UL 2218

STANDARD FOR SAFETY

Impact Resistance of Prepared Roof Covering Materials

UL Standard for Safety for Impact Resistance of Prepared Roof Covering Materials, UL 2218

Second Edition, Dated January 25, 2010

SUMMARY OF TOPICS

This revision of ANSI/UL 2218 dated November 29, 2022 includes terminology clarifications for consistency; 1.2 – 1.4, 4.1.1, 4.3.1, 4.4.3, 6.4, 8.1, and Section 9

Text that has been changed in any manner or impacted by UL's electronic publishing system is marked with a vertical line in the margin.

The revised requirements are substantially in accordance with Proposal(s) on this subject dated October 14, 2022.

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ANSI/UL 2218-2022

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UL 2218

Standard for Impact Resistance of Prepared Roof Covering Materials

First Edition – May, 1996

Second Edition

January 25, 2010

This ANSI/UL Standard for Safety consists of the Second Edition including revisions through November 29, 2022.

The most recent designation of ANSI/UL 2218 as an American National Standard (ANSI) occurred on November 29, 2022. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, and Title Page.

Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Proposals should be submitted via a Proposal Request in UL's On-Line Collaborative Standards Development System (CSDS) at https://csds.ul.com.

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INTRODUCTION

1 Scope

1.1 This test method provides impact resistance data for the evaluation of prepared steep slope roof covering materials. For purposes of this Standard, prepared roof covering materials are considered to be small units, sheets or panels designed for installation with multiple layers of such materials installed in overlapping rows on slopes of 2:12 (16.67%) and greater.

1.1A Impact resistance testing for the evaluation of low slope roofing systems are covered under UL 2218A, Impact Resistance of Roofing Systems.

1.2 The test evaluates the effect of impact from the steel ball at locations on the test assembly selected to be most vulnerable, such as (but not limited to) edges, corners, unsupported sections and joints.

1.3 This test method does not evaluate the effect of weathering, temperature, aging or similar effects on the impact resistance of prepared roof covering materials. These and other factors, including time, roof slope, roof system configuration and application influence the performance of prepared roof covering materials in the field. It is not the objective of this test to address all of these factors.

1.4 The impact energies used in this Standard were derived from impact energies of actual hailstones (see Appendix A). However, largely due to the effects discussed in 1.3, there is no currently established direct correlation between the performance of prepared roof covering materials when impacted by hailstones versus steel balls. Consequently, this test method does not provide a direct basis to compare expected performance under all hail conditions, but does provide a basis for comparison of the response of the prepared roof covering materials when subjected to the impact energies described herein.

2 General

2.1 Values stated without parentheses are the requirement. Values in parentheses are explanatory or approximate information.

PERFORMANCE

3 General

3.1 Representative samples of roof covering material, assembled to test decks as described in Preparation of Samples, Section 4, are to be subjected to the impact tests described in Test Apparatus, Section 5, and Test Procedure, Section 6.

4 Preparation of Samples

4.1 General

4.1.1 Representative samples of a prepared roof covering material are to be applied, as described in 4.3, to test decks constructed as described in 4.2. The assemblies are to be conditioned in accordance with 4.4 prior to testing.

4.2 Preparation of test decks

4.2.1 The test decks are to be 3 ft by 3 ft (0.91 m by 0.91 m) consisting of 15/32 in (11.9 mm) thick plywood securely nailed to a trade size 2- by 4-in [nominal 1-1/2 by 3-1/2 in (38.1 by 89 mm)] wood batten frame, with an additional trade size 2- by 4-in vertical support batten, midspan of the deck. The plywood is

to be A-C Grade, Group 1, exterior, placed "A" side up. The perimeter battens are to be located under and flush with the outer edges of the deck.

4.3 Application

4.3.1 The prepared roof covering material to be tested is to be applied in accordance with the manufacturer's instructions to the test deck. The material is to extend to and be flush with the edges of the deck.

4.4 Conditioning

4.4.1 The test assemblies are to be stored indoors at a temperature of 73.4 ±3.4°F (23.0 ±1.8°C) for the period of time necessary to cure the material; or stored under other conditions until moisture determinations indicate that the deck lumber has a maximum 12 percent moisture content. Test decks are to be stored so that each will be surrounded by freely circulating air.

4.4.2 For wood or wood composition samples expected to be hygroscopic in nature, the moisture content is to be determined by heating a small sample to constant weight in an oven at 100°C (212°F). If the moisture content exceeds 12 percent the material is to be conditioned in a cell at a temperature not exceeding 60°C (140°F) until its moisture content is 12 percent or less.

