

# CONCRETE FLOOR FINISHING AND TYPES OF FINISH

## CONCRETE STANDARD ENGINEERING SPECIFICATION

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SB 10 U

Page 1 of 4

### 1. SCOPE

1.1 This specification describes materials, types of finishes, and their application.

1.2 Du Pont personnel should refer to DB4L for selection of concrete finishes.

### 2. GENERAL

2.1 References to specifications and standards published by national societies and associations, including Du Pont standards or specifications, to which compliance is required by Du Pont, shall be the latest issue published at time of order.

2.2 Specifications SB1U and SB6U apply to and are a part of this specification.

2.3 For joints in floors on earth, see SB15U.

2.4 For curing materials and methods, see SB12U.

### 3. MATERIALS

3.1 When requested, samples of materials proposed for use, together with complete specifications, shall be submitted to Du Pont for approval.

3.2 **Metallic hardeners** shall consist of specially processed, ground and graded iron aggregates combined with a water-reducing (cement-dispersing) admixture and other plasticizing components. The aggregates shall be free of nonferrous metals, oil, grease, and other impurities. The aggregate shall be graded from coarse to fine, with not less than 90 percent passing a No. 8 sieve and less than 5 percent passing a No. 100 sieve.

3.3 **Nonmetallic hardeners** shall consist of emery, traprock, basalt, granite, or silica-quartz aggregates. They shall be clean and free of organic or other injurious materials. The aggregates shall be crushed angular stone, having a hardness of 6.5 or more on Mohs Scale. Aggregate gradation shall conform to the manufacturer's recommendations for the particular application involved.

3.4 **Abrasive (nonslip) aggregates** shall consist of aluminum oxide, silicon carbide, or emery having a hardness of 9 or more on Mohs Scale. The aggregates shall be rustproof, nonglazing and unaffected by freezing, moisture, salts, alkali, or cleaning compounds. The aggregates shall be sharp grained and uniformly graded

according to grit sizes shown below. Larger grit sizes are generally better for heavier duty traffic and wetter areas.

#### a. Aluminum Oxide

Normal traffic - grit size 30-60 to 40-70

b. **Silicon Carbide** (surface sparkles - for sidewalks, etc)

Normal traffic - grit size 12-30 or 36-60

#### c. Emery

Normal traffic - grit size 20 to fines

3.5 **Portland cement** shall be Type 1, per ASTM C 150.

3.6 **Concrete** shall be the minimum compressive strength as called for on the drawing and proportioning shall conform to SB6U.

3.7 **Concrete sealer** shall be a butadiene-styrene compound [Raylite B-12 with 1 coat of Raylite D-36 manufactured by Raylite Co, P. O. Box 7218, Wilmington, DE 19803, phone (302) 652-3904], or equal.

### 4. EQUIPMENT

4.1 Bull floats and darbies shall be made of wood for normal concrete and of aluminum or magnesium for air-entrained concrete when used for floor slabs.

4.2 Power floats shall be disk type equipped with metal hammers which rise and fall on a cam, or other internal means which is adjustable for various degrees of vibration.

4.3 Trowelling machines shall weigh at least 180 pounds and shall be equipped with smooth steel blades which may or may not be interchangeable with float blades.

### 5. SLAB PREPARATION

5.1 All slabs shall be straightedged, or a vibrating screed may be used to bring the surface to the levels indicated on the drawings and sloped to drainage points where required. Screed strips and supports shall be removed immediately to prevent shrinkage cracks at these locations, and the resulting holes and depressions shall be filled with fresh concrete. Immediately behind the screeding operation, the concrete shall be further consolidated and leveled with a bull float or, in small areas, with a darby.

Vendors and merchandise designations are given to describe materials and may not include all acceptable products. Substitutions by suppliers are to be made only on approval of the local authority initiating the use of this specification.

