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MILITARY SPECIFICATION

POLYURETHANE FOAM, RIGID OR FLEXIBLE, FOR PACKAGING

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers prefoamed polyurethane foams, both rigid and flexible for packaging applications.

1.2 Classification. The polyurethane foams shall be furnished in the following classes, categories, and grades. Additional characteristics shall be specified by the procuring activity (see 6.2).

Type I - Standard Foam

Class 1 - Rigid

Class 2 - Flexible

Grade A (Figure 1)

Grade B (Figure 2)

Grade C (Figure 3)

Type II - Deleted (see 6.7)

Type III - Anti-static Foam

Class 1 - Rigid

Class 2 - Flexible

Grade A (Figure 1)

Grade B (Figure 2)

Grade C (Figure 3)

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Air Force Packaging Evaluation Activity (HQ AFLC/DSTZ), Wright-Patterson AFB OH 45433, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC/NA

FSC 8135

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2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation.

SPECIFICATIONS

FEDERAL

PPP-B-601	-	Boxes, Wood, Cleated-Plywood
PPP-B-636	-	Boxes, Shipping, Fiberboard

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MIL-P-116	-	Preservation, Methods of
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STANDARDS

FEDERAL

FED-STD-101	-	Test Procedures for Packaging Materials
FED-STD-123	-	Marking for Shipment (Civil Agencies)
FED-STD-595	-	Colors

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MIL-STD-129	-	Marking for Shipment and Storage
MIL-STD-2073-1	-	DOD Material Procedures for Development and Application of Packaging Requirements

(Copies of military specifications, standards, drawings and publications required by manufacturers in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

2.2 Other publications. The following document(s) form a part of this specification to the extent specified herein. The issues of the documents which are indicated as DOD adopted shall be the issue listed in the current DoDISS and the supplement thereto, if applicable.

AMERICAN SOCIETY FOR TESTING MATERIALS (ASTM)

ASTM-D1621 (DOD Adopted)	Compressive Properties of Rigid Cellular Plastics
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ASTM-D1596	Shock Absorbing Characteristics of Package Cushioning Materials
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ASTM-D3951 (DOD Adopted) Standard Practice for Commercial Packaging

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia PA 19103.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

3. REQUIREMENTS

3.1 First article. When specified in the contract or purchase order, a sample shall be subjected to first article inspection (see 4.4.2 and 6.2).

3.2 Materials. The materials used in the production of polyurethane foams shall provide a product conforming to the requirements specified herein.

3.2.1 Form. The polyurethane foam shall be supplied in rolls, sheets, or molded shapes, as specified (see 6.2).

3.3 Density. The maximum permissible variation from the specified density shall not be more than ± 10 percent when tested in accordance with 4.6.3.3 (see 6.2 and 6.3).

3.4 Hydrolytic stability. Unless otherwise specified (see 6.2 and 6.4), all materials shall meet the requirements of 3.4.1 and 3.4.2 as applicable.

3.4.1 Class 1. After aging in accordance with 4.6.3.4, the minimum compressive strength at yield or 10 percent deflection, whichever occurs first shall not vary more than 10 percent from the values obtained prior to aging, (see 4.6.3.11 and 6.5).

3.4.2 Class 2. After aging in accordance with 4.6.3.4, the stresses necessary for 20 and 40 percent strains shall be within ± 10 percent of the stresses necessary to cause these same strains on the same unaged specimens when tested in accordance with 4.6.3.4.1.

3.5 Water absorption (class 1 only). Maximum water absorption by weight shall not exceed 170 percent when determined in accordance with 4.6.3.5.

3.6 Creep (class 2 only). Unless otherwise specified (see 6.2), the maximum percentage creep that occurs under the continuous loading stress necessary to cause an initial 20 percent strain shall be 10 percent when tested in accordance with 4.6.3.6.

3.7 Compression set (class 2) only. Unless otherwise specified (see 6.2), the compression set shall not be more than 10 percent of the original thickness (see 4.6.3.7).

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3.8 Pliability (class 2). Unless otherwise specified (see 6.2), the material shall show no cracks, tears, or separations when tested in accordance with 4.6.3.8. This requirement is limited to materials having a density of 4.0 lb/ft³ (64 kg/m³) or less.

3.9 Dimensions.

3.9.1 Molded or machined shapes. Special shapes (other than rolls or sheets) shall be of the configuration and dimensions as specified (see 6.2).

3.9.2 Roll or sheet stock. The length, width, and thickness shall be as specified by the procuring activity (see 6.2).

3.9.2.1 Tolerance. The tolerance for lengths, widths, and thicknesses shall be $\pm 1/8$ inch (0.32 cm).

3.10 Volume change. The change in volume of the polyurethane foam after aging shall be not greater than seven percent of the initial volume before aging (see 4.6.3.9).

3.11 Relative combustibility. The polyurethane foam shall be tested in accordance with 4.6.3.10. The flame front of each test specimen shall not advance to or beyond the 5.00 inch (12.7 cm) gage mark specified in the test. There shall be no visual evidence of burning or melting of the specimen at or beyond the 5.00 inch (12.7 cm) gage mark.

3.12 Compressive strength (class 1 only). *20.3 psi = 140 k Pa* Unless otherwise specified (see 6.2), the minimum compressive strength at yield or 10 percent deflection, whichever occurs first, shall be 20.0 psi (13.8 x 10⁴ Pa) with the force applied parallel and 12.0 psi (82.7 x 10³ Pa) with the force applied perpendicular to the direction of foam rise (see 4.6.3.11 and 6.5).

3.13 Dynamic cushioning properties (class 2 only). The peak G-static stress curves for grades A, B, and C shall conform to the shapes of the appropriate generalized curves presented in Figures 1, 2, and 3 respectively, within the specified tolerance bands, when tested in accordance with 4.6.3.12. A minimum of five peak G-static stress points, approximately equally spaced, shall be required to establish conformance. Two points shall be established within 10 percent of the static stress values at the extremities of the curve, and one at the approximate minimum peak acceleration point.

3.14 Anti-static property (type III, only). The cushioning material shall be uniformly impregnated with an anti-static agent. The static decay rate of the impregnated foam shall not exceed two seconds when tested as specified in 4.6.3.13.

3.15 Color coding (class 2) only. Unless otherwise specified (see 6.2 and 6.6.1), cushioning material grade and anti-static properties shall be identified according to color. Coding colors shall correspond to color

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numbers of FED-STD-595. The colors shall be evenly dispersed throughout the material. The material, grade, color, and color code number shall be:

Type I, Class 2 - Standard Foam

<u>Grade</u>	<u>Color</u>	<u>FED-STD 595 No.</u>
A	Blue	35550
B	Green	34672
C	Charcoal	36118

Type III, Class 2 - Anti-Static Foam

<u>Grade</u>	<u>Color</u>	<u>FED-STD 595 No.</u>
A	Yellow	23655
B	Red	31302
C	Brown	30117

3.16 Corrosivity. Anti-static cushioning material (Type III) shall not cause corrosion when tested as specified in 4.6.3.14.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1. Responsibility for compliance. All items must meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

4.2 Classification of inspections. The inspections shall be classified as follows:

- a. First Article Inspection (4.4.2)
- b. Quality Conformance Inspection (4.4.3).

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4.3 Sampling.

4.3.1 Lot. For purposes of sampling, a lot shall consist of all material produced under like conditions in one unchanged process by one manufacturer and submitted for acceptance at one time.

