

INCH-POUND

MIL-DTL-17902G(SH)

13 August 2013

SUPERSEDING

MIL-H-17902F(SH)

23 December 1988

## DETAIL SPECIFICATION

HOSE, END FITTINGS AND HOSE ASSEMBLIES,  
SYNTHETIC RUBBER, AIRCRAFT FUELS

This specification is approved for use by the Naval Sea Systems Command, Department of the Navy, and is available for use by all Departments and Agencies of the Department of Defense.

## 1. SCOPE

1.1 Scope. This specification covers both aircraft fuel, synthetic rubber collapsible and noncollapsible hose assemblies and end fittings.

1.2 Classification.

1.2.1 Part or identifying number (PIN). The military part number for the hose and end fittings covered by this specification should consist of the letter "M", the basic number of the specification, and the coded numbers or letters as shown in the following examples:

Hose and Hose Assembly							
M Prefix	Specification Number	Hyphen	Size (Diameter)	Hyphen	Hose		
					Type	Hyphen	Length
M	17902	-	A	-	CCA	-	50

Hose Fitting					
M Prefix	Specification Number	Hyphen	Size (Diameter)	Hyphen	Fitting Type
M	17902	-	A	-	FM

1.2.1.1 Hose, fitting, and hose assembly size. Size should be identified by a letter symbol as shown in [table I](#) (see 6.2).

TABLE I. Size designation.

Symbol	Size (id) (inch)
A	1½
B	2½

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1.2.1.2 Hose and hose assembly type. Type should be identified by a two-letter symbol as shown in [table II](#) (see 6.2).

TABLE II. Hose type designation.

Symbol	Hose type/configuration
CCA	Collapsible hose assembly
CCH	Collapsible hose only
NCA	Noncollapsible hose assembly
NCH	Noncollapsible hose only

1.2.1.3 Hose fitting type. Type should be identified by a two-letter symbol as shown in [table III](#) (see 6.2).

TABLE III. Fitting type designation.

Symbol	Fitting type
FM	Fitting, male
FF	Fitting, female

1.2.1.4 Hose and hose assembly length. Length should be identified by a two-number symbol as shown in [table IV](#).

TABLE IV. Hose and hose assembly length.

Symbol	Length (feet) (nominal) ( $\pm 1\%$ of nominal length)
25	25
50	50
75	75

Unless otherwise specified (see 6.2), the length of bulk hose or hose assemblies should be 50 feet, nominal.

## 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 of documents cited in sections 3, 4, or 5 of this specification, whether or not they are listed.

### 2.2 Government documents.

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

#### FEDERAL STANDARDS

- FED-STD-H28 - Screw-Thread Standards for Federal Services
- FED-STD-162 - Hose, Rubber, Visual Inspection Guide for

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## DEPARTMENT OF DEFENSE SPECIFICATIONS

- MIL-PRF-6855 - Rubber, Synthetic, Sheets, Strips, Molded or Extruded Shapes, General Specification for
- MIL-PRF-24667 - Coating System, Non-Skid, for Roll, Spray, or Self-Adhering Application
- MIL-DTL-83420 - Wire Rope, Flexible, for Aircraft Control, General Specification for

(Copies of these documents are available online at <http://quicksearch.dla.mil/> or <https://assist.dla.mil/>.)

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 A313/A313M - Standard Specification for Stainless Steel Spring Wire
- ASTM B16/B16M - Standard Specification for Free-Cutting Brass Rod, Bar and Shapes for Use in Screw Machines
- ASTM B121/B121M - Standard Specification for Leaded Brass Plate, Sheet, Strip, and Rolled Bar
- ASTM B129 - Standard Specification for Cartridge Brass and Cartridge Case Cups
- ASTM B176 - Standard Specification for Copper Alloy Die Castings
- ASTM B283/B283M - Standard Specification for Copper and Copper-Alloy Die Forgings (Hot-Pressed)
- ASTM B453/B453M - Standard Specification for Copper-Zinc-Lead Alloy (Leaded-Brass) Rod, Bar, and Shapes
- ASTM D156 - Standard Test Method for Saybolt Color of Petroleum Product (Saybolt Chromometer Method)
- ASTM D380 - Standard Test Methods for Rubber Hose
- ASTM D381 - Standard Test Method for Gum Content in Fuels by Jet Evaporation
- ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers – Tension
- ASTM D413 - Standard Test Methods for Rubber Property – Adhesion to Flexible Substrate
- ASTM D471 - Standard Test Method for Rubber Property – Effect of Liquids
- ASTM D573 - Standard Test Method for Rubber – Deterioration in an Air Oven
- ASTM D1149 - Standard Test Methods for Rubber Deterioration – Cracking in an Ozone Controlled Environment
- ASTM D2276 - Standard Test Method for Particulate Contaminant in Aviation Fuel by Line Sampling
- ASTM D6779 - Standard Classification System for and Basis of Specification for Polyamide Molding and Extrusion Materials (PA)
- ASTM E8/E8M - Standard Test Methods for Tension Testing of Metallic Materials

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

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2.4 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

### 3. REQUIREMENTS

3.1 First article. When specified (see 6.2), a sample shall be subjected to first article inspection (see 6.3) in accordance with 4.2.

3.2 Material. Material shall be new and unused. The hose shall have been manufactured not more than 12-18 months prior to date of delivery.

3.2.1 Tube. The tube shall be made of a rubber compounded for resistance to deterioration by aromatic and jet fuels and shall contain no phosphate plasticizers.

3.2.2 Cover. The cover shall be made of a rubber compounded for resistance to deterioration caused by atmospheric oxygen and ozone, sunlight, abrasion, and fuels. The cover shall be designed to withstand exposure and durability to rubbing against shipboard flight deck non-skid materials as specified in MIL-PRF-24667.

3.2.3 Reinforcement. The reinforcement may be of nylon, polyester, or high tenacity rayon that shall meet the requirements of this specification.

3.2.3.1 Wire helix (type NCA/NCH hose). The wire in the helix shall be heavily galvanized or copper plated steel with a diameter of not less than 0.035 inch. The cross-sectional area of wire per linear inch shall be determined based on the adaptability of the hose to cognizant fittings and successful completion of all testing parameters. The tensile strength of the wire shall be not less than 200,000 pounds per square inch (psi) (see 4.5.9.1). The wire shall show no defects in the steel (see 4.5.9.2). Flaking or peeling of the galvanized or copper coating on the wire shall not be considered a defect.

3.2.4 Friction or filler. The friction or filler used to impregnate the reinforcement shall be made of a rubber compounded for resistance to deterioration by aromatic and jet fuels.

3.2.5 Couplings and fittings. The materials for the couplings and contact assembly shall be as specified in [table V](#).

TABLE V. Materials for couplings and contact assembly.

Part no.	Name of part <sup>1/</sup>	Material	Applicable document
1	Contract button	Brass	ASTM B16/B16M
2	Spring	CRES	ASTM A313/A313M, Type 302
3	Front nut	Brass	ASTM B16/B16M
4	Spider	Molded nylon	ASTM D6779
5	Contact rod	Brass	ASTM B16/B16M
6	Washer	Brass	ASTM B121/B121M
7	Contact rod guide	Brass	ASTM B453/B453M
8	Lead washer	Virgin lead	ASTM B129
9	Double securing nut	Brass	ASTM B16/B16M
10	Cable connector bolt	Brass	ASTM B16/B16M
11	Coupling body, male	Brass, forging	ASTM B283/B283M UNS C37700
12	Coupling sleeve	Brass, pressure die casting	ASTM B176 UNS C87900

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TABLE V. Materials for couplings and contact assembly – Continued.

Part no.	Name of part <sup>1/</sup>	Material	Applicable document
13	Coupling grip	Brass wire cold worked (58 percent minimum copper)	
14	Gasket	Buna-N	MIL-R-6855, Class 1, Grade 80±5
15	Cable, control	<sup>2/</sup>	
16	Swivel nut	Brass, forging	ASTM B283/B283M
17	Coupling body, female	Brass, forging	ASTM B283/B283M UNS C37700
NOTES:			
<sup>1/</sup> Part numbers correspond to <a href="#">figure 1</a> through <a href="#">figure 5</a> .			
<sup>2/</sup> The control cable shall be in accordance with MIL-DTL-83420, Type II, Composition B.			

