

INCH-POUND
MIL-DTL-52471E
w/AMENDMENT 1
25 March 2004
SUPERSEDING
MIL-DTL-52471E
27 April 1998

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.

1.2 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	-	Four-spiral-wrap reinforcement.
Type 100RE	-	Four-spiral-wrap reinforcement.
Type 100R12	-	Four-spiral-wrap reinforcement.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 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 and 4 of this specification, whether or not they are listed.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Defense Supply Center, Columbus, DSCC-VAI, 3990 East Broad Street, Columbus, OH 43216-5000, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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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 listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

FEDERAL

- QQ-N-286 - Nickel-Copper-Aluminum Alloy, Wrought (UNS N5500)
- FF-B-575 - Deleted.
- A-A59267 - Phosphate Coating Compounds, Manganese or Zinc Base (for ferrous metals)

DEPARTMENT OF DEFENSE

- MIL-PRF-2104 - Lubricating Oil, Internal Combustion Engine, Combat/Tactical Service
- DOD-P-16232 - Deleted.
- MIL-DTL-52525 - Fittings, Hose Reusable, Field-Attachable and Clamp-Halves, General Specification for

(See supplement 1 for list of specification sheets.)

STANDARDS

FEDERAL

- FED-STD-H28 - Screw-Thread Standards for Federal Services

DEPARTMENT OF DEFENSE

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

(Copies of these documents are available online at <http://assist.daps.dla.mil/quicksearch/> or www.dodssp.daps.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 the documents which are DoD adopted are those listed in the issue of the DoDISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS are the issues of the documents cited in the solicitation (see 6.2).

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AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- ANSI/ASQC-Z1.4 - Sampling Procedures and Tables for Inspection by Attributes (DoD adopted)

(Application for copies of ANSI publications should be addressed to the American National Standards Institute, 11 West 42nd Street, New York, NY 10036.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

- ASME B46.1 - Surface Texture (Surface Roughness, Waviness, and Lay) (DoD adopted)

(Application for copies of ASME publications should be addressed to the American Society of Mechanical Engineers, 345 E. 47th Street, New York, NY 10017.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- ASTM A27 - Standard Specification for Steel Castings, Carbon, for General Application (DoD Adopted)
- ASTM A47 - Standard Specification for Ferritic Malleable Iron Castings (Metric) (DoD Adopted)
- ASTM A108 - Standard Specification for Steel Bars, Carbon, Cold-Finished Standard Quality (DoD Adopted)
- ASTM B164 - Standard Specification for Nickel-Copper Alloy Rod, Bar, and Wire (DoD Adopted)
- ASTM B165 - Standard Specification for Nickel-Copper Alloy (UNS N04400) Seamless Pipe and Tube (DoD Adopted)
- ASTM A220 - Standard Specification for Pearlitic Malleable Iron (DoD Adopted)
- ASTM A494 - Standard Specification for Castings, Nickel and Nickel Alloy (DoD Adopted)
- ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel (DoD Adopted)

(Applications for copies of ASTM publications should be addressed to the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

- SAE J343 - Test and Test Procedures for SAE 100R Series Hydraulic Hose and Hose Assemblies, Standard
- SAE J516 - Hydraulic Hose Fitting
- SAE J517 - Hydraulic Hose

(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. In the event of a conflict between this document and the references cited herein (except for related associated specifications or 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 (see 6.2).

3.2 Qualification. Hose, and hose assemblies furnished under this specification shall be products which are authorized by the qualifying activity for listing on the applicable qualified products list (QPL) before contract award (see 4.3 and 6.3).

3.2.1 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 with QPL-52525. The qualifying activity will review the requests based on similarity of the requested size and slash sheet to those already listed on QPL-52525. Similarity will be evaluated based on criteria such as test data, materials, manufacturing equipment, manufacturing processes, or other relevant criteria.

3.3 Materials.

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.

3.3.1.1 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.

3.3.1.2 Identification of materials and finishes. The contractor shall identify materials, finishes and treatments used and shall make this information available when specified in this contract (see 6.2).

3.3.2 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, 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.

