

SECTION 033536

POLISHED CONCRETE FINISH

This section includes editing notes to assist the user in editing the section to suit project requirements. These notes are included as hidden text, and can be revealed or hidden by one of the following methods:

Microsoft Word 2013: Display the FILE tab on the ribbon, click OPTIONS, then DISPLAY. Select or deselect HIDDEN TEXT.

Microsoft Word 2010: Display the FILE tab on the ribbon, click OPTIONS, then on left menu click on DISPLAY. Under ALWAYS SHOW THESE select or deselect HIDDEN TEXT.

Corel WordPerfect: From the pull-down menus select VIEW, then select or deselect the HIDDEN TEXT option.

This master specification section has been prepared by Endurable Concrete Products for use in the preparation of a project specification section covering polished finishes for concrete, with or without dye.

The following should be noted in using this specification:

Hypertext links to specific websites are included after manufacturer names and names of organizations whose standards are referenced within the text, to assist in product selection and further research. Hypertext links are contained in parenthesis and shown in blue, e.g.:

(www.astm.com)

Optional text requiring a selection by the user is enclosed within brackets, e.g.: "Section [090000.] [____.]"

Items requiring user input are enclosed within brackets, e.g.: "Section [____ - ____]."

Optional paragraphs are separated by an "OR" statement, e.g.:

**** OR ****

Sustainable requirements are included for projects requiring LEED certification, and are included as green text. For additional information on LEED, visit the U.S. Green Building Council website at www.usgbc.org.

For assistance on the use of the products in this section, contact Endurable Concrete Products by calling 800-910-3120, by email at info@endurableproducts.com, or visit their website at www.endurableproducts.com.

PART 1 GENERAL

1.1 SUMMARY

Edit the following paragraphs to include only those items specified in this section.

- A. Section Includes:
 - 1. [Dyed and] Polished concrete finish.

Coordinate the following paragraphs with other sections in the project manual.

- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

In the following paragraphs, retain only those reference standards that are used elsewhere in this section.

- A. ASTM International (ASTM) (www.astm.org):
1. C39 - Standard Test Method for Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 2. C779/C779M - Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces.
 3. C805/C805M - Standard Test Method for Rebound Number of Hardened Concrete.
 4. D624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
 5. D638 - Standard Test Method for Tensile Properties of Plastics.
 6. D2047 - Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine.
 7. D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings.
 8. D4060 - Standard Test Method for Abrasion Resistance of Organic Coatings by the Taser Abraser.
 9. D4260 - Standard Practice for Liquid and Gelled Acid Etching of Concrete.
 10. D4258 - Standard Practice for Surface Cleaning Concrete for Coating.
 11. D4259 - Standard Practice for Abrading Concrete.
 12. D4260 - Standard Practice for Liquid and Gelled Acid Etching of Concrete.
 13. D4366 - Standard Test Methods for Hardness of Organic Coatings by Pendulum Damping Tests.
 14. D4587 - Standard Practice for Fluorescent UV-Condensation Exposures of Paint and Related Coatings.
 15. E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.
 16. E430 - Standard Test Methods for Measurement of Gloss of High-Gloss Surfaces by Abridged Goniophotometry.
 17. F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
 18. F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
 19. F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In Situ Probes.
- B. Concrete Polishing Association of America (CPAA) (www.concretepolishingassociation.com):
1. Accreditation Program.
 2. D100.0 - Polished Concrete Definition.

1.3 SUBMITTALS

Limiting submittals to only those actually required helps to minimize liability arising from the review of submittals. Minimize submittals on smaller, less complex projects.

Include the following for submission of shop drawings, product data, and samples for the Architect's review.

- A. Submittals for Review:
1. Product Data: Manufacturer's descriptive data and application instructions for each product.
 2. Samples: [3 x 3] [__ x __] inch dyed concrete samples [showing available colors.] [in specified colors.]

Include the following for submission of sustainable design submittals.

