

SECTION 033543 – POLISHED CONCRETE FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete floor slab profiling including [**honing**] [**polishing**] [**dyeing**] and sealing.
2. Protecting finished concrete floor slab until Substantial Completion.

1.2 RELATED REQUIREMENTS

A. Concrete for polished concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, initial finishing and curing. Additional requirements are specified in Section 033000 "Cast-in-Place Concrete."

1. Coordinate with sections:
 - a. Section 032400 - Fibrous Reinforcing.
 - b. Section 033000 - Cast-in-Place Concrete.
 - c. Section 079000 - Joint Sealants.
2. Coordinate with finishing manufacturer for system "products" for sections above.

1.3 REFERENCES

A. ASTM International (ASTM):

1. ASTM C94/C94M: Standard Specification for Ready-Mixed Concrete
2. ASTM C156: Standard Test Method for Water Loss (from a Mortar Specimen) Through Liquid Membrane-Forming Curing Compounds for Concrete.
3. ASTM C779/C779M: Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces.
4. ASTM C805/C805M: Standard Test Method for Rebound Number of Hardened Concrete.
5. ASTM C878/C878M: Standard Test Method for Restrained Expansion of Shrinkage-Compensating Concrete.
6. ASTM C944/C944M: Standard Test Method for Abrasion Resistance of Concrete or Mortar Surfaces by the Rotating-Cutter Method.
7. ASTM C979/C979M: Standard Specification for Pigments for Integrally Colored Concrete.
8. ASTM C1077: Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation.

9. ASTM C1116/C1116M: Standard Specification for Fiber-Reinforced Concrete.
10. ASTM C1583/C1583M: Standard Test Method for Tensile Strength of Concrete Surfaces and the Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension (Pull-off Method).
11. ASTM C1895 - Standard Test Method for Determination of Mohs Scratch Hardness.
12. ASTM D4039: Standard Test Method for Reflection Haze of High-Gloss Surfaces.
13. ASTM D5767: Standard Test Method for Instrumental Measurement of Distinctness-of-Image (DOI) Gloss of Coated Surfaces.
14. ASTM E96/E96M-10: Standard Test Method for Water Vapor Transmission of Materials.
15. ASTM E329: Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.
16. ASTM E1155: Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers.
17. ASTM G152: Standard Practice for Operating Open Flame Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials.

B. American National Standards Institute (ANSI):

1. ANSI/NFSI B101.1-2009: Test Method for Measuring Wet SCOF of Common Hard-Surface Floor Materials.
2. ANSI/NFSI B101.3-2012: Test Method for Measuring Wet DCOF of Common Hard-Surface Floor Materials

C. American Concrete Institute (ACI):

1. ACI 302.1R-89-15: Guide to Concrete Floor and Slab Construction.
2. ACI 305.1-14(20) Specification for Hot Weather Concreting (Reapproved 2020).
3. ACI 306.1-90: Standard Specification for Cold Weather Concreting (Reapproved 2002).
4. ACI 310R-19: Guide to Decorative Concrete.

D. Concrete Sawing and Drilling Association, Inc. (CSDA):

1. CSDA ST-115: Measuring Concrete Micro Surface Texture.

E. International Code Council Evaluation Service (ICC ES):

1. ICC ES AC 32: Concrete with Synthetic Fibers.

1.4 PREINSTALLATION MEETING

A. Preinstallation Conference: Conduct conference at project site or video conference.

1. Schedule meeting between 7 and 14 days prior to first concrete slab placement of 10,000 SF or greater and after placement of test slab and after concrete submittals have been approved.
2. Obtain Pre-slab Installation Meeting Agenda from Green Umbrella, (844) 200-7336.
3. Require responsible representatives of each party involved with the interior concrete slab work to attend the meeting. Representatives to be present shall include personnel who are

directly involved in overseeing the work for each placement and who have authority to control the concreting work.

