SAE Aerospace
An SAE International Group

AEROSPACE STANDARD

AS1424	REV. F

Issued 1989-11
Revised 2006-09

Superseding AS1424E

(R) Hose Assemblies, Metal, Medium Pressure, High Temperature

RATIONALE

This specification is being revised to Revision F for the purpose of reducing the high temperature from 850 to 800 °F, revise the high temperature operating pressures to reflect actual material strengths, removal of the Strauss test, addition of a recommended usage for the noted hose assembly classes, addition of missing test parameters for clarification purposes, and to bring the specification into conformance with current aerospace usage requirements.

1. SCOPE

This SAE Aerospace Standard (AS) covers medium-pressure, high-temperature, flexible, metal-hose assemblies suitable for operation in pneumatic systems up to 800 °F with excursion to 1200 °F for Class “B” and “N” and primarily for use on jet aircraft power plants. Refer to 1.2.1 for recommended usage.

1.1 Types

a. Type 1: Convoluted helical inner tube

b. Type 2: Convoluted annular inner tube.

NOTE: Unless otherwise specified on a design activity controlled drawing, or contract, Type 1 or Type 2 inner tube construction may be supplied.

1.2 Classes

Hose assemblies furnished under this document may be of the following classes. If no class is defined the class “S” shall be utilized.

a. Class "A": Corrosion resistant Type 321 convoluted inner tube and nickel alloy Type 625 or 718 fitting components.

b. Class "B": Nickel alloy Type 625 convoluted inner tube and nickel alloy Type 625 or 718 fitting components

c. Class "N": Nickel alloy Type 625 convoluted inner liner and corrosion resistant Type 321 or 347 fitting components.

d. Class "S": Corrosion resistant Type 321 convoluted inner liner and corrosion resistant Type 321 or 347 fitting components.

NOTE: Refer to Table 1 for specific fitting material definition.

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
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1.2.1 Recommended Usage

a. Class “A” and “S” hose assemblies are recommended for continuous service use in static applications up to 800 °F maximum.

b. Class “B” and “N” hose assemblies are recommended for continuous service use in both static and dynamic flexure applications at continuous temperature up to 800 °F with excursions to 1200 °F within the pressure limits as defined in Figure 2.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

AMS 2759 Heat Treatment of Steel Parts General Requirements

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 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 5581 Nickel Alloy, Corrosion and Heat Resistant, Seamless or Welded Tubing, 62Ni 21.5Cr 9.0Mo 3.7Cb, Annealed (SAE 06625)

AMS 5589 Nickel Alloy, Corrosion and Heat Resistant, Seamless Tubing 52.5Ni 19Cr 3.0Mo 5.1Cb 0.9Ti 0.5Al 18Fe Consumable Electrode or Vacuum Induction Melted, 1775°F (968°C), Solution Heat Treated (UNS N07718)

AMS 5645 Steel Bars, Forging, Tubing, and Rings, Corrosion Resistant, 18Cr-10Ni- 0.40Ti, Solution Heat Treated (SAE 30321)

AMS 5646 Steel Bars, Forging, Tubing, and Rings, 18Cr-11Ni-0.60 (Cb+Ta), Solution Heat Treated (SAE 30347)

AMS 5662 Nickel Alloy, Corrosion and Heat Resistant, Bars, Forgings, and Rings 52.5Ni 19Cr 3.0Mo 5.1Cb 0.9Ti 0.5Al 18Fe Consumable Electrode or Vacuum Induction Melted, 1775°F (968°C), Solution Heat Treated, Precipitation Hardenable (UNS N07718)

AMS 5663 Nickel Alloy, Corrosion and Heat Resistant, Bars, Forgings, and Rings 52.5Ni 19Cr 3.0Mo 5.1Cb 0.9Ti 0.5Al 18Fe Consumable Electrode or Vacuum Induction Melted, 1775°F (968°C), Solution and Precipitation Heat Treated (UNS N07718)

AMS 5666 Nickel Alloy, Corrosion and heat Resistant, Bars, Forgings, Extrusions and Rings, 62Ni 21.5Cr 9.0Mo 3.65 (Cb+Ta) (SAE 06625), Annealed

