AEROSPACE STANDARD

AS85720	REV. A

Issued 1998-07
Revised 2008-09
Reaffirmed 2015-07

Superseding AS85720

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

FSC 4730

RATIONALE

AS85720A has been reaffirmed to comply with the SAE five-year review policy.

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 the references cited herein, the text of this document takes precedence. Nothing in this document however, supersedes applicable laws and regulations unless a specified 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.

AS603	Hose, Hydraulic, Tubing and Fitting Assemblies, Impulse Testing of
AS1701	Lubricant, Solid Film
AS8879	Screw Threads, Controlled Radius Root with Increased Minor Diameter, General Specifications for
AS1055	Hose, Flexible, Tube Assemblies, Coils, Fittings and System Components, Fire Testing of
ARP1185	Flexure Testing of Hydraulic Tubing Joints and Fittings
AIR1377	Fire Test Equipment for Flexible Hose and Tube Assemblies
AS4510/2	Fittings, Weld to Beam Seal, Fluid Connection
AS5272	Lubricant, Solid Film, Heat Cured, Corrosion Inhibiting Procurement Specification
AS9100	Quality Systems - Aerospace Model for Quality Assurance in Design, Development, Production, Installation and Servicing
AS85720/1	Fitting End, Standard Dimensions for Beam Seal, Male
AMS4921	Titanium, Bars, Forgings, and Rings, Annealed, 70,000 psi (485 MPa) Yield Strength
AMS4928	Titanium Alloy, Bars, Forgings and Rings 6Al-4V, Annealed, 120,000 psi (825 MPa) Yield Strength
AMS4946	Titanium Alloy Tubing, Seamless, Hydraulic - 3.0Al - 2.5V, Texture Controlled, 105,000 psi (724 MPa) Yield Strength
AMS4965	Titanium Alloy, Bars, Forgings and Rings, 6.0Al - 4.0V, Solution and Precipitation Heat Treated
AMS5561	Tubing, Steel, Welded and Drawn, Corrosion and Heat Resistant 9.0Mn - 20Cr - 6.5Ni - 0.28N, High Pressure Hydraulic
AMS5637	Steel Bars, Corrosion Resistant 18Cr - 9.0Ni (SAE 30302) Cold Drawn, 125,000 psi (860 MPa), Tensile Strength
AMS5643	Steel Bars, Forgings, Tubing and Rings, Corrosion Resistant, 16Cr - 4.0Ni - 0.30(Cb+Ta) - 4.0 Cu Solution Heat Treated

AMS5656 Bar, Steel, Forgings and Rings, Corrosion Resistant 9.0Mn - 20Cr - 6.5Ni - 0.27N

AMS5659 Bar, Forgings and Rings, Corrosion Resistant 15Cr - 4.5Ni - 0.30(Cb + Ta) - 3.5Cu Consumable Electrode Melted, Solution Heat Treated, Precipitation Hardenable

2.1.2 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-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-HDBK-505 Definitions of Item Levels, Item Exchangeability, Models and Related Terms

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, 22 Law Drive, P.O. Box 2900, Fairfield, NJ 07007-2900, Tel: 973-882-1170, www.asme.org.

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

ASME Y14.100 Engineering Drawing Practices

ASME Y14.35M Revision of Engineering Drawings and Associated Documents

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 D 1974 Fiberboard Shipping Containers, Methods of Closing, Sealing, and Reinforcing, Standard Practice for

ASTM D 3951 Packaging, Commercial

ASTM D 6251/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.

PD2001 Tasks and Procedures of the Qualification Product Management Council PD2101 Qualified Management Product Council for Qualified Products Groups

PD2101 Qualified Management Product Council for Qualified Products Group

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 Other Referenced Publications

The documents below are referenced for information only but are not part of the specific requirements of this standard.

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

AS5440 Hydraulic Systems, 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). 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) 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. All products shall conform to this procurement specification and shall be approved in accordance with the requirements of PD2001 and PD2101 for listing in the PRI Qualified Products List (QPL) PRI-QPL-AS85720 (http://www.pri.sae.org/QPL/qpl-list.htm). See also 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 PD2101, AS9100 and 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. All fittings shall be designed for the class 5000 system but may be qualified to class 8000. 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, or AMS4921	AMS5643 or AMS5659 Condition H1075 or AMS5656
Tubing	AMS4946	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.

