ANSI/NFPA 1964 An American National Standard February 12, 1993

NFPA 1964 Spray Nozzles (Shutoff and Tip) 1993 Edition

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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.

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NFPA 1964

Standard for

Spray Nozzles (Shutoff and Tip)

1993 Edition

This edition of NFPA 1964, *Standard for Spray Nozzles (Shutoff and Tip)*, was prepared by the Technical Committee on Fire Hose and acted on by the National Fire Protection Association, Inc. at its Fall Meeting held November 16-18, 1992, in Dallas, TX. It was issued by the Standards Council on January 15, 1993, with an effective date of February 12, 1993, and supersedes all previous editions.

The 1993 edition of this document has been approved by the American National Standards Institute.

Origin and Development of NFPA 1964

The Committee on Fire Hose felt there was a need for a standard that applied to portable adjustable-pattern nozzles for general fire department use and for use on hose attached to standpipes. The first edition of this standard was adopted in 1988.

In this second edition the text has been editorially reworked into a more usable format, separating the requirements for the nozzles from the test procedures. Details of the test procedures have been revised in a few areas to better reflect how the nozzles are used in the field. The requirement to pass the salt-spray test has been applied to all nozzles.

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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.

Committee Scope: This Committee shall have primary responsibility for documents on the size and design of fire hose connections, and the performance, maintenance, and selection of all types of fire hose, couplings, nozzles, and accessory equipment.

Contents

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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 Administration

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 3/4 in. (19 mm), 1 in. (25 mm), 1 1/2 in. (38 mm), and 2 1/2 in. (63 mm), or as determined by trade sizes of the coupling

(c) Nozzles for use on Class A and Class B fires

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

1-2 Purpose. The purpose of this standard is to provide minimum performance requirements for spray nozzles to assure purchasers that nozzles that comply with this standard are suitable for fire suppression use.

1-3 Definitions.

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

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

Constant Pressure (Automatic) Spray Nozzle. An adjustable-pattern nozzle in which the pressure remains constant through a range of discharge rates. The constant pressure provides the velocity for an effective stream reach at various discharge 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 effect a predetermined discharge rate. The discharge rate remains constant throughout the range of pattern selection from straight stream to wide spray.

Flush. A nozzle feature that allows the orifice to be opened so that small debris that might otherwise be trapped in the nozzle, causing pattern disruptions and discharge 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.

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 rubber, synthetic rubber, plastic, or latex-coated fabric.

Nozzle Pressure. The velocity pressure at which water is discharged from the nozzle. Pressure without discharge is known as static pressure. Pressure is measured in pounds per sq in. (psig) or kilopascals (kPag).

Rated Pressure. The pressure at which a nozzle is designed to operate to produce a specified discharge.

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 Tip. An adjustable-pattern and discharge appliance without a permanently attached shutoff butt. Where used with fire hose mounted on standpipe systems, it may or may not have a shutoff capability. A spray tip for fire department use may or may not include a twist-type shutoff.

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 a woven jacket that is usually of linen yarns and is of such quality that the yarn swells when wet, tending to seal the hose.

1-4 Units of Measurement. Metric units of measurement in this standard are in accordance with the modernized metric system known as the International System of Units (SI). The liter unit, which is not part of but is recognized by SI, is commonly used in international fire protection. In this standard, values for measurement are followed by an equivalent in SI units. The U.S. value shall be regarded as the requirement, because the SI value may be approximate.

Chapter 2 Operational Design Requirements

2-1 Discharge Performance.

2-1.1 Rated pressure for spray nozzles shall be 100 psig (690 kPag). The nozzle discharge rating shall be expressed as a rated discharge at a rated pressure [e.g., 60 gpm at 100 psig (225 L/min at 690 kPag)].

2-1.2 Basic spray nozzles shall discharge no less than the rated discharge at the rated pressure when tested in accordance with Section 4-1. The maximum discharge shall be no more than 10 percent above the rated discharge when measured at both the straight stream and full spray pattern settings.

2-1.3 Constant gallonage spray nozzles shall discharge no less than the rated discharge at the rated pressure and no more than 10 percent over the rated discharge minus 0 percent at the rated pressure when tested in accordance with Section 4-1.