AMS 5680 Steel, Corrosion and Heat Resistant, Welding Wire, 18.5Cr-11Ni-0.40Cb (SAE 30347)

AMS 5689 Steel, Corrosion and Heat Resistant, Wire, 18Cr-10.5Ni-0.40Ti, Solution Heat Treated (SAE 30321)

AMS 5832 Nickel Alloy, Corrosion and Heat Resistant Welding Wire, 52.5Ni 19Cr 3.0Mo 5.1Cb 0.90Ti 0.50Al 18Fe Consumable Electrode or Vacuum Induction Melted

AMS 5837 Nickel Alloy, Corrosion and Heat Resistant, Welding Wire, 62Ni-21.5Cr-9.0Mo- 3.7Cb (SAE 06625)

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

AS4375 Fitting End - Flareless, Design Standard

AS4395 Fitting End - Flared Tube Connection, Design Standard

ARP908 Hose Fitting - Installation and Qualification Test Torque Requirements

ARP1835 Preparation for Delivery, General Requirements for Hose Assemblies

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

AS21921 Nut-Sleeve Coupling, Flareless

AS85421 Fittings, Tube, Fluid Systems, Separable, Beam Seal, 3000/4000 psi, General Specifications for

2.1.2 ASTM Publications

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

ASTM A 262 Detecting Susceptibility to Intergranular Attack on Stainless Steel

ASTM A 580 Stainless and Heat-Resistant Steel Wire - Type 321 or 347, Condition A

ASTM B 444 Nickel-Chromium-Molybdenum-Columbium Alloys, Pipe and Tube (UNS 06625)

2.1.3 NAS Publications

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

NAS847 Caps and Plugs, Protective, Dust and Moisture Seal

NAS1760 Fitting End, Flareless Acorn, Standard Dimensions for

2.1.4 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/.

MIL-STD-810 Environmental Test Methods

MIL-HDBK-831 Preparation of Test Reports

2.1.5 PRI Publications

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

PD2001 Qualified Product Management Council Procedures for Qualified Products Group

PD2101 Aerospace Quality Assurance, Product Standard, Qualification Procedures, Fluid Systems

2.1.6 AWS Publications

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

AWS A5.9 Corrosion-resisting chromium & chromium-nickel steel bare & composite metal cored & standard arc welding electrodes & rods

AWS A5.14 Nickel & nickel alloy bare welding rods and electrodes

AWS D17.1 Specification for Fusion Welding for Aerospace Applications

2.1.7 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.

ASME Y14.100 Engineering Drawing Practices

2.2 Hose Assembly Procurement Documents

Refer to AS1424SUP1 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 defined in SUP1 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). When this procurement specification is specified on design activity controlled drawings, the approved sources of supply shall be defined by the design activity.

3.2 Material

The hose assembly materials shall be uniform in quality, free from defects, suitable for use in continuous ambient and/or fluid temperatures up to 800 °F with temperature excursions up to 1200 °F for class “B” and “N”, consistent with good manufacturing practices, and in conformance with the applicable specifications and the requirements specified herein. Materials used in these hose assemblies shall be selected from those listed in Table 1. Inner tube physical properties may vary from the requirements of Table 1 as required to achieve a convoluting grade of material.

TABLE 1 - HOSE ASSEMBLY MATERIALS

Component	Material Description	Specification
Flexible metal hose inner tube	Class "A" or "S" - 321 corrosion resistant steel	AMS 5557 or AMS-QQ-S-763
	Class "B" or "N" - nickel alloy Type 625	AMS 5581 or ASTM B 444
Hose reinforcement wire	321 corrosion resistant steel	ASTM A 580 or AMS 5689
Braid retainers	321 or 347 corrosion resistant steel	AMS 5556, AMS 5557, AMS 5570, AMS 5571, AMS 5645, AMS 5646, or AMS-QQ-S-763
All fitting components	Class "A" or "S" - corrosion resistant steel Type 321 or 347	AMS 5556, AMS 5557, AMS 5570, AMS 5571, AMS 5645, AMS 5646, or AMS-QQ-S-763
	Class "B" or "N" - nickel alloy Type 625 or 718	AMS 5581, AMS 5589, AMS 5662, AMS 5663, or AMS 5666
Nut retaining wire	321 or 347 corrosion resistant steel	ASTM A 580 or AMS-QQ-S-763
Identification bands	300 series corrosion resistant steel	AMS-QQ-S-763

NOTE: Other fitting materials may be qualified providing they meet all of the applicable performance requirements of this specification.

