SAE Aerospace
An SAE International Group

AEROSPACE STANDARD

SAE AS1975 | REV. E

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Superseding AS1975D

(R) Hose Assembly, Polytetrafluoroethylene, Para-Aramid Reinforced, 3000/4000 psi, 275 °F, Standard Duty, Hydraulic, Aircraft Systems

RATIONALE

Clarify Class 3000, Class 4000 and concurrent Class 3000/4000 Qualification, Sample and Periodic test requirements.

1. SCOPE

This SAE Aerospace Standard (AS) defines the requirements for a polytetrafluoroethylene (PTFE) lined, para-aramid fiber reinforced, hose assembly suitable for use up to 4000 psi, and up to 275 °F, aircraft and missile hydraulic and pneumatic systems.

1.1 Product Classification

CLASS 3000 - For use in pressure systems of 3000 psig, or lower, at the reduced bend radius per Table 2.

CLASS 4000 - For use in pressure systems of 4000 psig, or lower, at the bend radius per Table 1.

1.2 Field of Application

1.2.1 For use with phosphate ester or silicate ester hydraulic fluids. The oil immersion samples in 3.5.2.7 shall be preconditioned per 4.5.2.2 using both types of system fluids as specified. Due precaution must be taken in handling any toxic hydraulic fluid.

1.2.2 This is not recommended for gaseous service where minor effusion is detrimental.

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 obtained.

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http://www.sae.org/technical/standards/AS1975E

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.

AS150	Hose Assembly, Type Classifications of, Basic Performance and Fire Resistance
AS603	Impulse Testing of Hydraulic Hose, Tubing, and Fittings Assemblies
AS611	Hose Assembly and Tubing, Polytetrafluoroethylene, Cleaning Methods for
ARP908	Torque Requirements, Installation and Qualification Test, Hose and Tube Fitting
AS1055	Fire Testing of Flexible Hose, Tube Assemblies, Coils, Fittings, and Similar System Components
AS1072	Sleeve, Hose Assembly, Fire Protection
AIR1228	Standard Impulse Machine Equipment and Operation
AS1241	Fire Resistant Phosphate Ester Hydraulic Fluid for Aircraft
AIR1703	In-Flight Thrust Determination
ARP1835	Preparation for Delivery, General Requirements for Hose Assemblies
AS2078	Test Methods, Hose Assemblies, Polytetrafluoroethylene (PTFE)
AS4375	Fitting End, Flareless, Design Standard
AS4395	Fitting End, Flared, Tube Connection, Design Standard
AS4488	Tubular Assemblies, Fusion Welded, Inspection Processes and Acceptance Standards For
AS4658	Fitting End, External Thread, Short Flareless, Design Standard
AS4659	Fitting End, Bulkhead, External Thread, Short Flareless, Design Standard
AS4660	Nut, Short Flareless
AS4700	Short Flareless Fittings, Installation Procedures and Torque For
AS4702	Nut, Retained, Short Flareless
AS4703	Fitting End, Acorn, Short Flareless, Design Standard
AS5272	Lubricant, Solid Film, Heat Cured, Corrosion Inhibiting, Procurement Specification
AS7003	Nadcap Program Requirements
AS7112	National Aerospace and Defense Contractors Accreditation Program Requirements for Fluid System Components
AS8879	Screw Threads - UNJ Profile, Inch Controlled Radius Root with Increased Minor Diameter
AS21900	Adapter, Flareless Tube to a Flared Tube

AS33514	Fitting End, Standard Dimensions for Flareless Tube Connection and Gasket Seal
AS85421	Fittings, Tube, Fluid Systems, Separable, Beam Seal, 3000/4000 psi, General Specification For
AS85421/1	Fitting End, Standard Dimensions for Dynamic Beam Seal, Male
AMS2486	Conversion Coating of Titanium Alloys Flouride-Phosphate Type
AMS2700	Passivation of Corrosion Resistant Steels
AMS4921	Titanium Bars, Wire, Forgings, and Rings, Commercially Pure, 70 ksi (483 MPa) Yield Strength
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
AMS4965	Titanium Alloy, Bars, Wire, Forgings, and Rings, 6.0Al - 4.0V, Solution Heat Treated and Aged
AMS5536	Nickel Alloy, Corrosion and Heat-Resistant, Sheet, Strip, and Plate, 47.5Ni - 22Cr - 1.5Co - 9.0Mo - 0.60W - 18.5Fe, Solution Heat Treated
AMS5556	Steel, Corrosion and Heat-Resistant, Seamless or Welded Hydraulic Tubing, 18Cr - 11Ni - 0.70Cb (SAE 30347), Solution Heat Treated
AMS5557	Steel, Corrosion and Heat-Resistant, Seamless or Welded Hydraulic Tubing, 18.5Cr - 10.5Ni - 0.40Ti (SAE 30321), Solution Heat Treated
AMS5561	Steel, Corrosion and Heat-Resistant, Welded and Drawn or Seamless and Drawn Tubing, 9.0Mn - 20Cr - 6.5Ni - 0.28N, High-Pressure Hydraulic
AMS5567	Steel, Corrosion Resistant, Seamless or Welded Hydraulic Tubing, 19Cr - 10Ni (SAE 30304), Solution Heat Treated
AMS5570	Steel, Corrosion and Heat-Resistant, Seamless Tubing, 18Cr - 11Ni - 0.40Ti (SAE 30321), Solution Heat Treated
AMS5571	Steel, Corrosion and Heat-Resistant, Seamless Tubing, 18Cr - 10.5Ni - 0.70Cb (Nb) (347), Solution Heat Treated
AMS5575	Steel, Corrosion and Heat-Resistant, Welded Tubing, 18Cr - 10.5Ni - 0.70Cb(Nb) (SAE 30347), Solution Heat Treated
AMS5576	Steel, Corrosion and Heat-Resistant, Welded Tubing, 18Cr - 10.5Ni - 0.40Ti (SAE 30321), Solution Heat Treated
AMS5636	Steel, Corrosion-Resistant, Bars and Wire, 18Cr - 9.0Ni (SAE 30302), Solution Heat Treated and Cold Drawn, 100 ksi (689 MPa) Tensile Strength
AMS5637	Steel, Corrosion Resistant, Bars and Wire, 18Cr - 9.0Ni (SAE 30302), Solution Heat Treated, Cold Drawn and Stress Relieved, 125 ksi (862 MPa) Tensile Strength
AMS5639	Steel, Corrosion-Resistant, Bars, Wire, Forgings, Tubing, and Rings, 19Cr - 10Ni, Solution Heat Treated
AMS5643	Steel, Corrosion-Resistant, Bars, Wire, Forgings, Tubing, and Rings, 16Cr - 4.0Ni - 0.30Cb - 4.0Cu, Solution Heat Treated, Precipitation Hardenable

