

Basis of Design

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A. Mechanical

1. Code Requirements

a. Mechanical systems will be designed in accordance with all applicable Codes, Standards and authorities having jurisdiction, the Underwriter's Laboratory and in accordance with current engineering practices.

- 2018 International Building Code
- 2018 International Building Code
- 2020 Idaho Energy Conservation Code
- 2018 International Mechanical Code
- 2018 International Plumbing Code
- 2018 International Fire Code
- 2018 International Fuel Gas Code
- 2018 ASHRAE Standard 90.1
- National Fire Protection Association Applicable Codes and Local Amendments
- Underwriters Laboratories (UL)

b. Electrical energy for the building's HVAC systems will be purchased from Idaho Power. Natural gas for the building's HVAC system will be purchased from Intermountain.

2. Design Criteria

a. Outdoor Air Design Conditions

1) Summer Cooling: 90°F DB, 62°F WB

a) Peak monthly cooling temperature of 98°F utilized to size maximum cooling load capacity.

2) Winter Heating: -10°F

b. Indoor Air Design Conditions

1) Summer Cooling: maximum of 72°F

2) Winter Heating: minimum of 68°F

- 3) Storage/Utility: 86°F/68°F ± 3°F (no cooling)
3. Building Envelope Criteria
 - a. Glazing: minimum requirements per the 2020 Idaho Energy Conservation Code
 - 1) Glazing assembly U-value: 0.38 Btu/h-ft²-°F
 - 2) Glazing Solar Heat Gain Coefficient (SHGC): 0.38
 - b. Opaque Elements: Minimum requirements per the 2020 Idaho Energy Conservation Code
 - 1) Exterior Wall:
 - Wood Framed: R-13 batt + R-3.8 continuous insulation (ci)
 - 2) Roof:
 - R-30 ci entirely above deck
 - 3) Floor:
 - Cement Slab: R-15
 - 4) Slab F-factor: 0.54.
 - c. Infiltration: AHRAE 90.1 2018
 - 0.4 cfm/sf of wall area
 4. Internal Heat Gains
 - a. Occupancy:
 - 1) Office: 140 sf/p
 - 2) Kitchen: 50sf/p
 - 3) Retail: 33 sf/p
 - b. Lighting:
 - 1) 0.58 W/sf
 - c. Equipment:
 - 1) Office: 2 W/sf
 - 2) Kitchen: 2.5 W/sf
 - 3) Retail: 0.5 W/sf
 - d. Default occupancy counts will only be used in the absence of furniture layouts. Default

equipment loads will only be used in the absence of equipment data from applicable sub-consultants.

5. Ventilation Criteria

- a. Spaces will be designed to meet ASHRAE 62.1.2018
- b. Minimum office ventilation: 5 cfm per person
- c. Minimum ventilation in Children’s Museum spaces: 7.5 cfm per person
- d. All other occupied spaces are assumed to be designed to meet ASHRAE 62.1 + 30%.
- e. Operable windows are assumed to be provided in offices.

6. Air-side Sizing Criteria

- a. The following criteria are used to size air-side system components unless otherwise indicated. Velocities are shown in feet per minute (FPM)
- b. Duct Sizing Criteria will be based on the following:

Max Pressure Drop (in. w.g.) / 100 ft	Duct Location	NC	Maximum Velocity (fpm)	
			Rectangular Duct	Round Duct
Med. Pressure: 0.20	In Shaft or Above Drywall Ceiling	50	3200	4800
		45	2800	4200
		40	2400	3600
		35	2000	3000
		30	1600	2400
Low Pressure: 0.10	Above Lay-In Tile (ACT) Ceiling	50	2000	3200
		45	1600	2800
		40	1400	2400
		35	1200	2000
		30	1000	1600
Return/Exh: 0.10	Exposed Duct	50	975	1300
		45	900	1200
		40	825	1100
		35	750	1000
		30	625	900



7. Air Register Sizing Criteria

NC Rating of Space	Maximum Airflow Speed (fpm)	
	Supply Air Outlets	Return Air Openings
25	350	450
30	425	500
35	500	600
40	560	675
45	625	750
50	700	830

a. Intake Louvers

- 1) Maximum Velocity: 500 FPM (net free area)
- 2) Maximum Pressure Drop: 0.1 in w.g.

b. Exhaust Louvers

- 1) Maximum Velocity: 800 FPM (net free area)
- 2) Maximum Pressure Drop: 0.15 in w.g.

