

INCH-POUND

MIL-R-83248C

28 June 1994

SUPERSEDING

MIL-R-83248B

13 July 1990

MILITARY SPECIFICATION

RUBBER, FLUOROCARBON ELASTOMER, HIGH TEMPERATURE, FLUID, AND COMPRESSION SET RESISTANT

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

1. SCOPE

1.1 Scope. This specification covers high temperature, compression set, and fluid resistant fluorocarbon elastomer sheets, strips, molded parts, and extruded shapes for aeronautical and aerospace applications.

1.2 Classification. The synthetic rubber shall be furnished in the specified types and classes (see 6.2).

1.2.1 Types. The synthetic rubber types shall consist of the following:

- a. Type I: O-rings, compression seals, molded-in-place gaskets, and molded o-ring cord
- b. Type II: Molded parts (other than type I), sheets, strips, and extruded shapes

1.2.2 Classes. The synthetic rubber classes shall be designated as follows:

- a. Class 1: 75 ± 5 hardness
- b. Class 2: 90 ± 5 hardness

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: ASC/ENOSD, Wright-Patterson AFB OH 45433-7809, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

FSC 5330

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

MIL-R-83248C**2. APPLICABLE DOCUMENTS****2.1 Government documents**

2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the *Department of Defense Index Specifications and Standards (DODISS)* and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS**FEDERAL**

- | | | |
|-----------|---|---|
| UU-P-268 | – | Paper, Kraft, Wrapping |
| PPP-B-601 | – | Boxes, Wood, Cleated-Plywood |
| PPP-B-636 | – | Boxes, Shipping, Fiberboard |
| PPP-T-45 | – | Tape, Gummed, Paper, Reinforced and Plain, for Sealing and Securing |

MILITARY

- | | | |
|---------------|---|--|
| MIL-P-4861 | – | Packing, Preformed, Rubber, Packaging of |
| MIL-R-83248/1 | – | Rubber, Fluorocarbon Elastomer, High Temperature, Fluid, and Compression Set, Resistant, O-Rings, Class 1, 75 Hardness |
| MIL-R-83248/2 | – | Rubber, Fluorocarbon Elastomer, High Temperature, Fluid, and Compression Set, Resistant, O-Rings, Class 2, 90 Hardness |

STANDARDS**MILITARY**

- | | | |
|----------------|---|---|
| MIL-STD-105 | – | Sampling Procedures and Tables for Inspection by Attributes |
| MIL-STD-129 | – | Marking for Shipment and Storage |
| MIL-STD-147 | – | Palletized Unit Loads |
| 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-413 | – | Visual Inspection Guide for Elastomeric O-Rings |
| MIL-STD-2073-1 | – | DoD Material Procedures for Development and Application of Packaging Requirements |

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Defense Printing Service Detachment Office, Bldg 4D, 700 Robbins Avenue, Philadelphia PA 19111-5094.)

2.2 Non-Government publications. The following document(s) form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the *DODISS* cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the *DODISS* are the issues of the documents cited in the solicitation (see 6.2).

MIL-R-83248C**SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)**

AS 568 – Aerospace Size Standard for O-Rings

(Application for copies should be addressed to Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096-0001.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D297	– Rubber Products, Chemical Analysis of (DoD adopted)
ASTM D395	– Rubber Property – Compression Set, Tests for (DoD adopted)
ASTM D412	– Rubber Properties in Tension, Tests for (DoD adopted)
ASTM D471	– Rubber Property – Effect of Liquids, Tests for (DoD adopted)
ASTM D573	– Rubber – Deterioration in an Air Oven – Tests for (DoD adopted)
ASTM D1329	– Evaluating Rubber Property – Retraction at Low Temperatures (TR TEST), Test for (DoD adopted)
ASTM D1414	– Rubber O-Rings, Testing (DoD adopted)
ASTM D2240	– Rubber Property – Durometer Hardness, Tests for (DoD adopted)
ASTM D3951	– Standard Practice for Commercial Packaging (DoD adopted)

(Application for copies should be addressed to American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103-1187.)

