



AEROSPACE STANDARD

AS85720™**REV. C**

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Superseding AS85720B

Fittings, Tube, Fluid Systems, Separable, High Pressure Beam Seal,
5000/8000 psi, General Specification for

FSC 4730

RATIONALE

Modified periodic control testing procedures/tests (4.4.3); clarified flexure Tables 2A, 2B, and 2C; and added new tubing material options to Table 1.

1. SCOPE

1.1 Scope

This specification covers the design requirements and test procedures for separable beam seal fittings which include end fittings (see 2.4.2), connectors (see 2.4.3), and boss fittings for use in aerospace fluid systems. Design requirements are for Class 5000 and 8000 in titanium, and corrosion resistant steel (CRES). Definition of fittings and related terms are defined in 2.4.

1.2 Classification

Fittings shall be of the following type and pressure classes of fluid systems as specified below:

1.2.1 Type, as Defined in Hydraulic System Specifications AS5440 and AS8775

- a. Type II System - Temperature range -65 to +275 °F.
- b. Type III System - Temperature range -65 to +450 °F.

1.2.2 Pressure Classes

- a. Class 5000 - 5000 psi nominal operating pressure.
- b. Class 8000 - 8000 psi nominal operating pressure.

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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 +1 724-776-4970 (outside USA), www.sae.org.

AMS4928	Titanium Alloy Bars, Wire, Forgings, Rings, and Drawn Shapes, 6Al - 4V Annealed
AMS4945	Titanium Alloy Tubing, Seamless, Hydraulic, 3Al - 2.5V, Controlled Contractile Strain Ratio Cold Worked, Stress Relieved
AMS4946	Titanium Alloy Tubing, Seamless, Hydraulic, 3Al - 2.5V, Texture Controlled, Cold Worked, Stress Relieved
AMS4965	Titanium Alloy, Bars, Wire, Forgings, and Rings, 6.0Al - 4.0V, Solution Heat Treated and Aged
AMS5561	Steel, Corrosion and Heat-Resistant, Welded and Drawn or Seamless and Drawn Tubing, 9.0Mn - 20Cr - 6.5Ni - 0.28N, High-Pressure Hydraulic
AMS5637	Steel, Corrosion Resistant, Bars and Wire, 18Cr - 9.0Ni (302), Solution Heat Treated, Cold Drawn and Stress Relieved, 125 ksi (862 MPa) Tensile Strength
AMS5643	Steel, Corrosion Resistant, Bars, Wire, Forgings, Tubing, and Rings, 16Cr - 4.0Ni - 0.30 (Cb+Ta) - 4.0Cu, Solution Heat Treated, Precipitation Hardenable
AMS5656	Steel, Corrosion Resistant, Bars, Wire, Forgings, Extrusions, and Rings, 9.0Mn - 20Cr - 6.5Ni - 0.27N, Solution Heat Treated
AMS5659	Steel, Corrosion Resistant, Bars, Wire, Forgings, Rings, and Extrusions, 15Cr - 4.5Ni - 0.30Cb (Nb) - 3.5Cu, Consumable Electrode Remelted, Solution Heat Treated, Precipitation Hardenable
AIR1377	Fire Test Equipment for Flexible Hose and Tube Assemblies
ARP1185	Flexure Testing of Hydraulic Tubing Joints and Fittings
AS603	Impulse Testing of Hydraulic Hose, Tubing, and Fitting Assemblies
AS1055	Fire Testing of Flexible Hose, Tube Assemblies, Coils, Fittings, and Similar System Components
AS1376	Alternate Dimensions, Center Body Section, Shape Fluid Fitting, Design Standard
AS5620	Titanium Hydraulic Tubing, Ti-3Al-2.5V, Cold Worked and Stress Relieved, Up to 35000 kPa (5080 psi)
AS1701	Lubricant, Solid Film
AS4207	Fitting End, External Thread, Beam Seal, Design Standard