8. Air Pressure Relationships

a. Systems will be designed to maintain the following air pressure relationships in spaces:

- 1) Children's Museum Spaces: Positive pressure compared to the outdoors
- 2) Typical Office Spaces: Positive pressure compared to the outdoors
- 3) Restrooms: Negative to adjacent spaces
- 4) Kitchen/Servery: Negative to adjacent space
- 5) Warehouse: Negative to adjacent spaces

C. HVAC System

1. Space Heating and Cooling:
 - a. Rooftop Mechanical Units (RTUs)
 - 1) Dual fuel packaged rooftop mechanical units (RTUs) will be provided to serve the entire Children's Museum.
 - a) Units will be installed on the roof per provided mechanical layouts.
 - b) The heat pump portion of the RTU operates efficiently as both an air conditioner and a heater. In the summer, the heat pump cools, pulling the heat from the inside air and releasing the extracted heat outdoors. In the winter, the heat pump captures the heat present in the outdoor air and transfers it indoors.
 - c) A gas furnace element in the RTU will provide additional heating capacity for colder weather.
 - d) The RTUs will be mounted on isolation springs and connected to supply air ductwork and low pressure combined return/exhaust air ductwork.
 - e) A low ambient control will be provided to enable cooling operation of interior spaces in winter.
 - 2) Ventilation will be provided to each space as necessary via the packaged RTUs.
 - a) The units will provide a set minimum amount of air defined by ASHRAE 62.1.
 - b) RTUs will be equipped with economizers to modulate up to 100% outdoor air (i.e., no return recirculation) when ambient conditions allow using enthalpy control.
 - c) Ventilation to all spaces shall be maintained during occupied hours through RTU fan and OA damper operation.
 - d) The RTUs will incorporate a minimum of MERV13 filters to reduce the amount of particulate matter and biological contaminants supplied to the building.
 - b. Spaces with specific heating and cooling requirements are:
 - 1) Restrooms: Dedicated exhaust fans will directly ventilate restrooms. Exhaust ductwork

shall be routed to restrooms, and provide the code required ventilation. Restrooms at the building exterior or upper level will include small in-wall electric heaters, size limited by energy code. A small amount of cooled air will be provided directly to restrooms from RTU's serving adjacent zones, with additional exhaust air make-up coming via transfer air.

- 2) Janitor Closet and Storage Rooms: Spaces required by the International Mechanical Code and ASHRAE 62.1 to have ventilation air shall be ventilated directly by dedicated exhaust fans. A portion of the exhaust DOAS ductwork shall be routed to these rooms, and provide the code required ventilation. Storage rooms and janitor closets shall include small in-wall electric heaters, size limited by energy code. No cooling to be provided to these rooms.
 - 3) IT Room: A dedicated wall-mounted ductless fan coil "cassette" will be provided for 24/7 conditioning of the IT room. This unit will deliver cooling, as controlled by a wall thermostat. The outdoor "mini-split" condensing unit will have low ambient control for cooling year round.
2. Kitchen Ventilation:
- a. Kitchen exhaust is to be provided for a Type I grease hood, assumed to span approximately six feet. The hood will exhaust to the outdoors via one roof mounted exhaust fan located on the southwest corner of the roof. Type I hood shall be sized to no less than 400 cfm per lineal foot of cooking surface.
 - b. An exhaust fan for a Type II hood shall be provided if the project includes a commercial dishwasher. Sizing of fan serving a Type II hood shall be sized to no less than 200 cfm/ft.
 - c. Make up air will be provided to the hood with a dedicated make-up air unit (MAU). The MAU will bring in outside air from a louver on the southern exterior wall of the building above the kitchen. Outside air provided by the MAU will be conditioned using a natural gas burner for heat and a DX coil for cooling.

D. Plumbing

1. General

- a. Plumbing system will be designed in accordance with all applicable Codes, Standards and Authorities having jurisdiction, the Underwriter's Laboratory and in accordance with current engineering practices.
- b. The following codes are applicable:
 - 2018 International Building Code
 - 2018 International Mechanical Code
 - 2018 International Fuel Gas Code
 - 2018 International Plumbing Code
 - 2020 Idaho Energy Conservation Code

2. Water Supply

a. Overview:

- 1) Water will be supplied from a water main in the street.
- 2) Water metering shall be as required by code.
- 3) The Children's Museum will be served by a water lateral from the point of connection.
- 4) If needed, water pressure will be reduced to less than 80 PSI as required by code.
- 5) All equipment, i.e. water heaters, pressure reducers, etc. shall be NSF certified for domestic water use.

