

INCH-POUND

MIL-DTL-8603C
19 May 2025
SUPERSEDING
MIL-C-8603B
15 Nov 1984
AMENDMENT 1
18 May 1987

DETAIL SPECIFICATION

CLAMPS, LOOP TYPE, AND STRAPS, SUPPORT

Inactive for new design after 16 June 1997

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

1. SCOPE

1.1 Scope. This specification covers support loop clamps, both cushioned and non-cushioned, for the clamping of wire bundles and non-hydraulic tubing (see [6.1](#)).

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 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 and 4 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-DTL-25988	- Rubber, Fluorosilicone Elastomer, Oil -, Hydraulic Fluid-, and Fuel-Resistant, Sheets, Strips, Molded Parts, and Extruded Shapes
MIL-DTL-5541	- Chemical Conversion Coatings on Aluminum and Aluminum Alloys
AN742	- Clamp, Loop, Plain, Support, Aircraft
DS14273	- Strap, Retaining, Cushioned, Rectangular, Metric
MS21106	- Clamp, Loop, Cushioned, 1200 Degrees F, Cres Type IV, Class B
MS21122	- Clamp, Loop, Cushioned, Wedge, Polytetrafluoroethylene
MS21919	- Clamp, Loop Type, Cushioned, Support

Comments, suggestions, or questions on this document should be addressed to: DLA Land and Maritime, Attn: VAI, P.O. Box 3990, Columbus, OH 43218-3990, or emailed to FluidFlow@dla.mil. 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>.



(Copies of these documents are available online at <https://quicksearch.dla.mil>.)

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 A109/A109M	- Standard Specification for Steel, Strip, Carbon (0.25 Maximum Percent), Cold-Rolled
ASTM A380/A380M	- Standard Practice for Cleaning, Descaling, Pickling, and Passivation of Stainless Steel Parts, Equipment, and Systems
ASTM D297	- Standard Test Methods for Rubber Products—Chemical Analysis
ASTM D395	- Standard Test Methods for Rubber Property—Compression Set
ASTM D412	- Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension
ASTM D471	- Standard Test Method for Rubber Property—Effect of Liquids
ASTM D624	- Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
ASTM D1149	- Standard Test Methods for Rubber Deterioration—Cracking in an Ozone Controlled Environment
ASTM D2240	- Standard Test Method for Rubber Property—Durometer Hardness
ASTM D4894	- Standard Specification for Polytetrafluoroethylene (PTFE) Granular Molding and Ram Extrusion Materials

(Copies of these documents are available from <https://www.astm.org/> or the ASTM International, 100 Barr Harbor Drive, W. Conshohocken, PA 19428-2959.)

SAE INTERNATIONAL

SAE AMS-QQ-A-250/5	- Aluminum Alloy Alclad 2024, Plate and Sheet - UNS A82024
SAE AMS-QQ-P-416	- Plating, Cadmium (Electrodeposited)
SAE AMS2242	- Tolerances Corrosion and Heat Resistant Steel, Iron Alloy, Titanium and Titanium Alloy Sheet, Strip, and Plate
SAE AMS2491	- Surface Treatment of Polytetrafluoroethylene (PTFE) Preparation for Bonding
SAE AMS2700	- Passivation of Corrosion Resistant Steels
SAE AMS2770	- Heat Treatment of Wrought Aluminum Alloy Parts
SAE AMS2771	- Heat Treatment of Aluminum Alloy Castings
SAE AMS3209	- Chloroprene (CR) Rubber Weather Resistant 65 – 75
SAE AMS3215	- Acrylonitrile Butadiene (NBR) Rubber Aromatic Fuel Resistant 65 – 75
SAE AMS3303	- Elastomer: Silicone, Rubber (MQ/VMQ) General Purpose 55 - 65 Durometer Type "A" Hardness
SAE AMS5510	- Steel, Corrosion- and Heat-Resistant, Sheet, Strip, and Plate 18Cr - 10.5Ni - 0.40Ti (SAE 30321) Solution Heat Treated - UNS S32100
SAE AS5440	- Hydraulic Systems, Military Aircraft, Design and Installation, Requirements For

(Copies of these documents are available from <https://www.sae.org> or SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001.)

