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SUPERSEDING
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5 Sept 62

MILITARY SPECIFICATION

CUSHIONING MATERIAL, RESILIENT TYPE, GENERAL

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

1. SCOPE

1.1 Scope. This specification covers resilient materials (see 6.1) used for cushioning applications in the form of rolls, sheets, special die-cut pads or molded forms, as specified (see 6.2).

1.2 Classification. The cushioning material shall be classified as to the grade for each class of loading range as follows:

Class 1 - Very light loading range (less than 0.08 psi)
Class 2 - Light loading range (0.08 - 0.2 psi)
Class 3 - Medium loading range (0.2 - 0.5 psi)
Class 4 - Heavy loading range (0.5 - 1.0 psi)
Class 5 - Very heavy loading range (1.0 - 1.5 psi)
Class 6 - Extremely heavy loading range (1.5 - 4.0 psi)

Grade A - Very low peak acceleration (less than 20 G's)
Grade B - Low peak acceleration (less than 40 G's)
Grade C - Medium peak acceleration (less than 60 G's)
Grade D - High peak acceleration (less than 100 G's)

2. APPLICABLE DOCUMENTS

2.1 The following documents of the issue in effect on date of invitation for bids or request for proposal form a part of this specification to the extent specified herein:

SPECIFICATIONS

Federal

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

Military

MIL-P-116	Preservation, Methods of

STANDARDS

Federal

Federal Test Method Standard 101	Preservation, Packaging and Packing Materials: Test Procedures

FSC 8135

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Military

MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-129	Marking for Shipment and Storage
MIL-STD-831	Test Reports, Preparation of

(Copies of specifications and standards required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) STANDARDS:

D1596-64 Dynamic Properties of Package Cushioning Materials

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

UNIFORM CLASSIFICATION COMMITTEE

Uniform Freight Classification.

(Application for copies should be addressed to the Uniform Classification Committee, 202 Union Station, 516 West Jackson Boulevard, Chicago, Illinois 60606.)

NATIONAL MOTOR FREIGHT TRAFFIC ASSOCIATIONS, INC.

National Motor Freight Classification.

(Application for copies should be addressed to the American Trucking Association, Inc., 1616 P Street NW, Washington, DC 20036.)

(Technical society and technical association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

3. REQUIREMENTS

3.1 First Article. This specification provides for First Article testing (see 4.2).

3.2 Materials. The cushioning material shall be composed of any resilient material (see 6.1) which will provide a product complying with the requirements of this specification and suitable for the purpose intended.

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3.2.1 Hydrolytic stability. After aging, the stress necessary to cause a 50 percent strain on the specimens shall be within 20 percent of the stress necessary to cause the same strain on unaged specimens (see 4.3.9).

3.2.2 Density. Density, expressed in pounds per cubic foot, shall be as specified by the procuring activity (see 4.3.4 and 6.2).

3.2.3 Hydrogen ion concentration. The hydrogen ion concentration (pH) shall be not less than 5.0 nor more than 10.0 (see 4.3.5).

3.2.4 Breakdown. The weight loss resulting from the breakdown test shall not exceed 0.75 percent (see 4.3.6).

3.2.5 Tensile strength. The cushioning material shall sustain a tensile load of 1.5 pounds per square inch of cross sectional area without total separation (see 4.3.7).

3.2.6 Compression set. The compression set shall be not more than 15 percent of the original thickness (see 4.3.8).

3.3 Form and construction. The cushioning material shall be furnished noncompressed in rolls, flat sheets, molded, machined or die cut pads, as specified (see 6.2). The cushioning material may be unbacked, backed, or coated with a suitable material, as specified (see 6.2). Artificial cores or columns shall not be used in rolls or sheets.