4.3.2 Sampling for testing. Samples shall be selected as listed below and subjected to the tests described in 4.6. Specimen size and preparation shall be in accordance with 4.6.1.

a. Rolls: A sample roll shall be selected at random from the lot. Specimens of sufficient size to conduct the tests shall be taken from the sample after removal of two thicknesses of material from the roll.

b. Sheets: Three bundles shall be selected, the top three sheets of each bundle removed and samples taken at random from the remainder of each bundle.

c. Die-cut pads: Three samples of sufficient size for testing shall be selected from the sheet stock from which the pads are fabricated.

d. Molded shapes: Three rectangular blocks of sufficient size and molded in a similar fashion as the molded shapes shall be used to conduct the specified tests.

e. Machine shapes: Three samples of sufficient size to conduct the specified tests shall be selected and cut from the base stock.

4.4 Inspection and tests.

4.4.1 First article waiver. First article inspection may be waived when the procuring activity or contract administration has data or other evidence to indicate that prior successful first article inspection has been conducted (see 6.2). When the first article has been waived, the contractor shall certify that the material will conform to the requirements of this specification.

4.4.2 First article inspection. First article inspection shall consist of all tests in Table I and shall be performed by the contractor, after award of contract and prior to production, at a location acceptable to the Government. First article inspection shall be performed on sample units produced using materials, equipment, and procedures which will be used in fulfilling the contract. First article approval is valid only on the contract on which it is granted, unless extended by the Government to other contracts (see 3.1, 6.2, and 6.11).

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TABLE I. First Article Test Requirements and Methods

PROPERTIES	REQUIREMENTS		TEST METHOD
	Class 1	Class 2	
Form	3.2.1	3.2.1	4.5
Density	3.3	3.3	4.6.3.3
Hydrolytic Stability	3.4.1	3.4.2	4.6.3.4
Water Absorption	3.5	N/A	4.6.3.5
Creep	N/A	3.6	4.6.3.6
Compression Set	N/A	3.7	4.6.3.7
Pliability	N/A	3.8	4.6.3.8
Dimensions	3.9	3.9	
Special Shapes	3.9.1	3.9.1	4.6.3.1
Rolls, Sheets	3.9.2	3.9.2	4.6.3.1, 4.6.3.2
Volume Change	3.10	3.10	4.6.3.9
Combustibility	3.11	3.11	4.6.3.10
Compressive Strength	3.12	N/A	4.6.3.11
Dynamic Cushioning	N/A	3.13	4.6.3.12
Anti-Static Property (Type III only)	3.14	3.14	4.6.3.13

4.4.3 Quality conformance tests Quality conformance tests shall consist of all tests in Table II.

TABLE II. Quality Conformance Test Requirements.

<u>PROPERTIES</u>	<u>TEST METHOD</u>
Examination of Dimensions	4.6.3.1
Thickness	4.6.3.2
Density - (When Specified)	4.6.3.3
Combustibility	4.6.3.10
Coloring Coding (Type III, Class 2 only)	4.5
Anti-Static (Type III, Class 2 only)	4.6.3.13

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4.5 Visual inspection. Inspect item in accordance with classification of defects Table III.

TABLE III. CLASSIFICATION OF DEFECTS

Inspect	Defect	Classification
Form	Not as specified (see 3.2.1 and 6.2)	Major
Color	Not as specified (see 3.15 and 6.2)	Minor

4.6 Testing. The tests specified in Tables I and II shall be performed to assure compliance with the requirements of Section 3.

4.6.1 Preparation of test specimens. Unless otherwise specified, all test specimens shall be rectangular, having dimensions of 8.00 x 8.00 x 3.00 + 1/8 inches (20.3 x 20.3 x 7.60 cm + 0.32 cm). The length and width of the specimens shall be measured at the center lines. They shall not be subjected to any mechanical or chemical treatment prior to testing except as specifically described herein. The specimens shall be cut so as to avoid rounded or precompressed edges.

4.6.2 Test conditions. Unless otherwise specified, tests and measurements shall be made at room temperature 70.0 to 80.0 degrees F (21.1 to 26.7 degrees C). In case of dispute or rejection, the specimens shall be conditioned at 73.4 + 2 degrees F (23 + 1.1 degrees C) and 50 percent + 2 percent relative humidity for at least 16 hours before being tested.

4.6.3 Test methods.

4.6.3.1 Examination of dimensions. The length and width of rolls, sheets or pads shall be measured to determine conformance to 3.9. The dimensions of molded and machined shapes shall be examined for conformance to the requirements specified.

4.6.3.2 Thicknesses. Three specimens shall be prepared in accordance with 4.6.1 and placed on a flat, level surface and loaded with a rigid, flat plate which shall overhang by 1.00 inch (2.54 cm) the width and length of the specimen. The load shall be 0.025 + 0.005 pounds per square inch ($1.72 \times 10^2 + 34$ Pa). Thirty seconds after application of the plate, the vertical distance between the base surface and the plate at each of the four corners shall be measured to the nearest 1/16 inch (0.16 cm). The average of the four measurements shall be the thickness of the specimen. The thickness of the material shall be the average thickness of the three specimens. The thickness representative of the lot shall be the average of the material thicknesses of the samples tested.

4.6.3.3 Density. Three specimens shall be prepared in accordance with 4.6.1, the thickness of each specimen determined in accordance with 4.6.3.2

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and the weight of each specimen determined to the nearest 0.01 gram. The density of each specimen shall be determined in accordance with the following formula:

English	Metric
$D = \frac{3.81 \times w}{L \times W \times T}$	$D_M = D \times 16.01846$

where:	D	=	density in pounds per cubic foot
	w	=	weight of specimen in grams
	L	=	length of specimen in inches
	W	=	width of specimen in inches
	T	=	thickness of specimen in inches
	D_M	=	density in kilograms per cubic meter

The density of the material in a lot shall be the average of the densities of the three specimens.

4.6.3.3.1 Rejection of sample. If specimens from the sample block fail to meet the requirements of 3.3, the sample block shall be discarded and new specimens from a second sample shall be prepared. If specimens from the second sample block fail to meet the above requirements, the entire lot represented by the sample block shall be rejected.

4.6.3.4 Hydrolytic stability. The test specimens shall be exposed for 14 days at 158 ± 2 degrees F (70 ± 1.1 degrees C) and 95 percent ± 5 percent relative humidity. After exposure, the specimens shall be subjected to 120 ± 2 degrees F (49 ± 1.1 degrees C) in a mechanically convected dry air oven for 24 hours and then to the conditions specified in 4.6.2 for a minimum of 30 minutes. After conditioning, the Class 1 materials shall conform to the requirements of 3.4.1 and Class 2 materials shall conform to the requirements of 3.4.2.

4.6.3.4.1 Load deflection (class 2 only). Three test specimens shall be prepared in accordance with 4.6.1 and placed in a compression machine (Instron Compression Tester, or equal) or a weight-increment type device. The specimens shall be preworked prior to testing. Preworking shall consist of compressing the specimens between parallel rigid plates 65 percent of their original measured thickness. Compress a total of 10 times at a rate of 10.0 to 20.0 inches (25.4 to 50.8 cm) per minute. Three minutes after completion of the last compression, the thickness of the specimen shall be measured to the nearest one-hundredth of an inch (0.03 cm) after preloading to 1.60 lb (0.73 kg). The thickness after prework shall be used as the zero deflection point. The specimens shall be loaded at a rate of 0.20 inches per minute. The load shall be recorded at 20 and 40 percent strains, based on the thickness at the start of loading. If a weight-increment device is used, the deflection shall be determined approximately 30 seconds after the application of an incremental change in load.

