	5.10	0.295
SGR-110.6-1	SGR-110.6-2A4	SGR-110.6-3	4.396	4.435	5.60	0.295
SGR-111.7-1	SGR-111.7-2A4	SGR-111.7-3	4.436	4.480	5.60	0.295
SGR-112.8-1	SGR-112.8-2A4	SGR-112.8-3	4.481	4.520	5.60	0.295
SGR-113.8-1	SGR-113.8-2A4	SGR-113.8-3	4.521	4.560	5.60	0.295
SGR-114.8-1	SGR-114.8-2A4	SGR-114.8-3	4.561	4.605	5.60	0.295
SGR-116.0-1	SGR-116.0-2A4	SGR-116.0-3	4.606	4.645	5.60	0.295
SGR-117.0-1	SGR-117.0-2A4	SGR-117.0-3	4.646	4.685	5.60	0.295
SGR-118.0-1	SGR-118.0-2A4	SGR-118.0-3	4.686	4.730	5.60	0.295
SGR-119.2-1	SGR-119.2-2A4	SGR-119.2-3	4.731	4.770	5.60	0.295
SGR-120.2-1	SGR-120.2-2A4	SGR-120.2-3	4.771	4.810	5.60	0.295
SGR-121.2-1	SGR-121.2-2A4	SGR-121.2-3	4.811	4.855	5.60	0.295
SGR-122.3-1	SGR-122.3-2A4	SGR-122.3-3	4.856	4.895	5.60	0.295
SGR-123.3-1	SGR-123.3-2A4	SGR-123.3-3	4.896	4.935	6.10	0.295
SGR-124.4-1	SGR-124.4-2A4	SGR-124.4-3	4.936	4.980	6.10	0.295
SGR-125.5-1	SGR-125.5-2A4	SGR-125.5-3	4.981	5.020	6.10	0.295
SGR-126.5-1	SGR-126.5-2A4	SGR-126.5-3	5.021	5.060	6.10	0.295
SGR-127.5-1	SGR-127.5-2A4	SGR-127.5-3	5.061	5.105	6.10	0.295
SGR-128.7-1	SGR-128.7-2A4	SGR-128.7-3	5.106	5.145	6.10	0.295
SGR-129.7-1	SGR-129.7-2A4	SGR-129.7-3	5.146	5.185	6.10	0.295
SGR-130.7-1	SGR-130.7-2A4	SGR-130.7-3	5.186	5.230	6.10	0.295
SGR-131.9-1	SGR-131.9-2A4	SGR-131.9-3	5.231	5.270	6.10	0.295
SGR-132.9-1	SGR-132.9-2A4	SGR-132.9-3	5.271	5.310	6.10	0.295
SGR-133.9-1	SGR-133.9-2A4	SGR-133.9-3	5.311	5.355	6.10	0.295
SGR-135.0-1	SGR-135.0-2A4	SGR-135.0-3	5.356	5.395	6.10	0.295
SGR-136.0-1	SGR-136.0-2A4	SGR-136.0-3	5.396	5.435	6.60	0.295
SGR-137.1-1	SGR-137.1-2A4	SGR-137.1-3	5.436	5.480	6.60	0.295
SGR-138.2-1	SGR-138.2-2A4	SGR-138.2-3	5.481	5.520	6.60	0.295
SGR-139.2-1	SGR-139.2-2A4	SGR-139.2-3	5.521	5.560	6.60	0.295
SGR-140.2-1	SGR-140.2-2A4	SGR-140.2-3	5.561	5.605	6.60	0.295
SGR-141.4-1	SGR-141.4-2A4	SGR-141.4-3	5.606	5.645	6.60	0.295
SGR-142.4-1	SGR-142.4-2A4	SGR-142.4-3	5.646	5.685	6.60	0.295
SGR-143.4-1	SGR-143.4-2A4	SGR-143.4-3	5.686	5.730	6.60	0.295
SGR-144.6-1	SGR-144.6-2A4	SGR-144.6-3	5.731	5.770	6.60	0.295
SGR-145.6-1	SGR-145.6-2A4	SGR-145.6-3	5.771	5.810	6.60	0.295
SGR-146.6-1	SGR-146.6-2A4	SGR-146.6-3	5.811	5.855	6.60	0.295
SGR-147.7-1	SGR-147.7-2A4	SGR-147.7-3	5.856	5.895	6.60	0.295
SGR-148.7-1	SGR-148.7-2A4	SGR-148.7-3	5.896	5.935	7.10	0.295
SGR-149.8-1	SGR-149.8-2A4	SGR-149.8-3	5.936	5.980	7.10	0.295
SGR-150.9-1	SGR-150.9-2A4	SGR-150.9-3	5.981	6.020	7.10	0.295

*Custom Part - No Returns

Bearing Protection Ring Kit for NEMA & IEC Motors

Kits include AEGIS SGR™ Bearing Protection Ring and all mounting hardware



NEMA/IEC Bearing Protection Ring™ Kit

SOLID



- 1 AEGIS SGR™
- 1 mounting plate
- 3 screws (inches or metric)
- 3 washers
- 3 lock washers
- 3 spacers*

SPLIT



- 1 AEGIS Split Ring SGR™
- 1 split mounting plate
- 3 screws (inches or metric)
- 3 washers
- 3 lock washers
- 3 spacers*

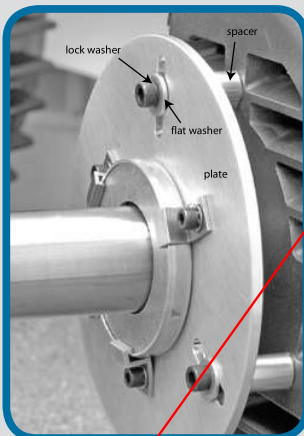
* each kit includes 3 spacer lengths: 1/4", 1/2", and 1" for NEMA kits and 7mm, 17mm, and 27mm for IEC kits.

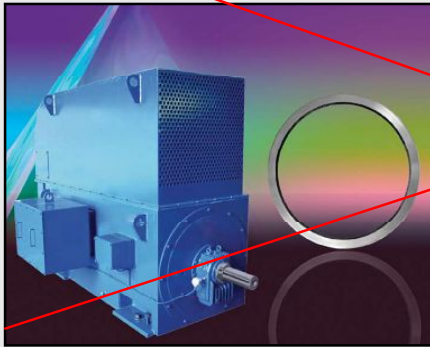
NEMA Motors Solid	NEMA Motors Split		
Catalog Number	Catalog Number	Motor shaft diameter "u" NEMA Frame	Plate OD
SGR-0.625-NEMA	SGR-0.625-NEMA-1A4	0.625" 56	3.75"
SGR-0.875-NEMA	SGR-0.875-NEMA-1A4	0.875" 143T, 145T	5.60"
SGR-1.125-NEMA	SGR-1.125-NEMA-1A4	1.125" 182T, 184T	5.60"
SGR-1.375-NEMA	SGR-1.375-NEMA-1A4	1.375" 213T, 215T	5.60"
SGR-1.625-NEMA	SGR-1.625-NEMA-1A4	1.625" 254T, 256T	6.30"
SGR-1.875-NEMA	SGR-1.875-NEMA-1A4	1.875" 284T, 286T, 324TS, 326TS, 364TS, 365TS	6.30"
SGR-2.125-NEMA	SGR-2.125-NEMA-1A4	2.125" 324T, 326T, 404TS, 405TS	6.60"
SGR-2.375-NEMA	SGR-2.375-NEMA-1A4	2.375" 364T, 365T, 444TS, 445TS, 447TS, 449TS	6.60"
SGR-2.875-NEMA	SGR-2.875-NEMA-1A4	2.875" 404T, 405T,	7.30"
SGR-3.375-NEMA	SGR-3.375-NEMA-1A4	3.375" 444T, 445T, 447T, 449T	7.60"

IEC Motors Solid	IEC Motors Split		
Catalog Number	Catalog Number	IEC shaft diameter IEC Frame	Plate OD
SGR-19-IEC	SGR-19-IEC-2A4	19mm IEC 80 (2, 4, 6, 8 pole)	142mm
SGR-24-IEC	SGR-24-IEC-2A4	24mm IEC 90S, 90L (2, 4, 6, 8 pole)	142mm
SGR-28-IEC	SGR-28-IEC-2A4	28mm IEC 100L, 112M (2, 4, 6, 8 pole)	142mm
SGR-38-IEC	SGR-38-IEC-2A4	38mm IEC 132S, 132M (2, 4, 6, 8 pole)	160mm
SGR-42-IEC	SGR-42-IEC-2A4	42mm IEC 160M, 160L (2, 4, 6, 8 pole)	160mm
SGR-48-IEC	SGR-48-IEC-2A4	48mm IEC 180M, 180L (2, 4, 6, 8 pole)	160mm
SGR-55-IEC	SGR-55-IEC-2A4	55mm IEC 200L (2, 4, 6, 8 pole); IEC 225S, 225M (2 pole)	168mm
SGR-60-IEC	SGR-60-IEC-2A4	60mm IEC 225S, 225M (4, 6, 8 pole) ; IEC 250M (2 pole)	168mm
SGR-65-IEC	SGR-65-IEC-2A4	65mm IEC 250M (4, 6, 8 pole); IEC 280M, 280S, 315S, 315M, 315L (2 pole)	185mm
SGR-75-IEC	SGR-75-IEC-2A4	75mm IEC 280S, 280M (4, 6, 8 pole); IEC 355M, 355L (2 pole)	193mm
SGR-80-IEC	SGR-80-IEC-2A4	80mm IEC 315S, 315M, 315L (4, 6, 8 pole)	193mm
SGR-95-IEC	SGR-95-IEC-2A4	95mm IEC 335L, 335M, 355L, 355M (4, 6, 8, 10 pole)	211mm

Custom Kits available for shaft diameters not shown above

- Easy to order and install for any NEMA or IEC frame size
- Clears any slinger, shaft shoulder or protrusion
- Adjustable slots adapt to most end bells
- Rigid mounting plate ensures alignment
- Split Ring kit allows for installation without decoupling equipment

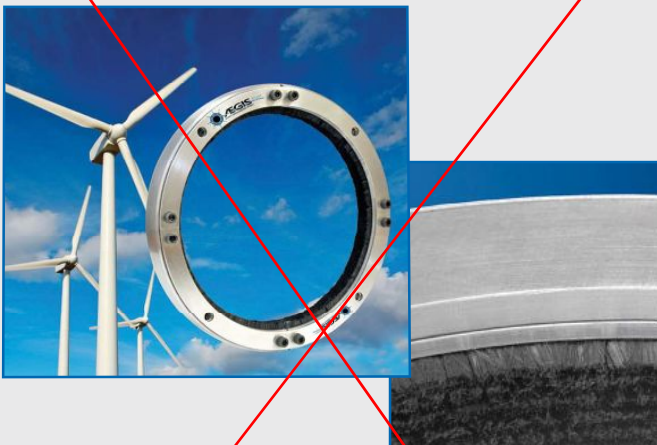




AEGIS SGR™ Bearing Protection Ring™ for Large Shaft Diameters

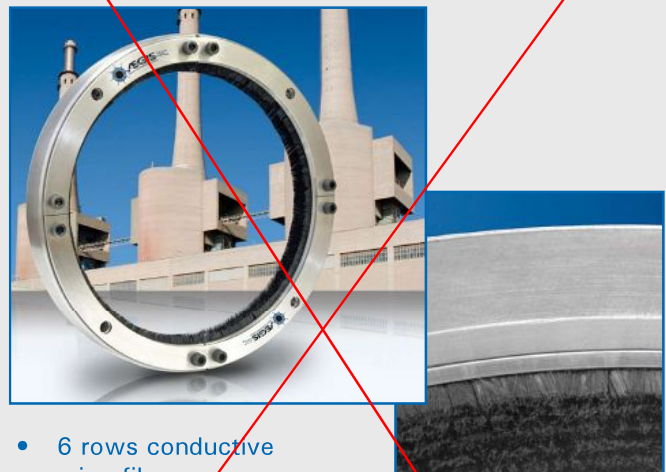
- For shaft diameters greater than 6" (152.4mm)
- Long term reliable performance
- Maintenance free system
- Available in solid or split ring design

AEGIS WTG™ Wind Turbine Bearing Protection



- 6 rows conductive microfiber
- High current capable
- AEGIS WTG™ shaft current monitoring compatible
- Long term reliable performance
- Maintenance free system
- Up-tower retrofit capable split ring configuration

AEGIS iPRO™ High Current Bearing Protection for Large Motors and Generators



- 6 rows conductive microfiber
- High current capable
- AEGIS iPRO shaft current monitoring compatible
- Long term reliable performance
- Maintenance free system
- Available in sizes up to 30" (762mm) shaft diameter

WARRANTY: Units are guaranteed for one year from date of purchase against defective materials and workmanship. Replacement will be made except for defects caused by abnormal use or mishandling. All statements and technical information contained herein, or presented by the manufacturer or his representative are rendered in good faith. User must assume responsibility to determine suitability of the product for intended use. The manufacturer shall not be liable for any injury, loss or damage, direct or consequential arising out of the use, or attempt to use the product.

Patent Numbers: 7,136,271; 7,193,836; and other patents pending



Engineering Specification:

All motors driven by a variable frequency PWM drive shall include a maintenance free, circumferential, conductive micro fiber shaft grounding ring (AEGIS SGR) to discharge shaft currents to ground.

Recommended part: AEGIS SGR™ Bearing Protection Ring

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BEARING PROTECTION RING™

CONSULTING - SPECIFYING
engineer

2009
PRODUCT OF THE YEAR Finalist



Catalog No. 2009-1

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An ITW Company

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www.est-aegis.com

BEST PRACTICES FOR VARIABLE FREQUENCY DRIVE (VFD) APPLICATIONS

VFD-induced shaft voltage can exist in every VFD driven motor application. It is not specific to the air movement industry, nor is it specific to any particular manufacturer's motors, drives or equipment. However, shaft voltage only becomes a problem when it leads to bearing current and consequential damage to the motor bearings.

NOTICE!

Risk of serious machine damage!

Appropriate measures must be implemented by the installation contractor to limit the shaft induced voltage to 1V – 2V as per IEEE 112.

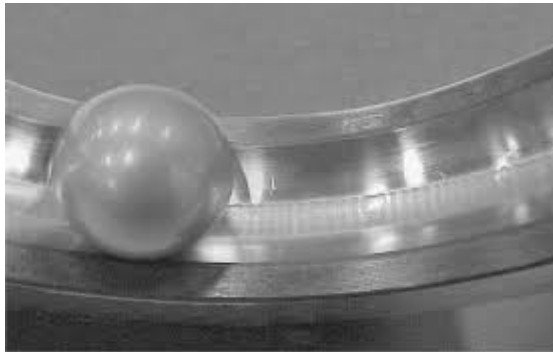


Figure 1 Bearing damage caused by EDM

Frequency converters (also known as variable frequency drives or VFD's) can induce a voltage on the shafts of drive motors and stages due to the high switching frequencies used in these drives. Shaft voltage can become a problem when it reaches a high enough level to discharge across the bearings, causing electrical discharge machining (EDM) and creating small grooves called fluting which can lead to premature bearing failure. The potential for this induced shaft voltage exists in every VFD driven motor application and must be addressed on an installation specific basis.

VFD induced voltage is a phenomenon that is somewhat rare and unpredictable. As additional protection, Aerzen USA offers options for mitigating induced shaft currents such as grounding rings and isolated motor non drive end bearings. Even with these options installed, there is no guarantee that this phenomenon will be entirely eliminated. Damage to the motor bearings from shaft / bearing currents is not covered by warranty from Aerzen, the motor manufacturer or VFD manufacturer.

GENERAL RECOMMENDATIONS:

Motors up to and including 100HP (75kW) – Low Voltage

For induction motors either foot mounted, c-face or d-flange mounted motors with single row radial ball bearings on both ends of the motors

- Install one AEGIS SGR Bearing Protection Ring on either the drive end or the non-drive end of the motor to discharge capacitive induced shaft voltage.

Motors Greater than 100HP (75kW)

For horizontally mounted motors with single row radial ball bearings on both ends of the motor:

- Non-Drive End (Opposite Drive End): Bearing housing must be isolated with insulated sleeve or coating or use insulated ceramic or hybrid bearing to disrupt circulating currents.
- Drive End: Install one AEGIS Bearing Protection Ring.

Motors in Hazardous Areas

Grounding rings are permitted. Consult Aerzen USA or your motor supplier for specific recommendations.



Aerzen USA Corporation

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Best Practices for VFD Applications

Date
09/2019

Doc #
BCH-6- 0410 revision B

Page
1 of 1

SECTION 6

Component Breakdown

Component	Material	Protection Method (Standard)	Quality Document (Standard)	Protection Method (Upgrade)	Quality Document (Upgrade)
Base/Silencer*	Carbon Steel	Painted Externally (Solvent Based)	QH-00408	SikaCor Zinc R	QH-00510
Belt Guard	Galvanized Sheet Metal	N/A	N/A	N/A	N/A
Belt Guard Supports	Galvanized Carbon Steel	N/A	N/A	N/A	N/A
Blower Stage	Cast Carbon Steel	Painted Externally (Water Based)	QH-00408	SikaCor Zinc R	QH-00510
Connecting Housing (DN50)	Cast Aluminum	N/A	N/A	N/A	N/A
Connecting Housing (DN80 - DN250)	Cast Iron	Powder Coated	QH-00552	SikaCor Zinc R	QH-00510
Fasteners - Bolts, Studs, Nuts	Carbon Steel	Zinc Coated	N/A	N/A	N/A
Flex Connector	Silicone	N/A	N/A	N/A	N/A
Hose Clamps	Carbon Steel	Zinc Coated	N/A	N/A	N/A
Inlet Filter/ Silencer Housing	Carbon Steel	Powder Coated	QH-00552	SikaCor Zinc R	A-6-450
Inlet Hose	Reinforced Rubber	N/A	N/A	N/A	N/A
Inlet Silencer	Carbon Steel	Powder Coated	QH-00552	SikaCor Zinc R	A-6-450
Motor Mounting Hardware	Galvanized Carbon Steel	N/A	N/A	N/A	N/A
Piping (Galvanized)	Galvanized Carbon Steel	N/A	N/A	N/A	N/A
Piping (Painted)	Carbon Steel	Painted Externally	QH-00408	SikaCor Zinc R	A-6-450
Pressure Safety/Vacuum Breaker Valves	Carbon Steel (Flange)	Painted Flange	QH-00408	N/A	N/A
Sound Enclosure - Base	Carbon Steel	Powder Coated	QH-00552	SikaCor Zinc R	QH-00510
Sound Enclosure	Galvanized Sheet Metal	Powder Coated	QH-00419	SikaCor Zinc R	QH-00510
Vent Silencer	Carbon Steel	Powder Coated	QH-00552	SikaCor Zinc R	A-6-450

*If made in the USA, Protection Method goes from Painted Externally to Powder Coated (A-6-450)

General Painting Information

The machine castings are fettled, cleaned and primed; the primer used is specially developed for machinery parts and is particularly notable for its excellent bonding characteristic and elasticity. Its base is a quick drying synthetic resin binder possessing a high degree of water resistance. The proportion of pigment to binder is such to ensure the best protection for the machines.

Total dry Film Thickness: 70 µm (2.75 mil)

Surface Preparation

Sand blasting, mechanical cleaning to near white surfaces per SA 2,5 acc. to DIN ISO 8501 or SSPC10

Primer

Alkyd Resin: RAL 6006 Manufacturer: Relius Coatings

Final Coat

Alkyd Resin: RAL 5001 Manufacturer: Relius Coatings (BASF) (Blue) or Dr. Demuth GmbH

General Powder Coating Information

SP Polyester Powder Paint, RAL 5001, structure, glossy
Relius No.: I536-5401

Total dry film thickness: 80 - 110µm

General Upgraded Protection Information

Surface Preparation Sa 2 ½

Priming Coat SikaCorEG4 (80µm max)

Intermediate Coat SikaCorEG1 (80µm max)

Finishing Coat SikaCorEG5 (80µm max)



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Delta Blower – Corrosion Protection

Date
11-13-2019

Doc #
B-6-0010 revision "J"

Page
Page 1 of 1

SECTION 7



Aerzen USA Corporation

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DELTA Blower Mechanical Run Test Procedure (30 min.)

Date	Document #	Revision
9-Mar-20	BC-6-0319-03	E

Sales Order No.: _____
Order Name: _____
Customer Name: _____
Customer PO No.: _____

Mechanical Run Test:

The blower package will be thoroughly inspected before being operated for 30 minutes at the discharge pressure specified on page 2. Measurements will be collected every 10 minutes to verify proper functionality of the blower package.

Procedure: *(The technician performing the test is required to initial after each step.)*

- 1) _____ Set and level blower package. (+/- 6mm)
- 2) _____ Visually inspect blower assembly
 - all bolted assemblies are tight
 - all electrical wires are free from rotating elements
 - all instrumentation lines are secured
- 3) _____ Vent all pressure and/or vacuum gauges.
 - Cut off vent nipple, or turn yellow vent lever to open position.
- 4) _____ Free hinged motor base in case of dealing with a Delta Blower or G5 package.
- 5) _____ Turn blower by hand. Should turn freely! Check with factory if restrictions can be felt.
- 6) _____ Add oil to both chambers of the blower if necessary.
 - Consult operating manual for type of oil and quantity.
- 7) _____ Make sure oil drain plugs are tight.
- 8) _____ Connect input power to motor and package as applicable.
- 9) _____ Remove V-belts and check rotation of main blower motor (see arrow tag on blower housing for proper rotation).
 - Change motor wiring if required.
- 10) _____ Replace V-belts
 - Check V-belt tension and alignment (if V-belt drive of non Delta Blower and G5 package).
 - Make sure electrical cable connected to the motor allows the free movement of the hinged motor and /or slide rail.
- 11) _____ Start blower and listen to noise. Shut off immediately if abnormal noise can be detected and investigate cause.
- 12) _____ Turn off blower and listen to run-down noise. Blower should run down freely.
- 13) _____ Start blower and record run data - see test points on sheet 2
 - The pressure relief valve is factory set and does not have to be tested in the field.
- 14) _____ Check operation of gauges and switches (if applicable).
- 15) _____ Turn off blower
- 16) _____ Visually inspect blower assembly
 - all bolted assemblies are tight and nothing unusual is noted



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DELTA Blower Level One Test Data (30 Min.)

Date	Document #	Revision
9-Mar-20	BC-6-0319-03	E

Machine Information:

Equipment # _____
 Equipment Name _____
 Aerzen Model # _____
 Serial # _____

The above mentioned component was tested at design / operating condition with the following test reference points:

Input Shaft Speed: _____
 Inlet Pressure: _____ Inlet Temperature: _____
 Discharge Pressure: _____ Discharge Temperature: _____
 Oil Pressure *: _____ Oil Temperature *: _____

* not applicable to all machines

** Refer to test protocol and data sheet for additional information

Motor Data: Voltage _____ amps _____ RPM _____

Machine Test Data:

	0 Min.	10 min.	20 min.	30 min.
Inlet Pressure (psia)				
Inlet Temperature (°F)				
Discharge Pressure (psig)				
Discharge Temperature (°F)				
Motor Amps (avg.) (amps)				

_____ During test, motor amps did not exceed tag information

_____ No air or oil leaks, abnormal vibration, or unusual noise were observed. (techs initials are required)

Aerzen USA Representative (name) _____

(signature) _____

(date) _____



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DELTA Blower Level Two (Supplemental) Test Data - 30 Minutes

Date	Document #	Revision
19-Sep-19	BC-6-0458-03	-

Customer Specific Information:

Fill in the following chart (where required) during the run test:

Sales Order: _____
Order Name: _____
Customer Name: _____

Specific Test Data:

PM Initial
 If Required

		Unit	0 Min.	10 Min.	20 Min.	30 Min.
Motor Current (per phase)	L1	(A)				
	L2					
	L3					
Applied Motor Voltage (phase-to-phase)	L1-L2	(V)				
	L2-L3					
	L1-L3					
Vibration Levels ¹	Horiz.	RMS (mm/s)				
	Vert.					
	Axial.					
Speed (measured at blower shaft)		(rpm)				
Barometer		(psia)				
Relative Humidity		%				

1: Vibration levels measured at rear side plate of blower stage.

Aerzen USA Representative

(name)

(signature)

(date)

Customer Witness

(name)

(signature)

(date)

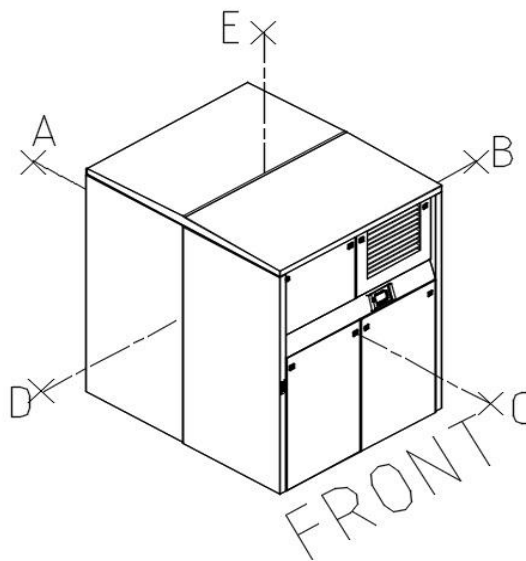


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Noise Level Test

Doc. Date	Document #
8/11/2016	BCHT-6-0232 Rev "C"

Aerzen Job #					Customer									
Aerzen Model #					Choose one					Stage Serial #				
Motor Manufacturer:					HP:					RPM:				
Inverter Manufacturer: (If Applicable)					Voltage:					Hz:				
Inverter Model:														
Test Point Number	Inlet Pressure (psia)	Discharge Pressure (psig)	Motor Hz	Stage Shaft Speed (RPM)	A	B	C	D	E					
Pre-run background Noise					dBA	dBA	dBA	dBA	dBA					
T.P. #1					dBA	dBA	dBA	dBA	dBA					
T.P. #2					dBA	dBA	dBA	dBA	dBA					
T.P. #3					dBA	dBA	dBA	dBA	dBA					
T.P. #4					dBA	dBA	dBA	dBA	dBA					
T.P. #5					dBA	dBA	dBA	dBA	dBA					
T.P. #6					dBA	dBA	dBA	dBA	dBA					
T.P. #7					dBA	dBA	dBA	dBA	dBA					
T.P. #8					dBA	dBA	dBA	dBA	dBA					
Post-run background noise					dBA	dBA	dBA	dBA	dBA					
Calculated free field value based on highest recorded value (dBA) during testing					-									
Guaranteed freefield machinery noise level to customer +/-2dB														



Aerzen USA Technician: _____
Test Date: _____

SECTION 8



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Pre-Commissioning Checklist

Document #

A-7-0288 rev "4"

The purpose of this pre-commissioning checklist is to ensure readiness to successfully commission your Aerzen packages. We will need some information from you in order to better prepare for the commissioning. We ask that your on-site representative complete and return this checklist to Aerzen USA at your earliest convenience.

We will also need to know if you have a target date in mind for our service technician to be on-site, and if the plant maintenance personnel will be on-site at that time to receive maintenance training. This training is normally hands-on in nature and should not take more than 1-2 hours. In addition to the pre-commissioning checklist, we will need an on-site contact and phone number for our service technician.

We will make every effort to meet your target date for commissioning. Please keep in mind that our start-up/commissioning schedule can run three to five weeks out. The earlier we know your target date the better chance we have of reserving your request on our schedule.

Please be aware that should the commissioning prerequisites not be completed prior to our arrival, Aerzen USA reserves the right to charge any and all responsible parties for additional time and travel expenses required to complete the commissioning service.

Below is a checklist of items requiring attention prior to our arrival. Please verify your understanding and completion of the prerequisites by initialing the check the boxes corresponding to each requirement. Please send this checklist to the Aerzen Service Coordinator once all the prerequisites have been verified

- 1 The Aerzen package has not been damaged during shipping and/or while on-site
- 2 The Aerzen package is installed in permanent position, is level, properly grounded and anchored.
- 3 The process pipework for the Aerzen package inlet and discharge is connected in its final position and independently supported (temporary supports are not acceptable)
- 4 Electrical connections have been completed for the motor using flexible conduit to allow the motor to be raised into its operational position.
- 4A The package safety switches (if applicable) are wired to the PLC or MCC (as applicable).
- 4B The Aerzen control panel (if applicable) is wired to the PLC or MCC (as applicable).
- 4C The correct voltage is fed to the control panel. Refer to the project specific wiring diagram for the voltage required
- 4D If there is a VFD or Soft-Starter and supplied by others, it has been configured with the following motor settings:
- 4D-1 Horsepower (kilowatt)
- 4D-2 Voltage
- 4D-3 Maximum Frequency



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Pre-Commissioning Checklist

Document #

A-7-0288 rev "4"

4D Continued

- 4D-4 Minimum Frequency - based on minimum speed of the blower or compressor in conjunction with the sheave combination
- 4D-5 Full Load Amps
- 4D-6 Time to Minimum Speed (3-5 seconds)
- 4D-7 Coast to Stop (do not brake)
- 4D-8 **CONSTANT TORQUE (VERY IMPORTANT!!!)**
- 4D-9 Restart - only when the machine has come to a complete stop.
- 5 Belts or coupling bolts removed for rotation test
- 6 Verification that machine is filled to proper oil level with correct oil (if delivered without oil)
- 7 Required personnel scheduled to attend startup (electrician, operators, maintenance personnel, etc)
- 8 Proper paperwork completed to allow Aerzen technician on site
- 9 If required, on-site safety training requirements for Aerzen personnel must be scheduled in advance. Please advise type, length and place of training).

Company

Project Name or Number

Number of Packages to be commissioned

Representative completing this check-list

Date Completed

Date requested for start-up



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Start-Up Report

Document # BCH-7-0353_02 rev "B"

1.0 Machine data

Date:	
Customer:	
Service Technician:	
Order # / SEO #:	
Serial #:	
Type:	
Package Serial #:	
Oil Type:	
Equipment ID:	
Operating hours total-Start:	
Operating hours total-End:	

2.0 Motor Data

Model #:		Serial #:		Notes:
Motor Manufacturer		Motor Frame		
Motor HP Rating		Full Load Amps		
Motor Voltage Rating		Hertz		
Motor RPM		Service Factor		
Motor cooling		Motor Protection Type	Thermistor / Thermostat	
Motor Protection	NO / NC	Motor Protection Resistance		

3.0 Starter Data

Manufacturer		Notes:
Starter type - Direct/Soft/VFD		
Actual voltage to motor		
Soft Start ramp up time		
VFD Max. Frequency		
VFD Min. Frequency		
VFD Ramp up Speed/Time		
VFD set to constant torque		
VFD Brake Mode = Coast		

4.0 Inspections

	OK	Not OK		OK	Not OK
Sound Enclosure Aesthetics			Motor rotates in proper direction		
Package is level			Verify all oil lines are tight		
Oil drain hose, jack and funnel present			Oil filter		
Unit is properly anchored			Oil demister		
Expansion joints/flex connectors			Oil drain plugs tight		
Verify package is grounded			Cooling fan clearance in shroud		
Process piping is properly supported			Motor conduit conforms to IA-004545 rev "B"		
Anti-vibration feet			Sheaves are properly installed, set screws tightened		
Inlet air filter in place, clean & housing tightened			Enclosure inlet and outlet are free from obstructions		
Blower room ventilation adequate			All fasteners are secure		
Instrument connections tight			Check process piping path to the termination point		
Neutral chamber venting			Validate process piping will not dead head at startup		
Vent all pressure and vacuum gauges			Validate any customer added safety devices		
Motor and machine rotate freely by hand			Discuss application with end user		

4.1 Notes / Not OK, reason why. Correction needed/taken.



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Start-Up Report

Document # BCH-7-0353_02 rev "B"

5.0 Belt Drive Applications

	OK	Not OK	Notes / Not OK, reason why. Correction needed/taken.
Verify motor alignment			
V belt installed and tensioned?			
Verify V belt has the proper length			

6.0 Direct Drive Applications

	OK	Not OK	Notes / Not OK, reason why. Correction needed/taken.
Coupling bolt			
Compression sleeves			
Coupling halves (properly distanced)			
Coupling Alignment			

7.0 Safety Settings and Verification

7.1 Safety chain - Switch Based

Switch	Unit	Switch Point	Gauge Reading	Shutdown Initiated	Notes:

7.2 Safety chain - Controller Based

Controller:	Unit	Alarm	Fault	Functional	Notes:

8.0 Startup

	OK	Not OK	Notes:
Smooth Start Up			
Lubricate drive motor per O&M			

9.0 Functional Testing

	OK	Not OK	Notes:
Aeromat			Closing time=
Aeropress			Closing time=
Aerovac			Closing time=
Unload/load device are in synch			Closing time=
Unload/Load Solenoid operational			
All gauges and switches operational			
S.E. fan has correct rotation			
PRV manual release functional			Set point =
After fault does unit remain off			
Non-return flap (check valve)			
System is leak free-oil			
System is leak free-air			
Smooth running			
Motor cooling properly			

10.0 Post Run Checks

	OK	Not OK	Notes:
Smooth Coast Down			
Oil Level Correct			
Sheave Alignment			
Bolt Tightness			



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Start-Up Report

Document # BCH-7-0353_02 rev "B"

11.0 Technical data

11.1 Operational Readings

Elapsed Run Time	0:00	0:00	0:00	0:00	0:00		Notes:
Pressures							
Temperatures							
Miscellaneous							

11.2 Motor Operational Readings

Elapsed Run Time	0:00	0:00	0:00	0:00	0:00		Notes:

11.3 Vibration Readings

Elapsed Run Time	0:00	0:00	0:00	0:00	0:00		Notes:	Readings are in:
Motor Non-Drive Horizontal								
Motor Non-Drive Vertical								
Motor Non-Drive Axial								
Motor Drive Horizontal								
Motor Drive Vertical								
Motor Drive Axial								

12.0 Notes/Summary



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Inspection Report

Document # BCH-7-0353 03 rev "C"

1.0 Machine data

Date:	
Customer:	
Service Technician:	
Order # / SEO #:	
Serial #:	
Type:	
Package Serial #:	
Oil Type:	
Equipment ID:	
Operating hours total-Start:	
Operating hours total-End:	

2.0 Motor Data

Model #:		Serial #:		Notes:
Motor Manufacturer		Motor Frame		
Motor HP Rating		Full Load Amps		
Motor Voltage Rating		Hertz		
Motor RPM		Service Factor		
Motor cooling		Motor Protection Type	Thermistor / Thermostat	
Motor Protection	NO / NC	Motor Protection Resistance		

3.0 Starter Data

Manufacturer		Notes:
Starter type - Direct/Soft/VFD		
Actual voltage to motor		
Soft Start ramp up time		
VFD Max. Frequency		
VFD Min. Frequency		
VFD Ramp up Speed/Time		
VFD set to constant torque		
VFD Brake Mode = Coast		

4.0 Inspections

	OK	Not OK		OK	Not OK
Sound Enclosure Aesthetics			Motor rotates in proper direction		
Package is level			Verify all oil lines are tight		
Oil drain hose, jack and funnel present			Oil filter		
Unit is properly anchored			Oil demister		
Expansion joints/flex connectors			Oil drain plugs tight		
Verify package is grounded			Cooling fan clearance in shroud		
Process piping is properly supported			Motor conduit conforms to IA-004545 rev "B"		
Anti-vibration feet			Sheaves are properly installed, set screws tightened		
Inlet air filter in place, clean & housing tightened			Enclosure inlet and outlet are free from obstructions		
Blower room ventilation adequate			All fasteners are secure		
Instrument connections tight			Check process piping path to the termination point		
Neutral chamber venting			Validate process piping will not dead head at startup		
Vent all pressure and vacuum gauges			Validate any customer added safety devices		
Motor and machine rotate freely by hand			Discuss application with end user		

4.1 Notes / Not OK, reason why. Correction needed/taken.

--

5.0 Maintenance

Item Replaced	Yes	No	Part # and Qty.	Notes:
Oil				
Belts				
Oil Filter				
Air Filter				
Coupling Pins				
Coupling Bushing				
Oil Sample Taken			Tracking #:	



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Inspection Report

Document # BCH-7-0353 03 rev "C"

6.0 Belt Drive Applications

	OK	Not OK	Notes / Not OK, reason why. Correction needed/taken.
Verify motor alignment			
V belt installed and tensioned?			
Verify V belt has the proper length			

7.0 Direct Drive Applications

	OK	Not OK	Notes / Not OK, reason why. Correction needed/taken.
Coupling bolt			
Compression sleeves			
Coupling halves (properly distanced)			
Coupling Alignment			

8.0 Safety Settings and Verification

8.1 Safety chain - Switch Based

Switch	Unit	Switch Point	Gauge Reading	Shutdown Initiated	Notes:

8.2 Safety chain - Controller Based

Controller:	Unit	Alarm	Fault	Functional	Notes:

9.0 Startup

	OK	Not OK	Notes:
Smooth Start Up			
Lubricate drive motor per O&M			

10.0 Functional Testing

	OK	Not OK	Notes:
Aeromat			Closing time=
Aeropress			Closing time=
Aerovac			Closing time=
Unload/load device are in synch			Closing time=
Unload/Load Solenoid operational			
All gauges and switches operational			
S.E. fan has correct rotation			
PRV manual release functional			Set point =
After fault does unit remain off			
Non-return flap (check valve)			
System is leak free-oil			
System is leak free-air			
Smooth running			
Motor cooling properly			

11.0 Post Run Checks

	OK	Not OK	Notes:
Smooth Coast Down			
Oil Level Correct			
Sheave Alignment			
Bolt Tightness			



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Inspection Report

Document # BCH-7-0353 03 rev "C"

12.0 Technical data

12.1 Operational Readings

Elapsed Run Time	0:00	0:00	0:00	0:00	0:00		Notes:
Pressures							
Temperatures							
Miscellaneous							

12.2 Motor Operational Readings

Elapsed Run Time	0:00	0:00	0:00	0:00	0:00		Notes:

12.3 Vibration Readings

Elapsed Run Time	0:00	0:00	0:00	0:00	0:00		Notes:	Readings are in:
Motor Non-Drive Horizontal								
Motor Non-Drive Vertical								
Motor Non-Drive Axial								
Motor Drive Horizontal								
Motor Drive Vertical								
Motor Drive Axial								

13.0 Notes/Summary



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Training Sign In

Document # BCH-7-0353_06 rev "C"

1.0 Customer

Date:	
Customer:	
End User:	
Site Address:	
Service Technician:	
Equipment Type:	
Equipment Serial Number:	
Order # / SEO #:	

2.0 Trainee's Signatures

	Print	Signature	Title
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

3.0 Training Topics

--

4.0 Signatures

Date	Customer Name	Customer Signature
Date	FST Name	FST Signature

4.3 VALVES

Stainless Steel 2 Piece Ball Valves

We offer a full selection of standard 2 piece stainless steel ball valves in sizes ranging from 1/4" to 2". To customize the valve to fit your needs, visit our website and configure the handle & stem, internal construction, and other options.

Design Features

- Blowout proof stem
- Adjustable packing gland
- Glass reinforced Teflon seats
- NPT end connections
- Drilled and tapped mounting holes standard
- 2 piece construction
- Stainless steel stem standard
- Conforms to API 598, API608, ASME B16.34
- Stainless Steel Series: meets NACE Std. MR-01-75
- 2000 PSI 1/4-1", 1500 PSI 1-1/4-2"

Common Options Available

- Lockable Extensions – Length Available 2-1/4"
- Vented Ball
- Hole in Ball Upstream

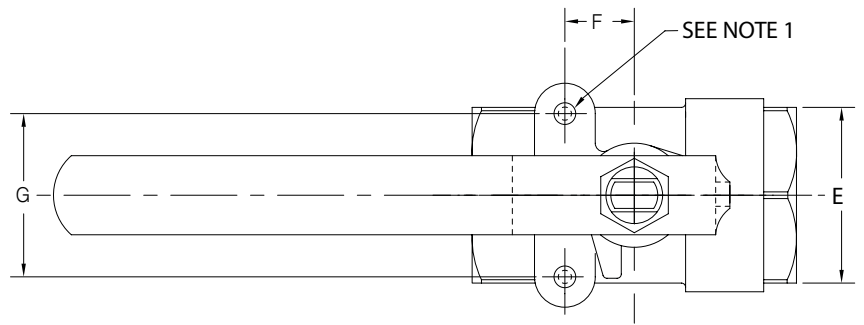
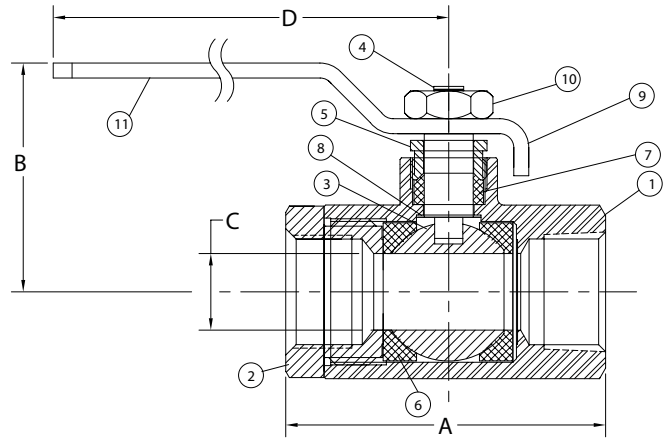
Please see our website for the full range of 40+ options available



Lance Valves has been a Leading Manufacturer and Supplier of Valves for More than 40 years.

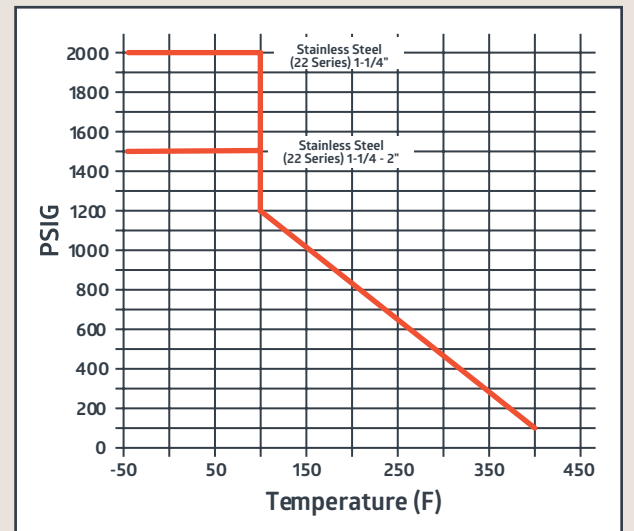
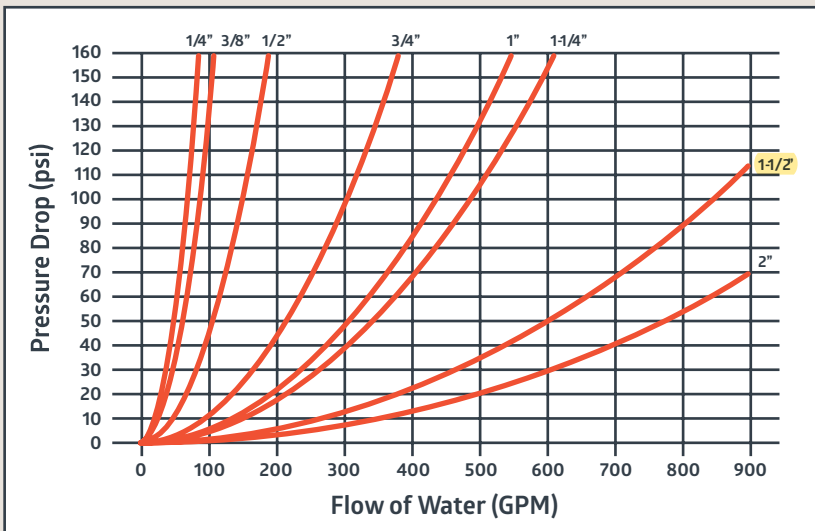
1. **BODY** - CF8M
2. **END CONNECTOR** - 316
3. **BALL** - 316
4. **STEM** - 316 Stainless
5. **GLAND NUT** - 316 Stainless
6. **SEATS** - Glass Filled Teflon
7. **STEM PACKING** - Glass Filled Teflon
8. **STEM BEARING** - Glass Filled Teflon
9. **HANDLE** - 304
10. **HANDLE NUT** - 18-8
11. **HANDLE GRIP** - Vinyl

API 598, API608, ASME B16.34
 Stainless Steel Series: Meets NACE Std. MR-01-75
 2000# WOG 1/4"-1"
 1500# WOG 1-1/4"-2"
 150# WSP 1/4"-2"



NOTE 1: Sizes 1/4" - 1": Tapped with 10-24 UNC threads. Sizes 1-1/4" - 2" Tapped with 1/4"-20 UNC threads.

SIZE	PART NO.	WEIGHT LB	TORQUE LB	A	B	C	D	E	F	G
1/4"	22-021	0.6	40	2.09	2.13	.37	3.7	1.12	.500	1.12
3/8"	22-031	0.56	40	2.09	2.13	.37	3.7	1.12	.500	1.12
1/2"	22-041	0.66	50	2.38	2.13	.49	3.7	1.12	.500	1.12
3/4"	22-061	1.27	90	3.00	2.125	.688	4.75	1.375	.875	1.375
1"	22-081	1.57	150	3.375	2.250	.875	4.75	1.625	.875	1.375
1-1/4"	22-101	3.13	240	4.00	2.625	1.00	5.50	2.00	.938	1.50
1-1/2"	22-121	4.3	320	4.250	2.875	1.25	5.50	2.375	.938	1.50
2"	22-161	6.5	360	5.375	3.063	1.50	5.50	2.75	.938	1.50



PRATT®

a MUELLER brand

BF SERIES WAFER / LUG BUTTERFLY VALVES

Engineering Creative Solutions for Fluid Systems Since 1901



MUELLER

PRATT®

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PRATT® BF SERIES BUTTERFLY VALVES - 2" - 48"

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CONSTRUCTION SPECIFICATION

Pratt® BF Series Butterfly Valves – 2" - 48"

SIZES	2" - 48"
BODY	Ductile Iron (65-45-12)
DISC	Ductile Iron Nickel Plated Ductile Iron Nylon 11 CF8M Stainless Steel Aluminum Bronze
STEM	416 S.S. Heat Treated
RESILIENT SEAT	EPDM, Buna-N Viton
ACTUATION OPTIONS	Worm Gear Lever Pneumatic Electric
PRESSURE RATINGS	2" – 12" 230 psi 14" – 48" 150 psi

* For installation between ANSI 125/150

** Substitute material may result in pressure rating change.
Contact factory for details.

FEATURES

- Innovative 3 point connection, tongue and groove seat allows for higher pressure rating and full Vacuum service
- Unique secondary shaft seals prevent leakage from shaft.
- Our two piece shaft design provides maximum strength and a high flow characteristic disc.



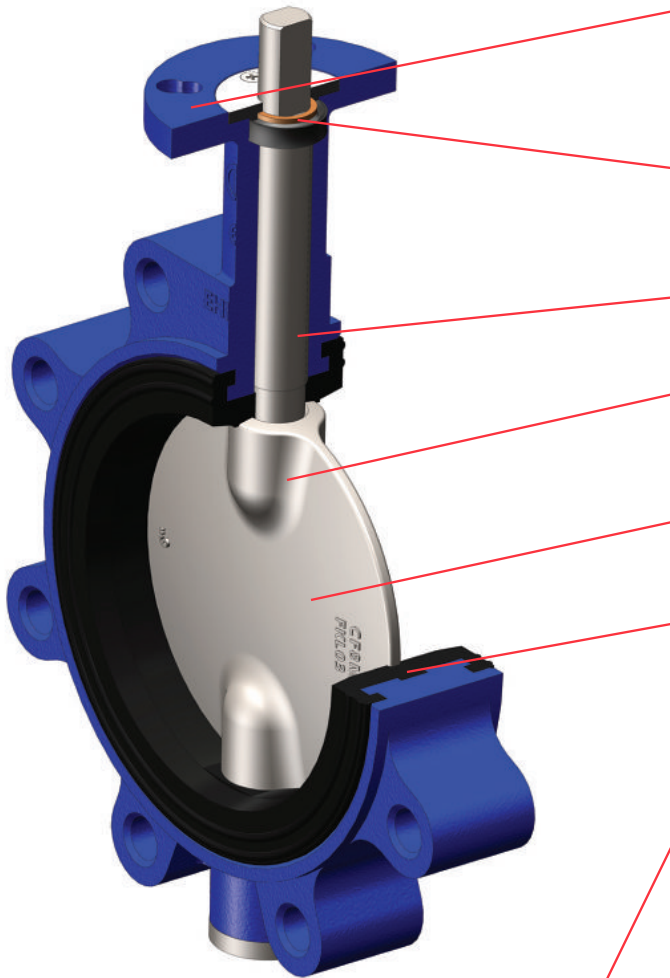
VALVE WITH ELECTRIC OPERATOR



VALVE WITH GEAR OPERATOR

DESIGN DETAILS

Pratt® BF Series Butterfly Valves – 2" - 48", 2"-12" 230 psi, 14"-48" 150 psi



TOP FLANGE

Conforms to ISO 5211 and KV industrial standard allowing a universal mounting pad for automation requirements which is suitable for most actuators in the market.

BLOWOUT PROOF STEM

Meets all API 609 requirements. Our unique design also creates a secondary stem journal seal preventing leakage to atmosphere.

A FULL LENGTH NYLATRON® BUSHING

Reduces stem journal friction and reduces torque.

UTILIZES 2 INTERNALLY DRIVEN SHAFTS

Creating a strong drive connection and allowing for a thin profile disc creating high Cv's.

THIN PROFILE, HIGH TENSILE STRENGTH DISC

Maximizes Cv's and allows for 230 psi pressure rating.

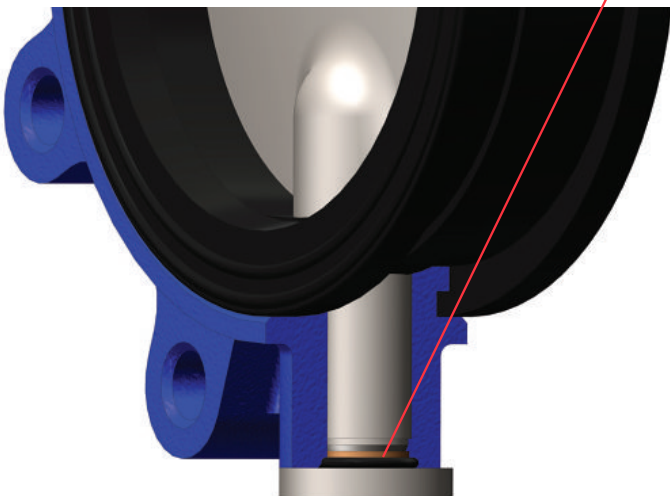
THE PRATT UNIQUE SEAT DESIGN

Utilizes 3 tongue and groove connection points to the valve body. Seats remain secure and stable even under high dead-end pressure and full vacuum services. The center tongue not only locks the seat in place, but allows rubber material to flow into the center body groove when cycling the valve, drastically reducing the operating torque.

THE BF SERIES BOTTOM CAP

Provides lower stem retention and also creates a secondary stem journal seal preventing external leakage to atmosphere. 2"-12" lower shafts ride on a precision wear guide reducing shaft drag.

14" and larger utilizes an axial bearing to support the weight of the shaft and disc, providing a close to friction-free movement.



SUGGESTED SPECIFICATION

Pratt® BF Series Butterfly Valves – 2" - 48", 2"-12" 230 psi, 14"-48" 150 psi

GENERAL

Valves shall be of the Wafer or Lug design for installation between ANSI 125 / 150 flanges. All valves shall be capable of bi-directional, end of line, bubble tight service to rated pressure. Valves are also rated to full vacuum service. Design Standards: API 608 category A.

PRESSURE RATING

2" – 12" – 230psi to fit between ANSI 125 / 150 flanges

14" – 48" – 150psi to fit between ANSI 125 / 250 flanges

BODY

Valve body shall be a 1 piece Ductile Iron ASTM A-536 (65-45-12) construction with a laying length conforming to the latest revision of ISO 5752 and a flange connection B16.1/B16.5.

DISC

Valve disc shall be Ductile iron ASTM A-536 Grade 65-45-12 with ENP plating or Nylon 11 coating, CF8M Stainless Steel, or Aluminum Bronze. Disc shall be designed to accommodate an upper and lower shaft with a thin center profile giving higher Cv values combined with strength.

SHAFT

Valve shaft shall be constructed of Heat Treated 416 Stainless Steel. Valve shall be designed to accommodate (2) shafts (1 upper and 1 lower). The upper shaft shall have a positive engagement in the disc utilizing an internal square drive and shall be retained by the body Top Cap and End Cap.

SEAT

Seat shall be EPDM, Buna-N or Viton. Seat design shall consist of 3 Tongues (2 located on the side walls and 1 located in the center bore) that engage into 3 groves in the body. These 3 tongue and groove connection points prevent seat movement in a radial and axial direction. Seats shall be field replaceable.

SHAFT SEALS

Upper Shaft Seal shall be self-adjusting V-type and shall be suitable for Pressure or Vacuum service. Packing shall be located above the bushing and shall create a positive seal against the Top Cap. Bottom end cap contains a captive o-ring creating a positive seal against external leakage.

BUSHINGS

Valve shall consist of (2) full length Nylatron® bushings (upper and lower) offering superior protection against friction, corrosion and impacts. Pratt's unique bushings design provide protection against shaft side loading.

TESTING

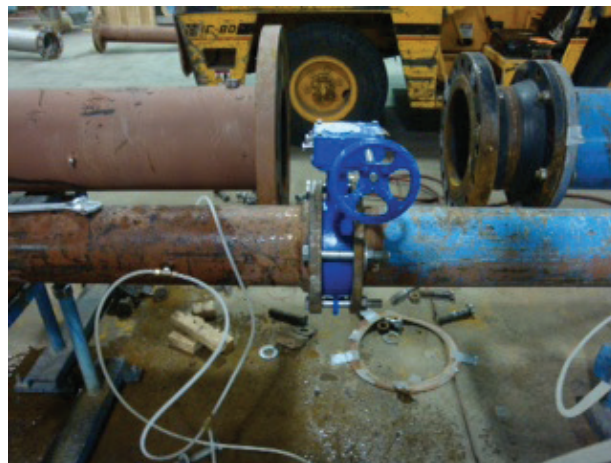
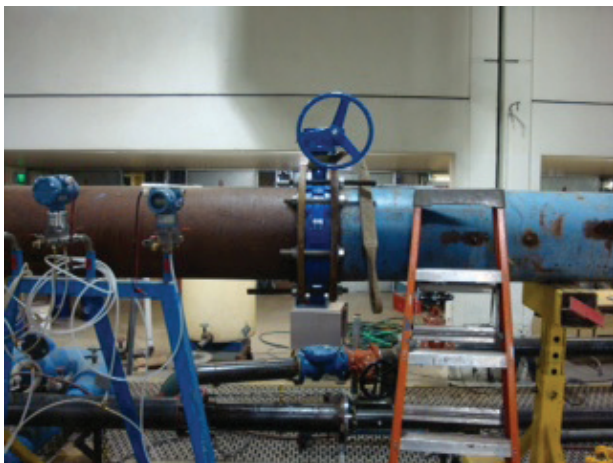
All valves shall be leak tested in the factory at their rated pressure per API 598.

CV FLOW DATA

Pratt® BF Series Butterfly Valves

During its product development phase, the Pratt BF Series Wafer / Lug Butterfly Valve was tested to ensure that it met our own rigorous standards for flow capacity. Throughout testing, the Pratt BF Series valve has consistently produced high Cv values which translates to lower flow resistance, and in turn, lowering system operating costs to the user over the life of the valve. The following Cv chart represents the flow characteristics for all sizes available.

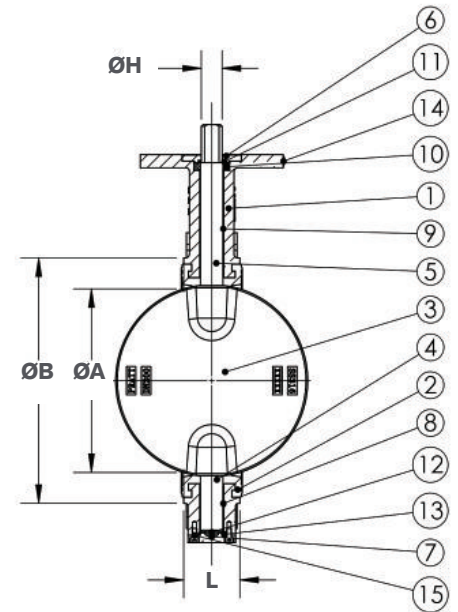
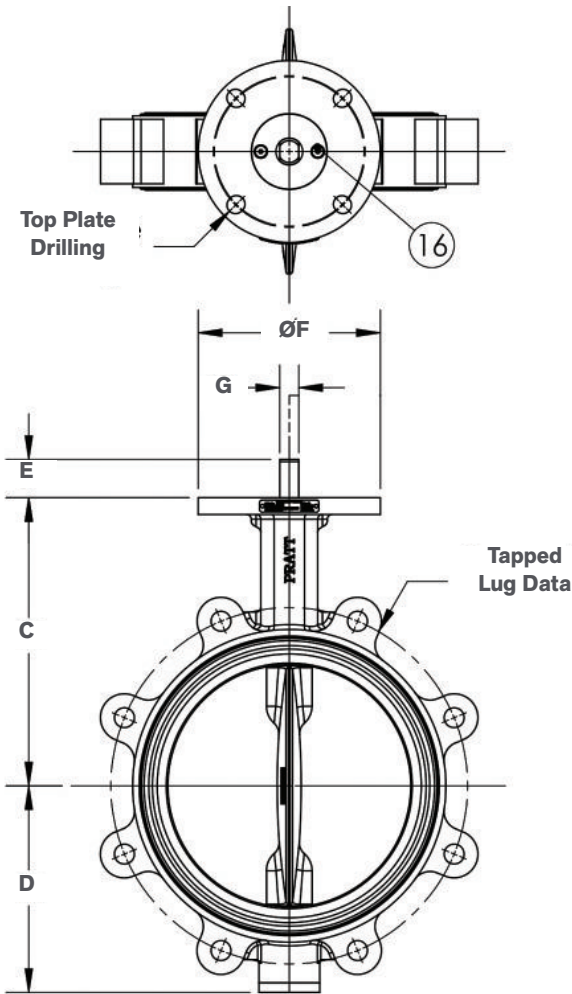
VALVE OPENING (DEG)	CV BY VALVE SIZE													
	2"	2.5"	3"	4"	5"	6"	8"	10"	12"	14"	16"	18"	20"	24"
10	1	2	3.5	6	8.5	14	18	28.1	40.5	55.1	72	91.1	112.5	162
20	1.8	2.9	4.1	7.4	11.5	16.5	29.4	185.5	267.1	363.6	474.9	601.1	742.1	1069
30	10.8	16.9	24.3	43.2	67.5	97.1	172.7	381.5	549.4	747.8	976.7	1236	1526	2198
40	22.1	34.5	49.7	88.4	138.1	198.8	353.4	683.1	983.6	1339	1749	2213	2732	3935
50	38.5	60.2	86.7	154.2	240.9	346.9	616.8	1161	1671	2275	2971	3761	4643	6685
60	65.3	102	146.9	261.1	408	587.6	1045	1944	2799	3810	4976	6298	7775	11196
70	111	173.5	249.8	444.1	693.9	999.2	1776	3232	4654	6335	8274	10472	12928	18617
80	176.2	275.2	396.3	704.6	1101	1585	2818	6215	8950	12182	15911	20138	24862	35801
90	206.4	322.5	464.4	825.6	1290	1858	3302	6420	9245	12583	16435	20801	25680	36979



Pratt BF Series Wafer / Lug Butterfly Valves being tested at an independent research laboratory

DIMENSIONAL DATA

Pratt® BF Series, Lug



PART NO.	PART NAME	MATERIAL	QTY.
1	Lug Body	DI	1
2	Seat	EPDM / NBR / Viton	1
3	Disc	SS316 / DI / C954 / Nylon 11	1
4	Lower Stem	SS416 / SS316 / SS630	1
5	Upper Stem	SS416 / SS316 / SS630	1
6	Top Cap	1020 Steel	1
7	End Cap	1020 Steel	1
8	Lower Bushing	Nylatron®	1
9	Upper Bushing	Nylatron®	1
10	V-packing	NBR	1
11	Washer	SS304	1
12	Wear Shim	SS304	1
13	O-ring	NBR	1
14	Data Plate	SS304	1
15	End Cap Bolt	SS304	2
16	Top Cap Bolt	SS304	2

SIZE	LBS	PRATT STANDARD TOP PLATE DRILLING										ISO 5211 TOP PLATE DRILLING			TAPPED LUG DATA					
		ØA	ØB	C	D	E	ØF	G	ØH	L	KEY	BOLT CIRCLE	NO. OF HOLES	HOLE DIA.	BOLT CIRCLE	NO. OF HOLES	HOLE DIA.	BOLT CIRCLE	NO. OF HOLES	TAPPED
2"	7.05	1.079	3.500	5.000	2.579	1.260	4.000	0.375	0.563	1.693	-	3.25	4	0.437	2.760	4	0.402	4.75	4	5/8"
2.5"	8.15	1.862	4.094	5.500	2.854	1.260	4.000	0.375	0.563	1.811	-	3.25	4	0.437	2.760	4	0.402	5.5	4	5/8"
3"	11.24	2.429	4.646	5.709	3.642	1.260	4.000	0.375	0.563	1.811	-	3.25	4	0.437	2.760	4	0.402	6	4	5/8"
4"	14.55	3.500	5.827	6.496	4.429	1.260	4.000	0.437	0.625	2.047	-	3.25	4	0.437	2.760	4	0.402	7.5	8	5/8"
5"	20.72	4.567	7.205	7.500	4.921	1.260	4.000	0.500	0.750	2.205	-	3.25	4	0.437	2.760	4	0.402	8.5	8	3/4"
6"	22.92	5.433	7.992	7.874	5.433	1.260	4.000	0.500	0.750	2.205	-	3.25	4	0.437	2.760	4	0.402	9.5	8	3/4"
8"	38.35	7.744	10.315	9.500	6.811	1.260	6.000	0.625	0.875	2.362	-	5	4	0.563	4.921	4	0.563	11.75	8	3/4"
10"	62.59	9.646	12.598	10.866	8.110	2.000	6.000	-	1.125	2.677	1/4" * 1/4"	5	4	0.563	4.921	4	0.563	14.25	12	7/8"
12"	83.53	11.339	14.567	12.205	9.713	2.000	6.000	-	1.125	3.071	1/4" * 1/4"	5	4	0.563	4.921	4	0.563	17	12	7/8"

BF SERIES PART NUMBER

Ordering Information

VALVE MODEL		ANSI CLASS		SIZE		BODY		DISC		STEM		SEAT		OPTIONS	
XXX		XXX		XXX		X		X		X		X		XX	
BF1	Wafer	125	Class 125	020	2"	8	Ductile Iron	9	DI/ENP	9	STEEL	9	BUNA	01	UC DISC
BF2	Lug	P10	PN10	025	2 1/2"	7	316SS/CF8M	8	DI/Nylon-11	8	416	8	EPDM	02	SILICONE FREE
		P16	PN16	030	3"			7	Al. Bronze	7	DUPLEX	7	VITON	03	O2 CLEANED
				040	4"			6	CF8M	6	316	6	WHITE BUNA	04	SPECIAL PAINTING
				050	5"			4	MONEL	5	MONEL	2	NAT. RUBBER	05	SPECIAL BOLTING
				060	6"			3	HAST C 276	4	HAST C 276	1	NEOPRENE	06	ANTISTATIC
				080	8"			2	17/4 PH	3	17/4			07	SPECIAL PACKING
				100	10"			1	ALLOY 20	2	ALLOY 20			12	NACE
				120	12"			0	DUPLEX 2205					13	GREASE INJECTOR
				140	14"			H	SMO255						
				160	16"										
				180	18"										
				200	20"										
				240	24"										
				300	30"										
				360	36"										
				400	40"										
				420	42"										
				480	48"										
				540	54"										
				600	60"										
				720	72"										
				D05	DN50										
				D06	DN65										
				D08	DN80										
				D10	DN100										
				D12	DN125										
				D15	DN150										
				D20	DN200										
				D25	DN250										
				D30	DN300										
				D35	DN350										
				D40	DN400										
				D45	DN450										
				D50	DN500										
				D60	DN600										

Standard Product
 Special Order Product
 Options only show in the figure number if there is an option

*Other material and options available upon request

Example Part #: BF1-125-020-8888

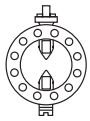
Valves to be supplied by Veolia are:

Qty (4) - 2.5" BF2-025-8747/HDR-030-1

Qty (4) - 3" BF2-030-8747/HDR-030-1

PRATT

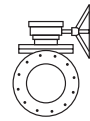
Product Guide



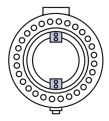
MODEL 2FII



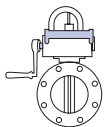
MONOFLANGE MKII



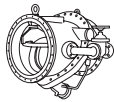
PLUG VALVES



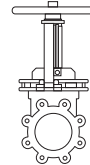
TRITON[®] XR70



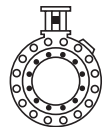
INDICATING BUTTERFLY VALVES UL & FM APPROVED



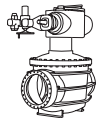
TILTING DISC CHECK VALVES



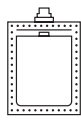
KNIFE GATE VALVES



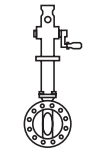
N-STAMP NUCLEAR BUTTERFLY VALVES



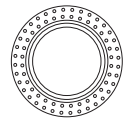
CONE VALVES



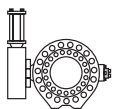
RECTANGULAR



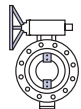
PIVA POST INDICATING VALVES ASSEMBLY UL & FM APPROVED



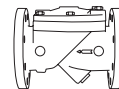
SLEEVE VALVES



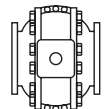
RUBBER SEATED BALL VALVES



TRITON[®] 250



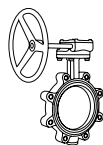
CHECK VALVES



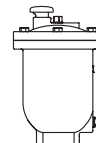
METAL SEATED BALL VALVE



CONTROL SYSTEMS



INDUSTRIAL VALVES



AIR VALVES

For more information about Pratt or to view our full line of water products, please visit www.prattvalve.com or call Pratt customer service at 1.800.423.1323.

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STAINLESS STEEL SOLENOID VALVES

Dependable • Packless



TYPE "KR" FULL PORT - NORMALLY OPEN 1/2" TO 3" PIPE SIZE

NO DIFFERENTIAL PRESSURE REQUIRED TO OPEN

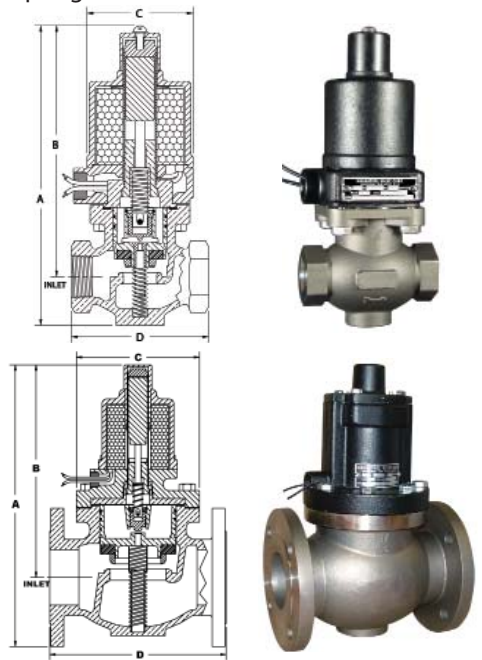
OPERATION:

Valve closes when energized and opens when de-energized. When the coil is energized the plunger presses the poppet, closing the pilot orifice, and opens a bleed passageway to permit pressure to build above the piston and seat it. Upon de-energizing the coil, the pilot orifice is opened, relieving the pressure above the piston allowing it to leave its seat. The bottom spring allows the valve to operate at zero pressure drop.

CONSTRUCTION:

- (*Wetted parts - No Copper Bearing Alloys in contact with fluid)
- *Valve Body - 304 Stainless Steel Globe Pattern - NPT ends
(For Flanged Ends see Options page 26)
- *Piston - 303 Stainless Steel
- Coil Enclosure - Malleable or Cast Iron, 1/2 " NPS conduit conn.
- *Plunger - 430 Stainless Steel
- *Poppet - 303 Stainless Steel
- *Stem - 303 Stainless Steel
- *Bonnet Tube - 304 Stainless Steel
- *Spring - Inconel
- *Body Seal - Non Asbestos Gasket
- *Orifice Seal - Glass Filled Teflon
- *AC Shading Coil - Silver
- *Stem Pin - 304 Stainless Steel
- Coil - Encapsulated Class H, 18" leads

**FOR
STEAM APPLICATIONS
SEE BULLETIN 3006-WR
Page 25**



**MAX. FLUID TEMP.
400° F**

**MAX. STATIC PRESSURE
300 PSI**

Except valves listed for 500 PSI

APPLICATION:

To control the flow of Corrosive Fluids, Deionized Water, Condensate, Ammonias, Vegetable Oils, Fuel Oils, Cryogenics, Flammable Liquids.** Cryogenic fluids include liquid oxygen (-297°F), liquid argon (-303°F) and liquid nitrogen (-320°F). Valve operates from zero to maximum differential pressure indicated in table. Valve must be mounted in horizontal pipe with solenoid enclosure vertical and on top.

**** CLEANING**

- Cryogenic valves are degreased & cleaned to keep them free of moisture.
- Oxygen valves are also "black light" tested.

Strainers are recommended for use with solenoid valves
(See page 19)

When you order please supply the following:

- Pipe Size
 - Valve Type
 - Voltage (AC or DC)
 - Hertz
 - Fluid
 - Fluid Temperature
 - Max. Diff. Pressure
 - Optional Features
- (See pages 26 & 27)

FOR OPTIONS & ACCESSORIES SEE PAGES 26 & 27

Pipe Size Inches	Max. Diff. PSI	Type No.	Watts AC	Amps Hold 120-60	Amps Inrush 120-60	Watts DC	Ship Wt. Lbs.	Dimensions In Inches					
								A	B	C	D	D (Flanged)	
												150#	300#
1/2	110	14KR42	25	0.5	1.5	18	7	8-1/8	7	2-7/8	3-1/4	6	6-1/2
	200	14KR32											
	300	29KR52	45	1.0	2.7	23	10	9-1/8	8	3-1/2			
	500	E29KR62								4			
3/4	110	14KR43	25	0.5	1.6	18	8	8-1/4	7-1/8	2-7/8	3-1/2	6	6-1/2
	200	29KR33											
	300	129KR53	65	1.5	4.3	33	12	9-1/4	8-1/8	3-1/2			
	500	E129KR63								4			
1	110	16KR44	25	0.5	1.8	18	10	9-1/8	7-3/4	3-1/4	4-1/8	6-1/2	7-1/2
	200	31KR34											
	300	131KR54	65	1.5	4.5	33	14	10	8-5/8	3-1/2			
	500	E131KR64								4			
1-1/2	115	35KR46	45	1.0	3.8	23	18	11-3/8	9-1/2	4	4-7/8	6-1/2	7-1/2
	200	41KR36	60	1.7	6.5	35	22	11-5/8	9-3/4	4-1/2			
	300	141KR56	85	3.5	9.7	45	27	12-3/8	10-1/8	5-3/8	6	8	9
	500	141KR66											
2	100	36KR47	45	1.0	4.2	23	32	12-5/8	10-3/8				
	200	42KR37	60	1.7	7.3	35	32	12-5/8	10-3/8	5-3/8	6	8	9
	300	42KR57											
	500	142KR67	85	3.5	11.0	45							
3	100	44KR49F1	60	1.7	8.8	35	69	14-3/8	11-1/8	6-5/8	N/A	9-1/2	N/A
	200	44KR39F1										N/A	12-1/2
	300	144KR59F3	85	3.5	13.0	45	82						

Shipping Weights above apply to Threaded Ends Only (except 3" which are Flanged Only)
For Flanged Ends contact factory for complete weight and dimensions
3" STAINLESS STEEL VALVES ARE SUPPLIED WITH FLANGED ENDS ONLY

MAGNATROL VALVE CORPORATION

4.4 DRAWINGS

Package Name: MD SUBMITTAL

Project Number: 5703212001

Project Name: ABERDEEN ID IFAS



MD TABLE OF CONTENTS

Created By: LHB
Revision: 1

ITEM	DRAWING NUMBER	DESCRIPTION	REV
1	2592935	DETAILS, MECHANICAL, PLAN AND SECTIONS	1
2	2591664	CONCRETE, 2 TRAIN, RETROFIT	1
3	1414466	ANG, 4" PIPE SUPPORT, 3.00" SQ X .25"THK X 11.75"LG	5
4	1425319	ANG, 3" PIPE SUPPORT, 3.00" SQ X .25"THK X 10.69"LG	3
5	1473820	WLDMT, SPARGER, Ø23" X 5'LG CYL SCREEN, 1.5" MANIFOLD	2
6	1473865	WLDMT, PIPE SUPPORT, 1-1/2" PIPE	1
7	1809708	WLDMT, PIPE, FOAM CONTROL SPRAY NOZZLE	1
8	1853090	ASSY, COVER, INSTRUMENT, Ø1.960" ID, 1-PC (BY KRUGER)	3
9	2026531	ANG, SPARGER SUPPORT, 2.00" SQ X .19"THK X 26.00"LG	1
10	2285068	WLDMT, CYLINDRICAL SCREEN, PERF, 22 7/8", 5'LG, Ø5/8" HOLES, w/1"-2" PIPE HANGER	0
11	2354578	ANG, 1-1/2" PIPE SUPPORT, 2.00" SQ X .19"THK X 9.44"LG	2
12	2384152	ANGLE, SUPPORT, KICKER, 2-1/2" X 2-1/2" X 1/4"	1
13	2406229	SCREEN, SCUM, 14 GA X 24.00" X 48.00"LG	0
14	2422663	WLDMT, SUPPORT, FOAM CONTROL, SPRAY NOZZLE	0
15	2592650	ASSY, AIR GRID, 4", (10) 1-1/4" LATERALS @ 24" OC, 9' W, 370 HOLES, FLG/CAP, RH	0
16	2592654	WLDMT, DROP PIPE, 4", 163.50"LG	1
17	2592980	ASSY, AIR GRID, 3", (7) 1" LATERALS @ 36" OC, 4' W, 98 HOLES, FLG/CAP, RH	0
18	2592981	WLDMT, DROP PIPE, 3", 164.75"LG	1
19	2593310	ASSY, AIR GRID, 4", (10) 1-1/4" LATERALS @ 24" OC, 9' W, 370 HOLES, FLG/CAP, LH	0
20	2593606	ASSY, AIR GRID, 3", (7) 1" LATERALS @ 36" OC, 4' W, 98 HOLES, FLG/CAP, LH	0
21	2593967	WLDMT, DROP PIPE, 1-1/2" SPARGER	0
22			
23			
24			

Package Name: MD SUBMITTAL
Project Number: 5703212001
Project Name: ABERDEEN ID IFAS

Created By: LHB
Revision: 1



REVISION TABLE

REV	CREATED	APPR	DATE	DESCRIPTION
0	LHB	SRW	09.07.23	RELEASED FOR SUBMITTAL
1	SRW	LHB	10.10.23	REVISED CONCRETE, DROP PIPES, SCREEN AND AIR GRID LOCATIONS

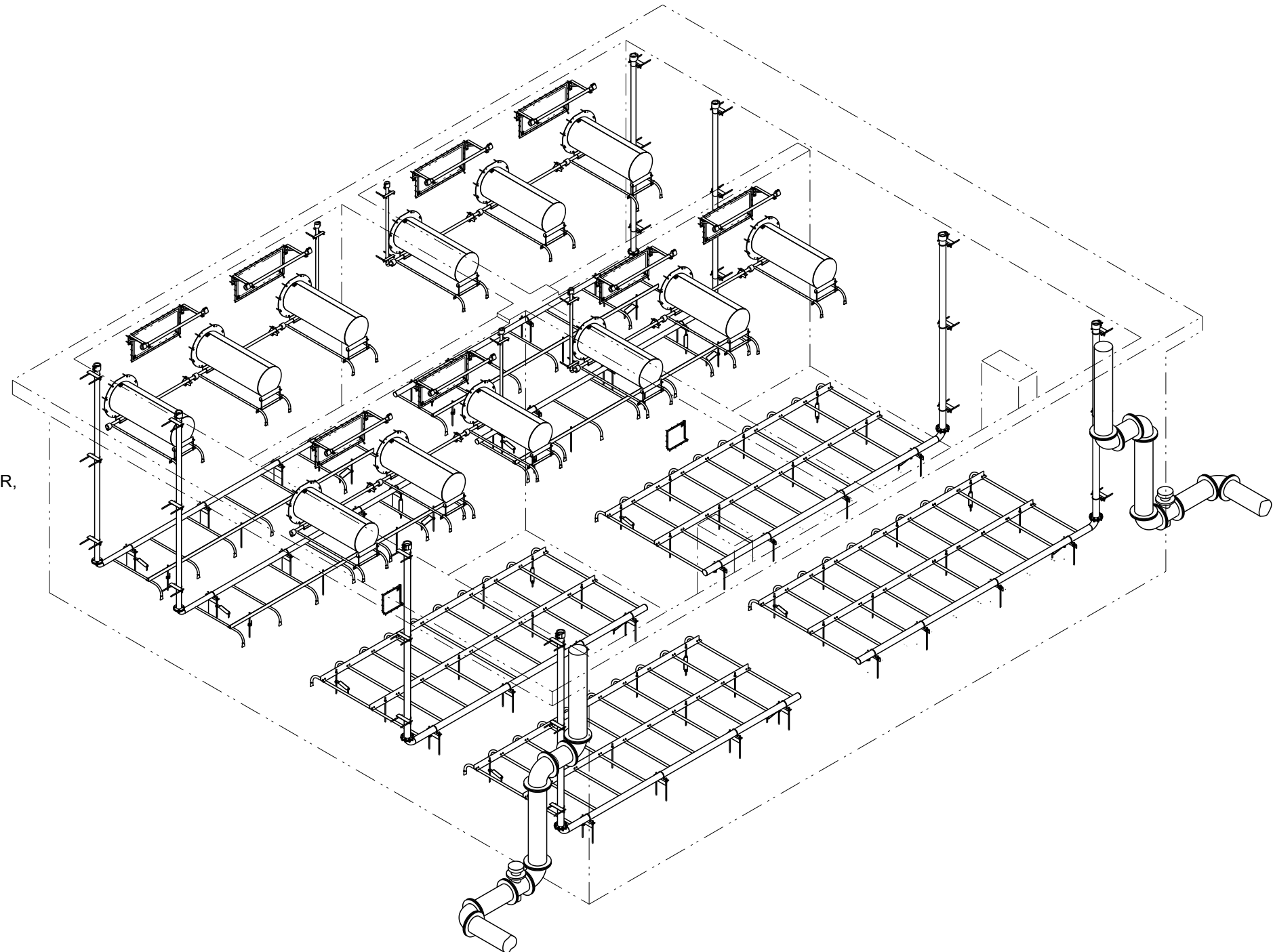
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NOTES:

1. ANY WALL THICKNESSES SHOWN ARE ESTIMATED AND ARE SHOWN FOR REFERENCE ONLY. ACTUAL WALL THICKNESSES AND FOOTINGS TO BE DETERMINED BY ENGINEER, NOT BY KRUGER.
2. ALL PIPE AND PIPE SUPPORTS NOT SPECIFICALLY INCLUDED IN KRUGER'S SCOPE ARE DESIGNED AND PROVIDED BY OTHERS. PIPE SUPPORTS SHALL BE PLACED SO THAT LOADS AND FORCES WILL NOT BE TRANSFERRED TO ANY KRUGER EQUIPMENT OR SUPPORTS.
3. ALL GASKETS AND HARDWARE FOR CONNECTING KRUGER PIPING/EQUIPMENT TO PIPING/EQUIPMENT PROVIDED BY OTHERS TO BE SUPPLIED BY INSTALLATION CONTRACTOR.
4. ANTI-SEIZE TO BE APPLIED TO ALL HARDWARE UNLESS OTHERWISE SPECIFIED.
5. ALL HARDWARE TO BE TIGHTENED TO APPROPRIATE TORQUE VALUES.
6. ALL ANCHOR BOLTS SHOWN SHALL UTILIZE HILTI HIT-HY 200 ADHESIVE ANCHORING SYSTEM PER ICC ESR-3187.
7. ALL PENETRATIONS, WATER STOPS, INSERTS THRU WALLS AND FLOORS, ACCESS LADDERS, AND MAN WAYS TO BE DESIGNED BY ENGINEER, AND SUPPLIED AND INSTALLED BY INSTALLATION CONTRACTOR.
8. ALL TANK OPENINGS MUST BE COVERED, SCREENED OR FILLED TO PREVENT MEDIA MIGRATION. SCREENS TO BE INSTALLED FLUSH WITH ALL SURFACES TO ENSURE NO GAPS GREATER THAN 3/32" BETWEEN THE SCREEN AND THE TANK SURFACE. PENDING OWNER INSPECTION OF THE TANKS, FLAT PERFORATED SCREENS SHALL BE DESIGNED AND SUPPLIED BY KRUGER AS REQUIRED (FLAT SCREENS TO BE SECURED USING SPIKE ANCHORS).
9. CONTRACTOR TO ENSURE CONCRETE SURFACE IS ADEQUATE FOR FLUSH SCREEN MOUNTING. GAPS BEHIND CYLINDRICAL SCREENS SMALLER THAN 1/4" MAY BE FILLED BY APPLYING A KRUGER APPROVED CAULK TO THE FACE OF THE SCREEN FLANGE BEFORE MOUNTING.
10. AIR GRID HEIGHT FROM FLOOR BASED ON MEAN FLOOR ELEVATION FOR EACH CELL.
11. ALL AIR GRIDS MUST BE LEVELED ALONG THEIR WIDTH AND LENGTH TO WITHIN $\pm 1/8"$.
12. ALL AIR GRIDS IN THE ENTIRE SYSTEM MUST BE AT THE SAME ELEVATION TO WITHIN $\pm 1/8"$.
13. A PERMANENT BENCHMARK SURFACE MUST BE PROVIDED IN THE FLOOR OF EACH REACTOR, ALONG WITH DOCUMENTATION OF ITS ELEVATION. THIS BENCHMARK WILL BE USED FOR VERIFYING AIR GRID ELEVATIONS ARE WITHIN TOLERANCE FROM REACTOR TO REACTOR.
14. CYLINDRICAL SCREEN SPARGERS AND MANIFOLDS WITHIN A REACTOR MUST ALL BE LEVEL, ALONG THEIR LENGTH AND TO EACH OTHER, TO WITHIN $\pm 1/8"$.
15. MIXER SIZE AND ORIENTATION ARE FOR REFERENCE ONLY. SEE MIXER SUPPLIER DRAWING FOR PROPER SIZE AND ORIENTATION.
16. KRUGER SUPPLIED VALVES TO BE ATTACHED TO CONTRACTOR PIPING. VALVES TO BE LOCATED OUTSIDE OF TANK FOR ACCESS.
17. SEE CONTRACT DRAWINGS FOR ALL ISOLATION VALVE LOCATIONS.

CONCRETE FINISH SPECIFICATIONS:

1. CONCRETE TO ADHERE TO REQUIREMENTS OF ACI 301 (2011) FOR FORM FACING MATERIALS AND AS-CAST FINISHES
 - (a) 2.2.1.1 FORM-FACING MATERIALS--UNLESS OTHERWISE SPECIFIED OR PERMITTED, FORM FACE MATERIAL IN CONTACT WITH CONCRETE SHALL BE LUMBER, PLYWOOD, TEMPERED CONCRETE-FORM-GRADE HARDBOARD, METAL, PLASTIC, OR PAPER THAT CREATES SPECIFIED APPEARANCE AND TEXTURE OF CONCRETE SURFACE.
 - (b) 5.3.3.3 AS-CAST FINISHES--USE FORM FACING MATERIALS MEETING THE REQUIREMENTS OF 2.2.1.1. PRODUCE AS-CAST FORMED FINISHES IN ACCORDANCE WITH CONTRACT DOCUMENTS AND 5.3.3.3.c
 - 5.3.3.3.c SURFACE FINISH-3.0 (SF-3.0)
 - PATCH VOIDS LARGER THAN 3/4" WIDE OR 1/2" DEEP;
 - REMOVE PROJECTIONS LARGER THAN 1/8";
 - PATCH TIE HOLES;
 - SURFAACE TOLERANCE CLASS A AS SPECIFIED IN ACI 117;
- AND PROVIDE MOCKUP OF CONCRETE SURFACE APPEARANCE AND TEXTURE.



2592935 | 1.2 | Released | 2592935 | 1.2 | Released

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**ANOXKALDNES
DETAILS, MECHANICAL, PLAN AND SECTIONS**

REV	DESCRIPTION	DRAWN	APPR	DATE
1	REVISED AIR GRID AND SCREEN LOCATIONS	SRW	LHB	10.09.23
0	RELEASED FOR SUBMITTAL	LHB	SRW	09.26.23

5703212001
ABERDEEN, ID

	SCALE 1:90	DRAWING NO 2592935	SHEET 1 of 13	REV 1
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MD BILL OF MATERIALS

DRAWING NUMBER: 2592935
 PROJECT NUMBER: 5703212001
 PROJECT NAME: ABERDEEN, ID

ITEM	QTY	MATERIAL	DRAWING NO.	DESCRIPTION
1	8	AISI 304	2354578	ANG, 1-1/2" PIPE SUPPORT, 2.00" SQ X .19" THK X 9.44" LG
2	28	AISI 304	1425319	ANG, 3" PIPE SUPPORT, 3.00" SQ X .25" THK X 10.69" LG
3	28	AISI 304	1414466	ANG, 4" PIPE SUPPORT, 3.00" SQ X .25" THK X 11.75" LG
4	12	AISI 304	2026531	ANG, SPARGER SUPPORT, 2.00" SQ X .19" THK X 26.00" LG
5	32	AISI 304	2384152	ANGLE, SUPPORT, KICKER, 2-1/2" X 2-1/2" X 1/4"
6	2	SEE BOM	2593606	ASSY, AIR GRID, 3", (7) 1" LATERALS @ 36" OC, 4" W, 98 HOLES, FLG/CAP, LH
7	2	SEE BOM	2592980	ASSY, AIR GRID, 3", (7) 1" LATERALS @ 36" OC, 4" W, 98 HOLES, FLG/CAP, RH
8	2	SEE BOM	2593310	ASSY, AIR GRID, 4", (10) 1-1/4" LATERALS @ 24" OC, 9" W, 370 HOLES, FLG/CAP, LH
9	2	SEE BOM	2592650	ASSY, AIR GRID, 4", (10) 1-1/4" LATERALS @ 24" OC, 9" W, 370 HOLES, FLG/CAP, RH
10	4	SEE BOM	1853090	ASSY, COVER, INSTRUMENT, Ø1.960" ID, 1-PC (BY KRUGER)
11	4	AISI 304L	-	CAP, PIPE, 1 1/2", SCH 10, BW
12	1	CONCRETE	2591664	CONCRETE, 2 TRAIN, RETROFIT
13	44	SEE MFG SHT	-	CPLG, PIPE, 1-1/2", STRAUB-OPEN-FLEX-1L-1.5-IPS-SS-E-SI-W5, 232 PSI (BY KRUGER)
14	4	SEE MFG SHT	-	CPLG, PIPE, 3", STRAUB-OPEN-FLEX-1L-3-IPS-SS-E-SI-W5, 232 PSI (BY KRUGER)
15	4	SEE MFG SHT	-	CPLG, PIPE, 4", STRAUB-OPEN-FLEX-1L-4-IPS-SS-E-SI-W5, 232 PSI (BY KRUGER)
16	4	EPDM	-	GSKT, FLG, FULL FACE, 3", 125/150 LB ANSI, 1/8" THK
17	4	EPDM	-	GSKT, FLG, FULL FACE, 4", 125/150 LB ANSI, 1/8" THK
18	8	BRONZE	-	NOZZLE, FOAM CONTROL, EASY FLUSH, SERIES 564, #564, 916. 32. BC, (BY KRUGER)
19	8	AISI 304L	2593948	PIPE, 1 1/2", SCH 10, SPARGER CONNECTING 56.38" LG
20	2	AISI 304	2186663	SCREEN, 14 GA, 18.00" X 18.00" LG, L-SHAPED
21	8	AISI 304	2406229	SCREEN, SCUM, 14 GA X 24.00" X 48.00" LG
22	12	SEE BOM	2285068	WLDMT, CYLINDRICAL SCREEN, PERF, 22 7/8", 5' LG, Ø5/8" HOLES, w/1"-2" PIPE HANGER
23	4	SEE BOM	2593967	WLDMT, DROP PIPE, 1-1/2" SPARGER
24	4	SEE BOM	2592981	WLDMT, DROP PIPE, 3", 164.75" LG
25	4	SEE BOM	2592654	WLDMT, DROP PIPE, 4", 163.50" LG
26	16	SEE BOM	1473865	WLDMT, PIPE SUPPORT, 1-1/2" PIPE
27	8	SEE BOM	2608736	WLDMT, PIPE, FOAM CONTROL SPRAY NOZZLE, LONG
28	12	SEE BOM	1473820	WLDMT, SPARGER, Ø23" X 5' LG CYL SCREEN, 1.5" MANIFOLD
29	16	SEE BOM	2422663	WLDMT, SUPPORT, FOAM CONTROL, SPRAY NOZZLE



DRAWING NUMBER: 2592935
 PROJECT NUMBER: 5703212001
 PROJECT NAME: ABERDEEN, ID

MD BILL OF MATERIALS

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ITEM	QTY	DESCRIPTION	MATERIAL
901	-	~~~LABEL AND SHIP LOOSE - 1-1/2" PIPE U-BOLT & FASTENERS~~~	AISI 304
	32	NUT, HEX, NYLOCK, 1/4-20, ANSI	
	16	U-BOLT, 1 1/2", 1/4-20, 2"ID, 3" LG, 1 1/4"THD, DALE CO. OR EQUIV.	
	32	WSHR, FLAT, 1/4", .313"ID, .625"OD, .051"THK, SAE	

ITEM	QTY	DESCRIPTION	MATERIAL
902	-	~~~LABEL AND SHIP LOOSE - 1-1/2" SPARGER MANIFOLD U-BOLT & FASTENERS~~~	AISI 304
	48	NUT, HEX, NYLOCK, 1/4-20, ANSI	
	24	U-BOLT, 1 1/2", 1/4-20, 2"ID, 3" LG, 1 1/4"THD, DALE CO. OR EQUIV.	
	48	WSHR, FLAT, 1/4", .313"ID, .625"OD, .051"THK, SAE	

ITEM	QTY	DESCRIPTION	MATERIAL
903	-	~~~LABEL AND SHIP LOOSE - 125 LB FLANGE 5/8" CONNECTION FASTENERS~~~	AISI 304
	48	NUT, HEX, NYLOCK, 5/8-11, ANSI	
	48	SCREW, HEX, 5/8-11 X 2-1/2"LG, ANSI	
	96	WSHR, FLAT, 5/8", .688"ID, 1.312"OD, .108"THK, SAE	

ITEM	QTY	DESCRIPTION	MATERIAL
904	-	~~~LABEL AND SHIP LOOSE - 1" PIPE U-BOLT & FASTENERS~~~	AISI 304
	48	NUT, HEX, NYLOCK, 1/4-20, ANSI	
	24	U-BOLT, 1", 1/4-20, 1 3/8"ID, 2 1/4" LG, 1 1/8"THD, DALE CO. OR EQUIV.	
	48	WSHR, FLAT, 1/4", .313"ID, .625"OD, .051"THK, SAE	

ITEM	QTY	DESCRIPTION	MATERIAL
905	-	~~~LABEL AND SHIP LOOSE - AERATION DROP PIPE WALL SUPPORT ANCHORS (3" PIPE)~~~	AISI 304
	48	NUT, HEX, 5/8-11, ANSI	
	24	NUT, HEX, NYLOCK, 5/8-11, ANSI	
	24	ROD, THD, 5/8-11 X 13"LG, ANSI	
	48	WSHR, FLAT, 5/8", .688"ID, 1.312"OD, .108"THK, SAE	



DRAWING NUMBER: 2592935
 PROJECT NUMBER: 5703212001
 PROJECT NAME: ABERDEEN, ID

MD BILL OF MATERIALS

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 REVISION: 1
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ITEM	QTY	DESCRIPTION	MATERIAL
906	-	~~~LABEL AND SHIP LOOSE - AERATION DROP PIPE WALL SUPPORT ANCHORS (4" PIPE)~~~	AISI 304
48		NUT, HEX, 5/8-11, ANSI	
24		NUT, HEX, NYLOCK, 5/8-11, ANSI	
24		ROD, THD, 5/8-11 X 11.50"LG, ANSI	
48		WSHR, FLAT, 5/8", .688"ID, 1.312"OD, .108"THK, SAE	

ITEM	QTY	DESCRIPTION	MATERIAL
907	-	~~~LABEL AND SHIP LOOSE - AERATION DROP PIPE WALL SUPPORT HDW (3" PIPE)~~~	AISI 304
24		NUT, HEX, NYLOCK, 3/8-16, ANSI	
12		U-BOLT, 3", 3/8-16, 3.9/16"ID, 4.3/4" LG, 2"THD, DALE CO. OR EQUIV.	
24		WSHR, FLAT, 3/8", .438"ID, .812"OD, .064"THK, SAE	

ITEM	QTY	DESCRIPTION	MATERIAL
908	-	~~~LABEL AND SHIP LOOSE - AERATION DROP PIPE WALL SUPPORT HDW (4" PIPE)~~~	AISI 304
24		NUT, HEX, NYLOCK, 3/8-16, ANSI	
12		U-BOLT, 4", 3/8-16, 4.9/16"ID, 5.3/4" LG, 2"THD, DALE CO. OR EQUIV.	
24		WSHR, FLAT, 3/8", .438"ID, .812"OD, .064"THK, SAE	

ITEM	QTY	DESCRIPTION	MATERIAL
909	-	~~~LABEL AND SHIP LOOSE - AERATION PIPE FLOOR SUPPORT ANCHORS (3" PIPE)~~~	AISI 304
64		NUT, HEX, 5/8-11, ANSI	
32		NUT, HEX, NYLOCK, 5/8-11, ANSI	
32		ROD, THD, 5/8-11 X 22-1/2"LG, ANSI	
64		WSHR, FLAT, 5/8", .688"ID, 1.312"OD, .108"THK, SAE	

ITEM	QTY	DESCRIPTION	MATERIAL
910	-	~~~LABEL AND SHIP LOOSE - AERATION PIPE FLOOR SUPPORT ANCHORS (4" PIPE)~~~	AISI 304
64		NUT, HEX, 5/8-11, ANSI	
32		NUT, HEX, NYLOCK, 5/8-11, ANSI	
32		ROD, THD, 5/8-11 X 22-7/8"LG, ANSI	
64		WSHR, FLAT, 5/8", .688"ID, 1.312"OD, .108"THK, SAE	



DRAWING NUMBER: 2592935
 PROJECT NUMBER: 5703212001
 PROJECT NAME: ABERDEEN, ID

MD BILL OF MATERIALS

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 REVISION: 1
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ITEM	QTY	DESCRIPTION	MATERIAL
911	-	~~~LABEL AND SHIP LOOSE - AERATION PIPE FLOOR SUPPORT HDW (3" PIPE)~~~	AISI 304
	32	NUT, HEX, NYLOCK, 3/8-16, ANSI	
	16	U-BOLT, 3", 3/8-16, 3 9/16"ID, 4 3/4" LG, 2"THD, DALE CO. OR EQUIV.	
	32	WSHR, FLAT, 3/8", .438"ID, .812"OD, .064"THK, SAE	

ITEM	QTY	DESCRIPTION	MATERIAL
912	-	~~~LABEL AND SHIP LOOSE - AERATION PIPE FLOOR SUPPORT HDW (4" PIPE)~~~	AISI 304
	32	NUT, HEX, NYLOCK, 3/8-16, ANSI	
	16	U-BOLT, 4", 3/8-16, 4 9/16"ID, 5 3/4" LG, 2"THD, DALE CO. OR EQUIV.	
	32	WSHR, FLAT, 3/8", .438"ID, .812"OD, .064"THK, SAE	

ITEM	QTY	DESCRIPTION	MATERIAL
913	-	~~~LABEL AND SHIP LOOSE - ANCHOR, SPIKE, 3/16", MSHRM HD, 1-1/2"LG ~~~	AISI 304
	256	ANCHOR, SPIKE, 3/16", MSHRM HD, 1-1/2"LG, McM #97073A820 (LABEL AND SHIP LOOSE)	

ITEM	QTY	DESCRIPTION	MATERIAL
914	-	~~~LABEL AND SHIP LOOSE - CYLINDRICAL SCREEN ANCHORS~~~	AISI 304
	96	NUT, HEX, NYLOCK, 3/8-16, ANSI	
	96	ROD, THD, 3/8-16, 4-3/4"LG, ANSI	
	96	WSHR, FLAT, 3/8", .438"ID, .812"OD, .064"THK, SAE	

ITEM	QTY	DESCRIPTION	MATERIAL
915	-	~~~LABEL AND SHIP LOOSE - DIFFUSER SUPPORT ANCHORS~~~	AISI 304
	96	NUT, HEX, 5/8-11, ANSI	
	48	NUT, HEX, NYLOCK, 5/8-11, ANSI	
	48	ROD, THD, 5/8-11 X 21"LG, ANSI	
	96	WSHR, FLAT, 5/8", .688"ID, 1.312"OD, .108"THK, SAE	



DRAWING NUMBER: 2592935
 PROJECT NUMBER: 5703212001
 PROJECT NAME: ABERDEEN, ID

MD BILL OF MATERIALS

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ITEM	QTY	DESCRIPTION	MATERIAL
916	-	~~~LABEL AND SHIP LOOSE - FOAM CONTROL SPRAY NOZZLE ANCHORS~~~	AISI 304
	32	NUT, HEX, 3/8-16, ANSI	
	32	ROD, THD, 3/8-16 X 4"LG, ANSI	
	32	WSHR, FLAT, 3/8", .438"ID, .812"OD, .064"THK, SAE	
	32	WSHR, LOCK, 3/8, ANSI	

ITEM	QTY	DESCRIPTION	MATERIAL
917	-	~~~LABEL AND SHIP LOOSE - MANIFOLD KICKER ANCHORS~~~	AISI 304
	32	NUT, HEX, NYLOCK, 5/8-11, ANSI	
	32	ROD, THD, 5/8-11 X 5-1/2"LG, ANSI	
	32	WSHR, FLAT, 5/8", .688"ID, 1.312"OD, .108"THK, SAE	

ITEM	QTY	DESCRIPTION	MATERIAL
918	-	~~~LABEL AND SHIP LOOSE - MANIFOLD KICKER HDW~~~	AISI 304
	64	NUT, HEX, 5/8-11, ANSI	
	64	WSHR, FLAT, 5/8", .688"ID, 1.312"OD, .108"THK, SAE	

ITEM	QTY	DESCRIPTION	MATERIAL
919	-	~~~LABEL AND SHIP LOOSE - SPARGER DROP PIPE WALL SUPPORT HDW (1-1/2" PIPE)~~~	AISI 304
	16	NUT, HEX, NYLOCK, 1/4-20, ANSI	
	8	U-BOLT, 1 1/2", 1/4-20, 2"ID, 3" LG, 1 1/4"THD, DALE CO. OR EQUIV.	
	16	WSHR, FLAT, 1/4", .313"ID, .625"OD, .051"THK, SAE	

ITEM	QTY	DESCRIPTION	MATERIAL
920	-	~~~LABEL AND SHIP LOOSE - SPARGER PIPE WALL SUPPORT ANCHORS~~~	AISI 304
	32	NUT, HEX, 3/8-16, ANSI	
	32	ROD, THD, 3/8-16, 3-3/4"LG, ANSI	
	32	WSHR, FLAT, 3/8", .438"ID, .812"OD, .064"THK, SAE	
	32	WSHR, LOCK, 3/8, ANSI	



DRAWING NUMBER: 2592935
 PROJECT NUMBER: 5703212001
 PROJECT NAME: ABERDEEN, ID

MD BILL OF MATERIALS

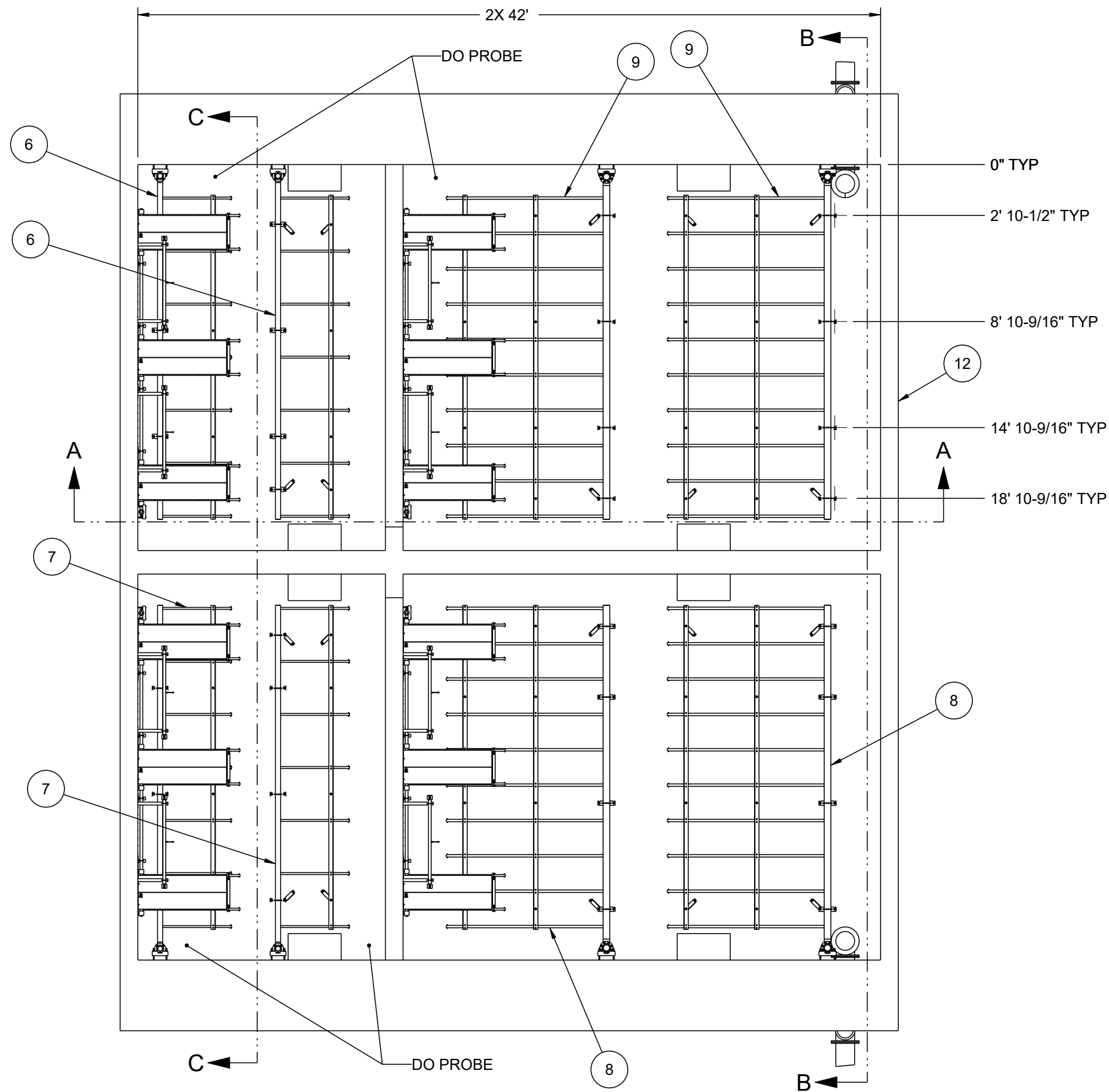
PAGE 7 OF 13
 REVISION: 1
 CREATED BY: LHB

ITEM	QTY	DESCRIPTION	MATERIAL
921	-	~~~LABEL AND SHIP LOOSE - SPARGER PIPE WALL SUPPORT HDW~~~	AISI 304
	32	NUT, HEX, 1/4-20, ANSI	
	16	U-BOLT, 1 1/2", 1/4-20, 2"ID, 3" LG, 1 1/4"THD, DALE CO. OR EQUIV.	
	32	WSHR, FLAT, 1/4", .313"ID, .625"OD, .051"THK, SAE	
	32	WSHR, LOCK, 1/4", ANSI	

ITEM	QTY	DESCRIPTION	MATERIAL
922	-	~~~LABEL AND SHIP LOOSE - SPARGER SUPPORT FASTENERS~~~	AISI 304
	48	NUT, HEX, 3/8-16, ANSI	
	48	NUT, HEX, NYLOCK, 3/8-16, ANSI	
	24	ROD, THD, 3/8-16 X 10"LG, ANSI	
	96	WSHR, FLAT, 3/8", .438"ID, .812"OD, .064"THK, SAE	

ITEM	QTY	DESCRIPTION	MATERIAL
923	-	~~~LABEL AND SHIP LOOSE - SPARGER DROP PIPE WALL SUPPORT ANCHORS (1-1/2" PIPE)~~~	AISI 304
	32	NUT, HEX, 5/8-11, ANSI	
	16	NUT, HEX, NYLOCK, 5/8-11, ANSI	
	16	ROD, THD, 5/8-11 X 9.75"LG	
	32	WSHR, FLAT, 5/8", .688"ID, 1.312"OD, .108"THK, SAE	





NOTE:
 INSTRUMENT LOCATIONS ARE APPROXIMATE.
 EXACT LOCATION TO BE DETERMINED BY ENGINEER.
 REFER TO INSTRUMENT SUBMITTAL FOR INSTALLATION INFORMATION.

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5703212001
 ABERDEEN, ID

ANOXKALDNES
 DETAILS, MECHANICAL, PLAN AND SECTIONS



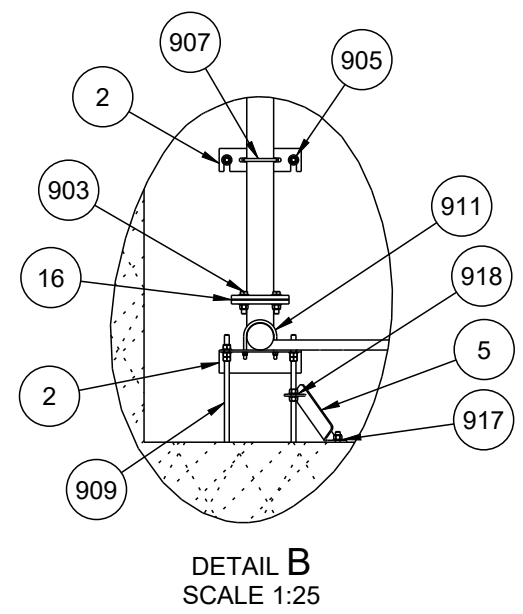
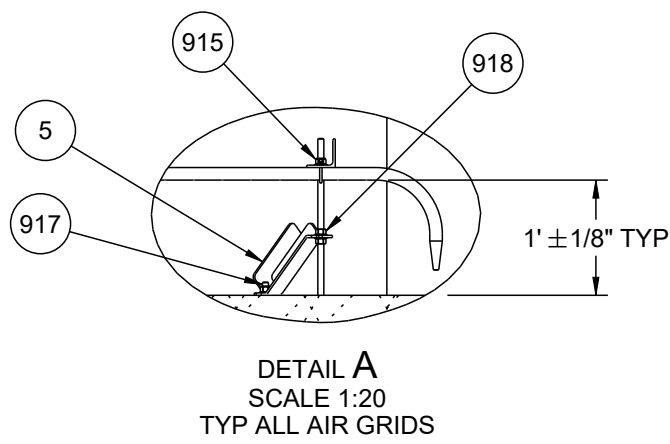
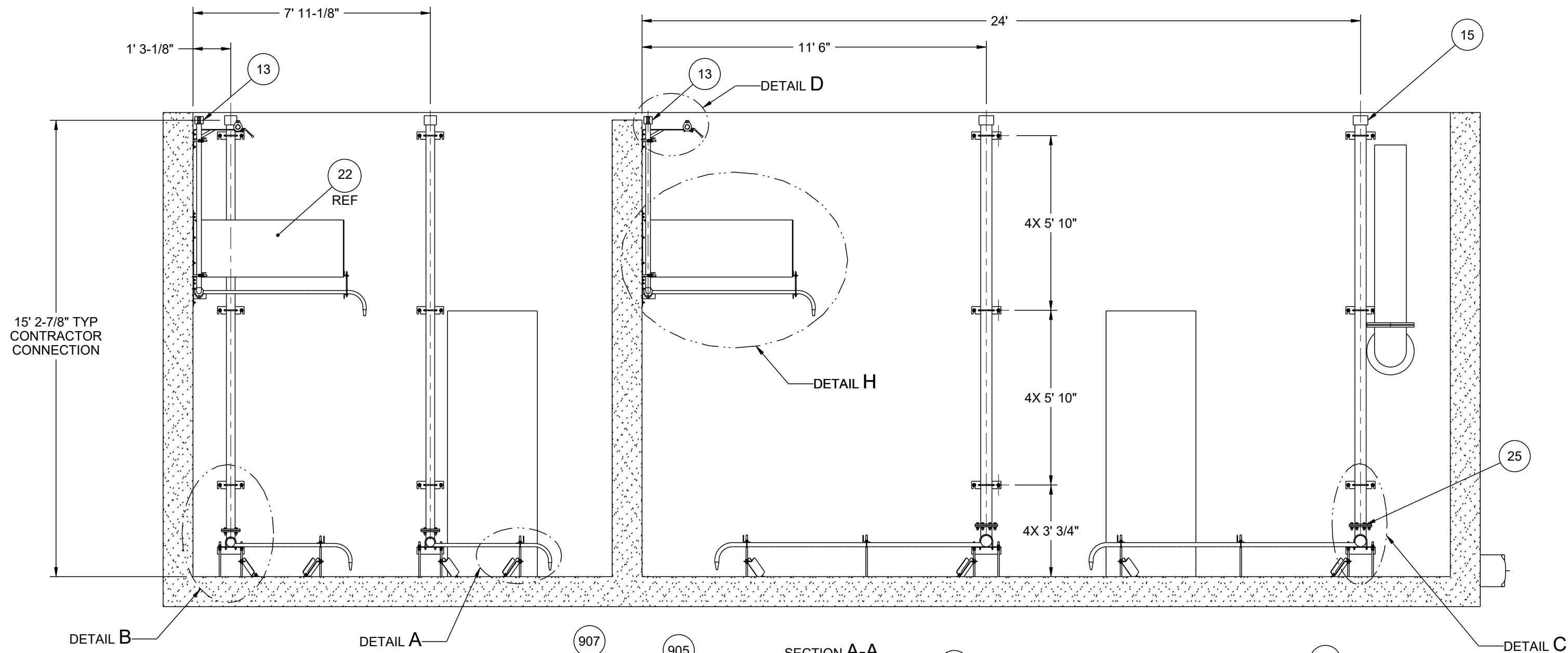
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DRAWING NO
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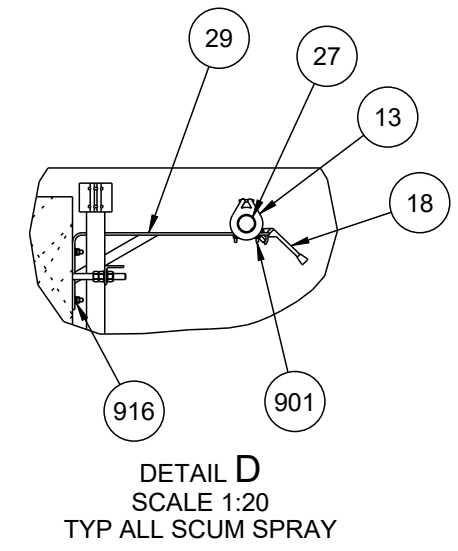
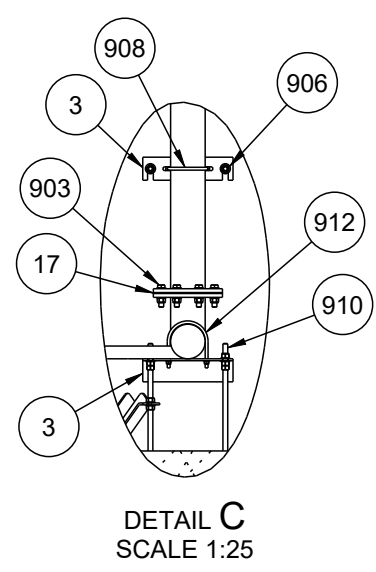
SHEET
 8 of 13

REV
 1

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SECTION A-A



1. ALL AIR GRIDS MUST BE LEVELED ALONG THEIR WIDTH AND LENGTH TO WITHIN 1/8"
2. ALL AIR GRIDS IN THE ENTIRE SYSTEM MUST BE AT THE SAME ELEVATION TO WITHIN 1/8".
3. A PERMANENT BENCHMARK SURFACE MUST BE PROVIDED IN THE FLOOR OF EACH REACTOR, ALONG WITH DOCUMENTATION OF ITS ELEVATION. THIS BENCHMARK WILL BE USED FOR VERIFYING AIR GRID ELEVATIONS ARE WITHIN TOLERANCE FROM REACTOR TO REACTOR.

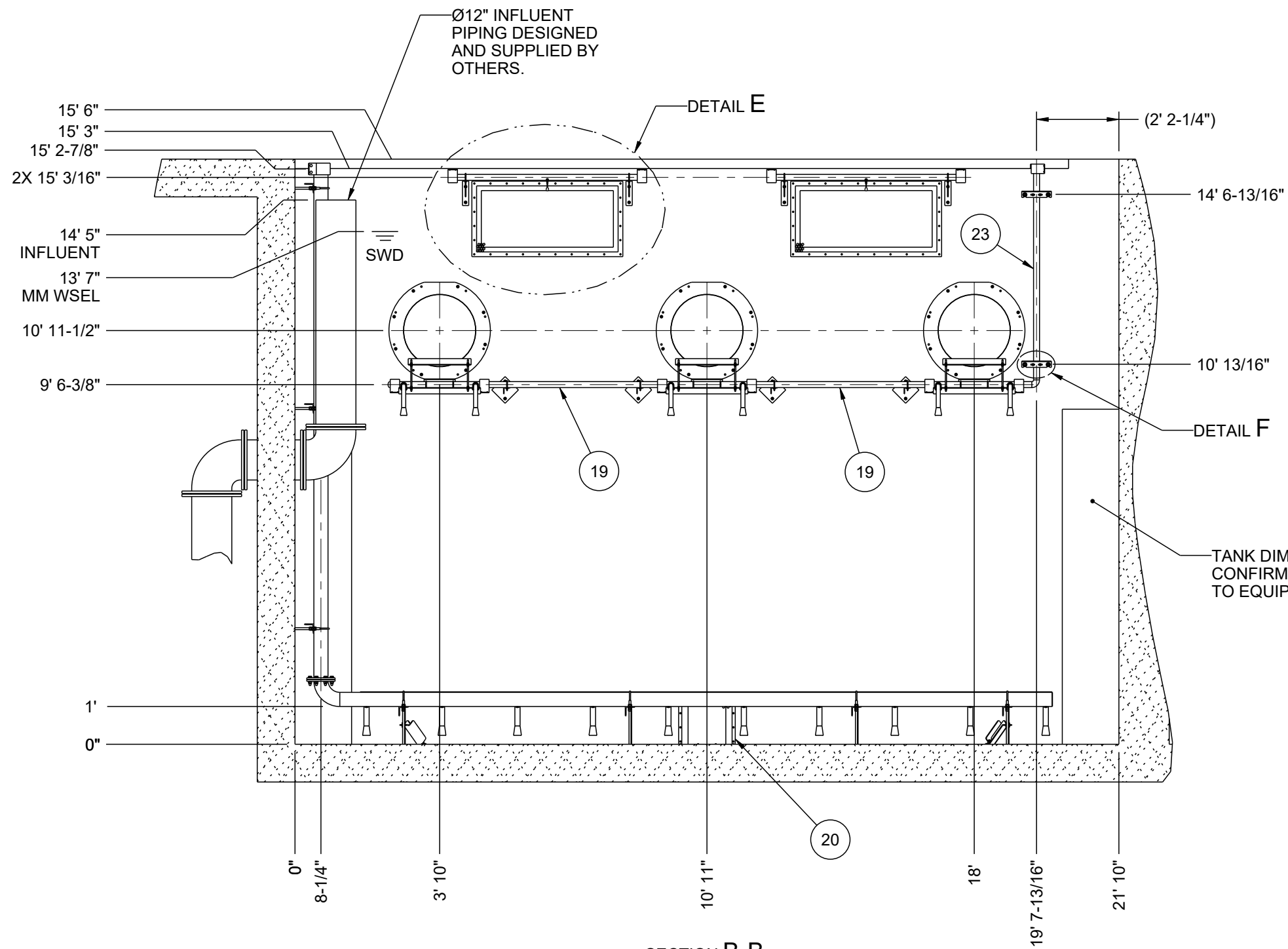
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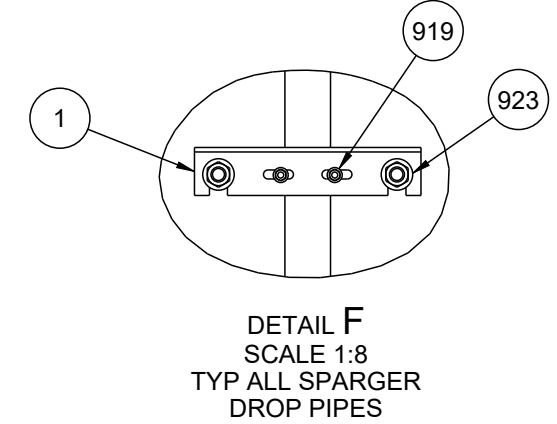
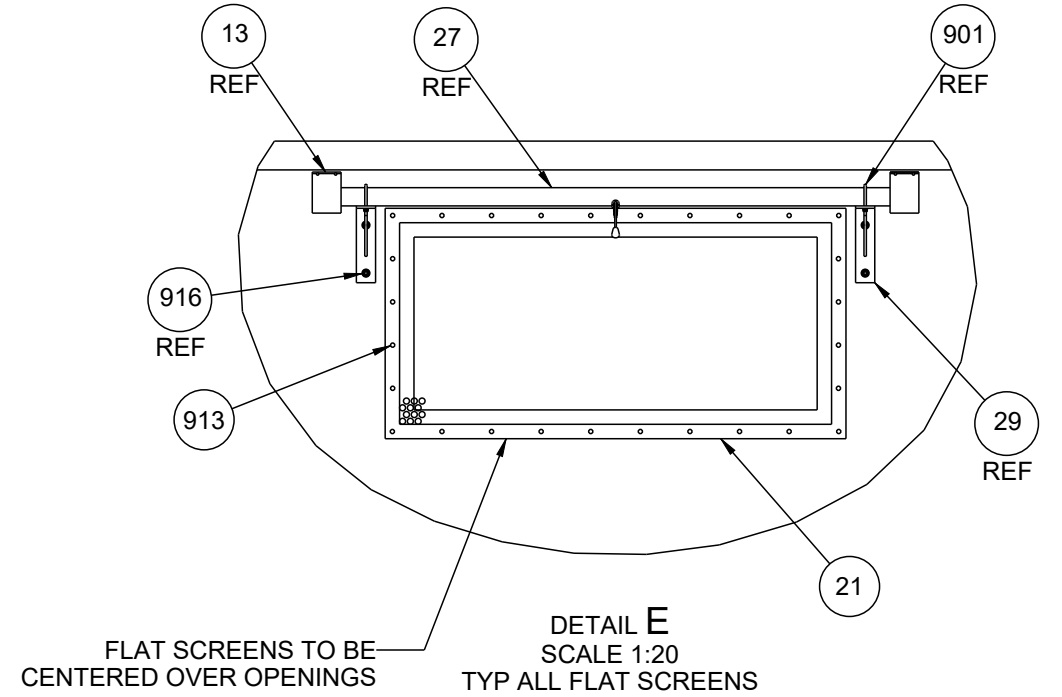
ANOXKALDNES
 DETAILS, MECHANICAL, PLAN AND SECTIONS

SCALE 1:40	DRAWING NO 2592935	SHEET 9 of 13	REV 1
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SECTION B-B
TYP BOTH TRAINS



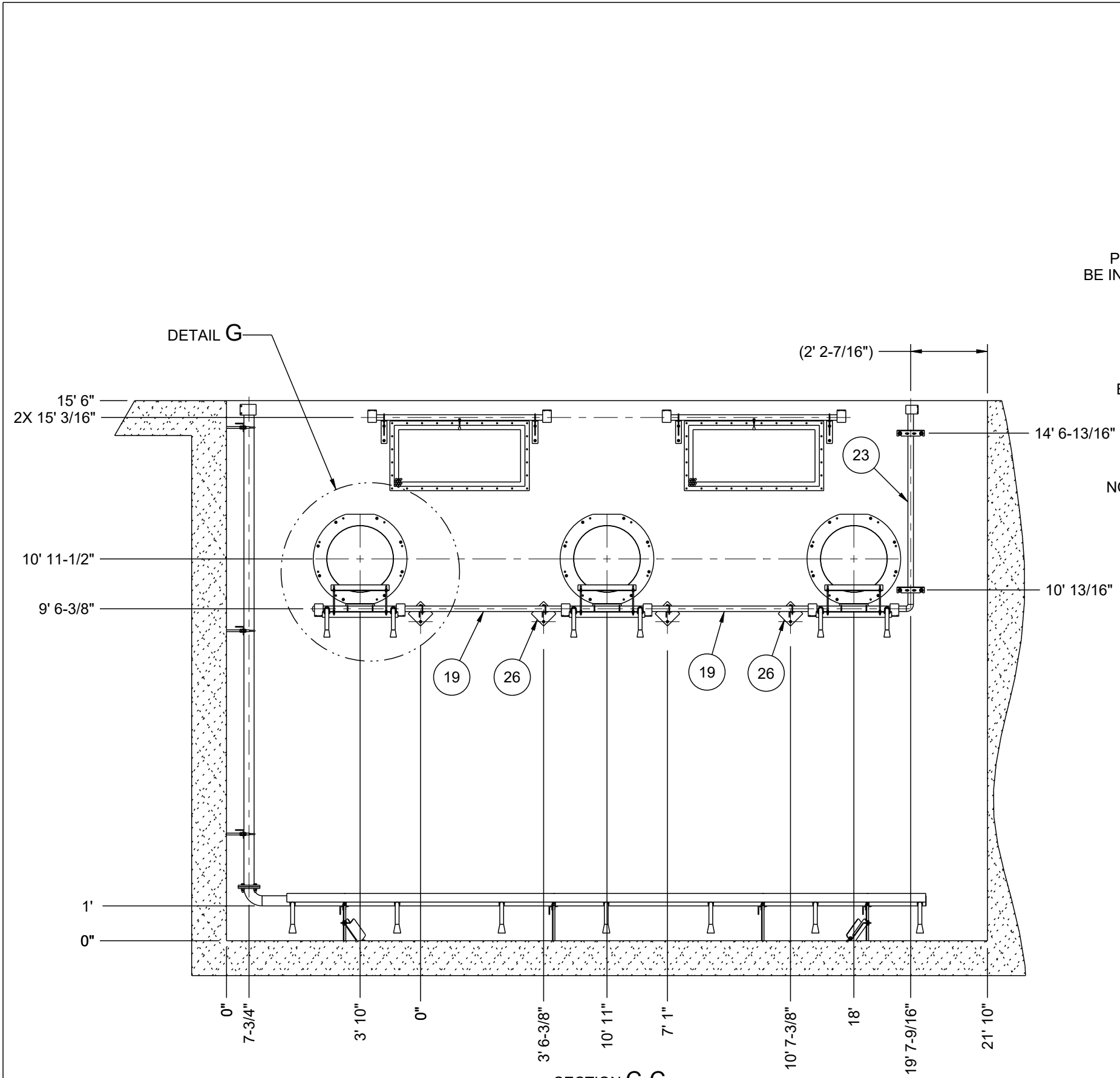
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DETAILS, MECHANICAL, PLAN AND SECTIONS

5703212001 ABERDEEN, ID	SCALE 1:40	DRAWING NO 2592935	SHEET 10 of 13	REV 1
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SECTION C-C
TYP BOTH TRAINS

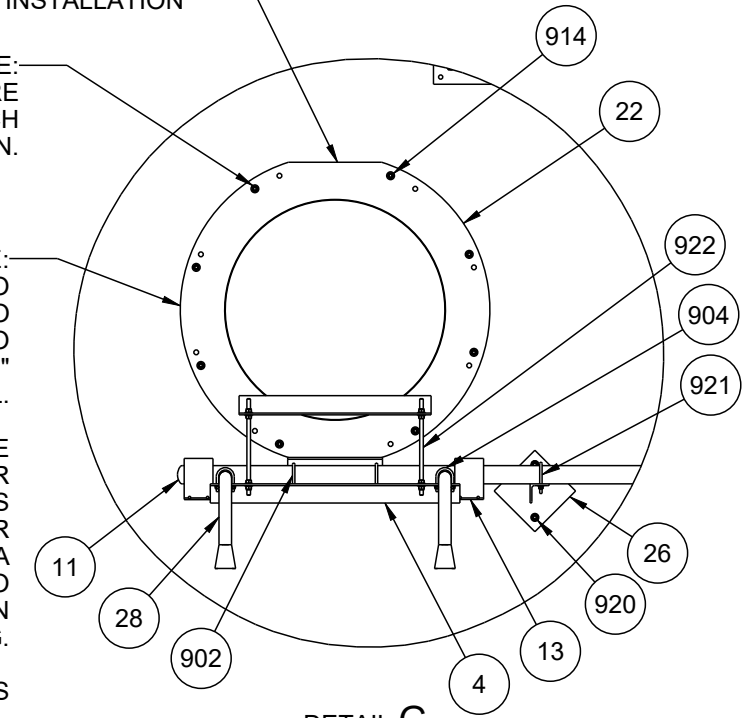
USE CHALK LINE TO ALIGN
FLATS ON ALL CYLINDRICAL
SCREENS FOR LEVEL INSTALLATION

NOTE:
ONLY (8) ANCHORS ARE
REQUIRED TO SECURE EACH
CYLINDRICAL SCREEN.

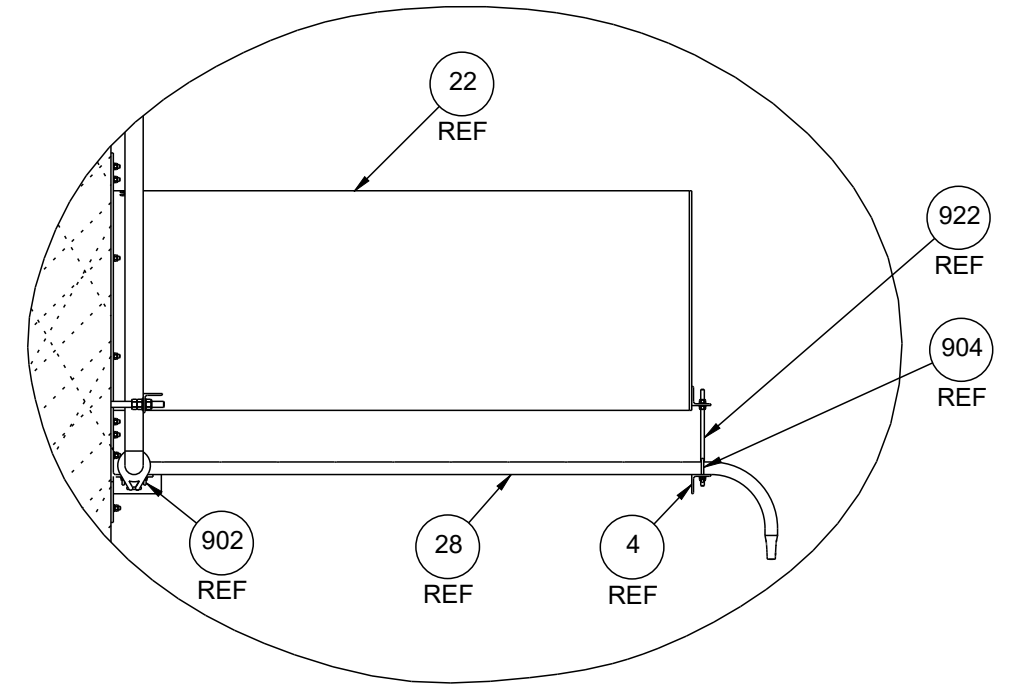
NOTE:
ALL SCREENS ARE DESIGNED TO
PREVENT MEDIA MIGRATION. SCREENS TO
BE INSTALLED FLUSH WITH ALL SURFACES TO
ENSURE NO GAPS GREATER THAN 3/32"
BETWEEN THE SCREEN AND THE WALL.

CONTRACTOR TO ENSURE CONCRETE
SURFACE IS ADEQUATE FOR
FLUSH SCREEN MOUNTING. GAPS
BEHIND CYLINDRICAL SCREENS SMALLER
THAN 1/4" MAY BE FILLED BY APPLYING A
KRUGER APPROVED CAULK TO
THE FACE OF THE SCREEN
FLANGE BEFORE MOUNTING.

NOTES TYP OF ALL CYLINDRICAL SCREENS



DETAIL G
SCALE 1:20



DETAIL H
SCALE 1:20
TYP ALL CYLINDRICAL SCREENS
(SEE SHEET 9 FOR PARENT VIEW)

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DETAILS, MECHANICAL, PLAN AND SECTIONS

5703212001 ABERDEEN, ID	SCALE 1:40	DRAWING NO 2592935	SHEET 11 of 13	REV 1
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905
S9

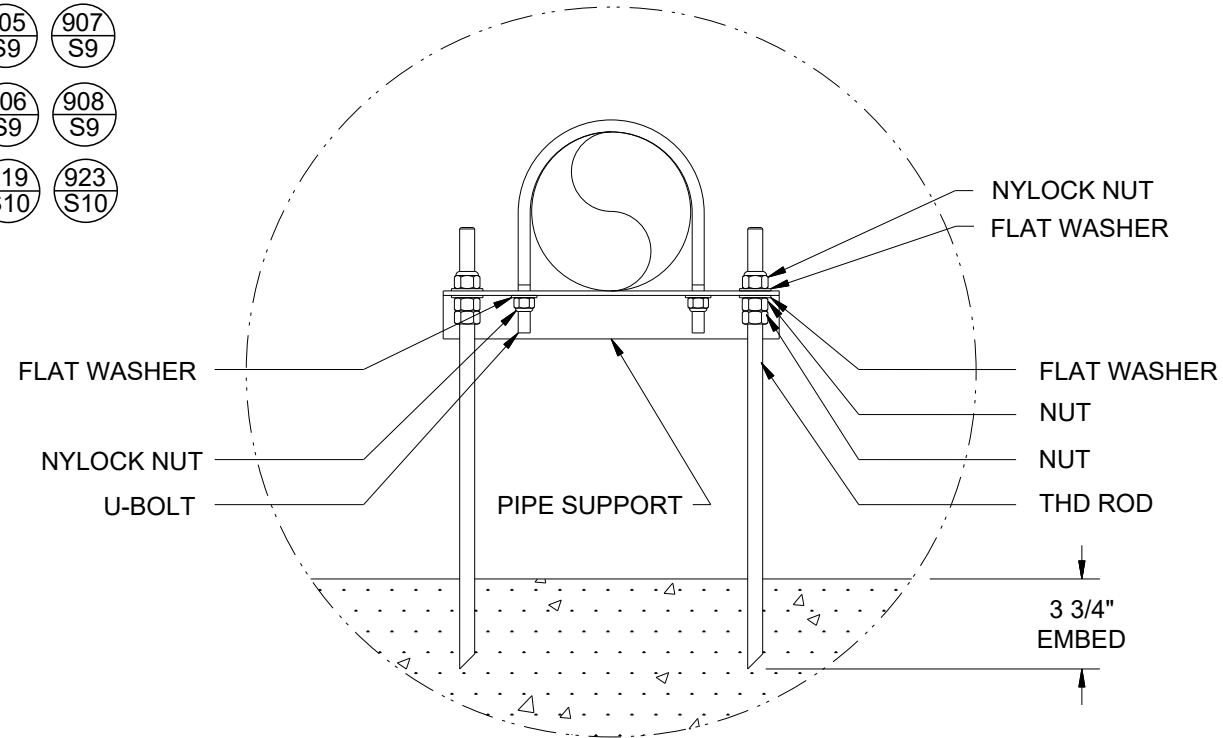
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S9

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S9

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S10

923
S10



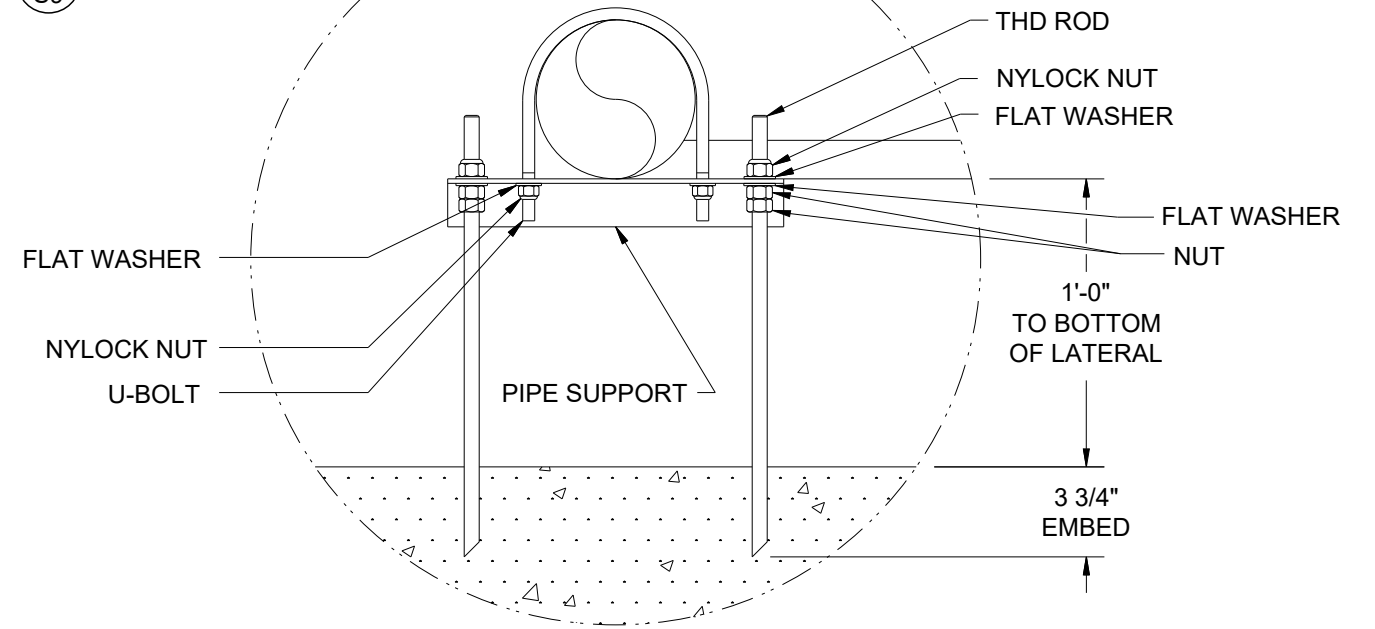
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CONNECTION & WALL
ANCHORING DETAIL
SCALE 1:8

909
S9

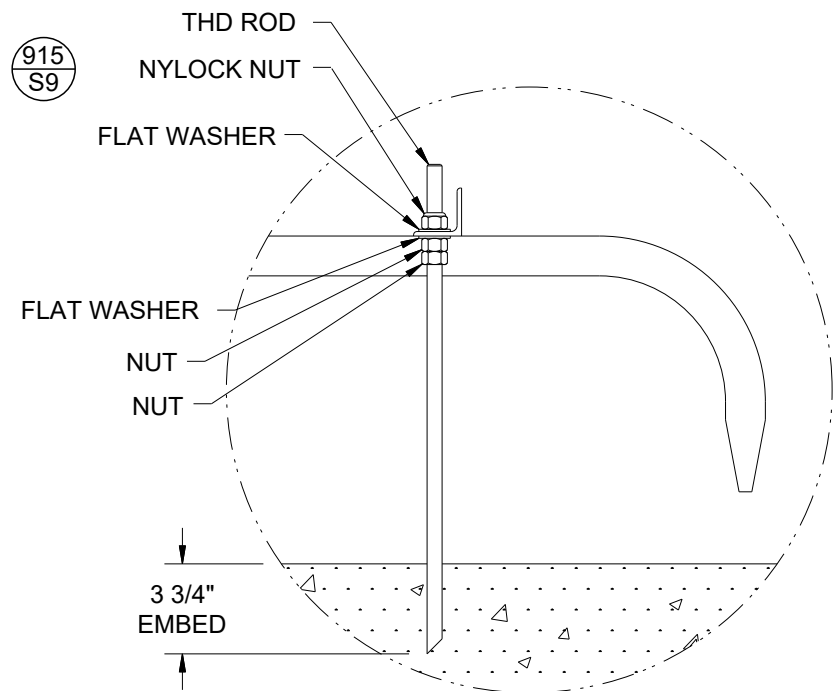
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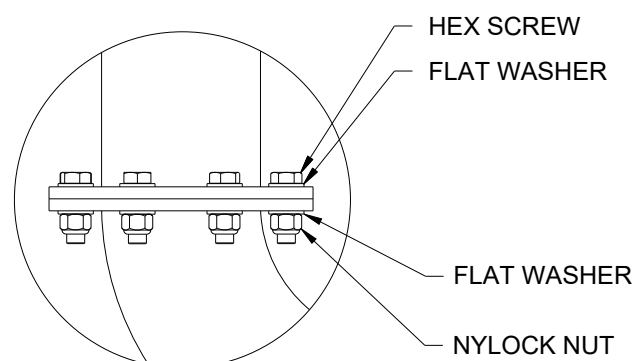


TYP AERATION PIPE SUPPORT
CONNECTION & FLOOR
ANCHORING DETAIL
SCALE 1:8



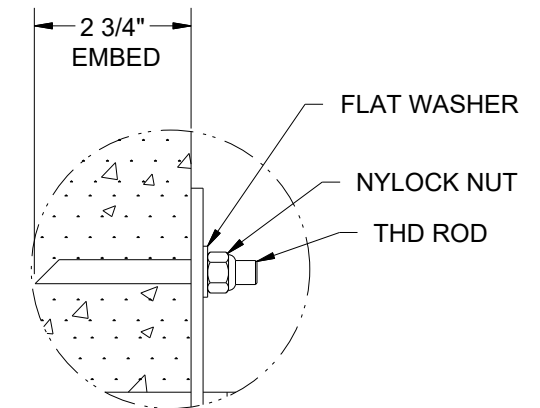
TYP DIFFUSER SUPPORT
ANCHORING DETAIL
SCALE 1:8

903
S9



TYP 125 LB FLANGE
CONNECTION DETAIL
SCALE 1:8

914
S11



TYP CYLINDRICAL SCREEN
ANCHORING DETAIL
SCALE 1:4

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DETAILS, MECHANICAL, PLAN AND SECTIONS



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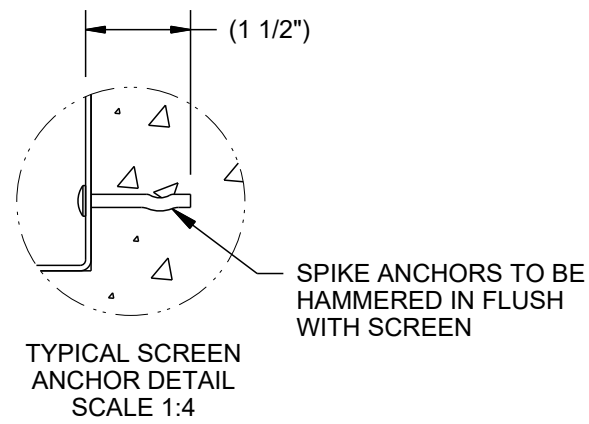
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2592935

SHEET
12 of 13

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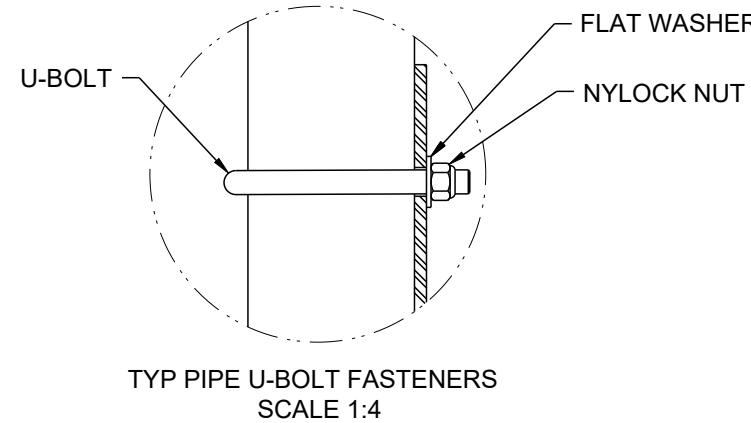
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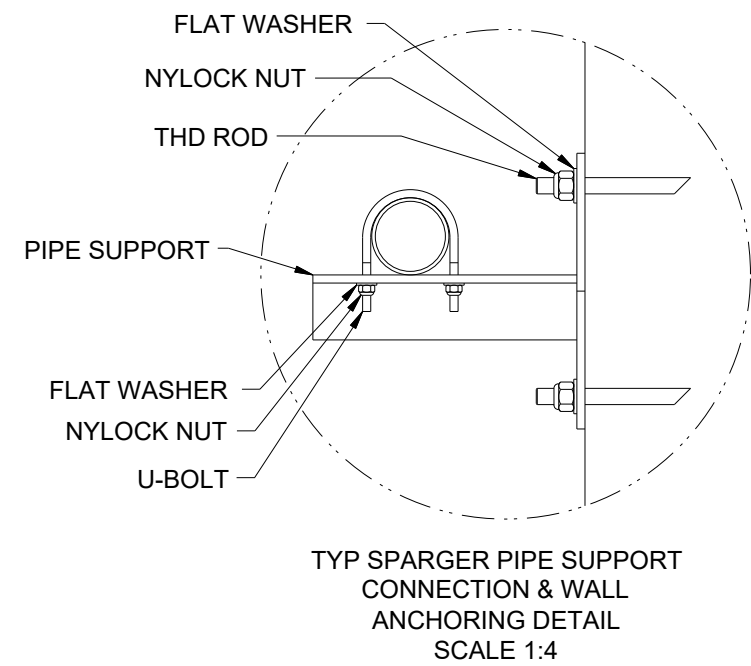
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S11



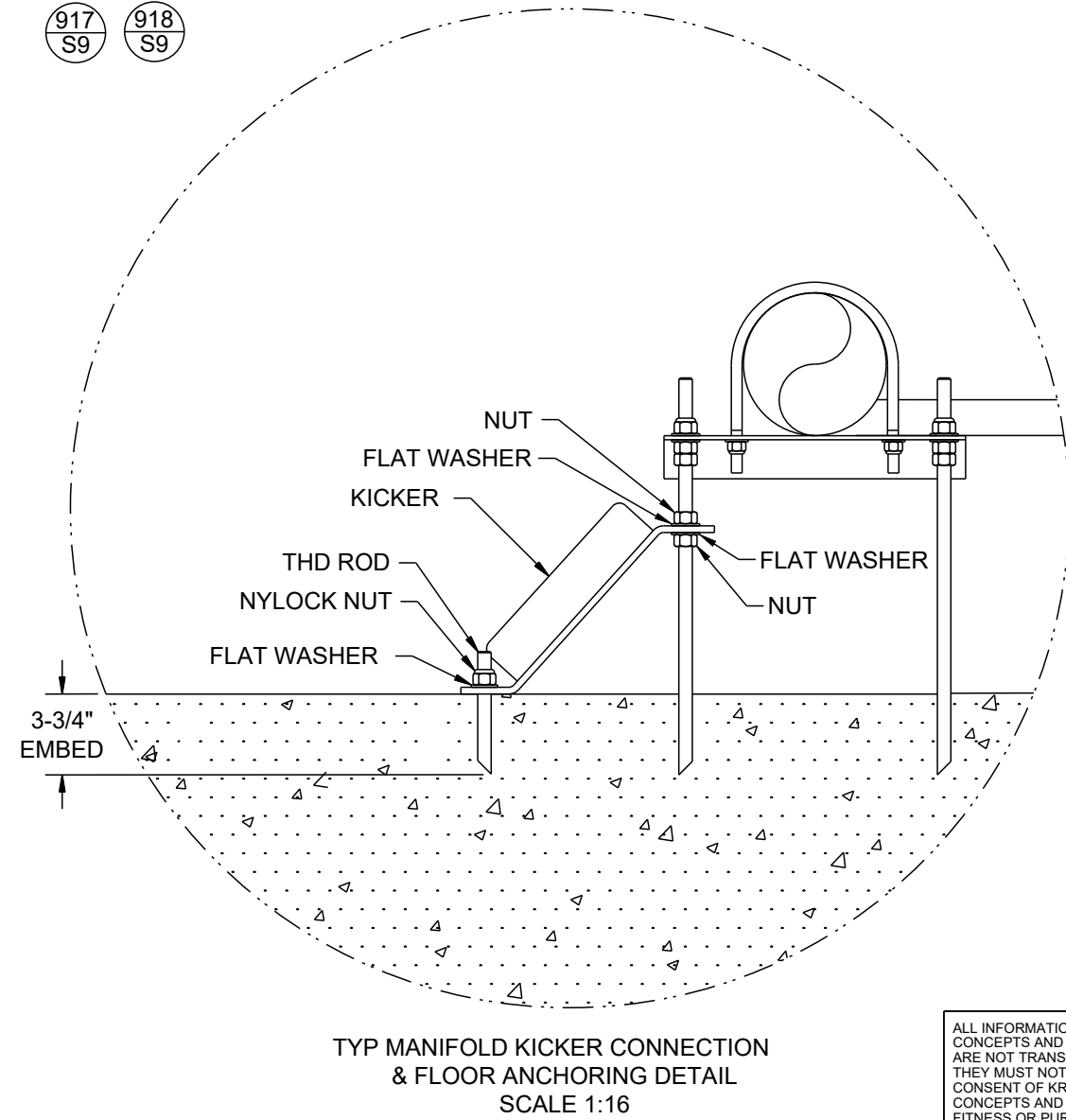
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S11

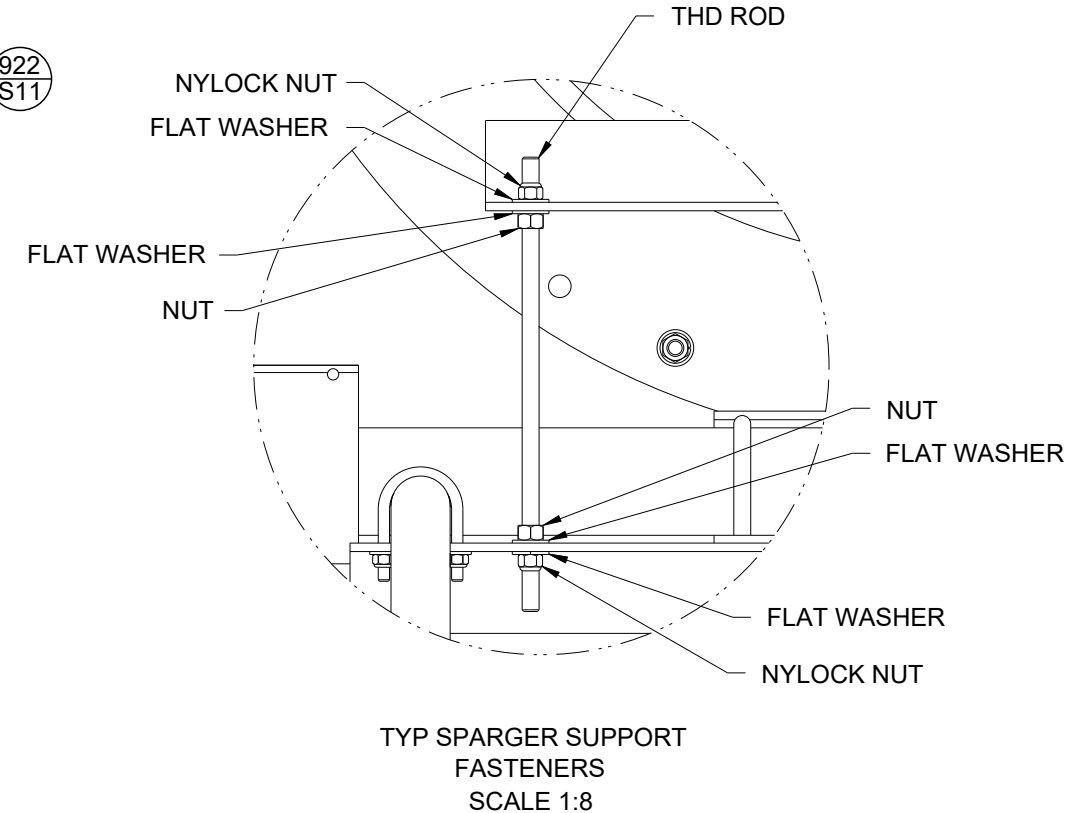


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S9

918
S9



922
S11



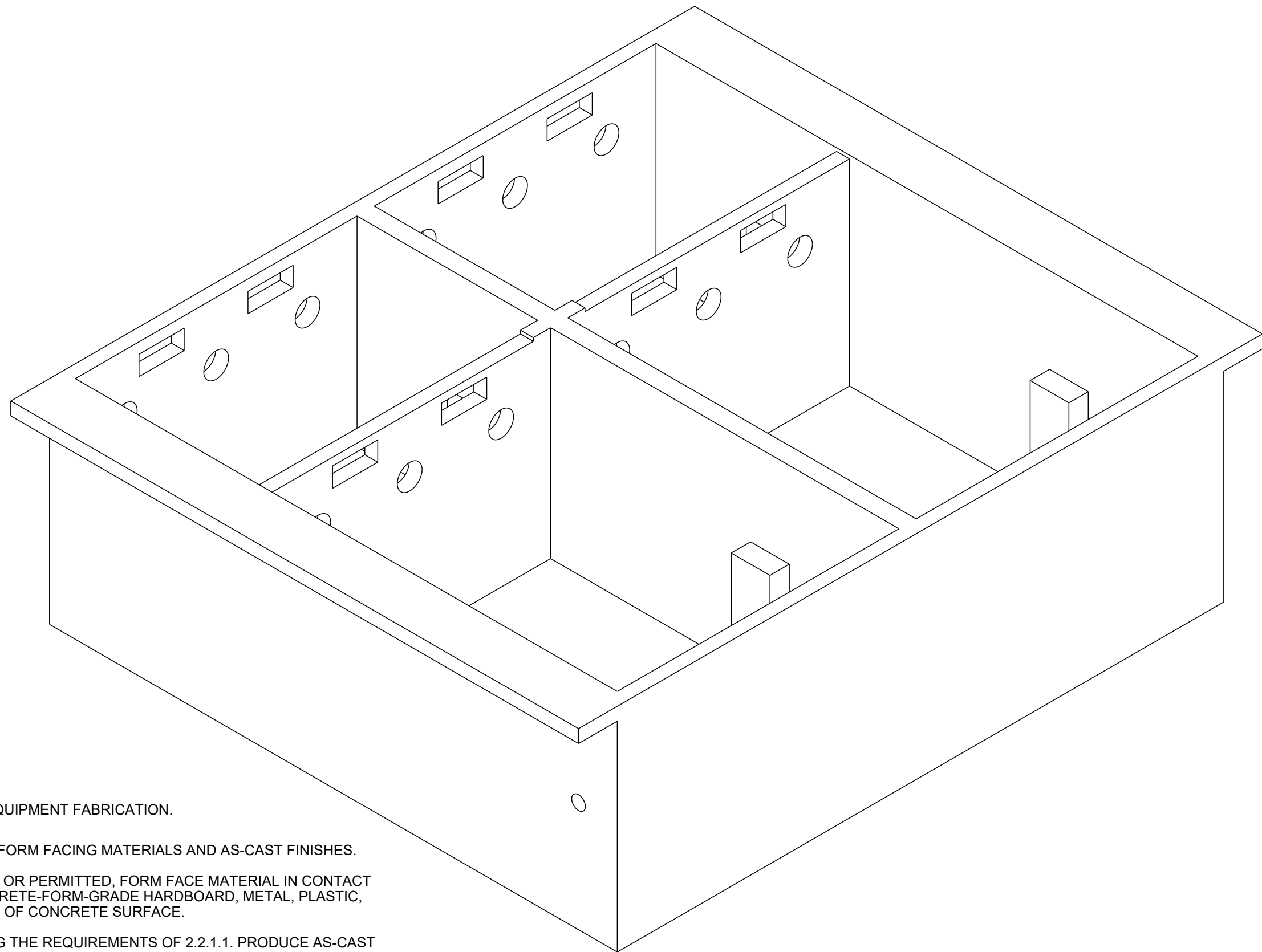
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ANOXKALDNES
DETAILS, MECHANICAL, PLAN AND SECTIONS

5703212001 ABERDEEN, ID	SCALE 1:80	DRAWING NO 2592935	SHEET 13 of 13	REV 1
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CONCRETE DIMENSIONS TO BE CONFIRMED BY OTHERS PRIOR TO EQUIPMENT FABRICATION.

CONCRETE FINISH SPECIFICATIONS:

1. CONCRETE TO ADHERE TO REQUIREMENTS OF ACI 301 (2011) FOR FORM FACING MATERIALS AND AS-CAST FINISHES.

(a) 2.2.1.1 FORM-FACING MATERIALS--UNLESS OTHERWISE SPECIFIED OR PERMITTED, FORM FACE MATERIAL IN CONTACT WITH CONCRETE SHALL BE LUMBER, PLYWOOD, TEMPERED CONCRETE-FORM-GRADE HARDBOARD, METAL, PLASTIC, OR PAPER THAT CREATES SPECIFIED APPEARANCE AND TEXTURE OF CONCRETE SURFACE.

(b) 5.3.3.3 AS-CAST FINISHES--USE FORM FACING MATERIALS MEETING THE REQUIREMENTS OF 2.2.1.1. PRODUCE AS-CAST FORMED FINISHES IN ACCORDANCE WITH CONTRACT DOCUMENTS AND 5.3.3.3.c SURFACE FINISH-3.0 (SF-3.0)

- PATCH VOIDS LARGER THAN 3/4" WIDE OR 1/2" DEEP;
- REMOVE PROJECTIONS LARGER THAN 1/8";
- PATCH TIE HOLES;
- SURFAACE TOLERANCE CLASS A AS SPECIFIED IN ACI 117; AND
- PROVIDE MOCKUP OF CONCRETE SURFACE APPEARANCE AND TEXTURE.

2591664 | 1.2 | Released | 2591664 | 1.2 | Released

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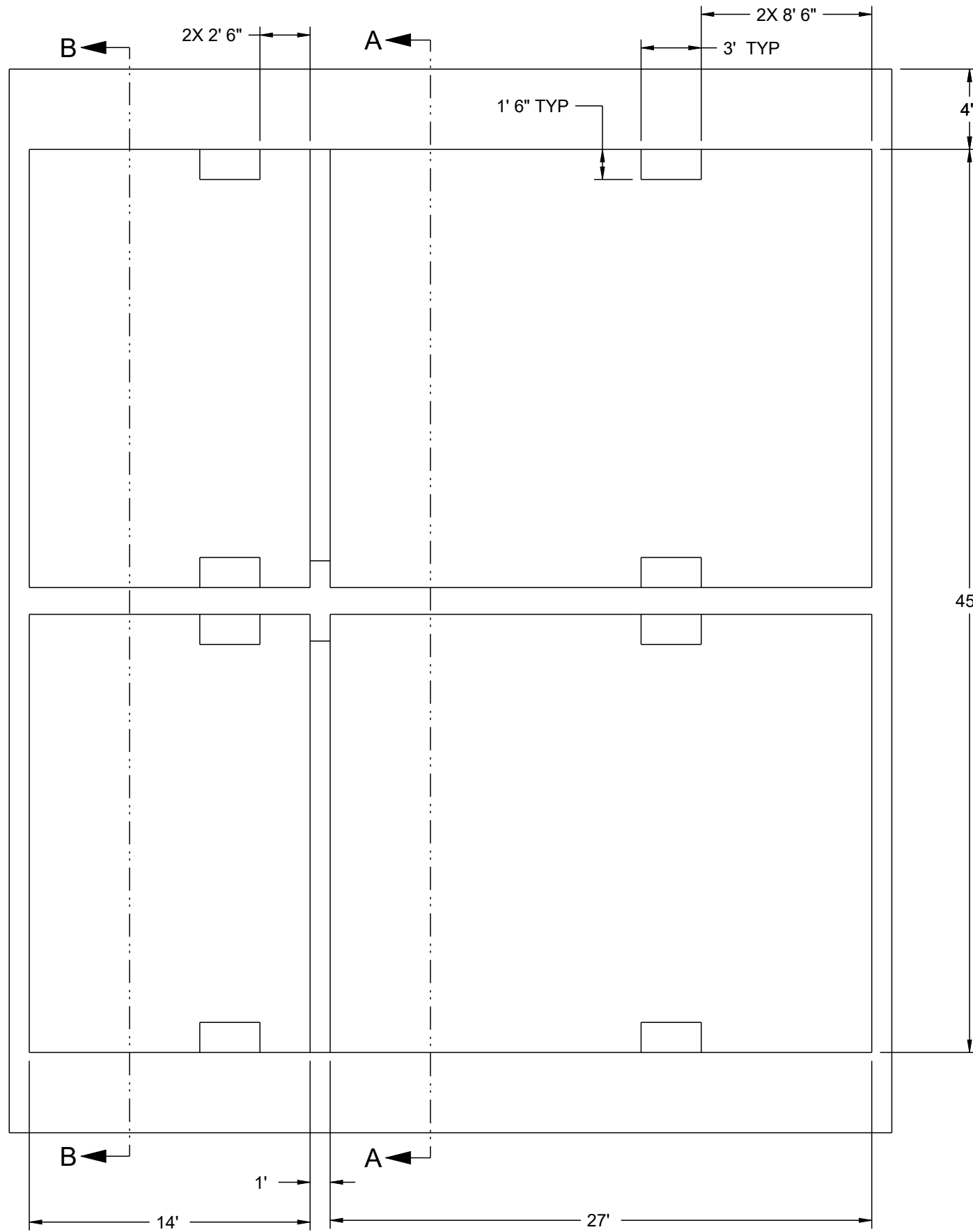
ANOXKALDNES
CONCRETE, 2 TRAIN, RETROFIT

REV	DESCRIPTION	DRAWN	APPR	DATE
1	UPDATED WALKWAYS AND SCREEN OPENINGS	SRW	LHB	10.10.23
0	PRELIMINARY RELEASE	KDH	SRW	09.26.23

±1/8"	ON LINEAR DIMENSIONS	.030 = .X	(X.XXX) = REFERENCE
±1/32"	ON HOLE Ø & LOCATIONS	.015 = .XX	(X.XXX) = INSPECTION
±1"	ON ANGULAR DIMENSIONS	.005 = .XXX	BREAK SHARP EDGES

SCALE	DRAWING NO	SHEET	REV
1:72	2591664	1 of 4	1


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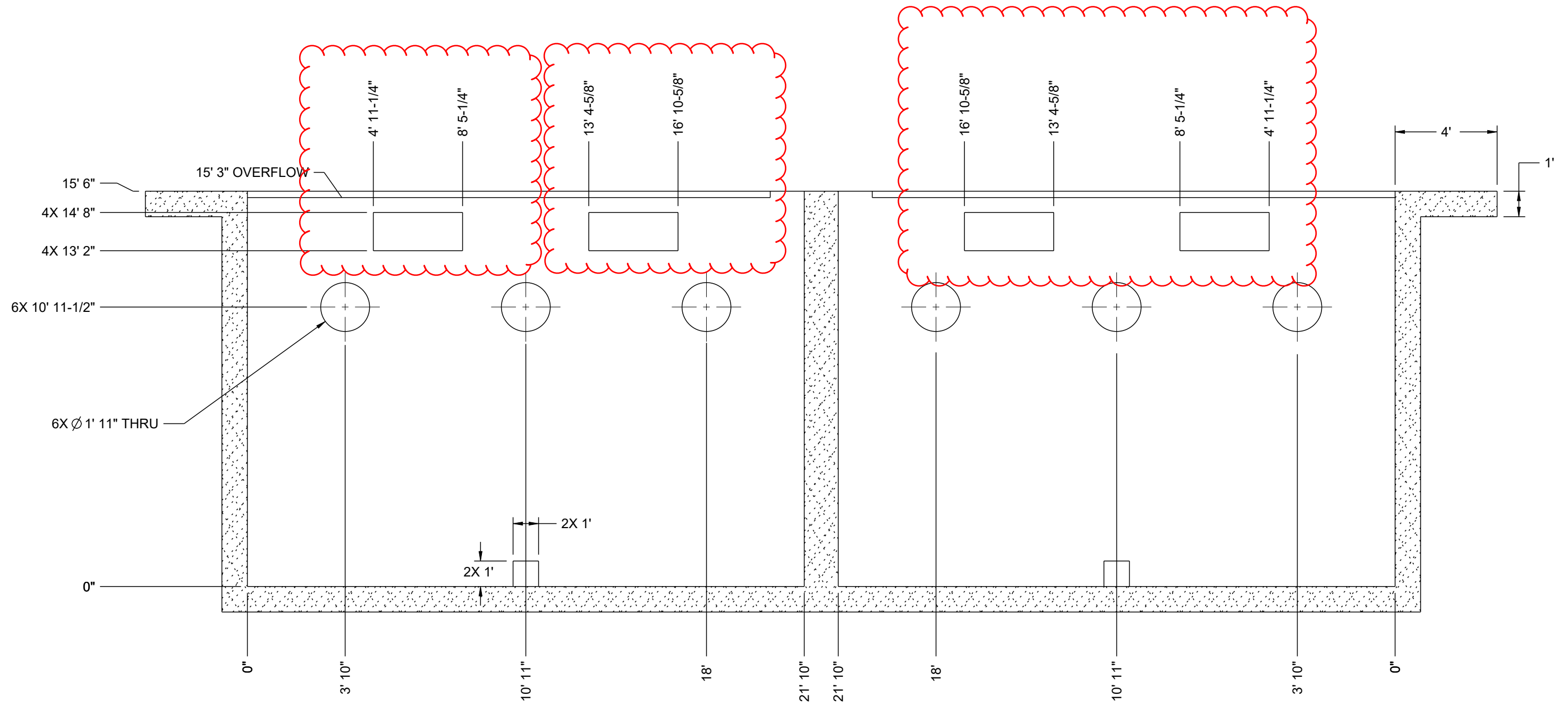
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ANOXKALDNES CONCRETE, 2 TRAIN, RETROFIT		 SCALE 1:80	DRAWING NO 2591664	SHEET 2 of 4	REV 1
±1/8" ON LINEAR DIMENSIONS ±1/32" ON HOLE Ø & LOCATIONS ±1" ON ANGULAR DIMENSIONS	.030 = .X (X.XXX) = REFERENCE .015 = .XX (X.XXX) = INSPECTION .005 = .XXX BREAK SHARP EDGES				

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SECTION A-A

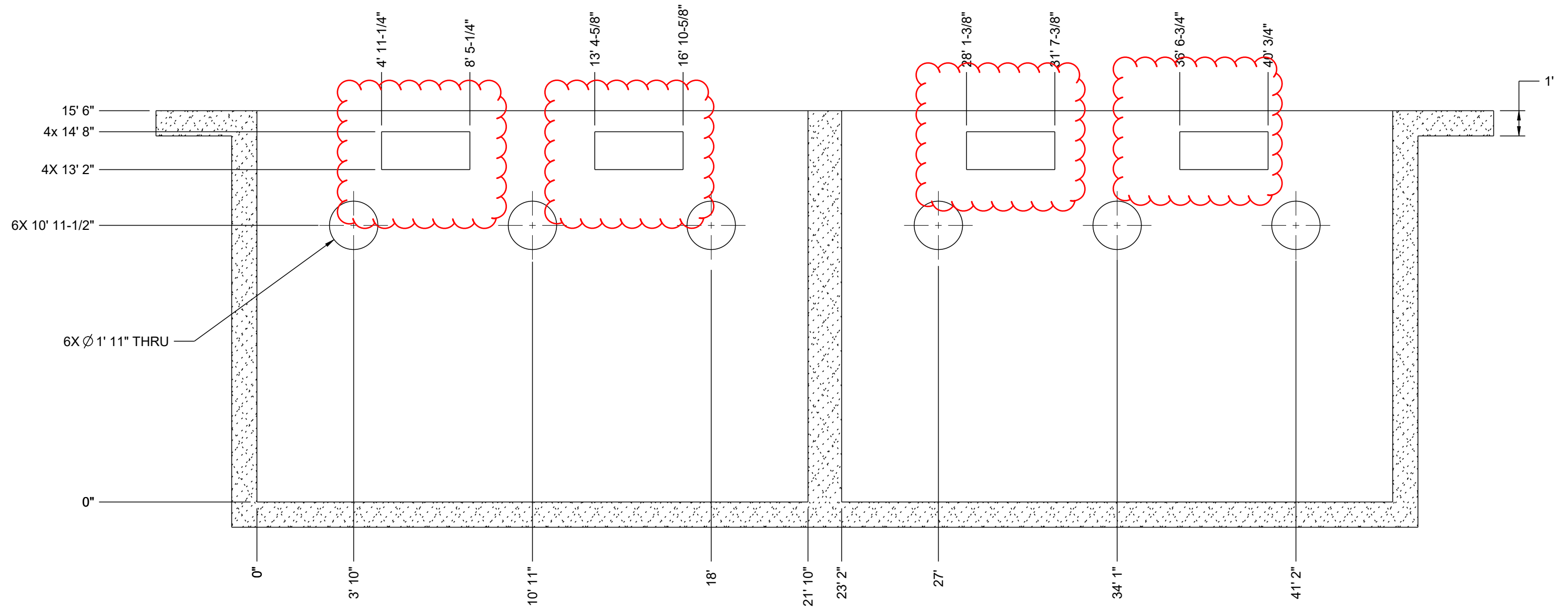
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NOT RELEASED

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SECTION B-B

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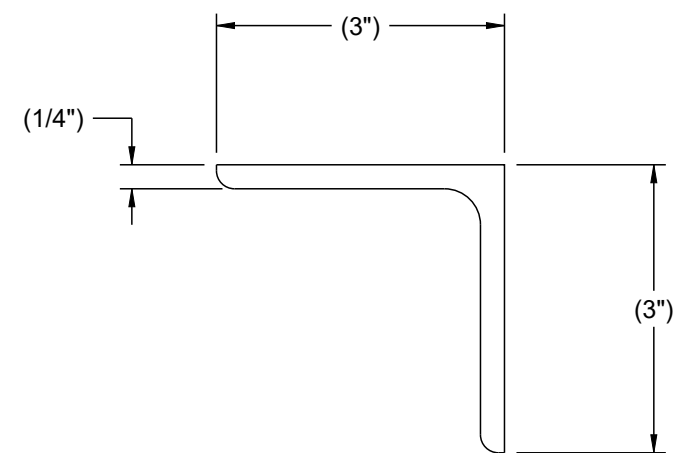
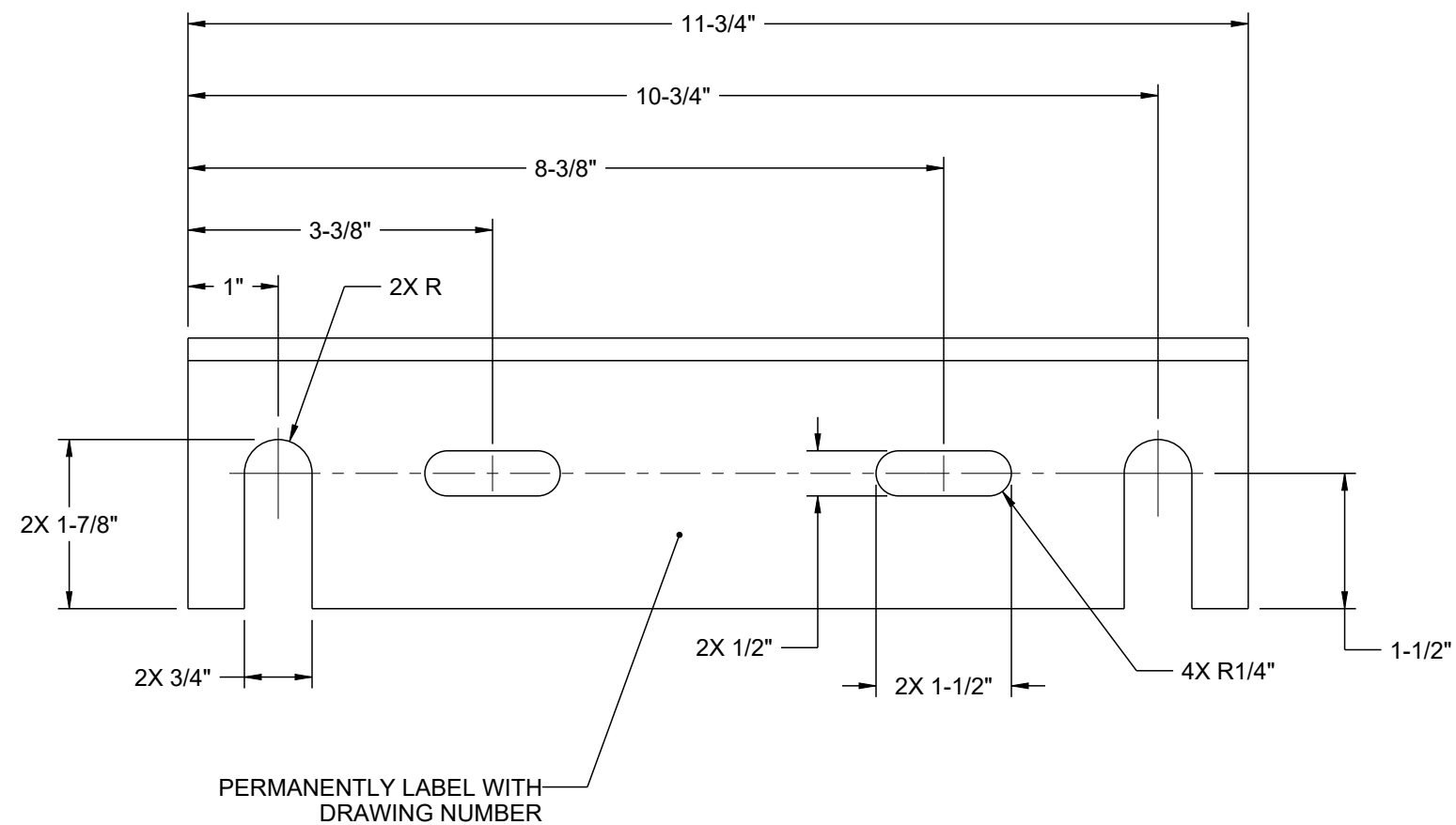
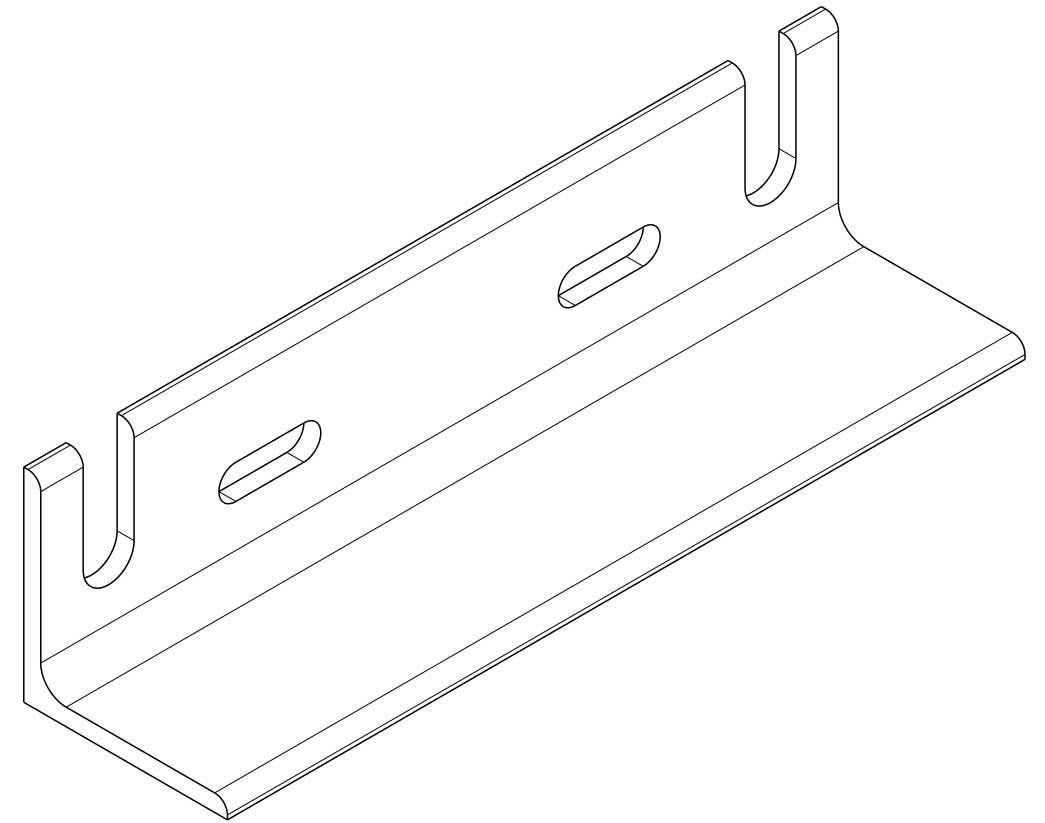
VEOLIA
 KRUGER
 4001 WESTON PKWY CARY, NC 27513 | (919) 677-8310

ANOXKALDNES
 CONCRETE, 2 TRAIN, RETROFIT

± 1/8"	ON LINEAR DIMENSIONS	.030 = .X	(X.XXX) = REFERENCE		SCALE 1:48	DRAWING NO 2591664	SHEET 4 of 4	REV 1
± 1/32"	ON HOLE Ø & LOCATIONS	.015 = .XX	(X.XXX) = INSPECTION					
± 1"	ON ANGULAR DIMENSIONS	.005 = .XXX	BREAK SHARP EDGES					

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EST. WT. = 5 LBS.
 MAT'L = AISI_304



1414466 5.1 Released		1414466 5.2 Released	
5	UPDATED TITLE BLOCK	MJG	SRW
REV	DESCRIPTION	DRAWN	APPR
			08.16.21
			DATE

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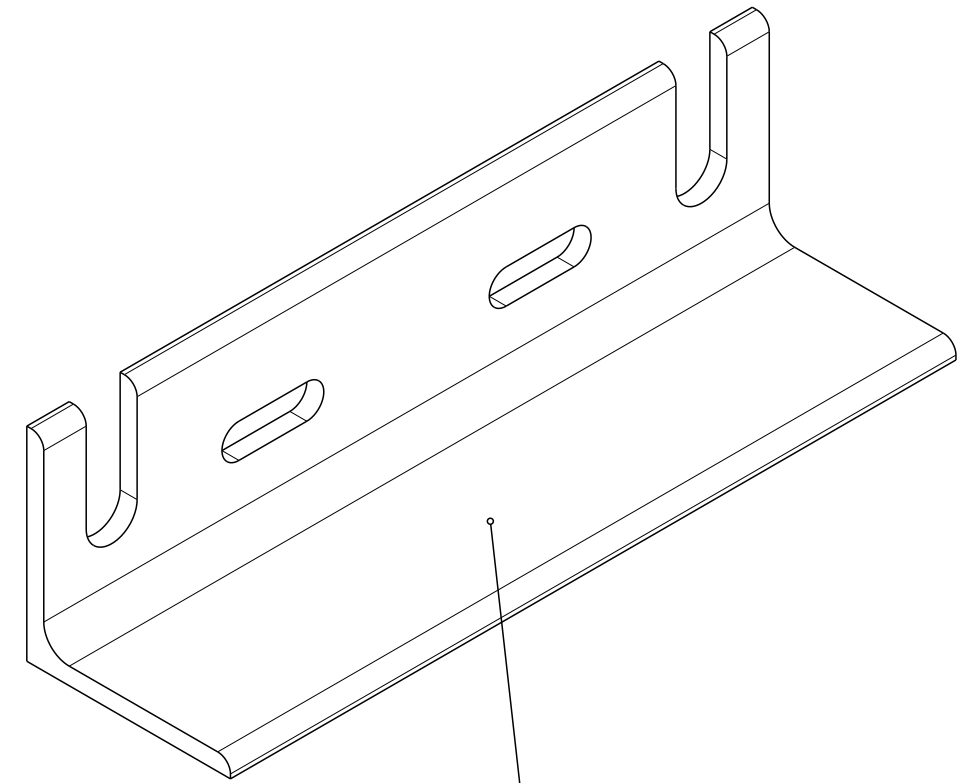
VEOLIA
 KRUGER
 4001 WESTON PKWY CARY, NC 27513 | (919) 677-8310

ANOXKALDNES
 ANG, 4" PIPE SUPPORT, 3.00" SQ X .25"THK X 11.75"LG

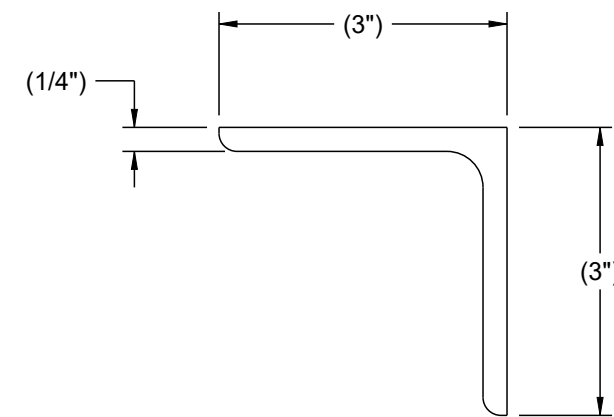
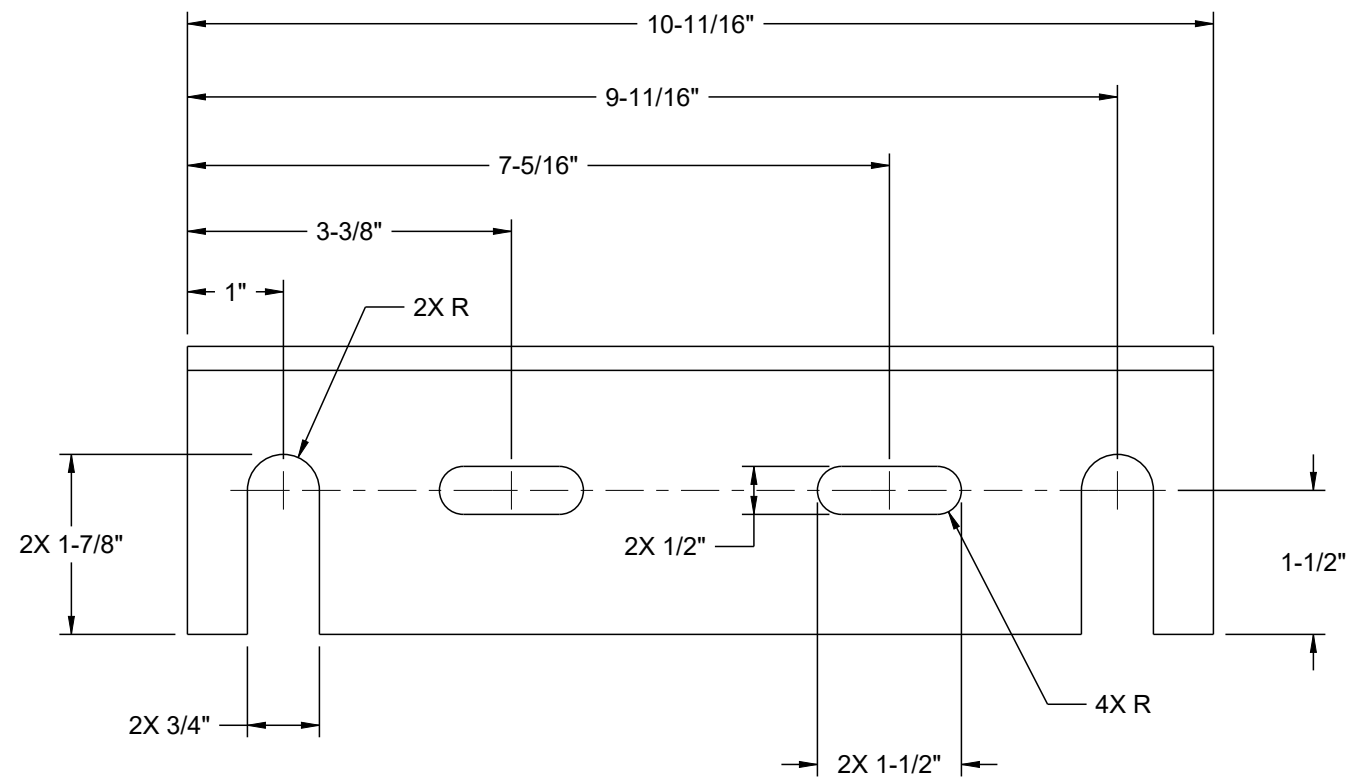
± 1/8"	ON LINEAR DIMENSIONS	.030 = .X	(X.XXX) = REFERENCE		SCALE 1:2	DRAWING NO 1414466	SHEET 1 of 1	REV 5
± 1/32"	ON HOLE Ø & LOCATIONS	.015 = .XX	(X.XXX) = INSPECTION					
± 1°	ON ANGULAR DIMENSIONS	.005 = .XXX	BREAK SHARP EDGES					

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EST. WT. = 4 LBS.
 MAT'L = AISI_304



PERMANENTLY LABEL WITH DRAWING NUMBER



1425319 | 3.5 | Released | 1425319 | 3.1 | Released

REV	DESCRIPTION	DRAWN	APPR	DATE
2	SLOTTED (2) Ø 3/4" HOLES	LHB	SRW	11.19.20
1	ADDED DRAWING NUMBER NOTE	MAB	SRW	03.20.19
0	RELEASED FOR FABRICATION	JCC	JJM	01.15.15

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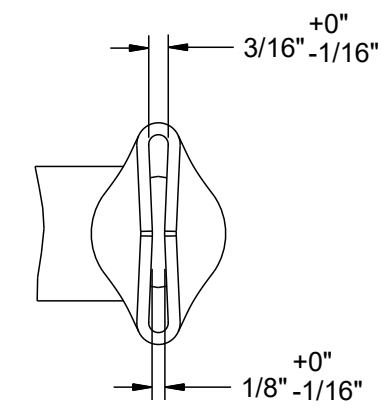
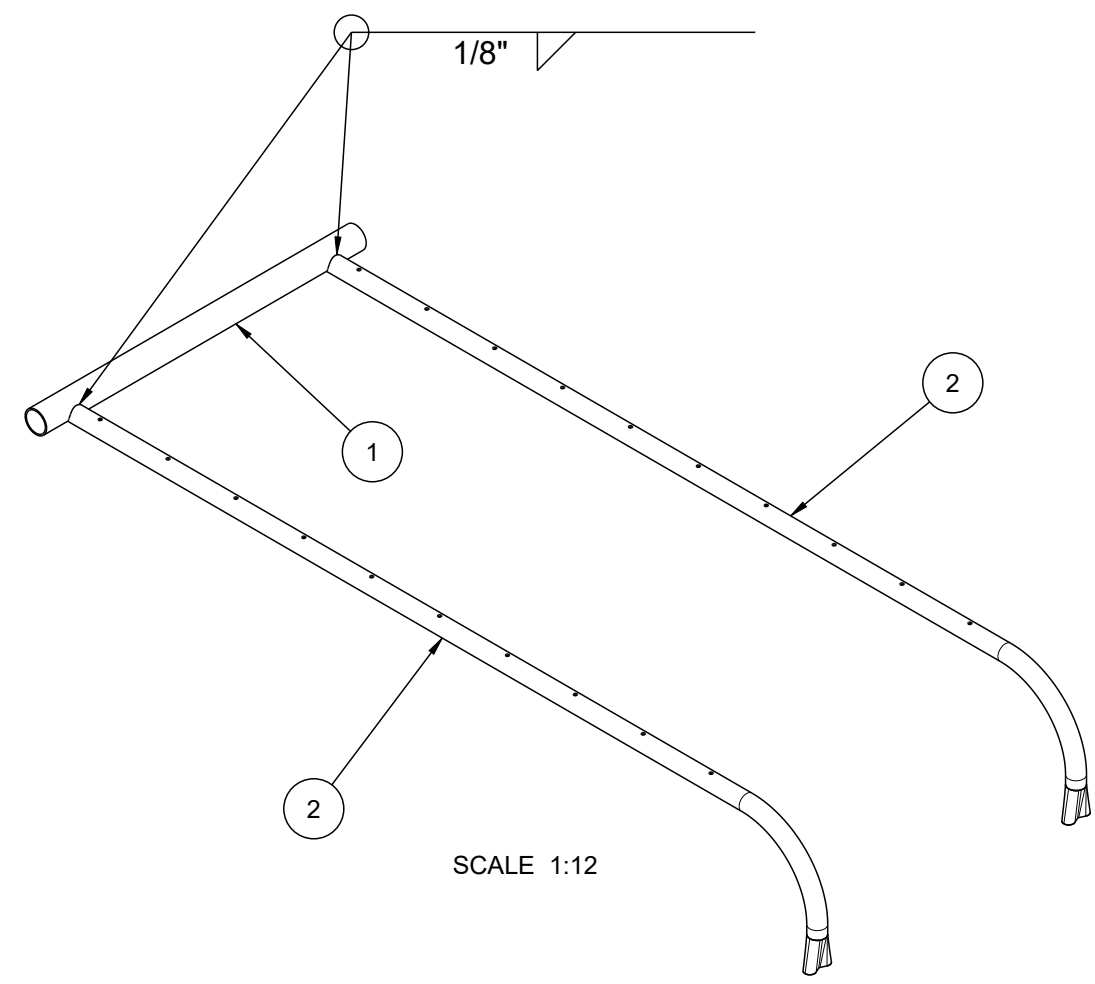
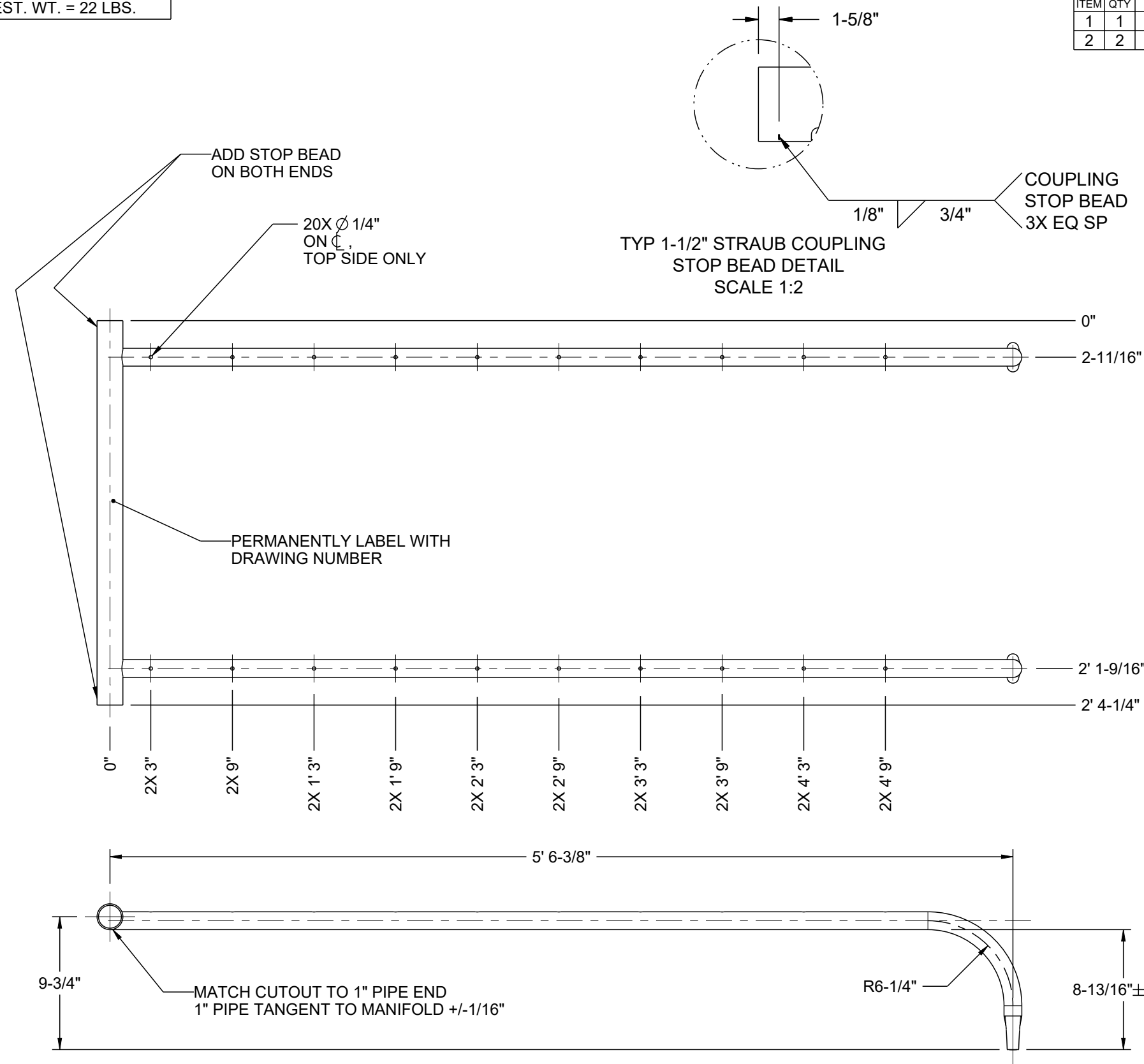
ANOXKALDNES
 ANG, 3" PIPE SUPPORT, 3.00" SQ X .25"THK X 10.69"LG

±1/8"	ON LINEAR DIMENSIONS	.030 = .X	(X.XXX) = REFERENCE		SCALE 1:2	DRAWING NO 1425319	SHEET 1 of 1	REV 3
±1/32"	ON HOLE Ø & LOCATIONS	.015 = .XX	(X.XXX) = INSPECTION					
±1°	ON ANGULAR DIMENSIONS	.005 = .XXX	BREAK SHARP EDGES					

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EST. WT. = 22 LBS.

ITEM	QTY	MATERIAL	DRAWING NO.	DESCRIPTION
1	1	AISI 304L	-	PIPE, 1 1/2", SCH 10, 28.25"LG
2	2	AISI 304L	-	PIPE, 1", SCH 10, 70.75"LG



- NOTES:
- REFER TO KRUGER "WELDING FABRICATION PROCEDURE" FOR WELD SPECIFICATIONS.
 - REMOVE WELD SLAG, CLEAN AND DEGREASE BEFORE PASSIVATION OR PAINTING.

REV	DESCRIPTION	DRAWN	APPR	DATE
2	REVISED HOLE DIA AND SPACING	KDH		04.06.22
1	REVISED NOZZLE CRIMP DETAIL SECTION A-A	LHB	-	02.15.17
0	RELEASED FOR FABRICATION	DSD	CDP	11.18.16

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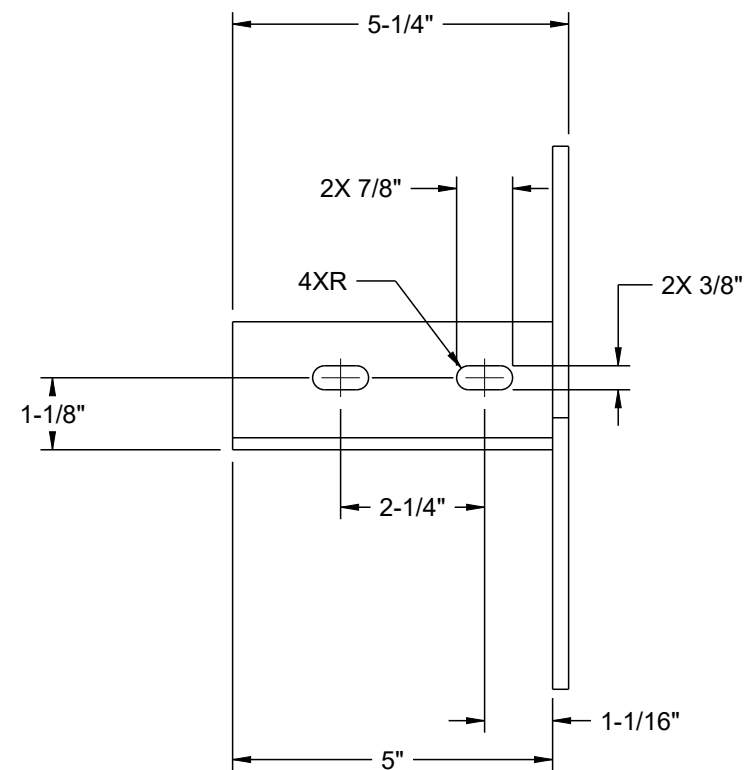
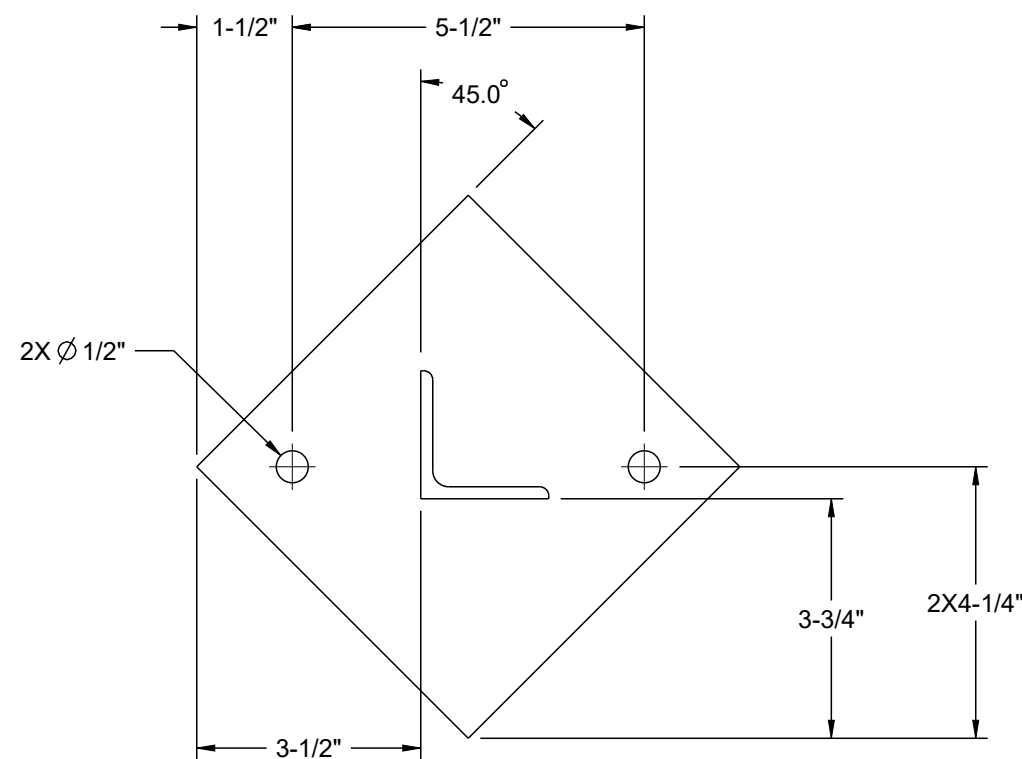
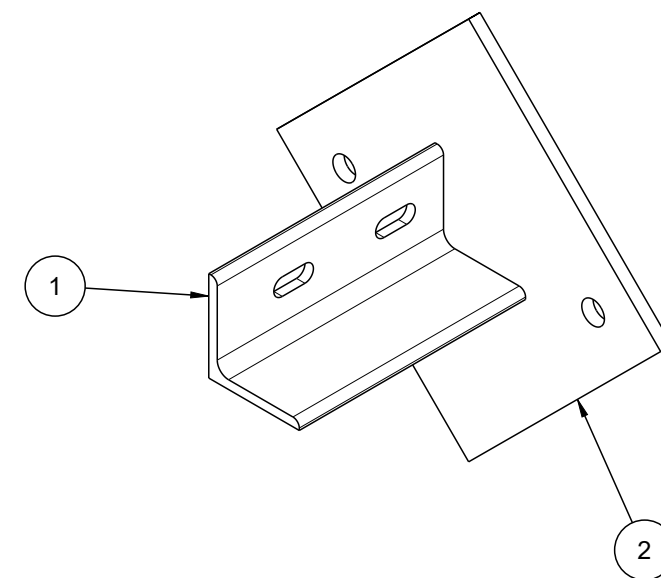
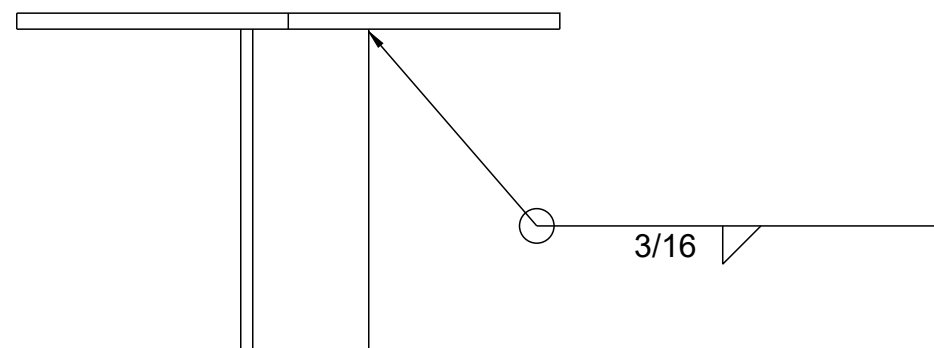
ANOXKALDNES
 WLDMT, SPARGER, Ø23" X 5'LG CYL SCREEN, 1.5"
 MANIFOLD

SCALE 1:9	DRAWING NO 1473820	SHEET 1 of 1	REV 2
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EST. WT. = 4 LBS.

ITEM	QTY	MATERIAL	DRAWING NO.	DESCRIPTION
1	1	AISI 304L	-	ANG, 2.00" X 2.00" X .19"THK X 5.00"LG
2	1	AISI 304L	-	PLATE, .25" X 6.00" X 6.00"LG



NOTES:

- REFER TO KRUGER "WELDING FABRICATION PROCEDURE" FOR WELD SPECIFICATIONS.
- REMOVE WELD SLAG, CLEAN AND DEGREASE BEFORE PASSIVATION OR PAINTING.

1473865 | 1.1 | Released | 1473865 | 1.1 | Released

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 KRUGER INC.
 4001 WESTON PKWY CARY, NC 27513 | (919) 677-8310

ANOXKALDNES
 WLDMT, PIPE SUPPORT, 1-1/2" PIPE

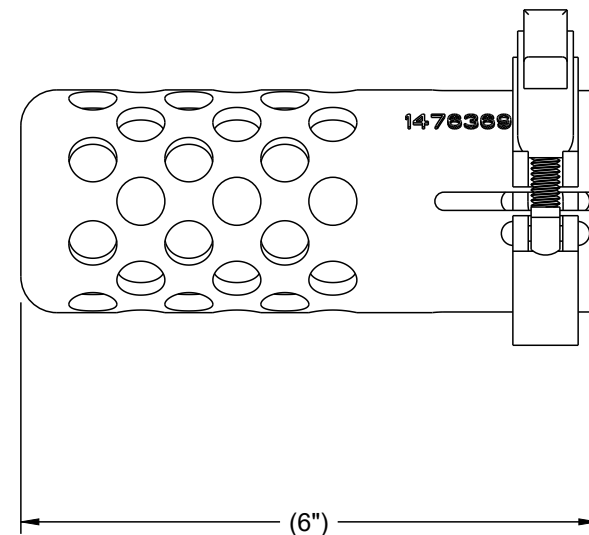
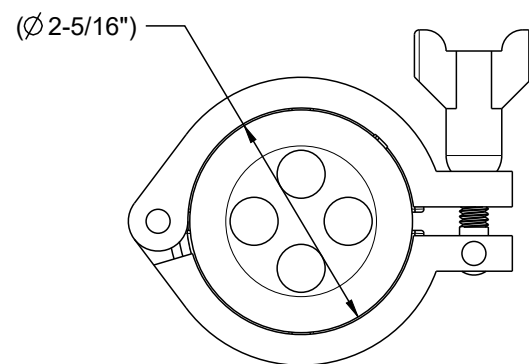
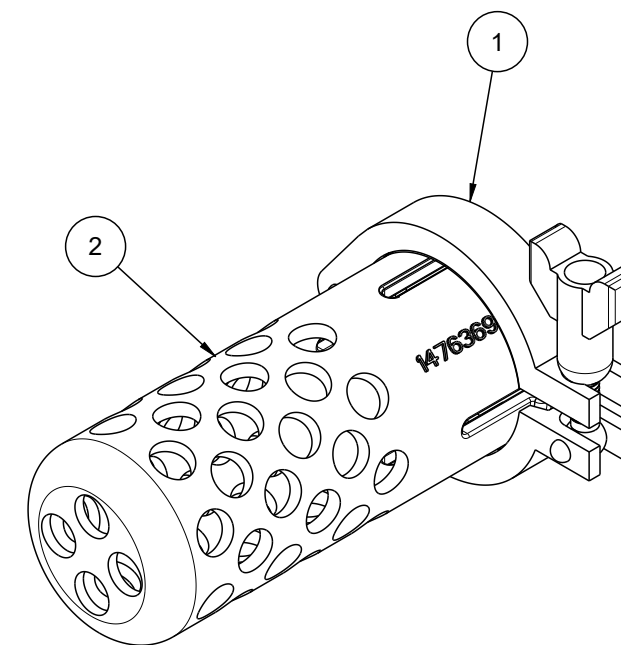
REV	DESCRIPTION	DRAWN	APPR	DATE
1	ADDED DIMENSIONS	CDP	LHB	05.31.17
0	RELEASED FOR FABRICATION	DSD	CDP	11.22.16

±1/8" ON LINEAR DIMENSIONS	.030 = X	(X.XXX) = REFERENCE		SCALE 1:3	DRAWING NO 1473865	SHEET 1 of 1	REV 1
±1/32" ON HOLE Ø & LOCATIONS	.015 = .XX	(X.XXX) = INSPECTION					
±1" ON ANGULAR DIMENSIONS	.005 = .XXX	BREAK SHARP EDGES					

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EST. WT. = 0.7 LBS.

ITEM	QTY	MATERIAL	DRAWING NO.	DESCRIPTION
1	1	AISI 304	-	CLAMP, SANITARY, Ø 2", McM #4322K153
2	1	NYLON	1476369	COVER, INSTRUMENT, Ø1.960" ID, 1-PC



SCREEN DESIGNED FOR:
HACH LDO 9020000

1853090	3.2	Released	1853090	3.2	Released
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KRUGER
4001 WESTON PKWY CARY, NC 27513 | (919) 677-8310

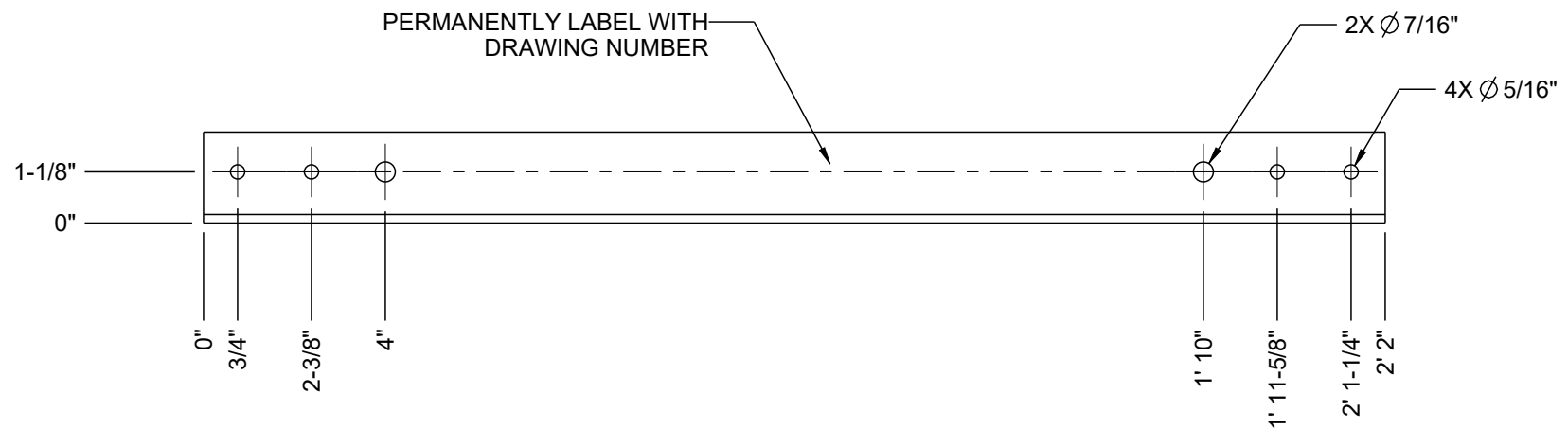
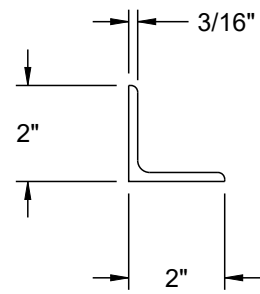
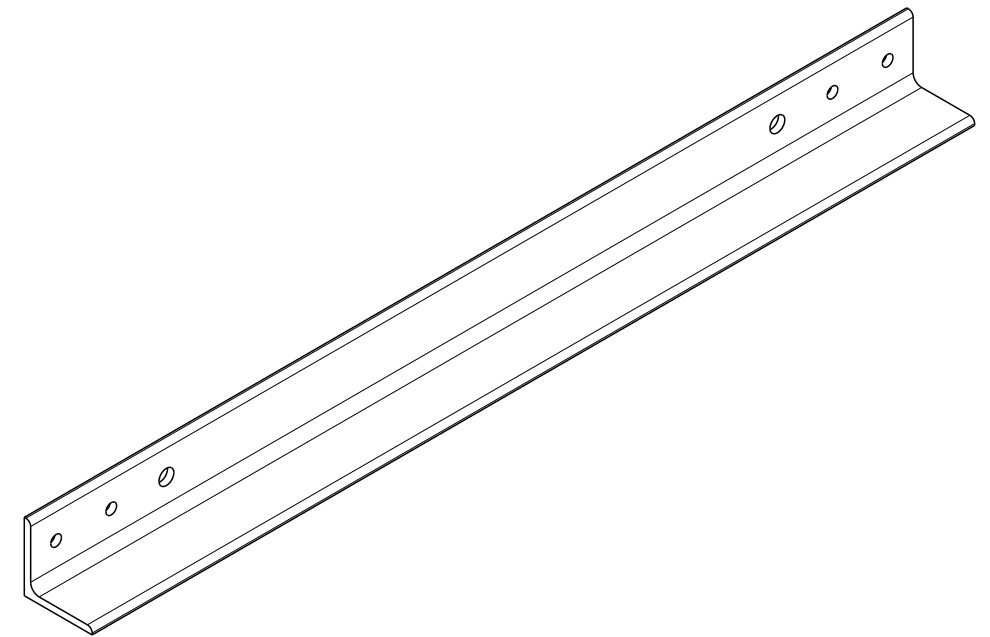
ANOXKALDNES
ASSY, COVER, INSTRUMENT, Ø1.960" ID, 1-PC (BY
KRUGER)

REV	DESCRIPTION	DRAWN	APPR	DATE
2	REVISED CLAMP SURFACE OD	MJG	SRW	04.21.21
1	REVISE DESCRIPTION	DSD	SRW	06.28.18
0	RELEASED FOR FABRICATION	DSD	SRW	08.14.17

± 1/8"	ON LINEAR DIMENSIONS	.030 = .X	(X.XXX) = REFERENCE		SCALE 1:2	DRAWING NO 1853090	SHEET 1 of 1	REV 3
± 1/32"	ON HOLE Ø & LOCATIONS	.015 = .XX	(X.XXX) = INSPECTION					
± 1°	ON ANGULAR DIMENSIONS	.005 = .XXX	BREAK SHARP EDGES					

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EST. WT. = 5 LBS.
 MAT'L = AISI_304



2026531 | 1.2 | Released | 2026531 | 1.3 | Released

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 KRUGER
 4001 WESTON PKWY CARY, NC 27513 | (919) 677-8310

ANOXKALDNEs
 ANG, SPARGER SUPPORT, 2.00" SQ X .19"THK X
 26.00"LG

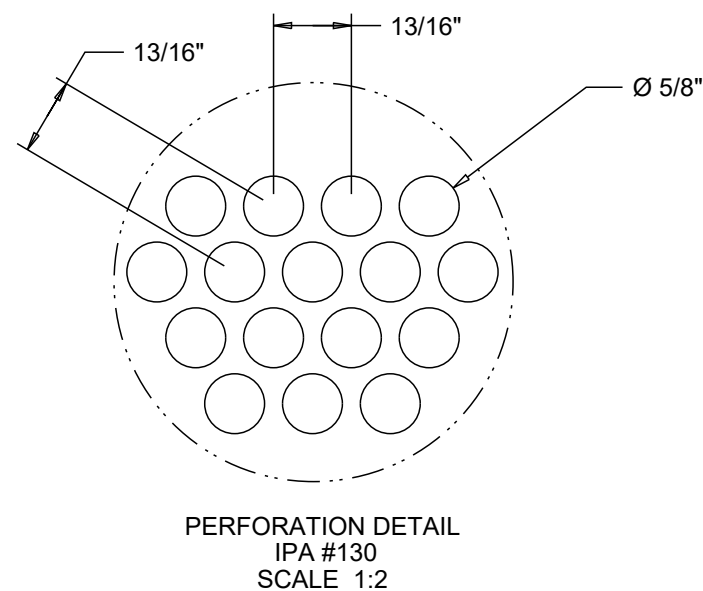
REV	DESCRIPTION	DRAWN	APPR	DATE
1	ADDED LABEL DRAWING NUMBER NOTE	LHB	SRW	10.01.18
0	RELEASED FOR FABRICATION	MRJB	.	07.12.18

$\pm 1/8"$	ON LINEAR DIMENSIONS	.030 = .X	(X.XXX) = REFERENCE		SCALE 1:4	DRAWING NO 2026531	SHEET 1 of 1	REV 1
$\pm 1/32"$	ON HOLE ϕ & LOCATIONS	.015 = .XX	(X.XXX) = INSPECTION					
$\pm 1"$	ON ANGULAR DIMENSIONS	.005 = .XXX	BREAK SHARP EDGES					

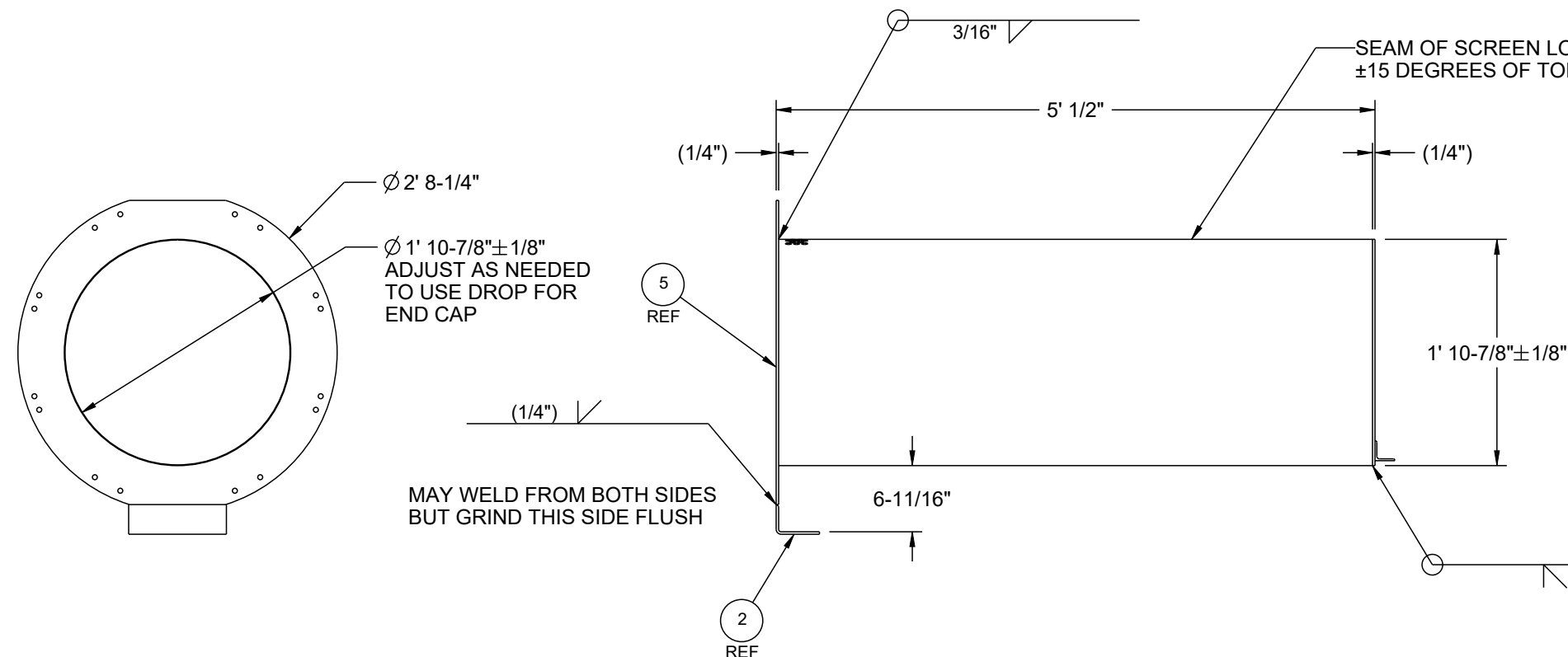
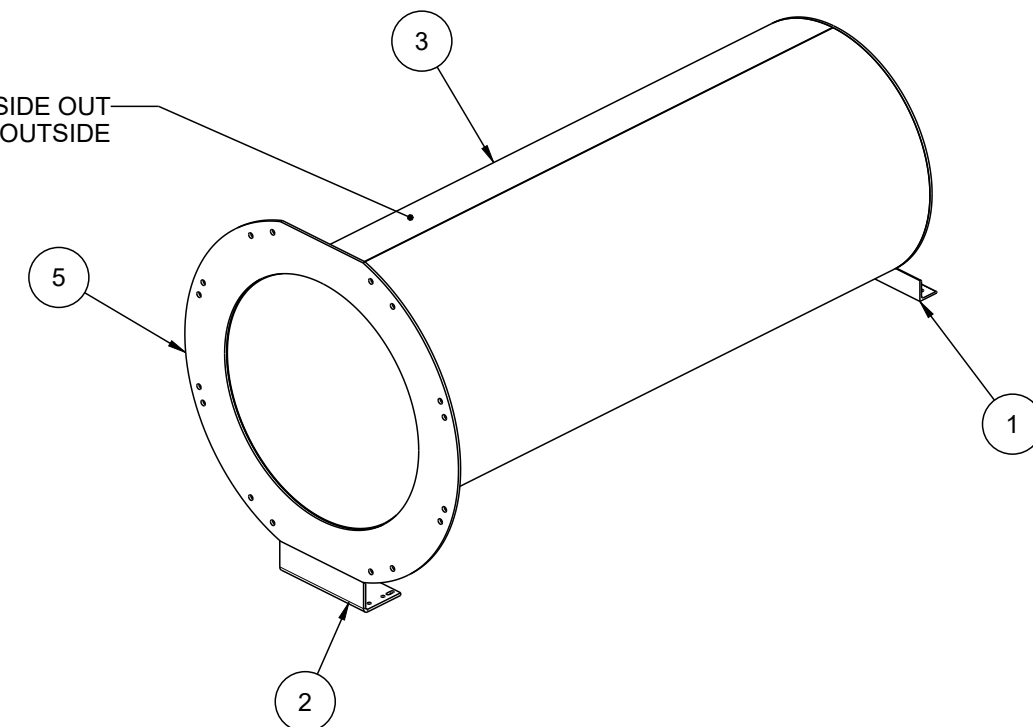
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EST. WT. = 160 LBS.

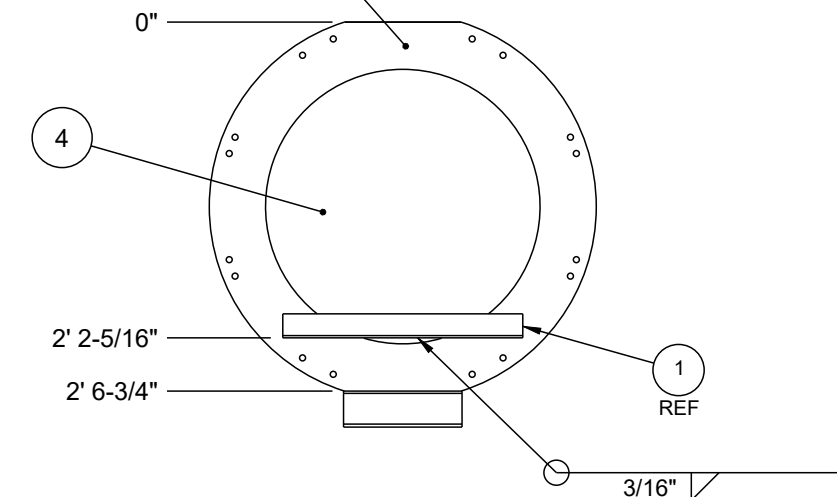
ITEM	QTY	MATERIAL	DRAWING NO.	DESCRIPTION
1	1	AISI 304L	2026527	ANG, SUPPORT, SPARGER LATERAL
2	1	AISI 304L	2276151	BRKT, PIPE SUPPORT, CYLINDRICAL SCREEN FOR 1"- 2" PIPE
3	1	AISI 304L	2026717	PERF, CYLINDRICAL SCREEN, 23", 5'-0"LG
4	1	AISI 304L	-	PLATE, .25" X Ø22.88"
5	1	AISI 304L	-	PLATE, .25" X Ø32.25"



SMOOTH PUNCHED SIDE OUT
NO BURRS ON OUTSIDE



PERMANENTLY LABEL WITH
DRAWING NUMBER



NOTES:

- REFER TO KRUGER "WELDING FABRICATION PROCEDURE" FOR WELD SPECIFICATIONS.
- REMOVE WELD SLAG, CLEAN AND DEGREASE BEFORE PASSIVATION OR PAINTING.
- UNFINISHED END PATTERNS.

2285068 | 0.3 | Released | 2285068 | 0.5 | Released

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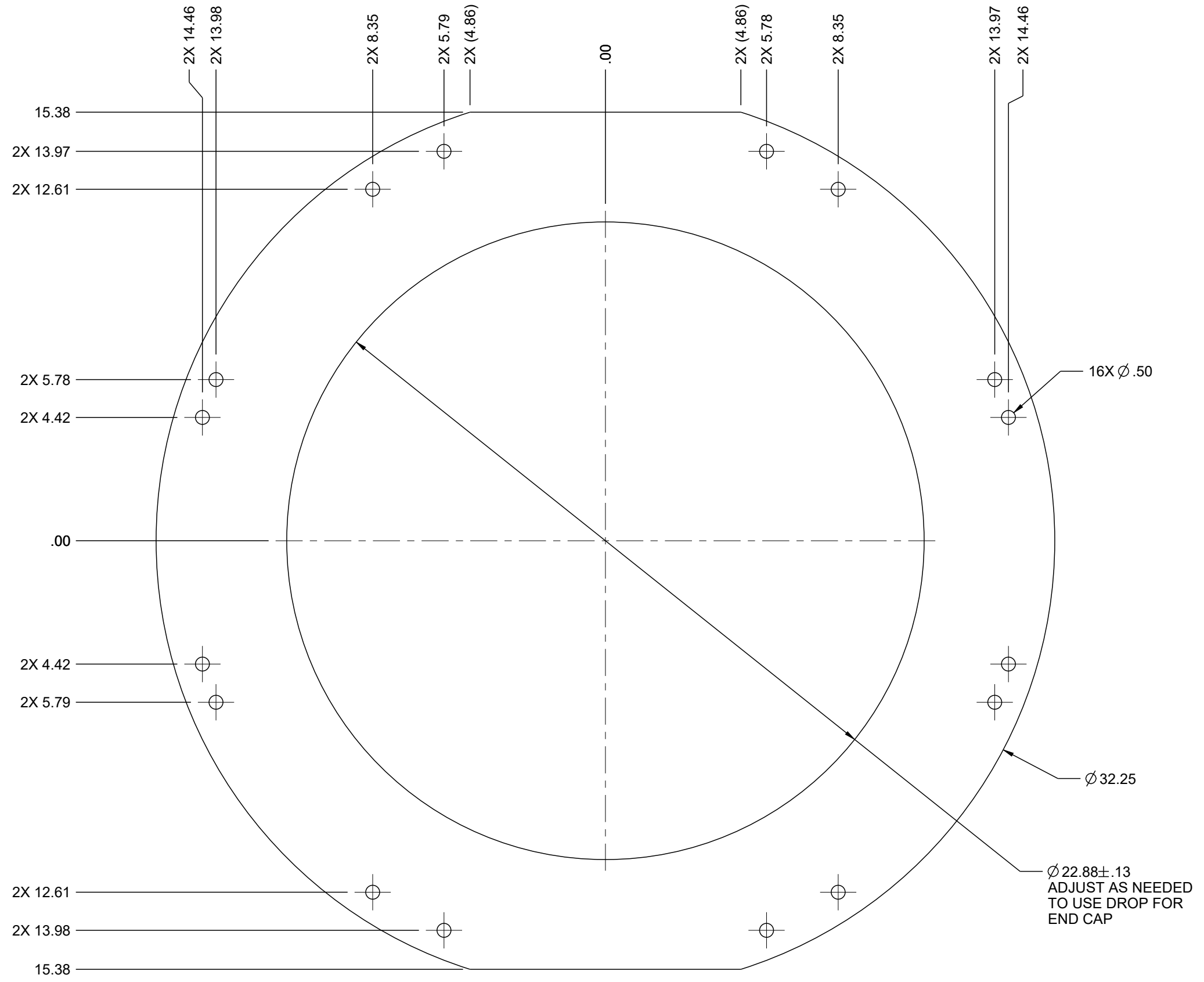
VEOLIA
KRUGER
4001 WESTON PKWY CARY, NC 27513 | (919) 677-8310

ANOXKALDNES
WLDMT, CYLINDRICAL SCREEN, PERF, 22 7/8", 5'LG,
Ø5/8" HOLES, w/1"-2" PIPE HANGER

REV	DESCRIPTION	DRAWN	APPR	DATE
0	RELEASED FOR FABRICATION	LHB	SRW	03.18.20

±1/8" ON LINEAR DIMENSIONS	.030 = .X	(X.XXX) = REFERENCE		SCALE 1:16	DRAWING NO 2285068	SHEET 1 of 2	REV 0
±1/32" ON HOLE Ø & LOCATIONS	.015 = .XX	(X.XXX) = INSPECTION					
±1" ON ANGULAR DIMENSIONS	.005 = .XXX	BREAK SHARP EDGES					

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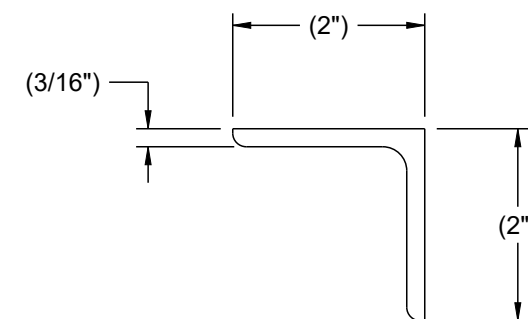
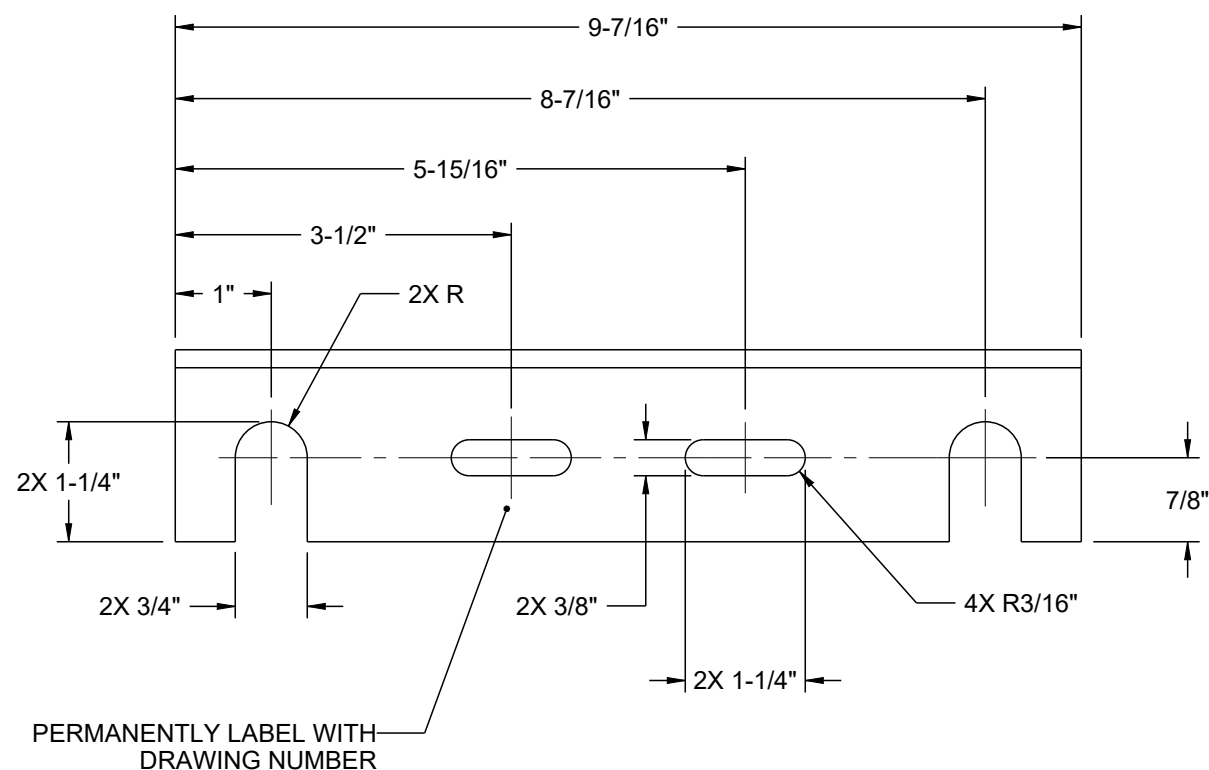
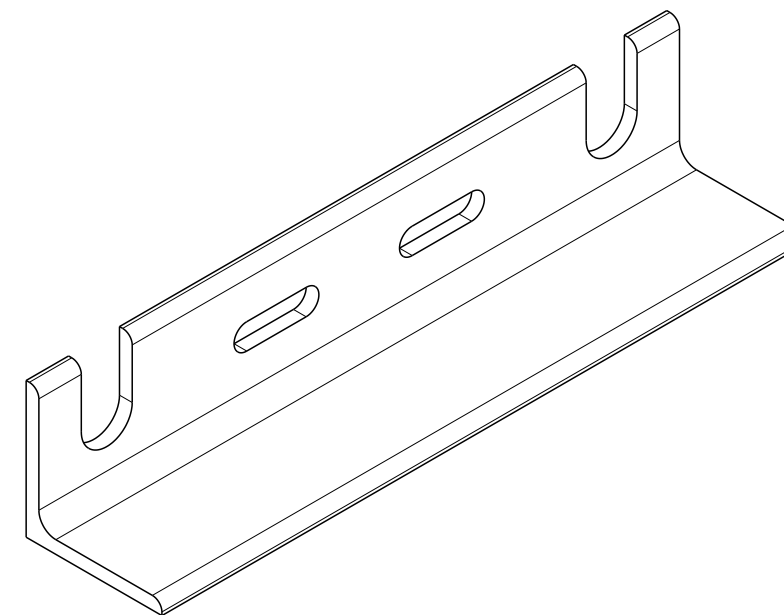


ANOXKALDNES		WLDMT, CYLINDRICAL SCREEN, PERF, 22 7/8", 5'LG, Ø5/8" HOLES, w/1"-2" PIPE HANGER	
± 1/8" ON LINEAR DIMENSIONS	.030 = .X	(X.XXX) = REFERENCE	
± 1/32" ON HOLE Ø & LOCATIONS	.015 = .XX	(X.XXX) = INSPECTION	
± 1" ON ANGULAR DIMENSIONS	.005 = .XXX	BREAK SHARP EDGES	
SCALE	DRAWING NO	SHEET	REV
1:4	2285068	2 of 2	0

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EST. WT. = 1.8 LBS.

MAT'L = AISI_304



2354578 | 2.2 | Released | 2354578 | 2.2 | Released

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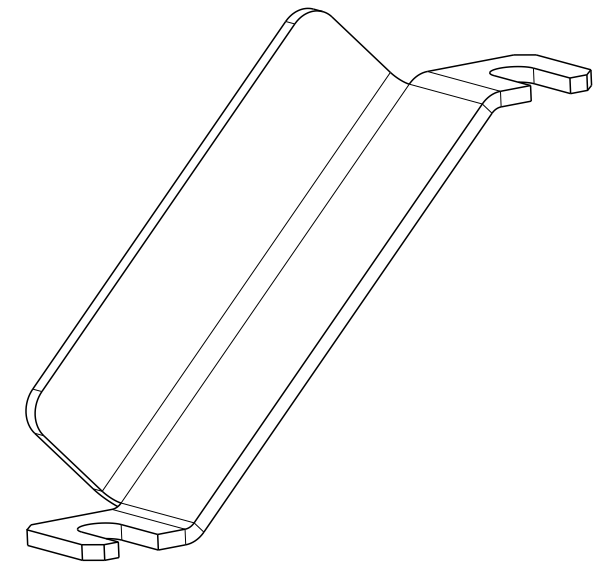
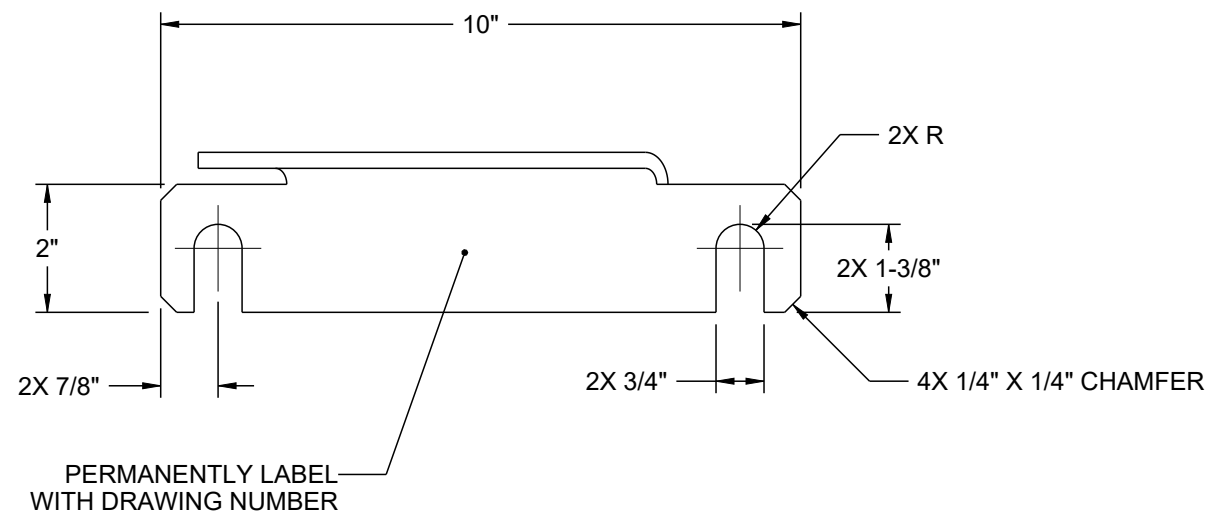
ANOXKALDNES
 ANG, 1-1/2" PIPE SUPPORT, 2.00" SQ X .19"THK X
 9.44"LG

REV	DESCRIPTION	DRAWN	APPR	DATE
1	SLOTTED (2) Ø 3/4" HOLES	LHB	SRW	11.20.20
0	RELEASED FOR FABRICATION	LHB	SRW	11.16.20

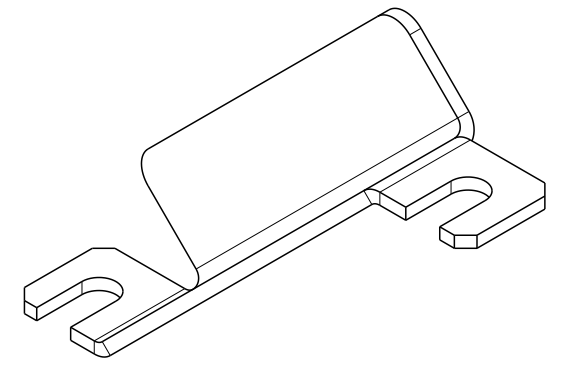
±1/8"	ON LINEAR DIMENSIONS	.030 = .X	(X.XXX) = REFERENCE		SCALE 1:2	DRAWING NO 2354578	SHEET 1 of 1	REV 2
±1/32"	ON HOLE Ø & LOCATIONS	.015 = .XX	(X.XXX) = INSPECTION					
±1°	ON ANGULAR DIMENSIONS	.005 = .XXX	BREAK SHARP EDGES					

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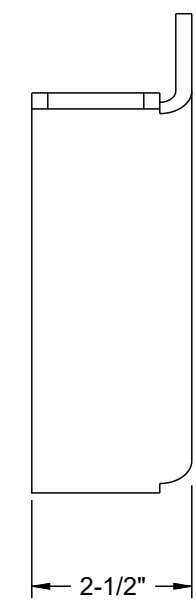
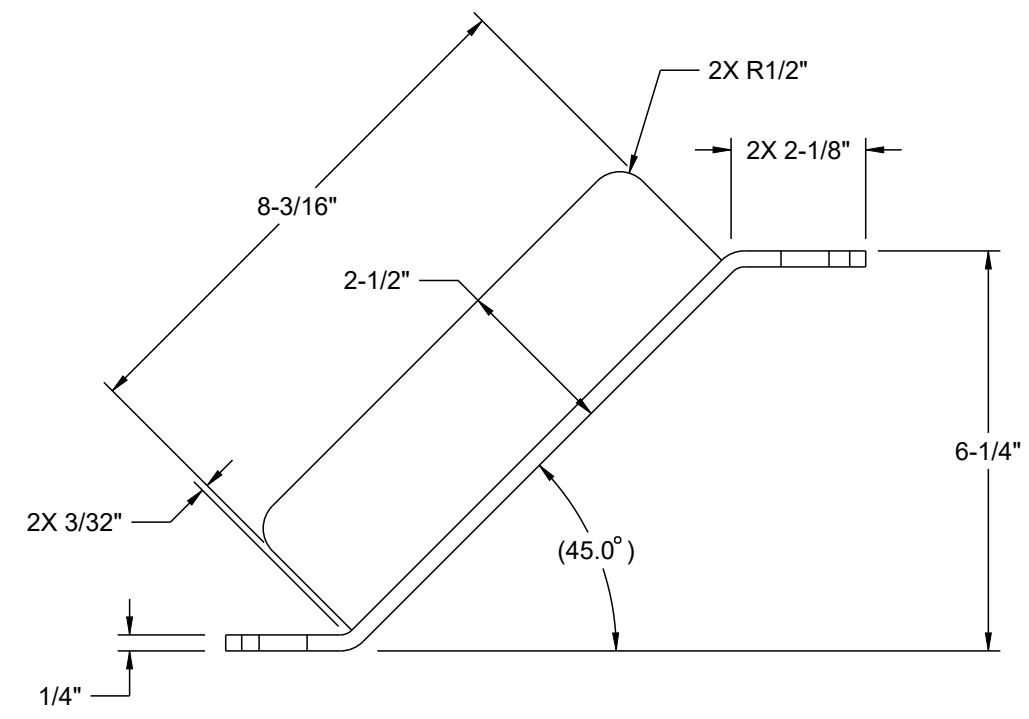
EST. WT. = 3 LBS.
 MAT'L = AISI_304



REVERSE ISOMETRIC VIEW



ISOMETRIC VIEW



NOTES:
 1. PART MAY BE FABRICATED FROM FORMED SHEET OR STRUCTURAL ANGLE.

2384152 | 1.3 | Released | 2384152 | 1.4 | Released

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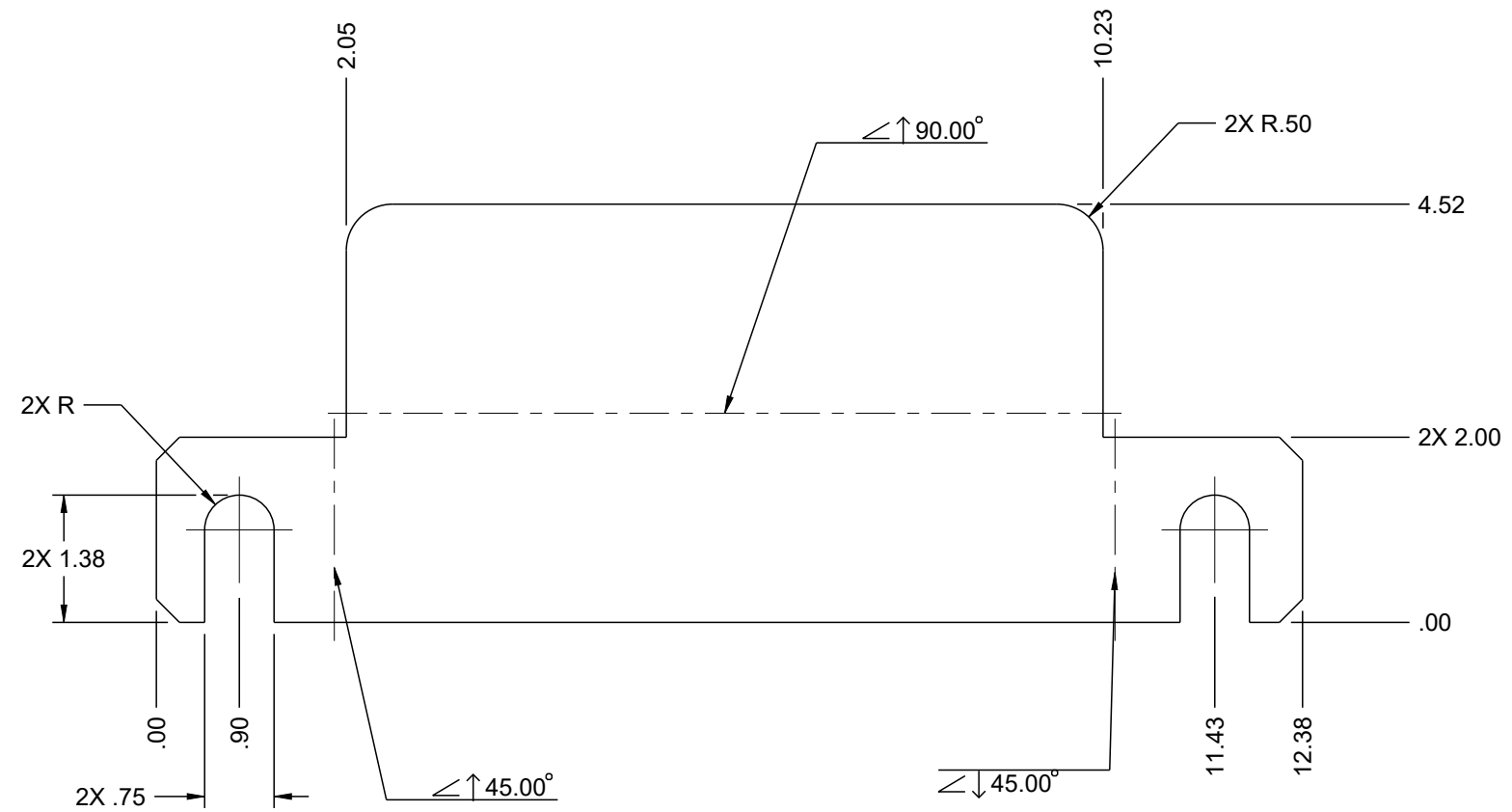
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ANOXKALDNES
 ANGLE, SUPPORT, KICKER, 2-1/2" X 2-1/2" X 1/4"

SCALE 1:3	DRAWING NO 2384152	SHEET 1 of 2	REV 1
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REV	DESCRIPTION	DRAWN	APPR	DATE
1	ADDED PERMANENTLY LABEL DRAWING NUMBER NOTE	LHB	SRW	04.07.21
0	RELEASED FOR FABRICATION	LHB	SRW	02.08.21

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FLAT PATTERN

NOTES:

1. CAD DRAWING OF FLAT PATTERNS AVAILABLE UPON REQUEST.
2. ALL FLAT PATTERN DIMENSIONS ARE FOR REFERENCE ONLY.
3. FLAT PATTERN BEND DEDUCTION (BD) = 0.482"

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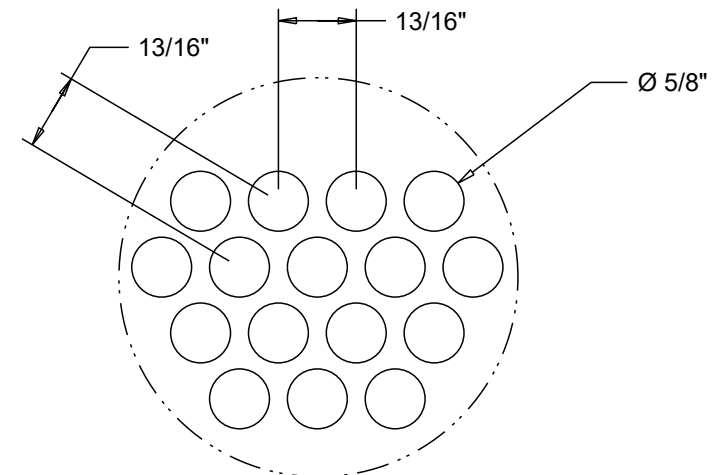
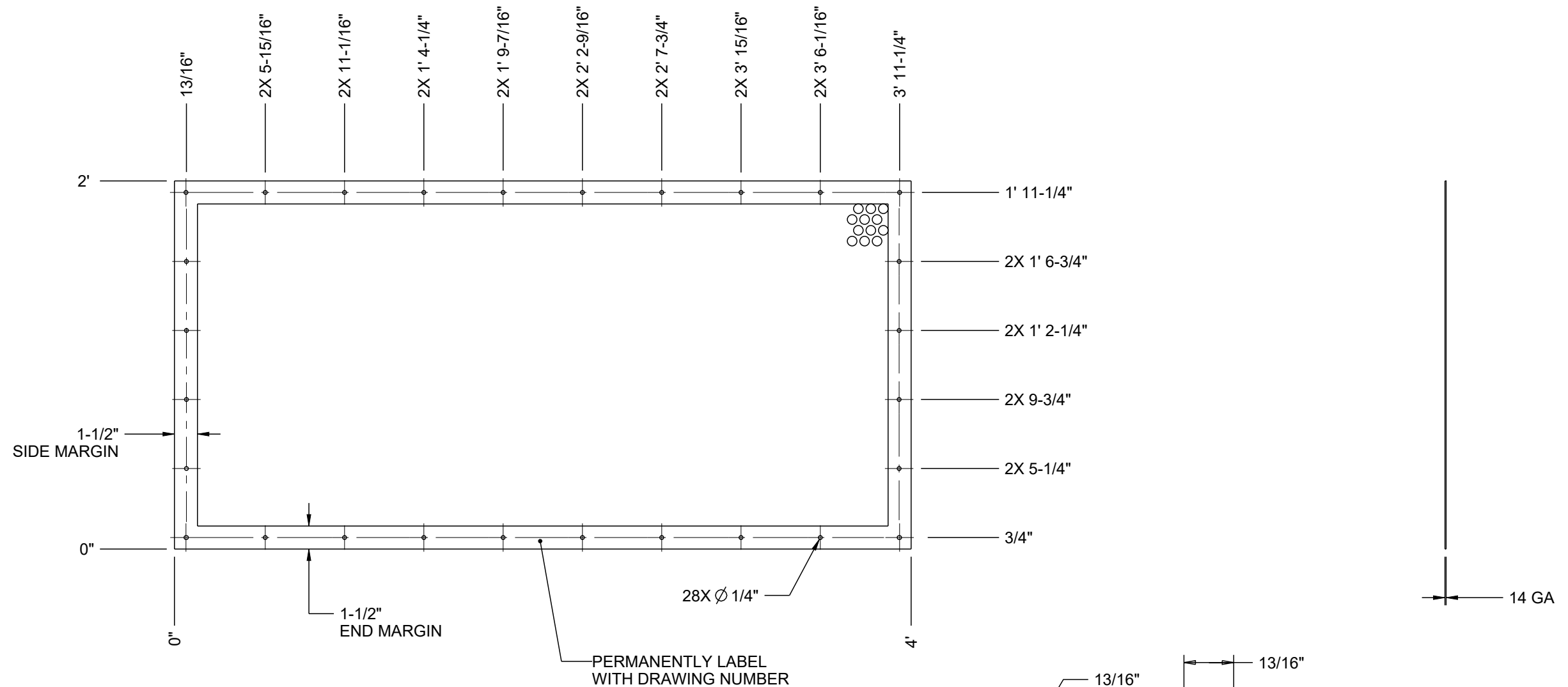
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ANOXKALDNES
 ANGLE, SUPPORT, KICKER, 2-1/2" X 2-1/2" X 1/4"

±1/8"	ON LINEAR DIMENSIONS	.030 = .X	(X.XXX) = REFERENCE		SCALE	DRAWING NO	SHEET	REV
±1/32"	ON HOLE Ø & LOCATIONS	.015 = .XX	(X.XXX) = INSPECTION					
±1°	ON ANGULAR DIMENSIONS	.005 = .XXX	BREAK SHARP EDGES					
					1:3	2384152	2 of 2	1

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EST. WT. = 19 LBS.
 MAT'L = AISI_304



PERFORATION DETAIL
 IPA #130
 SCALE 1:2

2406229	0.2	Released	2406229	0.2	Released
0	RELEASED FOR FABRICATION	MJG	SRW	03.15.22	
REV	DESCRIPTION	DRAWN	APPR	DATE	

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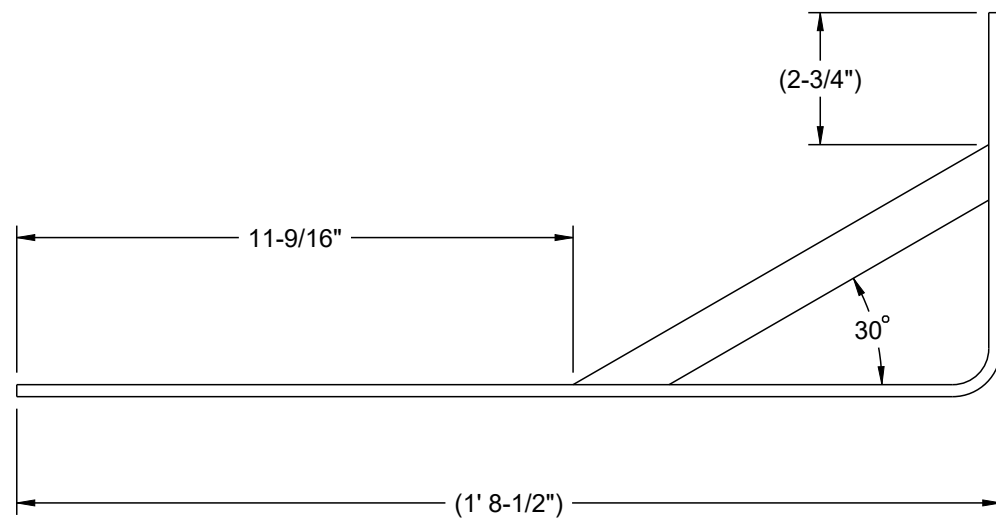
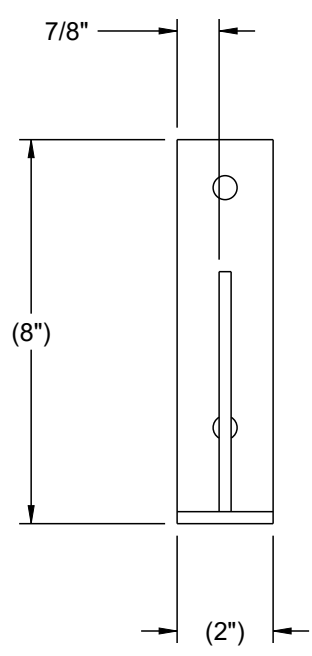
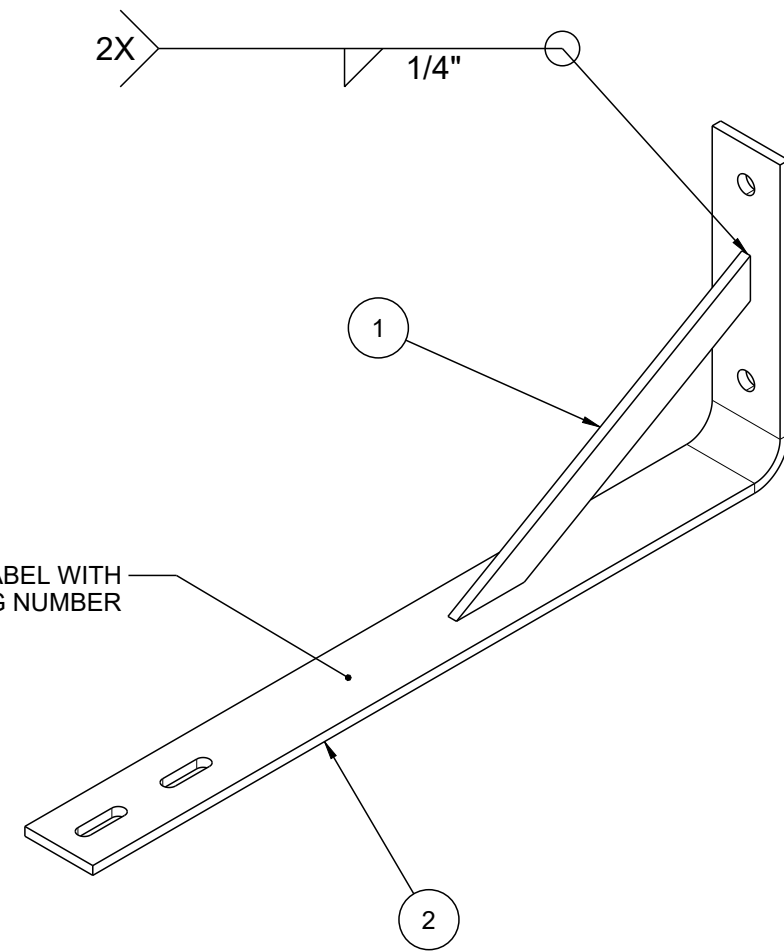
ANOXKALDNES
 SCREEN, SCUM, 14 GA X 24.00" X 48.00"LG

±1/8"	ON LINEAR DIMENSIONS	.030 = .X	(X.XXX) = REFERENCE		SCALE 1:8	DRAWING NO 2406229	SHEET 1 of 1	REV 0
±1/32"	ON HOLE Ø & LOCATIONS	.015 = .XX	(X.XXX) = INSPECTION					
±1°	ON ANGULAR DIMENSIONS	.005 = .XXX	BREAK SHARP EDGES					

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EST. WT. = 5 LBS.

ITEM	QTY	MATERIAL	DRAWING NO.	DESCRIPTION
1	1	AISI 304L	2422666	PLATE, 1/4" THK X 10.00" X 1.00"
2	1	AISI 304L	2422665	SHEET, 1/4" THK., 8.00" X 20.50" X 2.00"LG, FORMED ANGLE



- NOTES:
 1. REFER TO KRUGER "WELDING FABRICATION PROCEDURE" FOR WELD SPECIFICATIONS.
 2. REMOVE WELD SLAG, CLEAN AND DEGREASE BEFORE PASSIVATION OR PAINTING.

2422663	0.2	Released	2422663	0.2	Released
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ANOXKALDNES
 WLDMT, SUPPORT, FOAM CONTROL, SPRAY NOZZLE

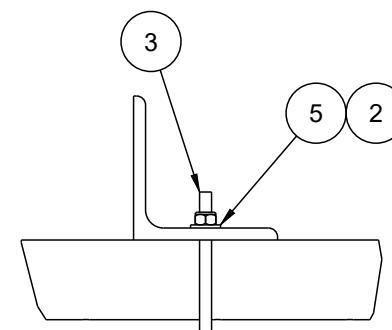
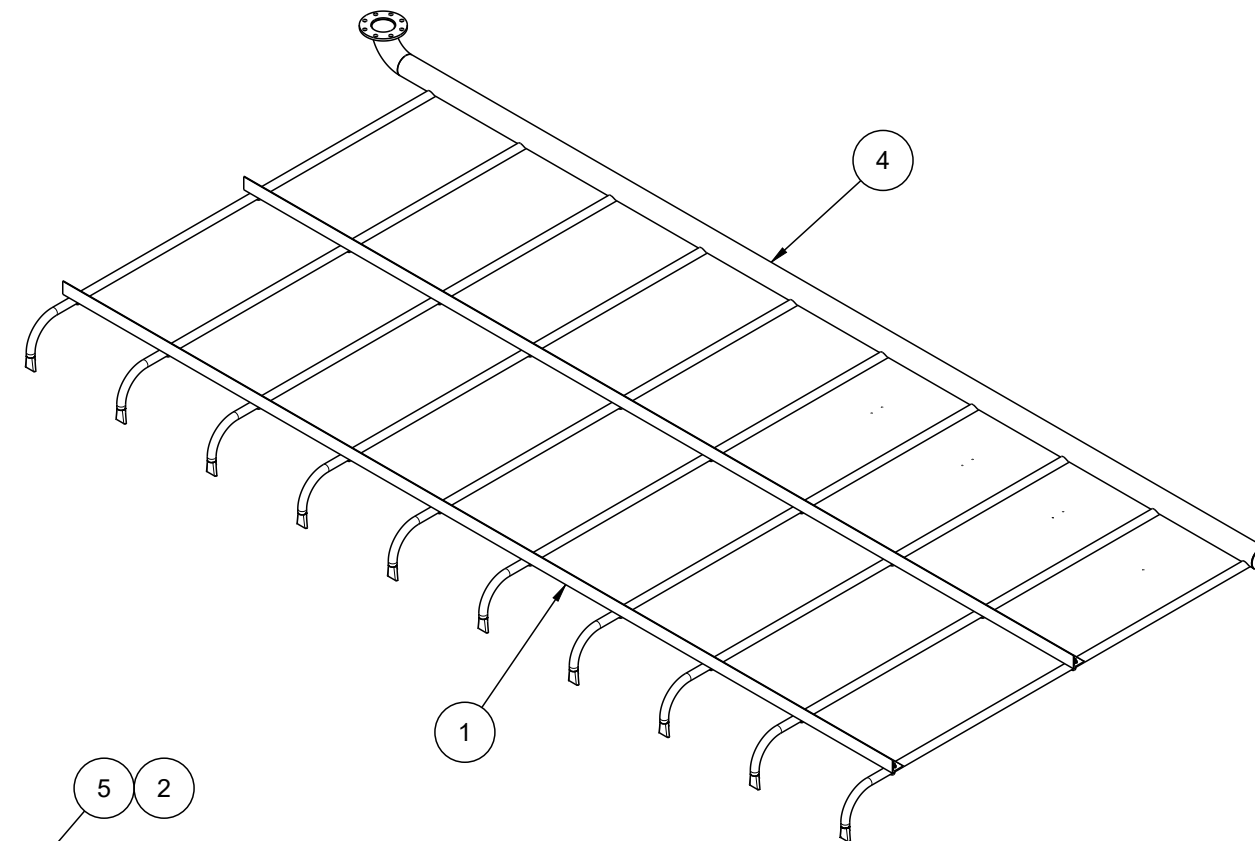
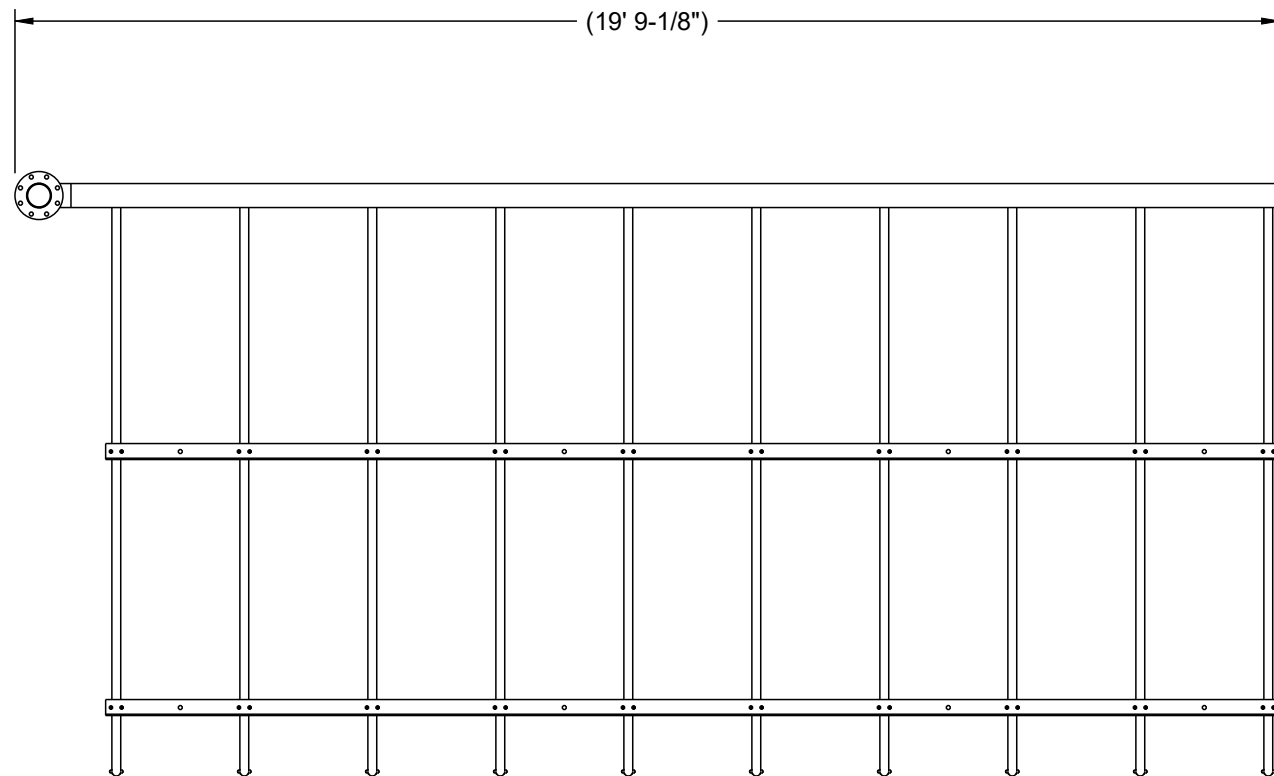
SCALE 1:4	DRAWING NO 2422663	SHEET 1 of 1	REV 0
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REV	DESCRIPTION	DRAWN	APPR	DATE
0	RELEASED FOR FABRICATION	LHB	SRW	02.08.22

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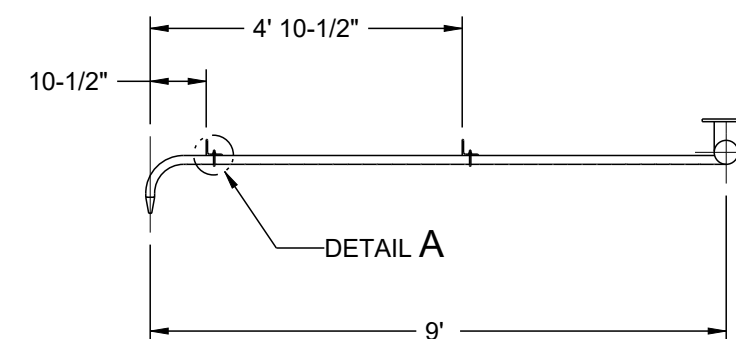
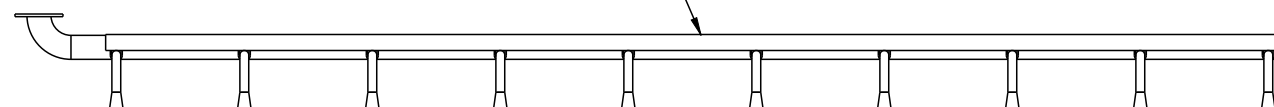
EST. WT. = 480 LBS.

ITEM	QTY	MATERIAL	DRAWING NO.	DESCRIPTION
1	2	AISI 304	2592701	AIR GRID SUPPORT, 3.00" SQ X .25"THK X 220.00"LG, (10) 1-1/4" LATERALS @ 24"OC
2	40	AISI 304	-	NUT, HEX, NYLOCK, 1/4-20, ANSI
3	20	AISI 304	-	U-BOLT, 1 1/4", 1/4-20, 1 3/4"ID, 2 3/4" LG, 1 1/8"THD, DALE CO. OR EQUIV.
4	1	SEE BOM	2592647	WLDMT, AIR GRID, 4", (10) 1-1/4" LATERALS @ 24" OC, 9' W, 370 HOLES, FLG/CAP, RH
5	40	AISI 304	-	WSHR, FLAT, 1/4", .313"ID, .625"OD, .051"THK, SAE



DETAIL A
TYP U-BOLT ATTACHMENT
SCALE 1:4

PERMANENTLY LABEL WITH
DRAWING NUMBER



- NOTES:
- CLEAN AND DEGREASE PARTS BEFORE ASSEMBLY.
 - ANTI-SEIZE TO BE APPLIED TO ALL HDWR UNLESS OTHERWISE SPECIFIED.
 - ALL HDWR TO BE TIGHTENED TO APPROPRIATE TORQUE VALUES.

2592650	0.3	Released	2592650	0.3	Released
0	RELEASED FOR FABRICATION	KDH	SRW	09.05.23	
REV	DESCRIPTION	DRAWN	APPR	DATE	

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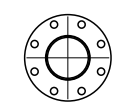
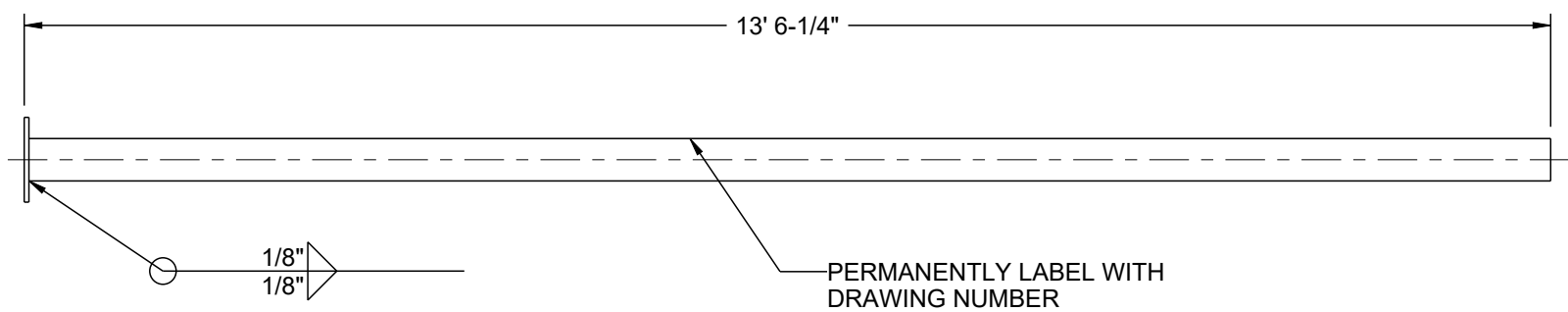
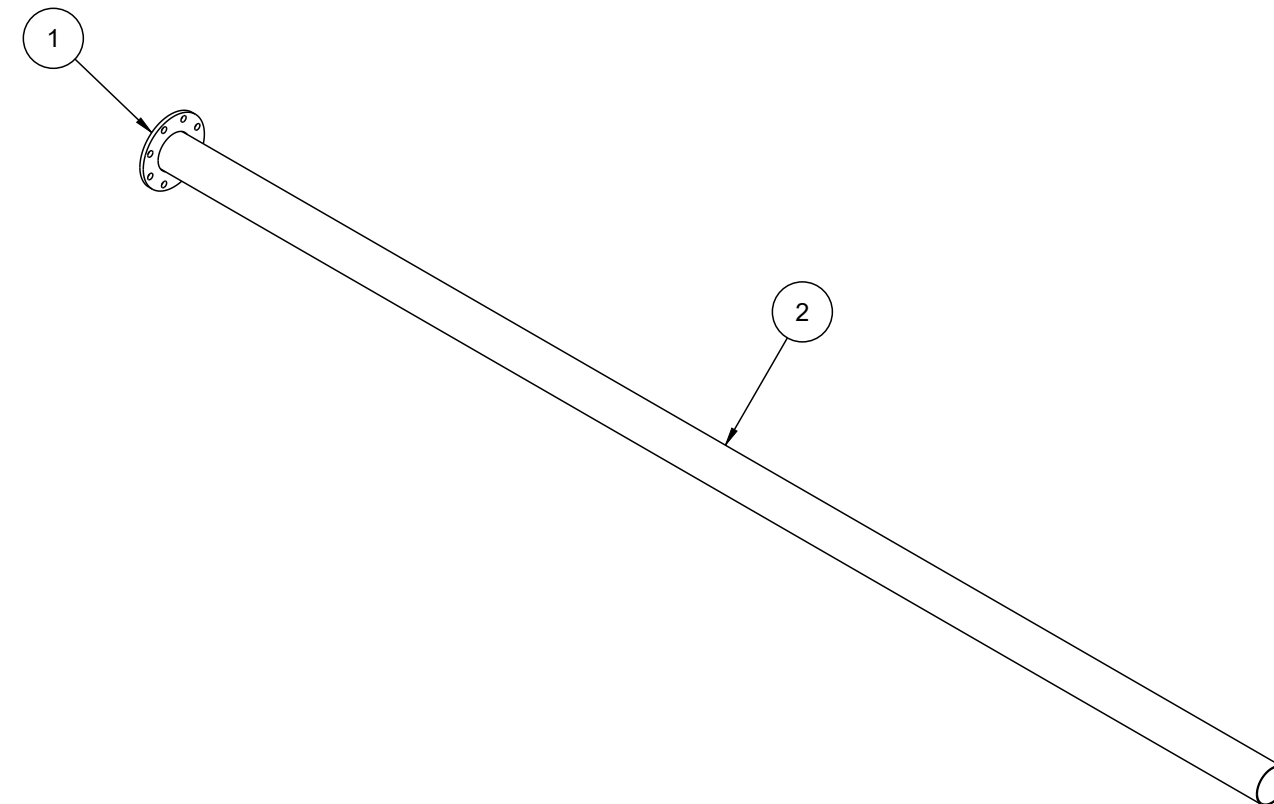
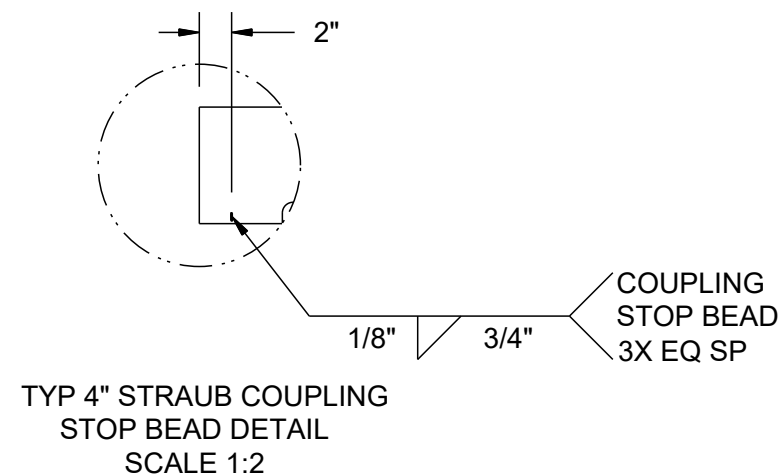
ANOXKALDNES
ASSY, AIR GRID, 4", (10) 1-1/4" LATERALS @ 24" OC, 9'
W, 370 HOLES, FLG/CAP, RH

±1/8"	ON LINEAR DIMENSIONS	.030 = .X	(X.XXX) = REFERENCE		SCALE 1:36	DRAWING NO 2592650	SHEET 1 of 1	REV 0
±1/32"	ON HOLE Ø & LOCATIONS	.015 = .XX	(X.XXX) = INSPECTION					
±1"	ON ANGULAR DIMENSIONS	.005 = .XXX	BREAK SHARP EDGES					

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EST. WT. = 84 LBS.

ITEM	QTY	MATERIAL	DRAWING NO.	DESCRIPTION
1	1	AISI 304L	-	FLG, PIPE, PL, 4", 1/2" THK, 125LB
2	1	AISI 304L	-	PIPE, 4", SCH 10, 162.00"LG



ADD STOP BEAD

REV	DESCRIPTION	DRAWN	APPR	DATE
1	REMOVED JOG IN DROP PIPE	SRW	LHB	
0	RELEASED FOR FABRICATION	KDH	SRW	09.05.23

2592654 | 1.2 | Released | 2592654 | 1.2 | Released

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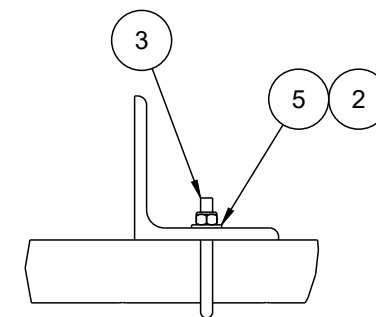
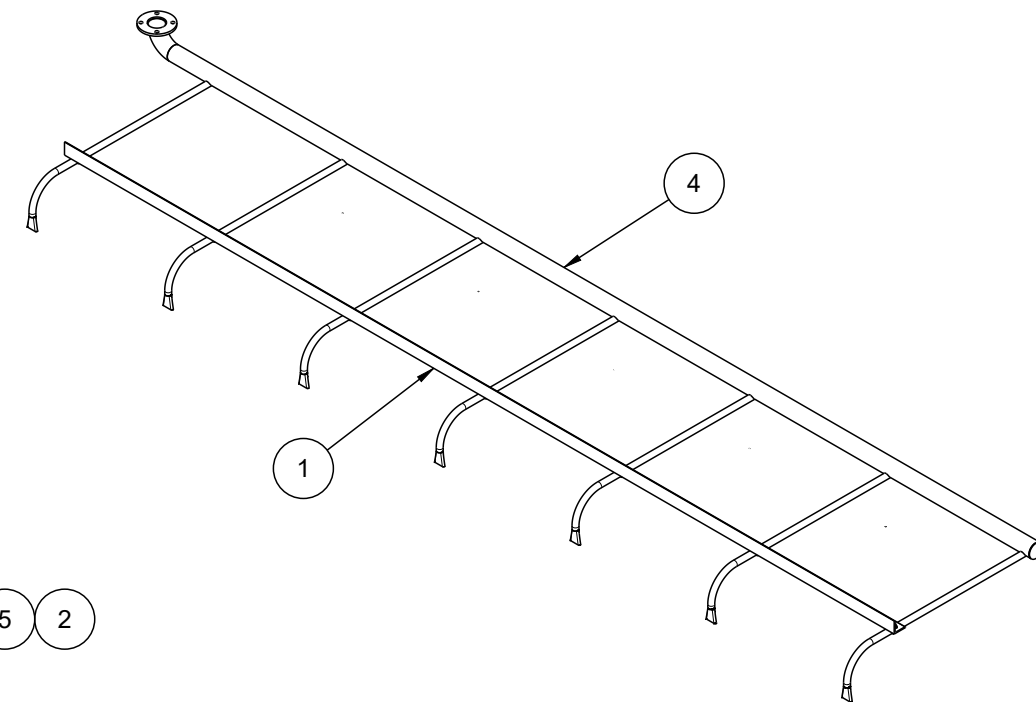
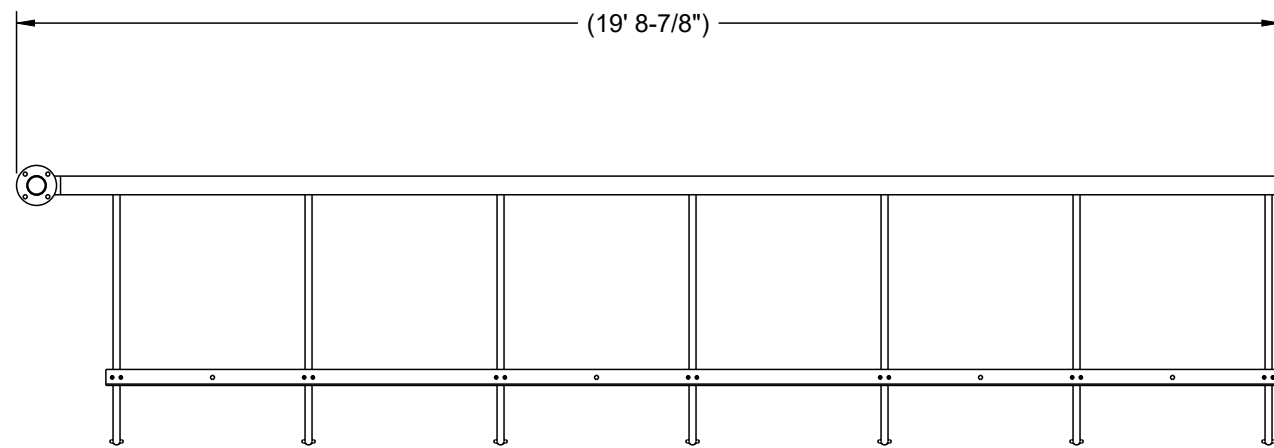
ANOXKALDNES
 WLDMT, DROP PIPE, 4", 163.50"LG

±1/8" ON LINEAR DIMENSIONS	.030 = .X	(X.XXX) = REFERENCE		SCALE 1:20	DRAWING NO 2592654	SHEET 1 of 1	REV 1
±1/32" ON HOLE Ø & LOCATIONS	.015 = .XX	(X.XXX) = INSPECTION					
±1" ON ANGULAR DIMENSIONS	.005 = .XXX	BREAK SHARP EDGES					

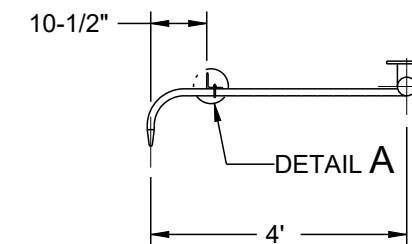
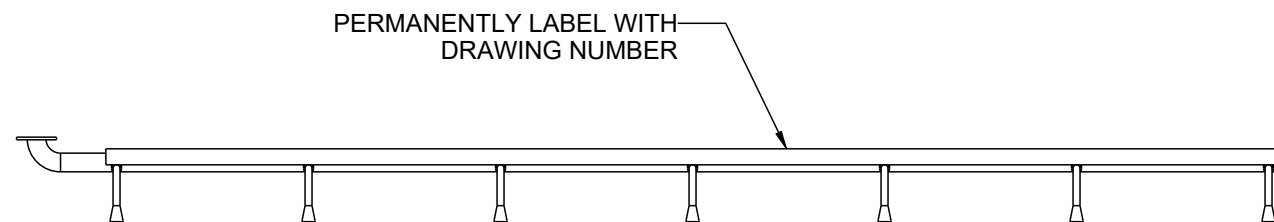
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EST. WT. = 230 LBS.

ITEM	QTY	MATERIAL	DRAWING NO.	DESCRIPTION
1	1	AISI 304	2593038	AIR GRID SUPPORT, 3.00" SQ X .25"THK X 220.00"LG, (7) 1" LATERALS @ 36"OC
2	14	AISI 304	-	NUT, HEX, NYLOCK, 1/4-20, ANSI
3	7	AISI 304	-	U-BOLT, 1", 1/4-20, 1 3/8"ID, 2 1/4" LG, 1 1/8"THD, DALE CO. OR EQUIV.
4	1	SEE BOM	2592979	WLDMT, AIR GRID, 3", (7) 1" LATERALS @ 36" OC, 4' W, 98 HOLES, FLG/CAP, RH
5	14	AISI 304	-	WSHR, FLAT, 1/4", .313"ID, .625"OD, .051"THK, SAE



DETAIL A
TYP U-BOLT ATTACHMENT
SCALE 1:4



NOTES:

- CLEAN AND DEGREASE PARTS BEFORE ASSEMBLY.
- ANTI-SEIZE TO BE APPLIED TO ALL HDWR UNLESS OTHERWISE SPECIFIED.
- ALL HDWR TO BE TIGHTENED TO APPROPRIATE TORQUE VALUES.

2592980 | 0.3 | Released | 2592980 | 0.3 | Released

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ANOXKALDNES
ASSY, AIR GRID, 3", (7) 1" LATERALS @ 36" OC, 4' W, 98
HOLES, FLG/CAP, RH

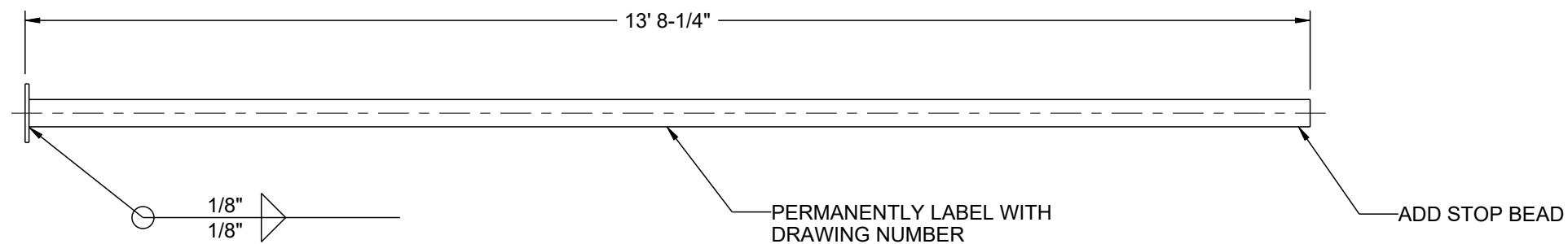
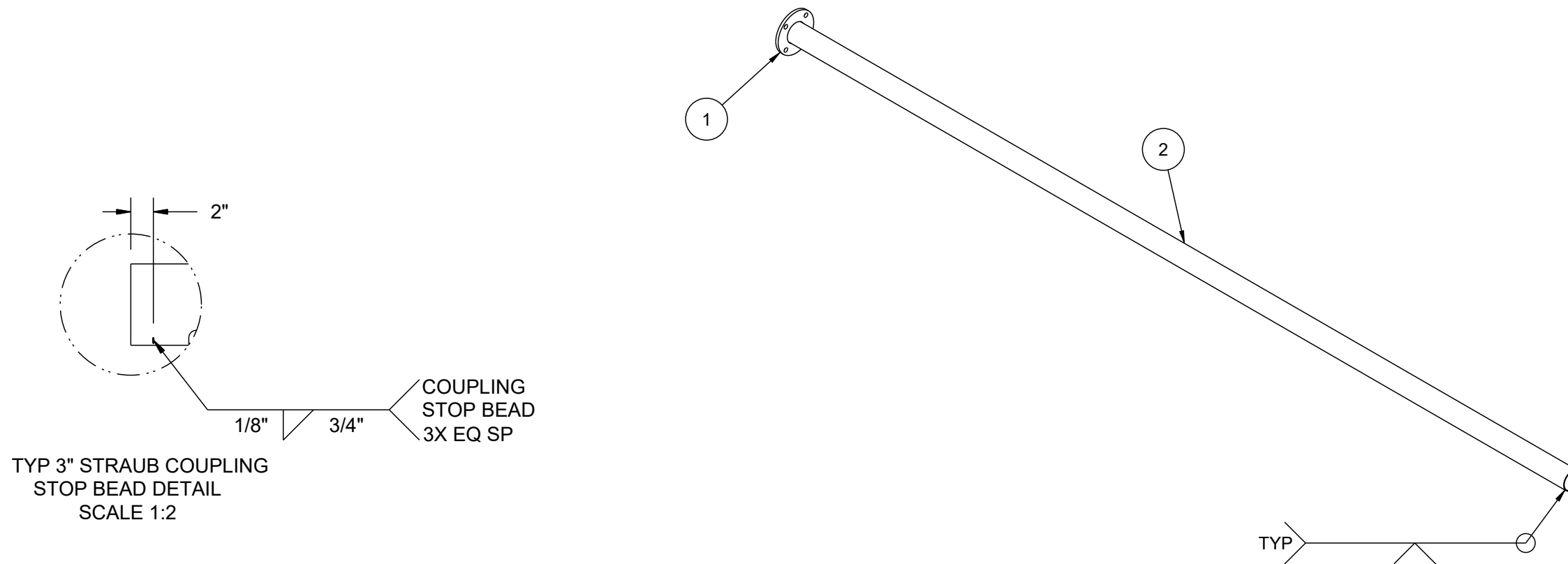
REV	DESCRIPTION	DRAWN	APPR	DATE
0	RELEASED FOR FABRICATION	KDH	SRW	09.01.23

± 1/8"	ON LINEAR DIMENSIONS	.030 = .X	(X.XXX) = REFERENCE		SCALE 1:36	DRAWING NO 2592980	SHEET 1 of 1	REV 0
± 1/32"	ON HOLE Ø & LOCATIONS	.015 = .XX	(X.XXX) = INSPECTION					
± 1"	ON ANGULAR DIMENSIONS	.005 = .XXX	BREAK SHARP EDGES					

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EST. WT. = 65 LBS.

ITEM	QTY	MATERIAL	DRAWING NO.	DESCRIPTION
1	1	AISI 304L	-	FLG, PIPE, PL, 3", 1/2" THK, 125LB
2	1	AISI 304L	-	PIPE, 3", SCH 10, 164.00"LG



2592981 | 1.2 | Released | 2592981 | 1.2 | Released

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ANOXKALDNES
 WLDMT, DROP PIPE, 3", 164.75"LG

REV	DESCRIPTION	DRAWN	APPR	DATE
1	REMOVED DOG LEG	SRW	LHB	10.10.23
0	RELEASED FOR FABRICATION	KDH	SRW	09.01.23

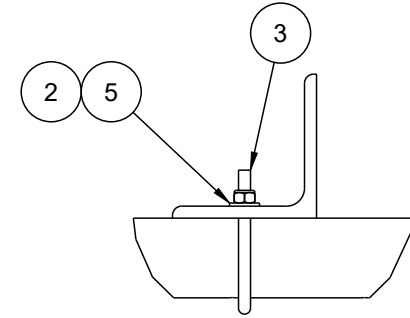
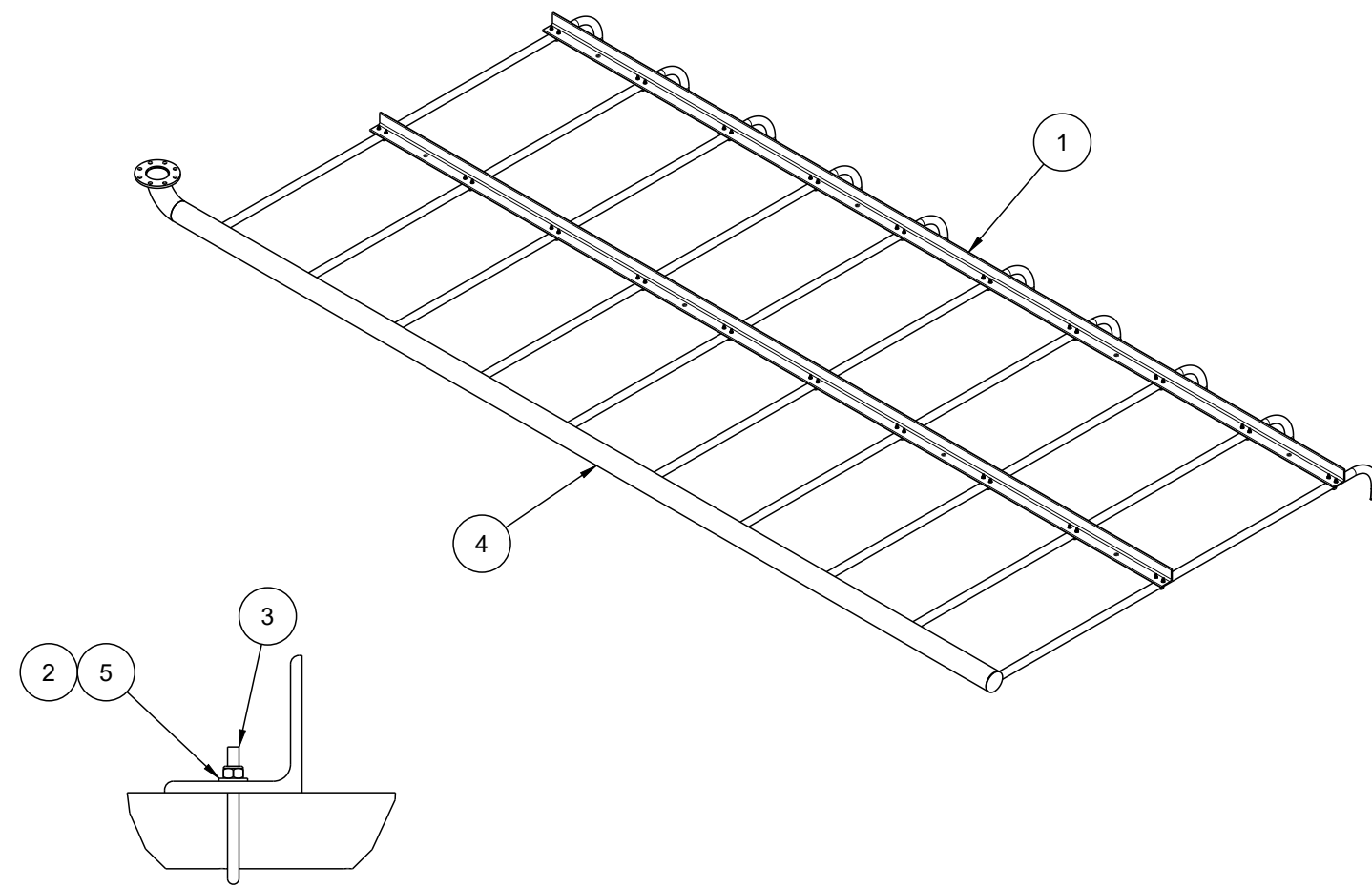
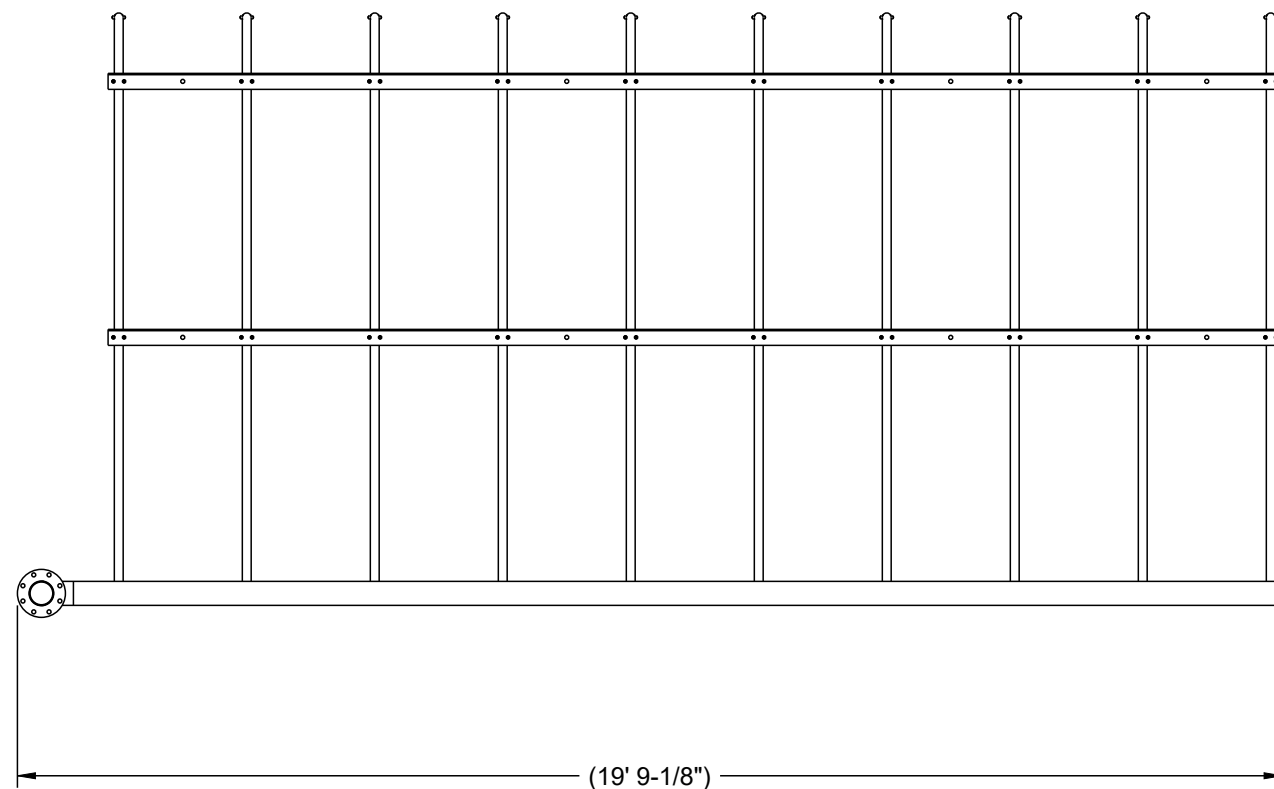
±1/8"	ON LINEAR DIMENSIONS	.030 = .X	(X.XXX) = REFERENCE
±1/32"	ON HOLE Ø & LOCATIONS	.015 = .XX	(X.XXX) = INSPECTION
±1"	ON ANGULAR DIMENSIONS	.005 = .XXX	BREAK SHARP EDGES

SCALE	DRAWING NO	SHEET	REV
1:20	2592981	1 of 1	1

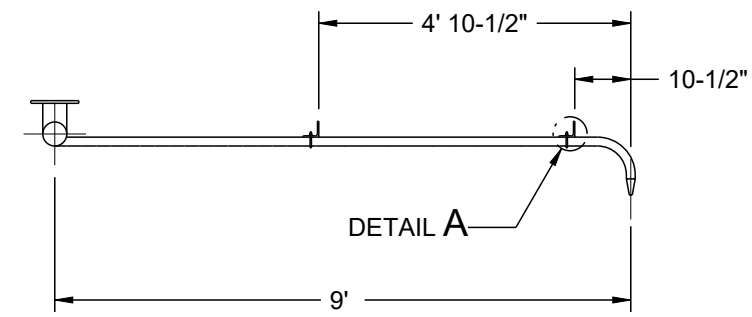
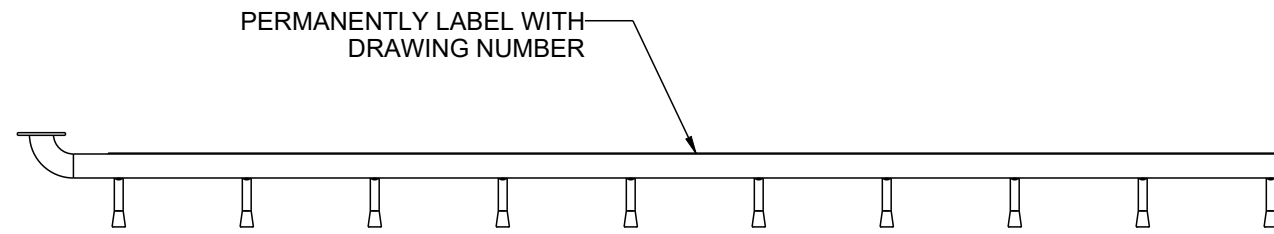
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EST. WT. = 480 LBS.

ITEM	QTY	MATERIAL	DRAWING NO.	DESCRIPTION
1	2	AISI 304	2594374	AIR GRID SUPPORT, 3.00" SQ X .25"THK X 220.00"LG, (10) 1-1/4" LATERALS @ 24"OC
2	40	AISI 304	-	NUT, HEX, NYLOCK, 1/4-20, ANSI
3	20	AISI 304	-	U-BOLT, 1 1/4", 1/4-20, 1 3/4"ID, 2 3/4" LG, 1 1/8"THD, DALE CO. OR EQUIV.
4	1	SEE BOM	2593311	WLDMT, AIR GRID, 4", (10) 1-1/4" LATERALS @ 24" OC, 9' W, 370 HOLES, FLG/CAP, LH
5	40	AISI 304	-	WSHR, FLAT, 1/4", .313"ID, .625"OD, .051"THK, SAE



DETAIL A
TYP U-BOLT ATTACHMENT
SCALE 1:4



- NOTES:
1. CLEAN AND DEGREASE PARTS BEFORE ASSEMBLY.
 2. ANTI-SEIZE TO BE APPLIED TO ALL HDWR UNLESS OTHERWISE SPECIFIED.
 3. ALL HDWR TO BE TIGHTENED TO APPROPRIATE TORQUE VALUES.

2593310 0.3 Released		2593310 0.3 Released	
0	RELEASED FOR FABRICATION	KDH	SRW
REV	DESCRIPTION	DRAWN	APPR
			DATE
			09.01.23

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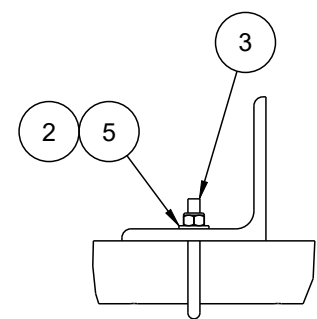
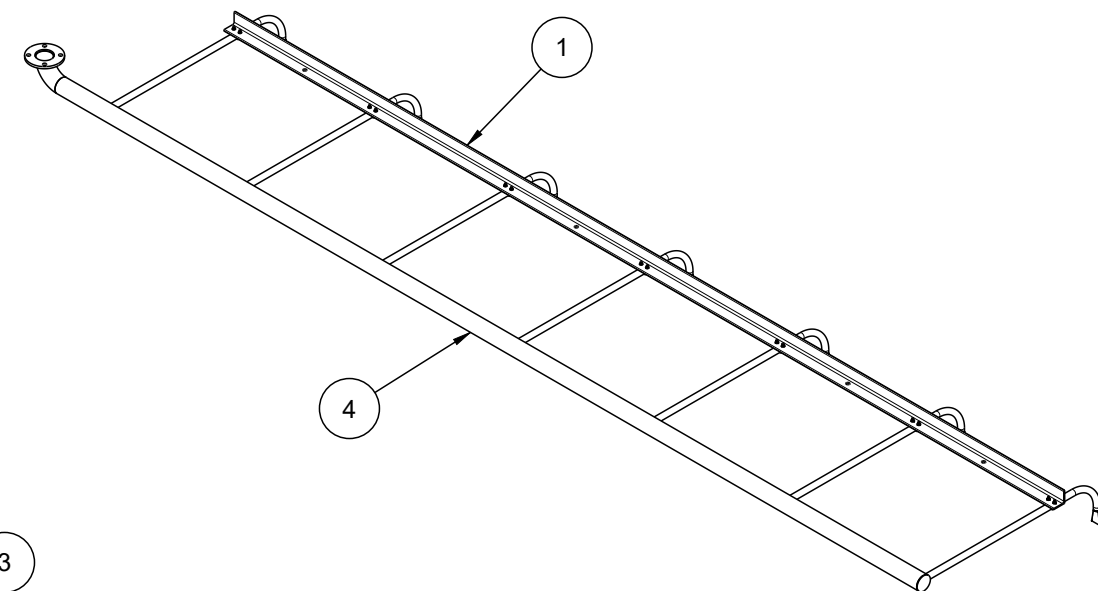
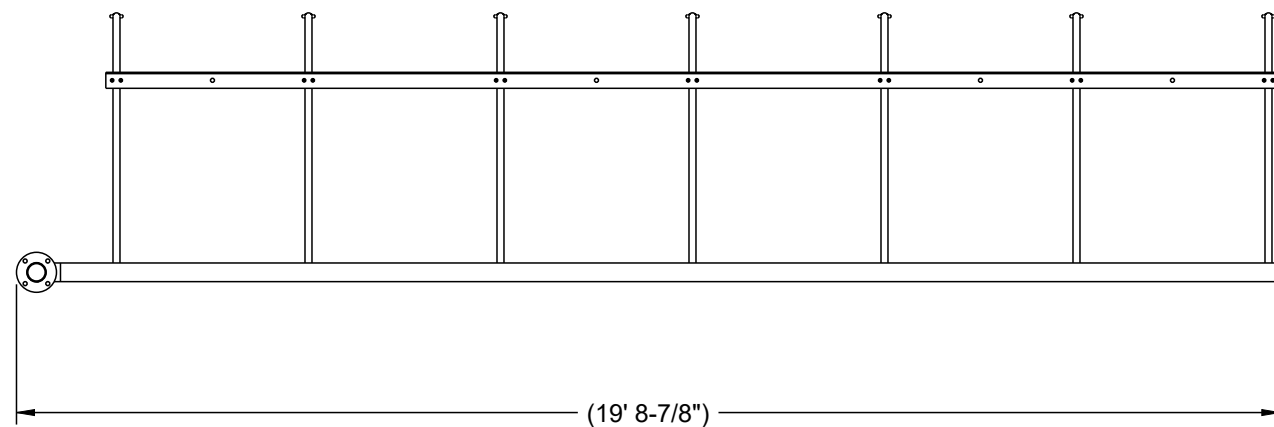
ANOXKALDNES
ASSY, AIR GRID, 4", (10) 1-1/4" LATERALS @ 24" OC, 9'
W, 370 HOLES, FLG/CAP, LH

SCALE 1:36	DRAWING NO 2593310	SHEET 1 of 1	REV 0
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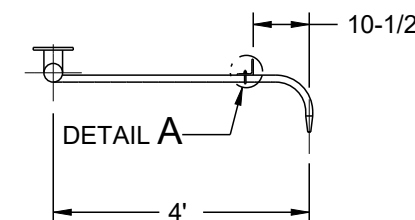
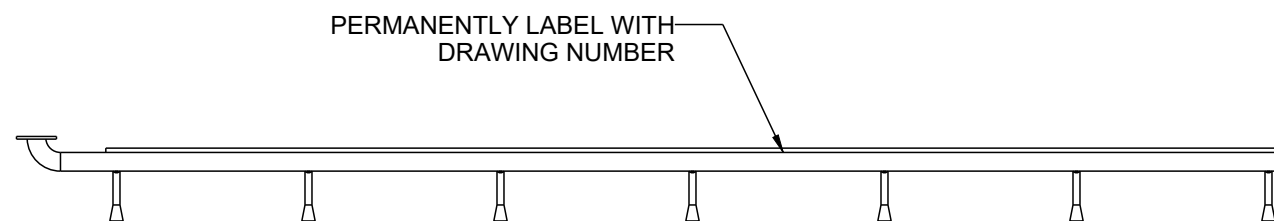
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EST. WT. = 230 LBS.

ITEM	QTY	MATERIAL	DRAWING NO.	DESCRIPTION
1	1	AISI 304	2594373	AIR GRID SUPPORT, 3.00" SQ X .25"THK X 220.00"LG, (7) 1" LATERALS @ 36"OC
2	14	AISI 304	-	NUT, HEX, NYLOCK, 1/4-20, ANSI
3	7	AISI 304	-	U-BOLT, 1", 1/4-20, 1 3/8"ID, 2 1/4" LG, 1 1/8"THD, DALE CO. OR EQUIV.
4	1	SEE BOM	2593607	WLDMT, AIR GRID, 3", (7) 1" LATERALS @ 36" OC, 4' W, 98 HOLES, FLG/CAP, LH
5	14	AISI 304	-	WSHR, FLAT, 1/4", .313"ID, .625"OD, .051"THK, SAE



DETAIL A
TYP U-BOLT ATTACHMENT
SCALE 1:4



NOTES:

1. CLEAN AND DEGREASE PARTS BEFORE ASSEMBLY.
2. ANTI-SEIZE TO BE APPLIED TO ALL HDWR UNLESS OTHERWISE SPECIFIED.
3. ALL HDWR TO BE TIGHTENED TO APPROPRIATE TORQUE VALUES.

2593606	0.3	Released	2593606	0.3	Released
0	RELEASED FOR FABRICATION	KDH	SRW	09.01.23	
REV	DESCRIPTION	DRAWN	APPR	DATE	

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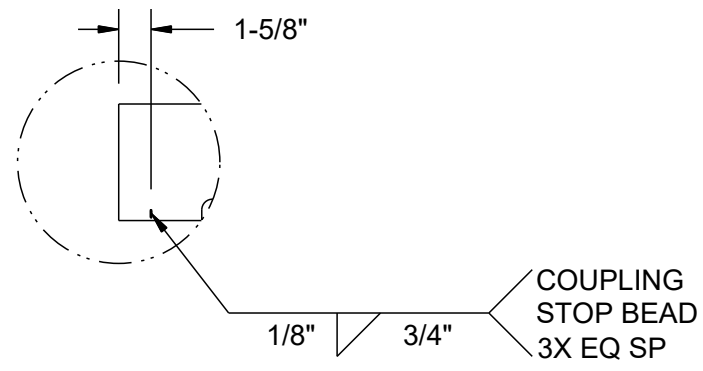
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KRUGER
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ANOXKALDNES
ASSY, AIR GRID, 3", (7) 1" LATERALS @ 36" OC, 4' W, 98 HOLES, FLG/CAP, LH

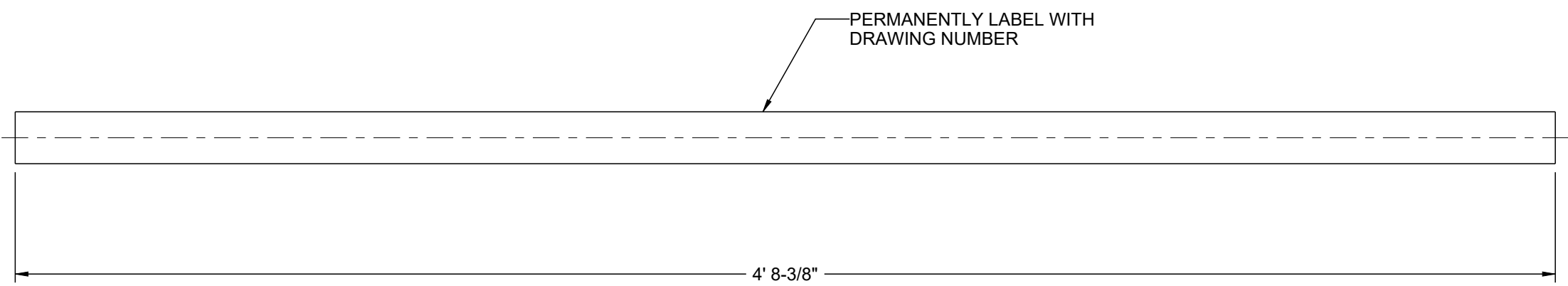
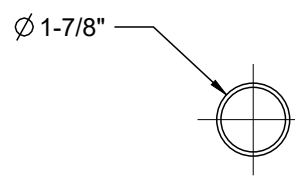
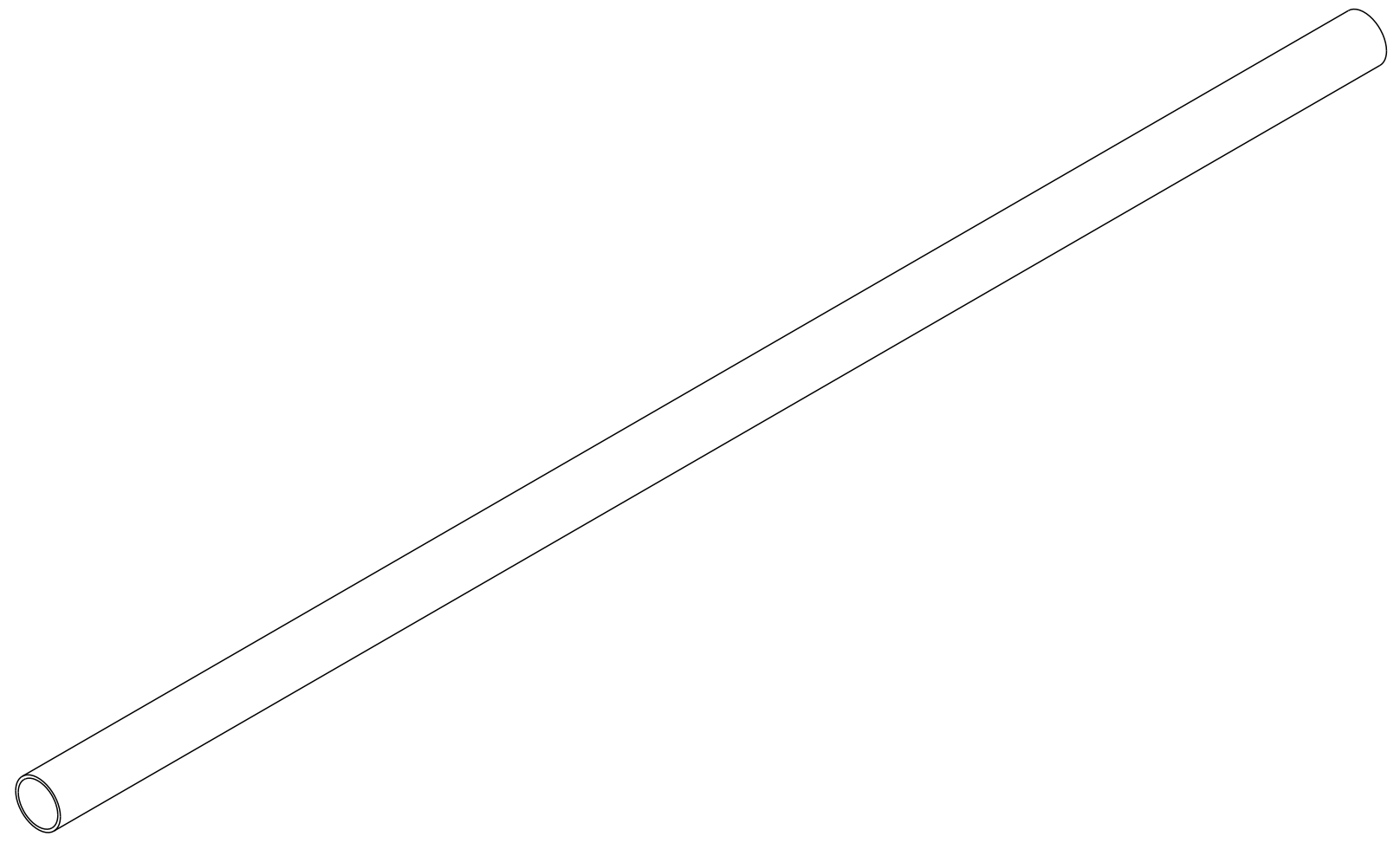
SCALE 1:36	DRAWING NO 2593606	SHEET 1 of 1	REV 0
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EST. WT. = 10 LBS.
 MAT'L = AISI_304L



TYP 1-1/2" STRAUB COUPLING
 STOP BEAD DETAIL
 SCALE 1:2
 TYP BOTH ENDS



2593948 | 0.2 | Released | 2593948 | 0.2 | Released

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ANOXKALDNES
 PIPE, 1 1/2", SCH 10, SPARGER CONNECTING 56.38"LG

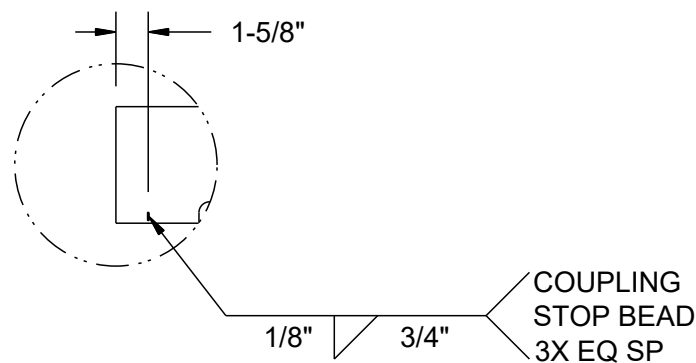
±1/8"	ON LINEAR DIMENSIONS	.030 = .X	(X.XXX) = REFERENCE		SCALE 1:5	DRAWING NO 2593948	SHEET 1 of 1	REV 0
±1/32"	ON HOLE Ø & LOCATIONS	.015 = .XX	(X.XXX) = INSPECTION					
±1"	ON ANGULAR DIMENSIONS	.005 = .XXX	BREAK SHARP EDGES					

REV	DESCRIPTION	DRAWN	APPR	DATE
0	RELEASED FOR FABRICATION	LHB	SRW	09.26.23

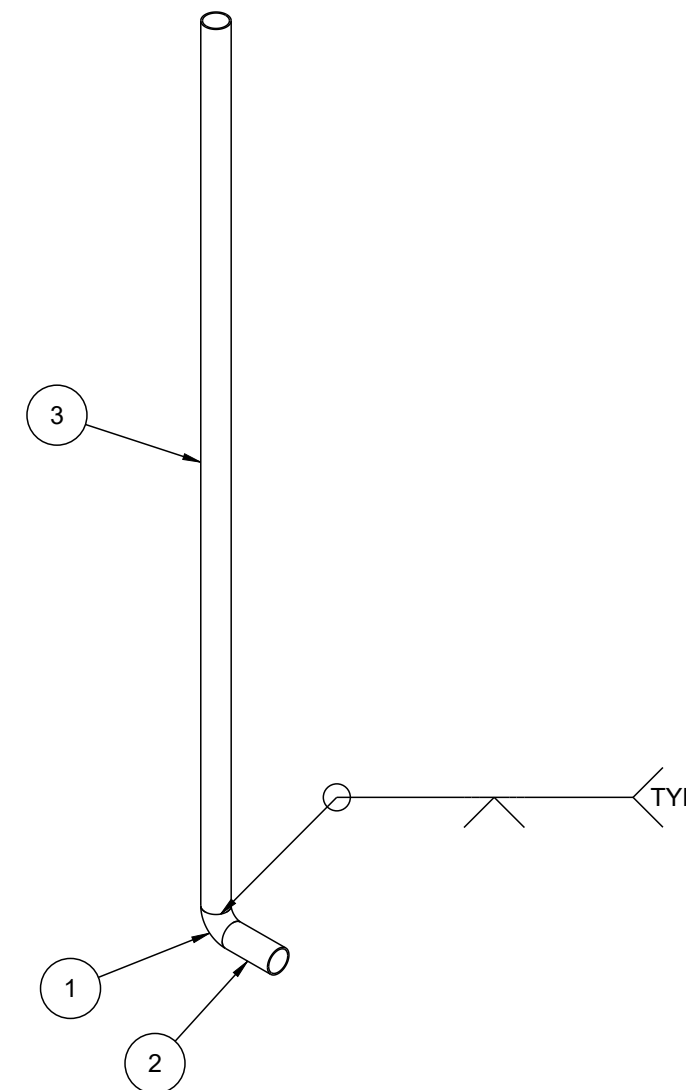
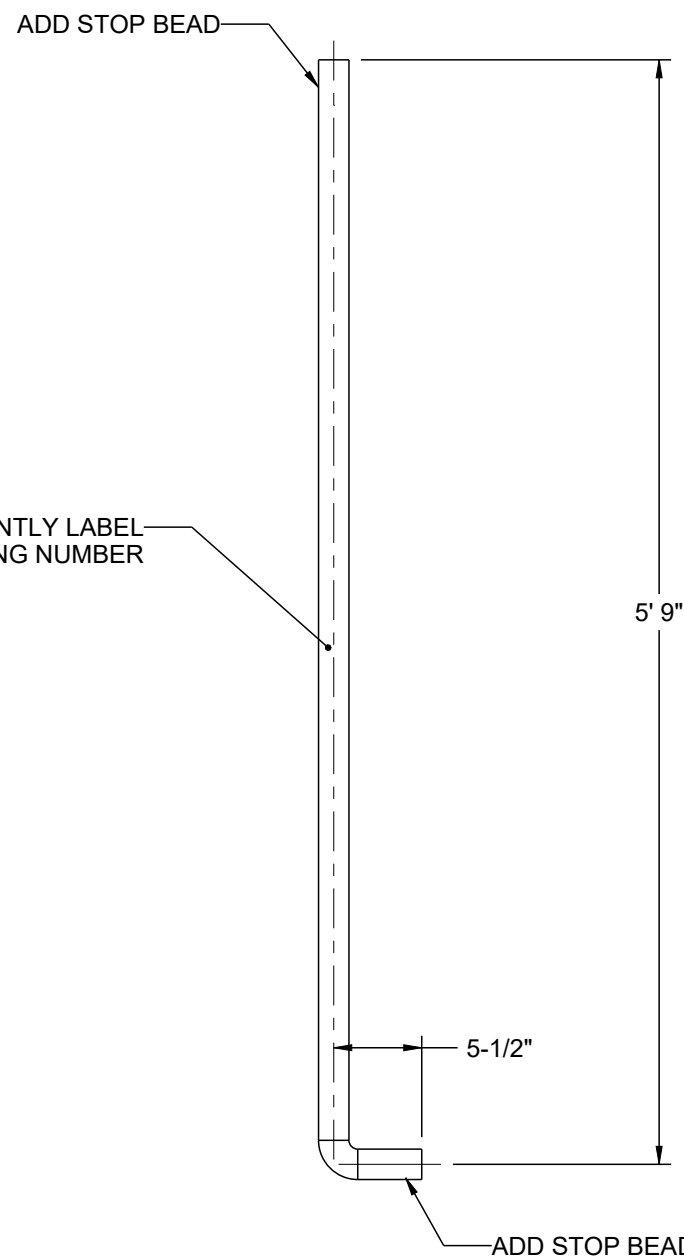
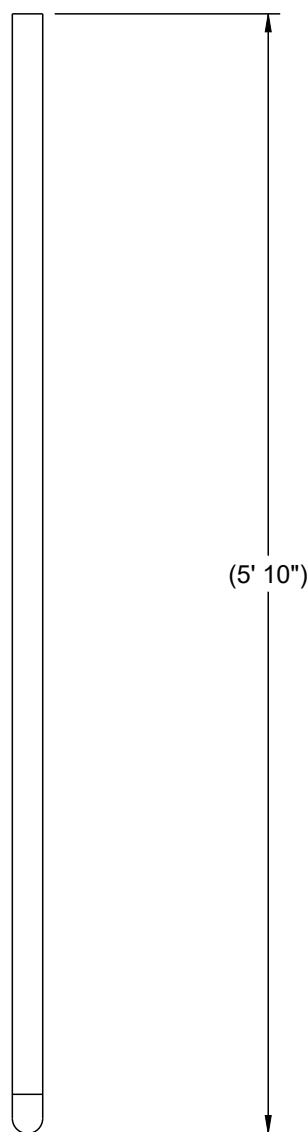
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EST. WT. = 13 LBS.

ITEM	QTY	MATERIAL	DRAWING NO.	DESCRIPTION
1	1	AISI 304L	-	ELB, PIPE, 1 1/2", SCH 10, BW
2	1	AISI 304L	-	PIPE, 1 1/2", SCH 10, 4.00"LG
3	1	AISI 304L	-	PIPE, 1 1/2", SCH 10, 67.53"LG



TYP 1-1/2" STRAUB COUPLING
STOP BEAD DETAIL
SCALE 1:2



PERMANENTLY LABEL
WITH DRAWING NUMBER

REV	DESCRIPTION	DRAWN	APPR	DATE
1	SHORTENED O.A.L. OF DROP PIPE	LHB	SRW	10.05.23
0	RELEASED FOR FABRICATION	KDH	SRW	09.01.23

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ANOXKALDNES
WLDMT, DROP PIPE, 1-1/2" SPARGER

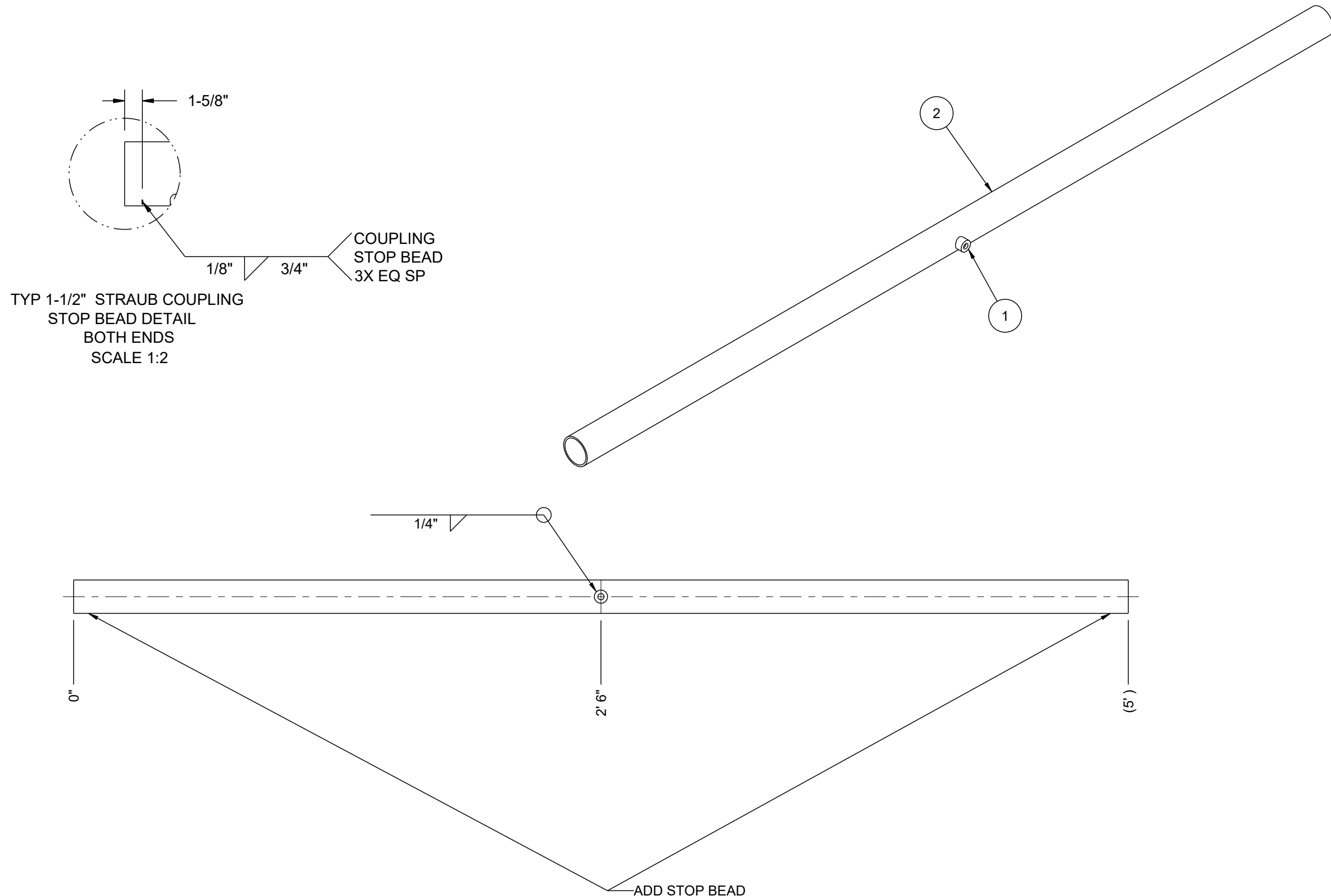
± 1/8" ON LINEAR DIMENSIONS	.030 = .XX	(X.XXX) = REFERENCE		SCALE 1:12	DRAWING NO 2593967	SHEET 1 of 1	REV 1
± 1/32" ON HOLE Ø & LOCATIONS	.015 = .XX	(X.XXX) = INSPECTION					
± 1° ON ANGULAR DIMENSIONS	.005 = .XXX	BREAK SHARP EDGES					

NOT RELEASED

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EST. WT. = 11 LBS.

ITEM	QTY	MATERIAL	DRAWING NO.	DESCRIPTION
1	1	AISI 304L	-	CPLG, HALF, 1/4" NPT, 1000PSI
2	1	AISI 304L	-	PIPE, 1 1/2", SCH 10, 60.00"LG



2608736	0.1	In Work	2608736	0.1	In Work
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ANOXKALDNES
 WLDMT, PIPE, FOAM CONTROL SPRAY NOZZLE, LONG

SCALE	DRAWING NO	SHEET	REV
1:6	2608736	1 of 1	0

REV	DESCRIPTION	DRAWN	APPR	DATE
0	RELEASED FOR FABRICATION	LHB	SRW	10.05.23

NOT RELEASED

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5.0 INSTRUMENTATION & CONTROLS

- 5.1 Bill of Materials**
- 5.2 Vendor Data Sheets**
- 5.3 Control Panel Drawings**
- 5.4 Field Instruments**

5.1 BILL OF MATERIALS

Rev0

Aberdeen, WY
PROJECT 5703212001
IFAS PLC
Bill of Material

Qty	Panel Tag	Part Number	Description	Manufacturer
1	PLC-100-B2	SCE-60EL4818FSD	TYPE 12 FREESTANDING ENCL. ("60Hx48"Wx18"D)	SAGINAW
1		SCE-60P48F1	BACKPANEL (57"Hx 45"W)	SAGINAW
1	SHELF	SCE-FS1212	PANEL SHELF	SAGINAW
1	CABLIGHT	SCELF24	CABINET LIGHT	SAGINAW
1	SA-L	2856702	SURGE PROTECTION	EATON
1	MCB-1	QOU120	20A MAIN CIRCUIT BREAKER, 1-POLE, 120VAC (MCB)	SQUARE D
1	DC1	2866750	24VDC POWER SUPPLY 5A	PHOENIX CONTACT
8	SA-(101-102)	28 38 22 8	ANALOG SURGE ARRESTOR	PHOENIX CONTACT
8	SA-(101-102)	28 39 20 8	ANALOG SURGE ARRESTOR BASE	PHOENIX CONTACT
16	IN-(101-102)	28 64 40 6	ANALOG ISOLATOR	PHOENIX CONTACT
9	IN-(101-102)	28 69 72 8	ANALOG ISOLATOR POWER BUS CONNECTOR	PHOENIX CONTACT
1	IN-(101-102)	28 64 13 4	ANALOG ISOLATOR POWER TERMINAL	PHOENIX CONTACT
2	N & G	3044160	SINGLE LEVEL TERMINAL (U10)	PHOENIX CONTACT
5	N, G, GND, COM, N1	3047028	SINGLE LEVEL TERMINAL END COVER	PHOENIX CONTACT
10	GND	3044128	SINGLE LEVEL TERMINAL, GROUND	PHOENIX CONTACT
20	COM, H1, N1	3044102	SINGLE LEVEL TERMINAL (U4)	PHOENIX CONTACT
39	TB103-104, PTB(1-2), VTB(1-5)	3044814	UTTB4 DOUBLE LEVEL TERMINAL BLOCK	PHOENIX CONTACT
8	TB103-104, PTB(1-2), VTB(1-5)	3047293	DOUBLE LEVEL END COVER	PHOENIX CONTACT
2	TBISB(1-2)	3002389	BLUE TRIPLE LEVEL TERMINAL BLOCK	PHOENIX CONTACT
2	TBISB(1-2)	3214314	BLUE TRIPLE LEVEL TERMINAL BLOCK END COVER	PHOENIX CONTACT
7	EB-2	1201413	DOUBLE LEVEL TERMINAL END BARRIER	PHOENIX CONTACT
7	EB-1	1201442	SINGLE LEVEL TERMINAL END BARRIER	PHOENIX CONTACT
14	CB-1-9, CB-101-105	9080GCB30	3.0A CIRCUIT BREAKER	SQUARE D
3	CB-GFCI, CB-UPS, MCB-2	QOU110	10.0A CIRCUIT BREAKER	SQUARE D
17	CR104, CR-UPS	700-HN222	RELAY BASES	ALLEN-BRADLEY
17	CR104, CR-UPS	700-HK32Z24	OUTPUT RELAY, 2PDT, FORM C CONTACT, 24VDC	ALLEN-BRADLEY
1	CR-UPS	RXM2AB1F7	OUTPUT RELAY, 2PDT, FORM C CONTACT, 120VAC	SQUARE D
1	CR-UPS	RXE2M114	RELAY BASES	SQUARE D
k 1	PLC	5069-L306ER	COMPACTLOGIC PLC PROCESSOR	ALLEN-BRADLEY
k 2	PLC	5069-IF8	DC POWERED ANALOG INPUT CARD	ALLEN-BRADLEY
k 1	PLC	5069-IB16	DC POWERED DISCRETE INPUT CARD	ALLEN-BRADLEY
k 1	PLC	5069-OB16	DC POWERED DISCRETE OUTPUT CARD	ALLEN-BRADLEY
k 4	PLC	5069-RTB18-SCREW	SCREW TERMINAL FOR MODULE	ALLEN-BRADLEY
k 1	PLC	5069-RTB64-SCREW	SCREW TERMINAL FOR POWER	ALLEN-BRADLEY
k 1	HMI	2711P-T15C22D9P	PANELVIEW PLUS 7 STANDARD 15" (24VDC)	ALLEN-BRADLEY
k 1	ENET	2891929	8 PORT ETHERNET SWITCH	PHOENIX CONTACT
2	PB-1, 2	9001SKR1BH5	PUSH BUTTON, FLUSH, NON-ILL, MOM. N.O. CONTACT	SQUARE D
1	UPS	SDU850B	UNINTERRUPTIBLE POWER SUPPLY 850VA	SOLA
4	ISB	KFD0-CS-Ex1.50P	INTRINSIC SAFETY BARRIER	PEPPER+FUCHS
2	UPS-IN, UPS-OUT	2963860	RECEPTACLE TO MATCH PLUG FROM UPS/ENET	PHOENIX CONTACT
1	GFCI	0804179	RECEPTACLE	PHOENIX CONTACT
LOT	MISC	AS REQUIRED	MISC. (WIRE, CABLE, WIRE DUCT, DIN RAIL, TERMINAL MARKERS, LEGENDS, NAMEPLATES, ETC.)	

AR- As required

5.2 VENDOR DATA SHEETS



Saginaw Control and Engineering
95 Midland Road Saginaw, MI 48638-5770
(800) 234-6871 - Fax: (989) 799-4524
SCE@SaginawControl.com

SCE-60EL4818FSD



Product Specifications:

Part Number: SCE-60EL4818FSD

Description: EL FSD Enclosure

Height: 60.00"

Width: 48.00"

Depth: 18.00"

Price Code: A2

List Price: \$2,649.49

Catalog Page: 138

Est. Ship Weight: 381.08 lbs

Construction

- * 0.104 In. carbon steel.
- * Two-Door Single Access.
- * Removable and interchangeable doors.
- * Seams continuously welded and ground smooth.
- * Lifting eyes for easy handling.
- * Black zinc die cast keylocking/padlocking handle.
- * 3-point latching mechanism.
- * Latch rods have ramp shoes for easier door closing.
- * Flange trough collar around all sides of door opening.
- * Removable center post.
- * Mounting channels welded horizontally on sides of interior body at top, bottom and middle for mounting optional panels or rack mounting angles.
- * Pour in place oil & water resistant gasket
- * Ground stud on door and body.
- * Provisions for light kit.
- * Concealed hinges.
- * Holes plugs provided to seal holes in bottom of enclosure.
- * Removable print pocket.

Application

Designed to house a variety of electrical and electronic controls and instruments. Provisions for optional surface mounting or rack mounting of almost any type of equipment. Provides protection from dust, dirt, water and oil. The enclosures are extra deep for applications requiring more interior space. For outdoor application a drip shield and drain vent is recommended.

For Details about the design, performance expectations, applications and design suggestions - See Design Considerations
www.saginawcontrol.com/instman/considerations.pdf

Finish

ANSI-61 gray finish Inside and outside. Optional sub-panels are powder coated white.

Industry Standards - (IS4)

- * NEMA Type 3R, 4, 12 and Type 13
- * UL Listed Type 3R, 4 and 12
- * CSA Type 3R, 4 and 12
- * IEC 60529
- * IP 66

Notes

Optional panels and accessories available.

Special Instructions apply for IS3, IS4 and IS6 to maintain the environmental rating of Type 3R for these parts. Instructions are located on the enclosure door. Drip shield is required on IS3, drip shield is recommended on IS4 and IS6. Drain holes are required on all.

Accessories Included

SCE-HS2S Hole Seal, 2 Inch Square

Optional Accessories

SCE-104941 Mechanical Interlock (Left Door Main)
SCE-105604 Mechanical Interlock (Right Door Main)
SCE-13ELJEXPP Pocket, Exterior Print
SCE-19ELJEXPP Pocket, Exterior Print
SCE-60FSCPS Support, Center Panel
SCE-60FSDHPS Panel Support Heavy Duty
SCE-60P24F1 Subpanel, Full
SCE-60P24F2 Subpanel, Half
SCE-60P48F1 Subpanel, Full
SCE-60RA19TH Angle, Rack
SCE-60RP24F5 Angle, Rack
SCE-60RP24F6 Angle, Rack
SCE-60SMP14 Subpanel, Side Mount
SCE-72P24F2 Subpanel, Half
SCE-72P48F2 Subpanel, Half
SCE-72RP24F5 Angle, Rack
SCE-72RP24F6 Angle, Rack
SCE-90P24F2 Subpanel, Half
SCE-90RP24F6 Angle, Rack
SCE-BVK Breather Vent
SCE-DS48N4 Shield, Drip
SCE-FS1212 Shelf, Folding
SCE-FS1818 Shelf, Folding
SCE-FS2424 Shelf, Folding
SCE-LF18 Fixture, LED Light
SCE-LF18NO Fixture, LED Light w/o Outlet
SCE-RDL60EL48FSD Door, Replacement
SCE-RDR60EL48FSD Door, Replacement

Similar Part Numbers

SCE-72EL4818FSDEL FSD Enclosure
SCE-72EL4824FSDEL FSD Enclosure
SCE-72EL6018FSDEL FSD Enclosure
SCE-72EL6024FSDEL FSD Enclosure
SCE-72EL6036FSDEL FSD Enclosure

Installation Information

- * Center Panel Support Assembly
- * Heavy Duty Panel Supports - In Two Door FS Enclosure
- * Rack Mounting Angles
- * Swing-Out Full Panel
- * Swing-Out Rack Mounting Frame
- * Swing-Out Half Panel
- * Drip Shield Kit Assembly
- * Folding Shelf Hole Pattern
- * Removable Wire Cover
- * LED Light Fixture
- * Hole Seal
- * Free-Standing Two-Door Single Access Accessories
- * Service Parts Free Standing & Floor Mount Enclosures
- * Design Considerations When Specifying Your Enclosure



SCE-60P48F1

Product Specifications:



Part Number: SCE-60P48F1
Description: Subpanel, Full
Height: 48.00"
Width: 44.00"
Depth: 0.88"
Price Code: p3
List Price: \$362.60
Catalog Page: 150
Est. Ship Weight: 98.00 lbs

Construction

- * 0.125 In. carbon steel.
- * 0.125 In. Galvanized.

Application

Panels for two-door enclosures, can be positioned anywhere along the Horizontal mounting channels. Mounting hardware is included. Made of heavy gauge steel and powder coated white. GALV panels made of galvanized steel.

Industry Standards - (IS17)

- * NEMA Not Applicable
- * UL Not Applicable
- * CSA N/A

Accessories Included

SCE-FSPS8 Kit, FS Panel Support

Similar Part Numbers

SCE-72P48F1Subpanel, Full
SCE-72P48F1GALVSubpanel, Full Galvanized
SCE-72P60F1Subpanel, Full
SCE-72P60F1GALVSubpanel, Full Galvanized

Installation Information

- * Individual Panel Supports



SCE-FS1212

Product Specifications:



Part Number: SCE-FS1212
Description: Shelf, Folding
Height: 12.00"
Width: 12.00"
Depth: 1.75"
Catalog Page: 413
Est. Ship Weight: 9.32 lbs

Application

Folding shelves can be installed on the inside or outside of large enclosures. They are designed to support test equipment and programmers. Locks in the horizontal position. When not in use, shelf can be folded down. Made of heavy gauge steel and powder coated. "SS" parts are stainless steel Type 304 with #4 brush finish.

Finish

Part number suffix indicates finish
SCE-FS**** _

No suffix - White
**LG - RAL 7035 Light Gray
**09 - SCE-09 Gray
**SS - Stainless steel

Industry Standards - (IS17)

- * NEMA Not Applicable
- * UL Not Applicable
- * CSA N/A

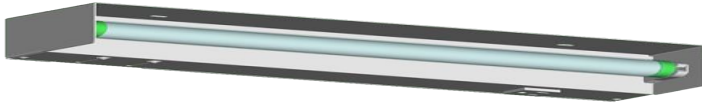
Notes

Provided with UL Recognized sealing washer to maintain Environmental Rating of the enclosure.



SCE-LF24

Product Specifications:



Part Number: SCE-LF24
Description: Fixture, LED Light
Height: 2.75"
Width: 24.18"
Depth: 4.00"
Price Code: P2
List Price: \$218.03
Catalog Page: 392
Est. Ship Weight: 7.00 lbs
Operating Temperature: -4 to 140 Degrees F

Construction

- * 4000K Frosted White
- * 18 inch 850 Lumens
- * 24 inch 900 Lumens
- * LF1824 24VDC 500 Lumens

Application

LED light fixture is designed to provide interior lighting for an enclosure. Can be mounted to light channels in the top of an enclosure or on the front flange of most enclosures. Door activated adjustable switch, switch can be removed and relocated. Terminal block on each end of fixture, making it easy to wire and daisy chain multiple lights continuously. LED bulb with PVC frosted white protective light diffuser included. Housing made from steel and powder coated white. Units with convenience receptacle outlet are 120 VAC with ground 50/60 HZ. Without convenience receptacle outlet 100 to 277 VAC 50/60 HZ. With the exception of SCE-LF1824VDC.

Industry Standards - (IS24)

- * UL Component Recognized

Notes


UL File # E358386

SFP 1-20/120AC

Order No. **2856702**<http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=2856702>

DIN rail module with device surge protection type 3 and mains suppression filter against high-frequency interference voltages. Integrated power display switches off automatically when there is a malfunction due to overload. Mounting on NS 35.

Commercial data

GTIN (EAN)	 4 017918 952648
sales group	J041
Pack	1 pcs.
Customs tariff	85363010
Catalog page information	Page 230 (TT-2011)

Product notes

WEEE/RoHS-compliant since:
06/23/2006



<http://www.download.phoenixcontact.com>
Please note that the data given here has been taken from the online catalog. For comprehensive information and data, please refer to the user documentation. The General Terms and Conditions of Use apply to Internet downloads.

Product description

Device protection with interference filter

Technical data

Standards

Housing material	ABS, aluminum
Inflammability class acc. to UL 94	V0
Color	aluminum
Standards for air and creepage distances	DIN VDE 0110-1
	IEC 60664-1: 1992-10
	IEC 61643-1
Surge voltage category	III
Pollution degree	2
Degree of protection	IP20
Design	Rail-mountable module, one-piece
Mounting type	DIN rail: 35 mm
Number of positions	2
Ambient temperature (storage/transport)	-40 °C ... 85 °C
Ambient temperature (operation)	-25 °C ... 40 °C
For country-specific use in	USA, CN, BR
Direction of action	L-N & L(N)-PE
Width	112.00 mm
Height	79.00 mm
Length	93.00 mm

Protective circuit

IEC category	III
	T3
EN type	T3
Nominal voltage U_N	120 V AC
Arrester rated voltage U_C (L-N)	150 V AC
Arrester rated voltage U_C (L-PE)	150 V AC
Nominal frequency f_N	50 Hz
	60 Hz
Nominal current I_N	20 A (40°C)
Operating effective current I_C at U_C	≤ 10 mA
Ground conductor current I_{PE}	≤ 0.5 mA
Nominal discharge surge current I_n (8/20) μ s (L-N)	3 kA

Nominal discharge surge current I_n (8/20) μ s (L-PE)	3 kA
Max. discharge surge current I_{max} (8/20) μ s maximum (L-N)	10 kA
Max. discharge surge current I_{max} (8/20) μ s maximum (L-PE)	10 kA
Combined surge U_{oc}	6 kV (3 kA)
Energy absorption symmetrical	170 J
Energy absorption, asymmetrical	2x 170 J
Protection level U_p (L-N)	≤ 450 V (at 6 kV/3 kA)
Protection level U_p (L-PE)	≤ 450 V (at 6 kV/3 kA)
Protection level U_p (N-PE)	≤ 450 V (at 6 kV/3 kA)
Residual voltage at I_n , (L-N)	≤ 450 V
Residual voltage at I_n , (L-PE)	≤ 450 V
Residual voltage at I_n , (N-PE)	≤ 450 V
Response time t_A (L-N)	≤ 25 ns
Response time t_A (L-PE)	≤ 25 ns
Response time t_A (N-PE)	≤ 25 ns
Inductivity in series	2x 1 mH ± 30 % (with current compensation)
Capacity (L-N)	2 μ F ± 10 % (X2, FOW X2-250V)
Capacity (L-PE)	2.2 nF ± 20 % (Y, FOW X2-250V)
Capacity (L-PEN)	2.2 nF ± 20 % (Y, FOW X2-250V)
Max. required back-up fuse	20 A (gL / gG)
	20 A (MCB, > 125 V, AIC: 14 kA)
Input attenuation aE, sym.	Typ. 40 dB (≥ 500 kHz / 50 Ω)
Input attenuation aE, asym.	Typ. 30 dB (≥ 1 MHz / 50 Ω)
Message: Surge protection fault	Remote indicator contact

Non-heating apparatus connection, power supply

Connection name	Input/output
Connection method	Screw terminal blocks
Connection type IN	Screw terminal blocks
Connection type OUT	Screw terminal blocks
Connection method	3-conductor (shielded)
Screw thread	M3
Conductor cross section stranded max.	4 mm ²
Conductor cross section solid max.	6 mm ²

Conductor cross section AWG/kcmil min.	12
Conductor cross section AWG/kcmil max	10

Remote indicator contact

Connection name	Remote fault indicator contact
Switching function	PDT contact
Connection method	Pluggable screw connection
Screw thread	M2
Tightening torque	0.25 Nm
Conductor cross section stranded min.	0.14 mm ²
Conductor cross section stranded max.	1.5 mm ²
Conductor cross section solid min.	0.14 mm ²
Conductor cross section solid max.	1.5 mm ²
Conductor cross section AWG/kcmil min.	28
Conductor cross section AWG/kcmil max	16
Maximum operating voltage U _{max.} AC	250 V AC
Max. operating current I _{max}	1 A (250 V AC)
	0.25 A (250 V DC)
	1 A (48 V DC)
Min. permissible switching capacity	(1.00 A / 48 V DC)
	(100 mA/ 12 V AC)
Switching capacity max. perm.	(0.25 A / 250 V DC)
	(1.0 A / 48 V AC)

Connection, protective circuit

Standards/regulations	IEC 61643-1
	EN 61643-11/A11

Protective circuit, filter

Discharge resistor	≤ 390 kΩ
Clamping voltage ringwave (L-N)	100 V (category A 100 kHz 6 kV/200 A)
	195 V (category B 100 kHz 6 kV/500 A)
Clamping voltage ringwave (L-PE)	390 V (category A 100 kHz 6 kV/200 A)
	390 V (category B 100 kHz 6 kV/500 A)

Certificates / Approvals

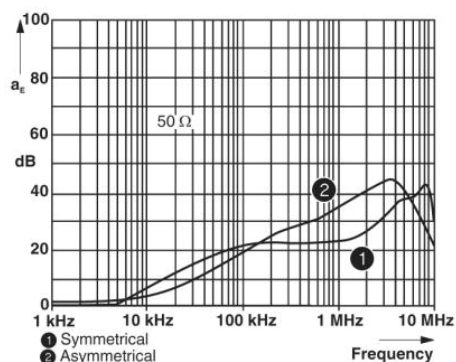


Certification

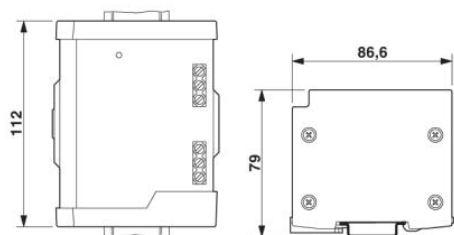
CSA, CSAus-COMP, CUL, GOST, UL

Diagrams/Drawings

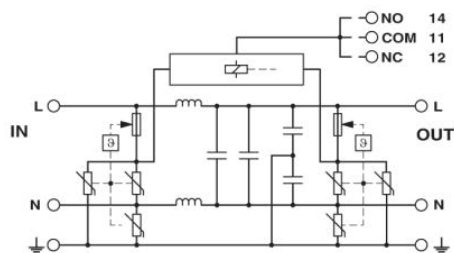
Diagram



Dimensioned drawing



Circuit diagram



Address

PHOENIX CONTACT Inc., USA
586 Fulling Mill Road
Middletown, PA 17057, USA
Phone (800) 888-7388
Fax (717) 944-1625
<http://www.phoenixcon.com>



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Product data sheet

Specifications

SQUARE D

Green Premium™



Mini circuit breaker, QOU, 20A, 1 pole, 120/240VAC, 10kA

QOU120

Product availability : Stock - Normally stocked in distribution facility

Price* : 40.20 USD

Main

Product or Component Type	Miniature circuit-breaker
Range of Product	QOU
Circuit breaker type	Standard
Circuit breaker application	HACR rated

Complementary

Line Rated Current	20 A
Electrical connection	Slotted box lugs, line side Slotted box lugs, load side
[Ue] rated operational voltage	120/240 V AC 120 V AC 48 V DC
Mounting Mode	Unit mount
AWG gauge	AWG 14...AWG 2 aluminium/copper
Height	4.05 in (102.87 mm)
Width	0.75 in (19.05 mm)
Depth	2.95 in (74.93 mm)
Tightening torque	45 lbf.in (5.08 N.m) (AWG 14...AWG 2)

Environment

Product Certifications	CSA IEC UL Listed
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Ordering and shipping details

Category	00900-QOU BREAKERS & SWITCH
Discount Schedule	DE2
GTIN	785901418535
Returnability	Yes
Country of origin	MX

* Price is "List Price" and may be subject to a trade discount – check with your local distributor or retailer for actual price.

Packing Units

Unit Type of Package 1	PCE
Number of Units in Package 1	1
Package 1 Height	0.36 in (0.914 cm)
Package 1 Width	0.16 in (0.406 cm)
Package 1 Length	0.49 in (1.245 cm)
Package 1 Weight	4.97 oz (141 g)

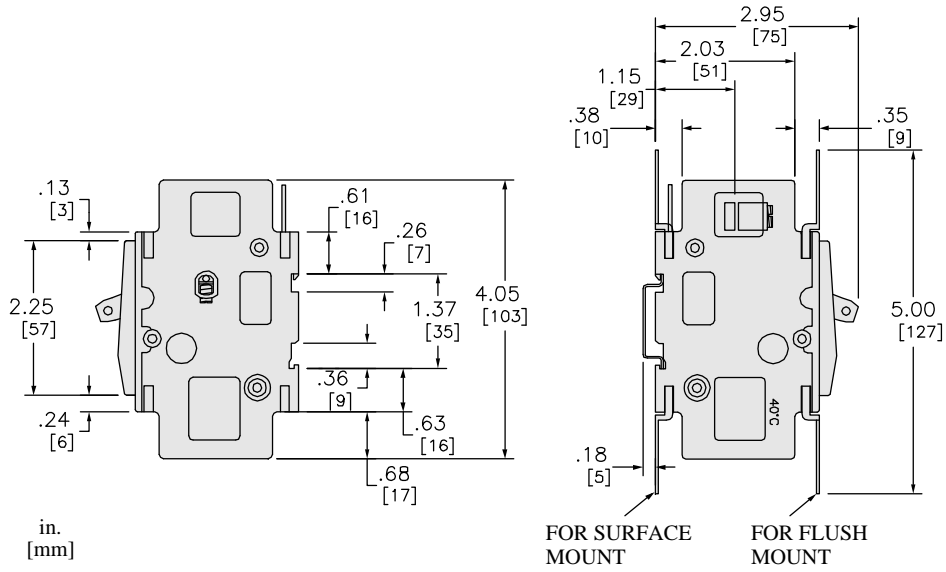
Offer Sustainability

Sustainable offer status	Green Premium product
REACH Regulation	REACH Declaration
EU RoHS Directive	Compliant EU RoHS Declaration
Toxic heavy metal free	Yes
Mercury free	Yes
RoHS exemption information	Yes
China RoHS Regulation	China RoHS declaration Product out of China RoHS scope. Substance declaration for your information.
Halogen content performance	Halogen free product

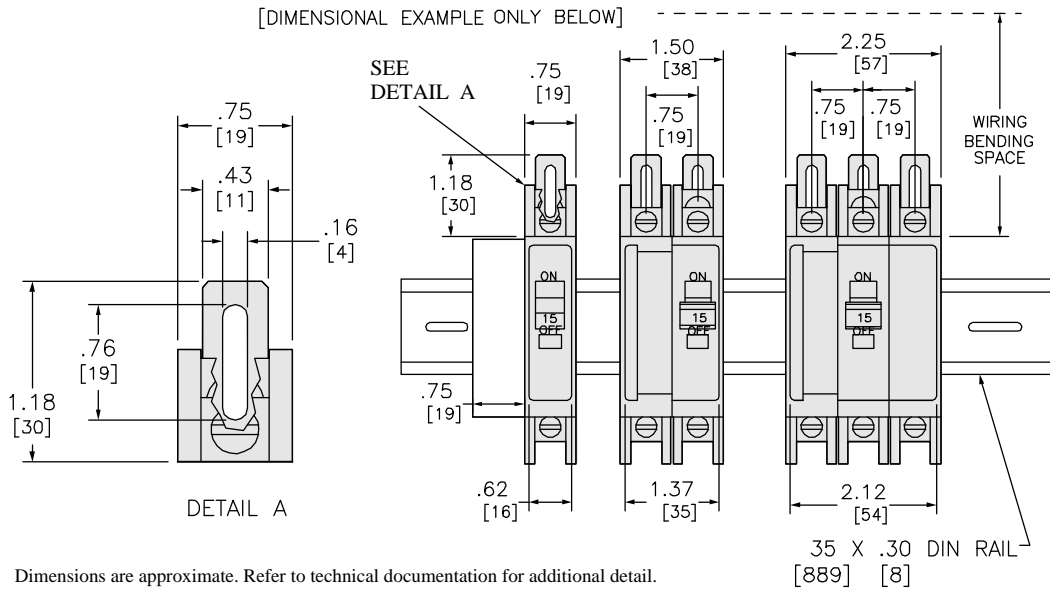
Contractual warranty

Warranty	18 months
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Dimensions



2.50 [64] MIN. WIRE BENDING SPACE FOR 2 AWG
 1.50 [38] MIN. WIRE BENDING SPACE FOR 14 AWG
 TYP. BOTH ENDS FOR ALL CB'S SHOWN PER ARTICLE 430-1-(B) NEC



Recommended replacement(s)

QUINT-PS-100-240AC/24DC/5

2866750

Single-Phase Primary-Switched Power Supply Unit



INTERFACE

Data Sheet

© PHOENIX CONTACT - 12/2005

Description

QUINT POWER devices are 60...960 W DC power supply units for universal use. This is ensured by the wide-range input, single and three-phase versions, and an international approval package.

QUINT POWER stands for guaranteed supply: powerful capacitors ensure mains buffering of more than 20 ms at full load.

All three-phase devices provide the full output power, even in the event of a continuous phase failure. The POWER BOOST power reserve starts loads with high inrush currents and ensures that fuses are reliably tripped.

Preventive function monitoring diagnoses impermissible operating states and minimizes downtimes in your system. An active transistor output and a floating relay contact are used for remote monitoring.

All QUINT POWER devices are idling-proof and short-circuit proof, and are available with a regulated and adjustable output voltage of 12, 24, and 48 V DC with output currents of 2.5, 5, 10, 20, 30, and 40 A.

Power supply units for use in Ex Zone 2, uninterruptible solutions, AS-i power supply units, and a QUINT diode complete the product range.



QUINT POWER is a built-in device. Installation and startup must only be carried out by qualified personnel. The relevant country-specific regulations (e.g., VDE, DIN) must also be observed.



Danger

The device contains dangerous live elements and high levels of stored energy. Never carry out work when the power is turned on.

Risk of burns

The housing temperature can reach high values depending on the ambient temperature and the load of the device.



Make sure you always use the latest documentation. It can be downloaded at www.download.phoenixcontact.com. A conversion table is available on the Internet at www.download.phoenixcontact.com/general/7000_en_00.pdf.



This data sheet is valid for all products listed on the following page:

Ordering Data

Product

Description	Type	Order No.	Pcs./Pkt.
Single-phase primary-switched power supply unit	QUINT-PS-100-240AC/24DC/5	29 38 58 1	1

Accessories

Description	Type	Order No.	Pcs./Pkt.
Assembly adapter for QUINT POWER 2.5 A and 5 A on S7 300 rails	QUINT-PS-ADAPTERS7/1	29 38 19 6	1

Technical Data

Input Data	
Nominal input voltage range	100...240 V AC
Input voltage range	85...264 V AC, 90...350 V DC
Frequency range	45...65 Hz (0 Hz at DC input)
Current consumption	1.6 A (at 120 V AC (nominal load)), approximately 0.84 A (at 230 V AC (nominal load)), approximately
Inrush current surge	< 20 A (typical), inrush current limiting/I ² t (25°C): < 2.5 A ² s
Mains buffering (for nominal load)	20 ms (at 120 V AC), > 120 ms (at 230 V)
Typical switch-on time	AP _g
Protective circuit	Transient surge protection varistor
Input fuse	5 A (slow-blow, internal)
Recommended backup fuse	Circuit breaker 6 A, 10 A or 16 A, Characteristic B
Discharge current to PE	< 3.5 mA
Connection method	COMBICON screw/plug-in connection
Stripping length	7 mm
Output Data	
Nominal output voltage	24 V DC ±1%
Setting range for the output voltage	22.5...28.5 V DC
Output current	5 A (-25...+60°C) 7.5 A (with POWER BOOST, -25...+40°C)
Derating	Above +60°C: 2.5% per Kelvin
Current limit	I _{BOOST} = 7.5 A (for short circuit), approximately
Maximum capacitive load	Unlimited
System deviation	< 1% (static load change 10...90%) < 2% (dynamic load change 10...90%) < 0.1% (input voltage change ±10%)
Power dissipation	
Maximum nominal load	14 W
Maximum no load	2 W
Efficiency	89% for 230 V AC and nominal
Rise time	< 2 ms (U _{OUT} (10...90%))
Residual ripple/switching peaks (20 MHz)	< 100 mV _{pp} (for nominal values)
Parallel connection	Yes, to create redundant systems and increase efficiency
Internal surge protection	Yes, limited to 35 V DC, approximately
Resistance to return supply	35 V DC
Connection method	COMBICON screw/plug-in connection
Stripping length	7 mm
DC OK Signal Output, Active	
Type of output	Transistor output, U _{out} > 0.9 x U _N : High signal
Continuous current	40 mA, maximum
Output voltage	+24 V DC (signal)

DC OK Signal Output, Floating

Type of output	Relay contact, $U_{out} > 0.9 \times U_N$: Contact closed
Continuous current	1 A, maximum
Maximum switching voltage	30 V AC/DC, maximum

General Data

Insulation voltage	
Input/output	4 kV AC (type test)/2 kV AC (routine test)
Input/PE	3.5 kV AC (type test)/2 kV AC (routine test)
Insulation voltage output/PE	500 V DC (routine test)
Mounting position	On horizontal NS 35 DIN rail according to EN 60715
Degree of protection	IP20
Protection class	I, with PE connection
MTBF	500,000 h according to IEC 61709 (SN 29500)
Housing version	ABS (AIMg1), closed
Weight	0.830 kg
Dimensions (width x height x depth)	55 mm x 130 mm x 125 mm
Dimensions (width x height x depth) for alternative assembly	122 mm x 130 mm x 58 mm

Status Indicators

DC OK status indicator	Green LED ($U_{out} < 0.9 \times U_N$: LED flashes)
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Climatic Data

Ambient temperature (operation)	-25...+70°C (> 60°C derating)
Ambient temperature (storage/transport)	-40...+85°C
Maximum permissible humidity (operation)	95% (at +25°C, no condensation)
Vibration (operation)	< 15 Hz, amplitude ± 2.5 mm according to IEC 60068-2-6 15...150 Hz, 2.3g, 90 minutes
Shock	30g in all space directions, according to IEC 60068-2-27
Pollution degree	2 according to EN 50178
Climatic class	3K3 according to EN 60721

Certification/Standards

Electrical equipment of machines	EN 60204 (Surge Voltage Category III)
Safety transformers for switched-mode power supply units	EN 61558-2-17
Electrical safety (of IT equipment)	EN 60950/VDE 0805 (SELV), EN 61558-2-17 CB Scheme j UL/C-UL Recognized UL 60950 U
Industrial control equipment	UL/C-UL Listed UL 508 ^U _{LISTED}
Electrical equipment for potentially explosive areas	UL/C-UL Recognized UL 1604, Class I, Division 2, Groups A, B, C, D
Shipbuilding	Germanischer Lloyd F, ABS
Electronic equipment for use in electrical power installations	EN 50178 (VDE 0160)
Safety extra-low voltage	PELV (EN 60204), SELV (EN 60950)
Safe isolation	DIN VDE 0100-410, DIN VDE 0106-1010
Protection against electric shock	DIN 57100-410
Protection against electric shock, basic requirements for safe isolation in electrical equipment	DIN VDE 0106-101
Limitation of harmonic line currents	According to EN 61000-3-2
Device safety	B (tested safety)

Conformance With EMC Directive 89/336/EEC and Low Voltage Directive 73/23/EEC

Noise Immunity Test According to EN 61000-6-2¹

Electrostatic discharge (ESD)	EN 61000-4-2	Criterion B ²	Housing	Level 4
			Air discharge	15 kV
			Contact discharge	8 kV
Electromagnetic HF field	EN 61000-4-3	Criterion A ³	Housing	Level 3
			Frequency range	80...1000 MHz/1.4...2.0 GHz
			Field strength	10 V/m
Fast transients (burst)	EN 61000-4-4	Criterion B ²	Input	4 kV (Inst. Class 4, asymmetrical: Cable to ground) 2 kV (Inst. Class 4, symmetrical: Cable to cable)
			Output	0.5 kV (Level 1, asymmetrical: Cable to ground) 0.5 kV (Level 1, symmetrical: Cable to cable)
			Signal	1 kV (Level 1, asymmetrical: Cable to ground)
Surge current load (surge)	EN 61000-4-5	Criterion B ²	Input	4 kV (Level 4, asymmetrical)
			Output	2 kV (Level 3, asymmetrical)
			Signal	1 kV (Level 2, asymmetrical)
Conducted interference	EN 61000-4-6	Criterion A ³	Input/output/signal	Level 3, asymmetrical
			Frequency range	0.15...80 MHz
			Voltage	10 V
Voltage dips	EN 61000-4-11	Criterion B	Input	Mains buffering > 20 ms

Noise Emission Test According to EN 61000-6-3

Noise emission of housing	EN 55011 (EN 55022) ⁴	Class B	Industrial and domestic applications
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¹ EN 61000 corresponds to IEC 61000

² Criterion B: Temporary adverse effects on the operating behavior, which the device corrects automatically.

³ Criterion A: Normal operating behavior within the specified limits.

⁴ EN 55011 corresponds to CISPR11/EN 55022 corresponds to CISPR22

Structure

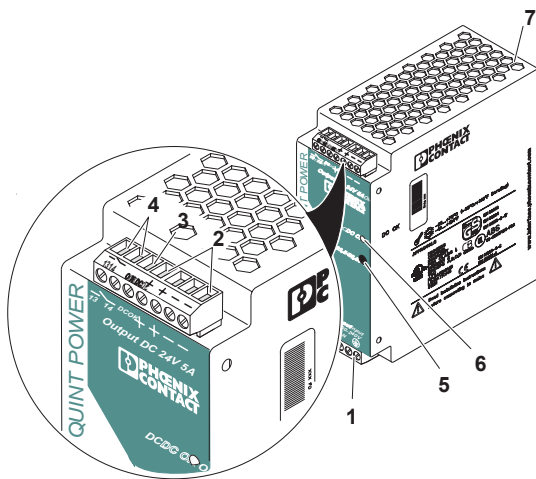


Figure 1 Operating elements

- 1 AC input
85...264 V AC input
voltage, 45...65 Hz
- 2 DC output
24 V DC output voltage (default),
can be set between 22.5 and 28.5 V
- 3 DC OK output active
- 4 DC OK output floating
- 5 Potentiometer (covered) 22.5...28.5 V DC
- 6 DC OK LED
- 7 Universal DIN rail adapter UTA 107

Block Diagram

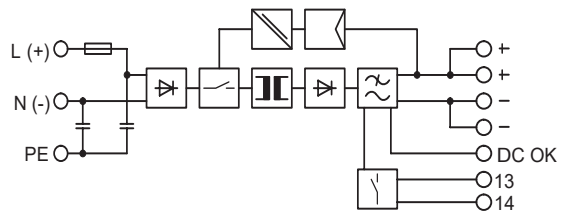


Figure 2 Block diagram

Safety Notes and Warning Instructions



Danger

The device contains dangerous live elements and high levels of stored energy.