AMS5644 Steel Bars and Forgings, Corrosion Heat Resistant, 17Cr - 7Ni - 1Al

AMS5645 Steel, Corrosion and Heat Resistant, Bars, Wire, Forgings, Tubing, and Rings, 18Cr - 10Ni - 0.40Ti (321), Solution Heat Treated

AMS5646 Steel, Corrosion and Heat-Resistant, Bars, Wire, Forgings, Tubing, and Rings, 18Cr - 11Ni - 0.60Cb(Nb) (347), Solution Heat Treated

AMS5647 Steel, Corrosion-Resistant, Bars, Wire, Forgings, Tubing, and Rings, 19Cr - 9.5Ni, Solution Heat Treated

AMS5659 Steel, Corrosion-Resistant, Bars, Wire, Forgings, Rings, and Extrusions, 15Cr - 4.5Ni - 0.30Cb (Nb) - 3.5Cu, Consumable Remelted, Solution Heat Treated, Precipitation Hardenable

AMS5743 Steel, Corrosion and Heat-Resistant, Bars and Forgings, 15.5Cr - 4.5Ni - 2.9Mo - 0.10N, Solution Heat Treated, Sub-Zero Cooled, Equalized, and Over-Tempered

AMS-QQ-S-763 Steel, Corrosion Resistant, Bars, Wire, Shapes, and Forgings

AMS-STD-2219 Fusion Welding for Aerospace Applications

2.1.2 ASTM Publications

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

ASTM A262 Standard Recommended Practices for Detecting Susceptibility to Intergranular Attack in Stainless Steel

ASTM B348 Titanium Alloy

ASTM D638 Precipitation Hardening Iron Base Superalloy Bars, Forgings, and Forging Stock for High Temperature Service, Standard Specification for

2.1.3 NAS Standards

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

NAS 847 Caps and Plugs, Protective, Dust and Moisture Seal

NAS 1760 Fitting End, Flareless Acorn, Standard Dimensions for

2.1.4 U.S. Government Publications

Available from DLA Document Services, Building 4/D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, Tel: 215-697-6396, http://quicksearch.dla.mil/.

MIL-PRF-680 Degreasing Solvent

TT-I-735 Isopropyl Alcohol

MIL-F-8815 Filter and Filter Elements, Fluid Pressure, Hydraulic Lines, 15 Micron Absolute and 5 Micron Absolute, Type II Systems

MIL-PRF-83282 Hydraulic Fluid, Fire Resistant Synthetic Hydrocarbon Base, Metric, NATO Code Number H-537

MIL-PRF-87257 Hydraulic Fluid, Fire Resistant; Low Temperature, Synthetic Hydrocarbon Base, Aircraft and Missile

MIL-STD-129 Military Marking for Shipment and Storage

MIL-STD-130 Identification Marking of U.S. Military Property

MIL-HDBK-831 Test Reports, Preparation of

MIL-STD-1839 Calibration and Measurement Requirements

MIL-STD-1916 DoD Preferred Methods for Acceptance of Products

2.1.5 ASME Publications

Available from American Society of Mechanical Engineers, 22 Law Drive, Box 2900, Fairfield, NJ 07007-2900, Tel: 973-882-1170, www.asme.org.

ASME B46.1 Surface Texture

ASME Y14-100 Engineering Drawing Practices

ASME Y14.5M 1982 Dimensioning and Tolerancing

2.1.6 AWS Publications

Available from American Welding Society, 550 NW LeJoune Rd, Miami, FL 33126, Tel: 1-800-443-9353, www.aws.org.

AWS D17.1 Specification for Fusion Welding for Aerospace Applications – Incorporating Errata 07/2001

2.1.7 PRI Publications

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

PD2001 Qualified Product Management Council Procedures for Qualified Products Group

PD2101 Aerospace Quality Assurance, Product Standard, Qualification procedures, fluid Systems

2.2 Hose Assembly Procurement Specifications

Refer to AS1975SUP1 for a listing of applicable hose assembly procurement standards applicable to this document.

3. TECHNICAL REQUIREMENTS

3.1 Qualification

Hose assemblies supplied in accordance with this document shall be representative of products which have been subjected to and which have successfully passed the qualification tests specified in this standard.

3.1.1 Manufacturer Qualification

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

3.1.2 Product Qualification

All hose assemblies shall conform to the requirements of this procurement specification and shall be approved in accordance with the requirements of PD2001 and PD2101 for listing in a Performance Review Institute (PRI) Qualified Parts List (QPL).

3.2 Materials

The hose assembly materials shall be uniform in quality, free from defects, consistent with good manufacturing practice, shall conform to applicable specifications and the requirements specified herein, and suitable for the purpose intended.

