INCH-POUND

MIL-DTL-52471F
w/AMENDMENT 1
26 October 2010
SUPERSEDING
MIL-DTL-52471F
4 December 2008

DETAIL SPECIFICATION

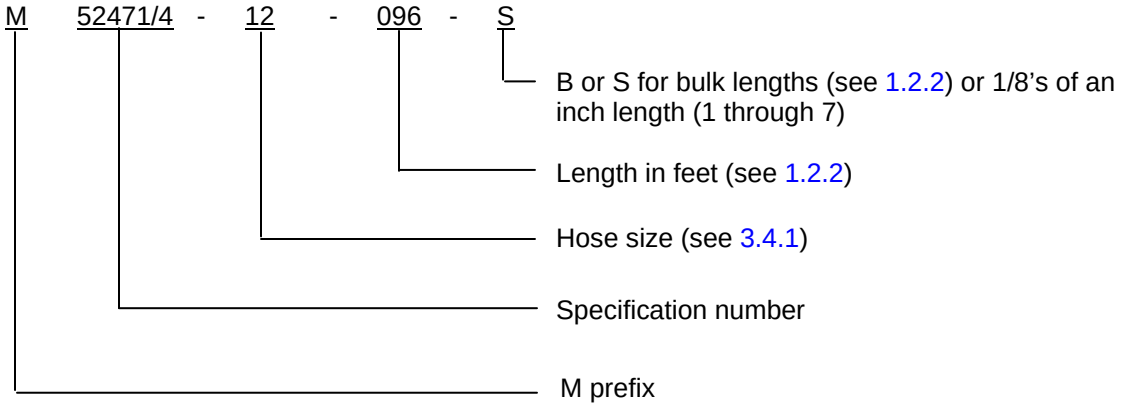
HOSE AND HOSE ASSEMBLIES, RUBBER, HYDRAULIC PRESSURE TYPE, GENERAL SPECIFICATION FOR

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

1. SCOPE

1.1 Scope. This specification covers pressure-type, wire-reinforced, rubber, hydraulic hose and hose assemblies. The core of this specification uses SAE-J517. The operating pressures range between 625 psi to 7,500 psi (4.3 to 48.3 MPa). The operating temperature range is -40°F to +212°F (-40°C to 100°C).

1.2 Part or Identifying Number (PIN) bulk hose or specific lengths. The PIN consists of the letter "M" the specification sheet number a dash, hose size number, a dash, a three digit number for length of hose (inches for specific lengths, feet for bulk lengths), a dash and the letter B or S for bulk lengths or a number for 1/8's of an inch.



PIN example: M52471/4-12-096-S, describes a type 100R1 hose, 3/4 inch ID, 96 feet long, with a tolerance of ±1% of the required length.

Comments, suggestions, or questions on this document should be addressed to: Commander, DLA Land and Maritime , Attn: VAI, P.O. Box 3990, Columbus, Ohio, 43218-3990 or email: to FluidFlow@dla.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at https://assist.daps.dla.mil.

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1.2.1 Classification. Hose and hose assemblies are to be of the following the following types:

Type 100R1	-	Single-wire-braid reinforcement.
Type 100R2	-	Double-wire-braid reinforcement.
Type 100R10 1/	-	Multiple-spiral-wrap reinforcement.
Type 100RE 2/	-	Multiple-spiral-wrap reinforcement.
Type 100R12	-	Four-spiral-wrap reinforcement.

1/ SAE-J517 hose type 100R10 has been discontinued beginning with the year 2005, due to lack of demand. For replacement data see MIL-DTL-52471/6.
2/ The letter "E" used in type 100RE is not related to SAE-J517, but is used in this standard to be in accordance with hose assembly operating pressures and other performance data called out in this specification and MIL-DTL-52525 and the associated slash sheets for hose and fitting selection.

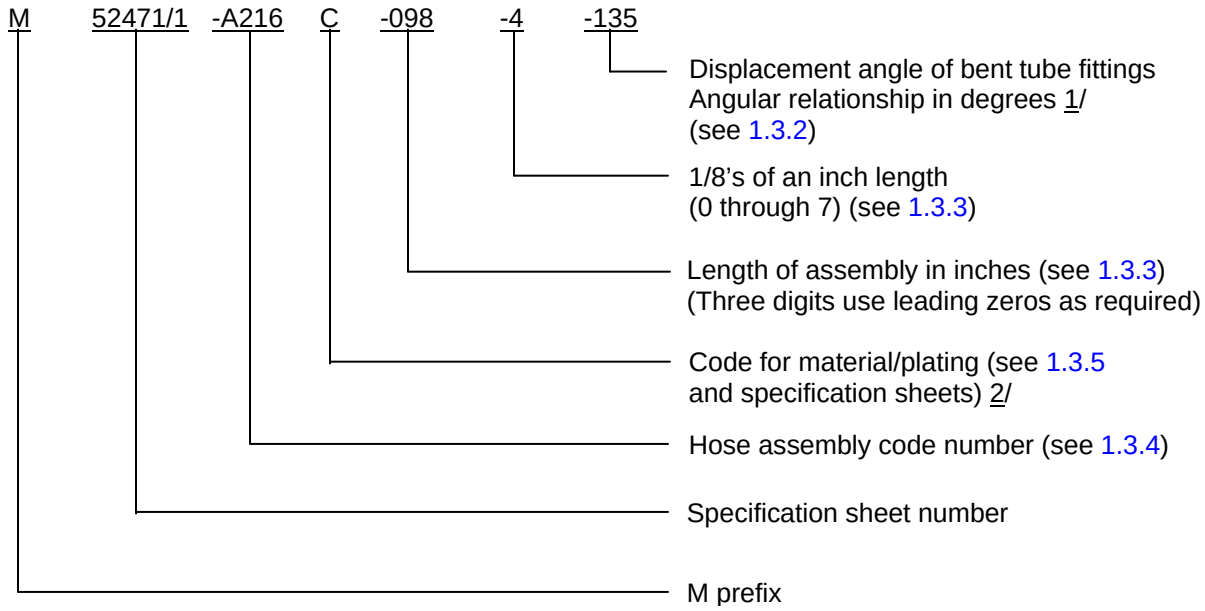
1.2.2 Bulk hose lengths. Bulk hose lengths are represented by the letter B or S. Bulk lengths are in increments of 20 feet or more (see 3.5.1). The S designator is used to define specific lengths in feet (see 3.5.2).