- B. Sustainable Design Submittals:
1. Regional Materials: Indicate products harvested, extracted, recovered, or manufactured within 500 mile radius of Project site.
 2. Low-Emitting Materials: Certify volatile organic compound (VOC) content.

Include the following for submission of closeout submittals for the Owner's record purposes.

- C. Closeout Submittals:

1. Maintenance Data: Include recommended materials and procedures for cleaning and maintenance of polished concrete surfaces, including list of detrimental materials.

1.4 QUALITY ASSURANCE

The following paragraph specifies a minimum level of experience required of the parties performing the work of this section. Retain if required, and edit to suit project requirements.

- A. Applicator Qualifications:
 1. Minimum [2] [] years [documented] experience in work of this Section.
 2. Certified by concrete treatment manufacturer.
 3. Supervisor certified as Craftsman or Master Craftsman by CCAA.
- B. Concrete:
 1. Mix Design: Free from admixtures and additives not specifically approved by concrete surface treatment manufacturer.
 2. Curing compound acceptable to concrete treatment manufacturer.

Include the following for a full size mockup.

- C. Mockup:
 1. Size: Minimum [4 x 8] [] x [] feet.
 2. Locate [] [where directed.]
 3. Show [dyed and] polished finish.
 4. Approved mockup may [not] remain as part of the work.

Include the following for a pre-installation conference attended by the parties performing the work of this section.

- D. Pre-Installation Conference:
 1. Convene at site [2] [] weeks prior to beginning work of this Section.
 2. Attendance: [Owner,] [Architect,] [Design/Builder,] [Contractor,] [Construction Manager,] concrete finisher, and related trades whose work could affect stained concrete before or after application.
 3. Review and discuss: Work sequence, substrate conditions, and protection before and after application.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Store materials in protected area between 40 and 80 degrees F.

1.6 PROJECT CONDITIONS

- A. Protect concrete surfaces scheduled to receive polished finish prior to finishing; prevent damage and staining:
 1. Prohibit vehicular traffic on surfaces to be polished.
 2. Prohibit pipe cutting operations on surfaces to be polished.
 3. Prohibit storage on surfaces to be polished for minimum 28 days after concrete placement.
 4. Prohibit ferrous metals storage on surfaces to be polished.
 5. Prevent liquid drippings from equipment on surfaces to be polished.
 6. Prevent acids and acidic detergents from contacting surfaces to be polished.
 7. Prevent painting over surfaces to be polished.
- B. Apply concrete treatment when ambient and surface temperatures are between 50 and 90 degrees F.
- C. Close areas to traffic during finishing and for minimum time period after finishing as recommended by concrete treatment manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Contract Documents are based on products by Endurable Concrete Products, 800-910-3120, www.endurableproducts.com.

Edit the following to indicate whether or not substitutions will be permitted for the products in this section.

- B. Substitutions: [Under provisions of Division 01.] [Not permitted.]

2.2 MATERIALS

Include the following if a dyed finish is required.

