INCH-POUND
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30 January 2007
SUPERSEDING
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DETAIL SPECIFICATION

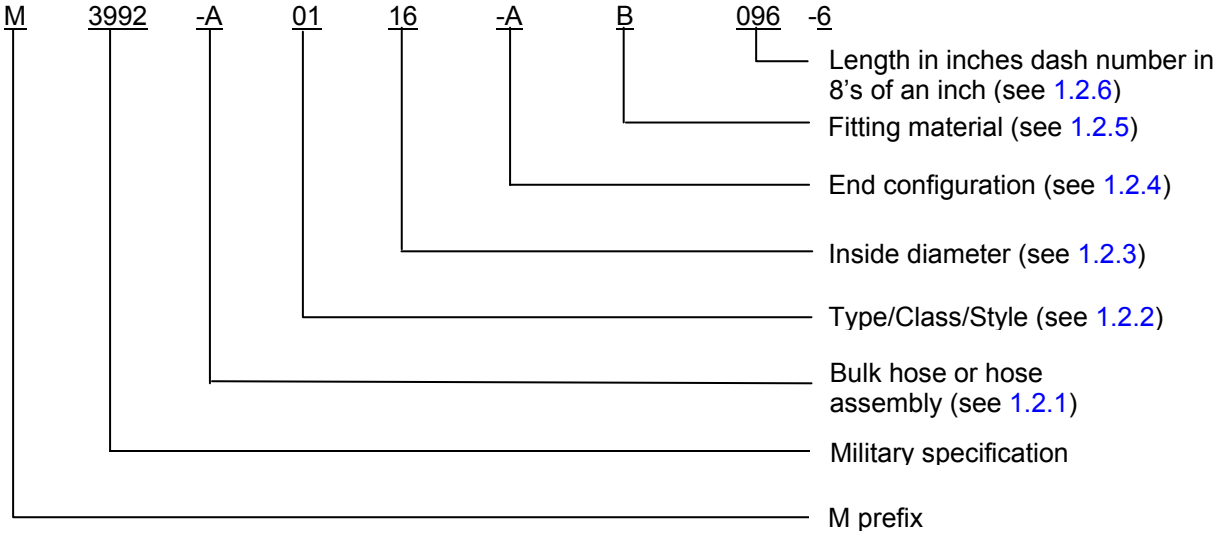
HOSE AND HOSE ASSEMBLY, RUBBER, AIR AND VACUUM BRAKE, SYSTEMS

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the construction, performance, and quality requirements of hose and hose assembly, rubber, air and vacuum brake systems intended for use as flexible connections on automotive air and vacuum brake systems in a temperature range from -60°F to +200°F (-51.1°C to +93.3°C), inclusive (see 6.1).

1.2 Part or Identifying Number (PIN). The PIN includes a "M" prefix, general specification number, followed by a dash, a letter for either a hose assembly or bulk hose, a two digit number for type/class/style, a two digit number for the inside diameter (ID), a dash and a letter for couplings if applicable, a letter for fitting material if applicable, and a three digit number for the length in inches. The PIN for 3/8 inch (.375 inch) (9.53 mm) air and vacuum hose assemblies are contained in MS39325. The PIN for bulk hose and hose assemblies acquired to this specification are composed as follows:



Comments, suggestions, or questions on this document should be addressed to: Defense Supply Center, Columbus, Attn: VAI, P.O. Box 3990, Columbus, OH 43218-3990, or emailed to Construction@dscc.dla.mil. Since contact information can change you may want to verify the currency of this address information using the ASSIST Online database at http://assist.daps.dla.mil.

1.2.1 Bulk hose or hose assembly.

A - Hose assembly.
B - Bulk hose.

1.2.2 Type, class, style. See table I for configurations available.

TABLE I. Type/class/style codes for PIN.

Designator	Type (see 1.2.2.1)	Class (see 1.2.2.2)	Style (see 1.2.2.3)
01	I	1	
02	I	2	
03	I	3	
04	I	4	
05	II		A
06	II		B

1.2.2.1 Type. The types of brake hoses are as follows:

I - Air brake hose.
II - Vacuum brake hose.
a. Light wall vacuum brake hose: 7/32, 11/32, and 15/32 inch.
b. Heavy wall vacuum brake hose: 1/4, 3/8, 1/2, 5/8, 3/4, and 1 inch.

1.2.2.2 Class. Type I hose to be furnished in the following classes:

1 - Mandrel-built, reinforced with cotton or synthetic fiber yarn.
2 - Non-mandrel-built, reinforced with cotton or synthetic fiber yarn.
3 - Mandrel-built, reinforced with one braid of high tensile steel wire.
4 - Mandrel-built, reinforced with two cotton or synthetic fiber yarn braids separated by a high tensile steel wire braid.

1.2.2.3 Style. Type II hose to be furnished in the following styles:

A - Heavy duty.
B - Light duty.

1.2.3 Inside diameter (ID). See table II for type I and table III for type II hose (see 1.2.2.1).

TABLE II. Type I inside diameters (ID).

ID designator	6	8	10	12	13	14	16	20
Inch/fraction	3/16	1/4	5/16	3/8	13/32	7/16	1/2	5/8
Inch/decimal	.188	.250	.313	.375	.406	.438	.500	.625
Metric (mm)	4.76	6.35	7.94	9.53	10.32	11.113	12.70	15.88

TABLE III. Type II inside diameters (ID).

ID designator	7	8	11	12	15	16	20	24	32
Inch/fraction	7/32	1/4	11/32	3/8	15/32	1/2	5/8	3/4	1
Inch/decimal	.219	.250	.344	.375	.469	.500	.625	.750	1.00
metric (mm)	5.56	6.35	8.73	9.53	11.91	12.70	15.88	19.05	25.40

The ID designator is calculated as follows:

Use the formula: $X \bullet 32 = Y$

X - inch/decimal number of ID required.
Y- ID designator.

When a 1/2 inch (.5 inch) ID is required the designator is figured as follows:

$.5 \bullet 32 = 16$

Designator would be 16.

1.2.4 End configuration (see figure 1).

A - One male/one female fitting
B - Female fittings, both ends.
Blank - Bulk hoses.

1.2.5 Fitting material.

B - Brass
S - Steel cadmium plated.
T - Steel zinc plated
Blank - Bulk hoses.