3.4 Construction.

3.4.1 Hose. Hose shall consist of an inner tube, wire reinforcement, and an outer cover. Hose shall be compatible with the applicable fittings qualified under MIL-DTL-52525. Hose size shall be in accordance with the applicable specification sheet listed in table I. The 100R(x) series of hose is similar to SAE J517.

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TABLE I. Hose.

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

3.4.1.1 Tube. The tube of the hose (inner liner) shall be seamless butadiene acrylonitrile or polymerized chloroprene.

3.4.1.2 Reinforcement. Hose reinforcement shall be steel wire.

3.4.1.3 Cover. The hose cover shall be polymerized chloroprene.

3.4.2 Hose assemblies. Hose assemblies shall be provided with the fitting on each end specified in the applicable specification sheet.

3.4.2.1 Configuration. Hose assembly configuration shall be in accordance with the applicable specification sheet listed in table II.

TABLE II. Hose assembly.

Type	Specification sheet
100R1	MIL-DTL-52471/1
100R2	MIL-DTL-52471/2
100R10	MIL-DTL-52471/3
100RE	MIL-DTL-52471/8
100R12	MIL-DTL-52471/10

3.4.2.2 Fittings. Unless otherwise specified herein, hose assembly fittings shall be reusable conforming to MIL-DTL-52525. When other than MIL-DTL-52525 fittings are required, hose assembly requirements shall conform to the following:

- a. Type of hose and hose size (see 3.4.1).
- b. Reusable or permanently attached fitting. Reusable fitting types are:
 1. 2 or 4 bolt, 2-segment socket.
 2. Multisegment socket with retaining rings.
 3. 2 segment socket, pin retained.
 4. Socket hinged on one side with the other side bolt secured.
 5. Finger-grip socket with retaining sleeve.
 6. Screw-together type.

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c. Type of termination fitting, including:

1. Male or female.
2. Swivel or nonswivel.
3. Bulkhead or nonbulkhead.
4. 37° flare, 45° flare, flareless, 45° inverted flare, 30° inverted flare, dryseal pipe thread, 500-pounds per square inch (psi) 4-bolt split-flange head, 3000-psi 4-bolt split-flange head, 6000-psi 4-bolt split-flange head, O-ring face, or straight-thread O-ring boss, male.

d. Termination fitting hose size: 3/16, 1/4, 5/16, 3/8, 1/2, 5/8, 3/4, 1, 1-1/4, 1-1/2 and 2.

e. Fitting configuration (angularity):

1. Straight.
2. Bent tube - 7-1/2°, 15°, 22-1/2°, 30°, 37-1/2°, 45°, 52-1/2°, 60°, 67-1/2°, 75°, 82-1/2°, 90° short drop, or 180°.

f. Fitting socket, nipple, and bent tube material.

1. Nickel-copper alloy conforming to ASTM B164 class optional, ASTM B165, or QQ-N-286 class A, form optional.
2. Nickel-copper-silicone alloy castings conforming to ASTM A494, composition optional.
3. Steel conforming to ASTM A27 grade and class optional, ASTM A108 chemical composition and hardness optional.
4. Malleable iron conforming to ASTM A47 or ASTM A220 grade optional.

g. Fitting finish.

1. Zinc plate conforming to ASTM B633 type II, FE/ZN 13.
2. Phosphate coating conforming to A-A59267 type Z.

3.4.2.2.1 Fitting design. Large external sections of the fitting envelope that adjoin relatively smaller sections shall be contoured to provide clearance for commercial automotive-type hand wrenches. The distance across wrench flats (hexagon or other) shall be in multiples of 1/16-inch. Tolerances shall not exceed the tolerances across flats for the regular hexagon head bolt nearest the fitting wrench flat size specified in SAE J516. Swivel nuts shall turn freely by hand.

3.5 Threads. Threads of fittings shall be in accordance with FED-STD-H28, except that threads that grip the hose are optional.

3.6 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 tolerance shall be ± 2 degrees on lengths up to and including 2 feet, and ± 3 degrees on lengths over 2 feet. The angular relationship of the fittings shall be as specified in the contract (see 6.2.2).