Never carry out work when the power is turned on.



Risk of burns

The housing temperature can reach high values depending on the ambient temperature and the load of the device.

To ensure that the device can be operated safely and all functions can be used, please read these instructions carefully.



QUINT POWER is a built-in device.

Installation and startup must only be carried out by qualified personnel. The relevant country-specific regulations (e.g., VDE, DIN) must also be observed.



Before startup please ensure:

The mains has been connected correctly and protection is provided against electric shock.

The device can be switched off outside the power supply according to EN 60950 regulations (e.g., by the line protection on the primary side).

The protective conductor is connected.

All supply lines have sufficient fuse protection and are the correct size.

All output cables are the correct size for the maximum device output current or have separate fuse protection.

Sufficient convection is ensured.

Installation

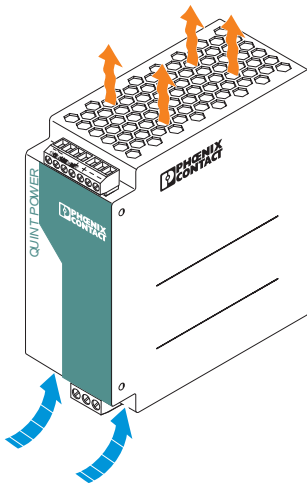


Figure 3 Convection



Risk of burns

The housing temperature can reach high values depending on the ambient temperature and the load of the device.



To ensure sufficient convection, the following minimum spacing is required between other modules:

5 cm above and below the device.

No minimum spacing to other modules at the sides is required for proper operation of the device.

The power supply unit can be snapped onto all DIN rails according to EN 60715 and must be mounted horizontally (connection terminal blocks facing downwards).

Mounting Position

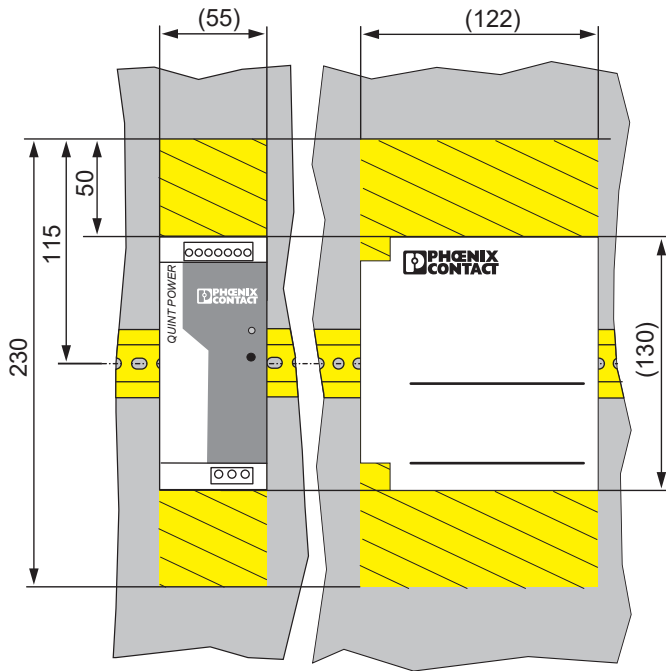
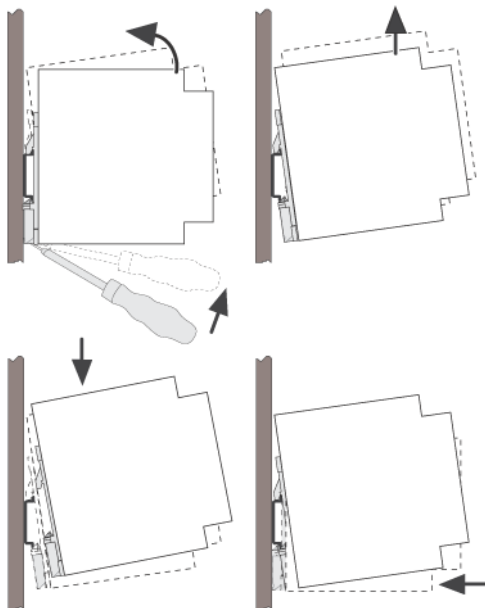


Figure 4 Mounting position (dimensions in mm)

Narrow mounting position: Installation depth 125 mm (+ DIN rail)

Flat mounting position: Installation depth 58 mm (+ DIN rail)

Narrow Mounting Position (Default Upon Delivery)



Assembly

Position the module with the DIN rail guideway on the top edge of the DIN rail and then snap it downwards.

Removal

Release the snap-on catch using a screwdriver and then detach the module from the bottom edge of the DIN rail.

Figure 5 Narrow mounting position

Flat Mounting Position

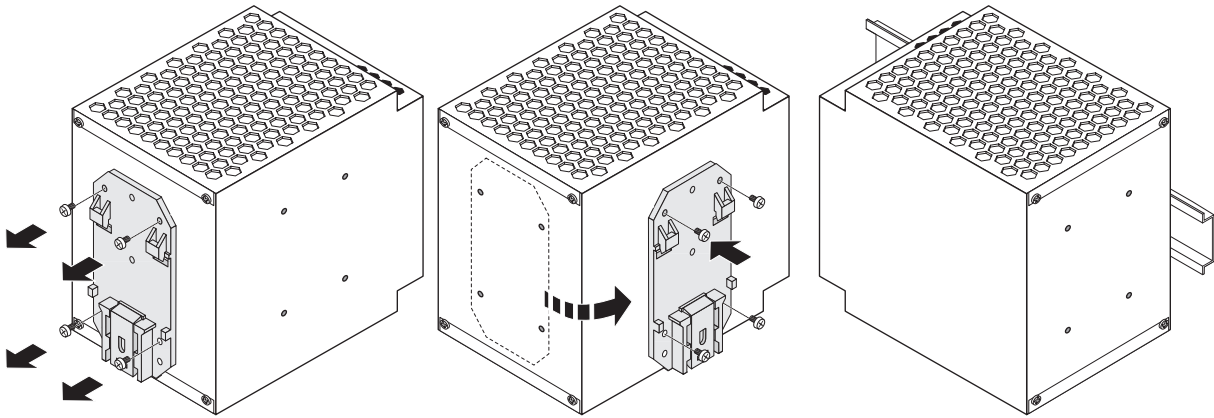


Figure 6 Flat mounting position

A flat mounting position can be achieved by mounting the module onto the DIN rail at a 90° angle. Mount the DIN rail adapter (UTA 107) as shown in Figure 6.

No additional assembly material is required.
Mounting screws: Torx T10 (torque 0.8...0.9 Nm).

Connection of Various Types of Network: 100...240 V AC Networks

The device can be connected to single-phase AC networks or to two external conductors for three-phase networks (TN, TT or IT network according to VDE 0100-300/ IEC 60364-3) with nominal voltages of 100...240 V AC.



An all-pole disconnecting device must be provided for 2-phase operation using two external conductors for a three-phase network.

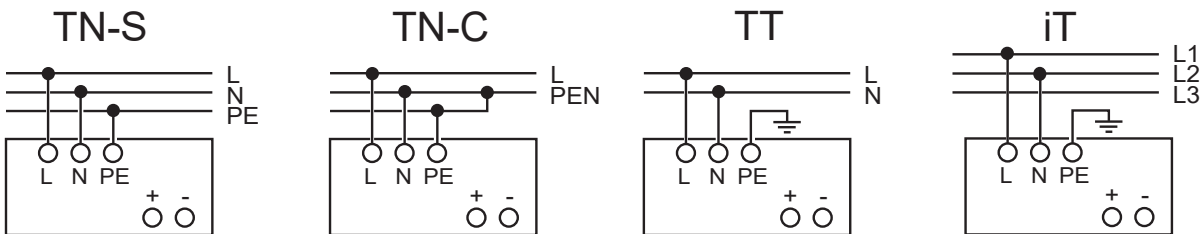


Figure 7 100...240 V AC networks

Connection of the Connecting Cable

The device is equipped with COMBICON connectors. This connection method enables quick device connection and visible isolation of the electrical connection, if required.



Connectors may only be operated when the power is switched off.

Use a screwdriver with the correct blade width for wiring. The cable cross sections listed in the table on the right can be connected. ...

	Solid	Stranded	AWG	Torque	Stripping Length
	[mm ²]			[Nm]	[mm]
Input	0.2...2.5	0.2...2.5	25...14	0.5...0.6	7 mm
Output	0.2...2.5	0.2...2.5	25...14	0.5...0.6	7 mm
Signal	0.2...2.5	0.2...2.5	25...14	0.5...0.6	7 mm

For reliable and safe-to-touch connections, strip the cable ends according to the table.

Input (1)

The 100...240 V AC connection is made using the L, N, and 5 screw connections.

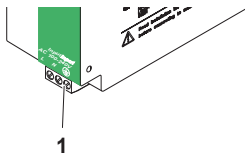


Figure 8 Input

Fuses

An **internal fuse** is provided for device protection. Additional device protection is not required.



If an internal fuse is blown, this is most probably due to a device fault. In this case, the device should be checked in the factory.

Recommended Backup Fuse

Circuit breaker 6 A, 10 A or 16 A, Characteristic B (or equivalent).



A suitable fuse should be provided for DC applications.

Protecting the Primary Side

The device must be installed according to the specifications of EN 60950.



It must be possible to switch off the device using a suitable disconnecting device outside the power supply. For example, primary side line protection could be used.

Output

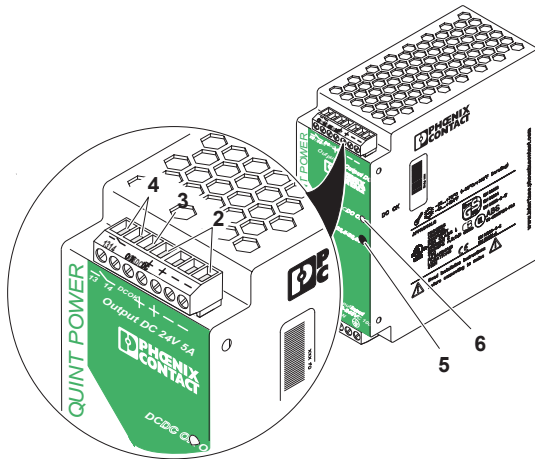


Figure 9 Output

Connecting the Output

The connection is made using the "+" and "-" screw connections on the screw connection 2. The output voltage set upon delivery is 24 V DC. The output voltage can be set on the potentiometer 5.

Protecting the Secondary Side

The device is electronically short-circuit-proof and idling-proof. In the event of an error, the output voltage is limited to a maximum of 35 V DC.



Make sure that all output cables are the correct size for the maximum output current or have separate fuse protection.

The cable cross sections in the secondary circuit must be large enough to keep the voltage drops on the cables as low as possible.

Signaling

The two DC OK outputs are for preventive function monitoring of the power supply unit. A floating signal contact 4 and an active DC OK signal 3 are available. In addition, the DC OK LED 6 can be used to evaluate the function of the power supply directly at the installation location (see "Status Indicator: DC OK LED" on page 10).

Floating Contact

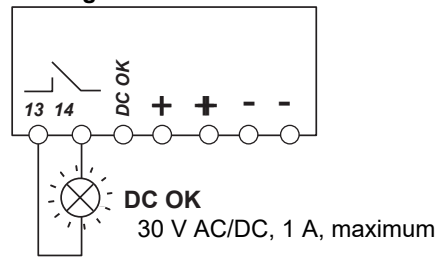


Figure 10 Floating contact

When opened, the floating signal contact indicates that the output voltage has fallen more than 10% below the set value. Signals and ohmic loads up to a maximum of 30 V and currents up to a maximum of 1 A can be switched.



With heavy inductive loads, e.g., a relay, a suitable protective circuit (e.g., free-wheeling diode) is required.

Active Signal Output

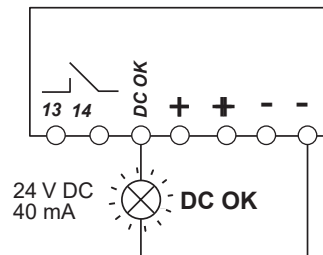


Figure 11 Active signal output

The 24 V DC signal is between the "DC OK" and "-" connection terminal blocks and can be loaded with 40 mA maximum. This signal output indicates that the output voltage has fallen more than 10% below the set value when "active high" changes to "low". The DC OK signal is isolated from the power output. This ensures that a separate supply does not enter from devices connected in parallel. The 24 V DC signal can be connected directly to a logic input for evaluation.

Signal Loop

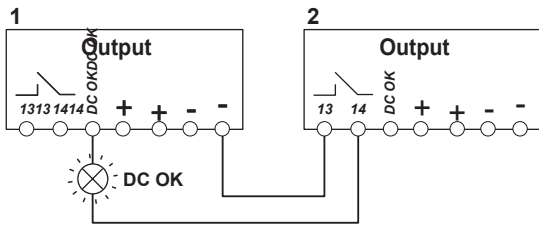


Figure 12 Signal loop

The two signal outputs described above can be easily combined.

Example: Monitoring two devices

Use the active alarm output of device 1 and loop in the floating alarm output of device 2. In the event of an error, a group error message is output. Any number of devices can be looped. This signal combination saves wiring costs and logic inputs.

Status Indicator: DC OK LED

The green DC OK LED enables local function evaluation in the control cabinet.

DC OK LED	ON	Flashing	OFF
Active DC OK switching output	U = +24 V (with reference to "-")	U = 0 V (with reference to "-")	U = 0 V (with reference to "-")
Floating DC OK output	Closed	Open	Open
Cause	Output voltage greater than 90% of the set voltage	Output voltage less than 90% of the set voltage	No voltage at the output
Meaning	Output voltage and current OK	QUINT POWER operating, but: Error at the load Current consumption greater than I _{BOOST} Output short circuit	QUINT POWER not operating, because: No mains voltage present The primary side fuse has blown The device is faulty

Function

Output Characteristic Curve

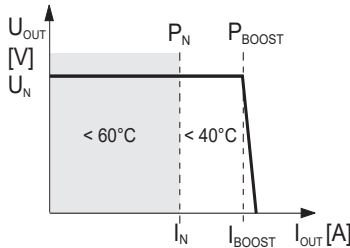


Figure 13 Output characteristic curve

The U/I characteristic curve ensures that both heavy capacitive loads and loads with DC/DC converters can be supplied by QUINT POWER in the input circuit. Connected fuses are tripped. The selectivity in your system configuration is ensured at all times.

- U_N = +24 V
- I_N = 5 A
- I_{BOOST} = 7.5 A
- P_N = 120 W
- P_{BOOST} = 180 W

At ambient operating temperatures T_{amb} < + 40 °C, the device can continuously supply an I_{BOOST} current at nominal voltage. In the event of heavier loads the working point demonstrates the U/I characteristic curve shown in the figure. The output current is limited to I_{BOOST}. The secondary voltage is reduced until the short circuit on the secondary side is removed.

Temperature Response

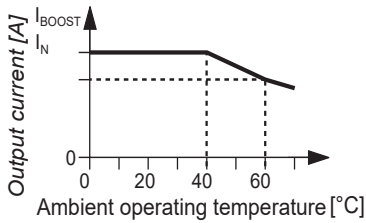


Figure 14 Temperature response

At an ambient operating temperature of up to +40°C, the device continuously supplies the I_{BOOST} output current.

The device can supply a nominal output current of I_N up to an ambient operating temperature of +60°C. The output power must be decreased by 2.5% per Kelvin temperature increase for ambient operating temperatures over +60°C.

At ambient operating temperatures above +70°C or in the event of a thermal overload, the device does not switch off. The output power is decreased to such an extent that device protection is provided. Once the device has cooled down, the output power is increased again.

Parallel Operation

Devices of the same type can be connected in parallel to increase both redundancy and power. The default setting does not have to be adjusted.



A maximum of five devices can be connected in parallel.

If the output voltage is adjusted, an even current distribution can be ensured by precisely setting all power supply units that are operated in parallel to the same output voltage.

To ensure symmetrical current distribution we recommend that all cable connections from the power supply unit to the DIN rail are the same length and have the same cross section.



Depending on the system, for parallel connection of more than two power supply units a protective circuit should be installed at each individual device output (e.g., decoupling diode or DC fuse). This prevents high return currents in the event of a secondary device fault.

Redundancy Operation

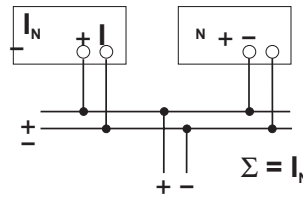


Figure 15 Redundancy operation

Redundant circuits are suitable for supplying systems, which place particularly high demands on operational safety.

If a fault occurs in the primary circuit of the first power supply unit, the second device automatically takes over the entire power supply, without interruption, and vice versa.

For this purpose, the power supply units to be connected in parallel must be large enough that the total current requirements of all loads can be fully met by one power supply unit.



External decoupling diodes are required for 100% redundancy (QUINT-DIODE/40, Order No. 29 38 96 3).

Increasing Power

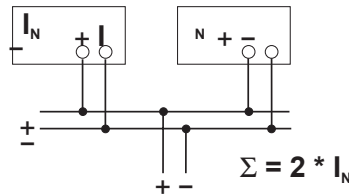


Figure 16 Increasing power

The output current can be increased to $n \times I_N$ where n is the number of devices connected in parallel.

Parallel connection for increasing power is used when extending existing systems. A parallel connection is recommended if the power supply unit does not cover the current consumption of the most powerful load.

Otherwise, the loads should be divided over independent individual devices.



A maximum of five devices can be connected in parallel.

PT 2X2-24DC-ST

Order No. 2838228

The illustration shows version PT 2x2- 5DC-ST



<http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=2838228>

PT protective connector with protective circuit for two 2-wire floating signal circuits. 24 V DC nominal voltage. HART-compatible.



Commercial data	
GTIN (EAN)	
sales group	J204
Pack	10 pcs.
Customs tariff	85363010
Catalog page information	Page 92 (TT-2011)

Product notes

WEEE/RoHS-compliant since: 05/01/2006

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Technical data	
General	
Housing material	PA 6.6
Inflammability class acc. to UL 94	V0
Color	black

Standards for air and creepage distances	VDE 0110-1
	IEC 60664-1: 1992-10
Total surge current (8/20) μ s	20 kA
Ambient temperature (operation)	-40 °C ... 85 °C
Mounting type	On base element
Design	DIN rail module, two-section, divisible
Degree of protection	IP20
Direction of action	Line-Line & Line-Signal Ground/Shield & optional Signal Ground/ Shield-Earth Ground
Arrester can be tested with CHECKMASTER from software version:	From SW rev. 1.00
Width	17.70 mm
Height	52.00 mm
Length	45.00 mm
Pitch unit	1 Div.

Protective circuit

IEC category	C1
	C2
	C3
	D1
VDE requirement class	C1
	C2
	C3
	D1
Nominal voltage U_N	24 V DC
Maximum continuous operating voltage U_C	28 V DC
	20 V AC
Maximum continuous voltage U_C (wire-wire)	28 V DC
	20 V AC
Maximum continuous voltage U_C (wire-ground)	28 V DC
	20 V AC
Nominal current I_N	450 mA (45°C)
Operating effective current I_C at U_C	$\leq 5 \mu$ A
Ground conductor current I_{PE}	$\leq 1 \mu$ A (BE: 2x2+F)
	$\leq 4 \mu$ A

Nominal discharge surge current I_n (8/20) μs (Core-Core)	10 kA
Nominal discharge surge current I_n (8/20) μs (Core-Earth)	10 kA
Total surge current (8/20) μs	20 kA
Max. discharge surge current I_{max} (8/20) μs maximum (Core-Core)	10 kA
Max. discharge surge current I_{max} (8/20) μs maximum (Core-Earth)	10 kA
Lightning test current (10/350) μs , peak value I_{imp}	2.5 kA (per path)
Output voltage limitation at 1 kV/ μs (Core-Core) spike	≤ 40 V
Output voltage limitation at 1 kV/ μs (Core-Earth) spike	≤ 450 V
Output voltage limitation at 1 kV/ μs (Core-Core) static	≤ 40 V
Output voltage limitation at 1 kV/ μs (Core-Earth) static	≤ 450 V
Residual voltage at I_n , (conductor-conductor)	≤ 40 V
Residual voltage at I_n , (conductor-GND)	≤ 450 V
Residual voltage with I_{an} (10/1000) μs (conductor-conductor)	≤ 50 V
Response time t_A (Core-Core)	≤ 1 ns
Response time t_A (Core-Earth)	≤ 100 ns
Input attenuation a_E , sym.	0.5 dB (≤ 1 MHz)
Cut-off frequency f_g (3 dB), sym. in 50 Ohm system	Typ. 6 MHz
Capacity (Core-Core)	1.4 nF
Resistance in series	2.2 Ω (Path 1-2/5-6) 2.2 Ω (Path 7-8, 11-12)
Max. required back-up fuse	500 mA (e.g. T (IEC 127-2/III))
Surge carrying capacity in acc. with IEC 61643-21 (Core-Core)	C2 (10 kV/5 kA)
Surge carrying capacity in acc. with IEC 61643-21 (Core-Earth)	C2 (10 kV/5 kA) D1 (2.5 kA)

Connection data

Connection method	Screw connection (in connection with the base element)
Connection type IN	PLUGTRAB plug-in system

Connection type OUT	PLUGTRAB plug-in system
Screw thread	M3
Tightening torque	0.8 Nm
Stripping length	8 mm
Conductor cross section stranded min.	0.2 mm ²
Conductor cross section stranded max.	2.5 mm ²
Conductor cross section solid min.	0.2 mm ²
Conductor cross section solid max.	4 mm ²
Conductor cross section AWG/kcmil min.	24
Conductor cross section AWG/kcmil max	12

Connection, protective circuit

Standards/regulations	IEC 61643-21
	DIN EN 61643-21
	UL 497B

Certificates / Approvals



Certification	GOST, UL Listed
Certification Ex:	CUL-EX LIS, UL-EX LIS

Accessories

Item	Designation	Description
Marking		
0811228	X-PEN 0,35	Marker pen without ink cartridge, for manual labeling of markers, labeling extremely wipe-proof, line thickness 0.35 mm
0814717	ZBF 15:SO/CMS	Zack strip, flat, 10-section, divisible, special printing, marking according to customer requirements
0808671	ZBF 5,LGS:FORTL.ZAHLEN	Zack marker strip, flat, printed horizontally: 10-section, with the numbers 1 - 10, 11 - 20, and so on up to 491 - 500, color: white
0810821	ZBF 5,LGS:GERADE ZAHLEN	Zack marker strip, flat, printed horizontally: 10-section, with even numbers, printed with the numbers: 2-20, 22-40, etc. up to 82-100

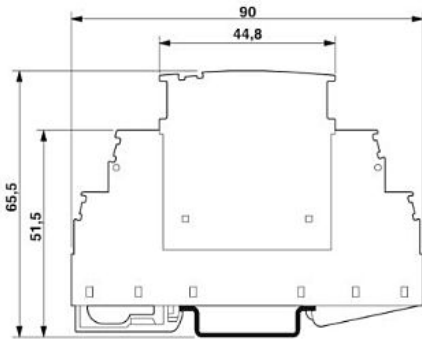
0810863	ZBF 5,LGS:UNGERADE ZAHLEN	Zack strip, flat, printed horizontally: 10-section, with odd numbers, printed with the numbers: 1-19, 21-39 etc. up to 81-99
0808697	ZBF 5,QR:FORTL.ZAHLEN	Zack marker strip, flat, printed vertically: 10-section, with the numbers 1 - 10, 11 - 20, and so on up to 91 - 100, color: white
0808668	ZBF 5/WH-100:UNBEDRUCKT	Zack strip, flat, unprinted: 10-section, for individual labeling with M-PEN or ZBF-T, large batch, sufficient for labeling 1000 terminal blocks, color: white
0808642	ZBF 5:UNBEDRUCKT	Zack strip, flat, unprinted: 10-section, for individual labeling with M-PEN or ZBF-T, sufficient for 100 terminal blocks, color: white
0800763	ZBN 18:SO/CMS	Marker labels, 5-section, special printing, labeled according to customer requirements (Please specify the required marking with order), for terminal width: 17.5 mm, color: White
2809128	ZBN 18:UNBEDRUCKT	Unprinted marker labels, strips with 5 labels for individual labeling with M-PEN or CMS system, for terminal block width: 17.5 mm, color: White

Additional products

Item	Designation	Description
Assembly		
2839295	SSA 3-6	shield fast connections for conductor diameter 3 - 6 mm. Potential connection cable: 200 mm, black
2839512	SSA 5-10	Shield fast connection for conductor diameters 5 - 10 mm. Potential connection cable: 200 mm, black
General		
2839224	PT 2X2+F-BE	Base element for protective plug PT with protective circuit for two 2-wire floating signal circuit, gas-filled surge arrester between the connections 3-4 (GND) and 9-10, for mounting on NS 35/7.5 and NS 35/15, housing width: 17.5 mm
2839208	PT 2X2-BE	Base element for protective plug PT with protective circuit for two 2-wire floating signal circuit, bridge between the connections 3-4 (GND) and 9-10, for mounting on NS 35/7.5 and NS 35/15, housing width: 17.5 mm

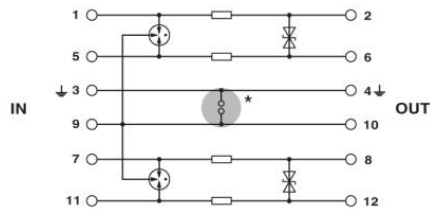
Diagrams/Drawings

Dimensioned drawing



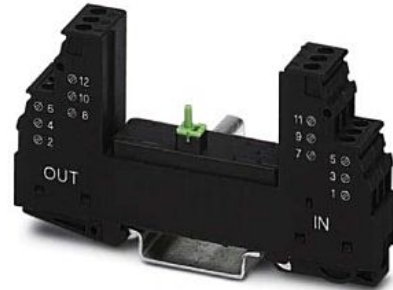
The figure shows the complete module consisting of a base element and connector

Circuit diagram



PT 2X2-BE


Order No. 2839208



<http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=2839208>

Base element for protective plug PT with protective circuit for two 2-wire floating signal circuit, bridge between the connections 3-4 (GND) and 9-10, for mounting on NS 35/7.5 and NS 35/15, housing width: 17.5 mm

Commercial data

GTIN (EAN)	 4 017918 182748
sales group	J201
Pack	10 pcs.
Customs tariff	85363010
Catalog page information	Page 92 (TT-2011)

Product notes

WEEE/RoHS-compliant since:
03/03/2006



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Technical data

General

Inflammability class acc. to UL 94	V0
Color	black
Ambient temperature (operation)	-40 °C ... 85 °C

Mounting type	DIN rail: 35 mm
Design	DIN rail module, two-section, divisible
Degree of protection	IP20
Width	17.70 mm
Height	52.00 mm
Length	89.80 mm
Pitch unit	1 Div.

Connection data

Connection method	Screw connection
Connection type IN	Screw terminal blocks
Connection type OUT	Screw terminal blocks
Screw thread	M3
Tightening torque	0.5 Nm
Stripping length	8 mm
Conductor cross section stranded min.	0.2 mm ²
Conductor cross section stranded max.	2.5 mm ²
Conductor cross section solid min.	0.2 mm ²
Conductor cross section solid max.	4 mm ²
Conductor cross section AWG/kcmil min.	24
Conductor cross section AWG/kcmil max	12

Certificates / Approvals

Certification

GOST, UL Listed

Certification Ex:

CUL-EX LIS, UL-EX LIS

Accessories

Item	Designation	Description
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Assembly

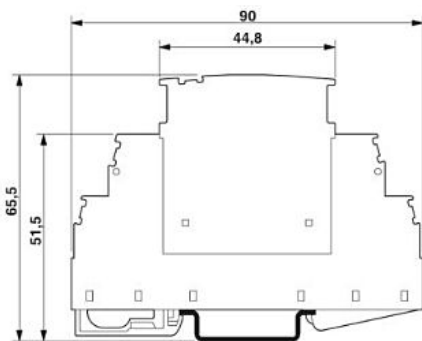
2839295	SSA 3-6	shield fast connections for conductor diameter 3 - 6 mm. Potential connection cable: 200 mm, black
2839512	SSA 5-10	Shield fast connection for conductor diameters 5 - 10 mm. Potential connection cable: 200 mm, black

Marking

1051993	B-STIFT	Marker pen, for manual labeling of unprinted Zack strips, smear-proof and waterproof, line thickness 0.5 mm
0811228	X-PEN 0,35	Marker pen without ink cartridge, for manual labeling of markers, labeling extremely wipe-proof, line thickness 0.35 mm
1050004	ZB 5 :UNBEDRUCKT	Zack strip, unprinted, 10-section, for individual labeling with M-PEN, ZB-T or CMS system, pack is sufficient for 100 terminal blocks, for a terminal width of 5.2 mm, color: White
2715212	ZB 5,8,LGS:FORTL.ZAHLEN	Zack marker strip, 10-section, printed horizontally: with consecutive numbers, 1-10, 11-20 etc. up to 991-1000, color: white
1050305	ZB 5,8:SO/CMS	Zack strip, 10-section, divisible, special printing, marking according to customer requirements
2715209	ZB 5,8:UNBEDRUCKT	Zack strip, unprinted, strips with 10 labels for individual labeling with M-PEN or CMS system, for terminal block width: 5.8 mm, color: White
1050295	ZB 5:SO/CMS	Zack strip, 10-section, divisible, special printing, marking according to customer requirements
0808642	ZBF 5:UNBEDRUCKT	Zack strip, flat, unprinted: 10-section, for individual labeling with M-PEN or ZBF-T, sufficient for 100 terminal blocks, color: white

Diagrams/Drawings

Dimensioned drawing



The figure shows the complete module consisting of a base element and connector

MINI MCR-SL-I-I

Order No. 2864406



<http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=2864406>

MCR 3-way isolating amplifier, for electrical isolation of analog signals, with screw connection, input signal: 0(4) mA ... 20 mA, output signal: 0(4) mA ... 20 mA



Commercial data	
GTIN (EAN)	 4 017918 956158
Note	Made-to-order
sales group	H520
Pack	1 pcs.
Customs tariff	85437090
Catalog page information	Page 335 (IF-2009)

Product notes

WEEE/RoHS-compliant since:
03/09/2006



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Product description

The 6.2 mm wide standard signal 3-way isolating amplifier MINI MCR-SL-I-I(-SP) is used for electrical isolation, amplification and filtering of standard signals.

On the input and output side, the analog standard signals 0...20 mA or 4...20 mA are available, electrically isolated.

Power (19.2 V DC to 30 V DC) can be supplied through connection terminal blocks on the modules or in conjunction with the DIN rail connector.

Technical data

Input data

Configurable/programmable	No
Current input signal	0 mA ... 20 mA
	4 mA ... 20 mA
Max. input current	50 mA
Input resistance current input	Approx. 50 Ω

Output data

Configurable/programmable	No
Current output signal	0 mA ... 20 mA
	4 mA ... 20 mA
Max. output current	28 mA
Load/output load current output	< 500 Ω (at 20 mA)

Power supply

Nominal supply voltage	24 V DC
Supply voltage range	19.2 V DC ... 30 V DC (to bridge the supply voltage, the DIN rail connector (ME 6,2 TBUS-2 1,5/5-ST-3,81 GN, Order No. 2869728) can be used. It can be snapped onto a 35 mm DIN rail according to EN 60715)
Max. current consumption	< 20 mA
Power consumption	< 450 mW

Connection data

Connection method	Screw connection
Conductor cross section solid min.	0.14 mm ²
Conductor cross section solid max.	2.5 mm ²
Conductor cross section stranded min.	0.2 mm ²
Conductor cross section stranded max.	2.5 mm ²
Conductor cross section AWG/kcmil min.	26
Conductor cross section AWG/kcmil max	12
Stripping length	12 mm
Screw thread	M3

General data

No. of channels	1
Width	6.2 mm

Height	93.1 mm
Depth	102.5 mm
Maximum transmission error	≤ 0.1 % (of final value)
Maximum temperature coefficient	< 0.01 %/K
Temperature coefficient, typical	< 0.002 %/K
Limit frequency (3 dB)	Approx. 100 Hz
Step response (10-90%)	Approx. 3.2 ms
Protective circuit	Transient protection
Ambient temperature (operation)	-20 °C ... 65 °C
Ambient temperature (storage/transport)	-40 °C ... 85 °C
Degree of protection	IP20
Electrical isolation	Basic insulation according to EN 61010
Surge voltage category	II
Pollution degree	2
Rated insulation voltage	50 V AC/DC
Test voltage, input/output/supply	1.5 kV (50 Hz, 1 min.)
Electromagnetic compatibility	Conformance with EMC Directive 2004/108/EC
Noise emission	EN 50081-2
Noise immunity	EN 61000-6-2:2005
Color	green
Housing material	PBT
Mounting position	Any
Assembly instructions	The DIN rail bus connector (TBUS) can be used for bridging the supply voltage. It can be snapped onto a 35 mm EN 60715 DIN rail.
Conformance	CE-compliant
ATEX	Ex II 3 G Ex nA II T4 X
UL, USA / Canada	UL 508 Recognized
GL	GL EMC 2 D

Certificates / Approvals



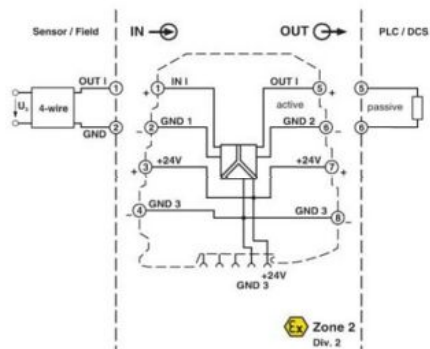
Certification	CUL, GL, UL
Certification Ex:	CUL-EX LIS, PxC-EX, UL-EX LIS

Accessories

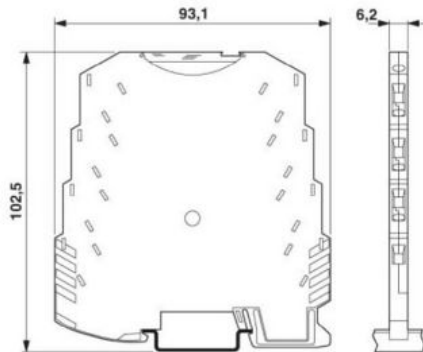
Item	Designation	Description
General		
2869728	ME 6,2 TBUS-2 1,5/5-ST-3,81 GN	DIN rail connector (TBUS), 5-pos., for bridging the supply voltage, can be snapped onto NS 35/... DIN rails according to EN 60715
2308111	MINI MCR DKL	Fold up transparent cover for MINI MCR modules with additional labeling option using insert strips and flat Zack marker strip 6.2 mm
2810272	MINI MCR-DKL-LABEL	Label for extended marking of MINI MCR modules in connection with the MINI MCR-DKL
2864134	MINI MCR-SL-PTB	MCR power terminal block for supplying several MINI Analog modules via the DIN rail connectors, with screw connection, current consumption up to max. 2 A
2864147	MINI MCR-SL-PTB-SP	MCR power terminal block for supplying several MINI-ANALOG modules via the DIN rail connectors, with spring-cage connection, current consumption up to max. 2 A
2866653	MINI-PS-100-240AC/24DC/1.5/ EX	DIN rail power supply unit, primary-switched mode, slim design, output: 24 V DC / 1.5 A, ATEX approval
2866983	MINI-SYS-PS-100-240AC/24DC/1.5	DIN rail power supply unit, primary-switched mode, slim design, output: 24 V DC / 1.5 A

Diagrams/Drawings

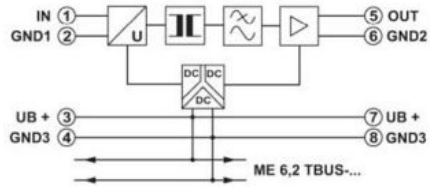
Block diagram



Dimensioned drawing



Circuit diagram



Address

PHOENIX CONTACT Inc., USA
586 Fulling Mill Road
Middletown, PA 17057, USA
Phone (800) 888-7388
Fax (717) 944-1625
<http://www.phoenixcon.com>



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DIN rail bus connectors - ME 6,2 TBUS-2 1,5/5-ST-3,81 GN - 2869728

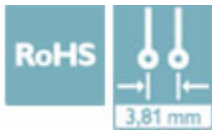
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DIN rail connector for DIN rail mounting. Universal for TBUS housing. Gold-plated contacts, 5-pos.




Your advantages

- ✓ For bridging the supply voltage
- ✓ One DIN rail connector for two MINI Analog modules
- ✓ Current carrying capacity of 8 A parallel to DIN rail and 2 A parallel to MINI Analog modules
- ✓ Reduced wiring effort
- ✓ Module replacement without interrupting the supply to the remaining modules (hot swappable)



Key Commercial Data

Packing unit	1 pc
Minimum order quantity	10 pc
GTIN	 4 017918 983093
GTIN	4017918983093
Weight per Piece (excluding packing)	6.240 g
Custom tariff number	85366990
Country of origin	Germany

Technical data

Width	6.2 mm
Number of positions	5

Dimensions

Width	6.2 mm
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DIN rail bus connectors - ME 6,2 TBUS-2 1,5/5-ST-3,81 GN - 2869728

Technical data

Dimensions

Pitch	3.81 mm
-------	---------

Technical data

Connection in acc. with standard	CUL
Nominal voltage U_N	150 V
Nominal current I_N	8 A
Indicator1	CUL1
Number of positions	5

Standards and Regulations

Connection in acc. with standard	CUL
----------------------------------	-----

Environmental Product Compliance

China RoHS	Environmentally friendly use period: unlimited = EFUP-e
	No hazardous substances above threshold values

Classifications

eCl@ss

eCl@ss 4.0	27180401
eCl@ss 4.1	27180401
eCl@ss 5.0	27180506
eCl@ss 5.1	27180500
eCl@ss 6.0	27180800
eCl@ss 7.0	27182702
eCl@ss 8.0	27182702
eCl@ss 9.0	27182702

ETIM

ETIM 2.0	EC001031
ETIM 3.0	EC001031
ETIM 4.0	EC002638
ETIM 5.0	EC001031
ETIM 6.0	EC001031
ETIM 7.0	EC001031

UNSPSC

UNSPSC 6.01	31261501
UNSPSC 7.0901	31261501

DIN rail bus connectors - ME 6,2 TBUS-2 1,5/5-ST-3,81 GN - 2869728

Classifications

UNSPSC

UNSPSC 11	31261501
UNSPSC 12.01	31261501
UNSPSC 13.2	31261501

Approvals


Approvals


Approvals


UL Recognized / cUL Recognized / EAC / cULus Recognized

Ex Approvals

Approval details

UL Recognized		http://database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/index.htm	FILE E 60425
	B	D	
Nominal voltage UN	150 V	150 V	
Nominal current IN	8 A	8 A	

cUL Recognized		http://database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/index.htm	FILE E 60425
	B	D	
Nominal voltage UN	150 V	150 V	
Nominal current IN	8 A	8 A	

EAC		B.01742
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cULus Recognized	
------------------	---

<https://www.phoenixcontact.com/us/products/2869728>



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MINI MCR-SL-PTB - Power terminal block



2864134

<https://www.phoenixcontact.com/us/products/2864134>

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MCR power terminal block for supplying several MINI Analog modules via the DIN rail connector, with screw connection, maximum current consumption of up to 2 A

Product Description

The 6.2 mm wide MINI MCR-SL-PTB... power terminal is used for supplying the DIN rail connector with supply voltage.

Two separate voltage inputs allow a redundant voltage supply of 24 V DC and a maximum current of 2 A.

A green LED on the front panel lights up when there is supply voltage on the DIN rail connector. Red LEDs indicate supply voltages connected with reversed polarity. When the supply voltage has been connected correctly, the red LED extinguishes.

Your advantages

- For supplying the supply voltage via the foot element (DIN rail connector) where DC voltages of up to 30 V are already available
- Status and error indication via diagnostic LEDs

Commercial Data

Item number	2864134
Packing unit	1 pc
Minimum order quantity	1 pc
Sales Key	C403
Product Key	CK12ZZ
Catalog Page	Page 118 (C-7-2015)
GTIN	4017918974770
Weight per Piece (including packing)	86.8 g
Weight per Piece (excluding packing)	69.5 g
Customs tariff number	85437090
Country of origin	DE

MINI MCR-SL-PTB - Power terminal block



2864134

<https://www.phoenixcontact.com/us/products/2864134>

Technical Data

Notes

Utilization restriction

EMC note	EMC: class A product, see manufacturer's declaration in the download area
----------	---

Product properties

Product type	Power module
Product family	MINI Analog

Input data

Input voltage range DC	20 V DC ... 30 V DC
Max. input current	2 A
Reverse polarity protection	yes

Output data

Output voltage range	Input voltage - 0.8 V
----------------------	-----------------------

Connection data

Input

Connection method	Screw connection
Conductor cross section, rigid min.	0.2 mm ²
Conductor cross section, rigid max.	2.5 mm ²
Conductor cross section flexible min.	0.2 mm ²
Conductor cross section flexible max.	2.5 mm ²
Conductor cross section AWG min.	26
Conductor cross section AWG max.	12
Stripping length	12 mm
Screw thread	M3

LED signaling

Status display	Green LED (supply)
Error indication	Red LED

Dimensions

Dimensional drawing	
---------------------	--

MINI MCR-SL-PTB - Power terminal block



2864134

<https://www.phoenixcontact.com/us/products/2864134>

Width	6.2 mm
Height	93.1 mm
Depth	102.5 mm

Material specifications

Fire protection for rail vehicles (DIN EN 45545-2) R22	HL 1 - HL 2
Fire protection for rail vehicles (DIN EN 45545-2) R23	HL 1 - HL 2
Fire protection for rail vehicles (DIN EN 45545-2) R24	HL 1 - HL 2
Housing material	PBT

Environmental and real-life conditions

Ambient conditions

Degree of protection	IP20
Ambient temperature (operation)	-20 °C ... 65 °C
Ambient temperature (storage/transport)	-40 °C ... 85 °C
Maximum altitude	≤ 2000 m
Permissible humidity (operation)	5 % ... 95 % (non-condensing)

Approval data

CE

Certificate	CE-compliant
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UKCA

Certificate	UKCA-compliant
-------------	----------------

UL, USA/Canada

Identification	UL 508 Listed
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Shipbuilding approval

Certificate	DNV GL TAA000020N
-------------	-------------------

DNV GL data

Temperature	B
Humidity	B
Vibration	B
EMC	A
Enclosure	Required protection according to the Rules shall be provided upon installation on board

EMC data

Electromagnetic compatibility	Conformance with EMC directive
Noise emission	EN 61000-6-4
Noise immunity	EN 61000-6-2
Note	When being exposed to interference, there may be minimal deviations.

MINI MCR-SL-PTB - Power terminal block



2864134

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Electrostatic discharge

Standards/regulations	EN 61000-4-2
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Electrostatic discharge

Comments	Safety measures must be taken to prevent electrostatic discharge.
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Electromagnetic HF field

Designation	Electromagnetic RF field
Standards/regulations	EN 61000-4-3
Evaluation criterion	A

Fast transients (burst)

Designation	Fast transients (burst)
Standards/regulations	EN 61000-4-4
Evaluation criterion	B

Surge current load (surge)

Standards/regulations	EN 61000-4-5
-----------------------	--------------

Surge current load (surge)

Comments	Criterion B
----------	-------------

Conducted interference

Designation	Conducted interferences
Standards/regulations	EN 61000-4-6
Evaluation criterion	A

Mounting

Mounting type	DIN rail mounting
Assembly instructions	The DIN rail connector can be used for bridging the supply voltage. It can be snapped onto a 35 mm EN 60715 DIN rail.
Mounting position	any

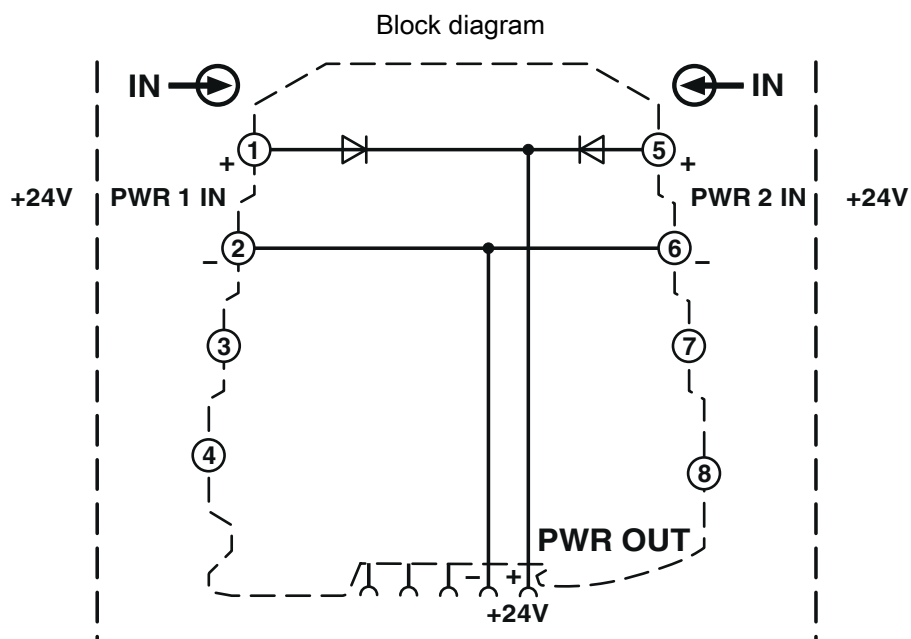
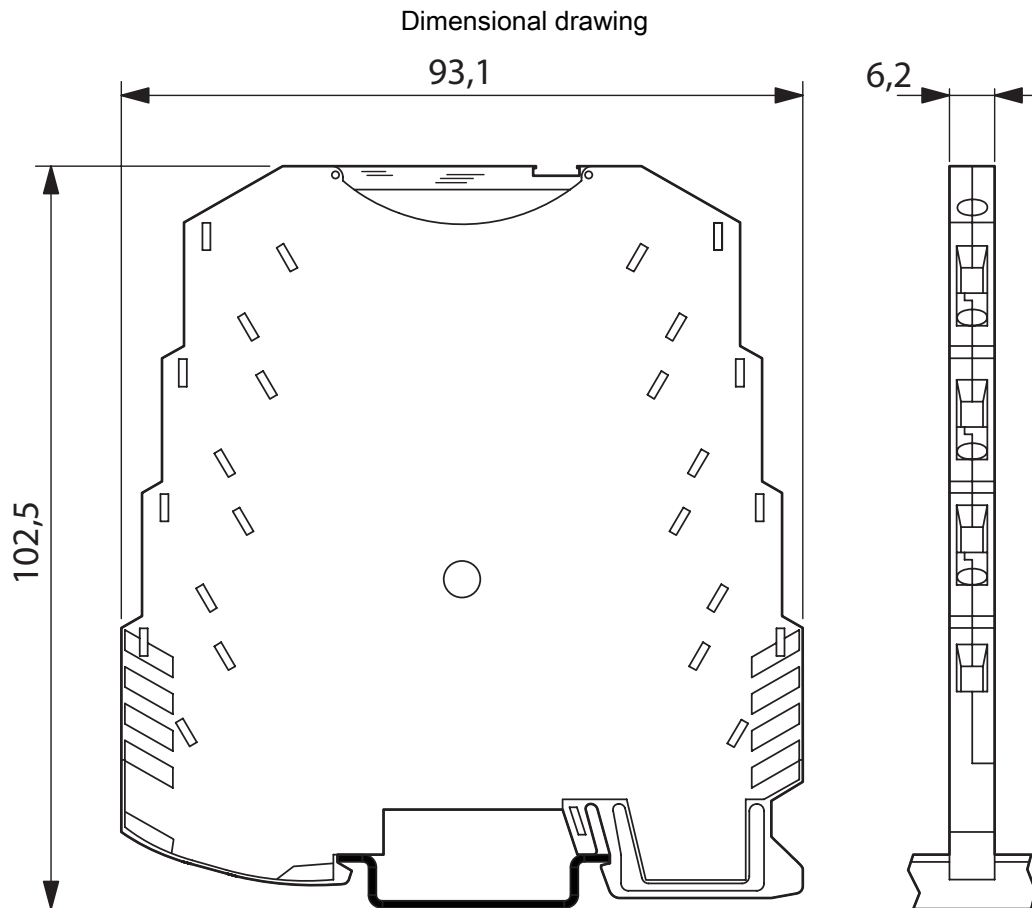
MINI MCR-SL-PTB - Power terminal block



2864134

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Drawings



MINI MCR-SL-PTB - Power terminal block



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<https://www.phoenixcontact.com/us/products/2864134>

Approvals



cUL Recognized
Approval ID: FILE E 238705



UL Recognized
Approval ID: FILE E 238705



DNV GL
Approval ID: TAA00002R0



cUL Listed
Approval ID: FILE E 199827



UL Listed
Approval ID: FILE E 199827

MINI MCR-SL-PTB - Power terminal block



2864134

<https://www.phoenixcontact.com/us/products/2864134>

Classifications

ECLASS

ECLASS-11.0

27371392

ETIM

ETIM 8.0

EC002498

UNSPSC

UNSPSC 21.0

39121100

MINI MCR-SL-PTB - Power terminal block



2864134

<https://www.phoenixcontact.com/us/products/2864134>

Environmental Product Compliance

REACH SVHC	Lead 7439-92-1
China RoHS	Environmentally Friendly Use Period = 50 years
	For information on hazardous substances, refer to the manufacturer's declaration available under "Downloads"

MINI MCR-SL-PTB - Power terminal block



2864134

<https://www.phoenixcontact.com/us/products/2864134>

Accessories

TC-D37SUB-AIO16-M-PS-UNI - Module carrier

2902934

<https://www.phoenixcontact.com/us/products/2902934>



Universal termination carrier for connecting 16 MINI Analog signal conditioners to digital or analog I/O cards, via D-SUB connector, 37-pos. (1:1 connection), with HART multiplexer connection

TC-D37SUB-ADIO16-M-P-UNI - Module carrier

2902933

<https://www.phoenixcontact.com/us/products/2902933>



Universal termination carrier for connecting 16 MINI Analog signal conditioners to digital or analog I/O cards, via D-SUB connector, 37-pos. (1:1 connection)

MINI MCR-SL-PTB - Power terminal block

2864134

<https://www.phoenixcontact.com/us/products/2864134>



ME 6,2 TBUS-2 1,5/5-ST-3,81 GN - DIN rail bus connectors

2869728

<https://www.phoenixcontact.com/us/products/2869728>



DIN rail connector for DIN rail mounting. Universal for TBUS housing. Gold-plated contacts, 5-pos.

MINI MCR DKL - Transparent cover

2308111

<https://www.phoenixcontact.com/us/products/2308111>



Fold up transparent cover for MINI MCR modules with additional labeling option using insert strips and flat Zack marker strip 6.2 mm

MINI MCR-SL-PTB - Power terminal block

2864134

<https://www.phoenixcontact.com/us/products/2864134>



MINI MCR-DKL-LABEL - Marking label

2810272

<https://www.phoenixcontact.com/us/products/2810272>

Label for extended marking of MINI MCR modules in connection with the MINI MCR-DKL



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Feed-through terminal block - UT 10

3044160

<https://www.phoenixcontact.com/us/products/3044160>

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Feed-through terminal block, nom. voltage: 1000 V, nominal current: 57 A, connection method: Screw connection, Rated cross section: 10 mm², cross section: 0.5 mm² - 16 mm², mounting type: NS 35/7,5, NS 35/15, color: gray

Your advantages

- The large wiring space enables the connection of solid and stranded conductors without ferrules, even above the nominal cross section
- As well as saving space, the compact design enables user-friendly wiring in a small amount of space
- Optimum screwdriver guidance through closed screw shafts
- The cable entry funnel enables the use of conductors with ferrules and plastic collars within the nominal cross section
- Tested for railway applications

Commercial Data

Item number	3044160
Packing unit	1 pc
Minimum order quantity	50 pc
Sales Key	B01
Product Key	BE1111
Catalog Page	Page 183 (C-1-2019)
GTIN	4017918960445
Weight per Piece (including packing)	17.33 g
Weight per Piece (excluding packing)	16.9 g
Customs tariff number	85369010
Country of origin	DE

Feed-through terminal block - UT 10



3044160

<https://www.phoenixcontact.com/us/products/3044160>

Technical Data

Product properties

Product type	Feed-through terminal block
Area of application	Railway industry
	Machine building
	Plant engineering
	Process industry
Number of connections	2
Number of rows	1
Potentials	1

Insulation characteristics

Overvoltage category	III
Degree of pollution	3

Electrical properties

Rated surge voltage	8 kV
Maximum power dissipation for nominal condition	1.82 W

Connection data

Number of connections per level	2
Nominal cross section	10 mm ²

Level 1 above 1 below 1

Screw thread	M4
Tightening torque	1.5 ... 1.8 Nm
Stripping length	10 mm
Internal cylindrical gage	A6
Conductor cross section solid	0.5 mm ² ... 16 mm ²
Cross section AWG	20 ... 6
Conductor cross section flexible	0.5 mm ² ... 16 mm ²
Conductor cross section, flexible [AWG]	20 ... 6
Flexible conductor cross section flexible (ferrule, w/o plastic sleeve)	0.5 mm ² ... 10 mm ²
Flexible conductor cross section (ferrule with plastic sleeve)	0.5 mm ² ... 10 mm ²
2 conductors with same cross section, solid	0.5 mm ² ... 4 mm ²
2 conductors with same cross section, flexible	0.5 mm ² ... 4 mm ²
2 conductors with same cross section, flexible, with ferrule without plastic sleeve	0.5 mm ² ... 2.5 mm ²
2 conductors with the same cross section, flexible, with TWIN ferrule with plastic sleeve	0.5 mm ² ... 6 mm ²
Nominal current	57 A
Maximum load current	76 A (with 16 mm ² conductor cross section)
Nominal voltage	1000 V

Feed-through terminal block - UT 10



3044160

<https://www.phoenixcontact.com/us/products/3044160>

Note	Note: Product releases, connection cross sections and notes on connecting aluminum cables can be found in the download area.
Nominal cross section	10 mm ²

Ex data

Rated data (ATEX/IECEX)

ATEX certificate	KEMA 04 ATEX 2048 U
IEC Ex certificate	IECEX KEM 06.0027 U
Identification	□ II 2 GD Ex eb IIC Gb
Operating temperature range	-60 °C ... 110 °C
Ex-certified accessories	3047028 D-UT 2,5/10 1205066 SZS 1,0X4,0 VDE 3022276 CLIPFIX 35-5 3022218 CLIPFIX 35
Bridge data	54 A / 10 mm ²
Ex temperature increase	40 K (60.1 A / 10 mm ²)
Rated voltage	690 V
for bridging with bridge	690 V
Rated insulation voltage	630 V

Ex level General

Rated current	54 A
Maximum load current	69 A
Contact resistance	0.16 mΩ

Ex connection data General

Torque range	1.5 Nm ... 1.8 Nm
Nominal cross section	10 mm ²
Rated cross section AWG	8
Connection capacity rigid	0.5 mm ² ... 16 mm ²
Connection capacity AWG	20 ... 6
Connection capacity flexible	0.5 mm ² ... 10 mm ²
Connection capacity AWG	20 ... 8
2 conductors with same cross section, solid	0.5 mm ² ... 4 mm ²
2 conductors with the same cross-section AWG rigid	20 ... 12
2 conductors with same cross section, stranded	0.5 mm ² ... 4 mm ²
2 conductors with the same cross-section AWG flexible	20 ... 12

Dimensions

Width	10.2 mm
End cover width	2.2 mm
Height	46.9 mm
Height NS 35/15	55 mm
Height NS 35/7,5	47.5 mm
Length	47.7 mm

Feed-through terminal block - UT 10



3044160

<https://www.phoenixcontact.com/us/products/3044160>

Material specifications

Color	gray
Flammability rating according to UL 94	V0
Insulating material group	I
Insulating material	PA
Static insulating material application in cold	-60 °C
Temperature index of insulation material (DIN EN 60216-1 (VDE 0304-21))	125 °C
Relative insulation material temperature index (Elec., UL 746 B)	130 °C
Fire protection for rail vehicles (DIN EN 45545-2) R22	HL 1 - HL 3
Fire protection for rail vehicles (DIN EN 45545-2) R23	HL 1 - HL 3
Fire protection for rail vehicles (DIN EN 45545-2) R24	HL 1 - HL 3
Fire protection for rail vehicles (DIN EN 45545-2) R26	HL 1 - HL 3
Calorimetric heat release NFPA 130 (ASTM E 1354)	27,5 MJ/kg
Surface flammability NFPA 130 (ASTM E 162)	passed
Specific optical density of smoke NFPA 130 (ASTM E 662)	passed
Smoke gas toxicity NFPA 130 (SMP 800C)	passed

Electrical tests

Surge voltage test

Result	Test passed
--------	-------------

Temperature-rise test

Requirement temperature-rise test	Increase in temperature \leq 45 K
Result	Test passed
Short-time withstand current 10 mm ²	1.2 kA
Result	Test passed

Power-frequency withstand voltage

Result	Test passed
--------	-------------

Mechanical properties

Mechanical data

Open side panel	Yes
-----------------	-----

Mechanical tests

Mechanical strength

Result	Test passed
--------	-------------

Attachment on the carrier

DIN rail/fixing support	NS 35
Test force setpoint	5 N
Result	Test passed

Feed-through terminal block - UT 10



3044160

<https://www.phoenixcontact.com/us/products/3044160>

Test for conductor damage and slackening

Rotation speed	10 rpm
Revolutions	135
Conductor cross section/weight	0.5 mm ² / 0.3 kg
	10 mm ² / 2 kg
	16 mm ² / 2.9 kg
Result	Test passed

Environmental and real-life conditions

Aging

Temperature cycles	192
--------------------	-----

Needle-flame test

Time of exposure	30 s
Result	Test passed

Oscillation/broadband noise

Specification	DIN EN 50155 (VDE 0115-200):2018-05
Spectrum	Service life test category 2, bogie-mounted
Frequency	f ₁ = 5 Hz to f ₂ = 250 Hz
ASD level	6.12 (m/s ²) ² /Hz
Acceleration	3.12g
Test duration per axis	5 h
Test directions	X-, Y- and Z-axis

Shocks

Specification	DIN EN 50155 (VDE 0115-200):2008-03
Pulse shape	Half-sine
Acceleration	30g
Shock duration	18 ms
Number of shocks per direction	3
Test directions	X-, Y- and Z-axis (pos. and neg.)
Result	Test passed

Ambient conditions

Ambient temperature (operation)	-60 °C ... 105 °C (max. short-term operating temperature RTI Elec.)
Ambient temperature (storage/transport)	-25 °C ... 60 °C (for a short time, not exceeding 24 h, -60 °C to +70 °C)
Ambient temperature (assembly)	-5 °C ... 70 °C
Ambient temperature (actuation)	-5 °C ... 70 °C
Permissible humidity (storage/transport)	30 % ... 70 %

Standards and regulations

Connection in acc. with standard	IEC 60947-7-1
----------------------------------	---------------

Feed-through terminal block - UT 10



3044160

<https://www.phoenixcontact.com/us/products/3044160>

Mounting

Mounting type	NS 35/7,5
	NS 35/15

Feed-through terminal block - UT 10

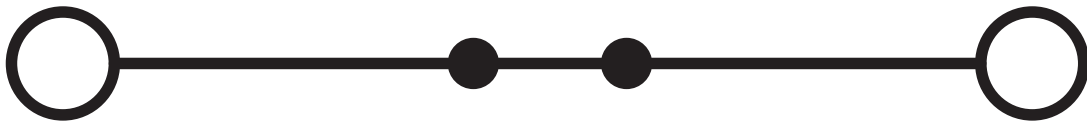
3044160

<https://www.phoenixcontact.com/us/products/3044160>



Drawings

Circuit diagram



Feed-through terminal block - UT 10



3044160

<https://www.phoenixcontact.com/us/products/3044160>

Approvals

DNV

Approval ID: TAE00001S9



CSA

Approval ID: 13631

	Nominal Voltage U_N	Nominal Current I_N	Cross Section AWG	Cross Section mm^2
Use group B				
	600 V	65 A	20 - 6	-
Use group C				
	600 V	65 A	20 - 6	-



IECEE CB Scheme

Approval ID: DE1-63061_M1

	Nominal Voltage U_N	Nominal Current I_N	Cross Section AWG	Cross Section mm^2
	1000 V	57 A	-	0.5 - 10



cULus Recognized

Approval ID: E60425

	Nominal Voltage U_N	Nominal Current I_N	Cross Section AWG	Cross Section mm^2
Use group B				
	600 V	65 A	20 - 6	-
Use group C				
	600 V	65 A	20 - 6	-



RS

Approval ID: 17.00013.272



VDE Zeichengenehmigung

Approval ID: 40013658

	Nominal Voltage U_N	Nominal Current I_N	Cross Section AWG	Cross Section mm^2
	1000 V	57 A	-	0.5 - 10



PRS

Approval ID: TE/2156/880590/17



ATEX

Approval ID: KEMA04ATEX2048U

Feed-through terminal block - UT 10



3044160

<https://www.phoenixcontact.com/us/products/3044160>



EAC Ex

Approval ID: RU C-DE.HA91.B.00066



IECEx

Approval ID: IECEx KEM 06.0027U



CCC

Approval ID: 2020322313000622



NEPSI

Approval ID: GYJ20.1194U

Feed-through terminal block - UT 10



3044160

<https://www.phoenixcontact.com/us/products/3044160>

Classifications

ECLASS

ECLASS-9.0	27141120
ECLASS-10.0.1	27141120
ECLASS-11.0	27141120

ETIM

ETIM 8.0	EC000897
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UNSPSC

UNSPSC 21.0	39121400
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End cover - D-UT 2,5/10

3047028

<https://www.phoenixcontact.com/us/products/3047028>

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End cover, length: 47 mm, width: 2.2 mm, height: 39.8 mm, color: gray



Commercial Data

Item number	3047028
Packing unit	1 pc
Minimum order quantity	50 pc
Sales Key	B01
Product Key	BE1Z1X
Catalog Page	Page 149 (C-1-2019)
GTIN	4017918960346
Weight per Piece (including packing)	2.52 g
Weight per Piece (excluding packing)	2.369 g
Customs tariff number	85389099
Country of origin	DE

Technical Data

Product properties

Product type	End cover
--------------	-----------

Ambient conditions

Ambient temperature (operation)	-60 °C ... 105 °C (max. short-term operating temperature RTI Elec.)
Ambient temperature (storage/transport)	-25 °C ... 60 °C (for a short time, not exceeding 24 h, -60 °C to +70 °C)
Ambient temperature (assembly)	-5 °C ... 70 °C
Ambient temperature (actuation)	-5 °C ... 70 °C
Permissible humidity (storage/transport)	30 % ... 70 %

Material specifications

Color	gray
Material	PA
Flammability rating according to UL 94	V0
Static insulating material application in cold	-60 °C
Temperature index of insulation material (DIN EN 60216-1 (VDE 0304-21))	125 °C
Relative insulation material temperature index (Elec., UL 746 B)	130 °C
Fire protection for rail vehicles (DIN EN 45545-2) R22	HL 1 - HL 3
Fire protection for rail vehicles (DIN EN 45545-2) R23	HL 1 - HL 3
Fire protection for rail vehicles (DIN EN 45545-2) R24	HL 1 - HL 3
Fire protection for rail vehicles (DIN EN 45545-2) R26	HL 1 - HL 3
Calorimetric heat release NFPA 130 (ASTM E 1354)	27,5 MJ/kg
Surface flammability NFPA 130 (ASTM E 162)	passed
Specific optical density of smoke NFPA 130 (ASTM E 662)	passed
Smoke gas toxicity NFPA 130 (SMP 800C)	passed

Dimensions

Width	2.2 mm
Height	39.8 mm
Length	47 mm

End cover - D-UT 2,5/10



3047028

<https://www.phoenixcontact.com/us/products/3047028>

Classifications

ECLASS

ECLASS-10.0.1	27141133
ECLASS-9.0	27141133
ECLASS-11.0	27141133

ETIM

ETIM 8.0	EC000886
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UNSPSC

UNSPSC 21.0	39121400
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Ground modular terminal block - UT 4-PE



3044128

<https://www.phoenixcontact.com/us/products/3044128>

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Ground modular terminal block, number of connections: 2, connection method: Screw connection, cross section: 0.14 mm² - 6 mm², mounting type: NS 35/7,5, NS 35/15, color: green-yellow

Your advantages

- Tested for railway applications

Commercial Data

Item number	3044128
Packing unit	1 pc
Minimum order quantity	1 pc
Sales Key	B01
Product Key	BE1121
Catalog Page	Page 159 (C-1-2019)
GTIN	4017918960407
Weight per Piece (including packing)	13.382 g
Weight per Piece (excluding packing)	12.7 g
Customs tariff number	85369010
Country of origin	DE

Ground modular terminal block - UT 4-PE



3044128

<https://www.phoenixcontact.com/us/products/3044128>

Technical Data

Product properties

Product type	Ground terminal block
Area of application	Railway industry
	Machine building
	Plant engineering
	Process industry
Number of connections	2
Number of rows	1

Insulation characteristics

Overvoltage category	III
Degree of pollution	3

Electrical properties

Rated surge voltage	8 kV
Maximum power dissipation for nominal condition	1.02 W

Connection data

Grounding foot	Yes
Number of connections per level	2
Nominal cross section	4 mm ²

Level 1 above 1 below 1

Screw thread	M3
Note	Please observe the current carrying capacity of the DIN rails.
Tightening torque	0.6 ... 0.8 Nm
Stripping length	9 mm
Internal cylindrical gage	A4
Conductor cross section solid	0.14 mm ² ... 6 mm ²
Cross section AWG	26 ... 10
Conductor cross section flexible	0.14 mm ² ... 6 mm ²
Conductor cross section, flexible [AWG]	26 ... 10
Flexible conductor cross section flexible (ferrule, w/o plastic sleeve)	0.25 mm ² ... 4 mm ²
Flexible conductor cross section (ferrule with plastic sleeve)	0.25 mm ² ... 4 mm ²
Note	Note: Product releases, connection cross sections and notes on connecting aluminum cables can be found in the download area.

Ex data

Rated data (ATEX/IECEX)

ATEX certificate	KEMA 04 ATEX 2048 U
IEC Ex certificate	IECEX KEM 06.0027 U

Ground modular terminal block - UT 4-PE



3044128

<https://www.phoenixcontact.com/us/products/3044128>

Identification	□ II 2 GD Ex eb IIC Gb
Operating temperature range	-60 °C ... 110 °C
Ex-certified accessories	3047028 D-UT 2,5/10
	1205053 SZS 0,6X3,5
	3022276 CLIPFIX 35-5
	3022218 CLIPFIX 35

Ex connection data General

Torque range	0.6 Nm ... 0.8 Nm
Nominal cross section	4 mm ²
Rated cross section AWG	12
Connection capacity rigid	0.14 mm ² ... 6 mm ²
Connection capacity AWG	26 ... 10
Connection capacity flexible	0.14 mm ² ... 4 mm ²
Connection capacity AWG	26 ... 12

Dimensions

Width	6.2 mm
End cover width	2.2 mm
Height	46.9 mm
Height NS 35/15	55 mm
Height NS 35/7,5	47.5 mm
Length	47.7 mm

Material specifications

Color	green-yellow
Flammability rating according to UL 94	V0
Insulating material group	I
Insulating material	PA
Static insulating material application in cold	-60 °C
Temperature index of insulation material (DIN EN 60216-1 (VDE 0304-21))	125 °C
Relative insulation material temperature index (Elec., UL 746 B)	130 °C
Fire protection for rail vehicles (DIN EN 45545-2) R22	HL 1 - HL 3
Fire protection for rail vehicles (DIN EN 45545-2) R23	HL 1 - HL 3
Fire protection for rail vehicles (DIN EN 45545-2) R24	HL 1 - HL 3
Fire protection for rail vehicles (DIN EN 45545-2) R26	HL 1 - HL 3
Calorimetric heat release NFPA 130 (ASTM E 1354)	27,5 MJ/kg
Surface flammability NFPA 130 (ASTM E 162)	passed
Specific optical density of smoke NFPA 130 (ASTM E 662)	passed
Smoke gas toxicity NFPA 130 (SMP 800C)	passed

Mechanical properties

Mechanical data

Ground modular terminal block - UT 4-PE



3044128

<https://www.phoenixcontact.com/us/products/3044128>

Open side panel	Yes
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Environmental and real-life conditions

Ambient conditions

Ambient temperature (operation)	-60 °C ... 105 °C (max. short-term operating temperature RTI Elec.)
Ambient temperature (storage/transport)	-25 °C ... 60 °C (for a short time, not exceeding 24 h, -60 °C to +70 °C)
Ambient temperature (assembly)	-5 °C ... 70 °C
Ambient temperature (actuation)	-5 °C ... 70 °C
Permissible humidity (storage/transport)	30 % ... 70 %

Standards and regulations

Connection in acc. with standard	IEC 60947-7-2
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Mounting

Mounting type	NS 35/7,5
	NS 35/15

Ground modular terminal block - UT 4-PE

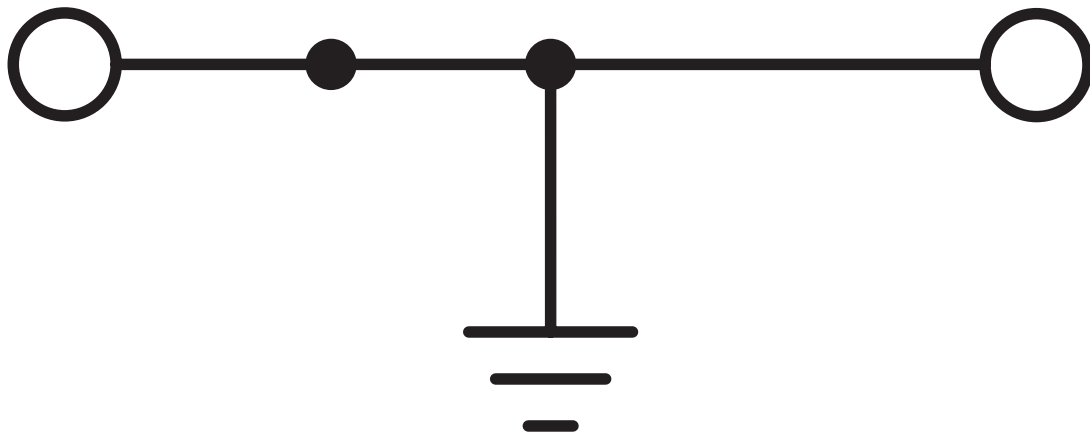


3044128

<https://www.phoenixcontact.com/us/products/3044128>

Drawings

Circuit diagram



Ground modular terminal block - UT 4-PE



3044128

<https://www.phoenixcontact.com/us/products/3044128>

Approvals

DNV

Approval ID: TAE00001S9



CSA

Approval ID: 13631

	Nominal Voltage U_N	Nominal Current I_N	Cross Section AWG	Cross Section mm^2
Use group B			26 - 10	-
Use group C			26 - 10	-



IECEE CB Scheme

Approval ID: DE1-63045

	Nominal Voltage U_N	Nominal Current I_N	Cross Section AWG	Cross Section mm^2
			-	-



EAC

Approval ID: RU C-DE.A*30.B.01742



cULus Recognized

Approval ID: E60425

	Nominal Voltage U_N	Nominal Current I_N	Cross Section AWG	Cross Section mm^2
Use group B			26 - 10	-
Multi-conductor connection			26 - 14	-
Use group C			26 - 10	-
Multi-conductor connection			26 - 14	-
Use group D			26 - 10	-
Multi-conductor connection			26 - 14	-



RS

Approval ID: 17.00013.272


Ground modular terminal block - UT 4-PE


3044128


<https://www.phoenixcontact.com/us/products/3044128>





	VDE Gutachten mit Fertigungsüberwachung Approval ID: 40013715			
	Nominal Voltage U_N	Nominal Current I_N	Cross Section AWG	Cross Section mm^2
			-	0.2 - 4


	PRS Approval ID: TE/2156/880590/17			
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	ATEX Approval ID: KEMA04ATEX2048U			
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	EAC Ex Approval ID: RU C-DE.HA91.B.00066			
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	IECEX Approval ID: IECEX KEM 06.0027U			
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	CCC Approval ID: 2020322313000622			
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	NEPSI Approval ID: GYJ20.1194U			
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Ground modular terminal block - UT 4-PE



3044128

<https://www.phoenixcontact.com/us/products/3044128>

Classifications

ECLASS

ECLASS-9.0	27141141
ECLASS-10.0.1	27141141
ECLASS-11.0	27141141

ETIM

ETIM 8.0	EC000901
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UNSPSC

UNSPSC 21.0	39121400
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Feed-through terminal block - UT 4

3044102

<https://www.phoenixcontact.com/us/products/3044102>

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Feed-through terminal block, nom. voltage: 1000 V, nominal current: 32 A, connection method: Screw connection, Rated cross section: 4 mm², cross section: 0.14 mm² - 6 mm², mounting type: NS 35/7,5, NS 35/15, color: gray

Your advantages

- The large wiring space enables the connection of solid and stranded conductors without ferrules, even above the nominal cross section
- As well as saving space, the compact design enables user-friendly wiring in a small amount of space
- Optimum screwdriver guidance through closed screw shafts
- The cable entry funnel enables the use of conductors with ferrules and plastic collars within the nominal cross section
- Tested for railway applications

Commercial Data

Item number	3044102
Packing unit	1 pc
Minimum order quantity	50 pc
Sales Key	B01
Product Key	BE1111
Catalog Page	Page 159 (C-1-2019)
GTIN	4017918960391
Weight per Piece (including packing)	9.419 g
Weight per Piece (excluding packing)	8.9 g
Customs tariff number	85369010
Country of origin	DE

Feed-through terminal block - UT 4



3044102

<https://www.phoenixcontact.com/us/products/3044102>

Technical Data

Product properties

Product type	Feed-through terminal block
Area of application	Railway industry
	Machine building
	Plant engineering
	Process industry
Number of connections	2
Number of rows	1
Potentials	1

Insulation characteristics

Overvoltage category	III
Degree of pollution	3

Electrical properties

Rated surge voltage	8 kV
Maximum power dissipation for nominal condition	1.02 W

Connection data

Number of connections per level	2
Nominal cross section	4 mm ²

Level 1 above 1 below 1

Screw thread	M3
Tightening torque	0.6 ... 0.8 Nm
Stripping length	9 mm
Internal cylindrical gage	A4
Conductor cross section solid	0.14 mm ² ... 6 mm ²
Cross section AWG	26 ... 10
Conductor cross section flexible	0.14 mm ² ... 6 mm ²
Conductor cross section, flexible [AWG]	26 ... 10
Flexible conductor cross section flexible (ferrule, w/o plastic sleeve)	0.14 mm ² ... 4 mm ²
Flexible conductor cross section (ferrule with plastic sleeve)	0.14 mm ² ... 4 mm ²
2 conductors with same cross section, solid	0.14 mm ² ... 1.5 mm ²
2 conductors with same cross section, flexible	0.14 mm ² ... 1.5 mm ²
2 conductors with same cross section, flexible, with ferrule without plastic sleeve	0.14 mm ² ... 1.5 mm ²
2 conductors with the same cross section, flexible, with TWIN ferrule with plastic sleeve	0.5 mm ² ... 2.5 mm ²
Nominal current	32 A (with 4 mm ² conductor cross section)
Maximum load current	41 A (with 6 mm ² conductor cross section)
Nominal voltage	1000 V

Feed-through terminal block - UT 4



3044102

<https://www.phoenixcontact.com/us/products/3044102>

Note	Note: Product releases, connection cross sections and notes on connecting aluminum cables can be found in the download area.
Nominal cross section	4 mm ²

Ex data

Rated data (ATEX/IECEX)

ATEX certificate	KEMA 04 ATEX 2048 U
IEC Ex certificate	IECEX KEM 06.0027 U
Identification	□ II 2 GD Ex eb IIC Gb
Operating temperature range	-60 °C ... 110 °C
Ex-certified accessories	3047028 D-UT 2,5/10 3047167 ATP-UT 1205053 SZS 0,6X3,5 3022276 CLIPFIX 35-5 3022218 CLIPFIX 35
Bridge data	27 A / 4 mm ²
Ex temperature increase	40 K (33.3 A / 4 mm ²)
Rated voltage	690 V
for bridging with bridge	690 V
- At bridging between non-adjacent terminal blocks	352 V
- At bridging between non-adjacent terminal blocks via PE terminal block	275 V
- At cut-to-length bridging with cover	220 V
- At cut-to-length bridging with partition plate	275 V
Rated insulation voltage	630 V

Ex level General

Rated current	30 A
Maximum load current	38 A
Contact resistance	0.26 mΩ

Ex connection data General

Torque range	0.6 Nm ... 0.8 Nm
Nominal cross section	4 mm ²
Rated cross section AWG	12
Connection capacity rigid	0.14 mm ² ... 6 mm ²
Connection capacity AWG	26 ... 10
Connection capacity flexible	0.14 mm ² ... 4 mm ²
Connection capacity AWG	26 ... 12
2 conductors with same cross section, solid	0.14 mm ² ... 1.5 mm ²
2 conductors with the same cross-section AWG rigid	26 ... 16
2 conductors with same cross section, stranded	0.14 mm ² ... 1.5 mm ²
2 conductors with the same cross-section AWG flexible	26 ... 16

Dimensions

Feed-through terminal block - UT 4



3044102

<https://www.phoenixcontact.com/us/products/3044102>

Width	6.2 mm
End cover width	2.2 mm
Height	46.9 mm
Height NS 35/15	55 mm
Height NS 35/7,5	47.5 mm
Length	47.7 mm

Material specifications

Color	gray
Flammability rating according to UL 94	V0
Insulating material group	I
Insulating material	PA
Static insulating material application in cold	-60 °C
Temperature index of insulation material (DIN EN 60216-1 (VDE 0304-21))	125 °C
Relative insulation material temperature index (Elec., UL 746 B)	130 °C
Fire protection for rail vehicles (DIN EN 45545-2) R22	HL 1 - HL 3
Fire protection for rail vehicles (DIN EN 45545-2) R23	HL 1 - HL 3
Fire protection for rail vehicles (DIN EN 45545-2) R24	HL 1 - HL 3
Fire protection for rail vehicles (DIN EN 45545-2) R26	HL 1 - HL 3
Calorimetric heat release NFPA 130 (ASTM E 1354)	27,5 MJ/kg
Surface flammability NFPA 130 (ASTM E 162)	passed
Specific optical density of smoke NFPA 130 (ASTM E 662)	passed
Smoke gas toxicity NFPA 130 (SMP 800C)	passed

Electrical tests

Surge voltage test

Test voltage setpoint	9.8 kV
Result	Test passed

Temperature-rise test

Requirement temperature-rise test	Increase in temperature \leq 45 K
Result	Test passed
Short-time withstand current 4 mm ²	0.48 kA
Short-time withstand current 6 mm ²	0.72 kA
Result	Test passed

Power-frequency withstand voltage

Test voltage setpoint	2.2 kV
Result	Test passed

Mechanical properties

Mechanical data

Open side panel	Yes
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Feed-through terminal block - UT 4



3044102

<https://www.phoenixcontact.com/us/products/3044102>

Mechanical tests

Mechanical strength

Result	Test passed
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Attachment on the carrier

DIN rail/fixing support	NS 35
Test force setpoint	1 N
Result	Test passed

Test for conductor damage and slackening

Rotation speed	10 rpm
Revolutions	135
Conductor cross section/weight	0.14 mm ² / 0.2 kg
	4 mm ² / 0.9 kg
	6 mm ² / 1.4 kg
Result	Test passed

Environmental and real-life conditions

Needle-flame test

Time of exposure	30 s
Result	Test passed

Oscillation/broadband noise

Specification	DIN EN 50155 (VDE 0115-200):2008-03
Spectrum	Service life test category 1, class B, body mounted
Frequency	$f_1 = 5 \text{ Hz}$ to $f_2 = 150 \text{ Hz}$
ASD level	1.857 (m/s ²)/Hz
Acceleration	0.8g
Test duration per axis	5 h
Test directions	X-, Y- and Z-axis
Result	Test passed

Shocks

Specification	DIN EN 50155 (VDE 0115-200):2008-03
Pulse shape	Half-sine
Acceleration	5g
Shock duration	30 ms
Number of shocks per direction	3
Test directions	X-, Y- and Z-axis (pos. and neg.)
Result	Test passed

Ambient conditions

Ambient temperature (operation)	-60 °C ... 105 °C (max. short-term operating temperature RTI Elec.)
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Feed-through terminal block - UT 4



3044102

<https://www.phoenixcontact.com/us/products/3044102>

Ambient temperature (storage/transport)	-25 °C ... 60 °C (for a short time, not exceeding 24 h, -60 °C to +70 °C)
Ambient temperature (assembly)	-5 °C ... 70 °C
Ambient temperature (actuation)	-5 °C ... 70 °C
Permissible humidity (storage/transport)	30 % ... 70 %

Standards and regulations

Connection in acc. with standard	IEC 60947-7-1
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Mounting

Mounting type	NS 35/7,5
	NS 35/15

Feed-through terminal block - UT 4

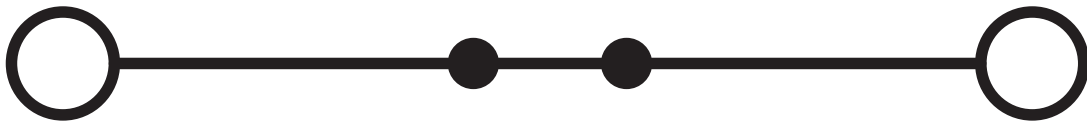


3044102

<https://www.phoenixcontact.com/us/products/3044102>

Drawings

Circuit diagram



Feed-through terminal block - UT 4

3044102

<https://www.phoenixcontact.com/us/products/3044102>



Approvals

DNV

Approval ID: TAE00001S9



CSA

Approval ID: 13631

	Nominal Voltage U_N	Nominal Current I_N	Cross Section AWG	Cross Section mm^2
Use group B				
	600 V	30 A	26 - 10	-
Use group C				
	600 V	30 A	26 - 10	-



IECEE CB Scheme

Approval ID: DE1-63061_M1

	Nominal Voltage U_N	Nominal Current I_N	Cross Section AWG	Cross Section mm^2
	1000 V	32 A	-	0.2 - 4



EAC

Approval ID: RU C-DE.BL08.B.00534



cULus Recognized

Approval ID: E60425

	Nominal Voltage U_N	Nominal Current I_N	Cross Section AWG	Cross Section mm^2
Use group B				
Factory wiring	600 V	40 A	26 - 10	-
	600 V	30 A	26 - 10	-
Multi-conductor connection	600 V	30 A	26 - 14	-
Use group C				
Factory wiring	600 V	40 A	26 - 10	-
	600 V	30 A	26 - 10	-
Multi-conductor connection	600 V	30 A	26 - 14	-



LR

Approval ID: LR2003762TA



RS

Approval ID: 17.00013.272


Feed-through terminal block - UT 4


3044102


<https://www.phoenixcontact.com/us/products/3044102>





 VDE Zeichengenehmigung Approval ID: 40013658				
	Nominal Voltage U_N	Nominal Current I_N	Cross Section AWG	Cross Section mm^2
	1000 V	32 A	-	0.2 - 4


 PRS Approval ID: TE/2156/880590/17				
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 ATEX Approval ID: KEMA04ATEX2048U				
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 cUL Recognized Approval ID: E192998				
	Nominal Voltage U_N	Nominal Current I_N	Cross Section AWG	Cross Section mm^2
Use group B				
	600 V	30 A	26 - 10	-
Use group C				
	600 V	30 A	26 - 10	-

 EAC Ex Approval ID: RU C-DE.HA91.B.00066				
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 IECEx Approval ID: IECEx KEM 06.0027U				
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 UL Recognized Approval ID: E192998				
	Nominal Voltage U_N	Nominal Current I_N	Cross Section AWG	Cross Section mm^2
Use group B				
	600 V	30 A	26 - 10	-
Use group C				
	600 V	30 A	26 - 10	-

 CCC Approval ID: 2020322313000622				
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 NEPSI				
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Feed-through terminal block - UT 4



3044102

<https://www.phoenixcontact.com/us/products/3044102>

Approval ID: GYJ20.1194U

cULus Recognized

Feed-through terminal block - UT 4



3044102

<https://www.phoenixcontact.com/us/products/3044102>

Classifications

ECLASS

ECLASS-9.0	27141120
ECLASS-10.0.1	27141120
ECLASS-11.0	27141120

ETIM

ETIM 8.0	EC000897
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UNSPSC

UNSPSC 21.0	39121400
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Double-level terminal block - UTTB 4

3044814

<https://www.phoenixcontact.com/us/products/3044814>

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Double-level terminal block, nom. voltage: 800 V, nominal current: 30 A, connection method: Screw connection, Rated cross section: 4 mm², cross section: 0.14 mm² - 6 mm², mounting type: NS 35/7,5, NS 35/15, color: gray

Your advantages

- Since there are two function shafts per level, all potential distribution tasks can be implemented quickly
- For a clear overview, each terminal point supports large-surface labeling
- As an option, the levels can be connected using the FBS-PV UT vertical bridge
- For example, two separate potentials can be routed side by side with the help of bridging between non-adjacent terminal blocks
- Tested for railway applications

Commercial Data

Item number	3044814
Packing unit	1 pc
Minimum order quantity	50 pc
Sales Key	B01
Product Key	BE1114
Catalog Page	Page 160 (C-1-2019)
GTIN	4046356055512
Weight per Piece (including packing)	19.366 g
Weight per Piece (excluding packing)	18.434 g
Customs tariff number	85369010
Country of origin	DE

Double-level terminal block - UTTB 4



3044814

<https://www.phoenixcontact.com/us/products/3044814>

Technical Data

Product properties

Product type	Multi-level terminal block
Area of application	Railway industry
	Machine building
	Plant engineering
	Process industry
Number of connections	4
Number of rows	2
Potentials	2

Insulation characteristics

Overvoltage category	III
Degree of pollution	3

Electrical properties

Rated surge voltage	8 kV
Maximum power dissipation for nominal condition	1.02 W

Connection data

Number of connections per level	2
Nominal cross section	4 mm ²

Level 1+2

Screw thread	M3
Tightening torque	0.6 ... 0.8 Nm
Stripping length	9 mm
Internal cylindrical gage	A4
Conductor cross section solid	0.14 mm ² ... 6 mm ²
Cross section AWG	26 ... 10
Conductor cross section flexible	0.14 mm ² ... 6 mm ²
Conductor cross section, flexible [AWG]	26 ... 10
Flexible conductor cross section flexible (ferrule, w/o plastic sleeve)	0.14 mm ² ... 4 mm ²
Flexible conductor cross section (ferrule with plastic sleeve)	0.14 mm ² ... 4 mm ²
2 conductors with same cross section, solid	0.14 mm ² ... 1.5 mm ²
2 conductors with same cross section, flexible	0.14 mm ² ... 1.5 mm ²
2 conductors with same cross section, flexible, with ferrule without plastic sleeve	0.14 mm ² ... 1.5 mm ²
2 conductors with the same cross section, flexible, with TWIN ferrule with plastic sleeve	0.5 mm ² ... 2.5 mm ²
Nominal current	30 A
Maximum load current	36 A (with 6 mm ² conductor cross section)
Nominal voltage	800 V

Double-level terminal block - UTTB 4



3044814

<https://www.phoenixcontact.com/us/products/3044814>

Nominal cross section	4 mm ²
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Ex data

Rated data (ATEX/IECEX)

ATEX certificate	KEMA 06 ATEX 0017 U
IEC Ex certificate	IECEX KEM 06.0013 U
Identification	□ II 2 GD Ex eb IIC Gb
Operating temperature range	-60 °C ... 110 °C
Ex-certified accessories	3047293 D-UTTBT 2,5/4 3047303 DP-UTTBT 2,5/4 3047316 ATP-UTTBT 2,5/4 1212587 SF-SL 0,6X3,5-100 S-VDE 3022276 CLIPFIX 35-5 3022218 CLIPFIX 35
Bridge data	25.5 A / 4 mm ²
Ex temperature increase	40 K (28.5 A / 4 mm ²)
Rated voltage	440 V
for bridging with bridge	440 V
- At bridging between non-adjacent terminal blocks	275 V
- At bridging between non-adjacent terminal blocks via PE terminal block	275 V
- At cut-to-length bridging with cover	220 V
- At cut-to-length bridging with partition plate	176 V
Rated insulation voltage	400 V

Ex level General

Rated current	25.5 A
Maximum load current	31.5 A

Ex connection data General

Torque range	0.6 Nm ... 0.8 Nm
Nominal cross section	4 mm ²
Rated cross section AWG	12
Connection capacity rigid	0.14 mm ² ... 6 mm ²
Connection capacity AWG	26 ... 10
Connection capacity flexible	0.14 mm ² ... 4 mm ²
Connection capacity AWG	26 ... 12
2 conductors with same cross section, solid	0.14 mm ² ... 1.5 mm ²
2 conductors with the same cross-section AWG rigid	26 ... 16
2 conductors with same cross section, stranded	0.14 mm ² ... 1.5 mm ²
2 conductors with the same cross-section AWG flexible	26 ... 16

Ex level Level 1

Contact resistance	0.35 mΩ
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Ex level Level 2

Double-level terminal block - UTTB 4



3044814

<https://www.phoenixcontact.com/us/products/3044814>

Contact resistance	0.2 mΩ
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Dimensions

Width	6.2 mm
End cover width	2.2 mm
Height NS 35/15	72.5 mm
Height NS 35/7,5	65 mm
Length	69.9 mm

Material specifications

Color	gray
Flammability rating according to UL 94	V0
Insulating material group	I
Insulating material	PA
Static insulating material application in cold	-60 °C
Temperature index of insulation material (DIN EN 60216-1 (VDE 0304-21))	130 °C
Relative insulation material temperature index (Elec., UL 746 B)	130 °C
Fire protection for rail vehicles (DIN EN 45545-2) R22	HL 1 - HL 3
Fire protection for rail vehicles (DIN EN 45545-2) R23	HL 1 - HL 3
Fire protection for rail vehicles (DIN EN 45545-2) R24	HL 1 - HL 3
Fire protection for rail vehicles (DIN EN 45545-2) R26	HL 1 - HL 3
Calorimetric heat release NFPA 130 (ASTM E 1354)	28 MJ/kg
Surface flammability NFPA 130 (ASTM E 162)	passed
Specific optical density of smoke NFPA 130 (ASTM E 662)	passed
Smoke gas toxicity NFPA 130 (SMP 800C)	passed

Electrical tests

Surge voltage test

Result	Test passed
--------	-------------

Temperature-rise test

Requirement temperature-rise test	Increase in temperature \leq 45 K
Result	Test passed
Short-time withstand current 4 mm ²	0.48 kA
Short-time withstand current 6 mm ²	0.72 kA
Result	Test passed

Power-frequency withstand voltage

Test voltage setpoint	2 kV
Result	Test passed

Mechanical properties

Mechanical data

Open side panel	Yes
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Double-level terminal block - UTTB 4



3044814

<https://www.phoenixcontact.com/us/products/3044814>

Mechanical tests

Mechanical strength

Result	Test passed
--------	-------------

Attachment on the carrier

DIN rail/fixing support	NS 35
Test force setpoint	1 N
Result	Test passed

Test for conductor damage and slacking

Rotation speed	10 rpm
Revolutions	135
Conductor cross section/weight	0.14 mm ² / 0.2 kg
	4 mm ² / 0.9 kg
	6 mm ² / 1.4 kg
Result	Test passed

Environmental and real-life conditions

Aging

Temperature cycles	192
--------------------	-----

Needle-flame test

Time of exposure	30 s
Result	Test passed

Ambient conditions

Ambient temperature (operation)	-60 °C ... 105 °C (max. short-term operating temperature RTI Elec.)
Ambient temperature (storage/transport)	-25 °C ... 60 °C (for a short time, not exceeding 24 h, -60 °C to +70 °C)
Ambient temperature (assembly)	-5 °C ... 70 °C
Ambient temperature (actuation)	-5 °C ... 70 °C
Permissible humidity (storage/transport)	30 % ... 70 %

Standards and regulations

Connection in acc. with standard	IEC 60947-7-1
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Mounting

Mounting type	NS 35/7,5
	NS 35/15

Double-level terminal block - UTTB 4



3044814

<https://www.phoenixcontact.com/us/products/3044814>

Drawings

Circuit diagram



Double-level terminal block - UTTB 4

3044814

<https://www.phoenixcontact.com/us/products/3044814>



Approvals

DNV

Approval ID: TAE00001S9



CSA

Approval ID: 13631

	Nominal Voltage U_N	Nominal Current I_N	Cross Section AWG	Cross Section mm^2
Use group B	300 V	30 A	26 - 10	-
Use group C	300 V	30 A	26 - 10	-
Use group D	600 V	5 A	26 - 10	-



EAC

Approval ID: RU C-DE.BL08.B.00534



cULus Recognized

Approval ID: E60425

	Nominal Voltage U_N	Nominal Current I_N	Cross Section AWG	Cross Section mm^2
Use group B	300 V	30 A	26 - 10	-
Multi-conductor connection	300 V	30 A	26 - 14	-
Use group C	300 V	30 A	26 - 10	-
Multi-conductor connection	300 V	30 A	26 - 14	-
Use group D	600 V	5 A	26 - 10	-
Multi-conductor connection	600 V	5 A	26 - 14	-



RS

Approval ID: 17.00013.272



PRS

Approval ID: TE/2156/880590/17

Double-level terminal block - UTTB 4



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ATEX

Approval ID: KEMA06ATEX0017U



cUL Recognized

Approval ID: E192998

	Nominal Voltage U_N	Nominal Current I_N	Cross Section AWG	Cross Section mm^2
Use group B	300 V	30 A	26 - 10	-
Use group C	300 V	30 A	26 - 10	-



EAC Ex

Approval ID: RU C-DE.HA91.B.00066



IECEx

Approval ID: IECEx KEM 06.0013U



UL Recognized

Approval ID: E192998

	Nominal Voltage U_N	Nominal Current I_N	Cross Section AWG	Cross Section mm^2
Use group B	300 V	30 A	26 - 10	-
Use group C	300 V	30 A	26 - 10	-



CCC

Approval ID: 2020322313000622



NEPSI

Approval ID: GYJ20.1194U

cULus Recognized

Double-level terminal block - UTTB 4



3044814

<https://www.phoenixcontact.com/us/products/3044814>

Classifications

ECLASS

ECLASS-9.0	27141120
ECLASS-10.0.1	27141120
ECLASS-11.0	27141120

ETIM

ETIM 8.0	EC000897
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UNSPSC

UNSPSC 21.0	39121400
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End cover - D-UTTB 2,5/4

3047293

<https://www.phoenixcontact.com/us/products/3047293>

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End cover, length: 69.9 mm, width: 2.2 mm, height: 57.5 mm, color: gray



Commercial Data

Item number	3047293
Packing unit	1 pc
Minimum order quantity	50 pc
Sales Key	B01
Product Key	BE1Z1X
Catalog Page	Page 149 (C-1-2019)
GTIN	4017918997267
Weight per Piece (including packing)	4.855 g
Weight per Piece (excluding packing)	4.594 g
Customs tariff number	85389099
Country of origin	DE

End cover - D-UTTB 2,5/4



3047293

<https://www.phoenixcontact.com/us/products/3047293>

Technical Data

Product properties

Product type	End cover
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Ambient conditions

Ambient temperature (operation)	-60 °C ... 105 °C (max. short-term operating temperature RTI Elec.)
Ambient temperature (storage/transport)	-25 °C ... 60 °C (for a short time, not exceeding 24 h, -60 °C to +70 °C)
Ambient temperature (assembly)	-5 °C ... 70 °C
Ambient temperature (actuation)	-5 °C ... 70 °C
Permissible humidity (storage/transport)	30 % ... 70 %

Material specifications

Color	gray
Material	PA
Flammability rating according to UL 94	V0
Static insulating material application in cold	-60 °C
Temperature index of insulation material (DIN EN 60216-1 (VDE 0304-21))	125 °C
Relative insulation material temperature index (Elec., UL 746 B)	130 °C
Fire protection for rail vehicles (DIN EN 45545-2) R22	HL 1 - HL 3
Fire protection for rail vehicles (DIN EN 45545-2) R23	HL 1 - HL 3
Fire protection for rail vehicles (DIN EN 45545-2) R24	HL 1 - HL 3
Fire protection for rail vehicles (DIN EN 45545-2) R26	HL 1 - HL 3
Calorimetric heat release NFPA 130 (ASTM E 1354)	27,5 MJ/kg
Surface flammability NFPA 130 (ASTM E 162)	passed
Specific optical density of smoke NFPA 130 (ASTM E 662)	passed
Smoke gas toxicity NFPA 130 (SMP 800C)	passed

Dimensions

Width	2.2 mm
Height	57.5 mm
Length	69.9 mm

End cover - D-UTTB 2,5/4



3047293

<https://www.phoenixcontact.com/us/products/3047293>

Classifications

ECLASS

ECLASS-9.0	27141133
ECLASS-10.0.1	27141133
ECLASS-11.0	27141133

ETIM

ETIM 8.0	EC000886
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UNSPSC

UNSPSC 21.0	39121400
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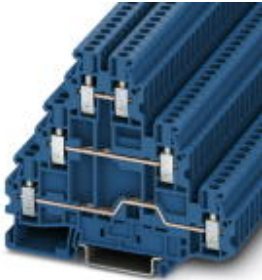
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<https://www.phoenixcontact.com>

Phoenix Contact USA
586 Fulling Mill Road
Middletown, PA 17057, United States
(+717) 944-1300
info@phoenixcon.com

Multi-level terminal block - UT 2,5-3L BU - 3002389

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Multi-level terminal block, connection method: Screw connection, cross section: 0.14 mm² - 4 mm², AWG: 26 - 12, width: 5.2 mm, color: blue, mounting type: NS 35/7,5, NS 35/15

Your advantages

- ✓ Since function shafts are provided on each level, all potential distribution tasks can be implemented quickly
- ✓ For a clear overview, each terminal point supports large-surface labeling
- ✓ A very high wiring density is achieved with the compact three-level terminal blocks
- ✓ Tested for railway applications

Key Commercial Data

Packing unit	1 pc
Minimum order quantity	50 pc
GTIN	 4 055626 300207
GTIN	4055626300207
Weight per Piece (excluding packing)	25.200 g
Custom tariff number	85369010
Country of origin	Poland

Technical data

General

Number of levels	3
Number of connections	6
Nominal cross section	2.5 mm ²
Color	blue
Insulating material	PA

Multi-level terminal block - UT 2,5-3L BU - 3002389

Technical data

General

Flammability rating according to UL 94	V0
Rated surge voltage	6 kV
Degree of pollution	3
Overvoltage category	III
Insulating material group	I
Maximum power dissipation for nominal condition	0.77 W (the value is multiplied when connecting multiple levels)
Ambient temperature (operation)	-60 °C ... 85 °C ()
Ambient temperature (storage/transport)	-25 °C ... 55 °C
Ambient temperature (assembly)	-5 °C ... 70 °C
Ambient temperature (actuation)	-5 °C ... 70 °C
Connection in acc. with standard	IEC 60947-7-1
Nominal current I_N	19 A (with a 2.5 mm ² conductor cross section)
Maximum load current	24 A (in case of a 4 mm ² conductor cross section, the maximum load current must not be exceeded by the total current of all connected conductors.)
Nominal voltage U_N	500 V
Open side panel	Yes
Number of positions	1
Relative insulation material temperature index (Elec.; UL 746 B)	130 °C
Temperature index of insulation material (DIN EN 60216-1 (VDE 0304-21))	130 °C
Static insulating material application in cold	-60 °C
Surface flammability NFPA 130 (ASTM E 162)	passed
Specific optical density of smoke NFPA 130 (ASTM E 662)	passed
Smoke gas toxicity NFPA 130 (SMP 800C)	passed
Calorimetric heat release NFPA 130 (ASTM E 1354)	28 MJ/kg
Fire protection for rail vehicles (DIN EN 45545-2) R22	HL 1 - HL 3
Fire protection for rail vehicles (DIN EN 45545-2) R23	HL 1 - HL 3
Fire protection for rail vehicles (DIN EN 45545-2) R24	HL 1 - HL 3
Fire protection for rail vehicles (DIN EN 45545-2) R26	HL 1 - HL 3

Dimensions

Width	5.2 mm
Length	90 mm
Height NS 35/7,5	77.5 mm
Height NS 35/15	85 mm

Connection data

Connection method	Screw connection
Conductor cross section solid min.	0.14 mm ²

Multi-level terminal block - UT 2,5-3L BU - 3002389

Technical data

Connection data

Conductor cross section solid max.	4 mm ²
Conductor cross section flexible min.	0.14 mm ²
Conductor cross section flexible max.	4 mm ²
Conductor cross section AWG min.	26
Conductor cross section AWG max.	12
Conductor cross section flexible, with ferrule without plastic sleeve min.	0.14 mm ²
Conductor cross section flexible, with ferrule without plastic sleeve max.	2.5 mm ²
Conductor cross section flexible, with ferrule with plastic sleeve min.	0.14 mm ²
Conductor cross section flexible, with ferrule with plastic sleeve max.	2.5 mm ²
2 conductors with same cross section, solid min.	0.14 mm ²
2 conductors with same cross section, solid max.	1.5 mm ²
2 conductors with same cross section, stranded min.	0.14 mm ²
2 conductors with same cross section, stranded max.	1.5 mm ²
Two conductors with the same cross section stranded, with ferrule and without plastic sleeve, minimum	0.14 mm ²
Two conductors with the same cross section stranded, with ferrule and without plastic sleeve, maximum	1.5 mm ²
Two conductors with the same cross section, flexible, with TWIN ferrules, with plastic sleeve, minimum	0.5 mm ²
Two conductors with the same cross section, flexible, with TWIN ferrules, with plastic sleeve, maximum	1.5 mm ²
Stripping length	9 mm
Internal cylindrical gage	A3
Screw thread	M3
Tightening torque, min	0.5 Nm
Tightening torque max	0.6 Nm

Standards and Regulations

Connection in acc. with standard	IEC 60947-7-1
Flammability rating according to UL 94	V0

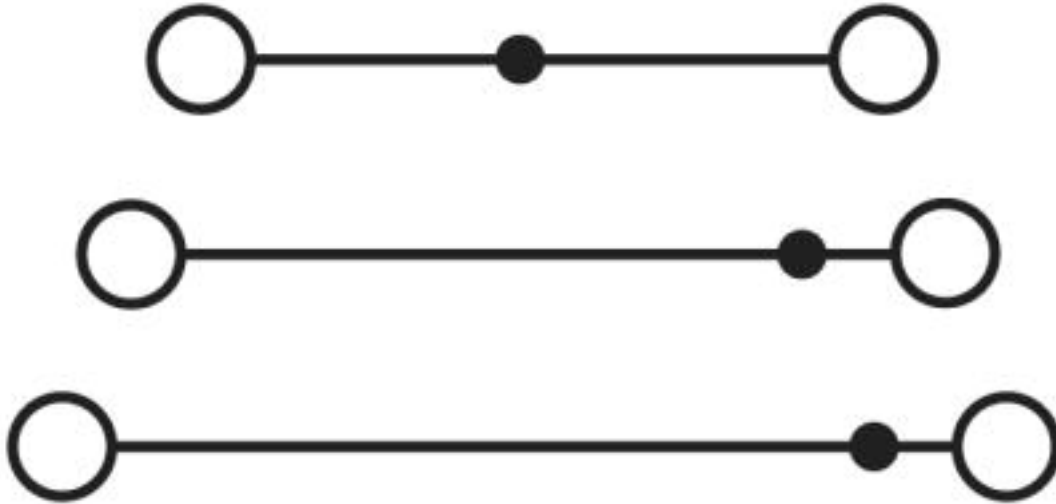
Environmental Product Compliance

	Lead 7439-92-1
China RoHS	Environmentally Friendly Use Period = 50
	For details about hazardous substances go to tab "Downloads", Category "Manufacturer's declaration"

Drawings

Multi-level terminal block - UT 2,5-3L BU - 3002389

Circuit diagram



Classifications

eCl@ss

eCl@ss 4.0	27141100
eCl@ss 4.1	27141100
eCl@ss 5.0	27141100
eCl@ss 5.1	27141100
eCl@ss 6.0	27141100
eCl@ss 7.0	27141120
eCl@ss 8.0	27141120
eCl@ss 9.0	27141120

ETIM

ETIM 2.0	EC000902
ETIM 3.0	EC000897
ETIM 4.0	EC000897
ETIM 5.0	EC000897
ETIM 6.0	EC000897
ETIM 7.0	EC000897

UNSPSC

UNSPSC 6.01	30211811
UNSPSC 7.0901	39121410
UNSPSC 11	39121410
UNSPSC 12.01	39121410

Multi-level terminal block - UT 2,5-3L BU - 3002389

Classifications

UNSPSC

UNSPSC 13.2	39121410
UNSPSC 18.0	39121410
UNSPSC 19.0	39121410
UNSPSC 20.0	39121410
UNSPSC 21.0	39121410

Approvals

Approvals

Approvals

EAC / EAC

Ex Approvals

Approval details

EAC		RU C- DE.A*30.B.01742
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EAC		RU C- DE.BL08.B.00534
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Accessories

Accessories

Bridge

Wire bridge - FBSW 2-5/250MM - 3030172

Wire bridge, length: 250 mm, width: 5.1 mm, number of positions: 1, color: red/black



Multi-level terminal block - UT 2,5-3L BU - 3002389

Accessories

Wire bridge - FBSW 2-5/60MM - 3030170



Wire bridge, length: 60 mm, width: 5.1 mm, number of positions: 1, color: red/black

Wire bridge - FBSW 2-5/110MM - 3030171



Wire bridge, length: 110 mm, width: 5.1 mm, number of positions: 1, color: red/black

Component plug terminal block

Component connector - P-CO 2-5 R47K - 3032447



Component connector, with 47 kOhm resistor for open circuit monitoring, pitch: 5.2 mm, length: 8.9 mm, width: 4.1 mm, height: 34.8 mm, number of positions: 2, color: black

DIN rail

DIN rail perforated - NS 35/ 7,5 PERF 2000MM - 0801733



DIN rail perforated, Standard profile, width: 35 mm, height: 7.5 mm, acc. to EN 60715, material: Steel, galvanized, passivated with a thick layer, length: 2000 mm, color: silver

DIN rail, unperforated - NS 35/ 7,5 UNPERF 2000MM - 0801681



DIN rail, unperforated, Standard profile, width: 35 mm, height: 7.5 mm, acc. to EN 60715, material: Steel, galvanized, passivated with a thick layer, length: 2000 mm, color: silver

Multi-level terminal block - UT 2,5-3L BU - 3002389

Accessories

DIN rail perforated - NS 35/ 7,5 WH PERF 2000MM - 1204119



DIN rail perforated, Standard profile, width: 35 mm, height: 7.5 mm, acc. to EN 60715, material: Steel, Galvanized, white passivated, length: 2000 mm, color: silver

DIN rail, unperforated - NS 35/ 7,5 WH UNPERF 2000MM - 1204122



DIN rail, unperforated, Standard profile, width: 35 mm, height: 7.5 mm, acc. to EN 60715, material: Steel, Galvanized, white passivated, length: 2000 mm, color: silver

DIN rail, unperforated - NS 35/ 7,5 AL UNPERF 2000MM - 0801704



DIN rail, unperforated, Standard profile, width: 35 mm, height: 7.5 mm, acc. to EN 60715, material: Aluminum, uncoated, length: 2000 mm, color: silver

DIN rail perforated - NS 35/ 7,5 ZN PERF 2000MM - 1206421



DIN rail perforated, Standard profile, width: 35 mm, height: 7.5 mm, acc. to EN 60715, material: Steel, galvanized, length: 2000 mm, color: silver

DIN rail, unperforated - NS 35/ 7,5 ZN UNPERF 2000MM - 1206434



DIN rail, unperforated, Standard profile, width: 35 mm, height: 7.5 mm, acc. to EN 60715, material: Steel, galvanized, length: 2000 mm, color: silver

Multi-level terminal block - UT 2,5-3L BU - 3002389

Accessories

DIN rail, unperforated - NS 35/ 7,5 CU UNPERF 2000MM - 0801762



DIN rail, unperforated, Standard profile, width: 35 mm, height: 7.5 mm, acc. to EN 60715, material: Copper, uncoated, length: 2000 mm, color: copper-colored

End cap - NS 35/ 7,5 CAP - 1206560



DIN rail end piece, for DIN rail NS 35/7.5

End block

End clamp - CLIPFIX 35 - 3022218



Quick mounting end clamp for NS 35/7,5 DIN rail or NS 35/15 DIN rail, with marking option, width: 9.5 mm, color: gray

End clamp - CLIPFIX 35-5 - 3022276



Quick mounting end clamp for NS 35/7,5 DIN rail or NS 35/15 DIN rail, with marking option, with parking option for FBS...5, FBS...6, KSS 5, KSS 6, width: 5.15 mm, color: gray

End clamp - E/NS 35 N - 0800886



End clamp, width: 9.5 mm, color: gray

Multi-level terminal block - UT 2,5-3L BU - 3002389

Accessories

End cover

End cover - D-UT 2,5-3L - 3214314



End cover, length: 90 mm, width: 2.2 mm, height: 69.8 mm, color: gray

Insulating sleeve

Insulating sleeve - MPS-IH WH - 0201663

Insulating sleeve, color: white



Insulating sleeve - MPS-IH RD - 0201676

Insulating sleeve, color: red



Insulating sleeve - MPS-IH BU - 0201689

Insulating sleeve, color: blue



Insulating sleeve - MPS-IH YE - 0201692

Insulating sleeve, color: yellow



Multi-level terminal block - UT 2,5-3L BU - 3002389

Accessories

Insulating sleeve - MPS-IH GN - 0201702

Insulating sleeve, color: green



Insulating sleeve - MPS-IH GY - 0201728

Insulating sleeve, color: gray



Insulating sleeve - MPS-IH BK - 0201731

Insulating sleeve, color: black



Jumper

Plug-in bridge - FBS 2-5 - 3030161



Plug-in bridge, pitch: 5.2 mm, length: 22.7 mm, width: 9 mm, number of positions: 2, color: red

Plug-in bridge - FBS 3-5 - 3030174



Plug-in bridge, pitch: 5.2 mm, length: 22.7 mm, width: 14.2 mm, number of positions: 3, color: red

Multi-level terminal block - UT 2,5-3L BU - 3002389

Accessories

Plug-in bridge - FBS 4-5 - 3030187



Plug-in bridge, pitch: 5.2 mm, length: 22.7 mm, width: 19.4 mm, number of positions: 4, color: red

Plug-in bridge - FBS 5-5 - 3030190



Plug-in bridge, pitch: 5.2 mm, length: 23 mm, width: 24.6 mm, number of positions: 5, color: red

Plug-in bridge - FBS 10-5 - 3030213



Plug-in bridge, pitch: 5.2 mm, length: 22.7 mm, width: 50.6 mm, number of positions: 10, color: red

Plug-in bridge - FBS 20-5 - 3030226



Plug-in bridge, pitch: 5.2 mm, number of positions: 20, color: red

Plug-in bridge - FBS 50-5 - 3038930



Plug-in bridge, pitch: 5.2 mm, number of positions: 50, color: red

Multi-level terminal block - UT 2,5-3L BU - 3002389

Accessories

Plug-in bridge - FBSR 2-5 - 3033702



Plug-in bridge, pitch: 5.2 mm, number of positions: 2, color: red

Plug-in bridge - FBSR 3-5 - 3001591



Plug-in bridge, pitch: 5.2 mm, number of positions: 3, color: red

Plug-in bridge - FBSR 4-5 - 3001592



Plug-in bridge, pitch: 5.2 mm, number of positions: 4, color: red

Plug-in bridge - FBSR 5-5 - 3001593



Plug-in bridge, pitch: 5.2 mm, number of positions: 5, color: red

Plug-in bridge - FBSR 10-5 - 3033710



Plug-in bridge, pitch: 5.2 mm, number of positions: 10, color: red

Multi-level terminal block - UT 2,5-3L BU - 3002389

Accessories

Plug-in bridge - FBS 2-5 BU - 3036877



Plug-in bridge, pitch: 5.2 mm, number of positions: 2, color: blue

Plug-in bridge - FBS 3-5 BU - 3036880



Plug-in bridge, pitch: 5.2 mm, number of positions: 3, color: blue

Plug-in bridge - FBS 4-5 BU - 3036893



Plug-in bridge, pitch: 5.2 mm, number of positions: 4, color: blue

Plug-in bridge - FBS 5-5 BU - 3036903



Plug-in bridge, pitch: 5.2 mm, number of positions: 5, color: blue

Plug-in bridge - FBS 10-5 BU - 3036916



Plug-in bridge, pitch: 5.2 mm, number of positions: 10, color: blue

Multi-level terminal block - UT 2,5-3L BU - 3002389

Accessories

Plug-in bridge - FBS 20-5 BU - 3036929



Plug-in bridge, pitch: 5.2 mm, number of positions: 20, color: blue

Plug-in bridge - FBS 50-5 BU - 3032114



Plug-in bridge, pitch: 5.2 mm, number of positions: 50, color: blue

Labeled terminal marker

Zack marker strip - ZB 5 CUS - 0824962



Zack marker strip, can be ordered: Strip, white, labeled according to customer specifications, mounting type: snap into tall marker groove, for terminal block width: 5.2 mm, lettering field size: 5.15 x 10.5 mm, Number of individual labels: 10

Zack marker strip - ZB 5,LGS:FORTL.ZAHLEN - 1050017



Zack marker strip, Strip, white, labeled, printed horizontally: consecutive numbers 1 ... 10, 11 ... 20, etc. up to 491 ... 500, mounting type: snap into tall marker groove, for terminal block width: 5.2 mm, lettering field size: 5.15 x 10.5 mm, Number of individual labels: 10

Zack marker strip - ZB 5,QR:FORTL.ZAHLEN - 1050020



Zack marker strip, white, Printed vertically: consecutive numbers 1 ... 10, 11 ... 20, etc. up to 491 ... 500, mounting type: snap into tall marker groove, for terminal block width: 5.2 mm, lettering field size: 5.15 x 10.5 mm

Multi-level terminal block - UT 2,5-3L BU - 3002389

Accessories

Zack marker strip - ZB 5,LGS:GLEICHE ZAHLEN - 1050033



Zack marker strip, Strip, white, labeled, can be labeled with: CMS-P1-PLOTTER, printed horizontally: Identical numbers 1 or 2, etc. up to 100, mounting type: snap into tall marker groove, for terminal block width: 5.2 mm, lettering field size: 5.15 x 10.5 mm, Number of individual labels: 10

Zack marker strip - ZB 5,LGS:L1-N,PE - 1050415



Zack marker strip, Strip, white, labeled, Horizontal: L1, L2, L3, N, PE, L1, L2, L3, N, PE, mounting type: snap into tall marker groove, for terminal block width: 5.2 mm, lettering field size: 5.15 x 10.5 mm, Number of individual labels: 10

Marker for terminal blocks - UC-TM 5 CUS - 0824581



Marker for terminal blocks, can be ordered: by sheet, white, labeled according to customer specifications, mounting type: snap into tall marker groove, for terminal block width: 5.2 mm, lettering field size: 10.5 x 4.6 mm, Number of individual labels: 96

Marker for terminal blocks - UCT-TM 5 CUS - 0829595



Marker for terminal blocks, can be ordered: by sheet, white, labeled according to customer specifications, mounting type: snap into tall marker groove, for terminal block width: 5.2 mm, lettering field size: 4.6 x 10.5 mm, Number of individual labels: 72

Marker pen

Marker pen - X-PEN 0,35 - 0811228



Marker pen without ink cartridge, for manual labeling of markers, labeling extremely wipe-proof, line thickness 0.35 mm

Multi-level terminal block - UT 2,5-3L BU - 3002389

Accessories

Partition plate

Partition plate - TP-UK - 3003046



Partition plate, length: 99 mm, width: 2 mm, height: 90 mm, color: gray

Spacer plate - DP PS-5 - 3036725



Spacer plate, length: 22.4 mm, width: 5.2 mm, height: 29 mm, number of positions: 1, color: red

Screwdriver tools

Screwdriver - SZS 0,6X3,5 - 1205053



Actuation tool, for ST terminal blocks, insulated, also suitable for use as a bladed screwdriver, size: 0.6 x 3.5 x 100 mm, 2-component grip, with non-slip grip

Screwdriver - SF-SL 0,6X3,5-100 S-VDE - 1212587



Actuation tool, for ST terminal blocks, VDE insulated, with slimmer insulation integrated in the blade, also suitable for use as a bladed screwdriver, size: 0.6 x 3.5 x 100 mm, 2-component grip, with non-slip grip

Terminal marking

Multi-level terminal block - UT 2,5-3L BU - 3002389

Accessories

Zack marker strip - ZB 5 :UNBEDRUCKT - 1050004



Zack marker strip, Strip, white, unlabeled, can be labeled with: PLOTMARK, CMS-P1-PLOTTER, mounting type: snap into tall marker groove, for terminal block width: 5.2 mm, lettering field size: 5.1 x 10.5 mm, Number of individual labels: 10

Marker for terminal blocks - UC-TM 5 - 0818108



Marker for terminal blocks, Sheet, white, unlabeled, can be labeled with: BLUEMARK ID COLOR, BLUEMARK ID, BLUEMARK CLED, PLOTMARK, CMS-P1-PLOTTER, mounting type: snap into tall marker groove, for terminal block width: 5.2 mm, lettering field size: 10.5 x 4.6 mm, Number of individual labels: 96

Marker for terminal blocks - UCT-TM 5 - 0828734



Marker for terminal blocks, Sheet, white, unlabeled, can be labeled with: TOPMARK NEO, TOPMARK LASER, BLUEMARK ID COLOR, BLUEMARK ID, BLUEMARK CLED, THERMOMARK PRIME, THERMOMARK CARD 2.0, THERMOMARK CARD, mounting type: snap into tall marker groove, for terminal block width: 5.2 mm, lettering field size: 4.6 x 10.5 mm, Number of individual labels: 72

Test plug terminal block

Test plugs - MPS-MT - 0201744



Test plugs, with solder connection up to 1 mm² conductor cross section, color: gray

Test plugs - PS-5 - 3030983



Test plugs, color: red

Multi-level terminal block - UT 2,5-3L BU - 3002389

Accessories

Test plugs - PS-5/2,3MM RD - 3038723



Test plugs, color: red

Test socket

Test adapter - PAI-4-FIX-5/6 BU - 3035975



4 mm test adapter, for terminal blocks with 5.2 mm and 6.2 mm pitch

Test adapter - PAI-4-FIX-5/6 OG - 3035974



4 mm test adapter, for terminal blocks with 5.2 mm and 6.2 mm pitch

Test adapter - PAI-4-FIX-5/6 YE - 3035977



4 mm test adapter, for terminal blocks with 5.2 mm and 6.2 mm pitch

Test adapter - PAI-4-FIX-5/6 RD - 3035976



4 mm test adapter, for terminal blocks with 5.2 mm and 6.2 mm pitch

Multi-level terminal block - UT 2,5-3L BU - 3002389

Accessories

Test adapter - PAI-4-FIX-5/6 GN - 3035978



4 mm test adapter, for terminal blocks with 5.2 mm and 6.2 mm pitch

Test adapter - PAI-4-FIX-5/6 BK - 3035980



4 mm test adapter, for terminal blocks with 5.2 mm and 6.2 mm pitch

Test adapter - PAI-4-FIX-5/6 GY - 3035982



4 mm test adapter, for terminal blocks with 5.2 mm and 6.2 mm pitch

Test adapter - PAI-4-FIX-5/6 VT - 3035979



4 mm test adapter, for terminal blocks with 5.2 mm and 6.2 mm pitch

Test adapter - PAI-4-FIX-5/6 BN - 3035981



4 mm test adapter, for terminal blocks with 5.2 mm and 6.2 mm pitch

Multi-level terminal block - UT 2,5-3L BU - 3002389

Accessories

Test adapter - PAI-4-FIX-5/6 WH - 3035983



4 mm test adapter, for terminal blocks with 5.2 mm and 6.2 mm pitch

End cover - D-UT 2,5-3L - 3214314


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End cover, length: 90 mm, width: 2.2 mm, height: 69.8 mm, color: gray



Key Commercial Data

Packing unit	1 pc
Minimum order quantity	50 pc
GTIN	 4 046356 575461
GTIN	4046356575461
Weight per Piece (excluding packing)	6.800 g
Custom tariff number	85389099
Country of origin	Germany

E/UK 1 - End clamp

1201413

<https://www.phoenixcontact.com/us/products/1201413>

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End clamps, for supporting the ends of double-level and three-level terminal blocks, width: 10 mm, color: gray

Your advantages

- Large-surface marking
- With universal foot for NS 35 and NS 32 DIN rails
- Tall and low-profile designs

Commercial data

Item number	1201413
Packing unit	1 pc
Minimum order quantity	50 pc
Sales key	BE07
Product key	BE7111
Catalog page	Page 538 (C-3-2019)
GTIN	4017918017316
Weight per piece (including packing)	10.806 g
Weight per piece (excluding packing)	10.2 g
Customs tariff number	39269097
Country of origin	PL

E/UK 1 - End clamp

1201413

<https://www.phoenixcontact.com/us/products/1201413>

Technical data

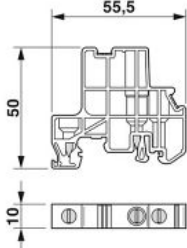
Product properties

Product type	End block
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Connection data

Tightening torque	... 0.8 Nm
-------------------	------------

Dimensions

Dimensional drawing	
Width	10 mm
Height	55.5 mm
Depth	50 mm
Depth on NS 35/7,5	51.5 mm
Length	55.5 mm

Material specifications

Color	gray
Material	PA
Flammability rating according to UL 94	V2
Temperature index of insulation material (DIN EN 60216-1 (VDE 0304-21))	125 °C
Relative insulation material temperature index (Elec., UL 746 B)	125 °C

Environmental and real-life conditions

Ambient conditions

Ambient temperature (operation)	-60 °C ... 105 °C (max. short-term operating temperature RTI Elec.)
Ambient temperature (storage/transport)	-25 °C ... 60 °C (for a short time, not exceeding 24 h, -60 °C to +70 °C)
Ambient temperature (assembly)	-5 °C ... 70 °C
Ambient temperature (actuation)	-5 °C ... 70 °C
Permissible humidity (storage/transport)	30 % ... 70 %

Mounting

Mounting type	NS 35/7,5
	NS 35/15

E/UK 1 - End clamp

1201413

<https://www.phoenixcontact.com/us/products/1201413>



NS 32

E/UK 1 - End clamp

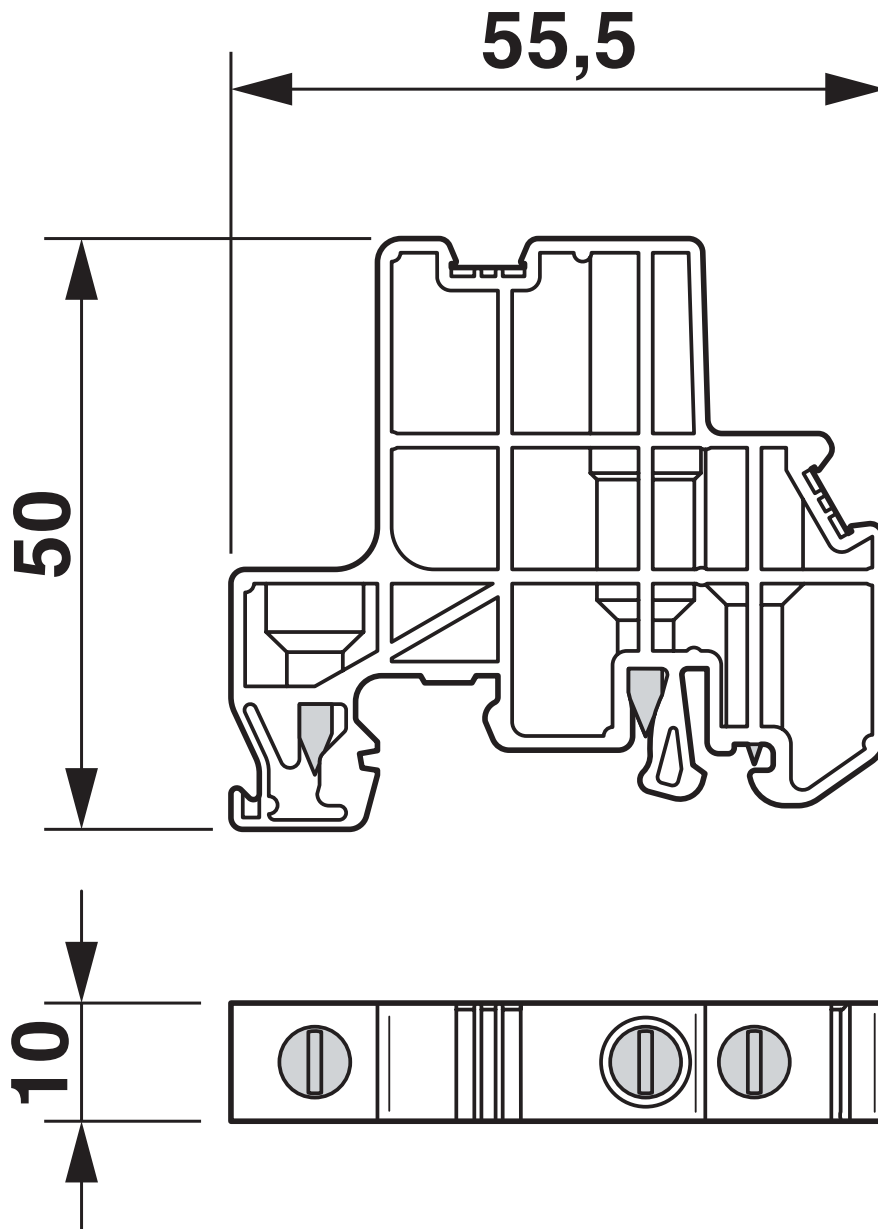
1201413

<https://www.phoenixcontact.com/us/products/1201413>



Drawings

Dimensional drawing



E/UK 1 - End clamp

1201413

<https://www.phoenixcontact.com/us/products/1201413>



Classifications

ECLASS

ECLASS-11.0	27141135
ECLASS-12.0	27141135
ECLASS-13.0	27250302

ETIM

ETIM 8.0	EC001041
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UNSPSC

UNSPSC 21.0	39121400
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E/UK 1 - End clamp

1201413

<https://www.phoenixcontact.com/us/products/1201413>



Environmental product compliance

China RoHS	Environmentally friendly use period: unlimited = EFUP-e
	No hazardous substances above threshold values

E/UK 1 - End clamp

1201413

<https://www.phoenixcontact.com/us/products/1201413>



Accessories

SBS10:UNBEDRUCKT - Marker card

1007248

<https://www.phoenixcontact.com/us/products/1007248>



Marker card, Card, white, unlabeled, can be labeled with: Marker pen, perforated, mounting type: snapped, snap into flat marker groove, for terminal block width: 10 mm, lettering field size: 6 x 10.1 mm, Number of individual labels: 250

NS 32 PERF 2000MM-VPE 10 - DIN rail perforated

1201002

<https://www.phoenixcontact.com/us/products/1201002>



DIN rail perforated, acc. to EN 60715, material: Steel, galvanized, passivated with a thick layer, G profile, color: silver, Pack of 10 (20 m)

E/UK 1 - End clamp

1201413

<https://www.phoenixcontact.com/us/products/1201413>



NS 32 UNPERF 2000MM-VPE 10 - DIN rail, unperforated

1201015

<https://www.phoenixcontact.com/us/products/1201015>



DIN rail, unperforated, acc. to EN 60715, material: Steel, galvanized, passivated with a thick layer, G profile, color: silver, Pack of 10 (20 m)

NS 35/ 7,5 PERF 2000MM - DIN rail perforated

0801733

<https://www.phoenixcontact.com/us/products/0801733>



DIN rail perforated, acc. to EN 60715, material: Steel, galvanized, passivated with a thick layer, Standard profile, color: silver, Pack of 25 (50 m)

E/UK 1 - End clamp

1201413

<https://www.phoenixcontact.com/us/products/1201413>



NS 35/ 7,5 UNPERF 2000MM - DIN rail, unperforated

0801681

<https://www.phoenixcontact.com/us/products/0801681>



DIN rail, unperforated, acc. to EN 60715, material: Steel, galvanized, passivated with a thick layer, Standard profile, color: silver, Pack of 25 (50 m)

NS 35/ 7,5 WH PERF 2000MM - DIN rail perforated

1204119

<https://www.phoenixcontact.com/us/products/1204119>



DIN rail perforated, acc. to EN 60715, material: Steel, Galvanized, white passivated, Standard profile, color: silver, Pack of 25 (50 m)

E/UK 1 - End clamp

1201413

<https://www.phoenixcontact.com/us/products/1201413>



NS 35/ 7,5 WH UNPERF 2000MM-VPE 10 - DIN rail, unperforated

1204122

<https://www.phoenixcontact.com/us/products/1204122>



DIN rail, unperforated, acc. to EN 60715, material: Steel, Galvanized, white passivated, Standard profile, color: silver, Pack of 10 (20 m)

NS 35/ 7,5 AL UNPERF 2000MM - DIN rail, unperforated

0801704

<https://www.phoenixcontact.com/us/products/0801704>



DIN rail, unperforated, acc. to EN 60715, material: Aluminum, uncoated, Standard profile, color: silver, Pack of 25 (50 m)

E/UK 1 - End clamp

1201413

<https://www.phoenixcontact.com/us/products/1201413>



NS 35/ 7,5 ZN PERF 2000MM - DIN rail perforated

1206421

<https://www.phoenixcontact.com/us/products/1206421>



DIN rail perforated, acc. to EN 60715, material: Steel, galvanized, Standard profile, color: silver, Pack of 25 (50 m)

NS 35/ 7,5 ZN UNPERF 2000MM - DIN rail, unperforated

1206434

<https://www.phoenixcontact.com/us/products/1206434>



DIN rail, unperforated, acc. to EN 60715, material: Steel, galvanized, Standard profile, color: silver, Pack of 25 (50 m)

E/UK 1 - End clamp

1201413

<https://www.phoenixcontact.com/us/products/1201413>



NS 35/ 7,5 CU UNPERF 2000MM-VPE 10 - DIN rail, unperforated

0801762

<https://www.phoenixcontact.com/us/products/0801762>



DIN rail, unperforated, acc. to EN 60715, material: Copper, uncoated, Standard profile, color: copper-colored, Pack of 10 (20 m)

NS 35/ 7,5 CAP - End cap

1206560

<https://www.phoenixcontact.com/us/products/1206560>

DIN rail end piece, for DIN rail NS 35/7.5



E/UK 1 - End clamp

1201413

<https://www.phoenixcontact.com/us/products/1201413>



NS 35/15 PERF 2000MM - DIN rail perforated

1201730

<https://www.phoenixcontact.com/us/products/1201730>



DIN rail perforated, similar to EN 60715, material: Steel, galvanized, passivated with a thick layer, Standard profile, color: silver, Pack of 25 (50 m)

NS 35/15 UNPERF 2000MM - DIN rail, unperforated

1201714

<https://www.phoenixcontact.com/us/products/1201714>



DIN rail, unperforated, similar to EN 60715, material: Steel, galvanized, passivated with a thick layer, Standard profile, color: silver, Pack of 25 (50 m)

E/UK 1 - End clamp

1201413

<https://www.phoenixcontact.com/us/products/1201413>



NS 35/15 WH PERF 2000MM - DIN rail perforated

0806602

<https://www.phoenixcontact.com/us/products/0806602>



DIN rail perforated, similar to EN 60715, material: Steel, Galvanized, white passivated, Standard profile, color: white, Pack of 25 (50 m)

NS 35/15 WH UNPERF 2000MM-VPE 10 - DIN rail, unperforated

1204135

<https://www.phoenixcontact.com/us/products/1204135>



DIN rail, unperforated, similar to EN 60715, material: Steel, Galvanized, white passivated, Standard profile, color: silver, Pack of 10 (20 m)

E/UK 1 - End clamp

1201413

<https://www.phoenixcontact.com/us/products/1201413>



NS 35/15 AL UNPERF 2000MM - DIN rail, unperforated

1201756

<https://www.phoenixcontact.com/us/products/1201756>



DIN rail, unperforated, similar to EN 60715, material: Aluminum, uncoated, Standard profile, color: silver

NS 35/15 ZN PERF 2000MM - DIN rail perforated

1206599

<https://www.phoenixcontact.com/us/products/1206599>



DIN rail perforated, similar to EN 60715, material: Steel, galvanized, Standard profile, color: silver, Pack of 25 (50 m)

E/UK 1 - End clamp

1201413

<https://www.phoenixcontact.com/us/products/1201413>



NS 35/15 ZN UNPERF 2000MM - DIN rail, unperforated

1206586

<https://www.phoenixcontact.com/us/products/1206586>



DIN rail, unperforated, similar to EN 60715, material: Steel, galvanized, Standard profile, color: silver, Pack of 25 (50 m)

NS 35/15 CU UNPERF 2000MM-VPE 10 - DIN rail, unperforated

1201895

<https://www.phoenixcontact.com/us/products/1201895>



DIN rail, unperforated, similar to EN 60715, material: Copper, uncoated, Standard profile, color: copper-colored, Pack of 10 (20 m)

E/UK 1 - End clamp

1201413

<https://www.phoenixcontact.com/us/products/1201413>



NS 35/15 CAP - End cap

1206573

<https://www.phoenixcontact.com/us/products/1206573>

DIN rail end piece, for DIN rail NS 35/15



NS 35/15-2,3 UNPERF 2000MM-VPE 10 - DIN rail, unperforated

1201798

<https://www.phoenixcontact.com/us/products/1201798>



DIN rail, unperforated, acc. to EN 60715, material: Steel, galvanized, passivated with a thick layer, Standard profile 2.3 mm, color: silver, Pack of 10 (20 m)

E/UK 1 - End clamp

1201413

<https://www.phoenixcontact.com/us/products/1201413>



ZB 10:UNBEDRUCKT - Zack marker strip

1053001

<https://www.phoenixcontact.com/us/products/1053001>



Zack marker strip, Strip, white, unlabeled, can be labeled with: PLOTMARK, CMS-P1-PLOTTER, mounting type: snapped, for terminal block width: 10.2 mm, lettering field size: 10.5 x 10.15 mm, Number of individual labels: 10

ZB 10 CUS - Zack marker strip

0824941

<https://www.phoenixcontact.com/us/products/0824941>



Zack marker strip, can be ordered: Strip, white, labeled according to customer specifications, mounting type: snap into tall marker groove, for terminal block width: 10.2 mm, lettering field size: 10,15 x 10,5 mm, Number of individual labels: 10

E/UK 1 - End clamp

1201413

<https://www.phoenixcontact.com/us/products/1201413>



ZB10,LGS:FORTL.ZAHLEN - Zack marker strip

1053014

<https://www.phoenixcontact.com/us/products/1053014>



Zack marker strip, Strip, white, labeled, can be labeled with: CMS-P1-PLOTTER, printed horizontally: consecutive numbers 1 ... 10, 11 ... 20, etc. up to 91 ... 100, mounting type: snapped, for terminal block width: 10.2 mm, lettering field size: 10,15 x 10,5 mm, Number of individual labels: 10

ZB10,QR:FORTL.ZAHLEN - Zack marker strip

1053027

<https://www.phoenixcontact.com/us/products/1053027>



Zack marker strip, Strip, white, labeled, can be labeled with: CMS-P1-PLOTTER, Printed vertically: consecutive numbers 1 ... 10, 11 ... 20, etc. up to 91 ... 100, mounting type: snapped, for terminal block width: 10.2 mm, lettering field size: 10,15 x 10,5 mm, Number of individual labels: 10

E/UK 1 - End clamp

1201413

<https://www.phoenixcontact.com/us/products/1201413>



ZB10,LGS:L1-N,PE - Marker for terminal blocks

1053412

<https://www.phoenixcontact.com/us/products/1053412>



Marker for terminal blocks, Strip, white, labeled, can be labeled with: CMS-P1-PLOTTER, horizontal: L1, L2, L3, N, PE, L1, L2, L3, N, PE, mounting type: snapped, for terminal block width: 10.2 mm, lettering field size: 10,15 x 10,5 mm, Number of individual labels: 10

ZB10,LGS:U-N - Marker for terminal blocks

1053438

<https://www.phoenixcontact.com/us/products/1053438>



Marker for terminal blocks, Strip, white, labeled, can be labeled with: CMS-P1-PLOTTER, horizontal: U, V, W, N, GND, U, V, W, N, GND, mounting type: snapped, for terminal block width: 10.2 mm, lettering field size: 10,15 x 10,5 mm, Number of individual labels: 10

E/UK 1 - End clamp

1201413

<https://www.phoenixcontact.com/us/products/1201413>



UC-TM 10 - Marker for terminal blocks

0818069

<https://www.phoenixcontact.com/us/products/0818069>



Marker for terminal blocks, Sheet, white, unlabeled, can be labeled with: BLUEMARK ID COLOR, BLUEMARK ID, BLUEMARK CLED, PLOTMARK, CMS-P1-PLOTTER, mounting type: snapped, for terminal block width: 10.2 mm, lettering field size: 9.6 x 10.5 mm, Number of individual labels: 48

UC-TM 10 CUS - Marker for terminal blocks

0824605

<https://www.phoenixcontact.com/us/products/0824605>



Marker for terminal blocks, can be ordered: by sheet, white, labeled according to customer specifications, mounting type: snap into tall marker groove, for terminal block width: 10.2 mm, lettering field size: 9.6 x 10.5 mm, Number of individual labels: 48

E/UK 1 - End clamp

1201413

<https://www.phoenixcontact.com/us/products/1201413>



UCT-TM 10 - Marker for terminal blocks

0829142

<https://www.phoenixcontact.com/us/products/0829142>



Marker for terminal blocks, Sheet, white, unlabeled, can be labeled with: TOPMARK NEO, TOPMARK LASER, BLUEMARK ID COLOR, BLUEMARK ID, BLUEMARK CLED, THERMOMARK PRIME, THERMOMARK CARD 2.0, THERMOMARK CARD, mounting type: snapped, for terminal block width: 10.2 mm, lettering field size: 8.9 x 9.6 mm, Number of individual labels: 36

UCT-TM 10 CUS - Marker for terminal blocks

0829623

<https://www.phoenixcontact.com/us/products/0829623>



Marker for terminal blocks, can be ordered: by sheet, white, labeled according to customer specifications, mounting type: snap into tall marker groove, for terminal block width: 10.2 mm, lettering field size: 8.9 x 9.6 mm, Number of individual labels: 36

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Middletown, PA 17057, United States
(+717) 944-1300
info@phoenixcon.com

End clamp - E/UK - 1201442

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End clamp, Mounting on a DIN rail NS 32 or NS 35, material: PA, color: gray

Your advantages

- With universal foot for NS 35 and NS 32 DIN rails
- Tall and low-profile designs
- Large-surface labeling

Key Commercial Data

Packing unit	1 pc
Minimum order quantity	50 pc
GTIN	 4 017918 017323
GTIN	4017918017323
Weight per Piece (excluding packing)	9.460 g
Custom tariff number	39269097
Country of origin	China

Product data sheet

Specifications

SQUARE D



Circuit protector, Linergy, thermal magnetic overcurrent, track mount, 3.0A, 250 VAC / 65 VDC

9080GCB30

Main

Range of Product	9080GCB
Product or Component Type	Circuit Protector
Trip Unit Type	Thermal-magnetic
Electrical Connection	Box lugs

Complementary

Protection Type	Overcurrent
Contact operation	Trip-free
Device Application	Industrial Application
Line Rated Current	3 A
Number of Poles	1P
Voltage Rating	250 V AC 65 V DC
Wire Size	AWG 16...AWG 10 copper
Wire stripping length	0.5 in (12.70 mm)
Terminal Tightening Torque	Control circuit 7 lbf.in (0.79 N.m) cage type connector
Terminal Rating	Factory wiring only
Operating Temperature	-22...140 °F (-30...60 °C)
Calibration Temperature	70 °F (21 °C)
Mounting Support	9080GH track 35 mm DIN rail
Height	3.45 in (87.63 mm)
Width	3.15 in (80.01 mm)
Depth	0.5 in (12.70 mm)

Environment

Product Certifications	CE UL recognized E233026 CCN QVNU2 CSA file 025490 class 3211 07
Standards	UL 1077 CSA C22.2 No 235 DIN 57470

Ordering and shipping details

Category	21703-9080 GCB
Discount Schedule	CP5
GTIN	785901481034
Nbr. of units in pkg.	1
Package weight(Lbs)	2.56 oz (72.575 g)
Returnability	Yes
Country of origin	DE

Packing Units

Unit Type of Package 1	PCE
Package 1 Height	1.00 in (2.54 cm)
Package 1 width	3.20 in (8.128 cm)
Package 1 Length	3.70 in (9.398 cm)
Unit Type of Package 2	PAL
Number of Units in Package 2	2000
Package 2 Weight	345.00 lb(US) (156.489 kg)
Package 2 Height	40.00 in (101.6 cm)
Package 2 width	40.00 in (101.6 cm)
Package 2 Length	48.00 in (121.92 cm)

Offer Sustainability

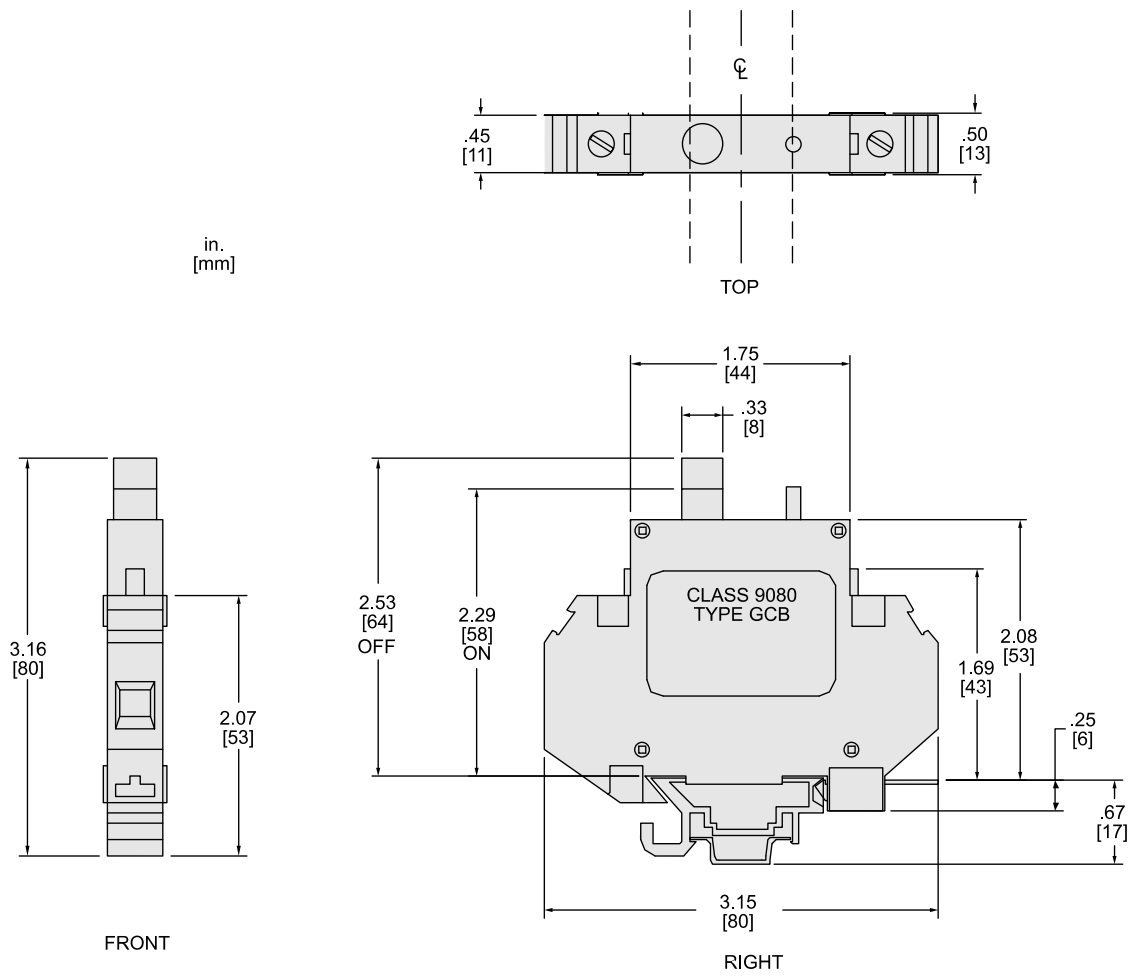
California proposition 65	WARNING: This product can expose you to chemicals including: Lead and lead compounds, which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov
REACH Regulation	REACH Declaration
REACH free of SVHC	Yes
EU RoHS Directive	Compliant EU RoHS Declaration
Mercury free	Yes
RoHS exemption information	Yes
China RoHS Regulation	China RoHS declaration Product out of China RoHS scope. Substance declaration for your information.

Contractual warranty

Warranty	18 months
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Dimensions

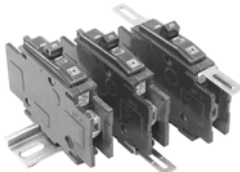


ALL DIMENSIONS ARE APPROXIMATE.
 ALSO SEE TECHNICAL DRAWINGS AND DOCUMENTATION.

		QOU Circuit Breakers				QOM1 and QOM2 Main Circuit Breakers		Multi 9™ Circuit Breakers and Supplementary Protectors							EDB Circuit Breakers							
																						
Circuit Breaker Type	Plug-on	—				—	—	—							—							
	Bolt-on	—				QOM1-VH	QOM2-VH	—							New! EDB EGB EJB							
	Unit Mount	QOU		QYU▲	—	—	UL 489 C60N			UL1077 C60N■		C60H-DC		—								
Number of Poles		1	2	3	1	2	2	1	2	3	1	2	3,4	1	2	1	2,3	1	2,3	1	2,3	
Current Range		10-100	10-125	10-100	10-30	50-125	100-225	0.5-35	0.5-35	0.5-35	0.5-63	1-63	1-63	0.5-40	0.5-40	15-70	15-125	15-70	15-125	15-70	15-125	
Interrupting Ratings																						
UL/CSA Rating (kA RMS) (50/60 Hz)		120 Vac	10	10	10	—	22	22	10	—	—	10	10	10	—	—	25	25	65	65	100	100
		120/240 Vac	10	10	10	—	22	22	5	10	10	10	10	10	—	—	18	25	35	65	65	100
DC Ratings		240 Vac◆	—	—	10	—	—	—	5	10	10	10	10	—	—	18	25	35	65	65	100	
		277 Vac	—	—	—	5	—	—	—	—	5	5	5	—	—	18	18	35	35	65	65	
IEC 60947-2 (50/60 Hz) lcu		480Y/277 Vac	—	—	—	—	—	—	10	10	10	—	5	5	—	—	18	—	35	—	65	
		48 Vdc	5★	5★	5★	—	—	—	—	—	—	10	10	—	5	5	—	—	—	—	—	
Other Standard		60 Vdc	5▼	5▼	5▼	—	—	—	10	10	—	—	—	5	5	—	—	—	—	—	—	
		65 Vdc	—	—	—	—	—	—	—	—	—	10	10	—	5	5	—	—	—	—	—	
Fed. Specs W-C-375B/GEN		125 Vdc	—	—	—	—	—	—	—	—	—	—	—	5	5	—	—	—	—	—	—	
		250 Vdc	—	—	—	—	—	—	—	—	—	—	—	5	5	—	—	—	—	—	—	
Accessories and Modifications		500 Vdc	—	—	—	—	—	—	—	—	—	—	—	—	5	5	—	—	—	—	—	
		240 Vac	—	—	—	—	—	—	20	20	20	10	10	10	20	10	20	—	—	—	—	
Dimensions (1P Unit Mount)		415 Vac	—	—	—	—	—	—	10	10	—	5	5	—	—	10	—	—	—	—	—	
Trip System Type			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			—	X	X	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Pages			Pages 7-14				Pages 1-2		Pages 7-16 through 7-19							Page 9-17						

Note: All circuit breakers on this chart are UL Listed and CSA Certified unless otherwise noted.

- ▲ QYU is a UL 1077 supplementary protector.
- C60N are recognized components per UL 1077.
- ◆ For information regarding 3Ø corner grounded systems see the Supplemental Digest.
- ★ 1P and 2P, 10-70 A and 3P 10-60 A only.
- ▼ QOU is UL Listed for 60 Vdc per pole 80-100 A, 1P; 80-125 A, 2P; and 70-100 A, 3P.
- △ HACR on QOU 1P and 3P 15-100 A, 2P 15-125 A;
- UL 489A for DC Telecom applications (1-pole only).
- ◇ Factory-installed option only
- ☆ QOM1 and QOM2 dimensions are for 2-pole unit.
- ▽ 480 V C60 height is 5.56 in. (141 mm).
- 2 poles must be wired in series for 500 Vdc.



Low Ampere QOU

Low Ampere QOU Miniature Circuit Breakers

QOU unit mount miniature circuit breakers (cable-in/cable-out) are ideal for OEM applications. They have Square D's unique Visi-Trip® feature and can be DIN rail-mounted or surface- or flush-mounted using mounting feet.

General Specifications Common to All Low Ampere QOU Circuit Breakers

- For convenient flush mount, surface mount or DIN mount (symmetrical rail 35 x 7.5 DIN/EN 50 022)
- Single handle with internal common trip
- Terminal lug wire size (1) 14–2 AWG Cu or Al
- Reversible line and load lugs
- Field-installable quick connectors
- UL Listed 48 Vdc (5 k AIR)
- UL Listed as HACR Type—10–70 A
- High magnetic trip circuit breakers (QOU-HM) are recommended for applications where high initial inrush may occur and for individual dimmer applications.
- For DIN mounting rails, see IEC Starters and Relays, Section 18

Table 7.20: QOU Low Ampere Miniature Circuit Breakers

Ampere Rating	1P 120/240 Vac		2P 120/240 Vac		2P 240 Vac		3P 240 Vac	
	Cat. No.	\$ Price	Cat. No.	\$ Price	Cat. No.▲	\$ Price	Cat. No.	\$ Price
10 k AIR								
10 A	QOU110	40.20	QOU210	87.00	—	168.00	QOU310	285.00
15 A	QOU115		QOU215		QOU215H		QOU315	
20 A	QOU120		QOU220		QOU220H		QOU320	
25 A	QOU125		QOU225		QOU225H		QOU325	
30 A	QOU130		QOU230		QOU230H		QOU330	
35 A	QOU135		QOU235		—		QOU335	
40 A	QOU140		QOU240		—		QOU340	
45 A	QOU145		QOU245		—		QOU345	
50 A	QOU150		QOU250		—		QOU350	
60 A	QOU160		QOU260		—		QOU360	
70 A	QOU170	78.00	QOU270	171.00	—	—	QOU370	363.00
22 k AIR								
15 A	QOU115VH	101.00	QOU215VH	189.00	—	—	QOU315VH	426.00
20 A	QOU120VH		QOU220VH		—		QOU320VH	
25 A	QOU125VH		QOU225VH		—		QOU325VH	
30 A	QOU130VH		QOU230VH		—		QOU330VH	
35 A	QOU135VH		QOU235VH		—		—	
40 A	QOU140VH		QOU240VH		—		—	
45 A	QOU145VH		QOU245VH		—		—	
50 A	QOU150VH		QOU250VH		—		—	
60 A	QOU160VH		QOU260VH		—		—	

▲ QOU-H interrupting rating is 10 kA at 240 Vac.

Table 7.21: QOU-HM Miniature Circuit Breakers (10 k AIR)

Ampere Rating	1P 120/240 Vac		2P 120/240 Vac		2P 240 Vac		3P 240 Vac	
	Cat. No.	\$ Price	Cat. No.	\$ Price	Cat. No.	\$ Price	Cat. No.	\$ Price
15 A	QOU115HM	40.20	—	—	—	—	—	—
20 A	QOU120HM		—	—	—	—	—	—

Table 7.22: QYU UL1077 Recognized Supplementary Protectors (5 k AIR)

Ampere Rating	1P 277 Vac		2P 120/240 Vac		2P 240 Vac		3P 240 Vac	
	Cat. No.	\$ Price	Cat. No.	\$ Price	Cat. No.	\$ Price	Cat. No.	\$ Price
10 A	QYU110	122.00	—	—	—	—	—	—
15 A	QYU115		—	—	—	—	—	—
20 A	QYU120		—	—	—	—	—	—
25 A	QYU125		—	—	—	—	—	—
30 A	QYU130		—	—	—	—	—	—



High Ampere QOU

High Ampere QOU Circuit Breakers

General Specifications Common to All High Ampere QOU Circuit Breakers

- Flush mount, surface mount, and DIN rail mount.
- Internal common trip.
- Non-reversible line and load lugs.
- Terminal lug wire size (1) 12– 2/0 AWG Cu or Al.
- UL Listed 60 Vdc per pole (5 k AIR). (Note: except switches)
- UL Listed as HACR type, 80–125 A.
- Non-automatic switches have the same physical packaging as miniature circuit breakers, but provide no overcurrent or short circuit protection. They are UL Listed per UL1087 and are CSA certified.

Table 7.23: QOU High Ampere Miniature Circuit Breakers (10 k AIR)

Ampere Rating	1P 120/240 Vac		2P 120/240 Vac		2P 240 Vac		3P 240 Vac	
	Cat. No.	\$ Price	Cat. No.	\$ Price	Cat. No.	\$ Price	Cat. No.	\$ Price
80 A	QOU180	176.00	QOU280	246.00	—	—	QOU380	416.00
90 A	QOU190		QOU290		—	QOU390		
100 A	QOU1100		QOU2100		—	QOU3100		
125 A	—		QOU2125		452.00	—	—	

Table 7.24: QOU Non-Automatic Switches

Ampere Rating	1P 120 Vac		2P 120/240 Vac		2P 240 Vac		3P 240 Vac	
	Cat. No.	\$ Price	Cat. No.	\$ Price	Cat. No.	\$ Price	Cat. No.	\$ Price
60 A	—	—	—	—	QOU200	87.00	QOU300	285.00
100 A	—	—	—	—	QOU2000	246.00	QOU3000	416.00
125 A	—	—	—	—	QOU20001	452.00	QOU30001	716.00

Interrupting Ratings Page 7-3
Accessories Page 7-12, 7-15
Dimensions Page 7-54



Bulletin 700-HK — “Slim Line” Relay

- 8 A/16 A contact ratings
- DPDT/SPDT
- Plug-in blade-style terminals
- Retainer clip with sockets
- Options: LED, push-to-test and manual override, socket-mounted surge suppressor module, or timer module
- Standard ON/OFF flag indicator
- Relay faceplate accepts optional Bulletin 1492 snap-in markers
- Choice of standard silver/nickel contacts or silver/nickel with gold plated contacts
- Maximum duty version available

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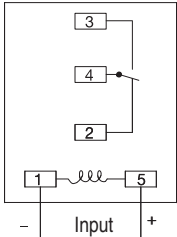
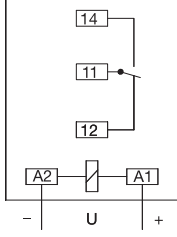

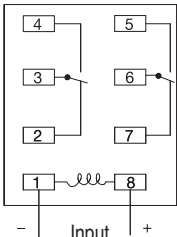
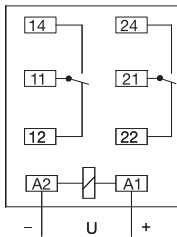
Product Selection this page
 Accessories..... 9-40
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Standards Compliance and Certifications

See Specification table in this section, page 9-42.

Product Selection

Slim Line Relay with Plug-in Quick Connect Terminations

	Description	Contact Rating	Wiring Diagrams		Coil Voltage	Cat. No.*‡
			U.S./Canada	International		
 Bulletin 700-HK SPDT	SPDT 1-Pole 1 Form C AgNi Contacts Socket	16 A	 700-HN121, 700-HN221, 700-HN223	 700-HN121, 700-HN221, 700-HN223	6V AC	700-HK36A06
			12V AC	700-HK36A12		
			24V AC	700-HK36A24		
			120V AC §	700-HK36A1		
			240V AC §	700-HK36A2		
			6V DC	700-HK36Z06		
			12V DC	700-HK36Z12		
24V DC §	700-HK36Z24					
48V DC	700-HK36Z48					
110V DC	700-HK36Z1					
 Bulletin 700-HK DPDT	DPDT 2-Pole 2 Form C AgNi Contacts Socket	8 A	 700-HN122, 700-HN222, 700-HN224	 700-HN122, 700-HN222, 700-HN224	6V AC	700-HK32A06
			12V AC	700-HK32A12		
			24V AC	700-HK32A24		
			120V AC	700-HK32A1		
			240V AC	700-HK32A2		
			6V DC	700-HK32Z06		
			12V DC	700-HK32Z12		
24V DC	700-HK32Z24					
48V DC	700-HK32Z48					
110V DC	700-HK32Z1					

* LED Option: Add suffix (-4) to the selected Bulletin 700-HK relay Cat. No. except for the 240V AC units, add (-4L).






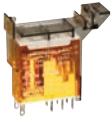

‡ For AgNi Contact with Gold Plating: Replace “3” with “X” in Cat. No. For example, if Cat. No. 700-HK36A1 is required with Gold Plating, the new catalog number is 700-HKX6A1.





‡ Push-to-Test + Manual Override + LED Option: Add suffix (-3-4) to the selected 700-HK Relay catalog number, except for the 240V AC Units, add (-3-4L).

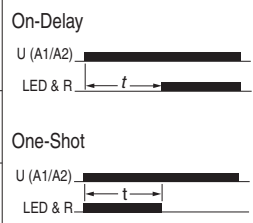
§ For high inductive, Tungsten, or Capacitive load applications, replace the “3” with a “M” in the catalog number. Only available in a SPDT configuration and with 24V DC, 120V AC or 240V AC coil voltages.

Bulletin 700-HK
Interposing/Isolation Relays
 Accessories

Accessories

	Description	Pkg. Qty.	Cat. No.
 Cat. No. 700-HN121	Screw Terminal Socket — Panel or DIN Rail Mounting 5-blade miniature socket with 10 A rating for use with 1-pole, Bulletin 700-HK relays. Accepts forked lug conductors. Socket includes a retainer clip.	10	700-HN121
 Cat. No. 700-HN221	Screw Terminal Socket — Panel or DIN Rail Mounting 5-blade miniature socket with 16 A rating for use with 1-pole, Bulletin 700-HK relays. Retainer clips are packaged separately with socket. Guarded terminal construction and compatible with optional plug-in module accessories.	10	700-HN221
	Spring Clamp Terminal Socket — Panel or DIN Rail Mounting 5-blade miniature socket for use with 1-pole, Bulletin 700-HX relays.	10	700-HN223
 Cat. No. 700-HN122	Screw Terminal Socket — Panel or DIN Rail Mounting 8-blade miniature socket with 5 A rating for use with 2-pole, Bulletin 700-HK relays. Accepts forked lug conductors. This socket includes a retainer clip.	10	700-HN122
 Cat. No. 700-HN222	Screw Terminal Socket — Panel or DIN Rail Mounting 8-blade miniature socket with 8 A rating for use with 2-pole, Bulletin 700-HK relays. Retainer clips are packaged separately with socket. Guarded terminal construction and compatible with optional plug-in module accessories.	10	700-HN222
	Spring Clamp Terminal Socket — Panel or DIN Rail Mounting 8-blade miniature socket for use with 2-pole Bulletin 700-HX relays.	10	700-HN224
 Cat. No. 700-HN226	Flange Mount Adapter Used for panel-mounting bulletin 700-HK relays. Order must be for 10 adapters or multiples of 10.	10	700-HN226
 Cat. No. 700-HN227	35 mm Rail Mount Adapter Mounts bulletin 700-HK relays to a 35 mm rail. Order must be for 10 adapters or multiples of 10.	10	700-HN227
 Cat. No. 700-HN229	Socket Retainer Clip and Ejection Lever For use with 700-HN22, -HN222, -HN223, and -HN224 sockets. Orders must be for 10 clips or multiples of 10.	10	700-HN229

	Description	Pkg. Qty.	Cat. No.
	Diode Surge Suppressor Voltage Range: 6...220V DC used with 700-HN221, 700-HN222 sockets	10	700-ADR
	Diode with LED Surge Suppressor Voltage Range: 6...24V DC used with 700-HN221, 700-HN222 sockets	10	700-ADL1R
	Diode with LED Surge Suppressor Voltage Range: 28...60V DC used with 700-HN221, 700-HN222 sockets	10	700-ADL2R
	Diode with LED Surge Suppressor Voltage Range: 110...220V DC used with 700-HN221, 700-HN222 sockets	10	700-ADL3R
	Varistor with LED Surge Suppressor Voltage Range: 6...24V AC used with 700-HN221, 700-HN222 sockets	10	700-AV1R
	Varistor with LED Surge Suppressor Voltage Range: 110...240V AC used with 700-HN221, 700-HN222 sockets	10	700-AV3R
	RC Surge Suppressor Voltage Range: 6...24V AC/DC used with 700-HN221, 700-HN222 sockets	10	700-AR1
	RC Surge Suppressor Voltage Range: 110...240V AC/DC used with 700-HN221, 700-HN222 sockets	10	700-AR2
	Timing Module On-Delay or One-Shot selectable voltage range: 12...24V AC/DC used with sockets that accept plug-in accessory modules.	1	700-AT3
	Timing Module On-Delay or One-Shot selectable voltage range: 110...125V AC used with sockets that accept plug-in accessory modules.		700-AT3A1
	Timing Module On-Delay or One-Shot selectable voltage range: 230...240V AC used with sockets that accept plug-in accessory modules.		700-AT3A2
 Cat. No. 700-HN180	8-Way Jumper can be cut to required length. Rated 10 A – 250V. Used with 700-HN221, 700-HN222 sockets.	1	Red 700-HN180R
			Grey 700-HN180G
			Blue 700-HN180B
 Cat. No. 199-DR1	DIN (#3) symmetrical hat rail 35 x 7.5 x 1 m	10	199-DR1
	Relay Identification Snap-in Markers Snap-in markers fit on top of product covers. The following are blank cards.	100	1492-MS6X9 1492-MS6X12 1492-MS8X12



Note: Spring clamp sockets are also available. Cat. No. 700-HN223 for Cat. No. 700-HK36 and Cat. No. 700-HN224 for 700-HK32.

Bulletin 700-HK Slim Line Relay, Socket, and Retainer Clip Reference Chart

Relay Type	Socket Cat. No.	Retainer Clip Cat. No.
700-HK32	700-HN122, 700-HN222, 700-HN224	Provided
700-HK36	700-HN121, 700-HN221, 700-HN223	

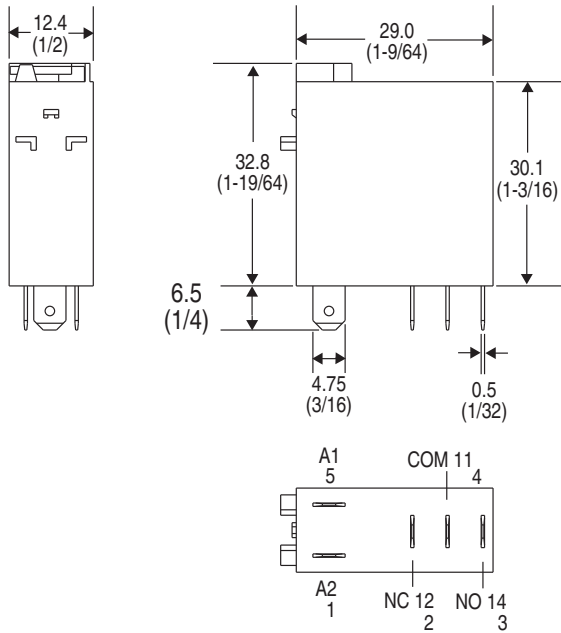
Bulletin 700-HK
Interposing/Isolation Relays
Specifications

		Cat. No. 700-HK...			
Electrical Ratings					
Rated Thermal Current (I_{th})		1-Pole, 1 CO, SPDT — 16 A		2-Pole, 2 CO, DPDT — 8 A	
Rated Insulation Voltage (U _i)		250V IEC, 300V UL/CSA			
Contacts	Inductive V AC	120V AC	AC-15, 6.2 A B300 Pilot Duty, 3 A A300 (700-HKM ₁) 1/3 Hp (0.24 kW) 1-phase	120V AC	AC-15, 2.9 A B300 Pilot Duty, 3.0 A 1/4 Hp (0.18 kW), 1-phase
		240V AC	AC-15, 3.1 A B300 Pilot Duty, 1.5 A A300 (700-HKM ₁) 3/4 Hp (0.55 kW), 1-phase	240V AC	AC-15, 1.4 A B300 Pilot Duty, 1.5 A 1/2 Hp (0.37 kW), 1-phase
		230V AC	0.55 kW, 1-phase	230V AC	0.37 kW, 1-phase
	Inductive V DC	24V DC	DC-13, 5.0 A	24V DC	DC-13, 3.0 A
		125V DC	DC-13, 0.2 A R300 Pilot Duty, 0.22 A	125V DC	DC-13, 0.2 A R300 Pilot Duty, 0.22 A
		250V DC	DC-13, 0.1 A R300 Pilot Duty, 0.11 A	5 A, 250V AC	DC-13, 0.1 A R300 Pilot Duty, 0.11 A
	Resistive	230V AC	AC-1, 16 A	230V AC	AC-1, 8 A
		277V AC	16 A, General Use	277V AC	8 A, General Use
Make, Break & Continuous	30V DC	DC-1, 12 A 10 A, Resistive	30V DC	DC-1, 6 A 6 A, Resistive	
Min. Permissible Contact Ratings		300 mW (5V/60 mA or 60V/5 mA) for AgNi Contacts (700-HK3 ₁) 50 mW (5V/10 mA or 25V/2 mA) for AgNi + Gold Contacts (700-HKX ₁) 500 mW (100V/5 mA or 5V/100 mA) for AgSnO ₂ Contacts (700-HKM ₁)			
Permissible Coil Voltage Variation	Pickup: holding Voltage: Must Dropout Voltage:	80...110% of Nominal Voltage at 50/60 Hz, 73...110% of Nominal Voltage at DC 80% of Nominal V AC at 50/60 Hz, 40% of Nominal V DC 20% of Nominal V AC at 50/60 Hz, 10% Nominal V DC			
Power Consumption		1.2V A (V AC Coils), 0.5 W (V DC Coils)			
Coil Voltages		See Overview/Product Selection			
Design Specification/Test Requirements					
Dielectric Withstand Voltage	Between Open Contacts (VRMS)	1000V AC			
	Contact to Coil (VRMS)	1600V AC			
Mechanical					
Degree of Protection		IP 20 (guarded terminal sockets), RT II — Flux-proof (Relay)			
Mechanical Life Operations		10 x 10 ⁶			
Electrical Life Cycles		230V AC, 16 A Resistive: 100 000 min. 277V AC, 16 A Resistive: 30 000 min. 30V DC, 10 A Resistive: 30 000 min. B300, R300, Hp (kW): 6000 min. A300 (700-HKM ₁): 100,000 min.		230V AC, 8 A Resistive: 100 000 min. 277V AC, 8 A Resistive: 30 000 min. 30V DC, 6 A Resistive: 30 000 min. B300, R300, Hp (kW): 6000 min.	
Switching Frequency		Mechanical: 18,000 cycles/hr. Electrical: 900 cycles/hr.			
Operating Time at Nominal Voltage at 20 °C (ms)	Pickup	15 ms max.			
	Dropout	5 ms max.			
Vibration	Operational	10...2000 Hz, 0.76 mm (0.03 in.) 2.5 G			
	Non-Operational	10...2000 Hz, 0.76 mm (0.03 in.) 5.0 G			
Shock	Operational	15 G			
	Non-Operational	50 G			
Environmental					
Temperature	Operating	-40...+70 °C (-40...+158 °F)			
	Storage	-40...+85 °C (-40...+185 °F)			
Altitude		2000 m (6560 ft)			
Construction					
Insulating Material		Molded High Dielectric Material			
Enclosure		Transparent Dust Cover			
Contact Material		700-HK3 ₁ : Silver nickel (AgNi); 700-HKX ₁ : Silver Nickel + Gold Plating (AgNi + Au); 700-HKM ₁ : Silver Tin Oxide (AgSnO ₂)			
Terminal Markings on Socket		In accordance with EN 50005			
Sockets	Screw Terminal	1-Pole		2-Pole	
		700-HN121 (10 A @ 70 °C) 700-HN221 (16 A @ 50 °C, 12 A @ 70 °C)		700-HN122 (2 x 5 A @ 70 °C) 700-HN222 (2 x 8 A @ 70 °C)	
	Spring Clamp (Available September 2006)	700-HN223 (15 A @ 40 °C with 2 conductors per terminal) (10 A @ 70 °C with 1 conductor per terminal)		700-HN224 (2 x 8 A @ 70 °C)	
Approvals					
Certifications		CSA Certified, File 75088, UL Recognized, File E3125 Guide NLDX2/NLCX8, cULus Listed with Allen-Bradley sockets (File No. 3125 Guide NLDX/NLDX7), CE Marked			
Standards		EN61810-1, CSA 22.2 No. 14, UL 508			

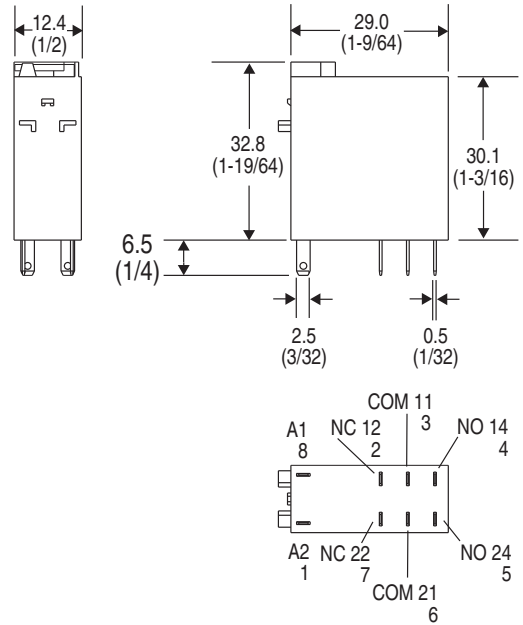


Approximate Dimensions

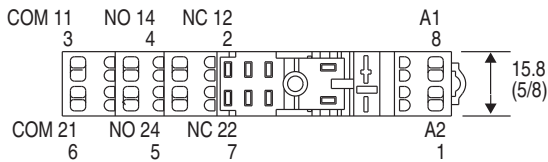
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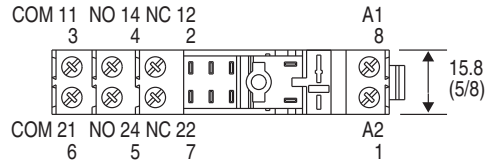
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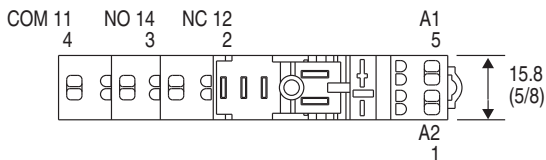
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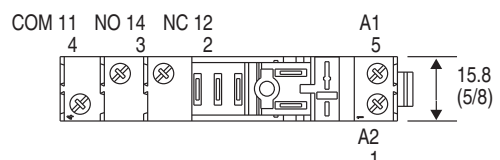
Cat. No. 700-HN224



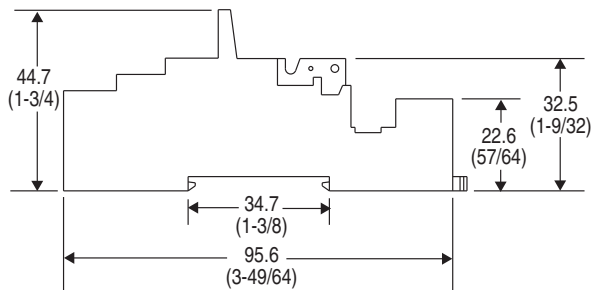
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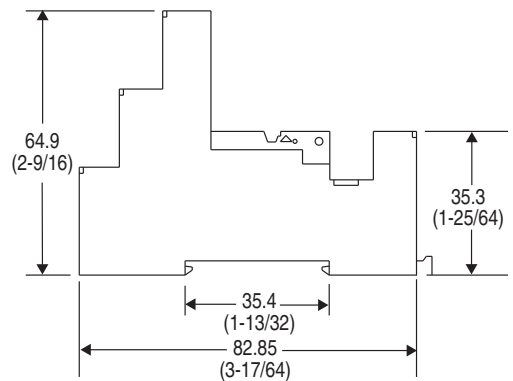
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Cat. No. 700-HN221



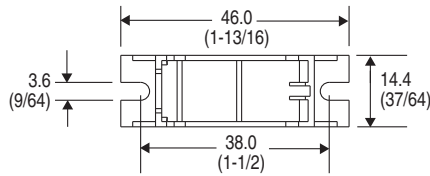
Cat. No. 700-HN223, 700-HN224
 Wire Size: 0.2 mm²...1.5 mm² (#24 AWG...#14 AWG)
 Either Solid or Stranded
 Strip Length: 8 mm (5/16 in)



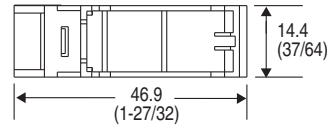
Cat. No. 700-HN221, 700-HN222
 Wire Size: 0.2 mm²...2.5 mm² (#24 AWG...#12 AWG)
 Either Solid or Stranded
 Strip Length: 8 mm (5/16 in), Torque: 0.8Nm (7.0 lb.-in.)

Bulletin 700-HK
Interposing/Isolation Relays
 Approximate Dimensions

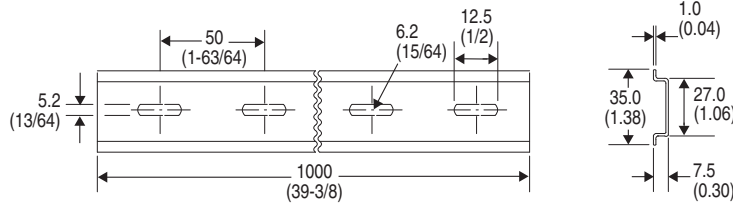
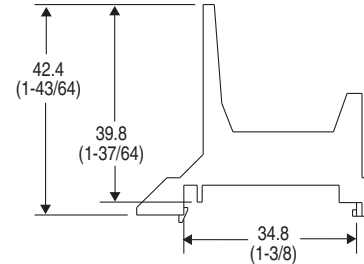
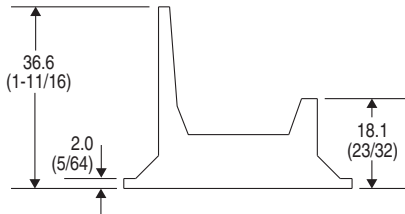
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Cat. No. 700-HN226

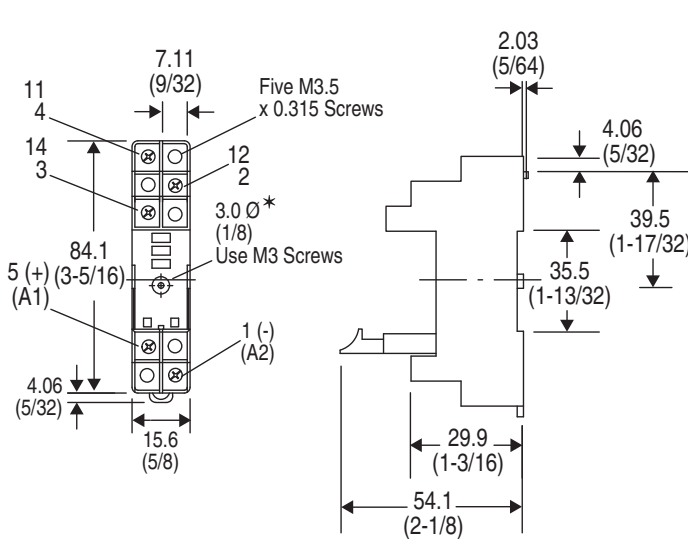


Cat. No. 700-HN227

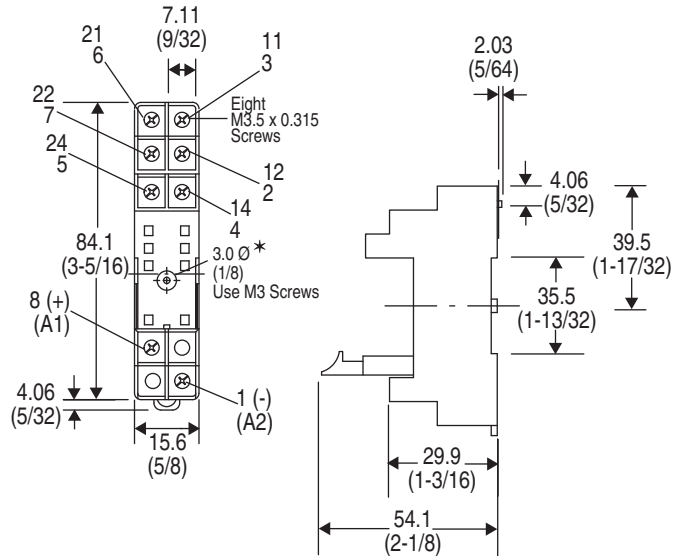


Cat. No. 199-DR4 DIN Mounting Rail Series B Has No Mounting Holes
 Cat. No. 199-DR1 DIN Mounting Rail Series B

Cat. No.	A	B	C	D	Approx. Shipping Wt.
199-DR1	35 (1-3/8)	27 (1-1/16)	7.5 (19/64)	1.02 (1/64)	1.85 kg (4.07 lb) (10/pkg)
199-DR4	35 (1-3/8)	27 (1-1/16)	15 (19/32)	2.3 (3/32)	3.68 kg (8 lb) (5/pkg)

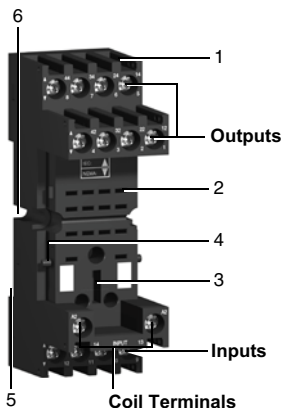
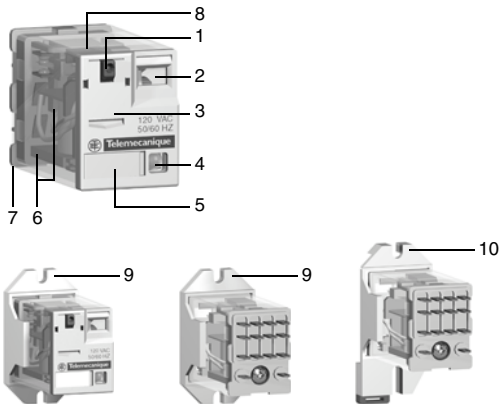
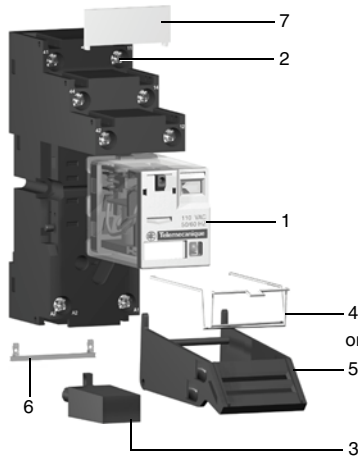


Cat. No. 700-HN121
 Wire Size: 2 x 2.5 mm²
 Single Wire – Up to #14 AWG
 Double Wire – 2 x 2.5 mm² (#2–14 AWG... #2–20 AWG)
 (Either Solid or Stranded)
 Strip Length: 9 mm (3/8 in.) – Torque: 0.8 N•m (7 lb•in)



Cat. No. 700-HN122
 Wire Size: 2 x 2.5 mm²
 Single Wire – Up to #14 AWG
 Double Wire – 2 x 2.5 mm² (#2–14 AWG... #2–20 AWG)
 (Either Solid or Stranded)
 Strip Length: 9 mm (3/8 in.) – Torque: 0.8 N•m (7 lb•in)

* Holes required for mounting [3 mm (1/8 in.) diameter].



Product Description

The RXM miniature relay range consists of:

1. 12 A relays with 2 C/O contacts, 10 A relays with 3 C/O contacts, 6 A relays with 4 C/O contacts, and 3 A "low level" relays with 4 C/O contacts. All these relays have the same dimensions.
2. Sockets with mixed or separate contact terminals.
3. Protection modules (diode, RC circuit or varistor). All these modules are common to all sockets.
4. A metal hold-down clip for all sockets.
5. A plastic hold-down clip for all sockets.
6. A 2-pole bus jumper that can be used on sockets with separate contact terminals to simplify wiring when creating a jumper between the coil terminals.
7. Clip-in markers for all the sockets except RXZ E2M114.

Relay Description

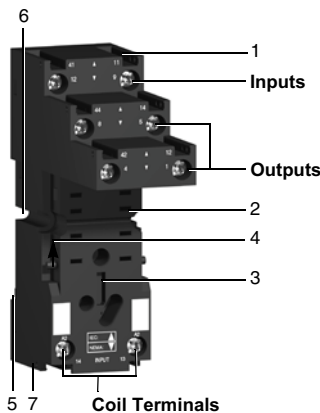
1. Spring return push button for testing the contacts (green: DC, red: AC).
2. Mechanical "relay status" indicator.
3. Removable lock-down door enabling forced maintaining of the contacts for test or maintenance purposes. During operation, this lock-down door must always be in the closed position.
4. Bipolar LED (depending on version) indicating the relay status.
5. Removable marker for relay identification.
6. Four notches for DIN rail mounting adapter or panel mounting adapter.
7. Eight, eleven, or fourteen pins.
8. Area by which the product can be easily gripped.
9. Mounting adapter enabling direct mounting of the relay on a panel.
10. Mounting adapter enabling direct mounting of the relay on a DIN rail.

Socket Description

Sockets with Mixed Contact Terminals

1. Connection by screw clamp terminals or box lug connector.
2. Fourteen female contacts for the relay pins.
3. Location for protection modules.
4. Locking components for plastic and metal hold-down clips.
5. Locating slot for mounting on DIN rail.
6. Two or four mounting holes for panel mounting.

NOTE: The inputs are mixed with the relay coil terminals, with the outputs being located on the opposite side of the socket.



Sockets with Separate Contact Terminals

1. Box lug connector.
2. Eight, eleven, or fourteen female contacts for the relay pins.
3. Location for protection modules.
4. Locking components for plastic and metal hold-down clips.
5. Locating slot for mounting on DIN rail.
6. Two mounting holes for panel mounting.
7. Location for bus jumpers (see mounting on sockets on page 10).

NOTE: The inputs and outputs are separated from the relay coil terminals.

General Characteristics

Conforming to standards		IEC/EN 61810-1 (iss. 2), UL 508, CSA C22-2 n° 14
Product certifications		cULus File E164862 CCN NLDX, NLDX7; cURus File E164862 CCN NLDX2, NLDX8; CSA pending; CE; RoHS compliant
Ambient air temperature around the device	Storage	-40–185 °F (-40–85 °C)
	Operation	-40–131 °F (-40–55 °C)
Vibration resistance	Conforming to IEC/EN 60068-2-6	> 6 gn (10–50 Hz)
Degree of protection	Conforming to IEC/EN 60529	IP 40
Shock resistance conforming to IEC/EN 60068-2-27	Opening	10 gn
	Closing	5 gn
Protection category (see page 36)		RT I
Mounting position		Any

Insulation characteristics

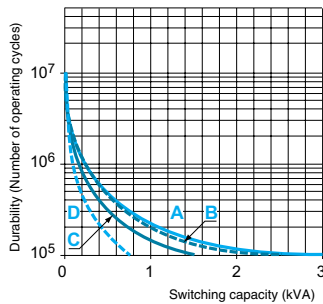
Rated insulation voltage (Ui)		250 V (IEC), 300 V (UL, CSA)
Rated impulse withstand voltage (Uimp)		3.6 kV (1.2/50 µs)
Dielectric strength (rms voltage)	Between coil and contact	2,500 Vac
	Between poles	2,500 Vac
	Between contacts	1,500 Vac

Contact characteristics

Relay type		RXM 2AB●●●	RXM 3AB●●●	RXM 4AB●●●	RXM 4GB●●●
Number and type of contacts (see page 11)		2 C/O	3 C/O	4 C/O	4 C/O
Contact materials		AgNi			AgAu
Conventional thermal current (Ith)	For ambient temperature ≤ 131 °F (55 °C)	12 A	10 A	6 A	3 A
	Conforming to IEC in utilization category AC-1	N/O 6 A	10 A 5 A	6 A 3 A	2 A 1 A
Rated operational current		Conforming to UL (resistive@277 Vac) 12 A	10 A	6 A	3 A
Maximum operating rate In operating cycles/hour	No load	18,000			
	Under load	1,200			
Switching voltage		Maximum 250 Vac/Vdc			
Switching capacity	Minimum	10 mA on 17 V			2 mA on 5 V
	Maximum	3,000 VA	2,500 VA	1,500 VA	750 VA
Utilization coefficient		20%			
Mechanical durability in millions of operating cycles		10			
Electrical durability in millions of operating cycles		Resistive load 0.1			

Electrical Durability of Contacts

Resistive load AC



A=RXM 2A●●● B=RXM 3A●●● C=RXM 4A●●● D=RXM 4B●●●

Coil characteristics

Average consumption	AC	1.2 VA									
	DC	0.9 W									
Drop-out voltage threshold	AC	≥ 0.15 Uc									
	DC	≥ 0.1 Uc									
Operating time (response time)	Between coil energization and making of the N/O contact	AC	20 ms								
		DC	20 ms								
	Between coil de-energization and making of the N/C contact	AC	20 ms								
		DC	20 ms								
Coil voltage Uc	12 V	24 V	48 V	110 V	120 V	125 V	220 V	230 V	240 V		
Relay coil voltage codes	JD	BD	ED	FD	–	GD	MD	–	–		
DC	Average resistance at 68 °F (20 °C) ± 10%	160 Ω	650 Ω	2,600 Ω	11,000 Ω	–	11,000 Ω	14,000 Ω	–	–	
	Operating voltage limits	Min.	9.6 V	19.2 V	38.4 V	88 V	–	100 V	176 V	–	–
		Max.	13.2 V	26.4 V	52.8 V	121 V	–	138 V	242 V	–	–
Relay coil voltage codes	–	B7	E7	–	F7	–	M7	P7	U7		
AC	Average resistance at 68 °F (20 °C) ± 15%	–	180 Ω	770 Ω	–	4,430 Ω	–	15,000 Ω	15,000 Ω	15,500 Ω	
	Operating voltage limits	Min.	–	19.2 V	38.4 V	–	96 V	–	176 V	184 V	192 V
		Max.	–	26.4 V	52.8 V	–	132 V	–	242 V	253 V	264 V

Socket characteristics

Socket type	RXZ E2S108M	RXZ E2S111M	RXZ E2S114M	RXZ E2M114	RXZ E2M114M
Relay types used	RXM 2●●●●●	RXM 3●●●●●	RXM 4●●●●●	RXM 2●●●●● ¹ RXM 4●●●●●	RXM 2●●●●● ¹ RXM 4●●●●●
Product certifications	cURus File E172326 CCN SWIV2, SWIV8; CSA (pending); CE; RoHS compliant				
Conventional thermal current (Ith)	12 A	10 A			
Degree of protection	Conforming to IEC/EN 60529 IP 20				
Connection	Solid wire without cable end	1 conductor: AWG 20–12 (0.5–2.5 mm ²) 2 conductors: AWG 20–14 (0.5–1.5 mm ²)			
	Flexible wire with cable end	1 conductor: AWG 24–14 (0.2–2.5 mm ²) 2 conductors: AWG 24–16 (0.2–1.5 mm ²)			
	Flexible wire without cable end	1 conductor: AWG 24–14 (0.2–2.5 mm ²) 2 conductors: AWG 24–16 (0.2–1.5 mm ²)			
Maximum tightening torque	5.3 lbf-in (0.6 Nm) (M3 screw)				
Contact terminal arrangement	Separate			Mixed	
Bus jumper Ith: 5 A	Yes			No	

¹ When mounting relay RXM 2●●●●● on socket RXZ E2M●●●●●, the thermal current must not exceed 10 A.



RXM ●AB2F7

Miniature relays without LED (sold in lots of 10)

Coil Voltage	Number and type of contacts - Thermal current (Ith)									
	2 C/O -12 A				3 C/O - 10 A			4 C/O - 6 A		
	Catalog Number	Weight		Catalog Number	Weight		Catalog Number	Weight		
lb.		kg	lb.		kg	lb.		kg		
12 Vdc	RXM 2AB1JD	0.08	0.037	RXM 3AB1JD	0.08	0.038	RXM 4AB1JD	0.08	0.036	
24 Vdc	RXM 2AB1BD	0.08	0.037	RXM 3AB1BD	0.08	0.038	RXM 4AB1BD	0.08	0.036	
48 Vdc	RXM 2AB1ED	0.08	0.037	RXM 3AB1ED	0.08	0.038	RXM 4AB1ED	0.08	0.036	
110 Vdc	RXM 2AB1FD	0.08	0.037	RXM 3AB1FD	0.08	0.038	RXM 4AB1FD	0.08	0.036	
220 Vdc	-	-	-	-	-	-	RXM 4AB1MD	0.08	0.036	
24 Vac	RXM 2AB1B7	0.08	0.037	RXM 3AB1B7	0.08	0.038	RXM 4AB1B7	0.08	0.036	
48 Vac	RXM 2AB1E7	0.08	0.037	RXM 3AB1E7	0.08	0.038	RXM 4AB1E7	0.08	0.036	
120 Vac	RXM 2AB1F7	0.08	0.037	RXM 3AB1F7	0.08	0.038	RXM 4AB1F7	0.08	0.036	
230 Vac	RXM 2AB1P7	0.08	0.037	RXM 3AB1P7	0.08	0.038	RXM 4AB1P7	0.08	0.036	
240 Vac	-	-	-	-	-	-	RXM 4AB1U7	0.08	0.036	

Miniature relays with LED (sold in lots of 10)

12 Vdc	RXM 2AB2JD	0.08	0.037	RXM 3AB2JD	0.08	0.038	RXM 4AB2JD	0.08	0.036
24 Vdc	RXM 2AB2BD	0.08	0.037	RXM 3AB2BD	0.08	0.038	RXM 4AB2BD	0.08	0.036
48 Vdc	RXM 2AB2ED	0.08	0.037	RXM 3AB2ED	0.08	0.038	RXM 4AB2ED	0.08	0.036
110 Vdc	RXM 2AB2FD	0.08	0.037	RXM 3AB2FD	0.08	0.038	RXM 4AB2FD	0.08	0.036
125 Vdc	-	-	-	-	-	-	RXM 4AB2GD	0.08	0.036
24 Vac	RXM 2AB2B7	0.08	0.037	RXM 3AB2B7	0.08	0.038	RXM 4AB2B7	0.08	0.036
48 Vac	RXM 2AB2E7	0.08	0.037	RXM 3AB2E7	0.08	0.038	RXM 4AB2E7	0.08	0.036
120 Vac	RXM 2AB2F7	0.08	0.037	RXM 3AB2F7	0.08	0.038	RXM 4AB2F7	0.08	0.036
230 Vac	RXM 2AB2P7	0.08	0.037	RXM 3AB2P7	0.08	0.038	RXM 4AB2P7	0.08	0.036



RXM 4GB2F7

Miniature relays with low level contacts, without LED (sold in lots of 10)

Coil Voltage	Number and type of contacts - Thermal current (Ith)		
	Catalog Number	Weight	
		lb.	kg
12 Vdc	RXM 4GB1JD	0.08	0.036
24 Vdc	RXM 4GB1BD	0.08	0.036
48 Vdc	RXM 4GB1ED	0.08	0.036
110 Vdc	RXM 4GB1FD	0.08	0.036
24 Vac	RXM 4GB1B7	0.08	0.036
48 Vac	RXM 4GB1E7	0.08	0.036
120 Vac	RXM 4GB1F7	0.08	0.036
230 Vac	RXM 4GB1P7	0.08	0.036

Miniature relays with low level contacts, with LED (sold in lots of 10)

Coil Voltage	Number and type of contacts - Thermal current (Ith)		
	Catalog Number	Weight	
		lb.	kg
12 Vdc	RXM 4GB2JD	0.08	0.036
24 Vdc	RXM 4GB2BD	0.08	0.036
48 Vdc	RXM 4GB2ED	0.08	0.036
110 Vdc	RXM 4GB2FD	0.08	0.036
24 Vac	RXM 4GB2B7	0.08	0.036
48 Vac	RXM 4GB2E7	0.08	0.036
120 Vac	RXM 4GB2F7	0.08	0.036
230 Vac	RXM 4GB2P7	0.08	0.036
240 Vac	RXM 4GB2U7	0.08	0.036

See page 8 for sockets and accessories.



RXZ E2M114M with relay RXM 4AB2P7TQ



RXZ E2S114M with relay RXM 4AB2F7TQ



RXM 041007



RE XL400



RXZ 400

Miniature relays without LED (sold in lots of 100)

Coil Voltage	Number and type of contacts - Thermal current (lth)					
	2 C/O - 12 A			4 C/O - 6 A		
	Catalog Number	Weight		Catalog Number	Weight	
		lb.	kg		lb.	kg
12 Vdc	—	—	—	RXM 4AB1JDTQ	0.08	0.036
24 Vdc	RXM 2AB1BDTQ	0.08	0.037	RXM 4AB1BDTQ	0.08	0.036
48 Vdc	—	—	—	RXM 4AB1EDTQ	0.08	0.036
110 Vdc	—	—	—	RXM 4AB1FDTQ	0.08	0.036
220 Vdc	—	—	—	RXM 4AB1MDTQ	0.08	0.036
24 Vac	RXM 2AB1B7TQ	0.08	0.037	RXM 4AB1B7TQ	0.08	0.036
48 Vac	—	—	—	RXM 4AB1E7TQ	0.08	0.036
120 Vac	RXM 2AB1F7TQ	0.08	0.037	RXM 4AB1F7TQ	0.08	0.036
230 Vac	RXM 2AB1P7TQ	0.08	0.037	RXM 4AB1P7TQ	0.08	0.036

Miniature relays with LED (sold in lots of 100)

24 Vdc	—	—	—	RXM 4AB2BDTQ	0.08	0.036
24 Vac	RXM 2AB2B7TQ	0.08	0.037	RXM 4AB2B7TQ	0.08	0.036
230 Vac	RXM 2AB2P7TQ	0.08	0.037	RXM 4AB2P7TQ	0.08	0.036

Sockets (sold in lots of 10)

Contact terminal arrangement	Connection	Relay type	Catalog Number	Weight	
				lb.	kg
Mixed	Screw clamp terminals	RXM 2●●●● ¹ RXM 4●●●●	RXZ E2M114 ²	0.11	0.048
	Box lug connector	RXM 2●●●● ¹ RXM 4●●●●	RXZ E2M114M ²	0.12	0.056
Separate	Box lug connector	RXM 2●●●● ³	RXZ E2S108M ³	0.13	0.058
		RXM 3●●●●	RXZ E2S111M ²	0.15	0.066
		RXM 4●●●●	RXZ E2S114M ²	0.15	0.070

¹ When mounting relay RXM 2●●●● on socket RXZ E2M●●●●, the thermal current must not exceed 10 A.

² Thermal current lth: 10 A

³ Thermal current lth: 12 A

Protection modules (sold in lots of 20)

Description	Voltage	For use with	Catalog Number	Weight	
				oz.	g
Diode	6–250 Vdc	All sockets	RXM 040W	0.11	3.0
RC circuit	24–60 Vac	All sockets	RXM 041BN7	0.35	10.0
	110–240 Vac	All sockets	RXM 041FU7	0.35	10.0
Varistor	6–24 Vac/Vdc	All sockets	RXM 021RB	1.06	30.0
	24–60 Vac/Vdc	All sockets	RXM 021BN	1.06	30.0
	110–240 Vac/Vdc	All sockets	RXM 021FP	1.06	30.0

Timing relays

Description	For use with	Catalog Number	Weight	
			lb.	kg
2 timed C/O contacts (function A—On-delay)	Sockets RXZ E●●●●	RE XL2●● ⁴	0.09	0.042
4 timed C/O contacts (function A—On-delay)		RE XL4●● ⁴	0.09	0.042

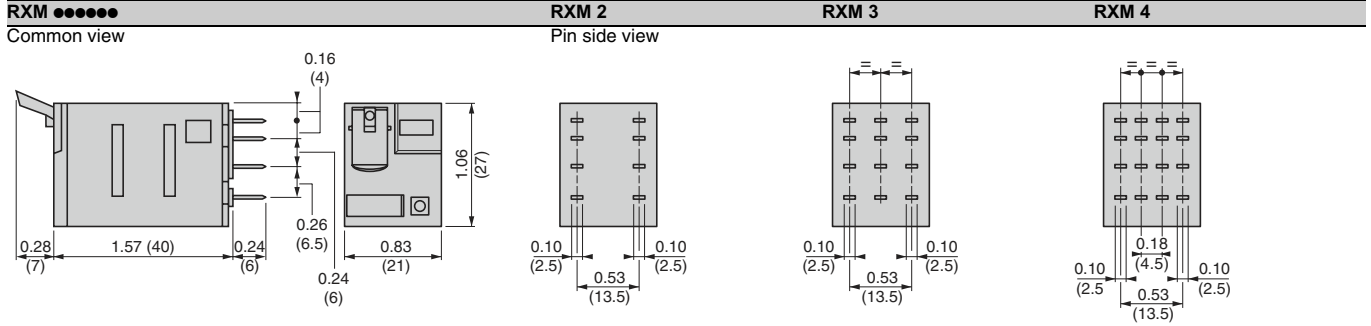
⁴ Please refer to the *Zelio® Time - Timers* catalog (9050CT0001R2/05).

Accessories (sold in lots of 10)

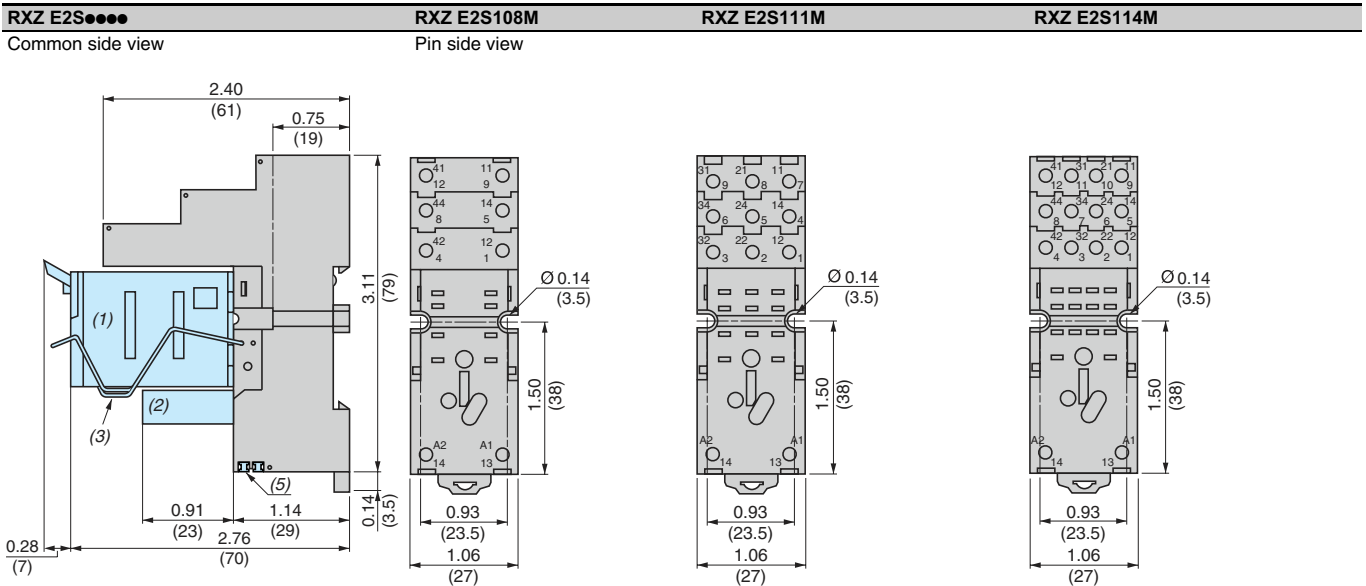
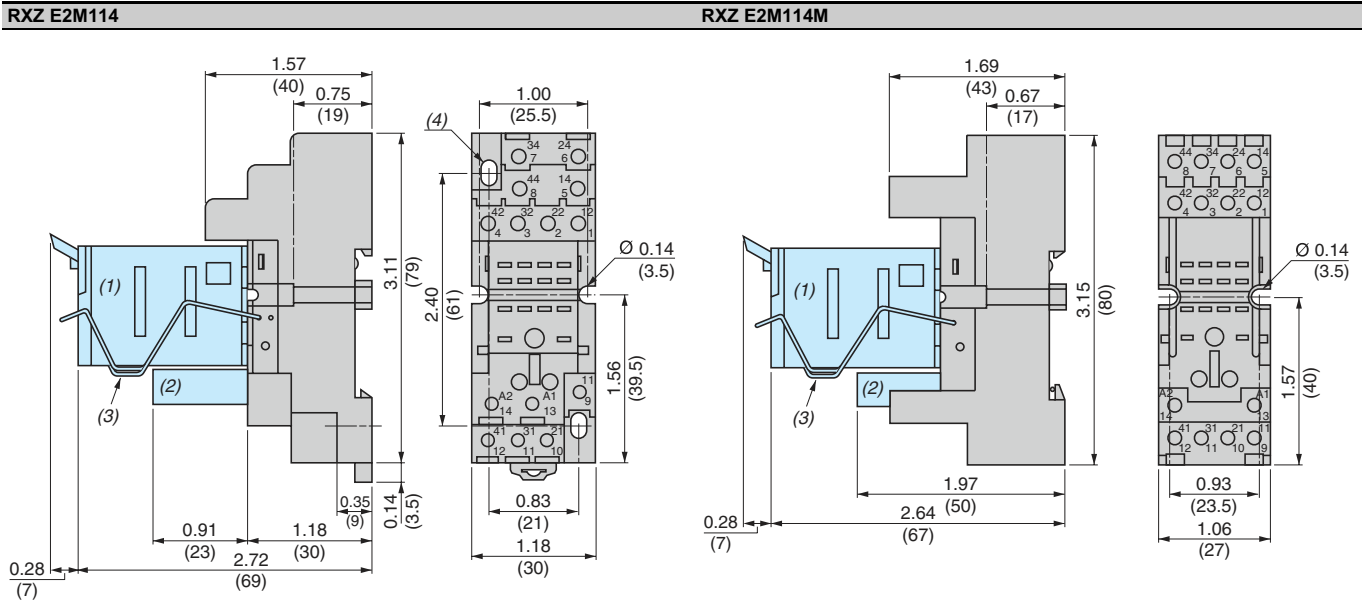
Description	For use with	Catalog Number	Weight	
			oz.	g
Metal hold-down clip	All sockets	RXZ 400	0.04	1.0
Plastic hold-down clip	All sockets	RXZ R335	0.18	5.0
Bus jumper, 2-pole (lth: 5 A)	All sockets with separate contacts	RXZ S2	0.18	5.0
Mounting adapter for DIN rail ⁵	All relays	RXZ E2DA	0.14	4.0
Mounting adapter for mounting directly to a panel	All relays	RXZ E2FA	0.07	2.0
Clip-in markers	All relays (sheet of 108 markers)	RXZ L520	2.82	80.0
	All sockets except RXZ E2M114	RXZ L420	0.04	1.0

⁵ Test button becomes inaccessible.

Relays



Sockets

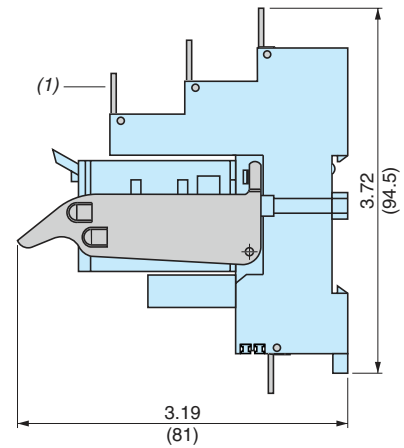
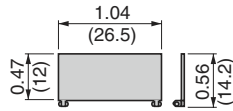
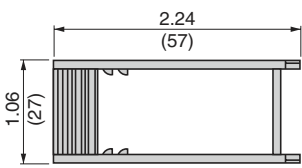


- (1) Relays
- (2) Add-on protection module
- (3) Hold-down clip
- (4) 2 elongated holes Ø 0.14 x 0.26 (3.5 x 6.5)
- (5) 2 bus jumpers

Dimensions = Inches
(mm)

Plastic clamp and clip-in markers

RXZ R335	RXZ L420	Mounting on all sockets
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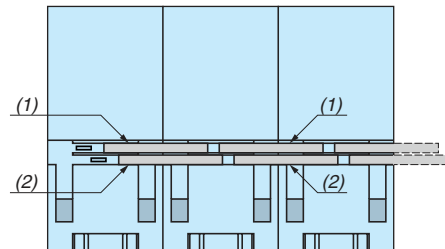
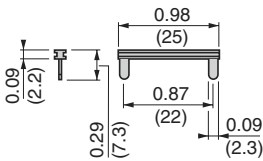


(1) Clip-in markers for all sockets except RXZ E2M114.

Bus jumper

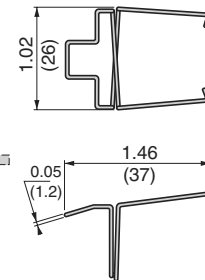
RXZ S2	Mounting on sockets with separate contacts (view from below)	RXZ 400
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Example of bus jumper mounting on sockets



(1) 2 bus jumpers (polarity A2)
(2) 2 bus jumpers (polarity A1)

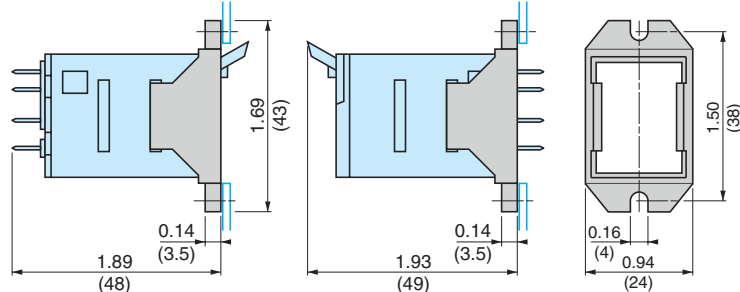
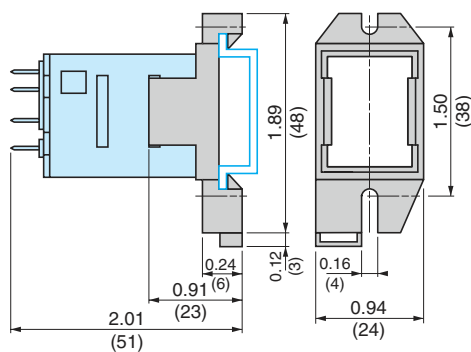
Metal clamp



Mounting adapter for rail ¹

RXZ E2DA	Mounting adapter for panel
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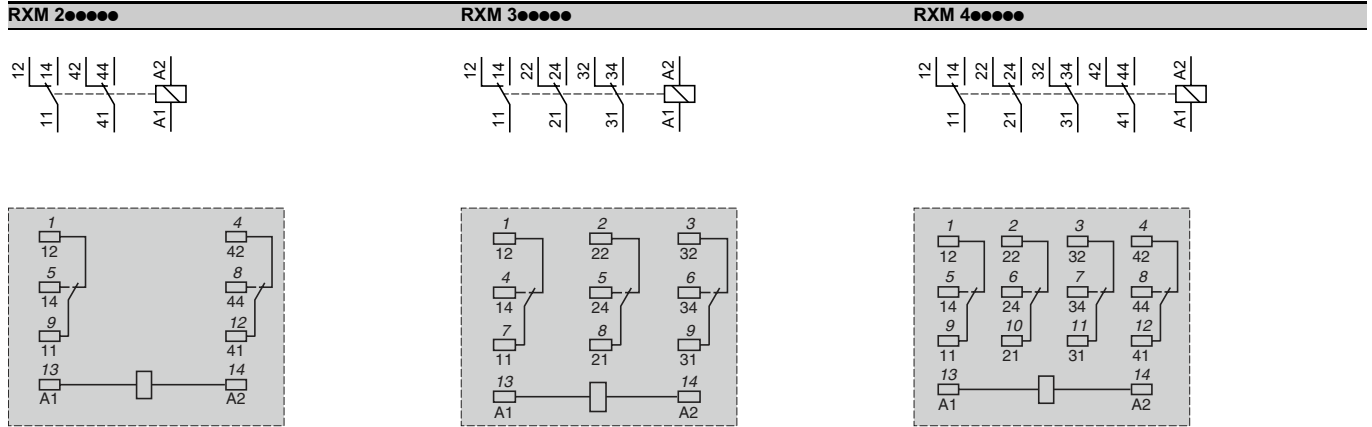
RXZ E2FA



¹ Test button becomes inaccessible

Dimensions = Inches
(mm)

Miniature relays



Numbers shown in *italics* correspond to NEMA marking. Viewed from pin end.



CompactLogix 5380, Compact GuardLogix 5380, and CompactLogix 5480 Controllers Specifications

Bulletin 5069

Topic	Page
Summary of Changes	2
Catalog Numbers	2
CompactLogix 5380 Controllers	3
Compact GuardLogix 5380 Controllers	7
Compact GuardLogix SIL 2 Controllers	8
Compact GuardLogix SIL 3 Controllers	12
CompactLogix 5480 Controllers	17
Controller Use with Other Devices	22
Accessories	26
Additional Resources	29

Summary of Changes

This publication contains the following new or updated information. This list includes substantive updates only and is not intended to reflect all changes.

Topic	Page(s)
Updated the following CompactLogix™ 5380 Controller Certifications: Ex, IECEx, CCC	6
Updated the following Compact GuardLogix® 5380 SIL 2 Controller Technical Specifications: UKEX/ATEX temperature code	9
Updated the following Compact GuardLogix 5380 SIL 2 Controller Environmental Specifications: Temperature (operating), Radiated RF immunity, EFT/B immunity, Surge transient immunity	10
Updated the following Compact GuardLogix 5380 SIL 2 Controller Certifications: UK and CE, Ex, IECEx, CCC, UKCA	10, 11
Updated the following Compact GuardLogix 5380 SIL 3 Controller Technical Specifications: UKEX/ATEX temperature code	13
Updated the following Compact GuardLogix 5380 SIL 3 Controller Environmental Specifications: Temperature (operating), Radiated RF immunity, EFT/B immunity, Surge transient immunity, Conducted RF immunity	14
Updated the following Compact GuardLogix 5380 SIL 3 Controller Certifications: UK and CE, Ex, IECEx, TÜV, CCC, UKCA	15

Catalog Numbers

This publication is applicable to the following controllers.

CompactLogix 5380 Controller Catalog Numbers	5069-L306ER, 5069-L306ERM, 5069-L310ER, 5069-L310ERM, 5069-L310ER-NSE, 5069-L320ER, 5069-L320ERM, 5069-L320ERP, 5069-L330ER, 5069-L330ERM, 5069-L340ER, 5069-L340ERM, 5069-L340ERP, 5069-L350ERM, 5069-L380ERM, 5069-L3100ERM
CompactLogix 5380 Conformal Coated Catalog Numbers	5069-L310ERMK, 5069-L320ERMK, 5069-L330ERMK, 5069-L350ERMK
CompactLogix 5380 Process Controller Catalog Numbers	5069-L320ERP, 5069-L340ERP
Compact GuardLogix 5380 SIL 2 Controller Catalog Numbers	5069-L306ERS2, 5069-L306ERMS2, 5069-L310ERS2, 5069-L310ERMS2, 5069-L320ERS2, 5069-L320ERMS2, 5069-L330ERS2, 5069-L330ERMS2, 5069-L340ERS2, 5069-L340ERMS2, 5069-L350ERS2, 5069-L350ERMS2, 5069-L380ERS2, 5069-L380ERMS2, 5069-L3100ERS2, 5069-L3100ERMS2
Compact GuardLogix 5380 SIL 2 Conformal Coated Catalog Numbers	5069-L310ERS2K, 5069-L310ERMS2K, 5069-L320ERS2K, 5069-L320ERMS2K, 5069-L330ERS2K, 5069-L330ERMS2K, 5069-L350ERS2K, 5069-L350ERMS2K
Compact GuardLogix 5380 SIL 3 Controller Catalog Numbers	5069-L306ERMS3, 5069-L310ERMS3, 5069-L320ERMS3, 5069-L330ERMS3, 5069-L340ERMS3, 5069-L350ERMS3, 5069-L380ERMS3, 5069-L3100ERMS3
Compact GuardLogix 5380 SIL 3 Conformal Coated Catalog Numbers	5069-L310ERMS3K, 5069-L320ERMS3K, 5069-L330ERMS3K, 5069-L350ERMS3K
CompactLogix 5480 Controller Catalog Numbers	5069-L430ERMW, 5069-L450ERMW, 5069-4100ERMW, 5069-L4200ERMW

CompactLogix 5380 Controllers

CompactLogix 5380 controllers are part of the Logix 5000[®] family of controllers. The controllers provide a scalable controller solution to address a wide variety of applications. The applications range from standalone systems to more complex systems with devices that are connected to the controller via an EtherNet/IP[™] network.

The controllers are mounted on a DIN rail. They can monitor and control local and remote I/O modules, and other devices connected to an EtherNet/IP network. The CompactLogix 5380 controllers support this functionality:

- Use of Compact 5000[™] I/O module as local I/O and remote I/O modules.
- Use Compact 5000 I/O modules, and other I/O modules, as remote I/O modules.
- Support for Integrated Motion over an EtherNet/IP network (not all controllers).
- Use of Dual-IP mode or Linear/DLR mode.
- Use of two Ethernet ports that let the controller connect to EtherNet/IP device-level and enterprise-level networks.
- Use of 1784-SD1, 1784-SD2, 1784-SDHC8, 1784-SDHC32, 9509-CMSDCD4 Secure Digital (SD) card for nonvolatile memory.
- USB programming port for temporary connection.
- CompactLogix 5380 Process controllers (5069-L320ERP, 5069-L340ERP) support PlantPax[®] 5.0, and are conformal coated to add a layer of protection when exposed to harsh, corrosive environments. For more information, see the PlantPax DCS Configuration and Implementation User Manual, publication [PROCES-UM100](#).

Features - CompactLogix 5380 Controllers

Feature	5069-L306ER, 5069-L306ERM	5069-L310ER, 5069-L310ER-NSE, 5069-L310ERM, 5069-L310ERMK	5069-L320ER, 5069-L320ERM, 5069-L320ERMK, 5069-L320ERP	5069-L330ER, 5069-L330ERM, 5069-L330ERMK	5069-L340ER, 5069-L340ERM, 5069-L340ERP	5069-L350ERM, 5069-L350ERMK	5069-L380ERM	5069-L3100ERM
Controller tasks Continuous Periodic Event	32 tasks 1000 programs/task All event triggers							
Built-in communication ports	1 - USB port 2 - Ethernet ports IMPORTANT: Consider the following: When the controller operates in Dual-IP mode, each Ethernet port requires a unique IP address. When the controller operates in Linear/DLR mode, the controller uses only one IP address.							
USB port communication	USB 2.0, Type B Full speed (12 Mbps) Programming, configuration, firmware update, and online edits only							
Ethernet performance	10 Mbps, 100 Mbps, 1 Gbps Full-duplex only							
I/O Capacity (Class 0/1) ⁽¹⁾	<ul style="list-style-type: none"> • 128,000 without CIP Security[™] • 40,000 with integrity • 20,000 with integrity and confidentiality 							
Message Rate Capacity HMI/MSG (Class 3) ⁽¹⁾	<ul style="list-style-type: none"> • 2000 without CIP Security • 1500 with integrity • 900 with integrity and confidentiality 							
EtherNet/IP modes supported	Dual-IP mode (Available with the Studio 5000 Logix Designer [®] application, version 29.00.00 or later) Linear/DLR mode							
EtherNet/IP network topologies supported	DLR Star Linear							
EtherNet/IP nodes supported, max ⁽²⁾	16	24	40	60	90	120	150	180
Socket interfaces supported, max	32							

Features - CompactLogix 5380 Controllers (Continued)

Feature	5069-L306ER, 5069-L306ERM	5069-L310ER, 5069-L310ER-NSE, 5069-L310ERM, 5069-L310ERMK	5069-L320ER, 5069-L320ERM, 5069-L320ERMK, 5069-L320ERP	5069-L330ER, 5069-L330ERM, 5069-L330ERMK	5069-L340ER, 5069-L340ERM, 5069-L340ERP	5069-L350ERM, 5069-L350ERMK	5069-L380ERM	5069-L3100ERM
Integrated motion ⁽³⁾	5069-L306ERM	5069-L310ERM, 5069-L310ERMK	5069-L320ERM, 5069-L320ERMK, 5069-L320ERP	5069-L330ERM, 5069-L330ERMK	5069-L340ERM, 5069-L340ERP	5069-L350ERM, 5069-L350ERMK	5069-L380ERM	5069-L3100ERM
Number of axes supported, max ⁽⁴⁾	256							
Number of Integrated Motion on EtherNet/IP™ drive axes (Position loop-configured) supported, max ⁽⁵⁾	5069-L306ERM: 2	5069-L310ERM: 4	5069-L320ERM, 5069-L320ERMK, 5069-L320ERP: 8	5069-L330ERM, 5069-L330ERMK: 16	5069-L340ERM, 5069-L340ERP: 20	24	28	32
Programming languages	Ladder Diagram (LD) Structured Text (ST) Function Block Diagram (FBD) Sequential Function Chart (SFC)							

- (1) I/O numbers are maximums; they assume no HMI/MSG. HMI/MSG numbers are maximums, they assume no I/O. Maximums assume that the processor is the target, not the originator. Packet rates vary depending on packet size. For more details, see Troubleshoot EtherNet/IP Application Technique, publication ENET-AT003, and the EDS file for a specific catalog number.
- (2) The maximum number of nodes that are listed represents when the controller is used with the Logix Designer application, version 31 or later. Some controllers can be used with earlier Logix Designer application versions. The maximum number of nodes that a controller supports can be fewer in Logix Designer application, versions 30 or earlier.
- (3) Only CompactLogix 5380 controllers that have an M or P in their catalog number support Integrated Motion on EtherNet/IP networks.
- (4) Any combination of Integrated Motion on EtherNet/IP drive, Virtual, Consumed, Regenerative AC/DC Converter and Non-Regenerative AC/DC Converter axis types.
- (5) The maximum number of Integrated Motion on EtherNet/IP drive axes (configured for Position Loop) that can be included in the total integrated motion axes count for a controller.

Technical Specifications - CompactLogix 5380 Controllers

Attribute	5069-L306ER, 5069-L306ERM	5069-L310ER, 5069-L310ER-NSE, 5069-L310ERM, 5069-L310ERMK	5069-L320ER, 5069-L320ERM, 5069-L320ERMK, 5069-L320ERP	5069-L330ER, 5069-L330ERM, 5069-L330ERMK	5069-L340ER, 5069-L340ERM, 5069-L340ERP	5069-L350ERM, 5069-L350ERMK	5069-L380ERM	5069-L3100ERM
User memory	0.6 MB	1 MB	2 MB	3 MB	4 MB	5 MB	8 MB	10 MB
Optional nonvolatile memory	<ul style="list-style-type: none"> 1784-SD1 (1 GB) 1784-SD2 (2 GB), ships with controller 1784-SDHC8 (8 GB) 1784-SDHC32 (32 GB) 9509-CMSDCD4 (4 GB) CodeMeter CmCard SD 							
Local I/O modules, max	8	8	16	31 ⁽¹⁾	31	31	31	31
Number of power cycles	80,000							
MOD Power voltage range	18...32V DC							
MOD Power current, max	450 mA							
MOD Power inrush	850 mA for 125 ms							
MOD Power passthrough ⁽²⁾	9.55 A @ 18...32V DC							
MOD Power current rating, max	10 A Do not exceed 10 A current draw at the MOD Power RTB.							
SA Power voltage ranges ⁽³⁾	0...32V DC 0...240V AC, 47...63 Hz EX, 125V AC max							
SA Power current, max ⁽³⁾	10 mA (DC power) 25 mA (AC power)							
SA Power passthrough ^{(3),(4)}	9.95 A @ 0...32V DC 9.975 A @ 0...240V AC, 47...63 Hz EX, 125V AC max							
SA Power current rating, max ⁽³⁾	10 A (AC or DC power) Do not exceed 10 A current draw at the SA Power RTB.							
Power dissipation, max	8.5 W							
Thermal dissipation, max	29 BTU/hr							
Isolation voltage	300V (continuous), Basic Insulation Type, SA, and MOD Power to Backplane 300V (continuous), Basic Insulation Type, SA to MOD Power 300V (continuous), Basic Insulation Type, Ethernet to Backplane 300V (continuous), Double Insulation Type, Ethernet to MOD Power 300V (continuous), Double Insulation Type, Ethernet to SA Power 50V (continuous), Functional Insulation Type, Ethernet to USB 300V (continuous), Basic Insulation Type, USB to Backplane 300V (continuous), Double Insulation Type, USB to MOD Power 300V (continuous), Double Insulation Type, USB to SA Power No isolation between Ethernet ports Type tested at 1500V AC for 60 s							
Weight, approx	0.768 kg (1.693 lb)							
Dimensions (HxWxD), approx	143.97 x 98.10 x 136.81 mm (5.67 x 3.86 x 5.39 in.)							

Technical Specifications - CompactLogix 5380 Controllers (Continued)

Attribute	5069-L306ER, 5069-L306ERM	5069-L310ER, 5069-L310ER-NSE, 5069-L310ERM, 5069-L310ERMK	5069-L320ER, 5069-L320ERM, 5069-L320ERMK, 5069-L320ERP	5069-L330ER, 5069-L330ERM, 5069-L330ERMK	5069-L340ER, 5069-L340ERM, 5069-L340ERP	5069-L350ERM, 5069-L350ERMK	5069-L380ERM	5069-L3100ERM
Location	DIN rail mount (horizontal mount only)							
DIN rail	Compatible zinc-plated, chromate steel DIN rail. EN50022 - 35 x 7.5 mm (1.38 x 0.30 in.)							
Removable terminal block	RTBs are available in separately ordered 5069 RTB kits. The MOD power connection uses a 4-point RTB, and the SA power connection uses a 6-point RTB. The following kits are available: <ul style="list-style-type: none"> Kit catalog number 5069-RTB64-SCREW contains RTB catalog numbers 5069-RTB6-SCREW and 5069-RTB4-SCREW. Kit catalog number 5069-RTB64-SPRING contains RTB catalog numbers 5069-RTB6-SPRING and 5069-RTB4-SPRING. 							
Terminal block torque	5069-RTB4-SCREW & 5069-RTB6-SCREW: 0.4 N•m (3.5 lb•in) 5069-RTB4-SPRING & 5069-RTB6-SPRING: Torque does not apply							
Wire size	5069-RTB4-SCREW, 5069-RTB6-SCREW connections: 0.5...1.5 mm ² (22...16 AWG) solid or stranded copper wire that is rated at 105 °C (221 °F), or greater, 3.5 mm (0.14 in.) max diameter including insulation, single wire connection only 5069-RTB4-SPRING, 5069-RTB6-SPRING connections: 0.5...1.5 mm ² (22...16 AWG) solid or stranded copper wire that is rated at 105 °C (221 °F), or greater, 2.9 mm (0.11 in.) max diameter including insulation, single wire connection only Ethernet connections: Ethernet Cabling and Installation according to IEC 61918 and IEC 61784-5-2							
Insulation stripping length	5069-RTB4-SCREW, 5069-RTB6-SCREW connections: 12 mm (0.47 in.) 5069-RTB4-SPRING, 5069-RTB6-SPRING connections: 10 mm (0.39 in.)							
Wire category ⁽⁵⁾	3 - on USB port 1 - on power ports 2 - on Ethernet ports							
Enclosure	None (open-style)							
North American temperature code	T4							
UKEX/ATEX temperature code	T4							
IECEx temperature code	T4							

- (1) When you use these controllers with the Studio 5000 Logix Designer application, version 29.00.00, the application limits the number of local I/O modules in the project to 16. For more information, see the Rockwell Automation Knowledgebase article [#942580](#), '5380 CompactLogix controllers limited to 16 local 5069 modules in V29 of Studio 5000'. The document is available at [rok.auto/knowledgebase](#).
With the Logix Designer application, version 30.00.00 or later, the controllers support as many as 31 local I/O modules.
- (2) Maximum level of MOD Power current that the controller can pass through to the next module in the system. The specific level of current passed through varies based on system configuration.
- (3) SA power specifications are based on the number and type of Compact 5000 I/O modules that are used in the system. If the set of I/O modules that are used in the system require AC and DC voltage, you must install a 5069-FPD field potential distributor to separate the module types.
- (4) Maximum level of SA Power current that the controller can pass through to the next module in the system. The specific level of current passed through varies based on system configuration.
- (5) Use this Conductor Category information to plan conductor routing. See the Industrial Automation Wiring and Grounding Guidelines, publication [1770-4.1](#).

Environmental Specifications - CompactLogix 5380 Controllers

Attribute	5069-L306ER, 5069-L306ERM, 5069-L310ER, 5069-L310ER-NSE, 5069-L310ERM, 5069-L310ERMK, 5069-L320ER, 5069-L320ERM, 5069-L320ERMK, 5069-L320ERP, 5069-L330ER, 5069-L330ERM, 5069-L330ERMK, 5069-L340ER, 5069-L340ERM, 5069-L340ERP, 5069-L350ERM, 5069-L350ERMK, 5069-L380ERM, 5069-L3100ERM
Temperature, operating IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock)	0 °C < Ta < +60 °C (+32 °F < Ta < +140 °F)
Temperature, nonoperating IEC 60068-2-1 (Test Ab, Unpackaged Nonoperating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Nonoperating Dry Heat), IEC 60068-2-14 (Test Na, Unpackaged Nonoperating Thermal Shock)	-40...+85 °C (-40...+185 °F)
Temperature, surrounding air, max	60 °C (140 °F)
Relative humidity IEC 60068-2-30 (Test Db, Unpackaged Damp Heat)	5...95% noncondensing
Vibration IEC 60068-2-6 (Test Fc, Operating)	5 g @ 10...500 Hz
Shock, operating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	30 g
Shock, nonoperating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	50 g
Emissions	IEC 61000-6-4
ESD immunity IEC 61000-4-2	6 kV contact discharges 8 kV air discharges
Radiated RF immunity IEC 61000-4-3	10V/m with 1 kHz sine-wave 80% AM from 80...6000 MHz
EFT/B immunity IEC 61000-4-4	± 4 kV at 5 kHz on power ports ± 2 kV at 5 kHz on Ethernet ports

Environmental Specifications - CompactLogix 5380 Controllers (Continued)

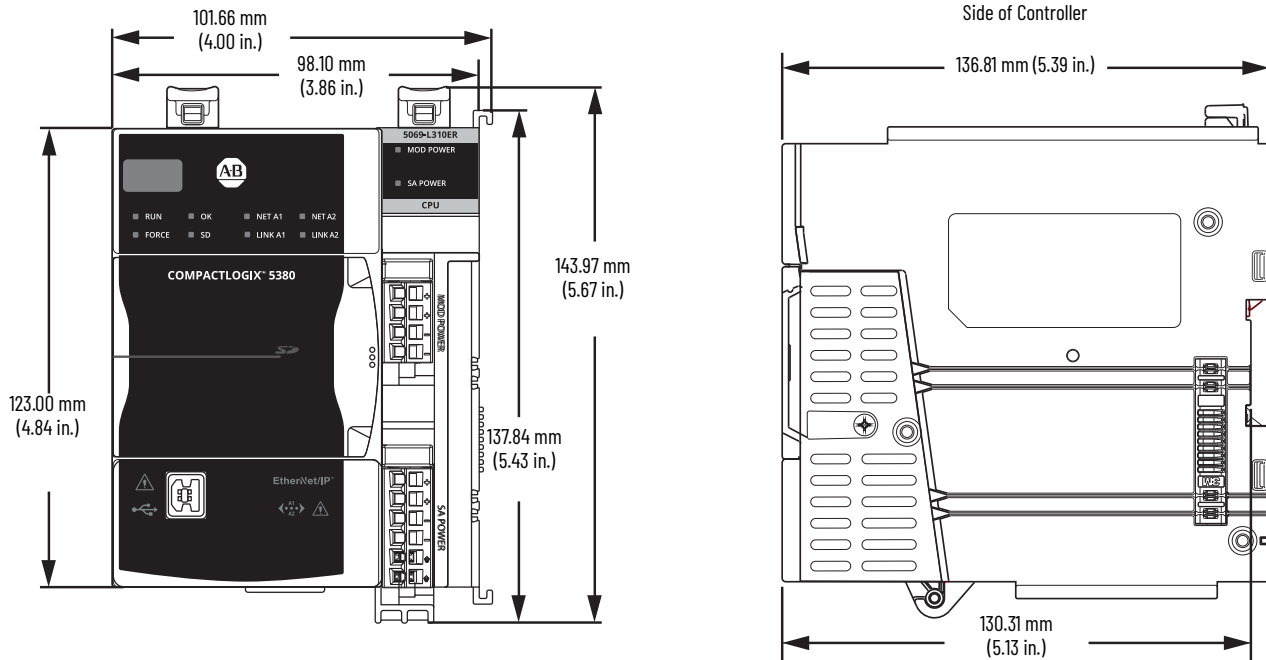
Attribute	5069-L306ER, 5069-L306ERM, 5069-L310ER, 5069-L310ER-NSE, 5069-L310ERM, 5069-L310ERMK, 5069-L320ER, 5069-L320ERM, 5069-L320ERMK, 5069-L320ERP, 5069-L330ER, 5069-L330ERM, 5069-L330ERMK, 5069-L340ER, 5069-L340ERM, 5069-L340ERMK, 5069-L350ERM, 5069-L350ERMK, 5069-L380ERM, 5069-L3100ERM
Surge transient immunity IEC 61000-4-5	± 1 kV line-line (DM) and ± 2 kV line-earth (CM) on power ports ± 2 kV line-earth (CM) on Ethernet ports
Conducted RF immunity IEC 61000-4-6	10V rms with 1 kHz sine-wave 80% AM from 150 kHz...80 MHz
Voltage variation IEC 61000-4-29	10 ms interruption on MOD Power port

Certifications - CompactLogix 5380 Controllers

Certification ⁽¹⁾	5069-L306ER, 5069-L306ERM, 5069-L310ER, 5069-L310ER-NSE, 5069-L310ERM, 5069-L310ERMK, 5069-L320ER, 5069-L320ERM, 5069-L320ERMK, 5069-L320ERP, 5069-L330ER, 5069-L330ERM, 5069-L330ERMK, 5069-L340ER, 5069-L340ERM, 5069-L340ERMK, 5069-L350ERM, 5069-L350ERMK, 5069-L380ERM, 5069-L3100ERM
c-UL-us	UL Listed Industrial Control Equipment, certified for US and Canada. See UL File E65584. UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada. See UL File E194810.
UK and CE	UK Statutory Instrument 2016 No. 1091 and European Union 2014/30/EU EMC Directive, compliant with: <ul style="list-style-type: none"> EN 61326-1; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61131-2; Programmable Controllers EN 61000-6-4; Industrial Emissions EN 61131-2; Programmable Controllers (Clause 8, Zone A & B) UK Statutory Instrument 2016 No. 1101 and European Union 2014/35/EU LVD, compliant with: <ul style="list-style-type: none"> EN 61010-2-201; Control Equipment Safety Requirements UK Statutory Instrument 2012 No. 3032 and European Union 2011/65/EU RoHS, compliant with: <ul style="list-style-type: none"> EN IEC 63000; Technical documentation
RCM	Australian Radiocommunications Act, compliant with: <ul style="list-style-type: none"> EN 61000-6-4; Industrial Emissions
Ex	European Union 2014/34/EU ATEX Directive, compliant with: <ul style="list-style-type: none"> EN IEC 60079-0; General Requirements EN IEC 60079-15; Potentially Explosive Atmospheres, Protection "n" II 3 G Ex nA IIC T4 Gc DEMKO15ATEX1455X (until Revision 10) Or UK Statutory Instrument 2016 No. 1107 and European Union 2014/34/EU ATEX Directive, compliant with: <ul style="list-style-type: none"> EN IEC 60079-0; General Requirements EN IEC 60079-7; Explosive Atmospheres, Protection "e" II 3 G Ex ec IIC T4 Gc DEMKO 15 ATEX 1455X and UL22UKEX2307X (from Revision 11)
IECEx	IECEx System, compliant with: <ul style="list-style-type: none"> IEC 60079-0: General Requirements IEC 60079-15; Potentially Explosive Atmospheres, Protection "n" II 3 G Ex nA IIC T4 Gc IECEx UL 15.0007X (until issue 10) Or <ul style="list-style-type: none"> IEC 60079-0: General Requirements IEC 60079-7; Explosive Atmospheres, Protection "e" II 3 G Ex ec IIC T4 Gc IECEx UL 15.0007X (from issue 11) when used at or below 125V AC
KC	Korean Registration of Broadcasting and Communications Equipment, compliant with: <ul style="list-style-type: none"> Article 58-2 of Radio Waves Act, Clause 3 IMPORTANT: This certification does not apply to the following catalog numbers: 5069-L320ERMK, 5069-L330ERMK, 5069-L350ERMK
EAC	Russian Customs Union TR CU 020/2011 EMC Technical Regulation Russian Customs Union TR CU 004/2011 LV Technical Regulation
Morocco	Arrêté ministériel n° 6404-15 du 1 er muharram 1437 Arrêté ministériel n° 6404-15 du 29 ramadan 1436
CCC	CNCA-C23-01:2019 强制性产品认证实施规则 防爆电气 CNCA-C23-01:2019 CCC Implementation Rule Explosion-Proof Electrical Products CCC: 202012230911301 and 2021122309113957
UKCA	2016 No. 1091 - Electromagnetic Compatibility Regulations 2016 No. 1101 - Electrical Equipment (Safety) Regulations 2016 No. 1107 - Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 2012 No. 3032 - Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations
EtherNet/IP	ODVA conformance tested to EtherNet/IP specifications
CIP Security	ODVA conformance tested to CIP Security specifications

(1) See the Product Certification link at rok.auto/certifications for Declarations of Conformity, Certificates, and other certification details.

Dimensions - CompactLogix 5380 Controllers



See [CompactLogix 5380 or Compact GuardLogix 5380 System Minimum Space Requirements on page 16](#) for space requirements.

Compact GuardLogix 5380 Controllers

Compact GuardLogix 5380 controllers are part of the Logix 5000 family of controllers. The controllers provide a scalable controller solution to address a wide variety of applications. The applications range from standalone systems to more complex systems with devices that are connected to the controller via an EtherNet/IP network.

The controllers can function in the same way as CompactLogix 5380 controllers and also provide the functionality to perform safety functions. A major benefit of this system is that it is still one project, safety and standard together.

The [Compact GuardLogix SIL 2 Controllers](#) can achieve up to SIL 2/PLd (Category 3) with the use of the safety task and safety I/O.

The [Compact GuardLogix SIL 3 Controllers](#), based on a 1oo2 design, and can achieve up to SIL 3/PLe (Category 4) with the use of the safety task and safety I/O.

During development, safety and standard have the same rules; multiple programmers, online editing, and forcing are all allowed. Once the safety system is validated and the safety signature is applied, safety memory is protected, the safety logic cannot be modified, and all safety functions operate with a safety integrity of up to SIL 2 for Compact GuardLogix SIL 2 controllers, and up to SIL 3 for Compact GuardLogix SIL 3 controllers.

The controllers are mounted on a DIN rail. They can monitor and control local and remote I/O modules, and other devices connected to an EtherNet/IP network. The controllers support this functionality:

- Use of Compact 5000 I/O standard and safety modules as local I/O and remote I/O modules.
- Use Compact 5000 I/O modules, and other I/O modules, as remote I/O modules.
- Support for Integrated Motion over an EtherNet/IP network (not all controllers).
- Use of Dual-IP mode or Linear/DLR mode.
- Use of two Ethernet ports that let the controller connect to EtherNet/IP device-level and enterprise-level networks.
- Use of 1784-SD1, 1784-SD2, 1784-SDHC8, 1784-SDHC32, 9509-CMSDCD4 Secure Digital (SD) card for nonvolatile memory.
- USB programming port for temporary connection.

Compact GuardLogix 5380 controllers are available with a conformal coating. The conformal coating provides a layer of protection against contaminants and humidity to help protect the assembly and extend product life in harsh, corrosive environments. Products with a conformal coating have a 'K' suffix at the end of the catalog number.

Compact GuardLogix SIL 2 Controllers

Features - Compact GuardLogix 5380 SIL 2 Controllers

Feature	5069-L306ERS2 5069-L306ERS2K	5069-L310ERS2 5069-L310ERS2K 5069-L310ERS2K	5069-L320ERS2 5069-L320ERS2K 5069-L320ERS2K	5069-L330ERS2 5069-L330ERS2K 5069-L330ERS2K	5069-L340ERS2 5069-L340ERS2K	5069-L350ERS2 5069-L350ERS2K 5069-L350ERS2K	5069-L380ERS2 5069-L380ERS2K	5069-L3100ERS2 5069-L3100ERS2K
Controller tasks • Continuous • Periodic • Event	31 standard tasks, 1 safety task 1000 programs/task All event triggers							
Built-in communication ports	1 USB port 2 Ethernet ports IMPORTANT: Consider the following: - When the controller operates in Dual-IP mode, each Ethernet port requires a unique IP address. - When the controller operates in Linear/DLR mode, the controller uses only one IP address.							
USB port communication	USB 2.0, Type B Full speed (12 Mbps) Programming, configuration, firmware update, and online edits only							
Ethernet performance	10 Mbps, 100 Mbps, 1 Gbps Full-duplex only							
I/O Capacity (Class 0/1) ⁽¹⁾	<ul style="list-style-type: none"> 128,000 without CIP Security 40,000 with integrity 20,000 with integrity and confidentiality 							
Message Rate Capacity HMI/MSG (Class 3) ⁽¹⁾	<ul style="list-style-type: none"> 2000 without CIP Security 1500 with integrity 900 with integrity and confidentiality 							
EtherNet/IP modes supported	Dual-IP mode Linear/DLR mode							
EtherNet/IP network topologies supported	DLR Star Linear							
EtherNet/IP nodes supported, max	16	24	40	60	90	120	150	180
Socket interfaces supported, max	32							
Integrated motion ⁽²⁾	5069-L306ERS2	5069-L310ERS2, 5069-L310ERS2K	5069-L320ERS2	5069-L330ERS2, 5069-L330ERS2K	5069-L340ERS2	5069-L350ERS2, 5069-L350ERS2K	5069-L380ERS2	5069-L3100ERS2
Number of axes supported, max ⁽³⁾	256							
Number of Integrated Motion on EtherNet/IP drive axes (Position loop-configured) supported, max ⁽⁴⁾	5069-L306ERS2: 2	5069-L310ERS2, 5069-L310ERS2K: 4	5069-L320ERS2: 8	5069-L330ERS2, 5069-L330ERS2K: 16	5069-L340ERS2: 20	5069-L350ERS2, 5069-L350ERS2K: 24	5069-L380ERS2: 28	5069-L3100ERS2: 32
Programming languages	Ladder Diagram (LD) Structured Text (ST) Function Block Diagram (FBD) Sequential Function Chart (SFC) Safety Task supports only RLL and the additional safety application instructions							

(1) I/O numbers are maximums; they assume no HMI/MSG. HMI/MSG numbers are maximums, they assume no I/O. Maximums assume that the processor is the target, not the originator. Packet rates vary depending on packet size. For more details, see Troubleshoot EtherNet/IP Application Technique, publication ENET-AT003, and the EDS file for a specific catalog number.

(2) Only controllers that have an M in their catalog number support Integrated Motion on EtherNet/IP networks.

(3) Any combination of Integrated Motion on EtherNet/IP drive, Virtual, Consumed, Regenerative AC/DC Converter and Non-Regenerative AC/DC Converter axis types.

(4) The maximum number of Integrated Motion on EtherNet/IP drive axes (configured for Position Loop) that can be included in the total integrated motion axes count for a controller.

Technical Specifications - Compact GuardLogix 5380 SIL 2 Controllers

Attribute	5069-L306ERS2 5069-L306ERS2K	5069-L310ERS2 5069-L310ERS2K 5069-L310ERS2K	5069-L320ERS2 5069-L320ERS2K 5069-L320ERS2K	5069-L330ERS2 5069-L330ERS2K 5069-L330ERS2K	5069-L340ERS2 5069-L340ERS2K	5069-L350ERS2 5069-L350ERS2K 5069-L350ERS2K	5069-L380ERS2 5069-L380ERS2K	5069-L3100ERS2 5069-L3100ERS2K
User memory	0.6 MB	1 MB	2 MB	3 MB	4 MB	5 MB	8 MB	10 MB
Safety memory	0.3 MB	0.5 MB	1 MB	1.5 MB	2 MB	2.5 MB	4 MB	5 MB
Optional nonvolatile memory	<ul style="list-style-type: none"> 1784-SD1 (1 GB) 1784-SD2 (2 GB), ships with controller 1784-SDHC8 (8 GB) 1784-SDHC32 (32 GB) 9509-CMSDCD4 (4 GB) CodeMeter CmCard SD 							
Local I/O modules, max	8	8	16	31	31	31	31	31

Technical Specifications - Compact GuardLogix 5380 SIL 2 Controllers (Continued)

Attribute	5069-L306ERS2, 5069-L306ERMS2, 5069-L310ERS2, 5069-L310ERS2K, 5069-L310ERMS2, 5069-L310ERMS2K, 5069-L320ERS2, 5069-L320ERMS2, 5069-L330ERS2, 5069-L330ERMS2, 5069-L340ERS2, 5069-L340ERMS2, 5069-L350ERS2, 5069-L350ERMS2, 5069-L380ERS2, 5069-L380ERMS2, 5069-L3100ERS2, 5069-L3100ERMS2, 5069-L320ERS2K, 5069-L320ERMS2K, 5069-L330ERS2K, 5069-L330ERMS2K, 5069-L350ERS2K, 5069-L350ERMS2K	
Number of power cycles	80,000	
MOD Power voltage range	18...32V DC SELV/PELV ⁽¹⁾	
MOD Power current, max	475 mA	
MOD Power inrush	1200 mA for 125 ms	
MOD Power passthrough voltage range ⁽²⁾	18...32V DC @ 4.525 A	
MOD Power current rating, max	5 A Do not exceed 5 A current draw at the MOD Power RTB.	
SA Power voltage ranges ⁽³⁾	0...32V DC SELV/PELV ⁽¹⁾	
SA Power current, max ⁽³⁾	10 mA (DC power)	
SA Power passthrough voltage ranges ^{(3), (4)}	0...32V DC @ 9.99 A	
SA Power current rating, max ⁽³⁾	10 A (DC power) Do not exceed 10 A current draw at the SA Power RTB.	
Power dissipation, max	9.0 W	
Thermal dissipation, max	30.9 BTU/hr	
Isolation voltage	300V (continuous), Basic Insulation Type, SA and MOD Power to Backplane 300V (continuous), Basic Insulation Type, SA to MOD Power 300V (continuous), Basic Insulation Type, Ethernet to Backplane 300V (continuous), Double Insulation Type, Ethernet to MOD Power 300V (continuous), Double Insulation Type, Ethernet to SA Power 50V (continuous), Functional Insulation Type, Ethernet to USB	300V (continuous), Basic Insulation Type, USB to Backplane 300V (continuous), Double Insulation Type, USB to MOD Power 300V (continuous), Double Insulation Type, USB to SA Power No isolation between Ethernet ports Type tested at 1500V AC for 60 seconds
Weight, approx	0.768 kg (1.693 lb)	
Dimensions (HxWxD), approx	143.97 x 98.10 x 136.81 mm (5.67 x 3.86 x 5.39 in.)	
Location	DIN rail mount (horizontal mount only)	
DIN rail	Compatible zinc-plated, chromate steel DIN rail. EN50022 - 35 x 7.5 mm (1.38 x 0.30 in.)	
Removable terminal block	RTBs are available in separately ordered 5069 RTB kits. The MOD power connection uses a 4-point RTB, and the SA power connection uses a 6-point RTB. The following kits are available: • Kit catalog number 5069-RTB64-SCREW contains RTB catalog numbers 5069-RTB6-SCREW and 5069-RTB4-SCREW • Kit catalog number 5069-RTB64-SPRING contains RTB catalog numbers 5069-RTB6-SPRING and 5069-RTB4-SPRING	
Terminal block torque	5069-RTB4-SCREW & 5069-RTB6-SCREW: 0.4 N•m (3.5 lb•in) 5069-RTB4-SPRING & 5069-RTB6-SPRING: Torque does not apply	
Wire size	5069-RTB4-SCREW, 5069-RTB6-SCREW connections: 0.5...1.5 mm ² (22...16 AWG) solid or stranded copper wire rated at 105 °C (221 °F), or greater, 3.5 mm (0.14 in.) max diameter including insulation, single wire connection only 5069-RTB4-SPRING, 5069-RTB6-SPRING connections: 0.5...1.5 mm ² (22...16 AWG) solid or stranded copper wire rated at 105 °C (221 °F), or greater, 2.9 mm (0.11 in.) max diameter including insulation, single wire connection only Ethernet connections: Ethernet Cabling and Installation according to IEC 61918 and IEC 61784-5-2	
Insulation stripping length	5069-RTB4-SCREW, 5069-RTB6-SCREW connections: 12 mm (0.47 in.) 5069-RTB4-SPRING, 5069-RTB6-SPRING connections: 10 mm (0.39 in.)	
Wire category ⁽⁵⁾	3 - on USB port 1 - on power ports 2 - on Ethernet ports	
Enclosure	None (open-style)	
North American temperature code	T4	
UKEX/ATEX temperature code	T4	
IECEx temperature code	T4	

(1) For Functional Safety applications, SELV/PELV power supplies are required for both MOD power and SA power.

(2) Maximum level of MOD Power current that the controller can pass through to the next module in the system. The specific level of current passed through varies based on system configuration.

(3) SA power specifications are based on the number and type of Compact 5000 I/O modules that are used in the system. For example, if the set of I/O modules that are used in a Compact GuardLogix 5380 controller system includes modules that use AC SA power, you must include a 5069-FPD field potential distributor in the system. In a Compact GuardLogix 5380 controller system, modules that use AC SA power must be installed to the right of a 5069-FPD field potential distributor.

(4) Maximum level of SA Power current that the controller can pass through to the next module in the system. The specific level of current passed through varies based on system configuration.

(5) Use this Conductor Category information to plan conductor routing. See the Industrial Automation Wiring and Grounding Guidelines, publication [1770-4.1](#).

Environmental Specifications - Compact GuardLogix 5380 SIL 2 Controllers

Attribute	5069-L306ERS2, 5069-L306ERMS2, 5069-L310ERS2, 5069-L310ERS2K, 5069-L310ERMS2, 5069-L310ERMS2K, 5069-L320ERS2, 5069-L320ERMS2, 5069-L330ERS2, 5069-L330ERMS2, 5069-L340ERS2, 5069-L340ERMS2, 5069-L350ERS2, 5069-L350ERMS2, 5069-L380ERS2, 5069-L380ERMS2, 5069-L3100ERS2, 5069-L3100ERMS2, 5069-L320ERS2K, 5069-L320ERMS2K, 5069-L330ERS2K, 5069-L330ERMS2K, 5069-L350ERS2K, 5069-L350ERMS2K
Temperature, operating IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock)	0 °C ≤ Ta ≤ +60 °C (+32 °F ≤ Ta ≤ +140 °F) For specific controller details, see CompactLogix 5380 or Compact GuardLogix 5380 System Minimum Space Requirements on page 16 .
Temperature, nonoperating IEC 60068-2-1 (Test Ab, Unpackaged Nonoperating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Nonoperating Dry Heat), IEC 60068-2-14 (Test Na, Unpackaged Nonoperating Thermal Shock)	-40...+85 °C (-40...+185 °F)
Temperature, surrounding air, max	60 °C (140 °F)
Relative humidity IEC 60068-2-30 (Test Db, Unpackaged Damp Heat)	5...95% noncondensing
Vibration IEC 60068-2-6 (Test Fc, Operating)	5 g @ 10...500 Hz
Shock, operating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	30 g
Shock, nonoperating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	50 g
Emissions	IEC 61000-6-4
ESD immunity IEC 61000-4-2	6 kV contact discharges 8 kV air discharges
Radiated RF immunity IEC 61000-4-3	10V/m with 1 kHz sine-wave 80% AM from 80...2000 MHz 10V/m with 1 kHz sine-wave 80% AM from 2000...2700 MHz 10V/m with 1 kHz sine-wave 80% AM from 2700...6000 MHz
EFT/B immunity IEC 61000-4-4	± 4 kV at 5 kHz on power ports ± 2 kV at 5 kHz on communication ports
Surge transient immunity IEC 61000-4-5	± 1 kV line-line (DM) and ± 2 kV line-earth (CM) on power ports ± 2 kV line-earth (CM) on communication ports
Conducted RF immunity IEC 61000-4-6	10V rms with 1 kHz sine-wave 80% AM from 150 kHz...80 MHz
Voltage variation IEC 61000-4-29	10 ms interruption on MOD Power port

Certifications - Compact GuardLogix 5380 SIL 2 Controllers

Certification ⁽¹⁾	5069-L306ERS2, 5069-L306ERMS2, 5069-L310ERS2, 5069-L310ERS2K, 5069-L310ERMS2, 5069-L310ERMS2K, 5069-L320ERS2, 5069-L320ERMS2, 5069-L330ERS2, 5069-L330ERMS2, 5069-L340ERS2, 5069-L340ERMS2, 5069-L350ERS2, 5069-L350ERMS2, 5069-L380ERS2, 5069-L380ERMS2, 5069-L3100ERS2, 5069-L3100ERMS2, 5069-L320ERS2K, 5069-L320ERMS2K, 5069-L330ERS2K, 5069-L330ERMS2K, 5069-L350ERS2K, 5069-L350ERMS2K
c-UL-us	UL Listed Industrial Control Equipment, certified for US and Canada. See UL File E65584. UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada. See UL File E194810.
UK and CE	UK Statutory Instrument 2016 No. 1091 and European Union 2014/30/EU EMC Directive, compliant with: <ul style="list-style-type: none"> EN 61326-1; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions EN 61131-2; Programmable Controllers (Clause 8, Zone A & B) UK Statutory Instrument 2008 No. 1597 and European Union 2006/42/EC MD, compliant with: <ul style="list-style-type: none"> EN 60204-1; Electrical equipment of machines EN ISO 13849-1; Safety-related parts of control systems EN 62061; Functional safety of safety-related control systems Cat. 3/PL d according to EN ISO 13849-1, and SIL 2 according to EN 62061/IEC 61508 TÜV 01/205U/5632 and TÜV 01/205/5632 UK Statutory Instrument 2012 No. 3032 and European Union 2011/65/EU RoHS, compliant with: <ul style="list-style-type: none"> EN IEC 63000; Technical documentation
RCM	Australian Radiocommunications Act, compliant with: <ul style="list-style-type: none"> EN 61000-6-4; Industrial Emissions
Ex	European Union 2014/34/EU ATEX Directive, compliant with: <ul style="list-style-type: none"> EN 60079-0; General Requirements EN 60079-15; Potentially Explosive Atmospheres, Protection "n" II 3 G Ex nA IIC T4 Gc DEMKO 17 ATEX 1976X (until Revision 2) Or UK Statutory Instrument 2016 No. 1107 and European Union 2014/34/EU ATEX Directive, compliant with: <ul style="list-style-type: none"> EN IEC 60079-0; General Requirements EN IEC 60079-7; Explosive Atmospheres, Protection "e" II 3 G Ex ec IIC T4 Gc DEMKO 17 ATEX 1976X and UL22UKEX2669X (from Revision 3)

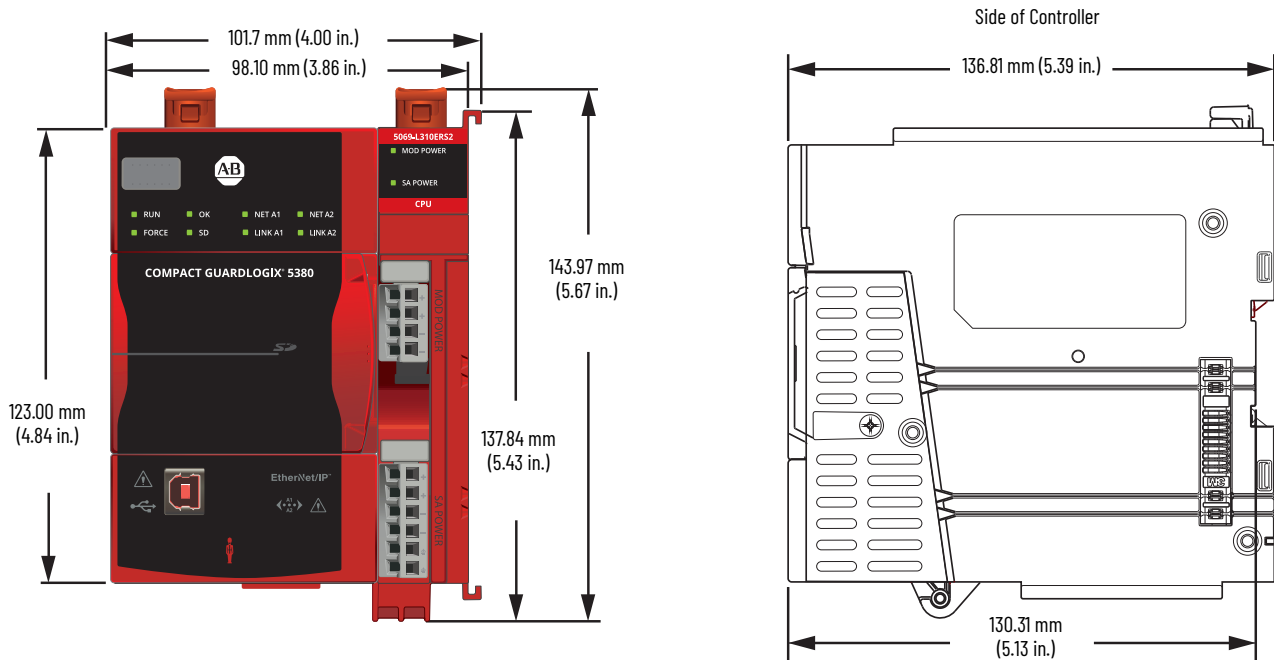
Certifications - Compact GuardLogix 5380 SIL 2 Controllers

Certification ⁽¹⁾	5069-L306ERS2, 5069-L306ERMS2, 5069-L310ERS2, 5069-L310ERS2K, 5069-L310ERMS2, 5069-L310ERMS2K, 5069-L320ERS2, 5069-L320ERMS2, 5069-L330ERS2, 5069-L330ERMS2, 5069-L340ERS2, 5069-L340ERMS2, 5069-L350ERS2, 5069-L350ERMS2, 5069-L380ERS2, 5069-L380ERMS2, 5069-L3100ERS2, 5069-L3100ERMS2, 5069-L320ERS2K, 5069-L320ERMS2K, 5069-L330ERS2K, 5069-L330ERMS2K, 5069-L350ERS2K, 5069-L350ERMS2K
IECEX	IECEX System, compliant with: <ul style="list-style-type: none"> IEC 600079-0: General Requirements IEC 60079-15: Potentially Explosive Atmospheres, Protection "n" II 3 G Ex nA IIC T4 Gc IECEX UL 17.0122X (until issue 4) Or <ul style="list-style-type: none"> IEC 600079-0: General Requirements IEC 60079-7: Explosive Atmospheres, Protection "e" II 3 G Ex ec IIC T4 Gc IECEX UL 17.0122X (from issue 5)
TÜV	TÜV Certified for Functional Safety ⁽²⁾ . <ul style="list-style-type: none"> Capable of SIL 2, CAT. 3/PL d
KC	Korean Registration of Broadcasting and Communications Equipment, compliant with: <ul style="list-style-type: none"> Article 58-2 of Radio Waves Act, Clause 3
EAC	Russian Customs Union TR CU 020/2011 EMC Technical Regulation Russian Customs Union TR CU 004/2011 LV Technical Regulation
CCC	CNCA-C23-01:2019 强制性产品认证实施规则 防爆电气 CNCA-C23-01:2019 CCC Implementation Rule Explosion-Proof Electrical Products CCC: 202012230911301 and 2021122309113957
UKCA	2016 No. 1091 – Electromagnetic Compatibility Regulations 2016 No. 1107 – Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 2008 No. 1597 – Supply of Machinery (Safety) Regulations 2012 No. 3032 – Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations
Morocco	Arrêté ministériel n° 6404-15 du 1 er muharram 1437 Arrêté ministériel n° 6404-15 du 29 ramadan 1436
EtherNet/IP	ODVA conformance tested to EtherNet/IP specifications
CIP Security	ODVA conformance tested to CIP Security specifications

(1) See the Product Certification link at rok.auto/certifications for Declarations of Conformity, Certificates, and other certification details.

(2) When used with specified firmware revisions.
See the Product Safety Certificate at rok.auto/certifications for a full list of safety-related certifications.

Dimensions - CompactLogix GuardLogix 5380 SIL 2 Controllers



See [CompactLogix 5380](#) or [Compact GuardLogix 5380 System Minimum Space Requirements](#) on page 16 for space requirements.

Compact GuardLogix SIL 3 Controllers

Features - Compact GuardLogix 5380 SIL 3 Controllers

Feature	5069-L306ERMS3	5069-L310ERMS3 5069-L310ERMS3K	5069-L320ERMS3 5069-L320ERMS3K	5069-L330ERMS3 5069-L330ERMS3K	5069-L340ERMS3	5069-L350ERMS3 5069-L350ERMS3K	5069-L380ERMS3	5069-L3100ERMS3
Controller tasks • Continuous • Periodic • Event	31 standard tasks, 1 safety task 1000 programs/task All event triggers							
Built-in communication ports	1 USB port 2 Ethernet ports IMPORTANT: Consider the following: - When the controller operates in Dual-IP mode, each Ethernet port requires a unique IP address. - When the controller operates in Linear/DLR mode, the controller uses only one IP address.							
USB port communication	USB 2.0, Type B Full speed (12 Mbps) Programming, configuration, firmware update, and online edits only							
Ethernet performance	10 Mbps, 100 Mbps, 1 Gbps Full-duplex only							
I/O Capacity (Class 0/1) - packets/second ^{(1) (2)}	<ul style="list-style-type: none"> 128,000 without CIP Security 40,000 with integrity 20,000 with integrity and confidentiality 							
Message Rate Capacity HMI/MSG (Class 3) - messages/second ^{(1) (3)}	<ul style="list-style-type: none"> 1000 without CIP Security 750 with integrity 450 with integrity and confidentiality 							
EtherNet/IP network topologies supported	DLR Star Linear							
EtherNet/IP nodes supported, max	16	24	40	60	90	120	150	180
Socket interfaces supported, max	32							
Integrated motion ⁽³⁾								
Number of axes supported, max ⁽⁴⁾	256							
Number of Integrated Motion on EtherNet/IP drive axes (Position loop-configured) supported, max ⁽⁵⁾	2	4	8	16	20	24	28	32
Programming languages	Ladder Diagram (LD) Structured Text (ST) Function Block Diagram (FBD) Sequential Function Chart (SFC) Safety Task supports only RLL and the additional safety application instructions							

- (1) I/O numbers are maximums; they assume no HMI/MSG. HMI/MSG numbers are maximums, they assume no I/O. Maximums assume that the processor is the target, not the originator. Packet rates vary depending on packet size. For more details, see Troubleshoot EtherNet/IP Application Technique, publication [ENET-AT003](#), and the EDS file for a specific catalog number.
- (2) For information on integrity and confidentiality, see the CIP Security with Rockwell Automation Products Application Technique, publication [SECURE-AT001](#).
- (3) Only controllers that have an M in their catalog number support Integrated Motion on EtherNet/IP networks.
- (4) Any combination of Integrated Motion on EtherNet/IP drive, Virtual, Consumed, Regenerative AC/DC Converter and Non-Regenerative AC/DC Converter axis types.
- (5) The maximum number of Integrated Motion on EtherNet/IP drive axes (configured for Position Loop) that can be included in the total integrated motion axes count for a controller.

Technical Specifications - Compact GuardLogix 5380 SIL 3 Controllers

Attribute	5069-L306ERMS3	5069-L310ERMS3 5069-L310ERMS3K	5069-L320ERMS3 5069-L320ERMS3K	5069-L330ERMS3 5069-L330ERMS3K	5069-L340ERMS3	5069-L350ERMS3 5069-L350ERMS3K	5069-L380ERMS3	5069-L3100ERMS3
User memory	0.6 MB	1 MB	2 MB	3 MB	4 MB	5 MB	8 MB	10 MB
Safety memory	0.3 MB	0.5 MB	1 MB	1.5 MB	2 MB	2.5 MB	4 MB	5 MB
Optional nonvolatile memory	<ul style="list-style-type: none"> 1784-SD1 (1 GB) 1784-SD2 (2 GB), ships with controller 1784-SDHC8 (8 GB) 1784-SDHC32 (32 GB) 9509-CMSDCD4 (4 GB) CodeMeter CmCard SD 							
Local I/O modules, max	8	8	16	31	31	31	31	31

Technical Specifications - Compact GuardLogix 5380 SIL 3 Controllers (Continued)

Attribute	5069-L306ERMS3, 5069-L310ERMS3, 5069-L310ERMS3K, 5069-L320ERMS3, 5069-L320ERMS3K, 5069-L330ERMS3, 5069-L330ERMS3K, 5069-L340ERMS3, 5069-L350ERMS3, 5069-L350ERMS3K, 5069-L380ERMS3, 5069-L3100ERMS3	
Number of power cycles	80,000	
MOD Power voltage range	18...32V DC SELV/PELV ⁽¹⁾	
MOD Power current, max	950 mA	
MOD Power inrush	2.375 A	
MOD Power passthrough voltage range ⁽²⁾	18...32V DC @ 4.05 A	
MOD Power current rating, max	5 A Do not exceed 5 A current draw at the MOD Power RTB.	
SA Power voltage ranges ⁽³⁾	0...32V DC SELV/PELV ⁽¹⁾	
SA Power current, max ⁽³⁾	10 mA (DC power)	
SA Power passthrough voltage ranges ^{(3), (4)}	0...32V DC @ 9.99 A	
SA Power current rating, max ⁽³⁾	10 A (DC power) Do not exceed 10 A current draw at the SA Power RTB.	
Power dissipation, max	18.0 W	
Thermal dissipation, max	18.0 W	
Isolation voltage	300V (continuous), Basic Insulation Type, SA and MOD Power to Backplane 300V (continuous), Basic Insulation Type, SA to MOD Power 300V (continuous), Basic Insulation Type, Ethernet to Backplane 300V (continuous), Double Insulation Type, Ethernet to MOD Power 300V (continuous), Double Insulation Type, Ethernet to SA Power 50V (continuous), Functional Insulation Type, Ethernet to USB	300V (continuous), Basic Insulation Type, USB to Backplane 300V (continuous), Double Insulation Type, USB to MOD Power 300V (continuous), Double Insulation Type, USB to SA Power No isolation between Ethernet ports Type tested at 1500V AC for 60 seconds
Weight, approx	1.2 kg (2.645 lb)	
Dimensions (HxWxD), approx	143.71 x 153.5 x 136.81 mm (5.65 x 6.04 x 5.39 in.)	
Location	DIN rail mount (horizontal mount only)	
DIN rail	Compatible zinc-plated, chromate steel DIN rail. EN50022 - 35 x 7.5 mm (1.38 x 0.30 in.)	
Removable terminal block	RTBs are available in separately ordered 5069 RTB kits. The MOD power connection uses a 4-point RTB, and the SA power connection uses a 6-point RTB. The following kits are available: • Kit catalog number 5069-RTB64-SCREW contains RTB catalog numbers 5069-RTB6-SCREW and 5069-RTB4-SCREW • Kit catalog number 5069-RTB64-SPRING contains RTB catalog numbers 5069-RTB6-SPRING and 5069-RTB4-SPRING	
Terminal block torque	5069-RTB4-SCREW & 5069-RTB6-SCREW: 0.4 N•m (3.5 lb•in) 5069-RTB4-SPRING & 5069-RTB6-SPRING: Torque does not apply	
Wire size	5069-RTB4-SCREW, 5069-RTB6-SCREW connections: 0.5...1.5 mm ² (22...16 AWG) solid or stranded copper wire rated at 105 °C (221 °F), or greater, 3.5 mm (0.14 in.) max diameter including insulation, single wire connection only 5069-RTB4-SPRING, 5069-RTB6-SPRING connections: 0.5...1.5 mm ² (22...16 AWG) solid or stranded copper wire rated at 105 °C (221 °F), or greater, 2.9 mm (0.11 in.) max diameter including insulation, single wire connection only Ethernet connections: Ethernet Cabling and Installation according to IEC 61918 and IEC 61784-5-2	
Insulation stripping length	5069-RTB4-SCREW, 5069-RTB6-SCREW connections: 12 mm (0.47 in.) 5069-RTB4-SPRING, 5069-RTB6-SPRING connections: 10 mm (0.39 in.)	
Wire category ⁽⁵⁾	3 - on USB port 1 - on power ports 2 - on Ethernet ports	
Enclosure	None (open-style)	
North American temperature code	T4	
UKEX/ATEX temperature code	T4	
IECEx temperature code	T4	

(1) For Functional Safety applications, SELV/PELV power supplies are required for both MOD power and SA power.

(2) Maximum level of MOD Power current that the controller can pass through to the next module in the system. The specific level of current passed through varies based on system configuration.

(3) SA power specifications are based on the number and type of Compact 5000 I/O modules that are used in the system. For example, if the set of I/O modules that are used in a Compact GuardLogix 5380 controller system includes modules that use AC SA power, you must include a 5069-FPD field potential distributor in the system. In a Compact GuardLogix 5380 controller system, modules that use AC SA power must be installed to the right of a 5069-FPD field potential distributor.

(4) Maximum level of SA Power current that the controller can pass through to the next module in the system. The specific level of current passed through varies based on system configuration.

(5) Use this Conductor Category information to plan conductor routing. See the Industrial Automation Wiring and Grounding Guidelines, publication [1770-4.1](#).

Environmental Specifications - Compact GuardLogix 5380 SIL 3 Controllers

Attribute	5069-L306ERMS3, 5069-L310ERMS3, 5069-L310ERMS3K, 5069-L320ERMS3, 5069-L320ERMS3K, 5069-L330ERMS3, 5069-L330ERMS3K, 5069-L340ERMS3, 5069-L350ERMS3, 5069-L350ERMS3K, 5069-L380ERMS3, 5069-L3100ERMS3
Temperature, operating IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock)	0 °C ≤ Ta ≤ +60 °C (+32 °F ≤ Ta ≤ +140 °F) For specific controller details, see CompactLogix 5380 or Compact GuardLogix 5380 System Minimum Space Requirements on page 16 .
Temperature, nonoperating IEC 60068-2-1 (Test Ab, Unpackaged Nonoperating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Nonoperating Dry Heat), IEC 60068-2-14 (Test Na, Unpackaged Nonoperating Thermal Shock)	-40...+85 °C (-40...+185 °F)
Temperature, surrounding air, max	60 °C (140 °F)
Relative humidity IEC 60068-2-30 (Test Db, Unpackaged Damp Heat)	5...95% noncondensing
Vibration IEC 60068-2-6 (Test Fc, Operating)	5 g @ 10...500 Hz
Shock, operating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	30 g
Shock, nonoperating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	50 g
Emissions	IEC 61000-6-4
ESD immunity IEC 61000-4-2	6 kV contact discharges 8 kV air discharges
Radiated RF immunity IEC 61000-4-3	20V/m with 1 kHz sine-wave 80% AM from 80...2000 MHz 10V/m with 1 kHz sine-wave 80% AM from 2000...2700 MHz 10V/m with 1 kHz sine-wave 80% AM from 2700...6000 MHz
EFT/B immunity IEC 61000-4-4	± 4 kV at 5 kHz on power ports ± 3 kV at 5 kHz on communication ports
Surge transient immunity IEC 61000-4-5	± 1 kV line-line (DM) and ± 2 kV line-earth (CM) on power ports ± 2 kV line-earth (CM) on communication ports
Conducted RF immunity IEC 61000-4-6	20V rms with 1 kHz sine-wave 80% AM from 150 kHz...80 MHz
Voltage variation IEC 61000-4-29	10 ms interruption on MOD Power port

Certifications - Compact GuardLogix 5380 SIL 3 Controllers

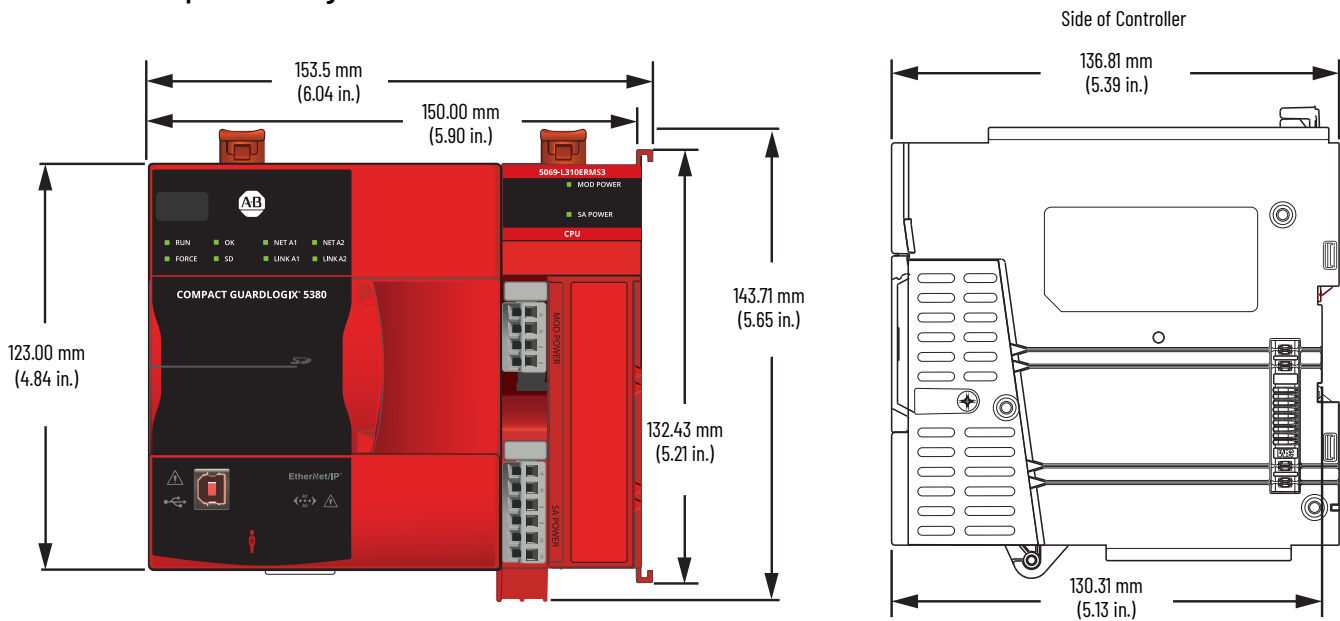
Certification ⁽¹⁾	5069-L306ERMS3, 5069-L310ERMS3, 5069-L310ERMS3K, 5069-L320ERMS3, 5069-L320ERMS3K, 5069-L330ERMS3, 5069-L330ERMS3K, 5069-L340ERMS3, 5069-L350ERMS3, 5069-L350ERMS3K, 5069-L380ERMS3, 5069-L3100ERMS3
c-UL-us	UL Listed Industrial Control Equipment, certified for US and Canada. See UL File E65584. UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada. See UL File E194810.
UK and CE	UK Statutory Instrument 2016 No. 1091 and European Union 2014/30/EU EMC Directive, compliant with: <ul style="list-style-type: none"> EN 61326-1; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions EN 61131-2; Programmable Controllers (Clause 8, Zone A & B) UK Statutory Instrument 2008 No. 1597 and European Union 2006/42/EC MD, compliant with: <ul style="list-style-type: none"> EN 60204-1; Electrical equipment of machines EN ISO 13849-1; Safety-related parts of control systems EN 62061; Functional safety of safety-related control systems Cat. 4/PL e according to EN ISO 13849-1 and SIL 3 according to EN 62061 / IEC 61508 TÜV 01/205/5775 and 01/205U/5775 UK Statutory Instrument 2012 No. 3032 and European Union 2011/65/EU RoHS, compliant with: <ul style="list-style-type: none"> EN IEC 63000; Technical documentation
RCM	Australian Radiocommunications Act, compliant with: <ul style="list-style-type: none"> EN 61000-6-4; Industrial Emissions
Ex	UK Statutory Instrument 2016 No. 1107 and European Union 2014/34/EU ATEX Directive, compliant with: <ul style="list-style-type: none"> EN 60079-0; General Requirements EN 60079-7; Explosive Atmospheres, Protection "e" II 3 G Ex ec IIC T4 Gc DEMKO 19 ATEX 2261X and UL22UKEX2536X
IECEX	IECEX System, compliant with: <ul style="list-style-type: none"> IEC 60079-0; General Requirements IEC 60079-7; Explosive Atmospheres, Protection "e" II 3 G Ex ec IIC T4 Gc IECEX UL 19.0081X
TÜV	TÜV Certified for Functional Safety ⁽²⁾ : <ul style="list-style-type: none"> Capable of SIL 3, CAT. 4/PL e
KC	Korean Registration of Broadcasting and Communications Equipment, compliant with: <ul style="list-style-type: none"> Article 58-2 of Radio Waves Act, Clause 3
EAC	Russian Customs Union TR CU 020/2011 EMC Technical Regulation Russian Customs Union TR CU 004/2011 LV Technical Regulation
CCC	CNCA-C23-01:2019 强制性产品认证实施规则 防爆电气 CNCA-C23-01:2019 CCC Implementation Rule Explosion-Proof Electrical Products CCC: 202012230911301 and 2021122309113957
UKCA	2016 No. 1091 - Electromagnetic Compatibility Regulations 2016 No. 1107 - Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 2008 No. 1597 - Supply of Machinery (Safety) Regulations 2012 No. 3032 - Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations
Morocco	Arrêté ministériel n° 6404-15 du 1 er muharram 1437 Arrêté ministériel n° 6404-15 du 29 ramadan 1436
EtherNet/IP	ODVA conformance tested to EtherNet/IP specifications
CIP Security	ODVA conformance tested to CIP Security specifications

(1) See the Product Certification link at rok.auto/certifications for Declarations of Conformity, Certificates, and other certification details.

(2) When used with specified firmware revisions.

See the Product Safety Certificate at rok.auto/certifications for a full list of safety-related certifications.

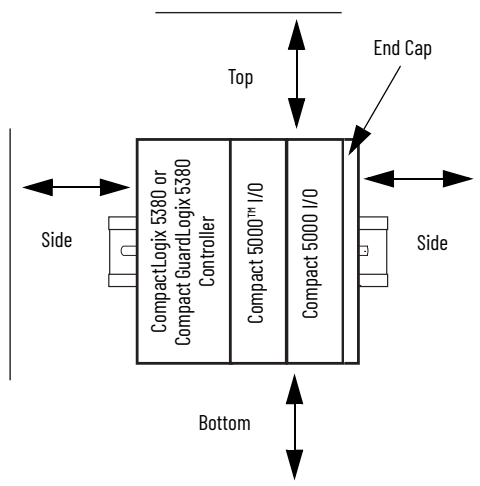
Dimensions - Compact GuardLogix 5380 SIL 3 Controller



CompactLogix 5380 or Compact GuardLogix 5380 System Minimum Space Requirements

The minimum distance between all sides of the CompactLogix 5380 system or Compact GuardLogix 5380 system and enclosure walls, wireways, and adjacent equipment varies based on the current operating temperature.

Controllers	Minimum Space at		
	50 °C (122 °F)	55 °C (131 °F)	60 °C (140 °F)
CompactLogix 5380 Standard and Process Controllers	50.8 mm (2.00 in)	50.80 mm (2.00 in)	101.60 mm (4.00 in)
Compact GuardLogix 5380 SIL 2 Controllers			
Series A catalog numbers	50.8 mm (2.00 in)	101.6 mm (4.00 in)	152.4 mm (6.00 in)
Series B catalog numbers	50.8 mm (2.00 in)	50.8 mm (2.00 in)	101.6 mm (4.00 in)
Compact GuardLogix 5380 SIL 3 Controllers	50.8 mm (2.00 in)	50.8 mm (2.00 in)	101.6 mm (4.00 in)



IMPORTANT If Compact 5000 I/O modules are installed next to a CompactLogix 5380 or Compact GuardLogix 5380, or CompactLogix 5480 controller, you must mount the system horizontally. You mount CompactLogix 5480 controllers in any orientation if there are no Compact 5000 I/O modules installed next to the controller.

CompactLogix 5480 Controllers

The CompactLogix 5480 controllers are part of the Logix 5000 family of controllers. The controllers are real-time controllers with the Windows® 10 IoT Enterprise commercial operating system (COS) that runs in parallel to the Logix control engine.

The CompactLogix 5480 controllers deliver scalable control that is ideal for mid-size to large applications that require high-performance control and data throughput. The CompactLogix 5480 controllers also provide a truly integrated motion solution.

The controllers are mounted on a DIN rail. They can monitor and control local and remote I/O modules, and other devices connected to an EtherNet/IP network. The CompactLogix 5480 controllers support the following functionality for use with the control engine:

- Use of Compact 5000 I/O module as local I/O modules.
- Use Compact 5000 I/O modules, and other I/O modules, as remote I/O modules.
- Support for Integrated Motion over an EtherNet/IP network.
- Use of three Ethernet ports that can connect to enterprise-level and device-level EtherNet/IP networks, including star, linear, and DLR EtherNet/IP network topologies.
- Support for Linear/DLR and Dual-IP mode.
- Use of USB port for firmware updates and programming.
- Use of 1784-SD1, 1784-SD2, 1784-SDHC8, 1784-SDHC32, 9509-CMSDCD4 Secure Digital (SD) card for nonvolatile memory.

The COS lets you perform tasks on the controller that must be performed on an external workstation in other Logix 5000 control systems. The CompactLogix 5480 controllers come with these features for use in Windows-based applications:

- Embedded Ethernet port to connect the COS to an EtherNet/IP network or Enterprise network.
- Two USB 3.0 ports to connect peripherals such as a keyboard and mouse.
- DisplayPort to connect a monitor.
- Support for the installation and use of Rockwell Automation® applications, such as FactoryTalk® View Site Edition.

Features - CompactLogix 5480 Controllers

Feature	5069-L430ERMW	5069-L450ERMW	5069-4100ERMW	5069-L4200ERMW
Controller tasks • Continuous • Periodic • Event	32 tasks 1000 programs/task All event triggers			
Built-in communication ports	Logix control engine use: • 3 - Ethernet, 10 Mbps/100 Mbps/1 Gbps • 1 - USB client IMPORTANT: Consider the following: • When the controller operates in Dual-IP mode, each Ethernet port requires a unique IP address. • When the controller operates in Linear/DLR mode, the controller DLR pair uses only one IP address. Windows 10 use: • 1 - Ethernet, 10 Mbps/100 Mbps/1 Gbps			
USB port communication	Logix control engine use: • USB 2.0, Type B • Full speed (480 Mbps) • Programming, configuration, firmware update, and online edits only Windows 10 use: • 2 - USB 3.0 ports to connect peripherals such as a keyboard and mouse			
Ethernet performance	10 Mbps, 100 Mbps, 1 Gbps Full-duplex only			
I/O Capacity (Class 0/1) ⁽¹⁾	128,000 packets/second			
Message Rate Capacity HMI/MSG (Class 3) ⁽¹⁾	2000 messages/second			
EtherNet/IP modes supported	Dual-IP mode Linear/DLR mode			
EtherNet/IP network topologies supported	DLR Star Linear			
EtherNet/IP nodes supported, max	60	120	180	250
Socket interfaces supported, max	32			

Features - CompactLogix 5480 Controllers (Continued)

Feature	5069-L430ERMW	5069-L450ERMW	5069-4100ERMW	5069-L4200ERMW
Integrated motion				
Number of axes supported, max ⁽²⁾	512			
Number of Integrated Motion on EtherNet/IP drive axes (Position loop-configured) supported, max ⁽³⁾	16	24	32	150
Programming languages	Ladder Diagram (LD) Structured Text (ST) Function Block Diagram (FBD) Sequential Function Chart (SFC)			

- (1) I/O numbers are maximums; they assume no HMI/MSG. HMI/MSG numbers are maximums, they assume no I/O. Maximums assume that the processor is the target, not the originator. Packet rates vary depending on packet size. For more details, see Troubleshoot EtherNet/IP Application Technique, publication [ENET-AT003](#), and the EDS file for a specific catalog number.
- (2) Any combination of Integrated Motion on EtherNet/IP drive, Virtual, Consumed, Regenerative AC/DC Converter and Non-Regenerative AC/DC Converter axis types.
- (3) The maximum number of Integrated Motion on EtherNet/IP drive axes (configured for Position Loop) that can be included in the total integrated motion axes count for a controller.

Technical Specifications - CompactLogix 5480 Controller

Attribute	5069-L430ERMW	5069-L450ERMW	5069-L4100ERMW	5069-L4200ERMW
User memory				
Windows 10 (COS on controller)	<ul style="list-style-type: none"> RAM - 6 GB SSD: 64 GB 			
Logix control engine	3 MB	5 MB	10 MB	20 MB
Optional nonvolatile memory	1784-SD1 (1 GB) 1784-SD2 (2 GB), ships with controller 1784-SDHC8 (8 GB) 1784-SDHC32 (32 GB) 9509-CMSDCC4 (4 GB) CodeMeter CmCard SD			
Local I/O modules, max	31			
MOD Power voltage range	18...32V DC			
MOD Power power, max	72 W			
MOD Power current, typical	4 A			
MOD Power inrush	4 A for 15 ms			
MOD Power passthrough ⁽¹⁾	6 A @ 18...32V DC			
MOD Power current rating, max	10 A Do not exceed 10 A current draw at the MOD power RTB. ⁽²⁾			
SA Power voltage ranges ⁽³⁾	0...32V DC 0...240V AC, 47...63 Hz			
SA Power current, max ⁽³⁾	10 mA (DC power) 25 mA (AC power)			
SA Power passthrough ^{(3),(4)}	9.99 A @ 0...32V DC 9.975 A @ 0...240V AC, 47...63 Hz			
SA Power current rating, max ⁽³⁾	Do not exceed 10 A current draw at the SA power RTB.			
Power dissipation, max	72 W			
Thermal dissipation, max	245.7 BTU/hr			
Isolation voltage	300V (continuous), Basic Insulation Type, SA, and MOD Power to Backplane 300V (continuous), Basic Insulation Type, SA to MOD Power 300V (continuous), Basic Insulation Type, Ethernet to Backplane 300V (continuous), Double Insulation Type, Ethernet to MOD Power 300V (continuous), Double Insulation Type, Ethernet to SA Power 50V (continuous), Functional Insulation Type, Ethernet to USB ports and DisplayPort 300V (continuous), Basic Insulation Type, USB ports, and DisplayPort to Backplane 300V (continuous), Double Insulation Type, USB ports, and DisplayPort to MOD Power 300V (continuous), Double Insulation Type, USB ports, and DisplayPort to SA Power No isolation between Ethernet ports Type tested at 1500V AC for 60 s			
Weight, approx	1.754 kg (3.868 lb)			
Dimensions (HxWxD), approx	166.20 x 130.21 x 126.54 mm (6.54 x 5.13 x 4.98 in.)			

Technical Specifications - CompactLogix 5480 Controller (Continued)

Attribute	5069-L430ERMW	5069-L450ERMW	5069-L4100ERMW	5069-L4200ERMW
Location	DIN rail mount (horizontal mount only)			
DIN rail	Compatible zinc-plated, chromate steel DIN rail. • EN50022 - 35 x 7.5 mm (1.38 x 0.30 in.) • EN50022 - 35 x 15 mm (1.38 x 0.60 in.)			
Removable terminal blocks	RTBs ship with the controller: • 5069-RTB64-SCREW kit: Includes 5069-RTB6-SCREW and 5069-RTB4-SCREW RTBs • 5069-L4UPSRTB			
Terminal block torque	5069-RTB4-SCREW, 5069-RTB6-SCREW, and 5069-L4UPSRTB connections: 0.4 N•m (3.5 lb•in) ATTENTION: Do not wire more than two conductors on one RTB terminal.			
Wire size	5069-RTB4-SCREW, 5069-RTB6-SCREW connections: 0.5...1.5 mm ² (22...16 AWG) solid or stranded copper wire rated at 105 °C (221 °F), or greater, 3.5 mm (0.14 in.) max diameter including insulation, single wire connection only 5069-L4UPSRTB connections: 0.5...1.5 mm ² (22...16 AWG) solid or stranded copper wire rated at 105 °C (221 °F), or greater, 2.9 mm (0.11 in.) max diameter including insulation, single wire connection only Ethernet connections: Ethernet Cabling and Installation according to IEC 61918 and IEC 61784-5-2			
Insulation stripping length	5069-RTB4-SCREW, 5069-RTB6-SCREW, and 5069-L4UPSRTB connections: 12 mm (0.47 in.)			
Wire category ⁽⁵⁾	3 - on USB ports and DisplayPort 2 - on power ports 2 - on Ethernet ports			
Enclosure	None (open-style)			

- (1) Maximum level of MOD Power current that the controller can pass through to the next module in the system. The specific level of current passed through varies based on system configuration.
- (2) Remember, MOD power usage includes the total power that the controller and local Compact 5000 I/O modules use. If you connect external power to both sets of MOD power RTB terminals, however, the local Compact 5000 I/O modules can draw a maximum of 10 A in addition to the current that the controller draws.
- (3) SA power specifications are based on the number and type of Compact 5000 I/O modules that are used in the system. If the set of I/O modules that are used in the system require AC and DC voltage, you must install a 5069-FPD field potential distributor to separate the module types.
- (4) Maximum level of SA Power current that the controller can pass through to the next module in the system. The specific level of current passed through varies based on system configuration.
- (5) Use this Conductor Category information to plan conductor routing. See the Industrial Automation Wiring and Grounding Guidelines, publication [1770-4.1](#).

Environmental Specifications - CompactLogix 5480 Controllers

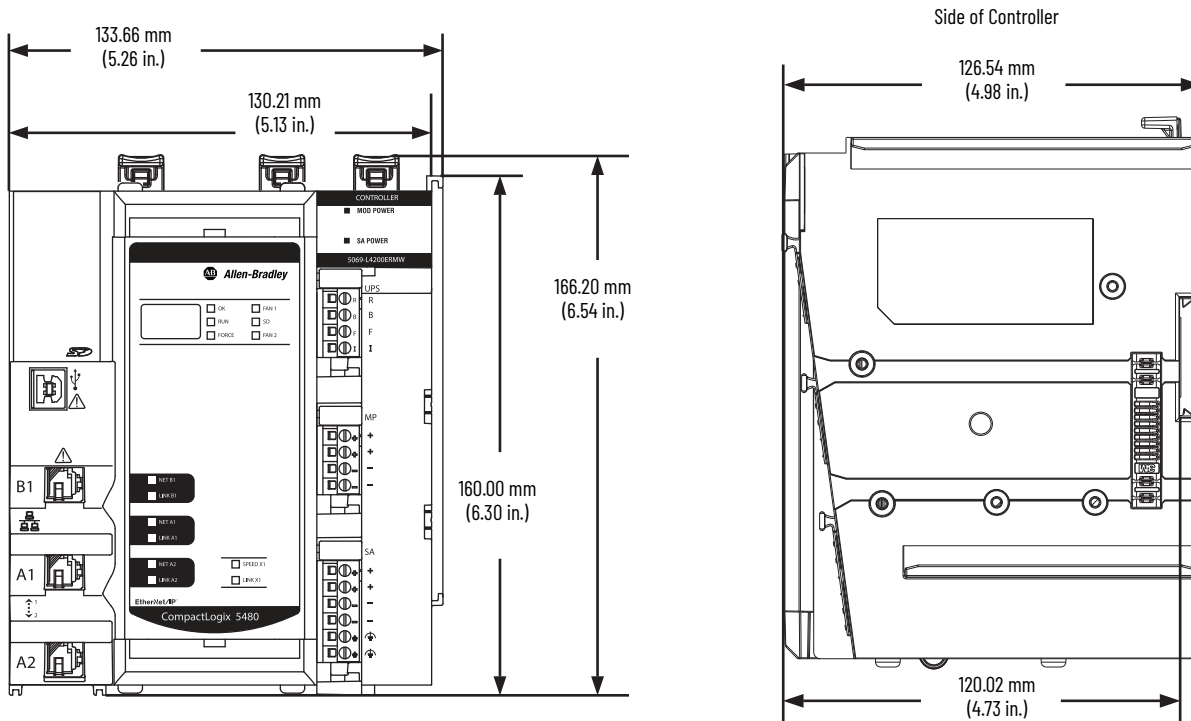
Attribute	5069-L430ERMW, 5069-L450ERMW, 5069-4100ERMW, 5069-L4200ERMW
Temperature, operating IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock)	0 °C < Ta < +60 °C (+32 °F < Ta < +140 °F)
Temperature, nonoperating IEC 60068-2-1 (Test Ab, Unpackaged Nonoperating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Nonoperating Dry Heat), IEC 60068-2-14 (Test Na, Unpackaged Nonoperating Thermal Shock)	-40...+85 °C (-40...+185 °F)
Temperature, surrounding air, max	60 °C (140 °F)
Relative humidity IEC 60068-2-30 (Test Db, Unpackaged Damp Heat)	5...95% noncondensing
Vibration IEC 60068-2-6 (Test Fc, Operating)	2 g @ 10...500 Hz
Shock, nonoperating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	30 g
Emissions	IEC 61000-6-4
ESD immunity IEC 61000-4-2	4 kV contact discharges 8 kV air discharges
Radiated RF immunity IEC 61000-4-3	10V/m with 1 kHz sine-wave 80% AM from 80...2000 MHz 10V/m with 200 Hz 50% Pulse 100% AM @ 900 MHz 10V/m with 200 Hz 50% Pulse 100% AM @ 1890 MHz 3V/m with 1 kHz sine-wave 80% AM from 2000...2700 MHz 3V/m with 1 kHz sine-wave 80% AM from 2700...6000 MHz
EFT/B immunity IEC 61000-4-4	± 2 kV at 5 kHz on power ports ± 1 kV at 5 kHz on Ethernet ports
Surge transient immunity IEC 61000-4-5	± 500V line-line (DM) and ± 1 kV line-earth (CM) on power ports ± 1 kV line-earth (CM) on Ethernet ports
Conducted RF immunity IEC 61000-4-6	10V rms with 1 kHz sine-wave 80% AM from 150 kHz...80 MHz on power and Ethernet ports
Magnetic Field Immunity IEC 61000-4-8	30 A/m long duration at 60 Hz
Voltage variation IEC 61000-4-29	10 ms interruption on MOD Power port

Certifications - CompactLogix 5480 Controller

Certification ⁽¹⁾	5069-L430ERMW, 5069-L450ERMW, 5069-4100ERMW, 5069-L4200ERMW
c-UL-us	UL Listed Industrial Control Equipment, certified for US and Canada. See UL File E65584.
CE	European Union 2014/30/EU EMC Directive, compliant with: <ul style="list-style-type: none"> EN 61326-1; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions EN 61131-2; Programmable Controllers (Clause 8, Zone A & B) European Union 2014/35/EU LVD, compliant with: <ul style="list-style-type: none"> EN 61010-2-201; Control Equipment Safety Requirements European Union 2011/65/EU RoHS, compliant with: <ul style="list-style-type: none"> EN IEC 63000; Technical documentation
RCM	Australian Radiocommunications Act, compliant with: <ul style="list-style-type: none"> EN 61000-6-4; Industrial Emissions
KC	Korean Registration of Broadcasting and Communications Equipment, compliant with: <ul style="list-style-type: none"> Article 58-2 of Radio Waves Act, Clause 3
EAC	Russian Customs Union TR CU 020/2011 EMC Technical Regulation Russian Customs Union TR CU 004/2011 LV Technical Regulation
Morocco	Arrêté ministériel n° 6404-15 du 1 er muharram 1437 Arrêté ministériel n° 6404-15 du 29 ramadan 1436
UKCA	2016 No. 1091 - Electromagnetic Compatibility Regulations 2016 No. 1101 - Electrical Equipment (Safety) Regulations 2016 No. 1107 - Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 2012 No. 3032 - Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations
EtherNet/IP	ODVA conformance tested to EtherNet/IP specifications

(1) See the Product Certification link at rok.auto/certifications for Declarations of Conformity, Certificates, and other certification details.

CompactLogix 5480 Controller Dimensions

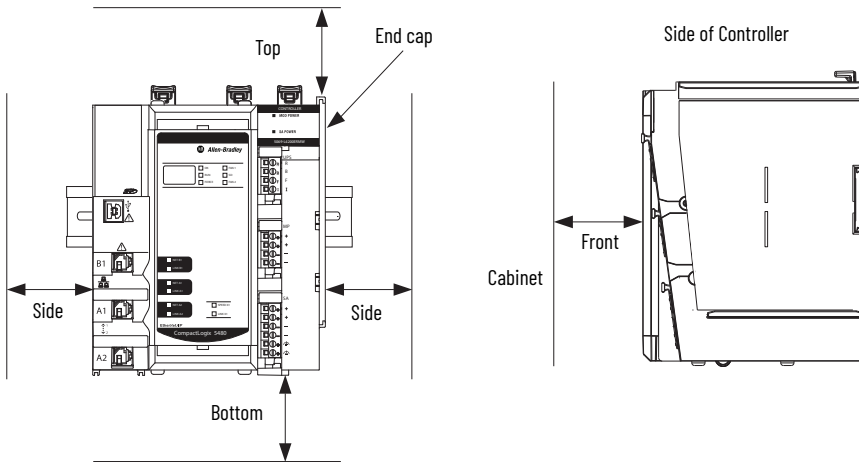


CompactLogix 5480 System Minimum Space Requirements

The minimum distance for a system that includes only a CompactLogix 5480 controller is as follows:

- 25.00 mm (0.98 in.) between the sides of the controller and the cabinet
- 25.00 mm (0.98 in.) between the front of the controller and the cabinet
- 50.00 mm (1.96 in.) between the top and bottom of the controller and the cabinet

We recommend that you install the controller near the bottom of the enclosure, where the ambient temperature is lower.



IMPORTANT If Compact 5000 I/O modules are installed next to a CompactLogix 5380, Compact GuardLogix 5380, or CompactLogix 5480 controller, you must mount the system horizontally. You mount CompactLogix 5480 controllers in any orientation if there are no Compact 5000 I/O modules installed next to the controller.

Controller Use with Other Devices

You can use your controller in the following ways:

- [Control I/O Modules](#)
- [Communicate with Other Controllers](#)

Control I/O Modules

The CompactLogix 5380 and Compact GuardLogix 5380 controllers can monitor and control local and remote I/O modules.

Local I/O Modules

- A CompactLogix 5380 and CompactLogix 5480 system supports Compact 5000 I/O standard modules as local I/O modules.
- A Compact GuardLogix 5380 system supports Compact 5000 I/O standard and safety modules as local modules.

The number of local I/O modules that are supported in a CompactLogix 5380 system or Compact GuardLogix 5380 system varies by controller catalog number.

Cat. No.	Local Compact 5000 I/O Modules Supported, Max	
	Standard I/O Modules	Any Combination of Standard and Safety I/O Modules
5069-L306ER, 5069-L306ERM	8	—
5069-L306ERS2, 5069-L306ERMS2, 5069-L306ERMS3		8
5069-L310ER, 5069-L310ER-NSE, 5069-L310ERM	8	—
5069-L310ERS2, 5069-L310ERS2K, 5069-L310ERMS2, 5069-L310ERMS2K, 5069-L310ERMS3, 5069-L310ERMS3K		8
5069-L320ER, 5069-L320ERM, 5069-L320ERMK, 5069-L320ERP	16	—
5069-L320ERS2, 5069-L320ERMS2, 5069-L320ERS2K, 5069-L320ERMS2K, 5069-L320ERMS3, 5069-L320ERMS3K		16
5069-L330ER, 5069-L330ERM ⁽¹⁾ , 5069-L330ERMK ⁽¹⁾	31	—
5069-L330ERS2, 5069-L330ERMS2, 5069-L330ERS2K, 5069-L330ERMS2K, 5069-L330ERMS3, 5069-L330ERMS3K		31
5069-L340ER, 5069-L340ERM, 5069-L340ERP	31	—
5069-L340ERS2, 5069-L340ERMS2, 5069-L340ERMS3		31
5069-L350ERM, 5069-L350ERMK	31	—
5069-L350ERS2, 5069-L350ERMS2, 5069-L350ERS2K, 5069-L350ERMS2K, 5069-L350ERMS3, 5069-L350ERMS3K		31
5069-L380ERM	31	—
5069-L380ERS2, 5069-L380ERMS2, 5069-L380ERMS3		31
5069-L3100ERM	31	—
5069-L3100ERS2, 5069-L3100ERMS2, 5069-L3100ERMS3		31
5069-L430ERMW, 5069-L450ERMW, 5069-4100ERMW, 5069-L4200ERMW	31	—

(1) When you use these controllers with the Logix Designer application, version 29.00.00, the application limits the number of local I/O modules in the project to 16. For more information, see the Rockwell Automation Knowledgebase article [#942580](#), '5380 CompactLogix controllers limited to 16 local 5069 modules in V29 of Studio 5000'. The document is available at rok.auto/knowledgebase. With the Logix Designer application, version 30.00.00 or later, the controllers support 31 local I/O modules.

Remote I/O Modules

The controllers can connect to these remote I/O modules over an EtherNet/IP network.

IMPORTANT For maximum performance, we recommend that you use Compact 5000 I/O modules when you use remote I/O modules.

Standard Remote I/O Modules supported by CompactLogix 5380, Compact GuardLogix 5380, and CompactLogix 5480 Controllers

Module Type	Standard I/O Module Family
Chassis-based I/O	1746 SLC™ I/O
	1756 ControlLogix® I/O
	1769 Compact I/O™
	Compact 5000 I/O standard modules
In-cabinet I/O	1734 POINT I/O™
	1794 FLEX™ I/O
	FLEX 5000® I/O
On-Machine™ I/O	1732 ArmorBlock® I/O
	1738 ArmorPOINT® I/O

Safety Remote I/O Modules supported by Compact GuardLogix 5380 Controllers

Module Type	Safety I/O Module Family
Chassis-based I/O	Compact 5000 I/O Safety I/O
	1756 ControlLogix Safety I/O
In-cabinet I/O	CompactBlock™ Guard I/O™
	POINT Guard I/O™
	FLEX 5000 Safety I/O
On-Machine™ I/O	1732 ArmorBlock® Guard I/O™

Communicate with Other Controllers

The controller can communicate with these programmable controllers.

Controller Type	Controller Family
Programmable automation controller	CompactLogix 5370
	CompactLogix 5380
	CompactLogix 5480
	Compact GuardLogix 5370 (safety)
	Compact GuardLogix 5380 (safety)
	ControlLogix 5570
	ControlLogix 5580
	GuardLogix 5570 (safety)
	GuardLogix 5580 (safety)
	1756 Armor™ ControlLogix (safety)
	1756 Armor™ GuardLogix® (safety)
	1768 Compact GuardLogix (safety)
	1768 CompactLogix
	1769 Modular CompactLogix
	1769 Packaged CompactLogix
	Programmable logic controllers
PowerFlex® with DriveLogix™	
1785 PLC-5 ^{®(1)}	
1747 SLC™ ⁽¹⁾	
1761 MicroLogix™ ⁽²⁾	
1762 MicroLogix ⁽²⁾	
1763 MicroLogix	
1764 MicroLogix ⁽²⁾	
1766 MicroLogix	

(1) These controllers require a built-in Ethernet port or a 1761-NET-ENI, EtherNet/IP RS-232-C interface to communicate with a CompactLogix 5380 controller over an EtherNet/IP network.

(2) These controllers require a 1761-NET-ENI, EtherNet/IP RS-232-C interface to communicate with a CompactLogix 5380 controller over an EtherNet/IP network.

Ethernet Node Limits

When you configure a CompactLogix 5380, Compact GuardLogix 5380, or CompactLogix 5480 control system, consider the number of Ethernet nodes that are used. The number of Ethernet nodes that you can include in the I/O configuration section in the Logix Designer application project is limited.

Maximum Number of Ethernet Nodes

The number of nodes that are supported in a Logix Designer application project varies by CompactLogix 5380, Compact GuardLogix 5380, and CompactLogix 5480 controller.

The maximum number of nodes that are listed represents when the controller is used with the Logix Designer application, version 31 or later. You can use CompactLogix 5380 controllers with earlier Logix Designer application versions. The maximum number of nodes that a controller supports can be fewer in the Logix Designer application, versions 30 or earlier.

Catalog Number	Ethernet Nodes Supported
5069-L306ER, 5069-L306ERM, 5069-L306ERS2, 5069-L306ERMS2, 5069-L306ERMS3	16
5069-L310ER, 5069-L310ER-NSE, 5069-L310ERM, 5069-L310ERMK, 5069-L310ERS2, 5069-L310ERS2K, 5069-L310ERMS2, 5069-L310ERMS2K, 5069-L310ERMS3, 5069-L310ERMS3K	24
5069-L320ER, 5069-L320ERM, 5069-L320ERMK, 5069-L320ERP, 5069-L320ERS2, 5069-L320ERS2K, 5069-L320ERMS2, 5069-L320ERMS2K, 5069-L320ERMS3, 5069-L320ERMS3K	40
5069-L330ER, 5069-L330ERM, 5069-L330ERMK, 5069-L330ERS2, 5069-L330ERS2K, 5069-L330ERMS2, 5069-L330ERMS2K, 5069-L330ERMS3, 5069-L330ERMS3K	60
5069-L340ER, 5069-L340ERM, 5069-L340ERP, 5069-L340ERS2, 5069-L340ERS2K, 5069-L340ERMS2, 5069-L340ERMS2K	90
5069-L350ERM, 5069-L350ERMK, 5069-L350ERS2, 5069-L350ERS2K, 5069-L350ERMS2, 5069-L350ERMS2K	120
5069-L380ERM, 5069-L380ERS2, 5069-L380ERMS2, 5069-L380ERMS3	150
5069-L3100ERM, 5069-L3100ERS2, 5069-L3100ERMS2, 5069-L3100ERMS3	180
5069-L430ERMW	60
5069-L450ERMW	120
5069-4100ERMW	180
5069-L4200ERMW	250

Any devices that you add directly to the I/O configuration section are counted toward the Ethernet node limit. The following are examples of devices that must be counted:

- Remote communication adapters
- Devices with an embedded Ethernet port, such as I/O modules, drives, and linking devices
- Remote controllers when a produce/consume connection is established between the two controllers
- HMI devices that are included in the I/O configuration tree
- Third-party devices that are directly connected to the EtherNet/IP network

Accessories

The following accessories are used with a CompactLogix 5380, Compact GuardLogix 5380, or CompactLogix 5480 controller:

- [End Cap](#)
- [Memory Cards](#)
- [Removable Terminal Kits](#) - For CompactLogix 5380 and Compact GuardLogix 5380 controllers, Removable Terminal Blocks (RTB) are available in separately ordered 5069 RTB kits. For CompactLogix 5480 controllers, the required RTB kit ships with the controllers.

End Cap

You must install an end cap, catalog number 5069-ECR, on the right side of the last module in a CompactLogix 5380, Compact GuardLogix 5380, or CompactLogix 5480 control system. The end cap is shipped with the controller.



SHOCK HAZARD: The end cap covers the exposed interconnections on the last module in the system. If you do not install the end cap before powering the system, equipment damage or injury from electric shock can result.

Memory Cards

Memory cards, also known as Secure Digital (SD) cards, offer nonvolatile memory to store a user program and tag data on a controller. Through the Logix Designer application, you can manually trigger the controller to save to or load from nonvolatile memory or configure the controller to load from nonvolatile memory on power-up.

A 1784-SD2 card ships with the controller. If you need additional SD cards, we recommend that you use one that is available from Rockwell Automation. The following SD cards are available to use with the controllers:

- 1784-SD1 (1 GB)
- 1784-SD2 (2 GB)
- 1784-SDHC8 (8 GB)
- 1784-SDHC32 (32 GB)
- 9509-CMSDCD4 (4 GB)

We recommend that you use the SD cards available from Rockwell Automation.

Technical Specifications - SD Cards

Attribute	1784-SD1	1784-SD2	1784-SDHC8	1784-SDHC32	9509-CMSDCD4 ⁽¹⁾
Memory	1 GB	2 GB	8 GB	32 GB	4 GB
Supported controllers	CompactLogix 5380, Compact GuardLogix 5380, CompactLogix 5480 controllers				
Weight, approx	1.76 g (0.062 oz)				2 g (0.07 oz)

(1) This card is used when license-based source protection and execution protection features are enabled.

Environmental Specifications - SD Cards

Attribute	1784-SD1, 1784-SD2
Temperature, operating IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock)	-40...+85 °C (-13...+185 °F)
Temperature, storage IEC 60068-2-1 (Test Ab, Unpackaged Nonoperating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Nonoperating Dry Heat), IEC 60068-2-14 (Test Na, Unpackaged Nonoperating Thermal Shock)	-65...+150 °C (-85...+302 °F)
Relative humidity IEC 60068-2-30 (Test Db, Unpackaged Damp Heat)	5...95% noncondensing
Vibration IEC 60068-2-6 (Test Fc, Operating)	15 g peak to peak
Shock, operating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	30 g
Shock, nonoperating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	50 g
Emissions	IEC 61000-6-4
ESD immunity IEC 61000-4-2	6 kV contact discharges 8 kV air discharges
Radiated RF immunity IEC 61000-4-3	10V/m with 1 kHz sine-wave 80% AM from 80...2000 MHz 10V/m with 200 Hz 50% Pulse 100% AM @ 900 MHz 10V/m with 200 Hz 50% Pulse 100% AM @ 1890 MHz 3V/m with 1 kHz sine-wave 80% AM from 2000...2700 MHz

Certifications - SD Cards

Certification ⁽¹⁾	1784-SD1, 1784-SD2
CE	European Union 2014/30/EU EMC Directive, compliant with: <ul style="list-style-type: none"> EN 61000-6-4; Industrial Emissions EN 61326-1; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61131-2; Programmable Controllers (Clause 8, Zone A & B)
RCM	Australian Radiocommunications Act, compliant with: <ul style="list-style-type: none"> AS/NZS CISPR 11; Industrial Emissions
KC	Korean Registration of Broadcasting and Communications Equipment, compliant with: <ul style="list-style-type: none"> Article 58-2 of Radio Waves Act, Clause 3

(1) When marked. See the Product Certification link at rok.auto/certifications for Declarations of Conformity, Certificates, and other certification details.

Removable Terminal Kits

You can order Removable Terminal Blocks (RTBs) to connect MOD power and SA power to CompactLogix 5380 and Compact GuardLogix 5380 controllers. The RTBs are used to wire power to the controllers. The MOD power connection uses a 4-point RTB, and the SA power connection uses a 6-point RTB.

CompactLogix 5380 and Compact GuardLogix 5380 Controllers - RTBs

Cat. No.	Description
5069-RTB64-SCREW	Contains the following: <ul style="list-style-type: none"> 5069-RTB6-SCREW - 6-point RTB that uses screw-type terminals 5069-RTB4-SCREW - 4-point RTB that uses screw-type terminals
5069-RTB64-SPRING	Contains the following: <ul style="list-style-type: none"> 5069-RTB6-SPRING - 6-point RTB that uses spring-type terminals to connect SA power to the controller. 5069-RTB4-SPRING - 4-point RTB that uses spring-type terminals to connect MOD power to the controller.

Notes:

Additional Resources

These documents contain additional information concerning related products from Rockwell Automation.

Resource	Description
CompactLogix Controllers Selection Guide, publication 1769-SG001	Describes how to design and select components for your CompactLogix™ controller system.
CompactLogix 5380 and Compact GuardLogix Controllers User Manual, publication 5069-UM001	Describes how to use CompactLogix 5380 and Compact GuardLogix® 5380 controllers.
CompactLogix 5480 Controllers User Manual, publication 5069-UM002	Describes how to use CompactLogix 5480 controllers.
Compact 5000 I/O Modules and EtherNet/IP Adapters Specifications Technical Data, publication 5069-TD001	Provides specifications, wiring diagrams, and functional block diagrams for Compact 5000™ I/O modules and EtherNet/IP™ adapters.
Compact 5000 I/O Digital Modules User Manual, publication 5069-UM004	Describes how to configure and operate Compact 5000 I/O digital and safety modules.
Compact 5000 I/O Analog Modules User Manual, publication 5069-UM005	Describes how to configure and operate Compact 5000 I/O analog modules.
Compact 5000 I/O High-speed Counter Module User Manual, publication 5069-UM006	Describes how to configure and operate a Compact 5000 I/O high-speed counter module.
Replacement Guidelines: Logix 5000 Controllers Reference Manual, publication 1756-RM100	Describes how to replace the following: ControlLogix® 5560/5570 controller with a ControlLogix 5580 controller CompactLogix 5370 L3 controllers with a CompactLogix 5380 controller
Compact 5000 EtherNet/IP Adapters User Manual, publication 5069-UM007	Describes how to use Compact 5000 I/O and FLEX 5000 I/O EtherNet/IP communication modules.
Integrated Architecture and CIP Sync Configuration Application Technique, publication IA-AT003	Provides information on CIP Sync™ and the IEEE 1588-2008 Precision Time Protocol.
Integrated Architecture Tools website, http://www.rockwellautomation.com/global/products-technologies/integrated-architecture/tools/overview.page	Provides information on tools that you can use in the selection, development, commissioning, and maintenance stages of the Integrated Architecture® lifecycle.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, rok.auto/certifications	Provides declarations of conformity, certificates, and other certification details.

You can view or download publications at rok.auto/literature.

Rockwell Automation Support

Use these resources to access support information.

Technical Support Center	Find help with how-to videos, FAQs, chat, user forums, and product notification updates.	rok.auto/support
Knowledgebase	Access Knowledgebase articles.	rok.auto/knowledgebase
Local Technical Support Phone Numbers	Locate the telephone number for your country.	rok.auto/phonesupport
Literature Library	Find installation instructions, manuals, brochures, and technical data publications.	rok.auto/literature
Product Compatibility and Download Center (PCDC)	Get help determining how products interact, check features and capabilities, and find associated firmware.	rok.auto/pcdc

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Rockwell Automation maintains current product environmental information on its website at rok.auto/pec.

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Analog I/O Modules

I/O Type	Cat. No.	Description	Page
Analog input	5069-IF8	8-channel current/voltage input module	50
	5069-IY4	4-channel current/voltage/RTD/Thermocouple input module	58
	5069-IY4K	4-channel conformal coated current/voltage/RTD/Thermocouple input module	
Analog output	5069-OF4	4-channel current/voltage output module	73
	5069-OF4K	4-channel conformal coated current/voltage output module	
	5069-OF8	8-channel current/voltage output module	

5069-IF8 Analog 8-channel Current/Voltage Input Module

The following table lists the devices that are supported with the 5069-IF8 module.

Device	Mode(s) ⁽¹⁾	Supported	Wiring Diagram Example
2-wire analog device	Current	Yes	page 51
4-wire analog device ⁽²⁾	Voltage		page 52
	Combination of current and voltage	Yes	page 53
1-wire analog device	N/A - These devices aren't supported regardless of the channel mode configuration.	No	—
3-wire analog device			
2-wire Thermocouple device			
2-wire RTD device			
3-wire RTD device			

(1) Make sure that the channel configuration in your Logix Designer application project matches the input device type that is connected to the channel. You choose the input type in the Channels category on the Module Properties dialog box. For example, if a current input device is connected to channel 0 on the module, the module configuration for channel must be Input Type = Current.

(2) These devices are 2-wire current and voltage devices with 2-wire sensor power connections.

The following figure shows a wiring diagram for the 5069-IF8 module with channels configured for current mode.

5069-IF8 Wiring Diagram - Current Mode

Channel Connections

The diagram shows devices that are connected to channels 0, 2, 5, and 7. You aren't restricted to using only this channel. You can connect devices to any channel or combination of channels as needed.

IMPORTANT: Remember the following:

- Place additional loop devices, for example, strip chart recorders, at either **A** location in the current loop.
- Use separate external power supplies to provide SA power to the system and to power external devices that are connected to the module.
- This module has only two shield terminals. Compact 5000 I/O module RTBs only support one wire per terminal.
- If you connect more than two devices to the module, you can ground two devices at the shield terminals. You must ground the remaining devices somewhere else, such as, to the DIN rail via a terminal strip. In this case, use the same power supply to power the additional devices. If separate power supplies are used to power the additional devices, ground the power supplies at the same ground location.

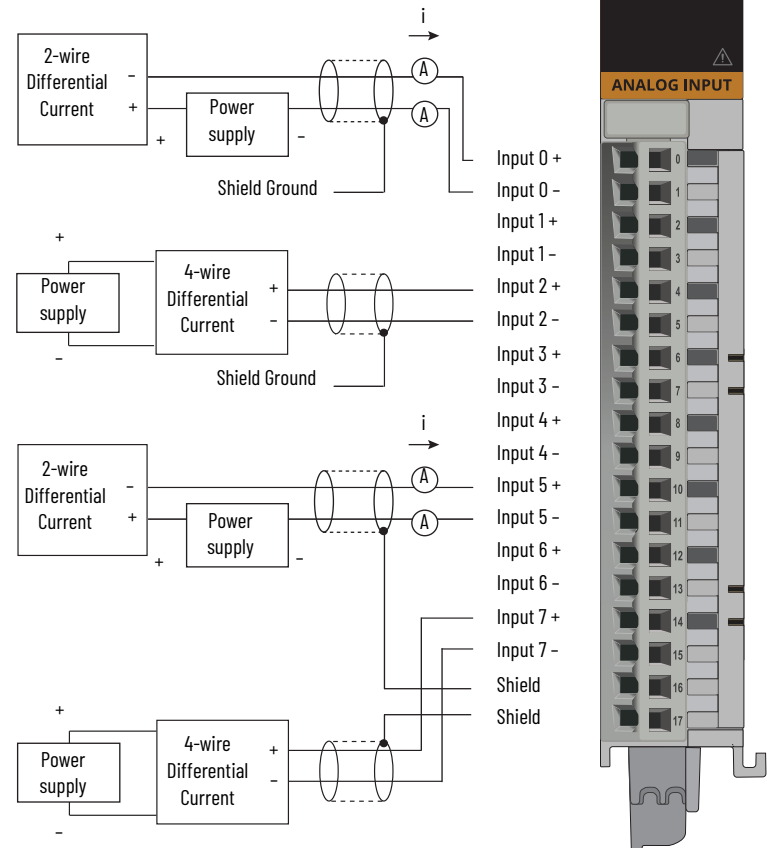
SA Power

Connections to an external power supply that provides SA power are made via the SA power RTB on one of the following:

- CompactLogix 5380 controller
- Compact GuardLogix 5380 controller
- CompactLogix 5480 controller
- 5069-AENTR or 5069-AEN2TR EtherNet/IP Adapter
- 5069-FPD field potential distributor

IMPORTANT: Remember the following:

- The 5069-IF8 module uses DC SA power. You must connect DC power to the component, that is, controller, adapter, or field potential distributor, that provides SA power to the modules.
- If you install modules in a system that use AC SA power and DC SA power, you must install them on separate SA power buses.
- You use a 5069-FPD field potential distributor to establish a new SA power bus in a system. SA power buses are isolated from each other. To keep the modules on separate SA power buses, complete these steps.
 - Install the modules that use one type of SA power, for example DC, to the right of the adapter or controller, that is, the first SA power bus.
 - Install the 5069-FPD field potential distributor to establish a second SA power bus.
 - Install the modules that use the other type of SA power, for example AC, on the second SA power bus.



The following figure shows a wiring diagram for the 5069-IF8 module with channels configured for voltage mode.

5069-IF8 Wiring Diagram - Voltage Mode

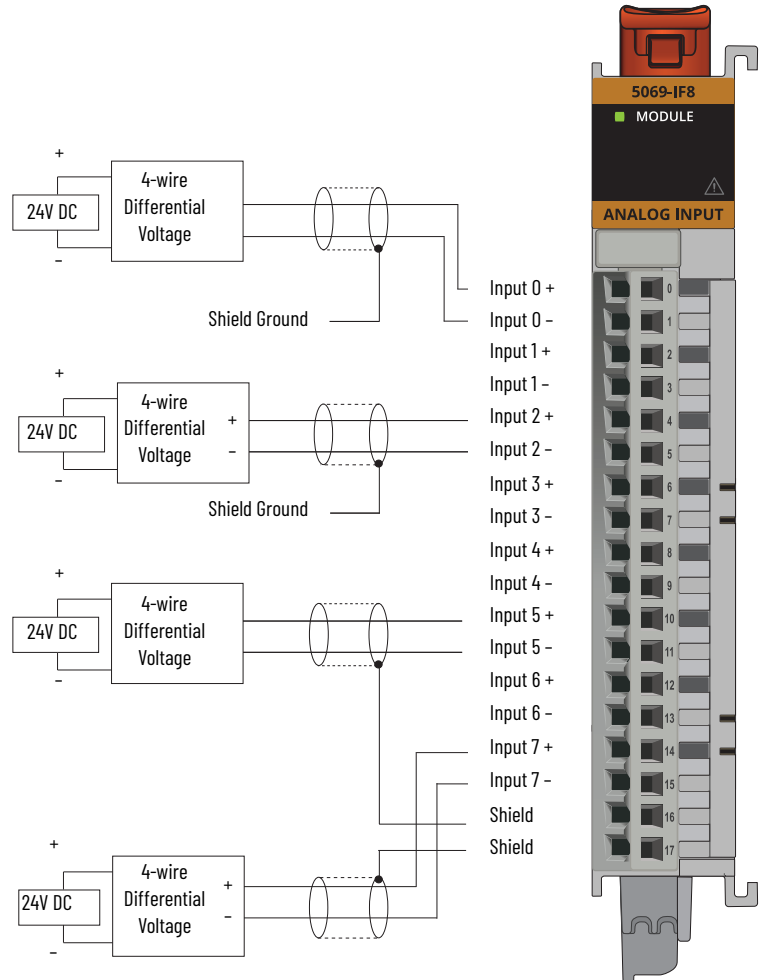
Channel Connections

The diagram shows devices that are connected to channels 0, 2, 5, and 7. You aren't restricted to using only this channel.

You can connect devices to any channel or combination of channels as needed.

IMPORTANT: Remember the following:

- Use separate external power supplies to provide SA power to the system and to power external devices that are connected to the module.
- This module has only two shield terminals. Compact 5000 I/O module RTBs only support one wire per terminal. If you connect more than two devices to the module, you can ground two devices at the shield terminals. You must ground the remaining devices somewhere else, such as, to the DIN rail via a terminal strip. In this case, use the same power supply to power the additional devices. If separate power supplies are used to power the additional devices, ground the power supplies at the same ground location.



The following figure shows a wiring diagram for the 5069-IF8 module with different device types connected to different channels. The device type and mode configuration for each channel must match.

5069-IF8 Wiring Diagram - Combination of Device Types Connected to the Module

Channel Connections

The diagram shows devices that are connected to channels 0, 2, 5, and 7. You aren't restricted to using only this channel. You can connect devices to any channel or combination of channels as needed.

IMPORTANT: Remember the following:

- Place additional loop devices, for example, strip chart recorders, at either **A** location in the current loop.
- Use separate external power supplies to provide SA power to the system and to power external devices that are connected to the module.
- This module has only two shield terminals. Compact 5000 I/O module RTBs only support one wire per terminal. If you connect more than two devices to the module, you can ground two devices at the shield terminals. You must ground the remaining devices somewhere else, such as, to the DIN rail via a terminal strip. In this case, use the same power supply to power the additional devices. If separate power supplies are used to power the additional devices, ground the power supplies at the same ground location.

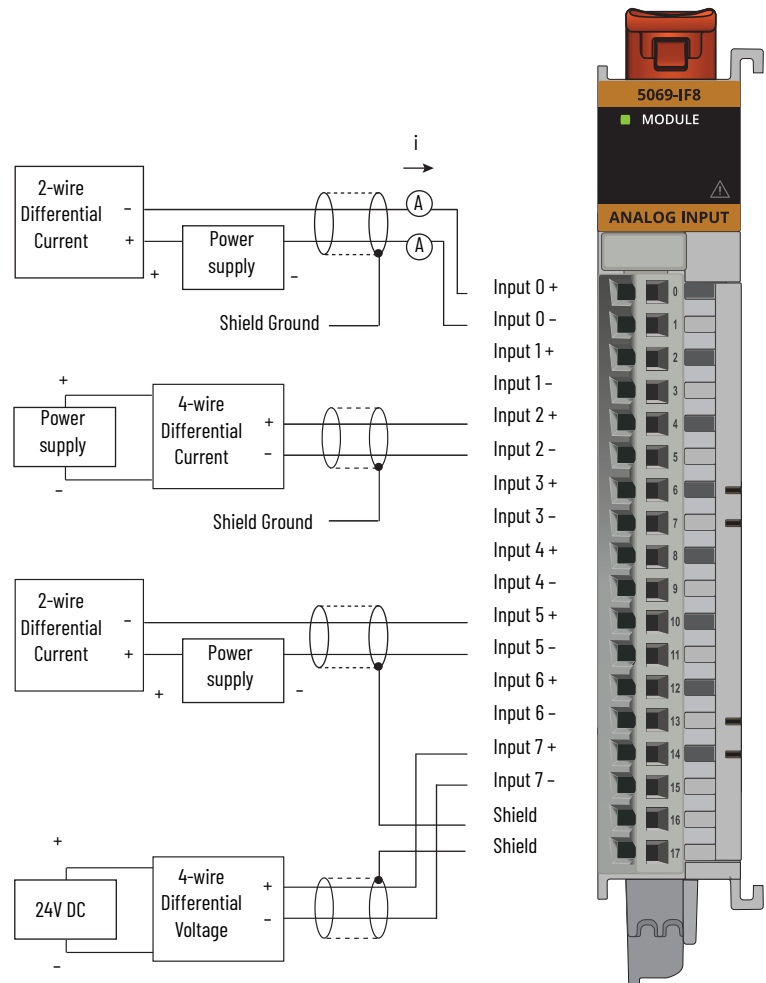
SA Power

Connections to an external power supply that provides SA power are made via the SA power RTB on one of the following:

- CompactLogix 5380 controller
- Compact GuardLogix 5380 controller
- CompactLogix 5480 controller
- 5069-AENTR or 5069-AEN2TR EtherNet/IP Adapter
- 5069-FPD field potential distributor

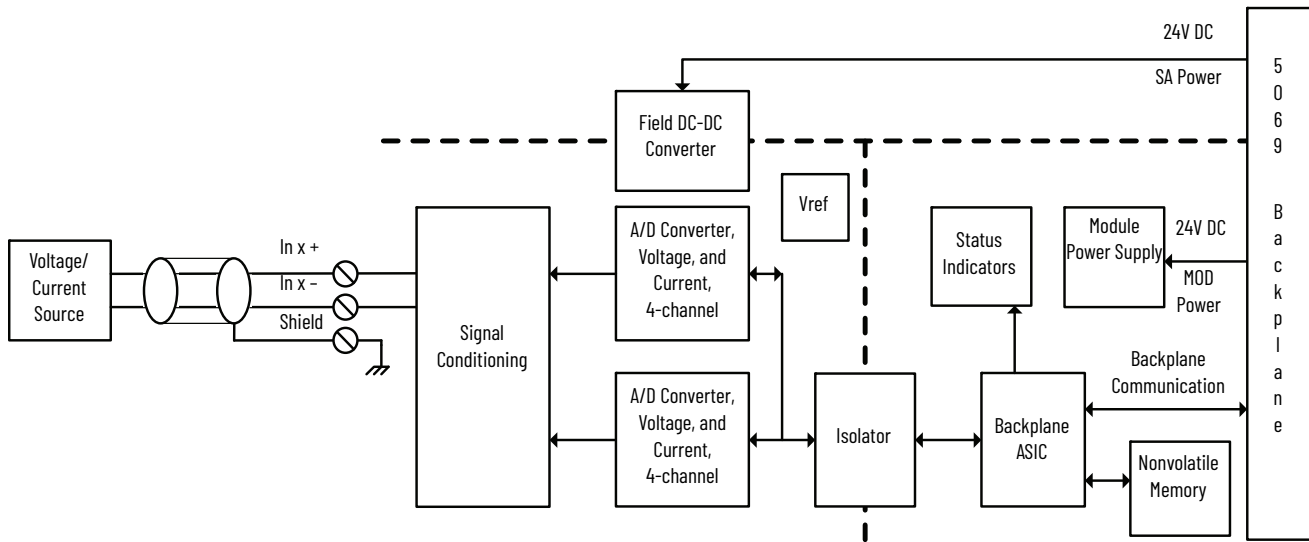
IMPORTANT: Remember the following:

- The 5069-IF8 module uses DC SA power. You must connect DC power to the component, that is, controller, adapter, or field potential distributor, that provides SA power to the modules.
- If you install modules in a system that use AC SA power and DC SA power, you must install them on separate SA power buses.
- You use a 5069-FPD field potential distributor to establish a new SA power bus in a system. SA power buses are isolated from each other. To keep the modules on separate SA power buses, complete these steps.
 - Install the modules that use one type of SA power, for example DC, to the right of the adapter or controller, that is, the first SA power bus.
 - Install the 5069-FPD field potential distributor to establish a second SA power bus.
 - Install the modules that use the other type of SA power, for example AC, on the second SA power bus.



The following figure shows a functional block diagram for the 5069-IF8 module.

5069-IF8 Functional Block Diagram



Technical Specifications - 5069-IF8

Attribute	5069-IF8
Inputs	8 differential
Input range, voltage	±10V 0...10V 0...5V
Input range, current	0...20 mA 4...20 mA
Input impedance	Voltage: >1 MΩ Current: 90 Ω typical, 70...110 Ω range
Common mode voltage (channel to channel)	±10V (Current mode) ±2V (Voltage mode)
Module conversion method	Sigma-Delta, Two 24-bit multiplexed ADC
Resolution, voltage ⁽¹⁾ (16 bits at 10 Hz notch filter)	±10.5V: <320 μV/count (15 bits plus sign bipolar) 0...10.5V: <160 μV/count (16 bits unipolar) 0...5.25V: <80 μV/count (16 bits unipolar)
Resolution, current ⁽¹⁾ (16 bits at 10 Hz notch filter)	0...21 mA: <0.32 μA/count (16 bits) 3.6...21 mA: <0.27 μA/count (16 bits)
Calibrated accuracy at 25 °C	Voltage 0.10% full scale Current 0.10% full scale
Accuracy drift with temperature	Voltage 0.20% full scale Current 0.30% full scale
Input Total Unadjusted Error (TUE) ⁽²⁾ (Over full temperature range)	Voltage 0.30% full scale Current 0.40% full scale
Scan Time Per channel Per group (channel group 0...3 or channel group 4...7)	625 μs 2.5 ms
Notch filter at minimum RPI (0.2 ms, 1 channel enabled)	62.5 kHz

Technical Specifications - 5069-IF8

Attribute	5069-IF8
Minimum notch filter frequency at RPI of 2.5 ms	10 kHz
Step response time to 63% of value (Notch filter 10 kHz)	7.5 ms
Input notch filter (Hz) selections	5, 10 (50/60 Default), 15, 20, 50, 60, 100, 200, 500, 1000, 2500, 5000, 10000, 15625, 25000, 31250, 62500
Input anti-aliasing filter cutoff frequency, nom	500 Hz
Input digital filter	First order lag, 0 ms (Default)...32,767 ms (32.767 s)
HART handheld compliance	Add an external 250 Ω resistor into the current loop for HART transmitter compliance.
Overvoltage protection, max	Voltage and Current modes: $\pm 30V$ DC
Overcurrent protection, max	Current mode: ± 30 mA
Data value during overload condition	Full scale, overrange flag, Data uncertain / data bad
Open circuit detection time	Voltage: + full scale, < 2 s Current: 4...20 mA range, < 2 s
Onboard data alarming	Yes
Scaling to engineering units	Yes
Real-time channel sampling	Yes
Data format	IEEE 32-bit floating point

(1) Notch filter dependent.

(2) Includes offset, gain, non-linearity, and repeatability error terms.

General Specifications - 5069-IF8

Attribute	5069-IF8
Voltage and current ratings	
Mod power	75 mA @ 18...32V DC
Mod power Passthrough, max ⁽¹⁾	9.55 A @ 18...32V DC
SA power	100 mA @ 18...32V DC
SA power Passthrough, max ⁽²⁾	9.95 A @ 18...32V DC
Do not exceed 10 A MOD or SA power (Passthrough) current draw.	
Power dissipation, max	Voltage mode: 2.1 W Current mode: 2.4 W
Thermal dissipation, max	Voltage mode: 7.2 BTU/hr Current mode: 8.2 BTU/hr
Isolation voltage	250V (continuous), Basic Insulation Type 50V Functional Isolation between SA power and input ports No isolation between individual Input ports
Calibration methods	Factory calibrated User-performed (optional)
Module keying	Electronic keying via programming software
Indicators	1 green/red module status indicator 8 yellow/red I/O status indicator
Slot width	1
Common mode noise rejection ratio	130 dB @ 50/60 Hz
Normal mode noise rejection ratio	65 dB @ 50/60 Hz, notch filter dependent
Dimensions (HxWxD), approx	144.57 x 22 x 105.42 mm (5.69 x 0.87 x 4.15 in.)

General Specifications - 5069-IF8

Attribute	5069-IF8
DIN rail	Compatible zinc-plated chromate-passivated steel DIN rail. You can use the EN50022 - 35 x 7.5 mm (1.38 x 0.30 in.) DIN rail.
RTB	One of these RTB types. <ul style="list-style-type: none"> 5069-RTB18-SPRING RTB 5069-RTB18-SCREW RTB IMPORTANT: You must order RTBs separately. RTBs do not ship with Compact 5000 I/O modules. We recommend that you order only the RTB type that your system requires.
RTB torque (5069-RTB18-SCREW RTB only)	0.4 N•m (3.5 lb•in)
RTB keying	None
Wire category ⁽³⁾	2 - shielded input ports 2 - power ports 1 wire per terminal for each signal port
Wire size	
5069-RTB18-SPRING removable terminal block	0.5...1.5 mm ² (22...16 AWG) solid or stranded copper wire rated at 105 °C (221 °F), or greater, 2.9 mm (0.11 in.) max diameter including insulation
5069-RTB18-SCREW removable terminal block	0.5...1.5 mm ² (22...16 AWG) solid or stranded copper wire rated at 105 °C (221 °F), or greater, 3.5 mm (0.14 in.) max diameter including insulation
Insulation-stripping length	
5069-RTB18-SPRING connections	10 mm (0.39 in.)
5069-RTB18-SCREW connections	12 mm (0.47 in.)
Weight, approx	175 g (0.39 lb)
Enclosure type	None (open-style)
North American temperature code	T4
ATEX temp code	T4
IECEX temp code	T4

- (1) Level of Mod power current that passes through the module depends on the system configuration, such as, module slot location and the other module types that are used in the system. For more information, see the CompactLogix 5380 and Compact GuardLogix 5380 Controllers User Manual, [5069-UM001](#), CompactLogix 5480 Controllers User Manual, [5069-UM002](#), and Compact 5000 EtherNet/IP Adapters User Manual, [5069-UM004](#).
- (2) Level of SA power current that passes through the module depends on the system configuration, such as, module slot location and the other module types that are used in the system. For more information, see the CompactLogix 5380 and Compact GuardLogix 5380 Controllers User Manual, [5069-UM001](#), CompactLogix 5480 Controllers User Manual, [5069-UM002](#), and Compact 5000 EtherNet/IP Adapters User Manual, [5069-UM004](#).
- (3) Use this Conductor Category information for planning conductor routing. See the Industrial Automation Wiring and Grounding Guidelines, publication [1770-4.1](#).

Environmental Specifications - 5069-IF8

Attribute	5069-IF8
Temperature, operating IEC 60068-2-1 (Test Ab, Operating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Nonoperating Dry Heat), IEC 60068-2-14 (Test Na, Operating Thermal Shock)	0...60 °C (32...140 °F)
Temperature, surrounding air, max	60 °C (140 °F)
Temperature, nonoperating IEC 60068-2-1 (Test Ab, Unpackaged Nonoperating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Nonoperating Dry Heat), IEC 60068-2-14 (Test Na, Unpackaged Nonoperating Thermal Shock)	-40...+85 °C (-40...+185 °F)
Relative humidity IEC 60068-2-30 (Test Db, Unpackaged Damp Heat)	5...95% noncondensing
Vibration IEC 60068-2-6 (Test Fc, Operating)	5 g @ 10...500 Hz
Shock, operating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	30 g

Environmental Specifications - 5069-IF8

Attribute	5069-IF8
Shock, nonoperating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	50 g
Emissions	IEC 61000-6-4
ESD immunity IEC 61000-4-2	6 kV contact discharges 8 kV air discharges
Radiated RF immunity IEC 61000-4-3	10V/m with 1 kHz sine wave 880% AM from 80...2000 MHz 10V/m with 200 Hz 50% pulse 100% AM at 900 MHz 10V/m with 200 Hz 50% pulse 100% AM at 1890 MHz 3V/m with 1 kHz sine wave 80% AM from 2000...2700 MHz
EFT/B immunity IEC 61000-4-4	±4 kV @ 5 kHz on power ports ±3 kV @ 5 kHz on shielded input ports
Surge transient immunity IEC 61000-4-5	±1 kV line-line (DM) and ±2 kV line-earth (CM) on power ports ±2 kV line-earth (CM) on shielded input ports
Conducted RF immunity IEC 61000-4-6	10V rms with 1 kHz sine wave 80% AM from 150 kHz...80 MHz
Voltage variation IEC 61000-4-29	10 ms interruption on Mod power port

Certifications - 5069-IF8

Certification ⁽¹⁾	5069-IF8
c-UL-us	UL Listed Industrial Control Equipment, certified for US and Canada. See UL File E65584. UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada. See UL File E194810.
CE	European Union 2014/30/EU EMC Directive, compliant with: <ul style="list-style-type: none"> EN 61326-1; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions EN 61131-2; Programmable Controllers (Clause 8, Zone A & B) European Union 2014/35/EU LVD, compliant with: <ul style="list-style-type: none"> EN 61010-2-201; Control Equipment Safety Requirements European Union 2011/65/EU RoHS, compliant with: <ul style="list-style-type: none"> EN 50581; Technical documentation
RCM	Australian Radiocommunications Act, compliant with: EN 61000-6-4; Industrial Emissions
Ex	European Union 2014/34/EU ATEX Directive, compliant with: <ul style="list-style-type: none"> EN 60079-0; General Requirements EN 60079-15; Potentially Explosive Atmospheres, Protection "n" II 3 G Ex nA IIC T4 Gc DEMKO 15 ATEX 1484X
IECEX	IECEX System, compliant with: <ul style="list-style-type: none"> IEC 60079-0; General Requirements IEC 60079-15; Potentially Explosive Atmospheres, Protection "n" II 3 G Ex nA IIC T4 Gc IECEX UL 15.0055X
KC	Korean Registration of Broadcasting and Communications Equipment, compliant with: Article 58-2 of Radio Waves Act, Clause 3
EAC	Russian Customs Union TR CU 020/2011 EMC Technical Regulation Russian Customs Union TR CU 004/2011 LV Technical Regulation

(1) When marked. See the Product Certification link at <http://www.ab.com> for Declarations of Conformity, Certificates, and other certification details.

5069-IB16, 5069-IB16K, and 5069-IB16F Digital 16-point Sinking Input Modules

The following figure shows a wiring diagram for the 5069-IB16, 5069-IB16K, and 5069-IB16F modules.

5069-IB16, 5069-IB16K, and 5069-IB16F Wiring Diagram

Channel Connections

The example shows devices that are connected to channels 0, 3, and 6. You are not restricted to using only those channels. You can connect devices to any channel or combination of channels as needed.

SA Power

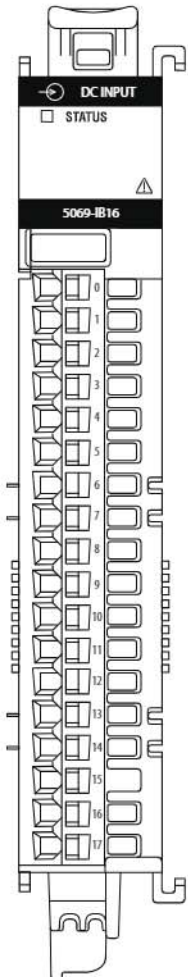
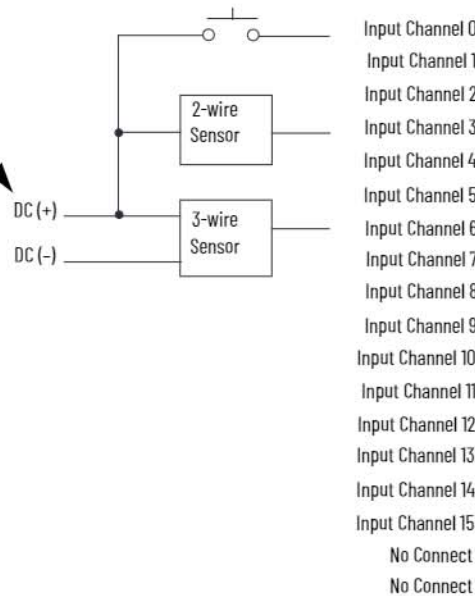
Connections to an external power supply that provides SA power via the SA Power RTB on one of the following:

- CompactLogix 5380 controller
- Compact GuardLogix 5380 controller
- CompactLogix 5480 controller
- 5069-AENTR or 5069-AEN2TR EtherNet/IP Adapter
- 5069-FPD field potential distributor

IMPORTANT: Remember the following:

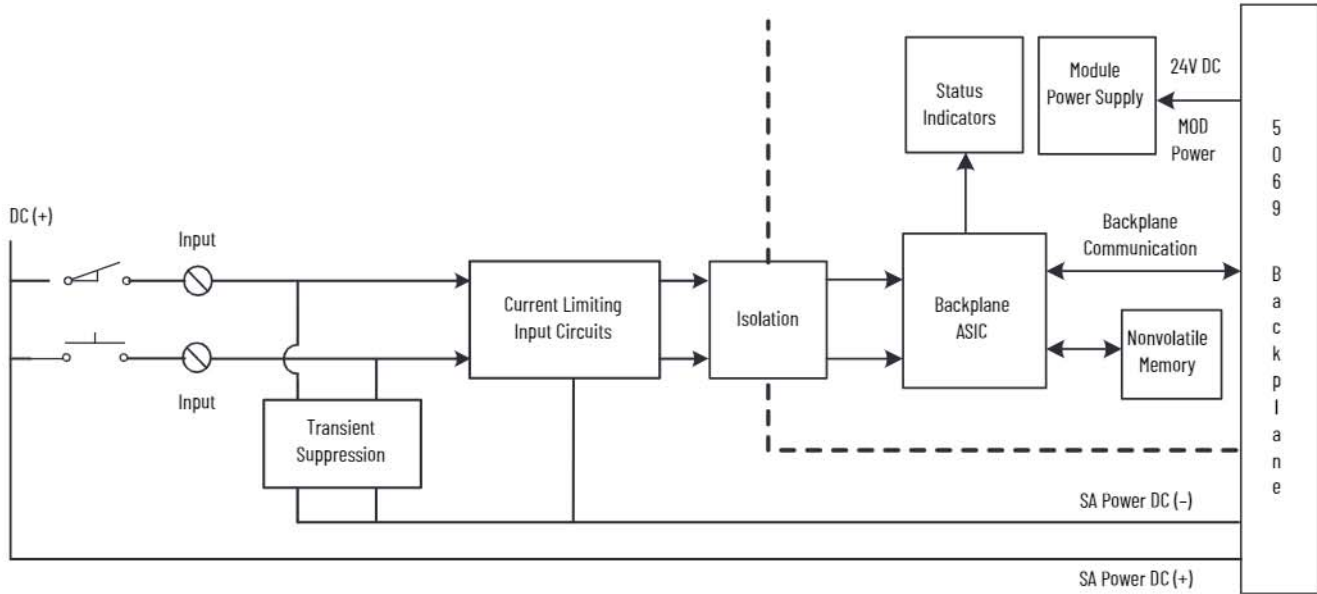
- The 5069-IB16, 5069-IB16K, and 5069-IB16F modules use DC SA power. You must connect DC power to the component, that is, controller, adapter, or field potential distributor, that provides SA Power to the modules.
- The 5069-IB16, 5069-IB16K, and 5069-IB16F module inputs use a shared common. The inputs have a return through internal module circuitry to the SA (-) terminal on the SA Power RTB.
- If you install modules in a system that use AC SA power and DC SA power, you must install them on separate SA power buses.
- You use a 5069-FPD field potential distributor to establish a new SA Power bus in a system. SA Power buses are isolated from each other. To keep the modules on separate SA Power buses, complete these steps.
 1. Install the modules that use one type of SA power, for example DC, to the right of the adapter or controller, that is, the first SA Power bus.
 2. Install the 5069-FPD field potential distributor to establish a second SA Power bus.
 3. Install the modules that use the other type of SA power, for example AC, on the second SA Power bus.

IMPORTANT: The 5069-IB16K and 5069-IB16F modules are wired the same as the wiring diagram that is shown for the 5069-IB16 module.



The following figure shows a functional block diagram for the 5069-IB16, 5069-IB16K, and 5069-IB16F modules.

5069-IB16, 5069-IB16K, and 5069-IB16F Functional Block Diagram



Technical Specifications - 5069-IB16, 5069-IB16K, and 5069-IB16F

Attribute	5069-IB16, 5069-IB16K	5069-IB16F
On-state voltage, min	10V DC	
On-state voltage, nom	24V DC	
On-state voltage, max	32V DC	
On-state current, min	4 mA @ 10V	
On-state current, nom	6 mA @ 24V DC	
On-state current, max	7.4 mA @ 32V DC	
Off-state voltage, max	5V DC	
Off-state current, max	1.5 mA	
Input impedance, min	1.33 kΩ	
Input impedance, nom	4.1 kΩ	
Input impedance, max	7.0 kΩ	
Inrush current, max	< 250 mA peak (decaying to, 37% in 22 ms, without activation)	
Input delay time (screw to backplane)		
Off to On	≤ 100 μs, ±10 μs @ 25 °C (77 °F)	≤ 10 μs, ±1 μs @ 25 °C (77 °F)
On to Off	≤ 100 μs, ±10 μs @ 25 °C (77 °F)	≤ 10 μs, ±1 μs @ 25 °C (77 °F)
Input drift over temperature span	±100 ns/°C (55.6 ns/°F) from 0...60 °C (32...140 °F)	< 10 ns/°C (5.56 ns/°F) from 0...60 °C (32...140 °F)
Input On to Off minimum pulse width	60 μs	6 μs
Input Off to On minimum pulse width	60 μs	6 μs

Technical Specifications - 5069-IB16, 5069-IB16K, and 5069-IB16F

Attribute	5069-IB16, 5069-IB16K	5069-IB16F
Input filter time		
Off to On	Hardware delay: 50 μ s + filter time User-selectable filter time: 0...50 ms	Hardware delay: 2 μ s + filter time User-selectable filter time: 0...50 ms
On to Off	Hardware delay: 50 μ s + filter time User-selectable filter time: 0...50 ms	Hardware delay: 3 μ s + filter time User-selectable filter time: 0...50 ms
Reverse polarity protection	Yes	
Overvoltage protection, max	36V (fuse protected)	
Pulse and period measurements	Not supported	± 2 μ s
Counter frequency	0 - f_{max} = 500 Hz (inv period 2 ms)	0 - f_{max} = 30 kHz (inv period 33.3 μ s)
Frequency counter	0 - f_{max} = 500 Hz (inv period 2 ms)	0 - f_{max} = 30 kHz (inv period 33.3 μ s)
Timestamp of inputs	Not supported	± 10 μ s accuracy 1 ns resolution
Overrides	Not supported	
Pulse latching	Not supported	Supported
Events	Not supported	Four events supported (triggered by any input or simple counters)
Pattern matching	Not supported	Supported
Extended counters	Not supported	

General Specifications - 5069-IB16, 5069-IB16K, and 5069-IB16F

Attribute	5069-IB16, 5069-IB16K	5069-IB16F
Inputs	16 Channels (1 group of 16), sinking	
Voltage category	12/24V DC Sink	
Voltage and current ratings		
Input ratings	4...7.4 mA per channel @ 10...32V DC	
MOD Power	75 mA @ 18...32V DC	
MOD Power Passthrough, max ⁽¹⁾	9.55 A @ 18...32V DC	
SA Power	200 mA @ 10...32V DC	
SA Power Passthrough, max ⁽²⁾	9.95 A @ 10...32V DC	
Power dissipation, max	3.9 W	
Thermal dissipation, max	13.3 BTU/hr	
Isolation voltage	250V (continuous), Basic Insulation Type No isolation between SA Power and input ports No isolation between individual input ports	
Module keying	Electronic keying via programming software	
Indicators	1 green/red module status indicator 16 yellow/red I/O status indicators	
Slot width	1	
Dimensions (HxWxD), approx	144.57 x 22 x 105.42 mm (5.69 x 0.87 x 4.15 in.)	
DIN rail	Compatible zinc-plated chromate-passivated steel DIN rail. You can use the EN50022 - 35 x 7.5 mm (1.38 x 0.30 in.) DIN rail.	

General Specifications - 5069-IB16, 5069-IB16K, and 5069-IB16F

Attribute	5069-IB16, 5069-IB16K	5069-IB16F
RTB	One of these RTB types. <ul style="list-style-type: none"> • 5069-RTB18-SPRING RTB • 5069-RTB18-SCREW RTB IMPORTANT: You must order RTBs separately. RTBs do not ship with Compact 5000 I/O modules. We recommend that you order only the RTB type that your system requires.	
RTB torque (5069-RTB18-SCREW RTB only)	0.4 N-m (3.5 lb-in)	
RTB keying	None	
Wire category ⁽³⁾	2 - input ports 2 - power ports 1 wire per terminal for each signal port	
Wire size		
5069-RTB18-SPRING connections	0.5...1.5 mm ² (22...16 AWG) solid or stranded shielded copper wire rated at 105 °C (221 °F), or greater, 2.9 mm (0.11 in.) max diameter including insulation, single wire connection only.	
5069-RTB18-SCREW connections	0.5...1.5 mm ² (22...16 AWG) solid or stranded shielded copper wire rated at 105 °C (221 °F), or greater, 3.5 mm (0.14 in.) max diameter including insulation, single wire connection only.	
Insulation stripping length	5069-RTB18-SPRING connections: 10 mm (0.39 in.) 5069-RTB18-SCREW connections: 12 mm (0.47 in.)	
Weight, approx	175 g (0.39 lb)	
Enclosure type	None (open-style)	
North American temp code	T4	
ATEX/IECEX temp code	T4	
IECEX temp code	T4	

(1) Level of MOD Power current that passes through the module depends on the system configuration, such as, module slot location and the other module types that are used in the system. For more information, see the CompactLogix 5380 and Compact GuardLogix 5380 Controllers User Manual, [5069-UM001](#), CompactLogix 5480 Controllers User Manual, [5069-UM002](#), and Compact 5000 EtherNet/IP Adapters User Manual, [5069-UM004](#).

(2) Level of SA Power current that passes through the module depends on the system configuration, such as, module slot location and the other module types that are used in the system. For more information, see the CompactLogix 5380 and Compact GuardLogix 5380 Controllers User Manual, [5069-UM001](#), CompactLogix 5480 Controllers User Manual, [5069-UM002](#), and Compact 5000 EtherNet/IP Adapters User Manual, [5069-UM004](#).

(3) Use this Conductor Category information for planning conductor routing. See the Industrial Automation Wiring and Grounding Guidelines, publication [1770-4.1](#).

Environmental Specifications - 5069-IB16, 5069-IB16K, and 5069-IB16F

Attribute	5069-IB16, 5069-IB16K, 5069-IB16F
Temperature, operating IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock)	0...60 °C (32...140 °F)
Temperature, surrounding air, max	60 °C (140 °F)
Temperature, nonoperating IEC 60068-2-1 (Test Ab, Unpackaged Nonoperating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Nonoperating Dry Heat), IEC 60068-2-14 (Test Na, Unpackaged Nonoperating Thermal Shock)	-40...+85 °C (-40...+185 °F)
Relative humidity IEC 60068-2-30 (Test Db, Unpackaged Damp Heat)	5...95% noncondensing
Vibration IEC 60068-2-6 (Test Fc, Operating)	5 g @ 10...500 Hz

Environmental Specifications - 5069-IB16, 5069-IB16K, and 5069-IB16F

Attribute	5069-IB16, 5069-IB16K, 5069-IB16F
Shock, operating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	30 g
Shock, nonoperating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	50 g
Emissions	IEC 61000-6-4
ESD immunity IEC 61000-4-2	6 kV contact discharges 8 kV air discharges
Radiated RF immunity IEC 61000-4-3	10V/m with 1 kHz sine-wave 80% AM from 80...2000 MHz 10V/m with 200 Hz 50% pulse 100% AM at 900 MHz 10V/m with 200 Hz 50% pulse 100% AM at 1890 MHz 3V/m with 1 kHz sine-wave 80% AM from 2000...2700 MHz
EFT/B immunity IEC 61000-4-4	±4 kV @ 5 kHz on power ports ±3 kV @ 5 kHz on input ports
Surge transient immunity IEC 61000-4-5	±1 kV line-line (DM) and ±2 kV line-earth (CM) on power ports ±1 kV line-line (DM) and ±2 kV line-earth (CM) on input ports
Conducted RF immunity IEC 61000-4-6	10V rms with 1 kHz sine-wave 80% AM from 150 kHz...80 MHz
Voltage variation IEC 61000-4-29	10 ms interruption on MOD Power port

Certifications - 5069-IB16, 5069-IB16K, and 5069-IB16F

Certification ⁽¹⁾	5069-IB16, 5069-IB16K, 5069-IB16F
c-UL-us	UL Listed Industrial Control Equipment, certified for US and Canada. See UL File E65584. UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada. See UL File E194810.
CE	European Union 2014/30/EU EMC Directive, compliant with: <ul style="list-style-type: none"> EN 61326-1; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions EN 61131-2; Programmable Controllers (Clause 8, Zone A & B) European Union 2014/35/EU LVD, compliant with: <ul style="list-style-type: none"> EN 61010-2-201; Control Equipment Safety Requirements European Union 2011/65/EU RoHS, compliant with: <ul style="list-style-type: none"> EN 50581; Technical documentation
RCM	Australian Radiocommunications Act, compliant with: EN 61000-6-4; Industrial Emissions
Ex	European Union 2014/34/EU ATEX Directive, compliant with: <ul style="list-style-type: none"> EN 60079-0; General Requirements EN 60079-15; Potentially Explosive Atmospheres, Protection "n" II 3 G Ex nA IIC T4 Gc DEMKO 15 ATEX 1484X
IECEX	IECEX System, compliant with: <ul style="list-style-type: none"> IEC 60079-0; General Requirements IEC 60079-15; Potentially Explosive Atmospheres, Protection "n" II 3 G Ex nA IIC T4 Gc IECEX UL 15.0055X
KC	Korean Registration of Broadcasting and Communications Equipment, compliant with: Article 58-2 of Radio Waves Act, Clause 3
EAC	Russian Customs Union TR CU 020/2011 EMC Technical Regulation Russian Customs Union TR CU 004/2011 LV Technical Regulation

(1) When marked. See the Product Certification link at <http://www.ab.com> for Declarations of Conformity, Certificates, and other certification details.

5069-OB16, 5069-OB16K, and 5069-OB16F Digital 16-point Sourcing Output Modules

The following figure shows a wiring diagram for the 5069-OB16, 5069-OB16K, and 5069-OB16F modules.

5069-OB16, 5069-OB16K, and 5069-OB16F Wiring Diagram

Channel Connections

The diagram shows devices that are connected to channels 0, 2, 4, and 6. You are not restricted to using only those channels.

You can connect devices to any channel or combination of channels as needed.

LA Power

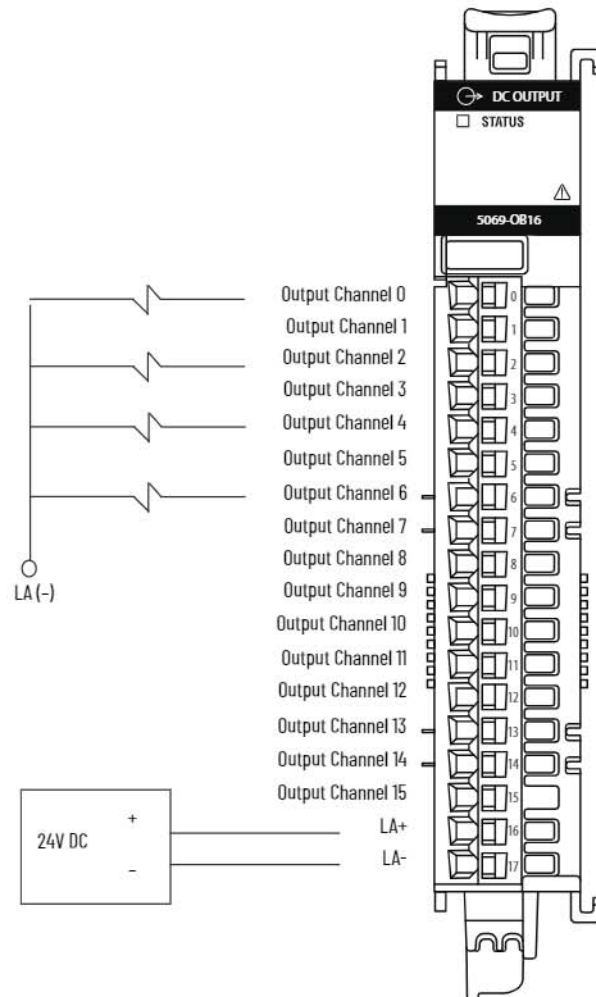
The Local Actuator (LA+ and LA -) connections are used to supply field-side power to the module.

The 5069-OB16, 5069-OB16K, and 5069-OB16F modules **do not draw current from the SA Power bus.**

Still, the modules are DC type modules, and you must install them on a DC SA Power bus.

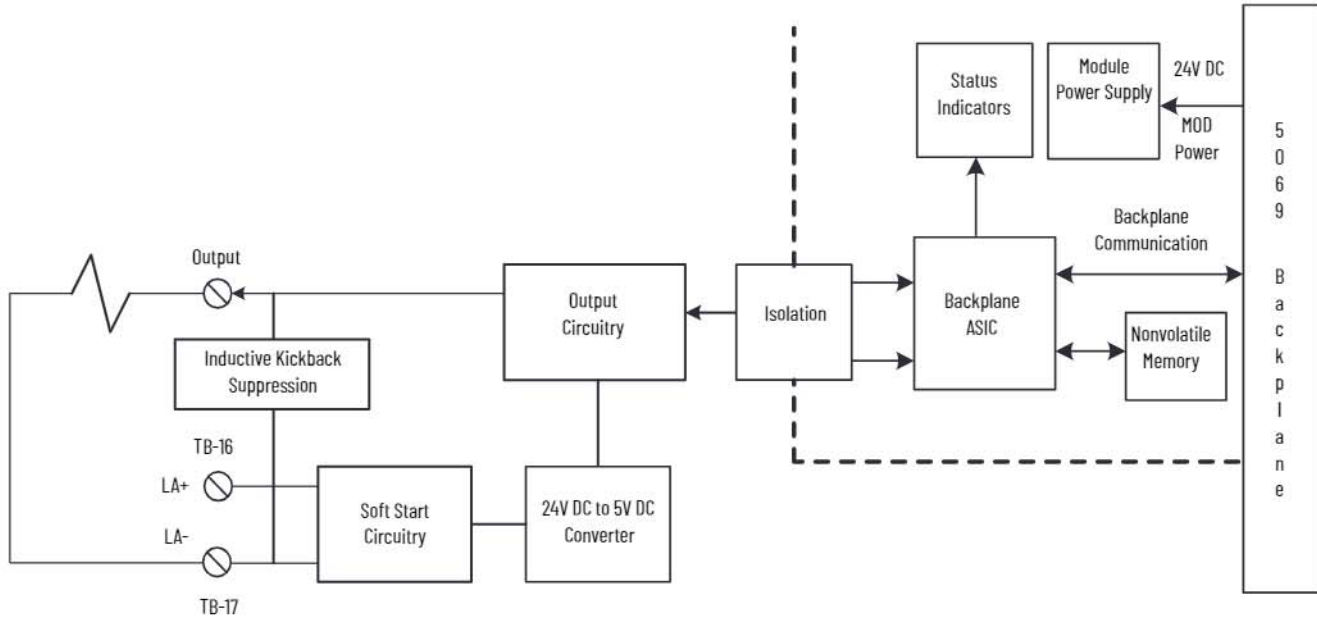
- If you install modules in a system that use AC SA power and DC SA power, you must install them on separate SA Power buses.
- You use a 5069-FPD field potential distributor to establish a new SA Power bus in a system. SA Power buses are isolated from each other. To keep the modules on separate SA Power buses, complete these steps.
 1. Install the modules that use one type of SA power, for example DC, to the right of the adapter or controller, that is, the first SA Power bus.
 2. Install the 5069-FPD field potential distributor to establish a second SA Power bus.
 3. Install the modules that use the other type of SA power, for example AC, on the second SA Power bus.