4. Require representatives of each entity directly concerned with concrete. Attendees shall include, but not be limited to the following:
 - a. Owner's Construction Manager.
 - b. Owner's Concrete Consultant.
 - c. Contractor:
 - 1) Project Manager.
 - 2) Superintendent.
 - d. Green Umbrella Certified Place/Finish Concrete Subcontractor:
 - 1) Green Umbrella Master Craftsman/Project Manager.
 - 2) Green Umbrella Craftsman/Finish Foreman.
 - e. Review sequencing. Review concrete profiling and protection of finished concrete.
 - f. Meeting Minutes: Record on the agenda document, discussions of meeting and decisions and agreements reached. Submit in accordance with the requirements of Submittals paragraph.
 - g. Changes to Contract Documents from recommendations or discussions at the Pre-slab Installation Meeting shall be approved in writing by Owner's Construction Manager prior to implementation.

1.5 SCHEDULING

- A. Give preference to Thursday or Friday placement and finishing to reduce interference and expedite project release to other trades.
- B. Profile, Hone and Polish Schedule: Submit plan showing polished concrete surfaces and schedule of abrasive polishing operations for each area of polished concrete. Review and approve before the start of concrete placement operations. Include locations of all joints, including construction joints. Indicate joint filler.

1.6 ACTION SUBMITTALS

- A. General: Provide submittals as required by this Specification in accordance with Contract Documents. No work shall be performed relating to a submittal until the submittal is approved by the Architect/Engineer in writing.
- B. Submit submittal items concurrently for submittals shown with the same submittal date specified in the Concrete Submittal Register included at the end of this Section. Do not submit submittals of this section together with submittals in any other Section. Identify submittals explicitly in accordance with the requirements of Section 013300.

- C. Green Umbrella Certified Place/Finish Concrete Subcontractor Qualification Statement: Submit Green Umbrella Certification Form including Floor Finisher Qualifications as required in Quality Assurance paragraph.
 - 1. Provide ACI certification documents for at least three finishers who will install all interior slab placements.

- D. Product Data: Material and Technical Data for all materials including, but not limited to:
 - 1. Concrete post-placement and abrasive finish, densifier, impregnating stain treatment.
 - 2. Process cutting agent and abrasive materials(s).
 - 3. Repair materials.
 - a. Surface Defect Repairs: The Owner's Representative shall submit map of locations where surface defects are to be repaired. Map shall be referenced to the building column line locations.
 - b. Crack Repair: The Owner's Representative shall submit a map of locations where cracking is to be repaired. Map shall be referenced to the building column line locations.
 - 4. Interior slab protection materials.
 - 5. Exterior slab protection materials.

- E. System Data: Technical data, testing and surface profile requirements for completed concrete finish system.

- F. Concrete Floor Protection Plan: Submit concrete floor protection plan addressing procedures specified in Part 3 of this Section.

- G. Equipment Data: Technical and performance data on all types of equipment to be used in the processing of concrete and application of finish systems. Mandatory documentation that indicates the number of and compliance of propane equipment with finishing and treatment manufacturer's written requirements and recommendations.
 - 1. Concrete Weighted Ultra High Speed Burnisher:
 - a. Manufactured by Green Umbrella.
 - b. Weighted pad driver.
 - c. CARB/EPA certified.
 - d. Width: 27 inch.
 - e. Maximum 90 dBA measured 3 feet from sound source per ISO 11201.
 - f. No substitute accepted.
 - g. Ergonomically designed to minimize vibration, noise, and user fatigue.
 - 2. Architectural Concrete Profile Equipment: Propane powered.
 - a. Rider Trowel & Profiler:

