



Designation: F3404 – 23a

Standard Specification for Heterogeneous Polyurethane Tile or Plank Flooring¹

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1. Scope

1.1 This specification covers the requirements for the compound and physical characteristics of heterogeneous polyurethane tile or plank flooring that is printed or otherwise decorated to achieve a pattern or visual and protected by a clear wear layer.

1.2 This specification covers heterogeneous polyurethane tile or plank flooring that shall be composed of binder, fillers, and pigments. The binder shall consist of one or more resins of polyurethane, polyurethane copolymers or other suitable or any desirable combination. Other suitable polymeric resins may be incorporated as part of the binder, provided the polyurethane portion of the binder is greater than 60 % in the base layer.

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

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the 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:²

F137 Test Method for Flexibility of Resilient Flooring Materials with Cylindrical Mandrel Apparatus

¹ This specification is under the jurisdiction of ASTM Committee F06 on Resilient Floor Coverings and is the direct responsibility of Subcommittee F06.80 on Specifications.

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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.

F141 Terminology Relating to Resilient Floor Coverings
F386 Test Method for Thickness of Resilient Flooring Materials Having Flat Surfaces
F410 Test Method for Wear Layer Thickness of Resilient Floor Coverings by Optical Measurement
F925 Test Method for Resistance to Chemicals of Resilient Flooring
F970 Test Method for Measuring Recovery Properties of Floor Coverings after Static Loading
F1410 Test Method for Measuring Maximum Functional Wet Volume of Utility Vacuum Cleaners
F1514 Test Method for Measuring Heat Stability of Resilient Flooring by Color Change
F1515 Test Method for Measuring Light Stability of Resilient Flooring by Color Change
F1914 Test Methods for Short-Term Indentation and Residual Indentation of Resilient Floor Covering
F2055 Test Method for Size and Squareness of Resilient Floor Tile by Dial Gauge Method
F2199 Test Method for Determining Dimensional Stability and Curling Properties of Resilient Flooring after Exposure to Heat
F2421 Test Method for Measurement of Resilient Floor Plank by Dial Gauge

2.2 ISO Standard:³

ISO 4918 Resilient, textile and laminate floor coverings — Castor chair test

2.3 ANSI Standard:⁴

ANSI/ASQC Z1.4 Sampling Procedures and Tables for Inspection by Attributes

3. Terminology

3.1 *Definitions:* For definitions of other terms used in this standard, see Terminology **F141**.

3.1.1 *polyurethane, n*—a polymer composed of organic units joined by carbamate (urethane) links. Polyurethanes can be thermosetting (duroplastic) or thermoplastic polymers.

³ Available from International Organization for Standardization (ISO), ISO Central Secretariat, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, <https://www.iso.org>.

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

4. Classification

4.1 Polyurethane tile or plank flooring covered by this specification shall be classified as: heterogeneous polyurethane tile or plank flooring with a clear wear layer. The surface structure can be either smooth or embossed.

5. Ordering Information

5.1 Purchaser shall state whether this specification is to be used, select the preferred options permitted herein, and include the following information in the invitation bid or purchase order:

- 5.1.1 Title, number, and date of this specification;
- 5.1.2 Pattern number;
- 5.1.3 Quantity in square feet;
- 5.1.4 Size required (9.2);
- 5.1.5 Thickness required (9.1);
- 5.1.6 Lot formation if other than as specified in ANSI/ASQC Z1.4 (see Sections 11 and 13);
- 5.1.7 Sampling if other than as specified in ANSI/ASQC Z1.4 (see Sections 11 and 13);
- 5.1.8 Packing requirements if other than as specified (Section 16);
- 5.1.9 Palletization if required (agreement between the manufacturer and the purchaser);
- 5.1.10 Marking required if other than specified (Section 15) (agreement between the manufacturer and the purchaser);
- 5.1.11 Chemical Resistance (8.1). The basic chemicals used in the test are those likely to be found in domestic, commercial and institutional use. Many proprietary compounds contain one or more of these basic chemicals. Should the flooring for unusual application need to be resistant to a specific chemical, this additional requirement should become part of the procurement document;
- 5.1.12 Other requirements (agreement between the manufacturer and the purchaser).

6. Materials and Manufacture

6.1 *Wear Layer:*

6.1.1 The flooring wear layer consists of polyurethane or other suitable combinations that minimally provide the same results as listed in Table 1.