IMPORTANT: The 5069-OB16K and 5069-OB16K modules are wired the same as the wiring diagram that is shown for the 5069-OB16 module.



The following figure shows a functional block diagram for the 5069-OB16, 5069-OB16K, and 5069-OB16F modules.

5069-OB16, 5069-OB16K, and 5069-OB16F Functional Block Diagram



Technical Specifications - 5069-OB16, 5069-OB16K, and 5069-OB16F

Attribute	5069-OB16, 5069-OB16K	5069-OB16F
On-state voltage, min ⁽¹⁾	10V DC	
On-state voltage, nom ⁽¹⁾	24V DC	
On-state voltage, max ⁽¹⁾	32V DC	
On-state voltage drop, max ⁽¹⁾	< 0.2V DC	
On-state current per channel, min ⁽¹⁾	1 mA	
Off-state voltage, max ⁽¹⁾	5V DC with 1 mA min load	
Off-state leakage current per point, max ⁽²⁾	< 0.5 mA per point	
Output current rating	0.5 A resistive per channel @ 10...32V DC 8 A resistive per module @ 10...32V DC, max	
Surge current per point	1 A max for 10 ms per point, repeatable every 2 s	
Output delay time (backplane to screw)		
Off to On	≤ 100 μs, ±10 μs @ 25 °C (77 °F) @ 0.5 A	10 μs, ±1 μs @ 25 °C (77 °F) @ 0.5 A
On to Off	≤ 100 μs, ±10 μs @ 25 °C (77 °F) @ 0.5 A	10 μs, ±1 μs @ 25 °C (77 °F) @ 0.5 A
Pulse width, min	200 μs @ 0.5 A @ 25 °C (77 °F)	20 μs @ 0.5 A @ 25 °C (77 °F)
Output drift over temperature span	±100 ns/°C (55.6 ns/°F) from 0...60 °C (32...140 °F) @ 0.5 A	±10 ns/°C (5.56 ns/°F) from 0...60 °C (32...140 °F) @ 0.5 A
Field power loss detection ⁽³⁾	Yes	

Technical Specifications - 5069-0B16, 5069-0B16K, and 5069-0B16F

Attribute	5069-0B16, 5069-0B16K	5069-0B16F
No load detection diagnostics	Yes (per channel diagnostics)	
Output short circuit/overload/overtemp detection	Yes (per channel diagnostics)	
Output short circuit/overload protection	Yes	
Reverse voltage protection	Yes	
Overvoltage protection, max	36V (fuse protected)	
Pilot duty rating	0.5 A pilot duty rating per channel @ 10...32V DC	
Output control in fault state per point	<ul style="list-style-type: none"> • Hold Last State • On • Off (default) 	
Output states in program mode per point	<ul style="list-style-type: none"> • Hold Last State • On • Off (default) 	
Output states in fault mode per point	<ul style="list-style-type: none"> • Hold Last State • On • Off (default) 	
Duration of fault mode per point	<ul style="list-style-type: none"> • 1 s • 2 s • 5 s • 10 s • Forever (default) 	
Scheduled outputs	Not supported	±10 µs accuracy 1 ns resolution

(1) Local Actuator (LA) Field Power related attributes.

(2) Recommended Loading Resistor - To limit the effects of leakage current through solid-state outputs, you can connect a loading resistor in parallel with your load. For 24V DC operation, use a 5.6 KΩ, 0.5 W resistor for transistor operation.

(3) Supported only on Series B hardware.

General Specifications - 5069-0B16, 5069-0B16K, and 5069-0B16F

Attribute	5069-0B16, 5069-0B16K	5069-0B16F
Outputs	16 Channels (1 group of 16), sourcing	
Voltage category	12/24V DC source	
Voltage and current ratings		
MOD Power	75 mA @ 18...32V DC	
MOD Power Passthrough, max ⁽¹⁾	9.55 A @ 18...32V DC	
LA Power	0.5 A per channel @ 10...32V DC 8 A per module @ 10...32V DC	
SA Power Passthrough, max ⁽²⁾ The module does not draw SA Power current.	9.95 A @ 10...32V DC	
Do not exceed 10 A MOD or SA Power (Passthrough) current draw		
Power dissipation, max	3.25 W (16 channels @ 0.5 A)	
Thermal dissipation, max	11.09 BTU/hr	

General Specifications - 5069-0B16, 5069-0B16K, and 5069-0B16F

Attribute	5069-0B16, 5069-0B16K	5069-0B16F
Isolation voltage	250V (continuous), Basic Insulation Type No isolation between LA power and output ports No isolation between individual output ports	
Module keying	Electronic, module keying, software configurable	
Indicators	1 green/red module status indicator 16 yellow/red I/O status indicators	
Slot width	1	
Dimensions (HxWxD), approx	144.57 x 22 x 105.42 mm (5.69 x 0.87 x 4.15 in.)	
DIN rail	Compatible zinc-plated chromate-passivated steel DIN rail. You can use the EN50022 - 35 x 7.5 mm (1.38 x 0.30 in.) DIN rail.	
RTB	One of these RTB types. <ul style="list-style-type: none"> • 5069-RTB18-SPRING RTB • 5069-RTB18-SCREW RTB IMPORTANT: You must order RTBs separately. RTBs do not ship with Compact 5000 I/O modules. We recommend that you order only the RTB type that your system requires.	
RTB torque (5069-RTB18-SCREW RTB only)	0.4 N•m (3.5 lb•in)	
RTB keying	None	
Wire category ⁽³⁾	2 - output ports 2 - power ports 1 wire per terminal for each signal port	
Wire size		
5069-RTB18-SPRING removable terminal block	0.5...1.5 mm ² (22...16 AWG) solid or stranded copper wire rated at 105 °C (221 °F), or greater, 2.9 mm (0.11 in.) max diameter including insulation	
5069-RTB18-SCREW removable terminal block	0.5...1.5 mm ² (22...16 AWG) solid or stranded copper wire rated at 105 °C (221 °F), or greater, 3.5 mm (0.14 in.) max diameter including insulation	
Insulation stripping length		
5069-RTB18-SPRING connections	10 mm (0.39 in.)	
5069-RTB18-SCREW connections	12 mm (0.47 in.)	
Weight, approx	175 g (0.39 lb)	
Enclosure type	None (open - style)	
North American temp code	T4	
ATEX temp code	T4	
IECEX temp code	T4	

(1) Level of MOD Power current that passes through the module depends on the system configuration, such as, module slot location and the other module types that are used in the system. For more information, see the CompactLogix 5380 and Compact GuardLogix 5380 Controllers User Manual, [5069-UM001](#), CompactLogix 5480 Controllers User Manual, [5069-UM002](#), and Compact 5000 EtherNet/IP Adapters User Manual, [5069-UM004](#).

(2) Level of SA Power current that passes through the module depends on the system configuration, such as, module slot location and the other module types that are used in the system. For more information, see the CompactLogix 5380 and Compact GuardLogix 5380 Controllers User Manual, [5069-UM001](#), CompactLogix 5480 Controllers User Manual, [5069-UM002](#), and Compact 5000 EtherNet/IP Adapters User Manual, [5069-UM004](#).

(3) Use this Conductor Category information for planning conductor routing. See the Industrial Automation Wiring and Grounding Guidelines, publication [1770-4.1](#).

Environmental Specifications - 5069-OB16, 5069-OB16K, and 5069-OB16F

Attribute	5069-OB16, 5069-OB16K, 5069-OB16F
Temperature, operating IEC 60068-2-1 (Test Ab, Operating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Nonoperating Dry Heat), IEC 60068-2-14 (Test Na, Operating Thermal Shock)	0...60 °C (32...140 °F)
Temperature, surrounding air, max.	60 °C (140 °F)
Temperature, nonoperating IEC 60068-2-1 (Test Ab, Unpackaged Nonoperating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Nonoperating Dry Heat), IEC 60068-2-14 (Test Na, Unpackaged Nonoperating Thermal Shock)	-40...+85 °C (-40...+185 °F)
Relative humidity IEC 60068-2-30 (Test Db, Unpackaged Damp Heat)	5...95% noncondensing
Vibration IEC 60068-2-6 (Test Fc, Operating)	5 g @ 10...500 Hz
Shock, operating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	30 g
Shock, nonoperating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	50 g
Emissions	IEC 61000-6-4
ESD immunity IEC 61000-4-2	6 kV contact discharges 8 kV air discharges
Radiated RF immunity IEC 61000-4-3	10V/m with 1 kHz sine-wave 80% AM from 80...2000 MHz 10V/m with 200 Hz 50% pulse 100% AM at 900 MHz 10V/m with 200 Hz 50% pulse 100% AM at 1890 MHz 3V/m with 1 kHz sine-wave 80% AM from 2000...2700 MHz
EFT/B immunity IEC 61000-4-4	±4 kV @ 5 kHz on power ports ±3 kV @ 5 kHz on output ports
Surge transient immunity IEC 61000-4-5	±1 kV line-line (DM) and ±2 kV line-earth (CM) on power ports ±1 kV line-line (DM) and ±2 kV line-earth (CM) on output ports
Conducted RF immunity IEC 61000-4-6	10V rms with 1 kHz sine-wave 80% AM from 150 kHz...80 MHz
Voltage variation IEC 61000-4-29	10 ms interruption on MOD power port

Certifications - 5069-0B16, 5069-0B16K, and 5069-0B16F

Certification ⁽¹⁾	5069-0B16, 5069-0B16K, 5069-0B16F
c-UL-us	UL Listed Industrial Control Equipment, certified for US and Canada. See UL File E65584. UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada. See UL File E194810.
CE	European Union 2014/30/EU EMC Directive, compliant with: <ul style="list-style-type: none"> • EN 61326-1; Meas./Control/Lab., Industrial Requirements • EN 61000-6-2; Industrial Immunity • EN 61000-6-4; Industrial Emissions • EN 61131-2; Programmable Controllers (Clause 8, Zone A & B) European Union 2014/35/EU, compliant with: <ul style="list-style-type: none"> • EN 61010-2-201; Control Equipment Safety Requirements European Union 2011/65/EU RoHS, compliant with: <ul style="list-style-type: none"> • EN 50581; Technical documentation
RCM	Australian Radiocommunications Act, compliant with: EN 61000-6-4; Industrial Emissions
Ex	European Union 2014/34/EU ATEX Directive, compliant with: <ul style="list-style-type: none"> • EN 60079-0; General Requirements • EN 60079-15; Potentially Explosive Atmospheres, Protection "n" • II 3 G Ex nA IIC T4 Gc • DEMKO 15 ATEX 1484X
IECEX	IECEX System, compliant with: <ul style="list-style-type: none"> • IEC 60079-0; General Requirements • IEC 60079-15; Potentially Explosive Atmospheres, Protection "n" • II 3 G Ex nA IIC T4 Gc • IECEX UL 15.0055X
KC	Korean Registration of Broadcasting and Communications Equipment, compliant with: Article 58-2 of Radio Waves Act, Clause 3
EAC	Russian Customs Union TR CU 020/2011 EMC Technical Regulation Russian Customs Union TR CU 004/2011 LV Technical Regulation

(1) When marked. See the Product Certification link at <http://www.ab.com> for Declarations of Conformity, Certificates, and other certification details.

PanelView Plus 7 Performance Terminals

Catalog Numbers 2711P-T7C22D9P, 2711P-T7C22D9P-B, 2711P-T7C22A9P, 2711P-T7C22A9P-B, 2711P-B7C22D9P, 2711P-B7C22D9P-B, 2711P-B7C22A9P, 2711P-B7C22A9P-B, 2711P-T9W22D9P, 2711P-T9W22D9P-B, 2711P-T9W22A9P, 2711P-T9W22A9P-B, 2711P-T10C22D9P, 2711P-T10C22D9P-B, 2711P-T10C22A9P, 2711P-T10C22A9P-B, 2711P-B10C22D9P, 2711P-B10C22D9P-B, 2711P-B10C22A9P, 2711P-B10C22A9P-B, 2711P-T12W22D9P, 2711P-T12W22D9P-B, 2711P-T12W22A9P, 2711P-T12W22A9P-B, 2711P-T15C22D9P, 2711P-T15C22D9P-B, 2711P-T15C22A9P, 2711P-T15C22A9P-B, 2711P-B15C22D9P, 2711P-B15C22D9P-B, 2711P-B15C22A9P, 2711P-B15C22A9P-B, 2711P-T19C22D9P, 2711P-T19C22D9P-B, 2711P-T19C22A9P, 2711P-T19C22A9P-B

Topic	Page
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Product Dimensions	7
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HMI Software	9
Additional Resources	10

Summary of Changes

Topic	Page
Updated system memory to 512 MB RAM and 512 MB storage. Updated user memory to 80 MB, approx, nonvolatile storage for applications.	4, 5, 6

The PanelView™ Plus 7 Performance terminals are operator interface devices. They monitor and control devices that are attached to ControlLogix® and CompactLogix™ 5370 controllers on an EtherNet/IP network. Animated graphic and text displays provide operators a view into the operating state of a machine or process. Operators interact with the control system by using touch screen or keypad input.



Features include the following:

- FactoryTalk® View Machine Edition software, version 8.1, provides a familiar environment for creating HMI applications
- Windows CE operating system with desktop access for configuration and third-party applications
- Connection to ControlLogix or CompactLogix 5370 controllers
- Ethernet communication that can support Device Level Ring (DLR), linear, or star network topologies
- Web browser, Microsoft file viewers, text editor, PDF viewer, remote desktop connection, and media player on the terminal desktop

Environmental Specifications

This table lists environmental specifications for the PanelView Plus 7 Performance terminals.

Attribute	Value
Temperature, operating ⁽¹⁾	0...55 °C (32...131 °F)
Temperature, nonoperating	-25...+70 °C (-13...+158 °F)
Heat dissipation ⁽²⁾	7-in. DC (touch, and touch with keypad), 51 BTU (typical) 7-in. AC (touch, and touch with keypad), 53 BTU (typical) 9-in. DC, 55 BTU (typical) 9-in. AC, 58 BTU (typical) 10-in. DC (touch, and touch with keypad), 51 BTU (typical) 10-in. AC (touch, and touch with keypad), 56 BTU (typical) 12-in. DC, 60 BTU (typical) 12-in. AC, 67 BTU (typical) 15-in. DC (touch, and touch with keypad), 61 BTU (typical) 15-in. AC (touch, and touch with keypad), 68 BTU (typical) 19-in. DC, 114 BTU (typical) 19-in. AC, 119 BTU (typical)
Altitude, operating	2000M
Relative humidity	5...95% without condensation
Vibration	0.012 pk-pk, 10...57 Hz 2 g peak at 57...500 Hz ⁽³⁾
Shock, operating	15 g at 11 ms
Shock, nonoperating	30 g at 11 ms
Enclosure ratings	NEMA and UL Type 12, 13, 4X, also rated IP66 as Classified by UL

(1) The 19-inch terminals (2711P-T19C22D9P, 2711P-T19C22D9P-B, 2711P-T19C22A9P, and 2711P-T19C22A9P-B) are rated up to 50 °C (122 °F) operating temperature.

(2) Typical BTU measurements were taken at 25 °C (77 °F).

(3) The 15-inch and 19-inch terminals (2711P-T15C22D9P, 2711P-T15C22D9P-B, 2711P-T15C22A9P, 2711P-T15C22A9P-B, 2711P-B15C22D9P, 2711P-B15C22D9P-B, 2711P-B15C22A9P, 2711P-B15C22A9P-B, 2711P-T19C22D9P, 2711P-T19C22D9P-B, 2711P-T19C22A9P, 2711P-T19C22A9P-B) are rated to: 0.006 in. pk-pk, 10...57 Hz, 1 g peak at 57...640 Hz.

Certifications

This table lists certifications for the PanelView Plus 7 Performance terminals.

Certification ⁽¹⁾	Value
cULus	cULus Listed Industrial Control Equipment for use in Hazardous Locations (E10314) per standards ANSI / ISA 12.12.01 and CSA C22.2 No. 213. rated: <ul style="list-style-type: none"> • Class I, Div 2, Groups A, B, C, D Enclosure type ratings per UL50 and CSA C22.2 No. 94.2-07. Enclosure ingress protection classified by UL per IEC 60529.
CE (EMC)	European Union 2004/108/EC EMC Directive, compliant with: <ul style="list-style-type: none"> • EN 61000-6-2; Industrial Immunity • EN 61000-6-4; Industrial Emissions • EN 61131-2; Programmable Controllers
CE (LVD)	European Union 2006/95/EC Low Voltage Directive, compliant with: <ul style="list-style-type: none"> • EN 61131-2; Programmable Controllers
RCM	Australian Radiocommunications Act, compliant with: <ul style="list-style-type: none"> • AS/NZS CISPR 11; Industrial Emissions
RoHS	China RoHS, Turkey RoHS, European RoHS
KCC	Certificate of compliance
EtherNet/IP	ODVA conformance tested to EtherNet/IP specifications

(1) When marked. See the Product Certification link at <http://www.rockwellautomation.com/global/certification/overview.page> for Declarations of Conformity, Certificates, and other certification details.

Technical Specifications

The tables in this section provide technical specifications for the PanelView Plus 7 Performance terminals.

PanelView Plus 7 Performance 7-in and 9-in Terminals

Attribute	7-in. Touch 2711P--T7C22D9P, 2711P--T7C22D9P-B ⁽¹⁾ 2711P-T7C22A9P, 2711P-T7C22A9P-B	7-in. Touch with Keypad 2711P-B7C22D9P, 2711P-B7C22D9P-B ⁽¹⁾ 2711P-B7C22A9P, 2711P-B7C22A9P-B	9-in. Touch 2711P-T9W22D9P, 2711P-T9W22D9P-B ⁽¹⁾ 2711P-T9W22A9P, 2711P-T9W22A9P-B
Operator input	Touch	Touch with keypad	Touch
Display type	TFT Color		
Display size, diagonal	6.5-in.	9-in. widescreen	
Viewing area (W x H)	132 x 99 mm (5.2 x 3.9 in.)	196 x 118 mm (7.7 x 4.6 in.)	
Display resolution	640 x 480 VGA, 18-bit color graphics	800 x 480 WVGA, 18-bit color graphics	
Aspect ratio	4:3	5:3	
Brightness, typical	300 cd/m ² (Nits)		
Backlight life	White light-emitting diode, solid-state Life: 50,000 h min at 40 °C (104 °F) to half-brightness, backlight is not replaceable		
Touch screen	Analog resistive Actuation rating: 1 million presses Operating force: 100 grams		
Battery (real-time clock backup)	Accuracy: +/-2 minutes per month. Battery life: 4 years min at 25 °C (77 °F) Replacement: CR2032 lithium coin cell		
Memory:	<ul style="list-style-type: none"> System User 		
Secure Digital (SD) card slot	<ul style="list-style-type: none"> 512 MB RAM and 512 MB storage 80 MB, approx, nonvolatile storage for applications 		
USB ports:	One SD card slot for external storage; supports cat. no. 1784-SDx cards		
• Host	<ul style="list-style-type: none"> Two USB high-speed 2.0 host ports (type A) support removable flash drives for external storage One high-speed 2.0 device port (type B) that will be functional in a future release 		
• Device			
Operating system	Windows CE with Extended Features and MS Office Viewers (includes FTP, VNC client server, ActiveX controls, PDF reader, third-party device support)		
Ethernet ports	Two 10/100Base-T, Auto MDI/MDI-X Ethernet ports that support Device Level Ring (DLR), linear, or star network topologies		
Software	FactoryTalk View Studio for Machine Edition, FactoryTalk ViewPoint, version 2.6 or later		

Electrical

Input voltage	24V DC nom (18...30V DC)	100...240V AC	24V DC nom (18...30V DC)	100...240V AC	24V DC nom (18...30V DC)	100...240V AC
Power consumption	50 W max (2.1 A at 24V DC)	105VA	50 W max (2.1 A at 24V DC)	105VA	50 W max (2.1 A at 24V DC)	105VA
Power supply	Supports (SELV) and (PELV) 24V DC supplies ⁽²⁾	—	Supports (SELV) and (PELV) 24V DC supplies ⁽²⁾	—	Supports (SELV) and (PELV) 24V DC supplies ⁽²⁾	—

Mechanical

Weight, approx	1.2 kg (2.65 lb)	1.47 kg (3.25 lb)	1.58 kg (3.48 lb)
Dimensions, approx (H x W x D)	170 x 212 x 69.6 mm 6.69 x 8.35 x 2.74 in.	179 x 285 x 69.6 mm 7.05 x 11.22 x 2.74 in.	190 x 280 x 69.6 mm 7.48 x 11.02 x 2.74 in.
Cutout dimensions, approx (H x W)	142 x 184 mm 5.59 x 7.24 in.	142 x 237 mm 5.59 x 9.33 in.	162 x 252 mm 6.38 x 9.92 in.

(1) Catalog numbers with a -B extension denote terminals that exclude the Allen-Bradley brand marking. Customers can put their own brand labels on these terminals.

(2) DC-powered terminals support safety extra low voltage (SELV) and protective extra low voltage (PELV) 24V DC power supplies such as cat. nos. 1606-XLP95E, 1606-XLP100E, 2711P-RSACDIN.

PanelView Plus 7 Performance 10-in and 12-in Terminals

Attribute	10-in. Touch 2711P-T10C22D9P, 2711P-T10C22D9P-B ⁽¹⁾ 2711P-T10C22A9P, 2711P-T10C22A9P-B	10-in. Touch with Keypad 2711P-B10C22D9P, 2711P-B10C22D9P-B ⁽¹⁾ 2711P-B10C22A9P, 2711P-B10C22A9P-B	12-in. Touch 2711P-T12W22D9P, 2711P-T12W22D9P-B ⁽¹⁾ 2711P-T12W22A9P, 2711P-T12W22A9P-B
Operator input	Touch	Touch with keypad	Touch
Display type	TFT Color		
Display size, diagonal	10.4-in.		12.1-in.
Viewing area (W x H)	211 x 158 mm (8.3 x 6.2 in.)		261 x 163 mm (10.3 x 6.4 in.)
Display resolution	800 x 600 SVGA, 18-bit color graphics		1280 x 800 WXGA, 18-bit color graphics
Aspect ratio	4:3		16:10
Brightness, typical	300 cd/m ² (Nits)		
Backlight life	White light-emitting diode, solid-state Life: 50,000 h min at 40 °C (104 °F) to half-brightness, backlight is not replaceable		
Touch screen	Analog resistive Actuation rating: 1 million presses Operating force: 100 grams		
Battery (real-time clock backup)	Accuracy: +/-2 minutes per month. Battery life: 4 years min at 25 °C (77 °F) Replacement: CR2032 lithium coin cell		
Memory: • System • User	<ul style="list-style-type: none"> • 512 MB RAM and 512 MB storage • 80 MB, approx, nonvolatile storage for applications 		
Secure Digital (SD) card slot	One SD card slot for external storage; supports cat. no. 1784-SDx cards		
USB ports: • Host • Device	<ul style="list-style-type: none"> • Two USB high-speed 2.0 host ports (type A) support removable flash drives for external storage • One high-speed 2.0 device port (type B) that will be functional in a future release 		
Operating system	Windows CE with Extended Features and MS Office Viewers (includes FTP, VNC client server, ActiveX controls, PDF reader, third-party device support)		
Ethernet ports	Two 10/100Base-T, Auto MDI/MDI-X Ethernet ports that support Device Level Ring (DLR), linear, or star network topologies		
Software	FactoryTalk View Studio for Machine Edition, FactoryTalk ViewPoint, version 2.6 or later		

Electrical

Input voltage	24V DC nom (18...30V DC)	100...240V AC	24V DC nom (18...30V DC)	100...240V AC	24V DC nom (18...30V DC)	100...240V AC
Power consumption	50 W max (2.1 A at 24V DC)	105VA	50 W max (2.1 A at 24V DC)	105VA	50 W max (2.1 A at 24V DC)	105VA
Power supply	Supports (SELV) and (PELV) 24V DC supplies ⁽²⁾	—	Supports (SELV) and (PELV) 24V DC supplies ⁽²⁾	—	Supports (SELV) and (PELV) 24V DC supplies ⁽²⁾	—

Mechanical

Weight, approx	2.28 kg (5.03 lb)	2.58 kg (5.69 lb)	2.54 kg (5.60 lb)
Dimensions, approx (H x W x D)	252 x 297 x 69.6 mm 9.92 x 11.69 x 2.74 in.	252 x 385 x 69.6 mm 9.92 x 15.16 x 2.74 in.	240 x 340 x 69.6 mm 9.69 x 13.39 x 2.74 in.
Cutout dimensions, approx (H x W)	224 x 269 mm 8.82 x 10.59 in.	224 x 335 mm 8.82 x 13.19 in.	218 x 312 mm 8.58 x 12.28 in.

(1) Catalog numbers with a -B extension denote terminals that exclude the Allen-Bradley brand marking. Customers can put their own brand labels on these terminals.

(2) DC-powered terminals support safety extra low voltage (SELV) and protective extra low voltage (PELV) 24V DC power supplies such as cat. nos. 1606-XLP95E, 1606-XLP100E, 2711P-RSACDIN.

PanelView Plus 7 Performance 15-in and 19-in Terminals

Attribute	15-in. Touch 2711P-T15C22D9P, 2711P-T15C22D9P-B ⁽¹⁾ 2711P-T15C22A9P, 2711P-T15C22A9P-B	15-in. Touch with Keypad 2711P-B15C22D9P, 2711P-B15C22D9P-B ⁽¹⁾ 2711P-B15C22A9P, 2711P-B15C22A9P-B	19-in. Touch 2711P-T19C22D9P, 2711P-T19C22D9P-B ⁽¹⁾ 2711P-T19C22A9P, 2711P-T19C22A9P-B
Operator input	Touch	Touch with keypad	Touch
Display type	TFT Color		
Display size, diagonal	15-in.		19-in.
Viewing area (W x H)	304 x 228 mm (12.0 x 9.0 in.)		376 x 301 mm (14.8 x 11.9 in.)
Display resolution	1024 x 768 XGA, 18-bit color graphics		1280 x 1024 SXGA, 18-bit color graphics
Aspect ratio	4:3		5:4
Brightness, typical	300 cd/m ² (Nits)		
Backlight life	White light-emitting diode, solid-state Life: 50,000 h min at 40 °C (104 °F) to half-brightness, backlight is not replaceable		
Touch screen	Analog resistive Actuation rating: 1 million presses Operating force: 100 grams		
Battery (real-time clock backup)	Accuracy: +/-2 minutes per month. Battery life: 4 years min at 25 °C (77 °F) Replacement: CR2032 lithium coin cell		
Memory: • System • User	<ul style="list-style-type: none"> • 512 MB RAM and 512 MB storage • 80 MB, approx, nonvolatile storage for applications 		
Secure Digital (SD) card slot	One SD card slot for external storage; supports cat. no. 1784-SDx cards		
USB ports: • Host • Device	<ul style="list-style-type: none"> • Two USB high-speed 2.0 host ports (type A) support removable flash drives for external storage • One high-speed 2.0 device port (type B) that will be functional in a future release 		
Operating system	Windows CE with Extended Features and MS Office Viewers (includes FTP, VNC client server, ActiveX controls, PDF reader, third-party device support)		
Ethernet ports	Two 10/100Base-T, Auto MDI/MDI-X Ethernet ports that support Device Level Ring (DLR), linear, or star network topologies		
Software	FactoryTalk View Studio for Machine Edition, FactoryTalk ViewPoint, version 2.6 or later		

Electrical

Input voltage, DC	24V DC nom (18...30V DC)	100...240V AC	24V DC nom (18...30V DC)	100...240V AC	24V DC nom (18...30V DC)	100...240V AC
Power consumption, DC	50 W max (2.1 A at 24V DC)	105VA	50 W max (2.1 A at 24V DC)	105VA	50 W max (2.1 A at 24V DC)	105VA
Power supply	Supports (SELV) and (PELV) 24V DC supplies ⁽²⁾	—	Supports (SELV) and (PELV) 24V DC supplies ⁽²⁾	—	Supports (SELV) and (PELV) 24V DC supplies ⁽²⁾	—

Mechanical

Weight, approx	3.69 kg (8.14 lb)	4.14 kg (9.13 lb)	5.62 kg (12.40 lb)
Dimensions, approx (H x W x D)	318 x 381 x 69.6 mm 12.52 x 15.00 x 2.74 in	329 x 484 x 69.6 mm 12.95 x 19.06 x 2.74 in	411 x 485 x 69.6 mm 16.18 x 19.09 x 2.74 in
Cutout dimensions, approx (H x W)	290 x 353 mm 11.42 x 13.90 in	290 x 418 mm 11.42 x 16.46 in	383 x 457 mm 15.08 x 17.99 in

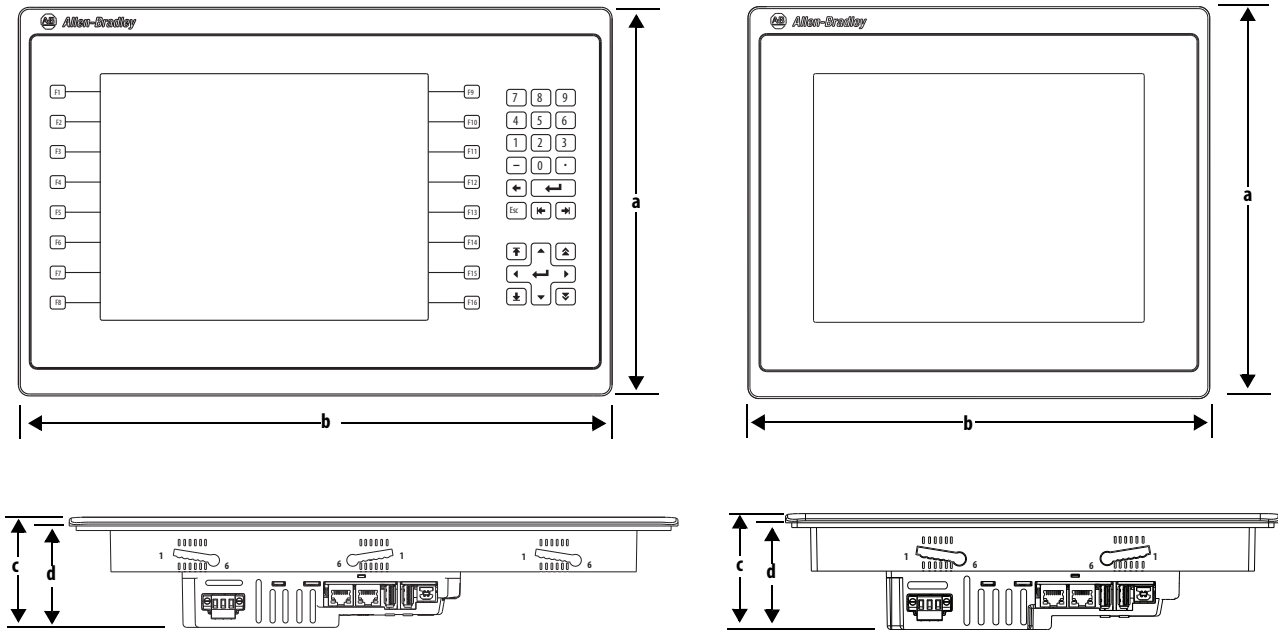
(1) Catalog numbers with a -B extension denote terminals that exclude the Allen-Bradley brand marking. Customers can put their own brand labels on these terminals.

(2) DC-powered terminals support safety extra low voltage (SELV) and protective extra low voltage (PELV) 24V DC power supplies such as cat. nos. 1606-XLP95E, 1606-XLP100E, 2711P-RSACDIN.

Product Dimensions

The table provides product dimensions. The 10.4-inch touch and combination keypad with touch devices are shown for illustrative purposes. All other terminal sizes look similar.

PanelView Plus 7 Performance Dimensions - 10.4-in. Model



Product Dimensions - PanelView Plus 7 Performance Terminals

Terminal Size	Input Type	Height (a) mm (in.)	Width (b) mm (in.)	Overall Depth (c) mm (in.)	Mounted Depth (d) mm (in.)
6.5-in.	Key/touch	179 (7.05)	285 (11.22)	69.6 (2.74)	63.6 (2.50)
	Touch	170 (6.69)	212 (8.35)		
9-in.	Touch	190 (7.48)	280 (11.02)		
10.4-in.	Key/touch	252 (9.92)	385 (15.16)		
	Touch	252 (9.92)	297 (11.69)		
12.1-in.	Touch	246 (9.69)	340 (13.39)		
15-in.	Key/touch	329 (12.95)	484 (19.06)		
	Touch	318 (12.52)	381 (15.00)		
19-in.	Touch	411 (16.18)	485 (19.09)		

TIP When mounted in a panel, the front of the bezel extends less than 6.36 mm (0.25 in.) from the front of the panel.

Accessories

The tables in this section list accessories for the PanelView Plus 7 Performance terminals.

Protective Overlays

Cat. No. ⁽¹⁾	Display Size	Operator Input	
		Touch	Key and Touch
2711P-RGT7SP	6.5-in.	•	
2711P-RGB7P			•
2711P-RGT9SP	9-in. (wide)	•	
2711P-RGT10SP	10.4-in.	•	
2711P-RGB10P			•
2711P-RGT12SP	12.1-in. (wide)	•	
2711P-RGT15SP	15-in.	•	
2711P-RGB15P			•
2711P-RGT19P	19-in.	•	

(1) Three overlays are shipped with each catalog number.

Power Supplies and Power Terminal Blocks

Cat. No.	Description	Quantity
1606-XLP95E	DIN rail power supply, 24...28V DC output voltage, 95 W	1
1606-XLP100E	DIN rail power supply, 24...28V DC output voltage, 100 W	1
2711P-RSACDIN	DIN rail power supply, AC-to-DC, 85...265V AC, 47...63 Hz	1
2711P-RTBAP	3-pin AC power terminal block	10
2711P-RTBDSP	3-pin DC power terminal block	10

Mounting Hardware

Cat. No.	Description	Quantity
2711P-RMCP ⁽¹⁾	Mounting levers (black)	16

(1) Catalog number 2711P-RMCP mounting levers are used with PanelView Plus 7 Performance terminals. Do not use gray mounting levers; they are not compatible with PanelView Plus 7 Performance terminals.

Secure Digital (SD) Cards

Cat. No.	Description
1784-SD1	1 GB SD card
1784-SD2	2 GB SD card
2711C-RCSA	USB to SD adapter for SD card

Battery Replacement

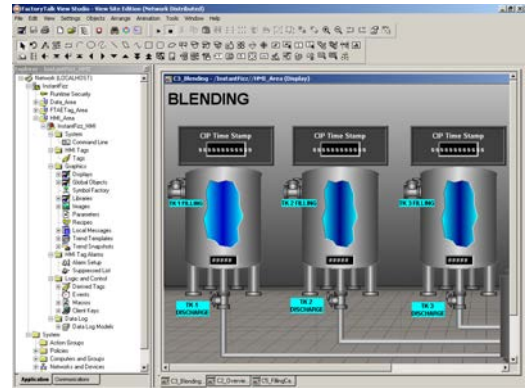
Cat. No.	Description	Quantity
2711P-RY2032	Lithium coin cell battery, CR2032 equivalent	1

HMI Software

All PanelView Plus 7 terminals are configured with FactoryTalk View Studio software and have an integrated runtime system called FactoryTalk View Machine Edition Station.

Machine Edition Station runs projects that are developed with FactoryTalk View Studio software and is included on all PanelView Plus 7 terminals.

Two versions of FactoryTalk View Studio software support application development for PanelView Plus 7 terminals.



Cat. No. ⁽¹⁾	Description
9701-VWSTMENE	FactoryTalk View Studio for Machine Edition software - Configuration software for developing and testing machine-level human machine interface (HMI) applications. Includes RSLinx® Enterprise and KEPServer Enterprise software.
9701-VWSTENE	FactoryTalk View Studio software - Configuration software for developing and testing machine-level and supervisory-level human machine interface (HMI) applications.

(1) To order localized versions of the software, replace EN in the catalog number with DE for German, FR for French, JP for Japanese, or ZH for Chinese.

You can import PanelView Standard/PanelBuilder® 32 and PanelView applications into FactoryTalk View Studio software as Machine Edition applications by using the Machine Edition Import Wizard. The Import Wizard steps you through a few options such as scaling to a new screen resolution size, and then converts objects, text, tags, and communication configurations to ones that are available in Machine Edition.



FactoryTalk ViewPoint software, an add-on to FactoryTalk View Studio software, allows plant managers, production supervisors, system integrators, and other key stakeholders to view and control real-time plant floor operations remotely from a web browser. FactoryTalk ViewPoint enabled displays are fully scalable and animated in the browser. The remote user can also view displays that are not the active display of the terminal.

Each PanelView Plus 7 terminal contains one license that supports one client connection to the terminal. No additional software is required.

For a complete list of available HMI software, visit <http://www.rockwellautomation.com/rockwellsoftware>.

Additional Resources

These documents contain more information about related products from Rockwell Automation.

Resource	Description
PanelView Plus 7 Performance Terminals User Manual, publication 2711P-UM008	Provides instructions on how to install, configure, and operate the PanelView Plus 7 Performance terminals.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines on how to install a Rockwell Automation industrial system.
Product Certifications website, http://www.rockwellautomation.com/global/certification/overview.page	Provides declarations of conformity, certificates, and other certification details.

You can view or download publications at <http://www.rockwellautomation.com/global/literature-library/overview.page>. To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.

Notes:

Rockwell Automation Support

Use the following resources to access support information.

Technical Support Center	Knowledgebase Articles, How-to Videos, FAQs, Chat, User Forums, and Product Notification Updates.	www.rockwellautomation.com/knowledgebase
Local Technical Support Phone Numbers	Locate the phone number for your country.	www.rockwellautomation.com/global/support/get-support-now.page
Direct Dial Codes	Find the Direct Dial Code for your product. Use the code to route your call directly to a technical support engineer.	www.rockwellautomation.com/global/support/direct-dial.page
Literature Library	Installation Instructions, Manuals, Brochures, and Technical Data.	www.rockwellautomation.com/literature
Product Compatibility and Download Center (PCDC)	Get help determining how products interact, check features and capabilities, and find associated firmware.	www.rockwellautomation.com/global/support/pcdc.page

Documentation Feedback

Your comments will help us serve your documentation needs better. If you have any suggestions on how to improve this document, complete the How Are We Doing? form at http://literature.rockwellautomation.com/idc/groups/literature/documents/du/ra-du002_-en-e.pdf.

Rockwell Automation maintains current product environmental information on its website at <http://www.rockwellautomation.com/rockwellautomation/about-us/sustainability-ethics/product-environmental-compliance.page>.

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FL SWITCH SFN 8TX

Order No.: 2891929

<http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=2891929>

Ethernet switch, 8 TP RJ45 ports, automatic detection of data transmission speed of 10/100 Mbps (RJ45), autocrossing function

Commercial data

GTIN (EAN)	
sales group	K000
Pack	1 pcs.
Customs tariff	85176200
Catalog page information	Page 84 (AX-2011)

Product notes

WEEE/RoHS-compliant since:
05/31/2006



<http://www.download.phoenixcontact.com>
Please note that the data given here has been taken from the online catalog. For comprehensive information and data, please refer to the user documentation. The General Terms and Conditions of Use apply to Internet downloads.

Technical data

Interfaces

Interface 1	Ethernet (RJ45)
No. of ports	8 (RJ45 ports)
Connection method	RJ45 female connector, auto negotiation and autocrossing
Transmission physics	Ethernet in RJ45 twisted pair
Transmission speed	10/100 MBit/s (RJ45)

Function

Basic functions	Unmanaged switch / autonegotiation, complies with IEEE 802.3, store and forward switching mode
Status and diagnostic indicators	LEDs: U _{S1} , link and activity per port

Network expansion parameters

Cascading depth	Network, linear, and star structure: any
Maximum conductor length ((twisted pair)	100 m

Supply voltage

Supply voltage	24 V DC
Residual ripple	3.6 V _{PP} (within the permitted voltage range)
Supply voltage range	18.5 V DC ... 30.2 V DC
Typical current consumption	Typ. 140 mA

General data

Width	50 mm
Height	120 mm
Depth	70 mm
Mounting type	DIN rail
Type AX	Block-oriented
Weight	365 g
Degree of protection	IP20
Ambient temperature (operation)	0 °C ... 60 °C
Ambient temperature (storage/transport)	-20 °C ... 70 °C
Permissible humidity (operation)	5 % ... 95 % (no condensation)
Permissible humidity (storage/transport)	5 % ... 95 % (no condensation)
Air pressure (operation)	86 kPa ... 108 kPa (up to 1500 m above mean sea level)
Air pressure (storage/transport)	66 kPa ... 108 kPa (up to 3500 m above mean sea level)
Housing material	Aluminum
Noise emission	EN 61000-6-4
Noise immunity	EN 61000-6-2:2005

Certificates / Approvals



Certification CUL, UL
Certification Ex: CUL-EX LIS, UL-EX LIS

Accessories

Item	Designation	Description
Cable/conductor		
2832250	FL CAT5 PATCH 0,3	Patch cable, CAT5, assembled, 0.3 m
2832263	FL CAT5 PATCH 0,5	Patch cable, CAT5, assembled, 0.5 m
2832276	FL CAT5 PATCH 1,0	Patch cable, CAT5, assembled, 1.0 m
2832221	FL CAT5 PATCH 1,5	Patch cable, CAT5, assembled, 1.5 m
2832629	FL CAT5 PATCH 10,0	Patch cable, CAT5, assembled, 10.0 m
2832289	FL CAT5 PATCH 2,0	Patch cable, CAT5, assembled, 2.0 m
2832292	FL CAT5 PATCH 3,0	Patch cable, CAT5, assembled, 3.0 m
2832580	FL CAT5 PATCH 5,0	Patch cable, CAT5, assembled, 5.0 m
2832616	FL CAT5 PATCH 7,5	Patch cable, CAT5, assembled, 7.5 m
General		
0800886	E/NS 35 N	End clamp, width: 9.5 mm, color: gray
2832991	FL RJ45 PROTECT CAP	Dust protection caps for RJ45 female connector
2832865	FL SEC PAC 4TX	Layer1 security elements for four RJ45 network connections for use with patch boxes and panels

Address

PHOENIX CONTACT Inc., USA
586 Fulling Mill Road
Middletown, PA 17057, USA
Phone (800) 888-7388
Fax (717) 944-1625
<http://www.phoenixcon.com>



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Product data sheet

Specifications



Push-button, Harmony 9001SK, plastic, flush, black, 30mm, spring return, 1 NO

9001SKR1BH5

Main

Range of Product	Harmony 9001SK
Product or Component Type	Push-button
Device short name	9001SK
Type of operator	spring return
Operator profile	Black flush, unmarked
Operator additional information	Plastic guard

Complementary

Bezel material	Plastic
Mounting diameter	1.18 in (30 mm)
Shape of signaling unit head	Octagonal
Contacts type and composition	1 NO
Contact operation	Standard
Connections - terminals	Screw clamp terminals 1 x 0.22...2 x 1.5 mm ² EN/IEC 60947-1
Tightening torque	7.08 lbf.in (0.8 N.m) EN/IEC 60947-1
Shape of screw head	Cross slotted
Mechanical durability	5000000 cycles
Operating position	Any position
[Ie] rated operational current	3 A 240 V, AC-15, A600-Q600 0.55 A 125 V, DC-13, A600-Q600
[Ui] rated insulation voltage	250 V 3)EN/IEC 60947-1
[Uimp] rated impulse withstand voltage	2.5 kV EN/IEC 60947-1
Contacts material	Silver alloy contacts
Positive opening	Without
Short-circuit protection	10 A cartridge fuse EN/IEC 60947-5-1
[Ith] conventional free air thermal current	10 A
[Icm] rated short-circuit making capacity	12 kA 600 V AC-15, 7200 VA 15 kA 480 V AC-15, 7200 VA 30 kA 240 V AC-15, 7200 VA

* Price is "List Price" and may be subject to a trade discount – check with your local distributor or retailer for actual price.

60 kA 120 V AC-15, 7200 VA
0.1 kA 600 V DC-13
0.27 kA 250 V DC-13
0.55 kA 125 V DC-13

Rated breaking capacity	3 kA 240 V AC-15, 720 VA 6 kA 120 V AC-15, 720 VA 1.2 kA 600 V AC-15, 720 VA 1.5 kA 480 V AC-15, 720 VA 0.1 kA 600 V DC-13 0.27 kA 250 V DC-13 0.55 kA 125 V DC-13
--------------------------------	--

Net Weight	0.19 lb(US) (0.086 kg)
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Device presentation	Complete product
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Environment

Standards	EN/IEC 60947-5-4 CSA C22.2 No 14 JIS C 4520 EN/IEC 60947-5-1 UL 508 JIS C 852 EN/IEC 60947-1
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Product Certifications	UL 508 NEMA
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Protective treatment	TC
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Ambient Air Temperature for Storage	-40...158 °F (-40...70 °C)
--	----------------------------

Ambient Air Temperature for Operation	-13...158 °F (-25...70 °C)
--	----------------------------

Vibration resistance	7 gn 2...500 Hz)IEC 60068-2-6
-----------------------------	-------------------------------

Shock resistance	50 gn IEC 60068-2-27
-------------------------	----------------------

Electrical shock protection class	Class II IEC 61140
--	--------------------

IP degree of protection	IP66 IEC 60529
--------------------------------	----------------

NEMA degree of protection	NEMA 1 NEMA 12 NEMA 13 NEMA 2 NEMA 3 NEMA 3R NEMA 4 NEMA 4X
----------------------------------	--

Ordering and shipping details

Category	21429-9001 SK,SKY
-----------------	-------------------

Discount Schedule	CS1
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GTIN	3389118037069
-------------	---------------

Nbr. of units in pkg.	1
------------------------------	---

Package weight(Lbs)	2.40 oz (68.039 g)
----------------------------	--------------------

Returnability	Yes
----------------------	-----

Country of origin	MX
--------------------------	----

Packing Units

Unit Type of Package 1	PCE
-------------------------------	-----

Package 1 Height	1.90 in (4.826 cm)
-------------------------	--------------------

Package 1 width	2.20 in (5.588 cm)
------------------------	--------------------

Package 1 Length	3.70 in (9.398 cm)
-------------------------	--------------------

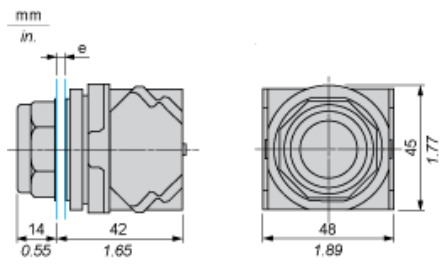
Offer Sustainability

Sustainable offer status	Green Premium product
California proposition 65	WARNING: This product can expose you to chemicals including: Lead and lead compounds, which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov
REACH Regulation	REACH Declaration
REACH free of SVHC	Yes
EU RoHS Directive	Pro-active compliance (Product out of EU RoHS legal scope) EU RoHS Declaration
Toxic heavy metal free	Yes
Mercury free	Yes
RoHS exemption information	Yes
China RoHS Regulation	China RoHS declaration
Environmental Disclosure	Product Environmental Profile
WEEE	The product must be disposed on European Union markets following specific waste collection and never end up in rubbish bins.

Contractual warranty

Warranty	18 months
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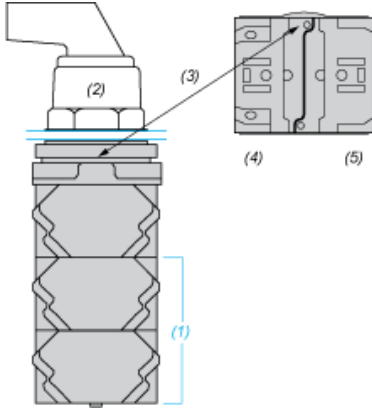
Dimensions



e panel thickness: 1 to 6 mm / 0.04 to 0.24 in.

Contact Block Mounting Position

Top and Rear views



- (1) It is possible to mount up to 3 levels of contacts blocks (maximum of 6 contacts blocks)
- (2) Operator
- (3) Locating notch
- (4) Side 1
- (5) Side 2



SDU AC - B SERIES DIN RAIL UPS

The SolaHD SDU AC - B Series DIN Rail UPS combines an industry leading compact design with a wide operation temperature range, enhanced communication and unique installation options. The SDU Series provides economical protection from damaging impulses and power interruptions. These units include easy to wire screw terminations for critical devices needing battery back up such as computer based control systems.

APPLICATIONS

- Programmable Logic Controllers
- Factory Automation
- Robotics
- Conveying Equipment
- Computer based Control Systems

FEATURES

- Lightweight, compact industrial design
- Communications port for optional Industrial Ethernet protocols or discrete communication card
- User Replaceable Battery
- Long-Life High-Temperature Battery
- Wide operation temperature range (0 °C to 50 °C)
- Cold start capability
- Software and cable included for easy installation
- Simulated sinewave output
- Remote turn-on and shutdown capabilities

- USB communication port
- Two year limited warranty
- Panel/wall mounting brackets (optional)

CERTIFICATIONS AND COMPLIANCES

- **CE**
 - Low Voltage Directive: EN62040-1
 - EMC Directive: EN62040-2 EN55032; EN 55011, EN 55024, EN 61000-6-1, EN 61000-6-2, EN 61000-6-3, EN 61000-6-4, EN 61326-1, EN61000-3-2, EN 61000-3-3, IEC/EN 61000-4 Series
- **UL** UL Recognized Component, UPS Equipment, E1729213
 - UL 1778 5th Ed., CSA C22.2 No. 107.3
 - Suitable for UL 508 at full load output (no derating) and Ind. Control Equipment Applications Overvoltage Cat III, Pollution Degree III

- **UL** UL Recognized Component, Hazardous Locations E491259
 - ANSI ISA 12.12.01/CSA 213
 - Class I, Division 2, Groups A, B, C, D, T4
- ODVA Compliant
 - EtherNet/IP™ SDUENETIPCARD has been tested and approved for conformance by the ODVA. More information about EtherNet/IP™ and the ODVA can be obtained from the following website: www.odva.org.
- RoHS Compliant

RELATED PRODUCTS

- Portable MCR Power Conditioners
- STV Surge Protective Devices
- SDN DIN Rail Power Supplies
- STFV Plus SolaHD Tracking Filters

SDU ACCESSORIES

Catalog Number	Description	Approx. Ship Weight - oz. (g)
SDU-PMBRK	Mounting brackets to secure UPS to wall, back of panel or enclosure	16.0 (454.0)
SDUEDC	Enhanced DIN Clip to secure UPS to DIN rail	1.6 (45.3)

COMM CARD ACCESSORIES

Catalog Number	Description	Approx. Ship Weight - oz. (g)
Active - (Industrial Ethernet)		
SDUENETIPCARD	2 Port EtherNet/IP™ COMM CARD	1.0 (28.4)
SDUECATCARD	2 Port EtherCAT COMM CARD	1.0 (28.4)
SDUMBUSCARD	2 Port Modbus® - TCP COMM CARD	1.0 (28.4)
SDUPNETCARD	2 Port Profinet Industrial Protocol COMM CARD	1.0 (28.4)
Passive		
SDUCFRELAYCARD	SDU CF Dry Contact I/O RELAY CARD	1.0 (28.4)

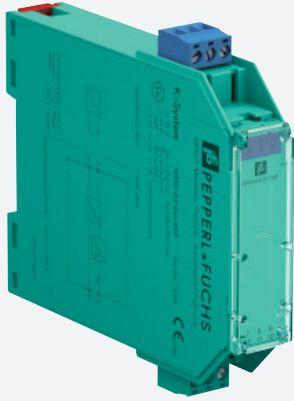
SOLAHD For product information:
www.solahd.com
 1.800.377.4384



CONSIDER IT SOLVED™

SPECIFICATIONS

Description	SDU 500B	SDU 850B	SDU 500B-5	SDU 850B-5
Input				
Capacity (VA/Watts)	500/300	850/510	500/300	850/510
Nominal Voltage	120 Vac		230 Vac	
Frequency	50 or 60 Hz			
Harmonic	THD: 38.1%; Maximum single harmonic distortion of: 31.3%			
Power Factor	0.6			
Output (Back-Up Mode)				
Voltage Vac	Simulated sinewave			
	120 V		230 V	
Frequency	50 or 60 Hz			
Transfer Time	Typical <8 ms			
Protection				
Input (Internal)	10 A	8 A	6.3 A	
Overload Protection	UPS shutdown if overload exceeds 105% of nominal at 20 s, 120% at 10 s, 130% at 3 s; auto-recovery			
Short Circuit (Utility Mode)	In the event of dead short on the outputs of the UPS, input fuse will break Once the fuse opens, UPS goes to battery mode and goes on battery mode short circuit protection until OSCP is removed			
Short Circuit (Battery Mode)	Retry until the short circuit is removed or battery defect			
Battery				
Type	Sealed, maintenance-free, lead acid batteries			
Typical Recharge Time	8 hours			
Typical Back-Up Time At full load/half load	4:20/14:30 min.	1:30/7:00 min.	4:20/14:30 min.	1:30/7:00 min.
Alarm				
ON Battery	Slow beeping every 10 seconds			
Battery Low	Rapid beeping every second			
Overload	Continuous beeping sound			
Environment				
Ambient Operation	0-95% humidity non-condensing, Ordinary Location: 0 to +50 °C (+32 to +122 °F) up to 3000 m (9842.5 ft.) Hazardous Location: 0 to +40 °C (+32 to +104 °F) up to 2000 m (6600 ft.)			
Audible Noise	< 40 dBA (1 meter from surface)			
Vibration	Operating - IEC60068-2-6, Sine Wave: 10 Hz to 60 Hz displacement of 0.35 mm, 60 Hz to 500 Hz @ 5G; 60 min. per axis for all X, Y, Z direction. Non-operating - IEC60068-2-6, Random: 5 Hz to 500 Hz@ 2 Grms; 20 min per axis for all X,Y,Z			
Shock	Operating - IEC60068-2-27, Half Sine Wave: 10 G for a duration of 10 ms, 3 shocks each in 3 axes in positive and negative direction. Non-operating - IEC60068-2-27, Half Sine Wave : 20 g for duration of 10 ms, 3 shocks in 3 axes in positive and negative direction.			
Dimensions				
Unit (H x W x D) - in. (mm)	4.89 x 10.91 x 5.22 (124.2 x 277.0 x 132.7)			
Weight - lbs (kg)	10.8 (4.9)	11.5 (5.2)	10.8 (4.9)	11.5 (5.2)



Repeater

KFD0-CS-Ex1.50P

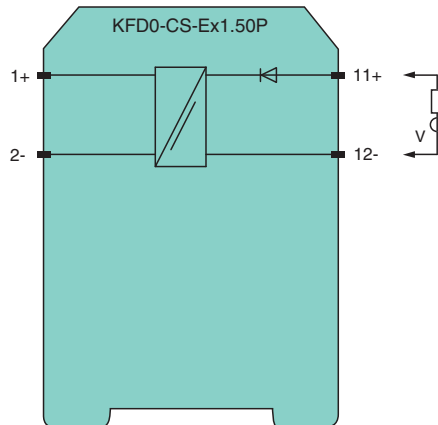
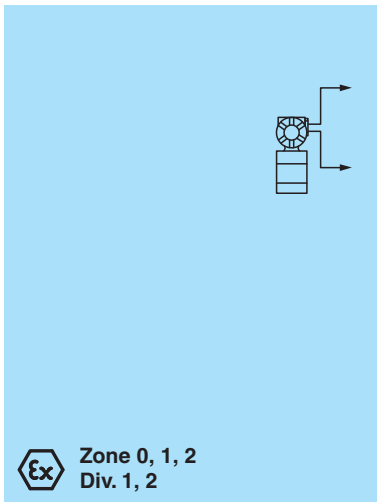
- 1-channel isolated barrier
- 24 V DC supply (loop powered)
- Current input/output 4 mA ... 20 mA
- transmitter power supply
- Accuracy 0.1 %
- Reverse polarity protection
- Up to SIL 2 (SC 3) acc. to IEC/EN 61508



Function

This isolated barrier is used for intrinsic safety applications. The device can be used as a repeater or transmitter power supply for 2-wire transmitters. This device is loop powered. No additional power supply has to be connected. Use the technical data to verify that proper voltage is available to the field devices.

Connection



Zone 2
Div. 2

Technical Data

General specifications	
Signal type	Analog input/analog output
Functional safety related parameters	
Safety Integrity Level (SIL)	SIL 2
Systematic capability (SC)	SC 3
Supply	
Rated voltage	U_r 5 ... 35 V DC , loop powered
Control circuit	
Connection	terminals 12-, 11+
Voltage	5 ... 35 V DC
Current	4 ... 20 mA

Release date: 2023-03-13 Date of issue: 2023-03-13 Filename: 294964_eng.pdf

Refer to "General Notes Relating to Pepperl+Fuchs Product Information".

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PEPPERL+FUCHS

Technical Data

Power dissipation	at 20 mA and $U_{in} < 24.3$ V: < 250 mW per channel at 20 mA and $U_{in} > 24.3$ V: < 500 mW per channel	
Field circuit		
Connection	terminals 1+, 2-	
Voltage	for $5V < U_{in} < 24.3V$: $\geq 0.9 \times U_{in} - (0.37 \times \text{current in mA}) - 1.0$ for $U_{in} > 24.3$ V: ≥ 21 V - (0.36 x current in mA)	
Short-circuit current	at $U_{in} > 24.3$ V : ≤ 65 mA	
Transfer current	≤ 40 mA	
Transfer characteristics		
Accuracy	0.1 %	
Deviation		
After calibration	$\leq \pm 20$ μ A; incl. calibration, linearity, hysteresis and load fluctuations at the field side up to a load of 1 k Ω at 20 °C (68 °F)	
Influence of ambient temperature	$\leq \pm 2$ μ A/K at $U_{in} \leq 20$ V; $\leq \pm 5$ μ A/K at $U_{in} > 20$ V	
Rise time	≤ 5 ms at bounce from 4 ... 20 mA and $U_{in} < 24$ V	
Galvanic isolation		
Field circuit/control circuit	safe electrical isolation acc. to IEC/EN 60079-11, voltage peak value 375 V	
Indicators/settings		
Labeling	space for labeling at the front	
Directive conformity		
Electromagnetic compatibility		
Directive 2014/30/EU	EN 61326-1:2013 (industrial locations)	
Conformity		
Electromagnetic compatibility	NE 21:2012 EN 61326-3-2:2008	
Degree of protection	IEC 60529:2001	
Protection against electrical shock	UL 61010-1:2012	
Ambient conditions		
Ambient temperature	-20 ... 70 °C (-4 ... 158 °F)	
Mechanical specifications		
Degree of protection	IP20	
Connection	screw terminals	
Mass	approx. 100 g	
Dimensions	20 x 107 x 115 mm (0.8 x 4.2 x 4.5 inch) (W x H x D) , housing type B1	
Mounting	on 35 mm DIN mounting rail acc. to EN 60715:2001	
Data for application in connection with hazardous areas		
EU-type examination certificate	BAS 98 ATEX 7343 X	
Marking	⊕ II (1)G [Ex ia Ga] IIC ⊕ II (1)D [Ex ia Da] IIIC ⊕ I (M1) [Ex ia Ma] I	
Voltage	U_o	25.2 V
Current	I_o	93 mA
Power	P_o	585 mW
Control circuit		
Maximum safe voltage	U_m	250 V _{eff} (Attention! The rated voltage can be lower.)
Field circuit		
Maximum safe voltage	U_m	250 V _{eff} (Attention! The rated voltage can be lower.)
Certificate	FIDI 22 ATEX 0001X	
Marking	⊕ II 3G Ex ec IIC T4 Gc	
Galvanic isolation		
Field circuit/control circuit	safe electrical isolation acc. to IEC/EN 60079-11, voltage peak value 375 V	
Directive conformity		
Directive 2014/34/EU	EN IEC 60079-0:2018 , EN 60079-11:2012 , EN IEC 60079-7:2015+A1:2018	
International approvals		
FM approval		

Release date: 2023-03-13 Date of issue: 2023-03-13 Filename: 294964_eng.pdf

Refer to "General Notes Relating to Pepperl+Fuchs Product Information".

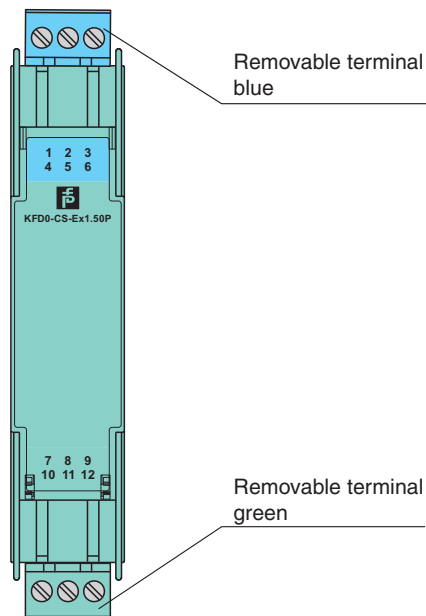
Pepperl+Fuchs Group
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pa-info@de.pepperl-fuchs.comSingapore: +65 6779 9091
pa-info@sg.pepperl-fuchs.com
 PEPPERL+FUCHS

Technical Data


Control drawing	116-0437
UL approval	E106378
Control drawing	116-0438 (cULus)
IECEX approval	
IECEX certificate	IECEX BAS 05.0004X IECEX CML 19.0040X
IECEX marking	[Ex ia Ga] IIC , [Ex ia Da] IIIC , [Ex ia Ma] I Ex ec IIC T4 Gc
General information	
Supplementary information	Observe the certificates, declarations of conformity, instruction manuals, and manuals where applicable. For information see www.pepperl-fuchs.com .

Assembly




Front view



Matching System Components

	K-DUCT-BU	Profile rail, wiring comb field side, blue
---	------------------	--

Accessories

	KF-ST-5GN	Terminal block for KF modules, 3-pin screw terminal, green
	KF-ST-5BU	Terminal block for KF modules, 3-pin screw terminal, blue
	KF-CP	Red coding pins, packaging unit: 20 x 6

Release date: 2023-03-13 Date of issue: 2023-03-13 Filename: 294964_eng.pdf

Refer to "General Notes Relating to Pepperl+Fuchs Product Information".

Socket - SD-US/SC/LA/GY - 2963860


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Control cabinet socket, for mounting on DIN rails and in the service interface, with LED, housing color: gray, with screw connection, national version: USA, housing width 45 mm



Key Commercial Data

Packing unit	1 pc
GTIN	 4 017918 859138
GTIN	4017918859138
Weight per Piece (excluding packing)	74.000 g
Custom tariff number	85366990
Country of origin	Greece

Technical data

Dimensions

Width	45 mm
Height	75 mm
Depth	70.5 mm

Ambient conditions

Ambient temperature (operation)	-20 °C ... 60 °C
Ambient temperature (storage/transport)	-20 °C ... 60 °C

General

Nominal voltage U_N	125 V AC
Nominal current I_N	15 A
Status display	Glow lamp or LED with preresistor

Socket - SD-US/SC/LA/GY - 2963860

Technical data

General

Contact material	CuZn37
For country-specific use in	USA
Color	gray
Insulating material	PA
Standards/regulations	IEC 83
	DIN 49440-1
	UL 498
	NEMA 5-15

Connection data

Conductor cross section solid min.	0.2 mm ²
Conductor cross section solid max.	4 mm ²
Conductor cross section flexible min.	0.2 mm ²
Conductor cross section flexible max.	2.5 mm ²
Conductor cross section AWG min.	30
Conductor cross section AWG max.	12
Connection method	Screw connection
Stripping length	8 mm
Screw thread	M3

Standards and Regulations

Standards/regulations	IEC 83
	DIN 49440-1
	UL 498
	NEMA 5-15

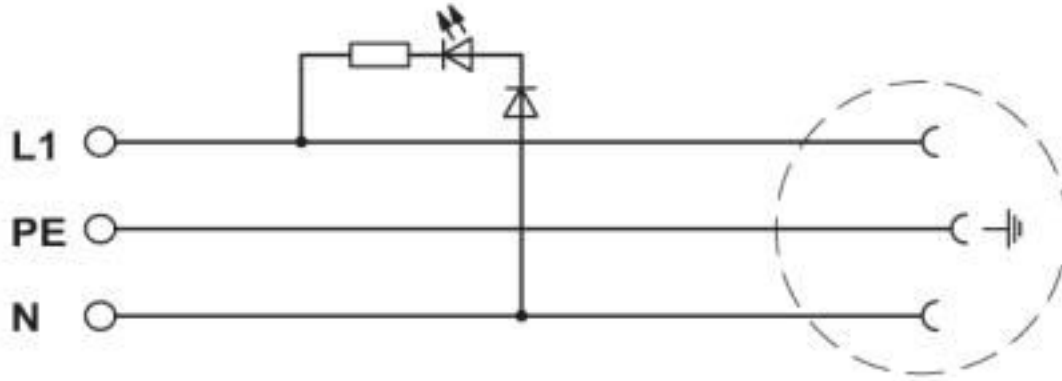
Environmental Product Compliance

China RoHS	Environmentally Friendly Use Period = 50 years
	For details about hazardous substances go to tab "Downloads", Category "Manufacturer's declaration"

Drawings

Socket - SD-US/SC/LA/GY - 2963860

Circuit diagram



Classifications

eCl@ss

eCl@ss 4.0	27142300
eCl@ss 4.1	27142300
eCl@ss 5.0	27142300
eCl@ss 5.1	27142300
eCl@ss 6.0	27142300
eCl@ss 7.0	27142305
eCl@ss 8.0	27142305
eCl@ss 9.0	27142305

ETIM

ETIM 2.0	EC001325
ETIM 3.0	EC001325
ETIM 4.0	EC001663
ETIM 5.0	EC001663
ETIM 6.0	EC001663
ETIM 7.0	EC001663

UNSPSC

UNSPSC 6.01	30211806
UNSPSC 7.0901	39121406
UNSPSC 11	39121406
UNSPSC 12.01	39121406
UNSPSC 13.2	39121406
UNSPSC 19.0	39121406

Socket - EO-AB/UT/SH/LED/DUO/V/GFI/15 - 0804179

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Socket, Pin connector pattern type AB 15A, Screw connection, with extended touch proofness / shutter, LED display, residual current operated circuit breaker, gray, for mounting on a DIN rail in the service interface or direct mounting, 125 V AC, 15 A, -20 °C, 60 °C, UL 508



Key Commercial Data

Packing unit	1 pc
Custom tariff number	85366990
Country of origin	Poland

Technical data

Dimensions

Width	54 mm
Height	137 mm
Depth	57.5 mm

Ambient conditions

Ambient temperature (operation)	-20 °C ... 60 °C
---------------------------------	------------------

General

Nominal voltage U_N	125 V AC (60 Hz)
Nominal current I_N	15 A
Status display	Yes
Contact material	CuZn37
Color	gray
Insulating material	PA
Flammability rating according to UL 94	V2
Standards/regulations	UL 508
Country ID	USA

Socket - EO-AB/UT/SH/LED/DUO/V/GFI/15 - 0804179

Technical data

Connection data

Conductor cross section solid min.	0.2 mm ²
Conductor cross section solid max.	4 mm ²
Conductor cross section flexible min.	0.2 mm ²
Conductor cross section flexible max.	2.5 mm ²
Conductor cross section AWG min.	24
Conductor cross section AWG max.	12
Connection method	Screw connection

Standards and Regulations

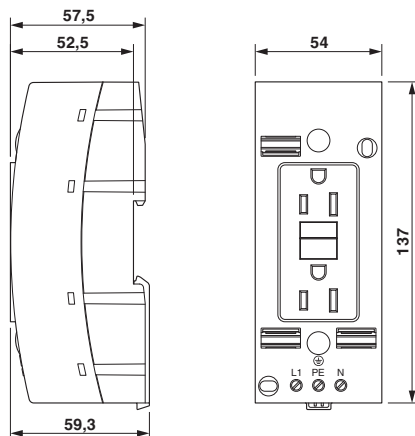
Standards/regulations	UL 508
Flammability rating according to UL 94	V2

Environmental Product Compliance

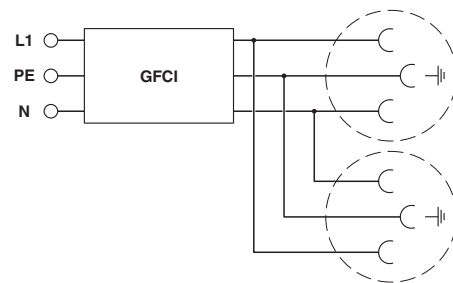
China RoHS	Environmentally Friendly Use Period = 25;
	For details about hazardous substances go to tab "Downloads", Category "Manufacturer's declaration"

Drawings

Dimensional drawing



Circuit diagram



Classifications

eCl@ss

eCl@ss 5.1	27142300
eCl@ss 6.0	27142300
eCl@ss 7.0	27142305
eCl@ss 8.0	27142305

Socket - EO-AB/UT/SH/LED/DUO/V/GFI/15 - 0804179

Classifications

eCl@ss

eCl@ss 9.0	27142305
------------	----------

ETIM

ETIM 5.0	EC001663
ETIM 6.0	EC001663

Accessories

Accessories

Terminal marking

Marker for terminal blocks - UC-TMF 8 - 0818137



Marker for terminal blocks, Sheet, white, unlabeled, can be labeled with: BLUEMARK ID COLOR, BLUEMARK ID, BLUEMARK CLED, PLOTMARK, CMS-P1-PLOTTER, mounting type: snap into flat marker groove, for terminal block width: 8.2 mm, lettering field size: 7.6 x 5.1 mm

Marker for terminal blocks - UC-TMF 16 - 0819262



Marker for terminal blocks, Sheet, white, unlabeled, can be labeled with: BLUEMARK ID COLOR, BLUEMARK ID, BLUEMARK CLED, PLOTMARK, CMS-P1-PLOTTER, mounting type: snap into flat marker groove, for terminal block width: 16 mm, lettering field size: 15.45 x 5.1 mm

Zack Marker strip, flat - ZBF 8:UNBEDRUCKT - 0808781



Zack Marker strip, flat, Strip, white, unlabeled, can be labeled with: PLOTMARK, CMS-P1-PLOTTER, mounting type: snap into flat marker groove, for terminal block width: 8 mm, lettering field size: 5.15 x 8.15 mm

Zack Marker strip, flat - ZBF 16:UNPRINTED - 0827464



Zack Marker strip, flat, Strip, white, unlabeled, can be labeled with: PLOTMARK, CMS-P1-PLOTTER, mounting type: snap into flat marker groove, for terminal block width: 16 mm, lettering field size: 16.25 x 10.5 mm

Socket - EO-AB/UT/SH/LED/DUO/V/GFI/15 - 0804179

Accessories

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5.3 CONTROL PANEL DRAWINGS

REV	DESCRIPTION	DRAWN	APPR	DATE
0	ISSUED FOR APPROVAL	NDB	.	9/22/23

DRAWING NO. DRAWING TITLE SHEET #

G-001	DRAWING LIST	1 of 12
P-001	FRONT PANEL LAYOUT	2 of 12
P-002	BACK PANEL LAYOUT	3 of 12
P-003	PLC RACK LAYOUT	4 of 12
P-004-1	POWER DISTRIBUTION	5 of 12
P-004-2	POWER DISTRIBUTION	6 of 12
I-101	PLC CHASSIS 1, SLOT 1 - ANALOG INPUT WIRING	7 of 12
I-102	PLC CHASSIS 1, SLOT 2 - ANALOG INPUT WIRING	8 of 12
I-103	PLC CHASSIS 1, SLOT 3 - DIGITAL INPUT WIRING	9 of 12
I-104	PLC CHASSIS 1, SLOT 4 - DIGITAL OUTPUT WIRING	10 of 12
C-001	COMMUNICATION LAYOUT	11 of 12
ISB-1	INTRINSIC SAFETY BARRIER LAYOUT	12 of 12

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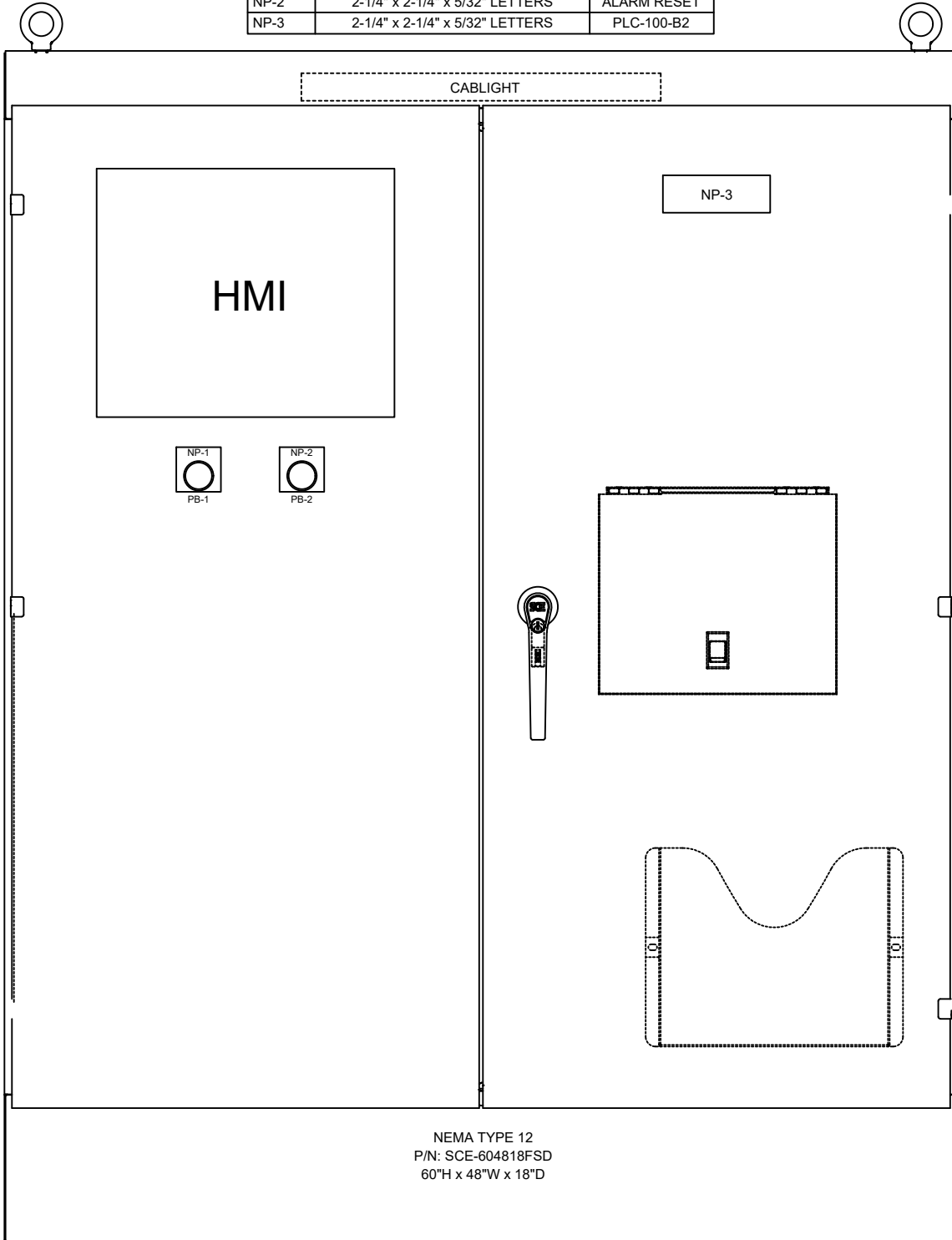
5703212001
ABERDEEN, ID

IFAS
IFAS CONTROL PANEL
DRAWING LIST

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REV	DESCRIPTION	DRAWN	APPR	DATE
0	ISSUED FOR APPROVAL	NDB	.	9/22/23

NAMEPLATE SCHEDULE		
No.	SIZE AND TEXT	LABEL
NP-1	2-1/4" x 2-1/4" x 5/32" LETTERS	ALARM SILENCE
NP-2	2-1/4" x 2-1/4" x 5/32" LETTERS	ALARM RESET
NP-3	2-1/4" x 2-1/4" x 5/32" LETTERS	PLC-100-B2



NEMA TYPE 12
P/N: SCE-604818FSD
60"H x 48"W x 18"D

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(919) 677-8310

5703212001
ABERDEEN, ID

IFAS
IFAS CONTROL PANEL
FRONT PANEL LAYOUT

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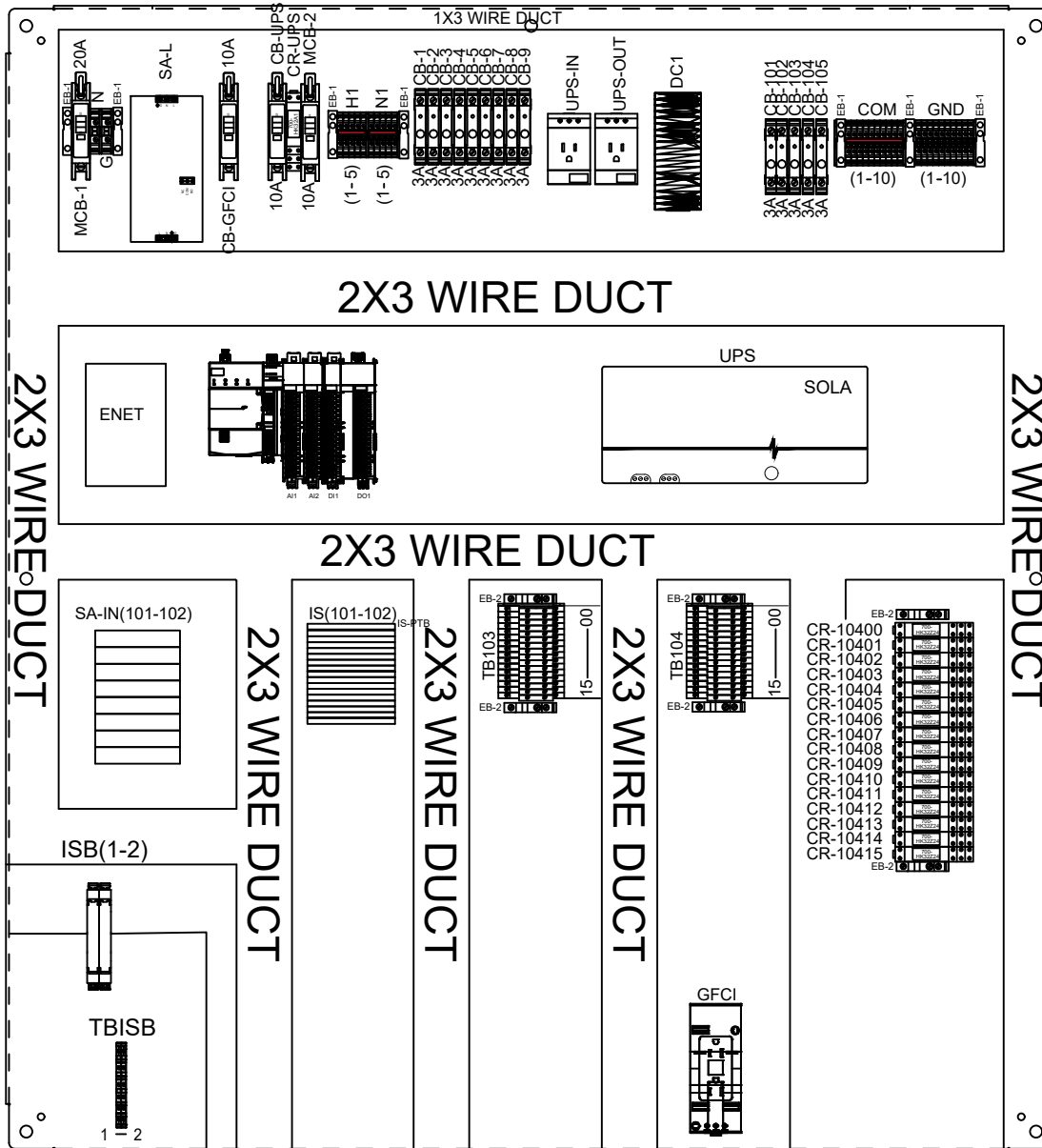
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P-001

SHEET
2 of 12

REV
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REV	DESCRIPTION	DRAWN	APPR	DATE
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P/N: SCE-60P48F1
57"H x 45"W

NOTE: ISB WIRES MUST ENTER AT BOTTOM LEFT OF PANEL. TO BE RAN IN SEPARATE CONDUIT FROM ALL OTHER WIRING

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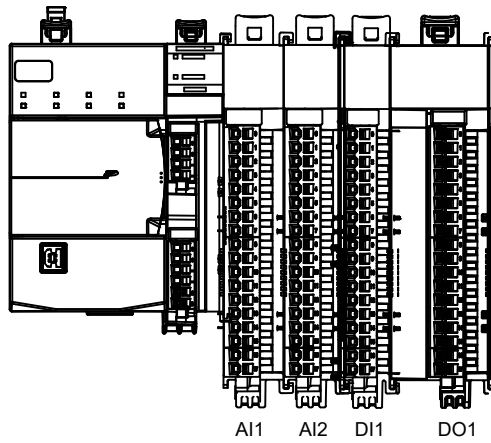
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IFAS
IFAS CONTROL PANEL
BACK PANEL LAYOUT

DRAWN NDB	CHECKED .	SCALE .	DRAWING NO P-002	SHEET 3 of 12	REV 0
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REV	DESCRIPTION	DRAWN	APPR	DATE
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5703212001
ABERDEEN, ID

IFAS
IFAS CONTROL PANEL
PLC RACK LAYOUT

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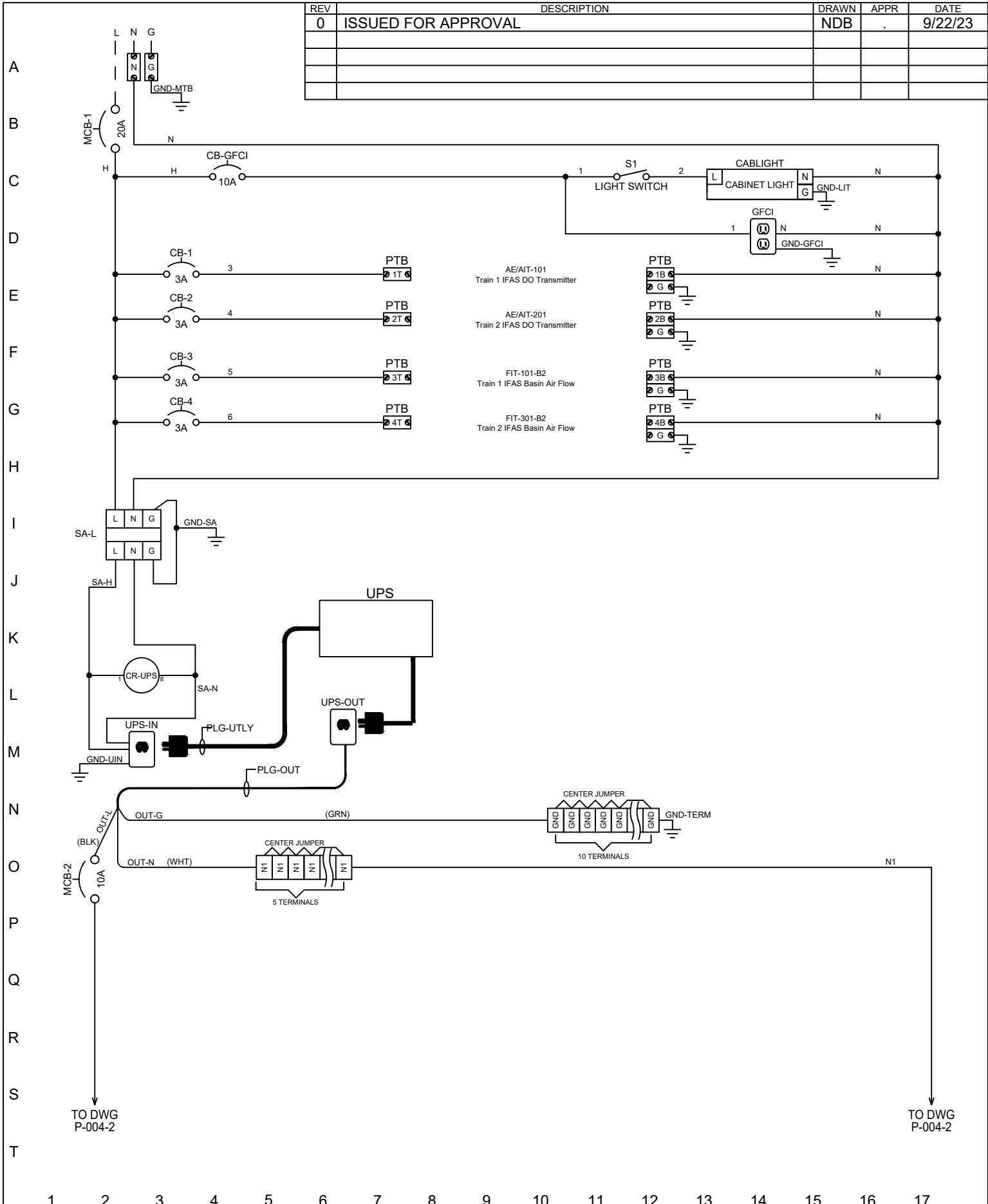
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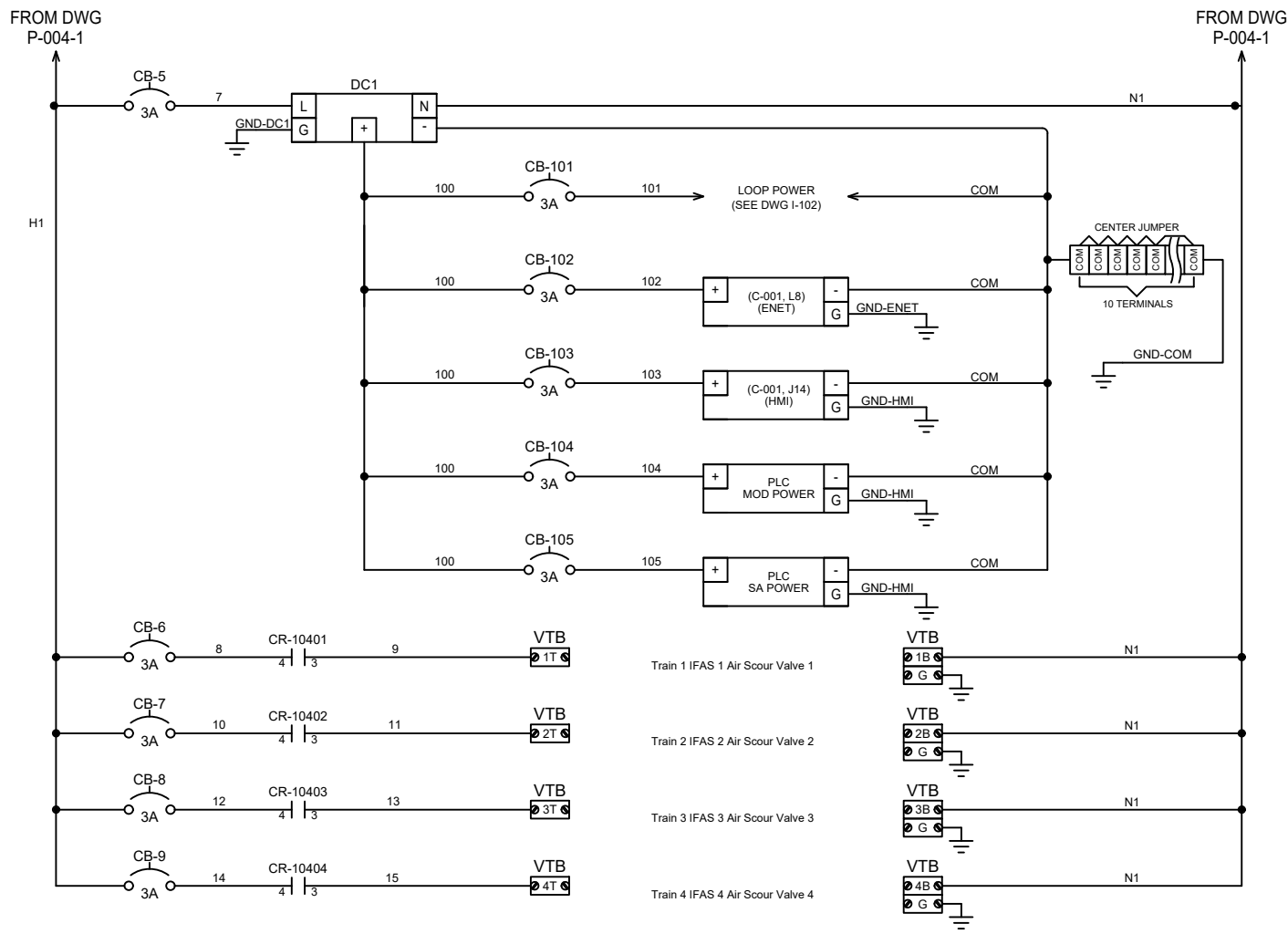
5703212001
ABERDEEN, ID

**IFAS
IFAS CONTROL PANEL
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ABERDEEN, ID

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IFAS CONTROL PANEL
POWER DISTRIBUTION**

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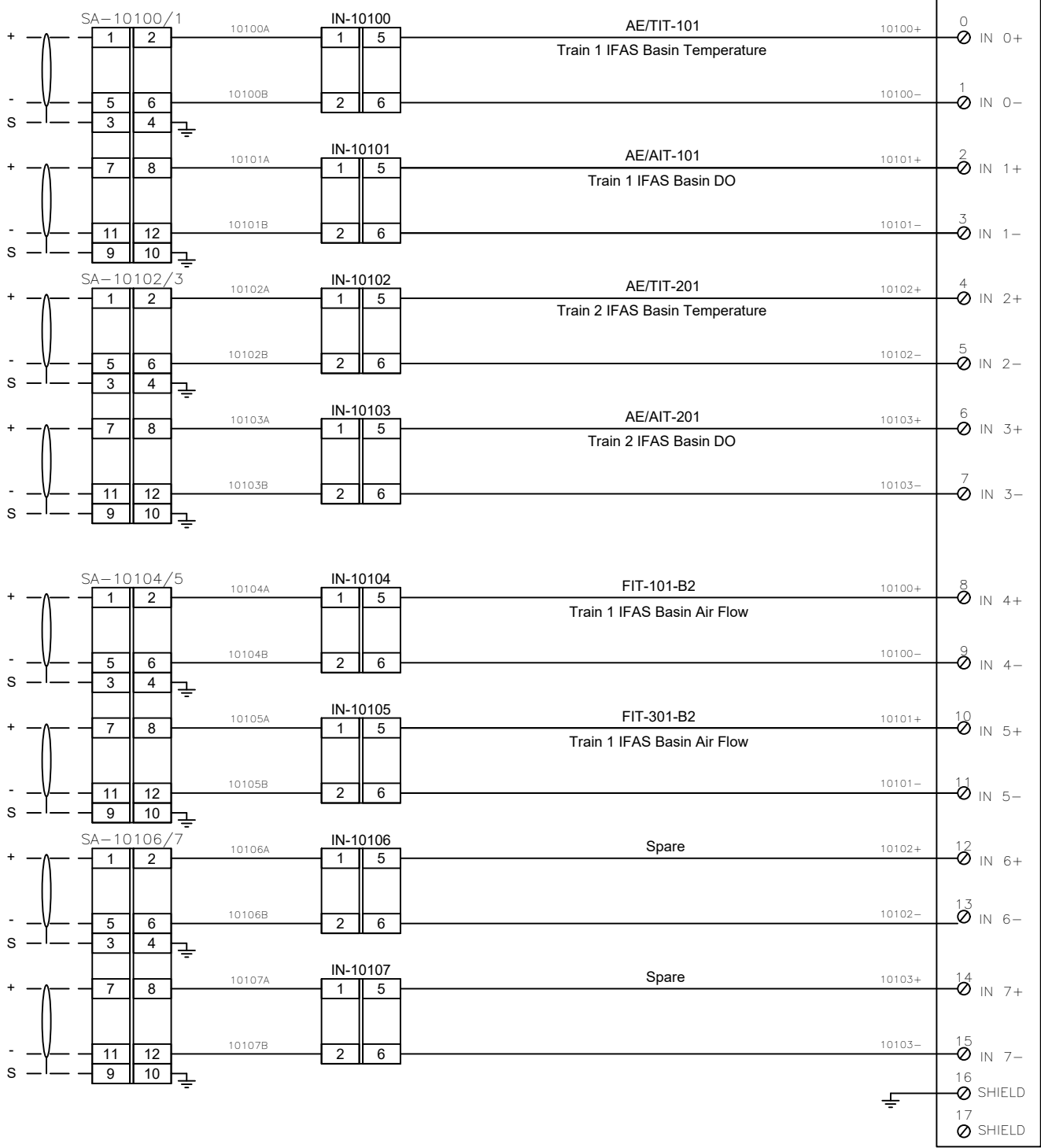
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FIELD WIRING BY OTHERS

ISOLATORS POWERED FROM DIN RAIL BUS CONNECTOR

SLOT 1
5069-IF8



1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17

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5703212001
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IFAS
IFAS CONTROL PANEL
PLC CHASSIS 1, SLOT 1 - ANALOG INPUT WIRING

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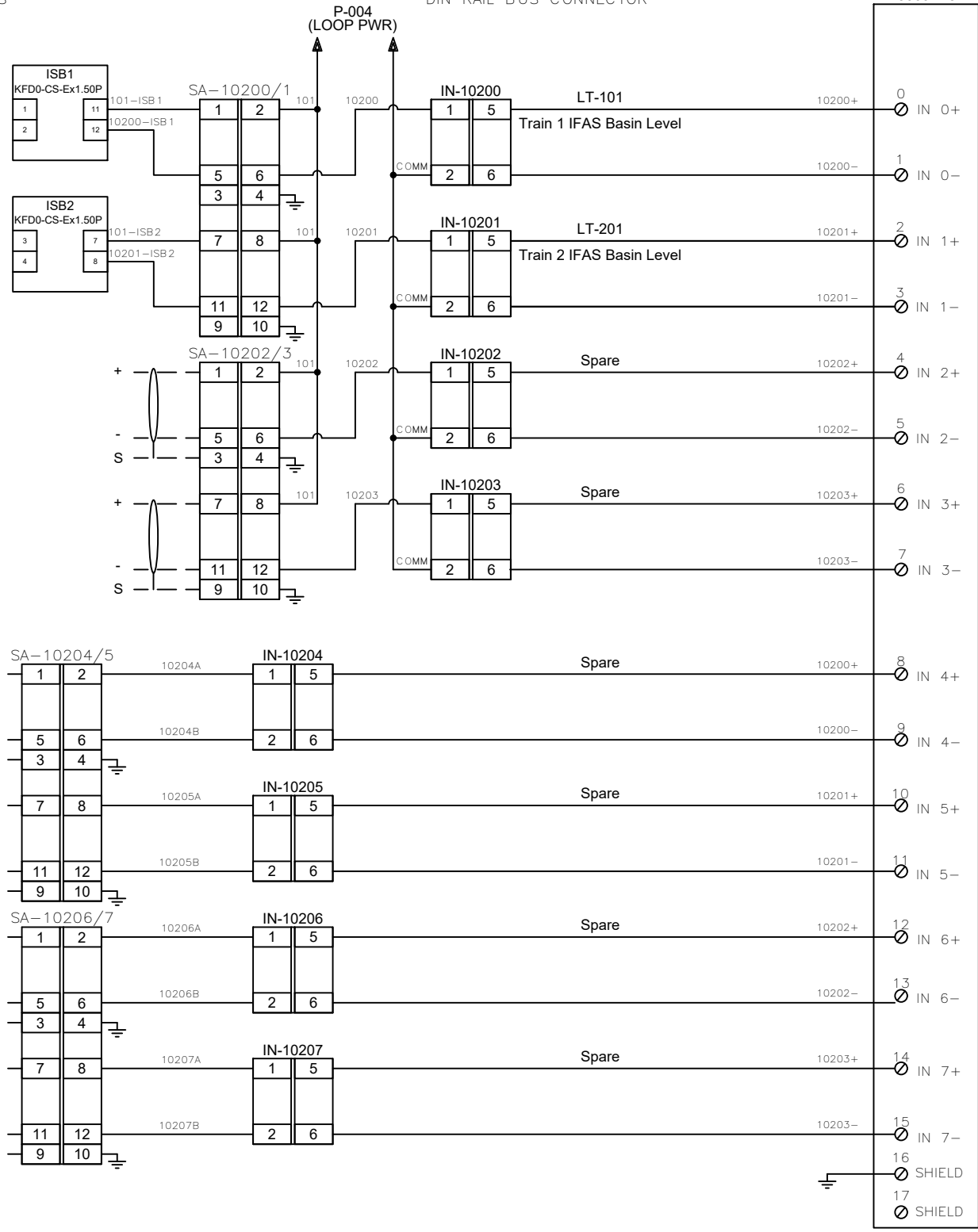
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FIELD WIRING BY OTHERS

ISOLATORS POWERED FROM DIN RAIL BUS CONNECTOR

SLOT 2
5069-IF8



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ABERDEEN, ID

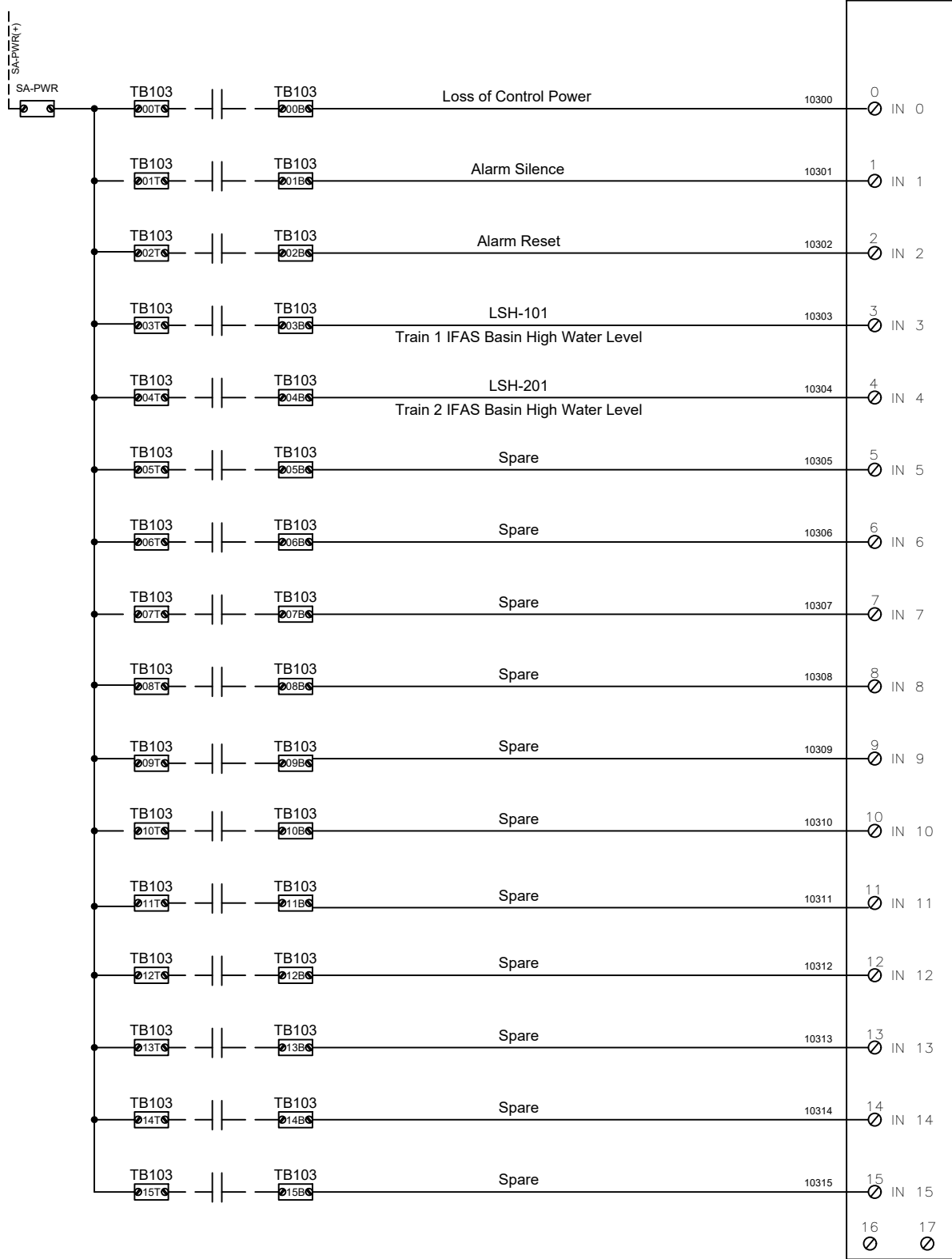
IFAS
IFAS CONTROL PANEL
PLC CHASSIS 1, SLOT 2 - ANALOG INPUT WIRING

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SLOT 3
5069-IB16



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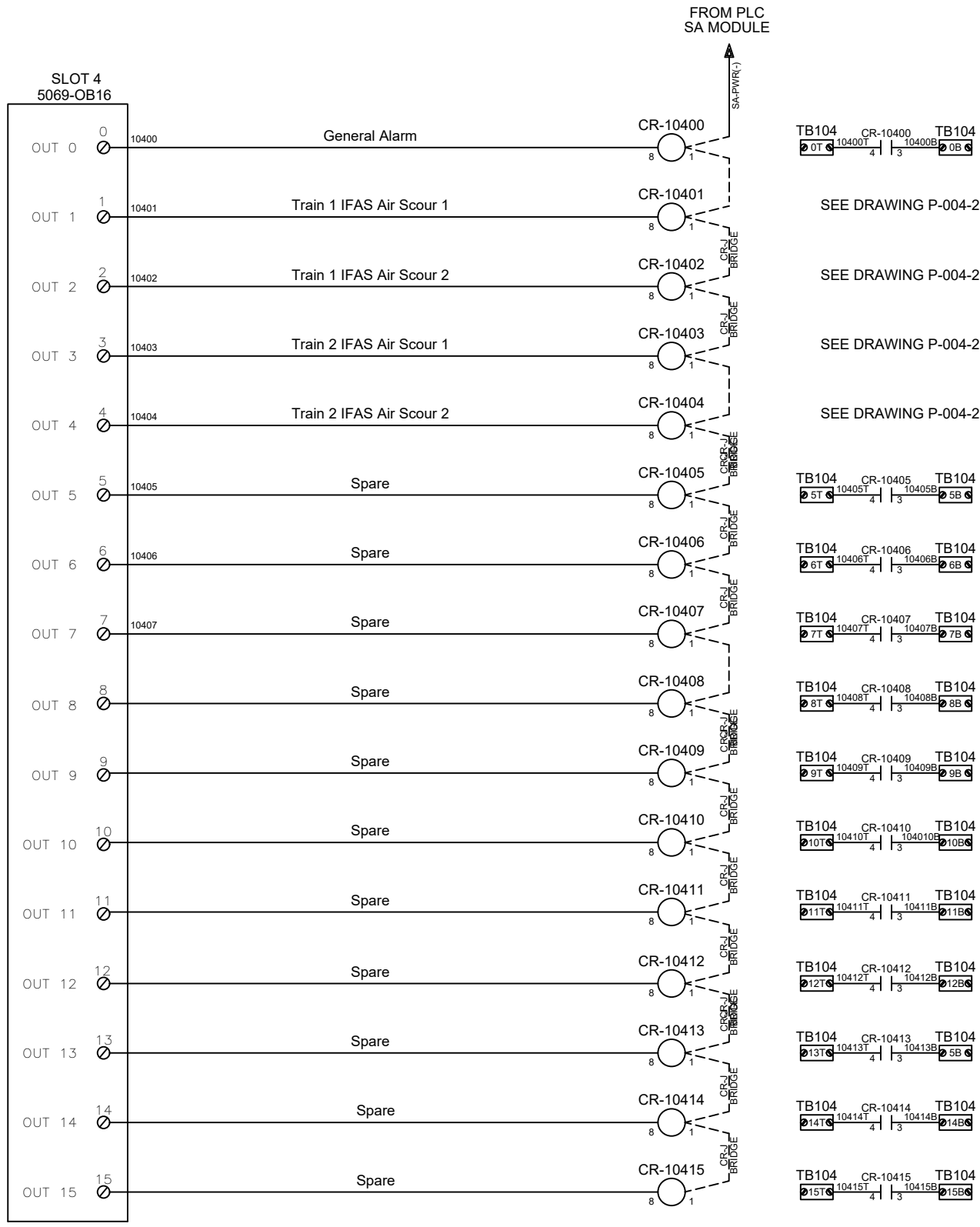
5703212001
ABERDEEN, ID

IFAS
IFAS CONTROL PANEL
PLC CHASSIS 1, SLOT 3 - DIGITAL INPUT WIRING

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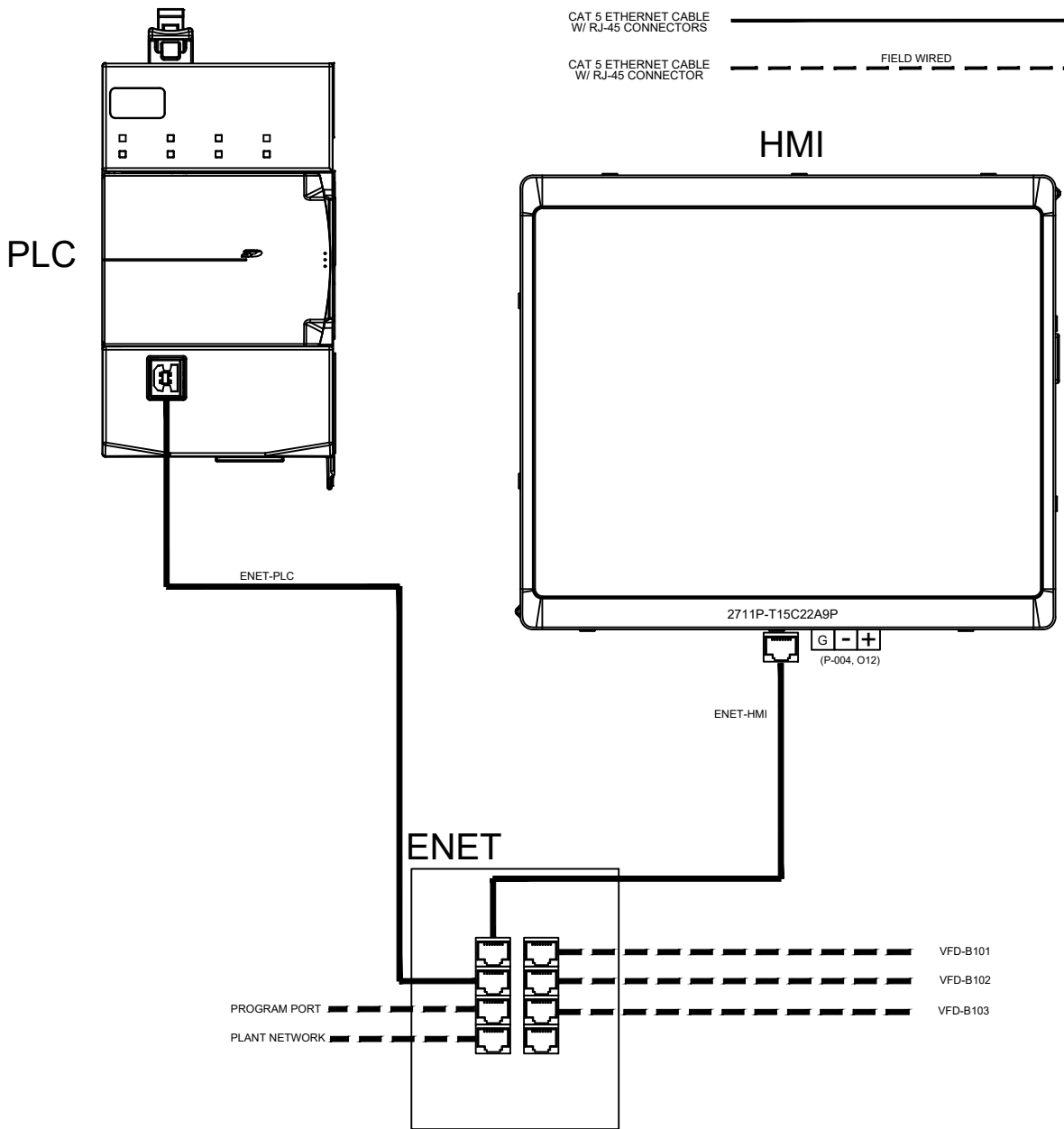
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ABERDEEN, ID

IFAS
IFAS CONTROL PANEL
PLC CHASSIS 1, SLOT 4 - DIGITAL OUTPUT WIRING

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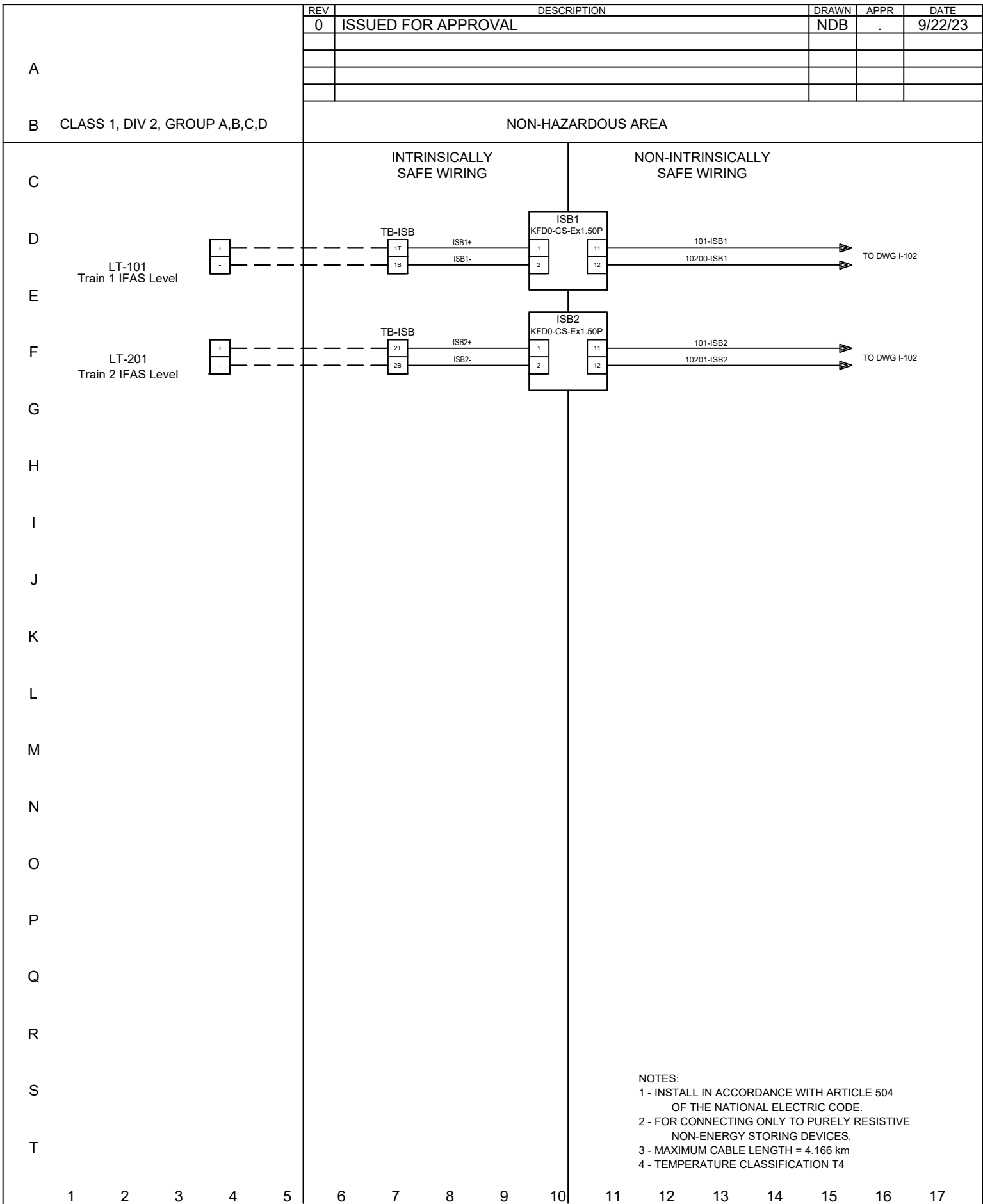


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ABERDEEN, ID

**IFAS
IFAS CONTROL PANEL
COMMUNICATIONS LAYOUT**

DRAWN NDB	CHECKED .	SCALE .	DRAWING NO C-001	SHEET 11 of 12	REV 0
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5.4 FIELD INSTRUMENTS

Aberdeen, ID

Kruger Project #5703212001

Instrumentation

Bill of Material

IFAS

Application	Location	Tag Number	Manufacturer	Model	Part Number	Quantity
Dissolved Oxygen	IFAS Aeration Basin 1 & 2	AIT/AE-101, 201	Hach	LDO-2	9020000	2
				Mounting Hardware	9253000	2
				Transmitter	LXV525.99.A11551	2
Level Transducer	IFAS Aeration Basin 1 & 2	LT-101, 102	E&H	FMX21	FMX21-CE221GGE20A+PO+PS	2
Air Flow Meter	IFAS Aeration Basin 1 & 2	FIT-101-B2, FIT-301-B2	FCI	ST51	ST51-2H12ET201	2
Float Switch	IFAS Aeration Basin 1 & 2	LSH-101, LSH-102	Anchor Scientific	GSI	GSI20NONC	2

		INSTRUMENT DATASHEET				
		PROJECT NAME: Aberdeen, ID				
		PROJECT NO.: 5703212001				
DO PROBE		AIT-101		IFAS 1		
Sensor			Transmitter			
Model No.:	LDO MODEL 2	Model No.:	Sc4500			
Range:	0-20 mg/L	Range:	NA			
Power Supply:	12V Powered by Transmitter	Power Supply:	120VAC			
Power Requirements:	.25A Powered by Transmitter	Power Requirements:	TBD			
Output Signal:	Digital	Output Signal:	4-20mA			
Enclosure Rating:	NEMA 4X	Enclosure Rating:	NEMA 4X			
Operating Temp:	32 - 122°F	Operating Temp:	-4 to 140°F			
Process Connection:	Immersion	Accuracy:	±0.1%			
Cable Length:	10 m	Integral/Remote Mount:	Remote Mount			
Cable Connection:	NA	Local Display:	YES			
Sensor Type:	DO	Input Signal:	(2) Digital			
Comments:						
Function	Signal	Units	Input		Output	
			LRV	URV	LRV	URV
DO	Analog Output 1	mg/L	0	20	4mA	20mA
Description	Manufacturer	Part Number			Qty	
Sensor	Hach	9020000			1	
Mounting Hardware	Hach	9253000			1	
Transmitter	Hach	LXV525.99.A11551			1	
Rev	Date	By	Approval	Remarks		
0	09/27/2023	NDB	.	ISSUED FOR APPROVAL		

		INSTRUMENT DATASHEET				
		PROJECT NAME: Aberdeen, ID				
		PROJECT NO.: 5703212001				
DO PROBE		AIT-201		IFAS 2		
Sensor			Transmitter			
Model No.:	LDO MODEL 2	Model No.:	Sc4500			
Range:	0-20 mg/L	Range:	NA			
Power Supply:	12V Powered by Transmitter	Power Supply:	120VAC			
Power Requirements:	.25A Powered by Transmitter	Power Requirements:	TBD			
Output Signal:	Digital	Output Signal:	4-20mA			
Enclosure Rating:	NEMA 4X	Enclosure Rating:	NEMA 4X			
Operating Temp:	32 - 122°F	Operating Temp:	-4 to 140°F			
Process Connection:	Immersion	Accuracy:	±0.1%			
Cable Length:	10 m	Integral/Remote Mount:	Remote Mount			
Cable Connection:	NA	Local Display:	YES			
Sensor Type:	DO	Input Signal:	(2) Digital			
Comments:						
Function	Signal	Units	Input		Output	
			LRV	URV	LRV	URV
DO	Analog Output 1	mg/L	0	20	4mA	20mA
Description	Manufacturer	Part Number			Qty	
Sensor	Hach	9020000			1	
Mounting Hardware	Hach	9253000			1	
Transmitter	Hach	LXV525.99.A11551			1	
Rev	Date	By	Approval	Remarks		
0	09/27/2023	NDB	.	ISSUED FOR APPROVAL		



Dissolved Oxygen: Hach LDO sc Probe, Model 2

Applications

- Wastewater
- Industrial Water
- Drinking Water



Accurate process monitoring of dissolved oxygen in water for precise aeration control

No Calibration Required

The Hach® LDO sc probe uses luminescent dissolved oxygen technology. Traditional DO probes require DO sensor calibration, which increase maintenance requirements.

No Membranes to Replace

There is virtually no maintenance with Hach's breakthrough luminescent technology. There are no membranes to replace, no electrolyte solution to replenish, and no anode or cathode to clean.

No Missed Cleaning Cycles

The Hach LDO sc probe is equipped with Prognosys, a predictive diagnostic system, that allows you to be proactive in your maintenance by alerting you to upcoming instrument issues. Know with confidence whether changes in your dissolved oxygen level measurements are due to changes

in your instrument or your water. To make sure routine cleaning cycles are never missed, the probe offers operators customizable diagnostic alert indicators, ensuring the probe can operate at its maximum performance level.

Customizable service indicators trigger a service message so that a cleaning cycle is never missed.

No Drift

Cutting-edge 3D calibration procedure is conducted prior to shipping, the DO probe will not drift and is more accurate than ever before.

No Complications

Our newest DO probe has a robust design with a smaller footprint allows for easier handling with enhanced durability.

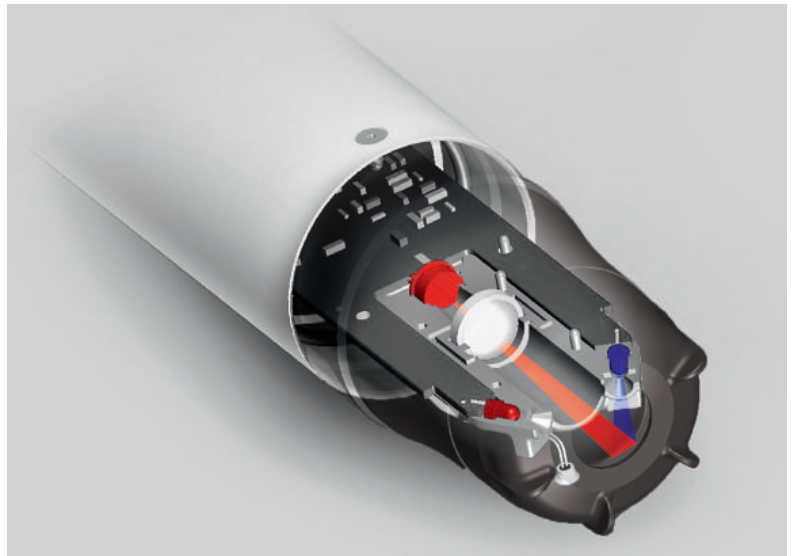
Technical Data*

Range	0 - 20.00 ppm	Flow Rate	None required	
	0 - 20.00 mg/L		Sensor Immersion Depth	Pressure Limits at 345 kPa 345 kPa (50 psi), maximum; accuracy may not be maintained at this depth
	0 - 200% saturation			
Accuracy	± 0.05 ppm below 5 ppm	Transmission Distance	1000 m (3280 ft.) maximum when used with a termination box	
	± 0.1 ppm above 5 ppm			
Response Time	T ₉₀ < 40 s	Cable Length	10 m (options with 30 m, 60 m, 100 m)	
	T ₉₅ < 60 s			
Resolution	0.01 ppm (mg/L)	Dimensions (D x L)	48.25 mm x 254 mm (1.9 in x 10 in)	
	0.1% saturation			
Repeatability	± 0.1 ppm (mg/L)	Weight	1 kg (2.2 lbs), probe only	

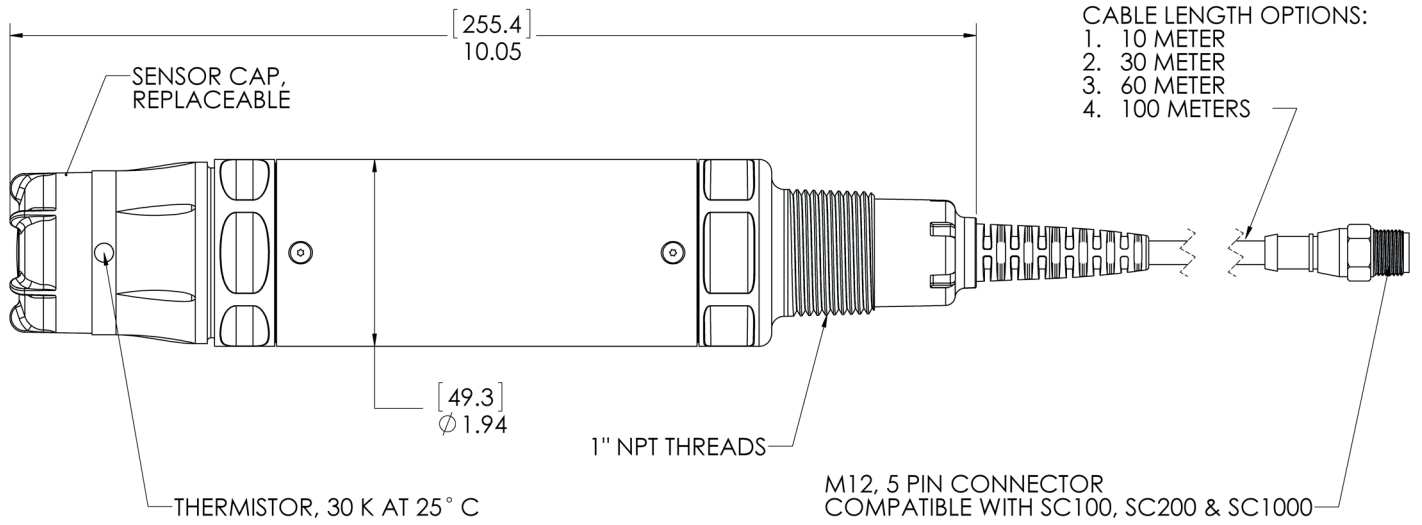
*Subject to change without notice.

Principle of Operation

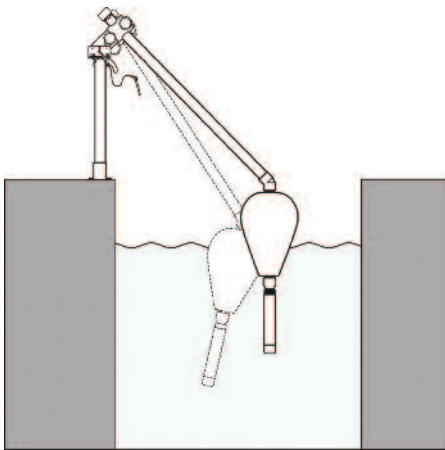
The Hach LDO sc sensor is coated with a luminescent material. Blue light from an LED is transmitted to the sensor surface. The blue light excites the luminescent material. As the material relaxes it emits red light. The time it takes for the red light to be emitted is measured. Between the flashes of blue light, a red LED is flashed on the sensor and used as an internal reference. Increased oxygen in the sample decreases the time it takes for the red light to be emitted. The time measurements correlate to the oxygen concentration.



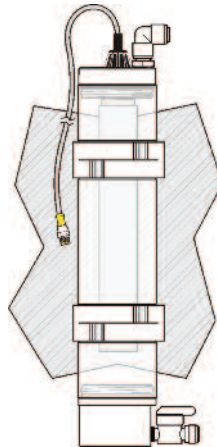
Dimensions



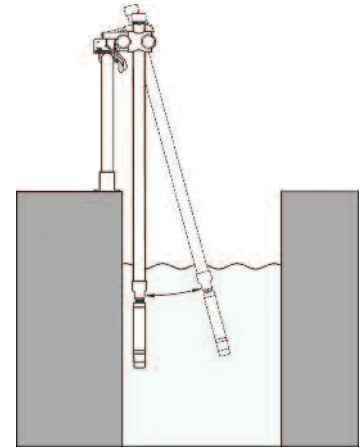
Installation / Mounting



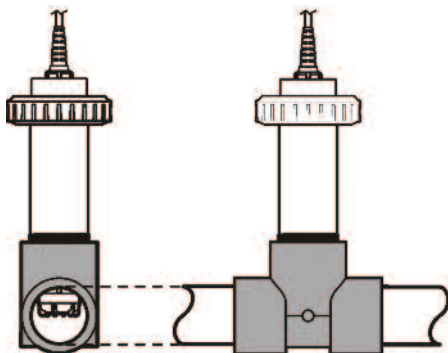
Float Mount Kit



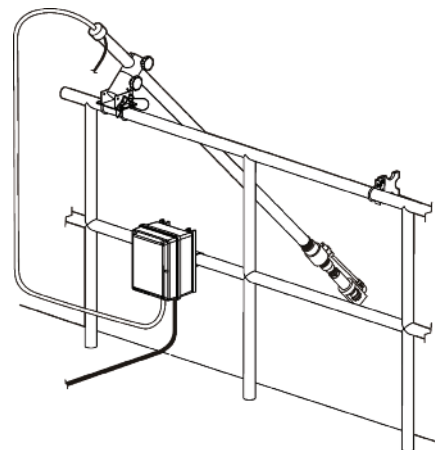
Flow Cell



Pole Mount Kit



Union Mount Kit



Air Blast Cleaning System

Order Information

Sensor

9020000 Hach LDO 2 sc Dissolved Oxygen Probe

9020000-UPGRADE Hach LDO 2 sc Dissolved Oxygen Probe, with Mounting Conversion Adapter

Please note that a Hach SC controller is required to operate the LDO sc Sensor, controller must be purchased separately.

Accessories

5867000 Digital Termination Box

5796000 Digital Extension Cable, 7.7 m (25 ft.)

5796100 Digital Extension Cable, 15 m (50 ft.)

5796200 Digital Extension Cable, 30 m (100 ft.)

6860000 High Output Air Blast Cleaning System, 115 VAC

6860100 High Output Air Blast Cleaning System, 230 Vac

9253500 Air Blast Hardware Components

Replacements and Parts

9021100 LDO sc Model 2 Sensor Cap Replacement Kit

Mounting Kits

9253000 Pole Mount Kit, PVC

9253100 Ball Float Mount Kit, PVC

9257000 Union Mount Kit, PVC

9253400 Mounting Conversion Adapter, LDO sc Model 1 to LDO sc Model 2

7300800 1" NPT sc Sensors Flow Cell

Controllers

SC4500 Digital Controllers

LXV525.99A11551 SC4500 Controller, Prognosis, 5x mA Output, 2 digital Sensors, without plug

LXV525.99A11541 SC4500 Controller, Prognosis, 5x mA Output, 1 digital Sensor, 1 mA Input, without plug

LXV525.99A11501 SC4500 Controller, Prognosis, 5x mA Output, 1 digital Sensor, 100-240 VAC, without power cord

SC200 Digital Controllers

LXV404.99.00512 SC200 controller, 2 channel, digital & pH/DO

LXV404.99.00522 SC200 controller, 2 channel, digital & Conductivity

LXV404.99.00532 SC200 controller, 2 channel, digital & Flow

SC1000 Digital Controllers

LXV402.99.00002 SC1000 Display Module

LXV400.99.1R572 SC1000 Probe Module, 4 Sensors, 4x 4-20mA Out, 4x 4-20mA In, 4x Relays, 100-240 V AC with Conduits

LXV400.99.1B572 SC1000 Probe Module, 4 Sensors, 4x 4-20mA Out, 4x 4-20mA In, Modbus[®] RS485, 4x Relays, 100-240 V AC with Conduits

LXV400.99.1F572 SC1000 Probe Module, 4 Sensors, 4x 4-20mA Out, 4x 4-20mA In, Profibus[®] DP, 4x Relays, 100-240 V AC with Conduits

LXV400.99.1R582 SC1000 Probe Module, 6 Sensors, 4x 4-20mA Out, 4x 4-20mA In, 4x Relays, 100-240 V AC with Conduits



This instrument connects to Claros, Hach's innovative Water Intelligence System. Claros allows you to seamlessly connect and manage instruments, data, and process – anywhere, anytime. The result is greater confidence in your data and improved efficiencies in your operations. To unlock the full potential of Claros, insist on Claros Enabled instruments.



With Hach Service, you have a global partner who understands your needs and cares about delivering timely, high-quality service you can trust. Our Service Team brings unique expertise to help you maximize instrument uptime, ensure data integrity, maintain operational stability, and reduce compliance risk.



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In the interest of improving and updating its equipment, Hach Company reserves the right to alter specifications to equipment at any time. **DOC053.53.35335.May22**

		INSTRUMENT DATASHEET				
		PROJECT NAME: Aberdeen, ID				
		PROJECT NO.: 5703212001				
PRSSURE/LEVEL TRANSDUCER		LT-101		IFAS 1		
Sensor			Transmitter			
Model No.:	FMX21	Model No.:	NA			
Range:	0-20FT	Range:	NA			
Power Supply:	LOOP POWER	Power Supply:	NA			
Power Requirements:	LOOP POWER	Power Requirements:	NA			
Output Signal:	4-20mA	Output Signal:	NA			
Enclosure Rating:	NA	Enclosure Rating:	NA			
Operating Temp:	32 to 122°F	Operating Temp:	NA			
Process Connection:	IMMERSION	Accuracy:	0.20%			
Cable Length:	30FT	Integral/Remote Mount:	NA			
Cable Connection:	N/A	Local Display:	NA			
Sensor Type:	LEVEL TRANSDUCER	Input Signal:	NA			
Comments:						
Function	Signal	Units	Input		Output	
			LRV	URV	LRV	URV
Flow	4-20mA	FT	0	20	4mA	20mA
Description	Manufacturer	Part Number				Qty
LEVEL TRANSDUCER	E&H	FMX21-CE221GGE20A+PO+PS				1
TAGS	E&H	SS TAGS				1
Rev	Date	By	Approval	Remarks		
0	09/27/2023	NDB	.	ISSUED FOR APPROVAL		

		INSTRUMENT DATASHEET				
		PROJECT NAME: Aberdeen, ID				
		PROJECT NO.: 5703212001				
PRSSURE/LEVEL TRANSDUCER		LT-201		IFAS 2		
Sensor			Transmitter			
Model No.:	FMX21	Model No.:	NA			
Range:	0-20FT	Range:	NA			
Power Supply:	LOOP POWER	Power Supply:	NA			
Power Requirements:	LOOP POWER	Power Requirements:	NA			
Output Signal:	4-20mA	Output Signal:	NA			
Enclosure Rating:	NA	Enclosure Rating:	NA			
Operating Temp:	32 to 122°F	Operating Temp:	NA			
Process Connection:	IMMERSION	Accuracy:	0.20%			
Cable Length:	30FT	Integral/Remote Mount:	NA			
Cable Connection:	N/A	Local Display:	NA			
Sensor Type:	LEVEL TRANSDUCER	Input Signal:	NA			
Comments:						
Function	Signal	Units	Input		Output	
			LRV	URV	LRV	URV
Flow	4-20mA	FT	0	20	4mA	20mA
Description	Manufacturer	Part Number				Qty
LEVEL TRANSDUCER	E&H	FMX21-CE221GGE20A+PO+PS				1
TAGS	E&H	SS TAGS				1
Rev	Date	By	Approval	Remarks		
0	09/27/2023	NDB	.	ISSUED FOR APPROVAL		

Technical Information

Waterpilot FMX21

Hydrostatic level measurement

Compact device for level measurement in fresh water, wastewater and saltwater, communication via HART



Reliable and robust level probe with ceramic measuring cell

Application

The Waterpilot FMX21 is a pressure sensor for hydrostatic level measurement. Endress+Hauser offers three different versions of the FMX21 sensor:

- FMX21 with a stainless steel housing, outer diameter of 22 mm (0.87 in): Standard version suitable for drinking water applications and for use in bore holes and wells with small diameters.
- FMX21 with a stainless steel housing, outer diameter of 42 mm (1.65 in): Heavy duty version, easy clean flush-mounted process diaphragm. Ideally suited for wastewater and sewage treatment plants.
- FMX21 with a plastic insulation, outer diameter of 29 mm (1.14 in): Corrosion resistant version generally for use in saltwater, particularly for ship ballast water tanks.

Your benefits

- High resistance to overload and aggressive media
- High-precision, robust ceramic measuring cell with long-term stability
- Climate proofed sensor thanks to completely potted electronics and 2-filter pressure compensation system
- 4 to 20 mA with superimposed HART 6.0 output signal
- Simultaneous measurement of level and temperature with optionally integrated Pt100 temperature sensor
- Accuracy
 - Reference accuracy ± 0.2 %
 - PLATINUM version ± 0.1 %
- Automatic density compensation to increase accuracy
- Usage in drinking water: KTW, NSF, ACS
- Approvals: ATEX, FM, CSA
- Marine certificate: GL, ABS, LR, BV, DNV
- Extensive range of accessories provides complete measuring point solutions





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Document information

Document conventions



Safety symbols

Symbol	Meaning
 A0011189-DE	DANGER! This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.
 A0011190-DE	WARNING! This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
 A0011191-DE	CAUTION! This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.
 A0011192-DE	NOTICE! This symbol contains information on procedures and other facts which do not result in personal injury.

Electrical symbols



Symbol	Meaning
 A0018335	Direct current A terminal to which DC voltage is applied or through which direct current flows.
 A0018336	Alternating current A terminal to which alternating voltage is applied or through which alternating current flows.
 A0018337	Direct current and alternating current <ul style="list-style-type: none"> ▪ A terminal to which alternating voltage or DC voltage is applied. ▪ A terminal through which alternating current or direct current flows.
 A0018338	Ground connection A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system..
 A0018339	Protective ground connection A terminal which must be connected to ground prior to establishing any other connections.
 A0011201	Equipotential connection A connection that has to be connected to the plant grounding system: This may be a potential equalization line or a star grounding system depending on national or company codes of praxis.

Symbols for certain types of information


Symbol	Meaning
 A0011193	Tip Indicates additional information.
 A0015484	Reference to page Refers to the corresponding page number.

Symbols in graphics

Symbol	Meaning
1, 2, 3, 4, ...	Item numbers
A, B, C, D, ...	Views




 A0011187	Hazardous area Indicates a hazardous area.
 A0011188	Safe area (non-hazardous area) Indicates a non-hazardous location.

Symbols at the device

Symbol	Meaning
	Connecting cable immunity to temperature change Indicates that the connecting cables must be able to withstand temperatures of at least 85 °C (185 °F).

Function and system design

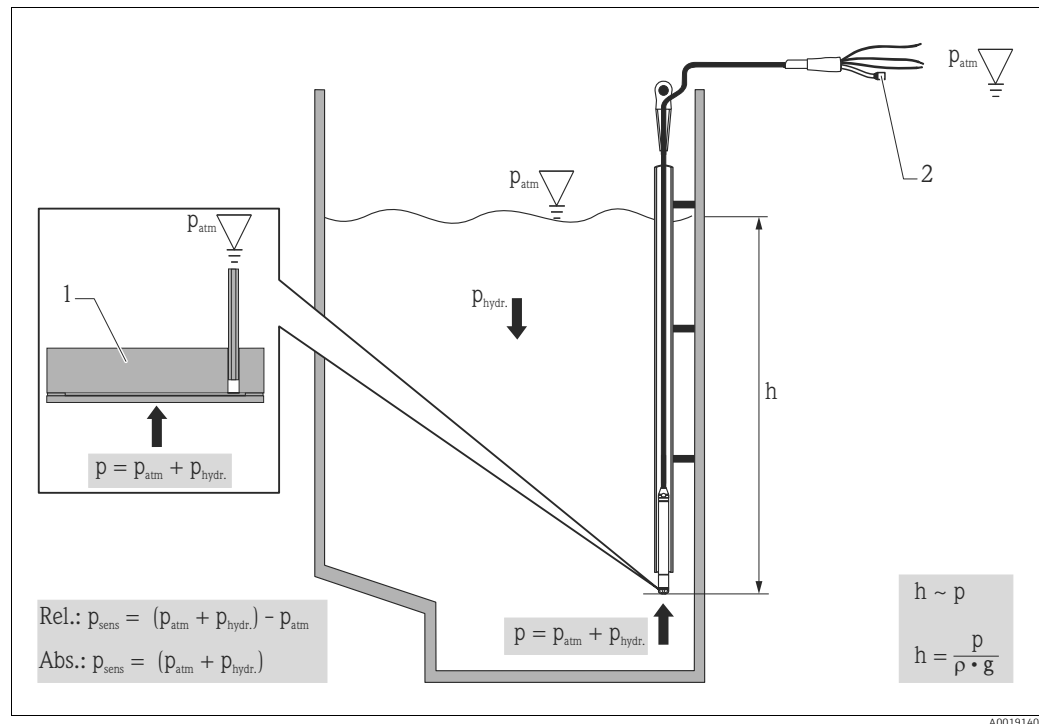
Device selection

Waterpilot FMX21	 A0018640	 A0018641	 A0018642
Field of application	Hydrostatic level measurement in deep wells e.g. drinking water	Hydrostatic level measurement in wastewater	Hydrostatic level measurement in saltwater
	<p>NOTICE The Waterpilot is not suitable for use in biogas plants since the gases can diffuse through the elastomers (seals, extension cable). ► For applications with biogas Endress+Hauser offers the level transmitter Deltapilot.</p>		
Process connection	<ul style="list-style-type: none"> ■ Mounting clamp ■ Extension cable mounting screw with G 1½" A or NPT 1½" thread 		
Outer diameter	22 mm (0.87 in)	42 mm (1.65 in)	max. 29 mm (1.14 in)
Extension cable	PE, PUR, FEP (→ 25)		
Seals	<ul style="list-style-type: none"> ■ FKM Viton ■ EPDM ¹⁾ 	FKM Viton	<ul style="list-style-type: none"> ■ FKM Viton ■ EPDM ¹⁾
Measuring ranges	<ul style="list-style-type: none"> ■ Gauge pressure: from 0 to 0.1 bar to 0 to 20 bar (0 to 1.5 psi to 0 to 300 psi) ■ Absolute pressure: from 0 to 2 bar to 0 to 20 bar (0 to 30 psi to 0 to 300 psi) 		<ul style="list-style-type: none"> ■ Gauge pressure: from 0 to 0.1 bar to 0 to 4 bar (0 to 1.5 psi bis 0 to 60 psi) ■ Absolute pressure: from 0 to 2 bar to 0 to 4 bar (0 to 1.5 psi bis 0 to 60 psi)
	<ul style="list-style-type: none"> ■ Customer-specific measuring ranges; factory-calibrated ■ The following output units can be configured: %, mbar, bar, kPa, MPa, mmH₂O, mH₂O, inH₂O, ftH₂O, psi and numerous level units. 		
Overload	Up to 40 bar (600 psi)		Up to 25 bar (375 psi)
Process temperature range	-10 to +70 °C (+14 to +158 °F)		0 to +50 °C (+32 to +122 °F)
Reference accuracy	<ul style="list-style-type: none"> ■ ±0.2 % of the set span ■ Optional: ±0.1 % of set span (PLATINUM version) 		
Supply voltage	10.5 to 35 V DC, Ex: 10.5 to 30 V DC		
Output	4 to 20 mA (invertible) with superimposed digital communication protocol HART 6.0, 2-wire		
Options	Drinking water approval	—	
	<ul style="list-style-type: none"> ■ Large selection of approvals, including ATEX, FM, CSA ■ Broad range of accessories ■ Integrated Pt100 temperature sensor and TMT182 temperature head transmitter (4 to 20 mA HART) ■ Marine certificate 		
Specialties	<ul style="list-style-type: none"> ■ High-precision, robust ceramic measuring cell with long-term stability ■ Automatic density compensation ■ Customer specific cable marking ■ Absolute pressure measuring cell 		

1) Recommended for drinking water applications and not for use in hazardous areas.

Measuring principle

The ceramic measuring cell is a dry measuring cell, i.e. pressure acts directly on the robust ceramic process isolating diaphragm of the Waterpilot FMX21. Any changes in the air pressure are routed through the extension cable, via a pressure compensation tube, to the rear of the ceramic process isolating diaphragm and compensated for. A pressure-dependent change in capacitance caused by the movement of the process isolating diaphragm is measured at the electrodes of the ceramic carrier. The electronics then convert this into a signal which is proportional to the pressure and is linear to the level of the medium.



- 1 Ceramic measuring cell
2 Pressure compensation tube

- h Level height
 p Total pressure = atmospheric pressure + hydrostatic pressure
 ρ Density of the medium
 g Gravitational acceleration
 $p_{hydr.}$ Hydrostatic pressure
 p_{atm} Atmospheric pressure
 p_{sens} Pressure displayed on the sensor

Temperature measurement with optional Pt100 resistance thermometer ¹⁾

Endress+Hauser also offers the Waterpilot FMX21 with an optional 4-wire Pt100 resistance thermometer to measure level and temperature simultaneously (→ [30](#)). The Pt100 belongs to Accuracy Class B in accordance with DIN EN 60751.

Temperature measurement with optional Pt100 and TMT182 temperature head transmitter ¹⁾

Endress+Hauser also offers the TMT182 temperature head transmitter with the HART protocol to convert the temperature signal to an analog, scalable 4 to 20 mA output signal superimposed with HART 6.0.

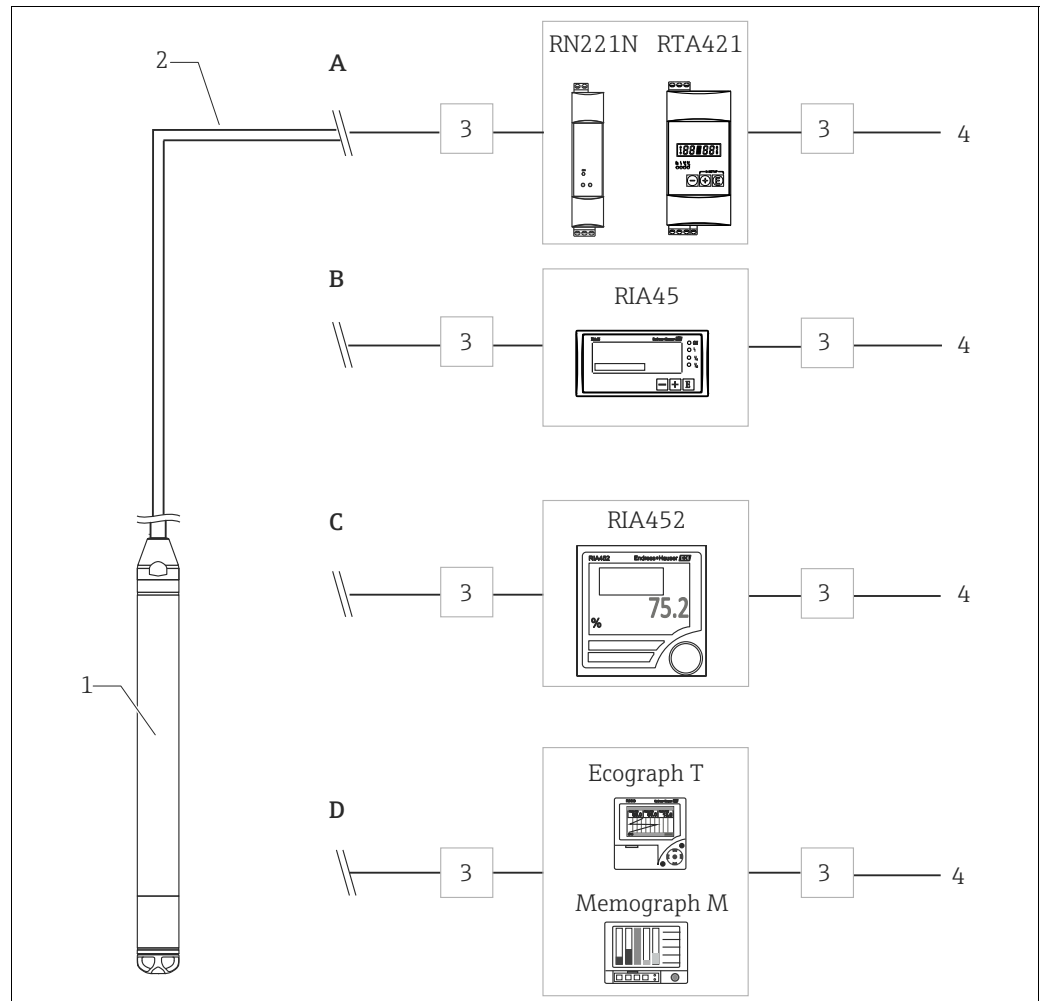
See also: "Density compensation with Pt100 temperature sensor" (→ [9](#)); "Ordering information" (→ [28](#)); "Accessories" (→ [30](#)) and Technical Information TI00078R.

1) Not for use in hazardous areas.

Measuring system

As standard, the complete measuring system consists of a Waterpilot FMX21 and a transmitter power supply unit with a supply voltage of 10.5 to 30 V DC (hazardous areas) or 10.5 to 35 V DC (non-hazardous areas).

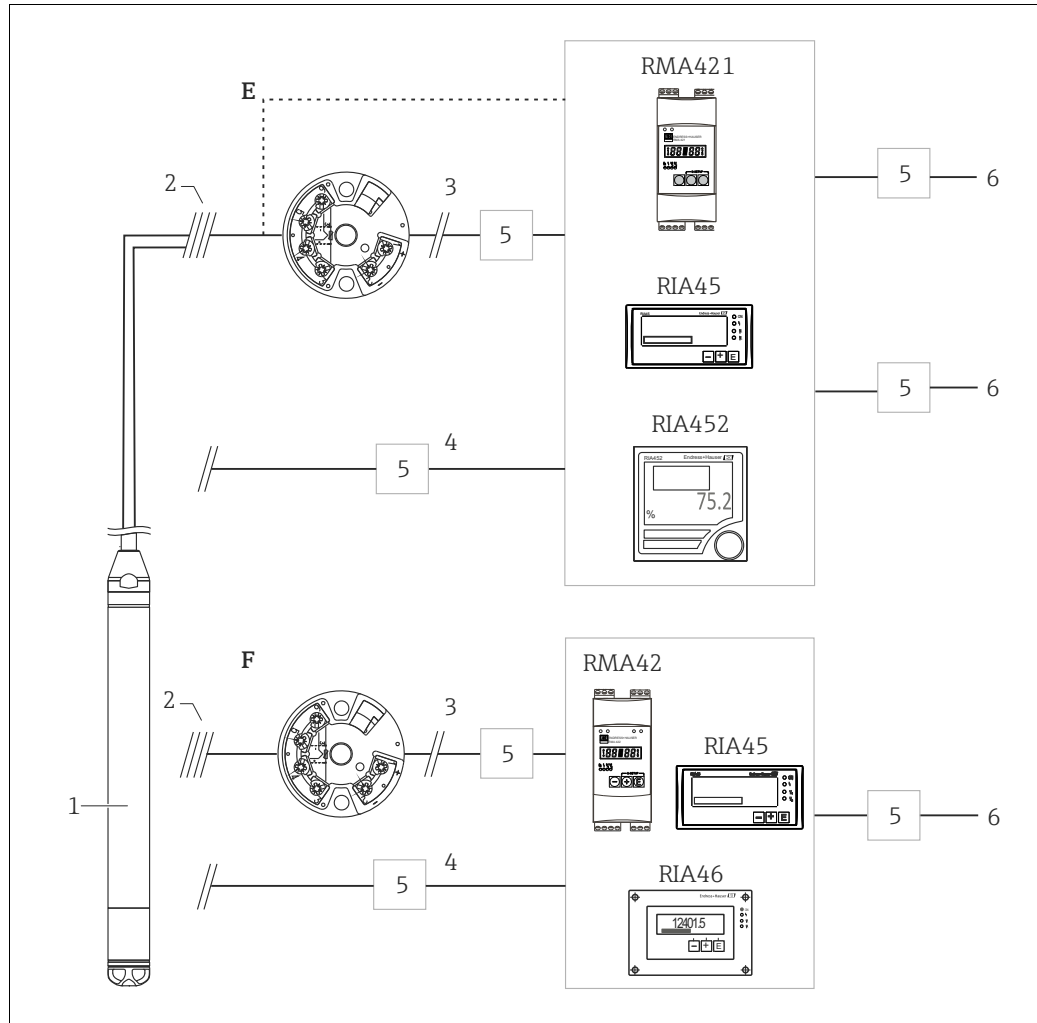
Possible measuring point solutions with a transmitter and evaluation units from Endress+Hauser:



Application examples

- 1 Waterpilot FMX21 HART
- 2 4 to 20 mA HART
- 3 Overvoltage protection (OP), e.g. HAW from Endress+Hauser (not for use in hazardous areas)
 - OP on the sensor side for field installation: HAW569; for top-hat rail/DINrail: HAW562/intrinsically safe HAW562Z
 - OP on the supply side for top-hat rail/DINrail: HAW561 (115/230 V) and HAW561K (24/48 V AC/DC)
 The overvoltage protection selected must be appropriate for the supply voltage.
- 4 Power supply

- A** Simple cost-effective measuring point solution: Power supply of Waterpilot in hazardous and non-hazardous areas using RN221N active barrier. Power supply and additional control of two consumers, e.g. pumps, via limit switch RTA421 with onsite display.
- B** Evaluation unit RIA45 (for panel mounting) provides a power supply system, an onsite display and two switch outputs.
- C** If several pumps are used, the pump service life can be prolonged by alternate switching. With alternating pump control, the pump which was out of service for the longest period of time is switched on. The evaluation unit RIA452 (for panel mounting) provides this option in addition to several other functions.
- D** State-of-the-art recording technology with graphic display recorders from Endress+Hauser, such as Ecograph T, Memograph M, or paper recorders such as Alphalog for documenting, monitoring, visualizing and archiving purposes.



A0018645

Application examples with Pt100

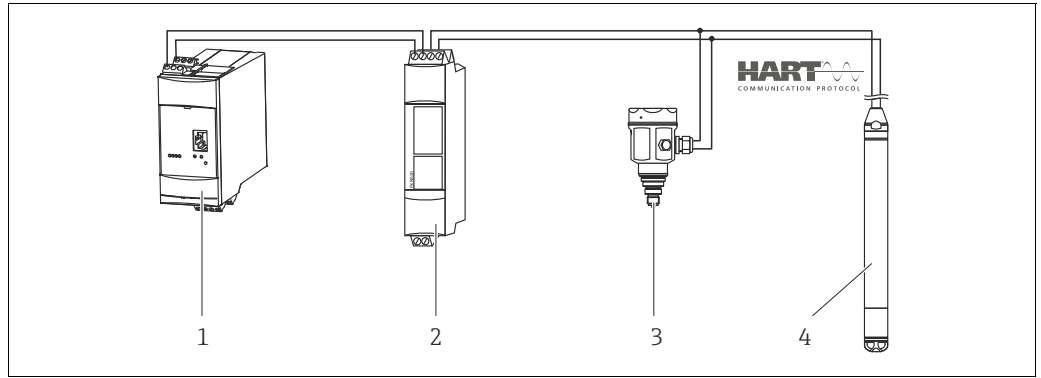
- 1 Waterpilot FMX21 HART
- 2 Connection for integrated Pt100 temperature sensor in the FMX21
- 3 4 to 20 mA HART (Temperature)
- 4 4 to 20 mA HART (Level)
- 5 Overvoltage protection (OP), e.g. HAW from Endress+Hauser (not for use in hazardous areas)
 - OP on the sensor side for field installation: HAW569; for top-hat rail/DINrail: HAW562/intrinsically safe HAW562Z
 - OP on the supply side for top-hat rail/DINrail: HAW561 (115/230 V) and HAW561K (24/48 V AC/DC)
 The overvoltage protection selected must be appropriate for the supply voltage.
- 6 Power supply

E If you want to measure, display and evaluate the temperature as well as the level, e.g. to monitor temperature in fresh water to detect temperature limits for germ formation, you have the following options:

The optional TMT182 temperature head transmitter can convert the Pt100 signal to a 4 to 20 mA HART signal and transfer it to any common evaluation unit. The RMA421, RIA45 and RIA452 evaluation units also offer a direct input for the Pt100 signal.

F If you want to record and evaluate the level and temperature measured value with one device, use the RMA42, RIA45 and RIA46 evaluation units with two inputs. It is even possible to mathematically link the input signals with this unit. These evaluation units are not HART-compatible.

Level measurement with absolute pressure probe and external pressure signal



- 1 Fieldgate FXA520
- 2 Multidrop-Connector FXN520
- 3 Cerabar
- 4 Waterpilot FMX21

A0018757

It is advisable to use an absolute pressure probe for applications in which condensation can occur. In the case of level measurement with an absolute pressure probe, the measured value is affected by fluctuations in the ambient pressure. To correct the resulting measured error, you can connect an external absolute pressure sensor (e.g. Cerabar) to the HART signal cable, switch the waterpilot to the burst mode and the Cerabar to operate in mode "Electr. Delta P". The external absolute pressure sensor then calculates the difference between the two pressure signals and can thus determine the level precisely. Only one level measured value can be corrected in this way.

i If using intrinsically safe devices, strict compliance with the rules for interconnecting intrinsically safe circuits as stipulated in IEC60079-14 (proof of intrinsic safety) is mandatory.

Density compensation with Pt100 temperature sensor

The Waterpilot FMX21 can correct measured errors that result from fluctuations in the density of the water caused by temperature. Users can choose from the following options:

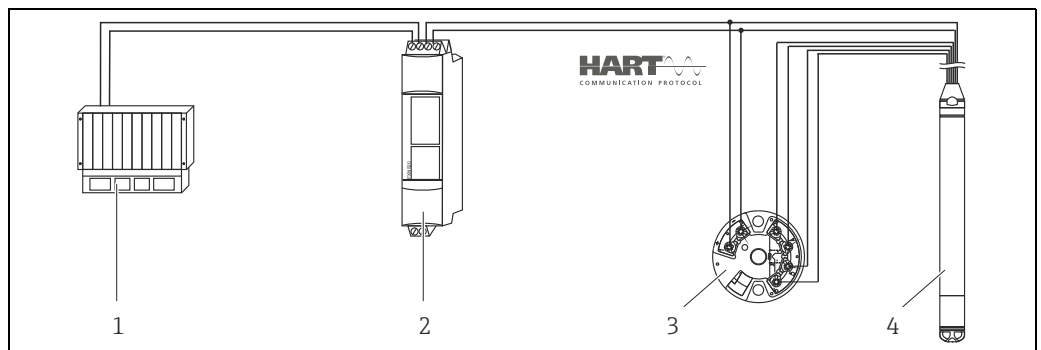
Use the internally measured sensor temperature of the FMX21

The internally measured sensor temperature is calculated in the Waterpilot FMX21 for density compensation. The level signal is thus corrected according to the density characteristic line of the water.

Use the optional internal temperature sensor for density compensation in a suitable HART master (e.g. PLC)

The Waterpilot FMX21 is available with an optional Pt100 temperature sensor. Endress+Hauser additionally offers the TMT182 temperature head transmitter to convert the Pt100 signal to a 4 to 20 mA HART signal.

The temperature and pressure signals are transmitted to the HART master (e.g. PLC) where a corrected level value can be generated using a stored linearization table or the density function (of a chosen medium).




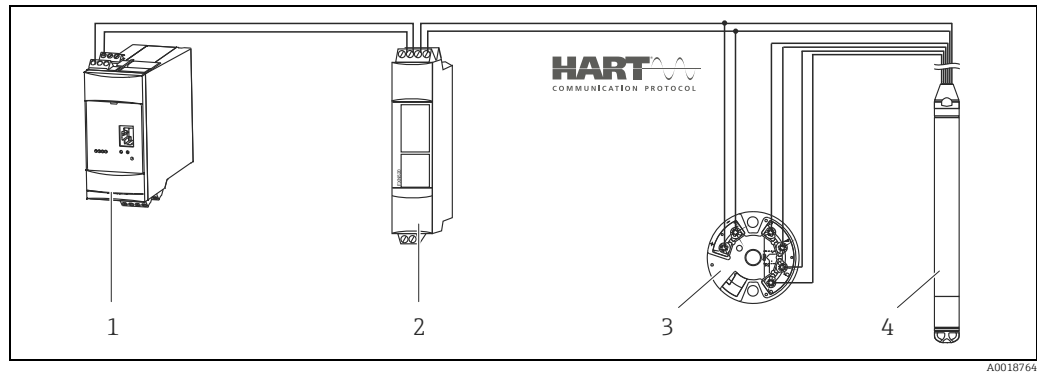
- 1 HART Master, e.g. PLC (programmable logic controller)
- 2 FXN520 Multidrop-Connector
- 3 TMT182 Temperature head transmitter
- 4 Waterpilot FMX21

A0018763

Use an external temperature signal which is transmitted to the FMX21 via HART burst mode


The Waterpilot FMX21 is available with an optional Pt100 temperature sensor. In this case, the signal of the Pt100 is analyzed using a HART-compliant (at least HART 5.0) temperature transmitter that supports BURST mode. The temperature signal can thus be transmitted to the FMX21. The FMX21 uses this signal for the density correction of the level signal.

 The TMT182 temperature head transmitter is not suitable for this configuration.




- 1 Fieldgate FXA520
- 2 Multidrop-Connector FXN520
- 3 TMT182 Temperature head transmitter
- 4 Waterpilot FMX21

Without additional compensation due to the anomaly of water, errors of up to 4 % may occur at a temperature of +70 °C (+158 °F), for example. With density compensation, this error can be decreased to 0.5% in the entire temperature range from 0 to +70 °C (+32 to +158 °F).

-  For further information please refer to the appropriate Technical documentation:
- TI00078R: TMT182 temperature head transmitter (4 to 20 mA/HART)
 - TI00369F: FXA520 Fieldgate
 - TI00400F: FXN520 multidrop connector

Communication protocol 4 to 20 mA HART with communication protocol

System integration The device can be fitted with a tag name, "Ordering information", feature 895 "Marking" version "Z1" (→  28).

Input

Measured variable	FMX21 + Pt100 (optional)	TMT182 temperature head transmitter (optional)
	<ul style="list-style-type: none"> ■ Hydrostatic pressure of a liquid ■ Pt100: temperature 	Temperature

Measuring range

- Customer-specific measuring ranges or factory calibration
- Temperature measurement from -10 to +70 °C (+14 to +158 °F) with Pt100 (optional)

Sensor measuring range [bar (psi)]	Smallest span that can be calibrated ¹⁾ [bar (psi)]	Vacuum resistance [bar _{abs} (psi _{abs})]	Version in the order code ²⁾
Gauge pressure			
0.1 (1.5)	0.01 (0.15)	0.3 (4.5)	1C
0.2 (3.0)	0.02 (0.3)	0.3 (4.5)	1D
0.4 (6.0)	0.04 (1.0)	0	1F
0.6 (9.0)	0.06 (1.0)	0	1G
1.0 (15.0)	0.1 (1.5)	0	1H
2.0 (30.0)	0.2 (3.0)	0	1K
4.0 (60.0)	0.4 (6.0)	0	1M
10.0 (150) ³⁾	1.0 (15)	0	1P
20.0 (300) ³⁾	2.0 (30)	0	1Q
Absolute pressure			
2.0 (30.0)	0.2 (3.0)	0	2K
4.0 (60.0)	0.4 (6.0)	0	2M
10.0 (150) ³⁾	1.0 (15)	0	2P
20.0 (300) ³⁾	2.0 (30)	0	2Q

- 1) Recommended Turn down: Max 100:1
Factory calibration Turn down: Max 20:1, higher on request.
- 2) Ordering information (→ 28)
- 3) These measuring ranges are not offered for the probe version with plastic insulation, outer diameter 29 mm (1.14 in) .

Input signal	FMX21 + Pt100 (optional)	TMT182 temperature head transmitter (optional)
	<ul style="list-style-type: none"> ■ Change in capacitance ■ Pt100: change in resistance 	Pt100 resistance signal, 4-wire

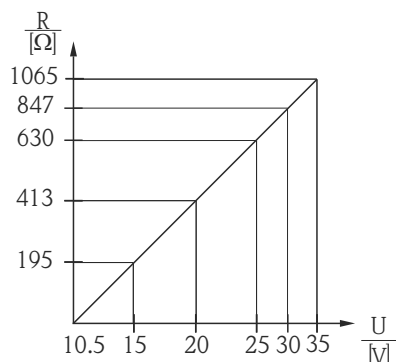
Output

Output signal	FMX21 + Pt100 (optional) <ul style="list-style-type: none"> ▪ 4 to 20 mA with overlying digital HART 6.0 communication protocol, 2-wire for hydrostatic pressure measured value ▪ Pt100: Temperature-dependent resistance values 	TMT182 temperature head transmitter (optional) <p>4 to 20 mA with overlying digital HART 5.0 communication protocol for temperature measured value, 2-wire</p>
Signal range	3.8 to 20.5 mA	
Signal on alarm	FMX21 + Pt100 (optional) <p>4 to 20 mA HART</p> <p>Options:</p> <ul style="list-style-type: none"> ▪ Max. alarm (factory setting 22mA): can be set from 21 to 23 mA ▪ Hold measured value: last measured value is held ▪ Min. alarm: 3.6 mA 	TMT182 temperature head transmitter (optional) <p>Options:</p> <ul style="list-style-type: none"> ▪ Max. alarm ≥ 21.0 mA ▪ Min. alarm ≤ 3.6 mA

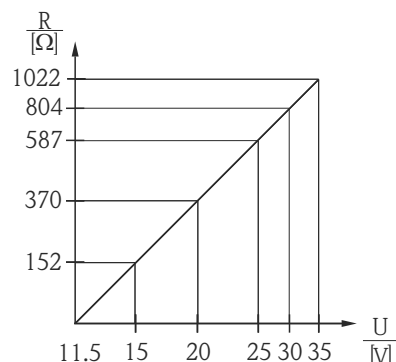
Load	FMX21 $R_{Lmax} \leq \frac{U - 10.5 \text{ V}}{23 \text{ mA}} - 2 \cdot 0.09 \frac{\Omega}{\text{m}} \cdot l - R_{add}$ <p style="text-align: right; font-size: small;">A0018753-EN</p>	TMT182 temperature head transmitter (optional) $R_{Lmax} \leq \frac{U - 11.5 \text{ V}}{0.023 \text{ A}} - R_{add}$ <p style="text-align: right; font-size: small;">A0018754-EN</p>
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- R_{Lmax} = Max. load resistance [Ω]
 R_{add} = Additional resistances such as resistance of evaluation unit and/or display unit, cable resistance [Ω]
 U = Supply voltage [V]
 l = Simple length of extension cable [m], (cable resistance per wire $\leq 0.09 \Omega/m$)

i When using the measuring device in hazardous areas, installation must comply with the corresponding national standards and regulations and the Safety Instructions or Installation or Control Drawings (XA).



FMX21 load chart for estimating the load resistance. Additional resistances, such as the resistance of the extension cable, have to be subtracted from the value calculated as shown in the equation.



Temperature head transmitter TMT182 load chart for estimating the load resistance. Additional resistances have to be subtracted from the value calculated as shown in the equation.

i When operating using a HART handheld terminal or a PC with an operating program, a minimum communication resistance of 250 Ω has to be taken into account.

Damping

- Continuously 0 to 999 s via HART handheld terminal or PC with operating program
- Factory setting: 2 s

Power supply



When using the measuring device in hazardous areas, installation must comply with the applicable national standards and regulations and the Safety Instructions (XAs) and the Installation or Control Drawings (ZDs). All explosion-protection data are given in a separate documentation which is available upon request. This documentation is provided with the devices as standard (→ 32).

Supply voltage**FMX21 + Pt100 (optional)**

- 10.5 to 35 V (non-hazardous area)
- 10.5 to 30 V (hazardous area)

TMT182 temperature head transmitter (optional)

11.5 to 35 V DC

Power consumption**FMX21 + Pt100 (optional)**

- ≤ 0.805 W at 35 V DC (non-hazardous area)
- ≤ 0.690 W at 30 V DC (hazardous area)

TMT182 temperature head transmitter (optional)

≤ 0.805 W at 35 V DC

Current consumption**FMX21 + Pt100 (optional)**

- Max. current consumption: ≤ 23 mA
Min. current consumption: ≥ 3.6 mA
- Pt100: ≤ 0.6 mA

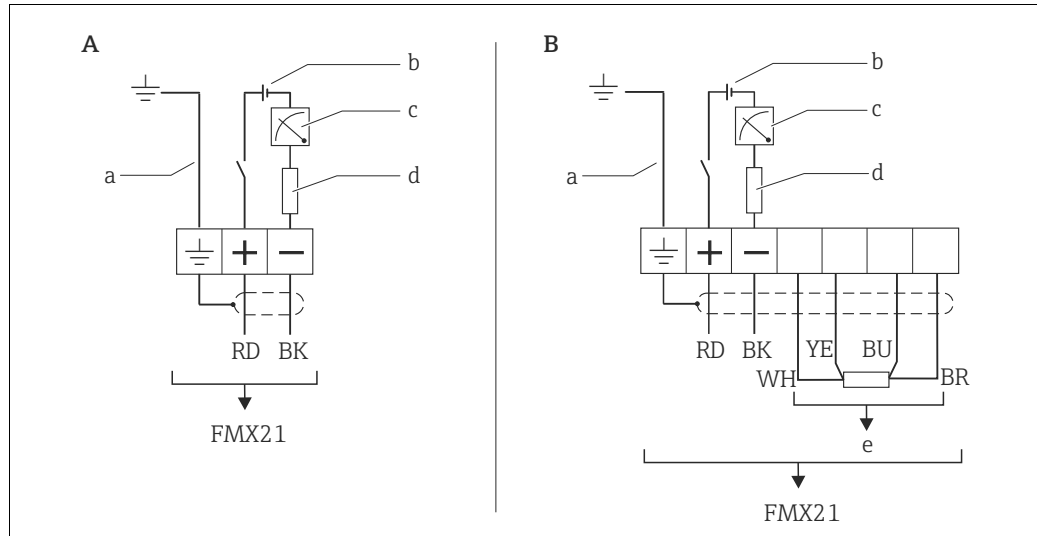
TMT182 temperature head transmitter (optional)

- Max. current consumption: ≤ 23 mA
Min. current consumption: ≥ 3.5 mA
- Pt100 via temperature head transmitter: ≤ 0.6 mA

Measuring unit electrical connection

- Reverse polarity protection is integrated in the Waterpilot FMX21 and in the TMT182 temperature head transmitter. Changing the polarities will not damage the devices.
- The cable must end in a dry room or a suitable terminal box. The terminal box (IP66/IP67) with a GORE-TEX® filter from Endress+Hauser is suitable for outdoor installations. The terminal box can be ordered as an accessory using the order code for FMX21 version "PS" for feature 620 (→ 28).

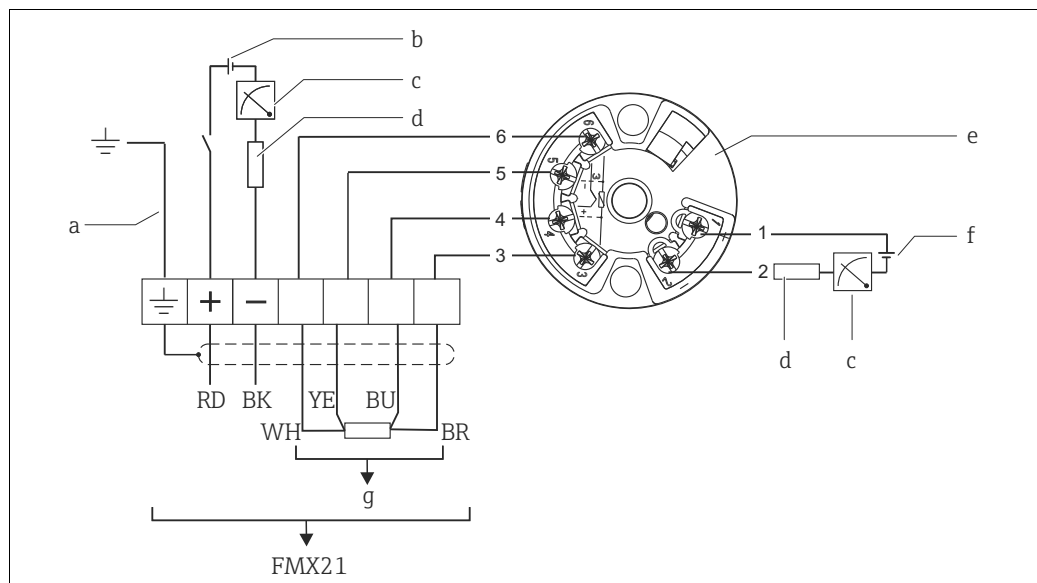
The electrical connection is made with the corresponding wires of the probe cable and with the optional use of the terminal box (Commubox FXA) or an active barrier (e.g. RN221N).



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A Waterpilot FMX21
B Waterpilot FMX21 with Pt100 ¹⁾; Version "NB" for feature 610 "Accessories" in the order code (→ 28)

- a Not for FMX21 with an outer diameter of 29 mm (1.14 in)
- b 10.5 to 30 V DC (Ex), 10.5 to 35 V DC
- c 4 to 20 mA
- d Resistance (R_t)
- e Pt100



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Waterpilot FMX21 with Pt100 and TMT182 temperature head transmitter (4 to 20 mA) ¹⁾ versions "NB" und "PT", feature 610 and 620 in the order code (→ 28)

- a Not for FMX21 with an outer diameter of 29 mm (1.14 in)
- b 10.5 to 35 V DC
- c 4 to 20 mA
- d Resistance (R_t)
- e TMT182 temperature head transmitter (4 to 20 mA)
- f 11.5 to 35 V DC
- g Pt100

¹⁾ Not for use in hazardous areas.

Wire colors

RD = red, BK = black, WH = white, YE = yellow, BU = blue, BR = brown

Connection classification as per IEC 61010-1:

- Overvoltage category 1
- Pollution degree 1

Connection data in the hazardous area

4 to 20 mA	Ex ia IIC T4 to T6
U _i	30 V DC
I _i	133 mA
P _i	1.0 W
C _i	10.3 nF (sensor); 180 pF/m (cable)
L _i	0 μH (sensor); 1 μH/m (cable)
T _a	-10 °C (+14 °F) ≤ T _a ≤ +70 °C (+158 °F) for T4; -10 °C (+14 °F) ≤ T _a ≤ +40 °C (+104 °F) for T6

Cable specifications

FMX21 + Pt100 (optional)

- Commercially available instrument cable
- Terminal, terminal box:
0.08 to 2.5 mm² (28 to 14 AWG)
- If the Pt100 signal is directly connected to a display and/or evaluation unit, Endress+Hauser recommends using a shielded cable.

TMT182 temperature head transmitter (optional)

- Commercially available instrument cable
- Terminal, terminal box:
0.08 to 2.5 mm² (28 to 14 AWG)
- Transmitter connection: max. 1.75 mm² (15 AWG)

Residual ripple

FMX21 + Pt100 (optional)

No impact on the 4 to 20 mA signal to ±5 % residual ripple within the permitted voltage range (according to HART Hardware Specification HCF_SPEC-54 (DIN IEC 60381-1))

TMT182 temperature head transmitter (optional)

$U_{ss} \geq 3 \text{ V}$ at $U \geq 13 \text{ V}$, $f_{max.} = 1 \text{ kHz}$

Performance characteristics

Reference operating conditions

FMX21 + Pt100 (optional)

- As per IEC 60770
- Ambient temperature T_A = constant, in range:
+21 to +33 °C (+70 °F to +91 °F)
- Humidity φ = constant, in range:
20 to 80 % RH
- Ambient pressure p_A = constant, in range:
860 to 1060 mbar (13 to 16 psi)
- Position of the measuring cell = constant, in range, vertical: ±1°
- Supply voltage constant: 21 V DC to 27 V DC
- Load with HART: 250 Ω
- Pt100: DIN EN 60770 T_A = 25 °C (77 °F)

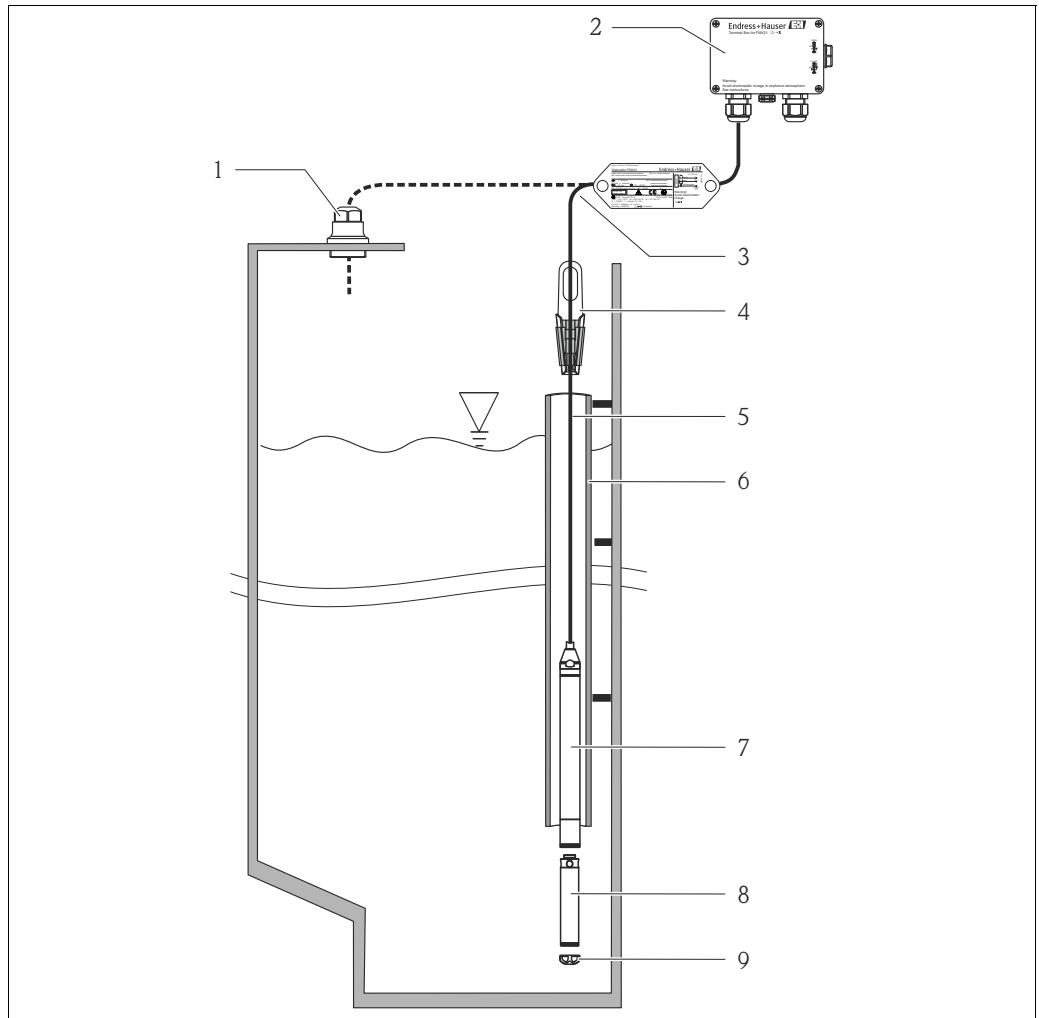
TMT182 temperature head transmitter (optional)

Calibration temperature 25 °C (77 °F) ±5 K

Reference accuracy	<p>FMX21 + Pt100 (optional)</p> <p>The reference accuracy comprises the non-linearity after limit point configuration, hysteresis and non-repeatability in accordance with IEC 60770.</p> <ul style="list-style-type: none"> ■ Setting $\pm 0.2\%$ <ul style="list-style-type: none"> - to TD 5:1: $< 0.2\%$ of the set span - from TD 5:1 to TD 10:1 $\pm(0.02 \times \text{TD} + 0.1)$ <p>PLATINUM version:</p> <ul style="list-style-type: none"> ■ Setting $\pm 0.1\%$ (optional) <ul style="list-style-type: none"> - to TD 5:1: $< 0.1\%$ of the set span - from TD 5:1 to TD 10:1 $\pm(0.02 \times \text{TD})$ ■ Class B to DIN EN 60751 <ul style="list-style-type: none"> - Pt100: max. $\pm 1\text{ K}$ 	<p>TMT182 temperature head transmitter (optional)</p> <ul style="list-style-type: none"> ■ $\pm 0.2\text{ K}$ ■ With Pt100: max. $\pm 0.9\text{ K}$
Resolution	<p>Current output: $1\ \mu\text{A}$</p> <p>Read cycle HART commands: 2 to 3 per second on average</p>	
Long-term stability	<p>FMX21 + Pt100 (optional)</p> <ul style="list-style-type: none"> ■ $\leq 0.1\%$ of URL/year ■ $\leq 0.25\%$ of URL/5 years 	<p>TMT182 temperature head transmitter (optional)</p> <p>$\leq 0.1\text{ K}$ per year</p>
Influence of medium temperature	<ul style="list-style-type: none"> ■ Thermal change in the zero output and the output span 0 to $+30\text{ °C}$ ($+32$ to $+86\text{ °F}$): $<(0.15 + 0.15 \times \text{TD})\%$ -10 to $+70\text{ °C}$ ($+14$ to $+158\text{ °F}$): $<(0.4 + 0.4 \times \text{TD})\%$ ■ Temperature coefficient (T_K) of the zero output and output span -10 to $+70\text{ °C}$ ($+14$ to $+158\text{ °F}$): $0.1\% / 10\text{ K URL}$ 	
Warm-up period	<p>FMX21 + Pt100 (optional)</p> <ul style="list-style-type: none"> ■ FMX21: $< 6\text{ s}$ ■ Pt100: 20 ms 	<p>TMT182 temperature head transmitter (optional)</p> <p>4 s</p>
Step response time	<p>FMX21 + Pt100 (optional)</p> <ul style="list-style-type: none"> ■ FMX21: 400 ms (T90 time), 500 ms (T99 time) ■ Pt100: 160 s (T90 time), 300 s (T99 time) 	<p>—</p>

Installation

Installation instructions



Installation examples, here illustrated with FMX21 with an outer diameter of 22 mm (0.87 in)

- 1 Extension cable mounting screw can be ordered via order code or as an accessory (→ 28)
- 2 Terminal box can be ordered via order code or as an accessory (→ 28)
- 3 Extension cable bending radius > 120 mm (4.72 in)
- 4 Mounting clamp can be ordered via order code or as an accessory (→ 28)
- 5 Extension cable, length (→ 25)
- 6 Guide pipe
- 7 Waterpilot FMX21
- 8 Additional weight can be ordered as an accessory for FMX21 with an outer diameter of 22 mm (0.87 in) and 29 mm (1.14 in)
- 9 Protection cap

Additional installation instruction

- Sideways movement of the level probe can result in measuring errors. For this reason, install the probe at a point free from flow and turbulence, or use a guide tube. The internal diameter of the guide tube should be at least 1 mm (0.04 in) bigger than the outer diameter of the selected FMX21.
- The device is provided with a protection cap to prevent mechanical damage to the measuring cell.
- The cable must end in a dry room or a suitable terminal box. The terminal box from Endress+Hauser provides optimum humidity and climatic protection and is suitable for outdoor installation (→ 30).
- Rod length tolerances: < 5 m (16 ft): ±17.5 mm (0.69 in); > 5 m (16 ft): ±0.2 % (→ 31)
- If the cable is shortened, the filter at the pressure compensation tube has to be reattached. Endress+Hauser offers a cable shortening kit for this purpose → 28 ff; (SD00552P/00/A6).
- Endress+Hauser recommends using twisted, shielded cables.
- Note for ship building applications: Measures for limitation of the propagation of fire along cable bundles are required (fire stops).



Environment

Ambient temperature range	FMX21 + Pt100 (optional) <ul style="list-style-type: none"> ■ With outer diameter of 22 mm (0.87 in) and 42 mm (1.65 in): -10 to +70 °C (+14 to +158 °F) (= medium temperature) ■ With outer diameter of 29 mm (1.14 in): 0 to +50 °C (+32 to +122 °F) (= medium temperature) Cable (fixed installation) <ul style="list-style-type: none"> ■ PE: -30 to +70 °C (-22 to +158 °F) ■ FEP: -40 to +70 °C (-40 to +158 °F) ■ PUR: -40 to +70 °C (-40 to +158 °F) Terminal box -40 to +80 °C (-40 to +176 °F)	TMT182 temperature head transmitter (optional) -40 to +85 °C (-40 to +185 °F)
Storage temperature range	FMX21 + Pt100 (optional) -40 to +80 °C (-40 to +176 °F) Cable (fixed installation) <ul style="list-style-type: none"> ■ PE: -30 to +70 °C (-22 to +158 °F) ■ FEP: -30 to +80 °C (-22 to +176 °F) ■ PUR: -40 to +80 °C (-40 to +176 °F) Terminal box -40 to +80 °C (-40 to +176 °F)	TMT182 temperature head transmitter (optional) -40 to +100 °C (-40 to +212 °F)
Degree of protection	FMX21 + Pt100 (optional) IP68, permanently hermetically sealed at 20 bar (290 psi)(~200 m H ₂ O) Terminal box (optional) IP66, IP67	TMT182 temperature head transmitter (optional) IP00, condensation permitted
Geometric height according to IEC61010-1 Ed.3	Up to 2 000 m (6 600 ft) above MSL.	
Electromagnetic compatibility (EMC)	FMX21 + Pt100 (optional) <ul style="list-style-type: none"> ■ EMC in accordance with all the relevant requirements of the EN 61326 series. Details are provided in the Declaration of Conformity. ■ Maximum deviation < 0.5 % of the span. 	TMT182 temperature head transmitter (optional) EMC in accordance with all the relevant requirements of the EN 61326 series. Details are provided in the Declaration of Conformity.

Overvoltage protection	<p>FMX21 + Pt100 (optional)</p> <ul style="list-style-type: none"> ■ Integrated overvoltage protection to EN 61000-4-5 (500 V symmetrical/1000 V asymmetrical) ■ Install overvoltage protection ≥ 1.0 kV, external if necessary 	<p>TMT182 temperature head transmitter (optional)</p> <p>Install overvoltage protection, external if necessary.</p>
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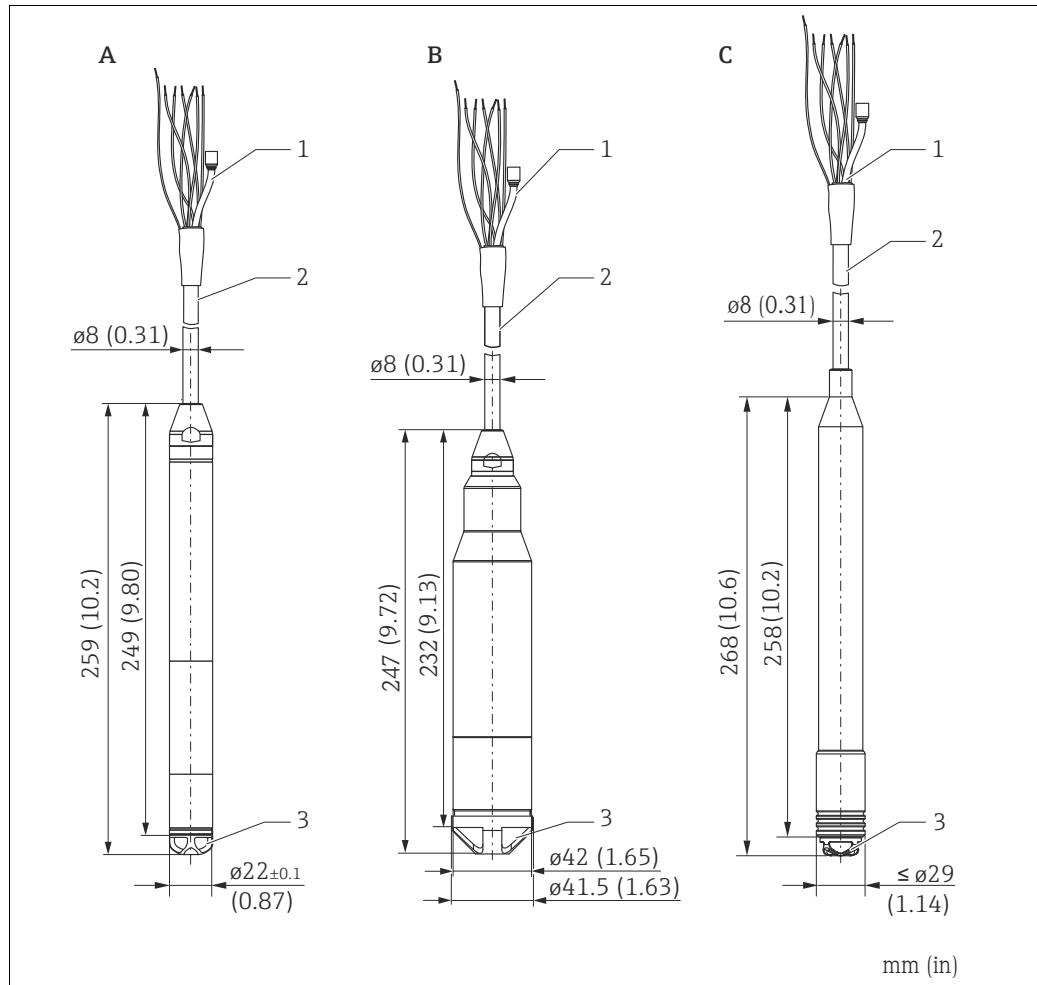
Process

Medium temperature range	<p>FMX21 + Pt100 (optional)</p> <ul style="list-style-type: none"> ■ With outer diameter of 22 mm (0.87 in) and 42 mm (1.65 in): -10 to +70 °C (+14 to +158 °F) ■ With outer diameter of 29 mm (1.14 in): 0 to +50 °C (+32 to +122 °F) 	<p>TMT182 temperature head transmitter (optional)</p> <p>—</p>
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Medium temperature limits	<p>FMX21 + Pt100 (optional)</p> <ul style="list-style-type: none"> ■ With outer diameter of 22 mm (0.87 in) and 42 mm (1.65 in): -20 to +70 °C (-4 to +158 °F) ■  In hazardous areas incl. CSA GP, the medium temperature limit is at -10 to +70 °C (+14 to +158 °F). ■ With outer diameter of 29 mm (1.14 in): 0 to +50 °C (+32 to +122 °F) ■  The FMX21 can be operated in this temperature range. The specification can then be exceeded, e.g. measuring accuracy. 	<p>—</p>
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Mechanical construction

Dimensions of the level probe



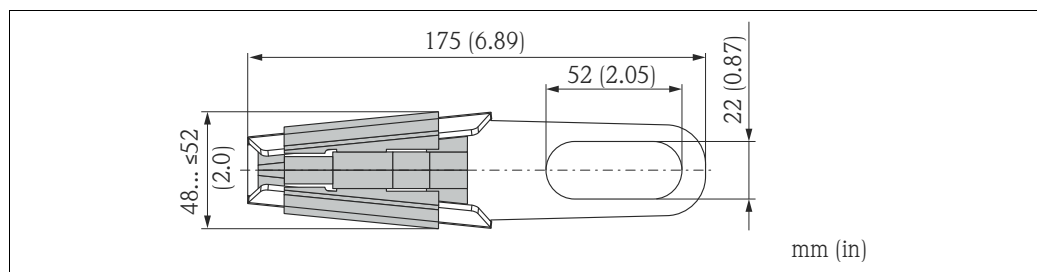
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Versions of the FMX21

- A** In the order code: feature 45 "Probe tube", version "1" or "Accessories" (\rightarrow [28](#))
- B** In the order code: feature 45 "Probe tube", version "2" (\rightarrow [28](#))
- C** In the order code: feature 45 "Probe tube", version "5" (\rightarrow [28](#))

- 1 Pressure compensation tube
- 2 Extension cable ((Length, see \rightarrow [25](#)))
- 3 Protection cap

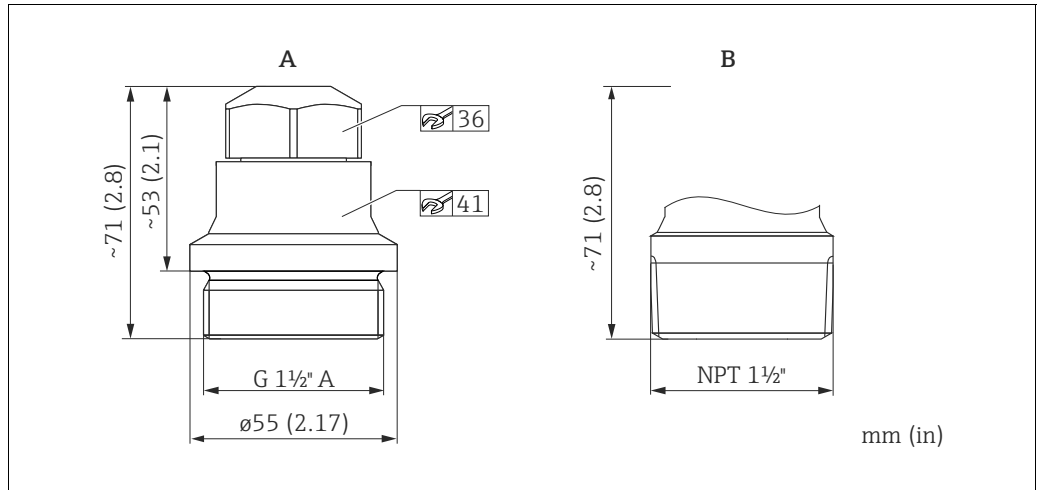
Dimensions of the mounting clamp




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In the order code: feature 620 "Accessories", version "PO" (\rightarrow [28](#))

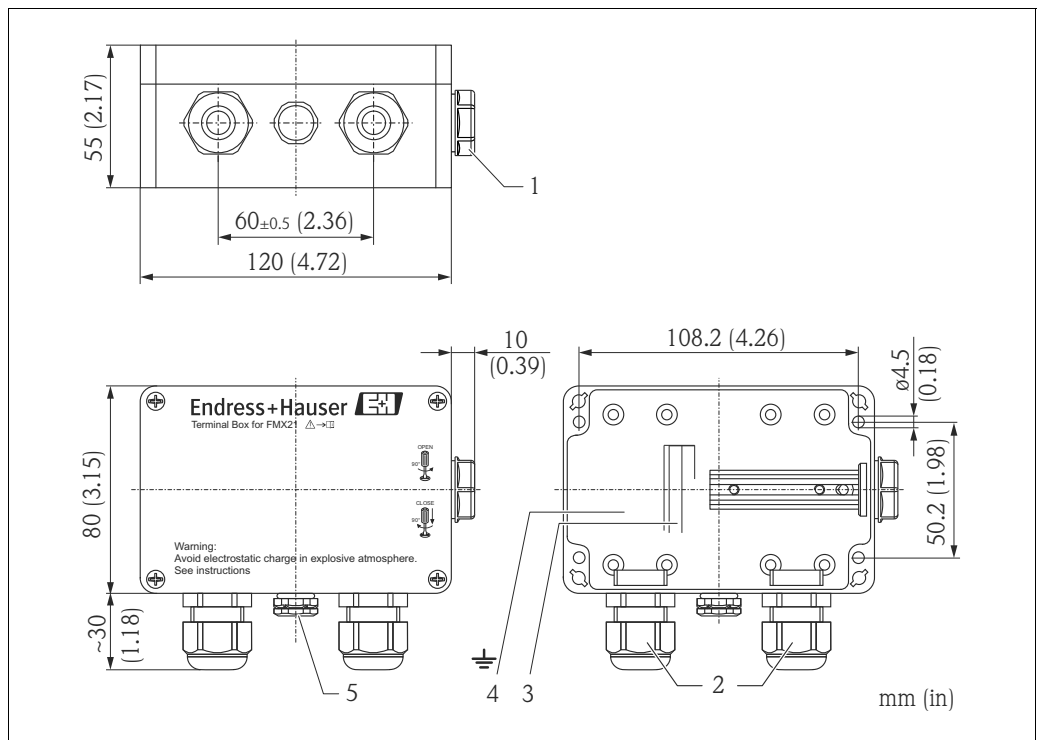
Dimensions of the extension cable mounting screws



- A** G 1 1/2" A, in the order code: feature 620 "Accessories", version "PQ" (→ 28)
- B** NPT 1 1/2", in the order code: feature 620 "Accessories", version "PR" for (→ 28)

 Application in unpressurized containers only.


Dimensions of the IP66, IP67 terminal boxes with filters



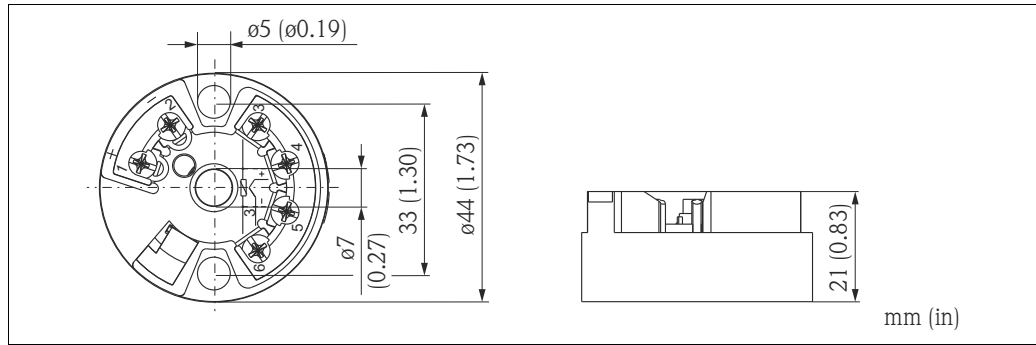
In the order code: feature 620, version "PS" or "PT" (→ 28)

- 1 Dummy plug M20x1.5
- 2 Cable gland M20x1.5
- 3 4 to 20 mA; terminals for 0.08 to 2.5 mm² (28 to 14 AWG)
- 4 Ground connection; terminals for 0.08 to 2.5 mm² (28 to 14 AWG)
- 5 GORE-TEX® filter

If ordered together with FMX21 but without the optional TMT182 temperatur transmitter, the terminal box is incl. a 4-terminal strip.

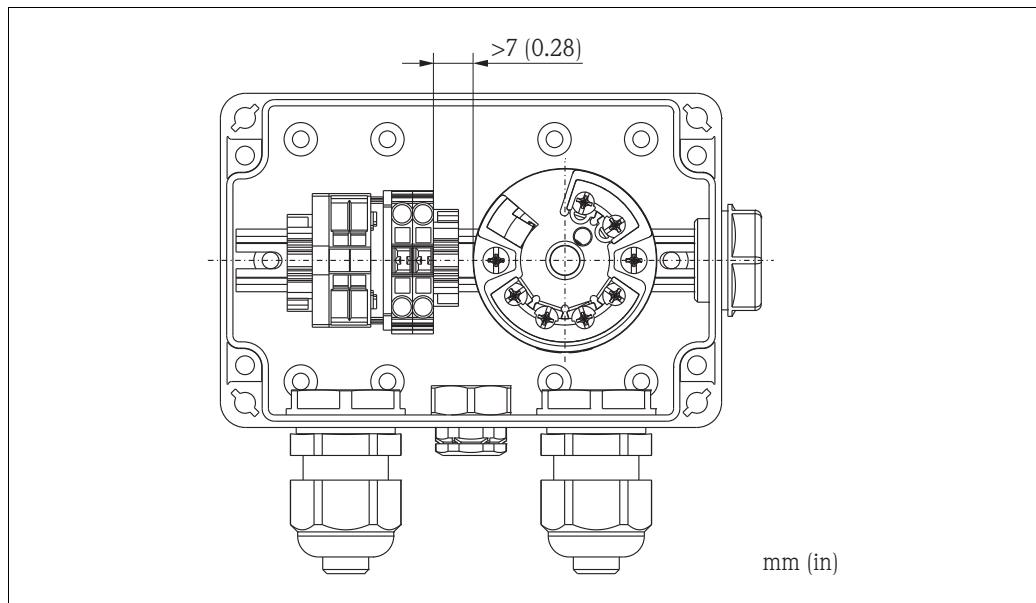
 The 4-terminal strip is not intended for use in hazardous areas incl. CSA GP.

Dimensions of the TMT182 temperature head transmitter



In the order code: feature 620 "Accessories", version "PT" for (→ 28)

Terminal box with integrated TMT182 temperature head transmitter (4 to 20 mA HART)

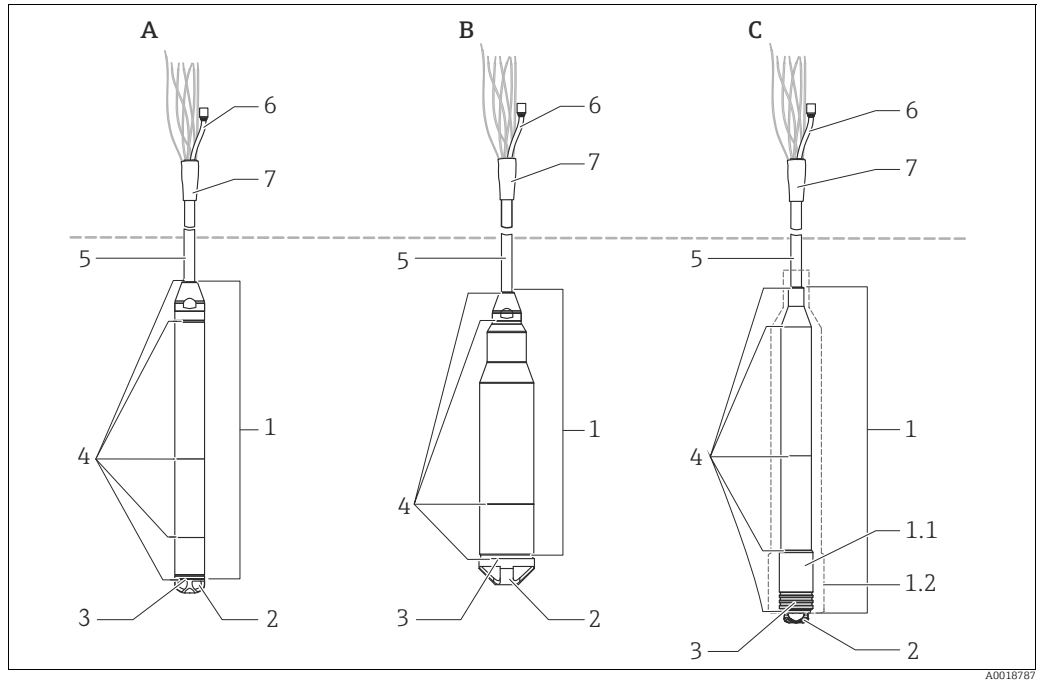


i A distance of > 7 mm (> 0.28 in mm) must be maintained between the terminal strip and the TMT182 temperature head transmitter.



Weight

Component part	Weight
Level probe, outer diameter 22 mm (0.87 in)	344 g (12.133 oz)
Level probe, outer diameter 42 mm (1.65 in)	1376 g (48.532 oz)
Level probe, outer diameter 29 mm (1.14 in)	394 g (13.896 oz)
Extension cable <ul style="list-style-type: none"> ▪ PE ▪ PUR ▪ FEP 	<ul style="list-style-type: none"> ▪ 52 g/m (0.035 lbs/1 ft) ▪ 60 g/m (0.040 lbs/1 ft) ▪ 108 g/m (0.072 lbs/1 ft)
Mounting clamp	170 g (5.996 oz)
Extension cable mounting screw G 1½" A	770 g (27.158 oz)
Extension cable mounting screw NPT 1½"	724 g (25.535 oz)
Terminal box	235 g (8.288 oz)
Temperature head transmitter TMT182	40 g (1.411 oz)
Additional weight	300 g (10.581 oz)
Testing adapter	39 g (1.376 oz)

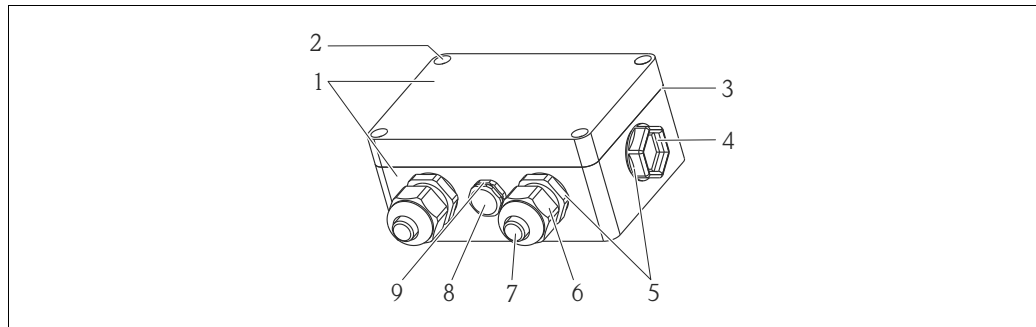
Material



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Material in contact with process		
Position number	Component part	Material
1	A: Level probe, outer diameter 22 mm (0.87 in) B: Level probe, outer diameter 42 mm (1.65 in) C: Level probe, outer diameter max. 29 mm (1.14 in)	316L (1.4404/1.4435)
1.1	Sensor sleeve	PPS (polyphenylene sulfide)
1.2	Heat-shrink sleeve	Polyolefin and hot-melt adhesive
	 The heat-shrink sleeve at the level probe acts as an insulation. It prevents electrical contact between the probe and the tank. Electrochemical corrosion is thus avoided.	
2	Protection cap <ul style="list-style-type: none"> ▪ A and C: with outer diameter 22 mm (0.87 in) and 29 mm (1.14 in) ▪ B: with outer diameter 42 mm (1.65 in) 	<ul style="list-style-type: none"> ▪ PPO (Polyphenylenoxid) ▪ PFA (Perfluoralkoxy)
3	Process ceramic	Al ₂ O ₃ (aluminum oxide ceramic)
4	Seal	EPDM or FKM Viton
5	Extension cable insulation For more information →  25	Either: <ul style="list-style-type: none"> ▪ PE-LD (low-density polyethylene) ▪ FEP (fluorinated ethylene propylene) ▪ PUR (polyurethane)
Material not in contact with process		
6	Pressure compensation tube	PA
7	Heat-shrink sleeve	Polyolefin

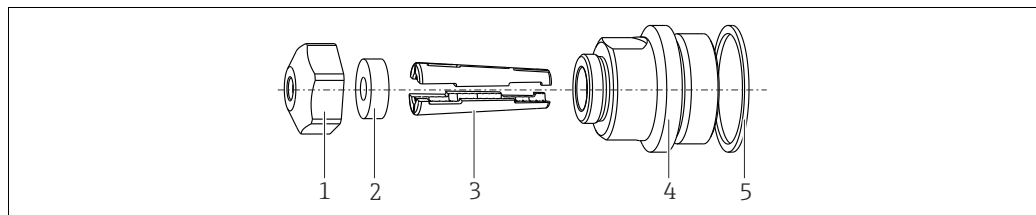
Terminal box (not in contact with process)



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Position number	Component part	Material
1	Housing	PC
2	Mounting screws (4 x)	A2
3	Seal	CR (Chloropren-Unvulcanized rubber)
4	Dummy plug M20x1.5	PBT-GF30
5	Cable gland M20x1.5	PE-HD
6		PA6
7		PA6-GF30
8	Pressure compensation tube	PA6-GF10, ePTFE
9	Pressure compensation tube O-ring	Silicone (VMQ)

Cable mounting screw (not in contact with process)



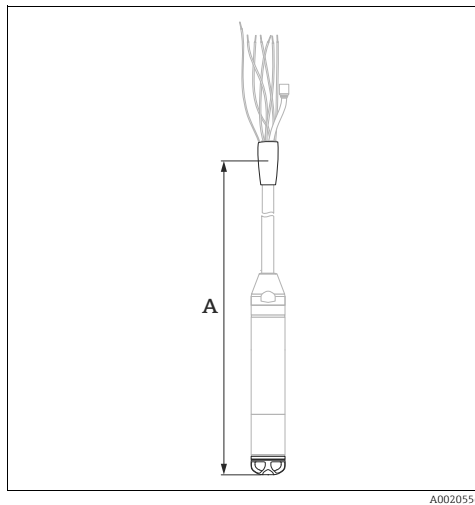
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Position number	Component part	Material
1	Cover cable gland	304 (1.4301)
2	Seal	NBR
3	Klemmhülsen	PA66-GF35
4	Anschlussstück cable gland G 1 1/2" A, NPT 1 1/2"	304 (1.4301)
5	Seal → only for G 1 1/2" A	EPDM

Extension cable

PE	PUR	FEP
<ul style="list-style-type: none"> ▪ Abrasion-resistant extension cable with Dynema strain-relief members ▪ Shielded with aluminum-coated film ▪ Insulated with polyethylene (PE), black ▪ Copper wires, twisted ▪ Pressure compensation tube with Teflon filter 	<ul style="list-style-type: none"> ▪ Abrasion-resistant extension cable with Dynema strain-relief members ▪ Shielded with aluminum-coated film ▪ Insulated with polyurethane (PUR), black ▪ Copper wires, twisted ▪ Pressure compensation tube with Teflon filter 	<ul style="list-style-type: none"> ▪ Abrasion-resistant extension cable ▪ Shielded with galvanized steel wire netting ▪ Insulated with fluorinated ethylene propylene (FEP), black ▪ Copper wires, twisted ▪ Pressure compensation tube with Teflon filter

Cable length



A Cable length

- Please refer also to "Load" (→ 12).
- Cable lengths that can be ordered
 - Customer-specific length in meters or feet (→ 28, "Ordering information")
 - Limited cable length when performing installation with freely suspended device with extension cable mounting screw or mounting clamp, as well as for hazardous areas: max. 300 m (984 ft).

i When using the measuring device in hazardous areas, installation must comply with the applicable national standards and regulations and the Safety Instructions (XAs) or the Installation or Control Drawings (ZDs) "Documentation"

Cross-section

- Total outer diameter: 8.0 mm (0.31 in) ±0.25 mm (±0.01 in)
- FMX21: 3 x 0.227 mm² (3 x 26 AWG) + pressure compensation tube with Teflon filter
- FMX21 with Pt100 (optional): 7 x 0.227 mm² (7x 26 AWG) + pressure compensation tube with Teflon filter
- Pressure compensation tube with Teflon filter: outer diameter 2.5 mm (0.1 in), internal diameter 1.5 mm (0.06 in)

Cable resistance

per wire: ≤ 0.09 Ω/m

Further technical data

- Minimum bending radius: 120 mm (4.72 in)
- Tensile strength: max. 950 N (213.56 lbf)
- Cable extraction force (= necessary tensile force to extract the cable from the level probe):
 - PE, FEP: typical ≥ 400 N (89.92 lbf), PUR: typical ≥ 150 N (33.72 lbf)
 - for use in hazardous areas: ≥ 100 N (73,75 lbf)
- Resistance to UV light
- PE: Usage in drinking water

Terminals

- Three terminals as standard in the terminal box
- 4-terminal strip can be ordered as an accessory, Order No: 52008938
Conductor cross-section 0.08 to 2.5 mm² (28 to 14 AWG)

i The 4-terminal strip is not intended for use in hazardous areas incl. CSA GP.

Operability

FieldCare

FieldCare is Endress+Hauser's plant asset management tool based on FDT technology. You can use FieldCare to configure all Endress+Hauser devices as well as third-party devices which support the FDT standard.

FieldCare supports the following functions:

- Configuration of transmitters in offline and online mode
- Loading and saving device data (upload/download)
- Documentation of the measuring point

Connection options:


- Via Commubox FXA195 and the USB port of a computer
- Via Fieldgate FXA520

For further information and free download of FieldCare see → www.endress.com → Download → Search: FieldCare

Field Xpert SFX

Field Xpert is an industrial PDA with integrated 3.5" touchscreen from Endress+Hauser based on Windows Mobile. It communicates via wireless with the optional VIATOR® Bluetooth® modem connected to a HART device point-to-point or wireless via WiFi and Endress+Hauser's Fieldgate FXA520. Field Xpert also works as a stand-alone device for asset management applications. For details refer to BA00060S/00/EN.

Certificates and approvals

CE mark	The device meets the legal requirements of the applicable EC Directives. Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.
Ex approval	<ul style="list-style-type: none"> ▪ ATEX ▪ CSA C/US ▪ FM ▪ IEC ▪ NEPSI ▪ INMETRO  <ul style="list-style-type: none"> ▪ The approvals to apply only for Waterpilot FMX21 without Pt100 and without TMT182. ▪ Waterpilot FMX21 is only available for use in hazardous areas with the FKM Viton seal. ▪ All explosion protection data are given in separate documentation which is available upon request. The Ex documentation is supplied as standard with all devices approved for use in explosion hazardous areas (→ 32).
Drinking water approval	<p>For FMX21 with outer diameter 22 mm (0.87 in)</p> <ul style="list-style-type: none"> ▪ KTW certificate ▪ NSF 61 approval ▪ ACS approval
Marine certificate	<ul style="list-style-type: none"> ▪ GL (Germanischer Lloyd) ▪ ABS (American Bureau of Shipping) ▪ LR (Lloyds Register) ▪ BV (Bureau Veritas) ▪ DNV (Det Norske Veritas)
Standards and guidelines	<p>The European standards and guidelines that have been applied are listed in the associated EC Declarations of Conformity. In addition, the following standards were also applied for the Waterpilot FMX21:</p> <ul style="list-style-type: none"> ▪ DIN EN 60770 (IEC 60770): Transmitters for use in industrial process control systems Part 1: Methods for performance evaluation ▪ DIN 16086: Electrical pressure measuring instruments, pressure sensors, pressure transmitters, pressure measuring instruments, concepts, specifications on data sheets ▪ EN 61326: Electrical equipment for measurement, control and laboratory use – EMC requirements ▪ EN 61010-1 (IEC 61010-1): Safety requirements for electrical equipment for measurement, control and laboratory use ▪ IEC 60529: Degrees of protection provided by enclosures

Ordering information

FMX21

You can enter the versions for the specific feature in the following table. The versions entered make up the complete order code. Options which are mutually exclusive are not marked.

10	Approval:			
	AA	Non-hazardous area		
	BE	ATEX II 2 G Ex ia IIC T6		
	BD	ATEX II 3 G Ex nA IIC T6		
	FE	FM IS, Cl. I Division 1, Groups A - D, AEx ia, zone 1		
	CE	CSA C/US IS Cl. I Division 1, Groups A - D, Ex ia, zone 1		
	CD	CSA General Purpose		
	IC	IEC Ex ia IIC T6 Gb		
	MA	INMETRO Ex ia IIC T6		
	NA	NEPSI Ex ia IIC T6		
20	Output:			
	2	4-20 mA HART		
45	Probe tube:			
	1	Outer diameter d = 22 mm, AISI 316L		
	2	Outer diameter d = 42 mm, flush-mounted, AISI 316L		
	5	Outer diameter d = 29 mm, AISI 316L, PPS/polyolefin for saltwater applications		
70	Sensor range:			
	Measuring range			
	1C	100 mbar/10 kPa/1.5 psi gauge, 1 m H ₂ O/3 ft H ₂ O/40 in H ₂ O		
	1D	200 mbar/20 kPa/3 psi gauge, 2 m H ₂ O/6 ft H ₂ O/80 in H ₂ O		
	1F	400 mbar/40 kPa/6 psi gauge, 4 m H ₂ O/13 ft H ₂ O/160 in H ₂ O		
	1G	600 mbar/60 kPa/9 psi gauge, 6 m H ₂ O/20 ft H ₂ O/240 in H ₂ O		
	1H	1 bar/100 kPa/15 psi gauge, 10 m H ₂ O/33 ft H ₂ O/400 in H ₂ O		
	1K	2 bar/200 kPa/30 psi gauge, 20 m H ₂ O/67 ft H ₂ O/800 in H ₂ O		
	1M	4 bar/400 kPa/60 psi gauge, 40 m H ₂ O/133 ft H ₂ O/1600 in H ₂ O		
	1P	10 bar/1 MPa/150 psi gauge, 100 m H ₂ O/333 ft H ₂ O/4000 in H ₂ O		
	1Q	20 bar/2 MPa/300 psi gauge, 200 m H ₂ O/667 ft H ₂ O/8000 in H ₂ O		
	2K	2 bar/200 kPa/30 psi absolute, 20 m H ₂ O/67 ft H ₂ O/800 in H ₂ O		
	2M	4 bar/400 kPa/60 psi absolute, 40 m H ₂ O/133 ft H ₂ O/1600 in H ₂ O		
	2P	10 bar/1 MPa/150 psi absolute, 100 m H ₂ O/333 ft H ₂ O/4000 in H ₂ O		
	2Q	20 bar/2 MPa/300 psi absolute, 200 m H ₂ O/667 ft H ₂ O/8000 in H ₂ O		
80	Reference accuracy:			
	D	Platinum		
	G	Standard		
90	Calibration, unit:			
	A	Sensor range; %		
	B	Sensor range; mbar/bar		
	C	Sensor range; kPa/MPa		
	D	Sensor range; mm/mH ₂ O		
	E	Sensor range; in H ₂ O/ft H ₂ O		
	F	Sensor range; psi		
	J	Customized pressure; see additional specification		
	K	Customized level; see additional specification		
FMX21-				Order code

→ Ordering information for continued on next page

FMX21 (continued)

100										Probe connection:	
										10	10 m cable, shortable, PE
										11	20 m cable, shortable, PE
										15 m cable, shortable, PE
										20	30 ft cable, shortable, PE
										21	60 ft cable, shortable, PE
										25 ft cable, shortable, PE
										30	10 m cable, shortable, FEP
										31	20 m cable, shortable, FEP
										35 m cable, shortable, FEP
										40	30 ft cable, shortable, FEP
										41	60 ft cable, shortable, FEP
										45 ft cable, shortable, FEP
										50	10 m cable, shortable, PUR
										51	20 m cable, shortable, PUR
										55 m cable, shortable, PUR
										60	30 ft cable, shortable, PUR
										61	60 ft cable, shortable, PUR
										65 ft cable, shortable, PUR
190										Seal:	
										A	FKM Viton
										H	EPDM
FMX21-											Order code

Additional ordering information (optional)


550										Calibration	
										F1	Works calib. certificate 5-point
570										Service	
										IA	Adjusted min alarm current
										IB	Adjusted HART Burst Mode PV
										IR	... m cable marking>installation
										IS	... ft cable marking>installation
										I9	Special version
590										Additional approval	
										LE	GL Marine certificate
										LF	ABS Marine certificate
										LG	LR Marine certificate
										LH	BV Marine certificate
										LI	DNV Marine certificate
										LQ	KTW potable water approval
										LR	NSF potable water approval
										LS	ACS potable water approval
610										Accessories mounted	
										NB	Temperature sensor Pt100, 4-wire
620										Accessories enclosed	
										PO	Suspension clamp, 316L
										PQ	Cable mounting screw G1½", 304
										PR	Cable mounting screw NPT1½", 304
										PS	Terminal box IP66/67
										PT	Temperature head transmitter TMT182, 2-wire, 4-20 mA, -20 to 80 °C
										PU	Additional weight, 316L
										PV	Adapter, function test
										PW	Shortening kit, extension cable
895										Marking	
										Z1	Tagging (TAG)
FMX21-											Order code

Accessories

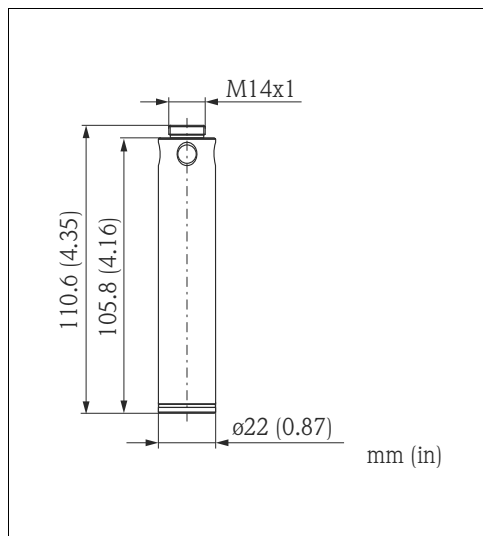
Mounting clamp

- Endress+Hauser offers a mounting clamp for easy FMX21 mounting (→ [20](#)).
- Material: 316L (1.4404) and fiberglass reinforced PA (polyamide)
- Order number 52006151, "Ordering information" (→ [28](#))

Terminal box

- IP66/IP67 terminal boxes with GORE-TEX® filter incl. 3 integrated terminals.
The terminal box is also suitable for installing a TMT182 temperature head transmitter or for four additional terminals (Order No. 52008938) → [21](#), "Ordering information" (→ [28](#)).
-  The terminal box is not intended for the FMX21 with Ex nA explosion protection in the hazardous area. When using the terminal box in hazardous areas, installation must comply with the corresponding national standards and regulations and the Safety Instructions or Installation or Control Drawings.

Additional weight




For FMX21 with outer diameter of 22 mm (0.87 in) or 29 mm (1.14 in)

- Endress+Hauser offers additional weights to prevent sideways movement that results in measuring errors, or to make it easier to lower the device in a guide tube.
You can screw several weights together. The weights are attached directly to the FMX21. For FMX21 with an outer diameter of 29 mm (1.14 in) a maximum of 5 weights may be attached. In combination with the Ex nA approval, for FMX21 with an outer diameter of 29 mm (1.14 in) a maximum of 1 additional weight may be attached.
- Material: 316L (1.4435)
- Weight: 300 g (10.581 oz)
- Order number 52006153, "Ordering information" (→ [28](#))

TMT182 temperature head transmitter (4 to 20 mA HART)

- 2-wire temperature head transmitter, configured for a measuring range from -20 to +80 °C (-4 to +158 °F). This setting offers a temperature range of 100 K which can be easily mapped. Please note that the Pt100 resistance thermometer is designed for a temperature range from -10 to +70 °C (-14 to +176 °F) → [22](#).
- Order number: 51001023, Ordering information (→ [28](#))

-  The TMT182 temperature head transmitter is not intended for use in hazardous areas incl. CSA GP.

Extension cable mounting screw

Endress+Hauser offers extension cable mounting screws to ease FMX21 mounting and to seal the measuring aperture (→ [21](#)).

- Order number for extension cable mounting screw:
 - 52008264 (G 1½" A)
 - 52009311 (NPT 1½")
- Material (→ [23](#))

Terminals

- Four terminals in strip for terminal box, suitable for wire cross-section: 0.08 to 2.5 mm² (28 to 14 AWG)
- Order number: 52008938

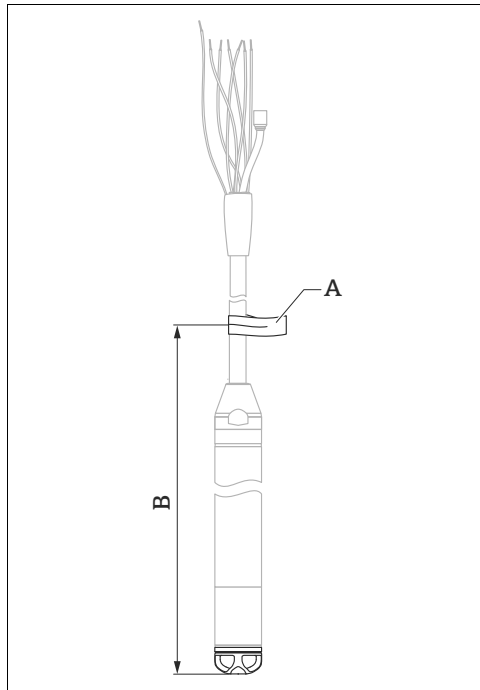
-  The 4-terminal strip is not intended for use in hazardous areas incl. CSA GP.

Cable shortening kit

- The cable shortening kit is used to easily and professionally shorten a cable.
- Order Number: 71222671, "Ordering information" and the documentation SD00552P/00/A6 (→ 28)

i The cable shortening kit is not intended for the FMX21 with FM/CSA approval.

Cable marking



A Cable marking
B Cable marking tolerance

- To make installation easier, Endress+Hauser offers a mark on the extension cable for a customer-specific length, see also → 28, "Ordering information".
- Cable marking tolerance (distance to the lower end of the cable probe):
Cable length < 5 m (16 ft): ±17.5 mm (0.69 in)
Cable length > 5 m (16 ft): ±0,2 %
- Material: PET, Adhesive: acrylic
- Immunity to temperature change: -30 to +100 °C (-22 to +212 °F)

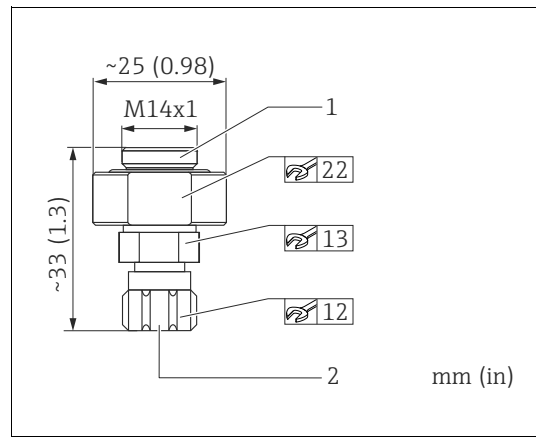
NOTICE

The mark is for installation purposes only.

- ▶ It must be thoroughly removed without trace in the case of devices with drinking water approval. The extension cable must not be damaged in the process

i Not for use in hazardous areas.

Testing adapter



1 FMX21 level probe connection
2 Compressed air hose connection, internal diameter of quick coupling piece 4 mm (0.16 in)

For FMX21 with outer diameter of 22 mm (0.87 in) and 29 mm (1.14 in)

- Endress+Hauser offers a testing adapter to ease function-testing of the level probes.
- Observe the maximum pressure for the compressed air hose and the maximum overload for the level probe (→ 11).
- Maximum pressure of the quick coupling piece supplied: 10 bar (145 psi)
- Adapter material: 304 (1.4301)
- Quick coupling piece material: anodized aluminum
- Adapter weight: 39 g (1.376 oz)
- Order number 52011868 (→ 28)

Documentation

The following document types are also available in the Download Area of the Endress+Hauser website:
www.endress.com → Download

Field of activities

- Pressure measurement: FA00004P/00/EN
- Recording technology: FA00014R/09/EN
- System components: FA00016K/09/EN

Technical Information

- Waterpilot FMX167 with 4 to 20 mA analog output: TI00351P/00/EN
- Deltapilot M: TI00437P/00/EN
- Temperature head transmitter iTEMP HART TMT182: TI00078R/09/EN

Operating Instructions

- Waterpilot FMX21: BA00380P/00/EN
- Cable shortening kit: SD00552P/00/A6
- Field Xpert: BA01211S/04/EN

Safety instructions

Safety Instructions (XA) are supplied with the device depending on the approval. These instructions are an integral part of the Operating Instructions.

Approval	Feature in Order code	Types of protection	Category	Documentation
ATEX	BD	Ex ia IIC	II 2 G	XA00454P
ATEX	BE	Ex nA IIC	II 3 G	XA00485P
IECEX	IC	Ex ia IIC	n/a	XA00455P
CSA C/US	CE	Ex ia IIC	n/a	ZD232P (960008976)
FM	FE	AEx ia IIC	n/a	ZD231P (960008975)
NEPSI	NA	Ex ia IIC	n/a	XA00456P
INMETRO	MA	Ex ia IIC	n/a	XA01066P



The nameplate provides information on the Safety Instructions (XA) that are relevant for the device.

Drinking water approval

- SD00289P/00/A3 (NSF)
- SD00319P/00/A3 (KTW)
- SD00320P/00/A3 (ACS)

Patents

This product is protected by at least one of the following patents. Further patents are pending.

- US 6,427,129 B1 \cong EP 0 892 249 B1
- US 6,703,943 A1
- DE 203 13 744.2 U1

Configuration data sheet

Level

The following configuration data sheet has to be filled in and included with the order if the option "K: customized level" has been selected in feature "090: Calibration; unit" in the product structure.

Pressure Engineering Unit	Output Unit (Scaled unit)																																			
<input type="checkbox"/> mbar <input type="checkbox"/> mmH ₂ O <input type="checkbox"/> mmHg <input type="checkbox"/> hPa <input type="checkbox"/> bar <input type="checkbox"/> mH ₂ O <input type="checkbox"/> kPa <input type="checkbox"/> psi <input type="checkbox"/> ftH ₂ O <input type="checkbox"/> MPa <input type="checkbox"/> inH ₂ O <input type="checkbox"/> kgf/cm ²	<table style="width: 100%; border-collapse: collapse;"> <thead> <tr style="background-color: #f2f2f2;"> <th style="width: 15%;">Mass</th> <th style="width: 15%;">Length</th> <th style="width: 15%;">Volume</th> <th style="width: 15%;">Volume</th> <th style="width: 15%;">Percent</th> </tr> </thead> <tbody> <tr> <td><input type="checkbox"/> kg</td> <td><input type="checkbox"/> m</td> <td><input type="checkbox"/> l</td> <td><input type="checkbox"/> gal</td> <td><input type="checkbox"/> %</td> </tr> <tr> <td><input type="checkbox"/> t</td> <td><input type="checkbox"/> dm</td> <td><input type="checkbox"/> hl</td> <td><input type="checkbox"/> lgal</td> <td></td> </tr> <tr> <td><input type="checkbox"/> lb</td> <td><input type="checkbox"/> cm</td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td><input type="checkbox"/> mm</td> <td><input type="checkbox"/> m³</td> <td></td> <td></td> </tr> <tr> <td></td> <td><input type="checkbox"/> ft</td> <td><input type="checkbox"/> ft³</td> <td></td> <td></td> </tr> <tr> <td></td> <td><input type="checkbox"/> inch</td> <td><input type="checkbox"/> in³</td> <td></td> <td></td> </tr> </tbody> </table>	Mass	Length	Volume	Volume	Percent	<input type="checkbox"/> kg	<input type="checkbox"/> m	<input type="checkbox"/> l	<input type="checkbox"/> gal	<input type="checkbox"/> %	<input type="checkbox"/> t	<input type="checkbox"/> dm	<input type="checkbox"/> hl	<input type="checkbox"/> lgal		<input type="checkbox"/> lb	<input type="checkbox"/> cm					<input type="checkbox"/> mm	<input type="checkbox"/> m ³				<input type="checkbox"/> ft	<input type="checkbox"/> ft ³				<input type="checkbox"/> inch	<input type="checkbox"/> in ³		
Mass	Length	Volume	Volume	Percent																																
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	<input type="checkbox"/> inch	<input type="checkbox"/> in ³																																		
Empty calibration [a]: low pressure value (empty) _____ [pres.eng.unit]	Empty calibration [a]: low level value (empty) _____ [scaled unit]																																			
Full calibration [b]: high pressure value (full) _____ [pres.eng.unit]	Full calibration [b]: high level value (full) _____ [scaled unit]																																			
Damping																																				
Damping: _____ sec																																				

Pressure

The following configuration data sheet has to be filled in and included with the order if the option "J: customized pressure" has been selected in feature "090: Calibration; unit" in the product structure.

Pressure Engineering Unit
<input type="checkbox"/> mbar <input type="checkbox"/> mmH ₂ O <input type="checkbox"/> mmHg <input type="checkbox"/> Pa <input type="checkbox"/> bar <input type="checkbox"/> mH ₂ O <input type="checkbox"/> kPa <input type="checkbox"/> psi <input type="checkbox"/> ftH ₂ O <input type="checkbox"/> MPa <input type="checkbox"/> inH ₂ O <input type="checkbox"/> kgf/cm ²
Calibration Range / Output
Low range value (LRV) _____ [pressure engineering unit] Upper range value (URV): _____ [pressure engineering unit]
Damping
Damping: _____ sec



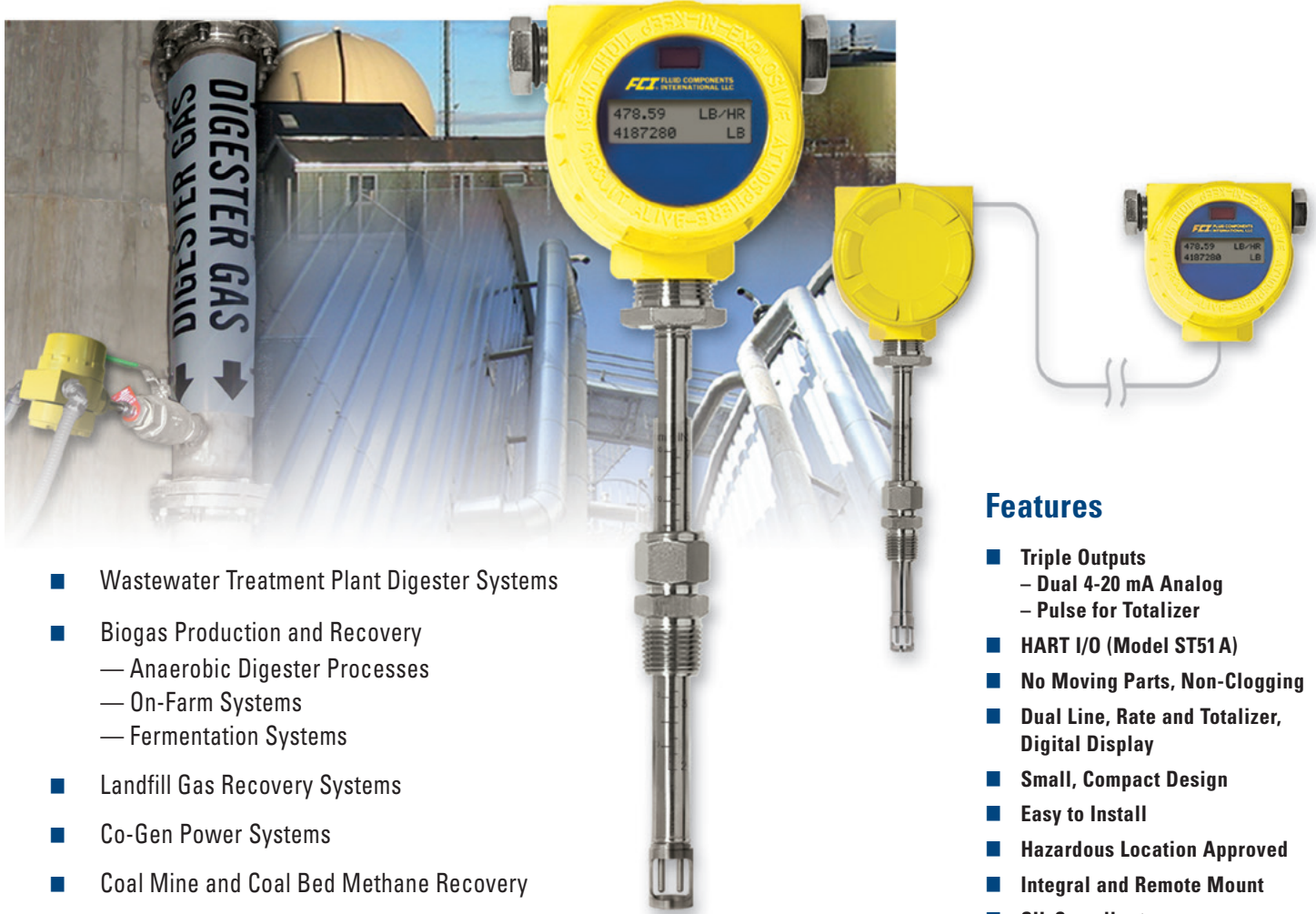
www.addresses.endress.com

		INSTRUMENT DATASHEET				
		PROJECT NAME: Aberdeen, ID				
		PROJECT NO.: 5703212001				
Air Flow Meter		FIT-101		IFAS 1		
Sensor			Transmitter			
Model No.:	ST51	Model No.:	NA			
Range:	0-400 SFPS	Range:	NA			
Power Supply:	120VAC	Power Supply:	NA			
Power Requirements:	12 W	Power Requirements:	NA			
Output Signal:	4-20mA	Output Signal:	NA			
Enclosure Rating:	NEMA 4X	Enclosure Rating:	NA			
Operating Temp:	0 to 140°F	Operating Temp:	NA			
Process Connection:	Insertion, 1/2" NPT	Accuracy:	0.20%			
Cable Length:	NA	Integral/Remote Mount:	NA			
Cable Connection:	N/A	Local Display:	NA			
Sensor Type:	Thermal Mass Flowmeter	Input Signal:	NA			
Comments:						
Function	Signal	Units	Input		Output	
			LRV	URV	LRV	URV
Flow	4-20mA	SFPS	0	400	4mA	20mA
Description	Manufacturer	Part Number				Qty
Air Flow Meter	FCI	ST51-2H12ET201				1
Rev	Date	By	Approval	Remarks		
0	09/27/2023	NDB	.	ISSUED FOR APPROVAL		

		INSTRUMENT DATASHEET				
		PROJECT NAME: Aberdeen, ID				
		PROJECT NO.: 5703212001				
Air Flow Meter		FIT-301		IFAS 2		
Sensor			Transmitter			
Model No.:	ST51	Model No.:	NA			
Range:	0-400 SFPS	Range:	NA			
Power Supply:	120VAC	Power Supply:	NA			
Power Requirements:	12 W	Power Requirements:	NA			
Output Signal:	4-20mA	Output Signal:	NA			
Enclosure Rating:	NEMA 4X	Enclosure Rating:	NA			
Operating Temp:	0 to 140°F	Operating Temp:	NA			
Process Connection:	Insertion, 1/2" NPT	Accuracy:	0.20%			
Cable Length:	NA	Integral/Remote Mount:	NA			
Cable Connection:	N/A	Local Display:	NA			
Sensor Type:	Thermal Mass Flowmeter	Input Signal:	NA			
Comments:						
Function	Signal	Units	Input		Output	
			LRV	URV	LRV	URV
Flow	4-20mA	SFPS	0	400	4mA	20mA
Description	Manufacturer	Part Number				Qty
Air Flow Meter	FCI	ST51-2H12ET201				1
Rev	Date	By	Approval	Remarks		
0	09/27/2023	NDB	.	ISSUED FOR APPROVAL		

ST51 / ST51 A Mass Flow Meters

For Biogas, Digester Gas, Methane and Natural Gas



- Wastewater Treatment Plant Digester Systems
- Biogas Production and Recovery
 - Anaerobic Digester Processes
 - On-Farm Systems
 - Fermentation Systems
- Landfill Gas Recovery Systems
- Co-Gen Power Systems
- Coal Mine and Coal Bed Methane Recovery

Features

- Triple Outputs
 - Dual 4-20 mA Analog
 - Pulse for Totalizer
- HART I/O (Model ST51 A)
- No Moving Parts, Non-Clogging
- Dual Line, Rate and Totalizer, Digital Display
- Small, Compact Design
- Easy to Install
- Hazardous Location Approved
- Integral and Remote Mount
- SIL Compliant

The **ST51 Series Flow Meter** is an accurate, easy to install, no moving parts solution for measuring and controlling biogases, digester gases, methane and natural gas flow. ST51 utilizes FCI proven thermal dispersion technology to provide direct mass flow measurement resulting in higher performance at a lower cost than orifice plates, DP, Vortex shedding and other thermal devices.

Biogas and digester gas applications are challenged by wide flow variations and dirty, wet gas. Flow variation is experienced as these processes move from low production start-up phases to a consistent, sustainable process and by seasonal temperature change, where cold temperatures slow gas production and higher temperature accelerate gas production. While the primary composition of these gases is methane and CO₂, residual H₂S and wet vapor leave deposits and corrode surfaces. ST51 provides the solution to these challenges. It features a wide-turndown ratio, up to 100:1 and is highly sensitive to low flow measurement. To measure correctly in fluctuating temperatures, flow meters must include temperature compensation circuitry and it is standard in ST51. ST51 has no moving parts to foul or clog and is easily pulled from the pipe for occasional cleaning.

ST51 installs in line sizes ranging from 2 inch to 24 inch [51 mm to 610 mm] with 1/2 inch or 3/4 inch NPT.

The ST51 uses precision, lithography structured platinum RTD sensors embedded in FCI's equal mass small diameter thermowells. Combined with microprocessor electronics and precision calibration, the ST51 achieves excellent accuracy, fast response and virtually maintenance free operation.



Biogas, digester gas and landfill gas compositions are dominated by methane (CH₄) and present a potentially hazardous installation environment. Sound engineering practice and often regulations mandate that instrumentation meet guidelines and have agency approvals for installation zone safety. Depending on actual installation location, at a minimum the environment will require Class I, Division II and often a more rigorous Class I, Division I [Zone 1 IIC] approvals. FCI ST51 meets all of these and has obtained the global agency approvals that ensure your installation is always safe and complies with regulations. And, unlike manufacturers who merely provide their transmitter electronics in an approved OEM enclosure, FCI submits its entire instrument to agency testing. FCI product approvals are different because they are comprehensive system approvals that also take into account the sensor and seal requirements as well the "T" (temperature) ratings. FCI agency approvals are on the total instrument. With ST51 you are assured of the integrity of total instrument approvals that meet or exceed safe engineering practice for your applications.

ST51 Specifications

Instrument

Media Compatibility: Biogas, digester gas, methane, natural gas, air, compressed air, nitrogen

Pipe/Line Size Compatibility: 2" to 24" [51 mm to 610 mm]¹

Flow Range: 0.3 SFPS to 400 SFPS [0,08 MPS to 122 MPS]

Accuracy: (at ≥ 0.75 SFPS [$\geq 0,21$ NMPS])²

Standard: $\pm 2\%$ reading $\pm 0.5\%$ full scale

Optional: $\pm 1\%$ reading $\pm 0.5\%$ full scale

Repeatability: $\pm 0.5\%$ reading

Temperature Compensation

Standard: 40 °F to 100 °F [4 °C to 38 °C];

Optional: 0 °F to 350 °F [-18 °C to 77 °C]

Temperature Coefficient

With temperature compensation; valid from 10% to 100% of full scale calibration

Flow: Maximum $\pm 0.015\%$ of reading / °F up to 350 °F [$\pm 0.03\%$ of reading / °C up to 177 °C]

Turndown Ratio: 3:1 to 100:1

Agency Approvals

FM, FMC: Class I, Division 1, Groups B, C, D; T4 Ta = 60°C
Class II/III, Division 1, Groups E, F, G; T4 Ta = 60°C; Type 4X/IP66
Class I, Division 2, Groups A, B, C, D; T4 Ta = 60°C

ATEX, IECEx: Zone 1, Zone 21
II 2 G Ex db IIC T6...T1 Gb
II 2 D Ex tb IIIC T85°C... T300°C Db; IP66/IP67
Ta = -40°C to +65°C

Other: EAC (TRCU) Russia, CE Marking, CRN

SIL (ST51A): SIL 1 compliant; Safe Failure Fraction (SFF) 78.5% to 81.1%

Warranty: ST51 – 1 year; ST51 A – 2 years

¹ For line sizes 2" [51 mm] or smaller, see FCI ST75 Series

² Contact FCI for accuracy below 0.75 SFPS [0,21 NMPS]

Flow Element

Installation: Insertion, variable length with 1/2" or 3/4" MNPT compression fitting

Type: Thermal dispersion

Material of Construction: 316L stainless steel body with Hastelloy-C22 thermowell sensors, 316 stainless steel compression fitting with Teflon or stainless steel ferrule

Pressure (Maximum Operating without Damage)

Stainless steel ferrule: 500 psig [34 bar (g)]

Teflon ferrule: 150 psig [10 bar (g)]

Operating Temperature

Stainless steel ferrule

ST51: -0 °F to 250 °F [-18 °C to 121 °C]

ST51 A: -0 °F to 350 °F [-18 °C to 177 °C]

Teflon ferrule: -0 °F to 200 °F [-18 °C to 93 °C]

Process Connection: 1/2" MNPT or 3/4" MNPT with stainless steel or

Teflon ferrule

Insertion Length (Field Adjustable)

1" to 6" [25 mm to 152 mm]

1" to 12" [25 mm to 305 mm]

1" to 18" [25 mm to 457 mm]

Flow Transmitter

Enclosure

Rating: NEMA 4X, IP67

Material: *Standard* – aluminum, polyester powdered coated
Optional – 316 stainless steel

Conduit/Cable Port: Dual 1/2" NPT or M20x1.5

Operating Temperature: 0 °F to 140 °F [-18 °C to 60 °C]

Input Power

DC: 18 Vdc to 36 Vdc (6 watts max.)

AC: 85 Vac to 265 Vac (12 watts max.; CE Marking approval from 100 Vac to 240 Vac)

Analog Output Signals: Dual 4-20 mA, user assignable to flow rate and/or temperature and a 0-500 Hz pulse output for total flow; ST51A output #1 has fault indication per NAMUR NE43 guidelines, user selectable for high (>21.0 mA) or low (<3.6 mA)

Bus Communications (ST51 A): HART (version 7); FieldComm Group certified; available over output #1; DD file included

Communication Port: RS-232C

Digital Display (Optional): Two-line x 16 character LCD; displays measured value and engineering units; top line assigned to flow rate, second line user assignable to temperature reading, as flow totalizer or alternating; display can be rotated in 90° increments for optimum viewing orientation

Installation and Mounting: Integral with sensor element or remote mountable up to 50' [15 m] with Model ST51, and up to 100' [30 m] with Model ST51A

Dual 4-20 mA outputs

4-20 mA per NAMUR NE43

HART I/O

500 Hz pulse output

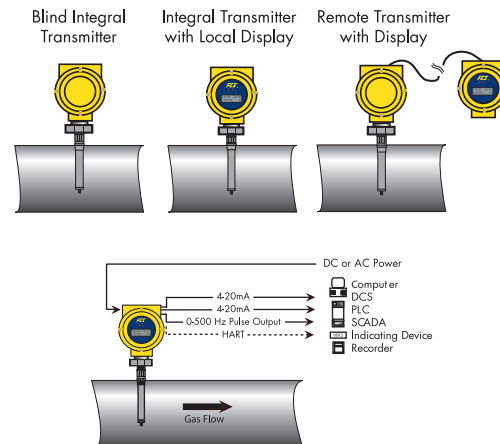
Process operating temperature

Maximum remote distance

SIL compliance rating

Warranty *Standard*

	ST51	ST51 A
Dual 4-20 mA outputs	■	■
4-20 mA per NAMUR NE43		■
HART I/O		■
500 Hz pulse output	■	■
Process operating temperature	To 250 °F [to 121 °C]	To 350 °F [to 177 °C]
Maximum remote distance	50' [15 m]	100' [30 m]
SIL compliance rating		■
Warranty <i>Standard</i>	1 year	2 years



FCI FLUID COMPONENTS INTERNATIONAL LLC

Locally Represented By:

Visit FCI online at www.FluidComponents.com | FCI is ISO 9001:2000 and AS9100 Certified

FCI World Headquarters

1755 La Costa Meadows Drive | San Marcos, California 92078 USA | Phone: 760-744-6950 Toll Free (US): 800-854-1993 Fax: 760-736-6250

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Persephonestraat 3-01 | 5047 TT Tilburg, The Netherlands | Phone: 31-13-5159989 Fax: 31-13-5799036

FCI Measurement and Control Technology (Beijing) Co., LTD | www.fluidcomponents.cn

Room 107, Xianfeng Building II, No.7 Kaituo Road, Shangdi IT Industry Base, Haidian District | Beijing 100085, P. R. China

Phone: 86-10-82782381 Fax: 86-10-58851152

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anchor scientific inc.

Box 378, Long Lake, MN 55356

952-473-7115 • FAX 952-473-6002 • www.anchorscientific.com

eco·float

Eco-Float Model G

Description

The Eco-float is a mercury-free float switch for controlling liquid levels in a variety of applications. A snap-action switch is activated by a steel ball rolling back and forth within a switching tube in a plastic float housing. There is a minimum differential between "on" and "off" of approximately 3.5 inches. Greater differentials can be achieved when the pipe mounted or externally weighted mounting styles are used. Various lengths of cable and circuit configurations are available and in stock.

Features

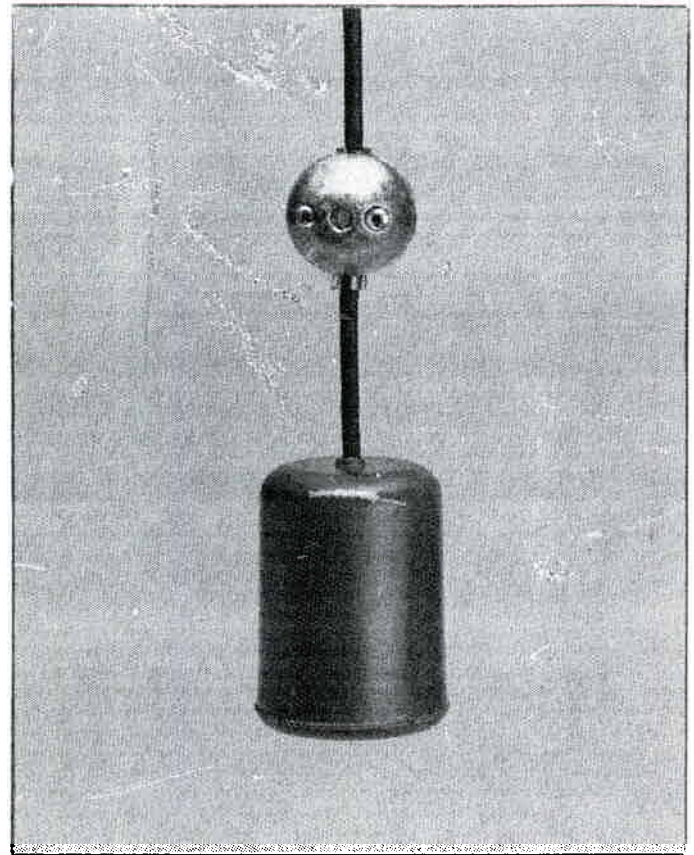
- Mercury Free
- Variety of Mounting Styles
- Variety of Circuit Configurations
- Installation Easy
- Differential In One Float
- Replaces Diaphragm and Mercury Switches

Applications

The Eco-Float can be used in a variety of liquid level monitoring applications including sumps, sewage ejectors, septic tanks, vaults, lift stations, and tanks. Eco-Floats are ruggedly constructed of corrosion resistant materials, enabling them to be used in a variety of different liquids. Some applications are subject to additional requirements described in the National Electric Code.

Specifications

Cable	18-2 or 18-3 SJO W/A, 60 C., 41 x 34 stranding dia. - .29(18-2); .31(18-3)
Float Housing	Polypropylene Dim: 3.0D x 4.25
Electrical Ratings	7A. @ 115 VAC; 3.5A @ 230VAC
Clamp	Polypropylene, (Model GP)
External Weight	Lead, 300 series stainless steel (Model GSE)
Temp. Limit	140° F

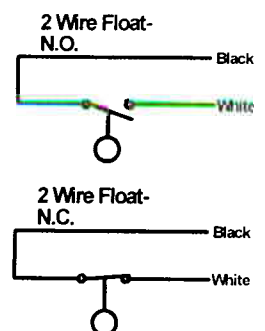
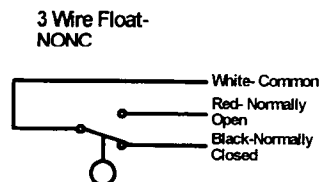


Model GSE

Ordering Information

Specify:	
Model	G
Mounting Style	SE (external weight) SI (internal weight) P (pipe mounted)
Cable Length	10, 15, 20 , 30, 40, 50 Custom lengths available
Circuit Configuration	NO (normally open) NC (normally closed) NONC (normally open/ normally closed)

Example
GSI 20NO - Eco-Float, suspended internal wt. 20',
normally open contacts.



6.0 SHIPPING, HANDLING, & STORAGE INSTRUCTIONS



Shipping, Handling, and Storage Instructions

SHIPPING

Most of the material for this project will be dropped shipped from an I. Krüger Inc. authorized supplier and delivered directly to the site. The authorized supplier has been informed to follow the following instructions:

- All items delivered will be clearly identified with Kruger's name, Kruger's project name and project number, and Kruger's purchase order number.
- All shipments will have a clear Packing List identifying all parts in the shipment. There should be no Packing List with "1 lot Machine Parts". The Packing List description will be descriptive.
- All boxes will be identified with a Packing List clearly identifying the contents of each box.
- All equipment will be tagged with the corresponding tag numbers shown on the design drawings (if applicable).
- The shipper is required to call the jobsite 48 hours in advance of delivery, and make arrangements with the contractor for receipt of material.

If there are more stringent requirements in the contract documents then they will take precedence over the above. If any of these requirements are not being following, please notify the Kruger's Project Manager immediately. The project manager will work with our suppliers to ensure the problem does not continue.

RECEIVING EQUIPMENT

After arriving at the site, all materials and equipment shall be examined by the receiver and any discrepancies, overages or shortages noted on the receiving report. All minor visible damage should be documented as described below, before off loading and formal receiving. Major visible damage, should be documented as described below. The load shall not be unloaded, but be returned to the carrier's terminal or fabricator who produced the parts.

- Receiver shall review all cartons, crates, boxes, equipment, skidded/palletized material, etc., for any sign of physical damage. All noted damage MUST be addressed as follows before off loading or receiving: (1) Receiver shall not off load or sign for the goods "as delivered" until all issues have been addressed with freight carrier. (2) DO NOT OFF LOAD. Receiver must take photograph of damaged item(s) (3) Receiver then must call Kruger's project manager and provide the name of the freight carrier, bill of lading number, description and a copy of the photograph for record. (4) Kruger's project manager shall contact both the supplier and the freight carrier to request a formal release based on "accept as noted," with the Trade Contractor noting the specific damage on the bill of lading, before signing for receipt of said goods.
- If the freight carrier refuses to give the Kruger's project manager an "accept as noted" release, based on said noted damage, Kruger's project manager shall notify the receiver to reject said shipment in full. Kruger shall notify both the supplier and the freight carrier to have the material returned to nearest carrier terminal for inspection by carrier's freight inspector. Acceptance of material damaged



in transit, subject to exceptions properly taken, does not jeopardize the successful prosecution of a claim against the freight carrier at a later date.

- Receiver shall report concealed damage to both the freight carrier and Kruger immediately upon discovery but preferably within five 5 days after receipt of material. As soon as the concealed damage is apparent, receiver shall stop unpacking, take photographs and notify the Kruger project manager of the damage.
- Receiver must submit all required documentation, bill of lading, inclusive of a full accounting of all of the details to I. Krüger Inc.'s project manager as soon as possible, in order for Kruger to file a formal claim with the freight carrier.
- Failure of the receiver to follow all of the above "Damage Goods" procedures, giving cause for Kruger or its suppliers to loose all rights to collect damages and make claims from the freight carrier, will cause all related costs to be born by the receiver and paid to the damaged party in full as documented.

STORING EQUIPMENT

Once the equipment has been checked for any damage that might have occurred in transit, use the following guideline if it is intended to store the equipment. Preferably, all equipment should be warehoused to protect the equipment against inclement weather, dust, damage by vehicles etc. **Spare parts should also be warehoused until used.** When indoor storage is limited then outdoor storage is acceptable for fabricated items such as SS Aeration grids, Screens, mixer shafts and impellers, Equipment such as drives for mixer, instrumentation and electrical items must be stored indoors in dry conditions and at temperatures above 40°F and less than 110°F. In either case the following procedure should be followed.

- All fabricated steel components should be stored in a clean and dry area that provides adequate ventilation. All equipment must be stored with adequate support underneath to prevent distortion and to raise equipment above any undesirable ground or floor conditions. Any tenting or tarpaulins must be well supported so as to provide adequate ventilation.
- Equipment with rotating components i.e. motors, pumps, gear drives etc. must have the component shafts hand rotated several times on a regular basis. For long term storage, please refer to the manufactures requirements for long term storage. It is highly recommended to log those events with date and name of person performing the operation.
- The contractor should recoat any parts with paint, primer or grease, which may have been scratched or wiped, clean of their protective coating in shipment. Periodic checking is necessary to remove any accumulated condensation or rust, and recoat as necessary.
- Painted and plastic surfaces are affected by long exposure to direct sunlight and should be shielded from the sun. In general, exposure to direct sunlight and subsequent cooling is conducive to condensation of moisture and should be avoided. Check periodically for accumulations of moisture and/or surface rusting. If rusting is present, prepare the surface and recoat with proper material. Increase ventilation and reduce humidity.
- Instrumentation, control panels and alike should always be in a climate controlled warehouse until



installation. Equipment containing PVC parts such as chemical feed equipment etc. should always be in a climate controlled warehouse until installation. Tarps etc. shall be supported to prevent damage from long term pressure to the equipment stored underneath

- Caution should be taken to prevent any carbon steel products or SS from the 400 series to be in contact with our stainless steel parts. If our components are stored outside, there **should not be** any carbon steel products or SS from the 400 series, stored above, due to contamination and staining from rain water runoff.
- For equipment **not** manufactured by **I. Krüger Inc.** refer to the appropriate section in the Installation, Operation, and Maintenance Manual to determine the manufacturer's storage requirements.



Un-loading, Storage and handling of Media

The carrier elements are typically delivered in 1.0 cubic meter bags. The bags weigh between 220 Lbs. and 350 lbs. each, depending of the media type. The bags can be lifted by their two ears located on the top of each bag by using a fork lift. The bags should be lifted over the side of the tank and media discharged into the reactors. The picture below shows what the 1.0 cubic meter media bags look like.



A 53 Ft box trailer will typically have 26 pallets each with 3 X 1M³ super bags, for a total of 78 of 1.0 cubic meter bags.

Delivery of the media will typically occur with 2 to 5 trailers arriving daily to the site, unless a different delivery schedule has been arranged with Kruger's project manager. The media must be offloaded from the containers/ trailers immediately. Demurrage charges will typically start two hours after arrival to the unloading site.

For reference, Contractors at other projects have typically unloaded three (3) trailers per day. The fastest offloading rate observed was five (5) trailers per day.

The media bags can be stored outside for long periods of time; however, they need to be covered to minimize any degradation of the bag itself due to sunlight. For short term coverage, blue tarps can be used to cover the bags of media until such time they are loaded into the reactor. For longer term coverage we recommend the use of UV reflective tarps. It should be expected that the bags begin decomposing after about 400 hours of UV exposure.

Pictures below show storage of the bags prior to being covered with tarps, and installation.



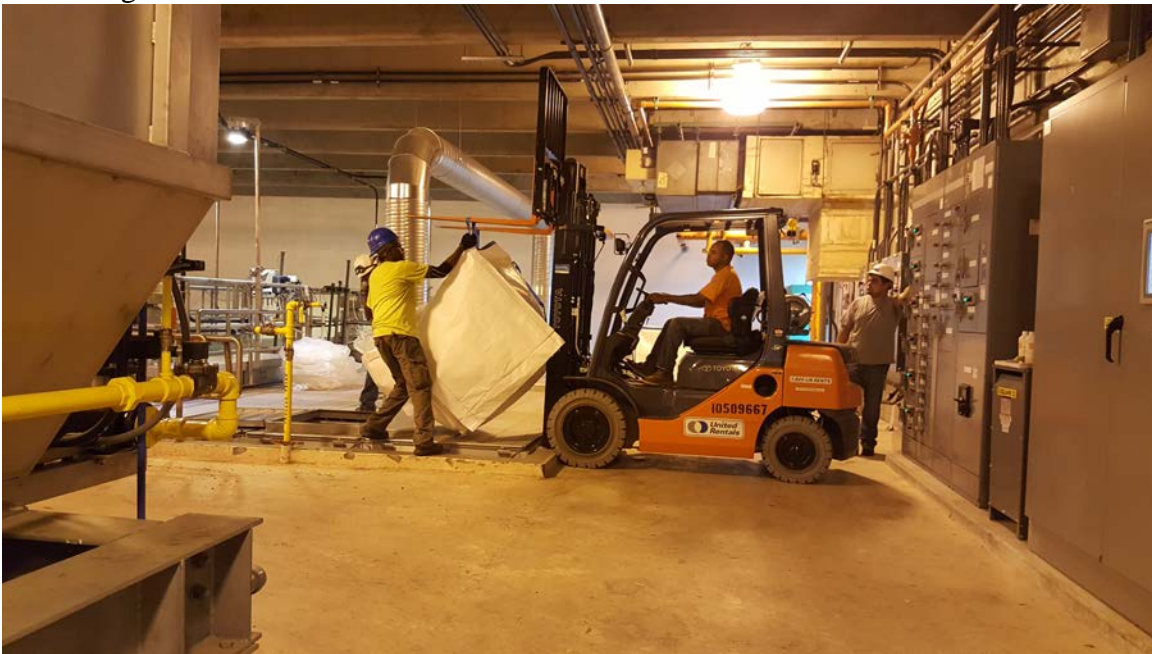


Seeded media should not be stored, but be installed at the time of delivery to the site. The media is typically delivered in a temperature controlled trailer and need to maintain a temperature about 36 to 40 °F until installed.

Seeded media bags



Unloading



7.0 WARRANTY



WARRANTY

Installation Site: City of Aberdeen WWTP Equipment Delivery: _____
Equipment Type: IFAS Warranty Begins: _____
Owner: City of Aberdeen WWTP Warranty Ends: _____

Length of Warranty: The system is warranted against defects in material and workmanship for eighteen (18) months from delivery or one year from beneficial use, whichever occurs first. Unless stated otherwise in the contract documents.

Warranty Coverage: Kruger's sole obligation under this warranty is limited to repairing or replacing, at its option, any item covered under this warranty. All equipment or parts covered by this warranty are guaranteed to be free from defective material and workmanship, under normal use and service and maintained in accordance with I. Kruger Inc. instructions. This guarantee does not cover failure of normal wearing parts unless failure of such part has resulted from defective material and workmanship. The warranty also does not apply to parts or equipment damaged from improper operation or misuse, neglect, accident, improper wiring or installation, or alterations and repairs made by any one other than I. Kruger Inc. or its authorized representative.

No Implied Warranties: ALL OTHER WARRANTIES EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE EXCLUDED.

Conditions: In the event of any defects developing within the warranty period, under normal and proper use, Kruger, Inc. is to be notified promptly in writing within 30 days of when the defect was discovered or should have been discovered. Kruger, Inc. must be given prompt and reasonable opportunity to inspect the defective equipment or parts and be given access to the Owner's logs and records to establish proper operation and maintenance. Kruger, Inc. will make all repairs at the manufacture's facility when practical. It is the owner's responsibility for all removal, outward-bound shipping, and re-installation charges.

Claims: Kruger Inc. does not accept liability for any corrective or other work or expenditures of any kind that have not been authorized by Kruger, Inc. in writing prior to the commencement of such work. Service calls, when requested and where no evidence of defective material or workmanship is found, will be at the expense of the Purchaser. In no event shall Kruger, Inc. be liable for special, indirect, incidental or consequential damages, including but not limited to, loss of profits or revenue, loss of use of equipment or any associated equipment, cost of capital, cost of substitute equipment, facilities or services, down time cost, or claims of customers of the Purchaser for such other damages. Kruger, Inc. will only be responsible for damages from proven negligent acts of its direct employees only.

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APPENDIX E

Dewatering Equipment

- E.1 Bid Documents and Contract
- E.2 Equipment Submittal

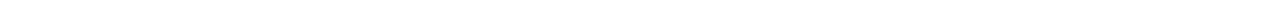


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APPENDIX E.1

Bid Documents and Contract



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CONSIDERING THE HUBER Q-PRESS®

Efficient and Cost Effective Dewatering

City of Aberdeen, ID | April 3, 2023

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HUBER – Privately Held Corporation for 5 Generations8
HUBER Screw Press Q-PRESS®10
APPENDICES.....16



Considering the HUBER Q-PRESS®

Thank you for your interest in HUBER Technology Inc. Q-PRESS® sludge dewatering screw press.

We understand the selection of the [right partner](#) is a critical choice in the procurement of dewatering equipment. At HUBER, we incorporate the following core characteristics to ensure a long term successful dewatering installation:

- [Experience](#) producing dewatering equipment in a variety of applications worldwide.
- A company with [longevity and stability](#) to will be around for years ahead.
- A record of [uncompromising quality and highest performing equipment](#).
- Equipment that is [optimized to reduce wear](#) and automated to [reduce operator attendance](#).
- A company committed [to supporting customers](#) in the field, for the lifetime of the equipment.

For your application at the City of Aberdeen, we feel the HUBER Q-PRESS® offers the [lowest cost](#) of installation and ownership. Some key features of the Q-PRESS® include:

- Highest dewatering performance with multiple secondary sludge dewatering applications [offering 15-20+% cake solids](#) or higher
- [Lowest maintenance requirements](#) with a slow turning system which can be maintained in place by plant personal
- [Completely automated dewatering](#) which automatically adjusts to changing feed characteristics. The Q-PRESS system is capable of extended operation, with some applications running 24/7, with plant staff only checking on the press 1-2 times per day.
- [Lowest installation](#) cost:
 - Inclined design which [does not require expensive](#) raised supports for further conveyance
 - Slow turning equipment which [does not require expensive](#) isolation pads or supports
 - [Does not require pre-thickening](#) with a thickener added before dewatering
 - Fully dewatered cake from startup, [does not require a bypass](#) for “slop” from startup operations

We have prepared the following information package, to provide some background on the HUBER Company, our guiding principles, financial stability, manufacturing and service capability. We hope to show that HUBER is the [ideal business partner](#) to design, manufacture and most importantly [support](#) the equipment that is provided. Please don't just take our word for it but contact some of our references listed in this package.

Also, please do not hesitate to contact myself or other members of the team with any questions, we are happy to assist.

Sincerely,

Christian Primm

Product Manager – Biosolids Systems
 HUBER Technology, Inc.
 Email: Christian.Primm@hhusa.net
 (704) 990-2433

Message from the President of HUBER Technology, Inc.



Thank you for the opportunity to introduce our company HUBER Technology, Inc., a leader in the field of municipal and industrial wastewater treatment market with high-quality liquid-solid separation technology.

Located in Denver, NC, with 67,000 sq. ft. of office, training, and manufacturing space, HUBER Technology, Inc. is a member of the HUBER Group is a wholly owned subsidiary of Huber SE, based in Berching (Bavaria), Germany.

Enclosed with this letter is documentation about our manufacturing facility in Denver, NC, and our parent company located in Berching (Bavaria), Germany, our products and services, including brochures, a reference list, and messages from my

leadership team.

Established in 1872, HUBER SE is a manufacturer with five generations of craftsmanship to its credit. HUBER SE has remained a family-owned business since its foundation in 1834, giving us financial independence.

One key reason for our continued success is the decentralized manner the HUBER Group operates. As President of HUBER Technology, Inc., I have direct responsibility for Sales, Marketing, R&D, Business Development, and Manufacturing for North America. This structure of local autonomy promotes an entrepreneurial spirit among my team, allowing them to react quickly and with flexibility to our customers' needs while still leveraging the history, know-how, and support of our Parent Company. As a result, we have experienced sustained growth and increased local sourcing and manufacturing. In 2022 we enter into an exciting new chapter with the expansion of our facility. We are adding approximately 122,000 ft² of space for offices and manufacturing, including sheet metal fabrication, enhanced machine shop capabilities, and pickling to augment our existing network of suppliers.

We have a talented group of individuals with deep knowledge and experience in water and wastewater, the North American market, and diverse backgrounds and styles. Our mission is to promote the sustainable use of water, energy, and resources measured by the customers we serve. This mission recognizes our commitment to our clients, culture, and a sense of purpose in improving water and energy.

We were recognized by Frost & Sullivan in 2013 for best practice in customer leadership, in 2018 for product line strategy leadership, and by WWEMA in 2021 for significant contributions to the water and wastewater industry. We partner with customers from the initial concept stage project fulfillment and aftersales service stages.

These values are hallmarks of HUBER's culture. They will remain in place, especially at this critical moment for American manufacturing with the new infrastructure investment, and we're proud to be a part of that process.

As you consider our technologies for your wastewater treatment application, you have my guarantee that HUBER Technology Inc. is committed to supporting you through the entire process.

We look forward to working with you.

Sincerely,

Henk-Jan van Ettehoven

President

HUBER Technology, Inc.

HUBER USA Service and Support Network

Message from the Director of Service



My role as the Director of Service for HUBER Technology, Inc. is to assure that you, our customer, are provided with the best possible service to maintain your investment in our technology. Here are just a few of the ways we are here for you:

- **Spare Parts:** We regularly stock over \$2 million in spare and wear parts at our headquarters in Denver, NC with dedicated weekly shipments from our vendors. It's our goal to have all parts for your equipment readily available. We stock customized parts packages for your machine. We can even ship same-day on most parts for orders received before 4PM EST!



- **Support:** We maintain an on-call staff of highly trained service technicians with over 75 years of combined mechanical and electrical wastewater Knowledge experience. In addition to HUBER's global service network, HUBER US has technicians based throughout the United States including; Charlotte, NC, Leeds, ME, Virginia Beach, VA, Orlando, FL, Houston, TX, Phoenix, AZ, and Las Vegas, NV. Additionally, we have multiple dedicated service inspectors in the United States as well as dedicated service inspectors from our factory in Berching, Germany with regular visits to our customers in North America. And, at our headquarters in Denver, North Carolina we maintain a full service repair and manufacturing facility.

We live on the [HUBER Service Edge™](#). What does this mean to me? After the initial sale of your equipment, Aftermarket Sales Team becomes your permanent, 24/7, HUBER resource for spare parts, technical support, and maintenance. Customer service has been coursing through our veins for five generations and counting! Furthermore, HUBER Technology, Inc. is the manufacturer, *not* a licensee. With many acquisitions & mergers in the industry lately, licensees are unable to meet aftermarket and service expectations, a looming problem for many customers. Once you've made the smart choice to purchase HUBER equipment, you will be gaining a partner in wastewater. Our goal is simple: To keep your equipment operating better and longer than expected, I think you'll quickly realize just how easy that is.

We have been recognized by Frost & Sullivan for Best Customer Service in the North American Solid / Liquid Separation Technology Market. Frost & Sullivan is renowned in our industry as one of the foremost market research consultants. They closely analyze key markets and their development, and the industrial enterprises which are active in these markets – constantly on the search for best-in-class companies. It is an honor to

receive such an award. Even more important it provides you with the assurance that we will provide industry leading service and support, and have been recognized for it.

- **Maintenance:** Whether you've signed up for one of our maintenance contracts to prolong the use of your equipment or have requested regular maintenance from us, we have the knowledge and experience to keep your Huber equipment running for many more years.
- **Safety:** We are the original manufacturer and my complete staff is factory trained and authorized to meet your service needs. Our technicians are licensed welders, and participate in annual safety training. It is important to us that we maintain OSHA compliance to better serve your needs. Our services include Start up services, installation support, repair services, maintenance and service contracts, operation support and optimization, training service, on-site pilot testing, and laboratory service. These resources we make available to you, to provide fast and effective solutions so that your HUBER equipment is running at peak efficiency throughout the entire lifecycle of your equipment.

Here is what our customers have to say about HUBER:

"My experience with HUBER was first rate, excellent customer service. Our technicians gained knowledge that will save them time on our next machine service, which is extremely valuable for us."

Bob Chenevey, Mechanical Systems Manager
Upper Occoquan Service Authority, Centreville, VA

"HUBER has provided us with outstanding customer service. Ordering parts, technical questions or advice for our mechanics that assist with preventative maintenance and operation. Fast and reliable service which is very critical to the operation and maintenance of our facility. We greatly appreciate the ongoing support that we continue to receive."

Justin Anderson, Maintenance Supervisor
Riverside Park Water Reclamation Facility, Spokane, WA

We hope you'll join the HUBER family!

Sincerely,

Joshua Dobbs

Director of Service – North America HUBER Technology, Inc

Message from the Director of Finance

HUBER Technology, Inc. has served the North American municipal and industrial wastewater treatment market with high quality liquid-solid separation technology for over 22 years. Based out of North Carolina, Huber Technology, Inc. is a wholly-owned subsidiary of HUBER SE.

HUBER SE is a German-based, family-owned manufacturer and holding company with a 150 year history of craftsmanship and innovation. Today, the HUBER group, through its more than 60 subsidiaries and partnerships, continues to deliver outstanding quality, value and service to its customers around the world.

In 2021, HUBER Technology, Inc. received over \$59 million in new order intake for 300 different machines. While the entire HUBER group received more than €350 million in new orders. Our private ownership and history of strong performance allows for financial independence, resulting in a business strategy based in long-term planning. In the US market, HUBER Technology, Inc. has leveraged its positive cash flow from operations to expand its American based manufacturing footprint. In 2020, the addition of 30,000 sq. ft. manufacturing facility in Denver North Carolina opened to help meet the North American market demand. An additional 122,000 sq. ft. manufacturing facility is currently under construction to allow for even greater capacity and reduce lead times for our customers.

Together HUBER Technology, Inc. and the HUBER Group offer financial stability, strength, and dependability – key features desired in a supplier. We look forward to a long-term partnership with your organization.

Sincerely,

Jason Miller
Director of Finance HUBER
Technology, Inc.



HUBER – An Original Source Manufacturer

Known as an innovator, Huber SE is the holder of multiple patents. Huber is the inventor and original manufacturer for the renowned ROTAMAT® rotary screen products and STEP SCREEN® and has proven experience and expertise with over 30,000 installations worldwide.

The company is an industry leader in North America with installations of over 3100 machines in over 1300 waste water treatment plants in the USA and Canada.

Supplying top-quality products to our customers requires not only excellent engineering and design, but also outstanding manufacturing quality. Our employees are well trained and highly motivated. Most of them have started with Huber as apprentices and are certified journeymen; some are certified trade masters. We use the latest manufacturing technologies for highest precision and lowest tolerance.

Our manufacturing is done in our own stainless-steel-only factory to prevent any contamination of our stainless steel products with rust and dust. We have a large in house pickling bath. This passivation process guarantees perfect finishing, highest surface purity and long life.

Production is the focus of our activities and is backed by our highly skilled experts who put their expertise to work and take pride in the superior quality of our products. Modern production machinery and plants, most of them computer-aided, are at their disposal, insuring the high level of accuracy, repeatable and faultless production results that our customers have come to expect.

It is the combination of our expertly trained staff, in conjunction with the latest production machinery, which enables us to offer high-quality products throughout the world.

The products that we manufacture for the environmental sector - machines and plants for water, sewage and sludge - must be extremely reliable. They must run smoothly 24 hours a day and 365 days a year. Our customers must be sure that they can rely on this consistency, which we are determined to provide by maintaining the high quality level of our production. All parts and products are treated in a special pickling solution prior to leaving our company.

Our production, in turn, is backed by an experienced team of design specialists. These design engineers elaborate related technical drawings drawn from their detailed knowledge of the specific application requirements for our products: Products which have been tailor-made to our customers' needs and which reflect our staff's expertise gained by practical experience combined with engineering proficiency.

Among the guide lines of our engineering activities is the "Integrated Product Policy" which means that the optimum use of materials, efficient operation of products, economic use of resources, compliance with environmental requirements with regard to functionality and the results achieved is taken into account right from the onset. The use of stainless steel for all our products therefore contributes to completely recovering resources and to closing the recycling loop.

The entire area of our design and construction services, as well as production, is subject to sustained quality control evidence which is documented by the relevant certificates.

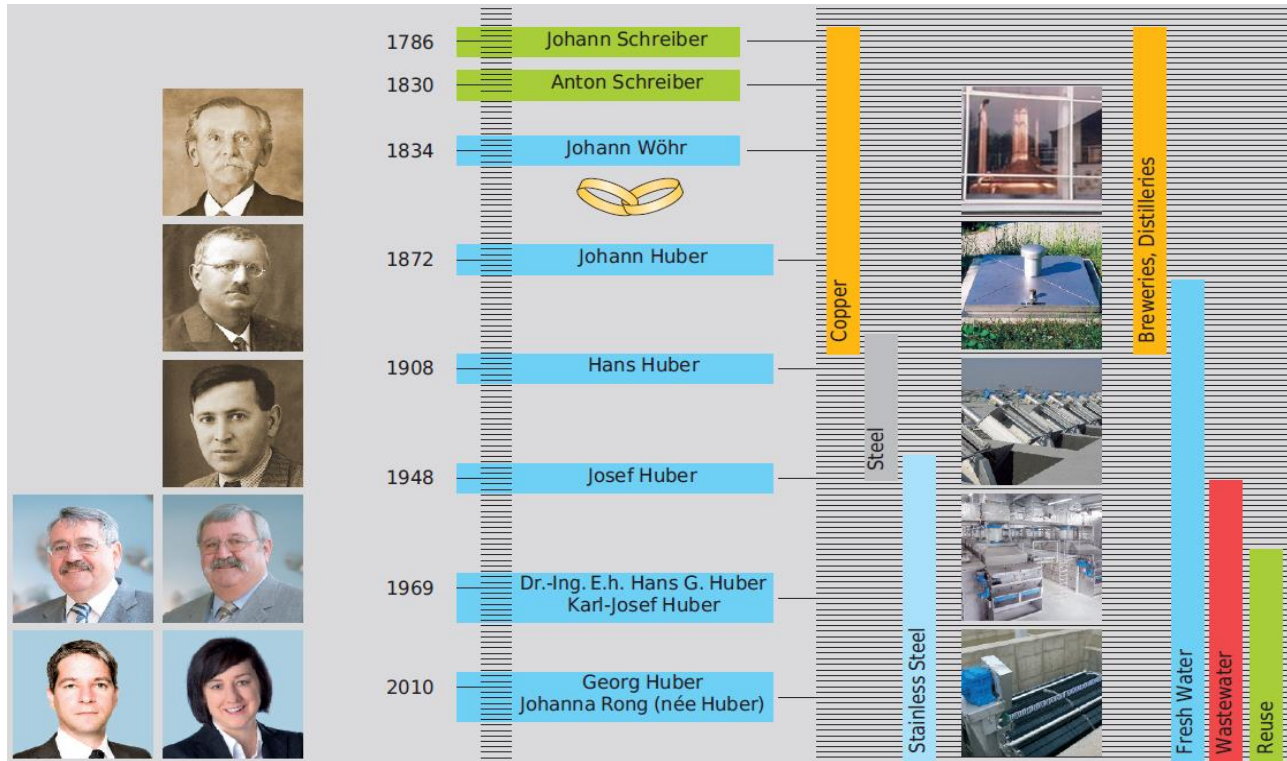
Experience, knowledge and vision provide the foundation of our design and construction activities which, together with our skilled staff, pave the way for optimized manufacturing and products which offer maximum efficiency, security and reliability.

This approach has made us a worldwide renowned manufacturer of quality products and we are committed to this philosophy for the future.

HUBER – Privately Held Corporation for 5 Generations

Established in 1872, Huber is an established manufacturer with five generations of craftsmanship to its credit.

Our company has remained a family owned business since its foundation in 1834 which has given us financial independence. This has resulted in a business strategy which has provided the basis for long term planning and development leading to profitable future growth.



Water, wastewater and energy as a whole

We offer our customers systems and services together with products that can purify, save and protect water. In addition we have processes that will utilize any beneficial residual materials that are produced.

Customer Service is a major priority

The customer's benefit and their satisfaction are the basis of our past and future success.

Overall Experience

Our flexibility and independence allow us to ensure customer satisfaction and we are confident that our strength and ability will guarantee the quality of the services we can provide. As an international company we are confident that we can provide the ideal elements within our value chain to attain the maximum benefit for each individual customer.

Living processes

As a company we are constantly working to improve our internal workflows and processes to ensure that the structure of our organization is efficient and forward looking. This enables us to continuously develop and enhance the quality of our solutions and products and allow us to provide excellent customer service

Success through co-operation

Our company actively encourages co-operation in working relationships and responsible management based on trust and respect. Our company employs highly qualified staff and we ask each and every one of them for a high level of commitment, motivation and professionalism.

Environmental Responsibility

Our products and services contribute to protecting the environment and we are committed to ensuring that our products and services act in accordance with the principles of sustainability.

Water is a Global Issue, we here at HUBER are ready to meet the challenges and that is why we are active throughout the world. The experience and suggestions we gather from all over the whole world have been integrated into the solutions we offer and we adapt to suit the specific requirements from our clients.

It is our aim to meet the social responsibility our company has.



HUBER Screw Press Q-PRESS®

The Q-PRESS® is the latest screw press design offered from HUBER Technology, Inc. Huber started installing screw presses in 1993 and has established ourselves as the market leader, installing 2200 units globally and 300 in North America since. HUBER has continued to innovate our screw press and are producing our 4th generation with the highest performance, lowest maintenance and highest throughput yet.

The Beginning – The S-PRESS

HUBER started producing screw presses in 2003 with the original S-Press. This first generation press has many features still incorporated in our latest designs which are unique to the market:

- Compact Inclined design for
 - [Increased dewatering results](#) using the gravity of the inclined design
 - [Easy connection of conveyance](#) equipment at the inclined end of the screw press without the need for expensive support frames



Containerized S-Press Design with Integrated Cake Conveyor

- Use of a robust wedge wire basket eliminating the need for [hydraulic limiting reinforcement](#) of perforated plate designs.



HUBER Wedge Wire

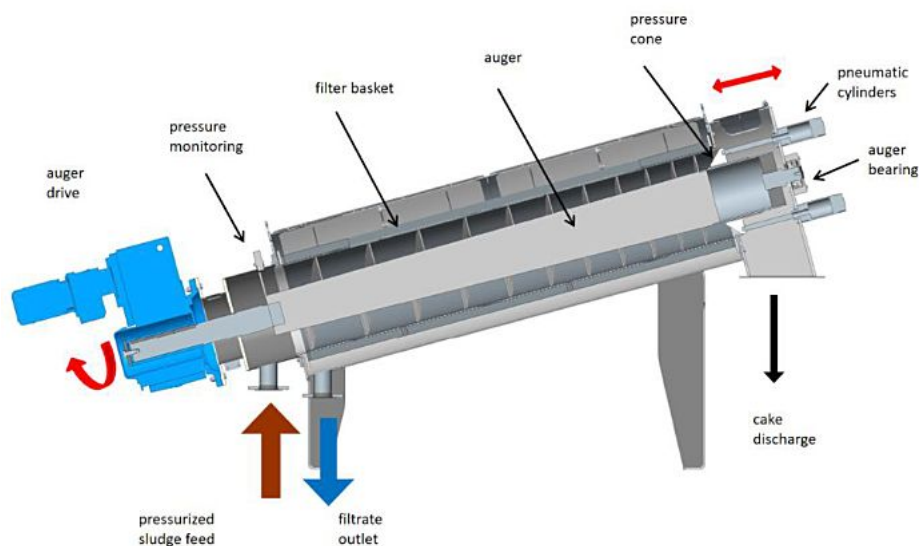
- Cleaning systems to automatically clean the filter basket [without the need of manual washing](#):
 - Use of a brush [to continuously clean](#) the filter basket while the auger rotates
 - Use of a high pressure washing system to [automatically clean](#) the external area of the basket.



HUBER S-PRESS with High Pressure Moving Spray Bar

The Revolutionary Q-PRESS®

In 2004 HUBER released a completely new screw press design which revolutionized the industry, the HUBER Q-PRESS®.



HUBER Q-PRESS Features

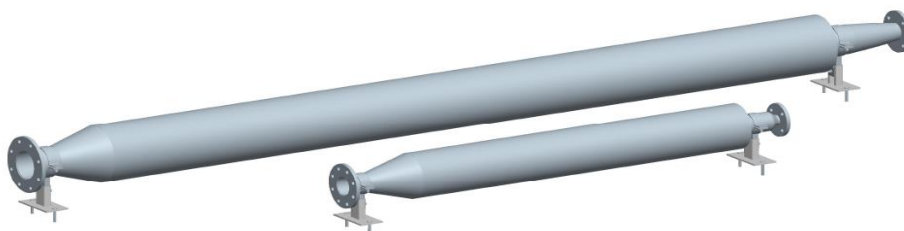
The first generation Q-PRESS® offered a major step forward in performance by:

- Utilizing a conical auger geometry and pneumatically controlled pressure cone which allowed the Q-PRESS® to “squeeze” the sludge more efficiently allowing for [higher cakes solids \(10% higher\)](#) than the first S-Press design.
- Introduced a larger filter surface area for [increased Hydraulic loading](#) in the same equipment size.



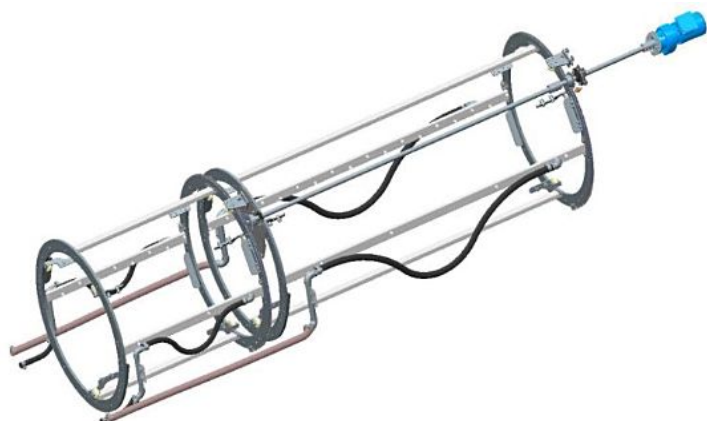
HUBER Q-PRESS® 280 Filter Basket

- Incorporated a new flocculation reactor design which used a pressure feed design in place of the old flocculation reactor tank.
 - Allowed for use of the feed piping to the press as a [dual purpose sludge pipe and flocculation reactor](#)
 - [Eliminates the need](#) for an extra tank
 - [Eliminates the need](#) of a motor and stirrer for the flocculation tank
 - Allowed for pressurized flow into the Q-PRESS® [increasing throughput](#) by “pushing” water out in the first zone of the press



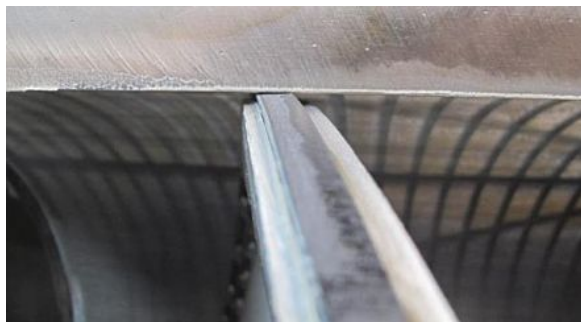
In 2015, HUBER introduced the second generation Q-PRESS®, the Q-PRESS® XXX.2, which included:

- More effective washing systems which offered better cleaning with less water consumption than the first generation Q-PRESS®. The new system can independently clean sections of the filter basket. Water [reductions of 33% or higher](#) can be achieved.

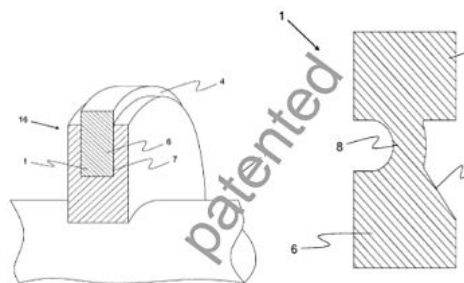


Huber Q-PRESS® 620.2 Wash Carousel

- A new patented block lip wiper with a spring mechanism to maintain contact as the wiper wears. This offers more effective cleaning and [twice the life](#) (up to 6000hr) of the original brush design carried over from the first generation S-Press.

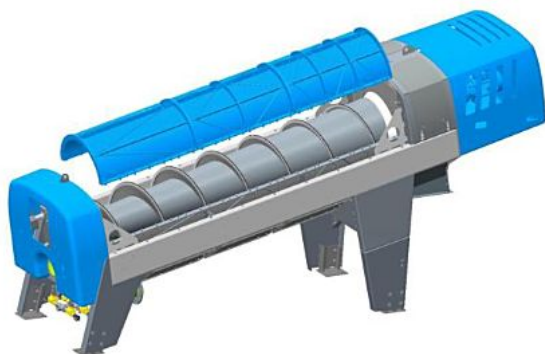


HUBER Block Lip Wiper Installed



HUBER Block Lip Wiper Design

- Split dewatering basket allowing for wiper replacement in place in **less than ½ the time** of the first generation Q-PRESS®.



HUBER Q-PRESS 620.2 with Split Basket

- Introduction of new Permanent Magnet (PM motors) which are **25% more efficient** and can operate over a much wider speed range increasing the operational capability of the equipment
- New filter basket design **increasing hydraulic throughput of 10%**



HUBER Q-PRESS Filter Basket

In 2018, HUBER introduced our Q-PRESS® (High Capacity) which included:

- Newly engineered auger offering **30% more** throughput with the same cake solids in the same footprint
- Second generation block lip wiper with offered **40% longer life** than the first generation block lip wiper (up to 10,000hr)
 - **Lower** feed pump pressure without the use of a check valve for mixing. Pressure losses of less than 1psi vs. 20-30psi for a typical check valve.
 - **Lower** polymer pump pressures without the use of a check valve for mixing. The pump doesn't have to overcome the back pressure of the check valve.
 - **Less** polymer dilution water due to use of higher polymer concentrations. This is less water the screw press has to separate. Reductions of close to 50% have been achieved.
 - **Lower** polymer consumption due to the use of higher mixing energy. Reductions of close to 50% have been seen in dewatering applications.

- **Higher** Solids Capture Rate due to better polymer mixing. Capture rates have been increased from the mid to high 90% range.



HUBER IPM Mixer

To highlight the evolution of the HUBER screw press design we would like to highlight side by side performance comparisons of our technologies.

Star, ID



S-PRESS (background) and Q-PRESS® 620.2 Installed in Star, ID

Our installation in Star, ID has both the original screw press design which was installed in 2009 (S-Press) as well as our 3rd generation Q-PRESS® (size 620.2) installed in 2017. This installation shows how HUBER’s Q-PRESS® greatly outperforms our first generation S-PRESS in the same footprint.

	S-Press	Q-PRESS® (Max Throughput)	Q-PRESS® (Max Performance)
Hydraulic Throughput (GPM)	30	65 (116%)	40 (33% increase)
Solids Throughput (lb/hr)	210	455 (116% increase)	280 (33% increase)
Cake Solids (%)	18.5%	19% (2.7% increase)	21% (13.5% increase)

Contact:

Ken Vose
Star Water and Sewer District

Email: kvosesswd@gmail.com

Dover, NH



Q-PRESS® 800.2 HiCap Installations in Dover, NH

Our latest 4th generation screw press, the Q-PRESS® HiCap (High Capacity,) retains the same performance of the Q-PRESS® with a new engineered auger allowing for 30% higher throughput in the same package size. This upgraded design in our size Q-PRESS® 800.2 has been installed in Dover, NH with the following performance increase over the standard Q-PRESS® 800.2:

	Q-PRESS® 800.2	Q-PRESS®800.2 (HiCap)
Hydraulic Throughput (GPM)	65	85 (31% increase)
Solids Throughput (lb/hr)	585	765 (31% increase)
Cake Solids (%)	34%	35% (2.9% increase)

Contact:

Ray Vermett
 City of Dover, NH
 Email: r.vermette@dover.nh.gov

APPENDICIES



BID FORM

PROJECT IDENTIFICATION:

City of Aberdeen - WWTP Equipment Pre-Purchase

ARTICLE 1 - BID RECIPIENT

- 1.01 This Bid is submitted to: **City of Aberdeen, ID**

- 1.02 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into a Contract with Buyer in the form included in the Bidding Documents to furnish the Goods and Special Services as specified or indicated in the Bidding Documents, for the prices and within the times indicated in this Bid, and in accordance with the other terms and conditions of the Bidding Documents.

ARTICLE 2 - BIDDER'S ACKNOWLEDGMENTS

- 2.01 Bidder accepts all of the terms and conditions of the Notice Inviting Bids and Instructions to Bidders, including without limitation those dealing with the deposition of Bid security. This Bid will remain subject to acceptance for 60 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Buyer. Bidder will sign and submit the Agreement with the Bonds and other documents required within 15 days after the date of Owner's Notice of Award herein is received.

- 2.02 Bidder acknowledges that this Contract, if awarded, will be assigned by the Owner to the Installation Contractor, and hereby consents to the assignment under the terms and conditions of the Contract Documents. Bidder accepts that, until the assignment of contract is executed by all parties, the Owner is not obligated to any monetary commitment associated with the Contract beyond that which is associated with Special Engineering Services.

ARTICLE 3 - BIDDER'S REPRESENTATIONS

- 3.01 In submitting this Bid, Bidder represents that:
 - A. Bidder has examined and carefully studied the Bidding Documents, the related data identified in the Bidding Documents, and the following Addenda, receipt of which is hereby acknowledged:

Date	Number	Initials
March 14, 2023	1	CTP
March 20, 2023	2	CTP
_____	_____	_____

- B. Bidder is familiar with and is satisfied as to all Laws and Regulations in effect as of the date of the Bid that may affect cost, progress, and the furnishing of Goods and Special Services.

- C. Bidder has carefully studied, considered, and correlated the information known to Bidder; information commonly known to sellers of similar goods doing business in the locality of the Point of Destination and the site where the Goods will be installed or where Special Services will be provided; information and observations obtained from Bidder's visits, if any, to the Point of Destination and the site where the Goods will be installed or where Special Services will be provided; and any reports and drawings identified in the Bidding Documents regarding the Point of Destination and the site where the Goods will be installed or where Special Services will be provided, with respect to the effect of such information, observations, and documents on the cost, progress, and performance of Seller's obligations under the Bidding Documents.
- D. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, and discrepancies that Bidder has discovered in the Bidding Documents, and the written resolution (if any) thereof by Engineer is acceptable to Bidder.
- E. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for furnishing the Goods and Special Services for which this Bid is submitted.

ARTICLE 4 - BIDDER'S CERTIFICATIONS

4.01 Bidder certifies that:

- A. This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive agreement or rules of any group, association, organization, or corporation;
- B. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid;
- C. Bidder has not solicited or induced any individual or entity to refrain from bidding; and
- D. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 4.01.D:
 - 1. "corrupt practice" means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process;
 - 2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process to the detriment of Buyer, (b) to establish bid prices at artificial non-competitive levels, or (c) to deprive Buyer of the benefits of free and open competition;
 - 3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Buyer, a purpose of which is to establish bid prices at artificial, non-competitive levels; and

4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process.

ARTICLE 5 - BASIS OF BID

5.01 BID SCHEDULE 1 – BASE BID: WWTP EQUIPMENT. Bidder will furnish the Goods (specifically equipment by vendors listed below) and Special Services in accordance with the Contract Documents for the following price(s). Vendors may provide bids for one or more of the following base bid items. State of Idaho taxes shall not be included (Section P-800 – Supplementary Conditions 5.05.A).

Item No.	Description	Unit	Amount
1A	SUBMITTALS AND SHOP DRAWINGS: As defined in the Agreement, price not to exceed 10% of the Contract price for the work outlined in Item 1B.	LS	\$
1B	INTEGRATED FIXED FILM ACTIVATED SLUDGE SYSTEM consisting of (1) IFAS system and all necessary appurtenances and services as described in Section 46 21 35 of the specifications.	LS	\$
1A + 1B	TOTAL ITEM PRICE \$ _____ (In Words)	LS	\$

Item No.	Description	Unit	Amount
2A	SUBMITTALS AND SHOP DRAWINGS: As defined in the Agreement, price not to exceed 10% of the Contract price for the work outlined in Item 2B.	LS	\$
2B	SAND FILTER SYSTEM consisting of sand filters with all necessary appurtenances and services as described in Section 46 61 27 of the specifications.	LS	\$
2A + 2B	TOTAL ITEM PRICE \$ _____ (In Words)	LS	\$

Item No.	Description	Unit	Amount
3A	SUBMITTALS AND SHOP DRAWINGS: As defined in the Agreement, price not to exceed 10% of the Contract price for the work outlined in Item 3B.	LS	42,454.40 \$
3B	MECHANICAL DEWATERING SYSTEM consisting of mechanical screw press equipment and all necessary appurtenances and services as described in Section 46 66 16 of the specifications.	LS	382,089.80 \$
3A + 3B	TOTAL ITEM PRICE \$ <u>Four-hundred twenty-four thousand, five-hundred forty-four</u> (In Words)	LS	424,544.00 \$

ARTICLE 6 - PRICE ESCALATION

- 6.01 Any selected vendor or vendors will be required to honor their submitted proposal pricing for the Goods and Services for 60 consecutive calendar days from the proposal due date for this RFP.
- 6.02 Where a signed agreement between the City and the manufacturer is not signed within 60 calendar days from the proposal due date, price escalation shall be allowed as follows: Price adjustment will be based on the net change of the ENR Construction Cost Index occurring in the period from 60 consecutive calendar days from the proposal due date to the date when the agreement is signed with the City.

ARTICLE 7 - TIME OF COMPLETION

- 7.01 Bidder agrees that the furnishing of Goods and Special Services will conform to the schedule below. Startup services and training shall be coordinated with the Installation Contractor and Owner but shall not occur more than 21 days after the Vendor has certified the installation of the equipment.

Item	Required Time for Completion (Calendar days from Vendor Bid Award)
Signing of Agreement	30
	Required Time for Completion (Calendar days from completion of Signed Agreement)
Accepted Submittals, including drawings, calculations, and anchor bolt design	75
	Required Time for Completion (Calendar days from Installation Contractor Bid Award)

Assignment of Agreement to Installation Contractor	30
Delivery	212

ARTICLE 8 - ATTACHMENTS TO THIS BID

8.01 The following documents are attached to and made a condition of this Bid:

- A. Information Required of Bidder;
- B. Required Bid Security;
- ~~C. If Bid amount exceeds \$10,000, signed Compliance Statement (RD 400-6). Refer to specific equal opportunity requirements set forth in paragraph 18.10 of the Supplemental Conditions to the agreement with the Contractor who will install the WWTP equipment and to who the City will assign the contract with the Vendor (attached);~~
- ~~D. If Bid amount exceeds \$25,000, signed Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transactions (AD-1048);~~
- ~~E. If Bid amount exceeds \$100,000, signed RD Instruction 1940-Q, Exhibit A01, Certification for Contracts, Grants and Loans.~~

ARTICLE 9 - BID SUBMITTAL

9.01 This Bid submitted by: _____

If Bidder is:

~~**An Individual**~~

~~Name (typed or printed): _____~~

~~By: _____
(Individual's signature)~~

~~Doing business as: _____~~

~~Business address: _____~~

~~_____~~

~~Phone: _____ Facsimile: _____~~

~~E-mail address: _____~~

Partnership

Partnership Name: _____ (SEAL)

By: _____
(Signature of general partner - attach evidence of authority to sign)

Name (typed or printed): _____

Business address: _____

Phone: _____ Facsimile: _____

E-mail address: _____

A Corporation

Corporation Name: HUBER Technology, Inc.

State of Incorporation: North Carolina

Type (General Business, Professional, Service, other): Manufacturer



[Signature]
(Signature - attach evidence of authority to sign)

Name (typed or printed): Henk-Jan van Ettehoven

Title: President

Attest [Signature] (CORPORATE SEAL)
(Signature of Corporate Secretary)

Business address: 1009 Airlie Parkway, Denver NC 28037

Phone: (704) 949-1010 Facsimile: (704) 949-1020

E-mail address: Josey.Chan@hhusa.net

A Limited Liability Company (LLC)

LLC Name: _____

State in which organized: _____

By: _____
(Signature - attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____

Business address: _____

Phone: _____ Facsimile: _____

E-mail address: _____

~~**A Joint Venture**~~

~~First Joint Venturer Name: _____(SEAL)~~

~~By: _____
(Signature - attach evidence of authority to sign)~~

~~Name (typed or printed): _____~~

~~Title: _____~~

~~Business address: _____~~

~~_____~~

~~Phone: _____ Facsimile: _____~~

~~E-mail address: _____~~

~~Second Joint Venturer Name: _____(SEAL)~~

~~By: _____
(Signature - attach evidence of authority to sign)~~

~~Name (typed or printed): _____~~

~~Title: _____~~

~~Business address: _____~~

~~_____~~

~~Phone: _____ Facsimile: _____~~

~~E-mail address: _____~~

~~Phone and Facsimile Number, and Address for receipt of official communications to Joint
Venture:~~

~~_____~~

~~_____~~

(Each joint venturer must sign. The manner of signing for each individual, partnership, corporation, and limited liability company that is a party to the joint venture should be in the manner indicated above.)

BID BOND

Any singular reference to Bidder, Surety, Owner, or other party shall be considered plural where applicable.

BIDDER (Name and Address):

Huber Technology, Inc.
1009 Airie Parkway
Denver, NC 28037

SURETY (Name, and Address of Principal Place of Business):

Travelers Casualty and Surety Company of America
One Tower Square
Hartford, CT 06183

OWNER (Name and Address):

City of Aberdeen
33 N. Main St.
Aberdeen, ID 83210

BID

Bid Due Date: 3/23/2023

Description (Project Name— Include Location): City of Aberdeen WWTP Improvements

BOND

Bond Number: N/A

Date: 3/23/2023

Penal sum Five Percent of Amount Bid \$ 5% of Bid

(Words)

(Figures)

Surety and Bidder, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Bid Bond to be duly executed by an authorized officer, agent, or representative.

BIDDER

Huber Technology, Inc.

SURETY

Travelers Casualty and Surety Company of America

Bidder's Name and Corporate Seal

Surety's Name and Corporate Seal

Huber Technology, Inc. (Seal) Travelers Casualty and Surety Company of America (Seal)

By: Catherine Thompson
Signature (Attach Power of Attorney)

Catherine Thompson
Print Name

Attorney-in-Fact
Title

Attest: James Webb
Signature

Title James Webb, Witness

Attest: Joy Chan
Signature

Title Contract Administrator



Note: Addresses are to be used for giving any required notice.
Provide execution by any additional parties, such as joint venturers, if necessary.

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Bidder's and Surety's liability. Recovery of such penal sum under the terms of this Bond shall be Owner's sole and exclusive remedy upon default of Bidder.
2. Default of Bidder shall occur upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.
3. This obligation shall be null and void if:
 - 3.1 Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or
 - 3.2 All Bids are rejected by Owner, or
 - 3.3 Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).
4. Payment under this Bond will be due and payable upon default of Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.
5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions shall not in the aggregate exceed 120 days from the Bid due date without Surety's written consent.
6. No suit or action shall be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety and in no case later than one year after the Bid due date.
7. Any suit or action under this Bond shall be commenced only in a court of competent jurisdiction located in the state in which the Project is located.
8. Notices required hereunder shall be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Registered or Certified Mail, return receipt requested, postage pre-paid, and shall be deemed to be effective upon receipt by the party concerned.
9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.
10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond shall be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute shall govern and the remainder of this Bond that is not in conflict therewith shall continue in full force and effect.
11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.



**Travelers Casualty and Surety Company of America
Travelers Casualty and Surety Company
St. Paul Fire and Marine Insurance Company**

POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS: That Travelers Casualty and Surety Company of America, Travelers Casualty and Surety Company, and St. Paul Fire and Marine Insurance Company are corporations duly organized under the laws of the State of Connecticut (herein collectively called the "Companies"), and that the Companies do hereby make, constitute and appoint **Catherine Thompson** of **CHARLOTTE, North Carolina**, their true and lawful Attorney(s)-in-Fact to sign, execute, seal and acknowledge any and all bonds, recognizances, conditional undertakings and other writings obligatory in the nature thereof on behalf of the Companies in their business of guaranteeing the fidelity of persons, guaranteeing the performance of contracts and executing or guaranteeing bonds and undertakings required or permitted in any actions or proceedings allowed by law.

IN WITNESS WHEREOF, the Companies have caused this instrument to be signed, and their corporate seals to be hereto affixed, this 21st day of April, 2021.



State of Connecticut

City of Hartford ss.

By: 
Robert L. Raney, Senior Vice President

On this the 21st day of April, 2021, before me personally appeared **Robert L. Raney**, who acknowledged himself to be the Senior Vice President of each of the Companies, and that he, as such, being authorized so to do, executed the foregoing instrument for the purposes therein contained by signing on behalf of said Companies by himself as a duly authorized officer.

IN WITNESS WHEREOF, I hereunto set my hand and official seal.

My Commission expires the 30th day of June, 2026




Anna P. Nowik, Notary Public

This Power of Attorney is granted under and by the authority of the following resolutions adopted by the Boards of Directors of each of the Companies, which resolutions are now in full force and effect, reading as follows:

RESOLVED, that the Chairman, the President, any Vice Chairman, any Executive Vice President, any Senior Vice President, any Vice President, any Second Vice President, the Treasurer, any Assistant Treasurer, the Corporate Secretary or any Assistant Secretary may appoint Attorneys-in-Fact and Agents to act for and on behalf of the Company and may give such appointee such authority as his or her certificate of authority may prescribe to sign with the Company's name and seal with the Company's seal bonds, recognizances, contracts of indemnity, and other writings obligatory in the nature of a bond, recognizance, or conditional undertaking, and any of said officers or the Board of Directors at any time may remove any such appointee and revoke the power given him or her; and it is

FURTHER RESOLVED, that the Chairman, the President, any Vice Chairman, any Executive Vice President, any Senior Vice President or any Vice President may delegate all or any part of the foregoing authority to one or more officers or employees of this Company, provided that each such delegation is in writing and a copy thereof is filed in the office of the Secretary; and it is

FURTHER RESOLVED, that any bond, recognizance, contract of indemnity, or writing obligatory in the nature of a bond, recognizance, or conditional undertaking shall be valid and binding upon the Company when (a) signed by the President, any Vice Chairman, any Executive Vice President, any Senior Vice President or any Vice President, any Second Vice President, the Treasurer, any Assistant Treasurer, the Corporate Secretary or any Assistant Secretary and duly attested and sealed with the Company's seal by a Secretary or Assistant Secretary; or (b) duly executed (under seal, if required) by one or more Attorneys-in-Fact and Agents pursuant to the power prescribed in his or her certificate or their certificates of authority or by one or more Company officers pursuant to a written delegation of authority; and it is

FURTHER RESOLVED, that the signature of each of the following officers: President, any Executive Vice President, any Senior Vice President, any Vice President, any Assistant Vice President, any Secretary, any Assistant Secretary, and the seal of the Company may be affixed by facsimile to any Power of Attorney or to any certificate relating thereto appointing Resident Vice Presidents, Resident Assistant Secretaries or Attorneys-in-Fact for purposes only of executing and attesting bonds and undertakings and other writings obligatory in the nature thereof, and any such Power of Attorney or certificate bearing such facsimile signature or facsimile seal shall be valid and binding upon the Company and any such power so executed and certified by such facsimile signature and facsimile seal shall be valid and binding on the Company in the future with respect to any bond or understanding to which it is attached.

I, **Kevin E. Hughes**, the undersigned, Assistant Secretary of each of the Companies, do hereby certify that the above and foregoing is a true and correct copy of the Power of Attorney executed by said Companies, which remains in full force and effect.

Dated this 23 day of March, 2023




Kevin E. Hughes, Assistant Secretary

**To verify the authenticity of this Power of Attorney, please call us at 1-800-421-3880.
Please refer to the above-named Attorney(s)-in-Fact and the details of the bond to which this Power of Attorney is attached.**



SCOPE OF SUPPLY

Aberdeen, ID

Equipment:

HUBER Screw Press Q-PRESS 620.2®

Section Number: 46 76 27

Addenda Numbers: 1

Represented by:

Goble Sampson Associates

Ryan Spanton

(801) 268-8790

rspanton@goblesampson.com

Regional Sales Director:

Ron Maiorana

704-990-2422

Ron.Maiorana@hhusa.net

Project Number: 409198

Revision: 0

Date: 3/31/2023

Design Information

Technical Data		
Sludge Type	Waste Activated Sludge	
Upstream Biological Process	Activated Sludge with Secondary Clarifier	
Upstream Digestion Process	Aerobic Digester	with 30 day sludge age
Design Feed Rate (given)	210	lb/hr
Feed Sludge Concentration	1.5	%
Sludge TDS (assumed)	800	mg/L
Sludge VSS	70	%
Sludge pH (assumed)	7.1	SU
Chloride Concentration (assumed)	50	mg/L
Phosphate Concentration (assumed)	25	mg/L
Calculated Hydraulic Loading Rate (total)	28 at 1.5% feed solids	gpm
Calculated Solids Loading Rate (total)	210 at 1.5% feed solids	lb/hr
Estimated Cake Solids ¹	16	%
Capture Rate ¹	≥95	%
Estimated Polymer Consumption ¹	32 - 40 lb active polymer/dry ton of sludge	
Average Spray Wash Water Requirement ²	62 gph at 72.5 psi	
Spray Water Connection	1.25	inch
Sludge Inlet Diameter	4	inch
Approximate Screw Press Empty Weight	6000	lbs
Approximate Screw Press Full Weight	7300	lbs

¹All performance is estimated based on typical screw press performance. In order to guarantee performance Huber must run a pilot test.

²Wash water cycle runs at approximately 36 gpm for 114 seconds. Typical applications experience 1-2 wash cycles per hour.

Equipment Details

Model	HUBER Screw Press Q-PRESS 620.2®
Quantity	1
Material	304L stainless steel construction; pickled and passivated in acid bath
Basket Material	Wire mesh; stainless steel
Auger Inclination	12°
Support Legs	304L stainless steel
Wiper Material	Wear resistant polyurethane
Anchor Bolts	M12, 316L stainless steel
Motor Data	3 hp drive motor, 460 VAC, 60 Hz, 3 ph
Spraywash Motor Data	0.25 hp spraywash motor, 460 VAC, 60 Hz, 3 ph

Polymer System	Velodyne VM-2P-300-D
Quantity	1
Neat Polymer Pump Motor	1/2 hp, 90 VDC
Mixer Motor	1/2 hp, 90 VDC

Ancillary Equipment	
Polymer Injection Ring	1, DN50 injection rings
Polymer Mixing Device	1, DN50 mixing valves
Air Compressor	Quantity: 1

Controls	One (1) Main Control Panel
<i>Power Supply: 480VAC-3PH-60HZ</i>	
<i>Panel Classification: NONE</i>	
<i>Location: Indoors</i>	
1 - Enclosure, NEMA 4X, 304 Stainless Steel w/ 3PT Latch	
1 - Enclosure Window Kit	
1 - Main Disconnect, Non-Fused Type, w/Through Door Disconnect Handle	
1 - Variable Frequency Drive, PowerFlex 525 Series, with Branch Circuit Protection	
[5HP - 480VAC Max, Press - PM Motor 3.0HP VFD]	
1 - Motor Starter, Reversing, NEMA, w/Overload Relay and CB Branch Circuit Protection	
[0.5HP - 480VAC Max, Spray Drive]	
1 - Surge Protection, 480VAC	
1 - Surge Protection, 120VAC	
1 - Phase Failure Voltage Monitoring Relay	
1 - Programmable Logic Controller, Allen-Bradley CompactLogix 5069 Series w/ Ethernet and Required IO	
1 - Operator Interface Unit, Allen-Bradley PanelView Plus, 12" Display	
1 - UPS Battery Backup - Phoenix or Equal	
1 - 24VDC Power Supply, Redundant - Phoenix or Equal	
1 - Ethernet Switch, Unmanaged	
1 - Panel Heater, with Thermostat	
1 - Lot, Circuit Breakers, 120VAC: [As Required]	
1 - Lot, Pilot Lights, LED, PTT Type: [As Required]	
1 - Lot, Push Buttons: [As Required]	
1 - Lot, Selector Switches: [As Required]	
1 - Lot, Control Relays, Socket Type: [As Required]	
1 - Lot, Terminal Blocks: [As Required]	
1 - Lot, Dry Contacts: [As Required]	
1 - UL Label	
Remote ETHERNET signals to/from Q-Press Control Panel and SCADA System:	
(1) Lot, Dewatering System Status - To / From SCADA	
- SCADA Remote Start	
- Press Running Status	
- Press Fault Status	
- Dewatering Mode Status	
- System Disturbance Status	

Remote HARDWIRED signals to/from Q-Press Control Panel (Items either exist or provided by others):

(1) Polymer Dosing System

- Call to Run
- Pacing Signal, 4-20mA
- System Auto Status
- System Running Status
- System Fault Status

(1) Feed Pump

- Call to Run
- Pacing Signal, 4-20mA
- System Auto Status
- System Running Status
- System Fault Status

(1) Cake Conveyor

- Call to Run
- System Auto Status
- System Running Status
- System Fault Status

(1) Sludge Storage Tank

- Tank Level, 4-20mA

Spare Parts

One (1) set	Wipers with mounting hardware
One (1)	Bearing assembly for shaft
One (1)	1-inch solenoid valve
Ten (10)	Nozzles for spray bar washing system

Freight and Startup Services

2 days and 1 trips	Startup, performance testing (day 1), and training.
Freight to jobsite.	

Pricing

Equipment	Model	Quantity	Pricing
HUBER Screw Press	Q-PRESS 620.2®	1	Included
Polymer System	VM-2P-300-D	1	Included
Ancillary Equipment			Included
HUBER Control Panel		1	Included
Spare Parts			Included
Freight and Startup Services		2 days, 1 trips	Included
TOTAL:			See Bid Form

This proposal has been reviewed for accuracy and approved for issue by: CTP

Project Clarifications

For the 46 76 27 equipment, HUBER is offering our well-proven Q-PRESS. HUBER's offering is designed to meet the performance requirements and intent of the specification. HUBER's equipment differs in construction from the specification, including (but not limited to) the following:

Section 46 76 27

Above proposal includes controls for a single Q-Press with dedicated feed pump, polymer system, and discharge cake conveyor. These controls do NOT consider any future Q-Press or other equipment, and are currently NOT equipped to accommodate and feed / polymer sharing with a future system.

Feed Pump VFD, Cake Conveyor Motor Starter, Booster Pump, and Sludge Holding Tank Level Sensor are NOT included and are to be supplied by others. The above proposal included status and control signaling to/from these system ONLY.

Flocculation piping to be supplied by others. HUBER has included a flocc piping report with their bid submission.

General Notes

1. HUBER Scope of Supply is based on bid documents dated Feb. 2023 equipment section 46 76 27.
2. HUBER is in receipt of the following addenda:
Addendum 1 dated 03/14/2023
3. All electrical interconnections, wirings, junction boxes, local motor disconnects, and terminations between the equipment and electrical components are to be provided by installing contractor.
4. Any item not specifically listed is not considered part of this scope of supply. Please contact the HUBER Technology representative listed for further clarification.
5. A fully functioning and programmed HMI/PLC will be delivered to site. Screens and symbols used on the HMI are based on HUBER's standard unless otherwise noted. Software licenses for the PLC/HMI program will not be included in this scope of supply unless stated otherwise. These items are available for additional price adder upon request.
6. The Control Panel is based on the specification provided and inclusive to meet the requirements of a Vendor designed panel, whereas the components and the factory testing of the panel will meet HUBER's requirements for function and warranty. Additional requirements or sections of the specification to meet local authority requirements or control panels designs unrelated to the equipment section, including special labeling, testing, or integration have not been included.
7. HUBER Technology, Inc. is offering the equipment and associated performance guarantees based on information available at the time of the issuance date. Information not made available to HUBER, whether HUBER is asking for specific information or not, which could affect the performance of the equipment might void warranty and performance guarantees.
8.
HUBER will ship all equipment to site inside of 20', 40' or 40'OT ocean containers as deemed appropriate by our factory. HUBER will not ship any equipment on flatbed truck. Flatbed truck shipping means that the equipment would need to be transferred at port from factory packaged containers to the flatbed. This process is out of HUBER's control and it is our experience that equipment always gets damaged during this process.
9. HUBER's standard submittal documents, programming, testing procedure and O&M documentation are included.
10. Blue motor covers are aesthetic only, and have not been included in the HUBER Scope of Supply.
11. Air compressor and polymer system shall be powered by others. 120VAC power for these items is not intended from HUBER panel.

HUBER Comments to Aberdeen, ID (Contractual)

1. EJCDC P-520, Article 4.04 Liquidated Damages: If HUBER is assessed liquidated damages as stated in this article, we kindly request that there should be a cap of 10% of the total value of the Agreement.
2. Section 01 29 76, Article 1.2.A Schedule of Payments: HUBER kindly request that the schedule of payments should be adjusted for the following:
 - Delivery of Goods 75%
 - Manufacturer's installation Certificate 5%
 - Successful Completion of Testing 5%
 - Engineer's Approval of O&M Manual 5%
 - Completion of Training 5%
 - Substantial Completion 5%
3. HUBER wants to confirm that their control panel does not need to account for the future system mentioned in the specifications. Please advise if the control panel should be designed to accommodate future VFD's, common conveyor logic, valve switchover, etc.

Thank you,

Manufacturer's Experience and References

Per Section 00 40 00, 1.4

Please see references in the following pages. HUBER has installed over 250 Q-PRESS units around the US. HUBER began producing equipment for the municipal wastewater industry in the late 1800's, and began their expanse into the North American market in the late 1990's.

Product Support Services
Per Section 00 40 00, 1.3

1. Provide examples or document past experience.

Elaborated on below.

2. List of office locations of the WWTP Equipment Manufacturer in North America. Provide location where the equipment is manufactured.

The HUBER Technology, Inc. North American headquarters and manufacturing facility is located in Denver, NC just 20 minutes north of Charlotte. This facility is currently undergoing a major expansion that will allow ALL HUBER equipment lines to be manufactured in the USA with US steel and components. HUBER also has 20 full-time and factory-trained service technicians stationed around the United States, with a Q-PRESS expert technician located in Blackfoot, ID, 45 minutes from Aberdeen. Equipment will – in all likelihood – be manufactured in Berching, Germany, as expansion efforts in Denver, NC will not be completed for this product line until late 2024.

3. List all service/maintenance locations in the United States for the WWTP equipment to be provided. Provide the following for each location:

- a. Location:

HUBER is expanding their current facilities as mentioned above, which will include a full service bay for overhauling equipment. This being said, all Q-PRESS maintenance procedures can be completed in place, by site, or by a HUBER technician.

- b. Type of support services provided:

HUBER is capable of sending technicians to site to troubleshoot, optimize, and repair equipment in Aberdeen, or in Denver, NC.

- c. Description of Service Provided by Manufacturer or Subcontractor

See above.

- d. Response Time for Technician to be in Aberdeen

As mentioned above, HUBER technicians are stationed around the US, with one located in Blackfoot, ID. While HUBER must schedule each technician visit on a case-by-case basis, technician proximity to the site in Aberdeen will allow for expedited service trips.

4. Describe the system start-up and operator training capabilities of the Equipment Manufacturer. In addition, provide resume for installation supervision and start-up personnel.

Equipment manufacturer is capable of performing full system inspection, start-up, optimization, and testing. Resume shall be provided prior to start-up, to ensure technician who is available for visit matches the resume provided.

5. Describe facilities, programs and methods, which the Equipment Manufacturer provides to Owners/operators for ongoing maintenance and troubleshooting.

HUBER has multiple Technical Support Managers on staff, who are capable of providing insight and optimization advice remotely, prior to HUBER sending a service technician to site. This allows HUBER to support our customers without our customers paying additional travel costs associated with visiting the site. On top of this, HUBER employs two full time Service Advisors who travel the country visiting facilities and inspecting HUBER equipment.

6. Provide description of available 24/7 telephone support services, additional operator training after start-up including conferences, available support groups and quarterly site visits.

HUBER maintains a 24/7 Service Hotline for emergency events. HUBER is also capable of providing additional site services upon request, including further training, scheduled service contract visits, and consultations with the Group Product Manager for Biosolids Treatment. HUBER attempts to check in with facilities multiple times per year to identify current machine performance, and to ensure that a proactive approach is taken to machine maintenance.

Q-PRESS - United States Installation/Order List

Total Units in USA: 293

date of order	size	project	quantity
03/09/2023	440.2	Brookings, SD; US	1.00
02/17/2023	800.2	Pocatello/ ID, US	2.00
12/22/2022	620.2	Rigby, ID_Q-Press, US	1.00
11/24/2022	440.2	Owosso / MI, US	2.00
11/08/2022	440.2	Hudson Creek- Crestline, US	2.00
10/26/2022	620.2	Shepherdstown, WV_Qpress; US	1.00
09/09/2022	620.2	Lebanon, NH	1.00
07/28/2022	800.2	Genoa Osceola, MI_Q-Press, US	1.00
05/25/2022	800.2	Roswell, NM, US	2.00
04/28/2022	800.2	Windsor, CO - Q-Press 800.2	2.00
04/26/2022	800.2	Reno, South Truckee Meadows, NV, US	1.00
03/30/2022	800.2	Old Orchard Beach, ME; US	1.00
01/24/2022	800.2	Klamath Falls, 2nd Machine, OR	1.00
01/19/2022	800.2	Chobani - Twin Falls, US	2.00
11/04/2021	620.2	Page, AZ	1.00
10/28/2021	440.2	Monroe City, Q-Press, MO	1.00
09/20/2021	440.2	San Bernardino, CA	1.00
09/08/2021	800.2	Danville, KY	2.00
09/02/2021	800.2	American Vally WWTP - Quincy, US	1.00
08/23/2021	800.2	Delano, MN	1.00
07/23/2021	800.2	UTRWD Peninsula, TX, US	1.00
07/07/2021	800.2	Gilroy, CA	2.00
06/25/2021	800.2	Galesburg, San District, IL, US	2.00
06/09/2021	620.2	Aberdeen, SD	2.00
06/01/2021	800.2	Mars Petcare - Fort Smith / AR, US	1.00
05/19/2021	620.2	Marianna / FL, US	2.00
05/19/2021	440.2	Monticello / WI, US	1.00
05/19/2021	800.2	Marion / KY, US	1.00
05/07/2021	440.2	Rome / GA, US	1.00
04/06/2021	440.2	Wawona / CA, US	1.00
03/15/2021	800.2	Klamath Falls, Spring Street, US	1.00
03/15/2021	800.2	Bozeman / MT, US	1.00
02/25/2021	800.2	East Peoria / IL, US	2.00
02/16/2021	440.2	Chino Valley, AZ, US	1.00
02/05/2021	620.2	Jeffersonville / IN, US	1.00
01/21/2021	440.2	Tulkoff Food, MD, US	1.00
01/14/2021	440.2	Mars Petcare - Columbus, OH, US	1.00
12/10/2020	800.2	St. Vrain / CO, US	2.00
11/25/2020	440.2	C.B. NICHOLS EG RANCH, US	1.00
07/28/2020	800.2	Cheyenne, Dry Creek / WI, US	2.00
05/04/2020	440.2	Celina / OH, US	2.00

04/23/2020	620.2	New Boston / TX, US	1.00
01/23/2020	620.2	Central City / KY, US	1.00
01/15/2020	620.2	East Peoria, STP#3 / IL, US	1.00
12/11/2019	800.2	Morris, Central WWTP / IL, US	1.00
12/11/2019	280	Roaring Fork, Carbondale / CO, US	1.00
12/10/2019	800.2	Richmond / ME, US	1.00
12/10/2019	800.2	Imperial, CA, US	2.00
11/08/2019	620.2	Mars Royal Canin, SD_Q-Press, US	1.00
11/08/2019	800.2	Premium Iowa Pork Luverne, US	1.00
10/28/2019	620.2	Premium Iowa Pork Hospers, IA, US	1.00
07/08/2019	800.2	Huntington, NY, US	1.00
05/16/2019	800.2	Gunnison WWTP, US	2.00
04/15/2019	800.2	City of Lewiston / ID, US	2.00
02/28/2019	800.2	Franklin / TN, US	2.00
02/18/2019	280	Kerry Foods / Afton MO, US	1.00
02/11/2019	800.2	Holmen / WI, US	1.00
02/08/2019	280	Las Cruces / NM, US	1.00
02/07/2019	440.2	Havana / FL, US	1.00
01/18/2019	800.2	Yuba City, CA - Q-Press, US	3.00
12/06/2018	440.2	Lincoln County WWTP, NC, US	1.00
10/25/2018	800.2	Midland WPCP, TX, US	5.00
10/10/2018	620.2	North Conway, NH, US	1.00
09/27/2018	800.2	Lebanon / IL, US	1.00
09/26/2018	440.2	Fairbury / IL, US	1.00
09/19/2018	440.2	Middle Oconee-Jackson Co., GA, US	1.00
08/31/2018	800.2	Dover / NH, US	2.00
07/09/2018	620.2	Oostburg / WI, US	1.00
06/29/2018	440.2	Dorchester County, SC, US	1.00
06/28/2018	800.2	South Beloit / IL, US	1.00
06/18/2018	620.2	Jeffersonville, IN - Oak Park, US	1.00
04/20/2018	440.2	Berwick / ME, US	1.00
03/23/2018	620.2	Yarmouth / ME, US	2.00
12/20/2017	280	Dynatec Z&S - Q280, US	2.00
11/30/2017	620.2	Dousman / WI, US	1.00
11/29/2017	620.2	Laie / HI, US	2.00
11/29/2017	440.2	Potawatomi / WI, US	1.00
11/24/2017	620.2	North Conway / NH, US	2.00
11/22/2017	280	Oak Hill / WV Rt. 61, US	1.00
11/22/2017	280	Oak Hill, Minden Road, WV	1.00
11/21/2017	440.2	Dyer / IN, US	2.00
10/23/2017	620.2	Mercer / PA, US	1.00
09/29/2017	800.2	Rochester / NH, US	2.00
09/29/2017	800.2	Chatsworth / GA, US	1.00
05/29/2017	620.2	Fountain Hills / AZ, US	2.00

05/05/2017	620.2	Moab / UT, US	1.00
04/07/2017	620.2	Far Best Food, US	1.00
04/07/2017	800.2	Old Orchard Beach, US	1.00
04/05/2017	620.2	Glen Rose / TX, US	1.00
04/04/2017	800.2	Marana / AZ, US	1.00
04/03/2017	800.2	Grants / NM, US	1.00
02/21/2017	440.2	Broad Creek WWTP, US	1.00
01/30/2017	620.2	Caveland, KY	1.00
01/13/2017	280	Hortonville / WI, US	1.00
12/20/2016	620.2	Castroville / TX, US	1.00
12/20/2016	280	Stockbridge-Munsee / WI, US	1.00
11/11/2016	620.2	Star / ID, US	1.00
11/02/2016	800.2	Sheboygan / WI, US	2.00
10/17/2016	280	Hortonville / WI, US	1.00
09/26/2016	800.2	Portsmouth / NH, US	2.00
08/23/2016	800	Dothan / AL, US	2.00
07/29/2016	800.2	Big Creek, GA	1.00
07/11/2016	620	Barstow / CA, US	1.00
07/07/2016	440	Stock Q-PRESS 220, US - 2x Walterboro, SC, 1x Lincoln County, NC - WTP, 1x Lihue Puihi, HI	5.00
06/15/2016	800	Trussville / AL, US	1.00
05/17/2016	620	Washington / IL, US	1.00
03/17/2016	440	Croswell / MI, US	1.00
03/10/2016	280	Albuquerque / NM, US	1.00
02/29/2016	800	Farmington / CT, US	2.00
12/18/2015	620	Newmarket / NH, US	1.00
12/16/2015	440	Spring Valley / IL, US	1.00
12/02/2015	800.2	Q-Press 800.2 Dover NH, US	1.00
10/30/2015	280	Dynatec Systems ? Ford RoS3Q, US	1.00
10/14/2015	800	West Richland / WA, US	1.00
09/21/2015	620	Schofield / HI, US	2.00
08/07/2015	800	City of Riverside / CA, US	2.00
08/07/2015	800	City of Riverside / CA, US	2.00
07/21/2015	800	Bucksport WWTF Upgrades / ME, US	1.00
06/11/2015	440	Robinson IL, US	1.00
05/28/2015	800	Chiquita WWTP, Rancho Santa M, US	2.00
05/07/2015	440	Jackson County / GA, US	1.00
04/07/2015	280	Stevensville / MT, US	1.00
03/16/2015	800	Dothan / AL, US	2.00
02/24/2015	440	Chillicothe Correctional Institutio	1.00
02/19/2015	440	Climber Twin Falls, US	1.00
02/04/2015	800	South Truckee Meadows WRF / NV, US	2.00
02/04/2015	800	Emporia / VA, US	1.00
01/19/2015	620	Hailey, ID, US	1.00

10/10/2014	620	Stock Q620, US	2.00
09/30/2014	280	Forreston, IL - Q280	1.00
09/02/2014	800	Genoa/Oceola / MI, US	1.00
08/08/2014	280	Sheridan / IL, US	1.00
06/04/2014	800	Big Creek / GA, US	4.00
06/03/2014	800	Portales NM, US	1.00
04/11/2014	800	Ogden/UT, US - WTP	1.00
02/26/2014	440	Ele'ele / HI, US	1.00
02/17/2014	280	Premium Iowa Pork, IA; US	1.00
01/29/2014	800	Reidsville NC, US	1.00
01/27/2014	280	Arcadis-Houston / TX, US	1.00
01/08/2014	800	BCR Deltona / FL, US	1.00
12/18/2013	280	Patawatomi / WI, US	1.00
12/13/2013	800	Durham / NH, US	2.00
11/08/2013	620	CRAMAERTON, US	2.00
11/07/2013	620	Barstow / CA, US	1.00
10/09/2013	280	Ruiz Foods, US	1.00
10/08/2013	620	Clayton GA, US	1.00
09/11/2013	620	York / ME, US	2.00
09/10/2013	800	Porterville / CA, US	1.00
08/29/2013	620	Clayton GA, US	1.00
06/14/2013	280	Lena / IL, US	1.00
04/30/2013	800	Riverside / CA, US	2.00
04/11/2013	800	Newberg OR, US	2.00
03/27/2013	440	Running Springs CA, US	1.00
03/19/2013	440	Acton TX, US	1.00
03/06/2013	800	Monticello MN, US	1.00
02/28/2013	280	Various Jobs and inventory, US	2.00
02/28/2013	440	Various Jobs and inventory, US	4.00
02/19/2013	440	Cumberland County NJ, US	1.00
01/29/2013	440	Deltona Lakes FL, US	1.00
01/17/2013	800	SGWASA NC-Sludge, US	1.00
01/16/2013	440	Box Elder SD SLUDGE, US	1.00
01/14/2013	440	Lebanon NH, US	2.00
01/10/2013	440	Lincoln County/NC, US - WTP	1.00
10/22/2012	440	Gadsden / AL, US	2.00
10/11/2012	800	Clarkston WA, US	2.00
10/02/2012	280	Louisiana MO, US	1.00
08/22/2012	800	Nashua NH, US	2.00
08/22/2012	800	Nashua NH, US	1.00
07/06/2012	440	Gadson AL, US	2.00
07/06/2012	440	Q440 HUBER USA 1, US	1.00
07/06/2012	440	Q440 HUBER USA 2, US	1.00
06/22/2012	800	Grifton-CMSD / NC, US	2.00

06/15/2012	800	Falkenburg FL, US	3.00
06/13/2012	440	Millbrook AL, US	1.00
05/04/2012	440	Biddeford ME, US	2.00
04/26/2012	440	Bonifay FL, US	1.00
04/25/2012	800	Moorefield WV, US	1.00
02/22/2012	440	Dorchester SC, US	1.00
02/14/2012	440	St. Vrain SD, US	2.00
11/30/2011	800	Pekin WWTP IL, US	2.00
11/22/2011	280	Knoxville / IL, US	1.00
11/17/2011	440	Clark County / OH, US	1.00
10/06/2011	800	Lakehaven WA, US	1.00
09/02/2011	280	Berwick ME, US	1.00
08/31/2011	280	Greenleaf ID, US	1.00
08/29/2011	800	Rexburg II ID, US	2.00
08/10/2011	440	South Berwick ME, US	2.00
07/27/2011	800	Boerne TX, US	1.00
07/21/2011	800	Springfield, IL - Spring Creek	2.00
04/28/2011	440	Libby MT, US	1.00
03/29/2011	440	Cumberland County NJ, US	1.00
03/29/2011	440	Allenstown, NH; US	1.00
03/09/2011	440	Mona UT, US	1.00
03/04/2011	280	MESSE HHUSA, US	1.00
01/27/2011	440	UConn CT, US	2.00
10/01/2010	440	Lincoln, ME; US	2.00
09/28/2010	440	Orange Beach / AL, US	2.00
09/14/2010	800	MAWSS, Mobile AL, US	1.00
08/17/2010	440	Daphne, AL; US	1.00
08/17/2010	440	Daphne, AL; US	1.00
05/05/2010	440	Brookings, SD; US	1.00
02/16/2010	440	Blairville, GA, USA	1.00
01/28/2010	440	Broad Creek WWTP, USA	1.00
12/15/2009	800	Charlotte, US	1.00
11/25/2009	440	Allenstown, NH; US	2.00
11/23/2009	280	Platte City / MO, USA	1.00
08/12/2009	440	South Paris, ME; US	1.00
02/19/2009	800	Santa Paula / CA, US	1.00
01/27/2009	280	Cokeville, WY; US	1.00
01/12/2009	440	Kennebunk, ME; US	2.00
05/13/2008	280	Trial unit RoS3Q 280, USA	1.00
04/04/2007	280	North Fork WRF, Sundance ID;US	1.00
09/21/2006	280	Hill City, SD	1.00
06/23/2006	280	Weftec 2006 - RoS3Q 280, US	1.00

HUBER Screw Press Q-PRESS® (Size 800)



Dover (WWTP), NH

484 Middle Road, Dover, NH 03820
Ray Vermette, Facility Supervisor
O (603) 516-6475 | r.vermette@doover.nh.gov
C (603) 396-4008

Three (3) Q-PRESS® 800.2
Installation date: 2015 & 2019



City of Newberg (WWTP), OR

2301 Wyooski Road, Newberg, OR 97132
Craig Pack, Supervisor
O (503) 554-7775 | craig.pack@newbergoregon.gov

Two (2) Q-PRESS® 800.0
Installation date: 11/2014



CMSD, Grifton, NC

900 Wiley Gaskins Road, Grifton, NC 28530
Chuck Smithwick, Plant Manager
O (252) 524-5584 | cmsd100@embarqmail.com

Two (2) Q-PRESS® 800.0
Installation date: 10/2013



City of Clarkston (WWTPS), WA
102 13th Street, Clarkston, WA 99403
Wes Ison, Plant Manager
O (509) 758-1674 | clarkstonwwtp@qwestoffice.net

Two (2) Q-PRESS® 800.0
Installation date: 06/2014



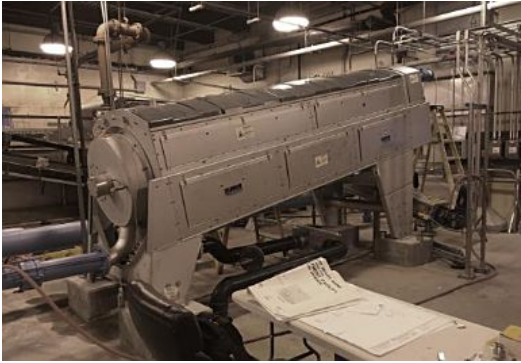
City of Chatsworth (Judson Vick WWTP), GA
300 Judson Vick Drive, Chatsworth GA 30705
Heath Harrison, Assistant General Manager
O (706) 695-3132 | heathh@chatsworthwater.com
C (706) 508-2477

One (1) Q-PRESS® 800.2
Installation date: 09/2019



Peirce Island (WWTF Upgrade), NH
200 Peirce Island Road, Portsmouth, NH 03801
Peter Conroy, Chief Plant Operator
O (603) 427-1553 | paconroy@cityofportsmouth.com

Two (2) Q-PRESS® 800.2
Installation date: 06/2019



Town of Old Orchard Beach (WWTP), ME
24 Manor Street, Ocean Park, ME 04063
Christopher White, Superintendent
C (207) 351-0030 | cwhite@oobmaine.com

One (1) Q-PRESS® 800.2
Installation date: 03/2018



Genoa-Oceola (WWTP), MI
900 Chilson Road, Howell, MI 48843
James "Jim" Aulette, MHOG Water Utility Lead Plant Operator
O (517) 548-1416 | jima@mhog.org
C (517) 672-9653

One (1) Q-PRESS® 800.0
Installation date: 06/2015

BID BOND

Any singular reference to Bidder, Surety, Owner, or other party shall be considered plural where applicable.

BIDDER (Name and Address):

Huber Technology, Inc.
1009 Airie Parkway
Denver, NC 28037

SURETY (Name, and Address of Principal Place of Business):

Travelers Casualty and Surety Company of America
One Tower Square
Hartford, CT 06183

OWNER (Name and Address):

City of Aberdeen
33 N. Main St.
Aberdeen, ID 83210

BID

Bid Due Date: 3/23/2023

Description (Project Name— Include Location): City of Aberdeen WWTP Improvements

BOND

Bond Number: N/A

Date: 3/23/2023

Penal sum Five Percent of Amount Bid \$ 5% of Bid
(Words) (Figures)

Surety and Bidder, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Bid Bond to be duly executed by an authorized officer, agent, or representative.

BIDDER

Huber Technology, Inc.

SURETY

Travelers Casualty and Surety Company of America

Bidder's Name and Corporate Seal

Surety's Name and Corporate Seal

Huber Technology, Inc. (Seal) Travelers Casualty and Surety Company of America (Seal)

By: Catherine Thompson
Signature (Attach Power of Attorney)



Signature
Signature

Print Name
Print Name

Title
Title

Corporate Secretary
Title

Attest: Signature
Signature

Title
Title

Contract Administrator
Title

Catherine Thompson
Signature (Attach Power of Attorney)

Catherine Thompson
Print Name

Attorney-in-Fact
Title

Attest: Signature
Signature

Title
Title

Note: Addresses are to be used for giving any required notice.
Provide execution by any additional parties, such as joint venturers, if necessary.

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Bidder's and Surety's liability. Recovery of such penal sum under the terms of this Bond shall be Owner's sole and exclusive remedy upon default of Bidder.
2. Default of Bidder shall occur upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.
3. This obligation shall be null and void if:
 - 3.1 Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or
 - 3.2 All Bids are rejected by Owner, or
 - 3.3 Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).
4. Payment under this Bond will be due and payable upon default of Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.
5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions shall not in the aggregate exceed 120 days from the Bid due date without Surety's written consent.
6. No suit or action shall be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety and in no case later than one year after the Bid due date.
7. Any suit or action under this Bond shall be commenced only in a court of competent jurisdiction located in the state in which the Project is located.
8. Notices required hereunder shall be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Registered or Certified Mail, return receipt requested, postage pre-paid, and shall be deemed to be effective upon receipt by the party concerned.
9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.
10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond shall be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute shall govern and the remainder of this Bond that is not in conflict therewith shall continue in full force and effect.
11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.



**Travelers Casualty and Surety Company of America
Travelers Casualty and Surety Company
St. Paul Fire and Marine Insurance Company**

POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS: That Travelers Casualty and Surety Company of America, Travelers Casualty and Surety Company, and St. Paul Fire and Marine Insurance Company are corporations duly organized under the laws of the State of Connecticut (herein collectively called the "Companies"), and that the Companies do hereby make, constitute and appoint **Catherine Thompson** of **CHARLOTTE, North Carolina**, their true and lawful Attorney(s)-in-Fact to sign, execute, seal and acknowledge any and all bonds, recognizances, conditional undertakings and other writings obligatory in the nature thereof on behalf of the Companies in their business of guaranteeing the fidelity of persons, guaranteeing the performance of contracts and executing or guaranteeing bonds and undertakings required or permitted in any actions or proceedings allowed by law.

IN WITNESS WHEREOF, the Companies have caused this instrument to be signed, and their corporate seals to be hereto affixed, this 21st day of April, 2021.



State of Connecticut

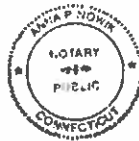
City of Hartford ss.

By: 
Robert L. Raney, Senior Vice President

On this the 21st day of April, 2021, before me personally appeared **Robert L. Raney**, who acknowledged himself to be the Senior Vice President of each of the Companies, and that he, as such, being authorized so to do, executed the foregoing instrument for the purposes therein contained by signing on behalf of said Companies by himself as a duly authorized officer.

IN WITNESS WHEREOF, I hereunto set my hand and official seal.

My Commission expires the 30th day of June, 2026




Anna P. Nowik, Notary Public

This Power of Attorney is granted under and by the authority of the following resolutions adopted by the Boards of Directors of each of the Companies, which resolutions are now in full force and effect, reading as follows:

RESOLVED, that the Chairman, the President, any Vice Chairman, any Executive Vice President, any Senior Vice President, any Vice President, any Second Vice President, the Treasurer, any Assistant Treasurer, the Corporate Secretary or any Assistant Secretary may appoint Attorneys-in-Fact and Agents to act for and on behalf of the Company and may give such appointee such authority as his or her certificate of authority may prescribe to sign with the Company's name and seal with the Company's seal bonds, recognizances, contracts of indemnity, and other writings obligatory in the nature of a bond, recognizance, or conditional undertaking, and any of said officers or the Board of Directors at any time may remove any such appointee and revoke the power given him or her; and it is

FURTHER RESOLVED, that the Chairman, the President, any Vice Chairman, any Executive Vice President, any Senior Vice President or any Vice President may delegate all or any part of the foregoing authority to one or more officers or employees of this Company, provided that each such delegation is in writing and a copy thereof is filed in the office of the Secretary; and it is

FURTHER RESOLVED, that any bond, recognizance, contract of indemnity, or writing obligatory in the nature of a bond, recognizance, or conditional undertaking shall be valid and binding upon the Company when (a) signed by the President, any Vice Chairman, any Executive Vice President, any Senior Vice President or any Vice President, any Second Vice President, the Treasurer, any Assistant Treasurer, the Corporate Secretary or any Assistant Secretary and duly attested and sealed with the Company's seal by a Secretary or Assistant Secretary; or (b) duly executed (under seal, if required) by one or more Attorneys-in-Fact and Agents pursuant to the power prescribed in his or her certificate or their certificates of authority or by one or more Company officers pursuant to a written delegation of authority; and it is

FURTHER RESOLVED, that the signature of each of the following officers: President, any Executive Vice President, any Senior Vice President, any Vice President, any Assistant Vice President, any Secretary, any Assistant Secretary, and the seal of the Company may be affixed by facsimile to any Power of Attorney or to any certificate relating thereto appointing Resident Vice Presidents, Resident Assistant Secretaries or Attorneys-in-Fact for purposes only of executing and attesting bonds and undertakings and other writings obligatory in the nature thereof, and any such Power of Attorney or certificate bearing such facsimile signature or facsimile seal shall be valid and binding upon the Company and any such power so executed and certified by such facsimile signature and facsimile seal shall be valid and binding on the Company in the future with respect to any bond or understanding to which it is attached.

I, **Kevin E. Hughes**, the undersigned, Assistant Secretary of each of the Companies, do hereby certify that the above and foregoing is a true and correct copy of the Power of Attorney executed by said Companies, which remains in full force and effect.

Dated this 23 day of March, 2023




Kevin E. Hughes, Assistant Secretary

**To verify the authenticity of this Power of Attorney, please call us at 1-800-421-3880.
Please refer to the above-named Attorney(s)-in-Fact and the details of the bond to which this Power of Attorney is attached.**

Product Support Services
Per Section 00 40 00, 1.3

1. Provide examples or document past experience.

Elaborated on below.

2. List of office locations of the WWTP Equipment Manufacturer in North America. Provide location where the equipment is manufactured.

The HUBER Technology, Inc. North American headquarters and manufacturing facility is located in Denver, NC just 20 minutes north of Charlotte. This facility is currently undergoing a major expansion that will allow ALL HUBER equipment lines to be manufactured in the USA with US steel and components. HUBER also has 20 full-time and factory-trained service technicians stationed around the United States, with a Q-PRESS expert technician located in Blackfoot, ID, 45 minutes from Aberdeen. Equipment will – in all likelihood – be manufactured in Berching, Germany, as expansion efforts in Denver, NC will not be completed for this product line until late 2024.

3. List all service/maintenance locations in the United States for the WWTP equipment to be provided. Provide the following for each location:

- a. Location:

HUBER is expanding their current facilities as mentioned above, which will include a full service bay for overhauling equipment. This being said, all Q-PRESS maintenance procedures can be completed in place, by site, or by a HUBER technician.

- b. Type of support services provided:

HUBER is capable of sending technicians to site to troubleshoot, optimize, and repair equipment in Aberdeen, or in Denver, NC.

- c. Description of Service Provided by Manufacturer or Subcontractor

See above.

- d. Response Time for Technician to be in Aberdeen

As mentioned above, HUBER technicians are stationed around the US, with one located in Blackfoot, ID. While HUBER must schedule each technician visit on a case-by-case basis, technician proximity to the site in Aberdeen will allow for expedited service trips.

4. Describe the system start-up and operator training capabilities of the Equipment Manufacturer. In addition, provide resume for installation supervision and start-up personnel.

Equipment manufacturer is capable of performing full system inspection, start-up, optimization, and testing. Resume shall be provided prior to start-up, to ensure technician who is available for visit matches the resume provided.

5. Describe facilities, programs and methods, which the Equipment Manufacturer provides to Owners/operators for ongoing maintenance and troubleshooting.

HUBER has multiple Technical Support Managers on staff, who are capable of providing insight and optimization advice remotely, prior to HUBER sending a service technician to site. This allows HUBER to support our customers without our customers paying additional travel costs associated with visiting the site. On top of this, HUBER employs two full time Service Advisors who travel the country visiting facilities and inspecting HUBER equipment.

6. Provide description of available 24/7 telephone support services, additional operator training after start-up including conferences, available support groups and quarterly site visits.

HUBER maintains a 24/7 Service Hotline for emergency events. HUBER is also capable of providing additional site services upon request, including further training, scheduled service contract visits, and consultations with the Group Product Manager for Biosolids Treatment. HUBER attempts to check in with facilities multiple times per year to identify current machine performance, and to ensure that a proactive approach is taken to machine maintenance.

Manufacturer's Experience and References

Per Section 00 40 00, 1.4

Please see references in the following pages. HUBER has installed over 250 Q-PRESS units around the US. HUBER began producing equipment for the municipal wastewater industry in the late 1800's, and began their expanse into the North American market in the late 1990's.

HUBER Screw Press Q-PRESS® (Size 800)



Dover (WWTP), NH

484 Middle Road, Dover, NH 03820
Ray Vermette, Facility Supervisor
O (603) 516-6475 | r.vermette@doover.nh.gov
C (603) 396-4008

Three (3) Q-PRESS® 800.2
Installation date: 2015 & 2019



City of Newberg (WWTP), OR

2301 Wyooski Road, Newberg, OR 97132
Craig Pack, Supervisor
O (503) 554-7775 | craig.pack@newbergoregon.gov

Two (2) Q-PRESS® 800.0
Installation date: 11/2014



CMSD, Grifton, NC

900 Wiley Gaskins Road, Grifton, NC 28530
Chuck Smithwick, Plant Manager
O (252) 524-5584 | cmsd100@embarqmail.com

Two (2) Q-PRESS® 800.0
Installation date: 10/2013



City of Clarkston (WWTPS), WA
102 13th Street, Clarkston, WA 99403
Wes Ison, Plant Manager
O (509) 758-1674 | clarkstonwwtp@qwestoffice.net

Two (2) Q-PRESS® 800.0
Installation date: 06/2014



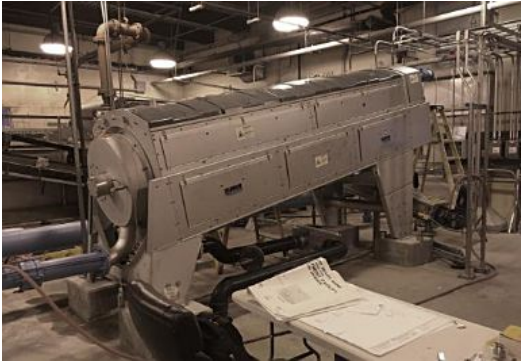
City of Chatsworth (Judson Vick WWTP), GA
300 Judson Vick Drive, Chatsworth GA 30705
Heath Harrison, Assistant General Manager
O (706) 695-3132 | heathh@chatsworthwater.com
C (706) 508-2477

One (1) Q-PRESS® 800.2
Installation date: 09/2019



Peirce Island (WWTF Upgrade), NH
200 Peirce Island Road, Portsmouth, NH 03801
Peter Conroy, Chief Plant Operator
O (603) 427-1553 | paconroy@cityofportsmouth.com

Two (2) Q-PRESS® 800.2
Installation date: 06/2019



Town of Old Orchard Beach (WWTP), ME
24 Manor Street, Ocean Park, ME 04063
Christopher White, Superintendent
C (207) 351-0030 | cwhite@oobmaine.com

One (1) Q-PRESS® 800.2
Installation date: 03/2018



Genoa-Oceola (WWTP), MI
900 Chilson Road, Howell, MI 48843
James "Jim" Aulette, MHOG Water Utility Lead Plant Operator
O (517) 548-1416 | jima@mhog.org
C (517) 672-9653

One (1) Q-PRESS® 800.0
Installation date: 06/2015

NOTICE OF AWARD

Date of Issuance: 5/3/2023
Owner: City of Aberdeen
Engineer: Keller Associates
Project: Aberdeen WWTP
Contract Name: Equipment Prepurchase
Bidder: HUBER Technology, Inc.
Bidder's Address: 1009 Airlie Parkway, Denver, NC 28037
Owner's Project No.:
Engineer's Project No.: 222032-001

You are notified that Owner has accepted your Bid dated **4/4/2023** for the above Contract, and that you are the Successful Bidder and are awarded a Contract for:

Mechanical Dewatering System Equipment

The Contract Price of the awarded Contract is **\$424,544**. Contract Price is subject to adjustment based on the provisions of the Contract, including but not limited to those governing changes, Unit Price Work, and Work performed on a cost-plus-fee basis, as applicable.

One unexecuted counterparts of the Agreement accompany this Notice of Award, and one copy of the Contract Documents accompanies this Notice of Award, or has been transmitted or made available to Bidder electronically.


Drawings will be delivered separately from the other Contract Documents.

You must comply with the following conditions precedent within 15 days of the date of receipt of this Notice of Award:

1. Deliver to Owner **one** counterparts of the Agreement, signed by Bidder (as Contractor).
2. Deliver with the signed Agreement(s) the Contract security (such as required performance and payment bonds) and insurance documentation, as specified in the Instructions to Bidders and in the General Conditions, Articles 2 and 6.
3. Other conditions precedent (if any): **none**

Failure to comply with these conditions within the time specified will entitle Owner to consider you in default, annul this Notice of Award, and declare your Bid security forfeited.

Within 10 days after you comply with the above conditions, Owner will return to you one fully signed counterpart of the Agreement, together with any additional copies of the Contract Documents as indicated in Paragraph 2.02 of the General Conditions.

Owner: **City of Aberdeen**
By (signature): 
Name (printed): Larry Barrett
Title: Mayor
Copy: Engineer

PROCUREMENT AGREEMENT

THIS AGREEMENT is by and between City of Aberdeen, Idaho ("Buyer")
and HUBER Technology, Inc. ("Seller").

Buyer and Seller hereby agree as follows:

ARTICLE 1 – GOODS AND SPECIAL SERVICES

- 1.01 Seller shall furnish the Goods and Special Services as specified or indicated in the Contract Documents.
- 1.02 Seller (Vendor) shall complete the Goods and Services as specified or indicated in the Buyer's Contract Documents and Specifications titled, "City of Aberdeen WWTP Equipment Pre-Purchase".
- 1.03 The Project, of which the Goods and Special Services may be the whole or only a part, is described as performing or providing all labor, services, engineering, manufacturing, testing, and documentation necessary for Installation Contractor to install and successfully start-up the WWTP Equipment.
- 1.04 The Goods are generally described as follows:
 - A. ~~Integrated Fixed Film Activated Sludge (IFAS) System: A biological treatment system designed to reduce BOD. The system shall include all major equipment components, including diffusers, blowers, control valves, instrumentation, motor controls and control panels as required in Section 46-53-36 and related sections.~~
 - B. ~~Sand Filter System: A sand filter system designed to remove phosphorus following a chemical addition and mixing system. The system shall include all major equipment components, such as internal piping and components, media bed, air compressors, instrumentation, motor controls and control panels as required in Section 46-61-27 – Upflow Moving Bed Filter and related sections.~~
 - C. **Mechanical Dewatering System:** Press system for dewatering of waste activated sludge to meet the minimum performance criteria identified in Section 46-76-27. System shall include all major equipment components including screw press, polymer activation and dosing skid, polymer injection and mixing assembly, instrumentation, motor controls, control panel, and other appurtenances as required in Section 46-76-27 and related sections.
- 1.05 The Services are generally described as follows:
 - D. **Submittals:** The Vendor will provide design of the Goods, submittal of the shop drawings, general arrangement drawings of equipment, and a control strategy description; will participate in meetings and assist Engineer during the design; and will make changes to the equipment system as required to coordinate the design with the Engineer during the submittal review process. Submittals shall meet the requirements of Section 01-30-00 – Vendor Submittals.

- E. **Supply and Shipping of Equipment:** The Vendor shall supply all equipment identified in the approved submittals and shall deliver equipment to site. During shipment, Vendor shall assume all responsibility for loss or damage.
- F. **Start-Up Services and Training:** The Vendor shall provide the minimum number of days and trips identified in the equipment specifications and Section 01 75 16 – Startup Procedures.
- G. **Anchoring Calculations:** Design of equipment supports, and anchor bolt design shall be provided by the Vendor, certified by a licensed professional engineering in the state where the equipment is to be installed. Anchor bolts are to be provided by the Installation Contractor.

ARTICLE 2 – ENGINEER

- 2.01 The Contract Documents for the Goods and Special Services have been prepared by Keller Associates, Inc., 305 North 3rd Avenue, Ste. A, Pocatello, ID 83201 ("Engineer"), which is to act as Buyer's representative, assume all duties and responsibilities, and have the rights and authority assigned to Engineer in the Contract Documents in connection with Seller's furnishing of Goods and Special Services.

ARTICLE 3 – POINT OF DESTINATION

- 3.01 The point of destination is:

2683 W 1750 S
Aberdeen, ID 83210

ARTICLE 4 – CONTRACT TIMES

- 4.01 *Time of the Essence*
 - A. All time limits for Milestones, if any, including the submittal of Shop Drawings and Samples, the delivery of Goods, and the furnishing of Special Services as stated in the Contract Documents, are of the essence of the Contract.
- 4.02 *Milestones:*
 - A. *Days for Submittal of Shop Drawings and Samples:* Seller shall submit all Shop Drawings and Samples required by the Contract Documents to Buyer for Engineer's review and approval as noted in the Bid Forms. If more than one resubmittal is necessary for reasons not the fault and beyond the control of Seller, then Seller shall be entitled to seek appropriate relief under Paragraph 7.02.B of the General Conditions.
 - B. *Days to Achieve Delivery of Goods:* It is expected that the Seller shall deliver the Goods to the Point of Destination and ready for Buyer's receipt of delivery as noted in the Bid Forms. The delivery of the Goods shall be coordinated with the Installation Contractor and provided at the Installation Contractor's request within their construction contract time. Staged delivery of the equipment shall be acceptable at the Installation Contractor's request.

- C. *Days for Furnishing Start-Up and Training Services:* The furnishing of start-up services, detailed installation and operation and maintenance manuals, testing services, and operator training shall be coordinated with the Installation Contractor and provided at the Installation Contractor's request within their construction contract time.

4.03 *Buyer's Final Inspection*

- A. *Days to Achieve Final Inspection:* Buyer shall make its final inspection of the Goods pursuant to Paragraph 8.01.C of the General Conditions within 30 days after Buyer's acknowledgement of receipt of delivery of the Goods and Seller's completion of furnishing Start-Up and Training Services. The final inspection shall be requested by the Installation Contractor.

4.04 *Liquidated Damages*

- A. Buyer and Seller recognize that Buyer will suffer financial loss if the Goods are not delivered at the Point of Destination and ready for receipt of delivery by Buyer within the times specified above, plus any extensions thereof allowed in accordance with Article 7 of the General Conditions. The parties also recognize that the timely performance of services by others involved in the Project is materially dependent upon Seller's specific compliance with the requirements of Paragraph 4.02. Further, they recognize the delays, expense, and difficulties involved in proving the actual loss suffered by Buyer if complete acceptable Goods are not delivered on time. Accordingly, instead of requiring such proof, Buyer and Seller agree that as liquidated damages for delay (but not as a penalty) Seller shall pay Buyer \$1,000.00 for each day that expires after the time specified in Paragraph 7.01 of Section C-400 - Bid Form for delivery of acceptable Goods. Liquidated damages shall be limited to 10% of the total value of the agreement. Other services provided by the Seller, such as start-up services and training, shall be performed per requirements specified in Article 4 herein and at the request of the Installation Contractor to comply with contractual dates for construction.

ARTICLE 5 – CONTRACT PRICE

- 5.01 Buyer shall pay Seller for furnishing the Goods and Special Services in accordance with the Contract Documents.

ARTICLE 6 – PAYMENT PROCEDURES

6.01 *Submittal and Processing of Payment*

- A. Seller shall submit Applications for Payment in accordance with Article 10 of the General Conditions and Section 01 29 76 - Schedule of Payments. Applications for Payment will be processed by Engineer as provided in the General Conditions.

6.02 *Progress Payments; Retainage*

- A. Buyer shall make progress payments on account of the Contract Price on the basis of Section 01 29 76 – Schedule of Payments on or about the 30th day of each month during performance of the Work provided that such Applications for Payment have been submitted in a timely manner and otherwise meet the requirements of the Contract.

1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below, but, in each case, less the aggregate of payments previously made and less such amounts as Buyer may withhold, including but not limited to liquidated damages, in accordance with the Contract.
 - a. 95 percent of Work completed (with the balance being retainage); and
 - b. 95 percent of cost of materials and equipment not incorporated in the Work (with the balance being retainage).
- B. Upon Substantial Completion, Owner shall pay an amount sufficient to increase total payments to Seller to 100 percent of the Work completed, less such amounts set off by Buyer pursuant to Paragraph 10.04 of the General Conditions, and less 200 percent of Engineer's estimate of the value of Work to be completed or corrected as shown on the punch list of items to be completed or corrected prior to final payment.

6.03 *Final Payment*

- A. Upon receipt of the final Application for Payment accompanied by Engineer's recommendation of payment, Buyer shall pay Seller the amount recommended by Engineer, less any sum Buyer is entitled to set off against Engineer's recommendation, including but not limited to liquidated damages.

ARTICLE 7 – INTEREST

7.01 [Reserved.]

ARTICLE 8 – SELLER'S REPRESENTATIONS

- 8.01 In order to induce Buyer to enter into this Agreement, Seller makes the following representations:
 - A. Seller has examined and carefully studied the Contract Documents and the other related data identified in the Bidding Documents, as applicable to Seller's obligations identified in Article 1 above.
 - B. If required by the Bidding Documents to visit the Point of Destination and site where the Goods are to be installed or Special Services will be provided, or if, in Seller's judgment, any local condition may affect cost, progress, or the furnishing of the Goods and Special Services, Seller has visited the Point of Destination and site where the Goods are to be installed or Special Services will be provided and become familiar with and is satisfied as to the observable local conditions that may affect cost, progress, and the furnishing of the Goods and Special Services.
 - C. Seller is familiar with and is satisfied as to all Laws and Regulations that may affect cost, progress, and the furnishing of the Goods and Special Services.
 - D. Seller has carefully studied, considered, and correlated the information known to Seller; information commonly known to sellers of similar goods doing business in the locality of the Point of Destination and the site where the Goods will be installed or where Special

Services will be provided: information and observations obtained from Seller's visits, if any, to the Point of Destination and site where the Goods are to be installed or Services will be provided; and any reports and drawings identified in the Bidding Documents regarding the Point of Destination and the site where the Goods will be installed or where Special Services will be provided, with respect to the effect of such information, observations, and documents on the cost, progress, and performance of Seller's obligations under the Contract Documents.

- E. Seller has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Seller has discovered in the Contract Documents, and the written resolution (if any) thereof by Engineer and Buyer is acceptable to Seller.
- F. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for furnishing Goods and Special Services.

ARTICLE 9 – CONTRACT DOCUMENTS

9.01 Contents

- A. The Contract Documents consist of the following:
 - 1. Notice Inviting Bids;
 - 2. Instruction to Bidders;
 - 3. Bid Forms including the Bid, Information required of Bidder, Bid Bond, and all required certificates and affidavits;
 - 4. This Procurement Agreement (EJCDC P-520);
 - 5. Performance Bond;
 - 6. Payment Bond;
 - 7. General Conditions (EJCDC P-700);
 - 8. Supplementary Conditions (EJCDC P-800);
 - 9. Specifications as listed in the Table of Contents;
 - a. Revised Section 01 29 76 (attached)
 - 10. Addenda (Numbers 1 to 2 , inclusive);
 - 11. Exhibits to this Agreement (enumerated as follows):
 - a. Seller's Bid, solely as to the prices set forth therein;
 - 12. The following, which may be delivered or issued on or after the Effective Date of the Agreement:
 - a. Written Amendments to this Agreement;

- b. Notice to Proceed;
 - c. Change Order(s);
 - d. Work Change Directive(s).
- B. The documents listed in Paragraph 9.01.A are incorporated into this Agreement by reference (except as expressly noted otherwise above).
- C. There are no Contract Documents other than those listed above in this Article 9.
- D. The Contract Documents may only be amended or supplemented as provided in Paragraph 3.04 of the General Conditions.

