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Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring[1]

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1. Scope

1.1 This practice covers the determination of the acceptability of a concrete floor for the installation of resilient flooring.

1.2 This practice includes suggestions for the construction of a concrete floor to ensure its acceptability for installation of resilient flooring.

1.3 This practice does not cover the adequacy of the concrete floor to perform its structural requirements.

1.4 This practice covers the necessary preparation of concrete floors prior to the installation of resilient flooring.

1.5 This practice does not supersede in any manner the resilient flooring or adhesive manufacturer's written instructions. Consult the individual manufacturer for specific recommendations.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

1.7 The values stated in inch-pound units are to be regarded as standard. The values in parentheses are mathematical conversions to SI units and are provided for information only.

2. Referenced Documents

2.1 *ASTM Standards:*

C 33 Specification for Concrete Aggregates[2]

C 109/C 109M Test Method for Compressive Strength of Hydraulic Cement Mortars[3]

C 309 Specification for Liquid Membrane-Forming Compounds for Curing Concrete[2]

C 472 Test Method for Compressive Strength of Gypsum Cement[3]

D 4259 Practice for Abrading Concrete[4]

E 1155 Test Method for Determining FF/FL (Floor Flatness and Floor Levelness)[5]

E 1745 Specification for Plastic Water Vapor Retarders Used In Contact With Soil or Granular Fill Under Concrete Slabs[5]

E 1486 Test Method for Determining Floor Tolerances Using Waviness, Wheel Path, and Levelness Criteria[5]

F 141 Terminology Relating to Resilient Floor Coverings[5]

F 1869 Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride[5]

NOTE 1—Specifications and test methods for cements and other related materials are found in ASTM Volume 04.01. Specifications and test methods for concretes and related materials are found in ASTM Volume 04.02.

2.2 *ACI Guides:*[6]

302.1R Guide for Concrete Floor and Slab Construction

117R Standard Tolerances for Concrete Construction and Materials

2.3 *Resilient Floor Covering Institute (RFCI):*[7]

Recommended Work Practices for the Removal of Resilient Floor Coverings

2.4 *Other Standards:*

MASTERSPEC Guide Spec Section 03300, "Cast-In-Place Concrete"[8]

SPECTEXT Guide Spec Section 03346, "Concrete Floor Finishing"[9]

3. Terminology

3.1 *Definitions*— For definitions of terms used in this practice, see Terminology F 141.

4. General Guidelines

4.1 Concrete floors to receive resilient flooring shall be permanently dry, clean, smooth, and structurally sound. They shall be free of dust, solvent, paint, wax, oil, grease, residual adhesive, adhesive removers, curing, sealing, hardening, or parting compounds, alkaline salts, excessive carbonation or laitence, mold, mildew, and other foreign materials that might prevent adhesive bond.

[1] This practice is under the jurisdiction of ASTM Committee F-6 on Resilient Floor Coverings and is the direct responsibility of Subcommittee F06.40 on Practices.

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[2] *Annual Book of ASTM Standards*, Vol 04.02.

[3] *Annual Book of ASTM Standards*, Vol 04.01.

[4] *Annual Book of ASTM Standards*, Vol 06.02.

[5] *Annual Book of ASTM Standards*, Vol 15.04.

[6] Available from American Concrete Institute, 19150 Redford Station, Detroit, MI 48219.

[7] Resilient Floor Covering Institute, 966 Hungerford Drive, Rockville, MD 20850.

[8] Available from MASTERSPEC, AIA Master Systems, King Street Station, 225 Reinekers Lane, Suite 215, Alexandria, VA 22314-2875.

[9] Available from SPECTEXT, National Institute of Building Sciences, 1090 Vermont Avenue, NW, Suite 700, Washington, DC 20005-4905.

4.2 Surface cracks, grooves, depressions, control joints or other non-moving joints, and other irregularities shall be filled or smoothed with latex patching or underlayment compound recommended by the resilient flooring manufacturer for filling or smoothing, or both. Patching or underlayment compound shall be moisture-, mildew-, and alkali-resistant, and, for commercial installations, shall provide a minimum of 3500 psi compressive strength after 28 days, when tested in accordance with Test Method C 109 or Test Method C 472, whichever is appropriate.

4.2.1 Joints such as expansion joints, isolation joints, or other moving joints in concrete slabs shall not be filled with patching compound or covered with resilient flooring. Consult the resilient flooring manufacturer regarding the use of an expansion joint covering system.

4.3 The surface of the floor shall be cleaned of all loose material by scraping, brushing, vacuuming, or other methods, or a combination thereof, as recommended by the resilient flooring manufacturer, immediately before commencing installation of resilient flooring.

