



Designation: E3369 – 24

Standard Specification for Determining the Flood Damage Resistance Rating of Building Materials¹

This standard is issued under the fixed designation E3369; 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 specification covers procedures for determining whether building materials are considered flood-damage-resistant for construction intended to comply with the requirements of the National Flood Insurance Program (NFIP) (44 CFR Part 60.3(a)(3)). It was developed from and is intended to supplement specifications in Technical Bulletin 2 (TB 2) (1)² for purposes of evaluating building materials that comply with requirements of the applicable building code that are not already recognized as acceptable in accordance with TB 2 (1).

1.2 This specification is intended to reduce the burden on the NFIP by improving the ability to construct flood-resistant buildings and structures and thereby decrease the number and magnitude of flood insurance claims. The goal is to identify materials that, when tested as part of an assembly representative of end use configuration, would be permitted for construction below the base flood elevation (BFE) and not require repair after a flood event due to adverse effects of water immersion and subsequent drying on performance.

1.3 This specification is intended to apply to building materials used in new construction, repair of substantially damaged buildings, and substantial improvement of existing buildings in special flood hazard areas (SFHAs) for construction used in non-habitable spaces below the BFE as permitted by the NFIP (44 CFR Part 60.3(a)(3)) and TB 2 (1) including, but not limited to, building materials used in foundations, walls, floors, ceilings, stairways, exterior cladding, and other similarly incorporated architectural and structural items. Evaluation of products for use in habitable spaces is outside of the scope of this specification.

1.4 This specification includes requirements for the purpose of evaluating effects of flooding on specimen physical properties, drying, and the ability to be cleaned.

1.5 The performance of a material specimen under the specified water immersion and drying conditions shall not be construed as fully representative of performance of the material for an actual flood event because actual flood conditions vary in factors such as makeup of water, and depth and duration of immersion, and drying conditions vary by factors such as ambient temperature and humidity.

1.6 Performance requirements vary based on the type of building material and the functions the building material is required to perform. The body of the specification gives general requirements applicable to a broad range of building materials with annexes provided for material-specific requirements.

1.7 Performance requirements for evaluation of other hazards associated with flood damage are outside the scope of this specification. These hazards include, but are not limited to, debris impact, flood velocity, wave action, water pressure differential, scour, erosion, varied biological contaminants in flood water including fungal matter and sewage, and chemical contaminants in floodwater, and other factors that would be adverse to continued use of the structure for its intended purpose including long-term occupant health impacts.

1.8 A commentary to this specification is provided in **Appendix X1**.

1.9 **Units**—The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are mathematical conversions to International System of Units (SI) units that are provided for information only and are not considered standard.

1.10 The text of this standard references notes and footnotes that provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of the standard.

1.11 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.12 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the*

¹ This specification is under the jurisdiction of ASTM Committee E06 on Performance of Buildings and is the direct responsibility of Subcommittee E06.25 on Whole Buildings and Facilities.

Current edition approved Feb. 1, 2024. Published March 2024. DOI: 10.1520/E3369-24

² The boldface numbers in parentheses refer to a list of references at the end of this standard.

Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

2. Referenced Documents

2.1 ASTM Standards:³

D2898 Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing

D3274 Test Method for Evaluating Degree of Surface Disfigurement of Paint Films by Fungal or Algal Growth, or Soil and Dirt Accumulation

D7338 Guide for Assessment Of Fungal Growth in Buildings

E631 Terminology of Building Constructions

E3075 Test Method for Water Immersion and Drying for Evaluation of Flood Damage Resistance

2.2 ASCE Standard:⁴

ASCE 24 Flood Resistant Design and Construction

2.3 ANSI Standards:⁵

ANSI/ICCRC S500 Standard for Professional Water Damage Restoration

ANSI/ICCRC S520 Standard for Professional Mold Remediation

2.4 Federal Standard:⁶

44 CFR Part 60.3(a)(3) Flood plain management criteria for flood-prone areas

2.5 U.S. Product Standards:

US DOC PS 1 Structural Plywood⁷

US DOC PS 20 American Softwood Lumber Standard⁸

2.6 Other Standards:⁹

AWPA U1 Use Category System: User Specification for Treated Wood

3. Terminology

3.1 Definitions are in accordance with Terminology **E631**, unless otherwise specified.

3.2 *Definitions of Terms Specific to this Standard (Consistent with NFIP):*

3.2.1 *base flood, n*—the flood that has a one percent chance of being equaled or exceeded in any given year (commonly called the “100-year” flood).

