INCH-POUND
MIL-PRF-6855F
w/AMENDMENT 1
27 February 2012
SUPERSEDING
MIL-PRF-6855F
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PERFORMANCE SPECIFICATION

RUBBER, SYNTHETIC, SHEETS, STRIPS, MOLDED OR EXTRUDED SHAPES, GENERAL SPECIFICATION FOR

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

1. SCOPE

1.1 Scope. This specification covers the requirements for low temperature resistant sheets, strips, and molded or extruded shapes fabricated from synthetic rubber (see 6.1).

1.2 Classification. The classes, types, grades, and forms of synthetic rubber covered by this specification are as specified herein (see 6.2). Type A material may also be supplied as Type B material.

1.2.1 Class (see 6.1).

Class 1	-	Fuel and petroleum oil resistant
Class 2	-	Petroleum oil, weather, and ozone resistant
Class 3	-	Non-oil resistant
Class 4	-	Petroleum oil, weather, and ozone resistant (for use in contact with acrylic and polycarbonate plastics)
Class 5	-	Non-oil resistant (for use in contact with acrylic and polycarbonate plastics)

1.2.2 Type (Classes 2 and 4 only) (see 6.1).

Type A	-	High ozone concentration
Type B	-	Low ozone concentration

1.2.3 Grade. The following grade designation numbers correspond to the ASTM D2240 Type A durometer hardness values:

30	60
40	70
50	80

1.2.4 Form. Forms covered by this specification are as follows:

Sheet
Strip (or tape)
Extruded shapes

Comments, suggestions, or questions on this document should be addressed to: Commander, Naval Sea Systems Command, ATTN: SEA 05S, 1333 Isaac Hull Avenue, SE, Stop 5160, Washington Navy Yard DC 20376-5160 or emailed to CommandStandards@navy.mil, with the subject line "Document Comment". Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at https://assist.dla.mil.

AMSC N/A FSC 9320

Molded shapes

1.3 Part or Identifying number (PIN). Part numbers consist of the prefix M, specification number, and specification sheet number followed by a six-digit dash number comprising a code which describes the item in explicit terms. Code is developed from specification sheet requirements.

M	**6855**	**/**	**X**	**-**	**XXXXXX**
Prefix for Military Specification	Specification Number		Specification Sheet Number		Six digit dash number comprising a code which describes the item in explicit terms. Code is developed from specification sheet requirements.

Example: M6855/1-XXXXXX
M6855/2-XXXXXX

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 of this specification. This section does not include documents cited in other sections of this specification 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 specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks 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.

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-PRF-5425	-	Plastic Sheet, Acrylic, Heat Resistant
MIL-PRF-6855/1	-	Rubber, Synthetic, Sheets
MIL-PRF-6855/2	-	Rubber, Synthetic, Strip (or Tape)
MIL-PRF-6855/4	-	Rubber, Synthetic, Tubing
MIL-PRF-6855/5	-	Rubber, Synthetic, Channel, Extruded

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-190	-	Identification Marking of Rubber Products
MIL-STD-289	-	Visual Inspection Guide for Rubber Sheet Material
MIL-STD-298	-	Visual Inspection Guide for Rubber Extruded Goods
MIL-STD-407	-	Visual Inspection Guide for Rubber Molded Items
MIL-STD-1916	-	DoD Preferred Methods for Acceptance of Product

DEPARTMENT OF DEFENSE HANDBOOKS

MIL-HDBK-695	-	Rubber Products: Recommended Shelf Life

(Copies of these documents are available online at https://assist.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.

ASTM INTERNATIONAL

ASTM D395	-	Standard Test Methods for Rubber Property - Compression Set (DoD adopted)
ASTM D412	-	Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension (DoD adopted)
ASTM D471	-	Standard Test Method for Rubber Property - Effect of Liquids (DoD adopted)
ASTM D792	-	Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement (DoD adopted)
ASTM D1149	-	Standard Test Methods for Rubber Deterioration-Cracking in an Ozone Controlled Environment (DoD adopted)
ASTM D2240	-	Standard Test Method for Rubber Property - Durometer Hardness (DoD adopted)

(Copies of these documents are available from ASTM International, 100 Barr Harbor Dr., P.O. Box C700, West Conshohocken, PA 19428-2959 or online at www.astm.org.)

SAE INTERNATIONAL

SAE-AMS-P-83310	-	Plastic Sheet, Polycarbonate, Transparent

(Copies of this document are available from SAE World Headquarters, 400 Commonwealth Drive, Warrendale, PA 15096-0001 or online at www.sae.org.)

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 (except for related specification sheets), 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 Specification sheets. The synthetic rubber sheets, strips, and molded or extruded shapes requirements shall be as specified herein and in accordance with the applicable specification sheet. In the event of any conflict between the requirements of this specification and the specification sheet, the latter shall govern.

3.2 First article inspection. When specified (see 3.2.1 and 6.2) a sample shall be subjected to first article inspection in accordance with 4.3.

3.2.1 First article inspection. First article inspection shall be performed when one or more of the following apply:

a. Upon initial offering of a material to the government by the vendor.

b. When any change in material formulation is made from previous first article test samples.

c. When any change in manufacturing processes or conditions are made from previous first article test samples.

d. When the product being offered is manufactured at a plant different than that of previous first article test samples.

e. When required by the Naval Sea Systems Command.

3.3 Materials. Material supplied to this specification shall have no adverse effect on the finished surfaces of wood, metal, or cloth with which it may come in contact.

3.3.1 Polyurethane. Polyurethane material shall be excluded under this specification.

3.4 Dimensions and tolerances. Dimensions and tolerances for rubber components supplied to this document shall be as specified (see 6.2). When tolerances are not specified for sheet, strip, tubing, or rod, they shall be in accordance with 3.4.1 for sheet and strip and 3.4.2 for tubing and rod.

3.4.1 Sheet and strip. When not specified (see 3.4), the tolerances for width and thickness shall be as specified in tables I and II respectively. Laminating thinner sheets and strip to obtain specified thickness shall not be allowed. The tolerance for length shall be the specified length -0 percent, +3 percent of the specified length.

