

INCH-POUND
MIL-G-24717(SH)
31 March 1989

MILITARY SPECIFICATION

GASKET, SHEET, REFRIGERATION, NON-ASBESTOS

This specification is approved for use by the Naval Sea Systems Command, Department of the Navy, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope This specification establishes the requirements for non-asbestos formulated sheet gasket material for refrigeration service applications up to 150 pounds per square inch (lb/in²) gauge, 275 degrees Fahrenheit (°F) (135 degrees Celsius (°C)) and in vacuum service applications up to 18 in mercury (Hg) gauge, minus 60°F (minus 51°C).

2. APPLICABLE DOCUMENTS

2.1 Government documents

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

SPECIFICATIONS

FEDERAL

- | | |
|----------|--|
| L-P-378 | - Plastic Sheet and Strip, Thin Gauge, Polyolefin |
| VV-L-825 | - Lubricating Oil, Refrigerant Compressor,
Uninhibited. |

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to Commander, Naval Sea Systems Command, SEA 5523, Department of the Navy, Washington, DC 20362-5101 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

DISTRIBUTION STATEMENT A

Approved for public release, distribution is unlimited

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FEDERAL - Continued

- PPP-B-636 - Boxes, Shipping, Fiberboard.
- PPP-B-640 - Boxes, Fiberboard, Corrugated, Triple-Wall
- PPP-B-1055 - Barrier Material, Waterproofed, Flexible.
- PPP-F-320 - Fiberboard; Corrugated and Solid, Sheet Stock (Container Grade), and Cut Shapes

MILITARY

- MIL-P-116 - Preservation, Methods of
- MIL-L-19140 - Lumber and Plywood, Fire-Retardant Treated

STANDARDS

MILITARY

- MIL-STD-1186 - Cushioning, Anchoring, Bracing, Blocking and Waterproofing, with Appropriate Test Methods
- MIL-STD-2073-1 - DoD Materiel Procedures for Development and Application of Packaging Requirements

(Unless otherwise indicated, copies of federal and military specifications and standards are available from the Naval Publications and Forms Center, (ATTN NPODS), 5801 Tabor Avenue, Philadelphia, PA 19120-5099)

2.2 Non-Government publications. The following documents 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).

AMERICAN NATIONAL STANDARDS INSTITUTE, INC. (ANSI)

- B16.5 - Pipe Flanges and Flanged Fittings (DoD adopted)

(Application for copies should be addressed to the American National Standards Institute, Inc , 1430 Broadway, New York, NY 10018.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- D 471 - Standard Test Method for Rubber-Property Effect of Liquids. (DoD adopted)
- D 3951 - Standard Practice for Commercial Packaging. (DoD adopted)
- F 36 - Standard Test Method for Compressibility and Recovery of Gasket Materials (DoD adopted)
- F 37 - Standard Test Methods for Sealability of Gasket Material. (DoD adopted)
- F 38 - Standard Test Methods for Creep Relaxation of a Gasket Material (DoD adopted)
- F 104 - Standard Classification System for Nonmetallic Gasket Materials (DoD adopted)
- F 146 - Standard Test Methods for Fluid Resistance of Gasket Materials. (DoD adopted)

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ASTM (Continued)

F 147 - Standard Test Method for Flexibility of Non-Metallic Gasket Materials. (DoD adopted)

F 152 - Standard Test Methods for Tension Testing of Nonmetallic Gasket Materials. (DoD adopted)

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

(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, the text of this document takes precedence Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 First article. When specified (see 6.2), a sample shall be subjected to first article inspection (see 6.4) in accordance with 4 3.

3 2 Material.

3.2.1 Composition. Unless otherwise specified (see 6 2), the sheet gasket material shall be composed of various organic or inorganic materials and binders according to the manufacturer's design. The material shall meet the requirements of this specification. Asbestos and components containing asbestos are prohibited. The contractor may use any standard test methods available to test for these materials.

3.2.2 Recovered materials. Unless otherwise specified herein, all material incorporated in the products covered by this specification shall be new and may be fabricated using materials produced from recovered materials to the maximum extent practicable without jeopardizing the intended use. The term "recovered materials" means materials which have been collected or recovered from solid waste and reprocessed to become a source of raw materials, as opposed to virgin raw materials. None of the above shall be interpreted to mean that the use of used or rebuilt products is allowed under this specification unless otherwise specifically specified.