3.3 Construction.

3.3.1 Hose. Both Type CC and Type NC hose shall consist of the following:

3.3.1.1 Type CCA/CCH hose:

- Inner tube of seamless extruded rubber.
- Two or more layers of braided reinforcement.
- Outer cover of rubber.
- Optional – breaker plies of rubber-impregnated fabric may be used at the option of the manufacturer.
- Optional – protective external cover for improved durability.

3.3.1.2 Type NCA/NCH hose:

- Inner tube or wrapped or seamless extruded rubber.
- Two or more layers of braided or spiral wrap reinforcement.
- Outer cover of rubber.
- Optional – breaker plies of rubber-impregnated fabric may be used at the option of the manufacturer.
- Optional – protective external cover for improved durability.
- Type NCA/NCH hose shall include a helix of round wire. The helix shall be thoroughly embedded in rubber, shall be between the layers of reinforcement, and shall not contact either the inner nor outer layer of reinforcement.

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3.3.2 Physical properties.

3.3.2.1 Physical properties of the hose. The hose shall meet the physical properties specified in [table VI](#).

TABLE VI. Physical properties of hose.

Physical property	Hose type			Test
	CC	NC		
	Size	Size		
	B	A	B	
Inside diameter (in) ±0.063	2½	1½	2½	4.5.1
Outside diameter (in) ±0.063	3⅛	2⅛	3⅛	4.5.1
Tube thickness (in), min.	0.063	0.063	0.063	4.5.1
Cover thickness (in), min.	0.063	0.094	0.094	4.5.1
Hose length (ft), nominal	50	50	50	4.5.1
Hose weight (lbs), max.	100	85	125	4.5.2
Proof test pressure (psi), min.	300	300	250	4.5.4
Burst test pressure (psi), min.	600	600	500	4.5.5
Vacuum (in Hg), Type NC only		22	22	4.5.3
Flattening test, Type CC only (cycles)	100,000			4.5.11

3.3.2.2 Physical properties of rubber components. The rubber components of the hose shall meet the physical properties specified in [table VII](#) (see 4.5)

TABLE VII. Physical properties of rubber components.

Properties	Requirements			Test
	Tube	Cover	Friction compound on reinforcement plies	
<u>Initial properties:</u>				
Tensile strength (psi), min.	2600	1800		4.5.8.1.1
Ultimate elongation (%), min.	300	300		4.5.8.1.1
<u>Adhesion, minimum, pounds per inch width:</u>				
Between tube and breaker ply	20			4.5.8.2.1
Between cover and reinforcement ply		15		4.5.8.2.1
Between reinforcement plies and filler on wire helix			15	4.5.8.2.1
<u>Properties after immersion in medium no. 6:</u>				
Tensile strength (psi), min.	1400	800		4.5.8.1.2
Ultimate elongation (%), min.	200	150		4.5.8.1.2
<u>Adhesion, minimum, pounds per inch width:</u>				
Between tube and breaker ply	12			4.5.8.2.2
Between cover and reinforcement ply		8		4.5.8.2.2
Volume increase (%), max. (no shrinkage allowed)	30	30	30	4.5.8.3

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TABLE VII. Physical properties of rubber components – Continued.

Properties	Requirements			Test
	Tube	Cover	Friction compound on reinforcement plies	
<u>Properties after oven aging:</u>				
Tensile strength (psi), min.	2000	1450		4.5.8.1.3
Ultimate elongation (%), min.	250	220		4.5.8.1.3
Resistance to ozone of hose cover		No cracks		4.5.8.4
Resistance to non-skid on hose cover		No cracks, revealing reinforcement threads		4.5.12
Nonvolatile extractable material in hose tube (%), max.	2.0			4.5.8.5
Saybolt color number of test fluid in hose tube, min.	+15			4.5.8.6

3.3.3 Hose assembly. When hose assemblies are being fabricated, each length of hose shall have one Type FM and one Type FF fitting attached. Two spider assemblies and a length of control cable shall be fitted to the hose assembly as shown on [figure 1](#).

3.3.3.1 Hose fittings. Fitting Types FF and FM shall be of the reusable compression grip type consisting of an internal tailpiece, an external, long tapered sleeve, and a brass wire helix grip. The fittings shall not exceed the dimension of [figure 1](#) and shall not have any sharp protruding edges which could damage the hose. The Type FM fitting shall be as shown on [figure 1](#) and [figure 2](#) and the Type FF fitting shall be as shown on [figure 1](#) and [figure 3](#). Threads shall be in accordance with FED-STD-H28. Female swivels shall not be held in place with compression wire retainers.

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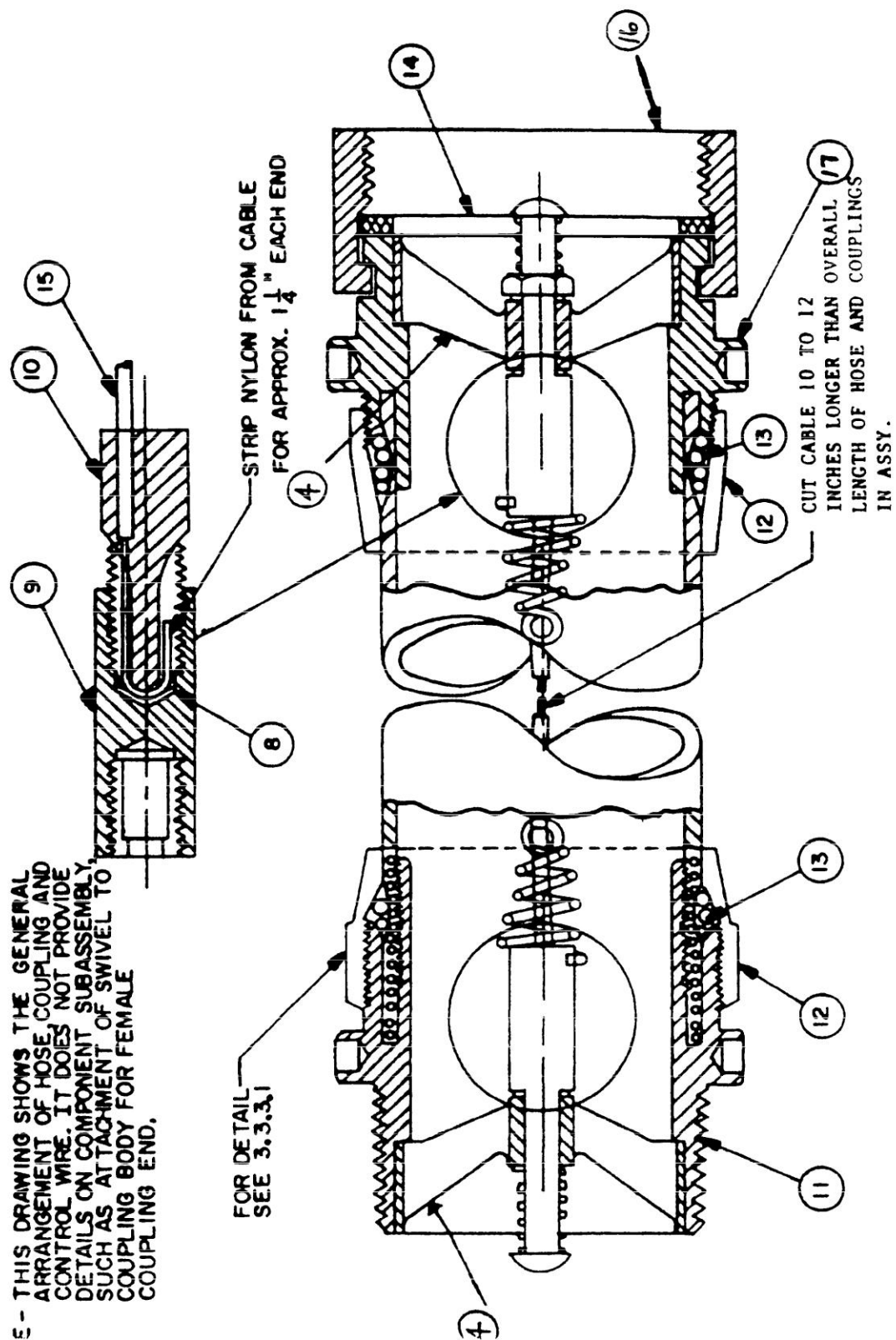
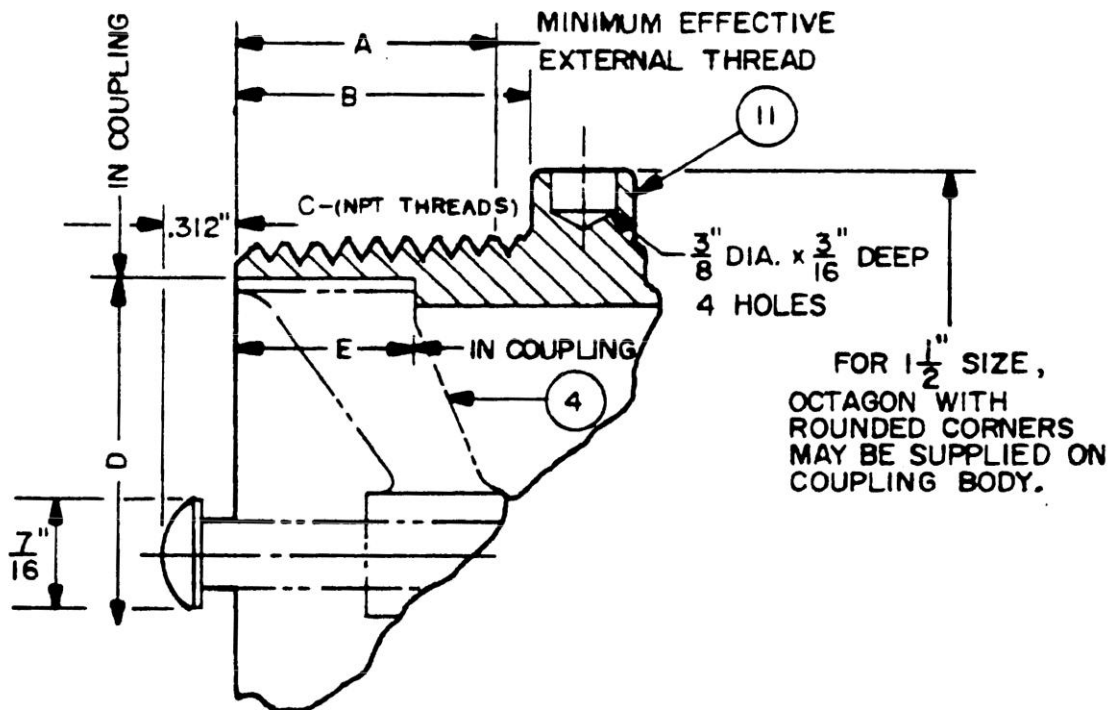