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of Precedence. In the event of a conflict between the text of this document and the references cited herein (except for related associated detail specifications, specification sheets, or MS standards), 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 Qualification. Parts furnished under this specification shall be products which are authorized by the qualifying agency for listing on the applicable qualified products list at the time set for opening of bids.

3.2 Materials. The cured compound of fluorocarbon elastomer shall be entirely suitable for the intended purpose, and shall be of the same composition as the material used for qualification. A dihydroxy/bisphenol cure system shall be used. Amine cure systems shall not be used. Material shall be based on 100% virgin fluorocarbon elastomer. No amount of reprocessed or reground fluorocarbon scrap or non-fluoro elastomer polymer is acceptable.

3.3 Physical properties. The physical properties of the fluorocarbon elastomer rubber shall conform to the requirements specified in table I, II, III, and IV as applicable.

MIL-R-83248CTABLE I. Physical properties, type I

	Class 1 (75 hardness)	Class 2 (90 hardness)
Original		
Tensile strength, psi, min	1400	1400
Elongation, %, min.	125	100
Hardness, points	75 \pm 5	90 \pm 5
Specific, gravity	As determined	As determined
Temperature retraction, 10% (TR-10)°F, max.	+5	+5
Air age 70 hours @ 518°F \pm 5°F		
Tensile strength decrease, %, max.	35	45
Elongation decrease, %, max.	15	20
Hardness change, points	+10, -5	+10, -5
Weight loss, %, max.	10	10
Air age 22 hours @ 392°F \pm 5°F		
Compression set, % of original deflection, max.		
0.066 to 0.110 inch, inclusive	20	35
over 0.110 inch	15	25
Air age 336 hours @ 392°F \pm 5°F		
Compression set, % of original deflection, max		
0.066 to 0.110 inch, inclusive	45	65
over 0.110 inch	40	60
Oil age 70 hours @ 392°F \pm 5°F in <i>ARM 200</i>		
Tensile strength decrease, %, max.	35	35
Elongation decrease, %, max.	20	20
Hardness change, points	+0, -15	+0, -15
Volume change, %	+1 to +25	+1 to +25
Compression set, % of original deflection, max.		
0.066 to 0.110 inch, inclusive	30	35
over 0.110 inch	10	20
Fuel age 70 hours @ 75°F \pm 5°F in ASTM Reference Fuel B (<i>ASTM D471</i>)		
Tensile strength decrease, %, max.	20	20
Elongation decrease, %, max.	20	20
Hardness change, points	\pm 5	\pm 5
Volume change, %	+0 to +5	+0 to +5

MIL-R-83248CTABLE II. Physical properties after humidity aging, type I (brown seals only)

The following properties shall be determined on brown O-rings that have been aged for 28 days at 77°F ± 2°F and 95 ± 3 percent relative humidity.		
	Class 1 (75 hardness)	Class 2 (90 hardness)
Properties		
Tensile strength, psi, min	1400	1400
Elongation, %, min.	125	100
Tensile strength decrease, %, max. <u>1/</u>	15	15
Elongation decrease, %, max. <u>1/</u>	15	15
Air age 70 hours @ 518°F ± 5°F		
Tensile strength decrease, %, max. <u>2/</u>	35	45
Elongation decrease, %, max. <u>2/</u>	25	25
Air age 22 hours @ 392°F ± 5°F		
Compression set, % of original deflection, max.	15	25
Oil age 70 hours @ 392°F ± 5°F in <i>ARM 200</i>		
Tensile strength decrease, %, max. <u>2/</u>	35	35
Elongation decrease, %, max. <u>2/</u>	20	20
Compression set, % of original deflection, max.	10	15

1/ Shall be based on the original tensile strength and elongation found when tested to the requirements of table I.

2/ Shall be based on the tensile strength and elongation found after aging 28 days at 77°F ± 2°F and 95 ± 3 percent relative humidity.