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 through-out 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 2 - FITTING AND TUBING DATA AND STRESS LEVEL FOR FLEXURE TEST

TABLE 2A - 5000 PSI CRES TUBING SIZES AND BENDING STRESSES

Tube Size	Tube Wall	Endurance Point Bending Stress 10 Million cycles, min (psi)	Data Point 1 Bending Stress 50 000 cycles, min (psi)	Data Point 2 Bending Stress 100 000 cycles, min (psi)	Data Point 3 Bending Stress 1 000 000 cycles, min (psi)
-03	.020	24 000	37 460	33 630	27 550
-04	.020	24 000	37 460	33 630	27 550
-05	.025	24 000	37 460	33 630	27 550
-06	.030	22 000	34 720	31 270	25 560
-07	.034	21 000	32 700	29 600	24 400
-08	.039	20 000	31 000	28 000	23 260
-09	.044	19 000	29 540	26 630	22 090
-10	.049	18 000	28 000	25 220	20 940
-11	.053	17 000	26 470	23 800	19 780
-12	.058	16 000	24 950	22 400	18 600
-14	.068	15 500	24 170	21 670	18 000
-16	.078	15 000	23 400	20 980	17 400
-20	.040*	15 000	23 400	20 980	17 400

TABLE 2B - 5000 PSI TITANIUM TUBING SIZES AND BENDING STRESSES

Tube Size	Tube Wall	Endurance Point Bending Stress 10 Million cycles, min (psi)	Data Point 1 Bending Stress 50 000 cycles, min (psi)	Data Point 2 Bending Stress 100 000 cycles, min (psi)	Data Point 3 Bending Stress 1 000 000 cycles, min (psi)
-03	.020	20 000	31 000	28 000	23 260
-04	.022	20 000	31 000	28 000	23 260
-05	.027	20 000	31 000	31 000	31 000
-06	.032	19 000	29 540	26 630	22 090
-07	.038	18 500	29 000	25 950	21 500
-08	.043	18 000	28 000	25 220	20 940
-09	.048	17 500	27 400	24 500	20 300
-10	.054	17 000	26 470	23 800	19 780
-11	.061	16 500	25 600	23 100	19 200
-12	.065	16 000	24 950	22 400	18 600
-14	.077	15 000	23 400	20 980	17 400
-16	.088	14 500	22 500	20 300	16 800
-20	.046*	14 000	21 800	19 600	16 200

TABLE 2C - 8000 PSI CRES TUBING SIZES AND BENDING STRESSES

Tube Size	Tube Wall	Endurance Point Bending Stress 10 Million cycles, min (psi)	Data Point 1 Bending Stress 50 000 cycles, min (psi)	Data Point 2 Bending Stress 100 000 cycles, min (psi)	Data Point 3 Bending Stress 1 000 000 cycles, min (psi)
-03	.020	24 000	37 460	33 630	27 550
-04	.023	24 000	37 460	33 630	27 550
-05	.029	24 000	37 460	33 630	27 550
-06	.034	22 000	34 720	31 270	25 550
-07	.040	21 000	32 700	29 600	24 400
-08	.046	20 000	31 000	28 000	23 260
-09	.051	19 000	29 540	26 630	22 090
-10	.057	18 000	28 000	25 220	20 940
-11	.062	17 000	26 470	23 800	19 780
-12	.037*	16 000	24 950	22 400	18 600
-14	.043*	15 500	24 170	21 670	18 000
-16	.050*	15 000	23 400	20 980	17 400
-20	.062*	15 000	23 400	20 980	17 400

