

(R) Couplings, Clamp, Grooved, V-Band

RATIONALE

This revision added the PRI-QPL and PRI-QML requirements, updated references where they had been changed, and clarified statements in a few places.

1. SCOPE

1.1 This SAE Aerospace Standard (AS) establishes the requirements for a V-band grooved clamp couplings that are intended for use on fluid-line tubing joints, tailpipe joints, and accessory mount joints, on flight vehicles or other attachments. The semi-rigid coupling joint assemblies, hereafter referred to as "the joint", shall operate within the temperature ranges specified in their applicable part standards.

1.2 Types

The coupling shall be classified as single or double latch couplings:

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 Coupling (-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)

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and 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.

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2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org

AMS 2700	Steel, Passivation Treatments for Corrosion Resistant
AMS 5731	Steel, Corrosion and Heat Resistant, Bars, Wire, Forgings, Tubing, and Rings 15Cr 25.5Ni 1.2Mo 2.1Ti 0.006B 0.30V, Consumable Electrode Melted, 1800°F (982°C) Solution Heat Treated
AMS 5732	Steel, Corrosion and Heat Resistant, Bars, Wire, Forgings, Tubing, and Rings 15Cr 25.5Ni 1.2Mo 2.1Ti 0.006B 0.30V, Consumable Electrode Melted, 1800°F (982°C) Solution and Precipitation Heat Treated
AMS 5737	Steel, Corrosion and Heat Resistant, Bars, Wire, Forgings, and Tubing 15Cr 25.5Ni 1.3Mo 2.1Ti 0.006B 0.30V, Consumable Electrode Melted, 1650°F (899°C), Solution and Precipitation Heat Treated
AMS-W-6858	Welding, Resistance; Spot and Seam
AS478	Identification Marking Methods
AS4108	T-Bolt and Eye Bolt, A-286 CRES, 1000° F Fatigue Rated
AS7003	Narional Aerospace and Defense Contractors Accreditation Program (NADCAP)
AS7112	Narional Aerospace and Defense Contractors Accreditation Program Requirements for Fluid System Components
AS8878	ScrewThreads – UNJ Profile, Inch, Controlled Radius Root with Increased Minor Diameter
AS24563	V-Coupling, Flange Profiles, Design Standard

2.1.2 ANSI Publications

Available from American National Standards Institute, 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, www.ansi.org

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

2.1.3 U. S. Government Publications

Available from the Document Automation and Production Service (DAPS), Building 4/D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, Tel: 215-697-6257, <http://assist.daps.dla.mil/quicksearch/>

MIL-STD-810	Environmental Test Methods
MIL- HDBK-831	Preparation of Test Reports,

2.1.4 American Welding Society Publications

Available from American Welding Society, 550 NW LeJeune Road, Miami, FL 33126, Tel: 1-800-443-9353, www.aws.org

AWS D17.1	Specification for Fusion Welding for Aerospace Applications
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2.1.5 PRI Publications

Available from Performance Review Institute, 161 Thornhill Road, Warrendale, PA 15086-7527, Tel: 724-772-1616, www.pri-network.org

PD2001 Qualified Product Management Council Procedures for Qualified Products Group

PD2101 Aerospace Quality Assurance, Product Standard, Qualification Procedures, Fluid Systems

3. TECHNICAL REQUIREMENTS

3.1 Qualification

Couplings supplied in accordance with this document shall be representative of products which have been subjected to and which have successfully passed the qualification tests specified in this standard.

3.1.1 Manufacturer Qualification

A manufacturer producing a product in conformance to this procurement specification shall be accredited in accordance with the requirements of PD2101, AS7003 and AS7112, and shall be listed in a Performance Review Institute (PRI) Qualified Manufacturers List (QML).

3.1.2 Product Qualification

All products shall conform to the requirements of this procurement specification and shall be approved in accordance with the requirements of PD2001 and PD2101, for listing in a Performance Review Institute (PRI) Qualified Parts List (QPL). When this procurement specification is specified on design activity controlled drawings, the approved source(s) of supply shall be defined by the design activity.

3.2 Materials

The joint component materials shall be uniform in quality, free from defects, suitable for service, consistent with good manufacturing practices, and in conformance with the applicable specifications and requirements stated herein.

3.2.1 Metals

Metals shall be corrosion-resistant steel and passivated in accordance with AS2700 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 Design

The coupling shall be designed to conform to the various sizes, types, temperatures, and loads in accordance with applicable AS standard drawing. The flanges shall be in accordance with AS24563, Type 2.

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 or nut.

