

MIL-G-21569B(SHIPS)  
5 February 1965

SUPERSEDING  
MIL-G-21569A(SHIPS)  
8 November 1961  
(See paragraph 6.4)

**MILITARY SPECIFICATION**  
**GASKETS, CYLINDER LINER SEAL, SYNTHETIC RUBBER**

**1. SCOPE**

1.1 Scope. - This specification covers synthetic rubber O-rings and other forms of gaskets.

1.2 Classes. - The gaskets shall be of the following classes, as specified (see 6.2).

Class I - Oil resistant.

Class II - High temperature resistant.

**2. APPLICABLE DOCUMENTS**

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

**STANDARDS**

**FEDERAL**

FED-STD-601 - Rubber: Sampling and Testing.

**MILITARY**

MIL-STD-407 - Visual Inspection Guide for Rubber Molded Items.

MIL-STD-413 - Visual Inspection Guide for Rubber O-Rings.

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

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

**OFFICIAL CLASSIFICATION COMMITTEE**

Uniform Freight Classification Rules.

(Copies may be obtained from the Official Classification Committee, 1 Park Avenue at 33rd St., New York 16, N. Y.)

**ASTM STANDARDS on Rubber; Carbon Black; Gaskets**

D 1390 - Method of Test for Stress Relaxation of Vulcanized Rubber in Compression

(Copies may be obtained from the American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa.)

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

## 3. REQUIREMENTS

3.1 Preproduction sample. - Prior to beginning production samples shall be tested as specified in 4.2 (see 6.3).

3.2 Material. - The rubber material used in the gaskets shall be as follows:

3.2.1 Class I. - A compound utilizing a copolymer of butadiene and acrylonitrile as a basic material.

3.2.2 Class II. - A compound utilizing elastomeric polysiloxanes as a basic material.

3.3 Form. - The gaskets shall be furnished in the form and dimensions specified (see 6.2).

3.4 Properties of rubber. - The rubber in the gaskets shall conform to the requirements specified in table I.

Table I - Physical requirements of rubber.

Initial properties:	<u>Class I</u>	<u>Class II</u>	<u>Test Procedure</u>
Tensile strength, psi, minimum	1800	500	4.8.1
Ultimate elongation, percent, minimum	250	120	4.8.1
Hardness, durometer points	65 ± 10	65 ± 10	4.8.2
Properties after oven aging:			
Tensile strength, percent of initial, minimum	75	75	4.8.3
Hot compression set, percent, maximum	50	50	4.8.4
Properties after water immersion:			
Tensile strength, percent of initial, minimum	75	65	4.8.5
Volume change, percent (no shrinkage allowed)	0 to 20	0 to 15	4.8.6
Properties after oil immersion:			
Tensile strength, percent of initial, minimum	75	50	4.8.5
Volume change, percent (no shrinkage allowed)	0 to 10	0 to 15	4.8.6
Compression stress relaxation, (O-rings only),			
Initial back load, pounds, minimum	50	40	4.8.7
Stress relaxation, percent, maximum	70	60	4.8.7

3.5 Marking. - Gaskets shall be marked with the class number, using a suitable permanent marking material or in the case of individual one-item packaging, the marking may be put on the package.

3.6 Workmanship. - The workmanship shall be in accordance with good commercial practice for this type of commodity. Defects shall be evaluated as specified in 4.4.

## 4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. - Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

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4.2 Preproduction inspection. - Preproduction inspection shall consist of the examination and tests specified in 4.4 and 4.8. The contractor shall not proceed with the production under the contract or order without written approval of the preproduction test results by the procuring activity. Preproduction tests are not required if the material was previously supplied under contract and subjected at that time to preproduction testing and found to conform to this specification, provided no changes have been made in production techniques or materials since such tests.

#### 4.3 Sampling. -

4.3.1 Lot. - All gaskets of the same size and class and produced from the same batch of rubber and offered for delivery at one time under a contract or order shall be considered a lot for purposes of sampling for examination and tests.

4.3.2 Sampling for visual and dimensional examination. - Sample gaskets shall be taken at random from each lot in accordance with table II for the examination specified in 4.4.

Table II - Sampling for visual and dimensional examination.

