SAE The Engineering Society For Advancing Mobility Land Sea Air and Space®
INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE STANDARD

SAE AS4468

REV. A

Issued 1992-02
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Superseding AS4468

Hose Assembly, 125 psi, Lined Silicone, Potable Water, Procurement Specification

1. SCOPE:

This SAE Aerospace Standard (AS) covers the requirements for a flexible, lightweight, low pressure, self-extinguishing, silicone hose assembly. The hose has a fully fluorinated fluoropolymer inner liner and is primarily intended for use in aircraft potable water systems.

2. APPLICABLE DOCUMENTS:

The following specifications and standards, of the issue in effect on the date of invitation for bids or request for proposal, form a part of this document to the extent specified herein.

2.1 SAE Publications:

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

AMS 4771	Brazing Filler Metal, Silver, 50 Ag 16 Cd 15.5 Zn 15.5 Cu 3.0 Ni (BAg-3) (1170° - 1270 °F)
AMS 4772	Brazing Filler Metal, Silver, 54 Ag 40 Cu 5.0 Zn 1.0 Ni (BAg-13) (1325° -1575 °F)
AMS 4777	Brazing Filler Metal - Nickel Alloy, 82 Ni - 4.5 Si - 7.0 Cr - 3.1B - 3.0 Fe
AMS 4778	Brazing Filler Metal, Nickel, 92 Ni - 4.5 Si - 3.1 B (BNi-3)
AMS 5556	Tubing, Seamless or Welded, Hydraulic - 18 Cr - 11Ni - 0.70 (Cb + Ta), Soulution Heat Treated (30347)
AMS 5557	Tubing, Seamless or Welded, Hydraulic - 18 Cr - 11 Ni- Ti Solution Heat Trated (30321)
AMS 5567	Tubing, Seamless or Welded, 19 Cr - 10 Ni, Hydraulic, Solution Heat Treated (30304)
AMS 5570	Tubing, Seamless, 18 Cr - 11 Ni - 0.40 Ti, Solution Heat Treated (30321)
AMS 5571	Tubing, Seamless - 18 Cr - 11 Ni - 0.70 (Cb + Ta) Solution Heat Treated (30347)
AMS 5575	Tubing, Welded - 18 Cr - 10.5 Ni - 0.70 (Cb + Ta), Solution Heat Treated (30347)

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2.1 (Continued):

AMS 5636	Bars - 18 Cr - 9 Ni, Cold Drawn, 100,000 TS (30302)
AMS 5637	Bars - 18 Cr - 9 Ni, Cold Drawn, 125,000 TS (30302)
AMS 5639	Bars, Forgings, Tubing, and Rings, 19 Cr - 10 Ni, Solution Heat Treated (30304)
AMS 5640	Bars, Wire, and Forgings, Free Machining 19 Cr 9 Ni
AMS 5645	Bars, Forgings, Tubings, and Rings - 18 Cr - 10Ni - 0.40 Ti, Solution Heat Treated (30321)
AMS 5646	Bars, Forgings, Tubing, and Rings - 18 Cr - 11 Ni - 0.60 (Cb + Ta), Solution Heat Treated (30347)
AMS 5647	Steel Bars, Forgings, Tubing and Rings, Corrosion Resistant - 19 Cr - 9.5 Ni (SAE 304L) Solution Heat Treated
AMS 5648	Bars, Forgings, Tubing, and Rings - 17 Cr - 12 Ni - 2.5 Mo (30316)
AMS 5650	Bars, Forgings, Tubing, and Rings - 23 Cr - 13.5 Ni Solution Heat Treated
AMS 5688	Wire - 18 Cr - 9.0 Ni, Spring Temper (30302)
AMS 5689	Wire - 18 Cr - 9.5 Ni - 0.40 Ti (30321), Solution Heat Treated
AMS 5690	Wire - 17 Cr - 12 Ni - 2.5 Mo, Solution Heat Treated (30316)
AMS 5697	Wire - 19 Cr - 9.5 Ni (30304)
AS611	Tetrafluoroethylene Hose Assembly Cleaning Methods
ARP908	Hose Fitting - Installation and Qualification Test Torque Requirements
AS1073	Sleeve, Hose Assembly, Heat Shrinkable
AS1472	Hose Assembly, Low Pressure, Flareless, Potable Water
AS1650	Coupling Assembly, Threadless, Flexible, Fixed Cavity
AS1656	Fitting End Threadless Coupling - Ferrule or Sleeve, Design Standard
AS4330	Tubing End, Standard Dimensions for
AS4375	Fitting End, External Thread, Flareless, Design Standard
AS4395	Fitting End, Flared Tube Connection, Design Standard
AS8879	Screw Threads, Controlled Radius With Minor Diameter, General Specification For
AS33514	Fitting End, Standard Dimensions for Flareless Tube Connection and Gasket Seal