- A. Hardener:
1. Source: Endurable Concrete Hardener.
 2. Description: 100 percent silica in proprietary solution; react with remaining unreacted calcium hydroxide in concrete, forming calcium silica hydrate.
 3. Physical characteristics:
 - a. Abrasion resistance: 33 percent increase at 30 minutes, tested to ASTM C779/C779M.
 - b. Compressive strength: 40 percent increase at full concrete cure, tested to ASTM C39.
 - c. Impact resistance: 14 percent increase at full concrete cure, tested to ASTM C805/805M.
 4. Volatile Organic Compound content: 0 grams per liter, tested to ASTM D3960.
- B. Sealer:
1. Source: Endurable Concrete Sealer - Gloss.
 2. Description: Heavy duty, 100 percent ultraviolet stable, anti-graffiti, chemical resistant clear sealer.
 3. Gloss: [Matte.] [Gloss.]
 4. Abrasion resistance: 260 mg loss, H-18 1000 cycles, tested to ASTM D4060.
 5. Abrasion resistance 25 mg loss, CS-17 1000 cycles, tested to ASTM D4060.
 6. Modulus of elasticity: 175 to 300 KSI, tested to ASTM D638.
 7. Tensile strength: 4400 to 7200 PSI, tested to ASTM D638.
 8. Tear strength, 150 to 300 pounds per linear inch, tested to ASTM D624.
 9. Artificial weathering: None, tested to ASTM D4587.
 10. Pendulum hardness; tested to ASTM D4366:
 - a. One day: 38 seconds for matte and gloss.
 - b. Five day: 154 seconds for matte, 174 seconds for gloss.
 - c. Seven day: 162 seconds for matte, 184 seconds for gloss.
 11. Coefficient of friction: 0.60 dry and 0.47 wet, tested to ASTM D2047.
 12. Water vapor transmission: 1.26 grains/hour/square foot, tested to ASTM E96/E96M.
 13. Volatile Organic Compound content: Maximum 47 grams per liter, tested to ASTM D3960.

2.3 ACCESSORIES

- A. Cleaning Products: Endurable Surface Cleaner. A Non-corrosive, neutral pH cleaner for heavy contaminants or light duty cleaning.
- B. Stripping Products: Endurable Power Stripper. A non-hazardous stripper for coatings, sealers, paints and varnishes.
- C. Stripping Products: Endurable Vertical Stripper. A non-hazardous stripper for coating, sealers, paints and varnishes.
- D. Patching Compound: 40 percent Portland cement, 45 percent limestone, and 15 percent vinyl acetate copolymer, mixed with dust salvaged from grinding process to form paste.
- E. Grout: Clear modified silicate sealant, free from latexes, mixed with dust salvaged from grinding process to form paste that reacts with calcium hydroxide in concrete.

2.4 EQUIPMENT

- A. Field Grinding and Polishing Equipment:
 - 1. Variable speed, multiple head, counter-rotating, walk-behind machine with minimum 600 pounds of down pressure on grinding or diamond polishing pads.
 - 2. If dry grinding, honing, or polishing, use dust extraction equipment with flow rate suitable for dust generated, with squeegee attachments.
- B. Edge Grinding and Polishing Equipment: Hand-held or walk-behind machines producing same results as field grinding and polishing equipment without noticeable differences.
- C. Burnishing Equipment: High speed walk-behind or ride-on machines capable of generating 1000 to 2000 revolutions per minute and with minimum head pressure of 20 pounds.
- D. Metal Bonded Pads: Grinding pads with embedded industrial grade diamonds of varying grits.
- E. Resin Bonded Pads: Polishing pads with embedded industrial grade diamonds of varying grits.
- F. Burnishing Pads: Maintenance pads for use with high speed burnishing equipment.

2.5 MIXES

- A. Mix materials in accordance with manufacturer's instructions.
- B. Dye:
 - 1. Mix with water, acetone, or denatured alcohol in proportions to match approved samples.
 - 2. Ensure uniform distribution by mixing with paddle mixer or shaking.
- C. Hardener:
 - 1. Mix one part hardener to three parts water.
 - 2. Ensure uniform distribution by mixing with paddle mixer or shaking.
- D. Sealer:
 - 1. First coat: Mix one part sealer to two parts water.
 - 2. Second coat: Mix one part sealer to one part water.
 - 3. Ensure uniform distribution by mixing with paddle mixer.

PART 3 EXECUTION

3.1 PREPARATION

- A. Clean surfaces to ASTM D4258, ASTM D4259, or ASTM D4260.

Include the following paragraph if the slab was used as a casting surface.

- B. Completely remove form oils and bond breakers.
- C. Remove adhered matter by scraping or machine sanding with 60 to 80 grit sandpaper. Prevent damage to surface.
- D. Remove paints with Endurable Power Stripper or Endurable Vertical Stripper.
- E. Remove oil with Endurable Surface Cleaner.

