INCH-POUND
MIL-DTL-24696D(SH)
21 July 2020
SUPERSEDING
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# DETAIL SPECIFICATION

# GASKET, SHEET, NON-ASBESTOS

This specification is approved for use by the Naval Sea Systems Command 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 of non-asbestos sheet gasket material for non-propulsion and propulsion steam, water applications, and all petroleum-based hydraulic and lube oil applications.

1.2 Classification.

a. Type I – Gaskets exposed to saturated steam service up to 366 °F and 150 pounds per square inch gauge (psig)

b. Type II – Gaskets not exposed to steam for:

(1) Water service applications up to 300 °F and 1,800 psig,

(2) Lube oil service up to 250 °F and 150 psig, and

(3) Hydraulic oil service up to 180 °F and 600 psig.

1.3 Part or identifying number (PIN). PINs to be used for non-asbestos sheet gasket material acquired to this specification are created as follows:

| **M** | **24696** | **-** | **X** | **X** |
|---|---|---|---|---|
| Prefix for Military Specification | Specification Number | - | Type (see code below) | Dimension Code (see code below) |

| Gasket Type Code | | Dimension Code | |
|---|---|---|---|
| Type | Code | Dimensions | Code |
| I | A | See table I | 001 through 034 |
| II | B | See table II | 051 through 077 |

Example: M24696-A001 is a 60-inch, 0.016-inch thick, 60-inch wide flat gasket sheet

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

AMSC N/A FSC 5330

TABLE I. Dimensions and tolerances for flat sheet gasket stock.

| Dash no. | Length in (±1.0) inches | Thickness in inches (tolerances) | Width in (±1.0) inches |
|---|---|---|---|
| 001 | 60 | 0.016 (±0.005, -0.002) | 60 |
| 002 | 59.1 | 0.030±0.005 | 59.1 |
| 003 | 36 | 0.031±0.005 | 24 |
| 004 | 54 | 0.031±0.005 | 31.5 |
| 005 | 50 | 0.031±0.005 | 50 |
| 006 | 60 | 0.031±0.005 | 60 |
| 007 | 75 | 0.031±0.005 | 60 |
| 008 | 36 | 0.062±0.006 | 18 |
| 009 | 36 | 0.062±0.006 | 36 |
| 010 | 40 | 0.062±0.006 | 40 |
| 011 | 50 | 0.062±0.006 | 50 |
| 012 | 54 | 0.062±0.006 | 31.5 |
| 013 | 60 | 0.062±0.006 | 60 |
| 014 | 59.1 | 0.060±0.006 | 59.1 |
| 015 | 63 | 0.062±0.006 | 54 |
| 016 | 150 | 0.062±0.006 | 50 |
| 017 | 48 | 0.094±0.009 | 36 |
| 018 | 50 | 0.094±0.009 | 50 |
| 019 | 63 | 0.094±0.009 | 54 |
| 020 | 20 | 0.125±0.010 | 12 |
| 021 | 24 | 0.125±0.010 | 24 |
| 022 | 36 | 0.125±0.010 | 36 |
| 023 | 36 | 0.125±0.010 | 72 |
| 024 | 50 | 0.125±0.010 | 50 |
| 025 | 60 | 0.125±0.010 | 36 |
| 026 | 60 | 0.125±0.010 | 60 |
| 027 | 59.1 | 0.120±0.012 | 59.1 |
| 028 | 153 | 0.125±0.010 | 36 |
| 029 | 36 | 0.188±0.020 | 24 |
| 030 | 36 | 0.188±0.020 | 36 |
| 031 | 50 | 0.188±0.020 | 50 |
| 032 | 50 | 0.250±0.025 | 50 |
| 033 | 12.31 | 0.062±0.006 | 1 |
| 034 | 50 | 0.125±0.010 | 10 |

TABLE II. Dimensions and tolerances for pre-cut round gaskets.[1/]

| Dash no. | O.D. in inches | Thickness in inches | I.D. in inches | Number of holes | Diameter of holes in inches | Bolt circle diameter in inches |
|---|---|---|---|---|---|---|
| 051 | 7.125 | 0.062 | 4 | --- | --- | --- |
| 052 | 3.5625 | 0.125 | 0.625 | --- | --- | --- |
| 053 | 3.625 | 0.125 | 0.6875 | 4 | 0.625 | 2.380 |
| 054 | 3.625 | 0.125 | 1.0625 | --- | --- | --- |
| 055 | 3.8125 | 0.125 | 0.750 | --- | --- | --- |
| 056 | 4.250 | 0.125 | 1.125 | --- | --- | --- |
| 057 | 4.250 | 0.125 | 1.3125 | 4 | 0.562 | 3.125 |
| 058 | 5.125 | 0.125 | 1.375 | --- | --- | --- |
| 059 | 5.5625 | 0.125 | 2.125 | 6 | 0.6875 | 4.4375 |
| 060 | 5.5625 | 0.125 | 2.250 | --- | --- | --- |
| 061 | 5.5625 | 0.125 | 2.375 | 6 | 0.562 | 4.4375 |
| 062 | 5.5625 | 0.125 | 2.500 | --- | --- | --- |
| 063 | 6.125 | 0.125 | 2.750 | --- | --- | --- |
| 064 | 6.125 | 0.125 | 2.875 | 6 | 0.562 | 5 |
| 065 | 6.625 | 0.125 | 3.375 | --- | --- | --- |
| 066 | 7.6875 | 0.125 | 4.500 | 8 | 0.562 | 6.562 |
| 067 | 9.0625 | 0.125 | 5.375 | --- | --- | --- |
| 068 | 9.0625 | 0.125 | 6.375 | --- | --- | --- |
| 069 | 2.0625 | 0.062 | 1.625 | --- | --- | --- |
| 070 | 5.875 | 0.062 | 3 | --- | --- | --- |
| 071 | 1 | 0.125 | 0.188 | --- | --- | --- |
| 072 | 7.875 | 0.062 | 0.062 | --- | --- | --- |
| 073 | 7.625 | 0.016 | 0.016 | 20 | 0.468 | 6.75 |
| 074 | 6.750 | 0.062 | 0.062 | --- | --- | --- |
| 075 | 4.620 | 0.125 | 0.125 | --- | --- | --- |
| 076 | 9.000 | 0.062 | 0.062 | 8 | 0.750 | 7.50 |
| 077 | 3.250 | 0.062 | 0.062 | --- | --- | --- |

NOTE:

[1/] Tolerances shall be in accordance with ASME B16.21.

## 2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

FEDERAL STANDARDS

FED-STD-313 - Material Safety Data, Transportation Data and Disposal Data for Hazardous Materials Furnished to Government Activities

(Copies of this document are available online at https://quicksearch.dla.mil.)

2.2.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

NAVAL SEA SYSTEMS COMMAND (NAVSEA) PUBLICATIONS

T9070-AL-DPC-020/077-2 - NAVSEA Hazardous Material Avoidance Process

(Copies of this document are available online via Technical Data Management Information System (TDMIS) at https://mercury.tdmis navy mil/ by searching for the document number without the suffix. Refer questions, inquiries, or problems to: DSN 296-0669, Commercial (805) 228-0669. This document is available for ordering (hard copy) via the Naval Logistics Library (NLL) at https://nll.navsup navy mil. For questions regarding the NLL, contact the NLL Customer Service at nllhelpdesk@navy.mil, (866) 817-3130, or (215) 697-2626/DSN 442-2626.)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.21 - Nonmetallic Flat Gaskets for Pipe Flanges

(Copies of this document are available online at www.asme.org.)

ASTM INTERNATIONAL

ASTM D471 - Standard Test Method for Rubber Property-Effect of Liquids

ASTM D512 - Standard Test Methods for Chloride Ion in Water

ASTM D1179 - Standard Test Methods for Fluoride Ion in Water

ASTM D1246 - Standard Test Method for Bromide Ion in Water

ASTM D3223 - Standard Test Method for Total Mercury in Water

ASTM D3557 - Standard Test Methods for Cadmium in Water

ASTM D4190 - Standard Test Method for Elements in Water by Direct-Current Plasma Spectroscopy

ASTM D4327 - Standard Test Method for Anions by Chemically Suppressed Ion Chromatography

ASTM F36 - Standard Test Method for Compressibility and Recovery of Gasket Materials

ASTM F37 - Standard Test Methods for Sealability of Gasket Materials

ASTM F38 - Standard Test Methods for Creep Relaxation of a Gasket Material

ASTM F104 - Standard Classification System for Nonmetallic Gasket Materials

ASTM F147 - Standard Test Method for Flexibility of Non-Metallic Gasket Materials

ASTM F152 - Standard Test Methods for Tension Testing of Nonmetallic Gasket Materials

ASTM F1574 - Standard Test Method for Compressive Strength of Gaskets at Elevated Temperatures

(Copies of these documents are available online at www.astm.org.)

GERMAN INSTITUTE FOR STANDARDIZATION (DIN)

DIN 52913 - Testing of Static Gaskets for Flange Connections – Compression Creep Testing of Gaskets Made from Sheets

(Copies of this document are available online at www.din.de.)

2.4 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 Qualification. Gaskets furnished under this specification shall be products that are authorized by the qualifying activity for listing on the applicable qualified products list before contract award (see 4.2 and 6.4).

3.2 Material.

3.2.1 Composition. The material shall not contain any asbestos. The material shall be according to the contractor's design and as specified in 3.2.1.1 or 3.2.1.2.

3.2.1.1 Type I composition. The sheet gasket material shall be of a graphite laminate type with a corrosion-resistant metal core.

3.2.1.2 Type II composition. The sheet gasket material shall be composed of various organic or inorganic materials and binders.

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

3.2.3 Safety data sheet (SDS). As specified (see 6.2), the SDS shall be provided in accordance with FED-STD-313.

3.2.4 Toxicity. When evaluated in accordance with 4.6.1, the gasket material shall pose no serious or high risk to the health of personnel or the environment when used for its intended purpose (see 4.6.1 and 6.3).

3.2.5 Prohibited materials. The gasket material shall not contain any chemicals categorized as "prohibited" in accordance with T9070-AL-DPC-020/077-2.

3.3 Dimensions and tolerances. The dimensions and tolerances of sheet gasket material shall be in accordance with table I and table II as specified (see 4.5.1.1, 4.5.1.2, and 6.2).

3.4 Tensile strength.

3.4.1 Type I. For a thickness of 0.0313-inch, tensile strength shall be a minimum of 3,500 psig in the weakest axis (see 4.5.2). For a thickness of 0.0625 inch, tensile strength shall be a minimum of 1,750 psig in the direction of the weakest axis (see 4.5.2). For a thickness of 0.125-inch, tensile strength shall be a minimum of 875 psig in the weakest axis (see 4.5.2).

3.4.2 Type II. For a thickness of 0.0625 inch, tensile strength shall be a minimum of 1,700 psig in the direction of the weakest axis (see 4.5.2).

3.5 Sealability (type II only). The gasket shall have a leak rate not greater than 0.034 ounces per hour (1 milliliter [mL]) (see 4.5.4).

3.6 Compressibility and recovery (type II only). Compressibility shall be within the range of 7 to 17 percent. Recovery shall be not less than 40 percent (see 4.5.5).

3.7 Creep relaxation (type II only). Creep relaxation shall be not greater than 60 percent (see 4.5.6).

3.8 Adhesion (type II only). Adhesion shall be not greater than step 3 of the scale specified in A.6.1.g of Appendix A (see 4.5.7).

3.9 Flexibility (type II only). The material shall not crack or delaminate when bent around a mandrel with a diameter 12 times the nominal thickness of the gasket material (see 4.5.8).

3.10 Compressive strength.

3.10.1 Type I. Compression resistance shall be 4,350 psi or higher when tested at a temperature of 572 °F (see 4.5.9.1).

3.10.2 Type II. Compressive strength shall be such that the area change is not greater than 20 percent (see 4.5.9.2).

3.11 Detrimental materials. Detrimental materials shall not exceed the maximum concentrations specified in table III (see 4.5.3).

TABLE III. Detrimental materials.

| Material | Maximum concentration permitted (ppm) |
|---|---|
| Asbestos | None permitted |
| Water leachable Halogens (total of chloride, fluoride, and bromide) 1/ | 1,000 |
| Lead | 250 |
| Mercury and compounds (none intentionally added) 2/ | 10 |
| Sulfur | 10,000 |

NOTES:

1/ Materials containing greater than 1,000 parts per million (ppm) total water leachable halides are acceptable provided that neither chlorides nor bromides exceed 250 ppm (see 4.5.3).

2/ During manufacturing, fabrication, handling, packaging, and packing, the gasket material shall not come in contact with mercury or mercury compounds.

3.12 Performance.

3.12.1 Steam exposure (type I).

3.12.1.1 Steam exposure using raised-face flanges. The gasket material shall provide a seal on two standard piping flange assemblies for 300 hours at 150 psig and maintained at a temperature of 366 °F (see 4.5.10.1.1).

3.12.1.2 Steam exposure using flat-faced flanges. The gasket material shall provide a seal on one standard piping flange assembly for 100 hours at 150 psig and be maintained at a temperature of 366 °F (see 4.5.10.1.2).

3.12.1.3 Steam exposure with dynamic pulse using flat-faced flanges. When tested as specified (see 4.5.10.1.3), the gasket shall not allow a blow-out or loss of 3.4 ounces per hour (100 mL) or more of fluid from the flange assembly.

3.12.2 Type II.

3.12.2.1 Water exposure.

3.12.2.1.1 Raised-face flange. The gasket material shall provide a seal on two standard piping flange assemblies for 300 hours at 400 psig and be maintained at a temperature of 300 °F during thermal cycles. Water system pressure shall be not less than 400 psig after each 100-hour cycle and at normal system pressure checks (see 4.5.10.2.1).

3.12.2.1.2 Flat-faced flange. The gasket material shall provide a seal for 100 hours at 315 psig minimum and be maintained at ambient temperature (see 4.5.10.2.2).

3.12.2.1.3 High-pressure exposure with raised-face flange.

3.12.2.1.3.1 Sealability. The gasket material shall provide a seal on two standard piping flange assemblies for 100 hours at 1,800 psig and be maintained at a temperature of 300 °F during thermal cycles. The minimum cool down time between cycles is 8 hours (see 4.5.10.2.3.1).

3.12.2.1.3.2 Blow-out test. Gasket materials shall be tested according to the blow-out test in Appendix J at 450°F and shall maintain integrity to a limit of 4,500 psig (see 4.5.10.2.3.2).

3.12.2.2 Lube oil exposure.

3.12.2.2.1 Raised-face flange. The gasket material shall provide a seal on a 1-inch standard piping flange assembly for 500 hours at 150 psig and shall be maintained at a temperature of 250 °F during thermal cycles (see 4.5.10.3.1).

3.12.2.2.2 Flat-faced flange. The gasket material shall provide a seal on a 3-inch standard piping flange assembly for 500 hours at 150 psig and shall be maintained at a temperature of 250 °F during thermal cycles (see 4.5.10.3.2).

3.12.2.3 Hydraulic oil exposure.

3.12.2.3.1 Raised-face flange. The gasket shall provide a seal on a raised-face flange for 500 hours at 600 psig and shall be maintained at a temperature of 180 °F during thermal cycles (see 4.5.10.4.1).