Examples:

When 30 feet total length is required the designator is: 030-B

When 30 feet continuous length is required with a 1% tolerance the designator is: 030-S

1.3 PIN for hose assemblies. The PIN consists of the letter "M" the specification sheet number, an assigned code number for the hose assembly, a letter for material/plating, three numbers for hose assembly length, a dash, a number for hose length in 1/8's of an inch, and angular relationship of fittings, when applicable.



1/ Not applicable for assemblies with straight fittings.
2/ A suffix indicating material and plating finish is to be specified with the assembly code number.

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PIN example: M52471/1-A216C-098-4-045, describes a hose assembly utilizing M52471/4-6, 3/8 ID hose, fitting X is M52525/5-6-6, bend angle 0°, fitting Y is M52525/6-6-6, bend angle 45°, cadmium plated, 98 ½ inches long, displacement angle 135°.

1.3.1 Bend angles. Bend angle is the angle of the tube on the fittings.

1.3.1.1 Hose assembly styles. There are six possible hose assembly styles (see figure 1). They are listed below:

1. Straight to straight
2. 45° bend to 45° bend
3. Straight to 45° bend
4. 45° bend to 90° bend
5. Straight to 90° bend
6. 90° bend to 90° bend

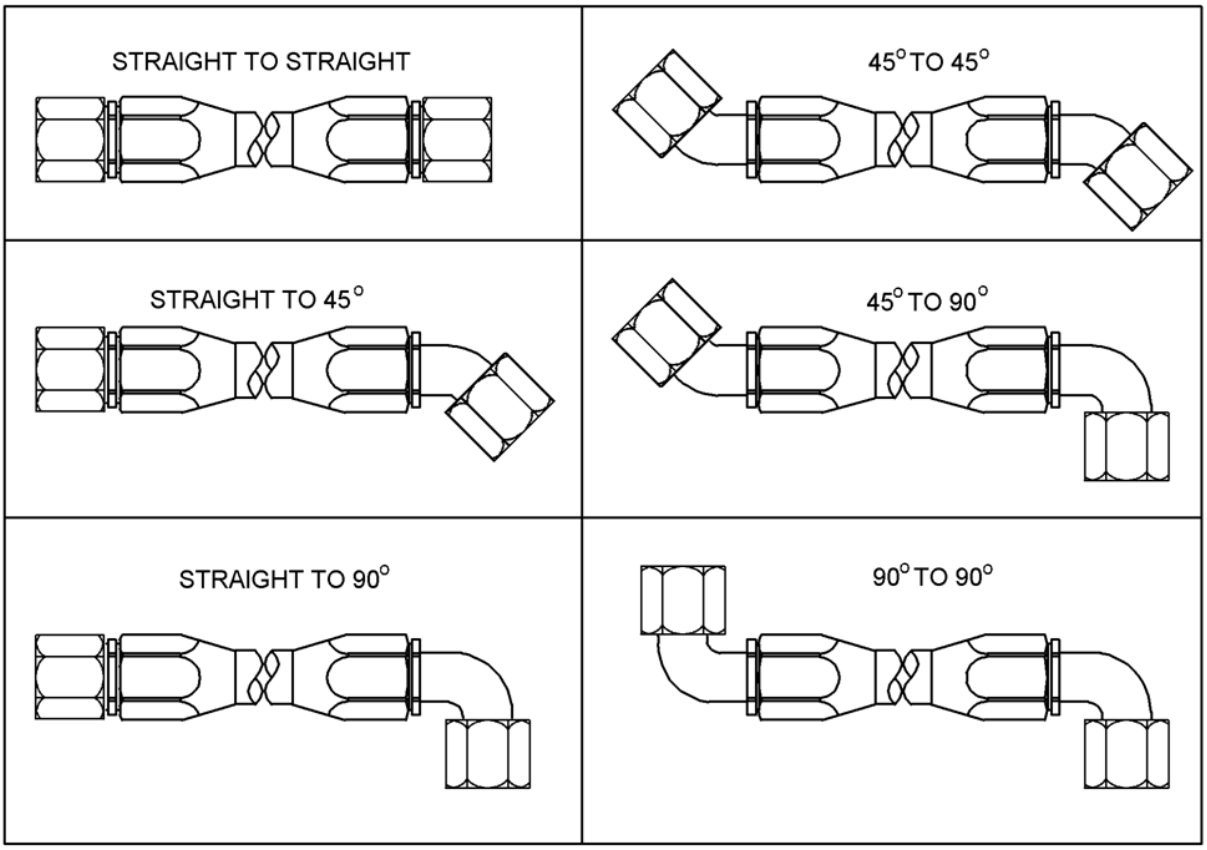

FIGURE 1. Hose assembly styles.

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1.3.2 Angular displacement for hose assemblies. Angular displacement for hose assemblies with elbow fittings on each end require that the angular displacement between the elbows be measured counter-clockwise from the centerline of the nearest fitting, positioned at six o' clock. Angular displacement is measured in degrees. Angular displacement angle may have any number of degrees up to 360 (000 is not acceptable). Always use 3 digits, use leading zeros as required (see figure 2). Not applicable for straight to straight fittings or straight to any angle, leave blank.