1.2.6 Length bulk hose or assembly length in inches. Lengths of hose are represented by inches and fractions are expressed in 1/8 inch increments (1 thru 7).

Note: For the inch designator insert the number zero in front of designator for lengths less than 100 inches.

Examples:

When 12 and 7/8 inch length is required the designator is: 012-7.

When 120 and 3/8 inch length is required the designator is: 120-3.

When 96 inches is required the designator is: 096.

PIN examples:

M3992-A0116-AB096 defines a MIL-DTL-3992 type I, class 1 hose assembly with a 1/2-inch ID that has brass male/female fittings and is 96 inches in length.

M3992-B0104 defines a MIL-DTL-3992 type I, class 1 bulk hose with a 1/4-inch ID and is 10.5 inches in length.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3, 4, or 5 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

FEDERAL SPECIFICATIONS

A-A-52484	-	Coupler, Automotive Air Brake Line: Quick Disconnect

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-130	-	Identification Marking of U.S. Military Property
MS39133	-	Adapter, Straight, Pipe to Hose, Automotive Air Brake Hose
MS39325	-	Hose Assemblies; Air Brake

(Copies of these documents are available online at http://assist.daps.dla.mil/quicksearch/ or http://assist.daps.dla.mil or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the cited in the solicitation or contract.

ASTM INTERNATIONAL

ASTM B633	-	Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
ASTM D380	-	Standard Test Methods for Rubber Hose (DOD Adopted)
ASTM D471	-	Standard Test Method for Rubber Property - Effect of Liquids
ASTM D622	-	Standard Test Methods for Rubber Hose for Automotive Air and Vacuum Brake System (DOD Adopted)
ASTM G21	-	Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi

(Copies of these documents are available online at http://www.astm.org or ASTM International, P.O. Box C700, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

NCSL INTERNATIONAL

NCSL Z540.1	-	Calibration Laboratories and Measuring and Test Equipment, General Requirements

(Copies of these documents are available online at http://www.ncsli.org or from NCSL International 2995 Wilderness Place, Suite 107 Boulder, Colorado 80301-5404)

SAE INTERNATIONAL

SAE-J1402	-	Automotive Air Brake Hose and Hose Assemblies
SAE-J1403	-	Vacuum Brake Hose
SAE-AMS-QQ-P-416	-	Plating, Cadmium (Electrodeposited)

(Copies of these documents are available online at http://www.sae.org or from the SAE World Headquarters, 400 Commonwealth Drive, Warrendale, PA 15096-0001.)

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for related specification sheets), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Specification sheets. The individual item requirements shall be as specified herein and in accordance with the applicable specification sheet. In the event of any conflict between requirements of this specification and the specification sheets, the latter shall govern.

3.2 Qualification and first article inspection.

3.2.1 Qualification inspection. Type I hose and hose assemblies furnished under this specification shall be manufactured and assembled by a qualified manufacturer and/or assembled by a qualified assembling distributor and shall be a product which has been tested and has passed the qualification tests specified herein and has been listed on or approved for listing on the applicable qualified products list (QPL) before contract award (see 4.3 and 6.3). Hose assemblies shall be qualified as a combination of hose and fittings from specific sources. Any subsequent change to either the hose or fitting source in a qualified assembly requires documented approval of the qualifying activity.

3.2.2 First article inspection. Type II hose and hose assemblies shall be subjected to first article inspection. Hose assemblies shall be tested as a combination of hose and fittings from specific sources. Any subsequent change to either the hose or fitting source in an approved assembly requires documented approval of the procuring activity.

3.3 Critical interface materials. Materials shall be as specified herein and in reference specifications, standards, drawings, or recognized industry equivalent standards. If materials other than those specified are used, the contractor shall certify to the preparing activity that the substitute material(s) enables the hose or hose assemblies to meet the performance requirements of this specification. Acceptance of any constituent materials shall not be construed as a guaranty of the acceptance of the product. When a definite material is not specified, a material shall be used which shall enable the hose or hose assembly to meet the performance requirements of this specification.

3.3.1 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle cost.

3.4 Design and construction.

3.4.1 Bulk hose.

3.4.1.1 Inner tube. The inner tube shall consist of a synthetic rubber compound capable of meeting the requirements of this specification including exposure to hydrocarbon test fluid (see 3.7.1.4). The inner tube shall have a smooth bore; it shall be free of pitting, cracks and other recognizable defects. The bore shall be free of dirt and other foreign material and shall not contain residual mandrel lubricant to the extent that the requirements of this specification cannot be met.

3.4.1.2 Reinforcement. The hose shall have a reinforcement of cotton or synthetic fiber yarn or fabric, steel wire, or a combination thereof.

3.4.1.3 Outer cover. The outer cover shall consist of a synthetic rubber compound that meets the requirements of this specification. The outer cover shall be of uniform thickness and be free of cuts, breaks, blisters and other recognizable defects.

3.4.2 Hose assembly (see MS39325 for 3/8 inch (.375 inch) (9.53 mm) hose assemblies). Hose assemblies shall be constructed of hose (see 3.4.1) with fittings assembled on each end (see figure 1). The default configuration for the assemblies shall be one male fitting and one female fitting. An alternate configuration shall be two female fittings.

