

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
SPECIFICATION FOR
SUCTION HOSE

1. SCOPE.

1.1. Scope. The suction hose described in this specification is designed to draft water from an open water source, such as a lake, stream, pond or creek in wildland firefighting operations. It is also used to siphon water from one portable tank to another. Suction hose is semirigid consisting of a rubberized, reinforced material. The coupling thread series designations are 1 inch 11-1/2 NPSH, 1-1/2 inch 9 NH, 2-1/2 inch 7-1/2 NH and 4 inch 4 NH, with hose lengths of 8 or 10 feet (2.44 or 3.05 m). Suction hose is capable of withstanding a vacuum of up to 25 inches mercury (85 kPa).

2. APPLICABLE DOCUMENTS.

2.1. Government Documents. 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 in effect on the date of the invitation for bids or request for proposals (see 6.2).

USDA Forest Service Standard

5100-190 - Threads, Gaskets, Rocker Lugs, Connections and Fittings, Fire Hose

USDA Forest Service Specification

5100-102 - Couplings, Fire and Suction Hose

5100-108 - Couplings, Lightweight, Fire and Suction Hose

Federal Standard

FED-STD-162 - Hose, Rubber, Visual Inspection, Guide for

Beneficial comments, recommendations, additions, deletions and any pertinent data that may be used in improving this document should be addressed to: USDA Forest Service, San Dimas Technology and Development Center, 444 East Bonita Avenue, San Dimas, CA 91773-3198 by using the Specification Comment Sheet at the end of this document or by letter.

Copies of federal standards and specifications are available from General Services Administration, Federal Supply Service Bureau, Specification Section, Suite 200, 470 East L'Enfant Plaza SW, Washington DC 20407.

Copies of USDA Forest Service Specifications and Standards are available from USDA Forest Service, San Dimas Technology and Development Center, 444 East Bonita Avenue, San Dimas, CA 91773-3198.

2.2. 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 in effect on the date of the invitation for bids or request for proposals.

American National Standards Institute Inc. (ANSI)/American Society For Quality Control (ASQC)

Z 1.4 - Sampling Procedures and Tables for Inspection by Attributes.

Address requests for copies to the American National Standards Institute Inc., 11 West 42nd Street, New York, NY 10036.

American Society for Testing and Materials (ASTM)

D 380 - Standard Methods for Testing Rubber Hose

D 412 - Standard Method of Tension Testing of Vulcanized Rubber

D 2240 - Standard Method of Test for Indentation Hardness of Rubber and Plastics by Means of a Durometer

E 380 - Practice for Use of the International System of Units

Address requests for copies to American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

Non-Government standards and other publications normally are available from the organizations that prepare or 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 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. Unless otherwise specified, first article inspection shall be performed on a product sample(s), in accordance with 4.4.3.

3.2. Construction. The hose shall be a rubber covered fabric hose or an all plastic hose.

3.2.1. Rubber Covered Fabric Hose. The construction of the rubber covered fabric hose shall consist of the following:

- a. A smooth bore inner tubing not less than 0.047 inch (1.19 mm) thick.
- b. Reinforcement shall be braided, loomed, spiraled, or plied of cotton or synthetic fiber impregnated or embedded in natural or synthetic rubber compound, causing the parts to adhere firmly to each other and to the tube and cover.
- c. A helix of wire or fiber between the plies of reinforcement completely embedded in natural or synthetic rubber.
- d. Ply or plies of fabric over the wire or fiber reinforcement and applied similar to (b) above.
- e. Abrasion resistant cover not less than 0.047 inch (1.19 mm) thick.

3.2.2. Plastic Hose. The plastic hose shall consist of a helix of wire or fiber completely embedded in a plastic material extruded in a one-piece construction. The inner surface shall be smooth bore and the cover shall be abrasion resistant.

3.2.3. Wire Reinforcement. When wire reinforcement is used on either type of hose, it shall be not less than 0.046 inch (1.17 mm) diameter. Wire spacing shall not be greater than 0.5 inch (12.7 mm).

