SAE Aerospace
An SAE International Group

AEROSPACE STANDARD

SAE AS620 REV. E

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Reaffirmed 2007-01

Superseding AS620D

Hose Assemblies, Convoluted Polytetrafluoroethylene Metallic Reinforced, High Temperature, Medium Pressure, Aircraft

RATIONALE

This document has been reaffirmed to comply with the SAE 5-year Review policy.

1. SCOPE:

This SAE Aerospace Standard (AS) defines the requirements for a convoluted polytetrafluoroethylene (PTFE) lined, metallic reinforced, hose assembly suitable for use in aircraft fluid systems at temperatures of -65 to 400 °F and at operating pressures per Table 1.

TABLE 1 - Physical Requirements of Hose Assemblies and Weight of Hose

Hose Size	Hose Weight Max[1] lb/in	Operating Pressure Max psi	Proof Pressure Max psi	Burst Pressure Room Temperature Min psi	Burst Pressure High Temperature Min psi	Bend Radius At Inside of Bend Min in
04	.008	1000	2000	4000	2800	1.25
06	.010	1000	2000	4000	2800	2.25
08	.015	1000	2000	4000	2800	2.88
10	.020	1000	1800	3600	2500	3.00
12	.027	1000	1800	3600	2500	3.75
16	.033	1000	1800	3600	2500	5.00
20	.050	1000	1800	3600	2500	6.25
24	.060	750	1500	3000	2100	7.50
32	.090	250	500	1000	700	10.00
40	.110	100	200	400	280	12.50
48	.145	100	200	400	280	15.00
64	.200	100	200	400	280	24.00

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

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1.1 Types:

1.1.1 Hose assemblies furnished under this document may be of two types:

Type I - Non-conductive Inner Tube
Type II - Conductive Inner Tube

1.1.2 Hose assemblies furnished under this document may be of the following classes. If no class is defined then Class 1 shall prevail.

Class 1 - Liquid Proof Test
Class 2 - Liquid and Pneumatic Proof Test

2. REFERENCES:

2.1 Applicable Documents:

The following publications form a part of this specification 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 purchase order. In the event of conflict between the text of this specification and references cited herein, the text of this specification takes precedence. Nothing in this specification, however, supersedes applicable laws and regulations unless a specific exemption is obtained.

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

AMS 5556	Steel, Corrosion and Heat Resistant, Seamless or Welded Tubing, 18Cr 11Ni 0.70(Cb+Ta) (SAE 30347), Hydraulic, Solution Heat Treated
AMS 5557	Steel Tubing, Seamless and Welded, Corrosion and Heat Resistant, 18.5Cr 10.5Ni 0.40Ti (SAE 30321), Hydraulic, Solution Heat Treated
AMS 5567	Steel Tubing, Seamless or Welded, Corrosion Resistant, 19Cr 10Ni (SAE 30304), Hydraulic, Annealed
AMS 5570	Steel, Corrosion and Heat Resistant, Seamless Tubing, 18Cr 11Ni 0.40Ti (SAE 30321), Solution Heat Treated
AMS 5571	Steel, Corrosion and Heat Resistant, Seamless Tubing, 18Cr 10.5Ni 0.70(Cb+Ta) (SAE 30347), Solution Heat Treated
AMS 5575	Steel, Corrosion and Heat Resistant, Welded Tubing, 18Cr 10.5Ni 0.70(Cb+Ta) (SAE 30347), Solution Heat Treated
AMS 5636	Steel, Corrosion Resistant, Bars and Wire, 18Cr 9.0Ni (SAE 30302) Solution Heat Treated and Cold Drawn, 100 ksi Tensile Strength
AMS 5637	Steel, Corrosion Resistant, Bars and Wire, 18Cr 9.0Ni (SAE 30302) Solution Heat Treated and Cold Drawn, 125 ksi Tensile Strength
AMS 5639	Steel Bars, Wire, Forgings, Tubing and Rings, Corrosion Resistant, 19Cr 10Ni (SAE 30304), Solution Heat Treated
AMS 5643	Steel, Corrosion Resistant, Bars, Wire, Forgings, Tubing and Rings, 16Cr 4.0Ni 0.30(Cb+Ta) 4.0Cu (SAE 17-4PH), Solution Heat Treated, Precipitation Hardenable
AMS 5644	Steel Bars and Forgings, Corrosion Resistant, 17Cr 7.0Ni 1.0Al (SAE 17-4PH)