2.2 Military Publications:

Available from Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

QQ-P-35	Passivation Treatments for Corrosion Resisting Steel
QQ-A-225	Aluminum and Aluminum Alloy Bar, Rod, Wire, or special shapes, Rolled, Drawn or Cold Finished General Specification For
QQ-S-763	Steel Bars, Wire, Shapes, and Forgings, Corrosion Resisting
FAR 25.853	Federal Aviation Regulation, Volume III, Part 25
USPHS No. 308	Handbook of Sanitation of Airlines (United States Public Health Service, Department of Health Education and Welfare).

2.2 (Continued):

MIL-A-8625	Anodic Coating for Aluminum and Aluminum Alloys
MIL-L-46010	Solid Film Lubricant
MIL-PRF-5501	Caps and Plugs, Protective, Dust and Moisture Seal, General Specification for
MIL-STD-129	Military Marking
MIL-STD-810	Environmental Test Methods
MIL-STD-2219	Welding, Metal Arc and Gas, Steels, and Corrosion and Heat Resistant Alloys, Process for
MS21921	Nut, Sleeve Coupling, Flareless
MS27073	Nut, Tube Coupling - Swivel

2.3 American Society for Testing and Materials:

Available from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM D 570	Standard Method of Test for Water Absorption of Plastics
ASTM A 580	Stainless and Heat-Resisting Steel Wire, Condition A
ASTM A 582	Specification for Free Machining Stainless and Heat Resistant Steel Bars, Hot Rolled and Cold Finished
ASTM E 1417	Inspection, Penetrant Method of

2.4 National Aerospace Standards:

Available from Aerospace Industries Association, 1250 Eye Street N.W., Washington, DC 20005.

NAS1367	Fittings - Coated Lubricant and Sealant
NAS1760	Fitting End, Flareless Acorn, Standard Dimension for

2.5 American Welding Society:

Available from the American Welding Society, P.O. Box 35140, Miami, FL 3315-1040.

AWS A5.9-77	Rods and Wire, Welding, Corrosion and Heat Resistant Alloys
AWS A5.14-76	Rods and Wire, Welding, Corrosion Resistant Alloys
AWS C3.6:1999	Specification for Furnace Brazing

3. REQUIREMENTS:

3.1 Qualification:

Hose assemblies furnished under this AS shall be products which are qualified by meeting all the requirements covered by this document. Manufacturers choosing to produce the hose assemblies listed herein shall qualify by complying with the requirements and performing all tests of this AS.

3.2 Materials:

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

Materials used in these hose assemblies shall be selected from those listed in Table 1.

