

INCH-POUND

MIL-DTL-27536C
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 SUPERSEDING
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DETAIL SPECIFICATION

COUPLING, CLAMP, GROOVED, V-BAND

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

1. SCOPE

1.1 Scope. This specification establishes the general requirements for V-band grooved clamp couplings.

1.2 Classification. The couplings will be classified by nominal size, temperature range, latch type, and axial load rating in accordance with the applicable specification sheet (see 6.2). The components are applicable to the following types, as shown on the specification sheets:

1.2.1 Single latch couplings.

Type B	-	Basic T-bolt (Bolt)
Type R	-	Quick Release (Release)
Type BL	-	Basic T-bolt with secondary safety latch (Bolt-Latch)
Type RL	-	Quick Release with secondary safety latch (Release-Latch)

1.2.2 Double Latch Couplings (-21 minimum size).

Type BR	-	Basic T-bolt and Quick Release (Bolt-Release)
Type BRL	-	Basic T-bolt and Quick Release with Secondary Safety Latches (Bolt-Release-Latch)

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: the Defense Industrial Supply Center, (Code DISC-EED), 700 Robbins Avenue, Phila., PA 19111-5096, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

FSC 5340

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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 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, 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 listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

FEDERAL

QQ-P-35 - Passivation Treatments for Corrosion Resistant Steel.

DEPARTMENT OF DEFENSE

MIL-P-116 - Preservation, Methods of.
 MIL-W-6858 - Welding, Resistance, Aluminum, Magnesium, Non-Hardening Steels or Alloys, Nickel Alloys, Heat-Resisting Alloys, and Titanium Alloys; Spot and Seam.
 MIL-N-7873 - Nut, Self-Locking, 1200°F.
 MIL-S-8879 - Screw Thread, Controlled Radius Root With Increased Minor Diameter, General Specification for.
 MIL-N-25027 - Nut, Self-Locking, 250°F, 450°F, 800°F.

STANDARDS

DEPARTMENT OF DEFENSE

MIL-STD-129 - Marking for Shipment and Storage.
 MIL-STD-130 - Identification Marking of U.S. Military Property.
 MIL-STD-810 - Environmental Test Methods.
 MIL-STD-831 - Test Reports, Preparation of.
 MIL-STD-2219 - Fusion Welding for Aerospace Applications.

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STANDARDS (Continued)

DEPARTMENT OF DEFENSE (Continued)

- MS24563 - Dimensions, Profile, V-Band Coupling Flanges; Design Standard for.
- MIL-DTL-27576/1 - Coupling, Clamp, Grooved, V-Band, 1.750 to 14.250 Flange OD (-65° to +800°F).
- MIL-DTL-27576/2 - Coupling, Clamp, Grooved, V-Band, 1.750 to 6.250 Flange OD (-450° to +250°F).
- MIL-DTL-27576/3 - Coupling, Clamp, Grooved, V-Band, 1,750 to 14.250 Flange OD (-320° to +1200°F).

(Unless otherwise indicated, copies of specifications, standards and handbooks are available from the Standardization Document Order Desk, 700 Robbins avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.3 Non-Government publications. The following document forms a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents which are DOD adopted shall be those listed in the issue of the DODISS specified in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issue of the documents cited in the solicitation (see 6.2).

AMERICAN NATIONAL STANDARDS INSTITUTE

- ANSI/ASME B46.1 - Surface Texture (Surface Roughness, Waviness and Lay).
- ANSI/ASQC Z1.4 - Sampling Procedures and Tables for Inspection by Attributes.

(Application for copies should be addressed to the American National Standards Institute, Inc., 11 West 42nd Street, New York, NY 10036.)