TABLE I. Width tolerances for sheet and strip.

Dimensions, Inches (mm)	Tolerances
Less than 0.5 (12.7)	±8%
0.5 (12.7) to 2 (50.8)	±5%
Over 2 (50.8)	±3%

TABLE II. Thickness tolerances for sheet and strip.

Nominal Thickness, Inches (mm)	Tolerances
Under 0.031 (0.79)	±20%
0.031 (0.79) to 0.062 (1.59) inclusive	±18%
Over 0.062 (1.59) to 0.125 (3.2) inclusive	±16%
Over 0.125 (3.2) to 0.187 (4.8) inclusive	±15%
Over 0.187 (4.8) to 0.375 (9.5) inclusive	±14%
Over 0.375 (9.5) to 0.562 (14.3) inclusive	±13%
Over 0.562 (14.3) to 0.750 (19.1) inclusive	±12%
Over 0.750 (19.1) up to 1.00 (25.4) inclusive	±11%
Over 1.00 (25.4)	±10%

3.4.2 Tubing and rod. When not specified (see 3.4), tolerances for tubing and rod shall be as specified in tables III and IV, respectively.

TABLE III. Tubing tolerances. 1/

Nominal Wall Thickness, Inches (mm)	Tolerance, Inches (mm)
0.047 (1.19) and under	+0.016 (0.40), -0
Over 0.047 (1.19) to 0.125 (3.20) inclusive	±0.016 (0.40)
Over 0.125 (3.20) to 0.156 (3.97) inclusive	±0.023 (0.60)
Over 0.156 (3.97) to 0.250 (6.40) inclusive	±0.031 (0.79)
Over 0.250 (6.40)	±10%

NOTE:
1/ The tolerance for all nominal inside diameters from 0.125 (3.2) to 1.750 (44.45) shall be ±0.016 (0.40).

TABLE IV. Rod tolerances.

Nominal Diameter, Inches (mm)	Tolerance, Inches (mm)
Under 0.156 (3.97) to 0.250 (6.40) inclusive	+0.031 (0.79), -0.016 (0.40)
Over 0.250 (6.40) to 0.500 (12.70) inclusive	±0.031 (0.79)
Over 0.500 (12.70) to 1.000 (25.40) inclusive	±0.047 (1.19)
Over 1.000 (25.40) to 1.500 (38.10) inclusive	±0.062 (1.57)
Over 1.500 (38.10)	±10%

3.5 Surface finish. Unless otherwise specified (see 6.2), the surfaces of the material shall be smooth and free from cloth imprint.

3.6 Physical and mechanical properties Physical and mechanical properties of Classes 1, 2, and 3 synthetic rubber shall conform to table V. Physical and mechanical properties of Classes 4 and 5 synthetic rubber shall conform to table VI.

3.6.1 Ozone resistance. Classes 2 and 4 (Types A and B) synthetic rubber shall show no signs of ozone cracking after being conditioned and tested as specified in 4.6.1.4.

3.6.2 Crazing. Classes 4 and 5 synthetic rubber material shall not craze acrylic or polycarbonate plastic sheet when tested as specified in 4.6.1.5.

3.6.3 Low temperature resistance.

3.6.3.1 Cold bend. The synthetic rubber shall show no evidence of cracking when tested as specified in 4.6.4.

3.7 Color. If material covered by this specification is required to be of a specified color, the color requirement and color conformance provisions shall be as specified (see 4.5.1.4 and 6.2).

3.8 Shelf-life. Shelf-life requirements, based on the type of material and conditions of storage and use, shall be as specified (see 6.2 and 6.7). MIL-HDBK-695 shall be used as guidance for specifying shelf-life, unless another document is specified.

3.9 Identification marking. The identification marking shall be in accordance with MIL-STD-190, except that colors indicating environmental resistance shall not be used. The fluid employed for marking shall be white in color, except that fluid employed for marking white synthetic rubber shall be black in color. The material shall be marked with the following:

a. Part number (see 1.3), if any.

b. Manufacturer’s designation (compound number), for sheet and strip only.

c. Material class number (see 1.2.1), immediately followed by the material grade number in parenthesis (see 1.2.3), and the material type (see 1.2.2) for Classes 2 and 4; for example, Class 2, Grade 40, Type A, shall be marked 2 (40) A.

d. The cure date and “use by” date (see 3.8) stated by year and quarter (for example: 4Q94 indicates the fourth quarter of calendar year 1994).

3.9.1 Marking frequency for sheet and strip. Unless otherwise specified (see 6.2), the identification markings specified in 3.9 shall appear at least once on each square foot (0.09 m^2) of sheet and strip material 12 inches (30.5 cm) or more in width, and shall appear at least once on each linear foot of sheet or strip material less than 12 inches (30.5 cm) wide.

3.9.2 Marking frequency for extruded shapes. Unless otherwise specified (see 6.2), the identification markings specified in 3.9 shall appear at least once for every 12 inches (30.5 cm) of length.

3.9.3 Marking for molded shapes and small pieces. Unless otherwise specified (see 6.2), the identification markings specified in 3.9 shall appear once on the outside of the envelope in which the individual parts are furnished.

3.10 Workmanship. The elastomeric materials shall be compounded and processed such that the resulting material meets the requirements of this specification.

TABLE V. Physical and mechanical properties[1/ 4/] – Classes 1, 2, and 3.

