AEROSPACE STANDARD	AS85449	REV. A
	Issued 2003-08 Revised 2008-03 Reaffirmed 2015-07 Superseding AS85449	

Clamp Assembly, Saddle Type, Cushioned, General Specification For

RATIONALE

AS85449A has been reaffirmed to comply with the SAE five-year review policy.

1. SCOPE

1.1 Application

This SAE Aerospace Standard (AS) defines the requirements for saddle-type clamps. Tests and criteria noted do not indicate any specific areas of application or usage. Supplemental testing may be necessary to determine suitability for specific environments and applications.

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.

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.

AMS2700	Passivation of Corrosion Resistant Steels
AMS3224	Nitrile-Butadiene Rubber Fuel, Fire, and Ozone Resistant 65-75
AMS3253	Ethylene Propylene Rubber Phosphate Ester Resistant 65-75
AMS3310	Rubber, Silicone Flame Retardant, Low Smoke Density, High Strength 65-75 Durometer Color White
AMS3316	Silicone Rubber, Fiberglass Fabric Reinforced

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
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SAE values your input. To provide feedback on this Technical Report, please visit
http://www.sae.org/technical/standards/AS85449A

AMS3652 Polytetrafluoroethylene (PTFE) Film Non-Critical Grade

AMS5510 Steel, Corrosion and Heat-Resistant, Sheet, Strip and Plate 18Cr - 10.5Ni - 0.40Ti (SAE 30321) Solution Heat Treated

AS478 Identification Marking Methods

AS5763 Clamp Assembly, Saddle Type, Cushioned, Fuel and Petroleum Based Hydraulic Fluid

AS7003 Nadcap Program Requirements

AS7112/3 Nadcap Requirements for Coupling and Formed Sheet Metal Components

AS85449/1 Clamp Assembly, Saddle Type, Cushioned, Fuel and Petroleum Based Hydraulic Fluid

AS85449/2 Clamp Assembly, Saddle Type, Cushioned, Phosphate Ester Fluid Resistant

AS85449/3 Clamp Assembly, Saddle Type, Cushioned, High Temperature

AS85449/4 Clamp Assembly, Saddle Type, Cushioned, PTFE

AS85449/5 Clamp Assembly, Saddle Type, Cushioned, Fire Resistance, Low Smoke Density and Toxicity

2.1.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM A 686 Tool Steel, Carbon and Carbon-Vanadium

ASTM D 624 Test Resistance of Vulcanized Rubber, Test for

ASTM D 1149 Rubber Deterioration – Surface Ozone Cracking in a Chamber, Test For

ASTM D 3182 Rubber Materials Equipment and Procedures for Mixing Standard Components and Preparing Standard Vulcanized Sheets

ASTM D 3951 Standard Practice for Commercial Packaging

2.1.3 PRI Publications

Available from Performance Review Institute, 161 Thorn Hill 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

2.1.4 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 Y14.5M Dimensioning and Tolerances

ANSI/ASQ Z1.4 Sampling Procedures and Tables for Inspection by Attributes

2.1.5 NAS Publications

Available from Aerospace Industries Association, 1000 Wilson Boulevard, Suite 1700, Arlington, VA 22209,-3928, Tel: 703-358-1000, www.aia-aerospace.org.

NAS1149 Washer, Flat

2.1.6 Department of Defense Publications

Available from Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094, http://assist.daps.dla.mil/quicksearch/.

MIL-STD-1916 Department of Defense Test Method Standard

3. TECHNICAL REQUIREMENTS

3.1 Standard Sheets

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

3.2 Qualification

Clamps 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.

3.2.1 Manufacturer Qualification

A manufacturer producing a product in conformance to this procurement specification will be accredited in accordance with the requirements of PD2101, AS7003 and AS7112/3, and shall be listed in a Performance Review Institute (PRI) Qualified Manufacturers List (QML).

3.2.2 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 PRI Qualified Products List (QPL).

3.3 Materials

Clamp band material and cushioning material shall be as specified on the applicable standard sheet.

3.4 Design and Construction

The design and construction of the clamp shall be as specified herein and in accordance with the applicable standard sheets.

3.4.1 Dimensions and Tolerances

Dimensions and tolerances shall be as specified on the applicable standard sheet.

3.5 Performance

Clamp cushions, clamp bands and clamp assemblies shall perform satisfactorily when subjected to the applicable tests specified in this specification, and the applicable standard sheets.

3.5.1 Clamp Cushion Performance

3.5.1.1 Physical Properties

When tested in accordance with 4.5.3.1, cushion material must meet the physical property requirements specified in the applicable cushion material specification.