3 3 Dimensions and tolerances

3 3 1 Thickness Thickness and tolerance of sheet gasket material shall be in accordance with ASTM F 104, as specified (see 6.2) and shall be determined as specified in 4.5.1.1

3.3.2 Width and length Gasket material shall be furnished in widths and lengths as specified (see 6.2) Since sheet gasket materials are normally produced in 60- by 180-inch sheets, acquisition requests should state lengths and

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widths, such as 60- by 60-inch sheets or 30- by 60-inch sheets. Tolerance limits for length and width for all sizes shall be plus or minus 1/4 inch. Width and length shall be determined in accordance with 4.5.1.2.

3.4 Tensile strength. Tensile strength shall be a minimum of 1,700 lb/in² in the weakest axis using a thickness of 1/16 inch (see 4.5.2).

3.5 Gasket and fluid compatibility. Fluid media compatibility shall be determined by comparing tensile strength measurements after fluid immersion with the tensile strength measurement before immersion (see 3.4). Tensile strength shall be a minimum of 1,300 lb/in² in the weakest axis after 1,000 hours of immersion in refrigerant lubricating oil RCO-2 (VV-L-825, type II) (see 4.5.3).

3.6 Sealability. The gasket leak rate shall not exceed 2 milliliters (mL) per hour (see 4.5.4).

3.7 Compressibility and recovery. Compressibility shall be within the range of 7 to 17 percent. Recovery shall be a minimum of 40 percent (see 4.5.5).

3.8 Creep relaxation. Creep relaxation shall be a maximum of 60 percent (see 4.5.6).

3.9 Adhesion. Adhesion shall not exceed step (3) of the scale specified in 60.1(g) of appendix A (see 4.5.7).

3.10 Flexibility. The material shall not crack or delaminate (see 4.5.8).

3.11 Refrigerant exposure and leakage (high side). The gasket material shall show no leakage when tested as specified in 4.5.9.

3.12 Refrigerant exposure and leakage (low side). The gasket material shall show no leakage when tested as specified in 4.5.9.

3.13 Identification markings. Unless otherwise specified (see 6.2), each sheet shall be legibly and permanently marked with the following information:

- (a) Non-asbestos
- (b) Specification number
- (c) Manufacturer's name
- (d) Manufacturer's product identification

Markings shall be not less than 3/8 inch in height on one side only and on every square foot or less of the material.

3.14 Workmanship. The gasket material shall be uniform in quality and condition. It shall be clean, smooth, and free from all foreign materials and defects that will impair material use and serviceability.

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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 the 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) First article inspection (see 4.3).
- (b) Quality conformance inspection (see 4.4).

4.2.1 Inspection conditions Unless otherwise specified (see 6.2) all inspections shall be performed in accordance with the test conditions specified herein.

4.3 First article inspection. First article inspection shall consist of the examination and tests specified in table I (see 6.3 and 6.4).

TABLE I. First article inspection.

Inspection	Requirement	Test method
Examination	3.14	4.4.3
Dimensions:		
Thickness	3.3.1	4.5.1.1
Width and length	3.3.2	4.5.1.2
Tensile strength	3.4	4.5.2
Fluid and media	3.5	4.5.3
Sealability	3.6	4.5.4
Compressibility and recovery	3.7	4.5.5
Creep relaxation	3.8	4.5.6
Adhesion	3.9	4.5.7
Flexibility	3.10	4.5.8
Refrigerant exposure and leakage	3.11 and 3.12	4.5.9

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4.4 Quality conformance inspection Quality conformance inspection shall be as specified in table II (for groups A, B, and C) and 4 4 1 through 4 4 4 (see 6 3)

TABLE II. Quality conformance.

Inspection	Requirement	Test method
Group A		
Thickness	3.3.1	4.5 1.1
Width and length	3.3 2	4.5.1.2
Group B		
Tensile strength	3.4	4.5.2
Fluid and media	3.5	4.5.3
Sealability	3.6	4.5.4
Flexibility	3.10	4.5.8
Group C		
Compressibility and recovery	3.7	4.5.5
Creep relaxation	3.8	4.5.6
Adhesion	3.9	4.5.7
Refrigerant exposure and leakage	3.11 and 3.12	4.5.9

4.4.1 Lot. For purposes of sampling, a lot shall consist of all sheets of the same class, thickness, width, and length produced under the same conditions and offered for delivery at one time.

4.4.2 Sampling.

4.4.2.1 Sampling for examination of gasket material A random sample of rolls or sheets shall be selected from each lot offered for examination in accordance with table III. The sample rolls or sheets shall be obtained in equal number from each shipping container.

