

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
SPECIFICATION FOR
NOZZLE TIPS, STRAIGHT STREAM AND SPRAY

1. SCOPE.

1.1. Scope. Nozzle screw tips used on fire hose nozzles can produce varied nozzle discharge patterns. The tips described in this specification include straight stream and spray types that can be connected to a 3/4-inch 11-1/2 NH garden hose threaded outlet. Straight stream tips are marked with bore diameter and spray tips are marked with flow rate (gpm).

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

5100-240 - Nozzle, Twin Tip, Shutoff, 1-Inch Base

Federal Specifications

QQ-A-225 - Aluminum and Aluminum Alloy Bar, Rod, Wire, or Special Shapes; Rolled, Drawn, or Cold Finished; General Specification for

QQ-A-225/10 - Aluminum Alloy Bar, Rod, and Wire; Rolled, Drawn, or Cold Finished, 6262

QQ-A-367 - Aluminum Alloy Forgings

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 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)

B 26 - Aluminum-Alloy Sand Castings

B 221 - Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

B 241 - Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube

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

Institute of Electrical and Electronics Engineers (IEEE)/American Society of Testing and Materials (ASTM)

SI 10 - Standard for Use of the International System of Units (SI): The Modern Metric System

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 types of nozzle tips are straight stream and spray. The components may be extruded, cast, forged or machined. The figures provided here are for information only and are not intended to designate a particular design or manufacturer.

3.2.1. Straight Stream Tip. The straight stream tip shall be constructed in one piece with a 3/4-inch 11-1/2 NH garden hose thread, female threaded inlet, gasket recess and tapering to a discharge orifice size of 1/8, 3/16, 1/4, 5/16, or 3/8 inch (3.18, 4.76, 6.35, 7.94, or 9.53 mm), as specified. A gasket shall be installed in each nozzle tip. See Figure 1 for configuration.

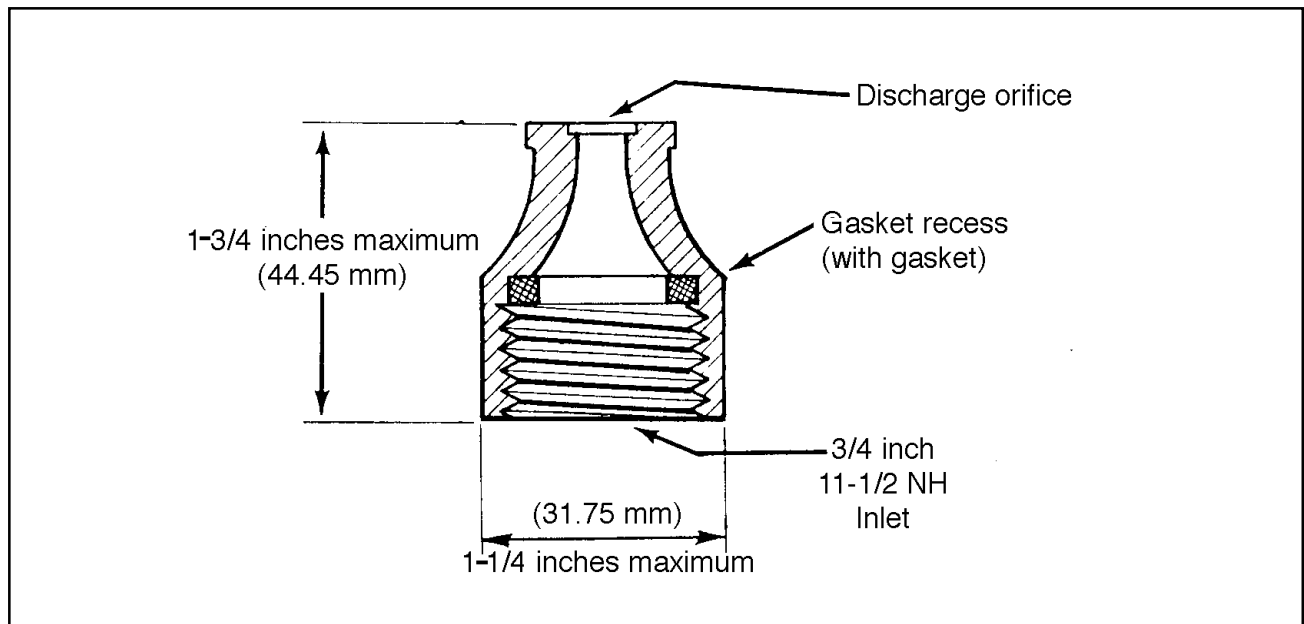


Figure 1. Straight stream tip configuration.

