



## SECTION 033543 - BONDED ABRASIVE POLISHED CONCRETE FLOORS

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### PART 1 – GENERAL

#### 1.1 SUMMARY

RETAIN THE BRACKETED OPTION IN THE FOLLOWING SUB-PARAGRAPH WHEN SPECIFYING COLORED FINISH.

- A. Section Includes: Products and procedures for [coloring and] bonded abrasive polished 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 Concrete Polishing Council (CPC) glossary.
- B. Polished Concrete: The act of changing a concrete floor surface, with or without surface exposure of aggregate, to achieve a specified level of appearance.
- C. Bonded Abrasive Polished Concrete: The multi-step operation of mechanically grinding, honing, and polishing 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 appearance as defined by the CPC.

#### 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. Maintenance Data: For inclusion in maintenance manual required by Division 01.
  - 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 that has successfully completed five projects 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 a 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, CPC Craftsman, or equivalent.
3. Manufacturer Qualification: Approved by manufacturer to apply liquid applied products.

### B. Field Mock-up: Before performing work of this Section, provide following 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 Architect specifically approves deviations in writing.

1. Form, reinforce, and cast concrete slab for 10 foot square field mock-up.
2. Concrete shall be same mix design as scheduled for Project.
3. Placement and finishing work shall be performed by same personnel as will place and finish concrete for Project.
4. Mock-up shall be representative of work to be expected.
5. Perform grinding, honing, and polishing work as scheduled for Project using same personnel as will perform work for Project.
6. Approval is for following aesthetic qualities:
  - a. Compliance with approved submittals.
  - b. Compliance with specified aggregate exposure class.
  - c. Compliance with specified appearance level.



**RETAIN THE FOLLOWING SUB-SUBPARAGRAPH WHEN SPECIFYING COLORED FINISH.**

- d. Compliance with specified color.
  7. Obtain Architect's approval before starting work on Project.
  8. Protect and maintain approved field mock-ups during construction in an undisturbed condition as a standard for judging completed work.
- C. Pre-Installation of Concrete Conference: Prior to placing concrete for areas scheduled for polishing, conduct conference at Project to comply with requirements of applicable Division 01 Sections.
1. Required Attendees:
    - a. Owner.
    - b. Architect.
    - c. Contractor, including supervisor.
    - d. Concrete producer.
    - e. Concrete finisher, including supervisor.
    - f. Concrete polisher, including supervisor.
    - g. 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) Applicable Division 03 Section on cast-in-place concrete



- a. Specific mix design.
- b. Specified curing methods/procedures.
- c. Projected 3, 14, and 28 day compressive strength test for finished floor and project phasing.
- d. Protection of concrete substrate during construction and prior to polishing process.
- e. Project phasing and scheduling for each step of grinding, honing and polishing operations including, but not limited to:
  - i. Quality of qualified personnel committed to project.
  - ii. Quality and size of grinders committed to project.
  - iii. Proper disposal of concrete slurry and/or concrete dust.
- f. Details of each step of grinding, honing, and polishing operations.

**RETAIN THE FOLLOWING SUB-SUBPARAGRAPH WHEN SPECIFYING COLORED FINISH.**

- i. Application of color.
  - ii. Application of liquid applied products.
  - iii. Protecting polished concrete floors after polishing work is complete.
3. Reports: Record discussions, including decisions and agreements reached, and furnish copy of record to each party attending.

**1.5 FIELD CONDITIONS**

- A. Damage and Stain Prevention: It is the responsibility of others to prevent damage and staining of concrete surfaces to be polished.
1. Prohibit use of markers, spray paint, and soapstone.
  2. Prohibit improper application of liquid membrane film forming curing compounds.
  3. Prohibit vehicle parking over concrete surfaces.
  4. Prohibit pipe-cutting operations over concrete surfaces.



5. Prohibit storage of any items over concrete surfaces for not less than 28 days after concrete placement.
  6. Prohibit ferrous metals storage over concrete surfaces.
  7. Protect from petroleum, oil, hydraulic fluid, or other liquid dripping from equipment working over concrete surfaces.
  8. Protect from acids and acidic detergents contacting concrete surfaces.
  9. Protect from painting activities over concrete surfaces.
- B. 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**

- A. 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.
1. Sodium Silicate
  2. Potassium Silicate
  3. Lithium Silicate
  4. Alkali solution of Colloidal Silicates or Silica

### **RETAIN ONE OF THE FOLLOWING THREE PARAGRAPHS WHEN SPECIFYING COLORED FINISH.**

- B. Dye: Non-film forming soluble colorant dissolved in a carrier designed to penetrate and alter coloration of a concrete floor surface without a chemical reaction.
- C. Pigmented Micro Stains: Fine pigment particles suspended in water-based silicate solution that penetrates concrete and reacts with calcium hydroxide to lock in color particles.
- D. Acid Stain: Reactive solution of one or more metal salts stabilized by acid that produces coloration in a concrete substrate by neutralization of acid followed by



precipitation of metal hydroxides or oxides.