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TABLE III. Sampling for examination of gasket material

Major Defects			
Lot size	Sample size	Accept	Reject <u>1/2/3/</u>
2 - 50	5	0	1
51 - 90	7	0	1
91 - 150	11	0	1
151 - 280	13	0	1
281 - 500	16	0	1
501 - 1200	19	0	1
1201 - 3200	23	0	1
3201 - 10000	29	0	1
10001 - 35000	35	0	1
35001 - OVER	40	0	1
Minor Defects			
2 - 15	2	0	1
16 - 25	3	0	1
26 - 90	5	0	1
91 - 150	6	0	1
151 - 280	7	0	1
281 - 500	9	0	1
501 - 1200	11	0	1
1201 - 3200	13	0	1
3201 - OVER	15	0	1

- 1/ All defective items shall be replaced with acceptable items prior to lot acceptance.
- 2/ Inspect sample size until reject criteria is reached.
- 3/ Rejected lots may be screened and resubmitted for inspection and retest

4.4.2.2 Sampling for tests. Two samples, each 12 by 12 inches, shall be selected from each lot for the tests specified in 4.5.2 through 4.5.9. Failure in any test shall be cause for rejection of that lot.

4.4.3 Preparation for examination. Each of the rolls or sheets shall be surface examined to determine conformance to table IV. Gasket material that is delivered in rolls shall be unrolled sufficiently to expose the required sample area (square foot). Both sides (faces) of the material shall be inspected, regardless of whether flat sheet or roll materials are being inspected.

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TABLE IV Classification of defects

Category	Item	Defect
Major 101	Sheets	Marking is not as specified, class and manufacturer's name and brand missing.
102	Sheets	Surface is not free of scratches, gouges, indentation or bumps.
103	Sheets	Evidence of lubricant on the sheets.
104	Sheets	Sheet is damaged; not suitable for making gaskets.
105	Sheets	Thickness not as specified.
Minor 201	Sheets	Width and length not as specified.

4.4.4 Lot tests The rolls or sheets shall be subjected to the tests specified in 4.5.2 through 4.5.9. Failure in any test shall be cause for rejection of the lot.

4.5 Tests.

4.5.1 Dimensions and tolerances.

4.5.1.1 Thickness Thickness shall be determined in accordance with ASTM F 104 (see 3.3.1)

4.5.1.2 Width and length. Width and length shall be determined by direct measurement using a standard tape or ruler (see 3.3.2).

4.5.2 Tensile strength. Tensile strength shall be determined in accordance with ASTM F 152, method A (see 3.4).

4.5.3 Fluid and media compatibility. Fluid and media compatibility shall be determined in accordance with ASTM F 146. The test shall be conducted at 70 to 85°F and specimens shall be conditioned as specified for type I (see 3.5)

4.5.4 Sealability. Sealability shall be determined in accordance with ASTM F 37, method B (see 3.6). An external compressive load of 3,000 lb/in² gauge, a control pressure of a 30 lb/in² gauge, and in accordance with ASTM D 471 standard fuel A shall be used.

4.5.5 Compressibility and recovery Compressibility and recovery shall be determined in accordance with procedure A of ASTM F 36 (see 3.7)

4.5.6 Creep relaxation. Creep relaxation shall be determined in accordance with method B of ASTM F 38 using steel platens and 1/16-inch thick material (see 3.8).

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4.5.7 Adhesion. Adhesion shall be determined in accordance with the procedure specified in appendix A (see 3.9).

4.5.8 Flexibility. Flexibility shall be determined in accordance with ASTM F 147. A mandrel with a diameter 12 times the nominal thickness of the specimen shall be used (see 3.10).

4.5.9 Performance. Performance testing shall be as specified in 4.5.9.1 and 4.5.9.2 using the criteria of appendix B (see 3.11 and 3.12).

4.5.9.1 Flange assemblies. Three standard flange assemblies shall be required as test fixtures. The flange assembly configuration is shown on figure 1 and specified as follows:

- (a) 1-inch steel flange in accordance with ANSI B16.5, class 400
- (b) 3-inch steel flange in accordance with ANSI B16.5, class 400.
- (c) 8-inch steel flange in accordance with ANSI B16.5, class 400

4.5.9.2 Testing the material. The gasket material shall be tested using the three flange assemblies for 300 hours. The assemblies shall be allowed to cool to ambient temperature at the end of 100-hour periods in order to evaluate thermal cycling. Retorquing of the flange bolts is permitted on start-up cycles, if required. A maximum of two retorques shall be permitted.

4.6 Inspection of packaging. Sample packages and packs, and the inspection of the preservation, packing and marking for shipment, stowage, and storage shall be in accordance with the requirements of section 5 and the documents specified therein.