3.12.2.3.2 Flat-faced flange. The gasket shall provide a seal on a flat-faced flange for 500 hours at 600 psig and shall be maintained at a temperature of 180 °F during thermal cycles (see 4.5.10.4.2).

3.13 Identification markings. Markings shall be not less than 0.375 inch in height, on one side only, and on every square foot or less of the material. Unless otherwise specified (see 6.2), each sheet shall be legibly and permanently marked with the following information:

a. Non-asbestos

b. Specification number, including type

c. Manufacturer’s name

d. Manufacturer's product identification

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.

4. VERIFICATION

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

a. Qualification inspection (see 4.2).

b. Conformance inspection (see 4.3).

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

4.2 Qualification inspection. Qualification inspection shall include the examination of 4.4 and the tests of 4.5 as specified in table IV. Qualification inspection shall be conducted at a laboratory acceptable to the Naval Sea Systems Command (NAVSEA).

4.2.1 Qualification sample. With the exception of performance tests (see 4.2.1.1), the qualification sample shall be drawn from a production batch and shall consist of a randomly selected sample quantity from each lot of completed rolls or sheets as specified in table V and table VI for all other qualification tests.

4.2.1.1 Sample for performance tests. One randomly selected sample for each test specified in 4.5.10 shall be tested.

TABLE IV. Examinations and tests.

| Item | Qualification testing required | Conformance testing required | Requirement paragraph | Test method paragraph |
|---|---|---|---|---|
| Toxicity | Yes | No | 3.2.4 | 4.6.1 |
| Prohibited materials | Yes | No | 3.2.5 | 4.6.2 |
| Thickness | Yes | Yes | 3.3 | 4.5.1.1 |
| Width and length | Yes | Yes | 3.3 | 4.5.1.2 |
| Tensile strength | Yes | Yes | 3.4 | 4.5.2 |
| Sealability (type II only) | Yes | Yes | 3.5 | 4.5.4 |
| Compressibility/recovery (type II only) | Yes | Yes | 3.6 | 4.5.5 |
| Creep relaxation (type II only) | Yes | Yes | 3.7 | 4.5.6 |
| Adhesion (type II only) | Yes | Yes | 3.8 | 4.5.7 |
| Flexibility (type II only) | Yes | Yes | 3.9 | 4.5.8 |
| Compressive strength | Yes | Yes | 3.10 | 4.5.9 |
| Total detrimental materials | Yes | No | 3.11 | 4.5.3 |
| Steam/water/lube oil/hydraulic oil exposure (performance) | Yes | No | 3.12 | 4.5.10 |
| Identification markings | Yes | Yes | 3.13 | 4.4 |
| Workmanship | Yes | Yes | 3.14 | 4.4 |

TABLE V. Sampling for visual examination of gasket material.

| Lot size (rolls or sheets) | | | Sample size (rolls or sheets) |
|---|---|---|---|
| 2 | to | 8 | 2 |
| 9 | to | 25 | 3 |
| 26 | to | 50 | 5 |
| 51 | to | 90 | 7 |
| 91 | to | 150 | 11 |
| 151 | to | 280 | 13 |
| 281 | to | 500 | 16 |
| 501 | to | 1,200 | 19 |
| 1,201 | to | 3,200 | 23 |
| 3,201 | to | 10,000 | 29 |
| 10,001 | to | 35,000 | 35 |

TABLE VI. Sampling for tests.[1/, 2/]

| Lot size (rolls or sheets) | | | Sample size (rolls or sheets) |
|---|---|---|---|
| 2 | to | 25 | 1 |
| 26 | to | 50 | 2 |
| 51 | to | 90 | 4 |
| 91 | to | 150 | 7 |
| 151 | to | 280 | 10 |
| 281 | to | 500 | 11 |
| 501 | to | 1,200 | 15 |
| 1,201 | to | 3,200 | 18 |
| 3,201 | to | 10,000 | 22 |
| 10,001 | to | 35,000 | 29 |

NOTES:

1/ Does not pertain to performance tests (see 4.2.1.1)

2/ For compressed sheet made from discreet batches or mixes, testing shall not exceed one sample per batch of material mixed.

4.3 Conformance inspection. Conformance inspection shall include the examination of 4.4 and the tests of 4.5 designated as conformance as specified in table IV.

4.3.1 Lot. For the purpose of conformance inspection and test sampling, a lot is defined as all sheets of the same composition, thickness, width, and length produced in one facility, using the same production processes and materials, and being offered for delivery at one time.

4.3.2 Sampling for conformance inspection.

4.3.2.1 Sampling for visual examination of gasket material. As a minimum, a sample quantity from each lot of completed rolls or sheets as specified in table V shall be randomly selected and inspected as specified in 4.4 for the characteristics of table VII.

4.3.2.2 Sampling for tests. As a minimum, a sample quantity shall be randomly selected, each 12 inches by 12 inches, from each lot of completed gasket material as specified in table VI, and test them as specified in 4.5.2, 4.5.4, 4.5.5, 4.5.6, 4.5.7, 4.5.8, and 4.5.9.

4.3.3 Noncompliance. If a sample fails to pass its conformance inspections, the lot shall be rejected.

4.4 Visual examination. Each of the sample rolls or sheets selected shall be surface examined for the defects classified in table VII. Gasket material delivered in rolls shall be unrolled sufficiently to expose the required sample area. Both sides (faces) of the material shall be inspected regardless of whether flat sheet or roll materials are being inspected. If one or more defects are found in any sample, the entire lot shall be rejected.

TABLE VII. Classification of defects.

| Category | Item | Defect |
|---|---|---|
| **Major** | | |
| 101 | Sheets | Thickness is not as specified. |
| 102 | Sheets | Width is less than specified. |
| 103 | Sheets | Length is less than specified. |
| 104 | Sheets | Marking is not as specified (see 3.13). |
| 105 | Sheets | Surface is not smooth. |
| 106 | Sheets | Evidence of lubricant on the sheets. |
| 107 | Sheets | Sheet is damaged; inappropriate for making gaskets. |
| 108 | Circular | Outside diameter (OD) is less than specified. |
| 109 | Circular | Inside diameter (ID) is more than specified. |
| 110 | Circular | ID is less than specified. |
| 111 | Holes | Number of holes is other than specified. |
| 112 | Holes | Size of holes is other than specified. |
| 113 | Holes | Size of holes exceeds tolerance specified. |

4.5 Test methods.

4.5.1 Dimensions and tolerances.

4.5.1.1 Thickness. Thickness shall be determined in accordance with ASTM F104 (see 3.3).

4.5.1.2 Width and length. Width and length shall be determined by direct measurement using a steel ruler with 1/64-inch graduations (see 3.3).

4.5.1.3 Circular dimensions and bolt holes. ID, OD, and bolt hole sizes shall be determined by direct measurement using a steel ruler with 1/64-inch graduations.

4.5.2 Tensile strength. Tensile strength shall be determined in accordance with method A of ASTM F152 (see 3.4).

4.5.3 Total detrimental materials.

4.5.3.1 Heavy metals. Heavy metals shall be analyzed in accordance with the methods specified in ASTM D3223, ASTM D3557, or ASTM D4190. NAVSEA approval to use equivalent methods is not required (see 3.11).

4.5.3.2 Water leachable halides. For determination of water leachable halides, the following test method shall be used (see 3.11):

a. Two gasket material test specimens shall be taken. Each test specimen shall weigh not less than 15 grams (0.0331 pounds) and shall be taken from a different sample. The test specimen of gasket material shall be representative of the sample cross-section.

b. The test specimens shall be cut into pieces not larger than 0.125 inch by 0.25 inch.

c. Each test specimen shall be weighed, transferred to a pressure vessel (that is, Parr bomb or equivalent), covered with 6.763 to 10.144 ounces (200 to 300 mL) of distilled or demineralized water, and maintained at approximately 500 °F for a minimum of 6 hours. The leach water shall then be separated by filtration and the filter rinsed. A blank determination shall be run using similarly cleaned equipment and distilled or demineralized water from the same source.

d. The concentration of bromide, chloride, and fluoride ions in each filtrate shall be determined by ASTM D512, ASTM D1179, ASTM D1246, and ASTM D4327, as appropriate, and shall be corrected by the results of the blank determination. NAVSEA approval to use equivalent analysis methods is not required but should be highlighted in test information.

e. The results of each test shall be calculated as net parts per million of extractable halide ion by weight of the test specimen.

4.5.4 Sealability. Sealability shall be determined in accordance with method B of ASTM F37 (see 3.5). An external compressive load of 3,000 psi, a control pressure of 30 psig, and ASTM D471 reference fuel A shall be used.

4.5.5 Compressibility and recovery. Compressibility and recovery shall be determined in accordance with procedure A of ASTM F36 (see 3.6).

4.5.6 Creep relaxation. Creep relaxation shall be determined in accordance with method B of ASTM F38 using steel platens and 0.0625-inch thick material (see 3.7).

4.5.7 Adhesion. Adhesion shall be determined in accordance with the procedure specified in APPENDIX A (see 3.8).

4.5.8 Flexibility. Flexibility shall be determined in accordance with ASTM F147. A mandrel with a diameter 12 times the nominal thickness of the specimen shall be used (see 3.9).

4.5.9 Compressive strength.

4.5.9.1 Type I. Resistance to compression at 572 °F shall be in accordance with DIN 52913 (see 3.10.1) using 0.0625-inch material or using the AMTEC gasket test machine, or equal, computer-operated, hydraulically loaded test stand that duplicates the DIN 52913 test using the same thickness being delivered.

4.5.9.2 Type II. Compressive strength at elevated temperature shall be in accordance with ASTM F1574 (see 3.10.2), using 10,000 psi load and 0.0625-inch material.

4.5.10 Performance tests. These tests are described in Appendices B, C, D, E, F, G, H, I, J, and K.

4.5.10.1 Steam exposure (type I only).

4.5.10.1.1 Raised-face flange. Testing shall be as specified in Appendix B.

4.5.10.1.2 Flat-faced flange. Testing shall be as specified in Appendix D.

4.5.10.1.3 Dynamic pulse. Testing shall be as specified in Appendix K.

4.5.10.2 Water exposure (type II only).

4.5.10.2.1 Raised-face flange. Testing shall be as specified in Appendix C.

4.5.10.2.2 Flat-faced flange. Testing shall be as specified in Appendix E.

4.5.10.2.3 High pressure exposure. Testing shall be as specified in Appendix J.

4.5.10.2.3.1 Sealability. Testing shall be as specified in Appendix J.

4.5.10.2.3.2 Blow-out. Testing shall be as specified in Appendix J.

4.5.10.3 Lube oil exposure (type II only).

4.5.10.3.1 Raised-face flange. Testing shall be as specified in Appendix F.

4.5.10.3.2 Flat-faced flange. Testing shall be as specified in Appendix H.

4.5.10.4 Hydraulic oil exposure (type II only).

4.5.10.4.1 Raised-face flange. Testing shall be as specified in Appendix G.

4.5.10.4.2 Flat-faced flange. Testing shall be as specified in Appendix I.

4.6 Toxicity and prohibited material.

4.6.1 Toxicity. A Health Hazard Assessment (HHA) will be conducted to ensure conformance to 3.2.4 as required by the qualifying activity. The Navy and Marine Corps Public Health Center (NMCPHC) will evaluate the material using data provided by the manufacturer/distributor to the NMCPHC (see 3.2.4 and 6.3).

4.6.2 Prohibited materials. Prohibited materials shall be verified for conformance to 3.2.5 as required by the qualifying activity.

## 5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

## 6. NOTES

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

6.1 Intended use. Sheet gasket material is intended for U.S. Navy non-propulsion and propulsion use in steam piping joints for service up to 150 psig, 366 °F; for use in water service applications up to 400 psig, 300 °F; and for high pressure water pump casing gaskets up to 1,800 psig, 300 °F. Sheet gasket material is also intended for use in lube oil service up to 150 psig, 250 °F and for use in all petroleum based hydraulic oil service applications up to 600 psig, 180 °F. Gasket material designated in this specification is generally described in ASTM F104 as type 7, class 1 or class 2 material.

6.2 Acquisition requirements. Acquisition documents should specify the following:

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

b. If required, the specific issue of individual documents referenced (see 2.2.1 and 2.3).

c. Requirement for an SDS in accordance with FED-STD-313 (see 3.2.3 and 6.5).

d. Thickness, length, and width required (see 3.3, table IV, and the associated PIN).

e. Identification markings, if other than specified (see 3.13).

f. Inspection conditions, if other than specified (see 4.1.1).

g. Packaging requirements (see 5.1).

6.3 Toxicity evaluation. The NMCPHC requires sufficient information to permit an HHA of the product. Upon completion of the HHA, a copy will be provided by the NMCPHC to the Government for evaluation. The HHA process is described on the NMCPHC's website, http://www med navy.mil/sites/nmcphc/industrial-hygiene/Pages/health-hazard-assessment.aspx.

6.4 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Products List QPL No. 24696 whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from Commander, Naval Sea Systems Command, ATTN: SEA 05S, 1333 Isaac Hull Avenue, SE, Stop 5160, Washington Navy Yard DC 20376-5160 or emailed to CommandStandards@navy.mil. An online listing of products qualified to this specification may be found in the Qualified Products Database (QPD) at https://assist.dla.mil.

6.5 Safety data sheets. Contracting officers will identify those activities requiring copies of completed Safety Data Sheets prepared in accordance with FED-STD-313. The pertinent Government mailing addresses for submission of data are listed in FED-STD-313.

6.6 Subject term (key word) listing.

Binders

Materials, inorganic

Polyolefin

Rolls

Sheet, plastic

Waterproofed

6.7 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

# PROCEDURE TO DETERMINE GASKET MATERIAL ADHESION TO METAL SURFACES

## A.1 SCOPE

A.1.1 Scope. This appendix describes the method used to determine the degree to which gasket materials will adhere to metal surfaces while under compression. It consists of procedures in accordance with ASTM F607. This appendix is a mandatory part of the specification. The information contained herein is intended for compliance.

## A.2 APPLICABLE DOCUMENTS

A.2.1 Government documents.

A.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 cited in the solicitation or contract.

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-L-24478 - Lubricant, Molybdenum Disulfide in Isopropanol

(Copies of this document are available online at https://quicksearch.dla.mil.)

A.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 these documents are those cited in the solicitation or contract.

ASTM INTERNATIONAL

ASTM F607 - Standard Test Method for Adhesion of Gasket Materials to Metal Surfaces

(Copies of this document are available online at www.astm.org.)

SAE INTERNATIONAL

SAE J429 - Mechanical and Material Requirements for Externally Threaded Fasteners

(Copies of this documents are available online at www.sae.org.)

## A.3 TEST APPARATUS

A.3.1 Equipment. Test equipment shall include the following:

a. Condition cabinet or room, maintained at 70 to 85 °F and at 50 to 55 percent relative humidity.

b. Controlled temperature oven, maintained at 366±7 °F.

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 0.375- by 3-inch bolt in accordance with grade 7 of SAE J429, 24 threads per inch. Platens shall be fabricated from the following metals:

(1) Bronze to bronze.