³ 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.

⁴ Available from American Society of Civil Engineers (ASCE), 1801 Alexander Bell Dr., Reston, VA 20191, <http://www.asce.org>.

⁵ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

⁶ Available from U.S. Government Accountability Office (GAO), 441 G St., NW, Washington, DC 20548, <http://www.gao.gov>.

⁷ Available from National Institute of Standards and Technology, 100 Bureau Drive, Gaithersburg, MD 20899.

⁸ Available from US Department of Commerce, 1401 Constitution Ave NW, Washington, DC 20230.

⁹ Available from American Wood Protection Association, Inc., 100 Chase Park S #116, Birmingham, AL 35244.

3.2.2 *base flood elevation (BFE), n*—the height of the base flood in relation to a specified datum, usually the North American Vertical Datum of 1988, or the National Geodetic Vertical Datum of 1929.

3.2.3 *flood-damage-resistant, adj*—capable of withstanding direct and prolonged contact with water without requiring repair.

3.2.4 *prolonged contact, n*—a period of time not less than 72 h.

4. Significance and Use

4.1 The procedures described in this specification are intended to be used to classify building materials as “acceptable” or “unacceptable” for flood damage resistance in accordance with the requirements of the National Flood Insurance Program (NFIP) (44 CFR Part 60.3(a)(3)) and TB 2 (1).

4.2 This specification is intended to evaluate a material specimen’s response to water immersion and ability to be cleaned following the specified exposure and drying conditions in Section 6 and the material specimen’s continued suitability for its required function in accordance with applicable building code requirements without repair.

5. Test Specimens

5.1 Test specimens shall be representative of installed building materials for which a flood damage resistance rating is sought.

5.2 Components of walls, floors, and ceilings shall be tested as installed in a representative assembly, which shall include joints, fasteners, adhesives, and other materials as appropriate to the intended function of the assembly. Wall assemblies shall be tested vertically, and floor and ceiling assemblies shall be tested horizontally.

5.3 Structural members, such as beams, columns, and piles, that may be placed below the floor shall be permitted to be tested in isolation.

5.4 Specimen Size:

5.4.1 Wall assembly test specimens shall be of suitable size to enable evaluation of the assemblage of full-size building material components that make up the wall assembly.

5.4.2 Floor assembly test specimens and ceiling assembly test specimens shall be of suitable size to enable evaluation of the assemblage of full-size building material components that make up the floor assembly or ceiling assembly.

5.4.3 For building materials tested in isolation, specimen dimensions shall be representative of the end-use product dimensions.

5.5 *Number of Specimens*—Three identical specimens shall be tested unless otherwise specified in the applicable material-specific annex. For Method A, a minimum of three control specimens constructed of recognized flood-damage-resistant materials shall also be tested.

6. Water Immersion, Drying and Cleaning Requirements

6.1 Specimens shall be tested in accordance with Test Method **E3075**.

NOTE 1—Test Method **E3075** establishes procedures to facilitate laboratory evaluation of test specimen response to water immersion, subsequent drying, and cleaning.

7. Evaluation

7.1 The evaluation for acceptable performance following water immersion, subsequent drying and cleaning in accordance with Test Method **E3075** shall be in accordance with either Method A – evaluation by equivalency to an acceptable control; or Method B – evaluation by use of applicable product standards and manufacturer specifications for new materials.

NOTE 2—Method A is an equivalency approach where the performance of alternative building materials is compared against performance of a suitable control following exposure under the standard test. This method is appropriate where there is a suitable control that is already acceptable in accordance with NFIP (44 CFR Part 60.3(a)(3)) and TB 2 (1) requirements for flood-damage-resistant materials. Method B conformance to requirements for new material is intended to enable a rating of “acceptable” for building materials that conform to performance metrics for new materials following exposure under the standard test.

