

INCH-POUND

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15 JANUARY 2009
 SUPERSEDING
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 2 JANUARY 1979

DETAIL SPECIFICATION

RUBBER, POLYURETHANE, CASTABLE, HUMIDITY RESISTANT

INACTIVE FOR NEW DESIGN AFTER 9 FEBRUARY 1998

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

1. SCOPE

1.1 Scope. This specification covers parts made from castable, general purpose, polyurethane rubber.

1.2 Classification. The polyurethane rubber parts covered by this specification are of the following classes, as specified (see 6.2).

Class 1	-	80 ± 5 hardness
Class 2	-	90 ± 5 hardness

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 of this standard. This section does not include documents cited in other sections of this standard or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3, 4, or 5 of this standard, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications and standards form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

FEDERAL STANDARDS

FED-STD-191	Textile Test Methods (Inactive for new design)
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Comments, suggestions, or questions on this document should be addressed to Defense Supply Center Philadelphia (DSCP), ATTN: DSCP-NASA, 700 Robbins Avenue, Philadelphia, PA 19111-5096 or e-mail to dscpg&ispeccomments@dla.mil . Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at http://assist.daps.dla.mil .

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DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-407

Visual Inspection Guide for Rubber Molded Items

(Copies of these documents are available online at <http://assist.daps.dla.mil/quicksearch/> or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D395	Rubber Property – Compression set
ASTM D412	Vulcanized Rubber and Thermoplastic Elastomers - Tension
ASTM D573	Rubber – Deterioration in an Air Oven
ASTM D624	Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
ASTM D1329	Evaluating Rubber Property – Retraction at Lower Temperatures (TR Test)
ASTM D2240	Rubber Property – Durometer Hardness

(Copies of these documents are available from www.astm.org or the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

AMERICAN SOCIETY FOR QUALITY (ASQ)

ASQ Z1.4	Sampling Procedures and tables for Inspection by Attributes.
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(Copies of this document are available from www.asq.org or the American Society for Quality, 600 North Plankinton Avenue, Milwaukee, WI 53203.)

2.4 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 First articles. When specified (see 6.2), a sample shall be subjected to first article inspection in accordance with 4.2.

3.2 Materials. The materials shall consist of a polyurethane system containing the necessary compounding ingredients formulated and processed to meet the requirements of this specification. All materials which are not specifically described herein shall be of high quality and suitable for the purpose intended.

3.2.1 Toxic products and formulations. The cured material shall have no adverse effect on the health of personnel when used for its intended purpose. Questions pertinent to the effect shall be referred by the procuring activity to the appropriate department medical service who will act as an advisor to the procuring agency.

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3.3 Dimensions and tolerances. Dimensions and tolerances shall be as specified on the drawing or in the contract or order.

3.4 Physical properties. Physical properties shall conform to the requirements specified in Table I.

3.5 Identification of product. Where the size of the product permits, the identification shall be on the product. The marking shall be applied by suitable means, using marking fluid that is not deleterious to the polyurethane rubber. The marking shall not be obliterated by normal handling. When identification marking of the product is impracticable, the unit package shall show the identification. The identification shall show the specification number, the manufacturer, the manufacturer's designation (compound number), hardness, and the cure date by quarter and year.

Example: MIL-DTL-83397
The Delectable Rubber Company
Compound No. 1980
80 Hardness
Cure date 3Q77

TABLE I. Properties

PROPERTIES	REQUIREMENTS	
	Class 1 80 Hardness	Class 2 90 Hardness
Specific gravity *	As Determined	As Determined
Tensile strength, psi (MPa), min.	4000 (27.58)	4500 (31.03)
Elongation, %, min.	400	300
Hardness, Durometer "A", points	80 \pm 5	90 \pm 5
Tear strength, psi (MPa), min	250 (1.72)	400 (2.76)
Temperature retraction (TR-10) °F (°C), max.	-45 (-42.8)	-20 (-28.9)
After aging 22 \pm .25 hours at 158° \pm 2°F (70° \pm 1°C)		
Compression set, % max.	35	35
After aging 7 days at 212° \pm 2°F (100° \pm 1°C)		
Tensile strength change, %	\pm 20	\pm 20
Elongation change, %	\pm 20	\pm 30
Hardness change, Durometer "A", points	\pm 5	\pm 5
After aging 120 days at 160° \pm 2°F (71° \pm 1°C) and 95% Relative Humidity		
Tensile strength change, %	\pm 25	\pm 25
Elongation change, %	\pm 20	\pm 20
Hardness change, Durometer "A", points	\pm 10	\pm 10
After aging 4 days at 180° \pm 2°F (82° \pm 1°C) over water (short term test)		
Tensile strength change, %	\pm 20	\pm 20
Ultraviolet resistance		
Tensile strength change, %	\pm 20	\pm 20
Elongation change, %	\pm 20	\pm 20

* The permissible variation in specific gravity during actual production from that value established in preproduction tests shall be \pm .02.