3.3 Design and Construction

The hose assembly shall consist of a seamless, or welded and redrawn convoluted, stabilized, corrosion-resistant alloy, pressure-carrying tube, uniform in size and wall thickness; reinforced with stabilized, corrosion-resistant steel, braided wire and having stabilized, corrosion-resistant alloy end fittings and nuts. End fittings shall be attached to the hose by welding.

3.3.1 End Fitting

All standard end fittings shall be a single piece construction from the mating surface to the convoluted tube attachment fitting. If welding is required in construction, welded butt joints shall be used. Fittings shall conform to applicable requirements in Tables 1 and 2. Standard hose assemblies shall have flared end fitting outlet design to mate with AS4395, flareless end fitting outlet dimensional design per NAS1760 to mate with AS4375, or beam seal end fitting outlet design to mate with AS85421, as applicable.

3.3.1.1 Coupling Nuts

When required, AN818, AS21921, or AS4370 type coupling nuts or functional equivalents shall be used. Wire retained coupling nuts, when used, shall have the retaining wire inserted in a clockwise direction when viewed from the open end of the nut.

3.3.1.2 Screw Threads

All fitting threads shall be Class 3 in accordance with AS8879 (ISO 3161). A thread tolerance increase of 10% after assembly or testing shall not be a cause for rejection.

3.3.2 Hose

3.3.2.1 Inner Tube Construction

The inner tube shall be either a Type 1 Helical, or a Type 2 Annular convoluted flexible tube design, made from seamless, or butt-welded and redrawn tubing. Tubing shall be uniform in size and quality and free from pitting, excessive die marks, and other defects. There shall be no inner tube splices on hose assemblies 3 ft in length or less. One splice is allowed for each additional 3 ft increment of hose assembly length. Splices are undesirable but if required, shall be low profile welds in accordance with 3.3.3 and Figure 1. After welding, the convolutes shall be closed as shown in Figure 1.

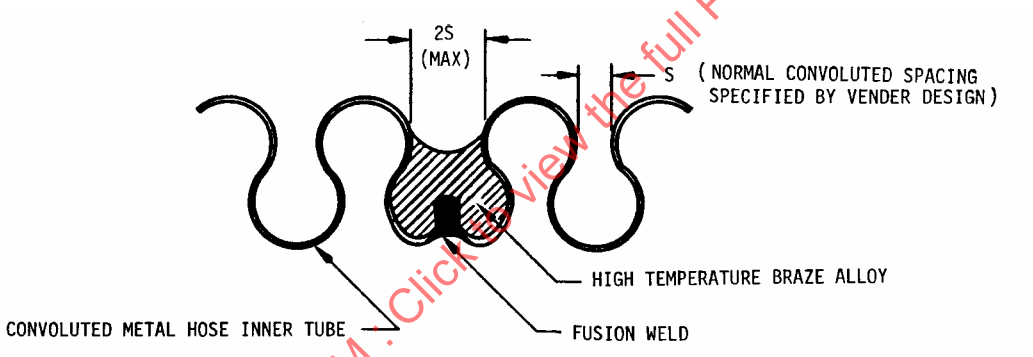


FIGURE 1 - INNER TUBE SPLICE CONFIGURATION

3.3.2.2 Braid

Braid shall be of corrosion-resistant steel wire braided in such a manner as to meet the requirements of this document. There shall be no splices allowed in the braid wire.

3.3.3 Welding

All pressure welds shall be fusion welds per AWS D17.1 Class B and braid attachment weld shall be per Class C. Equivalent or other comparable welding specifications may be substituted on prior approval by the purchaser. Filler wire, if used, shall be per AMS 5680 (Type 347) or AWS 5.9 Class ER347, for welding stainless steel components, and AMS 5837 (nickel alloy), or AWS A5.14 Class ERNiCrMo-3, for welding nickel alloy to nickel alloy, or nickel alloy to stainless steel components. If welding nickel alloy 718 to nickel alloy 718, AMS 5832 nickel alloy filler wire shall be used.