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4.6.3.5 Water absorption (class 1 only). Three samples shall be tested and examined for conformance to the requirements of 3.5. Water absorption shall be determined in accordance with the submersion technique of Method 4035 of FED-STD-101 with the following exceptions:

- a. The balance used shall be accurate to ± 0.01 gram with a readability of 0.01 gram.
- b. Test specimens shall be weighed to the nearest 0.01 gram.
- c. Test specimens shall be $4.00 \pm 1/8$ inches (10.2 ± 0.32 cm) square by $1 \pm 1/8$ inch (2.54 ± 0.32 cm) thick.
- d. Test specimens shall be submerged in a vessel containing distilled water maintained at 70.0 to 75.0 degrees F (21.1 to 23.8 degrees C).
- e. The submersion period shall be 96 ± 1 hours.

4.6.3.6 Determination of creep (class 2 only). Three specimens shall be prepared in accordance with 4.6.1 and preworked in accordance with 4.6.3.4.1. Three minutes after the last compression, the thickness of each specimen shall be measured with a 1.60 lb (0.73 kg) preload, in accordance with Method 1003 of Federal Test Method Standard 101. As an alternative, the thickness may be measured in accordance with 4.5.3.2 to the nearest one-hundredth of an inch (0.03 cm) and recorded as T (initial thickness). The test specimen shall be loaded to 20 percent initial strain. One hour after continuous loading, the thickness shall be measured and recorded as t (initial thickness loaded), for the determination of creep. The specimens shall remain under constant load and thickness measurements recorded approximately every 24 hours for a total of four 24 hour increments, or until the variation between two successive measurements does not exceed 1 percent of the initial thickness (t_i). The final measurement shall be recorded as (t_f). The percentage of creep shall be calculated as follows:

$$\text{Percentage of creep} = \frac{(t_i - t_f) \times 100}{t_i}$$

where t_i = initial thickness (loaded)

t_f = final thickness (loaded)

The creep of the material in a lot shall be the average of the creep of the three specimens (see 3.6).

4.6.3.7 Compression set (class 2 only). This test shall be conducted immediately following the test specified in 4.6.3.6 using the same specimens. Four hours after the load is removed, the specimen thickness shall be measured in accordance with 4.6.3.6 and the compression set calculated as follows:

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$$\text{Compression Set} = \frac{(T_i - T_f) \times 100}{T_i}$$

where T_i = initial thickness (unloaded)

T_f = final thickness after 4 hours in unloaded condition

The results shall not exceed the requirements of 3.7.

4.6.3.8 Pliability (class 2 only). The dimensions of each specimen shall be 6.00 x 6.00 x 1/2 inches (15.2 x 15.2 x 1.30 cm). The thickness tolerance shall be + 1/16 inch (0.21 cm). As rapidly as possible, each of three specimens shall be bent 180 around a cylinder having a 1/2 inch (1.3 cm) diameter. The test shall be conducted at room temperature (see 4.6.2) and -40 degrees F (-40 degrees C). For the low temperature test, the specimens shall be conditioned for at least four hours at -40 degrees F (-40 degrees C) and then bent at the temperature or, if not practical, within 5 seconds after removal from the low temperature environment. The specimens shall be examined for conformance with 3.8.

4.6.3.9 Volume change. Three test specimens shall be measured and the volume calculated and recorded. They shall then be subjected to the temperature and humidity conditions only, specified in 4.5.3.4 and remeasured. The volume change shall be calculated, expressed as a percent of the initial volume and examined for conformance to 3.10.

4.6.3.10 Relative combustibility. The combustibility of the foam shall be determined in accordance with the following subparagraphs. After completion of the test, foam samples shall be examined for conformance to 3.11. A test shall consist of determining the extent of burning of at least five foam samples. Samples shall be cut from sections at least 1 1/2 (3.81 cm) inches from exterior surfaces. The length of each sample shall be perpendicular to the direction of rise.

4.6.3.10.1 Apparatus.

a. Test Chamber - Any enclosure is satisfactory that is large enough to provide quiet draft-free air around the specimen during test, yet will permit normal thermal circulation of air past the specimen during burning. A hood is recommended in order to remove the sometimes noxious products of combustion. If a test chamber is used, it should be of such a design that it can be used in a hood. For referee purposes, test results with the chamber should be the same whether or not the hood exhaust is on. In cases of discrepancy, values obtained with the damper closed or the hood fan off, or both, will be considered valid. The recommended test chamber should be constructed of sheet metal or other fire-resistant material, having inside dimensions 12.0 inches wide, 24.0 inches long, 30.0 inches high (30.5 x 61 x 76.2 cm), open at the top, with a ventilating opening approximately 1.00 inch (2.54 cm) high around the bottom. A viewing window of heat-resistant glass should be of sufficient size and in

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such a position that the entire length of the specimen under test may be observed. The chamber should be readily opened and closed to facilitate mounting and ignition of the test specimen.

b. Burner - A standard 3/8 inch (0.95 cm) outside diameter barrel Bunsen or Tirrill burner fitted with a 2.00 inch (5.10 cm) width wing top. The wing top may have to be opened to approximately 1/8 inch (3.20 cm) to provide the flame required in Figure 5.

c. Fuel Supply - Propane gas of at least 85 percent purity.

d. Specimen Support - Wire cloth (wire screen) 1/4 inch (6.50-mm) mesh using 1/32 inch (0.08 cm) diameter steel wire. The wire cloth specimen support 3.00 inches x 8.00 inches (7.60 x 20.3 cm) shall have a 5/8 inch (1.59 cm) of length bent to form a right angle. This will form the specimen support as shown in Figure 4.

e. Specimen Support Holder - Any holding device that will clamp the wire cloth specimen support horizontally so that the bottom of the bent-up portion is 1/2 inch (1.27 cm) above the top of the burner wing top, as shown in Figure 4. A typical arrangement consists of two laboratory ring stands with two adjustable flat-surface clamps which may be locked in place by set screw and lock nut.

f. Timing Device - Readable to ± 1 second.

4.6.3.10.2 Test specimens.

a. Five specimens $2.00 \pm 1/16$ inches (5.10 ± 0.16 cm) wide and $6.00 \pm 1/16$ inches (15.2 ± 0.16 cm) long are needed.

b. Material thickness shall be $1/2 \pm 1/16$ inches (1.27 ± 0.16 cm).

c. Each test specimen shall be marked across its width by one line 5.00 inches (12.7 cm) from one end.

4.6.3.10.3 Conditioning. Specimens shall be conditioned prior to test for a minimum of 24 hours in an atmosphere having a temperature of (73.4 \pm 4 degrees F) (23 \pm 2 degrees C) and a relative humidity of 50 \pm 5 percent. Tests shall be made in this atmosphere or immediately after removal therefrom.