3.2.4. Couplings. The 1 inch (25 mm) diameter hose shall be supplied with 1 inch 11-1/2 NPSH couplings, 1-1/2 inch (38 mm) diameter hose shall be supplied with 1-1/2 inch 9 NH couplings and 2-1/2 inch (63.5 mm) diameter hose shall be supplied with 2-1/2 inch 7-1/2 NH couplings. 4 inch (101.6 mm) diameter hose shall be supplied with 4 inch 4 NH couplings. One end of the hose shall be equipped with an internal threaded coupling section with a gasket installed and the other end with an external threaded coupling section. The couplings shall be properly installed. Skiving, or modifications of the hose ends to allow the couplings to be attached is not permitted. The couplings shall be lightweight aluminum alloy couplings, USDA Forest Service qualified in accordance with the minimum requirements of Specification 5100-108, unless otherwise specified. Couplings qualified to USDA Forest Service Specification 5100-102 may be requested in lieu of the lightweight aluminum alloy couplings. See 6.2. Gasket material physical properties shall meet the requirements of USDA Forest Service Standard 5100-190. Aluminum alloy threaded surfaces shall be hard-coated in accordance with the requirements of USDA Forest Service Standard 5100-190.

3.3. Materials. Where more than one type of material is used in various components, there shall be no incompatibility between materials which may cause corrosion.

3.3.1. Rubber Covered Fabric Hose. The material for the rubber covered fabric hose shall be as follows:

- a. Inner tubing and cover material shall be natural or synthetic rubber.
- b. Fabric reinforcement shall be cotton or synthetic fabric or fiber cord.
- c. Reinforcing shall be by spring steel wire or synthetic fiber.

3.3.1.1. Rubber Covered Fabric Hose Physical Properties. When tested in accordance with 4.5.4, rubber covered fabric hose shall be tested for adhesion, tensile strength, ultimate elongation, before and after air-heat and ozone aging. Rubber covered fabric hose shall meet the minimum physical properties indicated in Table 1. In addition, after air-heat aging at 158.0 °F (69.9 °C) tensile strength and ultimate elongation shall not decrease more than 25 percent of the original value. No cracks shall be visible under 7 X magnification. After ozone exposure of the cover, no cracks shall be visible under 7 X magnification.

3.4. Dimensions and Weights. The hoses shall conform to the dimensions and weights as indicated in Table 3. Overall length, including couplings, shall be 8.0 or 10.0 ft (+ 0/- 1.0 inch) 2.44 or 3.05 meters (+ 0/- 25.4 mm).

Table 3. Hose Sizes and Weights

Thread Series Designation	Hose Size - Nominal Internal Diameter	Maximum External Diameter	Maximum Weight with couplings		Minimum Hose Bend Radius
			8 ft hose lb kg	10 ft hose lb kg	
1 inch 11-1/2 NPSH	1.00 (+ 0.03/-0) 25.40 (+ 0.76/-0)	1.56 39.62	8.38 3.80	10.38 4.71	6.00 152.64
1-1/2 inch 9 NH	1.50 (+ 0.03/-0) 38.10 (+ 0.76/-0)	2.06 52.32	10.48 4.75	12.88 5.84	9.00 228.60
2-1/2 inch 7-1/2 NH	2.50 (\pm 0.06) 63.50 (+ 1.53/-0)	3.19 81.03	20.40 9.25	25.00 11.34	15.00 381.60
4 inch 4 NH	4.00 (\pm 0.06) 101.60 (+ 1.53/-0)	4.69 119.13	33.90 15.38	41.50 18.82	24.00 610.60

3.4.1. Dimensional Tolerance. Unless otherwise noted, the following tolerances apply: one place (x.x) \pm 0.1 inch (2.5 mm); two places (x.xx) \pm 0.01 inch (0.25 mm) and three places (x.xxx) \pm 0.010 inch (0.254 mm).

3.5. Workmanship. Workmanship shall be equal to the best commercial practices consistent with the highest engineering standards in the industry and shall be free from any defect which may impair serviceability or detract from the product's appearance.

3.5.1. Symmetry. All sections shall be symmetrical and concentric to 0.030 inch (0.762 mm).

3.5.2. Extruded Components. Extruded sections shall be free from laps, sharp die marks, cracks or other defects.

3.5.3. Rubber or Plastic Components. All rubber or plastic components shall be evenly and fully formed and uniformly thick and circular throughout. There shall be no blisters, pinholes, pits, sink marks, crazing, wrinkles, voids, foreign material, or cracks. The surface of the material shall be tack free. The fabric or wire-reinforcement shall not protrude through the outer or inner surfaces but be completely embedded in the rubber or plastic material.