3.2.1.1. Tip Discharge. The discharge opening shall be recessed 0.0469 inch to 0.0625 inch (1.19 to 1.59 mm). The discharge face diameter shall be at least 0.50 inch (12.7 mm) more than the orifice.

3.2.1.2. Waterway Finish and Knurling. The inside finish of the waterway shall not be rougher than 125 microinches (3.175 μ m). The outside surface shall be knurled for a non-slip grip for a length of 0.75 +/- 0.062 inch (19.05 +/- 1.59mm).

3.2.2. Spray Tip. The spray tip shall include a housing, orifice plates, filter screen, gaskets, and connector end with 3/4-inch 11-1/2 NH garden hose thread, female threaded inlet. A gasket shall be installed in each nozzle tip. The spray tip shall be in size numbers 3, 6, 8, 9, 12, 15, 18 or 24, as appropriate. See Figure 2 for configuration.

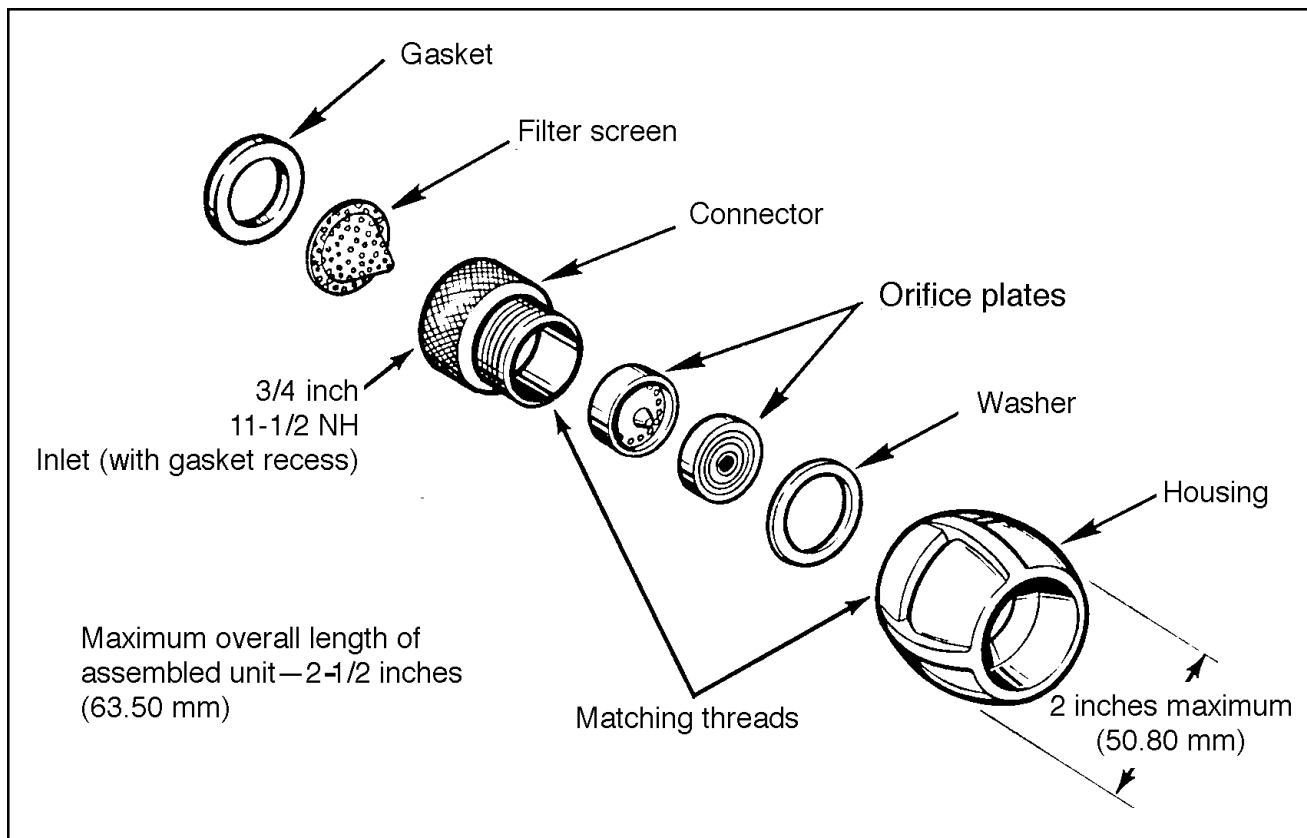


Figure 2. Spray tip configuration.