## 2.2 ACCESSORIES

- A. 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 equal to or greater than the surrounding concrete substrate.
- B. Grout Material: A thin mortar used for filling spaces. Acceptable products shall be:
  - 1. Epoxy, urethane, polyurea, or polyaspartic resins.
  - 2. Latex or acrylic binders mixed with cement dust from previous grinding steps.
  - 3. Silicate binders mixed with cement dust from previous grinding steps.

## 2.3 POLISHING EQUIPMENT

- A. Field Grinding and Polishing Equipment:
  - 1. 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.
  - 2. If dry grinding, honing, or polishing, use dust extraction equipment with flow rate suitable for dust generated, with squeegee attachments to meet OSHA requirements.
  - 3. If wet grinding, honing, or polishing, use slurry extraction equipment suitable for slurry removal and containment prior to proper disposal.
- B. Edge Grinding and Polishing Equipment: Hand-held or walk-behind machines which produces the same results, without noticeable differences, as field grinding and polishing equipment.
- C. 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.
- D. 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.



1. **Bonded Abrasive:** Abrasive medium that is held within a bonding that erodes away to expose new abrasive medium as it is used.
2. **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.
3. **Resin Bond Tooling:** Diamond tooling that contains industrial grade diamonds within a resinous bonded matrix (poly-phenolic, ester-phenolic, and 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.
4. **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.
5. **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.
6. **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**

#### **A. Acceptance of Surfaces and Conditions:**

1. Examine substrates to be polished for compliance with requirements and other conditions affecting performance.
  - a. Concrete finished floor flatness according to applicable Division 03 Section on cast-in-place concrete.



- b. Concrete curing methods according to applicable Division 03 Section on cast-in-place concrete.
  - c. Concrete compressive strength according to applicable Division 03 Section on cast-in-place concrete.
- B. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
- C. Starting work within a particular area will be construed as acceptance of surface conditions.

### **3.2 PREPARATION**

A. Cleaning New Concrete Surfaces:

1. Prepare and clean concrete surfaces.
2. 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.

**RETAIN THE FOLLOWING ARTICLE, PARAGRAPH, AND SUB-PARAGRAPHS WHEN SPECIFYING COLORED FINISH.**

### **3.4 COLORING CONCRETE FLOORS**

A. Dye or Pigmented Micro Stain Application:

1. Follow manufacturer's recommendation.

### **3.5 POLISHING CONCRETE FLOORS**

- A. Perform all polishing procedures to ensure a consistent visual appearance from wall to wall.
- B. Initial Grinding:
1. Use grinding equipment with metal or semi-metal bonded tooling.
  2. Begin grinding in one direction using sufficient size equipment and diamond tooling to meet specified aggregate exposure class.
  3. Make sequential passes with each pass perpendicular to previous pass using finer grit tool with each pass, up to 100 grit metal bonded tooling.





4. Achieve maximum refinement with each pass before proceeding to finer grit tools.
5. 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. Continue grinding until aggregate surface exposure matches approved field mock-up.

C. Treating Surface Imperfections:

1. Mix patching compound or grout material with dust created by grinding operations, manufacturer's tint, or sand to match color of adjacent concrete surfaces.
2. 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 micro pitting in finished work.
3. Work compound and treatment until color differences between concrete surface and filled surface imperfections, compared to mockup, are not reasonably noticeable when viewed from 20 feet away under lighting conditions that will be present after construction.

D. Liquid Densifier Application: Apply undiluted to point of rejection, remove excess liquid, and allow curing according to manufacturer's instructions.

E. Grout Grinding:

1. Use grinding equipment and appropriate grit and bond diamond tooling.
2. Apply grout, forced into the pore structure of the concrete substrate, to fill surface imperfections.
3. 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. Honing:

1. Use grinding equipment with hybrid or resin bonded tooling.
2. Hone concrete in one direction starting with 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.



3. 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.

