ANSI/NFPA 1964 An American National Standard December 2, 1987

NFPA 1964 Spray Nozzles (Shutoff and Tip) 1988 Edition

National Fire Protection Association Batterymarch Park, Quincy, MA 02269

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Policy Adopted by NFPA Board of Directors on December 3, 1982

The Board of Directors reaffirms that the National Fire Protection Association recognizes that the toxicity of the products of combustion is an important factor in the loss of life from fire. NFPA has dealt with that subject in its technical committee documents for many years.

There is a concern that the growing use of synthetic materials may produce more or additional toxic products of combustion in a fire environment. The Board has, therefore, asked all NFPA technical committees to review the documents for which they are responsible to be sure that the documents respond to this current concern. To assist the committees in meeting this request, the Board has appointed an advisory committee to provide specific guidance to the technical committees on questions relating to assessing the hazards of the products of combustion.

Statement on NFPA Procedures

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NATIONAL FIRE PROTECTION ASSOCIATION

Errata

NFPA 1964

Standard for

Spray Nozzles (Shutoff and Tip)

1988 Edition

The Fire Hose Committee notes the following error in the 1988 edition of NFPA 1964, *Standard for Spray Nozzles (Shutoff and Tip).*

In paragraph 2-3.5 change "200 inch-pounds (22.6 N × m)" *to* "20 inch-pounds (2.26 N × m)".

1.7M-4-89-FP

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This list represents the membership at the time the Committee was balloted on the text of this edition. Since that time, changes in the membership may have occurred.

NOTE: Membership on a Committee shall not in and of itself constitute an endorsement of the Association or any document developed by the Committee on which the member serves.

Contents

NFPA 1964

Standard for

Spray Nozzles (Shutoff and Tip)

1988 Edition

NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates explanatory material on that paragraph in Appendix A.

Information on referenced publications can be found in Chapter 6 and Appendix B.

Chapter 1 General Requirements

1-1* Scope. This standard applies to portable adjustable-pattern nozzles intended for general fire department use or for use with fire hoses affixed to standpipe systems. Unless otherwise specified, these requirements apply to:

(a) Basic spray, constant gallonage, and constant pressure spray nozzles.

(b) Trade sizes of ¾ in. (19 mm), 1 in. (25 mm), 1½ in. (38 mm), and 2½ in. (63 mm), or as determined by trade sizes of the coupling.

(c) Nozzles for use on Class A and B Fires.

(d) Nozzles for use with either lined or unlined hose.

1-1.1 Compliance. In order to be in compliance with this standard, nozzles shall meet or exceed performance and testing criteria established and set forth within this standard.

1-2 Units of Measurement. Within this standard, the first stated measurement shall be in English units followed by metric units rounded off to the nearest whole number and placed in parentheses, i.e., ¾ in. (19 mm). The second value may be only approximate. The first stated value is the requirement.

1-3 Markings.

1-3.1 Each nozzle shall be permanently identified with the following information using figures and letters not less than 3/16 in. (4.8 mm) in height. Information will be provided by either stamped or cast figures or letters or by labels meeting ANSI 969, *Marking and Labeling*, specifications.

(a) Name of manufacturer.

(b) Unique product or model designation.

1-3.2 Each spray nozzle shall be marked with the flow at positions of straight stream and full spray. Constant gallonage and select gallonage nozzles shall be marked to indicate flow at each setting. Constant pressure (automatic) nozzles shall be marked with the minimum and maximum flows as permitted in Section 2-1.

1-3.3 Nozzles equipped with a flush feature shall indicate the flush operating position with the letters FLUSH.

1-3.4 Adjustable-pattern nozzles shall be marked to indicate straight stream and spray pattern settings, or arrows shall indicate the direction of adjustments for straight stream or spray pattern.

1-4 Definitions.

Approved. Acceptable to the "authority having jurisdiction."

NOTE: The National Fire Protection Association does not approve, inspect or certify any installations, procedures, equipment, or materials nor does it approve or evaluate testing laboratories. In determining the acceptability of installations or procedures, equipment or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization concerned with product evaluations which is in a position to determine compliance with appropriate standards for the current production of listed items.

Authority Having Jurisdiction. The "authority having jurisdiction" is the organization, office or individual responsible for "approving" equipment, an installation or a procedure.

NOTE: The phrase "authority having jurisdiction" is used in NFPA documents in a broad manner since jurisdictions and "approval" agencies vary as do their responsibilities. Where public safety is primary, the "authority having jurisdiction" may be a federal, state, local or other regional department or individual such as a fire chief, fire marshal, chief of a fire prevention bureau, labor department, health department, building official, electrical inspector, or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the "authority having jurisdiction." In many circumstances the property owner or his designated agent assumes the role of the "authority having jurisdiction"; at government installations, the commanding officer or departmental official may be the "authority having jurisdiction."

Basic Spray Nozzle. An adjustable-pattern spray nozzle in which the rated flow is delivered at a designated nozzle pressure and nozzle setting. Due to its basic design, as the pattern is changed from straight stream through a wide spray pattern, the flow (gpm) will vary. The nozzle pressure will also be affected. This is caused by the orifice size changing to affect pattern adjustment.