TABLE 2D - 8000 PSI TITANIUM TUBING SIZES AND BENDING STRESSES

Tube Size	Tube Wall	Endurance Point Bending Stress 10 Million cycles, min (psi)	Data Point 1 Bending Stress 50 000 cycles, min (psi)	Data Point 2 Bending Stress 100 000 cycles, min (psi)	Data Point 3 Bending Stress 1 000 000 cycles, min (psi)
-03	.020	20 000	31 000	28 000	23 260
-04	.026	20 000	31 000	28 000	23 260
-05	.032	20 000	31 000	28 000	23 260
-06	.038	19 000	29 540	26 630	22 090
-07	.045	18 500	29 000	25 950	21 500
-08	.051	18 000	28 000	25 220	20 940
-09	.058	17 500	27 400	24 500	20 300
-10	.064	17 000	26 470	23 800	19 780
-11	.070	16 500	25 600	23 100	19 200
-12	.042*	16 000	24 950	22 400	18 600
-14	.049*	15 000	23 400	20 980	17 400
-16	.056*	14 500	22 500	20 300	16 800
-20	.071*	14 000	21 800	19 600	16 200

NOTES:

1. Tubing specifications per AMS5561 (21-6-9 Cres) or AMS4946 (3Al - 2.5V Ti) as noted in Table 1.

2. Sizes marked with *, are for return lines only. Maximum pressure is half the operating pressure.

3. Bending stress values shown in the tables are the axial stresses as measured by the strain gage when the test specimen is deflected by the test machine and prior to fluid pressure being applied (see 4.6.6).

3.3.6 Fitting Body Design

Fitting body shall be designed to prevent failure (see 2.3) of sealing surfaces. The sealing interface shall be integral with the fittings. Removable seals are not permitted. For fittings with pullback nuts, and prior to assembly, the nut shall be pulled back to a travel stop, such that the threaded end of the nut is flush within +0.032/-0.000 inch of the outer beam surface. When assembled at maximum torque (see Table 3A or 3B) the gap between the threaded end of the nut and the hex face of the male fitting body shall be a minimum of 0.030 inch.

3.3.7 Fitting Body Interface

All male and female end fittings shall be tested using fitting bodies with end configurations conforming to a design standard per AS85720/1. All female fitting bodies tested shall be compatible with male fitting bodies dimensioned as shown in this design standard.

3.3.8 Threads

All coupling threads shall be in accordance with AS8879. The surface finish of the thread flanks shall be 63 microinches Ra per ASME B46.1. Internal threads shall be coated with solid film lubricant per AS5272, Type I or Type II or AS1701 Type III or Type IV. External (male) threads shall not be coated, except as required for port type fittings of the ring locked type or with ends per AS930.

3.3.9 Solid Film Lubricant

Threads - Female threads shall be coated as shown below:

Type II Systems (-65 to +275 °F) use AS5272 type I or type II solid film lubricant

Type III Systems (-65 to + 450 °F) use AS1701 type III or type IV solid film lubricant

Male threads shall not be coated except as required on certain port type fittings (see 3.3.8).

Male Sealing Surfaces shall be coated with solid film lubricant as specified below:

Type II Systems (-65 to +275 °F) use AS5272 type I or type II solid film lubricant

Type III Systems (-65 to + 450 °F) use AS1701 type III or type IV solid film lubricant

No overspray in fitting bores allowed.

Female Sealing Surfaces - No coating shall be used.

Swivel Wires - See Table 1 for solid film lubricant requirement.

3.4 Performance

The fitting assemblies shall meet the performance requirements of 3.4.1 through 3.4.9.

3.4.1 Proof Pressure

The fitting assembly shall withstand pressure equal to twice the nominal operating pressure of the system for 5 minutes without leakage, evidence of permanent deformation, or other malfunction that shall affect assembly or disassembly using the torque values per Table 3A or 3B when tested in accordance with 4.6.2.