NOTE: When welding CRES 347 material to any other stainless steel, or nickel alloy, material component, appropriate filler wire material shall be used. Any exception to this requirement shall require prior approval from the approval activity based on submittal of appropriate design and process documentation.

3.3.4 Heat Treatment

If stress relieving of stainless steel alloy is required to meet the corrosion test requirements, the weld joints may be stress relieved per AMS 2759 as applicable.

3.4 Dimensions and Weights

3.4.1 Dimensions

Hose assembly dimensions, except for length, shall be as specified in Table 2.

TABLE 2 - HOSE AND FITTING DIMENSIONS

Hose Size	Rigid Tube OD (Ref)	Hose ID Min	Hose OD Max	Straight Fitting Bore Min	Spherical Ball Size for Determining Minimum Hose Assembly ID1 Straight Fitting	Spherical Ball Size for Determining Minimum Hose Assembly ID1 Elbow Fitting
04	.250	.23	.56	.141	.127	.120
05	.312	.28	.63	.197	.177	.167
06	.375	.34	.70	.250	.225	.212
08	.500	.45	.86	.360	.324	.306
10	.625	.57	1.00	.455	.410	.387
12	.750	.70	1.15	.568	.511	.483
16	1.000	.95	1.45	.760	.684	.646
20	1.250	1.20	1.75	.920	.828	.782

1. Minimum specified inside diameter through the hose assembly shall be verified by passing the applicable, or larger spherical ball through the assembly.

3.4.2 Assembly Length and Tolerance

Hose assembly length shall be as specified on the applicable procurement standards or drawing. Flareless hose assemblies with NAS1760 type end terminations shall be measured from gage point to gage point.

Assembly length tolerance shall be as follows:

a. ±.062 in for lengths under 10 in

b. ±.125 in for lengths from 10 to 36 in exclusive

c. ±.250 in for lengths from 36 to 50 in exclusive

d. ±1% for lengths of 50 in and over

3.4.3 Hose Weight

Hose consisting of inner tube and reinforcement shall not exceed the maximum weight noted in Table 3.

TABLE 3 - HOSE WEIGHT, BEND RADIUS, AND PRESSURES REQUIREMENT

Hose Size	Tube Size (Ref)	Hose Weight Max lb/in	Minimum Centerline Bend Radius Static	Minimum Centerline Bend Radius Flexing	Operating Pressure psig Nom Room Temp[1]	Proof Pressure psig Nom Room Temp	Burst Pressure psig Min Room Temp[1]
04	.250	.016	2.00	4.00	2000	3000	8000
05	.312	.018	2.50	5.00	1800	2700	7200
06	.375	.020	3.00	6.00	1600	2400	6400
08	.500	.028	4.00	8.00	1400	2100	5600
10	.625	.038	4.50	9.00	1200	1800	4800
12	.750	.042	5.00	10.00	1050	1575	4200
16	1.000	.058	6.00	12.00	800	1200	3200
20	1.250	.072	7.00	14.00	550	825	2200

NOTES:
1. For pressure rating at other elevated temperatures, multiply data in table by percentage factor from Figure 2 (expressed in decimal equivalent) for desired temperature level.
2. Unless otherwise specified, pressure values shall have a tolerance of ±5%.