3.6. Threads, Waterways, Gaskets, Gasket Recesses and Rocker Lugs. All threads, waterways, gaskets, gasket recesses and rocker lugs shall be in accordance with USDA Forest Service Standard 5100-190.

3.7. Markings. Coupling markings shall be in accordance with USDA Forest Service Standard 5100-190. In addition, markings on each length of hose shall be with a continuous type of embossing, or inlaying a rubber material brand, or applying ink bonding onto the cover in such a manner that the marking cannot be removed except by mechanical means. The type of marking shall not damage the hose. Continuous marking shall be defined as marking that extends the entire length of the hose, the last letter of one set of markings shall be followed within 6 inches (152.40 mm) by the first letter of the next set of markings. All letters and numerals shall be at least 0.75 inch (19.05 mm) high. Hose markings shall include "FSS"; the manufacturer's name, trademark or other identification; and the year of manufacture.

3.8. Surface Finish. The finish for all coupling surfaces, to include threaded surfaces, shall be in accordance with USDA Forest Service Standard 5100-190.

3.9. Performance.

3.9.1. Bend Radius. When tested in accordance with 4.6.2, the hose shall not show any indication of collapse or failure.

3.9.2. Vacuum. When tested in accordance with 4.6.3, the hose, after being subjected to 4.6.2 shall be capable of holding a vacuum of 25 inches mercury (85 kPa), without any signs of collapse or other failures. While under 25 inches mercury (85 kPa) vacuum, the test ball shall be able to pass freely from one end of the hose to the other.

3.9.3. Proof Pressure. When tested in accordance with 4.6.4, the hose shall be capable of withstanding 100 psig (690 kPag) hydrostatic pressure with no leaks from the threaded connection, cracks, breaks, permanent deformation, mechanical damage or structural failure.

3.9.4. Low Temperature Physical Properties. When tested in accordance with 4.5.7, the hose shall be tested for low temperature performance. After low temperature exposure, hydrostatic pressure testing shall be conducted in accordance with ASTM D 380 to determine if any failures have occurred. The hose shall not break or crack at -20 °F (-28.9 °C) while retaining its vacuum and pressure capabilities.

3.10. Metric Products. Metric dimensions are provided for information only, inch-pound units shall be the required units of measure for this specification. Thread series designations are indicated as 1 inch 11-1/2 NPSH, 1-1/2 inch 9 NH, 2-1/2 inch 7-1/2 NH and 4 inch 4 NH. Since these are thread series designations, not an indication of a specific dimension, the metric equivalent is not given. Products manufactured to metric dimensions shall be considered on an equal basis with those manufactured using inch-pound units, provided they fall within the tolerances specified using conversion tables contained in the latest revision of ASTM E 380, and all other requirements of this specification are met.

4. INSPECTION, SAMPLING AND TEST PROCEDURES.

4.1. General Inspection and Tests. Unless otherwise specified in the contract or purchase order, the contractor is responsible for performance of all inspection requirements prior to submission for Government acceptance inspection and tests. The contractor may utilize their own facilities or any commercial laboratory acceptable to the Government. Inspection records of the examination and tests shall be kept complete and available to the Government.

4.1.1. Inspection and Test Site. The Government shall conduct lot acceptance inspection and tests to determine compliance with the specification. If lot acceptance and tests are conducted at locations other than the manufacturing facilities, the contracting officer shall specify location and arrangements. In the case of on-site inspections at the contractor's facility, the contractor shall furnish the inspector all reasonable facilities for their work. During any inspection, the inspector may take from the lot one or more samples and submit them to an independent test laboratory approved by the Government or to a Government test facility for inspection and tests.

4.1.2. Testing With Referenced Documents. The contractor is responsible for ensuring that components and materials used were manufactured, examined and tested in accordance with referenced specifications and standards. The Government reserves the right to perform any of the inspections or tests set forth in this section where such action is deemed necessary to assure supplies and services conform to prescribed requirements.

4.2. Responsibility for Compliance. All items shall meet all requirements of sections 3 and 4. 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 this specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

4.3. Sampling for Inspection. When inspection is performed, sampling shall be in accordance with ANSI/ASQC Z 1.4.

4.3.1. Lot. All hoses of one size presented together in one delivery shall be considered a lot for the purpose of inspection. A sample unit shall be one length of coupled suction hose.