AS4208	Fitting End, Bulkhead, External Thread, Beam Seal, Design Standard
AS4510/2	Fittings, Weld to Beam, Seal, Fluid Connection
AS5272	Lubricant, Solid Film, Heat Cured, Corrosion Inhibiting Procurement Specification
AS6279	Standard Practice for Production, Distribution, and Procurement of Metal Stock
AS8879	Screw Threads - UNJ Profile, Inch, Controlled Radius Root with Increased Minor Diameter
AS85720/1	Fittings, Tube, Fluid Systems, Separable, High Pressure, Dynamic Beam Seal, Design Standard for Male End

2.1.2 U.S. Government Publications

Copies of these documents are available online at <https://quicksearch.dla.mil>.

MIL-HDBK-505	Definitions of Item Levels, Item Exchangeability, Models and Related Terms
MIL-PRF-5606	Hydraulic Fluid, Petroleum Base; Aircraft, Missile and Ordnance
MIL-PRF-83282	Hydraulic Fluid, Fire-Resistant, Synthetic Hydrocarbon Base, Aircraft, Metric, NATO Code Number H-537
MIL-STD-129	Marking for Shipment and Storage (Part 1 of 4 Parts)
MIL-STD-1916	DoD Preferred Method for Acceptance of Product
MIL-STD-2073-1	DoD Standard Practice for Military Packaging Requirements

2.1.3 ASME Publications

Available from ASME, P.O. Box 2900, 22 Law Drive, Fairfield, NJ 07007-2900, Tel: 800-843-2763 (U.S./Canada), 001-800-843-2763 (Mexico), 973-882-1170 (outside North America), www.asme.org.

ASME B46.1	Surface Texture (Surface Roughness, Waviness and Lay)
ASME Y14.35M	Revision of Engineering Drawings and Associated Documents
ASME Y14.100	Engineering Drawing Practices

2.1.4 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 D1974	Fiberboard Shipping Containers, Methods of Closing, Sealing, and Reinforcing, Standard Practice for
ASTM D3951	Packaging, Commercial
ASTM D6251/D6251M	Standard Specification for Wood-Cleated Panel Board Shipping Boxes

2.1.5 PRI Publications

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

PD1100	NADCAP – Program Requirements
PD2000	PRI-QPL Program Requirements
OP 2007 Appendix G3	Additional Requirements for The Aerospace Fluid Distribution Systems (G3) QPG
AC7112	National Aerospace and Defense Contractors Accreditation Program (NADCAP) - Fluid Systems Components Manufacturing Requirements
AC7112/2	National Aerospace and Defense Contractors Accreditation Program Requirements for Fittings and Other Machined Components
PRI-QPL-AS85720	Qualified Products List, Fittings (QPL), Tube, Fluid Systems, Separable, Beam Seal, 5000/8000 psi

2.1.6 AIA Publications

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

NAS847 Caps and Plugs, Protective, Dust and Moisture Seal

2.2 Related Publications

The following publications are provided for information purposes only and are not a required part of this SAE Technical Report.

2.2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AS5440 Hydraulic Systems, Military Aircraft, Design and Installation, Requirements For

AS8775 Hydraulic System Components, Aircraft and Missiles, General Specifications For

2.3 Order of Precedence

In the event of conflict between the text of this document and the references cited herein (except for related associated detail specifications, specification sheets, or MS standards), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.4 Definitions

2.4.1 BEAM SEAL FITTINGS

These are a class of separable fittings which are designed to mate with a standardized 8-1/2 degree male end (AS85720/1; or AS4207; or AS4208). The name comes from the female sealing system which employs an elastic “beam” which acts as a dynamic lip type seal. A secondary, axially very stiff seal also mates on the 8-1/2 degree male face to allow for developing high torque induced preloads while providing a deflection limit to the elastic primary seal.