3.7 Length.

3.7.1 Bulk hose. Unless otherwise specified (see 6.2.1), bulk hose shall be furnished in lengths of 45 feet or longer, except that not more than 25 percent may be furnished in lengths between 25 feet and 44 feet and not more than an additional 25 percent may be furnished in lengths between 15 feet and 24 feet.

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3.7.2 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. The length shall be as specified in the contract (see 6.2.2).

3.7.3 Tolerances. When hose assemblies are required or when a specific length of bulk hose is required, tolerances shall be ± 0.125 inch for lengths up to and including 12 inches, ± 0.187 inch for lengths above 12 inches up to and including 18 inches, ± 0.250 inch for lengths above 18 inches up to and including 36 inches, ± 1 percent measured to the nearest 0.125 inch for lengths over 36 inches.

3.8 Operational conditions.

3.8.1 Length change. When subjected to the operating pressure specified in the applicable specification sheet for 30 seconds, the hose length shall not change by more than +2 percent, or less than -4 percent for all sizes of hose (see 4.5.2.2).

3.8.2 Low temperature. Hose and hose assemblies shall be capable of withstanding bending to the hose minimum bend radius within 8 to 12 seconds while at -40 °F without evidence of splitting or cracking. After bending to the minimum bend radius at -40 °F, hose and hose assemblies shall be capable of withstanding the applicable proof pressure without evidence of leakage, rupture, or detachment of any fitting (see 4.5.2.3).

3.8.3 Proof pressure. Hose and hose assemblies 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 (see 4.5.2.4).

3.8.4 Burst pressure. The hose and hose assemblies shall be capable of withstanding a pressure equal to four times the operating pressure specified in the applicable specification sheet without evidence of leakage, rupture, or detachment of a fitting (see 4.5.2.5).

3.8.5 Impulse. Hose and hose assemblies shall be capable of withstanding impulse pressure for the average number of impulse cycles specified in table III, without evidence of leakage, rupture, detachment, or slippage of a fitting, after being subjected to $+212$ °F for 24 hours (see 4.5.2.6).

TABLE III. Impulse cycles.

Type of hose	Average number of impulse cycles
Type 100R1	150,000
Type 100R2	150,000
Type 100R10	300,000
Type 100RE	300,000
Type 100R12	500,000

3.8.6 Oil resistance. The change in volume of butadiene acrylonitrile shall not exceed 30 percent, the change in volume of polymerized chloroprene shall not exceed 100 percent, and there shall be no shrinkage, after immersion in oil at a temperature of $+212$ °F for 70 hours (see 4.5.2.7).

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3.8.7 Ozone resistance. The hose cover shall be capable of withstanding air with an ozone concentration of 50 parts per million maintained at +100 °F for 168 hours without evidence of cracking when observed under 7-power magnification (see 4.5.2.8).

3.9 Age. The hose shall be manufactured not more than 12 calendar quarters (3 years) prior to date of delivery, and hose used in hose assemblies shall be manufactured not more than 12 calendar quarters prior to date of delivery to the Government.

3.10 Marking.

3.10.1 Hose. The hose shall be marked in accordance with MIL-STD-130 at intervals not to exceed 24 inches 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, R10 for type 100R10 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. Military part number.

d. Cure date (quarter and year).

3.10.2 Hose assemblies. The hose of hose assemblies shall be marked in accordance with 3.10.1. When specified (see 6.2.2d) a metal tag, embossed or stamped with the hose assembly contractor's name or trademark and the contractor's hose assembly number, shall be attached to the hose assembly.

3.11 Workmanship.

3.11.1 Hose. The hose cover shall contain no patches or blisters and shall be free from wrinkles, except that minor impressions less than 0.031-inch deep (left by the curing wrap) will 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.