Include the following paragraph if the slab was driven on prior to staining.

- F. Remove tire marks with stripper recommended by sealer manufacturer. Apply in accordance with manufacturer's instructions. Remove stripper by wet vacuuming, then scrub with concrete cleaner/degreaser.
- G. Testing Concrete Floors:
 - 1. Alkalinity:
 - a. Test method: Measure pH according to ASTM F710.
 - b. Acceptable results: pH between 8 and 10.
 - 2. Moisture Vapor Transmission:
 - a. Test method: Perform anhydrous calcium chloride test to ASTM F1869.
 - b. Acceptable results: Maximum 5 pounds per 1000 square feet in 24 hours.
 - 3. Relative humidity:
 - a. Test method: Perform relative humidity test using in situ probes to ASTM F2170.
 - b. Acceptable results: Maximum 75 percent.

3.2 POLISHING

- A. Initial Grinding:
 - 1. Use grinding equipment with metal bonded grinding pads.
 - 2. Begin grinding in one direction using sufficient size grit pad.

Edit the following to indicate desired level of polishing.

- 3. Make sequential passes with each pass perpendicular to previous pass using finer grit pad with each pass, up to [200] [400] grit.
 - 4. Achieve maximum refinement with each pass before proceeding to finer grit pads.
 - 5. Vacuum floor using squeegee vacuum attachment after each pass.
 - 6. Continue grinding until aggregate exposure matches approved mockup.
- B. Treating Surface Imperfections:
 - 1. Mix patching compound and grout material with dust created by grinding operations to match color of adjacent concrete surface.
 - 2. Fill surface imperfections. Work compound and treatment until color differences between concrete surface and filled surface imperfections are not noticeable when viewed from 10 feet away under lighting conditions that will be present after construction.
- C. Dying:
 - 1. Apply dye in accordance with manufacturer's instructions.
 - 2. Allow surfaces to dry completely after cleaning.
 - 3. Coverage rate: 400 to 600 square feet per gallon.
 - 4. Apply solution using low-pressure pump sprayer with conical tip at rate of 0.05 to 0.15 gallons per minute at 40 PSI.
 - 5. Maintain wet edge, working newly applied solution into edges of adjacent wet edges of previously treated surfaces.
 - 6. Maintain consistent saturation throughout application.
 - 7. Prevent solution from contacting adjacent surfaces.
- D. Hardening:
 - 1. Apply hardener in accordance with manufacturer's instructions.
 - 2. Allow surfaces to dry completely after dying.
 - 3. Coverage rate: 300 to 700 square feet per gallon.
 - 4. Apply solution using low-pressure pump sprayer with conical tip at rate of 0.05 to 0.15 gallons per minute at 40 PSI.
 - 5. Maintain spray tip from 1 to 2 feet above surface; apply using circular motion.
 - 6. Apply enough product to achieve uniform coverage.
 - 7. Allow surfaces to dry completely.
 - 8. Apply second coat if required to achieve optimum formation of calcium silica hydrate, using same procedures as first coat.

- E. Additional Dye: If required, allow surfaces to dry completely, then apply additional dye using same procedures as first coat, to match approved mockups.
- F. Grout Grinding:
 - 1. Use grinding equipment and appropriate grit grinding pads.
 - 2. While applying fresh grout material prior to, grind concrete in direction perpendicular to initial grinding to remove scratches.
 - 3. Vacuum floor using squeegee vacuum attachment after each pass.
- G. Honing:
 - 1. Use grinding equipment with resin bonded grinding pads.
 - 2. Grind concrete in one direction starting with 50 grit pad; make as many sequential passes as required to remove scratches, each pass perpendicular to previous pass, up to 400 grit pad reaching maximum refinement with each pass before proceeding to finer grit pads.
 - 3. Auto scrub or vacuum floor using squeegee vacuum attachment after each pass.
- H. Polishing:
 - 1. Use polishing equipment with resin bonded polishing and burnishing pads.
 - 2. Begin polishing in one direction starting with 800 grit pad.
 - 3. Make sequential passes with each pass perpendicular to previous pass using finer grit pad with each pass.
 - 4. Achieve maximum refinement with each pass before proceeding to finer grit pads.
 - 5. Auto scrub or vacuum floor using squeegee vacuum attachment after each pass.
 - 6. Continue polishing until gloss appearance, as measured according to ASTM E430, matches approved mockup.