3.4 Loading range and efficiency. The cushioning material shall be assigned classes and grades as classified in 1.2. The classification shall be determined from a peak acceleration-static stress curve, established for a 24 inch drop height (see 4.3.10.2). The grades and classes under which a particular material falls are determined primarily by the manner in which the curve intersects the boundaries for class and grade. To be classified within a particular grade and class, the curve must occur completely below the boundaries for that grade through the entire stress range represented by the class.

3.5 Dimensions. The length, width, and thickness of rolls, sheets, or die-cut pads determined in accordance with 4.4.4.1 shall be as specified by the procuring activity (see 6.2). Rolls and sheets will normally be supplied in 2 or 3 foot widths with rolls in 50 or 100 foot lengths and sheets in 6, 8, 10 or 12 foot lengths. Special molded or machined shapes shall be of the configuration and dimensions specified by the procuring activity (see 6.2).

3.5.1 Dimensional tolerances for length and width.

3.5.1.1 Rolls and sheets. The length of rolls or sheets shall be within minus 1 to plus 5 percent of the specified length. The width shall be within ± 1 percent of the specified width (see 6.2).

3.5.1.2 Die-cut pads. Unless otherwise specified, the length and width of die-cut pads shall be within 1/4 inch of the specified dimensions (see 6.2).

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3.5.2 Dimensional tolerance for thickness. For a material 1-1/4 inch thick or less, the tolerance for the specified thickness shall be minus 10 to plus 20 percent. For a material exceeding 1-1/4 inch in thickness, the tolerance shall be minus 1/8 to plus 1/4 inch.

3.6 Technical data. For each material of a given class and grade, the manufacturer will furnish to the procuring activity his product's designation necessary to identify the specific material and the following technical data in Table I. The manufacturer, upon completion of the tests, shall prepare a test report in accordance with MIL-STD-831 and furnish three copies of the report to the procuring activity.

TABLE I

Technical Data	Test Procedure Paragraph
a. Stress-Strain Curve, stress in pounds per square inch versus strain in percent	4.3.10.1
b. Acceleration data, peak acceleration in G's versus static stress in pounds per square inch.	4.3.10.2
c. Creep characteristics, maximum stress of the loading range "class" for which the material is being tested.	4.6.10.3
d. Thickness, in inches.	4.3.3
e. Density in pounds per cubic foot.	4.3.4

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier 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.

4.2 Classification of tests. The inspection and testing of the cushioning material shall be classified as follows:

a. First Article tests ----------4.3
b. Quality Conformance tests ----------4.4

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4.3 First Article Test. No material shall be offered for acceptance under any contract or order until the first article samples prescribed in 4.3.1 have been subjected to the first article tests and pronounced satisfactory by the procuring activity. However, approval of the first article samples shall not relieve the supplier of his obligation to meet the quality conformance tests.

4.3.1 First Article test sample. Five rolls, sheets, die-cut pads or molded or machined shapes of the same material, manufactured under essentially the same conditions as to be used in production shall be selected for samples. Samples shall be of sufficient size to provide material for all the First Article tests.

4.3.2 Test conditions. Except as specified herein, tests and measurements shall be made at room temperature (70°F - 80°F) unless otherwise specified by the procuring activity (see 6.2). In case of dispute and prior to resumption of testing, the specimens shall be conditioned at 73°F ± 3.5°F and 50% ± 5% relative humidity or at the specified temperature and relative humidity (see 6.2) for at least 16 hours or until the difference between two successive weighings conducted at one-hour intervals is less than 1% of the average specimen weight.

4.3.3 Thickness determination.

4.3.3.1 Preparation of specimens. One square specimen shall be prepared from each of the samples. The length and width of the specimen shall be not less than twice its assumed thickness. The length and width of the specimens shall be measured at the center lines to the nearest 1/16 inch. The specimens for material less than 1-inch in thickness shall consist of sufficient stacked pieces to measure at least 1-inch in thickness. The specimens shall be cut to avoid rounded or precompressed edges.

