Designation: F1955 – 15

An American National Standard

Standard Test Method for Flammability of Sleeping Bags[1]

This standard is issued under the fixed designation F1955; 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 fire-test response test method contains a method to assess the flammability, expressed as a burn rate, of sleeping bags which use various materials and constructions in their manufacture.

1.2 Sleeping bags that comply with the requirements in this test method shall be permitted to be labeled as complying with the appropriate requirements, to facilitate the identification of products conforming to this test method.

1.3 This test method is technically equivalent to the flammability standard CPAI-75, issued by the Industrial Fabrics Association International (see 2.2), and which has been in use as a flammability requirement for the sleeping bag industry in the U.S.

NOTE 1—CPAI-75 expresses burn rate in units of inches/minute while this test method expresses burn rate in units of centimetres/minute.

1.4 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.5 *This standard is used to measure and describe the response of materials, products, or assemblies to heat and flame under controlled conditions, but does not by itself incorporate all factors required for fire hazard or fire risk assessment of the materials, products, or assemblies under actual fire conditions.*

1.6 *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.*

1.7 *Fire testing is inherently hazardous. Adequate safeguards for personnel and property shall be employed in conducting these tests.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D123 Terminology Relating to Textiles

D1776 Practice for Conditioning and Testing Textiles

D5025 Specification for Laboratory Burner Used for Small-Scale Burning Tests on Plastic Materials

E176 Terminology of Fire Standards

2.2 *Industrial Fabrics Association International Standard:*[3]

Specification CPAI-75 A Rate of Burn Standard for Sleeping Bags

3. Terminology

3.1 *Definitions*—For definitions of terms used in this test method associated with fire issues, refer to Terminology E176. For definitions of terms used in this test method associated with textile issues, refer to Terminology D123.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *burn rate, n*—the distance traveled by a flame on a burning material or product during a specified time under specified conditions.

3.2.2 *combustible, adj*—capable of undergoing combustion.

3.2.2.1 *Discussion*—The term combustible is often delimited to specific fire-exposure conditions.

3.2.3 *sleeping bag, n*—a structure made of down, synthetic fiberfill, shell fabrics, and/or other materials, that is designed for thermal protection while sleeping (for example, outdoors, tent, cabin).

4. Summary of Test Method

4.1 Ten specimens are cut from individual sleeping bags or from a physically accurate facsimile.

4.2 Five of these specimens are tested as received (after conditioning).

4.3 The other five of these specimens are laundered (or dry cleaned, as appropriate) three times in accordance with the

[1] This test method is under the jurisdiction of ASTM Committee F08 on Sports Equipment, Playing Surfaces, and Facilities and is the direct responsibility of Subcommittee F08.22 on Camping Softgoods.

Current edition approved April 1, 2015. Published May 2015. Originally approved in 1999. Last previous edition approved in 2005 as F1955 – 99 (2005) which was withdrawn in January 2014 and reinstated in April 2015. DOI: 10.1520/F1955-15.

[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.

[3] Support for Specification CPA1–75 is to be discontinued by the Industrial Fabrics Association International and replaced with Test Method F1955.

manufacturer's instructions and then conditioned. These specimens are also then tested after conditioning.

4.4 Each of the specimens to be tested is placed in the test apparatus. A standardized flame is applied to the folded edge for a specified time under controlled conditions and the burn rate is calculated to determine if the specimens meet the performance requirements.

5. Significance and Use

5.1 This test method is suitable to assess the fabric burn rate of sleeping bag fabrics.

5.2 This test method is applicable to all sleeping bags.

5.3 This test method is technically equivalent to CPAI-75, which is used for the acceptance of commercial shipments of sleeping bags.

5.4 When combustible fabrics are used for sleeping bags they are potentially dangerous to the user because of their ease of ignition (since all combustible materials will ignite) and because it is possible that they will exhibit a high burn rate.

5.5 Most fabrics used to make sleeping bags are combustible (see 3.2.2). Fabrics can be combustible due to the inherent chemical composition of the fabric material or due to the finishing processes used or both.