Class	Properties Under Standard Conditions					Properties After Accelerated Aging (Oven Aged 70±1 Hours at 212±2 °F) (100±1 °C)						Properties After Immersion							
												70±1 Hours at 212±2 °F (100±1 °C)					Phase A [2/] 7 Days at 75±9 °F (24±5 °C)	Phase B [2/] 7 Days at 75±9 °F (24±5 °C)	Phase C [2/] Dried 4 Hrs at 158±2 °F (70±1 °C)
												Water		Oil			Aromatic Type	Alkylate Type	Post Immersion Test
	Hard. Pts.	Ten. St. min., psi (MPa)	Ult. Elong. Min. (%)	Ten. Stress at 100% Elong.	Sp. Gr. Unit	Comp. Set (Max. %)	Change in				Ten. Stress at 100% Elong.	Change in		Change in			Change in Volume		
							Hard Pts.	Ten. St. Max. (%)	Ult. Elong. Max. (%)	Wt. Max. (%)		Hard. Pts.	Vol. (%)	Hard. Pts.	Ten. St. Max. (%)	Vol. (%)	Maximum % of Original		
1	30±5	1,000 (6.90)	500	[5/]	[3/]	40	+20 -0	-20	-50	-10	[5/]	±10	+25 -0	+30 -0	-	+10 -30	+40	-1	-10
	40±5	1,100 (7.60)	450	[5/]	[3/]	40	+20 -0	-20	-50	-10	[5/]	±10	+20 -0	+30 -0	-	+10 -30	+35	-1	-10
	50±5	1,200 (8.30)	350	[5/]	[3/]	40	+20 -0	-20	-50	-10	[5/]	±10	+20 -0	+30 -0	-	+10 -30	+30	-1	-15
	60±5	1,300 (9.00)	300	[5/]	[3/]	40	+20 -0	-20	-50	-10	[5/]	±10	+15 -0	+25 -0	-	+10 -25	+30	-1	-8
	70±5	1,400 (9.70)	200	[5/]	[3/]	40	+20 -0	-20	-50	-10	[5/]	±10	+15 -0	+25 -0	-	+10 -20	+30	-1	-7
	80±5	1,600 (11.0)	150	[5/]	[3/]	40	+15 -0	-20	-50	-10	[5/]	±10	+15 -0	+20 -5	-	+10 -20	+25	-1	-5
2	30±5	1,200 (8.30)	500	[5/]	[3/]	50	+15 -5	-15	-40	-10	[5/]	±15	+35 -0	±10	-35	±10	-	-	-
	40±5	1,300 (9.00)	500	[5/]	[3/]	50	+15 -5	-15	-40	-10	[5/]	±15	+30 -0	±10	-35	±10	-	-	-
	50±5	1,500 (10.3)	350	[5/]	[3/]	50	+15 -5	-15	-40	-10	[5/]	±15	+30 -0	±10	-30	±10	-	-	-
	60±5	1,500 (10.3)	300	[5/]	[3/]	50	+15 -5	-15	-40	-10	[5/]	±15	+25 -5	±10	-30	±10	-	-	-
	70±5	1,600 (11.0)	200	[5/]	[3/]	50	+15 -5	-15	-40	-10	[5/]	±15	+25 -0	±10	-25	±10	-	-	-
	80±5	1,600 (11.0)	150	[5/]	[3/]	50	+15 -5	-15	-40	-10	[5/]	±10	+20 -0	±10	-25	±10	-	-	-
3	30±5	1,000 (6.90)	450	[5/]	[3/]	40	+15 -0	-20	-40	-10	[5/]	±10	+20 -0	-	-	-	-	-	-
	40±5	1,000 (6.90)	400	[5/]	[3/]	40	+15 -0	-20	-40	-10	[5/]	±10	+20 -0	-	-	-	-	-	-
	50±5	1,500 (10.3)	350	[5/]	[3/]	40	+15 -0	-20	-40	-10	[5/]	±10	+20 -0	-	-	-	-	-	-
	60±5	1,500 (10.3)	300	[5/]	[3/]	40	+15 -0	-20	-40	-10	[5/]	±10	+20 -0	-	-	-	-	-	-
	70±5	1,500 (10.3)	200	[5/]	[3/]	40	+15 -0	-20	-40	-10	[5/]	±10	+20 -0	-	-	-	-	-	-
	80±5	1,500 (10.3)	150	[5/]	[3/]	40	+15 -0	-20	-40	-10	[5/]	±10	+15 -0	-	-	-	-	-	-

NOTES:

1/ See table VII for test requirements.

2/ Phase A, Phase B, and Phase C tests shall be conducted successively on the same specimens.

3/ "As determined" ±3% of the nominal first article value produced under the same conditions and cure as the sample being tested.

4/ Class 2 material shall meet the ozone requirements specified in 3.6.1.

5/ "As determined during test."

TABLE VI. Physical and mechanical properties[1/ 3/] – Classes 4 and 5.

Class	Properties Under Standard Conditions					Properties After Accelerated Aging (Oven Aged 70±1 Hours at 212±2 °F) (100±1 °C)						Properties After Immersion 70±1 Hours at 212±2 °F (100±1 °C)					Crazing 70±1 Hours at 110±2 °F (43±1 °C)
							Change in					Water		Oil			
	Hard. Pts.	Ten. St. Min., psi (MPa)	Ult. Elong. Min. (%)	Ten. Stress at 100% Elong.	Sp. Gr. Unit	Comp. set (Max. %)	Hard. Pts.	Ten. St. Max. (%)	Ult. Elong. Max. (%)	Wt. Max. (%)	Ten. Stress at 100% Elong.	Change in Hard. Pts.	Change in Vol. (%)	Change in Hard. Pts.	Change in Ten. St. Max. (%)	Change in Vol. (%)	
4	30±5	1,100 (7.60)	450	4/	2/	50	+15 -5	-15	-40	-10	4/	±15	+35 -0	±10	-35	±15	No crazing
	40±5	1,200 (8.30)	450	4/	2/	50	+15 -5	-15	-40	-10	4/	±15	+30 -0	±10	-35	±15	No crazing
	50±5	1,300 (9.00)	350	4/	2/	50	+15 -5	-15	-40	-10	4/	±15	+30 -0	±10	-30	±15	No crazing
	60±5	1,500 (10.3)	300	4/	2/	50	+15 -5	-15	-40	-10	4/	±15	+25 -0	±10	-30	±15	No crazing
	70±5	1,500 (10.3)	200	4/	2/	50	+15 -5	-15	-40	-10	4/	±10	+25 -0	±10	-25	±15	No crazing
	80±5	1,500 (10.3)	150	4/	2/	50	+15 -5	-15	-40	-10	4/	±10	+20 -0	±10	-25	±15	No crazing
5	30±5	1,000 (6.90)	450	4/	2/	40	+15 -0	-20	-40	-10	4/	±10	+25 -0	-	-	-	No crazing
	40±5	1,000 (6.90)	400	4/	2/	40	+15 -0	-20	-40	-10	4/	±10	+25 -0	-	-	-	No crazing
	50±5	1,200 (8.30)	350	4/	2/	40	+15 -0	-20	-40	-10	4/	±10	+20 -0	-	-	-	No crazing
	60±5	1,200 (8.30)	300	4/	2/	40	+15 -0	-20	-40	-10	4/	±10	+20 -0	-	-	-	No crazing
	70±5	1,300 (9.00)	200	4/	2/	40	+15 -0	-20	-40	-10	4/	±10	+20 -0	-	-	-	No crazing
	80±5	1,300 (9.00)	150	4/	2/	40	+15 -0	-20	-40	-10	4/	±10	+15 -0	-	-	-	No crazing

NOTES:

1/ See table VII for test requirements.