4.3.3.2 Test procedure. The specimen shall be placed upon a flat surface and loaded with a rigid, flat plate which overhangs by 1-inch the width and length of the specimen. The load exerted on the specimen shall be 0.025 plus or minus 0.003 pounds per square inch. Thirty seconds after application of the plate and while still under load, 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: the average of the four measurements shall be recorded as the original thickness. (A dial indicator located at the geometric center of the plate may also be used to measure thickness.) The thickness representative of the lot shall be the average of the material thickness of the specimens.

4.3.4 Density. The specimens shall be prepared in accordance with 4.3.3.1, the thickness of each specimen determined in accordance with 4.3.3.2 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:

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$$D = 3.8 \left(\frac{W}{lwt}\right)$$

Where D is density, in pounds per cubic foot
W is weight of specimen, in grams
l is length of specimen, in inches
w is width of specimen, in inches
t is thickness of specimen, in inches (minimum 1 inch thickness)

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

4.3.5 Hydrogen ion concentration. Hydrogen ion concentration (pH) shall be determined in accordance with Federal Test Method Standard 101, Method 6002.

4.3.6 Breakdown. A 2-inch square shall be cut from specimens of the material and weighed to the nearest 0.01 gram. The sample shall be cut to preclude a backing material that would prevent loss if material breakdown occurs. A cylindrical weight of 0.75 plus or minus 0.01 pound, having a flat face area of 1.48 plus or minus 0.02 square inches shall be dropped from a height of 10 inches above the top surface of the specimen so as to impact flatwise. After a total of 10 such drops, the specimen shall be weighed to the nearest 0.01 gram. The weight loss due to breakdown shall be computed as follows:

$$\text{Breakdown \%} = \frac{\text{(Original weight - weight after impact)}}{\text{Original weight}} \times 100$$

4.3.7 Tensile strength. Tensile strength shall be determined in accordance with Federal Test Method Standard 101, Method 2043. For fiberous materials, the load shall be applied in two directions, parallel with and transverse to the direction of the fibers.

4.3.8 Compression set. The test shall be conducted subsequent to completion of the procedure outlined in 4.3.10.3 and on the same specimens employed for determination of creep. Four hours after removal of the load, the thickness of the specimen shall be measured in accordance with 4.3.3 and the compression set calculated as follows:

$$\text{Compression Set \%} = \frac{(t_o - t_s)}{t_o} \quad 100$$

t_o is original thickness.
t_s is final thickness after 4 hours in unloaded condition.

4.3.9 Hydrolytic stability. The test specimens shall be prepared in accordance with 4.3.3.1 and then preworked (subjected to compression cycling in accordance with 4.3.10.1). The test specimens shall be loaded to 50 percent strain in accordance with 4.3.10.1 and the loads causing this strain shall be recorded. The same test specimens shall then be placed for 2 weeks in a humidity cabinet at 120°F ± 2°F and 95 ± 5 percent relative humidity. After the 2-week exposure period, the test specimens shall be subjected for 1 hour to the test conditions specified in 4.3.2. The test specimens shall then be loaded to 50 percent strain in accordance with the procedure specified in 4.3.10.1 and the loads causing this strain recorded. The average value of the loads before and after aging shall be examined for conformance to 3.2.1.

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4.3.10 Technical data. The following procedures shall be utilized in securing the necessary technical data (see 3.6).

4.3.10.1 Stress-strain. Test specimens shall be prepared in accordance with 4.3.3.1. The original thickness of each specimen will be determined in accordance with 4.3.3 and each sample will be compressed 65 percent of the original thickness 10 times or until the change in thickness between loading cycles does not exceed 2 percent of the original thickness. The thickness after preworking will be measured 3 minutes after the final preworking compression cycle. The test specimen shall then be placed in a compression machine (Tinius Olsen Compression Tester, Universal Tester, Instron Tester, or similar equipment) or a weight-increment type device. The thickness after prework shall be used as the zero deflection point. The specimens shall be loaded at a rate not greater than 1.0 inch per minute per inch of thickness. The load shall be recorded at increments of deflection not greater than 5 percent of the thickness (after preworking) and the loading continued until a 100 percent increase in load produces a change in deflection of less than 5 percent. If a weight-increment device is used, the deflection shall be determined approximately 30 seconds after the application of an incremental change in load.