3.2.1 Metals

Metals used in the hose and fittings shall be corrosion-resistant and shall conform to the following specifications:

a. Bars and Forgings:

1.	AMS-QQ-S-763	Class 302 - Cond. A or Cond. B (AMS5636 or AMS5637)
2.	AMS-QQ-S-763	Class 304 - Cond. A or Cond. B (AMS5639)
3.	AMS-QQ-S-763	Class 304L - Cond. A (AMS5647)
4.	AMS-QQ-S-763	Class 321 - Cond. A (AMS5645)
5.	AMS-QQ-S-763	Class 347 - Cond. A (AMS5646)
6.	AMS5643	17-4PH
7.	AMS5644	17-7PH
8.	AMS5659	15-5PH
9.	AMS5743	AM-355
10.	AMS4921	Titanium Alloy - Commercially pure
11.	AMS4928	Titanium 6Al-4V Annealed
12.	AMS4965	Titanium 6Al-4V Heat Treated
13.	ASTM B348	Titanium Alloy - Grade 2

b. Tubing:

1.	AMS5556	Type 1 or Type 2 Stainless Steel Tubing, 347
2.	AMS5557	Type 1 or Type 2 Stainless Steel Tubing, 321
3.	AMS5561	Welded Stainless Steel Tubing, 21-6-9
4.	AMS5567	Type 1 or Type 2 Stainless Steel Tubing, 304
5.	AMS5570	Seamless Stainless Steel Tubing, 321

6. AMS5571 Seamless Stainless Steel Tubing, 347

7. AMS5575 Welded Stainless Steel Tubing, 347

8. AMS5576 Welded Stainless Steel Tubing, 321

9. AMS4945 Titanium 3Al-2.5V Texture Controlled

3.2.2 Reinforcement

Para-aramid textile treated and applied to the hose with an outer polyester braid, polybenzimidazol/para-aramid blend or air textured nylon braid cover to meet all the requirements herein.

3.3 Design and Construction

The hose assembly shall consist of a seamless polytetrafluoroethylene (PTFE) inner tube, treated para-aramid reinforcement, polyester, polybenzimidazol/para-aramid blend or air textured nylon outer braid cover with optional PTFE tape interlayer, and corrosion-resistant steel and/or titanium alloy end fittings as required to meet the construction and performance requirements of this specification.

3.3.1 Inner Tube

The inner tube shall be of a seamless construction of virgin PTFE resin of uniform gage. It shall have a smooth bore and shall be free from pitting or projections on the inner surface. Additives may be included in the compound from which the tube is extruded.

3.3.2 Reinforcement

The reinforcement shall consist of a treated para-aramid braid and/or wraps with optional PTFE tape interlayer and polyester, polybenzimidazol/para-aramid blend or air textured nylon braided outer cover. The reinforcement shall be arranged over the inner tube to provide sufficient strength and protection to ensure conformance with the requirements specified herein. Broken reinforcing cords shall be cause for rejection. The outer braid shall provide 100% coverage to protect the para-aramid reinforcement from exposure to ultraviolet light. A continuous lay line interrupted with AS1975 and the hose manufacturer's name and trademark shall be permanently marked in contrasting color along the length of the hose.

3.3.3 Fittings

All fittings shall be permanently attached and proven to meet the requirements herein. Standard hose assemblies shall have flared fittings to mate with AS4395; flareless fittings according to NAS1760 to mate with AS33514 or AS4375 (-20 size and larger configurations may be per AS4703 to mate with AS4658 or AS4659 with nuts per AS4660 or AS4702) or dynamic beam seal fittings to mate with male end per AS85421/1 or AS4207 or other suitable end connections. Antitorque hexes/flats shall be provided and shall fit standard wrench openings. All internal surfaces of fitting nuts shall be lubricated with solid film per AS5272. Dry film on external surfaces is permitted.

3.3.3.1 Straight Fittings

Straight fittings shall be of one piece construction. Welded or brazed joints must not be located in the fluid paths. Elbow fittings may be classified per 3.3.3.2 for construction.

3.3.3.2 Other Fittings

Other fittings, including elbow fittings, shall be of one piece construction to the maximum extent possible. However, those made with other than one piece construction can use welded and redrawn corrosion-resistant steel tubing or seamless titanium tubing in accordance with 3.2.1. Fitting welds shall employ a butt weld joint design and be welded per AWS D17.1 and inspection per AS4488. If welding is used to attach stainless steel components, a stabilized grade of stainless steel shall be used.

3.3.3.3 End Fitting Collars (Sockets)

All end fitting collars (sockets) crimped or swaged, and if fabricated from Type 304 stainless steel, are required to be capable of passing an embrittlement test as specified in ASTM A262 Practice E, prior to assembly to the nipple and crimp or swaging operation. Sockets fabricated from stabilized austenitic steel (304L, 321, or 347) or titanium are acceptable without being subjected to the embrittlement test. Titanium collars are per ASTM B348 - Grade 2.

3.3.3.4 Fitting Finish

3.3.3.4.1 Corrosion Resistant Steel Parts

Unless otherwise specified, corrosion resistant steel parts shall be passivated in accordance with AMS2700.

3.3.3.4.2 Titanium Alloy Parts

If fluoride conversion coating is used, it shall be per AMS2486.

TABLE 1 - PHYSICAL REQUIREMENTS OF CLASS 4000 HOSE ASSEMBLIES AND WEIGHT OF HOSE

Hose Size	(Nominal Tube Size)	Hose Weight Max[1] pound/inch	Operating Pressure Max psi	Proof Pressure Min -0/+1000 psi	Burst Pressure Room Temperature Minimum psi	Burst Pressure High Temperature Minimum psi	Bend radius at inside of bend Minimum inch 4000 psi	Volumetric Expansion Maximum cm^3/inch
04	0.250	0.006	4000	8000	16 000	12 000	1.50	0.089
06	0.375	0.008	4000	8000	16 000	12 000	2.50	0.132
08	0.500	0.012	4000	8000	16 000	12 000	5.75	0.187
10	0.625	0.020	4000	8000	16 000	12 000	6.50	0.383
12	0.750	0.025	4000	8000	16 000	12 000	7.75	0.493
16	1.000	0.040	4000	8000	16 000	12 000	12.00	1.134

[1] Hose weight shall be determined on a minimum length of 12 inches.

TABLE 2 - PHYSICAL REQUIREMENTS OF CLASS 3000 HOSE ASSEMBLIES AND WEIGHT OF HOSE

Hose Size	(Nominal Tube Size)	Hose Weight Max[1] pound/inch	Operating Pressure Max psi	Proof Pressure Min -0/+1000 psi	Burst Pressure Room Temperature Minimum psi	Burst Pressure High Temperature Minimum psi	Bend radius at inside of bend Minimum inch 3000 psi	Volumetric Expansion Maximum cm^3/inch
04	0.250	0.006	3000	8000	12 000	9000	1.50	0.067
06	0.375	0.008	3000	8000	12 000	9000	2.50	0.100
08	0.500	0.012	3000	8000	12 000	9000	2.88	0.140
10	0.625	0.020	3000	8000	12 000	9000	3.25	0.287
12	0.750	0.025	3000	8000	12 000	9000	4.00	0.370
16	1.000	0.040	3000	8000	12 000	9000	7.50	0.850

[1] Hose weight shall be determined on a minimum length of 12 inches.

