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SUPERSEDING
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MILITARY 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 shall be classified by nominal size, temperature range, type, and axial load rating in accordance with the applicable MS standard (see 6.2). The components are applicable to the following types, as shown on the MS standards:

Type B - Basic T-bolt.

Type R - Quick release.

Type BL - Basic with secondary safety latch.

Type RL - Quick release with secondary safety latch.

Type BRL - Basic, quick release, and secondary safety latches on larger sizes.

* 2. APPLICABLE DOCUMENTS

* 2.1 Government documents.

* 2.1.1 Specifications and standards. The following specifications and standards form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: the Engineering Division, San Antonio ALC/MMEDO, Kelly AFB, TX 78241 by using the self addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

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FSC 5340

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SPECIFICATIONS

FEDERAL

QQ-P-416	Plating, Cadmium (Electrodeposited).
PPP-B-566	Box, Folding, Paperboard.
PPP-B-636	Boxes, Fiberboard.
PPP-B-676	Boxes, Setup.

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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-W-8611	Corrosion and Heat Resistant Alloys, Process for.
MIL-S-8879	Screw Thread, Controlled Radius Root with Increased Minor Diameter, General Specification for.
MIL-W-45223	Welding, Spot, Hardenable Steels.
DOD-D-1000	Drawings, Engineering and Associated Lists.

STANDARDS

MILITARY

MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-129	Marking for Shipment and Storage.
MIL-STD-130	Identification Marking of US Military Property.
MIL-STD-143	Specifications and Standards, Order of Precedence for the Selection of.
MIL-STD-794	Parts and Equipment Procedures for Packaging and Packing of.
MIL-STD-810	Environmental Test Methods.
MIL-STD-831	Test Reports, Preparation of.
MIL-STD-889	Dissimilar Metals.
MS24563	Dimensions, Profile, V-Band Coupling Flanges; Design Standard for.
MS27114	Coupling, Clamp, Grooved, V-Band, 1.750 to 14.250 Flange OD (-65° to +800°F).
MS27115	Coupling, Clamp, Grooved, V-Band, 1.750 to 6.250 Flange OD (-450° to +200°F).
MS27116	Coupling, Clamp, Grooved, V-Band, 1.750 to 14.250 Flange OD (-320° to +1500°F).

* (Copies of specifications and standards required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

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- * **2.2 Other publications.** The following document(s) form 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 shall be the issue of the nongovernment documents which is current on the date of the solicitation.

AMERICAN NATIONAL STANDARDS INSTITUTE

ANSI B46.1 Surface Texture (Surface Roughness, Waviness and Lay).

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

AEROSPACE MATERIAL SPECIFICATIONS

AMS5731 Steel 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 (980°C).

AMS5737 Steel 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 (900°C), Heat Treated, Solution and Precipitation.

AMS7478 Bolts and Screws, Steel, Corrosion and Heat Resistant Heat Treated, Roll Threaded, 1800°F (982.2C) Solution and Precipitation Heat Treated.

AMS7479 Bolts and Screws, Steel, Corrosion and Heat Resistant Heat Treated - Roll Threaded, 1650°F (898.9C) Solution and Precipitation Heat Treated.

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 380 Cleaning and Desealing Stainless Steel Parts, Equipment and Systems.

ASTM D 3951 Practice for Commercial Packaging.

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

- * **2.3 Order of precedence.** In the event of a conflict between the text of this specification and the references cited herein (except for associated detail specifications, specification sheets or MS standards), the text of this specification shall take precedence. Nothing in this specification, however, shall supersede 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 MS sheets. In the event of any conflict between requirements of this specification and the MS sheets, the latter shall govern.

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3.2 Qualification. The coupling clamps furnished under this specification shall be products which are qualified for listing on the applicable Qualified Products List at the time set for opening of bids (see 4.3 and 6.4).

3.3 Selection of specifications and standards. Specifications and standards for necessary commodities and services not specified herein shall be selected in accordance with MIL-STD-143.

3.4 Materials.

3.4.1 Metals. Metals shall be corrosion-resistant or suitably treated 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. Carbon steels with cadmium plate finish schemes per ASTM A 380, shall be used. Use of magnesium is prohibited. Materials shall not be used that are known to be highly susceptible to stress corrosion. V-band couplings shall be made of high-yield steel or of stainless or corrosion-resistant steel alloy, except that free machining steel shall not be used.

3.4.1.1 Dissimilar metals. Unless suitably protected against electrolytic corrosion, dissimilar metals shall not be used in intimate contact with each other. Dissimilar metals are defined in MIL-STD-889.

3.4.2 Reclaimed materials. The use of reclaimed materials shall be encouraged to the maximum extent possible.

3.5 Design. The coupling shall be designed to conform to the various sizes, types, temperatures, and loads in accordance with MS27114, MS27115, and MS27116. The coupling sizes shall be in accordance with MS24563.