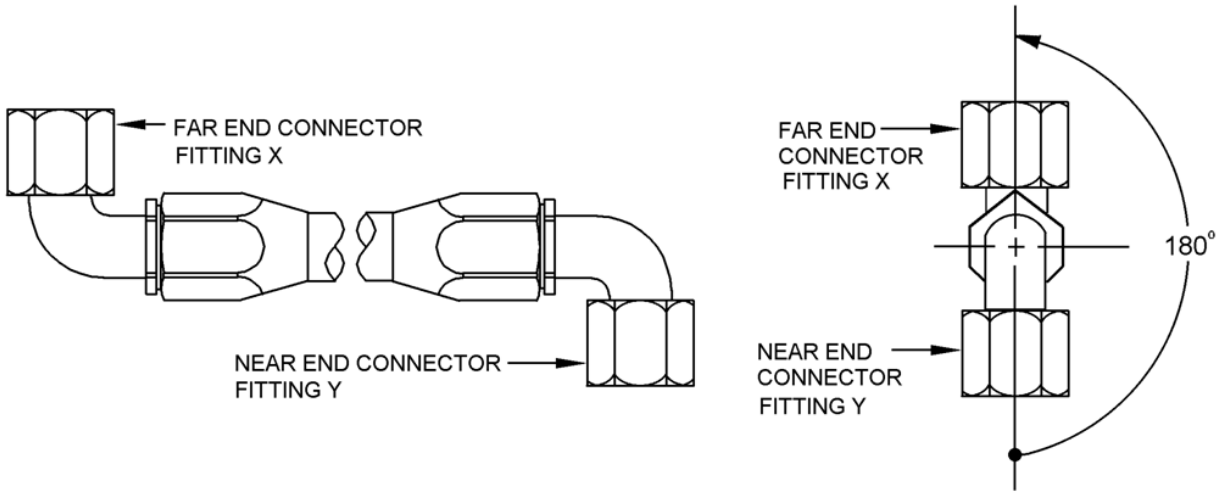

FIGURE 2. Angular displacement.

1.3.3 Assembly lengths. First 3 digits in inches, fourth digit in 8's of an inch (0 through 7) (see 3.5.3). Insert the number zero in front of designator for lengths less than 100 inches.

Examples:

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

When 96 inches is required the designator is: 096-0

1.3.4 Hose assembly code. The hose assembly code consists of hose ID size, SAE dash size, type of MIL-DTL-52525 fitting which is a harmonization of SAE-J516 and SAE-J518. The hose assembly code also includes the assembly style as seen in figure 1 or bend angle for each end. All this information is included in each individual specification sheet. This information is pertinent to each specific weapon system.

1.3.5 Plating options. To the users of this document, it is recommended that the use of carbon steel material with cadmium plating be used only when the other materials and finishes specified in this document cannot meet performance requirements.

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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.

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-PRF-2104	-	Lubricating Oil, Internal Combustion Engine, Combat/Tactical Service
MIL-DTL-52525	-	Fittings, Hose Reusable, Field-Attachable and Clamp-Halves, General Specification for

(See supplement 1 for list of specification sheets.)

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-130	-	Identification Marking of U.S. Military Property
MIL-STD-889	-	Dissimilar Metals

(Copies of these documents are available online at https://assist.daps.dla.mil/quicksearch/ 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 cited in the solicitation or contract.

ASTM INTERNATIONAL

ASTM D380	-	Standard Test Methods for Rubber Hose

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

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 17025	-	General requirements for the competence of testing and calibration laboratories

(Copies of these documents are available online at http://www.iso.ch or from the International Organization for Standardization American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036.)

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NCSL INTERNATIONAL

NCSL Z540.3	-	Requirements for the Calibration of Measuring and Test Equipment

(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-AS1946	-	Hose Assembly, Polytetrafluoroethylene, Metallic Reinforced, up to 1500 psi and 450° F, Hydraulic and Pneumatic
SAE-J343	-	Test and Test Procedures for SAE 100R Series Hydraulic Hose and Hose Assemblies, Standard
SAE-J517	-	Hydraulic Hose
SAE-J1475	-	Hydraulic Hose Fitting for Marine Applications
SAE-J1942	-	Hose and Hose Assemblies for Marine Applications

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

2.4 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between 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 the requirements of this specification and the specification sheet, the latter shall govern.

3.2 Qualification. Hose and hose assemblies furnished under this specification shall be products that are authorized by the qualifying activity for listing on the applicable qualified products list before contract award (see 4.5 and 6.3).

3.3 Materials.

3.3.1 Hose material. Hose material shall be in accordance with SAE-J517.

3.3.2 Fitting material. Fitting materials shall be in accordance with MIL-DTL-52525.

3.3.2.1 Dissimilar metals. Dissimilar metals shall not be used in intimate contact with each other unless protected against galvanic corrosion. Dissimilar metal combinations and methods of protection shall be in accordance with MIL-STD-889.

3.3.3 Identification of materials and finishes. The contractor shall identify the specific material, material finish or treatment for use with components and subcomponents, and shall make the information available, upon request, to the qualifying activity.

3.3.3.1 Material deterioration prevention and control. Excluding hose reinforcement wires, hose and hose assemblies shall be fabricated from compatible corrosion resistant materials, or shall be treated to prevent corrosion and deterioration that may be encountered in operating and storage environments.

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3.3.4 Recycled or environmentally preferable materials. Recycled or environmentally preferable materials shall 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 costs.

3.3.4.1 Recovered materials. Used, rebuilt, or remanufactured components, pieces, and parts shall not be incorporated in the hose and hose assemblies.

3.4 Hose construction. Hose shall be compatible with the applicable fittings qualified under MIL-DTL-52525. Hose construction shall be in accordance with the applicable specification sheet specified in table I.

TABLE I. Hose.

Type	Specification sheet
100R1	MIL-DTL-52471/4
100R2	MIL-DTL-52471/5
100R10 1/	MIL-DTL-52471/6
100RE 1/	MIL-DTL-52471/7
100R12	MIL-DTL-52471/9

1/ See 1.2.1.

3.4.1 Hose size. Hose size shall be in accordance with the applicable specification sheet listed in table I. The 100 R(x) series of hoses are similar to SAE-J517 except MIL-DTL-52471/7.

3.4.2 Hose concentricity . Hose concentricity shall be in accordance with SAE-J517.

3.4.2.1 Tube. The tube of the hose (inner liner) shall be seamless synthetic rubber. The tube shall allow for smooth fluid flow and shall be compatible with hydraulic fluids.

3.4.3 Reinforcement.

3.4.3.1 Wire reinforcement. The hose shall be reinforced with uniformly braided steel wires. The reinforcement layer shall consist of one or more sheaths in accordance with SAE-J517 (see 3.4).

3.4.3.2 Multiple wire braids. If more than one wire braid is used for reinforcement it shall be wrapped in alternating directions wire in accordance with SAE-J517. The reinforcement shall be able to resist the operating pressure for long hours of operation while being flexed and under vibration.

3.4.3.3 Interlayer cushioning. A ply or braid of suitable material may be used over the inner tube, to anchor the rubber to the wire. The ply or braid may also be used to over the spiral wrapped reinforcement.