3.4 Dimensions

The hose assembly dimensions, except for length, shall be as specified in Figure 1 and Table 3.

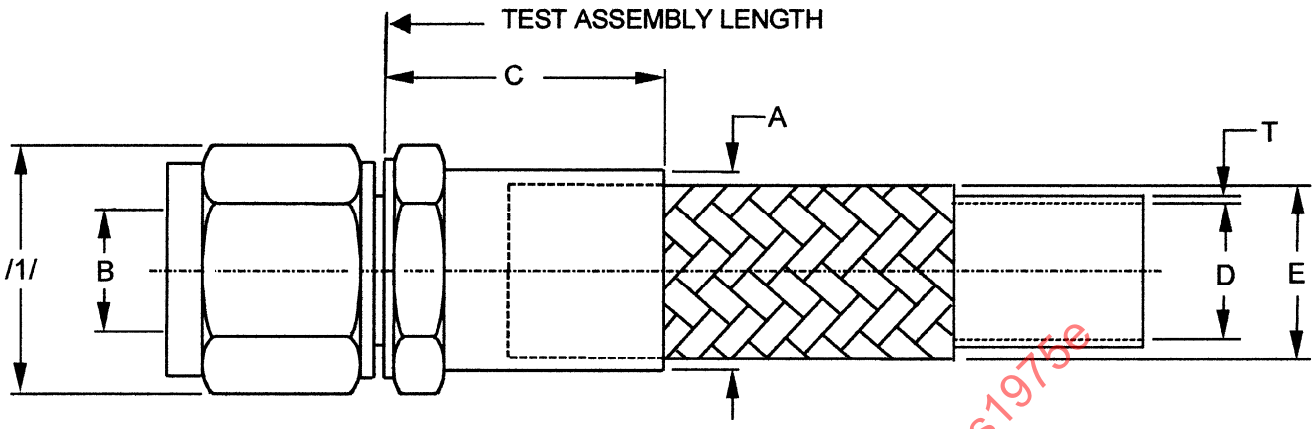

FIGURE 1 - HOSE AND FITTING DIMENSIONS

TABLE 3 - HOSE AND FITTING DIMENSIONS AS SHOWN IN FIGURE 1 (inch)

Hose Size	Rigid Tube OD (Ref)	Fitting OD A max	Fitting ID B[2] Min (Ref.)	Socket Length C max	Hose ID D Min	Hose OD E Min	Hose OD E Max	Unbraided Inner Tube Wall T Min	Spherical Ball Size for Determining min Hose Assy. ID[2] inch Straight Fittings	Spherical Ball Size for Determining min Hose Assy. ID[2] inch Elbow Fittings
04	0.250	0.690	0.135	1.25	0.212	0.405	0.465	0.035	0.122	0.115
06	0.375	0.800	0.240	1.45	0.298	0.495	0.555	0.035	0.216	0.204
08	0.500	0.970	0.340	1.78	0.391	0.650	0.710	0.040	0.306	0.289
10	0.625	1.150	0.410	2.25	0.485	0.850	0.920	0.045	0.369	0.349
12	0.750	1.380	0.510	2.50	0.602	0.995	1.075	0.045	0.459	0.434
16	1.000	1.660	0.760	3.00	0.852	1.285	1.365	0.045	0.684	0.646

/1/ Cross corners of nut and socket hex may exceed "A" dimension.
[2] Minimum specified inside diameter shall be verified by passing a spherical ball through the hose assembly.

3.4.1 Hose Weight

Hose consisting of inner tube and reinforcement as outlined in 3.3.1 and 3.3.2 shall not exceed the maximum hose weights specified in Tables 1 or 2.

3.5 Performance

The inner tube and hose assembly shall meet the following performance requirements:

3.5.1 PTFE Inner Tube

3.5.1.1 Tube Roll

The tube shall not leak, split, burst, or show any evidence of malfunction when rolled to the flattening and rounding gaps of AS2078 (3000 psi and higher) values. The test method is specified in 4.6.2.1.

3.5.1.2 Tube Proof Pressure

The tube, without reinforcement, shall not leak, burst, or show any evidence of malfunction when tested to the AS2078 (3000 psi and higher) proof pressure values. The test method is specified in 4.6.2.1.

3.5.1.3 Tensile Strength

The longitudinal tensile strength for all sizes of tubes shall be 2200 psi minimum. The transverse tensile strength for sizes -10 and larger shall be 1800 psi minimum. For sizes -08 and smaller, the transverse tensile strength need not be tested. The test method is specified in 4.6.2.2.

3.5.1.4 Elongation

Elongation shall be a minimum of 200%. The test method is specified in 4.6.2.3.

3.5.1.5 Specific Gravity

The specific gravity values of the hose inner tube shall not exceed 2.155 apparent and 2.190 relative. The test method is specified in 4.6.2.4.

3.5.2 Hose Assembly

The hose, complete with reinforcement and assembled with end fittings, shall meet the following performance requirements:

3.5.2.1 Proof Pressure

The hose assembly shall withstand the proof pressure listed in Table 1 or 2 without malfunction or leakage. The test method is specified in 4.6.3.

3.5.2.2 Elongation and Contraction

The hose assembly shall not change in length by more than ±2% in 10 inches of hose length when subjected to the maximum operating pressure in Table 1 or 2 for a minimum of 5 minutes. The test method is specified in 4.6.4.

3.5.2.3 Volumetric Expansion

The volumetric expansion of the hose assemblies shall not exceed the limits specified in Table 1 or 2. The test method is specified in 4.6.5.

3.5.2.4 Leakage

The hose assembly shall not leak (no external wetting) when subjected to two pressure cycles of 66% of minimum room temperature burst pressure. The test method is specified in 4.6.6.

3.5.2.5 Burst Pressure

3.5.2.5.1 Room Temperature Burst Pressure

The hose assembly shall not leak nor burst at any pressure below the room temperature burst value specified in Table 1 or 2. The test method is specified in 4.6.7.1.

