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INCH-POUND
MIL-DTL-24211A
25 November 1998
SUPERSEDING
MIL-G-24211
28 MARCH 1966

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-F-3922.

2. APPLICABLE DOCUMENTS

2.1 General. 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 documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

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

SPECIFICATIONS

DEPARTMENT OF DEFENSE

MIL-F-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).

FEDERAL

QQ-P-416	-	Plating, Cadmium (Electrodeposited).
ZZ-R-765	-	Rubber, Silicone (General Specification).

STANDARDS

DEPARTMENT OF DEFENSE

MIL-STD-202	-	Test Methods for Electronic and Electrical Component Parts.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Defense Supply Center Columbus, ATTN: DSCC-VAT, 3990 East Broad Street, Columbus, Ohio 43216-5000, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC 5985
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(Unless otherwise indicated, copies of the above specifications and standards are available from the Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

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 the documents which are DoD adopted are those listed in the issue of the DoDISS cited in the solicitation. Unless otherwise specified the issues of documents not listed in the DoDISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

AA 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.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

B26/B26M	-	Standard Specification for Aluminum-Alloy Sand Castings. (DoD adopted)
B85	-	Standard Specification for Aluminum-Alloy Die Castings. (DoD adopted)
B108	-	Standard Specification for Aluminum-Alloy Permanent Mold Castings. (DoD adopted)
B209	-	Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate. (DoD adopted)
B211	-	Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod and Wire. (DoD adopted)
B221	-	Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes. (DoD adopted)

(Application for copies should be addressed to the American Society for Testing and Materials, 100 Bar Harbor Drive, Coshohocken, PA 19428-2959).

NATIONAL CONFERENCE OF STANDARDS LABORATORIES (NCSL)

NCSL Z540-1	-	General Requirements for Calibration Laboratories and Measuring and Test Equipment (DoD adopted).

(Application for copies of NCSL publications should be addressed to National Conference of Standards Laboratories, 1800 30th Street, Suite 305B, Boulder, CO 80301.)

(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. In the event of a conflict between the text of this document and the references cited herein (except for related associated specification sheets) , the text of this document takes precedence. Nothing in this docu-ment, 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).

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TABLE I. Component materials inspection.

Component material	Requirement paragraph	Applicable specification
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/ANSI H35.1
Die casting	3.2.1.3	ASTM B85, B26/B26M or B108
Permanent mold casting	3.2.1.4	ASTM B108
Sheet	3.2.1.5	ASTM B209
Silicone rubber	3.2.2	ZZ-R-765
Plating	3.3.1	QQ-P-416 or equivalent

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.

3.2.2 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, ASTM B26/B26M or ASTM B108.

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.

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 ZZ-R-765.

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-F-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 used shall have equivalent form, fit, functional performance and corrosion resistance as cadmium plate, type I class 2, in accordance with 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 Workmanship. Gaskets shall be processed in such a manner as to be representative of controlled Industrial tech-niques, 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.

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.

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 Z540-1.

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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).

(2) Inspection of preparation for delivery (see 4.5.2).

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.

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	3.6	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.

TABLE III. Group A Sampling Plan.

Lot size	Sample size
1-13	100 percent
14-125	13
126-150	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
500,001and over	102

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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 reinspection to the table III sampling plan. Resubmitted lots shall be inspected using tightened inspection. Such lots shall be separate from new lots, and shall be clearly identified as reinspected 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 rescreen 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 spray (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	

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. In case of failure after re-inspection, information concerning the failure and corrective action taken shall be furnished to the contracting officer.

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. Temperature cycling shall be conducted in accordance with method 107, test condition B of MIL-STD-202. After cycling, the temperature shall be raised to 190^{o} C and held for 20 hours and then lowered to -40^{o} 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 recommended in 3.2.2.

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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
¼-20	80.0
5/16-18	140.0

4.6.3 Salt spray (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.

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^{o} 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.

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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. Issue of DoDISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2 and 2.3).

c. Packaging requirements (see 5.1).

d. The complete part number (see 3.1).

e. That the supplier must not substitute for a specified material or fabricated part unless he obtains approval from the Government. 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 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.

TABLE I. Component materials inspection.

Component material	Requirement/reference paragraph	Applicable specification
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/ANSI H35.1
Die casting	3.2.1.3	ASTM B85, B26/B26M or B108
Permanent mold casting	3.2.1.4	ASTM B108
Sheet	3.2.1.5	ASTM B209
Silicone rubber	3.2.2	ZZ-R-765
Plating	3.3.1	QQ-P-416 or equivalent

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

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

6.5 Subject term (key word) listing.

Adhesion
Corrosion
Cover
Interface
Leakage
Mounting bolts
Radio frequency
Seal

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

Preparing activity:
DLA - CC

(Project 5985-1095)

Review Activities:
Army - MI
Navy - AS, CG, MC
Air Force - 17, 19

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STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.

2. The submitter of this form must complete blocks 4, 5, 6, and 7.

3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-DTL-24211A	2. DOCUMENT DATE (YYMMDD)
3. DOCUMENT TITLE GASKETS, WAVEGUIDE FLANGE GENERAL SPECIFICATION FOR		
4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)		
5. REASON FOR RECOMMENDATION		
6. SUBMITTER		
a. NAME (Last, First, Middle initial)	b. ORGANIZATION	
c. ADDRESS (Include Zip Code)	d. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON (If applicable)	7. DATE SUBMITTED (YYMMDD)
8. PREPARING ACTIVITY		
a. NAME David Arps	b. TELEPHONE (Include Area Code) (1) Commercial (614) 692-0506 (2) AUTOVON 850-0506	
c. ADDRESS (Include Zip Code) DSCC-VAT Defense Supply Center Columbus 3990 East Broad Street Columbus, OH 43216-5000	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340	

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