TABLE 1 - Assembly Materials

Component	Material Designation	Material Specification	Finish
Nut (Coupling) MS21921, MS27073 or Equivalent	AISI 300 Series Corrosion-Resistant Steel	AMS 5636, AMS 5637, AMS 5639, AMS 5645, AMS 5646	Passivate per QQ-P-35 and Dry Film Lubricate per NAS 1367 or MIL-L-46010
	Aluminum 2024	QQ-A-225/6	Anodize per MIL-A-8625 Type II
Hose (Inner Tube)	Fully Fluorinated Fluoropolymer Lined Silicone Inner Tube		As Manufactured
Hose (Wire Reinforcement)	AISI 300 Series Corrosion-Resistant Steel	ASTM A 580 (AMS 5688, AMS 5689, AMS 5690, AMS 5697)	Passivate per QQ-P-35, prior to forming or applying to hose
Hose (Nonmetallic Braid, Reinforcement, and/or Covering)	Nylon, Polyester, Fire Resistant Composite Fiber, Fiberglass, or Similar Yarns	Commercial	Dark
Insert Fitting (Nipple or Elbow)	AISI Type 303 SE, 304, 304L, 316, or 321 or 347	AMS 5567, AMS 5556, AMS 5557, AMS 5570, AMS 5571, AMS 5575, QQ-S-763 (AMS 5648) ASTM A 582, AMS 5640	Passivate per QQ-P-35

TABLE 1 - Assembly Materials (Continued)

Component	Material Designation	Material Specification	Finish
Socket	AISI Type 303SE, 304, 304L, 321, or 347 Corrosion-Resistant Steel	AMS 5567, QQ-S-763 (AMS 5639) AMS 5645, AMS 5646 or AMS 5647) ASTM A 582, AMS 5650	Passivate per QQ-P-35
	Aluminum 6061	QQ-A-225/8	Anodize per MIL-A-8625 Type II
Band (Identification)	Polyester Film or Polyolefin with Permanent Marking, Corrosion-Resistant Steel		
Nut Retaining Wire	AISI Type 302, 304 or 305 Corrosion-Resistant Steel	ASTM A 313 & A 580 Condition A (AMS 5688, AMS 5689 AMS 5690, AMS 5697)	Passivate per QQ-P-35

3.3 Design and Construction:

The hose assembly shall consist of a smooth inner tube with reinforcement braid or covering to meet the requirements of this document and as required for its intended use. Unless other fittings are specified, hose assemblies may have flared fittings to mate with AS4395, flareless fittings per NAS1760 to mate with AS33514 or AS4375 fitting ends, or threadless coupling ends per AS1656. Hose end fittings shall be permanently attached to the hose by crimping or swaging. Hose splicing shall be used only for economical construction of long assemblies. Splices shall not be used in assembly lengths under 120 in. Splice design and attachment method shall be the same as the hose end fitting.

3.3.1 End Fitting:

3.3.1.1 Insert Fitting (Nipple and Elbow): Inserts (nipples and elbows) shall be made of corrosion-resistant steel. They may be one-piece construction, welded or brazed assemblies. Only fusion welded butt joints or brazed lap joints shall be used.

3.3.1.2 Coupling Nuts: Coupling nuts shall be corrosion-resistant steel or aluminum as specified on part standard or drawing. Flareless fitting nuts shall be dimensionally equivalent to MS21921 or MS27073. Nut threads and internal surfaces shall be dry film lubricated in accordance with NAS1367 or MIL-L-46010. Lubricant on external nut surfaces shall not be reason for rejection. Thread tolerances shall be maintained after the application of the lubricant.

3.3.1.3 Sockets (Collars): Sockets (collars) shall be corrosion resistant steel or aluminum as specified on the part standard or drawing. Sockets shall be crimped or swaged.

3.3.1.4 Screw Threads: All fitting threads shall be in accordance with AS8879, Class 3A or 3B as applicable. A thread tolerance increase of 10% during assembly or testing shall not be cause for rejection.

3.3.1.5 Joining of End Fittings: Fusion welds shall be per MIL-STD-2219 with 100% penetration. Filler wire, if required, shall be AISI Type 347 per AWS A5.9-77 ER347. Brazed joints shall be per AWS C3.6:1999, Class C, using a brazing alloy per AMS 4777, AMS 4778 (AMS 4772, AMS 4771 optional). Brazing shall be accomplished without flux in a vacuum, inert or dry hydrogen atmosphere. All welds shall be penetrant inspected (water washable) per ASTM E 1417.