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3.6 Vulcanized joints. Unless otherwise specified by the drawing, contract, or order, the tensile strength of permitted vulcanized joints shall be a minimum of 20 percent of the strength of the solid section. The vulcanized joint shall be of the same size as the original molded cross-section.

3.7 Workmanship. The product shall be manufactured by such processes to meet the requirements of this specification.

4. VERIFICATION

4.1 Classification of inspection. The inspection and testing of the polyurethane rubber shall be classified as follows:

- a. First article inspection (see 4.2).
- b. Conformance inspection (see 4.3).

4.2 First article inspection. First article inspection shall consist of all the tests specified (see 4.5).

4.2.1 First article test samples. First article test samples shall be nominally .075 inch (1.9 mm) thick sheets, prepared by a method similar to that to be used in making the product, such as, low pressure injection molded, of sufficient size to allow preparation of the test specimens.

4.2.2 Tests. First article tests shall consist of all the tests specified in 4.5.

4.3 Conformance inspection.

4.3.1 Sampling for inspection. Sampling for conformance inspection shall be in accordance with ASQ Z1.4, except where otherwise indicated herein. Conformance tests are required on final products for all production lots of material.

4.3.1.1 Lot. A lot shall consist of all material of the same identity cured in the same production run, from the same batch, and submitted at the same time for inspection.

4.3.1.2 Batch. A batch shall be quantity compounded in a mixer at one time.

4.3.2 Conformance test samples. Whenever possible, the end item, or specimens cut from the end item shall be used as the sample. If these items are unsuitable for use as test samples, tests shall be performed on samples from the same lot of identical composition and comparable state of cure as that of the end item.

4.3.3 Inspection of materials and components. The supplier is responsible for insuring that materials and components used were manufactured, tested, and inspected in accordance with referenced subsidiary specifications and standards to the extent specified, or if none, in accordance with this specification. In the event of conflict, this specification shall govern.

4.3.4 Inspection of the end item. Examination of the end item shall be in accordance with the classification of defects, inspection levels, and acceptance quality levels (AQL's) set forth herein. The lot size, for the purpose of determining the sample size in accordance with ASQ Z1.4, shall be expressed in units of parts for examinations as specified (see 4.3.4.1 and 4.3.4.2).

4.3.4.1 Examination for defects in appearance and workmanship.

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4.3.4.1.1 Molded parts. The sample unit shall be one molded part and the examination shall be in accordance with MIL-STD-407. The sample size shall be in accordance with ASQ Z1.4, inspection level II, and the AQL related to percent defective shall be 1.5.

4.3.4.2 Examination for dimensional defects.

4.3.4.2.1 Molded parts. The sample unit shall be one molded part. The dimensions shall be within the tolerances specified on the drawing, contract or order. The sample size shall be in accordance with ASQ Z1.4, inspection level II, and the AQL related to percent defective shall be 1.5.

4.3.5 Conformance tests. The following tests shall be conducted on each lot of material:

Original:	Air Aged (7 days at 212°F (100°C)):	Humidity Resistance (4 days at 180°F (82°C)):
Specific Gravity	Tensile Strength	Tensile Strength
Tensile Strength	Elongation	
Elongation	Hardness	
Hardness		
Tear Strength		

4.3.5.1 Rejection criteria. A lot shall be rejected upon the failure of any sample to meet the test requirements specified herein. A lot that has been rejected may be reworked to correct the deficiencies and resubmitted for acceptance. Before resubmitting full particulars concerning previous rejection and action taken to correct defects found in the original material shall be furnished to the procuring activity. Material rejected after retest shall not be submitted without specific approval of the procuring activity.

4.4 Test conditions. All test specimens shall be conditioned and tested at standard conditions (see 4.4.1) unless otherwise specified herein or in the applicable ASTM test method.