Constant Gallonage Spray Nozzle. An adjustable-pattern nozzle in which the flow is delivered at a designed nozzle pressure. At the rated pressure, the nozzle will deliver a constant gallonage from straight stream through a wide spread pattern. This is accomplished by maintaining a constant orifice size during flow pattern adjustment.

Constant Pressure (Automatic) Spray Nozzle. An adjustable-pattern nozzle in which the pressure remains constant through a range of flows. The constant pressure provides the velocity for an effective stream reach at various flow rates. This is accomplished by means of a pressure-activated self-adjusting orifice baffle.

Constant/Select Gallonage Feature. A nozzle feature that allows on-site manual adjustment of the orifice to change the flow rate to a predetermined flow. The flow remains constant throughout the range of pattern selection from straight stream to wide spray.

Flush. A feature in a nozzle that allows the orifice to be opened so that small debris that might otherwise be trapped in the nozzle, causing pattern disruptions and flow variation, can pass through. When the flush feature is engaged, the nozzle pressure will drop and pattern will deteriorate. In fire fighting, caution must be exercised when the flush feature is engaged.

Labeled. Equipment or materials to which has been attached a label, symbol or other identifying mark of an organization acceptable to the "authority having jurisdiction" and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

Lever-type Control. A control in which the handle operates along the axis of the nozzle.

Lined Fire Hose. A hose having a nonpermeable lining of a rubber, synthetic rubber, plastic, or latex-coated fabric.

Listed. Equipment or materials included in a list published by an organization acceptable to the "authority having jurisdiction" and concerned with product evaluation, that maintains periodic inspection of production of listed equipment or materials and whose listing states either that the equipment or material meets appropriate standards or has been tested and found suitable for use in a specified manner.

NOTE: The means for identifying listed equipment may vary for each organization concerned with product evaluation, some of which do not recognize equipment as listed unless it is also labeled. The "authority having jurisdiction" should utilize the system employed by the listing organization to identify a listed product.

Nozzle Pressure. The net or normal pressure exerted against the side of the hose by the water in the hose with or without flow. Without flow, this is known as static pressure. Pressure is measured in pounds per sq in. (psi) or kilopascals (kPa).

Rated Pressure. That pressure for which the nozzle is designed to operate at a specified flow(s).

Rotational-type Control. A control that rotates in a plane perpendicular to the axis of the nozzle.

Shall. Indicates a mandatory requirement.

Should. Indicates a recommendation or that which is advised but not required.

Spray Nozzle/Spray Nozzle Assembly. The spray nozzle used by fire department personnel shall have a water flow control that will provide a capability of full flow to completely shutting off the nozzle flow. This control device may be a permanently mounted valve or a break-apart shutoff butt assembly.

Spray Tip. Generally applies to the primary adjustable-pattern and -flow appliance without a permanently attached shutoff butt. When used with fire hose mounted on standpipe systems, it may or may not have a shutoff capability. A spray tip for fire department use shall operate from a wide spray pattern to a straight stream. These tips may or may not include a twist type of shutoff.

Standard. A document containing only mandatory provisions using the word "shall" to indicate requirements. Explanatory material may be included only in the form of "fine print" notes, in footnotes, or in an appendix.

Standpipe System. An arrangement of piping, valves, hose connectors, and allied equipment installed in a building or structure with the hose connections located in such a manner that water can be discharged in streams or spray patterns through attached hose and nozzles, for the purpose of extinguishing a fire to protect the occupants. This is accomplished by connections to water supply systems or by pumps, tanks, and other equipment necessary to provide an adequate supply of water to the hose connectors.

Unlined Fire Hose. A hose consisting of only the woven jacket and having such qualities that the yarn of the jacket swells when wetted, sealing the hose, which is usually made of linen yarns.

Chapter 2 Operational Design Requirements

2-1 Discharge Performance.

2-1.1 Rated pressure for spray nozzles shall be 100 psig (690 kPa). Nozzle discharge rating shall be expressed as a rated flow at a rated pressure (e.g., 60 gpm at 100 psig) (225 L/m at 690 kPa).

2-1.2 Basic spray nozzles shall flow no less than the rated discharge at the rated pressure when tested in accordance with Section 4-2 of this standard. The maximum discharge will be no more than 10 percent above the rated flow when measured at both the straight stream and full spray pattern settings.

2-1.3 Constant gallonage spray nozzles shall flow the rated discharge plus 10 percent minus 0 percent at the rated pressure when tested in accordance with Section 4-2 of this standard.

2-1.4 Constant/select gallonage spray nozzles shall comply with 2-1.3 and Section 4-2 of this standard at each selected rate.

2-1.5 Constant pressure (automatic) spray nozzles will maintain an inlet pressure of between 85 and 115 psig

(586 and 795 kPa) throughout the rated flow range when tested in accordance with Section 4-2 of this standard.

2-2 Discharge Pattern.

2-2.1 Fire fighting spray nozzles shall be capable of developing discharge flow patterns varying from straight stream to a wide angle spray.

2-2.2 The straight stream pattern setting shall provide a cohesive jet capable of delivering 90 percent of the rated flow within a circle 12 in. (30.5 cm) in diameter at a distance of 10 ft (3.0 m) from the nozzle.