Lot Size Number of gaskets	Sample size Number of gaskets	Number of nonconforming or defective gaskets	
		Acceptance Number	Rejection Number
1 to 9	all	0	1
10 to 25	8	0	1
26 to 62	13	0	1
63 to 160	20	1	2
161 to 410	32	1	2
411 to 1000	50	2	3
1001 to 2550	80	3	4

4.3.3 Sampling for tests. - Sample gaskets shall be taken at random from each lot that passes the examination of 4.4, in sufficient quantity to conduct the production check tests or quality conformance tests specified in 4.5 and 4.6, as applicable. If the gaskets are of such size or shape that test specimens cannot be prepared from them, a substitute sample shall be provided in the form of a piece or pieces of rubber having dimensions appropriate to the tests required. The substitute sample shall be certified to be of the same material and equivalent cure as that used in the lot of finished material offered for delivery.

4.4 Visual and dimensional examination. - The gaskets taken in accordance with 4.3.2 shall be examined to verify conformance to all of the requirements of this specification which do not involve tests. MIL-STD-407 or MIL-STD-413 shall be used to determine and evaluate defects through visual examination. If the number of nonconforming or defective gaskets in any sample exceeds the applicable acceptance number of 4.3.2, this shall be cause for rejection of the entire lot.

4.5 Production check tests. - Production check tests shall be conducted on samples taken or provided from the first lot of material offered for delivery under a contract or order, and on every fifth lot thereafter. All the tests specified in 4.8, except 4.8.7, shall be conducted.

4.6 Quality conformance tests. - Quality conformance tests shall be conducted on those lots for which production check tests are not conducted. The tests specified in 4.8.1, 4.8.2 and 4.8.5.2 shall be conducted on samples taken from or provided to represent the lot.

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**4.7 Rejection.** - If any sample fails to meet the requirements specified in 4.4 for any of the production check tests or quality conformance tests, this shall be cause for rejection of the entire lot represented by the sample. Furthermore, if a sample fails a production check test additional samples shall be selected from (or to represent) each subsequent lot of the same class and shall be subjected to the test or tests wherein the failure occurred. A lot shall then be accepted only upon satisfactory completion of the tests by all the samples selected to represent the lot. This additional testing shall be discontinued when 4 successive lots have passed the test or tests.

**4.8 Test procedures.** -

**4.8.1 Tensile strength and ultimate elongation.** - The tensile strength and ultimate elongation shall be determined by methods 4111 and 4121, respectively, of FED-STD-601. Die III specimens of 0.080 plus or minus 0.010 inch thickness shall be used for all determinations of these properties.

**4.8.2 Hardness.** - The hardness shall be determined with a Shore A type durometer in accordance with method 3021 of FED-STD-601. The 15 second reading shall be taken on plied-up specimens consisting of 3 plies of tensile sheet thickness.

**4.8.3 Oven aging.** - Tensile test specimens shall be aged and tested in accordance with method 7221 of FED-STD-601. The aging period shall be 336 plus or minus 2 hours at 194° plus or minus 2°F.

**4.8.4 Hot compression set.** - This test shall be performed in accordance with method 3311 of FED-STD-601 except that the deflection of specimens other than O-rings shall be 25 percent and the aging period shall be 336 plus or minus 2 hours at 194° ± 2°F. plus or minus. When O-rings are procured, the test specimens shall consist of 2 inch long pieces of O-ring material that are measured and compressed to 50 percent deflection with the mold flash horizontal. The aging period shall be as previously stated.

**4.8.5 Immersion in liquids.** - The tensile strength after immersion shall be determined by method 6111 of FED-STD-601, on die III specimens. The immersion conditions shall be as follows:

**4.8.5.1 In water.** - The test specimens shall be immersed in distilled water for 336 plus or minus 2 hours at 194° plus or minus 2°F.

**4.8.5.2 In oil.** - The test specimens shall be immersed in medium No. 2 oil of method 6001 of FED-STD-601 for 94 plus or minus 1/2 hours at 194° plus or minus 2°F.