3.2.2.1. Filter Screen. The conical filter screen located at the inlet of the spray tip shall be constructed from perforated screen material, 24 gauge, 0.025 inch (0.635 mm) thickness, 0.045 inch (1.14 mm) hole size with a minimum 28 percent open area per square inch or per 645.2 square mm. Construction of the filter shall not restrict performance of the spray tip as required by 3.10.2.

3.2.2.2. Knurling. The outside surface of the connector shall be knurled for a non-slip grip for a length of 0.75 inch +/- 0.062 inch (19.05 +/- 1.58 mm).

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. Tip Material. The straight stream and spray tip material shall conform to the following:

- a. Extruded aluminum alloy, 6061-T6, in accordance with ASTM B 221 and B 241 or
- b. Forged aluminum alloy, 6061-T6, in accordance with Federal Specification QQ-A-367 or
- c. Aluminum alloy, 6262-T9, in accordance with Federal Specifications QQ-A-225 and QQ-A-225/10 or
- d. Cast aluminum alloy, 356-T6, in accordance with ASTM B 26.

3.3.2. Spray Tip Orifice Plates and Filter Screen. Spray tip orifice plates shall be brass, copper, stainless steel, or acetal homopolymer plastic. The filter screen shall be a stainless steel appropriate for a water environment.

3.3.3. Gasket Material. Gasket material physical properties shall meet the requirements of USDA Forest Service Standard 5100-190.

3.3.4. Recoverable Materials. The contractor is encouraged to use recovered materials to the maximum extent practicable, in accordance with paragraph 23.403 of the Federal Acquisition Regulation (FAR), provided all performance requirements of this specification are met.

3.4. Dimensions. Dimensions shall be as shown in Figures 1 and 2.

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 (0.254 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 metal part sections shall be symmetrical and concentric to 0.030 inch (0.762 mm).

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

3.5.3. Cast Components. Cast parts shall be fine-grained, free from blowholes, pinholes, pits, porosity, hard spots, shrinkage, cracks or other defects.

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

3.7. Marking. Markings shall be in accordance with USDA Forest Service Standard 5100-190. In addition, straight stream tips shall be marked with the bore diameter (in fractions), and spray tips shall be marked with flow rate (gpm or L/m)

3.8. Surface Treatment. Aluminum alloy surfaces, to include threaded surfaces, shall be hardcoated in accordance with USDA Forest Service Standard 5100-190.

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

3.10. Performance.

3.10.1. Straight Stream Tip. When tested in accordance with 4.6.5, the straight stream tip shall be capable of performing at the ranges and flow rate indicated in Table 1. Stream pattern shall be uniform and evenly distributed. The discharge orifice inner diameter shall be as indicated in Table 1. The dimensional tolerance for the discharge orifice inner diameter is $\pm$ 0.010 inch (0.25 mm).

Table 1. Straight Stream Tip Range and Flow Rate

Discharge Orifice Inner Diameter	Minimum Straight Stream Range				Flow Rate	
	Tip Size	@ 100 psig (689 kPag)	@ 200 psig (1379 kPag)		@ 100 psig Minimum	(689 kPag) Maximum
	inch (mm)	feet (m)	feet (m)		gpm (L/m)	gpm (L/m)
	1/8 (3.18)	29 (8.84)	35 (10.67)		4.2 (15.9)	5.2 (19.7)
	3/16 (4.76)	34 (10.36)	45 (13.72)		9.4 (35.6)	11.6 (43.9)
	1/4 (6.35)	40 (12.19)	48 (14.63)		16.8 (63.9)	20.6 (78.0)
	5/16 (7.94)	41 (12.50)	51 (15.55)		25.3 (95.8)	32.1 (121.5)
	3/8 (9.53)	41 (12.50)	58 (17.68)		37.9 (143.5)	46.3 (175.2)

3.10.1.1. Straight Stream Tip Pressure Testing. When tested in accordance with 4.6.5.3, the straight stream nozzle tip shall withstand 200 psig (1379 kPag) nozzle inlet pressure with no leaks from the threaded connection, permanent deformation, mechanical damage or structural failure.

3.10.2. Spray Tip. When tested in accordance with 4.6.6, the spray tip shall perform at the discharge angles and flow rates indicated in Table 2, when a nozzle inlet pressure of 100 psig (689 kPag) is applied. Spray pattern shall be uniform and evenly distributed.