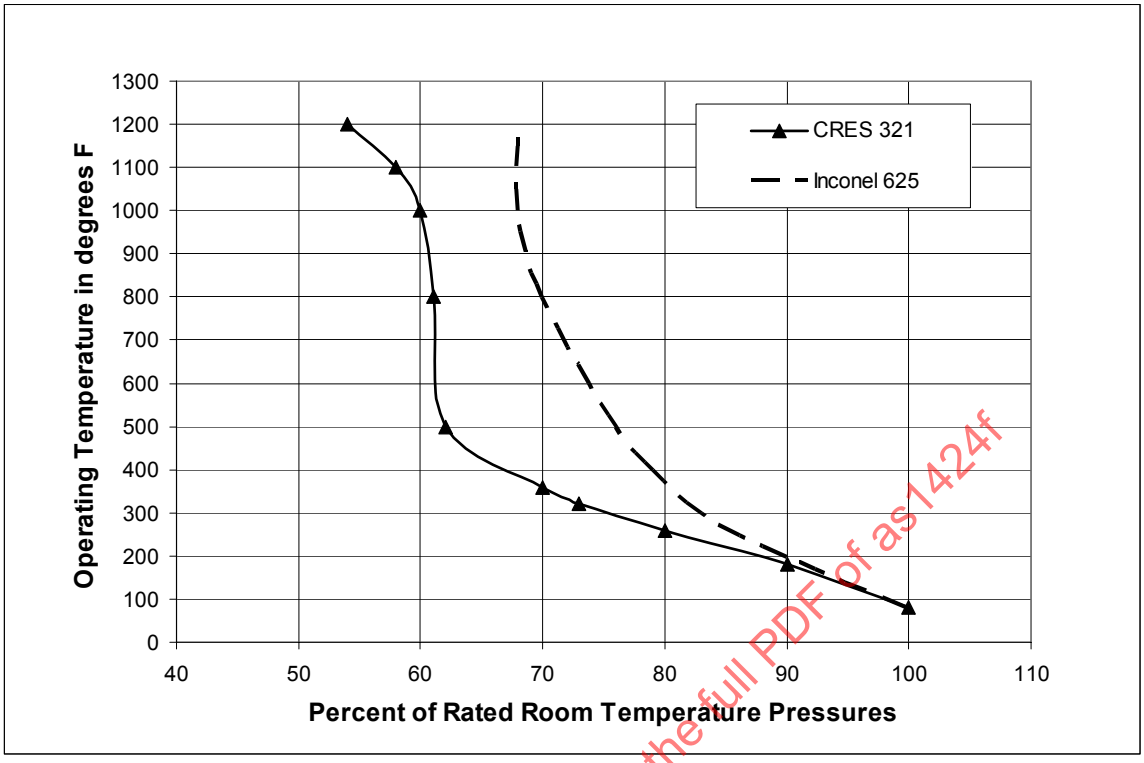


FIGURE 2 - PRESSURE CORRECTION AT ELEVATED TEMPERATURES

TABLE 4 - TEST PRESSURE REQUIREMENT AT 800 °F TEMPERATURE

Hose Size	Tube Size (Ref)	Operating Pressure psi Nom[1]		Burst Pressure psi Min	
		Class A / S	Class B / N	Class A / S	Class B / N
04	.250	1220	1400	4880	5600
05	.312	1098	1260	4392	5040
06	.375	976	1120	3904	4480
08	.500	854	980	3416	3920
10	.625	732	840	2928	3360
12	.750	640	735	2562	2940
16	1.000	488	560	1952	2240
20	1.250	336	385	1342	1540

1. Unless otherwise specified, operating pressure values shall have a tolerance of ±5%.

3.5 Performance

The hose assembly minimum bend radius and operating, proof, and burst pressure ratings, as shown in Table 3, shall be verified by demonstration of meeting or exceeding the following performance requirements through qualification testing as specified herein. Compliance with performance requirements shall be maintained by adherence to the quality assurance provisions as specified herein.

3.5.1 Examination of Product

Each assembly must conform dimensionally and materially to the applicable standard or drawing and to all requirements of this document, when examined in accordance with 4.6.1.

3.5.2 Proof Pressure

The hose assembly shall withstand the applicable room temperature proof pressure specified in Table 3, without leakage or evidence of permanent deformation or malfunction that would affect hose assembly installation or removal, when assembled with torque values per ARP908 or AS85421, as applicable, and tested in accordance with 4.6.2.

3.5.3 Corrosion Test

The hose assembly shall be capable of withstanding the proof pressure requirements of 3.5.2 after corrosion testing in accordance with 4.6.3.

3.5.4 Vibration

The hose assembly shall have no broken braid wire and shall be capable of withstanding, without leakage, the proof pressure requirements of 3.5.2 after vibration testing in accordance with 4.6.4.