5.6 Changes in finishes or in fabric surface treatments can exert a large effect on the fabric flammability. Therefore, sleeping bags shall be tested both before and after laundering (or dry cleaning, as appropriate) in accordance with the manufacturer's instructions.

5.7 In this procedure, the specimens are subjected to one or more specific sets of laboratory test conditions. If different test conditions are substituted or the end-use conditions are changed, it is not always possible by or from this test method to predict changes in the fire-test-response characteristics measured. Therefore, the results are valid only for the fire test exposure conditions described in this procedure.

5.8 It must be understood, moreover, that no guarantee can be given and none is implied that sleeping bags complying with the performance requirements of this test method will not be hazardous under certain conditions.

6. Sampling

6.1 *Lot Size*—A lot shall be considered the size of the contract between the buyer and the supplier unless otherwise agreed upon between the supplier and the buyer.

6.2 All specimens shall be selected randomly from the lot.

6.3 *Sample Unit*—A sample unit shall consist of ten specimens.

7. Test Specimens

7.1 *Test Specimens*—A total of ten test specimens shall be taken from the sleeping bag as shown in Fig. 1 and shall have a finished size of 30 by 36 cm (12 by 14 in.).

7.2 In the event that it is impossible to cut an actual sample from a sleeping bag due to its construction, a 30 by 71-cm (12 by 28-in.) facsimile shall be permitted to be constructed and folded. All components shall be used in their correct positions and amounts.

7.3 *Laundering*—Five of the ten test specimens to be tested shall be laundered (or dry cleaned, as appropriate) and dried three times in accordance with the procedures recommended by the manufacturer.

7.4 *Compression*—Samples shall be compressed to one half their original loft for 24 h prior to testing (see Note 2).

NOTE 2—An easy method of accomplishing this compression is to stack a number of specimens in a box and compress them all to half their original height under a board or plate held down by pins through the side of the box, and so forth.

7.5 *Re-Lofting*—Following the 24-h compression period, the specimens shall be allowed a minimum of 1 h to regain their loft before tests are conducted.

8. Conditioning

8.1 Condition the fabrics to be tested in accordance with the recommendations of Practice D1776 as related to textile test specimens. Fabrics shall be conditioned to moisture equilibrium (constant weight) at an ambient temperature of 23 ± 3°C (73 ± 5°F) and a relative humidity of 50 ± 5 %.

8.2 Conduct all tests in the conditioning room (8.1) or within 15 min of removal from the conditioning room atmosphere. After conditioning, specimens shall not be exposed to an environment with an uncontrolled relative humidity for more than 15 min prior to testing.

8.3 All testing shall be performed in a draft-free environment.

9. Apparatus

9.1 *Test Chamber*—Use the test chamber shown in Fig. 2 for testing. Place the test chamber under or in some type of exhaust or fume hood to allow for the venting of the fumes and smoke associated with the test method.

9.2 *Support Frame*—Use a support frame conforming to Fig. 3 to mount the test specimen. The support frame shall be constructed of 3-mm (⅛-in.) steel.

9.3 *Hold-Down Plate*—Use a hold down plate conforming to Fig. 4 for testing. It shall be constructed of 3-mm (⅛-in.) steel.

9.4 *Spacers and Clamps*—A spacer and clamping arrangement shall be used which is capable of positioning the hold-down plate with its bottom surface 25 mm (1 in.) above the top surface of the support frame, so that it will hold the test specimen at a 25 mm (1 in.) thickness on the two sides and the back.

9.5 *Thread*—Use #50 white mercerized cotton thread.

9.6 *Tape*—Use tape or an alternate method (such as small clips) for fastening the thread to the frame.

9.7 *Weights*—Use weights (for example small clamp-type paper clips) to attach to the timing threads.