MIL-R-83248CTABLE III. Physical properties, type II

	Class 1 (75 hardness)	Class 2 (90 hardness)
Original		
Tensile strength, psi, min	1600	1600
Elongation, %, min.	125	100
Hardness, points	75 ± 5	90 ± 5
Specific gravity	As determined	As determined
Temperature retraction, 10% (TR-10) °F, max.	+5	+5
Air age 70 hours @ 518°F ± 5°F		
Tensile strength decrease, %, max.	35	45
Elongation decrease, %, max.	15	20
Hardness change, points	+10, -5	+10, -5
Weight loss, %, max.	10	10
Air age 22 hours @ 392°F ± 5°F		
Compression set, % of original deflection, max.	15	25
Air age 336 hours @ 392°F ± 5°F		
Compression set, % of original deflection, max	45	65
Oil age 70 hours @ 392°F ± 5°F in <i>ARM 200</i>		
Tensile strength decrease, %, max.	35	35
Elongation decrease, %, max.	20	20
Hardness change, points	+0, -15	+0, -15
Volume change, %	+1 to +25	+1 to +25
Compression set, % of original deflection, max.	20	25
Fuel age 70 hours @ 75°F ± 5°F in ASTM Reference Fuel B (<i>ASTM D471</i>)		
Tensile strength decrease, %, max.	20	20
Elongation decrease, %, max.	20	20
Hardness change, points	±5	±5
Volume change, %	+0 to +5	+0 to +5

MIL-R-83248CTABLE IV. Physical properties after humidity aging, type II (brown material only)

The following properties shall be determined on brown specimens that have been cut from 6 inches by 6 inches by 0.075 inch platen sheets and have been aged for 28 days at 77°F ± 2°F and 95 ± 3 percent relative humidity.		
	Class 1 (75 hardness)	Class 2 (90 hardness)
Properties		
Tensile strength, psi, min	1600	1600
Elongation, %, min.	125	100
Tensile strength decrease, %, max. <u>1/</u>	15	15
Elongation decrease, %, max. <u>1/</u>	15	15
Air age 70 hours @ 518°F ± 5°F		
Tensile strength decrease, %, max. <u>2/</u>	35	45
Elongation decrease, %, max. <u>2/</u>	25	25
Air age 22 hours @ 392°F ± 5°F		
Compression set, % of original deflection, max.	15	25
Oil age 70 hours @ 392°F ± 5°F in <i>ARM 200</i>		
Tensile strength decrease, %, max. <u>2/</u>	35	35
Elongation decrease, %, max. <u>2/</u>	20	20
Compression set, % of original deflection, max.	15	20

1/ Shall be based on the original tensile strength and elongation found when tested to the requirements of table III.

2/ Shall be based on the tensile strength and elongation found after aging 28 days at 77°F ± 2°F and 95 ± 3 percent relative humidity.

MIL-R-83248C**3.4 Dimensions and tolerances**

3.4.1 Sheets and strips. Unless otherwise specified (see 6.2) the width of the sheet material shall be 36 ± 1 inch, and the tolerances on thickness shall be as shown in table V. The width of strip material, or of shapes cut from sheet, shall be as specified by the procuring activity, within a tolerance of ± 5 percent. The thickness of strip material, other than shapes cut from sheet, shall be as specified by the procuring activity within a tolerance of ± 5 percent, and the length shall be as specified by the procuring activity, within a tolerance of ± 1 percent.

TABLE V. Thickness tolerances for sheet

Nominal thickness (inch)	Tolerance (inch)
0.060 and less	± 0.010
Over 0.060 to 0.120, inclusive	± 0.016
Over 0.120 to 0.500, inclusive	± 0.031
Over 0.500 to 1.000, inclusive	± 0.047
Over 1.000	± 0.063

3.4.2 O-ring dimensions. Dimensions and tolerances of o-rings shall be in accordance with *MIL-R-83248/1* and *MIL-R-83248/2*, as applicable.

3.4.3 Molded parts dimensions. Unless otherwise specified (see 6.2) dimensions and tolerances of molded parts (excluding o-rings) and extruded shapes (including tubing) shall be as specified in the contract or order.

3.5 Color. The color of the material furnished to this specification shall be either black or brown. No other color shall be acceptable.