3.5.5 Flexure and Pressure Cycling Endurance

The hose assembly shall have no broken braid wire and shall be capable of maintaining operating pressure after 50,000 combination flexure and pressure cycles in accordance with 4.6.5

3.5.6 Repetitive Assembly Torque

The fitting shall withstand repetitive assembly tightening torque when tested in accordance with 4.6.6. There shall be no leakage, galling, or other malfunction of the fitting nut and sealing interface connection.

3.5.7 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 3, when tested in accordance with 4.6.7.

3.5.8 High Temperature Torque Test

Solid film lubricated, or silver plated, fitting ends shall not exhibit galling when tested in accordance with 4.6.8.

3.6 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 requirements of ASME Y14.100 shall govern the manufacturer's part number and changes thereto.

3.7 Identification of Product

The hose assemblies shall be marked for identification in accordance with the following:

3.7.1 Fittings

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

3.7.2 Assemblies

The hose assemblies shall have all identification marking permanently marked on one end fitting or on a permanently attached corrosion-resistant steel band not more than 1.00 in wide. The marking shall include, but is not limited to, the following:

a. Manufacturer's name or trademark and "CAGE" code

b. Complete hose assembly part number

c. Complete "AS" standard number or specification control number

d. "PSI OPR at 800 °F" (Refer to Table 4)

e. "PSI OPR at 70 °F" (Refer to Table 3)

f. Pressure test symbol "PT"

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

h. Hose inner tube manufacturer’s CAGE code (required only when hose inner tube manufacturer is different than hose assembly manufacturer).

3.8 Workmanship

The hose assembly, including all parts, shall be constructed and finished in a thoroughly workmanlike manner. All surfaces shall be free from burrs.

3.8.1 Dimensions and Tolerances

All pertinent dimensions and tolerances, where interchangeability, operation or performance of the hose assembly may be affected, shall be specified on the applicable "AS" standard or drawing.

3.8.2 Cleaning

The hose assemblies shall be cleaned according to the general commercial practice of the manufacturer to remove oil, grease, dirt or any other foreign material, both internally or externally to the hose unless otherwise specified on standard or drawing.

4. QUALITY ASSURANCE PROVISIONS

4.1 Supplier's Responsibility

The supplier is responsible for the performance of all quality assurance provisions as specified herein. Accurate records of the testing shall be kept by the supplier and shall be available to the purchaser for inspection, on request.

4.1.1 Rejection and Retest

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

4.1.1.1 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 contractor shall advise the purchaser of this condition, the method for identifying these parts and the 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. Configuration and end fitting conformance

b. Length

c. Marking

d. Pressure test

4.3 Classification of Inspections

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

a. Qualification inspections

b. Quality conformance inspections

4.4 Qualification Inspections

The qualification inspections outlined herein are intended to qualify a manufacturer's hose class, fitting attachment method, and end fitting construction and outlet design. The hose construction and attachment method used for qualification shall be fully described by the hose assembly manufacturer design standard drawing number and be included in the test report.

All test specimens for each hose size are required for qualifying each of the fitting attachment methods and for each type of end fitting construction and outlet design. Satisfactory completion of qualification on these hose assemblies shall also constitute qualification approval on other hose assemblies that have an identical hose construction, fitting attachment method, and end fitting outlet design.

4.4.1 Test Specimens

Seven flexible metal hose assemblies of each size shall be used for qualifying performance of the manufacturer's product. They shall be standard "AS" series hose assemblies, as defined in Table 5, fabricated according to the manufacturer's assembly drawing(s).

If a supplier qualifies one end fitting outlet design and at a later date desires to qualify another end fitting outlet design, qualification testing to the requirements of 4.4.1.1 shall be performed.