4.4.3 For prepared roof covering materials with factory-applied adhesives, the completed test assemblies are to be placed in a conditioning cell and maintained at a temperature of 57 – 60°C (135 – 140°F) for a continuous period of not less than 16 hours. To avoid damage when examining tested samples, prevent the self-seal adhesive from adhering by covering it with masking tape or other similar type material. After conditioning, the test assemblies are to be allowed to cool to room temperature. Care is to be taken to avoid disturbing shingle tabs or causing any twisting or distortion of the test panels in handling.

5 Test Apparatus

5.1 The test apparatus is to consist of lengths of 2-in (50.8 mm) diameter (ID) and 3-in (76.2 mm) diameter (ID) schedule 40 PVC pipe secured vertically over the target specimen. Drop positions are to be prepared to provide for the release of steel balls down the centerline of the pipe at the drop heights specified for each size (diameter) of steel ball. The 2-in diameter pipe is to be used for the 1.25 and 1.50 in steel balls. The 3-in diameter pipe is to be used for the 1.75 and 2.00 in steel balls. See Figure 5.1.

5.1A A light source that is bright enough to be clearly seen on the surface of the assembly being tested shall be mounted at the top of the pipe to be used for the purpose of positioning the assembly in the proper location for the desired location to be impacted. In lieu of a light source at the top of the pipe, one or more laser emitting devices may be mounted at the bottom of the pipe, with each laser aimed at the center line of the pipe, to designate the location to be impacted.

Exception: A drop method other than that specified in Figure 5.1 that assures consistent drops using the specified steel balls at the specified drop heights meets these drop method requirements.

5.2 The steel balls (chrome or stainless) are to be 1.25 ±0.01 in (31.8 ±0.25 mm), 1.50 ±0.01 in (38.1 ±0.25 mm) 1.75 ±0.01 in (44.5 ±0.25 mm) and 2.00 ±0.01 in (50.8 ±0.25 mm) in diameter, weighing 0.28 ±0.01 lb (126.9 ±4.5 g), 0.48 ±0.02 lbs (217.6 ±9 g), 0.79 ±0.04 lb (358.2 ±18.1 g) and 1.15 ±0.04 lbs (521.4 ±18 g), respectively, with a Rockwell C hardness of 57 to 66.

5.3 The release device is to be designed so as to assure a straight drop down the centerline of the pipe. A sketch of an acceptable device is shown in Figure 5.2. Release is achieved by sliding the fork from the pipe, thereby allowing the ball to fall between the adjustable screws down the centerline of the pipe. Other

release devices are acceptable when the objective for release of the steel balls down the centerline of the pipe is met.

5.4 Table 5.1 is to be used to determine the drop height to be used with each respective steel ball size (diameter). Table 5.1 also provides the corresponding kinetic energy associated with each drop.

Table 5.1
Drop height and kinetic energy

Class	Steel ball diameter		Distance		Kinetic energy	
	Inches	(mm)	Feet	(m)	ft-lbf	(J)
1	1-1/4	(31.8)	12.0	(3.7)	3.53	(4.78)
2	1-1/2	(38.1)	15.0	(4.6)	7.35	(9.95)
3	1-3/4	(44.5)	17.0	(5.2)	13.56	(18.37)
4	2	(50.8)	20.0	(6.1)	23.71	(32.12)