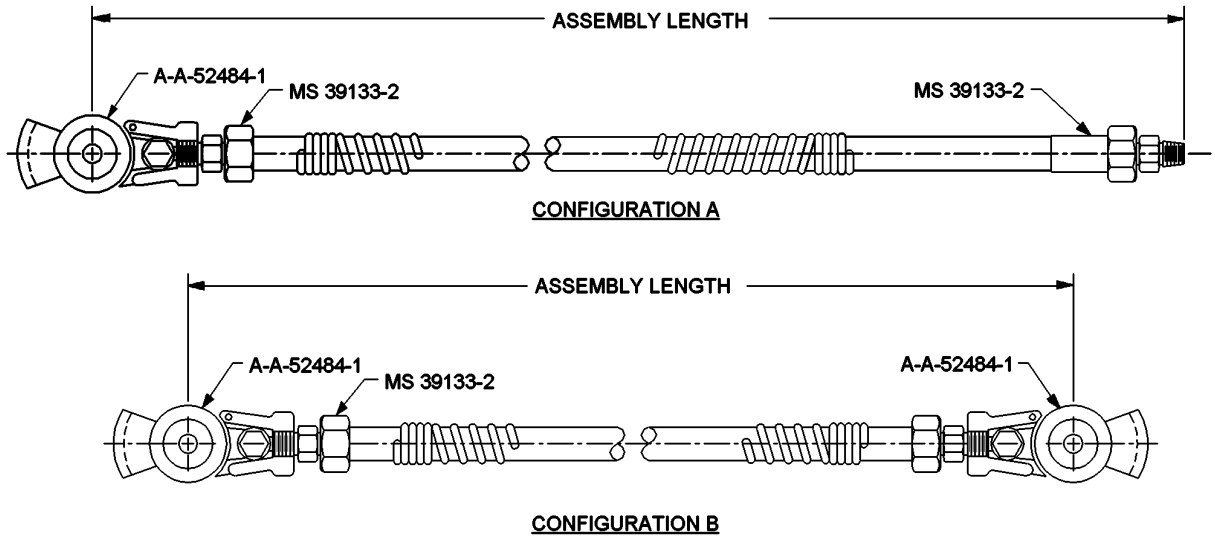


FIGURE 1. Hose assembly configurations.

3.4.2.1 Fittings. Dimensions and materials shall conform to the requirements of A-A-52484 or MS39133. Fittings shall be corrosion resistant or shall be protected to resist corrosion during the length of the service.

3.4.2.1.2 Steel hose fittings finish.

a. Stainless steel - None.

b. Steel fittings:

(1) Cadmium plate in accordance with SAE-QQ-P-416, type II, class 2.
(2) Zinc-plated in accordance with ASTM B633, type II or type III, Fe/Zn 5. Zinc platings specified in ASTM B633 type III shall meet the same 96 hour salt spray test endurance as ASTM B633 type II zinc plating.

3.4.2.2 Swivel fittings. Swivel fitting shall swivel freely with hand torque.

3.5 Hose inside (ID) and outside (OD) diameters. Available diameters and diameter tolerances shall be as shown in tables IV and table V.

TABLE IV. ID and OD diameter tolerances for type I. 1/ 2/

Nominal size I.D. [inches, fraction, decimal] metric (mm)	Inside diameter				Outside diameter			
	Class 1 (mm)	Class 2 (mm)	Class 3 (mm)	Class 4 (mm)	Classes 1 and 2 ± .031 (0.79 mm)	Class 3 4/ (mm)	Class 3 ± .031 (0.79 mm)	Class 4 (mm)
3/16 3/ .188 (4.76)	± .016 (0.41)	± .023 (5.84)	---	+.016, -.005 (+0.41, - 0.13)	.531 (13.49)	---	---	.500 - .539 (17.70 - 13.69)
1/4 .250 (6.35)	± .016 (0.41)	± .023 (5.84)	± .016 (0.41)	+.020, -.008 (+0.51, -0.20)	.625 (15.88)	.437 ± .023 (11.10 ± 0.58)	.625 (15.88)	.562 - .602 (14.27 - 15.29)
5/16 .313 (7.94)	± .016 (0.41)	± .023 (5.84)		+.023, -.008 (+0.58, - 0.20)	.687 (17.45)	---	---	.656 - .699 (16.66 - 17.75)
3/8 .375 (9.53)	± .016 (0.41)	± .023 (5.84)	± .016 (0.41)	---	.750 (19.05)	.594 ± .023 (15.09 ± 0.58)	.781 (19.84)	---
13/32 .406 (10.32)	---	---	---	+.023, -.008 (+0.58, - 0.20)		---	---	.742 - .789 (18.85 - 20.04)
7/16 .438 (11.11)	± .016 (0.41)	± .031 (0.79)	---	---	.812 (20.62)	---	---	---
1/2 .500 (12.70)	± .016 (0.41)	± .031 (0.79)	± .023 (0.58)	+.023, -.008 (+0.58, - 0.20)	.875 (22.23)	.718 ± .031 (18.24 ±0.79)	.906 (23.01)	.898 - .945 (22.81 - 24.00)
5/8 .625 (15.88)	± .016 (0.41)	± .031 (0.79)		+.023, -.008 (+0.58, - 0.20)	1.062 (26.97)	---	---	1.054 - 1.101 (26.77 - 27.97)
Special 5/8 .625 (15.88)	± .016 (0.41)	± .031 (0.79)	---	---	1.375 (34.93)	---	---	---

1/ Dimensions are in inches
2/ Metric equivalents are given for information only.
3/ Class 1 and 2 hose in the 3/16-inch size may be single ply reinforcement.
4/ Outside diameter over the wire reinforcement.

TABLE V. ID and OD diameter tolerances for type II. 1/ 2/

Nominal size I.D. (inches / fraction / decimal) metric (mm)	Inside diameter		Outside diameter	
	Style A (mm)	Style B (mm)	Style A ±. 031 (0.79 mm)	Style B ±. 031 (0.79 mm)
7/32 .219 (5.56)	---	+0.028, -0.032 (+0.71, -0.81)	---	.437 (11.10)
1/4 .250 (6.35)	+0.008, -0.020 (0.20, -0.51)	---	.562 (14.27)	---
11/32 .344 (8.73)	---	+0.028, -0.032 (+0.71, -0.81)	---	.687 (17.45)
3/8 .375 (9.53)	+0.008, -0.020 (0.20, -0.51)	---	.812 (20.62)	---
15/32 .469 (11.91)	---	+0.028, -0.032 (+0.71, -0.81)	---	.812 (20.62)
1/2 .500 (12.70)	+0.008, -0.020 (0.20, -0.51)	---	.937 (23.80)	---
5/8 .625 (15.88)	+0.008, -0.020 (0.20, -0.51)	---	1.062 (26.97)	---
3/4 .750 (19.05)	+0.008, -0.020 (0.20, -0.51)	---	1.812 (46.02)	---
1 1.00 (25.40)	+0.010, -0.022 (0.25, - 0.56)	---	1.469 (37.31)	---

1/ Dimensions are in inches.
2/ Metric equivalents are given for information only.

3.6 Lengths. Hose and hose assemblies shall be furnished in lengths specified in the procurement documentation (see 6.2).