TABLE 3A - TORQUE REQUIREMENTS, CLASS 5000

Fitting Size		03	04	05	06	08	10	12	14	16	20
Minimum Torque	lbf-in	97	160	173	290	470	650	830	918	1370	1512
Maximum Torque	lbf-in	108	180	192	320	520	720	920	1020	1520	1680

TABLE 3B - TORQUE REQUIREMENTS, CLASS 8000

Fitting Size		03	04	05	06	07	08	09	10	11
Minimum Torque	lbf-in	97	160	173	290	312	470	480	650	654
Maximum Torque	lbf-in	108	180	192	320	372	520	540	720	756

3.4.2 Burst Pressure

The fitting assembly shall not rupture or leak at any pressure less than or equal to four times the nominal operating pressure for class 5000 and three times the nominal operating pressure for class 8000. The test shall be conducted in accordance with 4.6.3 for a minimum of 5 minutes at the burst pressure. The fitting assembly shall not have to meet any disassembly or assembly requirements after this test.

3.4.3 Thermal Shock

The fitting assembly shall withstand the temperatures and pressures applied, when tested in accordance with 4.6.4 without leakage, evidence of permanent deformation, or other malfunction that shall affect assembly or disassembly of the fitting.

3.4.4 Impulse

The fitting assembly shall withstand 200 000 impulse pressure cycles without leakage (see 2.3) from the fitting or the fitting-tube junction when tested in accordance with 4.6.5.

3.4.5 Flexure

The fitting assembly shall not leak from the sealing surface or the fitting tube junction prior to completion of ten million cycles at the test stress level specified in Table 2, when tested in accordance with 4.6.6. Fittings shall be tested to demonstrate that no failures will occur when S/N tabulated bending stress values are applied per Table 2. Alternatively, historical data (i.e., data which predates revision A of this document) using six specimens all run at the endurance stress value only, may be accepted by the qualifying authority as proof of the flexure requirement. See also 4.6.6.

3.4.6 Repeated Connection

The fitting assembly shall withstand 25 repeated connections at the minimum and maximum torque values specified in Table 3A or 3B when tested in accordance with 4.6.7 without:

a. Leakage at any of the pressure tests of 4.6.7.

b. Inability to assemble the fitting to the point of interface by hand.

c. Nut deformation preventing engagement of nut hex with open end wrench.

d. Backing out of the swivel wire, when wired-on nuts are used (see 4.6.7 for requirements to check wired-on nuts and for back-out limits and for special test assembly configurations).

3.4.7 Stress Corrosion

The fitting assembly shall withstand 50 hours of salt spray exposure when tested in accordance with 4.6.8 without:

a. Indication of cracking or pitting of the exposed surfaces of fittings and tubing within one diameter of the end fittings greater than that exhibited on the balance of the tubing when visually examined with 10 power magnification.

b. Leakage or burst at a value less than the minimum burst pressure of the assembly

c. Indications of interior transgranular corrosive attack during metallurgical examination of longitudinal and transverse sections of the fitting and fitting-tube junction.

3.4.8 Pneumatic Leakage

The fitting assembly shall withstand pneumatic pressure equal to the maximum operating pressure for 5 minutes at room temperature without any visible bubbles starting after 1 minute at pressure or other malfunction that would affect assembly or disassembly using the minimum torque values specified in Table 3A or 3B when tested in accordance with 4.6.9.

3.4.9 Fire

The fitting assembly shall withstand a 2000 °F, 4500 btu/hour flame for 15 minutes when tested in accordance with 4.6.10. Heat input shall be measured by a 0.500 inch copper tube per AIR1377. There shall be no leakage detected by visual observation or failure of the test assembly prior to the specified time.

3.5 Part Numbering of Interchangeable Parts

All parts having the same design activity CAGE CODE (commercial and government entity) and part number shall be interchangeable as defined in MIL-HDBK-505. The item identification and part number requirements of ASME Y14.100 and ASME Y14.35M shall govern the design activity part numbers and changes thereto.

3.6 Dimensions and Tolerances

All pertinent dimensions, threads and tolerances, where interchangeability, operation, or performance of the fitting may be affected, shall be as specified on the AS85720 slash sheets, or applicable AS standard drawings or specification sheets.

3.7 Weight

Fitting weights shall not exceed those values shown on the applicable specification sheets.

3.8 Identification of Product

All fittings shall be identified as stated below.

3.8.1 Marking Method

Marking shall be impressed, embossed, laser etched, or electrochemical etched in a location and in a manner not detrimental to the fitting. Where practical, markings shall remain visible, after fitting is installed.