Table 2. Spray Tip Discharge Angle and Flow Rate at 100 psig (689 kPag)

Tip No.	Discharge Spray Angle		Flow Rate			
	Minimum (degrees)	Maximum (degrees)	Minimum gpm (L/m)	Maximum gpm (L/m)	Minimum gpm (L/m)	Maximum gpm (L/m)
3	18	22	2.0 (7.57)	4.0 (15.14)		
6	18	22	5.0 (18.93)	7.0 (26.50)		
8	18	22	7.0 (26.50)	9.9 (34.07)		
9	26	30	8.0 (30.28)	10.0 (37.85)		
12	26	30	11.0 (41.64)	13.0 (49.21)		
15	26	30	13.5 (51.10)	16.5 (62.45)		
18	26	30	16.5 (62.45)	19.5 (73.81)		
24	26	30	22.5 (85.16)	25.5 (96.52)		

3.10.2.1. Spray Tip Range. When tested in accordance with 4.6.6.3, the minimum range of any spray tip shall be 12 feet (3.65m), as measured in a horizontal plane from the tip end to the center of the pattern on the test room floor, when 150 psig (1034 kPag) nozzle inlet pressure is applied.

3.10.2.2. Spray Tip Pressure Testing. When tested in accordance with 4.6.6.4, the spray nozzle tip shall withstand 600 psig (4137 kPag) nozzle inlet pressure with no leaks from the threaded connection, permanent deformation, mechanical damage or structural failure.

3.11. Metric Products. Metric dimensions are provided for information only, inch-pound units shall be the required units of measure for this specification. Thread series designation is indicated as 3/4-inch 11-1/2 NH. Since this is a thread series designation, not an indication of a specific dimension, the metric equivalent is not given. Products manufactured to metric dimensions will 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 IEEE/ASTM SI 10, and all other requirements of this specification are met.

4. SAMPLING, INSPECTION 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 will 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 tips of one size presented together in one delivery shall be considered a lot for the purpose of inspection. A sample unit shall be one tip.

4.3.2. Sampling for Visual and Dimensional Examination. Sampling for visual and dimensional examination shall be S-3, with an Acceptable Quality Level (AQL) of 2.5 percent defective.

4.3.3. Sampling for Lot Acceptance Tests. Sampling for lot acceptance testing shall be S-3 with an AQL of 2.5 percent defective.

4.4. Inspection and Tests.

4.4.1. Visual and Dimensional Examination. When selected in accordance with 4.3.2, each sample nozzle tip shall be visually and dimensionally examined to determine conformance with this specification. Visual or dimensional defects shall be classified as major or minor. A defect not listed in Table 3 shall be classified as a minor defect. If the number of defects in any sample exceeds the indicated AQL, the lot shall be rejected.

Table 3. Major and Minor Defects

Defect	Classification	
	Major	Minor
1. Tip not complete.	X	
2. Hardcoating or anodizing not as required.	X	
3. Thread dimensions not within specified tolerances and failure to pass gage tests.	X	
4. Dimensions not as required.	X	
5. Material not as required.	X	
6. Laps, sharp die marks, or other defects.	X	
7. Threads not smooth and not free of imperfections.		X
8. Illegible or improper marking.		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 will 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 3.3.1, 3.3.3 and 3.8 (see 4.5.2, 4.5.3 and 4.5.4).

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. Tip Material. As required by 3.3.1, nozzle tip material shall meet the indicated material physical property requirement listed, when tested to defined test method.

4.5.3. Gasket Material Test. As required by 3.3.3, gasket material physical properties shall meet the requirements of USDA Forest Service Standard 5100-190.

4.5.4. Surface Treatment. As required by 3.8, aluminum alloy surfaces, to include threaded surfaces, shall be hardcoated in accordance with USDA Forest Service Standard 5100-190.

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 flow rate, range and discharge angle testing, and 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 will be conducted using municipally supplied potable water.

4.6.2. Straight Stream Pattern. A straight stream shall be defined as a cohesive jet, an unbroken flow of water particles with a distinct streamline boundary and with a uniform distribution about the nozzle centerline, not in a conical pattern, and at a specified nozzle inlet pressure. The nozzle tip stream shall meet the requirements for range and flow rate as specified in 3.10.1 and Table 1.

4.6.3. Spray Stream Pattern. The spray stream shall be defined as a mist of fine water particles, with a uniform distribution, within a given discharge angle range, and at a specified nozzle inlet pressure. The nozzle tip stream shall meet the requirements for range, discharge angle and flow rate as specified in 3.10.2 and Table 2.