3.5.1.2 Compression Set

The average compression set value of three cushion material specimens shall not exceed the value specified in the applicable cushion material specification (see 4.5.3.2).

3.5.1.3 Flammability

The cushion material shall be tested for flammability in accordance with the applicable cushion material specification sheet and as specified herein (see 4.5.3.3).

3.5.1.4 Titanium Compatibility

When tested in accordance with 4.5.3.4, there shall be no evidence of cracking or pitting of the titanium tubing when observed with a 5 to 10 power magnifying glass.

3.5.2 Clamp Assembly Performance

3.5.2.1 Vibration

When tested in accordance with 4.5.4.1, no clamp shall exhibit any evidence of cushion separation or other deterioration. There shall be no cracking or separation of metal components. The transmissibility ratio shall be recorded.

3.5.2.2 Ozone Resistance

(When specified on applicable material specification sheet.) When tested in accordance with 4.5.4.2, no clamp shall exhibit any evidence of cracking visible to the unaided eye, or distortion of the cushion material.

3.5.2.3 Thermal Shock

When tested in accordance with 4.5.4.3, the clamps shall exhibit no evidence of cracking, tackiness or degradation of the cushion material.

3.6 Surface Texture

All surfaces shall have a smooth finish and be free from burrs and sharp edges. The inside edges of the clamp band shall be rolled or provided with a radius to eliminate sharp edges.

3.7 Identification of Product

3.7.1 Identification of Clamps

All clamps shall be marked as specified on the applicable standard sheet for the clamps being procured.

3.7.2 Part Numbering and Drawing Numbering

The manufacturer's basic part number and drawing number shall be the same.

3.8 Workmanship

Workmanship shall be of a sufficiently high grade to ensure that clamps are of uniform quality and free from burrs, slivers, sharp edges, or other defects which would affect their service, and shall be uniform in appearance without any mold flash.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract, the supplier may utilize his own facilities or any commercial laboratory acceptable to the procuring activity. The procuring activity 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 examination and testing of clamps shall be classified as:

a. Qualification inspections (see 4.3)

b. Quality conformance inspections (see 4.4)

4.3 Qualification Inspections

4.3.1 Qualification Test Samples

Test samples for qualification tests shall consist of the following number clamps of each standard sheet to be qualified.

Size	-10	-12	-16	-20	-24	-28	-32	-36	-48
Quantity	17	12	22	12	12	6	6	6	11

In addition, 18 clamp cushion material slabs conforming to ASTM D 3182 for each type cushion material to be tested shall be provided. Fabric reinforced cushion materials for qualification must be supplied both with and without the fabric reinforcement molded into the slabs (18 slabs of each). The weave direction of the fabric reinforcement shall be identified.

4.3.2 Inspection Routine

Sample units shall be subjected to the qualification inspection specified in Table 1 in the order specified, conducted on applicable specimens.

TABLE 1 - QUALIFICATION TESTS

TABLE 1A - CLAMP CUSHION

Examination or Test	Requirement	Test	Number of Samples
Physical Properties	3.5.1.1	4.5.3.1	(See 4.3.1)
Compression Set	3.5.1.2	4.5.3.2	(See 4.3.1)
Flammability	3.5.1.3	4.5.3.3	(See 4.3.1)
Titanium Compatibility	3.5.1.4	4.5.3.4	(See 4.3.1)

TABLE 1B - CLAMP ASSEMBLY

Examination or Test	Requirement	Test	Number of Samples
Examination of Product	3.4	4.5.2	58
Vibration	3.5.2.1	4.5.4.1	-
Ozone Resistance[1]	3.5.2.2	4.5.4.2	5 (See 4.3.1)
Thermal Shock	3.5.2.3	4.5.4.3	5 (See 4.3.1)
[1] When specified on applicable material specification sheet			

4.3.3 Retention of Qualification

To retain qualification the manufacturer shall meet the requirements specified in 3.2.1 and 3.2.2.

4.3.4 Identification of Test Samples

Sample for each dash number shall be separately packaged and forwarded to the test facility specified by the qualifying activity. Samples shall be plainly identified by securely attached durable tags marked with the following information:

a. Sample for Qualification Test

b. Specification AS85449

c. Clamp Assembly, Saddle-Type, Cushion

d. Standard Sheet Part Number

e. Manufacturer's Part Number

f. Name of Manufacturer/Manufacturer's CAGE CODE

g. Submitted (Date) Under Authorization (Reference Letter Authorizing the Test)

4.3.5 Test Report

The supplier shall furnish the agency responsible for qualification with a certified test report showing quantitative results for tests required by this specification. The report shall designate the specification sheet part number of the clamps submitted. The report shall also include the manufacturer's drawing specifying the dimensions of the clamp, and the manufacturer of the cushion material.