3.3.1 Welding

Resistance or fusion welding of elements carrying hoop tension load shall be in accordance with AMS-W-6858 or AWS D17.1. Spot welding shall be in accordance with AMS-W-6858. Welding which is not critical to the structural integrity of the coupling, such as positioning spotwelds, need not conform to this requirement.

3.3.2 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.

3.4 Performance

The coupling shall satisfy the following performance requirements.

3.4.1 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.

3.4.2 Temperature

The coupling shall be capable of operation through the temperature range specified on the applicable AS standard drawing with load ratings adjusted in accordance with Table 1.

3.4.3 Rated Load

The coupling shall be capable of carrying total applied operating loads in accordance with the axial load rating of the applicable AS standard drawing and the temperature load factor specified in Table 1.

TABLE 1 - TEMPERATURE LOAD REDUCTION FACTOR

Operating Temperature	Load Factor (percent)	Load Factor (percent)
	AS5355/1 or AS5355/2	AS5355/3
Below 250 °F	100	100
250 to 800 °F	65	90
800 to 1200 °F	Not applicable	80

3.4.3.1 Pressure

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

$$L = pA \quad (\text{Eq. 1})$$

where:

L = Load, pounds

A = Sealed area, in²

p = Internal pressure minus ambient pressure, psi

3.4.3.2 Bending

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

$$L = \frac{4M}{D} \quad (\text{Eq. 2})$$

where:

L = Loads, pounds

M = Bending moment, lbf-in

D = Coupling diameter, inches

3.4.4 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:

$$\theta = \text{Tan}^{-1} \frac{0.030}{D} \quad (\text{Eq. 3})$$

where:

θ = Angular deflection, degrees

D = Coupling nominal diameter, inches

3.5 Bolt Requirements

3.5.1 Material

Bolts shall be made of type A-286 CRES to the chemical composition requirements of AMS 5731, or AMS 5732, or AMS 5737. The stock for heading shall have been solution heat treated at 1800 °F and then cold drawn to the condition required for fabrication and to meet the strength and quality requirements for bolts in accordance with AS4108.

3.5.2 Manufacture

Type A-286 bolts shall be manufactured to the requirements of AS4108.

3.5.3 Threads

Machine screw threads shall conform to AS8879. 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.

3.6 Nut

The nut shall be corrosion and heat resistant self-locking type nut with a running torque of 3.5 to 30 lb-in for 0.250 inch bolt diameter and 6.5 to 40 lb-in for 0.312 inch bolt diameter and shall conform to the rated temperature as specified on the applicable AS drawing. The nut shall have a minimum of 10 seating torque cycles when being run ON or OFF at less than 120 rpm and be capable of complete removal from the bolt on each cycle. The bolt threads shall conform to the appropriate standard thread gage at the conclusion of this test.

3.7 Band and Retainer Requirements

3.7.1 Material

Bands and retainers shall be made of the following materials:

- a. Standards: AS5355/1, AS5355/2, AS5355/3
- b. Material: 300 series CRES, A-286 CRES

3.8 Finish

All surfaces of the coupling shall have a finish equivalent to 63 to 125 μm Ra of 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 300 series stainless components may be given a thermal treatment, if necessary, to relieve any residual forming stresses.

3.9 Identification of Product

The coupling shall be marked for identification in accordance with AS478, class D and shall include the following as a minimum:

AS Number
Supplier Part No.
Supplier Name or Trademark and CAGE Code
Date of Manufacture
Operating Temperature Range
Torque

3.10 Workmanship

The joint components shall be free from defects and imperfections and manufactured and finished in a thoroughly workmanlike manner.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

4.1.1 Supplier's Responsibility

The supplier is responsible for the performance of all quality assurance provisions as specified herein. Records of the testing shall be maintained by the supplier and shall be available to the user for inspection on request. The supplier's test data, subject to the approval of the user, shall be considered adequate for product qualification. In the event the supplier is to perform testing for approval, the supplier shall submit a test procedure to the user defining in detail the tests to be performed, the method, and samples correlated to the tests. The supplier, upon approval by the user, shall conduct the tests per the approved test procedure and document the results in a test report using MIL-HDBK-831 as a guide.

Rejected joint components shall not be submitted for reinspection without furnishing full particulars concerning previous rejection and measures taken to overcome the defects.

If the investigation indicates that the defect causing the rejection may exist in joint components previously supplied to the user, the supplier shall advise the user of this condition, method of identifying these parts, and corrective action or disposition of the rejected parts.