2/ "As determined" ±3% of the nominal first article value produced under the same conditions and cure as the sample being tested.

3/ Class 4 material shall meet the ozone requirements specified in 3.6.1.

4/ "As determined during test."

4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are classified as follows:

a. First article inspection (see 4.3).

b. Conformance inspection (see 4.4).

4.2 Inspection conditions. Unless otherwise specified herein, all test specimens shall be conditioned and tested at standard conditions.

4.2.1 Standard conditions. Standard conditions shall be 75±5 °F (24±3 °C) and 50±5 percent relative humidity.

4.3 First article inspection. First article inspection shall be performed when a first article sample is required (see 3.2 and 3.2.1). This inspection shall include the tests specified in 4.5.

4.3.1 First article samples and tests. The test specimens submitted for first article examinations and tests shall be certified to have the same composition, construction, and manufacturing process as the material to be supplied on subsequent lots. If any of the first article examinations or tests do not conform to the applicable requirements, this shall be cause for denial to proceed with production of the sheets, strips, and molded or extruded shapes. When specified (see 6.2), the supplier shall prepare a first article test report. Production of the gaskets by the supplier prior to approval of the procuring activity or the completion of first article examinations and tests shall be at the supplier's risk.

4.3.2 First article test samples. Except as indicated below, first article test specimens shall be fabricated from the end items. If the end items for sheet, strip, or extrusions are of such shapes that suitable test specimens can not be obtained from them, the test specimens shall be fabricated from a test extrusion. The test extrusion shall be prepared from tubing 1.000±0.016 inch (25.4±0.41 mm) outer diameter (OD) by 0.075±0.008 inch (1.9±0.2 cm) in wall thickness which has been mechanically split and flattened into a strip and subsequently cured. The test extrusion shall be composed of the same batch of rubber and cured under the same conditions as the material it represents. If the end items for molded parts are of such shapes that suitable test specimens can not be cut from them, the test specimens shall be fabricated from molded test slabs 6 inches by 6 inches by 0.075 inches (150 mm by 150 mm by 1.9 mm). The test slabs shall be molded from the same batch of rubber and cured under the same conditions as the molded parts they represent.

4.4 Conformance inspection. Conformance inspection shall include the examinations of 4.5.1 and 4.5.2 and the conformance tests in table VII.

4.4.1 Lot formation. A lot shall consist of all items of the same form (such as sheet), manufactured from the same lot of rubber, processed in one continuous run, and ready for inspection at one time. A lot of rubber shall be the amount of compounded material run through a mill or mixer at the same time.

4.5 Sampling and inspection.

4.5.1 Visual examination for workmanship.

4.5.1.1 Molded parts. Samples of molded parts for visual examination shall be selected in accordance with MIL-STD-1916. The sample unit shall be one molded part. Each sample unit selected from the lot shall be examined for defects as specified in MIL-STD-407. Acceptance criteria shall be as specified (see 6.2).

4.5.1.2 Sheets, strips, and extruded shapes. Samples of sheets, strips, and extruded shapes for visual examination shall be selected in accordance with MIL-STD-1916. The sample unit shall be one yard (0.91 meter). Each sample unit selected from the lot shall be examined for defects as specified in MIL-STD-289 for sheet and strip, and MIL-STD-298 for extruded shapes. Defects in marking, such as incomplete or not legibly identified, shall be considered minor. Acceptance criteria shall be as specified (see 6.2).

TABLE VII. First article and conformance physical and mechanical property tests.

Property	Specification Reference		First Article	Conformance	Number of Specimens Required	Report Results as [1/]	Report Numerically to Nearest [2/]
	Requirement	Test Method					
Properties under standard conditions (all classes):							
Hardness	3.6	4.6.1.1	X	X	1	Average of 5 readings	unit
Tensile strength	3.6	4.6.1.2	X	X	5	Median of 5 tests	10 psi
Ultimate elongation	3.6	4.6.1.2	X	X	5	Median of 5 tests	5%
Tensile stress (modulus) at 100% elongation	3.6	4.6.1.2	X	X	5	Median of 5 tests	10 psi
Specific gravity	3.6	4.6.1.3	X	X	2	Average of 2 tests	unit
Properties after accelerated aging (all classes):							
Hardness change (points)	3.6	4.6.2.4	X		1	Change from std conditions	unit
Tensile strength change (%)	3.6	4.6.2.2	X		5	Change from std conditions	%
Ultimate elongation change (%)	3.6	4.6.2.2	X		5	Change from std conditions	%
Tensile stress (modulus) at 100% elongation	3.6	4.6.2.6	X		5	Median of 5 tests	10 psi
Weight change (%)	3.6	4.6.2.3	X		3	Change from std conditions	%
Compression set	3.6	4.6.2.5	X		2	Average of 2 tests	%
Properties after water immersion (all classes):							
Hardness change (points)	3.6	4.6.3.4	X		1	Change from std conditions	unit
Volume change (%)	3.6	4.6.3.2	X		3	Change from std conditions	%
Properties after oil immersion (Classes 1, 2, and 4 as applicable):							
Hardness change (points)	3.6	4.6.3.4	X		1	Change from std conditions	unit
Volume change (%)	3.6	4.6.3.2	X		3	Change from std conditions	%
Tensile strength change (%) (Classes 2 and 4 only)	3.6	4.6.3.3	X		5	Change from std conditions	%
Volume change (%) after fuel immersion (Class 1):							
Aromatic type (Phase A)	3.6	4.6.3.2	X		3	Change from std conditions	%
Alkylate type (Phase B)	3.6	4.6.3.2	X		3	Change from std conditions	%
Drying (Phase C)	3.6	4.6.3.2	X		3	Change from std conditions	%
Low temperature resistance (cold bend test):							
Class 1	3.6.3.1	4.6.4.1.1	X		3	Pass/fail for each test	---
Classes 2, 3, 4, and 5	3.6.3.1	4.6.4.1.2	X		3	Pass/fail for each test	---
Additional tests							
Ozone resistance (Classes 2 and 4)	3.6.1	4.6.1.4	X		2	Pass/fail for each test	---
Crazing (Classes 4 and 5)	3.6.2	4.6.1.5	X		3	Pass/fail for each test	---