2-1.4 Constant/select gallonage spray nozzles shall meet the requirements of 2-1.3 at each predetermined discharge rate.

2-1.5 Constant pressure (automatic) spray nozzles shall maintain an inlet pressure of between 85 psig and 115 psig (586 kPag and 795 kPag) throughout the rated discharge range when tested in accordance with Section 4-1.

2-2 Discharge Pattern.

2-2.1 Spray nozzles shall be capable of developing discharge patterns varying from straight stream to at least 100 degrees spray angle.

2-2.2 The straight stream pattern setting shall provide a cohesive jet capable of delivering 90 percent of the rated discharge 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.

2-3* Spray Nozzle Controls.

2-3.1 A spray nozzle designed to be used by fire department personnel shall have a water discharge control capable of functions ranging from full discharge to complete shutoff of the nozzle discharge. This control device shall be permitted to be a permanently mounted valve or a break-apart shutoff butt assembly.

2-3.2 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 linear-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.

2-3.3 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.

2-3.4 Trigger-type lever controls shall be in the "on" position when squeezed and the "off" position when released.

2-3.5 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 4-3.1.

2-3.6 For rotational-type controls, the operational force required to change the pattern setting and change the discharge, as well as to just close (sans discharge), to fully close, to just open (leak), and to fully open the valve, shall not exceed 40 lb (4.5 N) and shall not be less than 3 lb (0.33 N) when tested in accordance with 4-3.2 and 4-3.4.

2-3.7 When set at the maximum discharge settings, the nozzle shall be subjected to a pressure of 300 psig (2070 kPag) or one and one-half times the maximum rated pressure, whichever is higher. After the pressure is removed, all functions, such as pattern selection, flush, discharge adjustments, and shutoff, shall be tested at maximum rated pressure to ensure that they function properly, with not greater than a 25 percent increase in force over the maximum allowed at 100 psig (690 kPag).

2-3.8 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 4-3.3.

2-3.8.1 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) force greater than the force required to rotate the pattern control, as outlined in 2-3.6.

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

2-5 Flushing. All spray nozzles shall be designed to clear or flush the size of debris specified in Table 2-5 from the nozzle without shutting off the water to the hose. This may be accomplished either through the full open nozzle position or through a flush feature of the nozzle.

Table 2-5

Rated Discharge	Size of Steel Ball
up to 60 gpm (230 L/min)	1/8 in. (3.18 mm)
60-150 gpm (230-570 L/min)	3/16 in. (4.76 mm)
over 150 gpm (570 L/min)	1/4 in. (6.35 mm)

2-5.1 Nozzles shall be tested in accordance with Section 4-2 to verify compliance with Section 2-5.

2-5.2 Nozzles equipped with a flush feature shall 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 800 psig (5516 kPag) or 1 1/2 times the rated pressure, whichever is higher, and the shutoff shall be fully opened and closed. After the shutoff has been closed, the leakage, if any, shall be measured. The maximum leakage

allowed through the discharge orifice is 12 drops per min (1/2 ml/min). There shall be no leakage through any part of the nozzle other than the discharge orifice.

2-6.2 A nozzle with a twist shutoff shall be operated in accordance with 4-3.4. When it is returned to the fully closed position, the leakage shall not exceed that allowed in 2-6.1.

2-7 Rough Usage.

2-7.1 Spray nozzles shall be capable of continued operation after being subjected to the rough handling tests in Section 4-7.

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

2-7.3 The nozzle shall not deform beyond the point where it affects the operational use of the nozzle as defined in the requirements of this standard.

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 performance of the test in 2-7.4, samples shall again be subjected to the leakage test defined in Section 2-6. The leakage shall not increase by more than 10 percent from that determined before the test.

2-8 Handholds, Handgrips, and Ladder Hooks. Dual handholds, single handgrips, or ladder hooks provided on nozzles shall support a 300-lb (136-kg) nozzle reaction force when tested in accordance with Section 4-11. If more than one feature is provided on the same nozzle, each feature shall be tested separately. Test samples that distort or develop cracks or broken sections shall be considered as having failed to meet the test criteria.

2-9 Markings.