DIMENSION IN CM (IN)

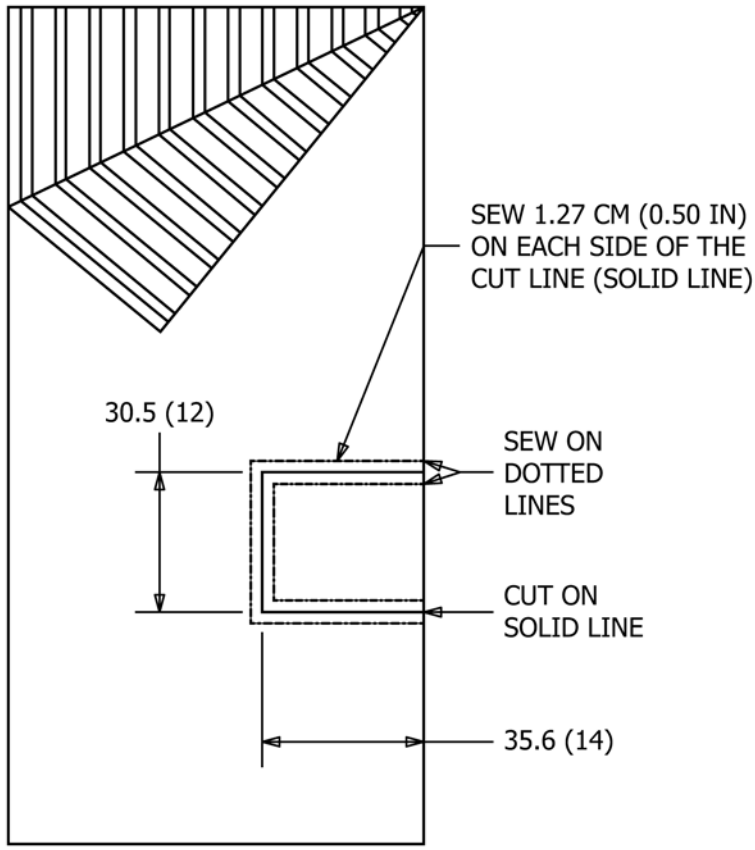

FIG. 1 Test Specimen

ITEM	NO. REQUIRED	DESCRIPTION, CM (IN)
1.	4	CORNER ANGLE, 2.5 × 71.1 (1 × 28)
2.	4	WINDOW FRAME, 7.6 × 71.1 (3 × 28)
3.	4	FRAME SPACER, 4.45 × 10.2 (1-3/4 × 4)
4.	4	WINDOW SEAT, 3.18 × 10.2 (1-1/4 × 4)
5.	1	WINDOW - HEAT RESISTANT GLASS 0.476 × 50.8 × 50.8 (3/16 × 20 × 20)
6.	3	PANEL, 60.96 × 60.96 (24 × 24)
7.	1	TOP PLATE, 62.0 × 66.0 (24-1/2 × 26)
8.	2	CHAIN, 61 (24)
9.	2	WINDOW STOP RODS, 6 MM DIA. × 10 CM (1/4 DIA × 4)
10.	4	S HOOKS
11.	22	BOLT WITH NUT, 6 MM - 25 × 2 CM (1/4-20 × 3/4)
12.	6	BOLT WITH NUT, 10 MM - 32 × 1 CM (10 - 24 × 1/2)
13.	2	HOLE, 6 MM DIA (1/4 IN DIA)