2.1.1 (Continued):

AMS 5645	Steel, Corrosion and Heat Resistant, Bars, Wire, Forgings, Tubing and Rings, 18Cr 10Ni 0.40Ti (SAE 30321), Solution Heat Treated
AMS 5646	Steel, Corrosion and Heat Resistant, Bars, Wire, Forgings, Tubing and Rings, 18Cr 11Ni 0.60(Cb+Ta) (SAE 30347), Solution Heat Treated
AMS 5656	Steel, Corrosion Resistant, Bars, Wire, Forgings, Extrusions and Rings, 9.0Mn 20Cr 6.5Ni 0.27N (SAE 21-6-9), Solution Heat Treated
AMS 5659	Steel, Corrosion Resistant, Bars, Wire, Forgings, Rings and Extrusions, 15Cr 4.5Ni 0.30Cb 3.5Cu (SAE 15-5PH), Consumable Electrode Melted, Solution Heat Treated, Precipitation Hardenable
AMS 5688	Steel, Corrosion Resistant, Wire, 18Cr 9.0Ni (SAE 30302) Spring Temper
AMS 5689	Steel, Corrosion and Heat Resistant, Wire 18Cr 10.5Ni 0.40Ti (SAE 30321), Solution Heat Treated
AMS 5690	Steel, Corrosion and Heat Resistant, Wire 17Cr 12Ni 2.5Mo (SAE 30316), Solution Heat Treated
AMS 5697	Steel, Corrosion Resistant, Wire 19Cr 9.5Ni (SAE 30304), Solution Heat Treated
AMS-QQ-P-35	Passivation Treatments for Corrosion-Resistant Steels
AMS-QQ-S-763	Steel Bars, Wire Shapes, and Forgings, Corrosion-Resisting
AS150	Hose Assembly, Type Classifications of, Basic Performance and Fire Resistance
AS611	Hose Assembly and Tubing, Polytetrafluoroethylene, Cleaning Methods
ARP908	Hose and Tube Fitting - Installation and Qualification Test Torque
AS1055	Fire Testing of Flexible Hose, Tube Assemblies, Coils, Fittings and Similar System Components
ARP1835	Preparation for Delivery General Requirements for Hose Assemblies
AS2078	Test Methods, Hose Assemblies, Polytetrafluoroethylene (PTFE)
AS33514	Fitting End, Standard Dimensions for Flareless Tube Connection and Gasket Seal
AS4395	End Fitting - Flared Tubing Connections, Design Standard
AS4658	Fitting End, External Thread, Short Flareless
AS4659	Fitting End, Bulkhead, External Thread, Short Flareless
AS4700	Installation Procedures and Torques for Short Flareless Fittings
AS4703	Fitting End, Acorn, Short Flareless
AS7003	National Aerospace and Defense Contractors Accreditation Program (NADCAP)
AS7112	National Aerospace and Defense Contractors Accreditation Program Requirements for Fluid System Components
AS8879	Screw Threads, Controlled Radius Root with Increased Minor Diameter; General Specification for

2.1.2 ASTM Publications: Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM A 262	Standard Recommended Practices for Detecting Susceptibility to Intergranular Attack in Stainless Steel
ASTM A 313	Standard Specification for Stainless Steel Spring Wire
ASTM A 580	Specification for Stainless and Heat Resisting Steel Wire
ASTM D 471	Standard Test Fluids, Hydrocarbons