3.11.2 Surfaces. Machined surfaces of fittings and clamps shall be free of burrs and longitudinal tool marks. Sealing surfaces shall be smooth except annular tool marks up to 100 microinches roughness height rating (rhr) as defined in ASME B46.1 will be acceptable. All other machined surfaces shall not exceed 125 rhr. Unmachined surfaces such as forging surfaces and bar stock flats shall be free of cracks, laps, and seams except for forging parting lines. Castings shall be sound and free from blowholes, porosity, cracks, spurs, and other defects. Welds shall be free from pits, blisters, blowholes, slivers, and laminations.

4. VERIFICATION

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

- a. Qualification inspection (see 4.3).
- b. Conformance inspection (see 4.4).

4.2 Inspection and tests. The inspection and tests are intended to verify that the items produced meet specified requirements.

4.3 Qualification inspection.

4.3.1 Examination. Hose and hose assemblies shall be examined in accordance with 4.5.1. Presence of one or more defects shall be cause for rejection.

4.3.2 Tests. In addition to the examination of 4.3.1, hose and hose assembly qualification inspection shall consist of the tests specified in table IV. Failure of any test shall be cause for rejection.

TABLE IV. Qualification test schedule

Schedule		Test	Test paragraph	Requirement paragraph	Number of specimens per qualified fitting
Test number	Test sequence				
	1	Length change	4.5.2.3	3.8.1	
1	2	Low temperature	4.5.2.2	3.8.2	4
	3 1/	Proof pressure	4.5.2.4	3.8.3	
2 1/	1	Burst pressure	4.5.2.5	3.8.4	4
3	1	Proof pressure	4.5.2.4	3.8.3	4
	2	Impulse	4.5.2.6	3.8.5	
4	1	Oil resistance	4.5.2.7	3.8.6	3 cover (total)
5	2	Ozone resistance	4.5.2.8	3.8.7	

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

4.4 Conformance inspection.

4.4.1 Lot size. A bulk hose lot shall consist of not more than 10,000 feet of hose produced over a period not to exceed 30 days. A hose assembly lot shall contain not more than 10,000 feet of hose. Each lot shall contain hose or hose assemblies, as applicable, of one size, manufactured under the same conditions, by the same manufacturer.

4.4.2 Sampling.

4.4.2.1 Unit of product. For examination purposes, each 2 feet of bulk hose or each 2 feet of hose used in hose assemblies shall be considered a unit of product.

4.4.2.2 Sampling for examination. Sampling for examination shall be in accordance with ANSI/ASQC-Z.1.4.

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4.4.2.3 Tests.

4.4.2.3.1 Bulk hose samples. Bulk hose samples shall be selected at random at the time of manufacture at the rate of three samples per lot. Each sample shall consist of sufficient hose to conduct the specified tests.

4.4.2.3.2 Hose assembly samples. Hose assembly samples shall be made from hose selected at random, at the time of assembly of fittings and hose, at the rate of three samples per lot. Each sample shall consist of sufficient hose assemblies to conduct the specified tests.

4.4.3 Allowable defects. Samples selected in accordance with 4.4.2.2 shall be examined as specified in 4.5.1. The number of allowable defects shall be as specified in the contract (see 6.2).

4.4.4 Tests.

4.4.4.1 Individual. Each length of bulk hose and each hose assembly in the lot shall be tested in accordance with 4.5.2.4. Any length of hose or any hose assembly that fails the test shall be cause for rejection of the hose or hose assembly.

4.4.4.2 Samples. Samples selected in accordance with 4.4.2.3 shall be tested as specified in 4.5.2.3 and 4.5.2.5. Failure of any test shall be cause for rejection of the lot.

4.4.4.2.1 Age samples. Age samples shall be tested as specified in 4.5.2.6. Four hose assemblies shall be prepared for test for each lot of bulk hose, or four hose assemblies shall be selected for test for each lot of hose assemblies. Failure of any test shall be cause for rejections.

4.5 Inspection procedure.

4.5.1 Examination. The hose or hose assemblies shall be examined as specified herein for the following defects. Examination for defect 101 may be performed during fabrication of the hose.