2-2.3 Spray pattern settings shall provide a full and uniform spray pattern.

2-2.4 Spray pattern adjustments shall provide spray patterns ranging from 25 degrees through 100 degrees at maximum flow rate.

2-3* Spray Nozzle Controls.

2-3.1 Nozzles equipped with a lever-operated shutoff handle shall be in the closed position when the handle is closest to the discharge end of the nozzle. Those equipped with a linearly acting pattern control lever or handle shall be in the straight stream position when the handle is closest to the discharge end of the nozzle.

2-3.2 Rotational controls shall traverse from a wide angle spray pattern to narrow spray, to straight stream, and to shutoff position on nozzles so equipped, in a clockwise manner when viewed from the rear of the nozzle.

2-3.3 Trigger-type lever controls shall be on when squeezed and off when released.

2-3.4 Lever-type controls shall require a force of no more than 16 lb (7.3 kg) of force and no less than 3 lb (1.4 kg) to open or close the shutoff or to adjust the stream pattern when tested in accordance with Section 4-4 of this standard.

2-3.5 For rotational-type controls, the operational torque required to change the pattern setting change flow as well as to just close (sans flow), to fully close, to just open (leak), and to fully open the valve shall not exceed 200 inch-pounds (22.6 N $\times$ m) and shall not be less than 4 inch-pounds (0.45 N $\times$ m) in accordance with Section 4-4 of this standard.

2-3.6 When set at the maximum discharge settings, the nozzle shall be subjected to a pressure of 300 psig (2070 kPa) or one and one-half times the maximum rated pressure specified by the purchaser — whichever is higher. All functions such as pattern selection, flush, flow adjustments, shutoff, etc., will be tested to ensure that they function properly at the test pressure, with not greater than a 25 percent increase in force than required at the rated pressure.

2-3.7 Nozzles equipped with a full-time swivel, which allows the nozzle to rotate once the swivel is tightened onto a coupling, shall require a minimum force of 10 lb (4.5 kg) to rotate the nozzle when tested in accordance with 4-4.3.

2-3.7.1 Nozzles equipped with rotational pattern controls, as well as a full-time swivel, shall have the force required to rotate the full-time swivel at least 1 lb (0.5 kg) greater than the force required to rotate the pattern control, as outlined in 2-3.5.

2-4* Threads. All nozzles, including replaceable, straight, and spray-type, shall be manufactured with the NH (National Hose) thread conforming to NFPA 1963, *Standard for Screw Threads and Gaskets for Fire Hose Connections*.

Table 2-4

Nominal Size of Connection Waterway	Approximate Outside Diameter of External Thread	Threads Per Inch
¾ in.-1 in. NH	1.375 ×	8
1½ in. NH	1.990 ×	9
2½ in. NH	3.0686 ×	7½

*See NFPA 1963, Table 4-2.2.

2-5 Flushing. All spray nozzles shall be designed to clear a reasonable collection of debris from the nozzle without shutting off the water to the hose.

2-5.1 Nozzles shall be able to clear particles of specific size in relation to nozzle size according to Section 4-3 of this standard.

2-5.2 Nozzles equiped with a flush feature must have a separate control or detent, or require increased force to indicate to the fire fighter when the flush feature is being engaged.

2-6 Leakage.

2-6.1 Nozzles equipped with a shutoff shall be pressurized to the higher of 800 psig or 1½ times the rated pressure and the shutoff fully opened and closed. After shutoff has been closed, the leakage, if any, will be measured. The maximum leakage allowed through the discharge orifice is 12 drops per min (½ mL per min). There shall be no leakage through any part of the nozzle other than the discharge orifice.

2-6.2 Increases in leakage shall not exceed 24 drops per min (½ mL per min) when subjected to the hydrostatic pressure in accordance with Section 3-1 of this standard.

2-7 Rough Usage.

2-7.1 Fire nozzles shall be capable of continued operation after being subjected to the rough handling tests in Section 4-9 of this standard.

2-7.2 Nozzles developing cracks or broken sections shall not be acceptable.

2-7.3 The nozzle shall not be deformed and shall be operational without the use of tools.

2-7.4 Samples shall be subjected to a comparative operating torque test. The operating torque shall not increase

more than 10 percent from that determined before the test.

2-7.5 Following the test in 2-7.4, samples shall again be subjected to the leakage test. The leakage shall not exceed 10 percent from that determined before the test.

2-8 Handholds and Ladder Hooks. Dual handholds, single handgrips, or ladder hooks provided on nozzles intended primarily for fire department use shall support a 300 lb (136 kg) nozzle reaction force for 5 min without breakage, cracking, or distortion.

Chapter 3 Construction Materials

3-1 Hydrostatic Strength. Nozzles shall be hydrostatically pressure tested to the higher of 1000 psig (3450 kPa) or five times the maximum working pressure specified by the purchaser.

3-2 High Temperature Exposure.

3-2.1 The nozzle shall be conditioned to 135°F (57°C), outlined in 4-7.1 of this standard.

3-2.2 Immediately after being removed from the heating chamber, the nozzle shall be tested for proper function of all adjustments and controls. There must be no binding of any function, such as pattern selection, flush, flow adjustment, shutoff, etc.