5. PACKAGING

(The packaging requirements specified herein apply only for direct Government acquisition.)

5.1 General. Unless otherwise specified (see 6.2), compressed sheet gasket material shall be furnished in roll form. Unless otherwise specified (see 6.2), roll weight shall be in accordance with the manufacturer's normal practice. Rolls shall consist of only one width and length of material.

5.1.1 Navy shipboard stowage fire-retardant requirements.

- (a) Treated lumber and plywood. Unless otherwise specified (see 6.2), all lumber and plywood including laminated veneer material used in shipping container and pallet construction, members, blocking, bracing, and reinforcing shall be fire-retardant treated material conforming to MIL-L-19140 as follows:

- Levels A and B - Type II - weather resistant
 - Category 1 - general use.
- Level C - Type I - non-weather resistant
 - Category 1 - general use.

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- (b) Fiberboard Fiberboard used in the construction of class-domestic, non-weather resistant fiberboard and cleated fiberboard boxes including interior packing forms shall meet the flame-spread index and the specific optic density requirements of PPP-F-320.

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

5.2.1 Level A. Rolls shall be individually protected as specified herein and shall meet the requirements for method IC (waterproof) of MIL-P-116. Rolls shall be restrained from unwinding. Each roll shall be wrapped with either an opaque or transparent barrier material conforming to PPP-B-1055 or L-P-378, respectively, at the contractor's option. The barrier wrap closures, seams, and joints shall be sealed to afford waterproofness equal to that of the protective barrier wrap. A minimum of 2-inch overlap shall be provided at all overlapping edges.

5.2.2 Level C. Rolls shall be protected as specified for level A, except that the barrier wrap material shall conform to commercial or industry standards.

5.2.3 Commercial. Preservation and unit packaging shall be in accordance with ASTM D 3951.

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

5.3.1 General requirements for levels A, B, and C.

5.3.1.1 Containers. Containers selected shall be of minimum weight and cube consistent with the protection required, of uniform size, and contain identical quantities of identical gasket material, and shall be packed in exterior containers in accordance with MIL-STD-2073-1, table VII of appendix C. Unless otherwise specified (see 6.2), container selection shall be at the contractor's option.

5.3.1.2 Case liners, closure, and gross weight.

5.3.1.2.1 Case liners. Unless otherwise specified (see 6.2), level A shipping containers shall be provided with waterproof case liners in accordance with MIL-STD-1186.

5.3.1.2.2 Closure. Shipping containers, except as otherwise specified herein, shall be closed, reinforced, or banded in accordance with the applicable container specification or appendix thereto. Fiberboard boxes conforming to PPP-B-636, class weather-resistant, shall be closed in accordance with method V and reinforced with nonmetallic or tape banding; class domestic shall be closed in accordance with method I using pressure sensitive tape in accordance with the appendix of the box specification.

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5.3.1.2.3 Weight. Unless otherwise specified (see 6.2), the gross weight of wood, plywood, and cleated boxes shall not exceed 200 pounds unless the weight of a single item exceeds 200 pounds. Boxes exceeding 200 pounds gross weight shall be modified as specified herein. Fiberboard boxes conforming to PPP-B-640 may be used for individual items exceeding 200 pounds provided the box is modified with reinforcing strength members for stacking and modified as specified herein. Wood, plywood, and cleated type containers exceeding 200 pounds gross weight shall be modified by the addition of skids in accordance with MIL-STD-2073-1, appendix F, or the applicable container specifications and appendix thereto.

5.3.1.2.4 Commercial. Material preserved as specified (see 5.2) shall be packed for shipment in accordance with ASTM D 3951 and 5.3.1.2.2.

5.3.1.2.5 Container modification. Shipping containers exceeding 200 pounds gross weight shall have a minimum of two 3- by 4-inch nominal wood skids laid flat, or a skid or sill type of base that will support the material and facilitate handling by mechanical handling equipment during transportation, storage, and stowage.

5.4 Palletized unit loads. When specified (see 6.2), shipping containers shall be palletized in accordance with MIL-STD-2073-1, appendix F.

5.5 Marking.

5.5.1 Level A, B, and C. In addition to any special marking required (see 3.13, 6.2, or herein), interior (unit and intermediate) packs, shipping containers and palletized unit loads shall be marked for shipment, storage, and stowage in accordance with MIL-STD-2073-1, appendix F.

5.5.2 Commercial. In addition to any special marking required (see 3.13, 6.2, or herein), interior (unit and intermediate) packs and shipping containers shall be marked in accordance with ASTM D 3951.