2.1.3 U.S. Government Publications: Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

P-D-680	Dry Cleaning Solvent
TT-I-735	Isopropyl Alcohol
MIL-H-5606	Hydraulic Fluid, Petroleum Based, Aircraft, Missile and Ordnance
MIL-HDBK-831	Preparation of Test Reports
MIL-PRF-5624	Turbine Fuel, Aviation, Grades JP-4 and JP-5
MIL-PRF-7808	Lubricating Oil, Aircraft Turbine Engine, Synthetic Base
MIL-PRF-83282	Hydraulic Fluid, Fire Resistant Synthetic Hydrocarbon Base, Aircraft
MIL-PRF-87257	Hydraulic Fluid, Fire Resistant, Low Temperature, Synthetic Hydrocarbon Base, Aircraft and Missile
MIL-STD-100	Engineering Drawings
MIL-STD-130	Identification Marking of U.S. Military Property

2.1.4 NAS Standards: Available from Aerospace Industries Association, 1250 Eye Street NW, Washington, DC 20005.

NAS 847	Caps and Plugs, Protective, Dust and Moisture Seal
NAS 1760	Fitting End, Flareless Acorn, Standard Dimensions for

2.1.5 ASME Publications: Available from ASME, 345 E. 47th Street, New York, NY 10017.

ASME B46.1	Surface Texture

2.1.6 PRI Publications: Available from Performance Review Institute, 161 Thornhill Road, Warrendale, PA 15096-7527 (www.pri.sae.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 AS620SUP1 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).

3.1.2 Product Qualification: All products 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 Material:

The hose assembly materials shall be uniform in quality, free from defects, consistent with good manufacturing practice and shall conform to applicable specifications and the requirements specified herein. All materials not specifically described herein shall be of the highest quality 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 (AMS 5636 or AMS 5637)
(2)	AMS-QQ-S-763	Class 304 - Cond. A or Cond. B (AMS 5639)
(3)	AMS-QQ-S-763	Class 321 - Cond. A (AMS 5645)
(4)	AMS-QQ-S-763	Class 347 - Cond. A (AMS 5646)
(5)	AMS 5643	17-4PH
(6)	AMS 5644	17-7PH
(7)	AMS 5656	21-6-9
(8)	AMS 5659	15-5PH

b. Tubing:

(1)	AMS 5556	Type 1 or Type 2 Stainless Steel Tubing, 347
(2)	AMS 5557	Type 1 or Type 2 Stainless Steel Tubing, 321
(3)	AMS 5567	Type 1 or Type 2 Stainless Steel Tubing, 304
(4)	AMS 5570	Seamless Stainless Steel Tubing, 321
(5)	AMS 5571	Seamless Stainless Steel Tubing, 347
(6)	AMS 5575	Welded Stainless Steel Tubing, 347

3.2.1 (Continued):

c. Wire:

(1)	ASTM A 580/A 313	Comp. 302 (AMS 5688)
(2)	ASTM A 580/A 313	Comp. 304 (AMS 5697)
(3)	ASTM A 580/A 313	Comp. 316 (AMS 5690)
(4)	ASTM A 580/A 313	Comp. 321 (AMS 5689)

3.3 Construction:

The hose assembly shall consist of a convoluted polytetrafluoroethylene inner tube, which may be covered with convoluted woven glass cloth and/or other suitable materials, corrosion-resistant steel-wire reinforcement, and corrosion-resistant steel end fittings as required to meet the construction and performance requirements of this document and as required for its intended use.

3.3.1 Inner Tube: The inner tube shall be of a convoluted construction of virgin polytetrafluoroethylene resin designed to promote easy bending. It shall be free from pitting or projections on the inner surface. Additives may be included in the compound from which the tube is fabricated.

3.3.2 Reinforcement: The reinforcement shall consist of corrosion-resistant steel wires conforming to the applicable specifications listed in 3.2.1. The wires shall be so arranged over the inner tube as to provide sufficient strength to ensure conformance with the requirements specified herein. Broken reinforcing wires shall be cause for rejection. Crossed-over reinforcing wires shall not be cause for rejection of the hose assembly.

3.3.3 Interlayers: Interlayers, if used, shall be of a suitable material and shall be resistant to all fluids with which the hose may come in contact during normal service. They shall be capable of withstanding temperatures of -65 to 400 °F and shall not extrude through the outer braid during testing or in service.