3-2.3 Within three minutes after being removed from the heating chamber, the nozzle shall be subjected to the rough usage tests in Section 4-9 of this standard.

3-3 Low Temperature Exposure.

3-3.1 The nozzle shall be conditioned to 25°F (-32°C) as specified in Section 4-8 of this standard.

3-3.2 Immediately after being removed from the cooling chamber, the nozzle shall be tested for proper function of all adjustments and controls. There must be no binding of any function, such as pattern selector, flush, flow adjustment, shutoff, etc.

3-3.3 Within three minutes after being removed from the cooling chamber, the nozzle shall be subjected to the rough usage tests outlined in Section 4-9 of this standard.

3-4 Corrosion Exposure.

3-4.1 Nozzles to be used in areas subject to salt water or other corrosive conditions shall meet the corrosion test in Section 4-10 of this standard.

3-4.2 After the completion of the salt spray test, all functions such as pattern selection, flush, flow adjustments, shutoff, etc., shall be operated to ensure that they function properly as required in Section 2-3 and 2-6 of this standard. There shall be no evidence of galvanic corrosion between dissimilar metals.

3-5 Ultraviolet Light-Water Exposure/Nonmetallic Nozzle Components.

3-5.1 Sample nozzles with exposed nonmetallic parts shall be exposed to ultraviolet light and water for 720 hrs. The samples shall be inspected for cracking or crazing after 360 hrs. If none are apparent, the 720 hr test will be completed.

3-5.2 At the conclusion of the test, the nozzle shall be inspected for cracking, crazing, and all functions such as pattern selection, flush, flow adjustments, shutoff, etc., shall be operated to ensure they function properly as described in Sections 2-3 and 2-5 of this standard.

3-6 Aging Exposure/Nonmetallic Nozzle Components.

3-6.1 Samples of nozzles shall be subjected to air-oven aging tests as described in Section 4-12 of this standard.

3-6.2 At the conclusion of the test, the nozzle shall be inspected for cracking or crazing and all functions such as pattern selection, flush, flow adjustment, shutoff, etc., will be operated to ensure they operate properly.

3-7 Mercurous-Nitrate Immersion Test.

3-7.1* Nozzles or components made from copper alloys containing more than 15 percent zinc shall withstand total immersion for 30 min, without cracking, in an aqueous-mercurous-nitrate solution containing 10 g of mercurous nitrate and 10 mL of nitric acid (specific gravity 1.42) per liter of solution.

3-7.2 The test sample shall be subjected to the physical stresses intended to be imposed on or within the sample as the result of assembly with a coupling. Such stresses are to be applied to the sample prior to and be effective during the test. A sample is to be connected to an appropriate male coupling and tightened to the minimum torque necessary to produce a leaktight assembly.

3-8 Tests for Rubber Sealing Materials.

3-8.1 A rubber material or synthetic elastomer used to form a seal shall have the following properties:

(a) In the as-received condition:

1. For silicone rubber (rubber having polyorganosiloxane as its characteristic constitutent), (a) tensile strength of not less than 500 psi (3.4 MPa) and at least 100 percent ultimate elongation, or (b) tensile strength at not less than 2200 psi (15.2 MPa) and at least 200 percent ultimate elongation determined in accordance with 3-8.2 and 3-8.3.

2. For material other than silicone rubber, (a) tensile strength of not less than 1500 psi (10.3 MPa) and (b) at least 200 percent ultimate elongation.

3. Tensile set of not more than $\frac{3}{16}$ in. (4.8 mm), determined in accordance with 3-8.2.

4. Compression set of not more than 15 percent, determined in accordance with 3-8.4.

(b) After accelerated aging in accordance with 3-8.5, not less than 70 percent of the as-received tensile strength and utlimate elongation.

3-8.2 Tensile Strength, Ultimate Elongation, and Tensile Set Tests. Tensile strength, ultimate elongation, and tensile set are to be determined in accordance with ASTM D 412-80, Method A, of the *Standard Test Methods for Rubber Properties in Tension*, except that, for tensile set determinations, the elongation is to be maintained for only 3 min, and the tensile set is to be measured 3 min after release of the specimen. The elongation of a specimen for a tensile set determination is to be such that the 1 in. (25.4 mm) part bench marks become separated to a distance of 3 in. (76 mm).

3-8.3 If a specimen breaks outside the bench marks, or if either the measured tensile strength or ultimate elongation of the specimen is less than the required value, an additional specimen is to be tested, and those results are to be considered final. Results of tests for specimens that break in the curved portion just outside the bench marks may be accepted if the measured strength and elongation values are within the minimum requirements.

3-8.4 Compression Set Test. Type I specimens of the material shall be prepared and the test conducted in accordance with ASTM D 395-78, Method B, of *Standard Test Methods for Rubber Property — Compression Set*. The specimens are to be exposed for 22 hrs at 70 ± 2°F (21 ± 1°C).

3-8.5 Accelerated Aging Test. Specimens shall be prepared in the same manner as for tensile strength and ultimate elongation tests, except for the bench marks 1 in. (25 mm) apart that are to be stamped on the specimens after the test exposure. The exposure shall be conducted in accordance with ASTM D 572-81, *Standard Test Method for Rubber — Deterioration by Heat and Oxygen*.