FIGURE 1. Hose and control wire assembly.



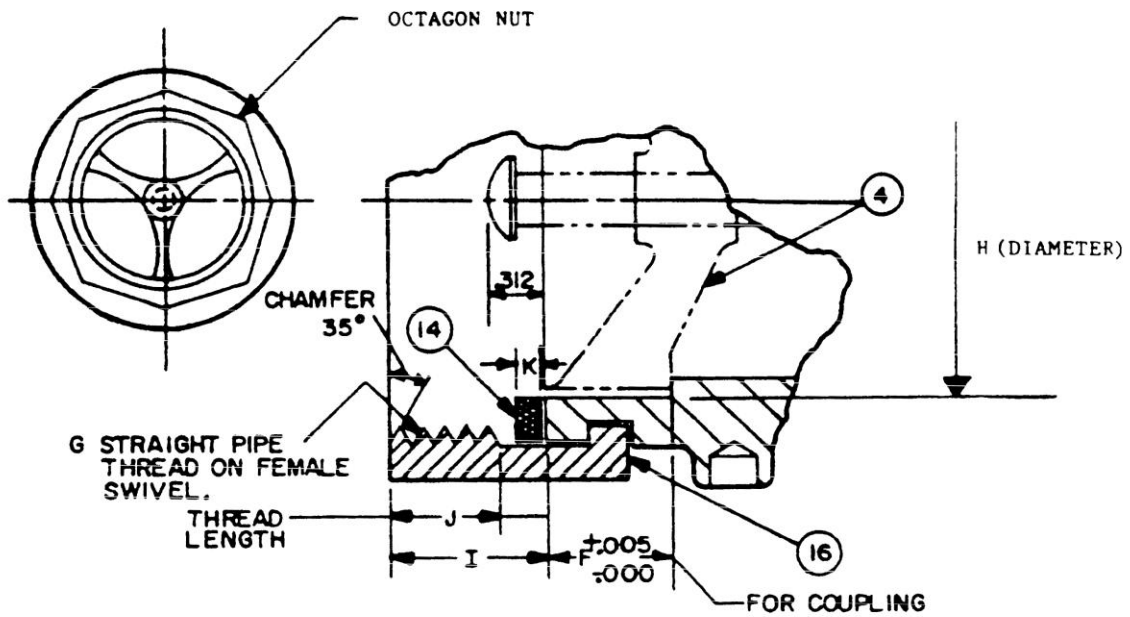
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SIZE	A	B MINIMUM	C	D	E
1 1/2	0.7235	15/16	1 1/2 - 11 1/2 NPT	1.520 ± 0.005	0.560 <sup>+0.005</sup> / <sub>-0.000</sub>
2 1/2	1.1375	1 1/4	2 1/2 - 8 NPT	2.520 ± 0.005	0.781 <sup>+0.005</sup> / <sub>-0.000</sub>

FIGURE 2. Male coupling dimensions.

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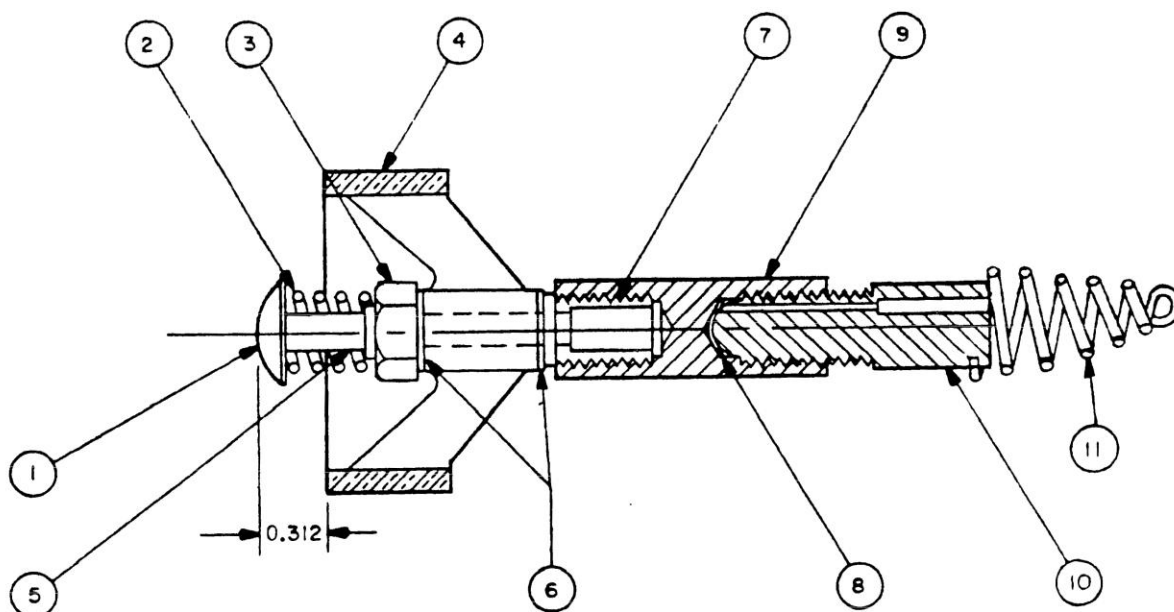


SIZE	F	G	H	I	J	K
1½	0.560	1½ - 11½ NPT	1.52	$\frac{19}{32}$	$\frac{15}{32}$	$\frac{1}{8}$
2½	0.781	2½ - 8 NPT	2.52	$\frac{15}{16}$	$\frac{11}{16}$	$\frac{3}{16}$

FIGURE 3. Partial detail of female coupling end.

