Designation: D7052/D7052M – 17

Standard Test Method for Determining Impact Resistance of New Low Slope Roof Membranes Using Steel Balls (Z8295Z)[1]

This standard is issued under the fixed designation D7052/D7052M; 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 determination of impact resistance of new low slope roof membranes when applied directly over rigid insulation or cover board, or structural concrete, lightweight insulating concrete, gypsum, cementitious wood fiber or wood roof decks. The procedures were developed to determine the potential for puncture or fracture of the new roof membrane resulting from impacts by free falling steel balls resulting in specific impact energies when the new roof membrane is applied over its tested substrate within an assembly.

1.2 This test method is intended to verify that products as described will meet a specific stated condition of impact resistance performance. Testing of asphalt shingles is beyond the scope of this test method. The tests yield classification identified as Class 2 and Class 3.

1.3 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the 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.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

A295/A295M Specification for High-Carbon Anti-Friction Bearing Steel

D1079 Terminology Relating to Roofing and Waterproofing

G154 Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials

3. Terminology

3.1 For definitions of terms used in this standard, see Terminology D1079.

3.2 *Definitions:*

3.2.1 *adhered roof membrane*—a single ply or base ply (part of a multi-ply system) membrane that is adhered using an adhesive.

3.2.2 *field seam*—a splice made in the field of a roof membrane which joins two sheets together using an adhesive, splicing tape, heat or solvent-welding.

3.2.3 *mechanically fastened membranes*—a single ply or base ply (part of a multi-layer system) membrane which has been positively attached at intervals to the substrate, usually with fasteners and plates, or other mechanical devices such as battens, or both.

4. Classification

4.1 *Class 2*—A designation achieved when a roof membrane subjected to an impact energy of approximately 11.0 ± 0.3 J [8.1 ± 0.2 ft-lb] in accordance to this test method meets the results stated in Section 11.

4.2 *Class 3*—A designation achieved when a roof membrane subjected to an impact energy of approximately 19.4 ± 0.4 J [14.3 ± 0.3 ft-lb] in accordance to this test method meets the results stated in Section 11.

NOTE 1—Class 1 is beyond the scope of this test method.

5. Summary of Test Method

5.1 This test method subjects roof membranes to impacts by dropping a solid steel ball ten times from the appropriate apparatus (Figs. 1 and 2) onto test samples of the roof membrane being examined.

5.2 Roof membrane samples are conditioned in a fluorescent ultraviolet condensation type artificial weathering apparatus.

5.2.1 Impact testing is performed on samples which are conditioned and not conditioned.

[1] This test method is under the jurisdiction of ASTM Committee D08 on Roofing and Waterproofing and is the direct responsibility of Subcommittee D08.20 on Roofing Membrane Systems.

Current edition approved March 1, 2017. Published March 2017. DOI: 10.1520/D7052_D7052M-17.

[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.