3.3.4 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 NAS 1760 to mate with AS33514 or AS4375, or short flareless fittings in accordance to AS4703 to mate with AS4658 or AS4659, in accordance with applicable documents (see 2.1). Fitting hex portions shall fit standard wrench openings.

3.3.4.1 Straight Fittings: Fittings shall be of one-piece construction. Weld or braze joints must not be located in the fluid paths, except welded and redrawn tubing per AMS 5567, AMS 5556 or AMS 5557 may be used.

3.3.4.2 Other Fittings: Other fittings, including elbow fittings, shall be of one piece construction to the maximum extent possible. When one piece construction is not used, the joints shall be welded using either butt-weld or lap-weld design. For double elbow assemblies, the elbows may be treated as non-standard.

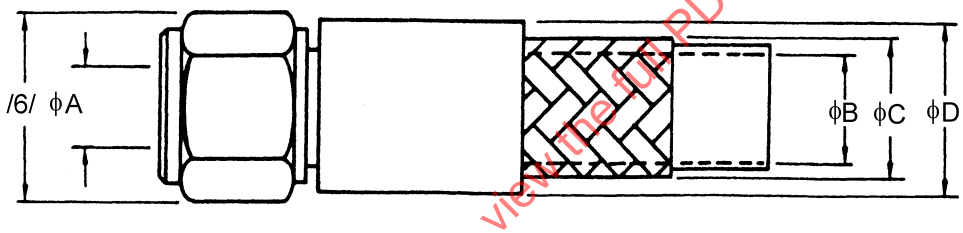
3.3.4.3 End Fitting Collars (Sockets): All end fitting collars (sockets) crimped or swaged, fabricated from Type 304 stainless steel are required to be capable of passing an embrittlement test as specified in ASTM A 262 Practice E, prior to assembly to the nipple or swaging operation. Sockets fabricated from stabilized austenitic steel (304L, 321 or 347) are acceptable without being subjected to the embrittlement test.

3.3.4.4 Fitting Finish:

3.3.4.4.1 Corrosion-Resistant Steel Parts: Unless otherwise specified, corrosion resistant steel fittings shall be passivated in accordance with AMS-QQ-P-35.

3.4 Dimensions:

The hose assembly dimensions, except for length, shall be as specified in Figure 1 and Table 2.



/1/ Cross corners of nut and socket hex may exceed “D” dimensions

FIGURE 1 - Hose and Fitting Dimensions

TABLE 2 - Hose and Fitting Dimensions - Inch

Hose Size	Rigid Tubing OD Ref in	Fitting ID Min A[1]	Hose ID Min B	Hose Wire Braid OD C ± .032	Fitting OD Max D
04	.250	.132	.270	.445	.55
06	.375	.256	.355	.555	.68
08	.500	.345	.510	.755	.86
10	.625	.430	.600	.850	.95
12	.750	.635	.765	1.060	1.28
16	1.000	.835	.980	1.298	1.47
20	1.250	1.085	1.220	1.526	1.70
24	1.500	1.310	1.480	1.790	2.00
32	2.000	1.825	1.937	2.325	2.56
40	2.500	2.278	2.437	2.875	3.00
48	3.000	2.771	2.937	3.430	3.70
64	4.000	3.700	3.937	4.455	4.70

[1]Hose assembly conformance to minimum specified inside diameter shall be verified by passing the designated or larger spherical ball through the hose assembly.

TABLE 3 - Minimum Inspection Ball Size for Hose Assembly[1]

Hose Size	Straight End Fitting in	Elbow End Fitting in
04	.119	.112
06	.230	.218
08	.310	.293
10	.387	.366
12	.572	.540
16	.752	.710
20	.976	.922
24	1.179	1.114
32	1.642	1.551
40	2.050	1.936
48	2.494	2.355
64	3.330	3.145

[1]Hose assembly conformance to minimum specified inside diameter shall be verified by passing the designated or larger spherical ball through the hose assembly.

3.4.1 Hose Weight: Hose consisting of inner tube, reinforcement and interlayers as outlined in 3.3.1 through 3.3.3 shall not exceed the maximum weights specified in Table 1.