3.7 Performance.

3.7.1 Requirements applicable to both type I and II hoses and hose assemblies.

3.7.1.1 Hydrostatic bursting test. The hose shall not burst or show signs of failure and the hose assemblies shall not leak at any hydrostatic pressure up to and including that shown in table VI see 4.8.2.1.

TABLE VI. Burst pressure requirements. 1/ 2/

Nominal hose size inches fraction	Nominal hose size inches decimal	Nominal hose size metric (mm)	Burst pressure		
			Type I Classes 1 and 2 psi (bar)	Type I Classes 3 and 4 psi (bar)	Type II Styles A and B psi (bar)
3/16	.188	4.76	900 (62.0)	10,000 (689.5)	---
7/32	.219	5.56	---	---	350 (24.13)
1/4	.250	6.35	900 (62.0)	10,000 (689.5)	1,200 (82.74)
5/16	.3125	7.94	900 (62.0)	9,000 (620.5)	---
11/32	.344	8.73	---	---	350 (24.13)
3/8	.375	9.53	900 (62.0)	8,000 (551.6)	1,200 (82.74)
13/32	.406	10.32	900 (62.0)	8,000 (551.6)	1,200 (82.74)
7/16	.438	11.11	900 (62.0)	---	---
15/32	.469	11.91	---	---	350 (24.13)
1/2	.500	12.70	900 (62.0)	7,000 (482.6)	1,000 (68.95)
5/8	.625	15.88	900 (62.0)	6,000 (413.7)	1,000 (68.95)
5/8 Special	.625	15.88	900 (62.0)	---	---
3/4	.750	19.05	---	---	800 (55.16)
1	1.00	25.40	---	---	800 (55.16)

1/ Dimensions are in inches.
2/ Metric equivalents are given for information only.

3.7.1.2 Adhesion. When tested as specified in 4.8.2.2 the hose specimens shall show no separation of the plies, the tube from the plies or the cover from the plies upon application of a load of not less than 10 pounds per 1 inch (4.53 kg per 25.4 mm) of hose width.

3.7.1.3 Ozone resistance. When tested as specified in 4.8.2.3 the hose outer cover specimens cut from untested hose shall exhibit no cracking after exposure to ozone.

3.7.1.4 Oil immersion. When tested as specified in 4.8.2.4 hose specimens shall not demonstrate a volume increase greater than 100%.

3.7.1.5 Fungus resistance. When tested as specified in 4.8.2.5 hose and hose assemblies shall be fungus resistant. After being exposed to fungus, specimens shall meet the length change requirements of 3.7.2.3.

3.7.2 Requirements applicable to type I air brake hose and hose assemblies.

3.7.2.1 Proof pressure test. When tested as specified in 4.8.3.1 an assembled length of hose shall exhibit no air leaks.

3.7.2.2 Assembly tension test. When tested as specified in 4.8.3.2 hose assemblies shall withstand a minimum pull of 325 pounds (147.42 kg) without separation from the fittings or rupture of the hose structure.

3.7.2.3 Elongation and contraction. When tested as specified in 4.8.3.3 type I hoses or hose assemblies shall not contract in length more than 3 percent or elongate more than 5 percent.

3.7.2.4 High-temperature resistance. When tested as specified in 4.8.3.4 the hose shall show no cracks, charring, or disintegration externally or internally when straightened after high temperature aging and flex tests.

3.7.2.5 Low-temperature resistance. When tested as specified in 4.8.3.5 hoses shall show no breaks or cracks after being conditioned at low temperature.

3.7.3 Requirements applicable to type II vacuum brake hose and hose assemblies.

3.7.3.1 Aging test. When tested as specified in 4.8.4.1 hose or hose assemblies shall show no cracks, breaks, or other external visual disintegration after being bent against a form. The hose or hose assembly shall then be subjected to a proof pressure 4.8.3.1 and examined for internal disintegration.

3.7.3.2 Cold test. When tested as specified in 4.8.4.2 the hose shall pass the hydrostatic proof pressure specified in 4.8.3.1.and then visually inspected. The hose when examined externally shall show no signs of cracks. The hose shall be cut lengthwise and the internal tube shall show no signs of cracks.

3.7.3.3 Collapse resistance (vacuum) test. When tested as specified in 4.8.4.3 the outside diameter of a hose specimen shall not collapse more than 1/16 inch (.0625 inch) (1.59 mm).

3.7.3.4 Hot vacuum collapse and degradation. When tested as specified in 4.8.4.4 the outside diameter of a hose specimen shall not collapse in excess of 15% of the original OD for light wall vacuum brake hose (7/32, 11/32, 15/32), and 10% of the original OD for heavy wall vacuum brake hose (1/4, 3/8, 1/2, 5/8, 3/4, 1) (reference SAE-J1403) after conditioning and application of an internal vacuum. There shall be no external or internal embrittlement or degradation. There shall be no leakage during proof pressure testing specified in SAE-J1403.

3.7.3.5 Bend collapse test. When tested as specified in 4.8.4.5 the outside diameter of a hose specimen shall not collapse in excess of the values shown in table VII after being bent until the ends meet.

TABLE VII. Bend test dimensions. 1/ 2/

Inside diameter of hose			Length of specimen				Maximum collapse of OD (% of OD)	
			Heavy wall		Light wall		Heavy wall	Light wall
Inches fraction	Inches decimal	metric (mm)	inches	mm	inches	mm	---	40%
7/32	.219	5.56	---	---	7	180	20%	---
1/4	.250	6.35	8	205	---	---	---	30%
11/32	.344	8.73	---	---	11	280	20%	---
3/8	.375	9.53	12	305	---	---	20%	30%
15/32	.469	11.91	---	---	14	355	20%	---
1/2	.500	12.70	16	405	---	---	20%	---
5/8	.625	15.88	22	560	---	---	20%	---
3/4	.750	19.03	28	710	---	---	20%	---
1	1.00	25.40	36	915	---	---	20%	---

1/ Dimensions are in inches.
2/ Metric equivalents are given for information only.