3.3.1.6 Threadless Coupling: Hose assemblies with threadless couplings per AS1650 series standards shall have insert ends per AS1656-1-(size) or AS1656-3-(size).

3.3.2 Hose:

3.3.2.1 Inner Tube: The inner tube shall be fully fluorinated fluoropolymer lined silicone of a seamless construction. It shall have a smooth inner surface, free of cracks, and shall be nonshedding or particle producing. Only virgin materials shall be used for the inner tube.

3.3.2.1.1 Inner Tube Liner: The inner liner shall be a fully fluorinated fluoropolymer. It shall be free of splits or holes. There shall be no leakage during 2 psi pneumatic proof testing of the fully chlorinated fluoropolymer inner liner, or visible defects when visually inspected against light. No rerun or reclaimed materials shall be used. The inner liner shall be white, no carbon shall be added. No material or combination of materials that are known to produce toxic effects shall be used. The hose shall not cause an objectionable odor or taste in the water.

3.3.2.2 Reinforcement and Covering: The inner tube shall be reinforced with plies of nonmetallic material and/or wire of sufficient number to meet the requirements of this document. A nonmetallic reinforcement braid may be utilized as the hose outer cover.

3.3.3 Service Life: The hose assembly shall be designed such that it will meet all the requirements of this document. Expected service life (no age limit or environmental degradation) is 20 years.

3.3.4 Corrosion Resistance: Materials (see Table 1) used shall not corrode or have detrimental effect on each other when the hose assembly is exposed to conditions normally encountered in service.

3.3.5 Public Health Service Compliance: All hose assembly materials (see Table 1) which come in contact with the potable water shall comply with Public Health Service Publication 308. The supplier shall obtain Public Health Service approval for any material not already approved.

3.3.6 Temperature Compliance: Each type hose assembly shall be capable of operating at the fluid and ambient temperature between -65 °F (-54 °C) and +160 °F (71 °C).

3.4 Dimensions and Weights:

3.4.1 Hose Dimensions: Minimum hose inside diameters and bend radii shall be in accordance with Table 2.

TABLE 2 - Hose Data, Dimensions, and Performance Ratings

Hose Size Code	Hose ID min	Hose OD max	Minimum Inside Bend Radius (in)	Operating Pressure psi max	Proof Pressure psi min	Burst Pressure psi min	Weight lb-in max
04	.230	.48	.50	125	250	500	.0060
06	.355	.59	.75	125	250	500	.0080
08	.475	.73	1.00	125	250	500	.0088
10	.600	.85	1.25	125	250	500	.0120
12	.725	.98	1.50	125	250	500	.0146
16	.975	1.23	2.00	125	250	500	.0194

3.4.2 Fitting Dimensions: Basic fitting dimensions shall be as specified on the applicable standard or drawing.

3.4.3 Assembly Length: Hose assembly length designations shall be as specified on the applicable aerospace standard. Flareless hose assemblies with NAS1760 ends shall be measured from gage point to gage point. Flareless hose assemblies with combinations NAS1760 to AS33514 end terminations shall be measured from the NAS1760 gage point to the AS33514 end surface. Hose assemblies with AS1656 fitting ends for threadless coupling shall be measured to the end of the ferrule.

3.4.4 Weights: Maximum hose weights shall be in accordance with Table 2. Weights of hose assemblies with standard end fittings shall be determined as shown in the applicable aerospace standard. Maximum weights of hose assemblies with nonstandard end fittings shall be listed on the supplier's drawing when submitted to purchaser for approval.

3.5 Performance:

The hose dimensions and ratings, shown in Table 2, shall be verified by meeting or exceeding the following requirements and quality assurance provisions as specified herein.

