



Standard Test Method for Resistance to Puncture of Cushioned Resilient Floor Coverings¹

This standard is issued under the fixed designation F924; 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 test method covers the laboratory procedure for determining the resistance of cushioned resilient floor coverings to punctures from dropped pointed objects such as dinner forks.

1.2 This test method employs a 35-g cylindrical dart with a flat, small-diameter tip that is dropped onto a specimen of flooring. The dart represents the weight of a typical fork and the tip produces a similar puncture to those which result from dropped forks.

1.3 Flooring with thick wear layers may not puncture under even the most severe drop. Although data can be obtained by increasing the drop height or the weight of the dart, values of this magnitude have no practical application.

1.4 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.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of whoever uses this standard to consult and establish appropriate safety and health practices and determine the applicability and regulatory limitations prior to use.* For specific precaution statement see 8.2.

2. Referenced Documents

2.1 *ASTM Standards:*²

E171 Practice for Conditioning and Testing Flexible Barrier Packaging

F141 Terminology Relating to Resilient Floor Coverings

F410 Test Method for Wear Layer Thickness of Resilient

¹ This test method is under the jurisdiction of ASTM Committee F06 on Resilient Floor Coverings and is the direct responsibility of Subcommittee F06.30 on Test Methods - Performance.

Current edition approved May 1, 2015. Published July 2015. Originally approved in 1985. Last previous edition approved in 2009 as F924 – 90 (2009). DOI: 10.1520/F0924-90R15.

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.

Floor Coverings by Optical Measurement

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of other terms used in this test method, refer to Terminology F141.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *puncture*—a break in the wear layer of the specimen. An indentation at the point of impact shall be considered a puncture only if the wear layer is broken completely through at some point.

3.2.2 *wicking*—the presence of ink below the wear layer of the specimen in areas adjacent to a puncture. This can be seen next to the actual cut, and appears either as spots on the pattern layer or as a general discoloration.

4. Significance and Use

4.1 Much of the cushioned resilient flooring in use today is in household kitchens. Kitchen flooring is frequently subjected to the hazard of dropped tableware and cutting knives, that can puncture the wear layer of cushioned resilient flooring. Food and soil that become embedded in these punctures often can not be removed by ordinary maintenance, resulting in unsightly marks. Moisture, grease, or oils that penetrate to the cushion layer can be wicked into the foam and cause permanent discoloration. Ultimately, the service life of the material is shortened.

5. Apparatus

5.1 *Dart Drop Assembly* (Fig. 1), consisting of a ½ in. plywood platform tilted 20° from horizontal, and a vertical slotted tube at least 40 in. (1016 mm) long with an inside diameter of 1.05 ± 0.05 in. (26.7 ± 2 mm). The mouth of the tube shall be approximately 2 in. (50.8 mm) above the center of the platform. The tube shall be marked in 1 in. or less graduations showing the height above the surface of a mounted specimen positioned on the platform. At the top of the tube shall be a flat cap with a ¼ in. diameter opening in the center. This hole should have smooth, rounded sides.

5.2 *Dart* (Fig. 2), consisting of a 0.970 ± 0.003 (246 ± 0.76 mm) outside diameter hollow cylindrical aluminum body with a 0.078 ± 0.0005 in. (2.0 ± 0.013 mm) diameter tip at one end