3.8 Marking. Marking shall be in accordance with MIL-STD-130.

3.8.1 Hose cover. The hose cover material shall have the following information legibly marked on the lay line of the hose at intervals of not more than 15 inches (381 mm):

a. PIN (see 1.2).
b. Date of manufacture (quarter (1 thru 4) and year (05) two numbers.
c. Manufacturer's CAGE

3.8.2 Hose assemblies. Each hose assembly shall be identified by means of a band around the hose. The band may move freely along the length of the assembly. The band shall be permanently embossed, etched or stamped with the following information:

a. PIN (see 1.2)
b. Date of assembly (quarter (1 thru 4) and year (05) two numbers)
c. Manufacturer's CAGE

3.9 Workmanship. Workmanship to produce hose or hose assemblies shall be in accordance with the best current manufacturing practice as to be uniform in quality and shall be free from burrs, crazing, cracks, voids, pimples, chips, blisters, pinholes, sharp cutting edges, and other defects that will adversely affect life, serviceability, or appearance.

4. VERIFICATION

4.1 Classification of inspection. The inspection requirements specified herein are classified as follows:

4.1.1 Type I.

a. Qualification inspection (see 4.3).
b. Conformance inspection (see 4.5).

4.1.2 Type II.

a. First article inspection (see 4.3).
b. Conformance inspection (see 4.4).

4.2 Inspection conditions.

4.2.1 Type I hose and hose assemblies inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the test conditions specified in 4.8.2.1, 4.8.2.2, 4.8.2.3, 4.8.2.4, 4.8.2.5, 4.8.3.1, 4.8.3.2, 4.8.3.3, 4.8.3.4, and 4.8.3.5. Unless otherwise specified, room temperature shall be defined as 60°F to 90°F (15.56°C to 32.22°C).

4.2.2 Type II hose and hose assemblies inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the test conditions specified in 4.8.2.1, 4.8.2.2, 4.8.2.3, 4.8.2.5, 4.8.4.1, 4.8.4.2, 4.8.4.3, 4.8.4.4, and 4.8.4.5. Unless otherwise specified, room temperature shall be defined as 60°F to 90°F (15.56°C to 32.22°C).

4.2.1 Test equipment and inspection facilities. Test and measuring equipment and inspection facilities of sufficient accuracy, quality and quantity to permit performance of the required inspection shall be used. The establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment shall be in accordance with NCSL Z540.1 or equivalent.

4.2.2 Responsibility for compliance. All items shall meet all requirements of sections 3, 4, and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

4.2.3 Assembly distributor (type I). All manufacturing and/or assembling locations must be qualified for listing on, or approved for listing on, the applicable qualified products list by the qualifying activity. This includes manufacturing sites for the bulk hose and sites for assembling hose and fittings, regardless of whether the site is operated by the original manufacturer or an authorized distributor producing hose assemblies.

4.3 Qualification inspection (type I). Qualification inspection shall be performed at a laboratory acceptable to the qualifying activity on sample units produced with equipment and procedures used in production. Qualification inspection shall be performed on type I hose and hose assemblies.

4.3.1 Samples for qualification. Samples for qualification shall be representative of the products proposed to be furnished to the Government. Samples shall be of one type and nominal size of hose and shall be of the quantity and length specified in the applicable test method.

4.3.2 Qualification inspection routine. All samples shall be subjected to qualification testing in accordance with table VIII the sequence is at the manufacturer's discretion.

TABLE VIII. Qualification inspection for type I (air brake) hose and hose assembly. 1/

Qualification Inspection	Requirement paragraph	Inspection paragraph
Examination of product 2/	3.1, 3.3, 3.4, 3.5, 3.6, 3.8 and 3.9	4.8.1
Hydrostatic bursting 2/	3.7.1.1	4.8.2.1
Adhesion	3.7.1.2	4.8.2.2
Ozone resistance	3.7.1.3	4.8.2.3
Oil immersion	3.7.1.4	4.8.2.4
Fungus resistance 3/ hydrostatic bursting	3.7.1.5 3.7.1.1	4.8.2.5 4.8.2.1
Proof pressure 2/	3.7.2.1	4.8.3.1
Assembly tension 2/	3.7.2.2	4.8.3.2
Elongation and contraction	3.7.2.3	4.8.3.3
High-temperature resistance	3.7.2.4	4.8.3.4
Low-temperature resistance	3.7.2.5	4.8.3.5

1/ Unless otherwise specified all tests apply to qualifying a hose assembly with previously unqualified bulk hose.
2/ Applies to qualifying a hose assembly with already qualified bulk hose.
3/ At the discretion of the qualifying activity the manufacturer may verify conformance to 3.7.1.5 with a certificate of compliance stating testing has been completed in accordance with 4.8.2.5.

4.3.3 Acceptance of qualification inspection data. Required qualification tests at the hose assembly level that were already performed at the bulk hose level may be eliminated if documented approval has been obtained from the qualifying activity.

4.3.4 Failures. One or more failures shall be cause for refusal to grant qualification.

4.4 First article inspection. First article inspection shall be performed at a laboratory acceptable to the procuring activity on sample units produced with equipment and procedures used in production. First article inspection shall be performed on type II hoses and hose assemblies.

4.4.1 Lot records. Manufacturers shall keep lot records for 3 years minimum. Manufacturers shall monitor for compliance to the prescribed procedures, and observe that satisfactory manufacturing conditions and records on lots are maintained for these hose assemblies. The records, including as a minimum, an attributes summary of all quality conformance inspections conducted on each lot, shall be available to review by customers at all times.

4.4.2 Samples for first article. Samples for first article shall be representative of the products proposed to be furnished to this specification. Sampling for bulk hose and hose assemblies shall be in accordance with 4.5.3.2 and 4.5.3.3 respectively. The samples shall be representative of the construction, workmanship, components, and materials to be used during production. When a manufacturer is in continuous production of the hose of hose assembly from one contract to another, submission of additional first article samples for a new contract may be waived at the discretion of the acquiring activity (see 6.2).

4.4.3 First article inspection routine. All samples shall be subjected to first article testing in accordance with table IX sequence is manufacturer's discretion.

TABLE IX. First article inspection for type II (vacuum brake) hose and hose assembly.