3.5 Performance:

The hose assembly shall meet the following performance requirements:

3.5.1 Proof Pressure:

3.5.1.1 Class 1 hose assemblies shall withstand the proof pressure listed in Table 1 without malfunction or leakage when tested with water in accordance with 4.6.2.1.

3.5.1.2 Class 2 hose assemblies shall meet the Class 1 proof pressure test requirement and shall withstand 25% of the operating pressure listed in Table 1 without malfunction or leakage in excess of the normal effusion rate of one bubble per minute for each inch of PTFE hose length plus one bubble per minute for each end fitting when tested pneumatically in accordance with 4.6.2.2.

3.5.2 Elongation and Contraction: The hose assembly shall not change in length by more than +0.3 in or -0.1 in in 10 in of hose length, when subjected to the operating pressure in Table 1 for a minimum of 5 min. The hose assembly shall be tested in accordance with 4.6.3.

3.5.3 Leakage: The hose assembly shall not leak (no external wetting) when subjected to two pressure cycles of 70% of minimum room temperature burst pressure, when tested in accordance with 4.6.4.

3.5.4 Room Temperature Burst Pressure: The hose assembly shall not leak nor burst at any pressure below room temperature burst pressure specified in Table 1, when tested in accordance with 4.6.5.

3.5.5 High Temperature Burst Pressure: The hose assembly shall not leak nor burst at any pressure below high temperature burst pressure specified in Table 1, when tested at 400 °F in accordance with 4.6.6.

3.5.6 Oil Resistance: The hose assembly shall show no evidence of leakage when tested with oil conforming to MIL-PRF-7808 (or other oils specified by the procuring activity) and with test fluid conforming to ASTM Reference Fuel B (70% Isooctane, 30% Toluene) as defined in ASTM D 471, when tested in accordance with 4.6.7.

3.5.7 Fuel Resistance: The hose assembly shall show no evidence of leakage when pressurized with fluid conforming to MIL-PRF-5624 (JP4) at Table 1 operating pressure. The test shall be conducted in accordance with 4.6.8.

3.5.8 Flexibility and Vacuum: A ball of the applicable diameter listed in Table 4 shall roll through the hose assembly from fitting to fitting after the hose assembly has been maintained for 4 h at 400 °F and the applicable vacuum listed in Table 4. Following this, the hose assembly shall show no evidence of leakage nor permanent damage after being tested to the applicable proof pressure specified in Table 1. Testing shall be conducted in accordance with 4.6.9.

TABLE 4 - Values for Vacuum Test

Hose Size	Negative Pressure in Hg	Ball Size MS19059 Dash No.	Ball Size in
04	28	1008	.125
06	28	1014	.250
08	28	1017	.344
10	28	1019	.406
12	28	1626	.625
16	28	1632	.812
20	20	1639	1.062
24	12	TBD	1.281
32	5	4851	1.812
40	5	TBD	2.250
48	5	TBD	2.750
64	3	TBD	3.688

3.5.9 Pressure Surge: The hose assembly shall show no evidence of leakage from the hose or end fitting when subjected to 50,000 pressure surges from zero to the Table 1 operating pressure while maintained at 400 °F, when tested in accordance with 4.6.10.

3.5.10 Electrical Conductivity (Type II only): Hose assembly sizes up to -08 shall conduct a DC equal to or greater than 6 µA and sizes -10 and above a DC equal to or greater than 12 µA with a test potential of 1000 V DC, when tested in accordance with 4.6.11.

3.5.11 Repetitive Assembly Torque: The fitting shall withstand repetitive assembly torque values specified in ARP908, or AS4700 for short flareless design, when tested in accordance with 4.6.12.

3.6 Screw Threads:

Coupling nut threads shall be in accordance with AS8879 (ISO 3161). Thread tolerance increase of 10% during assembly or testing shall not be cause for rejection of the hose assembly.