5.5.3 Bar coding. Unless otherwise specified (see 6.2), bar code markings shall be applied on interior (unit and intermediate) packs, exterior shipping containers, and palletized unit loads in accordance with MIL-STD-2073-1, appendix F.

6. NOTES

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

6.1 Intended use. Sheet gasket material is intended for use in refrigerant piping joints for service up to 150 lb/in² gauge, 275°F (135°C), and in vacuum service applications up to 18 inches Hg gauge and minus 60°F (minus 51°C). The gasket material specified in this specification is generally defined in ASTM F 104 as type 7, class 1 materials.

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6.2 Acquisition requirements Acquisition documents must specify the following:

- (a) Title, number, and date of this specification
- (b) Issue of DoDISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1.1 and 2.2).
- (c) First article sample, when required (see 3.1).
- (d) Material requirements, if other than as specified (see 3.2.1).
- (e) Thickness required (see 3.3 1)
- (f) Length and width required (see 3.3.2).
- (g) Identification markings, if other than as specified (see 3 13)
- (h) Inspection conditions, if other than as specified (see 4 2 1)
- (i) If form other than rolls is required (see 5.1).
- (j) Roll weight, if other than specified (see 5.1).
- (k) When fire-retardant treatment is not required (see 5.1.1)
- (l) Level of preservation and packing required (see 5.2 and 5.3)
- (m) When container selection is not at contractor's option (see 5.3.1.1).
- (n) When case liners are not required (see 5 3.1.2.1)
- (o) Gross weight, if other than specified (see 5.3.1.2.3)
- (p) Palletization, when required (see 5 4).
- (q) Special marking required (see 5.5.1 and 5.5.2).
- (r) When bar coding is not required (see 5.5.3).

6.3 Consideration of data requirements. The following data requirements should be considered when this specification is applied on a contract. The applicable Data Item Descriptions (DIDs) should be reviewed in conjunction with the specific acquisition to ensure that only essential data are requested/provided and that the DIDs are tailored to reflect the requirements of the specific acquisition. To ensure correct contractual application of the data requirements, a Contract Data Requirements List (DD Form 1423) must be prepared to obtain the data, except where DoD FAR Supplement 27.475-1 exempts the requirement for a DD Form 1423.

<u>Reference Paragraph</u>	<u>DID Number</u>	<u>DID Title</u>	<u>Suggested Tailoring</u>
4.3	DI-T-4902	First article inspection report	----
4.4	DI-T-5329	Inspection and test reports	----

The above DIDs were those cleared as of the date of this specification. The current issue of DoD 5010.12-L, Acquisition Management Systems and Data Requirements Control List (AMSDL), must be researched to ensure that only current, cleared DID's are cited on the DD Form 1423.

6.4 First article. When first article inspection is required, the contracting officer should provide specific guidance to offerors whether the item(s) should be a preproduction sample, a first article sample, a first production item, a sample selected from the first lot production items, a standard production item from the contractor's current inventory (see 3 1), and the number