4.4 Many resilient floorings may not be installed over concrete when residual asphalt adhesive residue is present. Consult the resilient flooring manufacturer's written recommendations concerning use of resilient flooring products in these situations.

4.5 Concrete floors shall be smooth to prevent irregularities, roughness, or other defects from telegraphing through the new resilient flooring. The surface of concrete floors shall be flat to within the equivalent of 3⁄16 in. (3.9 mm) in 10 ft, as described in ACI 117R, or as measured by the method described in Test Method E 1155 or any industry-recognized method specified. See X1.7 for more information regarding flatness measurement methods.

5. Testing Procedures

5.1 Concrete floors to receive resilient flooring shall be free of sealers, coatings, finishes, dirt, curing compounds, or other substances which may affect the rate of moisture dissipation from the concrete or the adhesion of resilient flooring to the concrete. Non-chemical methods for removal, such as abrasive cleaning or bead-blasting, including methods described in Practice D 4259 may be used on existing slabs with deleterious residues to achieve an appropriate state for testing. Cleaning shall take place a minimum of 48 h before testing.

NOTE 2—**Warning:** Hydraulic cement used in concrete construction may contain trace amounts of free crystalline silica. Prolonged exposure to airborne free crystalline silica may be a health hazard. Avoid actions that cause dust to become airborne. Use local or general ventilation to control exposures below applicable exposure limits.

5.2 *Moisture Testing*— In accordance with Test Method F 1869, the moisture emission from the concrete floor shall not exceed 3 lb/1000 ft^2 (170 $\mu g/m^2$) per 24 h at the time of testing, unless otherwise specified by the flooring or adhesive manufacturer. In addition to Test Method F 1869, other test methods may be acceptable to the resilient flooring manufacturer. These methods include, but are not limited to, the rubber mat test, moisture meter testing, hygrometer, or adhesive bond test. Consult the resilient flooring manufacturer's written instructions for acceptable test methods.

5.3 *Alkalinity Testing*—Concrete floors shall be tested for alkalinity prior to the installation of resilient flooring. Levels of pH shall not exceed the written recommendations of the resilient flooring manufacturer or the adhesive manufacturer, or both.

5.3.1 To test for pH at the surface of a concrete slab, use wide range pH paper, its associated pH chart, and distilled or deionized water. Place several drops of water on a clean surface of concrete, forming a puddle approximately 1 in. (25 mm) in diameter. Allow the puddle to set for 60 ± 5 s, then dip the pH paper into the water. Remove immediately, and compare to chart to determine pH reading. Readings in excess of 9.0 have been known to affect resilient flooring or adhesives, or both. Refer to resilient flooring manufacturer's written instructions for guidelines on acceptable pH levels. See X1.4 for more information about pH levels in concrete slabs.

6. Preparation of New Concrete Floors

6.1 New concrete slabs shall be properly cured and dried before installation of resilient flooring. Drying time before slabs are ready for moisture testing will vary depending on atmospheric conditions and mix design. See X1.3 for more information. Floors containing lightweight aggregate or excess water, and those which are allowed to dry from only one side, such as concrete on metal deck construction, may need a much longer drying time and should not be covered with resilient flooring unless the moisture vapor emission rate meets the manufacturer's installation specifications.

7. Preparation of Existing Concrete Floors

7.1 The resilient flooring manufacturer shall be consulted regarding the necessity of removal of old resilient flooring, adhesive residue, paint, or other surface contaminants. If old resilient flooring, paint, or adhesive residue is to be removed, follow Note 3 and Note 4:

NOTE 3—**Warning:** Do not sand, dry sweep, dry scrape, drill, saw, beadblast, or mechanically chip or pulverize existing resilient flooring, backing, lining felt, paint, asphaltic cutback adhesives, or other adhesives. These products may contain asbestos fibers or crystalline silica. Avoid creating dust. Inhalation of such dust is a cancer and respiratory tract hazard. Smoking by individuals exposed to asbestos fibers greatly increases the risk of serious bodily harm. Unless positively certain that the product is a nonasbestos-containing material, presume that it contains asbestos. Regulations may require that the material be tested to determine asbestos content. The Resilient Floor Covering Institute's (RFCI's) recommended work practices for removal of existing resilient floor coverings should be consulted for a defined set of instructions addressed to the task of removing all resilient floor covering structures.

NOTE 4—**Caution:** Certain paints may contain lead. Exposure to excessive amounts of lead dust presents a health hazard. Refer to applicable federal, state, and local laws and guidelines for hazard identification and abatement of lead-based paint published by the U.S. Department of Housing and Urban Development[10] regarding appropriate methods for identifying lead-based paint and removing such paint, and any licensing, certification, and training requirements for persons performing lead abatement work.

