

INCH-POUND
MIL-DTL-24211C
9 February 2011
SUPERSEDING
MIL-DTL-24211B
19 November 2004

DETAIL SPECIFICATION

GASKETS, WAVEGUIDE FLANGE GENERAL SPECIFICATION FOR

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

1. SCOPE

1.1 Scope. This specification covers the general requirements for pressure sealing gaskets used with general purpose cover flanges and flat face flanges covered by [MIL-DTL-3922](#).

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 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, 4 or 5 of this specification, whether or not they are listed.

2.2 Government documents.

2.2 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 (see [6.2](#)).

COMMERCIAL ITEM DESCRIPTIONS

[A-A-59588](#) - Rubber, Silicone.

DEPARTMENT OF DEFENSE SPECIFICATIONS

[MIL-DTL-3922](#) - Flanges Waveguide, General Purpose, General Specification for.

[MIL-DTL-24211/1](#) - Gaskets, Waveguide Flange (Cover).

[MIL-DTL-24211/2](#) - Gaskets, Waveguide Flange (Flat Face).

DEPARTMENT OF DEFENSE STANDARDS

[MIL-STD-202](#) - Test Methods for Electronic and Electrical Component Parts.

(Copies of these documents are available from the Standardization Document Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094 or at <https://assist.daps.dla.mil>.)

Comments, suggestions or questions on this document should be addressed to DLA Land and Maritime, ATTN: VAT, Post Office Box 3990, Columbus, OH 43218-3990, or emailed to TubesAmps@dla.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <https://assist.daps.dla.mil>.

MIL-DTL-24211C

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 cited in the solicitation or contract (see 6.2).

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

[ANSI-H35.1](#) - Alloy and Temper Designation Systems for Aluminum.

(Applications for copies of ANSI publications should be addressed to ANSI, 11 West 42nd Street, New York, NY 10036 or by e-mail at <http://web.ansi.org>.)

ASTM INTERNATIONAL (ASTM)

[ASTM-B26/B26M](#) - Aluminum-Alloy Sand Castings.
[ASTM-B85/B85M](#) - Aluminum-Alloy Die Castings.
[ASTM-B108/B108M](#)- Aluminum-Alloy Permanent Mold Castings.
[ASTM-B209](#) - Aluminum and Aluminum-Alloy Sheet and Plate.
[ASTM-B211](#) - Aluminum and Aluminum-Alloy Bar, Rod and Wire.
[ASTM-B221](#) - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.

(ASTM publications are available from ASTM International, 100 Barr Harbor Drive, Conshohocken, PA 19428-2959 or from <http://astm.org>).

NATIONAL CONFERENCE OF STANDARDS LABORATORIES (NCSL)

[NCSL-Z540.3](#) - Calibration Laboratories and Measuring and Test Equipment .

(Copies of the above document are available at National Conference of Standards Laboratories (NCSL), 2995 Wilderness Place Suite 107, Boulder, CO 80301-5404, United States, or at <http://www.ncsli.org>.)

SAE INTERNATIONAL (SAE) AEROSPACE MATERIALS SPECIFICATIONS (AMS)

[SAE-AMS-QQ-P-416](#)- Plating, Cadmium (Electrodeposited).

(Society of Automotive Engineering documents are available through SAE INTERNATIONAL, 400 Commonwealth Drive, Warrendale, PA 15096-0001, <http://www.sae.org>.)

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

2.4 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between the text of this document and the references cited herein (except for related specification sheets), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Specification sheets. The individual item requirements shall be as specified herein and in accordance with the applicable specification sheet. In the event of any conflict between the requirements of this specification and the specification sheet, the latter shall govern.

3.2 Materials. The material for each part shall be as specified herein and in [table I](#). When a definite material is not specified, a material shall be used which will enable the gaskets and the subassemblies to meet the performance requirements of this specification (see 6.2.e). Acceptance or approval of any constituent material shall not be construed as a guaranty of acceptance of the finished product (see 4.6.1).

MIL-DTL-24211C

TABLE I. Component materials inspection.

Component material	Requirement paragraph	Applicable document
Aluminum-base alloys:	3.2.1 --	
Bar stock and forging	3.2.1.1	ASTM-B221 or B211
Sand casting	3.2.1.2	ASTM-B26/B26M/ANS-H35.1
Die casting	3.2.1.3	ASTM-B85/B85M , B26/B26M or B108/B108M
Permanent mold casting	3.2.1.4 AST	M-B108/B108M
Sheet	3.2.1.5	ASTM-B209
Silicone rubber	3.2.2	A-A-59588
Plating	3.3.1	SAE-AMS-QQ-P-416

3.2.1 Aluminum-base alloys.

3.2.1.1 Bar stock and forging. When fabricated from bar stock or by forging, gaskets shall be made of an aluminum alloy conforming to alloy 6061 of [ASTM-B221](#) or [ASTM-B211](#); bar stock shall be temper T6.