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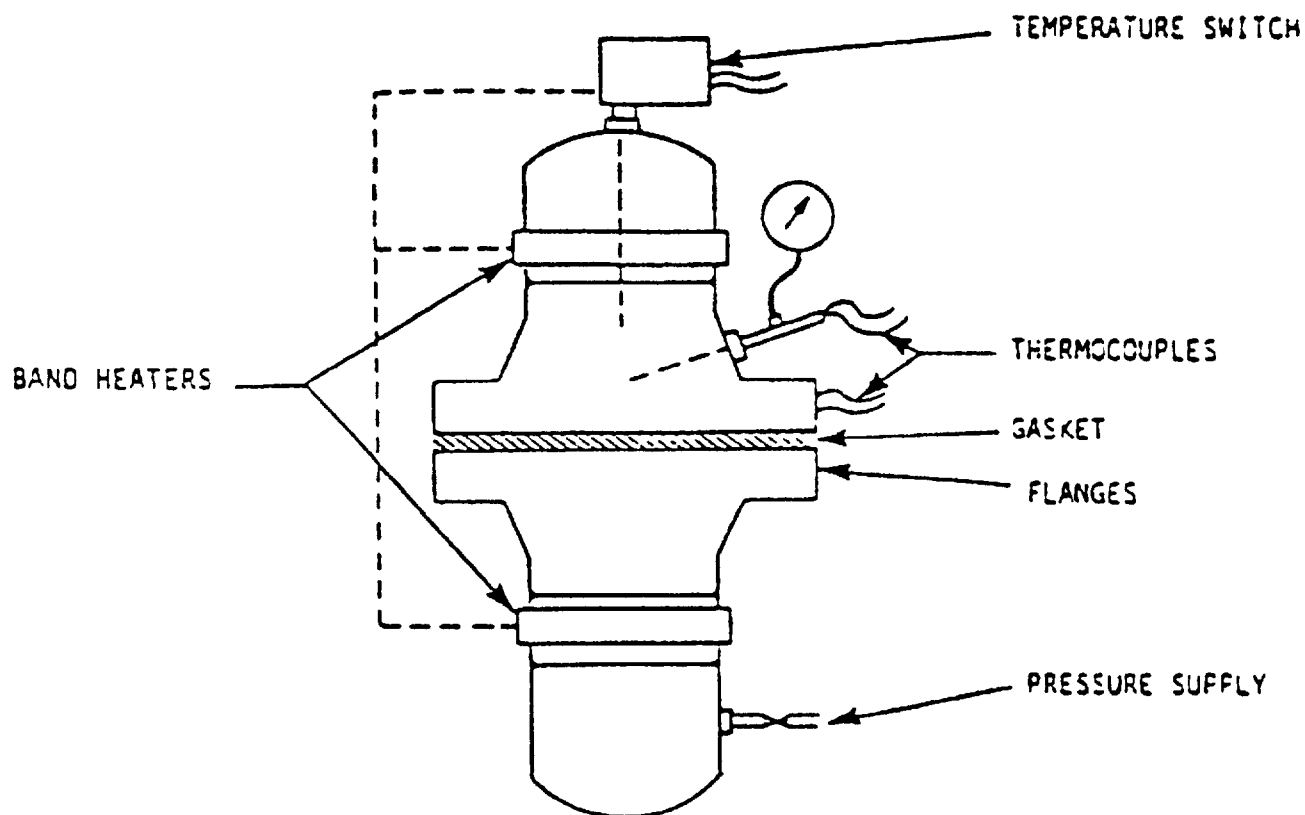
of items to be tested as specified in 4.3. The contracting officer should also include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results, and disposition of first articles. Invitations for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract. Bidders should not submit alternate bids unless specifically requested to do so in the solicitation

6.5 Subject term (key word) listing.

Binder
Creep relaxation
Flange assemblies
Fluid compatibility
Leachable chlorides
Mandrel

Preparing activity
Navy - SH
(Project 5330-N105)

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SH 131805

Flange data				Gasket specimen dimensions (inches)		
Flange size (inch)	Type	Class	Assembly vol. (liters)	Id	Od	Thickness
1	ANSI B16.5	400	2.54	1.31	2.88	1/32
3	ANSI B16.5	400	7.62	3.375	8.13	1/16
8	ANSI B16.5	400	20.32	8.62	12.00	1/8

FIGURE 1. Test flange assembly

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APPENDIX A

PROCEDURE TO DETERMINE GASKET MATERIAL
ADHESION TO METAL SURFACES

10. SCOPE

10.1 Scope. This appendix specifies the method used to determine the degree gasket materials will adhere to metal surfaces while under compression. It consists of procedures in accordance with ASTM F 607. This appendix is a mandatory part of the specification. The information contained herein is intended for compliance.

10.2 Plan. This test procedure involves placing a gasket material sample between flat platens of various metallic compositions, compressing the gasket material to a desired clamping load, and subjecting the assembly to a specified set of conditions. The force required to separate the platens and the condition of the gasket is then evaluated (see 3.9).

20. APPLICABLE DOCUMENTS

20.1 Non-Government publications. The following documents form a part of this specification 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.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

A 666 - Standard Specification for Austenitic Stainless Steel,
Sheet, Strip, Plate, and Flat Bar for Structural
Applications. (DoD adopted)

A 709 - Standard Specification for Structural Steel for
Bridges.

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

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

HS J429 - Mechanical and Material Requirements for Externally
Threaded Fasteners.

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

(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.)

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APPENDIX A

30 TEST APPARATUS

30.1 Equipment. Test equipment shall include the following.

- (a) Condition cabinet or room maintained at 70 to 85°F (21 to 29°C) with 50 to 55 percent relative humidity.
- (b) Controlled temperature oven maintained at $425 \pm 39^\circ\text{F}$ ($218 \pm 4^\circ\text{C}$)
- (c) Metal platens - flat, circular plates of metal as specified below having a diameter of 3 inches and a minimum thickness of 1 inch. A 0.405-inch diameter hole shall be drilled through the center of each platen to accommodate a 3/8 by 3-inch bolt in accordance with grade 7 of SAE HS J429, 24 threads per inch. Platens shall be fabricated from the following metals.
 - (1) Stainless steel to stainless steel (ASTM A 666 or equal)
 - (2) Carbon steel to carbon steel (ASTM A 709 or equal)
- (d) Socket set and torque wrench calibrated in foot-pounds.
- (e) Sharp knife, flat-bladed screwdriver, and a small hammer or mallet.