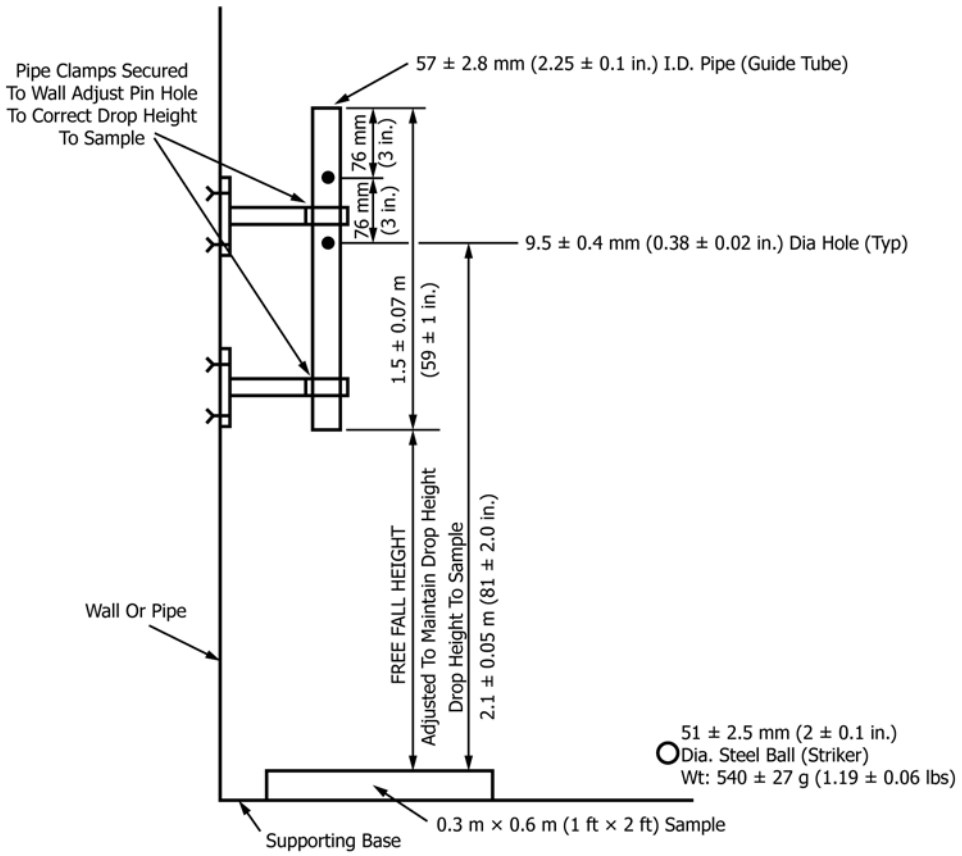

FIG. 1 Class 2 Test Setup

6. Significance and Use

6.1 This test method provides a means of evaluating new roof membranes for resistance to specific impact energies. The method evaluates new roof membranes when first applied and also after simulated deterioration caused by the ultraviolet radiation and moisture.

6.2 Use Class 2 for an impact resistance of 11.0 ± 0.3 J [8.1 ± 0.2 ft-lb] and Class 3 for an impact resistance of 19.4 ± 0.4 J [14.3 ± 0.3 ft-lb].

7. Apparatus

7.1 *Guide Tube*—The test apparatus consists of a section of a PVC pipe 57 ± 2.8 mm [2.25 ± 0.1 in.] I.D. supported above and perpendicular to the sample. This tube has two holes below the top of the tube, which allow a pin to be inserted through both sides of the tube. The pin acts as a stop for the steel ball. Adjustment is provided to maintain the drop height of the ball to accommodate different sample thicknesses (see Figs. 1 and 2).

7.2 *Striker*—A steel ball 51 ± 2.5 mm [2 ± 0.1 in.] diameter weighing 540 ± 27 g [1.19 ± 0.06 lb] meeting Specification A295/A295M–46T.

7.3 *Supporting Base*—Unless otherwise specified, the membrane-substrate assembly shall be placed directly on a flat solid concrete support such as a concrete floor (with or without tile) during impact test. The back surface of the substrate shall be in contact with the support. If a specimen support other than flat concrete is used, it shall be indicated on the test report.

7.4 *Class 2 (*Fig. 1*)*—A steel ball meeting Specification A295/A295M–46T, Type A is dropped from a height of 2.1 ± 0.05 m [81 ± 2 in.] onto the sample by removing the pin from the tube. This procedure generates an impact energy of approximately 11.0 ± 0.3 J [8.1 ± 0.2 ft-lb] over the impact area.

7.5 *Class 3 (*Fig. 2*)*—A steel ball meeting Specification A295/A295M–46T, Type A is dropped from a height of 3.6 ± 0.1 m [141.2 ± 4.3 in.] onto the sample by removing the pin from the tube. This procedure generates an impact energy of approximately 19.40 ± 0.4 J [14.3 ± 0.3 ft-lb] over the impact area.

8. Sampling, Test Specimens, and Test Units

8.1 Enough material for two representative roof membrane samples, minimum 0.3 by 0.6 m [1 by 2 ft] are selected for the material to be tested.

8.1.1 For materials supplied as sheets or rolls, the sample shall incorporate a field seam constructed in accordance with the manufacturer's instructions within the assembly, in the center and parallel to the long side of the sample.

8.1.2 One new roof membrane sample, cut to the appropriate size for the apparatus being used and having an exposure area not less than 305 by 457 mm [12 by 18 in.], is conditioned