ARTICLE 10 – MISCELLANEOUS

10.01 *Terms*

- A. Terms used in this Agreement will have the meanings indicated in the General Conditions and the Supplementary Conditions.

10.02 *Successors and Assigns*

- A. Buyer and Seller each binds itself, its partners, successors, assigns, and legal representatives to the other party hereto, its partners, successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.

10.03 *Severability*

- A. Any provision or part of the Contract Documents held to be void or unenforceable by a court of competent jurisdiction under any applicable Law or Regulation shall be deemed stricken, and all remaining provisions shall continue to be valid and binding upon Buyer and Seller. The Contract Documents shall be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

10.04 *Seller's Certifications*

- A. Seller certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or in executing the Contract. For the purposes of this Paragraph 10.04:
1. "corrupt practice" means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process or in the Contract execution;
 2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process or the execution of the Contract to the detriment of Buyer, (b) to establish Bid or Contract prices at artificial non-competitive levels, or (c) to deprive Buyer of the benefits of free and open competition;

3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Buyer, a purpose of which is to establish Bid prices at artificial, non-competitive levels; and
4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

10.05 *Limitations*

- A. Buyer and Seller waive against each other, and against the other's officers, directors, members, partners, employees, agents, consultants, and subcontractors, any and all claims for or entitlement to incidental, indirect, or consequential damages arising out of, resulting from, or related to the Contract. The terms of this mutual waiver do not apply to or limit any claim by either Buyer or Seller against the other based on any of the following: (a) contribution or indemnification, (b) costs, losses, or damages attributable to personal or bodily injury, sickness, disease, or death, or to injury to or destruction of the tangible property of others, (c) intentional or reckless wrongful conduct, or (d) rights conferred by any bond provided by Seller under this Contract.

10.06 *Insurance*

- A. Prior to the Buyer's execution of this Procurement Agreement, Seller shall secure, and shall thereafter maintain until completion of the Contract, such public liability and property damage insurance as shall protect Seller from claims for damages for personal injury, including accidental death, as well as from claims for property damage which may arise from or which may concern operations under the Contract, whether such operations be by or on behalf of Seller, any Subvendor or anyone directly or indirectly employed by, connected with or acting for or on behalf of any of them.
- B. All liability insurance shall be issued by an insurance company or companies authorized to transact liability insurance business in the State of Idaho and shall cover comprehensive general and automobile liability for both bodily injury (including death) and property damage, including, but not limited to aggregate products, aggregate operations, aggregate protective and aggregate contractual with the limits as specified in the Supplementary General Conditions.

10.07 *Assignment of Procurement Contract*

- A. The Contract may at the Owner's discretion be assigned by Owner to Contractor, and Vendor will accept such assignment, pursuant to the Procurement Documents. In the application of the terms and conditions of the Procurement Documents after said assignment, Vendor will function as a subcontractor to the Contractor, and all obligations of the Vendor to Owner will become obligations of the Vendor to Contractor. Notwithstanding this assignment, the guarantees and warranties specified in the Procurement Documents are intended for the benefit of Owner and the Contractor and may be enforced by either party.
- B. Assignment of the Purchase Agreement shall be accomplished on Exhibits A-1 and A-2, copies of which are attached to this Purchase Agreement.

- C. Miscellaneous Assignments. No further assignment by a party hereto of any rights under or interests in the Contract Documents will be binding on another party hereto without the written consent of the party sought to be bound; and specifically but without limitation monies that may become due and monies that are due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract Documents.

IN WITNESS WHEREOF, Buyer and Seller have executed this Agreement and acknowledge that all portions of the Contract Documents have been signed or identified by Buyer and Seller or on their behalf.

This Agreement will be effective on _____ ("Effective Date").

Buyer: City of Aberdeen
By: Larry Barnett
Date: 5-24-23

Seller: HUBER Technology, Inc.
By: [Signature]
Henk-Jan van Ettehoven, President
Date: May 17, 2023

[Corporate Seal]

[Corporate Seal]



Attest: Stephanie Wallace

Attest: [Signature]
Josey Chan, Contract Administrator

Address for giving notice:

Address for giving notice:
1009 Airlie Parkway
Denver, NC 28037

(If Buyer is a corporation, attach evidence of authority to sign. If Buyer is a public body, attach evidence of authority to sign and resolution or other documents authorizing execution of Buyer-Seller Agreement.)

Agent for service of process:
Henk-Jan van Ettehoven

(If Seller is a corporation or a partnership, attach evidence of authority to sign.)

Designated Representative:
Name: _____
Title: _____
Address: _____
Phone: _____
Facsimile: _____

Designated Representative:
Name: Ryan Spanton, Goble Sampson Associates
Title: Sales Representative
Address: 3500 S. Main Street, Suite 200, Salt Lake City, UT 84115
Phone: (801) 558-6805
Facsimile: (801) 268-8792

SECTION 01 29 76 – SCHEDULE OF PAYMENTS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. This Section defines the partial payment milestones and the corresponding payment amount, specified as a percent of the lump sum total contract price as submitted on Vendor's bid forms.

1.2 SCHEDULE OF PAYMENTS

- A. The schedule of payments, less retainage, for the supplying of the Goods and Special Services shall be based on the following schedule:

Task Completion	Amount
Engineer's Approval of Submittals	100% of Item A in the Bid Schedule
Delivery of all Goods	75% of Item B in the Bid Schedule
Manufacturer's Installation Certification	5% of Item B in the Bid Schedule
Successful Completion of Testing	5% of Item B in the Bid Schedule
Engineer's Approval of O&M Manual	5% of Item B in the Bid Schedule
Completion of All Training	5% of Item B in the Bid Schedule
Substantial Completion	5% of Item B in the Bid Schedule

- B. No partial payments will be paid for delivery of goods. Once all components are delivered to the site, Vendor will be eligible for payment for that task.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION NOT USED

END OF SECTION 01 29 76

**PERFORMANCE BOND
FOR PROCUREMENT CONTRACTS**

Any singular reference to Seller, Surety, Buyer, or other party shall be considered plural where applicable.

SELLER (Name and Address):
Huber Technology, Inc.
1009 Airtie Parkway, Denver, NC 28037

**SURETY (Name and Address of Principal
Place of Business):**

Travelers Casualty and Surety Company of America
One Tower Square, Hartford, CT 06183

BUYER (Name and Address):
City of Aberdeen
33 N. Main St., Aberdeen, ID 83210

CONTRACT

Date: 5/9/2023
Amount: \$424,544.00
Description (Name and Location): WWTP Improvements Pre-Purchase

BOND

Date (Not earlier than Contract Date): 5/18/2023
Bond Number: 107822826
Amount: \$424,544.00
Modifications to this Bond Form: None

Surety and Seller, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Performance Bond to be duly executed on its behalf by its authorized officer, agent, or representative.

Seller as Principal Huber Technology, Inc.
Company: (Corp. Seal)
Seal)

Surety Travelers Casualty and Surety Company of America
Company: (Corp.

Signature: *Jacqueline Stepha*
Name and Title: *Jacqueline Stepha
Corporate Secretary*



Signature: *Catherine Thompson*
Name and Title: Catherine Thompson, Attorney-in-Fact
(Attach Power of Attorney)
Address: PO Box 31817, Charlotte, NC 28231

Telephone Number: 704-376-9161

(Space is provided below for signatures of additional parties, if required.)

Seller as Principal
Company: (Corp. Seal)

Surety
Company: (Corp. Seal)

Signature:
Name and Title:

Signature:
Name and Title:
Address:
Telephone Number:

1. Seller and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to Buyer for the performance of the Contract, which is incorporated herein by reference. For purposes of this bond, Buyer means Buyer's assigns, if and when Buyer has assigned the Contract.
2. If Seller performs the Contract, Surety and Seller have no obligation under this Bond, except to participate in conferences as provided in Paragraph 3.1.
3. If there is no Buyer Default, Surety's obligation under this Bond shall arise after:
 - 3.1. Buyer has notified Seller and Surety pursuant to Paragraph 10 that Buyer is considering declaring a Seller Default and has requested and attempted to arrange a conference with Seller and Surety to be held not later than 15 days after receipt of such notice to discuss methods of performing the Contract. (If Buyer, Seller, and Surety agree, Seller shall be allowed a reasonable time to perform the Contract, but such an agreement shall not waive Buyer's right, if any, subsequently to declare a Seller Default); and
 - 3.2. Buyer has declared a Seller Default and formally terminated Seller's right to complete the Contract. Such Seller Default shall not be declared earlier than 20 days after Seller and Surety have received notice as provided in Paragraph 3.1; and
 - 3.3. Buyer has agreed to pay the Balance of the Contract Price to:
 - a. Surety in accordance with the terms of the Contract;
 - b. Another seller selected pursuant to Paragraph 4.3 to perform the Contract.
4. When Buyer has satisfied the conditions of Paragraph 3, Surety shall promptly and at Surety's expense take one of the following actions:
 - 4.1. Arrange for Seller, with consent of Buyer, to perform and complete the Contract; or
 - 4.2. Undertake to perform and complete the Contract itself, through its agents or through independent contractors; or
 - 4.3. Obtain bids or negotiated proposals from qualified sellers acceptable to Buyer for a contract for performance and completion of the Contract, arrange for a contract to be prepared for execution by Buyer and a seller selected with Buyer's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the Bonds issued on the Contract, and pay to Buyer the amount of damages as described in Paragraph 6 in excess of the Balance of the Contract Price incurred by Buyer resulting from Seller Default; or
 - 4.4. Waive its right to perform and complete, arrange for completion, or obtain a new seller, and with reasonable promptness under the circumstances, either:
 - a. determine the amount for which it may be liable to Buyer and, as soon as practicable after the amount is determined, tender payment therefore to Buyer; or
 - b. deny liability in whole or in part and notify Buyer citing reasons therefore.

5. If Surety does not proceed as provided in Paragraph 4 with reasonable promptness, Surety shall be deemed to be in default on this Bond 15 days after receipt of an additional written notice from Buyer to Surety demanding that Surety perform its obligations under this Bond, and Buyer shall be entitled to enforce any remedy available to Buyer. If Surety proceeds as provided in paragraph 4.4, and Buyer refuses the payment tendered or Surety has denied liability, in whole or in part, without further notice Buyer shall be entitled to enforce any remedy available to Buyer.
6. After Buyer has terminated Seller's right to complete the Contract, and if Surety elects to act under Paragraph 4.1, 4.2, or 4.3, then the responsibilities of Surety to Buyer shall not be greater than those of Seller under the Contract, and the responsibilities of Buyer to Surety shall not be greater than those of Buyer under the Contract. To a limit of the amount of this Bond, but subject to commitment by Buyer of the Balance of the Contract Price to mitigation of costs and damages on the Contract, Surety is obligated without duplication for:
 - 6.1. the responsibilities of Seller for correction or replacement of defective Goods and Special Services and completion of the Contract;
 - 6.2. additional legal, design professional, and delay costs resulting from Seller's Default, and resulting from the actions of or failure to act of Surety under Paragraph 4; and
 - 6.3. liquidated damages, or if no liquidated damages are specified in the Contract, actual damages caused by delayed performance or non-performance of Seller.
7. Surety shall not be liable to Buyer or others for obligations of Seller that are unrelated to the Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than Buyer or its heirs, executors, administrators, successors, or assigns.
8. Surety hereby waives notice of any change, including changes of time, to the Contract or to related subcontracts, purchase orders and other obligations.
9. Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location of the Point of Destination, and shall be instituted within two years after Seller Default or within two years after Seller ceased working or within two years after Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.
10. Notice to Surety, Buyer or Seller shall be mailed or delivered to the address shown on the signature page.
11. When this Bond has been furnished to comply with a statutory or other legal requirement in the location of the Point of Destination, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted here from and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory bond and not as a common law bond.
12. Definitions.
 - 12.1. *Balance of the Contract Price:* The total amount payable by Buyer to Seller under the Contract after all proper adjustments have been made, including allowance to Seller of any amounts

received or to be received by Buyer in settlement of insurance or other Claims for damages to which Seller is entitled, reduced by all valid and proper payments made to or on behalf of Seller under the Contract.

- 12.2. *Contract*: The agreement between Buyer and Seller identified on the signature page, including all Contract Documents and changes thereto.
- 12.3. *Seller Default*: Failure of Seller, which has neither been remedied nor waived, to perform or otherwise to comply with the terms of the Contract.
- 12.4. *Buyer Default*: Failure of Buyer, which has neither been remedied nor waived, to pay Seller as required by the Contract or to perform and complete or comply with the other terms thereof.

**PAYMENT BOND
FOR PROCUREMENT CONTRACTS**

Any singular reference to Seller, Surety, Buyer, or other party shall be considered plural where applicable.

SELLER (Name and Address):
Huber Technology, Inc.
1009 Airlie Parkway, Denver, NC 28037

**SURETY (Name and Address of Principal
Place of Business):**

Travelers Casualty and Surety Company of America
One Tower Square, Hartford, CT 06183

BUYER (Name and Address):
City of Aberdeen
33 N. Main St., Aberdeen, ID 83210

CONTRACT

Date: 5/9/2023
Amount: \$424,544.00
Description (Name and Location): WWTP Improvements Pre-Purchase

BOND

Date (Not earlier than Contract Date): 5/18/2023
Bond Number: 107822826
Amount: \$424,544.00
Modifications to this Bond Form: None

Surety and Seller, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Payment Bond to be duly executed on its behalf by its authorized officer, agent, or representative.

Seller as Principal Huber Technology, Inc.
Company: (Corp. Seal)

Surety Travelers Casualty and Surety Company of America
Company: (Corp. Seal)

Signature: *Jacqueline Steele*
Name and Title: *Jacqueline Steele
Corporate Secretary*



Signature: *Catherine Thompson*
Name and Title: Catherine Thompson
(Attach Power of Attorney)
Address: PO Box 31817, Charlotte, NC 28231
Telephone Number: 704-376-9161

(Space is provided below for signatures of additional parties, if required.)

Seller as Principal
Company: (Corp. Seal)

Surety
Company: (Corp. Seal)

Signature:
Name and Title:

Signature:
Name and Title:
Address:
Telephone Number:

1. Seller and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to Buyer to pay for labor, materials and equipment furnished for use in the performance of the Contract, which is incorporated herein by reference. For purposes of this bond, Buyer means Buyer's assigns, if and when Buyer has assigned the Contract.
2. With respect to Buyer, this obligation shall be null and void if Seller:
 - 2.1. Promptly makes payment, directly or indirectly, for all sums due Claimants, and
 - 2.2. Defends, indemnifies and holds harmless Buyer from all claims, demands, liens or suits by any person or entity who furnished labor, materials or equipment for use in the performance of the Contract, provided Buyer has promptly notified Seller and Surety (at the addresses described in Paragraph 12) of any claims, demands, liens or suits and tendered defense of such claims, demands, liens or suits to Seller and Surety, and provided there is no Buyer Default.
3. With respect to Claimants, this obligation shall be null and void if Seller promptly makes payment, directly or indirectly, for all sums due.
4. Surety shall have no obligation to Claimants under this Bond until:
 - 4.1. Claimants who are employed by or have a direct contract with Seller have given notice to Surety (at the address described in Paragraph 12) and sent a copy, or notice thereof, to Buyer stating that a claim is being made under this Bond and, with substantial accuracy, the amount of the claim.
 - 4.2. Claimants who do not have a direct contract with Seller:
 - a. have furnished written notice to Seller and sent a copy, or notice thereof, to Buyer, within 90 days after having last performed labor or last furnished materials or equipment included in the claim stating, with substantial accuracy, the amount of the claim and the name of the party to whom the materials were furnished or supplied or for whom the labor was done or performed; and
 - b. have either received a rejection in whole or in part from Seller or not received within 30 days of furnishing the above notice any communication from Seller by which Seller had indicated the claim will be paid directly or indirectly; and
 - c. not having been paid within the above 30 days, have sent a written notice to Surety (at the address described in Paragraph 12) and sent a copy, or notice thereof, to Buyer stating that a claim is being made under this Bond and enclosing a copy of the previous written notice furnished to Seller.
5. If a notice required by Paragraph 4 is given by Buyer to Seller or to Surety, that is sufficient compliance.
6. Reserved.
7. Surety's total obligation shall not exceed the amount of this Bond, and the amount of this bond shall be credited for any payments made in good faith by Surety.
8. Amounts owed by Buyer to Seller under the Contract shall be used for the performance of the Contract and to satisfy claims, if any, under any Performance Bond. By Seller furnishing and Buyer accepting this Bond, they agree that all funds earned by Seller in the performance of the Contract are dedicated to satisfy obligations of Seller and Surety under this Bond, subject to Buyer's priority to use the funds for the completion of the furnishing the Goods and Special Services.



**Travelers Casualty and Surety Company of America
Travelers Casualty and Surety Company
St. Paul Fire and Marine Insurance Company**

POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS: That Travelers Casualty and Surety Company of America, Travelers Casualty and Surety Company, and St. Paul Fire and Marine Insurance Company are corporations duly organized under the laws of the State of Connecticut (herein collectively called the "Companies"), and that the Companies do hereby make, constitute and appoint **Catherine Thompson** of **CHARLOTTE**, **North Carolina**, their true and lawful Attorney(s)-in-Fact to sign, execute, seal and acknowledge any and all bonds, recognizances, conditional undertakings and other writings obligatory in the nature thereof on behalf of the Companies in their business of guaranteeing the fidelity of persons, guaranteeing the performance of contracts and executing or guaranteeing bonds and undertakings required or permitted in any actions or proceedings allowed by law.

IN WITNESS WHEREOF, the Companies have caused this instrument to be signed, and their corporate seals to be hereto affixed, this 21st day of April, 2021.



State of Connecticut

City of Hartford ss.

By: 
Robert L. Raney, Senior Vice President

On this the 21st day of April, 2021, before me personally appeared Robert L. Raney, who acknowledged himself to be the Senior Vice President of each of the Companies, and that he, as such, being authorized so to do, executed the foregoing instrument for the purposes therein contained by signing on behalf of said Companies by himself as a duly authorized officer.

IN WITNESS WHEREOF, I hereunto set my hand and official seal.

My Commission expires the 30th day of June, 2026




Anna P. Nowik, Notary Public

This Power of Attorney is granted under and by the authority of the following resolutions adopted by the Boards of Directors of each of the Companies, which resolutions are now in full force and effect, reading as follows:

RESOLVED, that the Chairman, the President, any Vice Chairman, any Executive Vice President, any Senior Vice President, any Vice President, any Second Vice President, the Treasurer, any Assistant Treasurer, the Corporate Secretary or any Assistant Secretary may appoint Attorneys-in-Fact and Agents to act for and on behalf of the Company and may give such appointee such authority as his or her certificate of authority may prescribe to sign with the Company's name and seal with the Company's seal bonds, recognizances, contracts of indemnity, and other writings obligatory in the nature of a bond, recognizance, or conditional undertaking, and any of said officers or the Board of Directors at any time may remove any such appointee and revoke the power given him or her; and it is

FURTHER RESOLVED, that the Chairman, the President, any Vice Chairman, any Executive Vice President, any Senior Vice President or any Vice President may delegate all or any part of the foregoing authority to one or more officers or employees of this Company, provided that each such delegation is in writing and a copy thereof is filed in the office of the Secretary; and it is

FURTHER RESOLVED, that any bond, recognizance, contract of indemnity, or writing obligatory in the nature of a bond, recognizance, or conditional undertaking shall be valid and binding upon the Company when (a) signed by the President, any Vice Chairman, any Executive Vice President, any Senior Vice President or any Vice President, any Second Vice President, the Treasurer, any Assistant Treasurer, the Corporate Secretary or any Assistant Secretary and duly attested and sealed with the Company's seal by a Secretary or Assistant Secretary; or (b) duly executed (under seal, if required) by one or more Attorneys-in-Fact and Agents pursuant to the power prescribed in his or her certificate or their certificates of authority or by one or more Company officers pursuant to a written delegation of authority; and it is

FURTHER RESOLVED, that the signature of each of the following officers: President, any Executive Vice President, any Senior Vice President, any Vice President, any Assistant Vice President, any Secretary, any Assistant Secretary, and the seal of the Company may be affixed by facsimile to any Power of Attorney or to any certificate relating thereto appointing Resident Vice Presidents, Resident Assistant Secretaries or Attorneys-in-Fact for purposes only of executing and attesting bonds and undertakings and other writings obligatory in the nature thereof, and any such Power of Attorney or certificate bearing such facsimile signature or facsimile seal shall be valid and binding upon the Company and any such power so executed and certified by such facsimile signature and facsimile seal shall be valid and binding on the Company in the future with respect to any bond or understanding to which it is attached.

I, **Kevin E. Hughes**, the undersigned, Assistant Secretary of each of the Companies, do hereby certify that the above and foregoing is a true and correct copy of the Power of Attorney executed by said Companies, which remains in full force and effect.

Dated this 18 day of May, 2023




Kevin E. Hughes, Assistant Secretary

**To verify the authenticity of this Power of Attorney, please call us at 1-800-421-3880.
Please refer to the above-named Attorney(s)-in-Fact and the details of the bond to which this Power of Attorney is attached.**

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APPENDIX E.2

Equipment Submittal



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HUBER Screw Press Q-PRESS®



- The new generation of our well-proven sludge dewatering press
- even more efficient
 - increased reliability of operation
 - optimized operating costs

►► Sludge dewatering

Flocculated sludge is pumped into a cylindrical screen basket wherein an auger slowly rotates. The diameter of the auger's shaft increases towards the end of the basket and the gap between its flights decreases. The volume between basket, shaft and flights continuously decreases, and the pressure thus increases, as the sludge is moved through the basket. Sludge water is pressed through the basket's screen.

The auger pushes the increasingly thicker sludge towards the annular clearance, defined by a circular opening and an adjustable discharge cone therein. The cone is pressed against the opening by pneumatic cylinders, thus maintaining a defined sludge pressure at the discharge end.

Scrapers on the screw shaft permanently clean the filter basket from the inside. A stationary spray bar backwashes it periodically and segment by segment by segment from the outside without interrupting the dewatering process.

►► Innovation

Energy efficiency:

The screw drives exceed the current energy efficiency standards of electric motors. Due to maximised electrical efficiency the HUBER Screw Press Q-PRESS® can therefore be operated with higher solids throughputs.

Dewatering results:

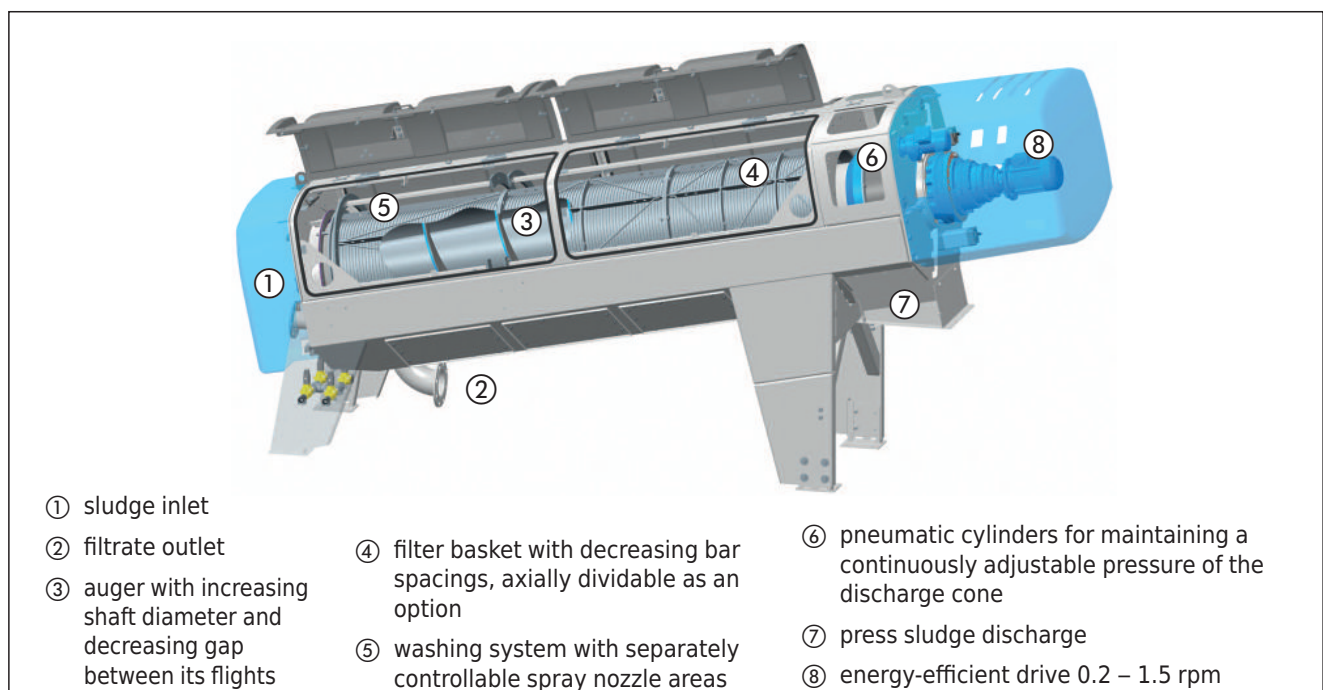
Unique scrapers on the screw shaft permanently and reliably clean the inner filter surface with every rotation of the screw. Additionally, the scrapers are optimally arranged to increase cleaning frequency. Free water can thus very easily run off. As a result, dewatering efficiency increases and flocculant consumption is reduced.

Due to the significantly enlarged open filter surface filter baskets with the same bar spacings are able to handle higher hydraulic loads without impairment of filtrate quality.

The outside of the filter is cleaned without interrupting the dewatering process. The predewatering and press zone can be washed independently of each other. Rewetting of press sludge through washing is reduced to a minimum especially in the press zone without neglecting the important washing in the predewatering zone.

Maintenance:

As an option, the three segments of the filter baskets are available as axially divided segments. Only the upper half of the basket needs to be removed for maintenance. The lower half of the filter basket can be removed from the screw shaft by means of a special mechanism but remains inside the filtrate chamber of the Q-PRESS® during maintenance. This saves a lot of time, reduces space requirements and the need for using lifting devices for maintenance.



Partial section of a HUBER Screw Press Q-PRESS®

►► Advantages

High dewatering

- defined sludge volume reduction in the screw press
- continuously adjustable counterpressure at the discharge end
- filtrate discharge enhanced by gravity due to inclined installation
- unique scraper system for permanent cleaning of the inner filter surface
- significantly increased free filter surface
- continuous dewatering

Reliable operation with little downtime

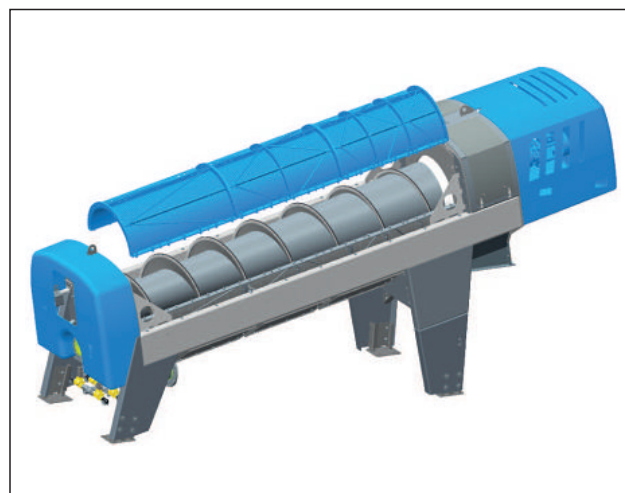
- virtually no wear because of < 1.5 rpm screw rotationspeed
- sturdy stainless steel design
- dividable filter baskets available as an option
- special filter dividing mechanism
- easy access through large inspection openings
- minimal space requirements for maintenance
- simple self-monitoring control strategy
- proven in hundreds of installations

Minimum operation costs

- outstanding energy efficiency
- specific power consumption < 8 kWh/t_{DR}
- little operator attention (< 20 min/day)
- high solids capture rate > 97%

Low total investment costs

- compact design and small footprint
- easy connection of the screw conveyor
- optional tube flocculator
- integrated support legs
- simple control system
- vibration-free, virtually noiseless operation
- fully enclosed design



HUBER Screw Press Q-PRESS® inclined installation with optionally dividable screen baskets



Sturdy wedge wire basket made of stainless steel



Stationary mounted screw press for 140 kgDS/h

➤➤ Special applications of the Q-PRESS®

Dewatering of thin sludges

Due to pump feeding, large volumes of sludge water are removed already in the pre-dewatering zone. This permits cost-efficient dewatering of thin sludges with a solids concentration < 1%.

Benefits

- sludge dewatering without the need for prior thickening
- typical dewatering results of 18 – 25% DS
- sludge volume reduction up to > 97% in a single step
- saves investment and operation costs for preceding sludge thickening
- little operator attention required

Variable sludge characteristics

Dewatering performance is usually impaired and operator attention increased by frequently varying sludge quality.

Our HUBER Screw Press Q-PRESS® automatically selfadjusts to over- and underloading. A control loop makes sure that optimal operation is always maintained.

Benefits

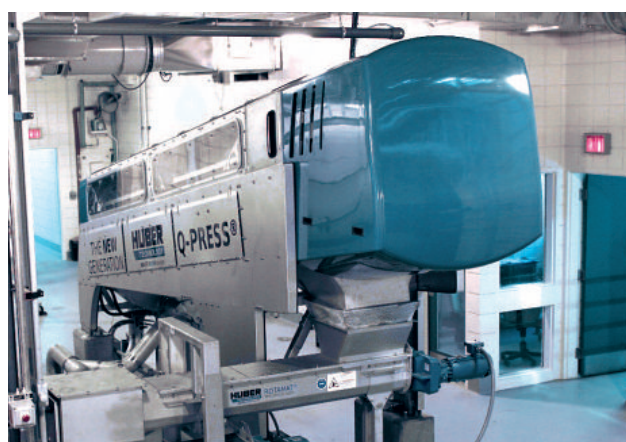
- always optimum performance
- flexible with varying sludge qualities
- minimised operator attention
- reliable operation

➤➤ Unit sizes / performance

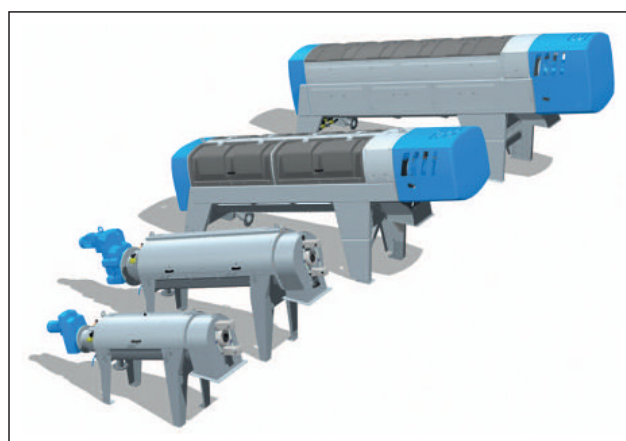
Size	Throughput [kg _{TR} /h]	Drive [kW]	Weight [t]
280	15 - 90	0.37	0.7
440.2	30 - 180	1.5	1.5
620.2	60 - 350	2.3	2.7
800.2	90 - 540	4.1	3.5



Contract dewatering with a trailer-mounted HUBER Screw Press Q-PRESS®



HUBER Screw Press Q-PRESS® 800.2 for 20 m³/h



HUBER Screw Press Q-PRESS®

HUBER TECHNOLOGY, Inc.

9735 Northcross Center Court STE A Huntersville, NC 28078
Phone: 704-949-1010 · Fax: 704-949-1020
Solutions@hhusa.net · <http://www.huber-technology.com>

Subject to technical modification
0,0 / 9 – 1.2016 – 7.2010

HUBER Screw Press Q-PRESS®

Reference Order List - HUBER Q-PRESS

Product

Q-PRESS

Design

Customer

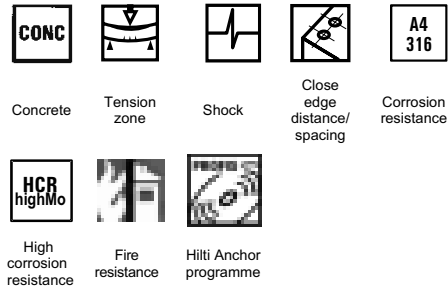
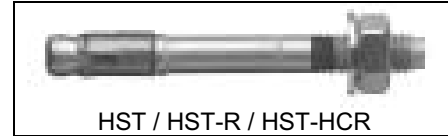
date of order	product	size	project	country	quantity
03/30/2023	Q-PRESS	440.2	Brownsville / TN, US	United States	1.00
03/24/2023	Q-PRESS	620.2	Chelan/ WA, US	United States	1.00
03/09/2023	Q-PRESS	440.2	Brookings, SD; US	United States	1.00
02/17/2023	Q-PRESS	800.2	Pocatello/ ID, US	United States	2.00
12/22/2022	Q-PRESS	620.2	Rigby, ID_Q-Press, US	United States	1.00
11/24/2022	Q-PRESS	440.2	Owosso / MI, US	United States	2.00
11/08/2022	Q-PRESS	440.2	Hudson Creek- Crestline, US	United States	2.00
10/26/2022	Q-PRESS	620.2	Shepherdstown, WV_Qpress; US	United States	1.00
09/09/2022	Q-PRESS	620.2	Lebanon, NH	United States	1.00
07/28/2022	Q-PRESS	800.2	Genoa Osceola, MI_Q-Press, US	United States	1.00
05/25/2022	Q-PRESS	800.2	Roswell, NM, US	United States	2.00
04/28/2022	Q-PRESS	800.2	Windsor, CO - Q-Press 800.2	United States	2.00
04/26/2022	Q-PRESS	800.2	Reno, South Truckee Meadows, NV, US	United States	1.00
03/30/2022	Q-PRESS	800.2	Old Orchard Beach, ME; US	United States	1.00
01/24/2022	Q-PRESS	800.2	Klamath Falls, 2nd Machine, OR	United States	1.00
01/19/2022	Q-PRESS	800.2	Chobani - Twin Falls, US	United States	2.00
11/04/2021	Q-PRESS	620.2	Page, AZ	United States	1.00
10/28/2021	Q-PRESS	440.2	Monroe City, Q-Press, MO	United States	1.00
09/20/2021	Q-PRESS	440.2	San Bernardino, CA	United States	1.00
09/08/2021	Q-PRESS	800.2	Danville, KY	United States	2.00
09/02/2021	Q-PRESS	800.2	American Vally WWTP - Quincy, US	United States	1.00
08/23/2021	Q-PRESS	800.2	Delano, MN	United States	1.00
07/23/2021	Q-PRESS	800.2	UTRWD Peninsula, TX, US	United States	1.00
07/07/2021	Q-PRESS	800.2	Gilroy, CA	United States	2.00
06/25/2021	Q-PRESS	800.2	Galesburg, San District, IL, US	United States	2.00
06/09/2021	Q-PRESS	620.2	Aberdeen, SD	United States	2.00
06/01/2021	Q-PRESS	800.2	Mars Petcare - Fort Smith / AR, US	United States	1.00
05/19/2021	Q-PRESS	620.2	Marianna / FL, US	United States	2.00
05/19/2021	Q-PRESS	440.2	Monticello / WI, US	United States	1.00
05/19/2021	Q-PRESS	800.2	Marion / KY, US	United States	1.00
05/07/2021	Q-PRESS	440.2	Rome / GA, US	United States	1.00
04/06/2021	Q-PRESS	440.2	Wawona / CA, US	United States	1.00
03/15/2021	Q-PRESS	800.2	Klamath Falls, Spring Street, US	United States	1.00
03/15/2021	Q-PRESS	800.2	Bozeman / MT, US	United States	1.00
02/25/2021	Q-PRESS	800.2	East Peoria / IL, US	United States	2.00
02/16/2021	Q-PRESS	440.2	Chino Valley, AZ, US	United States	1.00
02/05/2021	Q-PRESS	620.2	Jeffersonville / IN, US	United States	1.00
01/21/2021	Q-PRESS	440.2	Tulkoff Food, MD, US	United States	1.00

01/14/2021	Q-PRESS	440.2	Mars Petcare - Columbus, OH, US	United States	1.00
12/10/2020	Q-PRESS	800.2	St. Vrain / CO, US	United States	2.00
11/25/2020	Q-PRESS	440.2	C.B. NICHOLS EG RANCH, US	United States	1.00
07/28/2020	Q-PRESS	800.2	Cheyenne, Dry Creek / WI, US	United States	2.00
05/04/2020	Q-PRESS	440.2	Celina / OH, US	United States	2.00
04/23/2020	Q-PRESS	620.2	New Boston / TX, US	United States	1.00
01/23/2020	Q-PRESS	620.2	Central City / KY, US	United States	1.00
01/15/2020	Q-PRESS	620.2	East Peoria, STP#3 / IL, US	United States	1.00
12/11/2019	Q-PRESS	800.2	Morris, Central WWTP / IL, US	United States	1.00
12/11/2019	Q-PRESS	280	Roaring Fork, Carbondale / CO, US	United States	1.00
12/10/2019	Q-PRESS	800.2	Richmond / ME, US	United States	1.00
12/10/2019	Q-PRESS	800.2	Imperial, CA, US	United States	2.00
11/08/2019	Q-PRESS	620.2	Mars Royal Canin, SD_Q-Press, US	United States	1.00
11/08/2019	Q-PRESS	800.2	Premium Iowa Pork Luverne, US	United States	1.00
10/28/2019	Q-PRESS	620.2	Premium Iowa Pork Hospers, IA, US	United States	1.00
07/08/2019	Q-PRESS	800.2	Huntington, NY, US	United States	1.00
05/16/2019	Q-PRESS	800.2	Gunnison WWTP, US	United States	2.00
04/15/2019	Q-PRESS	800.2	City of Lewiston / ID, US	United States	2.00
02/28/2019	Q-PRESS	800.2	Franklin / TN, US	United States	2.00
02/18/2019	Q-PRESS	280	Kerry Foods / Afton MO, US	United States	1.00
02/11/2019	Q-PRESS	800.2	Holmen / WI, US	United States	1.00
02/08/2019	Q-PRESS	280	Las Cruces / NM, US	United States	1.00
02/07/2019	Q-PRESS	440.2	Havana / FL, US	United States	1.00
01/18/2019	Q-PRESS	800.2	Yuba City, CA - Q-Press, US	United States	3.00
12/06/2018	Q-PRESS	440.2	Lincoln County WWTP, NC, US	United States	1.00
10/25/2018	Q-PRESS	800.2	Midland WPCP, TX, US	United States	5.00
10/10/2018	Q-PRESS	620.2	North Conway, NH, US	United States	1.00
09/27/2018	Q-PRESS	800.2	Lebanon / IL, US	United States	1.00
09/26/2018	Q-PRESS	440.2	Fairbury / IL, US	United States	1.00
09/19/2018	Q-PRESS	440.2	Middle Oconee-Jackson Co., GA, US	United States	1.00
08/31/2018	Q-PRESS	800.2	Dover / NH, US	United States	2.00
07/09/2018	Q-PRESS	620.2	Oostburg / WI, US	United States	1.00
06/29/2018	Q-PRESS	440.2	Dorchester County, SC, US	United States	1.00
06/28/2018	Q-PRESS	800.2	South Beloit / IL, US	United States	1.00
06/18/2018	Q-PRESS	620.2	Jeffersonville, IN - Oak Park, US	United States	1.00
04/20/2018	Q-PRESS	440.2	Berwick / ME, US	United States	1.00
03/23/2018	Q-PRESS	620.2	Yarmouth / ME, US	United States	2.00

Anchor Bolts

HST stud anchor

Features:	
	- high loading capacity
	- force- controlled expansion
	- suitable for tension zone
	- suitable for shock loading
	- fire prevention assessment
	- pre-assembled with nut and washer → time saving
	- cold formed
Material:	
HST:	- carbon steel, zinc plated to min. 5 µm
HST-R:	- stainless steel; A4; 1.4401; EN 10088
HST-HCR:	- stainless steel; 1.4529



Basic loading data (for a single anchor): HST

All data on this page applies to

For detailed design method, see pages 86 - 91.

- concrete: as specified in the table
- no edge distance and spacing influence
- correct setting (See setting operations page 85)
- steel failure



Mean ultimate resistance, $R_{u,m}$ [kN]: concrete \cong C20/25

Anchor size	M8	M10	M12	M16	M20	M24
Tensile $N_{R_{u,m}}$	16.6	22.3	35.2	48.7	76.0	86.1
Shear $V_{R_{u,m}}$	23.0	26.5	44.2	72.2	119.1	125.0

M8	M10	M12	M16	M20	M24
10.3	11.6	21.9	31.1	44.9	60.2
22.8	24.4	47.5	67.6	107.4	116.4

Characteristic resistance, R_k [kN]: concrete \cong C20/25

Anchor size	M8	M10	M12	M16	M20	M24
Tensile N_{R_k}	9.0	16.0	20.0	35.0	50.0	60.0
Shear V_{R_k}	13.0	20.0	30.0	50.0	55.0	94.0

M8	M10	M12	M16	M20	M24
5.0	9.0	12.0	20.0	30.0	40.0
13.0	20.0	30.0	50.0	55.0	94.0

Following values according to the:

Concrete Capacity Method

Design resistance, R_d [kN]: concrete $f_{ck,cube} = 25 \text{ N/mm}^2$

Anchor size	M8	M10	M12	M16	M20	M24
Tensile N_{R_d}	5.0	10.7	13.3	23.3	33.3	40.0
Shear V_{R_d}	10.4	16.0	24.0	40.0	41.4	62.7

M8	M10	M12	M16	M20	M24
2.8	6.0	8.0	13.3	20.0	26.7
10.4	16.0	24.0	40.0	41.4	62.7

Recommended load, L_{rec} [kN]: concrete $f_{ck,cube} = 25 \text{ N/mm}^2$

Anchor size	M8	M10	M12	M16	M20	M24
Tensile N_{Rec}	3.6	7.6	9.5	16.7	23.8	28.6
Shear V_{Rec}	7.4	11.4	17.1	28.6	29.6	44.8

M8	M10	M12	M16	M20	M24
2.0	4.3	5.7	9.5	14.3	19.0
7.4	11.4	17.1	28.6	29.6	44.8

Basic loading data (for a single anchor): HST-R

All data on this section applies to

For detailed design method, see pages 86 – 91.

- concrete: as specified in the table
- no edge distance and spacing influence
- correct setting (See setting operations page 85)
- **steel** failure



Mean ultimate resistance, $R_{u,m}$ [kN]: concrete \cong C20/25

Anchor size	M8	M10	M12	M16	M20	M24
Tensile $N_{R_{u,m}}$	18.1	26.7	35.1	49.8	77.4	79.1
Shear $V_{R_{u,m}}$	22.8	31.9	50.3	84.0	136.0	151.4

M8	M10	M12	M16	M20	M24
12.7	18.4	20.1	36.0	55.1	70.5
20.6	31.9	45.5	84.0	106.6	151.4

Characteristic resistance, R_k [kN]: concrete \cong C20/25

Anchor size	M8	M10	M12	M16	M20	M24
Tensile N_{R_k}	9.0	16.0	20.0	35.0	50.0	60.0
Shear V_{R_k}	13.0	20.0	30.0	50.0	80.0	115.0

M8	M10	M12	M16	M20	M24
5.0	9.0	12.0	25.0	30.0	40.0
13.0	20.0	30.0	50.0	80.0	115.0

Following values according to the:

Concrete Capacity Method

Design resistance, R_d [kN]: concrete $f_{ck,cube} = 25 \text{ N/mm}^2$

Anchor size	M8	M10	M12	M16	M20	M24
Tensile N_{R_d}	6.0	10.7	13.3	23.3	33.3	40.0
Shear V_{R_d}	10.4	16.0	24.0	38.5	55.6	79.9

M8	M10	M12	M16	M20	M24
3.3	6.0	8.0	16.7	20.0	26.7
10.4	16.0	24.0	38.5	55.6	79.9

Recommended load, L_{rec} [kN]: concrete $f_{ck,cube} = 25 \text{ N/mm}^2$

Anchor size	M8	M10	M12	M16	M20	M24
Tensile N_{Rec}	4.3	7.6	9.5	16.6	23.8	28.6
Shear V_{Rec}	7.4	11.4	17.1	27.5	39.7	57.1

M8	M10	M12	M16	M20	M24
2.4	4.3	5.7	11.9	14.2	19.0
7.4	11.4	17.1	27.5	39.7	57.1

Basic loading data (for a single anchor): HST-HCR

All data on this section applies to

For detailed design method, see pages 86 - 91.

- concrete: as specified in the table
- no edge distance and spacing influence
- correct setting (See setting operations page 85)
- **steel** failure



Mean ultimate resistance, $R_{u,m}$ [kN]: concrete \cong C20/25

Anchor size	M8	M10	M12	M16
Tensile $N_{R_{u,m}}$	15.2	22.7	32.4	45.5
Shear $V_{R_{u,m}}$	14.0	21.6	32.4	59.4

M8	M10	M12	M16
13.8	16.2	21.5	32.4
14.0	21.6	32.4	59.4

HST stud anchor

Characteristic resistance, R_k [kN]: concrete \cong C20/25

Anchor size	M8	M10	M12	M16
Tensile N_{Rk}	9.0	16.0	20.0	35.0
Shear V_{Rk}	13.0	20.0	30.0	55.0

M8	M10	M12	M16
5.0	9.0	12.0	25.0
13.0	20.0	30.0	55.0

Following values according to the:

Concrete Capacity Method

Design resistance, R_d [kN]: concrete $f_{ck,cube} = 25 \text{ N/mm}^2$

Anchor size	M8	M10	M12	M16
Tensile N_{Rd}	5.0	8.9	11.1	19.4
Shear V_{Rd}	10.4	16.0	24.0	44.0

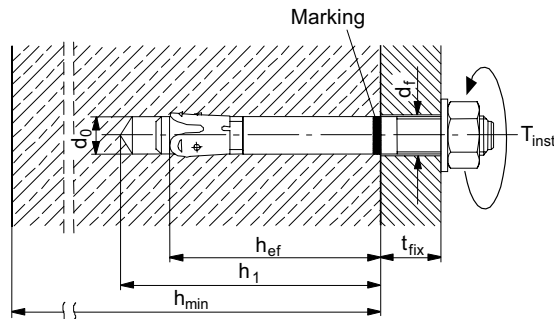
M8	M10	M12	M16
2.8	5.0	6.7	13.8
10.4	16.0	24.0	44.0

Recommended load, L_{rec} [kN]: concrete $f_{ck,cube} = 25 \text{ N/mm}^2$

Anchor size	M8	M10	M12	M16
Tensile N_{Rec}	3.6	6.4	7.9	13.9
Shear V_{Rec}	7.4	11.4	17.1	31.4

M8	M10	M12	M16
2.0	3.6	4.8	9.9
7.4	11.4	17.1	31.4

Setting details



Anchor size		M8	M10	M12	M16
Setting Details					
d_o	[mm] Nominal dia. of drill bit	8	10	12	16
T_{inst}	[Nm] Rec. tightening torque	HST	20	45	60
		HST-R HST-HCR	20	40	60
SW	[mm] Width across nut flats	13	17	19	24
d_f	[mm] Clearance hole diameter	9	12	14	18
h_1	[mm] Min. depth of drill hole	65	80	95	115
h_{ef}	[mm] Effective embed. depth	47	60	70	82
t_{fix}	[mm] Min. fasten. thickness	2	2	2	2
	[mm] Max. fasten. thickness	195	200	200	200
h_{min}	[mm] Min. concrete thickness	100	120	140	160
Drill bit		TE-CX-8	TE-CX-10	TE-CX-12	TE-C-16 or TE-Y-

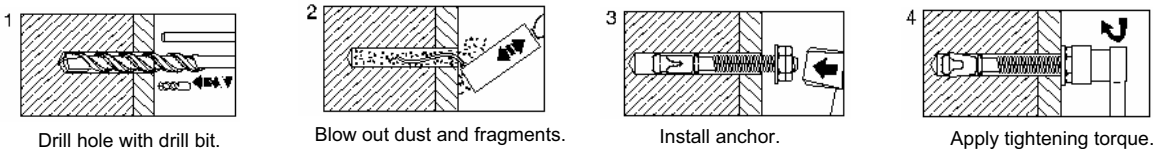
Anchor size		Setting Details	
		M20	M24
d_o	[mm] Nominal dia. of drill bit	20	24
T_{inst}	[Nm] Rec.tightening torque	240	300
SW	[mm] Width across nut flats	30	36
d_f	[mm] Clearance hole diameter	22	26
h_1	[mm] Min. depth of drill hole	140	170
h_{ef}	[mm] Effective embed. depth	101	125
t_{fix}	[mm] Min. fasten. thickness	2	2
	Max. fasten. thickness	305	330
h_{min}	[mm] Min. concrete thickness	200	250
Drill bit		TE-C-S 20 TE-Y 20	TE-C-S 24 TE-Y 24

HST-HCR is available up to M16.

Installation equipment

Rotary hammer (TE1, TE 2, TE5, TE6, TE6A, TE15, TE15-C, TE18-M, TE 35, TE 55, TE 76), drill bit, blow-out pump, torque wrench, appropriate size hexagon drive socket for correct setting.

Setting operations



Mechanical properties of anchor bolt

Anchor size		M8	M10	M12	M16	M20	M24	
f_{uk}	[N/mm ²] Nominal tensile strength	HST	800	800	800	680	550	530
		HST-R	700	700	700	650	700	700
		HST-HCR	700	700	700	700	-	-
f_{yk}	[N/mm ²] min. Yield strength	HST	640	640	640	480	400	450
		HST-R	500	500	500	500	500	500
		HST-HCR	450	450	450	450	-	-
A_s	[mm ²] Stressed cross-section in taper	24.2	41.3	57.4	105.7	167.4	240.5	
A_s	[mm ²] Stressed cross-section in thread	36.6	58	84.3	157	245	353	
W_{el}	[mm ³] Elastic moment of resistance	31.2	62.3	109	277	541	935	
$M_{Rd,s}$	[Nm] Design bending moment ¹⁾	HST	24.0	47.8	83.7	159.6	259.7	475.7
		HST-R	18.7	37.4	65.4	166.2	324.6	561
		HST-HCR	16.8	33.5	58.7	161.1	-	-

¹⁾ The design bending moment is calculated from $M_{Rd,s} = 1.2 \cdot W_{el} \cdot f_{uk} / \gamma_{Ms}$ where the partial safety factor γ_{Ms} varies with anchor type and size.

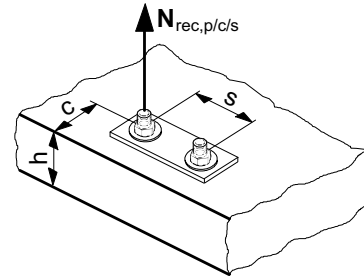
Detailed design method - Hilti CC

(The Hilti CC-Method is a simplified Version of ETAG Annex C)

TENSION

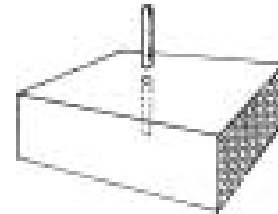
The tensile design resistance of a single anchor is the lower of,

- $N_{Rd,p}$: concrete pull-out resistance
- $N_{Rd,c}$: concrete cone resistance
- $N_{Rd,s}$: steel resistance



$N_{Rd,p}$: Pull-out resistance

$$N_{Rd,p} = N_{Rd,p}^0 \cdot f_B$$



$N_{Rd,p}^0$: Design pull-out resistance

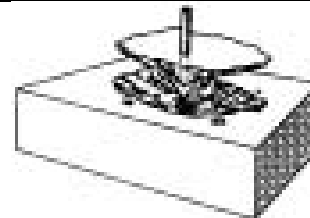
- Concrete compressive strength $f_{ck,cube(150)} = 25 \text{ N/mm}^2$

Anchor size		M8	M10	M12	M16	M20	M24	
$N_{Rd,p}^0$ [kN]	non-cracked concrete	HST	5.0	10.7	13.3	23.3	33.3	40.0
		HST-R	6.0	10.7	13.3	23.3	33.3	40.0
		HST-HCR	5.0	8.9	11.1	19.4	-	-
$N_{Rd,p}^0$ [kN]	cracked concrete	HST	2.8	6.0	8.0	13.3	20.0	26.7
		HST-R	3.3	6.0	8.0	16.7	20.0	26.7
		HST-HCR	2.8	5.0	6.7	13.8	-	-

¹⁾ The tensile design resistance is calculated from the tensile characteristic resistance $N_{Rk,p}^0$ by $N_{Rd,p}^0 = N_{Rk,p}^0 / \gamma_{Mp}$ where the partial safety factor γ_{Mp} varies with anchor type and size (as per relevant approval).

$N_{Rd,c}$: Concrete cone resistance

$$N_{Rd,c} = N_{Rd,c}^0 \cdot f_B \cdot f_{AN} \cdot f_{RN}$$



$N_{Rd,c}^0$: Design concrete cone resistance

- Concrete compressive strength $f_{ck,cube(150)} = 25 \text{ N/mm}^2$

Anchor size		M8	M10	M12	M16	M20	M24
$N_{Rd,c}^0$ [kN]	non-cracked concrete	9.0	15.6	19.7	24.9	34.1	47.0
$N_{Rd,c}^0$ [kN]	cracked concrete	6.4	11.2	14.1	17.8	24.4	33.5
h_{ef} [mm]	effective embedment depth	47	60	70	82	101	125

¹⁾ The tensile design resistance is calculated from the tensile characteristic resistance $N_{Rk,c}^0$ by $N_{Rd,c}^0 = N_{Rk,c}^0 / \gamma_{Mc,N}$, where the partial safety factor $\gamma_{Mc,N}$ varies with anchor type and size (as per relevant approval).

f_B :Influence of concrete strength

Concrete strength designation (ENV 206)	Cylinder compressive strength $f_{ck,cyl}$ [N/mm ²]	Cube compressive strength $f_{ck,cube}$ [N/mm ²]	f_B
C20/25	20	25	1.0
C25/30	25	30	1.1
C30/37	30	37	1.22
C35/45	35	45	1.34
C40/50	40	50	1.41
C45/55	45	55	1.48
C50/60	50	60	1.55

Concrete cylinder: height 30cm, 15cm diameter	Concrete cube: side length 15cm
Concrete test specimen geometry	

$$f_B = \sqrt{\frac{f_{ck,cube}}{25}}$$

Limits:

$$25 \text{ N/mm}^2 \leq f_{ck,cube(150)} \leq 60 \text{ N/mm}^2$$

2

f_{AN} :Influence of anchor spacing

Anchor spacing s [mm]	anchor size					
	M8	M10	M12	M16	M20	M24
60	0.71		0.64			
70	0.75	0.69	0.67	0.64		
90	0.82	0.75	0.71	0.68		
110	0.89	0.81	0.76	0.72	0.68	
130	0.96	0.86	0.81	0.76	0.71	0.67
150		0.92	0.86	0.80	0.75	0.70
170		0.97	0.90	0.85	0.78	0.73
190			0.95	0.89	0.81	0.75
210			1.00	0.93	0.85	0.78
230				0.97	0.88	0.81
250				1.00	0.91	0.83
270					0.95	0.86
290					0.98	0.89
310					1.00	0.91
330						0.94
350						0.97
380						1.00

$$f_{AN} = 0.5 + \frac{s}{6 \cdot h_{ef}}$$

Limits:

$$s_{min} \leq s \leq s_{cr,N}$$

s_{min} varies with edge distance, see table "minimum spacing & minimum edge distance", next page

$$s_{cr,N} = 3 \cdot h_{ef}$$

f_{RN} :Influence of edge distance

Edge distance c [mm]	anchor size					
	M8	M10	M12	M16	M20	M24
55	0.84	0.71	0.64			
60	0.89	0.75	0.68			
70	0.99	0.83	0.75	0.68		
80		0.92	0.82	0.74		
90		1.00	0.89	0.80		
100			0.96	0.86		
110				0.92		
120				0.98		
130						
140					0.94	
150					0.99	0.85
160						0.89
170						0.93
180						0.97

$$f_{RN} = 0.25 + 0.5 \cdot \frac{c}{h_{ef}}$$

Limits:

$$c_{min} \leq c \leq c_{cr,N}$$

c_{min} varies with spacing, see table "minimum spacing & minimum edge distance", next page

$$c_{cr,N} = 1.5 \cdot h_{ef}$$

Note:

If more than 3 edges are smaller than $c_{cr,N}$ consult the Hilti Technical Advisory Service

HST stud anchor

HST		M8	M10	M12	M16	M20	M24
Minimum spacing	s_{min} [mm]	60	55	60	70	100	125
	for $c \geq$ [mm]	50	80	85	110	225	255
Minimum edge distance	c_{min} [mm]	50	55	55	85	140	170
	for $s \geq$ [mm]	60	115	145	150	270	295

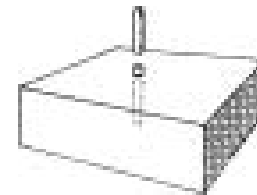
HST-R		M8	M10	M12	M16	M20	M24
Minimum spacing	s_{min} [mm]	60	55	60	70	100	125
	for $c \geq$ [mm]	60	70	80	110	195	205
Minimum edge distance	c_{min} [mm]	60	50	55	70	140	150
	for $s \geq$ [mm]	60	115	145	160	210	235

HST-HCR		M8	M10	M12	M16
Minimum spacing	s_{min} [mm]	60	55	60	70
	for $c \geq$ [mm]	60	70	80	110
Minimum edge distance	c_{min} [mm]	60	55	55	70
	for $s \geq$ [mm]	60	115	145	160

Intermediatate values by interpolation.

$N_{Rd,s}$: Steel design tensile resistance

Anchor size		M8	M10	M12	M16	M20	M24
$N_{Rd,s}^{1)}$ [kN]	HST	12.8	21.3	28.7	50.0	46.9	90.1
	HST-R	11.3	18.7	26.7	44.2	63.0	90.2
	HST-HCR	12.9	21.5	30.5	56.3	-	-



¹⁾ The design tensile resistance is calculated from the characteristic tensile resistance, $N_{Rk,s}$, using $N_{Rd,s} = N_{Rk,s} / \gamma_{Ms}$, where the partial safety factor γ_{Ms} varies with anchor type and size (as per relevant approval).

N_{Rd} : System design tensile resistance

$$N_{Rd} = \text{lower of } N_{Rd,p}, N_{Rd,c} \text{ and } N_{Rd,s}$$

Combined loading: Only if tensile load and shear load applied (See page 31 and section 4 "Examples").

Detailed design method – Hilti CC

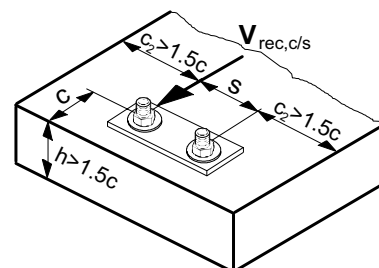
(The Hilti CC-Method is a simplified Version of ETAG Annex C)

SHEAR

The design shear resistance of a single anchor is the lower of,

$V_{Rd,c}$: concrete edge resistance

$V_{Rd,s}$: steel resistance

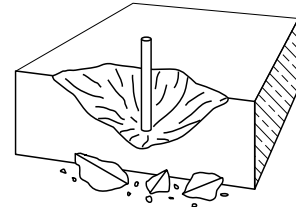


Note: If the conditions regarding h and c_2 are not met, consult your Hilti technical advisory service.

$V_{Rd,c}$: Concrete edge design resistance

The lowest concrete edge resistance must be calculated. All nearby edges must be checked, (not only the edge in the direction of shear). Shear direction is accounted for by the factor $f_{\beta,V}$.

$$V_{Rd,c} = V_{Rd,c}^0 \cdot f_B \cdot f_{\beta,V} \cdot f_{AR,V}$$



$V_{Rd,c}^0$: Concrete edge design resistance

- Concrete compressive strength $f_{ck,cube(150)} = 25 \text{ N/mm}^2$
- at a minimum edge distance c_{min}

HST	Anchor size	M8	M10	M12	M16	M20	M24
$V_{Rd,c}^0$ [kN]	non-cracked concrete	3.0	3.9	4.2	9.1	21.5	31.7
$V_{Rd,c}^0$ [kN]	cracked concrete	2.1	2.8	3.0	6.5	15.4	22.7
c_{min} [mm]	min. edge distance	50	55	55	85	140	170
for $s \geq$ [mm]	min. spacing distance	60	115	145	150	270	295

HST-R / HCR	Anchor size	M8	M10	M12	M16	M20	M24
$V_{Rd,c}^0$ [kN]	non-cracked concrete	3.9	3.4	4.2	6.8	21.5	26.3
$V_{Rd,c}^0$ [kN]	cracked concrete	2.8	2.4	3.0	4.9	15.4	18.8
c_{min} [mm]	min. edge distance	60	50	55	70	140	150
for $s \geq$ [mm]	min. spacing distance	60	115	145	160	210	235

HST-R / HCR	Anchor size	M8	M10	M12	M16
$V_{Rd,c}^0$ [kN]	non-cracked concrete	3.9	3.9	4.2	6.8
$V_{Rd,c}^0$ [kN]	cracked concrete	2.8	2.8	3.0	4.9
c_{min} [mm]	min. edge distance	60	55	55	70
for $s \geq$ [mm]	min. spacing distance	60	115	145	160

¹⁾ The shear design resistance is calculated from the shear characteristic resistance $V_{Rk,c}^0$ by $V_{Rd,c}^0 = V_{Rk,c}^0 / \gamma_{Mc,V}$, where the partial safety factor $\gamma_{Mc,V}$ is equal to 1.5.

f_B : Influence of concrete strength

Concrete strength designation (ENV 206)	Cylinder compressive strength $f_{ck,cyl}$ [N/mm ²]	Cube compressive strength $f_{ck,cube}$ [N/mm ²]	f_B
C20/25	20	25	1.0
C25/30	25	30	1.1
C30/37	30	37	1.22
C35/45	35	45	1.34
C40/50	40	50	1.41
C45/55	45	55	1.48
C50/60	50	60	1.55

$$f_B = \sqrt{\frac{f_{ck,cube}}{25}}$$

Limits:
 $25 \text{ N/mm}^2 \leq f_{ck,cube(150)} \leq 60 \text{ N/mm}^2$

Concrete cylinder: height 30cm, 15cm diameter	Concrete cube: side length 15cm
Concrete test specimen geometry	

HST stud anchor

$f_{\beta,V}$: Influence of shear load direction

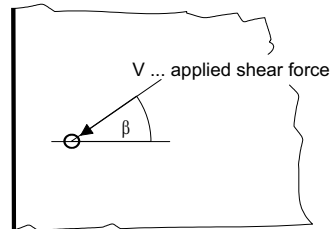
Angle β [°]	$f_{\beta,V}$
0 to 55	1
60	1.1
70	1.2
80	1.5
90 to 180	2

Formulae:

$$f_{\beta,V} = 1 \quad \text{for } 0^\circ \leq \beta \leq 55^\circ$$

$$f_{\beta,V} = \frac{1}{\cos \beta + 0.5 \sin \beta} \quad \text{for } 55^\circ < \beta \leq 90^\circ$$

$$f_{\beta,V} = 2 \quad \text{for } 90^\circ < \beta \leq 180^\circ$$



$f_{AR,V}$: Influence of spacing and edge distance

Formula for **single** anchor fastening influenced only by edge

$$f_{AR,V} = \frac{c}{c_{\min}} \sqrt{\frac{c}{c_{\min}}}$$

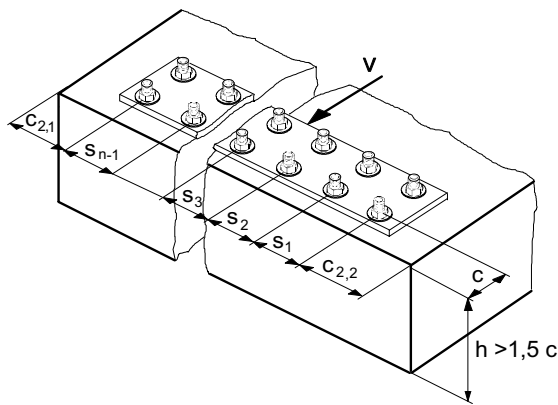
Formula for anchor **pair** valid for $s < 3c$

$$f_{AR,V} = \frac{3c + s}{6c_{\min}} \sqrt{\frac{c}{c_{\min}}}$$

General formula for **n** anchors (edge plus n-1 spacing) only valid where s_1 to s_{n-1} are all $< 3c$ and $c_2 > 1.5c$

$$f_{AR,V} = \frac{3c + s_1 + s_2 + \dots + s_{n-1}}{3nc_{\min}} \sqrt{\frac{c}{c_{\min}}}$$

results tabulated below



Note: It is assumed that only the row of anchors closest to the free concrete edge carries the centric shear load

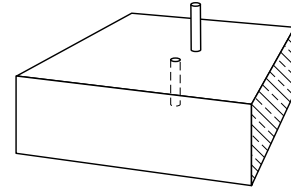
$f_{AR,V}$	c/c_{\min} →																
	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.2	3.4	3.6	3.8	4.0	
Single anchor with edge influence	1.00	1.31	1.66	2.02	2.41	2.83	3.26	3.72	4.19	4.69	5.20	5.72	6.27	6.83	7.41	8.00	
s/c_{\min} ↓	1.0	0.67	0.84	1.03	1.22	1.43	1.65	1.88	2.12	2.36	2.62	2.89	3.16	3.44	3.73	4.03	4.33
	1.5	0.75	0.93	1.12	1.33	1.54	1.77	2.00	2.25	2.50	2.76	3.03	3.31	3.60	3.89	4.19	4.50
	2.0	0.83	1.02	1.22	1.43	1.65	1.89	2.13	2.38	2.63	2.90	3.18	3.46	3.75	4.05	4.35	4.67
	2.5	0.92	1.11	1.32	1.54	1.77	2.00	2.25	2.50	2.77	3.04	3.32	3.61	3.90	4.21	4.52	4.83
	3.0	1.00	1.20	1.42	1.64	1.88	2.12	2.37	2.63	2.90	3.18	3.46	3.76	4.06	4.36	4.68	5.00
	3.5		1.30	1.52	1.75	1.99	2.24	2.50	2.76	3.04	3.32	3.61	3.91	4.21	4.52	4.84	5.17
	4.0			1.62	1.86	2.10	2.36	2.62	2.89	3.17	3.46	3.75	4.05	4.36	4.68	5.00	5.33
	4.5				1.96	2.21	2.47	2.74	3.02	3.31	3.60	3.90	4.20	4.52	4.84	5.17	5.50
	5.0					2.33	2.59	2.87	3.15	3.44	3.74	4.04	4.35	4.67	5.00	5.33	5.67
	5.5						2.71	2.99	3.28	3.57	3.88	4.19	4.50	4.82	5.15	5.49	5.83
	6.0						2.83	3.11	3.41	3.71	4.02	4.33	4.65	4.98	5.31	5.65	6.00
	6.5							3.24	3.54	3.84	4.16	4.47	4.80	5.13	5.47	5.82	6.17
	7.0								3.67	3.98	4.29	4.62	4.95	5.29	5.63	5.98	6.33
	7.5									4.11	4.43	4.76	5.10	5.44	5.79	6.14	6.50
	8.0										4.57	4.91	5.25	5.59	5.95	6.30	6.67
	8.5											5.05	5.40	5.75	6.10	6.47	6.83
	9.0											5.20	5.55	5.90	6.26	6.63	7.00
9.5												5.69	6.05	6.42	6.79	7.17	
10.0													6.21	6.58	6.95	7.33	
10.5														6.74	7.12	7.50	
11.0															7.28	7.67	
11.5																7.83	
12.0																8.00	

These results are for a two-Anchor fastening.

For fastening made with more than 2 anchors, use the general formulae for n anchors at the top of the page.

Anchor size		M8	M10	M12	M16	M20	M24
$V_{Rd,s}$ [kN]	HST	10.4	16.0	24.0	40.0	41.4	62.7
	HST-R	10.4	16.0	24.0	38.5	55.6	79.9
	HST-HCR	10.4	16.0	24.0	44.0	-	-

¹⁾ The design shear resistance is calculated from the characteristic shear resistance, $V_{Rk,s}$, using $V_{Rd,s} = V_{Rk,s} / \gamma_{Ms}$, where the partial safety factor γ_{Ms} varies with anchor type and size (as per relevant approval).



V_{Rd} : System design shear resistance

$V_{Rd} = \text{lower of } V_{Rd,c} \text{ and } V_{Rd,s}$

Combined loading: Only if tensile load and shear load applied (See page 31 and section 4 “Examples”).

COMPRESSOR
CALIFORNIA AIR TOOLS
15020C - 15 GAL 2-HP



California Air Tools #15020C Specifications

Zoro #: G4124989 Mfr #: 15020C

Tank Size: 15 gal.	Voltage: 120V
Max. Pressure: 150 psi	HP: 2
Tank Type: Steel	Free Air CFM @ Max. Pressure: 5.3 @ 90 psi
Includes: (2) Air Filters, (2) Pressure Control Gauges, 1/4 in Quick Connector, Condor Pressure Switch, Easy Start Valve, Thermal Overload Protector, Wheel Kit	Overall Length: 28 in
Compressor Type: Ultra Quiet and Oil Free Air Compressor	Overall Height: 31 in
Weight: 90	Standards: UL
Overall Width: 17 in	Free Air CFM @ 90 PSI - Air Compressor: 5.3
Cylinder Material: Steel	Full Load Amps: 14.0
Weight - Air Compressor: 90 lb	Motor RPM: 1,680 RPM
Motor Type: Induction	(F)NPT Outlet: 1/4 in
Lubrication Type - Air compressor: Oil Free	Input Voltage - Air Compressor: 110V AC
Max. Pressure - Air Compressor: 150 psi	Item - Air Compressor: Portable Air Compressor
Avg. Pump Life: 3,000 hr	Item: Ultra Quiet 2.0 HP 15G Air Compressor
Tank Size - Air Compressor: 15 gal	HP - Air Compressor: 2.0 hp
Tank Style - Air Compressor: Horizontal	Features: Two Pressure Control Gauges
Pump Life: 3,000 hours	Connector Type: One 1/4" Universal Quick Connectors
Width: 28	Maximum PSI: 125 PSI
CFM at 90 PSI: 5.30 CFM	AMPS: 15.0 Amps
Length: 30	Time to fill the Tank: 230 Seconds
Height: 17	CFM at 40 PSI: 6.40 CFM
Motor Speed: 1680 RPMS	Country of Origin (subject to change): Multiple



ULTRA QUIET & OIL FREE
AIR COMPRESSOR
OWNER'S MANUAL

CALIFORNIA AIR TOOLS
15020C

2.0 HP

6.40 CFM @ 40 PSI

5.30 CFM @ 90 PSI

15.0 GALLON STEEL TANK



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INTRODUCTION

WARNING

This manual contains important instructions for operating this product. For your safety, and the safety of others, be sure to read this manual thoroughly before operating the product.

Failure to properly follow all the instructions and precautions can cause you and others to be seriously hurt or killed.

Thank you for purchasing a California Air Tools, Inc. Air Compressor.

Please contact us if you have any questions.

Record the model and serial numbers indicated on your air compressor's nameplate:

Model No. _____

Serial No. _____

Date of Purchase: _____

Store/Dealer: _____

How to find a local service center:

Even quality built equipment might need service or repair parts. Contact the California Air Tools Customer Service Department:

Phone: 1-866-409-4581

Online: WWW.CALIFORNIAAIRTOOLS.COM

Please provide the information below:

Model number and Serial number and specifications shown on the Model number/Serial number plate.

Part number or numbers shown in the parts list section of the owner's manual for your air compressor model.

A brief description of the trouble with the air compressor.

Do not return your air compressor for service or parts to the store/dealer where purchased.

IMPORTANT SAFETY INSTRUCTIONS

Safety Messages & Signal Words:

⚠ DANGER

Indicates an immediate hazardous situation which, if not avoided, will result in death or serious injury to the operator or to bystanders.

⚠ WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury to the operator or to bystanders.

⚠ CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in moderate or minor injury to the operator or to bystanders.

NOTICE

Indicates a situation which, if not avoided, may result in damage to product components or other property.

⚠ DANGER



RISK OF CUTTING

Moving parts can cause severe trauma.

Keep hands and feet away from rotating parts, tie up long hair, remove jewelry, and DO NOT wear loose clothing.

⚠ DANGER



SHOCK

There is a danger of electric shock.

Use only undamaged electrical cords.

DO NOT touch bare wires or receptacles.

DO NOT operate air compressor in wet weather or in wet conditions.

DO NOT touch air compressor or cords if hands or feet are wet.

Ensure that all cords are free of damage before connecting to the power supply.

Ensure that you have a sufficient electrical supply for supporting the requirements of the motor.

Improper installation of the grounding plug is able to result in a risk of electric shock. When repair or replacement of the cord or plug is required, do not connect the grounding wire to either flat terminal. The wire with insulation having an outer surface that is green with or without yellow stripes is the grounding wire.

This product must be grounded. In the event of an electrical short circuit, grounding reduces the risk of electrical shock by providing an escape wire for the electric current.

This product is equipped with a cord having a grounding wire with an appropriate grounding plug. The plug must be plugged into an outlet that is properly installed and grounded in accordance with the local codes and ordinances.

This product is for use on a nominal 120-V circuit and has a grounding plug similar to the plug illustrated in sketch A. Only connect the product to an outlet having the same configuration as the plug.

Do not use an adapter with this product.

⚠ WARNING



RISK TO BREATHING

Dust or dust-like particulates caused by power-sanding, sawing, grinding, drilling or any other construction-like activities can contain contaminants that are harmful to breathe.

Always use your air compressor in a well-ventilated and clean area.

Never breathe the air that comes directly out of the air compressor or air hose. This air is not suitable for breathing.

Always wear approved safety equipment. When performing dust-creating activities, securely wear properly-fit face masks or respirators.

If you feel ill from breathing while operating your air compressor, stop and seek medical attention immediately.

⚠ WARNING



FLYING OBJECTS

Flying objects can cause injury to the eyes, head and other parts of the body.

Air-powered equipment and power tools are capable of propelling items (metal chips, fasteners and particulates) at high speed into the air and could result in injury.

Always wear approved head and eye protection.

Never point the air stream at any part of your body, or at another person or animal.

When operating the air compressor, make sure all other people and animals maintain a safe distance.

Do not move the air compressor when the air tank is under pressure.

Never use the air hoses to pull or move the air compressor.

Keep the air compressor on a flat surface.

⚠ WARNING



HOT SURFACE



FIRE

Air compressor surfaces become hot during operation.

DO NOT touch hot surfaces, because they can cause severe burns.

Do not touch the air compressor's cylinder head. During operation, the cooling fins of the cylinder head and delivery pipe become hot.

Allow the air compressor to cool before touching it.

DO NOT place a storage cover on the unit during operation. Only place a cover on the air compressor after it has thoroughly cooled down.

⚠ WARNING



EXPLOSION

Exercise caution when using pressurized air.

To prevent injury and for your general safety, only use high-pressure hoses, fittings and couplings designed for use with air compressors.

Inspect all hoses, fittings and couplings for leaks and wear. When leaks and wear are detected, stop use and replace those items immediately. Do not repair.

Never leave pressurized air in the air tank when performing maintenance.

Never leave the air compressor unattended with the power supply in use and the air hose connected.

⚠ WARNING



EXPLOSION

Improper care could lead to the air tank bursting or exploding.

Drain air tank daily or after each use to prevent moisture buildup in the air tank.

Rust can weaken the air tank and cause leaks or bursting. If rust is detected, replace tank immediately. Do not try to repair the air tank by welding, drilling or modifying it in any other way. These modifications can weaken the air tank and cause a hazardous condition.

If air tank develops a leak, replace the air tank immediately. Never repair, weld or make modifications to the air tank or its attachments.

Never make adjustments to the factory-set pressures.

Never exceed manufacturer's maximum-allowable pressure rating attachments.

Because of extreme heat, do not use plastic pipe or lead tin solder joints for a discharge line.

⚠ WARNING



EXPLOSION



FIRE

Use caution to minimize risk of fire or explosion.

It is normal for the air compressor motor and pressure switch to produce sparks while operating. If sparks come in contact with vapors from gasoline or solvents, they may ignite and cause a fire or explosion.

Abrasive tools such as grinders, drills and other tools are capable of making sparks that can ignite flammable materials.

Always operate the air compressor a safe distance away from flammable items. Use in well-ventilated areas.

Never exceed the maximum rated pressure.

⚠ CAUTION

Use caution when using extension cords.

Use an extension cord which is no more than 25' (7.6 m) long and at least 14 gauge.

Using an excessively long or thin-wired extension cord will cause severe damage to the motor.

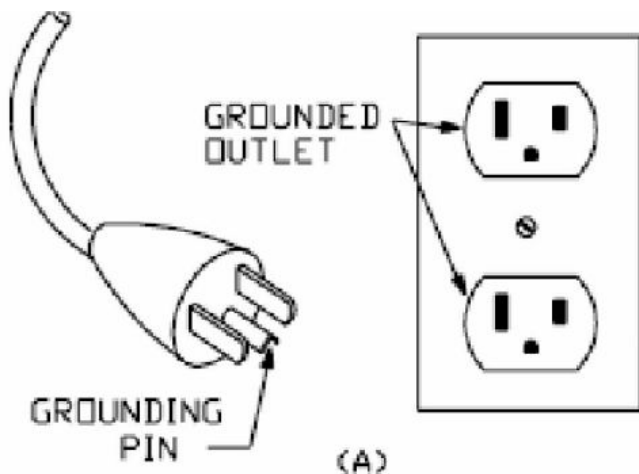
Use only a 3-wire extension cord that has a 3-blade grounding plug.

As undersized cord results in a drop in the line voltage and loss of power and overheating.

When in doubt, use a heavier gauge. The smaller the gauge the more current the cord can carry.

⚠ CAUTION

THIS EQUIPMENT INCORPORATES PARTS, SUCH AS SNAP SWITCHES, RECEPTACLES AND THE LIKE THAT TEND TO PRODUCE ARCS OR SPARKS, THERE, WHEN LOCATED IN A GARAGE, IT SHOULD BE IN A ROOM OR ENCLOSURE PROVIDED FOR THE PURPOSE, OR SHOULD BE 18 IN (45.7 CM) OR MORE ABOVE THE FLOOR.



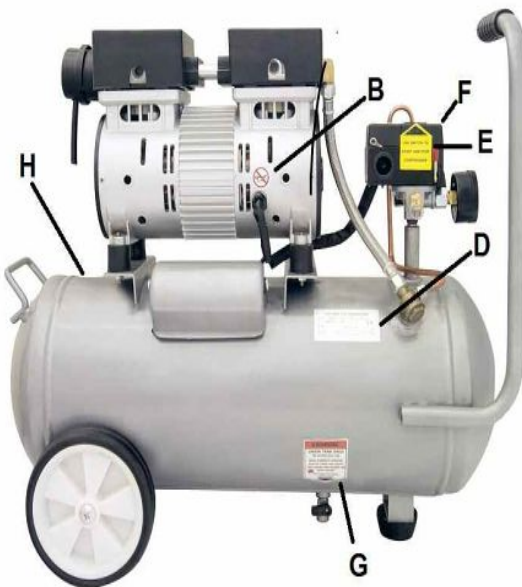
Check with a qualified electrician or serviceman when the grounding instructions are not completely understood, or when in doubt as to whether the product is properly grounded.

Do not modify the plug provided. If it does not fit the outlet, have the proper outlet installed by a qualified electrician.

LOCATIONS OF IMPORTANT LABELS

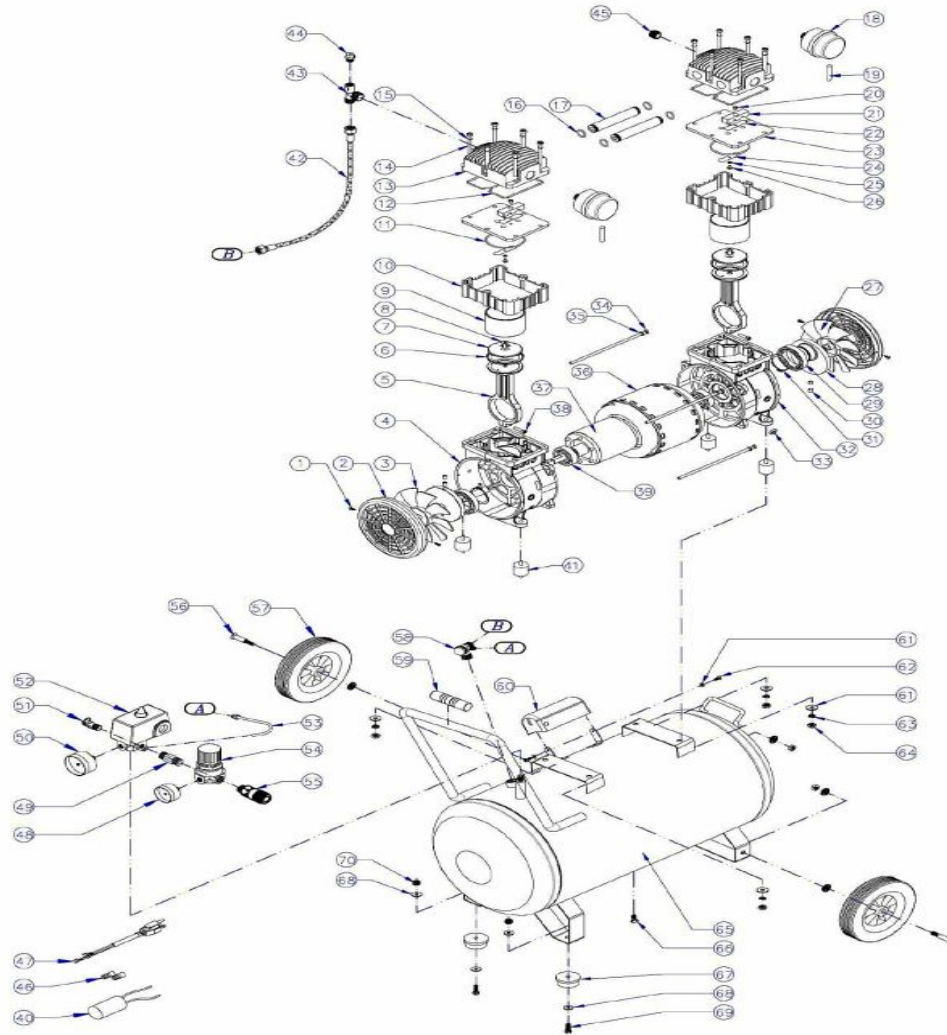
Read these important labels before operating.

These labels provide important safety and maintenance information. These labels should be considered as permanent parts of the air compressor. Should any of these labels become illegible, damaged or removed, please contact California Air Tools Customer Service department at 1-866-409-4581 for replacements.



PRODUCT LABEL							
A							
B							
C							
D							
E							
F							
G							
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AIR COMPRESSOR



NO.	Description	NO.	Description	NO.	Description	NO.	Description
1	Fan Screw	21	Limited Block	41	Shock Strut	61	Washer
2	Fan Cover	22	Gassing Valve Plate	42	Exhaust Hose	62	Screw
3	Left Fan	23	Valve Plate	43	Elbow	63	Washer
4	Left Crank Case	24	Air Inflow Valve Plate	44	Easy Start Valve	64	Nut
5	Connecting Rod	25	Metal Strengthen Sheet	45	Motor Head Plug	65	15 Gal. Steel Tank
6	Piston Ring	26	Screw	46	Wire Connector	66	Drain Valve
7	Pressure Plate	27	Right Fan	47	Power Cord with Plug	67	Cushion Foot
8	Pressure Plate Screw	28	Crank	48	2.0 Pressure Gauge	68	Washer
9	Cylinder	29	Bearing	49	Connecting Bar	69	Bolt
10	Adjustment Stent	30	Cheese Head Screw	50	2.5 Pressure Gauge	70	Nut
11	Cylinder Obturating Ring	31	Clip	51	Safety Valve	71	
12	Cylinder Head Obturating Ring	32	Right Crank Case	52	Pressure Switch (Condor)	72	
13	Cylinder Head	33	Leading-out Line Guard Circle	53	Uploading Pipe	73	
14	Cylinder Head Screw	34	Bolt	54	Regulator	74	
15	Spring Washer	35	Washer	55	1/4" Quick Connect	75	
16	Connecting Hose Oburating Ring	36	Stator	56	Wheel Bolt	76	
17	Connecting Hose	37	Rotor	57	Wheel	77	
18	Air Filter	38	Connecting Rod Screw	58	Check Valve	78	
19	Air Filter Hose	39	Bearing	59	Handle	79	
20	Screw	40	Capacitor	60	Capacitor Cover	80	

PRE-OPERATION CHECKLIST

Package Contents & Assembly

Model: 15020C

Package contents:

- Air Compressor
- Owner's Manual
- (2) Air Filters
- Wheel Assembly Kit
- 2 - #56 Wheel Bolt
- 2 - #68 Washer
- 2 - #57 Wheel
- 2 - #68 Washer
- 2 - #70 Nut
- 2 - #69 Bolt
- 2 - #68 Washer
- 2 - #67 Cushion Foot
- 2 - #68 Washer
- 2 - #70 Nut

Assembly:

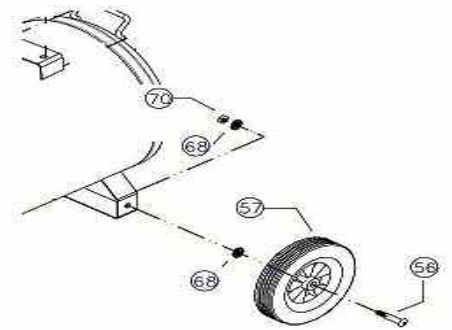
Install the Air Filter

1. Attach the air filters to the top right side of motor head.
(looking from the front to the back of the air compressor)
Screw the air filter into the motor head port

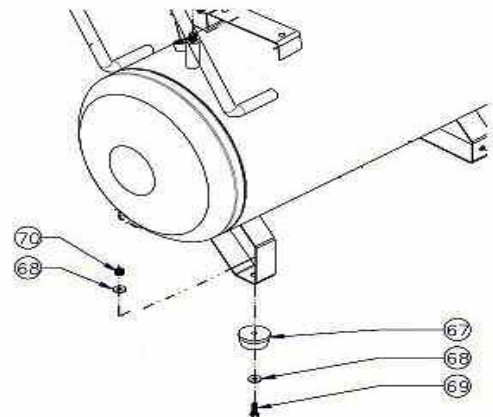


Install the Wheel Kit

1. Slide Bolt #56 through Wheel #57..
2. Slide the washer #68 onto Bolt #56.
3. Slide the bolt #56 through the wheel support hole located on the back bottom of the air compressor tank.
4. Attached the Washer #68 and Nut #70 to the Bolt #56 and tighten firmly.
5. Repeat steps 1-3 to assemble the other wheel.



6. Slide Bolt #69 through Washer #68 and Cushion Foot #67.
7. Slide Bolt #69 through cushion foot support hole located on the front bottom of the air compressor..
Attach Washer #69 and Nut #70 to Bolt # 69 firmly tighten.



Inspect for Damage

Before using the air compressor, make sure the air tank is not damaged, inspect all parts for damage, and check that all pipes are firmly connected.

Do not use the air compressor if any damage is found. If damaged, have an authorized service center inspect and test the air compressor to ensure that is working properly.

Save Packaging

IMPORTANT: Save all outside packaging in case you ever need to return the product for service or repair.

Compressor Location


Use on Flat Surface


For proper operation, the air compressor must be placed on a flat surface with an incline no greater than 15 degrees.

Maintain a Clear Area

It is very important that the air compressor is positioned so that there is adequate airflow around the machine. There must be at least 2 feet of obstacle-free space surrounding and above the air compressor.

⚠ WARNING


EXPLOSION


FIRE

Use caution to minimize risk of fire or explosion.

It is normal for the air compressor motor and pressure switch to produce sparks while operating. If sparks come in contact with vapors from gasoline or solvents, they may ignite and cause a fire or explosion.

Abrasive tools such as grinders, drills and other tools are capable of making sparks that can ignite flammable materials.

Always operate the air compressor a safe distance away from flammable items. Use in well-ventilated areas.

Never exceed the maximum rated pressure.

⚠ WARNING


RISK TO BREATHING

Dust or dust-like particulates caused by power-sanding, sawing, grinding, drilling or any other construction-like activities can contain contaminants that are harmful to breathe.

Always use your air compressor in a well-ventilated and clean area.

Never breathe the air that comes directly out of the air compressor or air hose. This air is not suitable for breathing.

Always wear approved safety equipment. When performing dust-creating activities, securely wear properly-fit face masks or respirators.

If you feel ill from breathing while operating your air compressor, stop and seek medical attention immediately.

Use in Areas with Clean Air

For proper operation and to maximize the longevity of the air compressor, it is very important that the air drawn into the air compressor is clean. The air compressor should not be used in areas where dust or particulates are in the air. This will damage the motor and impair proper operation.

IMPORTANT: Always use the air filter, properly installed.

Electrical Power

Electrical Power Requirements

⚠ DANGER



SHOCK

There is a danger of electric shock.

Use only undamaged electrical cords.

DO NOT touch bare wires or receptacles.

DO NOT operate air compressor in wet weather or in wet conditions.

DO NOT touch air compressor or cords if hands or feet are wet.

Ensure that all cords are free of damage before connecting to the power supply.

Ensure that you have a sufficient electrical supply for supporting the requirements of the motor.

Improper installation of the grounding plug is able to result in a risk of electric shock. When repair or replacement of the cord or plug is required, do not connect the grounding wire to either flat terminal. The wire with insulation having an outer surface that is green with or without yellow stripes is the grounding wire.

This product must be grounded. In the event of an electrical short circuit, grounding reduces the risk of electrical shock by providing an escape wire for the electric current.

This product is equipped with a cord having a grounding wire with an appropriate grounding plug. The plug must be plugged into an outlet that is properly installed and grounded in accordance with the local codes and ordinances.

This product is for use on a nominal 120-V circuit and has a grounding plug similar to the plug illustrated in sketch A. Only connect the product to an outlet having the same configuration as the plug.

Do not use an adapter with this product.

Before using the air compressor, refer to the serial label for voltage and amperage requirements. Make sure you have a sufficient electrical supply for supporting the motor's requirements.

Use a dedicated circuit for the best results.

Low voltage and/or an overload circuit can cause the motor's overload protection system circuit breaker to trip.

Electrical Extension Cords

⚠ CAUTION

Use caution when using extension cords.

Use an extension cord which is no more than 25' (7.6 m) long and at least 14 gauge.

Using an excessively long or thin-wired extension cord will cause severe damage to the motor.

Use only a 3-wire extension cord that has a 3-blade grounding plug.

As undersized cord results in a drop in the line voltage and loss of power and overheating.

When in doubt, use a heavier gauge. The smaller the gauge the more current the cord can carry.

Inspect all electrical extension cords to ensure that they are free of damage.

When using an extension cord, use a heavy-duty cord that is no more than 25 feet long and at least 14 gauge. Use only a 3-wire extension cord that has a 3-blade grounding plug.

OPERATING THE AIR COMPRESSOR

⚠ WARNING

This manual contains important instructions for operating this product. For your safety, and the safety of others, be sure to read this manual thoroughly before operating the product.

Failure to properly follow all the instructions and precautions can cause you and others to be seriously hurt or killed.

Save this manual for future reference.

Introduction

This air compressor features a compact structure, stable performance, a high airflow rate, easy operation and maintenance. Because the air compressor produces no oil in the airflow, it can be used as an independent air supply machine for situations in which oil in the airflow is an issue. The motor directly drives the pistons and is able to function without lubrication for a long period of time.

Assembly

1. Connect your air supply hose to a 1/4" male universal or industrial quick connect coupler. Connect the male quick connect coupler to the female quick connect coupler located on the air compressor
2. Make sure the drainage valve is off and that the pressure switch is in the OFF position.
3. Ensure that the power supply you are going to use is operating normally.
4. Insert the power supply cord into the power supply socket.

Test Run

Before using the air compressor for the first time, complete a test run as follows:

1. Turn the power switch to the OFF position. Plug the power supply cord into a power supply socket. Start the air compressor by turning the power switch to the ON position. The pressure gauge reading will slowly rise as pressure increases inside the air tank. When the gauge reading reaches 130 PSI, the pressure switch will automatically turn the power off. This indicates the compressor is working normally.

Turn the power switch to the Off position, unplug the power supply cord and release the air from the air tank. At this point proceed to the next step (daily operations).

Note: If the Air Compressor is not working properly, the pressure gauge will indicate that there is a decrease in pressure in the air tank. If there is an air leak from the compressor the pressure in the air tank decreases, the pressure switch resets and the motor automatically turns back on.

If you detect an air leakage, turn the power switch to the Off position, release the air from the tank by pulling on the safety valve. Unplug the power supply cord and contact Customer Support for Assistance.

! WARNING



FLYING OBJECTS

Flying objects can cause injury to the eyes, head and other parts of the body.

Air-powered equipment and power tools are capable of propelling items (metal chips, fasteners and particulates) at high speed into the air and could result in injury.

Always wear approved head and eye protection.

Never point the air stream at any part of your body, or at another person or animal.

When operating the air compressor, make sure all other people and animals maintain a safe distance.

Do not move the air compressor when the air tank is under pressure.

Never use the air hoses to pull or move the air compressor.

Keep the air compressor on a flat surface.

! WARNING



HOT SURFACE



FIRE

Air compressor surfaces become hot during operation.

DO NOT touch hot surfaces, because they can cause severe burns.

Do not touch the air compressor's cylinder head. During operation, the cooling fins of the cylinder head and delivery pipe become hot.

Allow the air compressor to cool before touching it.

DO NOT place a storage cover on the unit during operation. Only place a cover on the air compressor after it has thoroughly cooled down.

Daily Operation

Starting the compressor:

1. Turn the power switch to the OFF position.
2. Attach a 1/4" Industrial Male quick coupler to your air hose.
Attach the air hose to the quick coupler on the air compressor.
3. Close the drain valve.
4. Have the (2) air filters attached
5. Plug the power supply cord into a power supply socket.
6. Turn the power switch to the ON position.
7. Let the motor run and tank fill until motor turns off.
8. To regulate the air flow.
While the air compressor is running, turn "On" your tool and turn the regulator knob to the right increasing the pressure.
Turn the pressure up until the desired pressure is reached.
9. Operate air tool normally.
Do Not Run Non-Stop (continuously) for more than 1 hour.

Shutting down the compressor:

1. Turn the power switch to the OFF position.
2. Unplug the power supply cord.
3. Reduce the pressure in the air tank through the air hose.

MAINTENANCE

Draining the Air Tank

The frequency at which you should drain the air tank depends on the environmental conditions and the amount of operating time logged. The average draining frequency is every 1 to 2 days.

1. Place the air compressor above a container capable of holding water.
2. With compressed air in the air tank, slowly turn the drain valve knob to the forward (open) or straight position. The water in the air tank will drain out.
3. After all of the accumulated water has drained out, turn the drain valve knob to the closed or left position in order to avoid leakage.
4. Draining the air tank protects parts from rust and corrosion.

Cleaning or Changing the Air Filter

The air filter is designed to reduce noise and help prevent particulates in the air from entering and damaging the air compressor.

After being used for a period of time, the air filter will become clogged. This will reduce the air intake capabilities of the air compressor, reducing performance. Therefore, the air filter must be cleaned or replaced regularly.

1. Open the lid on the air filter, then remove the air filter element.
2. To clean the element blow off or brush off the dirt and dust.
3. If clogged, replace with a new air filter.

Testing for Leaks

Make sure all connections are tight. Do not overtighten.

A small leak in any hose or pipe connection will reduce the air compressor's performance.

To test for small leaks, spray a small amount of soapy water on the area suspected of leaking. If the soap bubbles, replace the broken part.

Cleaning

Clean items with a soft brush, or wipe with a moistened cloth using a biodegradable solvent.

Do not use flammable liquids such as gasoline or alcohol. Always keep parts clean from dirt and dust for better performance.

Pressure Switch

The pressure switch is factory pre-set to shut off at between 125 - 130 PSI and to re-start at between 95-100 PSI

STORAGE

Before storing for a prolonged period of time:

1. Turn off the power supply.
2. Disconnect the power cord from the power supply and wrap the power cord around the air compressor handle to reduce the risk of damage.
3. Pull the relief valve and release all the pressure from the air tank.
4. Clean the air compressor to remove all dirt and dust.
5. Cover the air compressor with a cover to protect the unit from dust and moisture.
6. Do not stack or store any items on top of or around the air compressor. Damage could occur.

CAUTION

**TO REDUCE THE RISK OF ELECTRIC SHOCK,
DO NOT EXPOSE TO RAIN.**

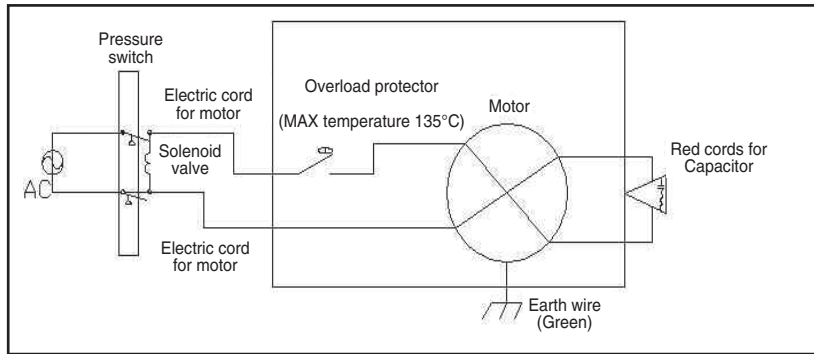
STORE INDOORS.

TROUBLESHOOTING

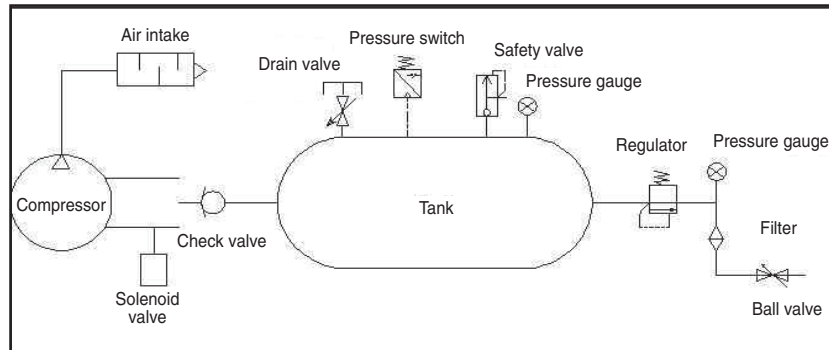
PROBLEM	POSSIBLE CAUSE	POSSIBLE SOLUTIONS
Pressure drop in the tank.	Air leaks at connections.	Let the compressor build pressure in the tank, to the maximum pressure if possible. Brush soapy water on air connections and look carefully for air bubbles. Tighten leaky connections. If the problem persists, contact the seller for further advice.
The unloader valve leaks when the compressor is idle.	Unloader valve seal is defective.	Let the air in the air tank flow out until all the pressure is released. Then remove the unloader valve plug and clean the valve seal. If necessary, replace the seal and then reinstall all components.
The compressor stopped and does not start.	The thermal protector turned on because the motor is overheating.	Check that the main voltage corresponds to the air compressor specifications. An extension cord that is too thin or too long can cause a voltage drop and cause the motor to overheat. Excessive use (over 1 hour continuous use) can cause the motor to overheat Allow the motor to cool down.
	Motor windings are burned out.	Contact Customer Support.
The motor does not start and makes a humming noise.	Capacitor is burned out.	Contact Customer Support
The motor does not start or starts slowly.	Low voltage supply to the motor.	Check that the main voltage corresponds to the air compressor specifications. An extension cord that is too thin or too long can cause a voltage drop.. Use heavy duty extension cords. Ensure that the air compressor is plugged into a fully functional power outlet
The compressor is noisy with metallic clangs.	Compressor head gasket or reed valve is damaged	Stop the compressor and contact the dealer.
The compressor does not reach the maximum pressure.	Compressor head gasket or reed valve is faulty.	Stop the compressor and contact the dealer.
The compressor doesn't seem to provide as much air as it did when new and/or the compressor cuts off within a much shorter time period.	The pressure switch needs adjusting.	Stop the compressor and contact the dealer.
	The tank is full of water due to condensation.	Open the drain valve and release the water from the tank.
The motor pump unit does not stop when the tank pressure reaches its maximum working pressure (130 PSI).	Pressure switch defective or needs adjusting.	Stop the compressor immediately and contact Customer Support.

SPECIFICATIONS

Electrical Circuit



Air Passage Drawing



CALIFORNIA AIR TOOLS INC. LIMITED WARRANTY

This warranty is limited to Air Compressors distributed by:

California Air Tools, Inc.
8560 Siempre Viva Road
San Diego, CA 92154

Limited Warranty

California Air Tools Inc. will repair or replace, free of charge, to the original retail customer who purchased a California Air Tools, Inc. Air Compressor from an authorized dealer, distributor or distributor's dealer in North America.

This warranty does not transfer to subsequent owners.

California Air Tools Inc. will repair or replace, at its option, any parts of the portable air compressor that are proven by an authorized service center to be defective in material or workmanship under normal use during the applicable warranty time period as stated below. This limited warranty covers the cost of the replacement parts and labor for all defects when installed by an authorized service center. Transportation charges are the responsibility of the customer. Any part replaced under warranty becomes the property of California Air Tools Inc.

All parts replaced under warranty will be considered as part of original product, and any warranty on those parts will expire coincident with the original product warranty.

Limited Warranty Periods

Non-commercial / Non-rental (personal use by a retail customer):	1 year parts and labor
Commercial / Rental (usage for income, business use):	1 year parts and labor

The limited warranty period begins on the date of retail purchase by the original purchaser.

Disclaimers, Limitations of Remedies & Exclusions

This warranty gives you specific legal rights, and you may also have other rights which may vary from state to state.

Disclaimer of Other Warranties

To the fullest extent permitted by applicable law, this limited warranty is exclusive and expressly in lieu of any and all other warranties, including, without limitation, any implied warranties of merchantability or fitness for a particular purpose or any other implied warranties that may arise from the course of dealing or usage of the trade. California Air Tools Inc. hereby disclaims and excludes all other warranties. To the extent that California Air Tools Inc. products are consumer products under applicable federal and state law with respect to any customer, the duration of any implied warranties (including but not limited to implied warranties of merchantability or fitness for a particular purpose) are limited to the shortest duration permitted by applicable law or the Limited Warranty period provided herein, whichever is longer.

Limitations of Remedies

California Air Tools Inc. shall not be liable to customer, or anyone claiming under customer, for any other obligations or liabilities, including but not limited to, obligations or liabilities arising out of breach of contract or warranty, negligence or other tort or any theory of strict liability, with respect to the air compressor or California Air Tools Inc. acts or omissions or otherwise. To the fullest extent permitted by applicable law, California Air Tools Inc. shall not in any event be liable for incidental, compensatory, punitive, consequential, indirect, special or other damages, including but not limited to loss of use, loss of income, loss of time, loss of sales, injury to personal property, or liability customer incurs with respect to any other person, or any other type or form of consequential damage or economic loss.

Exclusions

In addition to the foregoing disclaimers, limitations and terms, this limited warranty shall not apply to and does not cover accessories, nor does it cover products that are in any way subject to any of the following:

1. Improper setup, installation or storage.
2. Lack of proper maintenance and service.
3. Accident, damage, abuse or misuse.
4. Abnormal operating conditions or applications.
5. Repair or modification by customer or any third party without written consent of California Air Tools Inc.
6. Use under operating conditions or in applications not recommended by California Air Tools Inc.
7. Normal wear.
8. The use of accessories or attachments not recommended by California Air Tools Inc.
9. Acts of God.

The application of these exclusions will be determined at the sole discretion of California Air Tools Inc.

Registration

Warranty registration with California Air Tools Inc. is required on all products.

You can mail the enclosed registration form or register on-line.

How to Videos

California Air Tools provides "HOW TO VIDEOS" on our website WWW.CALIFORNIAAIRTOOLS.COM.

The "How to Videos" provide valuable information regarding set-up, operation and maintenance.

Please visit our website and view these videos for beneficial information.

Service or Parts

Warranty is also available by keeping and showing your original receipt from the date of purchase to an Authorized California Air Tools Service Center.

For all customer service inquiries call 1-866-409-4581 or visit

WWW.CALIFORNIAAIRTOOLS.COM

Go to the "Contact Us" Tab

Click on "Service & Parts" Button for the Fastest Service.

PRODUCT REGISTRATION

To register your product, please complete the information below and mail to the mailing address at the end of this page.

1. Personal Information:

Full Name (Include Middle Initial): _____

Mailing Address: _____

City: _____ State: _____ Zip Code: _____

Phone Number: _____

E-mail Address: _____

(Check here to receive product information and offers via e-mail)

(Check here to receive product information from other companies via e-mail)

2. Product Information:

Date of Purchase: _____ (MM / DD / YYYY)

Model Number: _____

Serial Number: _____ (Found on name plate)

Purchased Location: _____

Purchase Price: _____

Type of Primary Use for this Product: Home Recreation Emergency Rental Commercial

Other _____

Features Influencing Product Purchase: Brand Portability Power Rating Price Warranty

Other Features (describe) _____

What other Power Equipment are you interested in purchasing in the future? _____

Thank you for registering your product.

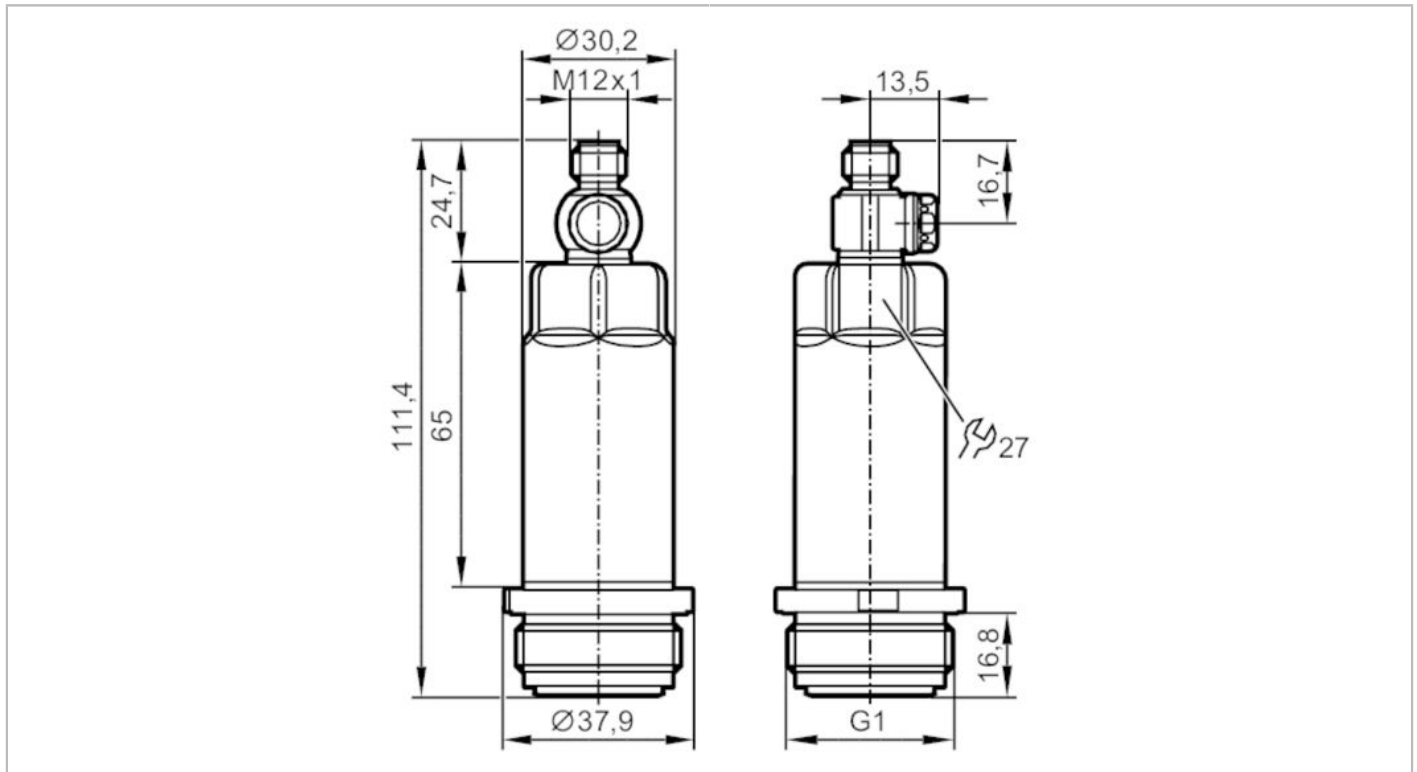
Mail to:
California Air Tools
8560 Siempre Viva Road
San Diego, CA 92154

PM1705



Electronic pressure sensor

PM-004-REA01-E-ZVG/US



EHEGD Certified



Reg31

Product characteristics

Output signal	analogue signal; (configurable)		
Measuring range	-1...4 bar	-14.5...58 psi	-100...400 kPa
Process connection	threaded connection G 1 external thread Aseptoflex Vario		

Application

Special feature	Gold-plated contacts		
Measuring element	ceramic-capacitive pressure measuring cell		
Application	food and beverage industry		
Media	viscous media and liquids with suspended particles; liquids and gases		
Medium temperature [°C]	-25...125; (150 max. 1h)		
Min. bursting pressure	100 bar	1450 psi	10000 kPa
Pressure rating	30 bar	435 psi	3000 kPa
Vacuum resistance [mbar]	-1000		
Type of pressure	relative pressure; vacuum		
No dead space	yes		
MAWP (for applications according to CRN) [bar]	30		

Electrical data

Operating voltage [V]	18...30 DC		
Min. insulation resistance [MΩ]	100; (500 V DC)		
Protection class	III		
Reverse polarity protection	yes		
Integrated watchdog	yes		

PM1705



Electronic pressure sensor

PM-004-REA01-E-ZVG/US

2-wire			
Current consumption	[mA]	3.5...21.5	
Power-on delay time	[s]	1	
3-wire			
Current consumption	[mA]	< 45	
Power-on delay time	[s]	0.5	
Inputs / outputs			
Number of inputs and outputs		Number of analogue outputs: 1	
Outputs			
Total number of outputs		1	
Output signal		analogue signal; (configurable)	
Number of analogue outputs		1	
Analogue current output	[mA]	4...20; (scalable)	
Max. load	[Ω]	700; (U _b = 24 V; (U _b - 9 V) / 21.5 mA)	
Short-circuit proof		yes	
Overload protection		yes	
Measuring/setting range			
Measuring range		-1...4 bar	-14.5...58 psi -100...400 kPa
Analogue start point		-1...3.2 bar	-14.5...46.4 psi -100...320 kPa
Analogue end point		-0.2...4 bar	-2.9...58 psi -20...400 kPa
In steps of		0.02 bar	0.05 psi 0.2 kPa
Factory setting			ASP = 0.0 bar AEP = 4.0 bar
Accuracy / deviations			
Repeatability	[% of the span]	< ± 0,1; (with temperature fluctuations < 10 K; Turn down 1:1)	
Characteristics deviation	[% of the span]	< ± 0,2 (DIN EN 61298-2); (incl. zero point and span error, non-linearity, hysteresis ; Turn down 1:1)	
Linearity deviation	[% of the span]	< ± 0,15; (Turn down 1:1)	
Hysteresis deviation	[% of the span]	< ± 0,15; (Turn down 1:1)	
Long-term stability	[% of the span]	< ± 0,1; (Turn down 1:1; per year)	
Temperature coefficient zero point	[% of the span / 10 K]	< ± 0,05; (0...70 °C)	
Temperature coefficient span	[% of the span / 10 K]	< ± 0,15; (0...70 °C)	
Response times			
Damping for the analogue output dAA	[s]	0...4	
2-wire			
Step response time analogue output	[ms]	30	
3-wire			
Step response time analogue output	[ms]	7	

PM1705



Electronic pressure sensor

PM-004-REA01-E-ZVG/US

Interfaces					
Communication interface	IO-Link				
Transmission type	COM2 (38,4 kBaud)				
IO-Link revision	1.1				
Profiles	Digital Measuring Sensor (0x000A), Identification and Diagnosis (0x4000)				
SIO mode	no				
Required master port type	A				
Process data analogue	3				
Min. process cycle time [ms]	3.2				
Supported DeviceIDs	<table border="1"><thead><tr><th>Type of operation</th><th>DeviceID</th></tr></thead><tbody><tr><td>Default</td><td>664</td></tr></tbody></table>	Type of operation	DeviceID	Default	664
Type of operation	DeviceID				
Default	664				
Operating conditions					
Ambient temperature [°C]	-25...80				
Storage temperature [°C]	-40...100				
Protection	IP 67; IP 68; IP 69K				
Tests / approvals					
EMC	<table border="1"><tbody><tr><td>DIN EN 61000-6-2</td><td></td></tr><tr><td>DIN EN 61000-6-3</td><td></td></tr></tbody></table>	DIN EN 61000-6-2		DIN EN 61000-6-3	
DIN EN 61000-6-2					
DIN EN 61000-6-3					
Shock resistance	<table border="1"><tbody><tr><td>DIN EN 60068-2-27</td><td>50 g (11 ms)</td></tr></tbody></table>	DIN EN 60068-2-27	50 g (11 ms)		
DIN EN 60068-2-27	50 g (11 ms)				
Vibration resistance	<table border="1"><tbody><tr><td>DIN EN 60068-2-6</td><td>20 g (10...2000 Hz)</td></tr></tbody></table>	DIN EN 60068-2-6	20 g (10...2000 Hz)		
DIN EN 60068-2-6	20 g (10...2000 Hz)				
MTTF [years]	323				
Note on approval	factory certificate available as download at www.factory-certificate.ifm				
UL approval	<table border="1"><tbody><tr><td>UL Approval no.</td><td>J021</td></tr></tbody></table>	UL Approval no.	J021		
UL Approval no.	J021				
Mechanical data					
Weight [g]	282.5				
Materials	stainless steel (1.4404 / 316L); PBT				
Materials (wetted parts)	ceramics (99.9 % Al ₂ O ₃); stainless steel (1.4435 / 316L); surface characteristics: Ra < 0,4 / Rz 4; PTFE				
Min. pressure cycles	100 million				
Tightening torque [Nm]	35				
Process connection	threaded connection G 1 external thread Aseptoflex Vario				
Displays / operating elements					
Display unit	bar; psi; kPa				
Remarks					
Pack quantity	1 pcs.				
Electrical connection					
Connector: 1 x M12; Contacts: gold-plated					

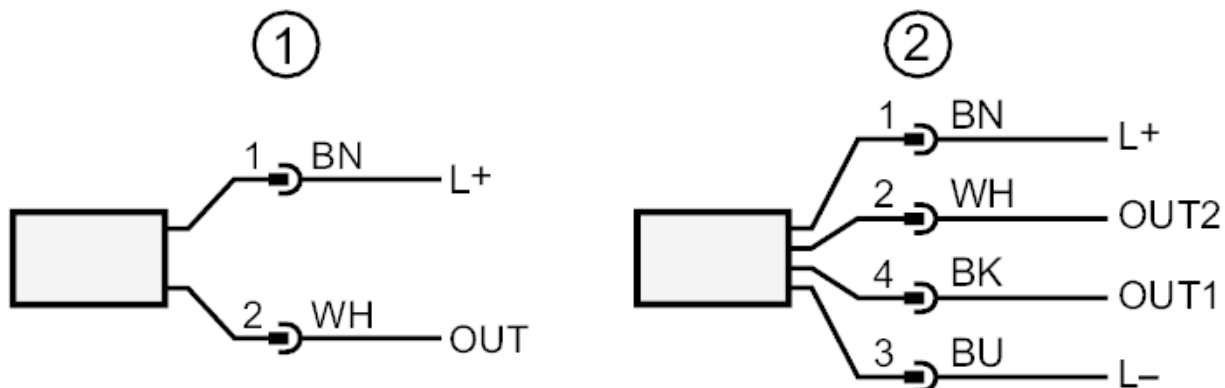
PM1705



Electronic pressure sensor

PM-004-REA01-E-ZVG/US

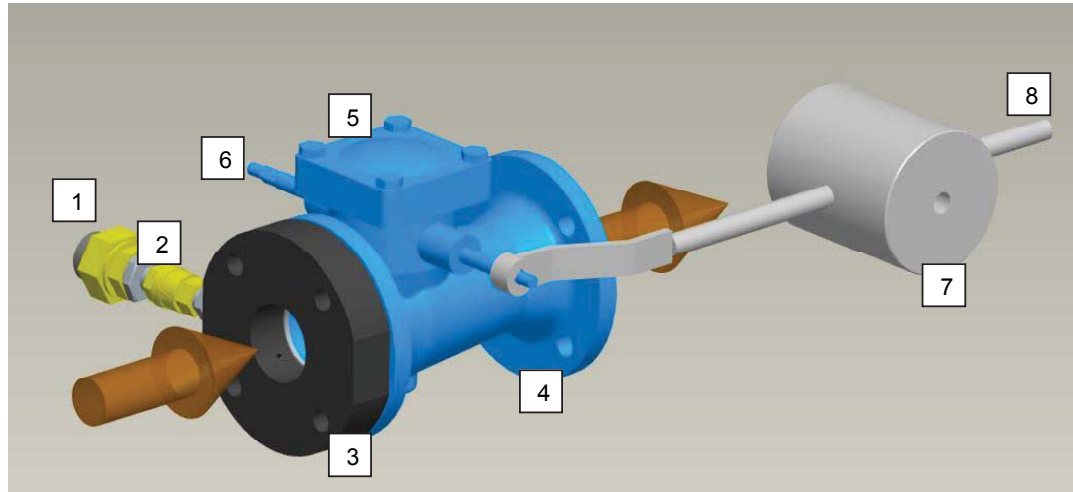
Connection



- 1 connection for 2-wire operation (analogue)
- 2 connection for 3-wire operation (analogue / IO-Link)
OUT1 : IO-Link
OUT2 : analogue output

Injection and mixing unit

Product specification



1 connection for polymer	5 cleaning opening
2 back valve	6 mixing valve shaft
3 injection ring	7 weight
4 mixing unit	8 lever

Design and function

The injection and mixing unit is a 2-part connection flange fitting. Via an injection ring the polymers are introduced into the sludge flow. Mixing of the sludge and polymers is achieved by means of a special mixing unit. A movable mixing valve inside reduces the pipeline cross section and generates a turbulent sludge flow.

The mixing valve is fitted on a projecting shaft with packing glands. The load on the mixing valve, and thus the mixing energy, is infinitely adjustable via a lever with displaceable weight.

Flock formation takes place in the following pressure pipeline running to the sludge treatment unit.

Both sludge and polymers must be forced through the injection and mixing unit by appropriate pumps.

Both the nominal width of the injection and mixing unit and the distance to the sludge treatment unit are very important for the formation of stable sludge flocks.

When selecting the pumps it is important to take into consideration that both the injection ring and mixing valve cause pressure losses, which are dependent on the material viscosity.

Transport and storage

The fittings require protection against external influences, such as damage or adverse weather conditions. The individual equipments components must be protected against shifting.

Installation

Preliminary work

Align inaccurate pipelines prior to starting any installation work. This will prevent stresses or breakage of the valve housing.

Check the ex works corrosion protection for transport damage and repair it if necessary.

Installation position

The selected installation position should ensure that the fitting is at any time easily accessible and dismantable for inspection or repair.

Especially the pivoting area of the lever and the area around the cleaning opening of the mixing unit should be kept free.

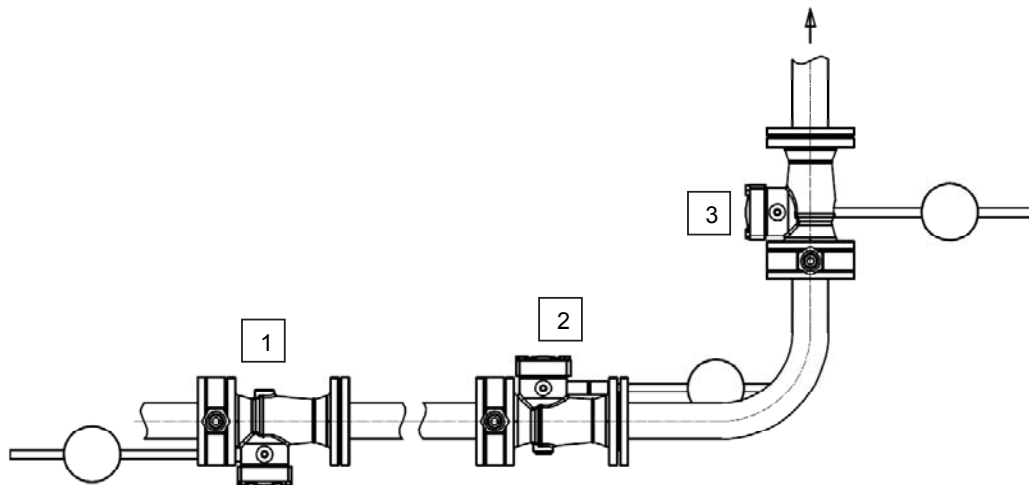
If installed outdoors protect the fitting with a cover against extreme weather, such as snow or ice.

Installation options

The injection and mixing unit must be installed in a completely filled pressure pipeline.	Note!
---	--------------

Partially filled pipelines are inappropriate for a sufficient flock formation due to the undefined flow conditions and residence times.

The following three installation options are recommendable.



<p>The sludge flows at first through the injection ring and then through the mixing unit. The metal cover ring of the injection ring points to the mixing unit. The mixing valve opens with the sludge flow. The weight-loaded lever closes the mixing valve against the sludge flow. The mixing valve shaft must be horizontal.</p>	Note!
--	--------------

The installation position of the injection ring around the pipeline axis is selectable according to the flange bore hole pattern.

The lever with weight can be mounted on both sides of the shaft.

Start-up:

The mixing energy is adjustable by displacing (or removing) the weight.
 The weight must be fixed reliably on the lever by means of the fixing screw.
 After start-up the weight fixing screw on the lever should point downwards in order to prevent water retention inside the weight.


When varying the sludge throughput or switching on or off the pumps the lever with weight may insignificantly move up and down.	Note!
Mixing different types of polymers (emulsions and dispersions) may produce lumps inside the injection ring or screwed in back valve. Please refer to the polymer suppliers' recommendations.	Note!
Depending on the type of pre-treatment, the intensive mixing may lead to gasing within the mixing unit. In order to prevent gas retention inside the pipeline, a venting valve should be installed at the following high point of the sludge pipeline.	Note

Maintenance and repair:

The only maintenance required for the injection and mixing unit is regular visual inspection for leakage.
 If required, the packing glands of the mixing unit can be re-adjusted, but be careful to maintain the movability of the mixing valve.

Cleaning:

The cause for a changing flock pattern on the sludge treatment unit may be dirt on the injection ring or mixing unit.

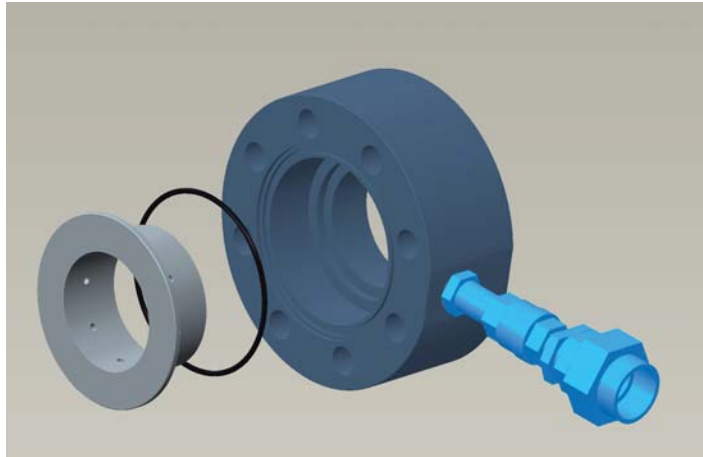
<p>Always stop the sludge treatment process on the plant's mains isolator prior to starting with any cleaning work.</p> <p>Sludge or polymers may exit when opening plant components.</p>	
---	---

Mixing valve:

- Open the cleaning openings of the mixing unit.
- Remove sediments from the mixing valve.
- Check the movability of the mixing valve.
- Close the cleaning openings.
- Repair the paint damage on the mixing unit.

Injection ring:

- Loosen the polymer feed line.
- Loosen the flange connection of the injection ring.
- Remove the injection ring from the pipeline.
- Remove the stub ring and O-ring from the injection ring.



- Check the channels in the injection ring for sedimentation.
- Clean the channels and back valve.

Polymers on an oil basis (emulsions) should not be washed off with water due to their agglutination tendency.

Attention!

- Insert new O-ring.
- Remount the injection and mixing unit.

When mounted, the stub ring must point against mixing direction.

Attention!



swing check valve

RKF13-special



Base properties:

<i>base type:</i>	RKF13
<i>connection:</i>	flange DIN2501
<i>nominal pressure:</i>	PN16
<i>body material:</i>	EN-JL1040-GG25 RAL5015
<i>material inlying parts:</i>	1.4021-SS
<i>sealing material:</i>	metallic
<i>temperature medium:</i>	0 up to +150°C

Description:

one-piece valve

exterior shaft

flange according to
DIN2501

Options:

- rubber-Niro sealing
- brass – sealing brass

Product properties:

A high quality swing type check valve with lever and weight, designed for high demands for industrial use.

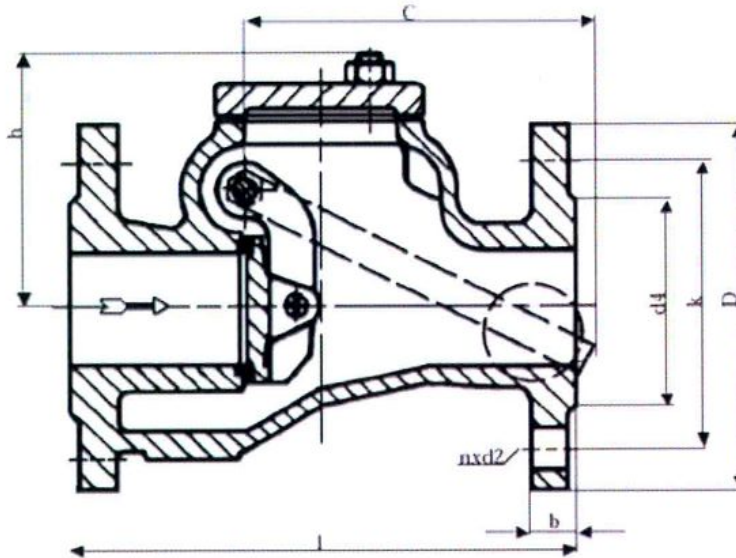
special design:

free of grease and oil

flange according to ANSI

custom sealings

Other special design on request.



The article is deliverable in default sizes (special sizes on demand):

Artikel-Nr	size	nominal size	one-side shaft	double-sided shaft	l	D	k	d4	h	n	d2	b	weight (kg)
110956	DN40	40mm	170		180	150	110	88	119	4	18	18	22,6
103212	DN50	50mm	180		200	165	125	102	120	4	18	20	24,8
103214	DN65	65mm		380	240	185	145	122	141	4	18	20	24,5
103213	DN80	80mm		400	260	200	160	138	168	8	18	22	33,2
103215	DN100	100mm		420	300	220	180	158	175	8	18	24	43,9
109537	DN125	125mm		450	350	250	210	188	199	8	18	26	59,2

Declarations:

material:

grey cast iron (GG-25), material-No.: **EN-JL1040**, short name: EN-GJL-250, AISI: A48-40B

stainless steel (V2A), material-No.: **1.4021**, short name: X20Cr13

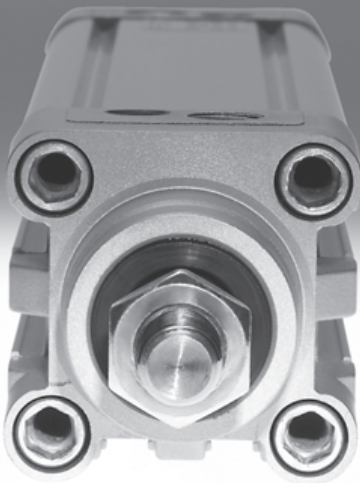
Revision: 09/2009

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PNEUMATIC CYLINDERS FOR PRESS CONE
(2x) FESTO DNC-125-250-P-A-R3

APPENDIX INFORMATION

Standard cylinders DNC, ISO 15552



Standard cylinders DNC, ISO 15552

Key features

FESTO

At a glance



- Standards-based cylinders to ISO 15552 (corresponds to the withdrawn standards ISO 6431, DIN ISO 6431, VDMA 24 562, NF E 49 003.1 and UNI 10290)

- The modern design and construction save up to 11% on fitting space compared to ordinary standard cylinders, thus permitting a considerably more compact system design

- An extensive range of accessories makes it possible to install the cylinder virtually anywhere
- The widest range of variants on the market provides the right DNC cylinder for every application

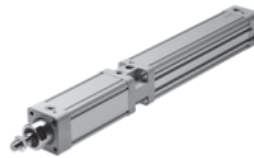
Cylinder with clamping units

DNC-KP



- Piston rod can be held or clamped in any position
- Piston rod can be held in position for long periods even with alternating loads, fluctuating operating pressure or leaks in the system

DNCKE



- Suitable for use in safety-related control systems in compliance with EN 954-1, EN 1050, EN 292 and EN 983
- Fail-safe
- Piston rod can be clamped in any position

Cylinder with end-position locking

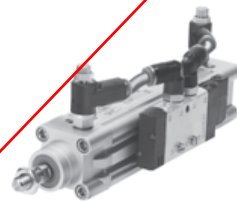
DNC- ... -EL



- Mechanical locking when the end position is reached
- Lock is only automatically released when pressure is supplied to the cylinder
- End-position locking at one or both ends

Cylinder/valve combination

DNC-V1 ... V6



- The cylinder/valve combination is assembled and fitted with tubing ready for connection
- Particularly suitable for decentralised use in larger systems

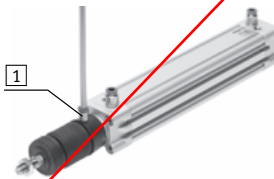
Tandem cylinder

DNCT



- Connection of 2 cylinders with the same piston diameter and stroke in series
- Double the thrust and return force in comparison to a standard cylinder

Longer service life thanks to the bellows kit DADB

















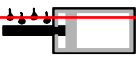
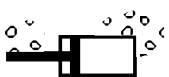
The bellows kit is a leak-free system. To prevent unwanted media being drawn in, the supply and exhaust air must be ducted via a pressure compensation hole in the connection part 1.

The kit protects the piston rod, seal and bearings from a wide range of media, for example:

- dust,
- chips,
- oil,
- grease,
- fuel.

Standard cylinders DNC, ISO 15552

Key features

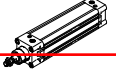
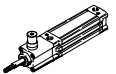
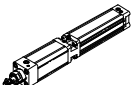
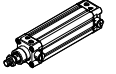
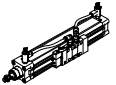
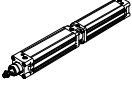
Variants from the modular product system		
Symbol	Key features	Description
	S2 Through piston rod	For working at both ends with the same force in the forward and return stroke, for attaching external stops
	S6 Heat-resistant seals	Temperature resistance up to max. 120 °C
	S10 Constant motion (slow speed) at low piston speeds	Suitable for slow stroke movements at a constant, stick-slip-free speed over the full stroke of the cylinder. Seal contains silicone grease (not free of paint-wetting impairment substances)
	S11 Low friction	Special seals considerably reduce system wear. This means a considerably lower response pressure. Seal contains silicone grease (not free of paint-wetting impairment substances)
	S20 Through, hollow piston rod	For supplying vacuum, small parts, media, etc.
	K2 Extended male piston rod thread	–
	K3 Female piston rod thread	–
	K5 Special piston rod thread	Metric standard thread to ISO
	K7 Piston rod with external hexagon	Special spanner flats
	K8 Extended piston rod	–
	K10 Smooth anodised aluminium piston rod	Ideal for use in welding environments: – Protection against welding spatter – Small working loads – Harder surface compared to steel – Long service life
	KP With clamping unit	Integrated clamping unit on the piston rod
	EL With end-position locking	Positive locking in the end position as a drop guard. If there is a drop in pressure, the piston rod is secured in its end position to prevent it from dropping
	Q Square piston rod	Protection against rotation. For correctly oriented feeding
	R3 High corrosion protection	All external cylinder surfaces comply with corrosion resistance class 3 to Festo standard 940 07Q. The piston rod is made from corrosion and acid-resistant steel
	R8 Dust protection (wiper seal)	The cylinder is equipped with a hard-chrome plated piston rod and a rigid wiper seal, which protects against dry, dusty media

Software tools
 → www.festo.com
 Configuration of Festo modular products
 → www.festo.com

Standard cylinders DNC, ISO 15552

Product range overview



Function	Design	Type	Piston Ø	Stroke	Position sensing	Protection against rotation	Through/hollow piston rod	Extended male piston rod thread	Female piston rod thread	Special piston rod thread	
			[mm]	[mm]							A
Double-acting	Basic version										
		DNC	32, 40, 50, 63, 80, 100, 125	20, 25, 30, 40, 50, 60, 70, 80, 100, 125, 150, 160, 200, 250, 300, 320, 400, 500	10 ... 2000	■	■	■	■	■	■
	Standard hole pattern, with clamping unit										
		DNC-KP	32, 40, 50, 63, 80, 100, 125	–	10 ... 2000	■	■	■ S2	■	■	■
		DNC-KE	40, 63, 100	–	10 ... 2000	■	–	–	–	–	–
	Standard hole pattern, with end-position locking										
		DNC-...-EL	32, 40, 50, 63, 80, 100	–	10 ... 2000	■	–	■ S2	■	■	■
Standard hole pattern, cylinder/valve combination											
	DNC-V1 ... V6	32, 40, 50, 63, 80, 100	–	100 ... 2000	■	■	■	■	■	■	
Standard hole pattern, tandem cylinder											
	DNCT	32, 40, 50, 63, 80, 100, 125	–	2 ... 500 3 ... 500	■	–	–	–	–	–	

Standard cylinders DNC, ISO 15552

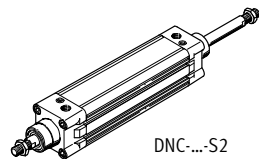
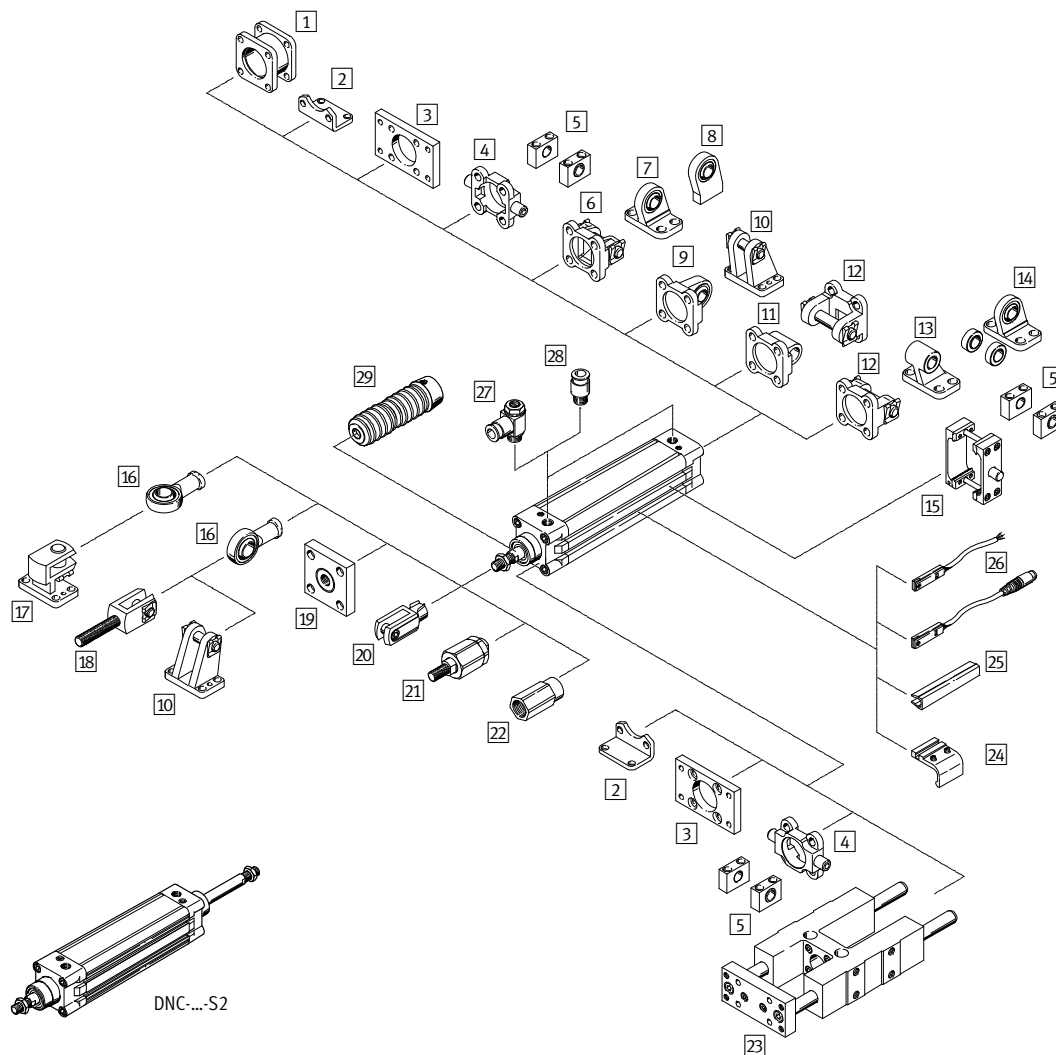
Product range overview



Type	Special spanner flats	Extended piston rod	Smooth anodised piston rod	Heat-resistant seals to max. 120 °C	Slow speed (constant motion)	Low friction	High corrosion protection	Dust protection	Cylinder/valve combination	→ Page/Internet
	K7	K8	K10	S6	S10	S11	R3	F8	V1 ... V6	
Basic version										
DNC	■	■	■	■	■	■	■	■	-	9
Standard hole pattern, with clamping unit										
DNC-KP	■	■	-	-	-	-	-	-	■	25
DNCKE	-	-	-	-	-	-	-	-	-	2
Standard hole pattern, with end-position locking										
DNC-...-EL	-	■	-	-	-	-	-	-	-	33
Standard hole pattern, cylinder/valve combination										
DNC-V1 ... V6	■	■	■	-	■	■	-	■	■	40
Standard hole pattern, tandem cylinder										
DNCT	-	-	-	■	-	-	-	-	-	2

Standard cylinders DNC, ISO 15552

Peripherals overview



Mounting attachments and accessories		DNC				Page/ Internet	
	Description	Basic version	KP	EL	V1 ... V6		
1	Multi-position kit DPNC	For connecting two cylinders with identical piston diameters to form a multi-position cylinder	■ ¹⁾	■	■	■ ¹⁾	49
2	Foot mounting HNC/CRHNC	For bearing or end caps	■	■	■	■	50
3	Flange mounting FNC/CRFNG	– For bearing or end caps – Cannot be used on the bearing cap in combination with bellows kit DADB	■	■	■	■	51
4	Trunnion flange ZNC/CRZNG	– For bearing or end caps – Cannot be used on the bearing cap in combination with bellows kit DADB	■	■	■	■	52
5	Trunnion support LNZG/CRLNZG	–	■	■	■	■	54
6	Swivel flange SNC	For end caps	■ ¹⁾	■ ¹⁾	■	■ ¹⁾	55
7	Clevis foot LSNG	With spherical bearing	■ ¹⁾	■ ¹⁾	■	■ ¹⁾	58
8	Clevis foot LSNSG	Weld-on, with spherical bearing	■ ¹⁾	■ ¹⁾	■	■ ¹⁾	58

Standard cylinders DNC, ISO 15552

Peripherals overview

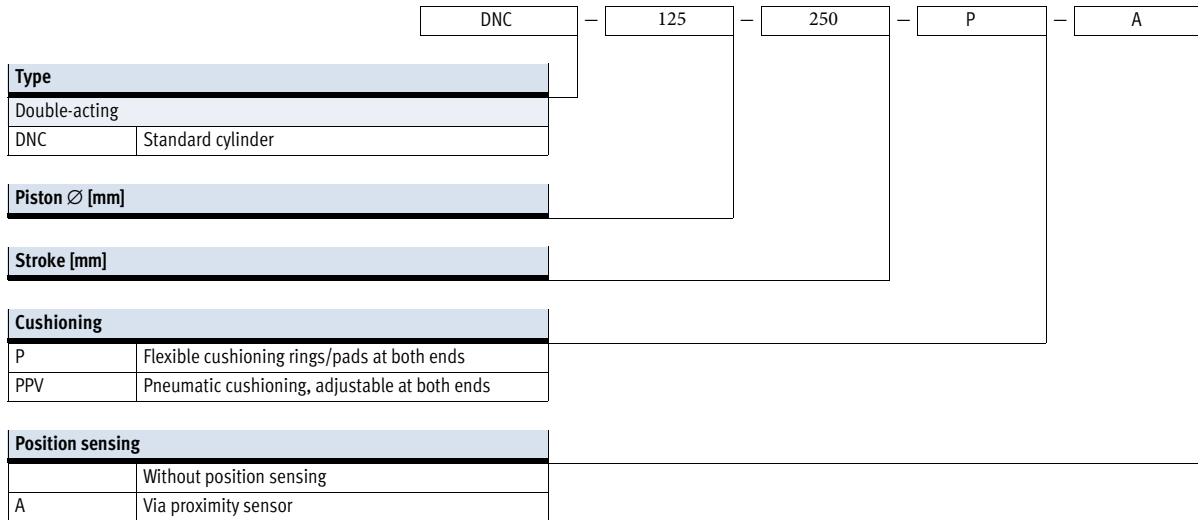
Mounting attachments and accessories							
	Description	DNC				→ Page/ Internet	
		Basic version	KP	EL	V1 ... V6		
9	Swivel flange SNCS/CRNCS/SNCS-...-R3	With spherical bearing for end caps	■ ¹⁾	■ ¹⁾	■	■ ¹⁾	57
10	Clevis foot LBG/LBG-...-R3	–	■ ¹⁾	■	■	■ ¹⁾	58
11	Swivel flange SNCL	For end caps	■ ¹⁾	■ ¹⁾	■	■ ¹⁾	57
12	Swivel flange SNCB/SNCB-...-R3	For end caps	■ ¹⁾	■ ¹⁾	■	■ ¹⁾	56
13	Clevis foot LNG/CRLNG	–	■ ¹⁾	■ ¹⁾	■	■ ¹⁾	58
14	Clevis foot LSN	With spherical bearing	■ ¹⁾	■ ¹⁾	■	■ ¹⁾	58
15	Trunnion mounting kit DAMT	For mounting anywhere along the cylinder profile barrel	■	■	■	■	53
16	Rod eye SGS/CRSGS	With spherical bearing	■	■	■	■	59
17	Right-angle clevis foot LQG	–	■	■	■	■	58
18	Rod clevis SGA	With male thread	■	■	■	■	59
19	Coupling piece KSG	To compensate for radial deviations	■	■	■	■	59
	Coupling piece KSZ	For cylinders with a non-rotating piston rod to compensate for radial deviations	■	■	■	■	59
20	Rod clevis SG/CRSG	Permits a swivelling movement of the cylinder in one plane	■	■	■	■	59
21	Self-aligning rod coupler FK/CRFK	For compensating radial and angular deviations	■	■	■	■	59
22	Adapter AD	For fitting a suction cup on a hollow cylinder piston rod	■	–	–	■	59
23	Guide unit FENG	For protecting standard cylinders against rotation at high torque loads	■	■ ∅ 50 and above	–	–	64
24	Mounting kit SMB-8-FENG	For attaching proximity sensor SMT-8 to cylinders in combination with guide unit FENG	■ ²⁾	■ ∅ 50 and above	■	–	64
25	Slot cover ABP-5-S	For protecting the sensor cables and keeping dirt out of the sensor slots	■	■	■	■	65
26	Proximity sensor SME/SMT-8	Can be integrated in the cylinder profile barrel	■	■	■	■	65
27	One-way flow control valve GRLA	For regulating speed	■	■	■	■	66
28	Push-in fitting QS	For connecting compressed air tubing with standard outside diameter	■	■	■	■	quick star
29	Bellows kit DADB	– Protects the cylinder (piston rod, seal and bearings) against a wide range of media and thus prevents premature wear – The kit can only be used in combination with an extended piston rod (K8)	■	–	■	■	60

1) Not with variant S2 or S20

2) For piston ∅ 32, 40 mm only with variant R3

Standard cylinders DNC, ISO 15552

Type codes



Note

The standard cylinder DNC can be ordered using either a fixed part number and type designation or via the modular product system. The type code listed above only

applies to the DNC standard cylinder with fixed part number and type designation. Variants can only be ordered using the modular product system.

Standard cylinders DNC, ISO 15552

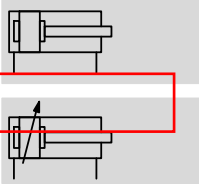


Technical data

Function

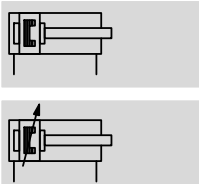
DNC...

Without position sensing



DNC...-A...

With position sensing



⊘ - Diameter
32 ... 125 mm

- | - Stroke length
10 ... 2000 mm

- [www.festo.com]

Wearing parts kits
→ 24



- Standards-based cylinders to ISO 15552 (corresponds to the withdrawn standards ISO 6431, DIN ISO 6431, VDMA 24 562, NF E 49 003.1 and UNI 10290)



DIN



General technical data

Piston Ø		32	40	50	63	80	100	125
Pneumatic connection		G $\frac{3}{8}$	G $\frac{1}{4}$	G $\frac{1}{4}$	G $\frac{3}{8}$	G $\frac{3}{8}$	G $\frac{1}{2}$	G $\frac{1}{2}$
Piston rod thread		M10x1.25	M12x1.25	M16x1.5	M16x1.5	M20x1.5	M20x1.5	M27x2
	K3	M6	M8	M10	M10	M12	M12	M16
	K5	M10	M12	M16	M16	M20	M20	M27
Constructional design		Piston						
		Piston rod						
		Profile barrel						
Max. torsional backlash of piston rod [°]	Q	±0.65	±0.6	±0.45	±0.45	±0.45	±0.45	-
Cushioning		Flexible cushioning rings/pads at both ends						
		Pneumatic cushioning, adjustable at both ends						
Cushioning length PPV [mm]		20	20	22	22	32	32	42
Position sensing		Via proximity sensor						
Type of mounting		Via female thread						
Mounting position		Via accessories						
		Any						

Note: This product conforms to ISO 1179-1 and to ISO 228-1

Standard cylinders DNC, ISO 15552

Technical data



Operating and environmental conditions		32	40	50	63	80	100	125
Piston Ø		32	40	50	63	80	100	125
Operating medium		Compressed air in accordance with ISO 8573-1:2010 [7:4:4]						
Note on operating/pilot medium		Operation with lubricated medium possible (in which case lubricated operation will always be required)						
Operating pressure [bar]		0.6 ... 12						
	R8	1.5 ... 12						0.6 ... 10
	S11	After 10 strokes						
		0.16 ... 12		0.1 ... 12		0.06 ... 12		0.06 ... 10
		After 24 hours						
		0.3 ... 12		0.2 ... 12		0.1 ... 12		0.1 ... 10
Ambient temperature ¹⁾ [°C]		-20 ... +80						
	S6	0 ... 120						
Corrosion resistance class CRC ²⁾		2						
	R3	3						
Certification		Germanischer Lloyd						
ATEX		Specified types → www.festo.com						

1) Note operating range of proximity sensors

2) Corrosion resistance class CRC 2 to Festo standard FN 940070

Moderate corrosion stress. Indoor applications in which condensation may occur. External visible parts with primarily decorative requirements for the surface and which are in direct contact with the ambient atmosphere typical for industrial applications.

Corrosion resistance class CRC 3 to Festo standard FN 940070

High corrosion stress. Outdoor exposure under moderate corrosive conditions. External visible parts with primarily functional requirements for the surface and which are in direct contact with a normal industrial environment.

Force [N] and impact energy [J]		32	40	50	63	80	100	125
Theoretical force at 6 bar, advancing		483	754	1178	1870	3016	4712	7363
	S2/S20	415	633	990	1682	2721	4418	6881
Theoretical force at 6 bar, retracting		415	633	990	1682	2721	4418	6881
	S2/S20	415	633	990	1682	2721	4418	6881
Max. impact energy at the end positions ¹⁾		0.1	0.2	0.2	0.5	0.9	1.2	5

1) The permissible impact energy is reduced by approx. 10% for variants K10 and S20


Permissible impact velocity:

$$v_{\text{perm.}} = \sqrt{\frac{2 \times E_{\text{perm.}}}{m_{\text{dead}} + m_{\text{load}}}}$$

$v_{\text{perm.}}$ Permissible impact velocity
 $E_{\text{perm.}}$ Max. impact energy
 $m_{\text{intrinsic}}$ Moving load (drive)
 m_{Load} Moving effective load

Maximum permissible load:

$$m_{\text{load}} = \frac{2 \times E_{\text{perm.}}}{v^2} - m_{\text{dead}}$$

 Note
 This data represents the maximum values that can be achieved. The maximum permissible impact energy must be observed.

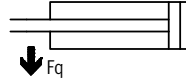
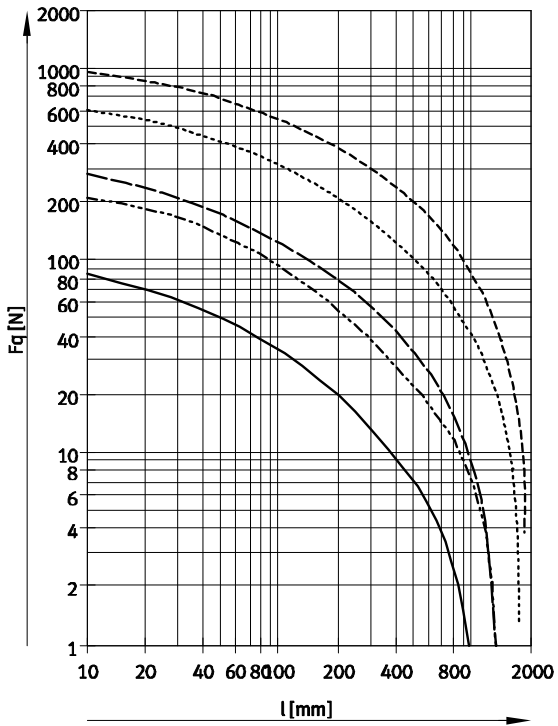
Standard cylinders DNC, ISO 15552

Technical data

FESTO

Lateral force F_q as a function of stroke length l

Basic version



- $\varnothing 32$
- - - $\varnothing 40$
- · - $\varnothing 50/63$
- · · $\varnothing 80/100$
- - - - $\varnothing 125$

Standard cylinders DNC, ISO 15552

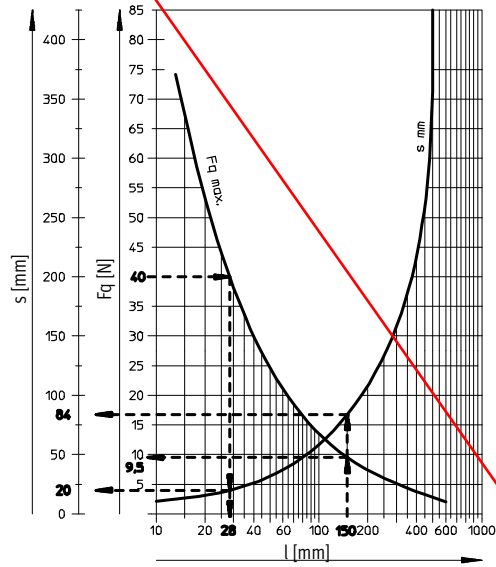
Technical data

Lateral force F_q as a function of stroke length l and lever arm s

Q – Square piston rod

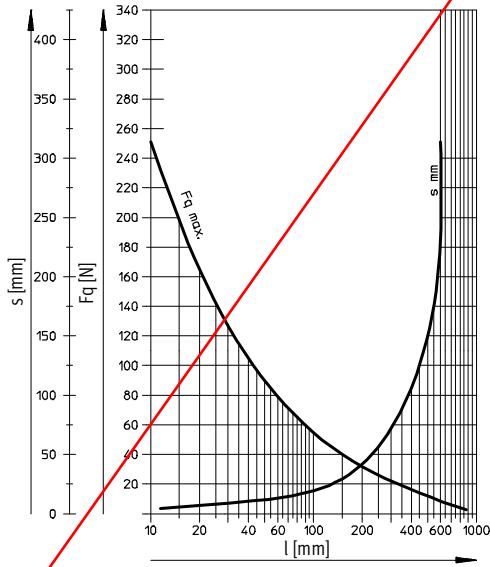
Ø 32

Max. torque = 800 Nmm / Max. stroke = 300 mm



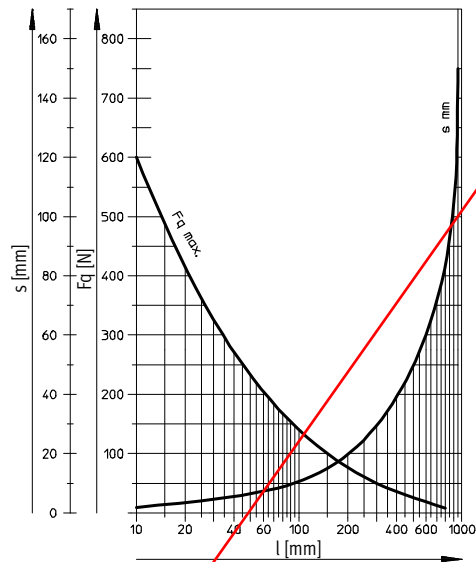
Ø 40

Max. torque = 1100 Nmm / Max. stroke = 400 mm



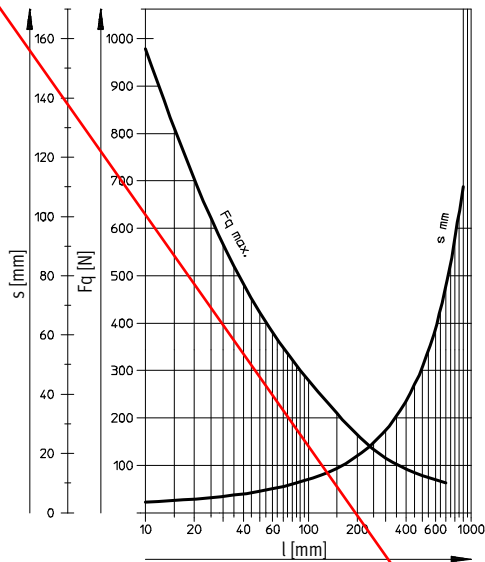
Ø 50/63

Max. torque = 1500 Nmm / Max. stroke = 500 mm



Ø 80/100

Max. torque = 3000 Nmm / Max. stroke = 600 mm



Examples for piston Ø 32 mm

Example 1:

Stroke length $l = 150$ mm

Result: permissible

Lateral force $F_q = 9.5$ N

Lever arm $s = 84$ mm

Example 2:

Lateral force $F_q = 40$ N

Result: permissible

Stroke length $l = 28$ mm

Lever arm $s = 20$ mm

Example 3:

Stroke length $l = 150$ mm

Lever arm $s = 100$ mm

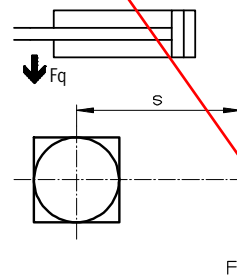
Max. torque 800 Nmm

Lever arm 100 mm

$F_q = 8$ N

Result: permissible

$F_q = 8$ N < $F_{q_{max}} = 9.5$ N



Standard cylinders DNC, ISO 15552

Technical data



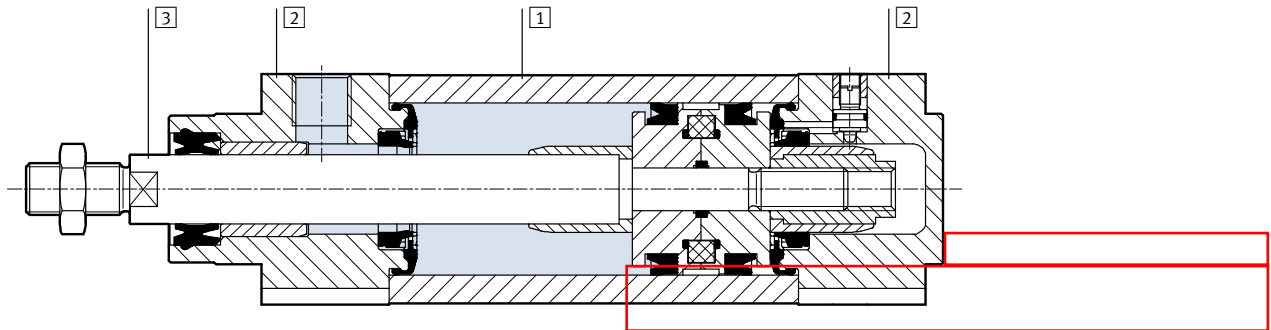
Weight [g]							
Piston Ø	32	40	50	63	80	100	125
Basic version							
Product weight with 0 mm stroke	517	800	1260	1709	2790	4653	6771
Additional weight per 10 mm stroke	30	45	64	73	106	115	168
Moving load with 0 mm stroke							
Product weight with 0 mm stroke	162	307	538	663	1131	1544	2809
Additional load per 10 mm stroke	9	16	25	25	38	38	63
Q – Square piston rod							
Product weight with 0 mm stroke	504	738	1187	1632	2652	4508	–
Additional weight per 10 mm stroke	29	41	60	68	99	108	–
Moving load with 0 mm stroke							
Product weight with 0 mm stroke	149	244	465	587	994	1399	–
Additional load per 10 mm stroke	8	11	20	20	31	31	–
S2 – Through piston rod							
Product weight with 0 mm stroke	576	895	1390	1917	3114	5297	7529
Additional weight per 10 mm stroke	39	61	89	98	144	153	231
Moving load with 0 mm stroke							
Product weight with 0 mm stroke	170	330	560	711	1200	1660	2925
Additional load per 10 mm stroke	18	32	50	50	76	76	126
K10 – Smooth anodised piston rod							
Product weight with 0 mm stroke	443	655	1001	1437	2302	4138	5719
Additional weight per 10 mm stroke	24	35	47	57	81	90	127
Moving load with 0 mm stroke							
Product weight with 0 mm stroke	88	162	279	391	643	1029	1757
Additional load per 10 mm stroke	3	6	8	9	13	13	22
S2-K10 – Through, smooth anodised piston rod							
Product weight with 0 mm stroke	514	766	1181	1676	2701	4821	6674
Additional weight per 10 mm stroke	27	40	56	65	94	103	148
Moving load with 0 mm stroke							
Product weight with 0 mm stroke	108	201	351	470	787	1184	2070
Additional load per 10 mm stroke	6	11	17	17	26	26	43

Standard cylinders DNC, ISO 15552

Technical data

Materials

Sectional view



Standard cylinder	Basic version	K10	R3
1 Profile barrel	Wrought aluminium alloy, smooth anodised	Wrought aluminium alloy, smooth anodised	
2 Bearing and end caps	Die-cast aluminium		
3 Piston rod	High-alloy steel	Wrought aluminium alloy, anodised	High-alloy stainless steel
- Seals	Polyurethane, nitrile rubber		
Note on materials	RoHS compliant		

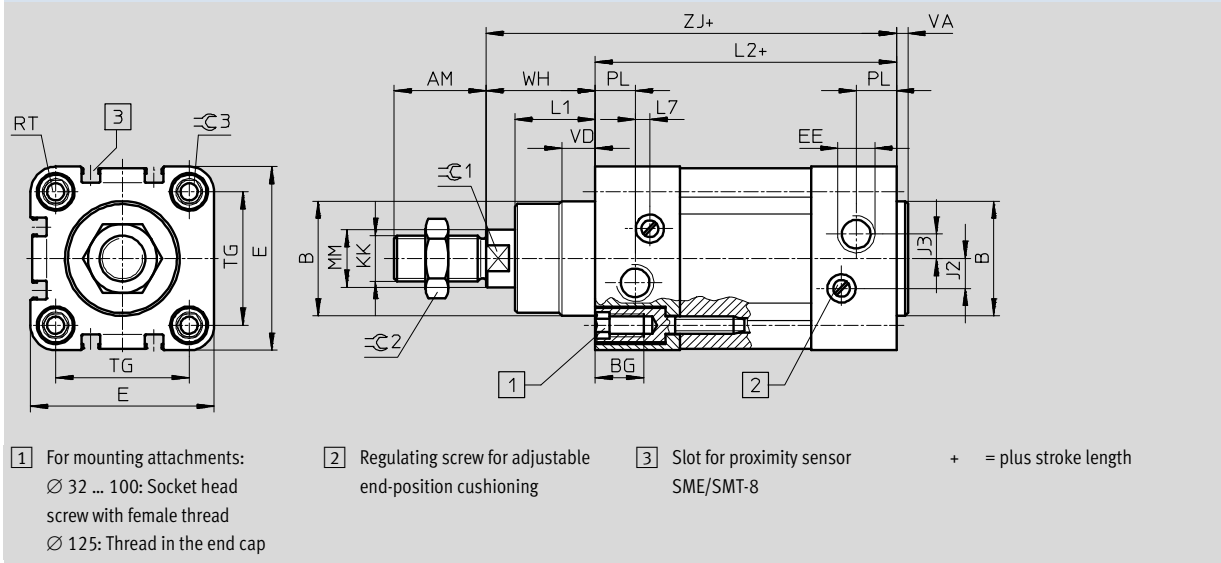
Standard cylinder	R8	S6	S10	S11
1 Profile barrel	Wrought aluminium alloy, smooth anodised			
2 Bearing and end caps	Die-cast aluminium			
3 Piston rod	Tempered steel, hard-chromium plated	High-alloy steel		
- Seals	Polyurethane, nitrile rubber	Fluoro rubber		
Note on materials	RoHS compliant			

Standard cylinders DNC, ISO 15552

Technical data

Dimensions – Basic version

Download CAD data → www.festo.com



Ø [mm]	AM	B Ø d11	BG	E	EE	J2	J3	KK	L1	L2
32	22	30	16	45	G $\frac{1}{8}$	6	5.2	M10x1.25	18	94
40	24	35	16	54	G $\frac{1}{4}$	8	6	M12x1.25	21.5	105
50	32	40	17	64	G $\frac{1}{4}$	10.4	8.5	M16x1.5	28	106
63	32	45	17	75	G $\frac{3}{8}$	12.4	10	M16x1.5	28.5	121
80	40	45	17	93	G $\frac{3}{8}$	12.5	8	M20x1.5	34.7	128
100	40	55	17	110	G $\frac{1}{2}$	12	10	M20x1.5	38.2	138
125	54	60	22	134	G $\frac{1}{2}$	13	8	M27x2	46	160

Ø [mm]	L7	MM Ø	PL	RT	TG	VA	VD	WH	ZJ	≡C1	≡C2	≡C3
32	3.3	12	15.6	M6	32.5	4	10	26	120	10	16	6
40	3.6	16	14	M6	38	4	10.5	30	135	13	18	6
50	5.1	20	14	M8	46.5	4	11.5	37	143	17	24	8
63	6.6	20	17	M8	56.5	4	15	37	158	17	24	8
80	10.5	25	16.4	M10	72	4	15.7	46	174	22	30	6
100	8	25	18.8	M10	89	4	19.2	51	189	22	30	6
125	14	32	18	M12	110	6	20.5	65	225	27	36	8

Note: This product conforms to ISO 1179-1 and to ISO 228-1

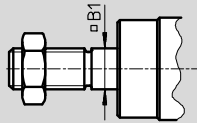
Standard cylinders DNC, ISO 15552

Technical data

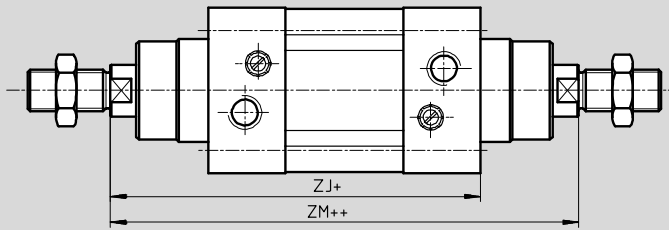
Dimensions – Variants

Download CAD data → www.festo.com

Q – Square piston rod

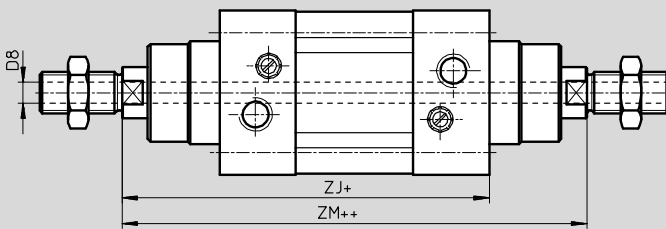


S2 – Through piston rod



+ = plus stroke length
++ = plus 2x stroke length

S20 – Through hollow piston rod



+ = plus stroke length
++ = plus 2x stroke length

∅	B1	D8	ZJ	ZM
[mm]	□	∅		
32	10	4.5	120	148
40	12	5.5	135	167
50	16	8 ¹⁾	143	183
63	16	8	158	199
80	20	11.7	174	222
100	20	11.7	189	240
125	-	13	225	291

- 1) Internal narrowing to ∅ 5.5 mm
- 2) Internal narrowing to ∅ 10.2 mm

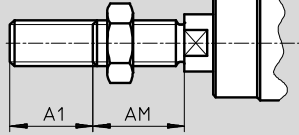
Standard cylinders DNC, ISO 15552

Technical data

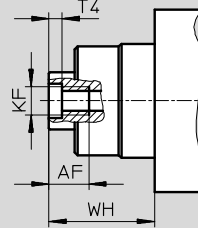
Dimensions – Variants

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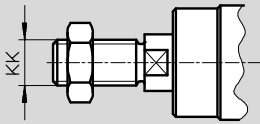
K2 – Extended male piston rod thread



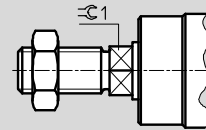
K3 – Female piston rod thread



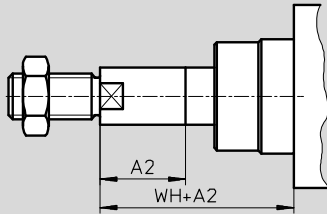
K5 – Special piston rod thread



K7 – Piston rod with external hexagon



K8 – Extended piston rod



-  Note

In combination with variant S2/S20, the piston rod is extended at one

end. In combination with variant Q, the square piston rod is extended.

∅ [mm]	A1 max.	A2 max.	AF	AM	KF	KK		T4	WH	≈C1
						Basic thread	Special thread ¹⁾			
32	35	500	12	22	M6	M10x1.25	M10	2.6	26	10
40	35	500	12	24	M8	M12x1.25	M12	3.3	30	13
50	70	500	16	32	M10	M16x1.5	M16	4.7	37	17
63	70	500	16	32	M10	M16x1.5	M16	4.7	37	17
80	70	500	20	40	M12	M20x1.5	M20	6.1	46	22
100	70	500	20	40	M12	M20x1.5	M20	6.1	51	22
125	70	500	32	54	M16	M27x2	M27	8	65	27

1) The special threads are only available as male threads. The mounting nut on the piston rod thread is included in the scope of delivery

Standard cylinders DNC, ISO 15552



Technical data

Ordering data – Without position sensing							
Piston Ø [mm]	Stroke [mm]	Part No.	Type ¹⁾	Piston Ø [mm]	Stroke [mm]	Part No.	Type ¹⁾
32	25	163319	DNC-32-25-PPV	40	25	163351	DNC-40-25-PPV
	40	163320	DNC-32-40-PPV		40	163352	DNC-40-40-PPV
	50	163321	DNC-32-50-PPV		50	163353	DNC-40-50-PPV
	80	163322	DNC-32-80-PPV		80	163354	DNC-40-80-PPV
	100	163323	DNC-32-100-PPV		100	163355	DNC-40-100-PPV
	125	163324	DNC-32-125-PPV		125	163356	DNC-40-125-PPV
	160	163325	DNC-32-160-PPV		160	163357	DNC-40-160-PPV
	200	163326	DNC-32-200-PPV		200	163358	DNC-40-200-PPV
	250	163327	DNC-32-250-PPV		250	163359	DNC-40-250-PPV
	320	163328	DNC-32-320-PPV		320	163360	DNC-40-320-PPV
	400	163329	DNC-32-400-PPV		400	163361	DNC-40-400-PPV
500	163330	DNC-32-500-PPV	500	163362	DNC-40-500-PPV		
50	25	163383	DNC-50-25-PPV	63	25	163415	DNC-63-25-PPV
	40	163384	DNC-50-40-PPV		40	163416	DNC-63-40-PPV
	50	163385	DNC-50-50-PPV		50	163417	DNC-63-50-PPV
	80	163386	DNC-50-80-PPV		80	163418	DNC-63-80-PPV
	100	163387	DNC-50-100-PPV		100	163419	DNC-63-100-PPV
	125	163388	DNC-50-125-PPV		125	163420	DNC-63-125-PPV
	160	163389	DNC-50-160-PPV		160	163421	DNC-63-160-PPV
	200	163390	DNC-50-200-PPV		200	163422	DNC-63-200-PPV
	250	163391	DNC-50-250-PPV		250	163423	DNC-63-250-PPV
	320	163392	DNC-50-320-PPV		320	163424	DNC-63-320-PPV
	400	163393	DNC-50-400-PPV		400	163425	DNC-63-400-PPV
500	163394	DNC-50-500-PPV	500	163426	DNC-63-500-PPV		
80	25	163447	DNC-80-25-PPV	100	25	163479	DNC-100-25-PPV
	40	163448	DNC-80-40-PPV		40	163480	DNC-100-40-PPV
	50	163449	DNC-80-50-PPV		50	163481	DNC-100-50-PPV
	80	163450	DNC-80-80-PPV		80	163482	DNC-100-80-PPV
	100	163451	DNC-80-100-PPV		100	163483	DNC-100-100-PPV
	125	163452	DNC-80-125-PPV		125	163484	DNC-100-125-PPV
	160	163453	DNC-80-160-PPV		160	163485	DNC-100-160-PPV
	200	163454	DNC-80-200-PPV		200	163486	DNC-100-200-PPV
	250	163455	DNC-80-250-PPV		250	163487	DNC-100-250-PPV
	320	163456	DNC-80-320-PPV		320	163488	DNC-100-320-PPV
	400	163457	DNC-80-400-PPV		400	163489	DNC-100-400-PPV
500	163458	DNC-80-500-PPV	500	163490	DNC-100-500-PPV		
125	25	163511	DNC-125-25-PPV				
	40	163512	DNC-125-40-PPV				
	50	163513	DNC-125-50-PPV				
	80	163514	DNC-125-80-PPV				
	100	163515	DNC-125-100-PPV				
	125	163516	DNC-125-125-PPV				
	160	163517	DNC-125-160-PPV				
	200	163518	DNC-125-200-PPV				
	250	163519	DNC-125-250-PPV				
	320	163520	DNC-125-320-PPV				
	400	163521	DNC-125-400-PPV				
500	163522	DNC-125-500-PPV					

1) The mounting nut on the piston rod thread is included in the scope of delivery

Standard cylinders DNC, ISO 15552



Technical data

Ordering data – With position sensing							
Piston Ø [mm]	Stroke [mm]	Part No.	Type ¹⁾	Piston Ø [mm]	Stroke [mm]	Part No.	Type ¹⁾
32	20	1922617	DNC-32-20-PPV-A	40	20	1922623	DNC-40-20-PPV-A
	25	163305	DNC-32-25-PPV-A		25	163337	DNC-40-25-PPV-A
	30	1922618	DNC-32-30-PPV-A		30	1922624	DNC-40-30-PPV-A
	40	163306	DNC-32-40-PPV-A		40	163338	DNC-40-40-PPV-A
	50	163307	DNC-32-50-PPV-A		50	163339	DNC-40-50-PPV-A
	60	1922619	DNC-32-60-PPV-A		60	1922625	DNC-40-60-PPV-A
	70	1922620	DNC-32-70-PPV-A		70	1922626	DNC-40-70-PPV-A
	80	163308	DNC-32-80-PPV-A		80	163340	DNC-40-80-PPV-A
	100	163309	DNC-32-100-PPV-A		100	163341	DNC-40-100-PPV-A
	125	163310	DNC-32-125-PPV-A		125	163342	DNC-40-125-PPV-A
	150	1922621	DNC-32-150-PPV-A		150	1922627	DNC-40-150-PPV-A
	160	163311	DNC-32-160-PPV-A		160	163343	DNC-40-160-PPV-A
	200	163312	DNC-32-200-PPV-A		200	163344	DNC-40-200-PPV-A
	250	163313	DNC-32-250-PPV-A		250	163345	DNC-40-250-PPV-A
	300	1922622	DNC-32-300-PPV-A		300	1922628	DNC-40-300-PPV-A
	320	163314	DNC-32-320-PPV-A		320	163346	DNC-40-320-PPV-A
400	163315	DNC-32-400-PPV-A	400	163347	DNC-40-400-PPV-A		
500	163316	DNC-32-500-PPV-A	500	163348	DNC-40-500-PPV-A		
50	20	1922629	DNC-50-20-PPV-A	63	20	1922635	DNC-63-20-PPV-A
	25	163369	DNC-50-25-PPV-A		25	163401	DNC-63-25-PPV-A
	30	1922630	DNC-50-30-PPV-A		30	1922636	DNC-63-30-PPV-A
	40	163370	DNC-50-40-PPV-A		40	163402	DNC-63-40-PPV-A
	50	163371	DNC-50-50-PPV-A		50	163403	DNC-63-50-PPV-A
	60	1922631	DNC-50-60-PPV-A		60	1922637	DNC-63-60-PPV-A
	70	1922632	DNC-50-70-PPV-A		70	1922638	DNC-63-70-PPV-A
	80	163372	DNC-50-80-PPV-A		80	163404	DNC-63-80-PPV-A
	100	163373	DNC-50-100-PPV-A		100	163405	DNC-63-100-PPV-A
	125	163374	DNC-50-125-PPV-A		125	163406	DNC-63-125-PPV-A
	150	1922633	DNC-50-150-PPV-A		150	1922639	DNC-63-150-PPV-A
	160	163375	DNC-50-160-PPV-A		160	163407	DNC-63-160-PPV-A
	200	163376	DNC-50-200-PPV-A		200	163408	DNC-63-200-PPV-A
	250	163377	DNC-50-250-PPV-A		250	163409	DNC-63-250-PPV-A
	300	1922634	DNC-50-300-PPV-A		300	1922640	DNC-63-300-PPV-A
	320	163378	DNC-50-320-PPV-A		320	163410	DNC-63-320-PPV-A
400	163379	DNC-50-400-PPV-A	400	163411	DNC-63-400-PPV-A		
500	163380	DNC-50-500-PPV-A	500	163412	DNC-63-500-PPV-A		

1) The mounting nut on the piston rod thread is included in the scope of delivery

Standard cylinders DNC, ISO 15552

FESTO

Technical data

Ordering data – With position sensing			
Piston Ø [mm]	Stroke [mm]	Part No.	Type ¹⁾
80	20	1922641	DNC-80-20-PPV-A
	25	163433	DNC-80-25-PPV-A
	30	1922642	DNC-80-30-PPV-A
	40	163434	DNC-80-40-PPV-A
	50	163435	DNC-80-50-PPV-A
	60	1922643	DNC-80-60-PPV-A
	70	1922644	DNC-80-70-PPV-A
	80	163436	DNC-80-80-PPV-A
	100	163437	DNC-80-100-PPV-A
	125	163438	DNC-80-125-PPV-A
	150	1922645	DNC-80-150-PPV-A
	160	163439	DNC-80-160-PPV-A
	200	163440	DNC-80-200-PPV-A
	250	163441	DNC-80-250-PPV-A
	300	1922646	DNC-80-300-PPV-A
	320	163442	DNC-80-320-PPV-A
400	163443	DNC-80-400-PPV-A	
500	163444	DNC-80-500-PPV-A	
100	25	163465	DNC-100-25-PPV-A
	40	163466	DNC-100-40-PPV-A
	50	163467	DNC-100-50-PPV-A
	80	163468	DNC-100-80-PPV-A
	100	163469	DNC-100-100-PPV-A
	125	163470	DNC-100-125-PPV-A
	160	163471	DNC-100-160-PPV-A
	200	163472	DNC-100-200-PPV-A
	250	163473	DNC-100-250-PPV-A
	320	163474	DNC-100-320-PPV-A
	400	163475	DNC-100-400-PPV-A
500	163476	DNC-100-500-PPV-A	
125	25	163497	DNC-125-25-PPV-A
	40	163498	DNC-125-40-PPV-A
	50	163499	DNC-125-50-PPV-A
	80	163500	DNC-125-80-PPV-A
	100	163501	DNC-125-100-PPV-A
	125	163502	DNC-125-125-PPV-A
	160	163503	DNC-125-160-PPV-A
	200	163504	DNC-125-200-PPV-A
	250	163505	DNC-125-250-PPV-A
	320	163506	DNC-125-320-PPV-A
	400	163507	DNC-125-400-PPV-A
500	163508	DNC-125-500-PPV-A	

1) The mounting nut on the piston rod thread is included in the scope of delivery

Standard cylinders DNC, ISO 15552

Technical data

Ordering data – Variable stroke			
Piston Ø [mm]	Stroke [mm]	Without position sensing	
		Part No.	Type ¹⁾
32	10 ... 2000	163318	DNC-32-...-PPV
40	10 ... 2000	163350	DNC-40-...-PPV
50	10 ... 2000	163382	DNC-50-...-PPV
63	10 ... 2000	163414	DNC-63-...-PPV
80	10 ... 2000	163446	DNC-80-...-PPV
100	10 ... 2000	163478	DNC-100-...-PPV
125	10 ... 2000	163510	DNC-125-...-PPV

1) The mounting nut on the piston rod thread is included in the scope of delivery

Ordering data – Variable stroke			
Piston Ø [mm]	Stroke [mm]	With position sensing	
		Part No.	Type ¹⁾
32	10 ... 2000	163304	DNC-32-...-PPV-A
40	10 ... 2000	163336	DNC-40-...-PPV-A
50	10 ... 2000	163368	DNC-50-...-PPV-A
63	10 ... 2000	163400	DNC-63-...-PPV-A
80	10 ... 2000	163432	DNC-80-...-PPV-A
100	10 ... 2000	163464	DNC-100-...-PPV-A
125	10 ... 2000	163496	DNC-125-...-PPV-A

1) The mounting nut on the piston rod thread is included in the scope of delivery

Standard cylinders DNC, ISO 15552



Ordering data – Modular products

M Mandatory data		O Options								
Module No.	Function	Stroke		Position sensing		Type of piston rod		Female thread		
	Piston Ø	Cushioning		Protection against rotation		Extended male thread		Special thread		
163302	DNC	32	10 ... 2000	P	A	Q	S2	...K2	K3	...K5
163334		40		PPV			S20			
163366		50								
163398		63								
163430		80								
163462		100								
163494		125								
Order example										
163430	DNC	- 80	- 550	- PPV	- A	- Q	- S2	-	- K3	-

Ordering table											163494	
Size	32	40	50	63	80	100	125	Condi-tions	Code	Enter code	125	
M Module No.	163302	163334	163366	163398	163430	163462	163494				250	
Function	Standard cylinder, double-acting, based on ISO 15552									DNC	DNC	
Piston Ø [mm]	32	40	50	63	80	100	125		-...		P	
Stroke [mm]	10 ... 2000									-...		
Cushioning	Flexible cushioning rings/pads at both ends									-P	A	
	Pneumatic cushioning, adjustable at both ends									15	-PPV	
O Position sensing	Via proximity sensor									-A		
Protection against rotation	Square piston rod									2	-Q	
Type of piston rod	Through piston rod									3	-S2	
	Through, hollow piston rod									4	-S20	
Extended male thread [mm]	Piston rod with extended male thread											
	1 ... 35			1 ... 70						5	-...K2	K8
Female thread	Piston rod with female thread											
	(M6)	(M8)	(M10)	(M10)	(M12)	(M12)	(M16)	6	-K3			
Special thread	Piston rod with special thread											
	M10	M12	M16	M16	M20	M20	M27	7	-...K5			

15 PPV For piston Ø 125 not with S11

2 Q Max. stroke: 10 ... 1500 mm.
In combination with S2: square piston rod at bearing cap end only.
Not with S20, K7, K10, S10, S11, R8

3 S2 In combination with K2: thread extended at both ends.
In combination with K3: female thread at both ends.
In combination with K5: special thread at both ends.
In combination with K8: piston rod extended at bearing cap end only.
Not with K7, S10, S11

4 S20 Max. stroke: 850 mm.
Not with K2, K3, K5, K8, K10, S6, S10, S11, R8

5 K2 Not with K3, K10

6 K3 With K5: on request.

Not with K7

7 K5 Not with K10

Transfer order code 125 250 P A - - - - -

DNC - - - - -

Standard cylinders DNC, ISO 15552

Ordering data – Modular products



→ Options

Special spanner flats		Improved running performance		Running characteristics		Wiper seal	
Extended piston rod		Temperature resistance		Slow speed (constant motion)		Corrosion protection	
K7	...K8	K10	S6	S10	S11	R3	R8
-	- 100K8	-	-	-	-	-	-

Ordering table										
Size	32	40	50	63	80	100	125	Condi- tions	Code	Enter code
↓ Special spanner flats	Piston rod with external hexagon							8	-K7	
0 Extended piston rod	Extended piston rod								...K8	
	[mm] 1 ... 500									
Improved running performance	Smooth anodised aluminium coated piston rod							-	9	-K10
Temperature resistance	Heat-resistant seals for temperatures up to 120 °C								10	-S6
Slow speed (constant motion)	Slow speed (constant motion at low piston speeds)							-	12	-S10
Running characteristics	Low friction								13	-S11
Corrosion protection	High corrosion protection								14	-R3
Wiper seal	Dust protection									-R8

- K7** Not with Q, S2, K10
- K10** Max. stroke: 1,000 mm.
Not with S6, R3, R8
- S6** Not with S10, S11, R8

- S10** Max. stroke: 500 mm; additional strokes on request.
Not with S11, R3, R8
- S11** Max. stroke: 500 mm; additional strokes on request.
Not with R3, R8
- CT, R3** Not with R8

Transfer order code - - - - - R3 -

- - - - - - - -

Standard cylinders DNC, ISO 15552

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Ordering data

Wearing parts kits					
	Part No.	Type	Part No.	Type	
Piston Ø	Basic version		S6 – Heat-resistant seals up to max. 120 °C		
32	369195	DNC-32-...-PPV-(A)	384214	DNC-32-...-PPV-(A)-S6	
40	369196	DNC-40-...-PPV-(A)	384215	DNC-40-...-PPV-(A)-S6	
50	369197	DNC-50-...-PPV-(A)	384216	DNC-50-...-PPV-(A)-S6	
63	369198	DNC-63-...-PPV-(A)	384217	DNC-63-...-PPV-(A)-S6	
80	369199	DNC-80-...-PPV-(A)	384218	DNC-80-...-PPV-(A)-S6	
100	369200	DNC-100-...-PPV-(A)	384219	DNC-100-...-PPV-(A)-S6	
125	369201	DNC-125-...-PPV-(A)	384220	DNC-125-...-PPV-(A)-S6	

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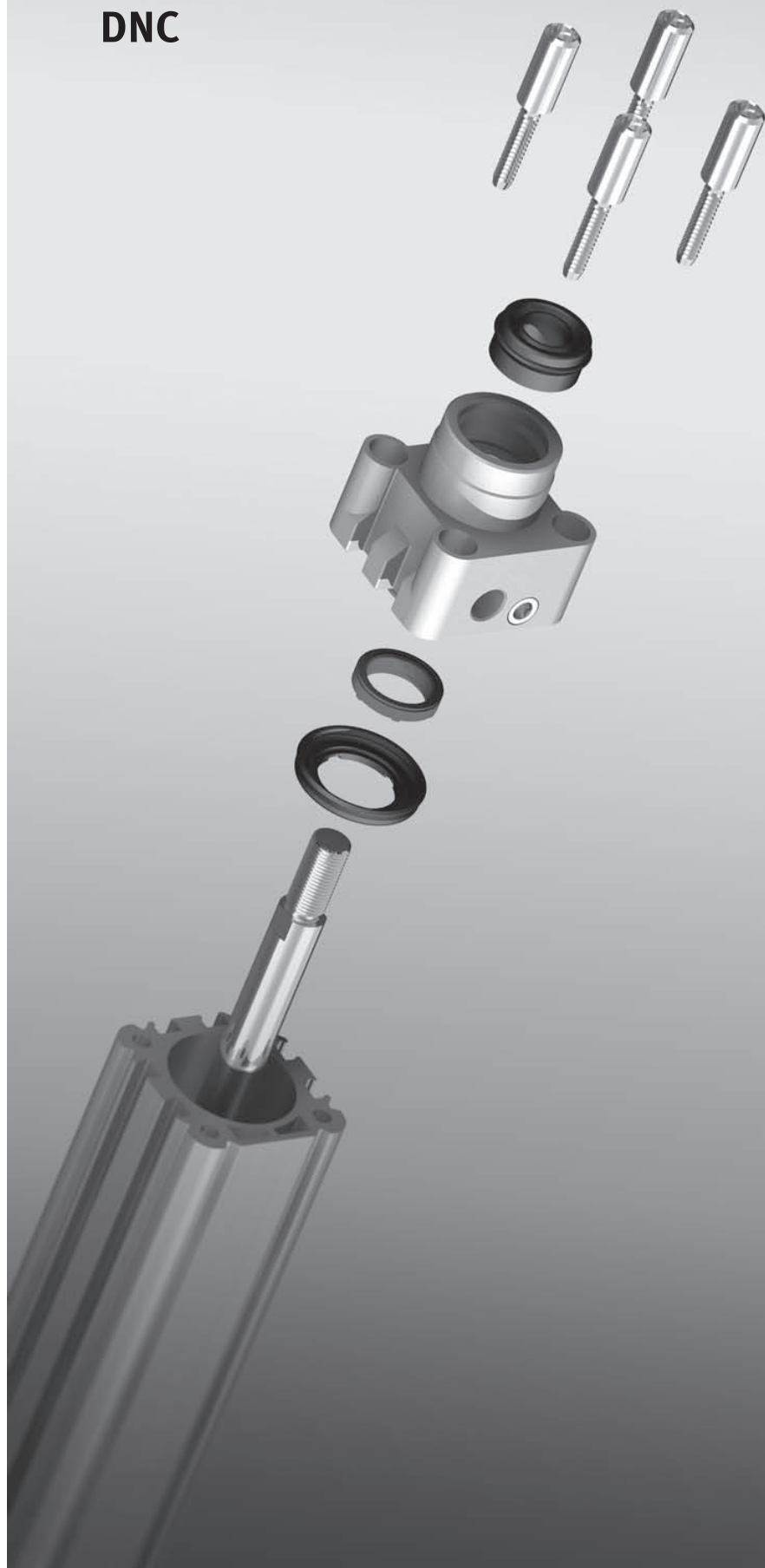
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Cylinders with piston rod

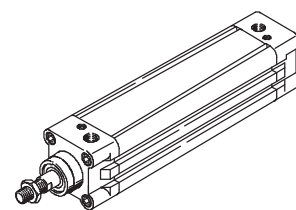
Standard cylinder to ISO 15552

DNC



FESTO

Repair
instructions (en)



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All technical data subject to change according to technical updates.

Foreword

These repair instructions are valid for the cylinders with piston rod listed on the title page to the exclusion of any liability claims.

Deviations compared to the descriptions in these repair instructions may arise depending on the design and/or modification status of the cylinder with piston rod. The user must check this prior to carrying out the repair and take the deviations into consideration if necessary.

These repair instructions have been prepared with care.

Festo AG & Co. KG does not, however, accept liability for any errors in these repair instructions or their consequences. Likewise, no liability is accepted for direct or consequential damage resulting from improper use of the products.

More detailed information on this can be found in section [8 “Liability”](#).

The relevant regulations on occupational safety, safety engineering and interference suppression as well as the stipulations contained in these repair instructions must be observed when working on the products.

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1 Important information

1.1 About these repair instructions

This document contains important information about the professional repair of the cylinder with piston rod of the type DNC.

The cylinder with piston rod DNC is fully repairable in the event of damage due to normal wear. The complete cylinder must be repaired in the event of damage to the cylinder barrel.

Before carrying out a repair, the relevant section in these instructions must be read in full and followed consistently.

For reasons of clarity, these repair instructions do not contain complete, detailed information. For that reason, the following documents should also be available when repairing the cylinder with piston rod:

- Operating instructions for the respective cylinder with piston rod**
 Contain information about the control sections and connections of the cylinder with piston rod as well as the function, structure, application, installation, commissioning, maintenance and care, etc. Can be found on the Festo website (www.festo.com).
- Assembly aids**
 Contain an overview of available assembly aids such as lubricating greases, locking agents, maintenance tools, etc. (aids for assembly and maintenance). Can be found in the online spare parts catalogue on the Festo website (www.festo.com).
- Spare parts documentation**
 Contains an overview of the spare and wearing parts as well as information on their installation. Can be found in the online spare parts catalogue on the Festo website (spareparts.festo.com).

1.2 Pictograms used in these repair instructions



Warning

This sign indicates a dangerous situation for persons and/or the product. Failure to observe this warning can result in injury to persons and/or damage to the device.



Note

This sign provides important tips and information that can make your work easier.



Environment

This sign provides information on the steps required for environmentally friendly use of materials and equipment, as well as the guidelines and regulations that may need to be observed.



Accessories

This sign contains information on accessories and attachments relevant to the context.



Documents

This sign contains references to other sections or documents containing additional information.

1.3 General safety information



Warning

The cylinder with piston rod must only be repaired by authorised and trained persons in accordance with the specifications in the technical documentation and using genuine spare parts.

Installation and repair by unauthorised and untrained persons, repairs using non-genuine spare parts as well as without the technical documentation required for installation and/or repair are dangerous and therefore not permitted.

Repairs must only be carried out in conjunction with these repair instructions as well as the respective operating instructions for the device.



Note

Instead of carrying out the repair yourself, your local Festo sales office offers the option of having the repair carried out by Festo.



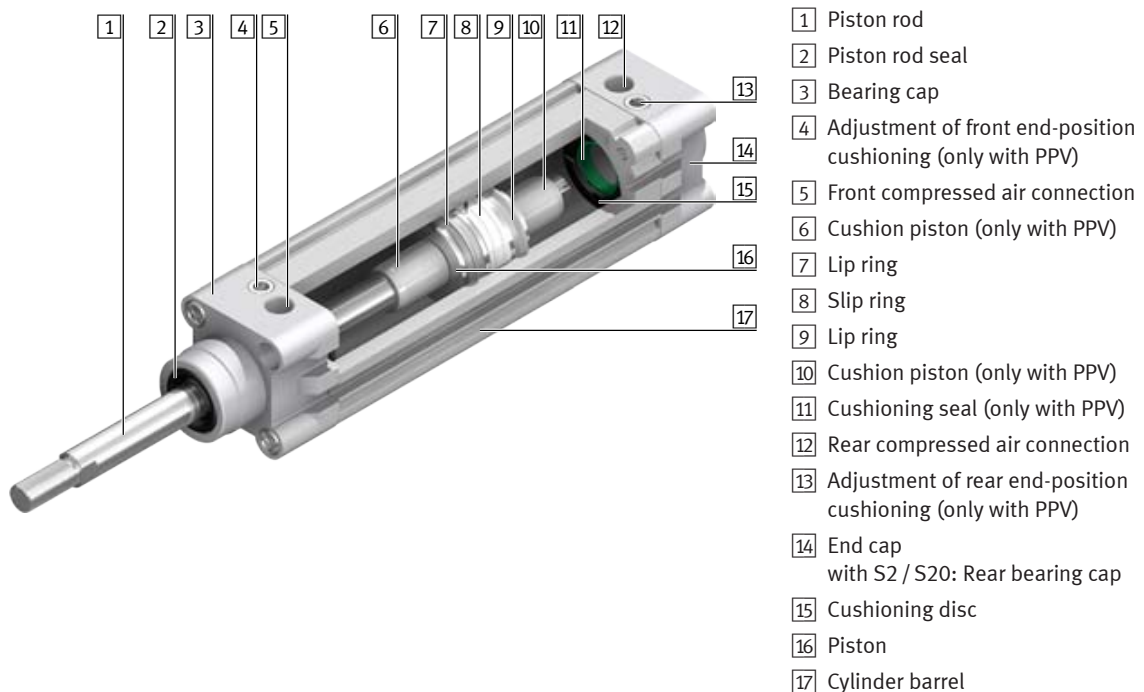
Environment

Components and equipment replaced as part of a repair must be disposed of in accordance with the locally valid environmental protection regulations.

2 General product description

2.1 Functional description

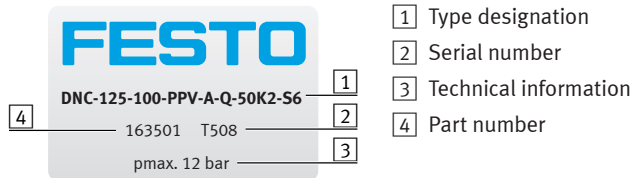
The piston moves in the cylinder barrel when the cylinder chamber is pressurised. The piston rod transmits the movement to the outside. The advanced piston rod is retracted again when the other cylinder chamber is pressurised.



2.2 Type codes (ascertaining the features of a cylinder)

The precise features of a cylinder with piston rod can be ascertained with the help of the name plate on the cylinder. The type designation is arranged directly beneath the Festo logo and describes the features contained in the cylinder separated by a hyphen (-).

Example:



- 1 Type designation
- 2 Serial number
- 3 Technical information
- 4 Part number

The type designation on this name plate provides the following information:

- DNC** Cylinder of the type DNC
- 125** Piston diameter 125 mm
- 100** Stroke 100 mm
- PPV** Adjustable end-position cushioning
- A** Sensing option (magnetic piston)
- Q** Square piston rod (protection against rotation)
- 50K2** Piston rod thread extended by 50 mm
- S6** Heat-resistant seals (repair-relevant feature (see section 2.3 “Repair-relevant feature”))



Note

A list and description of all possible equipment features of the cylinder with piston rod can be found in the data sheet. It is available on the Festo website (www.festo.com).

2.3 Repair-relevant feature

Some of the features that the cylinder with piston rod can be equipped with require a different repair approach. These features are called “repair-relevant” and are listed in the left-hand column in the table below.

If the cylinder to be repaired has one of these repair-relevant features, the appropriate repair description (see right-hand column in the table below) must be used.



Note

A cylinder can only have one repair-relevant feature. It can additionally be equipped with one or more other features (see middle column).

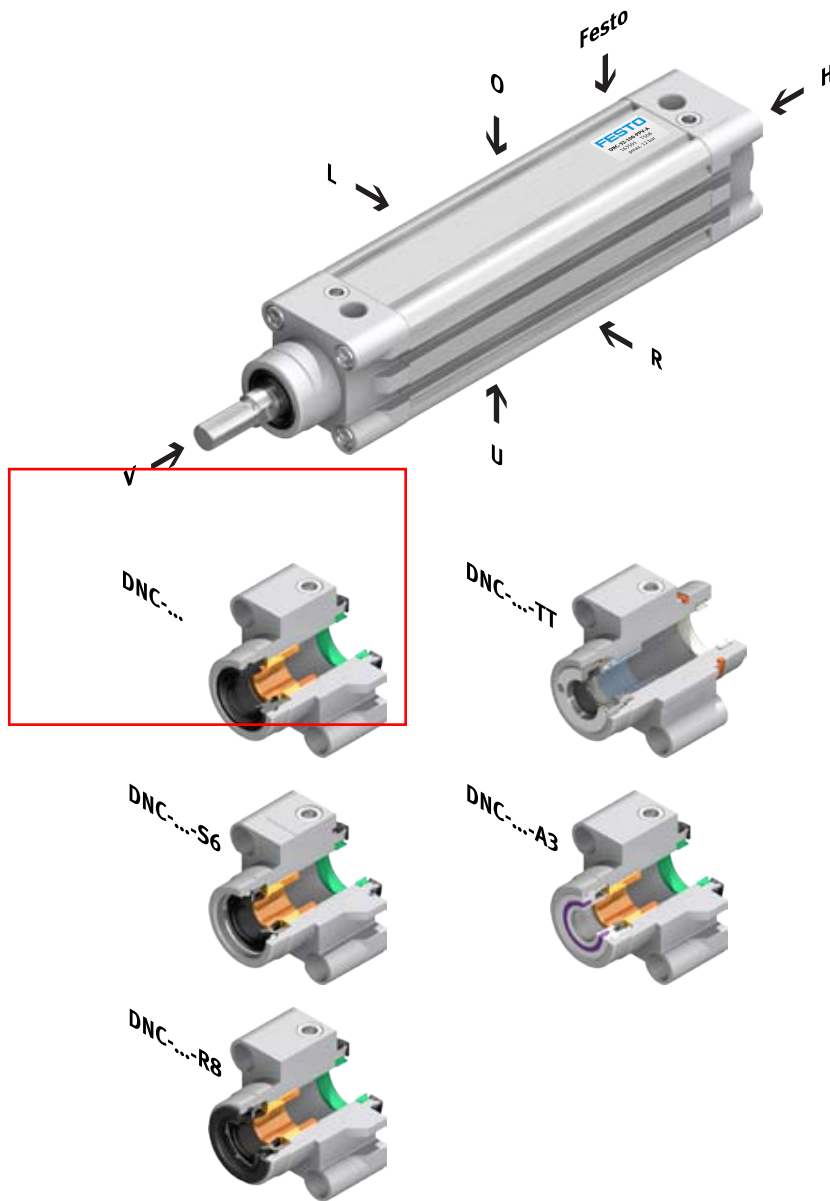
Cylinder and repair-relevant feature	Other features	Described from page
DNC-... without repair-relevant feature	PPV, A, Q, S2, S20, ...K2 – K10, S10, S11, R3	15
DNC-...- S6 (heat-resistant seals up to max. 120 °C)	PPV, A, Q, S2, S20, ...K2 – K10, R3	19
DNC-...- TT (resistant to low temperatures down to max. -40 °C)	PPV, A, S2, S20, ...K2, K3, ...K5, ...K8, R3	23
DNC-...- R8 (dust protected)	PPV, A, S2, ...K2 – ...K8	28
DNC-...- A3 (unlubricated operation)	PPV, A, S2, S20, ...K2 – K10, R3	32

Example for the cylinder in section 2.2 “Type codes (ascertaining the features of a cylinder)”

Of the features in the sample cylinder, the feature “S6” is relevant to repair. The description in section 3.2 “DNC-...-S6” on page 19 must therefore be used to repair this cylinder with piston rod.

2.4 Mounting direction and bearing cap variants

This diagram provides an overview of the direction designations for the cylinder with piston rod as well as the different structure of the bearing cap and seal packs for repair-relevant features.



Orientation:
Festo=product identification (logo) as reference point

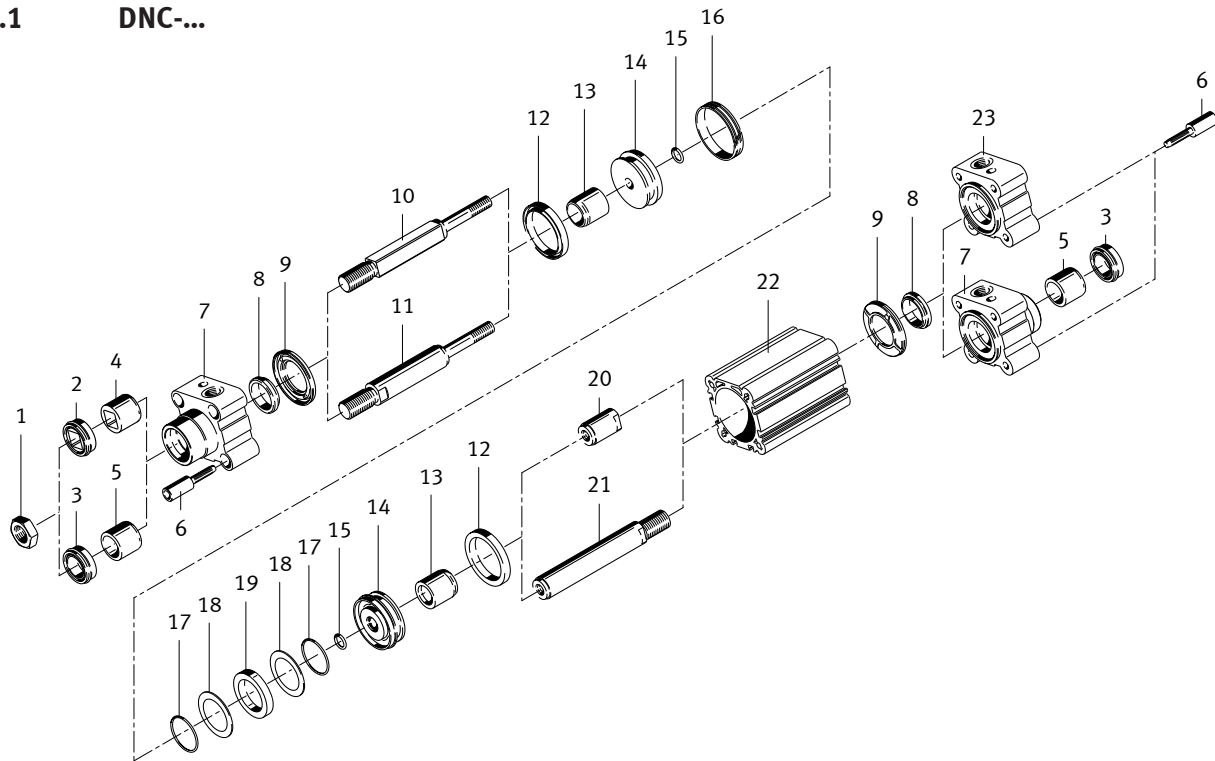
- O = top
- U = underneath
- R = right
- L = left
- V = front
- H = rear

Features:

- S6 = Heat-resistant seals
- R8 = Dust protection
- TT = Low temperature
- A3 = Unlubricated operation (PE seal)

3 **Component overview**

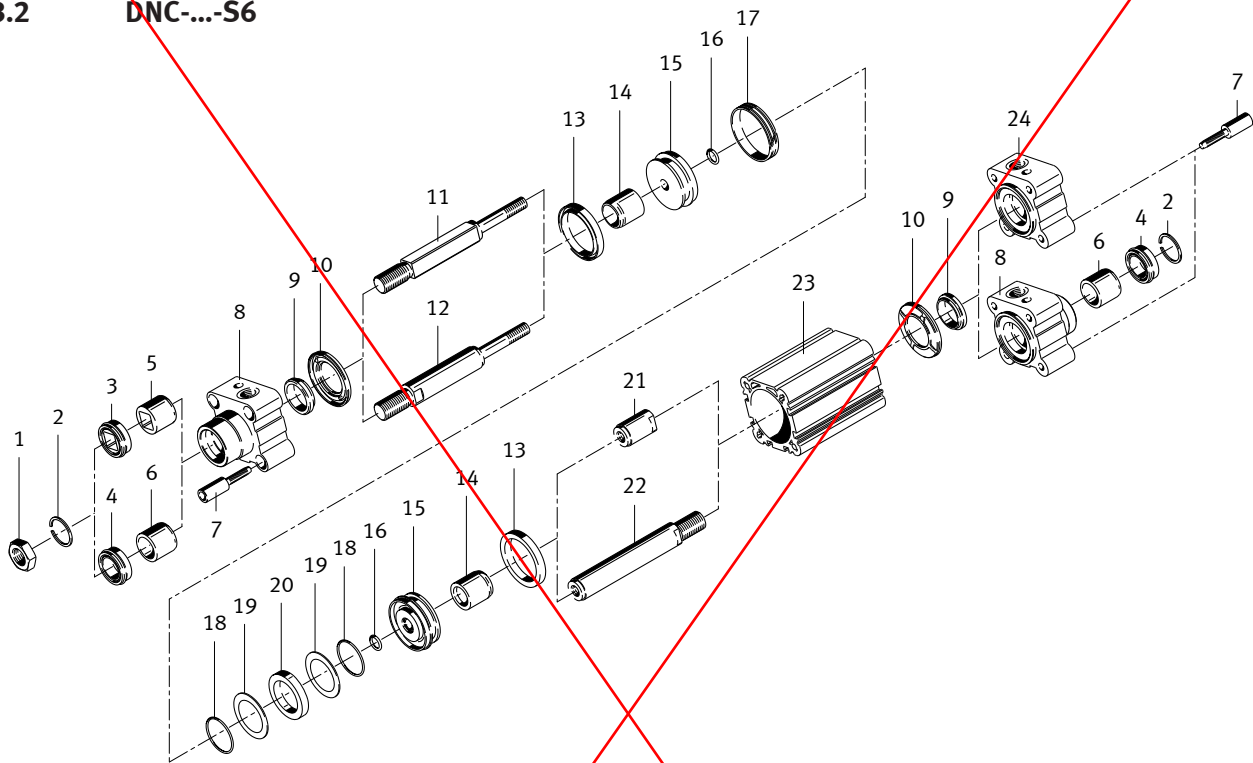
3.1 **DNC-...**



This diagram is intended only to provide an overview of the individual components. To order spare and wearing parts, please use the online spare parts catalogue on the Festo website (spareparts.festo.com).

Item	Designation	Note
1	Hex nut	
2	Piston rod seal	For square piston rod
3	Piston rod seal	For round piston rod
4	Bearing	For square piston rod
5	Bearing	For round piston rod
6	Flange screw	Use screw locking agent (wearing parts kit)
7	Bearing cap	
8	Cushioning seal	Only with -PPV-
9	Cushioning disc	
10	Piston rod (square)	
11	Piston rod (round)	
12	Lip ring (piston seal)	
13	Cushion piston	Only with -PPV-
14	Piston	
15	O-ring	
16	Slip ring	
17	O-ring	Only with -A-
18	Washer	Only with -A-
19	Magnet	Only with -A-
20	Threaded coupling	Use screw locking agent (wearing parts kit)
21	Piston rod	With through piston rod
22	Cylinder barrel	
23	End cap	

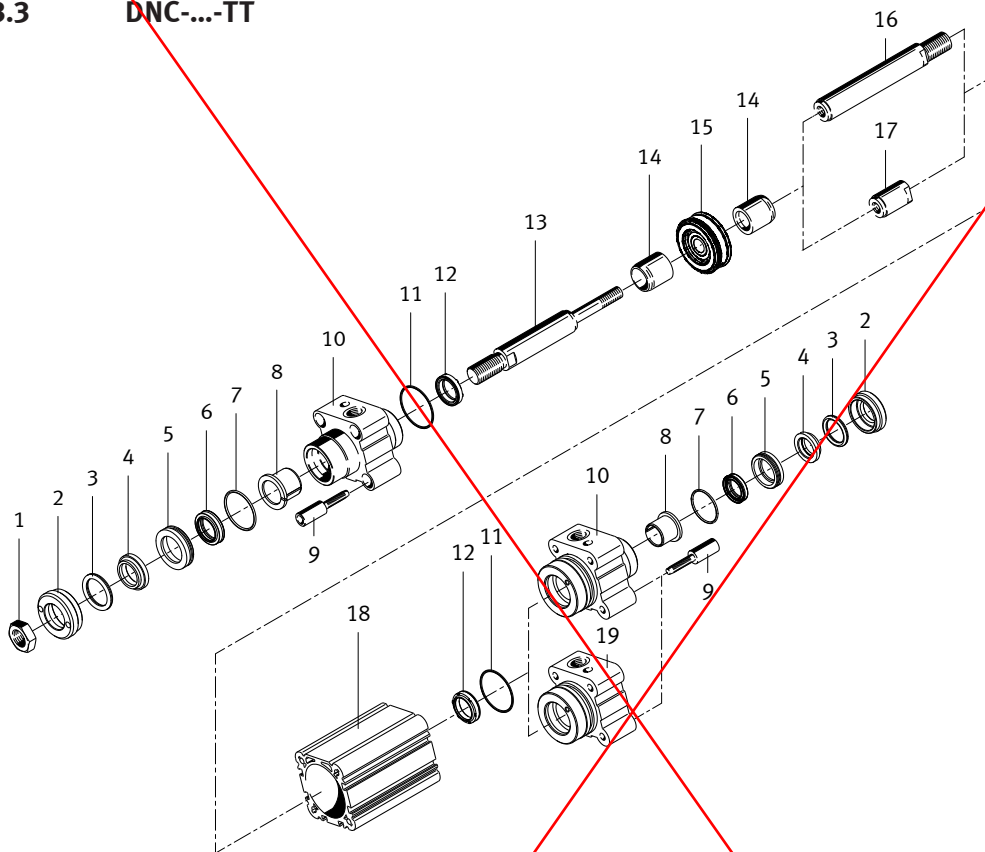
3.2 DNC-...-S6



This diagram is intended only to provide an overview of the individual components. To order spare and wearing parts, please use the online spare parts catalogue on the Festo website (spareparts.festo.com).

Item	Designation	Note
1	Hex nut	
2	Retaining ring	
3	Piston rod seal	For square piston rod
4	Piston rod seal	For round piston rod
5	Bearing	For square piston rod
6	Bearing	For round piston rod
7	Flange screw	Use screw locking agent (wearing parts kit)
8	Bearing cap	
9	Cushioning seal	Only with -PPV-
10	Cushioning disc	
11	Piston rod (square)	
12	Piston rod (round)	
13	Lip ring (piston seal)	
14	Cushion piston	Only with -PPV-
15	Piston	
16	O-ring	
17	Slip ring	
18	O-ring	Only with -A-
19	Washer	Only with -A-
20	Magnet	Only with -A-
21	Threaded coupling	Use screw locking agent (wearing parts kit)
22	Piston rod	With through piston rod
23	Cylinder barrel	
24	End cap	

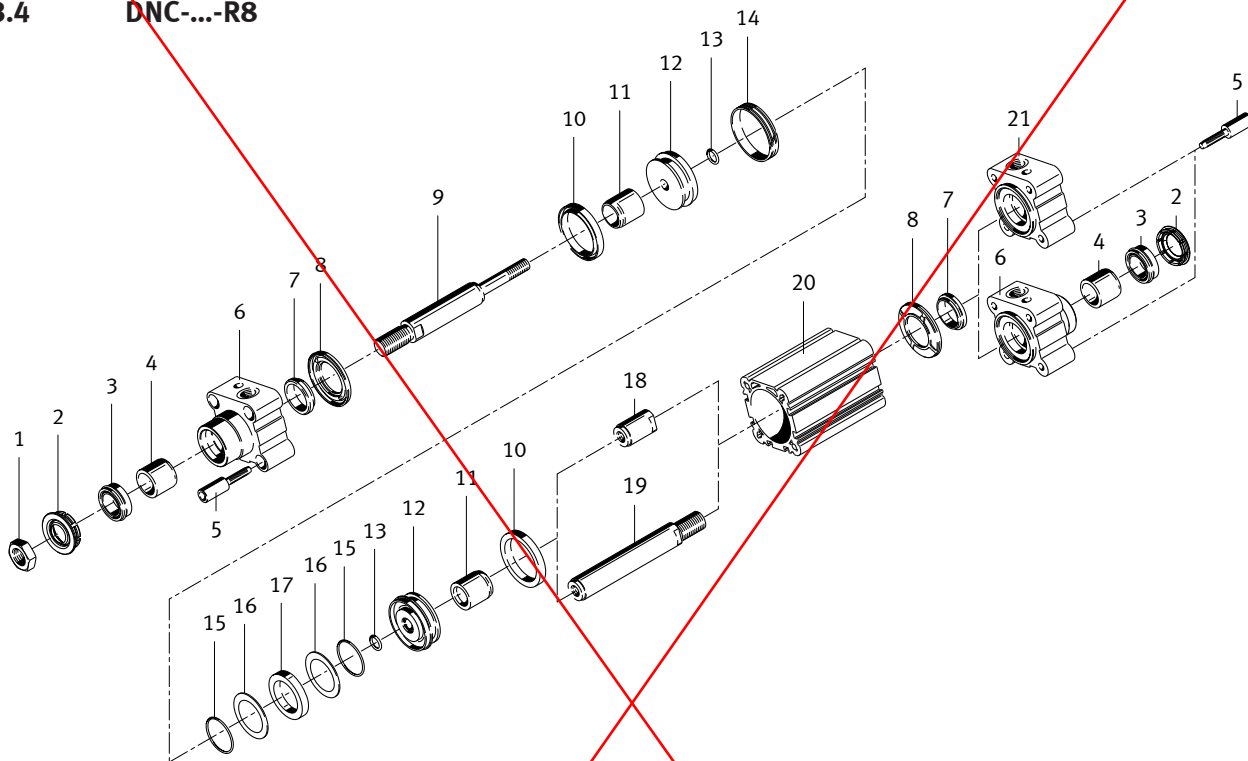
3.3 DNC-...-TT



This diagram is intended only to provide an overview of the individual components. To order spare and wearing parts, please use the online spare parts catalogue on the Festo website (spareparts.festo.com).

Item	Designation	Note
1	Hex nut	
2	Screwed insert	
3	O-ring	
4	Excluder	
5	Insert sleeve	
6	Wiper seal	
7	O-ring	
8	Flanged bearing	
9	Flange screw	Use screw locking agent (wearing parts kit)
10	Bearing cap	
11	O-ring	
12	Cushioning seal	
13	Piston rod	
14	Cushion piston	Only with -PPV-
15	Piston	
16	Piston rod	With through piston rod
17	Threaded coupling	Use screw locking agent (wearing parts kit)
18	Cylinder barrel	
19	End cap	

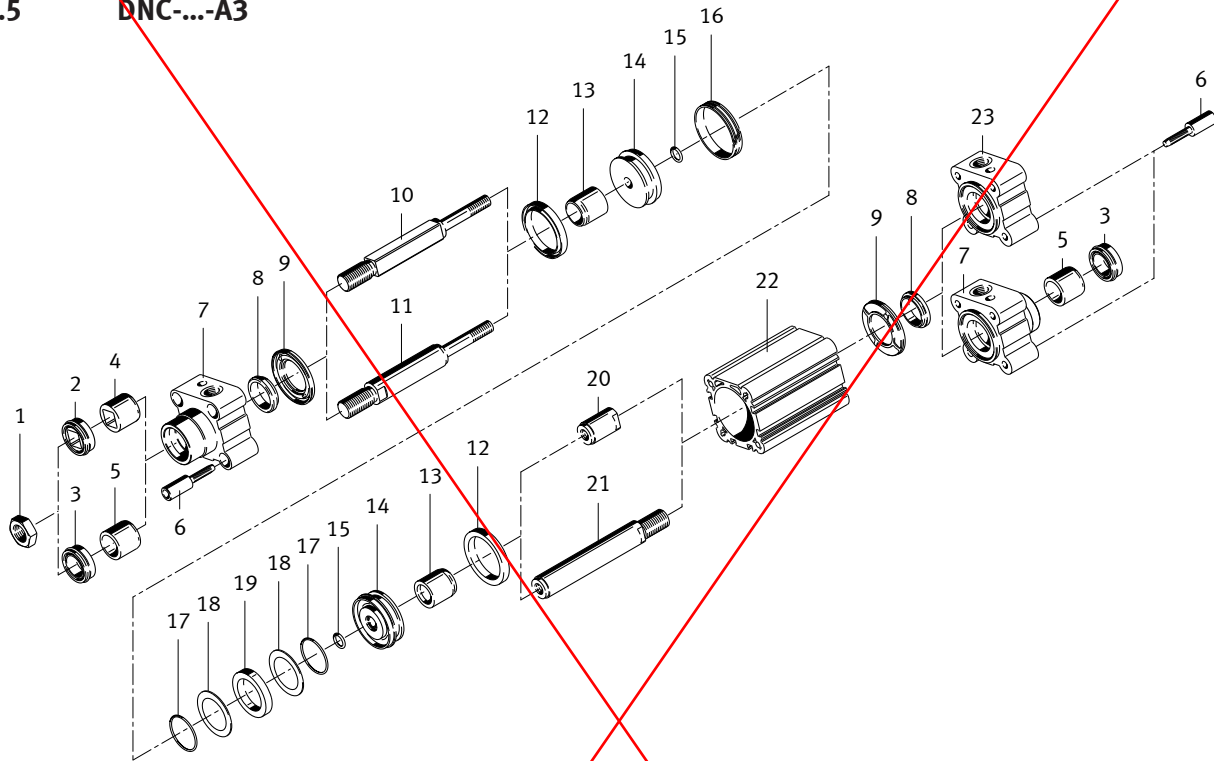
3.4 DNC-...-R8



This diagram is intended only to provide an overview of the individual components. To order spare and wearing parts, please use the online spare parts catalogue on the Festo website (spareparts.festo.com).

Item	Designation	Note
1	Hex nut	
2	Wiper seal	
3	Piston rod seal	
4	Bearing	
5	Flange screw	Use screw locking agent (wearing parts kit)
6	Bearing cap	
7	Cushioning seal	Only with -PPV-
8	Cushioning disc	
9	Piston rod	
10	Lip ring (piston seal)	
11	Cushion piston	Only with -PPV-
12	Piston	
13	O-ring	
14	Slip ring	
15	O-ring	Only with -A-
16	Washer	Only with -A-
17	Magnet	Only with -A-
18	Threaded coupling	Use screw locking agent (wearing parts kit)
19	Piston rod	With through piston rod
20	Cylinder barrel	
21	End cap	

3.5 DNC-...-A3



This diagram is intended only to provide an overview of the individual components. To order spare and wearing parts, please use the online spare parts catalogue on the Festo website (spareparts.festo.com).

Item	Designation	Note
1	Hex nut	
2	Piston rod seal	For square piston rod
3	Piston rod seal	For round piston rod
4	Bearing	For square piston rod
5	Bearing	For round piston rod
6	Flange screw	Use screw locking agent (wearing parts kit)
7	Bearing cap	
8	Cushioning seal	Only with -PPV-
9	Cushioning disc	
10	Piston rod (square)	
11	Piston rod (round)	
12	Lip ring (piston seal)	
13	Cushion piston	Only with -PPV-
14	Piston	
15	O-ring	
16	Slip ring	
17	O-ring	Only with -A-
18	Washer	Only with -A-
19	Magnet	Only with -A-
20	Threaded coupling	Use screw locking agent (wearing parts kit)
21	Piston rod	With through piston rod
22	Cylinder barrel	
23	End cap	

4 Repair steps

4.1 Preparatory measures

- Before starting the repair, remove any attachments (clamping device, end-position lock, etc.) in accordance with the instructions in the accompanying operating instructions.
- Keep your working environment tidy.
- Only use the spare parts and assembly aids (grease, locking agent, etc.) provided in the wearing parts kit.



Warning

Make sure that the bearing cap cannot suddenly come flying off.

- Remove the non-return valves and tubing connection from the cylinder and depressurise the cylinder completely so that any pressure present is not suddenly released when the cylinder is opened.

To prevent damage to sealing rims or guide surfaces, do not use pointed or sharp-edged assembly aids.

4.2 Visual inspection

Check the cylinder for visible damage that might impair its function (e.g. warping of the piston rod) as well as deposits and scoring. The cylinder must be replaced if it is exhibiting significant damage.

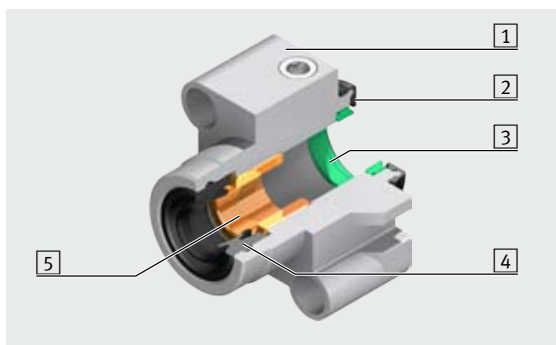
4.3 Repairing the cylinder DNC-...

The description in this section can be used to repair cylinders of the type DNC-... with the following features:

Code	Description
P	Elastic cushioning discs
PPV	Adjustable pneumatic cushioning
A	Position sensing
Q	Square piston rod
S2	Through piston rod
S20	Through, hollow piston rod
...K2	Extended male piston rod thread
K3	Female piston rod thread

Code	Description
...K5	Special piston rod thread
K7	Piston rod with external hexagon
...K8	Extended piston rod
K10	Smooth anodised aluminium piston rod
S10	Slow speed
S11	Low friction
R3	High corrosion protection

4.3.1 Structure of the bearing cap



- 1 Bearing cap
- 2 Cushioning disc
- 3 Cushioning seal (only on cylinders with adjustable cushioning PPV)
- 4 Piston rod seal
- 5 Bearing

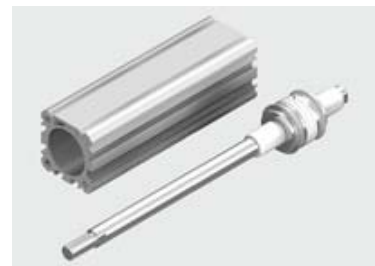
4.3.2 Removing the bearing and end caps

- Loosen the screws in the bearing and end caps (the rear bearing cap on cylinders with through piston rod (S2 / S20)) and remove them.
- Remove the bearing and end caps from the cylinder barrel and piston rod.



4.3.3 Replacing the piston components

- Pull the piston rod out of the cylinder barrel.
- Check the cylinder barrel and piston rod for damage.
The entire cylinder must be replaced if the cylinder barrel (particularly the bearing surface) is exhibiting significant damage.



- Unscrew the threaded coupling (the rear part of the piston rod on cylinders with through piston rod (S2 / S20)) from the piston rod.
- Remove the piston components from the piston rod, noting the sequence and alignment.
- Remove any residues of the screw locking agent from the thread of the piston rod and threaded coupling.
- Replace the components contained in the wearing parts kit and reassemble the piston components on the piston rod in the correct sequence.



- Apply the screw locking agent contained in the wearing parts kit to the inside of the threaded coupling (the rear part of the piston rod on cylinders with through piston rod (S2 / S20)) and screw it onto the piston rod with the corresponding torque (see table).



Type	Torque
DNC-32	9 Nm
DNC-40	20 Nm
DNC-50	30 Nm
DNC-63	45 Nm
DNC-80	60 Nm
DNC-100	60 Nm
DNC-125	170 Nm

4.3.4 Inserting the piston rod into the cylinder barrel

- Clean the inner surface of the cylinder barrel as described in section [5.1 “Cleaning”](#).
- Apply the grease contained in the wearing parts kit to the following parts:

Component	Cylinder with S10/S11	Other cylinders
Inner surface of cylinder barrel	Extremely thin film ¹⁾	Thin film ²⁾
Surface of piston rod	Extremely thin film ¹⁾	Thin film ²⁾
Piston seal lip rings	Thin film ²⁾ on outside	Thin film ²⁾ on outside
Piston surface between lip rings (grease reservoir ³⁾)	Fill 1/3 with grease	Fill 2/3 with grease
Cushion piston	Thin film ²⁾ on outside	Thin film ²⁾ on outside

¹⁾ See section [5.2.1 “Extremely thin grease film”](#)

²⁾ See section [5.2.2 “Thin grease film”](#)

³⁾ See section [5.2.3 “Grease reservoir”](#)

- Place the piston flat on the front side of the cylinder barrel and insert the lip ring into the cylinder barrel by tilting and turning it slightly.

The sealing lip must not fold back against the inside of the piston.



Note

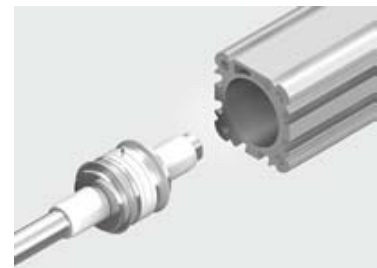
If necessary use a flat and blunt-edged object to insert the lip ring into the cylinder barrel.

- Insert the piston fully into the cylinder barrel.
- Push the piston far enough into the cylinder barrel that the first lip ring protrudes slightly at the other end of the cylinder barrel.
- Pull the piston rod back again until the piston is sitting fully in the cylinder barrel.



Note

This approach ensures that the sealing lips of the two lip rings sit correctly in the cylinder barrel.

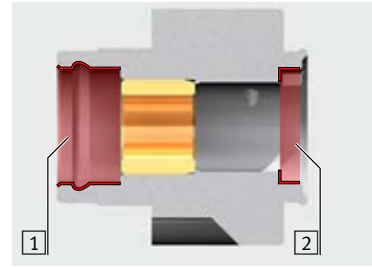


4.3.5 Repairing and attaching the bearing and end caps

- Remove the piston rod seal **1** from the bearing cap **2** (the front and rear bearing caps on cylinders with through piston rod (S2 / S20)).
- Remove the cushioning discs **4** from the bearing cap and end cap (the rear bearing cap on cylinders with through piston rod (S2 / S20)).
- **Only on cylinders with adjustable cushioning (PPV)**
Remove the cushioning seal **3** from the bearing cap and end cap (the rear bearing cap on cylinders with through piston rod (S2 / S20)).

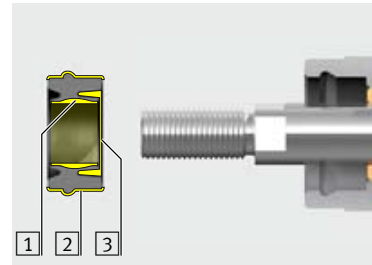


- Clean the seat of the piston rod seal 1.
- **Only on cylinders with adjustable cushioning (PPV)**
Clean the seat of the cushioning seal 2.



- Grease the new piston rod seal (one per bearing cap on cylinders with through piston rod (S2 / S20)) as follows:

Area	Cylinder with S10/S11	Other cylinders
1 Grease reservoir ¹⁾ with piston rod	Fill 1/3 with grease	Fill 2/3 with grease
2 External surface with bearing cap	Thin film ²⁾	Thin film ²⁾
3 Grease reservoir ¹⁾ with bearing	Fill 1/3 with grease	Fill 2/3 with grease



¹⁾ See section [5.2.3 “Grease reservoir”](#)

²⁾ See section [5.2.2 “Thin grease film”](#)

- Insert the piston rod seal into the bearing cap (both bearing caps on cylinders with through piston rod (S2 / S20)) using the appropriate insertion tool.



Note

Note the mounting direction (labelling facing out).
Note the mounting orientation on cylinders with square piston rod.



- **Only on cylinders with adjustable cushioning (PPV)**
Apply a thin film of grease to the new cushioning seals on the front side with the sealing surface and insert them into the bearing cap and end cap (the rear bearing cap on cylinders with through piston rod (S2 / S20)).
- Place the new cushioning discs on the bearing cap and end cap (the rear bearing cap on cylinders with through piston rod (S2 / S20)).



- To protect the bearing and seals, place the appropriate sleeve on the thread of the piston rod to prevent damage.



Note

On cylinders with extended piston rod thread, the sleeve may not cover the thread completely. If this happens, an appropriate sleeve must be custom fabricated. See section [7.2 “Special tools”](#) for information.

- Guide the bearing cap (both bearing caps on cylinders with through piston rod (S2 / S20)) over the sleeve onto the piston rod as far as the cylinder barrel.
- Place the end cap at the other end of the cylinder barrel.



- Apply the screw locking agent contained in the wearing parts kit to the screws.
- Fasten the screws through the bearing and end caps into the cylinder barrel.
- Align the bearing and end caps flush with the cylinder barrel.
- Tighten the screws to the appropriate torque (see table).



Type	Torque
DNC-32	7 Nm
DNC-40	7 Nm
DNC-50	13 Nm
DNC-63	13 Nm
DNC-80	35 Nm
DNC-100	35 Nm
DNC-125	40 Nm

- Perform a functional test as per the operating instructions (enclosed with the cylinder or can be called up on the Festo website (www.festo.com)) and commission the repaired cylinder.

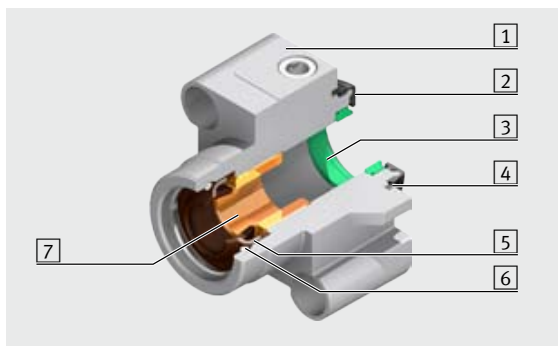
4.4 Repairing the cylinder DNC-...-S6

The description in this section can be used to repair cylinders of the type DNC-...-S6 with the following features:

Code	Description
P	Elastic cushioning discs
PPV	Adjustable pneumatic cushioning
A	Position sensing
Q	Square piston rod
S2	Through piston rod
S20	Through, hollow piston rod
...K2	Extended male piston rod thread

Code	Description
K3	Female piston rod thread
...K5	Special piston rod thread
K7	Piston rod with external hexagon
...K8	Extended piston rod
K10	Smooth anodised aluminium piston rod
R3	High corrosion protection

4.4.1 Structure of the bearing cap



- 1 Bearing cap
- 2 Cushioning disc
- 3 Cushioning seal
(only on cylinders with adjustable cushioning PPV)
- 4 Sealing ring
- 5 Piston rod seal with metal insert
- 6 Retaining ring
- 7 Bearing

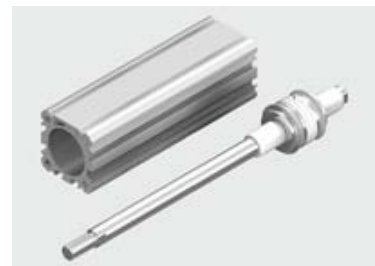
4.4.2 Removing the bearing and end caps

- Loosen the screws in the bearing and end caps (the rear bearing cap on cylinders with through piston rod (S2 / S20)) and remove them.
- Remove the bearing and end caps from the cylinder barrel and piston rod.



4.4.3 Replacing the piston components

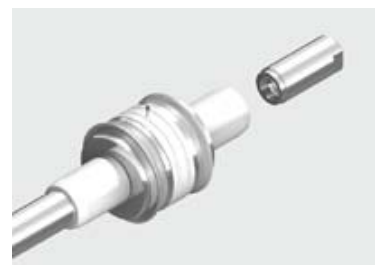
- Pull the piston rod out of the cylinder barrel.
- Check the cylinder barrel and piston rod for damage.
The entire cylinder must be replaced if the cylinder barrel (particularly the bearing surface) is exhibiting significant damage.



- Unscrew the threaded coupling (the rear part of the piston rod on cylinders with through piston rod (S2 / S20)) from the piston rod.
- Remove the piston components from the piston rod, noting the sequence and alignment.
- Remove any residues of the screw locking agent from the thread of the piston rod and threaded coupling.
- Replace the components contained in the wearing parts kit and reassemble the piston components on the piston rod in the correct sequence.



- Apply the screw locking agent contained in the wearing parts kit to the inside of the threaded coupling (the rear part of the piston rod on cylinders with through piston rod (S2 / S20)) and screw it onto the piston rod with the corresponding torque (see table).



Type	Torque
DNC-32	9 Nm
DNC-40	20 Nm
DNC-50	30 Nm
DNC-63	45 Nm
DNC-80	60 Nm
DNC-100	60 Nm
DNC-125	170 Nm

4.4.4 Inserting the piston rod into the cylinder barrel

- Clean the inner surface of the cylinder barrel as described in section [5.1 “Cleaning”](#).
- Apply the grease contained in the wearing parts kit to the following parts:

Component	Greasing
Inner surface of cylinder barrel	Thin film ¹⁾
Surface of piston rod	Thin film ¹⁾
Piston seal lip rings	Thin film ¹⁾ on outside
Piston surface between lip rings (grease reservoir ²⁾)	Fill 2/3 with grease
Cushion piston	Thin film ¹⁾ on outside

¹⁾ See section [5.2.2 “Thin grease film”](#)

²⁾ See section [5.2.3 “Grease reservoir”](#)

- Place the piston flat on the front side of the cylinder barrel and insert the lip ring into the cylinder barrel by tilting and turning it slightly.

The sealing lip must not fold back against the inside of the piston.



Note

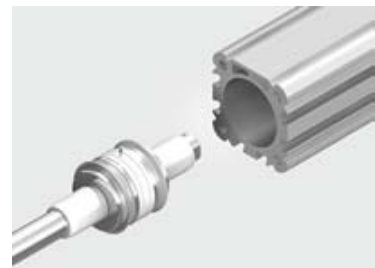
If necessary use a flat and blunt-edged object to insert the lip ring into the cylinder barrel.

- Insert the piston fully into the cylinder barrel.
- Push the piston far enough into the cylinder barrel that the first lip ring protrudes slightly at the other end of the cylinder barrel.
- Pull the piston rod back again until the piston is sitting fully in the cylinder barrel.



Note

This approach ensures that the sealing lips of the two lip rings sit correctly in the cylinder barrel.



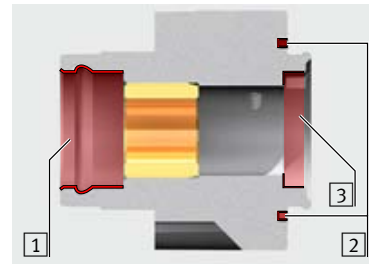
4.4.5 Repairing and attaching the bearing and end caps

- Remove the retaining ring **1** and the piston rod seal **2** from the bearing cap **3** (the front and rear bearing caps on cylinders with through piston rod (S2 / S20)).
- Remove the cushioning discs **6** from the bearing cap and end cap (the rear bearing cap on cylinders with through piston rod (S2 / S20)).
- Remove the sealing ring **5** from the bearing cap **3** and end cap (the front and rear bearing caps on cylinders with through piston rod (S2 / S20)).
- **Only on cylinders with adjustable cushioning (PPV)**

Remove the cushioning seal **4** from the bearing cap and end cap (the rear bearing cap on cylinders with through piston rod (S2 / S20)).



- Clean the seats of the piston rod seal **1** and the sealing ring **2**.
- **Only on cylinders with adjustable cushioning (PPV)**
Clean the seat of the cushioning seal **3**.

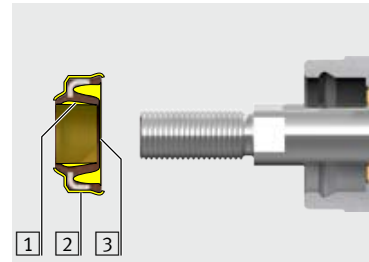


- Grease the new piston rod seal (one per bearing cap on cylinders with through piston rod (S2 / S20)) as follows:

Area	Greasing
1 Grease reservoir ¹⁾ with piston rod	Fill 2/3 with grease
2 External surface with bearing cap	Thin film ²⁾
3 Grease reservoir ¹⁾ with bearing	Fill 2/3 with grease

¹⁾ See section [5.2.3 “Grease reservoir”](#)

²⁾ See section [5.2.2 “Thin grease film”](#)



- Insert the piston rod seal into the bearing cap (both bearing caps on cylinders with through piston rod (S2 / S20)) using the appropriate insertion tool.



Note

Note the mounting direction (individual sealing lips facing out).
Note the mounting orientation on cylinders with square piston rod.



- Compress the retaining ring (e.g. using a pliers) and place it on the piston rod seal (in both bearing caps on cylinders with through piston rod (S2 / S20)).



- **Only on cylinders with adjustable cushioning (PPV)**
Apply a thin film of grease to the new cushioning seals on the front side with the sealing surface and insert them into the bearing cap and end cap (the rear bearing cap on cylinders with through piston rod (S2 / S20)).
- Insert the sealing ring in the groove of the bearing cap and end cap (the rear bearing cap on cylinders with through piston rod (S2 / S20)).
- Place the new cushioning discs on the bearing cap and end cap (the rear bearing cap on cylinders with through piston rod (S2 / S20)).



- To protect the bearing and seals, place the appropriate sleeve on the thread of the piston rod to prevent damage.



Note

On cylinders with extended piston rod thread, the sleeve may not cover the thread completely. If this happens, an appropriate sleeve must be custom fabricated. See section 7.2 “Special tools” for information.

- Guide the bearing cap (both bearing caps on cylinders with through piston rod (S2 / S20)) over the sleeve onto the piston rod as far as the cylinder barrel.
- Place the end cap at the other end of the cylinder barrel.
- Apply the screw locking agent contained in the wearing parts kit to the screws.
- Fasten the screws through the bearing and end caps into the cylinder barrel.
- Align the bearing and end caps flush with the cylinder barrel.
- Tighten the screws to the appropriate torque (see table).

Type	Torque
DNC-32	7 Nm
DNC-40	7 Nm
DNC-50	13 Nm
DNC-63	13 Nm
DNC-80	35 Nm
DNC-100	35 Nm
DNC-125	40 Nm

- Perform a functional test as per the operating instructions (enclosed with the cylinder or can be called up on the Festo website (www.festo.com)) and commission the repaired cylinder.



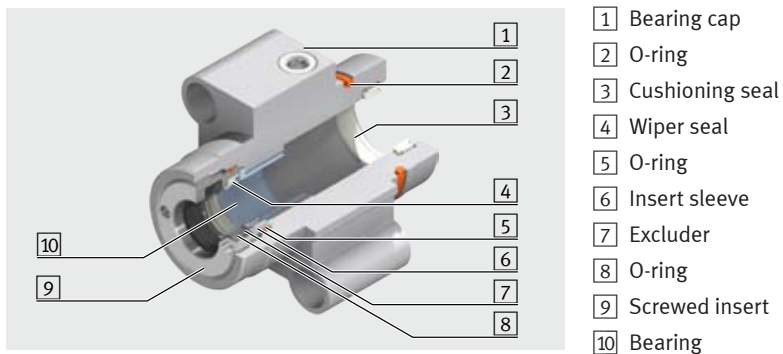
4.5 Repairing the cylinder DNC-...-TT

The description in this section can be used to repair cylinders of the type DNC-...-TT with the following features:

Code	Description
PPV	Adjustable pneumatic cushioning
A	Position sensing
S2	Through piston rod
S20	Through, hollow piston rod
...K2	Extended male piston rod thread

Code	Description
K3	Female piston rod thread
K3	Female piston rod thread
...K5	Special piston rod thread
...K8	Extended piston rod
R3	High corrosion protection

4.5.1 Structure of the bearing cap



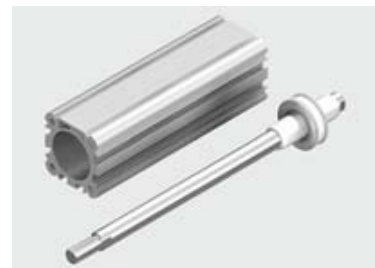
4.5.2 Removing the bearing and end caps

- Loosen the screws in the bearing and end caps (the rear bearing cap on cylinders with through piston rod (S2 / S20)) and remove them.
- Remove the bearing and end caps from the cylinder barrel and piston rod.



4.5.3 Replacing the piston components

- Pull the piston rod out of the cylinder barrel.
- Check the cylinder barrel and piston rod for damage.
 The entire cylinder must be replaced if the cylinder barrel (particularly the bearing surface) is exhibiting significant damage.



- Unscrew the threaded coupling (the rear part of the piston rod on cylinders with through piston rod (S2 / S20)) from the piston rod.
- Remove the piston components from the piston rod.
- Remove any residues of the screw locking agent from the thread of the piston rod and threaded coupling.
- Replace the piston and, if applicable, the cushion piston and reassemble the piston components on the piston rod in the correct sequence.



- Apply the screw locking agent contained in the wearing parts kit to the inside of the threaded coupling (the rear part of the piston rod on cylinders with through piston rod (S2 / S20)) and screw it onto the piston rod with the corresponding torque (see table).

Type	Torque
DNC-32	9 Nm
DNC-40	20 Nm
DNC-50	30 Nm
DNC-63	45 Nm
DNC-80	60 Nm
DNC-100	60 Nm



4.5.4 Inserting the piston rod into the cylinder barrel

- Clean the inner surface of the cylinder barrel as described in section [5.1 “Cleaning”](#).
- Apply the grease contained in the wearing parts kit to the following parts:

Component	Other cylinders
Inner surface of cylinder barrel	Thin film ¹⁾
Surface of piston rod	Thin film ¹⁾
Piston seal lip rings	Thin film ¹⁾ on outside
Piston surface between lip rings (grease reservoir ²⁾)	Fill 2/3 with grease
Cushion piston	Thin film ¹⁾ on outside

¹⁾ See section [5.2.2 “Thin grease film”](#)

²⁾ See section [5.2.3 “Grease reservoir”](#)

- Place the piston flat on the front side of the cylinder barrel and insert the lip ring into the cylinder barrel by tilting and turning it slightly.

The sealing lip must not fold back against the inside of the piston.



Note

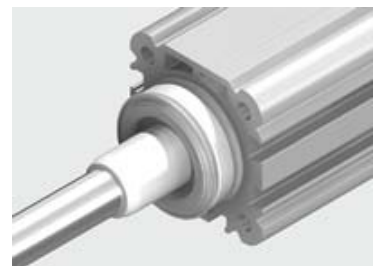
If necessary use a flat and blunt-edged object to insert the lip ring into the cylinder barrel.

- Insert the piston fully into the cylinder barrel.
- Push the piston far enough into the cylinder barrel that the first lip ring protrudes slightly at the other end of the cylinder barrel.
- Pull the piston rod back again until the piston is sitting fully in the cylinder barrel.



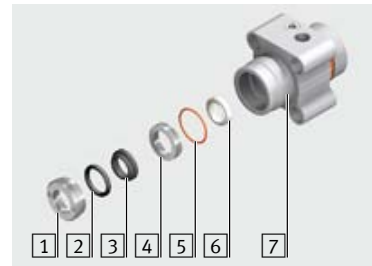
Note

This approach ensures that the sealing lips of the two lip rings sit correctly in the cylinder barrel.



4.5.5 Repairing and attaching the bearing and end caps

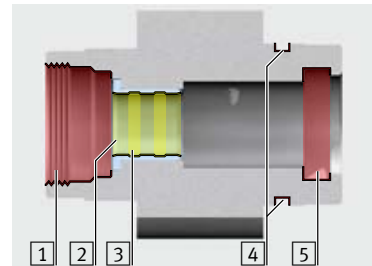
- Unscrew the screwed insert **1** from the bearing cap **7** (the front and rear bearing caps on cylinders with through piston rod (S2 / S20)).
- Remove the excluder **3** and the O-ring **2** from the screwed insert **1**.
- Remove the insert sleeve **4** with the wiper seal **6** and the O-ring **5** from the bearing cap **7** (the front and rear bearing caps on cylinders with through piston rod (S2 / S20)).
- Separate the wiper seal **6** and the O-ring **5** from the insert sleeve **4**.



- Remove the O-ring **2** from the bearing cap **1** and the end cap (the rear bearing cap on cylinders with through piston rod (S2 / S20)).
- Remove the cushioning seal **3** from the bearing cap **1** and the end cap (the rear bearing cap on cylinders with through piston rod (S2 / S20)).



- Remove residues of the screw locking agent from the thread of the bearing cap **1** and the screwed insert.
- Clean the seat of the insert sleeve beneath the thread **1**.
- Apply a thin film of the grease contained in the wearing parts kit to the sliding surfaces of the cylinder bearing **2**.
If there is a grease reservoir in the cylinder bearing **3**, fill it 2/3 with the grease contained in the wearing parts kit.
- Clean the seat of the cushioning seal **5** and the O-ring **4**.



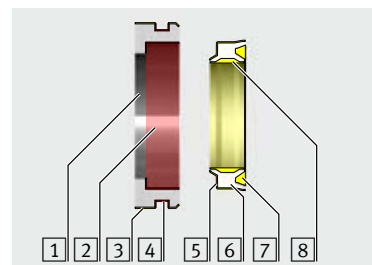
- Clean the seat of the wiper seal **2** and the O-ring **4** at the insert sleeve **1**.
- Grease the outside **3** of the insert sleeve **1**.
- Grease the new wiper seal **6** (one per bearing cap on cylinders with through piston rod (S2 / S20)) as follows:

Area	Other cylinders
5 Outer surface with insert sleeve	Thin film ¹⁾
7 Grease reservoir ²⁾ with bearing	Fill 2/3 with grease
8 Grease reservoir ²⁾ with piston rod	Fill 2/3 with grease

¹⁾ See section [5.2.2 "Thin grease film"](#)

²⁾ See section [5.2.3 "Grease reservoir"](#)

- Insert the greased wiper seal into the insert sleeve.



Note

Note the mounting direction (protruding sealing lip facing out, grease reservoir facing in).

- Apply the grease contained in the wearing parts kit to the new O-ring and insert it into the outer groove of the insert sleeve.
- Insert the insert sleeve into the bearing cap.



Note

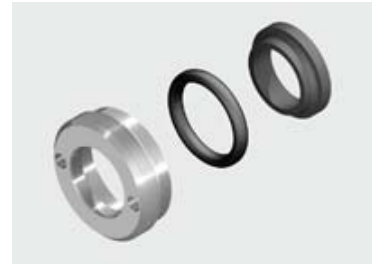
Note the mounting direction (chamfer facing the bearing cap).

- Apply the grease contained in the wearing parts kit to the excluder and O-ring and insert them both into the screwed insert.



Note

Note the mounting direction and sequence (O-ring between screwed insert and excluder).



- Screw the screwed insert into the bearing cap (the front and rear bearing caps on cylinders with through piston rod (S2 / S20)) and tighten it to the corresponding torque (see table).

Type	Torque
DNC-32	4 Nm
DNC-40	8 Nm
DNC-50	11 Nm
DNC-63	11 Nm
DNC-80	15 Nm
DNC-100	15 Nm



- Apply a thin film of the grease contained in the wearing parts kit to the cushioning seals on the front side with the sealing surface and insert them into the bearing cap and end cap (the rear bearing cap on cylinders with through piston rod (S2 / S20)).
- Apply the grease contained in the wearing parts kit to the new O-rings and insert them into the groove of the bearing cap and end cap (the rear bearing cap on cylinders with through piston rod (S2 / S20)).



- To protect the bearing and seals, place the appropriate sleeve on the thread of the piston rod to prevent damage.



Note

On cylinders with extended piston rod thread, the sleeve may not cover the thread completely. If this happens, an appropriate sleeve must be custom fabricated. See section 7.2 “Special tools” for information.

- Guide the bearing cap (both bearing caps on cylinders with through piston rod (S2 / S20)) over the sleeve onto the piston rod as far as the cylinder barrel.
- Place the end cap at the other end of the cylinder barrel.



- Apply the screw locking agent contained in the wearing parts kit to the screws.
- Fasten the screws through the bearing and end caps into the cylinder barrel.
- Align the bearing and end caps flush with the cylinder barrel.
- Tighten the screws to the appropriate torque (see table).



Type	Torque
DNC-32	7 Nm
DNC-40	7 Nm
DNC-50	13 Nm
DNC-63	13 Nm
DNC-80	35 Nm
DNC-100	35 Nm

- Perform a functional test as per the operating instructions (enclosed with the cylinder or can be called up on the Festo website (www.festo.com)) and commission the repaired cylinder.

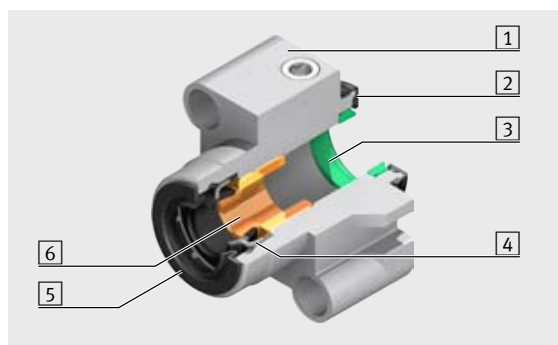
4.6 Repairing the cylinder DNC-...-R8

The description in this section can be used to repair cylinders of the type DNC-...-R8 with the following features:

Code	Description
P	Elastic cushioning discs
PPV	Adjustable pneumatic cushioning
A	Position sensing
S2	Through piston rod
...K2	Extended male piston rod thread

Code	Description
K3	Female piston rod thread
...K5	Special piston rod thread
K7	Piston rod with external hexagon
...K8	Extended piston rod

4.6.1 Structure of the bearing cap



- 1 Bearing cap
- 2 Cushioning disc
- 3 Cushioning seal (only on cylinders with adjustable cushioning PPV)
- 4 Piston rod seal with metal insert
- 5 Wiper seal
- 6 Bearing

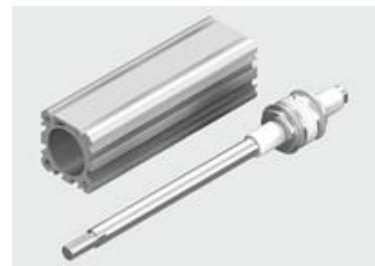
4.6.2 Removing the bearing and end caps

- Loosen the screws in the bearing and end caps (the rear bearing cap on cylinders with through piston rod (S2 / S20)) and remove them.
- Remove the bearing and end caps from the cylinder barrel and piston rod.



4.6.3 Replacing the piston components

- Pull the piston rod out of the cylinder barrel.
- Check the cylinder barrel and piston rod for damage.
The entire cylinder must be replaced if the cylinder barrel (particularly the bearing surface) is exhibiting significant damage.



- Unscrew the threaded coupling (the rear part of the piston rod on cylinders with through piston rod (S2 / S20)) from the piston rod.
- Remove the piston components from the piston rod, noting the sequence and alignment.
- Remove any residues of the screw locking agent from the thread of the piston rod and threaded coupling.
- Replace the components contained in the wearing parts kit and reassemble the piston components on the piston rod in the correct sequence.



- Apply the screw locking agent contained in the wearing parts kit to the inside of the threaded coupling (the rear part of the piston rod on cylinders with through piston rod (S2 / S20)) and screw it onto the piston rod with the corresponding torque (see table).



Type	Torque
DNC-32	9 Nm
DNC-40	20 Nm
DNC-50	30 Nm
DNC-63	45 Nm
DNC-80	60 Nm
DNC-100	60 Nm
DNC-125	170 Nm

4.6.4 Inserting the piston rod into the cylinder barrel

- Clean the inner surface of the cylinder barrel as described in section [5.1 “Cleaning”](#).
- Apply the grease contained in the wearing parts kit to the following parts:

Component	Greasing
Inner surface of cylinder barrel	Thin film ¹⁾
Surface of piston rod	Thin film ¹⁾
Piston seal lip rings	Thin film ¹⁾ on outside
Piston surface between lip rings (grease reservoir ²⁾)	Fill 2/3 with grease
Cushion piston	Thin film ¹⁾ on outside

¹⁾ See section [5.2.2 “Thin grease film”](#)

²⁾ See section [5.2.3 “Grease reservoir”](#)

- Place the piston flat on the front side of the cylinder barrel and insert the lip ring into the cylinder barrel by tilting and turning it slightly.

The sealing lip must not fold back against the inside of the piston.



Note

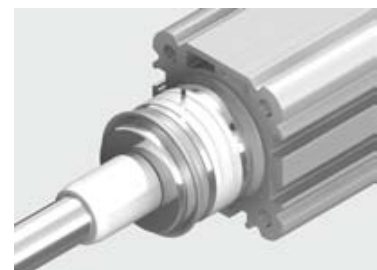
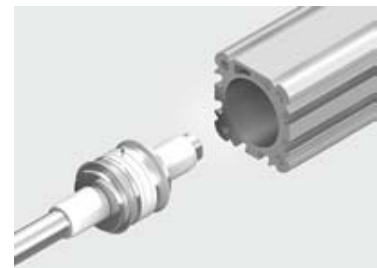
If necessary use a flat and blunt-edged object to insert the lip ring into the cylinder barrel.

- Insert the piston fully into the cylinder barrel.
- Push the piston far enough into the cylinder barrel that the first lip ring protrudes slightly at the other end of the cylinder barrel.
- Pull the piston rod back again until the piston is sitting fully in the cylinder barrel.



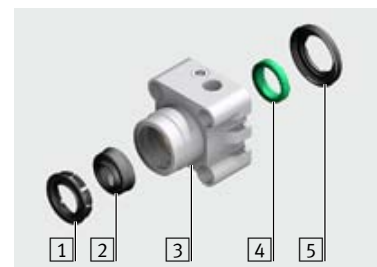
Note

This approach ensures that the sealing lips of the two lip rings sit correctly in the cylinder barrel.

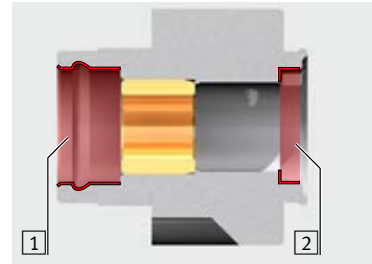


4.6.5 Repairing and attaching the bearing and end caps

- Remove the wiper seal **1** and the piston rod seal **2** from the bearing cap **3** (the front and rear bearing caps on cylinders with through piston rod (S2 / S20)).
- Remove the cushioning discs **5** from the bearing cap and end cap (the rear bearing cap on cylinders with through piston rod (S2 / S20)).
- **Only on cylinders with adjustable cushioning (PPV)**
Remove the cushioning seal **4** from the bearing cap and end cap (the rear bearing cap on cylinders with through piston rod (S2 / S20)).



- Clean the seats of piston rod seal **1**.
- **Only on cylinders with adjustable cushioning (PPV)**
Clean the seat of cushioning seal **1**.

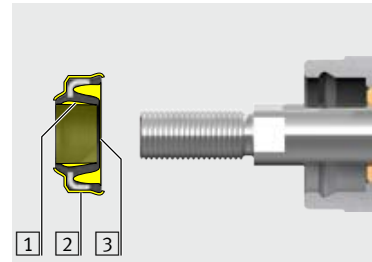


- Grease the new piston rod seal (one per bearing cap on cylinders with through piston rod (S2 / S20)) as follows:

Area	Greasing
1 Grease reservoir ¹⁾ with piston rod	Fill 2/3 with grease
2 External surface with bearing cap	Thin film ²⁾
3 Grease reservoir ¹⁾ with bearing	Fill 2/3 with grease

¹⁾ See section [5.2.3 “Grease reservoir”](#)

²⁾ See section [5.2.2 “Thin grease film”](#)



- Insert the piston rod seal into the bearing cap (both bearing caps on cylinders with through piston rod (S2 / S20)) using the appropriate insertion tool.



Note

Note the mounting direction (individual sealing lips facing out).
Note the mounting orientation on cylinders with square piston rod.



- Place the wiper seal on the piston rod seal (in both bearing caps on cylinders with through piston rod (S2 / S20)).



- **Only on cylinders with adjustable cushioning (PPV)**
Apply a thin film of grease to the new cushioning seals on the front side with the sealing surface and insert them into the bearing cap and end cap (the rear bearing cap on cylinders with through piston rod (S2 / S20)).
- Place the new cushioning discs on the bearing cap and end cap (the rear bearing cap on cylinders with through piston rod (S2 / S20)).



- To protect the bearing and seals, place the appropriate sleeve on the thread of the piston rod to prevent damage.



Note

On cylinders with extended piston rod thread, the sleeve may not cover the thread completely. If this happens, an appropriate sleeve must be custom fabricated. See section 7.2 “Special tools” for information.

- Guide the bearing cap (both bearing caps on cylinders with through piston rod (S2 / S20)) over the sleeve onto the piston rod as far as the cylinder barrel.
- Place the end cap at the other end of the cylinder barrel.
- Apply the screw locking agent contained in the wearing parts kit to the screws.
- Fasten the screws through the bearing and end caps into the cylinder barrel.
- Align the bearing and end caps flush with the cylinder barrel.
- Tighten the screws to the appropriate torque (see table).

Type	Torque
DNC-32	7 Nm
DNC-40	7 Nm
DNC-50	13 Nm
DNC-63	13 Nm
DNC-80	35 Nm
DNC-100	35 Nm
DNC-125	40 Nm



- Perform a functional test as per the operating instructions (enclosed with the cylinder or can be called up on the Festo website (www.festo.com)) and commission the repaired cylinder.

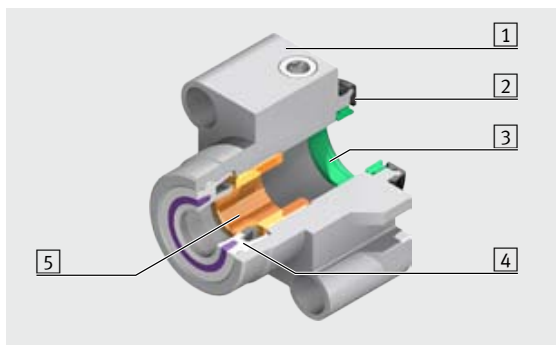
4.7 Repairing the cylinder DNC-...-A3

The description in this section can be used to repair cylinders of the type DNC-...-A3 with the following features:

Code	Description
P	Elastic cushioning discs
PPV	Adjustable pneumatic cushioning
A	Position sensing
Q	Square piston rod
S2	Through piston rod
S20	Through, hollow piston rod
...K2	Extended male piston rod thread

Code	Description
K3	Female piston rod thread
...K5	Special piston rod thread
K7	Piston rod with external hexagon
...K8	Extended piston rod
K10	Smooth anodised aluminium piston rod
R3	High corrosion protection

4.7.1 Structure of the bearing cap



- 1 Bearing cap
- 2 Cushioning disc
- 3 Cushioning seal
(only on cylinders with adjustable cushioning PPV)
- 4 Piston rod seal (PE)
- 5 Bearing

4.7.2 Removing the bearing and end caps

- Loosen the screws in the bearing and end caps (the rear bearing cap on cylinders with through piston rod (S2 / S20)) and remove them.
- Remove the bearing and end caps from the cylinder barrel and piston rod.



4.7.3 Replacing the piston components

- Pull the piston rod out of the cylinder barrel.
- Check the cylinder barrel and piston rod for damage.
The entire cylinder must be replaced if the cylinder barrel (particularly the bearing surface) is exhibiting significant damage.



- Unscrew the threaded coupling (the rear part of the piston rod on cylinders with through piston rod (S2 / S20)) from the piston rod.
- Remove the piston components from the piston rod, noting the sequence and alignment.
- Remove any residues of the screw locking agent from the thread of the piston rod and threaded coupling.
- Replace the components contained in the wearing parts kit and reassemble the piston components on the piston rod in the correct sequence.



- Apply the screw locking agent contained in the wearing parts kit to the inside of the threaded coupling (the rear part of the piston rod on cylinders with through piston rod (S2 / S20)) and screw it onto the piston rod with the corresponding torque (see table).

Type	Torque
DNC-32	9 Nm
DNC-40	20 Nm
DNC-50	30 Nm
DNC-63	45 Nm
DNC-80	60 Nm
DNC-100	60 Nm
DNC-125	170 Nm



4.7.4 Inserting the piston rod into the cylinder barrel

- Clean the inner surface of the cylinder barrel as described in section [5.1 “Cleaning”](#).
- Apply the grease contained in the wearing parts kit to the following parts:

Component	Greasing
Inner surface of cylinder barrel	Thin film ¹⁾
Surface of piston rod	Thin film ¹⁾
Piston seal lip rings	Thin film ¹⁾ on outside
Piston surface between lip rings (grease reservoir ²⁾)	Fill 2/3 with grease
Cushion piston	Thin film ¹⁾ on outside

¹⁾ See section [5.2.2 “Thin grease film”](#)

²⁾ See section [5.2.3 “Grease reservoir”](#)

- Place the piston flat on the front side of the cylinder barrel and insert the lip ring into the cylinder barrel by tilting and turning it slightly.

The sealing lip must not fold back against the inside of the piston.



Note

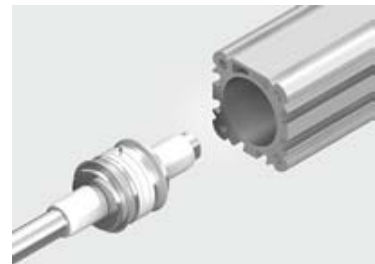
If necessary use a flat and blunt-edged object to insert the lip ring into the cylinder barrel.

- Insert the piston fully into the cylinder barrel.
- Push the piston far enough into the cylinder barrel that the first lip ring protrudes slightly at the other end of the cylinder barrel.
- Pull the piston rod back again until the piston is sitting fully in the cylinder barrel.



Note

This approach ensures that the sealing lips of the two lip rings sit correctly in the cylinder barrel.

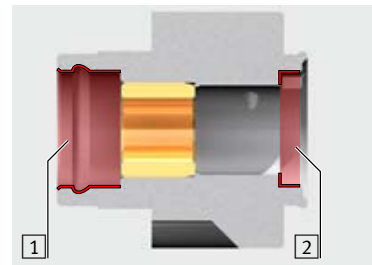


4.7.5 Repairing and attaching the bearing and end caps

- Remove the piston rod seal [1] from the bearing cap [2] (the front and rear bearing caps on cylinders with through piston rod (S2 / S20)).
- Remove the cushioning discs [4] from the bearing cap and end cap (the rear bearing cap on cylinders with through piston rod (S2 / S20)).
- Only on cylinders with adjustable cushioning (PPV)**
Remove the cushioning seal [3] from the bearing cap and end cap (the rear bearing cap on cylinders with through piston rod (S2 / S20)).



- Clean the seat of the piston rod seal [1].
- Only on cylinders with adjustable cushioning (PPV)**
Clean the seat of the cushioning seal [4].

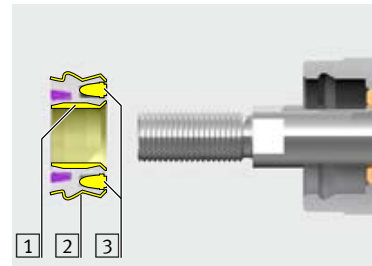


- Grease the new piston rod seal (one per bearing cap on cylinders with through piston rod (S2 / S20)) as follows:

Area	Greasing
[1] Grease reservoir ¹⁾ with piston rod	Fill 2/3 with grease
[2] External surface with bearing cap	Thin film ²⁾
[3] Grease reservoir ¹⁾ with bearing	Fill 2/3 with grease

¹⁾ See section [5.2.3 "Grease reservoir"](#)

²⁾ See section [5.2.2 "Thin grease film"](#)



Warning

Insert the piston rod seal into the bearing cap using the appropriate insertion sleeve as otherwise it may be damaged.

- Place the appropriate insertion sleeve on the bearing cap. The centring seat must be facing the bearing cap.
- Insert the piston rod seal into the bearing cap (both bearing caps on cylinders with through piston rod (S2 / S20)) using the appropriate insertion tool.



Note

Note the mounting direction (purple silicone ring facing out).
Note the mounting orientation on cylinders with square piston rod.



- **Only on cylinders with adjustable cushioning (PPV)**

Apply a thin film of grease to the new cushioning seals on the front side with the sealing surface and insert them into the bearing cap and end cap (the rear bearing cap on cylinders with through piston rod (S2 / S20)).

- Place the new cushioning discs on the bearing cap and end cap (the rear bearing cap on cylinders with through piston rod (S2 / S20)).



- To protect the bearing and seals, place the appropriate sleeve on the thread of the piston rod to prevent damage.



Note

On cylinders with extended piston rod thread, the sleeve may not cover the thread completely. If this happens, an appropriate sleeve must be custom fabricated. See section 7.2 “Special tools” for information.



- Guide the bearing cap (both bearing caps on cylinders with through piston rod (S2 / S20)) over the sleeve onto the piston rod as far as the cylinder barrel.
- Place the end cap at the other end of the cylinder barrel.
- Apply the screw locking agent contained in the wearing parts kit to the screws.
- Fasten the screws through the bearing and end caps into the cylinder barrel.
- Align the bearing and end caps flush with the cylinder barrel.
- Tighten the screws to the appropriate torque (see table).



Type	Torque
DNC-32	7 Nm
DNC-40	7 Nm
DNC-50	13 Nm
DNC-63	13 Nm
DNC-80	35 Nm
DNC-100	35 Nm
DNC-125	40 Nm

- Perform a functional test as per the operating instructions (enclosed with the cylinder or can be called up on the Festo website (www.festo.com)) and commission the repaired cylinder.

5 Cleaning and greasing

5.1 Cleaning

The seals are designed so that the lubricant film applied to them will be effective for the service life of the seal. In order for this so-called life-time lubrication to be retained, the cylinder must be thoroughly cleaned of all foreign particles, machining residues and old lubricants before the cylinders are greased.



Warning

Festo recommends Loctite 7063 and Loctite 7070 for cleaning.

When using other cleaning agents, make sure that they do not corrode the seals of the cylinder with piston rod. In case of doubt, check the resistance of the seals using the data on the Festo website (www.festo.com).

5.2 Greasing

The various components and seals of the cylinder with piston rod require different levels of greasing depending on a number of factors.



Warning

To guarantee the life-time lubrication, the piston rod with assembled piston and piston seals must be moved a number of times across the entire stroke of the cylinder barrel to produce an even lubricant film.

5.2.1 Extremely thin grease film

A barely continuous film of grease covers the bearing surface. The grease can give a sheen to the surface, however the colour of the grease must not darken it.

Recommendation:

Apply the grease using a cloth or similar dipped in the grease.

Remove the excess grease by drawing the respective seal system components over it once (e.g. by drawing the assembled piston with the piston rod once through the greased cylinder barrel fully) and then remove the excess on the seal components by wiping it off.

5.2.2 Thin grease film

A film of grease covers the bearing surface so that the grease colour darkens the surface slightly.

Recommendation:

Apply the grease with a soft brush or similar.

5.2.3 Grease reservoir

There is a defined quantity of oil enclosed between two sealing rims or in enclosed ring volumes.

6 Maintenance and care

Clean any dirt from the piston rod using a soft cloth.

All non-abrasive cleaning agents are permitted. Otherwise the cylinders do not require maintenance due to their service life lubrication. Regular removal of the lubricant on the surface of the piston rod reduces its service life.

7 Tools

This section provides an overview of the tools and aids required to repair the cylinder with piston rod.



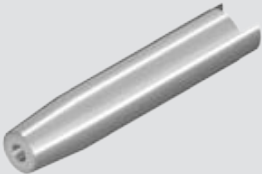
7.1 Standard tools

The following standard tools among others are required to repair the cylinder with piston rod:

- Screwdriver
- Wrench
- Flat pliers
- Torque wrench (see tables in the corresponding repair steps for values)
- Face pin wrench (only for cylinders with piston rod with the feature “TT” (low temperature))

7.2 Special tools

The following special tools are required to repair and service the cylinder with piston rod

Designation	Additional information	Reference	Photo
Push-in sleeve for piston rod seal	DNC-32	On request	
	DNC-40		
	DNC-50		
	DNC-53		
	DNC-80		
	DNC-100		
Insertion sleeve for piston rod seal (only for cylinders with seals for unlubricated operation (A3))	DNC-32		
	DNC-40		
	DNC-50		
	DNC-53		
	DNC-80		
	DNC-100		
Mounting sleeve for piston rod	DNC-32		
	DNC-40		
	DNC-50		
	DNC-53		
	DNC-80		
	DNC-100		
DNC-125			

¹⁾ See “Assembly aids” in the online spare parts catalogue on the Festo website (www.festo.com).

²⁾ Dimensional drawings for in-house production can be found on the Festo website (www.festo.com).

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1. Festo products are being continuously developed with regard to hardware and software. The hardware status and, where applicable, the software status of the product can be found on the name plate of the product. If the electronic documentation, in whatever form, is not supplied with the product, i. e. is not supplied on a portable data storage device (floppy disk, CD-ROM, removable disk), Festo does not guarantee that the electronic documentation corresponds to every hardware and software status of the product. In this case, the printed documentation from Festo accompanying the product alone is decisive for ensuring that the hardware and software status of the product matches that of the electronic documentation.
2. The information contained in this electronic documentation can be amended by Festo without prior notice and does not commit Festo in any way.

IV. Liability/Limitations of liability

1. Festo supplies this electronic documentation in order to assist the user in creating his machine and system documentation. In the case of electronic documentation that does not directly accompany a product in the form of portable data storage devices (floppy disk, CD-ROM, removable disk), i. e. that is not automatically supplied together with that product, Festo does not guarantee that the electronic documentation available/supplied separately matches the product actually used by the user.

The latter applies particularly to extracts of the documents for the user’s own documentation. The guarantee and liability for separately available/supplied data storage devices, i. e. except for the electronic documentation available via the Internet/Intranet, is limited exclusively to proper duplication of the software, whereby Festo guarantees that in each case the data storage device or software contains the latest update of the documentation. Concerning electronic documentation available on the Internet/Intranet, there is no guarantee that it will have the same version status as the last printed edition.

2. Furthermore, Festo cannot be held liable for the lack of economic success or for damage or claims by third parties resulting from the use of the documentation by the user, with the exception of claims arising from infringement of the protection rights of third parties concerning the use of the electronic documentation.
3. The limitations of liability as per paragraphs 1 and 2 do not apply if, in cases of intent or gross negligence or the lack of warranted quality, liability is compulsory. In such a case, Festo’s liability is limited to the damage discernable by Festo when the definitive circumstances are made known.

V. Safety guidelines/documentation

Warranty and liability claims in conformity with the aforementioned regulations (items III and IV) may be raised only if the user has observed the safety guidelines of the documentation in conjunction with the use of the machine and its safety guidelines. The user himself is responsible for ensuring that the electronic documentation, when not supplied with the product, matches the product actually used by the user.

Huber SE, DE-Berching

Date

Name : Unnamed

Changed By: ban

Date: 02.09.2016

Time: 10:57:20

ROLLING BEARING CALCULATION

Calculation Method: ISO 281:2007 and Manufacturer's Data - With constant a23-Factor (1.0)

General Data:

Speed (1/min)	1.000
Axial Force (N)	0.000
Necessary Lifespan(h)	500000.000

Rolling No. 1:

Bearing Type	SKF *22313 EK
Configuration	Spherical Roller Bearings
Load Bearing only Radial	
Radial Forces (N)	[Fr] 8500.000
Axial Forces (N)	[Fa] 0.000
Inside Diameter (mm)	[d] 65.000
External Diameter (mm)	[D] 140.000
Width (mm)	[B] 48.000
Dynamic Loading (kN)	[C] 357.000
Static Loading(kN)	[C0] 360.000
Speed Limit (Oil) (1/min)	[n.max] 5000
Dynamic Equipment Load (N)	[P] 8500.000
Static Equipment Load(N)	[P0] 8500.000
Rolling Frictional Moment (Nmm)	[Mrr] 11.463
Sliding Friction (Nmm)	[Msl] 515.593
Frictional Torque Seals (Nmm)	[Mseal] 0.000
Mseal by SKF-Main Catalogue 10000/1 EN:2013	
Friction Torque Flow Losses (Nmm)	[Mdrag] 0.000
Total Frictional Moment (Nmm)	[M] 527.056
Lifespan (h)	[Lh] 1000000.000
Safety Factor	[S0] 42.353

The frictional torque M is calculated according to data from the SKF catalogue 2013.

The coefficient for additives in lubricant mybl=0.15 is assumed.

End Protocol

Lines: 50

2/2-Way; 1/2"NPT-2"NPT; 2.8-140 PSI



Advantages/Benefits

- ▶ Less sensitive to dirty fluids and more corrosion resistant due to isolating diaphragm
- ▶ Long-life solenoid system
- ▶ High reliability
- ▶ Opening and closing times controlled by integrated flow control
- ▶ Lockable manual override is standard
- ▶ Waterhammer-free
- ▶ Wide range of cable plug options Type 2508

Design/Function

This valve offers a unique solution in brass or stainless steel for slightly contaminated, dirty and aggressive fluids.

This internally piloted solenoid valve incorporates a pivoting armature pilot. The pivoting armature, exclusive to Burkert valves, isolates the actuator from the fluid while providing increased system reliability.

Opening and closing times can be adjusted by integrated flow controls, which delay the pressure rise and drop above the diaphragm.

To simplify ordering, a wide selection of standard combinations can be ordered with one Item Number.

Cable plug options of Type 2508 are available to suit special electrical application requirements.

Options:

- **Normally open (N.O.)**
- **Diagnosis:**
Electrical feedback signaller

Applications

Fluids

- Neutral liquids up to 230 PSI
- Slightly contaminated and aggressive liquids

Applications

- Water/ sewage treatment
- Chemical processing
- Shipbuilding (centralized lubrication systems)
- Pollution control (filter systems)
- Drinking water systems
- Ceramic industry
- Offshore technology

Burkert Contromatic USA

2602 McGaw Avenue
Irvine, CA 92614
Tel. 949.223.3100
Fax 949.223.3198
www.burkert-usa.com

Burkert Contromatic Inc.

760 Pacific Road, Unit 3
Oakville, Ontario, Canada
L6L 6M5
Tel. (905) 847 5566
Fax (905) 847 9006

burkert
Easy Fluid Control Solutions

Solenoid Valve – Aggressive Fluids

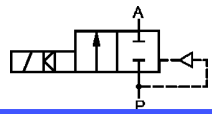
Type 5282

General Purpose

Technical Data

Circuit Function – A

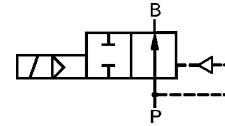
A – 2/2-way, normally closed, with 3-way pilot control



Symbol

Circuit Function – B

B – 2/2-way, normally open, with 3-way pilot control (on request)



Symbol

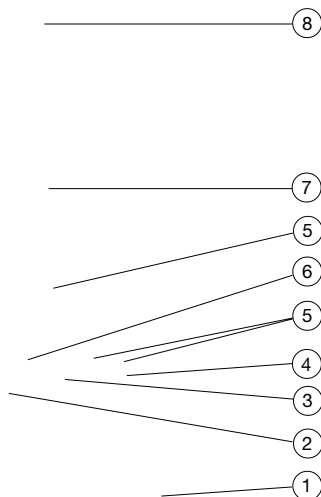
Operating Data (Valve)

Pressure range	2.8-140 PSI
Port connection	1/2" NPT - 2" NPT
Fluid	NBR (32°F to 194°F): Neutral fluids e.g. compressed air, water, oils and fat without additives.
	FPM (Viton) (32°F to 194°F): Per-solutions, hot oils, oils with additives.
Max. ambient temperature	131°F
Max. viscosity	21 cSt
Response times	opening: 0.1-0.8 s ¹⁾ closing: 1.0-4.0 s ¹⁾ <small>¹⁾Depends on orifice, fluid pressure and viscosity.</small>
Installation	As required, but preferably with solenoid system upright.

Operating Data (Actuator)

Operating voltages	AC 24 V/60 Hz AC 120, 240 V/60 Hz DC 24 V
Voltages tolerance	±10%
Power consumption	
Voltage (AC)	Inrush: 21 VA Hold: 12 VA/8 W
Voltage (DC)	Inrush and hold: 8 W
Duty cycle	100% continuously rated
Cycling rate	10-50 c.p.m.
Coil insulation class	U.L. Recognized, or U.L. Listed:
	Class H - Molded
Rating with cable plug	NEMA 4, IP 65
Electrical connection	Delivery standard: Cable plug DIN 43 650 A, 0-250 V (Other versions see accessories).
Agency approval	U.L. Recognized, U.L. Listed FM Class I, Div 1, Group A, B, C, D

Materials

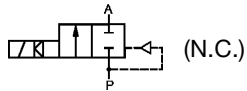



1 Valve body:	Brass, 316L Stainless Steel
2 Diaphragm support:	Brass, 316L Stainless Steel
3 Diaphragm:	NBR, FPM (Viton)
4 Cover:	Brass, 316L Stainless Steel
5 O-rings:	NBR, FPM (Viton)
6 Spring:	301 Stainless Steel
7 Coil:	Epoxy
8 Cable plug:	Polyamide

PROVIDE 316L STAINLESS STEEL

General Purpose

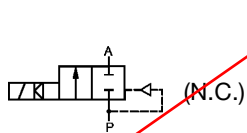
Specifications - Ordering Chart (Other Versions on Request)




U.L. Recognized 
with standard-cable plug
0-250 V AC/DC

Brass Body; NBR Seal; Temperature Range 32°F to 194°F

Port connection [Inch]	Orifice [inch]	Cv-value	Pressure Range [PSI]	Seal material	Weight [lbs.]	Item Number			
						Voltage / Frequency [V/Hz]			
						24/DC	24/60	120/60	240/60
1/2" NPT	1/2	4.66	2.8- 140	NBR	2.1	456 890 U	456 891 R	456 892 J	456 893 K
3/4" NPT	3/4	5.83	2.8- 140	NBR	3.1	456 894 L	456 895 M	456 896 N	456 897 P
1" NPT	1	11.65	2.8- 140	NBR	4.1	456 898 Y	456 899 Z	456 900 E	456 901 T
1 1/4" NPT	1 1/4	23.30	2.8- 140	NBR	5.7	456 902 U	456 903 V	456 904 W	456 905 X
1 1/2" NPT	1 1/2	23.30	2.8- 140	NBR	6.7	456 906 Y	456 907 Z	456 908 A	456 909 B
2" NPT	2	46.60	2.8- 140	NBR	11.3	456 910 X	456 911 L	456 912 M	456 913 N



STAINLESS STEEL BODY - IS THIS THE CORRECT CHART?

U.L. Recognized 
with standard-cable plug
0-250 V AC/DC

Stainless Steel Body; FPM (Viton) Seal; Temperature Range 32°F to 194°F

Port connection [Inch]	Orifice [inch]	Cv-value	Pressure Range [PSI]	Seal material	Weight [lbs.]	Item Number			
						Voltage / Frequency [V/Hz]			
						24/DC	24/60	120/60	240/60
1/2" NPT	1/2	4.66	2.8- 140	FKM	2.1	456 914 P	456 915 Q	456 916 R	456 917 J
3/4" NPT	3/4	5.83	2.8- 140	FKM	3.1	456 918 T	456 919 U	456 920 Z	456 921 N
1" NPT	1	11.65	2.8- 140	FKM	4.1	456 922 P	456 923 Q	456 924 R	456 925 J
1 1/4" NPT	1 1/4	23.30	2.8- 140	FKM	5.7	456 926 K	456 927 L	456 928 V	456 929 W
1 1/2" NPT	1 1/2	23.30	2.8- 140	FKM	6.7	456 930 T	456 931 Q	456 932 R	456 933 J
2" NPT	2	46.60	2.8- 140	FKM	11.3	456 934 K	456 935 L	456 936 M	456 937 N


Note:

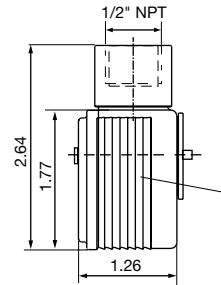
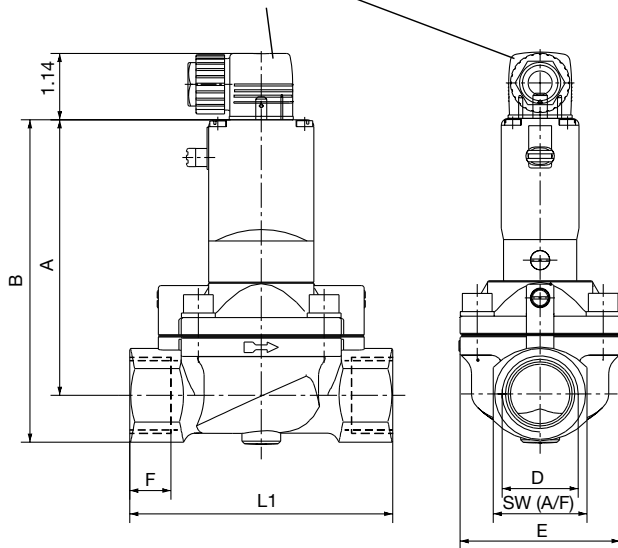
U.L. Listed


FM approval available on request

General Purpose

Dimensions [inch]

 U.L. Recognized with standard-cable plug Type 2508 (0-250 V AC/DC)



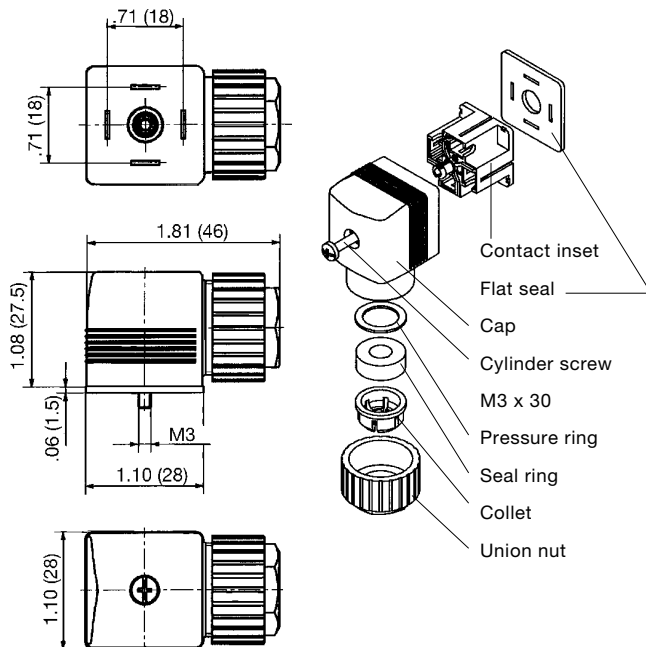
 U.L. Listed with conduit-plug Type 1053 (0-250 V AC/DC)

Variable Dimensions [inch]

Port-connection D	Orifice [inch]	A	B	F	E	L1	SW (A/F)
1/2" ¹⁾ NPT	1/2	4.29	4.85	0.53	1.58	2.56	1.06
1/2" ²⁾ NPT	3/4	4.53	5.16	0.53	2.36	3.94	1.26
3/4" NPT	3/4	4.53	5.16	0.55	2.36	3.94	1.26
1" NPT	1	4.75	5.56	0.66	2.76	4.53	1.62
1 1/4" NPT	1 1/4	4.81	5.79	0.68	3.35	4.96	1.97
1 1/2" NPT	1 1/2	4.96	6.15	0.68	3.35	4.96	2.36
2" NPT	2	5.61	6.99	0.69	4.53	6.46	2.76

¹⁾Only brass ²⁾Only stainless steel

Dimensions Accessories [inch (mm)]



Transparent cap, when wired with LED.

Ordering Chart for Accessories

Device/Accessory	Features	Item-No.
Cable-plugs¹⁾ Type 2508	Standard cable plug, 0–250 V AC/DC (standard-delivery) ¹⁾	008 376 N
	with LED, 12–24 V AC/DC	008 360 S
	with LED, 100–120 V AC/DC	008 361 P
	with LED + varistor, 12–24 V AC/DC	008 367 M
	with LED + varistor, 100–120 V AC/DC	008 368 W
	with LED + varistor, 200–240 V AC/DC	008 369 X

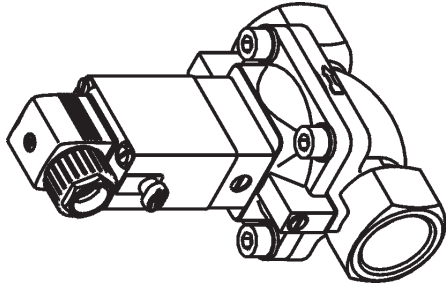
¹⁾ The standard cable plug (0-250 V AC/DC), Order-No. 008 376 N is part of the standard delivery.
Order optional cable plugs using separate item no.

For additional cable plug selections, see data sheet Type 2508

Type 5282

Operating instructions

2/2-way solenoid valve with servo-membrane



bürkert
Fluid Control Systems

Safety



Proper Usage



To ensure the proper function of the device and promote long service life, you must comply with the information in these Operating Instructions and the application conditions and specifications provided in the Type 5282 Data Sheet. Usage of the device in a manner that is contrary to these Operating Instructions or the application conditions and specifications provided in the Type 5282 Data Sheet is improper and will void your warranty. This device serves exclusively as a 2/2-way solenoid valve for the media stated to be permissible on the data sheet. Any other use is considered improper use. **Bürkert will not be responsible for any improper use of the device.**



ATTENTION!

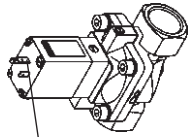
- Be sure to observe generally accepted safety rules when planning, installing and using this device. For example, take suitable measures to prevent unintentional operations of the device.
- Do not impair the operation of the device.
- Do not attempt to detach or unscrew any lines or valves in the system that are under pressure, and always be sure to switch off the voltage supply before working on the system.
- When attaching the coil to the plug socket, be sure the seal is properly seated.
- Never adjust the screws which are sealed with red paint, for any reason!
- For explosion-proof models, data from the conformity certificate PTB No. Ex-89.C.1041 must also be complied with!
- Do not touch the coil during use as it becomes very hot.

WARNING!

Safety

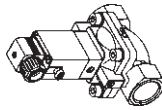
①

Voltage-free assembly



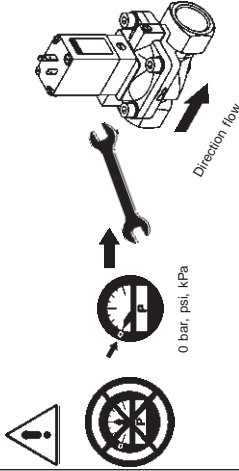
②

Electrical connection



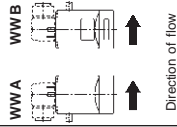
Safety

③ Fluid connection



④

Conversion from Function A to Function B



Technical Data

Temperature



Messing/brass

Temp.

Working material - Maximum
 NBR 0... +80 °C
 EPDM -30 .. +80 °C
 FPM -10 .. + 50 °C

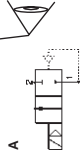
Nominal size

Circuit function

Type

burkert
 MADE IN GERMANY
 5282 A 13,0 FPM MS
 PN 0,2 -10 bar
 24V 50-60Hz 8W
450000 Y
 WW141A

Example



Id. No.



Voltage ($\pm 10\%$) - Frequency - Power
 Nominal pressure

We reserve the right to make technical changes without notice

BÜRKERT GERMANY

Chr.-Bürkert-Straße 13-17
74653 Ingelfingen
Ph: (0 79 40) 10-0
Fax: (0 79 40) 10-204

Berlin
Dortmund
Dresden
Frankfurt
Hannover
München
Stuttgart

Ph: (0 30) 67 97 17 - 0
Ph: (0 23 73) 96 81 - 0
Ph: (03 59 52) 36 30 - 0
Ph: (0 61 03) 94 14 - 0
Ph: (05 11) 9 02 76 - 0
Ph: (0 89) 82 92 28 - 0
Ph: (07 11) 4 51 10 - 0

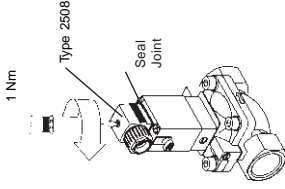
BÜRKERT INTERNATIONAL

A	Ph.	(01 894) 13 33	Fax	(01 894) 13 00
AUS	Ph.	(02 96 74) 61 66	Fax	(02 96 74) 61 67
B	Ph.	(03 325) 61 61	Fax	(03 325) 61 61
CDN	Ph.	(9005) 847 55 66	Fax	(9005) 847 90 06
CH	Ph.	(041) 785 66 66	Fax	(041) 785 66 33
CN	Ph.	(0512) 808 19 16	Fax	(0512) 824 51 06
CZ	Ph.	(0641) 22 61 80	Fax	(0641) 22 61 81
DK	Ph.	(044) 50 75 00	Fax	(044) 50 75 75
E	Ph.	(093) 371 08 58	Fax	(093) 371 77 44
F	Ph.	(01 48 10) 31 10	Fax	(01 48 91 90) 93
GB	Ph.	(01453) 73 13 53	Fax	(01453) 73 13 43
HKG	Ph.	(02 24 80) 12 02	Fax	(02 24 18 19) 45
I	Ph.	(02 95 90) 71	Fax	(02 95 90 72) 51
IRE	Ph.	(021) 861 33 36	Fax	(021) 86 13 37
J	Ph.	(03) 53 05 36 10	Fax	(03) 53 05 36 11
KOR	Ph.	(02) 34 62 55 92	Fax	(02) 34 62 55 94
MAL	Ph.	(04) 65 764 49	Fax	(04) 65 721 06
N	Ph.	(063) 84 44 10	Fax	(063) 84 44 55
NL	Ph.	(0346) 58 10 10	Fax	(0346) 56 37 17
NZ	Ph.	(09) 570 25 39	Fax	(09) 570 25 73
PL	Ph.	(022) 827 29 00	Fax	(022) 6 27 47 20
RC	Ph.	(02) 27 58 31 99	Fax	(02) 27 58 24 99
S	Ph.	(040) 664 51 00	Fax	(040) 664 51 01
SA	Ph.	(011) 397 29 00	Fax	(011) 397 44 28
SF	Ph.	(09) 54 97 06 00	Fax	(09) 503 12 75
SIN	Ph.	383 26 12	Fax	383 26 11
TR	Ph.	(0232) 459 53 95	Fax	(0232) 459 76 94
USA	Ph.	(0949) 223 31 00	Fax	(0949) 223 31 98

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info@de.buerkert.com

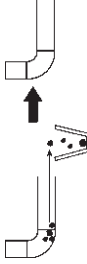
Assembly

① Instrument socket

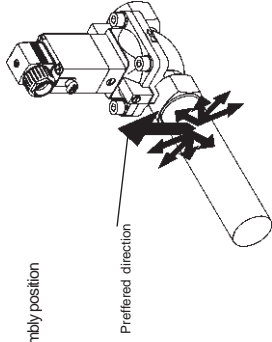


⚠ Always connect the protective

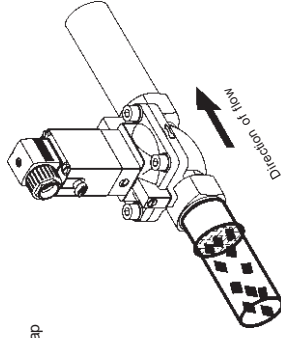
② Cleaning the pipeworks



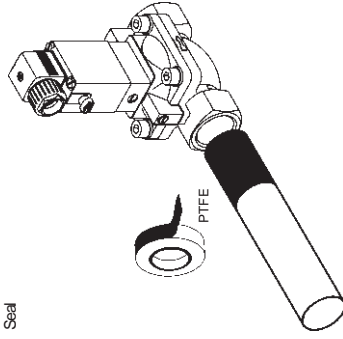
③ Any assembly position

**Assembly**

④ Dirt trap



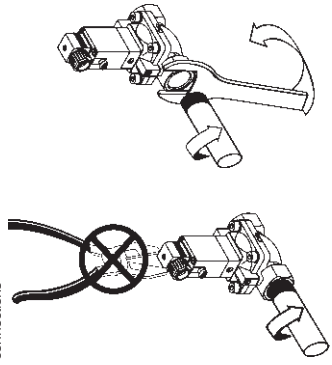
⑤ Seal



Assembly

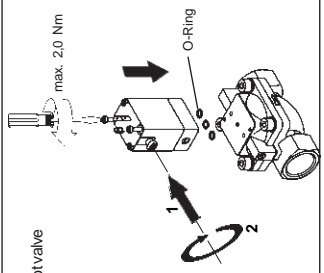
- ⑥

Screwing in the pipe connections



- ⑦

Assembly of pilot valve

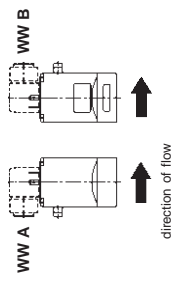


Manual locking

Assembly

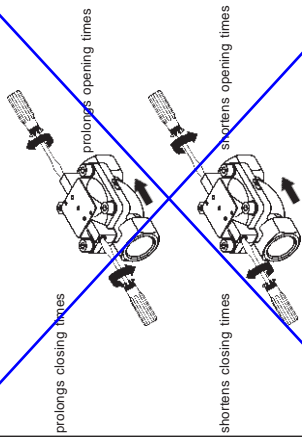
- ⑧

Configuration of the pilot control



- ⑧

Opening and dosing times



Do not move screws that are locked with red paint!

Troubleshooting



Check the voltage!



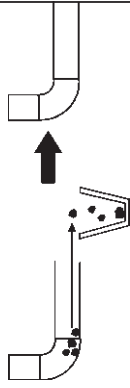
Check the pressure!



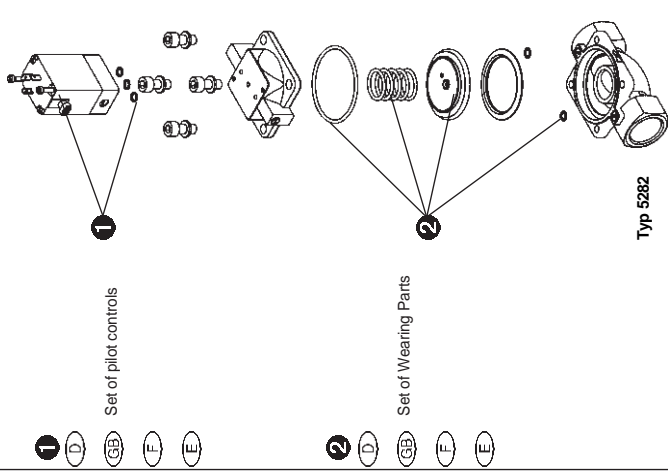
bar, psi, kPa



Check the pipework!



Spare parts



1

D

GB

F

E

2

D

GB

F

E

Typ 5282

Spare parts

1 Set of pilot controls			
Sealing material	Voltage	Order no.	
NBR	24 V/DC	138 109 A	138 117 R
NBR	24 V/56 Hz	138 112 L	138 114 N
NBR	110 V/56 Hz	138 111 K	138 115 P
NBR	230 V/56 Hz	138 110 W	138 116 Q
FPM	24 V/DC	138 120 Y	138 129 V
FPM	24 V/56 Hz	138 122 N	138 124 Q
FPM	110 V/56 Hz	138 123 P	138 126 J
FPM	230 V/56 Hz	138 118 S	138 125 R
EPDM	24 V/DC	138 100 D	138 106 X
EPDM	24 V/56 Hz	138 095 P	138 104 V
EPDM	110 V/56 Hz	138 096 Q	138 103 U
EPDM	230 V/56 Hz	138 097 R	138 101 S
1 Set of pilot controls			
NBR	24 V/DC	138 109 A	-
NBR	24 V/56 Hz	138 112 L	-
NBR	110 V/56 Hz	138 111 K	-
NBR	200 V/56 Hz	138 107 T	-
NBR	230 V/56 Hz	138 110 W	-
FPM	24 V/DC	-	138 129 V
FPM	24 V/56 Hz	-	138 124 Q
FPM	100 V/56 Hz	-	138 128 U
FPM	110 V/56 Hz	-	138 126 J
FPM	200 V/56 Hz	-	138 127 K
FPM	230 V/56 Hz	-	138 125 R

1 Set of pilot controls

Sealing material

Voltage

Order no.

1 Set of pilot controls

2 Set of Wearing Parts

DN


Sealing material

Order no.

SPRAY BAR PROXIMITY SENSOR
(2x) NAMUR NG5003

APPENDIX INFORMATION

Inductive sensors

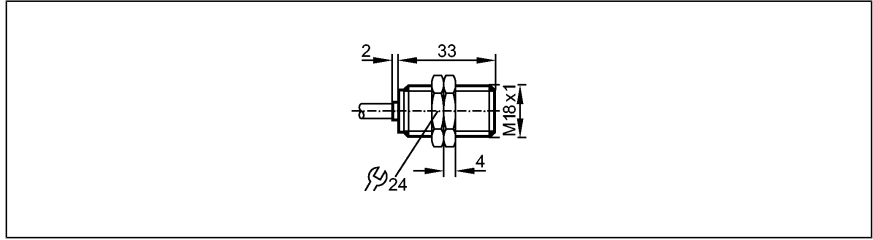
NAMUR EN 60947-5-6 

NG5003

IG-2008-N/1D/2G
Inductive sensor
Plastic thread M18 x 1
Cable







ATEX approval
Group II, category 1D
Group II, category 1G/2G

Sensing range 8mm [nf]
non-flush mountable



Made in Germany

Electrical design	
Output	
Nominal voltage	[V]
Supply voltage	[V]
Current rating	[mA]
Current consumption	[mA]
Internal capacitance	[nF]
Internal inductance	[μH]
Real sensing range (Sr)	[mm]
Switch-point drift	[% of Sr]
Hysteresis	[% of Sr]
Switching frequency	[Hz]
Correction factors	
Ambient temperature	[°C]
Protection	
Shock / vibration resistance	
EMC	
Approval	
Marking of the unit	
Housing materials	
Connection	
Weight	[kg]
Remarks	
Accessories (included)	

Connection to certified intrinsically safe circuits with the max. values U = 15 V / I = 50 mA / P = 120 mW normally closed	
	8.2 DC (1kΩ)
	7.5...30 DC when used outside the hazardous area
	< 30 when used outside the hazardous area
	< 1 *)
	< 155
	< 50
	8 ± 10 %
	-10...10
	1...15
	300
	mild steel = 1 / stainless steel approx. 0.7 / brass approx. 0.5 / Al approx. 0.4 / Cu approx. 0.3
	-20...80
	IP 67, II
	30g (11 ms) / 10-55 Hz (1 mm)
	EN 60947-5-6
	PTB 01 ATEX 2191 BVS 04 ATEX E153 TIIS TC16108
	 II 1D Ex iaD 20 T 90°C Ta: -20...70°C
	 II 1D Ex iaD 20 T 100°C Ta: -20...80°C
	 II 1G Ex ia IIB T6 Ta: -20...55°C
	 II 1G Ex ia IIB T5 Ta: -20...65°C
	 II 2G Ex ia IIC T6 Ta: -20...70°C
	 II 2G Ex ia IIC T5 Ta: -20...80°C
	PBT
	PVC cable / 2 m; 2 x 0.5 mm ²
	0.148
	*) damped; (> 2.1 mA undamped)
	2 lock nuts

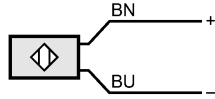
NG5003

Wiring

Core colors

BN brown

BU blue



SPRAY BAR NOZZLES

LECHLER SERIES 632

APPENDIX INFORMATION



Flat fan nozzles

- Belt cleaning
- Coating
- Steam cleaning
- Degreasing
- High pressure cleaning
- Gravel washing
- Cooling
- Surface treatment
- Phosphating
- Rain curtains
- Foam control
- Foam spraying
- Lubrication
- Filter cleaning
- Spray cleaning
- Washing processes
- and many others...



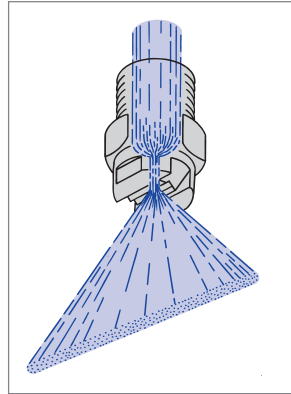
Flat fan nozzles

Lechler flat fan nozzles stand for uniform liquid distribution and jet pressures. Particularly powerful jets are generated with spray angles up to 60°. Nozzles with small flow rates are especially suited for humidifying and spraying in general. The flow geometry of the nozzle allows to produce accurate, compact jets, available with different liquid distribution patterns.

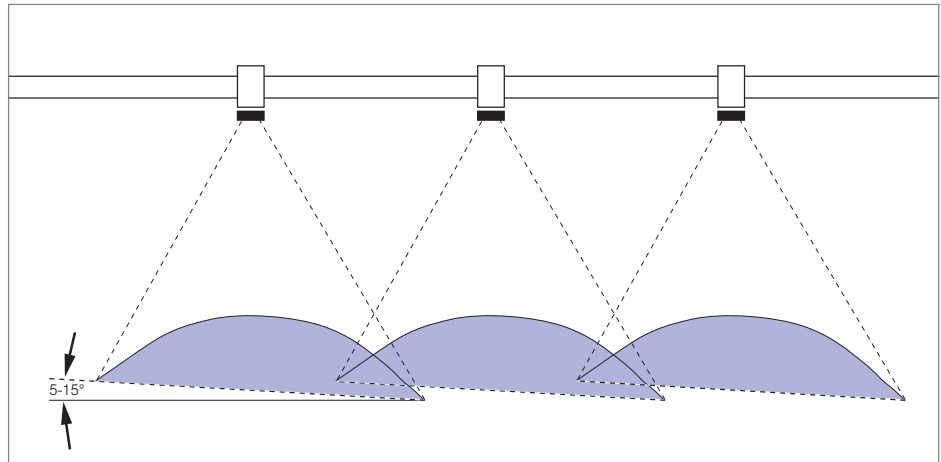
Basically, Lechler flat fan nozzles are designed for parabolic liquid distribution. Unaffected by transient pressures, they are suited for universal application. Their performance data are exactly defined. Operational values, such as flow rates, spray width, jet thickness and liquid distribution are readily available for a great variety of feed pressures. There are also special-design nozzles with rectangular or trapezoidal distribution of liquid.

Simple and cost-saving fixing attachments, as for instance dove-tail guides and eyelet clamps, considerably facilitate assembling and aligning of the nozzles.

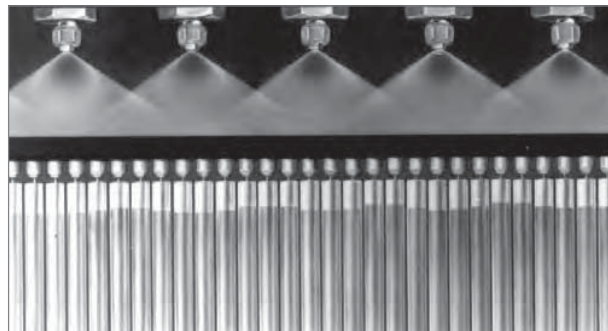
For all cleaning operations, in steelmaking and in many other fields of surface treatment, in short, wherever powerful, uniform water jets are required, Lechler flat fan nozzles constitute a decisive basis for achieving reliable process results.



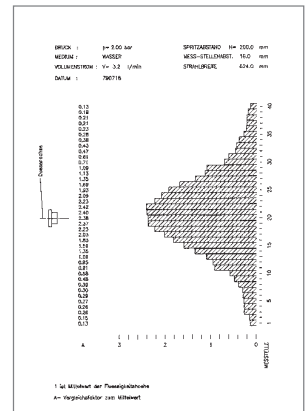
The **tongue-type nozzle** design represents a special kind of flat fan nozzle. With this nozzle type, the flat fan spray pattern is produced by a solid stream, impinging upon and deflecting from an outside deflector plate. As a result, a powerful, sharply delimited flat jet is shaped. The deflector plate has the form of a tongue, which determines the spray angle formation. Due to large free cross-sections, tongue-type nozzles are particularly clog-proof.



Arrangement of nozzles



Total liquid distribution



Liquid distribution single nozzle



Flat fan nozzles

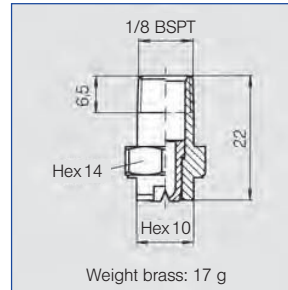
Series 632



Standard design with conical, self-sealing thread connection. Stable spray angle. Uniform, parabolical distribution of liquid. Spray pipes equipped with these nozzles show an extremely uniform total distribution of liquid.

Applications:

Spray cleaning, surface treatment, filter cleaning, belt cleaning, lubricating, coating.





Flat fan nozzles

Series 632



Spray angle	Ordering no.						A Ø [mm]	E Ø [mm]	V̇ [l/min]							Spray width B at p = 2 bar	
	Type	Material-no.				Code			p [bar]								
		16	17	30	5E				[US gal./min] at 40 psi								
		1.4305/303 SS	1.4571/316 SS	Brass	PVDF				1/8 BSPT	1/4 BSPT	0,5	1,0	2,0	3,0	5,0	10,0	H=250 mm
60°	632.304	○	○	○	○	CA CC	0,70	0,40	0,16*	0,23*	0,32	0,10	0,39	0,51	0,72	215	425
	632.334	○	○	○	○	CA CC	0,90	0,50	0,22*	0,32*	0,45	0,14	0,55	0,71	1,01	220	440
	632.364	○	○	○	○	CA CC	1,00	0,60	0,31*	0,44*	0,63	0,20	0,77	1,00	1,40	230	460
	632.404	○	○	○	○	CA CC	1,20	0,80	0,50*	0,71	1,00	0,31	1,23	1,58	2,24	245	485
	632.444	○	○	○	○	CA CC	1,35	0,90	0,62*	0,88	1,25	0,39	1,53	1,98	2,80	255	495
	632.484	○	○	○	○	CA CC	1,50	1,00	0,80*	1,13	1,60	0,50	1,96	2,53	3,58	260	510
	632.514	○	○	○	○	CA CC	1,65	1,10	0,95*	1,34	1,90	0,59	2,33	3,00	4,25	270	520
	632.564	○	○	○	○	CA CC	2,00	1,30	1,25	1,77	2,50	0,78	3,06	3,95	5,59	280	535
	632.604	○	○	○	○	CA CC	2,20	1,50	1,58	2,23	3,15	0,98	3,86	4,98	7,04	290	550
	632.644	○	○	○	-	CC	2,50	1,60	2,00	2,83	4,00	1,24	4,90	6,33	8,94	295	565
	632.674	○	○	○	-	CC	2,70	1,80	2,38	3,36	4,75	1,47	5,82	7,51	10,62	300	575
	632.724	○	○	○	-	CC	3,00	2,10	3,15	4,46	6,30	1,95	7,72	9,96	14,09	305	590
	632.764	○	○	○	-	CC	3,50	2,30	4,00	5,66	8,00	2,48	9,80	12,65	17,89	310	595
	632.804	○	-	○	-	CC	4,00	2,60	5,00	7,07	10,00	3,10	12,25	15,81	22,36	310	595
	632.844	○	-	○	-	CC	4,50	3,00	6,25	8,84	12,50	3,88	15,31	19,76	27,95	310	590
632.884	○	-	○	-	CC	5,00	3,40	8,00	11,31	16,00	4,96	19,60	25,30	35,78	300	570	
632.944	-	-	○	-	CC	5,70	4,40	11,20	15,84	22,40	6,95	27,43	35,42	50,09	300	570	
75°	632.145	○	-	○	-	CA CC	0,16	0,30	-	0,04*	0,05	0,02	0,06	0,08	0,11	280	550
	632.165	○	-	○	-	CA CC	0,20	0,34	-	0,05*	0,07	0,02	0,08	0,10	0,15	290	560
	632.185	○	-	○	-	CA CC	0,35	0,20	-	0,06*	0,08*	0,02	0,10	0,13	0,18	300	575
	632.215	○	-	○	-	CA CC	0,40	0,20	-	0,08*	0,11	0,03	0,14	0,18	0,25	300	580
	632.245	○	-	○	-	CA CC	0,50	0,30	-	0,12*	0,16*	0,05	0,20	0,26	0,36	310	585
	632.275	○	-	○	-	CA CC	0,60	0,30	0,11*	0,16*	0,22	0,07	0,27	0,35	0,49	310	590
90°	632.216	○	-	○	-	CA CC	0,40	0,20	-	0,08*	0,11*	0,03	0,14	0,18	0,25	370	700
	632.276	○	-	○	-	CA CC	0,60	0,30	0,11*	0,16*	0,22	0,07	0,27	0,35	0,49	375	720
	632.306	○	○	○	○	CA CC	0,70	0,40	0,16*	0,23*	0,32	0,10	0,39	0,51	0,72	380	740
	632.336	○	○	○	○	CA CC	0,90	0,50	0,22*	0,32*	0,45	0,14	0,55	0,71	1,01	415	800
	632.366	○	○	○	○	CA CC	1,00	0,50	0,31*	0,44*	0,63	0,20	0,77	1,00	1,41	420	810
	632.406	○	○	○	○	CA CC	1,20	0,70	0,50*	0,71	1,00	0,31	1,23	1,58	2,24	430	820
	632.446	○	○	○	○	CA CC	1,35	0,80	0,62*	0,88	1,25	0,39	1,53	1,98	2,80	435	830
	632.486	○	○	○	○	CA CC	1,50	0,80	0,80*	1,13	1,60	0,50	1,96	2,53	3,58	440	835
	632.516	○	○	○	○	CA CC	1,65	0,90	0,95*	1,34	1,90	0,59	2,33	3,00	4,25	440	840
	632.566	○	○	○	○	CA CC	2,00	1,10	1,25	1,77	2,50	0,78	3,06	3,95	5,59	445	850
	632.606	○	○	○	○	CA CC	2,20	1,20	1,58	2,23	3,15	0,98	3,86	4,98	7,04	450	860
	632.646	○	○	○	-	CC	2,50	1,30	2,00	2,83	4,00	1,24	4,90	6,33	8,94	455	865
	632.676	○	○	○	-	CC	2,70	1,40	2,38	3,36	4,75	1,47	5,82	7,51	10,62	465	875
	632.726	○	○	○	-	CC	3,00	1,70	3,15	4,46	6,30	1,95	7,72	9,96	14,09	470	885
	632.766	○	○	○	-	CC	3,50	1,90	4,00	5,66	8,00	2,48	9,80	12,65	17,89	475	890
632.806	○	-	○	-	CC	4,00	2,40	5,00	7,07	10,00	3,10	12,25	15,81	22,36	480	900	
632.886	○	-	○	-	CC	5,00	3,10	8,00	11,31	16,00	4,96	19,60	25,30	35,78	480	910	

A = Equivalent bore diameter · E = narrowest free cross section
 *Differing spray pattern
 Subject to technical modifications.

Continued on next page.

The folded page at the end of the catalogue will give you a survey on the various assembly possibilities. For complete assembly accessories, please refer to „Accessories“.

Example Type + Material no. + Code = Ordering no.
 for ordering: 632.304. + 16 + CA = 632.304.16.CA

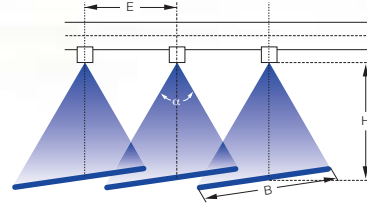
Conversion formula for the above series: $\dot{V}_2 = \dot{V}_1 \cdot \sqrt{\frac{p_2}{p_1}}$



Examples for nozzle arrangement.

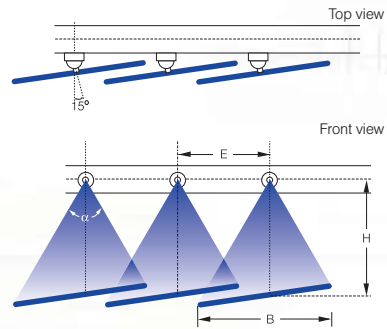
Arrangement of flat fan nozzles with parabolic liquid distribution

Lechler flat fan nozzles provide a consistent, uniform coverage over the impact area. For this purpose, the spray widths B ought to overlap each other by $1/3$ to $1/4$. To avoid interferences of the sprays, the nozzle orifices must be offset 5° - 15° to the pipe axis.



Alignment of tongue-type Nozzles

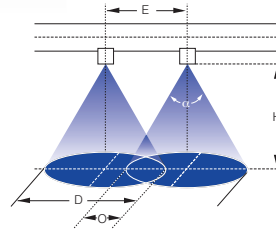
Lechler tongue-type nozzles have a rectangular liquid distribution. In order to achieve an even surface coverage the nozzles need to be aligned in such a way that spray widths B overlap by 50%. Therefore the nozzles should be inclined in an angle of 15° to the vertical of the horizontal axis of the tube (either with a weld base at an angle or a Lechler ball joint nozzle mount) in order to prevent a disturbance of the spray.



Arrangement of full cone and hollow cone nozzles

For full cone and hollow cone nozzles, the distance E should be sized so that the spray cones overlap by about $1/3$ to $1/4$.

- O = Overlap of spray angles
- D = Spray diameter
- E = Nozzle distance
- H = Installation distance of nozzles
- α = Spray angle



Square or offset arrangement of full cone or hollow cone nozzles

Square arrangement

Nozzle distance: $E = \frac{D}{\sqrt{2}}$

Overlap: $O = D - E$

Offset arrangement

Nozzle distance: $E_1 = \frac{D}{2} \times \sqrt{3}$

Nozzle distance: $E_2 = \frac{3}{4} D$

Overlap: $O = D - E_1$



**Aberdeen, ID WWTP
Submittal**

June 12, 2023

Equipment: VeloBlend Model: VM-3P-600-D-0-A-1

Sales Order #: 8472

VeloDyne Contact: Project Manager
Cooper Ashton
303-530-3298 x239
cashton@velodynesystems.com

Manufacturer's Representative: Huber Technology
Christian Primm
7040-990-2433
christian.primm@hhusa.net

**Velocity Dynamics, LLC (VeloDyne)
543 S. Pierce Ave.
Louisville, CO 80027
303-530-3298
www.velodynesystems.com**

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Section 1

Company Information

Company History

VeloDyne... a history in chemical feed equipment:

VeloDyne's history dates back to 1985 when Paul Plache, the company's founder, began his career in the polymer equipment industry as an owner and technical director of Fluid Dynamics, Inc. Since then, Mr. Plache has developed numerous technologies in the chemical systems field, including patented and patent-pending chemical blending technologies.

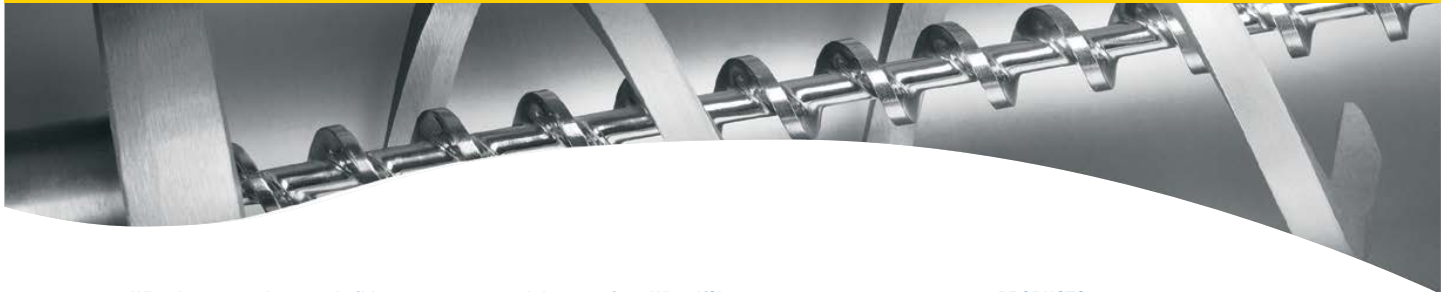
Founded in 2003 as Broad Reach Companies, Mr. Plache began to develop new technologies and provide business consulting services. In 2005 the company's name was changed to VeloDyne ("Velocity Dynamics") and its focus shifted to the sales and marketing of the company's new and improved technologies. While launching VeloDyne, Mr. Plache relied on his core business philosophy ... "it's not about the people, it's about the right people."

VeloDyne's team is comprised of the right people: former employees of his previous polymer systems company, as well as new polymer and chemical system experts. In sum, VeloDyne's team brings approximately 100 years of combined experience to the polymer system and chemical system integration industry.

VeloDyne's products are an extension of and an improvement upon the proven technologies our team has developed over the last twenty years, technologies which have been installed in over 4000 installations world-wide.

For more information please call 303-530-3298 or visit our website: www.velodynesystems.com.

VELODYNE PROFILE & CAPABILITIES



What happens when you build a company around the question, 'What If?'

The short answer is, you get a company like VeloDyne. Our products deliver superior results because of our almost obsessive nature for optimizing everything that goes into designing, building, installing and supporting our systems. We are driven by a deep understanding of maximizing polymer activation, chemical processing and bulk solids handling, and how this relates to industrial process and to water and wastewater treatment as a whole. We also know what's important to the people behind the systems, which heavily influences everything we do. When something isn't right, we look to fix the problem. When everything's working smoothly, we look for ways to make things work better. It's just who we are, and it's an approach to business that has served us well for more than 30 years in the industry.

SERVICES

Sales Team

- Chemical metering, mixing and activation, material handling and process systems consulting

Engineering

- System Integration & Design
- Mechanical Engineering & Design
- Electrical Engineering & Design
- Controls Programming
- Research & Development

Manufacturing

- Facilities: 24,000 sq. ft. Fabrication, Manufacturing and Systems Assembly
- UL & CUL Certified Control Panel Shop (CSA capable)
- Hydraulic, Electrical & Mechanical Testing

Customer Service & Technical Support

- Equipment Start-Up
- Equipment Service & Repair
- On-Site Equipment Refurbishment
- Mechanical, Electrical and System Trouble Shooting
- Process Optimization Consulting
- Spare Parts

PRODUCTS

• Auger Feeders

- Volumetric
- Gravimetric
- Loss-In-Weight

• Polymer Activation Systems

- VeloBlend (Liquid)
- HydraMax (Dry)
- ProBatch (Dry)

• Storage & Feed Systems

- Silos
- Bulk Bag Unloaders
- Hoppers
- Containers
- Lime Slakers (Retention & High Density)
- Polymer Make Down

• Dissolving

- Mix Tanks
- Wetting Cones/Bowls

• Solution/Slurry Metering Systems

- Progressive Cavity
- Peristaltic & Hose
- Diaphragm
- Booster Systems
- Secondary Dilution Systems
- Single to multi-pump designs

• Conveyors

- Tube
- Flexible
- Trough
- Micro

• System Controls

- Programming
- Design
- Assembly
- UL, CUL, and CSA control panel certifications available

Installed Projects

- 3,000 and counting...



A company driven to deliver the very best Polymer Blending, Chemical Feed, and Bulk Solids Handling Systems, fueled by constantly asking, "What If?"



VELODYNE-THE “WHAT IF?” COMPANY

Company Profile & Capabilities

EQUIPMENT AND CAPABILITIES



Liquid and Dry Polymer Blending and Activation

- Liquid (Rates up to 600 GPM solution)
- Dry (rates up to 1000#/hr)



Solution / Slurry Metering Systems

- Progressive Cavity
- Peristaltic / Hose
- Diaphragm
- Single and multi-pump skids



Silo Systems

- Bulk Dry Storage System
- Efficient Delivery
- Reduce Installation and Startup Cost
- Custom Feed Equipment



Containerized Systems

- Process System
- Mobile or Stationary Structure
- Reduce Installation and Startup Cost
- Custom Feed Equipment



Bulk Bag Systems

- Dry Product Storage
- Dry Product Feed/Dissolving
- Mix Tank or Wetting Cone
- Hoist or Fork Lift
- Dust Control
- Feed/Transfer Options



Tube Conveyors

- Horizontal or Incline Conveyance
- Easy Screw Removal
- 4”-6” Standard Screw OD
- Custom Sizes and Options



Manual Bag Systems

- Dry Product Feed/dissolving
- Mix Tank or Wetting Cone
- Manual Loading
- Dust Control
- Feed/Transfer Options



Trough Conveyors

- Horizontal or Incline Conveyance
- 6”-10” Standard Screw OD
- Custom Sizes and Options
- Clean Out Ports Available



Barracuda Volumetric Feeders

- Volumetric Screw Feeders
- Loss in Weight Feeders
- 1-2% Accuracy
- Direct Drive Assembly
- Easy Auger Removal



Flexible Conveyors

- Bag, Bin, or Hopper Filling
- Chemical Processing
- Easy Screw Removal
- 2”-6” Standard Helix Screw OD
- Up to 15' Discharge Height



Control Systems

- Turn Key Solutions
- Control Design
- Programming
- UL & CUL Certified
- In House Assembly
- CSA capable



Micro Conveyors

- Low Feed Rate Applications
- Great for Biomass Materials
- Up to 2” Screw OD
- Cooling Jacket



VeloDyneSystems.com



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Phone: 303-530-3298
E-Mail: Sales@VeloDyneSystems.com

1.3 References

VeloBlend[®] Liquid Polymer Activation & Feed System References

The following references of the VeloBlend[®] liquid polymer activation technology are from professionals in the consulting engineering, process equipment, end user and polymer manufacturing sectors of the market.

Keith Williams
Ashbrook Simon-Hartley
512-261-1820

VeloBlend is an Ashbrook's standard polymer system used to help optimize their dewatering technologies.

Carl Malkiewicz - Senior Project Manager
Andritz
(817) 465-5611

VeloBlend is Andritz' standard polymer system used to help optimize their dewatering technologies.

Allen Justice – National Sales Manager
Phoenix Process
(502) 499-1079

VeloBlend is Phoenix Dewatering's standard polymer system used to help optimize their dewatering technologies.

Gene Drake – Centrifuge Operations Expert
Centrisys Corporation
(262) 654-6006

VeloBlend is Centrisys' standard polymer system used to help optimize their dewatering technologies.

Michael Trent – Plant Operator
Tri City WWTP, Clackamas, OR
(503) 557-2803

The VeloBlend technology increased cake solids from 21.025% to 24.25% using the same polymer dosage. A new VeloBlend was purchased for a thickening application as a result of the superior performance witnessed during the trial.

Joe Pichotta - Account Manager
Ashland Chemical
(847) 951-1623

Ashland utilizes the VeloBlend during polymer trials to optimize polymer performance.

Ray Vermette, Jr
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603.516.6475

R.Vermette@dover.nh.gov

Liquid polymer batching system purchased in 2011. Second liquid polymer batching system and dry polymer feed system purchased in 2013. Both liquid polymer batching systems include automatic control of solution concentration; Rw.

Mr. Mark Streed – Lead Operator
Lafayette, CO Water Reclamation
(303) 665-6034 (Ext. 2)

The VeloBlend cut polymer usage by over 25% during a two month long side by side trial against the Stranco M Series.

Mark Marcelletti - Account Manager
Ashland Chemical
(805) 660-8360

Ashland utilizes the VeloBlend during polymer trials to optimize polymer performance.

Mark Wells - Account Manager
Ashland Chemical
(707) 479-2894

Ashland utilizes the VeloBlend during polymer trials to optimize polymer performance.

John Dieckmann
Konline-Sanderson
800-225-5457 x225

VeloBlend is a Komline-Sanderson standard polymer system used to help optimize their dewatering technologies.

Mr. Bob Sembach
Sacramento Regional
(916) 875-9000

SAC Regional ran a trial to evaluate new polymer blending technologies to replace their existing Stranco system. The VeloBlend outperformed the existing Stranco system and resolved ongoing maintenance issues.

Bill Beam
Western Riverside, CA
(951) 789-5000

Three VeloBlend systems were purchased to replace existing polymer blenders. Polymer consumption was reduced by approximately 20%.

Robbie Eyler
WWTP Operation & Maintenance Supervisor
City of Hagerstown- Utilities Dept.
Hagerstown Md. 21740
01-739-8577 ext. 655

VeloBlend polymer activation system with duty/spare neat polymer pumps and automatic polymer concentration control purchased in 2015. Duplicate unit purchased in 2018; Rp.

For additional information please contact Velocity Dynamics, LLC. (VeloDyne) at 303-530-3298 or visit our website at www.velodynesystems.com

Section 2

System Informaiton

VELOBLEND

Advanced Liquid Polymer Activation Technologies

The result of over 30 years pursuing optimum polymer performance and system reliability.



AS IT TURNS OUT, IT IS POSSIBLE TO PATENT “AND”

While the rest of the polymer equipment industry was engaged in a mechanical versus non-mechanical system debate, VeloDyne developed the next generation of advanced polymer activation technologies, a hybrid of the two approaches.



A company driven to deliver the very best Polymer Blending, Chemical Feed, and Bulk Solids Handling Systems, fueled by constantly asking, “What If?”



VELOBLEND

Advanced Liquid Polymer Activation Technologies

OPTIMIZING LIQUID POLYMER PERFORMANCE

There have been numerous technologies introduced over the last thirty years designed to activate liquid polymer. The advanced hybrid VeloBlend™ technology has proven to more efficiently induce ultra-high, non-damaging mixing energy, delivering the highest polymer performance over any other technology in the industry.

The VeloBlend is simply the best polymer activation technology ever developed.

—polymer consultant with over 30 years of industry experience

NEAT “AS-SUPPLIED” POLYMER

Neat polymer, as supplied, is primarily comprised of coiled-up polymer, oil, water, and inverting surfactant.



UNACTIVATED POLYMER MOLECULE— CAPABLE OF WITHSTANDING HIGH MIXING ENERGY

In its “neat” (as-supplied) state, the polymer is coiled up like a spring and is capable of withstanding ultra-high mixing energy without damage to its molecular structure.



DAMAGED POLYMER—CAUSED BY EXCESSIVE SHEAR

Once the polymer uncoils, the elongated polymer is now susceptible to damage caused by excessive shear. The result is increased polymer usage, increased polymer cost and reduced process performance.



PARTIALLY UNCOILED POLYMER—INSUFFICIENT MIXING ENERGY

If polymer is exposed to insufficient mixing energy, the polymer fails to fully activate with the same negative results in polymer cost and process performance as is seen with damaged polymer.



FULLY ACTIVATED, UNDAMAGED POLYMER— DELIVERING OPTIMAL PERFORMANCE

When neat, coiled-up polymer is properly exposed to ultra-high mixing energy, the oil is effectively “scrubbed” from the polymer, allowing it to become highly activated without damage.



The VeloBlend’s hybrid technology more effectively induces ultra-high, non-damaging mixing energy over the system’s full flow range than any other technology on the market.



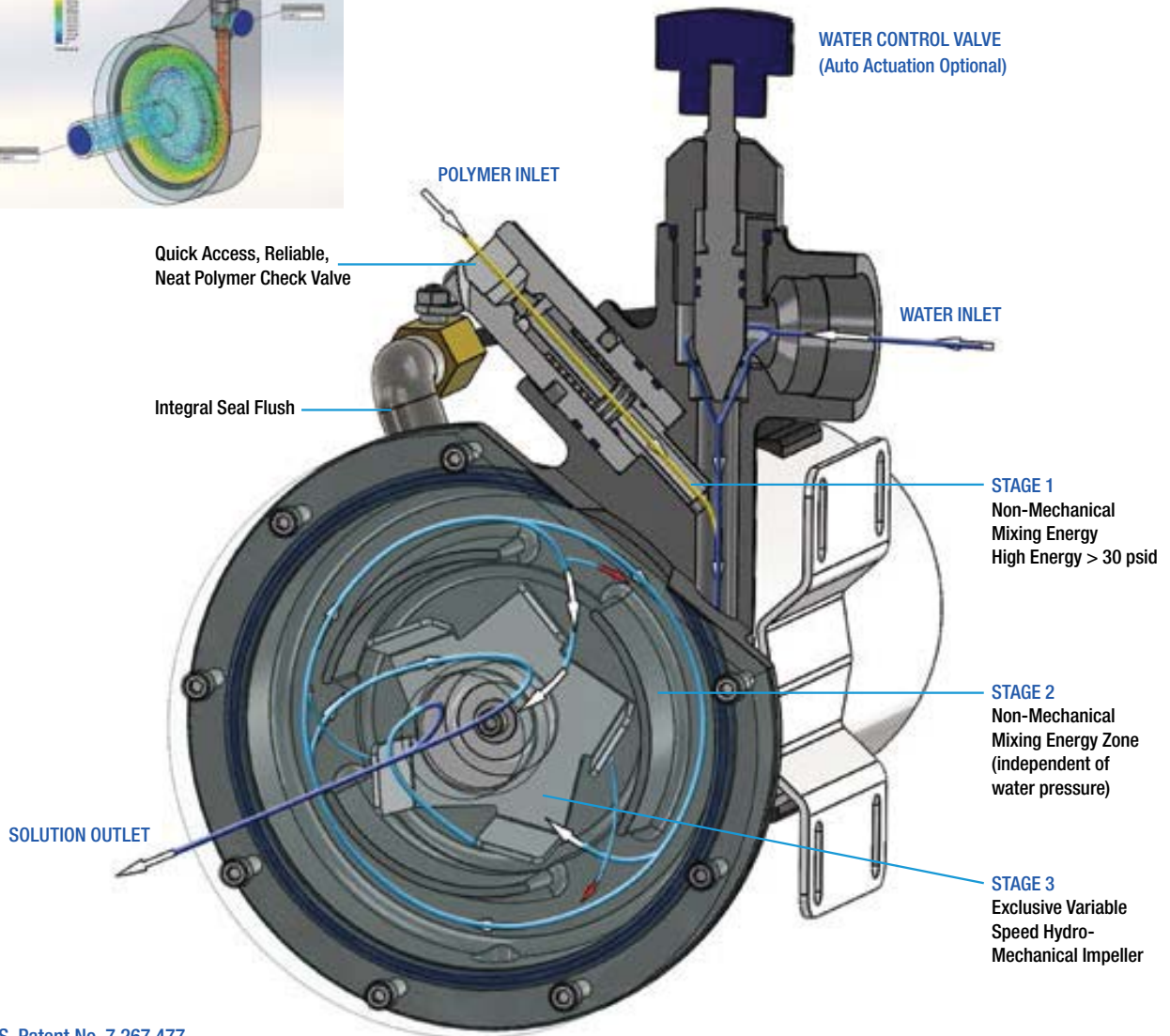
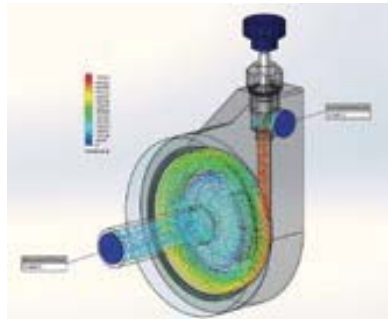
VELOBLEND

Advanced Liquid Polymer Activation Technologies

EXCLUSIVE HYBRID ACTIVATION TECHNOLOGY

We started by perfecting hydro-dynamic, non-mechanical mixing energy. Born from thirty years of experience, the VeloBlend VH series optimizes the use of non-mechanical mixing energy, exceeding the performance and reliability over existing technologies.

We then eliminated the biggest drawback to non-mechanical blending—its reliance on water pressure. The VeloBlend™ hybrid polymer activation technology combines the reliability of hydro-dynamic, non-mechanical mixing energy with controllable, variable speed hydro-mechanical mixing energy. This process allows for precise control of mixing conditions, allowing optimal performance of any polymer available.



U.S. Patent No. 7,267,477



VELOBLEND

Advanced Liquid Polymer Activation Technologies

THE VERSATILE VELOBLEND SYSTEM



SERIES 6000

- Skid Configuration #2
- Progressive Cavity Pump
- 0.2 to 100 GPM Solution
- Control Levels D thru RpSB

1. ACTIVATION CHAMBER

VeloBlend Advanced Liquid Polymer Activation Technology delivers unsurpassed performance and reliability.

2. DILUTION WATER SYSTEM

Up to 600 GPM to meet your application requirements.

3. NEMA 4X CONTROLS

Five standard control systems are available to meet your specific control requirements.

4. NEAT POLYMER PUMP

Progressive cavity pumps standard. Other pump types optional.

5. RUGGED STAINLESS STEEL SKID

Available in 304 or 316 stainless steel. Open design for ease of maintenance. Designed to provide ideal pump suction conditions.



SERIES 2400

- Skid Configuration #1
- Progressive Cavity Pump
- 0.2 to 50 GPM Solution
- Control Levels D & E



SERIES 12000

- Skid Configuration #3
- Progressive Cavity Pump
- 0.2 to 200 GPM Solution
- Control Levels D thru RpSB



SERIES 36000

- Skid Configuration #4
- Progressive Cavity Pump
- 40 to 600 GPM Solution
- Control Levels D thru Rrw

Blending Technology:

VM	Hydro-Mechanical
VH	Hydro-Dynamic
VMM	Hydro-Mechanical Mannich

Pump Flow Range:

Diaphragm	Progressive Cavity
0.4D	0.004 to 0.4 GPH
1.0D	0.01 to 1 GPH
2.0D	0.1 to 2 GPH
2.5D	0.025 to 2.5 GPH
4.5D	0.045 to 4.5 GPH
8D	0.08 to 8 GPH
10D	0.1 to 10 GPH
	2.0P
	3.0P
	5.0P
	10P
	15P
	20P
	30P
	50P

Pump Style:

D	Diaphragm
P	Progressive Cavity
PS	Peristaltic

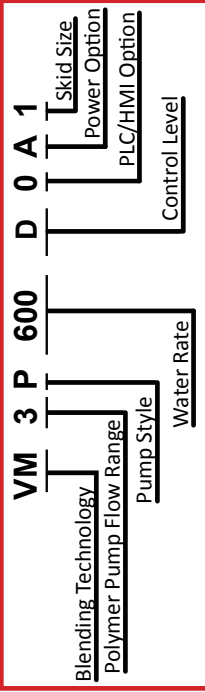
Water Rate:

20	2 to 20 GPH
60	6 to 60 GPH
120	12 to 120 GPH
300	0.5 to 5 GPM
600	1 to 10 GPM
1200	2 to 20 GPM
1800	3 to 30 GPM
2400	4 to 40 GPM
3600	6 to 60 GPM
4800	8 to 80 GPM
6000	10 to 100 GPM
12000	20 to 200 GPM
21000	35 to 350 GPM



VELOBLEND

X = Modification from standard options



PLC/HMI Option:

PLC Options	Color Touchscreen HMI Options					Skid Size	Control
	C-More		Allen Bradley		Magelis		
	8"	10"	7"	10"	12"		
1	A	B	C	D	E	F	G
2	Integral 6" Color TFT Touchscreen						
3	≥ 15P						
4	≥ 30P						
5	≥ 60P						
6	≥ 150P						

No PLC/HMI Option

0

Control Level:

CONTROL OPTIONS	C	D	E	Rw	Rp	RpSB
Local & Remote Start/Stop Discrete Input	☐	☑	☑	☑	☑	☑
4-20mA Pump Pacing Analog Input	☑	☑	☑	☑	☑	☑
4-20mA Solids Density Analog Input						
System Running Discrete Input				☑	☑	☑
System In Remote Discrete Input				☑	☑	☑
Pump Rate Analog Output				☑	☑	☑
Solution Rate Analog Output				☑	☑	☑
Common Alarm Discrete Input				☑	☑	☑
Manual Water Ratio Control				☑	☑	☑
Auto Water Ratio Control				☑	☑	☑
Smartblend™ Ratio Control	¥					
Ethernet Communication				☑	☑	☑

Power Option:

A	120V/1PH/60HZ	
B	240V/1PH/60HZ	REQUIRED 200 GPM WATER & ABOVE
C	240V/3PH/60HZ	
D	480V/3PH/60HZ	
E	600V/3PH/50HZ	

Skid Size:

	Width	Depth	Height
1	Compact	34"	24"
2	Tall	34"	30"
3	Full	48"	36"



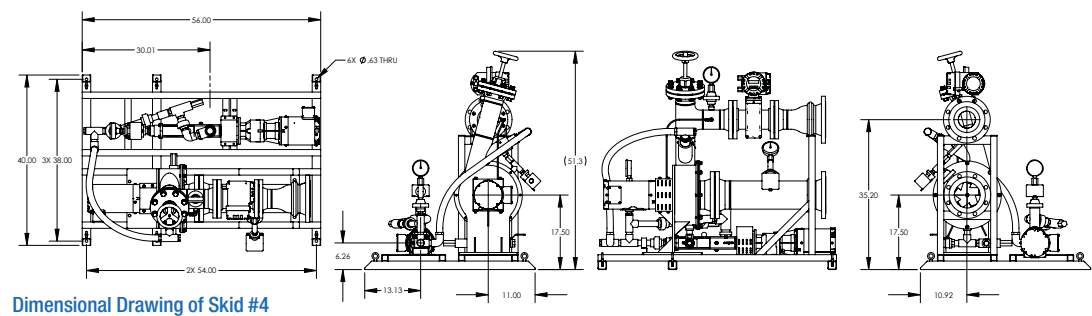
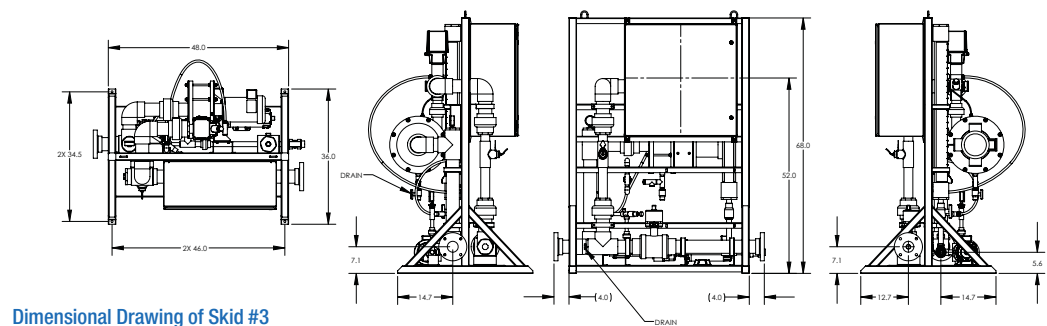
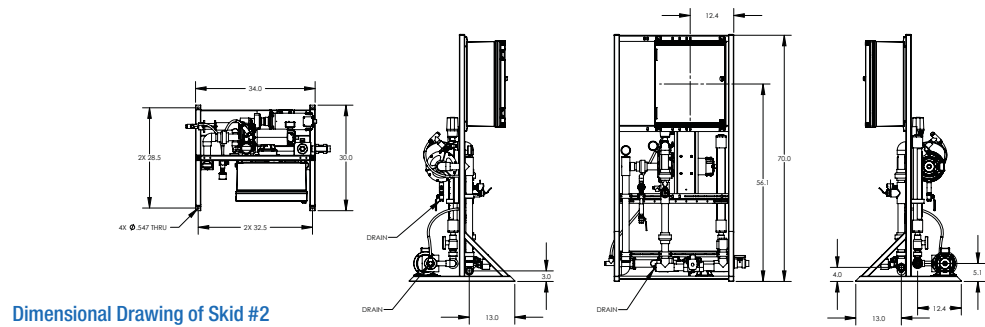
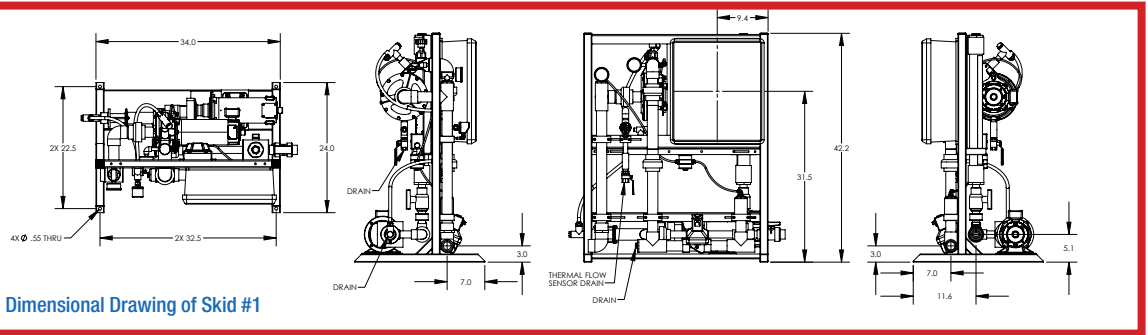
¥ See PLC/HMI Options



VELOBLEND

Advanced Liquid Polymer Activation Technologies

VELOBLEND SYSTEM DIMENSIONS



Note: drawings are for reference use only. Dimensions and designs are subject to change.



VELOBLEND

Advanced Liquid Polymer Activation Technologies

VELOBLEND HEAVY INDUSTRIAL

The VeloBlend industrial series is designed for the rigors of the pulp & paper, oil & gas, mining, and other demanding industries and applications.



VELOBLEND INDUSTRIAL SERIES FEATURES:

- Ratio control of polymer and water
- VeloBlend Stainless Mixing Chamber
- All stainless steel welded plumbing
- Magnetic flow meter for water flow
- Coriolis mass flow meter for neat polymer
- Skid mounted neat polymer strainer (simplex or duplex available)
- Heavy Duty stainless steel skid

POLYMER PROCESSING PLANTS





VELOBLEND

Advanced Liquid Polymer Activation Technologies

VELODYNE – THREE DECADES OF EXPERIENCE

For over thirty years our team has been dedicated to excellence. Through knowledge gained from thousands of installations worldwide, VeloDyne unites proven technologies with unsurpassed experience. Contact us to learn how our products and services can help optimize your treatment process.

MORE PROVEN SOLUTIONS FROM VELODYNE

Dry Polymer Activation



Auger Feeders & Conveyors



Manual Bag Systems



Liquid Chemical Metering & Feed Systems



Bulk-Bag Systems



Lime Slakers



Containerized Systems



Silo Systems



VeloDyneSystems.com



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Toll Free: 303-530-3298

The “No Comparison” Comparison.

The Advanced Technology of the VeloBlend Hydro-Mechanical Polymer Blending System

Reduces Polymer Consumption and Increases Process Performance.

The VeloBlend technology is the result of over twenty years of research and development. *The VeloBlend VM series optimizes polymer performance to reduce polymer consumption by an average of 21% in side by side trials through its patented hydro-mechanical hybrid blending process. The VeloBlend Difference is outlined below...*

Polymer Blending Systems Comparison:

Feature	VeloBlend VM Series	VeloBlend VH Series	Dynablend	Polyblend M Series	Polyblend PB Series	Prominent ProMix
Staged, High Energy Mixing	Yes	Yes*	Yes*	Yes	Yes	Yes
High Energy, Non-Mechanical Mixing	Yes*	Yes*	Yes*	No	No	No
Mixing Energy Independent of Water Pressure	Yes	No	No	Yes	Yes	Yes
Mixing Energy Independent of Mechanical Mixer	Yes	Yes	Yes	No	No	No
Non-Damaging Mixing Energy at All Flow Rates	Yes	Yes	Yes	No	No	No
Total Control Over Mixing Energy	Yes	No	No	Optional	No	Optional
Stainless Steel Impeller	Yes	N/A	N/A	No	Yes	No
Mechanical Seal Flush	Yes	N/A	N/A	No	No	No
Polymer Check Valve Accessible Without Tools	Yes	Yes	Yes	Yes	No	No
Polymer Injection Quill for Improved Polymer Activation	Yes	Yes	No	No	No	No
Clear Viewing Chamber	Yes	Yes	No	Yes	Yes	No
Plug-Free, Build-Up Free Mixing Chamber	Yes	Yes	No	No	No	No
Automatic Control of TOTAL Mixing Energy	Optional	No	No	No	No	No
Solution Flow Rates Up to 600 GPM	Yes	Yes	No	No	No	No
Limited Life-Time Mixing Chamber Warranty	Yes	Yes	Yes	No	No	No

* When adequate water pressure and flow exists.



For more information contact VeloDyne at 303-530-3298

sales@velodynesystems.com

www.polymersolution.com



SCOPE OF SUPPLY

Bid Type: VeloDyne is a named supplier in the specifications.

VeloDyne is pleased to offer the following proposal for the liquid polymer blending equipment, including options and accessories as indicated below.

QTY.	DESCRIPTION
1	<p><u>VeloBlend Model VM-3P-600-D-0-A-1 Liquid Polymer Blending System</u></p> <p>Polymer Flow Range: 0.15 to 3 GPH Dilution Water Flow: 60 to 600 GPH</p> <p><u>Each unit shall include the following unless otherwise indicated:</u></p> <p>1 Polymer Mixing Chamber:</p> <ul style="list-style-type: none"> A. Series: VeloBlend VM B. Type: Staged Hydro-Mechanical C. Mixer Motor: ½ HP, 90 VDC, 1750 RPM, wash-down duty D. Mixer Shaft Seal: Mechanical with seal flushing assembly E. VeloCheck™ Neat Polymer Check Valve with Quick Release Pin F. Construction: <ul style="list-style-type: none"> 1. Body: Stainless steel 2. Impeller: Stainless steel 3. Mechanical Seal: Ceramic, Carbon, Stainless steel, Viton 4. Cover: Clear polycarbonate with stainless steel reinforced flange & discharge G. Pressure Rating: 100 psi H. Pressure Relief Valve: Brass <p>1 Neat Polymer Metering Pump Assembly:</p> <ul style="list-style-type: none"> A. PVC FNPT union style polymer inlet B. Type: Progressive Cavity type C. Motor: ½ HP, 1750 RPM, 90 VDC, Wash-down duty motor with gear reducer D. Loss of polymer flow sensor E. Metering pump calibration assembly with isolation valves: 250 ml F. Plumbing: SCH. 80 PVC <p>1 Dilution Water Inlet Assembly shall be provided, including the following:</p> <ul style="list-style-type: none"> A. Stainless steel FNPT water inlet connection B. Dilution water ON/OFF solenoid valve C. Control Valve: Manual rate control valve D. Primary dilution water flow meter type: Rotameter E. Low differential pressure alarm switch F. 0-160 psi inlet water pressure gauge (stainless steel, liquid filled) G. Plumbing – SCH. 80 PVC <p>1 Solution Discharge Assembly:</p> <ul style="list-style-type: none"> A. Stainless steel FNPT solution discharge connection B. 0-160 psi solution discharge pressure gauge (stainless steel, liquid filled) C. Plumbing – SCH. 80 PVC

- 1 Control Panel:
 - A. Enclosure: NEMA 4X FRP
 - B. Power:
 - 1. Required: 120 VAC, 60 Hz., 1 Ph
 - 2. Disconnect: 10' power cord with 120 VAC plug
 - C. Motor controllers:
 - 1. Mixing Chamber
 - 2. Neat polymer metering pump
 - D. Miscellaneous:
 - 1. Control circuit protection
 - 2. Control relays
 - 3. Power supplies
 - 4. Grounding blocks
 - 5. Numbers terminal blocks
 - 6. Wire labels, shrink-tube type
 - E. Operator Interface – Discrete Selector Switch
 - 1. System ON / OFF(reset) / REMOTE
 - 2. Ten-Turn Potentiometer – Metering Pump Control
 - 3. One-Turn Potentiometer – Mixer Speed Control
 - F. Status / Alarm Indicators:
 - 1. System Running Indication
 - 2. Main Power ON Indication
 - 3. LED Display Metering Pump Rate
 - 4. Low Water Differential Pressure Alarm
 - 5. Low Polymer Flow Alarm
 - G. Inputs (signals by others):
 - 1. Remote Start / Stop (discrete dry contact)
 - 2. Pacing Signal Based on Process Flow (4-20mA)
 - H. Outputs:
 - 1. System Running (discrete dry contact)
 - 2. System Remote Mode (discrete dry contact)
 - 3. Common Alarm (discrete dry contact)

- 1 System Skid:
 - A. Frame: 304 stainless steel, open frame design for access to all components
 - B. Fasteners: 304 SS
 - C. Designed for bolt-down

- 1 Accessories (quantities shown are total for project – provided loose for field installation):
 - A. (1) Spare Progressive Cavity Pump Stator
 - B. (1) Spare Progressive Cavity Pump Packing Seal
 - C. (1) Banding Clamp Tool
 - D. (1) Spare Neat Polymer Check Valve, Complete
 - E. (12) Absorbent Pads

- 1 Engineering & Documentation:
 - A. Submittals for approval (electronic version in PDF, if requested)
 - 1. Detailed scope of supply
 - 2. Mechanical drawings (solids models in shaded isometric and wire orthogonal views)
 - 3. Mechanical component data sheets annotated for specific models, features, etc.
 - 4. Pump performance curves
 - 5. Electrical schematics with interconnecting layout
 - 6. Process & Instrumentation Drawings
 - 7. Process description
 - 8. Electrical component data sheets annotated for specific models, features, etc.
 - B. O&M Manuals for approval (electronic version in PDF, if requested)

1 3-Year Limited Warranty

1 Start-Up / Field Services: **Provided by Process Equipment Manufacturer.**

Note: a minimum of four (4) weeks' notice required for domestic orders prior to factory services being scheduled

Commercial Clarifications:

1. This proposal shall become part of the final purchase order documents.
2. This proposal is based on equipment delivery within one year from the date of this proposal.
3. Unless otherwise indicated above, the following are not included in this proposal: Taxes. Tariffs. Duties. Bonds.

Technical Clarifications:

1. Any equipment or appurtenances not specifically listed in the scope of supply shall be provided by others.
2. VeloDyne has proposed its standard equipment as detailed above, modified only to the extent to meet the intent of the project requirements.
3. Where there are contradictions between project specifications and drawings or omissions, VeloDyne is providing our best interpretation of the intent of the design as detailed in our scope of supply.
4. Unless otherwise indicated above, standard submittals and O&M manuals are included herein.
5. Unless otherwise indicated above, the following are not included in this proposal: Installation. Chemicals. Interconnecting wiring, conduit, piping, and valves. Anchor bolts. Field Painting.
6. 46 33 33, 2.1, A: Neat emulsion polymer has a viscosity of ~3500 cps max, not 45,000 cps.

Section 3

Mechanical

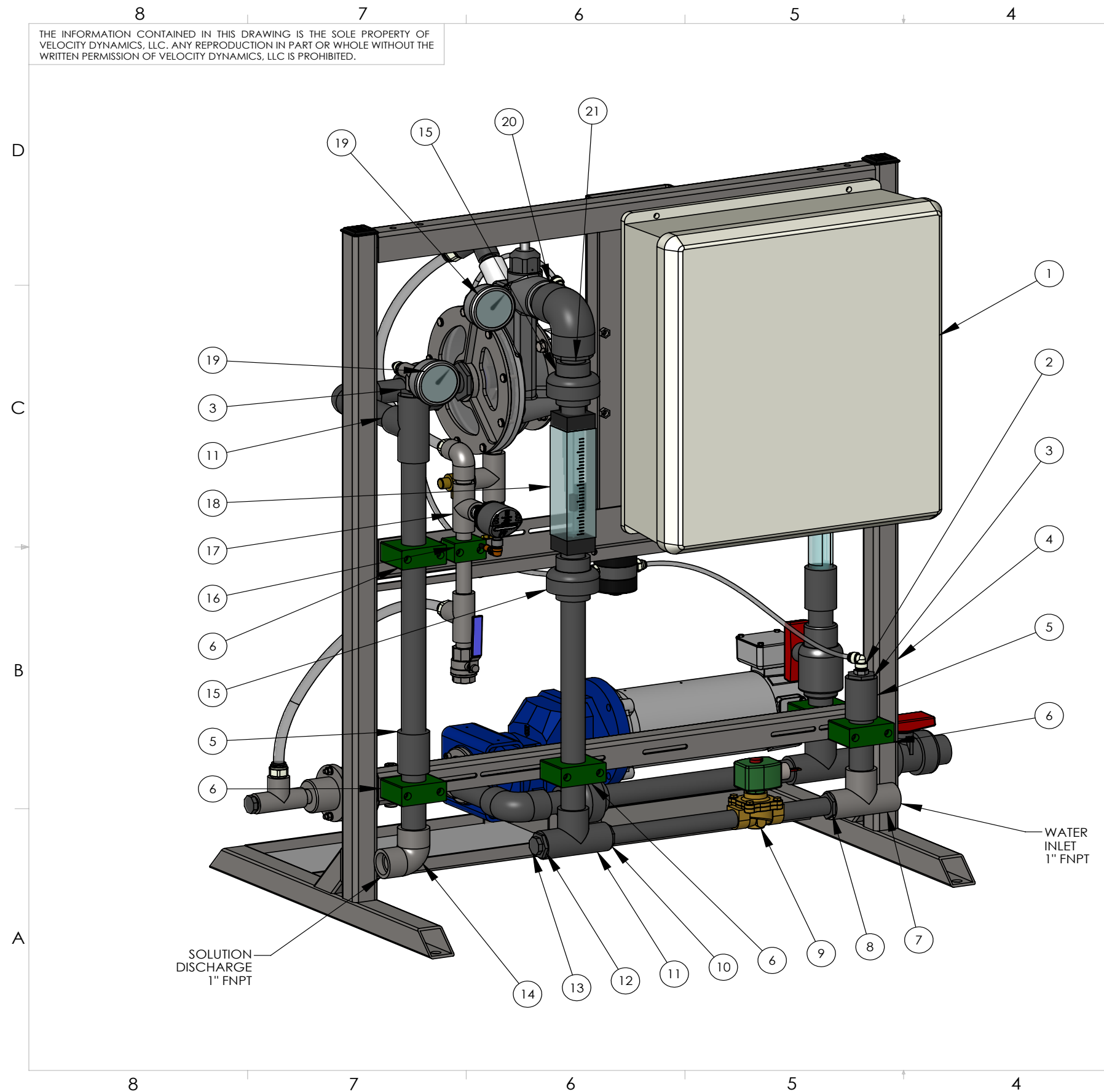
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3.1 Mechanical Drawings

3.1.1 System Drawings

THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF VELOCITY DYNAMICS, LLC. ANY REPRODUCTION IN PART OR WHOLE WITHOUT THE WRITTEN PERMISSION OF VELOCITY DYNAMICS, LLC IS PROHIBITED.