NOTES:

[1/] If failure is indicated, report description of failure.

[2/] Test reports shall include all values on which results are based.

4.5.1.2.1 Examination of rolls of sheet form for defects in workmanship. In addition to the inspection requirements in 4.5.1.2, samples of sheet material supplied in rolls shall be examined for defects in workmanship as specified in table VIII. The sample unit shall be one roll selected in accordance with MIL-STD-1916. Acceptance criteria shall be as specified (see 6.2).

TABLE VIII. Defects for sheet material supplies in rolls.

Any cut-out larger than four inches (10 cm) diameter.
More than four cut-outs per roll.
More than two cut-outs in any 10 linear feet (3 m).
Roll contains more than three pieces. Each piece shall be not less than 20 percent of the length of the entire roll.

4.5.1.3 Surface finish. Samples shall be examined for conformance to 3.5 (see 3.5 and 6.2).

4.5.1.4 Color. If material covered by this specification is required to be of a specified color, samples shall be examined for conformance to 3.7 in accordance with the color conformance provisions specified (see 3.7 and 6.2).

4.5.1.5 Shelf-life. Samples shall be examined for conformance with 3.8 (see 3.8 and 6.2).

4.5.2 Dimensional examination.

4.5.2.1 Molded parts. Samples of molded parts for dimensional examination shall be selected in accordance with MIL-STD-1916. The sample unit shall be one molded part. Each sample unit selected from the lot shall be dimensionally examined for conformance to 3.4. Acceptance criteria shall be as specified (see 6.2).

4.5.2.2 Sheets, strips, and extruded shapes. Samples of sheets, strips, and extruded shapes for dimensional examination shall be selected in accordance with MIL-STD-1916. The sample unit shall be one yard. Each sample unit selected shall be dimensionally examined for conformance to 3.4.1 or 3.4.2, as applicable. Acceptance criteria shall be as specified (see 6.2).

4.5.2.3 Examination of marking. An examination shall be made to determine that the marking complies with the requirements of 3.9. Samples shall be selected in accordance with MIL-STD-1916. Each sample shall be examined for defects in marking in accordance with 4.5.2.3.1. Acceptance criteria shall be as specified in the contract or purchase order (see 6.2 and 6.7).

4.5.2.3.1 Marking defects. Marking defects include interior or exterior markings (as applicable) that are omitted, illegible, incorrect, incomplete, or not in accordance with contract requirements.

4.5.3 Physical and mechanical property tests. Physical and mechanical property testing shall be conducted and the results reported in accordance with table VII. A sufficient quantity of the synthetic rubber items to conduct the tests in table VII shall be selected at random from each lot.

4.5.3.1 Test specimens. Except as indicated below, test specimens shall be fabricated from the items supplied in the lot. If sheet, strip, or extrusions are supplied in such shapes that suitable test specimens can not be obtained from them, the test specimens shall be fabricated from a test extrusion. The test extrusion shall be prepared from tubing 1.000±0.016 inch (25.4±0.41 mm) OD by 0.075±0.008 inch (1.9±0.2 mm) in wall thickness which has been mechanically split and flattened into a strip and subsequently cured. The test extrusion shall be composed of the same batch of rubber and cured under the same conditions as the lot of material it represents. If molded items are supplied in such shapes that suitable test specimens can not be cut from them, the test specimens shall be fabricated from molded test slabs 6 inches by 6 inches by 0.075 inches (150 mm by 150 mm by 1.9 mm). The test slabs shall be molded from the same batch of rubber and cured under the same conditions as the lot of molded parts they represent.

4.5.3.2 Rejection criteria. Failure of any sample to meet the test requirements specified herein shall result in rejection of the lot.

4.6 Test method.

4.6.1 Tests under standard conditions (see 4.2.1).

4.6.1.1 Hardness. Hardness testing shall be determined on one specimen in accordance with ASTM D2240, Type A durometer. The hardness shall be the average of five readings for each specimen tested.

4.6.1.2 Tensile properties. Tensile strength, ultimate elongation, and tensile stress (modulus) at 100 percent elongation shall be determined on at least five specimens in accordance with ASTM D412, Test Method A, using Die C test specimens. Tensile strength, ultimate elongation, and tensile stress shall be the average of the recorded values for the five specimens tested.

4.6.1.3 Specific gravity. Specific gravity shall be determined on two specimens in accordance with ASTM D792. The specific gravity shall be the average of the recorded values for the two specimens tested.

4.6.1.4 Ozone resistance test (classes 2 and 4). Two Type A specimens shall be prepared in accordance with ASTM D1149, Method B, procedure B1. Two Type B specimens shall be prepared in accordance with ASTM D1149 Method B, procedure B2. Specimens shall be tested in accordance with ASTM D1149. Ozone concentration, expressed in ozone partial pressures, shall be 100±5 millipascals (mPa) for Type A material and 50±5 mPa for Type B material. Exposure period for Type A and Type B specimens shall be 168 hours minimum. Observation magnification shall be 7×.