AEROSPACE MATERIAL SPECIFICATIONS

- AMS5731 - Bars, Forgings, Tubing, and Rings, Corrosion and Heat Resistant, 15 Cr - 25.5 Ni - 1.3 Mo - 2.1 Ti - 0.006B - 0.30V, Consumable Electrode Melted, 1800°F (982°C).
- AMS5732 - Bars, Wire, Forgings, Tubing, and Rings, 15 Cr - 25.5 Ni - 1.2 Mo - 2.1 Ti - 0.006B - 0.30V, Consumable Electrode Melted, 1800°F (982°C) Solution and Precipitation Heat Treated.
- AMS5737 - Bars, Forgings, and Tubing, Corrosion and Heat Resistant, 15 Cr - 25.5 Ni - 1.30 Mo - 2.1 Ti - 0.006B - 0.30V, Consumable Electrode Melted, 1650°F (899°C), Heat Treated, Solution and Precipitation.

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AEROSPACE MATERIAL SPECIFICATIONS (Continued)

AMS7478	-	Bolts and Screws, Steel, Corrosion and Heat Resistant Heat Treated, Roll Threaded, 1800°F (982°C) Solution and Precipitation Heat Treated.
AMS7479	-	Bolts and Screws, Steel, Corrosion and Heat Resistant Heat Treated - Roll Threaded, 1650°F (899°C) Solution and Precipitation Heat Treated.

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

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

3.2 Qualification. The coupling clamps 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).

3.3 Materials.

3.3 .1 Metals. Metals shall be corrosion-resistant steel and passivated in accordance with QQ-P-35 to resist corrosion in fuels, water-alcohol, salt spray, or atmospheric conditions to which the coupling shall be subjected when in storage or during normal service use. Materials shall not be used that are known to be highly susceptible to stress corrosion. V-band couplings shall be made of high-yield corrosion-resistant steel alloy, except that free machining steel shall not be used.

3.3 .2 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials shall 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.

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3.4 Design. The coupling shall be designed to conform to the various sizes, types, temperatures, and loads in accordance with MIL-DTL-27576/1, MIL-DTL-27576/2, and MIL-DTL-27576/3. The coupling sizes shall be in accordance with MS24563, Figure 2A Flanges.

The coupling shall consist of the following components:

- a. Latching member or members.
- b. Retaining member or members.

The latch of the quick-release type (Type R) shall be positive locking but easily released when the nut is backed off. All component parts of the quick-release couplings shall remain as an assembly during installation or removal. The basic T-bolt latches (Type B) may require removal of latch components such as the nut. Type L latches shall provide a secondary safety latch to preclude complete separation of the mated flanges in the event of failure of the primary T-bolt.

3.4 .1 Welding. Resistance or fusion welding of elements carrying hoop tension load shall be in accordance with MIL-W-6858 or MIL-STD-2219. Spot welding shall be in accordance with MIL-W-6858. Welding which is not critical to the structural integrity of the coupling, such as positioning spotwelds, need not conform to this requirement.

3.4 .2 Assembly. The coupling design shall be such as to allow ease of assembly and disassembly on tubing or flange ends in close and confined spaces such as are normally encountered in aircraft installations.

3.5 Performance. The coupling shall satisfy the following performance requirements.

3.5.1 Position. The connector assembly shall operate satisfactorily in any position attitude in the aircraft system. The coupling shall function satisfactorily with fluid flow in either direction.

3.5.2 Temperature. The coupling shall be capable of operation through the temperature range specified on the applicable MS standard with load ratings adjusted in accordance with table I.

3.5.3 Rated load. The coupling shall be capable of carrying total applied operating loads in accordance with the axial load rating of the applicable MS standard and the temperature load factor specified in table I.

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TABLE I. Temperature load reduction factor.

Operating temperature	Load factor (percent)	
	MIL-DTL-27536/1 or MIL-DTL-27536/2	MIL-DTL-27536/3
Below 250°F	100	100
250°F to 800°F	65	90
800°F to 1200°F	Not applicable	80

3.5.3.1 Pressure. The axial load due to pressure in a V-band coupling joint shall be determined from the following relationship:

$$L = pA$$

Where L=load, pounds

A=sealed area, in²

P=internal pressure minus ambient pressure, psi

3.5.3.2 Bending. The safe equivalent axial load to an applied bending moment shall be determined from the following relationship:

$$L = \frac{4M}{D}$$

Where L=loads, pounds

M=bending moment, lbf-in.

