

SECTION 033543

BONDED ABRASIVE STAINED POLISHED CONCRETE FLOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Products and procedures for coloring and bonded abrasive polishing concrete floors using multi-step wet/dry mechanical process, and accessories indicated, specified, or required to complete polishing.

1.2 DEFINITIONS

- A. Terminology: As defined by CPAA.
- B. Polished Concrete: The act of changing a concrete floor surface, with or without aggregate exposure, to achieve a specified level of gloss.
- C. Bonded Abrasive Polished Concrete: The multi-step operation of mechanically grinding, honing, polishing of a concrete floor surface with bonded abrasives to cut a concrete floor surface and to refine each cut to the maximum potential to achieve a specified level of finished gloss as defined by the CPAA. This yields the most durable finish and requires the least amount of maintenance.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product indicated, specified, or required. Include manufacturer's technical data, application instructions, and recommendations.
- B. Installer Qualifications: Data for company, principal personnel, experience, and training specified in PART 1 "Quality Assurance" Article.
- C. Field Quality Control - Dynamic Coefficient of Friction Test Reports: Reports of testing specified in PART 3 "Field Quality Control" Article.
- D. Field Quality Control - Static Coefficient of friction test reports: report of testing specified in Part 3 "Field Quality Control" article.
 - 1. Include instructions for maintenance of installed work, including methods and frequency recommended for maintaining optimum condition under anticipated use.
 - 2. Include precautions against cleaning products and methods which may be detrimental to finishes and performance.

1.4 QUALITY ASSURANCE

- A. Polisher Qualifications:
1. Experience: Company experienced in performing specified work similar in design, products, and extent to scope of this Project; with a record of successful in-service performance; and with sufficient production capability, facilities, and personnel to produce specified work.
 2. Supervision: Maintain competent supervisor who is at Project during times specified work is in progress, and is currently certified as Craftsman - Level I or higher by CPAA.
 3. Manufacturer Qualification: Approved by manufacturer to apply liquid applied products.
- B. Walkway Auditor: Certified by CPAA or NFSI to test bonded abrasive polished concrete floors for dynamic and static coefficient of friction according to ANSI B101.1 and B101.3.
- C. Coefficient of Friction: Achieve following coefficient of friction by field quality control testing in accordance to the following standards:
1. 1. ANSI B101.1 Static Coefficient of Friction - Achieve a minimum of .42 for level floor surfaces.
 2. 2. ANSI B101.3 Dynamic Coefficient of Friction - Achieve a minimum of .35 for level floor surfaces.
- D. Field Mock-up: Before performing work of this Section, provide field mock- up to verify selections made under submittals and to demonstrate aesthetic effects of polishing. Approval does not constitute approval of deviations from Contract Documents, unless Owner specifically approves deviations in writing.
1. Mock-up shall be representative of work to be expected.
 2. Perform grinding, honing, and polishing work as scheduled for Project using same personnel as will perform work for Project.
 3. Approval is for following aesthetic qualities:
 - a. Compliance with approved submittals.
 - b. Compliance with specified aggregate exposure.
 - c. Compliance with specified finished gloss level.
 - d. Compliance with specified color.
 4. Obtain Owner's approval before starting work on Project.
- E. Pre-Installation Conference: Prior to areas scheduled for polishing, conduct conference at Project.
1. Required Attendees:
 - a. Owner.
 - b. Concrete polisher, including supervisor.
 - c. Technical representative of liquid applied product manufacturers.

2. Minimum Agenda: Polisher shall demonstrate understanding of work required by reviewing and discussing procedures for, but not limited to, following:
 - a. Tour field mock-up and representative areas of required work, discuss and evaluate for compliance with Contract Documents, including substrate conditions, surface preparations, sequence of procedures, and other preparatory work performed by other installers.
 - b. Review Contract Document requirements.
 - c. Review approved submittals and field mock-up.
 - d. Review procedures, including, but not limited to:
 - 1) Details of each step of grinding, honing, and polishing operations.
 - a) Application of color.
 - b) Application of liquid applied products.
 - c) Protecting polished concrete floors after polishing work is complete.

1.5 FIELD CONDITIONS

1. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting liquid applied product application.

PART 2 - PRODUCTS

2.1 LIQUID APPLIED PRODUCTS

1. Liquid Densifier: An Aqueous solution of Silicon Dioxide dissolved in one of the following Hydroxides that penetrates into the concrete surface and reacts with the Calcium Hydroxide to provide a permanent chemical reaction that hardens and densifies the wear surface of the cementitious portion of the concrete. All of the following have the same chemistry varying only by the alkali used for solubility of the Silcone Dioxide.
2. Water-based silicate solution that penetrates concrete and reacts with calcium hydroxide to lock in color particles.
3. E. Sealer - Impregnating Stain Protection: Non film forming stain and food resistant penetrating sealer designed to be applied to densified and polished concrete which meets the requirements of OSHA for slip resistance as tested by ASTM D 2047 and stain resistance of ASTM D 1308.