TABLE 5 - TEST SPECIMEN CONFIGURATIONS

Specimen No.	Hose Assembly Type	Hose Nominal Tube Size .250	Hose Nominal Tube Size .312	Hose Nominal Tube Size .375	Hose Nominal Tube Size .500	Hose Nominal Tube Size .625	Hose Nominal Tube Size .750	Hose Nominal Tube Size 1.00	Hose Nominal Tube Size 1.25
1	Str.-Str.	L_1[1]	L_1[1]	L_1[1]	L_1[1]	L_1[1]	L_1[1]	L_1[1]	L_1[1]
2	Str.-Str.	L_1[1]	L_1[1]	L_1[1]	L_1[1]	L_1[1]	L_1[1]	L_1[1]	L_1[1]
3	Str.-90°	12 in	12 in	12 in	12 in	12 in	12 in	12 in	12 in
4	Str.-90°	12 in	12 in	12 in	12 in	12 in	12 in	12 in	12 in
5	Str.-Str.	L_2[2]	L_2[2]	L_2[2]	L_2[2]	L_2[2]	L_2[2]	L_2[2]	L_2[2]
6	Str.-Str.	L_2[2]	L_2[2]	L_2[2]	L_2[2]	L_2[2]	L_2[2]	L_2[2]	L_2[2]
7	Str.-Str.	L_2[2]	L_2[2]	L_2[2]	L_2[2]	L_2[2]	L_2[2]	L_2[2]	L_2[2]

1. Hose assembly length equal to dimension "L1" of Table 7.
2. Hose assembly length equal to dimension "L2" of Table 7.

4.4.1.1 Additional Fitting Outlet Designs

If qualification approval is desired for other type end fitting outlet designs, two additional hose assemblies, utilizing the same hose construction design and fitting attachment method previously qualified, shall be subjected to the following tests in the sequence a through d as indicated. The hose assemblies shall be 12 in length from fitting end to fitting end and incorporate straight to straight fitting construction. If high temperature torque testing is also required, three additional fittings of any size shall be subjected to the testing as noted in e.

a. Examination of product (see 4.6.1)

b. Proof pressure test (see 4.6.2)

c. Repetitive assembly torque test (see 4.6.6)

d. Room temperature burst test (see 4.6.7)

e. High temperature torque test (see 4.6.8)

4.4.2 Test Schedule and Sequence

The test specimens shall be subjected to qualification tests in the order indicated in Table 6 (from left to right):

TABLE 6 - TEST SCHEDULE AND SEQUENCE FOR QUALIFICATION TESTING

Specimen No.	Examination of Product 4.6.1	Proof Pressure 4.6.2	Corrosion Test 4.6.3	Proof Pressure 4.6.2	Vibration 4.6.4	Proof Pressure 4.6.2	Flexure Pressure Cycling Endurance 4.6.5	Repeated Torque 4.6.6	Proof Pressure 4.6.2	Burst Pressure 4.6.7
1	x	x			X [2]	x		x	x	x[1]
2	x	x			X [2]	x				x[1]
3	x	x						x	x	x
4	x	x						x	x	x
5	x	x	x	x	X [2]	x	x[1]			
6	x	x	x	x			x			
7	x	x					x			

1. The assemblies need not meet minimum requirements but all data should be accurately recorded and included in the report.
2. Vibration testing of Class “B” / “N” hose assembly size is not required if the hose construction design and fitting attachment method is identical to a previously tested and qualified Class “A” / “S” hose assembly size. Qualification test results shall note the prior Class “A” / “S” test report for reference purposes.

4.4.3 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 written using MIL-HDBK-831 as a guideline and shall include a report of all tests and outline description of the tests and conditions.

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

c. Drawings: Three sets of assembly drawings. The assembly drawings may have a cut-away section showing all details in their normal assembly position and shall define all details and subassemblies. In addition, the assembly drawing(s) shall define the type of hose assembly inner tube design, as defined in 1.1, that is being supplied.

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

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

4.5 Quality Conformance Inspections

Quality conformance inspections shall consist of the following:

a. Individual tests (100% inspection)

b. Sampling tests

c. Periodic control tests

4.5.1 Individual Tests (Functional Tests)

Each hose assembly shall be subjected to the following:

a. Examination of product

b. Proof pressure test

4.5.2 Sampling Tests

The following tests shall be performed on one straight to straight, 12 inch length, hose assembly, fabricated from bulk inner liner, and braid, selected at random from a production run, when the supplier has manufactured an accumulated total of approximately, but no more than, 3000 hose assemblies all of one dash number size in each class A/S or class B/N, as applicable, manufactured under essentially the same condition, but not necessarily during one continuous run. For limited production, testing shall be conducted within 30 calendar days of the end of a three year period as defined in PD2101.

a. Proof pressure test per 4.6.2

b. Burst test per 4.6.7

4.5.3 Periodic Control Tests

The flexure pressure cycling test in Table 6 shall be performed according to 4.6.5 except the test may be conducted at room temperature on two straight to straight hose assemblies, fabricated from bulk inner liner, and braid, selected at random from a production run, when a supplier has manufactured an accumulated total of approximately, but no more than, 5000 hose assemblies all of one dash number size in each class A/S or class B/N, as applicable, manufactured under essentially the same condition, but not necessarily during one continuous run. For limited production, testing shall be conducted within 30 calendar days of the end of a three year period as defined in PD2101.