3.5.2.5.2 High Temperature Burst Pressure

The hose assembly shall not leak nor burst at any pressure below the high temperature burst value specified in Table 1 or 2. The test method is specified in 4.6.7.2.

3.5.2.6 Thermal Shock

The hose assemblies shall not leak nor show any evidence of malfunction when subjected to the Table 1 or 2 proof and high temperature burst pressure, after being thermally shocked by rapidly increasing hose temperature from -65 to 275 °F. The test method is specified in 4.6.8.

3.5.2.7 Impulse

The hose assemblies shall be capable of withstanding 250 000 pressure impulse cycles for 3000 psi (Class 3000) or 100 000 pressure impulse cycles for 4000 psi (Class 4000) when tested in accordance with 4.6.9. Any hose or fitting leakage, hose burst, fitting blow-off, or any evidence of malfunction during the test shall constitute failure.

3.5.2.8 Assembly Flexibility

The hose assembly shall not leak nor show any evidence of failure or malfunction when subjected to the Table 1 or 2 proof pressure after 400 000 flexure cycles when tested from -65 to 275 °F . The test method is specified in 4.6.10.

3.5.2.9 Stress Degradation (Air Leakage)

The air leakage rate from the hose and two end fittings (not including "B" nuts) when held at the maximum operating pressure shown in Table 1 or 2 after completion of the stress degradation test shall not exceed 2.0 cm^3/inch/minute. The test method is specified in 4.6.11.

3.5.2.10 Pneumatic Surge

There shall be no evidence of inner tube collapse, sponging, or shedding of PTFE particles from the inner tube after 16 cycles of rapid reduction in pneumatic pressure from Table 1 or 2 maximum operating pressure to 0 psi. The test method is specified in 4.6.12.

3.5.2.11 Pneumatic Effusion

The effusion rate for any hose size shall not exceed 8.0 cm^3/feet of hose length. The test method is specified in 4.6.13.

3.5.2.12 Repetitive Assembly Torque

The flared and flareless fittings shall withstand the repetitive assembly torque values specified in ARP908, or beam seal fittings per AS85421. There shall be no leakage, galling, or other malfunction of the fitting nut and interface connection during the specified pressure test. The test method is specified in 4.6.14.

3.5.2.13 Electrical Conductivity

Hose assembly shall conduct a direct current equal to 900 µA minimum to 10 000 µA maximum with a test potential of 1000 V DC. The test method is specified in 4.6.15.

3.5.2.14 Push-Pull Test

The hose assembly shall withstand 50 000 push-pull cycles without leakage, kinking, or other failure when tested per 4.6.16.

3.6 Screw Threads

Coupling nut threads shall be in accordance with AS8879. Thread tolerance increase of 10% during assembly or testing shall not be cause for rejection of the hose assembly. For inspection purposes, all threads are categorized "other threads" per 3.1 and 6.2.7 of AS8879 unless otherwise required by the purchaser.

3.7 Length

Tolerances on hose assembly lengths shall be as follows:

a. ±0.125 inch for lengths under 18 inches

b. ±0.250 inch for lengths from 18 to 36 inches, exclusive

c. ±0.500 inch for lengths from 36 to 50 inches, exclusive

d. ±1% for lengths of 50 inches and over

3.8 Part Numbering of Interchangeable Parts

All parts having the same manufacturer's part number shall be functionally and dimensionally interchangeable. The item identification and part number requirement of MIL-STD-100 shall govern the manufacturer's part numbers and changes thereto.

3.9 Identification of Product

Equipment, assemblies, and parts shall be marked for identification in accordance with ASME Y14.100. The following special marking shall be added:

3.9.1 Fittings

The manufacturer's name or trademark shall be permanently marked on all end fittings.

3.9.2 Assembly

A permanent marking shall be applied on a fitting or on a permanent band, or bands, securely attached on the hose. If a metallic band is used on a bare hose, it shall be covered with a translucent shrink sleeve per AS1703 code “A” and extend beyond the edge of the band by approximately 0.125 inch. A permanent metallic band may be used on the collar or over a firesleeve. The band shall be no wider than 1 inch and shall not impair the flexibility or the performance of the hose. Unless otherwise specified, the marking on the fitting or band shall include the following information:

a. Assembly manufacturer's name or trademark and assembly specification AS1975

b. CAGE code and complete AS hose assembly part number

c. Operating pressure "3000 psi" or "4000 psi" as applicable

d. Operating temperature “275 °F”

e. Pressure test symbol "PT"

f. Date of hose assembly manufacture expressed in terms of month and year

g. Hose manufacturer's CAGE code number (required only when hose manufacturer is different than hose assembly manufacturer)

h. Fire resistance type per AS1055, Type and Class, or AS150 and Type (when applicable)

3.10 Workmanship

The hose assembly, including all parts, shall be constructed and finished in a thoroughly workmanlike manner. All surfaces shall be free from burrs. All sealing surfaces shall be smooth, except that annular tool marks up to 100 microinches Ra maximum per ASME B46.1 will be acceptable.

3.10.1 Dimensions and Tolerances

All pertinent dimensions and tolerances, where interchangeability, operation, or performance of the hose assembly may be affected, shall be specified on all drawings.

3.10.2 Cleaning

All hose assemblies shall be free from oil, grease, dirt or other foreign materials, both internally and externally. Unless otherwise specified, hose assemblies shall be cleaned to Class 0 of AS611, using approved alkaline cleaners only. Do not use chlorinated solvents.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to the procuring activity. The procuring activity reserves the right to perform any of the inspections set forth in the specification, where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Classification of Inspections

The examining and testing of hose assemblies shall be classified as:

a. Qualification inspections (see 4.3)

b. Quality conformance inspections (see 4.4)

4.3 Qualification Inspections

4.3.1 Qualification Test Samples

The number and length of test samples required to qualify each hose size are specified in Table 4. All specimens for each hose size are required for qualifying each of the methods of end fitting attachment and for each method of end fitting construction, bent tube or forged. Simultaneous qualification of different types of end fittings may be accomplished by having fittings of one type on one hose end and fittings of another type on the other end. If a supplier qualifies one end fitting outlet design and at a later date desires to qualify others, two hose assemblies of each size to be qualified shall be subjected to the tests specified in 4.5.1.1.