D=coupling diameter, inches

3.5.4 Deflection. The maximum axial deflection (flange separation) permitted by the coupling shall be 0.030 inch up to rated load. Accordingly, the maximum angular deflection due to rated bending moment shall be determined from the relationship:

$$\phi = \tan^{-1} \frac{0.030}{D}$$

Where ϕ =angular deflection, degrees

D=coupling nominal diameter, inches

3.6 Bolt requirements.

3.6.1 Material. Bolts shall be made of type A286 stainless steel to the chemical composition requirements of AMS5731, AMS5732, or AMS5737. The stock

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for heading shall be in the condition required for fabrication and to meet the strength and quality requirements for bolts in accordance with AMS7478.

3.6.2 Manufacture. Type A286 bolts shall be manufactured to the requirements of AMS7479.

3.6.3 Threads. Machine screw threads shall conform to MIL-S-8879. All external or internal threaded parts shall be securely locked in such manner as to prevent loosening under test conditions specified herein and under normal service usage. Threads shall be formed on the heat treated and finished blank by single rolling.

3.7 Band and retainer requirements.

3.7.1 Material. Bands and retainers shall be made of the following materials:

<u>Standards</u>	<u>Material</u>
MIL-DTL-27536/1, MIL-DTL-27536/2	300 series stainless steel
MIL-DTL-27536/3	A286 stainless steel

3.8 Finish. All surfaces of the coupling shall have a finish equivalent to 63-125 microinches Ra of ANSI/ASME B46.1 or smoother and shall be free from burrs and sharp edges or other injurious defects.

3.8.1 Protective treatment. Corrosion-resistant steel components shall be given a thermal treatment, if necessary, to relieve any locally high residual forming stresses, followed by mechanical or chemical removal of discoloration.

3.9 Identification of product. Equipment, assemblies and parts shall be marked for identification in accordance with MIL-STD-130. In addition, these special characteristics shall be added:

Complete MS part number

Manufacturer's name or trademark and CAGE code

Manufacturer's part number

Operating temperature range

Torque - (pounds - inch (KN))

3.10 Workmanship. The coupling shall be fabricated and finished in a thoroughly workmanlike manner. Particular attention shall be given to freedom from blemishes, defects, burrs, tool marks, and sharp edges.

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4. VERIFICATION

4.1 Classification of inspections. The inspection of couplings shall be classified as:

- a. Qualification inspections (see 4.2).
- b. Quality conformance inspections (see 4.3).

4.2 Qualification inspections.

4.2.1 Test samples. For qualification to a temperature range, the qualification test sampling shall consist of two couplings each of the following sizes:

-65° to +800°F	MIL-DTL-27576/1-5, -17, -27, -37
-450° to 250°F	MIL-DTL-27576/2-5, -17
-320° to 1200°F	MIL-DTL-27576/3-5, -17, -27, -37

Testing to a size shall qualify for all sizes up to and including the tested size.

For a specific size and temperature range, submission of two couplings is required for qualification testing. The test samples shall be identified with the manufacturer's part number and any additional information as required and forwarded to the activity responsible for testing as designated in the letter of authorization from that activity (see 6.4).

4.2.1.1 Data to accompany test samples. The test samples shall be accompanied by two complete sets of detail and assembly drawings. The following data shall be furnished on or together with the assembly drawings:

- a. Overall dimensions.
- b. Materials and construction, treatment and finish.
- c. Weight.
- d. Any special installation instructions considered necessary.

4.2.2 Test report. The test report submitted with the qualification test samples shall conform to MIL-STD-831 and shall include the following:

- a. Report of all tests, graphically presented when practicable, together with a detailed statement indicating conformance or extent of nonconformance with all requirements of this specification, referring especially to paragraph numbers. Whenever a requirement is considered to be not applicable, the report should so state.
- b. Diagrams of all test setups.
- c. Outline and description of test and test conditions.
- d. Copies of test log sheets.
- e. Photographs of test setups.