3.7 Length Tolerance:

Tolerances on hose assemblies shall be as follows:

±.125 in for lengths under 18 in
±.250 in for lengths from 18 through 36 in exclusive
±.500 in for lengths from 36 through 50 in exclusive
±1% for lengths 50 in 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 to be marked for identification in accordance with MIL-STD-130. The following special marking shall be added:

3.9.1 Fittings: The manufacturer's name and 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. The band shall be no wider than 1 in 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
b. CAGE code and complete hose assembly part number
c. Operating pressure in psi (as applicable)
d. Operating temperature "400 °F" (as applicable)
e. Pressure test symbol "PT"
f. Assembly Specification "AS620"
g. Date of hose assembly manufacture expressed in terms of month and year
h. Hose manufacturer's CAGE code number (required only when hose manufacturer is different than hose assembly manufacturer)
i. 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 the annular tool marks up to 100 µin Ra per ASME B46.1 maximum will be acceptable.

3.10.1 Dimensions and Tolerances: All pertinent dimensions and tolerances, where interchangeability, operation and 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.

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/her 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 examination and testing of hose assemblies shall be classified as:

a. Quality conformance inspections (see 4.3)
b. Qualification inspections (see 4.4).

4.3 Quality Conformance Inspections:

Quality conformance inspections shall consist of the following tests:

a. Individual test (see 4.3.1)
b. Sampling test (see 4.3.2)
c. Periodic control test (see 4.3.3)

4.3.1 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 4.6.2)

4.3.2 Sampling Test: The following shall be performed on one hose assembly picked at random from each lot. A lot is defined as 500 assemblies of a given dash size.

a. X-ray or fluoroscope to determine proper fitting installation
b. Elongation and contraction test (see 4.6.3), then
c. Leakage test (see 4.6.4)

4.3.3 Periodic Control Test: A fuel resistance test (see 4.6.8) shall be performed on at least two assemblies for each test selected from each 5000 hose assemblies for each dash size, not necessarily manufactured during one continuous production run.

4.3.4 Rejection and Retest: When one item selected from a production run fails to meet the specifications, no items still on hand or later produced shall be accepted until the extent and cause of failure are determined and corrective action, as necessary, taken.

4.3.4.1 Individual Tests May Continue: For operational reasons, the individual tests may be continued pending the investigation of a sampling or periodic control test failure. Final acceptance of items on hand or produced later shall not be made until it is determined that items meet the requirements on which the rejection was based.

4.4 Qualification Inspection:

4.4.1 Qualification Testing: The qualification of hose assemblies shall consist of all the tests described in this specification. Unless otherwise specified by the purchaser, qualification samples shall consist of the number of samples and lengths specified in Table 5 for each method of fitting attachment. The procedure shall be as specified in Table 6. The end fitting outlet design for the samples shall have flared fittings to mate with AS4395, or flareless fittings in accordance to NAS1760 to mate with AS33514, or AS4375, or short flareless fittings in accordance to AS4703 to mate with AS4568 or AS4569.

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 flared and flareless fittings may be accomplished by having fittings on one hose end flared and flareless fittings on the other end.

If a supplier qualifies one end fitting outlet design, and at a later date desires to qualify another fitting outlet design, two hose assemblies of each size to be qualified shall be subjected to the tests specified in 4.5.1.1.

TABLE 5 - Test Samples (Flareless Fittings)

Hose Size	Part Number	Sample Numbers[2]	Quantity
04	AS1633-04-0180	1-7	7
	AS1635-04-0180	8-11	4
06	AS1633-06-0180	1-7	7
	AS1635-06-0180	8-11	4
08	AS1633-08-0180	1-7	7
	AS1635-08-0180	8-11	4
10	AS1633-10-0180	1-7	7
	AS1635-10-0180	8-11	4
12	AS1633-12-0180	1-7	7
	AS1635-12-0180	8-11	4
16	AS1633-16-0180	1-7	7
	AS1635-16-0180	8-11	4
20	AS1633-20-0180	1-4	4
	AS1633-20-0200[3]	5-7	3
	AS1635-20-0200[1]	8-11	4
24	AS1633-24-0180	1-4	4
	AS1633-24-0250[3]	5-7	3
	AS1635-24-0250[1]	8-11	4
32	AS1633-32-0180	1-4	4
	AS1633-32-0310[3]	5-7	3
	AS1635-32-0310[1]	8-11	4
40	AS1633-40-0180	1-4	4
	AS1633-40-0380[3]	5-7	3
	AS1635-40-0380[1]	8-11	4
48	AS1633-48-0180	1-4	4
	AS1633-48-0450[3]	5-7	3
	AS1635-48-0450[1]	8-11	4