[10] *Lead-Based Paint: Interim Guidelines for Hazard Identification and Abatement in Public and Indian Housing*, U.S. Department of Housing and Urban Development, Washington, DC, 1990.

7.2 *Adhesive Removers*—There are a number of commercial adhesive removers that will properly remove adhesive residue from a subfloor, however, there are concerns that these products may adversely effect the new adhesive and new floor covering. The Resilient Floor Covering Institute's (RFCI's) recommended work practices for removal of existing resilient floor coverings and the resilient flooring manufacturer's written instructions should be consulted for a defined set of instructions which should be followed if existing adhesives must be removed.

8. Installation on Radiant Heated Floors

8.1 Most resilient flooring can be installed on radiant heated slabs providing the maximum temperature of the surface of the slab does not exceed 85°F (29°C) under any condition of use. Consult the resilient flooring manufacturer for specific recommendations.

9. Keywords

9.1 adhesive removers; cement; concrete floors; installation; moisture; moisture vapor emissions; pH testing; preparation; resilient flooring; rubber; slabs

APPENDIX

(Nonmandatory Information)

X1. CONCRETE COMPOSITION AND PRACTICES

X1.1 *General*—This brief information on concrete composition and practices is provided to help specifiers, resilient flooring installers, and resilient flooring manufacturers understand the properties of concrete. A concrete slab is not an inert substrate. It is a complex mixture of organic and inorganic substances whose properties and condition will affect the performance of a floor covering placed on its surface. Surface flatness, strength, joints, alkalinity, permeability, and many other concrete properties will have a significant effect on the long-term appearance and performance of resilient flooring.

X1.1.1 Concrete used for most floors is a mixture of hydraulic cement, fine aggregate (sand), coarse aggregate (stone), water and admixtures. In addition to these batch ingredients, chemical admixtures can be used to control the setting time, rate of strength development, workability, air entrapment, and other properties of concrete. For example, water-reducing admixtures can increase the slump of fresh concrete without adding additional water. Pozzolanic admixtures such as fly ash or ground granulated blast furnace slag are sometimes present as a partial replacement for the cement. Specifications and test methods for cements and related materials are found in the *Annual Book of ASTM Standards*, Vol 04.01.

X1.1.2 Lightweight concrete, less than 115 lb/ft ^{3} (1841 kg/m^3), may have such low strength that it is unsuitable for covering with resilient flooring unless 1 in. (25 mm) or more of standard weight concrete, generally 140 lb/ft^3 (2241 kg/m^3) or more, is used as a topping.

X1.2 *Water-Cement Ratio*—The most important factor affecting most concrete properties is the water-cement ratio. This is the ratio of the mass of water to the mass of cement in a standard volume of concrete. For a given concrete mix design, as the water-cement ratio is increased, most concrete properties are affected negatively. Of special interest to the floor covering industry, compressive and flexural strengths are decreased, permeability is increased, and drying times are lengthened. Moderate to moderately low water-cement ratios (0.40 to 0.45) can be used to produce floor slabs that can easily be placed, finished, and dried, and which will have acceptable permeability to moisture. Floor slabs with water-cement ratios above 0.60 take an exceedingly long time to dry and cause adhesives or floor coverings, or both, to fail due to high moisture permeability.

X1.3 *Curing and Drying New Concrete*:

X1.3.1 Freshly placed concrete sets and gains strength by the chemical reaction of water with the silicate and aluminate materials in the cement. As long as water is available during the planned curing period, the concrete will continue to gain strength and decrease its permeability. A minimum of 7 days wet curing is usually required. Two alternative approaches to curing concrete are wet curing and the use of curing compounds. Wet curing is accomplished by keeping the top surface of the concrete slab wet using soaker hoses, wet burlap, Kraft paper, plastic sheets, or a combination of these materials. Membrane-forming curing compounds meeting Specification C 309 are commonly spray-applied to the top surface of the slab immediately after finishing to retard moisture evaporation. Spray, roller, or brush applied cure-and-seal compounds are sometimes used instead of membrane-forming compounds. All of these compounds aid in retaining some moisture in the concrete, thus retarding the rate of drying. Resilient flooring and adhesive manufacturers specifications often prohibit the use of such compounds as they can interfere with the bond of the adhesive to the concrete.

X1.3.2 Such agents, in many cases, form a surface film of oil, wax, resins, or a combination thereof, that tend to obstruct the bond between the and the adhesive or may trap moisture in the concrete which will be released at a future date, or both, causing adhesive failure or other problems related to excess water vapor between the flooring and the slab. In all cases where curing compounds have been used, the resilient flooring or adhesive manufacturer, or both, shall be consulted.