3.6 Identification of material

3.6.1 Sheets and strips. Unless otherwise specified (see 6.2) sheet material (including strips cut from sheets) shall be marked to show the specification number, type, class, and the manufacturer, the manufacturer's designation (compound and lot number), and the cure date by quarter and year; for example 2Q82, thus:

MIL-R-83248, Type II, Class 2
 Compound No.
 Lot No.
 Cure date
 XYZ Co.

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The identification shall be applied by suitable means using marking fluid that is not deleterious to the fluorocarbon elastomer. The color shall be white. The marking shall not be obliterated by normal handling. The identification shall recur constantly, from one end of the sheet to the other, in rows spaced approximately 5 inches apart; shall be clear, legible, and not less than 0.375 inch high.

3.6.2 Molded parts and extruded shapes (including tubing). Where the size of the product permits, the identification shall be marked as indicated in 3.6.1. When identification marking of the product is impracticable, the unit package shall show the compound and lot number and manufacturer in addition to those markings specified in 5.3. Temporary marking of o-rings for the manufacturer's identification shall be permitted at the time of manufacture but shall in no way affect the properties or function of the o-rings.

3.7 Workmanship. The product shall be uniform in quality and condition, clean, and free from foreign materials and from defects detrimental to fabrication, appearance, or performance of parts.

4. QUALITY ASSURANCE PROVISIONS

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

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

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

- a. Qualification tests (see 4.4)
- b. Quality conformance inspection (4.5).

4.3 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the test conditions specified in section 4.

4.3.1 Control fluid. The control fluid used to conduct the oil aging in this specification shall be *ARM 200*. New fluid shall be used for each aging test.

4.3.2 Atmospheric conditions. All fluid cooling, conditioning, and physical property determinations of rubber shall be conducted at a temperature of $75^{\circ}\text{F} \pm 5^{\circ}\text{F}$.

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4.4 Qualification tests. Qualification testing shall be conducted every 3 years as a minimum. The preparing activity determines which tests should be performed for requalification.

4.4.1 Tests. Initial qualification tests shall consist of all the tests specified in 3.2 when tested in accordance with 4.6.

4.4.2 Samples. Test samples for type I material shall consist of 50 size -214 o-rings conforming to *MIL-R-83248/1* or *MIL-R-83248/2* from one production lot. Eight 1-inch nominal diameter by 1/4-inch minimum thickness hardness buttons made from the same formulation material as the o-rings shall also be supplied. For type II materials, ten 6-inches by 6-inches by 0.075-inch platen sheets shall be supplied.

4.5 Quality conformance inspection.

4.5.1 Quality conformance inspection testing. Quality conformance tests shall be required for all production lots of material. These tests may be performed by the manufacturer's laboratory or at an independent laboratory.

4.5.1.1 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.

4.5.1.2 Batch. A batch shall be the quantity of material compounded on a mill or mixer at one time.

4.5.1.3 Sampling. Except where otherwise indicated herein, sampling for quality conformance shall be in accordance with the specified zero defect sampling plans. One or more defects found in the sample shall be cause for the rejection of the lot.

4.5.1.4 Inspection of material and components. The supplier is responsible for ensuring 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 (see 4.1). In the event of conflict, this specification shall govern. Inspection records shall be kept complete and available to the procuring activity at all times.

4.5.2 Sampling plan A. 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 of identical composition and state of cure as that of the end item. The type I o-ring sizes that are suitable for test are shown in table VI. For all other sizes, the tests on type I materials shall be conducted on size -214 o-rings. If the type II items are unsuitable for test, the samples shall be cut from 6 inches by 6 inches by 0.075 inch platen sheets. If at all possible, compression set and specific gravity tests shall be conducted on the end item. The samples shall be subjected to the following tests that are conducted on each lot of material:

Original (Table VIII)

Tensile strength
Elongation
Hardness
Specific gravity

Air aged 22 hours @ 392°F ± 5°F (4.6.5)

Compression set

MIL-R-83248CTABLE VI. Suitable size test table

1/8" Spool			1/2" Spool		
CS	.070	–011 to –014	CS	.070	–022 to –050
				.103	–120 to –163
				.139	–214 to –258
1/4" Spool					
CS	.070	–015 to –021			
	.103	–113 to –119			
	.139	–211 to –213			

4.5.2.1 Rejection criteria. A lot shall be rejected upon failure of the samples to meet the test requirements specified in table I or table III when tested in accordance with table VIII or 4.6.5.