3.8.2 Markings

All tube fittings and fitting bodies shall be marked with the manufacturer's name or trademark, the material identification code, and complete part number as detailed in the applicable specification sheet. If space permits, the full manufacturer's part number and the manufacturer's CAGE CODE shall be marked to ensure positive identification. The manufacturer's basic part number and drawing number shall be the same.

3.9 Workmanship

Remove all burrs and unless otherwise specified, break all sharp edges. Sealing surfaces shall be free of detrimental, radial, and spiral tool marks. Unless a finer finish is specified on applicable drawings, sealing surfaces shall be smooth to a finish of 45 microinches Ra, as defined in ASME B46.1. Thread flanks shall be smooth to a finish of 63 microinches Ra. All other machined surfaces shall be smooth to 125 microinches Ra. Un-machined surfaces, such as forging surfaces and bar stock flats shall be free of cracks, laps, and seams. Finish in these areas to be 250 microinches RA.

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 (examination and tests) as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the qualifying activity. The qualifying activity may reserve 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.

4.1.1 Responsibility for Compliance

All items must meet the requirements of this specification. The inspections set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the customer for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the customer to accept defective material (see 6.3).

4.2 Classification of Inspection

The inspection requirements specified herein are classified as follows:

a. Qualification inspection (see 4.3).

b. Quality conformance inspection (see 4.4).

4.2.1 Record Maintenance

The supplier shall maintain a record of inspections for a minimum period of seven years.

4.2.2 Material Certification

Records of chemical analysis and mechanical property tests showing conformance to the applicable material specifications should be made available upon request by the customer. Material certification, heat treatment, and inspection records shall be retained for a minimum period of seven years from the date of purchase. The material shall conform to the applicable material specification before releasing for production

4.3 Qualification Inspection

The qualification inspection shall consist of the inspection methods conducted in the order shown in Table 5 for the applicable assembly styles (see Figure 1). Classes 5000 and 8000 beam seal fittings, furnished under this specification will have two distinct types of sealing attachment designs: (1) "non-hybrid" - separable beam seal (100% threaded interfaces) and (2) "hybrid" - beam seal threaded interfaces to permanent tube attachment designs (i.e., swage or weld/braze). This specification (AS85720) in addition to AS4510/2 qualifies these types of fitting design attachments.

4.3.1 Non-Hybrid - Separable Beam Seal

The qualification inspection shall consist of the inspection methods conducted in the order shown in Table 4 for the applicable separable fitting styles (see Figure 1, Styles A, B and C assemblies).

4.3.2 Hybrid - Beam Seal Threaded Interfaces to Permanent Tube Attachment

Figure 1, assembly styles A, B and C illustrates permanent tube attachment designs (swage or braze/weld types). The permanent tube attachment and separable beam seal designs, on the same fittings, have additional qualification inspection requirements contained in AS4510/2 (for welded fitting-to-tube connections). AS85720 requirements apply to all swage type connections as well as braze types.

4.3.2.1 Qualification of hybrid swaged (internal and external swaged) tube attachment and separable beam seal fitting designs shall meet or exceed the qualification inspection requirements of AS85720.

4.3.2.2 Qualification of hybrid braze/weld tube attachment and separable beam seal fitting designs shall meet or exceed the qualification inspection requirements of both AS85720 and AS4510/2 (see Tables 4 and 5). Where any conflict exists, AS85720 is the controlling document.

4.3.3 Test Samples for the Qualifying Activity

The contractor shall submit to the qualifying activity, if so asked, nineteen untested sample fitting assemblies for each size and tubing type in accordance with Table 4 (see 6.2). Threaded fittings designed for permanent attachment to adjacent tubing shall be assembled in accordance with the joint design feature (swage, braze or weld). The inspection shall be in accordance with 4.6.1.