(2) Carbon steel to carbon steel.

d. Socket set and torque wrench calibrated in foot-pounds (ft-lbs).

e. Sharp knife, flat-bladed screwdriver, and a small hammer or mallet.

A.4 TEST SPECIMENS

A.4.1 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 0.0625-inch gasket stock with an inside diameter of 1.27±0.02 inches and an outside diameter of 2.04±0.02 inches.

A.4.2 Platens. The metal platens used in the test shall be finished to ensure their surfaces are as parallel as practicable. The platen faces shall be finished to a profile of 60 microinches roughness absolute (Ra) maximum. The platens shall be chamfered slightly on all edges. They shall be washed clean with a non-ozone depleting 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 prior to assembly for testing.

A.5 CONDITIONING

A.5.1 Preparation. Specimens (platens and gasket material) shall be pre-conditioned for 1 hour at 212±3.6 °F and cooled to 70 to 85 °F in a desiccator containing anhydrous calcium chloride.

A.5.2 Before assembly. The test fixture assemblies (platens, bolts, washers, and nuts) shall be kept at 70 to 85 °F for at least 4 hours before assembly.

A.6 PROCEDURE

A.6.1 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 0.375- by 3-inch bolt very lightly, using MIL-L-24478 molybdenum disulfide lubricant 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 30 ft-lbs.

c. Place the platen and gasket assemblies in a controlled oven and maintain a temperature of 366±7 °F for 48 hours.

d. Remove the platen and gasket assemblies from the oven and allow them to cool to room temperature.

e. Remove the nut, bolt, and washer from the platen and gasket assembly.

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. 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. Cannot be removed from platen without further tearing. Must be scraped for complete removal.

# STEAM EXPOSURE TEST

## B.1 SCOPE

B.1.1 Scope. This appendix describes a steam 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.

## B.2 APPLICABLE DOCUMENTS

B.2.1 Government documents.

B.2.1.1 Specification, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-PRF-907 - Antiseize Thread Compound, High Temperature

DEPARTMENT OF DEFENSE HANDBOOKS

MIL-HDBK-267 - Guide for Selection of Lubricants and Hydraulic Fluids for Use in Shipboard Equipment

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

B.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 these documents are those cited in the solicitation or contract.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.5 - Pipe Flanges and Flanged Fittings

(Copies of this document are available online at www.asme.org.)

## B.3 FLANGE ASSEMBLY

B.3.1 Flange assembly. Two standard steel, raised-face flange assemblies are required as test fixtures. The flange assemblies shall be in accordance with table B-I and figure B-1. The flange assemblies shall have face surface finish roughness averages between 150 and 500 microinches. Surfaces shall be serrated with a concentric or phonograph pattern in accordance with ASME B16.5.

TABLE B-I. Flange assembly.

| **Flange data (all flanges are ASME B16.5)** | | | | **Gasket specimen dimension (inches)** | | |
|---|---|---|---|---|---|---|
| **Flange size (inches)** | **Flange face** | **Class** | **Assembly vol. 1/ (liters)** | **ID** | **OD** | **Thickness** |
| 1 | Raised | 300 | 2.54 | 1.31 | 2.88 | 0.03125 |
| 8 | Raised | 300 | 20.32 | 8.62 | 12.12 | 0.125 |

NOTE:
1/ Tolerance value is ±2 percent.

B.4 PROCEDURE

B.4.1 Steps. The following steps shall be performed for the steam exposure test:

a. Clean flange face.

b. Install the test gasket material in the 1- and 8-inch test assemblies.

c. Calculate the amount of water required to fill each flange assembly with saturated steam when the test conditions are at least 150 psig. Place a measured amount of water, slightly greater than required, in each flange assembly prior to closing. Alternately, live steam may be substituted for the method described here and in B.4.1.g provided that a continuous supply of steam is available to provide an uninterrupted test for 100 hours as described in B.4.1.j. When using live steam, a pressure of at least 150 psig is required.

d. Center the gasket on the flange and install the top half of the test flange. Lubricate and hand-tighten the flange bolts, selecting a lubricant such as MIL-PRF-907 (recommended for steel nuts and bolts of superheated steam applications at temperatures up to 1,050 °F), using the guidance provided in MIL-HDBK-267. This lubricant shall not be used as a release agent for the gasket.

e. Using the proper bolt tightening sequence (an 8-bolt flange assembly is shown on figure B-2 as an example), torque the flange bolts to the minimum required torque specified below. At no time during the test shall the maximum torque values specified be exceeded. Minimum and maximum torque values are:

1-inch flange, 0.625-inch bolts – minimum 80 ft-lbs; maximum 160 ft-lbs

8-inch flange, 0.875-inch bolts – minimum 230 ft-lbs; maximum 440 ft-lbs

Record the torque value.

f. Heat the flange assemblies to at least 366 °F, monitoring the flange temperature. Since the flange and pipe may heat up faster than the steam, the flange temperature shall be carefully monitored to ensure that overheating does not occur.

g. If not using live steam, and if necessary, admit water to the assembly in very small quantities until at least 150 psig is obtained.

h. Monitor for 4 hours, checking for leakage and pressure decay. Use an ultrasonic leak detector to assist with locating leakage. (Decreasing pressure may indicate gasket leakage.)

Note: If leakage occurs, retorque the flange bolts in 5-ft-lb increments and record torque values required to provide a tight pressure seal. Adjust to 150 psig, as required. Verify a tight seal for a 4-hour period. Retorque as necessary (up to maximum torque value) until seal is maintained for 4 hours.

i. Monitor the test assemblies for temperature and pressure three times per day using laboratory certified equipment.

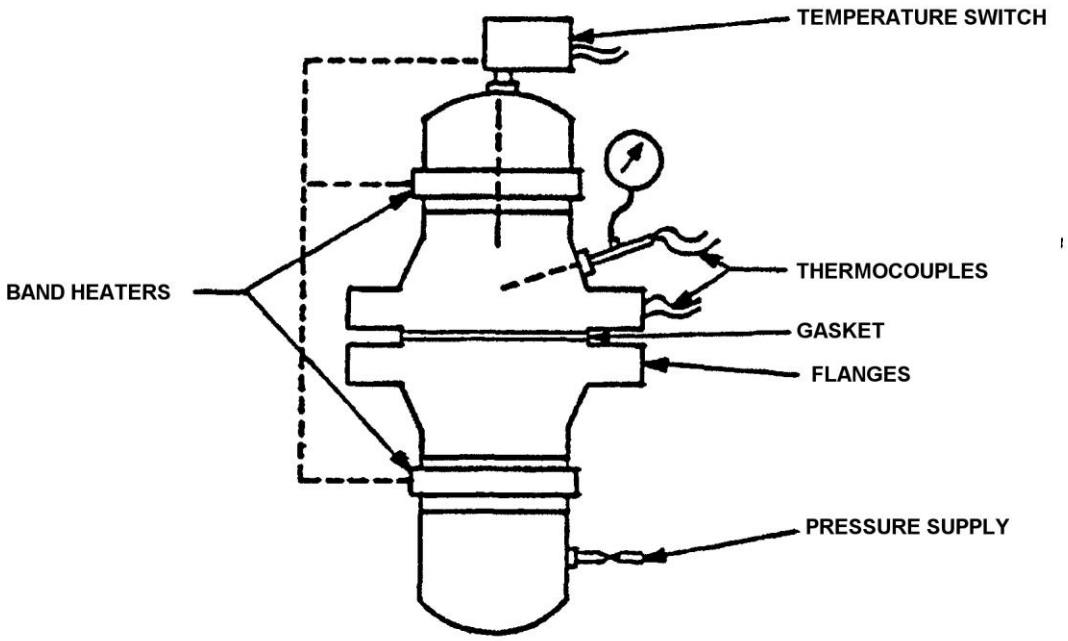
Note: If pressure decreases significantly, secure the heaters, allowing the flange to cool to ambient temperature, and then check the flange assembly for leakage using pressurized nitrogen at 400 psig. The minimum pressure requirement shall be met regardless of the source of the leakage. This pressure test (independent of temperature effects) is used to verify that the gasket is the source of the leakage, not the test fixture. Check the flange bolt torque; if necessary, tighten the bolts in 5-ft-lb increments (not exceeding the maximum torque) until the required sealing torque is attained. Record the torque values. If the flange assembly is the source of leakage, it shall be corrected, or the test shall stop and be considered a failure.

j. Every 100 hours, secure the heaters allowing the test assemblies to cool. Re-energize the heaters after 24 hours and continue test at specified conditions.

Note: If, at any time during the test (including start-up cycles), the pressure decreases significantly, or the gasket leaks, the torque may be increased in 5-ft-lb increments up to the maximum allowed. Once the maximum torque value has been reached, two additional retorques (to the maximum torque) are allowed. If the gasket material continues to leak or fails to hold pressure, the gasket shall be considered as not meeting basic requirements and the test a failure.

k. Recharge the flange assembly with the necessary amount of water prior to starting the next thermal cycle.

l. After testing each material and size, remove the gasket from flange assembly and examine, noting characteristics such as adhesion, deformation, corrosion, permanent indentation, or cracks.




NOTE: This is a typical schematic of a test assembly. The actual vessel used must conform to all applicable code requirements for pressure vessels.

FIGURE B-1. Test flange assembly.

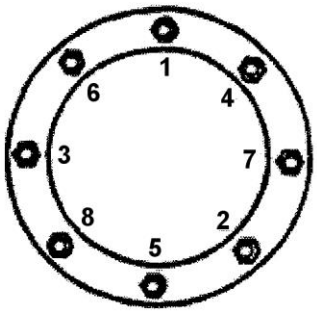



FIGURE B-2. Circular eight bolt.

# WATER EXPOSURE TEST

## C.1 SCOPE

C.1.1 Scope. This appendix describes a water 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.

## C.2 APPLICABLE DOCUMENTS

C.2.1 Government documents.

C.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 cited in the solicitation or contract.

DEPARTMENT OF DEFENSE SPECIFICATION

MIL-PRF-907 - Antiseize Thread Compound, High Temperature

DEPARTMENT OF DEFENSE HANDBOOK

MIL-HDBK-267 - Guide for Selection of Lubricants and Hydraulic Fluids for Use in Shipboard Equipment

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

C.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 these documents are those cited in the solicitation or contract.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.5 - Pipe Flanges and Flanged Fittings

(Copies of this document are available online at www.asme.org.)

## C.3 FLANGE ASSEMBLY

C.3.1 Flange assembly. Two standard steel, raised-face flange assemblies are required as test fixtures. The flange assemblies shall be in accordance with table C-I and figure C-1. The flange assemblies shall have face surface finish roughness averages between 150 and 500 microinches. Surfaces shall be serrated with a concentric or phonograph pattern in accordance with ASME B16.5.

TABLE C-I. Flange assembly.

| Flange data (all flanges are ASME B16.5) | | | | Gasket specimen dimension (inches) | | |
|---|---|---|---|---|---|---|
| **Flange size (inches)** | **Flange face** | **Class** | **Assembly vol. 1/ (liters)** | **ID** | **OD** | **Thickness** |
| 1 | Raised | 300 | 2.54 | 1.31 | 2.88 | 0.03125 |
| 8 | Raised | 300 | 20.32 | 8.62 | 12.12 | 0.125 |

NOTE:
1/ Tolerance value is ±2 percent.

C.4 PROCEDURE

C.4.1 Steps. The following steps shall be performed for the water exposure test:

a. Clean flange face.

b. Install the test gasket material in the 1- 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, selecting a lubricant such as MIL-PRF-907 (recommended for steel nuts and bolts of superheated steam applications at temperatures up to 1,050 °F), using the guidance provided in MIL-HDBK-267. This lubricant shall not be used as a release agent for the gasket.

d. Using the proper bolt tightening sequence (an 8-bolt flange assembly is shown on figure C-2 as an example), torque the flange bolts to the minimum required torque specified below. At no time during the test shall the maximum torque values specified be exceeded. Minimum and maximum torque values are:

1-inch flange, 0.625-inch bolts – minimum 40 ft-lbs; maximum 160 ft-lbs

8-inch flange, 0.875-inch bolts – minimum 100 ft-lbs; maximum 440 ft-lbs

Record the torque value.

e. Fill the assembly approximately 70 percent with fresh water.

f. Heat the flange assemblies to 300 °F minimum, 350 °F maximum, monitoring the flange temperature. Pressurize to 400 psig minimum. Since the flange and pipe may heat up faster than the water, the flange temperature shall be monitored carefully to ensure that overheating does not occur.

g. Monitor for 4 hours, checking for leakage and pressure decay. Visually examine the outer edges of the gasket to ensure no leaks occur. (Decreasing pressure may indicate gasket leakage.)

Note: If leakage occurs, retorque the flange bolts in 5-ft-lb increments and record torque values required to provide a tight pressure seal. Adjust to 400 psig, as required. Verify a tight seal for a 4-hour period. Retorque as necessary (up to maximum torque value) until seal is maintained for 4 hours.

h. Monitor the test assemblies for temperature and pressure three times per day using laboratory certified equipment conforming to the following tolerances: temperature ±10 °F; pressure ±5 psig.

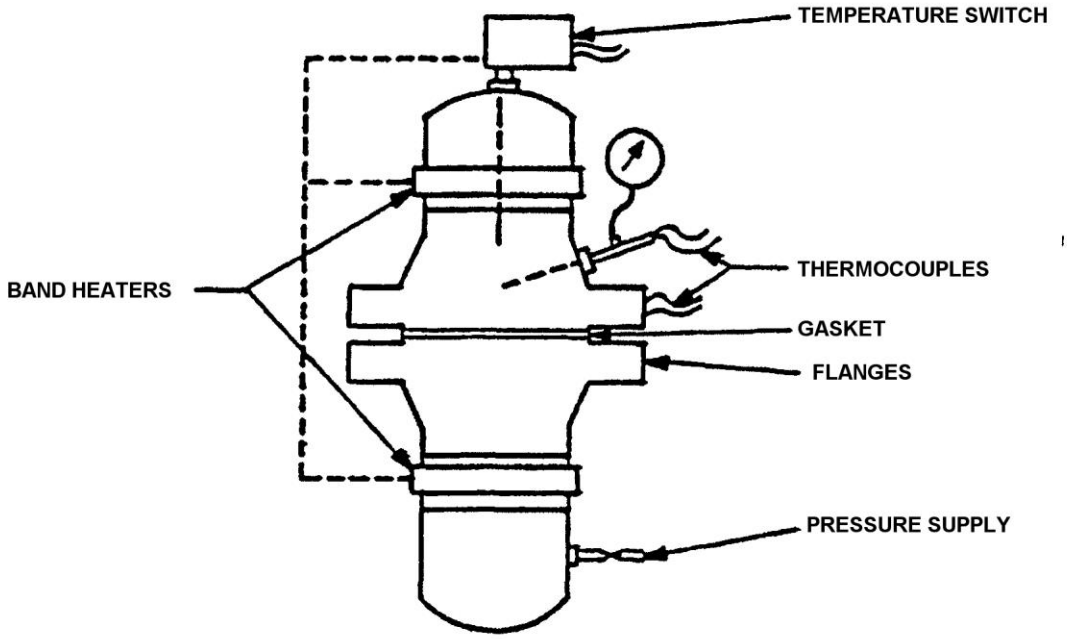
Note: If pressure decreases significantly, secure the heaters, allowing the flange to cool to ambient temperature, and then check the flange assembly for leakage using pressurized nitrogen at 400 psig. The minimum pressure requirement shall be met regardless of the source of the leakage. This pressure test (independent of temperature effects) is used to verify that the gasket is the source of the leakage, not the test fixture. Check the flange bolt torque; if necessary, tighten the bolts in 5-ft-lb increments (not exceeding the maximum torque) until the required sealing torque is attained. Record the torque values. If the flange assembly is the source of leakage, it shall be corrected, or the test shall stop and be considered a failure.

i. Every 100 hours at required temperature and pressure, secure the heaters allowing the test assemblies to cool. Re-energize the heaters after 24 hours and continue the test at the specified conditions.