AMERICAN SOCIETY FOR QUALITY (ASQ)

ASQ/ANSI Z1.4	- SAMPLING PROCEDURES AND TABLES FOR INSPECTION BY ATTRIBUTES
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(Copies of these documents are available from <https://www.asq.org> or the American Society for Quality, 611 East Wisconsin Avenue, Milwaukee, WI 53202.)

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI H35.2

- Dimensional Tolerances for Aluminum Mill Products

(Copies of these documents are available online at <https://www.ansi.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 individual item 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 Material.

3.2.1 Band. The bands shall be fabricated of the following materials as specified (see 3.1).

3.2.1.1 Aluminum alloy. Aluminum alloy shall be Alclad 2024 in accordance with SAE AMS-QQ-A-250/5.

3.2.1.2 Steel. Steel shall be AISI 1010, cold-rolled, temper No. 4, in accordance with ASTM A109/A109M.

3.2.1.3 Corrosion-resistant steel. Corrosion-resistant steel shall be Type 321 in accordance with SAE AMS5510 as specified in the individual specification sheets.

3.2.2 Cushion. The cushions shall be fabricated of the following materials as specified (see 3.1).

3.2.2.1 Nitrile rubber. Nitrile rubber shall be in accordance with SAE AMS3215, and the ozone resistance requirements specified herein (see 4.4.3). The colors shall be solid yellow.

3.2.2.2 Chloroprene rubber (neoprene). Chloroprene elastomer shall conform to SAE AMS3209, and the ozone resistance requirements as specified herein. The color shall be black with a blue identifier. Extruded material shall be identified by a blue stripe extending lengthwise along both edges of the cushion. The stripe width shall be equal to the width of the cushion edge. Molded material shall be identified by a blue area at the wedge end. The blue areas shall be on one or both edges of the cushion and may include the wedge and shall have a minimum length of 0.125 inch to a maximum of 0.750 inch. The blue area shall be located within an area not to exceed 1.500 inch or 50% of the total cushion length, whichever is smaller, when measured from the wedge end. In no case shall the blue area extend beyond 50% of the cushion length. The material used for the blue identifier shall be the same as the cushion material except colored blue. Inking or other surface coloring methods shall not be used.

3.2.2.3 Silicone rubber. Silicone rubber shall be in accordance with SAE AMS3303, except the minimum tear strength shall be 100 lbs/inch (17.5 kN/m) when tested as specified in 4.4.5. The color shall be solid (pigmented) white.

3.2.2.4 Fluorosilicone rubber. Fluorosilicone rubber shall be in accordance with MIL-DTL-25988, Type II, Class 1, Grade 60. The color shall be solid blue.

3.2.2.5 Ethylene propylene rubber. Ethylene propylene rubber shall have the properties specified in [Table I](#) when tested as specified in [4.4.6](#). The color shall be solid purple. Unless otherwise specified, the results of the tests shall be the average (arithmetic mean) of the results of five specimens. The property measurements shall be performed immediately after removal from the specified immersion bath.

3.2.2.5.1 Ethylene propylene compression set. When tested as specified in paragraph [4.4.6.7](#), the average compression set value of three specimens shall not exceed 70 percent.

3.2.2.6 Polytetrafluoroethylene (PTFE). PTFE material shall be in accordance with ASTM D4894 Type I. The color shall be solid brown.