3.4.4 Cover. The hose cover shall be made of synthetic rubber in accordance with SAE-J517. The cover shall be compatible with hydraulic fluid and shall be oil and weather resistant.

3.4.4.1 Cover design. The cover shall be designed to assemble with fittings in accordance with MIL-DTL-52525, which do not require removal of the cover or any portion of it. The cover shall be durable and excellent resistance to premature aging.

3.4.5 Hose assemblies. Hose assembly configuration shall be in accordance with the applicable specification sheet specified in table II.

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TABLE II. Hose assemblies.

Type	Specification sheet
100R1	MIL-DTL-52471/1
100R2	MIL-DTL-52471/2
100RE	MIL-DTL-52471/3
100RE	MIL-DTL-52471/8
100R12	MIL-DTL-52471/10

3.4.5.1 Connectors. Hose assembly connectors shall be in accordance with MIL-DTL-52525 and reusable. Swivel nuts shall turn freely by hand after assembly.

3.4.5.2 Angular relationship of bent tube fittings. When a hose assembly contains two bent tube fittings, one fitting shall be designated as the reference fitting for angular relationship measurement. Either fitting may be designated as the reference fitting. The reference orientation angle shall be measured in degrees counterclockwise from the reference fitting. Orientation angle tolerances shall be as follows:

a. Lengths up to and including 2 feet (61 cm): ± 2°.
b. Lengths over 2 feet (61 cm): ± 3°.

3.5 Length.

3.5.1 B designator for bulk hose. Bulk hose shall be furnished in lengths of 45 feet (13.7 m) or longer, except that not more than 25 percent may be furnished in lengths between 25 feet and 44 feet (7.6 m and 13.4 m) and not more than an additional 25 percent may be furnished in lengths between 15 feet and 24 feet (4.6 m and 7.3 m).

3.5.2 S designator for specific bulk hose lengths. When the order is for a specific length in feet, a tolerance of ±1% of the required length shall be used.

3.5.3 Hose assembly. The length of hose assemblies shall be the overall length measured from the extreme end of one fitting to the extreme end of the other fitting, except where bent tube fittings are required the length measurement shall be made between the center lines of the sealing surfaces of the fittings (see SAE-J517). The length shall be as specified in the contract or purchase order and embedded within the particular slash sheet PIN (see 6.2.2).

3.5.4 Hose assembly fittings. The fittings shall be MIL-DTL-52525 types using coding as called out in the specific slash sheets.

3.5.5 Marine based applications. For marine applications, use SAE-J1475 fittings and SAE-J1942 hose. The testing shall be in accordance with this document and shall be listed on the QPL in SAE-J1942-1. Note the fire flame, immersion, and burst testing being done in sea water. The U.S. Coast Guard maintains the QPL listing.

3.5.6 Tolerances. When hose assemblies are required or when a specific length of bulk hose is required, tolerances shall be as follows:

a. Lengths up to and including 12 inches: ±.125 inch (30.5 cm ±3.18mm).
b. Lengths above 12 inches up to and including 18 inches: ±.187 inch (30.5 cm up to and including 45.7 cm ± 4.75 mm).

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c. Lengths above 18 inches up to and including 36 inches: ±.250 inch (45.7 cm up to and including 91.4 cm ± 6.35 mm).
d. Lengths over 36 inches: ±1 percent measured to the nearest .125 inch (91.4 cm ±1 percent measure to the nearest 3.18 mm).

3.5.7 Steel ball test. A ball gage selected from the appropriate hose size dash number in table III shall fall through the section at the end of the adapter in the hose under its own weight without lubrication and without forcing the ball gage through the adapter-to-hose interfacing section.

TABLE III. Ball sizes to hose size. 1/ 2/

Hose size dash number	Steel Ball 3/ Spherical ball sizes for determining min hose assembly ID	
	Straight fittings 4/ Inches (mm)	Elbow fittings4/ Inches (mm)
03	.072 (1.83)	.068 (1.73)
04	.119 (3.02)	.112 (2.84)
05	.174 (4.42)	.164 (4.17)
06	.230 (5.84)	.218 (5.54)
08	.306 (7.77)	.289 (7.34)
10	.387 (9.83)	.366 (9.30)
12	.493 (12.52)	.466 (11.84)
16	.700 (17.78)	.661 (16.79)
20	.900 (22.86)	.850 (21.59)
24	1.125 (28.58)	1.063 (27.00)

1/ Dimensions are in inches.
2/ Metric equivalents are given for information only.
3/ Ball sizes are similar to SAE-AS1946.
4/ Minimum specified inside diameter shall be verified by passing a spherical ball through the hose assembly.

3.6 Operational conditions.

3.6.1 Length change. Hose and hose assemblies when tested in 4.8.2 a change in length in excess of the range of +2 or -4 percent shall constitute failure of this test.

3.6.2 Low temperature flexibility. Hose and hose assemblies when low temperature flexibility tested in 4.8.3 shall be capable of withstanding bending to the hose minimum bend radius within 8 to 12 seconds while at -40°F (-40°C) without evidence of splitting or cracking. After bending to the minimum bend radius at -40°F (-40°C), hose and hose assemblies shall be capable of withstanding the applicable proof pressure without evidence of leakage, rupture, or detachment of any fitting.

3.6.3 Proof pressure. Hose and hose assemblies when tested as specified in 4.8.4 shall be capable of withstanding a pressure equal to twice the operating pressure specified in the applicable specification sheet without evidence of leakage, rupture, slippage, or detachment of a fitting. There shall be no visual evidence of damage or permanent deformation.

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3.6.4 Burst pressure. The hose and hose assemblies when burst pressure tested in 4.8.5 shall be capable of withstanding a pressure equal to four times the operating pressure specified in the applicable specification sheet. Evidence of leakage, rupture, or detachment of a fitting prior to reaching the burst pressure shall constitute failure of this test.

3.6.5 Impulse. Hose and hose assemblies when impulse tested in 4.8.6 shall be capable of withstanding impulse pressure for the average number of impulse cycles specified in SAE-J343 and in table IV, without evidence of leakage, rupture, detachment, or slippage of a fitting shall constitute failure.

TABLE IV. Impulse cycles.

