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31 July 1987
SUPERSEDING
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MILITARY 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 (see 6.8). Hose and hose assemblies shall be of the following types, as specified (see 6.2):

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.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: USA Belvoir Research, Development, and Engineering Center, ATTN: STRBE-TSE, Fort Belvoir, VA 22060-5606 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC 4720

1.3 Part number. The military specification part numbers for the hose and hose assemblies shall be as follows:

EXAMPLE: Military specification part number M52471/6 -4

Military specification sheet number
Size dash number (see table I of specification sheet).

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specification and standards. The following specifications, and standards form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation.

SPECIFICATION

FEDERAL

FF-B-575	- Bolts, Hexagon and Square.
QQ-N-286	- Nickel-Copper-Aluminum Alloy, Wrought.
QQ-N-288	- Nickel-Copper Alloy and Nickel-Copper-Silicon Alloy Castings.
QQ-P-416	- Plating, Cadmium (Electrodeposited).

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MIL-P-775	- Packaging of Hose, Hose Assembly, Rubber, Plastic, Fabric, or Metal (Including Tubing); and Fittings, Nozzles, and Strainers.
MIL-L-2104	- Lubricating, Oil, Internal Combustion Engine, Tactical Service.
DOD-P-16232	- Phosphate Coating, Heavy, Manganese or Zinc Base (For Ferrous Metals).
MIL-F-52525	- Fittings, Wire Reinforced Hydraulic Hose and Clamp-Halves, General Specification For.

(See supplement 1 for list of associated specification sheets.)

STANDARDS

FEDERAL

FED-STD-H28	- Screw Thread Standard for Federal Services.

MILITARY

MIL-STD-105	- Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-129	- Marking for Shipment and Storage.
MIL-STD-889	- Dissimilar Metals.
MS39266	- Hose Assembly, Rubber: Hydraulic, Pressure Type, Length Measurement.
MS39267	- Hose Assembly, Rubber: Hydraulic, Pressure Type, Minimum Bend Radius.
MS39320	- Hose Assembly: Measurement of Coupling Orientation Angle.

(Copies of specifications and standards required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted shall be those listed in the issue of the DoDISS specified in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS shall be the issue of the non-Government documents which is current on the date of the solicitation.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

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

(Application for copies should be addressed to the American National Standards Institute, 1430 Broadway, New York, NY 10018.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

A 27	- Steel Castings, Carbon, for General application.
A 47	- Ferritic Malleable Iron Castings.
A 108	- Specification for Steel Bars, Carbon, Cold Finished, Standard Quality.
B 164	- Specification for Nickel-Copper Alloy Rod and Bar.

B 165 - Specification for Nickel-Copper Alloy (UNS N04460) Seamless Pipe and Tube.
A 220 - Pearlitic Malleable Iron Castings.
B 633 - Electrodeposited Coatings of Zinc on Iron and Steel.
D 3951 - Standard Practice for Commercial Packaging.

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103).

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

SAE Handbook. J343

(Application for copies should be addressed to the Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15086.)

(Non-Government standards and other publications are normally available from the organizations which prepare or which distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein (except for specification sheets), the text of this specification shall take precedence. Nothing in this specification, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1. Description. The hydraulic hose, hose assemblies with reusable fittings, and hose assemblies with permanently attached fittings, shall be as specified herein.

3.1.1 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. (If a specific requirement specified herein is not required for an item, it shall be so indicated on the specification sheet [e.g., "shock-N/A."]).

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 at the time set for opening of bids (see 4.3 and 6.3).

3.3 Material. Material shall be as specified herein. Materials not specified shall be selected by the contractor and shall be subject to all provisions of this specification.

3.3.1 Material deterioration prevention and control. Excluding hose reinforcement wires, hose and hose assemblies shall be fabricated from compatible materials inherently corrosion resistant or treated to provide protection against the various forms of corrosion and deterioration that may be encountered in any of the applicable operating and storage environments to which the hose and hose assemblies may be exposed.

3.3.1.1 Dissimilar metals. Dissimilar metals shall not be used in intimate contact with each other unless protected against galvanic corrosion. Dissimilar metals and methods of protection are defined and detailed in MIL-STD-889.

3.3.1.2 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 information available, upon request, to the contracting officer or designated representative.

3.3.2 Recovered materials. For the purpose of this requirement, recovered materials are those materials which have been collected from solid waste and reprocessed to become a source of raw materials, as distinguished from virgin raw materials. The components, pieces, and parts incorporated in the hose and hose assemblies may be newly fabricated from recovered materials to the maximum extent practicable, provided the hose and hose assemblies produced meets all other requirements of this specification. Used, rebuilt or remanufactured components, pieces, and parts shall not be incorporated in the hose and hose assemblies.