40. TEST SPECIMENS

40.1 Material. Three circular test specimens of each material shall be tested. The surface of the gasket material shall be kept clean and free of oil deposits and other foreign matter. No substances shall be used during the cutting operation for die lubrication or for any other purpose where they may come in contact with the specimen. Care shall be taken to cut cleanly, with minimum burrs or loose fibers. Specimens shall be cut from 1/16-inch gasket stock with an inside diameter of 1.25 inches and an outside diameter of 2.0 ± 0.02 inches.

40.2 Platens. The metal platens used in the test shall be finished to assure parallelism of the surfaces. The platen faces shall be finished to a profile of 60 microinches roughness absolute maximum. The platens shall be chamfered slightly on all edges. They shall be washed clean with reagent grade 1, 1, 1 - trichloroethane or other suitable solvent to remove any traces of oil, grease, or other foreign substance. Care should be taken after cleaning the platens to handle them by the edges before assembly for testing.

50. CONDITIONING

50.1 Preparation. Specimens shall be preconditioned for 4 hours at 70 to 85°F (21 to 29°C) in a desiccator containing anhydrous calcium chloride. Specimens shall then be transferred to a controlled humidity cabinet or to a room with gentle air circulation and conditioned for at least 20 hours at 70 to 85°F (21 to 29°C) with 50 to 55 percent relative humidity.

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60 PROCEDURE

60.1 Steps. The following steps shall be performed to determine gasket material adhesion to metal surfaces:

- (a) Assemble the platens with the conditioned gasket specimens to form a sandwich with the specimen carefully centered between the platens
- (b) Lubricate the threads of the 3/8 by 3-inch bolt very lightly, using molybdenum disulfide in powder or spray form (do not use oil). Carefully insert the bolt through the two platens, install a flat plate washer to the threaded side of the bolt, and screw on the nut, finger tight. Avoid contaminating the gasket and the platen with the lubricant. Place the assembly in a vise or other holding mechanism, clamp the bolt head, and torque the nut to 45 foot-pounds.
- (c) Place the platen and gasket assemblies in a controlled oven and maintain a temperature of 425°F (218°C) within 39°F (4°C) for 5 days (120 hours).
- (d) Remove the platen and gasket assemblies from the oven and allow to cool at room temperature for 24 hours.
- (e) Remove the nut, bolt, and washer from the platen and gasket assembly and test for adhesion.
- (f) Separate the platens from the gasket material. If necessary, pry the platens apart with a knife or flat-bladed screwdriver. A small hammer or mallet may be required to tap the prying tool between the platens. Take care to avoid or minimize damage to the surface of the platens.
- (g) Adhesion scale. The degree of adhesion shall be recorded using the following scale as a guideline
 - (1) Complete separation from both platens. No indication of adhesion or very slight adhesion.
 - (2) Slight force necessary to separate platens. Moderate adhesion to one platen, but gasket can be separated cleanly.
 - (3) Considerable force necessary to separate platens. Considerable adhesion to one platen. Gasket can be separated in one piece, but surface fibers remain adhering to one or both platens.
 - (4) Considerable force necessary to separate platens. Considerable adhesion to one platen. Gasket can be separated in one piece, but small patches remain adhering to one or both platens.
 - (5) Gasket torn or delaminated upon separation of platens and cannot be removed from platen without further tearing. Must be scraped for complete removal

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APPENDIX B

REFRIGERANT EXPOSURE AND LEAKAGE TEST

10 SCOPE

10.1 Scope. This appendix describes a refrigerant exposure test for determining the performance of gasket materials covered by this specification. This appendix is a mandatory part of the specification. The information contained herein is intended for compliance.

20 APPLICABLE DOCUMENTS

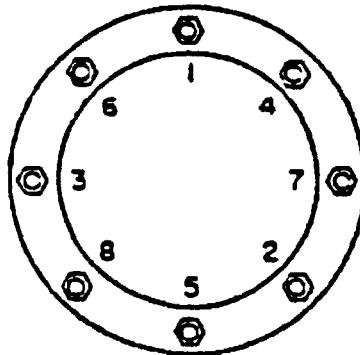
This section is not applicable to this appendix.

30. PROCEDURE

30.1 Steps. The following steps shall be performed for the refrigerant exposure test:

Preparation.