7.1.1 *Method A – Equivalency Approach*—Fabrication of suitable material specimens and control specimens and criteria for acceptance shall be as prescribed in the applicable annex for specific building materials. Control specimens and material test specimens shall also comply with the criteria for acceptance in 7.2 and 7.3, as applicable, to be deemed “acceptable.” A rating of “unacceptable” shall apply when a rating of “acceptable” is not achieved or where restoration of the control test specimen or material test specimen to be suitable for its intended function requires repair.

7.1.1.1 **Annex A1** for wood materials prescribes requirements for material specimens, control specimens, and the criteria for acceptance.

7.1.2 *Method B – Conformance to Requirements for New Materials Approach*—The criteria for acceptance shall be determined from applicable product standards and manufacturer specifications for new materials. Specimens shall also comply with the criteria for acceptance in 7.2 and 7.3, as applicable, to be deemed “acceptable.” A rating of “unacceptable” shall apply when a rating of “acceptable” is not achieved or where restoration of the material test specimen to be suitable for its intended function requires repair.

7.2 Evaluation Criteria for Building Materials:

7.2.1 The building material being evaluated shall remain suitable for its intended purpose after the test exposure and subsequent drying without repair and shall not cause damage to adjacent materials of the assembly of which the building material is a part.

7.2.2 The building material being evaluated shall not dissolve, deteriorate, delaminate, or exhibit other visible characteristics associated with loss of structural integrity.

7.2.3 The building material being evaluated shall not exhibit permanent dimensional changes that would render it unsuitable for its intended function or damage connected hardware or other components of the assembly.

NOTE 3—The intent of this requirement is to account for impairments to intended function due to visible characteristics such as permanent swelling, delamination, warping, sag, twist, or other deformation that would warrant repair.

7.2.3.1 For Method A, the change in dimension shall not be more than prescribed in the applicable annex.

7.2.3.2 For Method B, the change in dimension shall not be outside of the tolerances specified in applicable product standards and manufacturer specifications for new materials.

7.2.4 The building material being evaluated shall be suitable for its required function in accordance with applicable building code requirements.

NOTE 4—The intent of this requirement is to ensure that the test exposure and drying do not alter the building material in such a way that impairs its ability to perform its required function(s) in accordance with applicable building code requirements. In addition to the results of testing required by this specification, evidence may include supporting information from the material manufacturer that wet use has been accounted for in the establishment of structural design properties and that any chemical treatments required for code-prescribed performance (such as preservatives, fire-retardants, or corrosion inhibitors) remain effective after water exposure.

7.2.5 The building material being evaluated shall allow water to freely drain by gravity and not cause visible water to be trapped within the assembly. Material test specimens with concealed spaces shall be disassembled following drying to reveal surfaces of the concealed spaces. Within the concealed spaces, visible water shall not be present and visible fungal growth shall not be more than associated with a numerical rating of 4 in accordance with Test Method **D3274** along the surface in the concealed space.

NOTE 5—The intent of this requirement is to ensure that building materials provide a path for water to drain freely by gravity to facilitate the drying process. Presence of visible water in the concealed space and excessive fungal growth after conclusion of drying (that is, a numerical rating from Test Method **D3274** associated with more than 10 % coverage) indicate inadequate draining, inadequate drying performance, or both. The numerical rating from Test Method **D3274** is intended for use in visual evaluation of the concealed space and should not be regarded as acceptable fungal growth based on consideration of occupant health impacts (1.7). Given the makeup of the flood water sample used in testing, the presence of fungal growth should not be construed as representative of fungal growth for an actual flood event (1.5).

7.2.6 The building material being evaluated shall be capable of drying in accordance with 7.2.6.1 and 7.2.6.2. Where specimens have not reached equilibrium weight in accordance with Test Method **E3075** within 42 days of drying, specimen drying shall be assessed at 42 days.

7.2.6.1 For Method A, the evaluation of drying of the building material within 42 days shall be prescribed in the applicable annex.