Type of hose	Average number of impulse cycles
100R1	150,000
100R2	150,000
100RE	300,000
100R12	500,000

3.6.6 Oil resistance. Hose when subjected to oil resistance in 4.8.7 the change in volume of nitrile rubber or polymerized chloroprene (tube) shall not exceed 30 percent, the change in volume of polymerized chloroprene (cover) shall not exceed 100 percent, and there shall be no shrinkage, after immersion in oil at a temperature of +212°F (100°C) for 70 hours.

3.6.7 Ozone resistance. The hose cover when ozone resistance tested in 4.8.8 shall show no evidence of cracking when observed under 7-power magnification.

3.6.7.1 Hazardous substances and ozone depleting chemicals. The ozone resistance test (see 4.8.8) may contain hazardous chemicals. It shall be handled in accordance with Federal regulations and guidelines to perform those tests. For further information about toxic chemicals and hazardous materials list, consult the Environmental Protection Agency web database at www.epa.gov/ebtpages/pollutants.html.

3.7 Age. See 6.4 and SAE-J517 for age control and shelf life.

3.8 Marking.

3.8.1 Hose. The hose shall be marked in accordance with MIL-STD-130 at intervals not to exceed 24 inches (61 cm) on the layline. Order of marking may be in any sequence. The marking shall include as a minimum, the following:

a. R1 for type 100R1 hose, R2 for type 100R2 hose, RE for type 100RE hose, and R12 for type 100R12 hose.
b. Hose size 1/4, 3/8, 1/2, 3/4, 1, 1-1/4, 1-1/2 or 2.
c. PIN (see 1.2).
d. Cure date (quarter and year).

3.8.2 Hose assemblies. Hose assemblies shall be marked when specified (see 6.2.2d) with a metal tag, embossed or stamped with the following:

a. Hose assembly manufacturer's name or trademark
b. PIN (see 1.3)
c. Date of manufacture (month and year).

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3.9 Workmanship.

3.9.1 Hose examination (see 4.7.1). The hose cover shall contain no patches or blisters and shall be free from wrinkles, except that minor impressions less than .031-inch (9.45 mm) deep (left by the curing wrap) shall be acceptable. The hose cover and tube shall contain no laps, laminations, cracks, or holes and shall show no evidence of looseness (wrinkles when bent). The hose tube shall show no evidence of ridges. There shall be no evidence of reinforcement wire through the hose tube or cover. The hose shall be cleaned free from oil, grease, dirt, or other foreign material, both internally and externally. Mandrel lubricants not readily removable are allowed provided they are not detrimental to hydraulic system components and fluids.

4. VERIFICATION

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

a. Qualification inspection (see 4.5).
b. Conformance inspection (see 4.6).

4.2 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the test conditions specified herein and/or in accordance with SAE-J343 as applicable in accordance with the applicable test method referenced in the test procedures. Unless otherwise specified, room temperature shall be defined as +60°F to +90°F (15.56°C to 32.22°C).

4.3 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 the maintenance of a calibration system to control the accuracy of all test and measuring equipment shall be in accordance with ISO 17025 and NCSL Z540.3 as applicable.

4.4 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.

4.5 Qualification inspection. 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 hose and hose assemblies. Each nominal hose size (ID) shall be qualified individually.

4.5.1 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.

4.5.2 Tests. Hose and hose assembly qualification inspection shall consist of the tests specified in table V and in the sequence specified in table VI.

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4.5.3 Assembly distributor. 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.

4.5.4 Qualification by similarity. Qualification by similarity for any size, or any slash sheet, associated with MIL-DTL-52525 may be requested by any manufacturer already listed on QPL-52471. The qualifying activity will review the requests based on similarity of the requested size and slash sheet to those already listed on QPL-52471. Similarity will be evaluated based on criteria such as test data, materials, manufacturing equipment, manufacturing processes, or other relevant criteria.

TABLE V. Qualification inspection.

Test	Requirement	Test paragraph
Visual examination	3.9.1	4.7.1
Steel ball test 1/	3.5.7	---
Proof pressure	3.6.3	4.8.4
Low temperature flexibility	3.6.2	4.8.3
Length change	3.6.1	4.8.2
Burst pressure	3.6.4	4.8.5
Impulse	3.6.5	4.8.6
Oil resistance	3.6.6	4.8.7
Ozone resistance	3.6.7	4.8.8

1/ Hose assembly only.

TABLE VI. Qualification test sequence.

Test number	Test sequence	Test	Requirement paragraph	Test paragraph	Number of specimens per qualified fitting
1	1	Visual examination	3.9.1	4.7.1	All
2	1	Steel ball test	3.5.7	---	All
3	2	Length change	3.6.1	4.8.2	3
4	3	Low temperature flexibility	3.6.2	4.8.3	4
	4 1/	Proof pressure	3.6.3	4.8.4	
5 1/	2	Burst pressure	3.6.4	4.8.5	4
6	2	Proof pressure	3.6.3	4.8.4	4
	3	Impulse	3.6.5	4.8.6	4
7	2	Oil resistance	3.6.6	4.8.7	3 covers (total)
8	3	Ozone resistance	3.6.7	4.8.8	Cover samples

1/ The burst pressure test may be performed on the low temperature specimens, in which case separate burst test samples will not be required.

4.5.4.1 Test plans and qualification reports.

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4.5.4.2 Test plans. Test plans shall be prepared and submitted in accordance with the requirements of the qualification activity. The method of qualification proposed by the contractor is subject to the approval of the qualification activity. Manufacturers shall discuss with the qualifying activity the test specimens and test plans. These plans shall state specifically the component requirement to be verified during the test, such as test fixtures, setup, conditions, and identification of the successor failure criteria shall be included as appropriate.

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

4.6 Conformance inspection.

4.6.1. Individual inspection. Individual inspection shall consist of the inspections specified in table VII in the order shown.

TABLE VII. Individual inspections.

Inspections	Requirement paragraph	Inspection paragraph
Visual examination1/	---	4.7.1
Steel ball test 2/	3.5.7	---
Proof pressure 1/	3.6.3	4.8.4

1/ 100 percent inspection for bulk hose and hose assemblies.
2/ 100 percent inspection for hose assemblies only.

4.6.1.1. Individual inspections sampling plan. Individual inspections specified in table VII shall be performed on a production lot. The examination of product shall be 100% of the bulk hose length or hose assembly or an inspection plan approved in writing by the qualifying activity and the proof pressure shall be 100% of the bulk hose length or hose assembly.