4.5.3 Sampling plans B, C, and D. Examination of the end item shall be in accordance with the classification of defects and sample sizes set forth herein. The lot size, for the purpose of determining the sample size, shall be expressed in units of o-rings, molded parts, or yards of sheets, strips, or extruded shapes, as applicable for inspection as specified in 4.5.3.1, 4.5.3.2, and 4.5.3.3. If the end item is less than 1 yard, the sample unit shall be the end item.

4.5.3.1 Sampling plan B – examination for defects in appearance and workmanship. Except where otherwise noted herein, sampling for quality conformance will be in accordance with the specified zero defect sampling plans. One or more defects found in the sample will be cause for rejection of the lot.

4.5.3.1.1 Molded parts including o-rings. The sample unit shall be one molded part and the inspection shall be in accordance with *MIL-STD-413* for o-rings and *MIL-STD-407* for other molded products. The accept-on-zero sample size shall be as indicated below:

Lot Size	Sample Size
2 — 8	entire lot
9 — 90	8
91 — 150	12
151 — 280	19
281 — 500	21
501 — 12,000	27
12,001 — 32,000	35
32,001 — 100,000	38
100,001 — 350,000	46

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4.5.3.1.2 Sheets, strips, and extruded shapes. The sample unit shall be 1 linear yard, except if the end item is less than 1 linear yard, the sample unit shall be the end item. The inspection shall be in accordance with *MIL-STD-289* and *MIL-STD-298*, as applicable. Defects in marking such as “incomplete, not legibly identified,” or not as specified in 5.1, shall be considered minor. The accept-on-zero sample size shall be as indicated below:

Lot Size	Sample Size
2 — 50	5
51 — 90	7
91 — 150	11
151 — 280	13
281 — 500	16
501 — 12,000	19
12,001 — 32,000	23
32,001 — 100,000	29
100,001 — 350,000	35

4.5.3.2 Sampling plan C – examination for dimensional defects

4.5.3.2.1 Molded parts including o-rings. The sample unit shall be one molded part. The accept-on-zero sample size shall be as indicated below:

Lot Size	Sample Size
2 — 8	entire lot
9 — 90	8
91 — 150	12
151 — 280	19
281 — 500	21
501 — 12,000	27
12,001 — 32,000	35
32,001 — 100,000	38
100,001 — 350,000	46

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4.5.3.2.2 Sheets, strips, and extruded shapes. The sample unit shall be 1 linear yard, except if the end item is less than 1 linear yard, the sample unit shall be the end item. The dimensions shall be within the tolerances specified in 3.3.1. Dimensions for extruded shapes shall be as specified in the contract or order. The accept-on-zero sample size shall be as indicated below:

Lot Size	Sample Size
2 — 8	entire lot
9 — 90	8
91 — 150	12
151 — 280	19
281 — 500	21
501 — 12,000	27
12,001 — 32,000	35
32,001 — 100,000	38
100,001 — 350,000	46

4.5.3.3 Sampling plan D – inspection for defects in packaging for delivery. An examination in accordance with table VII shall be made to determine that the packaging, packing, and markings comply with section 5 and are in accordance with the applicable methods specified in table VII. The sample unit for this inspection shall be one shipping container fully packed, selected just prior to the closing operation. Shipping containers fully prepared for delivery shall be inspected for closure defects. The accept-on-zero sample size shall be as indicated below:

Lot Size	Sample Size
2 — 50	5
51 — 90	7
91 — 150	11
151 — 280	13
281 — 500	16
501 — 12,000	19
12,001 — 32,000	23
32,001 — 100,000	29
100,001 — 350,000	35