3.5.1 Examination of Product: Each assembly shall conform dimensionally and materially to this document and the applicable standards or drawings, when examined in accordance with 4.6.1.

3.5.2 Proof Pressure: The hose assembly shall withstand proof pressure of 250 psi at room temperature (70 °F) for 5 min without wetting, leakage, or evidence of permanent deformation or malfunction when tested in accordance with 4.6.2.

3.5.3 Hose Length and Diameter Change: The hose assembly shall not change in length and diameter by more than plus or minus the percentage values shown in Table 3 when subjected to operating pressure shown in Table 2 for not less than 30 min. The hose assembly shall be tested in accordance with 4.6.3.

TABLE 3 - Percent Change in Hose Length and Diameter

Hose Size Code	Length ± percent	Diameter ± percent
04	2	4
06	2	4
08	2	4
10	2.5	4
12	3	4
16	5	4

3.5.4 Repeated Freezing: The hose assembly, shall be capable of withstanding at least 20 repeated freezing cycles without rupture, bulging or collapsing hose cross section in excess of 10% of the original hose diameter when tested in accordance with 4.6.4.

3.5.5 Bend Radius: The hose assembly shall be capable of being bent a minimum of 180° around a mandrel having a diameter equal to two times minimum bend radius given in Table 2 without cracking or flattening of hose in excess of 10% of original diameter. The test shall be conducted at the low and high operating temperatures for the applicable type hose assembly. The hose assembly shall be tested in accordance with 4.6.5.

3.5.6 Hose Droop: The hose assembly shall not droop more than 0.25 inch in 20 inches when tested in accordance with 4.6.6.

3.5.7 Vacuum: The hose assembly shall be capable of withstanding 22 inches of mercury vacuum at 160 °F (71 °C) for at least 10 min without evidence of collapse and/or flattening of more than 10% of original unbent, and unpressurized diameter when tested in accordance with 4.6.7.

3.5.8 Tensile Strength: The hose assembly end fittings shall be capable of withstanding the Table 4 specified tensile pull without end fitting pull off or hose parting when tested in accordance with 4.6.8.

TABLE 4 - Minimum Dead Weight Load

Hose Size Code	04	06	08	10	12	16
Load (lb)	60	75	100	125	160	250

3.5.9 Repeated Torque: The hose assembly shall be capable of sealing and withstanding specified proof pressure requirements of 3.5.2 when tested in accordance with 4.6.9.

3.5.10 Chlorine and Detergent Resistance: The hose assembly shall show no evidence of leakage or deterioration from exposure to chlorinated water (500 ppm of chlorine) and detergents when tested in accordance with 4.6.10.

3.5.11 Odor and Taste Test: The hose assembly shall not cause any objectionable odor or taste to water when tested in accordance with 4.6.11.

3.5.12 Burst Pressure: The hose assembly shall not rupture and shall show no evidence of leakage at any pressure up to the burst pressure specified in Table 2 or during the 5-min hold at minimum burst pressure when tested in accordance with 4.6.12.

3.5.13 Flammability: Flammability tests may be witnessed by the purchaser, FAA, or FAA designated Engineering Representative (DER) as applicable.

3.5.13.1 Self Extinguishing: Hose, when tested vertically per 4.6.13, shall meet the self-extinguishing requirements of the Federal Aviation Regulation (FAR) Part 25, Amendment 25-32, Section 25.853(b) as follows:

a. Average self-extinguishing time: 15 seconds (max)
b. Average burn length: 8 inches or less
c. Average extinguishing time for drippings: 5 seconds or less

3.5.14 Water Absorption: Water absorption of the hose inner tube shall not be greater than 0.1% when tested in accordance with 4.6.14.

3.5.15 Fungus Resistance: The hose assembly inner tube shall not show microscopic evidence of fungus growth that would affect performance of intended purpose when tested per 4.6.15.