TABLE I. Properties of Ethylene Propylene Rubber

Test	Required Original Properties	Allowable Change after Hydraulic Fluid Immersion (Skydrol 500B) 22 Hrs at 275°F (135°C)	Allowable Change after Heat Aging 70 hrs at 275°F (135°C)
Hardness Durometer "A"	65-75	45 Min	85 Max
Tensile Strength – psi (kPA)	2000 (13790) Min	1000 (6895) Min	1600 (5516) Min
Elongation - %	500 Min	375 Min	350 Min
Tear Strength – ppi (kN/m)	200 (35) Min	120 (21 Min)	160 (28) Min
Specific gravity	As tested	-	±2%
Volume change - %	As measured	30% Increase	10% Decrease

3.3 Design and construction.

3.3.1 Dimensions. Dimensions and tolerances shall conform to the dimensional requirements of the applicable specification sheet.

3.3.2 Forming. Forming of the 90° bend foot and offset in aluminum bands shall be performed in the annealed condition. Curling (sizing) may be done subsequent to heat treatment.

3.3.2.1 Curling. The clamps shall be curled through a minimum of 270° of the mandrel circumference. The curve of the band material, due to the slitting operation, shall be oriented away from the clamp inner diameter. Normal spring-back of the clamp from the curled position is acceptable.

3.4 Heat treatment.

3.4.1 Aluminum alloy. Aluminum alloy bands shall be heat treated to T42 temper in accordance with SAE-AMS2770 or SAE-AMS2771, as applicable.

3.5 Finish.

3.5.1 Aluminum alloy. Aluminum alloy bands shall be finished in accordance with MIL-DTL-5541, Class 1A.

3.5.2 Steel. Steel bands shall be cadmium plated in accordance with SAE AMS-QQ-P-416, Type I, Class 2 (7.6 µm).

3.5.3 Corrosion-resistant steel. Corrosion-resistant steel shall be cleaned and descaled in accordance with ASTM A380/A380M and passivated per SAE AMS2700.

3.5.4 Polytetrafluoroethylene (PTFE). Cushions fabricated from PTFE shall be sodium treated in accordance with the surface treatment paragraphs of SAE AMS2491 to reduce the materials lubricity. All other paragraphs of SAE AMS2491 shall not apply.

3.6 Performance. The clamps shall meet the performance requirements specified herein when tested in accordance with Section 4.

3.7 Identification marking. Each clamp shall be marked with the complete part number in accordance with the applicable specification sheet. The marking shall be placed on the clamps' outer surface, and shall be visible with the cushion in place.

3.8 Wedge bond integrity (vulcanized wedges only). Clamp cushions of all types of materials, having a vulcanized wedge, as specified in the individual specification sheet, shall be tested in accordance with 4.4.7. Separation of the wedge from the extruded cushion, by failure of the bonded area, shall be cause for rejection of the clamp. Tearing of the wedge or cushion, without failure of the bonded area, shall not be cause for rejection.

3.9 Tolerances (metric). Tolerances on metrically dimensioned band materials shall be in accordance with the following:

Corrosion-resistant steel	– SAE AMS2242
Aluminum alloy	- ANSI H35.2 (M)

3.10 Workmanship. Clamps shall be processed in such a manner as to ensure that the clamps are of uniform quality. The bands shall have a smooth finish and shall be free of burrs, slivers, sharp edges or other defects which would adversely affect life, serviceability and appearances. Cushion material shall be uniform in quality, clean, smooth, and free from tears, voids, and imperfections detrimental to appearance and performance. The wedge shall be firmly attached and free from voids and gaps in the bonded area.

3.11 Recycled, recovered, environmentally preferable, or biobased materials. Recycled, recovered, environmentally preferable, or biobased materials should be used to the maximum extent possible, provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

4. VERIFICATION

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

- a. Material inspection (see 4.2).
- b. Conformance inspection (see 4.3).

4.2 Material inspection. Material inspection shall consist of certification supported by data verifying that the materials used in fabricating the clamps are in accordance with the requirements of 3.2 prior to such fabrication.