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NOTE

The surface shall be brought to a true grade, as described in Table 1 unless otherwise noted. Do not overwork the concrete surface as this may bring excess water and mortar to the surface. The above operation must be completed before any bleed water rises to the surface. Excessive bleeding may carry particles of light, weak fines to the surface - thereby increasing the surface water cement ratio which in turn may result in a softer, lower strength surface and increased dusting. Air-entrainment inhibits rise of bleed water.

**5.2** Surface water, which may appear during the process of the screeding or floating, shall not be disposed of by the process of dusting dry cement or cement-sand mixture on the surface, nor shall such mixtures be used as aids in promoting suitable finishing conditions. Bleed water must evaporate or be removed prior to floating. The best way to remove this water is to drag a rubber hose slowly over the surface.

**5.3 First Floating.** Concrete shall be floated as soon as water sheen disappears, and when it will support the weight of a man and a power float or a trowelling machine (with float blades flat) without digging into the surface. The perimeters shall be floated first because the concrete stiffens faster in this area. Mechanical floating shall be done only to within 4 inches of construction joints. This remaining surface shall be densified and floated by hand, then tooled with a square edger having a radius of not more than  $\frac{1}{8}$  inch. This operation shall be done after each trowelling.

## 6. APPLICATION METHODS

**6.1** The drawings shall indicate the type of finish required. The finish shall be obtained by use of the methods and sequences of work described hereafter, following slab preparation specified in section 5. Additional floating shall be done by means of power floats or a trowelling machine equipped with float blades in the flat position. Steel trowellings, except for the burnishing hand trowelling, shall be done with trowelling (finishing) machines. Except for hand trowelling at the perimeter of a pouring section, no hand finishing shall be done between mechanical operations.

**6.2 Surface Hardeners** (Types 4, 5, and 6 finishes). Immediately after the first floating, apply natural or manufactured aggregates uniformly by fanning in two directions (do not throw shake) and float into surface. Preparation, quantity, number of shakes, and rate of application shall conform to the required type of finish as stated herein or per manufacturer's recommendations.

**6.3 Trowelling.** The first mechanical steel trowelling (blades relatively flat) shall be done directly after the final floating, and should be sufficient to produce a

smooth surface free of defects. When required, the second and third mechanical steel trowellings (blades pitched slightly) shall be done when little paste clings to the trowel blades, and the floor will not be imprinted by the operator's feet. Mechanical steel trowelling shall be done only to within 4 inches of construction joints. The remaining surface shall be hand trowelled and then tooled with a square edger having a radius of not more than  $\frac{1}{8}$  inch. This operation shall be done after each additional trowelling. All ridges, marks, pinholes, etc. shall be removed from the surface upon completion of the final trowelling. Trowelling too soon or excessive early trowelling (or both) reduces surface strength and increases dusting.

**6.4 Final Burnishing, Hand Trowelling.** When required, this operation shall not begin until it can be done without "fat" clinging to the trowel, and when the passage of the trowel over the surface produces a distinct ringing sound. The trowel shall be applied with considerable pressure and when completed, the surface of Types 1, 5, and 6 finishes shall be free of chatter marks and shall exhibit a definite polished sheen.

**6.5** When finishing work begins, and when requested by Du Pont, a section of the area shall be completed in accordance with these specifications and shall be approved as to quality. The approved portion then shall serve as a basis of comparison for the rest of the area receiving the same type of finish. The quality of the remainder of the work shall be equal to that of the approved portion.

## 7. TYPE OF FINISH

**7.1 Type 1 - (Trowelled Finish).** A dense, hard, smooth-trowelled finish for use in manufacturing areas, shops, control rooms, general storage, etc. where there is light-wheeled traffic. Finish is extremely slippery when wet. Apply two or more mechanical steel trowellings and one hand trowelling for burnishing. Moisture cure or use of curing compound is required. Where approved, a chemical/abrasion resistant sealer may be required.