Chapter 4 Test Methods

4-1 Test Equipment. All gauges used for testing pressures required by this standard shall be calibrated with test equipment traceable to the National Bureau of Standards.

4-1.1 Pressure gauges installed in a piezometer ring shall measure the pressure at the inside surface of the waterway.

4-1.1.1 When testing nozzles equipped with a 1½-in. (38-mm) connection at flows in excess of 250 gpm (568 Lpm), the pressure gauge shall be mounted on a 2½-in. (65-mm) waterway. A tapered adaptor shall be used between the 2½-in. (65-mm) waterway and the 1½-in. (38-mm) inlet to the nozzle. The maximum included angle of the adaptor shall be 30 degrees.

4-1.2 Flow meters used to establish the flows referred to in this standard shall be calibrated volumetrically within 30 days prior to these tests to ensure their accuracy.

4-2 Discharge Test.

4-2.1 The nozzle shall be mounted such that the flow rate through the nozzle and pressure at the inlet to the nozzle can be measured. With the shutoff fully open, the inlet pressure will be adjusted to the rated pressure plus or minus 2 percent.

4-2.1.1 Basic spray nozzles shall be tested and flow measurement taken in both straight stream and wide angle spray pattern settings. Nozzle pressure shall be adjusted as specified in 4-2.1 for each of the pattern settings.

4-2.1.2 Constant gallonage nozzles shall be tested and flows monitored through the full range of pattern selection.

4-2.1.2.1 Constant/select gallonage nozzles shall be tested at each discrete flow selection and monitored through the entire range of pattern selection. The nozzle pressure will be adjusted as specified in 4-2.1 for each discrete flow selected.

4-2.1.3 Constant pressure (automatic) spray nozzles shall be tested on the same equipment as listed in Section 4-1 ensuring that the pressure gauge is as rated in 4-1.1.1. The flow will be increased to the minimum rated flow. The pressure at this flow will be recorded. The flow and nozzle pressure will be monitored through the entire range of pattern selection from straight stream to wide angle spray. Any deviation over 2 percent in flow or pressure will be recorded. Slowly increase the flow to the maximum rated flow while monitoring the pressure. Record the minimum and maximum pressures throughout the flow range. At the maximum rated flow, monitor the flow and pressure throughout the entire range of pattern selection.

4-3 Flushing.

4-3.1 Nozzles shall have a capability of clearing or flushing debris from the nozzle without shutting down the hose line. This may be accomplished either through the full open nozzle position or through a flush feature of the nozzle.

4-3.2 Nozzles shall be held in the vertical position, discharge end down, with the nozzle in either the fully open or flush position. The appropriate size ball must pass through the nozzle without changes in the control position. For flows up to 60 gpm (230 Lpm) ⅛ in. steel ball will be used. For flows 60-150 gpm (230-570 Lpm), a 3/16-in. steel ball will be used. For flows over 150-gpm (570 Lpm), a ¼-in. steel ball will be used.

4-4 Control Tests.

4-4.1 Nozzles equipped with lever-type shutoff and/or pattern changing devices shall be tested to determine the force required to operate the lever or handles with a flow pressure adequate to provide a minimum of 100 psig (690 kPa) nozzle pressure.

4-4.1.1 The nozzle shall be mounted in the closed position with an inlet pressure of 100 psig (690 kPa). A dynomometer, which records the maximum force reading, will be attached to the lever or handle, where it would be normally held during operation. The shutoff or pattern selection lever or handle shall be moved from the fully closed to fully open position or the full range of pat-

tern adjustment. The maximum force shall be recorded. The inlet pressure will be adjusted to 100 psig (690 kPa) while in the full flowing position. The dynomometer shall be used when moving the lever through the full range of positions and maximum force again measured and recorded. The maximum force recorded in both directions shall be compared to the requirements in Section 2-3 of this standard.

4-4.1.2 The nozzle shall be mounted without any pressure being applied to it. The controlling lever shall be placed in a closed or full forward position. The lever shall be moved from the full forward position. The force required to move the lever shall be measured with the dynomometer. The force to move the lever shall not be less than that identified in 2-3.4 of this standard.

4-4.2 Nozzles equipped with rotational pattern control shall be mounted on a rigid device and the force required to rotate the pattern sleeve shall be tested while water is flowing at 100 psig (690 kPa).

4-4.2.1 A length of twine or string, not to exceed $\frac{3}{32}$ in. (2.9 mm) diameter, shall be wrapped around the nozzle at the point where the nozzle would normally be held while rotating the pattern sleeve. The string shall be of sufficient length to wrap around the nozzle at least six times. The first two turns will overlap the starting end of the string, and the balance of the turns will not overlap any other turn. A force gauge, which records the maximum force reading, will be attached to a loop in the free end of the string.

The pattern sleeve shall be rotated by pulling the force gauge perpendicular to the center axis of the nozzle. As the pattern sleeve rotates, the string will unwind, so that the force always remains tangential to the pattern sleeve.

The pattern sleeve shall be rotated from the straight stream position to the wide spray position, or vice versa. If the nozzle is equipped with detents for the pattern settings, this test will commence with the pattern sleeve in the straight stream or wide spray detent.

