



AEROSPACE STANDARD	AS85720™	REV. C
	Issued 1998-07 Reaffirmed 2004-04 Revised 2022-09 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.

SAE Executive Standards Committee Rules provide that: "This report is published by SAE to advance the state of technical and engineering sciences. The use of this report is entirely voluntary, and its applicability and suitability for any particular use, including any patent infringement arising therefrom, is the sole responsibility of the user."

SAE reviews each technical report at least every five years at which time it may be revised, reaffirmed, stabilized, or cancelled. SAE invites your written comments and suggestions.

Copyright © 2022 SAE International

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of SAE.

TO PLACE A DOCUMENT ORDER: Tel: 877-606-7323 (inside USA and Canada)
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
http://www.sae.org

SAE WEB ADDRESS:

For more information on this standard, visit
<https://www.sae.org/standards/content/AS85720C/>

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” oversized 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” oversized 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

Table 2B - 5000 psi titanium 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	20000	31000	28000	23260
-04	0.022	20000	31000	28000	23260
-05	0.027	20000	31000	31000	31000
-06	0.032	19000	29540	26630	22090
-07	0.038	18500	29000	25950	21500
-08	0.043	18000	28000	25220	20940
-09	0.048	17500	27400	24500	20300
-10	0.054	17000	26470	23800	19780
-11	0.061	16500	25600	23100	19200
-12	0.065	16000	24950	22400	18600
-14	0.077	15000	23400	20980	17400
-16	0.088	14500	22500	20300	16800
-20	0.046*	14000	21800	19600	16200

Table 2C - 8000 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	0.023	24000	37460	33630	27550
-05	0.029	24000	37460	33630	27550
-06	0.034	22000	34720	31270	25550
-07	0.040	21000	32700	29600	24400
-08	0.046	20000	31000	28000	23260
-09	0.051	19000	29540	26630	22090
-10	0.057	18000	28000	25220	20940
-11	0.062	17000	26470	23800	19780

Table 2D - 8000 psi titanium 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	20000	31000	28000	23260
-04	0.026	20000	31000	28000	23260
-05	0.032	20000	31000	28000	23260
-06	0.038	19000	29540	26630	22090
-07	0.045	18500	29000	25950	21500
-08	0.051	18000	28000	25220	20940
-09	0.058	17500	27400	24500	20300
-10	0.064	17000	26470	23800	19780
-11	0.070	16500	25600	23100	19200

NOTES:

1. Tubing specifications shall be 21-6-9 CRES per AMS5561 and 3Al-2.5V Titanium alloy per AMS4945, AMS4946, or AS5620 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

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	183	290	470	650	830	918	1370	1512
Maximum Torque	lbf-in	108	180	200	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	183	290	312	470	480	650	654
Maximum Torque	lbf-in	108	180	200	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 200000 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

When tested in accordance with 4.6.6 the test sample shall not leak from the sealing surface or tube interface prior to achieving the minimum required number of cycles for the bending stresses specified in Table 2. 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:

- Leakage at any of the pressure tests of 4.6.7.
- Inability to assemble the fitting to the point of interface by hand.
- Nut deformation preventing engagement of nut hex with open end wrench.
- 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 10X 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/h 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 part standard. 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. Unmachined 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 7 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 7 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

