

Specification 5100-239c
October 2000
Superseding
Specification 5100-239b
August 1996

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
SPECIFICATION FOR
NOZZLE WITH SHUTOFF, COMBINATION BARREL

1. SCOPE.

1.1. Scope. Nozzles used on fire hose produce varied discharge patterns. The adjustable combination barrel nozzle described in this specification may be connected to 1 inch 11-1/2 NPSH or 1-1/2 inch 9 NH USDA Forest Service fire hose. The combination nozzle has a shutoff and adjustable barrel varying the flow and stream pattern from low flow straight stream to low flow fog to high flow straight stream to high flow fog.

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

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-225/3 - Aluminum Alloy Bar, Rod, and Wire; Rolled, Drawn, or Cold Finished, 2011

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, California 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 of Quality Control(ASQC)

Z 1.4 - Sampling Procedures and Tables for Inspection by Attributes

Address requests for copies to American National Standards Institute, Inc., 11 West 42nd Street, New York, New York 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 combination nozzle shall be the rotating barrel type. The inlet and outlet shall be axially aligned. A gasket shall be installed in each nozzle. Size and thread series shall be as indicated in Table 1. At the fully closed position, the threads on the spindle shall not be exposed. The discharge end shall have a retainer that can be removed, for disassembly of the barrel from the spindle, to permit cleaning and repair. The 1-1/2 inch 9 NH combination nozzle shall be furnished with a bumper ring, unless otherwise specified. See Figure 1 for configuration. Figure 1 is provided for information only and is not intended to designate a particular design or manufacturer.

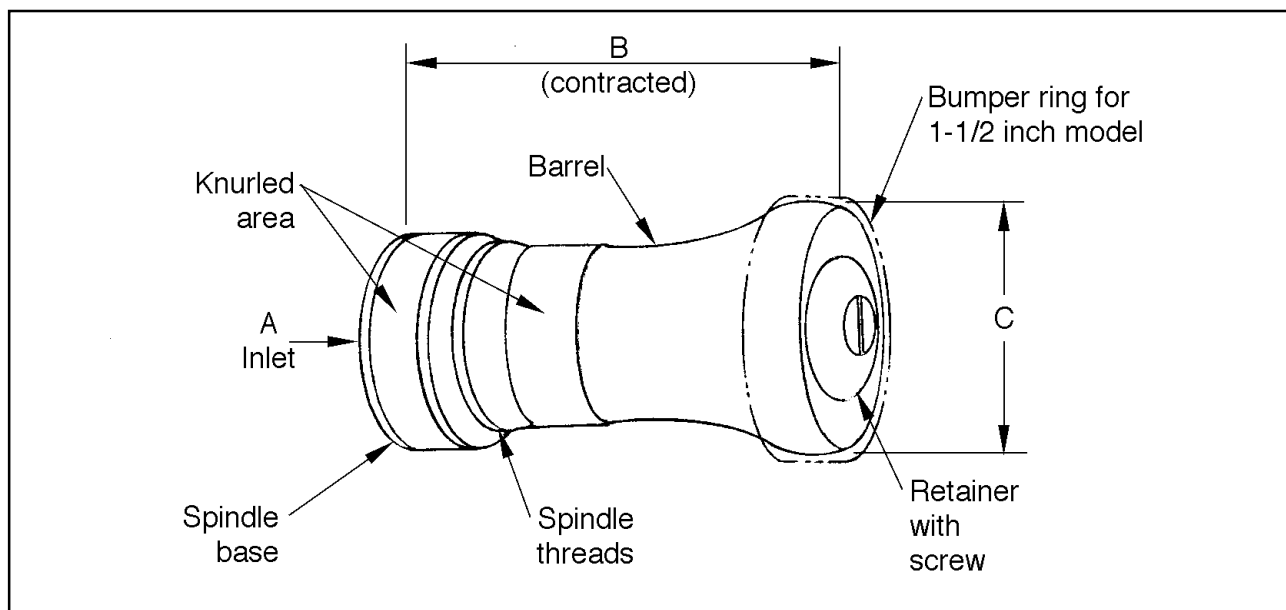


Figure 1. Combination nozzle configuration.