TABLE 4 - FITTING ASSEMBLIES

Assembly Numbers	* 1-4	5-6	7-14	15-16	17-19
Assembly Style (See Figure 1)	C	A	A	A	B
Length (See Figure 1)	9 inches	9 inches	Per ARP1185	9 inches	6 inches
Qualification Test (Perform in Sequence)	4.6.1 4.6.2 4.6.7 4.6.5 4.6.3	4.6.1 4.6.9 4.6.2 4.6.4	4.6.1 4.6.2 4.6.6	4.6.1 4.6.2 4.6.10	4.6.1 4.6.2 4.6.8
* Two samples with 90 degree elbows and two samples with bulkhead tees. See also the wired-on nut requirement of 4.6.7.					

TABLE 5 - QUALIFICATION INSPECTION REQUIREMENTS

Fitting Type	Class 5000	Class 8000
Hybrid (Swage and Separable)	AS85720	AS85720
Hybrid (Weld and Separable)	AS85720 and AS4510/2	AS85720 and AS4510/2
Hybrid (Braze and Separable)	AS85720	AS85720
Non-Hybrid (Separable only)	AS85720	AS85720

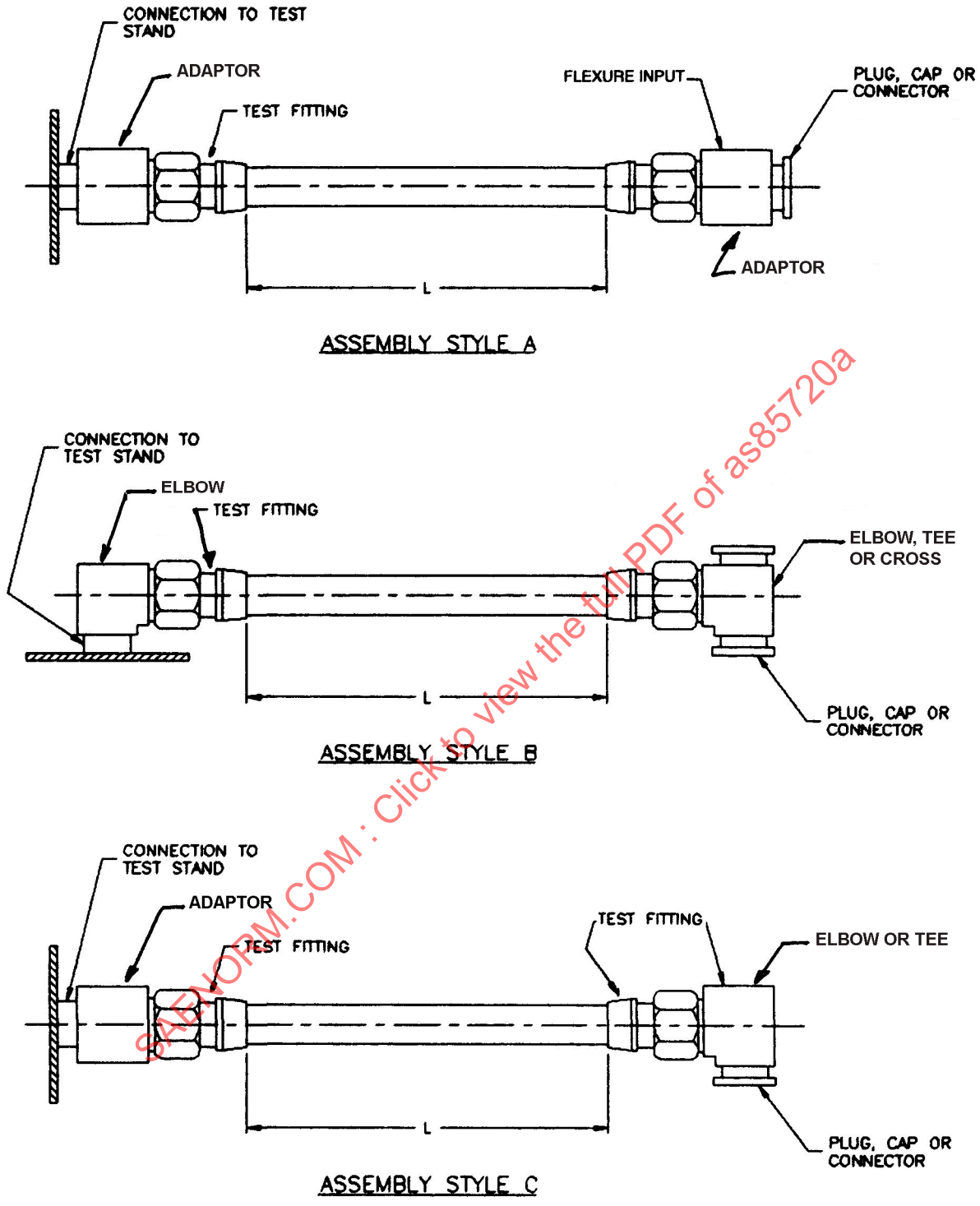

FIGURE 1 - FITTING ASSEMBLY STYLES FOR TESTING

4.3.4 Retention of Qualification

The retention of qualification shall consist of certification by the manufacturer to demonstrate compliance of the qualified fittings with the requirements of this specification. Certification shall be signed by a responsible official of management, attesting that the listed product(s) is still available from the listed plant, can be produced under the same conditions as originally qualified, i.e., same process, materials, construction, design, manufacturer's part number or designations, and meets the requirements of the current issue of the specification. Certification shall be conducted at intervals not exceeding two years. The activity responsible for certification approval is the qualifying activity, PRI (see 6.5).

4.4 Quality Conformance Inspection

The following tests shall be conducted from each lot of fittings submitted for inspection. The test sequence shall be in accordance with Table 6 (see 6.2).

a. Non-destructive test (see 4.4.2)

b. Destructive test (see 4.4.3)

TABLE 6 - QUALITY CONFORMANCE TEST

Test	Design Requirement Paragraph	Inspection Method Paragraph
Non-destructive test Examination of product	3.3.1	4.4.2
Destructive test (perform in sequence) (1) Proof pressure (2) Pneumatic leakage	 3.4.1 3.4.8	 4.6.2 4.6.9

4.4.1 Inspection Sampling