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 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 may require removal of latch components. 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.

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3.5.1 Welding. Resistance or fusion welding of elements carrying hoop tension load shall be in accordance with MIL-W-6858 or MIL-W-8611, respectively. Spot welding shall be in accordance with MIL-W-45223. Welding which is not ceitical to the structural integrity of the coupling, such as positioning spotwelds, need not conform to this requirement.

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

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

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

3.6.2 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.

Table I. Temperature load factor.

Operating temperature	Load factor (percent)
Below 200°F	100
200°F to 800°F	65
800°F to 1500°F	27

3.6.3 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.

3.6.3.1 Pressure. The axial load due to pressure in a v-band tubing joint shall be determined from the following relationship:

$$L=pA$$

Where L=load, pounds

A=sealed area, in ²

P=internal pressure minus ambient pressure, psi

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3.6.3.2 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, in.-lb

D=coupling diameter, inches

3.6.4 Deflection. The maximum axial deflection (flange separation) permitted by the coupling shall be .030 inch up to rated load. Accordingly, the maximum angular deflection due to rated bending moment shall be determined from the relationship:

$$\phi = \tan^{-1} \frac{.030}{D}$$

Where ϕ =angular deflection, degrees

D=coupling nominal diameter, inches

* 3.7 Part numbering of interchangeable parts. All parts having the same manufacturer's part number shall be functionally and dimensionally interchangeable. The item identification and part number requirements of DOD-D-1000 shall govern the manufacturer's part numbers and changes thereto.

* 3.8 Bolt requirements.

3.8.1 Material. Bolts shall be made of type A286 stainless steel to the chemical composition requirements of AMS 5731, or AMS5737. The stock for heading shall be in the condition required for fabrication and to meet the strength and quality requirements for bolts in accordance with AMS7478.

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

3.8.3 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.

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

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3.9.1 Protective treatment. Coupling components manufactured from non-corrosion-resistant material shall be cadmium plated in accordance with type II, class B or QQ-P-416, except that the maximum temperature limitation for cadmium-plated parts shall be 250° F. 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.

3.10 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:

MS sheet number

Manufacturer's name

Manufacturer's part number

Temperature

Torque - (inch-pounds)

3.11 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.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may utilize his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

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

- a. Qualification inspections (see 4.3).
- b. Quality conformance inspections (see 4.4).

* 4.3 Qualification inspections.

4.3.1 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	MS27114-5, -17, -27, -37
-450° to +200° F	MS27115-5, -17
-320° to +1, 500° F	MS27116-5 -17, -27, -37

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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).

4.3.1.1 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.

* 4.3.2 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.

4.3.3 Tests. The qualification tests shall consist of all the examinations and tests specified in 4.6 and 4.7.

4.3.4 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.

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

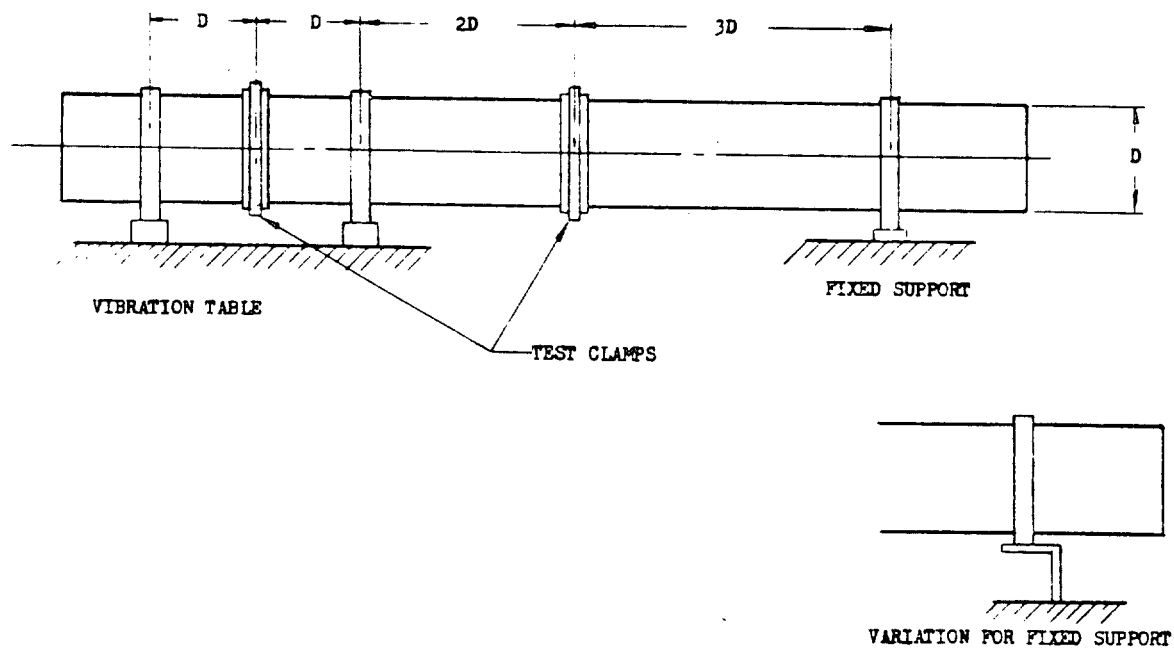
- a. Individual inspections (see 4.4.1).
- b. Sampling inspections (see 4.4.2).