4.6.3.10.4 Procedure. See Figures 4, 5, and 6.

a. Clamp the wire cloth specimen support horizontally so that the bottom of the wire cloth is 1/2 inch (1.30 cm) above the top of the burner wing top as shown in Figure 4. Place a layer of aluminum foil on the bottom of the test chamber to catch any dripping or flaming particles. The distance between the wire cloth and the foil shall be between 6.00 inches and 8.00 inches (15.2 and 20.3 cm). Change the foil after each

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test, if there is any debris on the surface from the previous determination. Burn off any material remaining on the wire cloth from the previous tests or use a new wire cloth for each test. If a new wire cloth is not used for each test, the wire cloth should be cool to the touch before being used. If dripping or melting material falls into the wing top, clean it before testing the next specimen.

b. Place the specimen on the support with one end touching the 5/8 inch (1.60 cm) bent-up portion of the support. The end of the specimen nearest the gage mark should be away from the bent-up end of the specimen support, so that the gage mark is 5.00 inches (12.7 cm) away from the bent-up end.

c. Adjust the burner with the wing top to provide a blue flame whose visible portion is 1 1/2 inches (3.81 cm) high with a clearly defined inner cone 1/4 inch (.6 cm) high. Place the burner under the upturned end of the specimen support so that one edge of the flame is in line with the upturned end of the wire cloth and the other edge of the flame extends into the front end of the specimen.

d. Start the timing device when the flame is first applied to the specimen. After 60 seconds, move the burner at least 6.00 inches (15.2 cm) away from the test specimen. If the flame goes out before reaching the gage mark, the extent of burning is equal to 5.00 inches (12.7 cm) minus the distance from the gage mark to the nearest evidence of the flame front, such as charring along the upper surface of the specimen measured to the nearest 1/16 inch (0.16 cm). Note burning characteristics such as expansion as a result of heating, melting, or dripping. Also record if the dropping on the foil burns. In some cases, the burning may cease in the first 60 seconds. This is evident by the disappearance of the yellow or characteristic flame.

4.6.3.10.5 Calculations.

a. If the flame front passes the gage mark in any one of the five specimens, the sample shall be judged as burning. This indicates the failure of the lot.

b. If the flame front does not reach the gage mark for all five specimens, average the distance burned in inches (or cm) as measured on the top surface.

4.6.3.10.6 Report. The report shall include the following:

a. The description of the material including the proprietary designation and complete description per this specification.

b. A description of samples that burned to gage mark.

EXAMPLES: (6.00 inch (15.2 cm) sample was consumed completely).

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c. Record burning characteristics, such as dripping.

d. For samples that did not burn to the gage mark, report the average extent of burning. (5.00 inches (12.7 cm) - less the distance between the gage mark and closest evidence of burning.)

4.6.3.10.7 Precision. The standard deviation for interlaboratory reproducibility is $3/8$ inch (0.95 cm).

4.6.3.11 Compressive strength (class 1 only). The compressive strength shall be determined in accordance with ASTM D1621, Procedure A, and examined for conformance to 3.12. After a 24-hour cure time, five specimens 4.00 x 4.00 x 2.00 inches (10.2 x 10.2 x 5.1 cm) shall be prepared from each of three 15.00 x 15.00 x 15.00 inch (38.1 x 38.1 x 38.1 cm) single-pour blocks of foam such that the depth dimensions of 2.00 inches (5.08 cm) is parallel to the direction of foam rise. These specimens shall then be tested for compressive strength values at yield or 10 percent deflection, whichever occurs first. Additionally, five specimens 4.00 x 4.00 x 2.00 inches (10.2 x 10.2 x 5.1 cm) shall be cut from each of the same three sample blocks such that the depth dimensions of 2.00 inches (5.08 cm) is perpendicular to the direction of foam rise, then tested as with the initial fifteen specimens. Failure of the average compressive strength value, recorded for each set of five specimens, to conform to the requirement of 3.12 shall be cause for rejection.

4.6.3.12 Dynamic cushioning properties (class 2) only.

4.6.3.12.1 Peak acceleration versus static stress data. The data to plot the peak acceleration in Gs (multiples of acceleration due to gravity (g)) versus static stress in pounds per square inch from a drop height of 24 inches (61.0 cm) shall be established in accordance with ASTM D1596 with exceptions specified herein.

4.6.3.12.2 Specimens. Three specimens shall be prepared 8.00 x 8.00 x $3.00 \pm 1/8$ inch (20.3 x 20.3 x 7.6 ± 0.3 cm).

4.6.3.12.2.1 Class 2. Each foam specimen shall be prepared in accordance with 4.5.1 with thickness determined in accordance with 4.6.3.2.

4.6.3.12.3 Preworking. Each specimen shall be preworked in accordance with 4.6.3.4.1. Specimen shall be rested for at least 16 but not more than 72 hours before conducting dynamic test procedure.

4.6.3.12.4 Dynamic test procedure. All test samples shall be measured to determine that samples are within 10 percent of the required thickness (3.00 inches (7.62 cm)) before starting the dynamic test procedure. Impact tests shall be conducted on each specimen so that the dropping head compresses the specimen at an initial velocity of 136 ± 2 inches per second (345 ± 5.08 cm per second). The acceleration-time record of the dropping head during compression of the cushion shall be recorded for each drop. With the dropping head at the lowest static stress point, five consecutive

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drops shall be made on each of the specimens comprising the sample material. At least one minute shall elapse between drops to permit the specimen to regain its shape. A quantity of weight shall then be added to the dropping head to obtain the next required higher static stress point and the drop test procedure repeated. This procedure shall be repeated until the qualifying test values have been obtained. Material samples will be replaced if the material exceeds a 10 percent set during testing or is degraded in any other manner.

4.6.3.12.5 Computations. The first reading obtained from each set of drops shall be discarded and the peak acceleration readings of the remaining 4 drops shall be averaged. The average values, one for each specimen shall then be averaged to obtain one value at each static stress point for the sample. The required peak G-static stress points shall be examined for conformance to 3.13.

4.6.3.13 Anti-static property test (type III only). Specimens shall be tested for conformance to the requirements of 3.14. Static decay time shall be determined in accordance with FED-STD-101, Method 4046, with the following exceptions:

- a. Test specimens shall be 3.00 inches (7.62 cm) x 5.00 inches (12.7 cm) having thickness of 1/2 inch, plus 1/8 inch (0.32 cm) minus zero inch.
- b. Prior to testing, specimens shall be conditioned in an atmosphere uniformly maintained at 73 ± 3.5 degrees F and relative humidity of 12 ± 3.0 percent RH.
- c. Each specimen, when tested, shall be mounted vertically between the electrodes and the wing nuts shall be tightened in such a manner to ensure intimate contact with the electrode surfaces without causing visible distortion or compression of the specimen.
- d. The charging cycles shall be terminated after the specimen's charge has decayed to the 50 volt level.

4.6.3.14 Corrosivity test. Anti-static cushioning material specimens shall be tested in accordance with FED-STD-101, Method 3005, Contact Corrosivity Test of Solid Materials in Flexible, Rigid, or Granular Forms. Two test surfaces shall be exposed for 72 hours and shall be:

- a. QQ-A-225/6 aluminum alloy 2024, temper T6.
- b. IPC-CF-150 copper foil, rolled, nominal weight 10 oz/ft², nominal thickness 0.014 inches.

Test surfaces shall not be ground or abraded, but otherwise shall be prepared according to 3.8.2 of FED-STD-101. After the exposure period, the presence of corrosion as defined in 2.1 of FED-STD-101 shall be cause for rejection.

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4.7 Inspection of packaging. Except when industrial packaging is specified, the sampling and inspection of the preservation and interior package marking shall be in accordance with groups A and B quality conformance inspection requirements of MIL-P-116. The sampling and inspection of the packing and marking for shipment and storage shall be in accordance with the quality assurance provisions of the applicable container specification shown in section 5 and the marking requirements of MIL-STD-129. The inspection of industrial packaging shall be as specified in the contract (see 6.2).