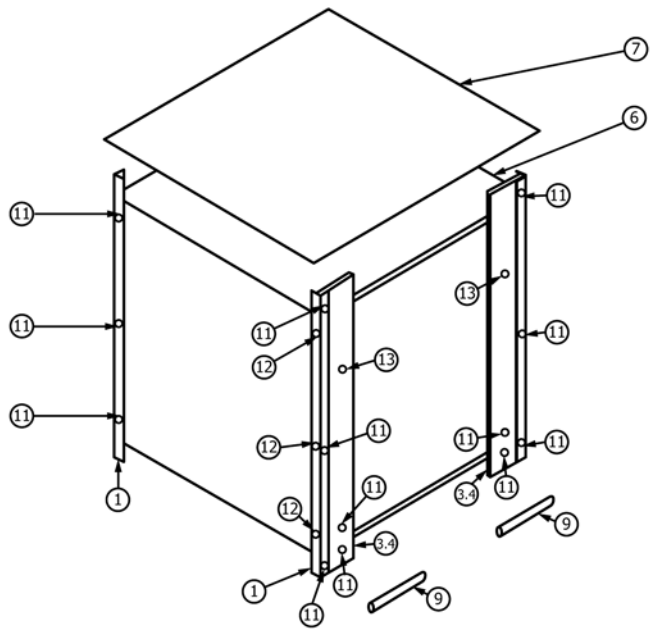

FIG. 2 Test Chamber

FIG. 1 Test Specimen

ITEM	NO. REQUIRED	DESCRIPTION, CM (IN)
1.	4	CORNER ANGLE, 2.5 X 71.1 (1 X 28)
2.	4	WINDOW FRAME, 7.6 X 71.1 (3 X 28)
3.	4	FRAME SPACER, 4.45 X 10.2 (1-3/4 X 4)
4.	4	WINDOW SEAT, 3.18 X 10.2 (1-1/4 X 4)
5.	1	WINDOW - HEAT RESISTANT GLASS 0.476 X 50.8 X 50.8 (3/16 X 20 X 20)
6.	3	PANEL, 60.96 X 60.96 (24 X 24)
7.	1	TOP PLATE, 62.0 X 66.0 (24-1/2 X 26)
8.	2	CHAIN, 61 (24)
9.	2	WINDOW STOP RODS, 6 MM DIA. X 10 CM (1/4 DIA X 4)
10.	4	S HOOKS
11.	22	BOLT WITH NUT, 6 MM - 25 X 2 CM(1/4-20 X 3/4)
12.	6	BOLT WITH NUT, 10 MM - 32 X 1 CM (10 - 24 X 1/2)
13.	2	HOLE, 6 MM DIA (1/4 IN DIA)

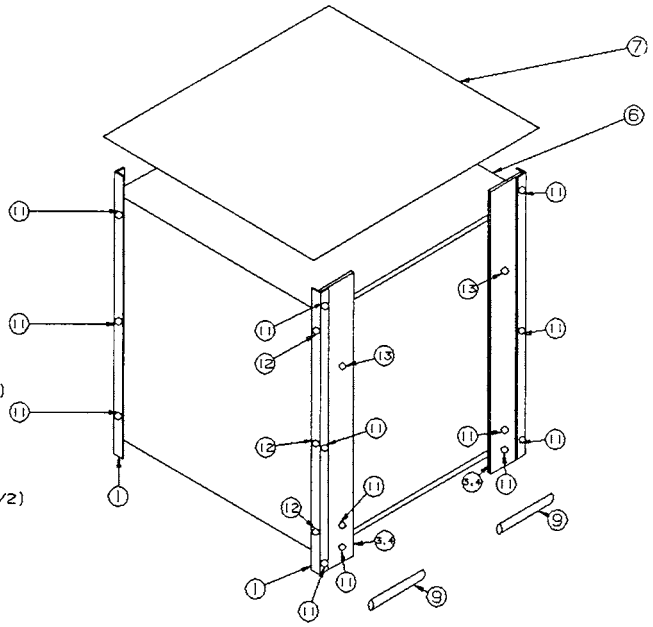

FIG. 2 Test Chamber

9.8 *Burner*—The burner shall consist of a barrel that threads onto a one-piece base and gas inlet. The components shall be constructed of metal, typically of brass or aluminum.

9.8.1 *Burner Barrel*—The burner barrel shall consist of a mixing tube and threaded air-inlet adapter. The mixing tube shall be of seamless construction, with an inside diameter of 9.5 ± 0.3 mm. The length of the barrel from the top of the air-inlet openings to the top of the mixing tube shall be 100 ± 10 mm. The top of the mixing tube shall not be equipped with end attachments, such as stabilizers. The air inlet adapter, located at the bottom of the mixing tube, shall be approximately 25 mm high and 20 mm in overall diameter. The minimum area of the air-inlet openings shall be 225 mm^2 distributed equidistant around the adapter. With the barrel fully screwed into the base and the lock nut in place, the air-inlet openings shall be completely closed.

NOTE 3—The requirement for the minimum area of the air-inlet openings has commonly been obtained with three openings, approximately 6.5 by 12.5 mm.