6.1.2 The wear layer shall have a minimum thickness of 0.00394 in. (0.1 mm).

6.1.3 The wear layer shall not be removable by maintenance procedures in accordance with manufacturer’s guidelines.

6.1.4 The wear layer shall be clear, a background or pattern may be printed on a pattern carrier with suitably formulated, color stable inks or otherwise prepared to create a color stable pattern. The color of the pattern created must be stable against heat and light deterioration. See 8.4 and 8.5.

6.1.5 The surface of the wear layer may be smooth, embossed or otherwise textured.

6.2 *Base Layer:*

6.2.1 The flooring base layer consists of polyurethane and a filler.

6.2.2 If necessary to meet the results listed in Table 1 the base layer can be equipped with a reinforcement layer to stabilize the product.

7. Physical Properties

7.1 The polyurethane tile or plank floor covering shall meet the requirements in Table 1.

8. Performance Requirements

8.1 *Resistance to Chemicals*—Tested in accordance with Test Method F925 for residential and commercial usages, polyurethane flooring tiles shall have no more than a slight change in surface dulling, surface attack, or staining when exposed to the following chemicals:

- 8.1.1 White vinegar (5 % acetic acid),
- 8.1.2 Rubbing alcohol (70 % isopropyl alcohol),
- 8.1.3 White mineral oil (medicinal grade),
- 8.1.4 Sodium hydroxide solution (5 % NaOH),
- 8.1.5 Hydrochloric acid solution (5 % HCl),
- 8.1.6 Sulfuric acid solution (5 % H₂SO₄),
- 8.1.7 Household ammonia solution (5 % NH₄OH),

TABLE 1 Characteristics and Tests

Characteristic	Requirement	Test Method	Reference
Size, tolerance			9.3
up to 12 in. ^A	±0.016 in. (0.40 mm)	F2055 Tile	
>12 in. ≤ 18 in. ^A	±0.018 in. (0.45 mm)		
> 18 in. ^A	±0.020 in. (0.50 mm)		
≥24 in. < 48 in. ^A	±0.060 in. (1.50 mm)	ISO 24337 Plank/F2421 Plank	9.4
≥ 48 in. ^A	±0.080 in. (2.00 mm)		
Thickness, product	as specified ±0.006 in. (±0.15 mm)	F386	9.1
Thickness, wear layer	min. 0.00394 in. (0.1 mm)	F410	9.2
Dimensional stability	≤ 0.02 in. per linear feet	F2199	8.6
Static Load Recovery	250 lb load, max residual indent 0.004 in. (0.1016 mm) after 24 h recovery	F970	8.2
Residual indentation	75 lb load, average ≤8 %, maximum single reading 10 %	F1914	8.3
Resistance to chemicals	no more than a slight change in surface dulling, surface attack or staining from listed chemicals	F925	8.1
Resistance to light	avg ΔE ≤ 4.0 after 300 h	F1515	8.5
Resistance to heat	avg ΔE ≤ 4.0 after 7 days exposure	F1514	8.4
Flexibility	passes 0.250 in. (6.4 mm) mandrel	F137	8.7
Castor chair test	25 000 cycles	ISO 4918	8.8

^A 12 in. (305 mm); 18 in. (457 mm); 24 in. (610 mm); 48 in. (1220 mm).

- 8.1.8 Household bleach (5.25 % NaOCl),
- 8.1.9 Olive oil (light),
- 8.1.10 Kerosene (K1),
- 8.1.11 Unleaded gasoline (regular grade),
- 8.1.12 Phenol (5 % active phenol).

NOTE 1—The basic chemicals are representative of those likely to be found in residential, commercial, healthcare and institutional use. Many proprietary compounds contain one or more of these basic chemicals. Should the flooring for an unusual application need to be resistant to a specific chemical, this additional requirement should become part of the procurement document.

8.2 *Static Load Recovery*—The residual indentation shall be determined in accordance with Test Method F970. The residual indentation after a 24-h recovery period using a 250 lb load shall not exceed 0.004 in.

8.3 *Residual Indentation*—When tested in accordance with Test Method F1914 under 75 lb (34.2 kg) load, 0.25 in. (6.35 mm) diameter flat foot and 15 min indentation, the average residual indentation at the end of 60 min recovery shall not exceed 8 %, and the maximum residual indentation of any single specimen shall not exceed 10 %.

8.4 *Resistance to Heat*—When tested in accordance with Test Method F1514, the color change of the polyurethane flooring shall have an average $\Delta E \leq 4.0$ after 7 days exposure.