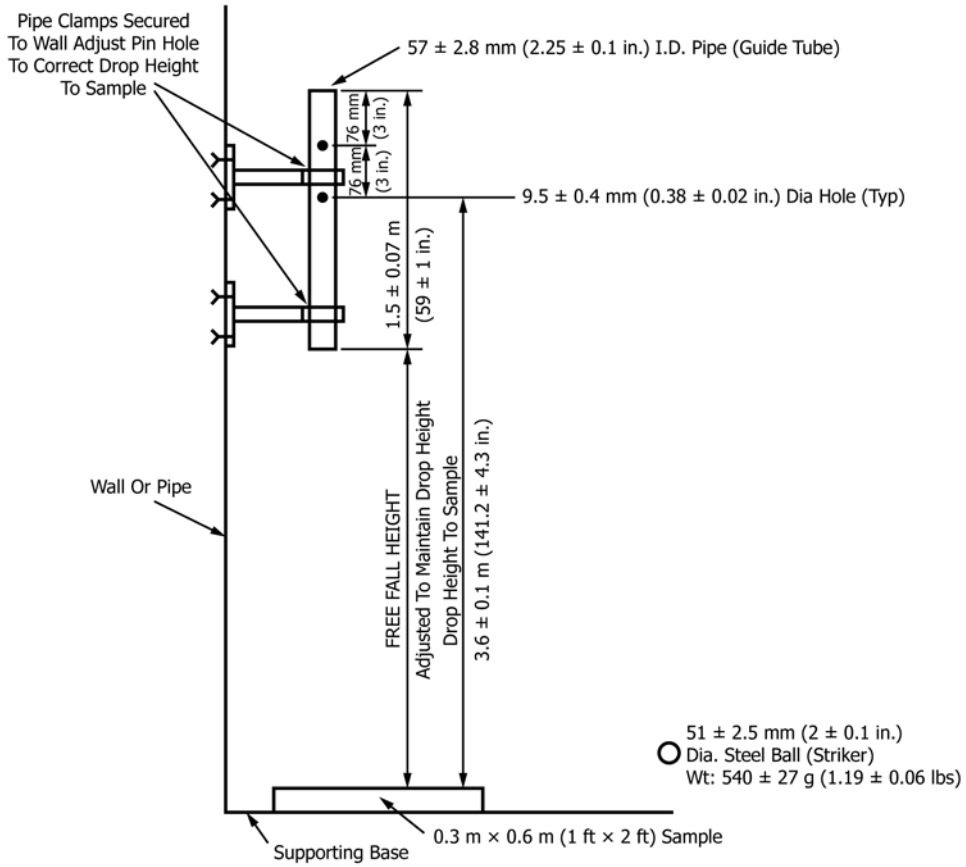

FIG. 2 Class 3 Test Setup

in a fluorescent ultraviolet condensation type artificial weathering apparatus as described in 9.1.

8.2 Adhered roof materials are installed in accordance with the manufacturer's instructions to the same substrate to be used in the field prior to conditioning (see Appendix X1). After impact testing the samples are examined for damage.

8.3 The mechanically attached roof membrane is secured in accordance with the manufacturer's instructions to the substrate to be used in the field. After impact testing, the sample is examined for damage.

8.4 For samples that incorporate fasteners and plates to secure the substrate, the substrate is applied over ¾ in. [19 mm] thick plywood and secured to the plywood with the fastener and plate agreed to by the sponsor and test laboratory.

8.5 For roof covers that are mechanically attached, the substrate is applied over ¾ in. [19 mm] thick plywood and the roof cover is applied over the substrate and mechanically attached to the plywood with the fastener and plate agreed to by the sponsor and test laboratory.

9. Conditioning

9.1 One roof membrane shall be conditioned for 1000 h in a fluorescent ultraviolet condensation device operated in accordance with Practice G154.

9.1.1 Use UVA 340 lamps conforming to the requirements of Practice G154.

9.1.2 Operate the device according to the following exposure cycle.

Cycle description and time	Set points	Operational fluctuation[A]
Light – 8 hours	Uninsulated black panel temperature: 63 °C [145 °F]	±3 °C [±5 °F]
	Irradiance (if controlled): 0.89 W/m^2 at 340 nm	±0.02 W/m^2
Dark with condensation – 8 hours	Uninsulated black panel temperature: 50 °C [122 °F]	±3 °C [± °F]
Repeat the 16 hour cycle described above continuously until the desired exposure time is reached.		

[A]The operational fluctuation is the allowed deviation from the set point of the controlled parameter indicated by the device during equilibrium conditions. If the reading indicated by the device is outside the limits defined by the operational fluctuation, discontinue the test and correct the cause of the problem before continuing.

9.2 Prior to conditioning, roof membranes fully or partially adhered to the substrate are allowed to set, that is, adhesive cure, at standard room temperatures for 28 days, if required.

9.3 Subsequent to conditioning, roof membranes are inspected for damage (see 11.1). If no damage is present, the conditioned roof membrane is subjected to impact per Section 10.

10. Procedure

10.1 Inspect the roof membrane to determine the normal condition of the membrane prior to impacting.

10.2 Impact the sample that has not been conditioned and the sample that has been conditioned. Ten drops (see 5.1) are required on each sample. All drops shall be conducted at laboratory conditions of approximately 23 ± 2 °C [73.4 ± 3.6 °F].

10.2.1 *Class 2*—The 51 ± 2.5 mm [2 ± 0.1 in.] diameter steel ball shall be dropped onto the sample from a height of 2.1 ± 0.05 m [81 ± 2 in.]. Each drop is to impact the sample at a different location. Impact locations shall be spaced a minimum of between 38 to 51 mm [1.5 to 2.0 in.] apart.