Note: If, at any time during the test (including start-up cycles), the pressure decreases significantly or the gasket leaks, the torque may be increased in 5-ft-lb increments up to the maximum allowed. Once the maximum torque value has been reached, two additional retorques (to the maximum torque) are allowed. If the gasket material continues to leak or fails to hold pressure, the gasket shall be considered as not meeting basic requirements and the test a failure.

j. Recharge the flange assembly with the necessary amount of water prior to starting the next thermal cycle.

k. After testing each material and size, remove the gasket from the flange assembly and examine, noting characteristics such as adhesion, deformation, corrosion, permanent indentation, or cracks.




NOTE: This is a typical schematic of a test assembly. The actual vessel used must conform to all applicable code requirements for pressure vessels.

FIGURE C-1. Test flange assembly.

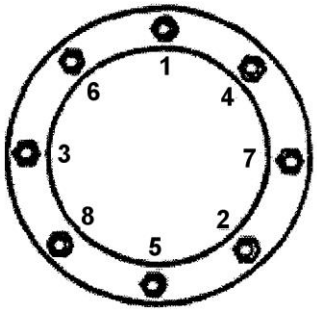



FIGURE C-2. Circular eight bolt.

# STEAM EXPOSURE TEST REQUIREMENTS WITH FLAT-FACED FLANGES

## D.1 SCOPE

D.1.1 Scope. This appendix describes a steam 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.

## D.2 APPLICABLE DOCUMENTS

D.2.1 Government documents.

D.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 cited in the solicitation or contract.

DEPARTMENT OF DEFENSE SPECIFICATIONS

| | | |
|---|---|---|
| MIL-PRF-907 | - | Antiseize Thread Compound, High Temperature |
| MIL-DTL-1222 | - | Studs, Bolts, Screws and Nuts for Applications Where a High Degree of Reliability is Required; General Specification for |
| MIL-PRF-20042 | - | Flanges, Pipe, Bronze (Silver Brazing) |
| MIL-L-24478 | - | Lubricant, Molybdenum Disulfide in Isopropanol |

DEPARTMENT OF DEFENSE HANDBOOK

| | | |
|---|---|---|
| MIL-HDBK-267 | - | Guide for Selection of Lubricants and Hydraulic Fluids for Use in Shipboard Equipment |

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

D.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 these documents are those cited in the solicitation or contract.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

| | | |
|---|---|---|
| ASME B16.5 | - | Pipe Flanges and Flanged Fittings |

(Copies of this document are available online at www.asme.org.)

## D.3 FLANGE ASSEMBLY

D.3.1 Flange assembly. A standard group 3.4 Nickel-Copper (NICU), flat-face flange assembly is required as a test fixture. The flange assembly shall be in accordance with table D-I and figure D-1. The flange assembly shall have a phonographic surface finish of 250 Roughness Height Reading (RHR).

TABLE D-I. Flange assembly.

| Flange data (all flanges are ASME B16.5) | | | | Gasket specimen dimension (inches) | | |
|---|---|---|---|---|---|---|
| **Flange size (inches)** | **Flange face** | **Class** | **Assembly vol. 1/ (liters)** | **ID** | **OD** | **Thickness** |
| 3 | Flat | 150 | 4.5 | 3.50 | 7.50 | 0.0625 |
| NOTE:<br>1/ Tolerance value is ±2 percent. | | | | | | |

D.4 PROCEDURE

D.4.1 Steps. The following steps shall be performed for the steam exposure test:

a. Clean the flange face.

b. Install the test gasket material in the 3-inch test assembly with 0.625-inch NICU bolts made in accordance with MIL-DTL-1222.

Note: An alternative test flange is a 3-inch, 400-lb, MIL-PRF-20042 bronze flange with a phonographic surface finish of 250 RHR. The flange shall be used with four 0.75-inch NICU bolts with a maximum torque of 85 ft-lbs, a minimum torque of 57 ft-lbs and gasket dimensions of 8.125 inches OD and 4.25 inches ID.

c. Calculate the amount of water required to fill each flange assembly with saturated steam when the test conditions are at least 150 psig. Place a measured amount of water, slightly greater than required, in each flange assembly prior to closing. Alternately, live steam may be substituted for the method described here and in D.4.1.g provided that a continuous supply of steam is available to provide an uninterrupted test for 100 hours as described in D.4.1.j. When using live steam, a pressure of at least 150 psig is required.

d. Center the gasket on the flange and install the test flange. Lubricate and hand-tighten the flange bolts using a lubricant selected using the guidance in MIL-HDBK-267 in accordance with MIL-L-24478 Molykote or equal. This lubricant shall not be used as a release agent for the gasket.

e. Using the proper bolt tightening sequence (a four-bolt flange assembly is shown on figure D-2 as an example), torque the flange bolts to 40 ft-lbs. The maximum torque value for a lubricated 0.625-inch NICU bolt is 60 ft-lbs (equivalent to 40 kilopound per square inch (ksi)-minimum yield of NICU).

(1) Record the torque value.

(2) If a nickel-based-containing anti-seize compound from MIL-PRF-907 is used as an alternative lubricant, the minimum and maximum torques shall be 50 ft-lbs and 76 ft-lbs, respectively.

f. Heat the flange assemblies to at least 366 °F, monitoring the flange temperature. Since the flange and pipe may heat up faster than the steam, the flange temperature shall be monitored carefully to ensure that overheating does not occur.

g. If not using live steam, and if necessary, admit water to the assembly in very small quantities until at least 150 psig is obtained.

h. Monitor for 4 hours, checking for leakage and pressure decay. Use an ultrasonic leak detector to assist with locating leakage. (Decreasing pressure may indicate gasket leakage.)

Note: If leakage occurs, retorque the flange bolts in 5-ft-lb increments and record torque values required to provide a tight pressure seal. Adjust to 150 psig, as required. Verify a tight seal for a 4-hour period. Retorque as necessary (up to maximum torque value) until seal is maintained for 4 hours.

i. Monitor the test assemblies for temperature and pressure three times per day using laboratory certified equipment.

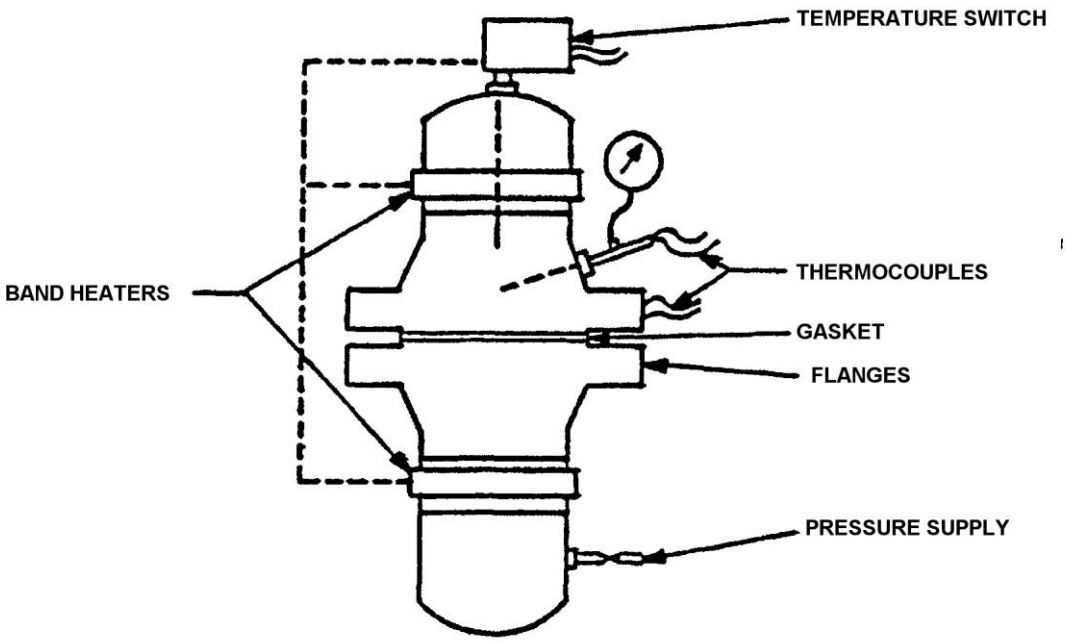
Note: If pressure decreases significantly, secure the heaters, allowing the flange to cool to ambient temperature, then check the flange assembly for leakage using pressurized nitrogen at 400 psig. The minimum pressure requirement shall be met regardless of the source of the leakage. This pressure test (independent of temperature effects) is used to verify that the gasket is the source of the leakage, not the test fixture. Check the flange bolt torque; if necessary, tighten the bolts in 5-ft-lb increments (not exceeding the maximum torque) until the required sealing torque is attained. Record the torque values. If the flange assembly is the source of leakage, it shall be corrected, or the test shall stop and be considered a failure.

j. Every 100 hours at required temperature and pressure, secure the heaters allowing the test assemblies to cool.

Note: If, at any time during the test, the pressure decreases significantly, or the gasket leaks, the torque may be increased in 5-ft-lb increments up to the maximum allowed. Once the maximum torque value has been reached, two additional retorques (to the maximum torque) are allowed. If the gasket material continues to leak or fails to hold pressure, the gasket shall be considered as not meeting basic requirements and the test a failure.

k. Recharge the flange assembly with the necessary amount of water prior to starting the next thermal cycle.

l. After testing each material and size, remove the gasket from the flange assembly and examine, noting characteristics such as adhesion, deformation, corrosion, permanent indentation, or cracks.




NOTE. This is a typical schematic of a test assembly. The actual vessel used must conform to all applicable code requirements for pressure vessels.

FIGURE D-1. Test flange assembly.

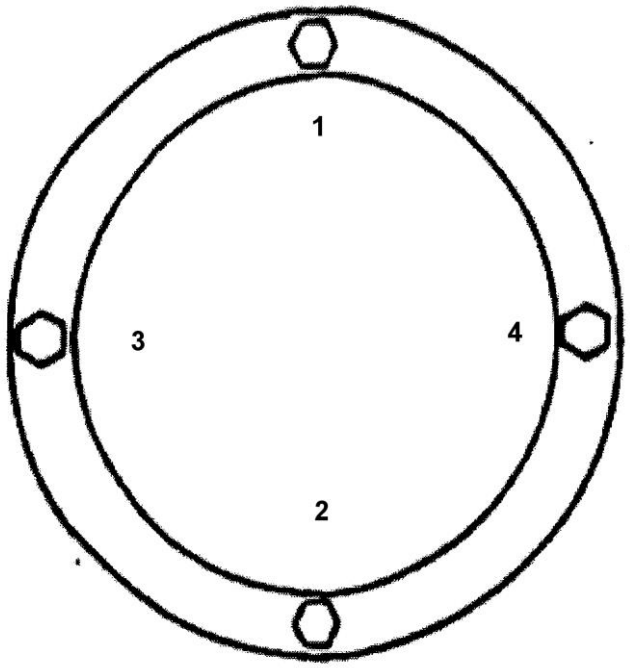



FIGURE D-2. Torquing sequence for circular four-bolt flange.

# WATER EXPOSURE TEST REQUIREMENTS WITH FLAT-FACED FLANGES

## E.1 SCOPE

E.1.1 Scope. This appendix describes a water 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.

## E.2 APPLICABLE DOCUMENTS

E.2.1 Government documents.

E.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 cited in the solicitation or contract.

DEPARTMENT OF DEFENSE SPECIFICATIONS

| | | |
|---|---|---|
| MIL-PRF-907 | - | Antiseize Thread Compound, High Temperature |
| MIL-DTL-1222 | - | Studs, Bolts, Screws and Nuts for Applications where a High Degree of Reliability is Required; General Specification for |
| MIL-PRF-20042 | - | Flanges, Pipe, Bronze (Silver Brazing) |
| MIL-L-24478 | - | Lubricant, Molybdenum Disulfide in Isopropanol |

DEPARTMENT OF DEFENSE HANDBOOKS

| | | |
|---|---|---|
| MIL-HDBK-267 | - | Guide for Selection of Lubricants and Hydraulic Fluids for Use in Shipboard Equipment |

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

E.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 these documents are those cited in the solicitation or contract.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

| | | |
|---|---|---|
| ASME B16.5 | - | Pipe Flanges and Flanged Fittings |

(Copies of this document are available online at www.asme.org.)

## E.3 FLANGE ASSEMBLY

E.3.1 Flange assembly. A standard group 3.4 (NICU), flat-face flange assembly is required as a test fixture. The flange assembly shall be in accordance with table E-I and shown on figure E-1. The flange assembly shall have a phonographic surface finish of 250 Root Mean Square (RHR).

TABLE E-I. Flange assembly.

| Flange data (all flanges are ASME B16.5) | | | | Gasket specimen dimension (inches) | | |
|---|---|---|---|---|---|---|
| **Flange size (inches)** | **Flange face** | **Class** | **Assembly vol. 1/ (liters)** | **ID** | **OD** | **Thickness** |
| 3 | Flat | 150 | 4.5 | 3.50 | 7.50 | 0.0625 |

NOTE:

1/ Tolerance value is ±2 percent.

E.4 PROCEDURE

E.4.1 Steps. The following steps shall be performed for the water exposure test:

a. Clean flange face.

b. Install the test gasket material in the 3-inch test assembly with 0.625-inch NICU bolts, made in accordance with MIL-DTL-1222.

Note: An alternative test flange is a 3-inch, 400-lb, MIL-PRF-20042 bronze flange with a phonographic surface finish of 250 RHR. The flange shall be used with four, 0.75-inch bolts with a maximum torque of 85 ft-lbs, a minimum torque of 57 ft-lbs and gasket dimensions of 8.125-inch OD and 4.25-inch ID.

c. Lubricate and hand tighten the flange bolts, selecting a lubricant using guidance in MIL-HDBK-267 in accordance with MIL-L-24478 (Molykote or equal). This lubricant shall not be used as a release agent for the gasket.

d. Using the proper bolt tightening sequence (a four-bolt flange assembly is shown on figure E-2 as an example), torque the flange bolts to 40 ft-lbs. The maximum torque value for a lubricated 0.625-inch NICU bolt is 60 ft-lbs (equivalent to a 40-ksi minimum yield of NICU). Center the gasket on the flange and install the test flange.

(1) Record the torque value.