4.4.1 Standard conditions. Standard conditions shall be 50 ± 5 percent relative humidity and at a temperature of $75^\circ \pm 5^\circ\text{F}$ ($24^\circ \pm 2.5^\circ\text{C}$).

4.5 Test Methods.

4.5.1 Properties. Unless otherwise specified herein, properties shall be determined in accordance with ASTM test methods for rubber products as follows:

<u>Property</u>	<u>ASTM method</u>
Tensile strength and elongation	D412
Hardness	D2240
Tear strength	D624 (use die B)
Temperature retraction (TR-10)	D1329

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4.5.2 Compression set. Compression set shall be determined in accordance with Method B of ASTM D395, except that the aging time and temperature shall be in accordance with Table I. Compression set tests shall be conducted on test specimens plied up from applicable test samples or parts.

4.5.3 Heat aging. Heat aging shall be conducted in accordance with ASTM D573, except that the aging time and temperature shall be in accordance with Table I, tensile strength, elongation, and hardness changes shall be determined as specified (see 4.5.1).

4.5.4 Humidity resistance.

4.5.4.1 Long term. Five ASTM D412 die C shall be suspended in a humidity chamber which maintains 95 ± 5 percent relative humidity at $160^\circ \pm 2^\circ\text{F}$ ($71^\circ \pm 1^\circ\text{C}$) for 120 days. After 120 days the specimens shall be removed, and cooled for 4 hours at $77^\circ \pm 2^\circ\text{F}$ ($25^\circ \pm 1^\circ\text{C}$) and 50 ± 5 percent relative humidity prior to test.

4.5.4.2 Short term. Humidity resistance shall be conducted by suspending three ASTM D412, die C specimens in a quart jar containing approximately 150 cc. distilled water. The screw cap closed jar shall be placed in an air oven for the time and temperature specified in Table I. Distilled water shall be added as required to maintain approximately 150 cc in the jar. After exposure, the specimens shall be cooled for 4 hours at $77^\circ \pm 2^\circ\text{F}$ ($25^\circ \pm 1^\circ\text{C}$) and 50 ± 5 percent relative humidity prior to the tensile strength test.

4.5.5 Ultraviolet resistance. Exposure shall be in accordance with Method 5660 of FED-STD-191. Tensile specimen; shall be suspended in the apparatus for 100 hours. After exposure the specimens shall be held at standard conditions (see 4.4.1) for a minimum of 2 hours prior to test.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The rubber covered by this specification is intended for use where resistance to tear and abrasion is required. This material has excellent resistance to humidity.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Class, hardness (see 1.2).
- c. Dimensions and tolerances (see 3.3)
- d. If first article samples are required (see 3.1).
- e. Packaging requirements (see 5.1).

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6.3 First article. When first article inspection is required, the contracting officer should provide specific guidance to offerers whether the first article (s) should be a preproduction sample, an initial production sample, a first production item or a standard production item from the contractor's current inventory; the number of samples to be inspected as specified in 4.2; and (when applicable) the specific tests to be performed on each sample. The contracting officer should also include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results, and disposition of first articles. Invitations for bid 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. Bidders should not submit alternate bids unless specifically requested to do so in the solicitation.

6.4 Shelf-life. This specification covers items where the assignment of a Federal shelf-life code is a consideration. Specific shelf-life requirements should be specified in the contract or purchase order, and should include, as a minimum, shelf-life code, shelf-life package markings in accordance with MIL-STD-129 or FED-STD-123, preparation of a material quality storage standard for type II (extendible) shelf-life items, and a minimum of 85 percent shelf-life remaining at time of receipt by the Government. These and other requirements, if necessary, are in DoD 4140.27-M, *Shelf-life Management Manual*. The shelf-life codes are in the Federal Logistics Information System Total Item Record. Additive information for Shelf-life management may be obtained from DoD 4140.27-M, or the designated shelf-life Points of Contact (POC). The POC should be contacted in the following order: (1) the Inventory Control Points that manage the item and (2) the DoD Services and Agency administrators for the DoD Shelf-Life Program. Appropriate POCs for the DoD Shelf-Life program can be contacted through the DoD Shelf-Life Management website: <https://www.shelflife.hq.dla.mil/>.

6.5 Subject term (key word) listing.

Molded part
Vulcanized joint

6.6 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

Custodians:
Army - MR
Navy - SH
Air Force - 11

Preparing activity:
DLA – IS

(Project 5330-2009-003)

Review activities:
Navy - AS
Air Force - 99

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at <http://assist.daps.dla.mil>.