4.3.10.2 Peak acceleration versus static stress data. The data to plot the peak acceleration in multiples of g versus static stress in pounds per square inch from a drop height of 24 inches for each thickness of material shall be established in accordance with ASTM D 1596 with the deviations specified herein (see 6.3).

4.3.10.2.1 Size. Each test specimen will be an 8-inch square. However, specimen size may be reduced only after it has been determined that adjustment of static stress cannot be accomplished by variational load. The least allowable altered specimen size for this test shall be 5 by 5 by 2-inches. The thickness shall be determined in accordance with 4.3.3 and will depend on the class and grade in which the material is being qualified.

4.3.10.2.2 Dynamic test procedure. Dynamic impact tests shall be conducted only on certified test equipment (see 6.3). Impact tests shall be so conducted on each specimen that the dropping head compresses the specimen at an initial velocity of 136 + 2 inches 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 weight range, five consecutive drops shall be made on each of the specimens comprising the sample of a 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 and five consecutive drops again made on each of the specimens. Several more such increments of weight shall be added. After the addition of each weight increment, the dropping procedure shall be repeated. The increments of weight shall be chosen so that the acceleration-static stress curve is clearly defined, usually five to nine points will be required to establish the curve.

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4.3.10.2.3 Computations. The first reading obtained from each set of five drops shall be discarded and the peak acceleration readings of the remaining four shall be averaged. The average values, one for each specimen, shall then be averaged to obtain one value at each weight increment for the sample. The average peak acceleration for each given weight shall be plotted directly against the corresponding static stress.

4.3.10.3 Determination of creep. The test specimens shall be prepared in accordance with 4.3.3.1 and uniformly loaded in accordance with 4.3.3.2 except that the specimens shall be loaded at the maximum stress of the loading range for which the material is being qualified. One hour after continuous loading and while under the originally applied load, the thickness shall be measured in accordance with 4.3.3 and the measurement recorded as the initial thickness for the determination of creep. The specimens shall remain under constant load and thickness measurements recorded approximately every 24 hours for a minimum of four 24-hour increments or until the total variation of 4 successive measurements does not exceed 1 percent of the original thickness. The last reading shall be recorded as the final thickness. The percentage of creep shall be calculated as follows:

$$\text{Creep } \% = \frac{(t_i - t_f)}{t_i}$$

t_i is initial thickness

t_f is final thickness

4.4 Quality Conformance Test.

4.4.1 Lot. A lot shall consist of all rolls, sheets, die-cut pads and molded or machined shapes within the same class and grade manufactured from the same material, under essentially the same conditions offered for delivery at one time.

4.4.2 Sampling for lot acceptance. A random sample of rolls, sheets, die-cut pads and molded or machined shapes shall be selected from each lot in accordance with MIL-STD-105 at inspection level S-3.

4.4.3 Inspection of materials. Materials selected in accordance with 4.4.2 shall be examined to verify compliance with this specification. Examination shall be conducted as specified in Table II. The Acceptable Quality Levels shall be 6.5 percent for major defects and 10.0 percent for minor defects. Test conditions shall be as specified in 4.3.2.

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TABLE II

Material Defects

Categories	Defect
Major	
101	Dimensions of die-cut or molded shapes not within specified tolerance.
102	Non-uniformity in quality and texture.
103	Not within class and grade specified in contract or order.
104	Use of artificial cores or columns to meet specified requirements on rolls or sheets
Minor	
201	Length and width of rolls or sheets not within specified limits.
202	Improper marking of shipping containers.