MIL-R-83248CTABLE VII. Packaging inspection

Inspect	Defect
Packing (O-rings, molded parts, and extruded shapes)	Not the level specified. Not packaged as specified or required. Packaging material, closures not as specified. Unit items not individually wrapped when specified.
(Sheets)	Not interleaved; separator sheets do not fully cover the full area of contact between the sheets.
(Strips)	Stacked over 10 inches high. Not in rolls; not wound on suitable cores. Rolls not wrapped or sealed as specified. Total length per roll varies by more than the indicated tolerances (5.1.1.3.2).
Packing	Not level specified; not in accordance with contract requirements. Container not as specified, closures not accomplished by specified or required methods or materials. Any nonconforming component, component missing, damaged or otherwise defective, affecting serviceability. Inadequate application of components such as; incomplete flaps, loose or inadequate strapping, bulged or distorted containers.
Count or units, as applicable.	Less than specified or indicated quantity, linear footage,
Weight	Gross weight exceeds specified requirements.
Markings	Interior or exterior markings, as applicable omitted, illegible, incorrect, incomplete, or not in accordance with contract requirements. Date of cure, storage instructions, missing.

MIL-R-83248C**4.6 Inspection test methods**

4.6.1 Physical properties tests. Conformance with the rubber product properties shall be determined in accordance with the applicable test methods specified in table VIII.

TABLE VIII. Physical properties tests

Characteristics	ASTM Method
Hardness	<i>D2240</i> (type A), <i>D1414</i> (o-rings)
Tensile strength and elongation	
Type I	<i>D1414</i>
Type II	<i>D412</i> , (Use die C for oil aging)
Volume change	<i>D471</i>
Specific gravity	<i>D297</i> , hydrostatic method
Temperature retraction (TR-10)	
Type I	<i>D1414</i>
Type II	<i>D1329</i>

4.6.2 Air aging at 518°F test. Air aging shall be conducted in accordance with *ASTM D573*, except that the rubber shall be aged for 70 hours at 518°F ± 5°F. Tensile strength, elongation, and hardness changes shall be determined as specified in 4.6.1.

4.6.2.1 Weight loss test. The weight loss test shall be conducted on samples air-aged in accordance with 4.6.2. Test specimens shall be conditioned for 24 hours in a desiccator before and after air-aging. The specimens shall be weighted immediately after the desiccation period before and after aging. The percentage weight loss shall be calculated as follows:

$$\text{weight loss} = \frac{W_1 - W_2}{W_1} \times 100$$

where W_1 = weight of sample before air-aging

W_2 = weight of sample after aging.

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4.6.3 Oil aging test. Oil aging of specimens shall be conducted in accordance with *ASTM D 471* and *ASTM D 1414*. Do not dip specimens in acetone, blot dry residual oil from specimens.

4.6.3.1 Oil aging time and temperature. The oil-aging time and temperature shall be 70 hours at $392^{\circ}\text{F} \pm 5^{\circ}\text{F}$. After aging and prior to the physical property determinations, the specimens shall be removed from the hot fluid and cooled 30 minutes in fresh fluid. Tensile strength, elongation, hardness, and volume change shall then be determined as specified in 4.6.1.

4.6.4 Fuel aging test. Specimens shall be immersed in test fluid conforming to ASTM Reference Fluid B (*ASTM D471*), for 70 hours at $75^{\circ}\text{F} \pm 5^{\circ}\text{F}$. The ratio of fluid to rubber shall be approximately 40 ml per gram. Aging shall be conducted in a glass container. An airtight seal shall be maintained for the duration of the test. One sample at a time shall be removed from the fluid, immediately blotted dry, and tested. The tensile strength, elongation, hardness, and volume change tests shall be conducted in accordance with 4.6.1.

4.6.5 Compression set test. Compression set shall be determined in accordance with *ASTM D395*, method B. Specimens for type I materials shall be two o-rings. Two circular plied-up buttons with dimensions to 1.129 ± 0.010 inches diameter and approximately 0.5 inch thick shall be used for type II material.