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-F-52525. Hose and hose size shall be in accordance with the applicable military specification sheet listed in table I, as specified (see 6.2.1).

TABLE I. Hose.

Type	Applicable specification sheet	Size
100R1	MIL-H-52471/4	Specification part number
100R2	MIL-H-52471/5	
100R10	MIL-H-52471/6	
100RE	MIL-H-52471/7	
100R12	MIL-H-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 a fitting on each end.

3.4.2.1 Configuration. Hose assembly configuration shall be in accordance with the applicable military specification sheet listed in table II, as specified (see 6.2.2).

TABLE II. Hose assembly.

Type	Applicable specification sheet	Size
100R1 100R2 100R10 100RE 100R12	MIL-H-52471/1 MIL-H-52471/2 MIL-H-52471/3 MIL-H-52471/8 MIL-H-52471/10	Specification part number

3.4.2.2 Fittings. Unless otherwise specified herein, hose assembly fittings shall be reusable conforming to MIL-F-52525. When other than MIL-F-52525 fittings are required, hose assembly requirements shall conform to the following, as specified (see 6.2.2):

a. Type of hose and hose size (see 3.4.1).
b. Reusable or permanently attached fitting. If reusable, whether:

(1) 2- or 4-bolt, 2-segment socket.
(2) Multisegment socket with retaining rings.
(3) 2-segment socket, pin retained.
(4) Socket that is hinged on one side with the other side bolt secured.
(5) Finger-grip socket with retaining sleeve.
(6) Screw-together.

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 size; .188 (3/16), .250 (1/4), .312 (5/16), .375 (3/8), .500 (1/2), .625 (5/8), .750 (3/4), 1.00 (1), 1.25 (1-1/4), 1.50 (1-1/2), 2.00(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 B 164, class optional or QQ-N-286, class A, form optional.
(2) Nickel-copper-silicon alloy castings conforming to QQ-N-288, composition optional.
(3) Nickel-copper alloy conforming to ASTM B 165.
(4) Steel conforming to ASTM A 108, chemical composition and hardness optional.
(5) Steel conforming to ASTM A 27, grade and class optional or malleable iron conforming to ASTM A 47 or A 220, grade optional.
(6) Or as specified.

g. Fitting finish:

(1) Zinc plate conforming to ASTM B 633, type II, Fe Zn 13 or cadmium plate conforming to QQ-P-416, type II, class 2 except the embrittlement test need not be run.
(2) Phosphate coating conforming to DOD-P-16232, type Z, class 1.
(3) Not required.

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 nominal 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 FF-B-575. 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, the angular relationship of the fittings shall

be as specified (see 6.2.2). Angular measurement and tolerance shall be in accordance with MS39320.

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 (13.7 meters [m]) or longer, except that not more than 25 percent may be furnished in lengths between 25 feet (7.6 m) and 44 feet (13.4 m) and not more than an additional 25 percent may be furnished in lengths between 15 feet (4.6 m) and 24 feet (7.3 m).

3.7.2 Hose assembly. The length of hose assemblies shall be as specified (see 6.2.2). Length of hose assemblies shall be determined in accordance with MS39266.

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 (3.18 millimeters [mm]) for lengths up to and including 12 inches (305 mm), ±0.187 inch (4.76 mm), for lengths above 12 inches (305 mm) up to and including 18 inches (457 mm), ±0.250 inch (6.35 mm), for lengths above 18 inches (457 mm) up to and including 36 inches (915 mm), ±1 percent measured to the nearest 0.125 inch (3.18 mm) for lengths over 36 inches (915 mm) (see 6.2.1 and 6.2.2).

3.8 Performance.

3.8.1 Environmental conditions.

3.8.1.1 Low temperature. Hose and hose assemblies shall withstand 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 withstand the applicable proof pressure without evidence of leakage, rupture, or detachment of any fitting (see 4.5.2.2, 6.4.1 and 6.4.2).

3.8.2 Length change. When subjected to the operating pressure specified in the applicable specification sheet (see 3.4.1) for 30 seconds, the hose length change shall be not more than +2 percent, not less than 4 percent for all sizes of hose (see 4.5.2.3).

3.8.3 Proof pressure. Hose and hose assemblies shall withstand a pressure equal to twice the applicable operating pressure specified in the applicable specification sheet without evidence of leakage, rupture, slippage, or detachment of a fitting (see 4.5.2.4 and 6.4).

3.8.4 Burst pressure. The hose and hose assemblies shall withstand a pressure equal to four times the applicable operating pressure specified in the applicable specification sheet without evidence of leakage, rupture, or detachment of a fitting (see 4.5.2.5 and 6.4.2).