4.4 Quality Conformance Inspections

Quality conformance inspections shall consist of the tests and inspections specified in Table 2, conducted in accordance with 4.4.2.

TABLE 2 - QUALITY CONFORMANCE TESTS

Examination or Test	Requirement	Test	Inspection Level	AQL
Examination of Product	3.4	4.5.2	II	4.0%
Cushion Tensile	3.5.1.1	4.5.3.1	S-3	4.0%
Cushion Elongation	3.5.1.1	4.5.3.1	S-3	4.0%
Ozone Resistance[1]	3.5.2.2	4.5.4.2	S-3	4.0%
[1] This test may be waived by procuring activity (see 6.2d)				

4.4.1 Inspection Lot

An inspection lot shall consist of clamps for a particular size, and material produced under essentially the same manufacturing conditions and presented for inspection at the same time.

4.4.2 Sampling for Nondestructive Tests

A random sample shall be selected from each inspection lot in accordance with general inspection levels of ANSI/ASQ Z1.4, inspection level II with Acceptance Quality Level AQL of 4.0%, and acceptance number zero (see Table 2). A preventative based quality system may be used in lieu of sampling inspection in accordance with MIL-STD-1916.

4.4.3 Sampling for Destructive Tests

Sampling shall be performed in accordance with special inspection levels of ANSI/ASQ Z1.4, Single Sampling Plan, Inspection Level S-3 with Acceptance Quality Level AQL of 4% and acceptance number zero (see Table 2). A preventative based quality system may be used in lieu of sampling inspection in accordance with MIL-STD-1916. Cushion material test specimens shall be cut from clamp cushions and shall be of sufficient size to be tested in accordance with the applicable test methods of the applicable material specification sheet. Tensile and elongation cushion material test specimens may be cut from larger size clamp cushions of the same inspection lot, and shall be provided by the manufacturer.

4.5 Test Methods

4.5.1 Test Conditions

4.5.1.1 Environment

Unless otherwise specified, all testing shall be performed at room temperature (60 to 90 °F).

4.5.1.2 Tolerances

Unless otherwise specified, test temperature tolerance shall be ±5 °F and test time tolerance shall be ±1% of the total test time.

4.5.2 Examination of Product

Clamps shall be examined to determine compliance with the requirements of this specification and applicable standard sheets with respect to material, workmanship, configuration, marking and dimensions as specified in 3.4.

4.5.3 Clamp Cushion Tests

4.5.3.1 Physical Properties Tests

Physical Property tests shall be conducted in accordance with the test methods specified in the applicable material specification. Cushion material samples shall meet the requirements specified in 3.5.1.1.

4.5.3.2 Compression Set Test

Compression set test shall be conducted in accordance with the test method specified in applicable material specification. Cushion material samples shall meet the requirements specified in 3.5.1.2.

4.5.3.3 Flammability Test

The flammability tests shall be performed as specified below. The flame source shall be a Bunsen burner or similar burner having a nominal tube internal diameter of 0.375 in. The burner shall be adjusted to provide a 1.50 in high flame of blue intensity. Verify flame temperature to be a minimum of 1550 °F, at the center of the flame, with the use of a thermocouple.

4.5.3.3.1 Preconditioning

All specimens shall be preconditioned at 70 °F ± 5 °F and 50% ± 5% relative humidity for a period of 24 h prior to testing. Clamps used for vertical burn test shall be uncurled until straight (strap section) before being placed in the preconditioning chamber. The cushion shall not be removed from the clamp band.

4.5.3.3.2 Vertical Burn Test

Three of size -16 clamps shall be used for vertical burn test (see 4.5.3.3.1). Remove the specimens one at a time from the preconditioning chamber immediately before performing test. Slide the cushion to one end of the clamp band. Position the specimen in the vertical position with the centerline of the cushion material 0.75 in above the top edge of the burner tube. Apply flame for 12 s and then remove. Testing shall be performed in a draft free environment. The average burn time of the three samples after removal of flame shall not exceed 15 s. The average burn length shall be less than the length of one of the specimens (cushion). Drippings from the burning specimens shall not continue to flame for more than 5 s after falling (see Figure 2).

4.5.3.3.3 Horizontal Burn Test

Three specimens fabricated in accordance with ASTM D 3182 shall be used for the Horizontal Burn Test. The specimens shall be removed one at a time from the preconditioning chamber and positioned so that the centerline of the edge being burned shall be 0.75 in above the top edge of the burner tube. The flame shall be applied for 15 s and then removed. Permit a minimum of 1.50 in to burn to calculate the burn rate. The burn rate shall not exceed 2.50 in per minute. Record burn rate (see Figure 2).