5. PACKAGING

5.1 Preservation. Preservation shall be level A or industrial as specified (see 6.2).

5.1.1 Level A. Unless otherwise specified, the material shall be preserved in accordance with Method III of MIL-P-116. Flat sheets, rolls, and molded shapes shall be packaged in containers conforming to PPP-B-636, grade V3C, or when loads exceed the limits of PPP-B-636, in containers conforming to PPP-B-601, overseas type. Closure and waterproofing shall be in accordance with the appendix to the applicable specification.

5.1.2 Industrial. Packaging shall conform to the requirements of ASTM D3951.

5.2 Packing. Packing shall be level A, B, or industrial as specified (see 6.2).

5.2.1 Level A. Foam unit packed in PPP-B-636 as specified in 5.1.1 shall be packed within a close-fitting box selected from MIL-STD-2073-1, Appendix C, for level specified. Closure and strapping shall be in accordance with appropriate specification.

5.2.2 Level B. Unless otherwise specified, rolls, flat sheets, and molded shapes packaged as specified in paragraph 5.1.1 shall require no further overpacking.

5.2.3 Industrial packing. Packing shall conform to the requirements of ASTM D3951.

5.3 Marking. In addition to the requirements of this specification, marking shall be in accordance with MIL-STD-129, FED-STD-123, or ASTM-D3951 as specified (see 6.2).

6. NOTES

6.1 Intended use. Materials covered by this specification are intended for use as cushioning and blocking/bracing in packages to protect equipment and items therein from damage by shocks or impacts incurred during shipment and handling.

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6.2 Ordering data. The following shall be specified.

- a. Title, number, and date of the specification.
- b. Type, class, and grade (see 1.2).
- c. Form required (rolls, sheets, etc.) (see 3.2.1).
- d. Density (optional - see 3.3) (express as pounds per cubic foot or Kg/M^3).
- e. Hydrolytic stability - state if not required (see 3.4 and 6.4).
- f. Maximum allowable percentage creep, if other than as specified in 3.6 (Class 2).
- g. Maximum allowable percentage compression set, if other than as specified in 3.7 (Class 2).
- h. Dimensions (see 3.9).
- i. Minimum compressive strength, if other than as specified in 3.12 (Class 1).
- j. Color coding (Class 2 only) - state if not required (see 3.15).
- k. Indicate whether first article inspection is required/waivered (see 3.1 and 4.4.1).
- l. Selection of applicable level of preservation (see 5.1).
- m. Selection of applicable level of packing (see 5.2).
- n. Marking (see 5.3).
- o. Ether or ester (Class 2 only) (see 6.4).
- p. Quantity.

6.3 Density. Density is an optional characteristic that may be specified (see 6.2).

6.4 Hydrolytic stability. The hydrolytic stability test has been made an optional requirement since some polyurethane foams (in particular, esters) will not pass this test, but, where this property is of no concern, will perform satisfactorily and meet all other requirements of this specification.

6.5 Compressive strength (Class 1 only). The compressive strength requirements of 3.12 were developed from test data obtained on materials

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with nominal densities of 2.0 lb/ft³ (32 kg/m³). If a different density material is specified, the compressive strengths should also be specified.

6.6 Dynamic cushioning data. The requirements of 3.13 are intended to insure procurement of a consistently uniform product of a quality attainable by most of the industry. The values presented in 3.13 should be considered as quality assurance requirements only, not as design criteria. For design purposes, complete cushioning data in the form of peak acceleration versus static stress curves can be obtained from other sources, such as MIL-HDBK-304.

6.6.1 Color coding (class 2 only). The color coding requirement has been made optional since this would be uneconomical for low volume users.

6.7 Cross-classification. This revision to MIL-P-26514, deletes Type II (Foam-In-Place) material. Refer to MIL-F-83671, General Specification for Foam-In-Place Packaging Materials for materials previously classified as MIL-P-26514, Type II.

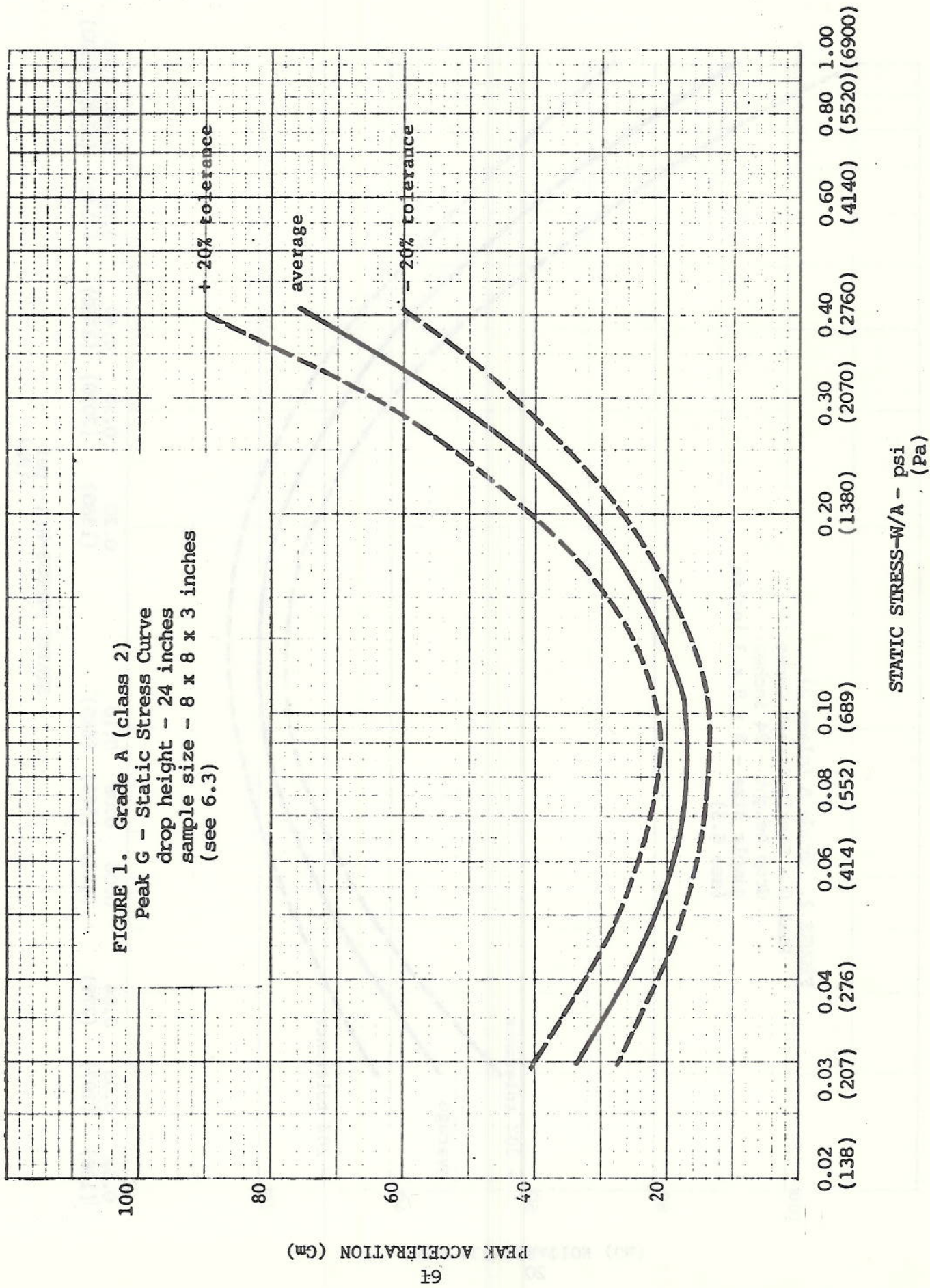
6.8 Disposability. One or more of the following methods shall be used to accomplish disposal of foam: reuse, recycling, baling, sanitary landfill, composting, incineration, pyrolysis, or sea disposal.