Required First Article Test	Requirement paragraph	Inspection paragraph
Visual inspection	3.1, 3.3, 3.4, 3.5, 3.6, 3.8 and 3.9	4.8.1
Hydrostatic bursting	3.7.1.1	4.8.2.1
Adhesion	3.7.1.2	4.8.2.2
Ozone resistance	3.7.1.3	4.8.2.3
Oil immersion	3.7.1.4	4.8.2.4
Fungus resistance 1/ Hydrostatic bursting	3.7.1.5 3.7.1.1	4.8.2.5 4.8.2.1
Aging External visual Proof Internal visual	3.7.3.1 3.7.3.1 3.7.2.1 3.7.3.1	4.8.4.1 4.8.4.1 4.8.3.1 4.8.4.1
Cold Proof pressure	3.7.3.2 3.7.2.1	4.8.4.2 4.8.3.1
Collapse resistance	3.7.3.3	4.8.4.3
Hot vacuum collapse and degradation	3.7.3.4	4.8.4.4
Bend collapse	3.7.3.5	4.8.4.5
Fit verification test (hose assemblies only) 2/	---	---

1/ At the discretion of the contracting officer the manufacturer may verify conformance to 3.7.1.5 with a certificate of compliance stating testing has been completed in accordance with 4.8.2.5.

2/ Fit verification testing is not a first article testing requirement unless the contracting agency deems this test necessary. Fit verification test may be required with or without first article testing.

4.4.4 Acceptance of first article inspection. Required first article tests at the hose assembly level that was already performed at the bulk hose level may be eliminated if documented approval has been obtained from the procuring activity.

4.4.5 Failures. All samples must meet all of the contract requirements. Failure of a sample unit to pass any test shall be cause for rejection of the entire lot and to grant first article approval.

4.4.6 First article information. Upon completion of first article inspection, the Government activity responsible for conducting the inspection program (see 6.2), shall report the results of the inspection, with appropriate recommendation, to the contracting officer. Approval of the first article samples or the waiving of first article inspection does not preclude the requirements for performing conformance inspection.

4.4.6.1 Disposition of samples. First article samples shall be furnished to the Government as directed by the contracting officer (see 6.2).

4.5. Conformance inspection.

4.5.1 Conformance inspection for qualified items.

4.5.1.1. Individual inspection. Individual inspection shall consist of the inspections specified in table X in the order shown.

4.5.1.2 Individual inspections sampling plan.

4.5.1.2.1 Individual inspection tests (type I). Individual inspection test specified in table X shall be performed on a production lot basis. All defects shall be removed and not supplied as qualified product.

4.5.2 Sampling and periodic inspection (type I). Sampling and periodic inspections shall consist of the inspections specified in table XI and shall be made on test samples which have been subjected to and passed the individual inspections (see table X).

4.5.3 Individual, sampling, and periodic inspection for first article (type II). For manufacturers that have successfully passed first article inspections and are continuously producing type II hose and hose assemblies to this specification on going inspections shall consist of individual inspections (see table X) and sampling and periodic inspections (see table XI). If first article is waived due to prior successful first article inspection the individual inspections and sampling and periodic inspections shall be the manufactures in-house inspection procedures.

TABLE X. Individual inspections. 1/

Inspections	Requirement paragraph	Inspection paragraph
Visual inspection	3.1, 3.3, 3.4, 3.5, 3.6, 3.8 and 3.9	4.8.1
Configuration	3.4.2	4.8.1
Proof pressure	3.7.2.1	4.8.3.1

1/ 100 percent inspection of bulk hose length and each hose assembly. Visual inspection and configuration inspection may be performed at an inspection plan approved in writing by the qualifying activity.

TABLE XI. Sampling and periodic inspections.

Inspections	Requirement paragraph	Inspection paragraph	Sampling 1/	Periodic
Elongation and contraction	3.7.2.3	4.8.3.3	X 2/	---
Hydrostatic bursting	3.7.1.1	4.8.2.1	X 3/	---
Adhesion	3.7.1.2	4.8.2.2		X 2/
Hot vacuum collapse and degradation	3.7.3.4	4.8.4.4	---	X 2/
Assembly tension	3.7.2.2	4.8.3.2		X 4/

1/ Sampling tests done on each lot shall be according to lot size.
2/ Type II hose only.
3/ Both hose and assembly.
4/ Hose assembly only.

4.5.3.1 Sampling testing sampling plan (type I).

4.5.3.2 Bulk hose samples. For each hose ID size, samples shall be selected from each continuous production run at the rate of one sample to be subjected to all sampling tests for each full or partial increment of 750 feet of bulk hose produced in the continuous run, up to a maximum of 2 samples. For continuous runs greater than 1500 feet, 2 samples will be selected, but they must be representative of the entire run.

4.5.3.3 Hose assembly samples. For each hose ID size, samples shall be selected at the rate of 8 samples to be subjected to all sampling tests for each 3000 assemblies produced (large lot option) or 1 sample for each 375 assemblies produced (small lot option). If there has been some production, but the manufacturer has not reached 375 assemblies for a specific size within three years, the manufacturer shall perform all sampling tests on one assembly of that size unless documented approval to not perform the testing is obtained from the qualifying activity.

4.5.4 Periodic testing sampling plan (type I).

4.5.4.1 Bulk hose samples. For each size manufactured under essentially the same conditions, periodic control testing shall be performed on either 4 samples for each test for every 20,000 feet (6096 m) or fraction thereof of bulk hose produced (large lot option) or 1 sample for each test for every 5,000 feet (1524 m) of bulk hose produced (small lot option). If there has been some production but the total number of footage produced has not reached 5,000 feet (1524 m) for a specific size within three years, the manufacturer shall perform periodic control tests on 1 sample of that size unless documented approval has been obtained from the qualifying activity. Periodic samples may be subjected to more than one periodic test at the discretion of the manufacturer. However, the manufacturer assumes the risk that the effect of one test will not have a detrimental impact on the following test.

4.5.4.2 Hose assembly samples. For each size manufactured under essentially the same conditions, periodic control testing shall be performed on either four (4) samples from every 10,000 hose assemblies produced (large lot option) or 1 sample from every 2,500 hose assemblies. If there has been some production but the number hose assemblies produced has not reached 2,500 for a specific size within three years, the manufacturer shall perform periodic control tests on 1 hose assemblies of that size unless documented approval has been obtained from the qualifying activity. Required periodic control tests at the hose assembly or fitting level that were already performed at the bulk hose level may be eliminated if documented approval has been obtained from the qualifying activity. Periodic samples may be subjected to more than one periodic test at the discretion of the manufacturer. However, the manufacturer assumes the risk that the effect of one test will not have a detrimental impact on the following test.