Major

101. Materials not as specified (see 3.3).
102. Materials not resistant to corrosion and deterioration, or treated to be resistant to corrosion and deterioration for the applicable storage and operating environments (see 3.3.1).
103. Dissimilar metals are not treated or effectively insulated from each other (see 3.3.1.1).
104. Contractor does not have documentation available for identification of material, material finishes, or treatment (see 3.3.1.2).
105. Used, rebuilt or remanufactured components, pieces, or parts incorporated in the hose and hose assemblies (see 3.4.2.2).
106. Hose does not conform to dimensions and tolerances specified on the applicable specification sheet (see 3.4.1).
107. Tube not as specified (see 3.4.1.1).
108. Reinforcement not as specified (see 3.4.1.2).
109. Cover not as specified (see 3.4.1.3).
110. Hose size not as specified (see 3.4.2.2,a).
111. Fitting not reusable or permanently attached as specified (see 3.4.2.2,b).
112. Type of reusable fitting not as specified (see 3.4.2.2,b).
113. Fitting termination not as specified (see 3.4.2.2,c).
114. Termination size not as specified (see 3.4.2.2,d).

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115. Fitting configuration not as specified (see 3.4.2.2,e).
116. Fitting material not as specified (see 3.4.2.2,f).
117. Fitting finish not as specified (see 3.4.2.2,g).
118. Fitting design not as specified (see 3.4.2.2.1).
119. Fitting threads not as specified (see 3.5).
120. Angular relationship of bent tube fittings not as specified (see 3.6).
121. Length not as specified (see 3.7.1).
122. Age not as specified (see 3.9).
123. Marking missing or not as specified (see 3.10).
124. Workmanship not as specified (see 3.11).
125. Patched cover (see 3.11.1).
126. Blistered or wrinkled cover (see 3.11.1).
127. Lap or lamination of hose tube or cover (see 3.11.1).
128. Crack or hole in cover or tube (see 3.11.1).
129. Loose tube or cover (wrinkles when bent) (see 3.11.1).
130. Ridge on tube (see 3.11.1).
131. Wire through tube or cover (see 3.11.1).
132. Surfaces of fittings not as specified (see 3.11.2).

Minor

201. Fitting wrench flats not as specified (see 3.4.2.2.1).
202. Fitting envelope design not as specified (see 3.4.2.2.1).
203. Depressed area of hose cover (exceeds outside diameter [OD] minimum tolerance)
(see 3.11.1).
204. Depressed area of hose tube (exceeds inside diameter [ID] maximum tolerance)
(see 3.11.1).
205. Presence of foreign material (see 3.11.1).

4.5.2 Tests.

4.5.2.1 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 the following:

$$90^\circ \text{ bend free length} = \frac{\pi r}{2} + 2D$$

$$180^\circ \text{ bend free length} = \pi r + 2D$$

Where: D = hose outside diameter

r = minimum bend radius specified on figure 1, and in table V.

$\pi = 3.14$

4.5.2.2 Length change. The length change shall be determined in accordance with the change in length test specified in SAE J343. Test pressure shall be in accordance with the maximum operating pressure specified in the applicable specification sheet. A change in length in excess of the range of +2 or -4 percent shall constitute failure of this test.