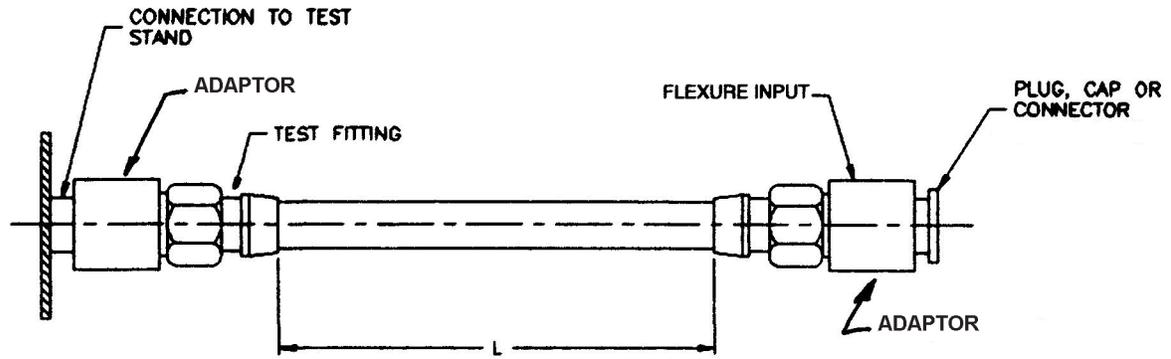
Assembly Numbers	* 1-4	5-6	7-14	15-16	17-19
Assembly Style (see Figure 1)	C	A	A	A	B
Length (see Figure 1)	9 inches	9 inches	Per ARP1185	9 inches	6 inches
Qualification Test (Perform in Sequence)	4.6.1	4.6.1	4.6.1	4.6.1	4.6.1
	4.6.2	4.6.9	4.6.2	4.6.2	4.6.2
	4.6.7	4.6.2	4.6.6	4.6.10	4.6.8
	4.6.5	4.6.4			
	4.6.3				
Periodic Control Test (Perform in Sequence) (see 4.4.3)	4.6.7 4.6.2 (tube assembly or fitting samples only may be tested)				

* For QPL Qualification, two samples with 90 degree elbows and two samples with bulkhead tees. See also the wired-on nut requirement of 4.6.7.

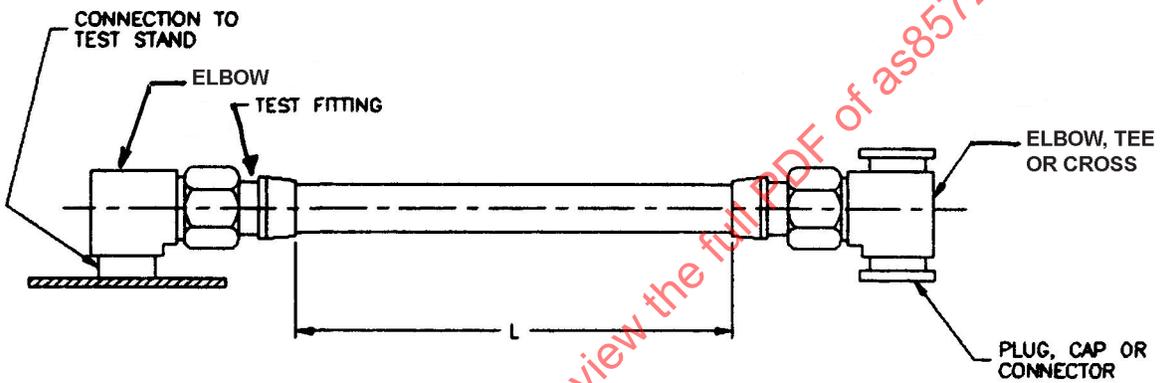
For periodic control tests, sample size requirements are per 4.4.3.

Table 5 - Qualification inspection requirements

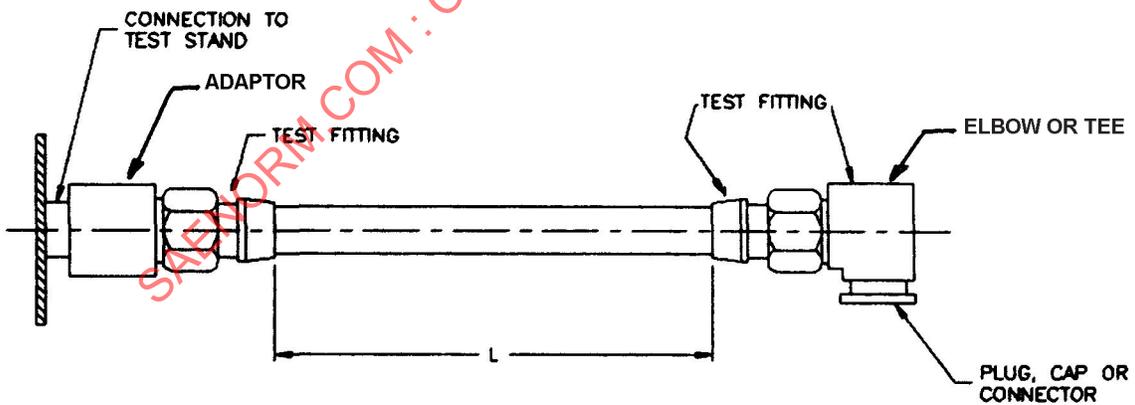
Fitting Type	Class 5000	Class 8000
Hybrid (Swage and Separable)	AS85720	AS85720
Hybrid (Weld and Separable)	AS85720 and AS4510/2	AS85720 and AS4510/2
Hybrid (Braze and Separable)	AS85720	AS85720
Non-Hybrid (Separable only)	AS85720	AS85720