4.5.5 Nonconformance.

4.5.5.1 Nonconformance qualified type I hose and hose assemblies. If a sample fails to pass any sampling and periodic inspection (see table XI), the manufacturer shall immediately notify the qualifying activity and cognizant inspection activity of such failure and take corrective action on the materials or processes, or both, as warranted, and on all units of product which can be corrected and which were manufactured under essentially the same conditions, with essentially the same materials and processes, and which are considered subject to the same failure. Acceptance and shipment of the product shall be discontinued until corrective action acceptable to the qualifying activity has been taken. After the corrective action has been taken, sampling and periodic inspection shall be repeated on additional samples (all inspections, or the inspection which the original sample failed, at the option of the qualifying activity). Individual and sampling and periodic inspections if applicable inspections may be reinstituted: however, final acceptance of the hose or hose assemblies shall be withheld until the sampling and periodic inspection has shown that the corrective action was successful. In the event of failure after inspection, information concerning the failure and corrective action taken shall be furnished to the qualifying activity.

4.5.5.2 First article non conformance sampling and periodic inspections (type II). In the event a failure should occur during sampling or periodic inspection tests, specified in table XI, then the production lot shall be screened for that particular defect and defects removed. An inspection lot shall be selected from the production lot and all sampling and periodic tests shall be performed. If one or more defects are found in the second inspection lot, the production lot shall be rejected and shall not be supplied to this specification. Test data of part performance shall be made available to the contracting agency upon request.

4.5.6 Disposition of test specimens. Test specimens that have been subjected to sampling and periodic inspection shall not be delivered on the contract or purchase order.

4.6 Discontinuation and resumption of production. At the discretion of the qualifying activity when production has resumed full qualification inspection shall be reinstated unless otherwise approved in writing, by the qualifying activity, to sample bulk hose or hose assemblies as specified in 4.6.1.

4.6.1 Discontinuation and resumption of production of bulk hose and hose assemblies. If there has been no production of a specific size hose or hose assembly for a period of three years or more, samples for each test shall be randomly selected from the first lot produced when production of that size has been resumed. Three (3) samples shall be subjected to the sampling tests and four (4) samples for each test shall be subjected to the periodic control tests (see table XI).

4.6.2 Acceptance of conformance inspection data. Required conformance tests at the hose assembly level that were already performed at the bulk hose level may be eliminated if documented approval has been obtained from the qualifying activity for QPL items or the procuring activity for first article inspections.

4.7 Additional QPL test and reporting requirements.

4.7.1 Retention of qualification. To retain qualification, the contractor shall submit a test report to the qualifying activity at 12 month intervals. The qualifying activity shall establish the initial reporting date. Each report shall consist of a summary of test and inspection results required by this specification that were performed during the 12 month reporting interval. As a minimum, the report shall include the following:

a. Number of lots produced and tested, including lot and sample sizes for each lot.
b. Identify which tests were performed.
c. Quantities passed.
d. Quantities failed.
e. All reworked sampling lots shall be accounted for and identified. A summary of corrective action taken shall be included.

4.7.2 Loss of product qualification.

4.7.2.1 Failure to meet test requirements. The manufacturer shall immediately notify the qualifying activity at any time during the 12-month reporting period when the qualified product fails to meet the test and inspection requirements of this specification. The manufacturer shall identify and indicate what corrective action will be taken to correct the problem. Failure to take corrective action acceptable to the qualifying activity may result in removal of the product from the QPL.

4.7.2.2 Failure to submit summary test data report. Failure to submit a test report within 30 days after the end of the 12 month reporting period may result in removal of qualification for the product.

4.7.2.3 Change to manufacturing process, materials or equipment. The manufacturer shall notify the qualifying activity, in writing, of any changes in the manufacturing process, materials, or equipment used to manufacture a QPL product. Subsequently, the qualifying activity will notify the manufacturer, in writing, if a full re-qualification, partial re-qualification, or no additional testing is required as a result of these changes.

4.7.2.4 No production during reporting period. When no production occurs during the reporting period, a report shall be submitted to the qualifying activity certifying that the manufacturer still has the capability and facilities necessary to produce the QPL product. If during two consecutive 12 month reporting periods there has been no production, the manufacturer may be required, at the discretion of the qualifying activity, to submit QPL products to a full qualification inspection in accordance with this specification.

4.8 Test methods.

4.8.1 Visual inspection. Hose and hose assemblies shall be examined to ensure conformance with this specification and associated specification sheets. Continuous examination shall be performed to assure compliance with the following requirements:

a. Specification sheets (3.1).
b. Materials (3.4).
c. Design, construction and physical dimensions (3.5 and 3.6).
d. Marking (3.8).
e. Workmanship (3.9).

4.8.2 Test requirements applicable to both type I and II hose and hose assemblies.

4.8.2.1 Hydrostatic bursting test (see 3.7.1.1). Hose specimens, 18 inch (457.20 mm) long, when subjected to hydrostatic bursting test in accordance ASTM D380 shall meet the requirements of 3.7.1.1. Oil IRM 903 in accordance with ASTM D471 may be used in lieu of water as the burst medium.

4.8.2.2 Adhesion (see 3.7.1.2). Hose specimens when subjected to adhesion tests in accordance with ASTM D622 shall meet the requirements of 3.7.1.2. The following details shall apply:

a. Fiber reinforced hose shall be tested in accordance with ASTM D413, machine method, the entire specimen should be separated to establish the average load required for separation of the plies.
b. Sharp abrupt changes in load for a short duration of time should be discounted in establishing the average load value for a given specimen.

4.8.2.3 Ozone resistance (see 3.7.1.3). Hose specimens when subjected to ozone resistance tests in accordance with ASTM D622 shall meet the requirements of 3.7.1.3.

4.8.2.4 Oil immersion test (see 3.7.1.4). Test specimens subjected to the oil immersion test in accordance with ASTM D471 shall meet the requirements of 3.7.1.4. The following details shall apply:

a. Test specimens in accordance with ASTM D471.
b. OIL - IRM 903.
c. Oil temperature 212°F ±3.6°F (100°C ±2°C).

4.8.2.5 Fungus resistance (see 3.7.1.5). Hose specimens when subjected to the fungus resistance test in accordance with ASTM G21 shall meet the requirements of 3.7.1.5. The following details shall apply:

a. Test specimens - 36 inches (914.40 mm) length.
b. Test shall be continuous for 90 days.
c. After 90 days, the hose shall be subjected to the hydrostatic burst pressure test specified in 4.8.2.1.