**4.8.6 Volume change.** - The volume change after immersion shall be determined on 1 by 2 by 0.07 to 0.09 inch specimens in accordance with method 6211 of FED-STD-601. The immersion conditions shall be the same as detailed in 4.8.5.1 and 4.8.5.2.

**4.8.7 Compression stress relaxation (O-ring only).** - When O-rings are procured, they shall be tested for compression stress relaxation in accordance with ASTM D 1390 with the following modifications:

**4.8.7.1 Specimen.** - The specimen shall be tested in a machined aluminum block which has two grooves in the top surface as shown in figure 1. The grooves in the aluminum block shall have the dimensions given in table III for each nominal O-ring diameter. One coat of rubber cement shall be brushed onto the bottom surfaces of the grooves and about 1/4 to 1/2 around the lower cylindrical portion of two 2-inch long pieces of O-ring material held with the mold flash horizontal. After a 1-hour drying time for the adhesive, the pieces of O-ring shall be cemented into the grooves of the block and a 1-pound weight applied to the top of the specimen. The following day the portions of O-ring material protruding beyond the block shall be cut off, leaving a specimen as shown in figure 1. Three such specimens shall be prepared from each O-ring material for determination of back load in the initial condition and after oven aging.

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Table III - Dimensions of grooves in aluminum block

Nominal cross-sectional diameter of O-ring, inch	Dimensions of groove	
	Width, inch	Depth, inch
0.210	0.262	0.147
.240	.294	.169
.250	.312	.177
.275	.343	.196

4.8.7.2 Amount of compression. - The stress relaxation apparatus shall be adjusted to compress the O-ring material an amount calculated from the equation:

$$\text{Amount of compression, inch} = \frac{\text{Cross-sectional diameter of O-ring material, inch}}{0.250 \text{ inch}} \times 0.063 \text{ inch}$$

Where:

0.063 inch is the amount of compression an O-ring 0.250 inch in diameter would receive in service.

4.8.7.3 Aging for compression stress relaxation. - The O-ring with assembled apparatus shall be aged in an oven for 500 plus or minus 2 hours at 194° plus or minus 2°F for determining stress relaxation after aging.

4.8.7.4 Calculations. - The calculations for determining back load and stress relaxation shall be as follows:

$$B. L. = L + W$$

$$S. R. = \frac{B. L. - B. L. F.}{B. L.} \times 100$$

Where B. L. = initial back load in pounds.

L. = external load in pounds measured on the testing machine.

W. = weight of load applicator in pounds.

S. R. = stress relaxation in percent.

B. L. F. = final back load (after oven aging) in pounds.

## 5. PREPARATION FOR DELIVERY

### 5.1 Domestic shipment and early material use. -

5.1.1 Preservation and packaging. - Preservation and packaging shall be sufficient to afford adequate protection against deterioration and physical damage during shipment from the supply source to the using activity and until early material use.

5.1.2 Packing. - Packing shall be accomplished in a manner which will insure acceptance by common carrier and will afford protection against physical or mechanical damage during direct shipment from the supply source to the using activity for early material use. The shipping containers or method of packing

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shall conform to the Uniform Freight Classification Rules and Regulations or other carrier regulations as applicable to the mode of transportation.

5.1.3 Marking. - Interior packages and exterior shipping containers shall be marked in accordance with the contractor's commercial practice. The information shall include nomenclature, Federal stock number or manufacturer's part number, contract or order number, contractor's name and destination and cure date (month and year).

5.2 Domestic shipment and storage or overseas shipment. The requirements and levels of preservation, packaging, packing and marking for shipment shall be specified by the procuring activity (see 6.2).

5.2.1 The following provides various levels of protection during domestic shipment and storage or overseas shipment, which may be required when procurement is made by a Government activity (see 6.2).

5.2.1.1 Preservation and packaging. -

5.2.1.1.1 Level A. -

5.2.1.1.1.1. Gaskets. - Gaskets in quantity specified (see 6.2), shall be packaged together with soapstone powder or talcum, interleaved with Kraft paper and unit packaged in folding, set-up paperboard or fiberboard boxes conforming to PPP-B-566, PPP-B-676, or PPP-B-636, respectively, at the option of the contractor. Box closure shall be as specified in the box specification or appendix thereto.