4.2.1 Material certification. Records of tests showing conformance to the applicable material specifications (see 3.2) for the band and cushion shall be made available to the clamp manufacturer for each lot of material. The clamp manufacturer shall require from each material supplier (band and cushion) a document certifying conformance to the applicable material specification and other parameters specified in the applicable paragraph.

4.3 Conformance inspection. Conformance inspection shall consist of the tests and inspections specified in Table II, conducted in accordance with 4.4.

TABLE II. Conformance Inspection.

Inspection	Requirement Paragraph	Test Method Paragraph
Group A		
Examination	<u>1/</u>	4.4.1
Closure test	3.3.1	4.4.2
Group B		
Nitrile ozone resistance	3.2.2.1	4.4.3
Chloroprene ozone resistance	3.2.2.2	4.4.4
Silicone tear strength	3.2.2.3	4.4.5
Ethylene Propylene hardness	3.2.2.5	4.4.6.1
Ethylene Propylene tensile strength	3.2.2.5	4.4.6.2
Ethylene Propylene elongation	3.2.2.5	4.4.6.3
Ethylene Propylene tear strength	3.2.2.5	4.4.6.4
Ethylene Propylene specific gravity	3.2.2.5	4.4.6.5
Ethylene Propylene volume change	3.2.2.5	4.4.6.6
Ethylene Propylene compression set	3.2.2.5.1	4.4.6.7
Wedge bond integrity	3.8	4.4.7

1/ All requirements not covered by tests.

4.3.1 Inspection lot. An inspection lot shall consist of clamps for a particular size and material, produced under essentially the same manufacturing conditions and presented for inspection at the same time.

4.3.2 Sampling for group A inspection. Sampling shall be in accordance with ANSI/ASQ Z1.4, inspection level II, with an Acceptable Quality Limit (AQL) of 1.0 percent defective for major defects. For minor defects, inspection level I with an AQL of 4.0 percent defective shall apply.

4.3.2.1 Classification of defects. Defects shall be classified as specified in [Table III](#).

TABLE III. Classification of Defects.

Category	Defect
Critical	
1	Specified material (cushion)
Major	
101	Material thickness (cushion)
102	Material thickness (band)
103	Inside loop diameter (clamp assy.)
104	Identification color (cushion)
105	Mounting hole diameter
106	Width of material (band)
107	Burrs, slivers, or sharp edges (band)
108	Tears or imperfections (cushion)
109	Separated wedge (cushion when required)
Minor	
201	All other dimensions
202	Marking missing, incorrect, insufficient, illegible, or not permanent

4.3.3 Sampling for group B inspection. Sampling shall be in accordance with ANSI/ASQ Z1.4, inspection level S3, with an AQL of 0.25 percent defective and may be made on sample units which have been subjected to and have passed group A inspection.

4.3.3.1 Cushion samples. Cushion material test specimens shall be cut from clamp cushions and shall be of sufficient size to be tested in accordance with the applicable test methods. Tensile and elongation cushion material test specimens may be cut from larger size clamp cushions of the same inspection lot, and shall be provided by the manufacturer.

4.3.4 Sampling for protective finish test. Sampling for protective finish test shall be in accordance with the applicable specifications referenced in 3.5.

4.4 Methods of inspection.

4.4.1 Examination. Sample clamps shall be thoroughly examined to determine conformance with this specification and applicable specification sheets with respect to all requirements not covered by tests.

4.4.2 Closure test. The clamp shall be installed on a bar by having a diameter equal to the nominal tube outside diameter within ± 0.001 inch (± 0.025 mm). The gap between the clamp legs, at the mounting screw holes, shall meet within the following specified tolerance limits; the holes shall be in alignment within 0.010 inch (0.254 mm) and the band shall be flat within 0.008 inch (0.203 mm) through the clamp width and circumference.

4.4.3 Nitrile ozone resistance. The nitrile rubber material shall be subject to the following test:

4.4.3.1 Test samples. Test samples shall be five (5) clamps/straps of the smallest size specified on the individual specification sheet. The clamps/straps shall be the complete assembly including the cushion. The clamps/straps shall be secured, in the normal manner, to a steel mandrel. The mandrel profile shall match the internal profile of the clamp/strap within $+0.000$, -0.005 inch (0, -1.27 mm).