4.2.3 Tests. The qualification tests shall consist of all the examinations and tests specified in 4.5 and 4.6.

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4.2.4 Retention of qualification. To retain qualification, the contractor shall forward a report at 12-month intervals to the qualifying activity. The qualifying activity shall establish the initial reporting date. The report shall consist of:

- a. A summary of the results of the tests performed for inspection of product for delivery, indicating as a minimum the number of lots that have passed, the number that have failed, and the group which they failed. The results of tests of all reworked lots shall be identified and accounted for.
- b. A summary of the results of tests performed for periodic inspection, including the number and mode of failures. The summary shall include results of all periodic inspection tests performed and completed during the 12-month period. If the summary of the test results indicates nonconformance with specification requirements, and corrective action acceptable to the qualifying activity has not been taken, action may be taken to remove the failing product from the qualified products list.

Failure to submit the report within 30 days after the end of each 12-month period may result in loss of qualification for the product. In addition to the periodic submission of inspection data, the contractor shall immediately notify the qualifying activity at any time during the 12-month period that the inspection data indicates failure of the qualified product to meet the requirements of this specification.

In the event that no production occurred during the reporting period, a report shall be submitted certifying that the company still has the capabilities and facilities necessary to produce the item. If during two consecutive reporting periods there has been no production, the manufacturer may be required, at the discretion of the qualifying activity, to submit his qualified products to testing in accordance with the qualification inspection requirements and the reason for no production.

4.3 Quality conformance inspections. Quality conformance inspections shall consist of:

- a. Individual inspections (see 4.3.1).
- b. Sampling inspections (see 4.3.2).

4.3.1 Individual inspections. Each coupling shall be subjected to the examination of product (see 4.5.1).

4.3.2 Sampling inspections. Sampling tests shall consist of the following tests:

- a. Individual inspections (see 4.3.1).
- b. Assembly and torque deformation (see 4.6.1).

4.3.2.1 Samples. Statistical sampling and inspection shall be in accordance with the general requirements of ANSI/ASQC Z1.4. Lot acceptance criteria shall be based on a single sampling plan with a zero acceptance number.

4.4 Test conditions.

4.4.1 Temperature. Unless otherwise specified, testing shall be conducted at normal room temperature.

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4.4.2 Test assembly. The coupling shall be installed on test flanges or solid mandrels conforming to the profile dimensions of MS24563, figure 2A. Test flanges shall be hardened carbon or alloy steel with a dry surface finish of HRC 32-63 in accordance with ANSI/ASME B46.1.

4.4.3 Vibration test setup. The test coupling shall be installed on test flanges or on a solid mandrel with essentially rigid bracket attachment to provide for axial and transverse vibration. A typical test setup is shown in figure 1.