2.2 ACCESSORIES

1. Repair Material: A product that is designed to repair cracks and surface imperfections. The specified material must have sufficient bonding capabilities to adhere after the polishing to the concrete surface and provide abrasion resistance

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- equal to or greater than the surrounding concrete substrate.
2. Grout Material: A thin mortar used for filling spaces. Acceptable products shall be:
 - a. Epoxy, urethane, polyurea, or polyaspartic resins.
 - b. Latex or acrylic binders mixed with cement dust from previous grinding steps.
 - c. Silicate binders mixed with cement dust from previous grinding steps.
 3. Protective Cover: Non-woven, puncture and tear resistant, polypropylene fibers laminated with a multi-ply, textured membrane, not less than 18 mils in thickness.

2.3 POLISHING EQUIPMENT

1. Field Grinding and Polishing Equipment:
 - a. A multiple head, counter rotating, walk behind or ride on machine, of various size and weights, with diamond tooling affixed to the head for the purpose of grinding concrete. Excludes janitorial maintenance equipment.
 - b. If dry grinding, honing, or polishing, use dust extraction equipment with flow rate suitable for dust generated, with squeegee attachments.
 - c. If wet grinding, honing, or polishing, use slurry extraction equipment suitable for slurry removal and containment prior to proper disposal.
2. Edge Grinding and Polishing Equipment: Hand-held or walk-behind machines which produces same results, without noticeable differences, as field grinding and polishing equipment.
3. Burnishing Equipment: High speed walk-behind or ride-on machines capable of generating 1000 to 2000 revolutions per minute and with sufficient head pressure of not less than 20 pounds to raise floor temperature by 20 degrees F.
4. Diamond Tooling: Abrasive tools that contain industrial grade diamonds within a bonded matrix (such as metallic, resinous, ceramic, etc) that are attached to rotating heads to refine the concrete substrate.
 - a. Bonded Abrasive: Abrasive medium that is held within a bonding that erodes away to expose new abrasive medium as it is used.
 - b. Metal Bond Tooling: Diamond tooling that contains industrial grade diamonds with a metallic bonded matrix that is attached to rotating heads to refine the concrete substrate. These tools are available in levels of soft, medium, and hard metallic matrices that are matched with contrasting concrete substrates (i.e. hard matrix/soft concrete, medium matrix/medium concrete, soft matrix/hard concrete) and are typically used in the grinding and early honing stages of the polishing process.
 - c. Resin Bond Tooling: Diamond tooling that contains industrial grade diamonds within a resinous bonded matrix (poly-phenolic, ester-phenolic, thermoplastic-phenolic) that is attached to rotating heads to refine the concrete substrate. Resin bond tooling does not have the soft/medium/hard characteristics of metal bond tooling and are typically used for the later honing and polishing stages of the polishing process.
 - d. Hybrid Tooling: Diamond tooling that combines metal bond and resin bond that has the characteristics of both types of tooling. These types of tools are

typically used as either transitional tooling from metal bond tools to resin bond tools or as a first cut tool on smooth concrete surfaces.

- e. Transitional Tooling: Diamond tooling that is used to refine the scratch pattern of metal bond tooling prior to the application of resin bond tooling in an effort to extend the life of resin bond tooling and to create a better foundation for the polishing process.
- f. Abrasive Pad: An abrasive pad, resembling a typical floor maintenance burnishing pad, that has the capability of refining the concrete surface on a microscopic level that may or may not contain industrial grade diamonds. These pads are typically used for the maintenance and/or restoration of previously installed polished concrete flooring.

PART 3 - EXECUTION

3.1 EXAMINATION

1. Acceptance of Surfaces and Conditions:

Examine substrates to be polished for compliance with requirements and other conditions affecting performance.

2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
3. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 PREPARATION

1. Cleaning Concrete Surfaces:

- a. Prepare and clean concrete surfaces.
- b. Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, paint splatter, and other contaminants incompatible with liquid applied products and polishing.

2. Cleaning Metal Coverings in Floor:

- a. Clean (remove paint and other substances) all metal floor coverings and repaint with industrial paint – Color to be selected by Owner.

3.3 VAPOR TESTING CONCRETE FLOORS

1. Alkalinity:

- a. Test Method: Measure pH according to method indicated in ASTM F 710.
- b. Acceptable Results: pH between 8 and 10.