2.4.2 END FITTING

Fitting(s) which are permanently attached to the tubing end. For beam seal fittings, this type fitting consists of a threaded male fitting (having geometry per AS85720/1, AS4207, or AS4208) or a female fitting having an internally threaded nut attached with a swivel wire (wired-on) or equivalent means, or a non-attached nut having slip-on geometry.

2.4.3 CONNECTOR

A fitting, not directly attached to tubing, which connects end fittings or bosses or ports, one with another by means of threads and compatible seal faces.

2.4.4 LEAKAGE

Is defined as the escape of fluid (gaseous or liquid) from any point of a "sealed" system. For purposes of qualification testing, leakage is further defined as any fluid escape from the test fitting or fitting junction as understood to include a distance of tubing of one nominal diameter in length beyond the fitting envelope.

2.4.5 LOT

Is defined as all parts of a given part number made from the same batch of material and processed at the same time.

3. TECHNICAL REQUIREMENTS

3.1 Qualification

The fittings and fitting bodies furnished under this specification shall be products which are authorized by the qualifying activity for listing on the applicable qualified products list at the time of award of contract (see 4.3 and 6.5).

3.1.1 Product Qualification

Fittings and nuts furnished under this specification shall be representative of products which have been qualified to the requirements of 4.3. This includes the starting raw stock form that was used for qualification. After successful qualifications are performed, the corresponding QPLs will indicate either "BAR STOCK," or "FORGING" (which includes either one-step oversized forging or near-net (standard) forging).

3.1.1.1 Successful qualifications performed with fittings processed from bar-stock does not qualify the OCM to manufacture same part numbered parts from oversized forgings or standard near-net forgings. Dimensional requirements shall be per AS1376. Grain orientation for fitting bodies machined from bar-stock shall follow the (L) longitudinal axis across the runs on tee shapes (parallel with the major axis) or follow the longest major axis on elbow or cross shapes (parallel with the longest axis) in accordance with AS6279.

3.1.1.2 Successful qualifications performed with fittings processed from near-net forgings also qualifies the OCM to manufacture same part numbered parts from "one-step" oversize forgings per 3.1.1.2.1 but does not qualify the OCM to manufacture same part numbered parts from bar-stock. If the shaped fitting (elbow, tee, cross) includes one or more ends that are "standard" sized (end sized according to the forging size), and one or more ends that are "reduced" size (end sized smaller than forging size), this shall be considered same as being qualified and manufactured from a standard sized near-net forging.

3.1.1.2.1 An alternate qualification method for manufacture from forgings will be successful qualifications performed with fittings processed from “one-step” oversize forgings. Successful qualification using “one-step” oversized forgings also qualifies the OCM for manufacturing from near-net forgings as per 3.1.1.2 but does not qualify the OCM to manufacture same part numbered parts from bar-stock. A “one-step” oversize forging is defined as a forging for a shaped fitting (elbow, tee, cross) that is one size larger than the largest fitting end size. For small size fittings dash 03 thru dash 05, this means a dash 04 forging is acceptable to manufacture a dash 03 fitting, a dash 05 forging is acceptable for a dash 04 fitting, and a dash 06 forging is acceptable for a dash 05 fitting. For large size fittings dash 06 thru dash 14, this means a dash 08 forging is acceptable to manufacture a dash 06 fitting, a dash 10 forging is acceptable for a dash 08 fitting, a dash 12 forging is acceptable for a dash 10 fitting, a dash 14 forging is acceptable for a dash 12 fitting, and a dash 16 forging is acceptable for a dash 14 fitting. For extra-large size fittings dash 16 and dash 20, up to a dash 20 forging is acceptable to manufacture a dash 16 fitting, and up to a dash 24 forging is acceptable for a dash 20 fitting. These are the only fitting/oversize forging combinations allowed for this alternate method of qualification and manufacture. Dimensional specifics per AS1376 are required.

3.1.1.3 All products shall conform to this procurement specification and shall be approved in accordance with the requirements of PD2000 and OP 2007 Appendix G3 for listing in the PRI Qualified Products List (QPL) PRI-QPL-AS85720. See <http://www.eAuditNet.com>.

