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Superseding MA2060

Fittings, Welded, Hydraulic, Titanium and Corrosion Resistant Steel, 21 000 kPa, Metric

1. SCOPE:

This aerospace specification defines the requirements for metric weld fittings and machine weldments using an orbiting welding head suitable for use on cold worked 3A1-2.5V titanium and 21Cr-6Ni-9Mn CRES tubing and associated fittings.

This specification is equivalent to AS1576 except for metric dimensions and standards.

2. REFERENCES:

2.1 Applicable Documents:

The following specifications and standards, of the issue in effect on the date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein:

2.1.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AMS 4928	Bars and Forgings, Ti-6Al-4V, Annealed
AMS 4944	Titanium Alloy Tubing, Seamless, Hydraulic 3A1-2.5V Cold Worked, Stress Relieved
AMS 5561	Tubing, Hydraulic, Welded and Drawn, Corrosion Resistant, 21Cr-6Ni-9Mn, High Pressure, Hydraulic
AMS 5656	Steel Bars, Forging and Rings, Corrosion Resistant 9Mn-20Cr-.5Ni
AMS 5659	Bars, Forgings and Rings, 15Cr-5Ni-0.03 (Cb + Ta) 4Cu, Con. Elect. Melted
MA2002	Impulse Testing of Hydraulic Hose Assemblies, Tubing and Fittings (ISO 6772)
MA2003	Rotary Flexure Testing of Hydraulic Tubing Joints and Fittings (ISO 7527)
MA2005	Tube Fittings, Metric, Aerospace Fluid Systems, Separable - General Specification for (ISO 7169)
MA2014	Fitting End, Fluid, Acorn, Standard Dimensions, for Metric (ISO 7321)
MA2040	Nut, Coupling, Flareless
MA2061	Fitting End, Welded Dimensions, Hydraulic 20 000 kPa, Metric

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2.1.1 (Continued):

MA2062	T-Ring, Tube Weld, Hydraulic 20 000 kPa, Metric
MA2063	Tube and Fitting End, Welded, Preparation and Installation, 20 000 kPa, Metric
MA2064	Sleeve, Tube Weld to Flareless Female, Hydraulic, 20 000 kPa, Metric
MA2065	Union, Tube Weld to Flareless Male, Hydraulic, 20 000 kPa, Metric
MA2066	Reducer, Tube Weld, Hydraulic, 20 000 kPa, Metric
MA2069	Elbow, 90° Tube Weld, Hydraulic, 20 000 kPa, Metric
MA2070	Tee, Tube Weld, Hydraulic, 20 000 kPa, Metric
MA2071	Cross, Tube Weld, 20 000 kPa, Hydraulic, 20 000 kPa, Metric
MA2095	Fitting End, 24° Cone

2.1.2 U.S. Government Publications: Available from Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-109	Quality Assurance Terms and Definitions
MIL-STD-129	Marking for Shipment and Storage
MIL-H-6875	Heat Treatment of Steels, Process for
MIL-STD-6866	Inspection, Penetrant Method of

2.1.3 ANSI Publications: Available from American National Standards Institute, 1430 Broadway, New York, NY 10018.

ANSI/AWS A3.0	Welding Terms and Definitions
ANSI B46.1	Surface Texture, Surface Roughness, Waviness, and Lay

3. TECHNICAL REQUIREMENTS:

3.1 Qualification:

Fittings furnished under this specification shall be products which have been subjected to and which have successfully passed the test requirements of this specification.

3.2 Materials:

3.2.1 Fitting Materials: Fittings and other parts shall be made of materials listed in Table 1.

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3.2.2 Fitting Forgings:

TABLE 1 - Materials

Type of Part	Material	Code	Specification
Straight Fittings and Shapes	Cres	V	AMS 5659 ¹ (15-5 PH, H-1075)
Straight Fittings and Shapes	Titanium	T	AMS 4928 (Ti-6Al-4V)
T-Rings	Cres	C	AMS 5656 21 CR-6Ni-9Mn

¹Solution heat treated, aged to H-1075 in accordance with MIL-H-6875 after machining.

3.2.2.1 Surface Defects: Forged fittings shall be free from cracks, laps, seams, and other defects.

NOTE: Surface defects may be removed as long as wall thickness requirements are met and as long as defects do not reappear after etching and in penetrant inspection.

3.2.2.2 Titanium Forgings: Titanium forgings shall exhibit an equiaxed microstructure. Oxide or other gas contaminated surface scale shall be removed by pickling.

3.2.3 Tubing Material: Tubing shall be in accordance with the requirements of AMS 4944 and AMS 5561 as applicable.

3.3 Design and Fabrication:

Fittings and other parts shall be in accordance with the following standards, as applicable:

- a. MA2061
- b. MA2062
- c. MA2063
- d. MA2064
- e. MA2065
- f. MA2066
- g. MA2069
- h. MA2070
- i. MA2071

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3.3.1 Passages:

3.3.1.1 Drill Offset: On fittings where the fluid passage is drilled from each end, the offset between the drilled holes at the meeting point of the drills shall not exceed 0.4 mm.

3.3.1.2 Cross Section: On angle fittings, the cross sectional area at the junction of the fluid passages shall not be smaller than the cross sectional area of the smaller passage.

3.4 Performance:

Fitting samples in accordance with Table 2 welded to tubing shall meet the requirements of 3.5.1, 3.5.2, 3.5.3, and 3.5.4 when tested in accordance with the test procedures specified in Section 4 of this document.

TABLE 2 - Qualification Test Samples

Part	Standard	Quantity	Test	Paragraph
Tube End	MA2063	3	Impulse	3.5.2, 4.6.3.3
		3	Burst	3.5.3, 4.6.3.4
		6	Flexure	3.5.4, 4.6.3.5
T-Ring (Tube-Tube)	MA2062	3	Impulse	3.5.2, 4.6.3.3
		3	Burst	3.5.3, 4.6.3.4
		6	Flexure	3.5.4, 4.6.3.5
Tee	MA2070	3	Impulse	3.5.2, 4.6.3.3
		3	Burst	3.5.3, 4.6.3.4
		2	Flexure	3.5.4, 4.6.3.5
Union, Sleeve, Nut	MA2065, MA2064, MA2040	3	Impulse	3.5.2, 4.6.3.3
		3	Burst	3.5.3, 4.6.3.4
		6	Flexure	3.5.4, 4.6.3.5
		4	Gaseous	3.5.5, 4.6.3.6
		4	Assembly	3.5.6, 4.6.3.7
Reducer	MA2066	3	Impulse	3.5.2, 4.6.3.3
		3	Burst	3.5.3, 4.6.3.4
		6	Flexure	3.5.4, 4.6.3.5

NOTE: All specimens shall be proof tested prior to impulse, burst, and flexure testing.

3.4.1 Proof Pressure: The assembly shall withstand proof pressures of 40 000 kPa without leakage or wetting, evidence of permanent deformation or, at separable connectors, other malfunction that would affect assembly or disassembly.

3.4.2 Impulse: The assemblies shall withstand 200 000 impulse pressure cycles without leakage or external wetting when impulse tested to the requirements of MA2002.