

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

RATIONALE

Added periodic testing requirements for fire resistant hose assemblies, relocated fire test requirement from NOTES paragraph 6.1.1 to performance requirement paragraph 3.5.12 and qualification testing paragraph 4.6.13.

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 <sup>1</sup> 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	0.010	1000	2000	4000	2800	1.25
06	0.010	1000	2000	4000	2800	2.25
08	0.022	1000	2000	4000	2800	2.88
10	0.020	1000	1800	3600	2500	3.00
12	0.027	1000	1800	3600	2500	3.75
16	0.040	1000	1800	3600	2500	5.00
20	0.055	1000	1800	3600	2500	6.25
24	0.060	750	1500	3000	2100	7.50
32	0.090	250	500	1000	700	10.00
40	0.110	100	200	400	280	12.50
48	0.145	100	200	400	280	15.00
64	0.200	100	200	400	280	24.00

<sup>1</sup> 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. 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 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](http://www.sae.org).

AMS2700	Passivation of Corrosion Resistant Steels
AMS5556	Steel, Corrosion and Heat-Resistant, Seamless or Welded 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
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
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 Heated 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
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 Remelted, Precipitation Hardenable
AMS5685	Steel, Corrosion Resistant, Safety Wire, 18Cr - 11.5Ni (SAE 30305) Solution Heat Treated, Cold Finished
AMS5688	Steel, Corrosion-Resistant, Wire, 18Cr - 9.0Ni (SAE 30302), Spring Temper
AMS5689	Steel, Corrosion and Heat Resistant, Wire, 18Cr - 10.5Ni - 0.40Ti (SAE 30321), Solution Heat Treated
AMS5690	Steel, Corrosion and Heat Resistant, Wire, 17Cr - 12Ni - 2.5Mo (SAE 30316), Solution Heat Treated
AMS5697	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, Corrosion Resistant, Bars, Wire, Shapes, and Forgings
AS150	Hose Assembly, Type Classifications of, Basic Performance and Fire Resistance
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
ARP1835	Preparation for Delivery, General Requirements for Hose Assemblies
AS2078	Test Methods, Hose Assemblies, Polytetrafluoroethylene (PTFE)
AS4395	Fitting End, Flared, Tube Connection, Design Standard
AS4658	Fitting End, External Thread, Short Flareless, Design Standard
AS4659	Fitting End, Bulkhead, External Thread, Short Flareless, Design Standard
AS4700	Short Flareless Fittings, Installation Procedures and Torque For

AS4703	Fitting End, Acorn, Short Flareless, Design Standard
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
AS33514	Fitting End, Standard Dimensions for Flareless Tube Connection and Gasket Seal

## 2.2 ASME Publications

Available from American Society of Mechanical Engineers, 22 Law Drive, P.O. Box 2900, Fairfield, NJ 07007-2900, Tel: 973-882-1170, [www.asme.org](http://www.asme.org).

ASME B46.1	Surface Texture
ASME Y14.100	Engineering Drawing Practices

## 2.3 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](http://www.astm.org).

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

## 2.4 NAS Standards

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

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

## 2.5 PRI Publications

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

PD2001	Qualified Product Management Council Procedures for Qualified Products Group
PD2101	Aerospace Quality Assurance, Product Standard, Qualification Procedures, Fluid Systems

## 2.6 U.S. Government Publications

Available from the Document Automation and Production Service (DAPS), Building 4/D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, Tel: 215-697-6257, <http://assist.daps.dla.mil/quicksearch/>.

TT-I-735	Isopropyl Alcohol
MIL-DTL-5624	Turbine Fuel, Aviation, Grades JP-4 and JP-5
MIL-HDBK-831	Preparation of Test Reports
MIL-PRF-680	Degreasing Solvent
MIL-PRF-5606	Hydraulic Fluid, Petroleum Based, Aircraft, Missile and Ordnance
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-130	Identification Marking of U.S. Military Property

## 2.7 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 (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 or Cond. B (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) AMS5656      | 21-6-9  |
| (9) AMS5659      | 15-5PH  |

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) AMS5567 | Type 1 or Type 2 Stainless Steel Tubing, 304 |
| (4) AMS5570 | Seamless Stainless Steel Tubing, 321         |
| (5) AMS5571 | Seamless Stainless Steel Tubing, 347         |
| (6) AMS5575 | Welded Stainless Steel Tubing, 347           |

c. Wire:

- |                      |                     |
|----------------------|---------------------|
| (1) ASTM A 580/A 313 | Comp. 302 (AMS5688) |
| (2) ASTM A 580/A 313 | Comp. 304 (AMS5697) |
| (3) ASTM A 580/A 313 | Comp. 316 (AMS5690) |
| (4) ASTM A 580/A 313 | Comp. 321 (AMS5689) |
| (5) AMS5685          | 305                 |

### 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 AMS5567, AMS5556 or AMS5557 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.

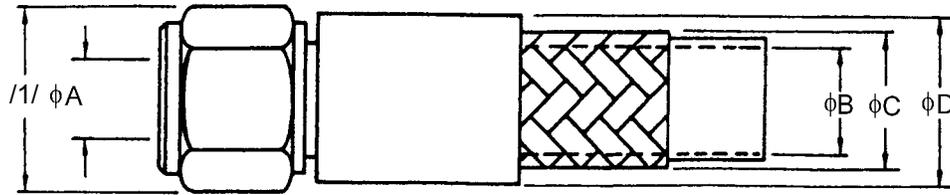
##### 3.3.4.4 Fitting Finish

###### 3.3.4.4.1 Corrosion-Resistant Steel Parts

Unless otherwise specified, corrosion resistant steel fittings shall be passivated in accordance with AMS2700 or 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, nipple hex or 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 <sup>1</sup>	Hose ID Min B	Hose Wire Braid OD C ± 0.032	Fitting OD Max D
04	0.250	0.132	0.270	0.445	0.55
06	0.375	0.256	0.355	0.555	0.68
08	0.500	0.345	0.510	0.755	0.86
10	0.625	0.430	0.600	0.850	0.95
12	0.750	0.635	0.765	1.060	1.28
16	1.000	0.835	0.980	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	1.780	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

