



Designation: ~~E 1643–98 (Reapproved 2005)~~ Designation: E 1643 – 09

Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs¹

This standard is issued under the fixed designation E 1643; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

~~1.1 This practice covers procedures for installing flexible, prefabricated sheet membranes in contact with earth or granular fill used as vapor retarders under concrete slabs.~~

~~1.2 Conditions subject to frost and either heave or hydrostatic pressure, or both, are beyond the scope of this practice.~~

~~1.3~~

1.1 This practice covers procedures for selecting, designing, installing, and inspecting flexible, prefabricated sheet membranes in contact with earth or granular fill used as vapor retarders under concrete slabs.

1.2 Conditions subject to frost and either heave or hydrostatic pressure, or both, are beyond the scope of this practice. Vapor retarders are not intended to provide a waterproofing function.

1.3 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.4 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.

~~1.4 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.~~

2. Referenced Documents

2.1 *ASTM Standards:*²

~~C33 Specification for Concrete Aggregates~~ E 1745 Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs

~~D224 Specification for Smooth-Surfaced Asphalt Roll Roofing (Organic Felt)~~

~~E631 Terminology of Building Constructions~~ E 1993 Specification for Bituminous Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs

F 710 Practice for Preparing Concrete Floors to Receive Resilient Flooring

2.2 *Other Standard:*

~~ACI 302.1R Guide for Concrete Floor and Slab Construction~~³

ACI 302.2R–06 Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials

3. Significance and Use

~~3.1 Vapor retarders provide a method of limiting water vapor transmission and capillary transport of water upward through concrete slabs on grade, which can adversely affect moisture-impermeable or moisture-sensitive floor finishes, floor finishes and interior humidity levels.~~

3.2 Adverse impacts include adhesion loss, warping, peeling, and unacceptable appearance of resilient flooring; deterioration of adhesives, ripping or separation of seams, and air bubbles or efflorescence beneath seamed, continuous flooring; damage to flat

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ Withdrawn.

³ Available from American Concrete Institute (ACI), P.O. Box 9094, Farmington Hills, MI 48333-9094, <http://www.concrete.org>.

electrical cable systems, buckling of carpet and carpet tiles, offensive odors, ~~and~~ growth of fungi, and undesired increases to interior humidity levels.

4. Manufacturer's Recommendations

~~4.1~~ 4.1 Where inconsistencies occur between this practice and the manufacturer's instructions, conform to the manufacturer's instructions for installation of vapor retarder.

5. Placement

- ~~5.1~~ Level and tamp or roll granular base.
- ~~5.2~~ Place vapor retarder sheeting with the longest dimension parallel with the direction of concrete pour.
- ~~5.3~~ Lap vapor retarder over footings or seal to foundation wall, or both, and seal around penetrations such as utilities and columns in order to create a monolithic membrane between the surface of the slab and moisture sources below the slab and at the slab perimeter (see Figs. 1-3).
- ~~5.4~~ Lap joints 6 in. (150 mm), or as instructed by the manufacturer, and seal with the manufacturer's recommended adhesive or pressure sensitive tape, or both. Material, Design, and Construction
 - 5.1 See ACI 302.2R-06 for material, design, and construction recommendations.
 - 5.2 See Specifications E 1745 and E 1993 for vapor retarder specifications.
 - 5.3 Vapor Retarder Material Selection— The following criteria should be considered when selecting a vapor retarder material.
 - 5.3.1 Local building code and regulatory requirements.
 - 5.3.1.1 Comply with local building code and regulatory requirements as a minimum consideration.
 - 5.3.2 The water-vapor permeance of the vapor retarder material.
 - 5.3.2.1 The water vapor permeance of the vapor retarder material shall be at such a rate so that adverse impacts to floor finishes and coatings do not occur
 - 5.3.2.2 Refer to X1.1 for discussion on water vapor transmission rate of vapor retarder.
 - 5.3.2.3 The perm rating determined under these criteria shall supersede that in references 5.2 should this value be less than required under references in 5.2.
 - 5.3.3 The types and amounts of deleterious compounds in the soil on the building site.
 - 5.3.3.1 Review building site soil analyses for deleterious materials and compounds and select a vapor retarder material that will withstand exposure to such deleterious materials or compounds.
 - 5.3.4 The tensile strength and puncture resistance of the vapor retarder material.
 - 5.3.4.1 Select a vapor retarder material capable of withstanding potential construction site damage.
 - 5.3.5 The type of base material on which the vapor retarder is to be installed.
 - 5.3.5.1 Select vapor retarder material capable of withstanding tear or puncture damage due to the type, gradation, and texture of the base material to be installed below the material. Prepare base material to minimize risk of puncture, for example, by rolling or compacting.
 - 5.3.6 The expected exposure of the vapor retarder to ultraviolet rays.
 - 5.3.6.1 Assess expected exposure of the vapor retarder material to ultra violet rays and select a material capable of withstanding such exposure and maintain its capability to perform its intended function.