Retain one of the following four paragraphs depending on desired floor finish.

- I. Final Polished Concrete Floor Finish: Class A - Cream Finish: Polish Portland cement paste resulting in little or no aggregate exposure.

**** OR ****

- J. Final Polished Concrete Floor Finish: Class B - Fine Aggregate Finish: Remove maximum 1/16 inch of concrete surface by grinding and polishing resulting in majority of exposure displaying fine aggregate with no, or small amount of, medium aggregate at random locations.

**** OR ****

- K. Final Polished Concrete Floor Finish: Class C - Medium Aggregate Finish: Remove maximum 1/8 inch of concrete surface by grinding and polishing resulting in majority of exposure displaying medium aggregate with no, or small amount of, large aggregate at random locations.

**** OR ****

- L. Final Polished Concrete Floor Finish: Class D - Large Aggregate Finish: Remove maximum 1/4 inch of concrete surface by grinding and polishing resulting in majority of exposure displaying large aggregate with no, or small amount of, fine aggregate at random locations.

Retain one of the following four paragraphs depending on desired floor gloss.

- M. Final Concrete Floor Gloss: Level 1 - Low Gloss Appearance:
 - 1. Procedure: Minimum four step process with full refinement of each diamond pad up to 400 grit resin bonded pad with one application of densifier.
 - 2. Gloss reading: Minimum 40, tested to ASTM E430 before sealer application.

**** OR ****

- N. Final Concrete Floor Gloss: Level 2 - Medium Gloss Appearance:

1. Procedure: Minimum five step process with full refinement of each diamond pad up to 800 grit resin bonded pad with one application of densifier.
2. Gloss reading: Minimum 55, tested to ASTM E430 before sealer application.

**** OR ****

- O. Final Concrete Floor Gloss: Level 3 - High Gloss Appearance:
1. Procedure: Minimum six steps with full refinement of each diamond pad up to 1500 grit resin bonded pad with one application of densifier.
 2. Gloss reading: Minimum 60, tested to ASTM E430 before sealer application.

**** OR ****

- P. Final Concrete Floor Gloss: Level 4 - Very High Gloss Appearance:
1. Procedure: Minimum seven steps with full refinement of each diamond pad up to 3000 grit resin bonded pad with one application of densifier.
 2. Gloss reading: Minimum 70, tested to ASTM E430 before sealer application.

3.3 SEALING

- A. Apply sealer in accordance with manufacturer's instructions.
- B. Allow surfaces to dry completely after hardening.
- C. Clean surfaces; remove loose and foreign matter that could interfere with application or performance of sealer.
- D. Remove dye and hardener residue using dry microfiber pad or by buffing.
- E. Coverage Rate: 1000 to 1500 square feet per gallon.
- F. Apply first coat using weighted microfiber T-bar applicator.
- G. Apply enough product to achieve uniform coverage.
- H. Allow surfaces to dry completely, then apply second coat using weighted microfiber T-bar applicator.
- I. Allow sealer to dry for 24 to 48 hours.
- J. Using burnishing equipment and 400, 800, and 1500 grit burnishing pads, burnish to uniform sheen matching approved mockup.

3.4 FIELD QUALITY CONTROL

- A. Measure slip resistance using BOT-3000 slip-tester; ensure compliance with specified slip resistance rating.

3.5 PROTECTION

- A. Close areas to traffic until products have dried.
- B. Protect completed work subject to damage or staining using nonstaining sheet coverings.

END OF SECTION