8.5 *Resistance to Light*—The resistance of the polyurethane floor covering to color change from exposure to light is simulated by a properly fitted xenon-arc radiant energy source over a time of 300 h. It shall be determined in accordance with Test Method F1515 and shall have an average $\Delta E \leq 4.0$.

8.6 *Dimensional Stability*—When tested in accordance with Test Method F2199, the dimensional change shall be ≤ 0.020 in. per linear feet in either direction.

8.7 *Flexibility*—The flexibility shall be determined in accordance with Test Method F137. The flexibility shall be such that the product/material will not crack or break when bent face out over a 0.250 in. (6.4 mm) diameter mandrel.

8.8 *Castor Chair*—When tested in accordance with ISO 4918 after 25 000 cycles, no delamination shall occur. No disturbance to the surface other than a slight change in appearance shall occur.

9. Dimensions, Mass, and Permissible Variations

9.1 *Overall Thickness*—The overall thickness shall be as specified and a tolerance of ± 0.006 in. (0.15 mm) shall be permitted when tested in accordance with Test Method F386.

9.2 *Wear Layer Thickness*—When tested in accordance with Test Method F410 the minimum wear layer thickness shall be 0.00394 in. (0.1 mm).

9.3 *Tile Size*—Unless otherwise specified for dimensions 12 in. (305 mm or smaller) a size tolerance of ± 0.016 in. (± 0.4 mm) shall be permitted. For tile dimensions larger than 12 in. (305 mm) but smaller than or equal to 18 in. (457 mm) a size tolerance of ± 0.018 in. (± 0.45 mm) will be allowed. For dimensions larger than 18 in. (457 mm), a size tolerance of ± 0.020 in. (± 0.5 mm) will be allowed, when measured in accordance with Test Method F2055. Certain specialty items

may be available in other sizes outside the scope of Test Method F2055. Planks will follow same basic guidelines based on allowable size tolerance.

9.4 *Plank Size*—For plank lengths equal to or larger than 24 in. (610 mm) but shorter than 48 in. (1220 mm), a size tolerance of ± 0.060 in. (± 1.50 mm) will be allowed; for plank lengths equal to or larger than 48 in. (1220 mm), a size tolerance of ± 0.080 in. (± 2.00 mm) will be allowed when measured in accordance with Test Method F2421. For plank lengths less than 24 in., use tile tolerance criteria. Certain specialty items may be available in other sizes outside the scope of Test Method F2421.

10. Workmanship, Finish, and Appearance

10.1 Materials furnished under this specification shall be an acceptable match to an approved sample(s) in pattern, color, and surface appearance. The product shall be free of defects that would adversely affect performance or appearance.

11. Sampling for Test

11.1 Sampling for testing physical characteristics listed in this specification shall be done in accordance with the provisions set forth in ANSI/ASQC Z1.4. The inspection level S-1 as noted in Table 1 of ANSI/ASQC Z1.4, and the acceptable quantity level (AQL) shall be 6.5 defects per hundred units as noted in Table 1 of ANSI/ASQC Z1.4 or as specified. The lot size shall be expressed in units. A unit represents a single, manufactured, inventoried, finished roll.

12. Specimen Preparation

12.1 *Conditioning in Air*—Condition the specimens for physical tests in air maintained at $73.4^\circ\text{F} \pm 3.6^\circ\text{F}$ ($23^\circ\text{C} \pm 2^\circ\text{C}$) and $50\% \pm 5\%$ relative humidity for not less than 3 h before testing.

13. Inspection

13.1 Sampling for inspection of the polyurethane tile floor covering for defects that would adversely affect performance shall be done in accordance with the provisions set forth in ANSI/ASQC Z1.4. The inspection level shall be Level I as noted in Table 1 of ANSI/ASQC Z1.4 and the acceptable quality level (AQL) shall be 6.5 defects per hundred units as noted in Table II-A of ANSI/ASQC Z1.4, or shall be as specified in 13.2. The lot size shall be expressed in units. A unit represents a single, manufactured, inventoried, finished roll.

13.2 Inspection of the polyurethane tile floor covering for defects that would adversely affect performance shall be agreed upon by the purchaser and the manufacturer as part of the procurement documents.

14. Certification

14.1 When specified in the purchase order or contract, a manufacturer's certification shall be furnished to the purchaser that the material was manufactured, sampled, tested, inspected and packaged in accordance with this specification and has been found to meet the requirements.