ASSEMBLY STYLE A



ASSEMBLY STYLE B



ASSEMBLY STYLE C

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 2 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).

Table 6 - Quality conformance test

Test	Design Requirement Paragraph	Inspection Method Paragraph
Non-destructive test Examination of product	3.3.1	4.4.2

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.

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 Periodic Control Tests

Periodic control tests (see Table 4) shall be conducted every 12 months to maintain PRI-QPL-AS85720 listings. The purpose of the periodic control test is to ensure manufacturing processes are maintained at the level as when parts were qualified. Each material in the manufacturer's QPL listing shall be tested. Three samples (any tube assembly style or fitting assembly style) each of two sizes shall be tested; one size selected from the range of sizes 03 to 10, and one size selected from the range of sizes 12 to 20. This test is required regardless of production quantities, including if no fittings in a particular material of size range were manufactured in the prior year. Periodic testing may be conducted at the manufacturer's facility. Manufacturer accreditation to ISO 17025 or PRI witnessing is not required (for periodic testing). The following tests shall be conducted on each sample in the order specified. The same test samples may be used for all tests:

- a. Repeated Connection per 4.6.7 except test may be modified as follows:

The pneumatic test is required only after the first torque tightening operation and the final (25th) tightening operation. The test samples shall be assembled at either minimum or maximum torque and after every fifth tightening operation, the torque shall be switched from minimum to maximum and vice versa until the twenty fifth (25th) tightening operation is achieved.

b. Proof Pressure Test per 4.6.2.

Test results shall be submitted to PRI for review. Failure to submit periodic control test data to PRI when requested will result in the manufacturer's QPL listing to be removed pending receipt and approval of the test data. If data is not received within 6 months of the requested date additional testing may be required, including possible requalification. Test reporting shall be done using the AS85720 periodic control test summary format shown in Appendix A. First periodic test data submission shall be due 12 months after initial listing onto corresponding AS85720 QPLs.

4.4.4 Failure of Sampling Test or Periodic tests

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 20000 psi \pm 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 20000 psi \pm 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 \pm 10 °F (Class II) or 450 °F \pm 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 $-65\text{ }^{\circ}\text{F} \pm 2\text{ }^{\circ}\text{F}$ for a minimum of 2 hours. At the end of this period, while the test chamber is still at $-65\text{ }^{\circ}\text{F}$, test fluid at $275\text{ }^{\circ}\text{F} \pm 5\text{ }^{\circ}\text{F}$ (Type II), or $450\text{ }^{\circ}\text{F}$, 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: 200000 cycles minimum.
- b. Temperature:
Maximum rated for 80000 cycles; then
Minimum rated ($-65\text{ }^{\circ}\text{F}$) for 40000 cycles; then
Maximum rated for 80000 cycles
NOTE: Test assembly to be stabilized at each temperature before beginning that portion of test.
- c. Rate of rise: 75000 to 650000 psi/s.
- d. Cycling rate: 70 cycles per minute \pm 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 maximum 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 through 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 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.