9.8.2 *Burner Orifice*—The base of the burner shall be equipped with an orifice of 0.90 ± 0.03 mm in diameter and 1.60 ± 0.05 mm in length.

9.8.3 *Needle Valve*—The base of the burner shall be equipped with a machined needle valve to restrict the orifice opening and regulate gas velocity through the burner. A knurled knob shall be provided for adjustment of the valve. The needle valve shall be machined with a conical point using an angle of 40° with a maximum flat top of 0.4 mm.

9.8.3.1 The needle must align with the orifice in the valve seat. Alignment can be confirmed by removing the barrel and igniting the fuel gas directly at the orifice. The flame shall remain vertical. Periodically confirm the alignment and take appropriate actions to ensure the flame remains vertical.

NOTE 4—If the flame slants, possible reasons include, but are not limited to: the orifice is off-center, or the needle is worn.

9.8.4 *Gas Inlet*—The base of the burner shall be provided with a serrated fitting for connection to the gas supply.

NOTE 5—The burner above corresponds to the burner in Specification D5025.

9.8.5 *Burner Flame*—The burner shall provide a flame, with the tube vertical, 38 mm (1½ in.) in height. The air inlet to the burner shall be closed during testing.

9.9 *Gas*—The gas used shall be methane gas of a technical grade of 97 % pure or better.

9.10 *Stopwatch*—A stopwatch or other timing device shall be used which is capable of measuring the burning time to within 0.2 s.

10. Procedure

10.1 Mount the specimen horizontally on the support frame with the sewn sides and end held at 2.5-cm (1-in.) thickness by the U-shaped hold-down frame, spacers, and clamps with the folded end of the specimen positioned at the open end of the U-shaped frame.

10.2 Attach two #50 white mercerized cotton threads to one edge of the frame at points 3.8 cm (1½ in.) and 28 cm (11½ in.) back from the open end, for example, with 25 cm (10 in.) in between, and stretch across the specimen, attaching small weights to the overhanging ends of the threads. Timing will begin and end as the respective threads burn through and their weights drop.

10.3 With the flame adjusted as in 9.8.5 and the frame with mounted specimen in the test chamber, position the burner so that the center of the burner tip is 1.9 cm (0.75 in.) below the center of the edge of the exposed end of the specimen.