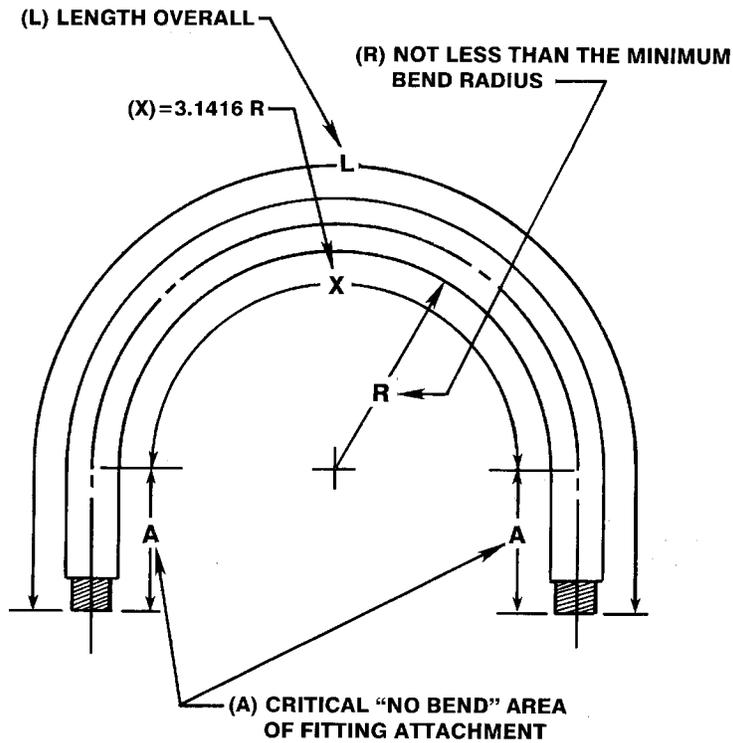
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4.5.2.3 Low temperature. The low temperature test shall be conducted at -40 °F in accordance with the cold bend test specified in SAE J343 except the uncapped hose or hose assembly shall be preconditioned by immersion in oil conforming to MIL-PRF-2104, 10 weight, for a minimum of 24 hours at a minimum temperature of 212 °F. Evidence of splitting or cracking, or inability to pass the proof pressure test specified in 4.5.2.4, shall constitute failure of this test.

4.5.2.4 Proof pressure. The proof pressure test shall be conducted in accordance with SAE J343. The test pressure shall be a pressure that is equal to twice the maximum operating pressure specified in the applicable specification sheet. Evidence of leakage, rupture, or detachment of a fitting shall constitute failure of this test.

4.5.2.5 Burst pressure. The burst pressure test shall be conducted in accordance with SAE J343. The test pressure shall be equal to or greater than four times the maximum operating pressure specified in the applicable specification sheet. Evidence of leakage, rupture, or detachment of a fitting shall constitute failure of this test.

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1. Stationary hose installation formula is $L=2A + X$
2. A= Coupling length plus 2 X hose ID

FIGURE 1. Minimum bend radius.

TABLE V. Minimum bend radius dimensions.

Hose size	Single wire braid 100 R1 (inches)	Double wire braid 100 R2 (inches)	Four spiral wrap 100 R10 (inches)
1/4	4	4	5
3/8	5	5	6
1/2	7	7	8
3/4	9 1/2	9 1/2	11
1	12	12	14
1 1/4	16 1/2	16 1/2	18
1 1/2	20	20	22
2	25	25	28

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4.5.2.6 Impulse. The impulse test shall be conducted in accordance with SAE J343 except as specified herein. The uncapped test samples shall be preconditioned by immersion in 10 weight oil conforming to MIL-PRF-2104 at a minimum temperature of 212 °F for a minimum of 24 hours. The test pressure shall be in accordance with table VI. The number of impulse cycles shall be in accordance with table VII. The impulse test oil temperature shall be 200 °F. Evidence of leakage, rupture, detachment or slippage of a fitting shall constitute failure of a test sample. Failure of a test sample below the minimum number of cycles listed in table VII, or failure of the samples to attain the average number of cycles listed in table VII shall constitute failure of this test.

TABLE VI. 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	
100R10	133 percent of the maximum operating pressure specified in the applicable specification sheet.
100RE	
100R12	

TABLE VII. Impulse cycles and calculation method. 1/

Type of hose	Minimum cycles allowed 2/	Minimum average	Maximum cycles for computing
100R1	100,000	150,000	200,000
100R2	100,000	150,000	200,000
100R10	225,000	300,000	375,000
100RE	225,000	300,000	375,000
100R12	425,000	500,000	575,000

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

Where

- N₁ = Number of cycles withstood by first test assembly.
- N₂ = Number of cycles withstood by second test assembly.
- N₃ = Number of cycles withstood by third test assembly.
- N₄ = Number of cycles withstood by fourth test assembly.

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

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4.5.2.7 Oil resistance. The oil resistance test shall be conducted in accordance with SAE J343. The test oil temperature shall be 212 °F \pm 5 °F. Nonconformance to 3.8.6 shall constitute failure of this test.