4.6.5.1 Oil aged test for specimen. Compression set shall be determined on specimens aged 70 hours at $392^{\circ}\text{F} \pm 5^{\circ}\text{F}$ immersed in fluid conforming to *ARM 200*. The compression set plates for testing type I material shall be approximately 0.375 inch by 2 inches by 4 inches. There shall be six 1/4-inch bolt holes; one on each corner and one located in the middle of each 4-inch edge and on the center line of the corner holes. There shall also be 1/4-inch holes through the middle of each half of the plates to allow fluid to be in contact with the inside diameter of the o-rings. Equivalent fixtures may be used. The compression set plates for type I compression seals other than o-rings and type II material shall be in accordance with *ASTM D395*. The original thickness of the specimens shall be measured and the test fixtures shall be assembled using two test specimens. The specimens shall be compressed 25 percent. The test fixture shall be placed in a 1-liter stainless steel beaker and 800 milliliters of *ARM 200* fluid shall be added to the beaker. The beaker shall be fitted with a suitable vented stainless steel cap. The cap shall be sealed with an o-ring conforming to type 1, class 1 of this specification (size-240, AS 568 has been used). The beaker shall be placed in a suitable oven at $392^{\circ}\text{F} \pm 5^{\circ}\text{F}$ with vent open. After the fluid has reached the test temperature (approximately 2 hours) the vent shall be closed and the beaker left in the oven for a total aging time of 70 hours. At the end of the aging time, the specimens shall be removed from the compression plates immediately and allowed to cool on paper towels for 30 minutes. Excess fluid shall be blotted from the specimens with paper towels and the final thickness determined.

4.6.6 Humidity aged test. Aging shall be conducted in a suitable chamber maintained at $77^{\circ}\text{F} \pm 2^{\circ}\text{F}$ and 95 ± 3 percent relative humidity for 28 days. The specimens shall be tested or subsequent exposures initiated within 30 minutes after removal from the humidity chamber.

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5. PACKAGING

5.1 Preservation. Preservation shall be level A or C, or commercial as specified (see 6.2).

5.1.1 Level A

5.1.1.1 Type I o-rings. Type I o-rings (require unit pack) shall be packaged in accordance with the requirements of *MIL-P-4861*, except clear or opaque polyethylene bags of at least 0.004 inch thickness are acceptable.

5.1.1.2 Type II material. Type II material shall be preserved to the *MIL-STD-2073* requirements for this level.

5.1.1.3 Type I compression seals other than o-rings and type II material

5.1.1.3.1 Sheets. Rubber sheets shall be interleaved with any suitable paper that will extend over the full area of contact between sheets. Unit quantity shall be a stack not to exceed 10 inches.

5.1.1.3.2 Strip. Rubber strips shall be wound on suitable cores that will provide rigid support and that will not distort nor change shape during handling or shipping. Each roll shall be wrapped in draft paper conforming to *UU-P-268* and sealed with tape conforming to *PPP-T-45*. Unless otherwise specified, each roll shall consist of 75 feet \pm 1 foot of rubber strip.

5.1.1.3.3 Extruded shapes. Extruded rubber shapes shall be wrapped in any suitable wrapping.

5.1.1.3.4 Molded parts. Molded rubber parts shall be packaged in containers conforming to *PPP-B-636*. The unit quantity shall be 25, or as specified by the procuring activity (see 6.2).

5.1.2 Level C. Type II material shall be preserved to the *MIL-STD-2073-I* requirements for this level. Fluorocarbon elastomer material shall be packaged in a manner which affords adequate protection against deterioration and physical damage during shipment from the supply source to the first receiving activity for immediate use.

5.1.3 Commercial. Type II material shall be preserved in accordance with the applicable requirements of *ASTM D3951*.

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

5.2.1 Level A

5.2.1.1 Type I o-rings. Type I o-rings (requires unit pack) shall be packaged in accordance with the level A requirements of *MIL-P-4861*.

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5.2.1.2 Type I compression seals other than o-rings and type II material. Shipping containers shall contain identical synthetic rubber items of the same shape and size and shall enclose the contents in a snug, tight-fitting manner. The inside height of containers for rubber sheet shall not exceed 10 inches. Rubber strip shall be packaged one roll per container. Containers for extruded rubber shapes shall have an inside maximum cross-sectional area of 36 square inches and, unless otherwise specified by the procuring activity, a maximum length of 10 feet. Unless otherwise specified by the procuring activity, rubber material, other than o-rings shall be packed in wood cleated-plywood shipping containers conforming to *PPP-B-601*, overseas type. As far as practical, containers shall be uniform in shape and size and contain identical quantities. Container closure and strapping shall be in accordance with the appendix to *PPP-B-601*. Gross weight of containers shall not exceed 200 pounds.