3.5.16 Inner Tube Adhesion: There shall be no evidence of lifting or separation of the inner tube from the silicone outer lining when subjected to the compression loads of 4.6.16.

NOTE: Shearing or tearing of the silicone outer lining is permitted as a result of the compressive loading applied by the serrated tool.

3.6 Identification of Hose Assembly:

Hose assemblies shall have permanent identification marking on a permanent stainless steel or plastic band, not more than 1.0 inch wide, or on the end fitting. The characters shall be a minimum of 0.064 inch high. The band shall be so designed as to remain tight on the hose to prevent relative movement and resultant chafing and be of sufficient strength to prevent removal by hand. After band installation, a 2.0 inch length of clear polyolefin, per AS1073, shall be heat shrunk to a tight fit over the band. Manufacturing date and "PT" symbol may be electroetched on one end fitting. Optional band material without the polyolefin is plastic (mylar, or equivalent). The identification marking shall show the following:

a. Potable water
b. Manufacturer's name or trademark
c. Complete manufacturer's CAGE number and part number
d. Complete "AS" Standard number
e. Operating pressure 125 psi
f. Pressure test symbol PT
g. Date of hose assembly manufacture in terms of month and year

Items (f) and (g) may be electroetched on one end fitting socket (collar).

3.7 Workmanship:

The hose assembly shall be constructed and finished to produce a product free from all defects which would affect functioning in service. Particular attention shall be given to thoroughness of assembly, alignment of parts, protective finish, and removal of burrs and sharp edges.

3.7.1 Dimensions and Tolerances: All pertinent dimensions and tolerances, where interchangeability, operation, or performance of the hose assembly may be affected shall be as specified on the applicable aerospace standard or drawing.

3.7.2 Cleaning: All hose assemblies shall be clean for use in potable water systems. Cleaning methods may be in accordance with AS611 Class II, except drying temperature shall not exceed 250 °F, or equivalent.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Suppliers Responsibility:

The supplier shall be responsible for performance of all quality assurance provisions and inspections specified herein. Accurate records of the testing shall be kept by the supplier and shall be available to the purchaser on request. The supplier's test data, subject to purchaser approval, shall be considered adequate for product qualification. The purchaser reserves the right to perform any of the inspections and tests set forth in this document to ensure conformance to this document.

4.1.1 Rejection and Retest: Rejected hose or hose assemblies shall not be submitted for reinspection without furnishing full particulars concerning the previous rejection and measures taken to overcome the defects.

4.1.2 Defects on Items Already Accepted: If the investigation of the rejection indicates that the defect or defects causing the rejection may exist in hose assemblies previously supplied to the purchaser, the supplier shall advise the purchaser of this condition, the method for identifying these parts, and the recommended corrective action or disposition of the defective parts.

4.2 User's Responsibility:

The user shall establish adequate inspection procedures to ensure that all requirements of this document are met. Emphasis shall be placed on the following aspects:

a. Dimensional conformance
b. Material, finish, and workmanship
c. Marking
d. Pressure test

4.3 Classification of Inspections:

The examining and testing of the hose assemblies are classified as follows:

a. Qualification inspections
b. Quality conformance inspections

4.4 Qualification Inspections:

The qualification inspections outlined herein are intended to qualify a manufacturer's hose construction and end fitting attachment method only. The configuration of the outlet ports shall be as described on the standard drawing. A number shall be assigned for each attachment method and hose construction used for qualification. The attachment method and hose shall be fully described in the test report by design standard drawings. All other end connections shall also be considered qualified, provided the hose and hose attachment method have not been altered.

4.4.1 Test Specimens: Seven hose assemblies of each hose size shall be used for qualifying performance of the manufacturer's product. For flareless end fitting configurations, the Table 5 standard "AS series" hose assemblies shall be used for qualifying hose assemblies to this document.