4.6.1.5 Crazing test (classes 4 and 5). Eight plastic strips, 1 inch by 7 inches by 0.25 inch (25.4 mm by 177.8 mm by 6.4 mm), shall be prepared. Four shall be cut from a piece of acrylic plastic conforming to MIL-PRF-5425, Finish A and four shall be cut from a piece of polycarbonate plastic conforming to SAE-AMS-P-83310. The plastic shall be cleaned with aliphatic naphtha and then allowed to air-dry at standard conditions for a minimum of 24 hours prior to testing. As specified on figure 1, the plastic strips shall be set up as cantilever beams in a circulating air oven maintained at a temperature of 110±2 °F (43±1 °C) for 70±1 hours. The beams shall be loaded to produce an outer fiber tensile stress of 2,000 psi (13.8 MPa) at the fulcrum as determined in 4.6.1.5.1. Ten minutes after the beams have been stressed, they shall be examined for crazing. Beams in which crazing has occurred shall be replaced with others that pass the 10-minute test. Classes 4 and 5 specimens, 1 inch by 2 inches by 0.075 inch (25.4 mm by 50.8 mm by 1.9 mm), shall be placed in intimate contact with three of the acrylic beams and three of the polycarbonate beams directly over the fulcrum. The specimens shall be held in firm contact with the surface of the plastic strips by applying a small load [3 ounce (85.1 gram) shot bag] on top of each rubber specimen. The remaining two beams, under the same stress without rubber specimen, shall be employed as controls. The examinations for crazing shall be made while the plastic is under stress, at the end, or at any time within the 70±1 hour test period. The beams, with rubber specimens removed, shall be observed for crazing over a source of light at such an angle that the light will be reflected to the eye from the surfaces of any crazing fissures which are present. To prevent overheating of beams, the light source shall be utilized only during examination for crazing. In the event that crazing occurs in one of the controls, the test shall be repeated for that particular plastic. Edge crazing, when observed within 0.125 inch (3.2 mm) from the edge of beam, shall be disregarded.

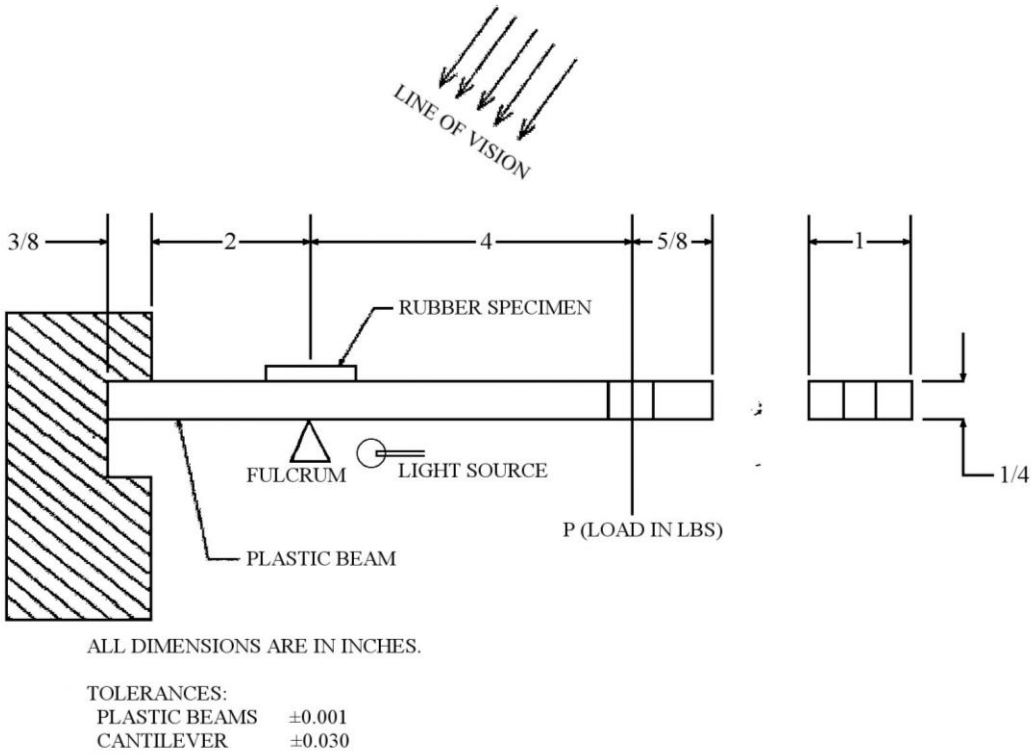

FIGURE 1. Sketch showing typical stress crazing beam.

4.6.1.5.1 Calculation. The load required for each beam shall be calculated as follows:

$$P = \frac{SBD^2}{24}$$

Where:

P = Load in pounds (kg) (applied at free end of beam, 4 inches (10.2 cm) from fulcrum)

B = Width of plastic strip (measured to nearest 0.001 inch (0.025 mm))

D = Depth of plastic strip (measured to nearest 0.001 inch (0.025 mm))

S = Stress in pounds per square inch (MPa) = 2,000 (13.8)

4.6.2 Tests after accelerated aging (oven aged).

4.6.2.1 Test conditions. The required specimens for each test to be conducted shall be subjected to accelerated aging for 70±1 hour in an air circulating oven at a temperature of 212±2 °F (100±1 °C). After the aging period, the specimens shall be removed from the oven and allowed to rest at standard conditions for not less than 16 hours nor greater than 70 hours before being subjected to tests for tensile stress, and the tests for changes in hardness, tensile strength, ultimate elongation, and weight. For the determination of compression set, the specimen shall be removed from the compression fixture after the aging period and allowed to rest on a wood surface at standard conditions for at least 30 minutes before compression set is determined.

4.6.2.2 Percent change in tensile strength and ultimate elongation. The tensile strength and ultimate elongation properties shall be determined in accordance with 4.6.1.2 after aging the specimens in accordance with 4.6.2.1. The results expressed as percent change for each mechanical property shall be calculated as follows:

$$\% \text{ change} = \frac{F-S}{S} \times 100$$

Where:

S = Standard condition value

F = Value after aging

Percent change in tensile strength and ultimate elongation shall be the average of the recorded percent change from standard conditions for each of the five specimens tested.