4.4.3.2 Conditioning treatment. The mounted test samples shall be conditioned by exposure to dry air at a temperature of $212 \pm 5^\circ\text{F}$ ($100 \pm 3^\circ\text{C}$) for a period of 70 hours.

4.4.3.3 Ozone test. The mounted test samples shall be placed in a test chamber having an ozone concentration of 6 ± 0.3 parts per million (PPM) and a temperature of $125 \pm 5^\circ\text{F}$ ($52 \pm 3^\circ\text{C}$). The duration of the test shall be six (6) hours. The ozone generation and measurement technique shall be in accordance with ASTM D1149.

4.4.3.4 Criteria for conformance. Criteria for conformance to the nitrile ozone resistance test is the ability of the clamp/strap cushion to meet the requirements of the test without any evidence of cracking or checking visible to the unaided eye.

4.4.4 Chloroprene ozone resistance. The chloroprene rubber material shall be subjected to the following test:

4.4.4.1 Test specimen. The test specimen shall be cut from an actual clamp cushion. If the particular clamp cushion is not sufficiently long to obtain the specimen, a longer section may be used as long as it is verified that the longer section comes from the same lot and cure as the short cushion section.

4.4.4.2 Conditioning treatment. The test specimen shall be conditioned by exposure to dry air at a temperature $212 \pm 5^\circ\text{F}$ ($100 \pm 3^\circ\text{C}$) for a period of 70 hours.

4.4.4.3 Test specimen shape. The test specimen shall be cut parallel to the longitudinal direction of the clamp cushion. The specimen shall be a dumbbell shape and shall have a reduced section width of 0.075 ± 0.010 inches (1.9 ± 0.25 mm) and a reduced length of 1, 1.5, or 2 inches (25, 38, or 51 mm), see Figure 1.

4.4.4.4 Ozone test. Measure the thicknesses of the specimens and record. Mount the specimens in a suitable fixture and longitudinally strain to 70 ± 3 percent. The fixture holding the strained test specimens shall be placed in a test chamber having an ozone concentration of 6 ± 0.3 parts per million (PPM) on and a temperature of $125 \pm 5^\circ\text{F}$ ($52 \pm 3^\circ\text{C}$). The ozone generation and measurement technique shall be in accordance with ASTM D1149. The duration of the test for various thicknesses shall be as follows:

<u>Unstrained specimen thickness</u>	<u>Exposure time</u>
0.041 to 0.050 in (1.04 to 1.27 mm)	2 hr 50 min
0.051 to 0.060 in (1.28 to 1.52 mm)	3 hr 30 min
0.061 to 0.070 in (1.53 to 1.78 mm)	4 hr 10 min
0.071 to 0.080 in (1.79 to 2.03 mm)	4 hr 50 min

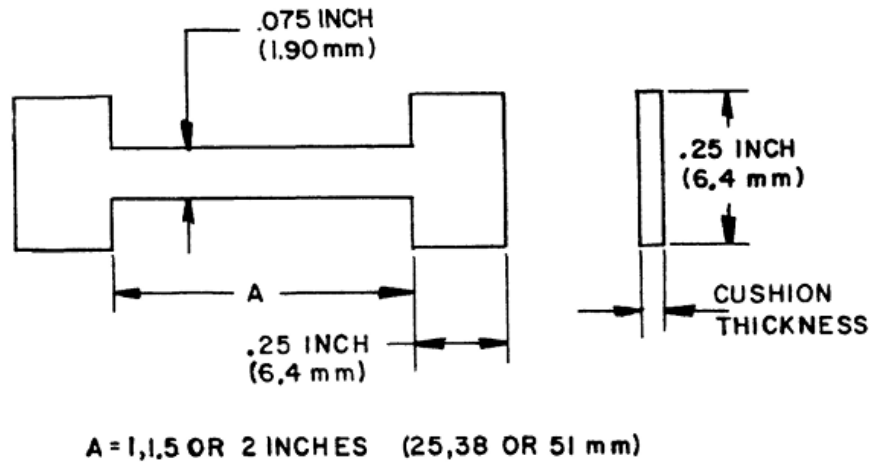


FIGURE 1. Dumbbell test specimen shape.