TABLE 5 - Test Specimen Configurations

Specimen	Basic Part Number	Hose Assembly Size Code and Specimen - Number 04	Hose Assembly Size Code and Specimen - Number 06	Hose Assembly Size Code and Specimen - Number 08	Hose Assembly Size Code and Specimen - Number 10	Hose Assembly Size Code and Specimen - Number 12	Hose Assembly Size Code and Specimen - Number 16
1	AS4470	-04-0180	-06-0180	-08-0180	-10-0180	-12-0220	-16-0290
2	AS4471	-04-0180	-06-0180	-08-0180	-10-0180	-12-0220	-16-0290
3	AS4469	-04-0180	-06-0180	-08-0200	-10-0200	-12-0240	-16-0240
4	AS4469	-04-0180	-06-0180	-08-0200	-10-0200	-12-0240	-16-0240
5	AS4469	-04-0080	-06-0080	-08-0100	-10-0100	-12-0120	-16-0120
6	AS4469	-04-0080	-06-0080	-08-0100	-10-0100	-12-0120	-16-0120
7	AS4474	E0700-000	G0700-000	H0700-000	J0700-000	K0700-000	M9700-000

4.4.2 Test Schedule and Sequence: The test specimens shall be subjected to qualification tests in the order indicated in Table 6.

TABLE 6 - Test Schedule and Sequence

Test Title	Paragraph Number	Specimen Numbers /1/ 1	Specimen Numbers /1/ 2	Specimen Numbers /1/ 3	Specimen Numbers /1/ 4	Specimen Numbers /1/ 5	Specimen Numbers /1/ 6	Specimen Numbers /1/ 7
1. Examination of Product	4.6.1	X	X	X	X	X	X	X
2. Proof Pressure Test	4.6.2	X	X	X	X	X	X	X
3. Length and Diameter Change Test	4.6.3	X	X					
4. Repeated Freeze Test	4.6.4			X	X			
5. Bend Radius Test	4.6.5	X	X					
6. Proof Pressure Test	4.6.2	X	X	X	X			
7. Hose Droop Test	4.6.6							X
8. Vacuum Test	4.6.7	X	X					
9. Tensile Test	4.6.8			X	X			
10. Repeated Torque Test	4.6.9					X	X	X
11. Proof Pressure Test	4.6.2	X	X			X	X	X
12. Chlorine and Detergent Test	4.6.10	X	X					
13. Odor and Taste Test /3/	4.6.11			X	X			
14. Burst Test	4.6.12	X	X			X	X	X
15. Flammability Test /2/	4.6.13							
16. Water Absorption Test /2/	4.6.14							
17. Fungus Test /2/	4.6.15							
18. Adhesion Test /2/	4.6.16							

/1/ See Table 5 for hose end fitting configuration and length.
/2/ Bulk hose or specimen cut from hose assembly, lengths as specified by applicable test procedure.
/3/ Test needed in one size only.

4.5 Quality Conformance Inspections:

Quality conformance inspections shall consist of the following:

a. Individual tests (100% inspection)
b. Periodic control tests

4.5.1 Individual Tests (Functional Tests): Each production hose assembly shall be subjected to the following:

a. Examination of product per 4.6.1.
b. Proof pressure test per 4.6.2, except 30 seconds duration.

4.5.2 Periodic Control Tests: The following tests shall be performed on three hose assemblies per size selected at random from a production run when the supplier has manufactured an accumulated total of no more than 18 000 linear feet of the hose assemblies, all of one dash size, regardless of hose diameters, made to this document.

a. Proof pressure test per 4.6.2 (all hose assemblies)
b. Repeated freeze test per 4.6.4 (one hose assembly)
c. Bend radius test per 4.6.5 (one hose assembly)
d. Tensile test per 4.6.8 (one hose assembly)
e. Adhesion test per 4.6.16 (one hose sample from each hose lot)

4.6 Test Methods:

4.6.1 Examination of Product: All test specimens, as shown in Table 6, shall be carefully examined to determine dimensional and material compliance with the applicable hose assembly standards or drawing.