3. Domestic Hot and Cold Water

- a. Domestic hot water will be supplied from a natural gas hot water heater with integral storage tank. As a means of mitigating waterborne illness, hot water will be stored and distributed at 140 °F. A thermostatic mixing valve shall be provided downstream of the storage tank to supply the building with the necessary hot water temperature.
- b. Domestic hot water distribution system will be recirculating type with aquastat control.

- c. All pipes, valves, solder, and fittings will comply with lead free requirements. Domestic Type L copper with wrought copper fittings.
 - d. A pressure-reduced valve manifold will be provided if required.
 - e. Hose bibbs will be provided at the building exterior and within mechanical rooms.
4. Sanitary Sewer and Waste System
- a. A new sewer line will be provided. Actual tie-in location to be coordinated with Civil Engineers.
 - b. Sizing to be determined for building drain.
 - c. Floor drains will be provided as required by code and Owner requirements.
 - d. Floor/wall cleanouts will be placed per code.
 - e. Sanitary waste and vent piping will be cast iron no-hub. Grease waste piping will be stainless steel.
 - f. Grease waste from the kitchen will be routed to a grease interceptor located in the parking lot outside of the building envelope. This location will allow for easy access for grease interceptor maintenance and pumping. Grease interceptor lids will be rated to bare the weight of vehicular traffic.
5. Plumbing Fixtures
- a. Plumbing fixtures will be of the low water demand type.
 - b. 1.28 GPF sensor-operated water closets will be provided in all restrooms per applicable code. Flush-valve toilets will have a Maximum Performance (MaP) test score of 800 or greater. All water closets will be ADA compliant height.
 - c. Lavatory faucets will have sensor-operated faucets with 0.5 gpm aerators.
 - d. Faucets and flush valves will be battery powered sensor operated.
 - e. All sinks will have WaterSaver deck mounted faucets with wrist blade handles.
 - f. All sink faucets will be provided with an anti-siphon vacuum breaker.
 - g. Kitchen fixtures shall be coordinated with kitchen consultant and architect

6. Condensate Piping

- a. Condensate waste from mechanical cooling equipment will discharge as an indirect waste in compliance with IPC. Condensate piping will be sized per mechanical code or per manufacturer requirements and sloped at $\frac{1}{8}$ " per foot. Condensate pumps will be provided where mechanical equipment is too low for piping to reach discharge point by gravity feed.

7. Underground Sanitary, Vent Piping

- a. Where required, underground sanitary and vent piping to be wrapped with polyethylene wrap to protect against contaminated soil.
- b. Piping Material: no-hub cast iron ASTM 888 or CISPI 301, heavyweight couplings.

F. Fire/Life Safety Systems

1. FIRE ALARM

a. General

- 1) The building will have a Fire Alarm system consisting of a local main fire alarm panel reporting back to a central alarm monitoring location to be determined by the Owner. It is assumed this will be a fully sprinklered building. The Fire Alarm system will be based on EST Fire Alarm Systems.
- 2) Initiation devices will consist of smoke detectors in corridors, electric rooms, data rooms, and other sensitive areas where smoke detection warnings would be beneficial to the staff and/or as required by the Fire Marshal.
- 3) Manual pull stations will be provided at staff only accessible areas.
- 4) Duct Smoke Detectors will be provided where required.
- 5) Heat Detectors will be provided in specific areas where having a high heat alarm signal before the sprinkler heads activate is advantageous, such as cooking and workshop areas.
- 6) The sprinkler system will be fully monitored through the fire alarm system.
- 7) Alarm notification will be provided using fire alarm horns and ADA compliant visual strobes.
- 8) Offsite monitoring will be accomplished using AES Intellinet Systems or cellular communications.

2. FIRE PROTECTION

a. General

- 1) The fire protection system will be designed in accordance with all applicable Codes, Standards and authorities having jurisdiction, local ordinances, and sound engineering practices.
- 2) The following Codes are applicable:
 - 2018 International Fire Code (IFC)