3.2.1.2 Sand casting. When fabricated by sand casting, gaskets shall be made of aluminum alloy conforming to [ANSI-H35.1](#) alloy designation alloys 295.0, condition T4; alloy 208.0, condition F; or alloy 712.0, condition T5 of [ASTM-B26/B26M](#).

3.2.1.3 Die casting. When fabricated by die casting, gaskets shall be made of aluminum alloy conforming to [ASTM-B85/B85M](#), [ASTM-B26/B26M](#) or [ASTM-B108/B108M](#).

3.2.1.4 Permanent mold casting. When fabricated by permanent mold casting, gaskets shall be made of an aluminum alloy conforming to alloy 356.0, condition T6 or alloy 355.0, condition T6 of [ASTM-B108/B108M](#).

3.2.1.5 Sheet. When fabricated from sheet aluminum, the alloy shall conform to [ASTM-B209](#).

3.2.2 Rubber compound. The rubber compound for the gaskets shall be silicone rubber, class 2A, grade 60, in accordance with [A-A-59588](#).

3.2.3 Dissimilar metals. Unless suitably protected against electrolytic corrosion, dissimilar metals shall not be used in intimate contact with each other (see 6.4.1). This pertains to different metals within the gaskets themselves, as well as to gasket metals in contact with waveguide flange metals. Waveguide flange metal materials are identified in [MIL-DTL-3922](#).

3.3 Interface and physical dimensions. Gaskets shall be of the design, interface and physical dimensions specified (see [3.1](#) and [4.6.1](#)).

3.3.1 Plating. The metal alloy (see [3.7](#)) used shall have equivalent form, fit, functional performance and corrosion resistance as cadmium plate, type I class 2, in accordance with [SAE-AMS-QQ-P-416](#), of sufficient density to withstand the salt spray (corrosion) test in [4.6.3](#) without evidence of corrosion or pitting. Plating must be accomplished prior to molding the rubber to the metal.

3.4 Seal. When tested as specified in [4.6.4](#), gaskets shall show no air leakage.

3.5 Radio Frequency (RF) leakage. When tested as specified in [4.6.5](#), RF leakage shall be at least 100 decibels (dB) below the transmitted power at the gasket.

3.6 Pure tin. The use of pure tin, as an underplate or final finish, is prohibited both internally and externally. Tin content of waveguide flange gasket components and solder shall not exceed 97 percent, by mass. Tin shall be alloyed with a minimum of 3 percent lead, by mass (see [6.6](#)).

3.7 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable 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. All components supplied shall be new and unused.

MIL-DTL-24211C

3.8 Workmanship. Gaskets shall be processed in such a manner as to be representative of controlled Industrial techniques, and all surfaces shall be free from burrs, die marks, chatter marks, scratches, dirt, grease, scale, splinters, and other defects that will affect life, serviceability, or appearance.

4. VERIFICATION

4.1 Test equipment and inspection facilities. Test equipment and inspection facilities shall be of sufficient accuracy, quality, and quantity to permit performance of the required inspection. The manufacturer shall establish and maintain calibration of inspection equipment to the satisfaction of the Government. Calibration of the standards which control the accuracy of inspection equipment shall comply with the requirements of [NCSL-Z540.3](#).

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

a. Component materials inspection (see [4.3](#)).

b. Conformance inspection (see [4.5](#)).

(1) Inspection of product for delivery (see [4.5.1](#)).

4.3 Component materials inspection. Materials inspection shall consist of verification that the component materials (see [3.2](#) through [3.2.2](#), [3.3.1](#), [3.7](#), [4.6.1](#) and [table I](#)) used in fabricating the waveguide gaskets, are in accordance with the applicable referenced specifications or requirements prior to such fabrication (see [3.7](#)).

4.4 Inspection conditions. Unless otherwise specified herein, all inspections shall be performed in accordance with the test conditions specified in [MIL-STD-202](#).

4.5 Conformance inspection.

4.5.1 Inspection of product for delivery. Inspection of product for delivery shall consist of group A and group B inspections.

4.5.1.1 Inspection lot. An inspection lot, as far as practicable, shall consist of all the gaskets of the same part number, produced under essentially the same conditions and offered for inspection at one time.

4.5.1.2 Rejected lots. If an inspection lot is rejected, the manufacturer may withdraw the lot, rework it to correct the defects, or screen out the defective units, as applicable, and re-inspect. Such lots shall be kept separate from new lots and shall be clearly identified as re-inspected lots. Rejected lots shall be inspected using tightened inspection.