4.6.2 Sampling and periodic inspections. Sampling and periodic inspections shall consist of the inspections specified in table VIII and shall be made on test samples from production lots which have been subjected to and passed the individual inspections (see table VII).

TABLE VIII. Sampling and periodic inspections.

Inspection	Requirement	Test paragraph	Sampling	Periodic
Length change 1/	3.6.1	4.8.2	X	
Burst 2/	3.6.4	4.8.5	X	
Impulse 2/ 3/	3.6.5	4.8.6		X

1/ Length change is for bulk hose only.
2/ Burst and impulse tests apply to bulk hose and hose assemblies.
3/ Preconditioning is not required for periodic inspection.

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4.6.3 Sampling inspections.

4.6.3.1 Inspection sample (bulk hose). Hose lengths randomly selected from production runs shall be subjected to the sampling inspections specified in table VIII. Sampling for bulk hose shall be performed on each continuous run under essentially continuous conditions. Samples shall be selected at a rate of 1 sample for each full or partial increment of 750 feet (228.60 m) of hose produced in the continuous run, up to a maximum of 2 samples. For continuous runs greater than 1500 feet (457 m), 2 samples, representative of the entire production run, shall be selected.

4.6.3.2 Inspection sample (hose assemblies). The inspection lot shall be 8 items tested for each 3000 assemblies produced (large lot option). At the option of the manufacturer, one item may be tested for each 375 assemblies produced (small lot option). If there has been some production, but the number hose assemblies produced has not reached 375 for a specific size within three years, the manufacture shall perform sampling tests on one hose assembly of that size unless documented approval to not perform the tests has been obtained from the qualifying activity.

4.6.4 Periodic testing sampling plan.

4.6.4.1 Periodic inspection.

4.6.4.2 Periodic inspection (bulk hose). Hose length, randomly selected from production runs shall be subjected to the periodic tests specified in table VIII. Periodic inspection shall be 4 samples tested to each required periodic test for each produced 20,000 feet (6096 m) for bulk hose specifications (large lot option). At the option of the manufacturer, 1 sample may be tested to each required periodic test for each produced 5,000 feet (1524 m) as applicable (small lot option).

4.6.4.3 Reduced production bulk hose. If there has been some production, but the footage of bulk hose produced has not reached 5,000 feet (1524 m) for a specific size within three years, the manufacturer shall perform periodic control tests on one sample of that size, for each required periodic test, unless documented approval to not perform the test has been obtained from the qualifying activity.

4.6.4.4 Periodic inspection (hose assemblies). Periodic inspection shall consist of the periodic inspection in table VIII. Periodic inspection shall be 4 samples tested to each required periodic test for each produced 10,000 assemblies (large lot option), or 1 sample shall be tested to each required periodic test for each produced 2,500 assemblies (small lot option). 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 manufacture shall perform peridoc tests on one hose assembly of that size unless documented approval to not perform the tests has been obtained from the qualifying activity.

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

4.6.5 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.

4.6.6 Nonconformance.

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4.6.6.1 Failures. If a sample fails to pass any sampling or periodic inspection, see table VIII, the manufacturer shall immediately notify the qualifying activity and cognizant inspection activity of such failure. The manufacturer shall take corrective action on the materials or processes or both as warranted, 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.

4.6.6.2 Acceptance and shipment. 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, see table VIII, shall be repeated on additional samples. At the discretion of the qualifying activity this may include all inspections, or the inspection which the original sample failed. Individual and sampling and periodic inspections, if applicable, 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.

4.6.7 Additional QPL test and reporting requirements.

4.6.7.1 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.

4.6.7.2 Loss of product qualification.

4.6.7.2.1 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.

4.6.7.2.2 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. No sampling or periodic testing is required for a specific size if there has been no production for that size in the reporting period.

4.6.7.2.3 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.

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4.6.7.2.4 Discontinuation and resumption of production of bulk hose (three years or more). If there has been no production of a specific size for a period of three years or more, three hose assemblies shall each be subjected to all individual tests (see table VII) and all sampling tests (see table VIII), and four samples shall be subjected to each periodic test (see table VIII) before production is resumed.

4.7 Inspection procedure.

4.7.1 Examination. The hose or hose assemblies shall be examined as specified herein for the defects specified in table IX.

TABLE IX. Visual examination.

Defect	Reference
Dimensions affecting interchangeability not within tolerance	3.4.1
Hose concentricity	3.4.2
Materials not resistant to corrosion and deterioration, or treated to be resistant to corrosion and deterioration for the applicable storage and operating environments.	3.3.3.1
Dissimilar metals are not treated or effectively insulated from each other	3.3.2
Contractor does not have documentation available for identification of material, material finishes, or treatment	3.3.3
Used, rebuilt or remanufactured components, pieces, or parts incorporated in the hose and hose assemblies	3.3.4.1
Tube not as specified	3.4.2.1
Reinforcement not as specified	3.4.3
Cover not as specified	3.4.4
Hose size not as specified	3.4.1
Fitting not reusable	3.4.5.1
Swivel nuts shall turn freely by hand	3.4.5.1
Fitting configuration not as specified	3.4.4
Fitting material not as specified	3.4.4
Fitting finish not as specified	1.3.5
Fitting design not as specified	3.4.5.1
Fitting threads not as specified	3.4.5.1
Angular relationship of bent tube fittings not as specified	3.4.5.2
Length not as specified	3.5
Age not as specified	3.7
Marking missing or not as specified	3.8
Workmanship not as specified	3.9.1
Patched cover	3.9.1
Blistered or wrinkled cover	3.9.1
Lap or lamination of hose tube or cover	3.9.1
Crack or hole in cover or tube	3.9.1
Loose tube or cover (wrinkles when bent)	3.9.1
Ridge on tube	3.9.1
Wire through tube or cover	3.9.1
Depressed area of hose cover (exceeds outside diameter [OD] minimum tolerance)	3.9.1
Depressed area of hose tube (exceeds inside diameter [ID] maximum tolerance)	3.9.1
Presence of foreign material	3.9.1

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4.8 Tests.