4.3.2 Qualification Test Sequence

Test sequence and procedure shall be as specified in Table 5 and, if applicable, 4.5.1.1.

4.3.3 Test Report, Test Samples and Data for the Procuring Agency

When the tests are conducted at a location other than the laboratory of the procuring activity, the following shall be furnished to that activity:

a. Test Report: The test report shall be in accordance with MIL-HDBK-831, which shall include a report of all tests and outline description of the tests and conditions.

b. Test Samples: Test samples when requested by the procuring activity. Samples subjected to qualification testing shall not be shipped as part of contract or order.

c. Drawings: Three sets of assembly and subassembly drawings. The assembly drawings shall have a cut-away section showing all details in their normal assembly position and shall define all details and subassemblies.

d. Sources: List of sources of hose or hose components, including source's name and product identification for inner tube, hose and assembly.

NOTE: Log sheets and recorded test data shall remain on file at the source test facility and are not to be sent to the qualifying activity unless specifically requested.

4.3.4 Qualification Inspection Methods

Qualification inspection methods shall consist of all the examinations and tests specified under 4.6.

TABLE 4 - LENGTH OF HOSE ASSEMBLIES FOR TEST (inch)
(REFER TO FIGURE 1)

Hose Assy Size	Six Assemblies for Impulse Test (4.6.9)		Two Assemblies for Flex Test (4.6.10)		Six Assemblies for Other Tests /3/	Two Assemblies for Push/Pull (4.6.16) /2/ Max Free Hose Length
	3000 psi	4000 psi	3000 psi	4000 psi		
04	10.5	10.5	14.0	14.0	18	13
06	14.5	14.5	18.0	18.0	18	15
08	17.0	26.0	20.5	29.5	18	18
10	20.5	30.5	24.0	34.0	18	21
12	24.0	36.0	27.5	39.45	18	24
16	38.0	52.0	41.5	55.0	18	-

NOTES:

1. The six test specimens required for the impulse test (4.6.9) shall have a straight end fitting on one end and a 90 elbow end fitting on the other end. All remaining test samples shall have straight end fittings on both ends.

/2/ Samples of each size in lengths shown shall be used for examination, push/pull test, and conductivity test (Samples No. 15 and 16, Table 5).

/3/ Two additional samples of each size are required if tests in accordance with 4.5.1.1 are conducted.

TABLE 5 - QUALIFICATION TEST SEQUENCE AND NUMBER OF TEST SPECIMENS

Test Para.	Relevant Inspection/Test	Inner Tube	Sample Hose Assemblies Test Specimen No. 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
4.6.1.1	Examination of Product[1]	X																			
4.6.2.1	Proof Pressure[1]	X																			
4.6.2.1	Tube Roll[1]	X																			
4.6.2.2	Tensile Strength[1]	X																			
4.6.2.3	Elongation[1]	X																			
4.6.2.4	Specific Gravity[1]	X																			
4.6.1.2	Examination of Product		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4.6.3	Proof Pressure		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4.6.4	Elongation and Contraction		X	X																	
4.6.5	Volumetric Expansion				X	X															
4.6.6	Leakage						X	X													
4.6.8	Thermal Shock						X	X													
4.6.9	Impulse Un-aged										X	X									
	Air-aged												X	X							
	Oil-aged														X	X					
4.6.10	Assembly Flexure		X	X																	
4.6.11	Stress Degradation								X	X											
4.6.12	Pneumatic Surge								X	X											
4.6.13	Pneumatic Effusion				X	X															
4.6.7.1	Room Temperature Burst Pressure				X																
4.6.7.2	High Temperature Burst Pressure					X															
4.6.14	Repeated Assembly		X	X																	
4.6.16	Push/Pull																X	X			
4.6.15	Electrical Conductivity																X	X			
6.1.1	Fire Resistance (when required)																		X	X	X

Key: X means one inspection/test

[1] Production lot records may be used to verify conformance to these tests if the PTFE tube or hose assembly is an established production item.
[2] When concurrently qualifying Class 4000 & Class 3000, test at Class 4000 parameters except for 4.6.9 and 4.6.10

4.4 Quality Conformance Inspections

Quality conformance inspections shall consist of the following tests:

a. Individual tests (see 4.4.1) (100% inspection)

b. Sampling tests (see 4.4.2)

c. Periodic control tests (see 4.4.3)

4.4.1 Individual Tests

Each hose assembly shall be subjected to the following tests:

a. Examination of product (see 4.6.1)

b. Proof pressure test (see 4.6.3)

NOTE: Production samples that are proof pressure tested with water should be air dried prior to capping (see cleaning requirements, 3.10.2).

4.4.2 Sampling Tests

The following inspections and tests shall be performed in the order indicated on eight hose assemblies with straight fittings at each end selected at random from each sampling lot. The sampling lot shall consist of approximately, but not more than, 3000 hose assemblies, all of one dash number size manufactured under essentially the same conditions, but not necessarily during one continuous run. One hose assembly tested from each lot of 375 hose assemblies is also permitted for protracted or small assembly run condition.

a. Internal cleanliness (AS611, Class 0)

b. Leakage tests (see 4.6.6)

c. Room temperature burst pressure test (see 4.6.7.1)

4.4.3 Periodic Control Tests

The following inspections and tests shall be performed as indicated on eight hose assemblies manufactured from bulk hose lengths selected at random from each periodic control lot. The periodic control lot shall consist of not more than 20 000 feet of hose, all of one dash number size, manufactured under essentially the same conditions, but not necessarily during one continuous run. Two hose assemblies manufactured and tested from each lot of 5000 feet of hose is also permitted. Periodic controls tests may be performed at the 4000 psi parameters using the 3000 psi bend radii and length to cover both pressure ranges.