(2) If a nickel-based-containing antiseize compound from MIL-PRF-907 is used as an alternative lubricant, the minimum and maximum torques shall be 50 ft-lbs and 76 ft-lbs, respectively.

e. Fill the assembly with fresh water at ambient temperature.

f. Pressurize to not less than 315 psig minimum in accordance with ASME B16.5 seat test pressure for a 150-lb steel flange.

g. Monitor for 4 hours, checking for leakage and pressure decay. Visually examine outer edges of the gasket to ensure no leaks occur. (Decreasing pressure may indicate gasket leakage.)

Note: If leakage occurs, retorque the flange bolts in 5-ft-lb increments and record torque values required to provide a tight pressure seal. Adjust to 315 psig, as required. Verify a tight seal for a 4-hour period. Retorque as necessary (up to maximum torque value) until seal is maintained for 4 hours.

h. Monitor the test assemblies for pressure three times per day, using laboratory certified equipment conforming to the following tolerances: Pressure ±5 psig.

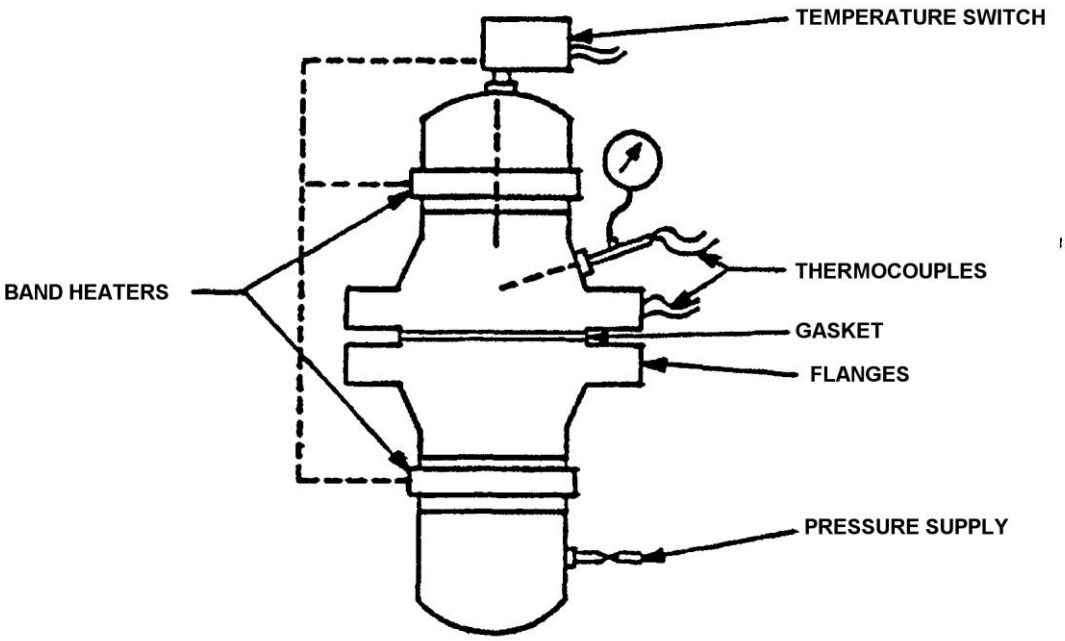
Note: If pressure decreases significantly, secure the heaters, allowing the flange to cool to ambient temperature, then check the flange assembly for leakage using pressurized nitrogen at 400 psig. The minimum pressure requirement shall be met regardless of the source of the leakage. This pressure test (independent of temperature effects) is used to verify that the gasket is the source of the leakage, not the test fixture. Check the flange bolt torque; if necessary, tighten the bolts in 5-ft-lb increments (not exceeding the maximum torque) until the required sealing torque is attained. Record the torque values. If the flange assembly is the source of leakage, it shall be corrected, or the test shall stop and be considered a failure.

i. Secure the test after 100 hours at 315 psig.

Note: If, at any time during the test, the pressure decreases significantly, or the gasket leaks, the torque may be

increased in 5-ft-lb increments up to the maximum allowed. Once the maximum torque value has been reached, two additional retorques (to the maximum torque) are allowed. If the gasket material continues to leak or fails to hold pressure, the gasket shall be considered as not meeting basic requirements and the test a failure.

j. After testing each material and size, remove the gasket from the flange assembly and examine, noting characteristics such as adhesion, deformation, corrosion, permanent indentation, or cracks.




NOTE. This is a typical schematic of a test assembly. The actual vessel used must conform to all applicable code requirements for pressure vessels.

FIGURE E-1. Test flange assembly.

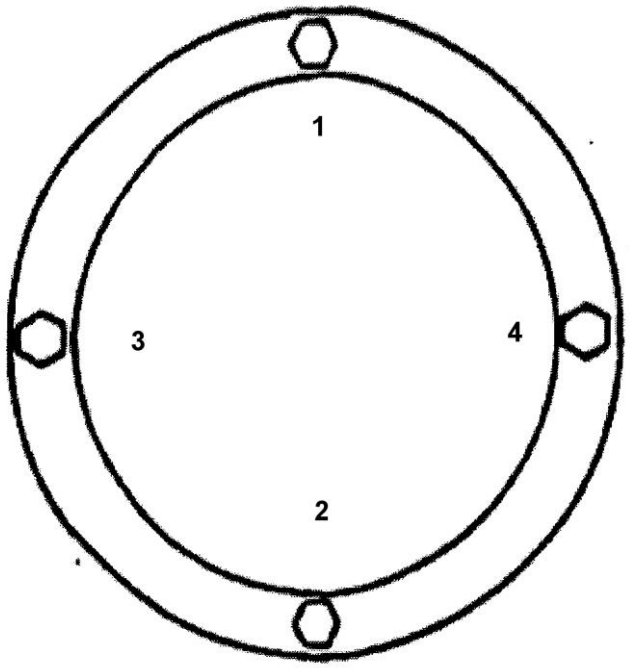



FIGURE E-2. Torquing sequence for circular four-bolt flange.

# LUBE OIL EXPOSURE TEST USING RAISED-FACE FLANGES

## F.1 SCOPE

F.1.1 Scope. This appendix describes a lube oil exposure test for determining the performance of gasket materials (using raised-face flanges) covered by this specification. This appendix is a mandatory part of the specification. The information contained herein is intended for compliance.

## F.2 APPLICABLE DOCUMENTS

F.2.1 Government documents.

F.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 cited in the solicitation or contract.

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-PRF-907 - Antiseize Thread Compound, High Temperature

MIL-PRF-17331 - Lubricating Oil, Steam Turbine and Gear, Moderate Service

DEPARTMENT OF DEFENSE HANDBOOK

MIL-HDBK-267 - Guide for Selection of Lubricants and Hydraulic Fluids for Use in Shipboard Equipment

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

F.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 these documents are those cited in the solicitation or contract.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.5 - Pipe Flanges and Flanged Fittings

(Copies of this document are available online at www.asme.org.)

## F.3 FLANGE ASSEMBLY

F.3.1 Flange assembly. Two standard steel, raised-face flange assemblies are required as test fixtures. The flange assemblies shall be in accordance with table F-1 and figure F-1. The flange assemblies shall have face surface finishes between 150 and 500 Root Mean Square (RMS). Surfaces shall be serrated with a concentric or phonograph pattern in accordance with ASME B16.5.

TABLE F-1. Flange assembly.

| **Flange data (all flanges are ASME B16.5)** | | | | **Gasket specimen dimension (inches)** | | |
|---|---|---|---|---|---|---|
| **Flange size (inches)** | **Flange face** | **Class** | **Assembly vol. 1/ (liters)** | **ID** | **OD** | **Thickness** |
| 1 | Raised | 150 | 2.3 | 1.31 | 2.88 | 0.03125 |
| 3 | Raised | 150 | 4.5 | 3.50 | 5.38 | 0.0625 |

NOTE:
1/ Tolerance value is ±2 percent.

F.4 PROCEDURE

F.4.1 Steps. The following steps shall be performed for the lube oil exposure test:

a. Clean the flange face.

b. Install the test gasket material in the 1-inch and 3-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, selecting a lubricant using the guidance provided in MIL-HDBK-267 such as MIL-PRF-907.

d. Using the proper bolt tightening sequence (an 8-bolt flange assembly is shown on figure F-2 as an example), torque the flange bolts to the minimum required torque specified below. At no time during the test shall the maximum torque values specified be exceeded. Minimum and maximum torque values are:

1-inch flange, 0.5-inch bolts – minimum 35 ft-lbs; maximum 80 ft-lbs

3-inch flange, 0.625-inch bolts – minimum 100 ft-lbs; maximum 160 ft-lbs

Record the torque value.

e. Fill the flange assembly approximately 70 percent with MIL-PRF-17331 lube oil.

f. Heat the flange assemblies to 250 °F minimum, 300 °F maximum, monitoring the flange temperature. Pressurize to 150 psig. Since the flange and pipe may heat up faster than the lube oil, the flange temperature shall be monitored carefully to ensure that overheating does not occur.

g. Monitor for 4 hours, checking for leakage and pressure decay. Visually examine outer edges of the gasket to ensure no leaks occur. (Decreasing pressure may indicate gasket leakage.)

Note: If leakage occurs, retorque the flange bolts in 5-ft-lb increments and record the torque values required to provide a tight pressure seal. Adjust to 150 psig, as required. Verify a tight seal for a 4-hour period. Retorque as necessary (up to maximum torque value) until seal is maintained for 4 hours.

h. Monitor the test assemblies for temperature and pressure three times per day using laboratory-certified equipment conforming to the following tolerances: temperature ±10 °F, pressure ±5 psig.

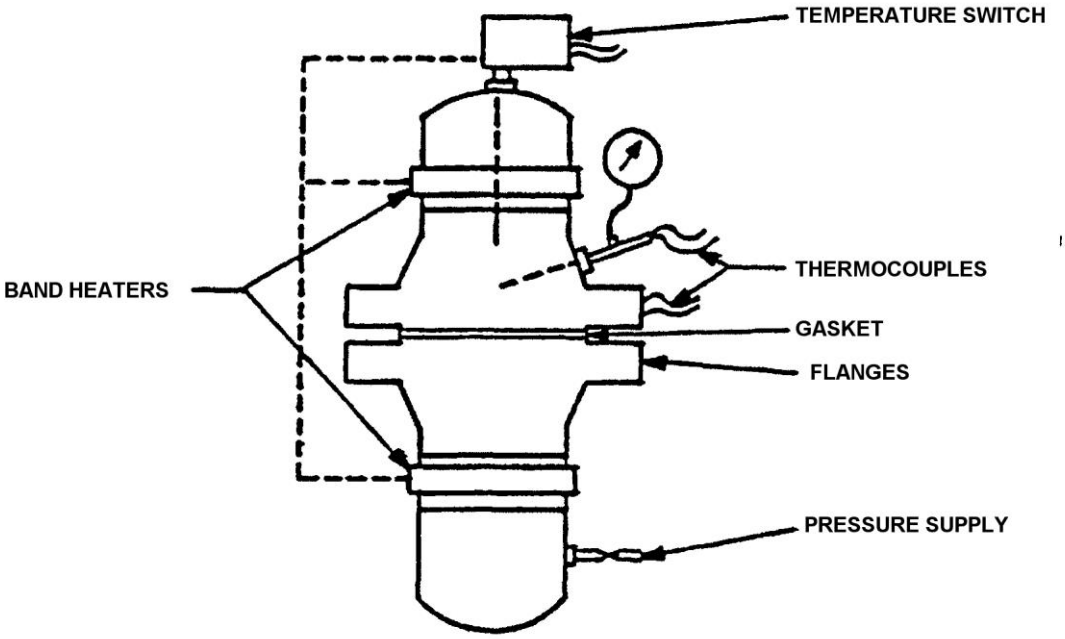
Note: If pressure decreases significantly, secure the heaters, allowing the flange to cool to ambient temperature, then check the flange assembly for leakage using pressurized nitrogen at 150 psig. This pressure test (independent of temperature effects) is used to verify that the gasket is the source of the leakage, not the test fixture. Check the flange bolt torque; if necessary, tighten the bolts in 5-ft-lb increments (not exceeding the maximum torque) until the required sealing torque is attained. Record the torque values. If the flange assembly is the source of leakage, it shall be corrected, or the test shall stop and be considered a failure.

i. Every 100 hours at required temperature and pressure, secure the heaters allowing the test assemblies to cool.

Note: If, at any time during the test, the pressure decreases significantly, or the gasket leaks, the torque may be increased in 5-ft-lb increments up to the maximum allowed. Once the maximum torque value has been reached, two additional retorques (to the maximum torque) are allowed. If the gasket material continues to leak or fails to hold pressure, the gasket shall be considered as not meeting basic requirements and the test a failure.

j. Recharge the flange assemblies with the necessary amount of lube oil prior to starting the next thermal cycle.

k. After testing each material and size, remove the gasket from the flange assembly and examine, noting characteristics such as adhesion, deformation, corrosion, permanent indentation, or cracks.




NOTE. This is a typical schematic of a test assembly. The actual vessel used must conform to all applicable code requirements for pressure vessels.

FIGURE F-1. Test flange assembly.

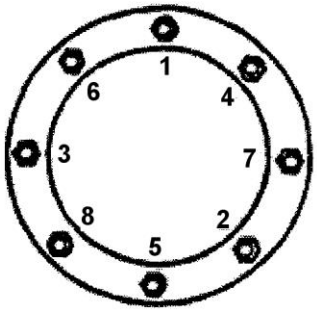



FIGURE F-2. Circular eight bolt.

# HYDRAULIC OIL EXPOSURE TEST USING RAISED-FACE FLANGES

## G.1 SCOPE

G.1.1 Scope. This appendix describes a hydraulic oil exposure test for determining the performance of gasket materials (using raised-face flanges) covered by this specification. This appendix is a mandatory part of the specification. The information contained herein is intended for compliance.

## G.2 APPLICABLE DOCUMENTS

G.2.1 Government documents.

G.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 cited in the solicitation or contract.

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-PRF-907 - Antiseize Thread Compound, High Temperature

MIL-PRF-17672 - Hydraulic Oil, Petroleum, Inhibited

DEPARTMENT OF DEFENSE HANDBOOK

MIL-HDBK-267 - Guide for Selection of Lubricants and Hydraulic Fluids for Use in Shipboard Equipment

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

G.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 these documents are those cited in the solicitation or contract.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.5 - Pipe Flanges and Flanged Fittings

(Copies of this document are available online at www.asme.org.)

## G.3 FLANGE ASSEMBLY

G.3.1 Flange assembly. A standard steel, raised-face flange assembly is required as a test fixture. The flange assembly shall be in accordance with table G-I and figure G-1. The flange assembly shall have a surface finish between 150 and 500 RMS. Surfaces shall be serrated with a concentric or phonograph pattern in accordance with ASME B16.5.

TABLE G-I. Flange assembly.

| Flange data (all flanges are ASME B16.5) | | | | Gasket specimen dimension (inches) | | |
|---|---|---|---|---|---|---|
| **Flange size (inches)** | **Flange face** | **Class** | **Assembly vol. 1/ (liters)** | **ID** | **OD** | **Thickness** |
| 1 | Raised | 600 | 2.3 | 1.31 | 2.88 | 0.03125 |

NOTE:
1/ Tolerance value is ±2 percent.