**7.2 Type 2 - (Trowelled Finish).** Plain, smooth-trowelled finish for areas where a Type 1 finish is not required or where a floor covering is to be applied. Apply one or more mechanical steel trowellings, as necessary, to produce a smooth finish free of all irregularities; otherwise, these imperfections may reflect through the floor covering. Moisture curing is preferred but curing compounds, compatible with final floor covering, may be used.

**7.3 Type 2A - (Floated Finish).** A plain, smooth finish for concrete roof slabs under single-ply or built-up roofing where a Type 2 finish is not required. Slab preparation shall be as described in 5.1 and 5.2. Floating shall be as described in 5.3 either with a power float, a trowelling

machine, or with a wood float. No trowelling required. The floating operation should remove most minor ridges and depressions. Moisture cure or where curing compound is used it must be compatible with the roof system.

**7.4 Type 3 - (Broom Finish).** Comparatively rough-broom finish for inside and outside slabs, sidewalks, pavements, stairs, etc. After floating, apply one manual or mechanical trowelling followed by a finishing operation with a stiff hairbrush (brooming) to produce a sandy surface similar to a "sidewalk" finish. Finishing shall be done after the concrete is hard enough to retain the scoring. Brooming shall be done transversely to the direction of main traffic. Sidewalks and similar areas shall be tooled along all edges using an edger with a 1/4 inch or 3/8 inch radius. In addition, walks shall be divided into segments approximately 5 feet - 0 inch oc maximum by tooling transversely with a groove equal to one-fourth the thickness of the slab and having the same radius as that used on the edges. Moisture cure or curing compounds may be used.

**7.5 Type 3A - (Broom Finish).** Comparatively rough finish as a bonding finish for epoxy coatings and ceramic or quarry tile set in thin-set or corrosion-resistant mortars. After floating, apply one manual or mechanical trowelling, followed by a finishing operation, using a carpet surfaced float. Finishing shall result in a uniform surface free of ridges, pronounced protrusions, and depressions. Moisture cure (cover cure with design approval).

**7.6 Type 4 - (Nonslip Finish).** For normal traffic (personnel), an abrasive, nonslip finish for floors, ramps, stairs, locker and washrooms, areas subject to moisture and oil contamination with no special requirements other than nonslip. Immediately after the first floating (5.3), uniformly apply aggregates to the surface per the manufacturer's recommendations by hand or shake screens, and work in with a wood or mechanical float. When the surface begins to lose its sheen, finish with one hand or mechanical steel trowelling. If the final steel trowelling produces too smooth a surface, lightly rub the surface with burlap to expose the aggregate. Moisture and cover or seal cure, or seal cure per SB12U.

**7.7 Type 5 - (Dry-Shake Finish).** Smooth steel-trowelled finish with metallic hardener for floors subject to heavy-duty forklift truck traffic, warehouses, or areas subject to impact loading, steel barrels rolled on chimes, etc. A ready-mixed metallic hardener (purchased-premixed metallic aggregate and portland cement) shall be applied at the rate of 1.5 pounds per square foot, per manufacturer's shake method.

**7.7.1** After the first floating (5.3), the metallic hardener shall be applied in two or more shakes, using

the proportions of two-thirds and one-third for two shakes. After each shake, the surface shall be floated with power floats. After all the hardener has been applied and properly floated, the surface shall be trowelled immediately with a mechanical trowelling machine. A second trowelling shall be applied at a point when the operator can walk on the surface without leaving an imprint. A final steel hand trowelling shall be applied at the point of set which will produce a ring as the trowel passes over the surface, and when no "fat" will cling to the trowel. The final trowelling shall produce a very hard, shiny surface.

**7.7.2** Moisture and cover or seal cure, or seal cure per SB12U.

**7.8 Type 6 - (Dry-Shake Finish).** Smooth, steel-trowelled finish with nonmetallic hardener for floors subject to moderate-duty forklift truck traffic, warehouses, manufacturing areas where excellent resistance to wear and dusting is required without using a Type 5 finish, or where a moisture condition occurs periodically which may cause a brownish discoloration of a Type 5 finish.