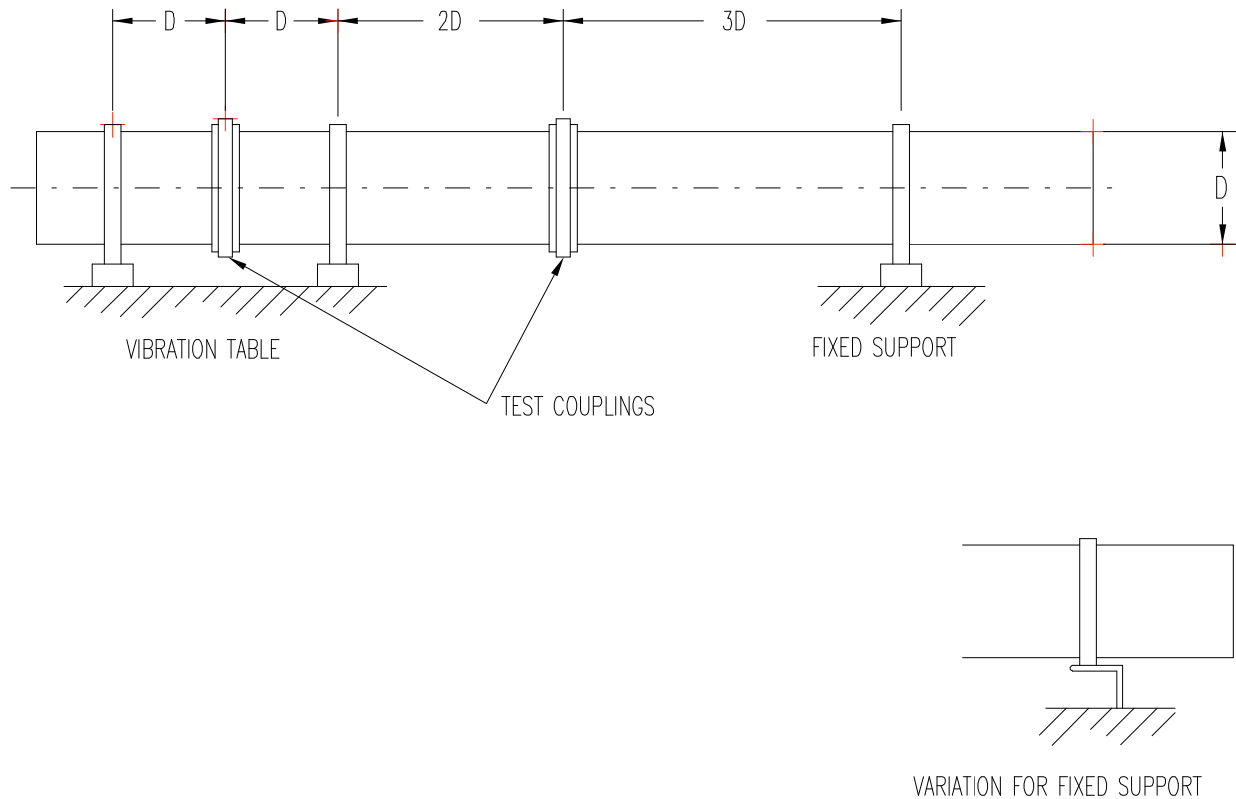


FIGURE 1. Vibration test setup.

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4.5 Examinations.

4.5.1 Examination of product. The coupling shall be examined to determine conformance with the requirements of this specification and the applicable detail specification sheet with respect to material, workmanship, dimensions, finish, and identification marking.

4.6 Test methods.

4.6.1 Assembly and torque deformation. The coupling shall be installed on a mandrel and the nut tightened to rated torque. Any interference, binding, galling, misalignment, or excessive deformation shall be cause for rejection.

4.6.2 Proof load. A test setup shall be arranged using test flanges suitably instrumented and connected to hydraulic cylinders so as to measure and apply axial load and deflection. Flanges shall be preset at a uniform axial gap of 0.060-0.070 inch. The coupling shall then be installed and tightened to pull the flanges together and reduce the axial gap. The hydraulic cylinder pressure may be regulated prior to the final two turns of the coupling latching device in order that the final two turns will bring the coupling to rated torque at a flange gap of 0.001 to 0.010 inch. The axial load shall then be recorded and this load shall be a minimum of 25 percent of the rated axial load specified in the applicable MS standard. The hydraulic cylinder pressure shall then be increased to apply rated axial load to the coupling. The increase in flange gap shall be recorded. The load shall be reduced to zero and the coupling removed and examined for signs of failure (see 6.3.1).

4.6.3 Temperature shock test. The coupling shall be assembled over the test flanges or mandrels of 4.4.2, and tightened to rated torque. The assembly shall be subjected to the temperature shock test of MIL-STD-810, Method 503.3, except that the initial and final temperatures shall be in accordance with table II herein. At the conclusion of the third cycle, the assembly shall be returned to room temperature, followed by visual examination and check of nut torque. Minimum final torque shall be 25 percent of rated torque.

TABLE II. Temperature for shock test.