G.4 PROCEDURE

G.4.1 Steps. The following steps shall be performed for the hydraulic oil exposure test:

a. Clean the flange face.

b. Install the test gasket material in the 1-inch test assembly.

c. Center the gasket on the flange and install the top half of the test flange. Lubricate and hand-tighten the flange bolts, selecting a lubricant using the guidance in MIL-HDBK-267, such as MIL-PRF-907.

d. Using the proper bolt tightening sequence (an eight-bolt flange assembly is shown on figure G-2 as an example), torque the flange bolts to the minimum required torque specified below. At no time during the test shall the maximum torque values specified be exceeded. Minimum and maximum torque values are:

l-inch flange, 0.625-inch bolts – minimum 75 ft-lbs; maximum 160 ft-lbs

Record the torque value.

e. Fill the assemblies approximately 70 percent with MIL-PRF-17672 hydraulic oil.

f. Heat the flange assemblies to 180 °F minimum, 230 °F maximum, monitoring the flange temperature. Pressurize to 600 psig. Since the flange and pipe may heat up faster than the hydraulic oil, the flange temperature shall be monitored carefully to ensure that overheating does not occur.

g. Monitor for 4 hours, checking for leakage and pressure decay. Visually examine outer edges of the gasket to ensure no leaks occur. (Decreasing pressure may indicate gasket leakage.)

Note: If leakage occurs, retorque the flange bolts in 5-ft-lb increments and record the torque values required to provide a tight pressure seal. Adjust to 600 psig, as required. Verify a tight seal for a 4-hour period. Retorque as necessary (up to maximum torque value) until seal is maintained for 4 hours.

h. Monitor the test assemblies for temperature and pressure three times per day using laboratory-certified equipment conforming to the following tolerances: temperature ±10 °F, pressure ±5 psig.

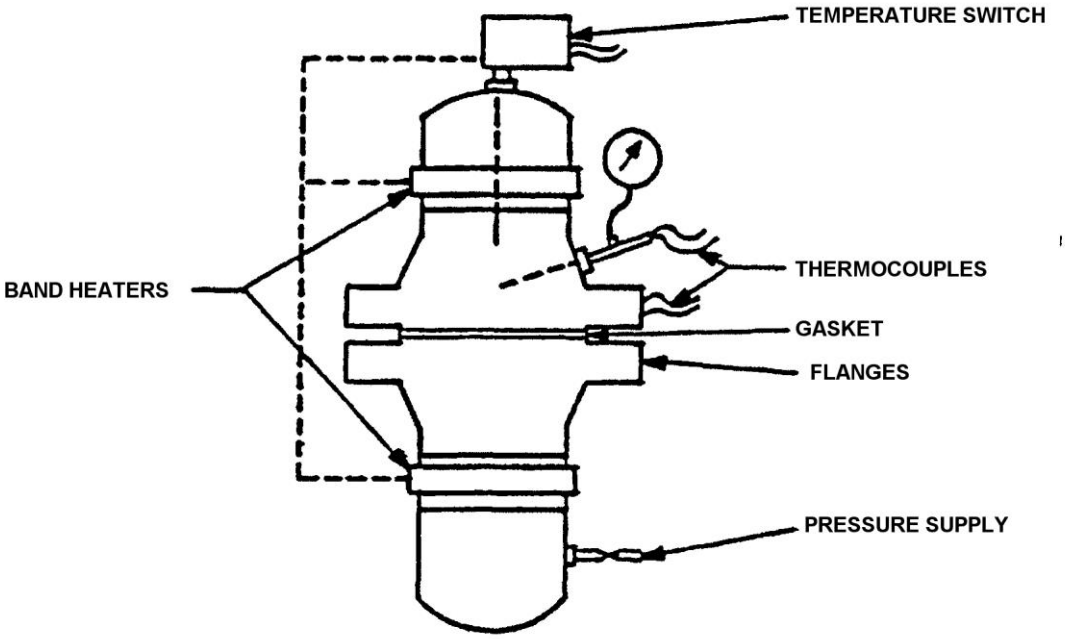
Note: If pressure decreases significantly, secure the heaters, allowing the flange to cool to ambient temperature, and then check the flange assembly for leakage using pressurized nitrogen at 600 psig. This pressure test (independent of temperature effects) is used to verify that the gasket is the source of the leakage, not the test fixture. Check the flange bolt torque; if necessary, tighten the bolts in 5-ft-lb increments (not exceeding the maximum torque) until the required sealing torque is attained. Record the torque values. If the flange assembly is the source of leakage, it shall be corrected, or the test shall stop and be considered a failure.

i. Every 100 hours, secure the heaters and allow the test assemblies to cool. Re-energize the heaters after 24 hours and continue the test at specified conditions.

Note: If, at any time during the test, the pressure decreases significantly, or the gasket leaks, the torque may be increased in 5-ft-lb increments up to the maximum allowed. Once the maximum torque value has been reached, two additional retorques (to the maximum torque) are allowed. If the gasket material continues to leak or fails to hold pressure, the gasket shall be considered as not meeting basic requirements and the test a failure.

j. Recharge the flange assemblies with the necessary amount of hydraulic oil prior to starting the next thermal cycle.

k. After testing each material and size, remove the gasket from the flange assembly and examine, noting characteristics such as adhesion, deformation, corrosion, permanent indentation, or cracks.




NOTE. This is a typical schematic of a test assembly. The actual vessel used must conform to all applicable code requirements for pressure vessels.

FIGURE G-1. Test flange assembly.

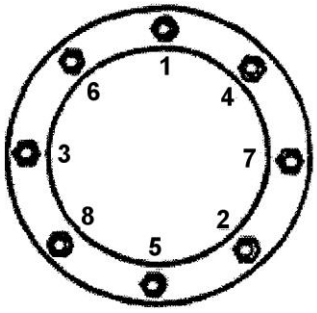



FIGURE G-2. Circular eight bolt.

# LUBE OIL EXPOSURE TEST USING FLAT-FACED FLANGES

## H.1 SCOPE

H.1.1 Scope. This appendix describes a petroleum-based lube oil exposure test for determining the performance of gasket materials (using flat-faced flanges) covered by this specification. This appendix is a mandatory part of the specification. The information contained herein is intended for compliance.

## H.2 APPLICABLE DOCUMENTS

H.2.1 Government documents.

H.2.1.1 Specifications, standards, and handbooks. Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-DTL-1222 - Studs, Bolts, Hex Cap Screws, Socket Head Cap Screws and Nuts

MIL-PRF-17331 - Lubricating Oil, Steam Turbine and Gear, Moderate Service

MIL-PRF-20042 - Flanges, Pipe and Bulkhead, Bronze (Silver Brazing)

MIL-L-24478 - Lubricant, Molybdenum Disulfide in Isopropanol

DEPARTMENT OF DEFENSE HANDBOOKS

MIL-HDBK-267 - Guide for Selection of Lubricants and Hydraulic Fluids for Use in Shipboard Equipment

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

H.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 these documents are those cited in the solicitation or contract.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.5 - Pipe Flanges and Flanged Fittings

(Copies of this document are available from ASME International, 22 Law Drive, PO Box 2900, Fairfield, NJ 07007-2900 or online at https://www.asme.org.)

## H.3 FLANGE ASSEMBLY

H.3.1 Flange assembly. A standard group 3.4 (NICU), flat-face flange assembly is required as a test fixture. The flange assembly shall be in accordance with table H-I and figure H-1. The flange assembly shall have a phonographic surface finish of 250 RHR.

TABLE H-I. Flange assembly.

| Flange data (all flanges are ASME B16.5) | | | | Gasket specimen dimension (inches) | | |
|---|---|---|---|---|---|---|
| **Flange size (inches)** | **Flange face** | **Class** | **Assembly vol. 1/ (liters)** | **ID** | **OD** | **Thickness** |
| 3 | Flat | 150 | 4.5 | 3.50 | 7.50 | 0.0625 |

NOTE:
1/ Tolerance value is ±2 percent.

H.4 PROCEDURE

H.4.1 Steps. The following steps shall be performed for the lube oil exposure test:

a. Clean the flange face.

b. Install the test gasket material in the 3-inch test assembly with 0.625-inch NICU bolts, made in accordance with MIL-DTL-1222.

Note: An alternative test flange is a 3-inch, 400-lb, MIL-PRF-20042 bronze flange with a phonographic surface finish of 250 RHR. The flange shall be used with four 0.75-inch bolts with a maximum torque of 96 ft-lbs, a minimum torque of 64 ft-lbs, and gasket dimensions of 8.125-inch OD and 4.25-inch ID.

c. Fill the flange assembly approximately 70 percent with MIL-PRF-17331 lube oil.

d. Center the gasket on the flange and install the test flange. Lubricate and hand-tighten the flange bolts, using lubricant specification in MIL-HDBK-267 in accordance with MIL-L-24478 (Molykote or equal). This lubricant shall not be used as a release agent for the gasket.

e. Using the proper bolt tightening sequence (a four-bolt flange assembly is shown on figure H-2 as an example), torque the flange bolts to the minimum required torque specified below. At no time during the test shall the maximum torque values specified in standard ASME specifications for flange bolts be exceeded. Minimum and maximum torque values are:

3-inch flange, 0.625-inch bolts – minimum 53 ft-lbs; maximum 80 ft-lbs

Record the torque value.

f. Heat the flange assembly to at least 250 °F, monitoring the flange temperature. Since the flange and pipe may heat up faster than the lube oil, the flange temperature shall be monitored carefully to ensure that overheating does not occur.

g. Use an external pressure source to achieve 150 psig minimum.

h. Monitor for 4 hours, checking for leakage and pressure decay. Visually examine outer edges of the gasket to ensure no leaks occur. (Decreasing pressure may indicate gasket leakage.)

Note: If leakage occurs, retorque the flange bolts in 5-ft-lb increments and record torque values required to provide a tight pressure seal. Adjust to 150 psig, as required. Verify a tight seal for a 4-hour period. Retorque as necessary (up to maximum torque value) until seal is maintained for 4 hours.

i. Monitor the test assemblies for temperature and pressure three times per day using laboratory-certified equipment.

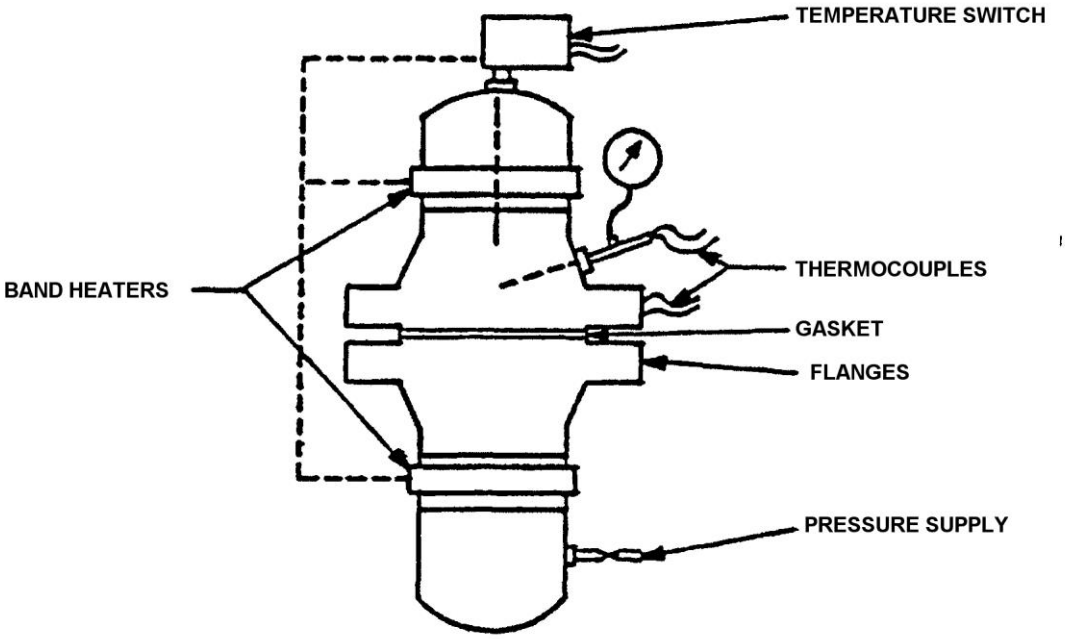
Note: If pressure decreases significantly, secure the heaters, allowing the flange to cool to ambient temperature, then check the flange assembly for leakage using pressurized nitrogen at 150 psig. This pressure test (independent of temperature effects) is used to verify that the gasket is the source of the leakage, not the test fixture. Check the flange bolt torque; if necessary, tighten the bolts in 5-ft-lb increments (not exceeding the maximum torque) until the required sealing torque is attained. Record the torque values. If the flange assembly is the source of leakage, it shall be corrected, or the test shall stop and be considered a failure.

j. Every 100 hours, secure the heaters and allow the test assemblies to cool. After at least 24 hours, re-energize the heaters and continue the test at specified conditions.

Note: If, at any time during the test, the pressure decreases significantly or the gasket leaks, the torque may be increased in 5-ft-lb increments up to the maximum allowed. Once the maximum torque value has been reached, two additional retorques (to the maximum torque) are allowed. If the gasket material continues to leak or fails to hold pressure, the gasket shall be considered as not meeting basic requirements and the test a failure.

k. Recharge the flange assemblies with the necessary amount of lube oil prior to starting the next thermal cycle.

l. After testing each material and size, remove the gasket from the flange assembly and examine, noting characteristics such as adhesion, deformation, corrosion, permanent indentation, or cracks.




NOTE. This is a typical schematic of a test assembly. The actual vessel used must conform to all applicable code requirements for pressure vessels.

FIGURE H-1. Test flange assembly.

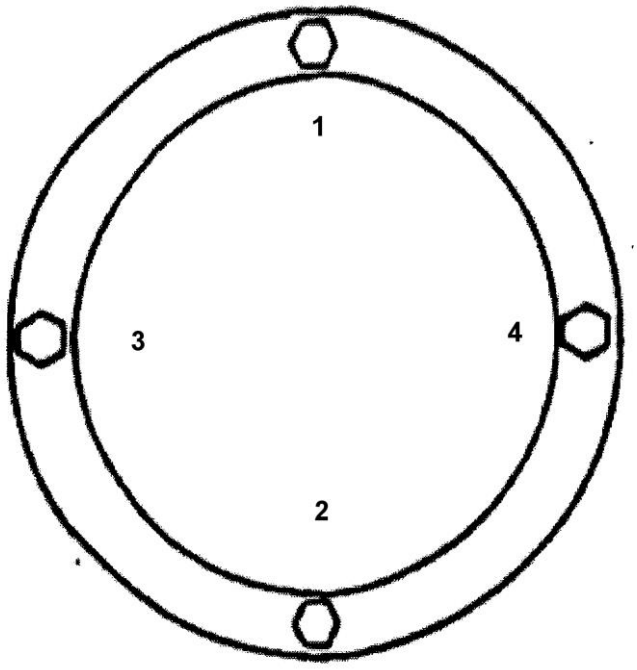



FIGURE H-2. Torquing sequence for circular four-bolt flange.