3.8.5 Impulse. Hose and hose assemblies, after being subjected to +212 °F (+100 °C) for 24 hours, shall withstand impulse pressure for the average number of impulse cycles specified in table III, without evidence of leakage, rupture, detachment, or slippage of a fitting (see 4.5.2.6 and 6.4).

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. After immersion in oil at a temperature of +212 °F (+100 °C) for 70 hours, 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 (see 4.5.2.7).

3.8.7 Ozone resistance. The hose cover shall withstand 50 parts of ozone per 100 million parts of air maintained at +100 °F (+38 °C) 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 at intervals not to exceed 24.00 inches (609.6 mm) on the layline. Order of marking may be in any sequence. The marking shall include but will not be limited to the following:

a. R1 for type 100R1 hose, R2 for type 100R2 hose, R10 for type 100R10 hose, and RE for type 100RE hose and R12 for type 100R12 hose.

b. Nominal size .250 (1/4), .375 (3/8), .500 (1/2), .750 (3/4), 1.00 (1), 1.25 (1-1/4), 1.50 (1-1/2) or 2.00 (2).
c. 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 6.2.2), 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 patch or blister and shall be free from wrinkles, except that minor impressions less than 0.031-inch (0.80 mm) 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 ANSI 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, sprues, and other defects. Welds shall be free from pits, blisters, blowholes, slivers, and laminations.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items must meet all requirements of section 3 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 assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

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

a. Qualification inspection (see 4.3).
b. Quality conformance inspection (see 4.4).
c. Inspection of packaging (see 4.6).

4.3 Qualification inspection.

4.3.1 Examination. Hose or 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. Hose and hose assemblies shall be tested as specified in table IV (see 6.3). 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	1	Length change	4.5.2.3	3.8.2	
	2	Low temperature	4.5.2.2	3.8.1.1	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	3 cover (total)

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 Quality conformance inspection.

4.4.1 Lot size. A bulk hose lot shall consist of not more than 10,000 feet (3048 m) of hose produced over a period not to exceed 30 days. A hose assembly lot shall contain not more than 10,000 feet (3048 m) of hose. Each lot shall contain hose or hose assemblies, as applicable, of one nominal size, manufactured under essentially the same conditions, by the same manufacturer.

4.4.2 Sampling.

4.4.2.1 Unit of product. For examination purposes, each 2 feet (609.6 mm) of bulk hose or each 2 feet (609.6 mm) of hose used in hose assemblies shall be considered a unit of product.

4.4.2.2 Examination. Sampling for examination shall be in accordance with MIL-STD-105.

4.4.2.3 Tests (see 6.6).

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 Examination. Samples selected in accordance with 4.4.2.2 shall be examined as specified in 4.5.1. AQL (Acceptable Quality Level) shall be 1.0 percent defective for major defects and 2.5 percent defective for minor defects.

4.4.4 Tests.

4.4.4.1 Individual. Each length of bulk hose and each hose asembly 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 (see 6.7). 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. 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 and 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 as defined in MIL-STD-889 are not 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 3.3.2).
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).
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. Fittings not as specified (see 3.4.2.2.1).
121. Angular relationship of bent tube fittings not as specified (see 3.6).
122. Length not as specified (see 3.7.1).
123. Age not as specified (see 3.9).
124. Marking missing or not as specified (see 3.10).
125. Workmanship not as specified (see 3.11).
126. Patched cover (see 3.11.1).
127. Blistered or wrinkled cover (see 3.11.1).
128. Lap or lamination of hose tube or cover (see 3.11.1).
129. Crack or hole in cover or tube (see 3.11.1).
130. Loose tube or cover (wrinkles when bent) (see 3.11.1).
131. Ridge on tube (see 3.11.1).
132. Wire through tube or cover (see 3.11.1).
133. 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. Unless otherwise specified herein, the free length of hose measured between fittings shall be determined using the following:

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

$$\text{180-degree bend free length} = \pi r + 2D$$

Where: D = hose outside diameter
r = minimum bend radius specified on MS39267
π = 3.14

4.5.2.2 Low temperature. The low temperature test shall be conducted at -40 °F (-40 °C) 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-L-2104, 10 weight for a minimum of 24 hours at a minimum temperature of 212 °F (100 °C). 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.

4.5.2.3 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.

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 (see 6.3).

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 (see 6.3).

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-L-2104 at a minimum temperature of 212 °F (100 °C) for a minimum of 24 hours. The test pressure shall be in accordance with table V. The number of impulse cycles shall be in

accordance with table VI. The impulse test oil temperature shall be 200 °F (93 °C). Evidence of leakage, rupture, detachment of 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 VI, or failure of the samples to attain the average number of impulse cycles listed in table VI shall constitute failure of this test (see 6.3).

TABLE V. Impulse test pressure.