Figure 5.1

Test apparatus

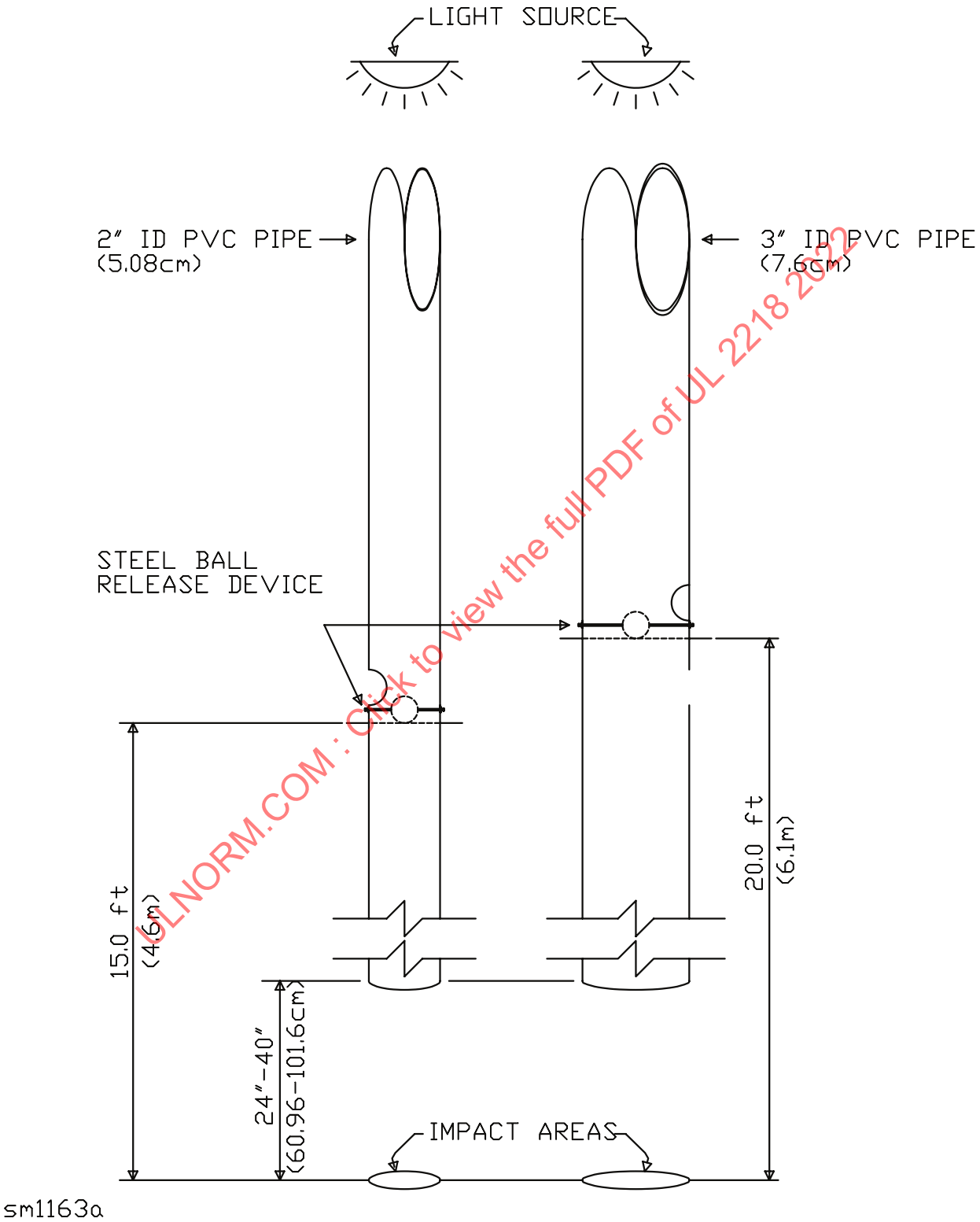
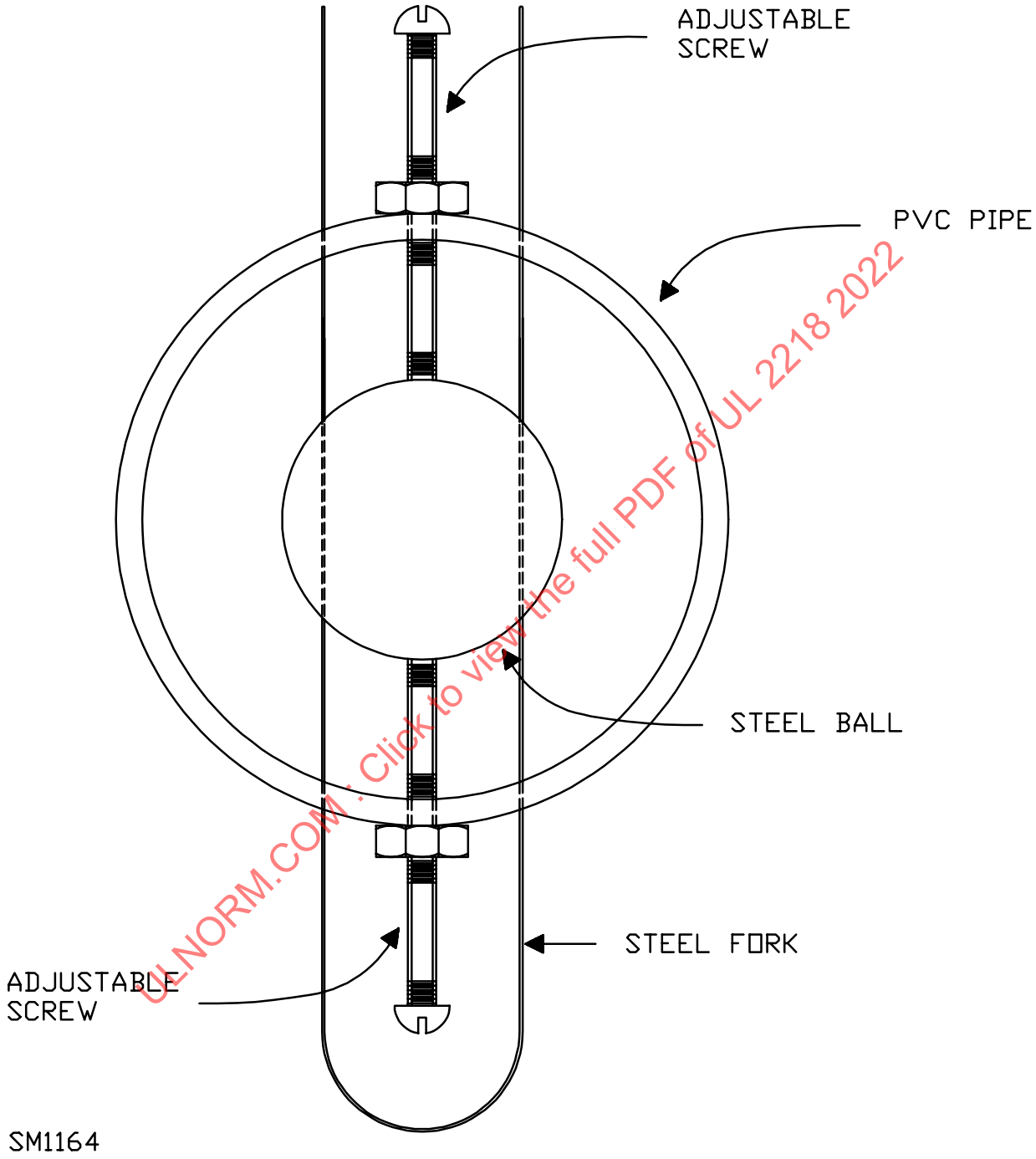