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3.3.3.2 Spider assemblies. Spider assemblies and components shall be in accordance with [figure 1](#), [figure 4](#), and [figure 5](#). Spiders shall be molded nylon in accordance with ASTM D6779.

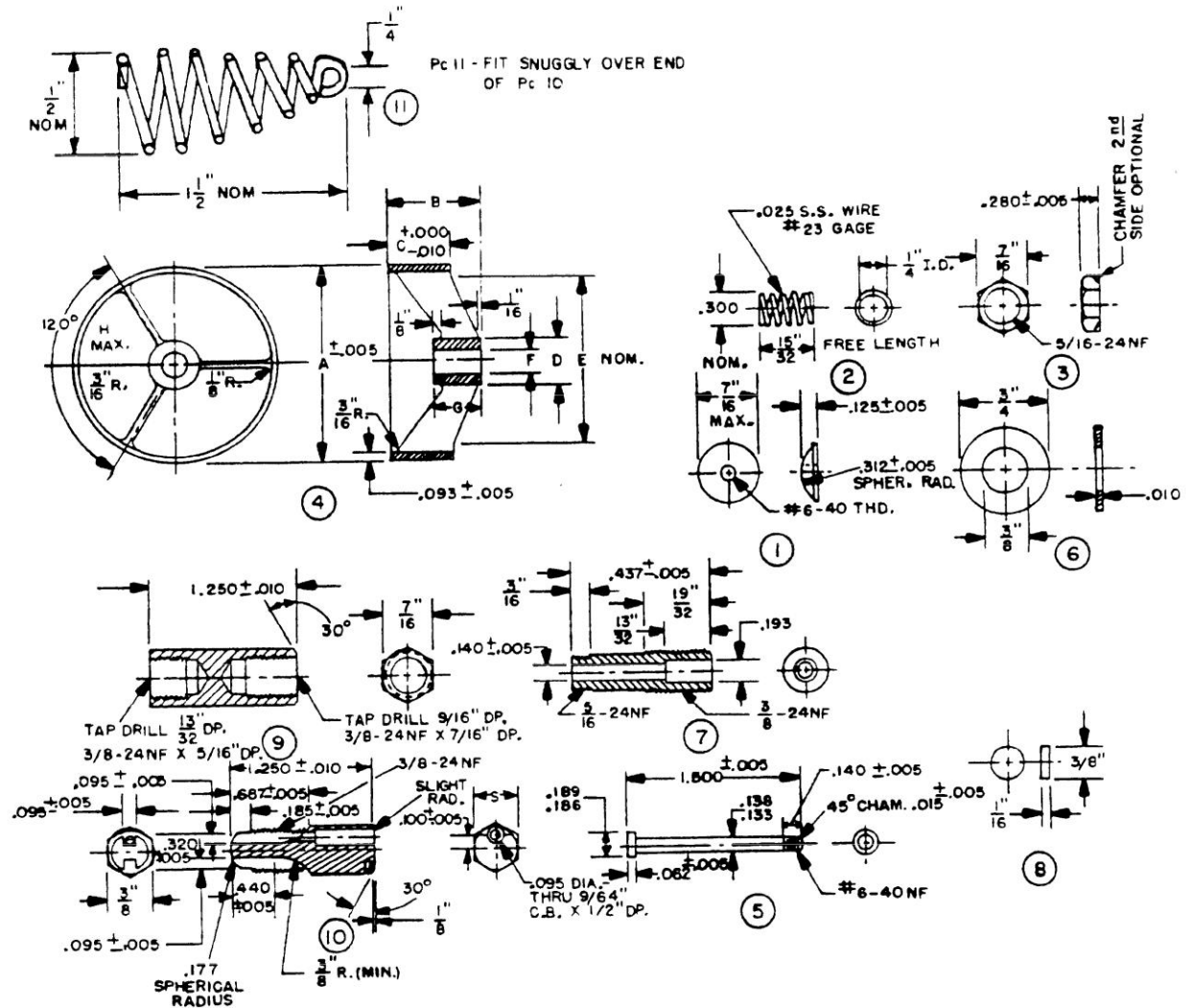


Parts list	
Part no.	Name
1	Contact button
2	Spring
3	Front nut
4	Spider
5	Contact rod
6	Washer (2 required)
7	Contact rod guide
8	Blind lead washer
9	Double securing nut
10	Cable connector
11	Cable support spring

Note: One of each required except for piece 6 which requires two for each spider assembly. Two spider assemblies required per hose.

FIGURE 4. Contact assembly.

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NOTE: Piece 4 is critical to the spider assembly. Piece 4 dimensions are nondeviation. Other components of the spider assembly may be modified.

## Part 4. Spider dimensions

Size	A	B	C	D	E	F	G	H
1 $\frac{1}{2}$	1.500	1.187	0.560	$\frac{9}{16}$	1 $\frac{5}{16}$	$\frac{5}{16}$	$\frac{5}{8}$	$\frac{3}{32}$
2 $\frac{1}{2}$	2.500	1.187	0.781	$\frac{9}{16}$	2 $\frac{1}{4}$	$\frac{5}{16}$	$\frac{5}{8}$	$\frac{3}{32}$

FIGURE 5. Spider assembly components.

## 3.4 Marking.

3.4.1 Hose. Each length of hose shall be permanently marked by one of the two following methods at the option of the hose manufacturer:

- Two brands inlaid and vulcanized to the cover, one brand approximately 4 feet from each end.
- Continuous embossed lay line.

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3.4.1.1 Marking information. The inlaid brands or continuous lay line shall include the following:

- a. Specification number.....M 17902
- b. Hose type.....CC or NC
- c. Hose size.....1½ or 2½
- d. Manufacturer's name or trade mark.....(as applicable)
- e. Quarter and year of manufacture.....(for example, 4-87)

3.4.2 Fittings. Each fitting assembly shall be stamped with the following information:

- a. Specification number.....M 17902
- b. Fitting size.....1½ or 2½
- c. Manufacturer's name or trade mark.....(as applicable)

Stamping shall be with low stress dies with the letter size not smaller than ⅛ inch in height. Stamping shall be placed on the external sleeve.

3.5 Electrical continuity. There shall be no electrical continuity between the couplings and the control cable. The resistance between the contact buttons at each end of the hose shall be not more than 40 ohms per 50-foot hose assembly (see 4.5.10).

3.6 Low temperature flexibility. The tube and cover shall show no signs of cracking (see 4.5.6).

3.7 Sedimentation. The interior surface of the hose shall be free from particulate materials to the extent that the weight of sediment contained in the flushing fluid from the tube shall be not more than 10 milligrams per liter (see 4.5.7).

3.8 Flattening. CCA and CCH hoses are subjected to vacuum on shipboard configurations. Upon conclusion of testing (see 4.5.11), the subject test hose shall not indicate signs of de-lamination, cracking, or any other form of component deficiency, in terms of the interior (inside surface area) or exterior (outside surface area) of the subject test hose.

3.9 Resistance to shipboard non-skid. The subject test hose shall not exhibit exterior surface area material failure revealing reinforcement threads when subjected to a cyclic abrasion test, at a minimum of 2000 cycles, against a test plate coated with non-skid material in accordance with MIL-PRF-24667.

3.10 Plugs and caps. After testing, each hose assembly shall be thoroughly dried. Plastic plugs and caps shall be installed on the threaded end fittings to protect the threads. Bulk hose shall be thoroughly dried after testing and shall have the ends protected with cloth or plastic backed self-adhesive tape.

3.11 Workmanship. Hoses and fittings shall be uniform in quality and material. Castings shall be free from patching, misalignment resulting from shifted coring, warping, and porosity. Sprues shall be removed and the casting shall be free from sand, dirt, and scale. Forgings shall be free from patching, warping, or other defects, and from dirt and scale. Machined parts shall be manufactured to tolerances and dimensions specified herein. Metal parts shall be free of sharp edges. Hose and hose assemblies shall be free of dirt, oil, and metal particles. Hose shall exhibit no cracks or blisters.