5.2.1.1.1.2 O-rings. - O-rings shall be individually packaged in accordance with MIL-P-4861.

5.2.1.1.2 Level C. - Preservation and packaging shall be sufficient to afford adequate protection against deterioration and physical damage during shipment from the supply source to the using activity for early installation. This level may conform to the supplier's commercial practice when such meets the requirements of this level.

5.2.1.2 Packing. -

5.2.1.2.1 Level A. - Material packaged as specified (see 6.2), shall be packed in overseas type, wood cleated fiberboard, nailed wood, fiberboard, wirebound wood, wood cleated veneer paper overlaid, or wood cleated plywood boxes conforming to PPP-B-591, PPP-B-621, PPP-B-636, weather-resistant, class PPP-B-585, PPP-B-576, class 2 or PPP-B-601, respectively, at the option of the contractor. Shipping containers shall have case liners conforming to MIL-L-10547. Case liners for boxes conforming to PPP-B-636 may be omitted provided all joints and corners of the boxes are sealed with minimum 1-1/2 inch wide tape conforming to PPP-T-76. Boxes shall be closed and strapped in accordance with the applicable box specification or appendix thereto, except fiberboard boxes may be banded with tape conforming to type IV of PPP-T-97 and the appendix thereto. The gross weight of wood or wood cleated boxes shall not exceed 200 pounds; that of fiberboard boxes shall not exceed the weight limitations of the applicable box specification. Unit boxes conforming to weather resistant class of PPP-B-636, closed, sealed and banded as specified herein, and used as the shipping container need not be overpacked.

5.2.1.2.2 Level B. - Material packaged as specified (see 6.2), shall be packed in domestic type wood cleated fiberboard, nailed wood, wirebound wood, cleated plywood or wood cleated veneer paper overlaid boxes or weather-resistant class fiberboard boxes conforming to PPP-B-591, PPP-B-621, PPP-B-585, PPP-B-601, PPP-B-576, class 1 or PPP-B-636, respectively, at the option of the contractor. Box closure shall be as specified in the applicable box specification or appendix thereto except strapping of fiberboard boxes conforming to weather-resistant class of PPP-B-636 will not be required. The gross weight of wood or wood cleated boxes shall not exceed 200 pounds; that of fiberboard boxes shall not exceed the weight limitations of the applicable box specification. Unit fiberboard boxes conforming to PPP-B-636, closed as specified herein, and used as the shipping container need not be overpacked.

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5.2.1.3 Marking. - In addition to any special marking required (see 3.5 and 6.2), interior packages and exterior shipping containers shall be marked in accordance with MIL-STD-129 and with the date cured.

## 6. NOTES

6.1 Intended use. - The gaskets covered by this specification are intended for use as seals for the cylinder liners in diesel engines.

6.2 Ordering data. - Procurement documents shall specify the following:

- (a) Title, number, and date of this specification.
- (b) Class required (see 1.2).
- (c) Form and dimensions of gaskets required (see 3.3).
- (d) Preservation, packaging, packing or marking requirements other than those required by 5.1 (see 5.2).

6.3 Preproduction. - Invitation for bids should provide that the Government reserves the right to waive the requirement for preproduction samples as to those bidders offering a product which has been previously procured or tested by the Government, and that bidders offering such products, who wish to rely on such preproduction or tests, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending procurement.

6.4 CHANGES FROM PREVIOUS ISSUE. - THE EXTENT OF CHANGES (DELETIONS, ADDITIONS, ETC.) PRECLUDE THE ANNOTATION OF THE INDIVIDUAL CHANGES FROM THE PREVIOUS ISSUE OF THIS DOCUMENT.