6. Protection

- ~~6.1~~ Take precautions to protect vapor retarder from damage during installation of reinforcing steel and utilities and during placement of concrete.
- ~~6.2~~ Use only concrete brick type reinforcing bar supports, or provide 6 by 6 in. (150 by 150 mm) protective pads of asphaltic hardboard or other material recommended by the vapor retarder manufacturer to protect the vapor retarder from puncture.
- ~~6.3~~ Avoid use of stakes driven through vapor retarder.
- ~~6.4~~ Refer to X2.2 and X2.3 for discussion of aggregate for protection of vapor retarder. Placement
 - 6.1 Level and compact base material.
 - 6.2 Install vapor retarder material with the longest dimension parallel with the direction of concrete pour.
 - 6.3 Face laps away from the expected direction of the concrete pour whenever possible.
 - 6.4 Extend vapor retarder over footings and seal to foundation wall or grade beam at an elevation consistent with the top of the slab or terminate at impediments such as water stops or dowels. Seal around penetrations such as utilities and columns in order to create a monolithic membrane between the surface of the slab and moisture sources below the slab as well as at the slab perimeter.
 - 6.5 Lap joints minimum 6 in. (150 mm), or as instructed by the manufacturer, and seal laps in accordance with the manufacturer's recommendations.
 - 6.6 Extend vapor retarder over the tops of pile caps and grade beams to a distance acceptable to the structural engineer and terminate as recommended by the manufacturer.

7. Repair

~~7.1 Repair vapor retarder damaged during placement of reinforcing or concrete with vapor barrier material or as instructed by manufacturer.~~

~~7.2 Lap beyond damaged areas a minimum of 6 in. and seal as prescribed for sheet joints. Protection~~

~~7.1 Take precautions to protect vapor retarder from damage during installation of reinforcing steel, utilities and concrete.~~

~~7.2 Use reinforcing bar supports with base sections that minimize the potential for puncture of the vapor retarder.~~

~~7.3 Avoid use of stakes driven through the vapor retarder.~~

~~7.4 Refer to ACI 302.2R-06 for discussion of aggregate for protection of vapor retarder, including the risks of installing aggregate fill above a vapor retarder that can act as a reservoir for water.~~

8. Suggested Field Check List

~~8.1 Moisture Entrapment Due to Rainfall or Ground Water Intrusion—Moisture entrapment can occur with tilt-up construction or other construction methods where exterior walls are erected before the concrete slab and underlying subgrade, base, or sand/small aggregate layer, or combination thereof, are protected from precipitation. This can be avoided by appropriate construction scheduling and sealing of any entry points in uncompleted slabs (see Fig. 4).~~

~~8.2 Integrity of Vapor Retarder—Check seams and penetrations at columns and utilities to look for discontinuities in the vapor retarder.~~

~~8.3 Damage and Repair—After installation of reinforcement (if used) but before pouring concrete, check for damage. Do not pour concrete until repairs are made, if required, in vapor retarder. This is particularly difficult if covered with sand or granular fill.~~

~~8.4 Moisture Conditions of Slab—Following placement of concrete and climatization of building, check to see that any specified tests for moisture emission have been made and a written report submitted prior to floor covering or coating installation. Inspection~~

~~8.1 Inspect and mark all areas of damage and insufficient installation of the vapor retarder sufficiently in advance of concrete placement such that deficiencies may be corrected before concrete is placed.~~

9. Repair

~~9.1 Repair vapor retarder damaged during placement of reinforcing or concrete with vapor barrier material or as instructed by manufacturer.~~

~~9.2 Lap beyond damaged areas a minimum of 6 in. (50 mm) and seal as prescribed for sheet joints.~~

10. Slab Moisture Content

~~10.1 Moisture Conditions of Slab—Following placement of the concrete and acclimatization of the building, comply with Practice F 710 and floor covering manufacturer's recommendations for any specified tests for moisture emissions from or moisture content of the slab on grade. Review written report(s) on test results prior to the installation of the floor covering or coating installation. Obtain written approval of acceptable slab conditions from the floor covering manufacturer and project design professional.~~

~~10.2 See ACI 302.2R-06.~~

11. Keywords

~~9.1 concrete slabs; vapor; vapor retarder~~

APPENDIXES

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APPENDIX

(Nonmandatory Information)

X1. PRE-DESIGN CONSIDERATIONS

~~X1.1 Architectural X1.1.1 Planning and Organization of Construction Documents—To avoid ambiguities, redundancies, conflicts, and omissions, plan the organization and coordination of drawings and specifications so that graphic, dimensional, and descriptive information on subgrade, granular base, vapor retarder, and protection course, if any, appears in only one place. Since the relationship of the subgrade (pad) elevation (usually shown on grading plans) to the rest of the building finish floor elevations and finished site grades is a function of the depth of the granular base and protection course, these dimensions should be shown in only one place. For graphic depictions and dimensions of the granular base and the protection course, the architectural drawings are preferred, but structural drawings are sometimes used. Specifications for sub-base conditions should be in the grading section. Specifications for base, vapor retarder, and protection course should be in the section on concrete, but there are advocates of a separate section in Division 7 for the vapor retarder system. Examination and testing of surface conditions should be in appropriate finish sections.~~