b. Design

- 1) Design, calculations, and system approvals for the fire protection system are the responsibility of the Fire Protection Contractor. Buildings are to be fully sprinklered in accordance with the above. An approved complete building fire protection system is to be provided. Coordinate with architect for riser and equipment locations.
- 2) Sprinkler head spacing shall be as required by IFC, except as follows:
 - a) In all locations, sprinkler heads shall be equidistant between lights, between wall and lights, between lights and air diffusers, and between wall, lights, and air diffusers.
 - b) Provide uniform and repetitive patterns for each room.
 - c) Center sprinkler heads on joints in acoustic tile or center in tiles in order to conform to the above.
 - d) Fire Protection Contractor should obtain approval from the Architect for the sprinkler head layout and coordinate with other trades as necessary.
- 3) Wet-Pipe Sprinkler System
 - a) The hydraulically designed sprinkler system shall be provided with a minimum 10 percent safety margin.
 - b) The actual fire sprinkler system provided is subject to the Fire Marshal's approval.
 - c) Sprinkler piping and head locations shall be coordinated with the Architect prior to submittal to the Fire Marshal for review and approval.
 - d) Each floor shall be provided with its own sprinkler zone control valve, flow switch and drain valve.
- 4) Sprinkler Occupancy Hazard Classifications according to IFC recommendations.

c. Water Supply

- 1) A post indicator valve shall be located on the side of the building. The system/piping is to connect to fire system.

- 2) All hydraulic calculations shall be based upon:
 - a) Minimum available water flow and pressure available onsite.
 - b) Static pressure, flow and residual pressure used to calculate the system shall be indicated on the plans.
 - c) The available static pressure, residual pressure and flow are to be determined by Fire Protection Contractor.
 - d) Fire Protection Contractor shall obtain current water flow and pressure data from a reliable source such as the Fire Department or water purveyor.
 - e) No test older than 6 months should be used.
- d. Seismic Criteria
 - 1) Seismic support of fire protection systems shall adhere to all relevant provisions of the latest version of the applicable Codes. Seismic calculations for support are to be reviewed by a licensed structural engineer.
 - 2) An acoustic consultant will provide recommendations for any vibration isolation or acoustic treatment of the fire protection systems.
- e. Training
 - 1) Fire Protection Contractor will provide training to personnel on the operation and maintenance and operation requirements for the system. Contractor shall provide a current copy of NFPA 25 to the building maintenance staff.

H. Electrical

1. General

- a. The Children's Museum of Magic Valley will be an approximately 18,000 square foot, two story museum geared toward children from birth to eleven years old. Founded in mid-2018 as a 501(c)3 non-profit organization, their mission is to engage children of all ages and abilities in learning through imaginative play and discovery. The property is located at Idaho Street South and 3rd Avenue South.

2. Electrical Scope

- a. The electrical systems for this building will provide lighting, power displays, create a comfortable environment and provide miscellaneous receptacle power to enhance the learning environment provided by this museum.

3. Electrical Service

- a. Incoming electrical service will be served from an on-site Idaho Power Company transformer located near the alley off of Idaho Street South, on CMMV property.
- b. From the transformer, underground feeders will bring 277/480 volt, 3 phase, 4 wire service to a 1200A Main Switchboard (MSB) in the building.
- c. From MSB, normal power will be distributed throughout the building using sub-panels for lighting, power and mechanical equipment and from these panels branch circuits will supply power to all electrical fixtures and devices.
- d. A power company meter will be mounted on the building. Each panel will be separately metered, include surge suppression and be of door-in-door construction.

4. Emergency Power

- a. Emergency egress and exit lighting will be served from a central lighting inverter to allow for ease of maintenance and testing. The Fire Alarm panel will be battery backed as allowed by NFPA 72.
- b. An emergency generator is not provided for the building.

5. Power Distribution

- a. All receptacles on the project will be tamper-resistant receptacles. Where requested or required by Owner preference, locking covers or switched receptacles will be provided in publicly accessible areas.
- b. Common Areas will be provided receptacles as determined by Owner preference and programming for the area.
- c. The kitchen will be provided an electrical panel for kitchen loads and electrical devices as required for the space.
- d. Offices will be provided two receptacles per office.
- e. Conference and Meeting rooms will be provided receptacles as determined by Owner preference and programming for the area. These areas will be provided floor outlets when required by NEC.
- f. Exterior building areas will be provided weatherproof, locking GFI receptacles on approximately 100' centers.