Coupling rated temperature range	Initial temperature	Final temperature
-65° to +800°F	-65°F	800°
-320° to +1200°F	-320°F	1200°F
-450° to +250°F	250°F	-320°F

4.6.4 Salt spray. Salt spray tests shall be in accordance with salt spray test of MIL-STD-810, method number 509.2 except equipment need not be operated.

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4.6.5 Vibration. The coupling shall be assembled as specified in 4.4.3 and the nut tightened to rated torque. Perform the vibration test in accordance with MIL-STD-810 method number 514.3, category 5. The high and low temperature portions of the tests shall be accomplished at the applicable high and low temperature values specified in table III. The vibration spectrum is to be extended to 2000 cycles per second at constant 10G acceleration. Omit the cycling test.

TABLE III. Temperature for vibration test.

Rated temperature range	Low temperature	High temperature
-65° to 800°F	"1/"	800°F
-450° to 250°F	-320°F	"1/"
-320° to 1200°F	-320°F	1200°F

1/ Where no low or high temperature tests are required the time of testing at room temperature shall be extended an equivalent amount of time.

4.6.5.1 Leakage test (type L - redundant safety latch only). In a pneumatic system tubing joint pressurized to 120 psi, with the manufacturer's recommended seal and with the T-bolt torqued within the specified limits, no leakage shall be allowed. With the V-band coupling restrained only by the secondary safety latch, the air leakage test shall not exceed 0.25 pound per minute per inch of tube size at any pressure up to 120 psi. This test shall be performed with the joint pressurized and primary latch failure simulated by cutting the normally torqued T-bolt or pulling a socket wrench off a split nut to test for engagement of the secondary latch and retention of the flanges. No deformation or malfunction of the secondary latch shall occur.

4.6.6 Life test. The coupling shall be assembled at rated torque over test flanges rigidly attached to suitable extensions. Apply 80 percent of rated bending load in alternate directions for a total of 100000 cycles. Rate of cycling shall be 60-120 cycles per minute. Check torque. At the conclusion of this test disassemble and examine coupling. Any evidence of failure shall be cause for rejection. The assembly shall be rotated 90 degrees in the test fixture each 25000 cycles without loosening or tightening the joint.

4.6.7 Ultimate load test. The couplings shall be assembled as specified in 4.6.2. Apply 150 percent rated torque. Hold at this torque for 48 hours, and, while at this torque, apply 150 percent rated load. Any evidence of separation or rupture shall be cause for rejection.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract 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 or 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

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

6.1 Intended use. The couplings procurable to this specification are intended for use on fluid-line tubing joints, tailpipe joints, and accessory mount joints, on flight vehicles or other attachments where high performance and light weight are required and corrected loads are safely below the rated or proof loads specified on the applicable specification sheet. The couplings are semi-rigid and are not intended to provide fluid-line flexibility except within the bending loads and deflections specified herein.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Type, size, temperature range, and applicable MS standard (see 1.2).
- c. Packaging requirements (see 5.1).
- d. Quantity required.

6.3 Definition.

6.3.1 Failure. Evidence of distortion, excessive deformation, elongation, or any other malfunction detrimental to performance.

6.4 Qualification. With respect to products requiring qualification, awards will be made only for such products as have, prior to the time set for opening of bids, been tested and approved for inclusion in the applicable Qualified Products List (QPL) whether or not such products have actually been so listed by that date. The attention of contractors is called to this requirement, 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. The activity responsible for the qualified products list is San Antonio Air Logistics Center/MMEDO, Kelly AFB, TX 78241, and information pertaining to qualification of products may be obtained from that activity.

6.5 Subject term (key word) listing.

Coupling
Clamp
Flanges
V-Band
V-Grooved
V-Retainer

6.6 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.

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6.7 International standardization. Certain provisions of this specification are the subject of international standardization agreement NATO STANAG 3312. When amendment, revision, or cancellation of this specification is proposed which will modify the international agreement concerned, the preparing activity will take appropriate action through international standardization channels including departmental standardization offices to change the agreement or make other appropriate accommodations.

Custodians:
Air Force - 99
Navy - AS

Preparing activity:
DLA-IS

Review activity:
Air Force - 11

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