**7.8.1 Emery and Silica-Quartz Nonmetallic Aggregates.** After the first floating, the dry-mixed aggregates shall be applied to the surface in two or more shakes per the manufacturer's recommended application rate. After each shake the surface shall be floated with power floats taking care not to bury the aggregates.

**7.8.2** After all the hardener has been applied and properly floated, the surface shall be trowelled immediately with a mechanical trowelling machine. A second trowelling shall be applied at a point when the operator can walk on the surface without leaving an imprint. A final steel hand trowelling shall be applied at the point of set which will produce a ring as the trowel passes over the surface, and when no "fat" will cling to the trowel. The final trowelling shall produce a very hard, shiny surface. Moisture and cover or seal cure, or seal cure per SB12U.

**7.9 Type 7 - (Heavy-Duty Topping Finish).** A special 1/2-inch thick topping composed of malleable metallic aggregate and high-strength binder providing a dense surface for high concentration of traffic, loading and unloading, high-point loads, extremely heavy impact, or heavy abrasion. Cure per manufacturer's recommendation.

**7.10 Type 8 - (Floated Finish).** For surfaces on floors under epoxy floor finishes, acidproof brick, wood block flooring, or waterproofing membrane. After screeding, apply one wood floating. Moisture cure (cover cure with design approval).

**7.11 Type 9 – (Scratched or Scored Finish).** For floor surfaces to receive concrete topping, terrazzo, ceramic, and quarry tile placed in a portland cement mortar bed  $\frac{3}{4}$ -inch to  $1\frac{1}{2}$ -inch thick stone slab, etc. After floating, and when slab has attained initial set, the surface shall be roughened with a light rake, being careful not to dislodge coarse aggregate or expose reinforcing steel. Moisture cure.

**7.12 Type 10 – (Dry-Shake Finish).** A special metallic floor that is static-disseminating or spark resistant. The floor must be grounded. The materials are ready mixed and shall conform to Navy BuDocks Specification TS-F15. Materials shall be installed under supervision of manufacturer's representative. Cure per manufacturer's recommendation.

### 8. FLOOR SEALER

Sealer shall not be applied to floors contaminated with grease, oil, paint, or curing compound. Sealer shall

be applied by brush, spray, or roller in two coats per manufacturer's instructions unless specified otherwise. Concrete surface to be coated shall have a moisture content of 15 percent or less. Sealer is usually applied 30 days after finishing, based upon manufacturer's recommendations. **(Curing compounds are not the same as sealers.)**

### 9. CAUTION

Where a possibility exists of contaminating concrete pours or finishes with aluminum chips from nearby or overhead fabrication of conduit, checker plate, etc, discontinue such work until the concrete surface has been finished and covered.

### 10. BONDING

It shall be the responsibility of person(s) installing a new topping, coating, or covering to prepare the floor sufficiently to assure a complete bonding between the two surfaces.

**TABLE 1 – FINISHING TOLERANCES OF  
CONCRETE SLABS AND FINISHES  
(Per ACI 301)**

Area	Levelness Tolerance
Offices Laboratories Manufacturing areas Control rooms Drying areas Wet areas Shower rooms Toilet areas Warehouse* Storage areas*	Class A – shall be within $\frac{1}{8}$ inch in 10 ft, as determined by a 10-ft straightedge placed anywhere on the slab in any direction.
Warehouse* Storage areas* Ramps Loading docks Shops Roofs	Class B – shall be true planes within $\frac{1}{4}$ inch in 10 ft, as determined by a straightedge placed anywhere on the slab in any direction.

\* In selecting the levelness class for warehouse and storage area slabs and finishes, the high-lift or high-stacking requirements must be considered