4.5.3.4 Titanium Compatibility Test

Mount five -10 clamps on a piece of titanium alloy tubing (Ti-3AL-2.5V cold work and stress relieved .625 x .032 wall) with no spacer between the feet. The tube shall be filled with hydraulic fluid, exposed to the clamp maximum rated service temperature for 12 days. Pressure shall be maintained at 3000 psi during the 12 days exposure. The test apparatus shall be removed and placed in an atmosphere of 158 °F and 95% relative humidity for 20 days. Performance requirements shall be as specified in 3.5.1.4.

4.5.4 Clamp Assembly Tests

4.5.4.1 Vibration and Transmissibility Test

Three clamps of each size to be tested -10, -12, -16, -20 and -24 shall be mounted on a mandrel conforming to 4.5.4.1.1 with spacing and dimensions as specified in Table 3, and as shown in Figure 1. The assembly shall be installed on a mounting block and shaker table as shown in Figure 1. Clamps shall be mounted flat on the mounting block with .190-32 UNF-3A bolts (160 ksi or higher strength) for .223 mounting hole and .250-28 UNF-3A for .281 mounting hole. A flat washer (NAS1149C0363R for .223 mounting hole and NAS1149C0463R for .281 mounting hole or equivalent) shall be used beneath the head of the mounting bolt with rounded edge against the clamp foot. An accelerometer measuring input shall be mounted on the test fixture-mounting block adjacent to but not touching the center clamp. A second accelerometer measuring output shall be mounted on the test mandrel adjacent to but not touching the centerline clamp. A resonance search shall be performed at an approximate constant sine wave vibration input of 2 g peak ±10% acceleration (in the horizontal axis of vibration, see Figure 1) from 50 to 500 cps, using a logarithmic sweep rate of 5 min per cycle, where a cycle shall consist of a sweep from 50 to 500 to 50 cps. Both accelerometers shall be continuously recorded. Each resonance frequency peak shall be observed and recorded. The transmissibility ratio (TR = g's Output Accelerometer/g's Input Accelerometer) shall be calculated for each resonance peak and recorded. The clamps and mandrels shall then be subjected to the most severe resonance peak for 30 min at a constant sine wave vibration input of 10g-peak ±10% acceleration until failure occurs or 10 000 000 cycles is attained. Record the total time to fail the clamp. All clamps shall meet the requirements specified in 3.5.2.1. The vibration test shall be repeated with 3 new clamps of the same size as specified. Upon completion of vibration test each clamp shall be examined for any excessive wear of the cushion distortion or failure of the band and base.

TABLE 3 - TEST MANDREL DIMENSIONS AND CLAMP SPACING

Clamp Size	Mandrel		Clamp Spacing (see Figure 1)	
	Diameter ±0.001	Length ±0.015	A ± 0.06	B ± 0.06
-10	0.625	25.0	10.0	2.5
-12	0.750	29.0	12.0	2.5
-16	1.000	29.0	12.0	2.5
-20	1.250	22.5	8.5	2.75
-24	1.500	22.5	8.5	2.75

4.5.4.1.1 Test Mandrels

All test mandrels unless otherwise specified shall be tool steel drill rod in accordance with ASTM A 686. All dimensions unless otherwise specified shall be as specified in Table 3 with surface finishes of 32 µin maximum. Spacing "A" and "B" shall be as shown in Figure 1.

4.5.4.2 Ozone Resistance Test

(When specified on applicable material specification sheet) Five test clamps of size -10 shall be disassembled and the strap cushions, tightly spiraled around a 0.125 in drill rod conforming to ASTM A 686. The ends of the cushion shall be securely fastened to the rod. The cushion and rod shall be conditioned for 70 h at 212 °F and then immersed in an ozone environment of 600-pphm concentration for 6 h at 125 °F. Unless otherwise specified, test shall be conducted in accordance with ASTM D 1149. Clamps shall meet the requirements specified in 3.5.2.2.

4.5.4.2.1 Ozone Resistance Test (Quality Conformance Only)

This test shall be conducted on clamps having cushions that are made from base materials that are prone to ozone attack. See cushion material specification sheet for an ozone resistance requirement. The ozone resistance test conducted for qualification testing (see 4.5.4.2) shall be conducted for quality conformance testing except that where clamps larger than size -10 are being tested. The larger cushions shall be removed from the clamp band, cut to the length of the -10 size cushion and tested. This test may be waived by the procuring activity if the procurement order is less than 5000 total parts.