- 1) Manufactured by Green Umbrella.
 - 2) Provide minimum of one unit per 10,000 sq. ft.
 - 3) Wet abrasive compatible.
 - 4) Rider may be limited in aggregate exposure due to gearbox design.
 - 5) Or Equal to.
- b. Variable Abrasive Concrete Grinder:
- 1) Manufactured by Green Umbrella.
 - 2) 800 lbs. or 580 head pressure model.
 - 3) Designed for wet abrasives.
 - 4) 30 inch grinding path.
 - 5) Emission shut down system (ESDS)
 - 6) 1400 square feet per hour production rate.
 - 7) Provide minimum of three units per 10,000 sq. ft.
- c. Variable Abrasive Concrete Edge Grinder:
- 1) Manufactured by Green Umbrella.
 - 2) Designed for wet abrasives.
 - 3) To assure edge/field profile same manufacture as Field Grinder.
 - 4) 1/4 inch cut to wall.
 - 5) Emission shut down system (ESDS).
 - 6) Provide minimum of 3 units per 10,000 sq. ft.
- H. Shop Drawings: Application area plans to show layout of colorant(s). Indicate locations and schedule of abrasive profile.
- I. Sustainable Design Submittals:
1. Laboratory Test Reports: For **[colorants]** **[and]** **[liquid concrete treatments]**, indicating compliance with requirements for low-emitting materials.
 2. Products shall comply with the requirements of the California Department of Public Health's (CDPH) "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- J. Samples for Initial Selection: Available colors prepared on manufacturer's standard samples, subject to Architect approval in mockups.
- K. Samples for Verification: Manufacturer's standard samples of each color and finish. Recreate approved samples in mockups as design reference samples for comparing Work in place, subject to Architect approval in mockups.
- L. Pre-Slab Installation Meeting Documents:
1. Record of notification of pre-slab meeting including company name, persons contacted, date, and method of contact.
 2. Meeting Agenda
 3. Meeting Minutes. Submit meeting minutes including attendance record to participants and Owner's Construction Manager. Minutes of the meeting shall be distributed to

partied in attendance by the Contractor within 5 days of the meeting. One copy of the minutes shall also be transmitted to Green Umbrella for informational purposes.

1.7 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Provide testing reports for each product. Indicate entity performing the testing, testing standards and results and the qualified testing agency that approves or certifies the testing and results.
- B. Provide manufacturer's written installation instructions and recommendations.
- C. Field quality control reports.
- D. Testing agency qualifications.
- E. Installer qualifications.

1.8 CLOSEOUT SUBMITTALS

- A. Maintenance Data: Manufacturer's written recommendations for protecting, cleaning, and maintaining concrete finishes.

1.9 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent testing agency qualified to perform specified or required testing in accordance with ASTM C1077 and ASTM E329.
- B. Green Umbrella Certified Qualifications: A firm currently certified as a Green Umbrella Craftsman or Master Craftsman approved by polished concrete finish manufacturer prior to project award.
 - 1. Acceptable Green Umbrella Craftsman: (www.greenumbrellasystems.com)
 - a. Contact Info. <mailto:tom@greenumbrellasystems.com> , 716-771-6352
- C. Manufacturer's Representative: Provide oversight and inspection by concrete finish manufacturer in accordance with manufacturer's requirements.
 - 1. Green Umbrella Representative: (www.greenumbrellasystems.com)
 - a. Contact Info TOM@greenumbrellasystems.com , 716-771-6352
- D. Mockups: Construct mockups [**as indicated on Drawings**], [**as directed by Architect**], [**minimum 20x20 feet**] for each finish to verify selections made and to demonstrate typical joints, surface profile and gloss, tolerances, and standard of workmanship. Build mockups using materials specified for the completed Work, and in compliance with recommendations of manufacturer.

1. Obtain Owner approval of mockups prior to starting construction.
2. Viewed in light similar to project completion.
3. Mock-up construction performance should demonstrate actual construction methodology to the extent possible. Differences in equipment and actual methodology will cause variations and differences between mock-up and finished floor.
4. Demonstrate profiling, finishing, and choice of protection of architectural concrete.
5. Maintain mockups, marked and undisturbed during construction to provide a baseline standard for assessing completed Work.
6. Remove mockup when directed.
7. Approved, undisturbed, and undamaged mockups may remain as a part of the Work.