TABLE 5 - Test Samples (Flareless Fittings) (Continued)

Hose Size	Part Number	Sample Numbers[2]	Quantity
64	AS1633-64-0180	1-4	4
	AS1633-64-0600[3]	5-7	3
	AS1635-64-0600[1]	8-11	4

[1] Assembly length required for pressure surge test.
[2] See Table 6 for test sequence for each hose sample.
[3] Assembly length for flexure and vacuum test.

4.4.2 Test Report, Test Samples and Data for the Procuring Activity: 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: The qualification test samples, when requested by the procuring activity.

c. Three sets of assembly and sub-assembly 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. 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 procuring activity unless specifically requested.

4.4.3 Qualification Test Sequence: Test sequence and procedure shall be as specified in Table 6 and, if applicable, 4.5.1.1.

TABLE 6 - Qualification Test Sequence

Sample No.	Assembly 1	Assembly 2	Assembly 3	Assembly 4	Assembly 5	Assembly 6	Assembly 7	Assembly 8	Assembly 9	Assembly 10	Assembly 11	Assembly 12[1]
Paragraph No.	4.6.1 4.6.2 4.6.3 4.6.4 4.6.12 4.6.6	4.6.1 4.6.2 4.6.4 4.6.12 4.6.6	4.6.1 4.6.2 4.6.7 4.6.5	4.6.1 4.6.2 4.6.8 4.6.5	4.6.1 4.6.2 4.6.7 4.6.9	4.6.1 4.6.2 4.6.8 4.6.9	4.6.1 4.6.2 4.6.9	4.6.1 4.6.2 4.6.10	4.6.1 4.6.2 4.6.10	4.6.1 4.6.2 4.6.10	4.6.1 4.6.2 4.6.10	4.6.1 4.6.11

[1] For Type II assemblies only. Add one additional AS1633-(SIZE)-0180 hose assembly to hose listed in Table 5 for each size to be qualified.

4.5 Test Conditions:

4.5.1 Fitting Ends: Qualification tests shall be conducted on test sample configurations as specified in Table 5. Satisfactory completion of qualification tests shall also constitute qualification approval for hose assemblies having other fittings that have an identical attachment method and design.

4.5.1.1 Additional Fitting End Designs: If qualification approval is required for other type end fittings mating design, two additional hose assemblies with the type end fittings and of the size to be qualified shall be subjected to the following tests in the sequence noted:

a. Examination of product (see 4.6.1)
b. Proof pressure test (see 4.6.2)
c. Leakage test (see 4.6.4)
d. Repetitive assembly torque test (see 4.6.12)
e. Room temperature burst pressure test (see 4.6.5)

4.5.2 Preparation of Samples:

4.5.2.1 Unless otherwise specified, length of sample assemblies shall be in accordance with Table 5.

4.5.2.2 Oil Aging: In all tests using oil aged samples, the hose assemblies shall be filled with a high temperature test fluid and soaked in an air oven at a temperature of 400 °F for seven days. All air shall be excluded from the bore of the assembly during the test. No pressure shall be applied to the assembly during the aging period.

4.5.2.3 Air Aging: Air aged samples shall be kept in air at a temperature of 400 °F for seven days.

4.5.2.4 Unaged Samples: Unaged assemblies shall be as fabricated from the hose assembly manufacturer.

4.5.3 Test Fluids: Unless otherwise specified, the pressure test fluid shall be hydraulic fluid conforming to MIL-H-5606, MIL-PRF-87257, or MIL-PRF-83282, turbine fuel conforming to MIL-PRF-5624, or water. Where high temperature test fluid is specified, the test fluid shall be MIL-PRF-83282 hydraulic fluid, MIL-PRF-7808 lubricating oil, or equivalent, unless otherwise specified by the procuring activity.