The distance from the center of the nozzle to where the string attaches shall be recorded for developing torque values from the force readings. The maximum torque calculated over the entire range of patterns shall meet the requirements of 2-3.5.

4-4.2.2 The nozzle shall have a hook or other device added so that a dynamometer, which records the maximum force reading, can be attached and force applied tangentially. The distance from the center of the nozzle to where the dynamometer attaches shall be recorded for developing torque values from the force reading.

4-4.3 Nozzles equipped with a full-time swivel shall be tested as outlined in 4-4.2, and the force to rotate the complete nozzle shall be recorded while water is flowing at 100 psig (690 kPa).

4-4.3.1 The pattern sleeve of the nozzle will be rotated to the end of its travel in the wide spray direction. The force will be applied in the same manner as in 4-4.2 to determine the force required to rotate the nozzle. This force will be compared to the requirement in 2-3.7.

4-4.4 A nozzle with a twist shutoff shall be mounted on a device equipped with a relief valve, or other means, to maintain 100 psig (690 kPa) in both the closed position, and fully open position flowing the rated flow. The test shall start with the nozzle in the closed position. The force gauge shall be used to twist the shutoff to the fully open position, following the method outlined in 4-4.2.1. The windings on the pattern sleeve shall be reversed, and the force gauge used in the same manner as above to rotate the shutoff from the fully open to the fully closed position. In the fully closed position, the leakage shall not exceed that allowed in 2-6.1.

The maximum torque calculated from the maximum force recorded in both directions shall not exceed the requirements in 2-3.5.

4-5 Overpressure Test. An overpressure test shall be conducted in the following manner: The nozzle shall be mounted in a closed position on a device capable of exerting a pressure of 1000 psig (6894 kPa). The pressure shall be increased by 50 psig (345 kPa) increments and held for 30 sec at each pressure to a maximum pressure of 1000 psig (6894 kPa). This pressure shall be held for one (1) min without rupture of the nozzle.

4-6 Leakage Test. The leakage test shall be conducted during the overpressure test. The leakage, if any, will be recorded at each pressure and compared to the requirements of 2-6.2.

4-7 High Temperature Tests.

4-7.1 The nozzle shall be conditioned to 135°F (57°C) for four hrs prior to the test.

4-7.2 Immediately after being removed from the heating chamber, the nozzle shall be tested for proper function of all adjustment and controls. There shall be no binding of any function, such as pattern selection, flush, flow adjustment, shutoff, etc.

4-7.3 Within three minutes after being removed from the heating chamber, the nozzle shall be subjected to the rough usage tests identified in Section 2-7 of this standard.

4-8 Low Temperature Tests.

4-8.1 A dry nozzle shall be conditioned to -25°F (-32°C) for 24 hrs prior to the test.

4-8.2 Immediately after being removed from the cooling chamber, the nozzle shall be tested for proper functions of all adjustments and controls. There shall be no binding of any function, such as pattern selection flush, flow adjustment, shutoff, etc.

4-8.3 Within three minutes after being removed from the cooling chamber, the nozzle shall be subjected to the rough usage tests identified in Section 2-7 of this standard.

4-9 Rough Usage Test.

4-9.1 At least three samples of each of the nozzle assemblies in each size are to be prepared in heating and cooling chambers.

4-9.2 One sample shall be attached to a length of hose at least 10 ft (3 m) long and remain dry. Another sample shall be connected to a hose line, loaded with water, of at least 10 ft (3 m) in length. Nozzles shall be placed on the shutoff position. Pressure shall be increased to 100 psig (690 kPa) on the loaded line.

4-9.3 Nozzles attached to the dry hose line shall be dropped from a height of 2 ft (61 cm) onto a concrete surface so that it impacts directly or squarely on the discharge end of the nozzle.

4-9.4 Both assemblies shall also be dropped twice from a height of 6 ft (182 cm) onto a concrete surface, such that the points of impact are on two different sides of the nozzle.

4-9.4.1 For nozzles equipped with a shutoff handle or lever, one of the points of impact shall be directly on that handle or lever while in the closed position.

4-9.4.2 For nozzles equipped with a handhold, one of the points of impact shall be directly on the handhold. For nozzles equipped with identical handholds, only one of these need be subjected to the test.

4-9.5 Samples developing cracks or broken sections and failing to meet operational control requirements in Section 2-3 shall fail to meet the test criteria.

4-10 Salt Spray Test. Test samples shall be supported vertically and exposed to salt spray (fog) as specified by ASTM B 117-73, *Salt Spray (Fog) Testing*, for 120 hrs.

4-11 Ultraviolet Light/Water Test (Nonmetallic Nozzle Components).

4-11.1 Sample nozzles shall be exposed to ultraviolet light and water for 720 hrs. They shall be inspected for cracking and crazing after 360 hrs and again at the completion of the test. Cracking or crazing shall indicate failure of the test.