Hose type	Test pressure
100R1	- 125 percent of the maximum operating pressure specified in the applicable specification sheet for hose 1-in ID and smaller and 100 percent for hoses larger than 1-in ID.
100R2	- 133 percent of the maximum operating pressure specified in the applicable specification sheet.
100R10	- 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.

TABLE VI. Impulse cycles and calculation method.*

Type of hose	Minimum cycles allowed**	Mimimum 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

* 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.

** Failure of a test assembly below this number shall constitute failure of test.

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 (100 °C) ±5 °F (2 °C). 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 (38 °C) ±5 °F (2 °C). 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.

Oven (without ingress or egress of air) at 160 ± 2°F and

4.6 Inspection of packaging. The preservation, packing and marking for level A and level B shall be examined to determine compliance with the applicable quality assurance provisions of MIL-P-775. The preservation, packing, and marking for commercial shall be examined for compliance to ASTM D3951.

5. PACKAGING

5.1 Preservation. Preservation shall be level A or commercial, as specified (see 6.2.2).

5.1.1 Level A. Hose and hose assemblies shall be preserved in accordance with the level requirements of MIL-P-775.

5.1.2 Commercial. Hose and hose assemblies shall be preserved in accordance with ASTM D 3951.

5.2 Packing. Packing shall be level A, level B, or commercial, as specified (see 6.2.2).

5.2.1 Level A. Hose and hose assemblies shall be packed in accordance with the level A requirements of MIL-P-775.

5.2.2 Level B. Hose and hose assemblies shall be packed in accordance with the level B requirements of MIL-P-775.

5.2.3 Commercial. Hose and hose assemblies shall be packed in accordance with ASTM D 3951. In addition, the cube and weight shall be marked on the shipping container.

5.3 Marking.

5.3.1 Military. Marking for military packaging shall be in accordance with MIL-STD-129.

5.3.2 Commercial. Marking for commercial packaging shall be in accordance with ASTM D 3951.

6. NOTES

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 (-40 °C) to +200 °F (+93 °C). Hoses, type SAE 100R are designed for ground vehicles, hydraulic test stands, and similar uses. They are not intended for aircraft use.

6.2 Ordering data. Acquisition documents should specify the following:

a. Title, number, and date of this specification.

b. Whether bulk hose or hose assemblies are required (see 1.2 and 6.2.1).

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).

e. Degree of preservation and degree of packing required (see 5.1 and 5.2).

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time set for opening of bids, qualified for inclusion in the Qualified Products List 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 purchase orders for the products covered by this specification. The activity responsible for the Qualified Products List is USA Belvoir Research, Development and Engineering Center, Fort Belvoir, VA 22060-5606, Attention: STRBE-JCP, and information pertaining to qualification of products may be obtained from that activity.

6.3.1 Bulk hose and reusable adapters and elbows. To insure interchangeability of fittings and hose within the supply system, bulk hose shall 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. The following definitions shall apply throughout this specification.

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-F-52525 are available for all sizes of hose specified in the applicable specification sheets.

6.6 Quality conformance testing. It is recommended that the procuring 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.

6.7 Low temperature. For equipment with -65 ^{o}F (-54 ^{o}C) requirement, use MIL-H-13531 hose and MIL-F-52525 fittings. Testing of the hose with these fittings should be required.

6.8 Classification changes. Changes in classification of the hose and hose assemblies between this revision of the specification and previous edition are as follows:

MIL-H-52471B	MIL-H-52471C	MIL-H-52471D
Type A	Type 100R1	Type 100R1
Type B	Type 100R2	Type 100R2
Type C	Type 100R10	Type 100R10
Type D	Type 100R11	Deleted
Type E	Type 100RX	Deleted
None	None	Type 100RE
None	None	Type 100R12

6.9 Subject term (key word) listing.

Hose, Hydraulic
Hose, Pressure Type
Hose, Rubber
Hose, Wire Reinforced

6.10 Changes from previous issue. Asterisks (or vertical lines) are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

Custodians:

Army - ME
Air Force - 99

Review activities:

Army - GL
Air Force - 82
DLA - CS

User activity:

Army - AR

Preparing activity:

Army - ME

Project 4720-0621

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STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions – Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE
MIL-H-52471D	Hose and Hose Assemblies, Rubber: Hydraulic Pressure-Type, General Specification For

3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION *(Mark one)*
	☐ VENDOR
b. ADDRESS *(Street, City, State, ZIP Code)*	☐ USER
	☐ MANUFACTURER
	☐ OTHER *(Specify)*: _____

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER *(Last, First, MI)* – Optional	b. WORK TELEPHONE NUMBER *(Include Area Code)* – Optional
c. MAILING ADDRESS *(Street, City, State, ZIP Code)* – Optional	8. DATE OF SUBMISSION *(YYMMDD)*

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