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2. Moisture Vapor Transmission Rate:
 - a. Test Method: Perform anhydrous calcium chloride test according to ASTM F 1869.
 - b. Acceptable Results: Not more than 5 pounds per 1000 square feet in 24 hours.
3. Relative Humidity:
 - a. Test Method: Perform relative humidity test using in situ probes according to ASTM F 2170.
 - b. Acceptable Results: Not more than 75 percent.

3.4 COLORING CONCRETE FLOORS

1. Dye or Pigmented Micro Stain Application:
 - a. Apply solution by methods and techniques required by manufacturer to produce finish matching approved field mock-ups.
 - b. Maintain wet edge, working newly applied solution into edges of adjacent wet edges of previously treated surfaces.
 - c. Maintain consistent saturation throughout application.
 - d. Avoid splashing, dripping, or puddling of solution on adjacent substrates.
 - e. When color matches approved mock-ups, neutralize as required by manufacturer.

3.5 POLISHING CONCRETE FLOORS

1. Perform all polishing procedures to ensure a consistent appearance from wall to wall.
2. Initial Grinding:
 - a. Use grinding equipment with metal or semi-metal bonded tooling.
 - b. Begin grinding in one direction using sufficient size equipment and diamond tooling to meet specified aggregate exposure class.
 - c. Make sequential passes with each pass perpendicular to previous pass using finer grit tool with each pass, up to 100 grit metal bonded tooling.
 - d. Achieve maximum refinement with each pass before proceeding to finer grit tools.
 - e. Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.
 - f. Continue grinding until aggregate exposure matches approved field mock-ups.
3. Treating Surface Imperfections:
 - a. Mix patching compound or grout material with dust created by grinding operations, manufacturer's tint, or sand to match color of adjacent concrete surfaces.
 - b. Fill surface imperfections including, but not limited to, holes, surface damage, small and micro cracks, air holes, pop-outs, and voids with grout to eliminate

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- micro pitting in finished work.
 - c. Work compound and treatment until color differences between concrete surface and filled surface imperfections are not reasonably noticeable when viewed from 10 feet away under lighting conditions that will be present after construction.
- 4. Liquid Densifier Application: Apply undiluted to point of rejection, remove excess liquid, and allow curing according to manufacturer's instructions.
- 5. Grout Grinding:
 - a. Use grinding equipment and appropriate grit and bond diamond tooling.
 - b. Apply grout, forced into the pore structure of the concrete substrate, to fill surface imperfections.
 - c. Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.
- 6. Honing:
 - a. Use grinding equipment with hybrid or resin bonded tooling.
 - b.hone concrete in one direction starting with a 100 grit tooling and make as many sequential passes as required to remove scratches, each pass perpendicular to previous pass, up to 400 grit tooling reaching maximum refinement with each pass before proceeding to finer grit tooling.
 - c. Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.
- 7. G. Polishing:
 - a. Use polishing equipment with resin-bonded tooling.
 - b. Begin polishing in one direction starting with 800 grit tooling.
 - c. Make sequential passes with each pass perpendicular to previous pass using finer grit tooling with each pass until the specified level of gloss has been achieved.
 - d. Achieve maximum refinement with each pass before proceeding to finer grit pads.
 - e. Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.
 - f. Stain Protection: Uniformly apply and remove excessive liquid according to manufacturer's instructions. Final film thickness should be less than .05 mils after cure.
 - g. Final Polish: Using burnishing equipment and finest grit abrasive pads, burnish to uniform reflective sheen matching approved field mock-up.
- 8. H. Final Polished Concrete Floor Finish:
 - a. Aggregate Exposure Class B - Fine / Sand Aggregate Finish: Remove not more than 1/16 inch of concrete surface by grinding and polishing resulting in

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majority of exposure displaying fine aggregate with no, or small amount of, medium aggregate at random locations.

- b. Finished Gloss Level 4 - Very High Gloss Appearance:
 - 1) a. Procedure: Recommended not less than 4 steps with full refinement of each diamond tool with one application of densifier.
 - 2) b. Gloss Measurement: Determine the specular gloss by incorporating the following:
 - 1.) Reflective Clarity Reading: Not less than 85 according to ASTM D5767 prior to the application of sealers.
 - 2.) Reflective Sheen Reading: Not less than 50 according to ASTM D523 prior to the application of sealers.

3.6 FIELD QUALITY CONTROL

- 1. Field Testing: Engage a qualified walkway auditor to perform field testing to determine if polished concrete floor finish complies with specified coefficient of friction;
 - a. ANSI B101.1 for static coefficient of friction
 - b. ANSI B101.3 for dynamic coefficient of friction

3.7 CLOSEOUT ACTIVITIES

- 1. Maintenance Training: CPAA Craftsman shall train Owner's designated personnel in proper procedures for maintaining polished concrete floor.