4.5.1.3 Group A inspection. Group A inspection shall consist of the examinations specified in [table II](#); all group A examinations shall be made on the same set of sample units.

TABLE II. Group A inspection.

Examination	Requirement paragraph	Method paragraph
Visual and mechanical	--	4.6.1
Material	3.1 , 3.2 , through 3.2.2 , 3.3.1	4.3 , 4.6.1
Interface	3.1 , 3.3 and 3.3.1	4.6.1
Workmanship	3.8 4.6.1	

4.5.1.3.1 Sampling plan. Statistical sampling and inspection shall be performed on an inspection lot basis with a random sample of gaskets selected in accordance with [table III](#). The acceptance levels shall be based upon the zero defective sampling plan. No failures shall be permitted.

MIL-DTL-24211C

TABLE III. Group A sampling plan.

Lot size	Sample size
1-13	100 percent
14-150	13
151-280	20
281-500	29
501-1200	34
1201-3200	42
3201-10,000	50
10,001-35,000	60
35,001-150,000	74
150,001-500,000	90
500,001 and over	102

4.5.1.3.2 Rejected lots. If an inspection lot is rejected, the contractor may rework it to correct the defects, or screen out the defective units, and resubmit for re-inspection to the [table III](#) sampling plan. Such lots shall be separate from new lots, and shall be clearly identified as re-inspected lots. If one or more defects are found in the second sample, the lot is rejected and shall not be supplied to this specification. (NOTE: This corrective action applies to the original defect found. If another defect type is found in the second sample, a re-screen for that defect is also permitted.)

4.5.1.4 Group B inspection. Group B inspection shall consist of the tests specified in [table IV](#).

TABLE IV. Group B inspection.

Test	Requirement paragraph	Method paragraph
Rubber adhesion	3.2.2	4.6.2
Salt atmosphere (corrosion)	3.3.1	4.6.3
Seal	3.4	4.6.4
RF leakage	3.5	4.6.5

4.5.1.4.1 Sampling plan. For the purpose of group B inspection, gaskets shall be in two size groups as listed in [table V](#). Group B inspection shall be performed on one sample per size group and inspection of one sample gasket in a group shall fulfill the group B inspection requirements for the entire group. Inspection shall be performed on a particular size group semi-annually if the manufacturer has been awarded a contract or order for a gasket in that group.

Table V. Group B inspection size groups.

Group I - X-band and smaller	Group II - Larger than X-band
M24211/1-001	M24211/2-001
M24211/1-002	M24211/2-002
M24211/1-003	M24211/2-003
M24211/1-004	M24211/2-004
M24211/1-005	M24211/2-005
M24211/1-006	M24211/2-006
M24211/2-009	M24211/2-007
M24211/2-010	M24211/2-008
M24211/2-011	

MIL-DTL-24211C

4.5.1.4.2 Noncompliance. If a sample fails to pass group B inspection, the manufacturer shall take corrective action on the materials, process, or both, as warranted, and on all units of product which can be corrected and which were manufactured under essentially the same conditions, with essentially the same materials, and processes, and which are considered subject to the same failure. Acceptance of the product shall be discontinued until corrective action, acceptable to the Government, has been taken. After the corrective action has been taken, group B inspection shall be repeated on additional sample units (all inspection, or the inspection which the original sample failed, at the option of the government). Group A inspection may be re-instituted; however, final acceptance shall be withheld until the group B inspection has shown that the corrective action was successful.

4.5.1.4.3 Disposition of samples. Sample units which have been tested under the group B inspection shall not be delivered on the contract or purchase order.

4.6 Methods of examination and test.

4.6.1 Visual and mechanical examination. Gaskets shall be examined to verify that the materials, design, interface, physical dimensions, plating and workmanship are in accordance with the applicable requirements (see 3.1 through 3.3.1, 3.6 and 4.3).

4.6.2 Rubber adhesion. A gasket shall be mounted between two applicable flanges with torque, as specified in table VI applied to the mounting bolts. Thermal shock shall be conducted in accordance with method 107, test condition B of MIL-STD-202. After cycling, the temperature shall be raised to 190° C and held for 20 hours and then lowered to -40° C and held for 4 hours, after which the gasket shall be removed and inspected. There shall be no evidence of the rubber's being permanently deformed or coming loose from the gasket. The rubber seal must meet or exceed the performance requirements of the materials required in 3.2.2.

TABLE VI. Applied torque (see 4.6.2 and 4.6.3).