4.1.2 User's Responsibility

The user shall establish adequate inspection procedures to ensure that all requirements of this document are met. Emphasis shall be placed on the following:

- a. Dimensional configuration
- b. Marking
- c. Size
- d. Functional capability

4.2 Classification of Tests

Inspection and testing of joint components shall be classified as:

- a. Qualification test (4.2.1)
- b. Quality conformance test and verification (4.2.2)

4.2.1 Qualification Test

Qualification tests specified in this standard are intended to qualify a manufacturer's parts. The configuration shall be as described on the standard pages. The witnessing of qualification tests by the user's representative(s) shall be optional. In the event the supplier already has performed the required testing, copies of the test report shall be submitted to the user for approval using MIL-HDBK-831 as a guide.

4.2.1.1 Sampling Instruction

Unless otherwise specified, statistical sampling and inspection shall be in accordance with the general requirements of ANSI/ASQ Z1.4. Lot acceptance criteria shall be based on a single sampling plan with a zero acceptance number.

4.2.1.2 Test Sample Identification

Each component of the joint assembly shall be permanently identified. Marking shall be such that legibility can be maintained throughout the qualification testing. In addition to part identification, 3.8, the words "Test Sample (#1, #2, #3, etc.)" shall be marked on the test parts.

4.2.1.3 Qualification by Similarity

Qualification of larger joints of the same type, material, identity, and manufacturer may qualify smaller joints of the same type of material and identity for that manufacturer. Qualification of smaller joints will not qualify the larger joints. Qualification of lower strength alloy couplings shall qualify higher strength alloy couplings of the same cross-section and size.

4.2.2 Quality Conformance Test and Verification

All items shall be examined and tested to the extent necessary to verify that all requirements of the AS drawings and this document have been met.

4.3 Test Conditions

4.3.1 Temperature

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

4.3.2 Test Assembly

The coupling shall be installed on test flanges or solid mandrels conforming to the profile dimensions of AS24563, Type 2. Test flanges shall be hardened carbon or alloy steel with a surface finish of 32 to 63 $\mu\text{m Ra}$ per ASME B46.1.

4.3.3 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.

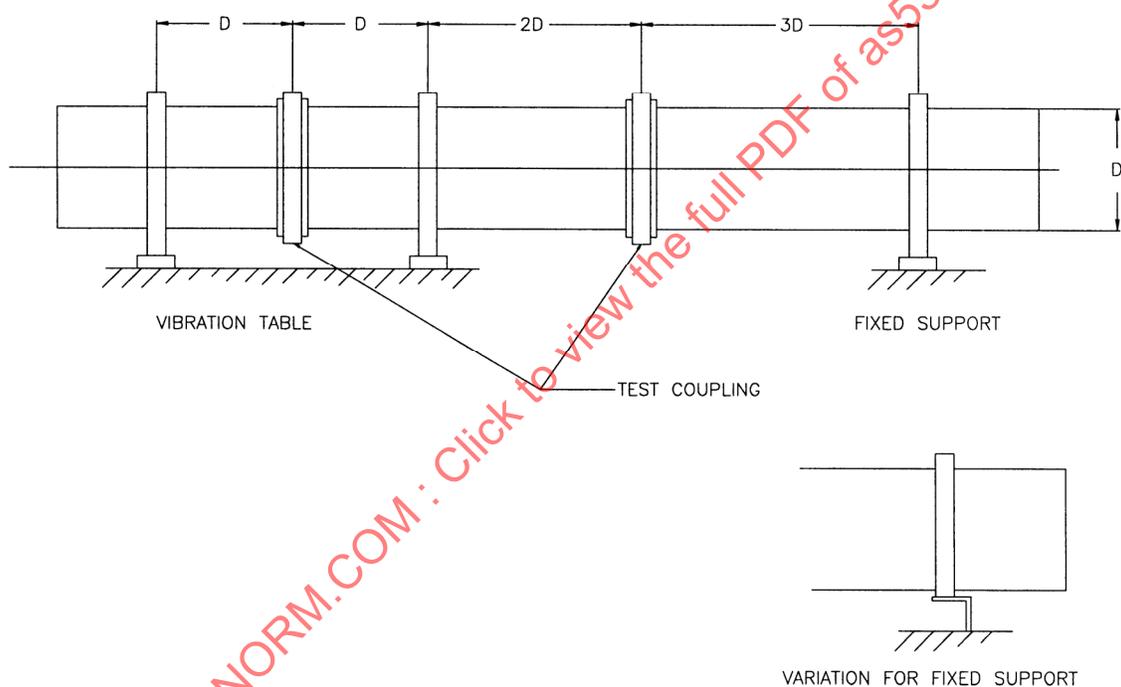


FIGURE 1 - VIBRATION TEST SETUP

4.4 Examination

4.4.1 Examination of Product

The test joint components shall be examined to determine conformance to this document and the appropriate AS drawing with respect to dimensions, weight, material, workmanship, finish, construction, marking, and identification of the product reported.