E. Protection of Concrete Finishes: Provide protection for concrete slab finishes as indicated in manufacturer's written instructions, 310R-19, and as follows:

1. Provide protection of concrete finishes from any contact with any substance that contains petroleum, acids or detergents.
 - a. Prohibit vehicle transit and parking on concrete surfaces without providing protection.
 - b. Prohibit storage, transit or use of hydraulic equipment on concrete surfaces without providing protection.
 - c. Prohibit construction operations that include the use of substances listed above without providing approved protection.
2. Provide protection to finished concrete surface from any materials placed and/or stored on the surface, including but not limited to:
 - a. Steel and iron.
 - b. Petroleum based products.
 - c. Vehicles and machinery.
 - d. Hydraulic fluid.
 - e. Paints and coatings.
 - f. Paper and plastic packaging.
 - g. Aggregates.
 - h. Food and beverages.
3. Surface Contaminant Cleaning Procedure:
 - a. Provided by system manufacturer.
 - b. On-site spill kits:
 - 1) Solid removal.
 - 2) Liquid removal.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver material in original containers with unbroken seals, bearing manufacturer labels indicating brand name and directions for storage.

- B. Protect materials from weather and elements. Do not allow liquid products to freeze.

1.11 PROJECT CONDITIONS

- A. Maintain environmental conditions on day of placement as recommended by treatment manufacturer and certified installer.
- B. Placing Environment:
 - 1. Architectural exposed concrete that will be profiled (PHP), shall be protected by enclosed structure after the roof membrane is completely installed and watertight
 - a. Roof construction, skylight installation, overhead painting, and roof drainage system shall be complete and weather tight prior to placement of sales floor slabs.
 - b. Lighting: Permanent lighting or equivalent temporary lighting shall be operational during all slab placements.

1.12 MANUFACTURER SPECIAL WARRANTY

- A. Provide manufacturer's 10-year warranty providing coverage that architectural concrete will remain water resistant, non-off-dusting, hardened and abrasion resistant throughout warranty period. Must accompany a time of installation report by certified installer, verified by manufacturer's consultant and/or Corporate Office.
- B. Must be installed by manufacturer's certified installer. Certified Craftsman Warranty: 1 year for installation defect.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Subject to compliance with requirements, provide products by the following:
 - 1. Green Umbrella Architectural Concrete Systems, Inc. 20 Jetview Dr. Rochester, NY 14624, basis of design manufacturer. Technical and Architectural Support:(844) 200-7336, info@greenumbrellasystems.com
 - 2. No substitutions.

2.2 PERFORMANCE REQUIREMENTS

- A. Burnished Concrete: per ACI 310R-19, 7.2.7.
- B. Slip Resistance: Minimum Dynamic Coefficient of Friction of 0.42, per ANSI/NFSI B101.3.

- C. Abrasion Resistance: Abrasion resistance of 0.25 mm at 30 minutes and 0.5 mm at 60 minutes, per ASTM C779/C779M.
- D. Abrasion Resistance: Special/DF, per BS EN 13892-4.
- E. Water Vapor Transmission of Materials: ASTM E96/E96M of 0.34 g/h/m².
- F. Ultra-Violet Light and Water Spray: No adverse effects to ultra-violet and water spray, per ASTM G152.
- G. Surface Profile:
 - 1. Class of Grind: per 310R-19, 7.2.5.
 - 2. Level of Gloss: per ACI 310R-19, 7.2.6.
 - 3. Level of Roughness Average: per CSDA ST-115.

2.3 MATERIALS

- A. Finish Surface Profile System:
 - 1. Green Umbrella, "Base Defense & Profile System"
 - a. Joint Sealer:
 - 1) Product: Green Umbrella Polylock
 - a) Pre-approved Equal recommend by System Manufacturer
 - b. Profiling, Honing, and Polishing Abrasive:
 - 1) Product: Green Umbrella, GreenCut Abrasives.
 - a) Stock removal, profile, hone and polish.
 - b) Early age wet cutting abrasive.
 - c) Compatible with liquid cutting agent.
 - d) Compatible with propane variable abrasive grinders and trowel profilers.
 - c. Wet Cutting Agent:
 - 1) Product: Green Umbrella, GreenCut Cutting Agent:
 - a) pH neutral.
 - b) Free from sodium, potassium butyl, and polymers.
 - c) Bearing manufacturer label.
 - d. Surface Colorant:
 - 1) Product: Green Umbrella, Nano Color.