#### 4. VERIFICATION

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

- a. First article inspection (see 4.2).
- b. Conformance inspection (see 4.3).

4.1.1 Inspection lot. Hose lengths with couplings of the same size with the same construction materials, produced under essentially the same conditions, and offered for inspection at one time shall be considered a lot for purposes of inspection.

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4.2 First article inspection. First article inspection shall be performed on one hose assembly when a first article sample is required (see 3.1). This inspection shall include the examination of 4.4 and the tests of 4.5. The first article may be a standard production item from the contractor's current inventory provided that the unit meets the requirements of the specification and is representative of the design, construction, and manufacturing techniques applicable to the remaining units to be furnished under the contract. A first article inspection shall be performed for new or modified hoses, which have been previously examined, if there were any changes in design, materials, or manufacturing processes.

4.3 Conformance inspection. Conformance inspection shall include the examinations and tests as specified in 4.3.1.

4.3.1 Individual examination and tests. Each length of hose or hose assembly shall be subjected to the examination and tests listed in [table VIII](#).

TABLE VIII. Test for physical properties.

Property	Requirement	Applicable ASTM standard	Test
Inside diameter	3.3.2.1 and <a href="#">table VI</a>	ASTM D380	4.5.1
Outside diameter	3.3.2.1 and <a href="#">table VI</a>	ASTM D380	4.5.1
Length	3.3.2.1 and <a href="#">table VI</a>	ASTM D380	4.5.1
Proof pressure	3.3.2.1 and <a href="#">table VI</a>	ASTM D380	4.5.4
Electrical continuity	3.5	----	4.5.10

4.3.2 Sampling for tests.

4.3.2.1 Sampling for vacuum test. Samples of hose assemblies shall be taken from each lot in accordance with [table IX](#) for the initial vacuum test specified in 4.5.3.

TABLE IX. Sampling for vacuum test.

Number of hose assemblies in lot	Number of hose assemblies in sample
8 and under	all
9 to 90	8
91 to 280	32
281 to 500	50
501 to 1200	80

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4.3.2.2 Sampling for all other tests. With each 100 hose assemblies, or less, offered for conformance inspection, samples shall be furnished in accordance with [table X](#).

TABLE X. Sampling for all other tests.

Test	Requirement	Test	Test <sup>2/</sup> sample	ASTM standard
Tube thickness	3.3.2.1 and <a href="#">table VI</a>	4.5.1	a	ASTM D380
Cover thickness	3.3.2.1 and <a href="#">table VI</a>	4.5.1	a	ASTM D380
Hose weight	3.3.2.1 and <a href="#">table VI</a>	4.5.2	a	---
Burst pressure	3.3.2.1 and <a href="#">table VI</a>	4.5.5	a	ASTM D380
Vacuum <sup>1/</sup>	3.3.2.1 and <a href="#">table VI</a>	4.5.3	a	ASTM D380
Low temperature flexibility	3.6	4.5.6	a	ASTM D471
Cleanliness	3.7	4.5.7	a	ASTM D471 and ASTM D2276
NOTES: <sup>1/</sup> For Type NC hose only. <sup>2/</sup> Sample selection shall be in accordance with the following: a. One hose assembly shall be provided in addition to the quantity required for delivery. This hose assembly shall be taken at random for the tests specified in <a href="#">table X</a> . b. Vulcanized samples, 6 by 6 inches by 0.080±0.005 inch in thickness of the friction and filler compounds used to impregnate the reinforcement and surround the wire helix, or both, shall be provided for the test specified in <a href="#">table X</a> (see 6.5). c. A straight 6-foot length of the helix wire used in the hose offered for conformance inspection for the tests specified in <a href="#">table X</a> .				

4.4 Visual and dimensional examination. Each of the sample hose assemblies selected in accordance with 4.3.1 shall be examined to verify conformance to the requirements of this specification regarding all parts of the hose assembly which do not involve tests. Visual defects shall be determined and evaluated in accordance with FED-STD-162. Length, outside diameter, and inside diameter shall be determined as specified in 4.5.1. Weight shall be determined as specified in 4.5.2. Overall workmanship shall observe the requirements of paragraph 3.11.

#### 4.5 Test methods.

4.5.1 Dimensions of hose. The procedure specified in ASTM D380 shall be used to determine the inside diameter, outside diameter, tube thickness, cover thickness, and length of the hose. Inside diameter, outside diameter, and length shall be measured on each of the sample hose assemblies selected in accordance with 4.3.2.2. Tube thickness and cover thickness shall be measured at six points equally spaced along the length of the sample hose selected in accordance with [table X](#). Each point shall be spaced 60 degrees apart around the circumference. The thickness values found shall not be averaged. Each thickness value shall conform to the requirements specified in [table VI](#).

4.5.2 Weight of hose. The weight of each sample hose assembly, complete with couplings, selected in accordance with 4.3.2.2, shall be determined with a precision of ±0.5 percent and shall conform to the requirements of [table VI](#).



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4.5.3 Resistance to vacuum (type NC only).

4.5.3.1 Initial. Each of the sample hose assemblies selected in accordance with [table X](#) shall be subjected to a vacuum equivalent to a 22-inch height of Hg for a period of not less than 5 minutes. The hose shall not collapse or otherwise deform more than 15 percent of original diameter. The decreases in diameter of the hose where deformation occurs shall be measured in accordance with ASTM D380.

4.5.3.2 After holding test fluid. A 5-foot length shall be cut from the sample hose assembly submitted in accordance with [table X](#), note 2a. One end shall be plugged and the hose filled with Reference Fuel B of ASTM D471. The other end shall then be closed and the hose let stand for 46 hours at a temperature of 70 to 80 degrees Fahrenheit (°F). At the end of this period, the fluid shall be drained from the hose. Within 5 minutes after removal of the fluid, the hose length shall be bent to a radius of 15 inches for the 1½-inch id hose, or 18 inches for the 2½-inch id hose. The bent hose length shall then be subjected to a vacuum equivalent to a 22-inch height of Hg for a period of not less than 15 minutes. The decrease in diameter of the hose where deformation occurs shall be measured. After release of the vacuum, the hose shall be dissected longitudinally and examined for evidence of failure by ply separation, blistering, collapse, or other damage.

4.5.4 Resistance to proof pressure. Each length of hose selected in accordance with 4.3.1 and previously used for the vacuum test (see 4.5.3) shall be measured for length and circumference as specified in ASTM D380. Each hose shall then be subjected to a hydrostatic test to the proof pressure in accordance with [table VI](#) for a period of not less than 10 minutes. At the end of this period, while the hose is still under pressure, its length and circumference shall again be measured, it shall be examined for leakage or other signs of weakness, and the contact assembly shall be checked electrically to assure that there is no electrical contact between the couplings and intercontrol cable.

4.5.5 Resistance to burst. A 3-foot length shall be cut from the sample hose selected in accordance with [table X](#), note 2a. Couplings shall be attached to the 3-foot length and the ends blanked off. The hose shall then be subjected to increasing hydrostatic pressure to the pressure stated in [table VI](#) with the rate of pressure rise not exceeding 100 psi per minute. The pressure at which leakage occurs shall be noted.

4.5.6 Low temperature flexibility. A 4-foot length shall be cut from the sample hose submitted in accordance with [table X](#). One end shall be plugged and the length filled with Reference Fuel B of ASTM D471. The other end of hose shall then be plugged, and the hose exposed to a temperature of  $-22 \pm 2$  °F for 24 hours while held straight. At the end of this period and while at  $-22$  °F, the hose shall be bent 90 degrees around a mandrel 30 inches in diameter within 4 seconds. The fluid shall be drained from the hose, and the hose cut in half longitudinally. The tube and cover shall be examined for cracks or other damage.