REVISIONS				
REV	ECO	DESCRIPTION	DATE	APPROVED
A		INITIAL RELEASE	7/7/20	B HEALY
B		SWITCHED TO WEG GEARBOX	7/1/21	D LOR



NOTES -

- 1) APPROXIMATE DRY WEIGHT 250 LBS
- 2) FOLLOW O&M PROCEDURES FOR DRAINING PRIOR TO STORAGE OR SHIPMENT
- 3) FRAME MATERIAL IS 304 SS AND HARDWARE IS 18-8 SS UNLESS OTHERWISE NOTED

ITEM #	NUMBER	DESCRIPTION	QTY
1	120CP-DFRP12P	CTRL PNL, STND, D LEVEL	1
2	194-1326	ELBOW, 1/4" TUBE - 1/4 MNPT, PP	2
3	194-2012	REDUCER, BUSHING, 1" X 1/4", SXT, SR, SCH 80, PVC	2
4	158-1932	FRAME, VELOBLEND, COMPACT, 3 SPAN, 18X16, GEARBOX MOUNT	1
5	194-0445	COUPLING, 1", SXS, PVC	2
6	194-0027	CLAMP, PIPE, 1", STAUFF	6
7	194-0442	TEE, 1", FPT, 304 SS	1
8	194-0406	REDUCER, BUSHING, 1" X 3/4", TXT, SCH 80, PVC	1
9	248-0576	VALVE, SOLENOID, 3/4" FNPT, BRASS/NBR, 120 VAC, ASCO	1
10	194-0660	REDUCER, BUSHING, 1" X 3/4", SXS, SCH 80, PVC	1
11	194-0314	TEE, 1" SOC, SCH 80, PVC	3
12	194-0690	REDUCER, BUSHING, 1" X 1/2", SXT, SCH 80, PVC	1
13	194-0407	PLUG, 1/2", T, SCH 80, PVC	3
14	194-0496	ELBOW, 90, 1" NPT, 304	1
15	194-0642	UNION, 1", SXS, PVC/VITON	4
16	194-0029	CLAMP, PIPE, 1/2", STAUFF	1
17	182-0462	SENSOR ASSY, FLOW, THERMAL, SI5006, AC, 1/2"	1
18	182-0080	FLOW METER, ROTAMETER, 10 GPM, 1" FNPT, ACRYLIC	1
19	182-0002	GAUGE, PRESSURE, 2.5", 160 PSI, SS/BRASS, 1/4" MNPT, BACK MNT, GLYCERINE FILL	2
20	194-0137	ELBOW, 90 DEG, 1 1/2" SOC, PVC	1
21	194-0687	REDUCER, BUSHING, 1.5" X 1", SXS, SCH 80, PVC	1

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
 TOLERANCES:
 DECIMALS: .XX = ±.015 .XXX = ±.005
 ANGLES: ± 1°
 63/ MINIMUM
 FILLET RADII TO BE .005 MAXIMUM
 BREAK ALL EDGES .005/.010
 MATERIAL

CAD GENERATED DRAWING, INTERPRET DRAWING PER ASME Y14.5M - 2018	
APPROVALS	DATE
MODELED	
BGH	7/7/2020
DRAWN	
BGH	7/7/2020
PROJECT MGR	
---	11/5/2018
PURCHASING MGR	
QUAL ENG	

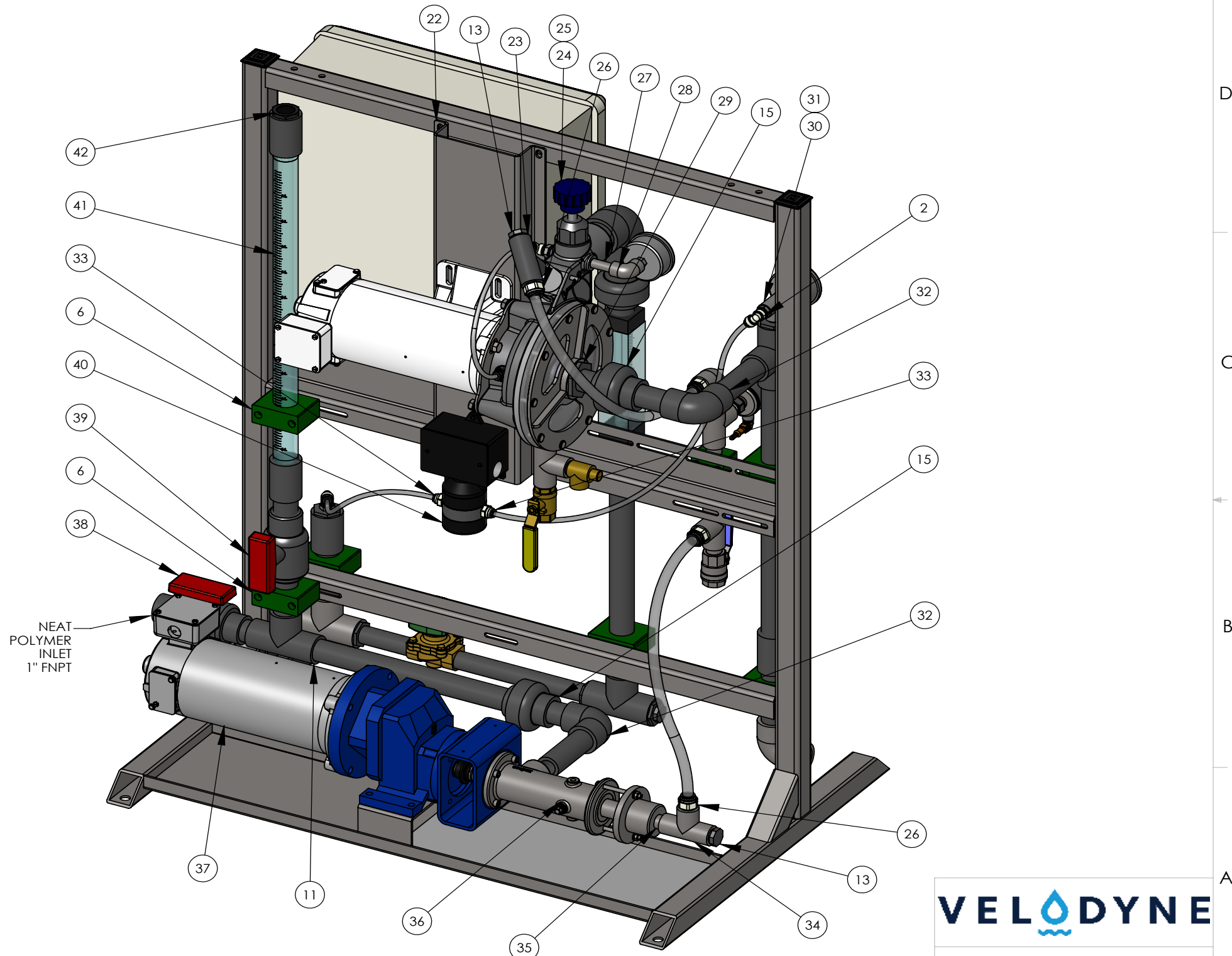


VELOBLEND, MECH MIX, 3 GPH POLY, 10 GPM H2O, D CTRL, 120V, COMPACT
 SIZE DWG. NO. 120VB-03P060D0A1 REV. B
 SCALE 1:6 CAD FILE: SHEET 1 OF 3

8 7 6 5 4 3 2 1

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ITEM #	NUMBER	DESCRIPTION	QTY
22	158-0426	BRACKET, MIXER MOUNT, VELOBLEND, UNIVERSAL	1
23	194-0304	TEE, 1/2", T X T X T, SCH 80, PVC	1
24	200-0399	VELOBLEND, 6", ACTIVE, CF16F, 1/2 HP, 90VDC	1
25	200-0043	ORIFICE, THROTTLE VALVE, 0.275", VELOBLEND, 10 GPM, 6" BLENDER	1
26	194-0638	ADAPTER, 1/2" TUBE - 1/2 MNPT, ACETAL	2
27	194-0634	NIPPLE, 1/4" X 2.00 L, 304	1
28	194-0055	ELBOW, 90, 1/4", TXT, 304	1
29	194-0688	REDUCER, BUSHING, 1.5" X 1", TXT, SCH 80, PVC	1
30	194-0587	TEE, 1/4", T X T X T, 304	1
31	194-0023	NIPPLE, 1/4" X CLOSE, 304	1
32	194-0621	ELBOW, 90, 1", S X S, SCH 80, PVC	2
33	194-0641	ADAPTER, 1/4" TUBE - 1/4 MNPT, ACETAL	2
34	194-0021	TEE, 1/2" FNPT, 304	1
35	194-0049	NIPPLE, 1/2" X CLOSE, 304	1
36	215-0644	PUMP, PROG CAV, .15 - 3.4 GPH, 5.09:1, PACKING, SS/VIT	1
37	191-0001	MOTOR, 1/2 HP, 1750 RPM, 90 VDC, 56 C, WASH DOWN	1
38	248-0004	VALVE, BALL, 1" SOC - 1" FNPT, TRUE UNION, PVC/VITON	1
39	248-0012	VALVE, BALL, 1" SOC, COMPACT, PVC/VITON	1
40	182-0272	SWITCH, PRESSURE DIFF, ASHCROFT, D4-24-B-60PSI	1
41	110-0002	CALIBRATION COLUMN, 250 ML, 1" FNPT	1
42	194-1976	VENT, BREATHER, POLYPROPYLENE, 1" MNPT	1

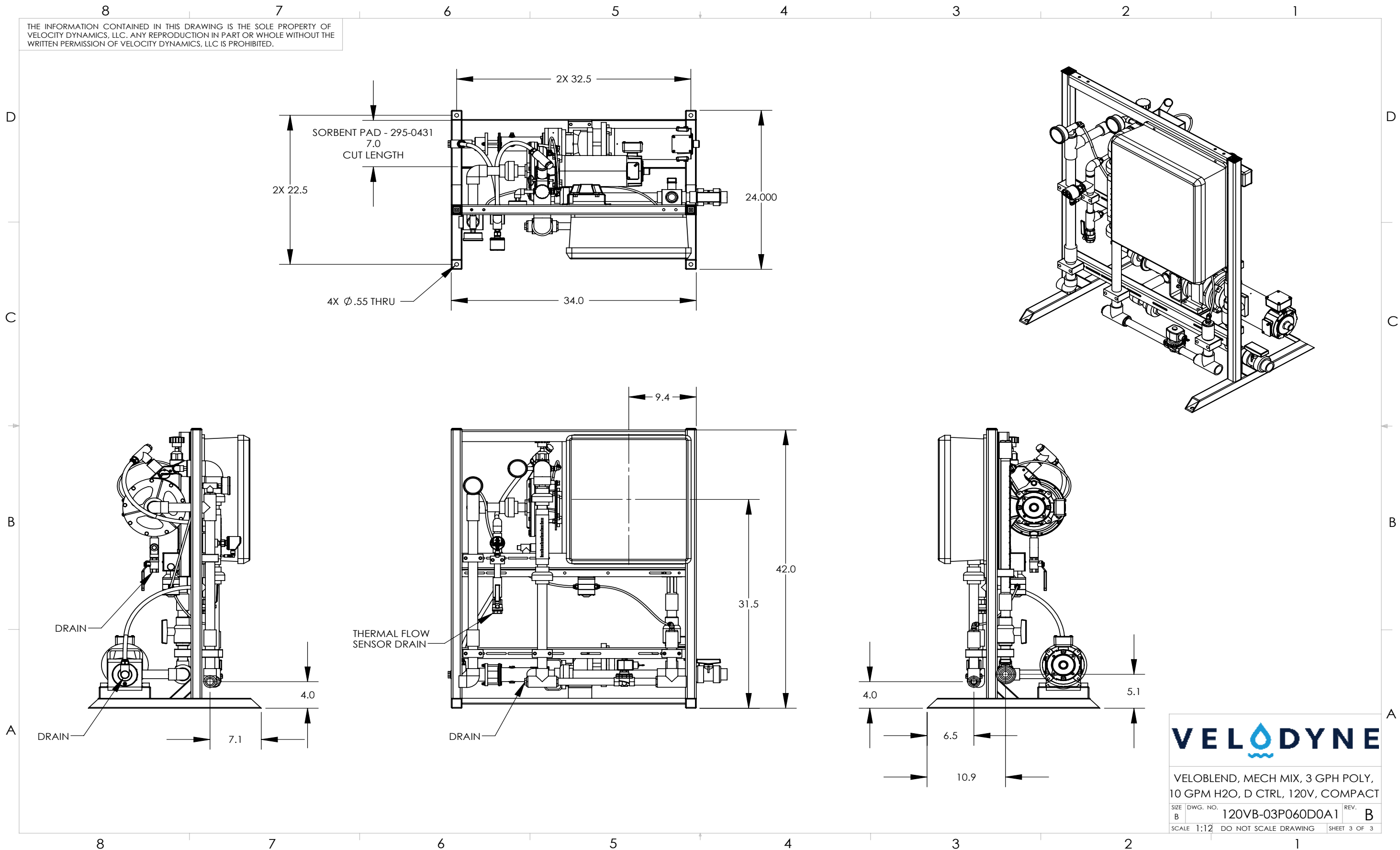


VELODYNE

VELOBLEND, MECH MIX, 3 GPH POLY,
10 GPM H2O, D CTRL, 120V, COMPACT

SIZE B	DWG. NO. 120VB-03P060D0A1	REV. B
SCALE 1:6	DO NOT SCALE DRAWING	SHEET 2 OF 3

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VELOCITY DYNAMICS

VELOBLEND, MECH MIX, 3 GPH POLY,
10 GPM H2O, D CTRL, 120V, COMPACT

SIZE	DWG. NO.	REV.
B	120VB-03P060D0A1	B

SCALE 1:12 DO NOT SCALE DRAWING SHEET 3 OF 3

3.2 Component Data Sheets: VeloBlend

3.2.1 Pump

215-0644 B1
 PUMP, PROG CAV, .15 - 3.4 GPH,
 5.09:1, SS/VIT
 5/5/21 - DL

SEEPEX.
 ALL THINGS FLOW

Item 21 ()

Progressive cavity pump

MD 0015-24 / A6-J0-J0-H5-A

Application data

Conveyed product	Neat polymer
Flowability	well flowable
Viscosity	250 Cp (apparent viscosity)
Solids content	without
Size of solids	not applicable
Concentration	≤ 1 %
Density	unknown, 1 kg/dm ³ assumed
Product temperature	32°F - 113°F
pH value	5-9
Kind of operation	continuous
Operating hours	24 h/day
Location	indoor, dry atmosphere
Altitude of installation	up to 1000 m assumed
Surrounding temperature	normal (32-113°F)

Performance data

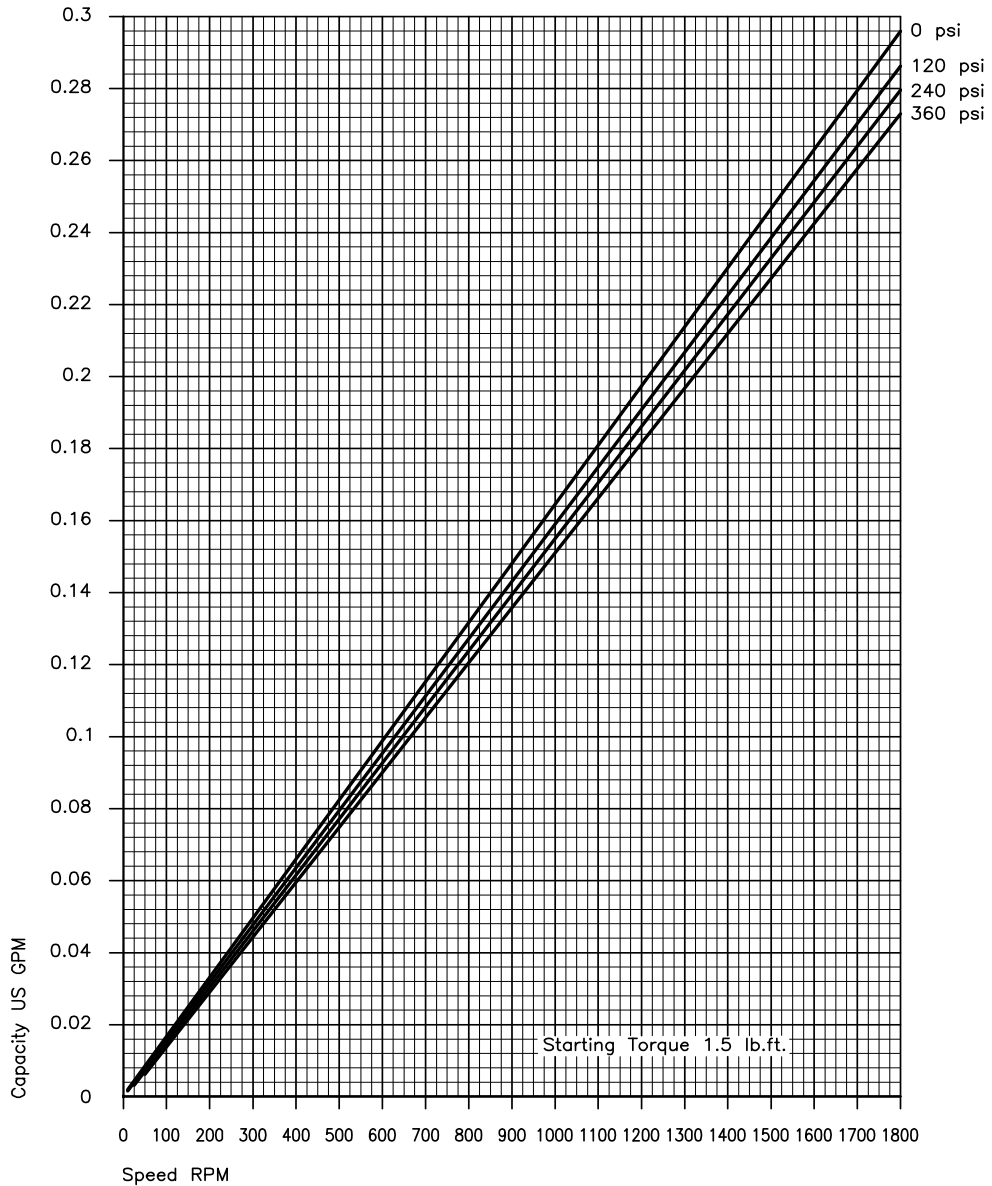
	Capacity	Pressure	Speed	
	0.1 USGPH	40 psi	12 rpm	min
	3.4 USGPH	40 psi	277 rpm	max
Starting torque	4 lb.ft			
Req. power at pump shaft	0.05 HP			
Inlet pressure	flooded suction (up to 0,5bar)			
NPSHr	6.65 ft			

Tolerances according to SEEPEX standards.

Materials and executions

Installation	horizontal
Direction of rotation	counter clockwise (left)
Lantern - Design	dummy shaft for shipment / with cover plates
Lantern - Material	1.0037 (st. 37-2)
Suction casing - Design	standard
Suction casing - Material	1.4408 / ASTM A351 grade CF8M
Pressure branch - Design	standard
Pressure branch - Material	1.4408 / ASTM A351 grade CF8M
Position of branch	position 1
Suction connection	1" NPT
Pressure connection	½" NPT
Joint - Design	pin joint with joint sleeve, grease filled
Joint - Material	standard, holding bands 1.4401
Joint - Universal joint sleeve: material	FPM
Coupling rod - Design	standard
Coupling rod - Material	1.6582 encapsulated
Rotor - Design	standard
Rotor - Material	1.4404 / AISI 316L
Stator - Design	standard
Stator - Material	FPM special
Shaft sealing	packing
Design	standard
Casing - material	1.4404 / AISI 316L
Packing ring - material	K40
Plug-in Shaft - Design	standard
Plug-in Shaft - Material	1.4404 / AISI 316L
Bolting - Design	stainless steel incl. locking screws

Characteristic Curves
Size
0015-24

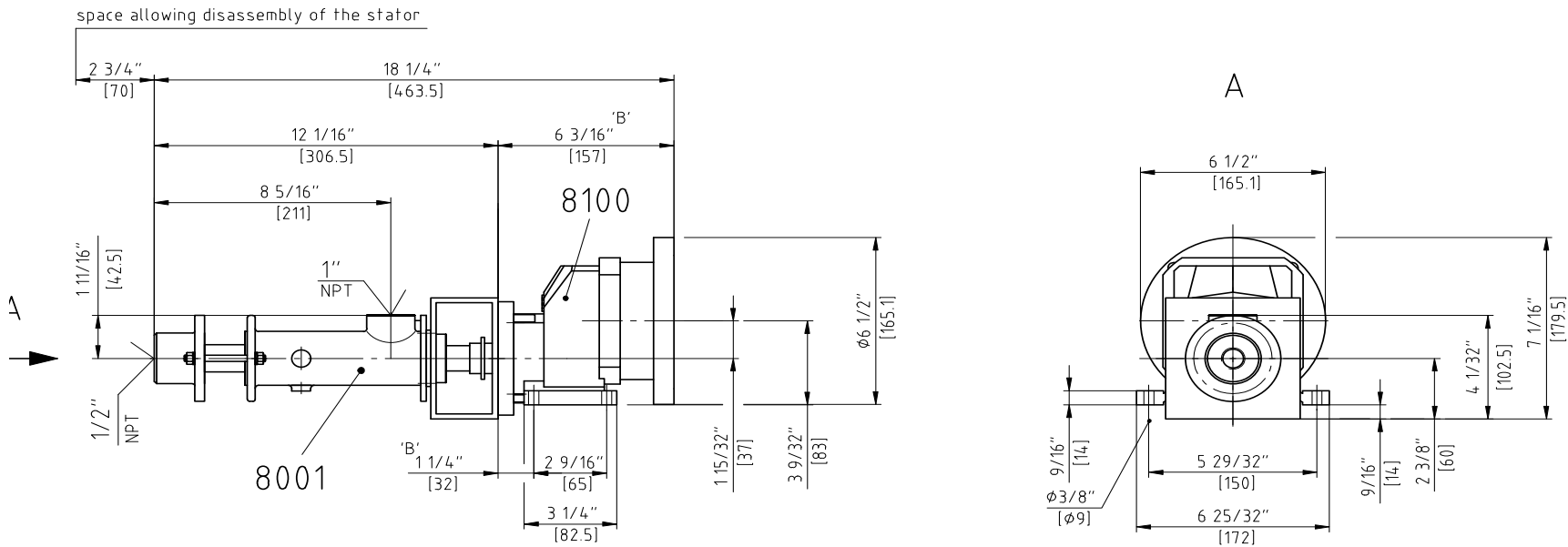


Values based upon water 68°F

CHA.0015-24 B 01.03us

Gear series :	Helical gear unit	
Type :	HG 41E NA56	
<hr/>		
Operation data :		
Ambient temperature :	+20	°C
Type of operation :	S1	
<hr/>		
Gear data :		
Max. perm. thermal power limit at +20 °C and S1 operation :	1.5	[kW]
Rated torque :	37	[Nm]
Gear stages :	1	
Ratio :	6.42	
ZT-Code :	0407/12077	
Circumferential backlash (min-max) :	9' - 22'	
Reduced circumferential backlash (min-max) (OPTION) :	9' - 14'	
Perm. input torque at fB1 :	5.8	[Nm]
Max. perm. input speed :	5000	[rpm]
Mounting position :	B3	
Output shaft :	Ø 20 k6 x 40	[mm]
Keyway :	DIN6885.1	
Painting :	LC1 - Indoor installation neutral atmosphere NDFT 60 µm (C1 - DIN EN ISO 12944-5)	
Color :	RAL 9007 (Grey aluminium)	
Weight :	9.3	[kg]
<hr/>		
Input side :		
Type :	NEMA Adapter 56	
Input shaft :	Ø 0,625 +0/-0,002 x 1,880 inch	
Input flange :	NEMA D=6,5 inch	
Torque losses :	3	[Nm]
<hr/>		
Further executions gear unit :		
Lubricant :	Mineral oil - CLP ISO VG 220	

right: This drawing is our property and patented for us according to the law of copyright and associated rights !



dimensions in [...] are in millimeter

gear: WEG HU-41E-NA56	8100	+adaptor	9
pump: MD / MDP 0005-24 / 0015-24 / 003-12	8001		4
st. Denomination	Item	Material	Note
2017	Name	Scale	Weight
Drawn	cbo	1:5	13 kg
Checked	lsh	EDP-No.	Denomination
		169000.dwg	dimensional drawing
			Drawing-no.
			103-C39/M030-C-705B4

tolerances for dimensions without specified tolerances acc. to DIN ISO 2768-v

EPEX.
- THINGS FLOW

191-0001 B4
MOTOR, 1/2 HP, 1750 RPM,
90 VDC, 56C, WASHDOWN
1/7/2021, BGH

BALDOR • RELIANCE

Product Information Packet

CDPWD3330

.5HP, 1750RPM, DC, 56C, 3336P, TENV, F1

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BALDOR • RELIANCE Product Information Packet: CDPWD3330 - .5HP,1750RPM,DC,56C,3336P,TENV,F1

Part Detail							
Revision:	AV	Status:	PRD/A	Change #:		Proprietary:	No
Type:	DC	Prod. Type:	3336P	Elec. Spec:	33WGZ122	CD Diagram:	CD0194
Enclosure:	TENV	Mfg Plant:		Mech. Spec:	33-2142	Layout:	33LY2142
Frame:	56C	Mounting:	F1	Poles:	00	Created Date:	
Base:	RG	Rotation:	R	Insulation:	F	Eff. Date:	09-28-2020
Field Type:		Literature:		Elec. Diagram:		Replaced By:	

Specs			
Enclosure:	TENV		
Frame:	56C		
Frame Material:	Steel		
Agency Approvals:	CE		
	CSA		
	UR		
	WEEE		
Base Indicator:	Rigid		
Bearing Grease Type:	Polyrex EM (-20F +300F)		
Drip Cover:	No Drip Cover		
Duty Rating:	CONT		
Feedback Device:	NO FEEDBACK		
Heater Indicator:	No Heater		
Insulation Class:	F		
Lifting Lugs:	No Lifting Lugs		
Motor Lead Quantity/Wire Size:	2 @ 18 AWG, A		

Product Information Packet: CDPWD3330 - .5HP,1750RPM,DC,56C,3336P,TENV,F1

Motor Lead Exit:	Ko Box		
Motor Lead Termination:	Flying Leads		
Mounting Arrangement:	F1		
Product Family:	Wash Down		
Pulley End Bearing Type:	Sealed Bearing		
RoHS Status:	ROHS COMPLIANT		
Shaft Extension Location:	Pulley End		
Shaft Ground Indicator:	No Shaft Grounding		
Shaft Rotation:	Reversible		
Shaft Slinger Indicator:	Shaft Slinger		
Motor Standards:	NEMA		

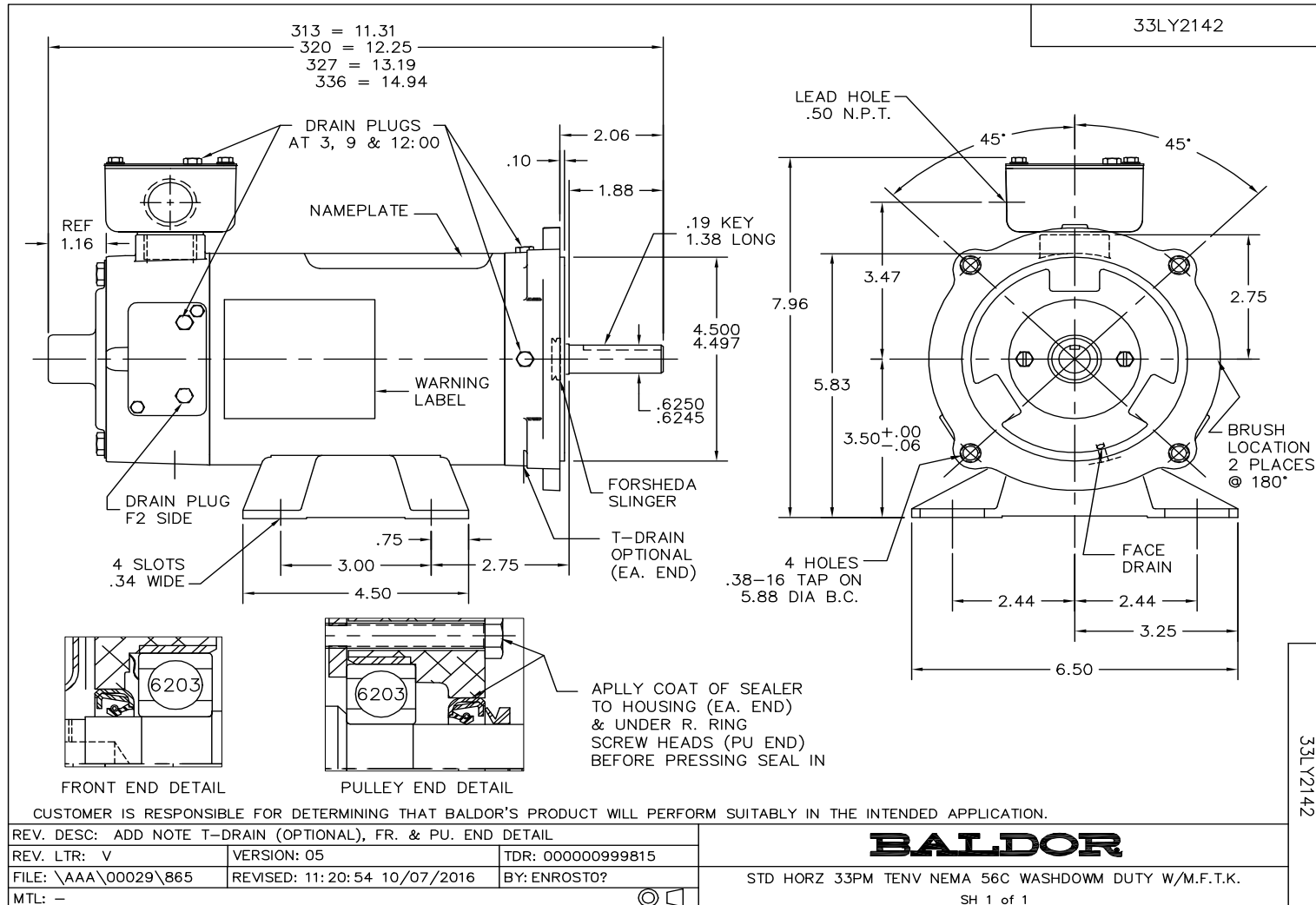
Nameplate NP1509			
CAT.NO.	CDPWD3330		
SPEC.	33-2142Z122		
HP	.5	ENCL	TENV
RPM	1750		
FRAME	56C	TYPE	3336P
ARM V	90	ARM A	4.8
FLD V		FLD A	
INSUL	F	AMB.	40
DUTY	CONT	SUPPLY	1.3
BRG/DE	6203	BRG/ODE	6203
BRUSHES	2/BP5011T01		
SER.	IP55	BLANK	
BLANK	KW.37 KG14		
APRV-CSA	<input type="checkbox"/> Y	APRV-UL	<input type="checkbox"/> Y
		APRV-CE	<input type="checkbox"/> Y

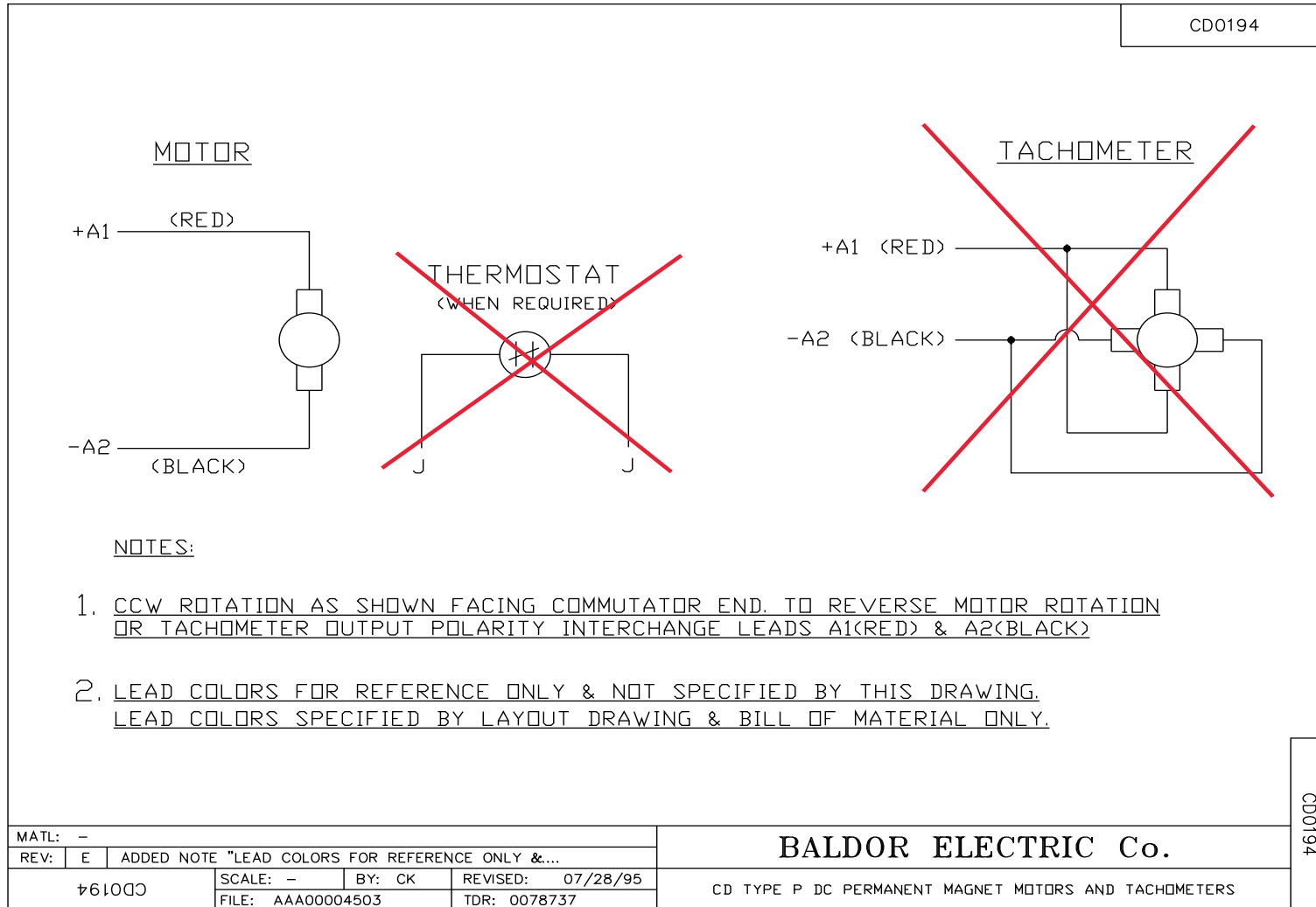
BALDOR • RELIANCE Product Information Packet: CDPWD3330 - .5HP,1750RPM,DC,56C,3336P,TENV,F1

Parts List		
Part Number	Description	Quantity
SA005091	SA 33-2142Z122	1.000 EA
AA002740	AA 33-2142Z122	1.000 EA
BP5011T01SP	CARBON BRUSH - 33P, 90V	1.000 EA
BP5012A04SP	BRUSH SPRING FOR DC MOTORS	1.000 EA
33CB3001B02G	CONDUIT BOX, MACH/COATED LIGHT GRAY PRIM	1.000 EA
33GS1013	GASKET - CONDUIT BOX, .062 WHITE NEOPREN	1.000 EA
51XT0832A08	8-32 X 1/2 TY23 HXWS SLDSR	3.000 EA
HW3001B02	BRASS CUP WASHER W/GROUND SYMBOL TAB,	1.000 EA
51XW0832G07	8-32 X 7/16 TY23 HXWS SLDSR GR	1.000 EA
51XW0832A07	8-32 X .44, TAPTITE II, HEX WSHR SLTD SE	4.000 EA
33EP3101A13W	FR ENDPLATE, MACH W/WHITE EPOXY PAINT	1.000 EA
HW4600A54	SEAL 0.668 X 1.064 X 0.250 DOUBLE SHIELD	1.000 EA
33CB4501A04W	BRUSH INSPECTION COVER, POWDER COAT	2.000 EA
33GS1014	GASKET, BRUSH INSP. COVERTDR 11640	2.000 EA
11XT0832S07	08-32 X 7/16 HX SL WS HD, 304 STAINLESS	6.000 EA
HA6887	SHAFT PROTECTOR STAMPED STEEL 20 GA.	1.000 EA
10XN2520S06	1/4 20X3/8 HX HD CAP S.S.	2.000 EA
HW5100A03	WAVY WASHER (W1543-017)	1.000 EA
33EP3302A14W	PULLEY ENDPLATE ENCL 33PM 56C W/WHITE EP	1.000 EA
HW4600A54	SEAL 0.668 X 1.064 X 0.250 DOUBLE SHIELD	1.000 EA
HW4600B39SP	V-RING SLINGER 0.550 X 0.790 X .18 VITON	1.000 EA
11XN1032S20	10-32 X 1-1/4 HEX WASHER HEAD, SLOTTED	2.000 EA
19XA1016S06	10-16X3/8 SS HEX WSHR SLOT HD TYPE AB	3.000 EA
WD4102A12	SR 6P-4 HEYCO STRN RELIEF OR 23MP06P40 M	1.000 EA

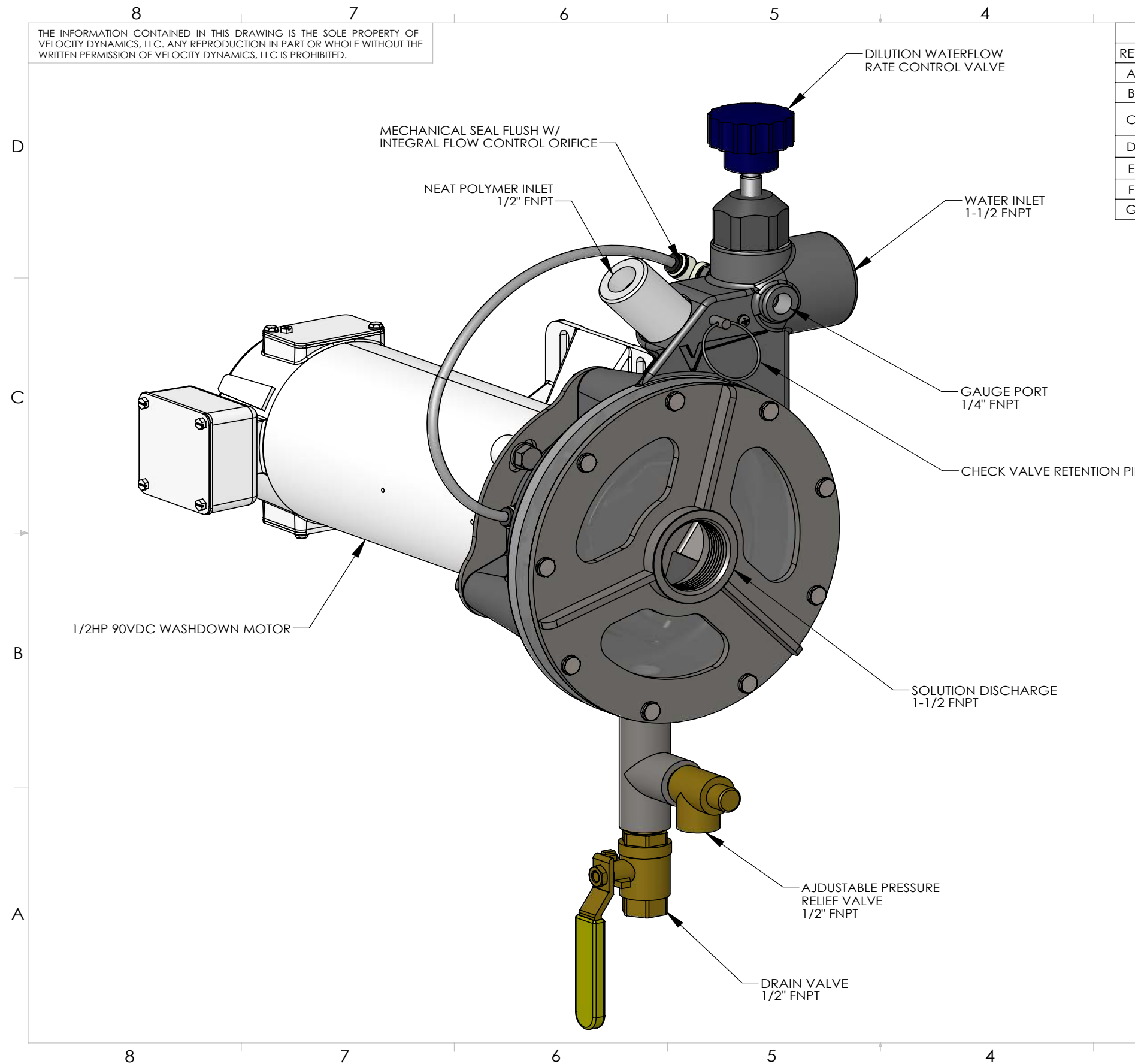
Parts List (continued)		
Part Number	Description	Quantity
34CB4500A10G	CONDUIT BOX LID, MACH W/GRAY EPOXY	1.000 EA
33GS1012	GASKET - CONDUIT BOX LID, MODEL 33PM	1.000 EA
11XT0832S07	08-32 X 7/16 HX SL WS HD, 304 STAINLESS	5.000 EA
HW2502D13	SS KEY, 3/16 SQ X 1.375	1.000 EA
HA7000A04	KEY RETAINER 0.625 DIA SHAFTS	1.000 EA
MG1025W01	WILKOFAS, 781.01, SIGNAL WHITE #9003	0.013 GA
33RK5004SP	ROCKERARM	1.000 EA
HA3100S03	THRUBOLT- 10-32 X 10.625 302 OR 303 SS	2.000 EA
MG1500Y02	WILKOPON PRIMER YELLOW	0.013 GA
85XU0407S04	4X1/4 U DRIVE PIN STAINLESS	2.000 EA
MJ5001A27	32220KN GRAY SEALER *MIN BUY 4 QTS=1GAL	0.001 QT
MN416A01	TAG-INSTAL-MAINT no wire (1200/bx) 3/19	1.000 EA
LB1164	LABEL,WARNING AND DRAIN	1.000 EA
LC0194	CONNECTION LABEL	1.000 EA
NP1509	DC, WD, UL CE CSA, W/O THERMAL	1.000 EA
27PA1001	PKG GRP, PRINT PK1027A06	1.000 EA
LB1451	WARNING LABEL, CE WARNING SYMBOLS ONLY	1.000 EA

No performance data has been
assigned to this product.





3.2.3 Mixing Chamber

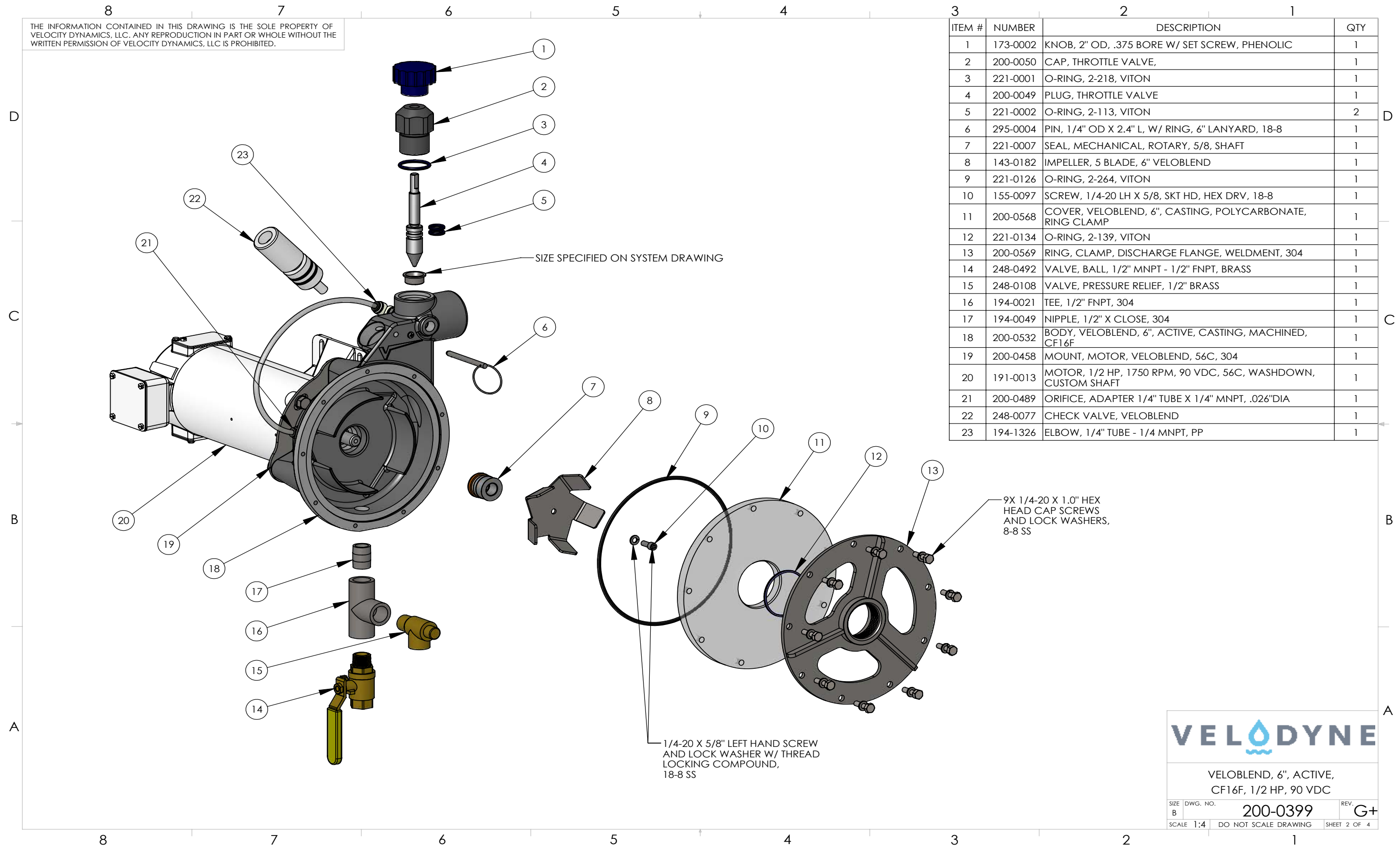


REVISIONS				
REV	ECO	DESCRIPTION	DATE	APPROVED
A	EC10081	INITIAL RELEASE	9/18/12	J Skuba
B	EC10143	CHANGED LENGTH OF LH BOLT FROM 3/4" TO 5/8"	01/29/13	T MORRIS
C	EC 10158	CHG'D FOR NEW CASTING DESIGN; CHG TO BRASS AND SS DRAIN/RELIEF VALVES	1/13/15	C WELLS
D	EC 10161	CHG COVER O-RING, SHOW NEW MOTOR MNT DESIGN	8/21/15	C WELLS
E	EC 10164	CHG THROTTLE VALVE CAP, COVER, CLAMP RING	1/4/16	B HEALY
F	EC 10169	CHANGE THROTTLE VALVE CAP	3/28/16	B HEALY
G		CORRECT MATERIAL DESCRIPTION	1/18/17	B HEALY

- NOTES -
- 1) APPROXIMATE DRY WEIGHT 55 LBS
 - 2) FOLLOW O&M PROCEDURES FOR DRAINING PRIOR TO STORAGE OR SHIPMENT

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES: DECIMALS .XX = ±.015 .XXX = ±.005 ANGLES ± 1° 63 ✓ MINIMUM FILLET RADII TO BE .005 MAXIMUM BREAK ALL EDGES .005/.010 MATERIAL	CAD GENERATED DRAWING. INTERPRET DRAWING PER ASME Y14.5M - 2009	APPROVALS		DATE
		MODELED		
FILENAME 200-0399	DO NOT SCALE DRAWING	DRAWN JB SKUBA	PROJECT MGR C HEUSEL	PURCHASING MGR J MITCHELL
		VELOBLEND, 6", ACTIVE, CF16F, 1/2 HP, 90 VDC		
SIZE B	DWG. NO. 200-0399	REV. G+	SHEET 1 OF 4	
		SCALE 1:2.5	CAD FILE:	

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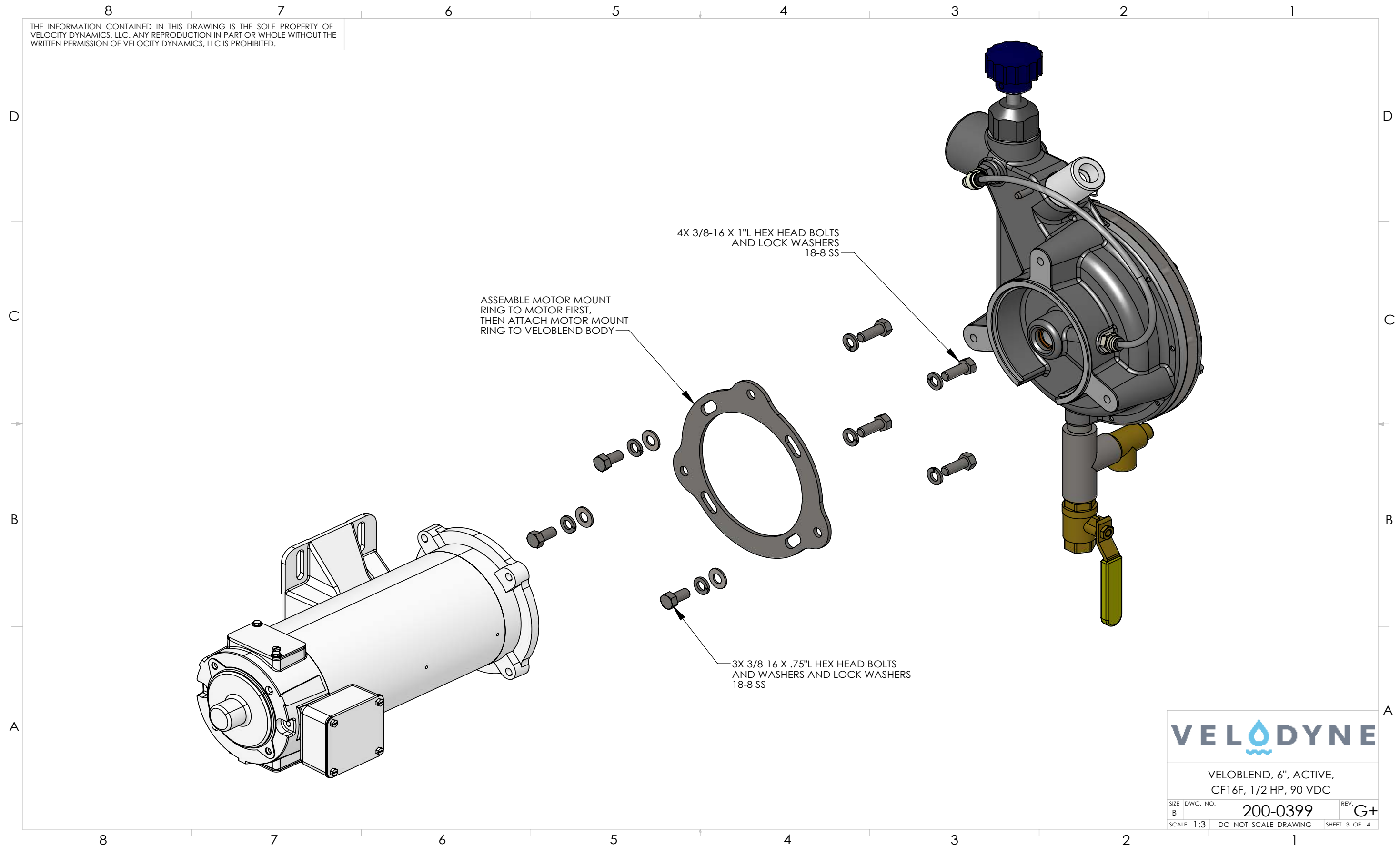
ITEM #	NUMBER	DESCRIPTION	QTY
1	173-0002	KNOB, 2" OD, .375 BORE W/ SET SCREW, PHENOLIC	1
2	200-0050	CAP, THROTTLE VALVE,	1
3	221-0001	O-RING, 2-218, VITON	1
4	200-0049	PLUG, THROTTLE VALVE	1
5	221-0002	O-RING, 2-113, VITON	2
6	295-0004	PIN, 1/4" OD X 2.4" L, W/ RING, 6" LANYARD, 18-8	1
7	221-0007	SEAL, MECHANICAL, ROTARY, 5/8, SHAFT	1
8	143-0182	IMPELLER, 5 BLADE, 6" VELOBLEND	1
9	221-0126	O-RING, 2-264, VITON	1
10	155-0097	SCREW, 1/4-20 LH X 5/8, SKT HD, HEX DRV, 18-8	1
11	200-0568	COVER, VELOBLEND, 6", CASTING, POLYCARBONATE, RING CLAMP	1
12	221-0134	O-RING, 2-139, VITON	1
13	200-0569	RING, CLAMP, DISCHARGE FLANGE, WELDMENT, 304	1
14	248-0492	VALVE, BALL, 1/2" MNPT - 1/2" FNPT, BRASS	1
15	248-0108	VALVE, PRESSURE RELIEF, 1/2" BRASS	1
16	194-0021	TEE, 1/2" FNPT, 304	1
17	194-0049	NIPPLE, 1/2" X CLOSE, 304	1
18	200-0532	BODY, VELOBLEND, 6", ACTIVE, CASTING, MACHINED, CF16F	1
19	200-0458	MOUNT, MOTOR, VELOBLEND, 56C, 304	1
20	191-0013	MOTOR, 1/2 HP, 1750 RPM, 90 VDC, 56C, WASHDOWN, CUSTOM SHAFT	1
21	200-0489	ORIFICE, ADAPTER 1/4" TUBE X 1/4" MNPT, .026"DIA	1
22	248-0077	CHECK VALVE, VELOBLEND	1
23	194-1326	ELBOW, 1/4" TUBE - 1/4 MNPT, PP	1

VELODYNE

VELOBLEND, 6", ACTIVE,
CF16F, 1/2 HP, 90 VDC

SIZE B	DWG. NO. 200-0399	REV. G+
SCALE 1:4	DO NOT SCALE DRAWING	SHEET 2 OF 4

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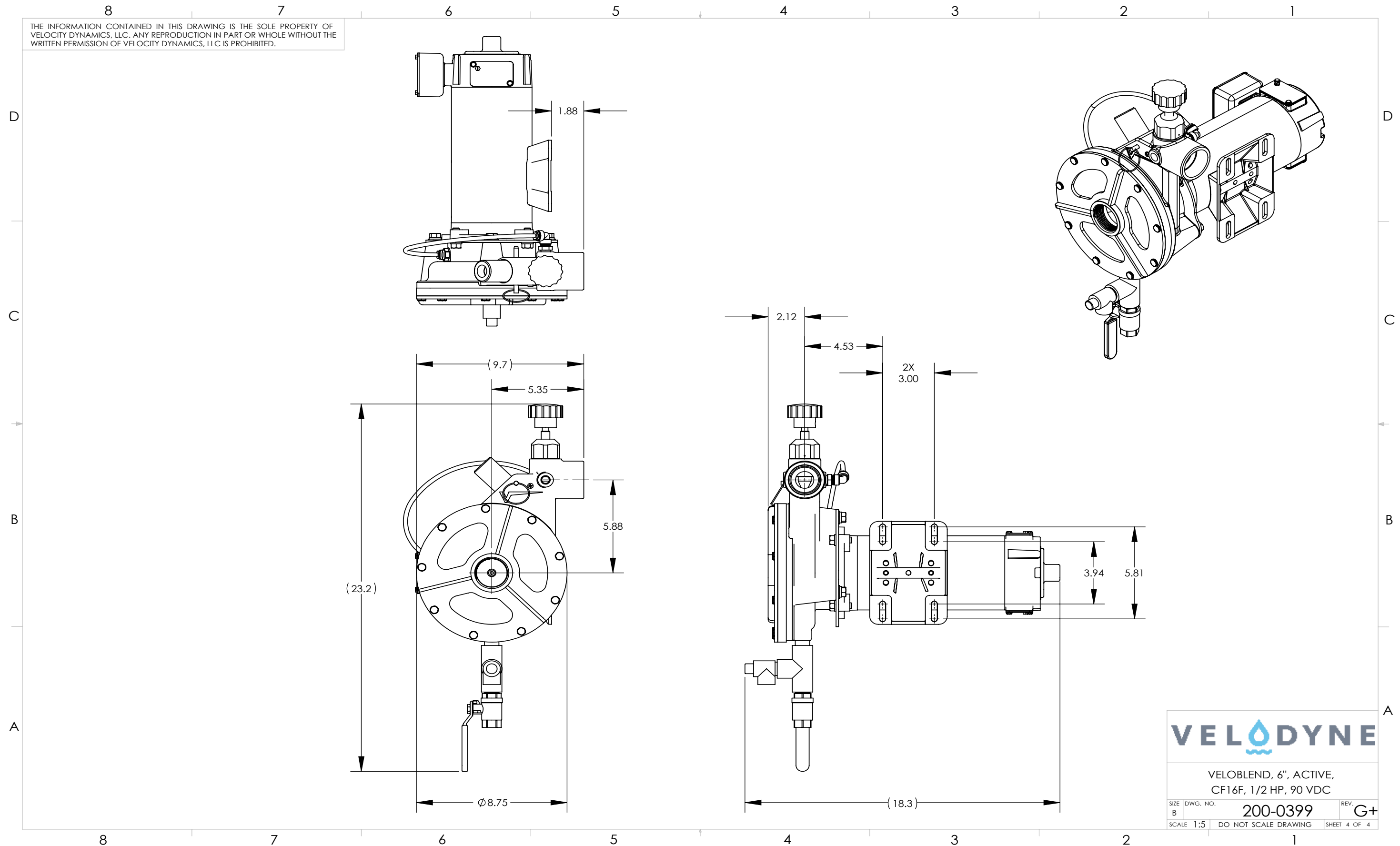
ASSEMBLE MOTOR MOUNT RING TO MOTOR FIRST, THEN ATTACH MOTOR MOUNT RING TO VELOBLEND BODY

4X 3/8-16 X 1" HEX HEAD BOLTS AND LOCK WASHERS 18-8 SS

3X 3/8-16 X .75" HEX HEAD BOLTS AND WASHERS AND LOCK WASHERS 18-8 SS

VELOBLEND, 6", ACTIVE, CF16F, 1/2 HP, 90 VDC			
SIZE B	DWG. NO. 200-0399	REV. G+	
SCALE 1:3	DO NOT SCALE DRAWING	SHEET 3 OF 4	

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VELOCITY DYNAMICS

VELOBLEND, 6", ACTIVE,
CF16F, 1/2 HP, 90 VDC

SIZE B	DWG. NO. 200-0399	REV. G+
SCALE 1:5	DO NOT SCALE DRAWING	SHEET 4 OF 4

191-0013 C2
MOTOR, 1/2 HP, 1750 RPM, 90 VDC, 56C, WASHDOWN,
CUSTOM SHAFT
1/12/2021, BGH



BALDOR • RELIANCE

Product Information Packet

33-2645Z122

.5HP, 1750RPM, DC, 56C, 3336P, TENV, F1, N

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BALDOR • RELIANCE Product Information Packet: 33-2645Z122 - .5HP,1750RPM,DC,56C,3336P,TENV,F1,N

Part Detail							
Revision:	-	Status:	PRD/I	Change #:		Proprietary:	No
Type:	DC	Prod. Type:	3336P	Elec. Spec:	33WGZ122	CD Diagram:	CD0194
Enclosure:	TENV	Mfg Plant:		Mech. Spec:	33-2645	Layout:	33LY2645
Frame:	56C	Mounting:	B7	Poles:	00	Created Date:	10-23-2017
Base:	RG	Rotation:	R	Insulation:	F	Eff. Date:	12-31-9998
Field Type:		Literature:		Elec. Diagram:		Replaced By:	

Nameplate NP1502			
CAT.NO.			
SPEC.	33-2645Z122		
HP	.5	ENCL	TENV
RPM	1750		
FRAME	56C	TYPE	3336P
ARM V	90	ARM A	4.8
FLD V		FLD A	
INSUL	F	AMB.	40
DUTY	CONT	SUPPLY	1.3
BRG/DE	6203	BRG/ODE	6203
BRUSHES	2/BP5011T01		
SER.		BLANK	
BLANK			
APRV-CSA		APRV-UL	

BALDOR CONFIRMED THIS MOTOR HAS CSA APPROVAL. BALDOR IS CURRENTLY IN PROCESS OF UPDATING DATASHEET.

BALDOR • RELIANCE Product Information Packet: 33-2645Z122 - .5HP,1750RPM,DC,56C,3336P,TENV,F1,N

Parts List		
Part Number	Description	Quantity
33WGZ122-C001	3336P,PM,CD0194,,S000,F,35AL2200,CM1032	1.000 EA
33WGZ122-R001	3336P-35, .500HP, 1750,F,TENV,MTR,CON	1.000 EA
33-2645	TENV RG 56C WD P N B7	1.000 EA
33BA3000W	BASE, ALUIM W/WHT EPOXY	1.000 EA
HW3001B01	BRASS CUP WASHER, FOR #8 SCREW	1.000 EA
59XW2520A07	.25-20X7/16HEX SER WSHR HD TAPTIE-II T	2.000 EA
BG6203E03	6203 D.SL,C3,POLYREX EM	1.000 EA
BG6203E03	6203 D.SL,C3,POLYREX EM	1.000 EA
MG1025W01	WILKOFAS, 781.01, SIGNAL WHITE #9003	0.013 GA
MG1500Y02	PRIMER,347.29+347.29C ACTIVATOR WILKOPON	0.013 GA
10XF0440S02	04-40 X 1/8 TYPE F HEX HD STAINLESS STIC	2.000 EA
MJ5001A27	32220KN GRAY SEALER *MIN BUY 4 QTS=1GAL	0.001 QT
33RK5004SP	ROCKERARM	1.000 EA
33SB3000A04	BAND, 336P	1.000 EA
33SH0120D01	14.03LX.938D SHOVS=2.94 416SS	1.000 EA
HA3100S03	THRUBOLT- 10-32 X 10.625 302 OR 303 SS	2.000 EA
LB1164	LABEL,WARNING AND DRAIN	1.000 EA
LC0194	CONNECTION LABEL	1.000 EA
MN416A01	TAG-INSTAL-MAINT no wire (1100/bx) 11/14	1.000 EA
NP1502	WASHDOWN NP "DC MOTORS" UL CSA	1.000 EA
36PA1000	PKG GRP, PRINT PK1016A06	1.000 EA

BALDOR • RELIANCE Product Information Packet: 33-2645Z122 - .5HP,1750RPM,DC,56C,3336P,TENV,F1,N

Parts List (continued)		
Part Number	Description	Quantity
LB1417	LABEL CARTON 6X4 PERFORATED BLANK ROLLS	1.000 EA

DC Motor Performance Data

Record # 216 - Typical performance - not guaranteed values

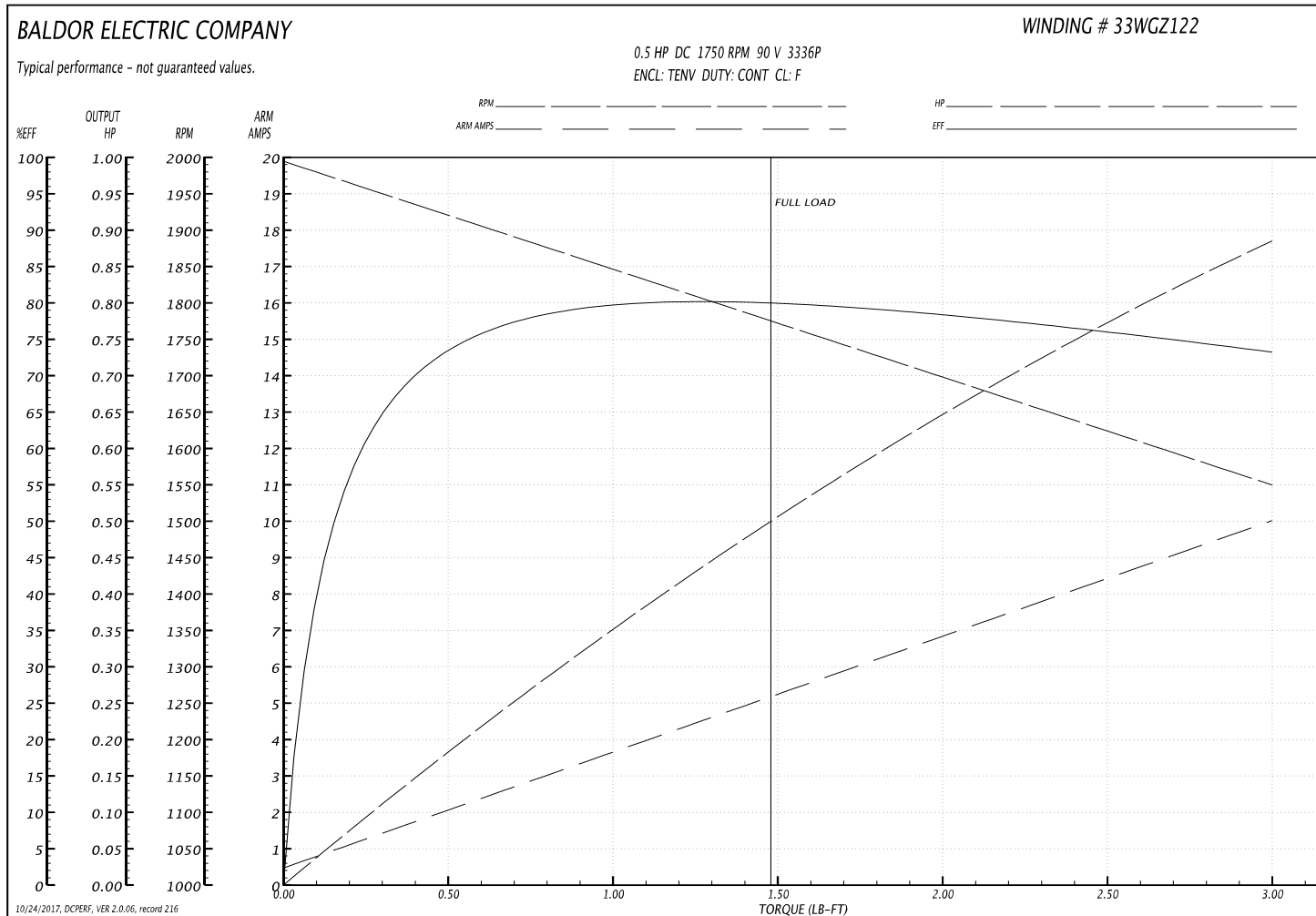
Winding: 33WGZ122-R001	Type: 3336P	Enclosure: TENV
-------------------------------	--------------------	------------------------

Nameplate Data		General Characteristics	
Rated Output (HP)	0.5	Armature Resistance @ 25°C	1.22 Ω
R.P.M.	1750		
Armature Volts	90		
Armature Amps	4.8		
Field Volts		Armature Inductance	15.574 mH
Field Amps			
Rating - Duty	40C AMB-CONT		
Form Factor	1.3	Maximum allowable inrush amps	44

Load Characteristics at 90 Armature Volts

Load Point	1	2	3	4	5	6	7
Armature Amps	0.474	2.065	3.656	5.247	6.838	8.429	10.02
R.P.M.	1995	1920	1846	1772	1698	1624	1550
Torque (LB-FT)	0	0.5	1	1.5	2	2.5	3

Performance Graph at 90.0 Arm V, 0.5HP Typical performance - Not guaranteed values



DC Motor Performance Data

Record # 515 - Typical performance - not guaranteed values

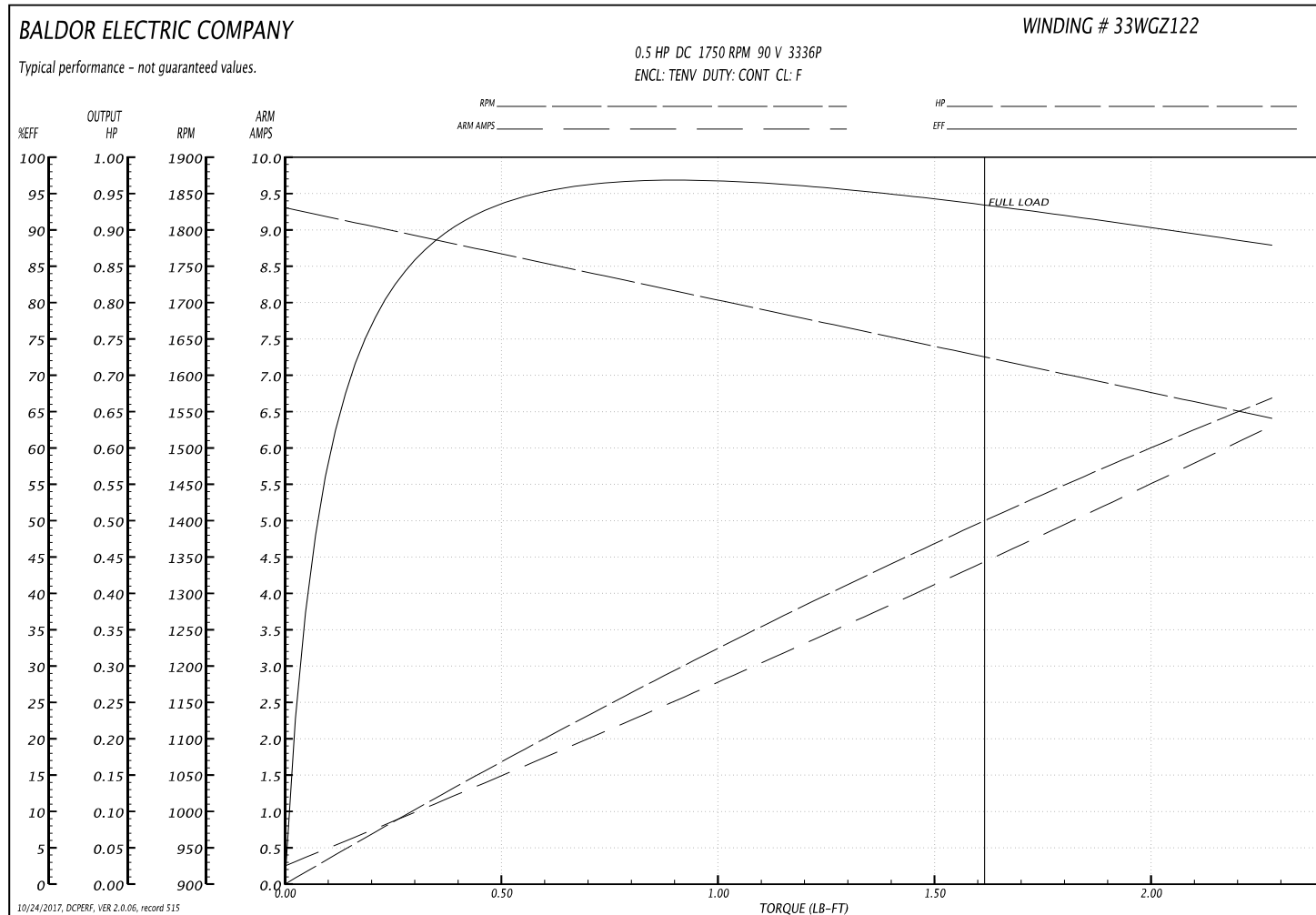
Winding: 33WGZ122-R001	Type: 3336P	Enclosure: TENV
-------------------------------	--------------------	------------------------

Nameplate Data		General Characteristics	
Rated Output (HP)	0.5	Armature Resistance @ 25°C	1.2779 Ω
R.P.M.	1750		
Armature Volts	90		
Armature Amps	4.8		
Field Volts		Armature Inductance	15.798 mH
Field Amps			
Rating - Duty	40C AMB-CONT		
Form Factor	1.3		

Load Characteristics at 90 Armature Volts

Load Point	1	2	3	4	5	6	7
Armature Amps	0.24	1.25	2.1	3.15	4.05	5.36	6.25
R.P.M.	1835	1793	1721	1672	1648	1584	1549
Torque (LB-FT)	0	0.38	0.76	1.14	1.5	1.9	2.28

Performance Graph at 90.0 Arm V, 0.5HP Typical performance - Not guaranteed values



DC Motor Performance Data

Record # 516 - Typical performance - not guaranteed values

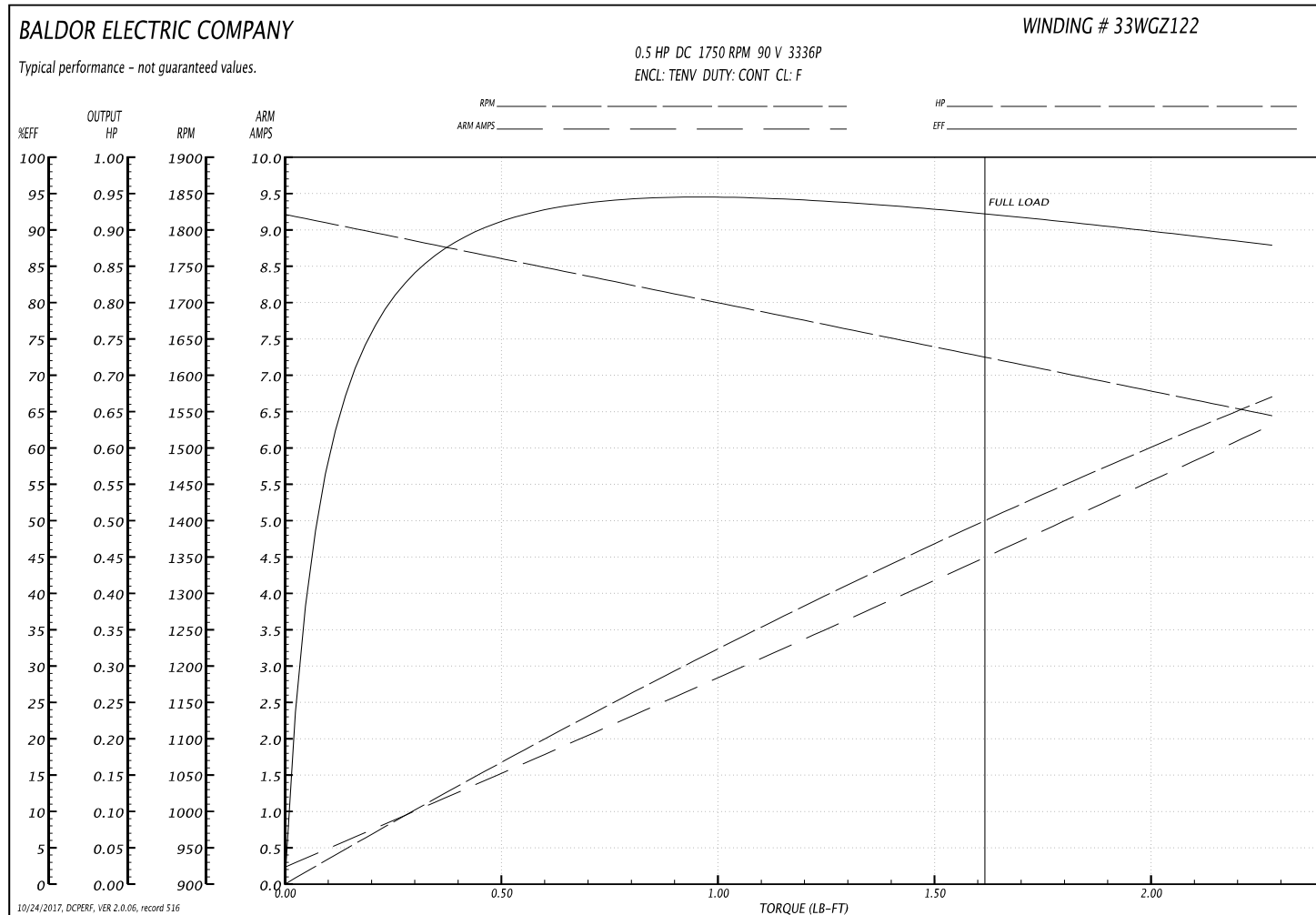
Winding: 33WGZ122-R001	Type: 3336P	Enclosure: TENV
-------------------------------	--------------------	------------------------

Nameplate Data		General Characteristics	
Rated Output (HP)	0.5	Armature Resistance @ 25°C	1.2525 Ω
R.P.M.	1750		
Armature Volts	90		
Armature Amps	4.8		
Field Volts		Armature Inductance	15.413 mH
Field Amps			
Rating - Duty	40C AMB-CONT		
Form Factor	1.3		

Load Characteristics at 90 Armature Volts

Load Point	1	2	3	4	5	6	7
Armature Amps	0.24	1.15	2.35	3.16	4.07	5.37	6.3
R.P.M.	1835	1770	1723	1683	1624	1588	1559
Torque (LB-FT)	0	0.38	0.76	1.14	1.5	1.9	2.28

Performance Graph at 90.0 Arm V, 0.5HP Typical performance - Not guaranteed values



DC Motor Performance Data

Record # 1619 - Typical performance - not guaranteed values

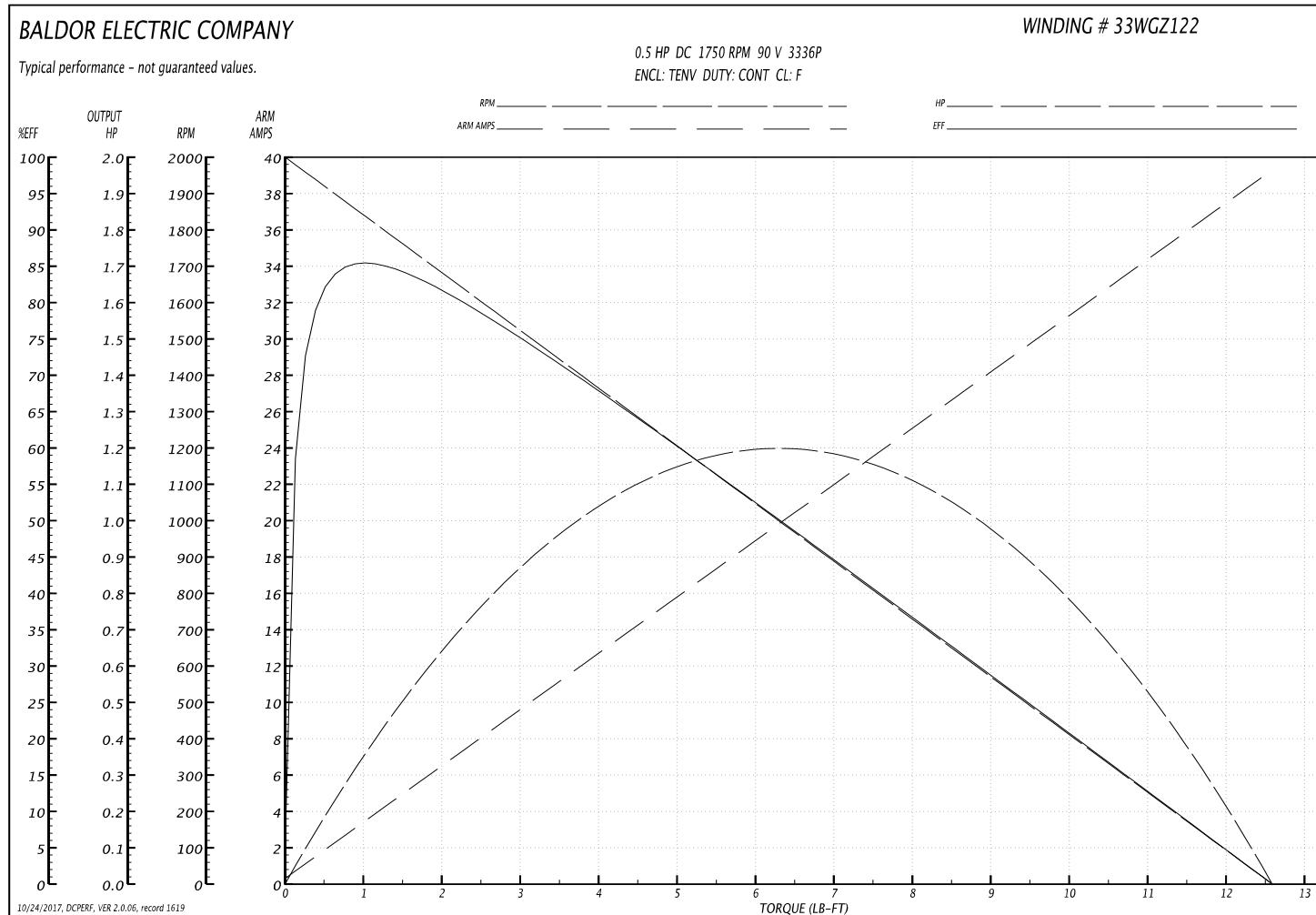
Winding: 33WGZ122-R001	Type: 3336P	Enclosure: TENV
-------------------------------	--------------------	------------------------

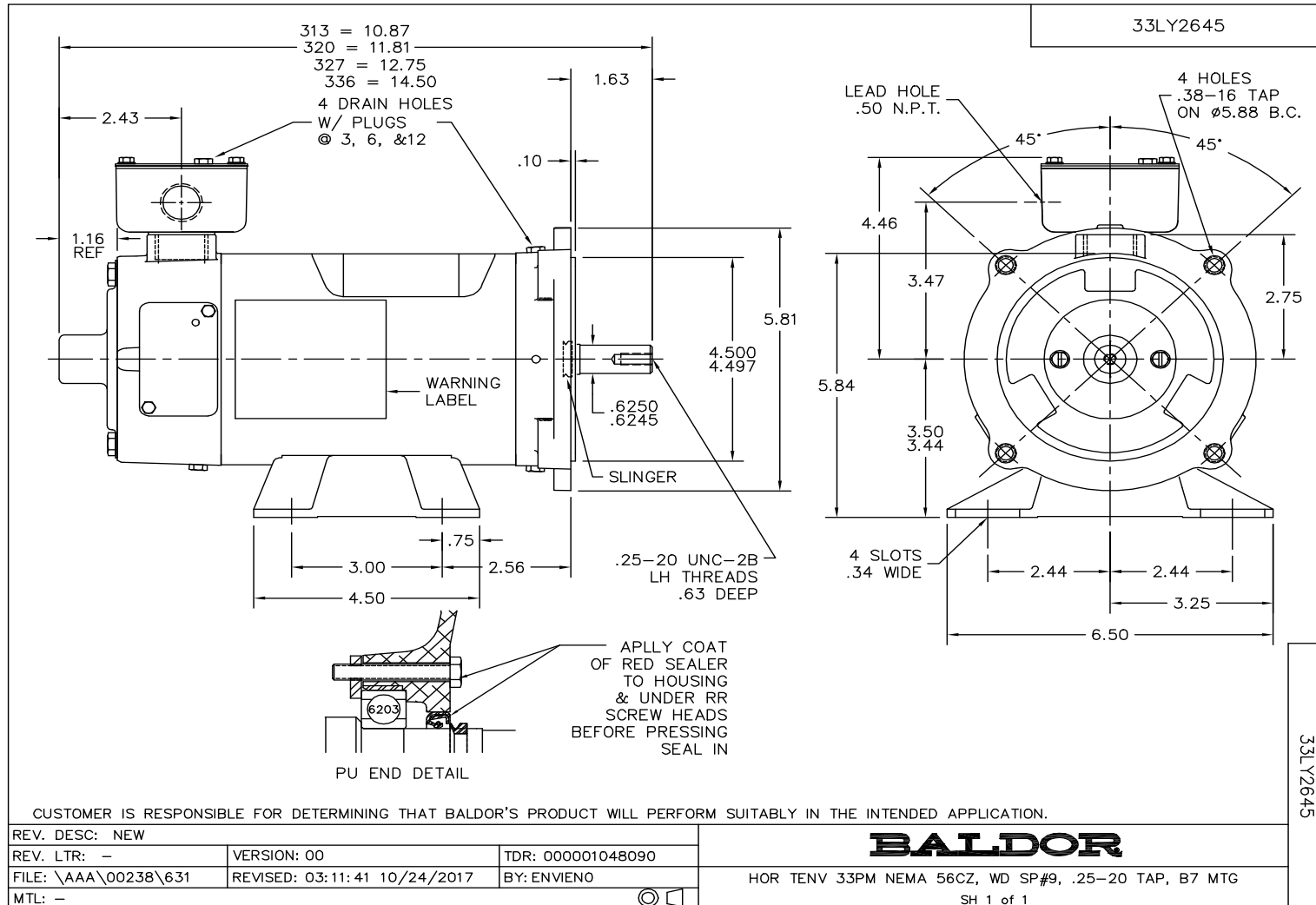
Nameplate Data		General Characteristics	
Rated Output (HP)	0.5	Armature Resistance @ 25°C	1.22 Ω
R.P.M.	1750		
Armature Volts	90	Voltage Constant	44.63 v/krpm
Armature Amps	4.8		
Field Volts		Armature Inductance	15.574 mH
Field Amps		Armature Inertia	14.0472 LI ²
Rating - Duty	40C AMB-CONT		
Form Factor	1.3		

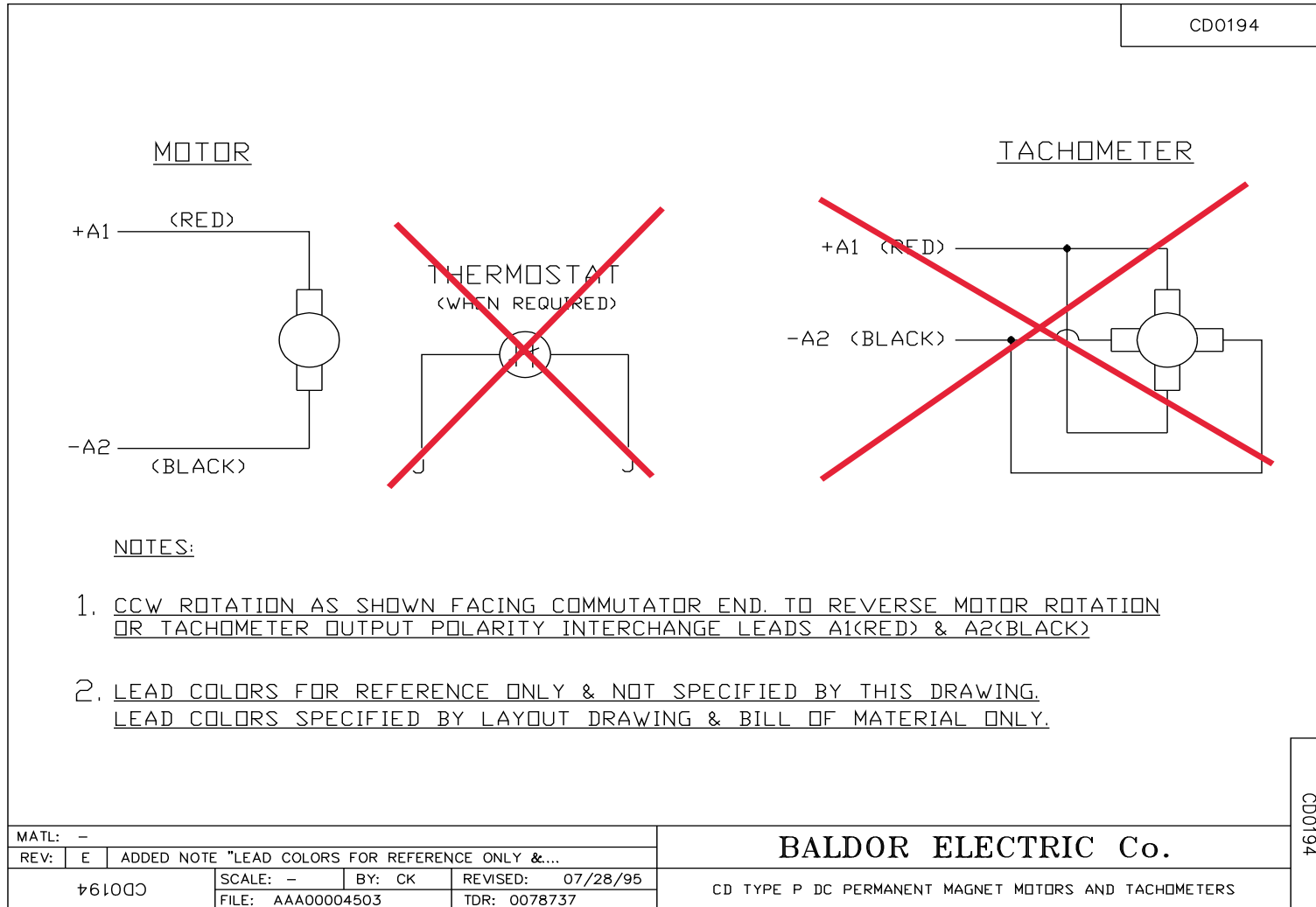
Load Characteristics at 90 Armature Volts

Load Point	1	2	3	4	5	6	7
Armature Amps	0.32	6.51	12.7	18.89	25.08	31.28	39.3
R.P.M.	2000	1682	1365	1047	729	412	0.1
Torque (LB-FT)	0	2	4	6	8	10	12.59

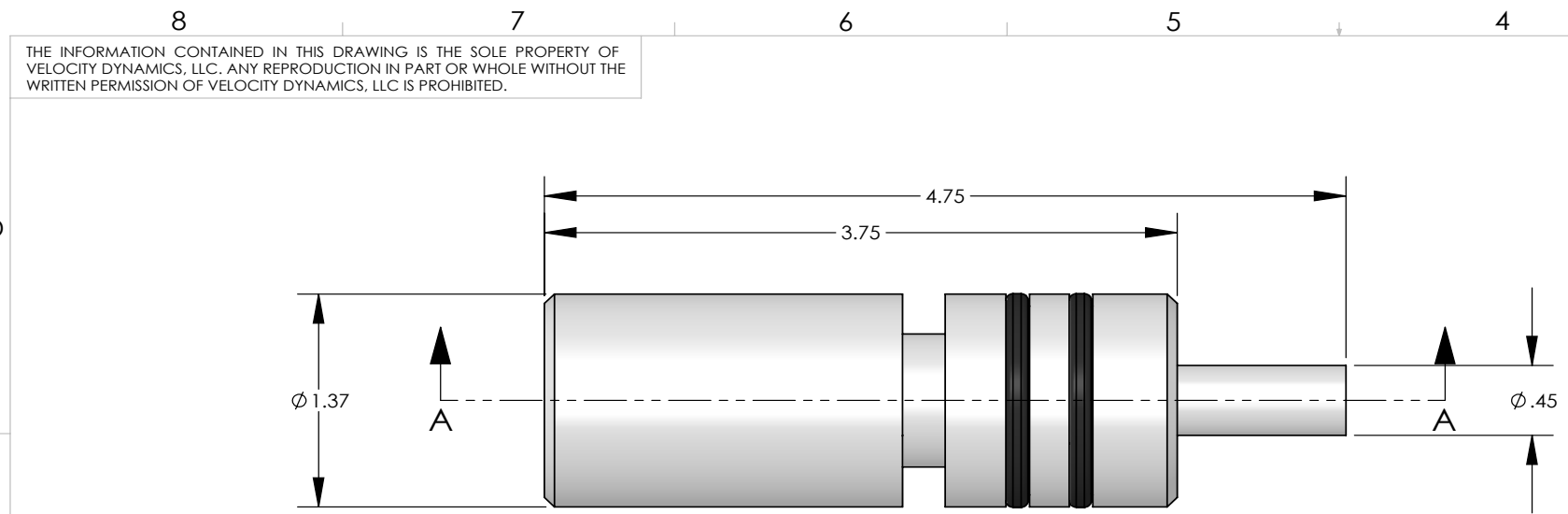
Performance Graph at 90.0 Arm V, 0.5HP Typical performance - Not guaranteed values



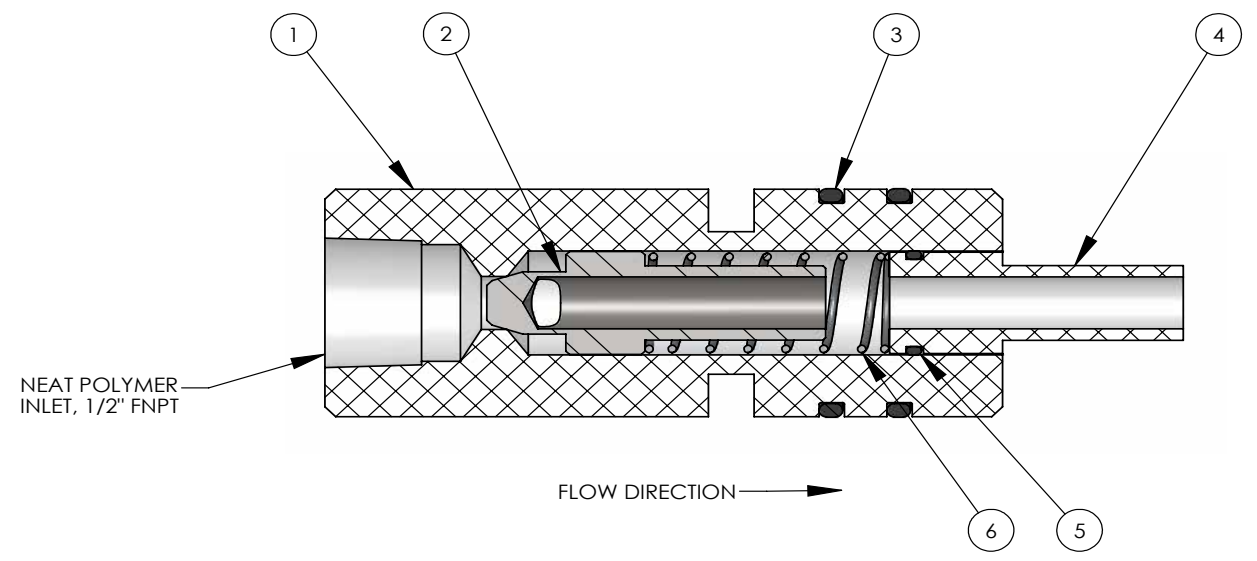
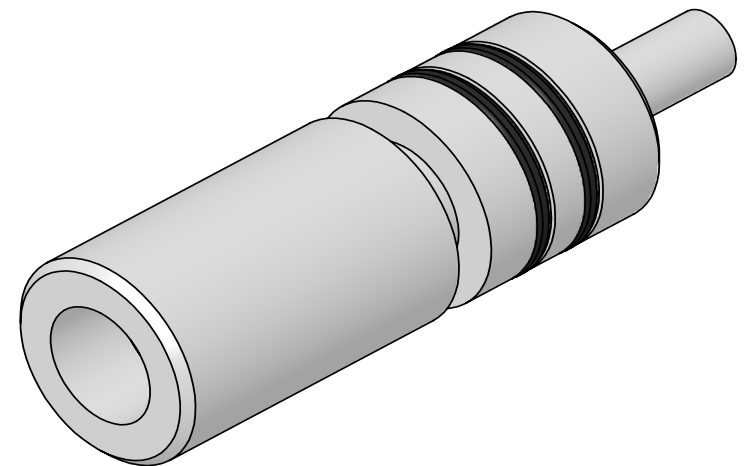




3.2.3.2 Check Valve



REVISIONS				
REV	ECO	DESCRIPTION	DATE	APPROVED
A	JS050331	INITIAL RELEASE AS A-05001	3/31/05	J SKUBA
B	EC10159	CHANGE TO LIGHTER SPRING (WAS 20 LB/IN AND 40PSI)	3/13/15	C WELLS



ITEM #	NUMBER	DESCRIPTION	QTY
1	200-0040	BODY, CHECK VALVE,	1
2	200-0041	POPPET, CHECK VALVE,	1
3	221-0022	O-RING, 2-123, VITON	2
4	200-0039	INJECTOR, CHECK VALVE,	1
5	221-0016	O-RING, 2-014, VITON	1
6	295-0424	SPRING, COMP, .6 OD X 1.5 FL, 5.6 LB/IN	1

- NOTES -
- 1) MATERIALS OF CONSTRUCTION: TEFLON BODY AND INJECTOR QUILL, 304 STAINLESS STEEL POPPET, 302 STAINLESS STEEL SPRING, VITON O-RINGS
 - 2) OPENS AT 15 PSI PRESSURE DIFFERENTIAL IN FLOW DIRECTION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		CAD GENERATED DRAWING, INTERPRET DRAWING PER ANSI Y14.5M - 1994	
TOLERANCES:		APPROVALS	
DECIMALS	ANGLES	MODELED	DATE
.XX = ±.015	± 1°	DRAWN	
.XXX = ±.005		PROJECT MGR	
63	MINIMUM	PURCHASING MGR	
FILLET RADII TO BE .005 MAXIMUM	BREAK ALL EDGES .005/.010	QUAL ENG	
MATERIAL			
FILENAME	248-0077	SCALE 1:1	CAD FILE:
DO NOT SCALE DRAWING		SIZE B	DWG. NO. 248-0077
			REV. B

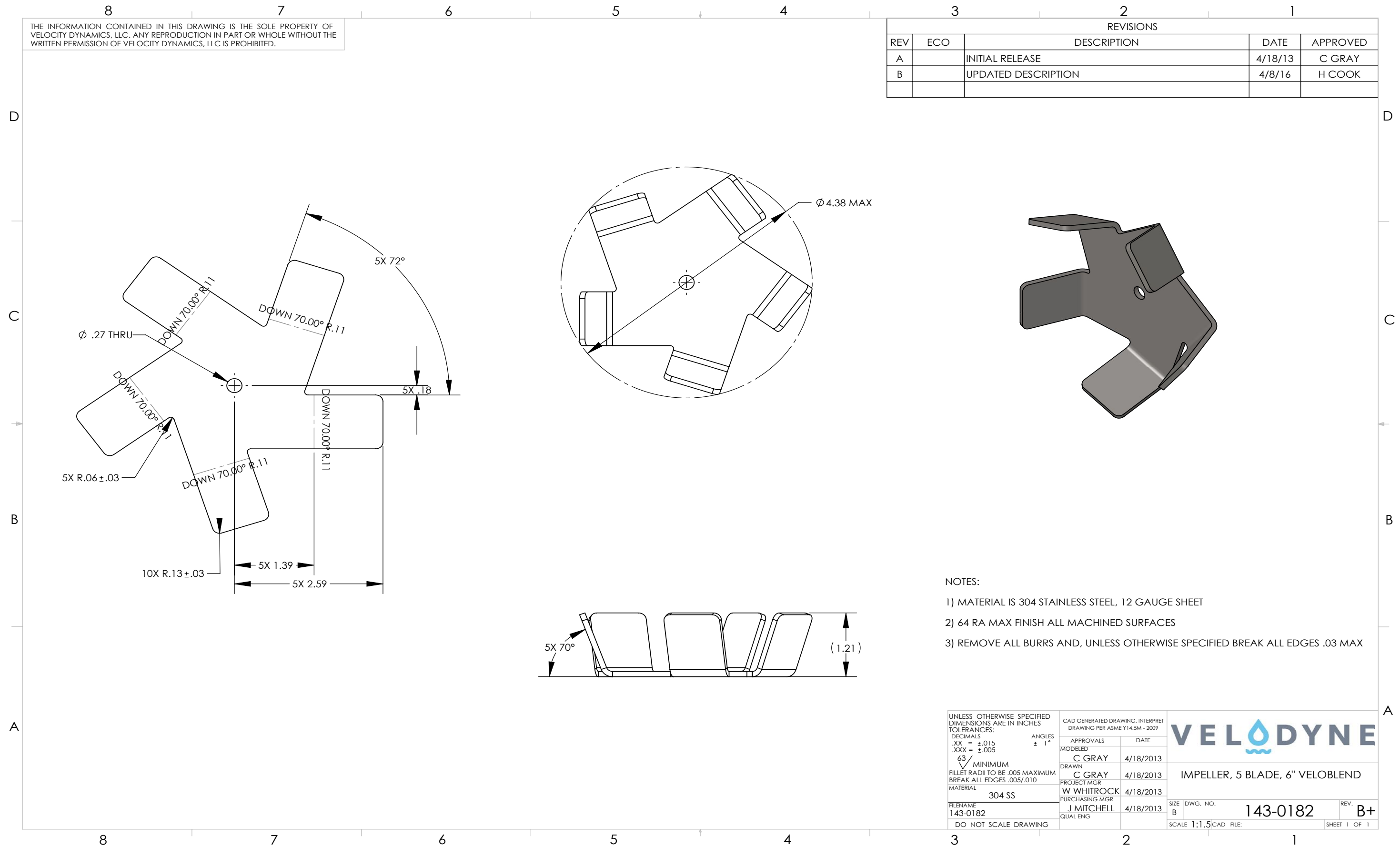


CHECK VALVE, VELOBLEND TEST

3.2.3.3 Impeller

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REVISIONS				
REV	ECO	DESCRIPTION	DATE	APPROVED
A		INITIAL RELEASE	4/18/13	C GRAY
B		UPDATED DESCRIPTION	4/8/16	H COOK



- NOTES:
- 1) MATERIAL IS 304 STAINLESS STEEL, 12 GAUGE SHEET
 - 2) 64 RA MAX FINISH ALL MACHINED SURFACES
 - 3) REMOVE ALL BURRS AND, UNLESS OTHERWISE SPECIFIED BREAK ALL EDGES .03 MAX

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES: DECIMALS .XX = $\pm .015$.XXX = $\pm .005$ ANGLES $\pm 1^\circ$	CAD GENERATED DRAWING. INTERPRET DRAWING PER ASME Y14.5M - 2009		
	APPROVALS MODELED C GRAY	DATE 4/18/2013	
63 MINIMUM FILLET RADII TO BE .005 MAXIMUM BREAK ALL EDGES .005/.010	DRAWN C GRAY	4/18/2013	SIZE DWG. NO. 143-0182 REV. B+ SCALE 1:1.5 CAD FILE: SHEET 1 OF 1
MATERIAL 304 SS	PROJECT MGR W WHITROCK	4/18/2013	
FILENAME 143-0182	PURCHASING MGR J MITCHELL	4/18/2013	
DO NOT SCALE DRAWING			

221-0007 REV C
 SEAL, MECHANICAL, ROTARY, 5/8" SHAFT
 CRW 2/6/15

5/8" ROTARY SHAFT SEAL

- Type 16 seal
- 304 stainless steel spring and housing
- Viton diaphragm
- Carbon seal & Ceramic seat
- Operating temperatures -25 to 400 °F
- Industry standard seal #200V-CMS
- US SEAL 200V-CMS
- McMaster-Carr #9281K62



SEAL HEADS – TYPES A and B

Identify seal head type - Determine Seal Size:
 Measure the inside diameter (ID) (dimension A)
 Measure the outside diameter (OD) (dimension B)

The operating height is generally the same for all A and B seals of the same shaft size. More positive identification will result from calculating the mating ring dimensions below. If unable to positively identify the seal, consult U.S. Seal Mfg.

MATING RING and GASKET

Identify the mating ring design from those shown on inside of front cover. Measure OD of the gasket while assembled on mating ring and subtract approximately .016" additional for rubber squeeze to obtain counterbore dimension (dimension D). Measure the combined insert and gasket width (dimension E).

Use the Dimensional Cross Reference guide (pages 130-179) to find the part number of the seal you need, start with Seal Size and find the line in the tables that matches the dimensions and material code.

248-0108 REV A
 VALVE, PRESSURE RELIEF, 1/2", BRASS
 1/2 LF530C
 CRW 3/17/14

LEAD FREE*

Series LF53, LF530C

Pressure Relief Valves (Calibrated and non-Calibrated)

Sizes: LF53: 1/2" or 3/4"
 LF530C: 1/2" or 3/4"

Watts Series LF53 and LF530C Pressure Relief Valves are spring operated Lead Free* brass relief valves designed to be used only as protection from the build up of excessive pressure in systems containing water, oil or air. These valves are not ASME approved safety relief valves and should not be used in system applications with this requirement. They feature a Lead Free* brass construction with stainless steel springs. Ideally suited as a bypass thermal expansion relief valve, the Series LF530C valves incorporate a calibrated adjustment feature for setting the valve to the relief pressure required. Its adjustable pressure range is 50-175psi (3.4-12.1 bar). Series LF53 is factory preset to standard pressure settings of 75, 100 or 125 (5.2, 6.9 or 8.6 bar). The LF53, LF530C features Lead Free* construction to comply with Lead Free* installation requirements.

Features

- Lead Free* brass
- Stainless steel springs
- Calibrated adjustment feature (Model LF530C)
- Protects against buildup of excessive pressure
- For use in systems containing water, oil, and air

Models

- LF530C - Pressure relief valve with calibrated adjustment feature
- LF53 - Pressure relief valve

*The wetted surface of this product contacted by consumable water contains less than 0.25% of lead by weight.

Watts product specifications in U.S. customary units and metric are approximate and are provided for reference only. For precise measurements, please contact Watts Technical Service. Watts reserves the right to change or modify product design, construction, specifications, or materials without prior notice and without incurring any obligation to make such changes and modifications on Watts products previously or subsequently sold.



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 Canada: Tel: (905) 332-4090 • Fax: (905) 332-7068 • www.watts.ca

ES-LF53_LF530C 1325



Materials

Body: Lead Free* brass
 Springs: Stainless steel
 Disc: Buna-N

Pressure

LF530C Pressure Range: 50-175psi (3.4-12.1 bar)
 LF53 Pressure Range: 75-125psi (5.2-8.6 bar)

Dimensions-Weights

MODEL	SIZE	HEIGHT		WIDTH		WEIGHT	
		in	mm	in	mm	lbs.	gms.
LF53	1/2 or 3/4	2 7/8	73	1 3/4	44	1/2	227
LF530C	1/2 or 3/4	3	76	1 5/8	41	5/8	284

NOTICE

The Watts products shown on this page are small type relief valves. Construction of these products does not meet the (ANSI Z21.22) nationally recognized applicable standard.

NOTICE

Inquire with governing authorities for local installation requirements



A Watts Water Technologies Company

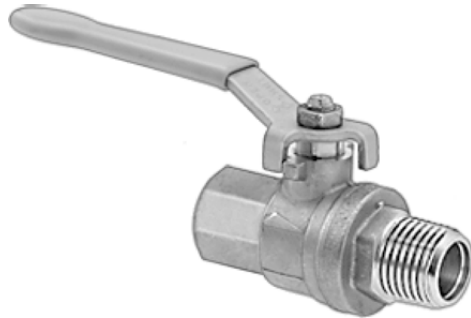
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(630) 833-0300
 (630) 834-9427 (fax)
 chi.sales@mcmaster.com
 Text 75420

Brass Ball Valve
 1/2" NPT Connection, Female x Male

In stock
 \$10.73 Each
 47865K43



Pipe Size	1/2"
End-to-End Length	2 3/4"
Maximum Pressure for Water, Oil, and Inert Gas	
1/4"-2"	600 psi @ 100° F
2 1/2"-4"	450 psi @ 100° F
Maximum Pressure for Steam	150 psi @ 366° F
Temperature Range	-50° to +400° F
Vacuum Rating	29.9" Hg
Additional Specifications	NPT Female x Male Lever

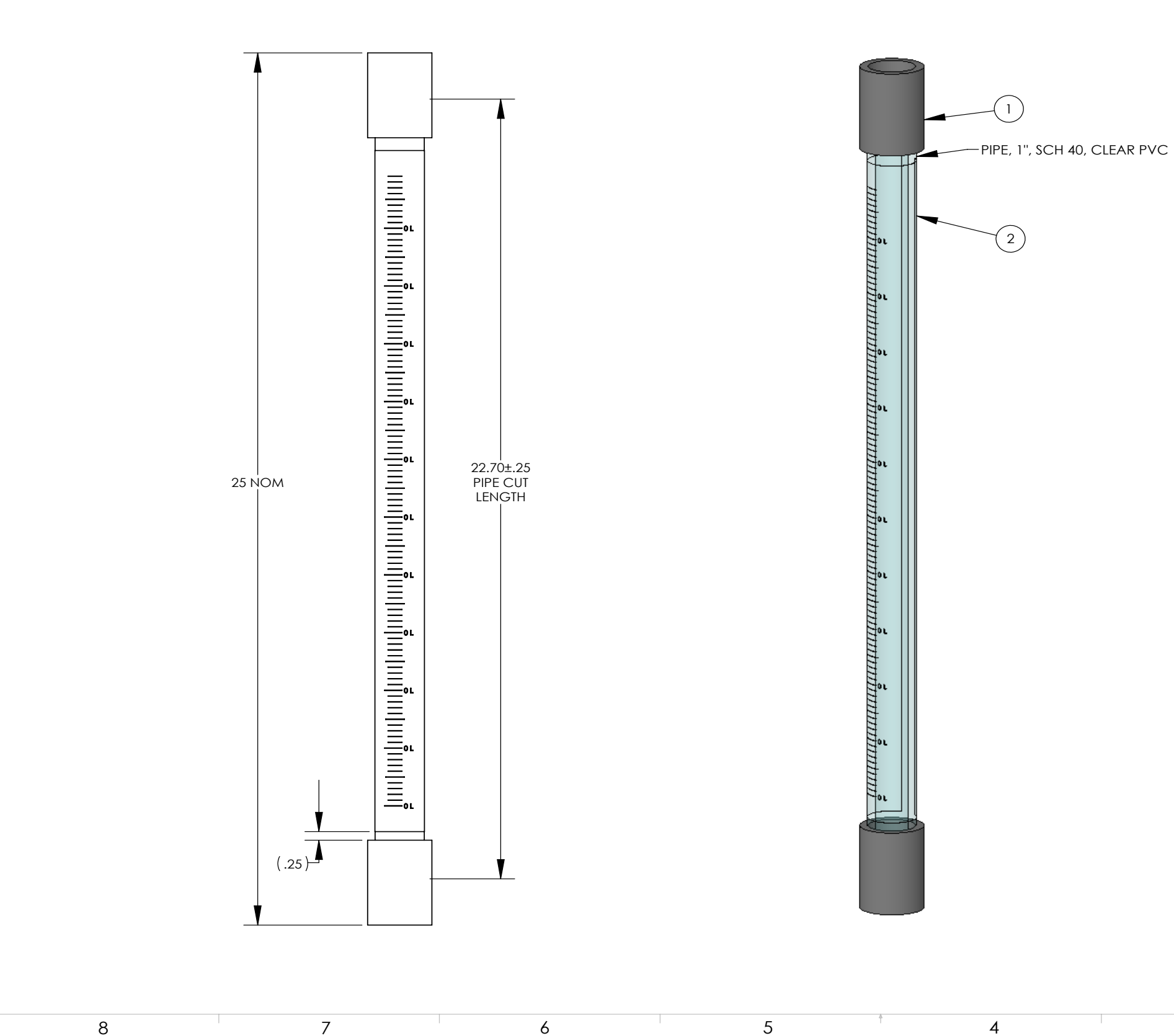
The choice for simple on/off control in general applications. Body is brass, ball is chrome-plated brass, and seats are PTFE. Valves have unrestricted flow (full port). Valves with up to 2" pipe size or tube size are UL and C-UL certified.

Male x female have PTFE packing. Valves with up to 2" pipe size are CSA and CSA-US certified and FM approved.

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3.2.4 Calibration Column

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REVISIONS				
REV	ECO	DESCRIPTION	DATE	APPROVED
A	EC10047	INITIAL RELEASE	3/31/11	J Skuba
D	EC10095	UPDATED DRAWING TO REFLECT CHANGES TO LABEL	7/3/12	T Crowley

NOTES -

- 1) USE PVC CEMENT TO JOIN ITEM 1 TO PIPE
- 2) JOINTS TO BE LEAK FREE TO 10 PSI WATER AT ROOM TEMPERATURE
- 3) APPLY ITEM 2 WITHOUT BUBBLES AND PARALLEL TO THE AXIS OF THE COLUMN WITHIN 1/16 IN

ITEM #	NUMBER	DESCRIPTION	QTY
1	194-0627	ADAPTER, FEMALE, 1", S XT, SCH 80, PVC	2
2	131-0039	LABEL, GRADUATED, 250 ML, CAL COLUMN	1

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		CAD GENERATED DRAWING, INTERPRET DRAWING PER ANSI Y14.5M - 1994	
TOLERANCES:		APPROVALS DATE	
DECIMALS	ANGLES	MODELED	
.XX = ±.015	± 1°	JB SKUBA	3/31/11
.XXX = ±.005		DRAWN	
63/ MINIMUM		JB SKUBA	3/31/11
FILLET RADII TO BE .005 MAXIMUM		PROJECT MGR	
BREAK ALL EDGES .005/.010		P PLACHE	3/31/11
MATERIAL		PURCHASING MGR	
		R ROCHE	3/31/11
FILENAME	110-0002	QUAL ENG	
DO NOT SCALE DRAWING		SCALE 1:3	CAD FILE: SHEET 1 OF 1

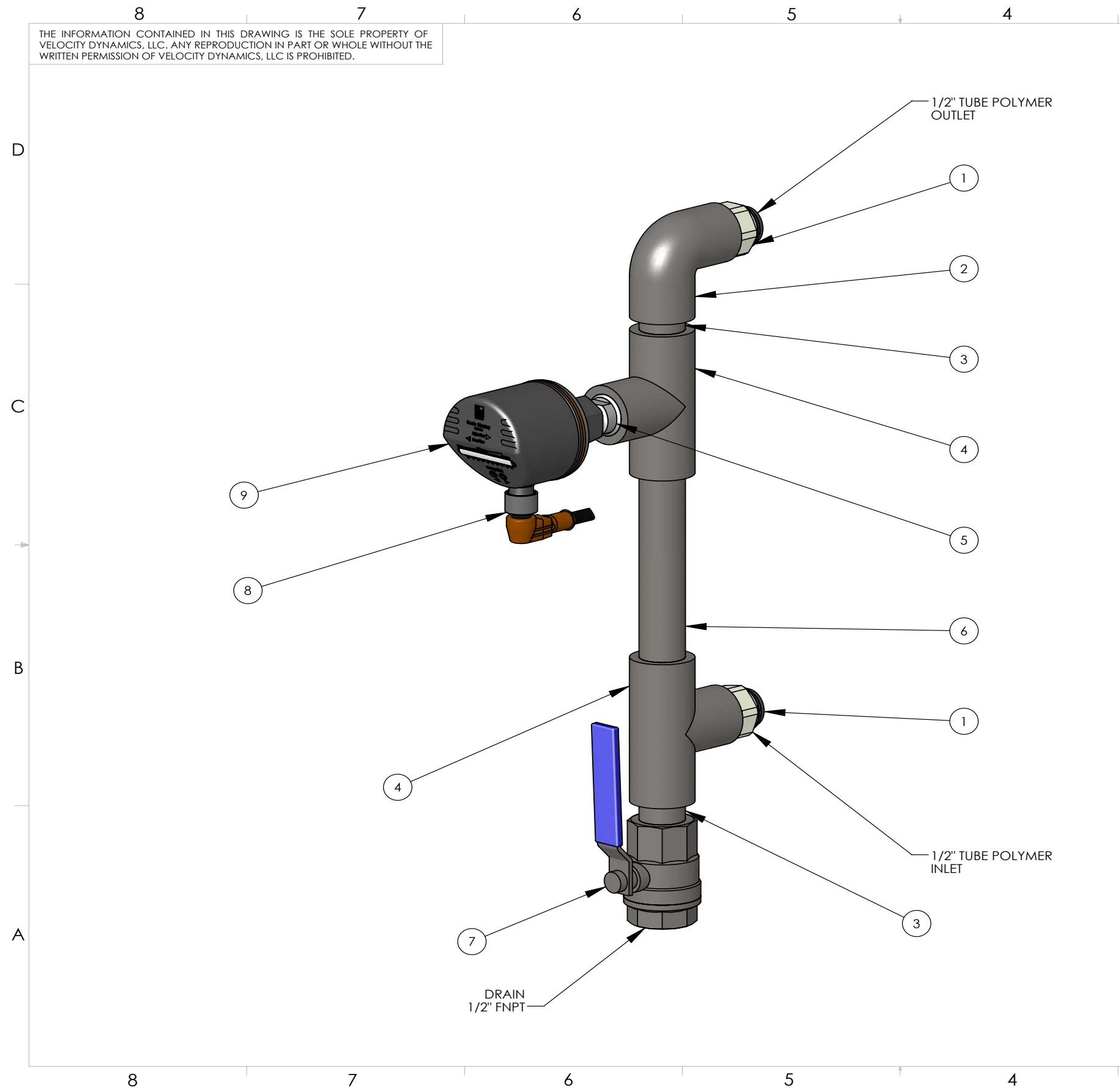
		CALIBRATION COLUMN, 250 ML, 1" FNPT	
		DWG. NO. 110-0002	REV. D

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3.2.5 Thermal Flow Sensor Assembly

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REV	ECO	DESCRIPTION	DATE	APPROVED
A		INITIAL RELEASE	4/23/14	C WELLS
B		CORRECT BOM TO AC SENSOR	5/21/14	C WELLS
C		ELBOWS CHANGED TO STAINLESS STEEL	6/29/15	B HEALY
D		ADDED DRAIN VALVE	2/24/16	B HEALY
E		ADJUSTED NIPPLE LENGTH	4/6/18	WBV
F		CHANGED VALVE TO FULL PORT	4/13/18	WBV



ITEM #	NUMBER	DESCRIPTION	QTY
1	194-0638	ADAPTER, 1/2" TUBE - 1/2 MNPT, ACETAL	2
2	194-0034	ELBOW, 90, 1/2", TXT, 304	1
3	194-0049	NIPPLE, 1/2" X CLOSE, 304	2
4	194-0021	TEE, 1/2" FNPT, 304	2
5	182-0068	ADAPTER, THERMAL FLOW SENSOR, 1/2" MNPT	1
6	194-0877	NIPPLE, 1/2" X 4.50 L, 304	1
7	248-0730	VALVE, BALL, 1/2" FNPT, 304, FULL PORT	1
8	182-0125	CABLE, IFM, 1/2" RIGHT ANGLE, 4M, 5 WIRE, AC	1
9	182-0012	SENSOR, FLOW, THERMAL, SI5006 AC	1

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
 TOLERANCES:
 DECIMALS: .XX = ±.015
 .XXX = ±.005
 ANGLES: ± 1°
 63 MINIMUM
 FILLET RADII TO BE .005 MAXIMUM
 BREAK ALL EDGES .005/.010
 MATERIAL

CAD GENERATED DRAWING. INTERPRET DRAWING PER ASME Y14.5M - 2009

APPROVALS	DATE
MODELED	
C WELLS	4/23/2014
DRAWN	
C WELLS	4/23/2014
PROJECT MGR	
C HEUSEL	4/23/2014
PURCHASING MGR	
D RICARDO	4/23/2014
QUAL ENG	

VELOCITY DYNAMICS

SENSOR ASSY, FLOW, THERMAL, SI5006, AC, 1/2"

FILENAME: 182-0462	SCALE: 1:2	DWG. NO.: 182-0462	REV.: F+
DO NOT SCALE DRAWING	CAD FILE:	SHEET 1 OF 1	

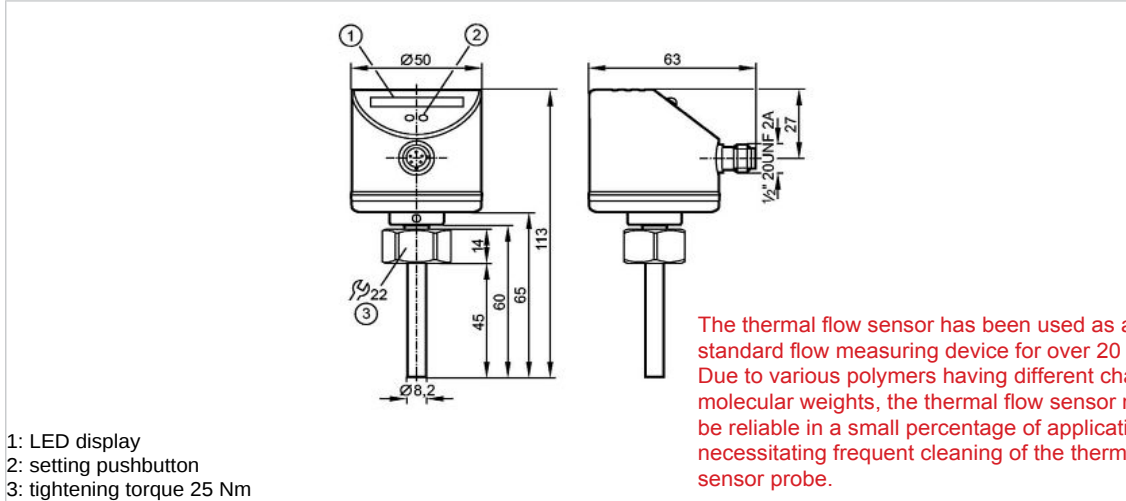
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Sensor, Flow, Thermal 1/4" MNPT
 IFM Efector SI5006
 182-0012
 HSC 5/18/2017

SI5006

SID10ADBFKOW/LS-100-IRF

Flow sensors



The thermal flow sensor has been used as a standard flow measuring device for over 20 years. Due to various polymers having different charges and molecular weights, the thermal flow sensor may not be reliable in a small percentage of applications necessitating frequent cleaning of the thermal flow sensor probe.

- 1: LED display
- 2: setting pushbutton
- 3: tightening torque 25 Nm



Product characteristics	
Flow monitor	
Compact type for adapter	
Process connection: internal thread M18 x 1.5 for adapter	
1 relay output	
Setting range: 3...300 cm/s (liquids)	
Application	
Application	liquids and gases
Pressure rating [bar]	300
Medium temperature [°C]	-25...80
Electrical data	
Electrical design	AC / relay
Operating voltage [V]	85...265 AC
Nominal voltage [V]	90...240 AC (45...65 Hz)
Voltage tolerance [%]	-5 / +10
Power consumption [VA]	< 3.5
Protection class	II
Reverse polarity protection	no
Outputs	
Output function	normally open / closed programmable
Contact rating	3 A (250 V AC / 30 V DC) †)
Short-circuit proof	no
Overload protection	no
Measuring / setting range	
Liquids	
Setting range [cm/s]	3...300
Greatest sensitivity [cm/s]	3...100
Gases	
Setting range [cm/s]	200...3000


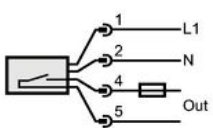
Greatest sensitivity	[cm/s]	200...800
Accuracy / deviations		
Switch point accuracy	[cm/s]	± 2...± 10 *)
Hysteresis	[cm/s]	2...5 *)
Repeatability	[% of Sr]	1...5 *)
Temperature drift	[cm/s x 1/K]	0.1 **)
Max. temperature gradient of medium	[K/min]	300
Reaction times		
Power-on delay time	[s]	10
Response time	[s]	1...10
Software / programming		
Adjustment of the switch point		pushbuttons
Environment		
MAWP (for applications according to CRN)	[bar]	208
Ambient temperature	[°C]	-25...80
Storage temperature	[°C]	-25...100
Protection		IP 67
Tests / approvals		
EMC		DIN EN 61000-6-2 DIN EN 61000-6-3
Shock resistance		DIN EN 60068-2-27 50 g (11 ms)
Vibration resistance		DIN EN 60068-2-6 20 g (55...2000 Hz)
MTTF	[Years]	221
Mechanical data		
Process connection		internal thread M18 x 1.5 for adapter
Materials (wetted parts)		stainless steel 316L / 1.4404; O-ring: FKM 8 x 1.5 gr 80° Shore A
Housing materials		stainless steel 316L / 1.4404; stainless steel (304S15); PC (polycarbonate); PBT-GF 20; EPDM/X
Weight	[kg]	0.254
Displays / operating elements		
Function display	LED	10 LEDs, three-colour
Electrical connection		
Connection		1/2" UNF-Connector
Wiring		
N.B: no protective insulation between relay circuit and supply voltage		
		Note: miniature fuse to IEC60127-2 sheet 1, ≤ 5 A (fast acting)
Remarks		
Remarks		<p>1) number of switching cycles: 20 million mechanically switching cycles with 3 A load: 100.000 electrically relay type: contact closed at work *) for water; 5...100 cm/s; 25°C (factory setting) **) for water; 5...100 cm/s; 10...70°C Recommendation: check the unit for reliable function after a short circuit.</p>

Figure 200A
STAINLESS STEEL BALL VALVES

FNW™

248-0730 A1
 VALVE, BALL, 1/2" FNPT, 304, FULL PORT
 WBV 4/13/2018

2 PC FULL PORT 1000 CWP

Features:

- 1000 PSI CWP Non-Shock
- 150 PSI WSP
- Full Port
- Blow-out Proof Stem
- Adjustable Packing
- Investment Cast Body
- Threaded NPT Ends
- Stainless Steel Handle
- Locking Lever
- RTFE Seats
- Vented Ball
- Stocked Configurations:
 - Standard Locking Lever (1/4"~2")
 - Oval Handle (1/4"~2")
- Manufactured Silicone Free
- Replacement Locking Handle Kits Available
- Optional Stem Extension Kit (Uses Existing Valve Handle)(1/4"~2")
- Optional Oval Handle Kit (1/4"~2")



Standards:

- Design: ASME B16.34, MSS SP-110
- End Connections: ASME B1.20.1
- Seat/Shell Test: MSS SP-110

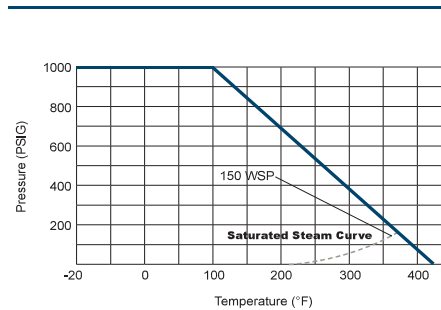
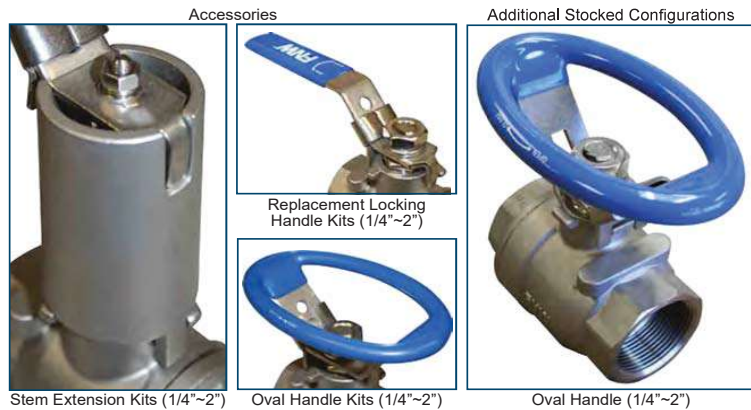
Figure Number Matrix

FNW 200A Handle Size	
HANDLE CODE	SIZE CODE
Standard Handle = Blank	1/4 = B
Oval Handle = OL	3/8 = C
	1/2 = D
	3/4 = F
	1 = G
	1-1/4 = H
	1-1/2 = J
	2 = K

Kit Codes (Order Separately)

FNW 310A Kit Size	
KIT TYPE	SIZE CODE
Locking Handle = LHK	1/4"~1/2" = BD
Stem Extension = SEK	3/4" = F
Oval Handle = OH	1"~1-1/4" = GH
	1-1/2"~2" = JK

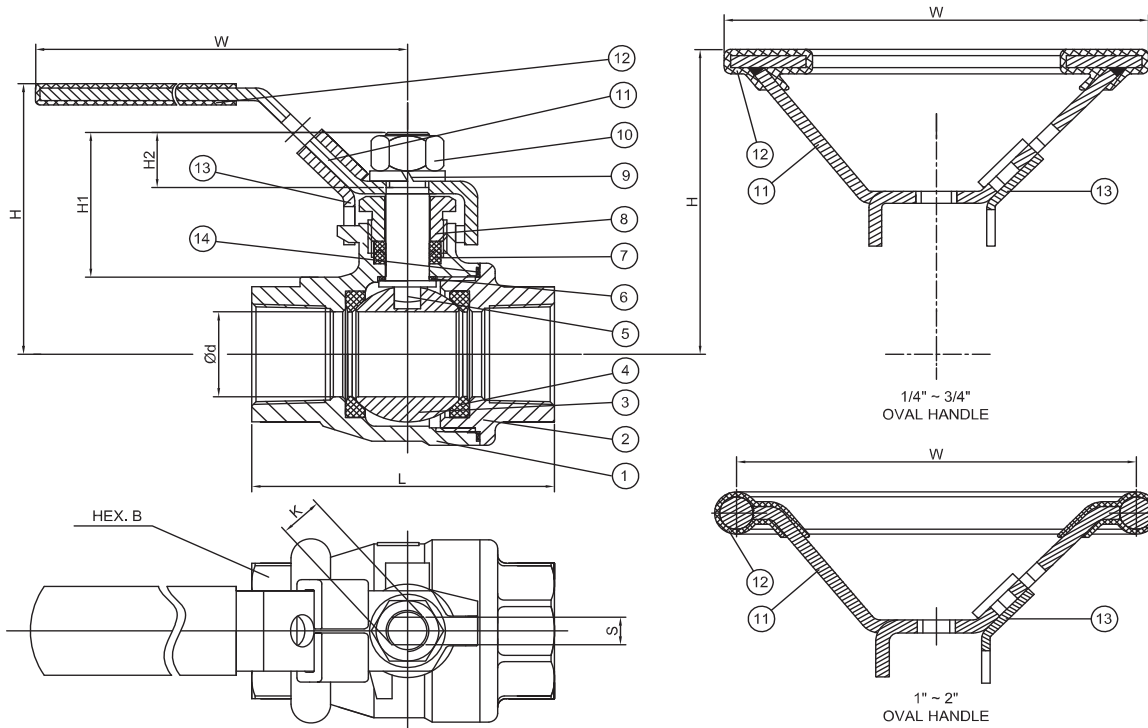
Note: The figure 200A uses the same accessories as the 310A.



Cv, Torque & Weight

Size	Cv	Torque (in-lbs)	Wt (lbs)
1/4	15	60	0.73
3/8	15	60	0.68
1/2	18	66	0.75
3/4	36	80	1.14
1	48	146	1.94
1-1/4	58	252	2.82
1-1/2	120	344	4.12
2	190	503	6.48

2 PC FULL PORT 1000 CWP



Dimensions (inches)

Size	Ød	L	H1	H2	Straight Lever		Oval Handle		K (UNC)	S	B
					H	W	H	W			
1/4	0.42	2.28	1.13	0.43	2.28	3.94	2.50	3.97	5/16-18	0.197	0.93
3/8	0.47	2.28	1.13	0.43	2.28	3.04	2.50	3.07	5/16-18	0.197	0.93
1/2	0.59	2.44	1.05	0.38	2.28	3.94	2.50	3.97	5/16-18	0.197	0.98
3/4	0.79	2.85	1.35	0.49	2.52	5.08	2.96	5.20	3/8-16	0.256	1.26
1	0.98	3.35	1.51	0.62	3.03	6.14	3.03	5.20	7/16-14	0.314	1.61
1-1/4	1.26	3.70	1.46	0.55	3.27	6.14	3.22	5.20	7/16-14	0.314	1.97
1-1/2	1.50	4.13	1.96	0.89	3.78	7.19	3.80	5.63	5/8-11	0.394	2.20
2	1.97	4.92	1.91	0.89	4.02	7.19	4.02	5.63	5/8-11	0.394	2.76

Standard Materials

Ref. No.	Description	Material	Qty
1	Body	ASTM A351 Gr. CF8M Stainless	1
2	End Cap	ASTM A351 Gr. CF8M Stainless	1
3	Ball	316SS Stainless	1
4	Seat	RTFE	2
5	Stem	316SS Stainless	1
6	Thrust Washer	PTFE	1
7	V-Ring Packing	PTFE	1 Set
8	Gland Nut	304SS Stainless	1
9	Stem Washer	304SS Stainless	1
10	Stem Nut	ASTM A194-8 Stainless	1
11	Handle	304SS Stainless	1
	1"~2" Oval Handle	304SS+CF8	1
12	Handle Sleeve	Vinyl Plastic	1
13	Locking Device	304SS Stainless	1
14	Body Gasket	PTFE	1

DOC: FNW200A11 Ver. 05/2013

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7510 & 7511 Series

Acrylic block construction with direct reading scale have white screen printed backs to enhance scale readability. Connections are in-line for easy installation.

Description

Metering Tube
Machined Cast Acrylic

Internal Components
316L Stainless Steel

Inlet/Outlet Fittings
FNPT, Vertical

Fitting Material
Standard: PVC
Optional: 316L Stainless Steel, Brass

Elastomers
Standard: EPR
Optional: Buna N, Viton

Options

Certified Calibrations
Conform to ISA RP 16.6

Scales
Can be produced in any volumetric unit



Acrylic Tube

182-0080 REV A
FLOW METER, ROTAMETER, 10
GPM, 1" FNPT, ACRYLIC
1/23/14

Performance

Capacities
7 GPH to 20 GPM – Water
2.6 SCFH to 60 SCFM – Air

Scale
50mm, 65mm, 100mm, 127mm, 250mm
Direct reading

Accuracy
± 6% of Full Scale Flow, 50mm scale
± 5% of Full Scale Flow, 65mm scale
± 4% of Full Scale Flow, 100mm scale
± 3% of Full Scale Flow, 127mm scale
± 2% of Full Scale Flow, 250mm scale

Turndown
10:1 to 12.5:1 unless otherwise indicated

Repeatability
3%, 50 mm scale
2%, 75 mm scale
2%, 100 mm scale
2%, 127 mm scale
1/2%, 250 mm scale

Max Temperature
130° F (54° C) - Liquid
100° F (38° C) - Gases

Max Pressure
Water – 125 psig
Air – 100 psig

Ambient Temperature
33° F to 125° F (1° C to 52° C)

Materials Of Construction

Model #	7510	7510	7511
Block #	2A	6A & 7A	2B & 5B
Meter Tube	Cast Acrylic	Cast Acrylic	Cast Acrylic
Fittings	Brass*	PVC*	PVC*
	PVC*	Brass	Brass
	316L SS	316L SS	316L SS
O-Rings	EPR*	EPR*	EPR*
	Buna-N	Buna-N	Buna-N
	Viton®	Viton®	Viton®

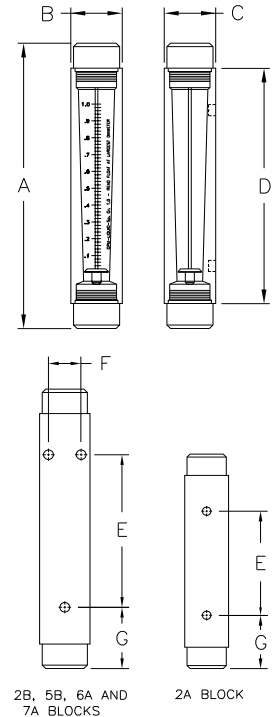
* Denotes standard construction.

7510 & 7511 Series

Acrylic Tube

Specifications:

Order Number	Flow Water	Order Number	Flow Air	Connection Size	Dimensions (Inches)						
					A	B	C	D	E	F	G
Block #2A, 50mm (2 Inch) Scale											
-	-	2A-01	2.6 SCFH	1/4" FNPT*	4.75	1	1.125	3.50	1.50	-	1
-	-	2A-03	5 SCFH	1/4" FNPT*	4.75	1	1.125	3.50	1.50	-	1
-	-	2A-05	10 SCFH	1/4" FNPT*	4.75	1	1.125	3.50	1.50	-	1
-	-	2A-07	20 SCFH	1/4" FNPT*	4.75	1	1.125	3.50	1.50	-	1
2A-02	7 GPH	2A-09	30 SCFH	1/4" FNPT*	4.75	1	1.125	3.50	1.50	-	1
2A-04	12 GPH	2A-11	70 SCFH	1/4" FNPT*	4.75	1	1.125	3.50	1.50	-	1
2A-06	22 GPH	2A-13	100 SCFH	1/4" FNPT*	4.75	1	1.125	3.50	1.50	-	1
2A-08	44 GPH	2A-15	180 SCFH	1/4" FNPT*	4.75	1	1.125	3.50	1.50	-	1
2A-10	60 GPH	2A-17	4 SCFM	1/4" FNPT*	4.75	1	1.125	3.50	1.50	-	1
2A-12	75 GPH	-	-	1/4" FNPT*	4.75	1	1.125	3.50	1.50	-	1
Block #2B, 65mm (2 1/2 Inch) Scale											
2B-02	1 GPM	2B-01	4 SCFM	1/2" FNPT	6.50	1.375	1.375	5	2.50	.937	1.25
2B-04	2 GPM	2B-03	8 SCFM	1/2" FNPT	6.50	1.375	1.375	5	2.50	.937	1.25
2B-06	3.6 GPM	2B-05	15 SCFM	1/2" FNPT	6.50	1.375	1.375	5	2.50	.937	1.25
2B-08	5 GPM	2B-07	20 SCFM	1/2" FNPT	6.50	1.375	1.375	5	2.50	.937	1.25
Block #5B, 127mm (5 Inch) Scale											
5B-02	1 GPM	5B-01	4.2 SCFM	1/2" FNPT	9.25	1.375	1.375	7.75	5.25	.937	1.25
5B-04	2 GPM	5B-03	8.2 SCFM	1/2" FNPT	9.25	1.375	1.375	7.75	5.25	.937	1.25
5B-06	3.5 GPM	5B-05	15 SCFM	1/2" FNPT	9.25	1.375	1.375	7.75	5.25	.937	1.25
5B-08	5 GPM	5B-07	21 SCFM	1/2" FNPT	9.25	1.375	1.375	7.75	5.25	.937	1.25
Block #6A, 100mm (4 Inch) Scale											
6A-02	10 GPM	6A-01	10 SCFM	1" FNPT	8.375	1.75	1.812	6.625	4	1.25	1.312
6A-04	15 GPM	6A-03	60 SCFM	1" FNPT	8.375	1.75	1.812	6.625	4	1.25	1.312
6A-06	20 GPM	-	-	1" FNPT	8.375	1.75	1.812	6.625	4	1.25	1.312
Block #7A, 250mm (10 Inch) Scale											
7A-02	2 GPM	7A-01	8 SCFM	3/4" FNPT	14.812	1.78	1.812	13	8	1.25	2.50
7A-04	3.5 GPM	7A-03	14.8 SCFM	3/4" FNPT	14.812	1.78	1.812	13	8	1.25	2.50
7A-06	5 GPM	7A-05	20 SCFM	3/4" FNPT	14.812	1.78	1.812	13	8	1.25	2.50
7A-08	10 GPM	7A-07	42 SCFM	3/4" FNPT	14.812	1.78	1.812	13	8	1.25	2.50



* Block 2A has 1/4" FNPT with Brass or Stainless Steel Fitting, 1/4" MNPT with PVC fittings

* 10-32 female thread. (Mounting Screws Not Supplied)

Ordering: 7510 - 2 - 1 - 6A - 02

Use the following guide to determine the specific product number you require.



Meter Series

7510 - 2A, 6A, 7A
7511 - 2B, 5B

Fitting Material

Brass - 1
PVC - 2
316L SS - 3

O-Ring Material

EPR - 1
Buna-N - 2
Viton® - 3

Order Number

See Specifications Table

Example: 7511 - 2 - 1 - 5B - 08

3.2.7 Differential Pressure Switch

182-0272 A3
SWITCH, PRESSURE, DIFFERENTIAL
9-60 PSI, 1/4" FNPT, NEMA 4x
3/27/17 BGH



B-Series Switches – Pressure, Differential Pressure & Hydraulic

D4-24-B-60 PSI

FEATURES

- Adjustable setpoints 15-100% of range
- Fixed or limited adjustable deadband
- Wide selection of switch elements
- Explosion proof enclosure provides uncompromising protection
- Special designs for NACE & fire applications

TYPICAL USES

- Offshore oil rigs
- Chemical and petrochemical plants
- Pulp and papermills
- Steel mills
- Power plants
- Water and sewage-treatment plants
- Other corrosive environments



SPECIFICATIONS

Setpoint:	Factory set or field adjustable
Setpoint Repeatability:	±1% of full range (Additional setpoint shift of ±1% of range per 50°F from initial setpoint set at 70°F typical)
Enclosure Rating:	B4/Hydraulic: NEMA 4X, IP66 B7: NEMA 7/9, IP66
Enclosure Material:	Epoxy coated aluminum (standard) Optional: 316 stainless steel (NEMA 7/9 only)
Diaphragm Material:	Buna N, Viton, Teflon, SS, Monel
Pressure Connection:	1/4 Female NPT (standard) Optional: 1/2 Female NPT, 1/4 Female NPT & 1/2 Male NPT Combo
Electrical Output:	SPDT or DPDT
Electrical Termination:	3/4 Female NPT (standard) Optional: 1/2 Female NPT
Ambient Temperature Range:	-20°F to 150°F (-19°C to 65°C) All units calibrated at 70°F
Process Temperature:	0°F to 150°F (Buna n or Teflon diaphragm) 20°F to 300°F (Viton diaphragm) 0°F to 300°F (SS or Monel diaphragm)
Pressure Ranges:	Pressure: Vac-3000#, Differential: 0-600#D Hydraulic: 1000-7500#
Approvals:	UL, CSA, FM, CE, RoHS (NEMA 4) ATEX, CSA, FM, IECEx, UL, RoHS (NEMA 7) UL: E38812, E34743 CSA: 55541 ATEX: Sira 02ATEX1391X IECEX SIR 14.007X FM: Limit Control and Steam Limit Control

- Highly reliable
- Designed for use in wide range of applications
- Pressure ranges from vacuum to 7500psi

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1 of 12

Data Sheet

B-Series Switches Pressure, **Differential Pressure** & Hydraulic

PRESSURE, DIFFERENTIAL PRESSURE & HYDRAULIC RANGES

PRESSURE/VACUUM RANGES			Overpressure Ratings		Approximate Deadband Switch Element				
Nominal Pressure			Proof psi	Burst psi	20, 26, 27	21, 24, 31	50	22	32, 42
Vacuum									
-30" Hg	-760mm Hg	-100 kPa	250	400	0.3-0.7	1.5-3.0	0.5-2.2	0.4-1.3	2.1-4.2
Compound									
-15" H ₂ O	-375mm H ₂ O	-3.7 kPa	20	35	0.15-.75	1.5-2.5	0.45-2.0	0.5-1.2	2.1-3.5
15" H ₂ O	375mm H ₂ O	3.7 kPa			0.15-.75	1.5-2.5	0.45-2.0	0.5-1.2	2.1-3.5
-30" H ₂ O	-760mm H ₂ O	-7.5 kPa	20	35	0.30-.60	1.5-2.5	0.45-2.0	0.5-1.5	2.1-3.5
30" H ₂ O	760mm H ₂ O	7.5 kPa			0.30-.60	1.5-2.5	0.45-2.0	0.5-1.5	2.1-3.5
-30" Hg	-760mm Hg	-100 kPa			0.5-1.0	2.0-3.0	0.75-2.5	0.7-1.8	2.8-4.2
15 psi	1.0 kg/cm ²	100 kPa	250	400	0.3-0.7	0.5-1.5	0.5-1.0	0.7-1.4	0.7-2.1
-30" Hg	-760mm Hg	-100 kPa			1.0-1.5	3.0-6.0	1.2-4.5	1.4-2.4	4.2-8.4
30 psi	2.0 kg/cm ²	200 kPa	250	400	0.3-0.8	1.0-2.0	0.7-1.5	0.4-1.3	1.4-2.8
-30" Hg	-760mm Hg	-100 kPa			2.0-3.0	5.0-9.0	2.5-7.0	2.8-4.5	7.0-12.0
60 psi	4.0 kg/cm ²	400 kPa	250	400	0.7-1.5	3.0-5.0	1.1-4.0	1.0-2.3	4.2-7.0
Pressure									
10" H ₂ O	250mm H ₂ O	2.5 kPa	20	35	0.2-0.5	1.0-2.0	0.35-1.5	0.4-1.0	1.4-2.8
30" H ₂ O	750mm H ₂ O	7.5 kPa	20	35	0.3-0.6	1.5-2.5	0.45-2.0	0.5-2.0	2.1-3.5
60" H ₂ O	1500mm H ₂ O	15 kPa	20	35	0.5-1.3	1.5-3.5	0.9-2.5	0.7-3.0	2.1-5.0
100" H ₂ O	2500mm H ₂ O	25 kPa	20	35	0.6-1.6	2.5-5.5	1.1-4.0	1.0-4.0	3.5-7.7
150" H ₂ O	3750mm H ₂ O	37 kPa	20	35	1.0-2.5	4.5-8.5	1.7-6.5	2.0-6.0	6.0-12.0
15 psi	1.0 kg/cm ²	100 kPa	500	1500	0.1-0.35	0.5-1.5	0.2-1.0	0.4-1.0	0.7-2.1
30 psi	2.0 kg/cm ²	200 kPa	500	1500	0.1-0.50	0.5-1.5	0.3-1.0	0.4-1.0	0.7-2.1
60 psi	4.0 kg/cm ²	400 kPa	500	1500	0.3-1.0	1.0-3.5	0.7-2.5	0.6-2.0	1.4-5.0
100 psi	7.0 kg/cm ²	700 kPa	1000	3000	0.5-1.7	1.5-5.0	1.1-3.5	1.0-4.5	2.1-7.0
200 psi	14 kg/cm ²	1400 kPa	1000	3000	1-3	5-13	2-9	3.0-7.5	7.0-18.2
400 psi	28 kg/cm ²	2800 kPa	2400	3000	4-7.5	5-24	5.5-15	4.0-11.0	7.0-33.6
600 psi	42 kg/cm ²	4200 kPa	2400	3000	4-11	9-30	7-20	5.0-23.0	12.6-42
1000 psi	70 kg/cm ²	7000 kPa	12000	18000	7-30	30-110	18-70	15-80	42-154
3000 psi	210 kg/cm ²	2100 kPa	12000	18000	15-60	80-235	37-160	30.0-230	112-329

DIFFERENTIAL PRESSURE RANGES			Pressure Ratings		Approximate Deadband Switch Element				
Nominal Pressure			Static Working Pressure	Proof psi	20, 26, 27	21, 24, 31	50	22	32, 42
30" H ₂ O	750mm H ₂ O	7.5 kPa	5.4	21.6	0.3-0.6	1.5-2.5	0.45-2.0	0.5-2.0	2.1-3.5
60" H ₂ O	1500mm H ₂ O	15 kPa	5.4	21.6	0.5-1.3	1.5-3.5	0.9-2.5	0.7-3.0	2.1-5.0
100" H ₂ O	2500mm H ₂ O	25 kPa	5.4	21.6	0.6-1.6	2.5-5.5	1.1-4.0	1.0-4.0	3.5-7.7
150" H ₂ O	3750mm H ₂ O	37 kPa	5.4	21.6	1.0-2.5	4.5-8.5	1.8-6.5	2.0-6.0	6.3-12.0
15 psid	1.0 kg/cm ²	100 kPa	500	2000	0.5-1.0	2.0-5.0	0.7-3.5	0.7-1.4	2.8-7.0
30 psid	2.0 kg/cm ²	200 kPa	500	2000	1.0-2.0	2.0-5.0	1.5-3.5	1.4-2.8	2.8-7.0
60 psid	4.0 kg/cm ²	400 kPa	500	2000	2.0-4.0	3.0-6.0	3.0-4.5	2.8-5.6	4.2-8.5
100 psid	7.0 kg/cm ²	700 kPa	1000	4000	4.0-10.0	11.0-20.0	7.0-15.0	6.0-14.0	16.0-28.0
200 psid	14.0 kg/cm ²	1400 kPa	1000	4000	5.0-15.0	12.0-40.0	10.0-26.0	7.0-21.0	17.0-56.0
400 psid	28.0 kg/cm ²	2800 kPa	1000	8000	10.0-20.0	20.0-60.0	15.0-40.0	14.0-28.0	28.0-84.0
600 psid	42.0 kg/cm ²	4200 kPa	1000	8000	20.0-40.0	80.0-150.0	30.0-115.0	30.0-56.0	12.0-210.0

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Data Sheet

B-Series Switches Pressure Differential Pressure

ORDERING CODE

Example: **D4 - 24 - B - 60PSI**

Enclosure

- B4** - Pressure switch, Type 400, watertight enclosure meets NEMA 3, 4, 4X, 13 and IP66 requirements.
- B7⁽¹⁾** - Pressure switch, Type 700, explosion-proof enclosure meets Div. 1 & 2, NEMA 7, 9 and IP66 requirements.
- D4** - Differential pressure switch, Type 400, water-tight enclosure meets NEMA 3, 4, 4X, 13 and IP66 requirements.
- D7⁽¹⁾** - Differential pressure switch, Type 700, explosion-proof enclosure meets Div. 1 & 2, NEMA 7, 9 and IP66 requirements.

Switch Element Selection - UL/CSA Listed SPDT

- 20⁽⁶⁾** - Narrow deadband ac, 15A - 125/250 Vac
- 21** - Ammonia service, 5A - 125/250 Vac
- 22⁽⁷⁾** - Hermetically sealed switch, narrow deadband, 5A - 125/250 Vac
- 23** - Heavy duty ac, 22A - 125/250 Vac
- 24⁽²⁾** - General purpose, 15A - 125/250/480 Vac, ½A - 125 Vdc, ¼A - 250 Vdc; 6A, 30 Vdc
- 25⁽³⁾** - Heavy duty dc, 10A - 125 Vac or dc, ½ HP - 125 Vac or dc
- 26⁽⁶⁾** - Sealed environment proof, 15A - 125/250 Vac
- 27** - High temperature 300°F, 15A - 125/250 Vac
- 28⁽⁶⁾** - Manual reset trip on, increasing 15A - 125/250 Vac
- 29⁽⁶⁾** - Manual reset trip on decreasing, 15A - 125/250 Vac
- 31** - Low level (gold) contacts, 1A - 125 Vac
- 32** - Hermetically sealed switch, general purpose, 11A - 125/250 Vac, 5A - 30 Vdc
- 42** - Hermetically sealed switch, gold contacts, 1A - 125 Vac
- 50** - Variable deadband, 15A - 125/250 Vac

Switch Element Selection - UL/CSA Listed Dual (2 SPDT) ⁽⁴⁾

- 61⁽⁶⁾** - Dual narrow deadband, 15A - 125/250 Vac
- 62⁽⁶⁾** - Dual sealed environment proof, 15A - 125/250 Vac
- 63** - Dual high temp. 300°F, 15A - 125/250 Vac
- 64** - Dual general purpose, 15A - 125/250/480 Vac, ½A - 125 Vdc, ¼A - 250 Vdc
- 65** - Dual ammonia service, 5A - 125/250 Vac
- 67⁽⁶⁾⁽⁷⁾** - Dual hermetically sealed switch, narrow deadband, 5A - 125/250 Vac
- 68⁽⁶⁾** - Dual hermetically sealed switch, general purpose, 11A - 125/250 Vac 5A, 30 Vdc
- 70** - Dual low level gold contacts, 1A - 125 Vac
- 71⁽⁶⁾** - Dual hermetically sealed switch, gold contacts, 1A - 125 Vac

Actuator Seal

Material	Process Temp. Limits °F ⁽¹⁰⁾	Range			
		Vac. H ₂ O	0-600 psi	0-1000 psi	0-3000 psi
B - Buna-N	0 to 150	•	•	•	•
V - Viton	20 to 300	•	•	•	•
T - Teflon	0 to 150	•	•	•	•
S - 316L ⁽⁹⁾	0 to 300		•	•	
P - Monel ⁽⁹⁾	0 to 300		•	•	

Options

Use table from page 6

Range

Select from table page 4

ORDERING CODE NOTES:

- 1 Standard housing epoxy coated aluminum. Use variation code XYW for 316SS housing.
- 2 Standard switch
- 3 Not available with psid ranges.
- 4 Dual switches are 2 SPDT snap-action switches, not independently adjustable.
- 5 Wires cannot be terminated inside B400 switch enclosure.
- 6 Not available with type 700 enclosure.
- 7 Estimated dc. rating, 2.5A, 28 Vdc (not UL listed).
- 8 Estimated dc rating, 0.4A, 120 Vdc (not UL listed).
- 9 Available on pressure only.
- 10 Ambient operating temperature limits -20 to 150°F, all styles, setpoint shift of ±1% of range per 50°F temperature change is normal. Switches are calibrated at 70°F reference.

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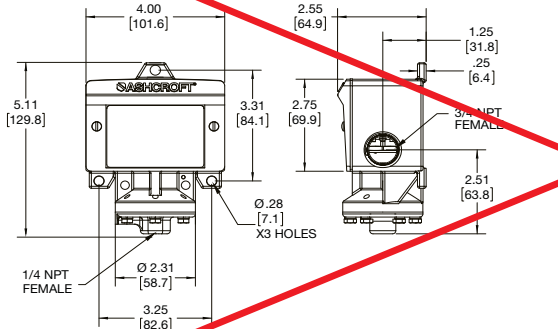
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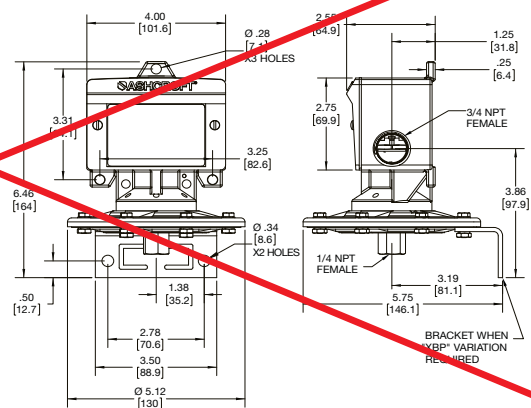
B-Series Switches Pressure, Differential Pressure & Hydraulic

~~B-100 DIMENSIONS~~

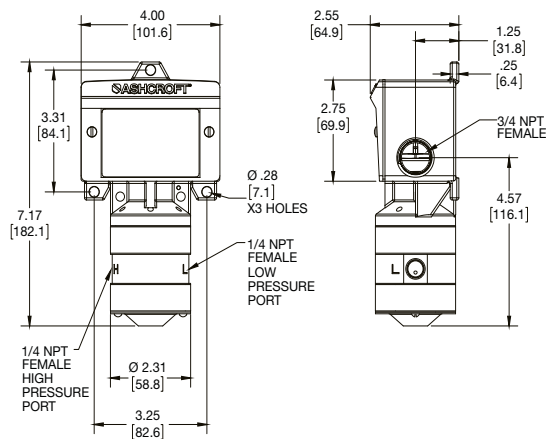
~~Pressure switch – psi ranges~~



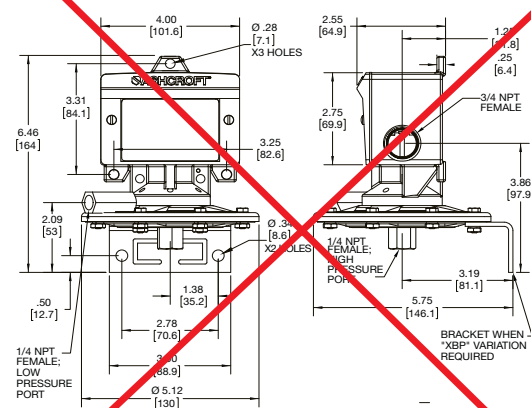
~~Pressure switch – inches of water ranges~~



Differential pressure switch – psi differential ranges



~~Differential pressure switch – inches of water ranges~~



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Data Sheet

1008A/AL Pressure Gauge

182-0002 REV B
 GAUGE, PRESSURE, 2.5", 160 PSI, SS/BRASS, 1/4"
 MNPT, BACK MNT, GLYCERINE FILL, W/ LOGO
 CRW 2020-01-22

FEATURES

- PowerFlex™ movement
- Meets ASME B40.100 specifications
- TrueZero™ a unique safety feature
- Available dry, liquid-fill or field-fillable versions
- Custom dials available
- Ventable fill plugs

TYPICAL USES

- Pumps and Compressors
- Hydraulics and Pneumatics
- OEM Equipment
- Pressure washers/sprayers
- Irrigation equipment

SPECIFICATIONS

Accuracy:	±3-2-3% of span (ASME B40.100, Grade B)
Sizes:	63mm (2½"), 100mm (4")
Ranges:	Vacuum, compound to 15,000 psi Equivalent metric ranges available
Process Connection Location:	Lower, center back
Process Connection Size:	¼ NPT
Dial:	Black figures on white background, aluminum
Pointer:	Black, aluminum
Movement:	PowerFlex™ movement, Brass/polyester segment
Dampening:	FlutterGuard™, Glycerin filled
Approvals:	CRN; IP66 rating; NEMA 4 for water and dust ingress

WETTED COMPONENTS

Bourdon Tube	Process Connection	Restrictor
Bronze (vac. compound to 6,000 psi), 316 SS (10,000 psi to 15,000 psi)	Brass/Soldered (Vacuum-6,000 psi), Brass/Brazed (10,000 psi-15,000 psi), O-ring Case Seal	Brass (0.013" orifice all ranges except vacuum & 15 psi)

NON-WETTED COMPONENTS

Case	Window	Ring
304 SS	Polycarbonate	304 SS, crimped



KEY BENEFITS

- Rugged construction suited for harsh environmental conditions
- Mounting kits allow for easy transition to a panel mount gauge
- Two-year warranty on liquid filled gauges
- Can be customized for a variety of applications

MIN/MAX TEMPERATURE LIMITS

Version	Ambient	Process	Storage
Dry	-40°F to 158°F (-40°C to 70°C)	-40°F to 158°F (-40°C to 70°C)	-40°F to 158°F (-40°C to 70°C)
Glycerin Fill	20°F to 158°F (-7°C to 70°C)	-4°F to 158°F (-20°C to 70°C)	-40°F to 158°F (-40°C to 70°C)
Silicone Fill	-40°F to 158°F (-40°C to 70°C)	-40°F to 158°F (-40°C to 70°C)	-40°F to 158°F (-40°C to 70°C)

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Data Sheet

1008A/AL Pressure Gauge

UPC # 632152 63-1008AL-02B 160#

ORDERING CODE	Example:	63	1008	A	02	L	XSF	100#
Size								
63 - 63 mm (2½")		63						
10 - 100 mm (4")								
Model								
1008			1008					
Case Design								
A - Dry				A				
AL - Liquid fill (glycerin standard)								
Process Connection Size								
02 - ¼ NPT male					02			
Process Connection Location								
B - Lower-back						L		
C - Center-back								
D - 3 o'clock (right side)								
E - 9 o'clock (left side)								
L - Lower								
T - Top								
Options (If choosing an option(s) must include an "X")							X	
BI - Black protective boot (63mm only)								
FF - Front flange								
GV - Silicone fill								
LJ - Sealed case, field fillable								
RF - Retrofit flange (Back connection only)								
RS - RoHS (EU Directives 2011/65/EU and 2015/863)								
SF - FlutterGuard™ (includes throttle plug – Dry Gauges only)							SF	
UC - U-clamp (Back connection only)								
T4 - Throttle plug 0.007"								
T7 - Throttle plug 0.020"								
T9 - Throttle plug 0.063"								
Range (coding example, see Table 1 on page 3 for all standard ranges)								
Single Scales								
100# - 100 psi								100#

Data Sheet

1008A/AL Pressure Gauge

TABLE 1 - RANGES

PSI	CODE	BAR	CODE	KPA	CODE	KG/CM	CODE
30IMV/0	VAC	-1/0	VAC-ABE	-100/0	VAC-AGF	76cmHg/0	VAC-ADP
30IMV/15	15#&VAC					76cmHg/0/1	15/V-ADB
30IMV/30	30#&VAC	-1/0/1.5	30/V-AAS	-100/0/150	30/V-AFT	76cmHg/0/2	30/V-ADD
30IMV/60	60#&VAC	-1/0/3	60#-AAV	-100/0/300	60/V-AFV	76cmHg/0/3	60/V-BEI
						76cmHg/0/4	60/V-ALQ
30IMV/100	100#&VAC	-1/0/5	100/V-AAW	-100/0/500	100/V-AFX	76cmHg/0/6	100/V-BEJ
30IMV/160	160#&VAC	-1/0/9	160/V-AAZ	-100/0/900	160/V-AFZ	76cmHg/0/10	160/V-ADI
		-1/0/15	200/V-ABB			76cmHg/0/15	200/V-BEK
30IMV/300	300#&VAC	-1/0/24	300/V-AUG			76cmHg/0/20	300/V-BEL
0/15	15#	0/1	15#-AAA	0/200	15#-AFB	0/1	15#-ACK
				0/160	20#-AFC		
0/30	30#	0/1.6	30#-AAB	0/100	30#-AFD	0/2	30#-ACM
		0/2.5	30#-AAD	0/250	30#-AFE	0/3	45#-ACO
0/60	60#	0/4	60#-AAF	0/400	60#-AFG	0/4	60#-ACP
0/100	100#	0/6	100#-AAG	0/600	100#-AFH	0/6	100#-ACQ
		0/7	100#-AAH	0/800	120#-BAT		
0/160	160#	0/10	160#-AAI	0/1000	160#-AFJ	0/10	160#-ACS
0/200	200#	0/16	200#-AAL	0/1600	200#-AFM	0/15	200#-BEA
0/300	300#					0/20	300#-BEB
0/400	400#	0/25	400#-AAN	0/2500	400#-AFO	0/25	400#-ACX
0/600	600#	0/40	600#-AAP	0/4000	600#-AFQ	0/35	600#-BEC
						0/40	600#-ACZ
						0/50	600#-BED
0/1000	1000#	0/60	1000#-AMK	0/6000	1000#-BAU	0/50	1000#-ANA
				0/8000	1000#-BAV	0/70	1000#-ANB
0/1500	1500#	0/100	1500#-AMM	0/10,000	1500#-ATK	0/100	1500#-ANC
0/2000	2000#			0/16,000	2000#-BAW	0/150	2000#-BEE
0/3000	3000#	0/160	3000#-AMO			0/160	3000#-ACE
0/4000	4000#	0/250	4000#-AMQ	0/25,000	4000#-BAX	0/250	4000#-ACG
0/5000	5000#					0/350	5000#-BEF
0/6000	6000#	0/400	6000#-AUE	0/40,000	6000#-ATU		
						0/500	6000#-BEG
0/10,000	10000#			0/60,000	10000#-BAY	0/700	10000#-BEH
0/15,000	15000#			0/80,000	10000#-BAZ		

FOR DUAL SCALE RANGES CONSULT FACTORY

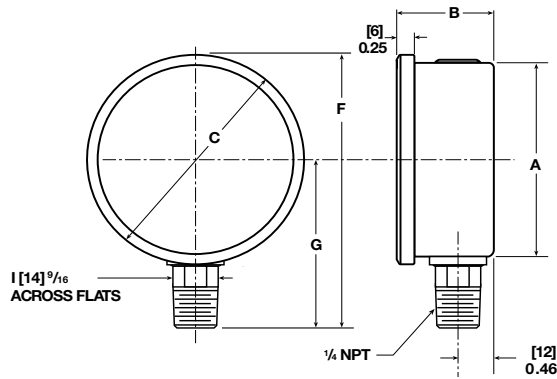
Data Sheet

1008A/AL Pressure Gauge

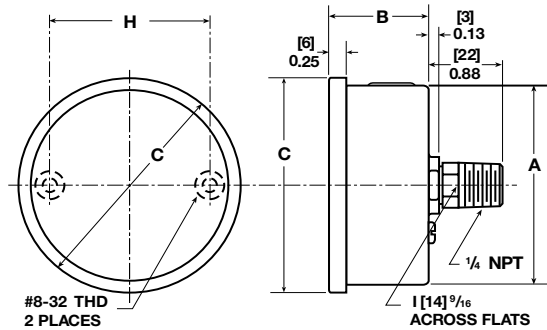
DIMENSIONS in [] are millimeters

For reference only, consult Ashcroft for specific dimensional drawings

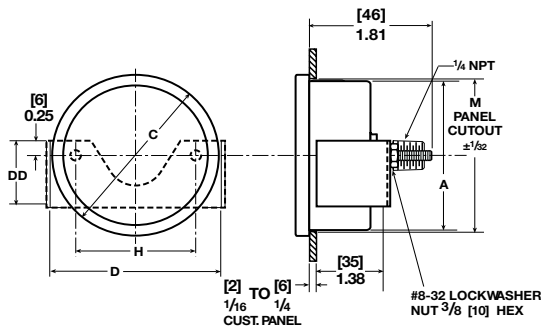
Lower Connection							
Size/Type	A	B	C	F	G	Weight oz / kg Dry	Weight oz / kg Wet
63mm	[63] 2.48	[31] 1.21	[69] 2.71	[90] 3.54	[56] 2.20	3.88 oz 0.110 kg	7.48 oz 0.212 kg
100mm	[100] 3.94	[31] 1.24	[106] 4.16	[126] 4.96	[74] 2.92	8.11 oz 0.230 kg	15.80 oz 0.448 kg



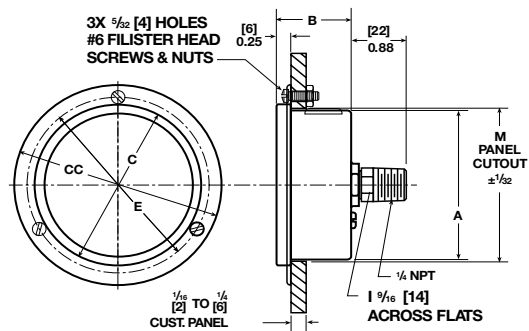
Back Connection						
Size/Type	A	B	C	H	Weight oz / kg Dry	Weight oz / kg Wet
63mm	[63] 2.48	[31] 1.21	[69] 2.71	[49] 1.94	4.09 oz 0.116 kg	7.69 oz 0.218 kg
100mm	[100] 3.94	[31] 1.24	[106] 4.16	[76] 3.00	7.13 oz 0.202 kg	14.82 oz 0.420 kg



Back Connection (XUC) U-Clamp								
Size/Type	A	C	D	DD	H	M	Weight oz / kg Dry	Weight oz / kg Wet
63mm	[63] 2.48	[69] 2.71	[75] 2.95	[28] 1.12	[49] 1.94	[65] 2.54	4.09 oz 0.116 kg	7.69 oz 0.218 kg
100mm	[100] 3.94	[106] 4.16	[107] 4.20	[28] 1.12	[76] 3.00	[101] 3.97	7.13 oz 0.202 kg	14.82 oz 0.420 kg



Back Connection (XFF) Front Flange							
Size/Type	B	C	CC	E	M	Weight oz / kg Dry	Weight oz / kg Wet
63mm	[31] 1.21	[69] 2.71	[86] 3.36	[75] 2.95	[65] 2.54	4.09 oz 0.116 kg	7.69 oz 0.218 kg
100mm	[31] 1.24	[106] 4.16	[133] 5.22	[116] 4.57	[101] 3.97	7.13 oz 0.202 kg	14.82 oz 0.420 kg



Proof Approval Custom Dial Artwork

Date Received: 12/02/19
 Date Required: 12/02/19
 Customer: VELODYNE
 Contact Name:
 Contact Fax:
 Contact Phone
 Contact email:
 Ashcroft Sales:
 Primary Range: 160#
 Secondary Range:
 Dial size: 1.5" 2.0" 2.5" 63 MM

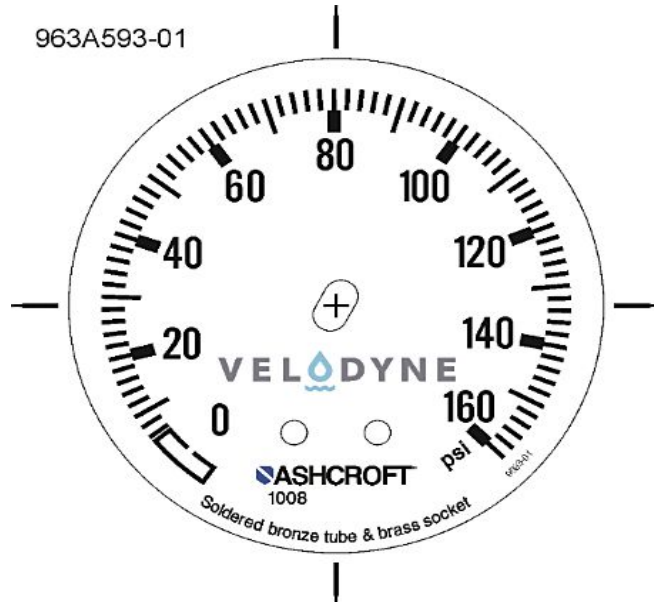
Standard Artwork: Spot PMS colors:

Dial Background PMS WHITE
 Primary Grads PMS BLACK
 Secondary Grads PMS
 Type PMS
 PMS
 PMS
 Logo PMS BLUE 306C
 PMS GRAY 430C

Custom Artwork For: Spot PMS colors:

Dial Background PMS
 Logo PMS
 PMS
 Type PMS
 Primary Grads PMS
 Secondary Grads PMS
 Other

1st Proof Date:
2nd Proof Date:
3rd Proof Date:
4th Proof Date:



Note:

Custom logo DIGITAL artwork MUST be supplied as Adobe Illustrator outline .ai or .eps files. No .tif, .jpg .bmp. pct .dwg or .dxf formats accepted.

ASHCROFT INC.
 Ashcroft Inc,
 250 East Main Street
 Stratford, CT 06614 USA
 Tel: 203-378-8281 • Fax: 203-385-0408

TITLE: DIAL FOR 63 1008AL 02L 160# W/ VELODYNE LOGO

DIAL PART NO 963A593-01



Pilot Operated
General Service Solenoid Valves
 Brass or Stainless Steel Bodies
 3/8" to 2 1/2" NPT

**2/2
 SERIES
 8210**

2-WAY

Features

- Wide range of pressure ratings, sizes, and resilient materials provide long service life and low internal leakage
- High flow valves for liquid, corrosive, and air/inert gas service
- Industrial applications include:
 - Car wash
 - Laundry equipment
 - Air compressors
 - Industrial water control
 - Pumps

Construction

Valve Parts in Contact with Fluids		
Body	Brass	304 Stainless Steel*
Seals and Discs	NBR or PTFE	
Disc-Holder	PA	
Core Tube	305 Stainless Steel	
Core and Plugnut	430F Stainless Steel	
Springs	302 Stainless Steel	
Shading Coil	Copper	Silver

*Catalog Numbers 8210G127, 8210G129, 8210G132, 8210G133 have 316L Stainless Steel bodies.

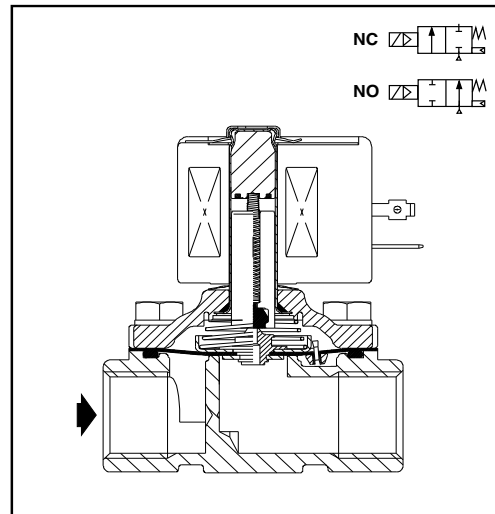
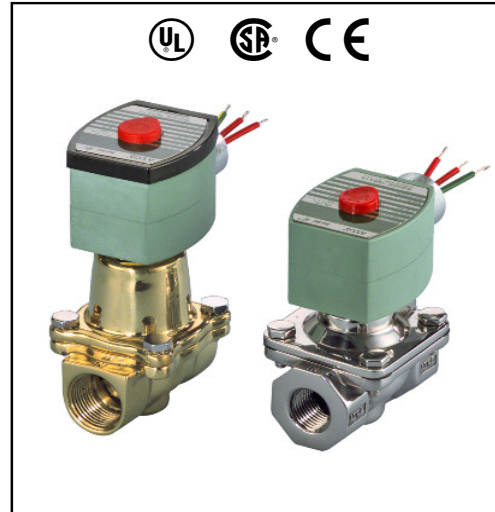
Electrical

Standard Coil and Class of Insulation	Watt Rating and Power Consumption				Spare Coil Part Number			
	DC Watts	AC			General Purpose		Explosionproof	
		Watts	VA Holding	VA Inrush	AC	DC	AC	DC
F	-	6.1	16	40	238210	-	238214	-
F	11.6	10.1	25	70	238610	238710	238614	238714
F	16.8	16.1	35	180	272610	97617	272614	97617
F	-	17.1	40	93	238610	-	238614	-
F	-	20	43	240	99257	-	99257	-
F	-	20.1	48	240	272610	-	272614	-
F	30.8	-	-	-	-	501695	-	501696
H	40.6	-	-	-	-	238910	-	238914

Standard Voltages: 24, 120, 240, 480 volts AC, 60 Hz (or 110, 220 volts AC, 50 Hz), 6, 12, 24, 120, 240 volts DC. Must be specified when ordering.
 Other voltages available when required.

Solenoid Enclosures

Standard: RedHat II - Watertight, Types 1, 2, 3, 3S, 4, and 4X; RedHat - Type I.
Optional: RedHat II - Explosionproof and Watertight, Types 3, 3S, 4, 4X, 6, 6P, 7, and 9; Red-Hat - Explosionproof and Watertight, Types 3, 4, 4X, 7, and 9.
 (To order, add prefix "EF" to catalog number, except Catalog Numbers 8210B057, 8210B058, and 8210B059, which are not available with Explosionproof enclosures.)
 See *Optional Features Section* for other available options.



Nominal Ambient Temp. Ranges

RedHat II/RedHat AC: 32°F to 125°F (0°C to 52°C)
 RedHat II DC: 32°F to 104°F (0°C to 40°C)
 RedHat DC: 32°F to 77°F (0°C to 25°C)
 (104°F/40°C occasionally)
 8210G227 AC: 32°F to 130°F (0°C to 54°C)
 DC: 32°F to 90°F (0°C to 32°C)

Refer to *Engineering Section* for details.

Approvals

UL listed as indicated. CSA certified.
 RedHat II meets applicable CE directives.
 Refer to *Engineering Section* for details.
 ATEX/IECEx certified with prefix "EV" as listed. Refer to *Optional Features Electrical Section* for details. 11

2-WAY

**2/2
SERIES
8210**

Specifications (English units)

Pipe Size (in)	Orifice Size (in)	Cv Flow Factor	Operating Pressure Differential (psi)						Max. Fluid Temp. °F		Brass Body			Stainless Steel Body			Watt Rating/Class of Coil Insulation ⑦		
			Min.	Max. AC			Max. DC			AC	DC	Catalog Number	Const. Ref. ④	UL Listing ⑤	Catalog Number	Const. Ref. ④	UL Listing ⑤	AC	DC
				Air-Inert Gas	Water	Light Oil @ 300 SSU	Air-Inert Gas	Water	Light Oil @ 300 SSU										
NORMALLY CLOSED (Closed when de-energized), NBR or PTFE ② Seating																			
3/8	3/8	1.5	①	150	125	-	40	40	-	180	150	8210G073 ③	1P	●	8210G036 ③	1P	●	6.1/F	11.6/F
3/8	5/8	3	0	150	150	-	40	40	-	180	150	8210G093	5D	○	-	-	-	10.1/F	11.6/F
3/8	5/8	3	5	200	150	135	125	100	100	180	150	8210G001 ▼	6D	○	-	-	-	6.1/F	11.6/F
3/8	5/8	3	5	300	300	300	-	-	-	175	-	8210G006 ✓	5D	○	-	-	-	17.1/F	-
1/2	7/16	2.2	①	150	125	-	40	40	-	180	150	8210G015 ③	2P	●	8210G037 ③	2P	●	6.1/F	11.6/F
1/2	5/8	4	0	150	150	-	40	40	-	180	150	8210G094 ✓	5D	○	-	-	-	10.1/F	11.6/F
1/2	5/8	4	0	150	150	125	40	40	-	175	150	-	-	-	8210G087 ✓	7D	●	17.1/F	11.6/F
1/2	5/8	4	5	200	150	135	125	100	100	180	150	8210G002 ▼	6D	○	-	-	-	6.1/F	11.6/F
1/2	5/8	4	5	300	300	300	-	-	-	175	-	8210G007	5D	○	-	-	-	17.1/F	-
1/2	3/4	4	5	-	300	-	-	300	-	130	90	8210G227	5D	○ †	-	-	-	17.1/F	40.6/H
3/4	5/8	4.5	0	150	150	125	40	40	-	175	150	-	-	-	8210G088 ✓	7D	●	17.1/F	11.6/F
3/4	3/4	5	5	125	125	125	100	90	75	180	150	8210G009 ▼	9D	○	-	-	-	6.1/F	11.6/F
3/4	3/4	5	0	150	150	-	40	40	-	180	150	8210G095 ✓	8D	○	-	-	-	10.1/F	11.6/F
3/4	3/4	6.5	5	250	150	100	125	125	125	180	150	8210G003 ▼	11D	○	-	-	-	6.1/F	11.6/F
3/4	3/4	6	0	350	300	200	200	200	200	180	180	8210G026 ② † ◆	40P/10D	●	-	-	-	16.1F	30.8/F
1	1	13	0	150	125	125	135	120	120	180	180	8210G054 † ◆	41D/31D	●	8210G089 † ◆	45D/15D	●	16.1/F	30.8/F
1	1	13	5	150	150	100	125	125	125	180	150	8210G004 ▼	12D	○	-	-	-	6.1/F	11.6/F
1	1	13.5	0	300	225	115	-	-	-	200	-	8210G027 †	42P	●	-	-	-	20.1/F	-
1	1	13.5	10	300	300	300	-	-	-	175	-	8210G078 †	13P	○	-	-	-	17.1/F	-
1 1/4	1 1/8	15	0	150	125	125	135	120	120	180	180	8210G055 † ◆	43D/32D	●	-	-	-	16.1/F	30.8/F
1 1/4	1 1/8	15	5	150	150	100	125	125	125	180	150	8210G008 ▼	16D	○	-	-	-	6.1/F	11.6/F
1 1/2	1 1/4	22.5	0	150	125	125	135	120	120	180	180	8210G056 † ◆	44D/33D	●	-	-	-	16.1/F	30.8/F
1 1/2	1 1/4	22.5	5	150	150	100	125	125	125	180	150	8210G022 ▼	18D	●	8210G127	-	-	6.1/F	11.6/F
2	1 3/4	43	5	150	125	90	50	50	50	180	150	8210G100	20P	●	8210G129	-	-	6.1/F	11.6/F
2 1/2	1 3/4	45	5	150	125	90	50	50	50	180	150	8210G101	21P	●	-	-	-	6.1/F	11.6/F
NORMALLY OPEN (Open when de-energized), NBR Seating (PA Disc-Holder, except as noted)																			
3/8	5/8	3	0	150	150	125	125	125	80	180	150	8210G033	23D	●	-	-	-	10.1/F	11.6/F
3/8	5/8	3	5	250	200	200	250	200	200	180	180	8210G011 ⑥ ⑩	39D	●	-	-	-	10.1/F	11.6/F
1/2	5/8	4	0	150	150	125	125	125	80	180	150	8210G034 ✓	23D	●	-	-	-	10.1/F	11.6/F
1/2	5/8	3	0	150	150	100	125	125	80	180	150	-	-	-	8210G030 ✓	37D	●	10.1/F	11.6/F
1/2	5/8	4	5	250	200	200	250	200	200	180	180	8210G012 ⑥ ⑩	39D	●	-	-	-	10.1/F	11.6/F
3/4	3/4	5.5	0	150	150	125	125	125	80	180	150	8210G035 ✓	25D	●	-	-	-	10.1/F	11.6/F
3/4	5/8	3	0	150	150	100	125	125	80	180	150	-	-	-	8210G038 ✓	38D	●	10.1/F	11.6/F
3/4	3/4	6.5	5	-	-	-	250	200	200	-	180	8210C013	24D	●	-	-	-	-	16.8/F
3/4	3/4	6.5	5	250	200	200	-	-	-	180	-	8210G013	46D	●	-	-	-	16.1/F	-
1	1	13	0	125	125	125	-	-	-	180	-	8210B057 ⑥ ⑩	34D	●	-	-	-	20/F	-
1	1	13	5	-	-	-	125	125	125	-	180	8210D014	26D	●	-	-	-	-	16.8/F
1	1	13	5	150	150	125	-	-	-	180	-	8210G014	47D	●	-	-	-	16.1/F	-
1 1/4	1 1/8	15	0	125	125	125	-	-	-	180	-	8210B058 ⑥ ⑩	35D	●	-	-	-	20/F	-
1 1/4	1 1/8	15	5	-	-	-	125	125	125	-	180	8210D018	28D	●	-	-	-	-	16.8/F
1 1/4	1 1/8	15	5	150	150	125	-	-	-	180	-	8210G018	48D	●	-	-	-	16.1/F	-
1 1/2	1 1/4	22.5	0	125	125	125	-	-	-	180	-	8210B059 ⑥ ⑩	36D	●	-	-	-	20/F	-
1 1/2	1 1/4	22.5	5	-	-	-	125	125	125	-	180	8210D032	29D	●	-	-	-	-	16.8/F
1 1/2	1 1/4	22.5	5	150	150	125	-	-	-	180	-	8210G032	49D	●	8210G132	-	-	16.1/F	-
2	1 3/4	43	5	-	-	-	125	125	125	-	150	8210 103	30P	●	-	-	-	-	16.8/F
2	1 3/4	43	5	125	125	125	-	-	-	180	-	8210G103	50P	●	8210G133	-	-	16.1/F	-
2 1/2	1 3/4	45	5	-	-	-	125	125	125	-	150	8210 104	27P	●	-	-	-	-	16.8/F
2 1/2	1 3/4	45	5	125	125	125	-	-	-	180	-	8210G104	51P	●	-	-	-	16.1/F	-

① 5 psi on Air; 1 psi on Water.
 ② Valve provided with PTFE main disc.
 ③ Valve includes Uitem (G.E. trademark) piston.
 ④ Letter "D" denotes diaphragm construction; "P" denotes piston construction.
 ⑤ ○ Safety Shutoff Valve; ● General Purpose Valve.
 Refer to Engineering Section (Approvals) for details.

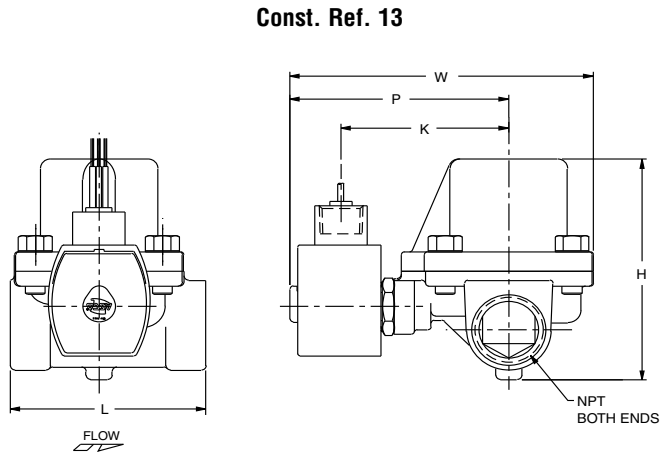
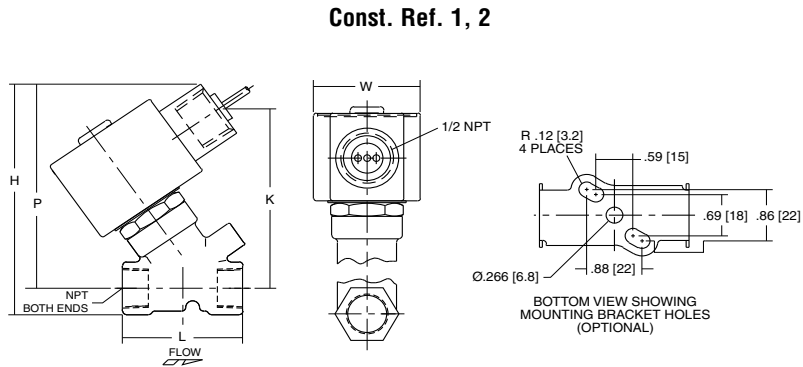
⑥ Valves not available with Explosionproof enclosures.
 ⑦ On 50 hertz service, the watt rating for the 6.1/F solenoid is 8.1 watts.
 ⑧ AC construction also has PA seating.
 ⑨ No disc-holder.
 ⑩ Stainless steel disc-holder.
 † UL listed for fire protection systems per UL429A 120/60, 110/50 24VDC, no prefix and voltage options offered.

‡ DC constructions must have solenoid mounted vertical and upright.
 ✓ ATEX/IECEx certified with prefix "EV".
 ▼ ATEX/IECEx certified for DC only with prefix "EV".
 ◆ Not available in 6 Volt DC. EF and HB prefix only.

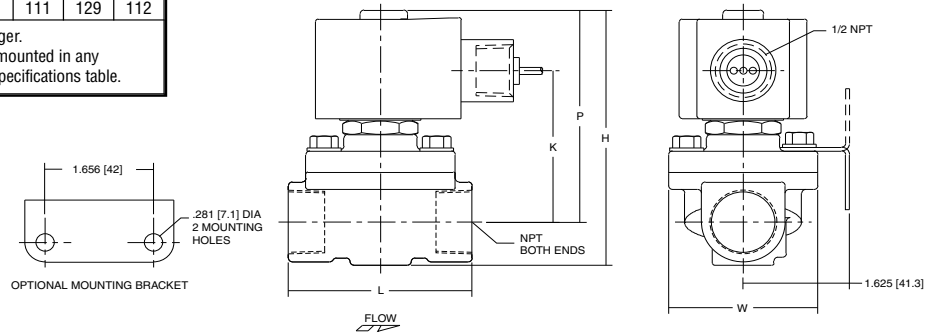
Dimensions: inches (mm)

Const. Ref.		H	K	L	P	W
1*	in	3.85	3.00	1.91	3.41	1.69
	mm	98	76	49	87	43
2*	in	4.17	3.25	2.28	3.63	1.69
	mm	106	83	58	92	43
5	in	3.84	2.31	2.75	3.28	2.28
	mm	98	59	70	83	58
6*	in	3.38	1.94	2.75	2.80	2.28
	mm	86	49	70	71	58
7	in	4.19	2.50	2.81	3.47	2.39
	mm	106	64	71	88	61
8	in	4.13	2.47	2.81	3.44	2.29
	mm	105	63	71	87	58
9*	in	3.66	2.10	2.81	2.96	2.28
	mm	93	53	71	75	58
10*	in	5.20	3.40	2.80	4.50	2.50
	mm	131	86	71	114	62
11*	in	4.16	2.66	3.84	3.52	2.75
	mm	106	68	98	89	70
12	in	5.64	3.15	3.75	4.01	3.36
	mm	143	80	95	102	85
13	in	4.44	3.22	3.75	4.19	5.81
	mm	113	82	95	106	147
15*	in	5.20	3.30	3.80	4.40	3.80
	mm	133	83	98	111	98
16	in	5.64	3.15	3.66	4.01	3.56
	mm	143	80	93	102	90
18*	in	6.11	3.30	4.38	4.16	3.92
	mm	155	84	111	106	100
20*	in	7.33	3.71	5.06	4.57	4.87
	mm	186	94	129	116	124
21*	in	7.33	3.71	5.50	4.57	4.87
	mm	186	94	140	116	124
23	in	4.35	2.65	2.75	3.79	2.28
	mm	110	67	70	96	58
24	in	5.06	X	3.78	4.44	2.75
	mm	129	X	96	113	70
25	in	4.64	2.81	2.81	3.94	2.28
	mm	118	71	71	100	58
26	in	6.53	X	3.75	4.91	3.19
	mm	166	X	95	125	81
27	in	8.22	X	5.50	5.47	4.87
	mm	209	X	140	139	124
28	in	6.53	X	3.66	4.91	3.19
	mm	166	X	93	125	81
29	in	7.03	X	4.38	5.06	4.40
	mm	179	X	111	129	112

* DC dimensions slightly larger.
IMPORTANT: Valves may be mounted in any position, except as noted in specifications table.



Const. Ref. 5-9, 11, 23, 25, 37,38, 40-46





248-0004 REV A
VALVE, BALL, 1" SOC - 1" FNPT, TRUE UNION, PVC/VITON
5/31/16

TU-2-0901

Multi-Featured Industrial Valve



Heavy Bodied PVC or CPVC Construction

Spears True Union Ball Valves never rust, scale, or pit, providing exceptional chemical and corrosion resistance.

Buttress Treaded Double Union Nuts

Strong buttress type threads on union nuts and seal carriers allow higher pressure handling capability and quick in-line installation and servicing.

Safe-T-Block Carrier

Stops flow in either direction, allowing safe removal of the downstream union nut for system service or modification.

PTFE Ball Seats

Spears PTFE floating seat design reduces seat wear for extended valve life, smooth operation, and bubble-tight shut-off. 100% factory tested.

EPDM or Viton® O-ring Options

Choice of high grade, abrasion resistant EPDM or Viton® elastomer O-rings allows application specific selection for optimum chemical resistance.

High Impact Polypropylene Handle

Features double stop engagement and exhibits excellent resistance to most chemical environments.

Safe-T-Shear® Stem

Developed to help prevent line fluids from leaking out in the event of ball valve stem damage. Engineered for high strength, the stem incorporates a special shear point to control accidental breakage. Over torquing breaks occur above the stem O-ring leaving the seal intact until repair or replacement can be made.

The unique design features of this quarter-turn shut off valve make it one of the most specified ball valves for industrial and chemical processing applications. Available in IPS sizes 1/2" through 4" with choice of socket, threaded or flanged end connectors, and 6" (venturied 4" valve) with choice of either socket or flanged end connectors. Also available in metric socket sizes 20mm through 110mm, and 1/2" through 4" BSP threads.

Full Schedule 80 Bore

In full open position, full bore virtually eliminates pressure drop, providing optimum flow.

Full 235 psi Pressure Rating

Maximum Internal Pressure at 73°F for the most demanding applications of 1/2" - 2" valves, 150 psi for 2-1/2" - 6" valves.

Suitable For Vacuum Service

Spears True Union Ball Valves are tested at 26 in. Hg vacuum for one hour with less than 1 in. Hg loss.

NSF Listed for Potable Water

All True Union Ball Valves are NSF Certified for potable water use.

Fully Repairable

Convenient Seat & O-ring Replacement Kits, or Full Cartridge Replacement Kits for easy ordering, servicing and extended valve life.

Easy Field Actuation, Or Custom Factory Actuation Available

Easily actuated in the field using optional mounting kits listed below. Spears in-house actuation program can quickly fit mechanical actuation to specific application needs.

Optional Accessories

- Round Safety Handle
- Stem Extension Kit
- Multi-Mount Valve Mounting Bracket
- Complete Multi-Mount Actuation Mounting Kit
- Mini-Mount Actuation Mounting Kit
- 2" Square/T-Style Operator Nut

For additional information, please refer to Spears' THERMOPLASTIC VALVES & ACCESSORIES PRODUCT GUIDE & ENGINEERING SPECIFICATIONS V-4 and THERMOPLASTIC VALVES & ACCESSORIES Price Schedule V-1.



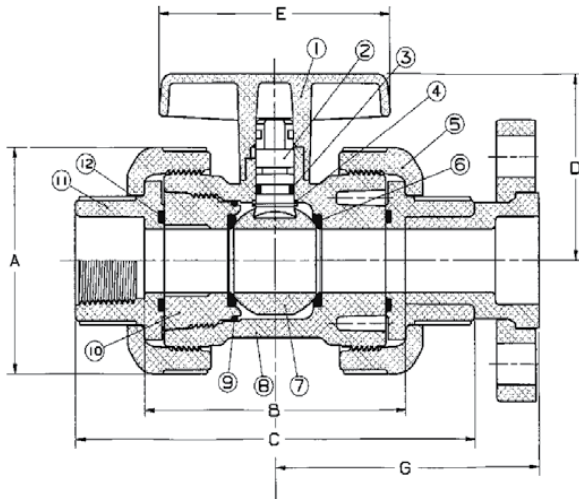
Sample Engineering Specification

All thermoplastic ball valves shall be True Union type constructed from PVC Type I, ASTM D 1784 Cell Classification 12454 or CPVC Type IV, ASTM D 1784 Cell Classification 23447. All O-rings shall be EPDM or genuine Viton®. All valves shall have Safe-T-Shear® stem and double stop Polypropylene handle. All valve union nuts shall have Buttress threads. All seal carriers shall be Safe-T-Blocked®. All valve components shall be replaceable. All valves shall be NSF International for use in potable water service. All 1/2" - 2" valves shall be pressure rated at 235 psi and all 2-1/2" - 4" valves shall be pressure rated at 150 psi for water at 73°F, as manufactured by Spears Manufacturing Company.

Viton® is a Registered Trademark of Dupont Dow Elastomers

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Replacement Parts

No.	Component	Qty.	Material
1	Handle	1	PP
2	Stem	1	PVC/ CPVC
3	Stem O-ring	1	EPDM/Viton®
4	Stem Bearing*	1	PP
5	Union Nut	2	PVC/ CPVC
6	Seat	2	PTFE
7	Ball	1	PVC/ CPVC
8	Body	1	PVC/ CPVC
9	Carrier O-ring	1	EPDM/Viton®
10	Seal Carrier	1	PVC/ CPVC
11	End Connector	2	PVC/ CPVC
12	End Connector O-ring	2	EPDM/Viton®

*sizes 1-1/4" and larger.
Seat O-ring (not shown) on sizes 2-1/2" and larger.

Dimensions, Weights, Operating Torque & Cv Values

Nominal Size	Dimension Reference (inches, ± 1/16)						Approx. Wt. (Lbs.)				Oper. ² Torque (in-lb.)	C _v ⁴ Values	
	A	B ¹	C	D	E	G	PVC		CPVC			Thd/Soc	Flanged
							Thd/Soc	Flanged	Thd/Soc	Flanged			
1/2	2-9/16	3-7/16	5-3/16	2-13/32	2-23/32	3-15/32	1.05	1.23	.95	1.14	20	25	18
3/4	2-1/2	4-1/16	6-2/16	3-5/8	3-2/16	4	1.44	1.64	1.50	1.73	20	51	36
1	3-13/32	4-8/16	6-9/16	2-13/16	3-23/32	4-5/16	1.91	2.22	2.08	2.43	40	97	67
1-1/4	3-11/16	4-1/2	7-1/16	2-31/32	4-1/8	4-19/32	2.38	2.78	2.52	2.91	60	201	142
1-1/2	4-3/8	5-5/16	8-1/32	3-9/32	4-15/32	5-9/32	3.63	4.00	3.82	4.26	80	285	201
2	5-3/16	5-13/16	8-13/16	4-13/32	5-1/4	5-23/32	5.40	6.14	5.70	6.54	90	540	381
2-1/2	7-7/16	8-3/8	11-7/8	4-29/32	9-7/8	7-3/16	12.87	14.26	13.44	15.85	300	712	512
3	7-7/16	8-3/16	11-15/16	4-29/32	9-7/8	7-11/32	13.24	15.67	13.85	16.96	300	1294	925
4	8-15/16	8-11/16	13-3/16	5-19/32	10-13/16	8-5/32	19.58	14.32	20.49	25.83	400	2629	1868
6 Socket ³	8-15/16	19-5/8	26-1/16	6-3/4	10-13/16	14-11/16	22.66	30.98	26.11	34.78	400	N/A	N/A
6 Flanged ³	11-3/16	29-3/8	N/A	6-3/4	10-13/16	14-11/16	N/A	N/A	N/A	N/A	400	N/A	N/A

- Valve Lay Lengths.
- Torque required at valve maximum internal pressure rating, 5 ft./sec. flow velocity.
- Consists of 4" True Union Ball Valve with two 4" x 6" Adapters.
- Gallons per minute at 1 psi pressure drop. Values calculated from valve laying length, based on derivative of Hazen-Williams equation with surface roughness factor of C=150. Cv Values for 6" venturied flange and socket valves are not available.

Temperature Pressure Rating

System Operating Temperature °F (°C)		100 (38)	110 (43)	120 (49)	130 (54)	140 (60)	150 (66)	160 (71)	170 (77)	180 (82)	190 (88)	200 (93)	210 (99)	
Valve Pressure Rating (psi (MPa))	1/2" - 2"	PVC	235 (1.62)	211 (1.45)	150 (1.03)	75 (.52)	50 (.34)	-0- (-0-)	-0- (-0-)	-0- (-0-)	-0- (-0-)	-0- (-0-)	-0- (-0-)	
		CPVC	235 (1.62)	210 (1.51)	170 (1.17)	145 (1.00)	130 (.90)	110 (.76)	90 (.62)	80 (.55)	70 (.48)	60 (.41)	50 (.34)	0- (-0-)
	2-1/2" - 4"	PVC	150 (1.03)	135 (.93)	110 (.76)	75 (.52)	50 (.34)	-0- (-0-)	-0- (-0-)	-0- (-0-)	-0- (-0-)	-0- (-0-)	-0- (-0-)	-0- (-0-)
		CPVC	150 (1.03)	140 (.97)	130 (.90)	120 (.83)	110 (.75)	100 (.70)	90 (.62)	80 (.55)	70 (.48)	60 (.41)	50 (.34)	-0- (-0-)

*Flanged valves are rated at 150 psi @ 73°F

NOT FOR USE WITH COMPRESSED AIR OR GASES

Spears Manufacturing Company DOES NOT RECOMMEND the use of thermoplastic piping products for systems to transport or store compressed air or gases, or the testing of thermoplastic piping systems with compressed air or gases in above and below ground locations. The use of our product in compressed air gas systems automatically voids any warranty for such products, and its use against our recommendation is entirely the responsibility and liability of the installer.

WARNING: DO NOT USE COMPRESSED AIR OR GAS TO TEST ANY PVC OR CPVC THERMOPLASTIC PIPING PRODUCT OR SYSTEM, AND SO NOT USE DEVICES PROPELLED BY COMPRESSED AIR OR GAS TO CLEAR SYSTEMS. THESE PRACTICES MAY RESULT IN EXPLOSIVE FRAGMENTATION OF SYSTEM PIPING COMPONENTS CAUSING SERIOUS OR FATAL BODILY INJURY.



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Spears

BALL VALVES

248-0012
VALVE, BALL, 1"
SOC, COMPACT,
PVC/VITON

Size (In.)	Threaded Part Number	Socket Part Number
PVC w/EPDM seals		
½	2121-005	2122-005
¾	2121-007	2122-007
1	2121-010	2122-010
1¼	2121-012	2122-012
1½	2121-015	2122-015
2	2121-020	2122-020
3	2121-030	2122-030
4	2121-040	2122-040
6	-	2122-060
PVC W/FKM Seals		
½	2131-005	2132-005
¾	2131-007	2132-007
1	2131-010	2132-010
1¼	2131-012	2132-012
1½	2131-015	2132-015
2	2131-020	2132-020
3	2131-030	2132-030
4	2131-040	2132-040
6	-	2132-060



Spears Compact Ball Valves Features:

- Pressure rating @ 73°F water:
½" - 2": 235 psi
3" - 6": 150 psi
- Maximum service temperature:
PVC = 140°F
CPVC = 200°F
- Assembled with silicon-free, water-soluble lubricant.
- 6" valves have lever handle (not shown).
- Rated for vacuum service.



PVC SCHEDULE 80 FITTINGS

80-2-1000

Performance Engineered & Tested



SPEARS Schedule 80 PVC fitting designs combine years of proven experience with computer generated stress analysis to yield the optimum physical structure and performance for each fitting. Material reinforcement is uniformly placed in stress concentration areas for substantially improved pressure handling capability. Resulting products are subjected to numerous verification tests to assure obtaining the very best PVC fittings available.

Full 1/4" Through 12" Availability

Spears comprehensive line of injection molded PVC fittings offers a variety of configurations in molded Schedule 80 sizes 1/4" through 12" conforming to ASTM D 2467 and Spears exclusive CL150 Flanges in sizes 1/2" through 16".

Exceptional Chemical & Corrosion Resistance

Unlike metal, PVC fittings never rust, scale, or pit, and will provide many years of maintenance-free service and extended system life.

High Temperature Ratings

PVC thermoplastic can handle fluids at service temperatures up to 140° F (60°C), allowing a wide range of process applications, including corrosive fluids.

Lower Installation Costs

Substantially lower material costs than steel alloys or lined steel, combined with lighter weight and ease of installation, can reduce installation costs by as much as 60% over conventional metal systems.

Higher Flow Capacity

Smooth interior walls result in lower pressure loss and higher volume than conventional metal fittings.

Additional Fabricated Configurations through 36"

Extra large, hard-to-find, and custom configurations are fabricated from NSF Certified pipe. Fittings are engineered and tested to provide full pressure handling capabilities according to Spears specifications.

Advanced Design Specialty Fittings

Spears wide range of innovative, improved products include numerous metal-to-plastic transition fittings and unions with Spears' patented stainless steel reinforced (SR) plastic threads.

PVC Valves

SPEARS PVC Valve products are available for total system compatibility and uniformity; see SPEARS' THERMOPLASTIC VALVES PRODUCT GUIDE & ENGINEERING SPECIFICATIONS (V-4).



Sample Engineering Specifications

All PVC Schedule 80 fittings shall be produced by Spears Manufacturing Company from PVC Type I, cell classification 12454, conforming to ASTM Standard D 1784. All injection molded PVC Schedule 80 fittings shall be Certified for potable water service by NSF International and manufactured in strict compliance to ASTM D 2467. All fabricated fittings shall be produced in accordance with Spears General Specifications for Fabricated Fittings. All PVC flanges shall be designed and manufactured to meet CL150 bolt pattern per ANSI Standard B16.5 and rated for a maximum internal pressure of 150 psi, non-shock at 73°F.

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PVC Thermoplastic Pipe Temperature Pressure De-Rating

To determine the maximum internal pressure rating at an elevated temperature, simply multiply the pipe pressure rating at 73°F by the percentage specified for the desired temperature.

System Operating Temperature °F (°C)	73 (23)	80 (27)	90 (32)	100 (38)	110 (43)	120 (49)	130 (54)	140 (60)
PVC	100%	90%	75%	62%	50%	40%	30%	22%

NOTE: Valves, Unions and Specialty Products have different elevated temperature ratings than pipe.

PVC Basic Physical Properties

Properties	ASTM Test Method	PVC
Mechanical Properties, 73°F		
Specific Gravity, g/cm ³	D 792	1.41
Tensile Strength, psi	D 638	7,000
Modulus of Elasticity, psi	D 638	440,000
Compressive Strength, psi	D 695	9,000
Flexural Strength, psi	D 790	13,200
Izod Impact, notched, ft-lb/in	D 256	.65
Thermal Properties		
Heat Deflection Temperature, °F at 66 psi	D 648	165
Thermal Conductivity, BTU/hr/sq ft/°F/in	C 177	1.2
Coefficient of Linear Expansion, in/in/°F	D 696	3.0 x 10 ⁻⁵
Flammability		
Limiting Oxygen Index, %	D 2863	43
UL 94 Rating	94V-0	
Other Properties		
Water Absorption, % 24 hr.	D 570	.05
Industry Standard Color	White / Dark Gray	
ASTM Cell Classification	D 1784	12454
NSF Potable Water Approved	Yes	

PVC Chemical Resistance

PVC is generally inert to most mineral acids, bases, salts and paraffinic hydrocarbon solutions. For more information on PVC chemical resistance refer to the Chemical Resistance of Rigid Vinyls Based on Immersion Test, published by the GEON® company.

NOT FOR USE WITH COMPRESSED AIR OR GASES

Spears Manufacturing Company DOES NOT RECOMMEND the use of thermoplastic piping products for systems to transport or store compressed air or gases, or the testing of thermoplastic piping systems with compressed air or gases in above and below ground locations. The use of our product in compressed air or gas systems automatically voids any warranty for such products, and its use against our recommendation is entirely the responsibility and liability of the installer.

WARNING: DO NOT USE COMPRESSED AIR OR GAS TO TEST ANY PVC OR CPVC THERMOPLASTIC PIPING PRODUCT OR SYSTEM, AND DO NOT USE DEVICES PROPELLED BY COMPRESSED AIR OR GAS TO CLEAR SYSTEMS. THESE PRACTICES MAY RESULT IN EXPLOSIVE FRAGMENTATION OF SYSTEM PIPING COMPONENTS CAUSING SERIOUS OR FATAL BODILY INJURY.



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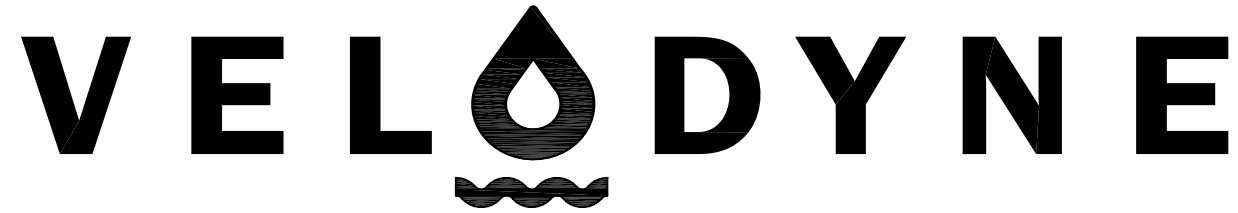
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Section 4

Electrical

4.1 Electrical Drawings

4.1.1 Title Page and Notes



543 SOUTH PIERCE AVE.
 LOUISVILLE, CO
 PHONE: 303-530-3298 / FAX: 303-530-3368

VELOBLEND LIQUID POLYMER SYSTEM VM-xP-D-0-A-1
DRAWING NUMBER: 120CP-DFRP12P

TABLE OF CONTENTS

SHEET #	DRAWING #	SHEET DESCRIPTION
SHEET 1	120CP-DFRP12P	TITLE PAGE & NOTES
SHEET 2	120CP-DFRP12P	120VAC POWER & CONTROL CIRCUITS
SHEET 3	120CP-DFRP12P	LAYOUT & DETAIL
SHEET 4	120CP-DFRP12P	BILL OF MATERIAL

NOTES:

1. VELODYNE TO PROVIDE ONLY THOSE ITEMS EXPRESSLY NOTED ON THESE DRAWINGS.
2. WIRE NUMBERS CORRESPOND TO TERMINAL NUMBERS.
3. DASHED LINES REPRESENTS WIRES TERMINATED IN THE FIELD AND/OR FIELD COMPONENTS.
4. ALL WIRE TO BE MTW TYPE INSIDE CONTROL ENCLOSURES.
5. ALL WIRES (INTERNAL & EXTERNAL) TO BE LABELED AT EACH TERMINATION POINT.
6. ALL FIELD WIRING TO BE THHN TYPE UNLESS OTHERWISE NOTED.
7. ALL CONDUIT TO BE RIGID GALVANIZED STEEL AND/OR NON-METALIC LIQUIDTIGHT FLEX WITH STAINLESS STEEL HANGERS & HARDWARE.



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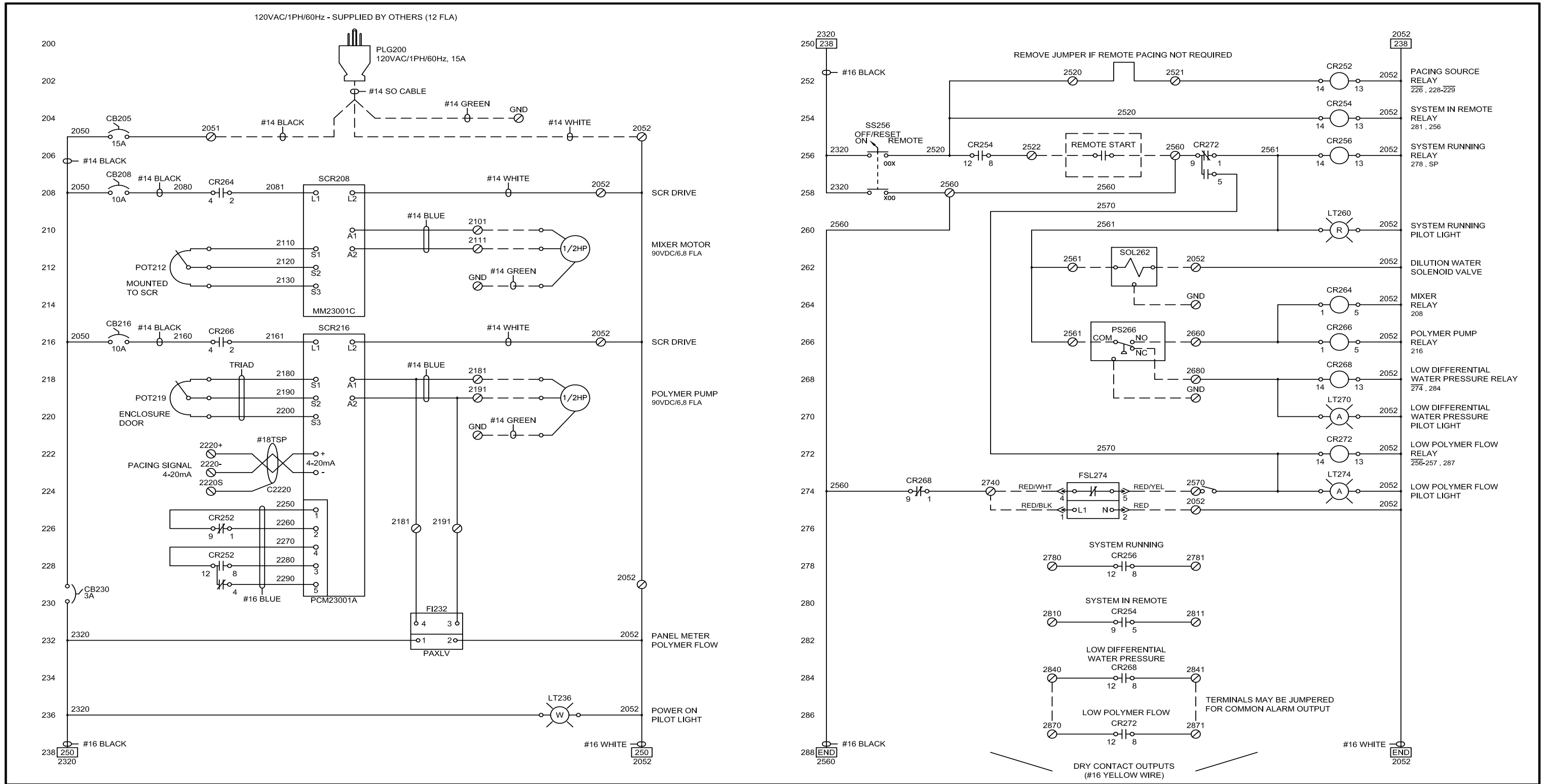
VELOBLEND LIQUID POLYMER SYSTEM
 VM-P-D-0-A-1

LOCAL CONTROL PANEL
 TITLE PAGE & NOTES

DATE:	DRFTR:	SHEET:	DRAWING NUMBER	REV
06/5/20	TH	1 OF 4	120CP-DFRP12P	A

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4.1.2 Schematics



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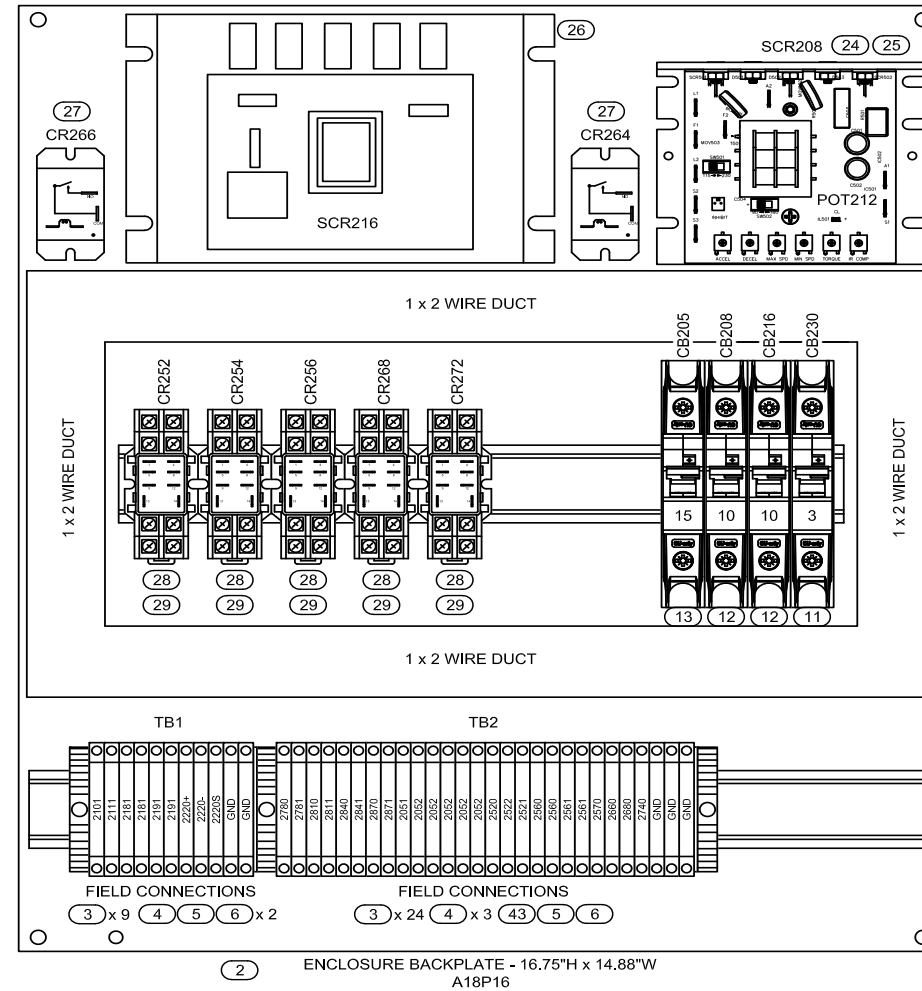
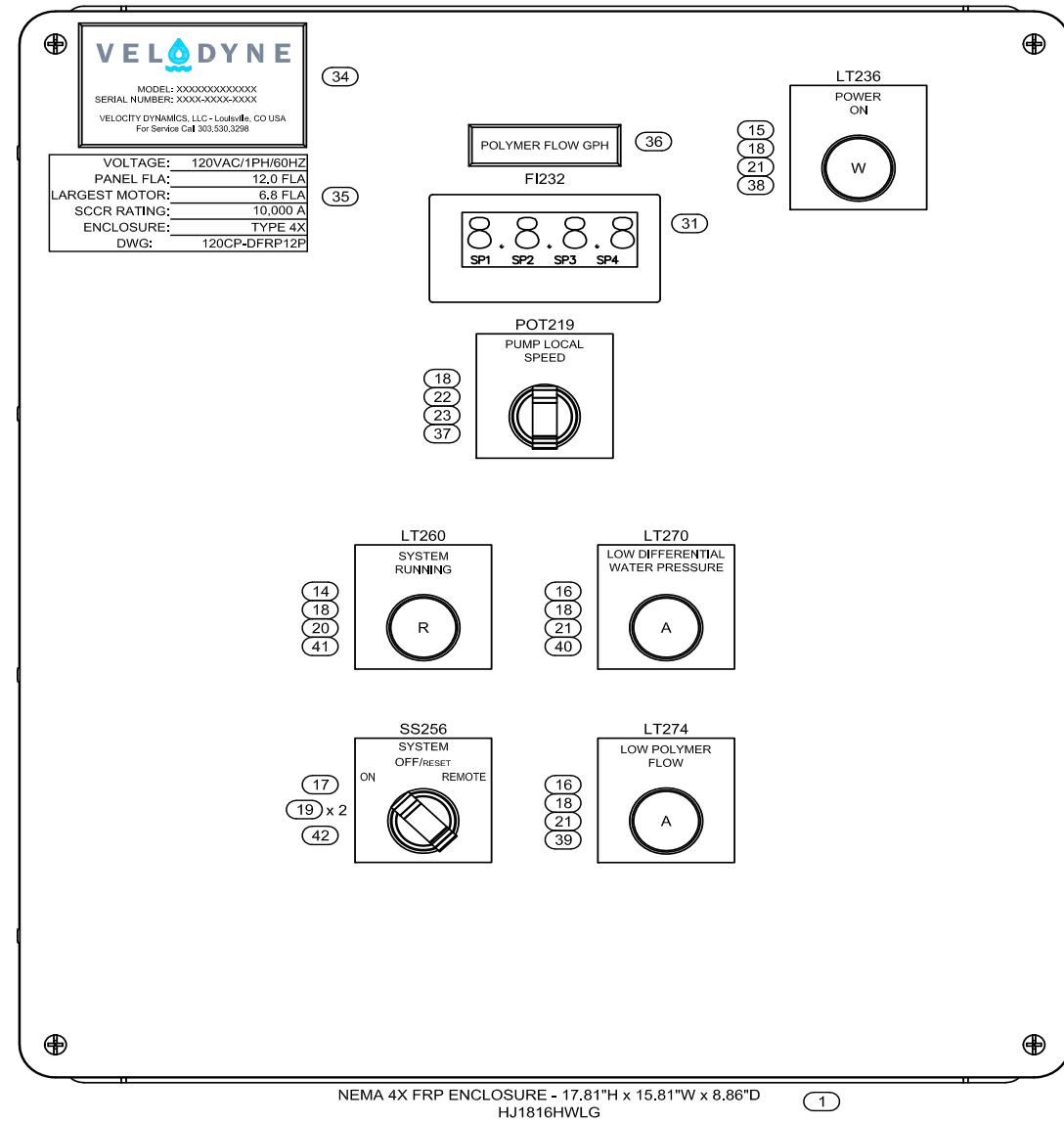
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VELOBLEND LIQUID POLYMER SYSTEM
VM-P-D-0-A-1
LOCAL CONTROL PANEL
120VAC POWER & CONTROL CIRCUITS

DATE:	DRFTR:	SHEET:	DRAWING NUMBER	REV
06/5/20	TH	2 OF 4	120CP-DFRP12P	A

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4.1.3 Control Panel Layout



FIELD CONNECTION TABLE - TB1

TERMINAL #	DESCRIPTION
1	2101 MIXER MOTOR (90VDC)
2	2111
3	2181 POLYMER PUMP (90VDC)
4	2181
5	2191
6	2191
7	2220+ REMOTE PACING SIGNAL INPUT (4-20mA)
8	2220-
9	2220S
10	GND MIXER MOTOR GROUND
11	GND POLYMER PUMP GROUND

FIELD CONNECTION TABLE - TB2

TERMINAL #	DESCRIPTION
1	2780 SYSTEM RUNNING DRY CONTACT
2	2781
3	2810 SYSTEM IN REMOTE DRY CONTACT
4	2811
5	2840 LOW WATER PRESSURE DRY CONTACT
6	2841
7	2870 LOW POLYMER FLOW DRY CONTACT
8	2871
9	2051 MAIN 120VAC (HOT)
10	2052 MAIN 120VAC (NEUTRAL)
11	2052 120VAC (NEUTRAL)
12	2052 DILUTION WATER SOLENOID VALVE (NEUTRAL)
13	2052 MIXER SCR (NEUTRAL)
14	2052 POLYMER PUMP SCR (NEUTRAL)
15	2520 PACING SOURCE RELAY/IN REMOTE RELAY
16	2522 REMOTE START FROM PLANT
17	2521 PACING SOURCE RELAY
18	2560 REMOTE START FROM PLANT
19	2560 ON SWITCH POWER
20	2561 DILUTION WATER SOLENOID VALVE
21	2561 DIFFERENTIAL PRESSURE SWITCH COMMON
22	2570 THERMAL FLOW SWITCH
23	2660 DIFFERENTIAL PRESSURE SWITCH NORMALLY OPEN
24	2680 DIFFERENTIAL PRESSURE SWITCH NORMALLY CLOSED
25	2740 THERMAL FLOW SWITCH
26	GND MAIN 120VAC (GROUND)
27	GND DILUTION WATER SOLENOID GROUND
28	GND DIFFERENTIAL PRESSURE SWITCH GROUND



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NO.	REVISION DESCRIPTION	DATE	BY	CK'D
A	INITIAL RELEASE	06/5/20	TH	

VELOBLEND LIQUID POLYMER SYSTEM
 VM-P-D-0-A-1

LOCAL CONTROL PANEL
 LAYOUT & DETAIL

DATE:	DRFTR:	SHEET:	DRAWING NUMBER	REV
06/5/20	TH	3 OF 4	120CP-DFRP12P	A

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4.1.4 Bill of Materials

BILL OF MATERIAL					
ITEM	QUANTITY	VDI #	DESCRIPTION	CATALOG #	MANUFACTURER
1	1	152-0094	Enclosure, Wall Mount, Continuous Hinge, FRP, NEMA 4X, 17.81"H x 15.81"W x 8.86"D	HJ1816HWLG	Hoffman
2	1	152-0017	Enclosure Subplate, Steel, 16.75"H x 14.88"W	A18P16	Hoffman
3	33	700-0000	Terminal, Din Style, 6mm, 30 AMP, Grey	1492-J4	Allen Bradley
4	5	700-0010	Terminal, Grounding, Din Style, 6mm, Green/Yellow	1492-JG4	Allen Bradley
5	2	700-0015	Terminal End Barrier, Din Style, 2mm, Gray	1492-EBJ3	Allen Bradley
6	3	700-0016	Terminal End Anchor, Din Style, 6mm, Gray	1492-EAJ35	Allen Bradley
7	2	700-0030	Terminal Marker Card, 6mm, 120/Card, Blank	1492-M6X12	Allen Bradley
8	1	700-0018	Terminal Center Jumper, 6 mm Center to Center, 10-Pole	1492-CJJ6-10	Allen Bradley
9	4	700-0021	Terminal Center Jumper, 6 mm Center to Center, 2-Pole	1492-CJJ6-2	Allen Bradley
10	1	290-0138	Din Rail, Low Rise, 35mm x 7.5mm x 1M long	1492-DR5	Allen Bradley
11	1	720-0004	UL 1489 Circuit Breaker, 277VAC - 48VDC Max Voltage, Trip C, 1-Pole, 3 AMP	1489-M1C030	Allen Bradley
12	2	720-0010	UL 1489 Circuit Breaker, 277VAC - 48VDC Max Voltage, Trip C, 1-Pole, 10 AMP	1489-M1C100	Allen Bradley
13	1	720-0012	UL 1489 Circuit Breaker, 277VAC - 48VDC Max Voltage, Trip C, 1-Pole, 15 AMP	1489-M1C150	Allen Bradley
14	1	740-0006	22.5mm, Pilot Light Lens, Red	800FP-P4	Allen Bradley
15	1	740-0007	22.5mm, Pilot Light Lens, Clear	800FP-P7	Allen Bradley
16	2	740-0004	22.5mm, Pilot Light Lens, Amber	800FP-P0	Allen Bradley
17	1	740-0012	22.5mm, Selector Switch, 3 Position, Maintained	800FP-SM32	Allen Bradley
18	5	741-0001	22.5mm, Mounting Latch	800F-ALP	Allen Bradley
19	2	741-0002	22.5mm, Contact Block, NO	800F-X10	Allen Bradley
20	1	741-0009	22.5mm, LED Module, 120VAC, Red	800F-N5R	Allen Bradley
21	3	741-0011	22.5mm, LED Module, 120VAC, White	800F-N5W	Allen Bradley
22	1	741-0052	Black Plastic Pot Operator Knob Without Resistor	KT-100B	ABB
23	1	743-0004	Potentiometer, 10k ohm, 10 Turn, 2W, Requires Operator	534-1-1-103	Vishay
24	1	743-1010	Potentiometer Assembly for SCR Drive	743-1010	Velodyne
25	1	767-0000	SCR Drive, DC, 1/8 to 2HP, Input Voltage 115/230VAC, Output Voltage 0-90/0-180VDC	MM23001C	Minarik
26	1	767-0001	SCR Drive, DC, 1/8 to 2HP, 4-20mA Input, Input Voltage 115/230VAC, Output Voltage 0-90/0-180VDC	PCM23001A	Minarik
27	2	731-1000	Relay, SPST, Form A, 30 Amp	AZ2280-1A-120-AF	American-Zettler
28	5	730-0000	Control Relay, RH Series, DPDT, 10 AMP Contacts, 120VAC Coil, Indicator	RH2B-UL-AC110-120V	IDEC
29	5	734-0000	Control Relay Socket, Standard DIN Rail Mount, 2-Pole	SH2B-05	IDEC
30	1	711-0500	Plug, 3 Prong, 15 Amp	LEV-515PV	Leviton
31	1	747-0004	Panel Meter, LED Display, DC Voltage Input, 115/230VAC Supply	PAXLV	Red Lion
32	5	290-0145	Wire Duct- 1" X 2"- Narrow Slot - Light Gray - Per Foot	F1X2LG6	Panduit
33	5	290-0140	Wire Duct Cover - 1.0" - Light Gray - Per Foot	C1LG6	Panduit
34	1	131-0003	Plaque, Veloblend S/N, 3.75" x 2.25", White With Black Text	131-0003	Velodyne
35	1	131-0126	Plaque, Panel Ratings, 4.25" x 1.75", White With Black Text	131-0120	Velodyne
36	1	131-0059	Plaque, "POLYMER FLOW GPH", 2.50" x 0.75", White With Black Text	131-0059	Velodyne
37	1	131-0061	Plaque, "PUMP LOCAL SPEED", 2.25" x 2.25", 0.88" Hole, White With Black Text	131-0061	Velodyne
38	1	131-0063	Plaque, "POWER ON", 2.25" x 2.25", 0.88" Hole, White With Black Text	131-0063	Velodyne
39	1	131-0064	Plaque, "LOW POLYMER FLOW", 2.25" x 2.25", 0.88" Hole, White With Black Text	131-0064	Velodyne
40	1	131-0067	Plaque, "LOW DIFFERENTIAL WATER PRESSURE", 2.25" x 2.25", 0.88" Hole, White With Black Text	131-0067	Velodyne
41	1	131-0068	Plaque, "SYSTEM RUNNING", 2.25" x 2.25", 0.88" Hole, White With Black Text	131-0068	Velodyne
42	1	131-0069	Plaque, "SYSTEM ON/OFF(RESET)/REMOTE", 2.25" x 2.25", 0.88" Hole, White With Black Text	131-0069	Velodyne
43	1	700-0011	Isolation Terminal Block, 22 Amp, Grey	1492-JKD4	Allen Bradley
44					
45					
46					
47					
48					
49					
50					



VELOCITY DYNAMICS, LLC
 543 SOUTH PIERCE AVE.
 LOUISVILLE, CO 80027
 P: 303-530-3298 WWW.VELODYNESYSTEMS.COM

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NO.	INITIAL RELEASE	DATE	TH	BY	CK'D
A	INITIAL RELEASE	06/5/20	TH		
NO.	REVISION DESCRIPTION	DATE	BY	CK'D	

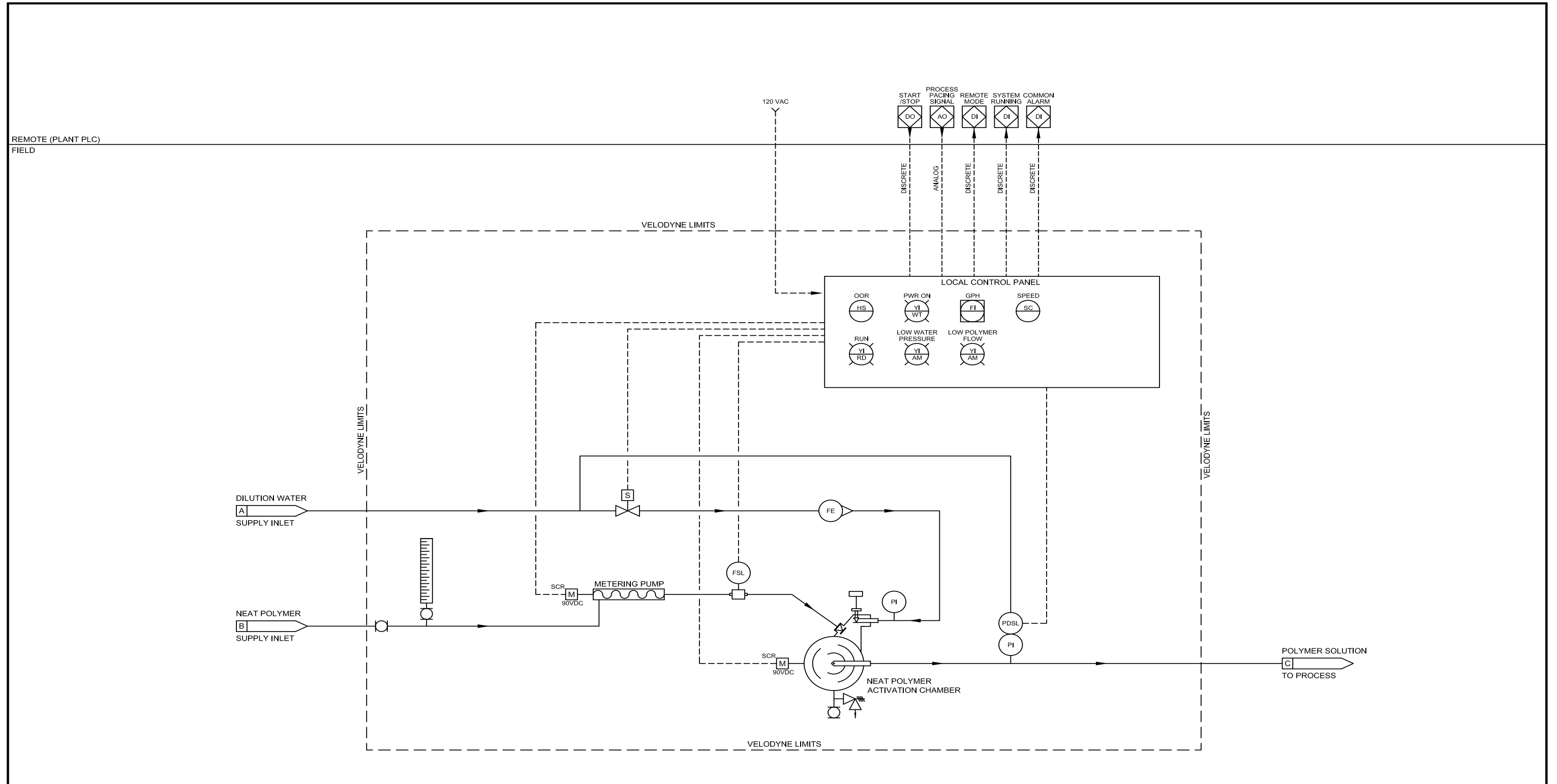
VELOBLEND LIQUID POLYMER SYSTEM
 VM-P-D-0-A-1

LOCAL CONTROL PANEL
 BILL OF MATERIAL

DATE:	DRFTR:	SHEET:	DRAWING NUMBER	REV
06/5/20	TH	4 OF 4	120CP-DFRP12P	A

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4.1.5 Process & Instrumentation Diagram



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A	FOR SUBMITTAL APPROVAL	6/5/20	TH	

VELOBLEND LIQUID POLYMER SYSTEM
 VM-P-D-0-A-1

PIPING & INSTRUMENTATION DIAGRAM

DATE:	DRFTR:	SHEET:	DRAWING NUMBER	REV
6/5/20	TH	1 OF 1	120CP-DFRP12P	A

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4.2 Electrical Component Data Sheets

4.2.1 Enclosure



Fiberglass Type 4X Overlapping Cover Enclosures

FIBERGLASS

Bulletin
HJ



152-0094
ENCLOSURE, 18 X 16 X 8.62, NEMA 4X,
FIBERGLASS

Application

The HJ series of fiberglass enclosures includes an overlapping cover and the integral mounting brackets often required in petrochemical, water treatment, and other corrosive environments. Choices of door style and door fasteners and a wide range of sizes provide application flexibility.

Construction

- Made from corrosion-resistant hot compression molded fiberglass-reinforced polyester
- Overlapping solid and window cover models are available in both flat and raised door versions
- Windows are clear polycarbonate
- Cover fastening options include screws or padlockable Type 316 stainless steel latches
- Type 304 stainless steel piano hinges on hinged models
- Integral mounting brackets
- Fifty-four models available in seven different sizes
- Capable of withstanding continuous temperatures from -58°F (-50°C) up to 302°F (150°C)
- Enclosures protect equipment and operators from indirect electrical contact

Finish

Fiberglass material is RAL 7035 light gray inside and out. Optional steel panels are painted white. Optional stainless steel, aluminum, conductive, and composite panels are unpainted.

Industry Standards

UL 508A, File Number E54315: Type 3, 3R, 4, 4X, I2, I3
NEMA/EEMAC Type 3, 3R, 4, 4X, I2, I3
CSA File Number 36508: Type 3, 3R, 4, 4X, I2, I3
IEC 60529, IP66
Enclosure Flammability Rating per UL 508A
Meets Type 3RX requirements

Accessories

Panels
Terminal Kit Assembly
Ventilators
A48 Swing Out Panel Kit

Modification Services Program

You can customize this product to your unique requirements by specifying from these options:

- Colors
- Holes and cutouts in body, doors, panels
- Tapped holes, fasteners in subpanel
- Mounting Brackets
- Panels
- Thermal Accessories
- Threaded Panel Extenders
- Windows Kits
- Standard accessories

To order, contact your local Hoffman sales representative.

NOTE: For information about modifications outside the scope of the Modification Services program, contact your Hoffman sales representative.



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Fiberglass Type 4X Overlapping Cover Enclosures

FIBERGLASS

Bulletin
HJ

Standard Sizes Flat Solid Screw Cover and Flat Solid Hinged Screw Cover Fiberglass Type 4X Enclosures

Catalog Number	Internal Dimensions A x B x C in. (mm)	Door Fasteners	L in. (mm)	W in. (mm)	D in. (mm)	O in. (mm)	K in. (mm)	G in. (mm)	H in. (mm)	P in. (mm)	Q in. (mm)	J in. (mm)	F in. (mm)	I in. (mm)	Panel Catalog Number ^a	Panel Size in. (mm)
HJ606HWLG	6.00 x 6.00 x 4.10 (152 x 152 x 104)	Hinged, 2 screws	7.31 (186)	7.31 (186)	4.96 (126)	1.38 (35)	0.50 (13)	6.77 (172)	4.01 (102)	4.26 (108)	4.25 (108)	4.34 (110)	4.64 (118)	7.52 (191)	A6P6 A6P6AL	4.88 x 4.88 (124 x 124)
HJ606WLG	6.00 x 6.00 x 4.10 (152 x 152 x 104)	4 screws	7.31 (186)	7.31 (186)	4.96 (126)	1.38 (35)	0.50 (13)	6.77 (172)	4.01 (102)	4.26 (108)	4.25 (108)	4.34 (110)	4.64 (118)	7.52 (191)	A6P6 A6P6AL	4.88 x 4.88 (124 x 124)
HJ806HWLG	8.00 x 6.00 x 4.10 (203 x 152 x 104)	Hinged, 2 screws	9.30 (236)	7.31 (186)	4.96 (126)	1.77 (45)	1.65 (42)	8.74 (222)	4.01 (102)	6.25 (159)	4.25 (108)	3.19 (81)	4.64 (118)	9.50 (241)	A8P6 A8P6AL	6.75 x 4.88 (171 x 124)
HJ806WLG	8.00 x 6.00 x 4.10 (203 x 152 x 104)	4 screws	9.30 (236)	7.31 (186)	4.96 (126)	1.77 (45)	1.65 (42)	8.74 (222)	4.01 (102)	6.26 (159)	4.25 (108)	3.19 (81)	4.64 (118)	9.50 (241)	A8P6 A8P6AL	6.75 x 4.88 (171 x 124)
HJ1008HWLG	10.00 x 8.00 x 4.59 (254 x 203 x 117)	Hinged, 2 screws	11.31 (287)	9.31 (236)	5.43 (138)	1.77 (45)	1.65 (42)	10.75 (273)	6.02 (153)	8.25 (210)	3.24 (158)	3.55 (93)	5.12 (130)	11.52 (293)	A10P8 A10P8AL	8.75 x 6.88 (222 x 102)
HJ1008WLG	10.00 x 8.00 x 4.59 (254 x 203 x 117)	4 screws	11.31 (287)	9.31 (236)	5.43 (138)	1.77 (45)	1.65 (42)	10.75 (273)	6.02 (153)	8.25 (210)	3.24 (158)	3.88 (93)	5.12 (130)	11.52 (293)	A10P8 A10P8AL	8.75 x 6.88 (222 x 102)
HJ1210HWLG	12.00 x 10.00 x 4.74 (305 x 254 x 120)	Hinged, 2 screws	13.30 (338)	11.29 (287)	5.58 (142)	1.77 (45)	1.65 (42)	12.75 (324)	8.01 (203)	10.25 (260)	8.25 (210)	3.81 (97)	5.24 (133)	5.24 (133)	A12P10 A12P10AL	10.75 x 8.88 (273 x 226)
HJ1210WLG	12.00 x 10.00 x 4.74 (305 x 254 x 120)	4 screws	13.30 (338)	11.29 (287)	5.58 (142)	1.77 (45)	1.65 (42)	12.75 (324)	8.01 (203)	10.25 (260)	8.25 (210)	3.81 (97)	5.24 (133)	5.24 (133)	A12P10 A12P10AL	10.75 x 8.88 (273 x 226)
HJ1412HWLG	14.00 x 12.00 x 5.74 (356 x 305 x 146)	Hinged, 2 screws	15.32 (389)	13.30 (338)	6.70 (170)	1.77 (45)	1.65 (42)	14.75 (375)	10.00 (254)	12.25 (311)	10.24 (260)	4.93 (125)	6.38 (162)	15.50 (394)	A14P12 A14P12AL	12.75 x 10.88 (324 x 276)
HJ1412WLG	14.00 x 12.00 x 5.74 (356 x 305 x 146)	4 screws	15.32 (389)	13.30 (338)	6.70 (170)	1.77 (45)	1.65 (42)	14.75 (375)	10.00 (254)	12.25 (311)	10.24 (260)	4.93 (125)	6.38 (162)	15.50 (394)	A14P12 A14P12AL	12.75 x 10.88 (324 x 276)
HJ1614HWLG	16.00 x 14.00 x 5.74 (406 x 356 x 146)	Hinged, 2 screws	17.31 (440)	15.30 (389)	6.70 (170)	1.77 (45)	1.65 (42)	16.75 (425)	12.00 (305)	14.25 (362)	12.24 (311)	4.93 (125)	6.38 (162)	14.52 (445)	A16P14 A16P14AL	14.75 x 12.88 (375 x 327)
HJ1614WLG	16.00 x 14.00 x 5.74 (406 x 356 x 146)	4 screws	17.31 (440)	15.30 (389)	6.70 (170)	1.77 (45)	1.65 (42)	16.73 (425)	12.00 (305)	14.25 (362)	12.24 (311)	4.93 (125)	6.83 (162)	17.52 (445)	A16P14 A16P14AL	14.75 x 12.88 (375 x 327)
HJ1816HWLG	18.00 x 16.00 x 8.62 (457 x 406 x 219)	Hinged, 2 screws	19.31 (490)	17.31 (440)	9.58 (243)	1.77 (45)	1.65 (42)	18.74 (476)	12.00 (305)	16.25 (413)	14.25 (362)	7.81 (198)	9.25 (235)	19.50 (495)	A18P16 A18P16AL	16.75 x 14.88 (425 x 378)
HJ1816WLG	18.00 x 16.00 x 8.62 (457 x 406 x 219)	4 screws	19.31 (490)	17.31 (440)	9.58 (243)	1.77 (45)	1.65 (42)	18.47 (476)	12.00 (305)	16.25 (413)	14.25 (362)	7.81 (198)	9.25 (235)	19.50 (495)	A18P16 A18P16AL	16.75 x 14.88 (425 x 378)

^aPurchase panels separately. Panel catalog numbers ending in AL are aluminum. Optional stainless steel, and composite material panels available for most sizes.



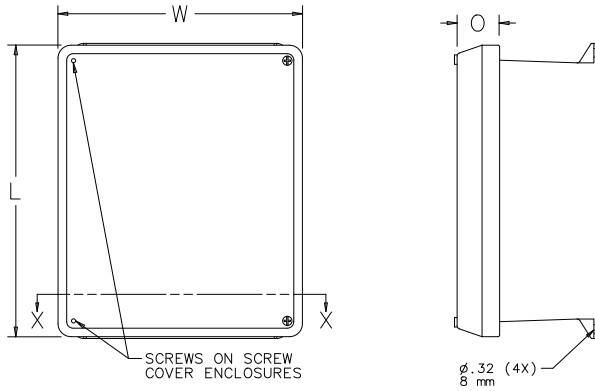
Fiberglass Type 4X Overlapping Cover Enclosures

FIBERGLASS

Bulletin
HJ

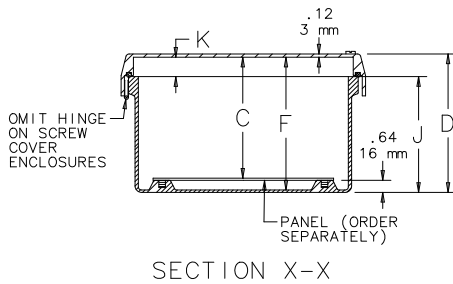
Corrosion-Resistant Enclosures

Solid Cover Enclosures



Top View with Door/Cover Removed

87575746





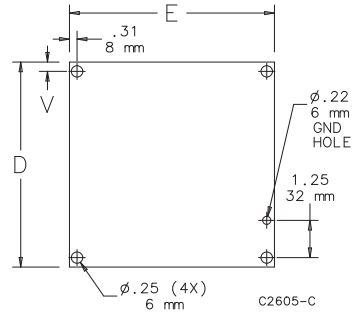
Panels for Enclosures

152-0017
BACK PANEL,
ENCLOSURE, 18
X 16, STD

Panels for Junction Boxes



Steel panels are 14 gauge, finished with white polyester powder paint or with a conductive, corrosion-resistant coating. Stainless steel panels are 14 gauge Type 304 and have a commercial #2B finish which is protected on one side with a plastic film. Aluminum panels are 5052-H32 aluminum alloy 0.080 in. (2mm) thick and protected on one side with a plastic film. Panel mounting hardware is furnished with all enclosures which accept these panels.

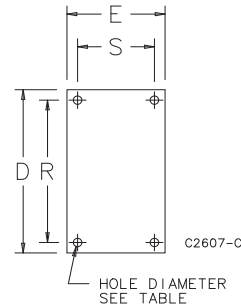


Accessories

Catalog Number Painted	Catalog Number Conductive	Catalog Number Stainless Steel	Catalog Number Aluminum	Panel Size D x E (in.)	Panel Size D x E (mm)	V (in.)	V (mm)
A6P4	A6P4G	A6P4SS	A6P4AL	4.88 x 2.88	124 x 73	0.31	8
A6P6	A6P6G	A6P6SS	A6P6AL	4.88 x 4.88	124 x 124	0.31	8
A8P6	A8P6G	A8P6SS	A8P6AL	6.75 x 4.88	171 x 124	0.25	6
A8P8	—	—	—	6.75 x 6.88	171 x 175	0.25	6
A10P8	A10P8G	A10P8SS	A10P8AL	8.75 x 6.88	222 x 175	0.25	6
A10P10	A10P10G	—	—	8.75 x 8.88	222 x 226	0.25	6
A12P6	A12P6G	—	—	10.75 x 4.88	273 x 124	0.25	6
A12P10	A12P10G	A12P10SS	A12P10AL	10.75 x 8.88	273 x 226	0.25	6
A12P12	A12P12G	A12P12SS	—	10.75 x 10.88	273 x 276	0.25	6
A14P8	A14P8G	—	—	12.75 x 6.88	324 x 175	0.25	6
A14P12	A14P12G	A14P12SS	A14P12AL	12.75 x 10.88	324 x 276	0.25	6
A16P10	A16P10G	—	—	14.75 x 8.88	375 x 226	0.25	6
A16P14	A16P14G	A16P14SS	A16P14AL	14.75 x 12.88	375 x 327	0.25	6
A18P16	A18P16G	A18P16SS	A18P16AL	16.75 x 14.88	425 x 378	0.25	6

Composite Panels for Junction Boxes and Small Wall-Mount Enclosures

Manufactured from light brown reinforced phenolic laminate sheet stock. This material has exceptional strength and chemical resistance, which makes it ideally suited for the most corrosive environments. Composite panels are intended for use in corrosion resistant enclosures. Panel sizes are available for junction boxes and small wall-mount enclosures. Composite panels may be drilled and tapped but work equally as well with self-threading or thread cutting screws. Refer to the table for recommended mounting specifications.



Catalog Number	Panel Size D x E (in.)	Panel Size D x E (mm)	R (in.)	R (mm)	S (in.)	S (mm)	Hole Dia. (in.)	Hole Dia. (mm)	Panel Thickness (in.)	Panel Thickness (mm)
A6P4C	4.88 x 2.88	124 x 73	4.25	108	2.25	57	0.25	6	0.12	3
A6P6C	4.88 x 4.88	124 x 124	4.25	108	4.25	108	0.25	6	0.12	3
A8P6C	6.75 x 4.88	171 x 124	6.25	159	4.25	108	0.25	6	0.12	3
A10P8C	8.75 x 6.88	222 x 175	8.25	210	6.25	159	0.25	6	0.12	3
A12P10C	10.75 x 8.88	273 x 226	10.25	260	8.25	210	0.25	6	0.19	5
A14P12C	12.75 x 10.88	324 x 276	12.25	311	10.25	260	0.25	6	0.19	5
A16P14C	14.75 x 12.88	375 x 327	14.25	362	12.25	311	0.25	6	0.19	5
A18P16C	16.75 x 14.88	425 x 379	16.25	413	14.25	362	0.25	6	0.19	5
A20P16C	17.00 x 13.00	432 x 330	15.25	387	11.25	286	0.50	13	0.19	5
A20P20C	17.00 x 17.00	432 x 432	15.25	387	15.25	387	0.50	13	0.19	5
A24P20C	21.00 x 17.00	533 x 432	19.25	489	15.25	387	0.50	13	0.19	5
A24P24C	21.00 x 21.00	533 x 533	19.25	489	19.25	489	0.50	13	0.19	5
A30P24C	27.00 x 21.00	686 x 533	25.25	641	19.25	489	0.50	13	0.19	5

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Bulletin No. PAXLI/V-D
Drawing No. LP0566
Released 10/08

**MODEL PAXLI - PAX LITE CURRENT METERS &
MODEL PAXLV - PAX LITE VOLTMETERS**



- **FOUR MULTI-RANGE UNITS COVER:**
199.9 μ A to 1.999 A *, 199.9 mV (AC or DC)
1.999 V to 300 V (AC or DC)
- **3 1/2-DIGIT, 0.56" (14.2 mm) HIGH LED DISPLAY W/POLARITY**
- **BUILT-IN SCALING PROVISIONS**
- **SELECTABLE DECIMAL POINT LOCATION**
- **AUTO ZEROING CIRCUITS**
- **OVER-RANGE INDICATION**
- **NEMA 4X/IP65 SEALED FRONT BEZEL**
- **OPTIONAL CUSTOM UNITS OVERLAY W/BACKLIGHT**

* Accessory Shunts Available For Higher Current Ranges.

GENERAL DESCRIPTION

PAX Lite Current and Volt Meters are premium quality instruments designed for tough industrial applications. With multi-range capability, built-in provision for scaling, and DIP switch selectable decimal points, these meters offer the ultimate in application flexibility. Four models cover your voltage and current indicator needs. The meter can provide direct readout from pressure, speed or flow transducers, or any other variable that can be translated to voltage or current. The built-in scaling allows the display to be scaled to the desired engineering unit.

The 3 1/2 -digit bi-polar display (minus sign displayed when current or voltage is negative) features a 0.56" high, 7-segment LEDs for easy reading. The meter is also available with custom units label capability. Using the PAX label kit (PAXLBK30), the selected label is installed behind the panel, keeping it safe from washdown or other environmental conditions. A DIP switch is used to control the backlight for the units label.

The meters have a NEMA 4X/IP65 sealed bezel and extensive testing of noise effects to CE requirements, allowing the meter to provide a tough yet reliable application solution.

SAFETY SUMMARY

All safety related regulations, local codes and instructions that appear in the literature or on equipment must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

DEFINITION OF TERMS

INSTALLATION CATEGORY (overvoltage category) I, (CAT I):
Signal level, special equipment or parts of equipment, telecommunication, electronic, etc. with smaller transient overvoltages than Installation Category (overvoltage category) II. (See IEC 664 & IEC 61010)

INSTALLATION CATEGORY (overvoltage category) II, (CAT II):
Local level, appliances, portable equipment, etc. with smaller transient overvoltages than Installation Category (overvoltage category) III. (See IEC 664 & IEC 61010)



CAUTION: Risk of Danger.
Read complete instructions prior to installation and operation of the unit.



CAUTION: Risk of electric shock.

DIMENSIONS In inches (mm)

Note: Recommended minimum clearance (behind the panel) for mounting clip installation is 2.1" (53.4) H x 5.0" (127) W.

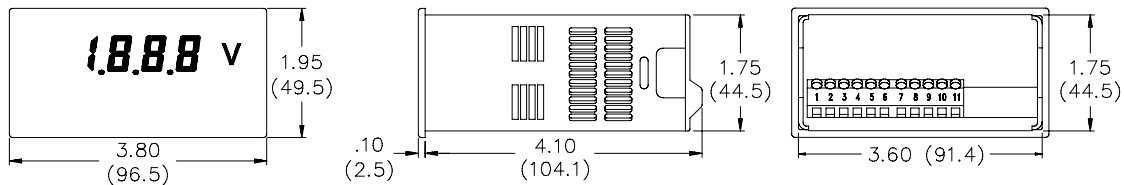
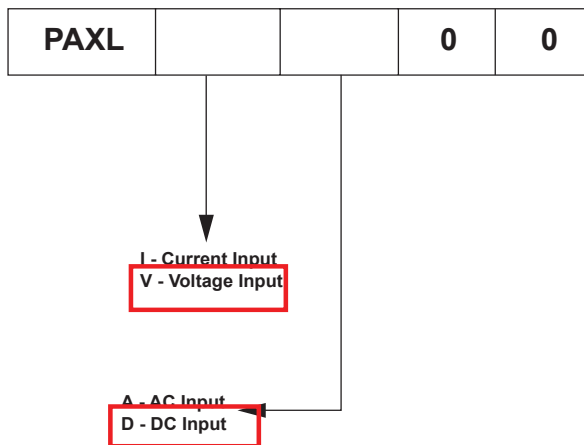


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Setting the Jumpers and Switches	4		

ORDERING INFORMATION

Meter Part Numbers



~~Accessories Part Numbers~~

TYPE	MODEL NO.	DESCRIPTION	PART NUMBERS
Accessories	PAXLBK	Units Label Kit Accessory	PAXLBK30
	APSCM	10 Amp DC Current Shunt	APSCM010
		100 Amp DC Current Shunt	APSCM100

GENERAL METER SPECIFICATIONS

- DISPLAY:** 3 1/2-digit, 0.56" (14.2 mm) high, 7-segment LED, (-) minus sign displayed when current or voltage is negative. Decimal points inserted before 1st, 2nd, or 3rd least significant digits by DIP switch selection.
- POWER:** 115/230 VAC, switch selectable. Allowable power line variation $\pm 10\%$, 50/60 Hz, 6 VA.

Isolation: 2300 Vrms for 1 min. between input and supply
Working Voltage: 300 V max., CAT II

- INPUT RANGES/RESOLUTION:** (Selectable by jumper connections.):

AC Voltmeters	AC Current Meters	DC Voltmeters	DC Current Meters
0-1.999 V/1 mV	0-199.9 μ A/0.1 μ A	± 1.999 V/1 mV	± 199.9 μ A/0.1 μ A
0-19.99 V/10 mV	0-1.999 mA/1 μ A	± 19.99 V/10 mV	± 1.999 mA/1 μ A
0-199.9 V/100 mV	0-19.99 mA/10 μ A	± 199.9 V/100 mV	± 19.99 mA/10 μ A
0-300 V/1 V	0-199.9 mA/100 μ A	± 300 V/1 V	± 199.9 mA/100 μ A
	0-1.999 A/1 mA		± 1.999 A/1 mA
	0-199.9 mV/100 μ V		± 199.9 mV/100 μ V

Working Voltage: 300 V max., CAT II

- ACCURACY:**

AC Voltmeters: $\pm(0.1\%$ of Reading + 3 digits) (45-500 Hz)

AC Current Meters (45-500 Hz):

199.9 μ A/199.9 mV, 1.999 mA, 19.99 mA: $\pm(0.1\%$ of Reading + 3 digits)

199.9 mA: $\pm(0.15\%$ of Reading + 3 digits)

1 A: $\pm(0.5\%$ of Reading + 3 digits)

DC Voltmeters: $\pm(0.1\%$ of Reading + 1 digit)

DC Current Meters:

199.9 μ A/199.9 mV, 1.999 mA, 19.99 mA: $\pm(0.1\%$ of Reading + 1 digit)

199.9 mA: $\pm(0.15\%$ of Reading + 1 digit)

1.999 A: $\pm(0.5\%$ of Reading + 1 digit)

Note: Any individual range may be recalibrated (scaled) to 0.1% accuracy with appropriate calibration equipment.

- OVER-RANGE INDICATION:** on all modes is indicated by blanking 3 least significant digits.
- MAX. VOLTAGE ON LOWEST INPUT RANGE:** 75 VAC or DC (Both voltmeters and current meters).
- MAX. VOLTAGE ON TERMINAL BLOCK:** 300 VAC or DC (Both voltmeters and current meters).
- MAX. CURRENTS (FOR CURRENT METERS):**
199.9 μ A through 19.99 mA: 10 times max. range current
199.9 mA: 1 A
1.999 A: 3 A

Caution: In circuits where fault currents can exceed the maximum shunt current, a fast-blow fuse should be installed in series with the input signal. Otherwise, a slow blow 10 amp fuse is recommended that will allow for start-up over current situations, while still protecting the instrument.

- TEMPERATURE COEFFICIENTS:**

Current meters	Voltmeters
DC: ± 100 PPM/ $^{\circ}$ C	DC: ± 75 PPM/ $^{\circ}$ C
AC: ± 200 PPM/ $^{\circ}$ C	AC: ± 150 PPM/ $^{\circ}$ C

- ENVIRONMENTAL CONDITIONS:**

Operating Temperature: 0 $^{\circ}$ to 60 $^{\circ}$ C

Storage Temperature: -40 $^{\circ}$ to 80 $^{\circ}$ C

Operating and Storage Humidity: 85% max. relative humidity (non-condensing)

Vibration According to IEC 68-2-6: Operational 5 to 150 Hz, in X, Y, Z direction for 1.5 hours, 2g's.

Shock According to IEC 68-2-27: Operational 30 g (10g relay), 11 msec in 3 directions.

Altitude: Up to 2000 meters

- RESPONSE TIME TO STEP CHANGE INPUT:** 1 sec. nominal
- READING RATE:** 2.5 readings/sec., nominal
- NORMAL MODE REJECTION:** 50 dB 50/60 Hz (DC units only)
- COMMON MODE REJECTION:** 110 dB DC or 50/60 Hz (DC units only)
- COMMON MODE VOLTAGE (COMM. TO EARTH):** 350 volt peak
- CERTIFICATIONS AND COMPLIANCES:**

SAFETY

UL Recognized Component, File #E179259, UL61010A-1, CSA C22.2 No. 61010-1

Recognized to U.S. and Canadian requirements under the Component Recognition Program of Underwriters Laboratories, Inc.

UL Listed, File #E137808, UL508, CSA C22.2 No. 14-M95

LISTED by Und. Lab. Inc. to U.S. and Canadian safety standards

Type 4X Enclosure rating (Face only), UL50

IECEE CB Scheme Test Certificate #UL/8843A/UL

CB Scheme Test Report #04ME11209-20041018

Issued by Underwriters Laboratories, Inc.

IEC 61010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.

IP65 Enclosure rating (Face only), IEC 529

ELECTROMAGNETIC COMPATIBILITY:

Immunity to Industrial Locations:

Electrostatic discharge	EN 61000-4-2	Criterion A 4 kV contact discharge 8 kV air discharge
Electromagnetic RF fields	EN 61000-4-3	Criterion B 10 V/m
Fast transients (burst)	EN 61000-4-4	Criterion B 2 kV power 2 kV signal
Surge	EN 61000-4-5	Criterion A 1 kV L-L, 2 kV L&N-E power
RF conducted interference	EN 61000-4-6	Criterion A 3 V/rms
Voltage dip/interruptions	EN 61000-4-11	Criterion A 0.5 cycle; 40 % variation

Emissions:

Emissions EN 55011 Class B

Emissions and Immunity to EN 61326: Electrical Equipment for Measurement, Control and Laboratory use.

Notes:

- Criterion A: Normal operation within specified limits.
- Criterion B: Temporary loss of performance from which the unit self-recovers.

- CONNECTIONS:** High compression cage-clamp terminal block

Wire Strip Length: 0.3" (7.5 mm)

Wire Gauge: 30-14 AWG copper wire

Torque: 4.5 inch-lbs (0.51 N-m) max.

- CONSTRUCTION:** This unit is rated for NEMA 4X/IP65 use. Installation Category II, Pollution Degree 2. One piece bezel/case. Flame resistant. Panel gasket and mounting clip included.

- WEIGHT:** 0.65 lbs. (0.24 Kg)

ACCESSORIES

UNITS LABEL KIT (PAXLBK)

Each meter has a units indicator with backlighting that can be customized using the Units Label Kit. The backlight is controlled by a DIP switch.

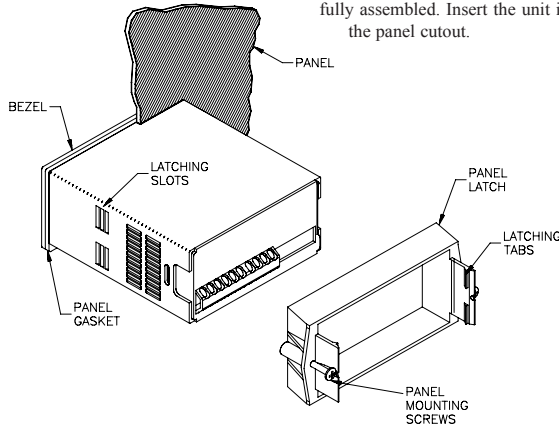
EXTERNAL CURRENT SHUNTS (APSCM)

To measure DC current signals greater than 2 ADC, a shunt must be used. The APSCM010 current shunt converts a maximum 10 ADC signal into 100.0 mV. The APSCM100 current shunt converts a maximum 100 ADC signal into 100.0 mV. The continuous current through the shunt is limited to 115% of the rating.

1.0 INSTALLING THE METER

Installation

The PAX meets NEMA 4X/IP65 requirements when properly installed. The unit is intended to be mounted into an enclosed panel. Prepare the panel cutout to the dimensions shown. Remove the panel latch from the unit. Slide the panel gasket over the rear of the unit to the back of the bezel. The unit should be installed fully assembled. Insert the unit into the panel cutout.

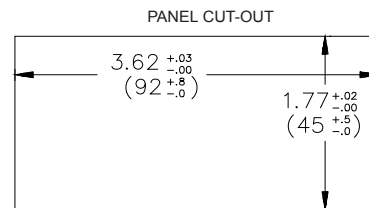


While holding the unit in place, push the panel latch over the rear of the unit so that the tabs of the panel latch engage in the slots on the case. The panel latch should be engaged in the farthest forward slot possible. To achieve a proper seal, tighten the latch screws evenly until the unit is snug in the panel (Torque to approximately 7 in-lbs [79N-cm]). Do not over-tighten the screws.

Installation Environment

The unit should be installed in a location that does not exceed the maximum operating temperature and provides good air circulation. Placing the unit near devices that generate excessive heat should be avoided.

The bezel should be cleaned only with a soft cloth and neutral soap product. Do NOT use solvents. Continuous exposure to direct sunlight may accelerate the aging process of the bezel.



2.0 SETTING THE JUMPERS AND SWITCHES

The meter has an input jumper and switches, which must be checked and/or changed prior to applying power. To access the input jumper and switches, remove the meter base from the case by firmly squeezing and pulling back on the side rear finger tabs. This should lower the latch below the case slot (which is located just in front of the finger tabs). It is recommended to release the latch on one side, then start the other side latch.

Power Selection Switch



Caution: Insure the AC power selection switch is set for the proper voltage before powering the meter. The meter is shipped from the factory in the 230 VAC position.

Input Range Jumper

A jumper is used for selection of the voltage or current input range. Select the proper input range that will be high enough to avoid input signal overload. It is important that only one jumper position is used at a time. Avoid placing a jumper across two different input ranges.

Set-Up DIP Switches

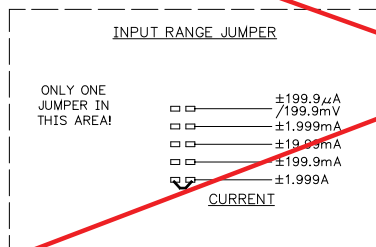
A DIP switch is located inside the meter. It is used for the selection of decimal points, backlight annunciator, and scaling. Selecting the "ON" position enables the function.

SWITCH	FUNCTION
1	Decimal Point 1 (000.0)
2	Decimal Point 2 (00.00)
3	Decimal Point 3 (0.000)
4	Backlight Annunciator for Units Label
5	Enables the Scaling Pot

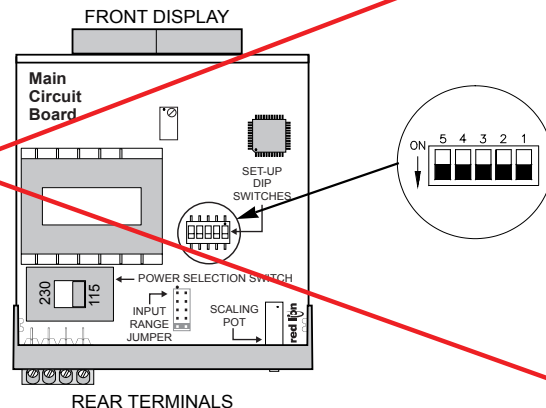
~~PAXII Jumper Selection~~

~~JUMPER SELECTIONS~~

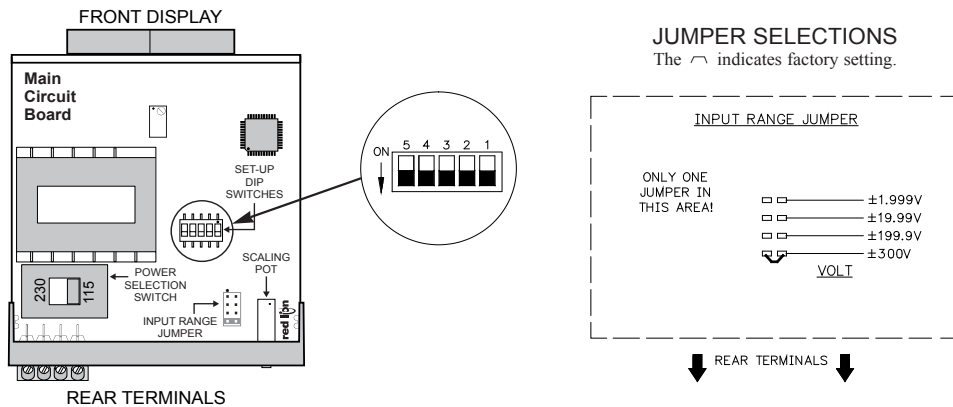
~~The \square indicates factory setting.~~



~~REAR TERMINALS~~



PAXLV Jumper Selection



3.0 WIRING THE METER

WIRING OVERVIEW

Electrical connections are made via screw-clamp terminals located on the back of the meter. All conductors should conform to the meter's voltage and current ratings. All cabling should conform to appropriate standards of good installation, local codes and regulations. It is recommended that power supplied to the meter (AC) be protected by a fuse or circuit breaker.

When wiring the meter, compare the numbers embossed on the back of the meter case against those shown in wiring drawings for proper wire position. Strip the wire, leaving approximately 0.3" (7.5 mm) bare lead exposed (stranded wires should be tinned with solder). Insert the lead under the correct screw-clamp terminal and tighten until the wire is secure. (Pull wire to verify tightness.)

EMC INSTALLATION GUIDELINES

Although this meter is designed with a high degree of immunity to Electro-Magnetic Interference (EMI), proper installation and wiring methods must be followed to ensure compatibility in each application. The type of the electrical noise, its source or the method of coupling into the unit may be different for various installations. Listed below are some EMC guidelines for successful installation in an industrial environment.

1. The meter should be mounted in a metal enclosure, which is properly connected to protective earth.
2. Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be run in metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter.
3. Signal or Control cables within an enclosure should be routed as far away as possible from contactors, control relays, transformers, and other noisy components.

4. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them on Signal and Control cables as close to the unit as possible. Loop the cable through the core several times or use multiple cores on each cable for additional protection. Install line filters on the power input cable to the unit to suppress power line interference. Install them near the power entry point of the enclosure. The following EMI suppression devices (or equivalent) are recommended:

Ferrite Suppression Cores for signal and control cables:

Fair-Rite # 0443167251 (RLC #FCOR0000)

TDK # ZCAT3035-1330A

Steward #28B2029-0A0

Line Filters for input power cables:

Schaffner # FN610-1/07 (RLC #LFIL0000)

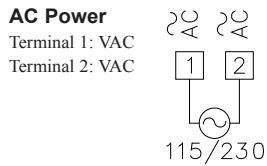
Schaffner # FN670-1.8/07

Corcom #1VR3

Note: Reference manufacturer's instructions when installing a line filter.

5. Long cable runs are more susceptible to EMI pickup than short cable runs. Therefore, keep cable runs as short as possible.
6. Switching of inductive loads produces high EMI. Use of snubbers across inductive loads suppresses EMI.
Snubber: RLC#SNUB0000.

3.1 POWER WIRING

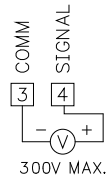


3.2 INPUT SIGNAL WIRING

Before connecting signal wires, the Input Range Jumper should be verified for proper position.

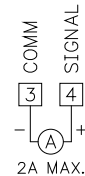
PAXLV Voltage Signal (self powered)

Terminal 4: + Volts DC/AC
Terminal 3: - Volts DC/AC



PAXLI Current Signal (self powered)

Terminal 4: + Amps DC/AC
Terminal 3: - Amps DC/AC



4.0 SCALING THE METER

PAXLV

DIRECT VOLTMETER READOUT

When the application requires direct voltmeter readout, the Scale Switch should remain in the "OFF" position. The Input Range Jumper is set to the voltage range being applied. It is possible to select a range higher than being applied to get lower resolution. The Decimal Point switches are set to resolution of the selected Input Range Jumper.

SCALING VOLTMETER READOUT

In many industrial applications, a voltmeter is required to display a reading in terms of PSI, RPM, or some other unit of measure. The signal voltage being measured can be generated by a transducer that senses the variations and delivers a linear output voltage. To provide the desired readout at the specified voltage, the voltmeter must be scaled.

Place the Scale Switch in the "ON" position. This enables the Scale Potentiometer which is accessible from the back of the meter. (Enabling the Scale Potentiometer does NOT affect the calibration of the meter.) Place the Decimal Point Switches to the proper location. To properly set the Input Range Jumper, the Division Factor must be determined by first using the below formula. After the Division Factor is calculated, use the Division Factor Range Selection Chart to choose the proper Input Range Jumper setting. Apply the meter power and the voltage signal. Adjust the Scale Potentiometer to the desired value.

This scaling only effects the span. There is no offset scaling. This means that only zero voltage can display a value of zero.

DIVISION FACTOR FORMULA:

$$\frac{VT \times D.D.P.}{D.R.} = D.F.$$

WHERE:

- VT = Maximum Transducer Output
- D.D.P. = Display Decimal Point
- D.F. = Division Factor
- D.R. = Desired Reading

D.D.P.	
0.000 = 1	The Display Decimal Point (D.D.P.) is determined by the desired decimal point placement in the readout.
00.00 = 10	
000.0 = 100	
0000 = 1000	

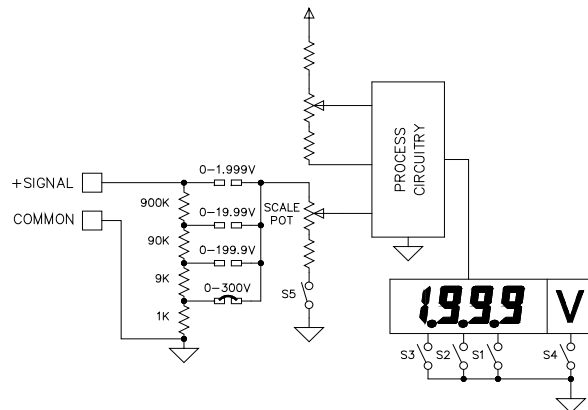
After the Division Factor for the application has been calculated, the proper voltage range jumper can be selected. Use the "Division Factor Range Selection Chart" to choose the proper jumper setting.

DIVISION FACTOR RANGE SELECTION CHART

D.F.	Use Input Position
0.1 to 1.2	Pos 1: 0-1.999 VDC
1.2 to 10.5	Pos 2: 0-19.99
10.5 to 100.5	Pos 3: 0-199.9
100.5 to 1300	Pos 4: 0-300

Note: Only one voltage jumper should be selected. Install the jumper before the voltage signal is applied.

BLOCK DIAGRAM PAXLV



EXAMPLE: A relative humidity transducer delivers a 7.0 VDC voltage at a relative humidity of 75%.

$$D.F. = \frac{VT \times D.D.P.}{D.R.} = \frac{7.0 \times 1000}{75} = 93.3$$

This Division Factor is between 10.5 and 100.5, therefore jumper position 3 (199.9 V) is selected. The Scaling Potentiometer is then adjusted for the desired readout at a known relative humidity.

PAXLI

DIRECT CURRENT METER READOUT

When the application requires direct current meter readout, the Scale Switch should remain in the "OFF" position. The Input Range Jumper is set to the current range being applied. It is possible to select a range higher than being applied to get lower resolution. The Decimal Point switches are set to resolution of the selected Input Range Jumper.

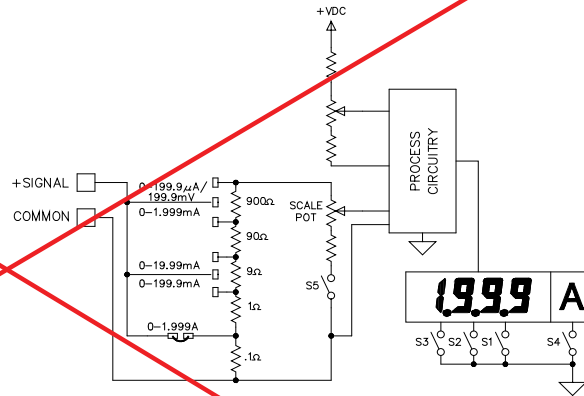
SCALING CURRENT METER READOUT

In many industrial applications, a current meter is required to display a reading in terms of PSI, RPM, or some other unit of measure. The signal voltage being measured can be generated by a transducer that senses the variations and delivers a linear output voltage. To provide the desired readout at the specified current, the current meter must be scaled.

Place the Scale Switch in the "ON" position. This enables the Scale Potentiometer which is accessible from the back of the meter. (Enabling the Scale Potentiometer does NOT affect the calibration of the meter.) Place the Decimal Point Switches to the proper location. The Input Range Jumper is set to the current range being applied. Apply the meter power and the current signal. Adjust the Scale Potentiometer to the desired value. Scaling to obtain a numerical readout higher than the normal value of the current can also be accomplished, in most cases, by selecting a lower current range. However, the maximum current for the range must not be exceeded. (See Specifications for maximum input currents.)

This scaling only effects the span. There is no offset scaling. This means that only zero amps can display a value of zero.

BLOCK DIAGRAM PAXLI



EXAMPLE: The Pax Current Meter has been connected to measure a circuit current to 120.0 mA maximum. However, in this application, the display is to indicate percent of load current with 120.0 mA equivalent to 100.0 percent. The scale potentiometer is adjusted to reduce the normal 120.0 mA signal input display reading of 120.0 to indicate the desired reading of 100.0 on the display. Scaling to obtain a numerical readout higher than the normal value of the current can also be accomplished in most cases by selecting a lower current range. However, the maximum current for the range must not be exceeded. (See Specifications for maximum input currents.)

5.0 TROUBLESHOOTING

PROBLEM	REMEDIES
NO DISPLAY	CHECK: Power switch and line voltage
INCORRECT DISPLAY	CHECK: Input jumper position CHECK: Scaling adjustment pot DIP switch position ADJUST: Scaling pot VERIFY: Input Signal
OVER-RANGE INDICATION	CHECK: Input jumper position VERIFY: Input signal

For further assistance, contact technical support at the appropriate company numbers listed.

6.0 CALIBRATION

The meter has been fully calibrated at the factory. Scaling to convert the input signal to a desired display value is performed by enabling the scale pot DIP switch. If the meter appears to be indicating incorrectly or inaccurately, refer to Troubleshooting before attempting to calibrate the meter.

When recalibration is required (generally every 2 years), it should only be performed by qualified technicians using appropriate equipment.

Input Calibration



WARNING: Calibration of this meter requires a signal source with an accuracy of 0.01% or better and an external meter with an accuracy of 0.005% or better.

Before starting, verify that the Input Range Jumper is set for the range to be calibrated. Also verify that the precision signal source is connected and ready. Allow a 30 minute warm-up period before calibrating the meter.

Then perform the following procedure:

1. Place jumper in 2 V range (PAXLV) or 2 mA range (PAXLI).
2. Set the DIP switch off to disable the scaling pot.
3. Apply half scale input signal.
4. Adjust calibration potentiometer as necessary for the display to read 1000 (ignore decimal point).
5. Apply zero signal and ensure display reads zero.
6. Apply full scale signal and ensure display reads 1999.

Note: Any individual range may be recalibrated (scaled) to 0.1% accuracy with appropriate calibration equipment.

LIMITED WARRANTY

The Company warrants the products it manufactures against defects in materials and workmanship for a period limited to two years from the date of shipment, provided the products have been stored, handled, installed, and used under proper conditions. The Company's liability under this limited warranty shall extend only to the repair or replacement of a defective product, at The Company's option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products.

The customer agrees to hold Red Lion Controls harmless from, defend, and indemnify RLC against damages, claims, and expenses arising out of subsequent sales of RLC products or products containing components manufactured by RLC and based upon personal injuries, deaths, property damage, lost profits, and other matters which Buyer, its employees, or sub-contractors are or may be to any extent liable, including without limitation penalties imposed by the Consumer Product Safety Act (P.L. 92-573) and liability imposed upon any person pursuant to the Magnuson-Moss Warranty Act (P.L. 93-637), as now in effect or as amended hereafter.

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767-0000
 SCR, DC, 1/8 to 2Hp
 MM23001C
 SS 3/4/15

1

Specifications

Model	Max. Armature Current (Amps DC)	HP Range @ 90 VDC	HP Range @ 180 VDC	Enclosure
MM23011C	1.5	1/20 - 1/8	1/10 - 1/4	Chassis
MM23111C				NEMA 1
MM23211C				NEMA 1 w/ Reversing
MM23411C				NEMA 4X
MM23072A				Chassis
MM23001C *	10	1/8 - 1	1/4 - 2	Chassis
MM23101C **				NEMA 1
MM23201C **				NEMA 1 w/ Reversing
MM23401C				NEMA 4X
MM23071A *				Chassis

* Heat sink kit 223-0159 must be used when the continuous output current is above 5 amps.
 ** Heat sink kit 223-0174 must be used when the continuous output current is above 5 amps.

AC Line Voltage	115 VAC or 230 VAC ±10%, 50/60 Hz, single phase
Armature Voltage (115 VAC Input)	0–90 VDC
Armature Voltage (230 VAC Input)	0–180 VDC
Form Factor	1.37 at base speed
Field Voltage (115 VAC Input)	50 VDC (F1 to L1); 100 VDC (F1 to F2)
Field Voltage (230 VAC Input)	100 VDC (F1 to L1); 200 VDC (F1 to F2)
Max. Field Current	1 ADC
Accel. Time Range:	
for 0–90 VDC Armature Voltage	0.5–11 seconds
for 0–180 VDC Armature Voltage	0.5–22 seconds
Decel. Time Range:	
for 0-90 VDC Armature Voltage	coast to a stop–13 seconds
for 0–180 VDC Armature Voltage	coast to a stop–25 seconds
Analog Input Voltage Range (signal must be isolated; S1 to S2):	
for 0–90 VDC Armature Voltage	0–1.4 VDC
for 0–180 VDC Armature Voltage	0–2.8 VDC

Specifications (Continued)

Input Impedance (S1 to S2)	100K ohms
Load Regulation	1% base speed or better
Vibration	0.5G max (0–50 Hz) 0.1G max (>50 Hz)
Safety Certification	UL Listed Equipment, file # E132235 UL Overload Protection CSA Certified Component, file # LR41380
Ambient Temp. Range (chassis drive)	10°C–55°C
Ambient Temp. Range (cased drive)	10°C–40°C

Suffix Definitions

- A: Basic drive with power LED and trim pots are perpendicular to board.
- C: Basic drive.
- C-H: Basic drive with inhibit style connector for meter.
Available on model MM23001C.
- C-Q: Basic drive with power LED and quick disconnect terminal.
Available on models MM23001C and MM23011C.

PCM23000A Series

Section 1. Specifications

767-0001
 SCR, DC, 1/8 to 2Hp
 PCM23001A
 SS 3/4/15

<i>Model</i>	<i>Maximum Armature Current (ADC)</i>	<i>HP Range with 90 VDC Motor</i>	<i>HP Range with 180 VDC Motor</i>	<i>Enclosure</i>
PCM23411A	1.5	1/20 - 1/8	1/10 - 1/4	NEMA 4X
PCM23001A	10.0	1/8 - 1	1/4 - 2	Chassis
PCM23401D				NEMA 4X

AC Line Voltage	115/230 VAC ± 10%, 50/60 Hz, single phase			
DC Armature Voltage	0 - 90 VDC			
<i>with 115 VAC Line Voltage</i>	0 - 180 VDC			
<i>with 230 VAC Line Voltage</i>				
Field Voltage	50 VDC (F1 to L1); 100 VDC (F1 to F2)			
<i>with 115 VAC Line Voltage</i>	100 VDC (F1 to L1); 200 VDC (F1 to F2)			
<i>with 230 VAC Line Voltage</i>				
Maximum Field Current	1 ADC			
Acceleration & Deceleration Time	1 second			
Analog Input Range	0 - 10 VDC, 4 - 20 mA			
Input Impedance (S1 to S2)	1K ohms			
Form Factor	1.37 at base speed			
Load Regulation	1% base speed or better			
Speed Range	60:1			
Vibration	0.5G maximum (0 - 50 Hz)			
	0.1G maximum (> 50 Hz)			
Safety Certifications	UL/cUL Recognized Equipment, File # E132235 (not PCM23411A) CSA Certified Component, File # LR41380			
Ambient Temperature Range	10°C - 55°C			
<i>Chassis Drive</i>	10°C - 40°C			
<i>Cased Drive</i>				

Selection Guide

720-0000 thru 720-0039



Control Circuit and Load Protection




LISTEN.
THINK.
SOLVE.®

Allen-Bradley • Rockwell Software

**Rockwell
Automation**

Circuit Protection Portfolio



1489-M Circuit Breakers
Approved for branch circuit protection in the United States and Canada, and certified as Miniature Circuit Breakers for IEC applications.



1492-SP Supplementary Protectors
Overcurrent protection for equipment where branch circuit protection is already provided, or is not required. Also Miniature Circuit Breakers as defined by IEC Standards.



188 Regional Circuit Breakers
Protective devices applied at the equipment level. Regional certifications only. Available for purchase only in China, Singapore, and Europe.



1492-RCD Residual Current Devices
By detecting small leakage currents and disconnecting all ungrounded conductors quickly, RCDs can prevent injury to exposed personnel and damage to equipment.

Rockwell Automation offers a wide range of Allen-Bradley circuit protection products designed for a variety of applications.

Miniature Circuit Breakers, Supplementary Protectors, and Residual Current Devices

Product	Certifications						Poles					Trip			Output Current Rating [A]									
	cULus	cURus	CSA	CE	VDE	CCC	1	1+N	2	3	3+N	4	B	C	D	0.2	0.5	0.8	1	1.2	1.5	1.6	2	2.5
1489-M	●		●	●	●	●	●		●	●	●		●	●		●			●				●	
1492-SP		★	●	●	●	●	●	●	●	●	●		●	●	●	●			●				●	
188				●	●	●	●	●	●	●	●		●	●	●	●			●				●	
1492-RCD		●	●	●	●	●			●															
1492-MC	●		●				●		●	●														
1492-GH,-GS	●		●	●			●		●	●						●	●	●	●	●	●	●	●	●

★ 1492-SP supplementary protectors are UL Recognized only.
● 1+N and 3+N devices are not cULus or CSA certified.

Electronic Circuit Protectors

Product	Certifications				Circuits		Output Current Rating [A]							
	cULus	CE	C1D2	NEC2	4	2x2	1	2	3	4	6	10	3/6	6/12
1692	●	●	●	●	●	●	●	●	●	●	●	●	●	●

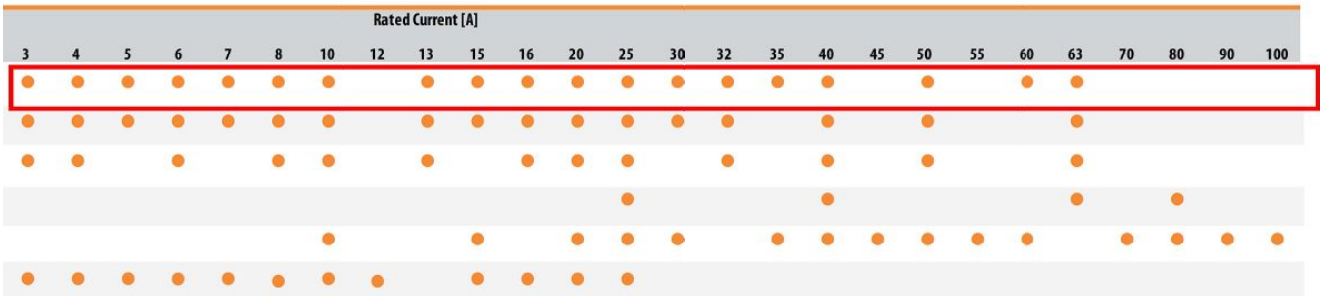
1692 Electronic Circuit Protectors
 Protection for secondary circuits of 24V DC switched mode power supplies. These modules monitor both supply voltage and load currents, and can be monitored and controlled locally and remotely.

1492-MC Circuit Breakers and Ground Fault Protectors
 Thermal magnetic circuit protection and sensing thresholds for personnel and equipment protection.

1492-GH, -GS High-density Supplementary Protectors
 Thermal magnetic circuit breakers with a high density design useful when DIN Rail space is a premium.

1492-FB Fuse Holders
 Designed for use in many OEM applications. Provides safe and convenient installation of Midget, Class CC, and Class J fuses.

- Test equipment
- Automotive systems
- Controller I/O points
- Power supplies
- Relay and contractor coils
- Medical equipment
- Control instrumentation
- Transformers
- Computers
- Solenoids



Typical North America Current Ratings: 0.5, 1, 2, 3, 4, 5, 6, 7, 8, 10, 15, 20, 25, 30, 40, 50, 60, 63 A.
 Typical IEC Current Ratings: 0.5, 1, 1.6, 2, 3, 4, 6, 8, 10, 13, 16, 20, 25, 32, 40, 50, 63 A.

Fuse Holders

Product	Certifications			Poles			Indication			Fuse Types			
	cULus	CSA	CE	1	2	3	none	L	D1	M30	C30	J30	J60
1492-FB	•	•	•	•	•	•	•	•	•	•	•	•	•

1489-M Circuit Breakers



Bulletin 1489-M thermal-magnetic Circuit Breakers are approved for branch circuit protection in the United States and Canada, and are certified as Miniature Circuit Breakers for IEC applications.

These branch protectors are compatible with many accessories to meet diverse application needs, including UL 508 Listed bus bars for convenience in panel assembly, auxiliary contacts, signal contacts and shunt trips for versatility, and lockout attachments for safety during maintenance.



Features

- Current limiting
- Fast breaking time
- High rated voltage
- Superior shock and vibration resistance to help prevent nuisance tripping
- Dual terminals allow a more secure connection of two wires, or both a wire and bus bar
- Terminal design helps prevent wiring misses by directing wires into the terminal openings, even while tightening
- Reversible line and load connections
- Single and multi-pole toggle mount lock out attachments available for Lockout/Tagout (LOTO)
- RoHS compliant and fully recyclable device
- Suitable for extreme ambient conditions

1489-M Circuit Breakers	
Rated Voltage	UL/CSA: Max. 480Y/277V AC IEC: U_c 230/400V AC
Interrupting Capacity	UL/CSA: 10 kA IEC: 15 kA
Current Ratings	0.5...63 A
Poles	1, 2, 3
Trip Curves	C, D
Standards Compliance	UL 489 CSA C22.2 No. 5.1 EN 60947-2 GB 14048.2
Certifications	UL Listed, File No. E197878 CSA Certified, File No. 259391 CE Marked VDE Certified CCC Certified RoHS Compliant

Product Selection

1-Pole Circuit Breakers

Photo/Wiring Diagram	UL/CSA Max. Voltage	IEC/EN Max. Voltage	Continuous Current Rating (I_n) [A]	Trip Curve C Inductive 5...10 I_n Cat. No.	Trip Curve D Highly Inductive 10...20 I_n Cat. No.
 	277V AC, 48V DC	230V AC	0.5	1489-M1C005	1489-M1D005
			1	1489-M1C010	1489-M1D010
			1.6	1489-M1C016	1489-M1D016
			2	1489-M1C020	1489-M1D020
			3	1489-M1C030	1489-M1D030
			4	1489-M1C040	1489-M1D040
			5	1489-M1C050	1489-M1D050
			6	1489-M1C060	1489-M1D060
			7	1489-M1C070	1489-M1D070
			8	1489-M1C080	1489-M1D080
			10	1489-M1C100	1489-M1D100
			13	1489-M1C130	1489-M1D130
			15	1489-M1C150	1489-M1D150
			16	1489-M1C160	1489-M1D160
			20	1489-M1C200	1489-M1D200
			25	1489-M1C250	1489-M1D250
			30	1489-M1C300	1489-M1D300
			32	1489-M1C320	1489-M1D320
			35	1489-M1C350	1489-M1D350
				C Curve: 277V AC, 48V DC D Curve: 240V AC, 48V DC	
	240V AC, 48V DC		50	1489-M1C500	1489-M1D500
			60	1489-M1C600	1489-M1D600
			63	1489-M1C630	1489-M1D630

AZ2280

731-1000
RELAY, SPST
AZ2280-1A-120-AF

30 AMP MINIATURE POWER RELAY

FEATURES

- Quick-connect leads for contacts and coil
- 1 Form A, B and C contacts available
- AC and DC coils available
- Epoxy sealed versions available
- UL Class F (155°C) standard
- UL, CUR file E44211
- VDE 40027037 (DC coil only)



CONTACTS

Arrangement	SPST (1 Form A, or B) SPDT (1 Form C)
Ratings	Resistive load: Max. switched power: 840 W or 8310 VA Max. switched current: 30 A (Form A) 15 A (Form B) Max. switched voltage: 277 VAC, 28 VDC
UL, CUR	<div style="border: 1px solid red; padding: 2px;"> 1 Form A 30 A at 277 VAC, General Use [1][2] 2 Hp at 250 VAC [1][2] 1 HP at 125 VAC [1][2] 30 A at 28 VDC [1] 20/60 (FLA/LRA) at 277 VAC 30k cycles [1] </div> 1 Form B 15 A at 277 VAC, General Use [1] 10 A at 28 VDC [1] 0.5 HP at 250 VAC [1] 0.25 HP at 125 VAC [1] 10/33 (FLA/LRA) at 277 VAC 30k cycles [1]
VDE	1 Form C 30/20 A (N.O./N.C.) at 277 VAC, General Use [1][2] 20/10 A (N.O./N.C.) at 28 VDC[1] 2/0.5 HP (N.O./N.C.) at 250 VAC[1][2] 1/0.25 HP (N.O./N.C.) at 125 VAC[1][2] 20/60 (FLA/LRA) at 277 VAC 30k cycles N.O. [1] 10/33 (FLA/LRA) at 277 VAC 30k cycles N.C. [1]
VDE	Contact factory for ratings
Material	Silver cadmium oxide [1], silver tin oxide [2]
Resistance	< 50 milliohms initially (24 V, 1 A voltage drop method)

COIL

Power	
At Pickup Voltage (typical)	DC: 500 mW AC: 1.4 VA
Max. Continuous Dissipation	DC: 1.7 W at 20°C (68°F) AC: 2.7 VA at 20°C (68°F)
Temperature Rise	38°C (68°F)
Temperature	Max. 155°C (311°F)

GENERAL DATA

Life Expectancy Mechanical Electrical	Minimum operations 1 x 10 ⁷ 1 x 10 ⁵ at 30 A 120 VAC Res. N.O.
Operate Time	15 ms at nominal coil voltage
Release Time	10 ms at nominal coil voltage (with no coil suppression)
Dielectric Strength (at sea level for 1 min.)	1500 Vrms contact to contact 2500 Vrms contact to coil
Insulation Resistance	1000 megohms min. at 500 VDC, 20°C 50% RH
Dropout	DC: Greater than 10% of nominal coil voltage AC: Greater than 20% of nominal coil voltage
Ambient Temperature Operating Storage	At nominal coil voltage -55°C (-67°F) to 85°C (185°F) -55°C (-67°F) to 155°C (311°F)
Vibration	0.062" DA at 10–55 Hz
Shock	10 g
Enclosure	P.B.T. polyester
Terminals	Tinned copper alloy, Quick Connects Note: Allow suitable slack on leads when wiring, and do not subject the terminals to excessive force.
Max. Solder Temp.	270°C (518°F)
Max. Solder Time	5 seconds
Max. Solvent Temp.	80°C (176°F)
Max. Immersion Time	30 seconds
Weight	36 grams

NOTES

1. All values at 20°C (68°F).
2. Relay may pull in with less than "Must Operate" value.
3. Specifications subject to change without notice.



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7/23/09

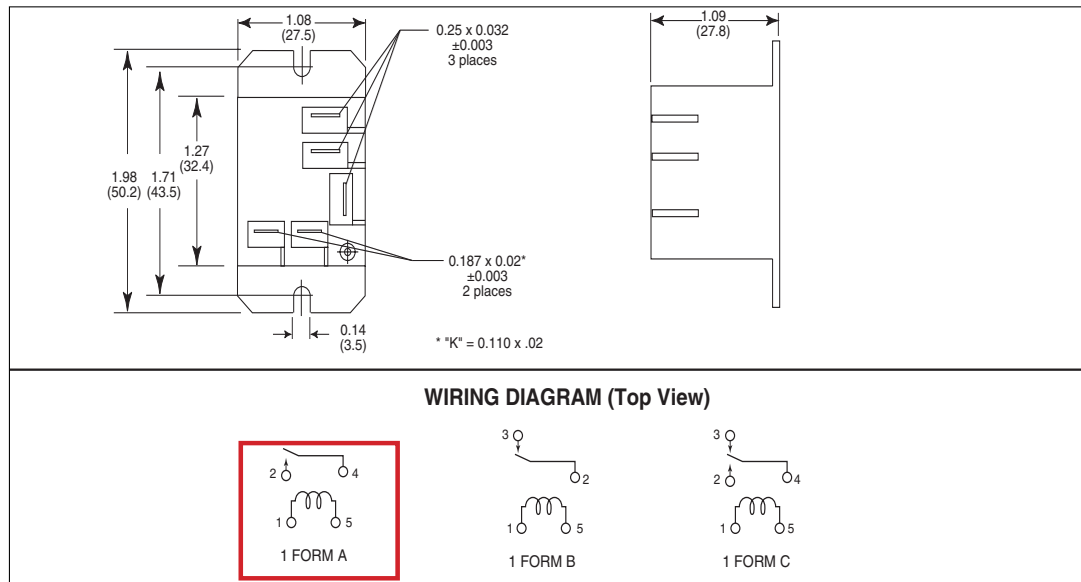
AZ2280

RELAY ORDERING DATA

COIL SPECIFICATIONS – DC Coil					ORDER NUMBER*
Nominal Coil VDC	Must Operate VDC	Max. Continuous VDC	Nominal Current mA ± 10%	Coil Resistance ± 10%	
5	3.75	6.4	185	27	AZ2280-1A-5DF
6	4.50	7.8	150	40	AZ2280-1A-6DF
9	6.75	12.2	93	97	AZ2280-1A-9DF
12	9.00	15.4	77	155	AZ2280-1A-12DF
15	11.25	19.8	59	256	AZ2280-1A-15DF
18	13.5	24.1	47	380	AZ2280-1A-18DF
24	18.00	32.0	36	660	AZ2280-1A-24DF
48	36.00	62.6	19	2560	AZ2280-1A-48DF
110	82.5	146.6	8.2	13450	AZ2280-1A-110DF
COIL SPECIFICATIONS – AC Coil 50/60 Hz					ORDER NUMBER*
Nominal Coil VAC	Must Operate VAC	Max. Continuous VAC	Nominal Coil Power VA	Coil Resistance ± 10%	
12	10.2	13.8	2.3	25	AZ2280-1A-12AF
24	20.4	27.6	2.1	100	AZ2280-1A-24AF
120	102.0	138.0	2.3	2,500	AZ2280-1A-120AF
208	176.8	239.0	2.2	11,000	AZ2280-1A-208AF
220/240	187.0	276.0	2.2/2.6	13,490	AZ2280-1A-240AF
277	235.4	318.5	2.2	15,000	AZ2280-1A-277AF

*Substitute "-1B" or "-1C" in place of "-1A" for 1 Form B or 1 Form C respectively. For silver tin oxide contacts substitute "-1AE" or "-1CE" in place of "-1A" or "-1C." Add "T" to "-1A", "-1AE", "-1B", "-1C" or "-1CE" for extended life contacts. Substitute "DEF" or "AEF" in place of "DF" or "AF" for epoxy sealed version. For 0.110 coil terminals change "F" to "KF."

MECHANICAL DATA



Dimensions in inches with metric equivalents in parentheses. Tolerance: ± .010"



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7/23/09

RH Series — General Purpose Midget Relays

Key features of the RH series include:

- Compact midget size saves space
- High switching capacity (10A)
- Choice of blade or PCB style terminals
- Relay options include indicator light, check button, and top mounting bracket
- DIN rail, surface, panel, and PCB type sockets available for a wide range of mounting applications



E
Relays

Specifications	Contact Material	Silver cadmium oxide
	Contact Resistance	50mΩ maximum (initial value)
	Minimum Applicable Load	24V DC/30mA, 5V DC/100mA (reference value)
	Operating Time	SPDT (RH1), DPDT (RH2): 20ms maximum 3PDT (RH3), 4PDT (RH4): 25ms maximum
	Release Time	SPDT (RH1), DPDT (RH2): 20ms maximum 3PDT (RH3), 4PDT (RH4): 25ms maximum
	Maximum Continuous Applied Voltage (AC/DC) at 20°C	110% of the rated voltage
	Minimum Operating Voltage (AC/DC) at 20°C	80% of the rated voltage
	Drop-Out Voltage (AC)	30% or more of the rated voltage
	Drop-Out Voltage (DC)	10% or more of the rated voltage
	Power Consumption	SPDT (RH1): DC: 0.8W AC: 1.1VA (50Hz), 1VA (60Hz) DPDT (RH2): DC: 0.9W AC: 1.4VA (50Hz), 1.2VA (60Hz) 3PDT (RH3): DC: 1.5W AC: 2VA (50Hz), 1.7VA (60Hz) 4PDT (RH4): DC: 1.5W AC: 2.5VA (50Hz), 2VA (60Hz)
	Insulation Resistance	100MΩ min (measured with a 500V DC megger)
	Dielectric Strength	SPDT (RH1) Between live and dead parts: 2,000V AC, 1 minute; Between contact circuit and operating coil: 2,000V AC, 1 minute; Between contacts of the same pole: 1,000V AC, 1 minute
		DPDT (RH2), 3PDT (RH3), 4PDT (RH4) Between live and dead parts: 2,000V AC, 1 minute; Between contact circuit and operating coil: 2,000V AC, 1 minute; Between contact circuits: 2,000V AC, 1 minute; Between contacts of the same pole: 1,000V AC, 1 minute
	Frequency Response	1,800 operations/hour
	Temperature Rise	Coil: 85°C maximum Contact: 65°C maximum
	Vibration Resistance	0 to 6G (55Hz maximum)
	Shock Resistance	SPDT/DPDT: 200N (approximately 20G) 3PDT/4PDT: 100N (approximately 10G)
	Life Expectancy	Electrical: over 500,000 operations at 120V AC, 10A; (over 200,000 operations at 120V AC, 10A for SPDT (RH1), 3PDT (RH3), 4PDT (RH4)) Mechanical: 50,000,000 operations
Operating Temperature	-30 to +70°C	
Weight	SPDT: 24g, DPDT: 37g (approximately) 3PDT: 50g, 4PDT: 74g (approximately)	



UL Recognized
Files No. RH1 = E66043
RH2 = E66043
RH3 = E66043
RH4 = E55996



CSA Certified
File No. LR35144



File No. B020813332452



Ordering Information

Order standard voltages for fastest delivery. Allow extra delivery time for non-standard voltages.

Basic Part No.

RH2B-U

Coil Voltage:

AC110-120V

730-0000
RELAY, 2PDT, 120VAC Coil, 10A Contacts
RH2B-UL-AC110-120V

Part Numbers

Part Numbers: RH Series with Options

Termination	Contact Configuration	Basic Part No.	Indicator Light	Check Button	Indicator Light and Check Button	Top Bracket
B (blade)	SPDT	RH1B-U	RH1B-UL	RH1B-UC	RH1B-ULC	RH1B-UT
	DPDT	RH2B-U	RH2B-UL	RH2B-UC	RH2B-ULC	RH2B-UT
	3PDT	RH3B-U	RH3B-UL	RH3B-UC	RH3B-ULC	RH3B-UT
	4PDT	RH4B-U	RH4B-UL	RH4B-UC	RH4B-ULC	RH4B-UT
V2 (PCB 0.078" [2mm] wide)	SPDT	RH1V2-U	RH1V2-UL	RH1V2-UC	RH1V2-ULC	—
	DPDT	RH2V2-U	RH2V2-UL	RH2V2-UC	RH2V2-ULC	—
	3PDT	RH3V2-U	RH3V2-UL	RH3V2-UC	RH3V2-ULC	—
	4PDT	RH4V2-U	RH4V2-UL	RH4V2-UC	RH4V2-ULC	—

Ratings

Coil Ratings

Rated Voltage	Rated Current ±15% at 20°C								Coil Resistance ±15% at 20°C				
	60Hz				50Hz								
	SPDT	DPDT	3PDT	4PDT	SPDT	DPDT	3PDT	4PDT	SPDT	DPDT	3PDT	4PDT	
AC	6V	150mA	200mA	280mA	330mA	170mA	238mA	330mA	387mA	18.8Ω	9.4Ω	6.0Ω	5.4Ω
	12V	75mA	100mA	140mA	165mA	86mA	118mA	165mA	196mA	76.8Ω	39.3Ω	25.3Ω	21.2Ω
	24V	37mA	50mA	70mA	83mA	42mA	59.7mA	81mA	98mA	300Ω	153Ω	103Ω	84.5Ω
	120V*	7.5mA	11mA	14.2mA	16.5mA	8.6mA	12.9mA	16.4mA	19.5mA	7,680Ω	4,170Ω	2,770Ω	2,220Ω
	240V†	3.2mA	5.5mA	7.1mA	8.3mA	3.7mA	6.5mA	8.2mA	9.8mA	3,1200Ω	15,210Ω	12,100Ω	9,120Ω
DC	6V	128mA	150mA	240mA	250mA	47Ω	40Ω	25Ω	24Ω				
	12V	64mA	75mA	120mA	125mA	188Ω	160Ω	100Ω	96Ω				
	24V	32mA	36.9mA	62mA	62mA	750Ω	650Ω	400Ω	388Ω				
	48V	18mA	18.5mA	30mA	31mA	2,660Ω	2,600Ω	1,600Ω	1,550Ω				
	110V‡	8mA	9.1mA	12.8mA	15mA	13,800Ω	12,100Ω	8,880Ω	7,340Ω				



* For RH2 relays = 110/120V AC.
 † For RH2 relays = 220/240V AC.
 ‡ For RH2 relays = 100/110V DC.

Rated Voltage	Coil Inrush				Coil Inductance								
					Energizing				De-Energizing				
	SPDT	DPDT	3PDT	4PDT	SPDT	DPDT	3PDT	4PDT	SPDT	DPDT	3PDT	4PDT	
AC	6V	250mA	340mA	520mA	620mA	0.09H	0.08H	0.05H	0.05H	0.06H	0.04H	0.03H	0.02H
	12V	120mA	170mA	260mA	310mA	0.037H	0.30H	0.22H	0.18H	0.22H	0.16H	0.12H	0.10H
	24V	56mA	85mA	130mA	165mA	1.5H	1.2H	0.9H	0.73H	0.9H	0.63H	0.5H	0.36H
	120V*	12mA	16mA	26mA	33mA	37H	33H	21H	18H	22H	15H	12H	9H
	240V†	7mA	8mA	12mA	16mA	130H	130H	84H	73H	77H	62H	47H	36H
DC	6V												
	12V												
	24V	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	48V												
	110V												



* For RH2 relays = 110/120V AC.
 † For RH2 relays = 220/240V AC.

Ratings con't

Contact Ratings

# of Poles	Max Contact Power		General Ratings		
	Resistive	Inductive	Voltage	Resistive	Inductive*
RH1	AC1540VA DC300W	AC990VA DC210W	AC110	10A	7A
			AC220	7A	4.5A
			DC30	10A	7A
RH2 RH3 RH4	AC1650VA DC300W	AC1100VA DC225W	AC110	10A	7.5A
			AC220	7.5A	5A
			DC30	10A	7.5A

*cosφ = 0.3
L/R - 7ms



UL Ratings

Voltage	Resistive			General Use			Horse Power Rating
	RH1, RH2	RH3	RH4	RH1, RH2	RH3	RH4	RH1, RH2 RH3
AC240V	10A	7.5A	7.5A	7A	6.5A	5A	1/3HP
AC120V	10A	10A	10A	7A	7.5A	7.5A	1/6HP
DC30V	10A	10A	—	7A	—	—	—
DC28V	10A	10A	10A	7A	—	—	—

TÜV Ratings

Voltage	RH1	RH2	RH3	RH4
AC240V	10A	10A	7.5A	7.5A
DC30V	10A	10A	10A	10A

CSA Ratings

Voltage	Resistive				General Use				HP Rating
	RH1	RH2	RH3	RH4	RH1	RH2	RH3	RH4	RH1, 2, 3
AC240V	10A	10A	—	7.5A	7A	7A	7A	5A	1/3HP
AC120V	10A	10A	10A	10A	7.5A	7.5A	—	7.5A	1/6HP
DC30V	10A	10A	10A	10A	7A	7.5A	—	—	—

E
Relays

Applicable Sockets

Part Numbers: Sockets

Relay	Standard DIN Rail Mount	Finger-Safe DIN Rail Mount	Surface Mount	Panel Mount	PCB Mount
RH1B	SH1B-05	SH1B-05C	—	SH1B-51	SH1B-62
RH2B	SH2B-05	SH2B-05C	SH2B-02	SH2B-51	SH2B-62
RH3B	SH3B-05	SH3B-05C	—	SH3B-51	SH3B-62
RH4B	SH4B-05	SH4B-05C	—	SH4B-51	SH4B-62



See Section F for details on sockets. All DIN rail mount sockets shown above can be mounted using DIN rail BNDN1000.

Spring & Clips (optional)

Part Number	Use With
SY2S-02F1③ SFA-101① SFA-202②	SH1B-05, 05C
SY4S-51F1③ SFA-301① SFA-302②	SH1B-51, 62
SY4S-02F1③ SFA-101① SFA-202②	SH2B-05, 05C
SY4S-51F1③ SFA-301① SFA-302②	SH2B-51, 62
SH3B-05F1③ SFA-101①, -202②	SH3B-05, 05C
SY4S-51F1③ SFA-301① SFA-302②	SH3B-51, 62
SH4B-02F1③ SFA-101①, -202②	SH4B-05, 05C
SY4S-51F1③ SFA-301① SFA-302②	SH4B-51, 62



- ① Top latch
- ② Side latch
- ③ Pullover spring

IDEC Relays

RH Series

Internal Circuits

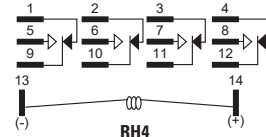
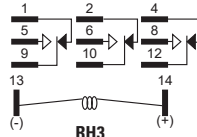
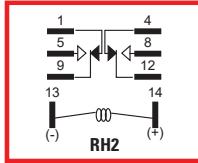
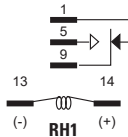
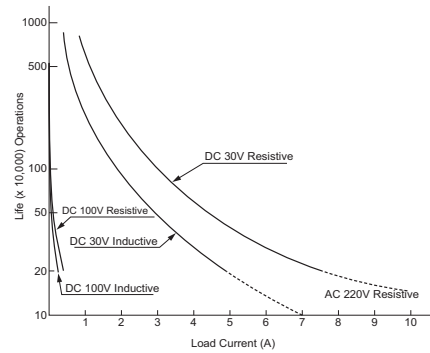
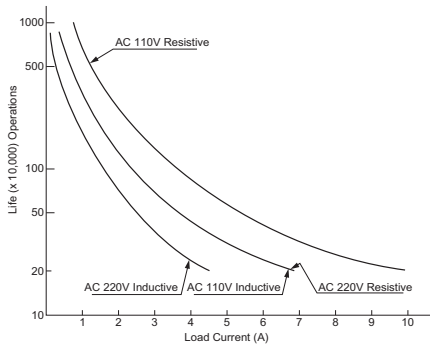


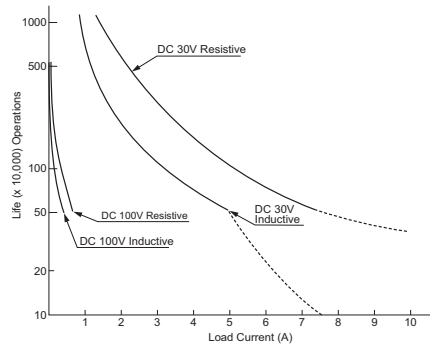
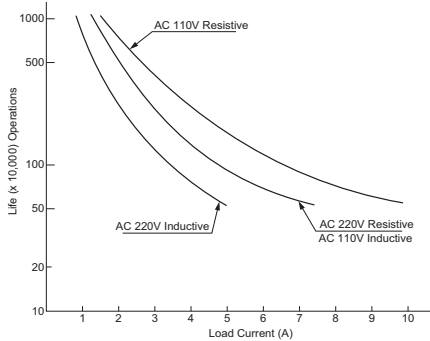
Image as viewed from bottom of relay. Refer to socket for exact wiring layout (Section F).

Electrical Life Curves

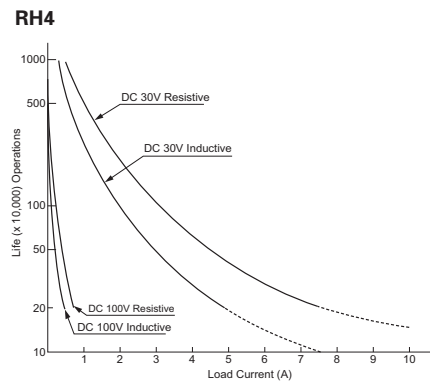
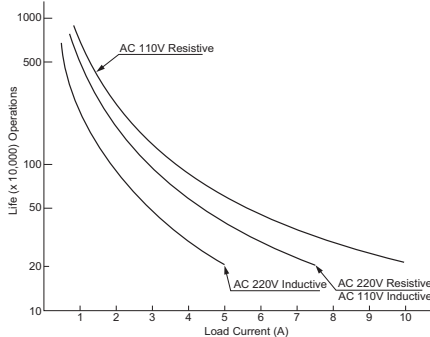
RH1



RH2



RH3



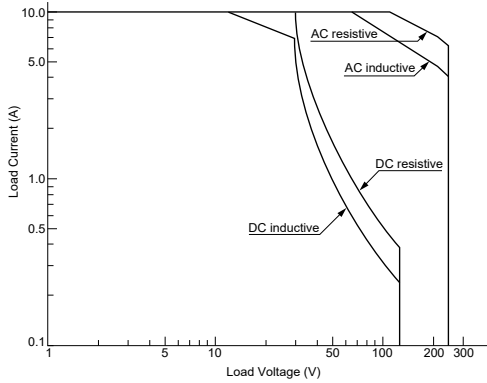
www.idec.com

USA: (800) 262-IDEC or (408) 747-0550, Canada: (888) 317-IDEC

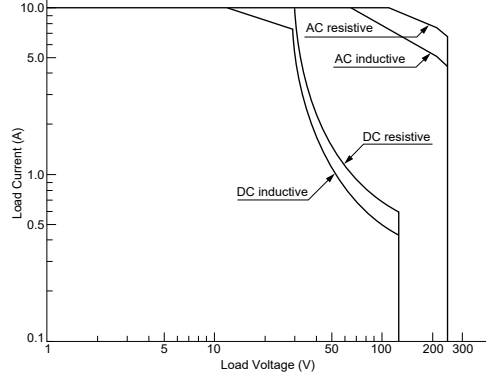
E-15

Maximum Switching Capacity

RH1



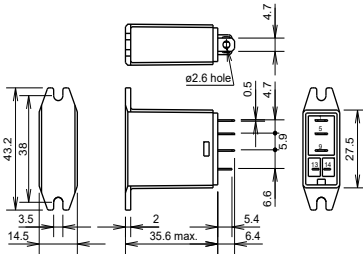
RH2/RH3/RH4



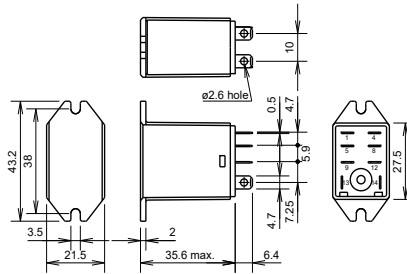
Relays

Dimensions

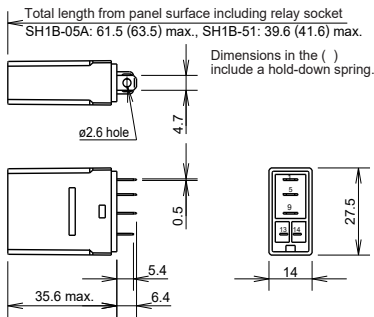
**Top Bracket Mounting
Blade Terminal
RH1B-UT**



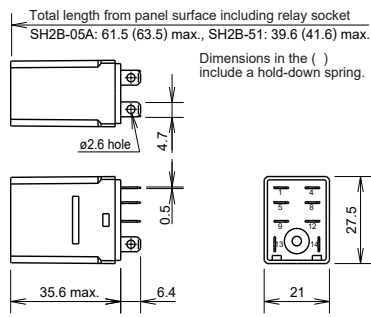
RH2B-UT



**Plug-in Blade Terminal
RH1B**



RH2B



All dimensions in mm.

700-0000
Terminal Block, Gry, J4
ALLEN BRADLEY 1492-J4
1/29/15

Terminal Block Specifications

Screw Type Terminal Blocks

	1492-WM3	1492-WM4	1492-WMD1
Dimensions are not intended to be used for manufacturing purposes. Note: Height dimension is measured from top of rail to top of terminal block.			
	1.14" (29 mm)	1.26" (32 mm)	1.76" (44.6 mm)
Specifications	Single-circuit mini terminal block.		Two-circuit mini terminal block.
Certifications	IEC CSA ATEX	IEC CSA ATEX	CSA IEC
Voltage Rating	300V AC/DC	500V AC/DC	300V AC/DC
Maximum Current	15 A	24 A	15 A
Wire Range (Rated Cross Section)	#30...14 AWG	0.5...2.5 mm ²	#22...16 AWG
Wire Strip Length	0.24 in. (6 mm)		0.35 in. (9 mm)
Recommended Tightening Torque	4.2...4.6 lb•in (0.47...0.52 N•m)		4.2...4.6 lb•in (0.47...0.52 N•m)
Density	61 pcs/ft (200/m)		61 pcs/ft (200/m)
Housing Temperature Range	-40...+195 °F (-40...+90 °C)		-40...+195 °F (-40...+90 °C)

	1492-WMG3	1492-WMG4
Dimensions are not intended to be used for manufacturing purposes. Note: Height dimension is measured from top of rail to top of terminal block.		
	0.84" (21.4 mm)	1.34" (34 mm)
Specifications	Single-circuit mini grounding terminal block.	
Certifications	IEC	IEC
Maximum Current	Grounding	Grounding
Wire Range (Rated Cross Section)	#14 AWG (2.5 mm ²)	#22...12 AWG
Wire Strip Length	0.31 in. (8 mm)	0.39 in. (10 mm)
Recommended Tightening Torque	6.2 lb•in (0.7 N•m)	5.3 lb•in (0.6 N•m)
Density	50 pcs/ft (166 pcs/m)	50 pcs/ft (166 pcs/m)
Housing Temperature Range	—	-40...+195 °F (-40...+90 °C)

	1492-J3	1492-J4	1492-J6
Dimensions are not intended to be used for manufacturing purposes. Note: Height dimension is measured from top of rail to top of terminal block.			
	2.36" (60 mm)	2.36" (60 mm)	2.36" (60 mm)
Specifications	Feed-through terminal block		
Certifications	CSA IEC ATEX	CSA IEC ATEX	CSA IEC ATEX
Voltage Rating	600V AC/DC	600V AC/DC	600V AC/DC
Maximum Current	25 A	35 A	50 A
Wire Range (Rated Cross Section)	#28...12 AWG	#22...10 AWG	#22...8 AWG
Wire Strip Length	0.39 in. (10 mm)		0.47 in. (12 mm)
Recommended Tightening Torque	4.5...7.1 lb•in (0.5...0.8 N•m)		14.2 lb•in (1.6 N•m)
Density	59 pcs/ft (196 pcs/m)		37 pcs/ft (123 pcs/m)
Housing Temperature Range	-58...+248 °F (-50...+120 °C)		-58...+248 °F (-50...+120 °C)

Bulletin 1492
Screw Connection Terminal Blocks
Isolation Blocks

700-0011
ISOLATION BLOCK, JKD4
ALLEN BRADLEY 1492-JKD4
JM 1/22/15

	1492-JKD3			1492-JKD3TP			1492-JKD4		
Dimensions are not intended to be used for manufacturing purposes. Note: Height dimension is measured from top of rail to top of terminal block.									
Specifications	<i>Knife Disconnect Feed-Through Terminal Block</i>			<i>Knife Disconnect Feed-Through Terminal Block with test plug socket</i>			<i>Single level feed-through terminal block with knife disconnect</i>		
Certifications		CSA	IEC		CSA	IEC		CSA	IEC
Voltage Rating	300V AC/DC		500V AC/DC	300V AC/DC		500V AC/DC	600V AC/DC	300V AC/DC	400V AC/DC
Maximum Current	10 A		24 A	10 A		24 A	22 A	10 A	32 A
Wire Range (Rated Cross Section)	#22...12 AWG		2.5 mm ²	#22...12 AWG		2.5 mm ²	#22...10 AWG		0.05...4.0 mm ²
Fuse Size (Dummy Fuse Supplied)	—			—			1/4 in. x 1-1/4 in.		
Wire Strip Length	0.39 in. (10 mm)			0.39 in. (10 mm)			0.512 in. (13 mm)		
Recommended Tightening Torque	7.1 lb•in. (0.8 N•m)			7.1 lb•in. (0.8 N•m)			9.0 lb•in. (1.0 N•m)		
Density	49 pcs/ft (163 pcs/m)			49 pcs/ft (163 pcs/m)			49 pcs/ft (163 pcs/m)		
Housing Temperature Range	-58...+248 °F (-50...+120 °C)			-58...+248 °F (-50...+120 °C)			-58...+248 °F (-50...+120 °C)		
Short-Circuit Current Rating	See page 12-43								
Terminal Blocks		Cat. No.	Pkg Qty.		Cat. No.	Pkg Qty.		Cat. No.	Pkg Qty.
Color:	Grey	1492-JKD3	50	1492-JKD3TP	50	1492-JKD4	50	1492-JKD4TP	50
with Test Points	Grey	—	—	—	—	—	—	—	—
Accessories		Cat. No.	Pkg Qty.		Cat. No.	Pkg Qty.		Cat. No.	Pkg Qty.
Mounting Rails:									
1 m Symmetrical DIN (Steel)		199-DR1	10	199-DR1	10	199-DR1	10	199-DR1	10
1 m Symmetrical DIN (Aluminum)		1492-DR5	10	1492-DR5	10	1492-DR5	10	1492-DR5	10
1 m Hi-Rise Sym. DIN (Aluminum)		1492-DR6	2	1492-DR6	2	1492-DR6	2	1492-DR6	2
1 m Angled Hi-Rise Sym. DIN (Steel)		1492-DR7	2	1492-DR7	2	1492-DR7	2	1492-DR7	2
End Barriers	Grey	1492-EBJ3	50	1492-EBJ3	50	1492-EBJ3	50	1492-EBJ3	50
	Yellow	—	—	—	—	1492-EBJ3-Y	50	1492-EBJ3-Y	50
End Anchors:									
Screwless End Retainer		1492-ERL35	20	1492-ERL35	20	1492-ERL35	20	1492-ERL35	20
DIN Rail — Normal Duty		1492-EAJ35	100	1492-EAJ35	100	1492-EAJ35	100	1492-EAJ35	100
DIN Rail — Heavy Duty		1492-EAHJ35	50	1492-EAHJ35	50	1492-EAHJ35	50	1492-EAHJ35	50
Jumpers:									
Plug-in Center Jumper — 50-Pole		1492-CJLJ5-50	10	1492-CJLJ5-50	10	—	—	—	—
Plug-in Center Jumper — 41-Pole		—	—	—	—	1492-CJLJ6-41	10	1492-CJLJ6-41	10
Plug-in Center Jumper — 10-Pole		1492-CJLJ5-10	20	1492-CJLJ5-10	20	1492-CJLJ6-10	20	1492-CJLJ6-10	20
Plug-in Center Jumper — 9-Pole		1492-CJLJ5-9	20	1492-CJLJ5-9	20	—	—	—	—
Plug-in Center Jumper — 8-Pole		1492-CJLJ5-8	20	1492-CJLJ5-8	20	—	—	—	—
Plug-in Center Jumper — 7-Pole		1492-CJLJ5-7	20	1492-CJLJ5-7	20	—	—	—	—
Plug-in Center Jumper — 6-Pole		1492-CJLJ5-6	20	1492-CJLJ5-6	20	—	—	—	—
Plug-in Center Jumper — 5-Pole		1492-CJLJ5-5	20	1492-CJLJ5-5	20	—	—	—	—
Plug-in Center Jumper — 4-Pole		1492-CJLJ5-4	60	1492-CJLJ5-4	60	1492-CJLJ6-4	60	1492-CJLJ6-4	60
Plug-in Center Jumper — 3-Pole		1492-CJLJ5-3	60	1492-CJLJ5-3	60	1492-CJLJ6-3	60	1492-CJLJ6-3	60
Plug-in Center Jumper — 2-Pole		1492-CJLJ5-2	60	1492-CJLJ5-2	60	1492-CJLJ6-2	60	1492-CJLJ6-2	60
Insulated Side Jumper — 24-Pole		1492-SJ5B-24	50	1492-SJ5B-24	50	—	—	—	—
Insulated Side Jumper — 10-Pole		1492-SJ5B-10	50	1492-SJ5B-10	50	—	—	—	—
Uninsulated Side Jumper — 10-Pole		—	—	—	—	1492-N49	10	1492-N49	10
Side Jumper — Insulating Sleeve		—	—	—	—	1492-SJS	10	1492-SJS	10
Screw Type Jumper Notching Tool		1492-T1	1	1492-T1	1	—	—	—	—
Other Accessories:									
Partition Plate		1492-EBJ16	20	1492-EBJ16	20	—	—	—	—
Test Plug		—	—	1492-TP23	20	—	—	—	—
Group Marking Carrier		1492-GM35	25	1492-GM35	25	1492-GM35	25	1492-GM35	25
Marking Systems:									
Snap-in marker cards		1492-M5X12 (144/card)	5	1492-M5X12 (144/card)	5	1492-MS8X12 (56/card)	5	1492-MS8X12 (56/card)	5
Snap-in marker cards		1492-M5X5 (200/card)	5	1492-M5X5 (200/card)	5	1492-MS8X9 (56/card)	5	1492-MS8X9 (56/card)	5
Adhesive Labels		—	—	—	—	1492-ALHFB (50/sheet)	1	1492-ALHFB (50/sheet)	1

12



Vishay Model 534-1-1-103, 10Kohm, 10 Turn
Potentiometer
VDI #: 743-0004

Model 533, **534**, 535

Vishay Spectrol

7/8" (22.2 mm) Multiturn Wirewound
533: 3 Turns/534: 10 Turns/535: 5 Turns



FEATURES

- Bushing and servo mount designs available
- Special resistance tolerances to 1 %
- Rear shaft extensions and support bearing
- Metric shaft available
- Dual gang configuration and concentric shafts
- High torque, center tap, slipping clutch on request
- Special markings and front shaft extensions



RoHS
COMPLIANT

Note

- The color of this product may either be black (US market) or blue (other regions)

ELECTRICAL SPECIFICATIONS			
PARAMETER	MODEL 533	MODEL 534	MODEL 535
Resistance Range - Standard Values	50 Ω to 20 kΩ	100 Ω to 100 kΩ	50 Ω to 50 kΩ
Capability Range	5 Ω to 60 kΩ	10 Ω to 200 kΩ	5 Ω to 100 kΩ
Standard Tolerance	± 5 %	± 5 %	± 5 %
Linearity (Independent)	± 0.25 %	± 0.25 %	± 0.25 %
Noise	100 Ω ENR	100 Ω ENR	100 Ω ENR
Rotation (Electrical and Mechanical)	1080° +10° -0°	3600° +10° -0°	1800° +10° -0°
Power Rating (at 70 °C)	1.0 W	2.0 W	1.5 W
Insulation Resistance	1000 MΩ minimum 500 V _{DC}		
Dielectric Strength	1000 V _{RMS} minimum 60 Hz		
Absolute Minimum Resistance	Not to exceed linearity x total resistance or 1 Ω, whichever is greater		
Temperature Coefficient	20 ppm/°C (standard values, wire only)		
End Voltage	0.25 % of total applied voltage, maximum		
Phasing	CCW end points - section 2 phased to section 1 within ± 2°		
Taps	Center tap only		

MARKING	
Unit Identification	Manufacturer's name and model number, resistance value and tolerance, linearity specification date code and terminal identification

RESISTANCE VALUES	
Ohms 533:	50R, 100R, 200R, 500R, 1K, 2K, 5K, 10K, 20K
534:	100R, 200R, 500R, 1K, 2K, 5K, 10K , 20K, 50K, 100K
535:	50R, 100R, 200R, 500R, 1K, 2K, 5K, 10K, 20K, 50K

ORDERING INFORMATION/DESCRIPTION								
The Models 533 (3 turns), 534 (10 turns) and 535 (5 turns) can be ordered by stating								
534	B	2	10K	20K	5 %	C	BO10	e4
MODEL	MOUNTING	NUMBER OF SECTIONS	OHMIC VALUE SECTION N° 1	OHMIC VALUE SECTION N° 2	TOLERANCE ON OHMIC VALUE	LINEARITY	PACKAGING	LEAD FINISH
	B: Bushing S: Servo					± 0.25 %	Box of 10 pieces	

SAP PART NUMBERING GUIDELINES							
534	B	2	103	203	J	C	B10
MODEL	STYLE	NUMBER OF SECTIONS	OHMIC VALUE SECTION N° 1	OHMIC VALUE SECTION N° 2	TOLERANCE ON OHMIC VALUE	LINEARITY	PACKAGING
	B: Bushing S: Servo		103 = 10K	203 = 20K	J: ± 5 % F: ± 1 %	C: ± 0.25 % D: ± 0.10 %	Box of 10 pieces

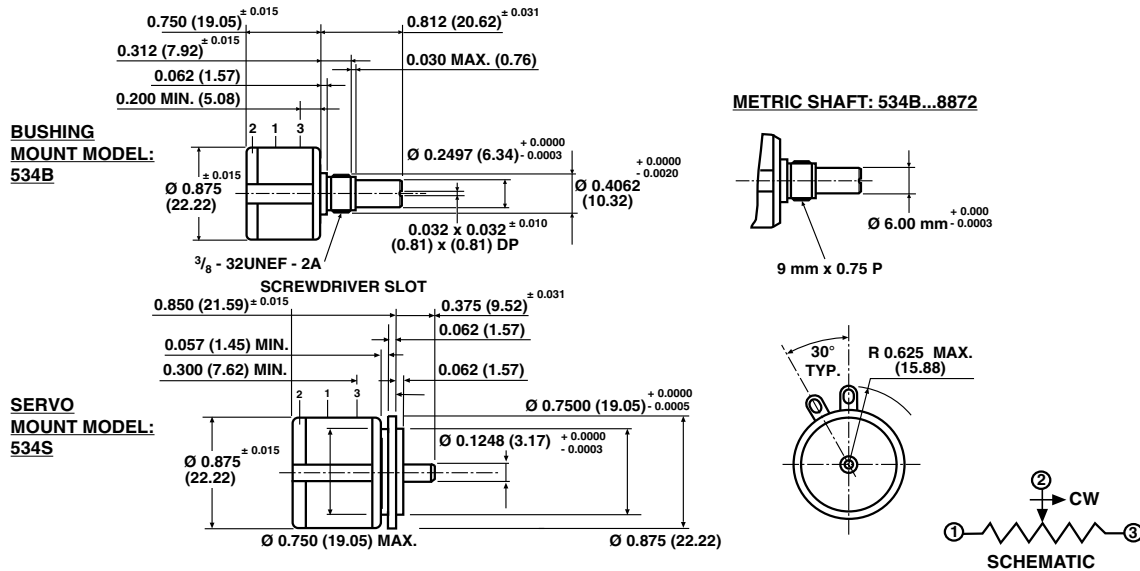
Model 533, 534, 535

Vishay Spectrol

7/8" (22.2 mm) Multiturn Wirewound
 533: 3 Turns / **534: 10 Turns** / 535: 5 Turns



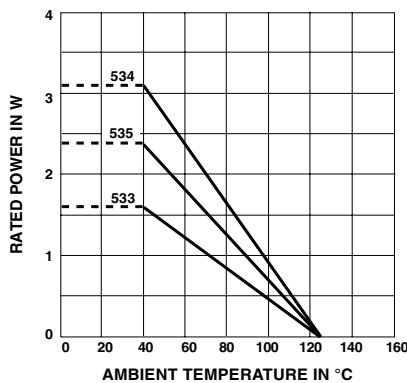
SINGLE SECTION DIMENSIONS in inches (millimeters)



Mounting hardware, washer and panel nut, nickel plated

MECHANICAL SPECIFICATIONS		
PARAMETER		
Bearing Type	Bushing: Sleeve bearing	Servo: Ball bearing
Torque (Maximums): Starting	534	533/535
Section 1	0.5 oz. - in (36 g - cm)	0.7 oz. - in (50 g - cm)
Section 2	0.9 oz. - in (65 g - cm)	1.1 oz. - in (79 g - cm)
Torque (Maximums): Running	534	533/535
Section 1	0.4 oz. - in (28.80 g - cm)	0.6 oz. - in (43.20 g - cm)
Section 2	0.7 oz. - in (50.40 g - cm)	0.9 oz. - in (64.8 g - cm)
Weight (Maximums)		
Section 1	0.75 oz. (21.26 g)	
Section 2	1.25 oz. (35.44 g)	
Stop Strength	75 oz. - in (static) (5.4 kg - cm)	
Ganging	2 sections maximum	

POWER RATING CHART



ENVIRONMENTAL SPECIFICATIONS	
Vibration	15 g thru 2000 Hz
Shock	50 g
Rotational Life (Shaft Revolution)	
533	300 000
534	1 000 000
534 (Servo)	> 1 000 000
535	500 000
Load Life	900 h
Temperature Range	- 55 °C to + 125 °C



Model 533, 534, 535

$\frac{7}{8}$ " (22.2 mm) Multiturn Wirewound
533: 3 Turns/534: 10 Turns/535: 5 Turns

Vishay Spectrol

RESISTANCE ELEMENT DATA														
RESISTANCE VALUE (Ω)			RESOLUTION %			OHMS PER TURN			MAXIMUM CURRENT AT 70 °C AMBIENT (mA)			MAXIMUM VOLTAGE ACROSS COIL (V)		
533	534	535	533	534	535	533	534	535	533	534	535	533	534	535
50	-	50	0.149	-	0.120	0.0746	-	0.0603	141.0	-	173.0	7.07	-	8.66
100	100	100	0.111	0.060	0.075	0.1114	0.0603	0.0746	100.0	141.0	122.0	10.0	14.1	12.2
200	200	200	0.097	0.037	0.061	0.1954	0.0746	0.1220	70.7	100.0	86.6	14.1	20.0	17.3
500	500	500	0.069	0.031	0.049	0.3424	0.1520	0.2459	44.7	63.2	54.7	22.4	31.6	27.4
1K	1K	1K	0.063	0.025	0.041	0.6331	0.2459	0.4113	31.6	44.7	38.7	31.6	44.7	38.7
2K	2K	2K	0.041	0.021	0.031	0.8206	0.4113	0.6331	22.4	31.6	27.4	44.7	63.2	54.8
5K	5K	5K	0.044	0.016	0.034	2.2330	0.8206	1.7230	14.1	20.0	17.3	70.7	100.0	86.6
10K	10K	10K	0.034	0.017	0.030	3.4510	1.7230	3.0160	10.0	14.1	12.2	100.0	141.0	122.0
20K	20K	20K	0.031	0.015	0.020	6.1790	3.0160	3.9910	7.07	10.0	8.66	141.0	200.0	173.0
-	50K	50K	-	0.009	0.015	-	4.6690	7.4560	-	6.32	5.47	-	316.0	274.0
-	100K	-	-	0.007	-	-	7.4560	-	-	4.47	-	-	447.0	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

711-0500
Plug, 3 Prong
3-Prong, NEMA 5-15P

LEVITON

About Products Library ez-Tools Distribution OEM Retail International What's New

- Electrical
- Network Solutions
- Lighting Controls
- Entertainment
- Home Automation
- Connected Home
- Energy Management
- Power Quality



515PV

Description

15 Amp, 125 Volt, NEMA 5-15P, 2P, 3W, Plug, Straight Blade, Commercial Gra Yellow

Additional Product Information

- [Dimensional Drawing](#)
- [Wiring Diagram](#)

Product Features

Grounding: Grounding
 Amperage: 15 Amp
 Voltage: 125 Volt
 NEMA: 5-15P
 Pole: 2
 Wire: 3
 Cord Range: .245 - .655
 Wire Gauge: 18-12 AWG
 Blades/Contacts: Brass
 Body Material: PVC
 Assembly Screws: Steel, Zinc Plated
 Color: Yellow
 Standards and Certifications: UL/CSA
 Warranty: 10-Year Limited

Color: Yellow



NEMA: 5-15P

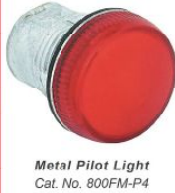


Features and Benefits

- Triple-drive heady screws - Standard, Phillips, Robertson
- NEMA configuration number & rating molded on face of device for easy
- Deep-slotted, backed out terminal screws draw backwire clamps secure conductivity
- Husk & module keyed for easy alignment during wiring
- Built-in cord grip adjusts automatically for use with No. 18-3 through No
- Rugged PVC body resists moisture and chemicals; suited for outdoor co
- Unique dimpled body design provides a secure grip
- Speed-thread assembly screws tighten with just a few quick turns
- Backed by a Limited 10-Year Warranty

Bulletin 800F 22.5 Mm Push Buttons

Pilot Light Operators



- 740-0006
PILOT LIGHT LENS, RED, 800F
ALLEN BRADLEY 800FP-P4
JM 8/17/15
- 740-0004
PILOT LIGHT LENS, AMBER, 800F
ALLEN BRADLEY 800FP-P0
JM 8/17/15
- 740-0007
PILOT LIGHT LENS, CLEAR, 800F
ALLEN BRADLEY 800FP-P7
JM 8/17/15

Color	Pkg. Quantity	Plastic	Metal
		Cat. No.*	Cat. No.*
Green	1	800FP-P3	800FM-P3
Red		800FP-P4	800FM-P4
Yellow		800FP-P5	800FM-P5

800F P – P 3 –

a b c d

a		b		c		d	
Operator Construction		Operator Type		Lens Cap*		Packaging	
Code	Description	Code	Description	Code	Color	Code	Description
P	Round plastic operator (IP66, Type 4/4X/13)	P	Diffuser	0	Amber‡	Blank	1 per package
M	Round metal operator (IP66, Type 4/13)			3	Green	BP	10 per package
				4	Red		
				5	Yellow‡		
				6	Blue‡		
				7	Clear		
				9	No lens		

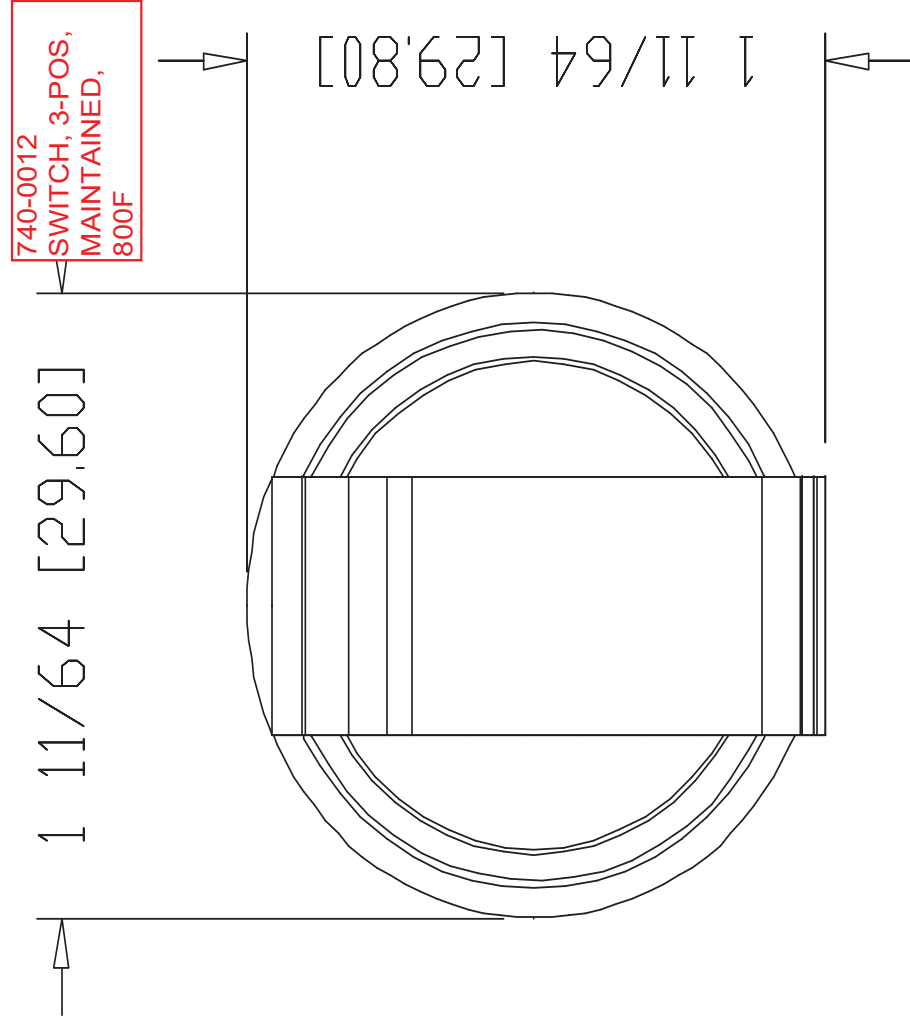
* For custom laser-engraved pilot light, order pilot light with applicable lens cap color plus custom laser-engraved diffuser on Custom Laser-Engraved Caps and Diffusers.
 ‡ When using LED for illumination, a white LED is recommended.

800FP-SM32

SCALE:

1 Inch

[10mm]



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Section 5

Warranty



543 S. Pierce Avenue, Louisville, CO 80027
 (PH) 303-530-3298 ♦ (F) 303-530-3368
www.velodynesystems.com

LIMITED WARRANTY

New Polymer Equipment Limited Warranty

***Warranty Period:** Three (3) years from date of Equipment Start-Up, not to exceed 42 calendar months from date of shipment; Limited.*

VeloDyne warrants each new Polymer System of VeloDyne's manufacture to be free from defects in material and workmanship, under normal use and service for three (3) years following the date of equipment start-up not to exceed 42 consecutive calendar months from the date the equipment is shipped to you. This Limited Warranty shall apply to the system's mixing chamber for life, and otherwise only to complete polymer systems of VeloDyne's manufacture; parts are covered by a separate Limited Warranty.

Equipment and accessories not of VeloDyne's manufacture are warranted only to the extent of the original manufacturer's warranty and subject to their allowance to VeloDyne (only if found to be defective by such manufacturer).

Warranty Terms

During the Limited Warranty period, any defect in material or workmanship in any warranted item of VeloDyne's Polymer System not expressly excluded below shall be repaired or replaced at VeloDyne's option without charge, provided that (a) the equipment and parts are used according to the manufacturer's recommended usage and in an ordinary manner, and (b) you give us prompt written notice within the time period set forth herein that the equipment or parts manufactured by us fail to function properly under normal and proper use.

Should your unit prove defective within the warranty period, you must contact our Service Department for a return authorization (RMA) number to submit with the returned equipment. This RMA must be noted prominently on the outside of your packaging and on any correspondence related to the return. VeloDyne's liability under this warranty is limited to the repair of or replacement in kind or credit, in VeloDyne's sole option and discretion, of any items proved to be defective, provided the allegedly defective goods are returned to VeloDyne's factory located at 543 S. Pierce Avenue, Louisville, CO 80027, by Purchaser transportation prepaid.

All costs and expense related to shipping of any replacement parts or goods shall be VeloDyne's expense, but Purchaser shall pay for all installation costs. The foregoing shall not apply to equipment or parts that shall have been altered or repaired after shipment to you by anyone except VeloDyne's authorized agents and/or service employees. Purchaser is responsible for determining the suitability of VeloDyne's equipment for Purchaser's intended use, and VeloDyne shall in no event be liable in this respect. Any equipment or parts manufactured by others but furnished to you by us will be repaired or replaced only to the extent of the original manufacturer's warranty. Purchaser must provide prompt written notice to VeloDyne of any warranty issues to obtain its benefits.

Should VeloDyne determine that the reason or action giving rise to the defect or operational issue with your warranted Equipment is the result of Owner's actions (or actions of Owner's employees, agents, representatives or affiliates), then this warranty shall not apply to the repair or replacement and VeloDyne will invoice the Owner for the cost of all parts, repairs, service calls and travel expenses incurred in investigating or repairing your defective equipment.

Purchaser's Responsibility

This Limited Warranty requires proper start-up maintenance and registration, and periodic inspections of the Polymer System Equipment as indicated in the Operator & Maintenance Manual furnished with each new system. The cost of routine or required maintenance and service(s) is the responsibility of Purchaser, and Purchaser is required to keep documented evidence that routine or required maintenance services were performed.

Warranty Exclusions and Limitations

The warranties contained herein SHALL NOT APPLY TO:

- 1: New Polymer System Equipment delivered to the Purchaser in which the warranty registration has not been completed and returned to VeloDyne within thirty (30) days from the date of delivery of the Equipment to Purchaser.
- 2: Any defect which was caused (in VeloDyne's sole judgment) by other than normal use and service of the Polymer System Equipment, or by any of the following:
 - Improper handling, storage, operation, interconnection, installation, alteration or repair by anyone other than VeloDyne or those authorized by VeloDyne.
 - Parts or accessories installed on the Equipment that were not manufactured or installed by VeloDyne authorized representatives.
 - Improper voltage or wiring and/or inconsistent power supply.
 - Use of parts that are not 100% compatible with the Equipment.
 - Improper exposure to the elements.
 - Freezing water or excessive heat.
 - Water damage.
 - Water pressure surges due to owner system.
 - Accidents.
 - Damage after delivery to the Shipping Point.
 - Lack of reasonable and proper maintenance.
 - Misuse or negligence.
 - Natural calamities.
 - Overloading the system.
 - Vandalism.
- 3: Any Polymer System Equipment whose identification numbers or marks have been altered or removed.
- 4: Any Polymer System Equipment which any of the required or recommended periodic inspection or services have been performed using parts not manufactured or supplied by VeloDyne or meeting VeloDyne specifications.
- 5: Any defect which was caused (in VeloDyne's sole judgment) by operation of the Polymer System Equipment not abiding by standard operating procedures outlined in the Operator's Manual.
- 6: Transportation costs, if any, to or from an authorized VeloDyne rep or supplier.
- 7: Travel time of VeloDyne's service personnel to make a repair on the Purchaser's site or other approved location.
- 8: In no event will VeloDyne's liability under this warranty exceed the purchase price of the Polymer System Equipment or component(s).
- 9: VeloDyne will not be responsible to any person, under any circumstances, for any incidental or consequential damages (including but not limited to loss of profits, out of service time, and the like) occurring for any reason at any time.
- 10: Diagnostic and overtime labor premiums are not covered under this Limited Warranty Policy.
- 11: Depreciation damage caused by normal wear, lack of reasonable and proper maintenance, failure to follow operating instructions, misuse, or lack of proper protection during storage.
- 12: Accessory systems or electronic components not of VeloDyne's manufacture are warranted only to the extent of such manufacturer's respective Limited Warranty, if any.
- 13: Tools are not covered under this warranty.
- 14: ***Consumables and Wear Items Not Covered:*** Air Filters, Ball Valves, Bearings, Belts, Optional Accessories, Pressure Relief Valves, Screens, Disconnect Valves, Hoses, Rotors, Stators, Pump

Diaphragms, Pump Seal Kits, and other customary consumables and wear items typically excluded from warranty coverage.

- 15: Stators are not covered under warranty if the pump is not installed properly (e.g., improper suction conditions) or is run dry.

Parts Warranty

Parts replaced during the warranty period will receive the balance of the New Polymer System Equipment Limited Warranty.

Replacement parts after the original Equipment warranty has expired are warranted to be free from defects of material for thirty (30) days or the part will be repaired or replaced (in VeloDyne's sole judgment and option). Removal and reinstallation labor is not covered.

All parts warranty claims must be filed within ten (10) business days of initial part failure or the warranty claim will be void.

Exclusion of Other Warranties

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, OBLIGATIONS AND LIABILITIES OF ANY KIND, EXPRESS OR IMPLIED, EXCEPT AS STATED HEREIN. THERE ARE NO IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR OTHERWISE, WHICH ARE HEREBY EXPRESSLY DISCLAIMED. VELODYNE'S OBLIGATION TO REPAIR OR REPLACE AS SET FORTH ABOVE IS OUR ENTIRE AND EXCLUSIVE LIABILITY AND YOUR EXCLUSIVE REMEDY FOR ANY CLAIM ARISING OUT OF THE GOODS OR SERVICES WE PROVIDE TO YOU, WHETHER SUCH CLAIM IS BASED ON CONTRACT, TORT OR ANY OTHER LEGAL THEORY. IN NO EVENT WILL WE BE LIABLE FOR ANY SPECIAL OR CONSEQUENTIAL DAMAGES. IF CIRCUMSTANCES CAUSE THE LIMITED REMEDY STATED HEREIN TO FAIL OF ITS ESSENTIAL PURPOSES, OUR LIABILITY FOR DAMAGES SHALL NOT EXCEED THE CONTRACT PRICE FOR THE GOODS FOR WHICH LIABILITY IS CLAIMED. ANY ACTION AGAINST US ARISING OUT OF THE GOODS OR SERVICES WE PROVIDE TO YOU SHALL BE BROUGHT WITHIN ONE YEAR OF THE DATE SUCH ACTION ACCRUES. THIS WARRANTY IS SOLELY FOR THE BENEFIT OF PURCHASER AND NO OTHERS.

Control System Submittal

Project Name: Aberdeen, ID

Customer: Huber Technology

Specification: Q-Press - Main Control Panel

Job Number: HBR9328

Project Engineer: Jayden Nguyen

Date: 06-23-2023

Submittal ID: D9328

Revision: 0

SUBMITTAL	D9328
<input type="checkbox"/> APPROVED	<input type="checkbox"/> APPROVED AS NOTED
<input type="checkbox"/> REJECTED	<input type="checkbox"/> REVISE AND RESUBMIT
BY:	_____
DATE:	_____

EleMech INC
2275 White Oak Circle
Aurora, IL 60502
630-499-7080

Table of Contents



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- C - Electrical Drawings
- D - Bill of Materials
- E - Catalog Cuts

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	Date: 06-23-2023		
Section Name: Table of Contents	By: JN	Job Number: HBR9328	Page # 1/1

Submittal Comments

B



Rev: 0

Date: 06-23-2023

By: JN

Section:

B

Job Number: HBR9328

Page # 1/1

Section Name: Submittal Comments

Project Name: Aberdeen, ID
Project Number: HBR9328
Customer Project: 73010205
Panel Type: Q-Press Control Panel

The control system submittal is provided for your review and approval. It represents a comprehensive response to the provided specifications and materials for the named project. Approval of these documents is requested prior to manufacturing.

The items listed below are specific requests for information or deviations for the project.

1. VFD driven motors are required in the design. If the cable length is expected to exceed 275 feet, additional filtering may need to be provided by the contractor.
2. Plan EI-016 illustrates a conveyor zero speed switch and E-stop pull cord, which are provided by the contractor. Advise if these devices need to be wired to the Screw Press control panel. If so, provide the datasheet for the zero-speed controller being provided.
3. Specification 467627- 2.10.H.24.f.2.c indicates that the Screw Press control panel is expected to monitor a hardwired 4-20 mA Sludge holding tank level signal. The current design includes monitoring of the Sludge holding tank level, but does not account for providing power to the Sludge holding tank sensor. If the Screw Press control panel is required to provide power to the Sludge holding tank sensor, please provide the datasheet.

Electrical Drawings



Rev: 0

Date: 06-23-2023

By: JN

Section:

C

Job Number: HBR9328

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Section Name: Electrical Drawings

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ABERDEEN, ID	
HBR9328	
SPECIFICATION	SECTION 46 76 27 SLUDGE DEWATERING SCREW PRESS
REFERENCE	73010205

TABLE OF CONTENTS	
DESCRIPTION	DRAWING SHEET NO.
COVER PAGE	HBR9328A01
CONTROL PANEL SPECIFICATION	HBR9328A02
ELECTRICAL SCHEMATICS	HBR9328A03
FIELD WIRING DIAGRAM	HBR9328A11
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DESIGNED	JN
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TECHNOLOGY
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Denver, NC 28037
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Q - PRESS CONTROL PANEL	
ABERDEEN, ID	SCALE: NONE
PROJECT NUMBER: 73010205	DRAWING NO: HBR9328A01
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Control Panel Enclosure

Rating:	NEMA TYPE 4X
Material:	304 SS
Disconnect Type:	Door Interlock - Non-Fused
<input checked="" type="checkbox"/> Drip Shield	<input type="checkbox"/>
Installation Conditions:	<input checked="" type="checkbox"/> Indoor - Unconditioned <input type="checkbox"/> Indoor - Conditioned <input type="checkbox"/> Outdoor - Direct Sunlight <input type="checkbox"/> Outdoor - Shaded
Environment Max Temperature Rating (°F):	125
Internal Device Max Temperature Rating (°F):	122
Climate Control Type:	Air Conditioner with Heater

Panel Construction

Certification:	UL698A
Listing Serial Number:	TBD
Options:	<input checked="" type="checkbox"/> Phase Failure Relay <input checked="" type="checkbox"/> UPS <input checked="" type="checkbox"/> Alarm Beacon/Horn <input checked="" type="checkbox"/> Redundant Power Supply
Nameplates and Legendplates:	
Material Type:	Thermal Printed
Attachment Type:	Adhesive
Colors:	Background: White Text: Black
Wire/ Cable Type:	<p>Wiring to be 14 AWG unless otherwise specified. 16 AWG minimum. Wire shall be MTW type, tinned copper, 600VAC, 105°C, UL1015/CSA.</p> <p>Analog signal wiring shall be 18 AWG shielded twisted pair rated 300V.</p> <p>Ethernet cables shall be 24AWG rated 600V. Cat5E.</p> <p>Fiber cables shall be SC-Duplex, 50µm multimode.</p>
Wire Color:	Black - Power Black - 120VAC Hot White - 120VAC Neutral Red - 120VAC Control Yellow - Foreign Voltage Green - Ground Blue - DC Positive White/Blue - DC Negative
Wire Labels:	<input checked="" type="checkbox"/> Adhesive, Self-laminating <input type="checkbox"/> Heat Shrink
	Note: Colors based on UL508A requirements.

Local Enclosure

Tag:	Pneumatic Panel	Rating:	NEMA 4X	Material:	Fiberglass
------	-----------------	---------	---------	-----------	------------

Power and Motor

Power Feed:	
Circuit 1 :	480 VAC 9.0 FLA SCCR 5 KAIC @ 480 VAC
Motor Data:	
Motor 1 :	460 VAC 5.4A FLA 4.02 HP Controller: VFD
Motor 2 :	460 VAC 0.46A FLA 0.12 HP Controller: FVR

Networking

Communication Type:	Ethernet/ IP				
Subnet:	255.255.255.0	Gateway:	0.0.0.0		
IP Address:					
PLC1:	To Be Determined				
OIU1:	To Be Determined				
VFD1:	To Be Determined				
Programming:					
PLC1:	CompactLogix 5069-L306ER	Software:	Studio 5000	Version:	Latest
OIU:	PanelView Plus 12"	Software:	FactoryTalk View ME	Version:	Latest
Notes:	1. PLC shall be programmed with ladder type only. 2. HMI shall be developed using EleMech's standard Global Object Library.				

Instrumentation

Tag:	N/A	Cable Length:	N/A
Rating:	<input type="checkbox"/> Non-Hazardous <input type="checkbox"/> Intrinsically Safe Class 1 Division 1,2 <input type="checkbox"/> Class 1, Division 2 <input type="checkbox"/> Class 1 Division 1,2		

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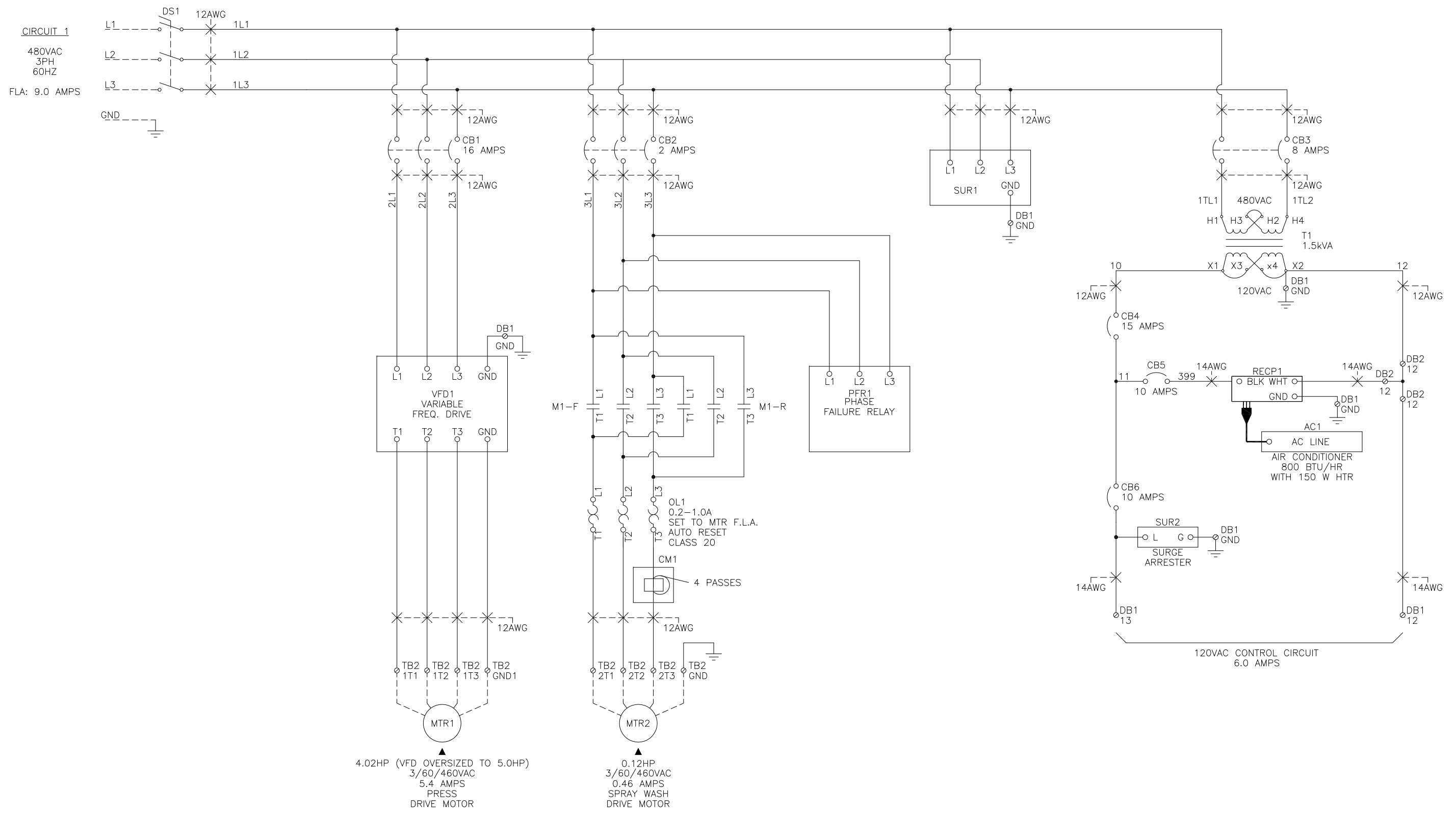
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Q - PRESS CONTROL PANEL

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- NOTES:**
- ▲ DEVICES LOCATED OUTSIDE CONTROL PANEL.
 - ⊙ TERMINAL BLOCK (TB) OR DISTRIBUTION BLOCK (DB) LOCATED IN CONTROL PANEL.
 - - - FIELD WIRING.
 - ELEMECH RESERVES THE RIGHT TO CHANGE, AS NECESSARY, THE SPACING, ORIENTATION, AND PHYSICAL LOCATION OF DEVICES IN ORDER TO OPTIMIZE THE DESIGN.
 - LOCAL MOTOR DISCONNECT SWITCHES SHALL BE PROVIDED BY OTHERS IF REQUIRED BY LOCAL REGULATIONS.
 - JUNCTION BOXES ARE NOT SHOWN AND SHALL BE PROVIDED BY OTHERS AS NECESSARY.