Figure 5.2

Release device



6 Test Procedure

6.1 Tests are to be conducted in a room at a temperature of 73.4 ±3.4°F (23.0 ±1.8°C). Each test assembly is to be subjected to a series of two coincident drops from a specific size steel ball at each of six locations selected based upon examination for vulnerability. These locations are to include but not be limited to edges, corners, unsupported areas, overlaps and joints. The drop shall be considered coincident when the approximate center of the impact depression of the second drop is measured to be within 1/2 in (12.7 mm) of the first.

6.1A The test assembly shall be placed on a flat concrete surface for the duration of the testing. Alternatively, a movable carriage shall be permitted to be used provided that the carriage employs castors that can be locked into place to resist movement during the test.

6.2 After the assembly has been subjected to all drops at the selected impact locations the prepared roof covering material is to be carefully removed from the test assembly and examined on both top and bottom surfaces at the impacted areas. Where multiple layers of the prepared roof covering material are located under the impacted area each layer is to be examined separately.

6.3 Visual damage observations are to be facilitated by examining the samples under 5X magnification and the observations recorded for each impact location, based upon the Acceptance Criteria in Section 7 and the Report information specified in Section 8.

6.4 For prepared roof covering materials having the flexibility to be bent over a 6-in (152.4 mm) diameter mandrel, damage assessments are to be facilitated by bending the prepared roof covering material over the mandrel at each impact location, with the top surface in contact with the mandrel. The prepared roof covering material area having received the impact is to be bent over the mandrel on two axes (machine direction and 90° to the machine direction).

7 Acceptance Criteria

7.1 The prepared roof covering material is to be examined after being subjected to the test procedure described in Section 6. The prepared roof covering material exposed surface, back surface and underneath layers shall show no evidence of tearing, fracturing, cracking, splitting, rupture, crazing or other evidence of opening through any prepared roof covering layer.

7.2 *Deleted*

7.3 A surface crack shall not be determined to be a failure. A crack that extends through the cross-section of the roof covering material layer shall be determined to be a failure.

7.4 Cosmetic damage not extending through the cross-sectional area of a roof covering material layer shall not be determined to be a failure.

REPORT

8 General

8.1 The report shall include the following:

a) Description of the sample preparation and deck construction;

b) Description of the sample;

c) Sample conditioning procedure;