4.5.7 Cleanliness test.

4.5.7.1 Specimen. A 4-foot length shall be cut from the sample hose submitted in accordance with [table X](#). Extraneous dust or other contaminants shall not enter the hose tube. The hose shall be closed with clean plugs at each end. Each plug shall have an outlet hole connected via a pipe nipple to a valve. The interiors of the pipe nipples and valves shall be carefully cleaned prior to use.

4.5.7.2 Apparatus. A machine is required that will impart a rotary motion in a vertical plane to a rigid bar that is attached at its center to a horizontal axle driven at  $12 \pm 1$  revolutions per minute (rpm). Four adjustable band clamps shall be attached symmetrically to the rigid bar to hold the specimen firmly.

4.5.7.3 Procedure. The specimen, having been sealed at one end by a prepared plug, shall be filled with Reference Fuel B of ASTM D471 and hung vertically for 16 to 24 hours. The fluid shall then be drained from the specimen and 2 liters of fresh medium number 6 added, and the open end plugged. The specimen shall then be clamped securely to the rotating bar so that the ends are spaced evenly from its center. After 120 minutes of rotary motion at 12 rpm at 70 to 80 °F, the first liter of the fluid shall be withdrawn for analysis. The amount of sediment shall be determined in milligrams per liter in accordance with ASTM D2276 using a 0.8-micrometer pore filter. The tests shall be performed in duplicate and the results averaged. A control analysis shall determine the amount of contaminant present per liter in the medium number 6 used for the test. The average amount of sediment found in the specimen shall be reduced by the amount found present in the control, and the difference recorded as the amount of particulate contaminant in the hose.



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4.5.8 Tests performed on rubber components. Tests, except the test for volume increase of the friction compound after immersion in test fluid (see 4.5.8.3), shall be performed on specimens prepared from the sample hose selected in accordance with 4.3.2.2 to determine conformance to 3.3.2.2.

4.5.8.1 Tensile properties. Tests for tensile properties shall be performed on dumbbell specimens in accordance with ASTM D412.

4.5.8.1.1 Initial tensile properties. Initial tensile strength and ultimate elongation at break shall be determined in accordance with ASTM D412.

4.5.8.1.2 Tensile properties after immersion. The tensile strength and ultimate elongation after immersion shall be measured by the procedure specified in ASTM D471, except the samples shall be immersed in Reference Fuel B for 46 hours at 70 °F. Tensile strength shall be based on the swollen cross-sectional areas of the specimen.

4.5.8.1.3 Tensile properties after oven aging. The tensile strength and ultimate elongation shall be determined after oven aging for 70±¼ hours at 212±2 °F in accordance with ASTM D573.

4.5.8.2 Adhesion. The adhesion between the several parts of the hose shall be determined initially and after immersion in test fluid. The adhesion shall be such that the rate of separation shall be not greater than 1 inch per minute under the minimum loads shown in [table VII](#).

4.5.8.2.1 Initial adhesion. The initial adhesion between the tube and breaker ply, between the cover and outer reinforcement plies, and between the reinforcement plies and the filler on the wire helix shall be determined in accordance with ASTM D413.

4.5.8.2.2 Adhesion after immersion. The adhesion after immersion shall be determined as specified in 4.5.8.2.2.1 through 4.5.8.2.2.3.

4.5.8.2.2.1 Test specimen. A 2-foot length shall be cut from the sample hose obtained as specified in [table X](#).

4.5.8.2.2.2 Apparatus. The apparatus for subjecting the test specimen to the action of the immersion fluids shall be as shown on [figure 6](#), or equivalent.

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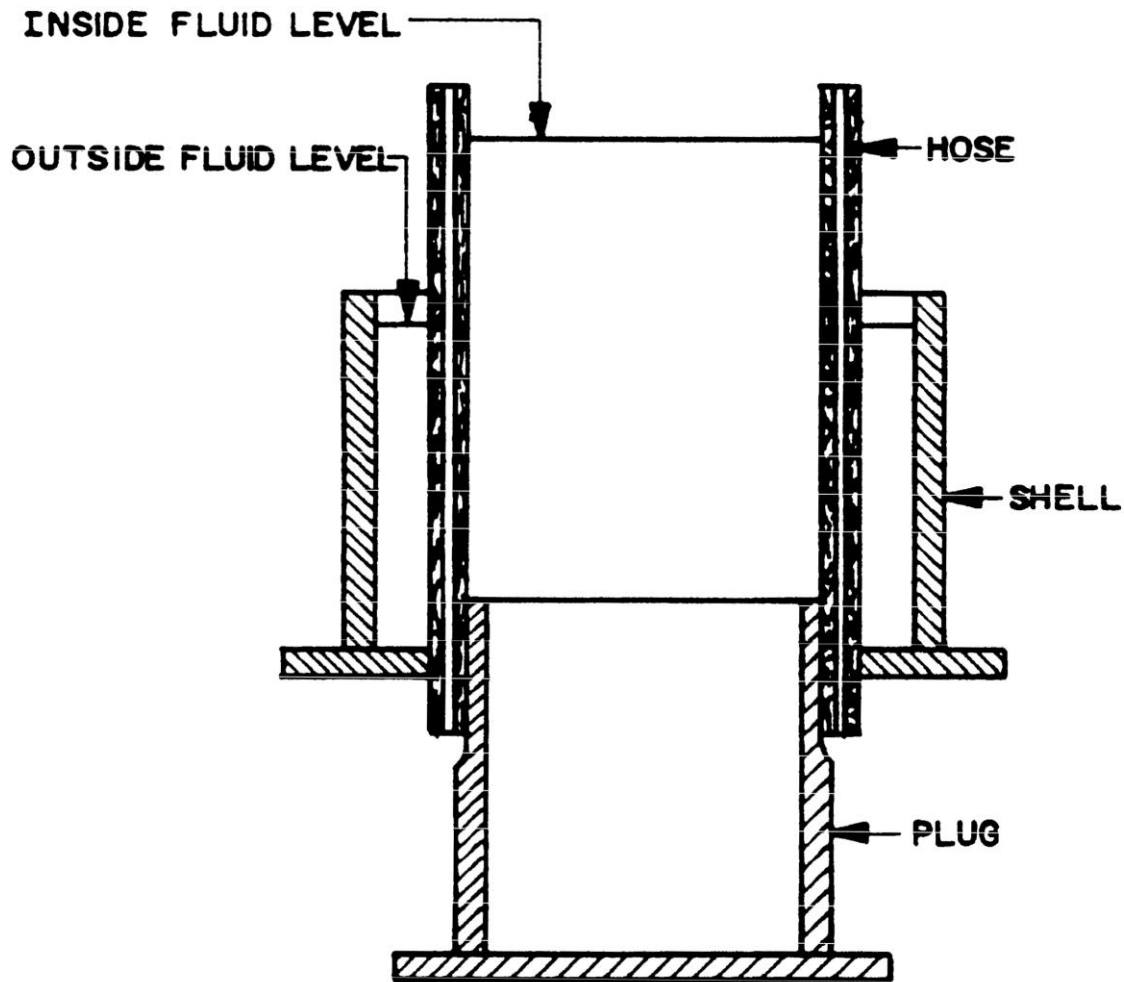


FIGURE 6. Jig for conditioning straight section of hose.

4.5.8.2.2.3 Procedure. The specimen shall be positioned in the apparatus and filled with Reference Fuel B of ASTM D471 to at least the height of the fluid on the outside of the specimen. The fluid surrounding the outside of the specimen shall be Reference Fuel A of ASTM D471. The specimen shall remain in contact with the test fluids for a period of  $46 \pm \frac{1}{4}$  hours at a temperature of 70 to 80 °F. At the end of this period, the specimen shall be removed and dried for a period of time not exceeding 30 minutes. The adhesion test specimens shall be cut from the specimen hose length during the drying period. The adhesion shall be determined within 2 minutes after completion of the drying period in accordance with ASTM D413.

4.5.8.3 Change in volume. The percent change in volume after immersion shall be measured by the procedure specified in ASTM D471, except the specimen shall be immersed in Reference Fuel B for  $46 \pm \frac{1}{4}$  hours at a temperature of 70 to 80 °F.