4.4.3.1 Four hose assemblies or one hose assembly from a lot of 5000 feet in accordance with Table 4 shall be subjected to the following tests in the order indicated:

a. Elongation and contraction test (see 4.6.4)

b. Impulse test (see 4.6.9) (unaged samples only and may have straight fittings on both ends)

4.4.3.2 Four hose assemblies or one hose assembly from a lot of 5000 feet in accordance with Table 4 shall be subjected to the following tests in the order indicated:

a. Stress degradation test (see 4.6.11)

b. Electrical Conductivity test (see 4.6.15)

c. Specific gravity tests (tubing only) (see 4.6.2.4)

4.4.4 Rejection and Retest

Where one or more items selected from a lot fails to meet the specification, all items in the lot shall be rejected.

4.4.4.1 Resubmitted Lots

Once a lot (or part of a lot) has been rejected by a procuring activity (Government or industry) and before it can be resubmitted for tests, full particulars concerning the cause of previous rejection, and the action taken to correct the defects in the lot, shall be furnished, in writing, by the contractor.

4.4.5 Inspection Procedure

All inspection plans shall be single sample plans with an accept number of zero.

4.4.6 Destructive Test Sample

Prior to testing, a letter "D" shall be permanently marked on each end fitting of those assemblies used for destructive tests (see 4.4.2 and 4.4.3).

4.5 Test Conditions

4.5.1 Fitting Ends

Qualification tests shall be conducted on assemblies using straight type swivel ends, except for the impulse test samples requiring 90 elbow fitting at one end. Satisfactory completion of qualification tests on these hose assemblies shall also constitute qualification approval for hose assemblies having nonstandard fittings that have an identical attachment method and design and meet the requirements of this document.

4.5.1.1 Additional Fitting End Designs

If qualification approval is desired for other type of standard mating end fitting designs, two additional hose assemblies with the type fittings and of the size to be qualified shall be subjected to the following tests in the sequence indicated:

a. Examination of product (see 4.6.1)

b. Proof pressure test (see 4.6.3)

c. Leakage test (see 4.6.6)

d. Repetitive assembly torque test (see 4.6.14)

e. Room temperature burst pressure test (see 4.6.7.1)

4.5.2 Preparation of Sample

4.5.2.1 Unless otherwise specified, length of sample assemblies shall be in accordance with Table 4.

4.5.2.2 Oil Aging

In all tests using oil aged samples, the hose assemblies shall be fully preconditioned in MIL-PRF-83282 or AS1241 Type IV or other system fluid, as specified. Preconditioning shall be done in two phases:

a. The hose assemblies shall be filled with applicable system fluid and shall then be pressurized to operating pressure as specified in Table 1 or 2. While maintaining the pressure at room temperature, the hose assembly shall be immersed in applicable system fluid for 8 to 10 minutes then allowed to air dry for the remainder of 1 hour. This sequence of immersion and air drying shall be repeated for a total of not less than 50 times.

b. After completing item (a), the hose shall be filled with applicable system fluid (excluding all air), and the hose shall then be pressurized to operating pressure as specified in Table 1 or 2 and aged at 275 °F in air for 168 hours.

4.5.2.3 Air Aging

Air aged samples shall be kept in air at a temperature of 275 °F for 168 hours.

4.5.2.4 Unaged Samples

Unaged assemblies shall be as manufactured.

4.5.3 Test Fluids

Unless otherwise specified, the pressure test fluid shall be hydraulic fluid conforming to MIL-PRF-87257 or water. Where a high temperature test fluid is specified, the test fluid shall be MIL-PRF-83282 hydraulic fluid.

4.5.4 Pressure Measurements

Unless otherwise specified, all pressures shall have a tolerance of ±100 psi.

4.5.5 Temperature Measurements

Unless otherwise specified, temperature measurements shall be taken within 6 inches of the hose assemblies under test. Unless otherwise specified, all temperatures shall have a tolerance of +15 °F, -5 °F.

4.5.6 End Connections

Except as otherwise noted, each hose end shall be connected to a male fitting end as per 3.3.3, and utilizing the installation torque range specified in ARP908, AS85421, or AS4700, as applicable. The use of test fluid as a lubricant for flared and flareless fitting is permitted.

4.6 Inspection Methods

4.6.1 Examination of Product

4.6.1.1 Inner Tube (PTFE)

Each length of tubing shall be examined to determine conformance to this specification with respect to material, size, workmanship, and dimensions.

4.6.1.2 Hose Assembly

All hose assemblies shall be visually inspected to determine conformance to this document with respect to material, size and workmanship. Broken or missing reinforcing strands or evidence of kink or any other evidence of malfunction shall be cause for rejection. Crossed over reinforcing strands shall not be cause for rejection.

4.6.2 Inner Tube Tests

4.6.2.1 Tube Roll and Proof Pressure Test

Each length of tubing shall be subjected to a tube roll and proof pressure test in accordance with AS2078. The flattening gap, rounding gap, and proof pressure values shall be as specified for 3000 psi and higher. The test media shall be air or water.

4.6.2.2 Tensile Strength

The tube shall be subjected to the tensile strength test in accordance with AS2078.

4.6.2.3 Elongation

The tube shall be subjected to the elongation in accordance with AS2078.

4.6.2.4 Specific Gravity of the Tube

4.6.2.4.1 Apparent Specific Gravity

Apparent specific gravity shall be determined in accordance with AS2078. When test samples are prepared from braided hose, the braid impression must be removed prior to testing.

4.6.2.4.2 Relative Specific Gravity

Relative specific gravity shall be determined in accordance with AS2078.

4.6.3 Proof Pressure Test

All hose assemblies shall be pressure tested to the values specified in Table 1 or 2 in accordance with AS2078. The test fluid may be either water or hydraulic fluid conforming to MIL-PRF-87257 for test conducted at room temperature. Proof pressure test of hose assemblies having fire sleeves shall be tested before sleeving, when possible, using water as the test media. Proof pressure shall be held for a minimum of 2 minutes during which time the fire sleeve, if installed, shall be pulled back from the end fittings.

4.6.4 Elongation and Contraction Test

Two hose assemblies of each size shall be subjected to the elongation and contraction test in accordance with AS2078 when subjected to the maximum operating pressure values specified in Table 1 or 2.

4.6.5 Volumetric Expansion Test

Two hose assemblies of each size shall be subjected to the volumetric expansion test in accordance with AS2078. The volumetric expansion of the test assemblies shall be in accordance with the values shown in Table 1 for 4000 psi operating pressure and Table 2 for 3000 psi operating pressure.