- a) Penetrating.
 - b) Non-film forming.
 - c) Approved: Ameripolish
 - e. Penetrating Protective Treatment:
 - 1) Product: Green Umbrella, Interior Microfilm.
 - a) Improved stain resistance.
 - b) Non-film forming.
 - 2) Mechanical:
 - a) Integral mechanical densification finishing trowel.
 - b) Rider trowel and walk-behind abrasive profiler.
 - c) Variable abrasive concrete grinder.
 - d) Black pad high-speed concrete weighted propane burnished.
- B. Interior Slab In Dry Protection Materials:
 - 1. Product: Green Umbrella Ramboard:
 - a. Forest Stewardship Council (FSC) certified. Recycled and recyclable materials.
 - b. Roll Dimensions (W x L): 38 inches x 100 feet (965 mm x 30.5 m). 317 sq ft.
Rolls per Pallet: 16.
 - c. Green Umbrella Ramboard Vapor-Cure Tape: Vapor-Cure used to cover seams which prevents tape lines. Allows vapors and moisture to escape from concrete.
 - d. Roll Dimensions (WxL): 3 inches x108 feet (76 mm x 32.9 m) Rolls per Box: 16.
 - e. Or Pre-Approved Equal.
 - 2. Product: Green Umbrella GreenGuard:
 - a. Roll Dimensions (W x L): 38 inches x 180 feet 10 mil.
 - b. Or Equal To.
 - c. Interior, dry conditions only.
- C. Exterior Slab Protection Materials:
 - 1. Product: Green Umbrella GreenGuard.
 - a. Exterior, wet conditions expected.
 - b. Pre-approved Equal.
- D. Cleaning Agent:
 - 1. Product: GreenClean with Slip Resist:
 - a. Slip resistance enhancing.
 - b. pH neutral.

2. Product: GreenClean and Degreaser:
 - a. Enzyme degreaser.
 - b. pH neutral.
 - c. Water treatment friendly.

3. Product: GreenClean Spill Kit:
 - a. Solid spill kit.
 - b. Liquid spill kit.
 - c. 72-hour recovery.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine architectural concrete substrates with polisher, for conditions that may affect the Work.
- B. Verify preparations and placement of concrete is in accordance with ACI standards and manufacturer's written instructions.
- C. Verify ambient and surface temperatures to be in accordance with manufacturer's requirements for all products for the work.
- D. Verify that the owner's testing agency results for Mohs Hardness test per ASTM C1895 are in accordance with this specification.

3.2 PREPARATION

- A. Site Conditions
 1. The building shell shall be completed sufficiently to keep out wind, rain, snow or other adverse weather affects that could damage the polishing work.
 2. Provide suitable water, power, lighting and ventilation.
 - a. Provide minimum lighting of 40-foot candles (440 lux) measured at floor surface.
 3. Provide and maintain minimum floor slab temperature of 50 degrees F.
- B. All penetrations, drains, floor embeds, or conduit shall be cut, capped, clearly identified and made safe prior to any polishing work.
- C. Prepare equipment to be used in profiling and application of finish system materials according to finish system manufacturer's written instructions.

- D. Completely clean liquid treatment application sprayers free of any potential contaminating material and make ready for application.