6.9 Changes from previous issue. Asterisks (or vertical bars) are not used in this revision to identify changes with respect to the previous issue, due to the extensiveness of the changes.

6.10 Subject term (keyword) listing.

- Packaging Materials
- Polyurethane Foam
- Cushioning
- Antistatic Foam
- Rigid Foam
- Flexible Foam
- Packaging

6.11 First article. When a first article inspection is required, the item(s) should be a first article sample. The first article sampling should conform to 4.3.2 requirements. The contracting officer should include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results and disposition of first articles. Invitations for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract.



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FIGURE 2. Grade B (class 2)
 Peak G - Static Stress Curve
 drop height - 24 inches
 sample size - 8 x 8 x 3 inches
 (see 6.3)

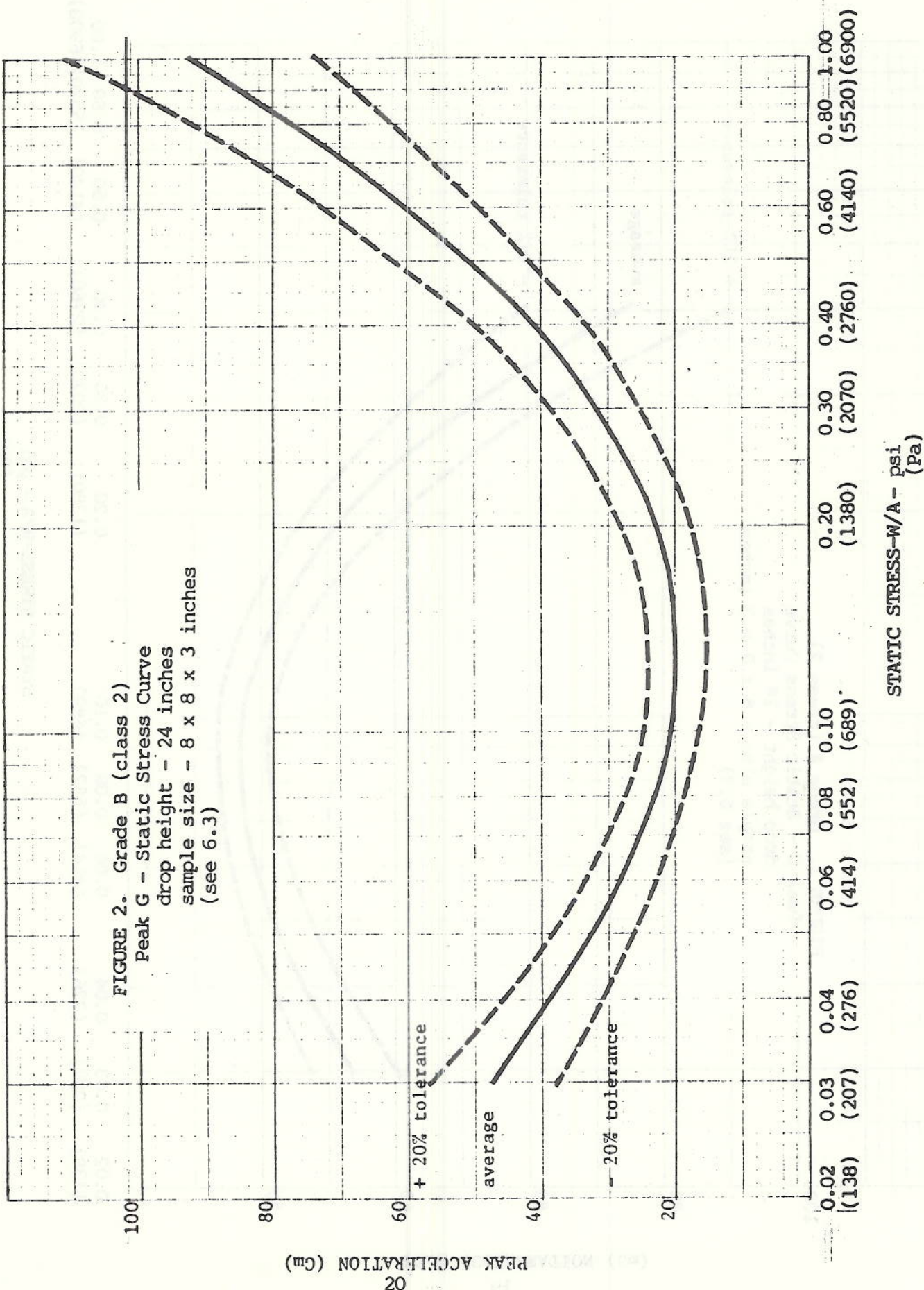
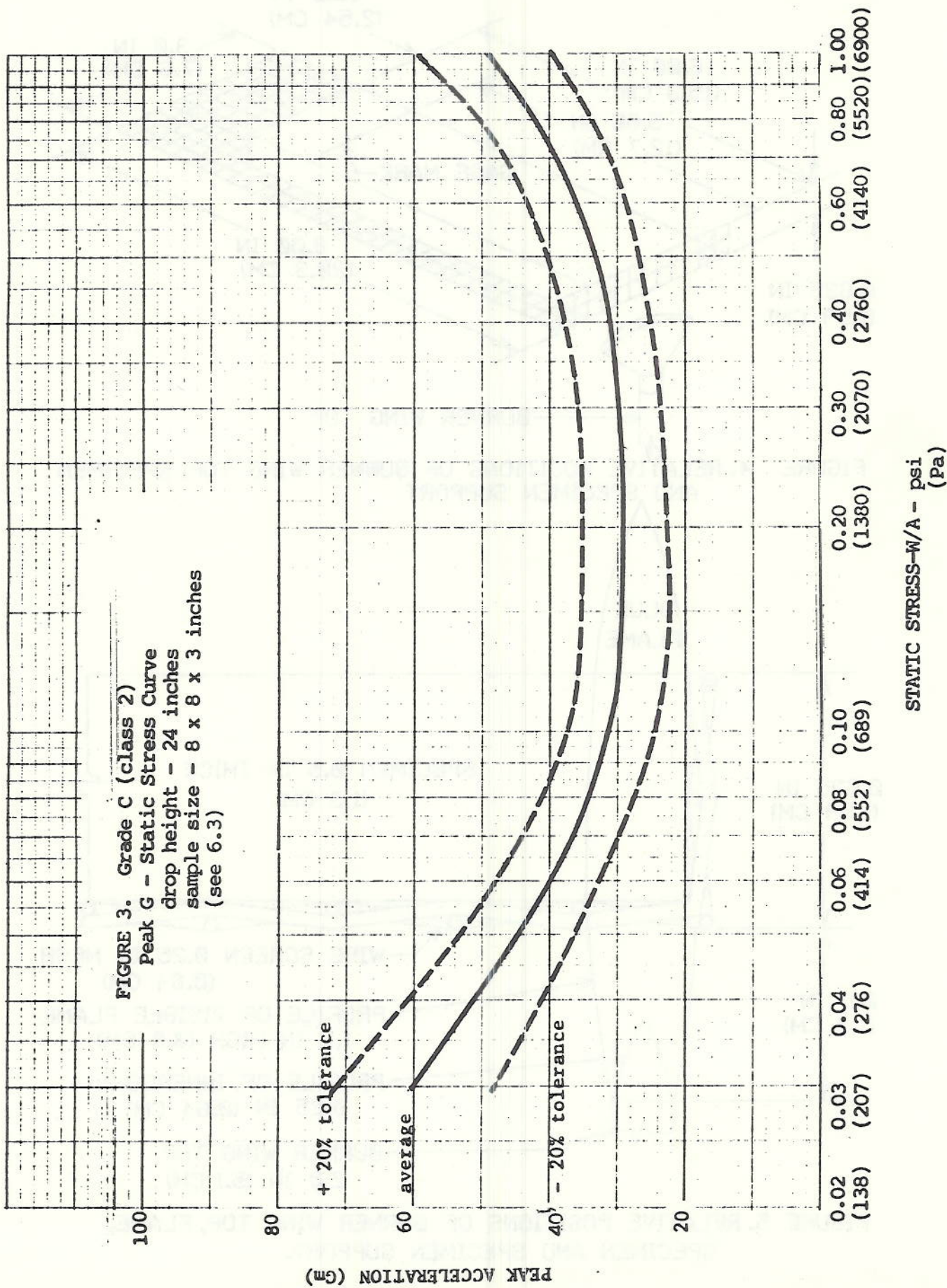