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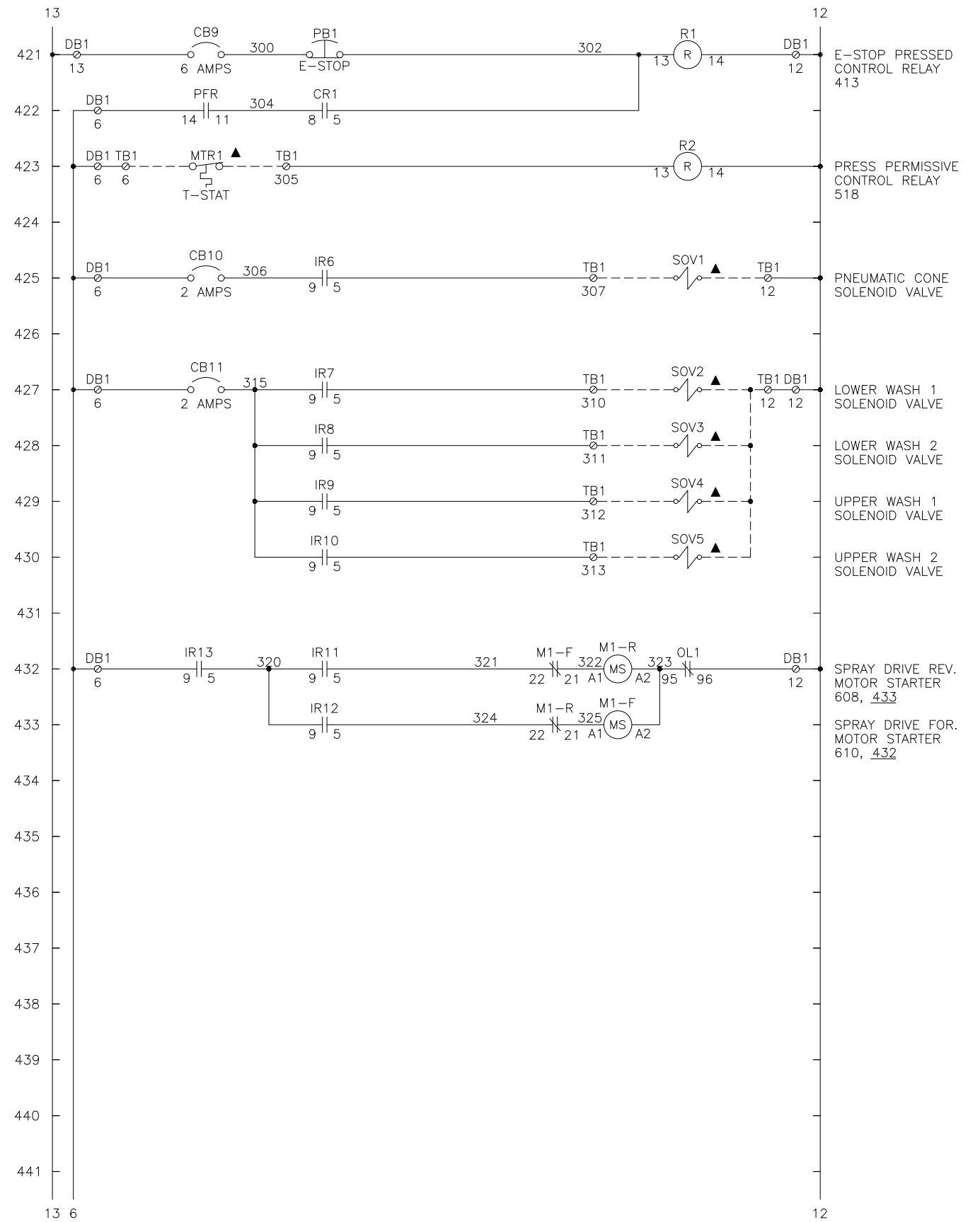
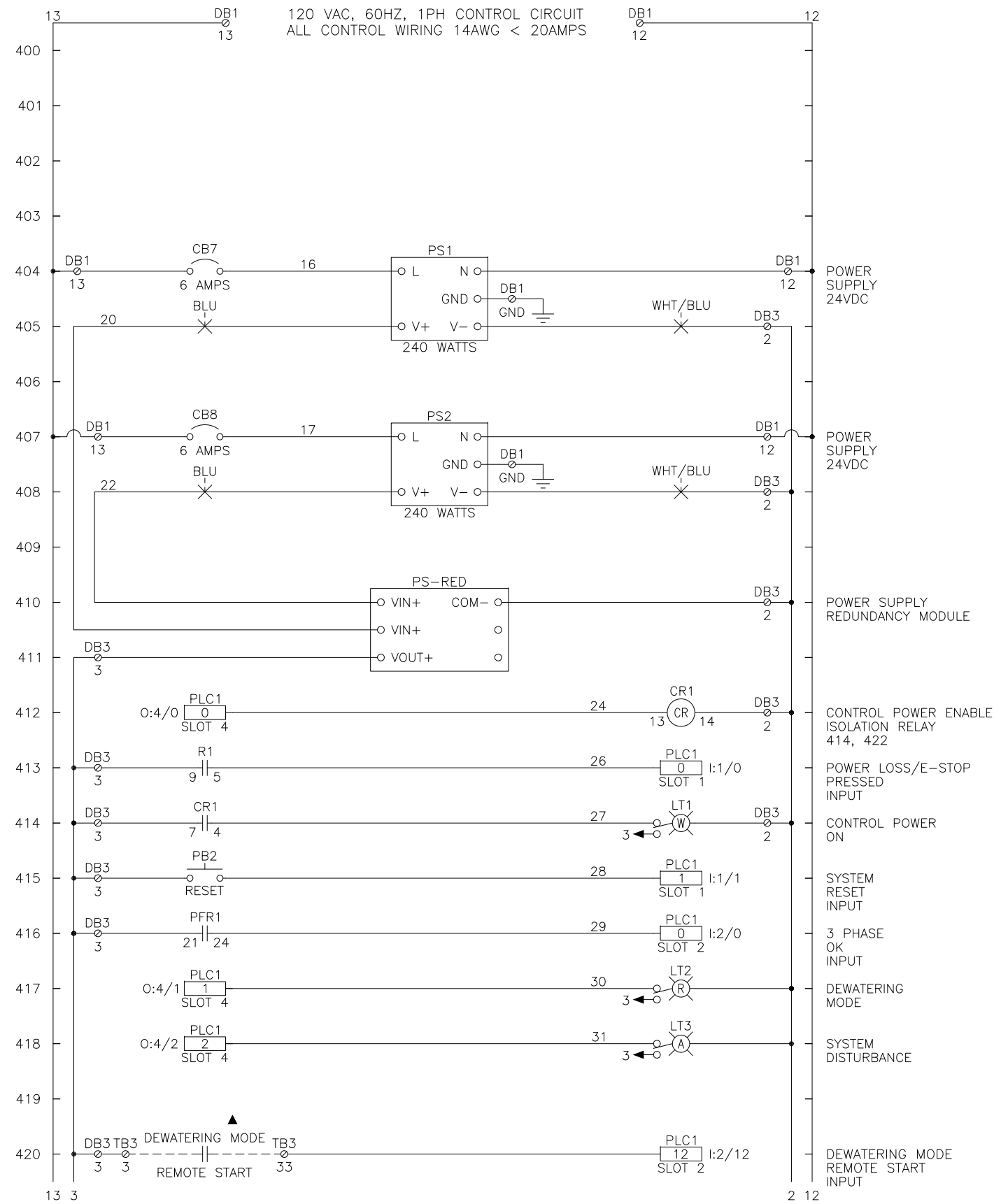
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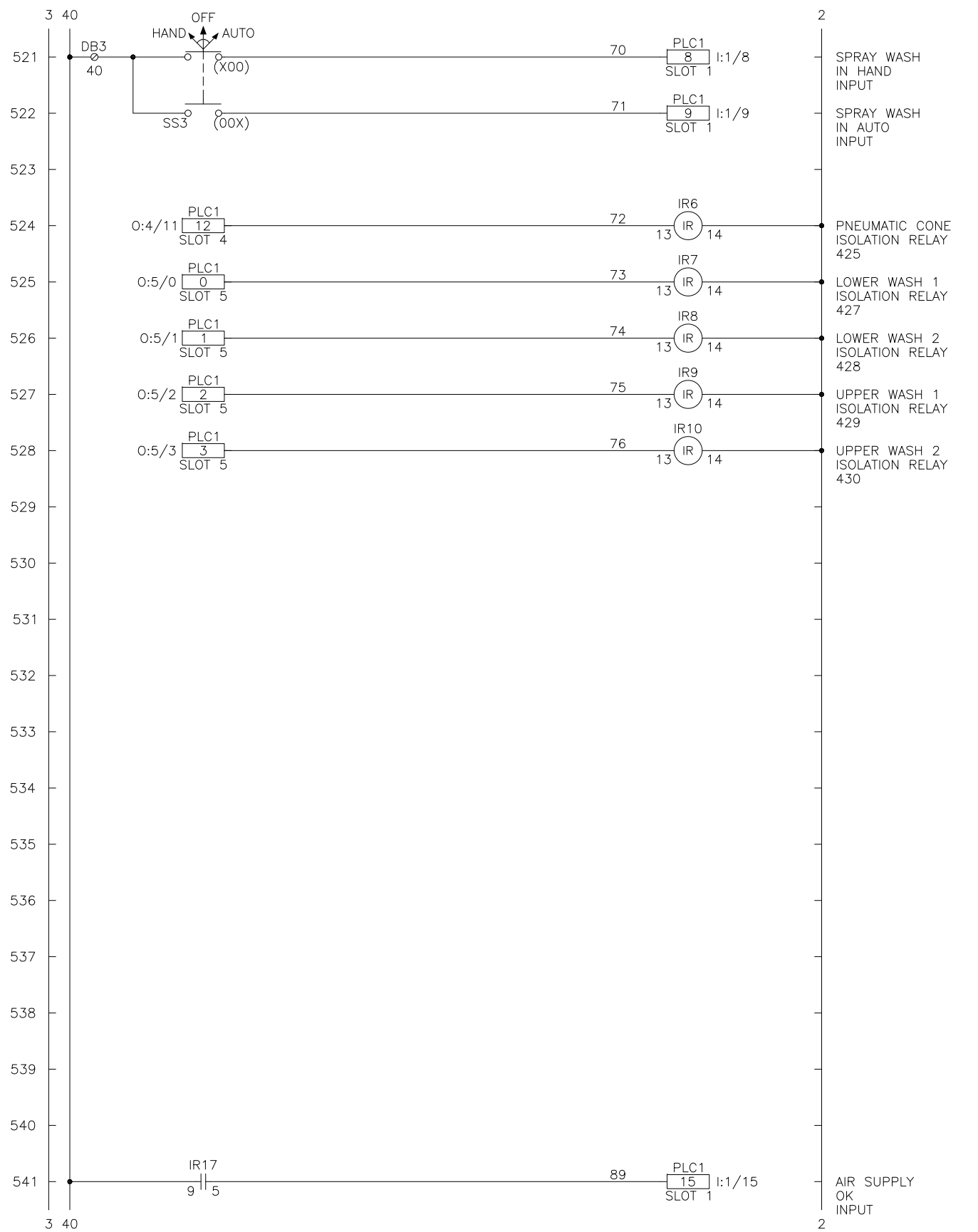
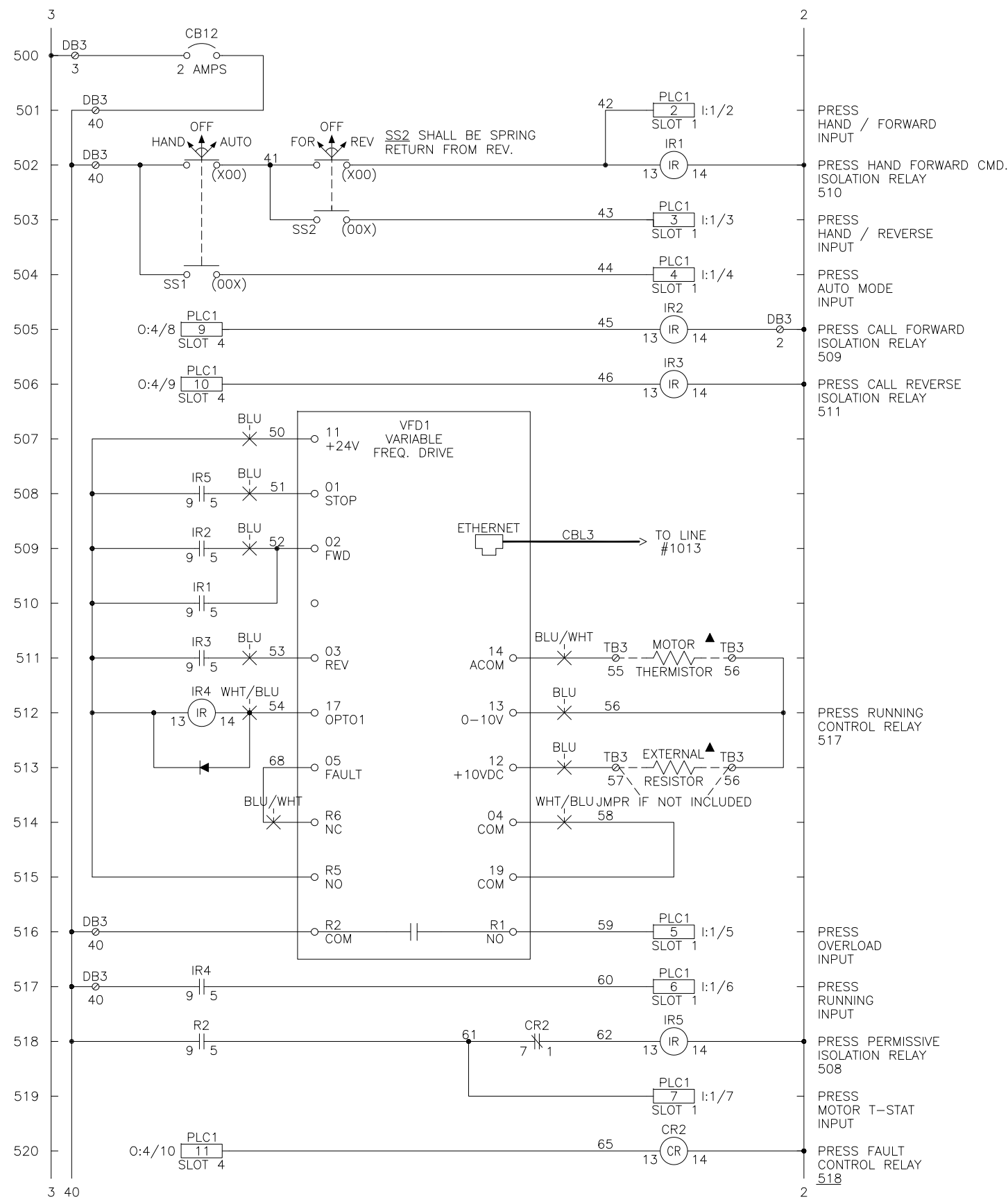


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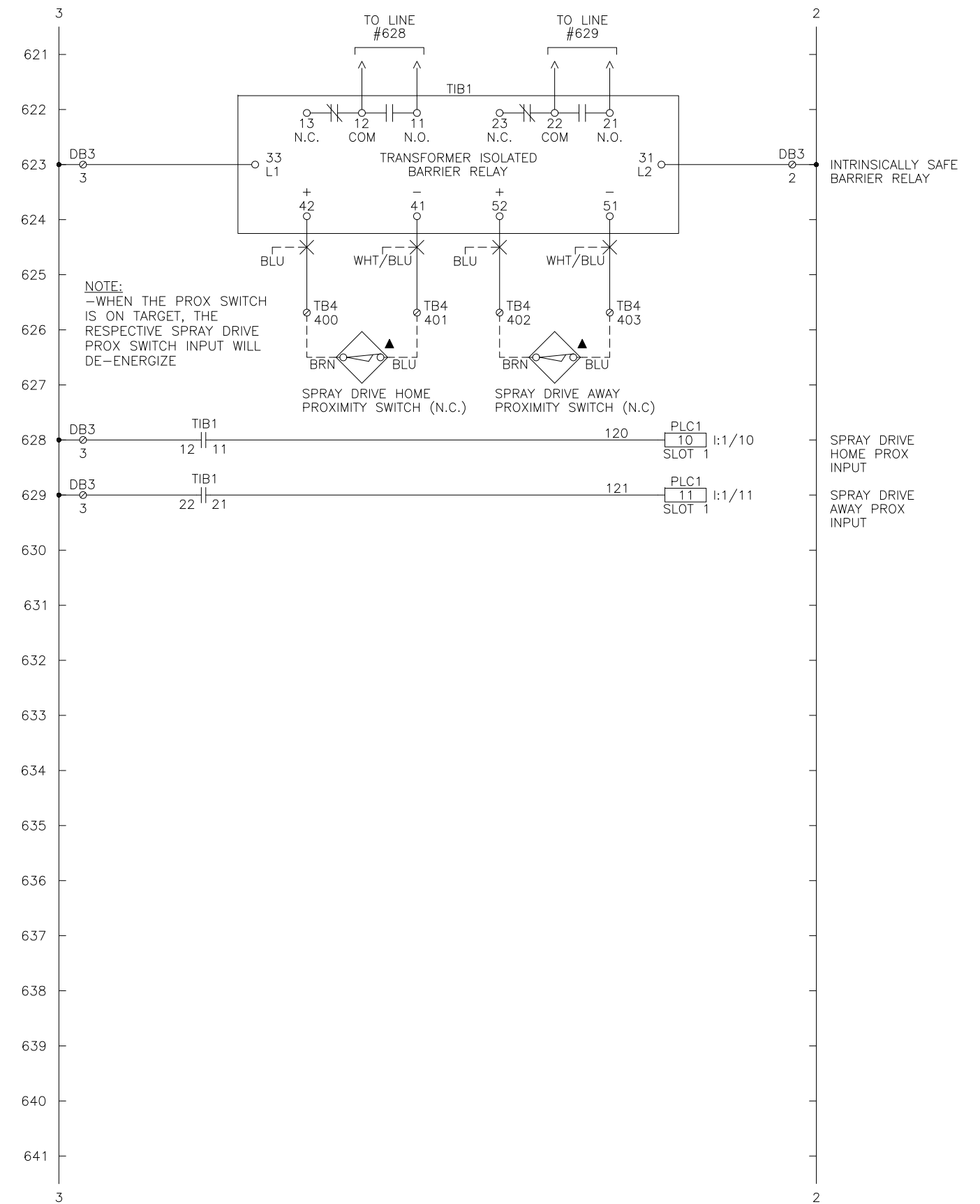
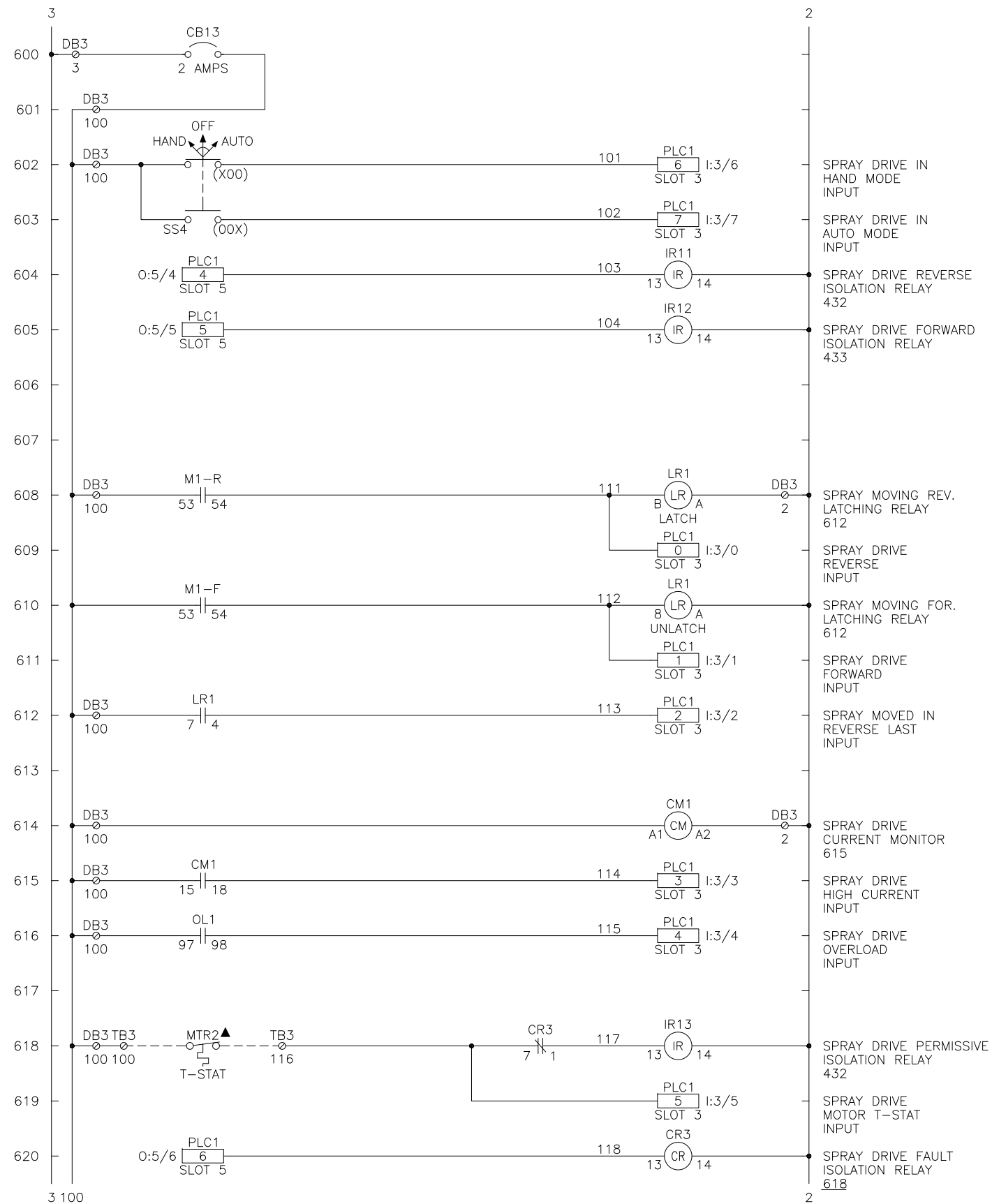
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NOTE:
 -WHEN THE PROX SWITCH IS ON TARGET, THE RESPECTIVE SPRAY DRIVE PROX SWITCH INPUT WILL DE-ENERGIZE

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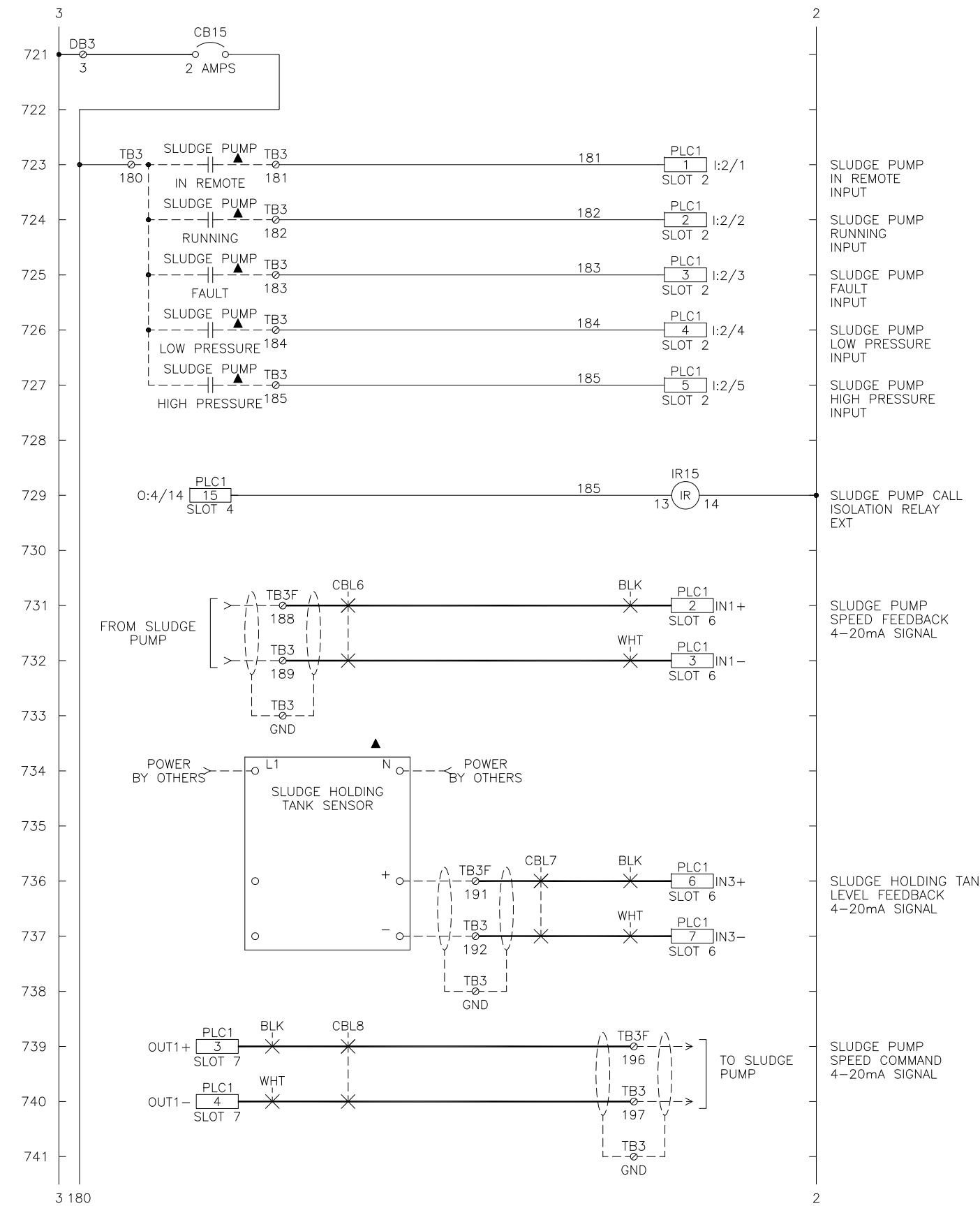
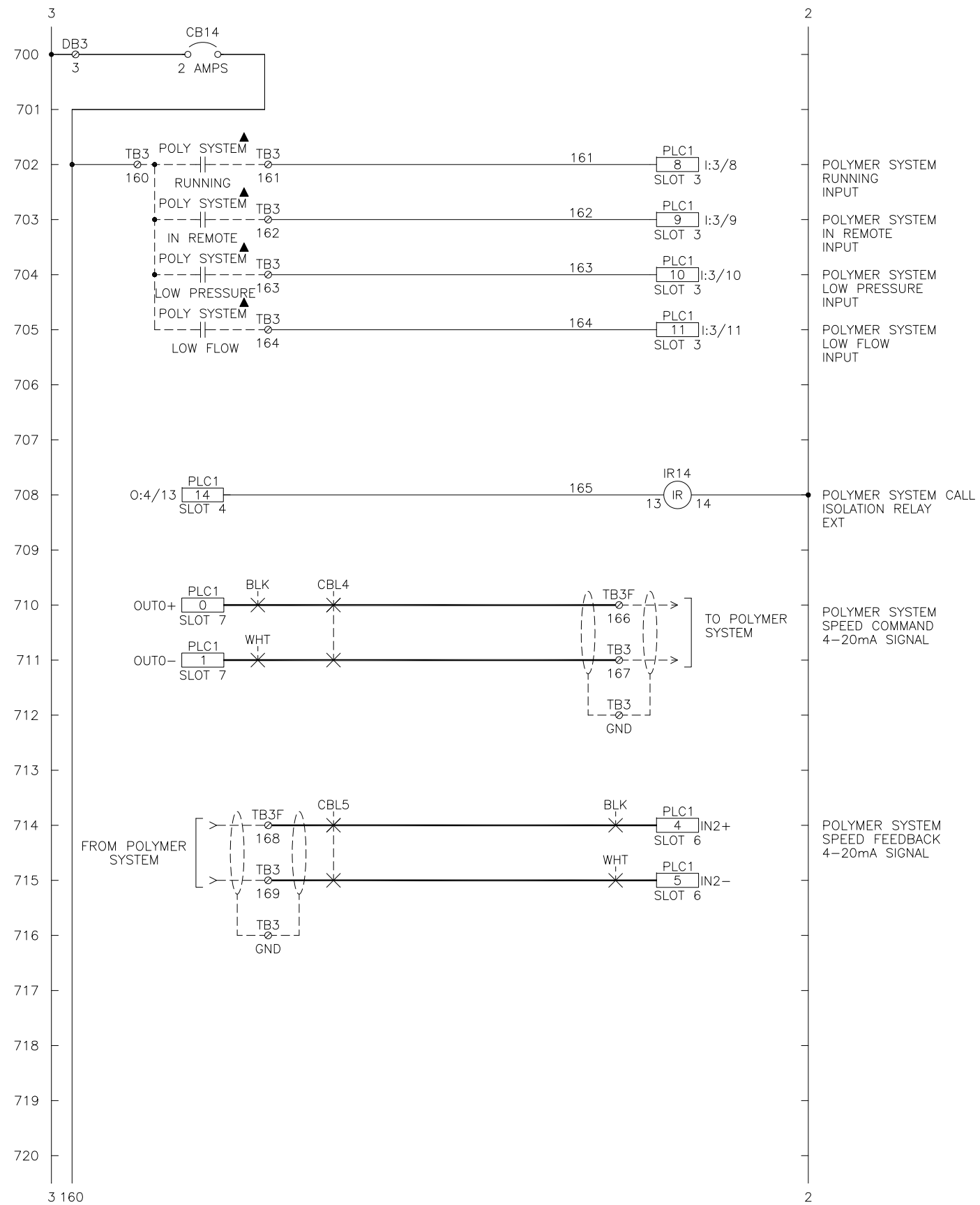
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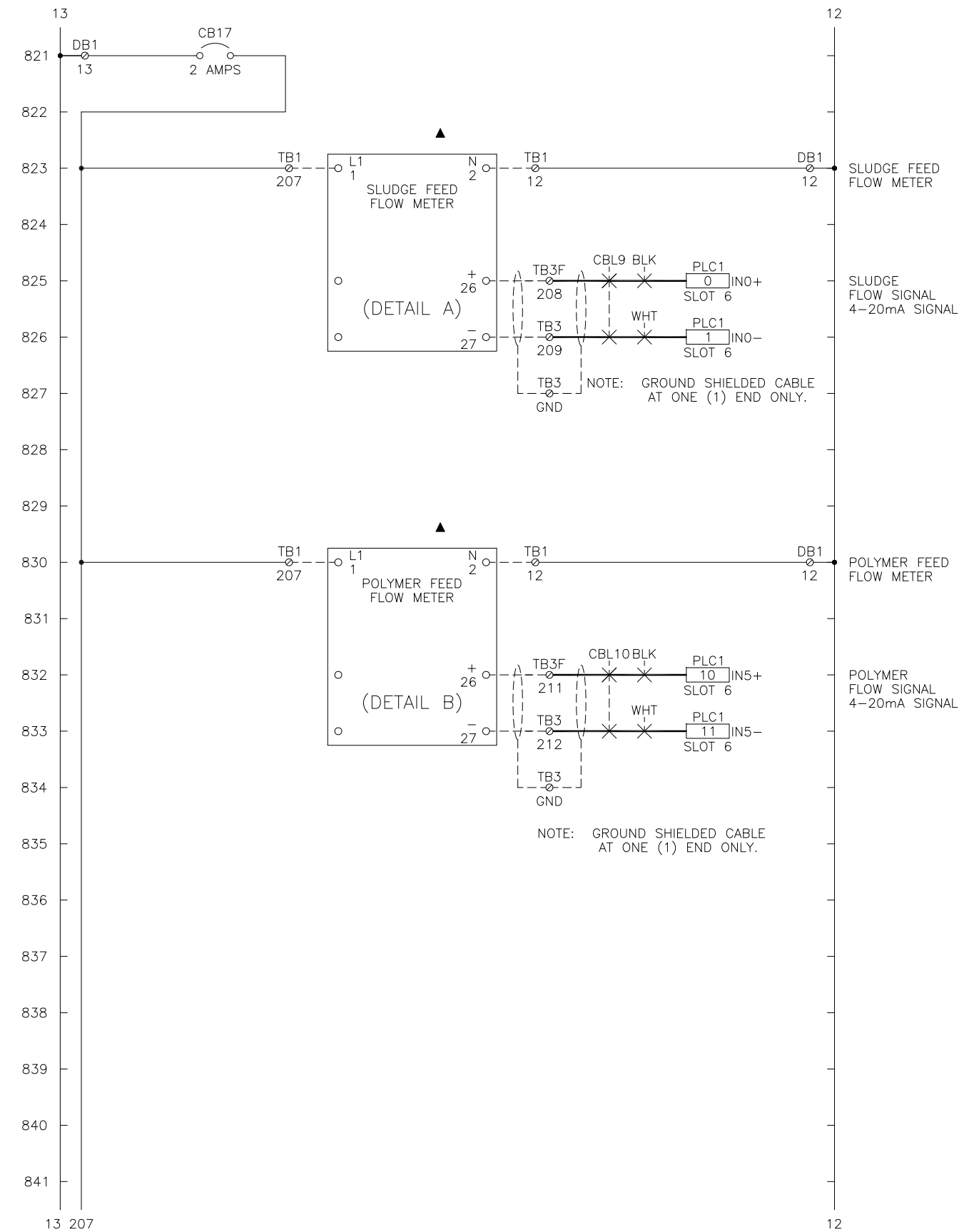
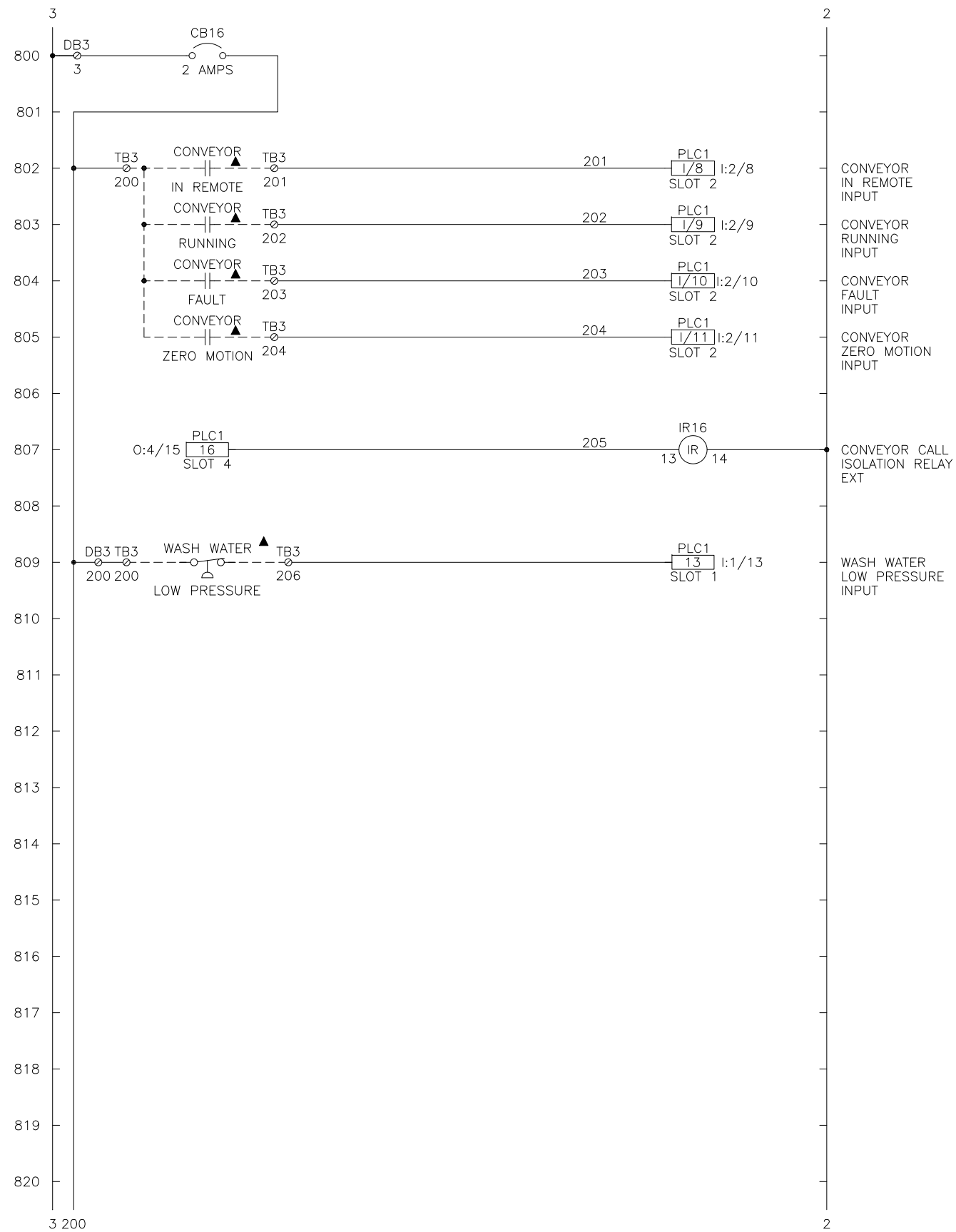
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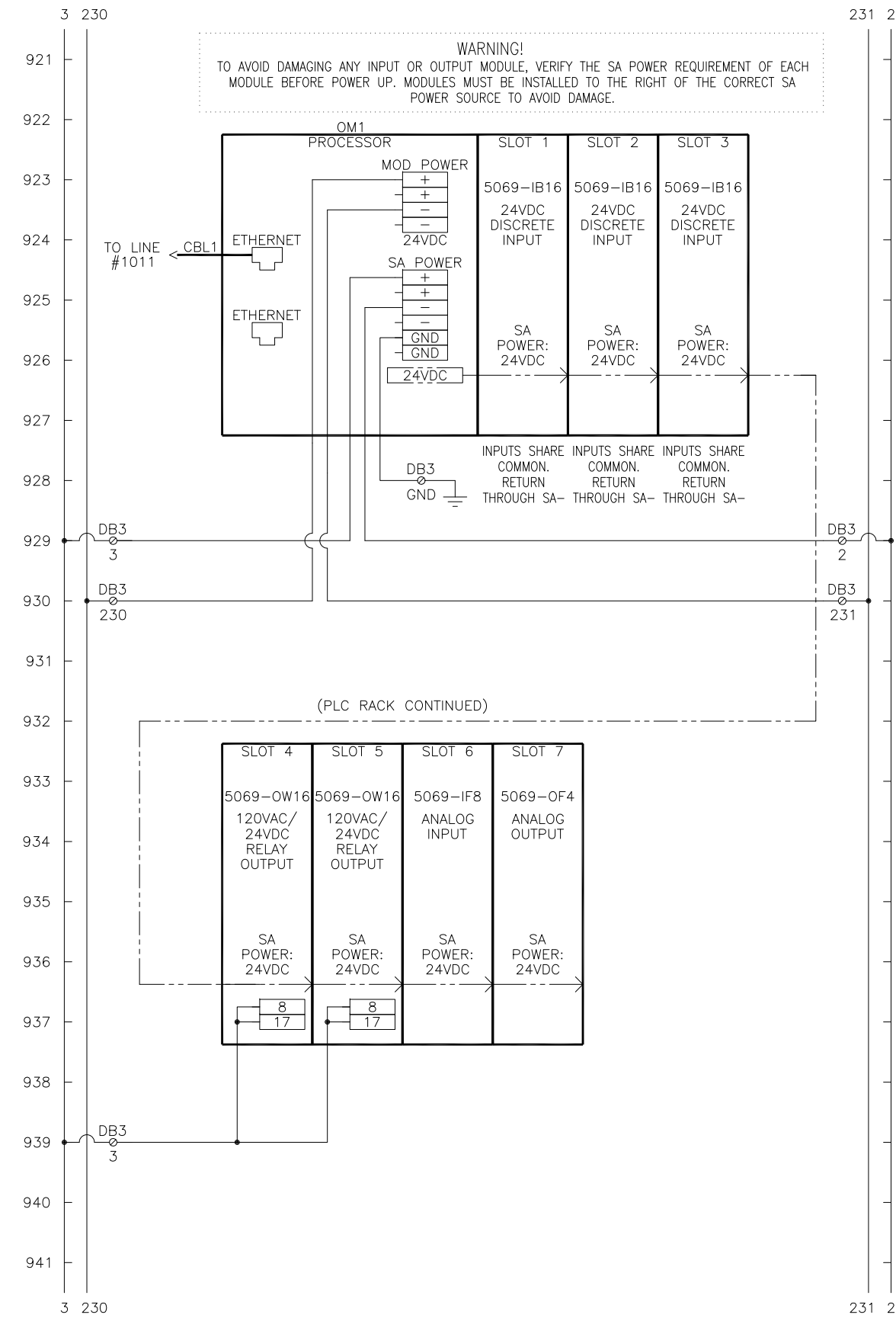
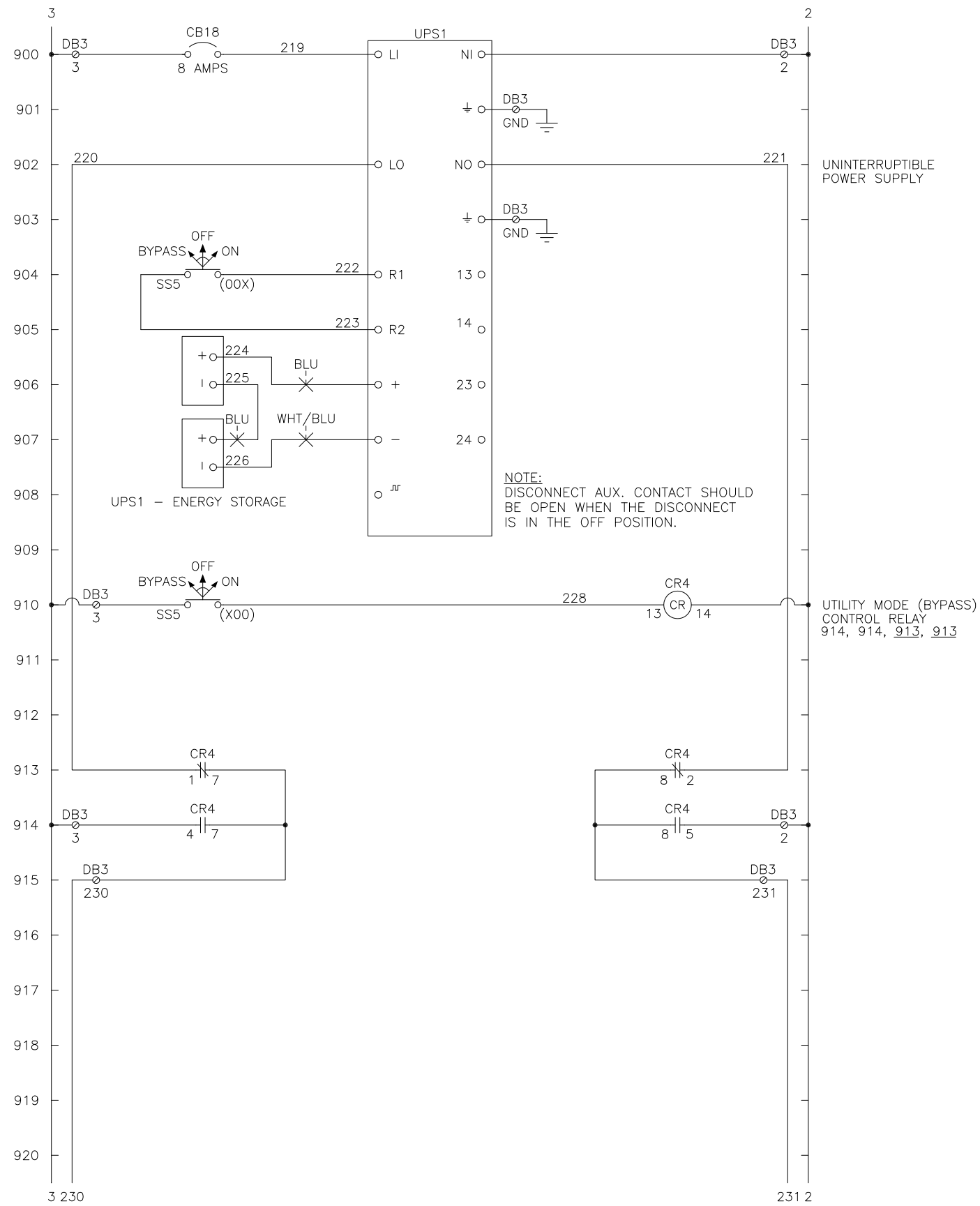
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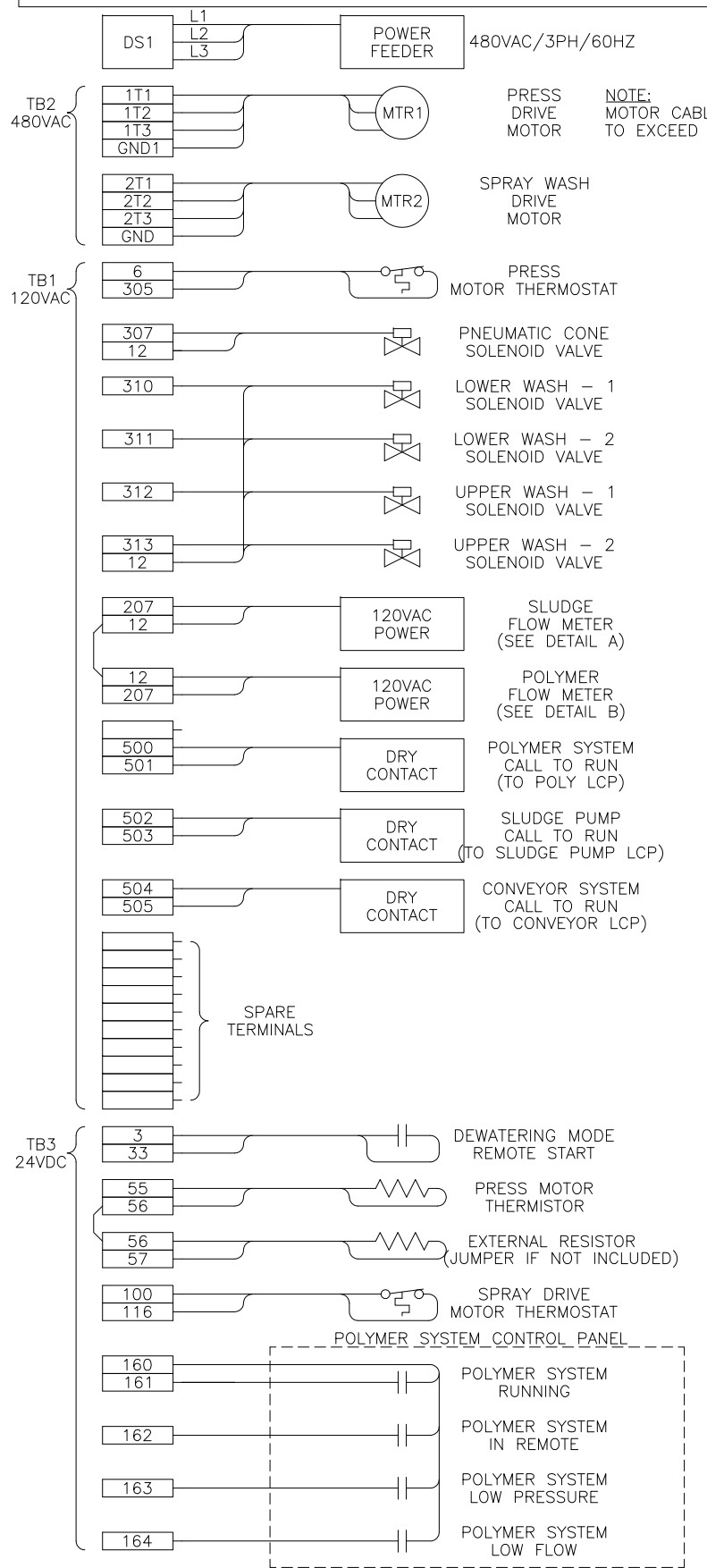
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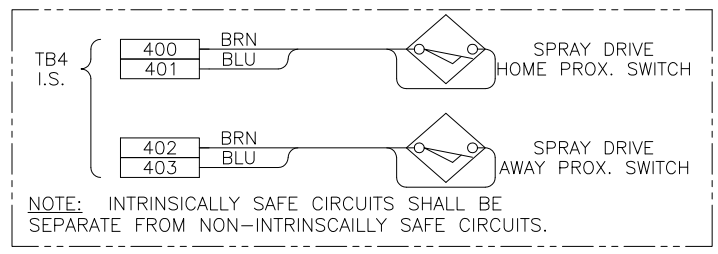
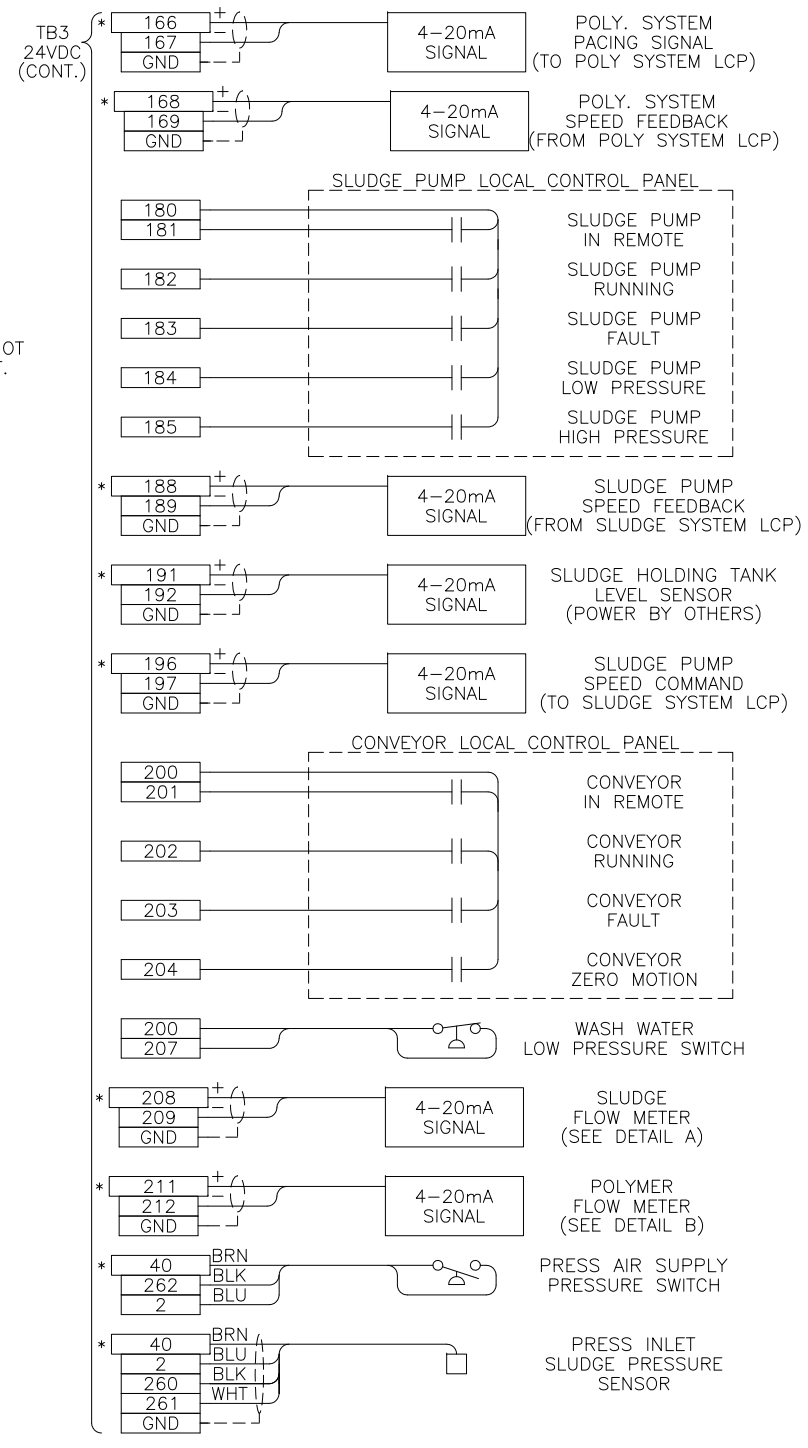
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FIELD WIRING DIAGRAM

WARNING DAMAGE RESULTING FROM INSTALLATION OF TOP ENTRY CONDUIT WILL VOID WARRANTY.
 - AVOID CUTTING HOLES DIRECTLY ABOVE ANY ELECTRICAL COMPONENTS
 - PROTECT INTERNAL COMPONENTS FROM METAL SHAVINGS, CUTTING OILS, DEBRIS, AND MOISTURE
 - USE PROPER FITTINGS, MYERS TYPE 4 OR EQUAL
 - CONDUITS AND FITTING MUST BE WATERTIGHT TO PREVENT WATER ENTRY
 - ALL PENETRATIONS MUST BE SEALED OFF TO PREVENT INTRUSION OF MOISTURE, CORROSIVE GASES, AND VAPORS FROM ENTERING THE ENCLOSURE



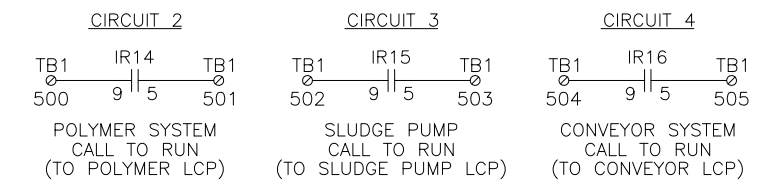
FIELD WIRING DIAGRAM



* TERMINAL SHALL CONTAIN 1 AMP FUSE

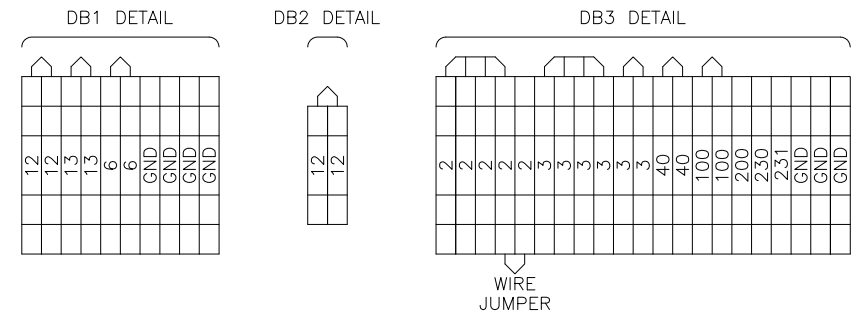
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DRY CONTACTS FOR PLANT USE

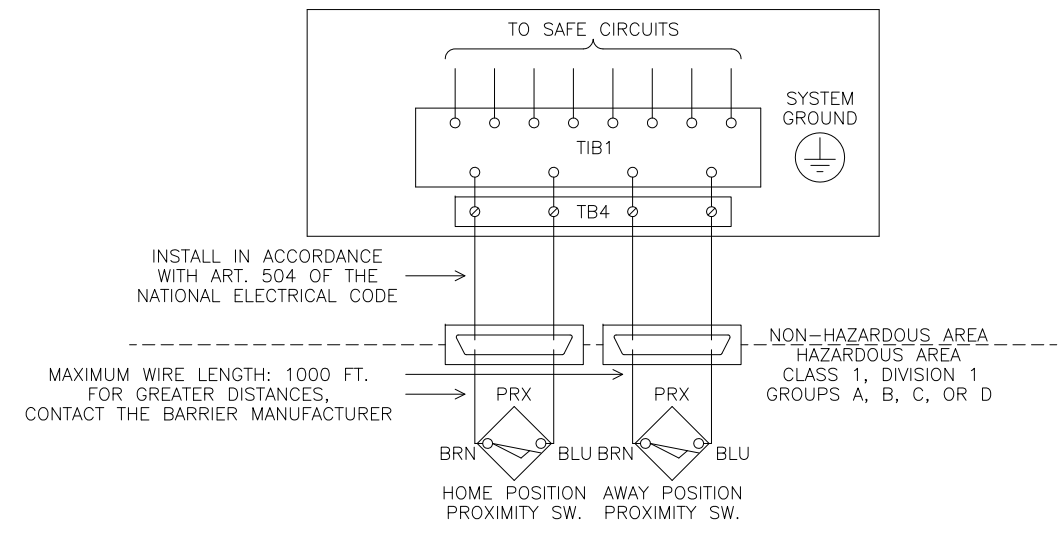


MAX. CONTROLLED LOAD: 10A @ 120VAC

NOTE: BRANCH CIRCUIT PROTECTION PROVIDED BY OTHERS PER N.E.C.



TIB1 WIRING DETAIL



NOTES:
 1. ENSURE CONTROL PANEL IS CONNECTED TO GROUND.
 2. CAUTION: MAINTAIN SEPARATION BETWEEN INTRINSICALLY SAFE WIRING AND OTHER WIRING.

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Q - PRESS CONTROL PANEL
 ABERDEEN, ID SCALE: NONE
 PROJECT NUMBER: 73010205 DRAWING NO: HBR9328A11
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PLC/OIU SETTINGS

L306ER CPU	DISCRETE IN	DISCRETE OUT	ANALOG IN	ANALOG OUT
	QTY: 3 SLOT 1-3	QTY: 2 SLOT 4,5	QTY: 1 SLOT 6	QTY: 1 SLOT 7

PLC INPUTS - SLOT NO.1

I/0	E-STOP PRESSED
I/1	SYSTEM RESET
I/2	PRESS IN HAND/FORWARD
I/3	PRESS IN HAND/REVERSE
I/4	PRESS IN AUTO
I/5	PRESS OVERLOAD
I/6	PRESS RUNNING
I/7	PRESS MOTOR T-STAT
I/8	SPRAY WASH IN HAND
I/9	SPRAY WASH IN AUTO
I/10	SPRAY DRIVE HOME POSITION
I/11	SPRAY DRIVE AWAY POSITION
I/12	SPARE
I/13	WASH WATER LOW PRESSURE
I/14	SPARE
I/15	AIR SUPPLY OK

PLC INPUTS - SLOT NO.2

I/0	POWER FEED OK
I/1	SLUDGE PUMP IN REMOTE
I/2	SLUDGE PUMP RUNNING
I/3	SLUDGE PUMP FAULT
I/4	SLUDGE PUMP LOW PRESSURE
I/5	SLUDGE PUMP HIGH PRESSURE
I/6	SPARE
I/7	SPARE
I/8	CONVEYOR IN REMOTE
I/9	CONVEYOR RUNNING
I/10	CONVEYOR FAULT
I/11	CONVEYOR ZERO MOTION
I/12	PRESS REMOTE START
I/13	SPARE
I/14	SPARE
I/15	SPARE

PLC INPUTS - SLOT NO.3

I/0	SPRAY DRIVE RUN REVERSE
I/1	SPRAY DRIVE RUN FORWARD
I/2	SPRAY DRIVE MOVED REV LAST
I/3	SPRAY DRIVE HIGH CURRENT
I/4	SPRAY DRIVE OVERLOAD
I/5	SPRAY DRIVE MOTOR TSTAT
I/6	SPRAY DRIVE IN HAND
I/7	SPRAY DRIVE IN AUTO
I/8	POLYMER SYSTEM RUNNING
I/9	POLYMER SYSTEM IN REMOTE
I/10	POLYMER SYSTEM LOW PRESSURE
I/11	POLYMER SYSTEM LOW FLOW
I/12	SPARE
I/13	SPARE
I/14	SPARE
I/15	SPARE

PLC OUTPUTS - SLOT NO.4

O/0	CONTROL POWER ENABLE
O/1	PRESS DEWATERING MODE
O/2	PRESS SYSTEM DISTURBANCE
O/3	COMMON ALARM
O/4	SPARE
O/5	SPARE
O/6	SPARE
O/7	SPARE
O/8	PRESS CALL TO RUN FORWARD
O/9	PRESS CALL TO RUN REVERSE
O/10	PRESS FAULT
O/11	PRESS PNEUMATIC CONE ENGAGE
O/12	SPARE
O/13	POLYMER SYSTEM CALL TO RUN
O/14	SLUDGE PUMP CALL TO RUN
O/15	CONVEYOR SYSTEM CALL TO RUN

PLC OUTPUTS - SLOT NO.5

O/0	PRESS LOWER WASH 1 CALL
O/1	PRESS LOWER WASH 2 CALL
O/2	PRESS UPPER WASH 1 CALL
O/3	PRESS UPPER WASH 2 CALL
O/4	SPRAY DRIVE CALL REVERSE
O/5	SPRAY DRIVE CALL FORWARD
O/6	SPRAY DRIVE FAULT
O/7	SPARE
O/8	SPARE
O/9	SPARE
O/10	SPARE
O/11	SPARE
O/12	SPARE
O/13	SPARE
O/14	SPARE
O/15	SPARE

PLC ANALOG INPUTS - SLOT NO.6

IN0	SLUDGE FEED FLOW RATE
IN1	SLUDGE PUMP SPEED FEEDBACK
IN2	POLYMER SYSTEM SPEED FEEDBACK
IN3	SLUDGE TANK LEVEL
IN4	PRESS INLET PRESSURE
IN5	POLYMER FEED FLOW RATE
IN6	SPARE
IN7	SPARE

PLC ANALOG OUTPUTS - SLOT NO.7

OUT0	POLYMER SPEED COMMAND
OUT1	SLUDGE SPEED COMMAND
OUT2	SPARE
OUT3	SPARE

PLC/OIU SETTINGS

PLC1 - COMMUNICATIONS SETUP

ETHERNET PORT PARAMETERS	VALUE
IP ADDRESS	10.0.0.1
SUBNET MASK	255.255.255.0
GATEWAY ADDRESS	0.0.0.0

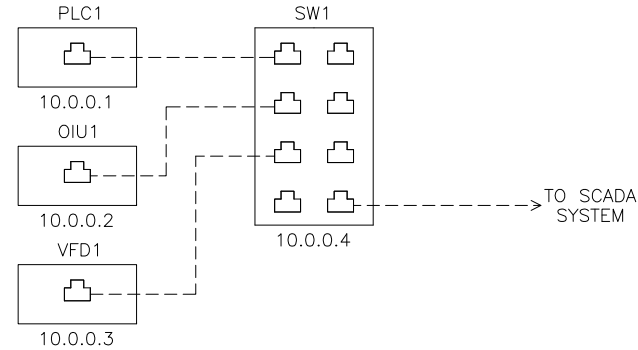
OIU1 - COMMUNICATIONS SETUP

ETHERNET PORT PARAMETERS	VALUE
IP ADDRESS	10.0.0.2
SUBNET MASK	255.255.255.0
GATEWAY ADDRESS	0.0.0.0

SW1 - COMMUNICATIONS SETUP

ETHERNET PORT PARAMETERS	VALUE
IP ADDRESS	10.0.0.4
SUBNET MASK	255.255.255.0
GATEWAY ADDRESS	0.0.0.0

ETHERNET NETWORK MAP



NOTES:

1. --- CAT5 ETHERNET CABLE

SUBNET MASK: 255.255.255.0

PLC/OIU SETTINGS

Q-PRESS SYSTEM OIU MAINTENANCE REMINDERS

PART DESCRIPTION	OPERATING TIME (HOURS)
INSPECT WIPER	2000
INSPECT COMPLETE SPRAY CAROUSEL	2000
INSPECT LOWER SHAFT SEALS & BUSHING	2000
INSPECT UPPER AUGER SHAFT BEARING	2000
INSPECT SOLENOID VALVES	100
INSPECT WASH SYSTEM HOSES	2000
REPLACE GEARBOX OIL	10000

DATE	REVISION	NO.	BY	CK	APP	DATE

DESIGNED	JN
DETAILED	
CHECKED	MSN
APPROVED	
DATE	06/08/23

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Q - PRESS
CONTROL PANEL

ABERDEEN, ID

SCALE:
NONE

PROJECT NUMBER:
73010205

DRAWING NO:
HBR9328A12

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PLC/OIU SETTINGS

PLC1 - SETPOINTS

REGISTER	DESCRIPTION	UNITS	DEFAULT	MIN	MAX
SP1[0].INT	EQUIPMENT STARTUP DELAY	SEC.	3	0	10
SP1[1].INT	DURATION MODE RUN DURATION	MIN.	900	1	9999
SP1[2].INT	VOLUME MODE PROCESS VOLUME	GAL	100	1	99999
SP1[3].INT	DATALOGGER INTERVAL	SEC.	10	1	999
SP1[10].INT	PRESS SHUTDOWN DURATION	MIN.	10	0	120
SP1[11].INT	PRESS DIRECTION CHANGE DWELL	SEC.	3	1	60
SP1[12].REAL	PRESS HAND SPEED	%	50	1	100
SP1[13].REAL	PRESS SPEED MINIMUM: LOW PRESSURE	%	10	1	100
SP1[14].REAL	PRESS SPEED MINIMUM: HIGH PRESSURE	%	50	1	100
SP1[15].REAL	PRESS SHUTDOWN SPEED	%	100	1	100
SP1[16].REAL	PRESS MAX TORQUE SPEED SETPOINT	%	60	1	100
SP1[17].REAL	PRESS HIGH PRESSURE INTERRUPT SPEED	%	100	1	100
SP1[20].INT	PNEUMATIC CONE AIR FAILURE FAULT DELAY	SEC.	10	1	20
SP1[40].INT	SPRAY WASH CYCLE DELAY	MIN.	15	1	60
SP1[41].INT	SPRAY WASH SHORT CYCLE COUNTER	COUNTS	2	1	10
SP1[42].INT	MAXIMUM TIME BETWEEN PROX. FAULT DELAY	SEC.	1	1	999
SP1[43].REAL	SPRAY DRIVE DIRECTION CHANGE DWELL	SEC.	1	0.5	999
SP1[44].REAL	SPRAY DRIVE INITIAL MOVE PROX. DELAY	SEC.	1	0.1	999
SP1[45].INT	SPRAY DRIVE FINAL FORWARD MOVE TIME	SEC.	5	1	30
SP1[60].REAL	INLET PRESSURE AT MIN SPEED	PSI	3	0	30
SP1[61].REAL	INLET PRESSURE AT MAX SPEED	PSI	15	0	30
SP1[62].REAL	INLET PRESSURE AT 4MA	PSI	0	0	30
SP1[63].REAL	INLET PRESSURE AT 20MA	PSI	14.7	0	30
SP1[64].REAL	HIGH PRESSURE INTERRUPT PRESSURE	PSI	12	0	30
SP1[65].INT	HIGH PRESSURE INTERRUPT OFF DELAY	SEC.	10	1	60
SP1[66].INT	MAINTAINED HIGH PRESSURE SHUTDOWN DELAY	SEC.	10	1	60
SP1[67].INT	HIGH PRESSURE COUNTS BEFORE SHUTDOWN	COUNTS	5	1	10
SP1[68].INT	HIGH PRESSURE COUNT RESET TIME	MIN.	60	1	600
SP1[69].INT	INLET PRESSURE DAMPENING TIME	SEC.	3	0	999
SP1[70].REAL	SLUDGE CONCENTRATION	%	3	0	10
SP1[71].REAL	REQUIRED SLUDGE FLOW RATE	GPM	30	5	150
SP1[72].REAL	SLUDGE PUMP MINIMUM SPEED	%	20	0	100
SP1[73].REAL	SLUDGE PUMP PID INITIAL SPEED	%	20	0	100
SP1[74].INT	SLUDGE PUMP PID ON DELAY	SEC.	10	0	999
SP1[75].REAL	SLUDGE PUMP PID GAIN (P) X 100	N/A	50	1	1000
SP1[76].REAL	SLUDGE PUMP PID TIME (I) X 10	N/A	12	1	1000
SP1[77].INT	SLUDGE ZERO FLOW FAULT DELAY	SEC.	300	1	999
SP1[78].INT	SLUDGE PUMP FAIL TO RUN FAULT DELAY	SEC.	10	1	999
SP1[79].REAL	SLUDGE FLOW AT 4MA	GPM	0	0	500
SP1[80].REAL	SLUDGE FLOW AT 20MA	GPM	100	0	500
SP1[82].INT	LOW PRESSURE FAULT DELAY	SEC.	10	1	999
SP1[83].INT	HIGH PRESSURE FAULT DELAY	SEC.	10	1	999
SP1[85].INT	GENERAL FAULT DELAY	SEC.	1	0	999
SP1[86].REAL	SLUDGE HOLDING TANK LOW LEVEL	IN.	*	0	999
SP1[87].REAL	SLUDGE HOLDING TANK HIGH LEVEL	IN.	*	0	999
SP1[88].REAL	SLUDGE HOLDING TANK AT 4MA	IN.	*	0	999
SP1[89].REAL	SLUDGE HOLDING TANK AT 20MA	IN.	*	0	999
SP1[90].REAL	POLYMER CONCENTRATION	%	100	0.05	100
SP1[91].REAL	LBS POLY PER TON OF SLUDGE	LB/TON	10	0.1	199.9
SP1[92].REAL	POLYMER PUMP MINIMUM CAPACITY	GPH	0	0	9.9
SP1[93].REAL	POLYMER PUMP MAXIMUM CAPACITY	GPH	3	0	999.9
SP1[94].INT	POLYMER PUMP FAIL TO RUN FAULT DELAY	SEC.	10	1	999
SP1[95].REAL	POLYMER FLOW AT 4MA	GPH	0	0	2400
SP1[96].REAL	POLYMER FLOW AT 20MA	GPH	5	0	2400
SP1[101].INT	LOW WATER PRESSURE FAULT DELAY	SEC.	10	1	999
SP1[103].INT	LOW POLY FLOW FAULT DELAY	SEC.	10	1	999
SP1[105].REAL	POLYMER SYSTEM INITIAL SPEED	%	20	0	100
SP1[106].INT	POLYMER SYSTEM DOSING CALC ON DELAY	SEC.	5	1	999
SP1[111].INT	CONVEYOR OFF DELAY	SEC.	30	0	999
SP1[112].INT	CONVEYOR FAIL TO RUN FAULT DELAY	SEC.	10	1	999
SP1[113].INT	CONVEYOR ZERO MOTION DELAY	SEC.	15	1	999
SP1[121].INT	WASH WATER LOW PRESSURE FAULT DELAY	SEC.	*	1	999

PLC/OIU SETTINGS

PLC1 - SETPOINTS

SP1[180].REAL	TORQUE AT MIN SPEED	NM	4.5	0	99.9
SP1[181].REAL	TORQUE AT MAX SPEED	NM	17.9	0	99.9
SP1[182].INT	HIGH TORQUE INTERRUPT TORQUE	NM	19	0	99.9
SP1[183].INT	HIGH TORQUE INTERRUPT OFF DELAY	SEC.	10	1	60
SP1[184].REAL	MAINTAINED HIGH TORQUE SHUTDOWN DELAY	MIN.	15	1	99
SP1[185].INT	HIGH TORQUE COUNTS BEFORE SHUTDOWN	COUNTS	5	1	10
SP1[186].INT	HIGH TORQUE COUNT RESET TIME	MIN.	60	1	600
SP1[187].INT	HIGH TORQUE INTERRUPT SPEED INCREASE	%	1	0	10
SP1[188].INT	TORQUE INTERRUPT SPEED INCREASE INTERVAL	SEC.	3	0	20
SP1[189].REAL	HIGH TORQUE OVERLOAD VALUE	NM	20	0	99.9
SP1[190].INT	TORQUE DAMPENING TIME	SEC.	200	0	999
SP1[191].INT	MOTOR NAMEPLATE POLES	POLES	4	2	8
SP1[192].INT	MOTOR MAX FREQUENCY	HZ	60	50	100
SP1[193].REAL	MOTOR NAMEPLATE POWER	KW	*	0	100

PLC/OIU SETTINGS

PLC1 - SCADA MONITORING

REGISTER NUMBER	DESCRIPTION	DATA TYPE	NORMAL STATE	ACTIVE STATE	SCADA FUNCTION
PLC IO STATUS					
S_INT[1]	PLC SLOT 1 DISCRETE INPUTS	(BIT)	0	1	READ
S_INT[2]	PLC SLOT 2 DISCRETE INPUTS	(BIT)	0	1	READ
S_INT[3]	PLC SLOT 3 DISCRETE INPUTS	(BIT)	0	1	READ
S_INT[4]	PLC SLOT 4 DISCRETE OUTPUTS	(BIT)	0	1	READ
S_INT[5]	PLC SLOT 5 DISCRETE OUTPUTS	(BIT)	0	1	READ
SCREW PRESS					
S_INT[9].0	PRESS RUNNING FORWARD	(BIT)	0	1	READ
S_INT[9].1	PRESS RUNNING REVERSE	(BIT)	0	1	READ
S_INT[9].2	PRESS IN AUTO	(BIT)	0	1	READ
S_INT[9].3	PRESS FAULT	(BIT)	0	1	READ
S_INT[9].4	PRESS IN DEWATERING MODE	(BIT)	0	1	READ
S_INT[9].5	SPRAY WASH ON	(BIT)	0	1	READ
S_INT[9].6	SPRAY IN AUTO	(BIT)	0	1	READ
S_INT[9].7	SPRAY DRIVE RUNNING	(BIT)	0	1	READ
S_INT[9].8	SPRAY DRIVE IN AUTO	(BIT)	0	1	READ
S_INT[9].9	SPRAY DRIVE FAULT	(BIT)	0	1	READ
S_INT[9].10	SYSTEM DISTURBANCE(COMMON ALARM)	(BIT)	0	1	READ
S_INT[9].11	DEWATERING SYSTEM READY	(BIT)	0	1	READ
S_REAL[0]	PRESS MOTOR CURRENT (AMPS)	(REAL)	-	-	READ
S_REAL[1]	PRESS INLET PRESSURE (PSI)	(REAL)	-	-	READ
S_REAL[2]	PRESS SPEED FEEDBACK (%)	(REAL)	-	-	READ
S_REAL[3]	PRESS TOTAL RUN TIME (HRS)	(REAL)	-	-	READ
S_REAL[4]	SPRAY DRIVE TOTAL RUN TIME (HRS)	(REAL)	-	-	READ
S_INT[100].0	DEWATERING REMOTE START	(BIT)	0	1	WRITE
SLUDGE PUMP					
S_INT[11].0	SLUDGE PUMP RUNNING	(BIT)	0	1	READ
S_INT[11].1	SLUDGE PUMP IN REMOTE	(BIT)	0	1	READ
S_INT[11].2	SLUDGE PUMP FAULT	(BIT)	0	1	READ
S_INT[11].3	SLUDGE FEED LOW PRESSURE	(BIT)	0	1	READ
S_INT[11].4	SLUDGE FEED HIGH PRESSURE	(BIT)	0	1	READ
S_REAL[10]	SLUDGE FEED FLOW RATE (GPM)	(REAL)	-	-	READ
S_REAL[11]	SLUDGE SPEED FEEDBACK (%)	(REAL)	-	-	READ
SLUDGE HOLDING TANK					
S_INT[12].0	HOLDING TANK LOW LEVEL	(BIT)	0	1	READ
S_INT[12].1	HOLDING TANK HIGH LEVEL	(BIT)	0	1	READ
S_REAL[12]	HOLDING TANK LEVEL (IN.)	(REAL)	-	-	READ
POLYMER SYSTEM					
S_INT[13].0	POLYMER SYSTEM RUNNING	(BIT)	0	1	READ
S_INT[13].1	POLYMER SYSTEM IN REMOTE	(BIT)	0	1	READ
S_INT[13].2	POLYMER SYSTEM LOW PRESSURE	(BIT)	0	1	READ
S_INT[13].3	POLYMER SYSTEM LOW POLY FLOW	(BIT)	0	1	READ
S_REAL[15]	POLYMER FLOW RATE (GPH)	(REAL)	-	-	READ
CONVEYOR					
S_INT[14].0	CONVEYOR RUNNING	(BIT)	0	1	READ
S_INT[14].1	CONVEYOR IN REMOTE	(BIT)	0	1	READ
S_INT[14].2	CONVEYOR FAULT	(BIT)	0	1	READ
S_INT[14].3	CONVEYOR ZERO MOTION FAULT	(BIT)	0	1	READ
GENERAL					
S_INT[15].0	E-STOP PRESSED	(BIT)	0	1	READ
S_INT[15].1	UTILITY POWER/PHASE LOSS	(BIT)	0	1	READ

DESIGNED	JN
DETAILED	
CHECKED	MSN
APPROVED	
DATE	06/08/23
REVISION	
NO.	
BY	
CK	
APP	

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Q - PRESS CONTROL PANEL

ABERDEEN, ID

SCALE:
NONE

PROJECT NUMBER:
73010205

DRAWING NO:
HBR9328A13

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DEVICE SETTINGS

CM1 - CURRENT MONITOR

DIP SETTINGS	
1	ON
2	OFF
3	ON
4	OFF
5	OFF
6	ON

DIAL SETTINGS	
HYSTERESIS	0%
LEVEL	FLA
DELAY	0.5s

WIRE PASSES	MAX AMPS	LEVEL RANGE (10-110%)
1	20	2-22A
2	10	1-11A
3	6.6	0.6-7.3A
4	5	0.5-5.5A

* ABOVE VALUES ASSUME 20A MAX DIP SETTINGS

NOTES:

- FIELD CONFIGURATION SHALL BE PERFORMED BY THE STARTUP TECHNICIAN PER THE APPROPRIATE TECHNICAL DOCUMENTS.
- MEASURING RANGE MAXIMUM AMPS SET BY DIP SETTINGS 1 AND 2
SW1 ON/SW2 OFF = 20A; SW1 ON/SW2 ON = 50A; SW1 OFF/SW2 ON = 100A

TIB1 - SETTINGS

JUMPER NUMBER	SET AT
CH1 JP11	1-2 (DIRECT)
JP12	2-3 (OFF)
CH2 JP21	1-2 (DIRECT)
JP22	2-3 (OFF)
JP23	2-3 (IN. 2 ACTIVE)

AL1 - ALARM LIGHT

SWITCH	SINGLE FLASH SETTING
1 2	SWITCH 1 = ON
<input type="checkbox"/> <input checked="" type="checkbox"/>	SWITCH 2 = OFF
FLASH	

PFR1 - SETTINGS

DIAL	SETTING
VOLTAGE	480 ON DELAY
Tt	5s
>U	10%
<U	10%

AC1 - SETTINGS

AC ON/OFF	90 °F
HEATER OFF/ON	60 °F

QL1 - SETTINGS

DIAL	SETTING
CLASS	AUTO - 20

DEVICE SETTINGS

VFD1 - POWERFLEX 525 SETTINGS

PARAMETER NUMBER	DESCRIPTION	DEFAULT	VFD1 SETTING
31	MOTOR VOLTAGE	460 VAC	460 VAC
32	MOTOR FREQUENCY	60 HZ	70 HZ
33	MOTOR OL CURRENT	*	5.4 AMPS
34	MOTOR NP FLA	*	5.4 AMPS
35	MOTOR NP POLES	*	4 POLES
36	MOTOR NP RPM	*	2100 RPM
37	MOTOR NP POWER (kW)	*	3 kW
39	TORQUE PERF MODE	1=SVC	4=PM MOTOR
41	ACCEL TIME 1	10 SEC.	5 SEC.
42	DECEL TIME 1	10 SEC.	5 SEC.
45	STOP MODE	0=RAMP	5=COAST
46	START SOURCE	1=KEYPAD	2=DIGIN TRMBLK
47	SPEED REFERENCE 1	1=DRIVE POT	15=ETHERNET/IP

TERMINAL BLOCK GROUP

65	DIG IN TERM BLK 05	7=PRESET FREQ.	12=AUX FAULT
76	RELAY OUT 1	0=READY	7=ABOVE CURRENT
77	RELAY OUT 1 LEVEL	0%	52%*
81	RELAY OUT 2 SEL	0=READY/FIT	10=ABOVE ANLG V
82	RELAY OUT 2 LEVEL	0	*

COMMUNICATIONS GROUP

125	COMM LOSS ACTION	0=FAULT	1=COAST STOP
128	EN ADDR SEL	0=BOOTP	1=PARAMETERS
129	EN IP ADDR CFG 1	0	10
130	EN IP ADDR CFG 2	0	0
131	EN IP ADDR CFG 3	0	0
132	EN IP ADDR CFG 4	0	3
133	EN SUBNET CFG 1	0	255
134	EN SUBNET CFG 2	0	255
135	EN SUBNET CFG 3	0	255
136	EN SUBNET CFG 4	0	0
137	EN GATEWAY CFG 1	0	0
138	EN GATEWAY CFG 2	0	0
139	EN GATEWAY CFG 3	0	0
140	EN GATEWAY CFG 4	0	0
143	EN COMM FLT ACTN	0=FAULT	3=HOLD LAST
144	EN IDLE FLT ACTN	0=FAULT	3=HOLD LAST
157	EN DATA OUT 1	0	3=OUTPUT CURRENT
158	EN DATA OUT 1	0	44=MAX. OUTPUT FREQ.

ADVANCED PROGRAM GROUP

501	PM IR VOLTAGE	11.50 V	(AUTOTUNE-NOTE 5)
502	PM IXd VOLTAGE	17.91 V	(AUTOTUNE-NOTE 5)
503	PM IXq VOLTAGE	53.21 V	(AUTOTUNE-NOTE 5)
504	PM BEMF VOLTAGE	1640.0 DRV	(AUTOTUNE-NOTE 5)

NOTES:

- THE ABOVE IS A PARTIAL LISTING OF SETPOINTS. ONLY THE SETPOINTS THAT ARE SHOWN ABOVE MARKED WITH A * SHALL BE ALTERED IN THE FIELD. REFER TO THE DRIVE MANUAL FOR A FULL LIST OF SETPOINTS AND ADDITIONAL DETAILS.
- PARAMETER 77 MUST BE SET TO THE MOTOR OVERLOAD TRIP POINT WHICH IS A PERCENT OF THE MAXIMUM DRIVE OUTPUT CURRENT.
(MAX DRIVE OUTPUT CURRENT VFD1 = 10.5A)
- VERIFY ALL MOTOR PARAMETERS TO THE ACTUAL MOTOR NAMEPLATE.
- VFD1 IS CONFIGURED FOR A PERMANENT MAGNET MOTOR WITH A WYE WIRING CONFIGURATION. ENSURE MOTOR JUMPERS ARE SET UP FOR A WYE CONFIGURATION.
- PRIOR TO MOTOR START UP, AN AUTOTUNE MUST BE PERFORMED. ONCE MOTOR NAMEPLATE PARAMETERS ARE CONFIRMED, NAVIGATE TO PARAMETER P040 AND CHANGE P040 TO A VALUE OF 1. PROVIDE THE VFD WITH A MAINTAINED MANUAL/HAND MODE CALL TO RUN. DURING THIS TIME, THE VFD WILL DISPLAY "RUN", BUT THE MOTOR WILL NOT OPERATE. ONCE THE AUTOTUNE IS FINISHED "RUN" WILL BE REMOVED FROM THE DISPLAY.

VFD1 - ETHERNET PORT

PARAMETERS	VALUE
IP ADDRESS	10.0.0.3
SUBNET MASK	255.255.255.0
GATEWAY ADDRESS	0.0.0.0

DESIGNED	JN
DETAILED	
CHECKED	MSN
APPROVED	
DATE	06/08/23
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HUBER

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Q - PRESS
CONTROL PANEL

ABERDEEN, ID

SCALE:
NONE

PROJECT NUMBER:
73010205

DRAWING NO:
HBR9328A14

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SEQUENCE OF OPERATION

CONTROL POWER ON-DELAY:

EACH TIME THE CONTROL PANEL POWER SUPPLY IS CYCLED, THE PLC WILL ALLOW ALL SOLID STATE DEVICES TO FULLY ENERGIZE BEFORE ENABLING THE CONTROL POWER CIRCUIT.

PRESS MODES OF OPERATION:

HAND: WHEN THE PRESS SELECTOR IS IN THE HAND POSITION, THE PRESS WILL RUN IN THE DIRECTION SELECTED BY THE PRESS FOR-OFF-REV SELECTOR AT A CONSTANT SPEED ENTERED BY THE OPERATOR INTO THE OIU.

NOTE: IN HAND MODE, THE PRESS WILL RUN FORWARD ONCE THE PNEUMATIC CONE HAS BEEN ACTUATED.

AUTO: WHEN THE PRESS SELECTOR IS IN THE AUTO POSITION THE PRESS WILL BEGIN TO CYCLE IN THE FORWARD DIRECTION AS DESCRIBED IN THE SYSTEM START SEQUENCE. ONCE RUNNING, THE PRESS WILL OPERATE AT SPEED BASED ON THE MEASURED MOTOR TORQUE AND INLET PRESSURE, AS DESCRIBED BELOW. THE PRESS WILL CONTINUE TO CYCLE UNTIL THE SYSTEM ENTERS SHUTDOWN MODE.

PRESS INTERLOCKS:

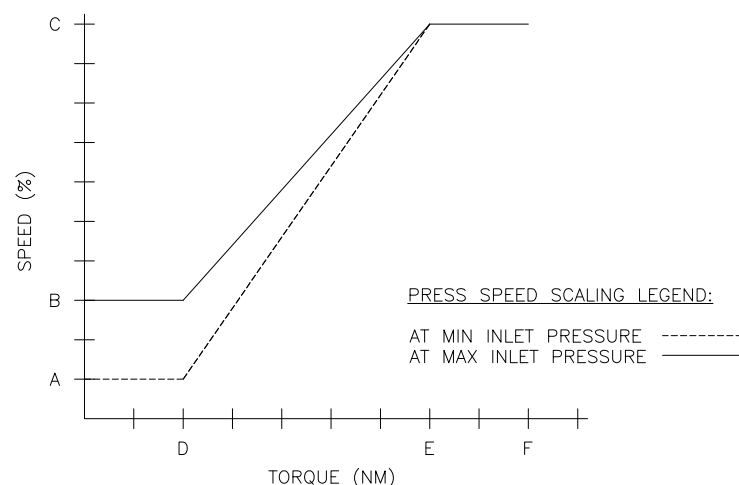
OPERATING THE PRESS, IN HAND OR AUTOMATIC, WILL REQUIRE THE FOLLOWING:

1. PRESSURIZED AIR SUPPLY TO BE ABOVE THE REQUIRED PRESSURE AS MEASURED BY THE PRESSURE SWITCH IN THE AIR SUPPLY LINE.
2. THE SOLENOID VALVE FOR THE PNEUMATIC ACTUATED CONE MUST ALSO BE ENERGIZED, UNLESS IN SLUDGE DEWATERING SYSTEM SHUTDOWN SEQUENCE.

PRESS SPEED CONTROL:

1. THE PRESS MINIMUM SPEED SETTING WILL BE LINEARLY ADJUSTED BASED ON THE MEASURED PRESS INLET PRESSURE. WHEN THE PRESS INLET PRESSURE IS AT OR BELOW THE INLET PRESSURE AT MINIMUM SPEED SETPOINT, THE PRESS MINIMUM SPEED SETTING WILL BE SET TO THE PRESS SPEED MINIMUM: LOW PRESSURE SETPOINT. WHEN THE PRESS INLET PRESSURE IS AT OR ABOVE THE INLET PRESSURE AT MAXIMUM SPEED SETPOINT, THE PRESS MINIMUM SPEED SETTING WILL BE SET TO THE PRESS SPEED MINIMUM: HIGH PRESSURE SETPOINT.
2. THE OVERALL PRESS SPEED WILL BE LINEARLY ADJUSTED BASED ON THE MEASURED PRESS TORQUE. WHEN THE PRESS TORQUE IS AT OR BELOW THE TORQUE AT MINIMUM SPEED SETPOINT, THE PRESS WILL OPERATE AT THE PRESS MINIMUM SPEED SETTING BASED ON PRESSURE, AS DESCRIBED ABOVE. WHEN THE PRESS TORQUE IS AT OR ABOVE THE TORQUE AT MAXIMUM SPEED SETPOINT, THE PRESS WILL OPERATE AT THE PRESS DEWATERING MODE MAXIMUM SPEED SETPOINT.
3. THE SPEED RATE OF CHANGED BASED ON THE MEASURED INLET PRESSURE AND TORQUE CAN BE AVERAGED OVER A SET TIME BY THE INLET PRESSURE AND TORQUE DAMPENING SETPOINTS.

SPEED VS. MOTOR TORQUE



PRESS SPEED SCALING LEGEND:

- AT MIN INLET PRESSURE -----
- AT MAX INLET PRESSURE _____

SPEED / MOTOR TORQUE SCALING SETPOINTS:

- A. PRESS SPEED MINIMUM: LOW PRESSURE SETPOINT
- B. PRESS SPEED MINIMUM: HIGH PRESSURE SETPOINT
- C. PRESS MAXIMUM TORQUE SPEED SETPOINT
- D. TORQUE AT MINIMUM SPEED SETPOINT
- E. TORQUE AT MAXIMUM SPEED SETPOINT
- F. HIGH TORQUE INTERRUPT SETPOINT

NOTES: THE MOTOR TORQUE WILL BE CALCULATED BY THE PLC USING THE FOLLOWING CALCULATION:

$$\text{MOTOR TORQUE (NM)} = \text{MOTOR POWER (W)} * 9.5488 / \text{MOTOR SPEED (RPM)}$$

THE MOTOR SPEED (RPM) WILL BE CALCULATED BY THE PLC USING THE FOLLOWING CALCULATION:

$$\text{MOTOR SPEED (RPM)} = \text{COMMANDED SPEED (HZ)} * (2 / \text{MOTOR POLES}) * 60$$

THE OPERATOR WILL NEED TO ENTER THE MOTOR NAMEPLATE POLES, POWER, AND MAX FREQUENCY THROUGH THE OIU.

SEQUENCE OF OPERATION

SPRAY DRIVE MODES OF OPERATION:

HAND: WHEN THE SPRAY DRIVE SELECTOR IS IN THE HAND POSITION, THE SPRAY DRIVE WILL DWELL, THEN MOVE IN THE OPPOSITE DIRECTION OF ITS LAST MOVEMENT. IT WILL CONTINUE IN THIS DIRECTION UNTIL THE SPRAY DRIVE PROXIMITY SWITCH IS ACTIVATED. ONCE THE PROXIMITY SWITCH IS ACTIVATED, THE SPRAY DRIVE WILL STOP, DWELL, AND START TO RUN IN THE OPPOSITE DIRECTION. THE DWELL-FORWARD-DWELL-REVERSE CYCLES WILL CONTINUE UNTIL THE SPRAY DRIVE SELECTOR IS PLACED IN THE OFF POSITION.

AUTO: WHEN THE SPRAY DRIVE SELECTOR IS IN THE AUTO POSITION, THE SPRAY DRIVE WILL OPERATE AS DESCRIBED IN THE SPRAY WASH SYSTEM SEQUENCE.

SPRAY WASH MODES OF OPERATION:

HAND: WHEN THE SPRAY WASH SELECTOR IS IN THE HAND POSITION, ALL SPRAY WASH SOLENOID VALVES WILL ENERGIZE AND REMAIN ENERGIZED UNTIL THE SELECTOR IS PLACED IN THE OFF POSITION.

AUTO: WHEN THE SPRAY WASH SELECTOR IS IN THE AUTO POSITION, THE SPRAY WASH SOLENOID VALVES WILL OPERATE AS DESCRIBED IN THE SPRAY WASH SYSTEM SEQUENCE.

POLYMER SYSTEM MODES OF OPERATION:

WHEN THE POLYMER SYSTEM IS IN REMOTE, THE DEWATERING CONTROL PANEL WILL PROVIDE A CALL TO RUN SIGNAL AS WELL AS A CALCULATED PACING SIGNAL. THE CALL TO RUN AND PACING SIGNALS WILL BE ACTIVE WHILE THE SYSTEM IS IN DEWATERING MODE. THE POLYMER SYSTEM WILL START TO OPERATE AT THE INITIAL SPEED SETPOINT FOR THE TIME SET IN THE DOSING CALCULATION ON DELAY TIMER. THE POLYMER SYSTEM SPEED WILL THEN VARY BASED ON THE SLUDGE CALCULATIONS VARIABLES EXPLAINED BELOW. THESE SIGNALS WILL BE DE-ACTIVATED WHEN THE SYSTEM ENTERS SHUTDOWN MODE.

CONVEYOR OPERATION:

THE CONVEYOR WILL BE CALLED TO RUN WHENEVER THE PRESS IS RUNNING, THE CONVEYOR WILL CONTINUE TO RUN AFTER THE PRESS HAS STOPPED FOR THE TIME SET IN THE CONVEYOR OFF DELAY TIMER SET THROUGH THE OIU.

SLUDGE PUMP MODES OF OPERATION:

WHEN THE SLUDGE FEED PUMP IS IN REMOTE, THE DEWATERING CONTROL PANEL WILL PROVIDE A CALL TO RUN SIGNAL AS WELL AS A USER SET PACING SIGNAL. THE CALL TO RUN AND PACING SIGNALS WILL BE ACTIVE WHILE THE SYSTEM IS IN DEWATERING MODE. THE SLUDGE PUMP WILL START TO OPERATE AT THE PID MINIMUM SPEED SETPOINT FOR THE TIME SET IN THE PID ON DELAY TIMER. THE SLUDGE PUMP SPEED WILL THEN VARY BASED ON THE SLUDGE FLOW FEEDBACK RECEIVED FROM THE FLOW METER. THESE SIGNALS WILL BE DE-ACTIVATED WHEN THE SYSTEM ENTERS SHUTDOWN MODE.

SLUDGE CALCULATIONS:

THE USER WILL BE RESPONSIBLE FOR ENTERING THE FOLLOWING PARAMETERS TO ENSURE THE CORRECT AMOUNT OF POLYMER IS DOSED WITH THE SLUDGE:

1. SLUDGE FEED FLOW RATE (GPM)
2. SLUDGE CONCENTRATION (% SOLIDS CONCENTRATION)
3. POLYMER DOSING RATE (LBS. NEAT POLYMER / TON DRY SOLIDS)
4. POLYMER CONCENTRATION (%)

PNEUMATIC PRESSURE CONE:

THE PNEUMATIC PRESSURE CONE IS OPERATED BY A SOLENOID VALVE. PRIOR TO EACH OPERATION OF THE PRESS, THE SOLENOID VALVE WILL BE ENERGIZED. THE ACTIVATION OF THE PNEUMATIC PRESSURE CONE IS REQUIRED PRIOR TO ANY OPERATION OF THE PRESS.

SEQUENCE OF OPERATION

DEWATERING MODE START SEQUENCE:

A DEWATERING MODE WILL BEGIN WHEN THE USER PRESSES THE START PUSHBUTTON ON THE OIU, AND THE EQUIPMENT WILL START UP IN THE FOLLOWING ORDER:

1. LONG WASH CYCLE WILL INITIATE
2. THE CONVEYOR WILL BE CALLED TO RUN
3. THE PNEUMATIC ACTUATED CONE IS ACTIVATED
4. PRESS WILL START TO RUN
5. POLYMER SYSTEM WILL BE CALLED TO RUN
6. SLUDGE PUMP WILL BE CALLED TO RUN

NOTE:

1. THERE WILL BE A DELAY BETWEEN THE START-UP OF EACH STEP.
2. A DEWATERING SYSTEM MAY ALSO BE STARTED BY RECEIVING A REMOTE START SIGNAL.
3. IF THE SYSTEM HAS STARTED DUE TO A REMOTE START SIGNAL, THE START PUSHBUTTON ON THE OIU WILL BE REPLACED WITH INDICATION THAT THE SYSTEM IS "IN REMOTE".
4. IF POWER IS LOST AND RESTORED TO THE SYSTEM AFTER A DEWATERING MODE HAS STARTED VIA THE START PUSHBUTTON ON THE OIU, THE OPERATOR WILL NEED TO RESTART THE SYSTEM FROM THE OIU ONCE AGAIN.
5. IF POWER IS LOST AND RESTORED TO THE SYSTEM AFTER A DEWATERING MODE HAS STARTED VIA THE REMOTE START SIGNAL AND THE SIGNAL IS STILL PRESENT, THE SYSTEM WILL AUTOMATICALLY START BACK UP.
6. IN THE PRESS SETTING MENU ON THE OIU, THE OPERATOR WILL FIND MULTIPLE MODES OF OPERATION FOR THE DEWATERING MODE WHICH CAN BE ENABLED OR DISABLED:
 - 6.1. START-STOP OPERATION. STARTING AND STOPPING THE SYSTEM BASED OFF PRESSING THE START AND STOP SOFT PUSHBUTTONS.
 - 6.2. TIME ON AND TIME OFF OPERATION. STARTING AND STOPPING THE SYSTEM AT USER SET TIMES OF THE DAY.
 - 6.3. RUN TIME OPERATION. STOPPING THE SYSTEM AFTER A USER SET TIME HAS ELAPSED.
 - 6.4. PROCESSED VOLUME OPERATION. STOPPING THE SYSTEM AFTER A USER SET AMOUNT OF VOLUME HAS BEEN PROCESSED.
 - 6.5. PROCESSED LEVEL MODE OPERATION. STOPPING THE SYSTEM AFTER THE LOW LEVEL SETPOINT HAS BEEN REACHED IN THE SLUDGE HOLDING TANK.
7. WHEN THE DEWATERING SYSTEM IS AUTO-READY, THE PRESS CAN BE STARTED BY HOLDING THE RESET PUSHBUTTON FOR 5 SECONDS. ONCE THE DEWATERING MODE HAS STARTED, THE PRESS CAN BE PLACED INTO SHUTDOWN MODE BY HOLDING THE RESET PUSHBUTTON FOR 5 SECONDS.

SPRAY WASH SYSTEM SEQUENCE:

ONCE A SPRAY WASH CYCLE IS INITIATED, THE SPRAY DRIVE WILL RETURN TO THE HOME POSITION. ONCE AT HOME, A SHORT SPRAY WASH CYCLE WILL BEGIN. AFTER COMPLETING THE SHORT SPRAY WASH CYCLE, A USER ENTERED TIME BETWEEN WASH CYCLES WILL BEGIN TIMING. AFTER THIS TIME HAS EXPIRED, THE SYSTEM WILL INITIATE ANOTHER SHORT SPRAY WASH CYCLE. THESE CYCLES WILL CONTINUE UNTIL THE SYSTEM HAS COMPLETED THE USER ENTERED NUMBER OF SHORT SPRAY WASH CYCLES. ONCE THE NUMBER OF SHORT SPRAY WASH CYCLES HAS REACHED THE USER ENTERED SETTING, AND THE SPRAY WASH DWELL TIMER HAS EXPIRED, THE SYSTEM WILL INITIATE A LONG SPRAY WASH CYCLE. ONCE THE LONG SPRAY WASH CYCLE IS COMPLETE, THE SEQUENCE WILL REPEAT ITSELF.

SHORT SPRAY WASH CYCLE:

THE FIRST LOWER WASH WILL OPEN AND THE SPRAY DRIVE WILL DWELL. AFTER DWELLING, THE SPRAY DRIVE WILL ROTATE IN THE FORWARD DIRECTION UNTIL THE AWAY PROXIMITY SWITCH IS ACTIVATED. AFTER ACTIVATING THE AWAY PROXIMITY SWITCH, THE SPRAY DRIVE WILL STOP, LOWER WASH 1 WILL CLOSE, AND THE SECOND LOWER WASH WILL OPEN. THE SPRAY DRIVE WILL AGAIN DWELL. AFTER DWELLING, THE SPRAY DRIVE WILL ROTATE IN THE REVERSE DIRECTION UNTIL THE HOME PROXIMITY SWITCH IS ACTIVATED. AFTER ACTIVATING THE HOME PROXIMITY SWITCH, THE SPRAY DRIVE WILL STOP AND LOWER WASH 2 WILL CLOSE.

LONG SPRAY WASH CYCLE:

A LONG SPRAY WASH CYCLE CONSISTS OF A SHORT SPRAY WASH CYCLE IN ADDITION TO THE FOLLOWING SEQUENCE. ONCE THE SHORT SPRAY WASH CYCLE IS COMPLETE, THE FIRST UPPER WASH WILL OPEN, AND THE SPRAY DRIVE MOTOR WILL DWELL. AFTER DWELLING, THE SPRAY DRIVE WILL ROTATE IN THE FORWARD DIRECTION UNTIL THE AWAY PROXIMITY SWITCH IS ACTIVATED. AFTER ACTIVATING THE AWAY PROXIMITY SWITCH, THE SPRAY DRIVE WILL STOP, UPPER WASH 1 WILL CLOSE, AND THE SECOND UPPER WASH WILL OPEN. THE SPRAY DRIVE WILL AGAIN DWELL. AFTER DWELLING THE SPRAY DRIVE WILL ROTATE IN THE REVERSE DIRECTION UNTIL THE HOME PROXIMITY SWITCH IS ACTIVATED. AFTER ACTIVATING THE HOME PROXIMITY SWITCH, THE SPRAY DRIVE WILL STOP AND UPPER WASH 2 WILL CLOSE.

NOTES:

1. IF THE SYSTEM IS NOT IN DEWATERING MODE AND THE SPRAY DRIVE AND SPRAY WASH SELECTORS ARE IN THE AUTO POSITION, A SPRAY WASH CYCLE WILL BE INITIATED WHEN THE PRESS IS RUNNING. DURING THIS CYCLE, THE SPRAY DRIVE AND SPRAY WASH WILL BOTH CYCLE THROUGH SHORT AND LONG SPRAY WASH CYCLES AS DESCRIBED IN THE SPRAY WASH SYSTEM SEQUENCE.
2. THE DEWATERING SYSTEM WILL CONTINUE TO INITIATE SPRAY WASH CYCLES WHILE THE SYSTEM IS IN SHUTDOWN MODE.
3. THE HOME POSITION WILL BE DEFINED AS THE FULLY REVERSED PROXIMITY POSITION.
4. THE AWAY POSITION WILL BE DEFINED AS THE FULLY FORWARD PROXIMITY POSITION.
5. THE SPRAY DRIVE OVER TRAVEL FAULT OCCURS WHEN THE HOME PROXIMITY SWITCH IS ACTIVATED WHEN OPERATING IN THE FORWARD DIRECTION, OR THE AWAY PROXIMITY SWITCH IS ACTIVATED WHEN OPERATING IN THE REVERSE DIRECTION.

DESIGNED	JN
DETAILED	
CHECKED	MSN
APPROVED	
DATE	06/08/23

HUBER
TECHNOLOGY

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Tel. 704-949-1010
info@hhusa.net

Q - PRESS CONTROL PANEL

ABERDEEN, ID

SCALE:
NONE

PROJECT NUMBER:
73010205

DRAWING NO:
HBR9328A15

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SEQUENCE OF OPERATION

PRESS HIGH PRESSURE FEED INTERRUPT:

WHEN THE PRESS INLET PRESSURE MEASURED EXCEEDS THE HIGH PRESSURE INTERRUPT SETPOINT, THE SLUDGE PUMP AND POLYMER FEED SIGNAL WILL SHUT DOWN IMMEDIATELY AND THE PRESS WILL RUN AT THE PRESS INTERRUPT SPEED SEPOINT. ONCE THE PRESSURE HAS DROPPED PAST THE HIGH PRESSURE INTERRUPT SETPOINT AND HOLDS FOR THE TIME SET IN THE HIGH PRESSURE INTERRUPT OFF DELAY, THE PUMPS WILL AUTOMATICALLY RESTART AND THE PRESS WILL RETURN TO ITS REGULAR SPEED.

PRESS HIGH PRESSURE SHUTDOWN:

HIGH PRESSURE SHUTDOWN WILL OCCUR IF THE NUMBER OF COUNTS OF HIGH PRESSURE INTERRUPTS, SET IN THE HIGH INLET PRESSURE FAULT COUNTER, OCCUR WITHIN A SET AMOUNT OF TIME. A HIGH PRESSURE SHUTDOWN WILL ALSO OCCUR ONCE THE HIGH PRESSURE SIGNAL IS REACHED AND MAINTAINED FOR A TIME SET IN THE MAINTAINED HIGH INLET PRESSURE SHUTDOWN DELAY TIMER. THE SYSTEM WILL ENTER SHUTDOWN MODE IMMEDIATELY WHEN A HIGH PRESSURE SHUTDOWN OCCURS.

NOTE: TO RESET A HIGH PRESSURE SHUTDOWN, PRESS THE RESET PUSHBUTTON.

PRESS HIGH TORQUE INTERRUPT:

WHEN THE PRESS MOTOR TORQUE MEASURED EXCEEDS THE HIGH TORQUE INTERRUPT SETPOINT, THE SLUDGE PUMP AND POLYMER FEED SIGNAL WILL SHUT DOWN IMMEDIATELY AND THE PRESSURE CONE WILL DE-ENERGIZE. THE PRESS WILL CONTINUE TO RUN AND GRADUALLY INCREASE SPEED BY THE % AMOUNT SET IN THE TORQUE INTERRUPT SPEED INCREASE SETPOINT EACH TIME THE TORQUE INTERRUPT SPEED INCREASE INTERVAL TIME SETPOINT HAS ELAPSED UNTIL THE PRESS IS OPERATING AT THE SPEED SET IN THE PRESS INTERRUPT SPEED SETPOINT. ONCE THE MOTOR TORQUE HAS DROPPED PAST THE HIGH TORQUE INTERRUPT SETPOINT AND HOLDS FOR THE TIME SET IN THE HIGH TORQUE INTERRUPT OFF DELAY, THE PUMPS WILL AUTOMATICALLY RESTART, THE PRESSURE CONE WILL BE ENERGIZED, AND THE PRESS WILL RETURN TO ITS REGULAR SPEED.

NOTE: IF THE SPRAY WASH CYCLE DELAY TIMER EXPIRES DURING A PRESS HIGH TORQUE INTERRUPT CONDITION, THE SPRAY WASH CYCLE WILL BE PAUSED UNTIL THE PRESS HIGH TORQUE INTERRUPT CONDITION IS REMOVED AND THE PRESSURE CONE HAS BEEN RE-ENERGIZED.

PRESS HIGH TORQUE INTERRUPT SHUTDOWN:

HIGH TORQUE SHUTDOWN WILL OCCUR IF THE NUMBER OF COUNTS OF HIGH TORQUE INTERRUPTS, SET IN THE HIGH TORQUE INTERRUPT FAULT COUNTER, OCCUR WITHIN A SET AMOUNT OF TIME. A HIGH TORQUE SHUTDOWN WILL ALSO OCCUR ONCE THE HIGH TORQUE SIGNAL IS REACHED AND MAINTAINED FOR A TIME SET IN THE MAINTAINED HIGH TORQUE SHUTDOWN DELAY TIMER. THE SYSTEM WILL ENTER SHUTDOWN MODE IMMEDIATELY WHEN A HIGH TORQUE SHUTDOWN OCCURS.

NOTE: TO RESET A HIGH TORQUE SHUTDOWN, PRESS THE RESET PUSHBUTTON.

SEQUENCE OF OPERATION

DEWATERING SYSTEM SHUTDOWN MODE CONDITIONS:

1. REMOTE CALL TO RUN SIGNAL REMOVED
 2. STOP PUSHBUTTON PRESSED ON THE OIU
 3. THE SPRAY WASH SELECTOR IS SWITCHED TO THE HAND OR OFF POSITION.
 4. THE SLUDGE PUMP IN REMOTE SIGNAL IS LOST.
 5. THE POLYMER SYSTEM IN REMOTE SIGNAL IS LOST.
 6. SLUDGE HOLDING TANK LOW LEVEL INDICATION RECEIVED.
- WHEN SHUTDOWN MODE CONDITIONS 1–6 OCCUR, THE SYSTEM WILL ENTER SHUTDOWN MODE.
7. SLUDGE PUMP FAULT INDICATION RECEIVED
 8. SLUDGE PUMP RUNNING INDICATION NOT RECEIVED WHILE CALLED TO RUN FOR THE TIME SET IN THE SLUDGE PUMP FAIL TO RUN FAULT DELAY TIMER
 9. SLUDGE LOW PRESSURE INDICATION RECEIVED
 10. SLUDGE HIGH PRESSURE INDICATION RECEIVED
 11. POLYMER SYSTEM LOW WATER PRESSURE INDICATION RECEIVED FOR THE TIME SET IN THE POLYMER SYSTEM LOW WATER PRESSURE FAULT DELAY TIMER
 12. POLYMER SYSTEM LOW POLYMER FLOW INDICATION RECEIVED FOR THE TIME SET IN THE POLYMER SYSTEM LOW POLYMER FLOW FAULT DELAY TIMER
 13. POLYMER SYSTEM RUNNING INDICATION NOT RECEIVED WHILE CALLED TO RUN FOR THE TIME SET IN THE POLYMER SYSTEM FAIL TO RUN FAULT DELAY TIMER
 14. ZERO SLUDGE FLOW INDICATION RECEIVED WHILE THE SYSTEM IS IN DEWATERING MODE FOR THE TIME SET IN THE SLUDGE ZERO FLOW FAULT DELAY TIMER
 15. WASH WATER LOW PRESSURE INDICATION RECEIVED FOR THE TIME SET IN THE WASH WATER LOW PRESSURE FAULT DELAY TIMER
 16. AIR SUPPLY LOW PRESSURE INDICATION RECEIVED
 17. PRESS HIGH PRESSURE SIGNAL MAINTAINED FOR THE TIME SET IN THE HIGH PRESSURE SHUTDOWN DELAY TIMER
 18. PRESS HIGH PRESSURE SIGNAL RECEIVED FOR THE AMOUNT OF TIMES SET IN THE HIGH PRESSURE COUNTS BEFORE SHUTDOWN COUNTER
 19. PRESS HIGH TORQUE MAINTAINED FOR THE TIME SET IN THE HIGH TORQUE SHUTDOWN DELAY TIMER
 20. PRESS HIGH TORQUE RECEIVED FOR THE AMOUNT OF TIMES SET IN THE HIGH TORQUE COUNTS BEFORE SHUTDOWN COUNTER

– WHEN ANY OF SHUTDOWN MODE CONDITIONS 7 – 20 OCCUR, THE SYSTEM DISTURBANCE PILOT LIGHT WILL ENERGIZE AND THE SYSTEM WILL ENTER SHUTDOWN MODE. THE SYSTEM DISTURBANCE PILOT LIGHT WILL REMAIN ENERGIZED UNTIL THE CONDITION IS CORRECTED.

ONCE THE SYSTEM IS IN SHUTDOWN MODE, THE EQUIPMENT WILL POWER DOWN IN THE FOLLOWING ORDER:

1. SLUDGE PUMP AND POLYMER SYSTEM CALL TO RUN SIGNALS WILL BE REMOVED AND THE PNEUMATIC CONE WILL DISENGAGE.
2. THE PRESS AND SPRAY WASH WILL CONTINUE UNTIL THE SHUTDOWN TIMER HAS COMPLETED.
3. ONCE THE SHUTDOWN TIMER HAS EXPIRED THE SPRAY WASH WILL COMPLETE ONE LAST LONG SPRAY WASH CYCLE. DURING THE FINAL SPRAY WASH CYCLE THE PNEUMATIC CONE WILL BE RE-ENGAGED.
4. THE SYSTEM WILL REMAIN OFF UNTIL THE NEXT DEWATERING MODE IS ACTIVATED

SEQUENCE OF OPERATION

SYSTEM FAULTS:

1. PRESS VFD DETECTS OVERLOAD
2. PRESS TORQUE OVERLOAD SETPOINT HAS BEEN REACHED
3. PRESS MOTOR THERMOSTAT IS TRIPPED
4. PRESS RUNNING INDICATION NOT RECEIVED WHILE CALLED TO RUN
5. CONVEYOR FAULT INDICATION RECEIVED
6. CONVEYOR RUNNING INDICATION NOT RECEIVED WHILE CALLED TO RUN
7. CONVEYOR ZERO SPEED FAULT INDICATION RECEIVED
8. SPRAY DRIVE HIGH CURRENT DETECTED
9. SPRAY DRIVE MOTOR OVERLOAD DETECTED
10. SPRAY DRIVE MOTOR THERMOSTAT IS TRIPPED
11. SPRAY DRIVE IS RUNNING REVERSE AND TRIGGERS THE AWAY PROXIMITY SWITCH.
12. SPRAY DRIVE IS RUNNING FORWARD AND TRIGGERS THE HOME PROXIMITY SWITCH.
13. SPRAY DRIVE IS RUNNING AND NEITHER PROXIMITY SWITCH IS TRIGGERED IN THE TIME SET IN THE OIU.

- WHEN ANY OF FAULTS 1 THROUGH 10 OCCUR, THE ALARM HORN, BEACON, AND SYSTEM DISTURBANCE PILOT LIGHT WILL ENERGIZE AND THE ENTIRE SYSTEM WILL SHUT DOWN IMMEDIATELY. THE ALARM BEACON AND SYSTEM DISTURBANCE PILOT LIGHT WILL REMAIN ENERGIZED UNTIL THE CONDITION IS CORRECTED.
- WHEN ANY OF FAULTS 11 THROUGH 13 OCCUR, THE ALARM HORN, BEACON, AND SYSTEM DISTURBANCE PILOT LIGHT WILL ENERGIZE AND THE ENTIRE SYSTEM WILL SHUT DOWN IMMEDIATELY. THE ALARM BEACON AND SYSTEM DISTURBANCE PILOT LIGHT WILL REMAIN ENERGIZED UNTIL THE OPERATOR ACKNOWLEDGES THE FOLLOWING PROMPTS:
- ALARM ANNUNCIATION MESSAGE
 - SPRAY DRIVE HAS MANUALLY BEEN ADJUSTED FROM THE OIU TO A SAFE POSITION
 - HOME AND AWAY PROXIMITY SWITCHES ARE WORKING PROPERLY

NOTES:

1. FOR SYSTEM FAULTS 11–13, THE SYSTEM RESET PUSHBUTTON WILL NOT BE ACTIVE UNTIL THE ABOVE THREE PROMPTS HAVE BEEN ACKNOWLEDGED BY THE OPERATOR.
2. IF THE PRESS OR SPRAY DRIVE SELECTORS ARE SWITCHED TO THE HAND OF OFF POSITION OR THE CONVEYOR IN REMOTE INDICATION IS REMOVED WHEN THE SYSTEM IS IN THE DEWATERING MODE, THE SYSTEM WILL SHUTDOWN IMMEDIATELY AND A MESSAGE WILL BE DISPLAYED ON THE OIU.

ALARM BEACON:

THE ALARM BEACON WILL ENERGIZE IF ANY OF THE SYSTEM FAULTS OCCUR. THE ALARM BEACON WILL REMAIN ENERGIZED UNTIL THE FAULT IS CLEARED AND THE SYSTEM RESET PUSHBUTTON IS PRESSED.

ALARM HORN AND ALARM SILENCE PUSHBUTTON:

THE ALARM HORN WILL ENERGIZE IF ANY OF THE SYSTEM FAULTS OCCUR. THE ALARM HORN CAN BE SILENCED AT ANY TIME BY PRESSING THE ALARM SILENCE PUSHBUTTON. THE ALARM SILENCE PUSHBUTTON WILL NOT RESET THE FAULT.


EMERGENCY STOP:

ALL DEWATERING EQUIPMENT WILL STOP IMMEDIATELY IF THE E-STOP PUSHBUTTON IS ACTIVATED. THE DEWATERING SYSTEM WILL NOT RESUME OPERATION UNTIL THE E-STOP IS RESET AND THE SYSTEM RESET PUSHBUTTON IS PRESSED.

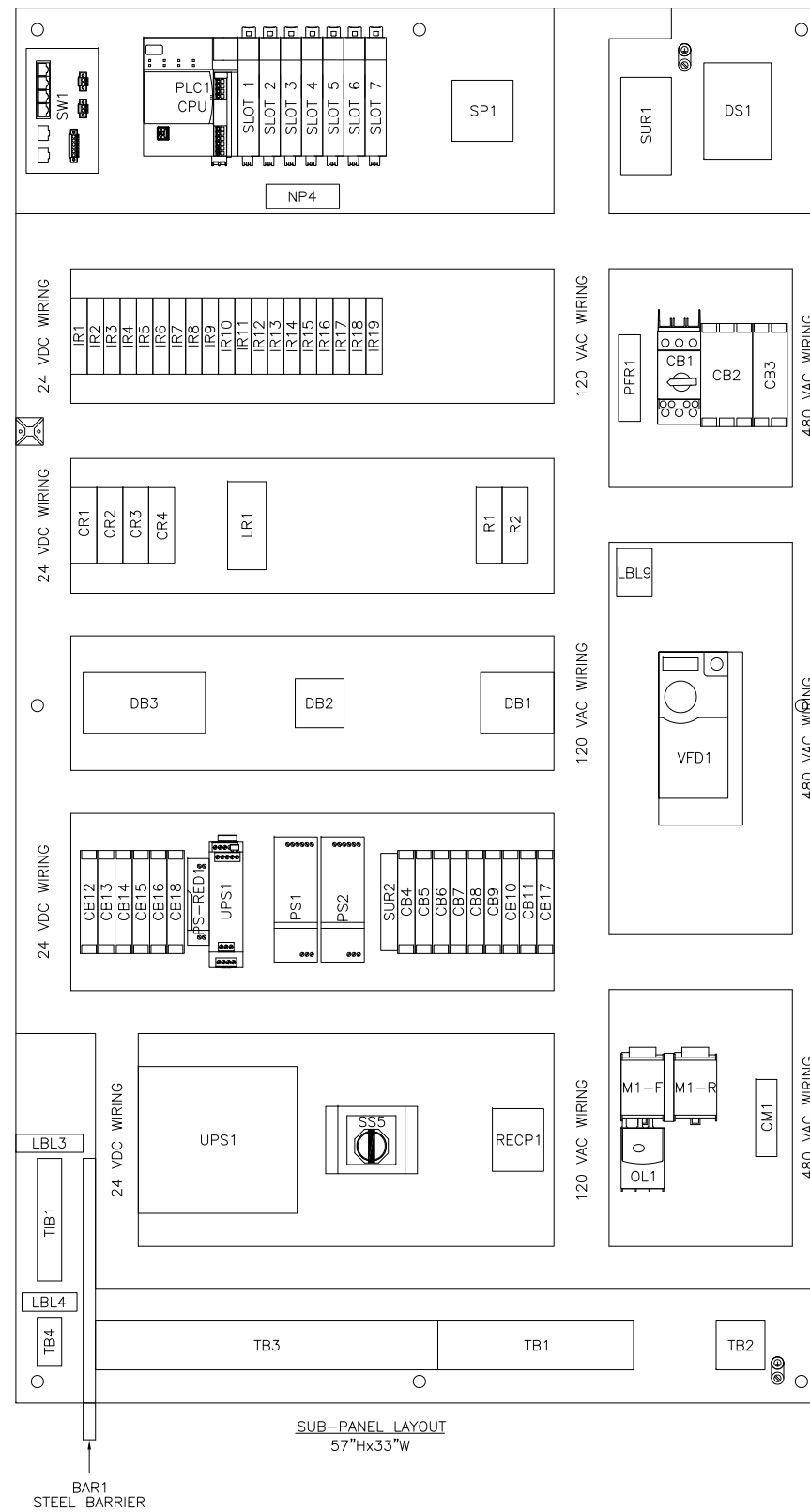
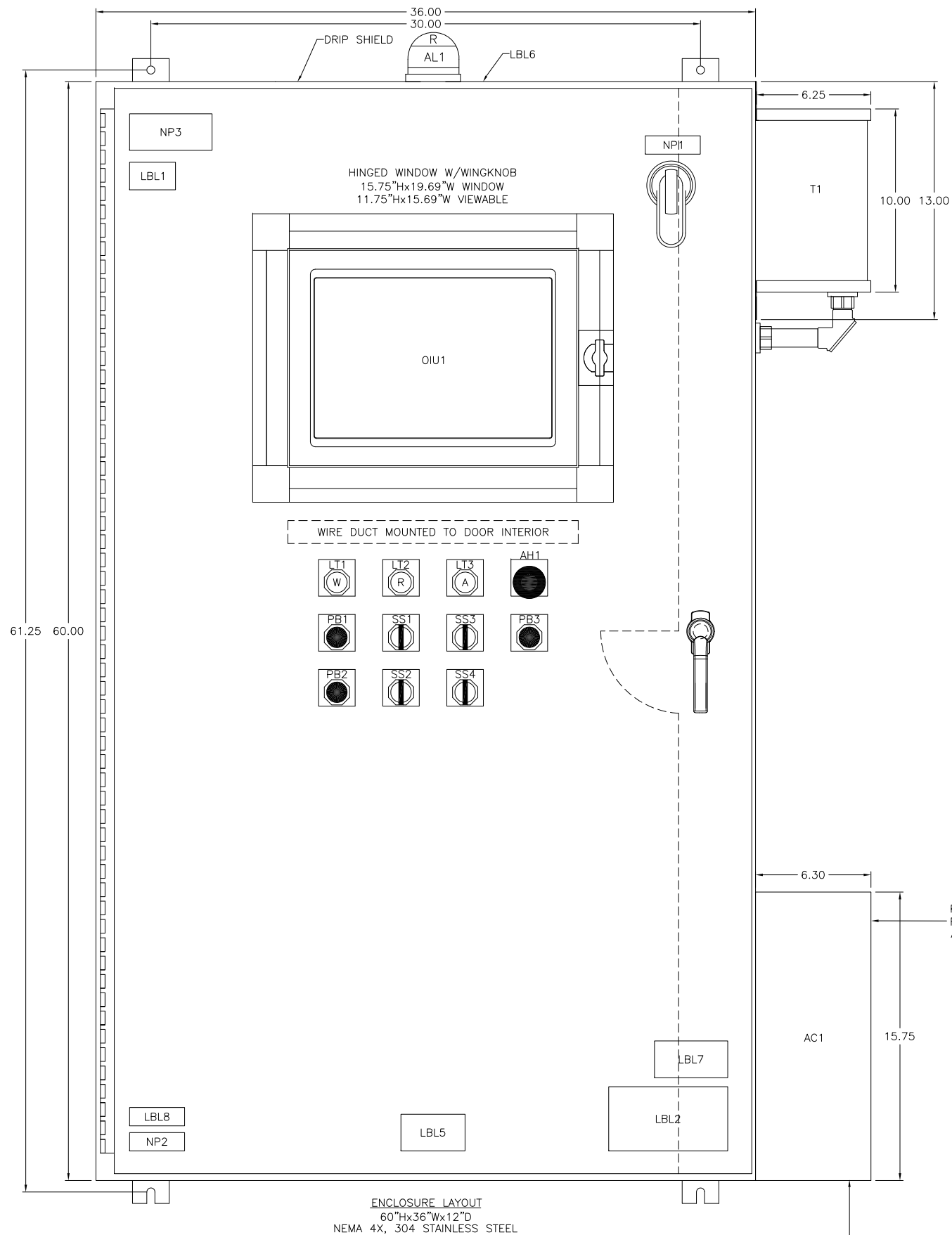
OIU – INFORMATION:

1. THE OIU WILL DISPLAY THE ELAPSED MOTOR RUN TIMES.
2. ALL ADJUSTABLE SETPOINTS CAN BE ACCESSED AND ADJUSTED THROUGH THE OIU.
3. THE PRESENT FAULT WILL BE DISPLAYED ON THE OIU.
4. THE HISTORY OF ALL PAST FAULTS CAN BE ACCESSED THROUGH THE OIU.
5. FLOW INDICATION AND AMOUNT SHALL BE DISPLAYED ON THE OIU.
6. RUNNING AND FAULTED STATUS FOR ALL MOTORS AND PUMPS WILL BE DISPLAYED ON THE OIU.
7. VFD SPEEDS MAY BE ADJUSTED THROUGH THE OIU.
8. THE PRESS MOTOR TORQUE WILL BE DISPLAYED ON THE OIU.
9. THE PRESS MINIMUM AND MAXIMUM SPEED RANGE WILL BE DISPLAYED ON THE OIU.
10. SLUDGE HOLDING TANK LEVEL WILL BE DISPLAYED ON THE OIU.
11. SLUDGE HOLDING TANK HIGH LEVEL BANNER WILL BE DISPLAYED ON THE OIU.
12. THE ALARM HISTORY WILL DISPLAY THE PEAK VALUE OF TORQUE MEASURED WHEN A TORQUE OVERLOAD FAULT OCCURS.

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					APPROVED	
DATE	REVISION	NO.	BY	CK	APP	DATE
						06/08/23

 <p>1009 Airle Parkway Denver, NC 28037 Tel. 704-949-1010 info@hhusa.net</p>		Q – PRESS CONTROL PANEL	
		ABERDEEN, ID	SCALE: NONE
PROJECT NUMBER: 73010205		DRAWING NO: HBR9328A16	
		16 OF 18	

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					DETAILED	
					CHECKED	MSN
					APPROVED	
					DATE	06/08/23

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Q - PRESS
CONTROL PANEL

ABERDEEN, ID SCALE: NONE

PROJECT NUMBER: 73010205 DRAWING NO: HBR9328A17

17 OF 18

PROVIDE 4" FOR PROPER AIR CIRCULATION

PROVIDE 8" CLEARANCE FOR FILTER REPLACEMENT

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PILOT DEVICE LEGENDPLATES (PANEL DOOR)				
DEVICE TAG	DESCRIPTOR LINE 1	DESCRIPTOR LINE 2	DESCRIPTOR LINE 3	
AH1	ALARM HORN			
LT1	CONTROL POWER	ON		
LT2	DEWATERING	MODE		
LT3	SYSTEM	DISTURBANCE		
PB1	EMERGENCY	STOP		
PB2	SYSTEM	RESET		
PB3	ALARM	SILENCE		
SS1	PRESS	OFF	HAND	AUTO
SS2	PRESS	OFF	FOR	REV
SS3	SPRAY WASH	OFF	HAND	AUTO
SS4	SPRAY DRIVE	OFF	HAND	AUTO
SS5	UPS MODE	OFF	BYPS	ON
MAX. CHARACTERS	15	15	4	4

LABEL DESCRIPTION	
LBL1	WARNING MULTIPLE SUPPLY SOURCES OPEN ALL DISCONNECTS BEFORE SERVICING EQUIPMENT OR OTHER UNIT WIRING
LBL2	DANGER HIGH VOLTAGE ENTRY BY QUALIFIED PERSON ONLY
LBL3	WARNING SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY
LBL4	INTRINSICALLY SAFE FIELD WIRING TERMINALS
LBL5	ELEMECH ELECTRICAL CONTROL SYSTEMS
LBL6	WARNING DAMAGE RESULTING FROM INSTALLATION OF TOP ENTRY CONDUIT WILL VOID WARRANTY. - AVOID CUTTING HOLES DIRECTLY ABOVE ANY ELECTRICAL COMPONENTS - PROTECT INTERNAL COMPONENTS FROM METAL SHAVINGS, CUTTING OILS, DEBRIS, AND MOISTURE - USE PROPER FITTINGS, MYERS TYPE 4 OR EQUAL - CONDUITS AND FITTING MUST BE WATERTIGHT TO PREVENT WATER ENTRY - ALL PENETRATIONS MUST BE SEALED OFF TO PREVENT INTRUSION OF MOISTURE, CORROSIVE GASES, AND VAPORS FROM ENTERING THE ENCLOSURE
LBL7	DANGER ARC FLASH AND SHOCK HAZARD FOLLOW ALL REQUIREMENTS NFPA 70E FOR SAFE WORK PRACTICES AND FOR PERSONAL PROTECTIVE EQUIPMENT.
LBL8	WARNING TO PREVENT IGNITION OF FLAMMABLE OR COMBUSTIBLE ATMOSPHERES, DISCONNECT POWER BEFORE SERVICING.
LBL9	VFD SETUP GUIDE

NAMEPLATES			
TAG	DESCRIPTOR LINE 1	DESCRIPTOR LINE 2	DESCRIPTOR LINE 3
NP1	480VAC-3PH-60HZ		
NP2	INTRINSICALLY	SAFE CIRCUITS	
NP3	CONTROL PANEL PROVIDES INTRINSICALLY SAFE CIRCUIT EXTENSIONS FOR USE IN CLASS I, DIVISION 1 GROUPS A,B,C,D; CLASS I, ZONE 0 AND 1, GROUP IIC; CLASS II, DIVISION 1 GROUPS E,F,G HAZARDOUS LOCATIONS WHEN CONNECTED PER PR ELECTRONICS INSTALLATION DRAWING NO. 5202QU01		
NP4	WARNING! TO AVOID DAMAGING ANY INPUT OR OUTPUT MODULE, VERIFY THE SA POWER REQUIREMENT OF EACH MODULE BEFORE POWER UP. MODULES MUST BE INSTALLED TO THE RIGHT OF THE CORRECT SA POWER SOURCE TO AVOID DAMAGE.		

NAMEPLATES AND LEGENDPLATES CONSTRUCTION					
	PANEL LEGENDPLATES	LCS LEGENDPLATES	NAMEPLATES	UL698 NAMEPLATES	DEVICE TAGS
TEXT COLOR	BLACK	BLACK	BLACK	BLACK	BLACK
BACKGROUND COLOR	WHITE/ YELLOW (E-STOPS)	WHITE/ YELLOW (E-STOPS)	WHITE	YELLOW	WHITE
MATERIAL	PHENOLIC ENGRAVED	PHENOLIC ENGRAVED	PHENOLIC ENGRAVED	PHENOLIC ENGRAVED	THERMAL TRANSFER
ATTACHMENT	ADHESIVE	ADHESIVE	ADHESIVE	ADHESIVE	ADHESIVE
TEXT SIZE	5/32" HIGH	5/32" HIGH	3/16" HIGH	1/8" HIGH	1/8" HIGH
DIMENSIONS	2.375"x2.375"	1.875"x1.875"	2.72"x1"	4"x2"	1"x1/2"
MAX. CHARACTERS PER LINE	15	15	17	35	7

PANEL DATA LABEL



ELEMECHINC.COM 630-499-7080

WARRANTY NOTICE
NO ALLOWANCE OR PAYMENT WILL BE MADE FOR WARRANTY REPAIR UNLESS PRIOR AUTHORIZATION HAS BEEN REQUESTED AND OBTAINED FROM THE ELEMECH SERVICE DEPT.

SERIAL: HBR9328 POWER: 3/60/480
REF: # 73010205 FLA: 9.0A
DATE: TBD LGST MOT: 5.4A

SHORT CIRCUIT CURRENT RATING
5 KA RMS SYMMETRICAL @ 480 VOLTS MAX

ENCLOSURE RATING: NEMA TYPE 4X

NAME: ABERDEEN, ID

CIRCUIT 2-4: 10A @ 120VAC

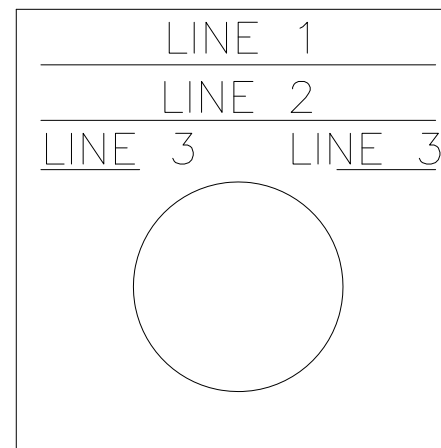
TORQUE SCREWS TO 12 IN-LBS

ALL FIELD WIRING SHALL BE 60°C COPPER CONDUCTOR ONLY

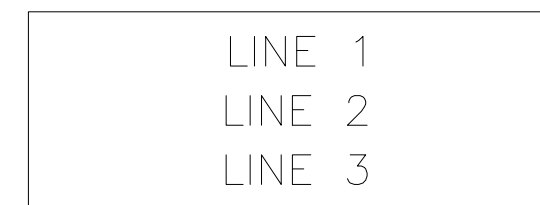
NOTE:
THE CONTROL PANEL WILL ALSO BE LISTED AND LABELED WITH A SERIALIZED LABEL AS OUTLINED IN THE CONTROL PANEL SPECIFICATION NOTES.

REPLACE TB3F WITH FAST ACTING FUSE RATED AT 250V, MAX 1 AMP FERRAZ-SHAWMUT AGC-1 OR EQUAL

PILOT DEVICE LEGENDPLATES



PANEL NAMEPLATE



DEVICE TAG



NOTE:
TEXT WILL REMAIN VERTICALLY CENTERED IF LESS THAN 3 LINES ARE USED.

DESIGNED	JN
DETAILED	
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DATE	06/08/23

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Tel. 704-949-1010
info@hhusa.net

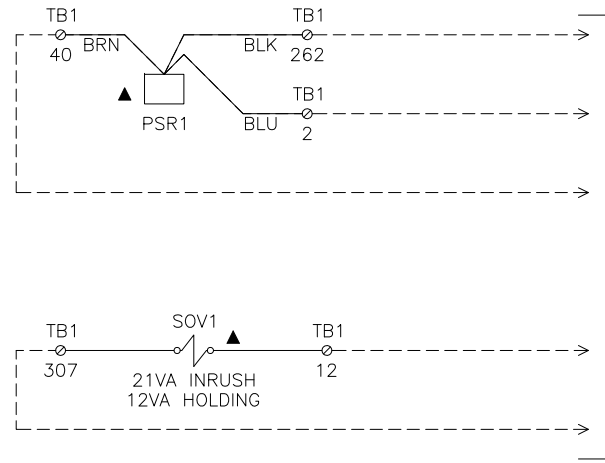
Q - PRESS
CONTROL PANEL

ABERDEEN, ID SCALE: NONE

PROJECT NUMBER: 73010205 DRAWING NO: HBR9328A18
18 OF 18

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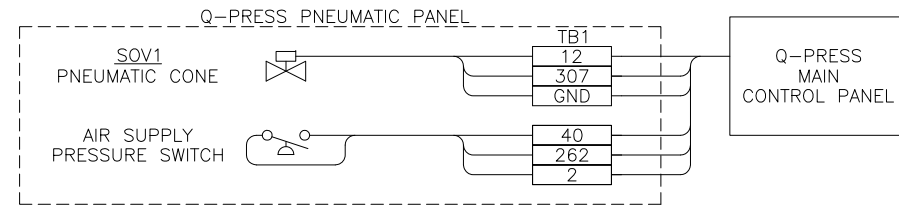
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TO Q-PRESS MAIN CONTROL PANEL

2
AIR SUPPLY OK PRESURE SWITCH
PNEUMATIC CONE SOLENOID VALVE
2

FIELD WIRING DIAGRAM



DESIGNED	JN			
DETAILED				
CHECKED	MSN			
APPROVED				
DATE	06/08/23			
NO.	BY	CK	APP	DATE

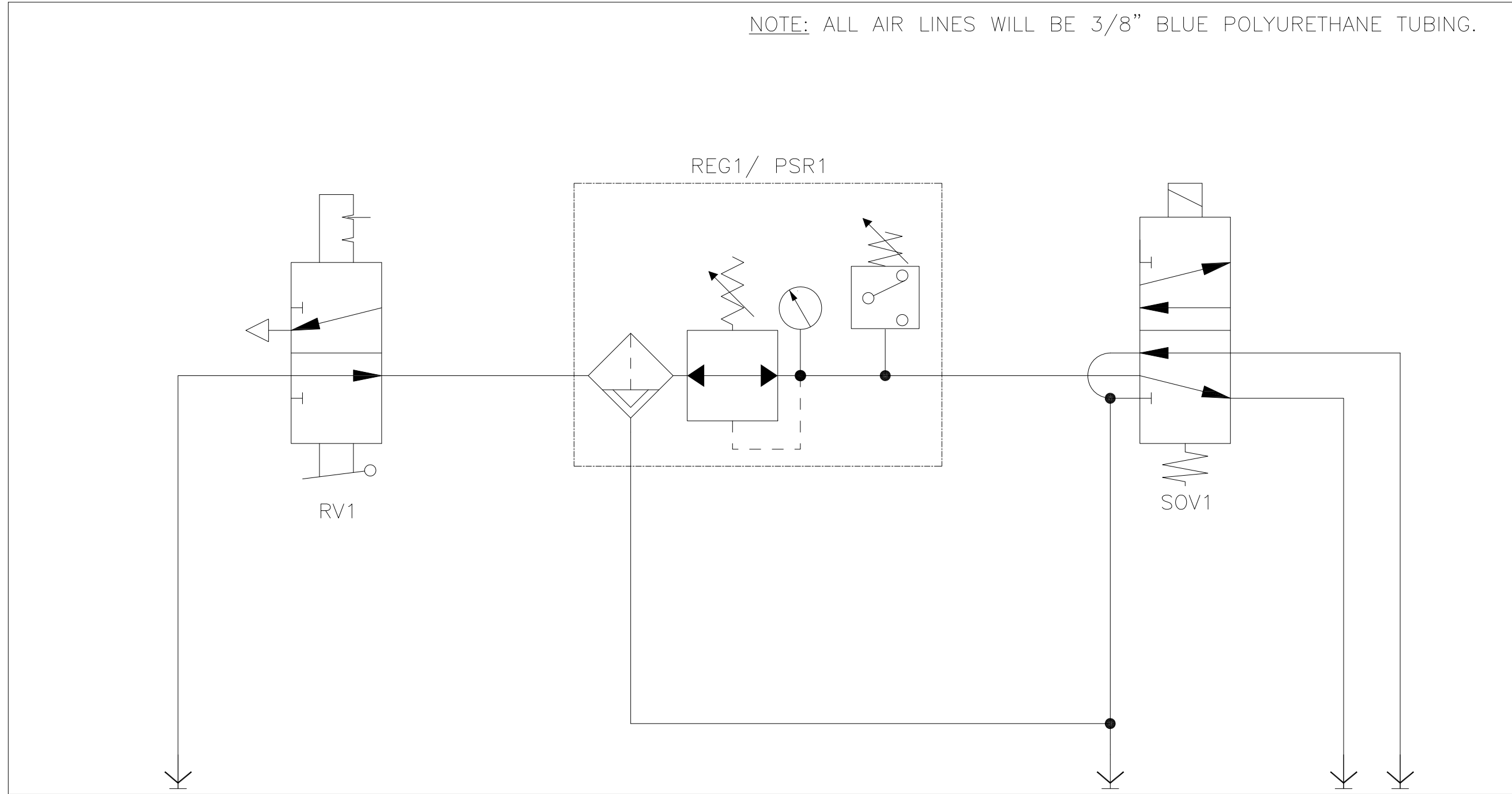
HUBER
TECHNOLOGY
1009 Airlie Parkway
Denver, NC 28037
Tel. 704-949-1010
info@hhusa.net

Q-PRESS PNEUMATIC CONTROL PANEL	
ABERDEEN, ID	SCALE: NONE
PROJECT NUMBER: 73010205	DRAWING NO: HBR9328B01
1 OF 3	

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PNEUMATIC
CONTROL PANEL

NOTE: ALL AIR LINES WILL BE 3/8" BLUE POLYURETHANE TUBING.



AIR SUPPLY
CONNECTION
STAINLESS STEEL
BULKHEAD
3/8"OD TUBE FITTING

DRAIN / EXHAUST
CONNECTION
STAINLESS STEEL
BULKHEAD
3/8"OD TUBE FITTING

CONTROL
CONNECTION
STAINLESS STEEL
BULKHEAD
3/8"OD TUBE FITTING

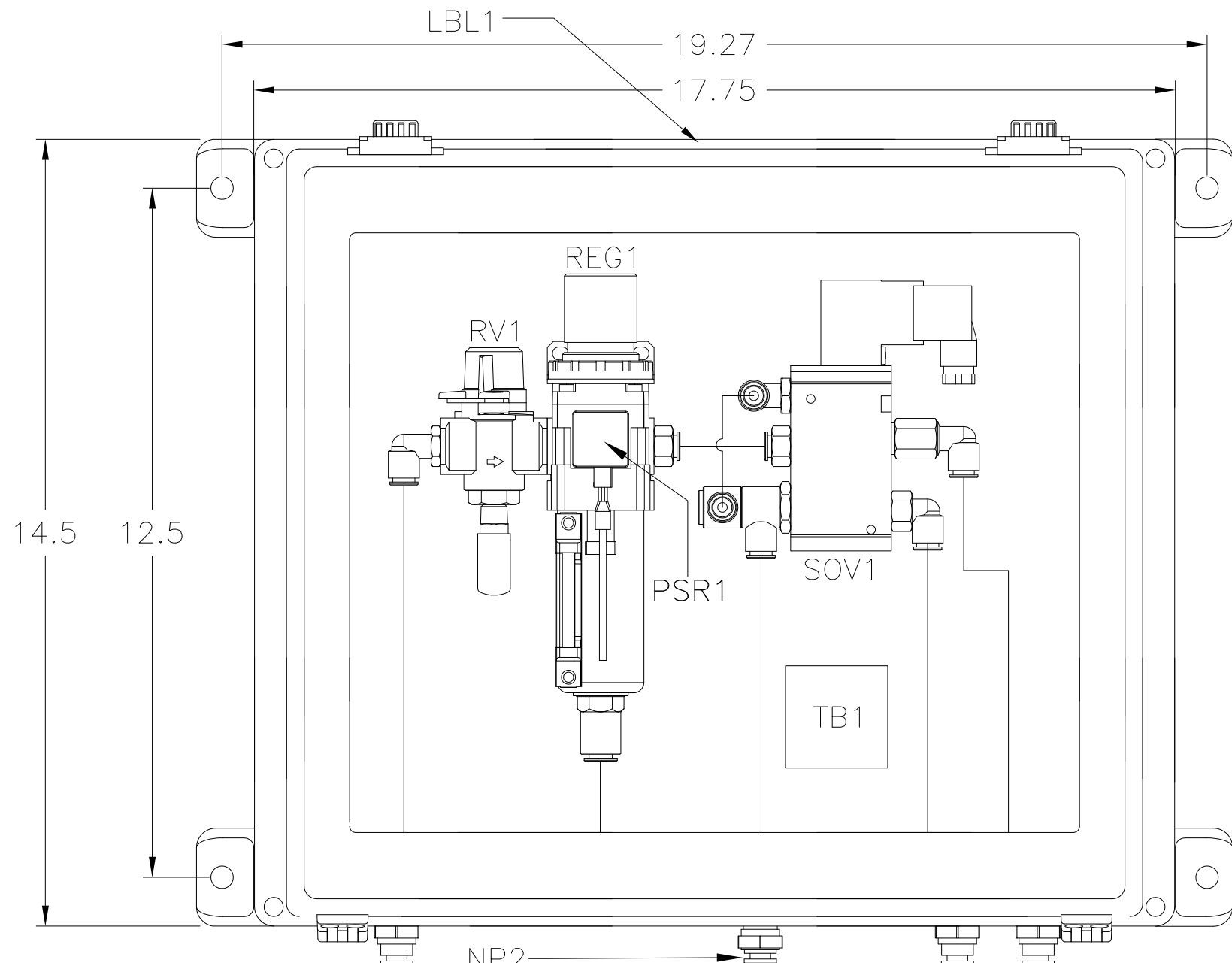
CONTROL
CONNECTION
STAINLESS STEEL
BULKHEAD
3/8"OD TUBE FITTING

DESIGNED	JN				
DETAILED					
CHECKED	MSN				
APPROVED					
DATE	REVISION	NO.	BY	CK	APP DATE
					06/08/23

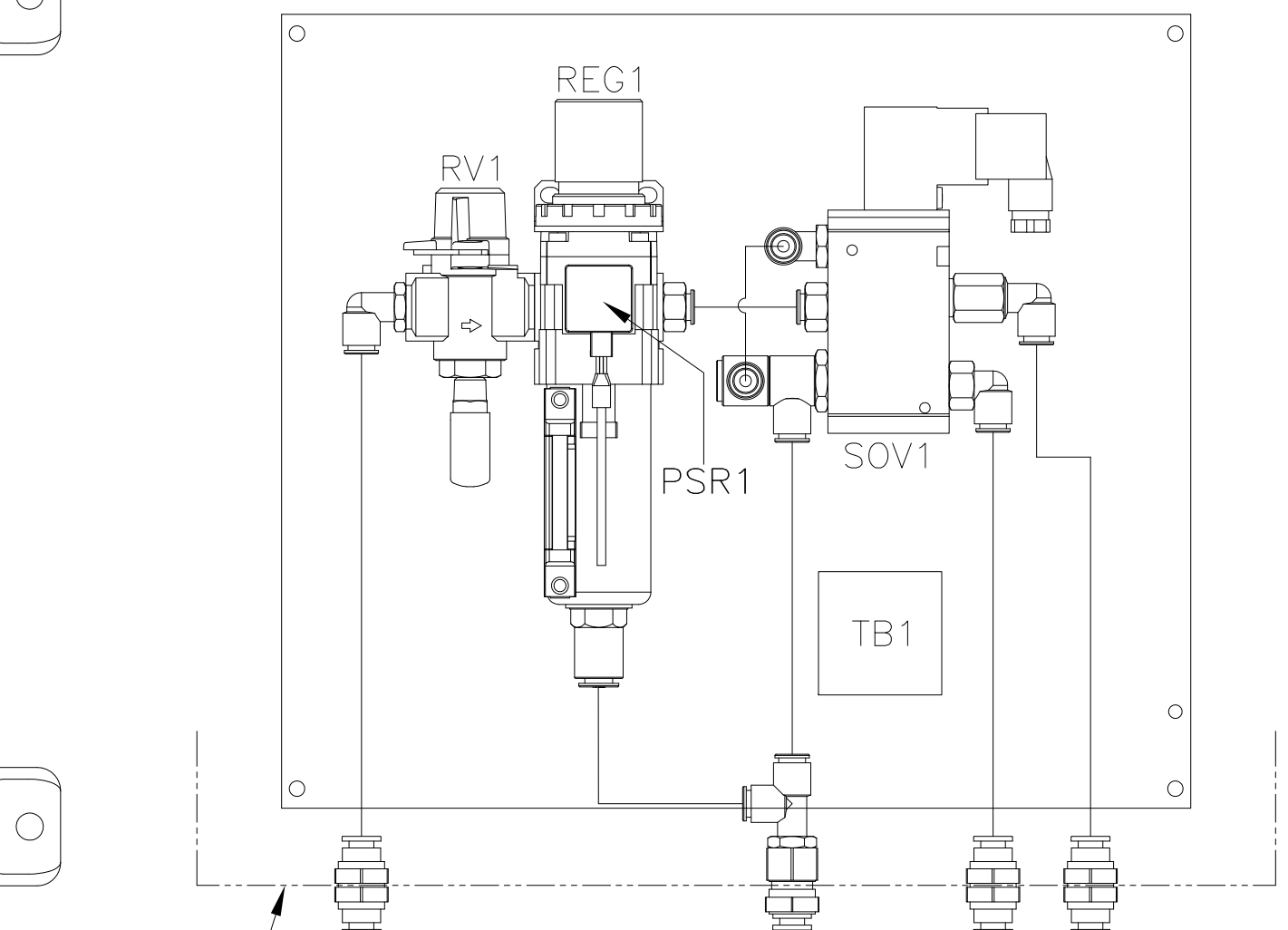
HUBER
TECHNOLOGY
1009 Airlie Parkway
Denver, NC 28037
Tel. 704-949-1010
info@hhusa.net

Q-PRESS PNEUMATIC CONTROL PANEL	
ABERDEEN, ID	SCALE: NONE
PROJECT NUMBER: 73010205	DRAWING NO: HBR9328B02 2 OF 3

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ENCLOSURE LAYOUT
 18"Hx14"Wx9"D
 NEMA 4X FIBERGLASS
 14.45"Hx11.06"W WINDOW



SUB-PANEL LAYOUT
 14.75"Hx12.88"W

LEGEND:
 NP1 - AIR SUPPLY CONNECTION
 NP2 - DRAIN CONNECTION
 NP3 - CONTROL CONNECTION
 NP4 - CONTROL CONNECTION

LBL1 - WARNING
 DAMAGE RESULTING FROM
 INSTALLATION OF TOP ENTRY
 CONDUIT WILL VOID WARRANTY
 - USE PROPER FITTINGS, MEYERS
 TYPE 4 OR EQUAL
 - PROTECT INTERIOR DEVICES
 FROM INSTALLATION DEBRIS
 - CONDUIT MUST BE SEALED
 WATERTIGHT TO PREVENT WATER
 ENTRY

DATE	REVISION	NO.	BY	CK	APP	DATE

DESIGNED	JN
DETAILED	
CHECKED	MSN
APPROVED	
	06/08/23

HUBER
TECHNOLOGY
 1009 Airlie Parkway
 Denver, NC 28037
 Tel. 704-949-1010
 info@hhusa.net

Q-PRESS PNEUMATIC
 CONTROL PANEL
 ABERDEEN, ID SCALE:
 NONE
 PROJECT NUMBER: 73010205 DRAWING NO: HBR9328B03
 3 OF 3

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Bill of Materials



Rev: 0

Date: 06-23-2023

By: JN

Section:

D

Job Number: HBR9328

Page # 1/1

Section Name:

Bill of Materials

Item	Component	Description	Manufacturer Part Number	QTY	Device
Q-Press - Main Control Panel (Quantity: 1)					
1	00-000-000	Wire, Hardware, Wire labels, etc.		2	
2	10-069-000	Wireway Duct Cover, 1.5"W, 6 Ft. Section, w/Panduit F Series	Panduit: C1.5WH6	6	
3	10-069-001	Wireway Duct Cover, 1"W, 6 Ft. Section, w/Panduit F Series	Panduit: C1WH6	6	
4	10-069-002	Wireway Duct Cover, 2"W, 6 Ft. Section, w/Panduit F Series	Panduit: C2WH6	9	
5	10-069-005	Wireway Duct, 1.5"Wx3"H, 6 Foot Section	Panduit: F1.5X3WH6	6	
6	10-069-007	Wireway Duct, 1"Wx3"H, 6 Foot Section	Panduit: F1X3WH6	6	
7	10-069-008	Wireway Duct, 2"Wx3"H, 6 Foot Section	Panduit: F2X3WH6	9	
8	25-000-A001	Legendplate Assembly, Yellow E-Stop, Standard Encl.	EleMech: 25-000-A001 Assembly	1	
9	25-000-A002	Legendplate Assembly, White, Black Text, Standard Encl.	EleMech: 25-000-A002 Assembly	10	
10	25-000-A019	Nameplate Assembly, White: Power Supply - 3/60/480VAC	EleMech: 25-000-A019 Assembly	1	
11	42-063-007	Terminal Block, Din Rail, 35MM Wide, 15 High, 2 Meters Long	Iboco: Omega 3 AF	2	
12	51-000-062	Wire, MTW Type, 600V, 105°C, CSA/UL1015, Tinned Copper	EleMech: 51-000-062	1	
13	52-000-003	Label, Underwriters Laboratories 698A, w/Decal Set	EleMech: 698A	1	
14	68-035-023	Air Cond, NEMA 4X, 800 BTU,115VAC,3.8 Amps,150WHTR,L2 Coated	Hoffman: T150116G173	1	AC1
15	01-005-008	Alarm Horn, Panel Mount, 24VDC, 45mm front, 22.5mm, NEMA 4X	Allen-Bradley: 855P-B30ME22	1	AH1
16	56-097-005	Beacon, Steady/Strobe, LED, NEMA 4X, 24VDC, Red, 1/2"Male -NS	Federal: LP22LED-012-024R	1	AL1
17	18-000-002	Steel Barrier, 14Ga., 0.5"Wx10.0"x6.0"D, Standard	EleMech: 18-000-002	1	BAR1
18	23-005-046	Motor Starter Protector, 3PH, 600V, 10-16 Amp Range, D/FRM	Allen-Bradley: 140MT-D9E-C16	1	CB1
19	23-005-050	Motor Starter Protector, Line Terminal Adapter, w/140MT-C,D	Allen-Bradley: 140MT-C-TE	1	CB1
20	03-058-119	Circuit Breaker, 1 Pole, 240VAC, 2A, 14kA, UL489, Type C	Square D: M9F42102	8	CB10-17
21	03-058-124	Circuit Breaker, 1 Pole, 240VAC, 8A, 14kA, UL489, Type C	Square D: M9F42108	1	CB18
22	03-058-148	Circuit Breaker, 3 Pole, 480VAC, 2A, 10kA, UL489, Type D	Square D: M9F43302	1	CB2
23	03-058-140	Circuit Breaker, 2 Pole, 480VAC, 8A, 10kA, UL489, Type D	Square D: M9F43208	1	CB3
24	03-058-126	Circuit Breaker, 1 Pole, 240VAC, 15A, 14kA, UL489, Type C	Square D: M9F42115	1	CB4
25	03-058-125	Circuit Breaker, 1 Pole, 240VAC, 10A, 14kA, UL489, Type C	Square D: M9F42110	2	CB5,6
26	03-058-123	Circuit Breaker, 1 Pole, 240VAC, 6A, 14kA, UL489, Type C	Square D: M9F42106	3	CB7-9
27	57-000-A030	Cable, Comm., Ethernet, CAT5e, 600V, RJ45M to RJ45M,Shielded	EleMech: 57-000-A030	2	CBL1,2
28	57-009-008	Cable, Comm., Ethernet, Cat. 5, 600V,4 PAIR, 24AWG, 6.6 FT	Belden: E505002-010S1	1	CBL3
29	04-094-000	Current Monitor, Selectable, SPDT, 120/24V ,2-100A, w/Delay	Gavazzi: DIB01CM24100A	1	CM1

Item	Component	Description	Manufacturer Part Number	QTY	Device
30	06-058-012	Control Relay, Bus Jumper, 2-Pole, w/Telemec. RXM Relay	Square D: RXZ S2	3	CR1-4
31	06-058-015	Control Relay, 3PDT,24VDC, 11Pin Spade, Indicator, Operator	Square D: RXM3AB2BD	4	CR1-4
32	38-058-003	Socket, 11 Pin Spade, Din, Screw Term., 3Tier, 250V w/3-Pole	Square D: RXZE2S111M	4	CR1-4
33	07-063-000	Distribution Block, End Cover, 4 Pole, 300V,10A, w/WK4E\U\VB	Wieland: 07.311.4053.1	2	DB
34	07-063-001	Distribution Block, Jumper, 4 Pole, 300V,10A, w/WK4E\U\VB	Wieland: Z7.210.3427	6	DB
35	07-063-002	Distribution Block, Single Pole, 10A, 300V, WK4E\U\VB	Wieland: 57.404.6955.1	24	DB
36	09-001-A030	Disconnect Assembly, Non-Fused, 60 Amp, NEMA 4X, 12" Depth	ABB: OT60F3 Assembly	1	DS1
37	11-000-340	Enclosure Drip Shield, Stainless Steel, Per Inch	EleMech: 11-000-340	36	EN1
38	11-000-A021	Wind Kit, Alum/Hinge,Wing Knob w/out Frame,16"Hx20"W	EleMech: 11-000-A021	1	EN1
39	11-035-143	Sub-Panel, Painted Steel, w/60"Hx36"W C. Hinge Encl	Hoffman: A-60P36	1	EN1
40	11-035-451	Enclosure, Nema 4X, 304SS, 60"Hx36"Wx12"D, C. Hinge, 3-PT	Hoffman: A-60H3612SSLP3PT	1	EN1
41	15-011-000	Ground Lug, 14AWG - 4AWG	Blackburn: L70	2	GND
42	06-058-027	Control Relay Retension Clip, w/Telemec. RPM 1-Pole Relay	Square D: RPZR235	18	IR1-18
43	06-058-028	Control Relay, SPDT, 24VDC, 5Pin Spade, Operator, 15A	Square D: RPM12BD	18	IR1-18
44	06-058-040	Diode, 6-250VDC, w/ RXM Sockets, RPZF1/2 Sockets	Square D: RXM040W	18	IR1-18
45	38-058-009	Socket, 5 Pin Spade, Din Mount, Screw Term., w/ RPM 1-Pole	Square D: RPZF1	18	IR1-18
46	52-137-002	Label, Multiple Supply Sources, Warning, 2.5"Wx1.5"H, Yellow	Nameplate Tech: 52-137-002	1	LBL1
47	52-137-001	Label, High Voltage, Danger, 6.5"Wx3.5"H, White/Black/Red	Nameplate Tech: 52-137-001	1	LBL2
48	06-005-077	Latching Relay, DPDT,24VDC, 11Pin Spade, Dual Coil	Allen-Bradley: 700HJD3Z2Z4	1	LR1
49	38-005-002	Socket, 11 Pin Spade, Din Rail Mount, Guarded Screw Terminal	Allen-Bradley: 700-HN153	1	LR1
50	32-005-A000	Pilot light, PTT, NEMA 4X, Universal, LED, White	Allen-Bradley: 800H-QRTH2W	1	LT1
51	32-005-A002	Pilot light, PTT, NEMA 4X, Universal, LED, Red	Allen-Bradley: 800H-QRTH2R	1	LT2
52	32-005-A003	Pilot light, PTT, NEMA 4X, Universal, LED, Amber	Allen-Bradley: 800H-QRTH2A	1	LT3
53	22-005-010	Aux. Contact, Top mounted, 3NO/1NC, w/A-B 100C/104C/300 Ser.	Allen-Bradley: 100-FA31	2	M1-F/R
54	22-005-117	Contact, 3PH, Reversing, NEMA 0, 1NO, 120VAC Coil, 18A	Allen-Bradley: 305-AOD-23	1	M1-F/R
55	25-000-A010	Nameplate Assembly, White, Black Text, 1"Hx3"W	EleMech: 25-000-A010 Assembly	3	NP1,2,4
56	25-000-A058	Nameplate Assembly, Yellow: Intrinsically Safe Circ: PR5202	EleMech: 25-000-A058 Assembly	1	NP3
57	26-005-091	OIU, PVP 7 Standard, 12" Display, 24VDC, Touch, Ethernet	Allen Bradley: 2711P-T12W21D8S	1	OIU1
58	HBR-170-P021	Program, OIU, PVP 7 12", Standard w/cplgx	EleMech: HBR-170-P021	1	OIU1
59	28-005-080	Overload Relay,E100, Adj Class,0.2-1.0A,w/100-C09...C23	Allen-Bradley: 193-1EFBB	1	OL1

Item	Component	Description	Manufacturer Part Number	QTY	Device
60	29-005-117	Pushbutton, E-Stop, NEMA 4X, Oper+1NC, Twist Rel. Red Head	Allen-Bradley: 800H-TFRXT6D2	1	PB1
61	29-005-002	Pushbutton, NEMA 4X, Oper+1NO, Flush Head, Black	Allen-Bradley: 800H-AR2D1	2	PB2,3
62	30-183-000	Phase Failure, Voltage Monitoring Relay,380-480VAC, 2 SPDT	Telemecanique: RM22TR33	1	PFR1
63	33-005-277	Compact 5069, Discrete Out., (16) 120AC/24DC Relay, 24VDC SA	Allen-Bradley: 5069-OW16	2	PLC1
64	33-005-280	Compact 5069, Term Block, 18 Pin, Screw Clamp, w/ I/O	Allen-Bradley: 5069-RTB18-SCREW	7	PLC1
65	33-005-282	Compact 5069, Term. Block, 6 Pin/4 Pin, Screw Clamp, w/CPU	Allen-Bradley: 5069-RTB64-SCREW	1	PLC1
66	33-005-299	Compact 5069, Analog Input, 8 Chnl., 24V SA Power	Allen-Bradley: 5069-IF8	1	PLC1
67	33-005-336	Compact 5069, CPU 0.6MB Mem, SD, 2-Ether, 8 Cards, 24VDC	Allen-Bradley: 5069-L306ER	1	PLC1
68	33-005-338	Compact 5069, Analog Output, 4 Chnl., 24V SA Power	Allen-Bradley: 5069-OF4	1	PLC1
69	33-005-347	Compact 5069, Discrete Input , (16) 24VDC Inputs, 24V SA	Allen-Bradley: 5069-IB16	3	PLC1
70	HBR-170-P008	Program, PLC, Compact Logix, Standard	EleMech: HBR-170-P008	1	PLC1
71	37-098-018	Power Supply, 240W, 85-264VAC IN, 24VDC OUT, UNO Series	Phoenix: 1096432	2	PS1,2
72	37-098-015	Power Supply, Redundancy Module, Din, w/ UNO	Phoenix: 2905489	1	PS-RED1
73	06-058-021	Control Relay, DPDT,120VAC, 8Pin Spade, Operator, 15A	Square D: RPM22F7	2	R1,2
74	38-058-008	Socket, 8 Pin Spade, Din Mount, Screw Term., w/ RPM 2-Pole	Square D: RPZF2	2	R1,2
75	14-543-001	Receptacle, Single, DIN Mount, 15A, w/Cover	Altech: DMRBU BLACKBOX	1	RECP1
76	13-000-A000	Spare Parts Box Assembly, Din Rail Mount	EleMech: 13-000-A000 Assembly	1	SP1
77	39-005-009	Selector Switch, NEMA 4X, 3 Pos. Maintained, 1NO-1NC	Allen-Bradley: 800H-JR2A	4	SS1,3-5
78	39-005-011	Selector Switch, Nema 4X, 3 Pos. Spring Fr. Right, 1NO-1NC	Allen-Bradley: 800H-JR5A	1	SS2
79	02-005-000	Contact Block, 1NO/1NC, w/A-B 800 Series	Allen-Bradley: 800T-XA	1	SS5
80	35-000-000	Pilot Device Mounting Bracket, 1 Device, Sub-Pan Mount	EleMech: GP-1	1	SS5
81	40-030-001	Surge Suppressor, 277/480V Wye, 3 Phase, 200kA, DIN	Mersen: STP480Y07	1	SUR1
82	40-030-002	Surge Suppressor, 1 Pole, 120VAC, 200kA SCCR, DIN	Mersen: STP120P07	1	SUR2
83	33-005-312	MAT-Ethernet Switch, 6 RJ45, Stratix 5700, Managed, Lite	Allen-Bradley: 1783-BMS06TL	1	SW1
84	41-018-A110	Transformer Assembly, 480/240-120VAC, 1.5KVA, 304SS	Cutler-Hammer: S20N11P16PSS Assembly	1	T1
85	42-063-001	Terminal Block, End Plate, Gray, w/WK4/U	Wieland: 07.311.0155.0	5	TB
86	42-063-003	Terminal Block, Single Pole Gray, 30A, 600V, 6MM Wide, WK4/U	Wieland: 57.504.0055.0	97	TB
87	42-063-015	Terminal Block, Jumper, w/WK4/U, 02 pole, Insulated	Wieland: Z7.281.1227	2	TB
88	42-063-000	Terminal Block, Labels, Custom Printed, w/WK4/U	Wieland: 04.242.6353-CUSTOM	260	TB,DB
89	42-063-004	Terminal Block, Ground, 30A, 600V, 6MM Wide, w/WK4/U	Wieland: 57.504.9055.0	14	TB,DB

Item	Component	Description	Manufacturer Part Number	QTY	Device
90	42-063-009	Terminal Block, End Clamp, w/WKN10/U	Wieland: Z5.522.8553	16	TB,DB
91	42-063-008	Terminal Block, Labels, Blank, w/WK4/U-(600 tags per box)	Wieland: Z4.242.6353	22	TB1
92	42-005-027	Terminal Block, Single Pole, 25A, 600V, 5.1MM Wide, 1492J3	Allen-Bradley: 1492-J3	7	TB2
93	42-005-029	Terminal Block, End Plate, Grey, w/1492-J Series	Allen-Bradley: 1492-EBJ3	1	TB2
94	42-005-035	Terminal Block, Labels, Blank, w/1492-J	Allen-Bradley: 1492-M5X5	1	TB2
95	13-012-034	Fuse, Glass, Fast Acting, 250VAC, 1A, 6.3mm	Bussman: AGC-1	9	TB3F
96	42-063-026	Terminal Block, Fused, Single Pole, 15A, 600V, 6.3mm Fuses	Wieland: 57.904.6355.0	9	TB3F
97	18-247-001	Transformer Isolated Barrier, Dual Channel, 120VAC/24VDC	PR Electronics: 5202B2	1	TIB1
98	48-000-039	Mounting Case, UPS Batt, Phoenix Quint, 7.5AH, 2 Batteries	EleMech: 48-000-039	1	UPS1
99	48-098-004	UPS, QUINT, 24VDC, 10A DIN Mtd.	Phoenix: 2320225	1	UPS1
100	48-592-002	UPS, Battery, 12VDC, 7.5Ah, T2 Spade Term	SigmatTek: SP12-7.5 T2	2	UPS1
101	52-000-068	Label, PowerFlex 525, Video QR Code	EleMech: 52-000-068	1	VFD
102	HBR-170-P019	Program, VFD, PowerFlex 525, Standard	EleMech: HBR-170-P019	1	VFD
103	50-005-075	Variable Freq. Drive, Open, 5HP, 480VAC, 3PH, Powerflex 525	Allen-Bradley: 25B-D010N104	1	VFD1
Q-Press Pressure Cone Pneumatic Panel (Standard) (Quantity: 1)					
104	51-000-062	Wire, MTW Type, 600V, 105°C, CSA/UL1015, Tinned Copper	EleMech: 51-000-062	1	
105	94-255-009	Tubing, 3/8"OD, Polyurethane, Blue, 100 Foot Roll	SMC USA: TIUB11BU-33	1	
106	94-255-008	Fitting, Bulkhead, Union, SS, w/ 3/8"OD Tube x 3/8"OD Tube	SMC USA: KQG2E11-00	3	BU1,3,4
107	94-255-042	Fitting, Bulkhead Union Connector 3/8"OD Tubex3/8"NPT 316SS	SMC USA: KQG2E11-N03	1	BU2
108	11-035-129	Sub-Panel, Painted Steel, w/16"Hx14"W Junction Box	Hoffman: A-16P14	1	EN1
109	11-035-176	Enclosure Mounting Feet, Fiberglass, J box	Hoffman: A-50MFKR	1	EN1
110	11-035-338	Enclosure, Nema 4X, Fiberglass, 17.5"Hx14"Wx8.78"D, w/Window	Hoffman: A-18149JFGQRPWR	1	EN1
111	94-255-005	Fitting, Male Connector, Straight, 3/8"OD Tube x 3/8"MNPT	SMC USA: KQ2H11-36AS	2	FIT
112	94-255-006	Fitting, Male Elbow, 3/8"OD Tube x 3/8"MNPT	SMC USA: KQ2L11-36AS	2	FIT
113	94-255-015	Fitting, Male Elbow, Extended, 3/8" OD Tube x 3/8" MNPT	SMC USA: KQ2W11-36AS	1	FIT
114	94-255-020	Fitting, Male Run Tee, 3/8"OD x 3/8" OD x 3/8" NPT	SMC USA: KQ2Y11-36AS	1	FIT
115	94-255-048	Fitting, Male Double Rotating Elbow, 3/8"OD Tube x 1/4"MNPT	SMC USA: KQ2VD11-35AS	1	FIT
116	94-255-049	Fitting, Male Elbow, 3/8"OD Tube x 1/4"MNPT	SMC USA: KQ2L11-35AS	1	FIT
117	94-255-004	Regulator, 0-120PSI, 3/8"NPT, w/ Filter and pressure switch	SMC USA: AW30-NO3BDE3-8Z	1	REG1
118	74-255-004	Solenoid Valve, Muffler, 1/4" NPT Port, 30 dB Reduction	SMC USA: AN20-NO2	1	RV1

Item	Component	Description	Manufacturer Part Number	QTY	Device
119	94-255-016	Relief Valve, 3-Port, Locking Holes, 3/8"NPT	SMC USA: VHS30-N03-Z	1	RV1
120	94-255-017	Relief Valve, Spacer, w/ Bracket	SMC USA: Y300T	1	RV1
121	74-255-006	Solenoid Valve, 2 Pos, Single, (3) 3/8"/(2) 1/4" NPT, 120VAC	SMC USA: VFS3120-3DZ-03T	1	SOV1
122	94-215-004	Fitting, Tube Connector, Straight, 3/8" OD x 10mm OD	McMaster-Carr: 5779K259	2	SPARE
123	42-063-000	Terminal Block, Labels, Custom Printed, w/WK4/U	Wieland: 04.242.6353-CUSTOM	12	TB1
124	42-063-001	Terminal Block, End Plate, Gray, w/WK4/U	Wieland: 07.311.0155.0	1	TB1
125	42-063-003	Terminal Block, Single Pole Gray, 30A, 600V, 6MM Wide, WK4/U	Wieland: 57.504.0055.0	5	TB1
126	42-063-004	Terminal Block, Ground, 30A, 600V, 6MM Wide, w/WK4/U	Wieland: 57.504.9055.0	1	TB1
127	42-063-007	Terminal Block, Din Rail, 35MM Wide, 15 High, 2 Meters Long	Iboco: Omega 3 AF	1	TB1
128	42-063-009	Terminal Block, End Clamp, w/WKN10/U	Wieland: Z5.522.8553	2	TB1
Spare Parts / Ship Loose (Total Quantity Provided)					
129	13-012-034	Fuse, Glass, Fast Acting, 250VAC, 1A, 6.3mm	Bussman: AGC-1	9	SPARE
130	61-000-012	Labor, Engineering, Submittal, Schematics, BOM	EleMech: 61-000-012	1	ENG

Catalog Cuts

5SJ4 1 10 - 7 HG41 **SIEMENS**

a b c d e

a Frame Style	
Code	Description
5SJ4	Standard Frame

b Poles	
Code	Description
1	1-Pole
2	2-Pole
3	3-Pole

c Rated Current	
Code	Rated Current (I _n)
14	0.3
05	0.5
01	1
15	1.6
02	2
03	3
04	4
11	5
06	6
08	8
10	10
13	13
18	15
16	16
20	20
25	25
30	30
32	32
25	35
40	40
45	45
50	50
60	60
63	63

d Trip Curve (Characteristic)			
Code	Trip Curve	Magnetic Trip Point	Thermal Trip Point
6	B	3 to 5 I _n	1.13 to 1.45 Breaker Rating
7	C	5 to 10 I _n	
8	D	10 to 20 I _n	

e Version	
Code	Description
HG40	240 VAC, Same Priority
HG41	240 VAC
HG42	480Y/277 VAC

Certifications:
CE
UL Listed and Certified to Canadian Standards
HACR Rated

SIEMENS 5SJ4 ... HG41

Rev: 0	Device Tag: CB5
Date: MM/DD/YYYY	Job Number: ELE 5000
By: Engineer initials	Page # 1/1

Manuf. Pts: SIEMENS: 5SJ4102-7HG40

ELEMECH
630-499-7080 www.elemechinc.com

03-056-035
EleMech Part Number Refer to Bill of Materials for more information

03-056-***
A '***' Suffix indicates this information is for multiple devices.

Refer to Electrical Drawings

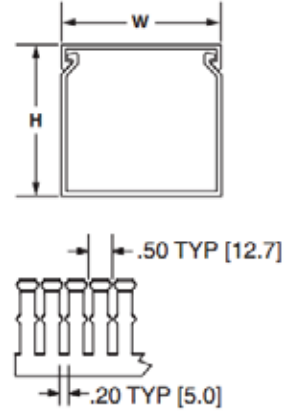
Manufacturer: Model Number

Reference Job #

- Narrow slot/finger design provides more slots to fit the spacing of high-density terminal blocks and other hardware
- Material: Lead-free PVC
- UL recognized continuous use temperature: 122°F (50°C)
- UL 94 flammability rating of V-0
- Conforms with NFPA 79-2007 section 13.3.1 requirement for flame retardant material
- Provided with mounting holes
- Base and cover length is 6 feet



Base Part Number	Duct Size (W x H)*		Slot Width		Cover Part Number	Std. Pkg. Qty.	Base Ctn. Qty.	Cover Ctn. Qty.
	In.	mm	In.	mm				
F.5X.5LG6	0.69 x 0.60	17.5 x 15.2	0.20	5.0	C.5LG6	6	120	120
F.5X1LG6	0.69 x 1.06	17.5 x 26.9	0.20	5.0	C.5LG6	6	120	120
F.75X.75LG6	0.93 x 0.82	23.6 x 20.9	0.20	5.0	C.75LG6	6	120	120
F.75X1.5LG6	0.93 x 1.57	23.6 x 39.9	0.20	5.0	C.75LG6	6	120	120
F1X1LG6	1.26 x 1.13	32.0 x 28.7	0.20	5.0	C1LG6	6	120	120
F1X1.5LG6	1.26 x 1.62	32.0 x 41.1	0.20	5.0	C1LG6	6	120	120
F1X2LG6	1.26 x 2.12	32.0 x 53.8	0.20	5.0	C1LG6	6	120	120
F1X3LG6	1.26 x 3.12	32.0 x 79.2	0.20	5.0	C1LG6	6	120	120
F1X4LG6	1.26 x 4.10	32.0 x 104.1	0.20	5.0	C1LG6	6	60	120
F1.5X1LG6	1.75 x 1.12	44.5 x 28.4	0.20	5.0	C1.5LG6	6	120	120
F1.5X1.5LG6	1.75 x 1.62	44.5 x 41.1	0.20	5.0	C1.5LG6	6	120	120
F1.5X2LG6	1.75 x 2.12	44.5 x 53.8	0.20	5.0	C1.5LG6	6	120	120
F1.5X3LG6	1.75 x 3.12	44.5 x 79.2	0.20	5.0	C1.5LG6	6	120	120
F1.5X4LG6	1.75 x 4.10	44.5 x 104.1	0.20	5.0	C1.5LG6	6	60	120
F2X1LG6	2.25 x 1.12	57.2 x 28.4	0.20	5.0	C2LG6	6	120	120
F2X1.5LG6	2.25 x 1.62	57.2 x 41.1	0.20	5.0	C2LG6	6	120	120
F2X2LG6	2.25 x 2.12	57.2 x 53.8	0.20	5.0	C2LG6	6	120	120
F2X3LG6	2.25 x 3.12	57.2 x 79.2	0.20	5.0	C2LG6	6	60	120
F2X4LG6	2.25 x 4.10	57.2 x 104.1	0.20	5.0	C2LG6	6	60	120
F2X5LG6	2.25 x 5.10	57.2 x 129.5	0.20	5.0	C2LG6	6	60	120
F2.5X3LG6	2.75 x 3.12	69.9 x 79.2	0.20	5.0	C2.5LG6	6	120	120
F3X1LG6	3.25 x 1.12	82.6 x 28.4	0.20	5.0	C3LG6	6	120	120
F3X2LG6	3.25 x 2.12	82.6 x 53.8	0.20	5.0	C3LG6	6	120	120
F3X3LG6	3.25 x 3.12	82.6 x 79.2	0.20	5.0	C3LG6	6	60	120
F3X4LG6	3.25 x 4.10	82.6 x 104.1	0.20	5.0	C3LG6	6	60	120
F3X5LG6	3.25 x 5.10	82.6 x 129.5	0.20	5.0	C3LG6	6	60	120
F4X2LG6	4.25 x 2.12	108.0 x 53.8	0.20	5.0	C4LG6	6	60	120
F4X3LG6	4.25 x 3.12	108.0 x 79.2	0.20	5.0	C4LG6	6	60	120
F4X4LG6	4.25 x 4.10	108.0 x 104.1	0.20	5.0	C4LG6	6	60	120
F4X5LG6	4.25 x 5.10	108.0 x 129.5	0.20	5.0	C4LG6	6	60	120
F6X4LG6	6.25 x 4.15	158.8 x 105.4	0.20	5.0	C6LG6	6	60	120



Part number shown for LG (Light Gray). For other color availability see color selection guide, page C1.48.

Base and cover sold separately.

**"H" dimension includes duct and cover.

Part Numbering System for Panduct® Wiring Duct

G	2	X	2	LG	-	6	-A
Type	Nominal Width In. or mm	Nominal Height In. or mm		Color		Length 6 ft. or 2m	Options
G = Wide Slot F = Narrow Slot FL = Flexible Duct FS = Solid Wall H = Hinged Cover Wide Slot HN = Hinged Cover, Narrow Slot HS = Hinged Cover, Solid Wall D = Round Hole NNC = Halogen Free, Metric NE = Halogen Free MC = Narrow Slot, Metric TNC = Low Smoke, Halogen Free				LG = Light Gray WH = White BL = Black IB = Intrinsic Blue IG = International Gray			-A = Adhesive backed NM = No mounting holes = Leave blank for no options



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By: JN	Page # 1/1	

Manuf.: . PNo:

Panduit: C1.5WH6

10-069-000

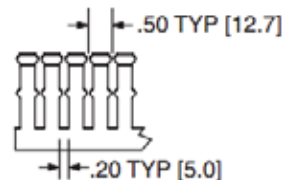
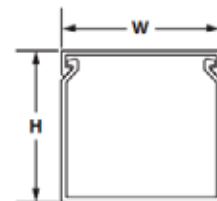
Panduit® Type F Narrow Slot Wiring Duct



- Narrow slot/finger design provides more slots to fit the spacing of high-density terminal blocks and other hardware
- Material: Lead-free PVC
- UL recognized continuous use temperature: 122°F (50°C)
- UL 94 flammability rating of V-0
- Conforms with NFPA 79-2007 section 13.3.1 requirement for flame retardant material
- Provided with mounting holes
- Base and cover length is 6 feet



Base Part Number	Duct Size (W x H)*		Slot Width		Cover Part Number	Std. Pkg. Qty.	Base Ctn. Qty.	Cover Ctn. Qty.
	In.	mm	In.	mm				
F.5X.5LG6	0.69 x 0.60	17.5 x 15.2	0.20	5.0	C.5LG6	6	120	120
F.5X1LG6	0.69 x 1.06	17.5 x 26.9	0.20	5.0	C.5LG6	6	120	120
F.75X.75LG6	0.93 x 0.82	23.6 x 20.9	0.20	5.0	C.75LG6	6	120	120
F.75X1.5LG6	0.93 x 1.57	23.6 x 39.9	0.20	5.0	C.75LG6	6	120	120
F1X1LG6	1.26 x 1.13	32.0 x 28.7	0.20	5.0	C1LG6	6	120	120
F1X1.5LG6	1.26 x 1.62	32.0 x 41.1	0.20	5.0	C1LG6	6	120	120
F1X2LG6	1.26 x 2.12	32.0 x 53.8	0.20	5.0	C1LG6	6	120	120
F1X3LG6	1.26 x 3.12	32.0 x 79.2	0.20	5.0	C1LG6	6	120	120
F1X4LG6	1.26 x 4.10	32.0 x 104.1	0.20	5.0	C1LG6	6	60	120
F1.5X1LG6	1.75 x 1.12	44.5 x 28.4	0.20	5.0	C1.5LG6	6	120	120
F1.5X1.5LG6	1.75 x 1.62	44.5 x 41.1	0.20	5.0	C1.5LG6	6	120	120
F1.5X2LG6	1.75 x 2.12	44.5 x 53.8	0.20	5.0	C1.5LG6	6	120	120
F1.5X3LG6	1.75 x 3.12	44.5 x 79.2	0.20	5.0	C1.5LG6	6	120	120
F1.5X4LG6	1.75 x 4.10	44.5 x 104.1	0.20	5.0	C1.5LG6	6	60	120
F2X1LG6	2.25 x 1.12	57.2 x 28.4	0.20	5.0	C2LG6	6	120	120
F2X1.5LG6	2.25 x 1.62	57.2 x 41.1	0.20	5.0	C2LG6	6	120	120
F2X2LG6	2.25 x 2.12	57.2 x 53.8	0.20	5.0	C2LG6	6	120	120
F2X3LG6	2.25 x 3.12	57.2 x 79.2	0.20	5.0	C2LG6	6	60	120
F2X4LG6	2.25 x 4.10	57.2 x 104.1	0.20	5.0	C2LG6	6	60	120
F2X5LG6	2.25 x 5.10	57.2 x 129.5	0.20	5.0	C2LG6	6	60	120
F2.5X3LG6	2.75 x 3.12	69.9 x 79.2	0.20	5.0	C2.5LG6	6	120	120
F3X1LG6	3.25 x 1.12	82.6 x 28.4	0.20	5.0	C3LG6	6	120	120
F3X2LG6	3.25 x 2.12	82.6 x 53.8	0.20	5.0	C3LG6	6	120	120
F3X3LG6	3.25 x 3.12	82.6 x 79.2	0.20	5.0	C3LG6	6	60	120
F3X4LG6	3.25 x 4.10	82.6 x 104.1	0.20	5.0	C3LG6	6	60	120
F3X5LG6	3.25 x 5.10	82.6 x 129.5	0.20	5.0	C3LG6	6	60	120
F4X2LG6	4.25 x 2.12	108.0 x 53.8	0.20	5.0	C4LG6	6	60	120
F4X3LG6	4.25 x 3.12	108.0 x 79.2	0.20	5.0	C4LG6	6	60	120
F4X4LG6	4.25 x 4.10	108.0 x 104.1	0.20	5.0	C4LG6	6	60	120
F4X5LG6	4.25 x 5.10	108.0 x 129.5	0.20	5.0	C4LG6	6	60	120
F6X4LG6	6.25 x 4.15	158.8 x 105.4	0.20	5.0	C6LG6	6	60	120



Part number shown for LG (Light Gray). For other color availability see color selection guide, page C1.48.

Base and cover sold separately.

**"H" dimension includes duct and cover.

Part Numbering System for Panduit® Wiring Duct

G	2	X	2	LG	-	6	-A
Type	Nominal Width In. or mm	Nominal Height In. or mm		Color		Length 6 ft. or 2m	Options
G = Wide Slot F = Narrow Slot FL = Flexible Duct FS = Solid Wall H = Hinged Cover Wide Slot HN = Hinged Cover, Narrow Slot HS = Hinged Cover, Solid Wall D = Round Hole NNC = Halogen Free, Metric NE = Halogen Free MC = Narrow Slot, Metric TNC = Low Smoke, Halogen Free				LG = Light Gray WH = White BL = Black IB = Intrinsic Blue IG = International Gray			-A = Adhesive backed NM = No mounting holes = Leave blank for no options



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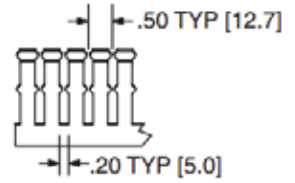
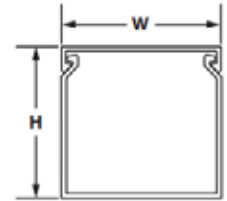
Panduit: C1WH6

10-069-001

- Narrow slot/finger design provides more slots to fit the spacing of high-density terminal blocks and other hardware
- Material: Lead-free PVC
- UL recognized continuous use temperature: 122°F (50°C)
- UL 94 flammability rating of V-0
- Conforms with NFPA 79-2007 section 13.3.1 requirement for flame retardant material
- Provided with mounting holes
- Base and cover length is 6 feet



Base Part Number	Duct Size (W x H)*		Slot Width		Cover Part Number	Std. Pkg. Qty.	Base Ctn. Qty.	Cover Ctn. Qty.
	In.	mm	In.	mm				
F.5X.5LG6	0.69 x 0.60	17.5 x 15.2	0.20	5.0	C.5LG6	6	120	120
F.5X1LG6	0.69 x 1.06	17.5 x 26.9	0.20	5.0	C.5LG6	6	120	120
F.75X.75LG6	0.93 x 0.82	23.6 x 20.9	0.20	5.0	C.75LG6	6	120	120
F.75X1.5LG6	0.93 x 1.57	23.6 x 39.9	0.20	5.0	C.75LG6	6	120	120
F1X1LG6	1.26 x 1.13	32.0 x 28.7	0.20	5.0	C1LG6	6	120	120
F1X1.5LG6	1.26 x 1.62	32.0 x 41.1	0.20	5.0	C1LG6	6	120	120
F1X2LG6	1.26 x 2.12	32.0 x 53.8	0.20	5.0	C1LG6	6	120	120
F1X3LG6	1.26 x 3.12	32.0 x 79.2	0.20	5.0	C1LG6	6	120	120
F1X4LG6	1.26 x 4.10	32.0 x 104.1	0.20	5.0	C1LG6	6	60	120
F1.5X1LG6	1.75 x 1.12	44.5 x 28.4	0.20	5.0	C1.5LG6	6	120	120
F1.5X1.5LG6	1.75 x 1.62	44.5 x 41.1	0.20	5.0	C1.5LG6	6	120	120
F1.5X2LG6	1.75 x 2.12	44.5 x 53.8	0.20	5.0	C1.5LG6	6	120	120
F1.5X3LG6	1.75 x 3.12	44.5 x 79.2	0.20	5.0	C1.5LG6	6	120	120
F1.5X4LG6	1.75 x 4.10	44.5 x 104.1	0.20	5.0	C1.5LG6	6	60	120
F2X1LG6	2.25 x 1.12	57.2 x 28.4	0.20	5.0	C2LG6	6	120	120
F2X1.5LG6	2.25 x 1.62	57.2 x 41.1	0.20	5.0	C2LG6	6	120	120
F2X2LG6	2.25 x 2.12	57.2 x 53.8	0.20	5.0	C2LG6	6	120	120
F2X3LG6	2.25 x 3.12	57.2 x 79.2	0.20	5.0	C2LG6	6	60	120
F2X4LG6	2.25 x 4.10	57.2 x 104.1	0.20	5.0	C2LG6	6	60	120
F2X5LG6	2.25 x 5.10	57.2 x 129.5	0.20	5.0	C2LG6	6	60	120
F2.5X3LG6	2.75 x 3.12	69.9 x 79.2	0.20	5.0	C2.5LG6	6	120	120
F3X1LG6	3.25 x 1.12	82.6 x 28.4	0.20	5.0	C3LG6	6	120	120
F3X2LG6	3.25 x 2.12	82.6 x 53.8	0.20	5.0	C3LG6	6	120	120
F3X3LG6	3.25 x 3.12	82.6 x 79.2	0.20	5.0	C3LG6	6	60	120
F3X4LG6	3.25 x 4.10	82.6 x 104.1	0.20	5.0	C3LG6	6	60	120
F3X5LG6	3.25 x 5.10	82.6 x 129.5	0.20	5.0	C3LG6	6	60	120
F4X2LG6	4.25 x 2.12	108.0 x 53.8	0.20	5.0	C4LG6	6	60	120
F4X3LG6	4.25 x 3.12	108.0 x 79.2	0.20	5.0	C4LG6	6	60	120
F4X4LG6	4.25 x 4.10	108.0 x 104.1	0.20	5.0	C4LG6	6	60	120
F4X5LG6	4.25 x 5.10	108.0 x 129.5	0.20	5.0	C4LG6	6	60	120
F6X4LG6	6.25 x 4.15	158.8 x 105.4	0.20	5.0	C6LG6	6	60	120



Part number shown for LG (Light Gray). For other color availability see color selection guide, page C1.48.

Base and cover sold separately.

**"H" dimension includes duct and cover.

Part Numbering System for Panduit® Wiring Duct

G	2	X	2	LG	-	6	-A
Type	Nominal Width In. or mm	Nominal Height In. or mm		Color		Length 6 ft. or 2m	Options
G = Wide Slot F = Narrow Slot FL = Flexible Duct FS = Solid Wall H = Hinged Cover Wide Slot HN = Hinged Cover, Narrow Slot HS = Hinged Cover, Solid Wall D = Round Hole NNC = Halogen Free, Metric NE = Halogen Free MC = Narrow Slot, Metric TNC = Low Smoke, Halogen Free				LG = Light Gray WH = White BL = Black IB = Intrinsic Blue IG = International Gray			-A = Adhesive backed NM = No mounting holes = Leave blank for no options



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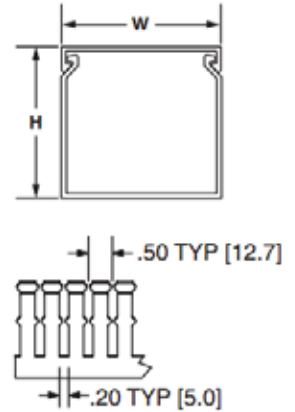
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10-069-002

- Narrow slot/finger design provides more slots to fit the spacing of high-density terminal blocks and other hardware
- Material: Lead-free PVC
- UL recognized continuous use temperature: 122°F (50°C)
- UL 94 flammability rating of V-0
- Conforms with NFPA 79-2007 section 13.3.1 requirement for flame retardant material
- Provided with mounting holes
- Base and cover length is 6 feet



Base Part Number	Duct Size (W x H)*		Slot Width		Cover Part Number	Std. Pkg. Qty.	Base Ctn. Qty.	Cover Ctn. Qty.
	In.	mm	In.	mm				
F.5X.5LG6	0.69 x 0.60	17.5 x 15.2	0.20	5.0	C.5LG6	6	120	120
F.5X1LG6	0.69 x 1.06	17.5 x 26.9	0.20	5.0	C.5LG6	6	120	120
F.75X.75LG6	0.93 x 0.82	23.6 x 20.9	0.20	5.0	C.75LG6	6	120	120
F.75X1.5LG6	0.93 x 1.57	23.6 x 39.9	0.20	5.0	C.75LG6	6	120	120
F1X1LG6	1.26 x 1.13	32.0 x 28.7	0.20	5.0	C1LG6	6	120	120
F1X1.5LG6	1.26 x 1.62	32.0 x 41.1	0.20	5.0	C1LG6	6	120	120
F1X2LG6	1.26 x 2.12	32.0 x 53.8	0.20	5.0	C1LG6	6	120	120
F1X3LG6	1.26 x 3.12	32.0 x 79.2	0.20	5.0	C1LG6	6	120	120
F1X4LG6	1.26 x 4.10	32.0 x 104.1	0.20	5.0	C1LG6	6	60	120
F1.5X1LG6	1.75 x 1.12	44.5 x 28.4	0.20	5.0	C1.5LG6	6	120	120
F1.5X1.5LG6	1.75 x 1.62	44.5 x 41.1	0.20	5.0	C1.5LG6	6	120	120
F1.5X2LG6	1.75 x 2.12	44.5 x 53.8	0.20	5.0	C1.5LG6	6	120	120
F1.5X3LG6	1.75 x 3.12	44.5 x 79.2	0.20	5.0	C1.5LG6	6	120	120
F1.5X4LG6	1.75 x 4.10	44.5 x 104.1	0.20	5.0	C1.5LG6	6	60	120
F2X1LG6	2.25 x 1.12	57.2 x 28.4	0.20	5.0	C2LG6	6	120	120
F2X1.5LG6	2.25 x 1.62	57.2 x 41.1	0.20	5.0	C2LG6	6	120	120
F2X2LG6	2.25 x 2.12	57.2 x 53.8	0.20	5.0	C2LG6	6	120	120
F2X3LG6	2.25 x 3.12	57.2 x 79.2	0.20	5.0	C2LG6	6	60	120
F2X4LG6	2.25 x 4.10	57.2 x 104.1	0.20	5.0	C2LG6	6	60	120
F2X5LG6	2.25 x 5.10	57.2 x 129.5	0.20	5.0	C2LG6	6	60	120
F2.5X3LG6	2.75 x 3.12	69.9 x 79.2	0.20	5.0	C2.5LG6	6	120	120
F3X1LG6	3.25 x 1.12	82.6 x 28.4	0.20	5.0	C3LG6	6	120	120
F3X2LG6	3.25 x 2.12	82.6 x 53.8	0.20	5.0	C3LG6	6	120	120
F3X3LG6	3.25 x 3.12	82.6 x 79.2	0.20	5.0	C3LG6	6	60	120
F3X4LG6	3.25 x 4.10	82.6 x 104.1	0.20	5.0	C3LG6	6	60	120
F3X5LG6	3.25 x 5.10	82.6 x 129.5	0.20	5.0	C3LG6	6	60	120
F4X2LG6	4.25 x 2.12	108.0 x 53.8	0.20	5.0	C4LG6	6	60	120
F4X3LG6	4.25 x 3.12	108.0 x 79.2	0.20	5.0	C4LG6	6	60	120
F4X4LG6	4.25 x 4.10	108.0 x 104.1	0.20	5.0	C4LG6	6	60	120
F4X5LG6	4.25 x 5.10	108.0 x 129.5	0.20	5.0	C4LG6	6	60	120
F6X4LG6	6.25 x 4.15	158.8 x 105.4	0.20	5.0	C6LG6	6	60	120



Part number shown for LG (Light Gray). For other color availability see color selection guide, page C1.48.

Base and cover sold separately.

**"H" dimension includes duct and cover.

Part Numbering System for Panduct® Wiring Duct

G	2	X	2	LG	-	6	-A
Type	Nominal Width In. or mm	Nominal Height In. or mm		Color		Length 6 ft. or 2m	Options
G = Wide Slot F = Narrow Slot FL = Flexible Duct FS = Solid Wall H = Hinged Cover Wide Slot HN = Hinged Cover, Narrow Slot HS = Hinged Cover, Solid Wall D = Round Hole NNC = Halogen Free, Metric NE = Halogen Free MC = Narrow Slot, Metric TNC = Low Smoke, Halogen Free				LG = Light Gray WH = White BL = Black IB = Intrinsic Blue IG = International Gray			-A = Adhesive backed NM = No mounting holes = Leave blank for no options



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Date: 06-23-2023	Job Number: HBR9328	Page # 1/1
By: JN		

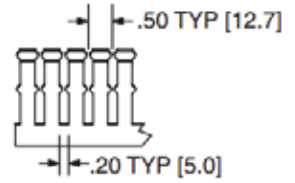
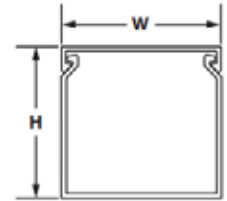
Manuf.: . PNO: Panduit: F1.5X3WH6

10-069-005

- Narrow slot/finger design provides more slots to fit the spacing of high-density terminal blocks and other hardware
- Material: Lead-free PVC
- UL recognized continuous use temperature: 122°F (50°C)
- UL 94 flammability rating of V-0
- Conforms with NFPA 79-2007 section 13.3.1 requirement for flame retardant material
- Provided with mounting holes
- Base and cover length is 6 feet



Base Part Number	Duct Size (W x H)*		Slot Width		Cover Part Number	Std. Pkg. Qty.	Base Ctn. Qty.	Cover Ctn. Qty.
	In.	mm	In.	mm				
F.5X.5LG6	0.69 x 0.60	17.5 x 15.2	0.20	5.0	C.5LG6	6	120	120
F.5X1LG6	0.69 x 1.06	17.5 x 26.9	0.20	5.0	C.5LG6	6	120	120
F.75X.75LG6	0.93 x 0.82	23.6 x 20.9	0.20	5.0	C.75LG6	6	120	120
F.75X1.5LG6	0.93 x 1.57	23.6 x 39.9	0.20	5.0	C.75LG6	6	120	120
F1X1LG6	1.26 x 1.13	32.0 x 28.7	0.20	5.0	C1LG6	6	120	120
F1X1.5LG6	1.26 x 1.62	32.0 x 41.1	0.20	5.0	C1LG6	6	120	120
F1X2LG6	1.26 x 2.12	32.0 x 53.8	0.20	5.0	C1LG6	6	120	120
F1X3LG6	1.26 x 3.12	32.0 x 79.2	0.20	5.0	C1LG6	6	120	120
F1X4LG6	1.26 x 4.10	32.0 x 104.1	0.20	5.0	C1LG6	6	60	120
F1.5X1LG6	1.75 x 1.12	44.5 x 28.4	0.20	5.0	C1.5LG6	6	120	120
F1.5X1.5LG6	1.75 x 1.62	44.5 x 41.1	0.20	5.0	C1.5LG6	6	120	120
F1.5X2LG6	1.75 x 2.12	44.5 x 53.8	0.20	5.0	C1.5LG6	6	120	120
F1.5X3LG6	1.75 x 3.12	44.5 x 79.2	0.20	5.0	C1.5LG6	6	120	120
F1.5X4LG6	1.75 x 4.10	44.5 x 104.1	0.20	5.0	C1.5LG6	6	60	120
F2X1LG6	2.25 x 1.12	57.2 x 28.4	0.20	5.0	C2LG6	6	120	120
F2X1.5LG6	2.25 x 1.62	57.2 x 41.1	0.20	5.0	C2LG6	6	120	120
F2X2LG6	2.25 x 2.12	57.2 x 53.8	0.20	5.0	C2LG6	6	120	120
F2X3LG6	2.25 x 3.12	57.2 x 79.2	0.20	5.0	C2LG6	6	60	120
F2X4LG6	2.25 x 4.10	57.2 x 104.1	0.20	5.0	C2LG6	6	60	120
F2X5LG6	2.25 x 5.10	57.2 x 129.5	0.20	5.0	C2LG6	6	60	120
F2.5X3LG6	2.75 x 3.12	69.9 x 79.2	0.20	5.0	C2.5LG6	6	120	120
F3X1LG6	3.25 x 1.12	82.6 x 28.4	0.20	5.0	C3LG6	6	120	120
F3X2LG6	3.25 x 2.12	82.6 x 53.8	0.20	5.0	C3LG6	6	120	120
F3X3LG6	3.25 x 3.12	82.6 x 79.2	0.20	5.0	C3LG6	6	60	120
F3X4LG6	3.25 x 4.10	82.6 x 104.1	0.20	5.0	C3LG6	6	60	120
F3X5LG6	3.25 x 5.10	82.6 x 129.5	0.20	5.0	C3LG6	6	60	120
F4X2LG6	4.25 x 2.12	108.0 x 53.8	0.20	5.0	C4LG6	6	60	120
F4X3LG6	4.25 x 3.12	108.0 x 79.2	0.20	5.0	C4LG6	6	60	120
F4X4LG6	4.25 x 4.10	108.0 x 104.1	0.20	5.0	C4LG6	6	60	120
F4X5LG6	4.25 x 5.10	108.0 x 129.5	0.20	5.0	C4LG6	6	60	120
F6X4LG6	6.25 x 4.15	158.8 x 105.4	0.20	5.0	C6LG6	6	60	120



Part number shown for LG (Light Gray). For other color availability see color selection guide, page C1.48.

Base and cover sold separately.

**"H" dimension includes duct and cover.

Part Numbering System for Panduit® Wiring Duct

G	2	X	2	LG	-	6	-A
Type	Nominal Width In. or mm	Nominal Height In. or mm		Color		Length 6 ft. or 2m	Options
G = Wide Slot F = Narrow Slot FL = Flexible Duct FS = Solid Wall H = Hinged Cover Wide Slot HN = Hinged Cover, Narrow Slot HS = Hinged Cover, Solid Wall D = Round Hole NNC = Halogen Free, Metric NE = Halogen Free MC = Narrow Slot, Metric TNC = Low Smoke, Halogen Free				LG = Light Gray WH = White BL = Black IB = Intrinsic Blue IG = International Gray			-A = Adhesive backed NM = No mounting holes = Leave blank for no options



Rev: 0	Device Tag:	
Date: 06-23-2023	Job Number: HBR9328	Page # 1/1
By: JN		

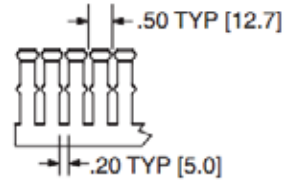
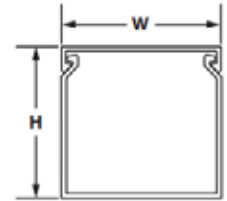
Manuf.: . PNo: Panduit: F1X3WH6

10-069-007

- Narrow slot/finger design provides more slots to fit the spacing of high-density terminal blocks and other hardware
- Material: Lead-free PVC
- UL recognized continuous use temperature: 122°F (50°C)
- UL 94 flammability rating of V-0
- Conforms with NFPA 79-2007 section 13.3.1 requirement for flame retardant material
- Provided with mounting holes
- Base and cover length is 6 feet



Base Part Number	Duct Size (W x H)*		Slot Width		Cover Part Number	Std. Pkg. Qty.	Base Ctn. Qty.	Cover Ctn. Qty.
	In.	mm	In.	mm				
F.5X.5LG6	0.69 x 0.60	17.5 x 15.2	0.20	5.0	C.5LG6	6	120	120
F.5X1LG6	0.69 x 1.06	17.5 x 26.9	0.20	5.0	C.5LG6	6	120	120
F.75X.75LG6	0.93 x 0.82	23.6 x 20.9	0.20	5.0	C.75LG6	6	120	120
F.75X1.5LG6	0.93 x 1.57	23.6 x 39.9	0.20	5.0	C.75LG6	6	120	120
F1X1LG6	1.26 x 1.13	32.0 x 28.7	0.20	5.0	C1LG6	6	120	120
F1X1.5LG6	1.26 x 1.62	32.0 x 41.1	0.20	5.0	C1LG6	6	120	120
F1X2LG6	1.26 x 2.12	32.0 x 53.8	0.20	5.0	C1LG6	6	120	120
F1X3LG6	1.26 x 3.12	32.0 x 79.2	0.20	5.0	C1LG6	6	120	120
F1X4LG6	1.26 x 4.10	32.0 x 104.1	0.20	5.0	C1LG6	6	60	120
F1.5X1LG6	1.75 x 1.12	44.5 x 28.4	0.20	5.0	C1.5LG6	6	120	120
F1.5X1.5LG6	1.75 x 1.62	44.5 x 41.1	0.20	5.0	C1.5LG6	6	120	120
F1.5X2LG6	1.75 x 2.12	44.5 x 53.8	0.20	5.0	C1.5LG6	6	120	120
F1.5X3LG6	1.75 x 3.12	44.5 x 79.2	0.20	5.0	C1.5LG6	6	120	120
F1.5X4LG6	1.75 x 4.10	44.5 x 104.1	0.20	5.0	C1.5LG6	6	60	120
F2X1LG6	2.25 x 1.12	57.2 x 28.4	0.20	5.0	C2LG6	6	120	120
F2X1.5LG6	2.25 x 1.62	57.2 x 41.1	0.20	5.0	C2LG6	6	120	120
F2X2LG6	2.25 x 2.12	57.2 x 53.8	0.20	5.0	C2LG6	6	120	120
F2X3LG6	2.25 x 3.12	57.2 x 79.2	0.20	5.0	C2LG6	6	60	120
F2X4LG6	2.25 x 4.10	57.2 x 104.1	0.20	5.0	C2LG6	6	60	120
F2X5LG6	2.25 x 5.10	57.2 x 129.5	0.20	5.0	C2LG6	6	60	120
F2.5X3LG6	2.75 x 3.12	69.9 x 79.2	0.20	5.0	C2.5LG6	6	120	120
F3X1LG6	3.25 x 1.12	82.6 x 28.4	0.20	5.0	C3LG6	6	120	120
F3X2LG6	3.25 x 2.12	82.6 x 53.8	0.20	5.0	C3LG6	6	120	120
F3X3LG6	3.25 x 3.12	82.6 x 79.2	0.20	5.0	C3LG6	6	60	120
F3X4LG6	3.25 x 4.10	82.6 x 104.1	0.20	5.0	C3LG6	6	60	120
F3X5LG6	3.25 x 5.10	82.6 x 129.5	0.20	5.0	C3LG6	6	60	120
F4X2LG6	4.25 x 2.12	108.0 x 53.8	0.20	5.0	C4LG6	6	60	120
F4X3LG6	4.25 x 3.12	108.0 x 79.2	0.20	5.0	C4LG6	6	60	120
F4X4LG6	4.25 x 4.10	108.0 x 104.1	0.20	5.0	C4LG6	6	60	120
F4X5LG6	4.25 x 5.10	108.0 x 129.5	0.20	5.0	C4LG6	6	60	120
F6X4LG6	6.25 x 4.15	158.8 x 105.4	0.20	5.0	C6LG6	6	60	120



Part number shown for LG (Light Gray). For other color availability see color selection guide, page C1.48.

Base and cover sold separately.

**"H" dimension includes duct and cover.

Part Numbering System for Panduct® Wiring Duct

G	2	X	2	LG	-	6	-A
Type	Nominal Width In. or mm	Nominal Height In. or mm		Color		Length 6 ft. or 2m	Options
G = Wide Slot F = Narrow Slot FL = Flexible Duct FS = Solid Wall H = Hinged Cover Wide Slot HN = Hinged Cover, Narrow Slot HS = Hinged Cover, Solid Wall D = Round Hole NNC = Halogen Free, Metric NE = Halogen Free MC = Narrow Slot, Metric TNC = Low Smoke, Halogen Free				LG = Light Gray WH = White BL = Black IB = Intrinsic Blue IG = International Gray			-A = Adhesive backed NM = No mounting holes = Leave blank for no options



Rev: 0	Device Tag:	
Date: 06-23-2023	Job Number: HBR9328	Page # 1/1
By: JN		

Manuf.: . PNo: Panduit: F2X3WH6

10-069-008

Panduit Raised Panel Label

25-000-A002

PRODUCT SPECIFICATIONS:

Description:	Material is RoHS compliant (European Union directive 2002/95/EC). GMH3-W consists of a polyester film laminated to a microcellular foam backed high tack adhesive.
Print Methods:	This material is recommended for thermal transfer printing.
Standard Colors:	White
Thickness:	28.0 +/- 1.0 mil (ASTM D3652)
Recommended Ribbons:	RMR4BL-A, RMR4BL, RMER4BL
Service Temperature Range:	-40°F to 212°F (-40°C to 100°C)
Minimum Application Temperature:	50°F (10°C)
Storage Conditions:	Store at 70°F (21°C) and 50% Relative Humidity.

Base Part Number	White	Width A	Height B	Print-On Area Height C	Vertical Repeat D	Horizontal Repeat E	Hole Diameter F
C240X240*	APT-30	2.40" (61.0mm)	2.40" (61.0mm)	.90" (22.8mm)	2.53" (64.1mm)	N/A	1.18" (30.0mm)



Rev: 0

Date: 06-23-2023

By: JN

Device Tag:

Job Number: HBR9328

Page # 1/1

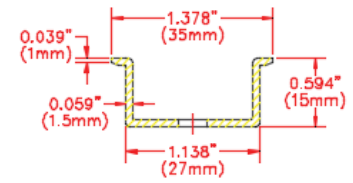
Manuf.: . PNo: EleMech: 25-000-A002 Assembly

DIN RAILS

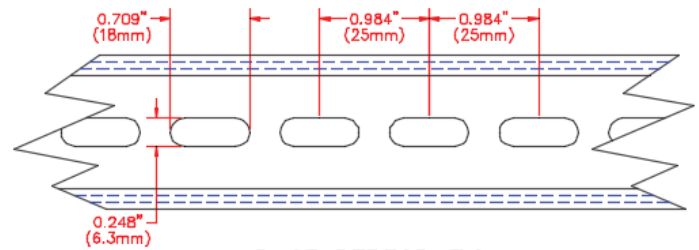
42-063-007

Catalog Number	Lengths per Pack
G1	12
G1F	12
G1F1	24
OMEGA 2F	20
OMEGA 2F1	40*
OMEGA 3	20
OMEGA 3F	20
OMEGA 3F1	40*
OMEGA 3FD	20
OMEGA 3A	10
OMEGA 3AF	10
OMEGA 3AF1	20*
OMEGA 3AFD	10
OMEGA 3B	10
OMEGA 3B1	10*
OMEGA 75	2

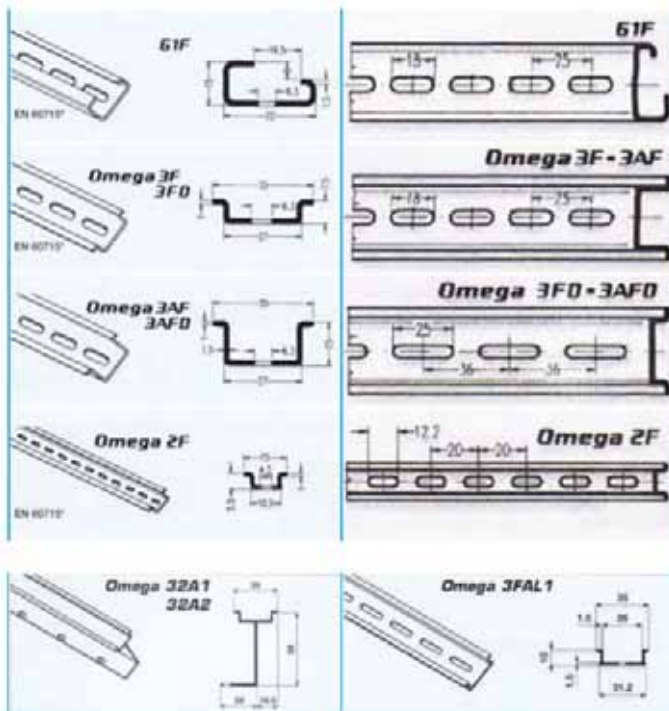
Treated with galvanic zinc plating and passivation (gal Zn 8c according to Din 50960)
 Minimum thickness 6 microns
 Standard length: 2 meters (6'6¾")



FRONT SECTION

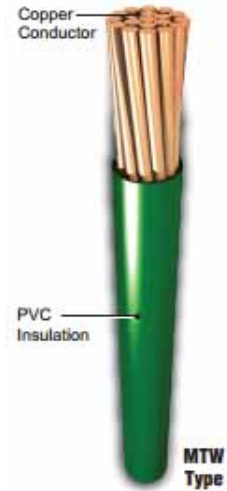


BASE PERFORATION



Wire – MTW Type

- CONDUCTORS:**
 - 22 AWG - 8AWG Stranded Tinned Copper per ASTM B-33
 - 22 AWG - 10 AWG Solid Tinned Copper per ASTM M-33
- INSULATION:**
 - Color-Coded Polyvinyl Chloride (PVC)
- TEMPERATURE RANGE/
VOLTAGE RATING:**
 - UL 1011/1015/1028/BC-5W2: 105°C/600V
 - UL MTW: 90°C/600V
 - CSA AWM I A/B & TEW: 105°C/600V
- FLAME COMPLIANCES:**
 - UL VW-1
 - CSA FT-1
- INDUSTRY APPROVALS:**
 - UL Standard 758 - Styles 1011/1015/1028/1032/1230/1231/1335/1344
 - UL Standard 1063 - MTW
 - UL Standard 1426 - BC-5W2: 16 AWG - 8 AWG
 - CSA AWM I A/B & TEW
 - UL THHW
 - UL CT Tray Rated
 - SAE J378
- STANDARD COLORS:**
 - Black, Orange, Blue, Violet, White, Yellow, Brown, Green/Yellow, Red, Green, Gray
- OPTIONS:**
 - Stripes available upon request (minimums may apply)
 - Other copper constructions available upon request (minimums may apply)



51-000-062

Catalog Number	Description
F22027	22 AWG (7/.0096) TC AWM 1015
F20037	20 AWG (10/30) TC AWM 1015
F18054	18 AWG (16/30) TC AWM 1015
F16032	16 AWG (26/30) TC AWM 1015
F14037	14 AWG (41/30) TC AWM 1015
F12024	12 AWG (65/30) TC AWM 1015
F10012	10 AWG (105/30) TC AWM 1015
F08010	8 AWG (7X19/29) TC AWM 1028

TEW/MTW Wire (Tinned Copper) Applications:

► This tinned copper hook up wire may be used for wiring of machine tools, appliances, and control cabinets.



Rev: 0
Date: 06-23-2023
By: JN

Device Tag:

Job Number: HBR9328

Page # 1/1

Manuf.: . PNo: EleMech: 51-000-062

T-SERIES COMPACT OUTDOOR WITH ADVANCED CORROSION PROTECTION

INDUSTRY STANDARDS

UL/cUL Listed; Type 12, 3R, 4; 4X optional; File No. SA6453
UR/cUR Recognized

UR/cUR Recognized on select models, reference performance data tables.

CE

EAC

Telcordia GR-487 capable

FEATURES

- Stock models equipped with head pressure control for low-ambient operation, compressor heater, coated condenser coil, malfunction switch, thermostat and heater package
- R134A earth-friendly refrigerant
- Models for 115, 230 and 460 VAC power input
- UL Listed to save customers time and money with agency approvals (some models UL recognized)
- Outdoor model operating temperature range from -40 F/-40 C to 131 F/55 C
- Exterior and fully recessed mounting options on many models
- Compact footprint to minimize real estate and maximize capacity
- Reliable mechanical thermostat on enclosure side of the unit
- Dual condenser-side air movers for performance redundancy
- Two levels of corrosion protection:
 - Level 1 - Protective coatings on all exposed copper tubing and solder joints, condenser coil and thermostat.
 - Level 2 - All protective coatings in Level 1 plus a coated evaporator coil. Foam wrap added over protective coatings on thermostat.

OPTIONS

- Outdoor Package
- Harsh Environment Package*
- Stainless Steel Package*
- Heater Package



COOLING PERFORMANCE

Nominal:

BTU/Hr.	800/800
Watts	235/235
At 131 F/131 F (55 C/55 C):	
BTU/Hr. (50/60 Hz)	819
W (50/60 Hz)	240
At 95 F/95 F (35 C/35 C):	
BTU/Hr. (50 /60 Hz)	948
W (50/60 Hz)	278
Refrigerant	R-134A
Refrigerant Charge (ounces/grams)	4/113
Operating Temperature Range:	
Maximum (°F/°C)	131/55
Minimum (°F/°C)	-40/-40
Airflow at 0 Static Pressure:	
Internal loop 50 Hz (CFM / m ³ /hr.)	25/42
External loop 50 Hz (CFM / m ³ /hr.)	48/82
Internal loop 60 Hz (CFM / m ³ /hr.)	30/51
External loop 60 Hz (CFM / m ³ /hr.)	53/90
Max. Heater W (Outdoor Models)	150
ELECTRICAL DATA	
Rated Voltage	100/115
Frequency (Hz)	50/60
Operating Range	+/- 10%
Max. Power Consumption (W at 50/60 Hz)	360/403
Max. Nominal Current (A at 50/60 Hz)	3.6/3.5
Starting Current (A)	8.0/9.2



Rev: 0

Date: 06-23-2023

By: JN

Device Tag:

AC1

Job Number: HBR9328

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Manuf.: PNo:

Hoffman: T150116G173

T-SERIES COMPACT OUTDOOR WITH ADVANCED CORROSION PROTECTION

Outdoor Model/SST/Corrosion/4X/Heater

- Two levels of corrosion protection:
 - Level 1 - Protective coatings on all exposed copper tubing and solder joints, condenser coil and thermostat.
 - Level 2 - All protective coatings in Level 1 plus a coated evaporator coil. Foam wrap added over protective coatings on thermostat.

Level 1 protective coatings are only applied to components on the condenser (exterior facing) side

Level 2 protective coatings are applied to all air conditioner components

No. 316 stainless steel hardware and shroud for G102 and G820 suffixed models

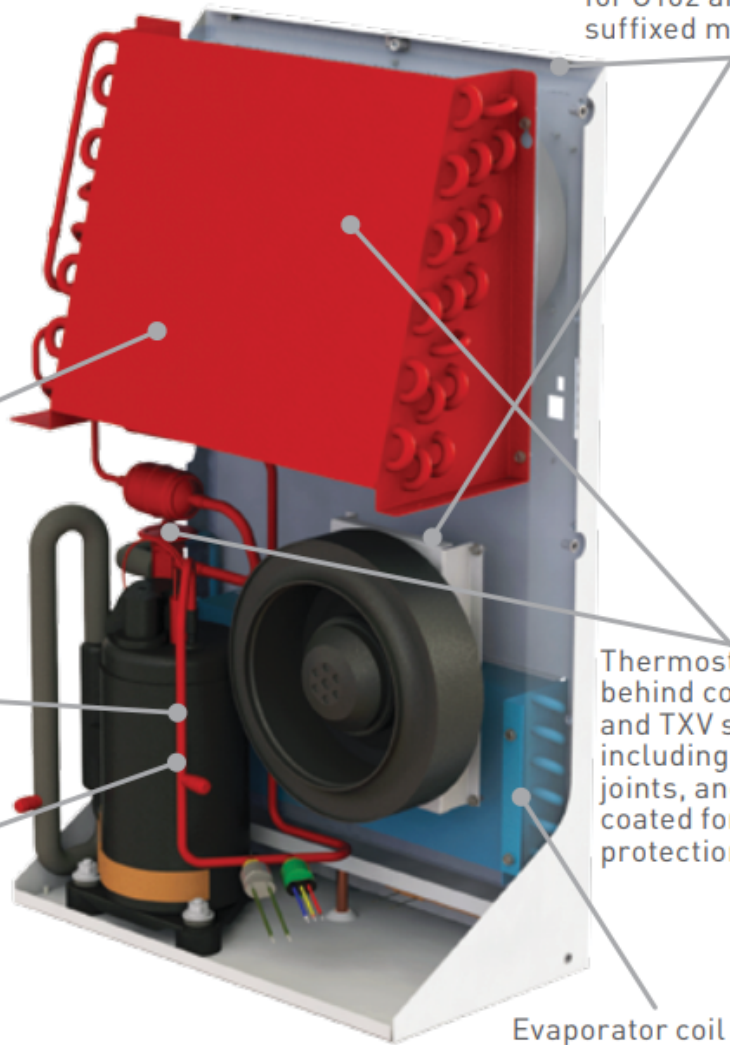
Condenser coil is coated for protection against corrosion

All exposed copper tubing is coated for protection against corrosion

All solder joints are coated for protection against corrosion

Thermostat (hidden behind condenser) and TXV solder joints, including sensing bulb joints, and copper are coated for corrosion protection

Evaporator coil is coated for protection against corrosion



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Date: 06-23-2023

By: JN

Device Tag:

AC1

Job Number: HBR9328

Page # 2/2

Manuf.: PNo:

Hoffman: T150116G173

Bulletin 855P Panel Mount Alarms Signaling Solutions...Loud and Clear



www.rockwellautomation.com

Advantages

- Mount in a standard 22.5 mm or 30 mm hole (with adapter ring)
- UL Type 4/4X/13, IP65 rated
- Sound output range from 80 dB to 105 dB @ 1 meter
- Selectable continuous or pulsing sounders and flashing or steady LED available
- Panel mount strobe light version available
- Combination sounder and LED products available to reduce your panel space
- Adjustable volume (ME and LE units)
- 12V AC/DC, 24V AC/DC, 120V AC, and 240V AC available
- Plug-in Terminal Block - IP2X Rated
- Rear securing eliminates unauthorized product removal
- cULus listed and CE Marked

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855P - **B**
a b c d

b

Voltage	
Code	Description
30	12...24V AC/DC
10	120V AC
20	240V AC

c

Size	
Code	Description
SE	30 mm
ME	45 mm
LE	65 mm

d

Mounting Hole	
Code	Description
22	22.5 mm



30 mm Panel Mount
Sounder



45 mm Panel Mount
Sounder



65 mm Panel Mount
Sounder



Rev: 0

Date: 06-23-2023

By: JN

Device Tag:

AH1

Job Number:
HBR9328

Page #
1/1

Manuf.: PNo:
Allen-Bradley: 855P-B30ME22

01-005-008



Model LP22LED

StreamLine® Low Profile LED Light

Perfect size meets superior performance.

A B C G R



Model LP22LED is a unique, multi-pattern LED light ideal for a variety of industrial applications requiring low profile signaling. The unit can be flush mounted or mounted on a 1/2" NPT pipe with the integrated pipe mount. The enclosure consists of a polycarbonate dome in five colors (Amber, Blue, Clear, Green and Red) and is rated Type 4X.

The LP22LED has four flash patterns (steady light, single flash, double flash and triple flash) selectable via dip-switch.

FEATURES

- Available in 12-24V AC/DC and 90-240VAC
- 1/2" NPT or flush mount
- Four flash patterns
- Five lamp/lens colors: Amber, Blue, Clear, Green and Red
- IP65, NEMA Type 4X enclosure
- Low profile — only 2.71" tall x 2.99" diameter (69mm x 76mm)
- UL and cUL Listed and CE Compliant

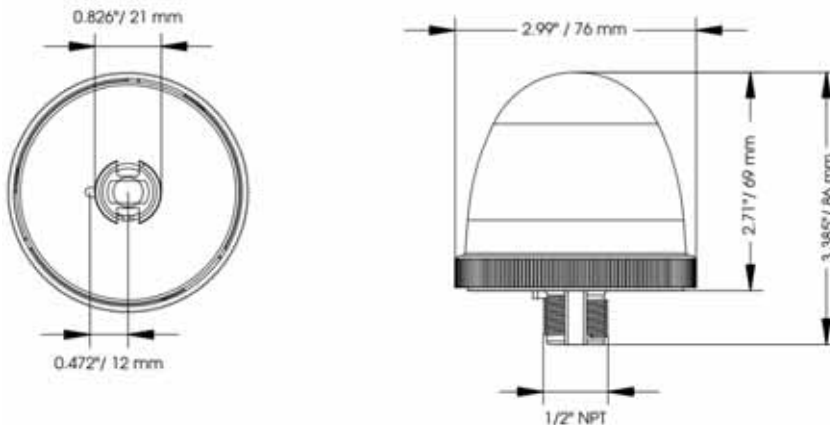
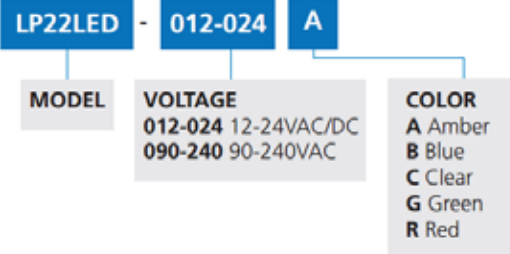
MODEL	VOLTAGE	FLASH RATE/MINUTE			
		STEADY	SINGLE FLASH	DOUBLE FLASH	TRIPLE FLASH
LP22LED-012-024*	12-24VAC/DC	N/A	120 (+/-10)	90 (+/-10)	140 (+/-10)
LP22LED-090-240*	90-240VAC	N/A	120 (+/-10)	90 (+/-10)	140 (+/-10)

* Indicates color: (A) Amber, (B) Blue, (C) Clear, (G) Green or (R) Red

SPECIFICATIONS

Lamp Life:	100,000 Hours
Light Source:	LED Array
Operating Temperature Range:	-22°F to 122°F -30°C to 50°C
Net Weight:	5.29 oz. 0.15 kg
Height — above surface:	2.71" 69 mm
Diameter:	2.99" 76 mm

HOW TO ORDER



Rev: 0

Date: 06-23-2023

By: JN

Device Tag:

AL1

Job Number: HBR9328

Page # 1/1

Manuf.: PNo: Federal: LP22LED-012-024R

140MT Motor Protection Circuit Breakers

Certifications



- ATEX
- CB Scheme
- CCC
- CE Marked
- cULus Listed
- EAC
- IECEx
- Morocco
- UKCA

Standards Compliance

- IEC/EN 60947-2, IEC/EN 60947-4-1
- UL 60947-4-1
- CSA C22.2, No. 60947-4-1
- EN45545-1, -2



23-005-046

C- and D-Frame Devices

140MT - C 3 E - B63
 a b c d e

a		b		c		d		e	
Bulletin Number		Current Rating/ Frame Size		Interrupting Rating/ Breaking Capacity		Function		Current Range	
Code	Description	Code	Description	Code	Description	Code	Description	Code	Description
140MT	140MT Motor Protective Switching Device (Thermal)	C	32 A, Frame C	3	Normal break	E	Adjustable Thermal/Fixed Magnetic (14 x I _n) MPCB	A	0.10 (example: A16 = 0.16 A)
		D	40 A, Frame D	9	High break	N	Fixed Magnetic (14 x I _n) MCP	B	1.0 (example: B16 = 1.6 A)
						T	Adjustable Thermal/Fixed Magnetic (18...22 x I _n) MPCB	C	10 (example: C16 = 16 A)
						V	Fixed Magnetic (application at output of VFD multi-motor)		

Rated Operational Current (I _n) [A]	Motor Current Adjustment Range [A]	Nominal Magnetic Trip Current [A]	Max Short-circuit Current [kA]		Max. 3-phase Hp Ratings ⁽¹⁾				Max. kW, 3-Phase – AC-3 ⁽¹⁾				Cat. No.
			400V (I _{cs})	480V (group motor)	200V	230V	480V	575V	230V	400/415V	500V	690V	
C-Frame, Adjustable Thermal/Fixed Magnetic (14 x I_n)													
0.16	0.10...0.16	2.2	100	65	–	–	–	–	–	0.02	0.06	0.06	140MT-C3E-A16
0.25	0.16...0.25	3.5	100	65	–	–	–	–	–	0.04	0.09	0.09	140MT-C3E-A25
0.4	0.25...0.40	5.6	100	65	–	–	–	–	0.06	0.09	0.12	0.18	140MT-C3E-A40
0.63	0.40...0.63	8.8	100	65	–	–	–	–	0.09	0.18	0.18	0.25	140MT-C3E-A63
1	0.63...1.0	14	100	65	–	–	0.5	0.5	0.18	0.25	0.37	0.55	140MT-C3E-B10
1.6	1.0...1.6	22	100	65	–	–	0.75	–	0.25	0.55	0.75	1.1	140MT-C3E-B16
2.5	1.6...2.5	35	100	65	0.5	0.5	1	1.5	0.37	0.75	1.1	1.8	140MT-C3E-B25
4	2.5...4.0	56	100	65	0.75	0.75	2	3	0.75	1.5	2.2	3	140MT-C3E-B40
6.3	4.0...6.3	88	100	65	1	1.5	3	5	1.5	2.2	3	4	140MT-C3E-B63
10	6.3...10	140	100	65	2	2	5	7.5	2.2	4	6.3	7.5	140MT-C3E-C10
18	10...18	224	65	30	3	5	10	10	4	2.5	10	13	140MT-C3E-C18
20	14.5...20	280	50	30	5	5	10	15	5.5	10	11	17	140MT-C3E-C20
25	18...25	350	15	30	5	7.5	15	20	5.5	11	15	22	140MT-C3E-C25
29	23...29	406	15	30	7.5	10	20	25	7.5	13	18.5	25	140MT-C3E-C29
32	26.5...32	448	15	30	7.5	10	20	30	7.5	15	20	25	140MT-C3E-C32
D-Frame, Adjustable Thermal/Fixed Magnetic (14 x I_n)													
0.63	0.40...0.63	8.8	100	65	–	–	–	–	0.09	0.18	0.18	0.25	140MT-D9E-A63
1	0.63...1.0	14	100	65	–	–	0.5	0.5	0.18	0.25	0.37	0.55	140MT-D9E-B10
1.6	1.0...1.6	22	100	65	–	–	0.75	–	0.25	0.55	0.75	1.1	140MT-D9E-B16
2.5	1.6...2.5	35	100	65	0.5	0.5	1	1.5	0.37	0.75	1.1	1.8	140MT-D9E-B25
4	2.5...4.0	56	100	65	0.75	0.75	2	3	0.75	1.5	2.2	3	140MT-D9E-B40
6.3	4.0...6.3	88	100	65	1	1.5	3	5	1.5	2.2	3	4	140MT-D9E-B63
10	6.3...10	140	100	65	2	2	5	7.5	2.2	4	6.3	7.5	140MT-D9E-C10
18	10...18	224	100	65	3	5	10	10	4	2.5	10	13	140MT-D9E-C18
20	14.5...20	280	100	65	5	5	10	15	5.5	10	11	17	140MT-D9E-C20
25	18...25	350	65	50	5	7.5	15	20	5.5	11	15	22	140MT-D9E-C25
29	23...29	406	50	50	7.5	10	20	25	7.5	13	18.5	25	140MT-D9E-C29
32	26.5...32	448	50	50	7.5	10	20	30	7.5	15	20	25	140MT-D9E-C32
38	30...38	432	50	30	10	10	25	30	–	18.5	20	25	140MT-D9E-C38 ⁽²⁾
40	34...40	480	50	30	10	10	30	30	–	20	24	30	140MT-D9E-C40 ⁽²⁾

 630-499-7080 · www.elemechinc.com	Rev: 0	Device Tag: CB1	
	Date: 06-23-2023		
Manuf.: PNO: Allen-Bradley: 140MT-D9E-C16	By: JN	Job Number: HBR9328	Page # 1/1

140MT-C-TE Type E Adapter



23-005-050

Installation instruction

Attention: To prevent electrical shock, disconnect from power source before installing or servicing. Install in suitable enclosure. Keep free from contaminants.

Montageanleitung

Achtung: Vor Installations- oder Servicearbeiten Stromversorgung unterbrechen, um Unfälle zu vermeiden. Die Geräte müssen in einem passenden Gehäuse eingebaut und gegen Verschmutzung geschützt werden.

Instruction de montage

Attention: Avant le montage et la mise en service, couper l'alimentation secteur afin d'éviter tout accident. Prévoir une mise en coffret ou armoire appropriée. Protéger le produit contre les environnements agressifs.

Istruzione per il montaggio

Attenzione: Per prevenire infortuni, togliere tensione prima dell'installazione o manutenzione. Installare in custodia idonea. Tenere lontano da contaminanti.

Instrucción de montaje

Atención: Desconectar la alimentación eléctrica antes de realizar el montaje y la puesta en servicio, con el objeto de evitar accidentes. Instalado en una caja o armario apropiado. Proteger el producto de los ambientes agresivos.



Spacing Adapter

- Required for self-protected combination motor controller (Type E) applications of Bul. 140MT-C, -D, and 140M-F MPCBs. Not for use with bus bars.

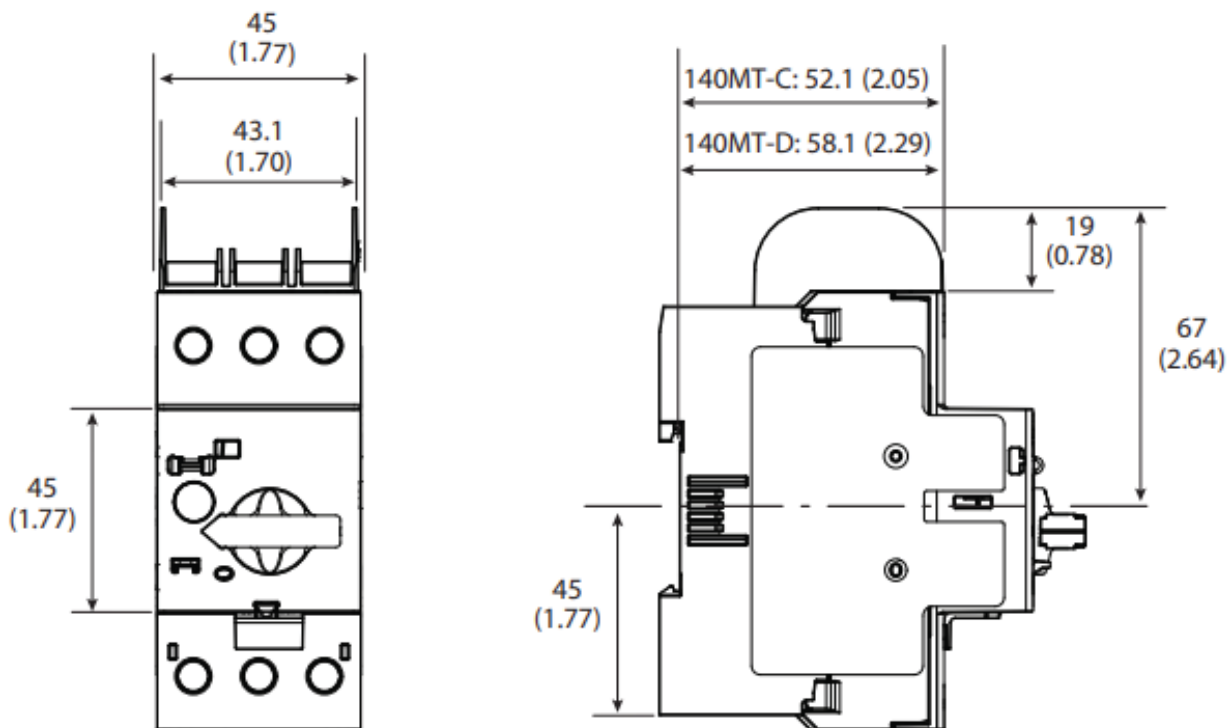
140MT-C, -D

140MT-C-TE

140M-F

140M-F-TE

Figure 17 - 140MT-C and 140MT-D with Cat. No. 140MT-C-TE Type E Adapter



Rev: 0

Date: 06-23-2023

By: JN

Device Tag:

CB1

Job Number: HBR9328

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Manuf.: PNO:

Allen-Bradley: 140MT-C-TE

Multi 9



UL 489 / CSA C22.2 No 5 / IEC/EN 60947-2 / GB 14048-2

C60BP are multi-standard miniature circuit breakers and branch circuit protection as defined by UL 489. It combines following functions:

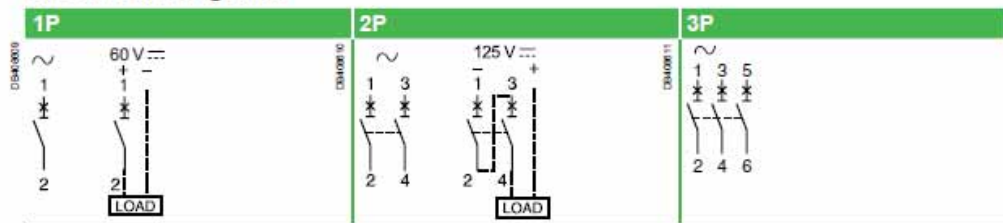
- circuit protection against short-circuit currents
- circuit protection against overload currents
- tripping and fault indication by the addition of auxiliaries.



Number of 18 mm (0.71 in.) poles	Rating (A) 25°C/77°F	Breaking capacity (kA rms) AIR				Icu IEC 60947-2			
		UL 489 / CSA C22.2 No 5				IEC 60947-2			
1P	Voltage (Ue)	277 V ~	240 V ~	120 V ~	60 V ~	440 V ~	415 V ~	240 V ~	60 V ~
	0.5 to 35	10	14	14	10	-	3	10	20
	40 to 63	-	10	10	10	-	3	10	20
2P	Voltage (Ue)	480Y/277 V ~		240 V ~	125 V ~	440 V ~	415 V ~	240 V ~	125 V ~
	1 to 25	10	-	14	10	6	10	20	-
	30 to 35	10	-	14	-	6	10	20	-
3P	1 to 35	10	-	14	-	6	10	20	-
2P/3P	40 to 63	-	-	10	-	6	10	20	-



Electrical diagrams



Catalogue numbers

Tunnel terminal connection											
Type	UL489 and CSA voltages	1P			2P			3P			
Auxiliaries		Remote indication and tripping, see page 43									
Rating (In)		Curve			Width in 9 mm modules	Curve		Width in 9 mm modules	Curve		Width in 9 mm modules
		Z	C	D (=K)		C	D (=K)		C	D (=K)	
C60BP											
0.5	480Y/277 V and 240 V	M9F44170	M9F42170	M9F43170	2	-	-	4	-	-	6
1		M9F44101	M9F42101	M9F43101		M9F42201	M9F43201		M9F42301	M9F43301	
2		M9F44102	M9F42102	M9F43102		M9F42202	M9F43202		M9F42302	M9F43302	
3		M9F44103	M9F42103	M9F43103		M9F42203	M9F43203		M9F42303	M9F43303	
4		M9F44104	M9F42104	M9F43104		M9F42204	M9F43204		M9F42304	M9F43304	
5		M9F44105	M9F42105	M9F43105		M9F42205	M9F43205		M9F42305	M9F43305	
6		M9F44106	M9F42106	M9F43106		M9F42206	M9F43206		M9F42306	M9F43306	
8		M9F44108	M9F42108	M9F43108		M9F42208	M9F43208		M9F42308	M9F43308	
10		M9F44110	M9F42110	M9F43110		M9F42210	M9F43210		M9F42310	M9F43310	
15		M9F44115	M9F42115	M9F43115		M9F42215	M9F43215		M9F42315	M9F43315	
20		M9F44120	M9F42120	M9F43120		M9F42220	M9F43220		M9F42320	M9F43320	
25		M9F44125	M9F42125	M9F43125		M9F42225	M9F43225		M9F42325	M9F43325	
30		M9F44130	M9F42130	M9F43130		M9F42230	M9F43230		M9F42330	M9F43330	
35	M9F44135	M9F42135	M9F43135		M9F42235	M9F43235		M9F42335	M9F43335		
40	240 V only	M9F44140	M9F42140	M9F43140	2	M9F42240	M9F43240	4	M9F42340	M9F43340	6
45		M9F44145	M9F42145	M9F43145		M9F42245	M9F43245		M9F42345	M9F43345	
50		M9F44150	M9F42150	M9F43150		M9F42250	M9F43250		M9F42350	M9F43350	
55		M9F44155	M9F42155	M9F43155		M9F42255	M9F43255		M9F42355	M9F43355	
63		M9F44163	M9F42163	M9F43163		M9F42263	M9F43263		M9F42363	M9F43363	



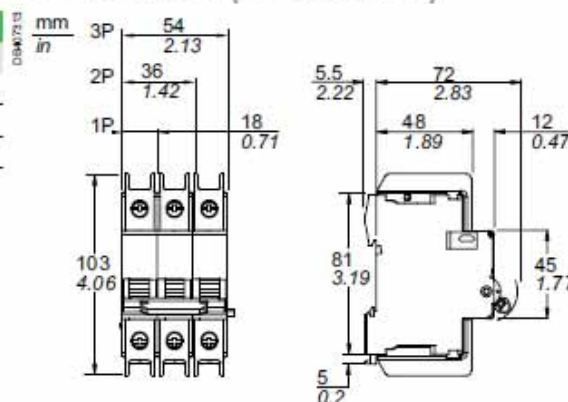
Rev: 0	Device Tag: CB10-17	
Date: 06-23-2023		
By: JN	Job Number: HBR9328	Page # 1/2

Manuf.: PNO: Square D: M9F42102

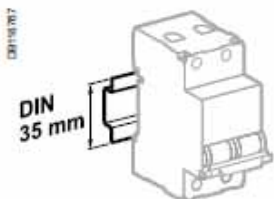
Weight (g / oz)

Circuit-breaker	
Type	C60BP
1P	130 g / 4.58 oz
2P	260 g / 9.17 oz
3P	390 g / 13.76 oz

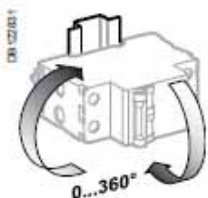
Dimensions (mm / inches)



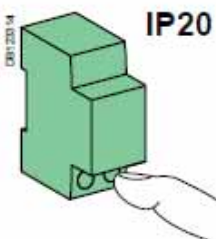
C60BP Tunnel terminal



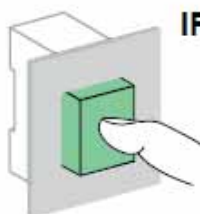
Clip on DIN rail 35 mm.



Indifferent position of installation.



IP20



IP40

Technical data

Main characteristics			
Insulation voltage (Ui)		500 V	
Service breaking capacity (Ics)	In alternating current	75 % of Icu	
	In direct current	100 % of Icu	
Pollution degree		3	
Rated impulse withstand voltage (Uimp)		6 kV	
Thermal tripping	Reference temperature	25°C / 77°F	
Magnetic tripping	Z curve	In alternating current	3 In ± 20 %
		In direct current	4.2 In ± 20 %
	C curve	In alternating current	8.5 In ± 20 %
		In direct current	12 In ± 20 %
D curve (=K curve)	In alternating current	12 In ± 20 %	
	In direct current	17 In ± 20 %	
Additional characteristics			
Degree of protection (IEC 60529)	Device only	IP20	
	Device in modular enclosure	IP40	
Endurance (O-C)	Electrical	10,000 cycles	
	Mechanical	20,000 cycles	
Operating temperature		-30°C to +70°C / -22°F to 158°F	
Storage temperature		-40°C to +80°C / -40°F to 176°F	
Tropicalization (IEC 60068-1)		Treatment 2 (relative humidity 95 % at 55°C / 131°F)	
Dissipated power		See page 68	

Multi 9



UL 489 / CSA C22.2 No 5 / IEC/EN 60947-2 / GB 14048-2

C60BP are multi-standard miniature circuit breakers and branch circuit protection as defined by UL 489. It combines following functions:

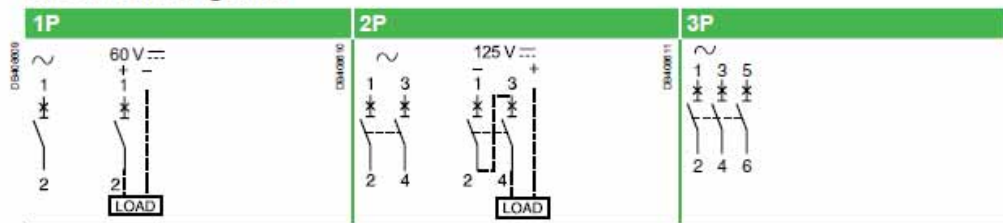
- circuit protection against short-circuit currents
- circuit protection against overload currents
- tripping and fault indication by the addition of auxiliaries.



Number of 18 mm (0.71 in.) poles	Rating (A) 25°C/77°F	Breaking capacity (kA rms) AIR				Icu IEC 60947-2			
		UL 489 / CSA C22.2 No 5				IEC 60947-2			
1P	Voltage (Ue)	277 V ~	240 V ~	120 V ~	60 V ∴	440 V ~	415 V ~	240 V ~	60 V ∴
	0.5 to 35	10	14	14	10	-	3	10	20
	40 to 63	-	10	10	10	-	3	10	20
2P	Voltage (Ue)	480Y/277 V ~		240 V ~	125 V ∴	440 V ~	415 V ~	240 V ~	125 V ∴
	1 to 25	10		14	10	6	10	20	-
	30 to 35	10		14	-	6	10	20	-
3P	1 to 35	10		14	-	6	10	20	-
2P/3P	40 to 63	-		10	-	6	10	20	-



Electrical diagrams



Catalogue numbers

Tunnel terminal connection											
Type	UL489 and CSA voltages	1P			2P			3P			
Auxiliaries		Remote indication and tripping, see page 43									
Rating (In)		Curve			Width in 9 mm modules	Curve		Width in 9 mm modules	Curve		Width in 9 mm modules
		Z	C	D (=K)		C	D (=K)		C	D (=K)	
C60BP											
0.5	480Y/277 V and 240 V	M9F44170	M9F42170	M9F43170	2	-	-	4	-	-	6
1		M9F44101	M9F42101	M9F43101		M9F42201	M9F43201		M9F42301	M9F43301	
2		M9F44102	M9F42102	M9F43102		M9F42202	M9F43202		M9F42302	M9F43302	
3		M9F44103	M9F42103	M9F43103		M9F42203	M9F43203		M9F42303	M9F43303	
4		M9F44104	M9F42104	M9F43104		M9F42204	M9F43204		M9F42304	M9F43304	
5		M9F44105	M9F42105	M9F43105		M9F42205	M9F43205		M9F42305	M9F43305	
6		M9F44106	M9F42106	M9F43106		M9F42206	M9F43206		M9F42306	M9F43306	
8		M9F44108	M9F42108	M9F43108		M9F42208	M9F43208		M9F42308	M9F43308	
10		M9F44110	M9F42110	M9F43110		M9F42210	M9F43210		M9F42310	M9F43310	
15		M9F44115	M9F42115	M9F43115		M9F42215	M9F43215		M9F42315	M9F43315	
20		M9F44120	M9F42120	M9F43120		M9F42220	M9F43220		M9F42320	M9F43320	
25		M9F44125	M9F42125	M9F43125		M9F42225	M9F43225		M9F42325	M9F43325	
30		M9F44130	M9F42130	M9F43130		M9F42230	M9F43230		M9F42330	M9F43330	
35	M9F44135	M9F42135	M9F43135		M9F42235	M9F43235		M9F42335	M9F43335		
40	240 V only	M9F44140	M9F42140	M9F43140	2	M9F42240	M9F43240	4	M9F42340	M9F43340	6
45		M9F44145	M9F42145	M9F43145		M9F42245	M9F43245		M9F42345	M9F43345	
50		M9F44150	M9F42150	M9F43150		M9F42250	M9F43250		M9F42350	M9F43350	
63		M9F44163	M9F42163	M9F43163		M9F42263	M9F43263		M9F42363	M9F43363	



Rev: 0

Date: 06-23-2023

By: JN

Device Tag:

CB18

Job Number: HBR9328

Page # 1/2

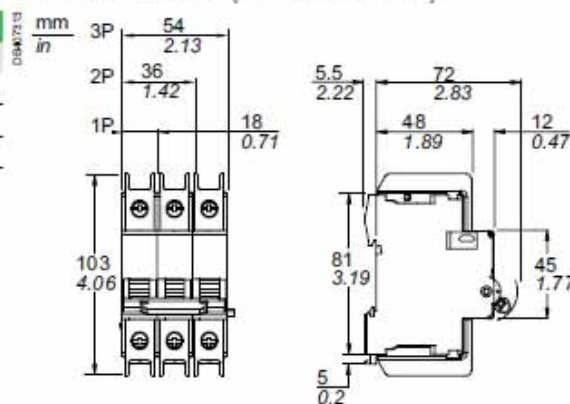
Manuf.: PNO:

Square D: M9F42108

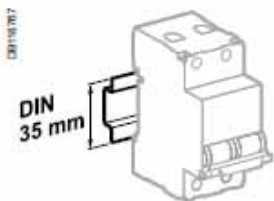
Weight (g / oz)

Circuit-breaker	
Type	C60BP
1P	130 g / 4.58 oz
2P	260 g / 9.17 oz
3P	390 g / 13.76 oz

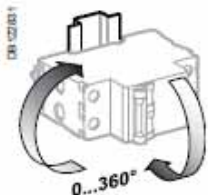
Dimensions (mm / inches)



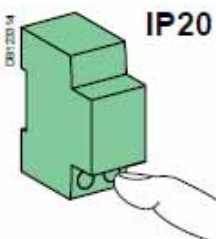
C60BP Tunnel terminal



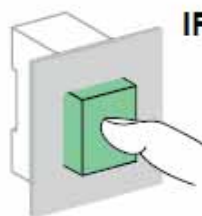
Clip on DIN rail 35 mm.



Indifferent position of installation.



IP20



IP40

Technical data

Main characteristics			
Insulation voltage (Ui)		500 V	
Service breaking capacity (Ics)	In alternating current	75 % of Icu	
	In direct current	100 % of Icu	
Pollution degree		3	
Rated impulse withstand voltage (Uimp)		6 kV	
Thermal tripping	Reference temperature	25°C / 77°F	
Magnetic tripping	Z curve	In alternating current	3 In ± 20 %
		In direct current	4.2 In ± 20 %
	C curve	In alternating current	8.5 In ± 20 %
		In direct current	12 In ± 20 %
D curve (=K curve)	In alternating current	12 In ± 20 %	
	In direct current	17 In ± 20 %	
Additional characteristics			
Degree of protection (IEC 60529)	Device only	IP20	
	Device in modular enclosure	IP40	
Endurance (O-C)	Electrical	10,000 cycles	
	Mechanical	20,000 cycles	
Operating temperature		-30°C to +70°C / -22°F to 158°F	
Storage temperature		-40°C to +80°C / -40°F to 176°F	
Tropicalization (IEC 60068-1)		Treatment 2 (relative humidity 95 % at 55°C / 131°F)	
Dissipated power		See page 68	

Multi 9



UL 489 / CSA C22.2 No 5 / IEC/EN 60947-2 / GB 14048-2

C60BP are multi-standard miniature circuit breakers and branch circuit protection as defined by UL 489. It combines following functions:

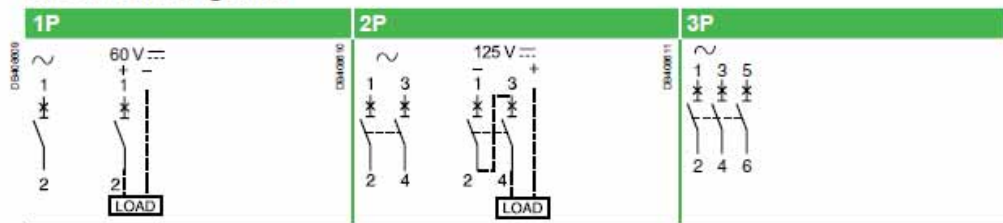
- circuit protection against short-circuit currents
- circuit protection against overload currents
- tripping and fault indication by the addition of auxiliaries.



Number of 18 mm (0.71 in.) poles	Rating (A) 25°C/77°F	Breaking capacity (kA rms) AIR				Icu IEC 60947-2			
		UL 489 / CSA C22.2 No 5				IEC 60947-2			
1P	Voltage (Ue)	277 V ~	240 V ~	120 V ~	60 V ∴	440 V ~	415 V ~	240 V ~	60 V ∴
	0.5 to 35	10	14	14	10	-	3	10	20
	40 to 63	-	10	10	10	-	3	10	20
2P	Voltage (Ue)	480Y/277 V ~		240 V ~	125 V ∴	440 V ~	415 V ~	240 V ~	125 V ∴
	1 to 25	10		14	10	6	10	20	-
	30 to 35	10		14	-	6	10	20	-
3P	1 to 35	10		14	-	6	10	20	-
2P/3P	40 to 63	-		10	-	6	10	20	-



Electrical diagrams



Catalogue numbers

Tunnel terminal connection												
Type	UL489 and CSA voltages	1P			2P			3P				
Auxiliaries		Remote indication and tripping, see page 43										
Rating (In)		Curve			Width in 9 mm modules	Curve		Width in 9 mm modules	Curve		Width in 9 mm modules	
		Z	C	D (=K)		C	D (=K)		C	D (=K)		
C60BP												
0.5	480Y/277 V and 240 V	M9F44170	M9F42170	M9F43170	2	-	-	4	-	-	6	
1		M9F44101	M9F42101	M9F43101		M9F42201	M9F43201		M9F42301	M9F43301		
2		M9F44102	M9F42102	M9F43102		M9F42202	M9F43202		M9F42302	M9F43302		
3		M9F44103	M9F42103	M9F43103		M9F42203	M9F43203		M9F42303	M9F43303		
4		M9F44104	M9F42104	M9F43104		M9F42204	M9F43204		M9F42304	M9F43304		
5		M9F44105	M9F42105	M9F43105		M9F42205	M9F43205		M9F42305	M9F43305		
6		M9F44106	M9F42106	M9F43106		M9F42206	M9F43206		M9F42306	M9F43306		
8		M9F44108	M9F42108	M9F43108		M9F42208	M9F43208		M9F42308	M9F43308		
10		M9F44110	M9F42110	M9F43110		M9F42210	M9F43210		M9F42310	M9F43310		
15		M9F44115	M9F42115	M9F43115		M9F42215	M9F43215		M9F42315	M9F43315		
20		M9F44120	M9F42120	M9F43120		M9F42220	M9F43220		M9F42320	M9F43320		
25		M9F44125	M9F42125	M9F43125		M9F42225	M9F43225		M9F42325	M9F43325		
30		M9F44130	M9F42130	M9F43130		M9F42230	M9F43230		M9F42330	M9F43330		
35		M9F44135	M9F42135	M9F43135		M9F42235	M9F43235		M9F42335	M9F43335		
40		240 V only	M9F44140	M9F42140	M9F43140	2	M9F42240	M9F43240	4	M9F42340	M9F43340	6
45			M9F44145	M9F42145	M9F43145		M9F42245	M9F43245		M9F42345	M9F43345	
50	M9F44150		M9F42150	M9F43150		M9F42250	M9F43250		M9F42350	M9F43350		
63	M9F44163		M9F42163	M9F43163		M9F42263	M9F43263		M9F42363	M9F43363		



Rev: 0

Date: 06-23-2023

By: JN

Device Tag:

CB2

Job Number: HBR9328

Page # 1/2

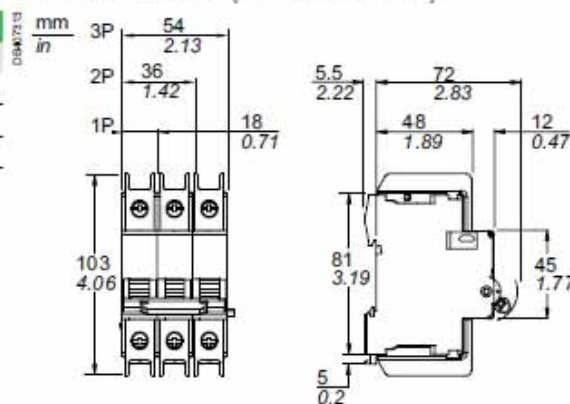
Manuf.: PNO:

Square D: M9F43302

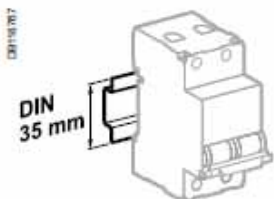
Weight (g / oz)

Circuit-breaker	
Type	C60BP
1P	130 g / 4.58 oz
2P	260 g / 9.17 oz
3P	390 g / 13.76 oz

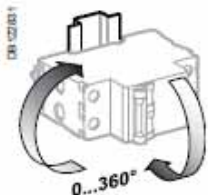
Dimensions (mm / inches)



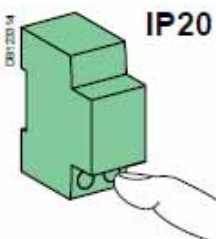
C60BP Tunnel terminal



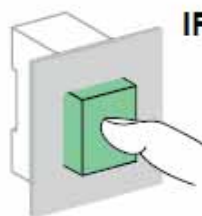
Clip on DIN rail 35 mm.



Indifferent position of installation.



IP20



IP40

Technical data

Main characteristics			
Insulation voltage (Ui)		500 V	
Service breaking capacity (Ics)	In alternating current	75 % of Icu	
	In direct current	100 % of Icu	
Pollution degree		3	
Rated impulse withstand voltage (Uimp)		6 kV	
Thermal tripping	Reference temperature	25°C / 77°F	
Magnetic tripping	Z curve	In alternating current	3 In ± 20 %
		In direct current	4.2 In ± 20 %
	C curve	In alternating current	8.5 In ± 20 %
		In direct current	12 In ± 20 %
D curve (=K curve)	In alternating current	12 In ± 20 %	
	In direct current	17 In ± 20 %	
Additional characteristics			
Degree of protection (IEC 60529)	Device only	IP20	
	Device in modular enclosure	IP40	
Endurance (O-C)	Electrical	10,000 cycles	
	Mechanical	20,000 cycles	
Operating temperature		-30°C to +70°C / -22°F to 158°F	
Storage temperature		-40°C to +80°C / -40°F to 176°F	
Tropicalization (IEC 60068-1)		Treatment 2 (relative humidity 95 % at 55°C / 131°F)	
Dissipated power		See page 68	

Multi 9



UL 489 / CSA C22.2 No 5 / IEC/EN 60947-2 / GB 14048-2

C60BP are multi-standard miniature circuit breakers and branch circuit protection as defined by UL 489. It combines following functions:

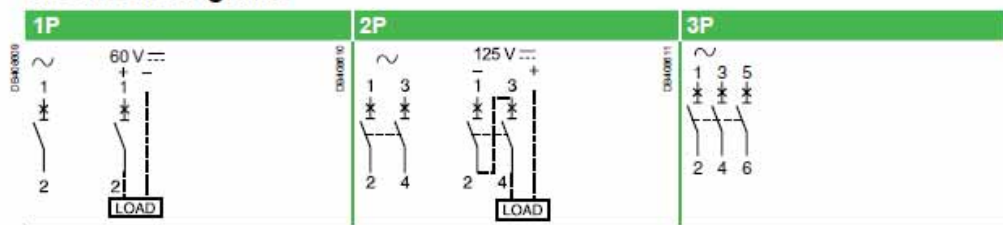
- circuit protection against short-circuit currents
- circuit protection against overload currents
- tripping and fault indication by the addition of auxiliaries.



Number of 18 mm (0.71 in.) poles	Rating (A) 25°C/77°F	Breaking capacity (kA rms) AIR				Icu IEC 60947-2			
		UL 489 / CSA C22.2 No 5							
1P	Voltage (Ue)	277 V ~	240 V ~	120 V ~	60 V ∴	440 V ~	415 V ~	240 V ~	60 V ∴
	0.5 to 35	10	14	14	10	-	3	10	20
	40 to 63	-	10	10	10	-	3	10	20
2P	Voltage (Ue)	480Y/277 V ~		240 V ~	125 V ∴	440 V ~	415 V ~	240 V ~	125 V ∴
	1 to 25	10		14	10	6	10	20	-
	30 to 35	10		14	-	6	10	20	-
3P	1 to 35	10		14	-	6	10	20	-
2P/3P	40 to 63	-		10	-	6	10	20	-



Electrical diagrams



Catalogue numbers

Tunnel terminal connection												
Type	UL489 and CSA voltages	1P			2P			3P				
Auxiliaries		Remote indication and tripping, see page 43										
Rating (In)		Curve			Width in 9 mm modules	Curve		Width in 9 mm modules	Curve		Width in 9 mm modules	
		Z	C	D (=K)		C	D (=K)		C	D (=K)		
C60BP												
0.5	480Y/277 V and 240 V	M9F44170	M9F42170	M9F43170	2	-	-	4	-	-	6	
1		M9F44101	M9F42101	M9F43101		M9F42201	M9F43201		M9F42301	M9F43301		
2		M9F44102	M9F42102	M9F43102		M9F42202	M9F43202		M9F42302	M9F43302		
3		M9F44103	M9F42103	M9F43103		M9F42203	M9F43203		M9F42303	M9F43303		
4		M9F44104	M9F42104	M9F43104		M9F42204	M9F43204		M9F42304	M9F43304		
5		M9F44105	M9F42105	M9F43105		M9F42205	M9F43205		M9F42305	M9F43305		
6		M9F44106	M9F42106	M9F43106		M9F42206	M9F43206		M9F42306	M9F43306		
8		M9F44108	M9F42108	M9F43108		M9F42208	M9F43208		M9F42308	M9F43308		
10		M9F44110	M9F42110	M9F43110		M9F42210	M9F43210		M9F42310	M9F43310		
15		M9F44115	M9F42115	M9F43115		M9F42215	M9F43215		M9F42315	M9F43315		
20		M9F44120	M9F42120	M9F43120		M9F42220	M9F43220		M9F42320	M9F43320		
25		M9F44125	M9F42125	M9F43125		M9F42225	M9F43225		M9F42325	M9F43325		
30		M9F44130	M9F42130	M9F43130		M9F42230	M9F43230		M9F42330	M9F43330		
35		M9F44135	M9F42135	M9F43135		M9F42235	M9F43235		M9F42335	M9F43335		
40		240 V only	M9F44140	M9F42140	M9F43140	2	M9F42240	M9F43240	4	M9F42340	M9F43340	6
45			M9F44145	M9F42145	M9F43145		M9F42245	M9F43245		M9F42345	M9F43345	
50	M9F44150		M9F42150	M9F43150		M9F42250	M9F43250		M9F42350	M9F43350		
63	M9F44163		M9F42163	M9F43163		M9F42263	M9F43263		M9F42363	M9F43363		



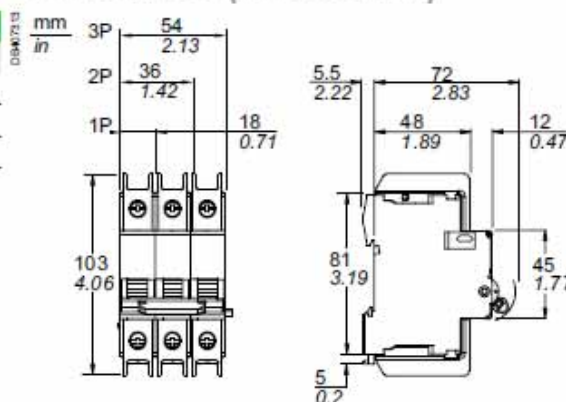
Rev: 0	Device Tag: CB3	
Date: 06-23-2023		
By: JN	Job Number: HBR9328	Page # 1/2

Manuf.: PNO: Square D: M9F43208

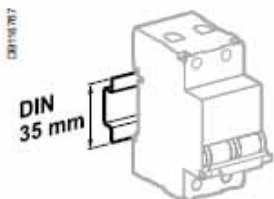
Weight (g / oz)

Circuit-breaker	
Type	C60BP
1P	130 g / 4.58 oz
2P	260 g / 9.17 oz
3P	390 g / 13.76 oz

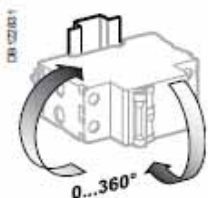
Dimensions (mm / inches)



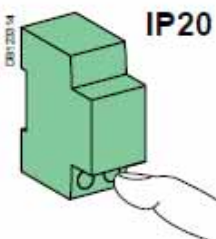
C60BP Tunnel terminal



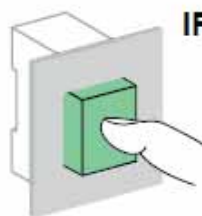
Clip on DIN rail 35 mm.



Indifferent position of installation.



IP20



IP40

Technical data

Main characteristics			
Insulation voltage (Ui)		500 V	
Service breaking capacity (Ics)	In alternating current	75 % of Icu	
	In direct current	100 % of Icu	
Pollution degree		3	
Rated impulse withstand voltage (Uimp)		6 kV	
Thermal tripping	Reference temperature	25°C / 77°F	
Magnetic tripping	Z curve	In alternating current	3 In ± 20 %
		In direct current	4.2 In ± 20 %
	C curve	In alternating current	8.5 In ± 20 %
		In direct current	12 In ± 20 %
D curve (=K curve)	In alternating current	12 In ± 20 %	
	In direct current	17 In ± 20 %	
Additional characteristics			
Degree of protection (IEC 60529)	Device only	IP20	
	Device in modular enclosure	IP40	
Endurance (O-C)	Electrical	10,000 cycles	
	Mechanical	20,000 cycles	
Operating temperature		-30°C to +70°C / -22°F to 158°F	
Storage temperature		-40°C to +80°C / -40°F to 176°F	
Tropicalization (IEC 60068-1)		Treatment 2 (relative humidity 95 % at 55°C / 131°F)	
Dissipated power		See page 68	

Multi 9



UL 489 / CSA C22.2 No 5 / IEC/EN 60947-2 / GB 14048-2

C60BP are multi-standard miniature circuit breakers and branch circuit protection as defined by UL 489. It combines following functions:

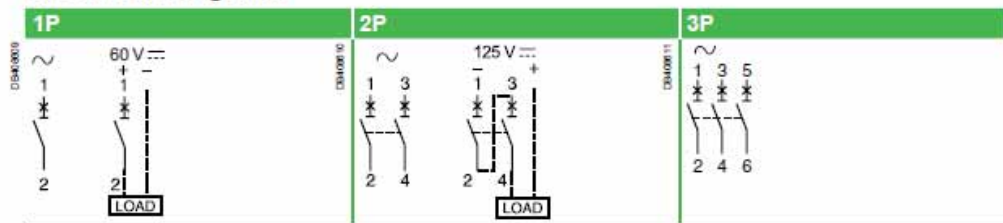
- circuit protection against short-circuit currents
- circuit protection against overload currents
- tripping and fault indication by the addition of auxiliaries.



Number of 18 mm (0.71 in.) poles	Rating (A) 25°C/77°F	Breaking capacity (kA rms) AIR				Icu IEC 60947-2			
		UL 489 / CSA C22.2 No 5							
1P	Voltage (Ue)	277 V ~	240 V ~	120 V ~	60 V ~	440 V ~	415 V ~	240 V ~	60 V ~
	0.5 to 35	10	14	14	10	-	3	10	20
	40 to 63	-	10	10	10	-	3	10	20
2P	Voltage (Ue)	480Y/277 V ~		240 V ~	125 V ~	440 V ~	415 V ~	240 V ~	125 V ~
	1 to 25	10		14	10	6	10	20	-
	30 to 35	10		14	-	6	10	20	-
3P	1 to 35	10		14	-	6	10	20	-
2P/3P	40 to 63	-		10	-	6	10	20	-



Electrical diagrams



Catalogue numbers

Tunnel terminal connection												
Type	UL489 and CSA voltages	1P			2P			3P				
Auxiliaries		Remote indication and tripping, see page 43										
Rating (In)		Curve			Width in 9 mm modules	Curve		Width in 9 mm modules	Curve		Width in 9 mm modules	
		Z	C	D (=K)		C	D (=K)		C	D (=K)		
C60BP												
0.5	480Y/277 V and 240 V	M9F44170	M9F42170	M9F43170	2	-	-	4	-	-	6	
1		M9F44101	M9F42101	M9F43101		M9F42201	M9F43201		M9F42301	M9F43301		
2		M9F44102	M9F42102	M9F43102		M9F42202	M9F43202		M9F42302	M9F43302		
3		M9F44103	M9F42103	M9F43103		M9F42203	M9F43203		M9F42303	M9F43303		
4		M9F44104	M9F42104	M9F43104		M9F42204	M9F43204		M9F42304	M9F43304		
5		M9F44105	M9F42105	M9F43105		M9F42205	M9F43205		M9F42305	M9F43305		
6		M9F44106	M9F42106	M9F43106		M9F42206	M9F43206		M9F42306	M9F43306		
8		M9F44108	M9F42108	M9F43108		M9F42208	M9F43208		M9F42308	M9F43308		
10		M9F44110	M9F42110	M9F43110		M9F42210	M9F43210		M9F42310	M9F43310		
15		M9F44115	M9F42115	M9F43115		M9F42215	M9F43215		M9F42315	M9F43315		
20		M9F44120	M9F42120	M9F43120		M9F42220	M9F43220		M9F42320	M9F43320		
25		M9F44125	M9F42125	M9F43125		M9F42225	M9F43225		M9F42325	M9F43325		
30		M9F44130	M9F42130	M9F43130		M9F42230	M9F43230		M9F42330	M9F43330		
35		M9F44135	M9F42135	M9F43135		M9F42235	M9F43235		M9F42335	M9F43335		
40		240 V only	M9F44140	M9F42140	M9F43140	2	M9F42240	M9F43240	4	M9F42340	M9F43340	6
45			M9F44145	M9F42145	M9F43145		M9F42245	M9F43245		M9F42345	M9F43345	
50	M9F44150		M9F42150	M9F43150		M9F42250	M9F43250		M9F42350	M9F43350		
63	M9F44163		M9F42163	M9F43163		M9F42263	M9F43263		M9F42363	M9F43363		



Rev: 0

Date: 06-23-2023

By: JN

Device Tag:

CB4

Job Number: HBR9328

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Manuf.: PNO:

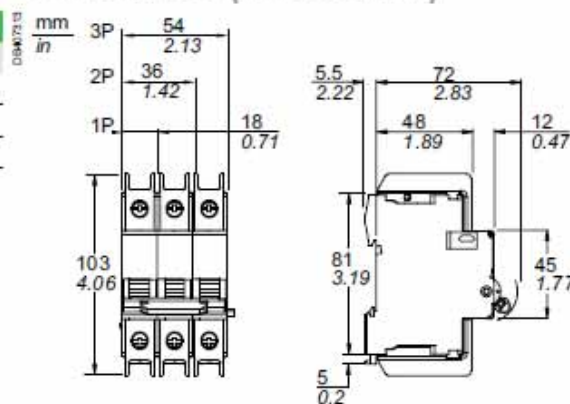
Square D: M9F42115

03-058-126

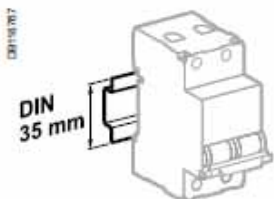
Weight (g / oz)

Circuit-breaker	
Type	C60BP
1P	130 g / 4.58 oz
2P	260 g / 9.17 oz
3P	390 g / 13.76 oz

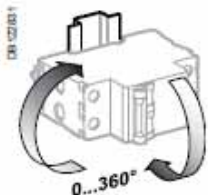
Dimensions (mm / inches)



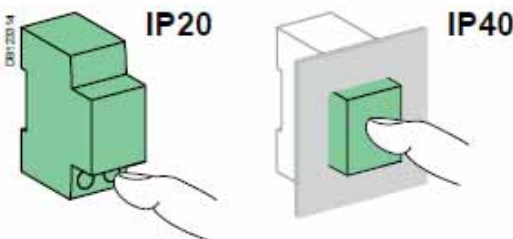
C60BP Tunnel terminal



Clip on DIN rail 35 mm.



Indifferent position of installation.



Technical data

Main characteristics			
Insulation voltage (Ui)		500 V	
Service breaking capacity (Ics)	In alternating current	75 % of Icu	
	In direct current	100 % of Icu	
Pollution degree		3	
Rated impulse withstand voltage (Uimp)		6 kV	
Thermal tripping	Reference temperature	25°C / 77°F	
Magnetic tripping	Z curve	In alternating current	3 In ± 20 %
		In direct current	4.2 In ± 20 %
	C curve	In alternating current	8.5 In ± 20 %
		In direct current	12 In ± 20 %
D curve (=K curve)	In alternating current	12 In ± 20 %	
	In direct current	17 In ± 20 %	
Additional characteristics			
Degree of protection (IEC 60529)	Device only	IP20	
	Device in modular enclosure	IP40	
Endurance (O-C)	Electrical	10,000 cycles	
	Mechanical	20,000 cycles	
Operating temperature		-30°C to +70°C / -22°F to 158°F	
Storage temperature		-40°C to +80°C / -40°F to 176°F	
Tropicalization (IEC 60068-1)		Treatment 2 (relative humidity 95 % at 55°C / 131°F)	
Dissipated power		See page 68	

Multi 9



UL 489 / CSA C22.2 No 5 / IEC/EN 60947-2 / GB 14048-2

C60BP are multi-standard miniature circuit breakers and branch circuit protection as defined by UL 489. It combines following functions:

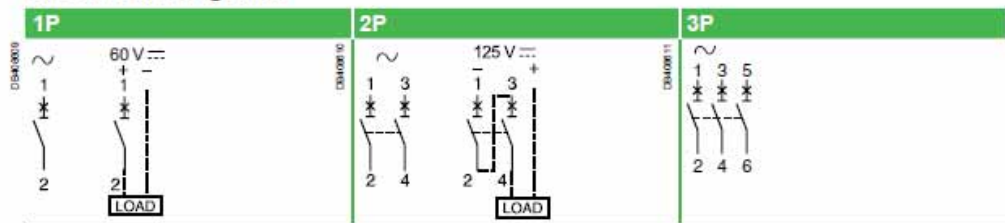
- circuit protection against short-circuit currents
- circuit protection against overload currents
- tripping and fault indication by the addition of auxiliaries.



Number of 18 mm (0.71 in.) poles	Rating (A) 25°C/77°F	Breaking capacity (kA rms) AIR				Icu IEC 60947-2			
		UL 489 / CSA C22.2 No 5				IEC 60947-2			
1P	Voltage (Ue)	277 V ~	240 V ~	120 V ~	60 V ∴	440 V ~	415 V ~	240 V ~	60 V ∴
	0.5 to 35	10	14	14	10	-	3	10	20
	40 to 63	-	10	10	10	-	3	10	20
2P	Voltage (Ue)	480Y/277 V ~		240 V ~	125 V ∴	440 V ~	415 V ~	240 V ~	125 V ∴
	1 to 25	10		14	10	6	10	20	-
	30 to 35	10		14	-	6	10	20	-
3P	1 to 35	10		14	-	6	10	20	-
2P/3P	40 to 63	-		10	-	6	10	20	-



Electrical diagrams



Catalogue numbers

Tunnel terminal connection											
Type	UL489 and CSA voltages	1P			2P			3P			
Auxiliaries		Remote indication and tripping, see page 43									
Rating (In)		Curve			Width in 9 mm modules	Curve		Width in 9 mm modules	Curve		Width in 9 mm modules
		Z	C	D (=K)		C	D (=K)		C	D (=K)	
C60BP											
0.5	480Y/277 V and 240 V	M9F44170	M9F42170	M9F43170	2	-	-	4	-	-	6
1		M9F44101	M9F42101	M9F43101		M9F42201	M9F43201		M9F42301	M9F43301	
2		M9F44102	M9F42102	M9F43102		M9F42202	M9F43202		M9F42302	M9F43302	
3		M9F44103	M9F42103	M9F43103		M9F42203	M9F43203		M9F42303	M9F43303	
4		M9F44104	M9F42104	M9F43104		M9F42204	M9F43204		M9F42304	M9F43304	
5		M9F44105	M9F42105	M9F43105		M9F42205	M9F43205		M9F42305	M9F43305	
6		M9F44106	M9F42106	M9F43106		M9F42206	M9F43206		M9F42306	M9F43306	
8		M9F44108	M9F42108	M9F43108		M9F42208	M9F43208		M9F42308	M9F43308	
10		M9F44110	M9F42110	M9F43110		M9F42210	M9F43210		M9F42310	M9F43310	
15		M9F44115	M9F42115	M9F43115		M9F42215	M9F43215		M9F42315	M9F43315	
20		M9F44120	M9F42120	M9F43120		M9F42220	M9F43220		M9F42320	M9F43320	
25		M9F44125	M9F42125	M9F43125		M9F42225	M9F43225		M9F42325	M9F43325	
30		M9F44130	M9F42130	M9F43130		M9F42230	M9F43230		M9F42330	M9F43330	
35	M9F44135	M9F42135	M9F43135		M9F42235	M9F43235		M9F42335	M9F43335		
40	240 V only	M9F44140	M9F42140	M9F43140	2	M9F42240	M9F43240	4	M9F42340	M9F43340	6
45		M9F44145	M9F42145	M9F43145		M9F42245	M9F43245		M9F42345	M9F43345	
50		M9F44150	M9F42150	M9F43150		M9F42250	M9F43250		M9F42350	M9F43350	
55		M9F44155	M9F42155	M9F43155		M9F42255	M9F43255		M9F42355	M9F43355	
63		M9F44163	M9F42163	M9F43163		M9F42263	M9F43263		M9F42363	M9F43363	



Rev: 0

Date: 06-23-2023

By: JN

Device Tag:

CB5,6

Job Number: HBR9328

Page # 1/2

Manuf.: PNO:

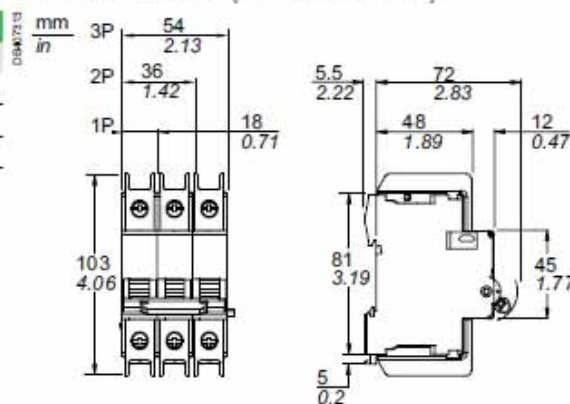
Square D: M9F42110

03-058-125

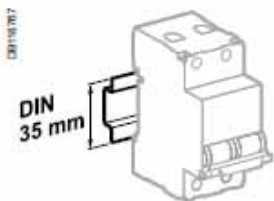
Weight (g / oz)

Circuit-breaker	
Type	C60BP
1P	130 g / 4.58 oz
2P	260 g / 9.17 oz
3P	390 g / 13.76 oz

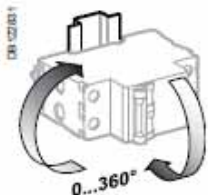
Dimensions (mm / inches)



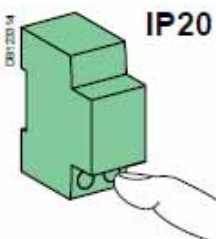
C60BP Tunnel terminal



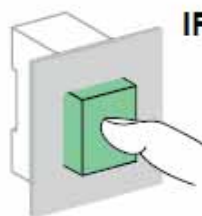
Clip on DIN rail 35 mm.



Indifferent position of installation.



IP20



IP40

Technical data

Main characteristics			
Insulation voltage (Ui)		500 V	
Service breaking capacity (Ics)	In alternating current	75 % of Icu	
	In direct current	100 % of Icu	
Pollution degree		3	
Rated impulse withstand voltage (Uimp)		6 kV	
Thermal tripping	Reference temperature	25°C / 77°F	
Magnetic tripping	Z curve	In alternating current	3 In ± 20 %
		In direct current	4.2 In ± 20 %
	C curve	In alternating current	8.5 In ± 20 %
		In direct current	12 In ± 20 %
	D curve (=K curve)	In alternating current	12 In ± 20 %
		In direct current	17 In ± 20 %
Additional characteristics			
Degree of protection (IEC 60529)	Device only	IP20	
	Device in modular enclosure	IP40	
Endurance (O-C)	Electrical	10,000 cycles	
	Mechanical	20,000 cycles	
Operating temperature		-30°C to +70°C / -22°F to 158°F	
Storage temperature		-40°C to +80°C / -40°F to 176°F	
Tropicalization (IEC 60068-1)		Treatment 2 (relative humidity 95 % at 55°C / 131°F)	
Dissipated power		See page 68	

Multi 9



UL 489 / CSA C22.2 No 5 / IEC/EN 60947-2 / GB 14048-2

C60BP are multi-standard miniature circuit breakers and branch circuit protection as defined by UL 489. It combines following functions:

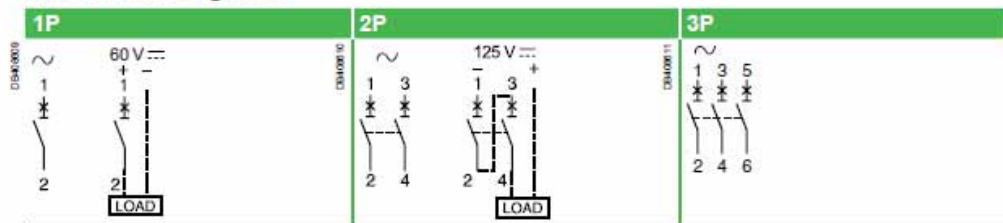
- circuit protection against short-circuit currents
- circuit protection against overload currents
- tripping and fault indication by the addition of auxiliaries.



Number of 18 mm (0.71 in.) poles	Rating (A) 25°C/77°F	Breaking capacity (kA rms) AIR				Icu IEC 60947-2			
		UL 489 / CSA C22.2 No 5				IEC 60947-2			
1P	Voltage (Ue)	277 V ~	240 V ~	120 V ~	60 V ∴	440 V ~	415 V ~	240 V ~	60 V ∴
	0.5 to 35	10	14	14	10	-	3	10	20
	40 to 63	-	10	10	10	-	3	10	20
2P	Voltage (Ue)	480Y/277 V ~		240 V ~	125 V ∴	440 V ~	415 V ~	240 V ~	125 V ∴
	1 to 25	10		14	10	6	10	20	-
	30 to 35	10		14	-	6	10	20	-
3P	1 to 35	10		14	-	6	10	20	-
2P/3P	40 to 63	-		10	-	6	10	20	-



Electrical diagrams



Catalogue numbers

Tunnel terminal connection											
Type	UL489 and CSA voltages	1P			2P			3P			
Auxiliaries		Remote indication and tripping, see page 43									
Rating (In)		Curve			Width in 9 mm modules	Curve		Width in 9 mm modules	Curve		Width in 9 mm modules
		Z	C	D (=K)		C	D (=K)		C	D (=K)	
C60BP											
0.5	480Y/277 V and 240 V	M9F44170	M9F42170	M9F43170	2	-	-	4	-	-	6
1		M9F44101	M9F42101	M9F43101		M9F42201	M9F43201		M9F42301	M9F43301	
2		M9F44102	M9F42102	M9F43102		M9F42202	M9F43202		M9F42302	M9F43302	
3		M9F44103	M9F42103	M9F43103		M9F42203	M9F43203		M9F42303	M9F43303	
4		M9F44104	M9F42104	M9F43104		M9F42204	M9F43204		M9F42304	M9F43304	
5		M9F44105	M9F42105	M9F43105		M9F42205	M9F43205		M9F42305	M9F43305	
6		M9F44106	M9F42106	M9F43106		M9F42206	M9F43206		M9F42306	M9F43306	
8		M9F44108	M9F42108	M9F43108		M9F42208	M9F43208		M9F42308	M9F43308	
10		M9F44110	M9F42110	M9F43110		M9F42210	M9F43210		M9F42310	M9F43310	
15		M9F44115	M9F42115	M9F43115		M9F42215	M9F43215		M9F42315	M9F43315	
20		M9F44120	M9F42120	M9F43120		M9F42220	M9F43220		M9F42320	M9F43320	
25		M9F44125	M9F42125	M9F43125		M9F42225	M9F43225		M9F42325	M9F43325	
30		M9F44130	M9F42130	M9F43130		M9F42230	M9F43230		M9F42330	M9F43330	
35		M9F44135	M9F42135	M9F43135		M9F42235	M9F43235		M9F42335	M9F43335	
40		240 V only	M9F44140	M9F42140	M9F43140	2	M9F42240	M9F43240	4	M9F42340	M9F43340
45	M9F44145		M9F42145	M9F43145		M9F42245	M9F43245		M9F42345	M9F43345	
50	M9F44150		M9F42150	M9F43150		M9F42250	M9F43250		M9F42350	M9F43350	
63	M9F44163		M9F42163	M9F43163		M9F42263	M9F43263		M9F42363	M9F43363	



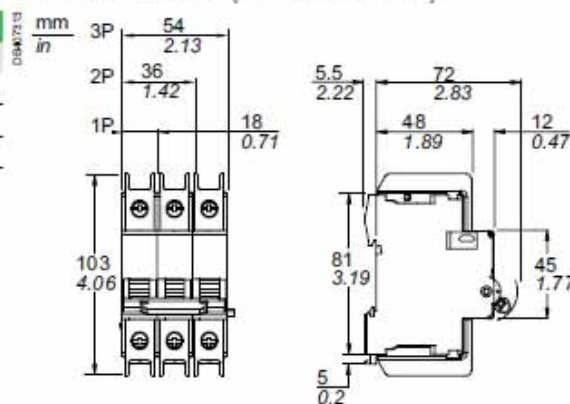
Rev: 0	Device Tag: CB7-9	
Date: 06-23-2023		
By: JN	Job Number: HBR9328	Page # 1/2

Manuf.: PNO: Square D: M9F42106

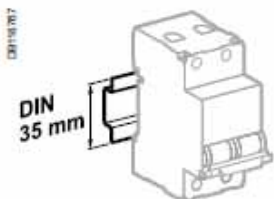
Weight (g / oz)

Circuit-breaker	
Type	C60BP
1P	130 g / 4.58 oz
2P	260 g / 9.17 oz
3P	390 g / 13.76 oz

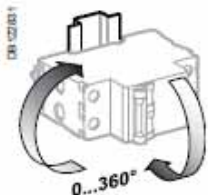
Dimensions (mm / inches)



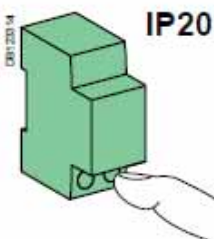
C60BP Tunnel terminal



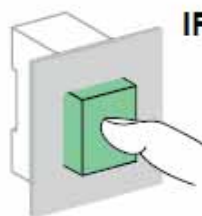
Clip on DIN rail 35 mm.



Indifferent position of installation.



IP20



IP40

Technical data

Main characteristics			
Insulation voltage (Ui)		500 V	
Service breaking capacity (Ics)	In alternating current	75 % of Icu	
	In direct current	100 % of Icu	
Pollution degree		3	
Rated impulse withstand voltage (Uimp)		6 kV	
Thermal tripping	Reference temperature	25°C / 77°F	
Magnetic tripping	Z curve	In alternating current	3 In ± 20 %
		In direct current	4.2 In ± 20 %
	C curve	In alternating current	8.5 In ± 20 %
		In direct current	12 In ± 20 %
D curve (=K curve)	In alternating current	12 In ± 20 %	
	In direct current	17 In ± 20 %	
Additional characteristics			
Degree of protection (IEC 60529)	Device only	IP20	
	Device in modular enclosure	IP40	
Endurance (O-C)	Electrical	10,000 cycles	
	Mechanical	20,000 cycles	
Operating temperature		-30°C to +70°C / -22°F to 158°F	
Storage temperature		-40°C to +80°C / -40°F to 176°F	
Tropicalization (IEC 60068-1)		Treatment 2 (relative humidity 95 % at 55°C / 131°F)	
Dissipated power		See page 68	

DataTuff® 5e, 4 Bonded-Pr #23 Sol BC, PO Ins, OS, PVC Jkt, CMR AWM 21047



57-000-A030



Physical Characteristics (Overall)

Conductor

AWG	Stranding	Material	No. of Pairs
24	Solid	BC - Bare Copper	4

Conductor Count:	8
Total Number of Pairs:	4

Insulation

Material	Nominal Wall Thickness
Polyolefin	0.01 in

Bonded-Pair:	Yes
--------------	-----

Color Chart

Number	Color
1	White/Blue Stripe & Blue
2	White/Orange Stripe & Orange
3	White/Green Stripe & Green
4	White/Brown Stripe & Brown

Outer Shield Material

Type	Material	Material Trade Name	Coverage [%]	Drainwire Material	Drainwire AWG	Drainwire Construction n x D
Tape	Alum / Poly	Beidloil®	100 %	TC - Tinned Copper	24	7x32

Outer Jacket Material

Material	Nominal Diameter	Ripcord
PVC - Polyvinyl Chloride	0.275 in	No

Temperature Range

Installation Temp Range:	-25°C To +75°C
UL Temp Rating:	60°C
Storage Temp Range:	-40°C To +75°C
Operating Temp Range:	-40°C To +75°C

Mechanical Characteristics

Bulk Cable Weight:	32 lbs/1000ft
Max Recommended Pulling Tension:	35 lbs
Min Bend Radius/Minor Axis:	0.5 in

Standards

NEC/(UL) Specification:	CMR, CMX-Outdoor, UL 444
CEC/C(UL) Specification:	CMR
UL AWM Style:	UL Style 21047
ISO/IEC Compliance:	ISO/IEC 11801 ed 2.1 (2008) Class D
CPR Euroclass:	Eca
Data Category:	Category 5e
Telecommunications Standards:	Category 5e - TIA 568.C.2
Other Specification:	NEMA WC-63.1 Category 5e, UL verified to Category 5e, Ethernet/IP™ Compliant

Applicable Environmental and Other Programs

EU Directive Compliance:	EU Directive 2003/11/EC (BFR)
Mil Order #39 (China RoHS):	Yes

Suitability

Suitability - Oil Resistance:	Yes
Suitability - Outdoor:	Yes
Suitability - Sunlight Resistance:	Yes

Flammability, LS0H, Toxicity Testing

UL Flammability:	UL1666 Riser
------------------	--------------



Rev: 0
Date: 06-23-2023
By: JN

Device Tag: CBL1,2
Job Number: HBR9328
Page # 1/1

Manuf.: . PNO: EleMech: 57-000-A030

DataTuff Industrial Ethernet Cord Sets (RJ45). Cat 5e 4-Pair, 24 AWG - Heavy Duty Oil- & Sunlight-Resistant Black Jackets

IP67 interface complies with the *EtherNet/IP* specification (IEC 61076-3-106 Variant 1)



• **Cord Sets (RJ45)**

Cat 6 or Cat 5e UTP or FTP with solid 24 AWG conductors and industrial-grade sunlight/oil resistant jackets. Suitable for use in IP67 or IP20 installations.

IP20 Cord Set



57-009-008

Shielded with Solid Conductors (ref: Belden Bonded-Pair Cable 7929A)

Cable Rating NEC: CMR, CMX-Outdoor CEC: CMR FT4. MSHA

Belden Part No.	IP Rating	Length meters (Ft.)	Tethered Cap	Package Quantity
E504001 010S1	IP67	1 m (3.3 ft.)	Yes	1
E504002 010S1	IP67	2 m (6.6 ft.)	Yes	1
E504003 010S1	IP67	3 m (9.8 ft.)	Yes	1
E504005 010S1	IP67	5 m (16.4 ft.)	Yes	1
E504025 010S1	IP67	25 m (82 ft.)	Yes	1
E505001 010S1	IP20	1 m (3.3 ft.)	-	1
E505002 010S1	IP20	2 m (6.6 ft.)	-	1
E505003 010S1	IP20	3 m (9.8 ft.)	-	1
E505005 010S1	IP20	5 m (16.4 ft.)	-	1

General Description:

2 meter (6.6 ft.), Shielded with solid conductors (ref: Belden Bonded-Pair Cable 7958A). Cable Rating NEC: CMR, CMX-Outdoor. CEC: CMR FT4. MSHA. 600V AWM Rated.

Item #	Putup	Ship Weight	Color	Notes	Item Desc
E605002 010S1	1 EA	0.226 LB	BLACK		CORDSET IP20 C6A FTP SO 2M BK

General Description:

2 meter (6.6 ft.), Shielded with solid conductors (ref: Belden Bonded-Pair Cable 7953A). Cable Rating NEC: CMR. CEC: CMR FT4. 600V AWM Rated.

Applicable Specifications and Agency Compliance (Overall)

Applicable Standards & Environmental Programs

EU Directive 2002/95/EC (RoHS):	Yes
EU RoHS Compliance Date (mm/dd/yyyy):	01/01/2006
Mil Order #39 (China RoHS):	EUP 50

Notes (Overall)

Notes: For additional information about this product, visit our web site at <http://www.belden.com>

Cable

Description:	4 pair, 23 AWG bare copper, Polyolefin Insulation, Bonded pairs, Overall Beldfoil® Shield, Industrial Grade PVC, Oil Res, Sun Res, CMR, FT4. 600V AWM Rated.
Part Number:	7953A
Shielding:	Aluminum Foil-Polyester Tape
Electrical Performance:	Category 6A
Maximum Operating Voltage:	300 V RMS (600 V AWM Rated)
Applicable Standards:	ANSI/TIA-568-C 2, ISO/IEC 11801, EtherNet/IP(tm) Specification, UL 1666 Riser



Rev:

0

Device Tag:

CBL3

Date:

06-23-2023

Job Number:

HBR9328

Page #

1/1

Manuf.: PNo:

Belden: E505002-010S1

By:

JN

Monitoring Relays 1-Phase True RMS AC Over or Under Current Type DIB01 100A



04-094-000

Ordering Key **DIB 01 C M24 100A**



Input Specifications

Input (current level) DIB01 100A	Built-in current transformer	Contact input DIB01 Disabled Enabled Latch disable	Terminals A1, Y1 Open < 10 kΩ > 500 ms
Measuring ranges Selectable by DIP-switch	Max current		
2 to 20 A AC	120 A		
5 to 50 A AC	120 A		
10 to 100 A AC	120 A		
Max. current for 30 s	250 A		
Max. current for 1 s	2000 A		

Supply Specifications

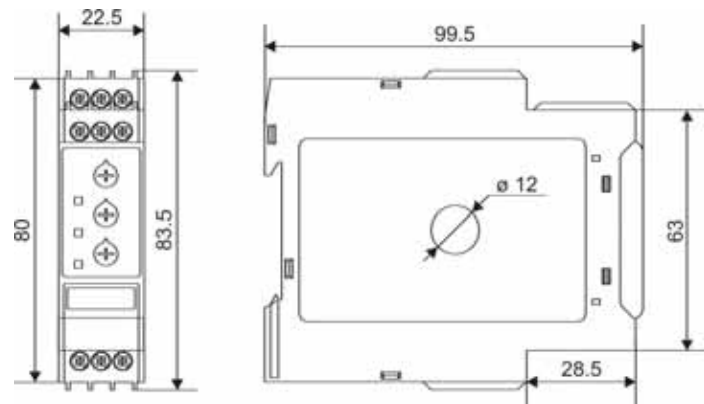
Power supply Rated operational voltage through terminals: A1, A2	Overvoltage cat. III (IEC 60664, IEC 60038) 24 VDC - 15% +10% 24 to 240 VAC ± 15% 45 to 65 Hz
Dielectric voltage Supply to input Supply to output Input to output	4 kV 4 kV 4 kV
Rated operational power DC AC	1 W 1 W / 35 VA

Output Specifications

Output Rated insulation voltage	SPDT relay 250 VAC
Contact ratings (AgSnO₂) Resistive loads DC 12 Small inductive loads AC 15 DC 13	μ 8 A @ 250 VAC 5 A @ 24 VDC 2.5 A @ 250 VAC 2.5 A @ 24 VDC
Mechanical life	≥ 30 x 10 ⁶ operations
Electrical life	≥ 10 ⁵ operations (at 8 A, 250 V, cos φ = 1)
Operating frequency	≤ 7200 operations/h
Dielectric strength Dielectric voltage Rated impulse withstand volt.	≥ 2 kVAC (rms) 4 kV (1.2/50 μs)

Approvals

UL, CSA



Rev: 0
 Date: 06-23-2023
 By: JN

Device Tag:
CM1
 Job Number:
 HBR9328

Page # 1/1

Manuf.: . PNo:
 Gavazzi: DIB01CM24100A

RXZS2

bus jumper for Zelio Relay RXZ sockets with separate contacts



06-058-012

Main

Commercial Status	Commercialised
Range of product	Zelio Relay
Accessory / separate part type	Jumper
Accessory / separate part designation	Bus jumper
Sale per indivisible quantity	10

Complementary

Product compatibility	Socket RXZ
Accessory / separate part destination	All RXZ sockets with separate contacts
[Ith] conventional free air thermal current	5 A
Product weight	0.005 kg

Ordering and shipping details

Category	21128 - ZELIO ICE CUBE RELAY ACCESSORIES
Discount Schedule	CP2
GTIN	00785901924098
Nbr. of units in pkg.	10
Package weight(Lbs)	0.01
Stock Code	Stock - Normally stocked in distribution facility
Returnability	Y
Country of origin	CN



Rev: 0
Date: 06-23-2023
By: JN

Device Tag:
CR1-4
Job Number:
HBR9328

Page # 1/1

Manuf.: . PNo: Square D: RXZ S2



RXMAB2F7

RXM Miniature Relays (page 4)

- 2 pole relays; 12 A, 1/2 hp (IEC rating = 12 A)
- 3 pole relays; 10 A, 1/3 hp (IEC rating = 10 A)
- 4 pole relays; 8 A, 1/3 hp (IEC rating = 6 A)
- 4 pole relays; 3 A (low level), 1/16 hp (IEC rating = 3 A)

- Mechanical "relay status" indicator on all relays
- Pilot light option available
- Manual operator optional for all relays
- Built-in marking area

Insulation characteristics

Rated insulation voltage (Ui)	250 V (IEC), 300 V (UL, CSA)	
Rated impulse withstand voltage (Uimp)	3.6 kV (1.2/50 µs)	
Dielectric strength (rms voltage)	Between coil and contact	2,500 Vac
	Between poles	2,500 Vac
	Between contacts	1,500 Vac



Contact characteristics

Relay type		RXM2AB***	RXM3AB***	RXM4AB***
Number and type of contacts (see page 12)		DPDT	3PDT	4PDT
Contact materials		AgNi		
Conventional thermal current (Ith)	For ambient temperature < 131 °F (55 °C)	12 A	10 A	6 A
	Conforming to IEC in utilization category AC-1	N.O. 6 A	10 A 5 A	6 A 3 A
	Conforming to UL Resistive @ 277 Vac, hp @ 120 Vac	12 A, 1/2 hp	10 A, 1/3 hp	8 A, 1/3 hp
Maximum operating rate In operating cycles/hour	No load	18,000		
	Under load	1,200		
Switching voltage	Maximum	250 Vac/Vdc		
	Minimum	10 mA on 17 V		
Switching capacity	Maximum	3,000 VA	2,500 VA	1,500 VA
	Utilization coefficient	20%		
Mechanical durability in millions of operating cycles		10		
Electrical durability in millions of operating cycles	Resistive load	0.1		

Coil characteristics

Average consumption	AC	1.2 VA									
	DC	0.9 W									
Drop-out voltage threshold	AC	≥ 0.15 U _c									
	DC	≥ 0.1 U _c									
Operating time (response time)	Between coil energization and making of the N.O. contact	AC	20 ms								
		DC	20 ms								
	Between coil de-energization and making of the N.C. contact	AC	20 ms								
		DC	20 ms								
Coil voltage U _c		12 V	24 V	48 V	110 V	120 V	125 V	220 V	230 V	240 V	
Relay coil voltage codes		JD	BD	ED	FD	—	GO	MD	—	—	
DC	Average resistance at 68 °F (20 °C) ± 10%	160 Ω	650 Ω	2,600 Ω	11,000 Ω	—	11,000 Ω	14,000 Ω	—	—	
	Operating voltage limits	Min.	9.6 V	19.2 V	38.4 V	88 V	—	100 V	176 V	—	—
		Max.	13.2 V	26.4 V	52.8 V	121 V	—	138 V	242 V	—	—
Relay coil voltage codes		—	B7	E7	—	F7	—	M7	P7	U7	
AC	Average resistance at 68 °F (20 °C) ± 15%	—	180 Ω	770 Ω	—	4,430 Ω	—	15,000 Ω	15,000 Ω	15,500 Ω	
	Operating voltage limits	Min.	—	19.2 V	38.4 V	—	96 V	—	176 V	184 V	192 V
		Max.	—	26.4 V	52.8 V	—	132 V	—	242 V	253 V	264 V

Environment

Dielectric strength	2000 V AC (between poles) 2000 V AC (between coil and contact) 1300 V AC (between contacts)
Product certifications	CSA GOST Lloyds UL
Standards	EN/IEC 61810-1 UL 508 CSA C22.2 No 14



Rev: 0
Date: 06-23-2023
By: JN

Device Tag: CR1-4
Job Number: HBR9328

Manuf.: PNo:

Square D: RXM3AB2BD

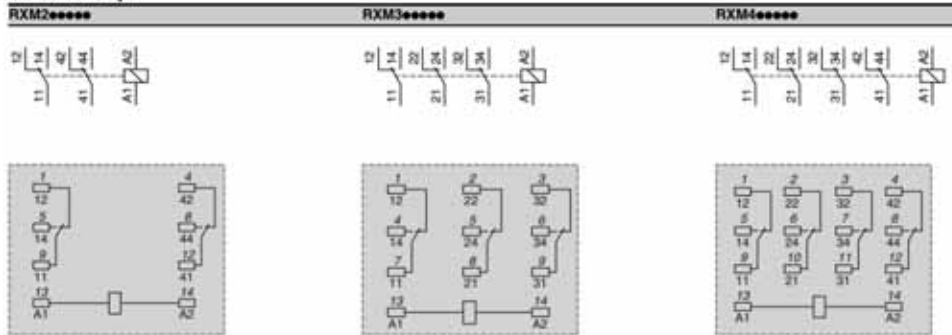
Miniature relays with lockable test button, without LED

Coil Voltage	Number and type of contacts - Thermal current (Ith)								
	DPDT - 12 A			3PDT - 10 A			4PDT - 6 A		
	Catalog Number	Weight		Catalog Number	Weight		Catalog Number	Weight	
		lb.	kg		lb.	kg		lb.	kg
12 Vdc	RXM2AB1JD	0.082	0.037	RXM3AB1JD	0.084	0.038	RXM4AB1JD	0.080	0.036
24 Vdc	RXM2AB1BD	0.082	0.037	RXM3AB1BD	0.084	0.038	RXM4AB1BD	0.080	0.036
48 Vdc	RXM2AB1ED	0.082	0.037	RXM3AB1ED	0.084	0.038	RXM4AB1ED	0.080	0.036
110 Vdc	RXM2AB1FD	0.082	0.037	RXM3AB1FD	0.084	0.038	RXM4AB1FD	0.080	0.036
220 Vdc	—	—	—	—	—	—	RXM4AB1MD	0.080	0.036
24 Vac	RXM2AB1B7	0.082	0.037	RXM3AB1B7	0.084	0.038	RXM4AB1B7	0.080	0.036
48 Vac	RXM2AB1E7	0.082	0.037	RXM3AB1E7	0.084	0.038	RXM4AB1E7	0.080	0.036
120 Vac	RXM2AB1F7	0.082	0.037	RXM3AB1F7	0.084	0.038	RXM4AB1F7	0.080	0.036
230 Vac	RXM2AB1P7	0.082	0.037	RXM3AB1P7	0.084	0.038	RXM4AB1P7	0.080	0.036
240 Vac	—	—	—	—	—	—	RXM4AB1U7	0.080	0.036

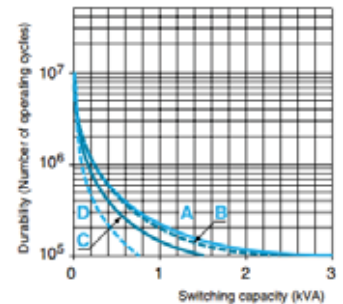
Miniature relays with lockable test button, with LED

12 Vdc	RXM2AB2JD	0.082	0.037	RXM3AB2JD	0.084	0.038	RXM4AB2JD	0.080	0.036
24 Vdc	RXM2AB2BD	0.082	0.037	RXM3AB2BD	0.084	0.038	RXM4AB2BD	0.080	0.036
48 Vdc	RXM2AB2ED	0.082	0.037	RXM3AB2ED	0.084	0.038	RXM4AB2ED	0.080	0.036
110 Vdc	RXM2AB2FD	0.082	0.037	RXM3AB2FD	0.084	0.038	RXM4AB2FD	0.080	0.036
125 Vdc	—	—	—	—	—	—	RXM4AB2GD	0.080	0.036
24 Vac	RXM2AB2B7	0.082	0.037	RXM3AB2B7	0.084	0.038	RXM4AB2B7	0.080	0.036
48 Vac	RXM2AB2E7	0.082	0.037	RXM3AB2E7	0.084	0.038	RXM4AB2E7	0.080	0.036
120 Vac	RXM2AB2F7	0.082	0.037	RXM3AB2F7	0.084	0.038	RXM4AB2F7	0.080	0.036
230 Vac	RXM2AB2P7	0.082	0.037	RXM3AB2P7	0.084	0.038	RXM4AB2P7	0.080	0.036

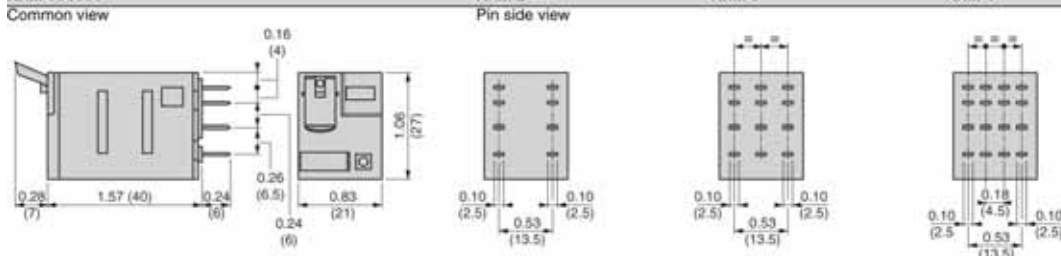
Miniature relays



Resistive load AC



RXM series



Rev: 0

Date: 06-23-2023

By: JN

Device Tag:

CR1-4

Job Number: HBR9328

Page # 2/2

Manuf.: PNO:

Square D: RXM3AB2BD

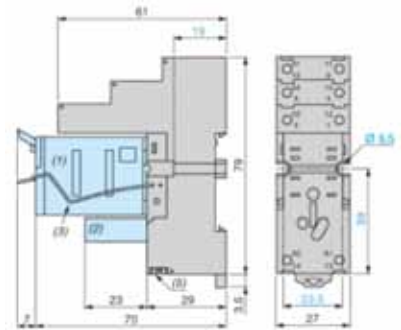
Sockets

RXZE2S108M



Complementary	
[Ith] conventional free air thermal current	12 A 5 A with bus jumper
[Ue] rated operational voltage	< 250 V
Tightening torque	<= 1 N.m (M3 screw(s))
Fixing mode	By screw mounting on panel Clip-on mounting on 35 mm symmetrical DIN rail
Marking	CE
Width	27 mm
Product weight	0.058 kg 0.07 kg

Environment	
Standards	IEC 61984
Product certifications	CSA UL
Ambient air temperature for storage	-40...85 °C
Ambient air temperature for operation	-40...55 °C
IP degree of protection	IP20 conforming to EN/IEC 60529
Dielectric strength	2500 V
RoHS EUR status	Compliant
RoHS EUR conformity date	0801



- 1 Relay
- 2 Protection Module
- 3 Carriage Stirrup
- 5 2 Links connection

Approvals for Sockets:



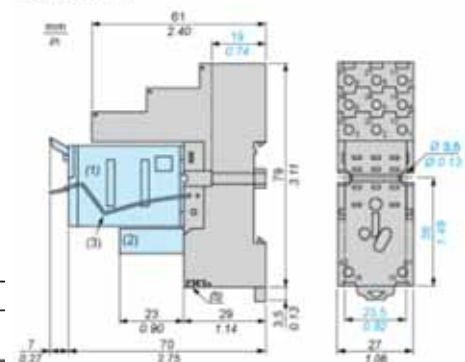
RXZE2S111M



Complementary	
[Ith] conventional free air thermal current	10 A 5 A with bus jumper
[Ue] rated operational voltage	< 250 V
Tightening torque	<= 1 N.m (M3 screw(s))
Fixing mode	By screw mounting on panel Clip-on mounting on 35 mm symmetrical DIN rail
Marking	CE
Width	27 mm
Product weight	0.066 kg

Environment	
Standards	IEC 61984
Product certifications	CSA UL
Ambient air temperature for storage	-40...85 °C
Ambient air temperature for operation	-40...55 °C
IP degree of protection	IP20 conforming to EN/IEC 60529
Dielectric strength	2500 V
RoHS EUR status	Compliant
RoHS EUR conformity date	0801

Dimensions



- (1) Relays
- (2) Protection module
- (3) Maintaining clamp
- (4) 2 elongated holes $\varnothing 3.5 \text{ mm} \times 6.5 \text{ mm} / \varnothing 0.13 \text{ in.} \times 0.25 \text{ in.}$
- (5) 2 bus jumpers

Approvals for Sockets:

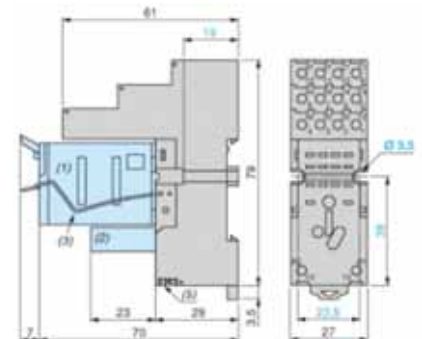


RXZE2S114M



Complementary	
[Ith] conventional free air thermal current	10 A 5 A with bus jumper
[Ue] rated operational voltage	< 250 V
Tightening torque	<= 1 N.m (M3 screw(s))
Fixing mode	By screw mounting on panel Clip-on mounting on 35 mm symmetrical DIN rail
Marking	CE
Width	27 mm
Product weight	0.058 kg 0.07 kg

Environment	
Standards	IEC 61984
Product certifications	CSA UL
Ambient air temperature for storage	-40...85 °C
Ambient air temperature for operation	-40...55 °C
IP degree of protection	IP20 conforming to EN/IEC 60529
Dielectric strength	2500 V
RoHS EUR status	Compliant
RoHS EUR conformity date	0801



- 1 Relay
- 2 Protection Module
- 3 Carriage Stirrup
- 5 2 Links connection

Approvals for Sockets:



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Date: 06-23-2023

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Device Tag:

CR1-4

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Manuf.: . PNO:

Square D: RXZE2S111M

38-058-003

General Data

Part No: 07.311.4053.1

Description: End Cover – Black

Type of end plate – Yes

Snap in - Yes

Inflammability Class of insulation material acc. With UL94 – V0



07-063-000



Rev: 0
Date: 06-23-2023

Device Tag:
DB

Manuf.: . PNo: Wieland: 07.311.4053.1

By: JN

Job Number: HBR9328

Page # 1/1

Cross connectors, (jumper bars) uninsulated



07-063-001

Type	Part no.	Std. pack
WKM 4/15	6 mm spacing	Screw: M 3
2pole 9215 - 2	Z7.210.3227.0	50
3pole 9215 - 3	Z7.210.3327.0	50
4pole 9215 - 4	Z7.210.3427.0	50
5pole 9215 - 5	Z7.210.3527.0	50
6pole 9215 - 6	Z7.210.3627.0	50
70pole 9215 M-70	Z7.210.3027.0	10



General

Colour	Other
Type	Cross connector
Modular spacing	6 mm
Number of bridged clamps	4
Mounting method	Screwable
Insulated	No

Accessories

Type	Cross connector
Mounting method	Screwable
Insulated	No
Colour	Other
Number of bridged clamps	4
Modular spacing	6 mm



Rev: 0
Date: 06-23-2023
By: JN

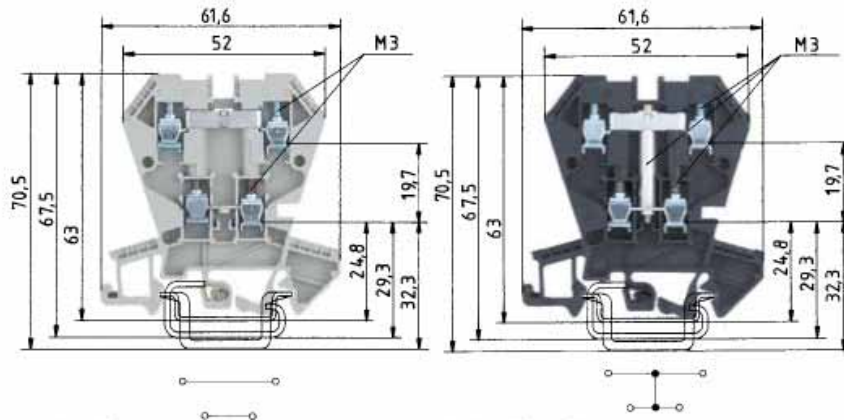
Device Tag: DB
Job Number: HBR9328
Page # 1/1

Manuf.: . PNo: Wieland: Z7.210.3427



Multi-tier blocks
with screw connection

selos^{10S}



0344 Ex II 2GD IM2
Ex e I/II
EN 60947-7-1:2002
EN 60947-7-2:2002
UL ratings
CSA ratings
KEMA 02 ATEX 2114 U¹⁾ EN 60079-0/EN 60079-7
Width
Approvals

Field/factory wiring
Wire strip length

WK 4 E/U

fine-stranded solid V A
0.5-4mm² 0.5-4mm² 400V/6kV/3²⁾ 32
No. 22-10 AWG 300V 20
No. 20-12 AWG 300V 10
0.5-4mm² 0.5-4mm² 275V 24/24²⁾
6mm 9mm

WK 4 E/U/VB

fine-stranded solid V A
0.5-4mm² 0.5-4mm² 400V/6kV/3 32
No. 22-10 AWG 300V 20
No. 20-12 AWG 300V 10
0.5-4mm² 0.5-4mm² 275V 24
6mm 9mm



	Type	Part No.	Std. Pack	Type	Part No.	Std. Pack
Multi-tier block	gray	WK 4 E/U	57.404.7055.0	100		
Multi-tier block, vert. connected	black				WK 4 E/U/VB SCHWARZ	57.404.6955.1
Multi-tier ground block	green/yellow					
Function block	red					
Function block	orange					
Accessories						
1. Mounting rail TS 35, DIN rail 7.5 mm high L = 2 m		35 x 27 x 7,5 EN 60715	98.300.0000.0	1	35 x 27 x 7,5 EN 60715	98.300.0000.0
Mounting rail TS 35, DIN rail, 15 mm high L = 2 m		35 x 24 x 15 EN 60715	98.360.0000.0	1	35 x 24 x 15 EN 60715	98.360.0000.0
Mounting rail TS 32, G rail* L = 2 m		9006 EN 60715 G-32	98.190.0000.0	1	9006 EN 60715 G-32	98.190.0000.0
2. End clamp with U-foot* 10mm wide		WE 1/U	25.523.5753.0	100	WE 1/U	25.523.5753.0
End clamp TS 35, with screw 8mm wide		9708/2 S35	25.522.8553.0	100	9708/2 S35	25.522.8553.0
End clamp TS 35, without screw 8mm wide		9708	25.522.7053.0	100	WEF 1/35	25.523.9353.0
3. End plate	gray	AP 4 E	07.311.4055.0	10	AP 4 E	07.311.4055.0
	blue					
4. Partition	gray	TW 4 E	07.311.5055.0	10	TW 4 E	07.311.5055.0
	blue					
5. Cross connector with screws	2 pole	9215-2	Z7.210.3227.0	50	9215-2	07.210.3227.0
	3 pole	9215-3	Z7.210.3327.0	50	9215-3	07.210.3327.0
	up to 6 pole	9215-6	Z7.210.3627.0	50	9215-6	07.210.3627.0
Jumper comb for lower tier block	2 pole	IVBS WK 4 E-2	Z7.256.4227.0	10	IVBS WK 4 E-2	Z7.256.4227.0
insulated, angled	up to 6 pole	IVBS WK 4 E-6	Z7.256.4627.0	10	IVBS WK 4 E-6	Z7.256.4627.0
Jumper comb for lower tier block	2 pole	IVB WK 4 E-2	Z7.255.2227.0	10	IVB WK 4 E-2	Z7.255.2227.0
insulated, straight	up to 6 pole	IVB WK 4 E-6	Z7.255.2627.0	10	IVB WK 4 E-6	Z7.255.2627.0
6. Partition plate with marking facility						
7. Single cover with marking facility		AD VB 4/15 GELB	04.326.2953.8	10	AD VB 4/15 GELB	04.326.2953.8
8. Cover with warning symbol over 4 blocks						
For more accessories see pages 60-77						
For marking systems see pages 70-75						

¹⁾ Please note the mounting instructions on the cover page. ²⁾ With/without jumper
³⁾ With end plates 500 V/6 kV/3 ^{*} Do not use in Ex environments.
⁴⁾ Ratings to adjacent feed-through blocks of the same series and size
⁵⁾ For the current carrying capability of the mounting rail see AT catalog section **facts & DATA**.



Rev:

0

Date:

06-23-2023

By:

JN

Device Tag:

DB

Job Number:

HBR9328

Page #

1/1

Manuf.: . PNo:

Wieland: 57.404.6955.1

Front operated non-fusible disconnect switches, base and DIN-rail mounting, UL/CSA



09-001-A030

Number of poles	Ampere rating A	Horsepower rating 3-phase			Type
		240 V AC	480 V AC	600 V AC	
3	20	5	10	10	OT16F3
4	20	5	10	10	OT16F4N2
3	30	7.5	15	20	OT25F3
4	30	7.5	15	20	OT25F4N2
3	40	10	20	25	OT40F3
4	40	10	20	25	OT40F4N2
3	60	15	30	30	OT63F3
4	60	15	30	30	OT63F4N2
3	80	20	40	40	OT80F3
4	80	20	40	40	OT80F4N2
3	30	10	20	30	OT30F3
4	30	10	20	30	OT30F4N2
3	60	20	40	40	OT60F3
4	60	20	40	40	OT60F4N2
3	100	30	50	50	OT100F3
4	100	30	50	50	OT100F4N2



Approvals:

- OT16,25,40,63,80: UL 508. CSA 22-2 No.14
- OT30,60,100: UL 98. CSA 22-2 No.4
- IEC 60947-3

Technical data according to UL/CSA, AC ratings

Switch type			OT16F	OT25F	OT40F	OT63F	OT80F	OT30F	OT60F						
Approval	cUL _{US} Listed	E63822	E63822	E63822	E63822	E63822	E63822	E101914	E101914						
		UL508	UL508	UL508	UL508	UL508	UL508	UL98	UL98						
Compliance	CSA C22.2 No.14	CSA C22.2 No.14	CSA C22.2 No.14	CSA C22.2 No.14	CSA C22.2 No.14	CSA C22.2 No.14	CSA C22.2 No.14	CSA C22.2 No.4	CSA C22.2 No.4						
		General purpose amp rating	pf= 0.7...0.8	-40° to 40 °C	20 A	30 A	40 A	60 A	80 A	30 A	60 A				
Max. operating voltage			600 V	600 V	600 V	600 V	600 V	600 V	600 V						
Max. horsepower rating / motor FLA current	pf= 0.4...0.5	240 V	5 HP/15.2 A	7.5 HP/22.0 A	10 HP/28.0 A	15 HP/42.0 A	20 HP/54.0 A	10 HP/28.0 A	20 HP/54.0 A						
		480 V	10 HP/14.0 A	15 HP/21.0 A	20 HP/27.0 A	30 HP/40.0 A	40 HP/52.0 A	20 HP/27.0 A	40 HP/52.0 A						
	600 V	10 HP/11.0 A	20 HP/22.0 A	25 HP/27.0 A	30 HP/32.0 A	40 HP/41.0 A	30 HP/32.0 A	40 HP/41.0 A							
	Single phase	120 V	1 HP/16.0 A	1.5 HP/20.0 A	2 HP/24.0 A	2 HP/24.0 A	2 HP/24.0 A	2 HP/24.0 A	2 HP/24.0 A	3 HP/34.0 A					
		240 V	2 HP/12.0 A	3 HP/17.0 A	5 HP/28.0 A	7.5 HP/40.0 A	10 HP/50.0 A	5 HP/28.0 A	7.5 HP/40.0 A						
		480 V	5 HP/14.0 A	7.5 HP/21.0 A	10 HP/26.0 A	15 HP/34.0 A	20 HP/44.0 A	-	-						
600 V	7.5 HP/16.0 A	10 HP/20.0 A	15 HP/27.0 A	15 HP/27.0 A	20 HP/38.5 A	-	-								
Short circuit rating with fuse	Maximum fuse size		30 A	60 A	30 A	60 A	30 A	60 A	100 A	150 A	100 A	150 A	60 A	60 A	
		Fuse type	J	10 kA	10 kA	10 kA	10 kA	10 kA	10 kA	100 kA	-	100 kA	-	200 kA	200 kA
		Fuse type	T	10 kA	10 kA	10 kA	10 kA	10 kA	10 kA	100 kA	-	100 kA	-	200 kA	200 kA



Rev: 0
Date: 06-23-2023
By: JN

Device Tag: DS1
Job Number: HBR9328

Manuf.: . PNo: ABB: OT60F3 Assembly

11-035-451

ENCLOSURE CATALOG NUMBER	ENCLOSURE DIMENSIONS (IN.)	SUB-PANEL CATALOG NUMBER
A-AHCBSS6LP3PT-W/MOD	A x B x C	A APB

NOTE:

1. 3PT INDICATES 3-POINT LATCH
2. MOD INDICATES PAINTED WHITE (CUSTOM)
3. "W" INDICATES PAINTED WHITE (CUSTOM)



APPLICATION

These enclosures feature Hoffman's exclusive POWERGLIDE™ Handle with 3-point latching, ideal for indoor or outdoor applications that require corrosion protection, convenient access, and padlocking security.

SPECIFICATIONS

- 14 gauge Type 304 or 316L stainless steel bodies and doors
- Seams continuously welded and ground smooth
- Seamless foam-in-place gasket
- Rolled lip around three sides of door
- Internal 3-point latch and Type 316L stainless steel padlocking POWERGLIDE Handle
- Remove door by pulling stainless steel continuous hinge pin
- Data pocket is high-impact thermoplastic
- Collar studs provided for mounting optional panels
- Exterior hardware on Type 316L stainless steel enclosures matches enclosure material
- Bonding provision on door; grounding stud on body

FINISH

Door, sides, top and bottom have smooth #4 brushed finish. Handle is electropolished.

ACCESSORIES

See also *Accessories*.
 Panels for Type 3R, 4, 4X, 12 and 13 Enclosures
 Steel and Stainless Steel Window Kits
 H2OMIT™ Vent Drains, Type 4X
 H2OMIT™ Thermoelectric Dehumidifier

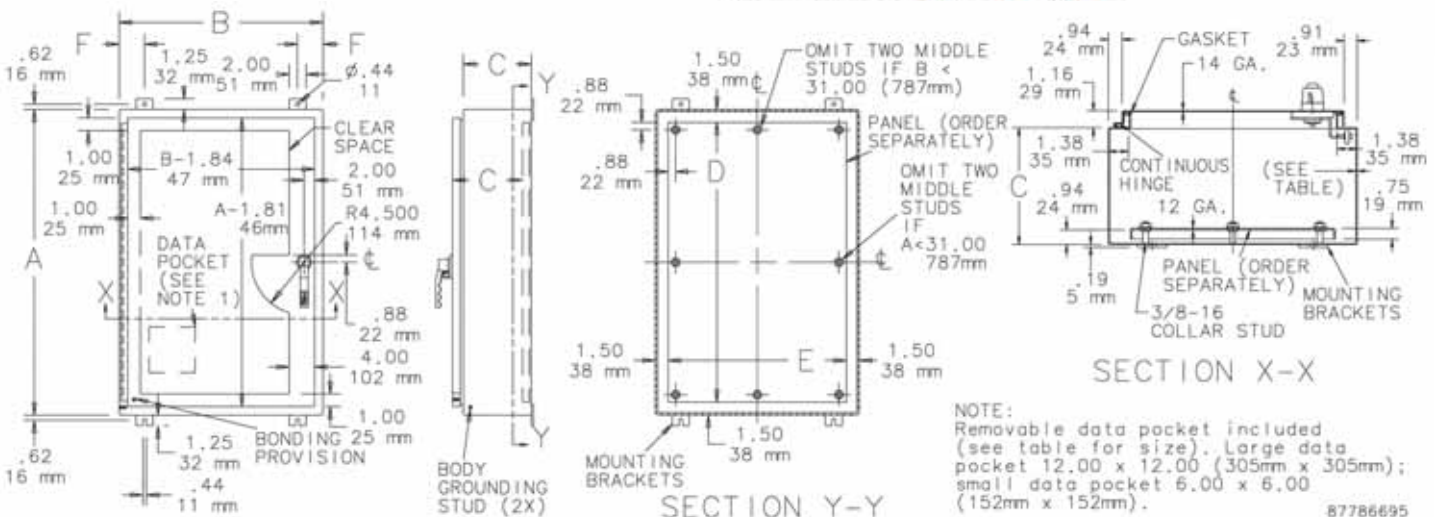
MODIFICATION AND CUSTOMIZATION

Hoffman excels at modifying and customizing products to your specifications. Contact your local Hoffman sales office or distributor for complete information.

INDUSTRY STANDARDS

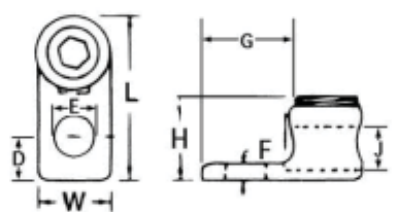
UL 508A Listed; Type 3R, 4, 4X, 12; File No. E61997
 cUL Listed per CSA C22.2 No 94; Type 3R, 4, 4X, 12; File No. E61997

NEMA/EEMAC Type 3R, 4, 4X, 12, 13
 IEC 60529, IP66
 Meets NEMA Type 3RX requirements



Rev:	0	Device Tag:	EN1
Date:	06-23-2023		
By:	JN	Job Number:	HBR9328
		Page #	1/1

Manuf.: PNo: Hoffman: A-60H3612SSLP3PT



Copper Connectors
T&B Catalog Number:

UPC Number: L70
 78378613002
Status: Active
Description:

Type L - Copper Single Conductor, One-Hole Mount for Conductor Range 14 Sol.-4 Str.

Features
 Cold forged from pure electrolytic copper with 99 percent conductivity.

General

Style	Type L - Copper Single Conductor, One-Hole Mount
Material	Copper
Wire Range	14 Sol.-4 Str.

Dimension Information

Length (inches)	1 1/8
Width (inches)	17/32
Height (inches)	35/64
D (inches)	9/32
E (inches)	9/32
F (inches)	3/32
G (inches)	21/32
J (inches)	9/32

Packaging

T&B Inner Pack	100
Package in Units	1000
T&B Sold in UOM	Each
T&B Weight Per UOM	3.32 lbs. per 100

Notes

Available with screwdriver slot head screws only.
 UL 486A tested.

Certifications

RoHS Compliance	Yes
-----------------	-----

Certifications



File Nbr:
 E9809

For further technical assistance, please contact us...

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 630-499-7080 · www.elemechinc.com	Rev: 0	GND	
	Date: 06-23-2023		
Manuf.: . PNo: Blackburn: L70	By: JN	Job Number: HBR9328	Page # 1/1

Zelio® Plug-In Relays

RPM power relays



RPZF2 + relay RPM22F7



RUW24



RPZ1DA



RPZ3FA

Sockets					
Contact terminal arrangement	Connection	Relay type	Sold in lots of	Catalog number	Weight kg
Mixed	Screw clamp terminals	RPM1	10	RPZF1	0.042
		RPM2	10	RPZF2	0.054
		RPM3	10	RPZF3	0.072
		RPM4	10	RPZF4	0.094

Protection modules					
Description	Voltage	Socket type	Sold in lots of	Catalog number	Weight kg
V					
Diode	--- 6...250	RPZF1RPZF2	20	RXM040W	0.003
		RPZF3 RPZF4	10	RUW240BD	0.004
		RPZF3 RPZF4	10	RUW241P7	0.004
RC circuit	~ 24...60	RPZF1RPZF2	20	RXM041BN7	0.010
	~ 110...240	RPZF1RPZF2	20	RXM041FU7	0.010
	~ 24...60	RPZF3 RPZF4	10	RUW241P7	0.004
		RPZF3 RPZF4	10	RUW241P7	0.004
Varistor	~ 6...24	RPZF1RPZF2	20	RXM021RB	0.030
	~ 24...60	RPZF1RPZF2	20	RXM021BN	0.030
	~ 110...240	RPZF1RPZF2	20	RXM021FP	0.030
	~ 24	RPZF3 RPZF4	10	RUW242B7	0.004
		RPZF3 RPZF4	10	RUW242P7	0.004
	~ 240	RPZF3 RPZF4	10	RUW242P7	0.004

Timer module (1)					
Description	Voltage	Socket type		Catalog number	Weight kg
V					
Multifunction	~ 24... 240	RPZF3 RPZF4		RUW101MW	0.020

Accessories					
Description	For use with	Sold in lots of	Catalog number	Weight kg	
Metal hold-down clip (for single-pole relays)	RPZF1	20	RPZR235	0.001	
Mounting adapters for DIN rail (2)	RPM1	20	RPZ1DA	0.004	
	RPM2	20	RXZE2DA	0.004	
	RPM3	20	RPZ3DA	0.004	
	RPM4	20	RPZ4DA	0.006	
Mounting adapters with fixing lugs for panel	RPM1	20	RPZ1FA	0.002	
	RPM2	20	RXZE2FA	0.002	
	RPM3	20	RPZ3FA	0.003	
	RPM4	20	RPZ4FA	0.004	
Clip-in ID tags (sheet of 108 ID tags)	All relays	10	RXZL520	0.080	

(1) See timer module description (selection of functions and time delays) on page 41
 (2) Test button becomes inaccessible.



Manuf.: . PNo:

Square D: RPZR235

Rev:

0

Date:

06-23-2023

By:

JN

Device Tag:

IR1-18

Job Number:

HBR9328

Page #

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Zelio® Plug-In Relays

RPM power relays



Telemecanique

06-058-028

General characteristics

Conforming to standards		IEC/EN 61810-1 (iss. 2), UL 508, CSA C22-2 n° 14	
Product certifications		cULus File E164862 CCN NLDX, NLDX7; cURus File E164862 CCN NLDX2, NLDX8; CSA; CE; RoHS compliant	
Ambient air temperature around the device	Storage	°C (F)	-40... +85 (-40... +185)
	Operation	°C (F)	-40... +55 (-40... +131)
Vibration resistance conforming to IEC/EN 60068-2-6	In operation	3 gn (10...150 Hz/± 1 mm / 5g/5 cycles)	
	Not operating	5 gn (10...150 Hz/± 1 mm / 5g/5 cycles)	
Degree of protection	Conforming to IEC/EN 60529	IP 40	
Shock resistance conforming to IEC/EN 60068-2-27	Opening	15 gn	
	Closing	15 gn	
Protection category		RT I	
Mounting position		Any	

Insulation characteristics

Rated insulation voltage (Ui)	Conforming to IEC/EN 60947	V	250 (IEC), 300 (UL, CSA)
Rated impulse withstand voltage (Uimp)		kV	4 (1.2/50 μs)
Dielectric strength (rms voltage)	Between coil and contact	~ V	1550
	Between poles	~ V	1550
	Between contacts	~ V	1500

Contact characteristics

Relay type		RPM1●●●	RPM2●●●	RPM3●●●	RPM4●●●
Number and type of contacts		1 C/O	2 C/O	3 C/O	4 C/O
Contact materials		AgNi			
Conventional thermal current (Ith)	For ambient temperature ≤ 55 °C	A	15		
Rated operational current in utilization categories AC-1 and DC-1	Conforming to IEC	NO	A	15	
		NC	A	7.5	
	Conforming to UL		A	15	
Switching current	Minimum	mA	10		
Switching voltage	Maximum	V	~/~ 250 (IEC)		
	Minimum	V	17		
Nominal load (resistive)		A	15 / 250 ~ V		
		A	15 / 28 ~ V		
Switching capacity	Maximum	~	VA	3750	
		~	W	420	
	Minimum	mW	170		
Maximum operating rate In operating cycles/hour	No-load		18 000		
	Under load		1200		
Utilization coefficient			20 %		
Mechanical durability	In millions of operating cycles		10		
Electrical durability In millions of operating cycles	Resistive load		0.1		0.06
	Inductive load		See curves below		
Electrical durability of contacts Resistive load ~			Reduction coefficient for inductive load ~ (depending on power factor cos φ)		Maximum switching capacity on resistive load ~



Rev: 0

Date: 06-23-2023

By: JN

Device Tag:

IR1-18

Job Number: HBR9328

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Manuf.: PNO:

Square D: RPM12BD

Power relays without LED (sold in lots of 10)

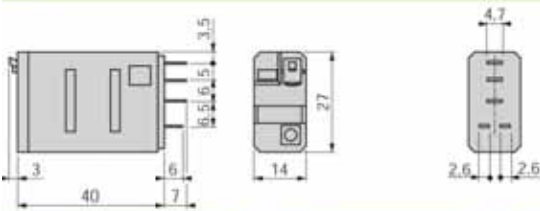
Control circuit voltage	Number and type of contacts - Thermal current (Ith)							
	1 C/O - 15 A		2 C/O - 15 A		3 C/O - 15 A		4 C/O - 15 A	
	Catalog number	Weight	Catalog number	Weight	Catalog number	Weight	Catalog number	Weight
V		kg		kg		kg		kg
≡ 12	RPM11JD	0.026	RPM21JD	0.036	RPM31JD	0.054	RPM41JD	0.071
≡ 24	RPM11BD	0.026	RPM21BD	0.036	RPM31BD	0.054	RPM41BD	0.071
≡ 48	RPM11ED	0.026	RPM21ED	0.036	RPM31ED	0.054	RPM41ED	0.071
≡ 110	RPM11FD	0.026	RPM21FD	0.036	RPM31FD	0.054	RPM41FD	0.071
~ 24	RPM11B7	0.026	RPM21B7	0.036	RPM31B7	0.054	RPM41B7	0.071
~ 48	RPM11E7	0.026	RPM21E7	0.036	RPM31E7	0.054	RPM41E7	0.071
~ 120	RPM11F7	0.026	RPM21F7	0.036	RPM31F7	0.054	RPM41F7	0.071
~ 230	RPM11P7	0.026	RPM21P7	0.036	RPM31P7	0.054	RPM41P7	0.071

Power relays with LED (sold in lots of 10)

≡ 12	RPM12JD	0.026	RPM22JD	0.036	RPM32JD	0.054	RPM42JD	0.071
≡ 24	RPM12BD	0.026	RPM22BD	0.036	RPM32BD	0.054	RPM42BD	0.071
≡ 48	RPM12ED	0.026	RPM22ED	0.036	RPM32ED	0.054	RPM42ED	0.071
≡ 110	RPM12FD	0.026	RPM22FD	0.036	RPM32FD	0.054	RPM42FD	0.071
~ 24	RPM12B7	0.026	RPM22B7	0.036	RPM32B7	0.054	RPM42B7	0.071
~ 48	RPM12E7	0.026	RPM22E7	0.036	RPM32E7	0.054	RPM42E7	0.071
~ 120	RPM12F7	0.026	RPM22F7	0.036	RPM32F7	0.054	RPM42F7	0.071
~ 230	RPM12P7	0.026	RPM22P7	0.036	RPM32P7	0.054	RPM42P7	0.071

Dimensions (mm):

Power relays
RPM 1

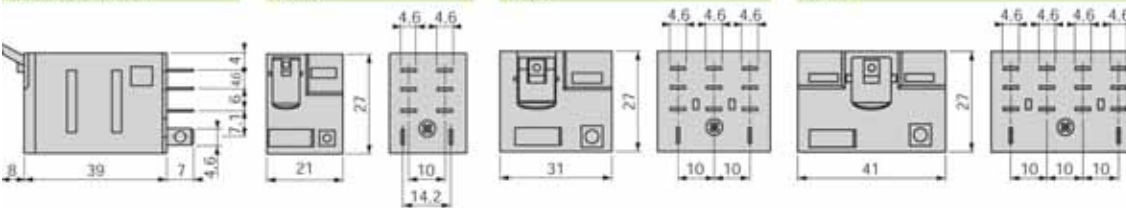


Common side view

RPM2

RPM 3

RPM 4



Rev: 0

Date: 06-23-2023

By: JN

Device Tag:

IR1-18

Job Number: HBR9328

Page # 2/2

Manuf.: PNo:

Square D: RPM12BD

RXM040W

Telemecanique

diode - 6..250 V DC - for RPZ/RXZ sockets

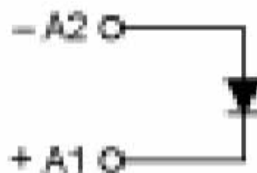


06-058-040

Main

Range of product	Zelio Relay
Accessory / separate part category	Protection accessories
Accessory / separate part type	Protection module
Accessory / separate part designation	Diode
Product compatibility	Socket RPZ (1 C/O) Socket RPZ (2 C/O) Socket RXZ (2 C/O) Socket RXZ (3 C/O) Socket RXZ (4 C/O)
Accessory / separate part destination	Zelio Relay RXM Zelio Relay RPM
[Uc] control circuit voltage	6...250 V DC
Sale per indivisible quantity	20

Wiring Diagram



Rev: 0

Date: 06-23-2023

By: JN

Device Tag:

IR1-18

Job Number: HBR9328

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Manuf.: PNo:

Square D: RXM040W

Power relays without LED (sold in lots of 10)

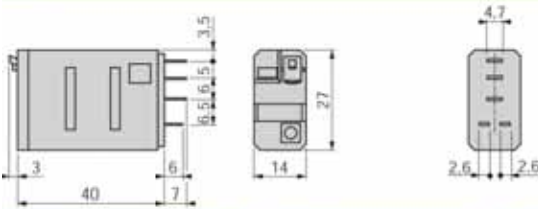
Control circuit voltage	Number and type of contacts - Thermal current (Ith)							
	1 C/O - 15 A		2 C/O - 15 A		3 C/O - 15 A		4 C/O - 15 A	
	Catalog number	Weight	Catalog number	Weight	Catalog number	Weight	Catalog number	Weight
V		kg		kg		kg		kg
≡ 12	RPM11JD	0.026	RPM21JD	0.036	RPM31JD	0.054	RPM41JD	0.071
≡ 24	RPM11BD	0.026	RPM21BD	0.036	RPM31BD	0.054	RPM41BD	0.071
≡ 48	RPM11ED	0.026	RPM21ED	0.036	RPM31ED	0.054	RPM41ED	0.071
≡ 110	RPM11FD	0.026	RPM21FD	0.036	RPM31FD	0.054	RPM41FD	0.071
~ 24	RPM11B7	0.026	RPM21B7	0.036	RPM31B7	0.054	RPM41B7	0.071
~ 48	RPM11E7	0.026	RPM21E7	0.036	RPM31E7	0.054	RPM41E7	0.071
~ 120	RPM11F7	0.026	RPM21F7	0.036	RPM31F7	0.054	RPM41F7	0.071
~ 230	RPM11P7	0.026	RPM21P7	0.036	RPM31P7	0.054	RPM41P7	0.071

Power relays with LED (sold in lots of 10)

≡ 12	RPM12JD	0.026	RPM22JD	0.036	RPM32JD	0.054	RPM42JD	0.071
≡ 24	RPM12BD	0.026	RPM22BD	0.036	RPM32BD	0.054	RPM42BD	0.071
≡ 48	RPM12ED	0.026	RPM22ED	0.036	RPM32ED	0.054	RPM42ED	0.071
≡ 110	RPM12FD	0.026	RPM22FD	0.036	RPM32FD	0.054	RPM42FD	0.071
~ 24	RPM12B7	0.026	RPM22B7	0.036	RPM32B7	0.054	RPM42B7	0.071
~ 48	RPM12E7	0.026	RPM22E7	0.036	RPM32E7	0.054	RPM42E7	0.071
~ 120	RPM12F7	0.026	RPM22F7	0.036	RPM32F7	0.054	RPM42F7	0.071
~ 230	RPM12P7	0.026	RPM22P7	0.036	RPM32P7	0.054	RPM42P7	0.071

Dimensions (mm):

Power relays
RPM 1

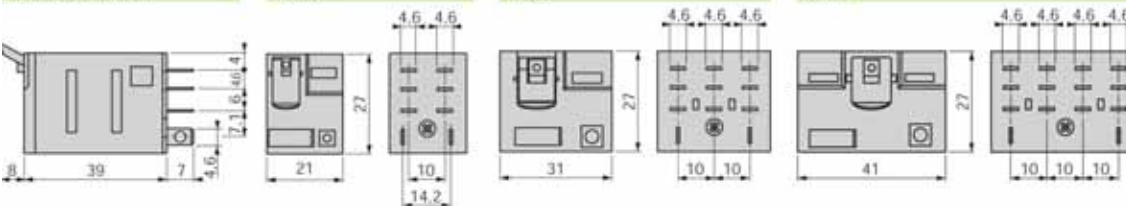


Common side view

RPM2

RPM3

RPM4



Rev: 0

Date: 06-23-2023

By: JN

Device Tag:

IR1-18

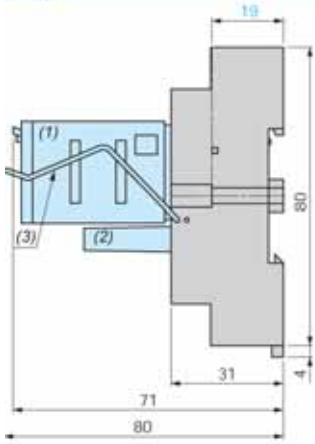
Job Number: HBR9328

Page # 2/2

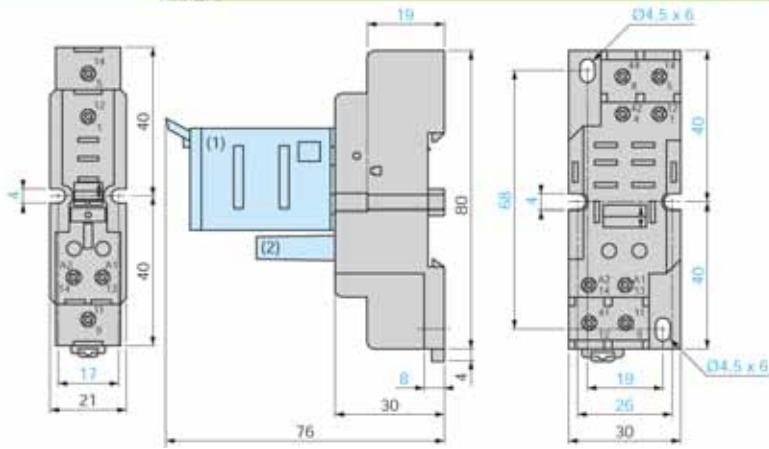
Manuf.: PNo:

Square D: RXM040W

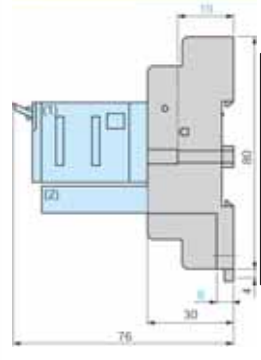
Sockets
RPZF1



RPZF2



Common side view



Socket characteristics

Socket type	RPZF1	RPZF2	RPZF3	RPZF4
Relay types used	RPM1●●●	RPM2●●●	RPM3●●●	RPM4●●●
Protection module types used	RXM02●●● RXM04●●●	RXM02●●● RXM04●●●	RUW24●●●	RUW24●●●
Contact terminal arrangement	Mixed			
Wire connection method	Screw clamp terminals			
Product certifications	cURus File E172326 CCN SWIV2, SWIV8; CSA; CE; RoHS compliant			
Conforming to standards	IEC 61984, CE			

Electrical characteristics

Conventional thermal current (Ith)	A	16
Maximum operating voltage	V	250 (IEC)

Insulation characteristics

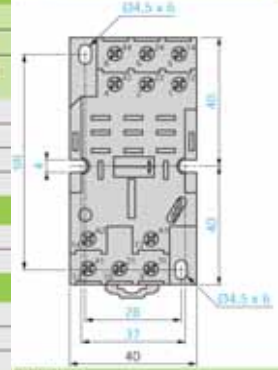
Between adjacent output contacts	Vrms	2500
Between input and output contacts	Vrms	2500
Between contacts and DIN rail	Vrms	2500

General characteristics

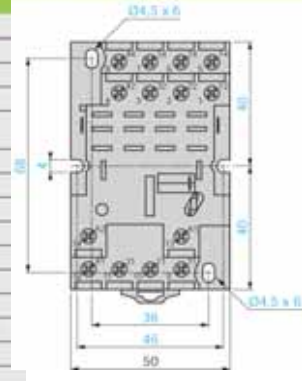
Ambient air temperature around the device	Operation	°C	-40...+55
	Storage	°C	-40...+85
Degree of protection	Conforming to IEC/EN 60529		IP 20
Connection	Solid wire	1 conductor	0.5...1.5 mm ² - AWG 20...AWG 16
		2 conductors	0.5...1.5 mm ² - AWG 20...AWG 16
	Flexible wire with cable end	1 conductor	0.25...1 mm ² - AWG 22...AWG 17
		2 conductors	0.25...1 mm ² - AWG 22...AWG 17
Maximum tightening torque / Screw size	Nm		1 / M3 screw
Mounting			35 mm DIN rail / panel mount
Mounting on DIN rail			By red plastic clip
Terminal referencing			IEC, NEMA
Compatibility with the metal hold-down clip			Yes No
Timer module compatibility			No Yes
Protection module			RXM040W, RXM041●●, RXM021●● RUW24●●
Clip-in ID tags			No
Wire connection method	Screw clamp terminals		



RPZF3



RPZF4



Sockets

Contact terminal arrangement	Connection	Relay type	Sold in lots of	Catalog number	Weight kg
Mixed	Screw clamp terminals	RPM1●●●	10	RPZF1	0.042
		RPM2●●●	10	RPZF2	0.054
		RPM3●●●	10	RPZF3	0.072
		RPM4●●●	10	RPZF4	0.094



Rev: 0	Device Tag: IR1-18
Date: 06-23-2023	
By: JN	Job Number: HBR9328
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Manuf.: . PNo: Square D: RPZF1

700-HJ Magnetic Latching Relay


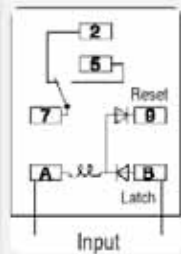
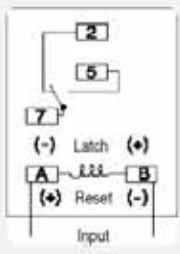
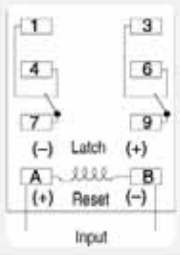
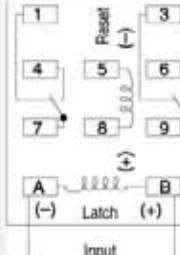


Allen-Bradley

- Magnetic Latching Relay
- 10 A Contact Rating
- SPDT
- DPDT Single Coil
- DPDT Dual Coil
- Blade Style Quick Connect Terminals



06-005-077

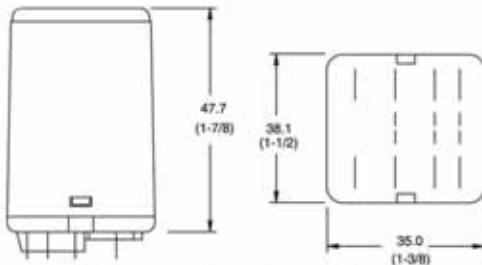
	Description	Contact Rating	Wiring Diagrams		Coil Voltage	Cat. No.
			AC*	DC‡		
	SPDT 1-Pole 1 Form C AgCdO Contacts (Single Coil AC or DC)	10 A			24V AC 120V AC 24V DC	700-HJ36A24 700-HJ36A1 700-HJ36Z24
	Sockets		700-HN153	700-HN154		
	DPDT 2-Pole 2 Form C AgCdO Contacts (Single Coil AC or DC)	10 A			24V AC 120V AC 240V AC 12V DC	700-HJ32A24 700-HJ32A1 700-HJ32A2 700-HJ32Z12
	Sockets		700-HN153	700-HN154	24V DC	700-HJ32Z24
	DPDT 2-Pole 2 Form C AgCdO Contacts (Dual Coil)5	10 A	DC Only		24V DC	700-HJD32Z24
	TYPE HJ	Sockets		700-HN153 or 700-HN154		

Certifications

CSA Certified, File LR700026, UL Recognized, File E3125, Guide NLDX 2

Standards

UL 508, CSA 22.2 No. 14, EN/IEC 60947-4-1, -5-1



Bulletin 700-HJ Relay

Relay Type	Socket Cat. No.	Retainer Clip Cat. No.
700-HJ	700-HN153	700-HN159
	700-HN154	700-HN159



Rev: 0

Device Tag:

Date: 06-23-2023

LR1

Manuf.: PNo:

Allen-Bradley: 700HJD32Z24

By: JN

Job Number: HBR9328

Page # 1/2



Cat. No. 700-HJ...

Electrical Ratings

Pilot Duty Rating -

Rated Thermal Current (I_{th}) 10 A

Rated Insulation Voltage (U_i) 250V IEC, 300V UL/CSA

Contacts	Inductive	Make	Break	Hp
		► ◄	◄ ►	
	120V AC 240V AC	30 A 15 A	3 A 1.5 A	1/4 1/3
	DC	24V DC, 10 A		

Permissible Coil Voltage Variation 85...110% of Nominal Voltage at 50 Hz
85...110% of Nominal Voltage at 60 Hz
80...110% of Nominal Voltage at DC

Coil Consumption ±10%	AC Coils	Inrush Sealed	Single AC Coil	Single DC Coil	Dual DC Coil
	DC Coils			1.2 W	12V 1.63 W 24V 1.67 W

Design Specification/Test Requirements

Dielectric Withstand Voltage	Pole-to-Pole	1500V AC
	Contact-to-Pole	1500V AC
	Contact-to-Frame	1500V AC

Mechanical

Degree of Protection Open Type (Guarded Terminal Sockets)

Mechanical Life Operations 10 x 10⁶

Switching Frequency Operations 1800/HR

Coil Voltages See Product Selection

Operating Time at Nominal Voltage at 20 °C Pickup 25 ms
Dropout 25 ms

Maximum Operating Rate -

Environmental

Temperature	Operating	-45...+50 °C (-49...+122 °F)
	Storage	-45...+100 °C (-49...+212 °F)



Rev: 0	Device Tag:	
Date: 06-23-2023	LR1	
By: JN	Job Number: HBR9328	Page # 2/2

Manuf.: PNo: Allen-Bradley: 700HJD32Z24

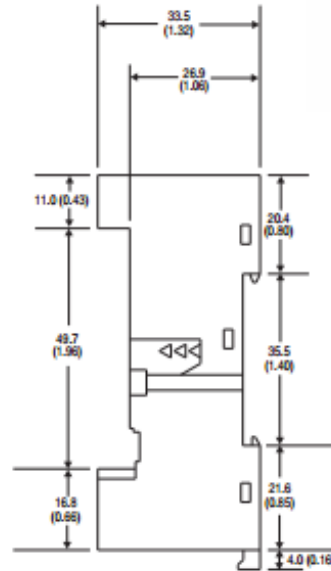
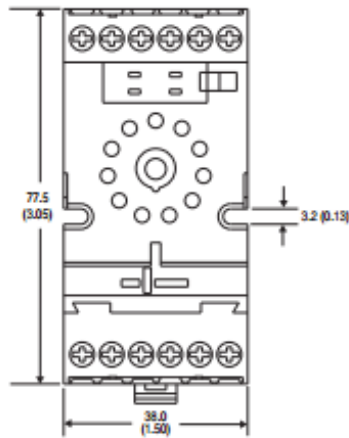
General Purpose Relays



Allen-Bradley



38-005-002



Cat. No. 700-HN205

Wire Size: 2 x 2.5 mm²

Single Wire – Up to #12 AWG

Double Wire – 2 x 2.5 mm² (#2–14 AWG ...#2–20 AWG)

(Either Solid or Stranded)

Strip Length: 9 mm (3/8 in.) – Torque: 0.8 N•m (7 lb•in)

3PDT 3-pole 3 Form C Single AgNi Contact	10 A B300	<p>700-HN126</p>	<p>700-HN101 700-HN205</p>	6V AC	700-HA33A06
				12V AC	700-HA33A12
Sockets				24V AC	700-HA33A24
				120V AC	700-HA33A1
				240V AC	700-HA33A2
				6V DC	700-HA33Z06
				12V DC	700-HA33Z12
				24V DC	700-HA33Z24
				48V DC	700-HA33Z48
				60V DC	700-HA33Z60
				80V DC	700-HA33Z80
				110V DC	700-HA33Z1
				125V DC	700-HA33Z01
				140V DC	700-HA33Z3
220V DC	700-HA33Z2				



Rev:

0

Device Tag:

LR1

Date:

06-23-2023

Job Number:

HBR9328

Page #

1/1

Manuf.: . PNo:

Allen-Bradley: 700-HN153

By:

JN

Pilot Light Devices 30.5 mm



Allen-Bradley



800 T - P T 16 G
a b c d e f g

a

Protection Rating	
Code	Description
T	Metal, Type 4/13
H	Plastic, Type 4/4X/13

b

Finger-Safe Guards	
Code	Description
Blank	No guards
C	Guards on terminals

c

Power Module Type		
800T Type 4/13	Description	800H Type 4/4X/13
Code		Code
P	Transformer (or dual input)	PR
Q	Full voltage/ Universal	QR

d

Lamp Test Options	
Code	Description
Blank	No test option
T	Push-to-test
D	Dual input — diode▲
DT	Dual input — transformer relay

Note: Push-to-test supplied with factory jumpered contact block.

e

Illumination Options	
Code	Description
Blank	Incandescent
H	LED▲

f

Voltage	
Transformer	
Code	Description
16	120V AC 50/60 Hz
26	240V AC 50/60 Hz
46	480V AC 50/60 Hz
56	600V AC 50/60 Hz
Full Voltage — Incandescent	
12	12V AC/DC
24	24V AC/DC
48	48V AC/DC
10	120V AC/DC
20	240V AC/DC
Universal — LED	
2	12...130V AC/DC
Dual Input	
16	120V AC
24	24V AC/DC (Dual input diode only)



g

Lens Color		
Code	Color	Glass Code ▲
Blank	No lens	Blank
A	Amber	D
B	Blue	E
C	Clear	F
G	Green	H
R	Red	J
W	White	K

Specifications*

Electrical Ratings		
Contact ratings	Refer to the contact ratings tables on page 10-4.	
Dielectric strength	2200V for one minute, 1300V for one minute (Logic Reed)	
Electrical design life cycles	1 000 000 at max. rated load, 200 000 at max. rated load (Logic Reed)	
Mechanical Ratings		
Vibration	10...2000 Hz, 1.52 mm displacement (peak-to-peak) max./ 10 G max. (except Logic Reed)	
Shock	1/2 cycle sine wave for 11 ms ≥ 25 G (contact fragility) and no damage at 100 G	
Degree of protection	Type 1/4/12/13 (800T); Type 1/4/4X/12/13 (800H); EN/IEC 60529 IP66/65	
Mechanical design life cycles		
Push buttons	(Momentary, non-illuminated)	10 000 000 min.
	(Momentary, illuminated)	250 000 min.
	(Push-pull/twist-to-release)	250 000 min.
Selector switches	(Non-illuminated)	1 000 000 min.
	(Illuminated, key-operated)	200 000 min.
Potentiometers	25 000 min.	
All other devices	200 000 min.	
Contact operation	Shallow, mini, and low-voltage contact blocks: Slow, double make and break Logic Reed and sealed switch contact blocks: Single break magnetic	
Wire gauge/Terminal screw torque	#18...14 AWG (#18...10 Max Duty) / 6...8 lb•in	
Typical operating forces		
Operators without contact blocks	Flush, extended button, standard mushroom, jumbo plastic mushroom: 2 lbs max. Jumbo and extended aluminum mushroom head: 3.95 lbs max. Maintained selector switch: 3.6 in•lb max.	
Spring return selector switches	3.6 in•lb to stop, 0.2 in•lb to return	
Illuminated push buttons and push-to-test pilot lights	5 lb max.	
2-position push-pull	8.0 lb max. push or pull	
3-position push-pull	8 lb max. push to in position or pull to center position (15 lb max. pull to out position)	
Twist-to-release or push-pull	9 lbs max. push or pull 30 in•oz max. twist, 6 in•oz minimum return	
Potentiometer	Rotational torque 3...12 in•oz; stopping torque 12 in•lb (minimum)	
Contact blocks	Standard	1 lb
	Logic Reed	1 lb max.
	Sealed switch	3 lb max. at 0.205 in. plunger travel
	Stackable sealed switch	1 lb max.
	MaxDuty	1.4 lb max.
	PenTUFF	1.4 lb max.
Self Monitoring	1.6 lb	
Environment		
Temperature range	Operating	-40...+131 °F (-40...+55 °C)
	Storage	-40...+185 °F (-40...+85 °C)
Note: Operating temperatures below freezing are based on the absence of moisture and liquids. Consult your local Rockwell Automation sales office or Allen-Bradley distributor for use in lower temperature applications.		
Humidity	50...95% RH from 77...140 °F (25...60 °C) per Procedure IV of MIL-STD-810C, Method 507.1 cycling test	

Certifications
 UL Listed
 (File No. E14840, E10314
 Guide No. NKCR, NOIV)
 CSA Certified
 (File No. LR1234, LR11924)
 CSA C22.2, No. 14

32-005-A000



Rev: 0

Date: 06-23-2023

By: JN

Device Tag:

LT1

Job Number: HBR9328

Page # 1/1

Manuf.: PNo: Allen-Bradley: 800H-QRTH2W

Pilot Light Devices 30.5 mm



Allen-Bradley



800 T - P T 16 G
a b c d e f g

a

Protection Rating	
Code	Description
T	Metal, Type 4/13
H	Plastic, Type 4/4X/13

b

Finger-Safe Guards	
Code	Description
Blank	No guards
C	Guards on terminals

c

Power Module Type		
800T Type 4/13	Description	800H Type 4/4X/13
Code		Code
P	Transformer (or dual input)	PR
Q	Full voltage/ Universal	QR

d

Lamp Test Options	
Code	Description
Blank	No test option
T	Push-to-test
D	Dual input — diode▲
DT	Dual input — transformer relay

Note: Push-to-test supplied with factory jumpered contact block.

e

Illumination Options	
Code	Description
Blank	Incandescent
H	LED▲

f

Voltage Transformer	
Code	Description
16	120V AC 50/60 Hz
26	240V AC 50/60 Hz
46	480V AC 50/60 Hz
56	600V AC 50/60 Hz

Full Voltage — Incandescent

12	12V AC/DC
24	24V AC/DC
48	48V AC/DC
10	120V AC/DC
20	240V AC/DC

Universal — LED

2	12...130V AC/DC
---	-----------------

Dual Input

16	120V AC
24	24V AC/DC (Dual input diode only)



g

Lens Color		
Code	Color	Glass Code ▲
Blank	No lens	Blank
A	Amber	D
B	Blue	E
C	Clear	F
G	Green	H
R	Red	J
W	White	K

Specifications*

Electrical Ratings		
Contact ratings	Refer to the contact ratings tables on page 10-4.	
Dielectric strength	2200V for one minute, 1300V for one minute (Logic Reed)	
Electrical design life cycles	1 000 000 at max. rated load, 200 000 at max. rated load (Logic Reed)	
Mechanical Ratings		
Vibration	10...2000 Hz, 1.52 mm displacement (peak-to-peak) max./ 10 G max. (except Logic Reed)	
Shock	1/2 cycle sine wave for 11 ms ≥ 25 G (contact fragility) and no damage at 100 G	
Degree of protection	Type 1/4/12/13 (800T); Type 1/4/4X/12/13 (800H); EN/IEC 60529 IP66/65	
Mechanical design life cycles		
Push buttons	(Momentary, non-illuminated)	10 000 000 min.
	(Momentary, illuminated)	250 000 min.
	(Push-pull/twist-to-release)	250 000 min.
Selector switches	(Non-illuminated)	1 000 000 min.
	(Illuminated, key-operated)	200 000 min.
Potentiometers		25 000 min.
All other devices		200 000 min.
Contact operation	Shallow, mini, and low-voltage contact blocks: Slow, double make and break Logic Reed and sealed switch contact blocks: Single break magnetic	
Wire gauge/Terminal screw torque	#18...14 AWG (#18...10 Max Duty) / 6...8 lb•in	
Typical operating forces		
Operators without contact blocks	Flush, extended button, standard mushroom, jumbo plastic mushroom: 2 lbs max. Jumbo and extended aluminum mushroom head: 3.95 lbs max. Maintained selector switch: 3.6 in•lb max.	
Spring return selector switches	3.6 in•lb to stop, 0.2 in•lb to return	
Illuminated push buttons and push-to-test pilot lights	5 lb max.	
2-position push-pull	8.0 lb max. push or pull	
3-position push-pull	8 lb max. push to in position or pull to center position (15 lb max. pull to out position)	
Twist-to-release or push-pull	9 lbs max. push or pull 30 in•oz max. twist, 6 in•oz minimum return	
Potentiometer	Rotational torque 3...12 in•oz; stopping torque 12 in•lb (minimum)	
Contact blocks	Standard	1 lb
	Logic Reed	1 lb max.
	Sealed switch	3 lb max. at 0.205 in. plunger travel
	Stackable sealed switch	1 lb max.
	MaxDuty	1.4 lb max.
	PenTUFF	1.4 lb max.
Self Monitoring	1.6 lb	
Environment		
Temperature range	Operating	-40...+131 °F (-40...+55 °C)
	Storage	-40...+185 °F (-40...+85 °C)
Note: Operating temperatures below freezing are based on the absence of moisture and liquids. Consult your local Rockwell Automation sales office or Allen-Bradley distributor for use in lower temperature applications.		
Humidity	50...95% RH from 77...140 °F (25...60 °C) per Procedure IV of MIL-STD-810C, Method 507.1 cycling test	

Certifications
 UL Listed
 (File No. E14840, E10314
 Guide No. NKCR, NOIV)
 CSA Certified
 (File No. LR1234, LR11924)
 CSA C22.2, No. 14

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Rev: 0
 Date: 06-23-2023
 By: JN

Device Tag: LT2
 Job Number: HBR9328

Page # 1/1

Manuf.: PNO: Allen-Bradley: 800H-QRTH2R

32-005-A002

Pilot Light Devices 30.5 mm



Allen-Bradley



800 T - P T 16 G
a b c d e f g

a

Protection Rating	
Code	Description
T	Metal, Type 4/13
H	Plastic, Type 4/4X/13

b

Finger-Safe Guards	
Code	Description
Blank	No guards
C	Guards on terminals

c

Power Module Type		
800T Type 4/13	Description	800H Type 4/4X/13
Code		Code
P	Transformer (or dual input)	PR
Q	Full voltage/ Universal	QR

d

Lamp Test Options	
Code	Description
Blank	No test option
T	Push-to-test
D	Dual input — diode▲
DT	Dual input — transformer relay

Note: Push-to-test supplied with factory jumpered contact block.

e

Illumination Options	
Code	Description
Blank	Incandescent
H	LED▲

f

Voltage	
Transformer	
Code	Description
16	120V AC 50/60 Hz
26	240V AC 50/60 Hz
46	480V AC 50/60 Hz
56	600V AC 50/60 Hz
Full Voltage — Incandescent	
12	12V AC/DC
24	24V AC/DC
48	48V AC/DC
10	120V AC/DC
20	240V AC/DC
Universal — LED	
2	12...130V AC/DC
Dual Input	
16	120V AC
24	24V AC/DC (Dual input diode only)



g

Lens Color		
Code	Color	Glass Code ▲
Blank	No lens	Blank
A	Amber	D
B	Blue	E
C	Clear	F
G	Green	H
R	Red	J
W	White	K

Specifications*

Electrical Ratings		
Contact ratings	Refer to the contact ratings tables on page 10-4.	
Dielectric strength	2200V for one minute, 1300V for one minute (Logic Reed)	
Electrical design life cycles	1 000 000 at max. rated load, 200 000 at max. rated load (Logic Reed)	
Mechanical Ratings		
Vibration	10...2000 Hz, 1.52 mm displacement (peak-to-peak) max./ 10 G max. (except Logic Reed)	
Shock	1/2 cycle sine wave for 11 ms ≥ 25 G (contact fragility) and no damage at 100 G	
Degree of protection	Type 1/4/12/13 (800T); Type 1/4/4X/12/13 (800H); EN/IEC 60529 IP66/65	
Mechanical design life cycles		
Push buttons	(Momentary, non-illuminated)	10 000 000 min.
	(Momentary, illuminated)	250 000 min.
	(Push-pull/twist-to-release)	250 000 min.
Selector switches	(Non-illuminated)	1 000 000 min.
	(Illuminated, key-operated)	200 000 min.
Potentiometers	25 000 min.	
All other devices	200 000 min.	
Contact operation	Shallow, mini, and low-voltage contact blocks: Slow, double make and break Logic Reed and sealed switch contact blocks: Single break magnetic	
Wire gauge/Terminal screw torque	#18...14 AWG (#18...10 Max Duty) / 6...8 lb•in	
Typical operating forces		
Operators without contact blocks	Flush, extended button, standard mushroom, jumbo plastic mushroom: 2 lbs max. Jumbo and extended aluminum mushroom head: 3.95 lbs max. Maintained selector switch: 3.6 in•lb max.	
Spring return selector switches	3.6 in•lb to stop, 0.2 in•lb to return	
Illuminated push buttons and push-to-test pilot lights	5 lb max.	
2-position push-pull	8.0 lb max. push or pull	
3-position push-pull	8 lb max. push to in position or pull to center position (15 lb max. pull to out position)	
Twist-to-release or push-pull	9 lbs max. push or pull 30 in•oz max. twist, 6 in•oz minimum return	
Potentiometer	Rotational torque 3...12 in•oz; stopping torque 12 in•lb (minimum)	
Contact blocks	Standard	1 lb
	Logic Reed	1 lb max.
	Sealed switch	3 lb max. at 0.205 in. plunger travel
	Stackable sealed switch	1 lb max.
	MaxDuty	1.4 lb max.
	PenTUFF	1.4 lb max.
Self Monitoring	1.6 lb	
Environment		
Temperature range	Operating	-40...+131 °F (-40...+55 °C)
	Storage	-40...+185 °F (-40...+85 °C)
Note: Operating temperatures below freezing are based on the absence of moisture and liquids. Consult your local Rockwell Automation sales office or Allen-Bradley distributor for use in lower temperature applications.		
Humidity	50...95% RH from 77...140 °F (25...60 °C) per Procedure IV of MIL-STD-810C, Method 507.1 cycling test	

Certifications
 UL Listed
 (File No. E14840, E10314
 Guide No. NKCR, NOIV)
 CSA Certified
 (File No. LR1234, LR11924)
 CSA C22.2, No. 14



Rev: 0
 Date: 06-23-2023
 By: JN

Device Tag: LT3
 Job Number: HBR9328

32-005-A003

Auxiliary Contacts

Allen-Bradley

22-005-010



Auxiliary Contact Blocks for Front Mounting ①

- 2- and 4-pole
 - Quick and easy mounting without tools
 - Electronic-compatible contacts down to 17V, 5 mA
 - Mutual positive guidance to the main contactor poles (except for L types)
 - Models with equal function with several terminal numbering choices
- L = Late break / Early make



Auxiliary contact blocks for front installation ②

- 2 and 4 poles
- Quick and easy mounting without tools
- Contacts compatible with electronics
- Mutual positive guidance with the main contactor poles (except for L types)
- Models with equal function with several terminal numbering choices

L = late break / early make

N.O.	N.C.	Connection Diagrams	For Use With	Cat. No.
0	2		100-C all C30®00...C85®00	100-FA02 100-FB02
1	1		100-C all C30®00...C85®00 C09®10...C23®10	100-FA11 100-FB11 100-FC11
2	0		100-C all C30®00...C85®00	100-FA20 100-FB20
1L	1L		100-C all C30®00...C85®00	100-FAL11 100-FBL11
0	4		100-C all	100-FA04
1	3		100-C all	100-FA13
2	2		100-C all C30®00...C85®00 C09®10...C23®10	100-FA22 100-FB22 100-FC22
3	1		100-C all C09®10...C23®10	100-FA31 100-FC31
4	0		100-C all	100-FA40
1+1L	1+1L		100-C all	100-FAL22



Rev: 0

Date: 06-23-2023

By: JN

Device Tag:

M1-F/R

Job Number: HBR9328

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Manuf.: PNo:

Allen-Bradley: 100-FA31

Bulletin 305 Energy-saving Reversing Contactors^(a)

22-005-117

- NEMA Sizes 00...4
- Electronic coils
 - AC/DC
 - Wide voltage range
 - Low power pick-up and hold-in
 - Optional PLC interface
- Reversing contactors
- 3 Main contacts



3-Pole AC- and DC-operated Reversing Contactors

NEMA Size	Continuous Ampere Rating [A]	Max. Horsepower Rating— Full-load Current Must Not Exceed Continuous Ampere Rating (60 Hz) [Hp]				Auxiliary Contacts		Interlock Type	Cat No.
		Hp (60 Hz)				1	2		
		200V	230V	380...415V	460...575V	N.O.	N.C.		
00	9	1.5	1.5	2	2	2 ⁽¹⁾	Electrical / Mechanical	305-T0⊗-23 ⁽²⁾	
						4	Mechanical	305-T0⊗-23Z	
0	18	3	3	5	5	2 ⁽¹⁾	Electrical / Mechanical	305-A0⊗-23 ⁽²⁾	
						4	Mechanical	305-A0⊗-23Z	
1	27	7.5	7.5	10	10	4 ⁽¹⁾	Electrical / Mechanical	305-B0⊗-23 ⁽²⁾	
						2	Mechanical	305-B0⊗-23Z	
2	45	10	15	25	25	2	Mechanical	305-C0⊗-23Z	
3	90	25	30	50	50	2	Mechanical	305-D0⊗-23Z	
4	135	40	50	100	100	1	Mechanical	305-E0⊗-23Z	

(1) Two N.C. auxiliary contacts are supplied as part of the mechanical/electrical interlock.
 (2) For AC voltages only.