4.3.2. Sampling for Visual and Dimensional Examination. Sampling for visual and dimensional examination shall be S-2, with an Acceptable Quality Level (AQL) of 1.0 percent defective.

4.3.3. Sampling for Lot Acceptance Tests. Sampling for lot acceptance testing shall be S-2 with an AQL of 1.0 percent defective.

4.4. Inspection and Tests.

4.4.1. Visual and Dimensional Examination. When selected in accordance with 4.3.2, each sample suction hose shall be visually and dimensionally examined to determine conformance with this specification. Visual or dimensional defects shall be classified as major or minor. Federal Standard FED-STD-162 shall be used to determine other major and minor defects not listed in Table 4. If the number of defects in any sample exceeds the indicated AQL, the lot shall be rejected.

Table 4. Major and Minor Defects

Defect	Classification	
	Major	Minor
1. Hose assembly not complete.	X	
2. Hose construction not as required.	X	
3. Weight and dimensions not as required.	X	
4. Couplings not as required.	X	
5. Inside surface of hose not as required.	X	
6. Major defects as per Federal Standard FED-STD-162.	X	
7. Minor defects as per Federal Standard FED-STD-162.		X
8. Illegible or improper marking.		X
9. Color not as required.		X

4.4.2. Lot Acceptance Tests. Each of the samples selected in accordance with 4.3.3, shall be tested in accordance with 4.6, to determine conformance with requirements of this specification.

4.4.3. First Article Inspection. Unless otherwise specified (see 6.2), the first article sample(s) indicated in 3.1, shall be inspected as specified in 4.4.1 and 4.6. All inspection and testing of the first article sample(s) shall stop upon a single failure and the sample(s) rejected. The contractor shall be informed as to the nature of the failure, but the Government shall not be obligated to continue testing a defective item, once it is known to be defective or when it is considered in the best interest of the Government.

4.4.4. Quality Conformance Inspection. Unless otherwise specified, sampling for inspection shall be performed in accordance with ANSI/ASQC Z 1.4. The inspection level and AQL shall be as specified in 4.3.3.

4.5. Certificate of Conformance. A Certificate of Conformance shall meet the requirements of USDA Forest Service Standard 5100-190. Where certificates of conformance are required, the Government reserves the right to verify test any such items to determine the validity of certification. These certificates shall be based on the testing of component materials and may be performed by the component material supplier. The contractor shall provide certificates of conformance for all materials used in 3.2.4, 3.3.1, 3.3.1.1, 3.3.2, 3.3.2.1 and 3.9.4 (see 4.5.2, 4.5.3, 4.5.4, 4.5.5, 4.5.6 and 4.5.7).

4.5.1. Certificates of Conformance in Lieu of Testing. Unless otherwise specified, certificates of conformance may be acceptable in lieu of testing end items.

4.5.2. Couplings. As required by 3.2.4, the couplings shall meet the indicated material physical property requirement listed, when tested to defined test method.

4.5.3. Rubber Covered Fabric Hose Material. As required by 3.3.1, the material for the rubber covered fabric hose shall meet the indicated material physical property requirement listed, when tested to defined test method.

4.5.4. Physical Properties Test of Rubber Covered Fabric Hose. As required by 3.3.1.1, rubber covered fabric hose shall be tested for adhesion, tensile strength, ultimate elongation, before and after air-heat and ozone aging, in accordance to ASTM D 380 and D 412 test methods.

4.5.5. Plastic Hose Material. As required by 3.3.2, the material for the plastic hose shall meet the indicated physical properties listed.

4.5.6. Physical Properties Test of Plastic Hose. As required by 3.3.2.1, plastic hose shall be tested for tensile strength, elongation, hardness, before and after air-heat and ozone aging, in accordance with ASTM D 380, D 412 and D 2240 test methods.

4.5.7. Low Temperature Test. As required by 3.9.4, the hose shall meet the indicated material physical property requirement listed, when tested to low temperature test procedure of ASTM D 380 test method.

4.6. Performance Testing. Samples shall be subjected to the following tests to determine if the samples meet the requirements of this specification.