Preparing activity:  
Navy - SH  
(Project 5330-N064SH)

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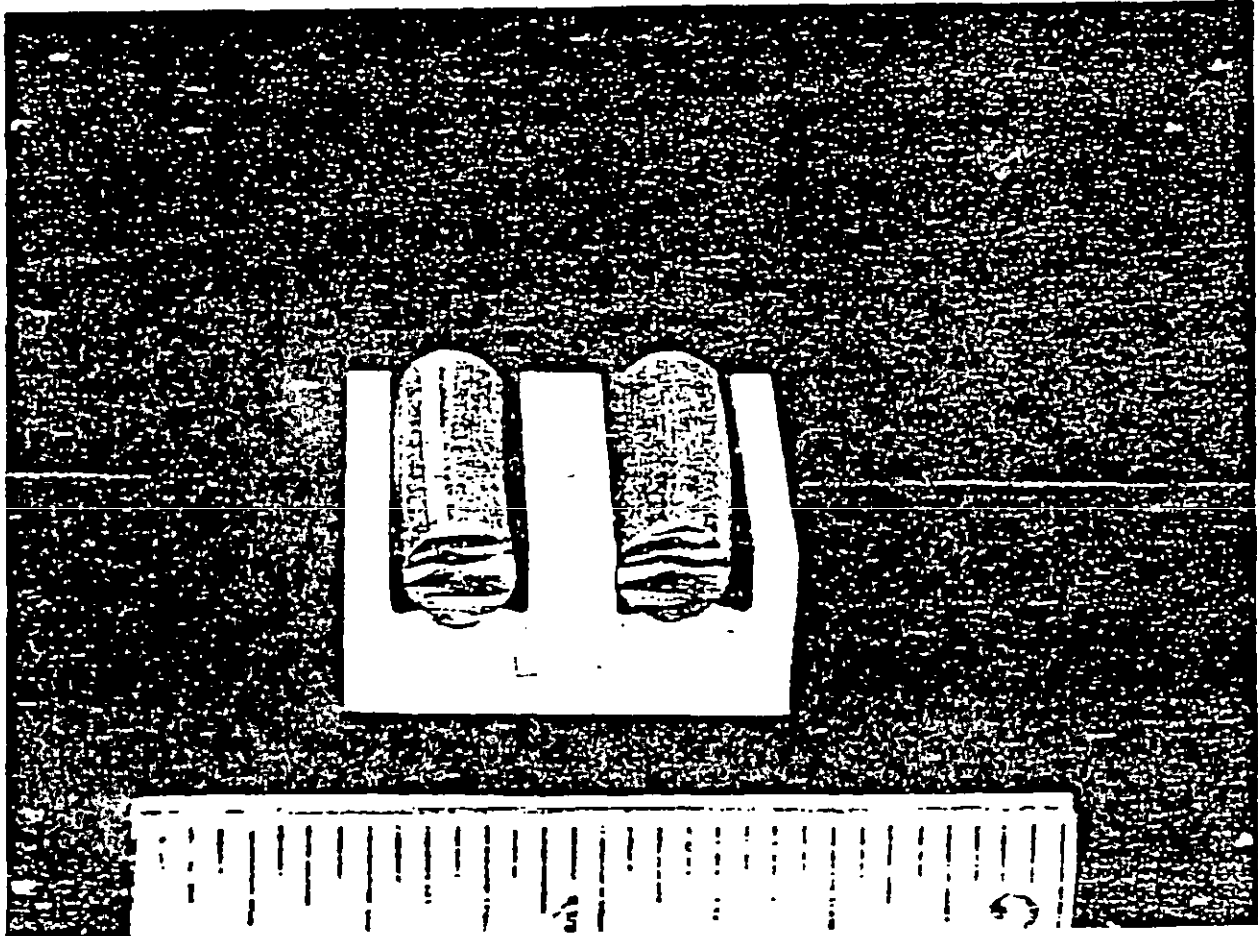


Figure 1 - Test specimen for load relaxation tests.



## STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions - Reverse Side)

1. DOCUMENT NUMBER

2. DOCUMENT TITLE

3a. NAME OF SUBMITTING ORGANIZATION

4. TYPE OF ORGANIZATION (Mark one)

☐

VENDOR

☐

USER

☐

MANUFACTURER

☐

OTHER (Specify): \_\_\_\_\_

b. ADDRESS (Street, City, State, ZIP Code)

## 5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

## 6. REMARKS

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

b. WORK TELEPHONE NUMBER (Include Area Code) - Optional

c. MAILING ADDRESS (Street, City, State, ZIP Code) - Optional

8. DATE OF SUBMISSION (YYMMDD)