4.4.4.5 Criteria for conformance. Criteria for conformance to the chloroprene ozone resistance test is the ability of the strained specimen to meet the requirements of the test without complete breakage. Surface deterioration or sever crack propagation without complete breakage shall not be cause for failure.

4.4.5 Silicone tear strength. The tear strength of silicone rubber shall be tested in accordance with ASTM D624, Die "B".

4.4.6 Ethylene propylene properties. Ethylene propylene rubber shall be tested as specified below and meet all requirements of [Table I](#).

4.4.6.1 Hardness. Hardness shall be tested in accordance with ASTM D2240.

4.4.6.2 Tensile strength. Tensile strength shall be tested in accordance with ASTM D412.

4.4.6.3 Elongation. Elongation shall be tested in accordance with ASTM D412.

4.4.6.4 Tear strength. Tear strength shall be tested in accordance with ASTM D624, Die "B".

4.4.6.5 Specific gravity. Specific gravity shall be tested in accordance with ASTM D297.

4.4.6.6 Volume change. Volume change shall be tested in accordance with ASTM D471.

4.4.6.7 Ethylene propylene compression set test. Three samples of the cushion material shall be subjected to dry air at a temperature of $212 \pm 5^{\circ}\text{F}$ ($100 \pm 3^{\circ}\text{C}$) for a period of 70 hours and then tested in accordance with ASTM D395, Method B. The ethylene propylene samples shall meet the requirements specified in 3.2.2.5.1.

4.4.7 Wedge bond test. Cushions with vulcanized wedges shall be subjected to a wedge bond test. The cushion shall be removed from the metal band and heat aged at $150 \pm 10^{\circ}\text{F}$ ($65.5 \pm 5.5^{\circ}\text{C}$) for 24 hours. Remove the cushion from the heat chamber and allow to cool to room temperature. Grip the wedge at approximately 50 percent of its height with a pair of approximately 1/2-inch (12.7 mm) wide, flat-nose, plain-jaw pliers. Pull on the wedge, without twisting motion until rubber tearing occurs. Pulling force shall be applied slowly. Wedge shall meet the criteria specified in 3.8.

4.4.8 Physical properties. The physical properties of the cushion material shall be tested in accordance with the specified material specification for the individual cushion material listed in 3.2.2. Test specimens shall be cut from actual clamp cushions. If a particular clamp cushion is not long enough to obtain a sample, a longer section may be used, provided it can be verified that the longer section comes from the same lot as the actual cushion sample. Test specimen failures in the area of the holding jaws outside of the test section shall be disregarded and another sample tested.

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 material 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 clamps are intended for use in general aircraft clamping applications including electrical systems. For high performance loop style clamps for use in SAE-AS5440 hydraulic systems, see MIL-DTL-85052. Plain (un-cushioned) AN742 clamps are for electrical bonding applications.

6.2 Ordering data. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Applicable part number (see 3.1).
- c. Applicable levels of preservation and packaging (see 5).

6.3 Subject term (key word) listing.

Cadmium
Chloroprene
Ethylene Propylene
Fluorosilicone
Nitrile
Polytetrafluoroethylene (PTFE)
Silicone Rubber

6.4 Changes from previous issue. 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 previous issue.

CONCLUDING MATERIAL

Custodians:

Army – AV

Navy – AS

Preparing Activity:

DLA – CC

(Project 5340-2025-013)

NOTE: The activities listed above were interested in this document as 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/>.