Unless otherwise specified in the contract or purchase order, sample fittings from each lot shall be selected at random in accordance with MIL-STD-1916. For non-destructive test the sample inspection shall be level II at an Acceptable Quality Level (AQL), as specified in the contract. For destructive test, the sampling inspection shall be level S-1 at an AQL of 0% defects. The sample fittings selected for the destructive test shall be those used for the non-destructive test. Destructive testing is not routinely performed and shall only be performed when specified by the customer.

4.4.2 Non-destructive Test

The non-destructive test shall be conducted in accordance with the examinations of 4.6.1 and 4.4.2.1.

4.4.2.1 Preparation for Delivery

All end fittings, connectors, and fitting assemblies shall be visually examined to ascertain that their preparation for delivery shall be in accordance with Section 5 of this specification.

4.4.3 Destructive Tests

The following destructive tests, when required (see 4.4.1) shall be conducted in sequence in the order specified:

a. Proof Pressure Test 4.6.2.

b. Pneumatic Test 4.6.9.

After the destructive testing, the test samples shall not be shipped or considered part of the contract or order.

4.4.4 Failure of Sampling Test

When fittings fail to pass a sampling test, the entire lot (see 2.3) represented by the sample shall be rejected. The reason for the failures shall be reported (see 6.3).

4.5 Test Conditions

4.5.1 Test Fluids

The test fluids used shall be MIL-PRF-83282 or MIL-PRF-5606.

4.5.2 Test Temperature

All tests except the burst pressure test, the thermal shock test, the impulse test, the flexure test and the fire test shall be conducted at an ambient temperature of 60 to 100 °F and a fluid temperature of 60 to 170 °F.

4.6 Inspection Methods

4.6.1 Examination of Product

All fittings and fitting assemblies from each lot shall be examined to determine conformance with this specification and the applicable standards with respect to material, design, dimensions, finish, marking, and workmanship.

4.6.1.1 Material Inspection

Fitting and tubing material shall meet the requirements of 3.2. The chemical analysis, mechanical properties, and heat treatment shall be in accordance with the material specifications shown in Table 1.