4.5.8.4 Resistance to ozone.

4.5.8.4.1 Test specimen. The specimen shall be a strip 1 by 5 inches taken lengthwise from the cover of the sample hose obtained as specified in 4.3.2.2. The specimen shall be buffed smooth on both sides. The maximum thickness after buffing shall be 0.100 inch. Duplicate specimens shall be tested.

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4.5.8.4.2 Procedure. The resistance to ozone shall be measured by the procedure specified in ASTM D1149. The specimen shall be clamped firmly at the ends in the holder at 20 percent extension and placed in an oven for 16 to 24 hours at  $100 \pm 2$  °F. After this preliminary exposure period, the specimen shall be placed in an ozone chamber at  $100 \pm 2$  °F with an ozone-air atmosphere of  $1.00 \pm 0.05$  parts of ozone per one million parts of air by volume. After exposure for  $166 \pm \frac{1}{2}$  hours, the specimen shall be removed from the ozone chamber and examined for surface cracking with a 7X magnifying lens. Cracks in the rubber within  $\frac{1}{8}$  inch of the clamps shall be ignored since they may be due to excessive strain in this region.

4.5.8.5 Nonvolatile extract.

4.5.8.5.1 Test specimen. The specimen shall consist of strips of the hose tube about  $\frac{1}{16}$  inch wide by  $\frac{1}{16}$  inch thick by  $1\frac{1}{2}$  inches long cut from the sample hose specified in 4.3.2.2. The total weight of strips shall be about 5 grams. Duplicate specimens shall be tested.

4.5.8.5.2 Procedure. This test shall utilize the procedure specified in ASTM D471, for "Procedure for Determining Mass of Soluble Matter Extracted by the Liquid", where a weighted specimen shall be placed in an extraction thimble, then inserted in a siphon cup of an extraction apparatus. One hundred milliliters of Reference Fuel A of ASTM D471 shall be added to the extraction flask. Extraction shall be carried out for  $46 \pm \frac{1}{2}$  hours at such a rate that  $2\frac{1}{2}$  to 3 minutes are required to fill and empty the syphon cup. The specimen and flask shall be rinsed with 25 milliliters of fresh fluid, and the wash added to the extract. The nonvolatile residue from the extract shall be determined in accordance with ASTM D381, except that the evaporation time shall be 45 minutes. The weight of the residue shall be expressed as percent of the original weight of the specimen. The results of duplicate tests shall be averaged.

4.5.8.6 Saybolt color number. The specimen shall consist of a 15-inch length cut from the sample hose obtained as specified in 4.3.2.2. The specimen shall be sealed at one end, filled within 2 inches of the top with Reference Fuel B of ASTM D471, and capped to prevent evaporation or adulteration by extraneous material. A suitable arrangement is shown on [figure 7](#). After  $168 \pm 2$  hours, the Saybolt color number of the fluid extract shall be determined in accordance with ASTM D156. Two duplicate tests shall be performed and the results averaged. The Saybolt color number of the uncontaminated medium number 6 used shall be plus 25, minimum.

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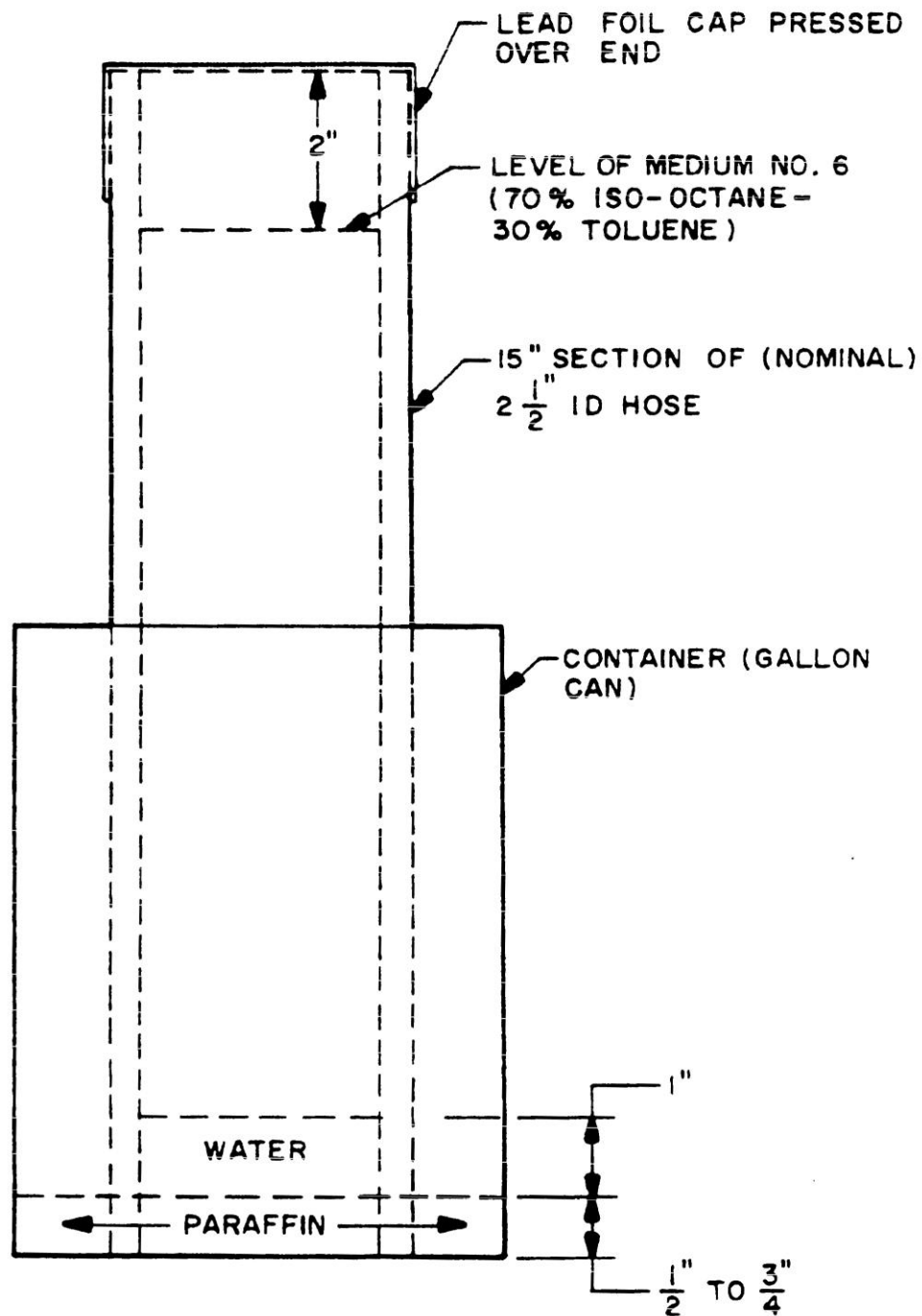


FIGURE 7. Assembly for obtaining extract for use in determining Saybolt color number.

#### 4.5.9 Tests performed on helix wire.

4.5.9.1 Tensile strength. The tensile strength of the wire shall be determined in accordance with ASTM E8/E8M.

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4.5.9.2 Wrapping test. Each of the samples of helix wire selected in accordance with 4.3.2.2 shall be wrapped six full turns around a mandrel having a diameter three times the diameter of the wire. The wrapped wire shall be examined for defects.

4.5.10 Electrical continuity test. Each hose assembly shall be tested with an ohmmeter to verify conformance to 3.5. Hose assembly shall be tested coupling to coupling and contact button to contact button.

4.5.11 Flattening test. One hose assembly shall be constructed for this test using the approved brass male coupling body, per item (11) of [table V](#) on one end, and the brass female coupling body, per item (17) of [table V](#) on the other end, without installing the control cable and spider assembly. The length of the hose shall be built with a minimum free hose length of 30 inches between each hose coupling, providing an overall length of 40½ inches from the end of each coupling. The female coupling end of the assembly is attached to a hydraulic cylinder and the male coupling end is extended straight over a roller bar, having a 1¾-inch outside diameter. A 20-pound hanging weight is connected to the male coupling end of the hose assembly which hangs freely from the roller bar. The current male hose coupling has a weight of approximately 5 pounds, giving a combined weight of the hanging weight equal to approximately 25 pounds. If the design of this coupling should ever change such that the weight changes, or if other couplings are approved having a different weight, then the hanging weight requires adjustment such that the combined weight of the hanging coupling and the hanging weight remains at approximately 25 pounds total.