10.2.2 *Class 3*—The 51 ± 2.5 mm [2 ± 0.1 in.] diameter steel ball shall be dropped onto the sample from a height of 3.6 ± 0.1 m [141.2 ± 4.3 in.]. Each drop is to impact the sample at a different location. Impact locations shall be spaced a minimum of between 38 to 51 mm [1.5 to 2.0 in.] apart.

10.3 All conditioned and not conditioned samples are subjected to impact testing unless otherwise noted (see 9.3). Each sample shall be examined to determine impact locations.

10.3.1 The selected locations shall be on the portion of the roof membrane that would normally be exposed in the field and shall include but not be limited to exposed edges, corners, unsupported areas, overlaps, joints, and five drops on a field-fabricated seam (two on the edge of the seam and three on the seam, one of which shall be on a fastener assembly within the seam, if present). The remaining five drops shall include one drop on a fastener assembly under the roof membrane, if present.

10.3.2 The samples are then inspected for damage (see 11.1).

11. Interpretation of Results

11.1 When examined under a 10 × magnification, the roof membrane and the field seam, if present, shall not show cracking, splitting, separation, delamination, fracturing, tearing, crazing, rupture or other evidence of openings of the prepared roof membrane. Both the top and underside of the membrane shall be examined at all impact locations. For any portion of the roof membrane that is impacted at an adhered location, only the top on the membrane shall be examined at those locations.

12. Report

12.1 Report the following information:

12.1.1 Materials used in sample construction. Report all materials used to fabricate samples, including substrate.

12.1.2 Date of sample construction.

12.1.3 Date and results (see 11.1) of not conditioned sample, subsequent to impact.

12.1.4 Date and time that sample was placed in the conditioning apparatus.

12.1.5 Date and time that sample was removed from the conditioning apparatus.

12.1.6 Date and results (see 10.1) of conditioned sample, prior to impact.

12.1.7 Date and results (see 10.1) of conditioned sample, subsequent to impact, if conducted.

12.1.8 Whether or not the membrane met Class 2 or Class 3.

13. Precision and Bias

13.1 No information is presented about either the precision or bias of Test Method of Determining Impact Resistance of Roof Membranes Using Steel Balls since the test is non-quantitative.

14. Keywords

14.1 conditioned; steel ball impact

APPENDIXES

(Nonmandatory Information)

X1. EXAMPLES OF ROOF MEMBRANES ADHERED TO THE SUBSTRATE

X1.1 Photos (Figs. X1.1-X1.4) show roof membranes adhered to the substrate and the test assembly placed on the weathering apparatus.

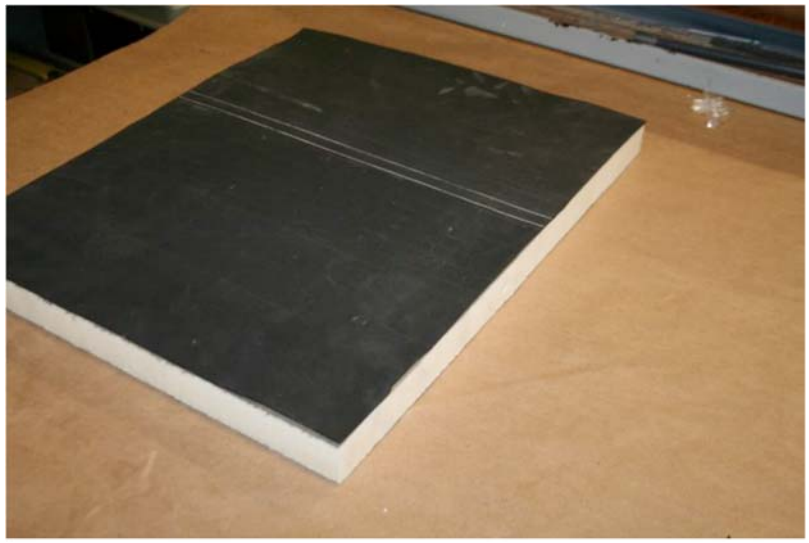

FIG. X1.1 Roof Membrane Adhered Directly to Foam Core Roof Insulation

FIG. X1.2 Roof Membrane Adhered Directly to Foam Roof Insulation Being Conditioned

FIG. X1.3 Roof Membrane Adhered Directly to Wood Fiber Board

FIG. X1.4 Roof Membrane Adhered Directly to Wood Fiber Board Being Conditioned

X2. INFORMATION ON IMPACT ENERGY CAN BE OBTAINED FROM THE FOLLOWING PUBLICATIONS

X2.1 Richard A. Critchell, Roofing Research and Standards Development, December 1986.

X2.2 FM Approvals LLC, Approval Standard for Single-Ply, Polymer-Modified Bitumen Sheet, Built-Up Roof (BUR) and Liquid Applied Roof Assemblies for use in Class 1 and Noncombustible Roof Deck Construction, June 2012.