4.8.1 Test assembly preparation. When bulk hose or reusable fittings are required, hose assemblies shall be assembled in accordance with the contractor's instruction sheet. When permanently attached fittings are to be supplied, the test assemblies shall be assembled in accordance with the manufacturer's instruction sheet. The hose of QPL samples shall be marked with white ink at the skirt of the fitting. The free length of hose measured between fittings shall be determined using SAE-J343.

4.8.2 Length change (see 3.6.1). The length change shall be determined in accordance with the change in length test in accordance with SAE-J343 and shall meet the requirements of 3.6.1. Test pressure shall be in accordance with the maximum operating pressure specified in the applicable specification sheet.

4.8.3 Low temperature flexibility (see 3.6.2). Hose assemblies when subjected to low temperature testing shall meet the requirements of 3.6.2. The following details shall apply:

a. The low temperature test shall be conducted at -40°F (-40°C) in accordance with the cold bend test specified in SAE-J343 except, with a 10 lb. weight, for a minimum of 24 hours at a minimum temperature of 212°F (100°C). Minimum bend radius shall be as specified in table X.
b. After the cold bend test the hose shall be subjected to proof pressure testing in accordance with 4.8.4.

TABLE X. Minimum bend radius dimensions. 1/ 2/

M52471 slash sheet	Size	Min Bend Radius Inches (mm)
M52471/4 hose type 100R1 single wire braid	-4	4.0 (100)
	-6	5.0 (125)
	-8	7.0 (180)
	-12	9.5 (240)
	-16	12.0 (300)
	-20	16.5 (420)
	-24	20.0 (500)
	-32	25.0 (630)
M52471/5 hose type 100R2 double wire braid	-4	4.0 (100)
	-6	5.0 (125)
	-8	7.0 (180)
	-12	9.5 (240)
	-16	12.0 (300)
	-20	16.5 (420)
	-24	20.0 (500)
	-32	25.0 (630)
M52471/7 hose type 100RE multiple-spiral-wrap	-8	8.00 (200)
	-12	11.00 (280)
	-16	12.00 (300)
M52471/9 hose type 100R12 four spiral wrap	-8	7.00 (180)
	-12	9.50 (240)
	-16	12.00 (300)

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

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4.8.4 Proof pressure (see 3.6.3). Hose and hose assemblies shall meet the proof pressure test in accordance with SAE-J343 and shall meet the requirements of 3.6.3. The following details shall apply:

a. The hose or hose assembly shall be subjected to twice the operating pressure specified in the applicable specification sheet for not less than 60 seconds and not more than 5 minutes.
b. Tolerance shall be ± 5%.

4.8.5 Burst pressure (see 3.6.4). The hose or hose assembly shall meet the requirements of 3.6.4 when subjected to the burst pressure test in accordance with ASTM D380. The following details shall apply:

a. Hose assembly shall be in accordance with SAE-J343 and shall meet the requirements therein for burst test.
b. An 18-inch (45.7 cm) length of hose shall be tested.
c. Hose assembly shall be subjected to pressure and the pressure increased until burst of the assembly occurs.
d. The test sample shall be observed throughout the test and the type of failure and the pressure at which it occurred shall be recorded.
e. The burst pressure shall be equal to or greater than four times the maximum operating pressure specified in the applicable specification sheet.

4.8.6 Impulse (see 3.6.5). The impulse test shall be conducted in accordance with SAE-J343. The following details shall apply:

a. The uncapped test samples shall be preconditioned by immersion in 10 weight oil in accordance with MIL-PRF-2104 at a minimum temperature of 212°F (100°C) for a minimum of 24 hours.
b. The test pressure shall be in accordance with table XI.
c. The number of impulse cycles shall be in accordance with table XII.
d. The impulse test oil temperature shall be 200°F± 1.7°F (93.3°C ±3°C).
e. Shall meet the requirements of 3.6.5. Failure of a test sample below the minimum number of cycles listed specified in table XI, or failure of the samples to attain the average number of cycles listed specified in table XII shall constitute failure of this test.

TABLE XI. Impulse test pressure.

Hose type	Test pressure
100R1	125 percent of the maximum operating pressure specified in the applicable specification sheet for hose 1 inch ID and smaller, and 100 percent for hoses larger than 1 inch ID.
100R2	133 percent of the maximum operating pressure specified in the applicable specification sheet.
100RE	133 percent of the maximum operating pressure specified in the applicable specification sheet.
100R12	133 percent of the maximum operating pressure specified in the applicable specification sheet.

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TABLE XII. Impulse cycles and calculation method. 1/

Hose type	Minimum cycles allowed 2/	Minimum average	Maximum cycles for computing
100R1	100,000	150,000	200,000
100R2	100,000	150,000	200,000
100RE	225,000	300,000	375,000
100R12	425,000	500,000	575,000

1/ Average number of cycles = $\frac{N_1 + N_2 + N_3 + N_4}{4}$

Where:

N_1= Number of cycles withstood by first test assembly.
N_2= Number of cycles withstood by second test assembly.
N_3= Number of cycles withstood by third test assembly.
N_4= Number of cycles withstood by forth test assembly.

2/ Inability of the hose assembly to meet this requirement shall constitute failure.

4.8.7 Oil resistance (see 3.6.6). The oil resistance test shall be conducted in accordance with SAE-J343. The test oil temperature shall be 212°F ±5 °F (100°C ±1.7°C). Nonconformance to 3.6.6 shall constitute failure of this test.

4.8.8 Ozone resistance (see 3.6.7). The ozone resistance test shall be conducted in accordance with SAE-J343 except as specified herein. The following details shall apply:

a. The ozone concentration shall be 50 parts per million.
b. The test temperature shall be 100°F ± 5°F (37.8°C ± 1.7°C).
c. The test duration shall be not less than 168 hours.
d. Ozone resistance shall meet the requirements of 3.6.7.

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 Controls 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.)

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6.1 Intended use. Hose and hose assemblies covered by this specification are intended for use in hydraulic equipment systems at temperatures ranging from -40°F to 200°F (-40°C to 93.3°C). Hoses, type 100R are designed for ground vehicles, hydraulic test stands, and ground support equipment. They are not intended for aircraft use. These hose assemblies are used in vehicle hydraulic systems requiring interoperability and compatibility with military associated components, in combat and or harsh environments.