4.6.2 Proof Pressure Test: All test specimens, as shown in Table 6, shall be subjected to a proof pressure test at room temperature with clean potable water or the option of air while immersed under water to a proof pressure of 250 psi. Pressure shall be maintained for 5 min. (See 3.5.2.)

4.6.3 Hose Length and Diameter Change Test: Test specimens 1 and 2, as shown in Table 6, shall be placed in a straight, unpressurized position. A standard 10 inch ± .015 length shall be marked off on each hose and the actual gage length recorded. The hose diameter shall be measured at least in three places randomly selected within the 10 inch length and the measurements averaged. The hose assemblies shall then be pressurized to operating pressure and the diameter and gage length measurements again taken in the same location as the first measurement while pressurized. (See 3.5.3.)

4.6.4 Repeated Freeze Test: Test specimens 3 and 4, as shown in Table 6, shall be filled with water. The hose assembly shall then be placed in a cold box stabilized at -65 °F ± 5 for a minimum period of 6 hours. The hose assembly shall be held horizontally and shall then be dropped 4 ft onto a concrete floor. The hose assembly shall then be allowed to reach room temperature at which point the water within the hose assembly shall be checked. Makeup water shall be added where necessary to compensate for hose expansion. The entire freeze test sequence shall be repeated 20 times. After completion of the freeze cycles, the hose assembly shall then be proof pressure tested per 4.6.2. (See 3.5.4.)

4.6.5 Bend Radius Test: Hose specimens 1 and 2, as shown in Table 6, shall be subjected to a bend radius test. The test shall be conducted at both low and high temperature. After conditioning the hose for at least 4 hours at specified temperature, the hose shall be removed from the conditioning chamber and immediately bent approximately 180° around a mandrel having a diameter equal to two times the minimum bend radius given in Table 2. The hose shall then be straightened, rotated 180°, and bent in the opposite direction for approximately 180° around the mandrel. Each specimen shall then be proof pressure tested per 4.6.2. (See 3.5.5.)

4.6.6 Hose Droop Test: Hose specimen 7, as shown in Table 6, shall be completely filled with water and capped in an unpressurized condition. The hose shall be mounted horizontally and shall be supported at 20-inch intervals with loop type support clamps. Without any external axial loads being applied to the hose, the maximum hose droop between supports shall be measured as shown in Figure 1. (See 3.5.6.)

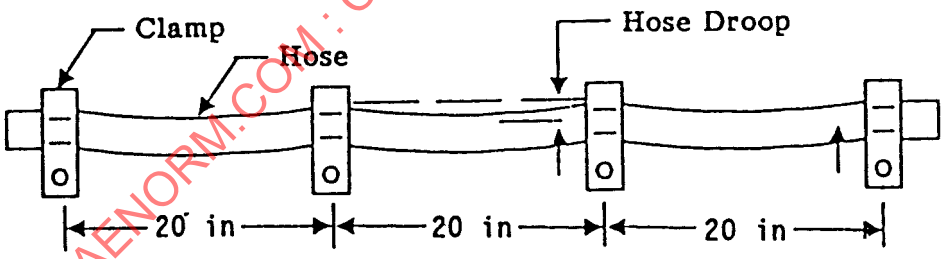

FIGURE 1 - Hose Droop

4.6.7 Vacuum Test: The hose assemblies shall be bent and maintained during test to the minimum bend radius specified in Table 2. Test specimens 1 and 2, as shown in Table 6, shall be conditioned at 160 °F ± 5 (71 °C ± 3) for at least 10 min. A suitable vacuum pump shall be used to evacuate the hose to a negative pressure equivalent to 22 inches of mercury. Negative pressure shall be maintained for not less than 10 min. (See 3.5.7.)

4.6.8 Tensile Test: A dead weight load (Table 4 and 3.5.8) shall be applied to hose and fittings of specimens 3 and 4, as shown in Table 6.