4.5.2.8 Ozone resistance. The ozone resistance test shall be conducted in accordance with SAE J343 except as specified herein. The ozone concentration shall be 50 parts per million. The test temperature shall be 100 °F \pm 5 °F. The test duration shall be not less than 168 hours. Evidence of cracking when observed under 7-power magnification shall constitute failure of this test.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of material is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's System Command. 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 in equipment hydraulic systems at temperatures ranging from -40 °F to 200°F. Hoses, type 100R are designed for ground vehicles, hydraulic test stands, and similar uses. They are not intended for aircraft use. These military unique hoses and hose assemblies are used in vehicle hydraulic systems requiring interoperability and compatibility with associated components, in combat or harsh environments. In the range of temperatures from -40 °F to 200°F this interoperability and compatibility has been assured through the strict adherence to military requirements which contain a substantial amount of detail. The detail assures item standardization and compatibility through specific dimensions, and tolerances in the MIL-DTL-52471 specification sheets and material control requirements in this specification. The qualification process ensures these items will perform under the extremes of the environments in which they are used. Users and prime equipment manufacturers depend on these detailed technical requirements to ensure delivered products meet the interoperability and compatibility requirements.

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6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number, and date of this specification and applicable specification sheet.
- b. Issue of DoDISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2.1 and 2.3).
- c. Whether bulk hose or hose assemblies are required.
- d. Number of allowable defects (see 4.4.3)
- e. Identification of materials and finishes if required (see 3.3.1.2).
- f. 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 part number) (see 1.2 and 3.4.1).
- b. Total length of bulk hose required, or specific length and number of specific lengths required (see 3.7.1 and 3.7.3).

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 part number) (see 1.2 and 3.4.2.1), or the following for each hose assembly:
 1. Type of hose and hose size required (see 3.4.2.2,a).
 2. Type of fitting attachment required (see 3.4.2.2,b).
 3. Type of termination fitting required (see 3.4.2.2,c).
 4. Termination fitting size required (see 3.4.2.2,d).
 5. Fitting configuration required (see 3.4.2.2,e).
 6. Fitting socket material, nipple material, and when applicable, bent tube material required (see 3.4.2.2,f).
 7. Fitting finish required (see 3.4.2.2,g).
- b. Angular relationship of bent tube fittings required when the hose assembly contains two bent tube fittings (see 3.6).
- c. Length of hose assembly required (see 3.7.2 and 3.7.3).
- d. When hose assemblies are to be tagged (see 3.10.2).

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6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Products List QPL-52471, whether or not such products have actually been so listed by that date. The attention of the 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 the Defense Supply Center, Columbus, DSCC-VQP, 3990 East Broad Street, Columbus, OH 43216-5000 or emailed to vap.go@dla.mil primary and secondary: <mailto:vqp.mp@dla.mil>.

6.3.1 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.

6.3.2 Size range. A size range may be qualified by testing the larger and smaller sizes of the range.

6.4 Definitions.

6.4.1 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.

6.4.2 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.

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

6.4.4 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.

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

6.6 Conformance testing. It is recommended that the acquiring activity waive sample testing on lots that contain fewer 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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6.7 Classification changes. Classification of the hose and hose assemblies in previous revisions of this specification is as follows:

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

6.7.1 Differences than commercial. Layline, and qualification.

6.8 Subject term (key word) listing.

Wire Reinforced
Layline
Automotive

6.9 Deleted.

6.10 Environmentally preferable material. Environmentally preferable materials should be used to the maximum extent possible to meet the requirements of this specification. Table VIII lists the Environmental Protection Agency (EPA) top seventeen hazardous materials targeted for major usage reduction. Use of these materials should be minimized or eliminated unless needed to meet the requirements specified herein (see section 3).

TABLE VIII. 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 Ketone	Trichloroethylene
Chromium and Compounds	Methyl Isobutyl Ketone	Xylenes
Cyanide and Compounds	Nickel and Compounds	

6.11 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.

6.12 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

Preparing activity:
DLA - CC

(Project 4720-0423-000)

Review activities:

Army - AR, GL
Navy - MC, SA
Air Force - 82

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://www.dodssp.daps.mil>.