<sup>1</sup> 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 ASSEMBLY1

Hose Size	Straight End Fitting in	Elbow End Fitting in
04	0.119	0.112
06	0.230	0.218
08	0.310	0.293
10	0.387	0.366
12	0.572	0.540
16	0.752	0.710
20	0.976	0.922
24	1.179	1.114
32	1.602	1.513
40	2.050	1.936
48	2.494	2.355
64	3.330	3.145

<sup>1</sup> 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-DTL-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 a minimum of 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	0.125
06	28	1014	0.250
08	28	1017	0.344
10	28	1019	0.406
12	28	1626	0.625
16	23	1632	0.812
20	18	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 0 to 7.5% operating pressure to the full 100% operating pressure of Table 1, 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  $\mu$ A and sizes -10 and above a DC equal to or greater than 12  $\mu$ A 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.

### 3.5.12 Resistance to Fire

When the hose assembly is required to withstand a specified resistance to fire, the hose assembly may be fitted with an Integral Silicone or AS1072 tubular, or equivalent, fire sleeve and shall withstand the effects of the flame without leakage when tested in accordance with 4.6.13.

## 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:

- +0.250/-0.125 in for lengths under 18 in
- +0.500/-0.250 in for lengths from 18 to 36 in exclusive
- +1.000/-0.500 in for lengths from 36 to 50 in exclusive
- +2%/-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

#### 4.3.3.1 Hose Assemblies

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.

#### 4.3.3.2 Fire Resistant Hose Assemblies

The following test shall be performed, as defined below, on one hose assembly of each QPL listed fire sleeve configuration type, Integral Silicone and AS1072 Tubular Sleeve, produced within the PRI defined reporting year. The test sample shall be built by production personnel using the same processes as used for product approval to the QPL.

- a. Test sample size: Fire testing shall be performed on the smallest hose size for each of the QPL listed fire sleeve type produced during the reporting year.
- b. Fire Test: Fire testing shall be performed to the requirements of AS1055.

- c. Flow Condition: Fire testing shall be performed at the lowest flow (most critical) condition,  $1xD^2$  or  $5xD^2$ , for each QPL approved product.
- d. Test Duration: Fire testing shall be performed at the longest (most critical) test duration; fireproof (15 min) or fire resistant (5 min) for each QPL approved product.

4.3.3.2.1 Where an assembly fails to meet the  $1xD^2$  flow condition, an additional assembly may be tested for conformance to the lesser  $5xD^2$  condition. If the assembly passes the  $5xD^2$ , product invoking the  $5xD^2$  are unaffected by the  $1xD^2$  failure.

4.3.3.2.2 Where an assembly fails to meet the 15 min test duration, but exceeds 5 min, only assemblies imposing the 15 min duration are affected.

4.3.3.2.3 Where the smallest QPL size fails the test, the next larger QPL qualified size may be tested. Should that test size pass the test, only the smallest size tested is affected.

#### 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. In the event of a failed fire test, all assemblies manufactured from the suspect material (Integral Silicone or AS1072 Tubular Sleeve) under the applicable Type Designation shall be rejected.

##### 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) (CONTINUED)

Hose Size	Part Number	Sample Numbers <sup>2</sup>	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 <sup>3</sup>	5-7	3
	AS1635-20-0200 <sup>1</sup>	8-11	4
24	AS1633-24-0180	1-4	4
	AS1633-24-0250 <sup>3</sup>	5-7	3
	AS1635-24-0250 <sup>1</sup>	8-11	4
32	AS1633-32-0180	1-4	4
	AS1633-32-0310 <sup>3</sup>	5-7	3
	AS1635-32-0310 <sup>1</sup>	8-11	4
40	AS1633-40-0180	1-4	4
	AS1633-40-0380 <sup>3</sup>	5-7	3
	AS1635-40-0380 <sup>1</sup>	8-11	4
48	AS1633-48-0180	1-4	4
	AS1633-48-0450 <sup>3</sup>	5-7	3
	AS1635-48-0450 <sup>1</sup>	8-11	4
64	AS1633-64-0180	1-4	4
	AS1633-64-06003	5-7	3
	AS1635-64-06001	8-11	4

<sup>1</sup> Assembly length required for pressure surge test.

<sup>2</sup> See Table 6 for test sequence for each hose sample.

<sup>3</sup> 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 <sup>1</sup>
Paragraph No.	4.6.1	4.6.1	4.6.1	4.6.1	4.6.1	4.6.1	4.6.1	4.6.1	4.6.1	4.6.1	4.6.1	4.6.1
	4.6.2	4.6.2	4.6.2	4.6.2	4.6.2	4.6.2	4.6.2	4.6.2	4.6.2	4.6.2	4.6.2	4.6.11
	4.6.3	4.6.4	4.6.7	4.6.8	4.6.7	4.6.8	4.6.9	4.6.10	4.6.10	4.6.10	4.6.10	
	4.6.4	4.6.12	4.6.5	4.6.5	4.6.9	4.6.9						
	4.6.12	4.6.6										
	4.6.6											

<sup>1</sup> For Type II assemblies only. Add one additional AS 1633-(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 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-PRF-5606, MIL-PRF-87257, or MIL-PRF-83282, turbine fuel conforming to MIL-DTL-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  $\pm 20$  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<sub>2</sub>) 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.