4.6.2.3 Percent change in weight. Three specimens approximately 1 inch by 2 inches by 0.075 inch (2.5 mm by 5.1 mm by 0.19 mm) in thickness shall be used. The specimens shall be held over night in a desiccator and weighed to the nearest milligram (mg) before being subjected to oven aging as specified in 4.6.2.1. After oven aging, the specimens shall be cooled in a desiccator for not less than 2 hours nor greater than 70 hours and again weighed to the nearest milligram. The change in weight shall be calculated as follows:

$$\% \text{ change in weight} = \frac{W2-W1}{W1} \times 100$$

Where:

W1 = Initial weight

W2 = Weight after oven aging

Percent change in weight shall be the average of the recorded percent change from standard conditions for each of the three specimens tested.

4.6.2.4 Change in hardness. A specimen from either the change in tensile strength (see 4.6.2.2) or the change in weight (see 4.6.2.3) test shall be used to determine the change in hardness. After aging in accordance with 4.6.2.1, the hardness value shall be determined in accordance with 4.6.1.1. The change in hardness determination shall be expressed as change in hardness points from the standard condition value.

4.6.2.5 Compression set. Compression set determination shall be conducted in accordance with ASTM D395 (Option 1), Method B. After oven aging as specified in 4.6.2.1, the specimens shall be removed from the compression fixture and allowed to rest on a wood surface at standard conditions for at least 30 minutes before compression set is determined.

4.6.2.6 Tensile stress. Tensile stress (modulus) at 100 percent elongation shall be determined in accordance with 4.6.1.2 after oven aging in accordance with 4.6.2.1.

4.6.3 After immersion tests (water, oil, and fuel).

4.6.3.1 Water, oil, and fuel immersion conditioning.

4.6.3.1.1 Water immersion conditioning. Specimens shall be completely immersed in distilled water in accordance with ASTM D471 for 70±1 hour at 212±2 °F (100±1 °C). At the end of the immersion period, the specimens shall be removed from the hot liquid and immediately immersed in fresh distilled water at standard conditions for 30±5 minutes. The test specimens shall then be dipped rapidly in acetone or alcohol, blotted lightly, and tested in accordance with 4.6.3.2 and 4.6.3.4 within 3 minutes.

4.6.3.1.2 Oil immersion conditioning (classes 1, 2, and 4). Classes 1, 2, and 4 specimens shall be completely immersed in IRM 901 in accordance with ASTM D471 for 70±1 hour at 212±2 °F (100±1 °C). At the end of the immersion period, the specimens shall be removed from the hot oil and immediately immersed in fresh IRM 901 at standard conditions for 30±5 minutes. Test specimens shall then be dipped rapidly in acetone or alcohol, blotted lightly, and tested in accordance with 4.6.3.2, 4.6.3.3 (Class 2 and 4 only), and 4.6.3.4 within 3 minutes.

4.6.3.1.3 Fuel immersion (class 1 volume change only). Class 1 specimens shall be successively exposed to the following phases of fuel immersion conditioning to determine change in volume:

Phase A - Immersion in Reference Fuel B of ASTM D471 for 7 days at standard conditions.

Phase B - Immersion in Reference Fuel A of ASTM D471 for 7 days at standard conditions.

Phase C - Dried at standard conditions for at least 16 hours, and followed by a drying for 4 hours in a circulating air oven at a temperature of 158±2 °F (70±1 °C).

Each specimen shall be exposed to Phases A, B, and C successively, determining volume change in accordance with 4.6.3.2 after exposure to each phase. Prior to determining volume change after Phase A and Phase B exposure, the test specimens shall be removed from the immersion medium, dipped rapidly in acetone or alcohol, blotted lightly, and tested within 3 minutes. The period between Phases A and B, during which the specimens are not immersed, shall not exceed 30 minutes.

4.6.3.2 Change in volume. Change in volume shall be determined after water immersion for all classes, oil immersion for Classes 1, 2, and 4, and fuel immersion for Class 1. Each test shall be conducted using three specimens 1 inch by 2 inches by 0.075 inch (2.5 mm by 5.1 mm by 0.19 mm). Prior to conditioning, the specimens shall be weighed in air and then in water using an analytical balance. As applicable for the class being tested, the specimens shall then be conditioned for water, oil, and fuel immersion as specified in 4.6.3.1.1, 4.6.3.1.2, and 4.6.3.1.3, respectively. After conditioning, the specimens shall be reweighed in air and then in water by means of a jolly or analytical balance. Percentage change in volume for each test specimen shall be based on the original unconditioned volume and shall be calculated as follows:

$$\% \text{ change in volume} = \frac{(W3-W4)-(W1-W2)}{(W1-W2)} \times 100$$

Where:

W1 = Initial (unconditioned) weight in air

W2 = Initial (unconditioned) weight in water

W3 = Weight in air after immersion

W4 = Weight in water after immersion

Percent change in volume shall be the average of the recorded percent change from standard conditions for each of the three specimens tested.

4.6.3.3 Change in tensile strength (Classes 2 and 4). Change in tensile strength shall be determined after oil immersion for Classes 2 and 4. After conditioning in accordance with 4.6.3.1.2, the tensile strength shall be determined in accordance with 4.6.1.2 using the specimens' original unconditioned cross-sectional area for the calculation of tensile strength. The results for each test specimen expressed as percent change for each mechanical property shall be calculated as follows:

$$\% \text{ change} = \frac{I-S}{S} \times 100$$

Where:

S = Standard condition value

I = Value after immersion

Percent change in tensile strength shall be the average of the recorded percent change from standard conditions for each of the five specimens tested.

4.6.3.4 Change in hardness. Change in hardness shall be determined after water immersion for all classes and after oil immersion for Classes 1, 2, and 4. Conditioning of the specimens for water and oil immersion shall be as specified in 4.6.3.1.1 and 4.6.3.1.2, respectively. Specimens from either the change in tensile strength (see 4.6.3.3) or volume (see 4.6.3.2) tests shall be used to determine change in hardness. After conditioning, the hardness value shall be determined in accordance with 4.6.1.1. The change in hardness determination shall be expressed as the change in hardness points from the standard condition value.