4.8.3 Tests for type I air brake hose.

4.8.3.1 Proof pressure test (see 3.7.2.1). Type I hose assembly when subjected to the proof pressure test in accordance with ASTM D622 shall meet the requirements of 3.7.2.1.

4.8.3.2 Assembly tension test (see 3.7.2.2). Type I hose when subjected to the assembly tension strength test specified in ASTM D622 shall meet the requirements of 3.7.2.2.

4.8.3.3 Elongation and contraction (see 3.7.2.3). Test specimens 18-inch (457.20 mm) length when subjected to the elongation and contraction test in accordance with ASTM D622 shall meet the requirements of 3.7.2.3.

4.8.3.4 High-temperature resistance test (see 3.7.2.4). Test specimens when tested in accordance with the high-temperature resistance test of SAE-J1402 shall meet the requirements of 3.7.2.4.

4.8.3.5 Low-temperature resistance test (see 3.7.2.5). Test specimens when tested in accordance with the low-temperature resistance test of ASTM D622 shall meet the requirements of 3.7.2.5. The following details shall apply:

a. Condition the specimens at -65°± 2°F (-53.89°C ± 1.11°C) for 70 ± 2 hours.
b. Test each sample in accordance with ASTM D622.

4.8.4 Test requirements applicable to type II vacuum brake hose and hose assemblies.

4.8.4.1 Aging test (see 3.7.3.1). Test specimens in accordance with ASTM D622 shall meet the requirements of 3.7.3.1.

4.8.4.2 Cold test (see 3.7.3.2). Test specimens when tested as specified in ASTM D622 shall meet the requirements of 3.7.3.2.

4.8.4.3 Collapse resistance (see 3.7.3.3). Test specimens in accordance with ASTM D622 shall meet the requirements of 3.7.3.3.

4.8.4.4 Hot vacuum collapse and degradation (see 3.7.3.4). When test samples (see table VI) are subjected to the hot vacuum collapse and degradation as specified in SAE-J1403 the test specimens shall meet the requirements of 3.7.3.4.

4.8.4.5 Bend collapse test (see 3.7.3.5). Test specimens subjected to the bend collapse test in accordance with ASTM D622 shall meet the requirements of 3.7.3.5.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature which may be helpful, but is not mandatory.)

6.1 Intended use. Hose and hose assemblies covered by this specification are intended for use as flexible connections in air or vacuum brake systems on automotive vehicles.

6.1.1 Military unique rationale. The hose and hose assemblies are military unique because they are to be used for applications operating in a temperature range not exceeding +200°F (93.33°C) and not below -60°F (-51.11°C). Commercial components are not designed to withstand these extreme conditions or sudden environmental changes and would experience catastrophic failure.

6.1.2 Vacuum hose. Type II hose is intended for, but not limited to, two different specific uses as follows:

Style A	-	Heavy-duty hose for service on truck-trailer combinations and similar applications.
Style B	-	Light-duty hose for service in conjunction with the power braking system on passenger cars and light trucks, where hose is used in a protected location.

6.2 Acquisition requirements.

6.2.1 Qualified type I hose and hose assemblies. Acquisition documents should specify the following:

a. Title, number, and date of the specification.
b. PIN (see 1.2).
c. Packaging requirements (see section 5).

6.2.2 First article inspection for type II hose and hose assemblies. Acquisition documents should specify the following:

a. Title, number, and date of this specification.
b. PIN (see 1.2).
c. Quantity required.
d. Whether first article inspection is waived (see 6.4).
e. Lot records if required (see 4.4.1).
f. Name and address of the first article inspection test facility to which first article samples (if required) are to be forwarded and the name and address of the Government activity responsible for conducting the first article inspection program (see 6.4).
g. Packaging requirements (see section 5).

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contact, qualified for inclusion in Qualified Products List QPL No. 3992 whether or not such products have actually been so listed by that date. The attention of contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from Defense Supply Center Columbus, P.O. Box 3990, ATTN: DSCC-VQ, Columbus, Ohio 43218-3990 or emailed to vqp.chief@dla.mil.

6.3.1 Provisions governing qualification (SD-6). Copies of "Provisions Governing Qualification" are available online at http://assist.daps.dla.mil or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.

6.3.2 QPL hose assembly manufacturer. An assembler must be on the QPL in order to assemble a QPL hose assembly. An assembler may not obtain the components from a QPL source and then assemble it themselves and consider it a QPL item.

6.4 First article. The contracting officer should include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results, and disposition of first articles. Invitations for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract.

6.5 Supersession information. The fittings referenced in MS39325 are now described by Commercial Item Description A-A-52484, coupler, automotive air brake line; quick disconnect, and MS39133, adapter, straight, pipe to hose, automotive air brake hose.

6.6 Environmentally preferable material. Environmentally preferable materials should be used to the maximum extent possible that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs. Table XII lists the Environmental Protection Agency (EPA) top seventeen hazardous materials targeted for major usage reduction. If any of these hazardous materials are required, it is recommended that they be used only when other materials cannot meet performance requirements.

TABLE XII. EPA top seventeen hazardous materials.

Benzene	Dichloromethane	Tetrachloroethylene
Cadmium and compounds	Lead and compounds	Toluene
Carbon Tetrachloride	Mercury and compounds	1,1,1 - Trichloroethane
Chloroform	Methyl Ethyl compounds	Trichloroethylene
Chromium and compounds	Methyl Isobutyl Ketone	Xylenes
Cyanide and compounds	Nickel and compounds	

6.7 Guidance on use of alternative parts with less hazardous or non-hazardous materials. This specification provides for a number of alternative plating materials via the PIN. Users should select the PIN with the least hazardous material that meets the form, fit, and function requirements of their application.

6.8 Subject term (keyword) listing.

Automotive
Bulk
Cadmium
Ozone
Trailer
Truck
Truck-Tractor

6.9 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

CONCLUDING MATERIAL

Custodians:
Army - AT
Navy - MC
Air Force - 99
DLA - CC

Preparing activity
DLA - CC

(Project 4720-2007-001)

Review activities:
Army - MI
Navy - SA
Air Force - 71

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at http://assist.daps.dla.mil.