# HYDRAULIC OIL EXPOSURE TEST USING FLAT-FACED FLANGES

## I.1 SCOPE

I.1.1 Scope. This appendix describes a petroleum-based hydraulic oil exposure test for determining the performance of gasket materials (using flat-faced flanges) covered by this specification. This appendix is a mandatory part of the specification. The information contained herein is intended for compliance.

## I.2 APPLICABLE DOCUMENTS

I.2.1 Government documents.

I.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 cited in the solicitation or contract.

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-DTL-1222 - Studs, Bolts, Hex Cap Screws, Socket Head Cap Screws and Nuts

MIL-PRF-17672 - Hydraulic Fluid, Petroleum, Inhibited

MIL-L-24478 - Lubricant, Molybdenum Disulfide in Isopropanol

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AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.5 - Pipe Flanges and Flanged Fittings

(Copies of this document are available online at http://www.asme.org.)

## I.3 FLANGE ASSEMBLY

I.3.1 Flange assembly. A standard group 3.4 (NICU), flat-face flange assembly is required as a test fixture. The flange assembly shall be in accordance with table I-I and figure I-1. The flange assembly shall have a phonographic surface finish of 250 RHR.

TABLE I-I. Flange assembly.

| **Flange data (all flanges are ASME B16.5)** | | | | **Gasket specimen dimension (inches)** | | |
|---|---|---|---|---|---|---|
| **Flange size (inches)** | **Flange face** | **Class** | **Assembly vol. 1/ (liters)** | **ID** | **OD** | **Thickness** |
| 3 | Flat | 600 | 4.5 | 3.50 | 8.25 | 0.0625 |

NOTE:

1/ Tolerance value is ±2 percent.

I.4 PROCEDURE

I.4.1 Steps. The following steps shall be performed for the hydraulic oil exposure test:

a. Clean the flange face.

b. Install the test gasket material in the 3-inch test assembly with 0.75-inch NICU bolts, made in accordance with MIL-DTL-1222.

c. Fill the flange assembly approximately 70 percent with MIL-PRF-17672 hydraulic oil.

d. Center the gasket on the flange and install the test flange. Lubricate and hand-tighten the flange bolts, selecting a lubricant using the guidance provided in MIL-HDBK-267 such as MIL-L-24478 (Molykote or equal). This lubricant shall not be used as a release agent for the gasket.

e. Using the proper bolt tightening sequence (an eight-bolt flange assembly is shown on figure I-2 as an example), torque the flange bolts to the minimum required torque specified below. At no time during the test shall the maximum torque values specified in standard ASME specifications for flange bolts be exceeded. Minimum and maximum torque values are:

3-inch flange, 0.75-inch bolts – minimum 64 ft-lbs; maximum 96 ft-lbs

Record the torque value.

f. Heat the flange assembly to at least 180 °F, monitoring the flange temperature. Since the flange and pipe may heat up faster than the hydraulic oil, the flange temperature shall be monitored carefully to ensure that overheating does not occur.

g. Use an external pressure source to achieve 600 psig minimum.

h. Monitor for 4 hours, checking for leakage and pressure decay. Visually examine outer edges of the gasket to ensure no leaks occur. (Decreasing pressure may indicate gasket leakage.)

Note: If leakage occurs, retorque the flange bolts in 5-ft-lb increments and record torque values required to provide a tight pressure seal. Adjust to 600 psig, as required. Verify a tight seal for a 4-hour period. Retorque as necessary (up to maximum torque value) until seal is maintained for 4 hours.

i. Monitor the test assemblies for temperature and pressure three times per day using laboratory-certified equipment.

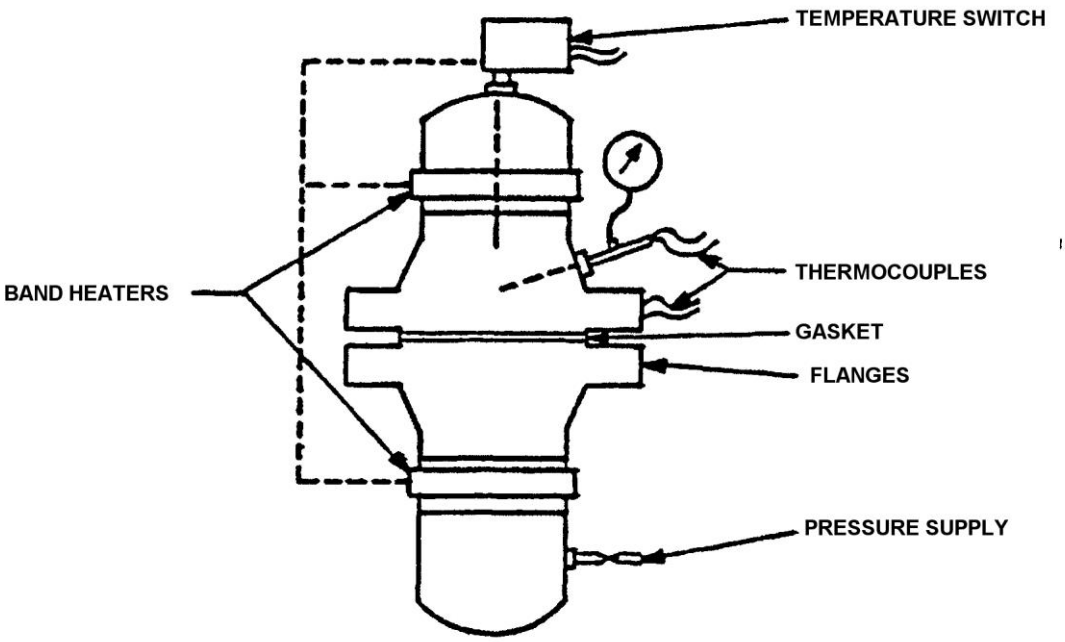
Note: If pressure decreases significantly, secure the heaters, allowing the flange to cool to ambient temperature, then check the flange assembly for leakage using pressurized nitrogen at 600 psig. This pressure test (independent of temperature effects) is used to verify that the gasket is the source of the leakage, not the test fixture. Check the flange bolt torque; if necessary, tighten the bolts in 5-ft-lb increments (not exceeding the maximum torque) until the required sealing torque is attained. Record the torque values. If the flange assembly is the source of leakage, it shall be corrected, or the test shall stop and be considered a failure.

j. Every 100 hours, secure the heaters and allow the test assemblies to cool. Re-energize the heaters after 24 hours and continue the test at specified conditions.

Note: If, at any time during the test, the pressure decreases significantly or the gasket leaks, the torque may be increased in 5-ft-lb increments up to the maximum allowed. Once the maximum torque value has been reached, two additional retorques (to the maximum torque) are allowed. If the gasket material continues to leak or fails to hold pressure, the gasket shall be considered as not meeting basic requirements and the test a failure.

k. Recharge the flange assemblies with the necessary amount of hydraulic oil prior to starting the next thermal cycle.

l. After testing each material and size, remove the gasket from the flange assembly and examine, noting characteristics such as adhesion, deformation, corrosion, permanent indentation, or cracks.




NOTE. This is a typical schematic of a test assembly. The actual vessel used must conform to all applicable code requirements for pressure vessels.

FIGURE I-1. Test flange assembly.

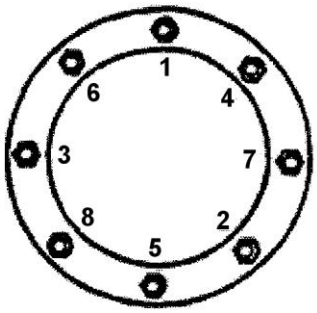



FIGURE I-2. Circular eight bolt.

# HIGH PRESSURE TEST

## J.1 SCOPE

J.1.1 Scope. This appendix describes a high-pressure test for determining the performance of gasket materials covered under this specification. This appendix is a mandatory part of this specification. The information contained herein is intended for compliance.

J.1.2 High-pressure performance test. This test determines whether a 0.0625-inch thick gasket material will satisfactorily maintain a seal over a 100-hour test period, while being subjected to thermal and pressure cycles. Water under elevated pressure and temperature (1,800 psig, 300 °F) is applied to a test assembly and monitored for leakage over the test period.

J.1.3 Blow-out test. This test determines the maximum pressure that may be applied to a gasket material that has been clamped between two flange plates. Pressure within the test assembly is increased until the gasket material is physically forced away from the flange sealing surfaces. Since pressure and temperature are both factors which contribute to gasket limitations, the blow-out test is conducted at temperatures and pressures above the maximum operating temperatures and pressures. This test is for high-pressure pump gaskets that must perform at 1,800 psig and 300 °F, with a reasonable safety margin. The blow-out tests use 0.0625-inch thick gasket material which is considered a worst-case thickness. The temperature shall be maintained at 450 °F and the pressure will be increased incrementally until blow-out occurs or 5,000 psig is achieved.

## J.2 APPLICABLE DOCUMENTS

J.2.1 Government documents.

J.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 cited in the solicitation or contract.

COMMERCIAL ITEM DESCRIPTIONS

A-A-59004 - Anti-Galling Compound, Thread Lubricating, Seizing Resistant, and Calcium Hydroxide Containing

(Copies of this document are available online at https://quicksearch.dla.mil.)

J.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 these documents are those cited in the solicitation or contract.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B1.1 - Unified Inch Screw Threads (UN and UNR Thread Form)

ASME B16.5 - Pipe Flanges and Flanged Fittings

(Copies of these documents are available online at www.asme.org.)

ASTM INTERNATIONAL

ASTM A193/A193M - Alloy-Steel and Stainless-Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications, Standard Specification for

ASTM A194/A194M - Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High Temperature Service or Both, Standard Specification for

(Copies of these documents are available online at www.astm.org.)

J.3 FLANGE ASSEMBLY

J.3.1 Flange assembly. Two standard steel, raised-face flange assemblies are required as test fixtures. The flange assemblies shall be in accordance with table J-I and figure J-1. The flange assemblies shall have face surface finish roughness averages of 125 microinches. Test assemblies shall have surfaces serrated with a concentric or phonograph pattern in accordance with ASME B16.5.

TABLE J-I. Flange assembly.

| Flange data (all flanges are ASME B16.5) | | | | Gasket specimen dimension (inches) | | |
|---|---|---|---|---|---|---|
| **Flange size (inches)** | **Flange face** | **Class** | **Assembly vol. 1/ (liters)** | **ID** | **OD** | **Thickness** |
| 8 | Raised | 2500 | 20.32 | 6.8 | 8.8 | 0.0625 |
| 2 | Raised | 2500 | Min. | 2.38 | 3.63 | 0.0625 |

NOTE:
1/ Tolerance value is ±2 percent.

J.4 HIGH-PRESSURE PERFORMANCE TEST

J.4.1 Test apparatus. The test fixture shall consist of two 8-inch ANSI class 2500, raised-face pipe flanges with an 8-inch diameter pipe extending between the flanges in sufficient length to meet the volumetric requirements. The test assembly volume shall be at least 1 liter for every 10 millimeters of pipe diameter (155 cubic inches for every 1 inch of pipe diameter). The volume of the 8-inch test assembly shall be at least 1,240 cubic inches (20.32 liters). The test fixture shall have heaters (thermostatically controlled) to maintain the temperature at 300±10 °F. Flanges shall have a contact surface 1-inch-wide, modified to accommodate a 6.8-inch ID and 8.8-inch OD gasket.

J.4.2 Test procedure. The following steps shall be performed for the high-pressure performance test:

a. Clean flange surfaces of the 8-inch flanges.

b. Prepare gasket materials by cutting to ID and OD of 6.8 inches and 8.8 inches, respectively.

c. Place gasket materials on stationary flange assemblies.

d. Place movable flange assemblies in place, ensuring that the gasket materials remain centered.

e. Use ASTM A193/A193M grade B7 or B16 bolts and ASTM A194/A194M grade 2H-4 or grade 7 nuts in these procedures. Bolts shall be threaded in accordance with ASME B1.1, class 2A with eight-pitch thread series. Threads for nuts shall be in accordance with ASME B1.1, 8-UN series, class 2B fit. These fasteners shall be free from nicks, burrs, and general wear. Hardware shall be uncoated steel. The bolts should be purchased from the same manufacturer's lot. The nuts should also be purchased from a homogeneous lot. Use SAE grade 5 washers made from plain, uncoated hardened steel. Do not over-stress fasteners at any time during testing. Use care in the handling and storage of fasteners to avoid damage. Bolt target parameters are listed as follows.

(1) For a 1-inch bolt diameter, the target torque is 45 ft-lbs.

(2) For a 2-inch bolt diameter, the target torque is 316 ft-lbs.

f. Lubricate the bolt threads, the bearing faces of the nuts, and the bearing faces of the washers with material in accordance with A-A-59004. Do not lubricate the bearing face of the bolt head.

g. Use two washers against the moving fastener (the nut), to reduce friction.

h. Hand tighten nuts.

i. Restrain the bolt head from rotation and tighten nuts in the sequence shown on figure J-2. Use a four-step tightening sequence. Apply 25 percent of the final torque value on each nut during each step. The final torque value is determined in accordance with J.4.2.e. Wait a minimum of 2 minutes between each tightening step.

j. Wait a minimum of 5 minutes after the final step of the tightening sequence and perform a series of check passes. During each check pass, apply the final torque from J.4.2.e. Begin the check pass sequence with position 1, shown on figure J-2. Proceed to the adjacent fastener in a clockwise pattern returning to position 1, which shall be checked a second time to minimize the effects of stress redistribution among fasteners. Wait a minimum of 2 minutes and repeat the check pass described above. Wait a minimum of 2 minutes, and again repeat the check pass described above. Repeat the check pass process until no bolt-nut movement is noted. Record the number of check passes.

k. Fill the test assembly with fresh water and pressurize to 100 psig. Check gasket joints for leakage and adjust bolt torque to stop leakage if necessary. Increase pressure in 300-psig increments to 1,000 psig, checking for and stopping leakage if observed. At 1,000 psig, place insulating boxes in place and energize heaters. Regulate pressure and temperature until 1,800 psig and 300 °F are reached. System pressure may fluctuate due to temperature controllers and band heater response time. Accordingly, the test loop may be modified to include an accumulator to stabilize pressure variations. If there is no leakage at 1,000 psig, leakage is not expected at higher pressure and temperatures. If leakage does occur, adjustments in bolt torque (not to exceed torque values from J.4.2.e), may be performed up to the end of the second thermal cycle. If leakage cannot be stopped, the test should be terminated, and the gasket material disqualified from further testing.

l. The first 30-hour test period begins when the pressure is stabilized at 1,800±50 psig, and temperature is at 300±10 °F. At the end of the 30-hour test period, secure the heaters and allow the test fixture to cool for 8 hours.

m. At the end of the 8-hour period, energize the heaters and again establish 1,800 psig and 300 °F. Adjustments to bolt torque (not to exceed torque values from J.4.2.e), to control leakage, may be performed if required. Continue the pressure and temperature test for 30 additional hours. At the end of the 30-hour test period, secure the heaters and allow the test fixture to cool for 8 hours. After the cooling cycle, energize the heaters and continue the pressure and temperature test for 40 hours. No adjustments to bolt torque shall be performed after the second heating cycle. Pressure adjustments to the test fixture should not be required after the second heating period, except for minor changes due to atmospheric conditions.

n. Record any pressure loss greater than 180 psig during the final test period. Confirm that any pressure loss greater than 180 psig is the result of leakage by visual inspection. Any such pressure loss shall be cause to stop the test and will result in disqualification of the gasket material.

o. Upon completion of the 100-hour test period, record the test fixture pressure, secure the heaters, and allow the test assembly to cool.

p. After the assembly cools to room temperature, drain the test assembly and remove the flange bolts and movable flange assemblies. Remove the gasket materials and observe adhesion effects and condition of gasket materials.