5.2.2 Level B. Type II materials that have been preserved and packaged as specified in 5.1 shall be packaged in exterior type shipping containers that conforms to *PPP-B-636*, class weather resistant. The closure of the shipping container shall be in accordance with the appendix of the applicable shipping container specification.

5.2.3 Level C. Type II materials that have been preserved and packaged as specified in 5.1 shall be packed in accordance with the requirements of *MIL-STD-2073-1*. Fluorocarbon elastomer material preserved and packaged as specified in 5.1.2 shall be packed in a manner which affords adequate protection against damage during direct shipment from the supply source to the first receiving activity for immediate use.

5.2.4 Commercial. Type II materials that have been preserved and packaged as specified in 5.1 shall be packed in accordance with the requirements of *ASTM D3951*.

5.3 Marking

5.3.1 Level A, B, C. In addition to any special marking or other identification markings required by the contract (see 6.2), each unit pack and exterior container shall be marked in accordance with *MIL-STD-129*. When applicable, interior packages shall be marked in accordance with 3.6 and as follows:

Rubber (angle, channel, special-shaped section, as applicable)
 Type _____, Class _____,
 Manufacturer's name and address
 Compound number
 Cross section and length (inches) or part number
 Solid (molded, extruded, as applicable)
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 STORE IN A COOL DRY PLACE

5.3.2 Commercial. Type II material shall be marked in accordance with the applicable requirements of *ASTM D3951*.

5.3.3 Palletization. Unitized loads, commensurate with the level of packing specified in the contract or order shall be palletized in accordance with *MIL-STD-147*. Palletized loads shall be uniform in size and quantities to the greatest extent possible. If the container is of a size which does not conform to any of the pallet patterns specified in *MIL-STD-147*, the pallet pattern shall first be approved by the contracting officer (see 6.2).

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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 procurable to this specification is intended for use where resistance to jet fuel, synthetic engine lubricants, and petroleum base hydraulic fluids are required. Generally, materials meeting this specification are usable over temperature range of -20°F to 500°F . Each application, however, has to be considered individually. Instances are known where this material has been used below -20°F and also above 500°F . Material furnished to this specification must be either black or brown in color.

6.2 Acquisition document. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Type and class (see 1.2)
- c. Material (see 3.2)
- d. Thickness and tolerances (see 3.4)
- e. Dimensions (see 3.4)
- f. Quantity
- g. Detail drawing and additional specification, if any.
- h. Unit quantity of molded parts if other than specified in 5.1.1.3.4.
- i. Applicable levels of preservation and packing (see 5.1 and 5.2).
- j. Any special marking required (see 5.3).
- k. When palletization is required (see 5.3.3)

6.3 Qualification. With respect to products requiring qualification, awards will be made only for such products as have, prior to the time set for opening of bids, been tested and approved for inclusion in the applicable Qualified Products List whether or not such products have actually been so listed by that date. The attention of the suppliers is called to this requirement, and manufacturers are urged to arrange to have the products that they propose to offer to the Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. The activity responsible for the Qualified Products List is the Air Force Wright Laboratories, Attn: WL/MLSE, 2179 Twelfth Street, Wright-Patterson AFB, Ohio 45433-7718, and information pertaining to qualification of products may be obtained from that activity.

6.4 ARM 200. ARM 200 can be purchased from the Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Phone (412) 776-4841.

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6.5 Subject term (key word) listing

Elongation
O-rings
Molded parts
Temperature retraction (TR-10)
Tensile strength

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

Custodians:

Army – MR
Navy – AS
Air Force – 11

Preparing activity:

Air Force – 11

(Project No. 5330-0902)

Review activities:

Navy – SH
Air Force – 82, 99