4.4.4 Testing for end item acceptance. Acceptance tests shall consist of the tests specified herein.

4.4.1 Dimensional inspection. The length, width and thickness of rolls, sheets, or die-cut pads shall be measured to the nearest 1/16 inch to determine conformance to 3.5. The dimensions, other than thickness, of molded or machined shapes shall be examined for conformance to the applicable drawing, specification, etc.

4.4.4.2 Breakdown. The specimens shall be subjected to the test specified in 4.3.6 and shall be examined for conformance to 3.2.4.

4.4.4.3 Tensile strength. The specimens shall be subjected to the test specified in 4.3.7 and shall be examined for conformance to 3.2.5.

4.4.4.4 Compression set. The specimens shall be subjected to the test specified in 4.3.8 except that the prerequisite procedure of 4.3.10.3 shall not apply. The results shall be examined for conformance to 3.2.6.

4.5 Inspection of packaging, packing and marking. Sample items or packs and the inspection of the packaging, packing and marking for shipment and storage shall be in accordance with the requirements of Section 5.

5. PREPARATION FOR DELIVERY

5.1 Packaging. Not applicable.

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

5.2.1 Level A and B. Unless otherwise specified, cushioning material of the same class and grade, in rolls, sheets, pads or molded forms as specified, shall be packed in containers conforming to PPP-B-636, Type CF, Class Weather Resistant, Grade V11c; 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.

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5.1.2 Level C. Cushioning material shall be [illegible] to afford [illegible] protection against damage from the supply source [illegible] the first receiving activity for immediate use. Containers and pa[illegible] shall comply with the Uniform Freight Classification Rules and National Motor Freight Classification Rules, as applicable.

5.3 Marking. In addition to any special markings required by the contract or order, the exterior shipping contai[illegible] shall be marked in accordance with MIL-STD-129.

6. NOTES

6.1 Composition and intended use. Materials that qualify under this specification are usually composed of either interlocking or bonded fibers or an elastomeric substance and are intended for use within packages to protect equipment from shocks or impacts incurred during shipment and handling. Care should be taken to insure that cushioning materials procured under this specification are not used as dunnage or in other areas where the full value of the cushioning ability is not realized. For the purpose of this specification, a resilient material is defined as that type which will recover 90 percent or more of its original thickness after being compressed 65 percent of the original thickness a total of ten times or until the change in thickness between compression cycles does not exceed 2 percent of the original thickness.

6.2 Ordering data. Procurement documents should specify the following:

a. Title, number, and date of this specification

b. Class and grade (see 1.2 and 3.4)

c. Density and thickness (see 3.5 and 3.11.2)

d. Form (rolls, sheets, molds, etc.) (see 3.3)

e. Backing or coating, etc., if desired (see 3.3)

f. Dimensions (see 3.11)

g. Level of packaging and packing desired (see 5.1 and 5.2)

h. When testing is required at other than room temperature (see 4.3).

6.3 Certification of test equipment. With respect to certification of test equipment for the peak acceleration versus static stress data of 3.6 (b), only those laboratories or test facilities which have, prior to the time of first article tests, had their equipment tested and approved for listing on the List of Certified Testing Facilities for MIL-C-26561 shall be acceptable for the performance of the test of 4.3.10.2. The attention of the suppliers is called to this requirement and manufactures

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are urged to arrange to have their equipment certified in order that they may be eligible to perform the test for peak acceleration versus static stress data under this specification. The agency responsible for certifying test equipment and maintaining the List of Certified Testing Facilities for MIL-C-26861 is Headquarters, Air Force Logistics Command, Air Force Packaging Evaluation Agency (DSPE), Wright-Patterson AFB, Ohio 45433, and information pertaining to certification of test equipment may be obtained from that activity.

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3a. NAME OF SUBMITTING ORGANIZATION

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- ☐ OTHER *(Specify)*: _____

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5. PROBLEM AREAS

a. Paragraph Number and Wording:

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c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER *(Last, First, MI)* – Optional

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