I. Lighting

1. Interior Lighting

- a. LED light sources will be provided for all lighting fixtures using a mixture of recessed and surface mount, wall and ceiling located, and linear and round fixtures as best selected for the purpose and location. Lighting will be designed to be complimentary to the museum exhibits as much as is practical and will be located away from children's reach.
- b. Typical Lighting Levels for interior spaces will be:
 - 1) Vestibule, Reception, Orientation – 20 foot-candles.
 - 2) General Retail – 50 foot-candles general and Displays about 3 times more than ambient.
 - 3) Exhibits – 30 foot-candles general ambient lighting for cleaning and setup dimmable down to Off depending on museum exhibit and specialty task lighting needs.
 - 4) Restrooms – 5 foot-candles general and 15 foot-candles at vanities.
 - 5) Storage – 10 foot-candles.
 - 6) Kitchen - 50 foot-candles general to 100 foot-candles for tasks.
 - 7) Break Room – 30 foot-candles.
 - 8) Work Room – 30 foot-candles.
 - 9) Conference Room – 30 foot-candles general and 50 foot-candles over table.
 - 10) Office - 30 foot-candles general with 50 foot-candles task.
 - 11) Classroom - 30 foot-candles general to 100 foot-candles task.
 - 12) Corridor – 10 foot-candles.
 - 13) Mechanical/Electrical Room – 20 foot-candles with facility for portable task lighting.

2. Exterior Lighting

- a. Exterior lighting LED fixtures will be a mix of pedestrian-oriented poles, bollards, and wall sconce fixtures dependent on Owner preference and programming for the area. There is no parking area lighting anticipated for the site.
- b. Typical Lighting Levels for exterior spaces will be:
 - 1) Building Entrance – 5 foot-candles.
 - 2) Security at Building Perimeter – 1 foot-candle with motion sensing to increase light level on demand.

3. Lighting Controls

- a. Lighting controls will vary from fully automatic lighting in public spaces using occupancy sensors and daylighting controls to (manual dimming) lighting control in Display and Office areas.
- b. All controls will be localized to the area of use.
- c. Lighting intensity variation based on occupant sensing may be provided in public spaces.
- d. Wireless lighting control will not be provided.
- e. Site lighting controls will use photocells and lighting intensity variation based on motion detection controls.

J. Telecommunications

1. Data/Voice:

- a. Cable Internet for the area is provided by Centruy Link and Sparklight. It is anticipated that service will route from one of the Utility Provider's poles in the alley behind the building, underground in conduit to the building demarcation point in the Main Telecommunications Equipment Room (MDF) located on the second floor.
- b. Each equipment rack and cabinet in the MDF room will have one 20-amp quad power receptacle on a dedicated circuit to that receptacle. One 30A (L5-30R) receptacle will be provided for Owner provided UPS equipment. A Telecommunications Bonding Backbone (TBB) and Main Grounding Busbar (TMGB) will be provided in this room.
- c. Telecommunications outlet locations will be provided with a 4" x 4" outlet box with a single gang mud ring, and a 1" conduit to an accessible ceiling area. Pull strings will be provided in all conduits. Additional conduits may be required in select areas. If more than two cables are used at an outlet a 5" x 5" outlet box with a single gang mud ring and a 1-1/2" conduit to an accessible ceiling area will be used.
- d. All data/voice cables will be CAT 6A. A typical "outlet" will contain two cables and two jacks that can be used for data or voice depending on patch panel connection at the MDF.
- e. Offices will be provided with one outlet near the desk. Work areas will be provided additional outlets to support equipment such as printers, scanners, etc.
- f. Telecommunications outlets will be provided at each telephone, computer, printer, monitor and every equipment reporting location.
- g. Wireless connectivity will be available to Staff and Visitors over multiple wireless networks.

2. Television:

- a. Television (TV) and/or Data (D) outlets will be provided in Museum areas where requested by Owner's preference.
- b. Conference and Break rooms will be provided with TV/D outlets.

- c. TV outlets will be provided with Cable TV. Data outlets will be provided with Cat 6A cable.
 - d. All televisions will be under Staff control only.
3. Audio/Visual (A/V)
- a. Building Ambient A/V systems requirements may be provided and are to be determined.
 - b. Independent A/V systems for specific exhibits will be provided by the Owner.
 - c. Telecommunications Infrastructure will route mainly in ceiling areas of the facility.

L. Security

- a. Security systems will include intrusion detection, access control, and security video.
- b. Intrusion Detection will be provided at all exterior doors for after hours alarm and can be used for door position monitoring if wanted. Exterior Doors will include doors on roof areas. Additional monitoring could be accomplished with motion sensors to monitor traffic in specific areas and/or with glass breaks to windows. The intrusion control system will be based on Bosch Security products.
- c. Access control using card or badge readers can be provided at specific staff entry points to the building if desired by the Owner. If wanted the access control system will be based on Vicon Access Systems.
- d. Security Video will be provided at exterior doors, exterior perimeter, interior public areas, and the exterior court area. Monitoring will be accomplished locally at the facility. Security Video will be based on Vicon Security Video systems.