- (a) Clean flange face.
- (b) Install the test gasket material in the 1-, 3-, and 8-inch test assemblies.
- (c) Center the gasket on the flange and install the top half of the test flange. Lubricate and hand tighten the flange bolts.
- (d) Using the proper bolt tightening sequence (an 8-bolt flange is shown on figure 2 as an example), torque the flange bolts to the required torque values to obtain a proper seal. Maximum torque ratings for flange bolts as specified in standard ANSI specifications for flange bolt specifications shall not be exceeded. Record the torque value.
- (e) Prior to high side testing and following high side and low side testing, evacuate the flange assemblies to 5 millimeters Hg absolute pressure, isolate the vacuum pump and allow the assemblies to stand under vacuum for 6 hours. There shall be no loss of vacuum during the 6-hour period.



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FIGURE 2. Circular eight bolt

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- (f) Charge the assemblies with refrigerant gas, N₂, and RCO-2 oil (VV-L-825, type II) as follows

1-inch assembly Freon R-12
3-inch assembly Freon R-11
8-inch assembly Freon R-114

Note: RCO-2 should be added first using approximately 10 percent of the volume of the assembly. Freon gas should be added next, then N₂ gas to raise the pressure to the test pressure.

High side testing. The following temperatures and pressures shall be maintained during high side tests.

<u>Refrigerant</u>	<u>Pressure (lb/in² gauge)</u>	<u>Temperature</u>
R-11	30	160 ± 10°F (71°C)
R-12	150	250 ± 10°F (121°C)
R-114	50	150 ± 10°F (66°C)

- (1) Slowly heat the flange assemblies to the specified temperatures and monitor. Pressurize as specified. The heaters are energized by temperature switches which sense the refrigerant temperature. Since the flange and pipe may heat up faster than the refrigerant, the flange temperature should be monitored carefully to insure that overheating does not occur.
- (2) Monitor for 4 hours, checking for leakage and pressure decay. Use a halide leak detector to assist with locating leakage (Decreasing pressure indicates gasket leakage).
- (3) If leakage occurs, retorque the flange bolts and record torque values required to provide a tight pressure seal. Adjust to specified pressure as required. Verify tight seal for a 4-hour period.
- (4) Monitor the test assemblies for temperature and pressure three times per day.
- (5) Check gasket joints each day for refrigerant leakage using a halogen leak detector set at a sensitivity of 1/2 ounce per year.
- (6) After each 100 hours, secure the heaters allowing the test assemblies to cool. Re-energize the heaters after 24 hours and continue test at specified conditions.
- (7) If pressure decreases significantly, check the flange assembly for leakage using pressurized nitrogen. This pressure test (independent of temperature effects) verifies the gasket is the source of the leakage, not the fixture. Check the flange bolt torque to determine if it is loose. Tighten the bolts in 5 foot-pound increments (using pressurized nitrogen) until the required sealing torque is attained. Record the torque values.

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- (8) Recharge the flange assembly with the necessary amount of refrigerant before starting the next thermal cycle.
- (9) If gasket material leaks or fails to hold pressure after two retorques, the gasket shall be considered inadequate.

Low side testing. The following temperatures and vacuum levels shall be maintained during low side tests:

<u>Refrigerant</u>	<u>Vacuum (Hg)</u>	<u>Temperature</u>
R-11	18	45 ± 5°F (7°C)
R-12	5	-20 ± 5°F (-29°C)
R-114	2	45 ± 5°F (7°C)

- (1) After high side testing is completed, install new gaskets using steps (a) through (d) above, and perform low side tests. Using a vacuum pump, pull to specified vacuum in each flange assembly (evacuation of freon is accepted).
- (2) Cool flange assemblies as specified. Flange assemblies may be contained in a refrigeration chamber to accomplish this test.
- (3) Monitor for 4 hours, checking for leakage (loss of vacuum indicates leakage). No retorques are allowed on low side tests.
- (4) Monitor the test assemblies for vacuum and temperature three times per day.
- (5) Check gasket joints each day for refrigerant leakage using a hydrogen leak detector set at a sensitivity of 1/2 ounce per year.
- (6) After each 100 hours, allow assemblies to return to ambient temperature for 24 hours.
- (7) After testing each material and size, remove gaskets from flange assemblies.
- (8) Examine for adhesion, deformation, corrosion, permanent indentations, or cracks.

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MILITARY SPECIFICATION

GASKET, SHEET, REFRIGERATION, NON-ASBESTOS

MIL-G-24717(SH) dated 31 March 1989, has been determined to be inactive for new design.

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