4.6.4 Low temperature tests (cold bend). Three strips 5.50 inches by 0.25 inch by 0.075 inch (140 mm by 6.4 mm by 1.9 mm) shall be used for the cold bend test. The bending device shall consist of two parallel jaws of suitable length, 2.5 inches (64 mm) apart, and designed to hold three specimens in a loop position between the jaws with each end of the specimen firmly fastened to the jaws and extending at least 0.75 inch (19.1 mm) into each jaw. The moving jaw shall be loaded with a dead load of 50 pounds (22.68 kg). The jaws shall be supported in guides so that they may be rapidly closed to 1 inch (25.4 mm) by releasing the dead load. The bending device shall be conditioned at a temperature of -67±2 °F (-55±1 °C) in a cold chamber.

4.6.4.1 Procedure.

4.6.4.1.1 Class 1. Class 1 synthetic rubber specimens shall first be conditioned as follows:

a. Soak in Reference Fuel B of ASTM D471 for 3 hours under reflux at 158±2 °F (70±1 °C).

b. Soak in Reference Fuel A of ASTM D471 for 3 hours under reflux at 158±2 °F (70±1 °C).

c. Transfer of specimens from Reference Fuel B to Reference Fuel A shall be made within a period of 1 hour. After removal from Reference Fuel A, specimens shall be dried at standard conditions on a wire screen for not less than 16 hours nor more than 24 hours.

After the above conditioning, the specimens shall be mounted in the preconditioned bending device, immersed in preconditioned Reference Fuel A of ASTM D471, and exposed to a temperature of -67±2 °F (-55±1 °C) in a cold chamber. After 300±15 minutes exposure, the specimens shall be flexed for five cycles while still immersed and in the cold chamber, and examined for evidence of cracking.

4.6.4.1.2 Classes 2, 3, 4, and 5. Classes 2, 3, 4, and 5 synthetic rubber specimens shall be mounted in the preconditioned bending device and exposed to a temperature of -67±2 °F (-55±1 °C) in a cold chamber. After 300±15 minutes exposure, the specimen shall be flexed for five cycles while still in the cold chamber, and examined for evidence of cracking.

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 material covered by this specification is intended for use where synthetic rubber is required for a specific application, such as:

6.1.1 Class 1. Class 1 material is intended for use where resistance to aromatic, alkylate or aviation fuel, and petroleum base lubricants is required.

6.1.2 Class 2. Class 2 material is intended for use where resistance to petroleum base lubricants and exposure to the elements is required.

6.1.2.1 Types A and B. Type A is intended for use where high concentrations of ozone exist in the atmosphere, particularly along the east and west coasts of the United States. Type B is intended for general use.

6.1.3 Class 3. Class 3 material is intended for general use where resistance to oil and fuel and the elements is not required.

6.1.4 Classes 4 and 5. Classes 4 and 5 materials are intended for general use in contact with acrylic plastics.

6.1.4.1 Class 4. Class 4 material is intended for use in applications requiring maximum resistance to the elements and petroleum base oil, and requires the same usage under Type A or Type B as indicated in 6.1.2.1.

6.1.4.2 Class 5. Class 5 material is intended for use where low temperature flexibility is required [-67±2 °F (-55±1 °C)]. Class 5 is not recommended for use with petroleum base oil, or where sunlight and ozone resistance is required.

6.1.5 Elastomers. Elastomers known to comply with the specific classes of this specification are as follows:

Class 1 - Nitrile-butadiene

Class 2 - Polychloroprene

Class 3 - Styrene-butadiene

Class 4 - Polychloroprene

Class 5 - Styrene-butadiene

Polyurethane rubber is not to be supplied to this specification due to its lack of hydrolytic stability and release of toxic fumes when burned.

6.1.6 U.S. Army Electronics Command use. Use of this specification for U.S. Army Electronics Command is restricted to Class 4 and Class 5.

6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number, and date of this specification and applicable specification sheet.

b. Military part number (if any), class, grade, form, dimensions, amount required (see 1.2 and 3.4).

c. Type of ozone resistance required, if Class 2 or 4 (see 1.2.2 and 6.1.2.1).

d. When first article is required (see 3.2, 3.2.1, and 6.3.1).

e. Detail drawings and additional specifications and tolerances, if any (see 3.4 and 4.5.1.3), including details of surface finish (if different than that in 3.5).

f. Color requirement and conformance provisions, if required (see 3.7 and 4.5.1.4).

g. Marking required (see 3.9.1, 3.9.2, and 3.9.3).

h. Shelf-life designation requirements (see 3.8, 4.5.1.5 and 6.7).

i. First article test report (see 4.3.1).

j. Acceptance criteria for visual (see 4.5.1) and dimensional (see 4.5.2) inspection.

k. Packaging requirements (see 5.1).

6.3.1 Prior approval. If a contractor has previously delivered material in accordance with the requirements of this specification and the product has been found to be satisfactory, the requirements for first article inspection for that product, in connection with any subsequent contract or order for that product, may be waived at the discretion of the procuring activity (see 6.2). The approval of first article samples or the waiving of the first article inspection does not relieve the contractor of his obligation to fulfill all other requirements of this specification and the contract.

6.4 Certified statement. When first article inspection is not required (see 3.2.1) the contractor may certify in writing that the material meets all the requirements of this specification.

6.5. Adhesively bonding rubber components. Difficulty has been reported when adhesively bonding rubber sheets due to surface contamination. Possible sources of contamination include the paper or dusting powder used to separate the sheets and latex gloves used to handle the sheets. In preparing documents to acquire material which will be bonded, appropriate measures to avoid this problem should be considered. Such measures would include supplemental specification of methods, materials, and protective gloves for use in production, handling, and packaging, as well as inspections and test methods to ensure that bonding surfaces have not been contaminated.

6.6 Subject (key word) listing.

Elastomer

6.7 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 materiel 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 Service 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/.

6.8 Amendment notations. The margins of this specification are marked with vertical lines to indicate where changes from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

Custodians:
Army – MR
Navy – SH
Air Force – 11
DLA – IS

Review Activities:
Army – EA
Navy – AS
Air Force - 99

Preparing Activity:
Navy – SH
(Project 9320-2011-047)

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 https://assist.dla.mil.