10.4 Lower the test chamber door.

10.5 Expose the specimen to the flame for 30 s to force ignition (see Section 11).

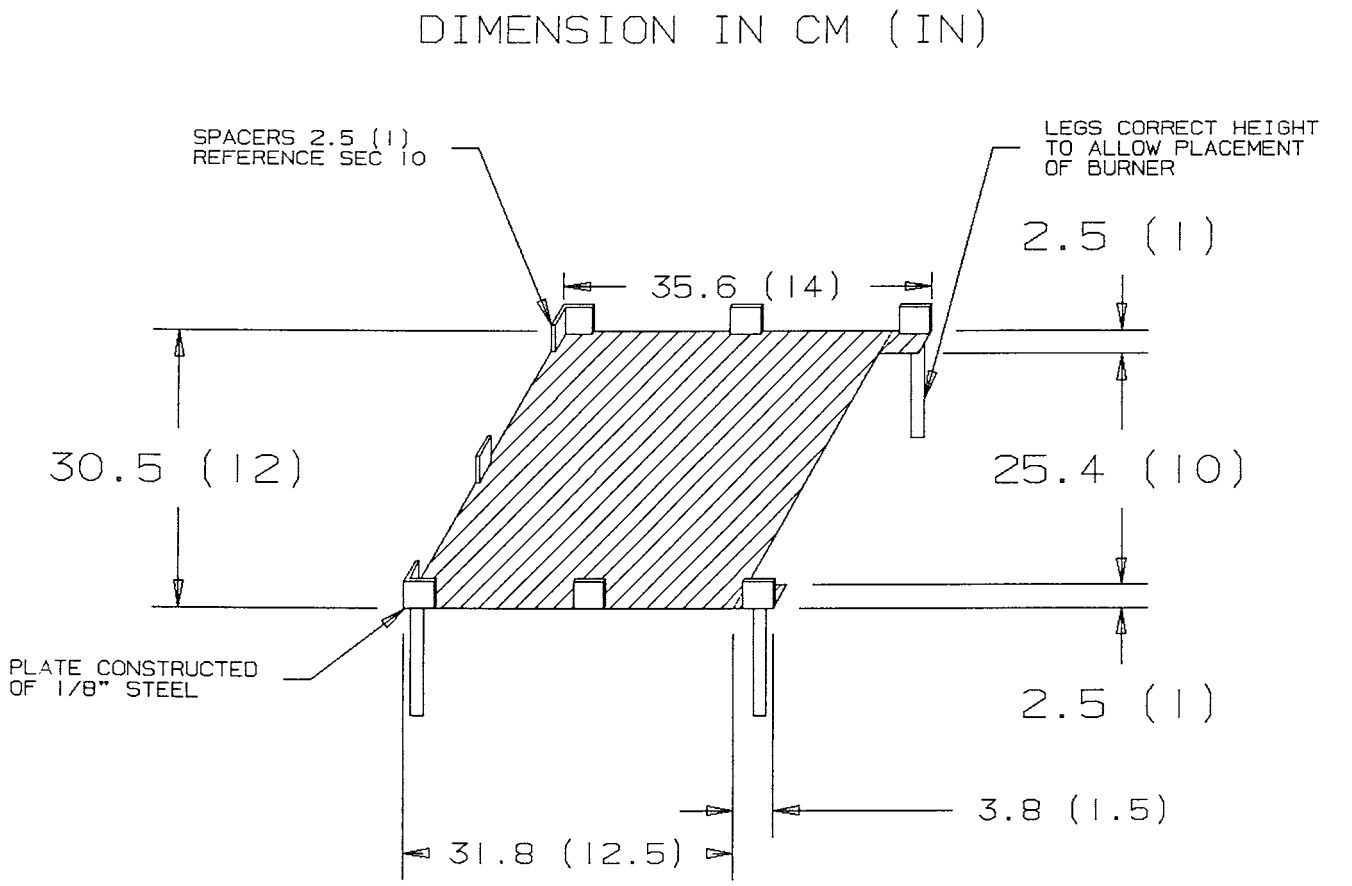

FIG. 3 Support Frame

10.6 Begin timing when the flame spread burns through the first thread causing the weights to fall. Continue timing until the flame spread burns through the second thread causing the weights to fall or the flame extinguishes itself before reaching the second thread. Stop the timing at this point.

10.7 The operator conducting this test method shall note on the report the amount of time which has elapsed and the distance that the flame has traveled. Repeat these procedures for the remaining nine test specimens.

11. Interferences

11.1 *Draft*—Uncontrolled air movement within the test chamber while tests are being performed can impact the test results severely, which is why the test is performed in a draft-free environment as noted in 8.3.

11.1.1 The fan in the fume or exhaust hood shall be turned off during the test and turned on after the test is completed, to exhaust the combustion gases.

11.1.2 If exhaust of the fumes becomes necessary during the actual burn time this shall be reported. Moreover the operator shall watch for any visible changes in the flaming, or increased burn rates, and either turn the fan down or off as necessary to avoid incorrect test results.

12. Calculation

12.1 *Burn Rate*—To calculate the burn rate (B, in units of cm per minute) use the following formula:

$$B = 60 \times (D / T) \quad (1)$$

where:

D = the distance the flame travels (in cm), and
T = the time for the flame to travel D cm (in seconds).

13. Report

13.1 *Performance Requirements*—When subjected to the test described in Section 10, the average burn rate shall not exceed 15 cm/min (approximately 6 in./min). No individual specimen shall have a burn rate of more than 20 cm/min (approximately 8 in./min).

13.2 *Test Results*—The results of the test shall be given as a statement of pass or fail.