The assembly shall be subjected to a 22-inch stroke of a hydraulic cylinder which forces the hose to flatten in the middle free hose length section away from the couplings. The test shall be conducted at a rate between 7 to 10 cycles per minute for a total of 100,000 cycles. Upon completion of the flattening test, the hose inner tube and cover shall be examined for any signs of delamination. If there are no signs of delamination, the hose assembly shall then be subjected to proof pressure testing of 4.5.4 to hydrostatic proof pressure in accordance with [table VI](#). The hose shall be examined for leakage or other signs of failure areas. Upon successful completion of proof testing, the hose assembly shall be subjected to burst pressure testing of 4.5.5 to hydrostatic burst pressure in accordance with [table VI](#). The pressure at which leakage occurs shall be noted. [Figure 8](#) depicts the test configuration.

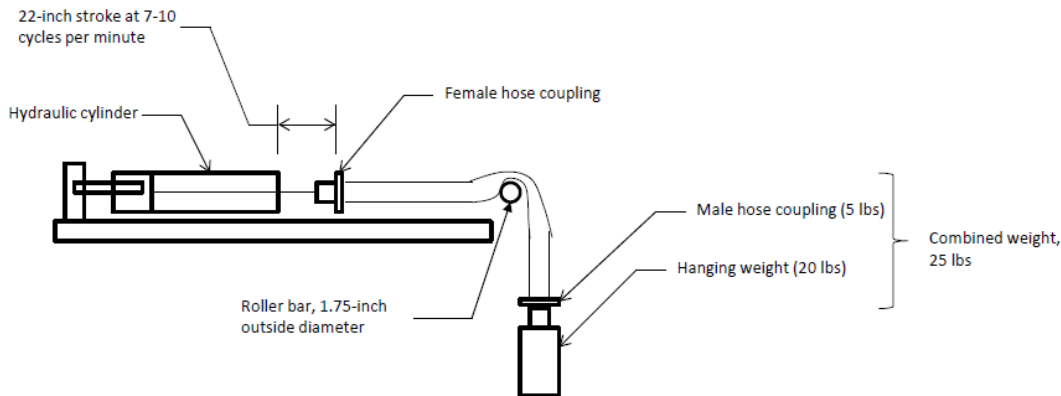


FIGURE 8. Flattening test configuration.

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4.5.12 Abrasion test (non-skid). This test applies to both collapsible and non-collapsible hose or assemblies. Similar to the flattening test in 4.5.11, one hose assembly shall be constructed for this test using the approved brass male coupling body, per item (11) of [table V](#) on one end, and the brass female coupling body, per item (17) of [table V](#) on the other end, without installing the control cable and spider assembly. The length of the hose shall be built with a minimum free hose length of 30 inches between each hose coupling, providing an overall length of 40 $\frac{1}{8}$  inches from the end of each coupling. The female coupling end of the assembly is attached to a hydraulic cylinder and the male coupling end is extended straight over a roller bar, having a 1 $\frac{3}{4}$ -inch outside diameter. A counterweight, hanging, is connected to the male coupling end of the hose assembly, which hangs freely from the roller bar. Provisions shall be taken to ensure complete contact of the test specimen to the non-skid coated plate throughout the test.

The exterior of the assembly shall be subjected to a rubbing-effect against a 12-inch by 12-inch plate,  $\frac{1}{2}$ -inch thick steel, coated with shipboard non-skid (MIL-PRF-24667) via a 22-inch stroke of a hydraulic cylinder, which forces the back-and-forth. One complete cycle is one forward and one reverse stroke. The test shall be conducted at a rate between 7 to 10 cycles per minute for a total of 2000 cycles. Upon completion of the abrasion test (non-skid), the hose exterior shall be examined for any signs of abnormal wear. The most minimum failure is indication of visible reinforcement threads. If there are no signs of abnormal wear, the hose assembly shall then be subjected to proof pressure testing of 4.5.4 to hydrostatic proof pressure in accordance with [table VI](#). The hose shall be examined for leakage or other signs of failure areas. [Figure 9](#) depicts the test configuration.

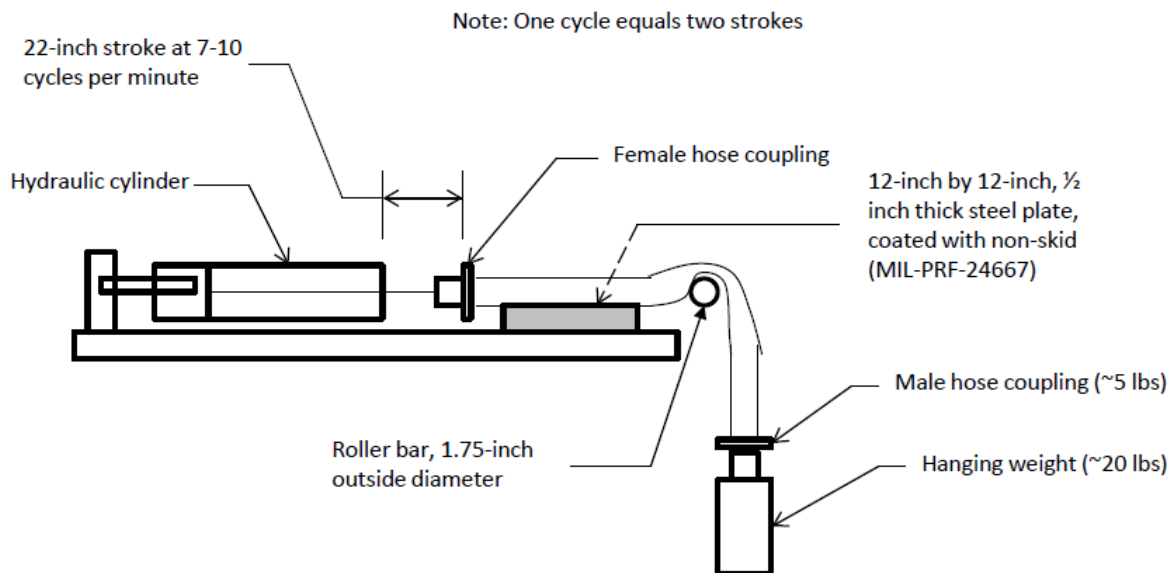


FIGURE 9. Abrasion test (non-skid) configuration.

## 5. PACKAGING

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

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## 6. NOTES

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

6.1 Intended use. Hose, fittings, and hose assemblies covered by this specification are intended for use as aircraft refueling hoses on board ships.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Number of lengths of hose and hose assemblies required.
- c. Size of hose, fitting, or hose assembly required (see 1.2.1.1).
- d. Type of hose or hose assembly required (see 1.2.1.2).
- e. Type of fittings required (see 1.2.1.3).
- f. Length of hose or hose assembly required (see 1.2.1.4).
- g. When first article is required (see 3.1).
- h. Packaging requirements (see 5.1).

6.3 First article. When first article inspection is required, the contracting officer should provide specific guidance to offerors whether the item should be a production sample, a first article sample, a first production item, a sample selected from production items, a standard production item from the contractor's current inventory (see 3.1), and the number of items to be tested as specified in 4.2. The contracting officer should also include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results, and disposition of first articles. Invitations for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract. Bidders should not submit alternate bids unless specifically requested to do so in the solicitation.

6.4 Sub-contracted material and parts. The packaging requirements of referenced documents listed in section 2 do not apply when material and parts are acquired by the contractor for incorporation into the equipment and lose their separate identity when the equipment is shipped.

6.5 Certification data/report. Vulcanized samples for conformance inspection [see [table X](#), note 2b] should be accompanied by a written certification from the manufacturer that the samples have the same compositions as the friction and filler, respectively, used in the hose and have equivalent cures.

6.6 Subject term (key word) listing.

Collapsible hose

Noncollapsible hose

Spider assembly

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

Preparing activity:

Navy – SH

(Project 4720-2012-030)

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 <https://assist.dla.mil>.