**RETAIN THE FOLLOWING ARTICLE, PARAGRAPH, AND SUB-PARAGRAPHS WHEN SPECIFYING FINISHED APPEARANCE LEVELS 3 OR 4.**

**G. Polishing:**

1. Use polishing equipment with resin-bonded tooling.
2. Begin polishing in one direction starting with 800 grit tooling.
3. Make sequential passes with each pass perpendicular to previous pass using finer grit tooling with each pass until the specified level of appearance has been achieved.
4. Achieve maximum refinement with each pass before proceeding to finer grit pads.
5. 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. Stain Protection: Uniformly apply and remove excessive liquid according to manufacturer's instructions. Final film thickness should be less than .05 mils after cure.
7. Final Polish: Using burnishing equipment and finest grit abrasive pads, burnish to uniform reflective sheen matching approved field mock-up.

**H. Final Polished Concrete Floor Finish:**

**RETAIN ONE OF THE FOLLOWING THREE SUBPARAGRAPHS FOR CLASS OF AGGREGATE EXPOSURE.**

1. Aggregate Exposure Class A – Cement Fines: Surface exposure of 85 to 95% cement fines and 5 to 15% fine aggregate based on visual observation of the overall area of the polished floor.
2. Aggregate Exposure Class B – Fine Aggregate: Surface exposure of 85 to 95% fine aggregate and 5 to 15% cement fines and coarse aggregate based on visual observation of the overall area of the polished floor.



3. Aggregate Exposure Class C – Coarse Aggregate: Surface exposure of 80 to 90% coarse aggregate and 10 to 20% cement fines and fine aggregate based on visual observation of the overall area of the polished floor.

**RETAIN ONE OF THE FOLLOWING FOUR SUBPARAGRAPHS FOR LEVEL OF APPEARANCE.**

4. Appearance Level 1 – Flat (Ground):

- a. Procedure: Recommended not less than 4 step process with full refinement of each diamond tool with one application of densifier.
- b. Measurement: Determine the Image Clarity Value, %, and the Haze Index:
  - 1) Image Clarity Value, %: An average value of 9 or less measured in accordance with ASTM D5767 prior to the application of sealers.
  - 2) Haze Index: An average value less than 10 measured in accordance with ASTM D4039 prior to the application of sealers.
  - 3) The minimum number of tests distributed across the polished surface should be three, for areas up to 1000 ft<sup>2</sup> and one additional test for each 1000 ft<sup>2</sup> or fraction thereof. This applies to both the Image Clarity Value and Haze Index.

5. Appearance Level 2 – Satin (Honed):

- a. Procedure: Recommended not less than 4 step process with full refinement of each diamond tool with one application of densifier.
- b. Measurement: Determine the Image Clarity Value, %, and the Haze Index:
  - 1) Image Clarity Value, %: An average value of 10 to 39 measured in accordance with ASTM D5767 prior to the application of sealers.
  - 2) Haze Index: An average value less than 10 measured in accordance with ASTM D4039 prior to the application of sealers.
  - 3) The minimum number of tests distributed across the polished surface should be three, for areas up to 1000 ft<sup>2</sup> and one additional test for each 1000 ft<sup>2</sup> or fraction thereof. This applies to both the Image Clarity Value and Haze Index.

6. Appearance Level 3 – Polished:



- a. Procedure: Recommended not less than 4 steps with full refinement of each diamond tool with one application of densifier.
  - b. Measurement: Determine the Image Clarity Value,%, and the Haze Index:
    - 1) Image Clarity Value, %: An average value of 40 to 69 measured in accordance with ASTM D5767 prior to the application of sealers.
    - 2) Haze Index: An average value less than 10 measured in accordance with ASTM D4039 prior to the application of sealers.
    - 3) The minimum number of tests distributed across the polished surface should be three, for areas up to 1000 ft<sup>2</sup> and one additional test for each 1000 ft<sup>2</sup> or fraction thereof. This applies to both the Image Clarity Value and Haze Index.
7. Appearance Level 4 –Highly Polished:
- a. Procedure: Recommended not less than 4 steps with full refinement of each diamond tool with one application of densifier.
  - b. Measurement: Determine the Image Clarity Value, %, and the Haze Index:
    - 1) Image Clarity Value, %: An average value of 70 to 100 measured in accordance with ASTM D5767 prior to the application of sealers.
    - 2) Haze Index: An average value less than 10 measured in accordance with ASTM D4039 prior to the application of sealers.
    - 3) The minimum number of tests distributed across the polished surface should be three for areas up to 1000 ft<sup>2</sup> and one additional test for each 1000 ft<sup>2</sup> or fraction thereof. This applies to both the Image Clarity Value and Haze Index.

### **3.6 PROTECTION**

- A. Protection is the responsibility of others.

END OF SECTION