Note: Alternate thermal cycling periods during testing may be substituted provided the following conditions are met:

(1) Total hot cycle testing must amount to 100 hours.

(2) A minimum of three thermal cycles must be used.

(3) Minimum cool-down time between cycles is 8 hours.

(4) All other conditions described in J.4.2.l and J.4.2.m must be followed without deviation.

J.5 BLOW-OUT TEST

J.5.1 Test apparatus. The test fixture shall consist of standard 2-inch pipe flange with 2-inch pipe stubs (capped) extending from the flange assembly in sufficient length to attach band heaters, pressure gauges, and temperature monitors. The 2-inch pipe stubs should be of minimum length since the test fixture does not have any specific volume requirements. A nitrogen flask may be used to pressurize the test fixture. A boost pump may also be required to achieve sufficient pressure to create a blow-out depending upon the fixture volume. Insulation containers may be placed over the test fixture to meet temperature requirements. For safety purposes, a blow-out shield or cylinder should be positioned around the test fixture prior to the blow-out test.

J.5.2 Procedure. The following steps shall be performed for the blow-out test:

a. Clean the surfaces of the 2-inch ASME flange.

b. Prepare gasket material by cutting to ID and OD of 2.38 inches and 3.63 inches, respectively.

c. Place gasket material on bottom flange assembly.

d. Install the top flange assembly. Ensure that the gasket material remains centered.

e. Use nuts and bolts as specified in J.4.2.e.

f. Lubricate the bolt threads, the bearing faces of the nuts, and the bearing faces of the washers with material in accordance with A-A-59004. Do not lubricate the bearing face of the bolt head.

g. Use two washers against the moving fastener (the nut) to reduce friction.

h. Hand tighten nuts.

i. Restrain the bolt head from rotation and tighten nuts in the sequence shown on figure J-3. Use a four-step tightening sequence. Apply 25 percent of the final torque value on each nut during each step. The final torque value is determined by J.4.2.e. Wait a minimum of two minutes between each tightening step.

j. Wait a minimum of 5 minutes after the final step of the tightening sequence and perform a series of check passes. During each check pass, apply the final torque from J.4.2.e. Begin the check pass sequence with position 1, shown on figure J-3. Proceed to the adjacent fastener in a clockwise pattern around to position 1, which shall be checked a second time to minimize the effects of stress redistribution among fasteners. Wait a minimum of 2 minutes and repeat the check pass described above. Wait a minimum of 2 minutes and again repeat the check pass described above. Repeat the check pass process until no bolt-nut movement is noted. Record the number of check passes.

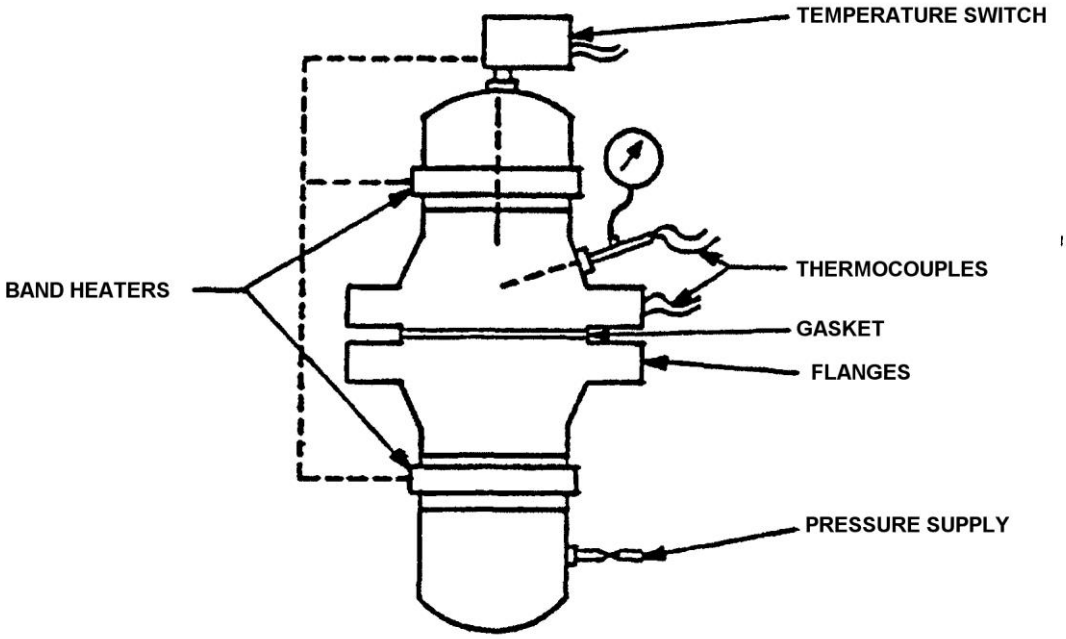
k. Secure band heaters to the flange assembly and place insulating boxes over the assembly.

l. Energize band heaters and heat the assembly to 450 °F. Maintain this temperature for a period of 1 hour.

m. Secure band heaters and remove insulating boxes from the flange assembly. Place blow-out shield around the flange assembly.

n. Open nitrogen supply valve and monitor assembly pressure until a blow-out occurs or until 5,000 psig is reached. Do not exceed 5,000 psig. If necessary, start boost pump to obtain a blow-out or to reach 5,000 psig.

o. Record temperature and blow-out pressure or maximum pressure attained.




NOTE. This is a typical schematic of a test assembly. The actual vessel used must conform to all applicable code requirements for pressure vessels.

FIGURE J-1. Test flange assembly.

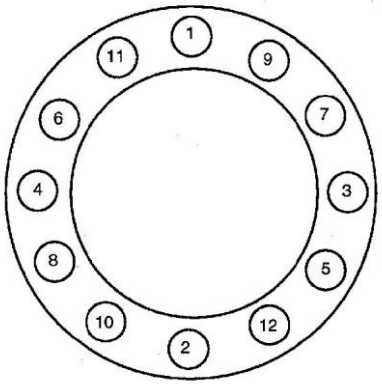



FIGURE J-2. Bolt tightening sequence.

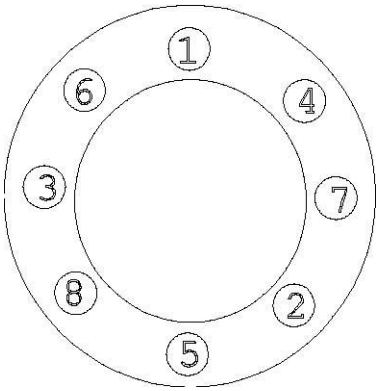



FIGURE J-3. Bolt tightening sequence.

# STEAM EXPOSURE PULSE TEST REQUIREMENTS WITH FLAT-FACED FLANGES

## K.1 SCOPE

K.1.1 Scope. This appendix describes a steam exposure pulse test for determining the performance of gasket materials exposed to saturated steam conditions. This appendix is a mandatory part of the specification. The information contained herein is intended for compliance.

## K.2 APPLICABLE DOCUMENTS

K.2.1 Government documents.

K.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 cited in the solicitation or contract.

DEPARTMENT OF DEFENSE SPECIFICATIONS

| | | |
|---|---|---|
| MIL-PRF-907 | - | Antiseize Thread Compound, High Temperature |
| MIL-DTL-1222 | - | Studs, Bolts, Screws and Nuts for Applications where a High Degree of Reliability is Required; General Specification for |
| MIL-PRF-17672 | - | Hydraulic Oil, Petroleum, Inhibited |
| MIL-L-24478 | - | Lubricant, Molybdenum Disulfide in Isopropanol |

DEPARTMENT OF DEFENSE HANDBOOKS

| | | |
|---|---|---|
| MIL-HDBK-267 | - | Guide for Selection of Lubricants and Hydraulic Fluids for Use in Shipboard Equipment |

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

K.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 these documents are those cited in the solicitation or contract.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

| | | |
|---|---|---|
| ASME B16.5 | - | Pipe Flanges and Flanged Fittings |

(Copies of this document are available online at www.asme.org.)

## K.3 FLANGE ASSEMBLY

K.3.1 Flange assembly. A flat-face flange assembly is required as a test fixture. The flange assembly shall be in accordance with table K-I and figure K-1. The flange assembly shall have a phonographic surface finish of 250 RHR.

TABLE K-I. Flange assembly.

| Flange data (all flanges are ASME B16.5) | | | | Gasket specimen dimension (inches) | | |
|---|---|---|---|---|---|---|
| **Flange size (inches)** | **Flange face** | **Class** | **Assembly vol. 1/ (liters)** | **ID** | **OD** | **Thickness** |
| 3 | Flat | 600 | Min. | 3.50 | 8.25 | 0.0625 |
| NOTE:<br>1/ Tolerance value is ±2 percent. | | | | | | |

K.4 PROCEDURE

K.4.1 Steps. The following steps shall be performed for the steam exposure pulse test:

K.4.1.1 Elevated temperature exposure.

a. Clean the flange face.

b. Install the test gasket material in the 3-inch test assembly with 0.75-inch NICU bolts, made in accordance with MIL-DTL-1222. The flange assembly shall be capable of being placed in an oven (or equipped with heating bands) for heating and be attachable to a dynamic pulse apparatus for simulating a “water hammer” effect. Refer to figure K-1.

c. Calculate the amount of water required to fill the flange assembly with saturated steam when the test conditions are at least 150 psig. Place a measured amount of water, slightly greater than required, in the flange assembly prior to closing. Alternately, live steam may be substituted for the method described in K.4.1.1.g and K.4.1.1 h provided that a continuous supply of steam is available to provide an uninterrupted test for 100 hours as described in K.4.1.1.j. When using live steam, a pressure of at least 150 psig is required.

d. Center the gasket on the flange and install the test flange. Lubricate and hand-tighten the flange bolts, selecting a lubricant using guidance provided in MIL-HDBK-267 such as MIL-L-24478 (Molykote or equal). This lubricant shall not be used as a release agent for the gasket.

e. Using the proper bolt tightening sequence (an eight-bolt flange assembly is shown on figure K-2 as an example), torque the flange bolts to 40 ft-lbs.

Note: If a nickel-based containing antiseize compound from MIL-PRF-907 is used as an alternative lubricant, the torque shall be 50 ft-lbs.

f. Slowly heat the flange assemblies to at least 366 °F monitoring the flange temperature.

g. If not using live steam, and if necessary, admit water to the assembly in very small quantities until at least 150 psig is obtained.

h. If not using live steam and if at any time during testing the pressure drops below 145 psig, add sufficient water to maintain 150 psig. Record the amount of water added.

i. Monitor the test assemblies for temperature and pressure three times per day, using laboratory certified equipment.

j. Maintain 366 °F, 150 psig for 100 hours.

k. Allow to cool to room temperature, remove water, and proceed to K.4.1.2.

K.4.1.2 Static elevated pressure.

a. Fill the flange assembly with MIL-PRF-17672 hydraulic oil.

b. Attach the room-temperature assembly to a dynamic pulse tester capable of maintaining pulse and static pressure up to 1,200 psig. Ensure that a blow-out shield is in place.

c. Increase pressure gradually until blow-out occurs or 600 psig is reached. Hold the pressure at 600 psig for 5 minutes.

d. Record the blow-out pressure or maximum pressure attained.

e. If blow-out did not occur, proceed to K.4.1.3.

K.4.1.3 Dynamic pulse pressure.

a. Begin pulsing of the hydraulic oil at 600 psig in intervals of 1 second at 600 psig and 1 second at 0 psig.

b. Continue pulsing for 1 hour or until failure occurs.

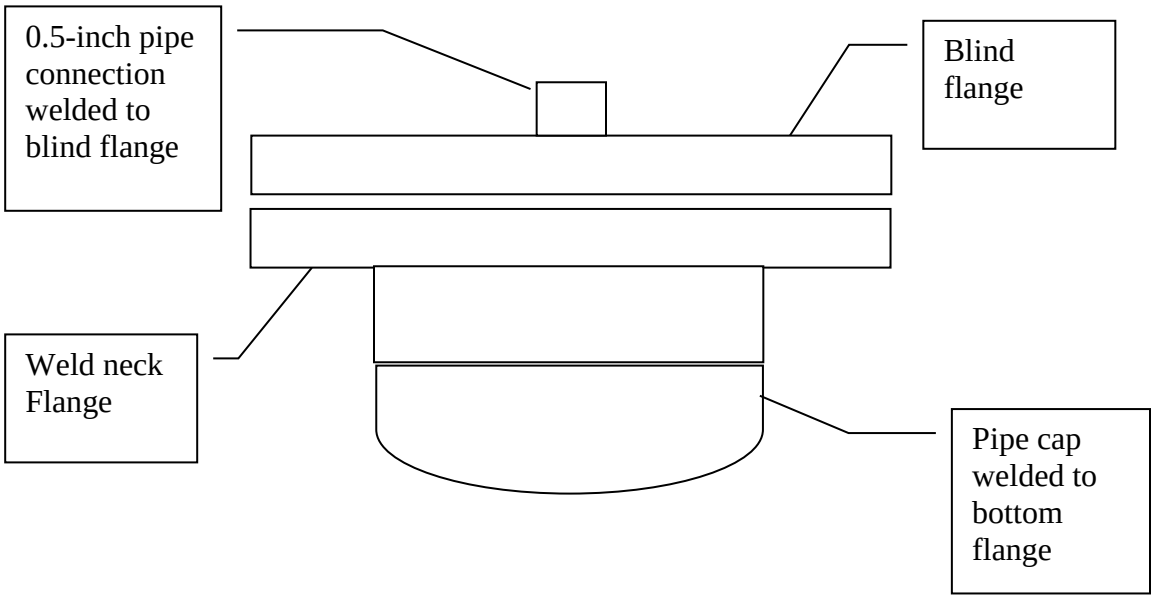



FIGURE K-1. Flange assembly for dynamic pulse pressure test.

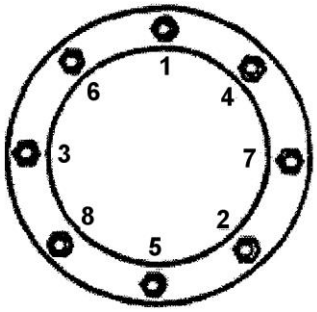



FIGURE K-2. Torquing sequence for circular eight-bolt flange.

CONCLUDING MATERIAL

Preparing Activity:
Navy – SH
(Project 5330-2019-003)

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at https://assist.dla.mil.