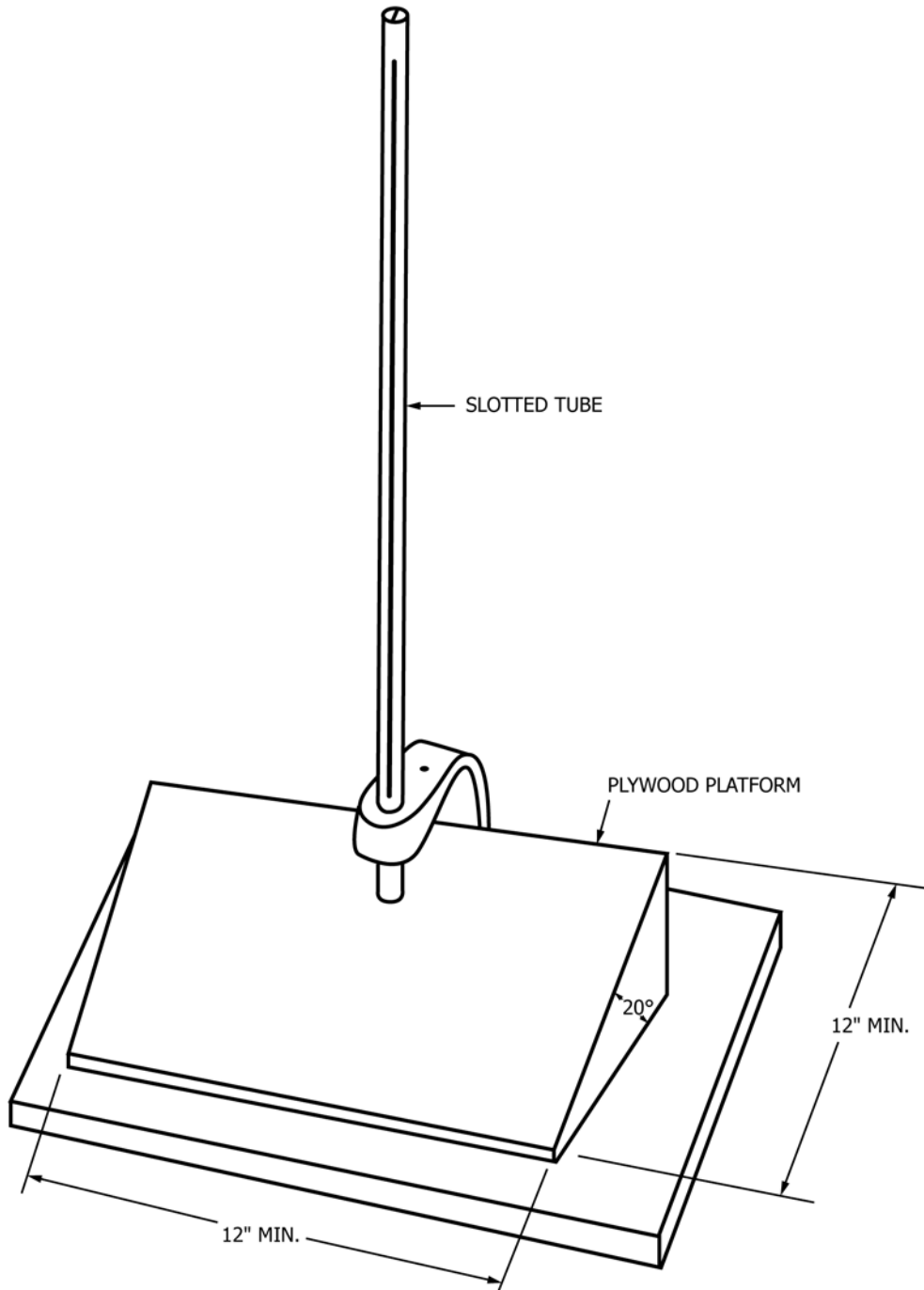


FIG. 1 Dart Drop Assembly

and a steel wire loop at the other end, weighing a total of 35 ± 0.10 g. A length of size “A” silk thread at least 60 in. long shall be attached to the wire loop.

5.3 *Microscope or magnifier*, 3X or greater.

5.4 *Alcohol-based ink*.

6. Test Specimens

6.1 The test specimen shall measure approximately 6 by 6 in. (152 by 152 mm).

6.2 The required number of specimens of each sample shall be 6.

7. Conditioning

7.1 Condition the specimens at $73.4 \pm 3.6^\circ\text{F}$. ($23 \pm 2^\circ\text{C}$) and $50 \pm 5\%$ relative humidity in accordance with Specification E171 for not less than 16 h prior to test.

7.2 Conduct tests in an atmosphere of $73.4 \pm 3.6^\circ\text{F}$ ($23 \pm 2^\circ\text{C}$) and $50 \pm 5\%$ relative humidity.