4.6.6.1 Combined Stress

The fitting assemblies shall be tested while pressurized with fluid at the nominal operating pressure. The combined stress is defined as the sum of the bending stress, plus the axial stress caused by the internal pressure. The fluid stress is calculated by Equation 1:

$$S = P \left(\frac{d^2}{D^2 - d^2} \right) \quad (\text{Eq. 1})$$

where:

S = axial tensile stress due to internal pressure

P = internal fluid pressure (nominal operating pressure)

d = tube inside diameter

D = tube outside diameter

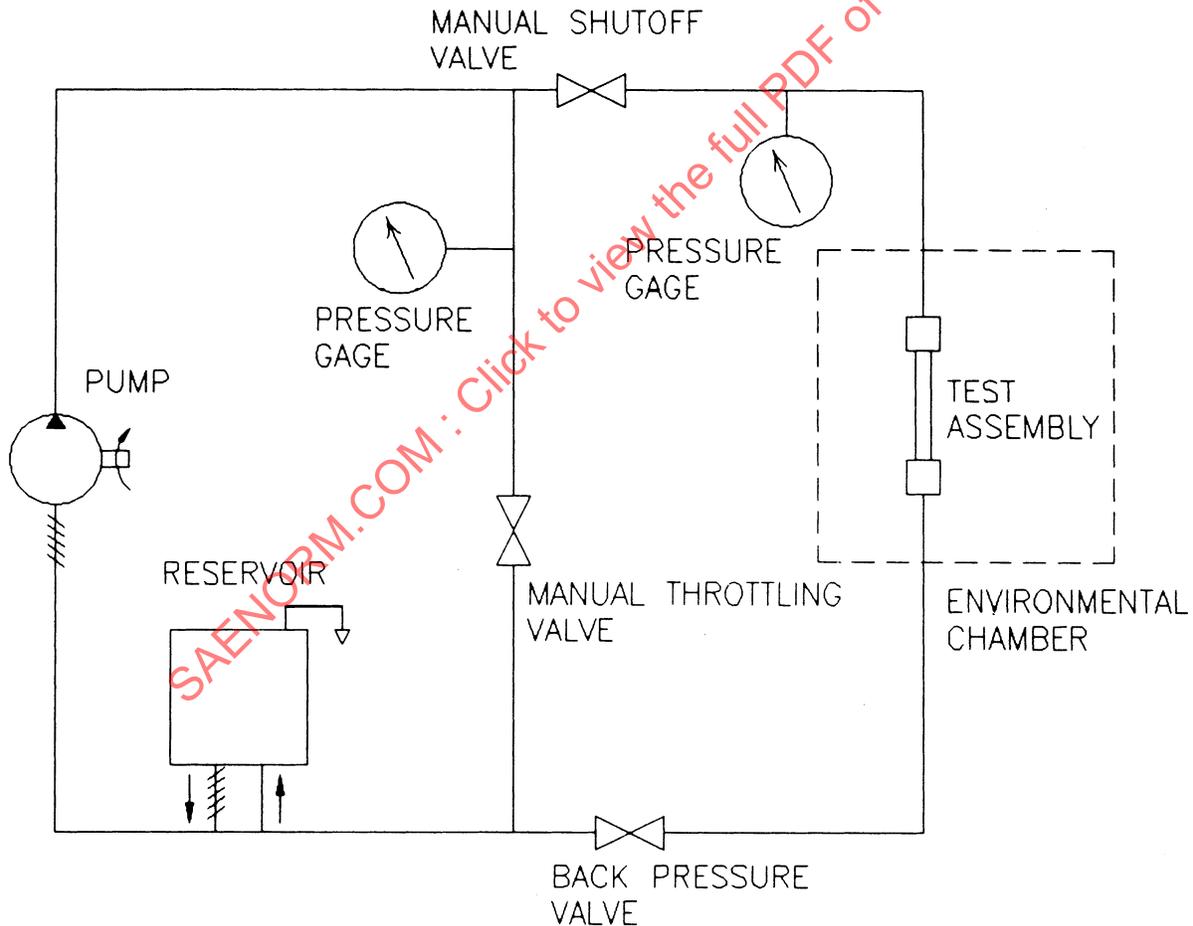


Figure 2 - Typical setup for thermal shock testing