4-11.2 The ultraviolet light shall be obtained from two stationary enclosed carbon-arc lamps. The arc of each lamp is to be formed between two vertical carbon electrodes, ½ in. (12.7 mm) in diameter, located at the center of a revolvable vertical meter cylinder, 31 in. (787 mm) in diameter and 17¾ in. (451 mm) in height. Each arc is to be enclosed with a number PX clear Pyrex-glass™ globe. The samples are to be mounted vertically on the inside of the revolvable cylinder, arcing the lamps, and the cylinder continuously revolved around the stationary lamps at 1 revolution per min. A system of nozzles is to be provided so that each sample in turn is sprayed with water as the cylinder revolves. During each operating cycle each sample is to be exposed to the light and water spray for 3 min and to the light only for 17 min (total 20 min). The air temperature within the revolving cylinder of the apparatus during operations is to be 63° ± 5°C.

4-12 Air-Oven Aging Tests (Nonmetallic Nozzle Components).

4-12.1 Aging tests shall be performed prior to the rough usage, leakage, and hydrostatic pressure tests.

4-12.2 Samples of the nozzles shall be subjected to air-oven aging for 180 days at 70°C (158°F) and then allowed to cool at least 24 hrs in air at 23°C (74°F) at 50 percent relative humidity prior to conducting all other tests identified in this standard.

4-13 Handholds and Ladder Hooks.

4-13.1 The sample nozzle shall be mounted in a fixture to simulate intended use. A force of 300 lb (136 kg) is then applied to the nozzle to simulate the nozzle reaction force. There shall be no breakage, cracking, or distortion of the handholds, grips, or ladder hooks.

4-13.2 Handholds and ladder hooks shall be subjected to drop tests as described in Section 4-9 of this standard.

Chapter 5 Sampling, Inspection, Maintenance, and Testing

5-1 Conformance Testing.

5-1.1 Ratings of nozzle designs shall be certified by a testing laboratory or by manufacturers with suitable test facilities, or suitable test facilities specified by the purchaser.

5-1.2 To comply with this specification, the manufacturer or distributor shall test three randomly selected nozzles of the same design, type, and model. All three nozzles must pass all of the requirements of this standard. Nozzle design, type, and model meeting these test requirements shall be certified by the manufacturer.

These test results shall be kept on file by the manufacturer or distributor. Copies shall be provided when requested by the purchaser.

5-1.3 Any changes to the design of the nozzle or in the materials of contruction that might affect performance of the nozzle shall be cause for retesting. When test results are requested by the purchaser, the manufacturer or distributor shall be responsible for verifying same.

5-2 Acceptance Testing.

5-2.1 Acceptance tests, on delivery, shall be conducted at a location specified by the purchaser.

5-2.2 Three randomly selected nozzles of each size and design shall be selected from the delivery for testing.

5-2.3 Acceptance field inspection and testing shall include the following items:

(a) Section 1-3, Markings.

(b) Section 2-1, Discharge Performance.

(c) Section 2-2, Discharge Pattern.

(d) Section 2-3, Controls (field evaluation only).

(e) Section 2-4, Threads.

Chapter 6 Referenced Publications

6-1 The following documents or portions thereof are referenced within this standard and shall be considered part of the requirements of this document. The edition indicated for each reference is the current edition as of the date of the NFPA issuance of this document.

6-1.1 NFPA Publications. National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

NFPA 1963-1985, *Standard for Screw Threads and Gaskets for Fire Hose Connections.*

6-1.2 Other Publications.

6-1.2.1 ASTM Publications. American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM B 30-1980, *Specification for Copper-Brass Alloys in Ingot Form*

ASTM B 117-1973, *Salt Spray (Fog) Testing*

ASTM D 395-1978, *Standard Test Methods for Rubber Property — Compression Set*

ASTM D 412-1980, *Standard Test Methods for Rubber Properties in Tension*

ASTM D 572-1981, *Standard Test Method for Rubber — Deterioration by Heat and Oxygen*

ASTM B 584-1979, *Specification for Copper Alloy Sand Castings for General Applications.*

6-1.2.2 ANSI Publication. American National Standards Institute, 1430 Broadway, New York, NY 10018.

ANSI 969-1982, *Marking and Labeling.*

Appendix A

This Appendix is not a part of the requirements of this NFPA document, but is included for information purposes only.

A-1-1 Purchasers may specify conformance testing to this specification. Any requirements for conformance testing or certification to this specification should be identified at the time of order.

A-2-3 In order for the fire fighter to be effective in combatting fire with fire nozzles, the nozzle must be opened and shut off and adjustments made to the flow and pattern without excessive exertion. Conversely, the controls must not be so loose as to be accidently altered in normal handling.

This section is not intended to limit intentional self-operated or limiting control features such as flow limiting "dead man" controls designed to reduce or shut off water flow when force is released from control, or pattern overtravel or limiting twist controls incorporated by design for special purposes.

A-2-4 The Committee recognizes that in different countries, different types of hose threads may be used. It is felt that it is extremely important for fire ground operations involving multiple jurisdictions that a common type of thread be used. Each country should make an effort to standardize thread types. Since 1905, there has been an effort in the United States to standardize hose threads. NFPA 1963, *Standard for Screw Threads and Gaskets for Fire Hose Connections*, provides criteria for the American National Fire Hose Connection Screw Thread. The purpose of NFPA 1963 is uniformity and interchangeability of fire hose coupling threads.