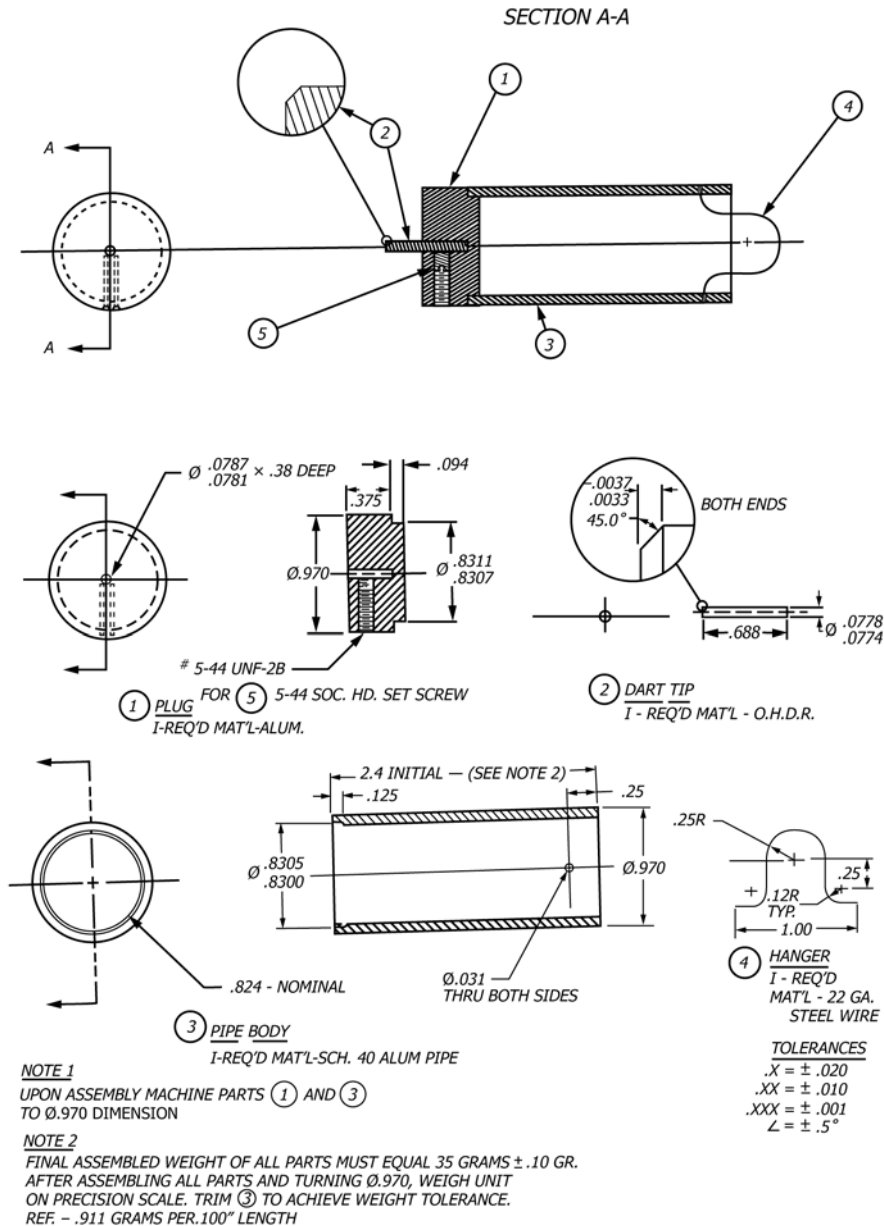


FIG. 2 Dart

8. Procedure

8.1 Adhere the specimen to a masonite base approximately 6 by 6 by ¼ in. (152 by 152 by 6 mm) using double faced tape under the entire sample leaving no air voids.

8.2 Wash the specimen with a nonabrasive detergent solution, rinse, and dry.

NOTE 1—**Caution:** Foreign matter or ink at the point of impact may act as a lubricant and can significantly change results.

8.3 Condition the specimen as described in Section 7.

8.4 Place the specimen on the platform. Position the specimen so that the dart will fall on the unembossed area (when possible). Deeply embossed areas must be avoided.

8.5 Place the dart inside the tube with the thread passing through the opening in the cap. Raise the dart by pulling the

free end of the thread until the tip of the dart is at the desired height above the specimen. Drop the dart by quickly releasing the thread. Initially, drop the dart from an “arbitrary height” that is low enough so the specimen will not be punctured. Raise the dart in 1-in. increments for successive drops until a puncture failure is determined. Repeat the procedure starting at the “arbitrary height” until four separate failure points have been determined for each specimen. Each point of impact shall be at least ½ in. (12.7 mm) from any other point of impact or from the edge.

8.6 To verify a puncture, use one or more of the following methods:

8.6.1 Examine the impact mark under the microscope with the specimen held at a 60° angle. If the pattern layer is exposed, this shall indicate a puncture.

8.6.2 Apply a drop of ink, allow 30 s, then remove the excess by blotting. Check for wicking, using a microscope if necessary. Wicking shall indicate a puncture.

8.6.3 Apply a drop of ink, allow 30 s, then remove the excess by blotting. Place the impact mark under the microscope. Depress the deepest area of the mark with a sharp probe. The appearance of ink bubbling out from beneath the wear layer shall indicate a puncture.

8.7 Two consecutive punctures resulting from drops at the same height will constitute a failure point.

8.8 Determine four failure points on each specimen.

8.9 Measure the thickness of each layer within the flooring by method of Test Method **F410**.

9. Interpretation of Results

9.1 For each specimen, average the drop heights corresponding to the four failure points. Report the average as the failure height.

9.2 If eight successive drops from 36 in. result in less than eight punctures, record the failure height as greater than 36 in.

10. Precision and Bias

10.1 The following criteria should be used to judge the acceptability of results.

10.1.1 *Repeatability*—The average of duplicate tests should be considered suspect if they differ by more than 10 %.

10.1.2 *Reproducibility*—The average of duplicate tests obtained by each of several laboratories should be considered suspect if they differ by more than 20 %.

10.2 *Bias*—The round robin data indicates the test shows relative differences in puncture resistance as a function of varying wear layer thicknesses.

11. Keywords

11.1 cushion; drop; pointed object; puncture; resilient flooring

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