4.6.6 Leakage Test

Two hose assemblies of each size shall be subjected to the leakage test in accordance with AS2078 except the pressure shall be 66% of the minimum room temperature burst pressure shown in Table 1 or 2.

4.6.7 Burst Pressure Tests

4.6.7.1 Room Temperature Burst Pressure Test

One hose assembly of each size shall be oil aged per 4.5.2.2 with MIL-PRF-83282 hydraulic fluid then subjected to a room temperature burst test in accordance with AS2078. The assembly shall be observed throughout the test and the type of failure and the pressure when failure occurred shall be recorded.

4.6.7.2 High Temperature Burst Pressure Test

One hose assembly of each size shall be oil aged per 4.5.2.2 with MIL-PRF-83282 hydraulic fluid then subjected to a high temperature burst test in accordance with AS2078 except that the maximum temperature shall be 275 °F. The assembly shall be monitored throughout the test and the type of failure and the pressure when failure occurred shall be recorded.

4.6.8 Thermal Shock Test

The thermal shock test shall be as follows:

a. Two hose assemblies of each size shall be subjected to this test. One assembly shall be air aged and one assembly shall be unaged. The assemblies shall be subjected to the proof pressure specified in Table 1 or 2 for a minimum of 5 minutes.

b. The test assemblies shall then be mounted empty in a low and high temperature test fixture (typical setup shown in Figure 2). The ambient temperature shall be reduced to -65 °F ± 2 °F for a minimum of 2 hours. At the end of this period, while maintaining this temperature, high temperature test fluid at a temperature of 275 °F shall be quickly introduced at a minimum pressure of 50 psi. Immediately after the hot fluid has filled the assembly, the pressure shall be raised to the proof pressure specified in Table 1 or 2 for a minimum of 5 minutes. Not more than 15 seconds shall elapse between the introduction of the high temperature fluid at 50 psi and the raising of the pressure to proof pressure.

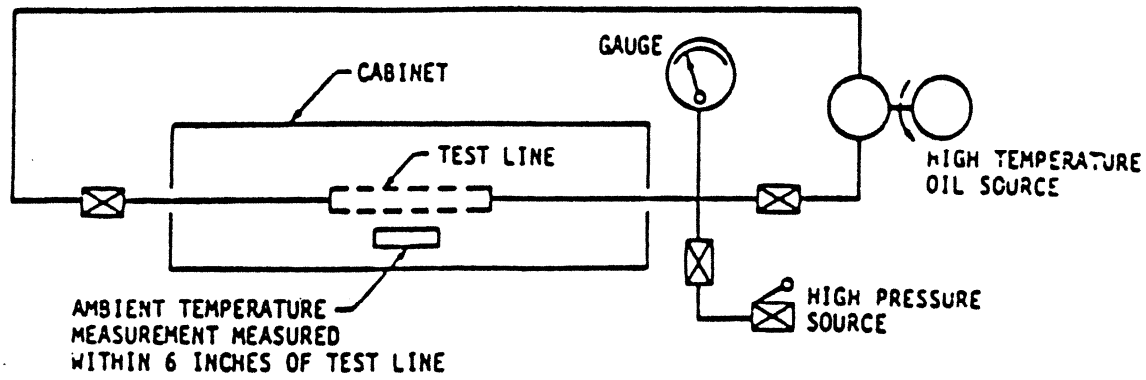

FIGURE 2 - TYPICAL SETUP FOR THERMAL SHOCK TESTING

c. The air aged assembly shall then be filled with MIL-PRF-83282 fluid at a pressure of 75 psi ± 24 psi and soaked with ambient and fluid temperature maintained at 275 °F for 1 hour. At the end of this period, the assembly shall be pressurized to the proof pressure specified in Table 1 or 2 for a minimum of 5 minutes. The pressure shall then be released and, while still maintaining the 275 °F, the pressure shall then be increased at the same rate of rise as specified in 4.6.7.2 until failure is obtained. The hose assembly pressure shall be under continuous observation during the preceding test, and the pressure when failure occurred and the type of failure shall be recorded.

d. The unaged assembly at room temperature will be filled with the test fluid and pressurized to the proof pressure specified in Table 1 or 2 for a minimum of 5 minutes. The pressure shall then be released to "0" psi and then increased at the same rate of rise specified in 4.6.7.1 until failure is obtained. The assembly and the pressure will be under observation during this test and the pressure when failure occurred and the type of failure shall be recorded.

e. During (b) and the proof portion of (c) and (d) of the test, any evidence of leakage from the hose or fittings, hose burst, fitting blow off, or other evidence of malfunction shall constitute failure. During the burst portion of (c) and (d), any of the above occurring below the minimum high temperature or room temperature burst pressure value respectively of Table 1 or 2 shall constitute failure.

4.6.9 Impulse Test

Impulse testing shall be performed as follows on six straight-to-90 elbow hose assemblies of each pressure and size. If the 3000 psi operating bend radius and length is used for the 4000 psi operating pressure, then only six assemblies need be tested to cover both pressure ranges. The impulse test equipment shall conform to AS603 and AIR1228.

a. Two hose assemblies shall be oil aged per 4.5.2.2, one assembly with MIL-PRF-83282 fluid and one assembly with AS1241 Type IV fluid, two assemblies shall be air aged, and two assemblies shall be unaged. The assemblies shall then be subjected at room temperature to the proof pressure specified in Table 1 or 2 for a minimum of 5 minutes.

b. The test assemblies shall be connected to rigid supports and bent in a U-shape as illustrated in Figure 3 with a bend radius at the apex of the bend as specified in Table 2 for 3000 psi or Table 1 for 4000 psi, as applicable, except that size -20 and larger shall be bent in a 90 shape to reduce fluid volume.

c. The impulse pattern shall be as specified in AS603 with peak pressures of 150% ± 5% of operating pressure as specified in Table 1 or 2 measured at the inlet manifold. Impulse shall occur at a rate of 70 cpm ± 10 cpm. The test fluid shall be MIL-PRF-83282 hydraulic fluid. Fluid temperature shall be maintained at 275 °F for all hose sizes and measured at the test manifold. Ambient temperature shall be 275 °F measured at a point within 6 inches from the hose assemblies.