7.2.6.2 For Method B, the building material being evaluated shall be capable of drying to a weight within 3 % of its initial weight within 42 days of drying. The criteria shall apply to the assembly and individual materials used in construction of the assembly.

7.2.7 Visible surfaces of materials shall be able to be cleaned without damage to the building material that would require repair. Observed or suspected mold growth and discoloration on visible surfaces shall be reported after Test Method **E3075** moisture exposure and drying and prior to cleaning of the specimen. After cleaning of the specimen in accordance with Test Method **E3075**, or by use of other cleaning techniques, the specimen shall be swabbed and tested in accordance with Test Method **E3075**.

Method **E3075** and the swab sample shall be analyzed for the presence of sewage surrogates and mold surrogates. Where additional cleaning is required to remove sewage surrogates and mold surrogates, such cleaning shall be described in the report and shall not cause damage to the specimen that would require repair. Cleaning of the material specimen or re-painting of painted surfaces of the specimen following drying is not considered to constitute repair.

7.3 Additional Evaluation Criterion for Operable Assemblies:

7.3.1 A rating of “acceptable” shall apply where criteria of **7.2** are evaluated and found “acceptable” and the operable assembly is capable of meeting its function in accordance with applicable building code requirements. Lubrication of operable assemblies is not considered to constitute repair.

8. Report

8.1 The following information shall be provided in a report:

8.1.1 Date(s) of test and report;

8.1.2 Names and addresses of the organization that requested the tests and the testing organization that conducted the tests;

8.1.3 A description of the test specimens, including all parts and components, manufacturer of products, applicable material standards, applicable material specifications, method of construction, drawings or photographs showing pertinent construction details, and the number of specimens tested;

8.1.4 A description of the test procedure, including a description of testing apparatus;

8.1.5 Detailed test results including a description of the performance of each test specimen after completion of each portion of testing, including details of specimen damage on visible surfaces, details of specimen damage including fungal

growth and discoloration on the surface of concealed interior spaces upon disassembly as applicable (**7.2.5**), presence of trapped water after removal from water immersion or wet surfaces after drying period, and any other pertinent observations including photographs;

8.1.6 Results for each test specimen including initial equilibrium weight, measurement of weight or moisture content as applicable during drying, permanent dimensional change after drying as applicable, and the ability to be cleaned;

8.1.7 Results for each test specimen shall include a statement of whether, upon completion of testing, the specimens were rated “acceptable” or “unacceptable” in accordance with specified criteria;

8.1.8 A description and photographs of the methods used to clean specimens;

8.1.9 The name(s) and titles of individual(s) conducting the test and the author of the report; and

8.1.10 Any additional data or information considered to be useful for a better understanding of the test results, conclusions, or recommendations (append to the report).

9. Precision and Bias

9.1 There has not been a study to determine repeatability and reproducibility of this specification.

9.2 *Bias*—There are no accepted reference materials suitable for determining the bias for this specification. Therefore, no statement on bias is being made.

10. Keywords

10.1 Federal Emergency Management Agency; FEMA; flood damage resistance; National Flood Insurance Program; NFIP; water immersion

ANNEX

(Mandatory Information)

A1. FLOOD-DAMAGE-RESISTANT WOOD MATERIALS

INTRODUCTION

This annex provides requirements for the evaluation of wood materials for use below the BFE in accordance with the NFIP. For applications where repeated or regular wetting or ground contact is expected, products with appropriate preservative treatments shall be provided in accordance with building code requirements.

A1.1 Recognized Flood-Damage-Resistant Materials

A1.1.1 Flood-damage-resistant wood materials acceptable for use below BFE, and which are suitable for construction of control specimens, are specified in **Table A1.1**.

A1.2 Wood materials not listed in **Table A1.1** shall be considered “unacceptable” unless they are evaluated and meet the criteria described in **A1.3**.

A1.3 Requirements for Evaluation using Method A Equivalence

A1.3.1 To be classified as “acceptable” for use below the BFE, a wood material not listed in **Table A1.1** shall meet the requirements for fabrication of material and control test specimen in **A1.4** and requirements in **A1.5** to demonstrate equivalence to one of the listed materials used in a similar application.