4.4.1 Individual inspections. Each coupling shall be subjected to the examination of product (see 4.6.1).

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

- a. Individual inspections (see 4.4.1).
- b. Assembly and torque deformation (see 4.7.1).

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FIGURE 1. Vibration test setup.

4.4.2.1 Samples. A random sample shall be selected from each inspection lot in accordance with MIL-STD-105, inspection level II. The AQL shall be 1 percent.

4.5 Test conditions.

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

* 4.5.2 Test assembly. The coupling shall be installed on test flanges or solid mandrels conforming to the profile dimensions of MS24563. Test flanges shall be hardened carbon or alloy steel with a dry surface finish of RHR 32-63 in accordance with ANSI B46-1-78.

4.5.3 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 on figure 1.

4.6 Examinations.

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

4.6.2 Inspection of packaging. Preparation for delivery shall be examined for conformance to section 5.

4.7 Test methods.

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

4.7.2 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 torqued 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).

4.7.3 Temperature shock test. The coupling shall be assembled over the test flanges or mandrels of 4.5.2, and tightened to rated torque. The assembly shall be subjected to the temperature shock test of MIL-STD-810 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 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°F
-320° to +1,500°F	-320°F	1,500°F
-450° to +200°F	200°F	-320°F

4.7.4 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.

4.7.5 Vibration. The coupling shall be assembled as specified in 4.5.3 and torqued 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 2,000 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 200°F	-320°F	"1/"
-320° to 1,500°F	-320°F	1,500°F

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

* 4.7.5.1 Leakage test (type L - redundant safety latch only). In an air 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 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 to test for engagement of the secondary latch and retention of the flanges. No deformation or malfunction of the secondary latch shall occur.

4.7.6 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 100,000 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 25,000 cycles without loosening or tightening the joint.

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* 4.7.7 Ultimate load test. The couplings shall be assembled as specified in 4.7.2. 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 Preservation. Preservation shall be level A, C or commercial as specified (see 6.2).

5.1.1 Level A.

5.1.1.1 Cleaning. Coupling shall be cleaned in accordance with MIL-P-116, process C-1.

5.1.1.2 Drying. Couplings shall be dried in accordance with MIL-P-116.

5.1.1.3 Preservative applications. Preservatives shall not be used.

5.1.1.4 Unit packs. Unless otherwise specified (see 6.2) each coupling shall be individually unit packed in accordance with method III of MIL-P-116.

5.1.1.5 Intermediate packs. Couplings, unit packed as specified in 5.1.1.4, shall be placed in intermediate containers conforming to PPP-B-566 or PPP-B-676. Intermediate container shall be uniform in size, shape, and quantities, shall be of minimum tare and cube and shall contain multiples of five unit packs, not to exceed 100 unit packs. No intermediate packs are required when the total quantities shipped to a single destination is less than 100 unit packs.

5.1.2 Level C. The level C preservation for coupling shall conform to the MIL-STD-794 requirements of this level.

5.1.3 Commercial. The commercial preservation of the couplings shall be in accordance with the requirements of ASTM-D-3951.

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

5.2.1 Level A. Couplings preserved and packaged as specified in 5.1.1 shall be packed in containers as specified in MIL-STD-794 for level A protection.

5.2.2 Level B. Couplings preserved and packaged as specified in 5.1.1 shall be packed in fiberboard containers conforming to PPP-B-636, class weather resistant, style optional, special requirements. Closures shall be in accordance with the appendix thereto.

5.2.3 Level C. Coupling preserved and packaged as specified in 5.1.2 shall be packed in fiberboard containers conforming to PPP-B-636, class domestic, style optional, special requirements. Closures shall be in accordance with the appendix thereto.

5.2.4 Commercial. The preserved couplings shall be packed in accordance with the requirements of ASTM-D-3951.

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5.3 Marking. In addition to any special marking required by the contract or purchase order (see 6.2), each unit pack intermediate and exterior container and unitized load shall be marked in accordance with the requirements of MIL-STD-129 or ASTM D 3951, as applicable.

6. NOTES

- * 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 MS standard. 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 Ordering data. 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. Selection of applicable levels of preservation, packaging and packing desired (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 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 Changed from previous issue. The margins of this specification are marked with asterisks to indicate where changes (additions, modifications, corrections, deletions) 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.

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- * 6.6 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:

Air Force - 82

Review activity:

Air Force - 11
DLA - IS

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