Table 1. Combination Nozzle Dimensions and Weight

-A- Inlet Thread Series Designation	-B- Maximum Length Contracted inch (mm)	-C- Maximum Diameter inch (mm)	Maximum Weight Ounce (g)
1 inch 11-1/2 NPSH	4.0 (101.6)	2.0 (50.8)	13.0 (369)
1-1/2 inch 9 NH	5.0 (127.0)	3.0 (76.2)	20.0 (567)

3.2.1. Sequence of Operation. The closed or shutoff position shall be when the barrel is fully extended. The sequence of operation as viewed by the operator, rotating the barrel counterclockwise and from the shutoff position, the nozzle shall produce a straight stream at low flow, then a fog at low flow, progressing to a high flow straight stream, then a high flow fog.

3.2.2. Knurling. The barrel and spindle base shall be knurled for a non-slip grip for a minimum length of 0.30 inch (7.6 mm) for the 1 inch 11-1/2 NPSH nozzle and 0.40 inch (10.2 mm) for the 1-1/2 inch 9 NH nozzle.

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. Barrel and Spindle Material. The nozzle barrel and spindle 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. Cast aluminum alloy, 356-T6, in accordance with ASTM B 26 or
- d. Aluminum alloy, 6262-T9, in accordance with Federal Specification QQ-A-225 and QQ-A-225/10 or
- e. Aluminum alloy, 2011-T3, in accordance with Federal Specification QQ-A-225 and QQ-A-225/3

3.3.2. Bumper Ring Material. The bumper ring material shall be ozone resistant neoprene, natural rubber or thermoplastic elastomer and shall meet the material requirements for gasket durometer as defined in USDA Forest Service Standard 5100-190.

3.3.3. Retainer and Screw Material. The retainer and screw material shall be 303 or 304 stainless steel.

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

3.3.5. Lubrication. Lubrication during nozzle assembly shall be limited to the spindle O-ring. The lubrication shall not cause damage to the seals or affect nozzle performance.

3.3.6. Color of the Nozzle. The nozzle body shall be red or maroon.

3.3.7. 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 and Weight. Dimensions and weight shall be as shown in Table 1.

3.4.1. Dimensional Tolerance. Unless otherwise noted, the following tolerances apply: one place (x.x) +/- 0.1 inch (2.5 mm); two places (x.xx) +/- 0.01 inch (0.25 mm) and three places (x.xxx) +/- 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 (0.762mm).

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 and 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.

3.8. Surface Treatment. Aluminum alloy surfaces, to include threaded surfaces, shall be hard coated 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. When tested in accordance with 4.6, the nozzle shall be adjustable to produce four different flow rates and patterns between the fully closed and fully opened position.

3.10.1. Straight Stream Ranges, Flow Rates and Discharge Spray Angles. When tested in accordance with 4.6.4, at a nozzle inlet pressure of 100 psig (689 kPag) the nozzle shall direct water in a straight stream in positions 1 and 3 (see 4.6.2), at the range, flow rate and discharge spray angle indicated in Table 2.

Table 2. Range, Flow Rate and Discharge Spray Angle

Nozzle Thread Series Designation	Pattern	Range		Flow Rate				Discharge Spray Angle Degrees Maximum
		Minimum feet	(m)	Minimum gpm	(L/m)	Maximum gpm	(L/m)	
1 inch 11-1/2 NPSH	1 LFSS	30	(9.1)	10	(37.9)	15	(56.8)	0
	2 LFF	12	(3.66)	NR	NR	NR	NR	NR
	3 HFSS	30	(9.1)	20	(75.6)	30	(114)	0
	4 HFF	12	(3.66)	NR	NR	NR	NR	NR
1-1/2 inch 9 NH	1 LFSS	30	(9.1)	20	(75.6)	30	(114)	0
	2 LFF	12	(3.66)	NR	NR	NR	NR	NR
	3 HFSS	30	(9.1)	60	(228)	80	(302)	0
	4 HFF	12	(3.66)	NR	NR	NR	NR	NR

NR = Not Required

3.10.2. Fog Range. When tested in accordance with 4.6.5, at a nozzle inlet pressure of 100 psig (689 kPag) the nozzle shall direct a fog stream in positions 2 and 4 (see 4.6.2), at the range indicated in Table 2.

3.10.3. Proof Pressure. When tested in accordance with 4.6.6, the nozzle shall withstand 600 psig (4137 kPag) hydrostatic pressure with no leaks, permanent deformation, mechanical damage or structural failure.

3.11. Markings. The nozzle markings shall be in accordance with USDA Forest Service 5100-190.

3.12. 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 and 1-1/2 inch 9 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 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 insuring 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 nozzles of one size presented together in one delivery shall be considered a lot for purpose of inspection. A sample unit shall be one nozzle.