4.6.2 Proof Pressure Test

Fitting assemblies shall be connected to a pressure source with one end free to move and proof pressure tested at a pressure value equal to two times the nominal operating pressure for a minimum period of 5 minutes. Use minimum torque values for both ends. Rate of pressure rise shall be 20 000 psi ± 5000 psi per minute. The exterior of the test fitting assembly including the fitting tube joint shall be clean and dry and show no evidence of test fluid prior to testing. At the end of the test, wipe the exterior of fitting assembly with a clean, dry towel and examine for evidence of leakage. Any evidence of fluid on a clean dry towel, after wiping the test connection, shall constitute failure of the test.

4.6.3 Burst Pressure Test

Fitting assemblies shall be connected to a pressure source and burst pressure tested at a pressure value equal to four times the nominal operating pressure for Class 5000 and three times the nominal operating pressure for Class 8000. Use minimum torque values for both ends. The pressure shall be increased at a rate of 20 000 psi ± 5000 psi per minute until the assembly bursts, leaks or the required burst pressure is obtained. Test samples 1 and 2 shall be tested at the ambient temperature (see 4.5.2), and test samples 3 and 4 shall be tested at the maximum rated temperature of 275 °F ± 10 °F (class II) or 450 °F ± 15 °F (class III). No more than one drop of fluid at the joint (either the beam seal end or tube attachment end) is permissible.

4.6.4 Thermal Shock Test

Use MIL-PRF-5606 or MIL-PRF-83282 hydraulic fluid for this test. The fitting assembly shall be mounted in a high temperature test set up with one end free to move. A typical test set up is shown in Figure 2. After the test fitting is filled with hydraulic fluid, the ambient temperature of the test chamber shall be reduced to -65 °F ± 2 °F for a minimum of 2 hours. At the end of this period, while the test chamber is still at -65 °F, test fluid at 275 °F ± 5 °F (type II), or 450 °F, for type III, shall be suddenly introduced into the test assembly at a minimum pressure of 50 psi. Within 15 seconds after the hot fluid has filled the fitting assembly, the pressure shall be raised to the proof pressure value.

Any leakage from the test fitting, fitting blow-off, burst or other evidence of malfunction shall constitute failure.

4.6.5 Impulse Test

Test fitting assemblies shall be tested in accordance with AS603 with the following deviations or additions. Fittings for return line sizes as designated in Table 2 shall not be impulse tested.

a. Duration of test: 200 000 cycles minimum.

b. Temperature:

Maximum rated for 80 000 cycles; then

Minimum rated (-65 °F) for 40 000 cycles; then

Maximum rated for 80 000 cycles

NOTE: Test assembly to be stabilized at each temperature before beginning that portion of test.

c. Rate of rise: 75 000 to 650 000 psi/second.

d. Cycling rate: 70 cycles per minute ± 5 cycles per minute.

e. Wave form: Per AS603.

f. Surge peaks: 130 to 140% of nominal operating pressure for Class 8000, and 140 to 157% of nominal operating pressure for Class 5000.

g. Assembly torque: Minimum torque value per Table 3A or 3B.

4.6.6 Flexure Test

Fitting assemblies shall be tested in accordance with the flexure test procedure of ARP1185 except as noted herein. For -03 size, the test assembly shall be 5 inches in length, test samples shall be assembled using maximum torque values per Table 3. Fitting assemblies shall be tested to bending stresses indicated in Table 2 at max rated temperature with static internal pressure equal to nominal operating pressure maintained. The bending stress shall be calculated from strain values measured with suitable strain gages on each assembly while at room temperature.

Testing to the bending stress values shown in Table 2, provides for S-N data points on a characteristic curve passing thru the endurance stress value for each size, material and pressure rating of the fittings being qualified.

In the event that historical data is being used to show conformance to this revision of specification AS85720, S/N type data may be plotted against the curves defined by the applicable Table 2 values. If the historical data plots above the curve, then this would confirm the acceptability of the historical test. If only endurance type testing was run, i.e., six (6) specimens all run at the listed “endurance bending stress” and all run for 10 million cycles without failure, this would also confirm the acceptability of the historical test.