⊗ Coil voltage code and terminal position—see page 8

⊗ Coil Voltage Codes

For 3-Pole Reversing Contactors

The Cat. No. as listed is incomplete. Select a coil voltage code from the table below to complete the Cat. No. Example: 305-B0J23

Electronic Coils	v ⁽¹⁾	12-20V DC	24V DC	24-60V AC, 20-60V DC	48-130V AC/DC	100-250V AC/DC	250-500V AC/DC
NEMA Size 00...4	Standard AC/DC	—	—	J	Y	D	B
NEMA Size 00...1	Low Consumption AC/DC	EQ	—	EJ	—	—	—
NEMA Size 00...1	Low Consumption/ Faster Drop-out DC	—	OJ	—	—	—	—
NEMA Size 4 ⁽²⁾	Standard AC/DC with PLC Input	—	—	—	—	ED	EN

(1) AC voltages are at 50/60 Hz
 (2) When ordering coil with PLC input, the PLC input must be used



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M1-F/R

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Manuf.: . PNo: Allen-Bradley: 305-AOD-23

PanelView Plus 7 Standard Terminals



26-005-091

Table 4 - PanelView Plus 7 Standard 7-in., 9-in., and 10-in. Terminals

Attribute	7-in. Touch 2711P-T7C21D8S, 2711P-T7C21D8S-B, 2711P-T7C22D8S, 2711P-T7C22D8S-B	9-in. Touch 2711P-T9W21D8S, 2711P-T9W21D8S-B, 2711P-T9W22D8S, 2711P-T9W22D8S-B	10-in. Touch 2711P-T10C21D8S, 2711P-T10C21D8S-B, 2711P-T10C22D8S, 2711P-T10C22D8S-B
Operator input	Touch	Touch	Touch
Display type	Color TFT LCD	Color TFT LCD	Color TFT LCD
Display size, diagonal	6.5 in.	9 in. widescreen	10.4 in.
Viewing area	132 x 99 mm	196 x 118 mm	211 x 158 mm
Display resolution	640 x 480 VGA, 18-bit color graphics	800 x 480 WVGA, 18-bit color graphics	800 x 600 SVGA, 18-bit color graphics
Aspect ratio	4:3	5:3	4:3
Brightness, typical	300 nits		
Backlight life	50,000 hr life, min at 40° C (104 °F) to half-brightness. Backlight is not replaceable.		
Touch screen	Analog resistive Actuation rating: 1 million presses Operating force: 100 grams		
Battery (real-time clock backup)	Accuracy: ±2 minutes per month. Battery life: 4 years min at 25 °C (77 °F) Replacement: CR2032 lithium coin cell (Allen-Bradley part number 2711P-RY2032)		
Memory	System User 512 MB RAM and 512 MB storage 80 MB nonvolatile storage for applications		
Secure Digital (SD) card slot	One SD card slot for storing application files Replacement: Allen-Bradley part number 1784-SD1 (1 GB) and 1784-SD2 (2 GB)		
USB ports	Host Device One USB 2.0 high-speed host port (type A) support removal flash drives for storage One high-speed 1.0 device port (type B) supports connection to host computer		
Ethernet port	Cat. Nos. with 21 Cat. Nos. with 22 One 10/100Base-T, Auto MDI/MDI-X Ethernet port with IEEE1588 support Two 10/100Base-T, Auto MDI/MDI-X Ethernet ports supporting star, linear, or DLR network topology		
Operating system	Windows CE includes FTP, VNC client server, ActiveX controls, PDF reader, third-party device support		
Software	FactoryTalk View Studio for Machine Edition, version 8.0 or later, FactoryTalk ViewPoint, version 2.6 or later		
Electrical			
Input voltage, DC	24V DC nom (18...30V DC), nonisolated DC power supply		
Power consumption, DC	50 W max (2.1A at 24V DC)		
Power supply	DIN-rail power supply, AC-to-DC, 85...265V AC, 47...63 Hz Recommended Replacement: Allen-Bradley part number 2711P-RSACDIN		
Mechanical			
Weight, approx	0.85 kg (1.86 lb)	1.29 kg (2.84 lb)	1.82 kg (4.0 lb)
Dimensions, HxWxD, approx	170 x 212 x 56.5 mm (6.69 x 8.35 x 2.22 in.)	190 x 280 x 56.5 mm (7.48 x 11.02 x 2.22 in.)	252 x 297 x 56.5 mm (9.92 x 11.69 x 2.22 in.)
Cutout dimensions, HxW, approx.	142 x 184 mm (5.59 x 7.24 in.)	162 x 252 mm (6.38 x 9.92 in.)	224 x 269 mm (8.82 x 10.59 in.)



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By: JN

Device Tag:
OIU1
Job Number: HBR9328

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Manuf.: PNO:
Allen Bradley: 2711P-T12W21D8S

Table 5 - PanelView Plus 7 Standard 12-in. and 15-in. Terminals

Attribute	12-in. Touch 2711P-T12W21D8S, 2711P-T12W21D8S-B, 2711P-T12W22D8S, 2711P-T12W22D8S-B	15-in. Touch 2711P-T15C21D8S, 2711P-T15C21D8S-B, 2711P-T15C22D8S, 2711P-T15C22D8S-B
Operator Input	Touch	Touch
Display type	Color TFT LCD	Color TFT LCD
Display size, diagonal	12.1 in. widescreen	15-in.
Viewing area	261 x 163 mm	304 x 228 mm
Display resolution	1280 x 800 WXGA, 18-bit color graphics	1024 x 768 XGA, 18-bit color graphics
Aspect ratio	5:3	4:3
Brightness, typical	300 nits	
Backlight life	50,000 h life, min. at 40° C to half-brightness. Backlight is not replaceable	
Touch screen	Analog resistive Actuation rating: 1 million presses Operating force: 100 grams	
Battery (real-time clock backup)	Accuracy: +/-2 minutes per month Battery life: 4 years min at 25 °C (77 °F) Replacement: CR2032 lithium coin cell	
Memory	System User	
	512 MB RAM and 512 MB storage 80 MB nonvolatile storage for applications	
Secure Digital (SD) card slot	One SD card slot for storing application files Replacement: Allen-Bradley part number 1784-SD1 (1 GB) and 1784-SD2 (2 GB)	
USB ports	Host Device	
	One USB 2.0 high-speed host port (type A) support removal flash drives for storage One high-speed 1.0 device port (type B) supports connection to host computer	
Ethernet port	Cat. Nos. with 21 Cat. Nos. with 22	
	One 10/100Base-T, Auto MDI/MDI-X Ethernet port with IEEE1588 support Two 10/100Base-T, Auto MDI/MDI-X Ethernet ports supporting star, linear, or DLR network topology	
Operating system	Windows CE includes FTP, VNC client server, ActiveX controls, PDF reader, third-party device support	
Software	FactoryTalk View Studio for Machine Edition, version 8.0 or later, FactoryTalk ViewPoint, version 2.6 or later	
Electrical		
Input voltage, DC	24V DC nom (18...30V DC), nonisolated DC power supply	
Power consumption, DC	50 W max (2.1A at 24V DC)	
Power supply	DIN-rail power supply, AC-to-DC, 85...265V AC, 47...63 Hz Recommended Replacement: Allen-Bradley part number 2711P-RSACDIN	
Mechanical		
Weight, approx.	1.95 kg (4.29 lb)	3.07 kg (6.75 lb)
Dimensions, HxWxD, approx.	240 x 340 x 56.5 mm (9.65 x 13.39 x 2.22 in.)	318 x 381 x 56.5mm (12.52 x 15.00 x 2.22 in.)
Cutout dimensions, HxW, approx.	218 x 312 mm (8.58 x 12.28 in.)	290 x 353 mm (11.42 x 13.90 in.)



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OIU1

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HBR9328Page #
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Manuf.: PNo:

Allen Bradley: 2711P-T12W21D8S

E100 Electronic Motor Overload Relay



28-005-080

Bulletin 193-1EF - Single- & Three-phase Devices

- Trip Class 10, 15, 20, 30
- Manual or Automatic Reset

Mounting Options	Current Range [A]	For Use With	Cat. No.
IEC Contactors	0.1...0.5	100-C09...C23	193-1EFAB
	0.2...1.0		193-1EFBB
	1.0...5.0		193-1EFCB
	3.2...16		193-1EFD B
	5.4...27		193-1EFEB
	5.4...27	100-C30...C55	193-1EFED
	11...55	193-1EFFD	
	20...100	100-C60...C97	193-1EFGE

Electrical Specifications

Control Relay Ratings

Attribute	Rating
Relay N.O. / N.C.	
Type of Contacts	Aq/Ni
Rated Thermal Current (I_{TMC})	B600: 5.0 A; C600: 2.5 A; R300: 1.0 A
Contact Reliability	17 V, 5 mA
Rated Insulation Voltage (U_i)	690V AC
Rated Operating Voltage (U_o) IEC	690V AC
Rated Operating Voltage (U_o) UL	600V AC
Rated Operating Current (I_o)	B600: 3 A (@120V AC), 1.5 A (@240V AC) C600: 1.5 A (@120V AC), 0.75 A (@240V AC) R300: 0.22 A (@125V DC), 0.11 A (@250V DC)
Minimum Operating Current	10 mA @ 5V DC
Rating Designation	N.O. C600 / N.C. B600 (AC) N.O. / N.C. R300 (DC)
Utilization Category	AC-15/DC-13
B600 VA Rating	3600VA make / 360VA break
C600 VA Rating	1800VA make / 180VA break
R300 VA Rating	28VA make / 28VA break

Overload Protection

Attribute	Rating	
	Cat. No. 193-1EE	Cat. No. 193-1EF, 592-1EF
Type of Relay	Ambient Compensated Time-Delay Phase Loss Sensitive	
Nature of Relay	Solid-state	
FLA Setting	Rotary Dial	
Trip Rating	120% FLA	
Trip Class	10, 20	10, 15, 20, 30
Reset Mode	Manual	Automatic or Manual
Overload Reset Level	Auto Reset occurs at 70% TCU when accessory powered, after 2 minutes when self powered. Manual Reset can occur anytime by pressing the manual reset button. Electronic Reset (ERIB input) can only occur below 70% TCU.	

Motor/Load Ratings

Attribute	Rating
Terminals	1/L1, 3/L2, 5/L3, 2/T1, 4/T2, 6/T3
Terminal Style Devices	
Rated Insulation Voltage U_i	690V AC
Rated Operating Voltage U_o IEC	690V AC
Rated Operating Voltage U_o UL	600V AC
Pass-thru Style Devices	
Rated Insulation Voltage U_i	1000V AC
Rated Operating Voltage U_o IEC	1000V AC
Rated Operating Voltage U_o UL	600V AC
Rated Impulse Voltage (U_{imp})	6 kV AC
Rated Operating Current I_o	See page 4
Rated Frequency	45...65 Hz

Environmental Specifications

Attribute	Overload Rating	Accessory Rating
Ambient Temperature		
Storage	-40...+85 °C (-40...+185 °F)	
Operating (open) ⁽¹⁾	-20...+65 °C (-4...+149 °F)	
Operating (enclosed)	-20...+50 °C (-4...+122 °F) -20...+55 °C (-4...+131 °F)	
Humidity		
Operating	5...95% Non-condensing; 92% relative humidity	
Damp Heat - Steady State (per IEC 60068-2-78)	93% relative humidity, 40 °C (104 °F), 56 days	
Damp Heat - Cyclic (per IEC 60068-2-30)	93% relative humidity, 25 °C/40 °C (77 °F/104 °F), 21 Cycles	
Cooling Method	Natural convection	
Vibration (per IEC 68-2-6), operating	Operating 3 G	
Shock (per IEC 68-2-27), operating	Operating 30 G	
Maximum Altitude	2000 m	
Pollution Environment	Pollution Degree 3	
Degree of Protection	IP20 (front of panel)	IP20

Standards Compliance

- CSA22.2, No. 60947-4-1
- EN 60947-4-1
- UL 60947-4-1
- GB/T 14048.4-2010
- SJ/T 11364, GB/T 26572, SJ/T 11388

Certifications

- cULus Listed - File No. E14840
- CE Marked
- RCM (formerly C-tick)
- ABS
- RINA
- DNV/GL
- CCC
- KC
- EAC
- Environmental Protection Use Period 25 (China RoHS)
- Morocco Regulatory Certification



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Rev: 0

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By: JN

Device Tag:

OL1

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Manuf.: PNO:

Allen-Bradley: 193-1EFBB

Bulletin 800T/H
30.5 mm Push Buttons
 Emergency Stop Operators



2-Position Red Trigger Action Twist-to-Release, Non-Illuminated

- Tamper resistant – front-of-panel mounting and non-removable operator head
- Compliant with global E-stop standards, including EN ISO 13850 and EN 60947-5-5



Cat. No. 800T-TFXJET6



Cat. No. 800T-TFXLET6



Cat. No. 800T-TFXK6



Cat. No. 800H-TFRXT6

Contact Type	Operator Position		Type 4/13			Type 4/4X/13
	Out	In	45 mm Plastic	63 mm Metal	Key Release	45 mm Plastic
No contacts	—	—	Cat. No.* ‡	Cat. No.* §	Cat. No.* ‡	Cat. No.* ‡
1 N.C.	X	O	800T-TFXT6D2	800T-TFXLT6D2	800T-TFXK6D2	800H-TFRXT6D2
1 N.O. - 1 N.C.	O	X	800T-TFXT6A	800T-TFXLT6A	800T-TFXK6A	800H-TFRXT6A
1 S.M.C.B.➤	X	O	800TC-TFXT6D4S	800TC-TFXLT6D4S	800TC-TFXK6D4S	800HC-TFRXT6D4S

Standards Compliance

UL 508

CCC

Certifications

UL Listed

(File No. E14840, E10314
 Guide No. NKCR, NOIV)

CSA Certified

(File No. LR1234, LR11924)

CSA C22.2, No. 14

EN/IEC: 60947-5-1

* For finger-safe contact block terminals, add a **C** to the cat. no. Example: Cat. No. 800TC-TFXT6 or 800HC-TFRXT6.

‡ To order a device with a jumbo (60 mm) plastic head add the letter **J** after **X**. Example: Cat. No. 800T-TFXJT6A or 800H-TFRXT6A.

§ To order a jumbo head device with "E-STOP" printed on the cap add the letters **JE** after **X**. Example: Cat. No. 800T-TFXJET6 or 800H-TFRXT6A.

➤ To order a device with "E-STOP" engraved on the cap add the letter **E** after **L**. Example: Cat. No. 800TC-TFXLET6D4S.

‡ Provided with two DO18 keys.

➤ Self-monitoring contact block.

800 **T** **-** **T** **FX** **T** **6** **D2**
a b c d e

Protection Rating	
Code	Description
T	Metal, Type 4/13
H	Plastic, Type 4/4X/13

Finger-Safe Guards	
Code	Description
Blank	No guards
C	Guards on terminals

Head Type‡		
800T Type 4/13	Description	800H Type 4/4X/13
Code		Code
FX	Standard (45 mm) mushroom head	FRX
FXJ	Jumbo (60 mm) mushroom head	FRXJ
FXJE	Jumbo (60 mm) mushroom head with "E-STOP"	FRXJE
FXK	45 mm mushroom head key release	—
FXL	63 mm anodized aluminum head	—
FXLE	63 mm anodized aluminum head with "E-STOP"	—

Release Function	
Code	Color
Blank	Key release‡
T	Twice release

Note: X = Closed/O = Open
 ‡ Configurable only with **FXK** head type.

Code	Operator Position		Description
	Out	In	
	Blank	—	—
Standard			
D1	O	X	1 N.O.
D2	X	O	1 N.C.
D4	X	O	1 N.C.L.B.
A	O	X	1 N.O. - 1 N.C.
A1	O	X	1 N.O. - 1 N.C.L.B.
A5	X	O	2 N.C.L.B.
PenTUFF (Low Voltage)			
D1V	O	X	1 N.O.
D2V	X	O	1 N.C.
D4V	X	O	1 N.C.L.B.
AV	O	X	1 N.O. - 1 N.C.
Class 1, Div. 2/Zone 2			
Logic Reed			
D1R	O	X	1 N.O.
D2R	X	O	1 N.C.
AR	O	X	1 N.O. - 1 N.C.
Sealed Switch			
D1P	O	X	1 N.O.
D2P	X	O	1 N.C.
AP	O	X	1 N.O.
	X	O	1 N.C.
Stackable Sealed Switch			
D1Y	O	X	1 N.O.
D2Y	X	O	1 N.C.
AY	O	X	1 N.O. - 1 N.C.
	X	O	



Rev: 0
 Date: 06-23-2023
 By: JN

Device Tag: PB1
 Job Number: HBR9328

Manuf.: PNO:
 Allen-Bradley: 800H-TFRXT6D2

30.5 mm Push Buttons



Allen-Bradley

800 T - A 1 A

a *b* *c* *d* *e* *f*

Protection Rating	
Code	Description
T	Metal, Type 4/13
H	Plastic, Type 4/4X/13

Finger-Safe Guards	
Code	Description
Blank	No guards
C	Guards on terminals

Operator Type		
800T Type 4/13	Description	800H Type 4/4X/13
Code		Code
A	Flush head	AR
B	Extended head	BR
D	Mushroom head	DR
DX	Mushroom head less color cap	DRX
—	Bootless guarded head	GR
—	Booted head	R+

Color Cap	
Code	Description
Blank	Used only when ordering Operator Type DX/DRX
1	Green
2	Black
3	Orange*

Color Cap	
Code	Description
4	Grey*
5	White*
6	Red
7	Blue
9	Yellow

Special Mushroom Head	
Code	Description
J§	Jumbo mushroom head — plastic
L§	Jumbo mushroom head — metal

Note: Special mushroom head options only apply to mushroom head operator type code D/DR (Table c).

Contact Block(s)	
Code	Description
Blank	No contacts
Standard	
D1	1 N.O.
D2	1 N.C.
D3	1 N.O.E.M.
D4	1 N.C.L.B.
D5	1 N.O. (Mini)
D6	1 N.C. (Mini)
A1	1 N.C.L.B. - 1 N.O.
A2	2 N.O.†
A4	2 N.C.
A7	1 N.C.L.B. - 1 N.C.
A	1 N.O. - 1 N.C.
B	2 N.O. - 2 N.C.



Certifications

UL Listed
(File No. E14840, E10314
Guide No. NKCR, NOIV)

CSA Certified
(File No. LR1234, LR11924)

CSA C22.2, No. 14

Specifications+

Electrical Ratings	
Contact ratings	Refer to the contact ratings tables on page 10-4.
Dielectric strength	2200V for one minute, 1300V for one minute (Logic Reed)
Electrical design life cycles	1 000 000 at max. rated load, 200 000 at max. rated load (Logic Reed)
Mechanical Ratings	
Vibration	10...2000 Hz, 1.52 mm displacement (peak-to-peak) max / 10 G max. (except Logic Reed)
Shock	1/2 cycle sine wave for 11 ms ≥ 25 G (contact fragility) and no damage at 100 G
Degree of protection	Type 1/4/12/13 (800T); Type 1/4/4X/12/13 (800H); EN/IEC 60529 IP66/65
Mechanical design life cycles	
Push buttons	(Momentary, non-illuminated) 10 000 000 min. (Momentary, illuminated) 250 000 min. (Push-pull/twist-to-release) 250 000 min.
Selector switches	(Non-illuminated) 1 000 000 min. (Illuminated, key-operated) 200 000 min.
Potentiometers	25 000 min.
All other devices	200 000 min.
Contact operation	Shallow, mini, and low-voltage contact blocks: Slow, double make and break Logic Reed and sealed switch contact blocks: Single break magnetic
Wire gauge/Terminal screw torque	#18...14 AWG (#18...10 Max Duty) / 6...8 lb•in
Typical operating forces	
Operators without contact blocks	Flush, extended button, standard mushroom, jumbo plastic mushroom: 2 lbs max. Jumbo and extended aluminum mushroom head: 3.95 lbs max. Maintained selector switch: 3.6 in•lb max.
Spring return selector switches	3.6 in•lb to stop, 0.2 in•lb to return
Illuminated push buttons and push-to-test pilot lights	5 lb max.
2-position push-pull	8.0 lb max. push or pull
3-position push-pull	8 lb max. push to in position or pull to center position (15 lb max. pull to out position)
Twist-to-release or push-pull	9 lbs max. push or pull 30 in•oz max. twist, 6 in•oz minimum return
Potentiometer	Rotational torque 3...12 in•oz; stopping torque 12 in•lb (minimum)
Contact blocks	Standard 1 lb Logic Reed 1 lb max. Sealed switch 3 lb max. at 0.205 in. plunger travel Stackable sealed switch 1 lb max. MaxDuty 1.4 lb max. PenTUFF 1.4 lb max. Self Monitoring 1.6 lb
Environment	
Temperature range	Operating -40...+131 °F (-40...+55 °C) Storage -40...+185 °F (-40...+85 °C)
Note: Operating temperatures below freezing are based on the absence of moisture and liquids. Consult your local Rockwell Automation sales office or Allen-Bradley distributor for use in lower temperature applications.	
Humidity	50...95% RH from 77...140 °F (25...60 °C) per Procedure IV of MIL-STD-810C, Method 507.1 cycling test

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Device Tag: PB2,3

Manuf.: PNO: Allen-Bradley: 800H-AR2D1

By: JN

Job Number: HBR9328 Page # 1/1

29-005-002

RM22TR33

 Modular 3-phase control relay, 8 A, 2 CO,
 380...480 V AC

Main

Range of product	Zelio Control
Product or component type	Modular measurement and control relays
Relay type	Control relay
Phase	3 phase
Relay name	RM22TR
Relay monitored parameters	Overvoltage and undervoltage detection Phase sequence Phase failure detection
Time delay type	Adjustable 0.1...30 s, +/- 10 % of the full scale value on crossing the threshold Tt
Switching capacity in VA	2000 VA
Measurement range	380...480 V voltage AC

Complementary

Reset time	1500 ms at maximum voltage
Maximum switching voltage	250 V AC
Minimum switching current	10 mA 5 V DC
Maximum switching current	8 A AC
[Us] rated supply voltage	380...480 V AC
Supply voltage limits	304...576 V AC
Operating limits	- 20 % + 20 % Un
Power consumption in VA	15 VA 480 V AC 60 Hz
Voltage detection threshold	< 100 V AC
Supply voltage frequency	50...60 Hz +/- 10 %
Output contacts	2 C/O
Nominal output current	8 A
Setting accuracy of the switching threshold	+/- 10 % of the full scale
Setting accuracy of time delay	10 P
Time delay drift	<= 0.05 % per degree centigrade depending permissible ambient air temperature <= 1 % within the supply voltage range
Hysteresis	2 % fixed selectable
Run-up delay at power-up	650 ms
Maximum measuring cycle	150 ms measurement cycle as true rms value
Threshold adjustment voltage	2...20 % of Un selected
Voltage range	380...480 V phase to phase
Repeat accuracy	+/- 0.5 % input and measurement circuit +/- 3 % time delay
Measurement error	< 1 % over the whole range with voltage variation < 0.05 %/°C with temperature variation
Response time	<= 300 ms
Overvoltage category	III IEC 60664-1 III UL 508
Insulation resistance	> 100 MOhm 500 V DC IEC 60255-27
Mounting position	Any position
Connections - terminals	Screw terminals, 2 x 0.5...2 x 2.5 mm ² AWG 20...AWG 14) solid without cable end Screw terminals, 2 x 0.2...2 x 1.5 mm ² AWG 24...AWG 16) flexible with cable end Screw terminals, 1 x 0.5...1 x 3.3 mm ² AWG 20...AWG 12) solid without cable end Screw terminals, 1 x 0.2...1 x 2.5 mm ² AWG 24...AWG 14) flexible with cable end
Tightening torque	5.31...8.85 lbf.in (0.6...1 N.m) IEC 60947-1



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Manuf.: PNo:

Telemecanique: RM22TR33

Housing material	Self-extinguishing plastic
Status LED	Relay ON LED Yellow) Power ON LED Green)
Mounting support	35 mm DIN rail EN/IEC 60715
Electrical durability	100000 cycles
Mechanical durability	10000000 cycles
Utilisation category	AC-15 IEC 60947-5-1 DC-13 IEC 60947-5-1 AC-1 IEC 60947-4-1 DC-1 IEC 60947-4-1
Safety reliability data	MTTFd = 388.1 years B10d = 350000
Contacts material	Cadmium free
Maximum Width	0.89 in (22.5 mm)
Net Weight	0.20 lb(US) (0.09 kg)

Environment

Immunity to microbreaks	10 ms
Electromagnetic compatibility	Immunity for residential, commercial and light-industrial environments EN/IEC 61000-6-1 Immunity for industrial environments EN/IEC 61000-6-2 Emission standard for residential, commercial and light-industrial environments EN/IEC 61000-6-3 Emission standard for industrial environments EN/IEC 61000-6-4 Electrostatic discharge 6 kV contact discharge)level 3 IEC 61000-4-2 Electrostatic discharge 8 kV air discharge)level 3 IEC 61000-4-2 Radiated radio-frequency electromagnetic field immunity test 10 V/mlevel 3 IEC 61000-4-3 Electrical fast transient/burst immunity test 4 kV direct)level 4 IEC 61000-4-4 Electrical fast transient/burst immunity test 2 kV capacitive coupling)level 4 IEC 61000-4-4 Surge immunity test 4 kV common mode)level 4 IEC 61000-4-5 Surge immunity test 2 kV differential mode)level 4 IEC 61000-4-5 Conducted and radiated emissionsclass B group 1 CISPR 11 Conducted and radiated emissionsclass B CISPR 22
Standards	EN/IEC 60255-1
Product certifications	CSA CCC EAC China RoHS RCM CE GL UL
Ambient air temperature for storage	-40...158 °F (-40...70 °C)
Ambient air temperature for operation	-4...122 °F (-20...50 °C) 60 Hz -4...140 °F (-20...60 °C) 50 Hz AC/DC
Relative humidity	93...97 % 77...131 °F (25...55 °C) IEC 60068-2-30
Vibration resistance	0.075 mm 10...58.1 Hz) not in operation IEC 60068-2-6 1 gn 10...58.1 Hz) not in operation IEC 60068-2-6 0.035 mm 58.1...150 Hz) in operation IEC 60068-2-6 0.5 gn 58.1...150 Hz) in operation IEC 60068-2-6
Shock resistance	15 gn 11 ms) not in operation IEC 60068-2-27 5 gn 11 ms) in operation IEC 60068-2-27
IP degree of protection	IP20 IEC 60529 terminals) IP40 IEC 60529 housing) IP50 IEC 60529 front panel)
Pollution degree	3 IEC 60664-1 3 UL 508
Dielectric test voltage	2.5 kV AC 50 Hz, 1 min IEC 60255-27

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	Date: 06-23-2023		
Manuf.: PNo: Telemecanique: RM22TR33	By: JN	Job Number: HBR9328	Page # 2/2

5069-0W16 Digital 16-point Relay Output Module

33-005-277



Technical Specifications - 5069-0W16

Attribute	5069-0W16
Relay ratings	2 A resistive per channel @ 5...30V DC 2 A resistive per channel @ 5...264V AC, 50/60 Hz 2 A general use per channel @ 5...250V AC, 50/60 Hz 2 A @ 5...125V AC, ATEX/IECEx
Off-state leakage current per point, max	0 mA (dry contact, no onboard snubbers)
Output current per group, max	8 A
Output current per module, max	16 A
Output delay time, max	Off to On On to Off
Switching frequency	1 operation every 3 seconds (0.3 Hz at rated load)
Initial contact resistance, max	30 mΩ
Bounce time, mean	500 μs
Delay to fault	Supported
Fusing	Outputs are not fused
Minimum load current	1 mA
Expected contact life	300K cycles resistive, 100K cycles inductive
Pilot duty rating	5...240V AC, 50/60 Hz, C300 pilot duty per channel 5...125V DC, R150 pilot duty per channel
Increased output current capability	16 outputs can be paralleled to increase current capability by 1 A per channel 8 outputs can be paralleled to increase current capability by 2 A per channel
Output control in fault state per point	<ul style="list-style-type: none"> Hold Last State On Off (default)
Output states in program mode per point	<ul style="list-style-type: none"> Hold Last State On Off (default)
Output states in fault mode per point	<ul style="list-style-type: none"> Hold Last State On Off (default)
Duration of fault mode per point	<ul style="list-style-type: none"> 1 2 5 10 s Forever (default)

General Specifications - 5069-0W16

Attribute	5069-0W16
Outputs	16 (Two groups of 8) - Form A (normally open)
Output voltage range	5...125V DC 5...264V AC
MOD Power	75 mA @ 18...32V DC
MOD Power (Passthrough) ⁽¹⁾	9.55 A @ 18...32V DC
SA Power	150 mA @ 18...32V DC
SA Power (Passthrough) ⁽²⁾	9.95 A @ 18...32V DC
Do not exceed 10 A MOD or SA Power (Passthrough) current draw. The 5069-0W16 module complies with ATEX/IECEx when used at or below 125V AC or 30V DC.	
Power dissipation	3.0 W
Thermal dissipation	10.2 BTU/hr
Isolation voltage	300V (continuous), Basic Insulation Type Type tested at 1800V AC for 60 s No isolation between individual channels

Environmental Specifications - 5069-0W16

Attribute	5069-0W16
Temperature, operating IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Hb, Operating Thermal Shock)	0 °C < Ta < +60 °C (+32 °F < Ta < +140 °F)
Temperature, surrounding air, max	60 °C (140 °F)
Temperature, nonoperating IEC 60068-2-1 (Test Ab, Unpackaged Nonoperating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Nonoperating Dry Heat), IEC 60068-2-14 (Test Hb, Unpackaged Nonoperating Thermal Shock)	-40...+85 °C (-40...+185 °F)
Relative humidity IEC 60068-2-30 (Test Db, Unpackaged Damp Heat)	5...95% noncondensing
Vibration IEC 60068-2-6 (Test Fc, Operating)	4.6 g @ 10...500 Hz
Shock, operating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	10 g

Certifications - 5069-0W16

Certification ⁽¹⁾	5069-0W16
c-UL-us	UL Listed Industrial Control Equipment, certified for US and Canada. See UL File E65584. UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada. See UL File E194810.



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By: JN

Device Tag:
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Job Number:
HBR9328

Removable terminal blocks

Allen-Bradley



33-005-280

RTB

One of the following RTB types.

- 5069-RTB18-SPRING RTB
- 5069-RTB18-SCREW RTB

IMPORTANT: You must order RTBs separately. RTBs do not ship with COMPACT 5000 I/O modules. We recommend that you order only the RTB type that your system requires.



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Manuf.: PNo: Allen-Bradley: 5069-RTB18-SCREW

Removable terminal blocks

Allen-Bradley



33-005-282

IMPORTANT: You must order RTBs separately. The RTBs are available in 5069 RTB kits.

- The 5069-RTB64-SCREW kit contains the 5069-RTB6-SCREW and 5069-RTB4-SCREW RTBs.
- The 5069-RTB64-SPRING kit contains the 5069-RTB6-SPRING and 5069-RTB4-SPRING RTBs.
- The 5069-RTB5-SCREW kit contains the 5069-RTB5-SCREW RTBs.
- The 5069-RTB5-SPRING kit contains the 5069-RTB5-SPRING RTBs.

We recommend that you order only the RTB type that your system requires.



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Manuf.: PNo: Allen-Bradley: 5069-RTB64-SCREW

5069-IF8 Analog 8-channel Current/Voltage Input Module



33-005-299



Technical Specifications - 5069-IF8

Attribute	5069-IF8
Inputs	8 differential
Input range, voltage	±10V 0...10V 0...5V
Input range, current	0...20 mA 4...20 mA
Input impedance	Voltage: >1 MΩ Current: 90 Ω typical, 70...110 Ω range
Common mode voltage (channel to channel)	±10V
Module conversion method	Sigma-Delta, Two 24-bit multiplexed ADC
Resolution, voltage ⁽¹⁾ (16 bits at 10 Hz notch filter)	±10.5V: <320 μV/count (15 bits plus sign bipolar) 0...10.5V: <160 μV/count (16 bits unipolar) 0...5.25V: <80 μV/count (16 bits unipolar)
Resolution, current ⁽¹⁾ (16 bits at 10 Hz notch filter)	0...21 mA: <0.32 μA/count (16 bits) 3.6...21 mA: <0.27 μA/count (16 bits)
Calibrated accuracy at 25 °C	Voltage 0.10% full scale Current 0.10% full scale
Accuracy drift with temperature	Voltage 0.20% full scale Current 0.30% full scale
Input Total Unadjusted Error (TUE) ⁽²⁾ (Over full temperature range)	Voltage 0.30% full scale Current 0.40% full scale

General Specifications - 5069-IF8

Attribute	5069-IF8
Voltage and current ratings	
MOD Power	75 mA @ 18...32V DC
MOD Power Passthrough, max ⁽¹⁾	9.55 A @ 18...32V DC
SA Power	100 mA @ 18...32V DC
SA Power Passthrough, max ⁽²⁾	9.95 A @ 18...32V DC
Do not exceed 10 A MOD or SA Power (Passthrough) current draw.	
Power dissipation, max	Voltage mode: 2.1 W Current mode: 2.4 W
Thermal dissipation, max	Voltage mode: 7.2 BTU/hr Current mode: 8.2 BTU/hr
Isolation voltage	250V (continuous), Basic Insulation Type 50V Functional Isolation between SA power and input ports No isolation between individual input ports
Calibration methods	Factory calibrated User-performed (optional)
Module keying	Electronic keying via programming software
Indicators	1 green/red module status indicator 8 yellow/red I/O status indicator
Slot width	1

Certifications - 5069-IF8

Certification ⁽¹⁾	5069-IF8
c-UL-us	UL Listed Industrial Control Equipment, certified for US and Canada. See UL File E65584. UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada. See UL File E194810.



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Manuf.: PNo: Allen-Bradley: 5069-IF8



Allen-Bradley

CompactLogix 5380 Controllers



33-005-336

Features - CompactLogix 5380 Controllers

Feature	5069-L306ER, 5069-L306ERM	5069-L310ER, 5069-L310ER-NSE, 5069-L310ERM	5069-L320ER, 5069-L320ERM, 5069-L320ERMK, 5069-L320ERP	5069-L330ER, 5069-L330ERM, 5069-L330ERMK	5069-L340ER, 5069-L340ERM, 5069-L340ERP	5069-L350ERM, 5069-L350ERMK	5069-L380ERM	5069-L3100ERM
Controller tasks Continuous Periodic Event	32 tasks 1000 programs/task All event triggers							
Built-in communication ports	1 - USB port 2 - Ethernet ports IMPORTANT: Consider the following: When the controller operates in Dual-IP mode, each Ethernet port requires a unique IP address. When the controller operates in Linear/DLR mode, the controller uses only one IP address.							
USB port communication	USB 2.0, Type B Full speed (12 Mbps) Programming, configuration, firmware update, and online edits only							
Ethernet performance	10 Mbps, 100 Mbps, 1 Gbps Full-duplex only							
I/O Capacity (Class 0/1) ⁽¹⁾	128,000 packets/second							
Message Rate Capacity HMI/MSG (Class 3) ⁽¹⁾	2000 messages/second							
EtherNet/IP modes supported	Dual-IP mode (Available with the Studio 5000 Logix Designer® application, version 29.00.00 or later) Linear/DLR mode							
EtherNet/IP network topologies supported	DLR Star Linear							
EtherNet/IP nodes supported, max ⁽²⁾	16	24	40	60	90	120	150	180
Socket interfaces supported, max	32							
Integrated motion ⁽³⁾	5069-L306ERM	5069-L310ERM	5069-L320ERM, 5069-L320ERMK, 5069-L320ERP	5069-L330ERM, 5069-L330ERMK	5069-L340ERM, 5069-L340ERP	5069-L350ERM, 5069-L350ERMK	5069-L380ERM	5069-L3100ERM

- (1) I/O numbers are maximums; they assume no HMI/MSG. HMI/MSG numbers are maximums, they assume no I/O. Maximums assume the processor is target, not originator. Packet rates vary depending on packet size. For more details, see Troubleshoot EtherNet/IP Application Technique, publication [ENET-AT003](#), and the EDS file for a specific catalog number.
- (2) The maximum number of nodes that are listed represents when the controller is used with the Logix Designer application, version 31 or later. Some controllers can be used with earlier Logix Designer application versions. The maximum number of nodes that a controller supports can be fewer in Logix Designer application, versions 30 or earlier.
- (3) Only CompactLogix 5380 controllers that have an M or P in their catalog number support Integrated Motion on EtherNet/IP networks.



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Manuf.: PNo:

Allen-Bradley: 5069-L306ER

CompactLogix 5380 Controllers



Allen-Bradley

33-005-336

Technical Specifications - CompactLogix 5380 Controllers

Attribute	5069-L306ER, 5069-L306ERM	5069-L310ER, 5069-L310ER-NSE, 5069-L310ERM	5069-L320ER, 5069-L320ERM, 5069-L320ERMK, 5069-L320ERP	5069-L330ER, 5069-L330ERM, 5069-L330ERMK	5069-L340ER, 5069-L340ERM, 5069-L340ERP	5069-L350ERM, 5069-L350ERMK	5069-L380ERM	5069-L3100ERM
User memory	0.6 MB	1 MB	2 MB	3 MB	4 MB	5 MB	8 MB	10 MB
Optional nonvolatile memory	<ul style="list-style-type: none"> • 1784-SD1 (1 GB) • 1784-SD2 (2 GB), ships with controller • 1784-SDHC8 (8 GB) • 1784-SDHC32 (32 GB) • 9509-CMSDCD4 (4 GB) CodeMeter CmCard card 							
Local I/O modules, max	8	8	16	31 ⁽¹⁾	31	31	31	31
MOD Power voltage range	18...32V DC							
MOD Power current, max	450 mA							
MOD Power inrush	850 mA for 125 ms							
MOD Power passthrough ⁽²⁾	9.55 A @ 18...32V DC							
MOD Power current rating, max	10 A Do not exceed 10 A current draw at the MOD Power RTB.							
SA Power voltage ranges ⁽³⁾	0...32V DC 0...240V AC, 47...63 Hz ATEX/IECEX, 125V AC max							
SA Power current, max ⁽³⁾	10 mA (DC power) 25 mA (AC power)							
SA Power passthrough ^{(3), (4)}	9.95 A @ 0...32V DC 9.975 A @ 0...240V AC, 47...63 Hz ATEX/IECEX, 125V AC max							
SA Power current rating, max ⁽³⁾	10 A (AC or DC power) Do not exceed 10 A current draw at the SA Power RTB.							
Power dissipation, max	8.5 W							
Thermal dissipation, max	29 BTU/hr							
Isolation voltage	300V (continuous), Basic Insulation Type, SA, and MOD Power to Backplane 300V (continuous), Basic Insulation Type, SA to MOD Power 300V (continuous), Basic Insulation Type, Ethernet to Backplane 300V (continuous), Double Insulation Type, Ethernet to MOD Power 300V (continuous), Double Insulation Type, Ethernet to SA Power 50V (continuous), Functional Insulation Type, Ethernet to USB 300V (continuous), Basic Insulation Type, USB to Backplane 300V (continuous), Double Insulation Type, USB to MOD Power 300V (continuous), Double Insulation Type, USB to SA Power No isolation between Ethernet ports Type tested at 1500V AC for 60 s							
Weight, approx	0.768 kg (1.693 lb)							



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Manuf.: PNo:

Allen-Bradley: 5069-L306ER

CompactLogix 5380 Controllers



Allen-Bradley

33-005-336

Technical Specifications - CompactLogix 5380 Controllers (Continued)

Attribute	5069-L306ER, 5069-L306ERM	5069-L310ER, 5069-L310ER-NSE, 5069-L310ERM	5069-L320ER, 5069-L320ERM, 5069-L320ERMK, 5069-L320ERP	5069-L330ER, 5069-L330ERM, 5069-L330ERMK	5069-L340ER, 5069-L340ERM, 5069-L340ERP	5069-L350ERM, 5069-L350ERMK	5069-L380ERM	5069-L3100ERM
Dimensions (HxWxD), approx	143.97 x 98.10 x 136.81 mm (5.67 x 3.86 x 5.39 in.)							
Location	DIN rail mount (horizontal mount only)							
DIN rail	Compatible zinc-plated, chromate steel DIN rail. EN50022 - 35 x 7.5 mm (1.38 x 0.30 in.)							
Removable terminal block	RTBs are available in separately ordered 5069 RTB kits. The MOD power connection uses a 4-point RTB, and the SA power connection uses a 6-point RTB. The following kits are available: • Kit catalog number 5069-RTB6-SCREW contains RTB catalog numbers 5069-RTB6-SCREW and 5069-RTB4-SCREW. • Kit catalog number 5069-RTB6-SPRING contains RTB catalog numbers 5069-RTB6-SPRING and 5069-RTB4-SPRING.							
Terminal block torque	5069-RTB4-SCREW & 5069-RTB6-SCREW: 0.4 N-m (3.5 lb-in) 5069-RTB4-SPRING & 5069-RTB6-SPRING: Torque does not apply							
Wire size	5069-RTB4-SCREW, 5069-RTB6-SCREW connections: 0.5...1.5 mm ² (22...16 AWG) solid or stranded copper wire that is rated at 105 °C (221 °F), or greater, 3.5 mm (0.14 in.) max diameter including insulation, single wire connection only 5069-RTB4-SPRING, 5069-RTB6-SPRING connections: 0.5...1.5 mm ² (22...16 AWG) solid or stranded copper wire that is rated at 105 °C (221 °F), or greater, 2.9 mm (0.11 in.) max diameter including insulation, single wire connection only Ethernet connections: Ethernet Cabling and Installation according to IEC 61918 and IEC 61784-5-2							
Insulation stripping length	5069-RTB4-SCREW, 5069-RTB6-SCREW connections: 12 mm (0.47 in.) 5069-RTB4-SPRING, 5069-RTB6-SPRING connections: 10 mm (0.39 in.)							
Wire category ⁽⁵⁾	3 - on USB port 1 - on power ports 2 - on Ethernet ports							
Enclosure	None (open-style)							
North American temperature code	T4							
ATEX temperature code	T4							
IECEx temperature code	T4							

- (1) When you use these controllers with the Studio 5000 Logix Designer application, version 29.00.00, the application limits the number of local I/O modules in the project to 16. For more information, see the Rockwell Automation Knowledgebase article #942580, '5380 CompactLogix controllers limited to 16 local 5069 modules in version 29 of Studio 5000® environment. The document is available at <http://www.rockwellautomation.com/knowledgebase>.
With the Logix Designer application, version 30.00.00 or later, the controllers support as many as 31 local I/O modules.
- (2) Maximum level of MOD Power current that the controller can pass through to the next module in the system. The specific level of current passed through varies based on system configuration.
- (3) SA power specifications are based on the number and type of Compact 5000 I/O modules that are used in the system. If the set of I/O modules that are used in the system require AC and DC voltage, you must install a 5069-FPD field potential distributor to separate the module types.
- (4) Maximum level of SA Power current that the controller can pass through to the next module in the system. The specific level of current passed through varies based on system configuration.
- (5) Use this Conductor Category information for planning conductor routing. See the Industrial Automation Wiring and Grounding Guidelines, publication [1770-4.1](#).

 630-499-7080 · www.elemechinc.com	Rev: 0	Device Tag:	
	Date: 06-23-2023	PLC1	
Manuf.: PNO: Allen-Bradley: 5069-L306ER	By: JN	Job Number: HBR9328	Page # 3/3

5069-OF4 and 5069-OF8 Analog Current/Voltage Output Module



General Specifications - 5069-OF4, 5069-OF4K, and 5069-OF8

Attribute	5069-OF4, 5069-OF4K	5069-OF8
Voltage and current ratings		
Analog output ratings	+/-10V DC, 0...20 mA per channel	
MOD Power	75 mA @ 18...32V DC	
MOD Power Passthrough, max ⁽¹⁾	9.55 A @ 18...32V DC	
SA Power	150 mA @ 18...32V DC	250 mA @ 18...32V DC
SA Power Passthrough, max ⁽²⁾	9.95 A @ 18...32V DC	
Power dissipation, max	3.3 W	5.3 W
Thermal dissipation, max	11.3 BTU/hr	18.1 BTU/hr
Isolation voltage	250V (continuous), Basic Insulation Type 50V Functional Isolation between SA power and output ports No isolation between individual output ports	
Calibration methods	Factory Calibrated User-performed (optional)	
Module keying	Electronic keying via programming software	
Indicators	1 green/red module status indicator 4 yellow/red I/O status indicators	1 green/red module status indicator 8 yellow/red I/O status indicators
Slot width	1	
Dimensions (HxWxD), approx	144.57 x 22 x 105.42 mm (5.69 x 0.87 x 4.15 in.)	
DIN rail	Compatible zinc-plated chromate-passivated steel DIN rail. You can use the EN50022 - 35 x 7.5 mm (1.38 x 0.30 in.) DIN rail.	
RTB	One of these RTB types. • 5069-RTB18-SPRING RTB • 5069-RTB18-SCREW RTB IMPORTANT: You must order RTBs separately. RTBs do not ship with Compact 5000 I/O modules. We recommend that you order only the RTB type that your system requires.	
RTB torque (5069-RTB18-SCREW RTB only)	0.4 N-m (3.5 lb-in)	
RTB keying	None	
Wire category ⁽³⁾	2 - shielded input ports 2 - power ports 1 wire per terminal for each signal port	
Wire size		
5069-RTB18-SPRING removable terminal block	0.5...1.5 mm ² (22...16 AWG) solid or stranded copper wire rated at 105 °C (221 °F), or greater, 2.9 mm (0.11 in.) max diameter including insulation	
5069-RTB18-SCREW removable terminal block	0.5...1.5 mm ² (22...16 AWG) solid or stranded copper wire rated at 105 °C (221 °F), or greater, 3.5 mm (0.14 in.) max diameter including insulation	
Insulation stripping length		
5069-RTB18-SPRING connections	10 mm (0.39 in.)	
5069-RTB18-SCREW connections	12 mm (0.47 in.)	



33-005-338

Technical Specifications - 5069-OF4, 5069-OF4K, 5069-OF8

Attribute	5069-OF4, 5069-OF4K	5069-OF8
Outputs	4 voltage or current	8 voltage or current
Output range, voltage	± 10V 0...10V 0...5V	
Output range, current	0...20 mA 4...20 mA	
Resolution	16 bits across ± 10.5V - 320 µV/bit 16 bits across 10.5V - 160 µV/bit 16 bits across 5.25V - 80 µV/bit 16 bits across 21 mA - 320 nA/bit	
Drive capability	Voltage - 1000 Ω min Current - 500 Ω max	
Capacitive load, max (voltage mode only)	1 µF	
Inductive load, max (current mode only)	1 mH	
Open circuit detection	Current mode only	
Short circuit detection	Voltage mode only - output electronically limited to 16 mA or less	
Data format	IEEE 32-bit floating point	
Module conversion method	R-Ladder DAC, monotonicity with no missing codes	
Conversion time per channel	25 µs	
Scan time	• Per group 0...3 (OF4/OF8) • Per group 0...7 (OF8 only)	
Step response time to 63% of value	Voltage mode - 18 µs max Current mode - 1 ms max	
Overvoltage protection, max	± 32V DC	
Repeatability	0.05%	
Calibrated accuracy at 25 °C (77 °F)	Voltage - 0.10% full scale Current - 0.10% full scale	
Accuracy drift with temperature	Voltage - 0.30% full scale Current - 0.50% full scale	

Environmental Specifications - 5069-OF4, 5069-OF4K, and 5069-OF8

Attribute	5069-OF4, 5069-OF4K, 5069-OF8
Temperature, operating IEC 60068-2-1 (Test Ab, Operating Cold), IEC 60068-2-2 (TestBb, Unpackaged Nonoperating Dry Heat), IEC 60068-2-14 (Test Na, Operating Thermal Shock)	0...60 °C (32...140 °F)
Temperature, surrounding air, max	60 °C (140 °F)
Temperature, nonoperating IEC 60068-2-1 (Test Ab, Unpackaged Nonoperating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Nonoperating Dry Heat), IEC 60068-2-14 (Test Na, Unpackaged Nonoperating Thermal Shock)	-40...+85 °C (-40...+185 °F)
Relative humidity IEC 60068-2-30 (Test Db, Unpackaged Damp Heat)	5...95% noncondensing
Vibration IEC 60068-2-6 (Test Fc, Operating)	5 g @ 10...500 Hz
Shock, operating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	30 g
Shock, nonoperating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	50 g
Emissions IEC 61000-6-4	IEC 61000-6-4
ESD immunity IEC 61000-4-2	6 kV contact discharges 8 kV air discharges
Radiated RF immunity IEC 61000-4-3	10V/m with 1 kHz sine-wave 80% AM from 80...200 MHz 10V/m with 200 Hz 50% pulse 100% AM at 900 MHz 10V/m with 200 Hz 50% pulse 100% AM at 1890 MHz 3V/m with 1 kHz sine-wave 80% AM from 2000...2700 MHz



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Manuf.: . PNo: Allen-Bradley: 5069-OF4

5069-IB16 Compact I/O Digital 16-point 24VDC Input Module



33-005-347

Certifications - 5069-IB16 and 5069-IB16F

Certification ⁽¹⁾	5069-IB16, 5069-IB16F
c-UL-us	UL Listed Industrial Control Equipment, certified for US and Canada. See UL File E65584. UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada. See UL File E194810.

Technical Specifications - 5069-IB16 and 5069-IB16F

Attribute	5069-IB16
On-state voltage, min	10V DC
On-state voltage, nom	24V DC
On-state voltage, max	32V DC
On-state current, min	4 mA @ 10V
On-state current, nom	6 mA @ 24V DC
On-state current, max	7.4 mA @ 32V DC
Off-state voltage, max	5V DC
Off-state current, max	1.5 mA
Input impedance, min	1.33 kΩ
Input impedance, nom	4.1 kΩ
Input impedance, max	7.0 kΩ
Inrush current, max	< 250 mA peak (decaying to, 37% in 22 ms, without ac)
Input delay time (screw to backplane)	
Off to On	≤ 100 μs, ±10 μs @ 25 °C (77 °F)
On to Off	≤ 100 μs, ±10 μs @ 25 °C (77 °F)
Input drift over temperature span	±100 ns/°C (55.6 ns/°F) from 0...60 °C (32...140 °F)
Input On to Off minimum pulse width	60 μs
Input Off to On minimum pulse width	60 μs

General Specifications - 5069-IB16 and 5069-IB16F

Attribute	5069-IB16
Inputs	16 Channels (1 group of 16), sinking
Voltage category	12/24V DC Sink
Voltage and current ratings	
Input ratings	4...7.4 mA per channel @ 10...32V DC
MOD Power	75 mA @ 18...32V DC
MOD Power Passthrough, max ⁽¹⁾	9.55 A @ 18...32V DC
SA Power	200 mA @ 10...32V DC
SA Power Passthrough, max ⁽²⁾	9.95 A @ 10...32V DC
Power dissipation, max	3.9 W
Thermal dissipation, max	13.3 BTU/hr
Isolation voltage	250V (continuous), Basic Insulation Type No isolation between SA Power and input ports No isolation between individual input ports
Module keying	Electronic keying via programming software
Indicators	1 green/red module status indicator 16 yellow/red I/O status indicators
Slot width	1
Dimensions (HxWxD), approx	144.57 x 22 x 105.42 mm (5.69 x 0.87 x 4.15 in.)

Environmental Specifications - 5069-IB16 and 5069-IB16F

Attribute	5069-IB16, 5069-IB16F
Shock, nonoperating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	50 g
Emissions	IEC 61000-6-4
ESD immunity IEC 61000-4-2	6 kV contact discharges 8 kV air discharges
Radiated RF immunity IEC 61000-4-3	10V/m with 1 kHz sine-wave 80% AM from 80...2000 MHz 10V/m with 200 Hz 50% pulse 100% AM at 900 MHz 10V/m with 200 Hz 50% pulse 100% AM at 1890 MHz 5V/m with 1 kHz sine-wave 80% AM from 2000...2700 MHz
EFT/B immunity IEC 61000-4-4	±4 kV @ 5 kHz on power ports ±3 kV @ 5 kHz on input ports
Surge transient immunity IEC 61000-4-5	±1 kV line-line (DM) and ±2 kV line-earth (CM) on power ports ±1 kV line-line (DM) and ±2 kV line-earth (CM) on input ports
Conducted RF immunity IEC 61000-4-6	10V rms with 1 kHz sine-wave 80% AM from 150 kHz...80 MHz
Voltage variation IEC 61000-4-29	10 ms interruption on MOD Power port



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Manuf.: . PNo:

Allen-Bradley: 5069-IB16

Power supply unit - UNO

UNO2-PS/1AC/24DC/240W

1096432



37-098-018

Input data

Supply system configuration	Star network (TN, TT, IT (PE))
Nominal input voltage range	100 V AC ... 240 V AC
Input voltage range	100 V AC ... 240 V AC -15 % ... +10 %
Derating	< 90 V AC (1 %/V)
Typical national grid voltage	120 V AC 230 V AC
Voltage type of supply voltage	AC
Inrush current	typ. 10 A (at 25 °C)
Inrush current integral (I ² t)	< 0.2 A ² s
Frequency range (f _N)	50 Hz ... 60 Hz ±10 %
Mains buffering time	typ. 16 ms (120 V AC) typ. 20 ms (230 V AC)
Current consumption	2.6 A (100 V AC) 2.2 A (120 V AC) 1.13 A (230 V AC) 1.2 A (240 V AC)
Protective circuit	Transient surge protection; Varistor, gas-filled surge arrester
Switch-on time	typ. 400 ms
Device mains fuse	5 A internal (device protection), fast-blow
Recommended breaker for input protection	6 A ... 16 A (Characteristic B, C, D, K or comparable)
Discharge current to PE	< 3.5 mA

Output data

Efficiency	typ. 92 % (120 V AC) typ. 93.7 % (230 V AC)
Nominal output voltage	24 V DC
Setting range of the output voltage (U _{Set})	24 V DC ... 28 V DC (> 24 V DC, constant capacity restricted)
Nominal output current (I _N)	10 A
Short-circuit-proof	yes
No-load proof	yes
Crest factor	typ. 1.65 (120 V AC) typ. 1.63 (230 V AC)
Output power (P _N)	240 W
Connection in parallel	yes, for redundancy
Connection in series	yes, for increased output voltage
Feedback voltage resistance	≤ 35 V DC
Protection against overvoltage at the output (OVP)	≤ 35 V DC
Residual ripple	typ. 50 mV _{pp} (with nominal values)
Control deviation	< 1 % (change in load, static 10 % ... 90 %) < 3 % (change in load, dynamic 10 % ... 90 %)
Rise time	< 1 s (U _{Out} = 10 % ... 90 %)
Minimum no-load power dissipation	< 4 W (120 V AC)
Maximum no-load power dissipation	< 4 W (230 V AC)
Minimum nominal load power dissipation	< 25 W (120 V AC)
Power loss nominal load max.	< 19 W (230 V AC)



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PS1,2

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Manuf.: . PNO:

Phoenix: 1096432

By:

JN

Redundancy module - UNO-DIODE 5-24DC/2X10/1X20 - 2905489



37-098-015

Input data

Nominal input voltage range	5 V DC ... 24 V DC
Input voltage range	4.5 V DC ... 30 V DC
Nominal input current	2x 10 A (-25 °C ... 55 °C)
	1x 20 A (-25 °C ... 55 °C)
	2x 10 A (-25 °C ... 55 °C)
	1x 20 A (-25 °C ... 55 °C)

Output data

Nominal output current (I _N)	20 A
	10 A
Derating	55 °C ... 70 °C (2.5%/K)
Power loss nominal load max.	5 W (I _{OUT} = 10 A)

General

Net weight	0.2 kg
Efficiency	> 97 %
	> 60600000 h (40 °C)
Insulation voltage input/output	1 kV AC (type test)
	0.5 kV AC (routine test)
Degree of protection	IP20
Protection class	III
Inflammability class in acc. with UL 94 (housing / terminal blocks)	V0
Housing material	Polycarbonate
Foot latch material	POM (Polyoxymethylene)
Mounting position	horizontal DIN rail NS 35, EN 60715



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PS-RED1

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Manuf.: . PNo:
Phoenix: 2905489

Zelio® Plug-In Relays

RPM power relays



Telemecanique

06-058-021

General characteristics

Conforming to standards		IEC/EN 61810-1 (iss. 2), UL 508, CSA C22-2 n° 14	
Product certifications		cULus File E164862 CCN NLDX, NLDX7; cURus File E164862 CCN NLDX2, NLDX8; CSA; CE; RoHS compliant	
Ambient air temperature around the device	Storage	°C (F)	-40... +85 (-40... +185)
	Operation	°C (F)	-40... +55 (-40... +131)
Vibration resistance conforming to IEC/EN 60068-2-6	In operation	3 gn (10...150 Hz/± 1 mm / 5g/5 cycles)	
	Not operating	5 gn (10...150 Hz/± 1 mm / 5g/5 cycles)	
Degree of protection	Conforming to IEC/EN 60529	IP 40	
Shock resistance conforming to IEC/EN 60068-2-27	Opening	15 gn	
	Closing	15 gn	
Protection category		RT I	
Mounting position		Any	

Insulation characteristics

Rated insulation voltage (Ui)	Conforming to IEC/EN 60947	V	250 (IEC), 300 (UL, CSA)
Rated impulse withstand voltage (Uimp)		kV	4 (1.2/50 µs)
Dielectric strength (rms voltage)	Between coil and contact	~ V	1550
	Between poles	~ V	1550
	Between contacts	~ V	1500

Contact characteristics

Relay type		RPM1●●●	RPM2●●●	RPM3●●●	RPM4●●●
Number and type of contacts		1 C/O	2 C/O	3 C/O	4 C/O
Contact materials		AgNi			
Conventional thermal current (Ith)	For ambient temperature ≤ 55 °C	A	15		
Rated operational current in utilization categories AC-1 and DC-1	Conforming to IEC	NO	A	15	
		NC	A	7.5	
	Conforming to UL	A	15		
Switching current	Minimum	mA	10		
Switching voltage	Maximum	V	~/∞ 250 (IEC)		
	Minimum	V	17		
Nominal load (resistive)		A	15 / 250 ~ V		
		A	15 / 28 ∞ V		
Switching capacity	Maximum	~	VA	3750	
		∞	W	420	
	Minimum	mW	170		
Maximum operating rate In operating cycles/hour	No-load			18 000	
	Under load			1200	
Utilization coefficient				20 %	
Mechanical durability		In millions of operating cycles		10	
Electrical durability In millions of operating cycles	Resistive load			0.1	0.06
	Inductive load			See curves below	
Electrical durability of contacts Resistive load ~		Reduction coefficient for inductive load ~ (depending on power factor cos φ)		Maximum switching capacity on resistive load ∞	



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Manuf.: PNO: Square D: RPM22F7

Power relays without LED (sold in lots of 10)

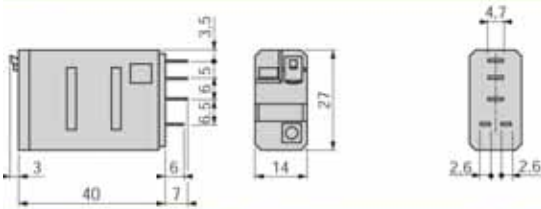
Control circuit voltage	Number and type of contacts - Thermal current (Ith)							
	1 C/O - 15 A		2 C/O - 15 A		3 C/O - 15 A		4 C/O - 15 A	
	Catalog number	Weight	Catalog number	Weight	Catalog number	Weight	Catalog number	Weight
V		kg		kg		kg		kg
≡ 12	RPM11JD	0.026	RPM21JD	0.036	RPM31JD	0.054	RPM41JD	0.071
≡ 24	RPM11BD	0.026	RPM21BD	0.036	RPM31BD	0.054	RPM41BD	0.071
≡ 48	RPM11ED	0.026	RPM21ED	0.036	RPM31ED	0.054	RPM41ED	0.071
≡ 110	RPM11FD	0.026	RPM21FD	0.036	RPM31FD	0.054	RPM41FD	0.071
~ 24	RPM11B7	0.026	RPM21B7	0.036	RPM31B7	0.054	RPM41B7	0.071
~ 48	RPM11E7	0.026	RPM21E7	0.036	RPM31E7	0.054	RPM41E7	0.071
~ 120	RPM11F7	0.026	RPM21F7	0.036	RPM31F7	0.054	RPM41F7	0.071
~ 230	RPM11P7	0.026	RPM21P7	0.036	RPM31P7	0.054	RPM41P7	0.071

Power relays with LED (sold in lots of 10)

≡ 12	RPM12JD	0.026	RPM22JD	0.036	RPM32JD	0.054	RPM42JD	0.071
≡ 24	RPM12BD	0.026	RPM22BD	0.036	RPM32BD	0.054	RPM42BD	0.071
≡ 48	RPM12ED	0.026	RPM22ED	0.036	RPM32ED	0.054	RPM42ED	0.071
≡ 110	RPM12FD	0.026	RPM22FD	0.036	RPM32FD	0.054	RPM42FD	0.071
~ 24	RPM12B7	0.026	RPM22B7	0.036	RPM32B7	0.054	RPM42B7	0.071
~ 48	RPM12E7	0.026	RPM22E7	0.036	RPM32E7	0.054	RPM42E7	0.071
~ 120	RPM12F7	0.026	RPM22F7	0.036	RPM32F7	0.054	RPM42F7	0.071
~ 230	RPM12P7	0.026	RPM22P7	0.036	RPM32P7	0.054	RPM42P7	0.071

Dimensions (mm):

Power relays
RPM 1

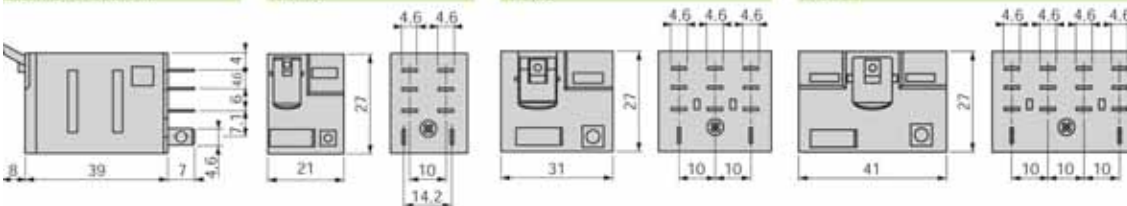


Common side view

RPM2

RPM3

RPM4



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Manuf.: PNo:

Square D: RPM22F7

Zelio® Plug-In Relays

RPM power relays



Telemecanique

38-058-008

General characteristics

Conforming to standards		IEC/EN 61810-1 (iss. 2), UL 508, CSA C22-2 n° 14	
Product certifications		cULus File E164862 CCN NLDX, NLDX7; cURus File E164862 CCN NLDX2, NLDX8; CSA; CE; RoHS compliant	
Ambient air temperature around the device	Storage	°C (F)	-40... +85 (-40... +185)
	Operation	°C (F)	-40... +55 (-40... +131)
Vibration resistance conforming to IEC/EN 60068-2-6	In operation	3 gn (10...150 Hz/± 1 mm / 5g/5 cycles)	
	Not operating	5 gn (10...150 Hz/± 1 mm / 5g/5 cycles)	
Degree of protection	Conforming to IEC/EN 60529	IP 40	
Shock resistance conforming to IEC/EN 60068-2-27	Opening	15 gn	
	Closing	15 gn	
Protection category		RT I	
Mounting position		Any	

Insulation characteristics

Rated insulation voltage (Ui)	Conforming to IEC/EN 60947	V	250 (IEC), 300 (UL, CSA)
Rated impulse withstand voltage (Uimp)		kV	4 (1.2/50 μs)
Dielectric strength (rms voltage)	Between coil and contact	~ V	1550
	Between poles	~ V	1550
	Between contacts	~ V	1500

Contact characteristics

Relay type		RPM1●●●	RPM2●●●	RPM3●●●	RPM4●●●	
Number and type of contacts		1 C/O	2 C/O	3 C/O	4 C/O	
Contact materials		AgNi				
Conventional thermal current (Ith)	For ambient temperature ≤ 55 °C	A	15			
	Conforming to IEC	NO	A	15		
Rated operational current in utilization categories AC-1 and DC-1	Conforming to IEC	NC	A	7.5		
	Conforming to UL		A	15		
Switching current	Minimum	mA	10			
Switching voltage	Maximum	V	~/∞ 250 (IEC)			
	Minimum	V	17			
Nominal load (resistive)		A	15 / 250 ~ V			
		A	15 / 28 ∞ V			
Switching capacity	Maximum	~ ∞	VA	3750		
			W	420		
			mW	170		
Maximum operating rate In operating cycles/hour	No-load		18 000			
	Under load		1200			
Utilization coefficient			20 %			
Mechanical durability	In millions of operating cycles		10			
	Electrical durability In millions of operating cycles	Resistive load		0.1		
	Inductive load		See curves below			

Electrical durability of contacts
Resistive load ~

Reduction coefficient for inductive load ~
(depending on power factor cos φ)

Maximum switching capacity on resistive load ∞



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Manuf.: PNO: Square D: RPZF2

Power relays without LED (sold in lots of 10)

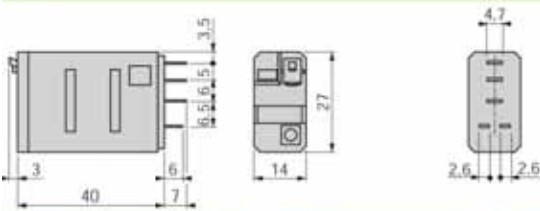
Control circuit voltage	Number and type of contacts - Thermal current (Ith)							
	1 C/O - 15 A		2 C/O - 15 A		3 C/O - 15 A		4 C/O - 15 A	
	Catalog number	Weight	Catalog number	Weight	Catalog number	Weight	Catalog number	Weight
V		kg		kg		kg		kg
≡ 12	RPM11JD	0.026	RPM21JD	0.036	RPM31JD	0.054	RPM41JD	0.071
≡ 24	RPM11BD	0.026	RPM21BD	0.036	RPM31BD	0.054	RPM41BD	0.071
≡ 48	RPM11ED	0.026	RPM21ED	0.036	RPM31ED	0.054	RPM41ED	0.071
≡ 110	RPM11FD	0.026	RPM21FD	0.036	RPM31FD	0.054	RPM41FD	0.071
~ 24	RPM11B7	0.026	RPM21B7	0.036	RPM31B7	0.054	RPM41B7	0.071
~ 48	RPM11E7	0.026	RPM21E7	0.036	RPM31E7	0.054	RPM41E7	0.071
~ 120	RPM11F7	0.026	RPM21F7	0.036	RPM31F7	0.054	RPM41F7	0.071
~ 230	RPM11P7	0.026	RPM21P7	0.036	RPM31P7	0.054	RPM41P7	0.071

Power relays with LED (sold in lots of 10)

≡ 12	RPM12JD	0.026	RPM22JD	0.036	RPM32JD	0.054	RPM42JD	0.071
≡ 24	RPM12BD	0.026	RPM22BD	0.036	RPM32BD	0.054	RPM42BD	0.071
≡ 48	RPM12ED	0.026	RPM22ED	0.036	RPM32ED	0.054	RPM42ED	0.071
≡ 110	RPM12FD	0.026	RPM22FD	0.036	RPM32FD	0.054	RPM42FD	0.071
~ 24	RPM12B7	0.026	RPM22B7	0.036	RPM32B7	0.054	RPM42B7	0.071
~ 48	RPM12E7	0.026	RPM22E7	0.036	RPM32E7	0.054	RPM42E7	0.071
~ 120	RPM12F7	0.026	RPM22F7	0.036	RPM32F7	0.054	RPM42F7	0.071
~ 230	RPM12P7	0.026	RPM22P7	0.036	RPM32P7	0.054	RPM42P7	0.071

Dimensions (mm):

Power relays
RPM 1

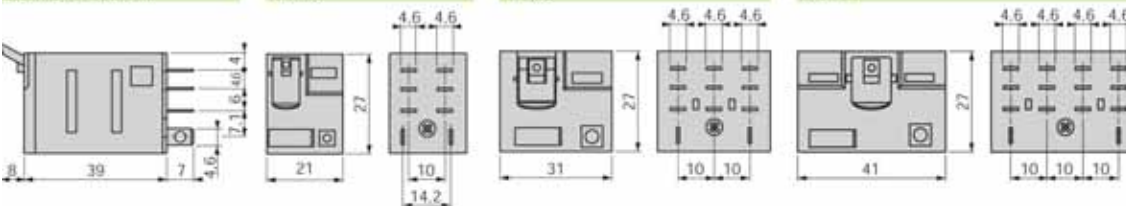


Common side view

RPM2

RPM3

RPM4



Rev: 0

Date: 06-23-2023

By: JN

Device Tag:

R1,2

Job Number: HBR9328

Page # 2/2

Manuf.: PNo:

Square D: RPZF2

Receptacles

Altech®

DMRBU BLACKBOX

Features:

- DIN Rail, Panel Mount or Wall Mount
- Rating: 15A/125V AC
- Finger Protection: IP54
- Available in 3 colors.

Includes Sealing Gasket



14-543-001

External Dimension (HxWxL mm)	58.5 x 84 x 53.5
Stripping Length	10 mm
Insulation Material	Thermoplastic
Type of Connection	3 screw clamps
Approvals*	cULus E154664
Voltage Rating	125 V
Current Rating	15 A


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Rev: 0

Date: 06-23-2023

By: JN

Device Tag:

RECP1

Job Number: HBR9328

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Manuf.: PNo: Altech: DMRBU BLACKBOX

30.5 mm Push Buttons Selector Switches

Allen-Bradley

800 T - J 2 C

a b c d e e f (cont'd)



39-005-009

Protection Rating	
Code	Description
T	Metal, Type 4/13
H	Plastic, Type 4/4X/13

Finger-Safe Guards	
Code	Description
Blank	No guards
C	Guards on terminals

Knob Insert Colors		
800T Type 4/13	Description	800H Type 4/4X/13
J	White	JR
JX	Packet of colored inserts*	JRX

Metal Wing Lever Colors*		
Code	Color	Code
JA	Red	—
JG	Grey	—

Knob/Lever Type Operators	
Standard Knob	
Code	Operator Function
2	Maintained
4	Spring return from left
5	Spring return from right
91	Spring return from both

Knob Lever*	
Code	Operator Function
17	Maintained
18	Spring return from left
19	Spring return from right
20	Spring return from both

Cam Option†	
Code	Description
KC1	KC1 cam
KC7	KC7 cam
KD7	KD7 cam
KE7	KE7 cam
KQ1	KQ1 cam
KQ7	KQ7 cam
KR1	KR1 cam
KR7	KR7 cam
KT1	KT1 cam
KT7	KT7 cam
KU7	KU7 cam

Contact Blocks*	
Code	Description
Blank	No contacts
Class 1, Div. 2/Zone 2	
Logic Reed	
AR	1 N.O. - 1 N.C. 1-800T-XAR on white side 2 N.O. - 2 N.C. 2-800T-XARs — 1 on white side/1 on black side
Sealed Switch	
AP	1 N.O. - 1 N.C. 1-800T-XAP on white side 2 N.O. - 2 N.C. 2-800T-XAPs — 1 on white side/1 on black side
BP	1 on white side/1 on black side
Stackable Sealed Switch	
AY	1 N.O. - 1 N.C. 1-800T-XAY on white side 2 N.O. - 2 N.C. 2-800T-XAYs — 1 on white side/1 on black side
BY	1 on white side/1 on black side

Metal Wing Lever*	
Code	Operator Function
11	Maintained
15	Spring return from left
16	Spring return from right
141	Spring return from both

Coin Slot*	
Code	Operator Function
10	Spring return from both

Contact Blocks	
Code	Description
Blank	No contacts on operator
Standard	
A	1 N.O. - 1 N.C. 1-800T-XA on white side 2 N.O. - 2 N.C. 2-800T-XAs — 1 on white side/1 on black side
B	1 on white side/1 on black side
PenTUFF (Low Voltage)	
AV	1 N.O. - 1 N.C. 1-800T-XAV on white side 2 N.O. - 2 N.C. 2-800T-XAVs — 1 on white side/1 on black side
BV	1 on white side/1 on black side

* One insert of each color (blue, green, orange, red, and yellow).
 * Only available on Bul. 800T, Type 4/13 operators.
 † If an overlapping cam is required, consult your local distributor.
 ‡ Not available with wing levers.
 § See Table 1 for cam selections and associated targets.

Specifications*

Electrical Ratings	
Contact ratings	Refer to the contact ratings tables on page 10-4.
Dielectric strength	2200V for one minute, 1300V for one minute (Logic Reed)
Electrical design life cycles	1 000 000 at max. rated load, 200 000 at max. rated load (Logic Reed)
Mechanical Ratings	
Vibration	10...2000 Hz, 1.52 mm displacement (peak-to-peak) max./10 G max. (except Logic Reed)
Shock	1/2 cycle sine wave for 11 ms ≥ 25 G (contact fragility) and no damage at 100 G
Degree of protection	Type 1/4/12/13 (800T); Type 1/4/4X/12/13 (800H); EN/IEC 60529 IP66/65
Mechanical design life cycles	
Push buttons	(Momentary, non-illuminated) 10 000 000 min. (Momentary, illuminated) 250 000 min. (Push-pull/twist-to-release) 250 000 min. (Non-illuminated) 1 000 000 min.
Selector switches	(Illuminated, key-operated) 200 000 min.
Potentiometers	25 000 min.
All other devices	200 000 min.
Contact operation	Shallow, mini, and low-voltage contact blocks: Slow, double make and break Logic Reed and sealed switch contact blocks: Single break magnetic
Wire gauge/Terminal screw torque	#18...14 AWG (#18...10 Max Duty) / 6...8 lb•in
Typical operating forces	
Operators without contact blocks	Flush, extended button, standard mushroom, jumbo plastic mushroom: 2 lbs max. Jumbo and extended aluminum mushroom head: 3.95 lbs max. Maintained selector switch: 3.6 in•lb max.
Spring return selector switches	3.6 in•lb to stop, 0.2 in•lb to return
Illuminated push buttons and push-to-test pilot lights	5 lb max.
2-position push-pull	8.0 lb max. push or pull
3-position push-pull	8 lb max. push to in position or pull to center position (15 lb max. pull to out position)
Twist-to-release or push-pull	9 lbs max. push or pull 30 in•oz max. twist, 6 in•oz minimum return
Potentiometer	Rotational torque 3...12 in•oz; stopping torque 12 in•lb (minimum)
Contact blocks	Standard 1 lb Logic Reed 1 lb max. Sealed switch 3 lb max. at 0.205 in. plunger travel Stackable sealed switch 1 lb max. MaxDuty 1.4 lb max. PenTUFF 1.4 lb max. Self Monitoring 1.6 lb
Environment	
Temperature range	Operating -40...+131 °F (-40...+55 °C) Storage -40...+185 °F (-40...+85 °C)
Note: Operating temperatures below freezing are based on the absence of moisture and liquids. Consult your local Rockwell Automation sales office or Allen-Bradley distributor for use in lower temperature applications.	
Humidity	50...95% RH from 77...140 °F (25...60 °C) per Procedure IV of MIL-STD-810C, Method 507.1 cycling test

Certifications

UL Listed
 (File No. E14840, E10314
 Guide No. NKCR, NOIV)
 CSA Certified
 (File No. LR1234, LR11924)
 CSA C22.2, No. 14



Rev: 0	Device Tag: SS1,3-5
Date: 06-23-2023	
By: JN	Job Number: HBR9328
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Manuf.: . PNO: Allen-Bradley: 800H-JR2A

Accessories

30.5 mm Push Buttons



Allen-Bradley



Shallow Block



PenTUFF™ (Low Voltage)
Contact Block



Logic Reed Block



Sealed Switch Block



Stackable Sealed
Switch Block

Contact Type	Shallow Block*†		PenTUFF (Low Voltage) Block*†		Logic Reed Block‡		Sealed Switch Block‡		Stackable Sealed Switch Block‡	
	Cat. No.	Code	Cat. No.	Code	Cat. No.	Code	Cat. No.	Code	Cat. No.	Code
1 N.O.	800T-XD1	D	800T-XD1V	H	800T-XD1R	V	800T-XD1P	R	800T-XD1Y	5
1 N.C.	800T-XD2	E	800T-XD2V	U	800T-XD2R	W	800T-XD2P	S	800T-XD2Y	6
1 N.O.E.M.	800T-XD3	G	800T-XD3V	I	—	—	—	—	—	—
1 N.C.L.B.	800T-XD4	J	800T-XD4V	Q	—	—	—	—	—	—
1 N.O. - N.C.	800T-XA	A	800T-XAV	F	800T-XAR	T	800T-XAP	P	800T-XAY	7
2 N.O.	800T-XA2§	M	—	—	800T-XA2R§	Y	—	—	800T-XA2Y	8
2 N.C.	800T-XA4	N	—	—	800T-XA4R	Z	—	—	800T-XA4Y	9
1 N.C.L.B. - 1 N.O.	800T-XA1	B	—	—	—	—	—	—	—	—
1 N.C.L.B. - 1 N.C.	800T-XA7	C	—	—	—	—	—	—	—	—

Note: Modular suffix codes can be used when specifying selector switches with multiple contact blocks.

PenTUFF™ (Low Voltage) Contact Ratings

Minimum DC: 5V, 1 mA
 Maximum thermal continuous current I_{th} 2.5 A AC/1.0 A DC. Bulletin 800T units with 800T-XAV contacts have ratings as follows:

Max. Opertnl. Volts U_e	Utilization Category		Rated Operational Currents		
	IEC	NEMA	Volts U_e	Make	Break
AC 300	AC-15	C300	120...300 0...120	1800VA 15 A	180VA 1.5 A
DC 150	DC-13	R150	24...150 0...24	28VA 1.0 A	

Stackable Sealed Switch Contact Ratings

Minimum: 5V, 10 mA (digital); 24V, 1 mA (analog)
 Maximum continuous current I_{th} 2.5 A. Bulletin 800T units have control circuit ratings with sealed switch contact blocks as follows:

Max. Opertnl. Volts U_e	Utilization Category		Rated Operational Currents		
	IEC	NEMA	Volts U_e	Make	Break
AC 300	AC-15	C300	120...300 0...120	1800VA 15 A	180VA 1.5 A
DC 150	DC-13	Q150	24...150 0...24	69VA 2.5 A	

MaxDuty Contact Rating

Maximum thermal continuous current I_{th} 24 A.
 Pilot Duty — 120V AC, 12 A; 24V DC, 10 A
 Motor Ratings — 120V AC, 1.5 Hp; 240V AC, 3 Hp; 24V DC, 10 A FLA/60 A LRA

Logic Reed Contact Ratings

Minimum — DC: 5V, 1 mA
 Maximum — DC: 30V, 0.06 A, AC: 150V, 0.15 A
 Should only be used with resistive loads.

Product Certifications

Certifications	UR/UL, CSA, CCC, CE
Standards Compliance — CE Marked	NEMA ICS-5; UL 508, EN ISO 13850, EN 60947-1, EN 60947-5-1, EN 60947-5-5



Rev: 0	Device Tag: SS5	
Date: 06-23-2023		
By: JN	Job Number: HBR9328	Page # 1/1

Manuf.: PNo: Allen-Bradley: 800T-XA

02-005-000

STP Series Pluggable

Surge-Trap®

SURGE PROTECTIVE DEVICE

DIN-RAIL PLUGGABLE SPD FOR
ANSI/UL 1449 TYPE 1 AND 2 APPLICATIONS

MERSEN
Expertise, our source of energy



40-030-001

RATINGS:

- Volts (U_n): 120-690VAC
- Nominal Discharge Current Rating (I_n): 10-20kA
- Surge Capacity: 75kA
- Short-Circuit Current Rating (SCCR): 200kA

APPROVALS:

- ANSI/UL 1449 4th Edition, Type 1 Component Assembly SPD, File E210793
- ANSI/IEEE C62.41.1, C62.41.2, C62.45
- RoHS Compliant



GENERAL PRODUCT SPECIFICATIONS

Mounting:	35mm DIN-Rail	Operating & Storage Temperature:	- 40°C to + 85°C
Wire Range:	4-14AWG Solid / Stranded CU	Visual End of Life Indicator:	RED = End of Life
Terminal Torque:	35.4 lbs-in	Remote End of Life Indicator:	NO/NC Dry Contact
Degree of Protection:	IP 20	Frequency:	50-60 Hz
Flammability:	UL94 V0		

1-POLE, SINGLE-PHASE, 2-WIRE

Catalog Number	Nominal Voltage (VAC)	Maximum Continuous Operating Voltage (MCOV, VAC)				Voltage Protection Rating (VPR, VAC)				replacement plug	I_n (kA)
		L-N	L-G	N-G	L-L	L-N	L-G	N-G	L-L		
STP120P07(M)	120	175	-	-	-	600	-	-	-	SP07U175	20
STP230P07(M)	240	275	-	-	-	600	-	-	-	SP07U275	20
STP277P07(M)	277	320	-	-	-	600	-	-	-	SP07U320	20
STP347P07(M)	347	420	-	-	-	800	-	-	-	SP07U420	10

2-POLE, SPLIT-PHASE, 3-WIRE

Catalog Number	Nominal Voltage (VAC)	Maximum Continuous Operating Voltage (MCOV, VAC)				Voltage Protection Rating (VPR, VAC)				replacement plug	I_n (kA)
		L-N	L-G	N-G	L-L	L-N	L-G	N-G	L-L		
STP240S07(M)	120/240	175	-	-	350	600	-	-	1800	SP07U175	20
STP480S07(M)	240/480	275	-	-	550	600	-	-	1200	SP07U275	20

3-POLE, 3-PHASE DELTA, 4-WIRE

Catalog Number	Nominal Voltage (VAC)	Maximum Continuous Operating Voltage (MCOV, VAC)				Voltage Protection Rating (VPR, VAC)				replacement plug	I_n (kA)
		L-N	L-G	N-G	L-L	L-N	L-G	N-G	L-L		
STP240D07(M)	240	-	275	-	550	-	900	-	1800	SP07U275	20
STP480D07(M)	480	-	550	-	1100	-	1500	-	3000	SP07U550	10

3-POLE, 3-PHASE WYE, 4-WIRE

Catalog Number	Nominal Voltage (VAC)	Maximum Continuous Operating Voltage (MCOV, VAC)				Voltage Protection Rating (VPR, VAC)				replacement plug	I_n (kA)
		L-N	L-G	N-G	L-L	L-N	L-G	N-G	L-L		
STP208Y07(M)	120/208	175	-	-	350	600	-	-	1200	SP07U175	20
STP480Y07(M)	277/480	320	-	-	640	1500	-	-	2500	SP07U320	20
STP600Y07(M)	347/600	420	-	-	840	1500	-	-	2500	SP07U420	10
STP690Y07(M)	400/690	550	-	-	1100	1500	-	-	2500	SP07U550	10



Rev: 0

Date: 06-23-2023

By: JN

Device Tag:

SUR1

Job Number: HBR9328

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Manuf.: PNO:

Mersen: STP480Y07

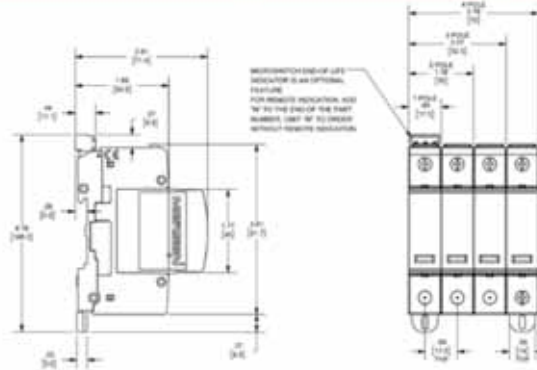
STP Series Pluggable

Surge-Trap®

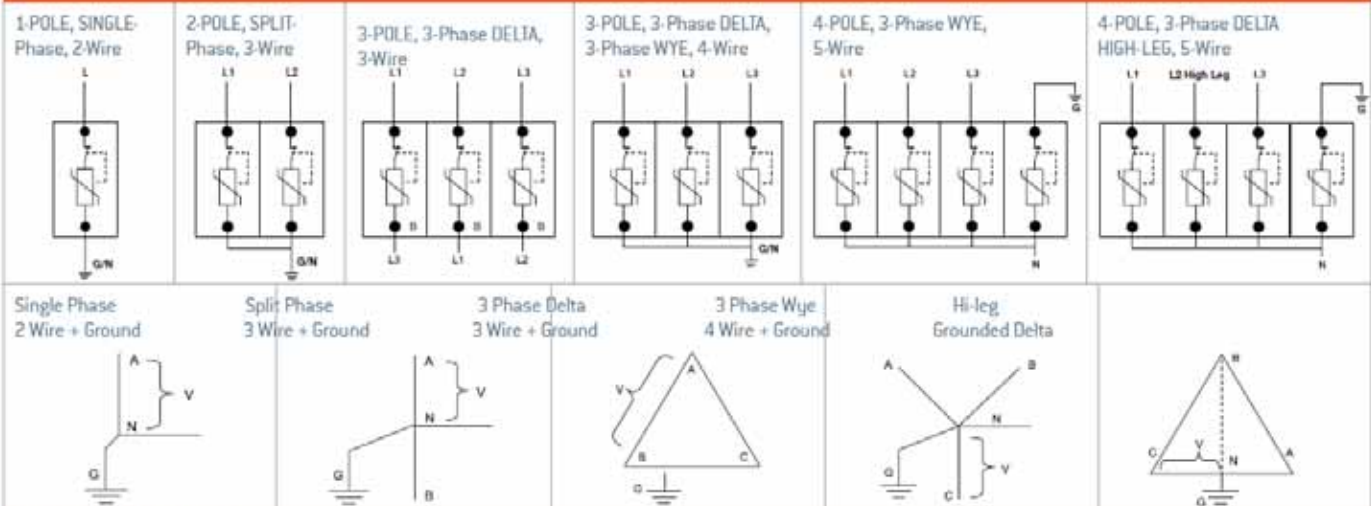
40-030-001

DIMENSIONS - STP SERIES

poles	a	
	IN	MM
1 Pole	0.69	17.5
2 Pole	1.38	35
3 Pole	2.07	52.5
4 Pole	2.76	70



WIRING DIAGRAMS



REMOTE STATUS INDICATOR



ST and STP Series: for remote indication, add "M" to the end of the catalog number. For example, ST4803PYGM.

STP Series Pluggable

Surge-Trap®

SURGE PROTECTIVE DEVICE

DIN-RAIL PLUGGABLE SPD FOR
ANSI/UL 1449 TYPE 1 AND 2 APPLICATIONS

MERSEN
Expertise, our source of energy



40-030-002

RATINGS:

- Volts (U_n): 120-690VAC
- Nominal Discharge Current Rating (I_n): 10-20kA
- Surge Capacity: 75kA
- Short-Circuit Current Rating (SCCR): 200kA

APPROVALS:

- ANSI/UL 1449 4th Edition, Type 1 Component Assembly SPD, File E210793
- ANSI/IEEE C62.41.1, C62.41.2, C62.45
- RoHS Compliant



GENERAL PRODUCT SPECIFICATIONS

Mounting:	35mm DIN-Rail	Operating & Storage Temperature:	- 40°C to + 85°C
Wire Range:	4-14AWG Solid / Stranded CU	Visual End of Life Indicator:	RED = End of Life
Terminal Torque:	35.4 lbs-in	Remote End of Life Indicator:	NO/NC Dry Contact
Degree of Protection:	IP 20	Frequency:	50-60 Hz
Flammability:	UL94 V0		

1-POLE, SINGLE-PHASE, 2-WIRE

Catalog Number	Nominal Voltage (VAC)	Maximum Continuous Operating Voltage (MCOV, VAC)				Voltage Protection Rating (VPR, VAC)				replacement plug	I_n (kA)
		L-N	L-G	N-G	L-L	L-N	L-G	N-G	L-L		
STP120P07(M)	120	175	-	-	-	600	-	-	-	SP07U175	20
STP230P07(M)	240	275	-	-	-	600	-	-	-	SP07U275	20
STP277P07(M)	277	320	-	-	-	600	-	-	-	SP07U320	20
STP347P07(M)	347	420	-	-	-	800	-	-	-	SP07U420	10

2-POLE, SPLIT-PHASE, 3-WIRE

Catalog Number	Nominal Voltage (VAC)	Maximum Continuous Operating Voltage (MCOV, VAC)				Voltage Protection Rating (VPR, VAC)				replacement plug	I_n (kA)
		L-N	L-G	N-G	L-L	L-N	L-G	N-G	L-L		
STP240S07(M)	120/240	175	-	-	350	600	-	-	1800	SP07U175	20
STP480S07(M)	240/480	275	-	-	550	600	-	-	1200	SP07U275	20

3-POLE, 3-PHASE DELTA, 4-WIRE

Catalog Number	Nominal Voltage (VAC)	Maximum Continuous Operating Voltage (MCOV, VAC)				Voltage Protection Rating (VPR, VAC)				replacement plug	I_n (kA)
		L-N	L-G	N-G	L-L	L-N	L-G	N-G	L-L		
STP240D07(M)	240	-	275	-	550	-	900	-	1800	SP07U275	20
STP480D07(M)	480	-	550	-	1100	-	1500	-	3000	SP07U550	10

3-POLE, 3-PHASE WYE, 4-WIRE

Catalog Number	Nominal Voltage (VAC)	Maximum Continuous Operating Voltage (MCOV, VAC)				Voltage Protection Rating (VPR, VAC)				replacement plug	I_n (kA)
		L-N	L-G	N-G	L-L	L-N	L-G	N-G	L-L		
STP208Y07(M)	120/208	175	-	-	350	600	-	-	1200	SP07U175	20
STP480Y07(M)	277/480	320	-	-	640	1500	-	-	2500	SP07U320	20
STP600Y07(M)	347/600	420	-	-	840	1500	-	-	2500	SP07U420	10
STP690Y07(M)	400/690	550	-	-	1100	1500	-	-	2500	SP07U550	10

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Rev: 0

Date: 06-23-2023

By: JN

Device Tag:

SUR2

Job Number: HBR9328

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Manuf.: PNO:

Mersen: STP120P07

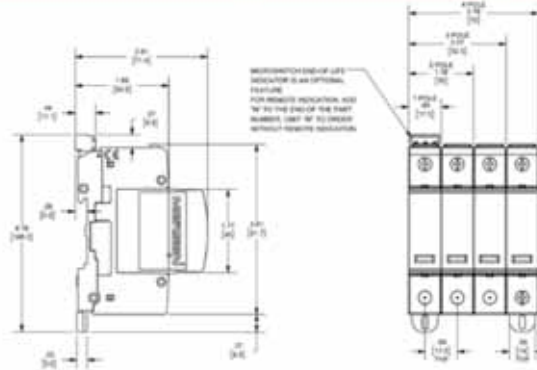
STP Series Pluggable

Surge-Trap®

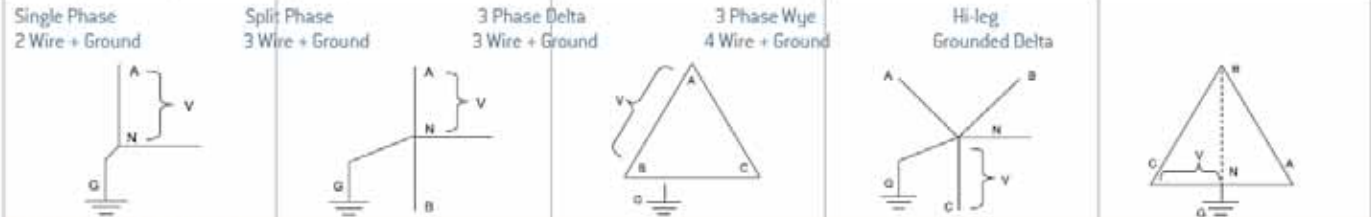
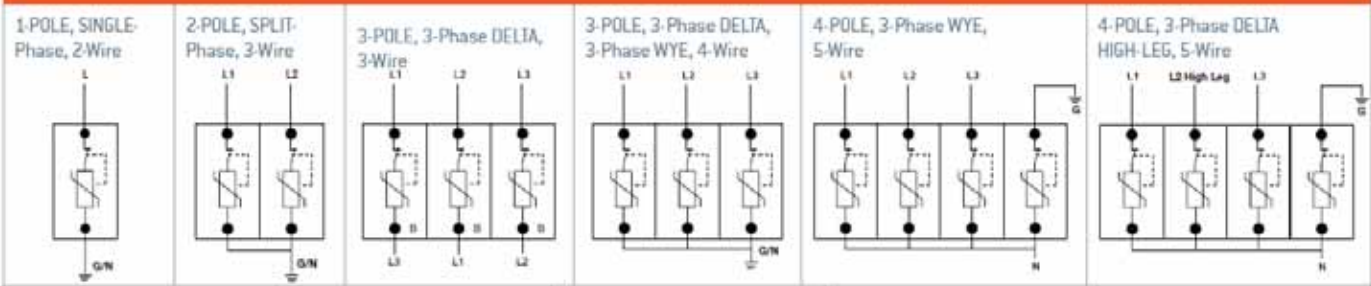
40-030-002

DIMENSIONS - STP SERIES

poles	a	
	IN	MM
1 Pole	0.69	17.5
2 Pole	1.38	35
3 Pole	2.07	52.5
4 Pole	2.76	70



WIRING DIAGRAMS



REMOTE STATUS INDICATOR

ST Series	<table border="1"> <tr><td>NO</td><td>1</td></tr> <tr><td>Common</td><td>2</td></tr> <tr><td>NC</td><td>3</td></tr> </table>	NO	1	Common	2	NC	3		Signal Wire Range	#16 to #30 AWG
NO	1									
Common	2									
NC	3									
STP Series	<table border="1"> <tr><td>NO</td><td>14</td></tr> <tr><td>Common</td><td>11</td></tr> <tr><td>NC</td><td>12</td></tr> </table>	NO	14	Common	11	NC	12	Terminal Torque	2.2 lb-in	
NO	14									
Common	11									
NC	12									
			Cont. between Comm + NO	Product Offline, Not Protected						
			Cont. between Comm + NC	Product Online, Protected						
125 VAC - 3A max										

ST and STP Series: for remote indication, add "M" to the end of the catalog number. For example, ST4803PYGM.



Rev:	0	Device Tag:	
Date:	06-23-2023	SUR2	
By:	JN	Job Number:	HBR9328
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Manuf.: PNo: Mersen: STP120P07



Technical Specifications - Stratix 5700 Switches

Attribute	1783-BMS06SL, 1783-BMS06SA, 1783-BMS06TL, 1783-BMS06TA, 1783-BMS06SGL, 1783-BMS06SGA, 1783-BMS06TGL, 1783-BMS06TGA	1783-BMS10CL, 1783-BMS10CA, 1783-BMS10CGL, 1783-BMS10CGA	1783-BMS10CGN, 1783-BMS10CGP	1783-BMS20CL, 1783-BMS20CA, 1783-BMS20CGL, 1783-BMS20CGP, 1783-BMS20CGN, 1783-BMS20CGPK	1783-BMS4S2SGL, 1783-BMS4S2SGA
Alarm relay ratings	1 A @ 30V DC or 0.5 A @ 48V DC				
Power requirements	0.5...2.0 A max @ 12...48V DC Class 2/SELV			0.5...3.0 A max @ 12...48V DC Class 2/SELV	0.5...2.0 A max @ 12...48V DC Class 2/SELV
Power consumption	9.5 W @ 24V DC @ 40 °C (104 °F) 15 W max	12.5 W @ 24V DC/40 °C (104 °F) 17 W max	15 W @ 24V DC/40 °C (104 °F) 20 W max	21 W @ 24V DC/40 °C (104 °F) 30 W max	12.5 W @ 24V DC/40 °C (104 °F) 14 W max
Isolation voltage	50V (continuous), basic insulation type, DC power ports to ground, DC power ports to Ethernet ports, and DC power ports to alarm ports No isolation between individual Ethernet ports No isolation between console port and system Type tested at 850V DC for 60 s			60V (continuous), basic insulation type, DC power ports to ground, alarm ports to ground, and DC power ports to alarm ports No isolation between console port and system Type tested at 707V DC for 60 s	
Ethernet connection ⁽¹⁾	RJ45 connector according to IEC 60603-7, 2- or 4-pair Category 5e minimum cable according to TIA 568-B.1 or Category 5 cable according to ISO/IEC 24702				—
DC power connection	0.5...0.8 mm ² (20...18 AWG) solid or stranded copper wire rated at 75 °C (167 °F) or greater, 1.2 mm (3/64 in.) insulation max, 6.3 mm (0.25 in.) ±0.5 mm (0.02 in.) strip length				
Alarm connection	0.5...0.8 mm ² (20...18 AWG) solid or stranded, UL/CSA-rated style 1007 or 1569 twisted-pair copper appliance wiring material (AWM) wire, 6.3 mm (0.25 in.) ±0.5 mm (0.02 in.) strip length				
Ground connection	4.0 mm ² (12 AWG) min, stranded copper wire				
SFP modules ⁽²⁾	<ul style="list-style-type: none"> • 1783-SFP100FX • 1783-SFP1G5X • 1783-SFP100LX • 1783-SFP1GLX 				
Memory card	1784-SD1				
Torque	0.23 N-m (2.0 lb-in) on power and alarm connectors 0.96 N-m (8.5 lb-in) max on ground terminals			0.23 N-m (2.0 lb-in) on power and alarm connectors 0.4 N-m (3.5 lb-in) max on ground terminals	
Weight, approx	1.11 kg (2.45 lb)	1.25 kg (2.75 lb)	1.38 kg (3.05 lb)	2.04 kg (4.50 lb)	1.22 kg (2.69 lb)
Wiring category ⁽³⁾	3 - on console and alarm ports 2 - on DC power ports 2 - on Ethernet ports			3 - on console ports 2 - on DC power and alarm ports	
Enclosure type rating	None (open-style)				
Pilot duty rating	Alarm not rated				
North American temp code	T4				
IEC temp code	T4				



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SW1
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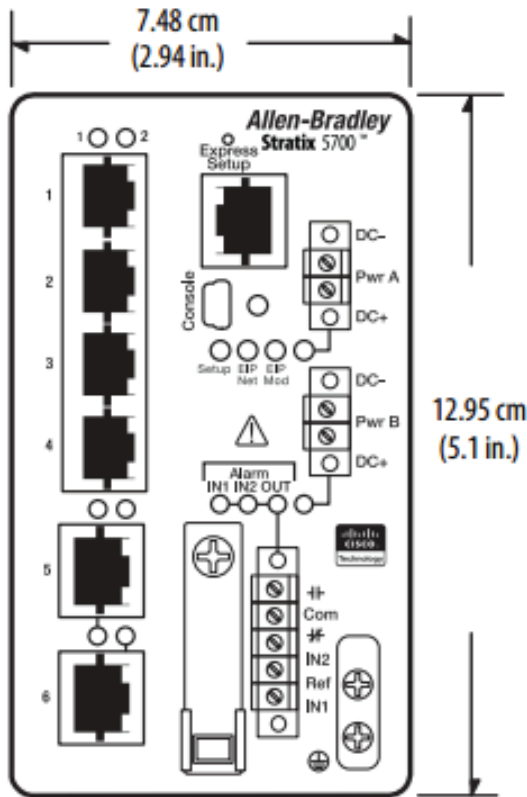
6-port Switches

1783-BMS06SL, 1783-BMS06SA, 1783-BMS06TL, 1783-BMS06TA,
1783-BMS06SGL, 1783-BMS06SGA, 1783-BMS06TGL, 1783-BMS06TGA



Allen-Bradley

33-005-312



Certifications - Stratix 5700 Switches

Certifications (when product is marked) ⁽¹⁾	Stratix 5700 Switches
c-UL-us	UL Listed Industrial Control Equipment, certified for US and Canada. See UL File E65584. UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada. See UL File E194810. UL Listed for Class I, Zone 2 Hazardous Locations, certified for U.S. and Canada. See UL File E194810. AEx/Ex nA nC IIC T4 Gc X
CE	European Union 2004/108/EC EMC Directive, compliant with: • EN 61326-1; Meas./Control/Lab., Industrial Requirements • EN 61000-6-2; Industrial Immunity • EN 61000-6-4; Industrial Emissions • EN 61131-2; Programmable Controllers (Clause 8, Zone A & B) European Union 2011/65/EU RoHS, compliant with: • EN 50581; Technical Documentation
C-Tick	Australian Radiocommunications Act, compliant with: • AS/NZS CISPR 11; Industrial Emissions
Ex	European Union 94/9/EC ATEX Directive, compliant with: • EN 60079-15; Potentially Explosive Atmospheres, Protection "n" • EN 60079-0; General Requirements II 3 G Ex nA nC IIC T4 Gc X
KC	Korean Registration of Broadcasting and Communications Equipment, compliant with: • Article 58-2 of Radio Waves Act, Clause 3
EtherNet/IP	ODVA conformance tested to EtherNet/IP specifications



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Manuf.: PNO:

Allen-Bradley: 1783-BMS06TL



Standards and Certifications

- UL listed
- CSA certified



Enclosures

- Encapsulated design
- Suitable for indoor or outdoor applications
- Mountable in any position indoors and upright-only outdoors

120 x 240 Volts to 120/240 Volts ①

kVA	Full Capacity Taps		Type	°C Temp. Rise	Frame	Wiring Diagram Number	Weight Lbs (kg)	Weathershield	Style Number
	FCAN	FCBN							
0.5	—	—	EP	115	FR57P	3E	16 (7)	Indoor-Outdoor	S10N11P51P
1	—	—	EP	115	FR67P	3E	31 (14)	Indoor-Outdoor	S10N11P01P
1.5	—	—	EP	115	FR67P	3E	42 (19)	Indoor-Outdoor	S10N11P16P
2	—	—	EP	115	FR68P	3E	42 (19)	Indoor-Outdoor	S10N11P02P
3	—	—	EP	115	FR176	3E	55 (25)	Indoor-Outdoor	S10N11S03N
5	—	—	EP	115	FR177	3E	113 (51)	Indoor-Outdoor	S10N11S05N
7.5	—	—	EP	115	FR178	3E	123 (56)	Indoor-Outdoor	S10N11S07N
10	—	—	EP	115	FR179	3E	193 (88)	Indoor-Outdoor	S10N11S10N
15	—	—	EP	115	FR180	3E	216 (98)	Indoor-Outdoor	S10N11S15N
25	—	—	EP	115	FR182	3E	375 (170)	Indoor-Outdoor	S10N11S25N

240 x 480 Volts to 120/240 Volts Stainless Steel ②

kVA	Full Capacity Taps		Type	°C Temp. Rise	Frame	Wiring Diagram Number	Weight Lbs (kg)	Weathershield	Style Number
	FCAN	FCBN							
3	—	—	EP	115	FR176	3A	65 (30)	Indoor-Outdoor	S20N11S03SS
5	—	—	EP	115	FR177	3A	113 (51)	Indoor-Outdoor	S20N11S05SS
7.5	—	—	EP	115	FR178	3A	123 (56)	Indoor-Outdoor	S20N11S07SS
10	—	—	EP	115	FR179	3A	193 (88)	Indoor-Outdoor	S20N11S10SS
15	—	—	EP	115	FR180	3A	205 (93)	Indoor-Outdoor	S20N11S15SS
25	—	—	EP	115	FR182	3A	375 (170)	Indoor-Outdoor	S20N11S25SS

208 Volts to 120/240 Volts ③

kVA	Full Capacity Taps		Type	°C Temp. Rise	Frame	Wiring Diagram Number	Weight Lbs (kg)	Weathershield	Style Number
	FCAN	FCBN							
0.5	—	—	EP	115	FR57P	26A	16 (7)	Indoor-Outdoor	S29N11P51P
1	—	—	EP	115	FR67P	26A	31 (14)	Indoor-Outdoor	S29N11P01P
1.5	—	—	EP	115	FR67P	26A	42 (19)	Indoor-Outdoor	S29N11P16P
2	—	—	EP	115	FR68P	26A	42 (19)	Indoor-Outdoor	S29N11P02P
3	—	—	EP	115	FR176	26A	65 (30)	Indoor-Outdoor	S29N11S03N
5	—	—	EP	115	FR177	26A	113 (51)	Indoor-Outdoor	S29N11S05N
7.5	—	—	EP	115	FR178	26A	123 (56)	Indoor-Outdoor	S29N11S07N
10	—	—	EP	115	FR179	26A	193 (88)	Indoor-Outdoor	S29N11S10N
15	—	—	EP	115	FR180	26A	216 (98)	Indoor-Outdoor	S29N11S15N
25	—	—	EP	115	FR182	26A	395 (179)	Indoor-Outdoor	S29N11S25N

Notes

For 304 grade stainless steel enclosure, replace 10th character of catalog number with an "SS" suffix, e.g., P48G11S03SS, or add "SS" suffix before the addition of "CUB."
 For 316 grade stainless steel enclosure, replace 10th character of catalog number with an "S6" suffix, e.g., P48G11S03S6, or add "S6" suffix before the addition of "CUB."
 For other ratings or catalog numbers not shown, or for special enclosure types (including stainless steel), refer to Eaton. Frame drawings/dimensions information begins on **Page V2-T2-215**.



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By: JN

Device Tag:

T1

Job Number: HBR9328

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Manuf.: PNo: Cutler-Hammer: S20N11P16PSS Assembly

240 x 480 Volts to 120/240 Volts

kVA	Full Capacity Taps		Type	°C Temp. Rise	Frame	Wiring Diagram Number	Weight Lbs (kg)	Weathershield	Style Number
	FCAN	FCBN							
0.050	—	—	EP	115	FR52	3A	7 (3)	Indoor-Outdoor	S20N11S81N
0.075	—	—	EP	115	FR54	3A	7 (3)	Indoor-Outdoor	S20N11S85N
0.100	—	—	EP	115	FR54	3A	7 (3)	Indoor-Outdoor	S20N11S82N
0.150	—	—	EP	115	FR55	3A	8 (4)	Indoor-Outdoor	S20N11S83N
0.25	—	—	EP	115	FR57P	3A	12 (5)	Indoor-Outdoor	S20N11P26P
0.5	—	—	EP	115	FR57P	3A	16 (7)	Indoor-Outdoor	S20N11P51P
0.75	—	—	EP	115	FR58AP	3A	26 (12)	Indoor-Outdoor	S20N11P76P
1	—	—	EP	115	FR67P	3A	31 (14)	Indoor-Outdoor	S20N11P01P
1.5	—	—	EP	115	FR67P	3A	42 (19)	Indoor-Outdoor	S20N11P16P
2	—	—	EP	115	FR68P	3A	42 (19)	Indoor-Outdoor	S20N11P02P
3	—	—	EP	115	FR176	3A	65 (30)	Indoor-Outdoor	S20N11S03N
3	②	②	EP	115	FR176	3A	65 (30)	Indoor-Outdoor	S20K11S03N
5	—	—	EP	115	FR177	3A	113 (51)	Indoor-Outdoor	S20N11S05N
5	②	②	EP	115	FR177	9A	105 (48)	Indoor-Outdoor	S20K11S05N
7.5	—	—	EP	115	FR178	3A	105 (48)	Indoor-Outdoor	S20N11S07N
7.5	②	②	EP	115	FR178	9A	123 (56)	Indoor-Outdoor	S20K11S07N
10	—	—	EP	115	FR179	3A	193 (88)	Indoor-Outdoor	S20N11S10N
10	②	②	EP	115	FR179	9A	193 (88)	Indoor-Outdoor	S20K11S10N
15	—	—	EP	115	FR180	3A	216 (98)	Indoor-Outdoor	S20N11S15N
15	③	③	EP	115	FR180	23A	216 (98)	Indoor-Outdoor	S20L11S15N
25	—	—	EP	115	FR182	3A	385 (175)	Indoor-Outdoor	S20N11S25N
25	③	③	EP	115	FR182	23A	375 (170)	Indoor-Outdoor	S20L11S25N
37.5	④	④	EP	115	FR300A	248A	735 (334)	Indoor-Outdoor	S20L11S37 ④

600 Volts to 120/240 Volts

kVA	Full Capacity Taps		Type	°C Temp. Rise	Frame	Wiring Diagram Number	Weight Lbs (kg)	Weathershield	Style Number
	FCAN	FCBN							
0.5	—	2 at -5%	EP	115	FR57P	2I	16 (7)	Indoor-Outdoor	S60G11P51P
0.75	—	2 at -5%	EP	115	FR58AP	2I	26 (12)	Indoor-Outdoor	S60G11P76P
1	—	2 at -5%	EP	115	FR67P	2I	31 (14)	Indoor-Outdoor	S60G11P01P
1.5	—	2 at -5%	EP	115	FR67P	2I	42 (19)	Indoor-Outdoor	S60G11P16P
2	—	2 at -5%	EP	115	FR68P	2I	42 (19)	Indoor-Outdoor	S60G11P02P
3	—	2 at -5%	EP	115	FR176	2I	65 (30)	Indoor-Outdoor	S60G11S03N
5	—	2 at -5%	EP	115	FR177	2I	105 (48)	Indoor-Outdoor	S60G11S05N
7.5	—	2 at -5%	EP	115	FR178	2I	123 (56)	Indoor-Outdoor	S60G11S07N
10	—	2 at -5%	EP	115	FR179	2I	193 (88)	Indoor-Outdoor	S60G11S10N
15	—	4 at -2.5%	EP	115	FR180	527A	216 (98)	Indoor-Outdoor	S60J11S15N
25	—	4 at -2.5%	EP	115	FR182	527A	385 (175)	Indoor-Outdoor	S60J11S25N
25	2 at 2.5%	4 at -2.5%	EP	115	FR132	83B	395 (180)	Indoor-Outdoor	S60M11S25N

Notes

- ① Contact Eaton for availability of 0.05–0.25 kVA designs.
- ② 1 at +10% FCBN at 240 volts; 2 at +5% FCBN at 480 volts.
- ③ 2 at +5% FCBN at 240 volts; 4 at +2.5% FCBN at 480 volts.
- ④ Floor-mount only.

Contact your local Eaton sales office for CE Mark transformer requirements. For other ratings or styles not shown, or for special enclosure types (including stainless steel), refer to Eaton. Frame drawings/dimensions information begins on **Page V2-T2-213**.



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Date: 06-23-2023

By: JN

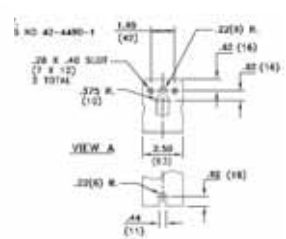
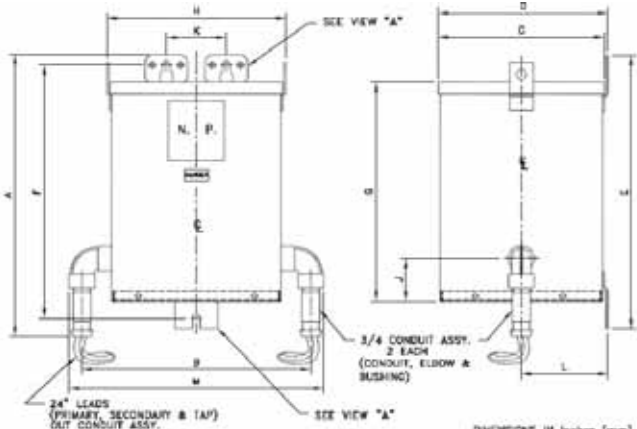
Device Tag:

T1

Job Number: HBR9328

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Manuf.: PNo: Cutler-Hammer: S20N11P16PSS Assembly



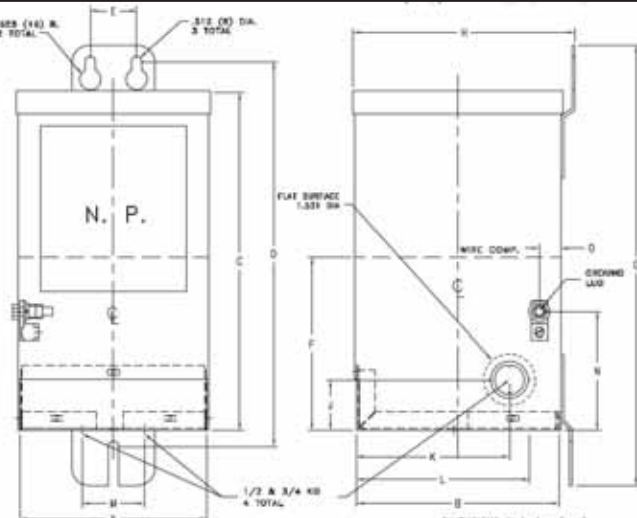
24" LEADS (PRIMARY, SECONDARY & TAP) OUT CONDUIT ASSY.

3/4 CONDUIT ASSY. 2 EACH (CONDUIT, ELBOW & BUSHING)

SEE VIEW "A"

DIMENSIONS IN inches (mm)

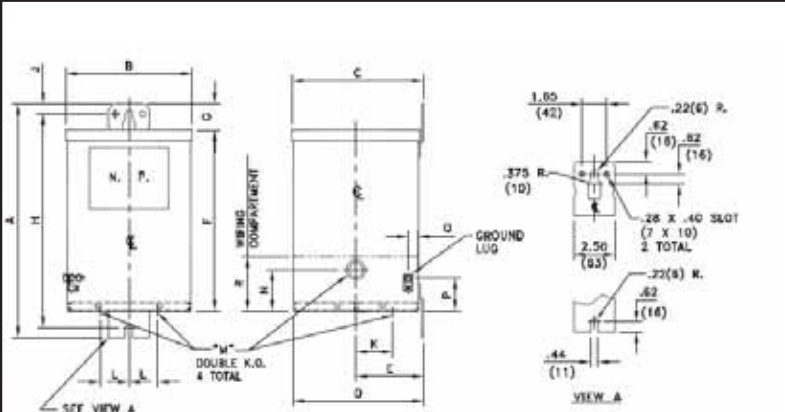
FRAME	APPROX NET WT. LBS(KG)	A	B	C	D	E	F
FR177H	113(51) 120(56)	16.53(420)	13.78(350)	9.47(246)	9.88(251)	16.15(410)	14.90(378)
		G	H	J	K	L	M
		12.82(326)	10.06(256)	2.50(64)	3.50(89)	5.06(128)	13.54(343)



DIMENSIONS IN inches (mm)

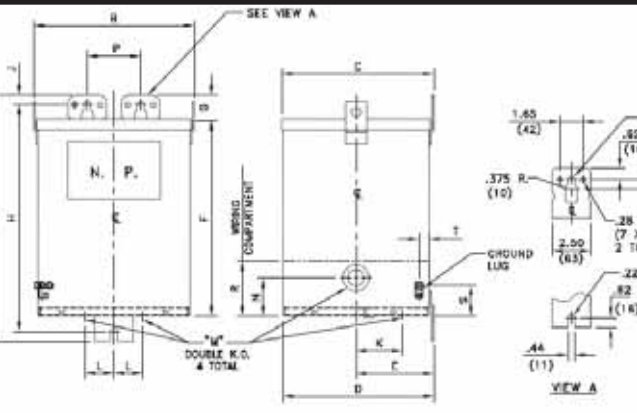
FRAME	A	B	C	D	E	F
FR177F	5.53(141)	8.88(226)	10.00(254)	11.40(291)	1.37(35)	5.12(130)
	G	H	J	K	L	M
	13.02(331)	6.54(167)	1.50(38)	4.32(110)	3.11(79)	1.85(47)
	H	D				
	3.50(89)	3.64(93)				

Rev 1 - MAR/10



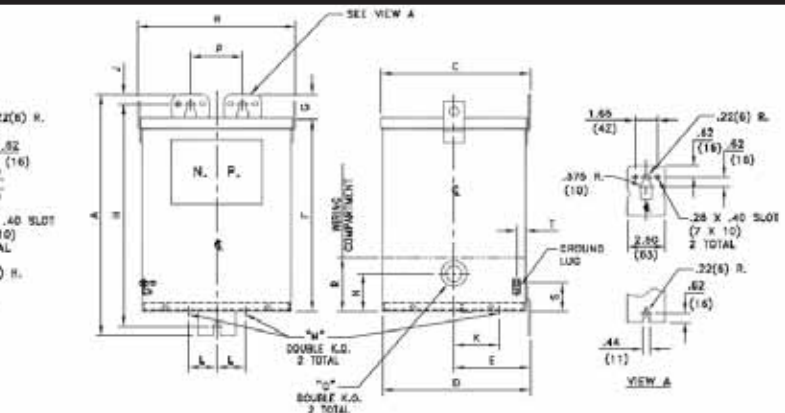
DIMENSIONS IN inches (mm)

FRAME	APPROX NET WT. LBS(KG)	A	B	C	D	E	F	G	H	J
FR176	45(30) 49(35)	14.25(362)	7.68(195)	8.00(203)	7.94(202)	4.00(103)	11.00(281)	1.53(41)	13.00(330)	.63(16)
		K	L	M	N	R	P	Q		
		2.25(57)	1.75(44)	.75(19.19)	2.50(64)	3.32(84)	2.00(51)	.65(17)		



DIMENSIONS IN inches (mm)

FRAME	APPROX NET WT. LBS(KG)	A	B	C	D	E	F	G	H
FR178	123(55) 132(60)	14.00(406)	10.38(264)	9.99(254)	9.80(249)	5.06(129)	12.82(326)	1.63(41)	14.70(373)
		J	K	L	M	N	P	R	
		.83(16)	3.00(76)	1.80(46)	.75, 1.25(19, 32)	2.60(66)	3.48(88)	3.61(92)	
		S	T						
		2.00(51)	.65(17)						



DIMENSIONS IN inches (mm)

FRAME	APPROX NET WT. LBS(KG)	A	B	C	D	E	F	G	H	J
FR179	193(87) 202(91)	19.00(483)	13.38(340)	10.50(267)	10.48(266)	5.43(138)	15.80(402)	1.83(47)	17.75(451)	.63(16)
		K	L	M	N	P	Q	R		
		3.38(86)	1.88(48)	.75, 1.25 (19, 32)	2.50(64)	3.48(88)	1.00, 1.50 (25, 38)	3.75(95)		
		S	T							
		2.00(51)	.65(17)							



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By: JN

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Manuf.: PNo: Cutler-Hammer: S20N11P16PSS Assembly



Datasheet

Art.No. 07.311.0155.0

End plate AP 2,5 -4 V0

End plate for DIN rail terminal blocks type WK ..., color gray



Art.No.	07.311.0155.0
EAN	4015573392663
Order unit	10 pieces

Approvals

Technical data

General

Colour	Grey
Type of end plate	Yes
Type of partition	No
Thickness	1.5 mm
Snap in	Yes
Inflammability class of insulation material acc. with UL94	V0

Accessories

Type of end plate	Yes
Type of partition	No
Colour	Grey
Thickness	1.5 mm
Snap in	Yes
Inflammability class of insulation material acc. with UL94	V0



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Date: 06-23-2023

By: JN

Device Tag:

TB

Job Number: HBR9328

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Manuf.: . PNo: Wieland: 07.311.0155.0

Feed-through blocks with screw connection

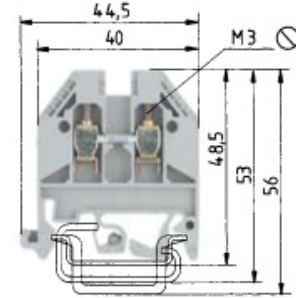
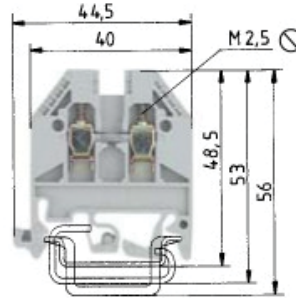
selosIOS



42-063-003

UL wire connection versions

- ⁴⁾ or 2x no. 14 sol/str AWG
or 2x no. 16 sol/str AWG
or 2x no. 18 sol/str AWG
or 3x no. 20 sol/str AWG or 3x no. 22 sol/str AWG
- ⁵⁾ or 2x no. 12 sol/str AWG
or 2x no. 16 sol/str AWG
or 3x no. 18 sol/str AWG or 3x no. 22 sol/str AWG
- ⁶⁾ or 2x no. 12 sol/str AWG
or 2x no. 14 sol/str AWG
or 3x no. 16 sol/str AWG



0344 Ex II 2GD IM2
Ex e I/II
EN 60947-7-1:2002
UL ratings
CSA ratings
KEMA 02 ATEX 2114 U¹⁾ EN 60079-0/EN 60079-7
Width
Approvals

Field/factory wiring
EN 60079-0/EN 60079-7
Wire strip length

WK 2,5/U

fine-stranded solid V A
0.5-2.5 mm² 0.5-4 mm² 800V/8 kV/3 24
No. 22-12 AWG 600V 20/30
No. 24-12 AWG 600V 25
0.5-2.5 mm² 0.5-4 mm² 690V 23
5 mm 9 mm

WK 4/U

fine-stranded solid V A
0.5-4 mm² 0.5-6 mm² 800V/8 kV/3 32
No. 22-10 AWG⁴⁾ 600V 30/35
No. 20-10 AWG 600V 40
0.5-4 mm² 0.5-6 mm² 690V 14/27⁶⁾
6 mm 9 mm

UL ATEX LR UL AEx Ex

UL ATEX LR UL AEx Ex

	Type	Part No.	Std. Pack	Type	Part No.	Std. Pack	
Feed-through block	gray	WK 2,5/U	57.503.0055.0	100	WK 4/U	57.504.0055.0	100
Feed-through block Ex i	blue	WK 2,5/U BLAU	57.503.0055.6	100	WK 4/U BLAU	57.504.0055.6	100
Accessories							
1. Mounting rail TS 35, DIN rail 7.5 mm high	L = 2 m	35 x 27 x 7,5 EN 60715	98.300.0000.0	1	35 x 27 x 7,5 EN 60715	98.300.0000.0	1
Mounting rail TS 35, DIN rail, 15 mm high	L = 2 m	35 x 24 x 15 EN 60715	98.360.0000.0	1	35 x 24 x 15 EN 60715	98.360.0000.0	1
Mounting rail TS 32, G rail ²⁾	L = 2 m	9006 EN 60715 G-32	98.190.0000.0	1	9006 EN 60715 G-32	98.190.0000.0	1
2. End clamp with U-foot ²⁾	10mm wide	WE 1/U	25.523.5753.0	100	WE 1/U	25.523.5753.0	100
End clamp TS 35, with screw	8mm wide	9708/2 S35	25.522.8553.0	100	9708/2 S35	25.522.8553.0	100
End clamp TS 35, without screw	8mm wide	WEF 1/35	25.523.9353.0	100	WEF 1/35	25.523.9353.0	100
3. End plate	gray	AP 2,5 - 4	07.311.0155.0	10	AP 2,5 - 4	07.311.0155.0	10
	blue	AP 2,5 - 4 BLAU	07.311.0155.6	10	AP 2,5 - 4 BLAU	07.311.0155.6	10
4. Partition	gray	TW 2,5 - 4	07.311.1155.0	10	TW 2,5 - 4	07.311.1155.0	10
	blue	TW 2,5 - 4 BLAU	07.311.1155.6	10	TW 2,5 - 4 BLAU	07.311.1155.6	10
5. Cross connector with screws	2 pole	IVB WK 2,5 - 2	Z7.280.2227.0	10	IVB WK 4 - 2	Z7.281.1227.0	10
insulated	3 pole	IVB WK 2,5 - 3	Z7.280.2327.0	10	IVB WK 4 - 3	Z7.281.1327.0	10
	up to 12 pole	IVB WK 2,5 - 12	Z7.280.3227.0	10	IVB WK 4 - 12	Z7.281.2227.0	10
6. Partition plate with marking facility		TS 2,5 GELB	07.311.2053.8	10	TS 4 GELB	07.311.2153.8	10
7. Single cover with marking facility		AD VB 2,5 GELB	04.326.2053.8	10	AD VB 4 GELB	04.326.2153.8	10
8. Cover with warning symbol over 4 blocks		AD VB 5/4 GELB	04.343.4756.8	10	AD VB 6/4 GELB	04.343.4856.8	10

For more accessories see pages 60-77
For marking systems see pages 70-75
¹⁾ For maintaining the proper isolation distances, the open side of a feed-through terminal block as well as both sides of a jumper are to be enclosed by partitions.
²⁾ Please note the mounting instructions on the cover page. ³⁾ Do not use in Ex environments. ⁴⁾ With/without jumper

 630-499-7080 · www.elemechinc.com	Rev: 0	Device Tag: TB	
	Date: 06-23-2023		
Manuf.: . PNo: Wieland: 57.504.0055.0	By: JN	Job Number: HBR9328	Page # 1/1

Item No. Z7.281.1227.0

Insulated jumper bar IVBWK 4 - 2

Cross connector, insulated for DIN rail terminal blocks type WK ..., 2-pole

Item No.	Z7.281.1227.0
EAN	4015573156081
order unit	10 Piece(s)

Technical data

Accessories

ArticlePrice	
Colour	Yellow
Type	Cross connector
Modular spacing	5.95 mm
Number of bridged clamps	2
Mounting method	Screwable
Insulated	Yes



Type	Part no.	Std. pack	Type	Part no.	Std. pack	Type	Part no.	Std. pack
for terminal blocks type			WK 4/U	6 mm spacing Screw: M 3		WK 4/3-6 SKO	6 mm spacing Screw: M 3	
WK 2,5/U	5 mm spacing Screw: M 2.5		WK 4TKS D/U			2pole 2072/2	Z7.220.0227.0	50
WK 2,5 - 4 KOI/U			WK 4 3 S 1 K/U			3pole 2072/3	Z7.220.0327.0	50
WK 2,5 U/8113 S/H			WK 4 3-6 S 1 K/U			4pole 2072/4	Z7.220.0427.0	50
WKN 2,5 E/U			WK 4 5 S 2,8 1 K/U			5pole 2072/5	Z7.220.0527.0	50
2pole VB WK 2,5-2	Z7.280.0227.0	10	WK 4 3 S 1 K/IW/U			6pole 2072/6	Z7.220.0627.0	50
3pole VB WK 2,5-3	Z7.280.0327.0	10	WK 4 3-6 S 1 K/IW/U			70pole 2072/M	Z7.210.1027.0	10
4pole VB WK 2,5-4	Z7.280.0427.0	10	WK 4/U F1					
5pole VB WK 2,5-5	Z7.280.0527.0	10	WK 4/U F2			WK/5 S/U	6 mm spacing Screw: M 3	
6pole VB WK 2,5-6	Z7.280.0627.0	10	2pole VB WK 4-2	Z7.281.0227.0	10	WK/5-10 S/U		
80pole VB WK 2,5 M-80	Z7.280.0027.0	10	3pole VB WK 4-3	Z7.281.0327.0	10	WK/3-6 S/U		
			4pole VB WK 4-4	Z7.281.0427.0	10	WK/4 S/U		
WKM 2,5/15	5 mm spacing Screw: M 2.5		5pole VB WK 4-5	Z7.281.0527.0	10	WK/4-8 S/U		
WKM 2,5 F1/15			6pole VB WK 4-6	Z7.281.0627.0	10	2pole 9703/6-2	Z7.211.0227.0	50
WKM 2,5 F2/15			70pole VB WK 4 M-70	Z7.281.0027.0	10	3pole 9703/6-3	Z7.211.0327.0	50
WKM 2,5/2 S 2,8 1 K/15						4pole 9703/6-4	Z7.211.0427.0	50
WKM 2,5 TP1 O/15			WK 4/D 1/2 U	6 mm spacing Screw: M 3		5pole 9703/6-5	Z7.211.0527.0	50
WKM 2,5 TP2 O/15			WK 4/D 2/2 U			6pole 9703/6-6	Z7.211.0627.0	50
2pole VB WKM 2,5/15-2	Z7.215.4227.0	50	2pole VB WK 4 D...2	Z7.281.6227.0	10	70pole 9703/6 M-70	Z7.211.0027.0	10
3pole VB WKM 2,5/15-3	Z7.215.4327.0	50	3pole VB WK 4 D...3	Z7.281.6327.0	10			
4pole VB WKM 2,5/15-4	Z7.215.4427.0	50	4pole VB WK 4 D...4	Z7.281.6427.0	10			
5pole VB WKM 2,5/15-5	Z7.215.4527.0	50	5pole VB WK 4 D...5	Z7.281.6527.0	10			
6pole VB WKM 2,5/15-6	Z7.215.4627.0	50	6pole VB WK 4 D...6	Z7.281.6627.0	10			
60pole VB WKM 2,5/15 M-60	Z7.215.4027.0	10	70pole VB WK 4 D... M-70	Z7.281.6027.0	10			
WK/3 S/IW/U	6 mm spacing Screw: M 3		WKM 4/15	6 mm spacing Screw: M 3				
WK/3 - 6 S/IW/U			WK 4/D EU					
WK/4 S/IW/U			WK 4 E/U for upper tier block					
WK/4-8 S/IW/U			WK 4 E/U GU ORANGE					
2pole VB WK/...S/IW/U-2	Z7.281.3227.0	10	WK 4 E/U GO					
3pole VB WK/...S/IW/U-3	Z7.281.3327.0	10	WK 4 E/U G2					
4pole VB WK/...S/IW/U-4	Z7.281.3427.0	10	WK 4 E/U G1 ORANGE					
5pole VB WK/...S/IW/U-5	Z7.281.3527.0	10	WK 4 E/U G-URL					
6pole VB WK/...S/IW/U-6	Z7.281.3627.0	10	WK 4 E/U G-URL					
20pole VB WK/...S/IW/U-20	Z7.281.3027.0	10	WK 4 E/U VB SCHWARZ					
			2pole 9215 - 2	Z7.210.3227.0	50			
			3pole 9215 - 3	Z7.210.3327.0	50			
			4pole 9215 - 4	Z7.210.3427.0	50			
			5pole 9215 - 5	Z7.210.3527.0	50			
			6pole 9215 - 6	Z7.210.3627.0	50			
			70pole 9215 M-70	Z7.210.3027.0	10			



Rev: 0
Date: 06-23-2023
By: JN

Device Tag: TB
Job Number: HBR9328
Page #: 1/1

Manuf.: . PNo: Wieland: Z7.281.1227



2.5 mm²/5 mm Width

4 mm²/6 mm Width

10 mm²/10 mm Width

16 mm²/12 mm Width

35 mm²/16 mm Width

42-063-000

Type	Part no.	Std. pack	Type	Part no.	Std. pack	Type	Part no.	Std. pack
Marking strips, unmarked			Marking strips, unmarked			10 mm²/10 mm Width		
9705 A/5/10	04.242.5053.0	25	9705 A/6/10	04.242.6053.0	25	10 mm²/10 mm Width		
Marking strips, marked			Marking strips, marked			marked for 5 blocks (every 2nd tag) *		
9705 A/5/9 B 1 - 9	04.842.4953.0	25	9705 A/6/9 B 1 - 9	04.842.5953.0	25	9705 A/5/10/5 B	04.842.5553.0	25
9705 A/5/10 B*	04.842.5053.0	25	9705 A/6/10 B*	04.842.6053.0	25			
9705 A/5/10 B 1 - 10	04.845.0153.0	25	9705 A/6/10 B 1 - 10	04.846.0153.0	25			
11 - 20	04.845.0253.0	25	11 - 20	04.846.0253.0	25			
21 - 30	04.845.0353.0	25	21 - 30	04.846.0353.0	25			
31 - 40	04.845.0453.0	25	31 - 40	04.846.0453.0	25	16 mm²/12 mm Width		
41 - 50	04.845.0553.0	25	41 - 50	04.846.0553.0	25	marked for 5 blocks (every 2nd tag) *		
51 - 60	04.845.0653.0	25	51 - 60	04.846.0653.0	25	9705 A/6/10/5 B	04.842.6553.0	25
61 - 70	04.845.0753.0	25	61 - 70	04.846.0753.0	25			
71 - 80	04.845.0853.0	25	71 - 80	04.846.0853.0	25			
81 - 90	04.845.0953.0	25	81 - 90	04.846.0953.0	25			
91 - 100	04.845.1053.0	25	91 - 100	04.846.1053.0	25	35 mm²/16 mm Width		
⊕ (10 x)	04.855.0053.0	25	⊕ (10 x)	04.856.0053.0	25	marked for 5 blocks (every 2nd tag) *		
± (10 x)	04.855.0153.0	25	± (10 x)	04.856.0153.0	25	9705 A/6/10/5 B	04.842.8553.0	25
+ (10 x)	04.855.0253.0	25	+ (10 x)	04.856.0253.0	25			
- (10 x)	04.855.0353.0	25	- (10 x)	04.856.0353.0	25			
L1 (10 x)	04.855.0453.0	25	L1 (10 x)	04.856.0453.0	25			
L2 (10 x)	04.855.0553.0	25	L2 (10 x)	04.856.0553.0	25			
L3 (10 x)	04.855.0653.0	25	L3 (10 x)	04.856.0653.0	25			
PE (10 x)	04.855.0753.0	25	PE (10 x)	04.856.0753.0	25			
SL (10 x)	04.855.3153.0	25	SL (10 x)	04.856.3153.0	25			
N (10 x)	04.855.3253.0	25	N (10 x)	04.856.3253.0	25			
F1 (10 x)	04.855.0953.0	25	F1 (10 x)	04.856.0953.0	25			
F2 (10 x)	04.855.1053.0	25	F2 (10 x)	04.856.1053.0	25			
L1, L2, L3, N, PE (2 x)	04.855.0853.0	25	L1, L2, L3, N, PE (2 x)	04.856.0853.0	25			
with enlarged marking area			with enlarged marking area					
9705 AL/5/10	04.242.5153.0	25	9705 AL/6/10	04.242.6353.0	25			
*Custom marking upon request			*Custom marking upon request			* indicate required marking with part no.		

Item No. 57.504.9055.0



Earth terminal WK 4 SL/ U /N0

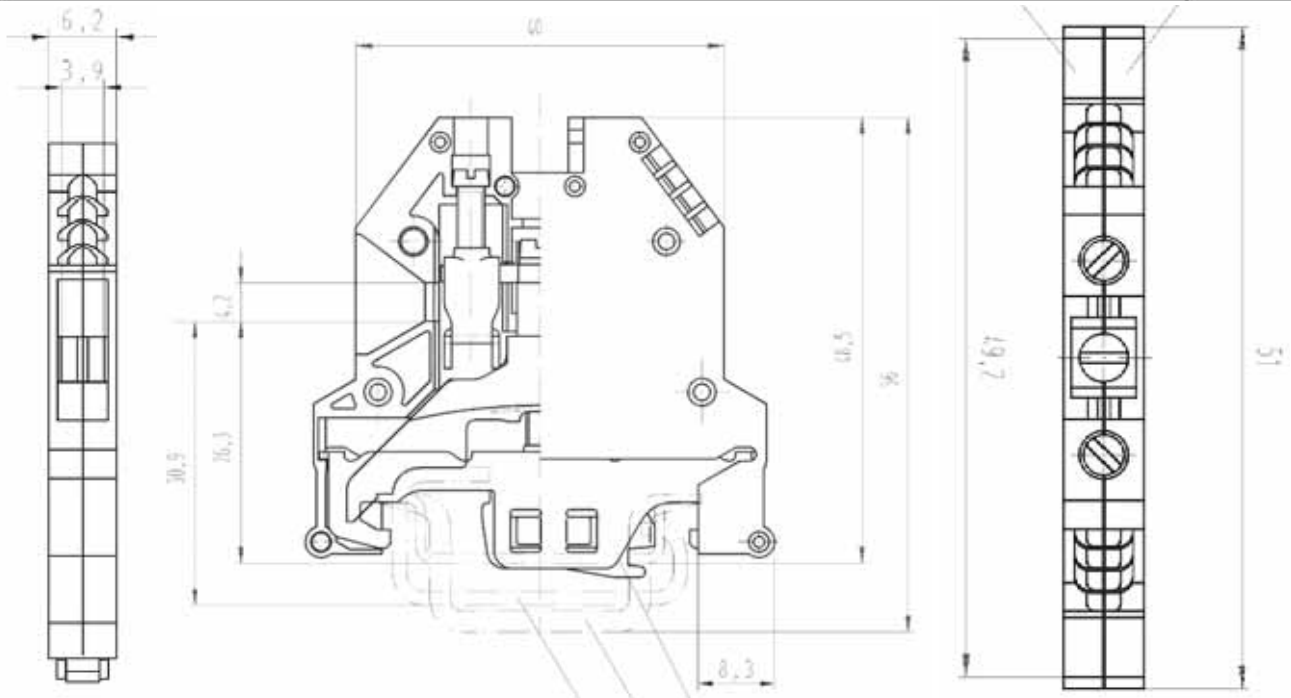
Ground DIN rail terminal block with screw connection for mounting on TS 35 and TS 32, nominal cross section 4 mm², width 6 mm, color green/yellow



42-063-004



Rated impulse voltage	8 kV
Pollution degree	3
Closing plate required	No
Length	51 mm
Type of insulation material	Thermoplastic
Cross section UL	22-10 AWG
Cross section CSA	20-10 AWG
Maximum cross section fine stranded	4 mm ²
Wire strip length	9 mm
Torque conductor mounting	0.5 Nm
Torque rail mounting	0,5



Rev: 0

Date: 06-23-2023

By: JN

Device Tag:

TB,DB

Job Number: HBR9328

Page # 1/1

Manuf.: . PNo: Wieland: 57.504.9055.0

Item No. Z5.522.8553.0
 End bracket 9708 / 2 S 35
 End clamp for mounting rail TS 35

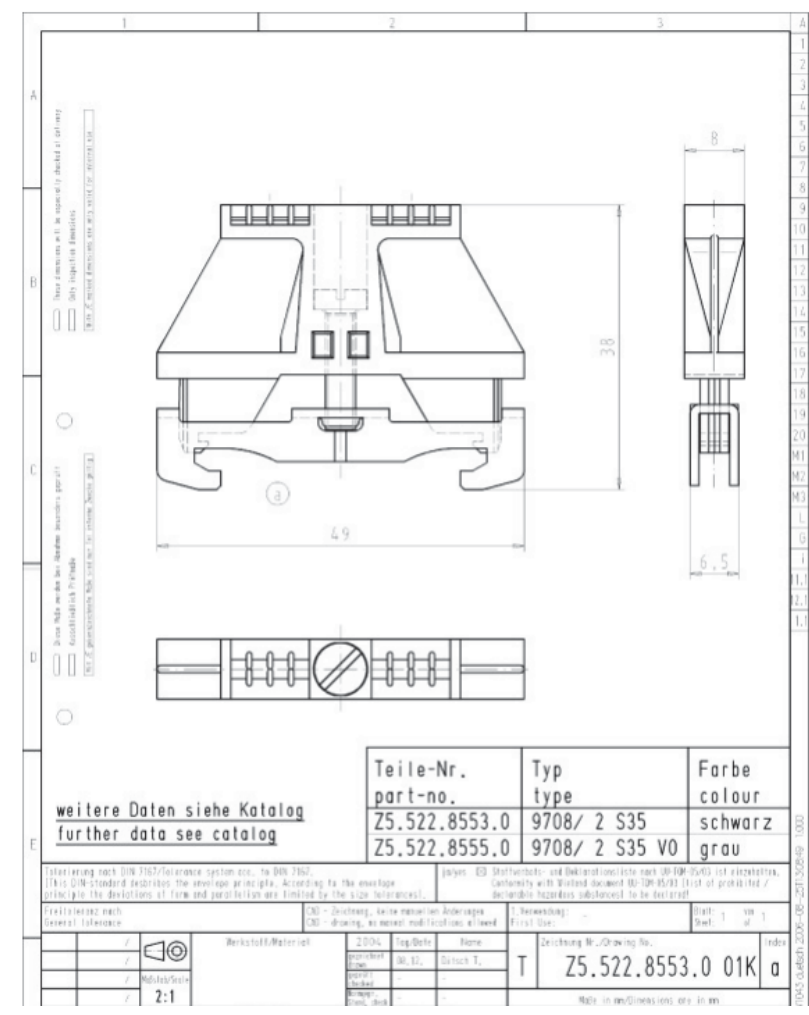


42-063-009

Item No.	Z5.522.8553.0
EAN	4015573141766
order unit	100 Piece(s)

Technical data

ArticlePrice	udp_no_price
Colour	Black
Inflammability class of insulation material acc. with UL94	V2
Width/grid dimension	8 mm
Latching	Screwable
Length	49 mm
Material	Metal
Mounting method	DIN rail (top hat rail) 35/7.5 mm



Rev:	0	Device Tag:	TB,DB
Date:	06-23-2023		
By:	JN	Job Number:	HBR9328
		Page #	1/1

Manuf.: . PNo:
 Wieland: Z5.522.8553



2.5 mm²/5 mm Width



4 mm²/6 mm Width



10 mm²/10 mm Width

16 mm²/12 mm Width

35 mm²/16 mm Width

Type	Part no.	Std. pack	Type	Part no.	Std. pack	Type	Part no.	Std. pack
Marking strips, unmarked			Marking strips, unmarked			10 mm²/10 mm Width		
9705 A/5/10	04.242.5053.0	25	9705 A/6/10	04.242.6053.0	25	10 mm²/10 mm Width		
Marking strips, marked			Marking strips, marked			marked for 5 blocks (every 2nd tag) *		
9705 A/5/9 B 1 - 9	04.842.4953.0	25	9705 A/6/9 B 1 - 9	04.842.5953.0	25	9705 A/5/10/5 B	04.842.5553.0	25
9705 A/5/10 B*	04.842.5053.0	25	9705 A/6/10 B*	04.842.6053.0	25			
9705 A/5/10 B 1 - 10	04.845.0153.0	25	9705 A/6/10 B 1 - 10	04.846.0153.0	25			
11 - 20	04.845.0253.0	25	11 - 20	04.846.0253.0	25			
21 - 30	04.845.0353.0	25	21 - 30	04.846.0353.0	25	16 mm²/12 mm Width		
31 - 40	04.845.0453.0	25	31 - 40	04.846.0453.0	25	marked for 5 blocks (every 2nd tag) *		
41 - 50	04.845.0553.0	25	41 - 50	04.846.0553.0	25	9705 A/6/10/5 B	04.842.6553.0	25
51 - 60	04.845.0653.0	25	51 - 60	04.846.0653.0	25			
61 - 70	04.845.0753.0	25	61 - 70	04.846.0753.0	25			
71 - 80	04.845.0853.0	25	71 - 80	04.846.0853.0	25			
81 - 90	04.845.0953.0	25	81 - 90	04.846.0953.0	25			
91 - 100	04.845.1053.0	25	91 - 100	04.846.1053.0	25	35 mm²/16 mm Width		
⊕ (10 x)	04.855.0053.0	25	⊕ (10 x)	04.856.0053.0	25	marked for 5 blocks (every 2nd tag) *		
± (10 x)	04.855.0153.0	25	± (10 x)	04.856.0153.0	25	9705 A/6/10/5 B	04.842.8553.0	25
+ (10 x)	04.855.0253.0	25	+ (10 x)	04.856.0253.0	25			
- (10 x)	04.855.0353.0	25	- (10 x)	04.856.0353.0	25			
L1 (10 x)	04.855.0453.0	25	L1 (10 x)	04.856.0453.0	25			
L2 (10 x)	04.855.0553.0	25	L2 (10 x)	04.856.0553.0	25			
L3 (10 x)	04.855.0653.0	25	L3 (10 x)	04.856.0653.0	25			
PE (10 x)	04.855.0753.0	25	PE (10 x)	04.856.0753.0	25			
SL (10 x)	04.855.3153.0	25	SL (10 x)	04.856.3153.0	25			
N (10 x)	04.855.3253.0	25	N (10 x)	04.856.3253.0	25			
F1 (10 x)	04.855.0953.0	25	F1 (10 x)	04.856.0953.0	25			
F2 (10 x)	04.855.1053.0	25	F2 (10 x)	04.856.1053.0	25			
L1, L2, L3, N, PE (2 x)	04.855.0853.0	25	L1, L2, L3, N, PE (2 x)	04.856.0853.0	25			
with enlarged marking area			with enlarged marking area					
9705 AL/5/10	04.242.5153.0	25	9705 AL/6/10	04.242.6353.0	25			
*Custom marking upon request			*Custom marking upon request			* indicate required marking with part no.		

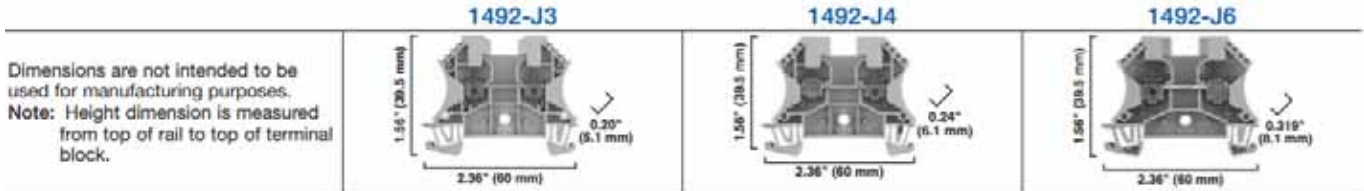
42-063-008

<p>630-499-7080 · www.elemechinc.com</p>	Rev: 0	Device Tag: TB1	
	Date: 06-23-2023		
Manuf.: . PNo: Wieland: Z4.242.6353	By: JN	Job Number: HBR9328	Page # 1/1

Screw Connection Terminal Blocks



42-005-027



Specifications	<i>Feed-through terminal block</i>			<i>Feed-through terminal block</i>			<i>Feed-through terminal block</i>							
Certifications		CSA	IEC	ATEX		CSA	IEC	ATEX		CSA	IEC	ATEX		
Voltage Rating	600V AC/DC			800V AC/DC	550V AC/DC	600V AC/DC			800V AC/DC	690V AC/DC	600V AC/DC		800V AC/DC	550V AC/DC
Maximum Current	25 A	20 A	24 A	21 A	35 A	25 A	32 A	28 A	50 A		41 A	36 A		
Wire Range (Rated Cross Section)	#22...12 AWG	#26...12 AWG	2.5 mm ²	2.5 mm ² (#20...14 AWG)	#22...10 AWG	#26...10 AWG	4 mm ²	4 mm ² (#20...12 AWG)	#22...8 AWG		6 mm ²	6 mm ² (#20...10 AWG)		
Wire Strip Length	0.39 in. (10 mm)				0.39 in. (10 mm)				0.47 in. (12 mm)					
Recommended Tightening Torque	4.5...7.1 lb•in (0.5...0.8 N•m)				9.0 lb•in (1.0 N•m)				14.2 lb•in (1.6 N•m)					
Density	59 pcs/ft (196 pcs/m)				49 pcs/ft (163 pcs/m)				37 pcs/ft (123 pcs/m)					
Housing Temperature Range	-58...+248 °F (-50...+120 °C)				-58...+248 °F (-50...+120 °C)				-58...+248 °F (-50...+120 °C)					
Short-Circuit Current Rating	See page 12-42													

Terminal Blocks		Cat. No.	Pkg Qty.	Cat. No.	Pkg Qty.	Cat. No.	Pkg Qty.
Color:	Grey	1492-J3	100	1492-J4	100	1492-J6	100
	Red	1492-J3-RE	100	1492-J4-RE	100	1492-J6-RE	100
	Blue	1492-J3-B	100	1492-J4-B	100	1492-J6-B	100
	Black	1492-J3-BL	100	1492-J4-BL	100	1492-J6-BL	100
	Green	1492-J3-G	100	1492-J4-G	100	1492-J6-G	100
	Yellow	1492-J3-Y	100	1492-J4-Y	100	1492-J6-Y	100
	Orange	1492-J3-OR	100	1492-J4-OR	100	1492-J6-OR	100
	Brown	1492-J3-BR	100	1492-J4-BR	100	1492-J6-BR	100
	White	1492-J3-W	100	1492-J4-W	100	1492-J6-W	100
	Violet	1492-J3-V	100	1492-J4-V	100	—	—

 <p>630-499-7080 · www.elemechinc.com</p>	Rev: 0	Device Tag: TB2	
	Date: 06-23-2023		
Manuf.: . PNo: Allen-Bradley: 1492-J3	By: JN	Job Number: HBR9328	Page # 1/1

Screw Connection Terminal Blocks



42-005-029

	1492-J3				1492-J4				1492-J6				
Dimensions are not intended to be used for manufacturing purposes. Note: Height dimension is measured from top of rail to top of terminal block.													
Specifications	Feed-through terminal block				Feed-through terminal block				Feed-through terminal block				
Certifications		CSA	IEC	ATEX		CSA	IEC	ATEX		CSA	IEC	ATEX	
Voltage Rating	600V AC/DC			800V AC/DC	550V AC/DC	600V AC/DC			800V AC/DC	690V AC/DC	600V AC/DC		
Maximum Current	25 A	20 A	24 A	21 A	35 A	25 A	32 A	28 A	50 A	41 A	36 A	36 A	
Wire Range (Rated Cross Section)	#22...12 AWG		#26...12 AWG	2.5 mm ² (#20...14 AWG)	#22...10 AWG		#26...10 AWG	4 mm ² (#20...12 AWG)	#22...8 AWG		6 mm ²	6 mm ² (#20...10 AWG)	
Wire Strip Length	0.39 in. (10 mm)				0.39 in. (10 mm)				0.47 in. (12 mm)				
Recommended Tightening Torque	4.5...7.1 lb•in (0.5...0.8 N•m)				9.0 lb•in (1.0 N•m)				14.2 lb•in (1.6 N•m)				
Density	59 pcs/ft (196 pcs/m)				49 pcs/ft (163 pcs/m)				37 pcs/ft (123 pcs/m)				
Housing Temperature Range	-58...+248 °F (-50...+120 °C)				-58...+248 °F (-50...+120 °C)				-58...+248 °F (-50...+120 °C)				
Short-Circuit Current Rating	See page 12-42												
Terminal Blocks		Cat. No.	Pkg Qty.		Cat. No.	Pkg Qty.		Cat. No.	Pkg Qty.		Cat. No.	Pkg Qty.	
Color:	Grey	1492-J3	100		1492-J4	100		1492-J6	100		1492-J6	100	
	Red	1492-J3-RE	100		1492-J4-RE	100		1492-J6-RE	100		1492-J6-RE	100	
	Blue	1492-J3-B	100		1492-J4-B	100		1492-J6-B	100		1492-J6-B	100	
	Black	1492-J3-BL	100		1492-J4-BL	100		1492-J6-BL	100		1492-J6-BL	100	
	Green	1492-J3-G	100		1492-J4-G	100		1492-J6-G	100		1492-J6-G	100	
	Yellow	1492-J3-Y	100		1492-J4-Y	100		1492-J6-Y	100		1492-J6-Y	100	
	Orange	1492-J3-OR	100		1492-J4-OR	100		1492-J6-OR	100		1492-J6-OR	100	
	Brown	1492-J3-BR	100		1492-J4-BR	100		1492-J6-BR	100		1492-J6-BR	100	
	White	1492-J3-W	100		1492-J4-W	100		1492-J6-W	100		1492-J6-W	100	
	Violet	1492-J3-V	100		1492-J4-V	100		—	—		—	—	



Rev:	0	Device Tag:	TB2
Date:	06-23-2023		
By:	JN	Job Number:	HBR9328
		Page #	1/1

Manuf.: . PNo:
Allen-Bradley: 1492-EBJ3

Fast-Acting 1/4" x 1 1/4" Glass Tube Fuses

AGC Series



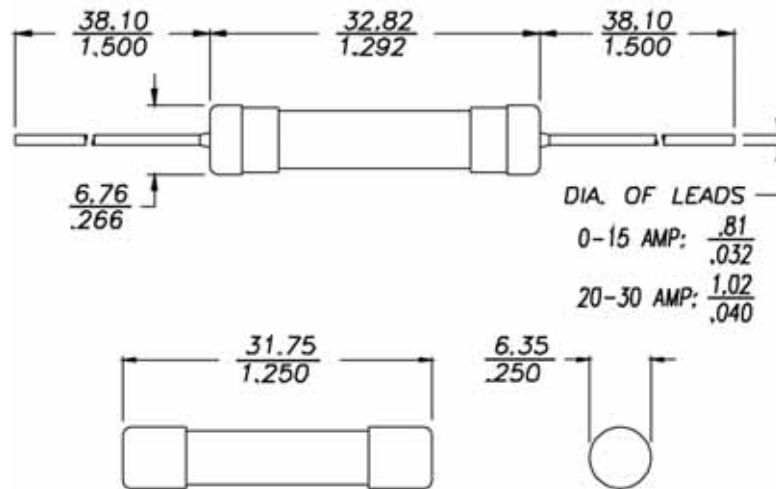
13-012-034

Non-RoHS Part Number	RoHS Part Number	AC Voltage Rating	AC Interrupting Rating (amps)			Typical DC Cold Resistance* (Ω)	Typical Melting I ² t AC	Typical Voltage Drop [†]
			250	125	32			
AGC-1/8	AGC-1/8-R	250	35	10,000	—	4.500	0.00773	0.67
AGC-1/8	AGC-1/8-R	250	35	10,000	—	12.565	0.000787	6.00
AGC-1/4	AGC-1/4-R	250	35	10,000	—	6.800	0.00131	4.67
AGC-1/4	AGC-1/4-R	250	35	10,000	—	4.900	0.00637	4.12
AGC-1/4	AGC-1/4-R	250	35	10,000	—	3.360	0.00435	4.51
AGC-1/4	AGC-1/4-R	250	35	10,000	—	2.300	0.0148	0.89
AGC-3/8	AGC-3/8-R	250	35	10,000	—	1.670	0.0208	2.88
AGC-3/8	AGC-3/8-R	250	35	10,000	—	1.203	0.0321	4.59
AGC-1/2	AGC-1/2-R	250	35	10,000	—	0.615	0.269	0.59
AGC-1/2	AGC-1/2-R	250	35	10,000	—	0.312	0.815	0.37
AGC-1	AGC-1-R	250	35	10,000	—	0.190	1.615	0.31
AGC-1-1/4	AGC-1-1/4-R	250	100	10,000	—	0.145	0.018	0.35
AGC-1-1/2	AGC-1-1/2-R	250	100	10,000	—	0.115	0.0149	0.27
AGC-2	AGC-2-R	250	100	10,000	—	0.078	0.00509	0.28
AGC-2-1/4	AGC-2-1/4-R	250	100	10,000	—	0.067	0.00588	0.26
AGC-2-1/2	AGC-2-1/2-R	250	100	10,000	—	0.057	0.00879	0.31
AGC-3	AGC-3-R	250	100	10,000	—	0.045	0.0167	0.25
AGC-4	AGC-4-R	250	200	10,000	—	0.030	0.0305	0.22
AGC-5	AGC-5-R	250	200	10,000	—	0.024	0.045	0.23
AGC-6	AGC-6-R	250	200	10,000	—	0.020	0.071	0.23
AGC-7	AGC-7-R	250	200	10,000	—	0.017	0.105	0.23
AGC-7-1/2	AGC-7-1/2-R	250	200	10,000	—	0.0146	—	—
AGC-8	AGC-8-R	250	200	10,000	—	0.014	0.152	0.19
AGC-9	AGC-9-R	250	200	10,000	—	0.012	0.21	0.18
AGC-10	AGC-10-R	250	200	10,000	—	0.008	0.492	0.20
AGC-12	AGC-12-R	32	—	—	1000	0.0070	—	—
AGC-14	AGC-14-R	32	—	—	1000	0.0062	—	—
AGC-15	AGC-15-R	32	—	—	1000	0.006	0.566	0.14
AGC-20	AGC-20-R	32	—	—	1000	0.004	1.438	0.12
AGC-25	AGC-25-R	32	—	—	1000	0.003	2.109	0.11
AGC-30	AGC-30-R	32	—	—	1000	0.002	3.807	0.12
AGC-35	AGC-35-R	32	—	—	70	0.0014	—	—
AGC-40	AGC-40-R	32	—	—	80	0.0019	—	—

* DC Cold Resistance (Measured at ≤10% of rated current)
 † Typical Melting I²t (A²Sec) (I²t was measured at listed interrupting rating and rated voltage.)
 ‡ Typical Voltage Drop (Voltage drop was measured at 25°C ambient temperature at rated current)

Dimensions (mm/in)

Drawing Not to Scale



Agency Information

- UL Listed Card: AGC 1/500-10
- UL Recognition Card: AGC 11-45
- CSA Component Acceptance Card (Class No. 1422 30)
- CSA Certification Card (Class No. 1422 01)



Rev: 0

Date: 06-23-2023

By: JN

Device Tag:

TB3F

Job Number: HBR9328

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Manuf.: PNo: Bussman: AGC-1

Item No. 57.904.6355.0
 Fuse terminal WK 4/THSI6,3 U /V0



Approvals



42-063-026

Technical data

Rated current	10 A
Rated voltage	800 V
Rated impulse voltage	8 kV
Pollution degree	3
Closing plate required	No
Length	77.2 mm
Type of insulation material	Thermoplastic
Maximum cross section solid	6 mm ²
Minimum cross section fine stranded	0.5 mm ²
Maximum cross section fine stranded	4 mm ²
Wire strip length	8 mm
Torque conductor mounting	0.5 Nm

Technical Data UL/CSA

Cross section UL	22-10 AWG
Voltage UL	600
Current factory wiring	15 A
Current field wiring	15 A
Cross section CSA	22-10 AWG
Voltage CSA	600 V
Current CSA	10 A



Rev: 0	Device Tag: TB3F	
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Manuf.: . PNo: Wieland: 57.904.6355.0

Pulse isolator



5202B

- 2 channels - 2 or 4 outputs
- Dual output
- 5-port 3.75 kVAC galvanic isolation
- Cable error detection
- Universal supply by AC or DC



18-247-001

Environmental Conditions

Operating temperature.....	-20°C to +60°C
Calibration temperature.....	20...28°C
Relative humidity.....	< 95% RH (non-cond.)
Protection degree.....	IP20

Mechanical specifications

Dimensions (HxWxD).....	109 x 23.5 x 130 mm
Weight approx.....	230 g
Wire size.....	1 x 2.5 mm ² stranded wire
Screw terminal torque.....	0.5 Nm

Common specifications

Supply	
Supply voltage, universal.....	21.6...253 VAC, 50...60 Hz or 19.2...300 VDC
Fuse.....	400 mA SB / 250 VAC
Max. required power.....	≤ 1.5 W (2 channels), 5202B1 and 5202B2
Max. required power.....	≤ 2.0 W (2 channels), 5202B4
Internal power dissipation.....	≤ 1.5 W (2 channels), 5202B1 and 5202B2
Internal power dissipation.....	≤ 2.0 W (2 channels), 5202B4

Isolation voltage

Isolation voltage, test / working.....	3.75 kVAC / 250 VAC
PELV/SELV.....	IEC 61140

Auxiliary supplies

NAMUR supply.....	8 VDC / 8 mA
EMC immunity influence.....	< ±0.5%
Extended EMC immunity: NAMUR NE21, A criterion, burst.....	< ±1%

Input specifications

Sensor types.....	NAMUR according to EN 60947-5-6 / mechanical contact
Frequency range.....	0...5 kHz
Pulse length.....	> 0.1 ms
Input resistance.....	1 kΩ
Trig level, signal.....	< 1.2 mA, > 2.1 mA
Trig level, cable fault.....	< 0.1 mA, > 6.5 mA

Output specifications

Relay output

Max. switching frequency.....	20 Hz
Max. voltage.....	250 VRMS
Max. current.....	2 AAC
Max. AC power.....	100 VA
Max. load at 24 VDC.....	1 A

NPN outputs

Max. switching frequency.....	5 kHz
Min. pulse length.....	> 0.1 ms
Max. load, current / voltage.....	80 mA / 30 VDC

Voltage drop at 25 mA / 80 mA.....

< 0.75 VDC / < 2.5 VDC

Observed authority requirements

EMC.....	2014/30/EU
LVD.....	2014/35/EU
EAC.....	TR-CU 020/2011

Approvals

ATEX.....	DEMKO 99ATEX127186, II (1) GD [EEx ia] IIC
UL.....	UL 913, UL 508
EAC Ex.....	RU C-DK.HA65.B.00355/19
SIL.....	Hardware assessed for use in SIL applications



Rev:

0

Device Tag:

TIB1

Date:

06-23-2023

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HBR9328

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Manuf.: . PNo:

PR Electronics: 5202B2

By:

JN



Uninterruptible power supply - QUINT-UPS/ 24DC/ 24DC/10 - 2320225

Input data

Input voltage	24 V DC
Nominal input voltage	24 V DC
Input voltage range	18 V DC ... 30 V DC
Current consumption (maximum)	19 A (maximum, mains operation)
Current consumption (charging process)	4 A (Charging, mains operation)
Fixed backup threshold	≤ 22 V DC
Variable connect threshold	1 V/0.1 s

Output data (24 V DC mains operation)

Nominal output voltage	24 V DC
Output voltage range (depends on the input voltage)	18 V DC ... 30 V DC
Nominal output current (I _N)	10 A (-25 °C ... 60 °C)
POWER BOOST (I _{Boost})	15 A (-25 °C ... 40 °C)
Selective Fuse Breaking (I _{SFB})	60 A (-25 °C ... 60 °C)

Output data (24 V DC battery operation)

Nominal output voltage	24 V DC
Output voltage range (depends on the input voltage)	19.2 V DC ... 27.6 V DC (U _{OUT} = U _{BAT} - 0.5 V DC)
Nominal output current (I _N)	10 A (-25 °C ... 60 °C)
POWER BOOST (I _{Boost})	15 A (-25 °C ... 40 °C)
Selective Fuse Breaking (I _{SFB})	65 A (-25 °C ... 60 °C)

Approvals

DNV GL / PRS / BV / LR / ABS / UL Listed / UL Recognized / cUL Recognized / cUL Listed / EAC / EAC / UL Recognized / LR / UL Listed / cUL Listed / cUL Recognized / ABS / PRS / DNV GL / BV / EAC / EAC

Ex Approvals

UL Listed / cUL Listed / UL Listed / cUL Listed



Rev: 0
Date: 06-23-2023
By: JN

Device Tag: UPS1
Job Number: HBR9328

Specifications

Nominal Voltage	12V		
Nominal Capacity (20HR)	15AH		
Dimension	Length	151mm (5.95 inches)	
	Width	98mm (3.86 inches)	
	Height	94mm (3.70 inches)	
	Total Height (with Terminal)	100mm (3.94 inches)	
Approximate Weight	4.25 kg (9.37 lbs)		
Battery Type	Valve Regulated Lead-Acid Battery, AGM Design		
Terminal Type	T2		
Rated Capacity	14.0AH	(20hr, 1.75V/cell, 25°C/77°F)	
	12.8AH	(10hr, 1.75V/cell, 25°C/77°F)	
	12.1AH	(5hr, 1.75V/cell, 25°C/77°F)	
	12.1AH	(3hr, 1.60V/cell, 25°C/77°F)	
	10.4AH	(1hr, 1.60V/cell, 25°C/77°F)	
Max. Discharge Current	175A		
Internal Resistance	15mΩ		
Operating Temp. Range	Discharge:	-20°C (-4°F)~50°C (122°F)	
	Charge:	-20°C (-4°F)~50°C (122°F)	
	Storage:	-20°C (-4°F)~40°C (104°F)	
Nominal Operating Temp. Range	25±3°C (77±5°F)		
Container Material	ABS (Option: 94-HB & 94-V0 flame retardant case)		
Capacity affected by Temperature	40°C (104°F)	103%	
	25°C (77°F)	100%	
	0°C (32°F)	86%	
Self Discharge	SigmaTek SP series batteries may be stored for up to 6 months at 25°C (77°F) and then a freshening charge is recommended. For higher temperatures the time interval will be shorter.		



Applications

- Uninterruptible Power Supply (UPS)
- Electric wheelchairs, scooters, bikes
- Electronic apparatus and equipment
- Alarm and security systems
- Emergency first responder equipment
- Emergency lighting
- Medical devices
- Electric carts
- Telecom equipment
- Switchgear
- Solar power systems



Constant Current Discharge (Amperes Per Battery) at 25°C (77°F)

F.V. (V/cell) \ Discharge Time	5min	10min	15min	30min	1h	2h	3h	5h	8h	10h	20h
1.60V	62.0	40.6	32.0	18.3	10.4	5.77	4.04	2.54	1.63	1.33	0.73
1.67V	60.0	39.8	31.3	18.2	10.3	5.70	3.97	2.50	1.61	1.32	0.72
1.70V	57.5	38.9	30.6	17.8	10.2	5.62	3.90	2.46	1.59	1.30	0.71
1.75V	54.5	37.5	29.9	17.5	10.0	5.54	3.83	2.42	1.56	1.28	0.70
1.80V	47.1	34.7	29.3	17.2	9.70	5.44	3.75	2.37	1.53	1.25	0.69

Constant Power Discharge (Watts Per Cell) at 25°C (77°F)

F.V. (V/cell) \ Discharge Time	5min	10min	15min	30min	1h	2h	3h	5h	8h	10h	20h
1.60V	112.7	73.9	56.9	33.3	19.1	10.6	7.48	4.75	2.88	2.52	1.28
1.67V	109.6	72.5	55.7	33.0	18.7	10.4	7.36	4.66	2.83	2.48	1.26
1.70V	104.7	70.8	54.9	32.6	18.2	10.2	7.32	4.60	2.80	2.45	1.25
1.75V	99.13	68.3	52.9	32.0	17.9	10.1	7.15	4.53	2.75	2.40	1.25
1.80V	85.66	63.1	50.5	31.5	17.6	9.83	6.96	4.45	2.68	2.36	1.23



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JN

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UPS1

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HBR9328

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Manuf.: . PNo:

SigmaTek: SP12-7.5 T2

PowerFlex® 525 AC Drive



50-005-075



PowerFlex® 525 AC Drives	
Power Ratings	100 - 120V: 0.4 to 1.1 kW / 0.5 to 1.5 Hp 380 - 480V: 0.4 to 22 kW / 0.5 to 30 Hp 200 - 240V: 0.4 to 2.2 kW / 0.5 to 20 Hp 525 - 600V: 0.4 to 22 kW / 0.5 to 30 Hp
Motor Control	Volts per Hertz Closed Loop Velocity Vector Control Sensorless Vector Control Permanent Magnet Motor Control
Application	Open Loop Speed Regulation Closed Loop Speed Regulation
Overload Capability	Normal Duty Application: 110% for 60 seconds, 150% for 3 sec Heavy Duty Application: 150% for 60 seconds, 180% for 3 sec (200% programmable)
Input Specification	1 Phase Voltage: 100 ... 120V/200 ... 240V Voltage: Adjustable 0V to rated motor voltage; -15% / +10% voltage tolerance 3 Phase Voltage: 200 ... 240V/380 ... 480V/525 ... 600V Frequency: 50 to 60 Hz Logic Control Ride Through: >0.5 seconds, 2 seconds typical 1/2 DC Bus operation (selectable) Maximum Short Circuit Rating: 100,000 amps symmetrical
Output Voltage Range	Adjustable 0V to rated motor voltage Intermittent Current: 150% for 60 seconds
Frequency Range	Max Output Frequency 500 Hz Input Frequency Variation 47 to 63 Hz
Ambient Operating Temperatures*	-20°C to 50°C (-4°F to 122°F) -20°C to 60°C (-4°F to 140°F) with current derating -20°C to 70°C (-4°F to 158°F) with current derating (with optional control module fan kit)
Altitude	1000 m (3280 ft) with derating guideline for up to max 4000 m (13,123 ft), with the exception of 600V at max 2000 m (6,561ft)
Enclosures	IP20 NEMA/Open IP30 NEMA/UL Type 1 (with conduit kit)
Mounting	DIN rail (frames A,B and C) Zero Stacking 50mm (1.96 in) air-flow gap at the top and bottom**
Configuration	Integral HIM, LCD, 5 digits, 16 segments, multi-language Connected Components Workbench Software Studio 5000™
Control I/O	7 Digital Inputs (24V DC, 6 programmable) 1 Analog Output (1 unipolar voltage or current) 2 Digital Outputs 2 Relays (1 form A relay & 1 form B relay; 24V DC, 120V AC, 240V AC) 2 Analog Inputs (1 bipolar voltage, 1 current)
Dynamic Braking	7th IGBT braking, DC braking
Carrier Frequency	2 to 16 kHz. 4 kHz default
EMC Filtering	Embedded 1 ph 240V and 3 ph 480V. Available as an external option for all voltages
Safety	Embedded ISO 13849-1 SIL2/PLd Cat 3 Safe Torque-Off
Communications	Embedded EtherNet/IP port Integral RS485 with Modbus RTU/DSI Dual port EtherNet/IP option card PROFIBUS® DP option card DeviceNet option card
Feedback Types	Line Driver Type Encoder Quadrature (dual channel) or Single Channel -Single ended or differential (A, B channel); Duty cycle of 50%, +10% Pulse-Train Input (1 to 100kHz) -Configurable Input Voltage: 5VDC (±10%); 10-12VDC (±10%), or 24V DC (±15%) Allowance Pulse Frequency -DC to 250Kz Frequency controlled PWM Allowable Pulse Frequency
Protection	Fault history log, Password-lock security
Standards	UL TUV C-Tick Semi F47 ATEX CE Marine (RINA) RoHS ACS 156 CE cUL GOST-R KCC
Control Features	Flying start Fiber application specific features V/F ratioBus regulator PTC input compatible Process PID Position Control Common DC Bus Regulation with encoder feedback or analog input StepLogic™ functions (relays and timers) 1/2 DC Bus Operation



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Manuf.: PNo: Allen-Bradley: 25B-D010N104

PowerFlex 525 AC Drives

50/60Hz	Normal Duty (ND)		Heavy Duty (HD)		Output Current	Catalog No.	Frame Size
	HP	kW	HP	kW			
100-120V, 10 No Filter	0.5	0.4	0.5	0.4	2.5A	25B-V2P5N104	A
	1	0.75	1	0.75	4.8A	25B-V4P8N104	B
	1.5	1.1	1.5	1.1	6.0A	25B-V6P0N104	B
200-240V, 10 No Filter	0.5	0.4	0.5	0.4	2.5A	25B-A2P5N104	A
	1	0.75	1	0.75	4.8A	25B-A4P8N104	A
	2	1.5	2	1.5	8.0A	25B-A8P0N104	B
	3	2.2	3	2.2	11.0A	25B-A011N104	B
200-240V, 10 EMC Filter	0.5	0.4	0.5	0.4	2.5A	25B-A2P5N114	A
	1	0.75	1	0.75	4.8A	25B-A4P8N114	A
	2	1.5	2	1.5	8.0A	25B-A8P0N114	B
	3	2.2	3	2.2	11.0A	25B-A011N114	B
200-240V, 30 No Filter	0.5	0.4	0.5	0.4	2.5A	25B-B2P5N104	A
	1	0.75	1	0.75	5.0A	25B-B5P0N104	A
	2	1.5	2	1.5	8.0A	25B-B8P0N104	A
	3	2.2	3	2.2	11.0A	25B-B011N104	A
	5	4	5	4	17.5A	25B-B017N104	B
	7.5	5.5	7.5	5.5	24.0A	25B-B024N104	C
	10	7.5	10	7.5	32.2A	25B-B032N104	D
	15	11	15	11	48.3A	25B-B048N104	E
380-480V, 30 No Filter	0.5	0.4	0.5	0.4	1.4A	25B-D1P4N104	A
	1	0.75	1	0.75	2.3A	25B-D2P3N104	A
	2	1.5	2	1.5	4.0A	25B-D4P0N104	A
	3	2.2	3	2.2	6.0A	25B-D6P0N104	A
	5	4	5	4	10.5A	25B-D010N104	B
	7.5	5.5	7.5	5.5	13.0A	25B-D013N104	C
	10	7.5	10	7.5	17.0A	25B-D017N104	C
	15	11	15	11	24A	25B-D024N104	D
	20	15	15	11	30A	25B-D030N104	D
	25	18.5	20	15	37A	25B-D037N114*	E
380-480V, 30 EMC Filter	0.5	0.4	0.5	0.4	1.4A	25B-D1P4N114	A
	1	0.75	1	0.75	2.3A	25B-D2P3N114	A
	2	1.5	2	1.5	4.0A	25B-D4P0N114	A
	3	2.2	3	2.2	6.0A	25B-D6P0N114	A
	5	4	5	4	10.5A	25B-D010N114	B
	7.5	5.5	7.5	5.5	13.0A	25B-D013N114	C
	10	7.5	10	7.5	17.0A	25B-D017N114	C
	15	11	15	11	24A	25B-D024N114	D
	20	15	15	11	30A	25B-D030N114	D
	25	18.5	20	15	37A	25B-D037N114	E
525-600V, 30 No Filter	0.5	0.4	0.5	0.4	0.9A	25B-E0P9N104	A
	1	0.75	1	0.75	1.7A	25B-E1P7N104	A
	2	1.5	2	1.5	3.0A	25B-E3P0N104	A
	3	2.2	3	2.2	4.2A	25B-E4P2N104	A
	5	4	5	4	6.6A	25B-E6P6N104	B
	7.5	5.5	7.5	5.5	9.9A	25B-E9P9N104	C
	10	7.5	10	7.5	12.0A	25B-E012N104	C
	15	11	15	11	19.0A	25B-E019N104	D
	20	15	15	11	22.0A	25B-E022N104	D
	25	18.5	20	15	27.0A	25B-E027N104	E
30	22	25	18.5	32.0A	25B-E032N104	E	

Dimensions mm (in)	Frame A: 152 (5.98) H x 72 (2.83) W x 172 (6.77) D
	Frame B: 180 (7.08) H x 87 (3.42) W x 172 (6.77) D
	Frame C: 220 (8.66) H x 109 (4.29) W x 184 (7.24) D
	Frame D: 260 (10.23) H x 130 (5.11) W x 212 (8.34) D
	Frame E: 300 (11.81) H x 185 (7.28) W x 279 (10.98) D



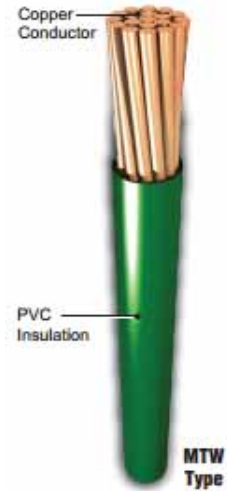
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By: JN	Job Number: HBR9328	Page # 2/2

Manuf.: PNO: Allen-Bradley: 25B-D010N104

50-005-075

Wire – MTW Type

- CONDUCTORS:**
 - 22 AWG - 8AWG Stranded Tinned Copper per ASTM B-33
 - 22 AWG - 10 AWG Solid Tinned Copper per ASTM M-33
- INSULATION:**
 - Color-Coded Polyvinyl Chloride (PVC)
- TEMPERATURE RANGE/
VOLTAGE RATING:**
 - UL 1011/1015/1028/BC-5W2: 105°C/600V
 - UL MTW: 90°C/600V
 - CSA AWM I A/B & TEW: 105°C/600V
- FLAME COMPLIANCES:**
 - UL VW-1
 - CSA FT-1
- INDUSTRY APPROVALS:**
 - UL Standard 758 - Styles 1011/1015/1028/1032/1230/1231/1335/1344
 - UL Standard 1063 - MTW
 - UL Standard 1426 - BC-5W2: 16 AWG - 8 AWG
 - CSA AWM I A/B & TEW
 - UL THHW
 - UL CT Tray Rated
 - SAE J378
- STANDARD COLORS:**
 - Black, Orange, Blue, Violet, White, Yellow, Brown, Green/Yellow, Red, Green, Gray
- OPTIONS:**
 - Stripes available upon request (minimums may apply)
 - Other copper constructions available upon request (minimums may apply)



51-000-062

Catalog Number	Description
F22027	22 AWG (7/.0096) TC AWM 1015
F20037	20 AWG (10/30) TC AWM 1015
F18054	18 AWG (16/30) TC AWM 1015
F16032	16 AWG (26/30) TC AWM 1015
F14037	14 AWG (41/30) TC AWM 1015
F12024	12 AWG (65/30) TC AWM 1015
F10012	10 AWG (105/30) TC AWM 1015
F08010	8 AWG (7X19/29) TC AWM 1028

TEW/MTW Wire (Tinned Copper) Applications:

► This tinned copper hook up wire may be used for wiring of machine tools, appliances, and control cabinets.



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By: JN		

Manuf.: . PNo: EleMech: 51-000-062

Polyurethane Tubing



94-255-009



Specifications

Operating Fluid	Air, Water
Max. Operating Pressure	115 psi (0.8MPa) at 68°F (20°C)
Burst Pressure	Refer to burst pressure characteristic chart
Operating Temperature	Air: -4° to 140°F (-20° to 60°C) Water: 40° to 105°F (5° to 40°C)
Material	Polyurethane
Hardness	Shore A 95

Dimensions

Inch	Series TIUB						
	Model	TIUB01	TIUB05	TIUB07	TIUB11	TIUB13	
Tube OD (Inches)	1/8	5/32	3/16	1/4	5/16	3/8	1/2
Tube ID (Inches)	0.08	0.1	0.13	0.17	0.2	0.25	0.33
Min. bending radius (Inches)	0.39	0.39	0.6	0.91	0.79	1.06	1.38

How To Order

TIUB 05 BU - 33

Polyurethane → (under TIUB)
 Inch Size → (under 05)
 *Color Indication → (under BU)
 Length Per Roll → (under 33)

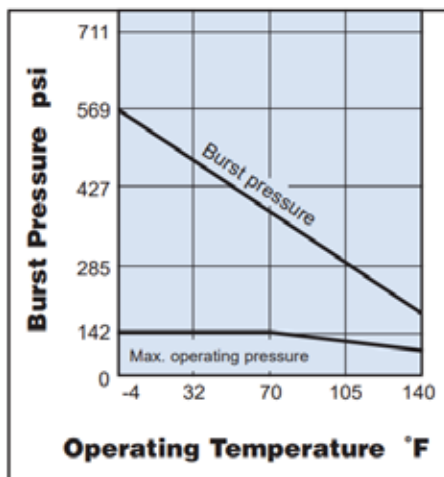
Symbol	Tube Size
01	1/8
See Note*	5/32
05	3/16
07	1/4
See Note*	5/16
11	3/8
13	1/2

Symbol	Color
B	Black
W	White
R	Red
BU	Blue
Y	Yellow
G	Green
C	Clear
YR	Orange

Symbol	Roll Size
20	66ft
33 ¹	100ft
153 ¹	500ft
305 ¹	1000ft

Longer lengths available upon request
¹ Stocked item

Burst Pressure Characteristics Chart



Caution

1. Can be used with general industrial water. For other fluids, please consult SMC.
2. Max. operating pressure and minimum bending radius are measured at 68°F.
3. When using tubing with SMC fittings, the chemical resistance of the fitting has to be investigated as well.



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Manuf.: . PNO: SMC USA: TIUB11BU-33

Stainless Steel 316 One-touch Fittings *Series KQG2*



Applicable Tube: Inch Size, Connection Thread: UNF, NPT

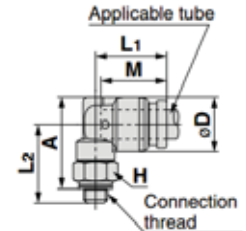
Male Elbow: KQG2L

Applicable tube O.D. (inch)	Connection thread UNF, NPT	Model	H (Width across flat)	Note 1) ϕD	L1	L2	A*	M	Note 2) Effective area (mm ²)	Weight (g)
$\phi 1/8"$	10-32UNF	KQG2L01-32	8	8.3	13.1	14.8	16	12	2.6	6.3
	1/8	KQG2L01-N01S	12		13.6	14.9	15.8		3	9
	1/4	KQG2L01-N02S	14		18.7	18.4	16.7			
$\phi 5/32"$	10-32UNF	KQG2L03-32	8	9.1	13.7	15.2	16.8	12.6	3.5	6.9
	1/8	KQG2L03-N01S	12		14.4	15.3	16.6		4.2	9.9
	1/4	KQG2L03-N02S	14		19.1	19.2	17.6			
$\phi 1/4"$	10-32UNF	KQG2L07-32	8	11.7	14.7	16.5	19.3	13.5	3.5	8.9
	1/8	KQG2L07-N01S	12		16.6	19.2	11.7			
	1/4	KQG2L07-N02S	14		15.9	20.4	21.8		19.4	
	3/8	KQG2L07-N03S	19		22.2	23.3	34.2			
$\phi 5/16"$	1/8	KQG2L09-N01S	12	13.7	18.6	18.3	21.9	16.1	21.6	15.1
	1/4	KQG2L09-N02S	14		19.1	21.5	23.9		21.1	
	3/8	KQG2L09-N03S	19		23.3	25.4	35.7			
$\phi 3/8"$	1/8	KQG2L11-N01S	12	16	20	19.4	24.2	16.6	21.6	19.7
	1/4	KQG2L11-N02S	14		22.6	26.2	23.2			
	3/8	KQG2L11-N03S	19		21	24.4	27.7		36.7	
	1/2	KQG2L11-N04S	22		28.2	29.8	60.2			
$\phi 1/2"$	1/4	KQG2L13-N02S	14	19.6	22.7	24.4	29.8	18.5	50.2	29.4
	3/8	KQG2L13-N03S	19		23.7	26.1	31.2		39.2	
	1/2	KQG2L13-N04S	22		29.9	33.3	61.3			

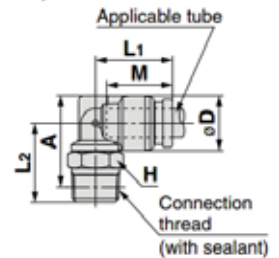
* Reference dimensions after installation of NPT thread
 Note 1) ϕD is maximum diameter.
 Note 2) Value of FEP tube.



(10-32UNF)



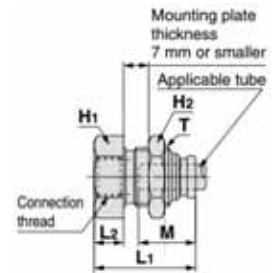
(NPT)



Bulkhead Connector: KQG2E

Applicable tube O.D. (inch)	Connection thread NPT	Model	T (UNF)	Width across flat		L1	L2	Mounting hole	M	Note) Effective area (mm ²)	Weight (g)
				H1	H2						
$\phi 1/8"$	1/4	KQG2E01-N02	7/16-20UNF	17	14	32.8	15.3	12.5	12	3.4	30.6
$\phi 5/32"$	1/4	KQG2E03-N02	7/16-20UNF	17	14	32.6	15.3	12.5	12.6	5.6	30.1
$\phi 1/4"$	1/4	KQG2E07-N02	1/2-20UNF	17	17	32.7	14.8	14	13.5	13.1	32.6
$\phi 5/16"$	3/8	KQG2E09-N03	5/8-18UNF	19	19	35	15.1	17	16.1	26.1	38.2
$\phi 3/8"$	3/8	KQG2E11-N03	3/4-16UNF	21	22	33.8	13.3	20.5	16.6	41.5	51.7
$\phi 1/2"$	3/8	KQG2E13-N03	7/8-14UNF	24	26	34.6	12.3	23.5	18.5	58.3	73.2
	1/2	KQG2E13-N04				41.4	19.1				74.7

Note) Value of FEP tube.



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BU2

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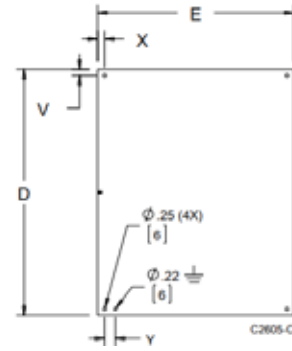
Manuf.: PNo:

SMC USA: KQG2E11-N03

94-255-042

PANELS FOR JUNCTION BOXES

SUB-PANEL CATALOG NUMBER	SUB-PANEL DIMENSIONS (IN.)
A-DPESS	D x E



11-035-129

NOTE:

1. 6 indicates 316 Stainless Steel.
2. AL indicates Aluminum
3. G indicates Conductive Steel

Catalog Number	Material	Panel Size D x E (in.)	Panel Size D x E (mm)	V (in.)	V (mm)	X (in.)	X (mm)	Y (in.)	Y (mm)
A4P4G	Conductive	2.88 x 2.88	73 x 73	.31	8	.31	8	1.25	32
A6P4	Painted steel	4.88 x 2.88	124 x 73	.31	8	.31	8	1.25	32
A6P4G	Conductive steel	4.88 x 2.88	124 x 73	.31	8	.31	8	1.25	32
A6P4SS	Stainless Steel	4.88 x 2.88	124 x 73	.31	8	.31	8	1.25	32
A6P4AL	Aluminum	4.88 x 2.88	124 x 73	.31	8	.31	8	1.25	32
A6P6	Painted steel	4.88 x 4.88	124 x 124	.31	8	.31	8	1.25	32
A6P6G	Conductive steel	4.88 x 4.88	124 x 124	.31	8	.31	8	1.25	32
A6P6SS	Stainless Steel	4.88 x 4.88	124 x 124	.31	8	.31	8	1.25	32
A6P6AL	Aluminum	4.88 x 4.88	124 x 124	.31	8	.31	8	1.25	32
A7P7G	Conductive	5.88 x 5.88	149 x 149	.31	8	.31	8	1.25	32
A8P6	Painted steel	6.75 x 4.88	171 x 124	.25	6	.31	8	1.25	32
A8P6G	Conductive steel	6.75 x 4.88	171 x 124	.25	6	.31	8	1.25	32
A8P6SS	Stainless Steel	6.75 x 4.88	171 x 124	.25	6	.31	8	1.25	32
A8P6AL	Aluminum	6.75 x 4.88	171 x 124	.25	6	.31	8	1.25	32
A8P8	Painted steel	6.75 x 6.88	171 x 175	.25	6	.31	8	1.25	32
A8P8G	Conductive Steel	6.75 x 6.88	171 x 175	.25	6	.31	8	1.25	32
A8P8AL	Aluminum	6.75 x 6.88	171 x 175	.25	6	.31	8	1.25	32
A9P6G	Conductive	7.38 x 4.63	187 x 118	.31	8	.31	8	1.25	32
A10P8	Painted steel	8.75 x 6.88	222 x 175	.25	6	.31	8	1.25	32
A10P8G	Conductive steel	8.75 x 6.88	222 x 175	.25	6	.31	8	1.25	32
A10P8SS	Stainless Steel	8.75 x 6.88	222 x 175	.25	6	.31	8	1.25	32
A10P8AL	Aluminum	8.75 x 6.88	222 x 175	.25	6	.31	8	1.25	32
A10P10	Painted steel	8.75 x 8.88	222 x 226	.25	6	.31	8	1.25	32
A10P10G	Conductive steel	8.75 x 8.88	222 x 226	.25	6	.31	8	1.25	32
A10P10AL	Aluminum	8.75 x 8.88	222 x 226	.25	6	.31	8	1.25	32
A12P6	Painted steel	10.75 x 4.88	273 x 124	.25	6	.31	8	1.25	32
A12P6G	Conductive steel	10.75 x 4.88	273 x 124	.25	6	.31	8	1.25	32
A12P10	Painted steel	10.75 x 8.88	273 x 226	.25	6	.31	8	1.25	32
A12P10G	Conductive steel	10.75 x 8.88	273 x 226	.25	6	.31	8	1.25	32
A12P10SS	Stainless Steel	10.75 x 8.88	273 x 226	.25	6	.31	8	1.25	32
A12P10AL	Aluminum	10.75 x 8.88	273 x 226	.25	6	.31	8	1.25	32
A12P12	Painted steel	10.75 x 10.88	273 x 276	.25	6	.31	8	1.25	32
A12P12G	Conductive steel	10.75 x 10.88	273 x 276	.25	6	.31	8	1.25	32
A12P12SS	Stainless Steel	10.75 x 10.88	273 x 276	.25	6	.31	8	1.25	32
A14P8	Painted steel	12.75 x 6.88	324 x 175	.25	6	.31	8	1.25	32
A14P8G	Conductive steel	12.75 x 6.88	324 x 175	.25	6	.31	8	1.25	32
A14P12	Painted steel	12.75 x 10.88	324 x 276	.25	6	.31	8	1.25	32
A14P12G	Conductive steel	12.75 x 10.88	324 x 276	.25	6	.31	8	1.25	32
A14P12SS	Stainless Steel	12.75 x 10.88	324 x 276	.25	6	.31	8	1.25	32
A14P12AL	Aluminum	12.75 x 10.88	324 x 276	.25	6	.31	8	1.25	32
A16P10	Painted steel	14.75 x 8.88	375 x 226	.25	6	.31	8	1.25	32
A16P10G	Conductive steel	14.75 x 8.88	375 x 226	.25	6	.31	8	1.25	32
A16P14	Painted steel	14.75 x 12.88	375 x 327	.25	6	.31	8	1.25	32
A16P14G	Conductive steel	14.75 x 12.88	375 x 327	.25	6	.31	8	1.25	32
A16P14SS	Stainless Steel	14.75 x 12.88	375 x 327	.25	6	.31	8	1.25	32
A16P14AL	Aluminum	14.75 x 12.88	375 x 327	.25	6	.31	8	1.25	32
A18P16	Painted steel	16.75 x 14.88	425 x 378	.25	6	.31	8	1.25	32
A18P16G	Conductive steel	16.75 x 14.88	425 x 378	.25	6	.31	8	1.25	32
A18P16SS	Stainless Steel	16.75 x 14.88	425 x 378	.25	6	.31	8	1.25	32
A18P16AL	Aluminum	16.75 x 14.88	425 x 378	.25	6	.31	8	1.25	32
A20P16J	Painted	18.75 x 14.88	476 x 378	.47	12	.54	14	.81	21
A20P16JAL	Aluminum	18.75 x 14.88	476 x 378	.47	12	.54	14	.81	21

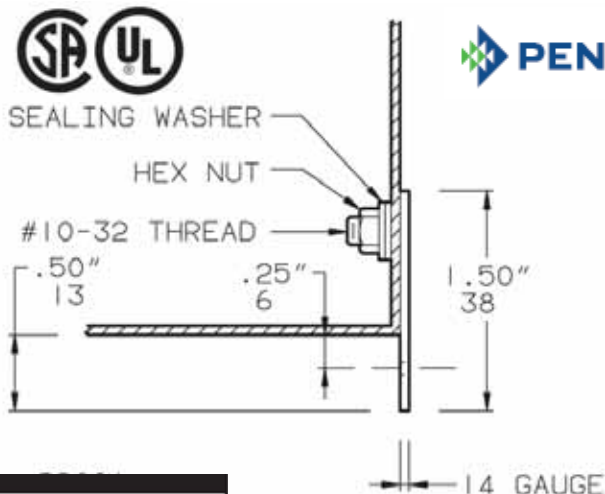


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By: JN

Device Tag:
EN1
Job Number:
HBR9328

Mounting Bracket Kits

Mounting bracket kits DMFK1 and DMFK2 include two 14 gauge steel external mounting brackets and fasteners. Mounting bracket kit CMFK and CMFKSS each contain four 12 gauge steel or Type 304 stainless steel external mounting brackets and fasteners. Sealing washers are provided with each kit to maintain Type 4 or 12 rating after installation. Steel mounting brackets are zinc plated with clear chromate finish.



11-035-176

Catalog Number	Description
† DMFK1	Mounting bracket kit
† DMFK2	Mounting bracket kit
† CMFK	Steel mounting bracket kit
†† CMFKSS	Stainless steel mounting bracket kit
†† CMTGFT	Composite mounting bracket kit

† Maintains UL/CSA Type 4 and Type 12.

†† Maintains UL/CSA Type 4 Type 4X, and Type 12.



Fiberglass Mounting Bracket Kit

Catalog Number	Bulletin Number
A50MFKR	A50Y



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EN1

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Manuf.: PNo:

Hoffman: A-50MFKR

ENCLOSURE CATALOG NUMBER	ENCLOSURE DIMENSIONS (IN.)	SUB-PANEL CATALOG NUMBER
A-ABCJFGQRPWR	A x B x C	A APB

NOTE: 1. PWR indicates with window cover.
2. R indicates with solid cover.



INDUSTRY STANDARDS

Mounting brackets required to meet UL/CSA external mounting requirements.

UL 508A Listed; Type 3, 3R, 4, 4X, 12, 13; File No. E61997
cUL Listed per CSA C22.2 No 94; Type 3, 3R, 4, 4X, 12, 13;
File No. E61997
Enclosure flammability evaluated per UL 508A
Window flammability evaluated per UL 508A

NEMA/EEMAC Type 3, 3R, 4, 4X, 12, 13
CSA File No. 42186: Type 3R, 4, 4X, 12
IEC 60529, IP66
Meets NEMA Type 3RX requirements

APPLICATION

Able to withstand harsh environments, these small enclosures feature a simple, traditional non-metallic design that is suitable for a broad range of applications.

SPECIFICATIONS

- Compression-molded fiberglass material has excellent temperature and chemical resistance qualities and exhibits outstanding physical properties
- Fiberglass material is easily punched, drilled, filed or sawed
- Seamless foam-in-place gasket assures water-tight and dust-tight seal
- Threaded internal bosses provided for mounting optional panels and terminal block kits

- Scratch-resistant polycarbonate windows are permanently bonded in place
- Screw-cover enclosures have easily removable covers attached to body with internal plated steel hinges. Cover securely fastens to the body with four captivated Type 316 stainless steel cover screws.
- Enclosures with quick-release latches have corrosion-resistant polyester hinges and polyester latches with a Type 316L stainless steel bail. Attached with Type 316 stainless steel screws. A Type 316L stainless steel padlock hasp is furnished with each enclosure.
- Sealing washers are furnished with enclosure

FINISH

Fiberglass material is light-gray inside and out. Optional steel panels are painted white. Optional stainless steel, aluminum and composite panels are unpainted.

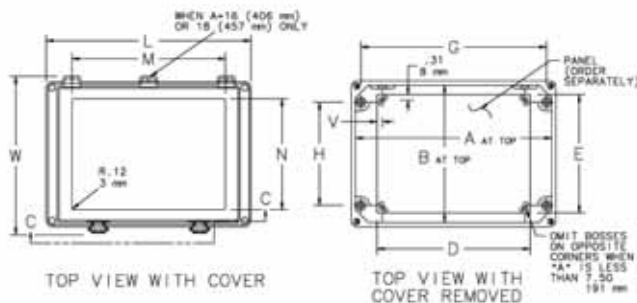
ACCESSORIES

See also *Accessories*.
H2OMIT® Vent Drains, Type 4X
HOL-SEALERS™ Non-Metallic Hole Seals
Panels for Junction Boxes

MODIFICATION AND CUSTOMIZATION

Hoffman excels at modifying and customizing products to your specifications. Contact your local Hoffman sales office or distributor for complete information.

BULLETIN: A50



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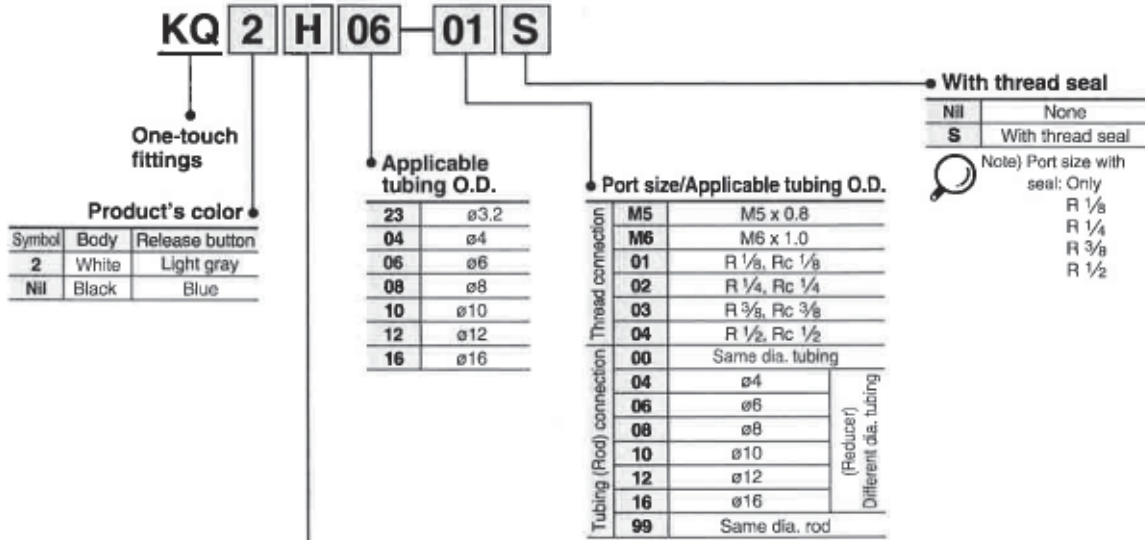
Manuf.: . PNO: Hoffman: A-18149JFGQRPWR

One-touch Fittings Series KQ2

Applicable Tubing: Metric Size
Connection Thread: M, R, Rc



94-255-020



Model

H	Male connector	T	Male branch tee
	Straight union		Union tee
	Different diameter straight		Different diameter tee * Note)
S	Hex. socket head male connector	TW	Cross*
F	Female connector	TX	Different diameter cross*
L	Male elbow	TY	Different diameter cross*
	Union elbow	Y	Male run tee
	Plug-in elbow	D	Male delta union
	Reducer elbow		Delta union
LU	Male branch connector	U	Branch
	Branch union elbow		Union "Y"
	45° male elbow		Different dia. union "Y"
K	45° male elbow	U	Plug-in "Y"
V	Universal male elbow		Delta branch
VS	Hexagon socket head universal male elbow	UD	Different dia. double union "Y"
VF	Universal female elbow	XD	Double plug-in "Y"
LF	Female elbow	X	Different diameter plug-in "Y"
VD	Double universal male elbow	R	Plug-in reducer
VT	Triple universal male elbow	E	Bulkhead union
Z	Branch universal male elbow		Bulkhead connector
ZF	Branch universal female elbow	LE	Bulkhead male elbow
ZD	Double branch universal male elbow		
ZT	Triple branch universal male elbow		
W	Extended plug-in elbow		
	Extended male elbow		

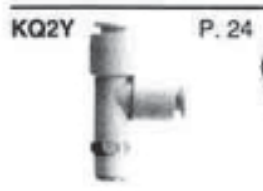
Accessory

Symbol	Name
	Nipple
KQ2N	Reducer nipple
	Adaptor
KQ2C	Tube cap
KQ2C	Color cap
KQ2P	Plug (White)
KQP	Plug (Blue)

Use the below part number to order the gasket for M5 and M6 threads.
Gasket for M5 thread: M-5G2
Gasket for M6 thread: M-6G

* Available only for white color body.
Note) KQT06-04, KQT08-06, KQT10-08, and KQT12-10 are available as made to order.

Male run tee



Use to branch line in the same direction from female thread and in 90° direction.

Applicable tubing O.D. (inch)	Connection thread NPT	Model	H (Width across flats)	Note) øD1	øD2	L1	L2	A *	M	Min. port size	Weight (g)
3/8	1/4	KQ2Y11-35S	17.46	17.9	17	25.5	29.5	49	21	7	29
	3/8	KQ2Y11-36S	22.23				31.5	51			38
	1/2	KQ2Y11-37S	22.23				35.5	53			64



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Manuf.: PNo: SMC USA: KQ2Y11-36AS



One-Touch Fittings

Manufacturing Pneumatics Worldwide



94-255-048

Series KQ2

Applicable Tubing: Metric Size



Threaded Type

KQ2 H 07 - 34 A S

Model

H	Male Connector
S	Hexagon Socket Head Male Connector
F	Female Union
L	Male Elbow
K	45 Degree Male Elbow
V	Universal Male
VS	Hexagon Socket Head Universal Male Elbow
VF	Universal Female Elbow
LF	Female Elbow
VD	Double Universal Male Elbow
VT	Triple Universal Male Elbow
Z	Branch Universal Male Elbow
ZD	Double Branch Universal Male Elbow
ZT	Triple Branch Universal Male Elbow
W	Extended Male Elbow
T	Male Branch Tee
Y	Male Run Tee
U	Branch "Y"
X	Different Diameter Plug In "Y"
E	Bulkhead Union Bulkhead Connector
LE	Bulkhead Union Elbow
N	Reducer Nipple

• Tube O.D.

01	1/8"
03	5/32"
05	3/16"
07	1/4"
09	5/16"
11	3/8"
13	1/2"

• Applicable Thread Type

32	10-32UNF
33	NPT 1/16
34	NPT 1/8
35	NPT 1/4
36	NPT 3/8
37	NPT 1/2
*00	Same Diameter Tubing

*Only for "Bulkhead union" and "Bulkhead union elbow"

• Thread Sealing Method

S	With Thread Sealant
----------	---------------------

• Thread Material/Plating

A	Brass
N	Electroless Nickel Plated Brass
<input type="checkbox"/> J	Interchangeable with KJE



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JN

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FIT

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Manuf.: . PNo:

SMC USA: KQ2VD11-35AS



One-Touch Fittings

Manufacturing Pneumatics Worldwide



94-255-049

Series KQ2

Applicable Tubing: Metric Size



Threaded Type

KQ2 H 07 - 34 A S

Model

H	Male Connector
S	Hexagon Socket Head Male Connector
F	Female Union
L	Male Elbow
K	45 Degree Male Elbow
V	Universal Male
VS	Hexagon Socket Head Universal Male Elbow
VF	Universal Female Elbow
LF	Female Elbow
VD	Double Universal Male Elbow
VT	Triple Universal Male Elbow
Z	Branch Universal Male Elbow
ZD	Double Branch Universal Male Elbow
ZT	Triple Branch Universal Male Elbow
W	Extended Male Elbow
T	Male Branch Tee
Y	Male Run Tee
U	Branch "Y"
X	Different Diameter Plug In "Y"
E	Bulkhead Union Bulkhead Connector
LE	Bulkhead Union Elbow
N	Reducer Nipple

• Tube O.D.

01	1/8"
03	5/32"
05	3/16"
07	1/4"
09	5/16"
11	3/8"
13	1/2"

• Applicable Thread Type

32	10-32UNF
33	NPT 1/16
34	NPT 1/8
35	NPT 1/4
36	NPT 3/8
37	NPT 1/2
*00	Same Diameter Tubing

*Only for "Bulkhead union" and "Bulkhead union elbow"

• Thread Sealing Method

S	With Thread Sealant
----------	---------------------

• Thread Material/Plating

A	Brass
N	Electroless Nickel Plated Brass
<input type="checkbox"/> J	Interchangeable with KJE



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JN

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FIT

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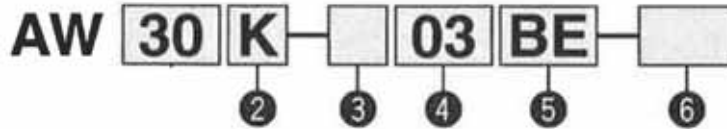
Manuf.: . PNo:

SMC USA: KQ2L11-35AS

Modular Type Filter Regulators



94-2555-004



②	With backflow mechanism	Nil	Without backflow mechanism	
		K (Note 1)	With backflow mechanism	
+				
③	Thread type	Nil	Rc	
		N (Note 2)	NPT	
		F (Note 3)	G	
+				
④	Port size	02	1/4	
		03	3/8	
+				
⑤ Option	a	Mounting	Nil	Without mounting option
			B (Note 5)	With bracket
			H	With set nut (for panel fitting)
	+			
	b	Float type auto drain	Nil	Without auto drain
			C	Float type auto drain (N.C.)
			D	Float type auto drain (N.O.)
	+			
	c	Pressure gauge	Nil	Without pressure gauge
			E	Square embedded type pressure gauge (with limit indicator)
			G	Round type pressure switch (without limit indicator)
				Round type pressure switch (with limit indicator)
Digital pressure switch		E1 (Note 6)	Output: NPN output / Electrical entry: Wiring bottom entry	
		E2 (Note 6)	Output: NPN output / Electrical entry: Wiring top entry	
+				
d	Set pressure	Nil	0.05 to 0.85 MPa set	
		1 (Note 7)	0.02 to 0.2 MPa set	
+				
⑥ Semi-standard	e	Bowl	Nil	Polycarbonate bowl
			2	Metal bowl
			6	Nylon bowl
			8	Metal bowl with level gauge
+				
⑥ Semi-standard	f	Drain port (Note 8)	Nil	With drain cock
			J (Note 9)	Drain guide 1/8
				Drain guide 1/4
			W (Note 10)	Drain cock with barb fitting: For ø6 x ø4 nylon tube
+				
g	Exhaust mechanism	Nil	Relieving type	
		N	Non-relieving type	
+				
h	Flow direction	Nil	Flow direction: Left to right	
		R	Flow direction: Right to left	
+				
i	Pressure unit	Nil	Name plate, caution plate for bowl, and pressure gauge in imperial units: MPa	
		Z (Note 11)	Name plate, caution plate for bowl, and pressure gauge in imperial units (PSI, F)	
		ZA (Note 12)	Digital pressure switch: With unit switching function	



Rev:	0	Device Tag:	
Date:	06-23-2023	REG1	
By:	JN	Job Number:	Page #
		HBR9328	1/2

Manuf.: PNO: SMC USA: AW30-NO3BDE3-8Z

Standard Specifications

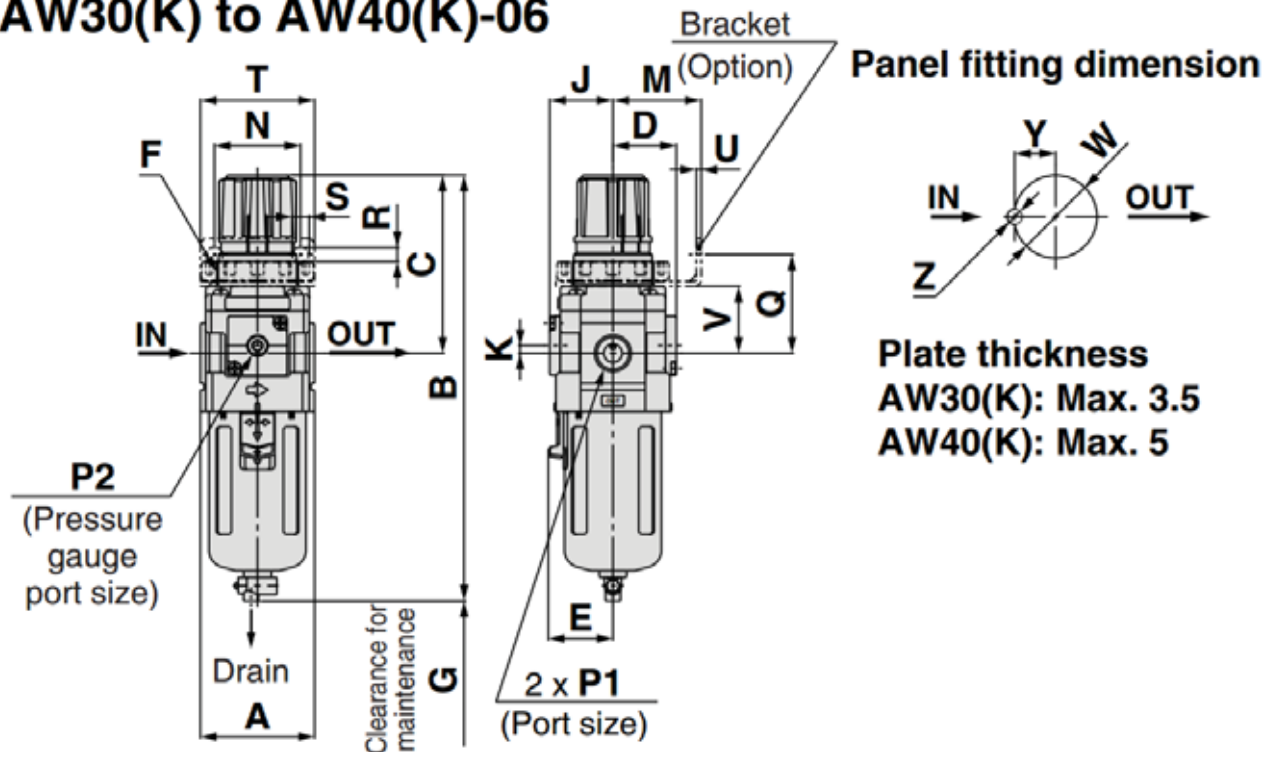


94-2555-004

Model	AW30(K)
Port size	1/4, 3/8
Pressure gauge port size ^{Note 1)}	1/8
Fluid	Air
Ambient and fluid temperature ^{Note 3)}	-5 to 60°C
Proof pressure	1.5 MPa
Maximum operating pressure	1.0 MPa
Set pressure range	0.05 to 0.85 MPa
Relief pressure	Set pressure + 0.05 MPa
Nominal filtration rating	5 m
Drain capacity (cm ³)	25
Bowl material	Polycarbonate
Bowl guard	Standard
Construction	Relieving type
Weight (kg)	0.40

Model	Standard specifications												Optional specifications				
	P1	P2	A	B ^{Note)}	C	D	E	F	G	J	K	H	J	H	J		
AW30(K)	1/4, 3/8	1/8	53	201	86	29.5	30	M38 x 1.5	55	29.5	3.5	□28	30.5	□27.8	41	φ37.5	66

AW30(K) to AW40(K)-06



Manuf.: PNo: SMC USA: AW30-NO3BDE3-8Z

Rev: 0
 Date: 06-23-2023
 By: JN

Device Tag: REG1
 Job Number: HBR9328
 Page #: 2/2

Silencer
Compact Resin Type/Male Thread
Series AN05 to 40



74-255-004



AN 20 - 02

Body size

Symbol
05
10
15
20
30
40

Thread type

	M thread	R
Nll		
N		NPT

Thread connection port size

Symbol	Port size	Applicable model
M5	M5 x 0.8	AN05
01	1/8	AN10
02	1/4	AN15/20
03	3/8	AN30
04	1/2	AN40

Specifications

Fluid	Compressed air
Max. operating pressure ^{Note 1)}	145psi (1.0 MPa)
Noise reduction	30 dB(A) ^{Note 2)}
Ambient and fluid temperature	41 to 140°F (5 to 60°C) ^{Note 3)}

Note 1) It indicates the inlet pressure for solenoid valve.

Note 2) The value may vary, depending on the pneumatic circuit or pressure that is exhausted from the solenoid valve.

Note 3) The product can be used in temperatures 14 to 140°F (-10 to 60°C) if there is no risk of water droplets forming and freezing.

Performance

Model	Effective area mm ²	Sonic conductance C [dm ³ /(s·bar)]	Recommended flow m ³ /min(ANR)	Weight g
AN05-M5	5	1	0.4 or less	0.5
AN10-01	10	2	0.8 or less	1
AN15-02	15	3	1.0 or less	2.5
AN20-02	35	7	3.0 or less	4
AN30-03	60	12	5.0 or less	5.5
AN40-04	90	18	8.0 or less	8.5

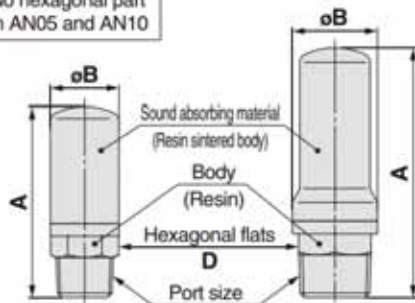
Note) Recommended flow rate is the flow at 72.5psi (0.5 MPa) in the inlet pressure.

Construction/Parts/Dimensions

AN05/10/20

AN15/30/40

No hexagonal part
in AN05 and AN10



Dimensions (mm)

Model	Port size R, NPT	A	B	D
AN05-M5	M5 x 0.8	15	6.5	-
AN10-01	1/8	23	11	-
AN15-02	1/4	32	16	14
AN20-02	1/4	45	16.5	14
AN30-03	3/8	58.5	20	17
AN40-04	1/2	68	24	21



Rev: 0

Date: 06-23-2023

By: JN

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RV1

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HBR9328

Page # 1/1

Manuf.: . PNO:
SMC USA: AN20-NO2

Conforming to OSHA Standard Pressure Relief 3 Port Valve With Locking Holes



94-255-016

VHS **30** - **03** - **RZ** -

Pressure relief
3 port valve

Body size

Symbol	Standard port size
20	1/8
30	3/8
40	1/2
50	3/4

Thread type

Nil	Rc
N	NPT
F	G

Made to Order

Nil	Standard
X1	Body: Red
X502	Built-in silencer (EXH port)

Optional specifications

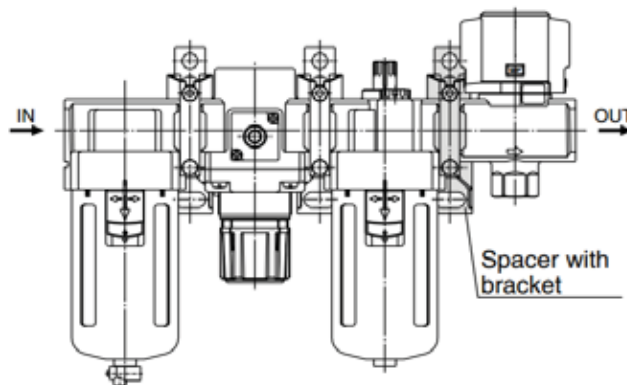
Symbol	Description
B	Knob color: Black
R	Flow direction: Right to left
Z ^{Note)}	PSI as unit displayed on label

Note) Only for the NPT thread.
Under the New Measurement Law,
products for overseas use only
(SI unit type for use in Japan).

Port size

Symbol	Port size	Body size			
		20	30	40	50
01	1/8	●	—	—	—
02	1/4	●	●	●	—
03	3/8	—	●	●	—
04	1/2	—	—	●	—
06	3/4	—	—	●	●
10	1	—	—	—	●

Pressure relief 3 port valve	Spacer part no.	Spacer with bracket part no.	Applicable air preparation equipment
VHS20	Y200	Y200T	AC20
VHS30	Y300	Y300T	AC25, AC30



Rev:

0

Device Tag:

RV1

Date:

06-23-2023

Job Number:

HBR9328

Page #

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Manuf.: PNo:

SMC USA: VHS30-N03-Z

By:

JN

Conforming to OSHA Standard Pressure Relief 3 Port Valve With Locking Holes



94-255-017

VHS **30** - **03** - **RZ** -

Pressure relief 3 port valve

Body size

Symbol	Standard port size
20	1/8
30	3/8
40	1/2
50	3/4

Thread type

Nil	Rc
N	NPT
F	G

Made to Order

Nil	Standard
X1	Body: Red
X502	Built-in silencer (EXH port)

Optional specifications

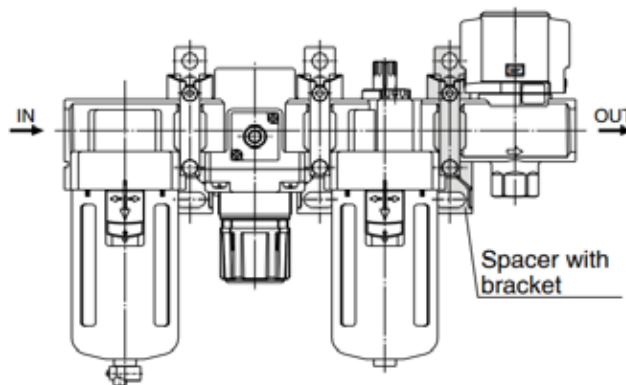
Symbol	Description
B	Knob color: Black
R	Flow direction: Right to left
Z ^{Note)}	PSI as unit displayed on label

Note) Only for the NPT thread.
Under the New Measurement Law,
products for overseas use only
(SI unit type for use in Japan).

Port size

Symbol	Port size	Body size			
		20	30	40	50
01	1/8	●	—	—	—
02	1/4	●	●	●	—
03	3/8	—	●	●	—
04	1/2	—	—	●	—
06	3/4	—	—	●	●
10	1	—	—	—	●

Pressure relief 3 port valve	Spacer part no.	Spacer with bracket part no.	Applicable air preparation equipment
VHS20	Y200	Y200T	AC20
VHS30	Y300	Y300T	AC25, AC30



Rev:

0

Device Tag:

RV1

Date:

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HBR9328

Page #

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Manuf.: PNo:

SMC USA: Y300T

By:

JN

5 Port Pilot Operated Solenoid Valve Metal Seal, Body Ported



Series VFS3000

Model

Type of actuation	Model		Port size Rc	Flow characteristics						Max. operating cycle (cpm) ⁽¹⁾	Response time (ms) ⁽²⁾	Mass (kg) ⁽³⁾	
	Plug-in	Non plug-in		1 → 4/2(P → A/B)			4/2 → 5/3(A/B → R1/R2)						
				C [dm ³ /(s·bar)]	b	Cv	C [dm ³ /(s·bar)]	b	Cv				
2 position	Single	VFS3120	VFS3130	1/4	5.0	0.20	1.1	6.8	0.30	1.7	1200	20 or less	0.33
				3/8	6.1	0.14	1.4	7.3	0.23	1.8			
	Double	VFS3220	VFS3230	1/4	5.0	0.20	1.1	6.8	0.3	1.7	1500	15 or less	0.43
				3/8	6.1	0.14	1.4	7.3	0.23	1.8			
3 position	Closed center	VFS3320	VFS3330	1/4	5.0	0.20	1.1	6.3	0.27	1.6	600	40 or less	0.45
				3/8	5.7	0.20	1.4	6.8	0.21	1.7			
	Exhaust center	VFS3420	VFS3430	1/4	4.9	0.24	1.1	6.5	0.28	1.6	600	40 or less	0.45
				3/8	5.8	0.15	1.4	7.0	0.22	1.7			
	Pressure center	VFS3520	VFS3530	1/4	4.9	0.23	1.1	6.6	0.28	1.6	600	40 or less	0.45
				3/8	6.5	0.15	1.6	7.0	0.23	1.7			

Note 1) Based on JIS B 8375 (once per 30 days) for the minimum operating frequency. Note 3) In the case of grommet type.
Note 2) Based on JIS B 8375-1981. (The value at supply pressure 0.5 MPa.) Note 4) Factors of "Note1)" and "Note 2)" are achieved in controlled clean air.

VFS3 1 20 - 1 G - 02 -

Symbol

- 1: 2 position single
- 2: position double
- 3: position closed center
- 4: position exhaust center
- 5: position pressure center

* Reverse pressure: Can be used by external pilot specifications.

Body (Pilot exhaust)

- 20: Individual EXH
- 30*: Common EXH

* Manifold only

Pilot type

Nil	Internal pilot
R*	External pilot

* Option. It will be an individual external pilot. (External pilot port: Body side. For 30 type, common external pilot (on manifold side).)

Thread type

Nil	Rc
N*	NPT
T*	NPTF
F*	G

* Option

Port size

02	Rc 1/4
03	Rc 3/8

Option

F: With foot bracket

* Mountable only for VFS3120.

Manual override

Nil: Non-locking push type (Flush)	A*: Non-locking push type (Extended)	B*: Locking type (Tool required)
------------------------------------	--------------------------------------	----------------------------------

* Option

Light/Surge voltage suppressor

Nil	None
Z	With light/surge voltage suppressor
S*	With surge voltage suppressor

* Grommet type is available only w/ surge voltage suppressor, not w/ indicator light.

Electrical entry

G: Grommet	E: Grommet terminal	T: Conduit terminal	D, Y: DIN terminal
------------	---------------------	---------------------	--------------------

Coil rated voltage

1	100 VAC (50/60 Hz)
2	200 VAC (50/60 Hz)
3 ^P	110 to 120 VAC (50/60 Hz)
4*	220 VAC (50/60 Hz)
5	24 VDC
6*	12 VDC
7*	240 VAC (50/60 Hz)
9*	Other

* Option



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Rev: 0

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SOV1

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Manuf.: . PNo:

SMC USA: VFS3120-3DZ-03T

74-255-006

Push-to-Connect Tube Fitting for Air

McMASTER-CARR

Adapter, for 3/8" Tube OD x 10 mm Tube OD

5779K259



94-215-004

For Use With	Air
Shape	Straight
Type	Adapter
Tube Connections	
Type	Push to Connect
Gender	Female
For Tube OD	
(A)	3/8"
(B)	10mm
Material	Nylon Plastic
Maximum Pressure	290 psi @ 72° F
Maximum Vacuum	28 in. of Hg @ 72° F
Temperature Range	0° to 170° F
For Tubing	Firm (Durometer A95) Polyurethane, Firm (Durometer D44) Polyethylene Plastic, and Hard (Durometer D62) Nylon Plastic
Release Ring	
Material	Plastic
Color	Black
Color	Black
Specifications Met	ISO 14743
RoHS	Compliant



Rev: 0

Date: 06-23-2023

By: JN

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SPARE

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Manuf.: . PNO:

McMaster-Carr: 5779K259



2.5 mm²/5 mm Width



4 mm²/6 mm Width



10 mm²/10 mm Width

16 mm²/12 mm Width

35 mm²/16 mm Width

42-063-000

Type	Part no.	Std. pack	Type	Part no.	Std. pack	Type	Part no.	Std. pack
Marking strips, unmarked			Marking strips, unmarked			10 mm²/10 mm Width		
9705 A/5/10	04.242.5053.0	25	9705 A/6/10	04.242.6053.0	25	10 mm²/10 mm Width		
Marking strips, marked			Marking strips, marked			marked for 5 blocks (every 2nd tag) *		
9705 A/5/9 B 1 - 9	04.842.4953.0	25	9705 A/5/9 B 1 - 9	04.842.5953.0	25	9705 A/5/10/5 B	04.842.5553.0	25
9705 A/5/10 B*	04.842.5053.0	25	9705 A/5/10 B*	04.842.6053.0	25			
9705 A/5/10 B 1 - 10	04.845.0153.0	25	9705 A/5/10 B 1 - 10	04.846.0153.0	25			
11 - 20	04.845.0253.0	25	11 - 20	04.846.0253.0	25			
21 - 30	04.845.0353.0	25	21 - 30	04.846.0353.0	25			
31 - 40	04.845.0453.0	25	31 - 40	04.846.0453.0	25	16 mm²/12 mm Width		
41 - 50	04.845.0553.0	25	41 - 50	04.846.0553.0	25	marked for 5 blocks (every 2nd tag) *		
51 - 60	04.845.0653.0	25	51 - 60	04.846.0653.0	25	9705 A/6/10/5 B	04.842.6553.0	25
61 - 70	04.845.0753.0	25	61 - 70	04.846.0753.0	25			
71 - 80	04.845.0853.0	25	71 - 80	04.846.0853.0	25			
81 - 90	04.845.0953.0	25	81 - 90	04.846.0953.0	25			
91 - 100	04.845.1053.0	25	91 - 100	04.846.1053.0	25	35 mm²/16 mm Width		
⊕ (10 x)	04.855.0053.0	25	⊕ (10 x)	04.856.0053.0	25	marked for 5 blocks (every 2nd tag) *		
± (10 x)	04.855.0153.0	25	± (10 x)	04.856.0153.0	25	9705 A/8/10/5 B	04.842.8553.0	25
+ (10 x)	04.855.0253.0	25	+ (10 x)	04.856.0253.0	25			
- (10 x)	04.855.0353.0	25	- (10 x)	04.856.0353.0	25			
L1 (10 x)	04.855.0453.0	25	L1 (10 x)	04.856.0453.0	25			
L2 (10 x)	04.855.0553.0	25	L2 (10 x)	04.856.0553.0	25			
L3 (10 x)	04.855.0653.0	25	L3 (10 x)	04.856.0653.0	25			
PE (10 x)	04.855.0753.0	25	PE (10 x)	04.856.0753.0	25			
SL (10 x)	04.855.3153.0	25	SL (10 x)	04.856.3153.0	25			
N (10 x)	04.855.3253.0	25	N (10 x)	04.856.3253.0	25			
F1 (10 x)	04.855.0953.0	25	F1 (10 x)	04.856.0953.0	25			
F2 (10 x)	04.855.1053.0	25	F2 (10 x)	04.856.1053.0	25			
L1, L2, L3, N, PE (2 x)	04.855.0853.0	25	L1, L2, L3, N, PE (2 x)	04.856.0853.0	25			
with enlarged marking area			with enlarged marking area					
9705 AL/5/10	04.242.5153.0	25	9705 AL/6/10	04.242.6353.0	25			
*Custom marking upon request			*Custom marking upon request			* indicate required marking with part no.		

<p>630-499-7080 · www.elemechinc.com</p>	Rev: 0	Device Tag: TB1	
	Date: 06-23-2023		
Manuf.: . PNo: Wieland: 04.242.6353-CUSTOM	By: JN	Job Number: HBR9328	Page # 1/1



Datasheet

Art.No. 07.311.0155.0

End plate AP 2,5 -4 V0

End plate for DIN rail terminal blocks type WK ..., color gray



Art.No.	07.311.0155.0
EAN	4015573392663
Order unit	10 pieces

Approvals

Technical data

General

Colour	Grey
Type of end plate	Yes
Type of partition	No
Thickness	1.5 mm
Snap in	Yes
Inflammability class of insulation material acc. with UL94	V0

Accessories

Type of end plate	Yes
Type of partition	No
Colour	Grey
Thickness	1.5 mm
Snap in	Yes
Inflammability class of insulation material acc. with UL94	V0



Rev: 0
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 Wieland: 07.311.0155.0

By: JN

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Feed-through blocks with screw connection

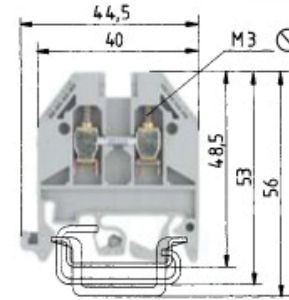
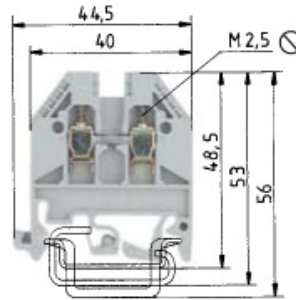
selosIOS



42-063-003

UL wire connection versions

- ⁴⁾ or 2x no. 14 sol/str AWG
or 2x no. 16 sol/str AWG
or 2x no. 18 sol/str AWG
or 3x no. 20 sol/str AWG or 3x no. 22 sol/str AWG
- ⁵⁾ or 2x no. 12 sol/str AWG
or 2x no. 16 sol/str AWG
or 3x no. 18 sol/str AWG or 3x no. 22 sol/str AWG
- ⁶⁾ or 2x no. 12 sol/str AWG
or 2x no. 14 sol/str AWG
or 3x no. 16 sol/str AWG



0344 Ex II 2GD IM2
Ex e I/II
EN 60947-7-1:2002
UL ratings
CSA ratings
KEMA 02 ATEX 2114 U¹⁾ EN 60079-0/EN 60079-7
Width
Approvals

Field/factory wiring
EN 60079-0/EN 60079-7
Wire strip length

WK 2,5/U

fine-stranded solid V A
0.5-2.5 mm² 0.5-4 mm² 800V/8 kV/3 24
No. 22-12 AWG 600V 20/30
No. 24-12 AWG 600V 25
0.5-2.5 mm² 0.5-4 mm² 690V 23
5 mm 9 mm

WK 4/U

fine-stranded solid V A
0.5-4 mm² 0.5-6 mm² 800V/8 kV/3 32
No. 22-10 AWG⁴⁾ 600V 30/35
No. 20-10 AWG 600V 40
0.5-4 mm² 0.5-6 mm² 690V 14/27⁶⁾
6 mm 9 mm



Feed-through block	gray	Type	Part No.	Std. Pack	Type	Part No.	Std. Pack
Feed-through block	gray	WK 2,5/U	57.503.0055.0	100	WK 4/U	57.504.0055.0	100
Feed-through block Ex i	blue	WK 2,5/U BLAU	57.503.0055.6	100	WK 4/U BLAU	57.504.0055.6	100
Accessories							
1. Mounting rail TS 35, DIN rail 7.5 mm high	L = 2 m	35 x 27 x 7,5 EN 60715	98.300.0000.0	1	35 x 27 x 7,5 EN 60715	98.300.0000.0	1
Mounting rail TS 35, DIN rail, 15 mm high	L = 2 m	35 x 24 x 15 EN 60715	98.360.0000.0	1	35 x 24 x 15 EN 60715	98.360.0000.0	1
Mounting rail TS 32, G rail ²⁾	L = 2 m	9006 EN 60715 G-32	98.190.0000.0	1	9006 EN 60715 G-32	98.190.0000.0	1
2. End clamp with U-foot ³⁾	10mm wide	WE 1/U	25.523.5753.0	100	WE 1/U	25.523.5753.0	100
End clamp TS 35, with screw	8mm wide	9708/2 S35	25.522.8553.0	100	9708/2 S35	25.522.8553.0	100
End clamp TS 35, without screw	8mm wide	WEF 1/35	25.523.9353.0	100	WEF 1/35	25.523.9353.0	100
3. End plate	gray	AP 2,5 - 4	07.311.0155.0	10	AP 2,5 - 4	07.311.0155.0	10
	blue	AP 2,5 - 4 BLAU	07.311.0155.6	10	AP 2,5 - 4 BLAU	07.311.0155.6	10
4. Partition	gray	TW 2,5 - 4	07.311.1155.0	10	TW 2,5 - 4	07.311.1155.0	10
	blue	TW 2,5 - 4 BLAU	07.311.1155.6	10	TW 2,5 - 4 BLAU	07.311.1155.6	10
5. Cross connector with screws	2 pole	IVB WK 2,5 - 2	Z7.280.2227.0	10	IVB WK 4 - 2	Z7.281.1227.0	10
insulated	3 pole	IVB WK 2,5 - 3	Z7.280.2327.0	10	IVB WK 4 - 3	Z7.281.1327.0	10
	up to 12 pole	IVB WK 2,5 - 12	Z7.280.3227.0	10	IVB WK 4 - 12	Z7.281.2227.0	10
6. Partition plate with marking facility		TS 2,5 GELB	07.311.2053.8	10	TS 4 GELB	07.311.2153.8	10
7. Single cover with marking facility		AD VB 2,5 GELB	04.326.2053.8	10	AD VB 4 GELB	04.326.2153.8	10
8. Cover with warning symbol over 4 blocks		AD VB 5/4 GELB	04.343.4756.8	10	AD VB 6/4 GELB	04.343.4856.8	10

For more accessories see pages 60-77
For marking systems see pages 70-75
¹⁾ For maintaining the proper isolation distances, the open side of a feed-through terminal block as well as both sides of a jumper are to be enclosed by partitions.
²⁾ Please note the mounting instructions on the cover page. ³⁾ Do not use in Ex environments. ⁴⁾ With/without jumper

 630-499-7080 · www.elemechinc.com	Rev: 0	Device Tag: <h1 style="font-size: 2em;">TB1</h1>	
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Item No. 57.504.9055.0



Earth terminal WK 4 SL/ U /N0

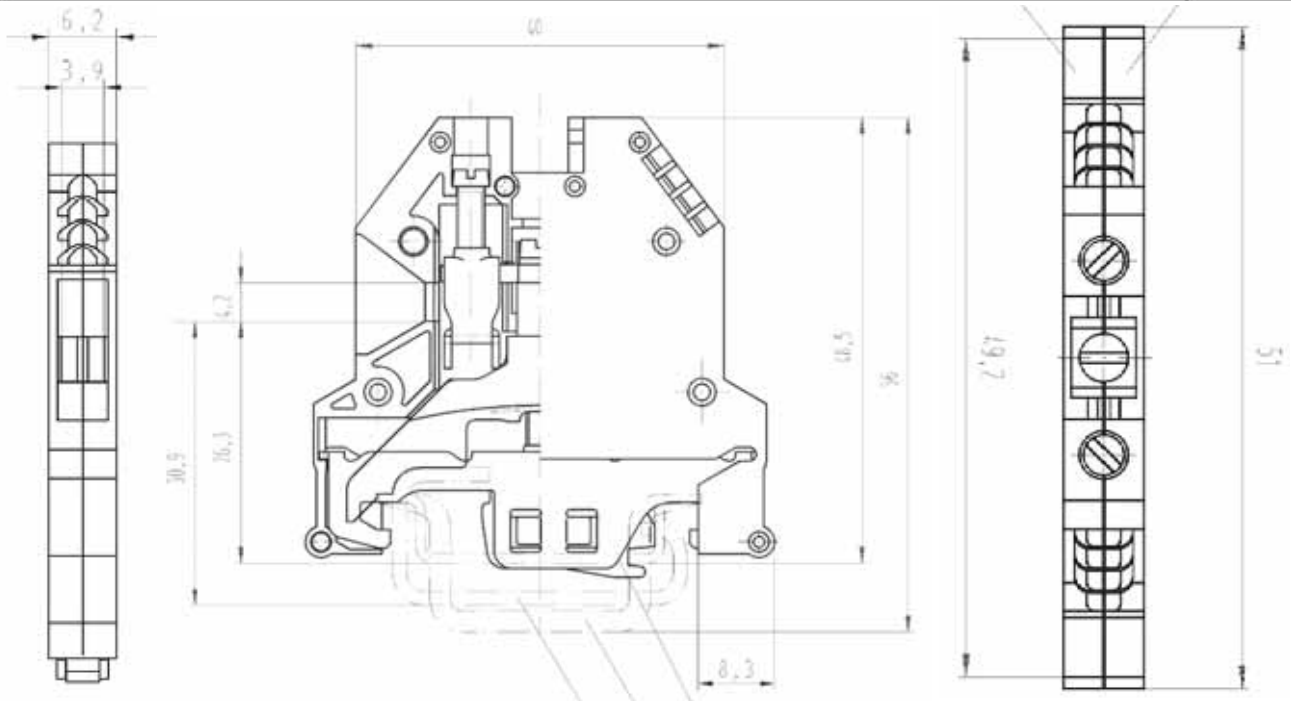
Ground DIN rail terminal block with screw connection for mounting on TS 35 and TS 32, nominal cross section 4 mm², width 6 mm, color green/yellow



42-063-004



Rated impulse voltage	8 kV
Pollution degree	3
Closing plate required	No
Length	51 mm
Type of insulation material	Thermoplastic
Cross section UL	22-10 AWG
Cross section CSA	20-10 AWG
Maximum cross section fine stranded	4 mm ²
Wire strip length	9 mm
Torque conductor mounting	0.5 Nm
Torque rail mounting	0,5



Rev: 0

Date: 06-23-2023

By: JN

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TB1

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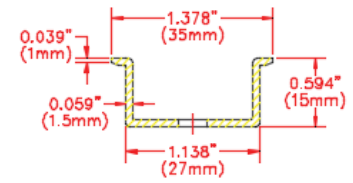
Manuf.: . PNo: Wieland: 57.504.9055.0

DIN RAILS

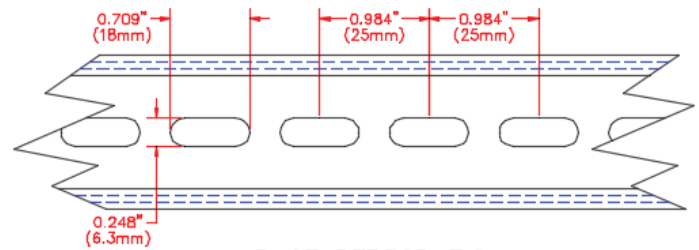
42-063-007

Catalog Number	Lengths per Pack
G1	12
G1F	12
G1F1	24
OMEGA 2F	20
OMEGA 2F1	40*
OMEGA 3	20
OMEGA 3F	20
OMEGA 3F1	40*
OMEGA 3FD	20
OMEGA 3A	10
OMEGA 3AF	10
OMEGA 3AF1	20*
OMEGA 3AFD	10
OMEGA 3B	10
OMEGA 3B1	10*
OMEGA 75	2

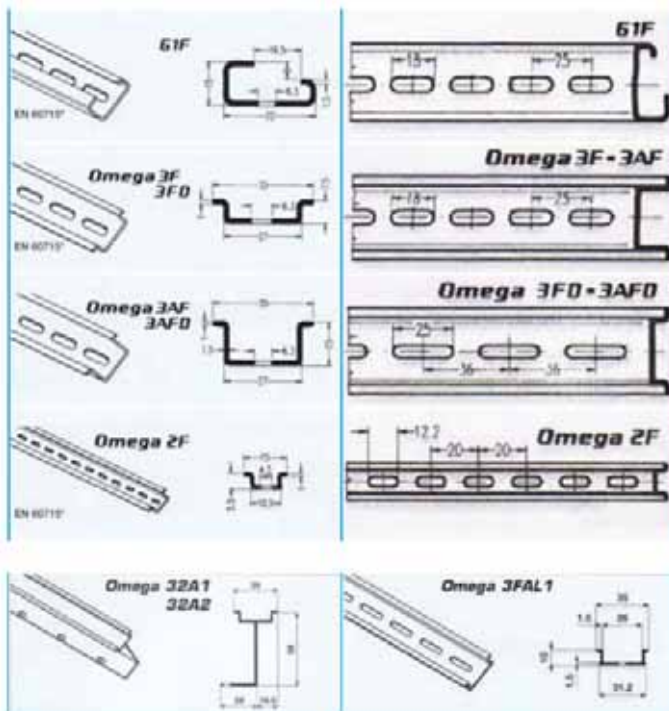
Treated with galvanic zinc plating and passivation (gal Zn 8c according to Din 50960)
 Minimum thickness 6 microns
 Standard length: 2 meters (6'6¾")



FRONT SECTION



BASE PERFORATION



Item No. Z5.522.8553.0
 End bracket 9708 / 2 S 35
 End clamp for mounting rail TS 35

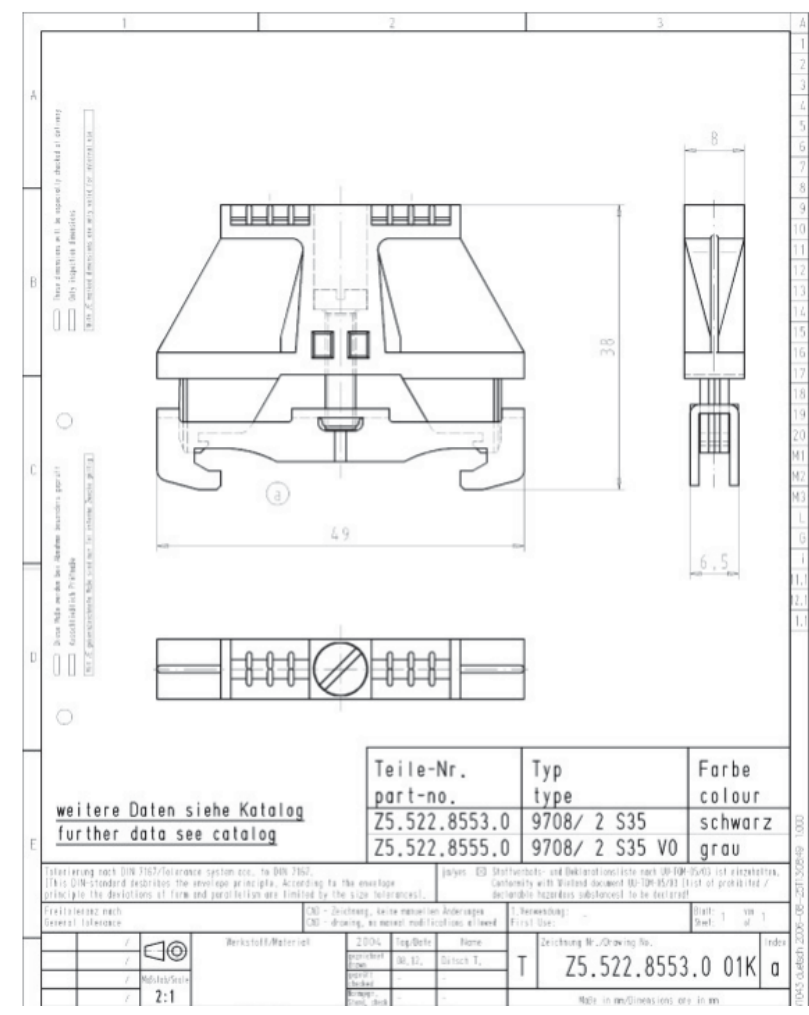


42-063-009

Item No.	Z5.522.8553.0
EAN	4015573141766
order unit	100 Piece(s)

Technical data

ArticlePrice	udp_no_price
Colour	Black
Inflammability class of insulation material acc. with UL94	V2
Width/grid dimension	8 mm
Latching	Screwable
Length	49 mm
Material	Metal
Mounting method	DIN rail (top hat rail) 35/7.5 mm



Rev:	0	Device Tag:	TB1
Date:	06-23-2023		
By:	JN	Job Number:	HBR9328
Manuf.: . PNo:		Wieland: Z5.522.8553	
		Page #	1/1

Fast-Acting 1/4" x 1 1/4" Glass Tube Fuses

AGC Series



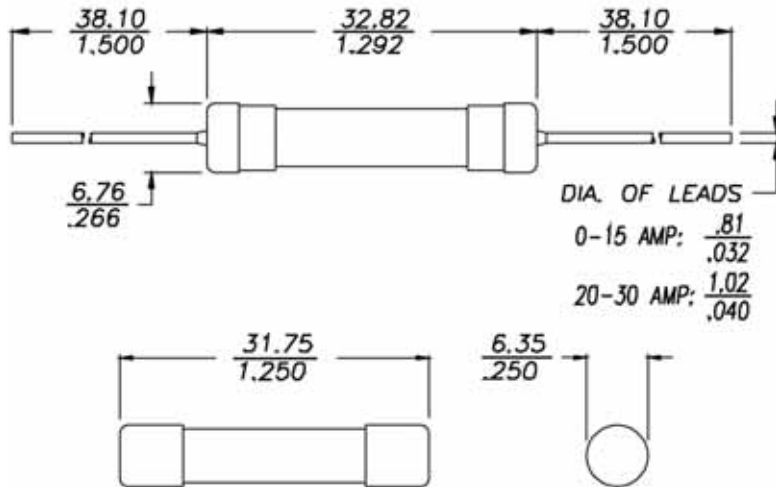
13-012-034

Non-RoHS Part Number	RoHS Part Number	AC Voltage Rating	AC Interrupting Rating (amps)			Typical DC Cold Resistance* (Ω)	Typical Melting I ² t AC	Typical Voltage Drop [†]
			250	125	32			
AGC-1/8	AGC-1/8-R	250	35	10,000	—	4.500	0.00773	0.67
AGC-1/8	AGC-1/8-R	250	35	10,000	—	12.565	0.000787	6.00
AGC-1/4	AGC-1/4-R	250	35	10,000	—	6.800	0.00131	4.67
AGC-1/4	AGC-1/4-R	250	35	10,000	—	4.900	0.00637	4.12
AGC-1/4	AGC-1/4-R	250	35	10,000	—	3.360	0.00435	4.51
AGC-1/4	AGC-1/4-R	250	35	10,000	—	2.300	0.0148	0.89
AGC-3/8	AGC-3/8-R	250	35	10,000	—	1.670	0.0208	2.88
AGC-1/2	AGC-1/2-R	250	35	10,000	—	1.203	0.0321	4.59
AGC-1/2	AGC-1/2-R	250	35	10,000	—	0.615	0.269	0.59
AGC-1/2	AGC-1/2-R	250	35	10,000	—	0.312	0.815	0.37
AGC-1	AGC-1-R	250	35	10,000	—	0.190	1.615	0.31
AGC-1-1/4	AGC-1-1/4-R	250	100	10,000	—	0.145	0.018	0.35
AGC-1-1/2	AGC-1-1/2-R	250	100	10,000	—	0.115	0.0149	0.27
AGC-2	AGC-2-R	250	100	10,000	—	0.078	0.00509	0.28
AGC-2-1/4	AGC-2-1/4-R	250	100	10,000	—	0.067	0.00588	0.26
AGC-2-1/2	AGC-2-1/2-R	250	100	10,000	—	0.057	0.00879	0.31
AGC-3	AGC-3-R	250	100	10,000	—	0.045	0.0167	0.25
AGC-4	AGC-4-R	250	200	10,000	—	0.030	0.0305	0.22
AGC-5	AGC-5-R	250	200	10,000	—	0.024	0.045	0.23
AGC-6	AGC-6-R	250	200	10,000	—	0.020	0.071	0.23
AGC-7	AGC-7-R	250	200	10,000	—	0.017	0.105	0.23
AGC-7-1/2	AGC-7-1/2-R	250	200	10,000	—	0.0146	—	—
AGC-8	AGC-8-R	250	200	10,000	—	0.014	0.152	0.19
AGC-9	AGC-9-R	250	200	10,000	—	0.012	0.21	0.18
AGC-10	AGC-10-R	250	200	10,000	—	0.008	0.492	0.20
AGC-12	AGC-12-R	32	—	—	1000	0.0070	—	—
AGC-14	AGC-14-R	32	—	—	1000	0.0062	—	—
AGC-15	AGC-15-R	32	—	—	1000	0.006	0.566	0.14
AGC-20	AGC-20-R	32	—	—	1000	0.004	1.438	0.12
AGC-25	AGC-25-R	32	—	—	1000	0.003	2.109	0.11
AGC-30	AGC-30-R	32	—	—	1000	0.002	3.807	0.12
AGC-35	AGC-35-R	32	—	—	70	0.0014	—	—
AGC-40	AGC-40-R	32	—	—	80	0.0019	—	—

* DC Cold Resistance (Measured at ≤10% of rated current)
 † Typical Melting I²t (A²Sec) (I²t was measured at listed interrupting rating and rated voltage.)
 ‡ Typical Voltage Drop (Voltage drop was measured at 25°C ambient temperature at rated current)

Dimensions (mm/in)

Drawing Not to Scale



Agency Information

- UL Listed Card: AGC 1/500-10
- UL Recognition Card: AGC 11-45
- CSA Component Acceptance Card (Class No. 1422 30)
- CSA Certification Card (Class No. 1422 01)



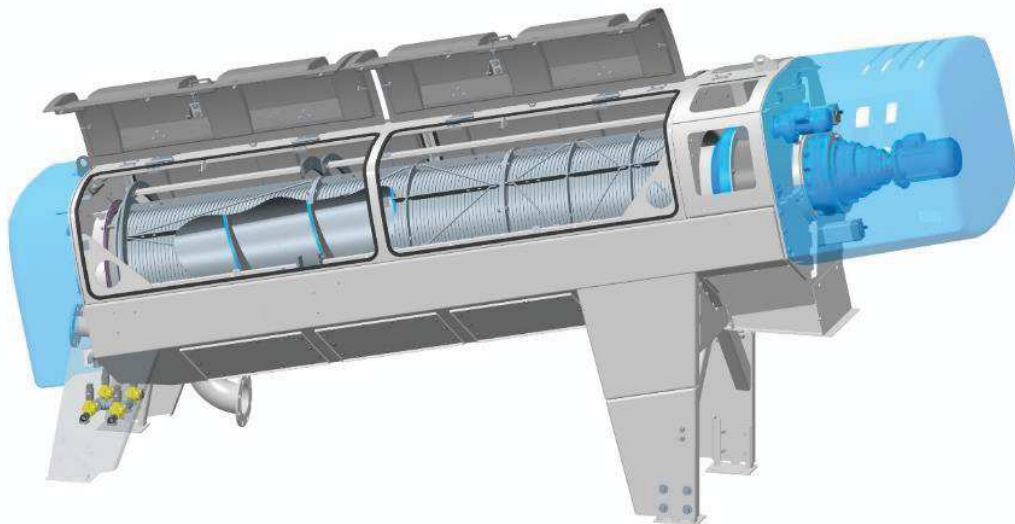
Rev: 0	Device Tag: SPARE	
Date: 06-23-2023	Job Number: HBR9328	Page #: 1/1
By: JN		

Manuf.: PNo: Bussman: AGC-1

Operation Manual


HUBER Screw Press Q-PRESS®

620.2
800.2



HUBER Technology, Inc
1009 Airlie Parkway
Denver, NC 28037

Original Operating Manual
Version 03/22

	NOTICE
	<p>This manual is part of the plant and must be available for the operators any time. The safety instructions must be observed. In case of selling the plant, the manual must be included. For a better overview this manual may contain photos/graphics of the machine without safety devices. Operation of the machine is only permitted when all prescribed safety devices as e.g. covers or railings are mounted.</p>

Translation

For delivery in the EEA, the operating manual is to be translated into the language of the target country.

If inconsistencies occur in the text, refer to the original operating manual (German), or contact the manufacturer.

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1 Product specification

1.1 Intended use

The plant is designed for continuous dewatering of freely flowing conditioned suspensions (sewage sludge) by gravity, pressure and shear forces.

Fields of application: treatment of municipal and industrial sludge

Any other or additional use does not comply with the intended use. The manufacturer does not assume any liability for consequential damage caused by non-observance of these operating instructions. The operator bears the full risk.

The intended use also includes:

- Observance of the start-up, operation and maintenance conditions as set out in this operating manual.
- Due consideration of foreseeable misuse
- Operation by skilled workers only (who are familiar with the correct procedures and know the dangers)

WARNING

The machine is intended exclusively for the above specified use.

Any additional use or rebuilding of the equipment without prior written approval by the manufacturer does not comply with the intended use.

The manufacturer will not assume liability for consequential damage. The operator alone will bear the risk.

Do not start up the machine before there has been ensured that all safety devices are completely mounted and operable, and that the plant into which the machine may be incorporated complies with the rules.

1.2 EMC advice

NOTICE

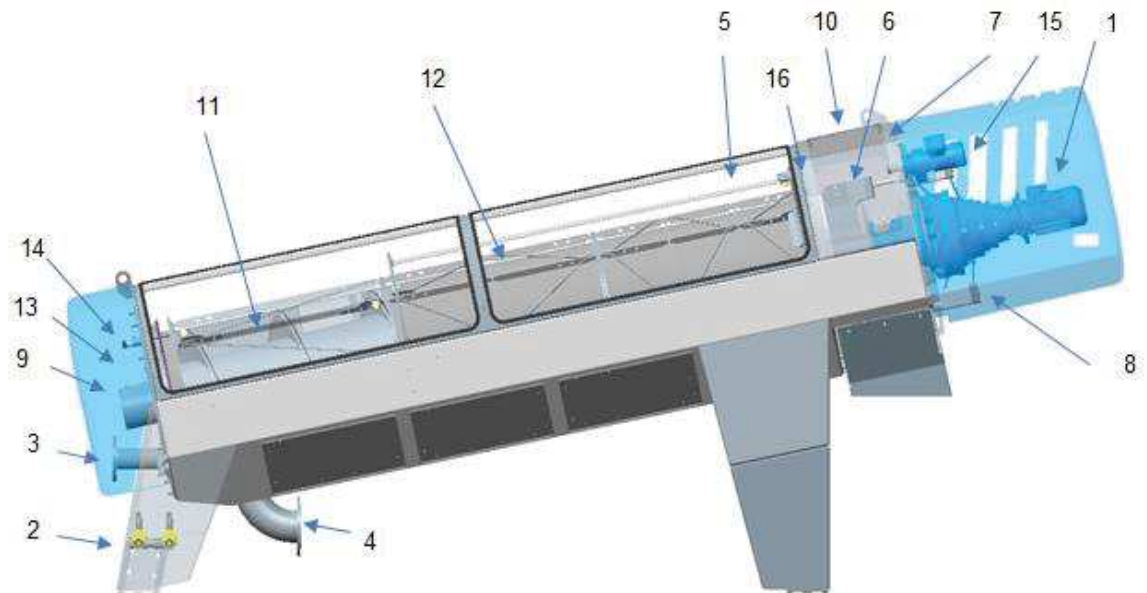
Advice for applying the EC rule EMV 2014/30/EU:

The plant is prepared for operation in industrial areas acc. to DIN EN 61000-6-4 (generic standards for transient emissions in industrial areas). Wiring and control technology have to meet additionally the requirements of DIN EN 61000-6-3 (transient emission in living areas) for operation in living areas, in business and commercial areas and in small companies.

1.3 Definition of terms for equipment components

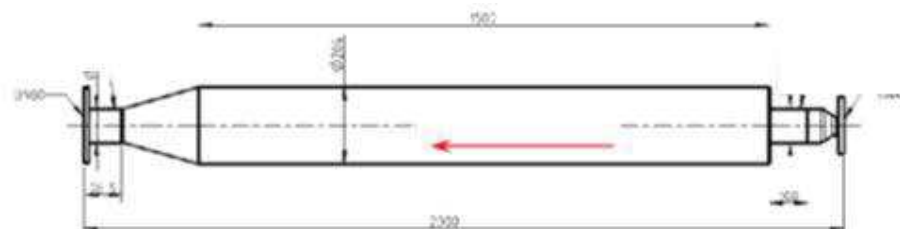
Definition of terms:

Partial section of a size 620.2 unit:

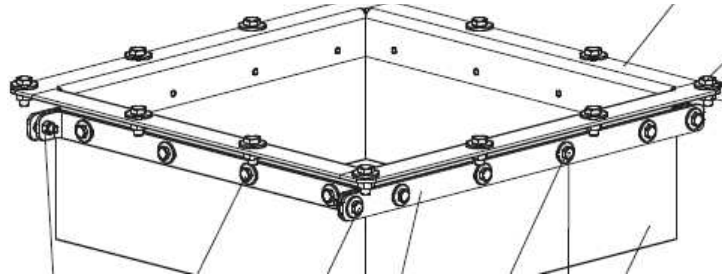


- | | | | |
|---|--|----|---|
| 1 | Screw drive | 9 | Screw bearing lubricator |
| 2 | Wash water connection to 4 solenoid valves | 10 | Sludge discharge inspection cover |
| 3 | Sludge inlet flange | 11 | Screw shaft |
| 4 | Filtrate outlet flange | 12 | Cylindrical screen drum |
| 5 | Spray nozzle bar / spray nozzles | 13 | Screening zone inspection cover |
| 6 | Pressure cone | 14 | Pressure sensor of sludge inlet chamber |
| 7 | Sludge discharge chamber | 15 | Drive of spray nozzle basket |
| 8 | Pneumatic cylinder with connections for compressed air | 16 | Proximity switch of spray nozzle basket |

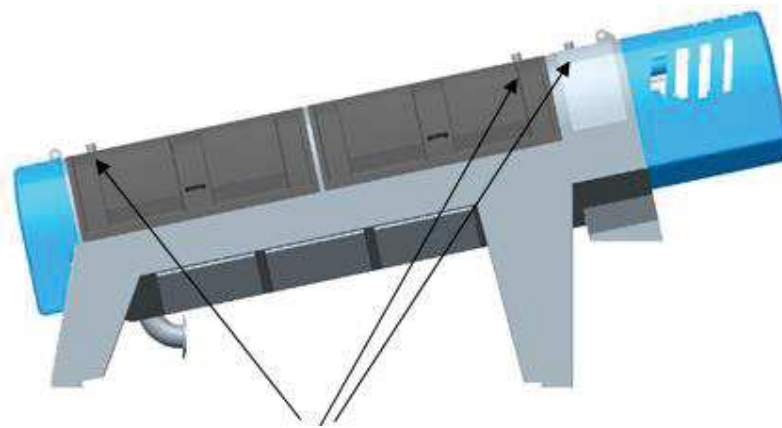
Optional equipment:



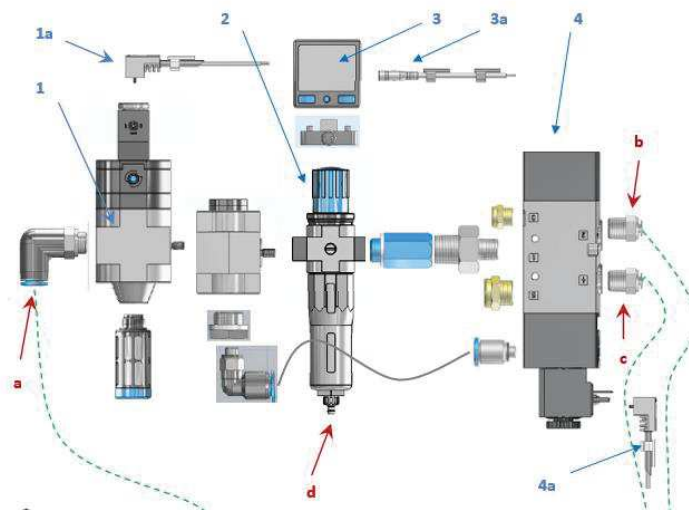
Tubular flocculation reactor for sludge conditioning, flow direction from right to left



Transfer chamber to downstream conveying system



Ventilation pipe sockets for the connection of an external ventilation plant



Pneumatic control unit for pressure cone control

1.4 Functional description

The dewatering machine is a screw press with a conical screw shaft and cylindrical sieve consisting of three treatment zones: inlet and drive zone, three-part thickening and dewatering zone, and press zone with pneumatic counter-pressure cone.

The screw press must be fed with flocculated sludge of sufficient stability. In the first section of the sieve the feed pump removes the free supernatant liquor quickly from the sludge via a large free screening surface and with low primary pressure. The pressure probe in the inlet protects the plant against excessive primary pressure and consequently excessive pollution of the filtrate liquor.

In the second section of the sieve the volume of material between the screw flights is reduced by the conical screw and the sludge pressed against the inner screen surface so that the sludge is dewatered, with a continuous reduction of filter cake thickness. The screen apertures are much smaller in this section of the sieve.

In the third section of the sieve the pneumatic counterpressure cone presses the residual water out of the sludge with a minimum filter cake thickness. Depending on the type and consistency of the sludge flocks the pressure applied on the sludge can be varied infinitely.

The dewatered sludge is pushed by the conveying screw past the pressure cone into the discharge chamber.

The sludge residence time in the screw press and thus the filtration time can be adjusted to individual requirements by adjusting the rotational speed of the screw shaft.

Scrapers fitted on the flights ensure permanent automatic sieve cleaning from inside. Intervallic cleaning of the sieves from outside is accomplished by means of a spray nozzle bar. On Q-PRESS® 440.2 units, the spray bar is stationary mounted whereas the screen basket is a rotating element. For the purpose of cleaning the feed into the screw press is temporarily stopped and the shaft starts to reverse. As the flexibly supported screen drum rotates passing by the spray nozzle bar, the screen surface is cleaned. In pressing mode sludge feeding starts again and the screw shaft rotates forwards. The screen basket rotates until arrested by ratchet pawls anchored in the casing. On Q-PRESS® 620.2 and 800.2 units, the dewatering process is not interrupted while the washing mode is active, i.e. the machine does not stop during a wash cycle. Four separately controllable spray nozzle segments permit screen basket washing zone by zone.

2 EC Conformity Certificate, Certificate of Incorporation

The machine complies with the EC standards which prescribe the CE label. The EC Declaration of Conformity confirms that the operable machine fulfils all relevant safety and health requirements. The EC Declaration of Conformity is provided only if the HUBER plant is supplied as a ready-to-operate unit complete with the electrical switchboard and control panel, and if plant installation and commissioning are performed by HUBER SE.

The Declaration of Incorporation is required if the supplied incomplete machine is not operable independently, i.e. if the machine is to be incorporated in other machines for example to obtain an operable complete plant, or if the electrical switchboard and control panel is supplied by a third party. We herewith declare that the design of the incomplete machine as supplied complies with standards, EC directives and DIN EN standards, as far as applicable as delivery does not include the electrical switchboard and control panel. Any modification of the machine without our prior approval will invalidate this declaration. Start-up of the machine is prohibited until the complete plant is in conformity with the quoted directives.

The Declaration of Incorporation is attached in the appendix and additionally included in the table of contents.

3 Safety

3.1 General safety instructions

DANGER

„DANGER“ indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

„WARNING“ indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

„CAUTION“ indicates a hazardous situation which, if not avoided, may result in minor or moderate injury.

NOTICE

„NOTICE“ indicates a property damage message. Follow notices to avoid material damage!

This operating manual has to remain attached to the machine. It must be ensured that all personnel operating the machine have access to the operating manual at all times. In addition to these operating instructions, instructions in the sense of the labour protection law and ordinance regulating the use of tools have to be available.

The operating manual contains fundamental guidelines which must be observed during installation, operation and maintenance. For this reason, this operating manual must be read by the technicians responsible before assembly and commissioning. The operating manual must always be available in the immediate vicinity of the machine. In addition to the general safety guidelines listed in this section, the specific safety guidelines listed under the main points below must also be observed.

3.1.1 Due diligence of the operator

The system is designed and built according to a risk assessment, careful selection of harmonised mandatory standards and additional technical specifications. The plant complies with state-of-the-art technology and offers the maximum amount of safety.



However, this level of safety can only be achieved during operation if all of the required measures are taken. The operator of the machine is responsible for planning these measures and ensuring that they are implemented.



The operator must especially ensure that

- The equipment is only used as intended (see chapter Product Specification).
- The equipment is only operated when it is in working order and that the function of the safety mechanisms is checked regularly.
- Personal protective equipment for the operating, maintenance and repair personnel is available and used.
- These operating manual is always in a legible state and is available in its entirety in the immediate vicinity of the machine.

- Only sufficiently qualified and authorised personnel operates, maintains and repairs the machine.
- Such personnel receive regular briefing concerning all questions of safety and environmental protection and know these operating instructions, especially the safety instructions contained.
- All safety and warning notices on the machine are not removed and can be read at all times.

3.1.2 Description of safety symbols

	 WARNING
	<p>Occupational safety symbol This symbol will accompany all safety instructions that are associated with risks to life and/or limb. Follow these instructions and proceed carefully! At the same time, follow all applicable laws, general safety and accident prevention regulations.</p>

	 WARNING
	<p>Electric current warning This symbol warns of electric current. Prior to performing any work, switch off the mains isolator and make sure that the system is off-circuit. At the same time, follow all applicable laws, general safety and accident prevention regulations.</p>

	 WARNING
	<p>Automatic machine start: Be careful not to get caught when starting up, servicing or repairing the machine!</p>

<h2 style="margin: 0;">NOTICE</h2>
<p>This symbol is found where special attention is required to ensure compliance with instructions concerning correct operating sequences to prevent damage to the machine or its function.</p>

- Instructions directly attached to the machine, e.g.
- Notice and warning signs
 - Identification signs for liquid supply connections
 - Rotational direction arrow
- must be adhered to and fully legible at all times.
 Damaged or illegible signs must be replaced immediately.

3.1.3 Qualification and training of personnel

Only well-trained and briefed persons who know these operating instructions and act according to these instructions are authorized to operate the machine. The individual areas of responsibility of operating staff must be defined clearly. The area of authority, responsibility and control of the personnel must be precisely regulated by the operator. The operator must further ensure that the personnel has fully understood these operating instructions.


Personnel being trained must in the beginning work under the supervision of an experienced person. The completed successful training and briefing must be confirmed in writing.

Any electrical control and safety devices must generally be operated by instructed and authorized persons only.
 Any person performing work on the machine must read these operating instructions and confirm by signature that the operating instructions have been understood.

3.1.4 Safety instructions for maintenance, inspection, installation

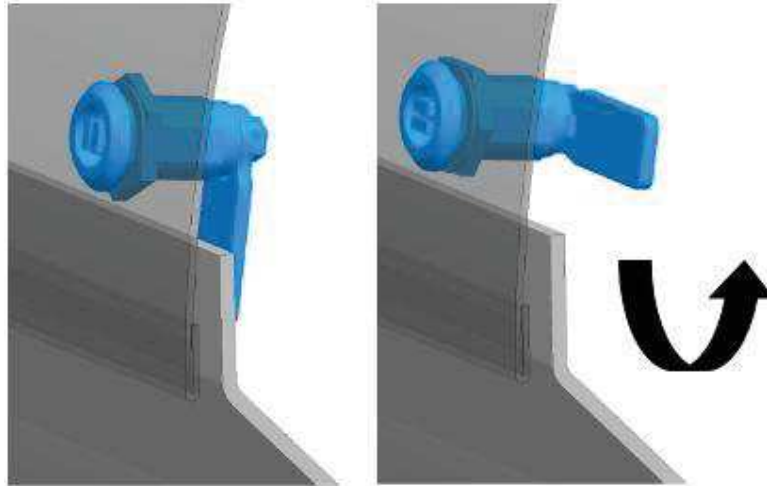
Maintenance work must only be carried out by qualified personnel.
 Any inspection and installation work must be carried out by authorised and qualified personnel only. Work on electrical equipment must only be carried out by qualified electricians according to DIN VDE 1000-10.
 Work on the plant may only be carried out when the plant is disconnected from the mains.

Enclosed rooms of wastewater treatment plants that must be entered for service and maintenance have to be aerated in a way that prevents a dangerous explosive atmosphere, lack of oxygen and presence of harmful concentrations of gas or vapour.

	<p>⚠ WARNING</p>
	<p>Shutdown procedure: Switch off mains isolator and lock it. Each person who is commissioned to perform maintenance work on the machine must have his own padlock. Starting the machine is only possible when all padlocks on the mains isolator have been removed. Check if upstream and downstream equipment may cause a danger, switch off power supply for upstream and downstream equipment before performing maintenance or repair. If the whole plant cannot be disconnected from the mains for operational reasons, individual machines must be disconnected by a skilled electrician in accordance with DIN VDE 1000-10 and secured against unintentional restart acc. to DIN EN 50110-1 VDE 0105-1. As an option all machine drives can be supplied with a repair switch. For maintenance work the machine or area concerned can be switched off acc. to DIN VDE 0100-200. The repair switches must be switched off and locked as described above..</p>

Opening the machine:
 All inspection openings are secured with screw connections or turning locks to prevent they are opened by unauthorized persons.

<p>⚠ CAUTION</p>
<p>Open the inspection covers only after shutdown of the machine or for visual inspection while the machine is running. Never grip into the inside of the machine while the machine is running.</p>



Turning locks closed

Turning locks open

Do not immediately re-start the machine, if the reason why it has stopped is unclear. Somebody could have stopped the machine in order to make a manual adjustment and may have forgotten to secure it against starting. The unexpected start could result in serious injury of personnel.

It is in your own interest to clean the machine prior to working on it to prevent the danger of infections.

⚠ CAUTION

Always protect yourself by means of waterproof protective gear, boots, gloves, and, if possible, also by face protection during cleaning of the machine - especially if a high pressure cleaner is being used – to avoid being hit by waste water, organic material, etc. Re-attach all safety equipment, covers, grates completely to their original place and assure that they are properly and completely reattached. Use only tools and means that are expressly intended for such work. Before starting the machine check the closed position of the turning lock on safety equipment like covers, these locks keep the covers in safe position.

Before starting the machine again, check the items mentioned in chapter Start-up.

3.1.5 Residual risk

The residual risk describes the risk of a system that remains after the implementation of planned risk containment measures and in spite of existing safety devices.

The following residual risks may appear:

- Automatic machine start
- Aerosols contaminated by viruses and bacteria caused by manual cleaning
- Reaching into the running machine

3.1.6 Unauthorised rebuilding and production of spare parts

Alterations or changes to the machine:

For safety reasons, it is not permitted to make unauthorized alterations or changes to the machine. This applies also to welding work on bearing components.

Any intended modifications, alterations or changes require the prior written consent of HUBER SE.

Use only original spare parts, original wearing parts and original accessories as these are especially designed for the machine. Components purchased from other sources give no guarantee that they have been designed and manufactured to suit the specific operating and safety requirements.

3.2 Machine identification

Any specifications made in these operating instructions apply to only the type of machine that is named on the title page.

The identification plate is attached to the screenings discharge and specifies the following.

- Name and address of supplier
- CE label
- Serial name and type, optionally serial number
- Year of manufacture

Always forward the machine type, year of manufacture and order number when inquiring or ordering spare parts to ensure perfect and prompt processing of your queries and orders.

3.3 Incorporated safety systems

The incorporated safety systems are subject to regular checkups (**t** = daily, **w** = weekly, **m** = monthly, **j** = yearly). The following methods are applied:
S = sight inspection, **F** = functional test, **M** = measuring.

These specifications refer to a 24 hour operation on 365 days a year.

Mains isolator

The mains isolator is located on the control panel and disconnects/connects the machine from/with the mains supply.

Padlock the mains isolator after switch-off prior to performing service or repair work.

Inspection	
Interval	Method
y	F

Emergency cutoff circuit

The machine is equipped with an emergency cutoff circuit. Whenever the emergency cutoff switch (option) is operated, the machine or complete plant including incorporated units will be set into a safe operating state.

The emergency cutoff switch can be released by pulling or turning to the right.

Inspection	
Interval	Method
m	F

Motor protection switch

The machine is equipped with an indirect current overload protection with a motor protection switch. The motor will be switched off, if the overload is too much. The thermal delayed overcurrent protective device must be selected that the drive unit will be switched off in time t_E .

Inspection	
Interval	Method
y	F, M

Motor temperature control (option)

The motor is equipped with a temperature sensor, which must be evaluated with an evaluation relay or a frequency converter. If the permissible temperature is exceeded, this must lead to the motor being switched off.

Inspection	
Interval	Method
y	V, F, M

Overpressure control

The machine is equipped with a feed pressure controller. If the pressure exceeds maximum pressure of 500 mbar the complete plant included incorporated units must be set into a safe operating state. When the pressure has fallen below maximum pressure and the fault has been reset, the plant can be re-started.

Inspection	
Interval	Method
m	F

Pneumatic isolation / maintenance system

As an option the machine is equipped with a pneumatic maintenance mechanism.

The pneumatic pressure cone can be depressurized for the purpose of executing maintenance and inspection work.

Inspection	
Interval	Method
m	F

Wash cycle monitoring

The machine is equipped with a wash cycle monitoring mechanism. The end position of the spray basket is monitored by a proximity switch.

Inspection	
Interval	Method
m	F, M

Machine control

Internal machine control includes a 5-conductor feed system, 3 phase, with separate earth line with GREEN/YELLOW line coating.

Additionally earth the machine casing for potential equalization. Please check earthing connection on corrosion.

Inspection	
Interval	Method
y	V, F, M

Categories according to DIN EN ISO 13849-1
 The following categories are installed in the plant:

Category	System performance	Component	Inspection interval
1	<ul style="list-style-type: none"> • A fault may cause the loss of safety function, • Some faults may stay unrecognized 	Main switch, water shut-off device with protection against restart	1x per year or acc. to instructions of supplier of components
2	<ul style="list-style-type: none"> • A fault may cause the loss of safety function between the tests. • The loss of safety function is recognized by the test. 	Emergency stop (emergency cut-off relays with push-button and cut-off protection)	1x per year or acc. to instructions of supplier of components

WARNING

Control panels can only be opened by using a special key. The special key may only be handed to an authorized person. Take care that doors of control panels are only opened by skilled staff for maintenance work and fault detection, otherwise the doors must stay locked!

NOTICE

These operating instructions are part of the machine and have to be available for the operating staff at any time.
 The safety instructions contained must be observed.
 It is strictly prohibited to override any safety instructions or change the mode of action of safety instructions.

3.4 Safety measures

It is the operator's responsibility to instruct his operating and servicing staff concerning:

- Protective devices on the machine,
- Control of observance of safety measures.

This copy of operating instructions has to be stored to be at hand when needed in the future. Observe the intervals for inspection and control measures! In these operating instructions, the work is described so that it can be understood

- by an instructed person (referring to chapter Operation and operation modes
- by skilled staff (referring to chapters Transport, Installation, Maintenance, Trouble Shooting and Repair).

The chapters Transport, Installation, Maintenance, Trouble Shooting and Repair are intended for skilled staff only. Any work described under these chapters must be performed by skilled staff only.

Instructed person

An instructed person is a person that has been instructed by a skilled person, and trained if necessary, about the assigned jobs and possible risks arising from improper performance and informed about necessary protective devices and protective measures.

Skilled persons

Skilled persons are persons that are able to evaluate assigned jobs and recognize possible risks, due to their professional skills, expertise and experience and knowledge of corresponding standards.

This definition follows EN 60204-1

3.5 Operator's duty of care**NOTICE**

The valid national version of the framework directive 89/391/EEG and corresponding individual directives, especially 89/655/EEG concerning minimum requirements for safety and health protection of staff when using work equipment, are applicable in EEA countries and must be observed.

For Germany, the occupational safety directive of 2015 is applicable and must be observed.

The operator has to obtain the local operating license and observe the respective requirements. In addition, the operator has to observe the local laws concerning

- Safety of personnel (accident prevention regulations)
- Safety of work equipment (protective gear and maintenance)
- Product disposal (Waste Management Law)
- Material disposal (Waste Management Law)
- Cleaning (cleaning agent and disposal)
- Environmental compliance

Connections:

The operator has to ensure before start-up of the machine, if installation and start-up are performed by the operator himself, to comply with local standards (such as for electrical connection for instance).

NOTICE**Lighting**

The operator has to provide sufficient and equal lighting in all areas of the plant. The recommended illumination level is 300 lux (value for maintenance; in Germany acc. to ASR).

3.6 Safety inspections

Safety inspections are carried out by the manufacturer in the factory.

1. Measurement of airborne noise

- according to appendix 1 of the EU Machinery Directive (1.74/f).

The machine noise level is below 70 dB(A).

2. Tested and verified in accordance with DIN EN 60204-1

- Check of electrical equipment for correspondence with the technical documentation (chapter 18.1)
- Function tests (chapter 18.1)
Test functions of the electrical equipment, especially those which are related to safety and safety measures.

4 Handling and transporting

Observe the following points to avoid damage to the machine or persons when handling the equipment:

- Only qualified persons are permitted to perform transport work, observing the safety instructions.
- Lifting and righting of the equipment must be done only by the lifting eyes provided.
- Use only the lifting devices specified hereunder to transport the machine.
- Empty the machine prior to transporting it.
- Read also the chapter General Safety Instructions.

NOTICE

Do not step on the plastic covers and do not put weight on them by lashing straps.

4.1 Dimensions and weight

Several plant sizes are available. The plant dimensions are specified in the project-specific installation drawing. The weight of the plant depends on its size. The weights are specified in the installation drawing. The weight is also specified on the nameplate.

The machine is transported with the machine feet dismantled.



4.2 Approved equipment and accessories for transportation

⚠ CAUTION

Have transport and unloading done by experienced experts only.

⚠ WARNING

Approval of lifting devices for mass to be moved

Assure yourself that the lifting devices have the required load bearing capacity by means of the capacity specifications on the lifting devices and the weight specifications of the loads to be moved.

Transport the plant on site with the greatest possible care and observe the following instructions: If the plant was already operated before, then remove all connected supply lines from the machine prior to moving the machine.



⚠ WARNING

Transport by forklift is forbidden, never insert the fork under the machine!



⚠ WARNING

Pay attention to always keeping the plant in an upright position!

Hook the shackles, load hooks, etc. into the lifting eyes on the upper side of the plant. The attachment points are marked with the label in the margin. The lifting equipment cables must be freely suspended and must not be attached beyond 45° from the vertical line. The machine must be suspended horizontally during unloading.

If you notice any damage which has occurred during transportation, note this on the consignment note and inform the carrier and the manufacturer immediately!

NOTICE

Make sure the delivery is complete by carefully checking all received materials against the bill of delivery.

4.3 Storage

The plant can be stored as supplied. The minimum ambient temperature should be + 8 C up to max. 45° C.

The place of installation must be vibration-free.
 Never store organic solvents in the machine storage place.
 Avoid UV radiation as well as ozone, hydrogen sulphide and chloride containing ambient air.

When selecting the storage place take care that the components cannot be damaged by vehicles or careless working. Make sure the components cannot get dirty due to splashes of concrete or mortar and protect the equipment against spark fountains from angle grinders etc.

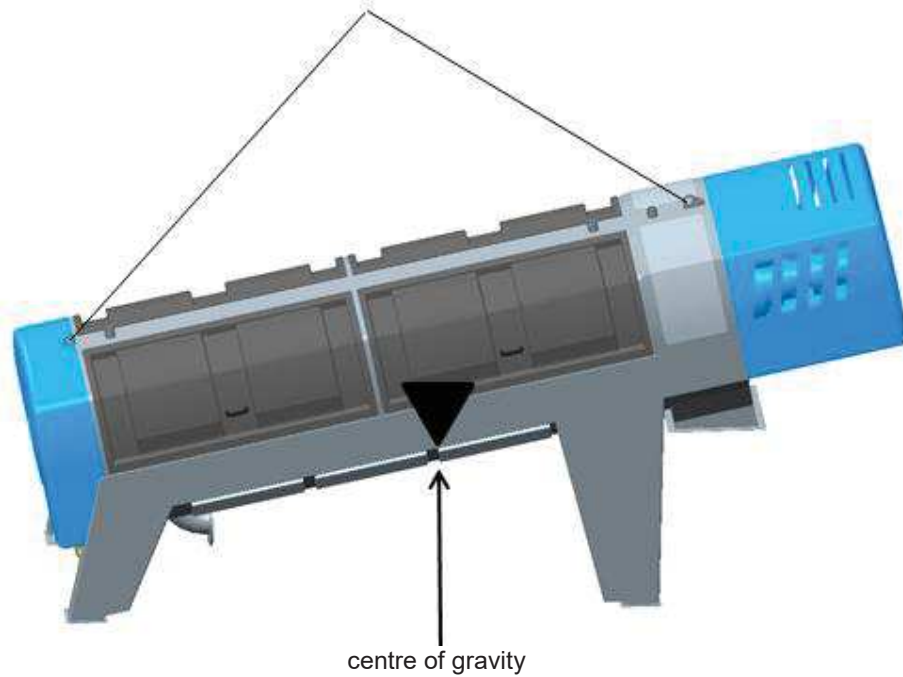
4.4 Lifting by crane

Size 620.2

- Mount appropriate load-carrying equipment to the 2 outer lifting eyes at the top of the machine. (See below photo.)

Make sure the load-carrying equipment is suitable to bear the machine weight. The machine weight is specified in the dimension drawing.

Please note that the tractive forces increase if the rope guide is not vertical.



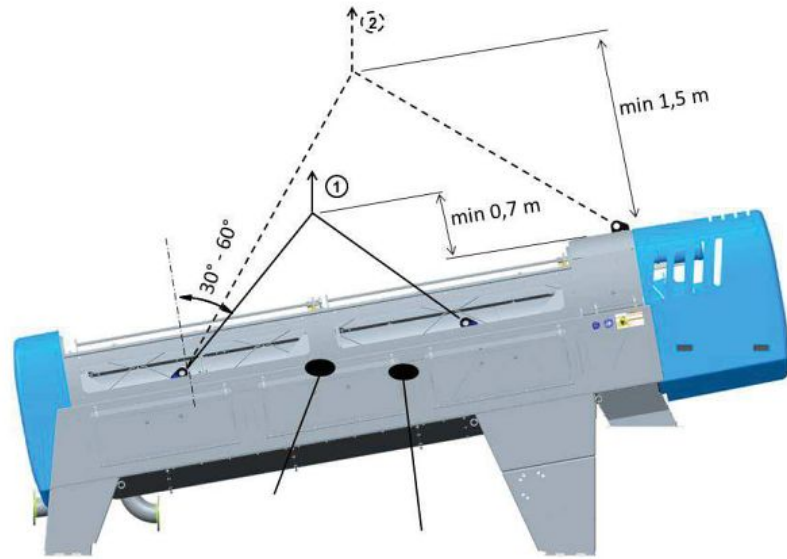
Size 800.2

- Remove the upper covers from the machine.
- Mount appropriate load-carrying equipment to the 4 inner lifting eyes on the base frame inside the machine (see below figure.) Alternatively the machine can be lifted on 2 inner and one outer lifting eye on the discharge housing (figure version 2).

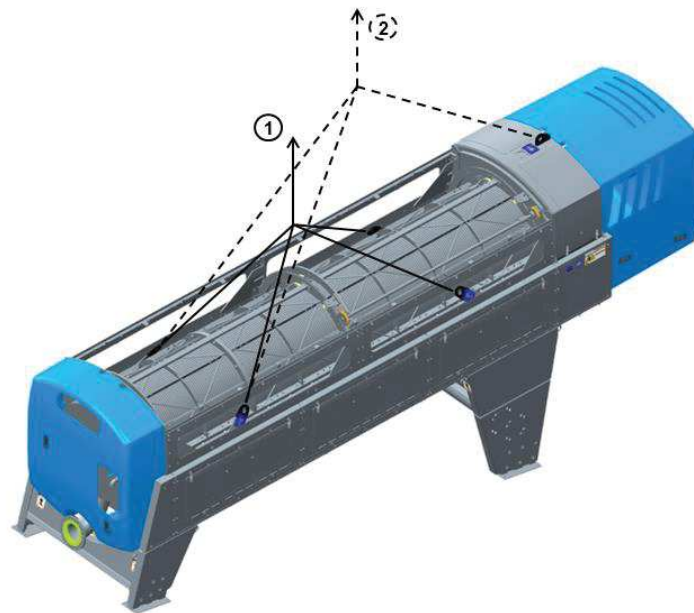
Make sure the lifting devices do not exert any pressure load on the machine casing, covers or internals.

Make sure the load-carrying equipment is suitable to bear the machine weight. The machine weight is specified in the dimension drawing.

Please note that the tractive forces increase at the maximum permissible rope angles.




centre of gravity filled / empty




The machine feet on the discharge end may have been dismantled for transport.

Carefully lift the machine and balance it.

	! WARNING
	The maximum working load of the lifting device must be above the weight of the single machine components. Observe the stability of the lifting device.

! CAUTION
Wear safety shoes with steel caps to prevent injuries.

	! WARNING
	Always stand clear off a suspended load!

5 Installation

Observe the following safety instructions when installing the machine to avoid critical injuries, damage to the machine and other damage.

- Only qualified persons are permitted to perform installation work, observing the safety instructions.
- Check the machine for transport damage prior to starting with any installation work.
- Make sure that only authorized persons have access to the working area and that installation work does not endanger any other persons.
- When laying machine connections, make sure that no one can trip over laid cables, hoses, pipelines, etc.
- Observe the prescribed bending radii when laying cables/hoses/pipelines.
- Observe the instructions for operating media, lubricants, auxiliary material used.
- Read also the chapter General Safety Instructions.

5.1 Acceptable environmental conditions for installation

NOTICE

Strictly observe the requirements specified below prior to installing and starting up the plant. The manufacturer does not assume any liability for damage caused by non-observance of these requirements.

The plant is designed for installation in a building. The manufacturer assumes no liability for any damage resulting from outdoor installation and inadequate protection against bad weather (frost, storm, snow, ice, etc.).

The minimum protection grade of the electrical consuming devices of the Q-PRESS® is IP 55.

Foundation

The foundation must be designed to bear the machine weight and must allow for horizontal machine mounting and installation. This point must especially be observed when erecting bearing steel constructions. (See attached installation plan and dimension scheme.)

NOTICE

In the case of a concrete foundation the concrete should be at least class C20/25 to ensure safe anchorage of the machine.

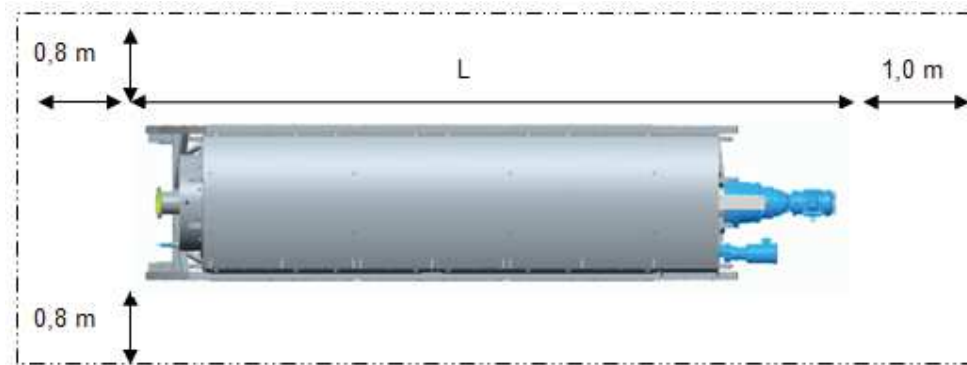
Clean the installation place prior to starting with any installation work. In addition, use a water level to check that the surface of the installation place is level.

Drainage of the operation room

Floor drainage is generally required to remove cleaning water.

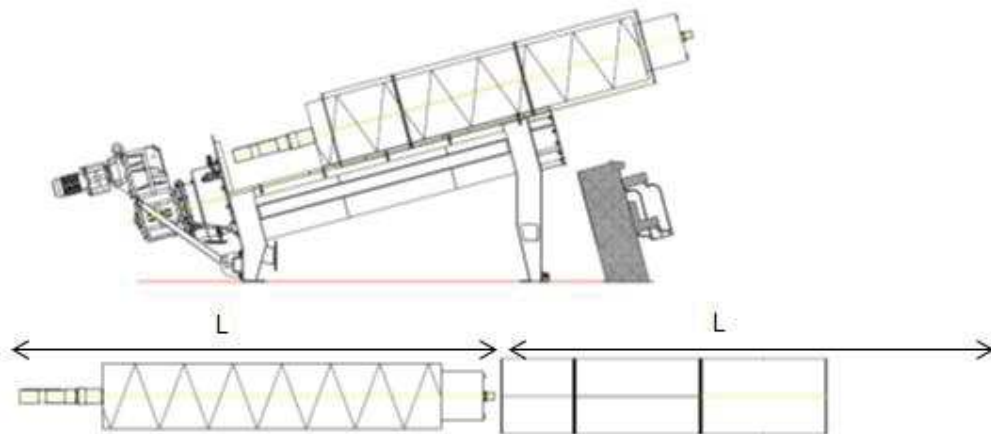
Space requirements

Recommended minimum space for **operation/inspection/maintenance**:



Additional space for **maintenance** is required for machines with screen baskets that cannot be divided:

If the screen basket is not dividable, an additional space of approximately two times the machine length must be available outside the machine casing for separating the screw shaft from the screen basket.



If the scraper on the screw flights needs to be replaced, the screw shaft must be lifted out with the screen basket. Therefore, either sufficient free space must be available in longitudinal machine direction or a crane runway that provides the possibility to bring the machine into a position with sufficient space for scraper replacement.

Lightning protection concept:

The plant must be integrated into the complete concept of the treatment plant for observing the Lightning Protection Standard DIN EN 62305-3.

The state of the art of a functioning overall concept for wastewater treatment plants is particularly described in the supplement 2.

Lighting

The lighting system must be designed to ensure at any time riskless and safe working on any machine parts.

NOTICE**Lighting**

The operator has to provide sufficient and equal lighting in all areas of the plant. The recommended illumination level is 300 lux (value for maintenance; in Germany acc. to ASR).

Supply connections**Wash water:**

The wash water supply system must be designed to ensure that it supplies at any time the amount of wash water required by the spray nozzle bar for screen basket cleaning. (See Technical Data.) The required connections are specified in the Technical Data.

Minimum required wash water pressure: 5 bar
 Maximum permissible wash water pressure: 8 bar

Water quality:

Maximum permissible particle size: 0.3 mm
 Maximum permissible particle concentration: 200 ppm

To avoid sedimentation on the filter cloth, the wash water should have an as low as possible chloride and iron oxide content and a pH in excess of 6.5.

If fresh water is used, it is necessary to provide a return flow inhibitor complying with EN 1717 to prevent return flow of wastewater into the potable water network.

NOTICE

Depressurize the wash water supply line prior to executing any maintenance work. A shutoff valve must therefore be installed in the wash water line.

The connection of the wash water line to the screw press should consist of a flexible rubber fabric hose to facilitate the connection to the machine and reduce shock pressures when the valve closes.

Compressed air:

The compressed air supply system must be designed to ensure that it supplies the pneumatic pressure cone of the screw press at any time with the required amount of wash water. The required connections are specified in the Technical Data. Pneumatic lines must be laid in protective tubes to avoid damage.

The working pressure of the pneumatic pressure cone is manually adjustable via an optional control unit.

Working pressure: 0.5 – 6 bar
 The input pressure into the control unit must be 6 – 10 bar.

Minimum compressed air quality: according to DIN ISO 8573 class 4:

Maximum residual moisture: 37 g/m³ (1 bar, 25°C)

Maximum residual dust: 8 mg/Nm³

Maximum residual oil content: 5 mg/Nm³

NOTICE

Depressurize the compressed air lines prior to executing any maintenance work. A suitable means to achieve this is a maintenance unit with arrestable pressure reducer.

Technical ventilation:

The optional ventilation connections of the screw press are provided to connect a customer supplied exhaust air plant.

Ventilation of machine interior and sludge discharge housing

- avoids an explosive atmosphere
- reduces odour nuisance
- reduces corrosion in the machine interior.

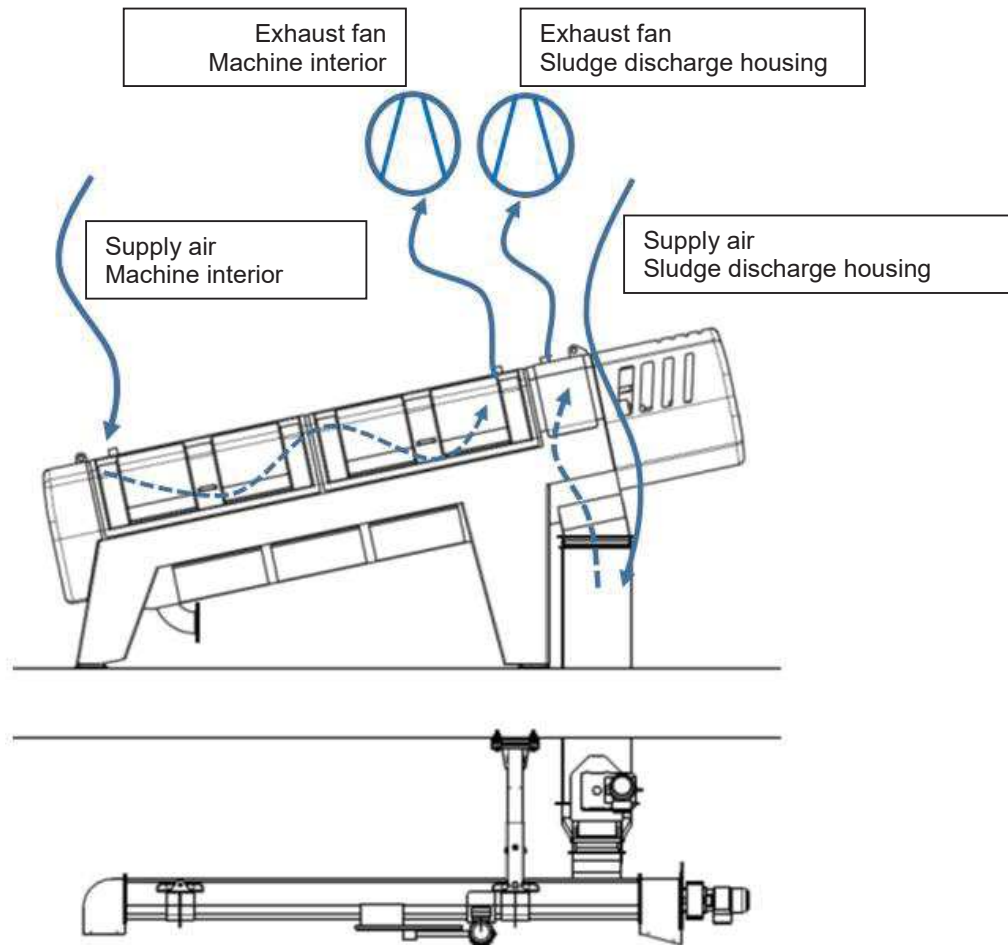
Recommendation:

The air volume flow should permit approx. 20 air changes of the machine volume per hour.

Size	Machine volume	Volume of sludge discharge housing (plus discharge shafts, conveyor screws...)
Q 620.2	3,5 m ³	0,5 m ³
Q 800.2	8,0 m ³	1,0 m ³

There is no gas exchange between machine and sludge discharge housing resp. possible following transport devices for pressed sludge. In case of explosion zoning both areas must be looked at separately.

Avoid contamination by loaded atmosphere e.g. through the filtrate discharge pipes of the screw press.



Product connections

Details on the machine connections are provided in the dimension sheet.

Product connections:

- Sludge inlet flange
- Filtrate outlet pipe connection
- Sludge discharge chamber
- Connection for wash water
- Connections for compressed air

Electrical connections

The electrical power supply must comply with the circuit and wiring diagrams. (See appendix.)

Electrical consumers on the screw press:

- Screw shaft drive motor
- Drive motor of the spray basket
- Solenoid valves on wash water connection
- Pressure sensors of sludge inlet chamber
- Proximity switch
- Pressure switch of pressure supply unit (option)

Potential adjustment

If mechanical and electrical plant installation is not executed by HUBER SE but by a third party, the operator shall be responsible to provide a connection for potential adjustment on the plant.

5.2 Installation

- Clean the installation place with a broom.
- Use a water level or levelling device to check the planeness of the machine foundations.

The height offset of the machine foundations must not exceed 2 mm.

- Mark the machine fixing points according to the axial dimensions specified in the installation drawing.
- Transport the plant to its intended installation place as described above under Handling and Transporting.
- Mount the machine feet to the machine casing.
- Check that the fixing points are in accordance with the machine feet.

Observe the installation instructions for the supplied fixing material.

- Drill the holes for the fixing material.

NOTICE

Blow the holes for the stainless steel plugs under pressure after drilling (using bellows, air pump, etc.) to ensure a professional durable adhesive joint.

Use grease for all unlockable screws, thus providing a durable mobility of thread.

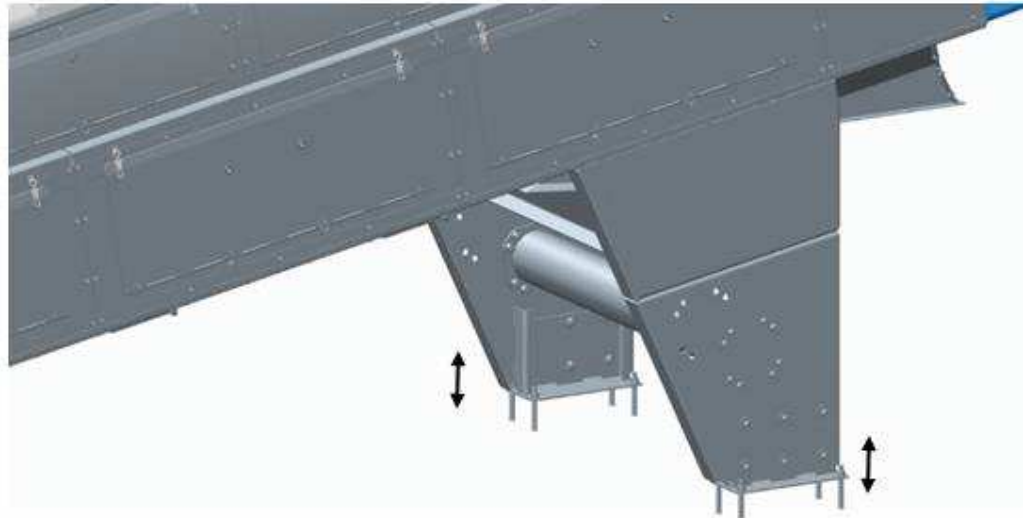
NOTICE

Use only the supplied mounting material for installation of the machine!

Alignment of screw press size 620.2 / 800.2 units

The screw press must be aligned to ensure that the height offset between the machine feet does not exceed ± 2 mm.

The machines have 4 height-adjustable feet.



NOTICE

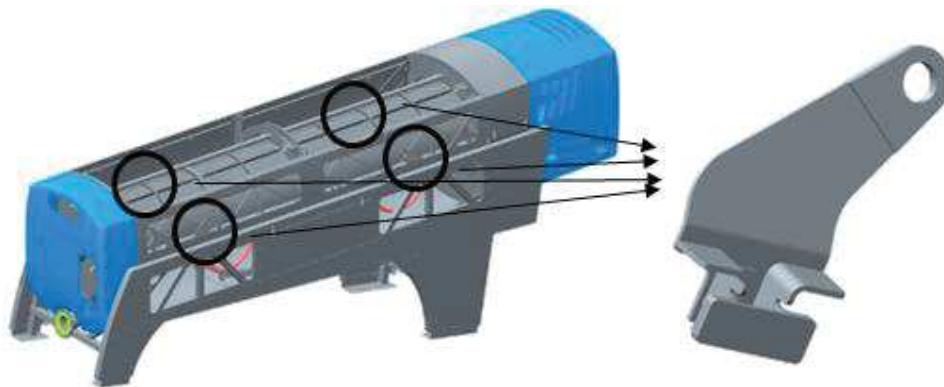
Do not remove the load-carrying equipment before all fixing screws of the four feet have been screwed tightly with the machine and the machine foundation.
Secure the bottom plates by welding them to the machine feet.

NOTICE

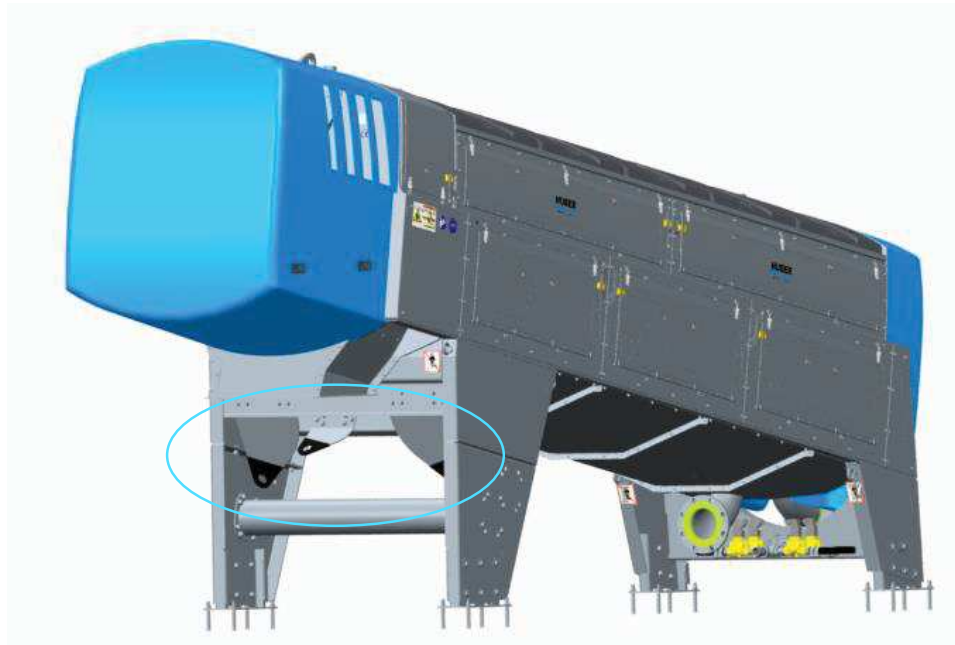
The machine must not be screwed in place and operated before it has been aligned on the machine foundations!

Additional preparatory work on the size 800.2 screw press

Remove the four lifting eyes from the machine.



Fix the 4 lifting eyes at the park positions provided between the support legs at the discharge side.

**⚠ WARNING**

Use the lifting eyes only with the provided number of screws at the provided positions on the machine.
Check the lifting eyes and screws according to the enclosed inspection sheet before reuse.

Mount the machine covers.

5.3 Customer-supplied connections

NOTICE

Ensure the tension-free installation of all connections.

Establish the following mechanical connections:

- Removal of dewatered sludge



Use a flexible transition piece between the sludge discharge of the screw press and the conveying unit.

WARNING

In case of open access to the discharge area, protect the machine against unintended start-up and secure the danger zone prior to starting the machine or executing maintenance on (or dismantling) a downstream machine. The requirements of DIN EN 13857 ("Safe distances to prevent danger zones being reached by the upper limbs") must be observed.

- Sludge inlet



NOTICE

The sludge line to the screw press should run horizontal or ascending.
Sloping lines bear the risk of gas accumulation or unfavourable pressure conditions.

- Polymer injection and mixing unit



Observe the operating instructions for the injection and mixing unit.

Provide for a sample taking pipe socket between the thin sludge pump and injection and mixing appliance to allow for sampling of unflocculated sludge.

- Filtrate outlet

The filtrate runs off without pressure through the filtrate outlet of the screw press. The filtrate line must be laid with an inclination.

Provide for a sampling cock in the submerged area of the filtrate drain line to facilitate filtrate sampling.

- Wash water supply line



The wash water connection should be flexible.

- (Optional) exhaust air extraction, if required
- Air lines between pneumatic cylinders and pneumatic control unit

NOTICE

Check that no tools or mounting materials has been left inside the pipelines. Otherwise, the plant may suffer damages.

General information for electrical installation:

Installation must be carried out in accordance with these instructions if electrical installation is not part of the supply contract with HUBER SE.

If the customer assembles the machine, the manufacturer assumes no liability for damage which may occur as a result of improper assembly.

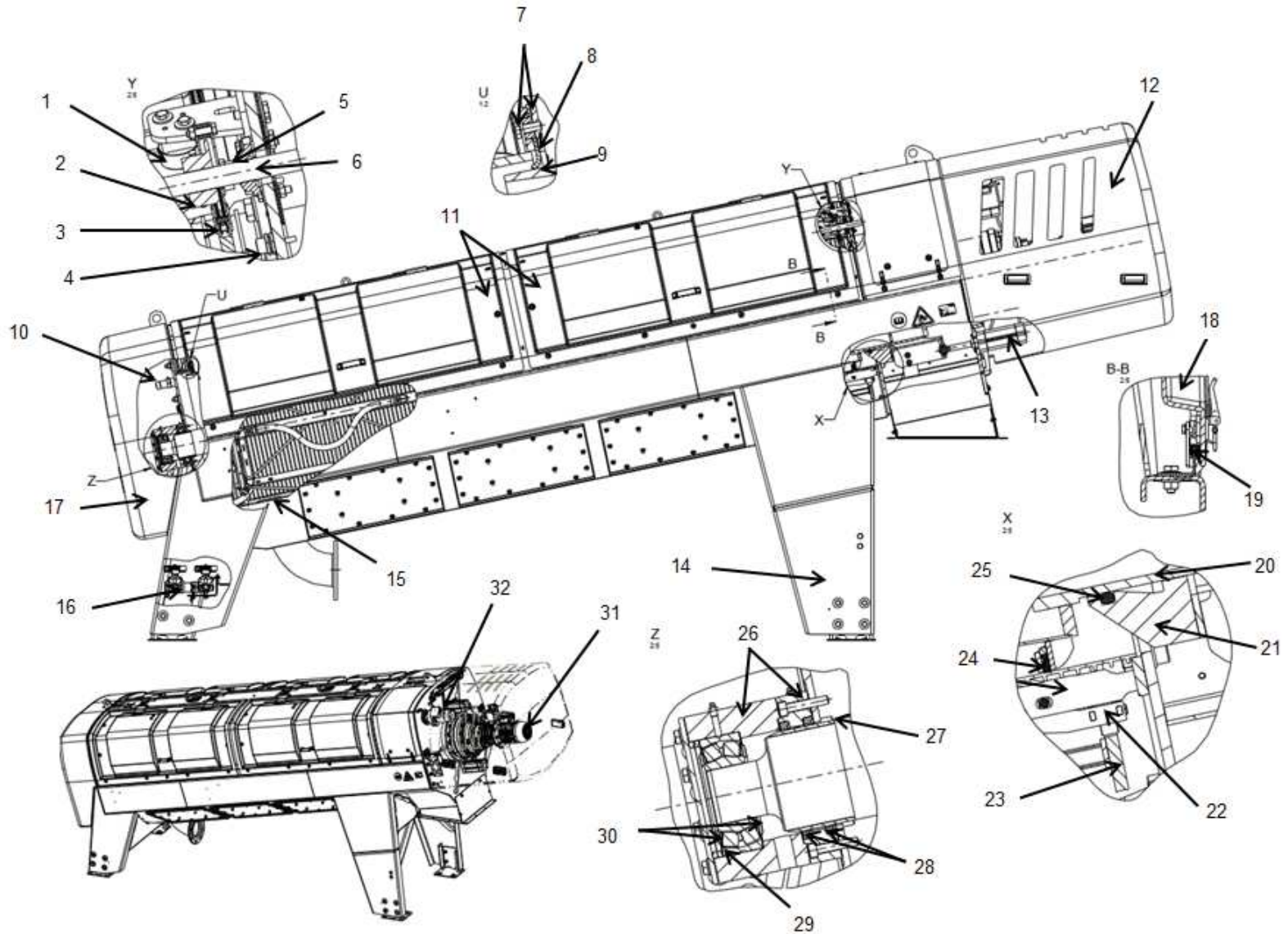
Wiring:



WARNING

Make sure that power supply is isolated!
Take appropriate measures to ensure that this is the case!
Have the electrical connection work executed only by an electric specialist only or by sufficiently instructed staff under the supervision of an electric specialist.

- When laying all supply lines, make sure that they do not become a trip hazard for operating staff.
- Have laying of the electric connections executed by a specialist only. (See connecting/wiring diagram.)
- Prepare earth connection to the plant prior to beginning any other work, and earth the gear motor and solenoid valves (optional). The degree of protection of the terminal boxes and cable glands must match that of the safety area in which the machine is installed. Fix the control panel (option) with bolts in its intended position.
- Fix the adjacent control box (option) with dowels next to / onto the machine.
- Prepare all cables between the plant, control panel and adjacent control box and connect the plant to the power supply according to the specifications in the wiring diagram. The wiring diagram and cable list are attached in the appendix, if the electrical switchboard and control panel is part of the HUBER supply contract.



- | | | | |
|----|--|----|--|
| 1 | Roller with journal bearings, running axle | 17 | Inlet-end cover |
| 2 | Chain wheel | 18 | Cover |
| 3 | Roller chain | 19 | Sealing profile |
| 4 | Proximity switch | 20 | Screw shaft |
| 5 | Flange bearing | 21 | Pressure cone |
| 6 | Drive shaft of the spray nozzle basket | 22 | Roller with journal bearings, running axle |
| 7 | Sealing fixation | 23 | Running surface of spray nozzle basket |
| 8 | Sealing | 24 | Screw flight with scraper lip, screening element |
| 9 | Clamping ring on screen basket | 25 | Round cord |
| 10 | Pressure probe | 26 | Retainer for the grooved ring and bearing |
| 11 | Cover | 27 | Bushing |
| 12 | Discharge-end cover | 28 | Grooved ring |
| 13 | Pneumatic cylinder | 29 | Self-aligning roller bearing |
| 14 | Protective conductor connection point | 30 | Nilos rings |
| 15 | Pressure hose | 31 | Planetary gear motor |
| 16 | Solenoid valve | 32 | Gear motor |

The following items are to be earthed with a potential equalisation conductor 6 mm²: 16, 31, 32

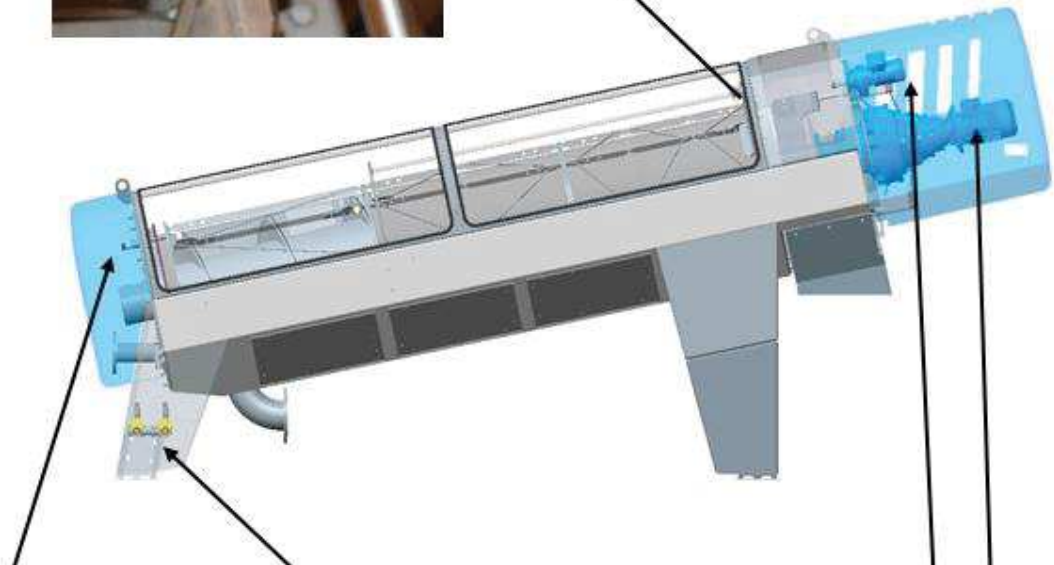
Protective conductor terminal: (M8 x min. 20 mm)

The conductor terminal as connection to the main potential equalisation acc. to DIN EN 60204-1 (VDE 0113-1) is shown by the conductor marking grounding EN 61310 D 20, see pictogram aside. Observe local protective measures as per local standards (DIN, VDE, EN, EeEx-Atex 100a).



Electrical consumers on the screw press:

Proximity switch



Pressure switch

Solenoid valves

Drive motors

Check the running direction of the motors prior to initial start-up and prior to any re-start (e.g. after a change of voltage supply)!

NOTICE

Running direction checks must be limited to only few seconds. The missing "lubricating" effect of sludge/water may lead to loud noise and/or wear of pumps or the screw press.

Safety guideline for the use of frequency converters

CAUTION

This plant uses electrical equipment, e.g. frequency converters. Due to operating conditions and in the event of a fault direct currents and high-frequency alternating currents may occur which cannot be handled by customary residual current circuit breakers type A or AC so that no sufficient operator and plant protection can be guaranteed any more. We recommend the use of an AC/DC sensitive residual current circuit breaker type B.

NOTICE

The drive motor of the machine may be designed as a permanently-energised synchronous motor. Permanently-energised synchronous motors must only be operated on suitable frequency converters.

5.4 Check-up of connections

Check all electrical connections with a rotation direction test.

NOTICE

Check only for few seconds if the rotation direction is correct.
Longer dry running may cause damage.

Check all safety devices by means of a functional test.

 Caution

When operating feed pumps in hand operation, the pressure monitoring of the screw press must also be activated in manual mode.

 CAUTION

Risk of injury! For functional checks with the control voltage switched on, the selector switch (mains isolator) must be switched on. Never put your hands into the machine interior, reactor or thick sludge trough!

NOTICE

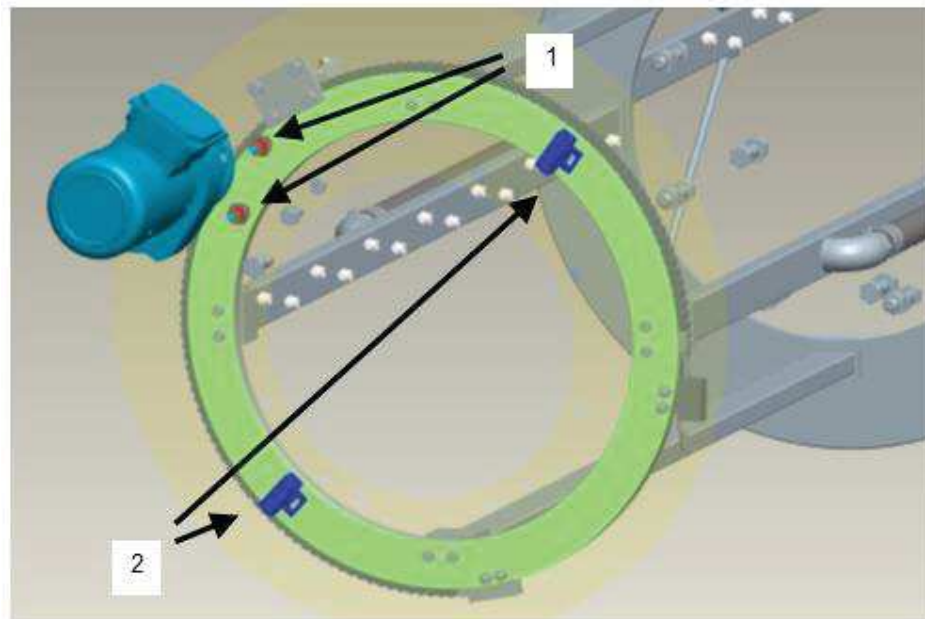
Wet the screen basket of the screw press with water before carrying out the functional test to prevent excessive noise or wear during dry running.

Check all mechanical connections for

- leakage when charged with water or compressed air.
- vibrations.

NOTICE

Check the spray nozzle basket position before starting with plant start-up.
None of the two proximity switches below the spray nozzle basket drive must be positioned in end position (directly on the cam switch of the spray nozzle basket).



- 1: Proximity switch in the machine casing
- 2: Cam switches on the spray nozzle basket

6 Start-up

Personnel

Have initial plant start-up executed by a start-up engineer of HUBER SE or specially trained external personnel. On that occasion your own operating staff must be instructed how to handle the equipment.

Prerequisites

- The equipment must have been installed exactly as specified in the operating instructions.
- All mechanical and electrical installations must have been executed properly.
- Setting parameters of probes and electrical drives must be recorded according to the electrical control system description.

NOTICE

Note especially the parameters for a limitation of the motor load and the inlet pressure.

- The wash water supply to the machine must be sufficient.
- Peripheral plant equipment that is required for the function and operation of the dewatering process, such as coagulant agent conditioning unit, pumps, probes, measuring devices, indicators, platforms, etc., must be fully operable.
- It is recommended to commission test engineers of flocculant suppliers with the pre-selection of suitable coagulant agents.

NOTICE

Strictly observe the supplied operating instructions. The manufacturer does not assume any liability for consequential damage caused by non-observance of these operating instructions. The operator bears the full risk.

Carefully fill in the start-up report and have it signed by the start-up engineer and responsible operator. Keep the report in safe custody together with the operating instructions and send one copy to HUBER SE.

6.1 Instructions for start-up

Suitable coagulant agents should be selected by means of flocculation tests prior to start-up of the screw press. The screw press normally requires flocks of a very high shearing stability.

Due to the long sludge residence time inside the press, modifications of the screw press settings, e.g. screw speed, cone pressure or flocculant dose, may become effective later than one to two hours.

The optimal screw press adjustment is always a compromise between throughput, dewatering results, filtrate quality, coagulant agent consumption and wear.

6.2 Screw press start-up

6.2.1 Preparatory work

- Prepare a suitable polymer solution.
- Make sure sufficient mixing takes place in the intermediate sludge storage tank.
- Calculate the polymer dose required for the requested sludge throughput on the basis of the polymer tests.
- Wait until the ripening time stated by the flocculant supplier has expired.

6.2.2 Starting the screw press

- Drive the pressure cone completely back (open).
- Start the screw press with approx. 50 Hz.
- Start the polymer dosing pump.
- Start the sludge feed pump.
- Inspect the sludge structure at the discharge.

The discharged sludge should be thickened, i.e. not contain visible free water any more. The flock structure should be visible.

If free water can still be seen, the polymer dose may be too high, so that the screening surface becomes clogged with polymer. The free water may be milky turbid.

If no flocks can be seen, the flocculant is unsuitable, the dose too low or the polymer mix-in energy unfavourable.

6.2.3 Rough adjustment of the screw press

- Reduce the screw speed until clear water escapes on top of the first part of the sieve. In this way the inlet area is impounded and a small preliminary pressure built up.
- Drive the pressure cone with a low pressure against the escaping sludge.
- Make sure the power consumption of the motor remains within the permissible range.

Due to the counter pressure from the pressure cone the screw press becomes filled with sludge and the dewatering process starts. Along the second and third part of the screen some solids are pressed through the screen surface.

- Change the polymer settings if filtrate quality is insufficient.

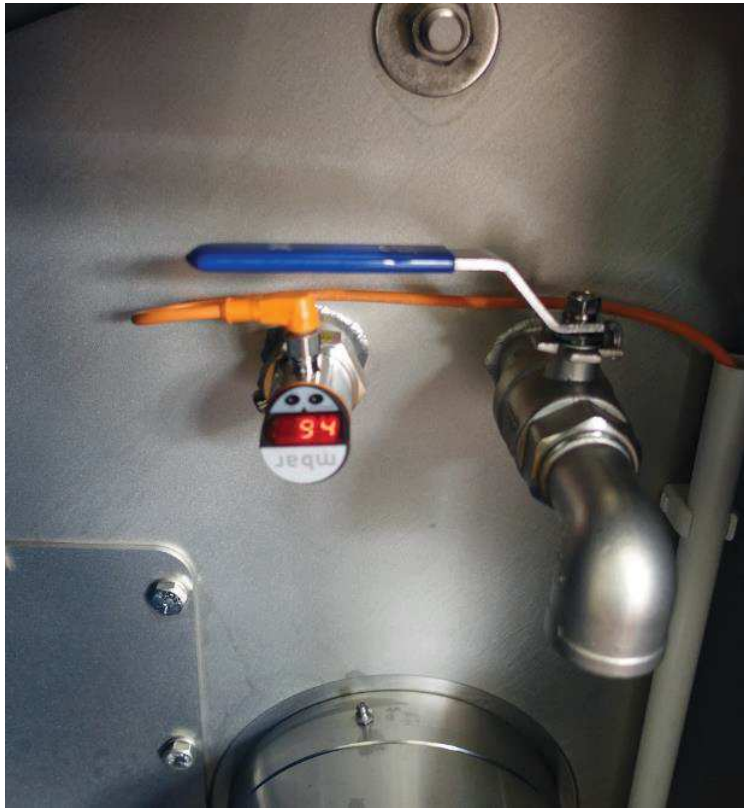
6.2.4 Optimisation of settings

- Increase the cone pressure until the requested dewatering result is achieved, or filtrate quality becomes insufficient respectively.
- Too high a cone pressure may impair dewatering results and filtrate quality.

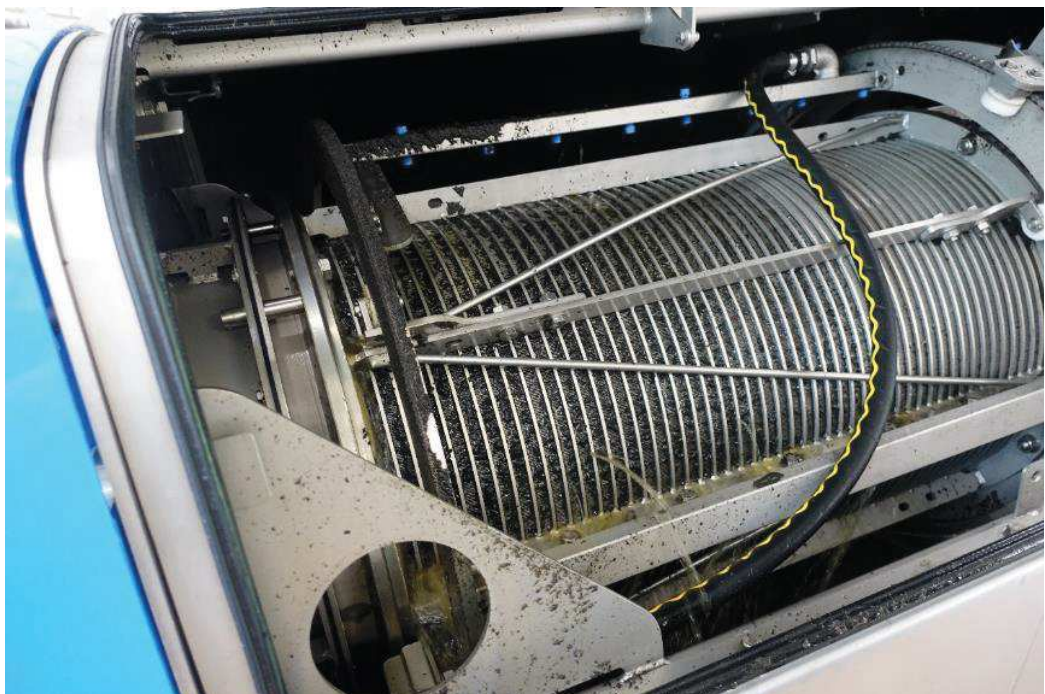


- Massive sludge deposition on the second and third screen sections, as shown in the photo above, are a sign for insufficient flocculation or a too high cone pressure.
- Deposition on the first part of the sieve (inlet area), as shown in the photo below, is a sign for insufficient screw speed or wrong polymer settings. As a result, the pressure in the inlet screen becomes too high which causes entrainment of solids into the filtrate. Read the pressure in the inlet from the pressure probe. Program the pressure at which too many solids are forced through the sieve as the limit pressure. As a safety function the plant will at this pressure switch off the feed pumps in automatic mode in the future.
- Observe the attached operating instructions for the pressure switch.
- Typical settings and limit values can be found in the separate electrical control description.





- Make sure the motor torque output lies below the nominal motor torque.
- The settings are optimal when clear water is pressed out of the screen basket in the inlet area, the middle and third part of the screen are completely filled with sludge with only few solids escaping, and sludge is discharged evenly around the pressure cone. (See below.)





- Since every washing cycle means water entry into the sludge, screen washing should be activated as infrequently as possible. Screen washing must be activated if the screen has become clogged from the outside and no filtrate can escape any more.

NOTICE

Check the motor torque of the screw drive motor whenever you have modified any settings. If the torque exceeds the nominal motor torque, this may lead to motor stoppage, screw blocking or even damage to the drive or screen.

7 Operation

7.1 Safety instructions

Operate the machine only when it is in a safe and functionable condition.

If any malfunction (incl. operating behaviour) occurs, report this immediately to the responsible authority. If required, the machine must immediately be shut down and locked! Have the causes of troubles eliminated immediately!

Prior to switching on the machine, always make sure no one can be endangered when the machine is operating.

7.2 Operation mode

The basic plant functions are automatic and do not require any manual operation.

The plant is controlled exclusively via the automatic system inside the central control panel. The complete plant is switched on and off there.

Manually adjust the plant settings (polymer settings, screw speed, inlet pressure, cone pressure, wash cycle settings, etc.) to the sludge quality.

CAUTION

In order to switch off the complete plant, it needs to be switched off at the control panel.

8 Trouble shooting and repair

8.1 Mechanical-technical and mechanical operational faults

Fault	Possible cause / Repair
Fault indication on all drives of the sludge treatment unit	
Motor fault Motor protection switch has tripped.	Remove any mechanical blockage. Check motor power consumption. Switch off mains isolator. Check the drive. Determine the cause and repair if required. Switch on motor protection switch and operate reset key. Check that there are no solid objects in the pump feed lines.
Phase breakdown	Check fuses in control panel. Check preceding fuses.
PLC (CPU) failure	Observe battery replacement intervals.
Sludge treatment does not start although no fault is indicated.	
External power supply is interrupted.	Make sure external power supply is OK.
Mains isolator is in OFF position.	Switch ON mains isolator.
Pre-selected operation: SEMI-AUTO mode	Set preselected operation mode to AUTO mode.
Emergency stop button activated	Release emergency stop button Operate reset button
Control fuse has melted.	Find the cause and replace the fuse.
Sludge feed pump does not deliver although no fault is indicated.	
Pre-selected operation: SEMI-AUTO mode	Set preselected operation mode to AUTO mode.
Air in pump housing	Shortly lift and then re-lower the switched-on feed pump on the lifting device.
Back valve is blocked.	Clean the back valve.
Intake pipe is blocked. A solid object blocks the inlet.	Clean the intake pipe. Remove the object.
Frequency converter overload	Check fault signal on frequency converter. Check the fuse. Check/change calibration
MAX pressure in the machine inlet	Wait for delay time.
The delivery flow of the sludge feed pump is too small or there is no flow at all.	
Check delivery flow control.	Frequency converter (see manufacturer's instructions) Check servo motor limit switch and adjust if required.
Check delivery flow indicator.	Re-calibrate flow indicator if required.
Worn rotor/stator assembly	Replace the rotor/stator.

Symptom	Possible cause / Repair
Coagulant agent dosing pump does not start or stops.	
Pre-selected operation: SEMI-AUTO mode	Set preselected operation mode to AUTO mode.
MIN or dry run probe in coagulant agent conditioning plant responds.	Check that coagulant agent conditioning plant is filled with sufficient medium.
Dry run protection has tripped.	Check if there is medium on the pump's suction side. Activate reset button and evaluation device.
Overpressure protection has tripped.	Find the cause. Clean the valve and back valve if required and wash the pipeline. Clean the coagulant agent dilution unit and pipeline. Activate the reset button and evaluation device.
Coagulant agent deposits in the casing or dosing line or a solid object block the inlet.	Clean and/or remove the object.
Frequency converter overload	Check fault signal on frequency converter. Check the fuse. Check/change calibration
The delivery flow of the coagulant agent dosing pump is too small or there is no flow at all.	
Check delivery flow control.	Frequency converter (see manufacturer's instructions) Adjust servo motor limit switch.
Check delivery flow indicator.	Re-calibrate flow indicator if required.
Worn rotor/stator system	Replace system according to manufacturer's instructions.
Coagulant agent deposits in the casing or dosing line or a solid object block the inlet.	Clean and/or remove the object.
Coagulant agent deposits in the coagulant agent dilution unit or dosing line or a solid object block the inlet.	Clean coagulant agent dilution unit, in particular the mixing unit and dosing line, and/or remove the object.
Shaft packing of coagulant agent dosing pump is untight.	
Shaft packing drips.	Check its seat. Re-adjust, if required. See manufacturer's instructions.
Slide ring sealing drips.	Replace slide ring sealing. (See manufacturer's instructions.)
Sludge dewatering machine does not start although no fault is indicated.	
Pre-selected operation: SEMI-AUTO mode	Set preselected operation mode to AUTO mode.
Frequency converter overload	Check fault signal on frequency converter. Check the fuse. Check/change calibration

8.2 Process-technical operational faults

Symptom	Possible cause / Repair
Flock production is disturbed (instable) – Coagulant agent overdosing and/or underdosing	
Only water is “conditioned”.	Check that coagulant agent concentrate tank is filled with sufficient medium. Dosing point / 3-way valve on coagulant agent conditioning plant is blocked. Clean it.
The dose delivered by the coagulant agent dosing pump is too high/small.	Check magnetic inductive flow meter. Check dose and flow rate and correct it. Clean coagulant agent injection nozzles of injection and mixing unit. Check adjustment of the back valve of the injection and mixing unit and correct it.
Incorrect secondary dilution of coagulant agent.	Check secondary dilution and correct flow rate.
Thin sludge concentration changed	Check concentration and correct flow rate.
Thin sludge amount is too high/small.	Check magnetic inductive flow meter. Check dose and flow rate and correct it.
Incorrect coagulant agent concentration in the conditioning plant	Water and/or coagulant agent concentrate inlet is disturbed. Re-adjust. Clean coagulant agent disperser. Check and clean filling level probes. Check if stirrers of coagulant agent conditioning plant work properly. Clean them if required. Check if coagulant agent concentrate line is clogged and clean it. Measure content of coagulant agent concentrate pump in litres. Check impulse/pause dosing times. Clean coagulant agent concentrate dosing screw and measure content in litres again. Remove deposits in the intermediate storage tank for powdery coagulant agent concentrate. Check heating. Check durability and effective substance of coagulant agent.
Coagulant agent not suitable for the sludge (summer-winter operation)	Test coagulant agents and select a suitable product.
Coagulant agent conditioning plant does not start, or stops, although no fault is indicated.	
Dry run of coagulant agent conditioning plant	Fill the plant with water and coagulant agent.
Pre-selected operation: SEMI-AUTO mode	Set preselected operation mode to AUTO mode.
Chemicals tank is empty (dry run protection).	Fill the intermediate chemicals storage tank.
Water supply is disturbed.	Ensure supply of process water; or water pressure is too low.
Reduced flow. The float element falls below the magnetic contact.	Clean the sieve. Install a pressure reducer.

Symptom	Possible cause / Repair
The coagulant agent concentrate dosing process stops.	Process water supply is disturbed or water pressure too low.
MIN or dry run probe in preparation tank responds.	No conditioning of coagulant agent has taken place – plant EMPTY Reduce extraction rate and/or prepare new coagulant agent. Plant is set to AUTO operation while in SEMI-AUTO mode. (Change operation mode.)
Inlet pressure in screw press too high	
Sieve clogging	Check polymer settings.
Screw speed too low	Adjust screw speed.
Sieve apertures are blocked.	Clean the sieve / use a high pressure cleaner.
Scraper lip wear	Replace the scraper lip.
Varying solids load	Adjust solids-specific polymer doses.
Filtrate load too high	
Screw speed too low	Adjust screw speed.
Varying solids load	Adjust solids-specific polymer doses.
Cone pressure too high	Adjust cone pressure.
Unfavourable polymer dose	Check polymer settings.
Insufficient dewatering results	
Unfavourable polymer dose	Check polymer settings.
Unfavourable cone pressure.	Check cone pressure.
Screw speed too high.	Adjust screw speed.
Sieve clogging/blocking	Adjust washing cycles. / Clean the sieve.
Insufficient sieve washing	
No wash water pressure.	Check/clean the wash water pump. Clean the pump suction side. Clean the wash water intermediate storage tank.
No water jet.	Clean/replace the nozzles. Clean the wash water intermediate storage tank.
Solenoid valve does not switch.	Clean solenoid valve / servo boring.
Spray nozzle basket does not rotate any more.	Proximity switch / overtravel of end positions Manually turn back the spray nozzle basket and adjust the proximity switch. Make sure both sprockets are working at a time!
Screw shaft overload (material jamming)	Reverse the screw shaft briefly, activate washing and discharge the soggy press cake with a high screw speed and with the pressure cone open.

9 Maintenance, repairs and cleaning

CAUTION

Enclosed rooms of wastewater treatment plants that must be entered for service and maintenance have to be aerated in a way that prevents a dangerous explosive atmosphere, lack of oxygen and presence of harmful concentrations of gas or vapour.



CAUTION



The chapter maintenance and repair is intended for skilled staff only. Any maintenance or repair work must be performed by skilled staff only. Skilled staff has to be equipped with personal protective gear (such as gloves, etc.).

Qualified technician

A person that is able to evaluate assigned jobs and recognize possible risks, due to his/her professional skills, expertise and experience and knowledge of corresponding standards. (Definition adapted from EN 60204-1.)

In order to prevent faults during operation, the machine must be cleaned and maintained at regular intervals.

	<h3> CAUTION</h3> <p>When cleaning the machine always protect yourself with waterproof protective clothing, boots, gloves, and also with a face mask (if available and especially when using a high-pressure cleaner, in order to avoid coming into contact with wastewater, faeces, etc.)</p>
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	<h3> WARNING</h3> <p>Shutdown procedure: Switch off the mains isolator and lock it. All persons responsible for carrying out maintenance work on the machine must have their own padlock. The machine can only be restarted when all padlocks have been removed from the mains isolator. Interrupt the water and compressed air supply. Secure the shut-off devices against re-opening. Depressurize the plant.</p>
---	---

In order to prevent injuries and damage to the machine, it is important to observe the following points when carrying out maintenance on the machine:

- First cordon off a large space around the area in which maintenance work is to be carried out.
- Switch off all voltage sources and ensure that they cannot unintentionally be switched back on.
- Depressurize the pneumatic and water lines.
- Secure the shut-off devices against re-opening.
- Never use any other than the specified operating media.
- Only use spare parts which are listed in our spare parts lists.
- Also refer to the chapter *General Safety Instructions*.

The above maintenance measures add to the prolongation of the machine life. Furthermore, they improve machine availability and performance.

9.1 Inspection intervals

NOTICE

Check the potential equalisation regularly, as described in chapter 3.3, Incorporated safety systems!

Prior to starting with any inspection work, clean the respective equipment parts.

CAUTION

Never use a high pressure unit to clean electrical plant equipment!

Risk of injury! Always wear protective goggles when cleaning the machine with a water jet. Never direct the jet towards a person standing nearby!

WARNING



Automatic machine start:

Risk of injury! For visual inspections with the control voltage switched on, the maintenance switch (main switch) must be switched on.

**Never put your hands into the machine interior, reactor or thick sludge trough!
Risk of injury! If you want to carry out function tests that require access to the machine interior, you must shut down the plant before.**

9.1.1 Weekly visual inspection

Visual inspection of the complete machine is required once a week. Visual inspection is also required whenever process settings have been changed or processes been adapted.

Check in particular the following:

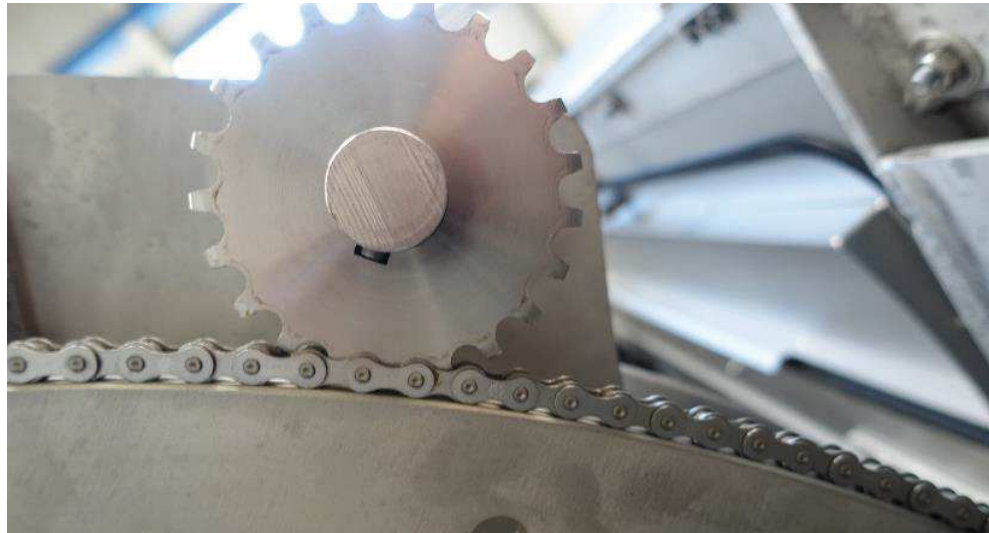
- Screen basket cleanness
- Function of the spray nozzle basket
- Filtrate chamber cleanness
- Functional test of cleaning nozzles
- Inspection of electric cables
- Inspection of connections

9.1.1.1 Screen basket

Check the screen basket once a week for cleanness (visual inspection).

9.1.1.2 Function of the spray nozzle basket

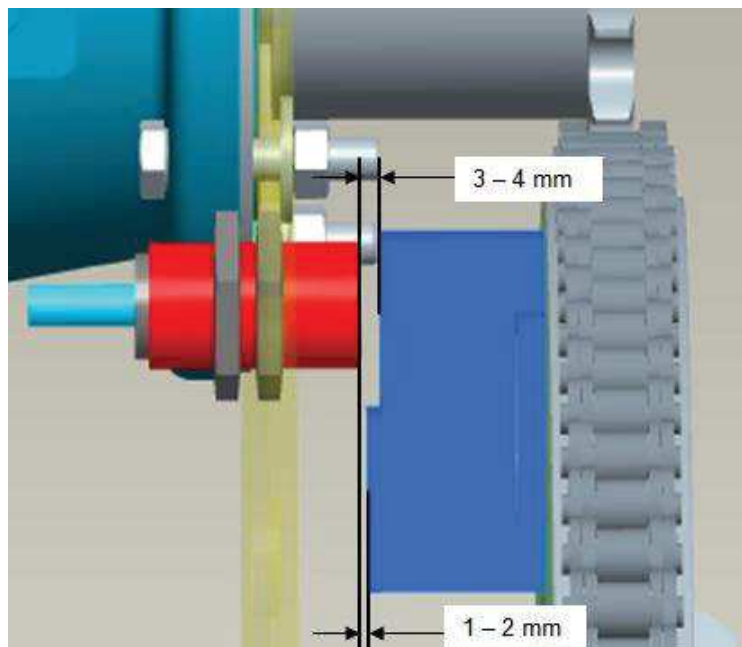
The screen basket must run without play. Worn rollers must be replaced. The drive pinion must engage into the drive chain deeply in the middle.



The spray nozzle basket must change its rotary direction when reaching the respective end positions.

NOTICE

To ensure that the spray nozzle basket performs perfectly, the distance between the cam switches and the according proximity switch must be 2 mm (minimum) to 6 mm (maximum).



The distance between the proximity switch and the cam switch can be adjusted on the thread on the proximity switch.

9.1.1.3 Filtrate chamber

Check once a week that the filtrate chamber is clean (visual inspection).

9.1.1.4 Spray nozzles

- Check the nozzles by examining the jet pattern. Screw out and clean the nozzles that are clogged.

9.1.1.5 Electric cables

- Check all cables for damage.
- Have all damaged cables replaced by a specialist.

9.1.1.6 Connections

- Check that all connections of the machine are tight (leak-proof) and undamaged (pneumatic hoses, etc.).

9.1.2 Monthly functional test

Monthly execute the following maintenance work:

- Check the sieve apertures.
- Check the feed end oil seal.
- Check the pressure cone system.

Check the pressure sensor during operation, without dismounting:

Check if the display shows 0 mbar at empty machine or tank.

Clean any dirt from the filter cover and deposits from the process membrane if the deviation is bigger than 2% of the measurement range.

9.1.2.1 Inspection of sieve apertures

- After the washing mode, check the sieve apertures for organic or mineral sediments.

Mineral deposits caused by wash water with a high lime or iron content or organic deposits caused by sludges that contain grease for example may blind the screen apertures and reduce filtration efficiency. (See below.)





Useful is regular washing with warm water, using additives or screen basket cleaning with acid-containing agents.

CAUTION

Wear lye-resistant clothes and gloves, sealed goggles and respiratory protection to protect yourself while carrying out chemical purification! Pay attention that the working area is sufficiently ventilated. If you get in contact with hazardous substances, immediately take off your clothes and wash the affected skin with water.

Observe also separate safety instructions (safety data sheets) of the chemicals suppliers.

NOTICE

In order not to impair the durability of the construction materials of the machine, observe the instructions for use provided by the suppliers of the chemicals.

The following recommendations for the use of cleaners apply additionally:

- Empty contaminated machine parts before chemical cleaning, clean them with clear water and let them dry.
- Use only chemical cleansers with a corrosion inhibitor.
- Dilute high-concentration acids or lyes to a concentration of 12% maximum.
- Let the cleaner react for 20 minutes maximum.
- Wash the cleaner off thoroughly after expiry of the reaction time.

9.1.2.2 Feed-end oil seal

The oil seal can be inspected through a leakage opening below the grease nipples at the feed end. If sludge escapes at the point marked below, either the grease filling of the seal chamber is insufficient or the seal is defective.



9.1.2.3 Checking the pressure cone system

- Remove deposits from the shaft surface in the cone area.
- Remove deposits from the pushing rods of the pneumatic cylinder.
- Check the pneumatic cylinders at the pushing rods and exterior air connections.
- Drain the water collected in the pneumatic lines.



9.1.3 Yearly functional test

Yearly maintenance (shutdown machine, disassemble)

Cleaning of pressure sensor:

Clean the process membrane with a soft sheet and suitable cleaners.

Overpressure or touching the membrane with hard metallic objects may damage the measurement electronics.

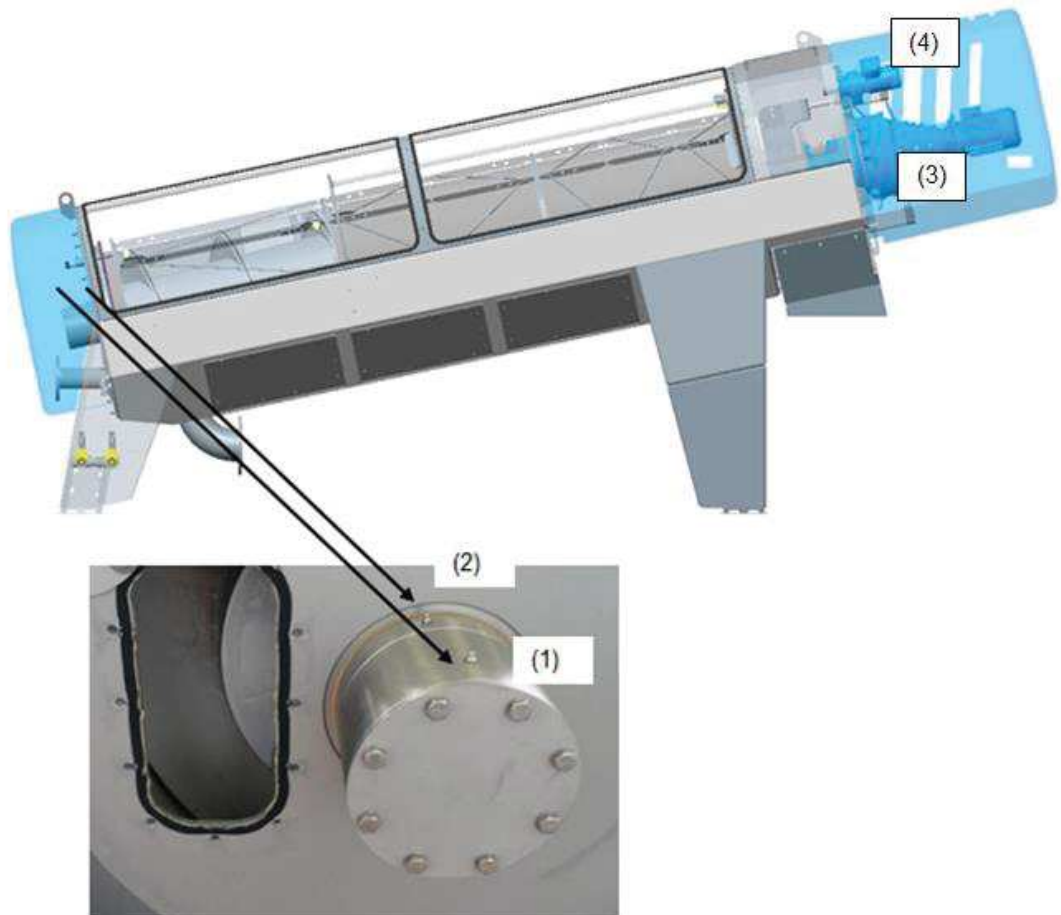
9.2 Maintenance

9.2.1 Lubrication

Lubrication point	Interval	(Proposed) lubricant
Feed-end screw shaft bearing (1)	monthly or every 500 operating hours 5 g lubricant	Plantogel 2 S
Feed-end oil seal (2)	monthly or every 500 operating hours 1 g lubricant (620) 2 g lubricant (800)	Plantogel 2 S

Lubricant specification according to DIN 51502: KPE 2 K-30

Lubricant specification according to DIN 51519: ISO-VG 100



If the bearing or oil seal is to be replaced, the new bearing or new sealing must be filled 100% with lubricant.

NOTICE

Grease the bearing points while the screw shaft is rotating to ensure the complete lubrication of the bearings.

9.2.2 Oil change

Observe the attached operating instructions for the gear motor.

CAUTION

When working on the gear motor, provide a suitable work platform, which complies with the general safety and accident prevention regulations.

Lubrication point	Interval	(Proposed) lubricant
screw shaft gear (3)	first time after 100 operating hours, then every 2 500 operating hours resp. after 2 years latest	Fuchs Renolin PG 320
Spray basket gear (4)	every 10 000 operating hours resp. after 2 years latest	Fuchs Renolin CLP 220

9.3 Repair

It may be necessary to dismount the machine or parts of the machine to do maintenance and repair work.

WARNING

Consider that some machine components may swing back and forth when they are lifted.

Use separate lifting devices to secure machine components which are installed inclined (e.g. the screw drive) against pendular movement.

NOTICE

Do not step on the plastic covers and do not put weight on them by lashing straps.

These auxiliary means and special tools facilitate maintenance work:

- Mounting rail above the machine's longitudinal axis
- Moveable portal crane or fork lift
- Torque wrench up to 800 Nm

The heaviest individual machine parts and their weight:

Size	Screw shaft	Screen baskets	Screw drive
Q 620.2	400 kg	420 kg 210 kg half-shell	280 kg
Q 800.2	650 kg	720 kg 360 kg half-shell	400 kg

Size 620.2 machines **without** dividable screen basket

- Pull-in device for screw shaft
- Chain hoists, lifting power ≥ 1.5 t
- Bearing blocks, load-bearing capacity ≥ 1.5 t

Weight of the heaviest assembly group to be handled: 1.8 t

This assembly group consists of the screen basket, screw shaft, discharge chamber with motors and pressure cone, and the spray nozzle basket.

CAUTION

Observe the safety instructions under chapter Handling and transporting.
Risk of injury! Always wear protective goggles when cleaning the machine with a water jet.
Never direct the jet towards a person standing nearby!

For durable and reproducible positioning of plant components some connections are secured with at least 2 adjust pins (connections of the screen baskets, inlet/outlet chambers, screw shaft bearing).

NOTICE

Pay attention to the drill holes for the adjust pins when you adjust and align the components during assembly.
Use new adjust pins to secure the connections.

WARNING



Shutdown procedure: Switch off the mains isolator and lock it.
All persons responsible for carrying out maintenance work on the machine must have their own padlock. The machine can only be restarted when all padlocks have been removed from the mains isolator.
Check if hazards arise from upstream or downstream equipment. Switch off the power supply of upstream and downstream machines before carrying out maintenance or repair work.
If, for operational reasons, it is not possible to disconnect the entire plant the responsible electrician, who must be qualified according to DIN VDE 1000-10, has to disconnect the individual machines and make sure according to DIN EN 50110-1 VDE 0105-1 they cannot be restarted unintentionally.
As an option, all drives and machines can be equipped with a repair switch which allows to switch off the respective machines/areas prior to carrying out repair work, according to DIN VDE 0100-200. The repair switches must be switched off and locked as described above.

9.3.1 Replacing the rollers of the spray nozzle basket

If the spray nozzle basket shows a radial play on the screen basket or the drive pinion does not perfectly engage into the drive chain any more, the rollers of the spray nozzle basket must be replaced.

- Completely deplete the machine.
- Shut down the machine.
- Remove the machine covers.
- Clean the machine interior and the drive elements of the spray nozzle basket using a high-pressure unit.
- Temporarily close the filtrate outlet with paper to avoid that screws or tools get lost.
- Remove the pinions of the spray nozzle basket from the machine.
- Remove the hose lines from the spray nozzle basket.
- Turn the spray nozzle basket in the machine into a position where the flange plates of the spray nozzle basket can be accessed.
- Secure the upper and bottom half shells of the spray nozzle basket on the screen basket or on the machine frame so it cannot move.
- Loosen the flange plates of the spray nozzle basket paying attention to the markings on the elements for later reassembly.



- Lower the bottom half of the spray nozzle basket into the filtrate chamber of the machine.
- Lift the upper half of the spray nozzle basket out of the machine.
- Replace the axial and radial rollers including the axle bolts and pins.



- When reassembling the equipment, pay attention to the markings on the individual elements.

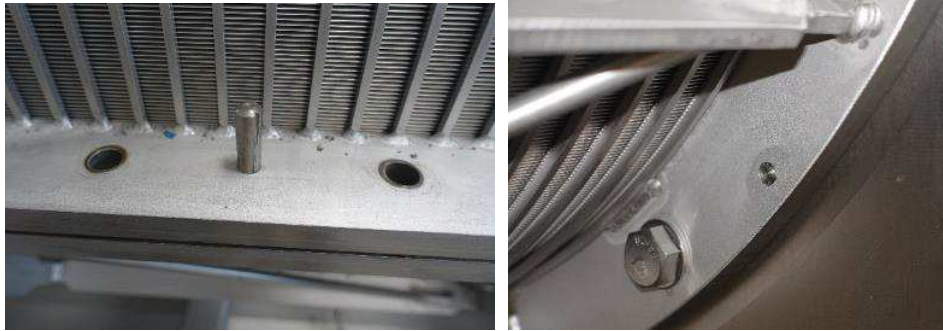
- After completed reassembly, check the concentric alignment towards the screen basket. Check also that the drive pinions engage perfectly and that the cam switches have the correct distance to the proximity switches.

9.3.2 Replacing the scraper on the screw shaft

Replace the scraper if the dewatering efficiency decreases significantly, or if the feeding pressure or the rotary speed of the screw increases despite otherwise unchanged sludge properties and settings for the flocculant.

How to proceed with machines with a splittable screen basket:

- Divide the spray nozzle basket as described above.
- Loosen the radial grooved pins on the half shells of the screen basket.
- Loosen the axial grooved pins on both ends of the upper half shell of the screen basket.



- Loosen the through-bolts on the holder of the screen basket support at the inlet end of the machine. The clamping ring at the inlet side can now be pushed some centimetres into the inlet chamber. The upper half of the screen basket now has axial play inside the machine casing.



- Temporarily fix the pushed back clamping ring in the inlet chamber.



- Lift the upper half of the spray nozzle basket out of the machine casing.



- Loosen now the exposed headless screws that fix the scraper.



- Give the screw shaft a half turn.

⚠ WARNING

The machine must be in maintenance mode when turning the screw shaft (see Electrical Control Description).

- only tip operation (no intervention into the machine possible at the same time)
- significantly reduced rotary speed
- only forward moving
- time-limited

⚠ WARNING

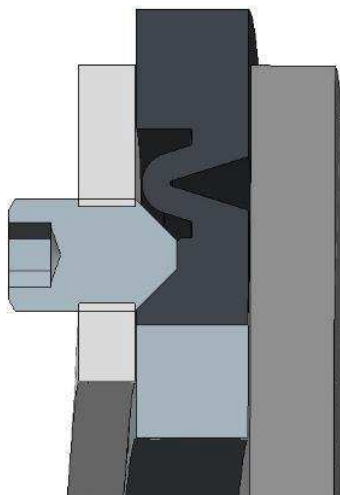


Automatic machine start:

Risk of injury! For visual inspections with the control voltage switched on, the maintenance switch (main switch) must be switched on.

Never put your hands into the machine interior, reactor or thick sludge trough! Risk of injury! If you want to carry out function tests that require access to the machine interior, you must shut down the plant before.

- Loosen the other headless screws that fix the scraper.
- Pull the worn scraper out of its frame.
- Thoroughly clean the frame.
- Insert a new scraper lip into the frame beginning on the discharge end.
- Push the ends of the scraper into the pockets of the frame.



- Fix the scraper with threaded pins on the first half, exposed turn. The screwed-in threaded pins should be flush with the metal frame.
- Bevel the scraper with a knife on the first 3 cm to make it flush with the upper edge of the screw flight and thus allow the scraper to easily slide into the bottom half of the screen basket when the screw shaft is turned.
- Lubricate the scraper with flocculant or soft soap.



- Give the screw shaft a half turn and fix the scraper with screws.
- Continue this way to replace the scraper over the whole screw shaft.
- Cut off the projecting length. Bevel the last 3 cam with a knife to make it flush with the upper edge of the shaft.
- Reassemble the machine proceeding in reverse order.
- Use new grooved pins when pinning the individual components.
- Prior to restarting the machine, check that the drive pinions of the spray nozzle basket engage correctly and that the distance between the cam switches and the proximity switches is correct.

How to proceed with machines with a non-dividable screen basket:

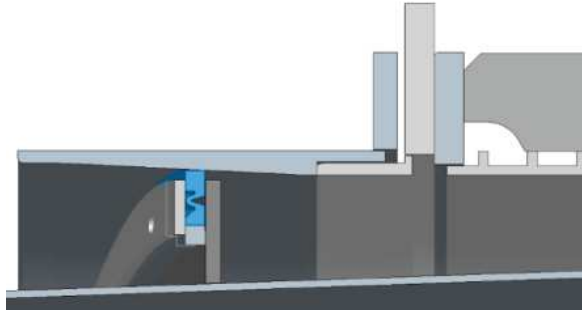
- Completely deplete the machine.
- Shut down the machine.
- Remove the machine covers.
- Clean the machine interior and the drive elements of the spray nozzle basket using a high-pressure unit.
- Temporarily close the filtrate outlet with paper to avoid that screws or tools get lost.
- Remove the electrical connections of the motors and the pneumatic hoses from the pressure cone.
- If any, loosen the connections to the press sludge conveying unit.
- Remove the wash water hoses from the spray nozzle basket.
- Remove the discharge casing from the machine frame.
- Remove the radial screen basket holders from the machine frame.



- Attach the end of the screen basket on the inlet side and the discharge casing to the lifting device.
- Slowly pull out of the machine the screen basket along with the washing system and the discharge casing with the motors and the pressure cone. Pull in axial direction until the shaft journal can be seen.
- Lift the complete assembly group upwards out of the machine casing.
- Place the assembly group onto bearing blocks beside the machine.



- Loosen the screws that connect the gearing and screw shaft.
- Pull the screw shaft out of the screen basket at the inlet end.
- Replace the scraper on the screw shaft as described above.
- Separate the drive shaft of the spray nozzle basket from the drive journal.
- Separate the discharge chamber from the screen basket.
- Lubricate the scraper and screen basket.
- Attach the screw shaft at the inlet end to the conical clamping ring on the screen basket.
- Pull the screw shaft out of the screen basket at the inlet end.



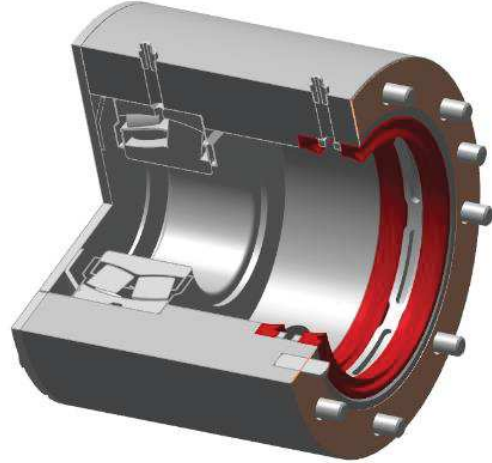
- Pay attention that the scraper does not get jammed but slides easily into the screen basket.



- Replace the sealing ring in the pressure cone.
- Replace the rollers of the spray nozzle basket, if necessary.
- Reassemble the machine proceeding in reverse order.
- Use new grooved pins when pinning the individual components.
- Pay attention that the tightening torques are correct when fixing the screw shaft to the output flange of the gearing.
620.2: 510 Nm (M20 A2-70)
800.2: 780 Nm (M30 A2-70)
- Prior to restarting the machine, check that both drive pinions of the spray nozzle basket engage correctly and evenly and that the distance between the cam switches and the proximity switches is correct.

9.3.3. Replacing the feed end shaft sealing/bearing

Replace the shaft sealing if sludge exits from the leakage borehole under the grease nipple. The bearing holder and the sealing support are screwed together. The sealing support is screwed and pinned to the inlet chamber.



- Loosen the bearing cover, bearing bush and sealing support, one after the other.
- Replace the shaft sleeve.
- Replace the shaft sealing rings and, if necessary, the shaft bearing.
- Before reassembly, completely fill the shaft bearing and the sealing gap with grease.
- Re-mount the components proceeding in reverse order.
- Lubricate the bearing and the shaft sealing only while the screw shaft is rotating. Pay attention to apply the correct amount of lubricant and lubricate in the required intervals.

9.4 Spares, wear parts

a) Wear parts

Our guarantee does not include wearing parts that are subject to natural wear during operation. Wearing parts are defined as parts that show increased wear due to their function – such as the rotating plant parts, shaft seal and gearbox seals, scrapers, packing strips, etc. – the degree of wear depending on operational conditions, running hours and plant maintenance.

These are the main wear parts of the plant:

1. Scraper brushes on the screw flights
2. Shaft sealing with shaft sleeve
3. Shaft bearing
4. Rollers of the spray nozzle basket (620.2, 800.2)
5. Rollers of the spray nozzle basket (620.2, 800.2)
6. Nozzles of the spray nozzle basket
7. Hoses of the spray nozzle basket
8. Pneumatic cylinder

If the plant is fed with abrasive material (as frequently contained especially in industrial sludges), the life of the cleaning brushes may significantly be reduced. Components subject to emery wear are excluded from warranty.

b) Spare parts

For other spare parts such as gear motor, solenoid valve, lubricator, etc. see appendix.

Please provide the following details when ordering spare parts:

Type of machine

Size

Order number = machine number

Year of manufacture

Operating voltage of the electrical part

Order number from the spare part list (see appendix)

Required number of units

Delivery address

10 Shutdown

In order to avoid injury, damage to machinery and environmental damage when decommissioning the machine, the following safety guidelines must always be observed:

- The machine must only be decommissioned by authorised, qualified personnel.
- Please contact the manufacturer if you have questions concerning the disposal of the machine.
- Take care of environmentally sound disposal of operating media, lubricants and auxiliary material (e.g. gearbox oil): Observe the regulations for eco-friendly waste disposal!
- The machine must only be lifted at the points specified for the purpose.
- Only the lifting equipment and accessories listed here must be used for lifting the machine and parts of the machine.

WARNING

Use the lifting eyes only with the provided number of screws at the provided positions on the machine.
Check the lifting eyes and screws according to the enclosed inspection sheet before reuse.

- Also refer to the chapter *Transportation*.
- Also refer to the chapter *General Safety Instructions*.

10.1 Temporary shutdown

- Make sure there are no sludge residues left in the tanks and sludge dewatering machine after cleaning which might lead to biogas production.
- Empty the coagulant agent concentrate and dosing line (suction and pressure lines).
- Completely evacuate the coagulant agent conditioning plant.
- Flush all dosing pumps and deplete them.
- Empty the feed reactor.
- Empty the thick sludge trough.
- Clean coagulant agent injection nozzles of injection and mixing unit.
- Completely evacuate the sludge thickening machine and manually remove sludge residues. Make sure the filter surfaces are completely clean.
- Clean the nozzles of the filter cleaning system.
- Empty the coagulant agent concentrate pump.
- Frost-protect the pipelines and prevent deposits.
- Check control panel battery of the PLC (E-Prom).
- Completely evacuate the coagulant agent conditioning tank.
- Lubricate all bearings and sealings.