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 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. Nozzle not complete.	X	
2. Hard coating or anodizing not as required.	X	
3. Thread dimensions not within specified tolerances and failure to pass gage tests.	X	
4. Dimensions and weight 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
9. Excessive lubrication.		X

4.4.2. Lot Acceptance Tests. Each of the sample units 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 and be rejected upon a single failure. 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 interests 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, 3.3.2, 3.3.4 and 3.8 (see 4.5.2, 4.5.3 and 4.5.4).

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

4.5.2. Nozzle Component Material. As required by 3.3.1, barrel and spindle material shall meet the indicated material physical property requirement listed, when tested to defined test method. Retainer and screw material shall be identified.

4.5.3. Gasket And Bumper Ring Material. As required by 3.3.2, gasket and bumper material physical properties shall meet the requirements of USDA Forest Service Standard 5100-190. Bumper ring material shall be of an ozone resistant neoprene, natural rubber or thermoplastic elastomer and shall have a Shore Type A durometer measurement of 65 to 85 durometer, when tested in accordance with ASTM D 2240.

4.5.4. Surface Treatment. As required by 3.8, aluminum alloy surfaces, to include threaded surfaces, shall be hard coated 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 proof pressure testing. If the contractor does not have access to a municipal water supply, 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. Barrel Positions. There are four distinct discharge flow patterns corresponding to four different barrel positions. Starting at opening the nozzle, position 1 shall be a low flow straight stream (LFSS); position 2 shall be a low flow fog (LFF); position 3 shall be a high flow straight stream (HFSS); and position 4 shall be a high flow fog (HFF).

4.6.2.1. Straight Stream Pattern. A straight stream shall be defined as a cohesive jet, an unbroken flow of water with a distinct streamline boundary, not in a conical pattern, with a uniform distribution about the nozzle flow centerline at a specified nozzle inlet pressure and outlet flow range.

4.6.2.2. Fog Stream Pattern. A fog stream shall be defined as a mist of fine water particles with a uniform distribution about the nozzle flow centerline at a specified nozzle inlet pressure and outlet flow range. The stream pattern shall be uniform, equally distributed, and conical, increasing in diameter beyond the nozzle tip.

4.6.3. Nozzle Test Preparation. The test nozzle 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 outlet centerline from the floor shall be 33 inches +/- 3 inches (0.84 m +/- 76 mm).

4.6.4. Straight Stream Tests. As required by 3.10.1, the nozzle shall be tested for range, flow rate and discharge spray angle. The range shall be measured as the distance in feet (meters) from the tip of the nozzle to the center of the water pattern on a horizontal surface 33 inches +/- 3 inches (0.84 m +/- 76 mm) below the nozzle outlet centerline.

4.6.4.1. 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 nozzle tip to the center of the pattern on the test room floor shall be measured.

4.6.4.2. Straight Stream Flow Rate Test. As required by 3.10.1, the nozzle 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.

4.6.4.3. Straight Stream Discharge Spray Angle Test. As required by 3.10.1, the discharge spray angle shall be measured. A nozzle inlet pressure of 100 psig (689 kPag) shall be applied and held. The discharge spray angle shall be measured on a horizontal plane. The pattern shall be observed for uniformity.

4.6.5. Nozzle Fog Test. As required by 3.10.2, the nozzle shall be tested for range. A nozzle inlet pressure of 100 psig (689 kPag) shall be applied and held. The horizontal distance from the nozzle tip to the center of the pattern on the test room floor shall be measured. The pattern shall be observed for uniformity.

4.6.6. Proof Pressure Test. As required by 3.10.3, the nozzle shall be pressure tested by attaching it to a water pressure source. Place the nozzle in the shutoff position. A hydrostatic pressure of 600 psig (4137 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 1 to 2 minute time interval. There shall be no leaks, permanent deformation, mechanical damage or structural failure.

5. PACKAGING, PACKING AND MARKING

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

6. NOTES.

6.1. Intended Use. The nozzle described in this specification is designed to produce varied discharge patterns for use with 1 inch 11-1/2 NPSH and 1-1/2 inch 9 NH fire hose 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 (3.1 and 4.4.3).
- c. Size of nozzle 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 of use 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 5100-239c, Nozzle with Shutoff, Combination Barrel**

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):

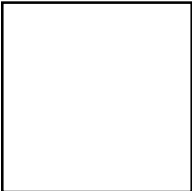
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USDA Forest Service
San Dimas Technology & Development Center
Attn: Water Handling Project Leader
444 East Bonita Avenue
San Dimas, CA 91773-3198

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