6.1.1 Military uniqueness. The interoperability and compatibility is assured through an assembly code number found on each slash sheet. This assembly code number was designed by Army Tank Command (Army-AT). This document also requires more severe low temperature bend testing. Which uses preconditioning and a 10lb. (4.5 kg) weight, at the -40°F (-40°C) temperature.

6.2 Acquisition requirements. Acquisition documents must specify the following:

a. Title, number, and date of this specification.
b. Whether bulk hose or hose assemblies are required (see 6.2.1 or 6.2.2).
c. Identification of materials and finishes if required (see 3.3.3).
d. Shelf life (6.4)
e. Packaging requirements (see 5.1).

6.2.1 Bulk hose. When bulk hose is required, acquisition documents should specify the following:

a. Type of hose and hose size required (specification PIN) (see 1.2 and 3.4.1).
b. Total length of bulk hose required, or specific length and number of specific lengths required (see 3.5.1 and 3.5.2).

6.2.2 Hose assemblies. When hose assemblies are required, acquisition documents should specify the following:

a. Type hose and size hose assembly required (specification sheet PIN) (see 1.3 and 3.4.1), or the following for each hose assembly:
b. Angular relationship of bent tube fittings required when the hose assembly contains two bent tube fittings (see 3.4.5.2).
c. Length of hose assembly required (see 3.5.1 and 3.5.2).
d. When hose assemblies are to be tagged (see 3.8.2).

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. 52471 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 DLA Land and Maritime, P.O. Box 3990, ATTN: DSCC-VQ, Columbus, Ohio 43218-3990 or emailed to vqp.chief@dla.mil. An online listing of products qualified to this specification may be found in the Qualified Products Database (QPD) at https://assist.daps.dla.mil.

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

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6.4 Shelf life. This specification covers items where the assignment of a Federal shelf-life code is a consideration. Specific shelf-life requirements should be specified in the contract or purchase order, and should include, as a minimum, shelf-life code, shelf-life code, shelf-life package markings in accordance with MIL-STD-129 or FED-STD-123, preparation of a materiel quality storage standard for type II (extendible) shelf-life items, and a minimum of 85 percent shelf-life remaining at time of receipt by the Government. These and other requirements, if necessary, are in DoD4140.27-M, *Shelf-life Management Manual.* The shelf-life codes are in the Federal Logistics Information System Total Item Record. Additive information for shelf-life management may be obtained from DoD 4140.27-M, or the designated shelf-life Points of Contact (POC). The POC should be contacted in the following order: (1) the Inventor Control Points that manage the item and (2) the DoD Service and Agency administrators for the DoD Shelf-Life Program. Appropriate POCs for the DoD Shelf-Life Program can be contacted through the DoD Shelf-Life Management website: https://www.shelflife.hq.dla.mil/.

6.5 Bulk hose and reusable adapters and elbows. To insure interchangeability of fittings and hose within the supply system, bulk hose should be tested with a standard fitting of the applicable type and size selected by the qualifying activity.

6.6 MIL-DTL-52471/6 replacement hose. MIL-DTL-52471/6 hose has been canceled refer to cancellation notice for suggested replacement hose. MIL-DTL-52471/3 hose assembly document is being retained so replacement parts can be ordered from this slash sheet. The intent is for users to use PIN's from MIL-DTL-52471/3 to order parts.

6.7 Definitions.

6.7.1 Leakage. Any passage of fluid from the inner portion of a fitting, hose, or hose assembly, as determined by sight, touch, or pressure loss. Leaks occur through the hose, the fitting body, at the junction between the hose and fitting, or at the sealing surface, thread or flange face, of a fitting. Failure of a test fixture is not included.

6.7.2 Rupture. A leak which causes visible damage to the fitting, or hose, as evidenced by the rapid loss of volume of the pressurizing fluid, or sharp reduction in pressure.

6.7.3 Slippage of a fitting. Permanent movement of a fitting, measured when the hose is in a relaxed condition.

6.7.4 Detachment. The loss of contact between the fitting and the hose to which it is attached, or the loss or partial loss of contact between the fitting and hose or the fitting and test fixture fitting by virtue of thread stripping or severance of a fitting body. Failure of a test fixture fitting is not included.

6.8 Reusable fittings. Reusable fittings meeting all requirements of MIL-DTL-52525 are available for all sizes of hose specified in the applicable specification sheets.

6.9 Conformance testing. It is recommended that the acquiring activity waive sample testing on lots that contain less than 500 units of product when the contractor has tested and furnished a like item to the Government within the past two years.

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6.10 Classification changes. Classification of the hose and hose assemblies in previous revisions of this specification is as follows:

MIL-H-52471B	MIL-H-52471C	MIL-H-52471D	MIL-DTL-52471E	MIL-DTL-52471F
Type A	Type 100R1	Type 100R1	Type 100R1	Type 100R1
Type B	Type 100R2	Type 100R2	Type 100R2	Type 100R2
Type C	Type 100R10	Type 100R10	Type 100R10	Type 100R10 1/
Type D	Type 100R11	Deleted		Type 100RE
Type E	Type 100RX	Deleted		Type 100RE
		Type 100R11	Type 100R11	Type 100R11
		Type 100R12	Type 100R12	Type 100R12

1/ See 6.6 for suggested replacement hose assemblies.

6.11 Subject term (key word) listing.

Automotive
Flexible
Fluid
Ground carts
Layline
Ozone
Permanent
Reusable
Test stands
Wire reinforced

6.12 Environmentally preferable material. Environmentally preferable materials should be used to the maximum extent possible to meet the requirements of this specification. As of the dating of this document, the U.S. Environmental Protection Agency (EPA) is focusing efforts on reducing 31 priority chemicals. The list of chemicals and additional information is available on their website http://www.epa.gov/osw/hazard/wastemin/priority.htm. Included in the EPA list of 31 priority chemicals are cadmium, lead, and mercury. Use of these materials should be minimized or eliminated unless needed to meet the requirements specified herein (see section 3).

6.13 Guidance on use of alternative parts with less hazardous or nonhazardous 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.

6.14 Amendment notations. The margins of this specification are marked with vertical lines to indicate modifications generated by this amendment. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations.

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CONCLUDING MATERIAL

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

Review activities:
Army - GL
Navy - CG, MC, SA

Preparing activity:
DLA - CC

(Project 4720-2010-010)

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