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

4.5.5 Pressure Measurements: Unless otherwise specified, pressure measurements shall have a tolerance of ±20 psi.

4.5.6 End Connections: Unless otherwise specified, each hose end shall be connected to a male fitting end in accordance with AS4395, AS33514, AS4375, AS4568 or AS4569, and utilizing the installation torque range specified in ARP908 or AS4700 (as applicable). The use of test fluid as a lubricant is permitted.

4.6 Inspection Methods:

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

4.6.2 Proof Pressure Test:

4.6.2.1 All Class 1 hose assemblies shall be pressure tested with water to the applicable proof pressure specified in Table 1 for not less than 30 s and not more than 5 min. Failure to meet the requirements of 3.5.1.1 shall be cause for rejection.

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

4.6.2.2 All Class 2 hose assemblies shall be tested in accordance with 4.6.2.1. The assemblies shall then be pneumatically (air or N_2) tested for 3 min under water to 25% of the applicable operating pressure specified in Table 1. Failure to meet the requirements of 3.5.1.2 shall be cause for rejection.

4.6.3 Elongation and Contraction Test: One hose assembly of each size shall be subjected to the elongation and contraction test in accordance with AS2078. See 3.5.2.

4.6.4 Leakage Test: Two hose assemblies of each size shall be leakage tested in accordance with AS2078. See 3.5.3.

4.6.5 Room Temperature Burst Pressure Test: Two hose assemblies of each size shall be subjected to the room temperature burst test in accordance with AS2078. The assemblies shall be observed throughout the test and the type of failure and the pressure when failure occurred shall be recorded. See 3.5.4.

4.6.6 High Temperature Burst Pressure Test: Two hose assemblies of each size shall be subjected to the high temperature burst test in accordance with AS2078 except the maximum ambient and fluid temperature shall be 400 °F. The assemblies shall be observed throughout the test and the type of failure and the pressure when failure occurred shall be recorded. See 3.5.5.

4.6.7 Oil Resistance Test:

4.6.7.1 Two hose assemblies of each size shall be filled with oil conforming to specification MIL-PRF-7808 or another oil approved for use by the procuring activity and placed in an oven which shall be maintained at 400 °F. Care shall be taken to insure against the assembly coming in contact with parts of the oven which are at a higher temperature. The same test fluid shall be used throughout this test, unless otherwise specified. The assembly shall have a pressure applied equal to the rated operating pressure as specified in Table 1.

4.6.7.2 At the end of a minimum of 16 h, the assembly shall be removed from the oven, drained and refilled with test fluid conforming to ASTM Reference Fuel B (70% Isooctane, 30% Toluene) as defined in ASTM D 471. A pressure shall be applied equal to the rated operating pressure and maintained for a minimum of 2 h at room temperature.

4.6.7.3 The test as specified in 4.6.7.1 and 4.6.7.2 shall be repeated for a total of 3 times.

4.6.7.4 At the completion of the above tests, the test samples shall be filled with oil and placed in a cold chamber for 4 h, while maintained at -67 °F ± 2 °F. After the 4-h cold soak, the samples shall be subjected to a pressure equal to the operating pressure specified in Table 1. The pressure shall be held for a minimum of 5 min and then released. This shall be repeated for a total of 10 times with a minimum of 5 min between each pressure application.

4.6.7.5 The assemblies shall again be placed in a cold chamber where the temperature is -67 °F ± 2 °F for 24 h. At the end of this time, oil at a temperature of 400 °F shall be circulated through the assemblies. Within 15 s after introduction of the hot oil, the pressure shall be increased to the rated proof pressure and held for a minimum of 2 min.

4.6.7.6 Any leakage of the test fluid from the assemblies during the preceding tests shall be evidence of failure.

4.6.7.7 At the conclusion of the above tests, one of the test assemblies shall be subjected to the burst test of 4.6.5. The other assembly shall be subjected to the flexibility and vacuum test of 4.6.9.