FIGURE 3. Grade C (class 2)
Peak G - Static Stress Curve
 drop height - 24 inches
 sample size - 8 x 8 x 3 inches
 (see 6.3)



MIL-P-26514F

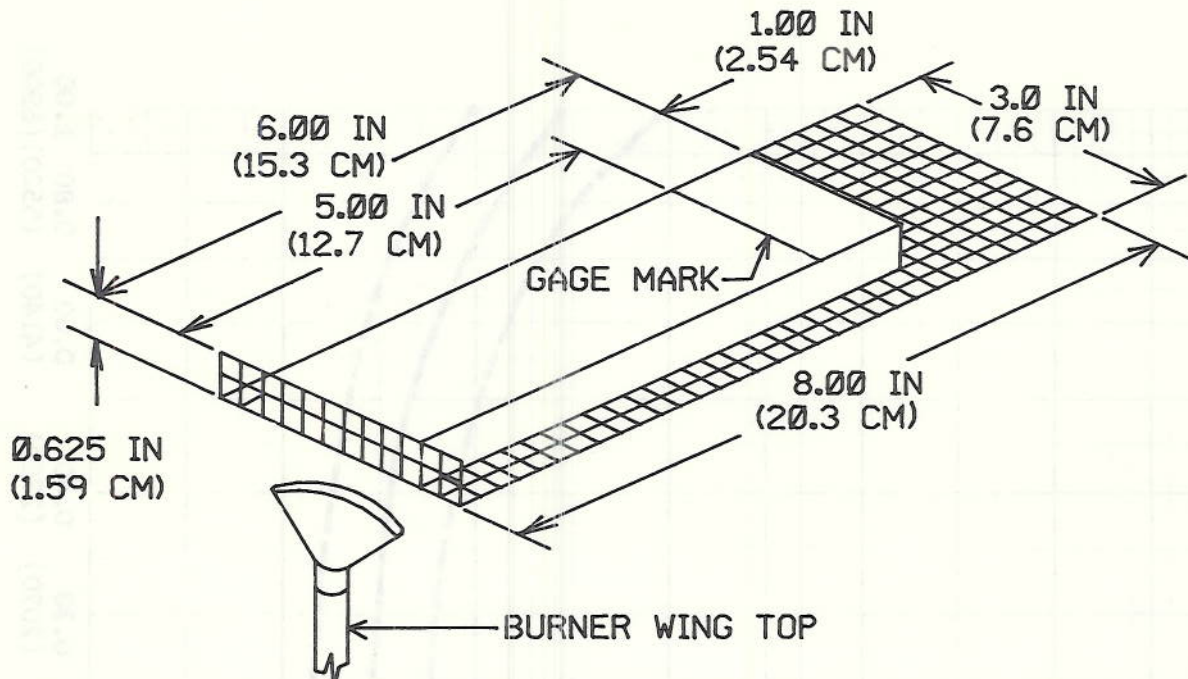


FIGURE 4. RELATIVE POSITIONS OF BURNER WING TOP, SPECIMEN AND SPECIMEN SUPPORT

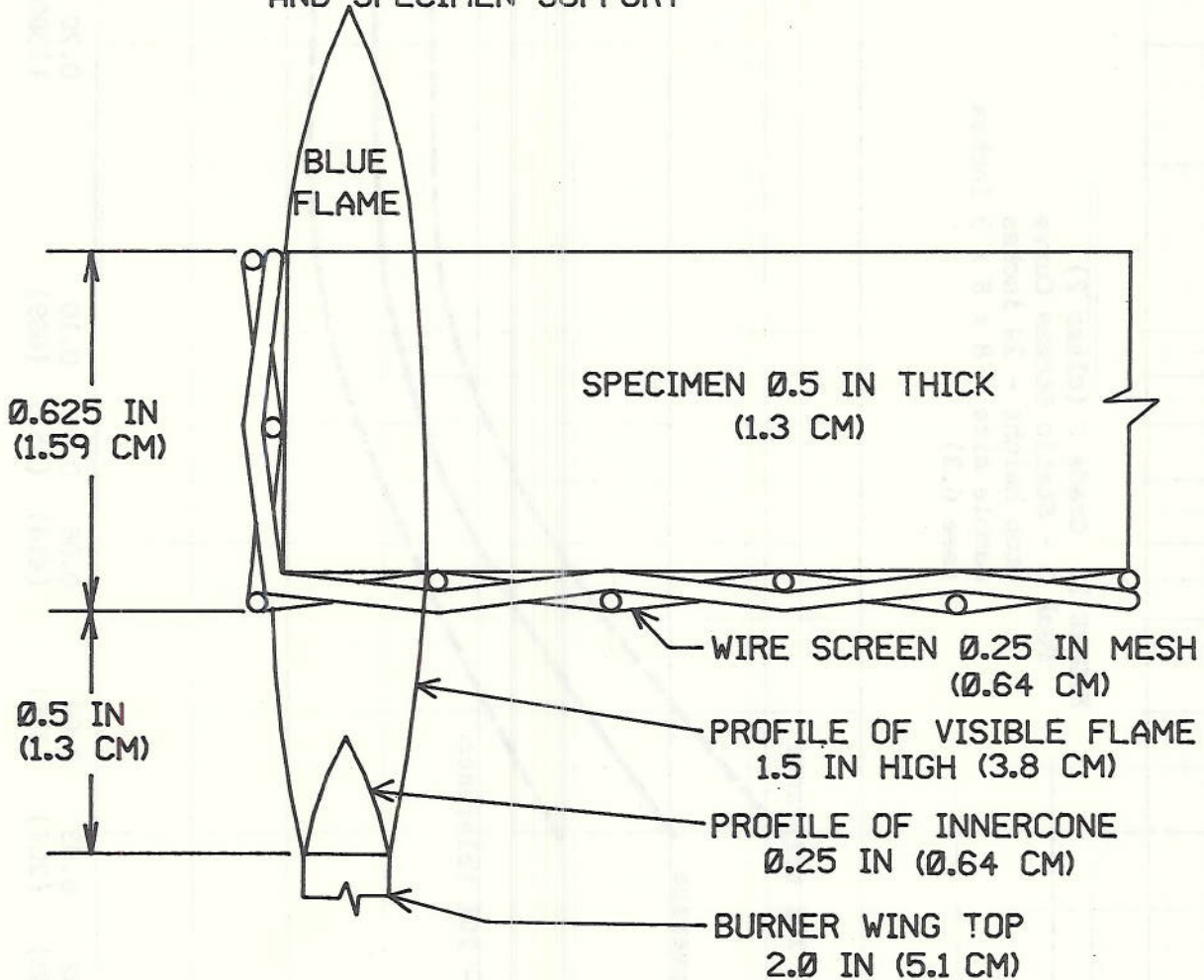


FIGURE 5. RELATIVE POSITIONS OF BURNER WING TOP, FLAME, SPECIMEN AND SPECIMEN SUPPORT.

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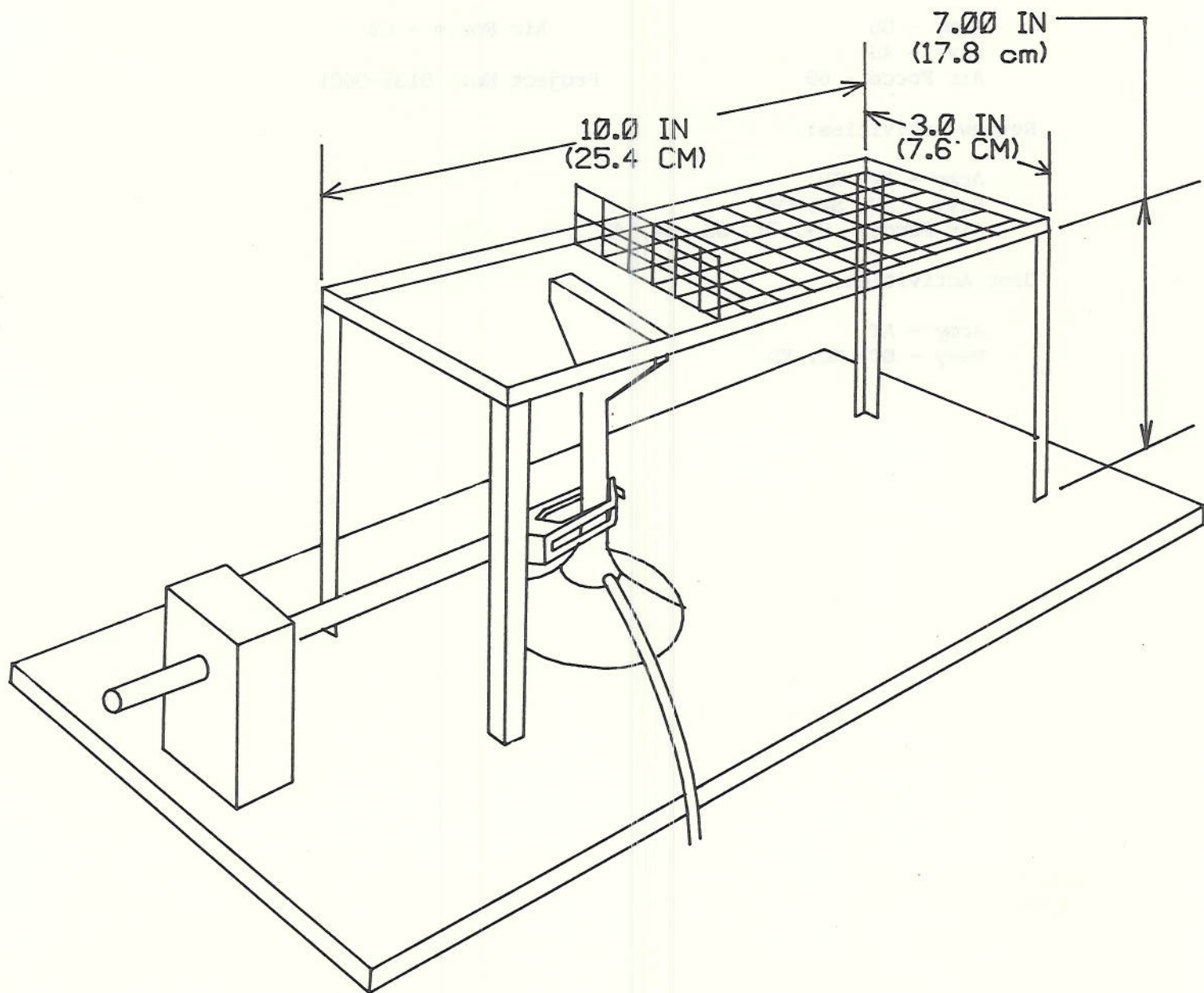


FIGURE 6. APPARATUS FOR SUPPORT OF SPECIMEN.

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Custodian:

Army - GL
Navy - AS
Air Force - 69

Preparing Activity:

Air Force - 69
Project No: 8135-0601

Review Activities:

Army - AV, AR
Navy - SH, SA, OS
Air Force - 99, 71, 80, 84, 43

User Activities:

Army - AT
Navy - EC, MC, YD

FIGURE 8. APPARATUS FOR SUPPORT OF SPECIMEN

INSTRUCTIONS: In a continuing effort to make our standardization documents better, the DoD provides this form for use in submitting comments and suggestions for improvements. All users of military standardization documents are invited to provide suggestions. This form may be detached, folded along the lines indicated, taped along the loose edge (*DO NOT STAPLE*), and mailed. In block 5, be as