A-3-7.1 Instructions for preparation of solutions and procedures for replenishing, together with descriptions for cleaning and degreasing of the samples, are covered in ASTM B 154-1973, *Mercurous-Nitrate Test for Copper and Copper Alloys.*

CAUTION: TESTING WITH MERCURY IS A HEALTH HAZARD AND IT IS RECOMMENDED THAT EQUIPMENT BE PROVIDED FOR THE REMOVAL OF MERCURY VAPOR PRODUCED IN A VOLATILIZATION. RUBBER GLOVES SHOULD BE USED DURING TESTING.

Appendix B Referenced Publications

B-1 The following documents or portions thereof are referenced within this standard for informational purposes only and thus are not considered part of the requirements of this document. The edition indicated for each reference is the current edition as of the date of the NFPA issuance of this document.

B-1.1 ASTM Publications. American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM B 154-1973, *Mercurous-Nitrate Test for Copper and Copper Alloys.*

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SUBMITTING PROPOSALS ON NFPA TECHNICAL COMMITTEE DOCUMENTS

Contact NFPA Standards Administration for final date for receipt of proposals on a specific document.

INSTRUCTIONS

Please use the forms which follow for submitting proposed amendments. Use a separate form for each proposal.

1. For each document on which you are proposing amendment indicate:
   (a) The number and title of the document
   (b) The specific section or paragraph.

2. Check the box indicating whether or not this proposal recommends new text, revised text, or to delete text.

3. In the space identified as "Proposal" include the wording you propose as new or revised text, or indicate if you wish to delete text.

4. In the space titled "Statement of Problem and Substantiation for Proposal" state the problem which will be resolved by your recommendation and give the specific reason for your proposal including copies of tests, research papers, fire experience, etc. If a statement is more than 200 words in length, the technical committee is authorized to abstract it for the Technical Committee Report.

5. Check the box indicating whether or not this proposal is original material, and if it is not, indicate source.

6. If supplementary material (photographs, diagrams, reports, etc.) is included, you may be required to submit sufficient copies for all members and alternates of the technical committee.

NOTE: The NFPA Regulations Governing Committee Projects in Paragraph 10-10 state: Each proposal shall be submitted to the Council Secretary and shall include:

(a) identification of the submitter and his affiliation (Committee, organization, company) where appropriate, and

(b) identification of the document, paragraph of the document to which the proposal is directed, and

(c) a statement of the problem and substantiation for the proposal, and

(d) proposed text of proposal, including the wording to be added, revised (and how revised), or deleted.

FORM FOR PROPOSALS ON NFPA TECHNICAL COMMITTEE DOCUMENTS

Mail to: Secretary, Standards Council
National Fire Protection Association, Batterymarch Park, Quincy, Massachusetts 02269

Date 5/18/85 Name John B. Smith Tel. No. 617-555-1212

Address 9 Seattle St., Seattle, WA 02255

Representing (Please indicate organization, company or self) Fire Marshals Assn. of North America

1. a) Document Title: Protective Signaling Systems NFPA No. & Year NFPA 72D

   b) Section/Paragraph: 2-7.1 (Exception)

2. Proposal recommends: (Check one) ☐ new text
   ☐ revised text
   ☒ deleted text.

3. Proposal (include proposed new or revised wording, or identification of wording to be deleted):

   Delete exception.

4. Statement of Problem and Substantiation for Proposal:

   A properly installed and maintained system should be free of ground faults. The occurrence of one or more ground faults should be required to cause a "trouble" signal because it indicates a condition that could contribute to future malfunction of the system. Ground fault protection has been widely available on these systems for years and its cost is negligible. Requiring it on all systems will promote better installations, maintenance and reliability.

5. ☒ This Proposal is original material.
   ☐ This Proposal is not original material; its source (if known) is as follows: _____

(Note. Original material is considered to be the submitter's own idea based on or as a result of his own experience, thought, or research and, to the best of his knowledge, is not copied from another source.)

I agree to give NFPA all and full rights, including rights of copyright, in this Proposal and I understand that I acquire no rights in any publication of NFPA in which this Proposal in this or another similar or analogous form is used.

John B. Smith
Signature

PLEASE USE SEPARATE FORM FOR EACH PROPOSAL

FORM FOR PROPOSALS ON NFPA TECHNICAL COMMITTEE DOCUMENTS

Mail to: Secretary, Standards Council
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Date _____ Name _____ Tel. No. _____

Address _____

Representing (Please indicate organization, company or self) _____

1. a) Document Title: _____ NFPA No. & Year _____

   b) Section/Paragraph: _____

2. Proposal recommends: (Check one) ☐ new text
   ☐ revised text
   ☐ deleted text.

3. Proposal (include proposed new or revised wording, or identification of wording to be deleted):

Cut Here

4. Statement of Problem and Substantiation for Proposal:

5. ☐ This Proposal is original material.
   ☐ This Proposal is not original material; its source (if known) is as follows: _____

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(Note Original material is considered to be the submitter's own idea based on or as a result of his own experience, thought, or research and, to the best of his knowledge, is not copied from another source.)

I agree to give NFPA all and full rights, including rights of copyright, in this Proposal and I understand that I acquire no rights in any publication of NFPA in which this Proposal in this or another similar or analogous form is used.

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