Bolt size	Torque (inch pounds)
4-40	4.5
6-32	8.5
8-32	18.0
10-24	23.0
1/4-20	80.0
5/16-18	140.0

4.6.3 Salt atmosphere (corrosion). Gaskets shall be tested in accordance with method 101 of MIL-STD-202. The following details shall apply:

- a. The specimen shall be mounted between two applicable flanges attached to waveguide pieces which are sealed on the ends. Torque as indicated in table IV shall be applied to the mounting bolts.
- b. Test condition B.
- c. Before the salt deposit is removed, the gasket shall be removed and examined. There shall be no salt on the flange or gasket from the center of the rubber seal inward. The gasket shall then be washed and examined. The requirements of 3.3.1 shall be met.

4.6.4 Seal. Gaskets shall be tested in accordance with method 112 of MIL-STD-202, test condition A. Tap water is to be used instead of oil. Observation is to be for a minimum of 2 minutes. After adhering air bubbles have been removed, and further escaping bubbles indicate a bad seal, the item shall be rejected.

4.6.4.1 Seal (alternate method).

- a. Gaskets shall be mounted by the same method as in 4.6.3, except one waveguide piece shall be provided with a fitting for applying compressed air or nitrogen.
- b. The bolted assembly shall be immersed in water and pressurized with air or nitrogen to 15 psig.
- c. Gaskets shall pass visual inspection as in 4.6.1 during and after seal test.

MIL-DTL-24211C

4.6.5 RF leakage. With a gasket, which has been coupled 5 times, inserted in a flange junction of a test line, a known amount of RF power shall be transmitted through the line. The flange junction shall be probed to determine the amount of RF leakage from the junction. The RF power level shall be such that leakage of at least 100 dB below the transmitted power of the gasket is measurable. A tunable one-quarter wavelength probe shall be issued to insure a high impedance across the junction. The center conductor of the probe shall be extended to touch one flange, and the shell of the probe shall touch the mating flange. The flange shall be probed 360° and shall meet the requirements of 3.5.

5. PACKAGING

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

6. NOTES

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

6.1 Intended use. The gaskets covered by this specification are intended for use in military applications where their performance characteristics are required. The gaskets are suitable for installation in military systems when used within the limitations of their specified performance requirements. These gaskets are not to be used with cover-choke flange combinations. The gaskets specified herein must function in and withstand for prolonged periods worldwide military unique environments. These gaskets are military unique because expensive changes to field systems would be required to maintain proper form, fit and function, if other than these standard military components are used.

6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number, and date of this specification and of the applicable specification sheet.
- b. The specific issue of individual documents referenced (see 2.2 and 2.3), cf. <https://assist.daps.dla.mil>.
- c. Packaging requirements (see 5.1).
- d. The complete part number (see 3.1).
- e. Unless approval is obtained from the procuring activity, the supplier must not substitute for a specified material or fabricated part. Evidence to substantiate his claim that such a substitute is suitable must be submitted with his request. Similar notification and substantiating evidence must be submitted at any later time if substitution becomes necessary or desirable. At the discretion of the Government, test samples may be required to prove the suitability of the proposed substitute.

6.3 Definition. For the purpose of this specification, the following definition applies:

6.3.1 Dissimilar metals. Dissimilar metals are defined in MIL-STD-889.

6.4 Subject term (key word) listing.

Adhesion	Leakage
Corrosion	Mounting bolts
Cover	Radio frequency
Interface	Seal

MIL-DTL-24211C

6.5 Environmentally preferable material. Environmentally preferable materials should be used to the maximum extent possible to meet the requirements of this specification. As of the dating of this document, the U.S. Environmental Protection Agency (EPA) is focusing efforts on reducing 31 priority chemicals. The list of chemicals and additional information is available on their website <http://www.epa.gov/osw/hazard/wastemin/priority.htm>. Use of these materials should be minimized or eliminated unless needed to meet the requirements specified herein (see Section 3).

6.6 Tin whisker growth. The use of alloys with tin content greater than 97 percent, by mass, may exhibit tin whisker growth problems after manufacture. Tin whiskers may occur anytime from a day to years after manufacture and can develop under typical operating conditions, on products that use such materials. Conformal coatings applied over top of a whisker-prone surface will not prevent the formation of tin whiskers. Alloys of 3 percent lead, by mass, have shown to inhibit the growth of tin whiskers (see 3.6). For additional information on this matter, refer to ASTM-B545 (Standard Specification for Electrodeposited Coatings of Tin).

6.7 Changes from previous issue. The margins of this specification are marked with vertical lines to indicate where changes from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue..

Custodians:
Army - CR
Navy - EC
Air Force - 85
DLA - CC

Preparing activity:
DLA - CC

(Project 5985-2011-012)

Review Activities:
Army - MI
Navy - AS, CG, MC
Air Force - 19

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.daps.dla.mil/>.