4.6 Test Methods

4.6.1 Examination of Product

Hose assemblies shall be visually and dimensionally inspected to determine compliance with the applicable hose assembly standard and examined for compliance with requirements of 4.3.

4.6.2 Proof Pressure Test

Hose assemblies shall be proof pressure tested under water at room temperature to the applicable pressures of Table 3 using air or nitrogen as test medium. Pressure shall be held 5 min minimum. All hose assemblies shall be thoroughly dried after testing. For individual tests (functional tests) only, the pressure shall be held 1 min minimum.

4.6.3 Corrosion Test

Test specimens 5 and 6, as shown in Table 6 shall be subjected to a corrosion test as follows:

a. Pressurize the hose assembly to the room temperature operating pressure listed in Table 3 and maintain the pressure for steps b through d.

b. Immerse in 3.5% ± 0.1% NaCl solution by weight for 8 to 10 min.

c. Air dry for remainder of 1 h at room temperature.

d. Repeat b and c for a total of 50 times.

e. Proof test assemblies according to 4.6.2.

f. Without removing salt or cleaning hose, continue testing according to Table 6 sequence.

4.6.4 Vibration Test

Test specimens 1, 2, and 5, as shown in Table 6, shall be subjected to the vibration test. The test specimens shall be mounted as shown in Figures 3 and 3A and pressurized with air or nitrogen to operating pressure per Table 4 at a temperature of 800 °F. Hose temperature must be stabilized at 800 °F ± 25 °F. One end of the specimen shall be fixed and the other end vibrated. Vibration shall be induced in three mutually perpendicular axes, one axis at a time, as follows:

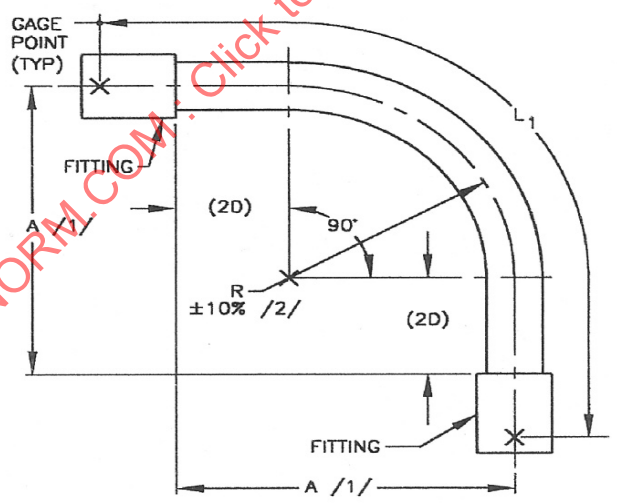
a. One axis parallel to the plane of the specimen and the centerline of the free end fitting.

b. One axis parallel to the plane of the specimen and the centerline of the fixed end fitting.

c. One axis perpendicular to the plane of the specimen.

The vibration testing consists of three parts: (1) resonance search, (2) resonant dwell, and (3) sinusoidal cycling. This testing shall be conducted in the indicated order. The required vibration test envelope is:

5 - 30 Hz:	±0.015 in
30 - 53 Hz:	±1.5G
53 - 100 Hz:	±0.005 in
100 - 350 Hz:	±5.0G
350 - 490 Hz:	±0.0004 in
490 - 1000 Hz:	±10.0G



Refer to Table 7 for L_1 Dimensions
/1/ Refer to Table 8 for A Dimensions

FIGURE 3 - VIBRATION TEST (4.6.4)
(TEST SPECIMENS NO. 1 & 2)