3.3 ABRASIVE PROFILE-HONE-POLISH

- A. Profile and Hone designated concrete substrates using a wet polishing process per manufacturer's written instructions.
 - 1. Profile Cut: **Class B Salt and Pepper.**
 - 2. Prepared to apply setting/curing catalyst immediately upon completion of finishing operations.
- B. Final polishing abrasive as recommended by treatment system manufacturer to achieve required finish.
 - 1. Level of Gloss : Distinctness-of-Image (DOI) Gloss: Image Clarity as measured by Image Clarity Meter, per ASTM D5767.
 - a. **[Level 3: High Gloss Polished; Image clarity 50-60 percent.]**
 - 2. Haze Index: Haze Index value of less than 10, as measured by Gloss meter per ASTM D4039.
 - 3. Surface Finish: Average Roughness (Ra) in micro-meters or micro-inches measured by Surface Profilometer, per CSDA ST-115: Measuring Concrete Micro Surface Texture
 - a. Green Umbrella BaseDefense; Ra 32 μ inch \pm 2 μ inch
- C. Thoroughly sweep floor. Auto scrub with manufacturer's cleaning agent, neutral pH Green Clean and Degreaser.
- D. Burnish with a non-resinous black pad in accordance with manufacture recommendation.

3.4 SURFACE COLORANT

- A. Apply Green Umbrella NanoDye following manufacturer's instructions using a pump-up sprayer with conical tip. Use overlapping circular motion holding tip approximately 12 inches from the surface; ensure consistent coverage. Before proceeding, remove excess dye using an auto scrubber.
- B. Logo and quick-dry applications:
 - 1. Acetone may be used as dye carrying agent. Acetone sprayer required.
 - 2. Acetone is VOC exempt.
 - 3. Use in well ventilated area.
 - 4. For color evaluation: Wait 1 to 2 minutes, clean with an auto-scrubber and wipe a small area with a dry white cloth to ensure color penetration and retention.
- C. Reduced Downtime Application:

1. Densifier and Colorant Application Method: Combine Green Umbrella NanoDye and Green Umbrella DryShield as dye carrying agent, with appropriate sprayer and in accordance with manufacturer's instruction.
2. Wait until dry, then clean with auto-scrubber and wipe small area with dry cloth; ensure color acceptability.

3.5 PROTECTIVE TREATMENTS

- A. Installation of Cure Protective Finish Treatment (Green Umbrella, Shield and Enhance):
- B. Installation of Cure Protective Finish Treatment (Green Umbrella, IceCap):
- C. Installation of Abrasive Protective Finish Stain Treatment (Green Umbrella, RTU Microfilm):
 1. Remove all dirt, dust, and debris from concrete surface. Clean the surface with manufacturer's recommended cleaning agent.
 2. Spray-apply the protective treatment using high volume, low pressure (pump or battery powered) sprayers at a rate specified by manufacturer.
 3. Spread the protective treatment using an applicator as recommended by manufacturer. Provide uniform treatment coverage and allow to dry for a minimum of 1 hour.
 4. After the protective treatment has dried completely another application may be applied as recommended by manufacturer. Avoid over application, which may cause poor results.
 5. Once dry, High Speed Burnish the protective treatment using a thick, black, non-resinous transfer concrete pad (Green Umbrella Black Pads). Use only equipment as recommended by concrete treatment manufacturer in writing.

3.6 EQUIPMENT

- A. Refer to manufacturer's written instructions for requirements of installation equipment, including but not limited to: sprayers, burnishers, auto scrubbers, profiling, honing and polishing abrasives and dust collection system.

3.7 FIELD QUALITY CONTROL

- A. Measure Gloss Rating, DOI and Haze Index as specified herein, re-polish if required to achieve specified requirements.
- B. Measure concrete micro surface RA texture as specified herein, re-polish if required to achieve specified requirements.
- C. Measure slip resistance using certified slip-test method; verify compliance with specified slip resistance rating. NFSI approved tribometer.

3.8 PROTECTION AND CLEANING

- A. Prohibit wheeled traffic on finished surfaces for a minimum of 8 hours following application or with approval of Green Umbrella Craftsman.
- B. Protect finished floor as specified above and as indicated in manufacturer's written instructions and 310R-19.
- C. Provide daily scrubbing of the entire exposed concrete slab surface with riding equipment that utilizes only pads and water, Daily scrubbing shall continue from time of dried initial application of surface densifier until time of store turnover. Use white or red pads, cleaned or replaced daily, and avoid using excessive downward head pressure that may damage the slab surface
- D. Provide Green Umbrella Maintenance procedures to owner at turnover

END OF SECTION 033509