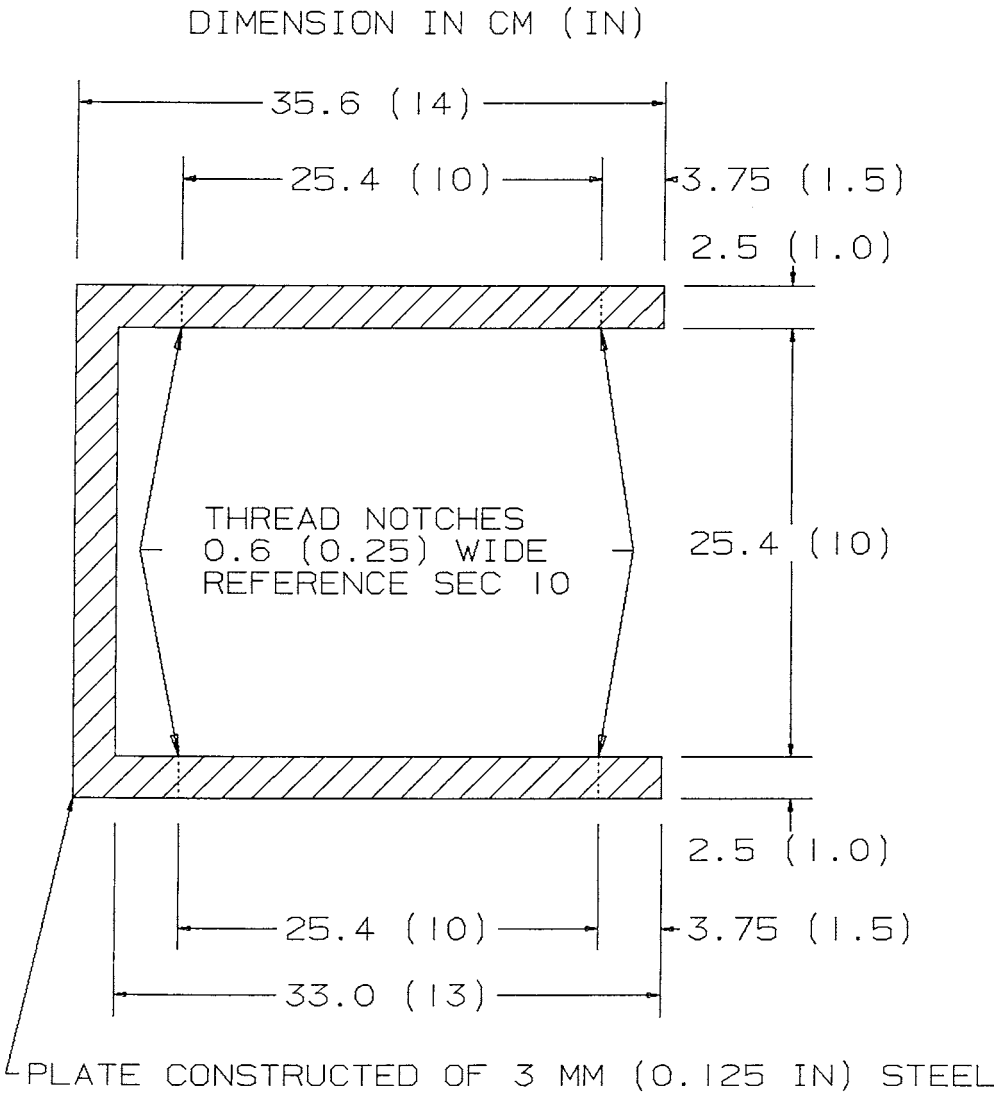

FIG. 4 Hold-Down Plate

13.3 *Labeling of Sleeping Bag*—A label or labels shall be permanently affixed to each sleeping bag containing the following information:

13.3.1 *Certification*—A statement that this sleeping bag conforms to the requirements of ASTM Test Method F1955.

13.3.2 NOTE – SLEEPING BAGS WILL BURN. KEEP AWAY FROM FIRE SOURCES.

14. Precision and Bias

14.1 *Precision*—When tested in conformance to the criteria for certification as stated in the procedure, no justifiable statements can be made on the precision of this test method since the test results are pass/fail.

14.2 *Bias*—The true value of the flammability of a sleeping bag can only be described in the terms of a test method. Within this limitation, this test method has no known bias.

15. Keywords

15.1 burn rate; fire test; flammability; sleeping bag