4.6.1. Fluid Medium. All testing requiring the use of a fluid medium shall be performed using municipally supplied potable water; this shall include, but is not limited to proof pressure testing. If the contractor does not have access to a municipal water supply, the testing shall be performed using any clear fresh water normally available for firefighting. First article testing performed by the Government shall be conducted using municipally supplied potable water.

4.6.2. Bend Radius Test. As required by 3.9.1, the hose shall be tested for bend radius. The hose shall be flexed five times through a 180 degree arc starting at one end of the hose. The radius of the arc shall be 6 times the inside diameter of the hose.

4.6.3. Vacuum Test. As required by 3.9.2, the hose shall be vacuum tested. The hose shall be positioned in a straight line on a flat level surface. One end of the hose shall be fitted with transparent windowed fixture. The other end shall be fitted with a light source and connected to a vacuum pump. Apply 25 inches mercury (85 kPa) vacuum. The hose shall be examined through the windowed end with a light source for any defects or failures. A ball with a diameter of 0.25 inch (6.35 mm) less than the hose inside diameter shall be inserted into the hose, the windowed fixture reinstalled and the vacuum pump restarted. A vacuum of 25 inches mercury (85 kPa) shall be applied and the ball passed from one end of the hose to the other. The ball shall be observed through the windowed fixture to determine if it rolls freely. The inner tubing shall be smooth, without any visible ribs, ripples, indentations, or any uneven surface.

4.6.4. Proof Pressure Test. As required by 3.9.3, the full length coupled hose shall be tested for proof pressure by attaching it to a water pressure source. The hose shall be charged by removing all air, filling with water and capping the discharge end. A hydrostatic pressure of 100 psig (690 kPag) shall be applied. The rate for applying hydrostatic pressure for the following tests shall not be less than 300 psig (2069 kPag) per minute and not more than 600 psig (4137 kPag) per minute, i.e., at a uniform rate over a 10 to 20 second time interval. The hose shall not burst before or upon reaching a hydrostatic pressure of 100 psig (690 kPag). There shall be no leaks from the threaded connection, cracks, breaks, permanent deformation, mechanical damage or structural failure.

5. PACKAGING, PACKING AND MARKING.

5.1. Packaging, Packing and Marking. The packaging, packing and marking shall be as specified in the contract or order.

6. NOTES.

6.1. Intended Use. The suction hose described in this specification is designed to draft water from an open water source, such as a lake, stream, pond or creek in wildland firefighting operations. It is also used to siphon water from one portable tank to another.

6.2. Acquisition Requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. If a first article sampling and inspection is not required (see 3.1, 4.4.3, and 6.3).
- c. Coupling size and length of hose required.
- d. If couplings qualified to USDA Forest Service Specification 5100-102 are required in lieu of lightweight aluminum alloy couplings.
- e. If certificates of conformance are acceptable in lieu of lot by lot testing (see 4.4.2 and 4.5).
- f. Packaging, packing and marking (see 5.1).
- g. Date of the invitation for bids or request for proposals (see 2.1).

6.3. First Article. When a first article sample(s) is required, it shall be inspected and approved in accordance with the First Article clauses set forth in the solicitation. Specific instructions shall be included regarding arrangements for selection, inspection, and approval of the first article sample(s).

6.4. Notice. When Government drawings, specifications, or other data are used for any purpose other than in connection with a related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever.

6.5. Preparing Activity. USDA Forest Service, San Dimas Technology and Development Center, 444 East Bonita Avenue, San Dimas, CA 91773-3198.

**United States Department of Agriculture, Forest Service
Standardization Document Improvement Proposal**

Instructions: This form is provided to solicit beneficial comments which may improve this document and enhance its use. Contractors, government activities, manufacturers, vendors, or other prospective users of this document are invited to submit comments to the USDA Forest Service, San Dimas Technology and Development Center, 444 East Bonita Avenue, San Dimas, California 91773-3198. Attach any pertinent data which may be used in improving this document. If there is additional documentation, attach it to the form and place both in an envelope addressed to the preparing activity. A response will be provided when a name and address are included.

Note: This form shall not be used to submit request for waivers, deviation, or for clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

Standard Number and Title: **Specification 5100-184c, Suction Hose**

Name of Organization and Address:

_____ Vendor _____ User _____ Manufacturer

1. _____ Has any part of this document created problems or required interpretation in procurement use?
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Give paragraph number and wording:

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