10.2 Final decommissioning / disposal

Qualified staff only is authorized to perform electrical and mechanical shutdowns. Prior to a final shutdown, follow the instructions for a temporary shutdown and the following additional instructions:

Completely empty the coagulant agent conditioning plant and coagulant agent concentrate tank. Clean the coagulant agent conditioning plant with appropriate agents. Return/dispose unused chemicals to the supplier.

11 Additional information

Do you have any further questions or requests? We will be happy to assist you.

Our company address:

HUBER Technology, Inc.
1009 Airlie Parkway
Denver, NC 28037

Phone: 704-949-1010
Fax: 704-949-1020
E-mail: huber@hhusa.net

You can contact our central customer service by:

Phone: 1-877-US HUBER
E-mail: service@hhusa.net

We will help you to quickly find the right technical expert to answer your questions.

You can also visit us online at: huber-technology.com

You can also find up-to-date information on our service division there.

Our range of services includes **preventive maintenance, maintenance, and rapid repairs**.
Our service hotline is available **24 hours a day, 7 days a week**.

Our service department will provide you with the customer-oriented and reliable service that our customers have come to expect. Our qualified employees and skilled management offer you assistance with:

- **Installation and commissioning**
- **Advice, information and training of operating personnel**
- **Maintenance at regular intervals**
- **System optimisation**
- **Maintenance of product performance**
- **Repairs and standard spare parts within 48 hours**

This comprehensive range of services ensures that your system can be operated safely and reliably. This is an important aspect for municipalities and industry. The support provided by our service department means that you can more effectively carry out the task of maintaining the functionality of your system.

Certificate

Pickling Plant HUBER SE

We confirm with this certificate that

- All HUBER SE stainless steel products are acid treated in a pickling bath and passivated in the fully automatic pickling plant installed in the Hans Huber SE factory.
- The pickling tank size is 12m x 3m x 3m to ensure the treatment of even big equipment parts. Later welding work at the time of machine assembly can be avoided.
- The pickling process consists of preliminary washing, pickling and secondary washing. The plant is operated fully automatically.
- The pickling plant is operated as a circulation system and equipped with a state-of-the-art wastewater treatment plant. The corresponding threshold values are met considerably.

Only these measures ensure the material retains its excellent properties and remains corrosion-resistant according to its material quality.

The pickling process is annually inspected by an external environmental verifier. The pickling process is further monitored continuously by the operator himself, additionally by external maintenance specialists and the local authorities.

Nürnberg, June 19th 2015



Dipl.-Phys. R. Mirz
Environmental Verifier DE-V-0260

Certificate

Standard **ISO 9001:2015**

Certificate Registr. No. **01 100 1700023**

Certificate Holder: **Huber SE**
Industriepark Erasbach A1
92334 Berching
Germany

Scope: Development, manufacture and sales of machine equipment and plant for water, wastewater, sludge for municipalities and industries as well as products for the drinking- and wastewater sector

Proof has been furnished by means of an audit that the requirements of ISO 9001:2015 are met.

Validity: The certificate is valid from 2020-08-13 until 2023-08-12.
First certification 2017

2020-06-30


TÜV Rheinland Cert GmbH
Am Grauen Stein · 51105 Köln

C E R T I F I C A T E

ISO 14001:2015

for

HUBER SE

at the site

92334 Berching, Industriepark Erasbach A1

The DAU-accredited environmental verifier hereby certifies that the named organization has implemented an Environmental Management System.

Scope: Development, production and sales of machine equipment and plants for water/waste water and sludge treatment for municipalities and industries as well as products for the drinking and waste water sector

With an audit it has been assessed that the requirements of ISO 14001:2015 are fulfilled.

Nürnberg, 6 May 2021

The follow-up certificate No. UG0247-2021 is valid until 29 May 2024.


Dipl.-Phys. Reinhard Mirz
Environmental Verifier
DE-V-0260


Dr. Reiner Beer
Environmental Verifier Organization
DE-V-0279

Warranty

Aberdeen, ID
HUBER Q-PRESS 620.2

LIMITED WARRANTY: Huber warrants that the equipment and components furnished will be free from defects in workmanship and materials and perform the general process function intended, solely under the conditions defined by Huber for a period of (a) twelve (12) months from completion of installation, start-up or owner acceptance of the equipment assuming the equipment is accepted by the owner within 6 months of delivery or (b) eighteen (18) months from the date of delivery to Purchaser, whichever date comes first. Huber will replace, modify or repair, at its sole option, any such defective component or equipment at no charge provided that Huber is notified promptly in writing of any claimed defect. If requested by Huber, any such defective part or component shall be returned to Huber, freight prepaid. Huber will provide on-site Field Service when reasonably assured of payment therefore if this warranty does not apply or when such service is required in its judgments. This warranty does not apply to any defect or malfunction arising out of failure to store, install, operate or maintain the equipment in accordance with instructions by Huber. Warranty shall be voided for any misuse of equipment; operation under conditions other than those defined by Huber in its operation and maintenance (O&M) manuals for said equipment, or gross operator negligence. Any unauthorized modification or alteration of the equipment or repair or replacement of components may void this warranty, at the sole option of Huber. For any billable repairs completed outside of the initial warranty period, a sixty (60) day guarantee on work performed and parts supplied will apply.

HUBER TECHNOLOGY INC. MAKES NO OTHER WARRANTY, EXPRESS OR IMPLIED, WITH REGARD TO THE DESIGN, SALE, MERCHANTABILITY OR FITNESS OF THE GOODS FOR A PARTICULAR PURPOSE OR USE EXCEPT AS EXPRESSLY SET FORTH IN HUBER'S TERMS AND CONDITIONS. HUBER IS NOT SUBJECT TO ANY OTHER OBLIGATIONS OR LIABILITIES ARISING OUT OF BREACH OF CONTRACT OR WARRANTY, TORT CLAIMS INCLUDING NEGLIGENCE AND STRICT LIABILITY, OR ANY OTHER THEORIES OF LAW. HUBER IS UNDER NO EVENT LIABLE FOR ANY SPECIFIC, INDIRECT, INCIDENTAL OR CONSEQUENTIAL LOSS, DAMAGES, EXPENSE, INJURY, DISMEMBERMENT, OR DEATH OF ANY KIND WHATSOEVER

LIST OF MATERIALS NEED FOR SERVICE

Aberdeen, ID

Specification Section: 46 76 27

Addenda Numbers: 1

Equipment:

Q-Press 620.2 with Controls

Other than the machine itself, there are no other materials needed to perform the service work.

LIST OF SPECIAL TOOLS

Aberdeen, ID

Specification Section: 46 76 27

Addenda Numbers: 1

Equipment:

Q-Press 620.2 with Controls

Huber verifies that no special tools are required for maintenance or repair of this equipment.

NUMBER OF DAYS AND TRIPS FOR START-UP

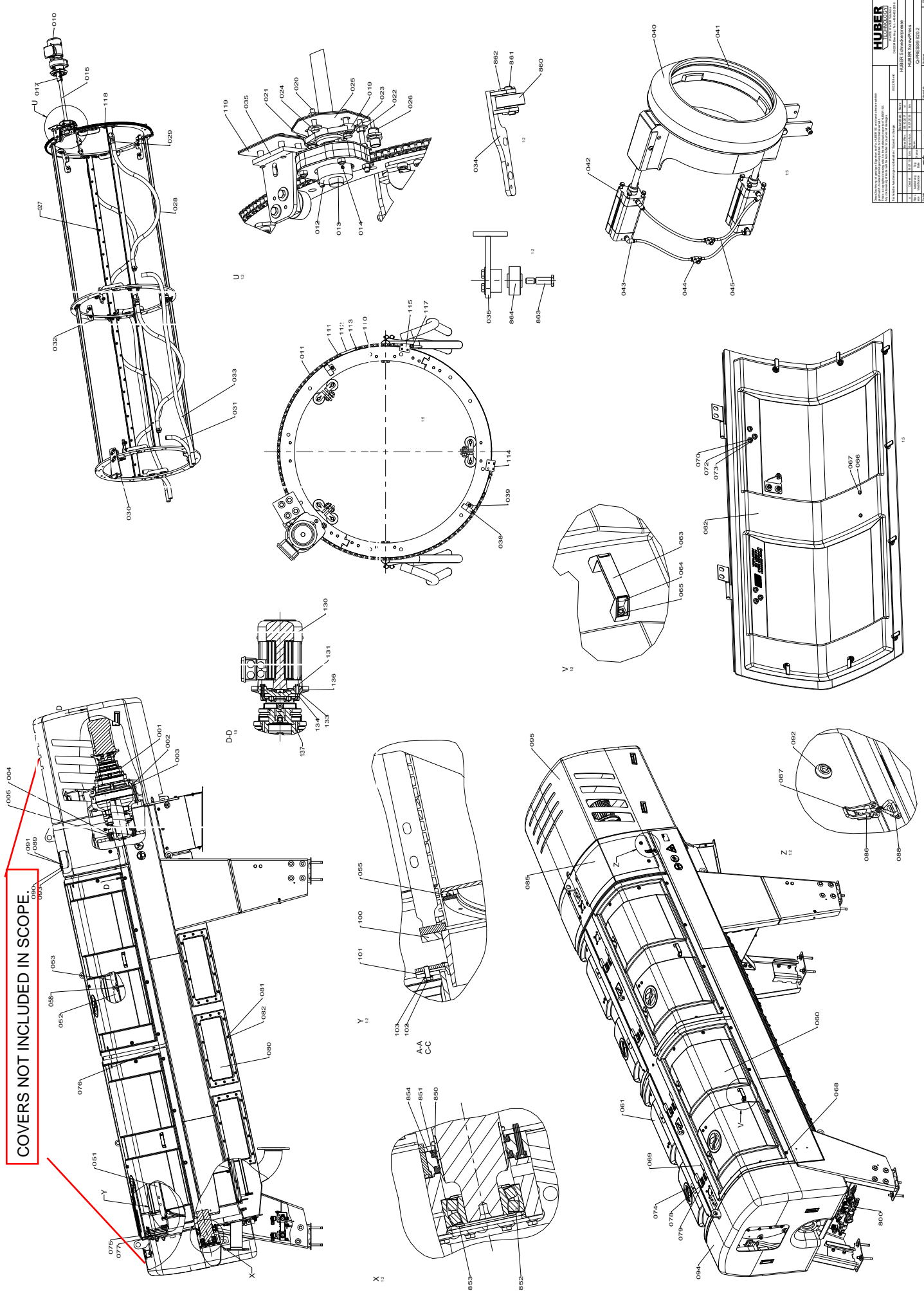
Aberdeen, ID HUBER Q-PRESS 620.2

Huber will provide a total of one (1) trip, for a total of two (2) on-site days, per specification.

These trips are to inspect the final installation, supervise initial start-up and operation and to train operating personnel in the proper operation and maintenance of the system. These trips also account for startup services for performance testing and two site visits during first year of equipment operation.

Additional services are available on a per diem rate upon request.

COVERS NOT INCLUDED IN SCOPE.



HUBER		HUBER		HUBER	
HUBER		HUBER		HUBER	
HUBER		HUBER		HUBER	
01	02	03	04	05	06
07	08	09	10	11	12
13	14	15	16	17	18
19	20	21	22	23	24
25	26	27	28	29	30
31	32	33	34	35	36
37	38	39	40	41	42
43	44	45	46	47	48
49	50	51	52	53	54
55	56	57	58	59	60
61	62	63	64	65	66
67	68	69	70	71	72
73	74	75	76	77	78
79	80	81	82	83	84
85	86	87	88	89	90
91	92	93	94	95	96
97	98	99	100	101	102

Ersatz- und Verschleißteile

spare and wear parts

HUBER Schneckenpresse Q-PRESS® 620.2

HUBER Screw Press Q-PRESS® 620.2

Als Verschleißteile gelten Teile, die aufgrund ihrer Funktion einen erhöhten Verschleiß aufweisen. Der Verschleiß hängt dabei sehr stark ab von:

- Einsatzbedingungen (z.B. erhöhter Sandanteil bzw. abrasive Materialien)
- Betriebsstunden
- Wartung

Wearing parts are parts that are subject to increased wear due to their specific function. Such wear depends to a great extent on:

- Application conditions (such as an increased grit rate, or abrasive materials)
- Running hours
- Maintenance

Ersatzteil / spare part: s
Verschleißteil / wear part: w

Empfohlene 2 Jahre / recommended 2 years	Empfohlene 5 Jahre / recommended 5 years	Pos item	Benennung / description		
		001	Antriebseinheit	drive unit	s
		002	Zylinderschraube DIN 912	cylinder head screw	s
		003	Scheibe DIN 125	washer	s
		004	Sechskantschraube DIN 933	hexagon head screw	s
		005	Scheibe	washer	s
		010	Getriebemotor	geared engine	s
x		011	Rollenkette lang	roller chain long	w
x		012	Ritzel	pinion	w
		013	Passfeder DIN 6885	adjusting spring	s
		014	Zylinderschraube DIN 912	cylinder head screw	s
		015	Antriebswelle	shaft short	s
		017	Kupplung Motor/Welle	coupling engine/shaft	s
		019	Flanschlager	flange bearing	s
		020	Sechskantschraube DIN 933	hexagon head screw	s
		021	Scheibe DIN 125	washer	s
		022	Sechskantmutter DIN 934	hexagonal nut	s
		023	Sechskantschraube DIN 933	hexagon head screw	s
		024	Scheibe DIN 125	washer	s
		025	Dichtung	sealing	w
		026	Näherungsschalter	proximity switch	s
x		027	Flachstrahldüse	flat jet nozzle	w
x		028	Schlauch HD 1"	hose	w
		029	Schlauchbinder 1"	hose clamp	s
		030	Axiallagerung	axial bearing	s
		031	Schlauch HD 1"	hose	s
		032	Radiallagerung	radial bearing	s
		033	Schlauch HD 1"	hose	s
		034	Radiallagerung	radial bearing	s
		035	Axiallagerung	axial bearing	s
		036	Eingreifschutz Ritzel	pinion protection	s
		037	Radiallagerung	radial bearing	s
		038	Kontaktgeber	contact	s
		039	Senkkopfschraube DIN 7991	countersunk screw	s
		040	Druckkonus	pressure cone	s
x		041	Dichtprofil	sealing profile	w
		042	Pneumatikzylinder	pneumatic cylinder	w
		043	L-Steckverschraubung	L-plug connection	s

Empfohlene 2 Jahre / recommended 2 years	Empfohlene 5 Jahre / recommended 5 years	Pos item	Benennung / description		
		044	T-Steckverschraubung	T-plug connection	s
		045	Schlauch	hose	s
		050	Druckschalter	manometric switch	s
		051	Sieb vorne	screen	s
		052	Sieb Mitte	screen	s
		053	Sieb hinten	screen	s
		054	Schneckenwelle	shaft	s
x	x	055	Abstreiflippe	wiper	w
x	x	057	Gewindestift DIN 914	thread pin	w
		058	Paßkerbstift DIN 1472	locating dowel pin	s
		060	Deckel rechts (komplett)	cover right (complete)	s
		061	Deckel links (komplett)	cover left (complete)	s
		062	Deckel	cover	
		063	Bügelgriff	handle	s
		064	Deckel für Bügelgriff	cover for handle	s
		065	Sechskantmutter DIN 934	hexagonal nut	s
		066	Dichtring	sealing ring	s
		067	Sechskantschraube DIN 933	hexagon head screw	s
		068	Drehriegel	turning bolt	s
		069	Deckelscharnier re.	frame joint for cover right	s
		070	Linsenkopfschraube DIN 7380	lens head screw	s
		072	Scheibe mit EPDM	washer	s
		073	Sechskantmutter DIN 934	hexagonal nut	s
		074	Deckelscharnier li.	frame joint for cover left	s
		075	Kantenschutzprofil	sealing	w
x	x	076	Streifendichtung	strip sealing	s
x	x	077	Streifendichtung	strip sealing	s
		078	Linsenkopfschraube DIN 7380	lens head screw	s
		079	Scheibe DIN 9021	washer	s
		080	Deckel (komplett)	cover (complete)	s
		081	Dichtring	sealing ring	s
		082	Sechskantschraube DIN 933	hexagon head screw	s
		085	Abdeckung Auswurfkasten	cover	s
		086	Exzenterverschluß	eccentric lock	s
		087	Senkschraube DIN 963	countersunk screw	s
		088	Schließhaken	door latch	s
		089	Sechskantmutter DIN 934	hexagonal nut	s
		090	Senkschraube DIN 963	countersunk screw	s
		091	Scheibe DIN 9021	washer	s
		092	Drehriegel	turning bolt	s
	x	093	Streifendichtung	strip sealing	w
		094	GFK-Abdeckung Einlauf (optional)	GFP cover inlet (optional)	s
		095	GFK-Abdeckung Auslauf (optional)	GFP cover outlet (optional)	s
		100	Klemmring	clamping ring	s
		101	Dichtung	sealing	s
		102	Sechskantschraube DIN 933	hexagon head screw	s
		103	Scheibe	washer	s
		110	Rollenkette kurz	roller chain short	s

Empfohlene 2 Jahre / recommended 2 years	Empfohlene 5 Jahre / recommended 5 years	Pos item	Benennung / description		
		111	Verbindungsglied	connection link	s
		112	Kettenlasche Leerlauf	link plate freerun	s
		113	Kettenhülse Leerlauf	sleeve freerun	s
		114	Kettenhalterung	chain attachment	s
		115	Kettenhalterung	chain attachment	s
		116	Kettenspanner	chain tightener	s
		117	Sechskantmutter DIN 934	hexagon nut	s
		118	Zylinderschraube DIN 6912	cylindric screw M12x20	s
		119	Dichtung	sealing	s
		130	Elektromotor	electric motor	s
		131	Sechskantschraube DIN 933	hexagon head screw	s
		132	Scheibe	washer	s
		133	Scheibe DIN 125	washer	s
		134	Sechskantmutter DIN 934	hexagonal nut	s
		135	Isolierhülse	insulating bush	s
		136	Dichtung	sealing	s
		137	Getriebe	gearbox	s
		800	Magnetventil	solenoid valve	s
x		850	Buchse	bush	w
x		851	Nutring	oil-seal	w
		852	Pendelrollenlager	self aligning roller bearing	s
		853	Nilos-Ring	seal ring	s
x		854	Dichtung	sealing	w
x		860	Laufrolle Radiallager	roller radial	w
x		861	Rollenachse Radiallager	roller axes radial bearing	w
x		862	Splint	cotter pin	w
x		863	Rollenachse Axiallager	roller axes radial bearing	w
x		864	Laufrolle Axiallager	roller axes axial bearing	w

**LIST OF SPARE PARTS SUPPLIED
BY HUBER WITH EQUIPMENT
Aberdeen, ID**

By Specification 46 76 27:

- one (1) set of wipers with mounting hardware
- one (1) bearing assembly for shaft
- one (1) solenoid valve
- ten (10) nozzles for spray washing system

Included for customer benefit:

- pinion/roller chain for cleaning system
- hose for cleaning system
- sealing pressure cone
- sealing for inspection lid
- bearing rotating cleaning system

**Lindsay Barnes
Aftermarket Sales Specialist NE
704-990-2050**

Lindsay.Barnes@hhusa.net

A member of the HUBER Group

STORAGE PROCEDURE

ABERDEEN, ID

Mechanical Equipment Storage:

When selecting the location for storage, take care that the components cannot be damaged due to vehicles or careless working. The components may not become dirty due to splashes of concrete or mortar. There should be no spark fountains from angle grinders etc. Exposed electrical components of the equipment (sensors and motors) must be wrapped with a waterproof bag. The equipment may not be stored externally near the coast. The storage location must be vibration free. Do not store organic dissolvents at the location of storage. Avoid ultraviolet radiation as well as ambient air containing ozone, hydrogen sulfide, and chloride. If equipment is stored for longer than 6 months, the gearbox oil should be drained and refilled with new oil. Please contact Huber on the project specific external storage strategy for approval.

Control Panel Storage:

When selecting the storage place take care that the components cannot be damaged due to vehicles or careless working. The components may not become dirty due to splashes of concrete or mortar. There are no spark fountains from angle grinders etc. The control panel must be stored internally in a climate controlled environment within a non-classified environment. The storage temperature shall not drop below 35°F and shall not exceed 95°F. Specific external storage strategies are allowed upon prior written permission by Huber. In these cases, please provide detailed storage plan, in writing, so that a component by component evaluation can be completed for the control system.

KOLIBRIEN[®]

July 5, 2023

Julia Hahn
Huber Technology, Inc.
1009 Airlie Parkway
Denver, NC 28037

Re: Aberdeen, ID – PID73010205 Q-Press

Julia,

We have reviewed the material specifications you provided and prepared structural analysis and seismic anchorage within this submittal. Q-press anchorage shall use epoxy anchor 5/8"Ø Hilti HIT-HY 200 V3 + HAS-V-36 (ASTM F1554 Gr.36) w/ 4in. effective embedment depth, minimum 8in. edge distance, and minimum concrete thickness of 8" per ESR-4868. Or in lieu of epoxy anchors, use wedge anchor 5/8"Ø Hilti Kwik Bolt TZ2 SS304 or SS316 w/ 4in. effective embedment depth, minimum 8in. edge distance, and minimum concrete thickness of 8" per ESR-4266.

The calculations performed for this project by Kolibrien are based on current Idaho Building Code, ASCE 7-16 Minimum Design Loads for Buildings and Other Structures, ACI 318-14 Building Code Requirements for Structural Concrete, AISC Steel Construction Manual 15th Ed., as well as the project specifications.

If you have any questions, please feel free to contact us.

Sincerely,

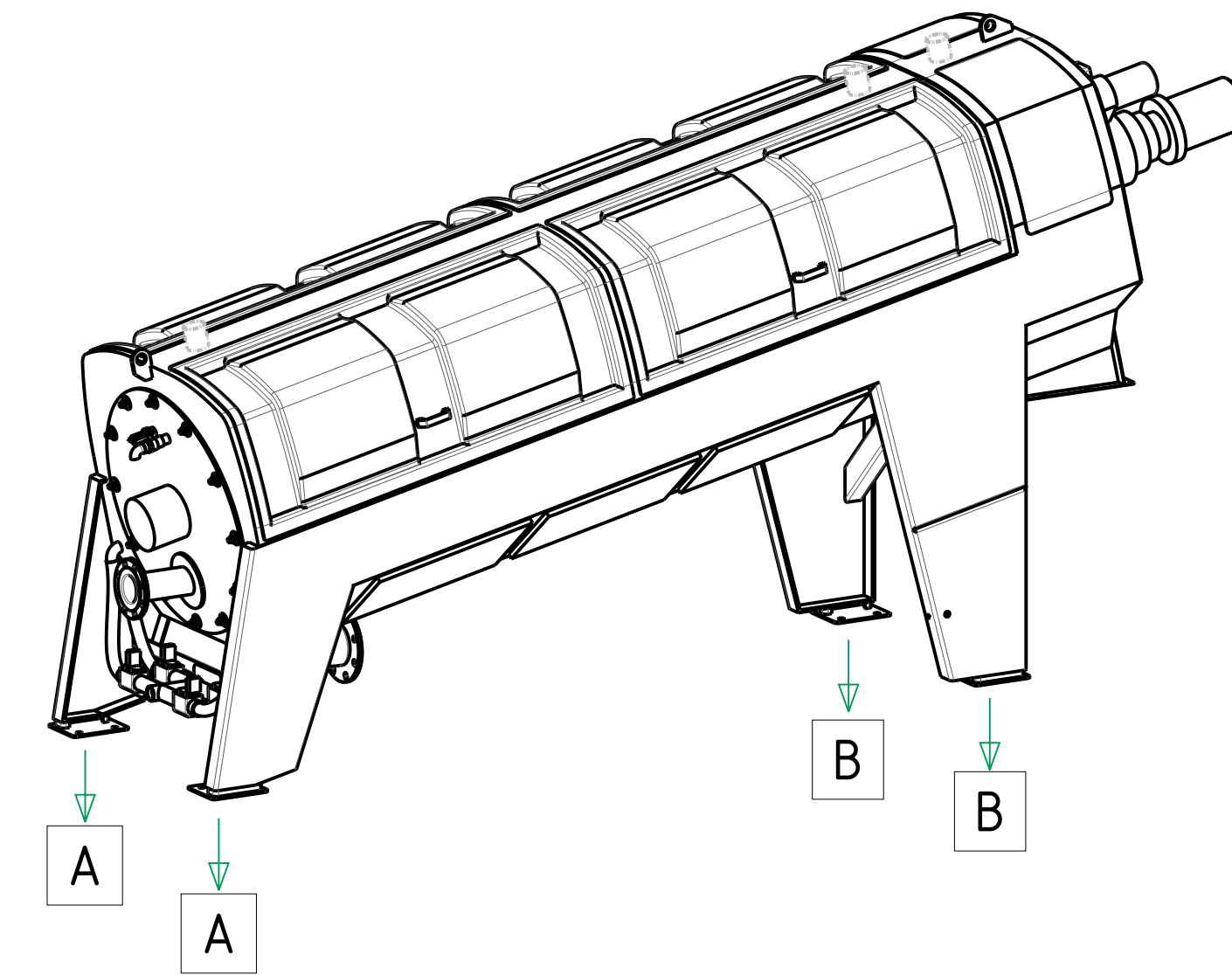
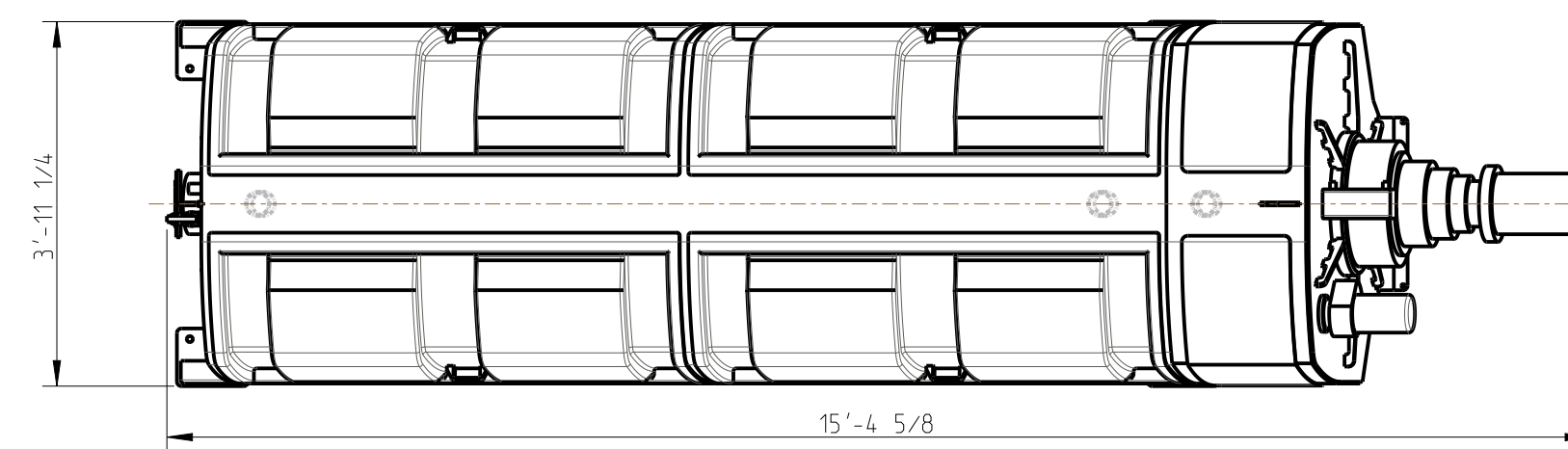
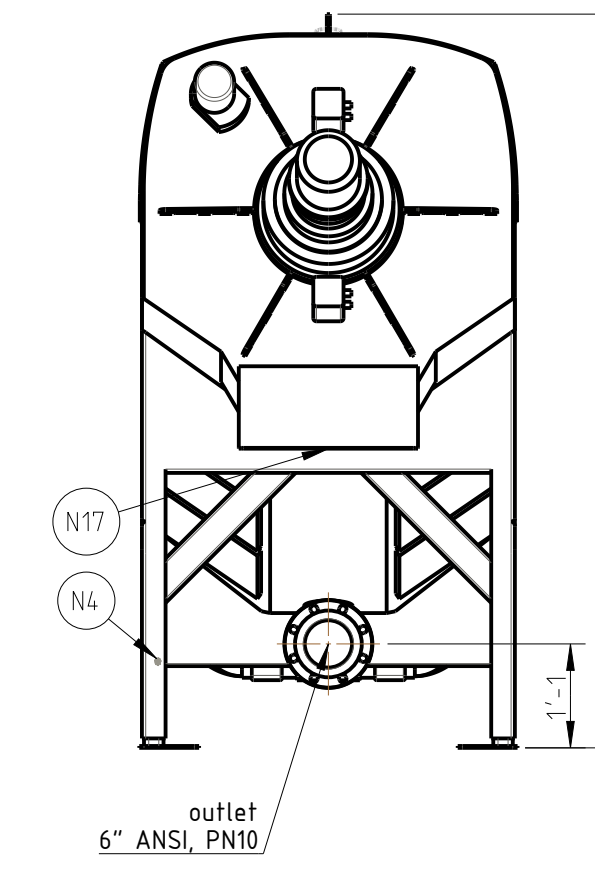
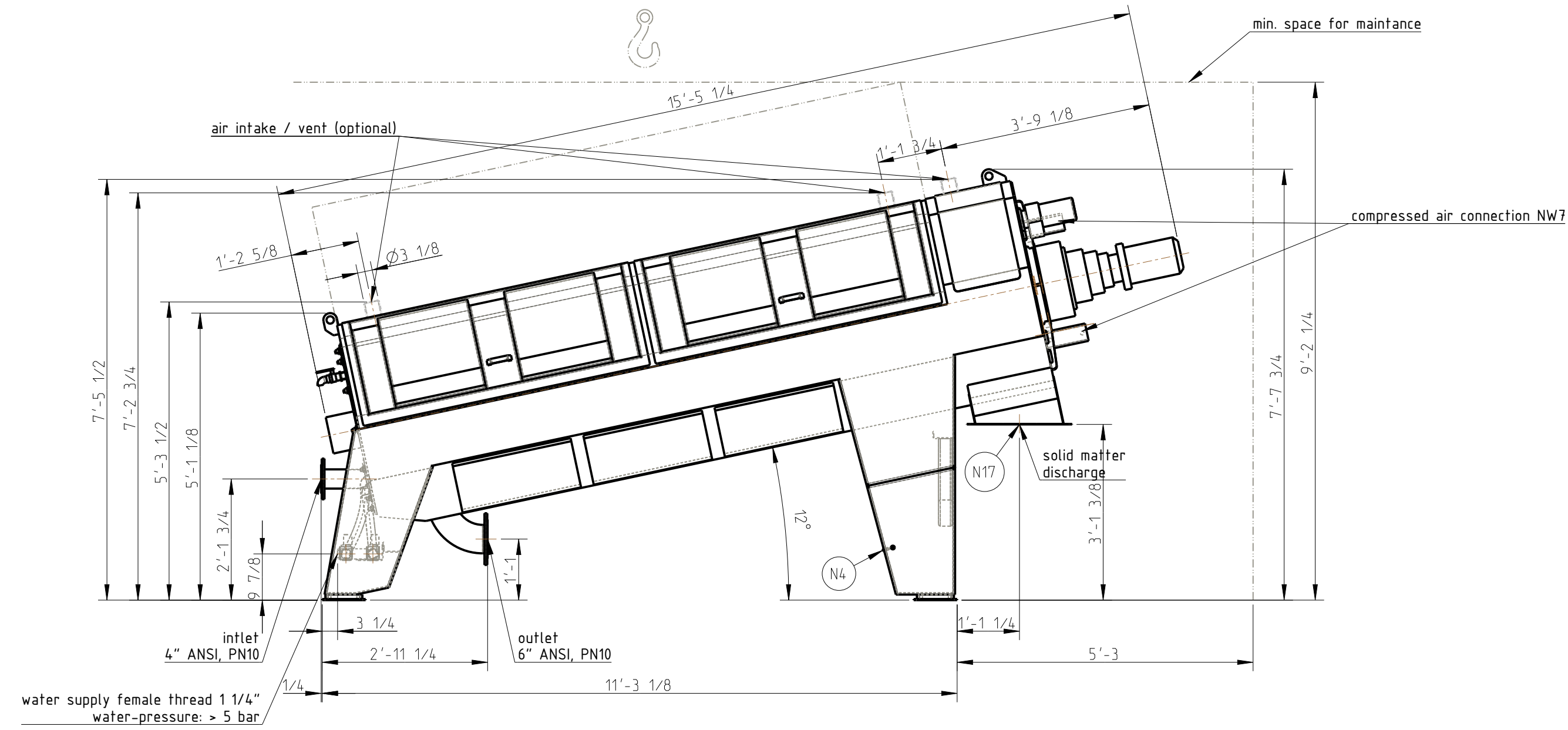
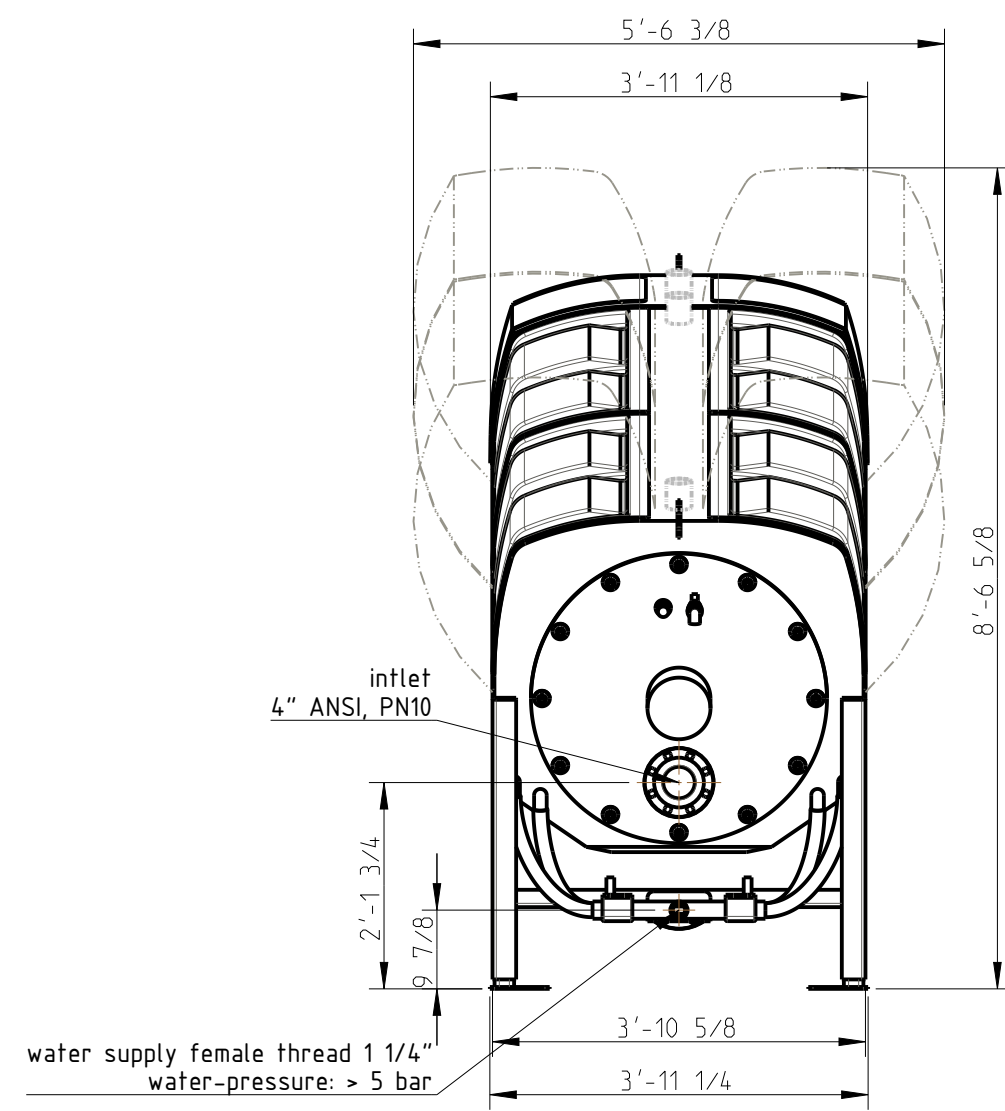
John Johnson, P.E.
Principal Engineer
KOLIBRIEN CORP.



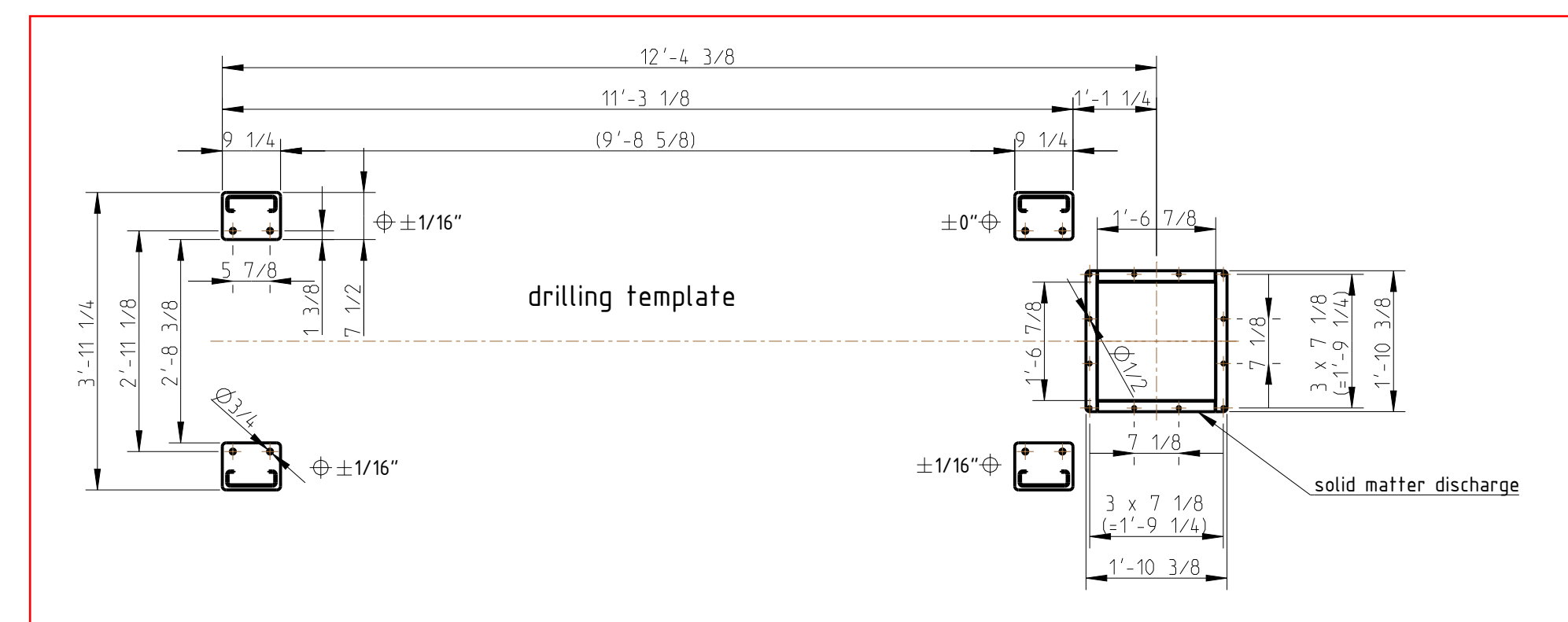
A handwritten signature in blue ink, appearing to be "John Johnson", written over the bottom portion of the professional seal.

Attachments:

- 1: Supporting documents*
- 2: Structural calculations*



Note:	
N1	Compliance of the machinery directive: For the planning and building construction security precautions, safety requirements as well as country specific regulations must be respected.
N2	Anchor base Normal reinforced concrete, concrete strength minimal C20/25 up to a maximum of C50/60. Anchor type: HILTI AG, type stud anchor HST2-R M16x140/25
N3	The firm standing of the machine is only guaranteed after anchoring!
N4	Equipotential bonding Connection point for protective conductor size M8: (grounding cable 10 mm ² copper) Connection point for the connection to the main equipotential bonding according to DIN EN 60204-1 (VDE 0113-1). The local safety measures according to the guidelines (DIN, VDE, EN, ATEX) must be noted.
N10	Free drain of the tank must be guaranteed! Additional drain pipe >= 4 per thousand
N11	Additional loads (e. g. pipelines, service platforms,...) on our plant are not allowed
N17	Comply with safety distances for reaching and passing through to solid discharge: Chute / shaft (H > 550mm) closed on all sides optional or customer supplied (slot opening at flange <= 20mm). Alternatively provide protective structures! At discharge heights over 2500mm no additional attachments necessary.



	empty	in operation
A	1237 lbf	1709 lbf
B	1800 lbf	2001 lbf
weight	5953 lbs	7275 lbs

Intellectual property of HUBER Technology, Inc. Technical information subject to change.			HUBER Screw Press	
Designed:	knj	Date	04.04.2022	
Approved:	ll	Scale:	1:1	Fig. No. 1/1
Modified:	-	Scale:	1:1	Dimension Sheet
Rev.	-	Modification	-	Size: D
				Drawing No. 51801392

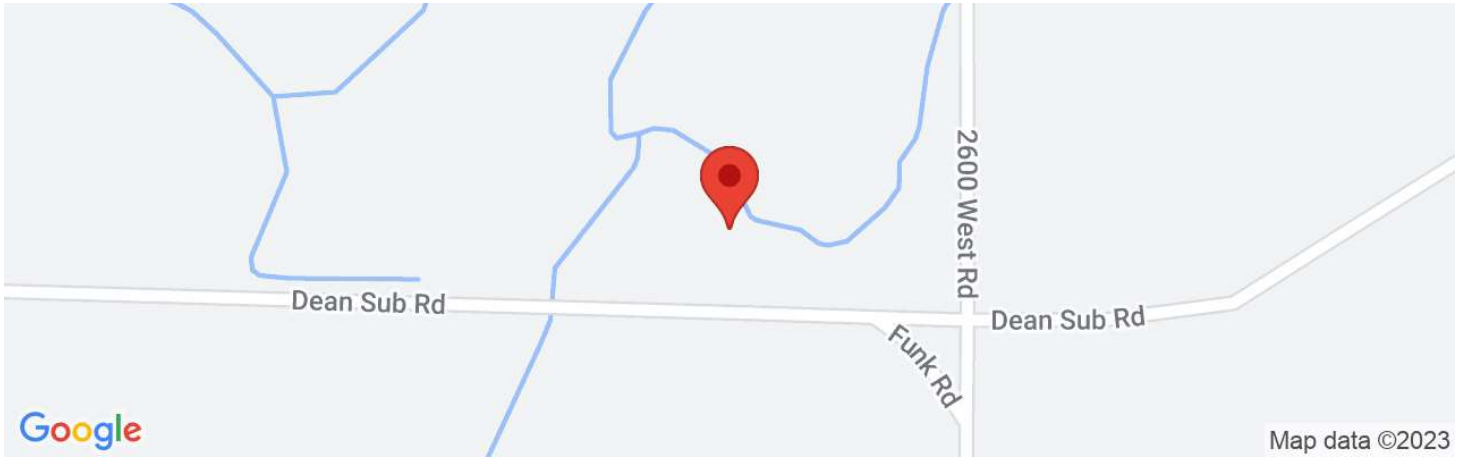
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ABERDEEN, IDAHO WWTP

2610 1900 South Rd, Aberdeen, ID 83210, USA

Latitude, Longitude: 42.9225271, -112.8133682



Date	7/5/2023, 5:27:20 PM
Design Code Reference Document	ASCE7-16
Risk Category	III
Site Class	D - Default (See Section 11.4.3)

Type	Value	Description
S_S	0.263	MCE_R ground motion. (for 0.2 second period)
S_1	0.109	MCE_R ground motion. (for 1.0s period)
S_{MS}	0.418	Site-modified spectral acceleration value
S_{M1}	0.261	Site-modified spectral acceleration value
S_{DS}	0.279	Numeric seismic design value at 0.2 second SA
S_{D1}	0.174	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	C	Seismic design category
F_a	1.589	Site amplification factor at 0.2 second
F_v	2.381	Site amplification factor at 1.0 second
PGA	0.113	MCE_G peak ground acceleration
F_{PGA}	1.574	Site amplification factor at PGA
PGA_M	0.178	Site modified peak ground acceleration
T_L	6	Long-period transition period in seconds
S_{sRT}	0.263	Probabilistic risk-targeted ground motion. (0.2 second)
S_{sUH}	0.283	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
S_{sD}	1.5	Factored deterministic acceleration value. (0.2 second)
S_{1RT}	0.109	Probabilistic risk-targeted ground motion. (1.0 second)
S_{1UH}	0.115	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S_{1D}	0.6	Factored deterministic acceleration value. (1.0 second)
$PGAd$	0.5	Factored deterministic acceleration value. (Peak Ground Acceleration)
PGA_{UH}	0.113	Uniform-hazard (2% probability of exceedance in 50 years) Peak Ground Acceleration

Type	Value	Description
C_{RS}	0.931	Mapped value of the risk coefficient at short periods
C_{R1}	0.953	Mapped value of the risk coefficient at a period of 1 s
C_V	0.826	Vertical coefficient

I COMPONENT ANCHORAGE - ASCE 7-16

SITE SPECIFIC SEISMIC DATA PER ASCE 7-16 CHAPTER 13 - COMPONENTS:

DESIGN, 5% DAMPED SPECTRAL RESPONSE ACCELERATION PARAMETERS (REFERENCE STRUCTURAL NOTES):

0.2-SECOND, S_{DS} : $S_{DS} = 0.279 g$

SEISMIC SITE CLASS: D
 SEISMIC DESIGN CATEGORY: D

BUILDING OCCUPANCY & COMPONENT IMPORTANCE FACTOR:

BUILDING CLASSIFICATION:

BUILDINGS AND OTHER STRUCTURES, THE FAILURE OF WHICH COULD POSE A SUBSTANTIAL RISK TO HUMAN LIFE.

BUILDING OCCUPANCY CATEGORY: III

BUILDING IMPORTANCE FACTOR: $I_e = 1.25$

ASCE 7-16 COMPONENT CLASSIFICATION:

THE COMPONENT IS REQUIRED TO FUNCTION FOR LIFE-SAFETY PURPOSES AFTER AN EARTHQUAKE, INCLUDING FIRE PROTECTION PRRINKLER SYSTEM.

COMPONENT IMPORTANCE FACTOR: $I_p = 1.50$

ASCE 7-16 COMPONENT CLASSIFICATION:

ENGINES, TURBINES, PUMPS, COMPRESSORS, AND PRESSURE VESSELS NOT SUPPORTED ON SKIRTS AND NOT WITHIN THE SCOPE OF CHAPTER 15

COMPONENT SEISMIC PARAMETERS:

COMPONENT AMPLIFICATION FACTOR: $a_p = 1.0$
 COMPONENT RESPONSE MODIFICATION FACTOR: $R_p = 2.5$
 OVERSTRENGTH AS REQUIRED FOR ANCHORAGE TO CONCRETE: $\Omega = 2.0$
 COMPONENT VIBRATION ISOLATION: NOT ISOLATED
 BUMPER RESTRAINT OR SHUBBER IN EACH DIRECTION WITH LESS THAN 1/4" AIR GAP? N/A
 RESTRAINT CLEARANCE FACTOR FOR ISOLATED EQUIPMENT: $f_{cr} = 1.00$

HEIGHT OF COMPONENT IN STRUCTURE: $z/h = 0.5$ anchored to foundation

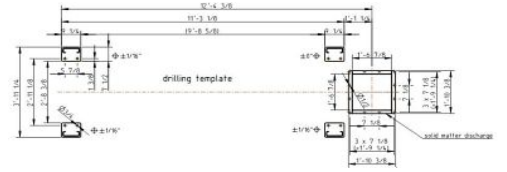
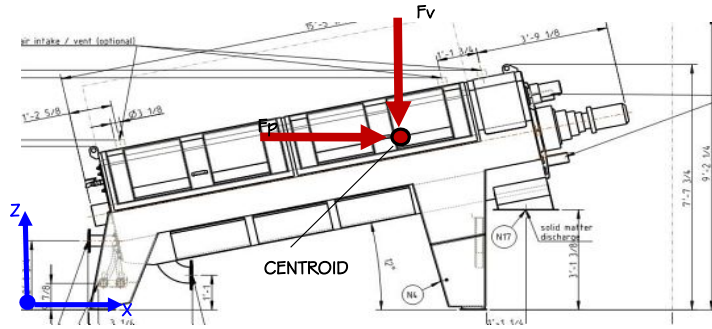
COMPONENT SEISMIC DESIGN FORCE:

	LRFD	ASD
$F_v = 0.2 \times S_{DS} \times W_p =$	0.06 W_p	$0.7F_v = 0.04 W_p$
$F_p = [(0.4 \times a_p \times S_{DS} \times W_p) / (R_p / I_p)] \times [1 + 2(z/h)] =$	0.13 W_p	$0.7F_p = 0.09 W_p$
$F_{p,min} = 0.3 \times S_{DS} \times I_p \times W_p =$	0.13 W_p	$0.7F_p = 0.09 W_p$
$F_{p,max} = 1.6 \times S_{DS} \times I_p \times W_p =$	0.67 W_p	$0.7F_p = 0.47 W_p$
$F_{p,design} =$	0.13 W_p	$0.7F_{p,design} = 0.09 W_p$

PROJECT: Q-PRESS SEISMIC ANCHORAGE
 PROJECT #:
 REFERENCE: ABERDEEN, ID WWTP

PREPARED BY: DT
 CHECKED BY: JHJ
 DATE: 7/5/2023

WIND LOADING ANALYSIS ASCE 7-16
 EQUIPMENT LOCATED INDOORS: WIND ANALYSIS NOT APPLICABLE



BOLT PATTERN FOR REFERENCE

Q-PRESS INFO

Total Weight = $W_p = 7,275$ lb
 Centroid Height = $Z_c = 2/3 * H = 61.17$ in CONSERVATIVE

GOVERNING DESIGN FORCES WITH ANCHORAGE TO CONCRETE

LRFD WITH OVERSTRENGTH	Fv factor	Fp factor	
$(1.2 + 0.2S_{DS})W_p + \Omega_0 F_p$	1.06	0.27	Governs
$(0.9 - 0.2S_{DS})W_p + \Omega_0 F_p$	0.84	0.27	

FORCES AND MOMENTS AT BASE CENTROID 'A'

Overturing Moment = $M_o = F_p * W_p * Z_c = 119,185$ in-lb
 Base shear $V_b = F_p * W_p = 1,949$ lb
 Seismic Weight $F_v = F_v * W_p = 7,681$ lb


SEE HILTI REPORT FOR ANCHORAGE CALCULATIONS

www.hilti.com

Company:		Page:	1
Address:		Specifier:	
Phone Fax:		E-Mail:	
Design:	ABERDEEN, ID WWTP - Q-PRESS - EPOXY	Date:	7/6/2023
Fastening point:			

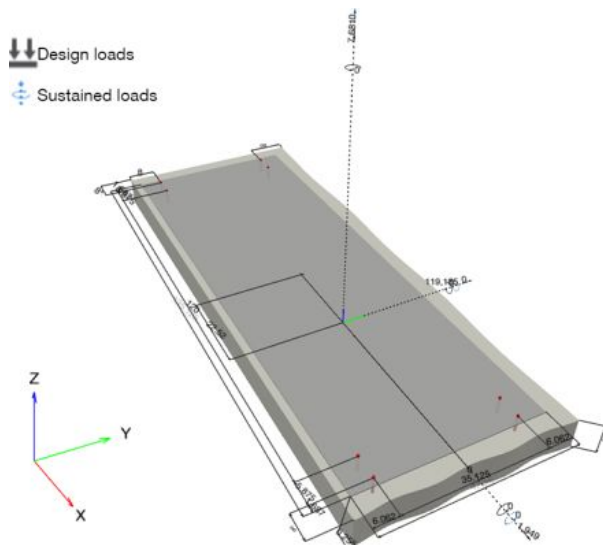
Specifier's comments: **EPOXY OPTION**

1 Input data

Anchor type and diameter:	HIT-HY 200 V3 + HAS-V-36 (ASTM F1554 Gr.36) 5/8	
Item number:	2198024 HAS-V-36 5/8"x6" (element) / 2334276 HIT-HY 200-R V3 (adhesive)	
Effective embedment depth:	$h_{ef,act} = 4.000$ in. ($h_{ef,limit} = -$ in.)	
Material:	ASTM F1554 Grade 36	
Evaluation Service Report:	ESR-4868	
Issued Valid:	11/1/2022 11/1/2024	
Proof:	Design Method ACI 318-14 / Chem	
Stand-off installation:	$e_b = 0.000$ in. (no stand-off); $t = 0.250$ in.	
Anchor plate ^R :	$l_x \times l_y \times t = 135.125$ in. x 47.250 in. x 0.250 in.; (Recommended plate thickness: not calculated)	
Profile:	no profile	
Base material:	cracked concrete, 3000, $f'_c = 3,000$ psi; $h = 8.000$ in., Temp. short/long: 32/32 °F	
Installation:	hammer drilled hole, Installation condition: Dry	
Reinforcement:	tension: condition B, shear: condition B; no supplemental splitting reinforcement present edge reinforcement: none or < No. 4 bar	
Seismic loads (cat. C, D, E, or F)	Tension load: yes (17.2.3.4.3 (d)) Shear load: yes (17.2.3.5.3 (c))	

^R - The anchor calculation is based on a rigid anchor plate assumption.

Geometry [in.] & Loading [lb, in.lb]



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1.1 Design results

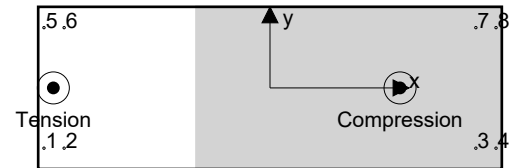
Case	Description	Forces [lb] / Moments [in.lb]	Seismic	Max. Util. Anchor [%]
1	Combination 1	N = -7,681; V _x = 1,949; V _y = 0; M _x = 0; M _y = 119,185; M _z = 0; N _{sus} = 0; M _{x,sus} = 0; M _{y,sus} = 0;	yes	8

2 Load case/Resulting anchor forces

Anchor reactions [lb]

Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	3	244	244	0
2	2	244	244	0
3	0	244	244	0
4	0	244	244	0
5	3	244	244	0
6	2	244	244	0
7	0	244	244	0
8	0	244	244	0



max. concrete compressive strain: 0.00 [‰]
 max. concrete compressive stress: 4 [psi]
 resulting tension force in (x/y)=(-63.145/0.000): 10 [lb]
 resulting compression force in (x/y)=(37.902/-0.000): 7,691 [lb]

Anchor forces are calculated based on the assumption of a rigid anchor plate.

3 Tension load

	Load N _{ua} [lb]	Capacity ϕN_n [lb]	Utilization $\beta_N = N_{ua} / \phi N_n$	Status
Steel Strength*	3	9,832	1	OK
Bond Strength**	10	10,649	1	OK
Sustained Tension Load Bond Strength*	N/A	N/A	N/A	N/A
Concrete Breakout Failure**	10	10,456	1	OK

* highest loaded anchor **anchor group (anchors in tension)



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3.1 Steel Strength

N_{sa} = ESR value refer to ICC-ES ESR-4868
 $\phi N_{sa} \geq N_{ua}$ ACI 318-14 Table 17.3.1.1

Variables

$A_{se,N}$ [in. ²]	f_{uta} [psi]
0.23	58,000

Calculations

N_{sa} [lb]
13,110

Results

N_{sa} [lb]	ϕ_{steel}	ϕN_{sa} [lb]	N_{ua} [lb]
13,110	0.750	9,832	3



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3.2 Bond Strength

$$N_{ag} = \left(\frac{A_{Na}}{A_{Na0}} \right) \Psi_{ec1,Na} \Psi_{ec2,Na} \Psi_{ed,Na} \Psi_{cp,Na} N_{ba} \quad \text{ACI 318-14 Eq. (17.4.5.1b)}$$

$$\phi N_{ag} \geq N_{ua} \quad \text{ACI 318-14 Table 17.3.1.1}$$

A_{Na} see ACI 318-14, Section 17.4.5.1, Fig. R 17.4.5.1(b)

$$A_{Na0} = (2 c_{Na})^2 \quad \text{ACI 318-14 Eq. (17.4.5.1c)}$$

$$c_{Na} = 10 d_a \sqrt{\frac{\tau_{uncr}}{1100}} \quad \text{ACI 318-14 Eq. (17.4.5.1d)}$$

$$\Psi_{ec,Na} = \left(\frac{1}{1 + \frac{e_N}{c_{Na}}} \right) \leq 1.0 \quad \text{ACI 318-14 Eq. (17.4.5.3)}$$

$$\Psi_{ed,Na} = 0.7 + 0.3 \left(\frac{c_{a,min}}{c_{Na}} \right) \leq 1.0 \quad \text{ACI 318-14 Eq. (17.4.5.4b)}$$

$$\Psi_{cp,Na} = \text{MAX} \left(\frac{c_{a,min}}{c_{ac}}, \frac{c_{Na}}{c_{ac}} \right) \leq 1.0 \quad \text{ACI 318-14 Eq. (17.4.5.5b)}$$

$$N_{ba} = \lambda_a \cdot \tau_{k,c} \cdot \alpha_{N,seis} \cdot \pi \cdot d_a \cdot h_{ef} \quad \text{ACI 318-14 Eq. (17.4.5.2)}$$

Variables

$\tau_{k,c,uncr}$ [psi]	d_a [in.]	h_{ef} [in.]	$c_{a,min}$ [in.]	$\alpha_{overhead}$	$\tau_{k,c}$ [psi]
2,261	0.625	4.000	8.000	1.000	1,192
$e_{c1,N}$ [in.]	$e_{c2,N}$ [in.]	c_{ac} [in.]	λ_a	$\alpha_{N,seis}$	
0.208	0.000	7.202	1.000	0.990	

Calculations

c_{Na} [in.]	A_{Na} [in. ²]	A_{Na0} [in. ²]	$\Psi_{ed,Na}$
8.920	792.33	318.25	0.969
$\Psi_{ec1,Na}$	$\Psi_{ec2,Na}$	$\Psi_{cp,Na}$	N_{ba} [lb]
0.977	1.000	1.000	9,265

Results

N_{ag} [lb]	ϕ_{bond}	$\phi_{seismic}$	$\phi_{nonductile}$	ϕN_{ag} [lb]	N_{ua} [lb]
21,843	0.650	0.750	1.000	10,649	10



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3.3 Concrete Breakout Failure

$$N_{cbg} = \left(\frac{A_{Nc}}{A_{Nc0}} \right) \psi_{ec,N} \psi_{ed,N} \psi_{c,N} \psi_{cp,N} N_b \quad \text{ACI 318-14 Eq. (17.4.2.1b)}$$

$$\phi N_{cbg} \geq N_{ua} \quad \text{ACI 318-14 Table 17.3.1.1}$$

A_{Nc} see ACI 318-14, Section 17.4.2.1, Fig. R 17.4.2.1(b)

$$A_{Nc0} = 9 h_{ef}^2 \quad \text{ACI 318-14 Eq. (17.4.2.1c)}$$

$$\psi_{ec,N} = \left(\frac{1}{1 + \frac{2 e_N}{3 h_{ef}}} \right) \leq 1.0 \quad \text{ACI 318-14 Eq. (17.4.2.4)}$$

$$\psi_{ed,N} = 0.7 + 0.3 \left(\frac{c_{a,min}}{1.5 h_{ef}} \right) \leq 1.0 \quad \text{ACI 318-14 Eq. (17.4.2.5b)}$$

$$\psi_{cp,N} = \text{MAX} \left(\frac{c_{a,min}}{c_{ac}}, \frac{1.5 h_{ef}}{c_{ac}} \right) \leq 1.0 \quad \text{ACI 318-14 Eq. (17.4.2.7b)}$$

$$N_b = k_c \lambda_a \sqrt{f_c} h_{ef}^{1.5} \quad \text{ACI 318-14 Eq. (17.4.2.2a)}$$

Variables

h_{ef} [in.]	$e_{c1,N}$ [in.]	$e_{c2,N}$ [in.]	$c_{a,min}$ [in.]	$\psi_{c,N}$
4.000	0.208	0.000	8.000	1.000
c_{ac} [in.]	k_c	λ_a	f_c [psij]	
7.202	17	1.000	3,000	

Calculations

A_{Nc} [in. ²]	A_{Nc0} [in. ²]	$\psi_{ec1,N}$	$\psi_{ec2,N}$	$\psi_{ed,N}$	$\psi_{cp,N}$	N_b [lb]
429.00	144.00	0.967	1.000	1.000	1.000	7,449

Results

N_{cbg} [lb]	$\phi_{concrete}$	$\phi_{seismic}$	$\phi_{nonductile}$	ϕN_{cbg} [lb]	N_{ua} [lb]
21,449	0.650	0.750	1.000	10,456	10



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4 Shear load

	Load V_{ua} [lb]	Capacity ϕV_n [lb]	Utilization $\beta_V = V_{ua} / \phi V_n$	Status
Steel Strength*	244	3,067	8	OK
Steel failure (with lever arm)*	N/A	N/A	N/A	N/A
Pryout Strength (Concrete Breakout Strength controls)**	1,949	62,137	4	OK
Concrete edge failure in direction y-**	1,949	43,564	5	OK

* highest loaded anchor **anchor group (relevant anchors)

4.1 Steel Strength

$V_{sa,eq}$ = ESR value refer to ICC-ES ESR-4868
 $\phi V_{steel} \geq V_{ua}$ ACI 318-14 Table 17.3.1.1

Variables

$A_{se,V}$ [in. ²]	f_{uta} [psi]	$\alpha_{V,seis}$
0.23	58,000	0.600

Calculations

$V_{sa,eq}$ [lb]
4,719

Results

$V_{sa,eq}$ [lb]	ϕ_{steel}	$\phi V_{sa,eq}$ [lb]	V_{ua} [lb]
4,719	0.650	3,067	244



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4.2 Pryout Strength (Concrete Breakout Strength controls)

$$V_{cp,g} = k_{cp} \left[\left(\frac{A_{Nc}}{A_{Nc0}} \right) \psi_{ec,N} \psi_{ed,N} \psi_{c,N} \psi_{cp,N} N_b \right] \quad \text{ACI 318-14 Eq. (17.5.3.1b)}$$

$$\phi V_{cp,g} \geq V_{ua} \quad \text{ACI 318-14 Table 17.3.1.1}$$

A_{Nc} see ACI 318-14, Section 17.4.2.1, Fig. R 17.4.2.1(b)

$$A_{Nc0} = 9 h_{ef}^2 \quad \text{ACI 318-14 Eq. (17.4.2.1c)}$$

$$\psi_{ec,N} = \left(\frac{1}{1 + \frac{2 e_N}{3 h_{ef}}} \right) \leq 1.0 \quad \text{ACI 318-14 Eq. (17.4.2.4)}$$

$$\psi_{ed,N} = 0.7 + 0.3 \left(\frac{c_{a,min}}{1.5 h_{ef}} \right) \leq 1.0 \quad \text{ACI 318-14 Eq. (17.4.2.5b)}$$

$$\psi_{cp,N} = \text{MAX} \left(\frac{c_{a,min}}{c_{ac}}, \frac{1.5 h_{ef}}{c_{ac}} \right) \leq 1.0 \quad \text{ACI 318-14 Eq. (17.4.2.7b)}$$

$$N_b = k_c \lambda_a \sqrt{f'_c} h_{ef}^{1.5} \quad \text{ACI 318-14 Eq. (17.4.2.2a)}$$

Variables

k_{cp}	h_{ef} [in.]	$e_{c1,N}$ [in.]	$e_{c2,N}$ [in.]	$c_{a,min}$ [in.]
2	4.000	0.000	0.000	8.000
$\psi_{c,N}$	c_{ac} [in.]	k_c	λ_a	f'_c [psi]
1.000	7.202	17	1.000	3,000

Calculations

A_{Nc} [in. ²]	A_{Nc0} [in. ²]	$\psi_{ec1,N}$	$\psi_{ec2,N}$	$\psi_{ed,N}$	$\psi_{cp,N}$	N_b [lb]
858.00	144.00	1.000	1.000	1.000	1.000	7,449

Results

$V_{cp,g}$ [lb]	$\phi_{concrete}$	$\phi_{seismic}$	$\phi_{nonductile}$	$\phi V_{cp,g}$ [lb]	V_{ua} [lb]
88,768	0.700	1.000	1.000	62,137	1,949

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4.3 Concrete edge failure in direction y-

$$V_{cbg} = \left(\frac{A_{Vc}}{A_{Vc0}} \right) \Psi_{ec,V} \Psi_{ed,V} \Psi_{c,V} \Psi_{h,V} \Psi_{parallel,V} V_b \quad \text{ACI 318-14 Eq. (17.5.2.1b)}$$

$$\phi V_{cbg} \geq V_{ua} \quad \text{ACI 318-14 Table 17.3.1.1}$$

 A_{Vc} see ACI 318-14, Section 17.5.2.1, Fig. R 17.5.2.1(b)

$$A_{Vc0} = 4.5 c_{a1}^2 \quad \text{ACI 318-14 Eq. (17.5.2.1c)}$$

$$\Psi_{ec,V} = \left(\frac{1}{1 + \frac{2e_v}{3c_{a1}}} \right) \leq 1.0 \quad \text{ACI 318-14 Eq. (17.5.2.5)}$$

$$\Psi_{ed,V} = 0.7 + 0.3 \left(\frac{c_{a2}}{1.5c_{a1}} \right) \leq 1.0 \quad \text{ACI 318-14 Eq. (17.5.2.6b)}$$

$$\Psi_{h,V} = \sqrt{\frac{1.5c_{a1}}{h_a}} \geq 1.0 \quad \text{ACI 318-14 Eq. (17.5.2.8)}$$

$$V_b = \left(7 \left(\frac{l_e}{d_a} \right)^{0.2} \sqrt{d_a} \right) \lambda_a \sqrt{f'_c} c_{a1}^{1.5} \quad \text{ACI 318-14 Eq. (17.5.2.2a)}$$

Variables

c_{a1} [in.]	c_{a2} [in.]	e_{cV} [in.]	$\Psi_{c,V}$	h_a [in.]
8.000	8.000	0.000	1.000	8.000
l_e [in.]	λ_a	d_a [in.]	f'_c [psi]	$\Psi_{parallel,V}$
4.000	1.000	0.625	3,000	2.000

Calculations

A_{Vc} [in. ²]	A_{Vc0} [in. ²]	$\Psi_{ec,V}$	$\Psi_{ed,V}$	$\Psi_{h,V}$	V_b [lb]
736.00	288.00	1.000	1.000	1.225	9,942

Results

V_{cbg} [lb]	$\phi_{concrete}$	$\phi_{seismic}$	$\phi_{nonductile}$	ϕV_{cbg} [lb]	V_{ua} [lb]
62,234	0.700	1.000	1.000	43,564	1,949

5 Combined tension and shear loads

β_N	β_V	ζ	Utilization $\beta_{N,V}$ [%]	Status
0.001	0.079	5/3	2	OK

$$\beta_{NV} = \beta_N^{\zeta} + \beta_V^{\zeta} \leq 1$$



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6 Warnings

- The anchor design methods in PROFIS Engineering require rigid anchor plates per current regulations (AS 5216:2021, ETAG 001/Annex C, EOTA TR029 etc.). This means load re-distribution on the anchors due to elastic deformations of the anchor plate are not considered - the anchor plate is assumed to be sufficiently stiff, in order not to be deformed when subjected to the design loading. PROFIS Engineering calculates the minimum required anchor plate thickness with CBFEM to limit the stress of the anchor plate based on the assumptions explained above. The proof if the rigid anchor plate assumption is valid is not carried out by PROFIS Engineering. Input data and results must be checked for agreement with the existing conditions and for plausibility!
- Condition A applies where the potential concrete failure surfaces are crossed by supplementary reinforcement proportioned to tie the potential concrete failure prism into the structural member. Condition B applies where such supplementary reinforcement is not provided, or where pullout or pryout strength governs.
- Design Strengths of adhesive anchor systems are influenced by the cleaning method. Refer to the INSTRUCTIONS FOR USE given in the Evaluation Service Report for cleaning and installation instructions.
- For additional information about ACI 318 strength design provisions, please go to <https://submittals.us.hilti.com/PROFISAnchorDesignGuide/>
- An anchor design approach for structures assigned to Seismic Design Category C, D, E or F is given in ACI 318-14, Chapter 17, Section 17.2.3.4.3 (a) that requires the governing design strength of an anchor or group of anchors be limited by ductile steel failure. If this is NOT the case, the connection design (tension) shall satisfy the provisions of Section 17.2.3.4.3 (b), Section 17.2.3.4.3 (c), or Section 17.2.3.4.3 (d). The connection design (shear) shall satisfy the provisions of Section 17.2.3.5.3 (a), Section 17.2.3.5.3 (b), or Section 17.2.3.5.3 (c).
- Section 17.2.3.4.3 (b) / Section 17.2.3.5.3 (a) require the attachment the anchors are connecting to the structure be designed to undergo ductile yielding at a load level corresponding to anchor forces no greater than the controlling design strength. Section 17.2.3.4.3 (c) / Section 17.2.3.5.3 (b) waive the ductility requirements and require the anchors to be designed for the maximum tension / shear that can be transmitted to the anchors by a non-yielding attachment. Section 17.2.3.4.3 (d) / Section 17.2.3.5.3 (c) waive the ductility requirements and require the design strength of the anchors to equal or exceed the maximum tension / shear obtained from design load combinations that include E, with E increased by ω_0 .
- Installation of Hilti adhesive anchor systems shall be performed by personnel trained to install Hilti adhesive anchors. Reference ACI 318-14, Section 17.8.1.

Fastening meets the design criteria!

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7 Installation data

Profile: no profile

Hole diameter in the fixture: $d_f = 0.687$ in.

Plate thickness (input): 0.250 in.

Recommended plate thickness: not calculated

Drilling method: Hammer drilled

Cleaning: Compressed air cleaning of the drilled hole according to instructions for use is required

Anchor type and diameter: HIT-HY 200 V3 + HAS-V-36 (ASTM F1554 Gr.36) 5/8

Item number: 2198024 HAS-V-36 5/8"x6" (element) / 2334276 HIT-HY 200-R V3 (adhesive)

Maximum installation torque: 720 in.lb

Hole diameter in the base material: 0.750 in.

Hole depth in the base material: 4.000 in.

Minimum thickness of the base material: 5.500 in.

5/8 Hilti HAS Carbon steel threaded rod with Hilti HIT-HY 200 V3 Safe Set System

7.1 Recommended accessories

Drilling

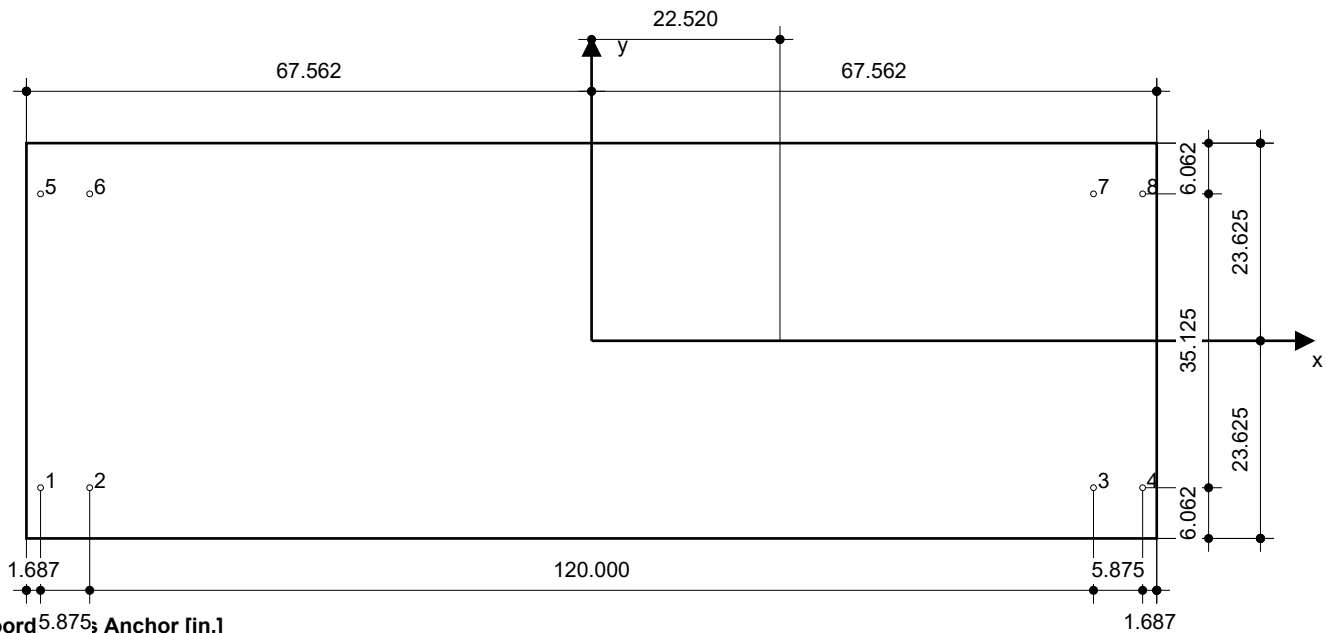
- Suitable Rotary Hammer
- Properly sized drill bit

Cleaning

- Compressed air with required accessories to blow from the bottom of the hole
- Proper diameter wire brush

Setting

- Dispenser including cassette and mixer
- Torque wrench



Coord 5.875; Anchor [in.]

Anchor	x	y	C _{-x}	C _{+x}	C _{-y}	C _{+y}	Anchor	x	y	C _{-x}	C _{+x}	C _{-y}	C _{+y}
1	-65.875	-17.562	8.000	-	8.000	-	5	-65.875	17.562	8.000	-	43.125	-
2	-60.000	-17.562	13.875	-	8.000	-	6	-60.000	17.562	13.875	-	43.125	-
3	60.000	-17.562	133.875	-	8.000	-	7	60.000	17.562	133.875	-	43.125	-
4	65.875	-17.562	139.750	-	8.000	-	8	65.875	17.562	139.750	-	43.125	-

Input data and results must be checked for conformity with the existing conditions and for plausibility!
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8 Remarks; Your Cooperation Duties

- Any and all information and data contained in the Software concern solely the use of Hilti products and are based on the principles, formulas and security regulations in accordance with Hilti's technical directions and operating, mounting and assembly instructions, etc., that must be strictly complied with by the user. All figures contained therein are average figures, and therefore use-specific tests are to be conducted prior to using the relevant Hilti product. The results of the calculations carried out by means of the Software are based essentially on the data you put in. Therefore, you bear the sole responsibility for the absence of errors, the completeness and the relevance of the data to be put in by you. Moreover, you bear sole responsibility for having the results of the calculation checked and cleared by an expert, particularly with regard to compliance with applicable norms and permits, prior to using them for your specific facility. The Software serves only as an aid to interpret norms and permits without any guarantee as to the absence of errors, the correctness and the relevance of the results or suitability for a specific application.
- You must take all necessary and reasonable steps to prevent or limit damage caused by the Software. In particular, you must arrange for the regular backup of programs and data and, if applicable, carry out the updates of the Software offered by Hilti on a regular basis. If you do not use the AutoUpdate function of the Software, you must ensure that you are using the current and thus up-to-date version of the Software in each case by carrying out manual updates via the Hilti Website. Hilti will not be liable for consequences, such as the recovery of lost or damaged data or programs, arising from a culpable breach of duty by you.

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Specifier's comments: **MECHANICAL WEDGE OPTION**

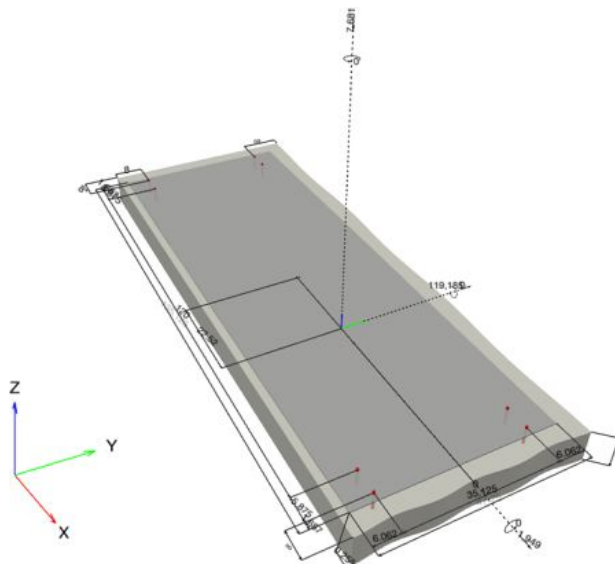
1 Input data

Anchor type and diameter:	Kwik Bolt TZ2 - SS 304 5/8 (4) hnom3
Item number:	2210279 KB-TZ2 5/8x6 SS304
Effective embedment depth:	$h_{ef,act} = 4.000$ in., $h_{nom} = 4.500$ in.
Material:	AISI 304
Evaluation Service Report:	ESR-4266
Issued Valid:	12/17/2021 12/1/2023
Proof:	Design Method ACI 318-14 / Mech
Stand-off installation:	$e_b = 0.000$ in. (no stand-off); $t = 0.250$ in.
Anchor plate ^R :	$l_x \times l_y \times t = 135.125$ in. x 47.250 in. x 0.250 in.; (Recommended plate thickness: not calculated)
Profile:	no profile
Base material:	cracked concrete, 3000, $f'_c = 3,000$ psi; $h = 8.000$ in.
Installation:	hammer drilled hole, Installation condition: Dry
Reinforcement:	tension: condition B, shear: condition B; no supplemental splitting reinforcement present edge reinforcement: none or < No. 4 bar
Seismic loads (cat. C, D, E, or F)	Tension load: yes (17.2.3.4.3 (d)) Shear load: yes (17.2.3.5.3 (c))



^R - The anchor calculation is based on a rigid anchor plate assumption.

Geometry [in.] & Loading [lb, in.lb]



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1.1 Design results

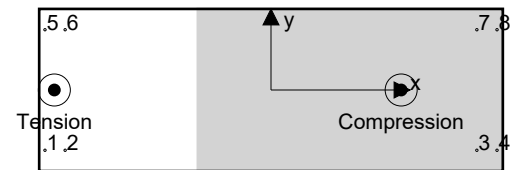
Case	Description	Forces [lb] / Moments [in.lb]	Seismic	Max. Util. Anchor [%]
1	Combination 1	N = -7,681; V _x = 1,949; V _y = 0; M _x = 0; M _y = 119,185; M _z = 0;	yes	5

2 Load case/Resulting anchor forces

Anchor reactions [lb]

Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	2	244	244	0
2	2	244	244	0
3	0	244	244	0
4	0	244	244	0
5	2	244	244	0
6	2	244	244	0
7	0	244	244	0
8	0	244	244	0



max. concrete compressive strain: 0.00 [%]
 max. concrete compressive stress: 4 [psi]
 resulting tension force in (x/y)=(-63.145/0.000): 8 [lb]
 resulting compression force in (x/y)=(37.938/-0.000): 7,689 [lb]

Anchor forces are calculated based on the assumption of a rigid anchor plate.

3 Tension load

	Load N _{ua} [lb]	Capacity φ N _n [lb]	Utilization β _N = N _{ua} /φ N _n	Status
Steel Strength*	2	14,132	1	OK
Pullout Strength*	N/A	N/A	N/A	N/A
Concrete Breakout Failure**	8	10,457	1	OK

* highest loaded anchor **anchor group (anchors in tension)



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Fastening point:			

3.1 Steel Strength

N_{sa} = ESR value refer to ICC-ES ESR-4266
 $\phi N_{sa} \geq N_{ua}$ ACI 318-14 Table 17.3.1.1

Variables

$A_{se,N}$ [in. ²]	f_{uta} [psi]
0.16	114,604

Calculations

N_{sa} [lb]
18,843

Results

N_{sa} [lb]	ϕ_{steel}	$\phi_{nonductile}$	ϕN_{sa} [lb]	N_{ua} [lb]
18,843	0.750	1.000	14,132	2



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3.2 Concrete Breakout Failure

$$N_{cbg} = \left(\frac{A_{Nc}}{A_{Nc0}} \right) \psi_{ec,N} \psi_{ed,N} \psi_{c,N} \psi_{cp,N} N_b \quad \text{ACI 318-14 Eq. (17.4.2.1b)}$$

$$\phi N_{cbg} \geq N_{ua} \quad \text{ACI 318-14 Table 17.3.1.1}$$

$$A_{Nc} \text{ see ACI 318-14, Section 17.4.2.1, Fig. R 17.4.2.1(b)}$$

$$A_{Nc0} = 9 h_{ef}^2 \quad \text{ACI 318-14 Eq. (17.4.2.1c)}$$

$$\psi_{ec,N} = \left(\frac{1}{1 + \frac{2 e_N}{3 h_{ef}}} \right) \leq 1.0 \quad \text{ACI 318-14 Eq. (17.4.2.4)}$$

$$\psi_{ed,N} = 0.7 + 0.3 \left(\frac{c_{a,min}}{1.5 h_{ef}} \right) \leq 1.0 \quad \text{ACI 318-14 Eq. (17.4.2.5b)}$$

$$\psi_{cp,N} = \text{MAX} \left(\frac{c_{a,min}}{c_{ac}}, \frac{1.5 h_{ef}}{c_{ac}} \right) \leq 1.0 \quad \text{ACI 318-14 Eq. (17.4.2.7b)}$$

$$N_b = k_c \lambda_a \sqrt{f'_c} h_{ef}^{1.5} \quad \text{ACI 318-14 Eq. (17.4.2.2a)}$$

Variables

h_{ef} [in.]	$e_{c1,N}$ [in.]	$e_{c2,N}$ [in.]	$c_{a,min}$ [in.]	$\psi_{c,N}$
4.000	0.207	0.000	8.000	1.000
c_{ac} [in.]	k_c	λ_a	f'_c [psij]	
9.000	17	1.000	3,000	

Calculations

A_{Nc} [in. ²]	A_{Nc0} [in. ²]	$\psi_{ec1,N}$	$\psi_{ec2,N}$	$\psi_{ed,N}$	$\psi_{cp,N}$	N_b [lb]
429.00	144.00	0.967	1.000	1.000	1.000	7,449

Results

N_{cbg} [lb]	$\phi_{concrete}$	$\phi_{seismic}$	$\phi_{nonductile}$	ϕN_{cbg} [lb]	N_{ua} [lb]
21,451	0.650	0.750	1.000	10,457	8



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4 Shear load

	Load V_{ua} [lb]	Capacity ϕV_n [lb]	Utilization $\beta_v = V_{ua} / \phi V_n$	Status
Steel Strength*	244	8,034	4	OK
Steel failure (with lever arm)*	N/A	N/A	N/A	N/A
Pryout Strength**	1,949	62,137	4	OK
Concrete edge failure in direction y-**	1,949	43,564	5	OK

* highest loaded anchor **anchor group (relevant anchors)

4.1 Steel Strength

$V_{sa,eq}$ = ESR value refer to ICC-ES ESR-4266
 $\phi V_{steel} \geq V_{ua}$ ACI 318-14 Table 17.3.1.1

Variables

$A_{se,V}$ [in. ²]	f_{uta} [psi]	$\alpha_{v,seis}$
0.16	114,604	1.000

Calculations

$V_{sa,eq}$ [lb]
12,360

Results

$V_{sa,eq}$ [lb]	ϕ_{steel}	$\phi_{nonductile}$	$\phi V_{sa,eq}$ [lb]	V_{ua} [lb]
12,360	0.650	1.000	8,034	244



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4.2 Pryout Strength

$$V_{cp,g} = k_{cp} \left[\left(\frac{A_{Nc}}{A_{Nc0}} \right) \psi_{ec,N} \psi_{ed,N} \psi_{c,N} \psi_{cp,N} N_b \right] \quad \text{ACI 318-14 Eq. (17.5.3.1b)}$$

$$\phi V_{cp,g} \geq V_{ua} \quad \text{ACI 318-14 Table 17.3.1.1}$$

A_{Nc} see ACI 318-14, Section 17.4.2.1, Fig. R 17.4.2.1(b)

$$A_{Nc0} = 9 h_{ef}^2 \quad \text{ACI 318-14 Eq. (17.4.2.1c)}$$

$$\psi_{ec,N} = \left(\frac{1}{1 + \frac{2 e_N}{3 h_{ef}}} \right) \leq 1.0 \quad \text{ACI 318-14 Eq. (17.4.2.4)}$$

$$\psi_{ed,N} = 0.7 + 0.3 \left(\frac{c_{a,min}}{1.5 h_{ef}} \right) \leq 1.0 \quad \text{ACI 318-14 Eq. (17.4.2.5b)}$$

$$\psi_{cp,N} = \text{MAX} \left(\frac{c_{a,min}}{c_{ac}}, \frac{1.5 h_{ef}}{c_{ac}} \right) \leq 1.0 \quad \text{ACI 318-14 Eq. (17.4.2.7b)}$$

$$N_b = k_c \lambda_a \sqrt{f'_c} h_{ef}^{1.5} \quad \text{ACI 318-14 Eq. (17.4.2.2a)}$$

Variables

k_{cp}	h_{ef} [in.]	$e_{c1,N}$ [in.]	$e_{c2,N}$ [in.]	$c_{a,min}$ [in.]
2	4.000	0.000	0.000	8.000
$\psi_{c,N}$	c_{ac} [in.]	k_c	λ_a	f'_c [psi]
1.000	9.000	17	1.000	3,000

Calculations

A_{Nc} [in. ²]	A_{Nc0} [in. ²]	$\psi_{ec1,N}$	$\psi_{ec2,N}$	$\psi_{ed,N}$	$\psi_{cp,N}$	N_b [lb]
858.00	144.00	1.000	1.000	1.000	1.000	7,449

Results

$V_{cp,g}$ [lb]	$\phi_{concrete}$	$\phi_{seismic}$	$\phi_{nonductile}$	$\phi V_{cp,g}$ [lb]	V_{ua} [lb]
88,768	0.700	1.000	1.000	62,137	1,949

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4.3 Concrete edge failure in direction y-

$$V_{cbg} = \left(\frac{A_{Vc}}{A_{Vc0}} \right) \Psi_{ec,V} \Psi_{ed,V} \Psi_{c,V} \Psi_{h,V} \Psi_{parallel,V} V_b \quad \text{ACI 318-14 Eq. (17.5.2.1b)}$$

$$\phi V_{cbg} \geq V_{ua} \quad \text{ACI 318-14 Table 17.3.1.1}$$

 A_{Vc} see ACI 318-14, Section 17.5.2.1, Fig. R 17.5.2.1(b)

$$A_{Vc0} = 4.5 c_{a1}^2 \quad \text{ACI 318-14 Eq. (17.5.2.1c)}$$

$$\Psi_{ec,V} = \left(\frac{1}{1 + \frac{2e_v}{3c_{a1}}} \right) \leq 1.0 \quad \text{ACI 318-14 Eq. (17.5.2.5)}$$

$$\Psi_{ed,V} = 0.7 + 0.3 \left(\frac{c_{a2}}{1.5c_{a1}} \right) \leq 1.0 \quad \text{ACI 318-14 Eq. (17.5.2.6b)}$$

$$\Psi_{h,V} = \sqrt{\frac{1.5c_{a1}}{h_a}} \geq 1.0 \quad \text{ACI 318-14 Eq. (17.5.2.8)}$$

$$V_b = \left(7 \left(\frac{l_e}{d_a} \right)^{0.2} \sqrt{d_a} \right) \lambda_a \sqrt{f'_c} c_{a1}^{1.5} \quad \text{ACI 318-14 Eq. (17.5.2.2a)}$$

Variables

c_{a1} [in.]	c_{a2} [in.]	e_{cV} [in.]	$\Psi_{c,V}$	h_a [in.]
8.000	8.000	0.000	1.000	8.000
l_e [in.]	λ_a	d_a [in.]	f'_c [psi]	$\Psi_{parallel,V}$
4.000	1.000	0.625	3,000	2.000

Calculations

A_{Vc} [in. ²]	A_{Vc0} [in. ²]	$\Psi_{ec,V}$	$\Psi_{ed,V}$	$\Psi_{h,V}$	V_b [lb]
736.00	288.00	1.000	1.000	1.225	9,942

Results

V_{cbg} [lb]	$\phi_{concrete}$	$\phi_{seismic}$	$\phi_{nonductile}$	ϕV_{cbg} [lb]	V_{ua} [lb]
62,234	0.700	1.000	1.000	43,564	1,949

5 Combined tension and shear loads

β_N	β_V	ζ	Utilization $\beta_{N,V}$ [%]	Status
0.001	0.045	5/3	1	OK

$$\beta_{NV} = \beta_N^{\zeta} + \beta_V^{\zeta} \leq 1$$



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6 Warnings

- The anchor design methods in PROFIS Engineering require rigid anchor plates per current regulations (AS 5216:2021, ETAG 001/Annex C, EOTA TR029 etc.). This means load re-distribution on the anchors due to elastic deformations of the anchor plate are not considered - the anchor plate is assumed to be sufficiently stiff, in order not to be deformed when subjected to the design loading. PROFIS Engineering calculates the minimum required anchor plate thickness with CBFEM to limit the stress of the anchor plate based on the assumptions explained above. The proof if the rigid anchor plate assumption is valid is not carried out by PROFIS Engineering. Input data and results must be checked for agreement with the existing conditions and for plausibility!
- Condition A applies where the potential concrete failure surfaces are crossed by supplementary reinforcement proportioned to tie the potential concrete failure prism into the structural member. Condition B applies where such supplementary reinforcement is not provided, or where pullout or pryout strength governs.
- Refer to the manufacturer's product literature for cleaning and installation instructions.
- For additional information about ACI 318 strength design provisions, please go to <https://submittals.us.hilti.com/PROFISAnchorDesignGuide/>
- An anchor design approach for structures assigned to Seismic Design Category C, D, E or F is given in ACI 318-14, Chapter 17, Section 17.2.3.4.3 (a) that requires the governing design strength of an anchor or group of anchors be limited by ductile steel failure. If this is NOT the case, the connection design (tension) shall satisfy the provisions of Section 17.2.3.4.3 (b), Section 17.2.3.4.3 (c), or Section 17.2.3.4.3 (d). The connection design (shear) shall satisfy the provisions of Section 17.2.3.5.3 (a), Section 17.2.3.5.3 (b), or Section 17.2.3.5.3 (c).
- Section 17.2.3.4.3 (b) / Section 17.2.3.5.3 (a) require the attachment the anchors are connecting to the structure be designed to undergo ductile yielding at a load level corresponding to anchor forces no greater than the controlling design strength. Section 17.2.3.4.3 (c) / Section 17.2.3.5.3 (b) waive the ductility requirements and require the anchors to be designed for the maximum tension / shear that can be transmitted to the anchors by a non-yielding attachment. Section 17.2.3.4.3 (d) / Section 17.2.3.5.3 (c) waive the ductility requirements and require the design strength of the anchors to equal or exceed the maximum tension / shear obtained from design load combinations that include E, with E increased by ω_0 .
- Hilti post-installed anchors shall be installed in accordance with the Hilti Manufacturer's Printed Installation Instructions (MPII). Reference ACI 318-14, Section 17.8.1.

Fastening meets the design criteria!

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7 Installation data

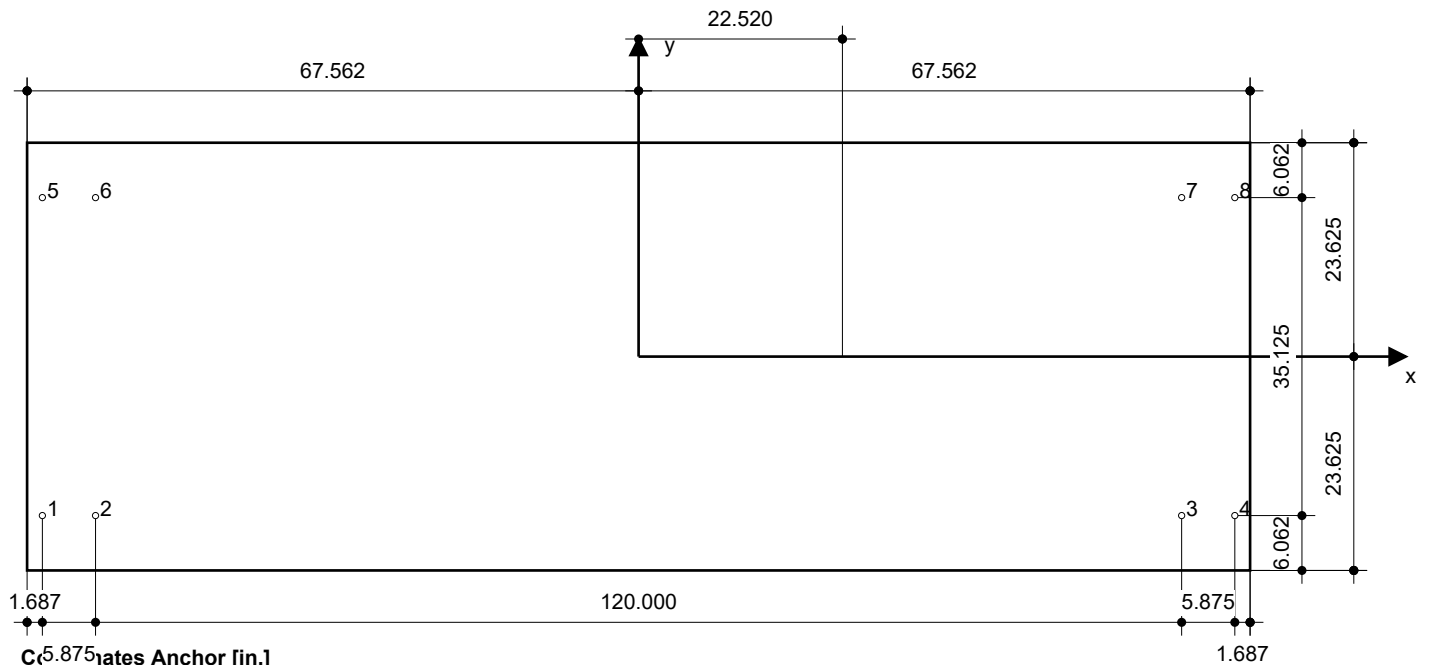
Profile: no profile
 Hole diameter in the fixture: $d_f = 0.687$ in.
 Plate thickness (input): 0.250 in.
 Recommended plate thickness: not calculated
 Drilling method: Hammer drilled
 Cleaning: Manual cleaning of the drilled hole according to instructions for use is required.

Anchor type and diameter: Kwik Bolt TZ2 - SS 304 5/8 (4) hnom3
 Item number: 2210279 KB-TZ2 5/8x6 SS304
 Maximum installation torque: 722 in.lb
 Hole diameter in the base material: 0.625 in.
 Hole depth in the base material: 4.750 in.
 Minimum thickness of the base material: 6.000 in.

Hilti KB-TZ2 stud anchor with 4.5 in embedment, 5/8 (4) hnom3, Stainless steel, installation per ESR-4266

7.1 Recommended accessories

Drilling	Cleaning	Setting
<ul style="list-style-type: none"> Suitable Rotary Hammer Properly sized drill bit 	<ul style="list-style-type: none"> Manual blow-out pump 	<ul style="list-style-type: none"> Torque controlled cordless impact tool Torque wrench Hammer



Coordinates Anchor [in.]

Anchor	x	y	C _{-x}	C _{+x}	C _{-y}	C _{+y}	Anchor	x	y	C _{-x}	C _{+x}	C _{-y}	C _{+y}
1	-65.875	-17.562	8.000	-	8.000	-	5	-65.875	17.562	8.000	-	43.125	-
2	-60.000	-17.562	13.875	-	8.000	-	6	-60.000	17.562	13.875	-	43.125	-
3	60.000	-17.562	133.875	-	8.000	-	7	60.000	17.562	133.875	-	43.125	-
4	65.875	-17.562	139.750	-	8.000	-	8	65.875	17.562	139.750	-	43.125	-

Input data and results must be checked for conformity with the existing conditions and for plausibility!
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8 Remarks; Your Cooperation Duties

- Any and all information and data contained in the Software concern solely the use of Hilti products and are based on the principles, formulas and security regulations in accordance with Hilti's technical directions and operating, mounting and assembly instructions, etc., that must be strictly complied with by the user. All figures contained therein are average figures, and therefore use-specific tests are to be conducted prior to using the relevant Hilti product. The results of the calculations carried out by means of the Software are based essentially on the data you put in. Therefore, you bear the sole responsibility for the absence of errors, the completeness and the relevance of the data to be put in by you. Moreover, you bear sole responsibility for having the results of the calculation checked and cleared by an expert, particularly with regard to compliance with applicable norms and permits, prior to using them for your specific facility. The Software serves only as an aid to interpret norms and permits without any guarantee as to the absence of errors, the correctness and the relevance of the results or suitability for a specific application.
- You must take all necessary and reasonable steps to prevent or limit damage caused by the Software. In particular, you must arrange for the regular backup of programs and data and, if applicable, carry out the updates of the Software offered by Hilti on a regular basis. If you do not use the AutoUpdate function of the Software, you must ensure that you are using the current and thus up-to-date version of the Software in each case by carrying out manual updates via the Hilti Website. Hilti will not be liable for consequences, such as the recovery of lost or damaged data or programs, arising from a culpable breach of duty by you.

Owner:	City of Aberdeen, Idaho	Date:	5/3/2024
Project Name:	City of Aberdeen WWTP Improvements - Prepurchase	Project No.:	222032-000
Vendor:	Huber Technology, Inc.	Vendor Address:	1009 Airlie Parkway Denver, NC 28037
Attention:	Julia Hahn, PM		

Spec Section: 46 33 33 – Polymer Mix-Feed Units, 46 76 27 – Sludge Dewatering Screw Press

Item of Equipment or Material: Dewatering Equipment

Subject submittal has been reviewed with review action(s) required as shown below:

Submittal No.	Subject of Shop Drawing or Data	No Exception Taken	Furnish as Corrected	Revise and Resubmit	Record Copy
46 76 27 - 01	Huber Screw Press Dewatering System	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Remarks: See attached drawings for your information.

1. Page 21 of 68: Include drawing with blue motor cover.
2. Page 26 of 68: Motor sizes for press drive and spray wash do not match scope of supply motor sizes. Correct as required.
3. 1.4, A.3: Bearing life calculations shall be sealed by a Professional Engineer in the State of Idaho.
4. 1.4, A.4: Provide anchoring calculations sealed by a Professional Engineer licensed in the State of Idaho.
5. Appendix A_Product Information: No comments.
6. Appendix B_Mechanical Data Sheets:
 - a. Anchor Bolts: Delete this section and include anchor product literature in Appendix J with anchoring calculations. Anchor bolts shall be Type 304 in accordance with the specifications (2.3, A.1).
 - b. Air Compressor: No comments.
 - c. Pressure Sensor: No comments.
 - d. Injection Ring/Mixing Valve: Combine injection ring and mixing valve sections into one section and include complete drawing provided for design which includes the stainless spool sections to be provided by Huber.
 - e. Pneumatic Cylinders for Press Cone: No comments.
 - f. Roller Bearing Calculations: Idaho-licensed Professional Engineer shall seal calculations.
 - g. Solenoid Stainless Steel: See comments on product literature. Cover shall be Type 316L stainless steel. Confirm valve model number on Page 3 of 10. Brass body valve is indicated in lieu of stainless steel.
 - h. Spray Bar Prox. Sensor: No comments.
 - i. Spraybar Nozzles: No comments.
- Section 46 33 33 Polymer Mix Units**
 - j. Velodyne Polymer System Submittal:
 - Provide design calculations and assumptions for the design of the polymer feed system and dilution water.
7. Appendix C_Controls Data Sheets:
 - a. 2.10, H.10: Confirm start/stop functions for sludge feed pumps, polymer feed system, and conveyors at the HMI panel. Unclear if the equipment can be manually started at the panel.
 - b. 2.10, H.18: Provide information to confirm these functions for each piece of equipment listed.
 - c. Confirm whether a polymer flow meter should be installed in the polymer solution discharge piping.

- d. Page 16 of 68: The City has several sludge storage tanks and may draw sludge from any tank. Delete the tank level sensor shown in the controls. The City does not think this information will be useful.
- e. Page 16 of 68: There will be two sludge feed pumps (1 duty, 1 redundant). Either pump may be used to feed sludge to the screw press. There is also a sludge bypass line to the sludge drying beds should an alternate method of dewatering be required. On past projects, the duty pump has been selected at the Huber panel. This should be discussed prior to finalizing the controls.
- 8. Appendix D_Operating Instructions: No comments.
- 9. Appendix E_ISO Certification: No comments.
- 10. Appendix F_Warranty Information: Warranty shall commence upon Substantial Completion for the construction project and will expire a minimum of one (1) year from that date.
- 11. Appendix G_Service: No comments.
- 12. Appendix H_Spare Parts:
 - a. Cover will be part of scope; remove note from Q press spare parts drawing.
 - b. 2.11, A.5.: Confirm spare relays to be provided.
- 13. Appendix I_Long Term Storage: No comments.
- 14. Appendix J_Seismic Calculations: Calculations shall be sealed by an Idaho licensed Professional Engineer. Provide stainless steel anchors as noted above. Engineer's preference is for adhesive anchors when equipment may vibrate. Include anchor bolt product literature in this section.
- 15. 1.4, A.5: Provide Operation and Maintenance Manuals in accordance with Section 01 78 23 prior to startup.
- 16. 2.2, D:
 - a. 3. Floc reactor to be provided by Huber as part of the construction project as previously discussed.
 - b. 6. Two (2) sludge feed pumps will be provided. Either pump can feed sludge to the screw press and to the sludge drying beds as a backup.
 - c. 7. Sludge holding tank level sensors will not be installed as part of the construction project.
 - d. 8. Air gap system to be installed to provide washwater to the screw press. System pressure controlled by air gap control panel.
 - e. 9. Three sludge conveyors will be provided to convey sludge to a truck. A conveyor panel to be provided to start/stop conveyor system.
- 17. 2.3, A.2: Provide access cover material.
- 18. 2.3, B.13.: Provide flanged flexible connection to facilitate connection of the discharge to the sludge conveyors.
- 19. 2.5 Drives: Provide product literature including gear box and motor drawings, motor specifications, and efficiency over operating range for screw press drive. Confirm output speed and output torque.
- 20. 2.9 Electric Motors: Provide motor data and shop drawings for 3 hp motor listed in scope of supply. Motor provided is 3kw which equates to 4.02 hp. Product literature should list gearbox and motor requirements for comparison to the specifications. Is the motor a TEFC-type?
- 21. 3.1: Panel shall be factory tested and a report of test results submitted prior to shipment.

Corrections or comments made relative to submittals during this review do not relieve the Contractor from compliance with the requirements of the drawings and specifications. This check is only for review of general conformance with the design concept of the project and general information given in the contract documents. The Contractor is responsible for confirming and correlating all quantities and dimensions; selecting fabrication processes and techniques of construction; coordinating his work with that of other trades, and performing his work in a safe and satisfactory manner.

Keller Associates, Inc.

Engineer

100 E. Bower Street, Suite 110

Meridian, ID

(Address)

By (Authorized Signature)

(Printed Name)

5/3/2024

Date

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Field (0)

**Equipment &
Controls Submittal**

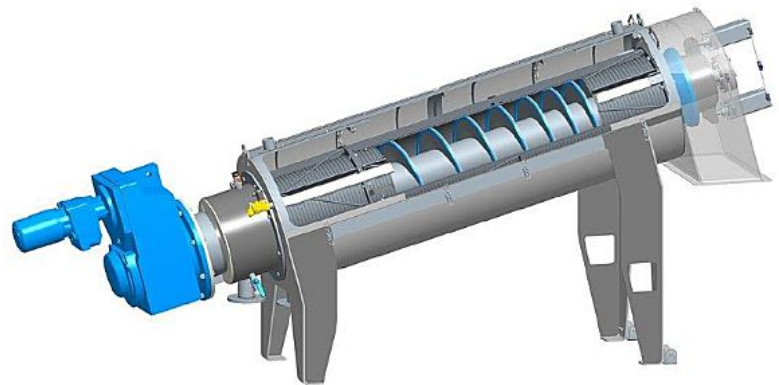
Aberdeen, ID

Q-PRESS 620.2

Project: 73010205

Date: 7/11/2023

Revision: 00



Submittal Content:

- Q-PRESS
- Polymer System
- Controls
- Spare Parts

Project Manager: Julia Hahn, julia.hahn@hhusa.net

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APPENDIX CONTENTS

APPENDIX A:	Product Information <ul style="list-style-type: none">- Brochure- Order Reference List
APPENDIX B:	Mechanical Data Sheets <ul style="list-style-type: none">- Anchor Bolts- Air Compressor- IFM Pressure Sensor- DN50 Injection Ring- DN50 Mixing Valve- Pneumatic Cylinders- Roller Bearing Calculations- Solenoid Valves- Spray Bar Prox. Sensor- Spray Bar Nozzles- Velodyne Polymer System
APPENDIX C:	Controls Data Sheets <ul style="list-style-type: none">- Electrical components data sheets
APPENDIX D:	Operating Instructions
APPENDIX E:	Certifications <ul style="list-style-type: none">- ISO 9001- ISO 14001- Pickling and Passivation
APPENDIX F:	Warranty Information
APPENDIX G:	Service <ul style="list-style-type: none">- Special tools and materials- Start Up Days/Trips
APPENDIX H:	Spare Parts <ul style="list-style-type: none">- Spare Parts Supplied- Spare Parts List- Spare Parts Drawing
APPENDIX I:	Long Term Storage <ul style="list-style-type: none">- Long term storage instructions
APPENDIX J:	Seismic Calculations <ul style="list-style-type: none">- Kolibrien Structural/Seismic

SECTION 1
REVISION HISTORY

Project: Albertville, MN – One (1) Q-PRESS 620.2	Project #: 73010205
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Submittal Revision History

Rev	Date	Changes	By
0	7/11/2023	Initial submission to Keller Associates.	JH
	Date		
	Date		
	Date		
	Date		
	Date		
	Date		
	Date		
	Date		
	Date		

SECTION 2
Project Timing and Milestones

Aberdeen, ID Project Milestones

PID: 73010205



Project Milestones	Duration		Planned		Owner	Notes
	Work Days	Weeks	Start	End		
PO Received	1	0.2	05/09/23	05/09/23	Client	
Contract Review	5	1	05/09/23	05/16/23	HUBER	
PO T&C Agreed	1	0.2	05/18/23	05/18/23	Client	
Handover/Project KO	1	0.2	05/17/23	05/18/23	HUBER	
Submittal Development	38	7.8	05/18/23	07/11/23	HUBER	
Submittals Sent	1	0.2	07/11/23	07/11/23	HUBER	
Submittal Review/Approval	20	4	07/11/23	08/08/23	Client	Assumes Comments and Review within 4 weeks.
Submittal Update	10	2	08/08/23	08/22/23	HUBER	If required
Re-Submittals Sent	1	0.2	08/22/23	08/23/23	HUBER	If required
Submittals Approved	10	2	08/23/23	09/06/23	Client	Assumes Review and Approval within 2 weeks
Engineering Component Drawings	5	1	09/06/23	09/13/23	HUBER	
Release	5	1	09/13/23	09/20/23	HUBER	
Procurement	65	13	09/20/23	12/20/23	HUBER	
Assembly & Passivation	30	6	12/20/23	01/31/24	HUBER	
Approval to Ship	2	0.4	01/31/24	02/02/24	Client	
Shipping to US Port	30	6	02/02/24	03/15/24	HUBER	Includes loading to ship, ocean transport, unload and customs clearance
Shipping to Site	3	0.6	03/15/24	03/20/24	HUBER	

Items in blue are milestones driven by customer approval. HUBER Technology reserves the right to adjust project schedule based on customer delays to these milestones. Please note, each day late can result in up to a 2 day delay to project delivery. Example: 4 weeks (20 work days) can result in a 8 week (40 work day) shift to the delivery schedule. Delays exceeding 6 weeks are subject to re-quote.

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 Phone: 704.949.1010 – Fax: 704.949.1020
 huber@hhusa.net – www.hubertechnology.com

SECTION 3
OPEN ISSUES/SCOPE CLARIFICATION



Project: 73010205 - Aberdeen, ID
 Product: Q-PRESS 620.2
 Open Issue Deck (OID)

#	Priority	Status	Owner	Type	Date Created	Days Open	Date Closed	Title	Action	Notes
1	Normal	Closed	HUBER	Specification	07/11/23	0		Specification Acknowledgement	n/a	Spec section 46 76 27 - 1.1.A - Dimensional drawings have been provided. Screw press will not be shipped in smaller sections with exception of leg extensions.
2	Normal	Closed	Elemech	Specification	07/11/23	0		Specification Acknowledgement	n/a	There is signaling but no starters for the cake pump and the conveyor.
3	Normal	Open	HUBER	Approval	07/11/23	0		Submittal Comments	n/a	Submittal sent to Keller Associates for approval.
4	Select	Select	Select	Select					n/a	
5	Select	Select	Select	Select					n/a	
6	Select	Select	Select	Select					n/a	
7	Select	Select	Select	Select					n/a	
8	Select	Select	Select	Select					n/a	
9	Select	Select	Select	Select					n/a	
10	Select	Select	Select	Select					n/a	
11	Select	Select	Select	Select					n/a	
12	Select	Select	Select	Select					n/a	
13	Select	Select	Select	Select					n/a	
14	Select	Select	Select	Select					n/a	
15	Select	Select	Select	Select					n/a	
16	Select	Select	Select	Select					n/a	
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31	Select	Select	Select	Select					n/a	
32	Select	Select	Select	Select					n/a	

SECTION 4
KEY CONTACTS

PRIMARY POINT OF CONTACT

Project Management

HUBER Technology Project Manager

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HUBER Technology Regional Sales Director

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Engineer on Record

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ADDITIONAL HUBER CONTACTS

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SECTION 5
SCOPE OF SUPPLY



SCOPE OF SUPPLY

Aberdeen, ID

Equipment:

HUBER Screw Press Q-PRESS 620.2®
Section Number: 46 76 27
Addenda Numbers: 1

Represented by:

Goble Sampson Associates
Ryan Spanton
(801) 268-8790
rspanton@goblesampson.com

Regional Sales Director:

Ron Maiorana
704-990-2422
Ron.Maiorana@hhusa.net

Project Number: 409198
Revision: 1
Date: 5/23/2023

Design Information

Technical Data		
Sludge Type	Waste Activated Sludge	
Upstream Biological Process	Activated Sludge with Secondary Clarifier	
Upstream Digestion Process	Aerobic Digester	with 30 day sludge age
Design Feed Rate (given)	210	lb/hr
Feed Sludge Concentration	1.5	%
Sludge TDS (assumed)	800	mg/L
Sludge VSS	70	%
Sludge pH (assumed)	7.1	SU
Chloride Concentration (assumed)	50	mg/L
Phosphate Concentration (assumed)	25	mg/L
Calculated Hydraulic Loading Rate (total)	28 at 1.5% feed solids	gpm
Calculated Solids Loading Rate (total)	210 at 1.5% feed solids	lb/hr
Estimated Cake Solids ¹	16	%
Capture Rate ¹	≥95	%
Estimated Polymer Consumption ¹	32 - 40 lb active polymer/dry ton of sludge	
Average Spray Wash Water Requirement ²	62 gph at 72.5 psi	
Spray Water Connection	1.25	inch
Sludge Inlet Diameter	4	inch
Approximate Screw Press Empty Weight	6000	lbs
Approximate Screw Press Full Weight	7300	lbs

¹All performance is estimated based on typical screw press performance. In order to guarantee performance Huber must run a pilot test.

²Wash water cycle runs at approximately 36 gpm for 114 seconds. Typical applications experience 1-2 wash cycles per hour.

Equipment Details

Model	HUBER Screw Press Q-PRESS 620.2®
Quantity	1
Material	304L stainless steel construction; pickled and passivated in acid bath
Basket Material	Wire mesh; stainless steel
Auger Inclination	12°
Support Legs	304L stainless steel
Wiper Material	Wear resistant polyurethane
Anchor Bolts	M12, 316L stainless steel
Motor Data	3 hp drive motor, 460 VAC, 60 Hz, 3 ph
Spraywash Motor Data	0.25 hp spraywash motor, 460 VAC, 60 Hz, 3 ph

Polymer System	Velodyne VM-3P-600-D
Quantity	1
Neat Polymer Pump Motor	1/2 hp, 90 VDC
Mixer Motor	1/2 hp, 90 VDC

Ancillary Equipment	
Polymer Injection Ring	1, DN50 injection rings
Polymer Mixing Device	1, DN50 mixing valves
Air Compressor	Quantity: 1

Controls	One (1) Main Control Panel
<i>Power Supply: 480VAC-3PH-60HZ</i>	
<i>Panel Classification: NONE</i>	
<i>Location: Indoors</i>	
1 - Enclosure, NEMA 4X, 304 Stainless Steel w/ 3PT Latch	
1 - Enclosure Window Kit	
1 - Main Disconnect, Non-Fused Type, w/Through Door Disconnect Handle	
1 - Variable Frequency Drive, PowerFlex 525 Series, with Branch Circuit Protection	
[5HP - 480VAC Max, Press - PM Motor 3.0HP VFD]	
1 - Motor Starter, Reversing, NEMA, w/Overload Relay and CB Branch Circuit Protection	
[0.5HP - 480VAC Max, Spray Drive]	
1 - Surge Protection, 480VAC	
1 - Surge Protection, 120VAC	
1 - Phase Failure Voltage Monitoring Relay	
1 - Programmable Logic Controller, Allen-Bradley CompactLogix 5069 Series w/ Ethernet and Required IO	
1 - Operator Interface Unit, Allen-Bradley PanelView Plus, 12" Display	
1 - UPS Battery Backup - Phoenix or Equal	
1 - 24VDC Power Supply, Redundant - Phoenix or Equal	
1 - Ethernet Switch, Unmanaged	
1 - Panel Heater, with Thermostat	
1 - Lot, Circuit Breakers, 120VAC: [As Required]	
1 - Lot, Pilot Lights, LED, PTT Type: [As Required]	
1 - Lot, Push Buttons: [As Required]	
1 - Lot, Selector Switches: [As Required]	
1 - Lot, Control Relays, Socket Type: [As Required]	
1 - Lot, Terminal Blocks: [As Required]	
1 - Lot, Dry Contacts: [As Required]	
1 - UL Label	
Remote ETHERNET signals to/from Q-Press Control Panel and SCADA System:	
(1) Lot, Dewatering System Status - To / From SCADA	
- SCADA Remote Start	
- Press Running Status	
- Press Fault Status	
- Dewatering Mode Status	

- System Disturbance Status
Remote HARDWIRED signals to/from Q-Press Control Panel (Items either exist or provided by others):
(1) Polymer Dosing System
- Call to Run
- Pacing Signal, 4-20mA
- System Auto Status
- System Running Status
- System Fault Status
(1) Feed Pump
- Call to Run
- Pacing Signal, 4-20mA
- System Auto Status
- System Running Status
- System Fault Status
(1) Cake Conveyor
- Call to Run
- System Auto Status
- System Running Status
- System Fault Status
(1) Sludge Storage Tank
- Tank Level, 4-20mA

Spare Parts	
One (1) set	Wipers with mounting hardware
One (1)	Bearing assembly for shaft
One (1)	1-inch solenoid valve
Ten (10)	Nozzles for spray bar washing system

Freight and Startup Services	
2 days and 1 trips	Startup, performance testing (day 1), and training.
Freight to jobsite.	

Pricing

Equipment	Model	Quantity	Pricing
HUBER Screw Press	Q-PRESS 620.2®	1	Included
Polymer System	VM-3P-600-D	1	Included
Ancillary Equipment			Included
HUBER Control Panel		1	Included
Spare Parts			Included
Freight and Startup Services		2 days, 1 trips	Included
TOTAL:			See Bid Form

This proposal has been reviewed for accuracy and approved for issue by: CTP

Project Clarifications

For the 46 76 27 equipment, HUBER is offering our well-proven Q-PRESS. HUBER's offering is designed to meet the performance requirements and intent of the specification. HUBER's equipment differs in construction from the specification, including (but not limited to) the following:

Section 46 76 27

Above proposal includes controls for a single Q-Press with dedicated feed pump, polymer system, and discharge cake conveyor. These controls do NOT consider any future Q-Press or other equipment, and are currently NOT equipped to accommodate and feed / polymer sharing with a future system.

Feed Pump VFD, Cake Conveyor Motor Starter, Booster Pump, and Sludge Holding Tank Level Sensor are NOT included and are to be supplied by others. The above proposal included status and control signaling to/from these system ONLY.

Flocculation piping to be supplied by others. HUBER has included a flocc piping report with their bid submission.

General Notes

1. HUBER Scope of Supply is based on bid documents dated Feb. 2023 equipment section 46 76 27.
2. HUBER is in receipt of the following addenda:
Addendum 1 dated 03/14/2023
3. All electrical interconnections, wirings, junction boxes, local motor disconnects, and terminations between the equipment and electrical components are to be provided by installing contractor.
4. Any item not specifically listed is not considered part of this scope of supply. Please contact the HUBER Technology representative listed for further clarification.
5. A fully functioning and programmed HMI/PLC will be delivered to site. Screens and symbols used on the HMI are based on HUBER's standard unless otherwise noted. Software licenses for the PLC/HMI program will not be included in this scope of supply unless stated otherwise. These items are available for additional price adder upon request.
6. The Control Panel is based on the specification provided and inclusive to meet the requirements of a Vendor designed panel, whereas the components and the factory testing of the panel will meet HUBER's requirements for function and warranty. Additional requirements or sections of the specification to meet local authority requirements or control panels designs unrelated to the equipment section, including special labeling, testing, or integration have not been included.
7. HUBER Technology, Inc. is offering the equipment and associated performance guarantees based on information available at the time of the issuance date. Information not made available to HUBER, whether HUBER is asking for specific information or not, which could affect the performance of the equipment might void warranty and performance guarantees.
8. HUBER will ship all equipment to site inside of 20', 40' or 40'OT ocean containers as deemed appropriate by our factory. HUBER will not ship any equipment on flatbed truck. Flatbed truck shipping means that the equipment would need to be transferred at port from factory packaged containers to the flatbed. This process is out of HUBER's control and it is our experience that equipment always gets damaged during this process.
9. HUBER's standard submittal documents, programming, testing procedure and O&M documentation are included.
10. Blue motor covers are aesthetic only, and have not been included in the HUBER Scope of Supply.
11. Air compressor and polymer system shall be powered by others. 120VAC power for these items is not intended from HUBER panel.

Flocculation Piping Report

HUBER has prepared the attached report to identify the requirements for flocculation piping for the Aberdeen, ID facility. Please note that this report is based on the following parameters:

Given/Assumed Parameters:			Assumption?
Sludge Flowrate:	42	gpm	
Feed Solids Concentration:	1	%	
Desired Pipe Diameter:	6	inches	
Desired Retention Time:	45	seconds	
Desired Polymer Injection/Mixing Device:	Injection Ring & Mixing Valve		
Active Polymer Content:	41	%	Assumed
Neat Polymer Content in Solution:	0.25	%	Assumed
Active Polymer Dose:	32	lb active/dry ton solids	Assumed

Calculated Parameter:

Neat Polymer Dose:	78.0	lbs neat/dry ton solids
Solids Loading:	210	lbs/hour
Polymer Flowrate:	1.0	gallons/hour
Dilution Water Flowrate:	393	gallons/hour
Total Solution Flowrate:	6.6	gallons/minute

Final Flocculation Calculation:

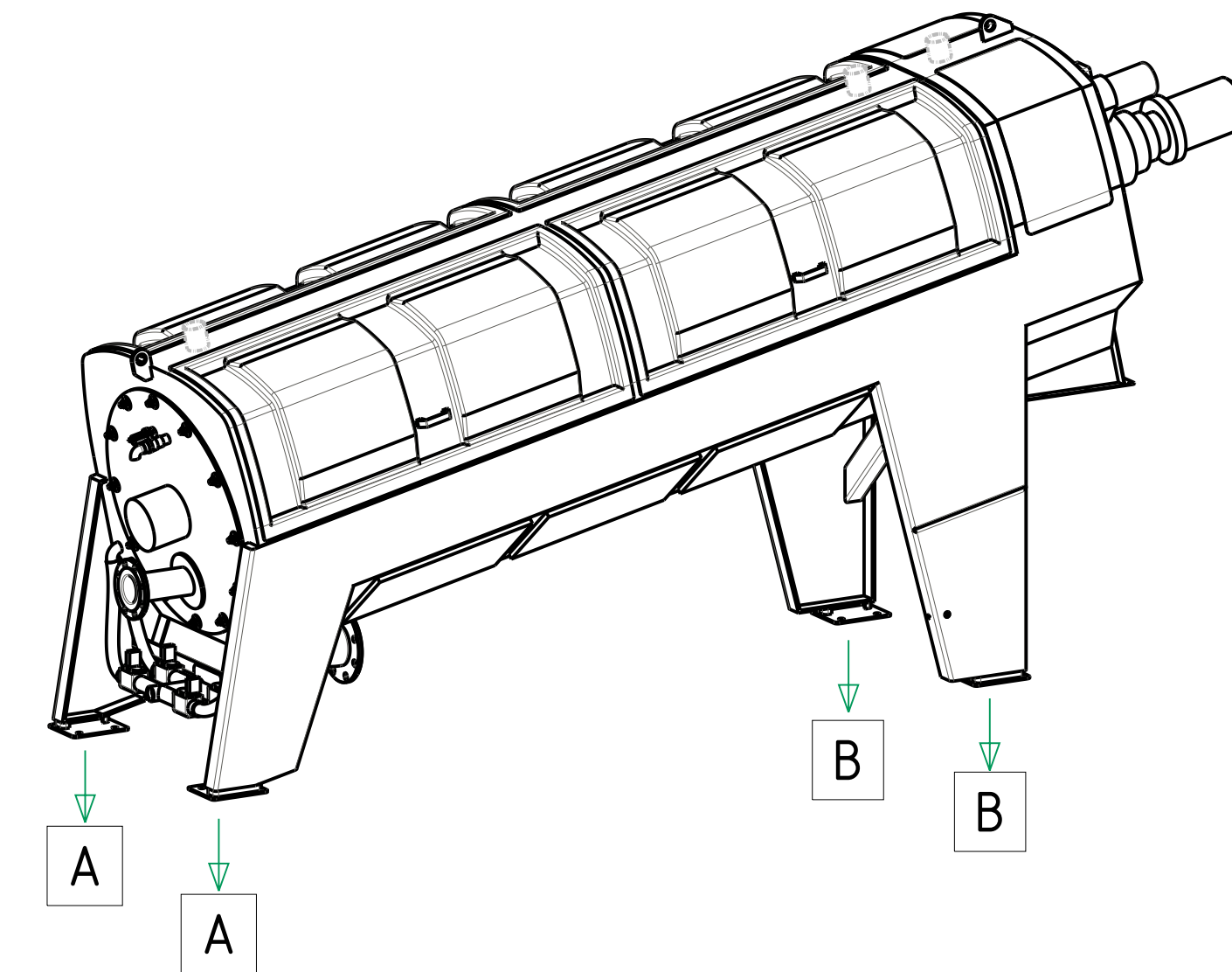
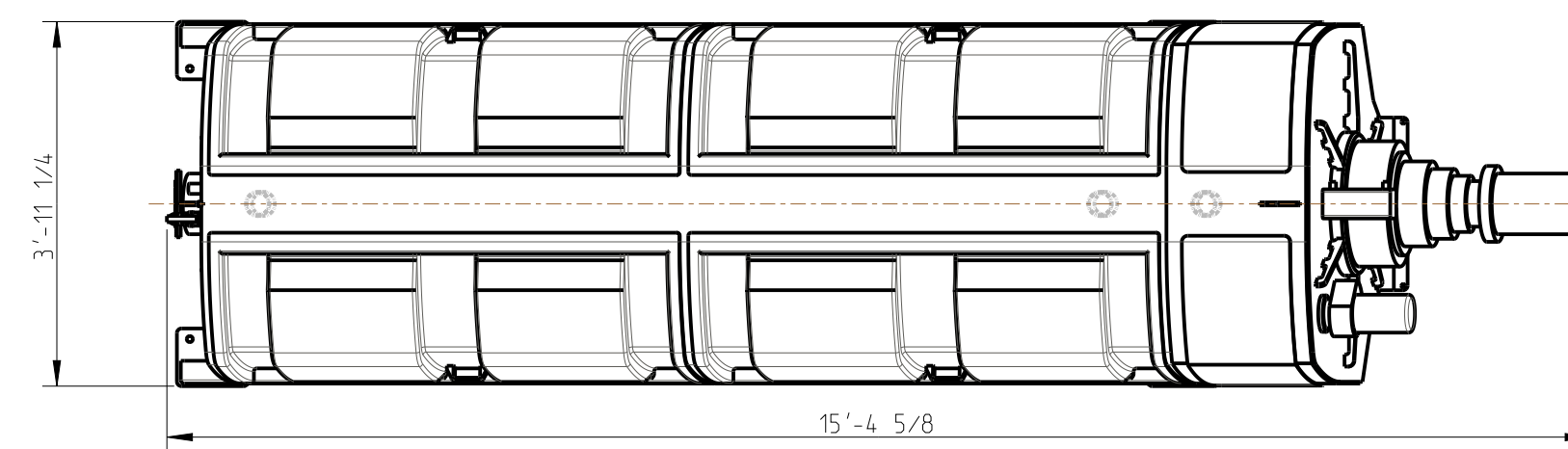
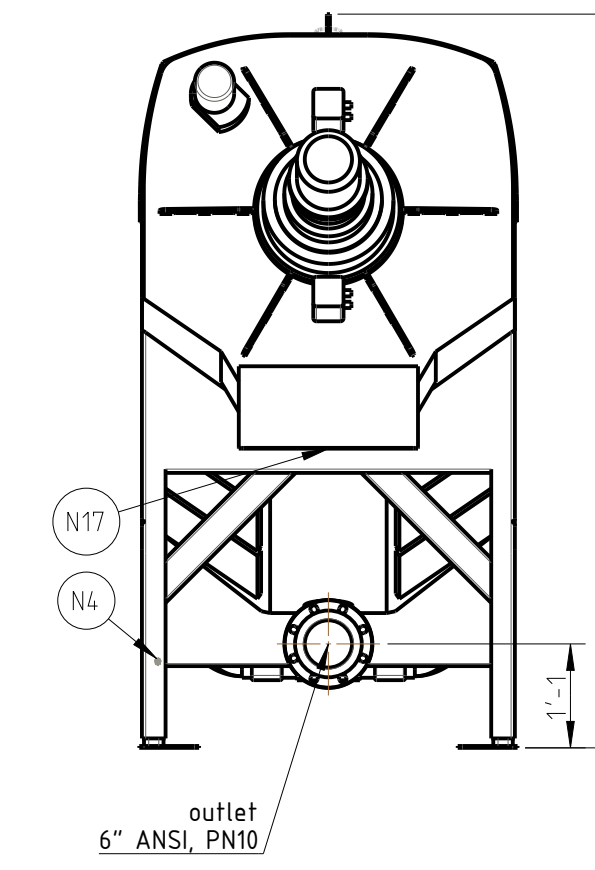
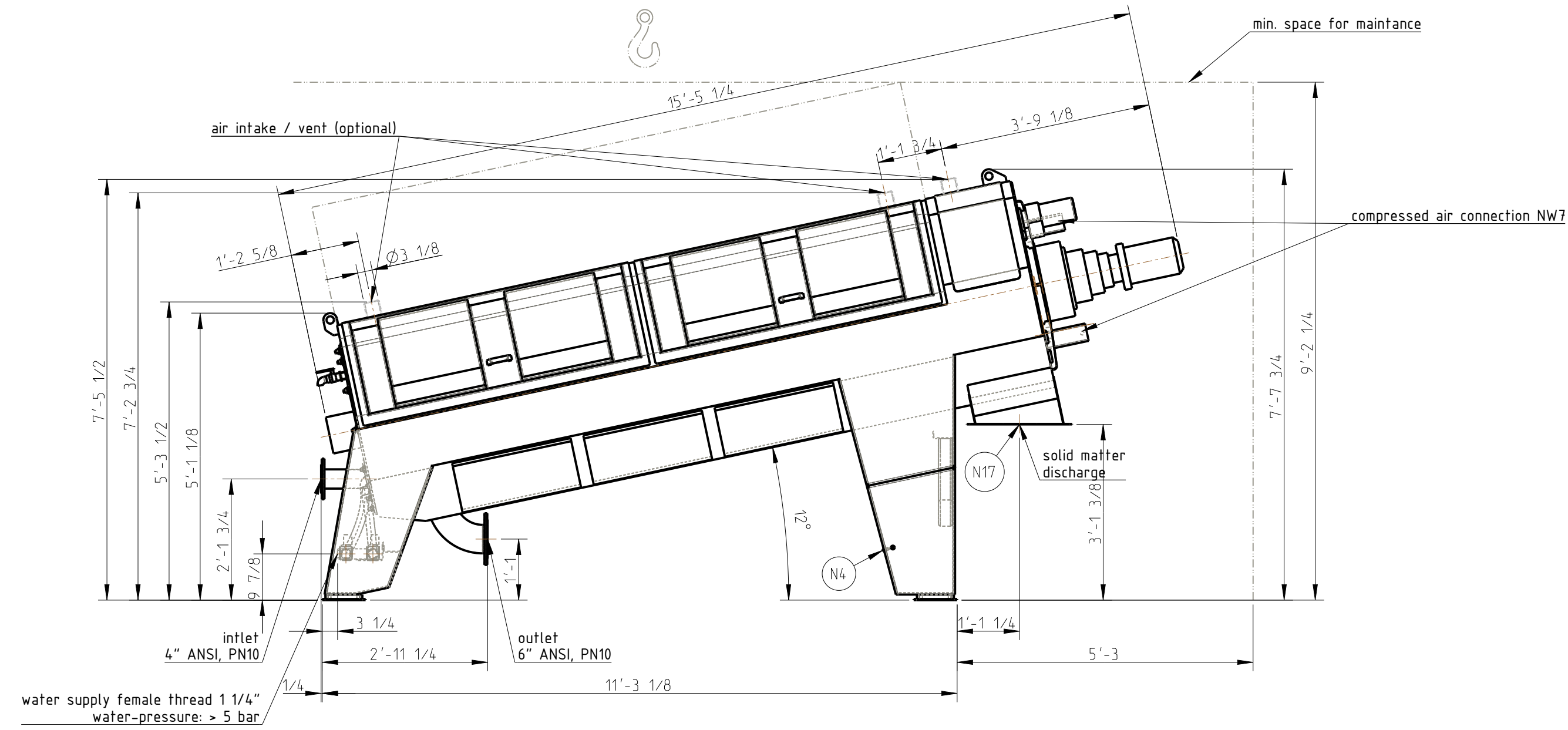
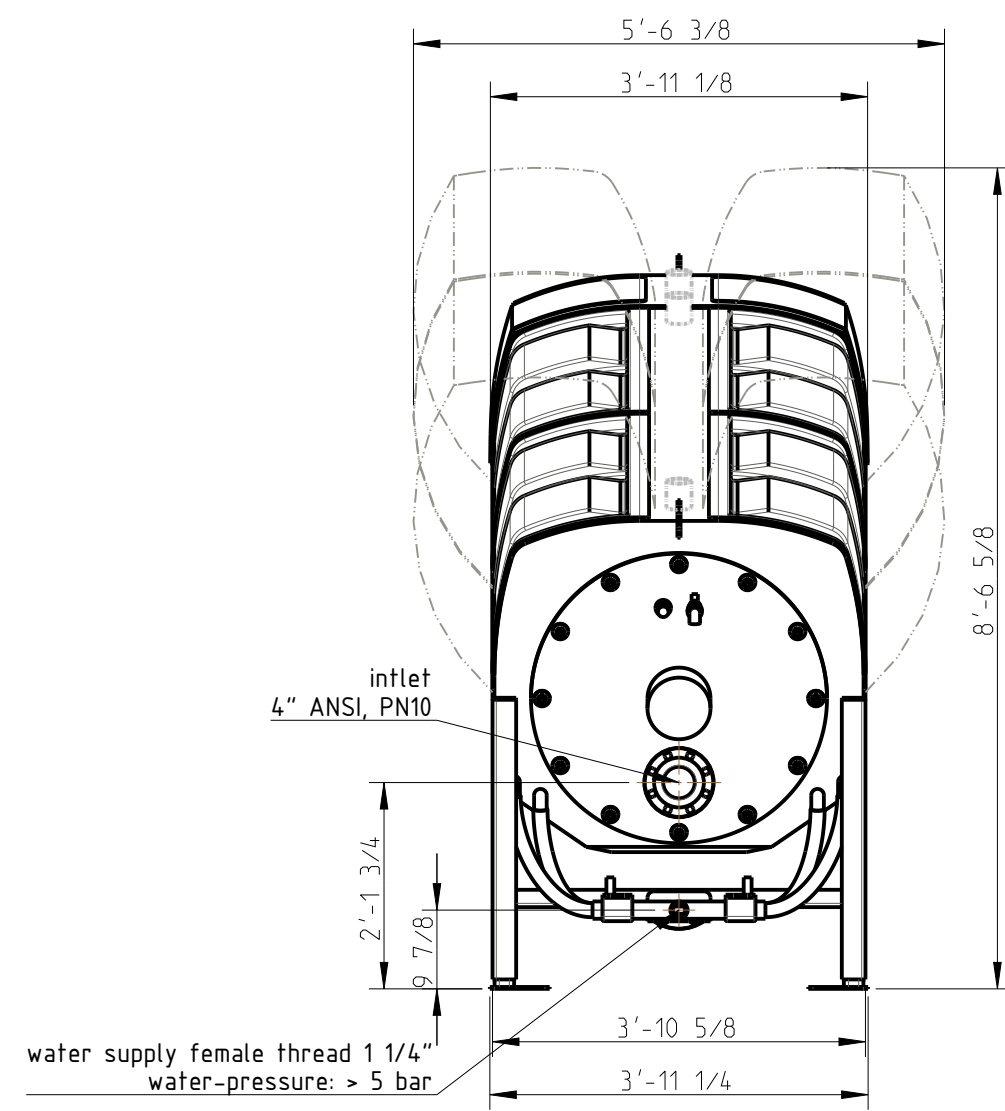
Total Hydraulic Loading Rate:	48.6 gallons/minute
Sludge Velocity:	0.55 feet/second
Required Flocculation Piping Distance:	24.8 feet

Please note that assumptions have been made in the preparation of this report. HUBER values may be limited in their accuracy based upon the information available to HUBER at the time of this report.

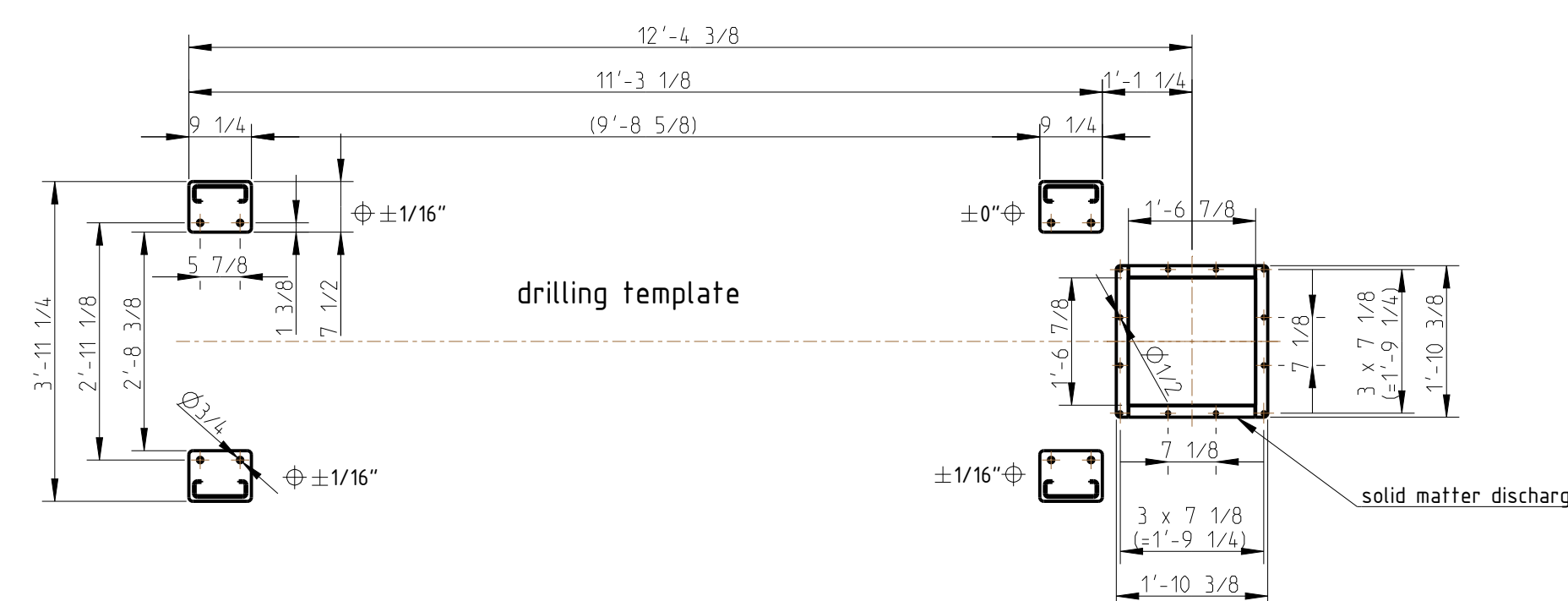
Design has been based on a worst case hydraulic condition of 210 lb/hr @ 1.0% solids.

SECTION 5
LAYOUT & MECHANICAL DRAWINGS

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Note:	
N1	Compliance of the machinery directive. For the planning and building construction security precautions, safety requirements as well as country specific regulations must be respected.
N2	Anchor base Normal reinforced concrete, concrete strength minimal C20/25 up to a maximum of C50/60. Anchor type: HILTI AG, type stud anchor HST2-R M16x140/25
N3	The firm standing of the machine is only guaranteed after anchoring!
N4	Equipotential bonding Connection point for protective conductor size M8: (grounding cable 10 mm ² copper) Connection point for the connection to the main equipotential bonding according to DIN EN 60204-1 (VDE 0113-1). The local safety measures according to the guidelines (DIN, VDE, EN, ATEX) must be noted.
N10	Free drain of the tank must be guaranteed! Additional drain pipe >= 4 per thousand
N11	Additional loads (e. g. pipelines, service platforms,...) on our plant are not allowed
N17	Comply with safety distances for reaching and passing through to solid discharge: Chute / shaft (H > 550mm) closed on all sides optional or customer supplied (slot opening at flange <= 20mm). Alternatively provide protective structures! At discharge heights over 2500mm no additional attachments necessary.



	empty	in operation
A	1237 lbf	1709 lbf
B	1800 lbf	2001 lbf
weight	5953 lbs	7275 lbs

Intellectual property of HUBER Technology, Inc. Technical information subject to change.		HUBER TECHNOLOGY WASTE WATER SOLUTIONS 1000 Airline Parkway Denver, CO 80237		HUBER Screw Press	
Designed:	knj	Date:	04.04.2022	Q-PRESS® 620.2	
Approved:	ll		ll	Fig. No.:	1/1
Modified:	-		-	Scale:	1:1
Rev.		Modification:		Dimension Sheet	Size: D
					Drawing No.: 51801392

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SECTION 7
ELECTRICAL & CONTROLS DRAWINGS

Electrical Drawings



Rev: 0

Date: 06-23-2023

By: JN

Section:

C

Job Number: HBR9328

Page # 1/1

Section Name: Electrical Drawings

ABERDEEN, ID	
HBR9328	
SPECIFICATION	SECTION 46 76 27 SLUDGE DEWATERING SCREW PRESS
REFERENCE	73010205

TABLE OF CONTENTS	
DESCRIPTION	DRAWING SHEET NO.
COVER PAGE	HBR9328A01
CONTROL PANEL SPECIFICATION	HBR9328A02
ELECTRICAL SCHEMATICS	HBR9328A03
FIELD WIRING DIAGRAM	HBR9328A11
PLC IO & DEVICE SETPOINTS	HBR9328A12
SEQUENCE OF OPERATION	HBR9328A15
ENCLOSURE LAYOUT	HBR9328A17
NAMEPLATE AND LABEL SCHEDULE	HBR9328A18
PNEUMATIC PANEL	HBR9328B01

					DESIGNED	JN
					DETAILED	
					CHECKED	MSN
					APPROVED	
DATE	REVISION	NO.	BY	CK	APP	DATE
						06/08/23

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Tel. 704-949-1010
info@hhusa.net

Q - PRESS CONTROL PANEL	
ABERDEEN, ID	SCALE: NONE
PROJECT NUMBER: 73010205	DRAWING NO: HBR9328A01 1 OF 18

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Control Panel Enclosure

Rating:	NEMA TYPE 4X
Material:	304 SS
Disconnect Type:	Door Interlock - Non-Fused
<input checked="" type="checkbox"/> Drip Shield	<input type="checkbox"/>
Installation Conditions:	
<input checked="" type="checkbox"/> Indoor - Unconditioned	<input type="checkbox"/> Indoor - Conditioned
<input type="checkbox"/> Outdoor - Direct Sunlight	<input type="checkbox"/> Outdoor - Shaded
Environment Max Temperature Rating (°F):	125
Internal Device Max Temperature Rating (°F):	122
Climate Control Type:	Air Conditioner with Heater

Panel Construction

Certification:	UL698A
Listing Serial Number:	TBD
Options:	
<input checked="" type="checkbox"/> Phase Failure Relay	<input checked="" type="checkbox"/> UPS
<input checked="" type="checkbox"/> Alarm Beacon/Horn	<input checked="" type="checkbox"/> Redundant Power Supply
Nameplates and Legendplates:	
Material Type:	Thermal Printed
Attachment Type:	Adhesive
Colors:	Background: White Text: Black
Wire/ Cable Type:	Wire Color:
Wiring to be 14 AWG unless otherwise specified. 16 AWG minimum. Wire shall be MTW type, tinned copper, 600VAC, 105°C, UL1015/CSA.	Black - Power Black - 120VAC Hot White - 120VAC Neutral Red - 120VAC Control Yellow - Foreign Voltage Green - Ground Blue - DC Positive White/Blue - DC Negative
Analog signal wiring shall be 18 AWG shielded twisted pair rated 300V.	Wire Labels:
Ethernet cables shall be 24AWG rated 600V. Cat5E.	<input checked="" type="checkbox"/> Adhesive, Self-laminating <input type="checkbox"/> Heat Shrink
Fiber cables shall be SC-Duplex, 50µm multimode.	Note: Colors based on UL508A requirements.

Local Enclosure

Tag:	Pneumatic Panel	Rating:	NEMA 4X	Material:	Fiberglass
------	-----------------	---------	---------	-----------	------------

Power and Motor

Power Feed:	
Circuit 1 :	480 VAC 9.0 FLA SCCR 5 KAIC @ 480 VAC
Motor Data:	
Motor 1 :	460 VAC 5.4A FLA 4.02 HP Controller: VFD
Motor 2 :	460 VAC 0.46A FLA 0.12 HP Controller: FVR

Networking

Communication Type:	Ethernet/ IP
Subnet:	255.255.255.0 Gateway: 0.0.0.0
IP Address:	
PLC1:	To Be Determined
OIU1:	To Be Determined
VFD1:	To Be Determined
Programming:	
PLC1:	CompactLogix 5069-L306ER Software: Studio 5000 Version: Latest
OIU:	PanelView Plus 12" Software: FactoryTalk View ME Version: Latest
Notes:	1. PLC shall be programmed with ladder type only. 2. HMI shall be developed using EleMech's standard Global Object Library.

Instrumentation

Tag:	N/A	Cable Length:	N/A
Rating:	<input type="checkbox"/> Non-Hazardous <input type="checkbox"/> Intrinsically Safe Class 1 Division 1,2	<input type="checkbox"/> Class 1, Division 2	<input type="checkbox"/> Class 1 Division 1,2

DESIGNED	JN			
DETAILED				
CHECKED	MSN			
APPROVED				
DATE	06/08/23			
NO.	BY	CK	APP	DATE
DATE	REVISION			

HUBER TECHNOLOGY

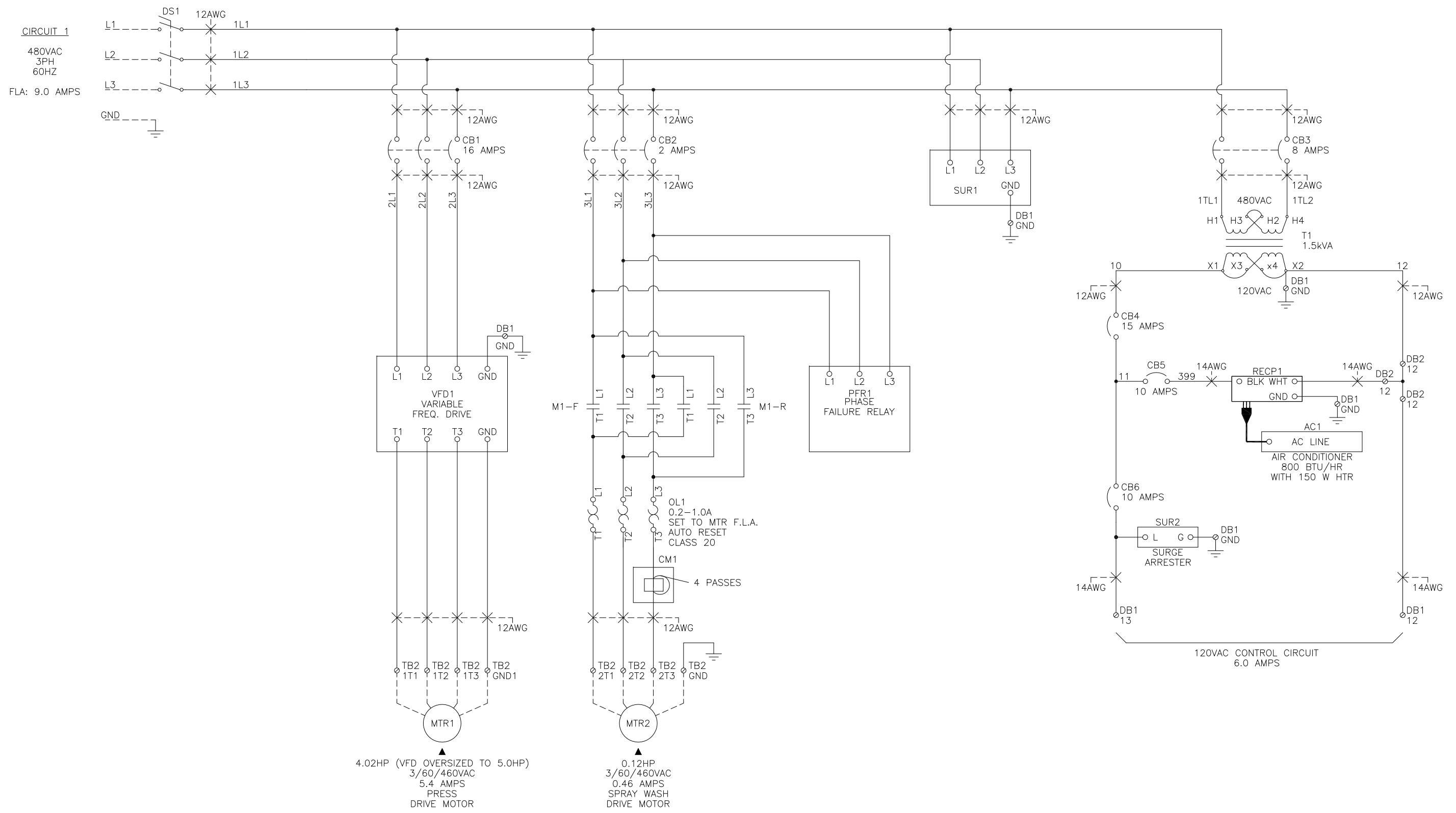
1009 Airlie Parkway
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Tel. 704-949-1010
info@hhusa.net

Q - PRESS CONTROL PANEL

ABERDEEN, ID SCALE: NONE

PROJECT NUMBER: 73010205 DRAWING NO: HBR9328A02
2 OF 18

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NOTES:

1. ▲ DEVICES LOCATED OUTSIDE CONTROL PANEL.
2. ∅ TERMINAL BLOCK (TB) OR DISTRIBUTION BLOCK (DB) LOCATED IN CONTROL PANEL.
3. --- FIELD WIRING.
4. ELEMENCH RESERVES THE RIGHT TO CHANGE, AS NECESSARY, THE SPACING, ORIENTATION, AND PHYSICAL LOCATION OF DEVICES IN ORDER TO OPTIMIZE THE DESIGN.
5. LOCAL MOTOR DISCONNECT SWITCHES SHALL BE PROVIDED BY OTHERS IF REQUIRED BY LOCAL REGULATIONS.
6. JUNCTION BOXES ARE NOT SHOWN AND SHALL BE PROVIDED BY OTHERS AS NECESSARY.

DATE	REVISION	NO.	BY	CK	APP	DATE

DESIGNED	JN
DETAILED	
CHECKED	MSN
APPROVED	
DATE	06/08/23

HUBER
TECHNOLOGY

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Q - PRESS CONTROL PANEL

ABERDEEN, ID

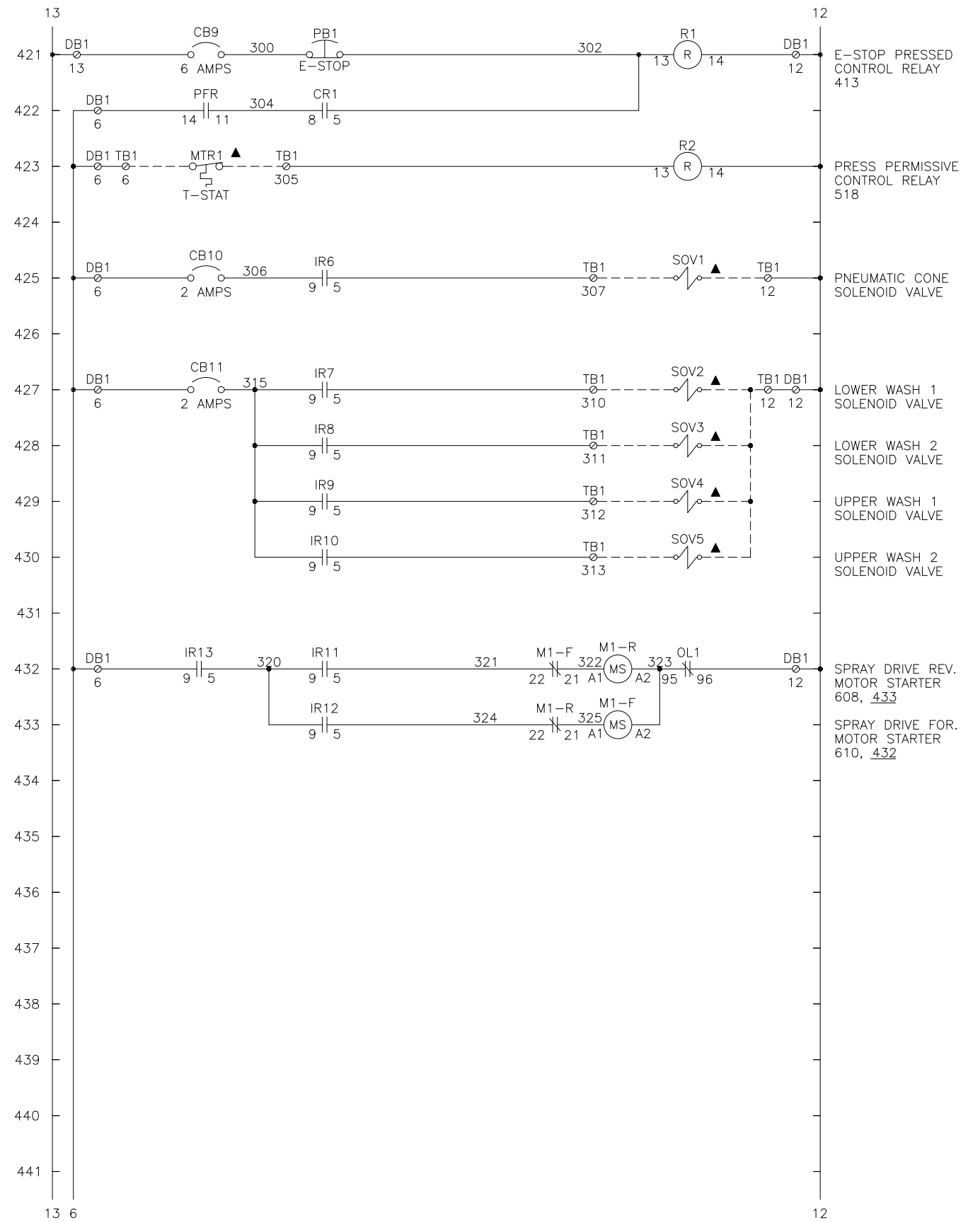
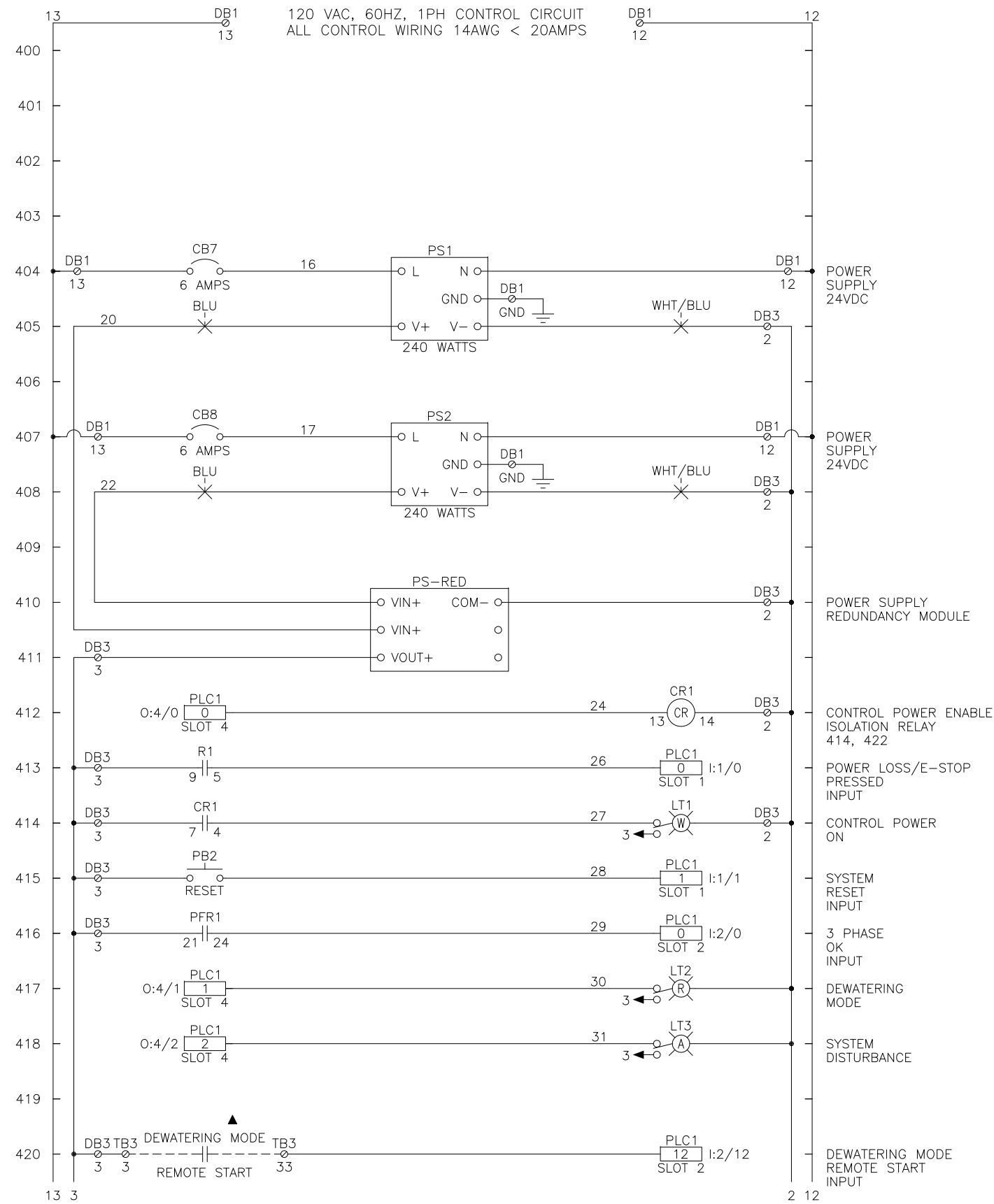
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PROJECT NUMBER:
73010205

DRAWING NO:
HBR9328A03

3 OF 18

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DATE	REVISION	NO.	BY	CK	APP	DATE
					DESIGNED	JN
					DETAILED	
					CHECKED	MSN
					APPROVED	
					DATE	06/08/23

HUBER
TECHNOLOGY

1009 Airlie Parkway
Denver, NC 28037
Tel. 704-949-1010
info@hhusa.net

Q - PRESS
CONTROL PANEL

ABERDEEN, ID

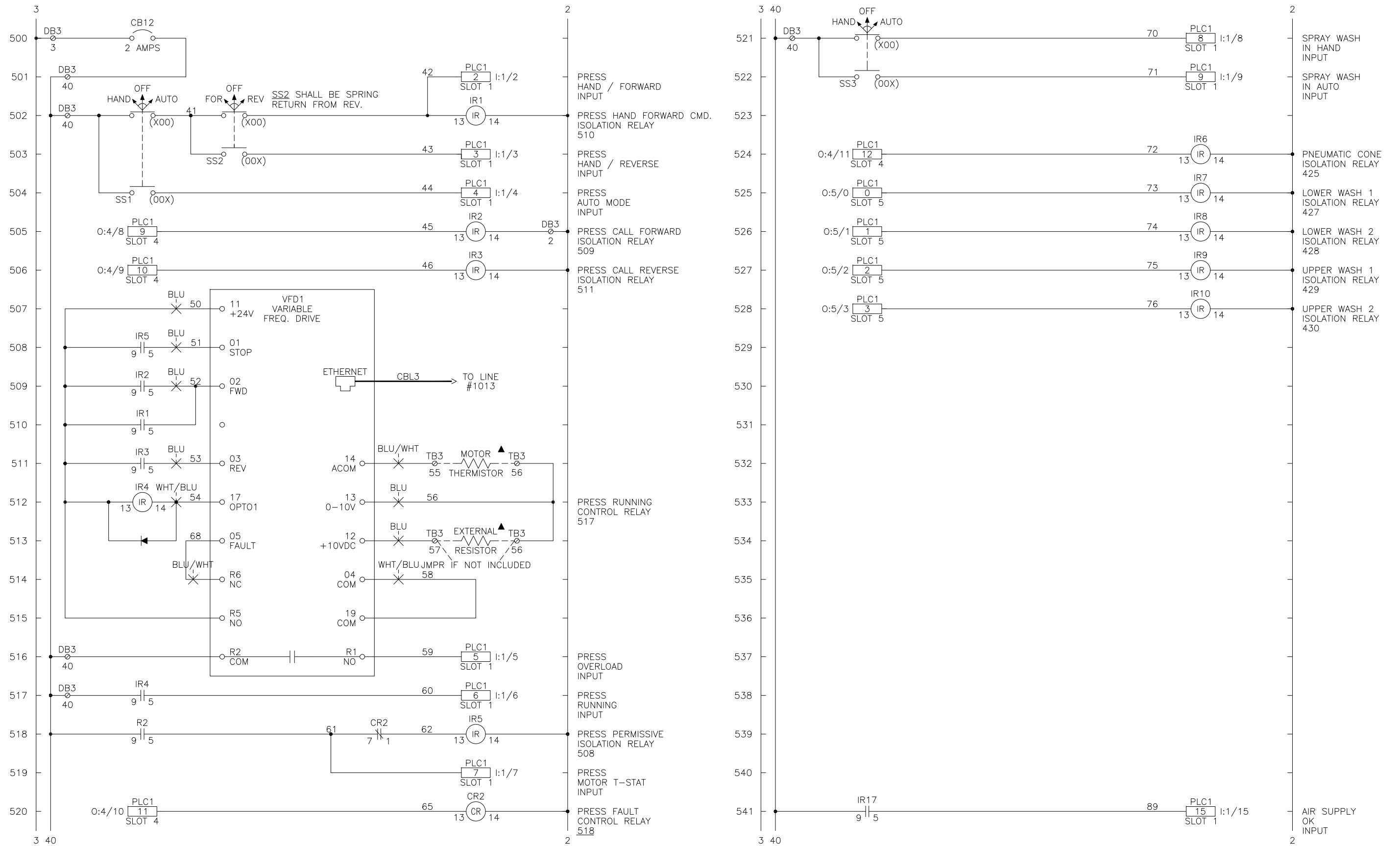
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PROJECT NUMBER:
73010205

DRAWING NO:
HBR9328A04

4 OF 18

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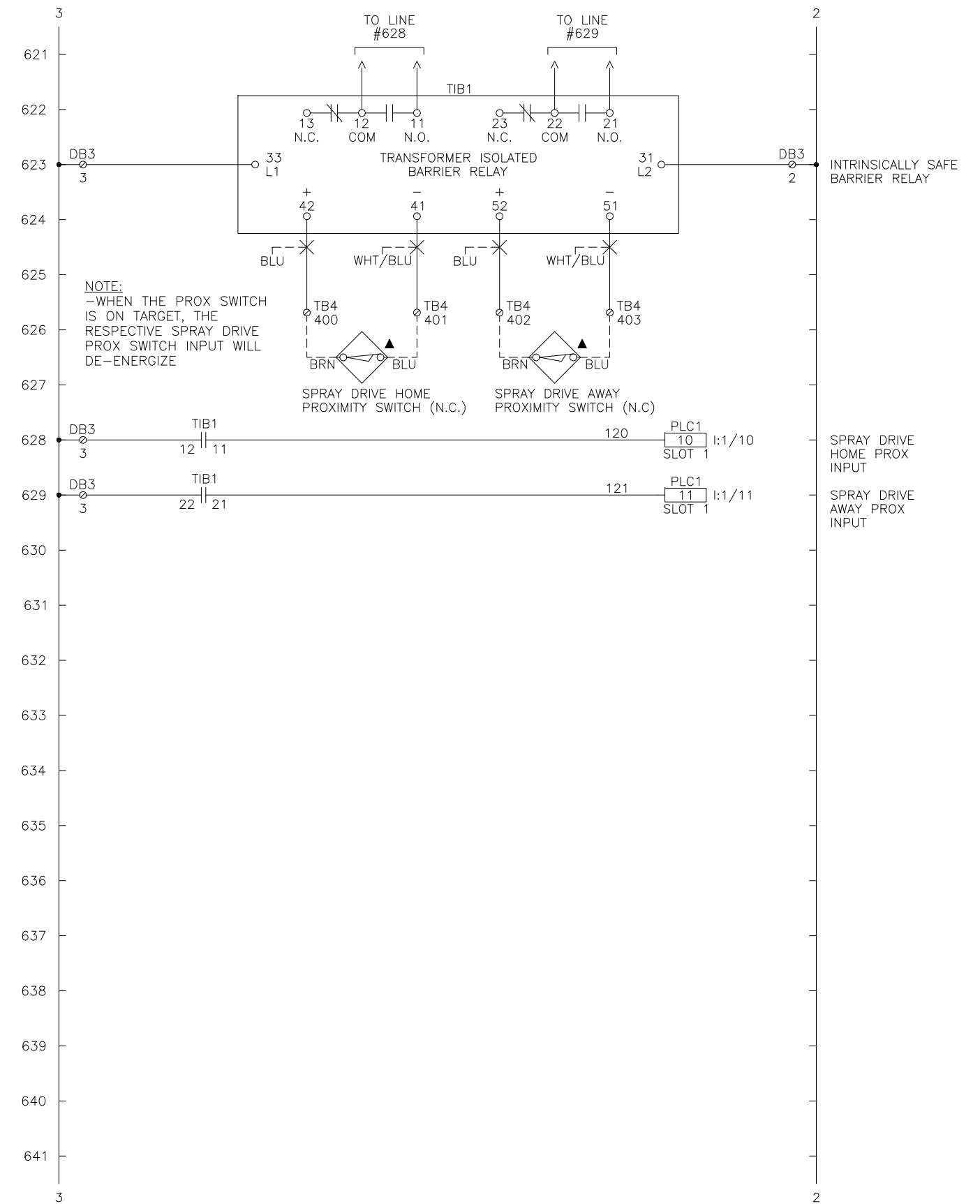
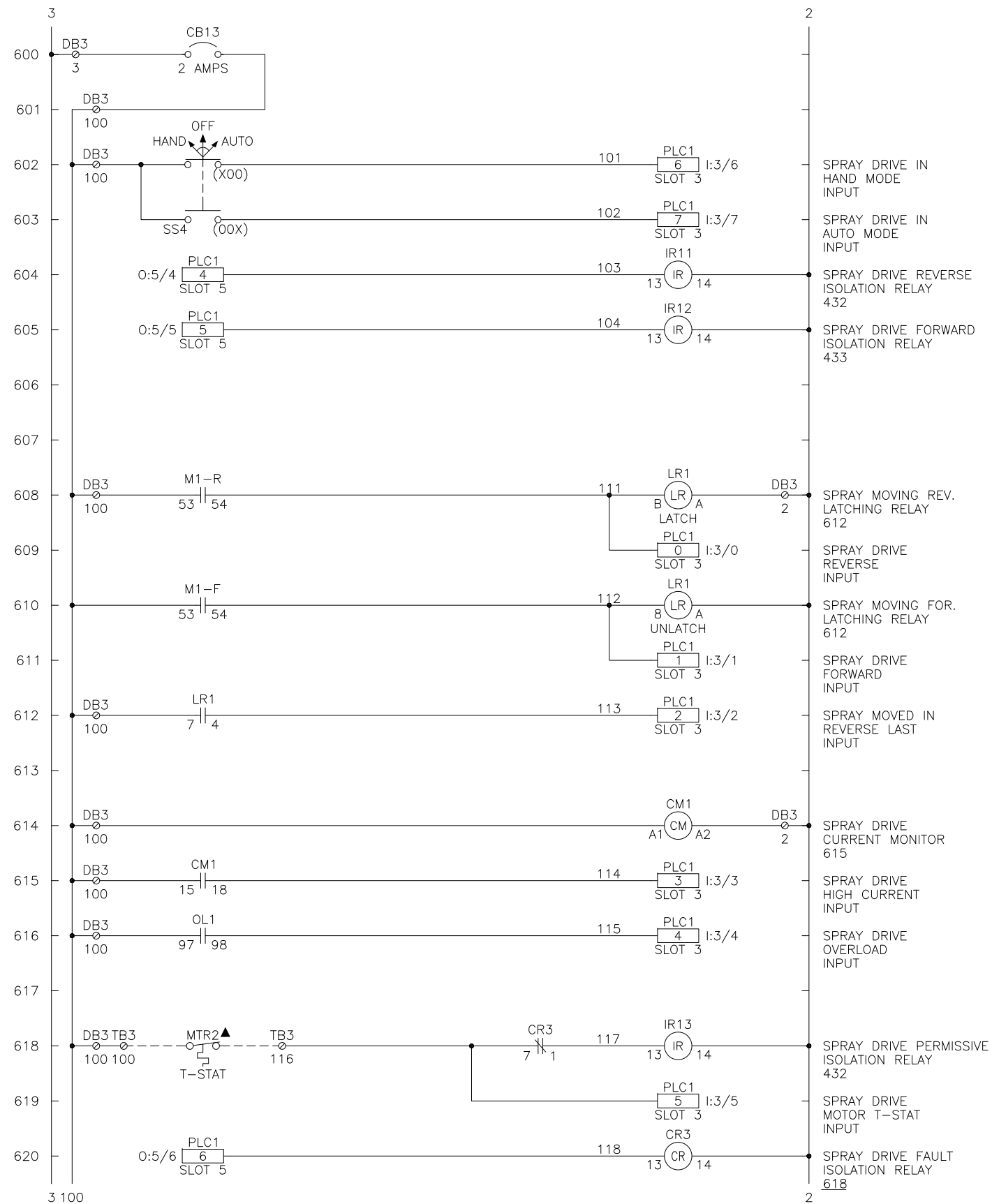
DESIGNED	JN
DETAILED	
CHECKED	MSN
APPROVED	
DATE	06/08/23

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 info@hhusa.net

Q - PRESS CONTROL PANEL

ABERDEEN, ID	SCALE: NONE
PROJECT NUMBER: 73010205	DRAWING NO: HBR9328A05
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Q - PRESS CONTROL PANEL

ABERDEEN, ID

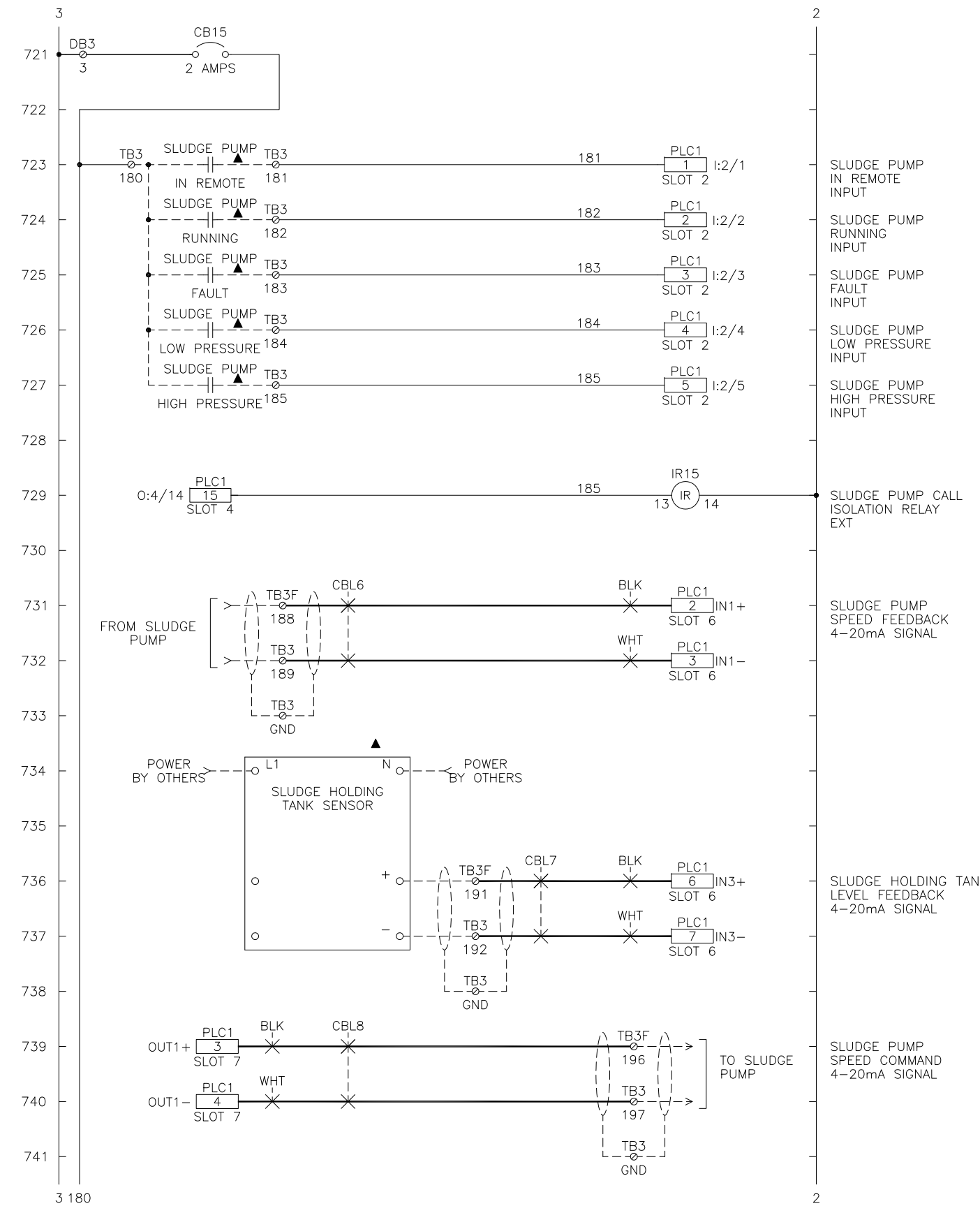
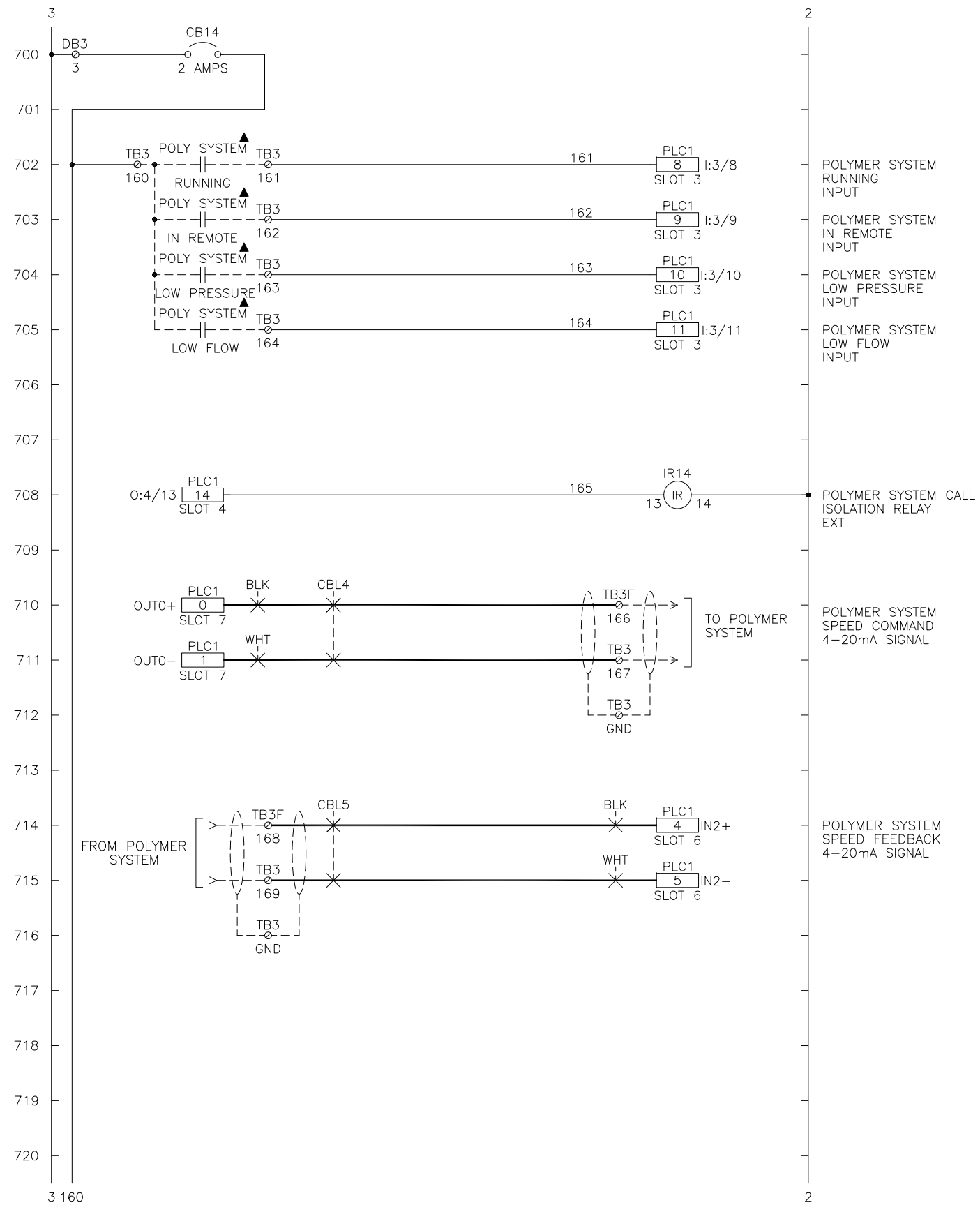
PROJECT NUMBER: 73010205

DRAWING NO: HBR9328A06

SCALE: NONE

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Q - PRESS CONTROL PANEL

ABERDEEN, ID

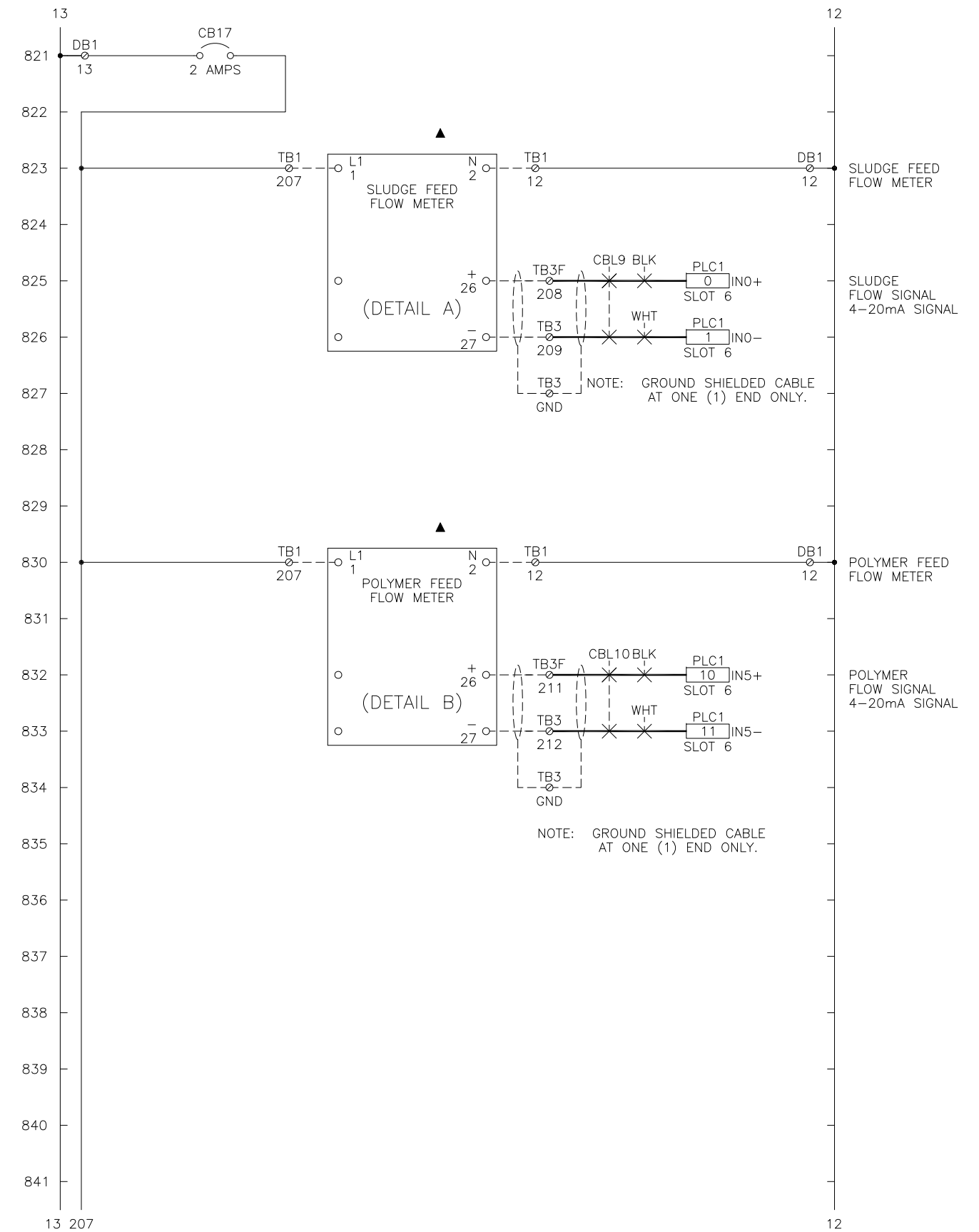
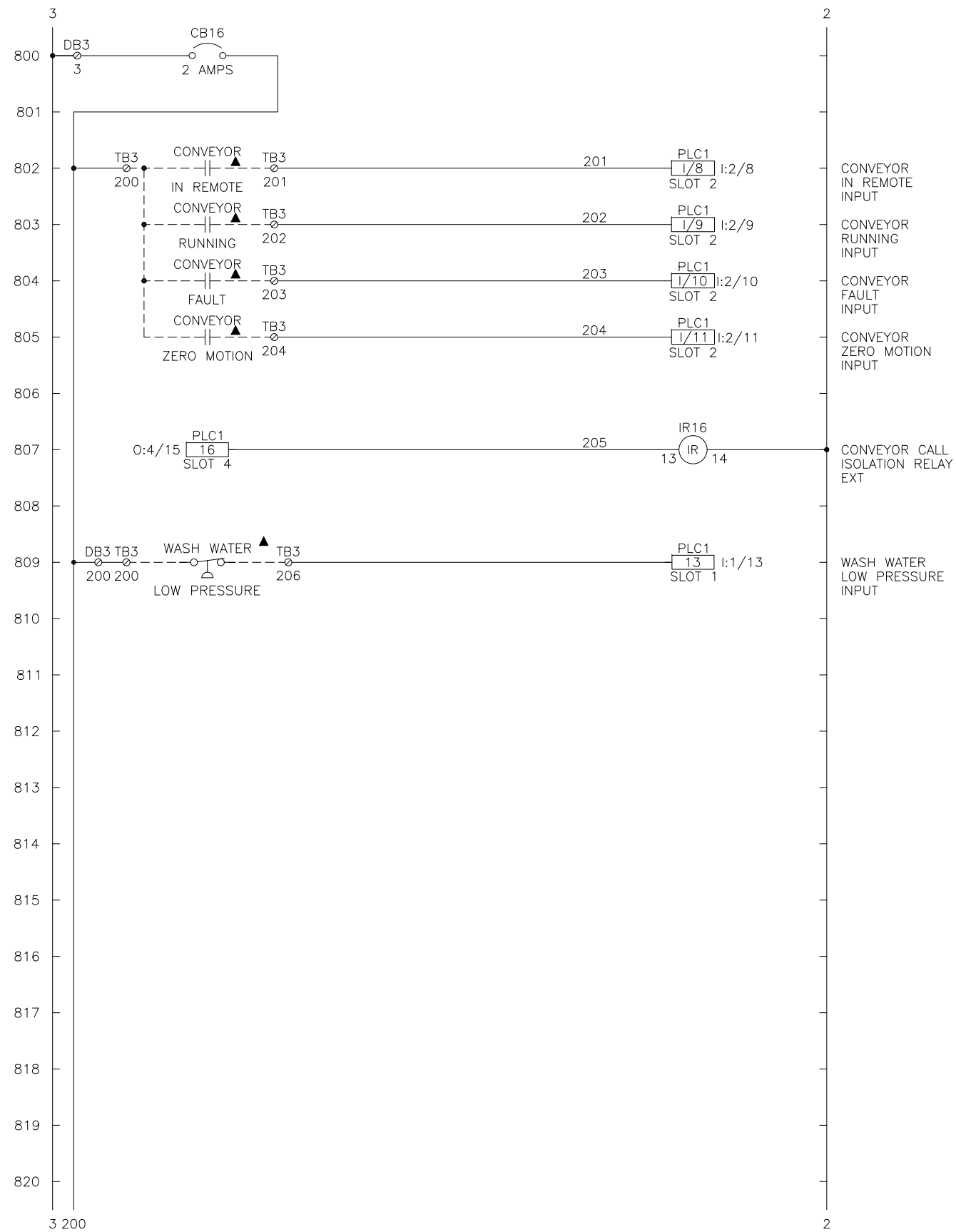
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PROJECT NUMBER: 73010205

DRAWING NO: HBR9328A07

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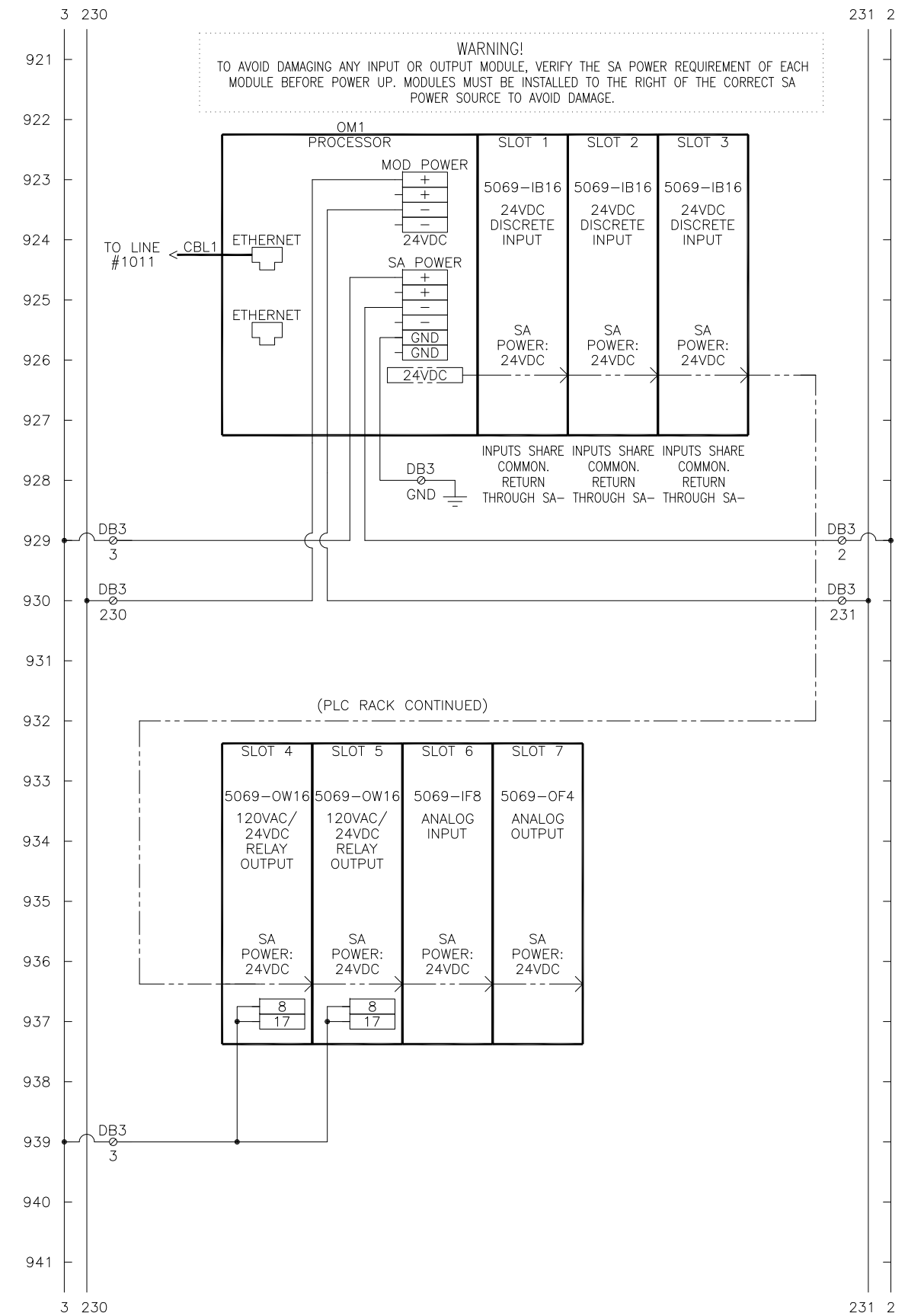
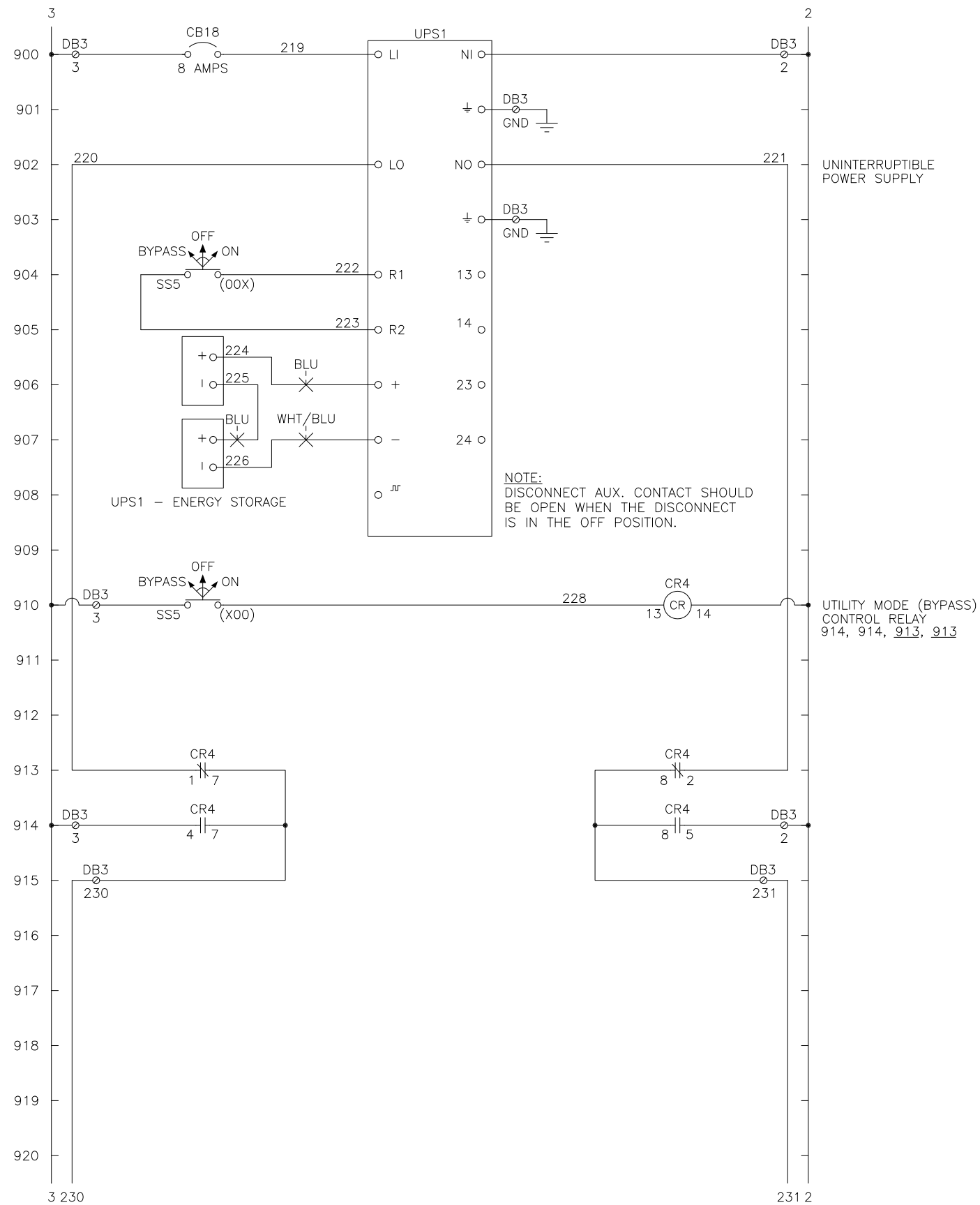
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ABERDEEN, ID SCALE: NONE
PROJECT NUMBER: 73010205 DRAWING NO: HBR9328A08
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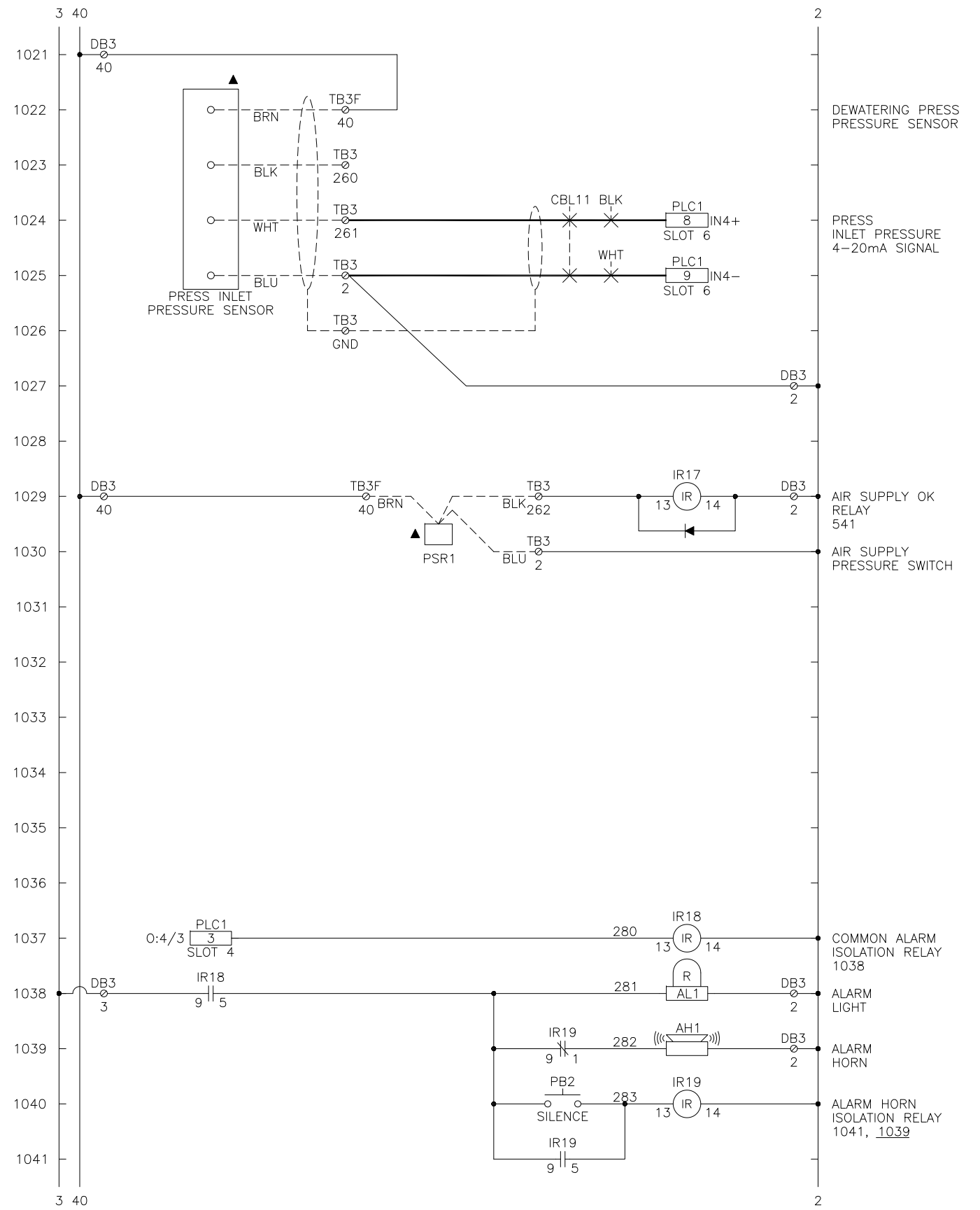
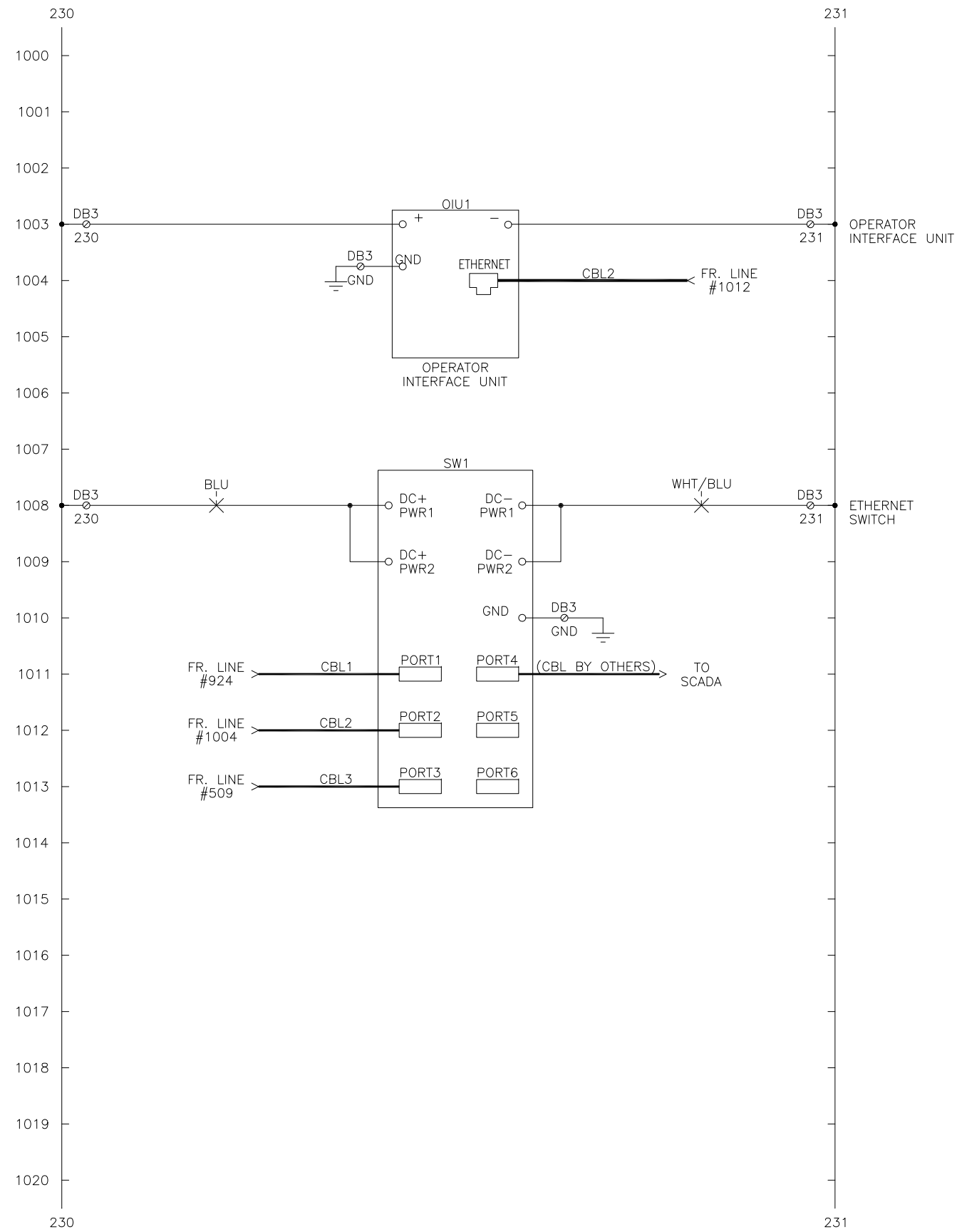
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					DETAILED	
					CHECKED	MSN
					APPROVED	
					DATE	06/08/23

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ABERDEEN, ID	SCALE: NONE
PROJECT NUMBER: 73010205	DRAWING NO: HBR9328A09
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Q - PRESS CONTROL PANEL

ABERDEEN, ID

SCALE:
NONE

PROJECT NUMBER:
73010205

DRAWING NO:
HBR9328A10

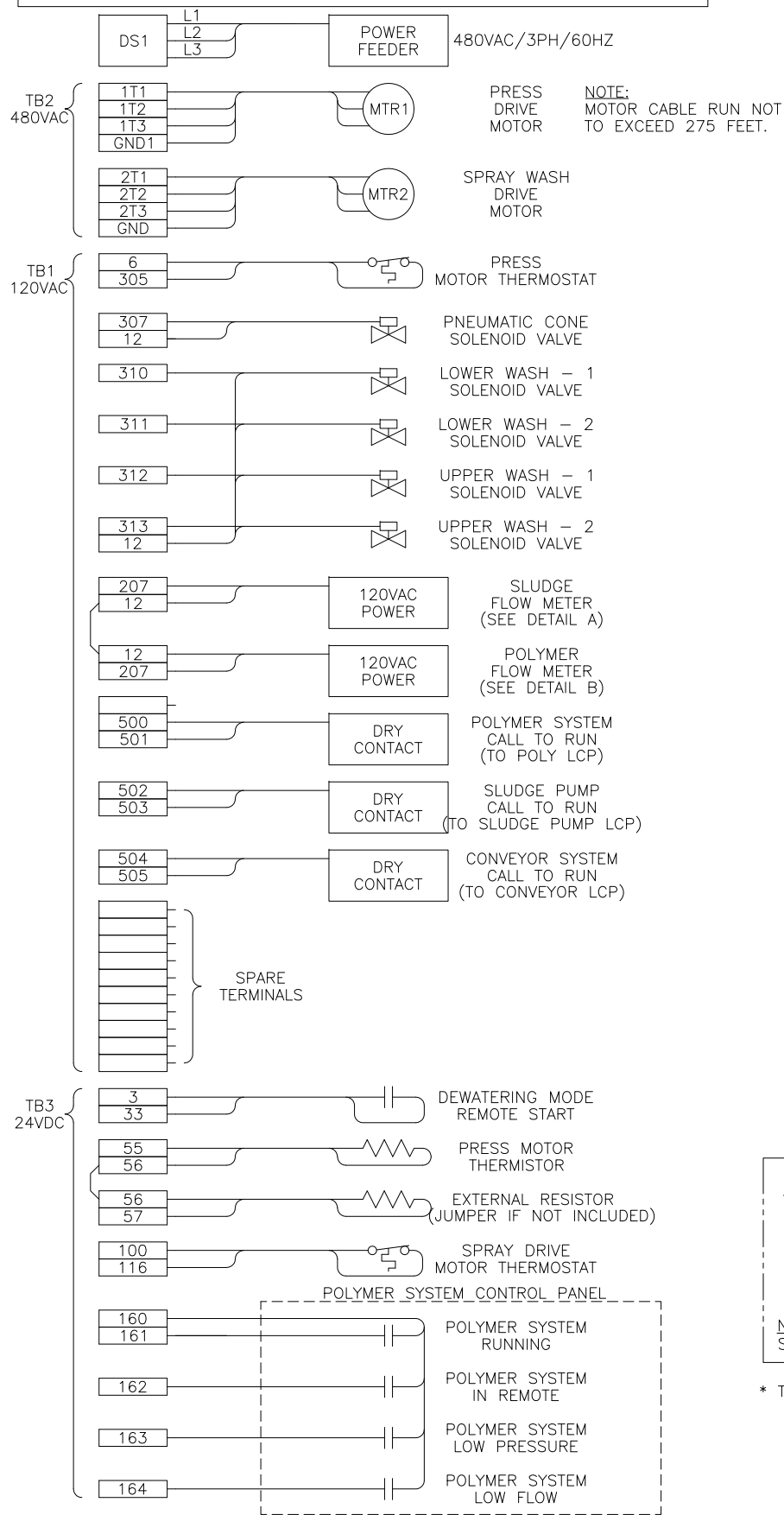
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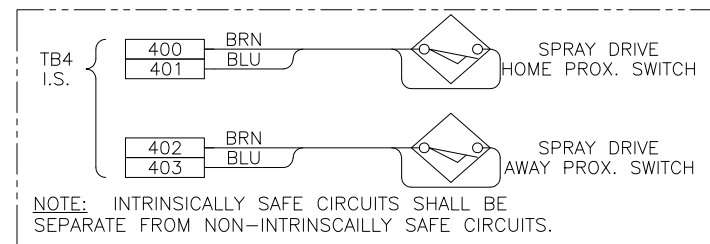
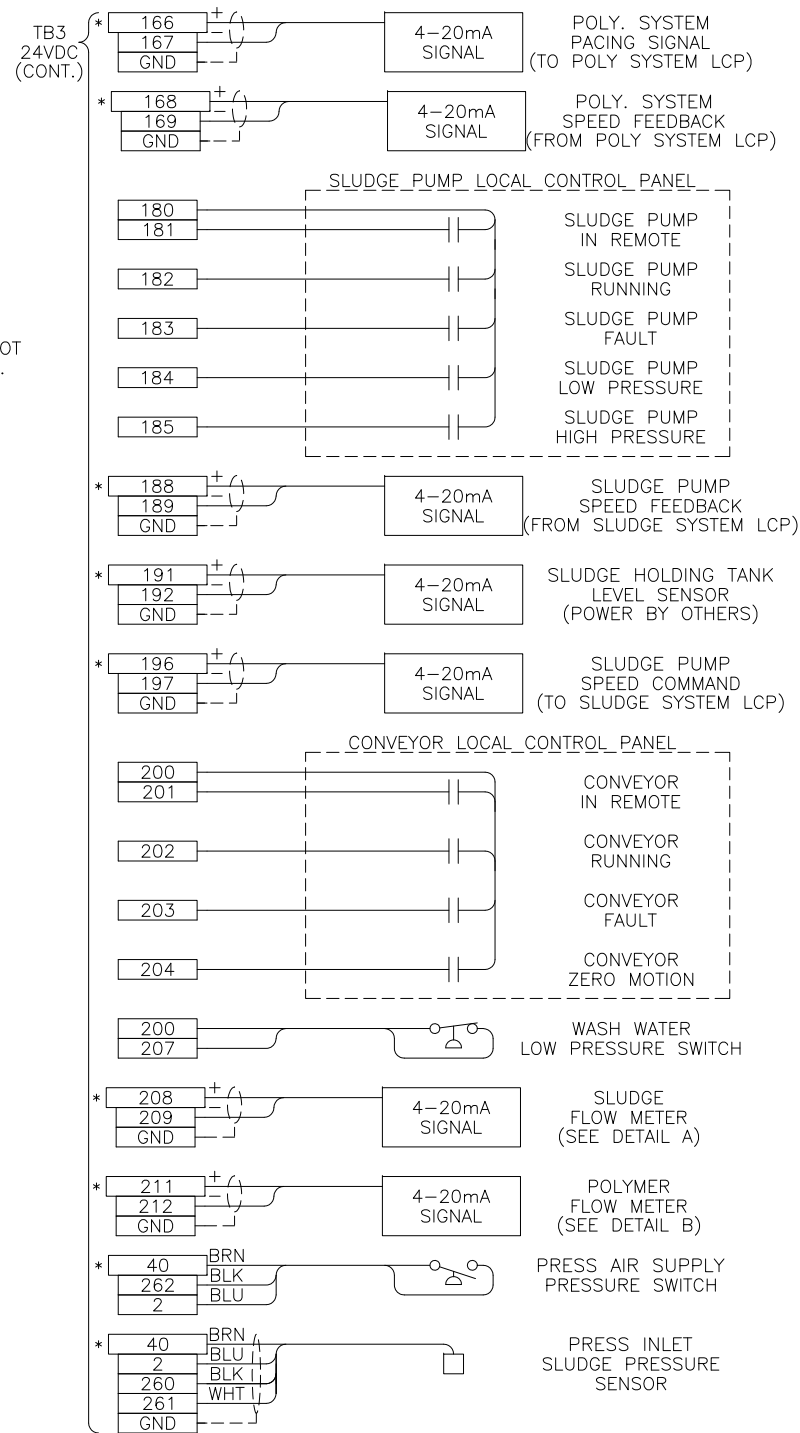
FIELD WIRING DIAGRAM

WARNING DAMAGE RESULTING FROM INSTALLATION OF TOP ENTRY CONDUIT WILL VOID WARRANTY.

- AVOID CUTTING HOLES DIRECTLY ABOVE ANY ELECTRICAL COMPONENTS
- PROTECT INTERNAL COMPONENTS FROM METAL SHAVINGS, CUTTING OILS, DEBRIS, AND MOISTURE
- USE PROPER FITTINGS, MYERS TYPE 4 OR EQUAL
- CONDUITS AND FITTING MUST BE WATERTIGHT TO PREVENT WATER ENTRY
- ALL PENETRATIONS MUST BE SEALED OFF TO PREVENT INTRUSION OF MOISTURE, CORROSIVE GASES, AND VAPORS FROM ENTERING THE ENCLOSURE



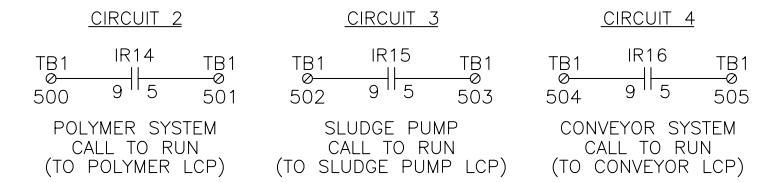
FIELD WIRING DIAGRAM



* TERMINAL SHALL CONTAIN 1 AMP FUSE

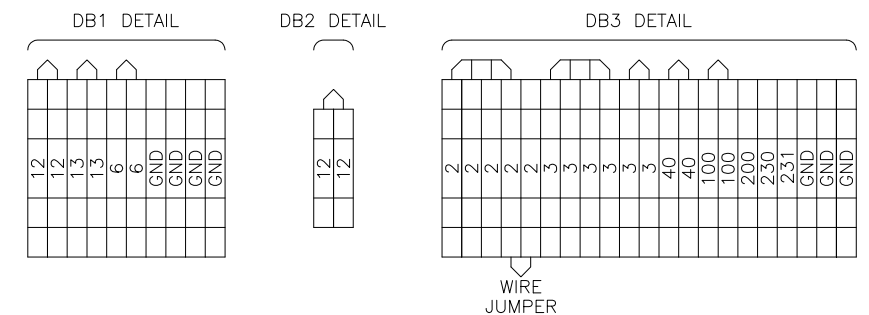
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DRY CONTACTS FOR PLANT USE

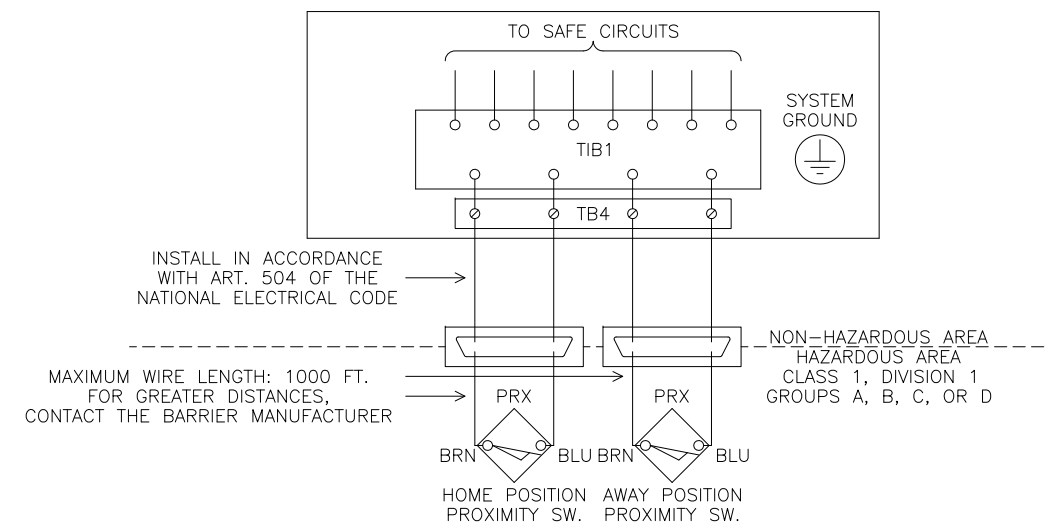


MAX. CONTROLLED LOAD: 10A @ 120VAC

NOTE: BRANCH CIRCUIT PROTECTION PROVIDED BY OTHERS PER N.E.C.



TIB1 WIRING DETAIL



- NOTES:
1. ENSURE CONTROL PANEL IS CONNECTED TO GROUND.
 2. CAUTION: MAINTAIN SEPARATION BETWEEN INTRINSICALLY SAFE WIRING AND OTHER WIRING.

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Q - PRESS CONTROL PANEL

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PROJECT NUMBER: 73010205 DRAWING NO: HBR9328A11
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PLC/OIU SETTINGS

L306ER CPU	DISCRETE IN	DISCRETE OUT	ANALOG IN	ANALOG OUT
	QTY: 3 SLOT 1-3	QTY: 2 SLOT 4,5	QTY: 1 SLOT 6	QTY: 1 SLOT 7

PLC INPUTS - SLOT NO.1

I/0	E-STOP PRESSED
I/1	SYSTEM RESET
I/2	PRESS IN HAND/FORWARD
I/3	PRESS IN HAND/REVERSE
I/4	PRESS IN AUTO
I/5	PRESS OVERLOAD
I/6	PRESS RUNNING
I/7	PRESS MOTOR T-STAT
I/8	SPRAY WASH IN HAND
I/9	SPRAY WASH IN AUTO
I/10	SPRAY DRIVE HOME POSITION
I/11	SPRAY DRIVE AWAY POSITION
I/12	SPARE
I/13	WASH WATER LOW PRESSURE
I/14	SPARE
I/15	AIR SUPPLY OK

PLC INPUTS - SLOT NO.2

I/0	POWER FEED OK
I/1	SLUDGE PUMP IN REMOTE
I/2	SLUDGE PUMP RUNNING
I/3	SLUDGE PUMP FAULT
I/4	SLUDGE PUMP LOW PRESSURE
I/5	SLUDGE PUMP HIGH PRESSURE
I/6	SPARE
I/7	SPARE
I/8	CONVEYOR IN REMOTE
I/9	CONVEYOR RUNNING
I/10	CONVEYOR FAULT
I/11	CONVEYOR ZERO MOTION
I/12	PRESS REMOTE START
I/13	SPARE
I/14	SPARE
I/15	SPARE

PLC INPUTS - SLOT NO.3

I/0	SPRAY DRIVE RUN REVERSE
I/1	SPRAY DRIVE RUN FORWARD
I/2	SPRAY DRIVE MOVED REV LAST
I/3	SPRAY DRIVE HIGH CURRENT
I/4	SPRAY DRIVE OVERLOAD
I/5	SPRAY DRIVE MOTOR TSTAT
I/6	SPRAY DRIVE IN HAND
I/7	SPRAY DRIVE IN AUTO
I/8	POLYMER SYSTEM RUNNING
I/9	POLYMER SYSTEM IN REMOTE
I/10	POLYMER SYSTEM LOW PRESSURE
I/11	POLYMER SYSTEM LOW FLOW
I/12	SPARE
I/13	SPARE
I/14	SPARE
I/15	SPARE

PLC OUTPUTS - SLOT NO.4

O/0	CONTROL POWER ENABLE
O/1	PRESS DEWATERING MODE
O/2	PRESS SYSTEM DISTURBANCE
O/3	COMMON ALARM
O/4	SPARE
O/5	SPARE
O/6	SPARE
O/7	SPARE
O/8	PRESS CALL TO RUN FORWARD
O/9	PRESS CALL TO RUN REVERSE
O/10	PRESS FAULT
O/11	PRESS PNEUMATIC CONE ENGAGE
O/12	SPARE
O/13	POLYMER SYSTEM CALL TO RUN
O/14	SLUDGE PUMP CALL TO RUN
O/15	CONVEYOR SYSTEM CALL TO RUN

PLC OUTPUTS - SLOT NO.5

O/0	PRESS LOWER WASH 1 CALL
O/1	PRESS LOWER WASH 2 CALL
O/2	PRESS UPPER WASH 1 CALL
O/3	PRESS UPPER WASH 2 CALL
O/4	SPRAY DRIVE CALL REVERSE
O/5	SPRAY DRIVE CALL FORWARD
O/6	SPRAY DRIVE FAULT
O/7	SPARE
O/8	SPARE
O/9	SPARE
O/10	SPARE
O/11	SPARE
O/12	SPARE
O/13	SPARE
O/14	SPARE
O/15	SPARE

PLC ANALOG INPUTS - SLOT NO.6

IN0	SLUDGE FEED FLOW RATE
IN1	SLUDGE PUMP SPEED FEEDBACK
IN2	POLYMER SYSTEM SPEED FEEDBACK
IN3	SLUDGE TANK LEVEL
IN4	PRESS INLET PRESSURE
IN5	POLYMER FEED FLOW RATE
IN6	SPARE
IN7	SPARE

PLC ANALOG OUTPUTS - SLOT NO.7

OUT0	POLYMER SPEED COMMAND
OUT1	SLUDGE SPEED COMMAND
OUT2	SPARE
OUT3	SPARE

PLC/OIU SETTINGS

PLC1 - COMMUNICATIONS SETUP

ETHERNET PORT PARAMETERS	VALUE
IP ADDRESS	10.0.0.1
SUBNET MASK	255.255.255.0
GATEWAY ADDRESS	0.0.0.0

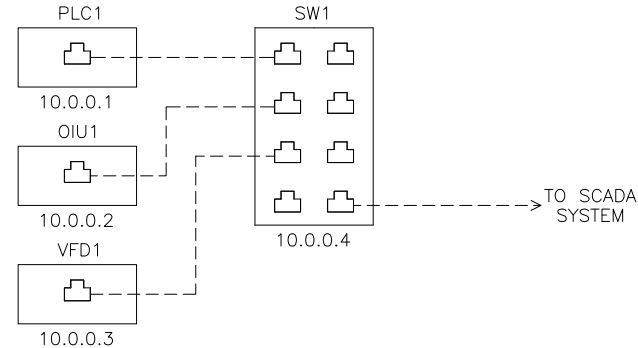
OIU1 - COMMUNICATIONS SETUP

ETHERNET PORT PARAMETERS	VALUE
IP ADDRESS	10.0.0.2
SUBNET MASK	255.255.255.0
GATEWAY ADDRESS	0.0.0.0

SW1 - COMMUNICATIONS SETUP

ETHERNET PORT PARAMETERS	VALUE
IP ADDRESS	10.0.0.4
SUBNET MASK	255.255.255.0
GATEWAY ADDRESS	0.0.0.0

ETHERNET NETWORK MAP



NOTES:

1. --- CAT5 ETHERNET CABLE

SUBNET MASK: 255.255.255.0

PLC/OIU SETTINGS

Q-PRESS SYSTEM OIU MAINTENANCE REMINDERS

PART DESCRIPTION	OPERATING TIME (HOURS)
INSPECT WIPER	2000
INSPECT COMPLETE SPRAY CAROUSEL	2000
INSPECT LOWER SHAFT SEALS & BUSHING	2000
INSPECT UPPER AUGER SHAFT BEARING	2000
INSPECT SOLENOID VALVES	100
INSPECT WASH SYSTEM HOSES	2000
REPLACE GEARBOX OIL	10000

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Q - PRESS
CONTROL PANEL

ABERDEEN, ID

SCALE:
NONE

PROJECT NUMBER:
73010205

DRAWING NO:
HBR9328A12

12 OF 18

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PLC/OIU SETTINGS

PLC1 - SETPOINTS

REGISTER	DESCRIPTION	UNITS	DEFAULT	MIN	MAX
SP1[0].INT	EQUIPMENT STARTUP DELAY	SEC.	3	0	10
SP1[1].INT	DURATION MODE RUN DURATION	MIN.	900	1	9999
SP1[2].INT	VOLUME MODE PROCESS VOLUME	GAL	100	1	99999
SP1[3].INT	DATALOGGER INTERVAL	SEC.	10	1	999
SP1[10].INT	PRESS SHUTDOWN DURATION	MIN.	10	0	120
SP1[11].INT	PRESS DIRECTION CHANGE DWELL	SEC.	3	1	60
SP1[12].REAL	PRESS HAND SPEED	%	50	1	100
SP1[13].REAL	PRESS SPEED MINIMUM: LOW PRESSURE	%	10	1	100
SP1[14].REAL	PRESS SPEED MINIMUM: HIGH PRESSURE	%	50	1	100
SP1[15].REAL	PRESS SHUTDOWN SPEED	%	100	1	100
SP1[16].REAL	PRESS MAX TORQUE SPEED SETPOINT	%	60	1	100
SP1[17].REAL	PRESS HIGH PRESSURE INTERRUPT SPEED	%	100	1	100
SP1[20].INT	PNEUMATIC CONE AIR FAILURE FAULT DELAY	SEC.	10	1	20
SP1[40].INT	SPRAY WASH CYCLE DELAY	MIN.	15	1	60
SP1[41].INT	SPRAY WASH SHORT CYCLE COUNTER	COUNTS	2	1	10
SP1[42].INT	MAXIMUM TIME BETWEEN PROX. FAULT DELAY	SEC.	1	1	999
SP1[43].REAL	SPRAY DRIVE DIRECTION CHANGE DWELL	SEC.	1	0.5	999
SP1[44].REAL	SPRAY DRIVE INITIAL MOVE PROX. DELAY	SEC.	1	0.1	999
SP1[45].INT	SPRAY DRIVE FINAL FORWARD MOVE TIME	SEC.	5	1	30
SP1[60].REAL	INLET PRESSURE AT MIN SPEED	PSI	3	0	30
SP1[61].REAL	INLET PRESSURE AT MAX SPEED	PSI	15	0	30
SP1[62].REAL	INLET PRESSURE AT 4MA	PSI	0	0	30
SP1[63].REAL	INLET PRESSURE AT 20MA	PSI	14.7	0	30
SP1[64].REAL	HIGH PRESSURE INTERRUPT PRESSURE	PSI	12	0	30
SP1[65].INT	HIGH PRESSURE INTERRUPT OFF DELAY	SEC.	10	1	60
SP1[66].INT	MAINTAINED HIGH PRESSURE SHUTDOWN DELAY	SEC.	10	1	60
SP1[67].INT	HIGH PRESSURE COUNTS BEFORE SHUTDOWN	COUNTS	5	1	10
SP1[68].INT	HIGH PRESSURE COUNT RESET TIME	MIN.	60	1	600
SP1[69].INT	INLET PRESSURE DAMPENING TIME	SEC.	3	0	999
SP1[70].REAL	SLUDGE CONCENTRATION	%	3	0	10
SP1[71].REAL	REQUIRED SLUDGE FLOW RATE	GPM	30	5	150
SP1[72].REAL	SLUDGE PUMP MINIMUM SPEED	%	20	0	100
SP1[73].REAL	SLUDGE PUMP PID INITIAL SPEED	%	20	0	100
SP1[74].INT	SLUDGE PUMP PID ON DELAY	SEC.	10	0	999
SP1[75].REAL	SLUDGE PUMP PID GAIN (P) X 100	N/A	50	1	1000
SP1[76].REAL	SLUDGE PUMP PID TIME (I) X 10	N/A	12	1	1000
SP1[77].INT	SLUDGE ZERO FLOW FAULT DELAY	SEC.	300	1	999
SP1[78].INT	SLUDGE PUMP FAIL TO RUN FAULT DELAY	SEC.	10	1	999
SP1[79].REAL	SLUDGE FLOW AT 4MA	GPM	0	0	500
SP1[80].REAL	SLUDGE FLOW AT 20MA	GPM	100	0	500
SP1[82].INT	LOW PRESSURE FAULT DELAY	SEC.	10	1	999
SP1[83].INT	HIGH PRESSURE FAULT DELAY	SEC.	10	1	999
SP1[85].INT	GENERAL FAULT DELAY	SEC.	1	0	999
SP1[86].REAL	SLUDGE HOLDING TANK LOW LEVEL	IN.	*	0	999
SP1[87].REAL	SLUDGE HOLDING TANK HIGH LEVEL	IN.	*	0	999
SP1[88].REAL	SLUDGE HOLDING TANK AT 4MA	IN.	*	0	999
SP1[89].REAL	SLUDGE HOLDING TANK AT 20MA	IN.	*	0	999
SP1[90].REAL	POLYMER CONCENTRATION	%	100	0.05	100
SP1[91].REAL	LBS POLY PER TON OF SLUDGE	LB/TON	10	0.1	199.9
SP1[92].REAL	POLYMER PUMP MINIMUM CAPACITY	GPH	0	0	9.9
SP1[93].REAL	POLYMER PUMP MAXIMUM CAPACITY	GPH	3	0	999.9
SP1[94].INT	POLYMER PUMP FAIL TO RUN FAULT DELAY	SEC.	10	1	999
SP1[95].REAL	POLYMER FLOW AT 4MA	GPH	0	0	2400
SP1[96].REAL	POLYMER FLOW AT 20MA	GPH	5	0	2400
SP1[101].INT	LOW WATER PRESSURE FAULT DELAY	SEC.	10	1	999
SP1[103].INT	LOW POLY FLOW FAULT DELAY	SEC.	10	1	999
SP1[105].REAL	POLYMER SYSTEM INITIAL SPEED	%	20	0	100
SP1[106].INT	POLYMER SYSTEM DOSING CALC ON DELAY	SEC.	5	1	999
SP1[111].INT	CONVEYOR OFF DELAY	SEC.	30	0	999
SP1[112].INT	CONVEYOR FAIL TO RUN FAULT DELAY	SEC.	10	1	999
SP1[113].INT	CONVEYOR ZERO MOTION DELAY	SEC.	15	1	999
SP1[121].INT	WASH WATER LOW PRESSURE FAULT DELAY	SEC.	*	1	999

PLC/OIU SETTINGS

PLC1 - SETPOINTS

SP1[180].REAL	TORQUE AT MIN SPEED	NM	4.5	0	99.9
SP1[181].REAL	TORQUE AT MAX SPEED	NM	17.9	0	99.9
SP1[182].INT	HIGH TORQUE INTERRUPT TORQUE	NM	19	0	99.9
SP1[183].INT	HIGH TORQUE INTERRUPT OFF DELAY	SEC.	10	1	60
SP1[184].REAL	MAINTAINED HIGH TORQUE SHUTDOWN DELAY	MIN.	15	1	99
SP1[185].INT	HIGH TORQUE COUNTS BEFORE SHUTDOWN	COUNTS	5	1	10
SP1[186].INT	HIGH TORQUE COUNT RESET TIME	MIN.	60	1	600
SP1[187].INT	HIGH TORQUE INTERRUPT SPEED INCREASE	%	1	0	10
SP1[188].INT	TORQUE INTERRUPT SPEED INCREASE INTERVAL	SEC.	3	0	20
SP1[189].REAL	HIGH TORQUE OVERLOAD VALUE	NM	20	0	99.9
SP1[190].INT	TORQUE DAMPENING TIME	SEC.	200	0	999
SP1[191].INT	MOTOR NAMEPLATE POLES	POLES	4	2	8
SP1[192].INT	MOTOR MAX FREQUENCY	HZ	60	50	100
SP1[193].REAL	MOTOR NAMEPLATE POWER	KW	*	0	100

PLC/OIU SETTINGS

PLC1 - SCADA MONITORING

REGISTER NUMBER	DESCRIPTION	DATA TYPE	NORMAL STATE	ACTIVE STATE	SCADA FUNCTION
PLC IO STATUS					
S_INT[1]	PLC SLOT 1 DISCRETE INPUTS	(BIT)	0	1	READ
S_INT[2]	PLC SLOT 2 DISCRETE INPUTS	(BIT)	0	1	READ
S_INT[3]	PLC SLOT 3 DISCRETE INPUTS	(BIT)	0	1	READ
S_INT[4]	PLC SLOT 4 DISCRETE OUTPUTS	(BIT)	0	1	READ
S_INT[5]	PLC SLOT 5 DISCRETE OUTPUTS	(BIT)	0	1	READ
SCREW PRESS					
S_INT[9].0	PRESS RUNNING FORWARD	(BIT)	0	1	READ
S_INT[9].1	PRESS RUNNING REVERSE	(BIT)	0	1	READ
S_INT[9].2	PRESS IN AUTO	(BIT)	0	1	READ
S_INT[9].3	PRESS FAULT	(BIT)	0	1	READ
S_INT[9].4	PRESS IN DEWATERING MODE	(BIT)	0	1	READ
S_INT[9].5	SPRAY WASH ON	(BIT)	0	1	READ
S_INT[9].6	SPRAY IN AUTO	(BIT)	0	1	READ
S_INT[9].7	SPRAY DRIVE RUNNING	(BIT)	0	1	READ
S_INT[9].8	SPRAY DRIVE IN AUTO	(BIT)	0	1	READ
S_INT[9].9	SPRAY DRIVE FAULT	(BIT)	0	1	READ
S_INT[9].10	SYSTEM DISTURBANCE(COMMON ALARM)	(BIT)	0	1	READ
S_INT[9].11	DEWATERING SYSTEM READY	(BIT)	0	1	READ
S_REAL[0]	PRESS MOTOR CURRENT (AMPS)	(REAL)	-	-	READ
S_REAL[1]	PRESS INLET PRESSURE (PSI)	(REAL)	-	-	READ
S_REAL[2]	PRESS SPEED FEEDBACK (%)	(REAL)	-	-	READ
S_REAL[3]	PRESS TOTAL RUN TIME (HRS)	(REAL)	-	-	READ
S_REAL[4]	SPRAY DRIVE TOTAL RUN TIME (HRS)	(REAL)	-	-	READ
S_INT[100].0	DEWATERING REMOTE START	(BIT)	0	1	WRITE
SLUDGE PUMP					
S_INT[11].0	SLUDGE PUMP RUNNING	(BIT)	0	1	READ
S_INT[11].1	SLUDGE PUMP IN REMOTE	(BIT)	0	1	READ
S_INT[11].2	SLUDGE PUMP FAULT	(BIT)	0	1	READ
S_INT[11].3	SLUDGE FEED LOW PRESSURE	(BIT)	0	1	READ
S_INT[11].4	SLUDGE FEED HIGH PRESSURE	(BIT)	0	1	READ
S_REAL[10]	SLUDGE FEED FLOW RATE (GPM)	(REAL)	-	-	READ
S_REAL[11]	SLUDGE SPEED FEEDBACK (%)	(REAL)	-	-	READ
SLUDGE HOLDING TANK					
S_INT[12].0	HOLDING TANK LOW LEVEL	(BIT)	0	1	READ
S_INT[12].1	HOLDING TANK HIGH LEVEL	(BIT)	0	1	READ
S_REAL[12]	HOLDING TANK LEVEL (IN.)	(REAL)	-	-	READ
POLYMER SYSTEM					
S_INT[13].0	POLYMER SYSTEM RUNNING	(BIT)	0	1	READ
S_INT[13].1	POLYMER SYSTEM IN REMOTE	(BIT)	0	1	READ
S_INT[13].2	POLYMER SYSTEM LOW PRESSURE	(BIT)	0	1	READ
S_INT[13].3	POLYMER SYSTEM LOW POLY FLOW	(BIT)	0	1	READ
S_REAL[15]	POLYMER FLOW RATE (GPH)	(REAL)	-	-	READ
CONVEYOR					
S_INT[14].0	CONVEYOR RUNNING	(BIT)	0	1	READ
S_INT[14].1	CONVEYOR IN REMOTE	(BIT)	0	1	READ
S_INT[14].2	CONVEYOR FAULT	(BIT)	0	1	READ
S_INT[14].3	CONVEYOR ZERO MOTION FAULT	(BIT)	0	1	READ
GENERAL					
S_INT[15].0	E-STOP PRESSED	(BIT)	0	1	READ
S_INT[15].1	UTILITY POWER/PHASE LOSS	(BIT)	0	1	READ

DESIGNED	JN
DETAILED	
CHECKED	MSN
APPROVED	
DATE	06/08/23
REVISION	
NO.	
BY	
CK	
APP	

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Q - PRESS CONTROL PANEL

ABERDEEN, ID

SCALE:
NONE

PROJECT NUMBER:
73010205

DRAWING NO:
HBR9328A13

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DEVICE SETTINGS

CM1 - CURRENT MONITOR

DIP SETTINGS	
1	ON
2	OFF
3	ON
4	OFF
5	OFF
6	ON

DIAL SETTINGS	
HYSTERESIS	0%
LEVEL	FLA
DELAY	0.5s

WIRE PASSES	MAX AMPS	LEVEL RANGE (10-110%)
1	20	2-22A
2	10	1-11A
3	6.6	0.6-7.3A
4	5	0.5-5.5A

* ABOVE VALUES ASSUME 20A MAX DIP SETTINGS

NOTES:

- FIELD CONFIGURATION SHALL BE PERFORMED BY THE STARTUP TECHNICIAN PER THE APPROPRIATE TECHNICAL DOCUMENTS.
- MEASURING RANGE MAXIMUM AMPS SET BY DIP SETTINGS 1 AND 2
SW1 ON/SW2 OFF = 20A; SW1 ON/SW2 ON = 50A; SW1 OFF/SW2 ON = 100A

TIB1 - SETTINGS

JUMPER NUMBER	SET AT
CH1 JP11	1-2 (DIRECT)
JP12	2-3 (OFF)
CH2 JP21	1-2 (DIRECT)
JP22	2-3 (OFF)
JP23	2-3 (IN. 2 ACTIVE)

AL1 - ALARM LIGHT

SWITCH	SINGLE FLASH SETTING
1 2	SWITCH 1 = ON
<input type="checkbox"/> <input type="checkbox"/>	SWITCH 2 = OFF
FLASH	

PFR1 - SETTINGS

DIAL	SETTING
VOLTAGE	480 ON DELAY
Tt	5s
>U	10%
<U	10%

AC1 - SETTINGS

AC ON/OFF	90 °F
HEATER OFF/ON	60 °F

QL1 - SETTINGS

DIAL	SETTING
CLASS	AUTO - 20

DEVICE SETTINGS

VFD1 - POWERFLEX 525 SETTINGS

PARAMETER NUMBER	DESCRIPTION	DEFAULT	VFD1 SETTING
31	MOTOR VOLTAGE	460 VAC	460 VAC
32	MOTOR FREQUENCY	60 HZ	70 HZ
33	MOTOR OL CURRENT	*	5.4 AMPS
34	MOTOR NP FLA	*	5.4 AMPS
35	MOTOR NP POLES	*	4 POLES
36	MOTOR NP RPM	*	2100 RPM
37	MOTOR NP POWER (kW)	*	3 kW
39	TORQUE PERF MODE	1=SVC	4=PM MOTOR
41	ACCEL TIME 1	10 SEC.	5 SEC.
42	DECEL TIME 1	10 SEC.	5 SEC.
45	STOP MODE	0=RAMP	5=COAST
46	START SOURCE	1=KEYPAD	2=DIGIN TRMBLK
47	SPEED REFERENCE 1	1=DRIVE POT	15=ETHERNET/IP

TERMINAL BLOCK GROUP

65	DIG IN TERM BLK 05	7=PRESET FREQ.	12=AUX FAULT
76	RELAY OUT 1	0=READY	7=ABOVE CURRENT
77	RELAY OUT 1 LEVEL	0%	52%*
81	RELAY OUT 2 SEL	0=READY/FIT	10=ABOVE ANLG V
82	RELAY OUT 2 LEVEL	0	*

COMMUNICATIONS GROUP

125	COMM LOSS ACTION	0=FAULT	1=COAST STOP
128	EN ADDR SEL	0=BOOTP	1=PARAMETERS
129	EN IP ADDR CFG 1	0	10
130	EN IP ADDR CFG 2	0	0
131	EN IP ADDR CFG 3	0	0
132	EN IP ADDR CFG 4	0	3
133	EN SUBNET CFG 1	0	255
134	EN SUBNET CFG 2	0	255
135	EN SUBNET CFG 3	0	255
136	EN SUBNET CFG 4	0	0
137	EN GATEWAY CFG 1	0	0
138	EN GATEWAY CFG 2	0	0
139	EN GATEWAY CFG 3	0	0
140	EN GATEWAY CFG 4	0	0
143	EN COMM FLT ACTN	0=FAULT	3=HOLD LAST
144	EN IDLE FLT ACTN	0=FAULT	3=HOLD LAST
157	EN DATA OUT 1	0	3=OUTPUT CURRENT
158	EN DATA OUT 1	0	44=MAX. OUTPUT FREQ.

ADVANCED PROGRAM GROUP

501	PM IR VOLTAGE	11.50 V	(AUTOTUNE-NOTE 5)
502	PM IXd VOLTAGE	17.91 V	(AUTOTUNE-NOTE 5)
503	PM IXq VOLTAGE	53.21 V	(AUTOTUNE-NOTE 5)
504	PM BEMF VOLTAGE	1640.0 DRV	(AUTOTUNE-NOTE 5)

NOTES:

- THE ABOVE IS A PARTIAL LISTING OF SETPOINTS. ONLY THE SETPOINTS THAT ARE SHOWN ABOVE MARKED WITH A * SHALL BE ALTERED IN THE FIELD. REFER TO THE DRIVE MANUAL FOR A FULL LIST OF SETPOINTS AND ADDITIONAL DETAILS.
- PARAMETER 77 MUST BE SET TO THE MOTOR OVERLOAD TRIP POINT WHICH IS A PERCENT OF THE MAXIMUM DRIVE OUTPUT CURRENT.
(MAX DRIVE OUTPUT CURRENT VFD1 = 10.5A)
- VERIFY ALL MOTOR PARAMETERS TO THE ACTUAL MOTOR NAMEPLATE.
- VFD1 IS CONFIGURED FOR A PERMANENT MAGNET MOTOR WITH A WYE WIRING CONFIGURATION. ENSURE MOTOR JUMPERS ARE SET UP FOR A WYE CONFIGURATION.
- PRIOR TO MOTOR START UP, AN AUTOTUNE MUST BE PERFORMED. ONCE MOTOR NAMEPLATE PARAMETERS ARE CONFIRMED, NAVIGATE TO PARAMETER P040 AND CHANGE P040 TO A VALUE OF 1. PROVIDE THE VFD WITH A MAINTAINED MANUAL/HAND MODE CALL TO RUN. DURING THIS TIME, THE VFD WILL DISPLAY "RUN", BUT THE MOTOR WILL NOT OPERATE. ONCE THE AUTOTUNE IS FINISHED "RUN" WILL BE REMOVED FROM THE DISPLAY.

VFD1 - ETHERNET PORT

PARAMETERS	VALUE
IP ADDRESS	10.0.0.3
SUBNET MASK	255.255.255.0
GATEWAY ADDRESS	0.0.0.0

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Q - PRESS
CONTROL PANEL

ABERDEEN, ID

SCALE:
NONE

PROJECT NUMBER:
73010205

DRAWING NO:
HBR9328A14

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SEQUENCE OF OPERATION

CONTROL POWER ON-DELAY:

EACH TIME THE CONTROL PANEL POWER SUPPLY IS CYCLED, THE PLC WILL ALLOW ALL SOLID STATE DEVICES TO FULLY ENERGIZE BEFORE ENABLING THE CONTROL POWER CIRCUIT.

PRESS MODES OF OPERATION:

HAND: WHEN THE PRESS SELECTOR IS IN THE HAND POSITION, THE PRESS WILL RUN IN THE DIRECTION SELECTED BY THE PRESS FOR-OFF-REV SELECTOR AT A CONSTANT SPEED ENTERED BY THE OPERATOR INTO THE OIU.

NOTE: IN HAND MODE, THE PRESS WILL RUN FORWARD ONCE THE PNEUMATIC CONE HAS BEEN ACTUATED.

AUTO: WHEN THE PRESS SELECTOR IS IN THE AUTO POSITION THE PRESS WILL BEGIN TO CYCLE IN THE FORWARD DIRECTION AS DESCRIBED IN THE SYSTEM START SEQUENCE. ONCE RUNNING, THE PRESS WILL OPERATE AT SPEED BASED ON THE MEASURED MOTOR TORQUE AND INLET PRESSURE, AS DESCRIBED BELOW. THE PRESS WILL CONTINUE TO CYCLE UNTIL THE SYSTEM ENTERS SHUTDOWN MODE.

PRESS INTERLOCKS:

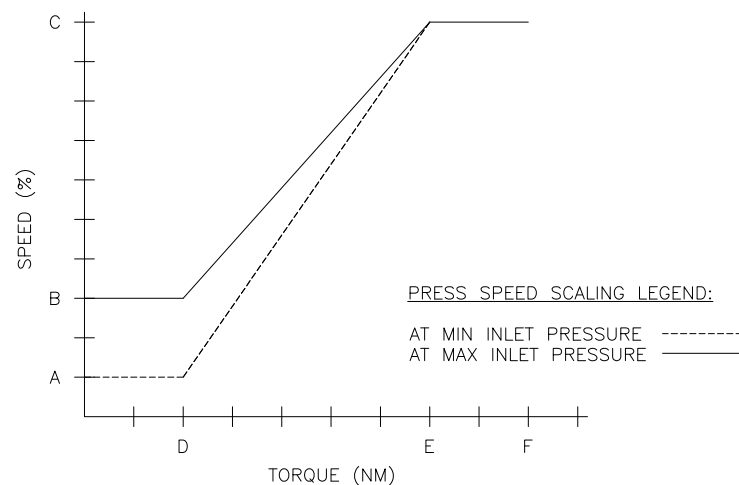
OPERATING THE PRESS, IN HAND OR AUTOMATIC, WILL REQUIRE THE FOLLOWING:

- PRESSURIZED AIR SUPPLY TO BE ABOVE THE REQUIRED PRESSURE AS MEASURED BY THE PRESSURE SWITCH IN THE AIR SUPPLY LINE.
- THE SOLENOID VALVE FOR THE PNEUMATIC ACTUATED CONE MUST ALSO BE ENERGIZED, UNLESS IN SLUDGE DEWATERING SYSTEM SHUTDOWN SEQUENCE.

PRESS SPEED CONTROL:

- THE PRESS MINIMUM SPEED SETTING WILL BE LINEARLY ADJUSTED BASED ON THE MEASURED PRESS INLET PRESSURE. WHEN THE PRESS INLET PRESSURE IS AT OR BELOW THE INLET PRESSURE AT MINIMUM SPEED SETPOINT, THE PRESS MINIMUM SPEED SETTING WILL BE SET TO THE PRESS SPEED MINIMUM: LOW PRESSURE SETPOINT. WHEN THE PRESS INLET PRESSURE IS AT OR ABOVE THE INLET PRESSURE AT MAXIMUM SPEED SETPOINT, THE PRESS MINIMUM SPEED SETTING WILL BE SET TO THE PRESS SPEED MINIMUM: HIGH PRESSURE SETPOINT.
- THE OVERALL PRESS SPEED WILL BE LINEARLY ADJUSTED BASED ON THE MEASURED PRESS TORQUE. WHEN THE PRESS TORQUE IS AT OR BELOW THE TORQUE AT MINIMUM SPEED SETPOINT, THE PRESS WILL OPERATE AT THE PRESS MINIMUM SPEED SETTING BASED ON PRESSURE, AS DESCRIBED ABOVE. WHEN THE PRESS TORQUE IS AT OR ABOVE THE TORQUE AT MAXIMUM SPEED SETPOINT, THE PRESS WILL OPERATE AT THE PRESS DEWATERING MODE MAXIMUM SPEED SETPOINT.
- THE SPEED RATE OF CHANGED BASED ON THE MEASURED INLET PRESSURE AND TORQUE CAN BE AVERAGED OVER A SET TIME BY THE INLET PRESSURE AND TORQUE DAMPENING SETPOINTS.

SPEED VS. MOTOR TORQUE



PRESS SPEED SCALING LEGEND:

AT MIN INLET PRESSURE -----
 AT MAX INLET PRESSURE _____

SPEED / MOTOR TORQUE SCALING SETPOINTS:

- PRESS SPEED MINIMUM: LOW PRESSURE SETPOINT
- PRESS SPEED MINIMUM: HIGH PRESSURE SETPOINT
- PRESS MAXIMUM TORQUE SPEED SETPOINT
- TORQUE AT MINIMUM SPEED SETPOINT
- TORQUE AT MAXIMUM SPEED SETPOINT
- HIGH TORQUE INTERRUPT SETPOINT

NOTES: THE MOTOR TORQUE WILL BE CALCULATED BY THE PLC USING THE FOLLOWING CALCULATION:

$$\text{MOTOR TORQUE (NM)} = \text{MOTOR POWER (W)} * 9.5488 / \text{MOTOR SPEED (RPM)}$$

THE MOTOR SPEED (RPM) WILL BE CALCULATED BY THE PLC USING THE FOLLOWING CALCULATION:

$$\text{MOTOR SPEED (RPM)} = \text{COMMANDED SPEED (HZ)} * (2 / \text{MOTOR POLES}) * 60$$

THE OPERATOR WILL NEED TO ENTER THE MOTOR NAMEPLATE POLES, POWER, AND MAX FREQUENCY THROUGH THE OIU.

SEQUENCE OF OPERATION

SPRAY DRIVE MODES OF OPERATION:

HAND: WHEN THE SPRAY DRIVE SELECTOR IS IN THE HAND POSITION, THE SPRAY DRIVE WILL DWELL, THEN MOVE IN THE OPPOSITE DIRECTION OF ITS LAST MOVEMENT. IT WILL CONTINUE IN THIS DIRECTION UNTIL THE SPRAY DRIVE PROXIMITY SWITCH IS ACTIVATED. ONCE THE PROXIMITY SWITCH IS ACTIVATED, THE SPRAY DRIVE WILL STOP, DWELL, AND START TO RUN IN THE OPPOSITE DIRECTION. THE DWELL-FORWARD-DWELL-REVERSE CYCLES WILL CONTINUE UNTIL THE SPRAY DRIVE SELECTOR IS PLACED IN THE OFF POSITION.

AUTO: WHEN THE SPRAY DRIVE SELECTOR IS IN THE AUTO POSITION, THE SPRAY DRIVE WILL OPERATE AS DESCRIBED IN THE SPRAY WASH SYSTEM SEQUENCE.

SPRAY WASH MODES OF OPERATION:

HAND: WHEN THE SPRAY WASH SELECTOR IS IN THE HAND POSITION, ALL SPRAY WASH SOLENOID VALVES WILL ENERGIZE AND REMAIN ENERGIZED UNTIL THE SELECTOR IS PLACED IN THE OFF POSITION.

AUTO: WHEN THE SPRAY WASH SELECTOR IS IN THE AUTO POSITION, THE SPRAY WASH SOLENOID VALVES WILL OPERATE AS DESCRIBED IN THE SPRAY WASH SYSTEM SEQUENCE.

POLYMER SYSTEM MODES OF OPERATION:

WHEN THE POLYMER SYSTEM IS IN REMOTE, THE DEWATERING CONTROL PANEL WILL PROVIDE A CALL TO RUN SIGNAL AS WELL AS A CALCULATED PACING SIGNAL. THE CALL TO RUN AND PACING SIGNALS WILL BE ACTIVE WHILE THE SYSTEM IS IN DEWATERING MODE. THE POLYMER SYSTEM WILL START TO OPERATE AT THE INITIAL SPEED SETPOINT FOR THE TIME SET IN THE DOSING CALCULATION ON DELAY TIMER. THE POLYMER SYSTEM SPEED WILL THEN VARY BASED ON THE SLUDGE CALCULATIONS VARIABLES EXPLAINED BELOW. THESE SIGNALS WILL BE DE-ACTIVATED WHEN THE SYSTEM ENTERS SHUTDOWN MODE.

CONVEYOR OPERATION:

THE CONVEYOR WILL BE CALLED TO RUN WHENEVER THE PRESS IS RUNNING, THE CONVEYOR WILL CONTINUE TO RUN AFTER THE PRESS HAS STOPPED FOR THE TIME SET IN THE CONVEYOR OFF DELAY TIMER SET THROUGH THE OIU.

SLUDGE PUMP MODES OF OPERATION:

WHEN THE SLUDGE FEED PUMP IS IN REMOTE, THE DEWATERING CONTROL PANEL WILL PROVIDE A CALL TO RUN SIGNAL AS WELL AS A USER SET PACING SIGNAL. THE CALL TO RUN AND PACING SIGNALS WILL BE ACTIVE WHILE THE SYSTEM IS IN DEWATERING MODE. THE SLUDGE PUMP WILL START TO OPERATE AT THE PID MINIMUM SPEED SETPOINT FOR THE TIME SET IN THE PID ON DELAY TIMER. THE SLUDGE PUMP SPEED WILL THEN VARY BASED ON THE SLUDGE FLOW FEEDBACK RECEIVED FROM THE FLOW METER. THESE SIGNALS WILL BE DE-ACTIVATED WHEN THE SYSTEM ENTERS SHUTDOWN MODE.

SLUDGE CALCULATIONS:

THE USER WILL BE RESPONSIBLE FOR ENTERING THE FOLLOWING PARAMETERS TO ENSURE THE CORRECT AMOUNT OF POLYMER IS DOSED WITH THE SLUDGE:

- SLUDGE FEED FLOW RATE (GPM)
- SLUDGE CONCENTRATION (% SOLIDS CONCENTRATION)
- POLYMER DOSING RATE (LBS. NEAT POLYMER / TON DRY SOLIDS)
- POLYMER CONCENTRATION (%)

PNEUMATIC PRESSURE CONE:

THE PNEUMATIC PRESSURE CONE IS OPERATED BY A SOLENOID VALVE. PRIOR TO EACH OPERATION OF THE PRESS, THE SOLENOID VALVE WILL BE ENERGIZED. THE ACTIVATION OF THE PNEUMATIC PRESSURE CONE IS REQUIRED PRIOR TO ANY OPERATION OF THE PRESS.

SEQUENCE OF OPERATION

DEWATERING MODE START SEQUENCE:

A DEWATERING MODE WILL BEGIN WHEN THE USER PRESSES THE START PUSHBUTTON ON THE OIU, AND THE EQUIPMENT WILL START UP IN THE FOLLOWING ORDER:

- LONG WASH CYCLE WILL INITIATE
- THE CONVEYOR WILL BE CALLED TO RUN
- THE PNEUMATIC ACTUATED CONE IS ACTIVATED
- PRESS WILL START TO RUN
- POLYMER SYSTEM WILL BE CALLED TO RUN
- SLUDGE PUMP WILL BE CALLED TO RUN

NOTE:

- THERE WILL BE A DELAY BETWEEN THE START-UP OF EACH STEP.
- A DEWATERING SYSTEM MAY ALSO BE STARTED BY RECEIVING A REMOTE START SIGNAL.
- IF THE SYSTEM HAS STARTED DUE TO A REMOTE START SIGNAL, THE START PUSHBUTTON ON THE OIU WILL BE REPLACED WITH INDICATION THAT THE SYSTEM IS "IN REMOTE".
- IF POWER IS LOST AND RESTORED TO THE SYSTEM AFTER A DEWATERING MODE HAS STARTED VIA THE START PUSHBUTTON ON THE OIU, THE OPERATOR WILL NEED TO RESTART THE SYSTEM FROM THE OIU ONCE AGAIN.
- IF POWER IS LOST AND RESTORED TO THE SYSTEM AFTER A DEWATERING MODE HAS STARTED VIA THE REMOTE START SIGNAL AND THE SIGNAL IS STILL PRESENT, THE SYSTEM WILL AUTOMATICALLY START BACK UP.
- IN THE PRESS SETTING MENU ON THE OIU, THE OPERATOR WILL FIND MULTIPLE MODES OF OPERATION FOR THE DEWATERING MODE WHICH CAN BE ENABLED OR DISABLED:
 - START-STOP OPERATION. STARTING AND STOPPING THE SYSTEM BASED OFF PRESSING THE START AND STOP SOFT PUSHBUTTONS.
 - TIME ON AND TIME OFF OPERATION. STARTING AND STOPPING THE SYSTEM AT USER SET TIMES OF THE DAY.
 - RUN TIME OPERATION. STOPPING THE SYSTEM AFTER A USER SET TIME HAS ELAPSED.
 - PROCESSED VOLUME OPERATION. STOPPING THE SYSTEM AFTER A USER SET AMOUNT OF VOLUME HAS BEEN PROCESSED.
 - PROCESSED LEVEL MODE OPERATION. STOPPING THE SYSTEM AFTER THE LOW LEVEL SETPOINT HAS BEEN REACHED IN THE SLUDGE HOLDING TANK.
- WHEN THE DEWATERING SYSTEM IS AUTO-READY, THE PRESS CAN BE STARTED BY HOLDING THE RESET PUSHBUTTON FOR 5 SECONDS. ONCE THE DEWATERING MODE HAS STARTED, THE PRESS CAN BE PLACED INTO SHUTDOWN MODE BY HOLDING THE RESET PUSHBUTTON FOR 5 SECONDS.

SPRAY WASH SYSTEM SEQUENCE:

ONCE A SPRAY WASH CYCLE IS INITIATED, THE SPRAY DRIVE WILL RETURN TO THE HOME POSITION. ONCE AT HOME, A SHORT SPRAY WASH CYCLE WILL BEGIN. AFTER COMPLETING THE SHORT SPRAY WASH CYCLE, A USER ENTERED TIME BETWEEN WASH CYCLES WILL BEGIN TIMING. AFTER THIS TIME HAS EXPIRED, THE SYSTEM WILL INITIATE ANOTHER SHORT SPRAY WASH CYCLE. THESE CYCLES WILL CONTINUE UNTIL THE SYSTEM HAS COMPLETED THE USER ENTERED NUMBER OF SHORT SPRAY WASH CYCLES. ONCE THE NUMBER OF SHORT SPRAY WASH CYCLES HAS REACHED THE USER ENTERED SETTING, AND THE SPRAY WASH DWELL TIMER HAS EXPIRED, THE SYSTEM WILL INITIATE A LONG SPRAY WASH CYCLE. ONCE THE LONG SPRAY WASH CYCLE IS COMPLETE, THE SEQUENCE WILL REPEAT ITSELF.

SHORT SPRAY WASH CYCLE:

THE FIRST LOWER WASH WILL OPEN AND THE SPRAY DRIVE WILL DWELL. AFTER DWELLING, THE SPRAY DRIVE WILL ROTATE IN THE FORWARD DIRECTION UNTIL THE AWAY PROXIMITY SWITCH IS ACTIVATED. AFTER ACTIVATING THE AWAY PROXIMITY SWITCH, THE SPRAY DRIVE WILL STOP, LOWER WASH 1 WILL CLOSE, AND THE SECOND LOWER WASH WILL OPEN. THE SPRAY DRIVE WILL AGAIN DWELL. AFTER DWELLING, THE SPRAY DRIVE WILL ROTATE IN THE REVERSE DIRECTION UNTIL THE HOME PROXIMITY SWITCH IS ACTIVATED. AFTER ACTIVATING THE HOME PROXIMITY SWITCH, THE SPRAY DRIVE WILL STOP AND LOWER WASH 2 WILL CLOSE.

LONG SPRAY WASH CYCLE:

A LONG SPRAY WASH CYCLE CONSISTS OF A SHORT SPRAY WASH CYCLE IN ADDITION TO THE FOLLOWING SEQUENCE. ONCE THE SHORT SPRAY WASH CYCLE IS COMPLETE, THE FIRST UPPER WASH WILL OPEN, AND THE SPRAY DRIVE MOTOR WILL DWELL. AFTER DWELLING, THE SPRAY DRIVE WILL ROTATE IN THE FORWARD DIRECTION UNTIL THE AWAY PROXIMITY SWITCH IS ACTIVATED. AFTER ACTIVATING THE AWAY PROXIMITY SWITCH, THE SPRAY DRIVE WILL STOP, UPPER WASH 1 WILL CLOSE, AND THE SECOND UPPER WASH WILL OPEN. THE SPRAY DRIVE WILL AGAIN DWELL. AFTER DWELLING THE SPRAY DRIVE WILL ROTATE IN THE REVERSE DIRECTION UNTIL THE HOME PROXIMITY SWITCH IS ACTIVATED. AFTER ACTIVATING THE HOME PROXIMITY SWITCH, THE SPRAY DRIVE WILL STOP AND UPPER WASH 2 WILL CLOSE.

NOTES:

- IF THE SYSTEM IS NOT IN DEWATERING MODE AND THE SPRAY DRIVE AND SPRAY WASH SELECTORS ARE IN THE AUTO POSITION, A SPRAY WASH CYCLE WILL BE INITIATED WHEN THE PRESS IS RUNNING. DURING THIS CYCLE, THE SPRAY DRIVE AND SPRAY WASH WILL BOTH CYCLE THROUGH SHORT AND LONG SPRAY WASH CYCLES AS DESCRIBED IN THE SPRAY WASH SYSTEM SEQUENCE.
- THE DEWATERING SYSTEM WILL CONTINUE TO INITIATE SPRAY WASH CYCLES WHILE THE SYSTEM IS IN SHUTDOWN MODE.
- THE HOME POSITION WILL BE DEFINED AS THE FULLY REVERSED PROXIMITY POSITION.
- THE AWAY POSITION WILL BE DEFINED AS THE FULLY FORWARD PROXIMITY POSITION.
- THE SPRAY DRIVE OVER TRAVEL FAULT OCCURS WHEN THE HOME PROXIMITY SWITCH IS ACTIVATED WHEN OPERATING IN THE FORWARD DIRECTION, OR THE AWAY PROXIMITY SWITCH IS ACTIVATED WHEN OPERATING IN THE REVERSE DIRECTION.

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Q - PRESS
 CONTROL PANEL

ABERDEEN, ID

SCALE:
 NONE

PROJECT NUMBER:
 73010205

DRAWING NO:
 HBR9328A15

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SEQUENCE OF OPERATION

PRESS HIGH PRESSURE FEED INTERRUPT:

WHEN THE PRESS INLET PRESSURE MEASURED EXCEEDS THE HIGH PRESSURE INTERRUPT SETPOINT, THE SLUDGE PUMP AND POLYMER FEED SIGNAL WILL SHUT DOWN IMMEDIATELY AND THE PRESS WILL RUN AT THE PRESS INTERRUPT SPEED SEPOINT. ONCE THE PRESSURE HAS DROPPED PAST THE HIGH PRESSURE INTERRUPT SETPOINT AND HOLDS FOR THE TIME SET IN THE HIGH PRESSURE INTERRUPT OFF DELAY, THE PUMPS WILL AUTOMATICALLY RESTART AND THE PRESS WILL RETURN TO ITS REGULAR SPEED.

PRESS HIGH PRESSURE SHUTDOWN:

HIGH PRESSURE SHUTDOWN WILL OCCUR IF THE NUMBER OF COUNTS OF HIGH PRESSURE INTERRUPTS, SET IN THE HIGH INLET PRESSURE FAULT COUNTER, OCCUR WITHIN A SET AMOUNT OF TIME. A HIGH PRESSURE SHUTDOWN WILL ALSO OCCUR ONCE THE HIGH PRESSURE SIGNAL IS REACHED AND MAINTAINED FOR A TIME SET IN THE MAINTAINED HIGH INLET PRESSURE SHUTDOWN DELAY TIMER. THE SYSTEM WILL ENTER SHUTDOWN MODE IMMEDIATELY WHEN A HIGH PRESSURE SHUTDOWN OCCURS.

NOTE: TO RESET A HIGH PRESSURE SHUTDOWN, PRESS THE RESET PUSHBUTTON.

PRESS HIGH TORQUE INTERRUPT:

WHEN THE PRESS MOTOR TORQUE MEASURED EXCEEDS THE HIGH TORQUE INTERRUPT SETPOINT, THE SLUDGE PUMP AND POLYMER FEED SIGNAL WILL SHUT DOWN IMMEDIATELY AND THE PRESSURE CONE WILL DE-ENERGIZE. THE PRESS WILL CONTINUE TO RUN AND GRADUALLY INCREASE SPEED BY THE % AMOUNT SET IN THE TORQUE INTERRUPT SPEED INCREASE SETPOINT EACH TIME THE TORQUE INTERRUPT SPEED INCREASE INTERVAL TIME SETPOINT HAS ELAPSED UNTIL THE PRESS IS OPERATING AT THE SPEED SET IN THE PRESS INTERRUPT SPEED SETPOINT. ONCE THE MOTOR TORQUE HAS DROPPED PAST THE HIGH TORQUE INTERRUPT SETPOINT AND HOLDS FOR THE TIME SET IN THE HIGH TORQUE INTERRUPT OFF DELAY, THE PUMPS WILL AUTOMATICALLY RESTART, THE PRESSURE CONE WILL BE ENERGIZED, AND THE PRESS WILL RETURN TO ITS REGULAR SPEED.

NOTE: IF THE SPRAY WASH CYCLE DELAY TIMER EXPIRES DURING A PRESS HIGH TORQUE INTERRUPT CONDITION, THE SPRAY WASH CYCLE WILL BE PAUSED UNTIL THE PRESS HIGH TORQUE INTERRUPT CONDITION IS REMOVED AND THE PRESSURE CONE HAS BEEN RE-ENERGIZED.

PRESS HIGH TORQUE INTERRUPT SHUTDOWN:

HIGH TORQUE SHUTDOWN WILL OCCUR IF THE NUMBER OF COUNTS OF HIGH TORQUE INTERRUPTS, SET IN THE HIGH TORQUE INTERRUPT FAULT COUNTER, OCCUR WITHIN A SET AMOUNT OF TIME. A HIGH TORQUE SHUTDOWN WILL ALSO OCCUR ONCE THE HIGH TORQUE SIGNAL IS REACHED AND MAINTAINED FOR A TIME SET IN THE MAINTAINED HIGH TORQUE SHUTDOWN DELAY TIMER. THE SYSTEM WILL ENTER SHUTDOWN MODE IMMEDIATELY WHEN A HIGH TORQUE SHUTDOWN OCCURS.

NOTE: TO RESET A HIGH TORQUE SHUTDOWN, PRESS THE RESET PUSHBUTTON.

SEQUENCE OF OPERATION

DEWATERING SYSTEM SHUTDOWN MODE CONDITIONS:

1. REMOTE CALL TO RUN SIGNAL REMOVED
 2. STOP PUSHBUTTON PRESSED ON THE OIU
 3. THE SPRAY WASH SELECTOR IS SWITCHED TO THE HAND OR OFF POSITION.
 4. THE SLUDGE PUMP IN REMOTE SIGNAL IS LOST.
 5. THE POLYMER SYSTEM IN REMOTE SIGNAL IS LOST.
 6. SLUDGE HOLDING TANK LOW LEVEL INDICATION RECEIVED.
- WHEN SHUTDOWN MODE CONDITIONS 1–6 OCCUR, THE SYSTEM WILL ENTER SHUTDOWN MODE.
7. SLUDGE PUMP FAULT INDICATION RECEIVED
 8. SLUDGE PUMP RUNNING INDICATION NOT RECEIVED WHILE CALLED TO RUN FOR THE TIME SET IN THE SLUDGE PUMP FAIL TO RUN FAULT DELAY TIMER
 9. SLUDGE LOW PRESSURE INDICATION RECEIVED
 10. SLUDGE HIGH PRESSURE INDICATION RECEIVED
 11. POLYMER SYSTEM LOW WATER PRESSURE INDICATION RECEIVED FOR THE TIME SET IN THE POLYMER SYSTEM LOW WATER PRESSURE FAULT DELAY TIMER
 12. POLYMER SYSTEM LOW POLYMER FLOW INDICATION RECEIVED FOR THE TIME SET IN THE POLYMER SYSTEM LOW POLYMER FLOW FAULT DELAY TIMER
 13. POLYMER SYSTEM RUNNING INDICATION NOT RECEIVED WHILE CALLED TO RUN FOR THE TIME SET IN THE POLYMER SYSTEM FAIL TO RUN FAULT DELAY TIMER
 14. ZERO SLUDGE FLOW INDICATION RECEIVED WHILE THE SYSTEM IS IN DEWATERING MODE FOR THE TIME SET IN THE SLUDGE ZERO FLOW FAULT DELAY TIMER
 15. WASH WATER LOW PRESSURE INDICATION RECEIVED FOR THE TIME SET IN THE WASH WATER LOW PRESSURE FAULT DELAY TIMER
 16. AIR SUPPLY LOW PRESSURE INDICATION RECEIVED
 17. PRESS HIGH PRESSURE SIGNAL MAINTAINED FOR THE TIME SET IN THE HIGH PRESSURE SHUTDOWN DELAY TIMER
 18. PRESS HIGH PRESSURE SIGNAL RECEIVED FOR THE AMOUNT OF TIMES SET IN THE HIGH PRESSURE COUNTS BEFORE SHUTDOWN COUNTER
 19. PRESS HIGH TORQUE MAINTAINED FOR THE TIME SET IN THE HIGH TORQUE SHUTDOWN DELAY TIMER
 20. PRESS HIGH TORQUE RECEIVED FOR THE AMOUNT OF TIMES SET IN THE HIGH TORQUE COUNTS BEFORE SHUTDOWN COUNTER

– WHEN ANY OF SHUTDOWN MODE CONDITIONS 7 – 20 OCCUR, THE SYSTEM DISTURBANCE PILOT LIGHT WILL ENERGIZE AND THE SYSTEM WILL ENTER SHUTDOWN MODE. THE SYSTEM DISTURBANCE PILOT LIGHT WILL REMAIN ENERGIZED UNTIL THE CONDITION IS CORRECTED.

ONCE THE SYSTEM IS IN SHUTDOWN MODE, THE EQUIPMENT WILL POWER DOWN IN THE FOLLOWING ORDER:

1. SLUDGE PUMP AND POLYMER SYSTEM CALL TO RUN SIGNALS WILL BE REMOVED AND THE PNEUMATIC CONE WILL DISENGAGE.
2. THE PRESS AND SPRAY WASH WILL CONTINUE UNTIL THE SHUTDOWN TIMER HAS COMPLETED.
3. ONCE THE SHUTDOWN TIMER HAS EXPIRED THE SPRAY WASH WILL COMPLETE ONE LAST LONG SPRAY WASH CYCLE. DURING THE FINAL SPRAY WASH CYCLE THE PNEUMATIC CONE WILL BE RE-ENGAGED.
4. THE SYSTEM WILL REMAIN OFF UNTIL THE NEXT DEWATERING MODE IS ACTIVATED

SEQUENCE OF OPERATION

SYSTEM FAULTS:

1. PRESS VFD DETECTS OVERLOAD
2. PRESS TORQUE OVERLOAD SETPOINT HAS BEEN REACHED
3. PRESS MOTOR THERMOSTAT IS TRIPPED
4. PRESS RUNNING INDICATION NOT RECEIVED WHILE CALLED TO RUN
5. CONVEYOR FAULT INDICATION RECEIVED
6. CONVEYOR RUNNING INDICATION NOT RECEIVED WHILE CALLED TO RUN
7. CONVEYOR ZERO SPEED FAULT INDICATION RECEIVED
8. SPRAY DRIVE HIGH CURRENT DETECTED
9. SPRAY DRIVE MOTOR OVERLOAD DETECTED
10. SPRAY DRIVE MOTOR THERMOSTAT IS TRIPPED
11. SPRAY DRIVE IS RUNNING REVERSE AND TRIGGERS THE AWAY PROXIMITY SWITCH.
12. SPRAY DRIVE IS RUNNING FORWARD AND TRIGGERS THE HOME PROXIMITY SWITCH.
13. SPRAY DRIVE IS RUNNING AND NEITHER PROXIMITY SWITCH IS TRIGGERED IN THE TIME SET IN THE OIU.

- WHEN ANY OF FAULTS 1 THROUGH 10 OCCUR, THE ALARM HORN, BEACON, AND SYSTEM DISTURBANCE PILOT LIGHT WILL ENERGIZE AND THE ENTIRE SYSTEM WILL SHUT DOWN IMMEDIATELY. THE ALARM BEACON AND SYSTEM DISTURBANCE PILOT LIGHT WILL REMAIN ENERGIZED UNTIL THE CONDITION IS CORRECTED.
- WHEN ANY OF FAULTS 11 THROUGH 13 OCCUR, THE ALARM HORN, BEACON, AND SYSTEM DISTURBANCE PILOT LIGHT WILL ENERGIZE AND THE ENTIRE SYSTEM WILL SHUT DOWN IMMEDIATELY. THE ALARM BEACON AND SYSTEM DISTURBANCE PILOT LIGHT WILL REMAIN ENERGIZED UNTIL THE OPERATOR ACKNOWLEDGES THE FOLLOWING PROMPTS:
- ALARM ANNUNCIATION MESSAGE
 - SPRAY DRIVE HAS MANUALLY BEEN ADJUSTED FROM THE OIU TO A SAFE POSITION
 - HOME AND AWAY PROXIMITY SWITCHES ARE WORKING PROPERLY

NOTES:

1. FOR SYSTEM FAULTS 11–13, THE SYSTEM RESET PUSHBUTTON WILL NOT BE ACTIVE UNTIL THE ABOVE THREE PROMPTS HAVE BEEN ACKNOWLEDGED BY THE OPERATOR.
2. IF THE PRESS OR SPRAY DRIVE SELECTORS ARE SWITCHED TO THE HAND OF OFF POSITION OR THE CONVEYOR IN REMOTE INDICATION IS REMOVED WHEN THE SYSTEM IS IN THE DEWATERING MODE, THE SYSTEM WILL SHUTDOWN IMMEDIATELY AND A MESSAGE WILL BE DISPLAYED ON THE OIU.

ALARM BEACON:

THE ALARM BEACON WILL ENERGIZE IF ANY OF THE SYSTEM FAULTS OCCUR. THE ALARM BEACON WILL REMAIN ENERGIZED UNTIL THE FAULT IS CLEARED AND THE SYSTEM RESET PUSHBUTTON IS PRESSED.

ALARM HORN AND ALARM SILENCE PUSHBUTTON:

THE ALARM HORN WILL ENERGIZE IF ANY OF THE SYSTEM FAULTS OCCUR. THE ALARM HORN CAN BE SILENCED AT ANY TIME BY PRESSING THE ALARM SILENCE PUSHBUTTON. THE ALARM SILENCE PUSHBUTTON WILL NOT RESET THE FAULT.


EMERGENCY STOP:

ALL DEWATERING EQUIPMENT WILL STOP IMMEDIATELY IF THE E-STOP PUSHBUTTON IS ACTIVATED. THE DEWATERING SYSTEM WILL NOT RESUME OPERATION UNTIL THE E-STOP IS RESET AND THE SYSTEM RESET PUSHBUTTON IS PRESSED.

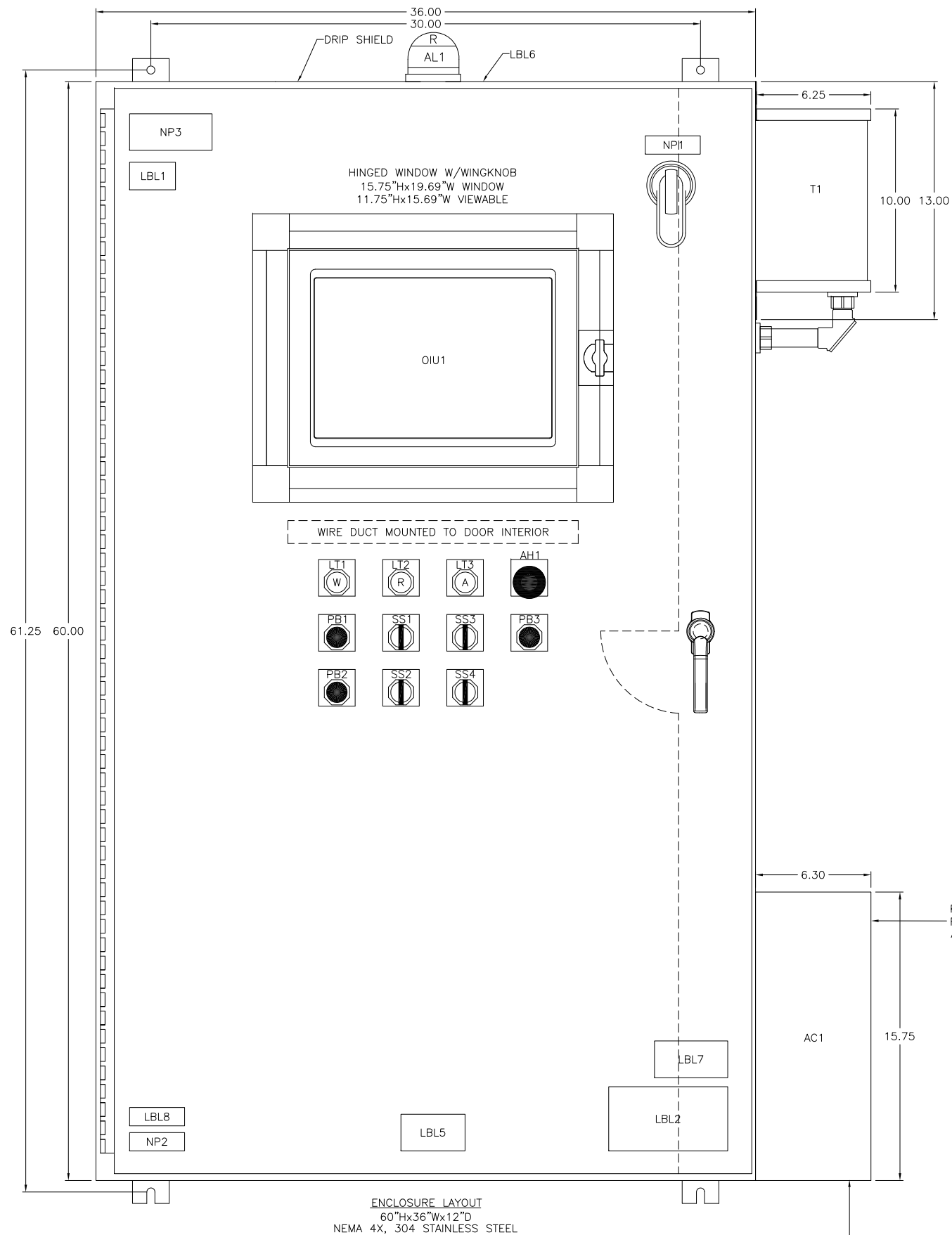
OIU – INFORMATION:

1. THE OIU WILL DISPLAY THE ELAPSED MOTOR RUN TIMES.
2. ALL ADJUSTABLE SETPOINTS CAN BE ACCESSED AND ADJUSTED THROUGH THE OIU.
3. THE PRESENT FAULT WILL BE DISPLAYED ON THE OIU.
4. THE HISTORY OF ALL PAST FAULTS CAN BE ACCESSED THROUGH THE OIU.
5. FLOW INDICATION AND AMOUNT SHALL BE DISPLAYED ON THE OIU.
6. RUNNING AND FAULTED STATUS FOR ALL MOTORS AND PUMPS WILL BE DISPLAYED ON THE OIU.
7. VFD SPEEDS MAY BE ADJUSTED THROUGH THE OIU.
8. THE PRESS MOTOR TORQUE WILL BE DISPLAYED ON THE OIU.
9. THE PRESS MINIMUM AND MAXIMUM SPEED RANGE WILL BE DISPLAYED ON THE OIU.
10. SLUDGE HOLDING TANK LEVEL WILL BE DISPLAYED ON THE OIU.
11. SLUDGE HOLDING TANK HIGH LEVEL BANNER WILL BE DISPLAYED ON THE OIU.
12. THE ALARM HISTORY WILL DISPLAY THE PEAK VALUE OF TORQUE MEASURED WHEN A TORQUE OVERLOAD FAULT OCCURS.

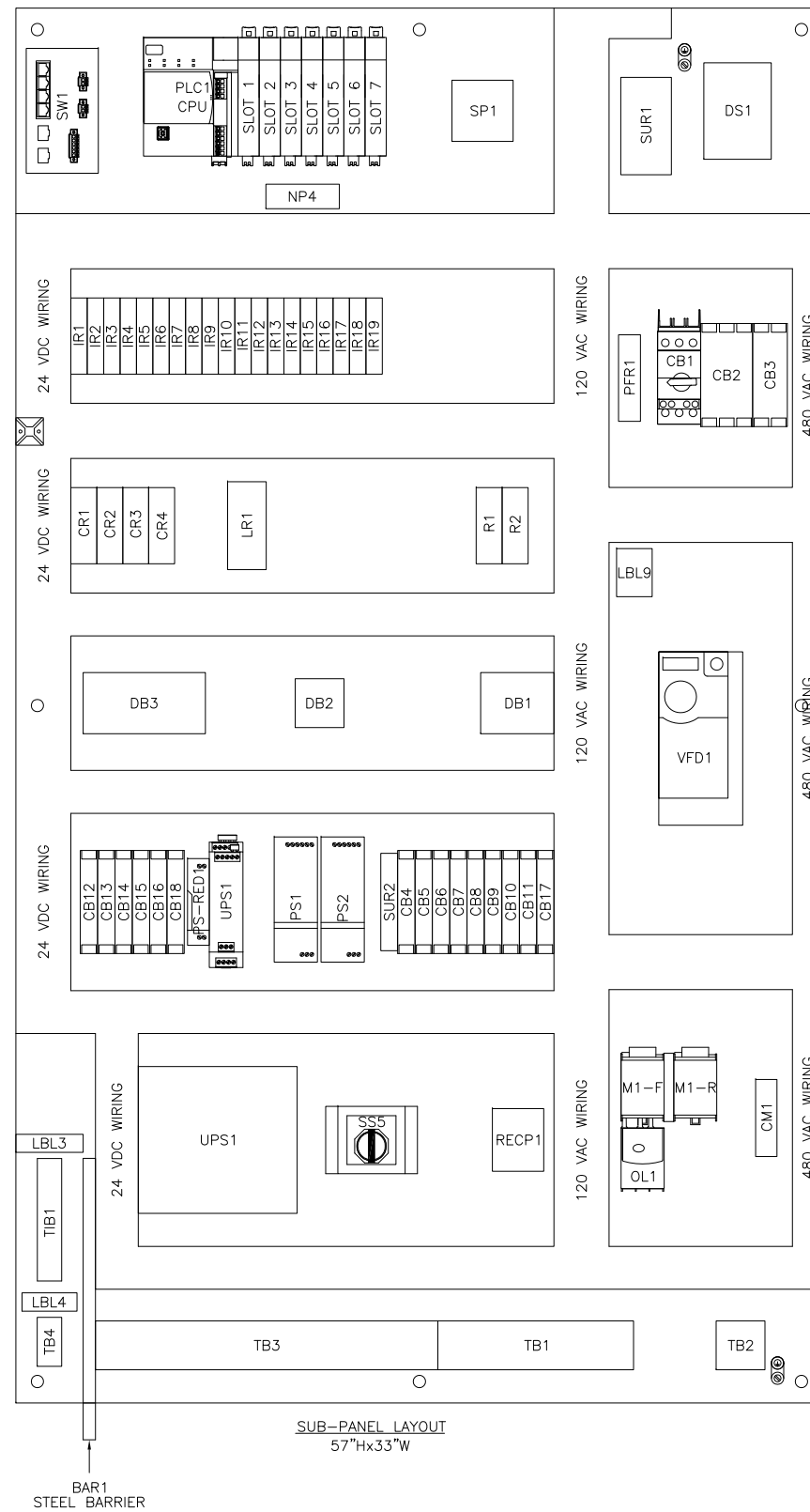
					DESIGNED	JN
					DETAILED	
					CHECKED	MSN
					APPROVED	
DATE	REVISION	NO.	BY	CK	APP	DATE
						06/08/23

 <p>1009 Airle Parkway Denver, NC 28037 Tel. 704-949-1010 info@hhusa.net</p>		Q – PRESS CONTROL PANEL	
		ABERDEEN, ID	SCALE: NONE
PROJECT NUMBER: 73010205		DRAWING NO: HBR9328A16	
		16 OF 18	

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ENCLOSURE LAYOUT
60"Hx36"Wx12"D
NEMA 4X, 304 STAINLESS STEEL



SUB-PANEL LAYOUT
57"Hx33"W

DATE	REVISION	NO.	BY	CK	APP	DATE
					DESIGNED	JN
					DETAILED	
					CHECKED	MSN
					APPROVED	
					DATE	06/08/23

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Q - PRESS
CONTROL PANEL

ABERDEEN, ID SCALE:
NONE

PROJECT NUMBER: 73010205 DRAWING NO: HBR9328A17
17 OF 18

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PILOT DEVICE LEGENDPLATES (PANEL DOOR)				
DEVICE TAG	DESCRIPTOR LINE 1	DESCRIPTOR LINE 2	DESCRIPTOR LINE 3	
AH1	ALARM HORN			
LT1	CONTROL POWER	ON		
LT2	DEWATERING	MODE		
LT3	SYSTEM	DISTURBANCE		
PB1	EMERGENCY	STOP		
PB2	SYSTEM	RESET		
PB3	ALARM	SILENCE		
SS1	PRESS	OFF	HAND	AUTO
SS2	PRESS	OFF	FOR	REV
SS3	SPRAY WASH	OFF	HAND	AUTO
SS4	SPRAY DRIVE	OFF	HAND	AUTO
SS5	UPS MODE	OFF	BYPS	ON
MAX. CHARACTERS	15	15	4	4

LABEL DESCRIPTION	
LBL1	WARNING MULTIPLE SUPPLY SOURCES OPEN ALL DISCONNECTS BEFORE SERVICING EQUIPMENT OR OTHER UNIT WIRING
LBL2	DANGER HIGH VOLTAGE ENTRY BY QUALIFIED PERSON ONLY
LBL3	WARNING SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY
LBL4	INTRINSICALLY SAFE FIELD WIRING TERMINALS
LBL5	ELEMECH ELECTRICAL CONTROL SYSTEMS
LBL6	WARNING DAMAGE RESULTING FROM INSTALLATION OF TOP ENTRY CONDUIT WILL VOID WARRANTY. - AVOID CUTTING HOLES DIRECTLY ABOVE ANY ELECTRICAL COMPONENTS - PROTECT INTERNAL COMPONENTS FROM METAL SHAVINGS, CUTTING OILS, DEBRIS, AND MOISTURE - USE PROPER FITTINGS, MYERS TYPE 4 OR EQUAL - CONDUITS AND FITTING MUST BE WATERTIGHT TO PREVENT WATER ENTRY - ALL PENETRATIONS MUST BE SEALED OFF TO PREVENT INTRUSION OF MOISTURE, CORROSIVE GASES, AND VAPORS FROM ENTERING THE ENCLOSURE
LBL7	DANGER ARC FLASH AND SHOCK HAZARD FOLLOW ALL REQUIREMENTS NFPA 70E FOR SAFE WORK PRACTICES AND FOR PERSONAL PROTECTIVE EQUIPMENT.
LBL8	WARNING TO PREVENT IGNITION OF FLAMMABLE OR COMBUSTIBLE ATMOSPHERES, DISCONNECT POWER BEFORE SERVICING.
LBL9	VFD SETUP GUIDE

NAMEPLATES			
TAG	DESCRIPTOR LINE 1	DESCRIPTOR LINE 2	DESCRIPTOR LINE 3
NP1	480VAC-3PH-60HZ		
NP2	INTRINSICALLY	SAFE CIRCUITS	
NP3	CONTROL PANEL PROVIDES INTRINSICALLY SAFE CIRCUIT EXTENSIONS FOR USE IN CLASS I, DIVISION 1 GROUPS A,B,C,D; CLASS I, ZONE 0 AND 1, GROUP IIC; CLASS II, DIVISION 1 GROUPS E,F,G HAZARDOUS LOCATIONS WHEN CONNECTED PER PR ELECTRONICS INSTALLATION DRAWING NO. 5202QU01		
NP4	WARNING! TO AVOID DAMAGING ANY INPUT OR OUTPUT MODULE, VERIFY THE SA POWER REQUIREMENT OF EACH MODULE BEFORE POWER UP. MODULES MUST BE INSTALLED TO THE RIGHT OF THE CORRECT SA POWER SOURCE TO AVOID DAMAGE.		

NAMEPLATES AND LEGENDPLATES CONSTRUCTION					
	PANEL LEGENDPLATES	LCS LEGENDPLATES	NAMEPLATES	UL698 NAMEPLATES	DEVICE TAGS
TEXT COLOR	BLACK	BLACK	BLACK	BLACK	BLACK
BACKGROUND COLOR	WHITE/ YELLOW (E-STOPS)	WHITE/ YELLOW (E-STOPS)	WHITE	YELLOW	WHITE
MATERIAL	PHENOLIC ENGRAVED	PHENOLIC ENGRAVED	PHENOLIC ENGRAVED	PHENOLIC ENGRAVED	THERMAL TRANSFER
ATTACHMENT	ADHESIVE	ADHESIVE	ADHESIVE	ADHESIVE	ADHESIVE
TEXT SIZE	5/32" HIGH	5/32" HIGH	3/16" HIGH	1/8" HIGH	1/8" HIGH
DIMENSIONS	2.375"x2.375"	1.875"x1.875"	2.72"x1"	4"x2"	1"x1/2"
MAX. CHARACTERS PER LINE	15	15	17	35	7

PANEL DATA LABEL



ELEMECHINC.COM 630-499-7080

WARRANTY NOTICE
NO ALLOWANCE OR PAYMENT WILL BE MADE FOR WARRANTY REPAIR UNLESS PRIOR AUTHORIZATION HAS BEEN REQUESTED AND OBTAINED FROM THE ELEMECH SERVICE DEPT.

SERIAL: HBR9328 POWER: 3/60/480
REF: # 73010205 FLA: 9.0A
DATE: TBD LGST MOT: 5.4A

SHORT CIRCUIT CURRENT RATING
5 KA RMS SYMMETRICAL @ 480 VOLTS MAX

ENCLOSURE RATING: NEMA TYPE 4X

NAME: ABERDEEN, ID

CIRCUIT 2-4: 10A @ 120VAC

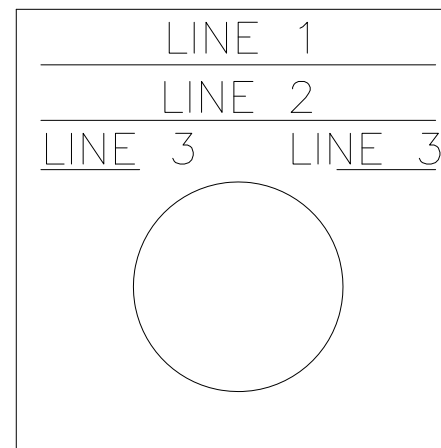
TORQUE SCREWS TO 12 IN-LBS

ALL FIELD WIRING SHALL BE 60°C COPPER CONDUCTOR ONLY

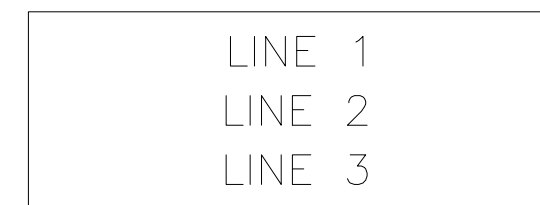
NOTE:
THE CONTROL PANEL WILL ALSO BE LISTED AND LABELED WITH A SERIALIZED LABEL AS OUTLINED IN THE CONTROL PANEL SPECIFICATION NOTES.

REPLACE TB3F WITH FAST ACTING FUSE RATED AT 250V, MAX 1 AMP FERRAZ-SHAWMUT AGC-1 OR EQUAL

PILOT DEVICE LEGENDPLATES



PANEL NAMEPLATE



DEVICE TAG



NOTE:
TEXT WILL REMAIN VERTICALLY CENTERED IF LESS THAN 3 LINES ARE USED.

DESIGNED	JN			
DETAILED				
CHECKED	MSN			
APPROVED				
DATE	06/08/23			
NO.	BY	CK	APP	DATE
REVISION				

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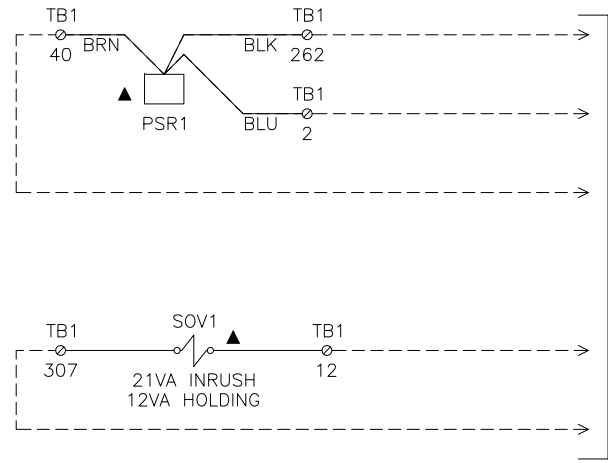
Q - PRESS
CONTROL PANEL

ABERDEEN, ID SCALE: NONE

PROJECT NUMBER: 73010205 DRAWING NO: HBR9328A18
18 OF 18

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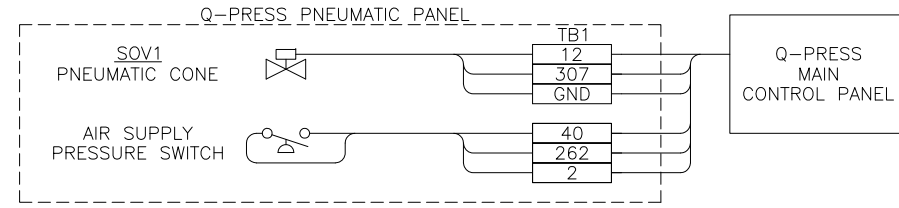
3
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TO Q-PRESS MAIN CONTROL PANEL

2
AIR SUPPLY OK PRESURE SWITCH
PNEUMATIC CONE SOLENOID VALVE
2

FIELD WIRING DIAGRAM



DESIGNED	JN			
DETAILED				
CHECKED	MSN			
APPROVED				
DATE	06/08/23			
NO.	BY	CK	APP	DATE
DATE	REVISION			

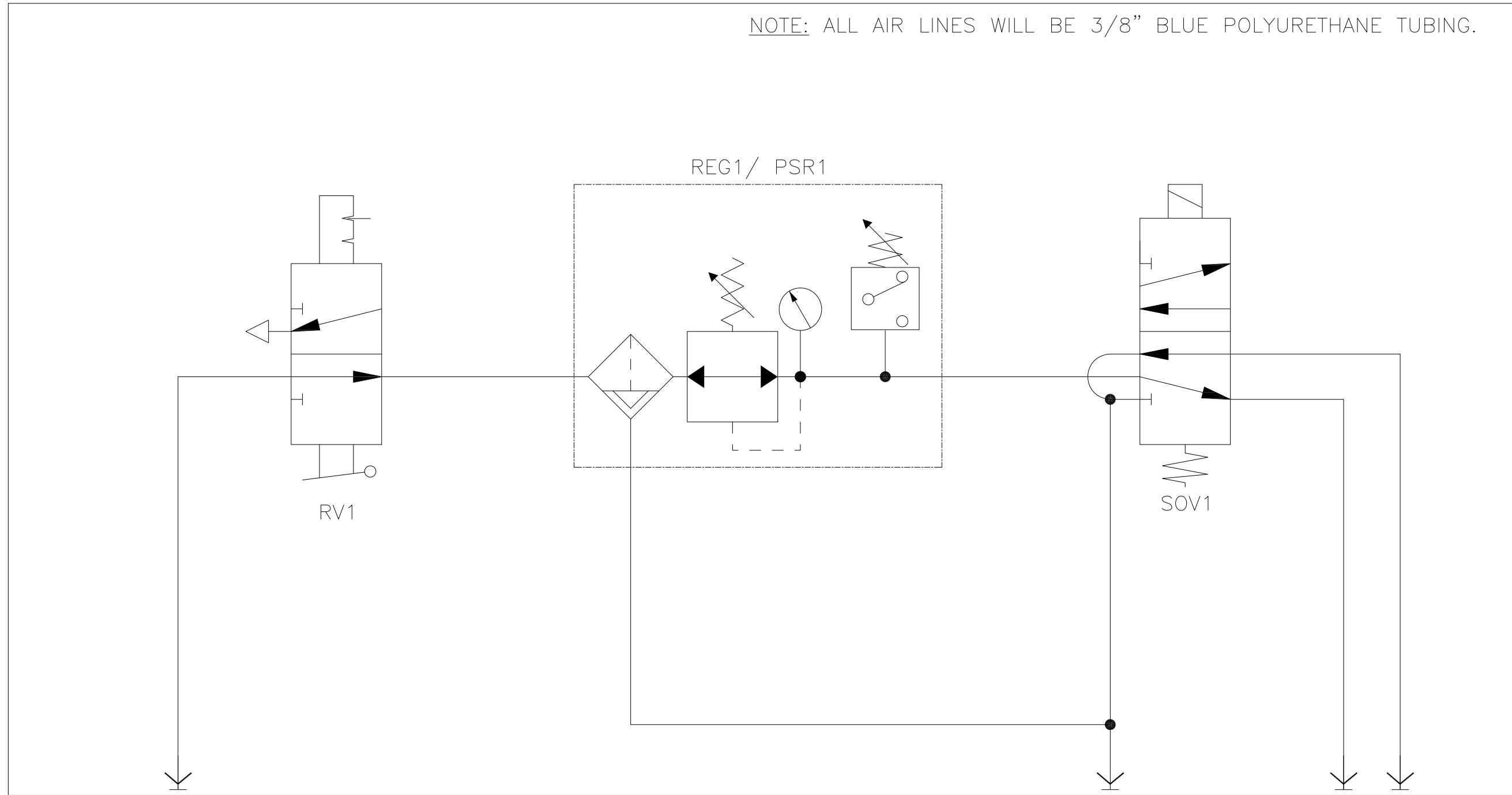
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Q-PRESS PNEUMATIC CONTROL PANEL	
ABERDEEN, ID	SCALE: NONE
PROJECT NUMBER: 73010205	DRAWING NO: HBR9328B01
1 OF 3	

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PNEUMATIC
CONTROL PANEL

NOTE: ALL AIR LINES WILL BE 3/8" BLUE POLYURETHANE TUBING.



AIR SUPPLY
CONNECTION
STAINLESS STEEL
BULKHEAD
3/8"OD TUBE FITTING

DRAIN / EXHAUST
CONNECTION
STAINLESS STEEL
BULKHEAD
3/8"OD TUBE FITTING

CONTROL
CONNECTION
STAINLESS STEEL
BULKHEAD
3/8"OD TUBE FITTING

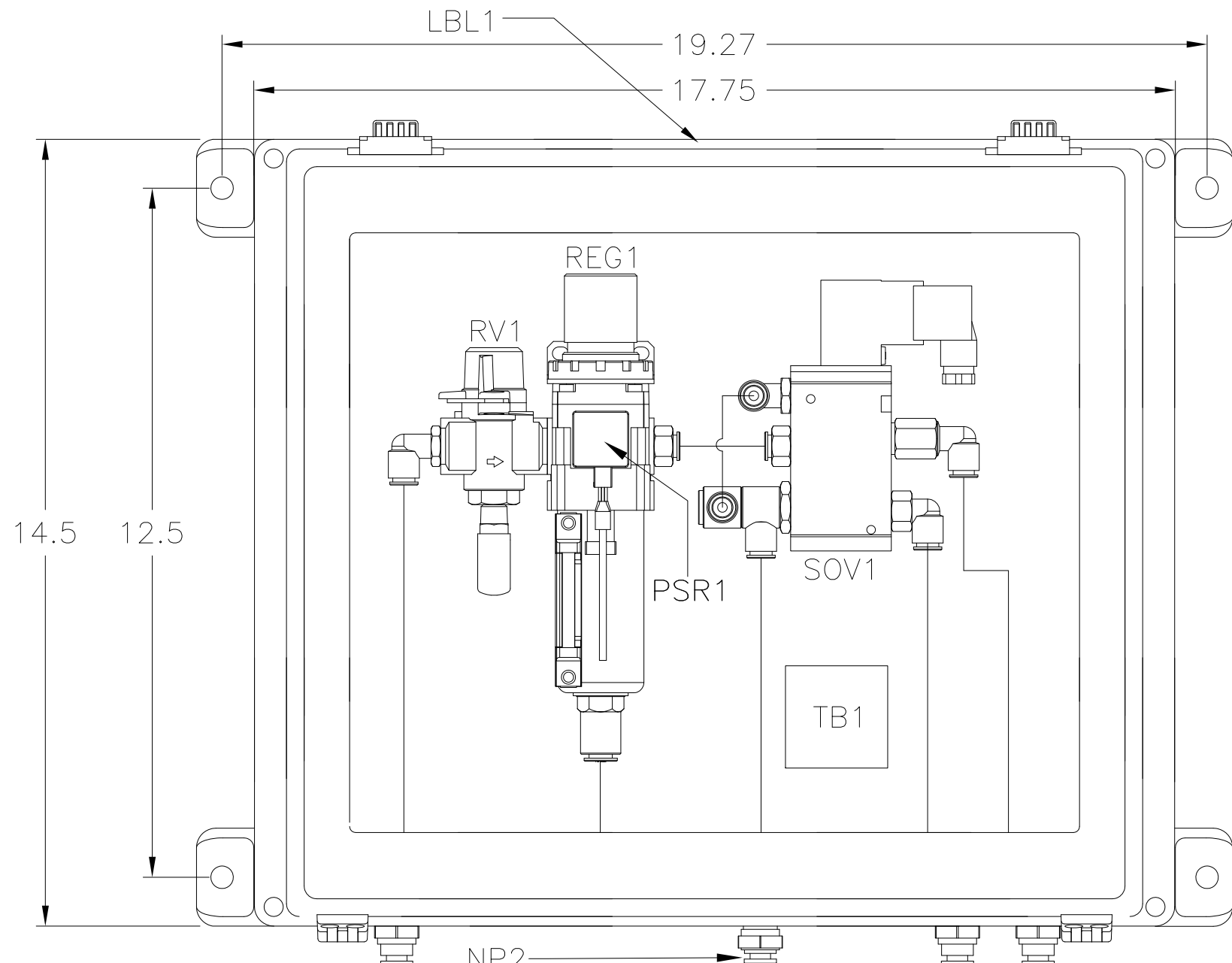
CONTROL
CONNECTION
STAINLESS STEEL
BULKHEAD
3/8"OD TUBE FITTING

					DESIGNED	JN
					DETAILED	
					CHECKED	MSN
					APPROVED	
DATE	REVISION	NO.	BY	CK	APP	DATE
						06/08/23

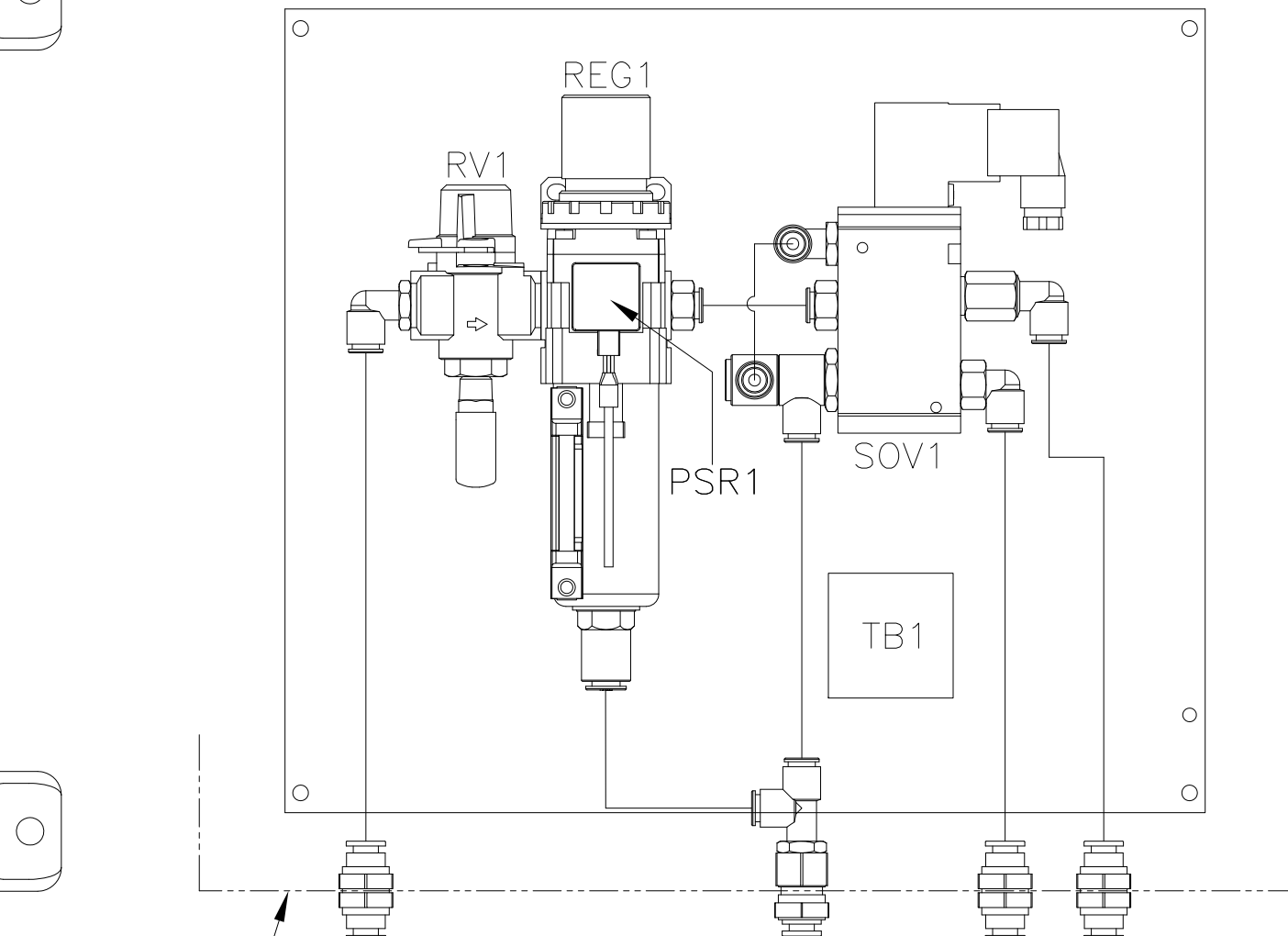
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Denver, NC 28037
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Q-PRESS PNEUMATIC CONTROL PANEL	
ABERDEEN, ID	SCALE: NONE
PROJECT NUMBER: 73010205	DRAWING NO: HBR9328B02
2 OF 3	

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ENCLOSURE LAYOUT
 18"Hx14"Wx9"D NEMA 4X FIBERGLASS
 14.45"Hx11.06"W WINDOW



SUB-PANEL LAYOUT
 14.75"Hx12.88"W

LEGEND:
 NP1 - AIR SUPPLY CONNECTION
 NP2 - DRAIN CONNECTION
 NP3 - CONTROL CONNECTION
 NP4 - CONTROL CONNECTION

LBL1 - WARNING
 DAMAGE RESULTING FROM
 INSTALLATION OF TOP ENTRY
 CONDUIT WILL VOID WARRANTY
 - USE PROPER FITTINGS, MEYERS
 TYPE 4 OR EQUAL
 - PROTECT INTERIOR DEVICES
 FROM INSTALLATION DEBRIS
 - CONDUIT MUST BE SEALED
 WATERTIGHT TO PREVENT WATER
 ENTRY

DATE	REVISION	NO.	BY	CK	APP	DATE

DESIGNED	JN
DETAILED	
CHECKED	MSN
APPROVED	
	06/08/23

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 Denver, NC 28037
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 info@hhusa.net

Q-PRESS PNEUMATIC CONTROL PANEL	
ABERDEEN, ID	SCALE: NONE
PROJECT NUMBER: 73010205	DRAWING NO: HBR9328B03
3 OF 3	

Bill of Materials



Rev: 0

Date: 06-23-2023

Section:

D

Section Name:

Bill of Materials

By: JN

Job Number: HBR9328

Page # 1/1

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Item	Component	Description	Manufacturer Part Number	QTY	Device
Q-Press - Main Control Panel (Quantity: 1)					
1	00-000-000	Wire, Hardware, Wire labels, etc.		2	
2	10-069-000	Wireway Duct Cover, 1.5"W, 6 Ft. Section, w/Panduit F Series	Panduit: C1.5WH6	6	
3	10-069-001	Wireway Duct Cover, 1"W, 6 Ft. Section, w/Panduit F Series	Panduit: C1WH6	6	
4	10-069-002	Wireway Duct Cover, 2"W, 6 Ft. Section, w/Panduit F Series	Panduit: C2WH6	9	
5	10-069-005	Wireway Duct, 1.5"Wx3"H, 6 Foot Section	Panduit: F1.5X3WH6	6	
6	10-069-007	Wireway Duct, 1"Wx3"H, 6 Foot Section	Panduit: F1X3WH6	6	
7	10-069-008	Wireway Duct, 2"Wx3"H, 6 Foot Section	Panduit: F2X3WH6	9	
8	25-000-A001	Legendplate Assembly, Yellow E-Stop, Standard Encl.	EleMech: 25-000-A001 Assembly	1	
9	25-000-A002	Legendplate Assembly, White, Black Text, Standard Encl.	EleMech: 25-000-A002 Assembly	10	
10	25-000-A019	Nameplate Assembly, White: Power Supply - 3/60/480VAC	EleMech: 25-000-A019 Assembly	1	
11	42-063-007	Terminal Block, Din Rail, 35MM Wide, 15 High, 2 Meters Long	Iboco: Omega 3 AF	2	
12	51-000-062	Wire, MTW Type, 600V, 105°C, CSA/UL1015, Tinned Copper	EleMech: 51-000-062	1	
13	52-000-003	Label, Underwriters Laboratories 698A, w/Decal Set	EleMech: 698A	1	
14	68-035-023	Air Cond, NEMA 4X, 800 BTU, 115VAC, 3.8 Amps, 150WHTR, L2 Coated	Hoffman: T150116G173	1	AC1
15	01-005-008	Alarm Horn, Panel Mount, 24VDC, 45mm front, 22.5mm, NEMA 4X	Allen-Bradley: 855P-B30ME22	1	AH1
16	56-097-005	Beacon, Steady/Strobe, LED, NEMA 4X, 24VDC, Red, 1/2" Male -NS	Federal: LP22LED-012-024R	1	AL1
17	18-000-002	Steel Barrier, 14Ga., 0.5"Wx10.0"x6.0"D, Standard	EleMech: 18-000-002	1	BAR1
18	23-005-046	Motor Starter Protector, 3PH, 600V, 10-16 Amp Range, D/FRM	Allen-Bradley: 140MT-D9E-C16	1	CB1
19	23-005-050	Motor Starter Protector, Line Terminal Adapter, w/140MT-C,D	Allen-Bradley: 140MT-C-TE	1	CB1
20	03-058-119	Circuit Breaker, 1 Pole, 240VAC, 2A, 14kA, UL489, Type C	Square D: M9F42102	8	CB10-17
21	03-058-124	Circuit Breaker, 1 Pole, 240VAC, 8A, 14kA, UL489, Type C	Square D: M9F42108	1	CB18
22	03-058-148	Circuit Breaker, 3 Pole, 480VAC, 2A, 10kA, UL489, Type D	Square D: M9F43302	1	CB2
23	03-058-140	Circuit Breaker, 2 Pole, 480VAC, 8A, 10kA, UL489, Type D	Square D: M9F43208	1	CB3
24	03-058-126	Circuit Breaker, 1 Pole, 240VAC, 15A, 14kA, UL489, Type C	Square D: M9F42115	1	CB4
25	03-058-125	Circuit Breaker, 1 Pole, 240VAC, 10A, 14kA, UL489, Type C	Square D: M9F42110	2	CB5,6
26	03-058-123	Circuit Breaker, 1 Pole, 240VAC, 6A, 14kA, UL489, Type C	Square D: M9F42106	3	CB7-9
27	57-000-A030	Cable, Comm., Ethernet, CAT5e, 600V, RJ45M to RJ45M, Shielded	EleMech: 57-000-A030	2	CBL1,2
28	57-009-008	Cable, Comm., Ethernet, Cat. 5, 600V, 4 PAIR, 24AWG, 6.6 FT	Belden: E505002-010S1	1	CBL3
29	04-094-000	Current Monitor, Selectable, SPDT, 120/24V, 2-100A, w/Delay	Gavazzi: DIB01CM24100A	1	CM1

Item	Component	Description	Manufacturer Part Number	QTY	Device
30	06-058-012	Control Relay, Bus Jumper, 2-Pole, w/Telemec. RXM Relay	Square D: RXZ S2	3	CR1-4
31	06-058-015	Control Relay, 3PDT,24VDC, 11Pin Spade, Indicator, Operator	Square D: RXM3AB2BD	4	CR1-4
32	38-058-003	Socket, 11 Pin Spade, Din, Screw Term., 3Tier, 250V w/3-Pole	Square D: RXZE2S111M	4	CR1-4
33	07-063-000	Distribution Block, End Cover, 4 Pole, 300V,10A, w/WK4E\U\VB	Wieland: 07.311.4053.1	2	DB
34	07-063-001	Distribution Block, Jumper, 4 Pole, 300V,10A, w/WK4E\U\VB	Wieland: Z7.210.3427	6	DB
35	07-063-002	Distribution Block, Single Pole, 10A, 300V, WK4E\U\VB	Wieland: 57.404.6955.1	24	DB
36	09-001-A030	Disconnect Assembly, Non-Fused, 60 Amp, NEMA 4X, 12" Depth	ABB: OT60F3 Assembly	1	DS1
37	11-000-340	Enclosure Drip Shield, Stainless Steel, Per Inch	EleMech: 11-000-340	36	EN1
38	11-000-A021	Wind Kit, Alum/Hinge,Wing Knob w/out Frame,16"Hx20"W	EleMech: 11-000-A021	1	EN1
39	11-035-143	Sub-Panel, Painted Steel, w/60"Hx36"W C. Hinge Encl	Hoffman: A-60P36	1	EN1
40	11-035-451	Enclosure, Nema 4X, 304SS, 60"Hx36"Wx12"D, C. Hinge, 3-PT	Hoffman: A-60H3612SSLP3PT	1	EN1
41	15-011-000	Ground Lug, 14AWG - 4AWG	Blackburn: L70	2	GND
42	06-058-027	Control Relay Retension Clip, w/Telemec. RPM 1-Pole Relay	Square D: RPZR235	18	IR1-18
43	06-058-028	Control Relay, SPDT, 24VDC, 5Pin Spade, Operator, 15A	Square D: RPM12BD	18	IR1-18
44	06-058-040	Diode, 6-250VDC, w/ RXM Sockets, RPZF1/2 Sockets	Square D: RXM040W	18	IR1-18
45	38-058-009	Socket, 5 Pin Spade, Din Mount, Screw Term., w/ RPM 1-Pole	Square D: RPZF1	18	IR1-18
46	52-137-002	Label, Multiple Supply Sources, Warning, 2.5"Wx1.5"H, Yellow	Nameplate Tech: 52-137-002	1	LBL1
47	52-137-001	Label, High Voltage, Danger, 6.5"Wx3.5"H, White/Black/Red	Nameplate Tech: 52-137-001	1	LBL2
48	06-005-077	Latching Relay, DPDT,24VDC, 11Pin Spade, Dual Coil	Allen-Bradley: 700HJD32Z24	1	LR1
49	38-005-002	Socket, 11 Pin Spade, Din Rail Mount, Guarded Screw Terminal	Allen-Bradley: 700-HN153	1	LR1
50	32-005-A000	Pilot light, PTT, NEMA 4X, Universal, LED, White	Allen-Bradley: 800H-QRTH2W	1	LT1
51	32-005-A002	Pilot light, PTT, NEMA 4X, Universal, LED, Red	Allen-Bradley: 800H-QRTH2R	1	LT2
52	32-005-A003	Pilot light, PTT, NEMA 4X, Universal, LED, Amber	Allen-Bradley: 800H-QRTH2A	1	LT3
53	22-005-010	Aux. Contact, Top mounted, 3NO/1NC, w/A-B 100C/104C/300 Ser.	Allen-Bradley: 100-FA31	2	M1-F/R
54	22-005-117	Contact, 3PH, Reversing, NEMA 0, 1NO, 120VAC Coil, 18A	Allen-Bradley: 305-AOD-23	1	M1-F/R
55	25-000-A010	Nameplate Assembly, White, Black Text, 1"Hx3"W	EleMech: 25-000-A010 Assembly	3	NP1,2,4
56	25-000-A058	Nameplate Assembly, Yellow: Intrinsically Safe Circ: PR5202	EleMech: 25-000-A058 Assembly	1	NP3
57	26-005-091	OIU, PVP 7 Standard, 12" Display, 24VDC, Touch, Ethernet	Allen Bradley: 2711P-T12W21D8S	1	OIU1
58	HBR-170-P021	Program, OIU, PVP 7 12", Standard w/cplgX	EleMech: HBR-170-P021	1	OIU1
59	28-005-080	Overload Relay,E100, Adj Class,0.2-1.0A,w/100-C09...C23	Allen-Bradley: 193-1EFBB	1	OL1

Item	Component	Description	Manufacturer Part Number	QTY	Device
60	29-005-117	Pushbutton, E-Stop, NEMA 4X, Oper+1NC, Twist Rel. Red Head	Allen-Bradley: 800H-TFRXT6D2	1	PB1
61	29-005-002	Pushbutton, NEMA 4X, Oper+1NO, Flush Head, Black	Allen-Bradley: 800H-AR2D1	2	PB2,3
62	30-183-000	Phase Failure, Voltage Monitoring Relay,380-480VAC, 2 SPDT	Telemecanique: RM22TR33	1	PFR1
63	33-005-277	Compact 5069, Discrete Out., (16) 120AC/24DC Relay, 24VDC SA	Allen-Bradley: 5069-OW16	2	PLC1
64	33-005-280	Compact 5069, Term Block, 18 Pin, Screw Clamp, w/ I/O	Allen-Bradley: 5069-RTB18-SCREW	7	PLC1
65	33-005-282	Compact 5069, Term. Block, 6 Pin/4 Pin, Screw Clamp, w/CPU	Allen-Bradley: 5069-RTB64-SCREW	1	PLC1
66	33-005-299	Compact 5069, Analog Input, 8 Chnl., 24V SA Power	Allen-Bradley: 5069-IF8	1	PLC1
67	33-005-336	Compact 5069, CPU 0.6MB Mem, SD, 2-Ether, 8 Cards, 24VDC	Allen-Bradley: 5069-L306ER	1	PLC1
68	33-005-338	Compact 5069, Analog Output, 4 Chnl., 24V SA Power	Allen-Bradley: 5069-OF4	1	PLC1
69	33-005-347	Compact 5069, Discrete Input, (16) 24VDC Inputs, 24V SA	Allen-Bradley: 5069-IB16	3	PLC1
70	HBR-170-P008	Program, PLC, Compact Logix, Standard	EleMech: HBR-170-P008	1	PLC1
71	37-098-018	Power Supply, 240W, 85-264VAC IN, 24VDC OUT, UNO Series	Phoenix: 1096432	2	PS1,2
72	37-098-015	Power Supply, Redundancy Module, Din, w/ UNO	Phoenix: 2905489	1	PS-RED1
73	06-058-021	Control Relay, DPDT,120VAC, 8Pin Spade, Operator, 15A	Square D: RPM22F7	2	R1,2
74	38-058-008	Socket, 8 Pin Spade, Din Mount, Screw Term., w/ RPM 2-Pole	Square D: RPZF2	2	R1,2
75	14-543-001	Receptacle, Single, DIN Mount, 15A, w/Cover	Altech: DMRBU BLACKBOX	1	RECP1
76	13-000-A000	Spare Parts Box Assembly, Din Rail Mount	EleMech: 13-000-A000 Assembly	1	SP1
77	39-005-009	Selector Switch, NEMA 4X, 3 Pos. Maintained, 1NO-1NC	Allen-Bradley: 800H-JR2A	4	SS1,3-5
78	39-005-011	Selector Switch, Nema 4X, 3 Pos. Spring Fr. Right, 1NO-1NC	Allen-Bradley: 800H-JR5A	1	SS2
79	02-005-000	Contact Block, 1NO/1NC, w/A-B 800 Series	Allen-Bradley: 800T-XA	1	SS5
80	35-000-000	Pilot Device Mounting Bracket, 1 Device, Sub-Pan Mount	EleMech: GP-1	1	SS5
81	40-030-001	Surge Suppressor, 277/480V Wye, 3 Phase, 200kA, DIN	Mersen: STP480Y07	1	SUR1
82	40-030-002	Surge Suppressor, 1 Pole, 120VAC, 200kA SCCR, DIN	Mersen: STP120P07	1	SUR2
83	33-005-312	MAT-Ethernet Switch, 6 RJ45, Stratix 5700, Managed, Lite	Allen-Bradley: 1783-BMS06TL	1	SW1
84	41-018-A110	Transformer Assembly, 480/240-120VAC, 1.5KVA, 304SS	Cutler-Hammer: S20N11P16PSS Assembly	1	T1
85	42-063-001	Terminal Block, End Plate, Gray, w/WK4/U	Wieland: 07.311.0155.0	5	TB
86	42-063-003	Terminal Block, Single Pole Gray, 30A, 600V, 6MM Wide, WK4/U	Wieland: 57.504.0055.0	97	TB
87	42-063-015	Terminal Block, Jumper, w/WK4/U, 02 pole, Insulated	Wieland: Z7.281.1227	2	TB
88	42-063-000	Terminal Block, Labels, Custom Printed, w/WK4/U	Wieland: 04.242.6353-CUSTOM	260	TB,DB
89	42-063-004	Terminal Block, Ground, 30A, 600V, 6MM Wide, w/WK4/U	Wieland: 57.504.9055.0	14	TB,DB

Item	Component	Description	Manufacturer Part Number	QTY	Device
90	42-063-009	Terminal Block, End Clamp, w/WKN10/U	Wieland: Z5.522.8553	16	TB,DB
91	42-063-008	Terminal Block, Labels, Blank, w/WK4/U-(600 tags per box)	Wieland: Z4.242.6353	22	TB1
92	42-005-027	Terminal Block, Single Pole, 25A, 600V, 5.1MM Wide, 1492J3	Allen-Bradley: 1492-J3	7	TB2
93	42-005-029	Terminal Block, End Plate, Grey, w/1492-J Series	Allen-Bradley: 1492-EBJ3	1	TB2
94	42-005-035	Terminal Block, Labels, Blank, w/1492-J	Allen-Bradley: 1492-M5X5	1	TB2
95	13-012-034	Fuse, Glass, Fast Acting, 250VAC, 1A, 6.3mm	Bussman: AGC-1	9	TB3F
96	42-063-026	Terminal Block, Fused, Single Pole, 15A, 600V, 6.3mm Fuses	Wieland: 57.904.6355.0	9	TB3F
97	18-247-001	Transformer Isolated Barrier, Dual Channel, 120VAC/24VDC	PR Electronics: 5202B2	1	TIB1
98	48-000-039	Mounting Case, UPS Batt, Phoenix Quint, 7.5AH, 2 Batteries	EleMech: 48-000-039	1	UPS1
99	48-098-004	UPS, QUINT, 24VDC, 10A DIN Mtd.	Phoenix: 2320225	1	UPS1
100	48-592-002	UPS, Battery, 12VDC, 7.5Ah, T2 Spade Term	SigmatTek: SP12-7.5 T2	2	UPS1
101	52-000-068	Label, PowerFlex 525, Video QR Code	EleMech: 52-000-068	1	VFD
102	HBR-170-P019	Program, VFD, PowerFlex 525, Standard	EleMech: HBR-170-P019	1	VFD
103	50-005-075	Variable Freq. Drive, Open, 5HP, 480VAC, 3PH, Powerflex 525	Allen-Bradley: 25B-D010N104	1	VFD1
Q-Press Pressure Cone Pneumatic Panel (Standard) (Quantity: 1)					
104	51-000-062	Wire, MTW Type, 600V, 105°C, CSA/UL1015, Tinned Copper	EleMech: 51-000-062	1	
105	94-255-009	Tubing, 3/8"OD, Polyurethane, Blue, 100 Foot Roll	SMC USA: TIUB11BU-33	1	
106	94-255-008	Fitting, Bulkhead, Union, SS, w/ 3/8"OD Tube x 3/8"OD Tube	SMC USA: KQG2E11-00	3	BU1,3,4
107	94-255-042	Fitting, Bulkhead Union Connector 3/8"OD Tubex3/8"NPT 316SS	SMC USA: KQG2E11-N03	1	BU2
108	11-035-129	Sub-Panel, Painted Steel, w/16"Hx14"W Junction Box	Hoffman: A-16P14	1	EN1
109	11-035-176	Enclosure Mounting Feet, Fiberglass, J box	Hoffman: A-50MFKR	1	EN1
110	11-035-338	Enclosure, Nema 4X, Fiberglass, 17.5"Hx14"Wx8.78"D, w/Window	Hoffman: A-18149JFGQRPWR	1	EN1
111	94-255-005	Fitting, Male Connector, Straight, 3/8"OD Tube x 3/8"MNPT	SMC USA: KQ2H11-36AS	2	FIT
112	94-255-006	Fitting, Male Elbow, 3/8"OD Tube x 3/8"MNPT	SMC USA: KQ2L11-36AS	2	FIT
113	94-255-015	Fitting, Male Elbow, Extended, 3/8" OD Tube x 3/8" MNPT	SMC USA: KQ2W11-36AS	1	FIT
114	94-255-020	Fitting, Male Run Tee, 3/8"OD x 3/8" OD x 3/8" NPT	SMC USA: KQ2Y11-36AS	1	FIT
115	94-255-048	Fitting, Male Double Rotating Elbow, 3/8"OD Tube x 1/4"MNPT	SMC USA: KQ2VD11-35AS	1	FIT
116	94-255-049	Fitting, Male Elbow, 3/8"OD Tube x 1/4"MNPT	SMC USA: KQ2L11-35AS	1	FIT
117	94-255-004	Regulator, 0-120PSI, 3/8"NPT, w/ Filter and pressure switch	SMC USA: AW30-NO3BDE3-8Z	1	REG1
118	74-255-004	Solenoid Valve, Muffler, 1/4" NPT Port, 30 dB Reduction	SMC USA: AN20-NO2	1	RV1

Bill of Material

EleMech S.O. HBR9328

Item	Component	Description	Manufacturer Part Number	QTY	Device
119	94-255-016	Relief Valve, 3-Port, Locking Holes, 3/8"NPT	SMC USA: VHS30-N03-Z	1	RV1
120	94-255-017	Relief Valve, Spacer, w/ Bracket	SMC USA: Y300T	1	RV1
121	74-255-006	Solenoid Valve, 2 Pos, Single, (3) 3/8"/(2) 1/4" NPT, 120VAC	SMC USA: VFS3120-3DZ-03T	1	SOV1
122	94-215-004	Fitting, Tube Connector, Straight, 3/8" OD x 10mm OD	McMaster-Carr: 5779K259	2	SPARE
123	42-063-000	Terminal Block, Labels, Custom Printed, w/WK4/U	Wieland: 04.242.6353-CUSTOM	12	TB1
124	42-063-001	Terminal Block, End Plate, Gray, w/WK4/U	Wieland: 07.311.0155.0	1	TB1
125	42-063-003	Terminal Block, Single Pole Gray, 30A, 600V, 6MM Wide, WK4/U	Wieland: 57.504.0055.0	5	TB1
126	42-063-004	Terminal Block, Ground, 30A, 600V, 6MM Wide, w/WK4/U	Wieland: 57.504.9055.0	1	TB1
127	42-063-007	Terminal Block, Din Rail, 35MM Wide, 15 High, 2 Meters Long	iboco: Omega 3 AF	1	TB1
128	42-063-009	Terminal Block, End Clamp, w/WKN10/U	Wieland: Z5.522.8553	2	TB1
Spare Parts / Ship Loose (Total Quantity Provided)					
129	13-012-034	Fuse, Glass, Fast Acting, 250VAC, 1A, 6.3mm	Busman: AGC-1	9	SPARE
130	61-000-012	Labor, Engineering, Submittal, Schematics, BOM	EleMech: 61-000-012	1	ENG

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SECTION 8
TECHNICAL SPECIFICATIONS

SK01F-63S/6 CUS



standard gear units



Gearmotors

Description	Material
Product name	Helical geared motor
Motor Type	CUS
Motor speed	1.050 1/min
Ratio	111,60
Output speed	9,400 1/min
Service factor	1,00
Output Torque M2 (Nm)	91,30
Power (kW)	0,090
Voltage (V)	265/460
Frequency (Hz)	60
Mode of operation	S1
Type of enclosure	IP66
Insulation Class	F
Nominal current 1 (AMP)	0,80
Nominal current 2 (AMP)	0,46
Cosinus 1	0,62
Environmental temp. motor	40°C
Mounting pos. of the gearbox	M4
Tilted mounting position	M6-45-M1
second tilted mounting pos.	M4-60-M1
Type of housing	Flange B5
Shaft dimension	17X30
Part no. special output shaft	000000000050134940
Flange diameter (mm)	120
Breather	Spring-loaded breather
Type of motor connection	Star; High Voltage
Position of terminal box	2/I
Lubricant type	ISO VG 220 mineral oil
class oil	CLP 220
Colour	RAL 5015 Sky blue
Paint type	Standard paint
Painting instruction Old	Paint coat 3.2 standard
Extra work Old	Sealing
Nameplate/Terminalbox	GNP+MNP+TB Std (VA)
CE Logo	Yes
CCC Logo	No
Weight	approx. 13 KG /PC

Motor Data Sheet

3 phase motor			Motor type: 63S/6 CUS		
Electrical data:			Order data:		
Frequency (f):	60	Hz	Order No.:	101588725-100	
Output (P):	0,09	kW	Customer reference No.:		
Speed (n):	1050	1/min	Serial No.:		
Connection of stator:	D/Y		Motor No.:		
Voltage (V):	265/460	V	Stator No.:	11042670	
Current (I):	0,80/0,46	A	General data:		
Voltage range (U _{WB}):			Direction of rotation:	CW/CCW	
Wide range current (I _{WB}):			Design:	Motoranb. WN Pos 958	
Starting current/Current (I _s /I):	1,80		Duty:	S1	
Rated motor torque (M _N):	0,82	Nm	Type bearing:		
Starting motor torque (M _A):	2 (2,44)*		Housing material:	Aluminium	
Minimum motor torque (M _S):	1,90 (2,32)*		Insulation class:	F	
Breakdown motor torque (M _K):	2 (2,44)*		Type of protection:	IP 66	
cos phi:	0,62	Last	Cable entry:	2 I	
Eta(%):	39,90	100%	Moment of inertia:	0,00028	kgm ²
Eta(%):	75%		Maximum altitude of site:	1.000	m
Eta(%):	50%		Ambient temperature:	-20°C	to +40°C
Service Faktor:	1,15		Fan Type:	Standard IC 411	
Code letter:	F				
Tested data:					
Connection of stator:	D/Y		Classification authorities:		
Voltage (V):	265/460	V	 		
No load current (I ₀):	0,64/0,37	A	NEMA (ELECTRICAL)		
No load output (P ₀):	0,094	kW			
Noise level (L _{pA}):					
Resistance stator winding at 20°C (R): 89 U1-U2	Ohm				
Temperature rise (T):					
(at the stator resistance method)					
Insulation resistance (R _{isol}):	100	Mega Ohm			
Winding test:	2352	V/4 sek.			
Class of vibration:					

Motor Performance curve



Stator: 11042670

Mn= 0,8 Nm

In= 0,46 A
Io= 0,45 A

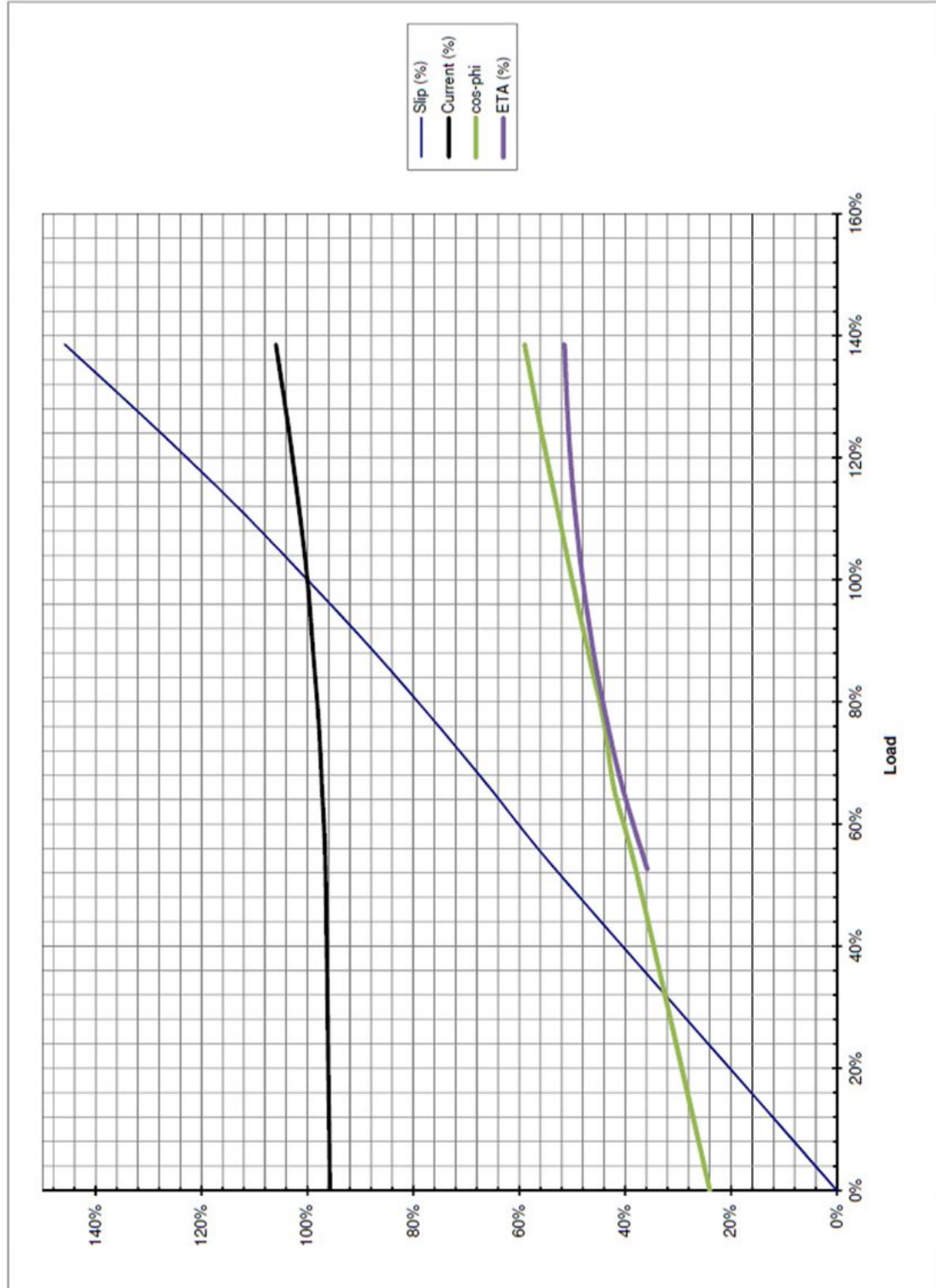
n= 1050 1/min
f= 60 Hz

Voltage: 460 V

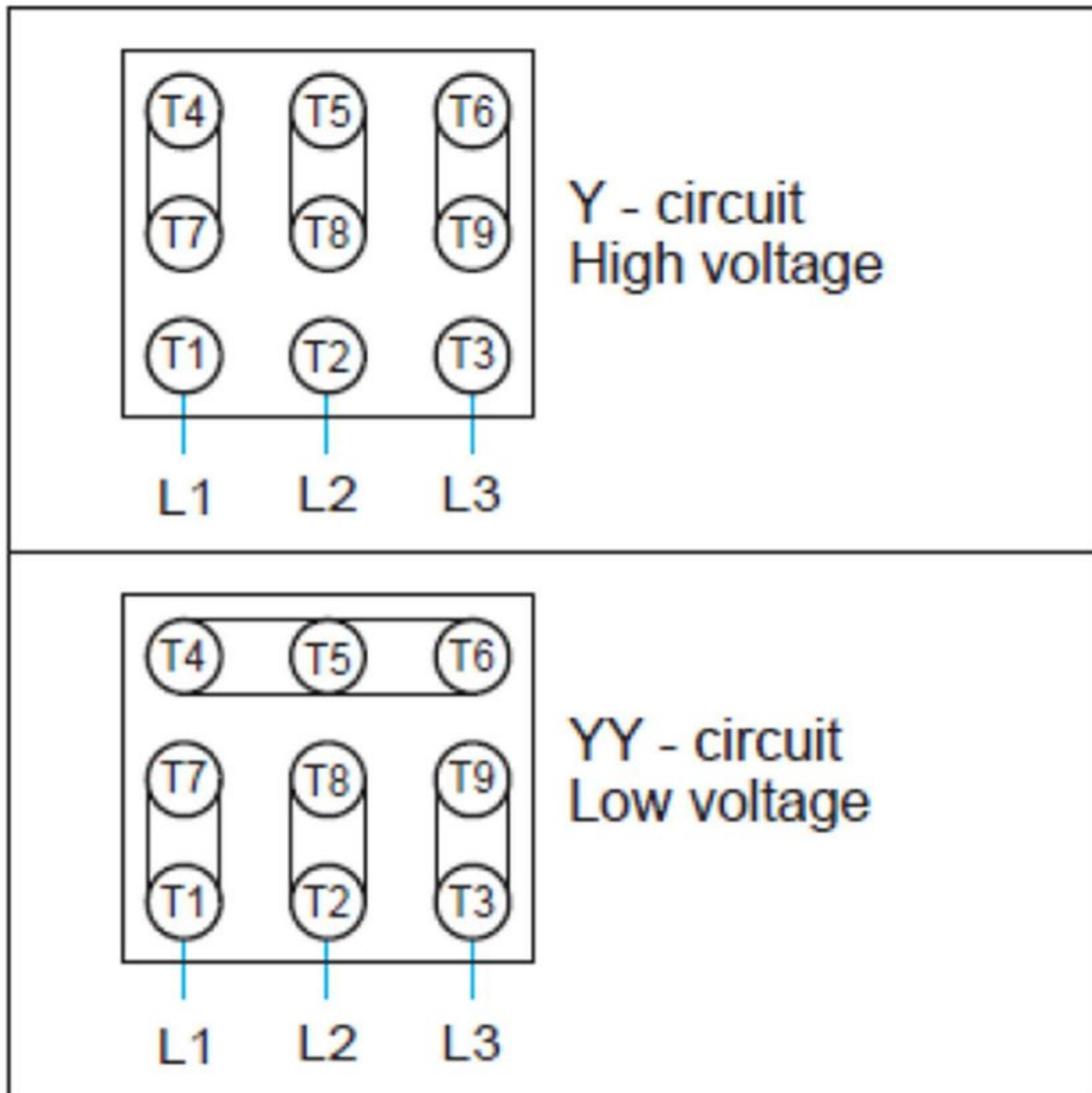
Power: 0,09 kW

Duty: S1

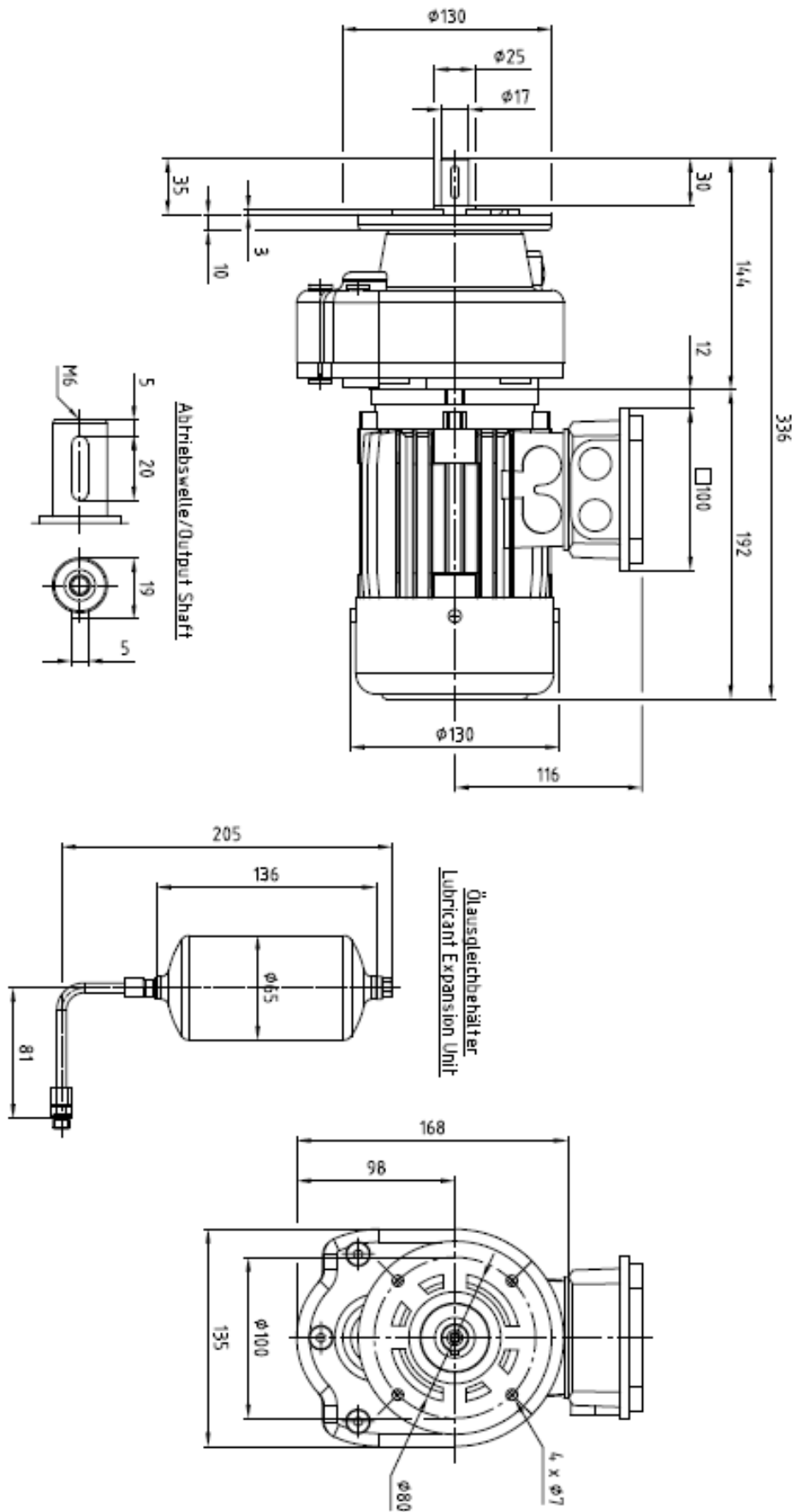
Load curves 63S/6 CUS



Motor Connection Diagrams







Drawing



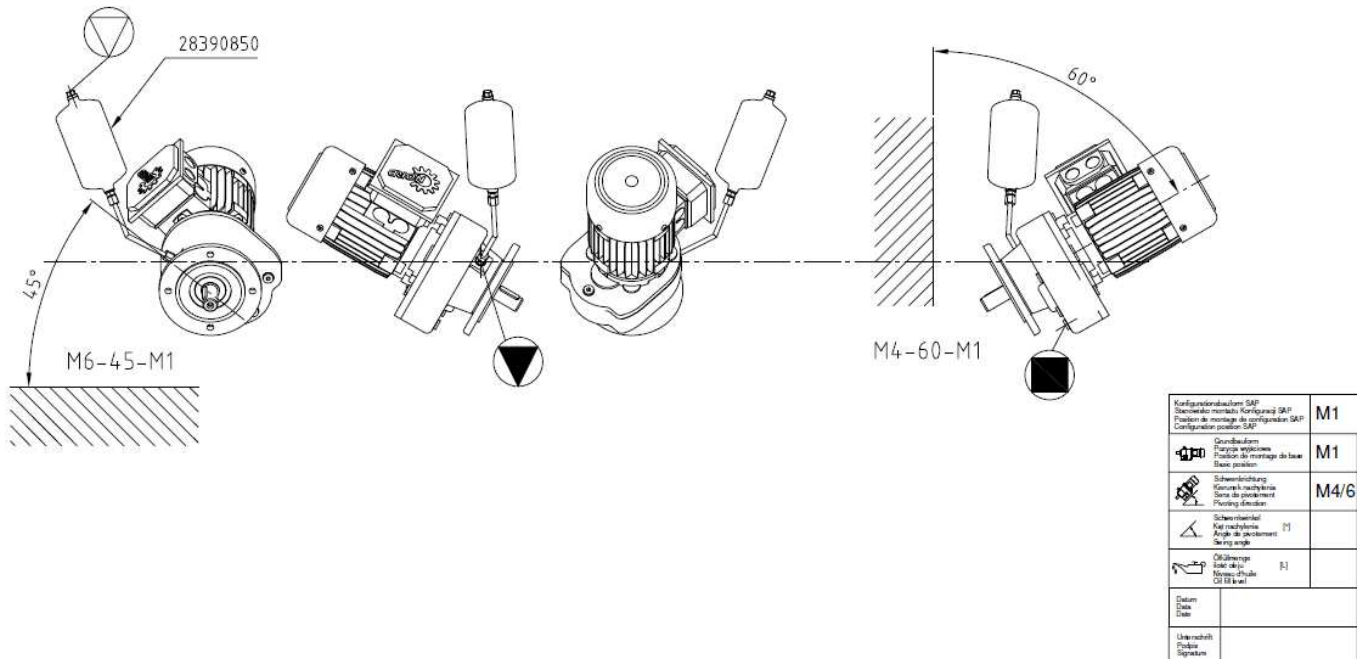
Lubricant table

This table shows comparable lubricants from various manufacturers. The manufacturer can be changed within a particular viscosity or lubricant type. Getriebebau NORD must be contacted in case of change of viscosity or lubricant type, as otherwise no warranty for the functionality of our gearboxes can be accepted.




Lubricant type	Details on type plate	DIN (ISO) / Ambient temperature					
Mineral oil	CLP 680	ISO VG 680 0...40 °C	Alpha EP 680 Alpha SP 680 Optgear BM 680 Tribol 1100 / 680	Renolin CLP 680 Renolin CLP 680 Plus	Klüberoil GEM 1-680 N	Mobilgear 600 XP 680	Omala S2 G 680
	CLP 220	ISO VG 220 -10...40 °C	Alpha EP 220 Alpha SP 220 Optgear BM 220 Tribol 1100 / 220	Renolin CLP 220 Renolin CLP 220 Plus Renolin Gear 220 VCI	Klüberoil GEM 1-220 N	Mobilgear 600 XP 220	Omala S2 G 220

Lubrication quantity in L: tbd

Symbols for oil screw plugs in the mounting positions



Attention: The OA has a 45 ° bend, insert as manufacturing note

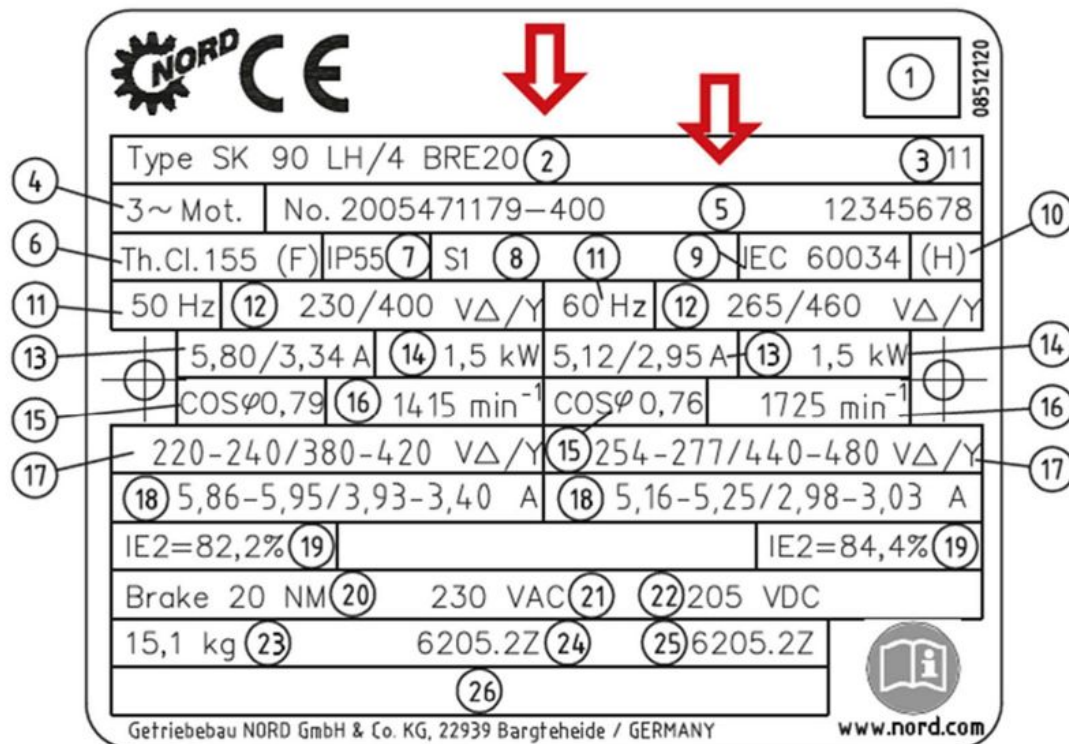
-  Entlüftung / Vent
-  Ölstand / Oil Level
-  Ölablass / Oil Drain

Explanation of the rating plate

Erläuterung des Typenschildes

Explanation of the rating plate

Explication de la plaque signalétique



DE

- 1 Matrix – Barcode
- 2 NORD - Motortyp
- 3 Herstellungsjahr
- 4 Phasenzahl
- 5 Fabrikationsnummer
- 6 Wärmeklasse
- 7 Schutzart
- 8 Betriebsart
- 9 Norm
- 10 Halbkeilwuchtung
- 11 Frequenz
- 12 Motorspannung
- 13 Nennstrom
- 14 Nennleistung
- 15 Leistungsfaktor
- 16 Nenn Drehzahl
- 17 Motorspannung - Weitbereich
- 18 Nennstrom - Weitbereich
- 19 Wirkungsgrad
- 20 Bremsmoment
- 21 Anschlußspannung Bremse
- 22 Bremsenspannung
- 23 Gewicht
- 24 Lagerung A-Seite
- 25 Lagerung B-Seite
- 26 Kundenzeile

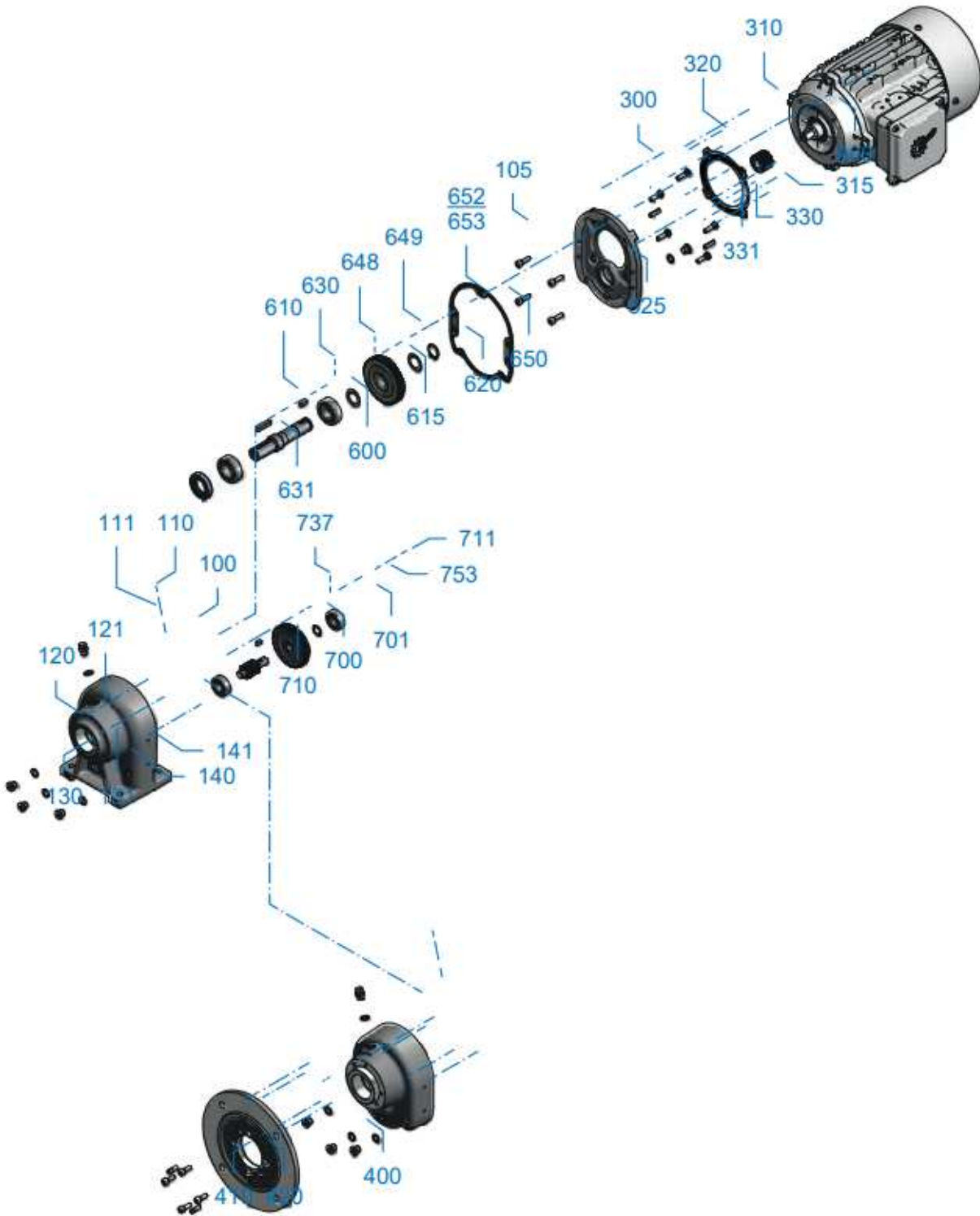
EN

- 1 Matrix – Barcode
- 2 NORD - Motor type
- 3 Year of manufacture
- 4 Number of phases
- 5 Serial number
- 6 Heat class
- 7 Protection class
- 8 Operating mode
- 9 Standard
- 10 Half key balancing
- 11 Frequency
- 12 Motor voltage
- 13 Nominal current
- 14 Nominal power
- 15 Power factor
- 16 Nominal speed
- 17 Motor voltage - wide range
- 18 Nominal current - wide range
- 19 Efficiency
- 20 Braking torque
- 21 Brake connection voltage
- 22 Braking voltage
- 23 Weight
- 24 A side bearing
- 25 B side bearing
- 26 Customer line

FR

- 1 Code matriciel, à barres
- 2 Type de moteur NORD
- 3 Année de fabrication
- 4 Nombre de phases
- 5 Numéro de série
- 6 Classe thermique
- 7 Type de protection
- 8 Type de fonctionnement
- 9 Norme
- 10 Équilibrage dynamique avec une demi-clavette
- 11 Fréquence
- 12 Tension du moteur
- 13 Intensité nominale
- 14 Puissance nominale
- 15 Facteur de puissance
- 16 Vitesse nominale
- 17 Tension du moteur – plage étendue
- 18 Intensité nominale - plage étendue
- 19 Rendement
- 20 Couple de freinage
- 21 Tension de raccordement du frein
- 22 Tension de freinage
- 23 Poids
- 24 Palier côté A
- 25 Palier côté B
- 26 Ligne réservée au client

Part list



Part list

DE	EN	FR			
100	Gehäuse	100	Housing	100	Carter
105	Dichtung	105	Seal	105	Joints d'étanchéité
110	Schraube	110	Screw	110	Vis
111	Dichtung	111	Seal	111	Joints d'étanchéité
120	Schraube	120	Screw	120	Vis
121	Dichtung	121	Seal	121	Joints d'étanchéité
130	Schraube	130	Screw	130	Vis
131	Dichtung	131	Seal	131	Joints d'étanchéité
140	Schraube	140	Screw	140	Vis
141	Dichtung	141	Seal	141	Joints d'étanchéité
300	Getriebedeckel	300	Gear unit cover	300	Couvercle du réducteur
310	Dichtung	310	Seal	310	Joints d'étanchéité
315	Stift	315	Pin	315	Goupille
320	Schraube	320	Screw	320	Vis
325	Schraube	325	Screw	325	Vis
330	Schraube	330	Screw	330	Vis
331	Dichtung	331	Seal	331	Joints d'étanchéité
400	Flansch	400	Flange	400	Bride
410	Schraube	410	Screw	410	Vis
420	Stift	420	Pin	420	Goupille
600	Abtriebswelle	600	Output shaft	600	Arbre de sortie
610	Wälzlager	610	Roller bearing	610	Palier à roulement
615	Wälzlager	615	Roller bearing	615	Palier à roulement
620	Abtriebsrad	620	Output gear	620	Roue de sortie
630	Passfeder	630	Parallel key	630	Clavette
631	Wellendichtring	631	Shaft sealing ring	631	Bague d'étanchéité de l'arbre
648	Passfeder	648	Parallel key	648	Clavette
649	Passscheibe	649	Shim	649	Rondelle d'ajustage
650	Sicherungsring	650	Circlip	650	Circlip
652	Passscheibe	652	Shim	652	Rondelle d'ajustage
653	Passscheibe	653	Shim	653	Rondelle d'ajustage
700	Ritzelwelle	700	Pinion shaft	700	Arbre de pignon
701	Antriebsrad	701	Drive gear	701	Roue d'entrée
710	Wälzlager	710	Roller bearing	710	Palier à roulement
711	Wälzlager	711	Roller bearing	711	Palier à roulement
737	Passfeder	737	Parallel key	737	Clavette
753	Passscheibe	753	Shim	753	Rondelle d'ajustage
900	Antriebsritzel	900	Drive pinion	900	Pignon d'entrée

Certificate

CERTIFICATE OF COMPLIANCE

Certificate Number 20170217-E191510
Report Reference E191510-19981208
Issue Date 2017-FEBRUARY-16

Issued to: NORD MOTORIDUTTORI SRL
VIA NEWTON 22
40017 S GIOVANNI PERSICETO BO ITALY

This is to certify that representative samples of MOTORS
SEE ADDENDUM PAGE.

Have been investigated by UL in accordance with the Standard(s) indicated on this Certificate.

Standard(s) for Safety: UL 1004-1, CSA C22.2 No. 100-14 - Rotating Electrical Machines – General Requirements

Additional Information: See the UL Online Certifications Directory at www.ul.com/database for additional information

Only those products bearing the UL Certification Mark should be considered as being covered by UL's Certification and Follow-Up Service.

Look for the UL Certification Mark on the product.



Bruce Mahrenholz, Director North American Certification Program
UL LLC

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Certificate

CERTIFICATE OF COMPLIANCE

Certificate Number	20170217-E191510
Report Reference	E191510-19981208
Issue Date	2017-FEBRUARY-16

This is to certify that representative samples of the product as specified on this certificate were tested according to the current UL requirements.

Model CUS series three phase motors. 2 or 3 digit prefix numbers indicating frame size followed by 1 or 2 letter indicating stator size followed by "r" plus numbers indicating speed(s). Letters and numbers follow model designation to indicate options and nominal power. Frames 63 to 250.

Model HM & HMT series three phase motors. 2 or 3 digit prefix numbers indicating frame size followed by 1 or 2 letter indicating stator size followed by "r" plus numbers indicating speed(s). Letters and numbers follow model designation to indicate options and nominal power. Frames 80 to 100.



Bruce Mahrenholz, Director North American Certification Program
UL LLC

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Corona, CA 92882

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SERVICE

There are 3 North Service Centers in Central America. The right contact person can be found on our website www.nord.com you will also find your contact person for North and South America there.

article number Huber (IFS)	51508372
Manufacturer	STM/Nord
Article number Manufacturer	
Gear motor type	Flach/parallel shaft
Gear type	EX2804 HD / 100B5 (51047837)
Motor type	100T2/4 TF UL/CSA (51508374)
Motor technology	PM
Power P2	0-3,0
Rotation speed n2 <rpm>	0-1,1
Torque M2	0-26986
Service factor_max.	
Voltage	380-500
max. continuous torque (override)	21
max. continuous current (override)	8,3 Y
Effizienzclass IEC	IE4
Nominal torque with effizienzclass; M2	26986
max. nominal current with effizienzclass	5,4
Explosion protection	No
Explosion protection marking	
temperature rise time tE	
Protection grade	66
Operation mode	S1
Heat/insulation class	F (155°C)
Thermal motor protection	yes / ja
Gear ratio (reduction)	2035,8
Ventilation	Yes
Brake	No
Voltage Brake <V>	
Colour/paint	5015
Paint type/corrosion protection	others
Flange type	others

Bolt circle	d370 15x bo17
Hollow shaft with key	
Lubricant quantity	10,3
Lubricant class/type	others
Special design	Yes
voltage heating <V>	
According to offer	18010289 STM / 101572144 Nord
Supplier's item no.	2230053351 STM
Total weight (incl. oil filling)	270
Delivered wiring	Y
Wiring	Y
Motor rated power <kW>	3,0
Nominal voltage <V>	385
Nominal frequency <Hz>	70
Nominal current <A>	5,4
Rated speed <rpm>	2100
Rated torque <Nm>	13,6
Stator resistance Rstr <Ohm>	
Danfoss stator resistance RS <Ohm>	1,33
Number of motor poles	4
Longitudinal inductance D-axis Ld <mH>	22,6
Transverse inductance Q-axis Lq <mH>	45,9
Voltage constant ke <V/1000rpm>	161
(Back EMF at 1000RPM)	
Torque constant kt <Nm/A>	2,6
Peak current I _{max} 10 sec <A>	16,5
peak torque	41
Motor efficiency <%>	91,4
cos phi	0,92
Frequency 1	5
Power with frequency 1	0,21
Current with frequency 1	5,26
Speed with frequency 1	150

Torque with frequency 1	13,3
Frequency 2	16,66
Power with frequency 2	0,71
Currency with frequency 2	5,4
Speed with frequency 2	500
Torque with frequency 2	13,6
Frequency 3	33,33
Power with frequency 3	1,42
Currency with frequency 3	5,4
Speed with frequency 3	1000
Torque with frequency 3	13,6
Nominal Frequency	50
Power with nominal frequency	2,2
Currency with nominal frequency	5,4
Speed with nominal frequency	1500
Torque with nominal frequency	13,6
Max Frequency	70
Power with max frequency	3,0
Currency with max frequency	5,4
Speed with max frequency	2100
Design	M1 12° geneigt (Welle oben)
Terminal box position / cable entry	3/1
Torque with max frequency	13,6
Title	
Motor Status	Standard
Motor Successor	
Checked by ATT	No
Checked by OPT	Yes

Content Type: Motor

Version: 8.0

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APPENDIX A-J

See submittal package for Appendix A through Appendix J folders.

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