specific as possible about particular problem areas such as wording which required interpretation, was too rigid, restrictive, loose, ambiguous, or was incompatible, and give proposed wording changes which would alleviate the problems. Enter in block 6 any remarks not related to a specific paragraph of the document. If block 7 is filled out, an acknowledgement will be mailed to you within 30 days to let you know that your comments were received and are being considered.

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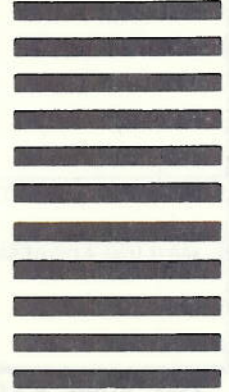
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HQ AFLC/DSTZT
Wright-Patterson AFB OH 45433-5999



STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions – Reverse Side)

1. DOCUMENT NUMBER

MTL-P-26514F

2. DOCUMENT TITLE

Polyurethane Foam, Rigid or Flexible, For Packaging

3a. NAME OF SUBMITTING ORGANIZATION

4. TYPE OF ORGANIZATION *(Mark one)*

VENDOR

USER

MANUFACTURER

OTHER *(Specify):* _____b. ADDRESS *(Street, City, State, ZIP Code)*

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER *(Last, First, MI) – Optional*b. WORK TELEPHONE NUMBER *(Include Area Code) – Optional*c. MAILING ADDRESS *(Street, City, State, ZIP Code) – Optional*8. DATE OF SUBMISSION *(YYMMDD)*