3.1.2 Manufacturer Qualification

A manufacturer producing a product in conformance to this procurement specification shall be accredited in accordance with the requirements of PD1100, OP 2007 Appendix G3, AC7112, and AC7112/2 and will be listed in the PRI Qualified Manufacturers List (QML).

3.2 Material

3.2.1 Fittings

The material used shall be titanium alloys or corrosion resistant steels as specified in Table 1. For lower pressures, see AS85421. The material shall be heat treated, as required, and have surface protection to meet the test requirements of this specification.

3.2.2 Recycled, Recovered, or Environmentally Preferable Materials

Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible, provided the materials meet or exceed the operational and maintenance requirements, and promote economically advantageous life cycle costs.

Table 1 - Fitting and tubing materials

Item Name	Titanium	CRES
Nuts Internally Threaded	AMS4965	AMS5643 or AMS5659 Condition H1075
Fitting Bodies	AMS4965, AMS4928 (Bars or Forgings)	AMS5643 or AMS5659 Condition H1075 or AMS5656 (Bars or Forgings)
Tubing	AMS4945, AMS4946, or AS5620	AMS5561
Swivel Wires	AMS5637 with dry lube Per AS5272 Type I or Type II; or AS1701 Type III or Type IV	

3.2.3 Tubing

The tubing used for the fabrication of the test fitting assemblies shall be in accordance with Tables 1 and 2.

3.3 Design and Construction

3.3.1 Configuration and Dimensions

The configuration and dimensions shall conform to requirements of this document and the design requirements specified on the applicable specification sheet AS85720/1, as well as any of the applicable AS standard sheets for beam seal fittings. If the center body section of shaped fitting is machined from bar or oversized forging (in lieu of standard near-net forging) it shall conform to AS1376, Table 4.

3.3.2 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 0.015 inch. Angular misalignment shall not exceed 2 degrees.

3.3.3 Reduction in Fluid Passage (Bore) Cross-Section

Straight and non-reducer shape fittings shall be bored throughout the passage such that a ball having a diameter, 0.020 inch less than the minimum specified bore shall pass through the passage. For non-straight and reducer shape fittings (such as crosses, tees, elbows, etc.) the cross-sectional area at the junction of the fluid passage shall not be smaller than the cross-sectional area of the smallest passage.

3.3.4 Tube Attachment

The method of joining the tubing to the end fitting (brazing, welding, mechanical attachment, swaging, etc.) shall not adversely affect the properties, strength, or geometry of the tubing or end fitting, as verified by the performance requirements of this specification. The joint shall be of a quality compatible with the design and performance requirements of this specification and shall permit inspection by direct measurement, X-ray, or other means.

3.3.5 Installation Tooling

Size of tool envelope required to install fittings on tubing in aircraft shall be kept to a minimum. The wrench flats or pads of the fittings shall permit use of standard wrenches.

Table 2A - 5000 psi CRES tubing sizes and bending stresses

Tube Size	Tube Wall	Endurance Point Bending Stress	Data Point 1 Bending Stress	Data Point 2 Bending Stress	Data Point 3 Bending Stress
		10 Million Cycles, Min (psi)	50000 Cycles, Min (psi)	100000 Cycles, Min (psi)	1000000 Cycles, Min (psi)
-03	0.020	24000	37460	33630	27550
-04	0.020	24000	37460	33630	27550
-05	0.025	24000	37460	33630	27550
-06	0.030	22000	34720	31270	25560
-07	0.034	21000	32700	29600	24400
-08	0.039	20000	31000	28000	23260
-09	0.044	19000	29540	26630	22090
-10	0.049	18000	28000	25220	20940
-11	0.053	17000	26470	23800	19780
-12	0.058	16000	24950	22400	18600
-14	0.068	15500	24170	21670	18000
-16	0.078	15000	23400	20980	17400
-20	0.040*	15000	23400	20980	17400