4.6.4. Tip Test Preparation. A twin tip nozzle meeting requirements of USDA Forest Service Specification 5100-240 shall be connected to a water pressure source. A sample tip shall be installed on the appropriate nozzle discharge end, in preparation for the following tests. The nozzle with sample tip shall be positioned so as to direct the discharge end, in a horizontal plane with the test room floor. The vertical height of the nozzle centerline shall be 33 inches +/- 3 inches (0.84 m +/- 76 mm).

4.6.5. Straight Stream Tip Tests. As required by 3.10.1 and 3.10.1.1, the straight stream tip shall be tested for range and flow rate. In addition, the straight stream nozzle tip shall be pressure tested.

4.6.5.1. Straight Stream Range Test. As required by 3.10.1, a nozzle inlet pressure of 100 psig (689 kPag) shall be applied and the distance in a horizontal plane from the tip end to the center of the pattern on the test room floor shall be measured. Increase the nozzle inlet pressure to 200 psig (1379 kPag) and repeat the measurement of the distance in a horizontal plane from the tip end to the center of the pattern on the test room floor .

4.6.5.2. Straight Stream Flow Rate Test. As required by 3.10.1, the nozzle tip shall be tested for flow rate by attaching it to a water pressure source. At a nozzle inlet pressure of 100 psig (689 kPag), the flow rate shall be measured using a calibrated flow meter or weigh tank.

4.6.5.3. Straight Stream Pressure Testing. As required by 3.10.1.1, the tip shall be pressure tested by attaching it to a water pressure source. A nozzle inlet pressure of 200 psig (1379 kPag) shall be applied and held for 3 minutes. The rate for applying the nozzle inlet pressure shall not be less than 300 psig (2068 kPag) per minute and not more than 600 psig (4137 kPag) per minute, i.e., at a uniform rate over a 20 to 40 second time interval. There shall be no leaks from the threaded connection, permanent deformation, mechanical damage or structural failure.

4.6.6. Spray Tip Tests. As required by 3.10.2 and 3.10.2.1, the spray tip shall be tested for discharge angle, flow rate and range. As required by 3.10.2.2, the spray tip shall be pressure tested.

4.6.6.1. Spray Discharge Angle Test. As required by 3.10.2, a nozzle inlet pressure of 100 psig (689 kPag) shall be applied and the discharge angle of the spray cone will be measured on a horizontal plane and the pattern observed for uniformity.

4.6.6.2. Spray Flow Rate Test. As required by 3.10.2, the nozzle tip shall be tested for flow rate by attaching it to a water pressure source. At a nozzle inlet pressure of 100 psig (689 kPag), the flow rate shall be measured using a suitable calibrated flow meter or weigh tank.

4.6.6.3. Spray Range Test. As required by 3.10.2.1, a nozzle inlet pressure of 150 psig (1034 kPag) shall be applied and the distance in a horizontal plane measured from the tip end to the center of the pattern on the test room floor. The vertical height of the nozzle centerline shall be 33 inches +/- 3 inches (0.84 m +/- 76 mm).

4.6.6.4. Spray Pressure Testing. As required by 3.10.2.2, the tip shall be pressure tested by attaching it to a water pressure source. A nozzle inlet pressure of 600 psig (4137 kPag) shall be applied and held for 3 minutes. The rate for applying the nozzle inlet pressure shall be not less than 300 psig (2068 kPag) per minute and not more than 600 psig (4137 kPag) per minute, i.e., at a uniform rate over a 1 to 2 minute time interval. There shall be no leaks from the threaded connection, 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 nozzle tips described in this specification are for use on fire hose nozzles to produce varied nozzle discharge patterns. The tips are of the straight stream and spray types, designed to be connected to 3/4-inch 11-1/2 NH garden hose threaded nozzle outlet, in the application of water in wildland firefighting activities.

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 and 4.4.3).
- c. Size and type of tip required.
- d. If certificates of conformance are acceptable in lieu of lot by lot testing (see 4.4.2 and 4.5).
- e. Packaging, packing and marking (see 5.1).

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 5100-244d, Straight Stream and
Spray Nozzle Tips.**

Name of Organization and Address:

_____ Vendor _____ User _____ Manufacturer

1. _____ Has any part of this document created problems or required interpretation in procurement use?
_____ Is any part of this document too rigid, restrictive, loose or ambiguous? Please explain below.

Give paragraph number and wording:

Recommended change(s):

Reason for recommended change(s):

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