2-9.1 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. The following information shall be provided by either stamped or cast figures or letters or by labels meeting UL/ANSI 969, *Standard for Safety Marking and Labeling Systems*:

(a) Name of manufacturer

(b) Unique product or model designation.

2-9.2 Each spray nozzle shall be marked with the discharge at positions of straight stream and full spray. Constant gallonage and select gallonage nozzles shall be marked to indicate the discharge at each setting. Constant pressure (automatic) nozzles shall be marked with the minimum and maximum discharge as permitted in Section 2-1.

2-9.3 Nozzles equipped with a flush feature shall indicate the flush operating position with the letters FLUSH.

2-9.4 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.

Chapter 3 Construction Materials

3-1* Hydrostatic Strength. Nozzles shall be designed to withstand a hydrostatic pressure of 1000 psig (6895 kPag) or five times the maximum designed working pressure, whichever is higher. The hydrostatic strength shall be confirmed by testing in accordance with Section 4-4.

3-2 High-Temperature Exposure. The nozzle shall be capable of operation after storage in temperatures of 135°F (57°C). Test samples that develop cracks or broken sections, or that fail to meet the operational control requirements in Section 2-3 after being tested in accordance with Section 4-5, shall be considered as having failed to meet this requirement.

3-3 Low-Temperature Exposure. The dry nozzle shall be capable of operation in temperatures as low as −25°F (−32°C). Test samples that develop cracks or broken sections, or that fail to meet the operational control requirements in Section 2-3 after being tested in accordance with Section 4-6, shall be considered as having failed to meet this requirement.

3-4* Corrosion Exposure. All functions such as pattern selection, flush, discharge adjustments, and shutoff shall continue to function properly and to meet the requirements of Section 2-3 after the nozzle has been subjected to a salt spray test in accordance with Section 4-8. There shall be no evidence of galvanic corrosion between dissimilar metals. The nozzle shall then be tested for any leakage in accordance with Section 2-6.

3-5 Ultraviolet Light and Water Exposure of Nonmetallic Nozzle Components.

3-5.1 The test samples of nozzles with exposed nonmetallic parts shall be subjected to the ultraviolet light and water test as described in Section 4-9.

3-5.2 At the conclusion of the test, the nozzle shall be inspected for cracking or crazing. Cracking or crazing shall indicate failure of the test. All functions such as pattern selection, flush, discharge adjustment, and shutoff shall operate properly as described in Sections 2-3 and 2-5.

3-6 Aging Exposure of Nonmetallic Nozzle Components.

3-6.1 The test samples of nozzles with nonmetallic components other than rubber gaskets where a nozzle connects to a hose line shall be subjected to the air-oven aging tests as described in Section 4-10.

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, discharge adjustment, and shutoff shall operate as described in Section 2-3.

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 minutes, 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 Rubber Sealing Materials. A rubber material or synthetic elastomer used to form a seal shall have the following properties:

(a) Materials in the as-received condition:

1. For silicone rubber (rubber having polyorganosiloxane as its characteristic constituent):

a. Tensile strength of not less than 500 psig (3.4 MPag) and at least 100 percent ultimate elongation, or

b. Tensile strength at not less than 2200 psig (15.2 MPag) and at least 200 percent ultimate elongation determined in accordance with Section 4-12.

2. For material other than silicone rubber:

a. Tensile strength of not less than 1500 psig (10.3 MPag), and

b. At least 200 percent ultimate elongation.

3. Tensile set of not more than $^3/_{16}$ in. (4.8 mm), determined in accordance with 4-12.1.

4. Compression set of not more than 15 percent, determined in accordance with Section 4-13.

(b) After accelerated aging in accordance with Section 4-14, materials shall have not less than 80 percent of the as-received tensile strength and 50 percent of the ultimate elongation.

Chapter 4 Test Methods

4-1 Discharge Test.

4-1.1 Test Equipment.

4-1.1.1 Pressure gauges connected to a piezometer ring shall be used to measure the water pressure at the nozzle inlet.

4-1.1.2 When testing nozzles equipped with a $1^1/_2$-in. (38-mm) connection at a discharge rate of 250 gpm (568 L/min) and higher, the pressure gauge shall be mounted on a $2^1/_2$-in. (65-mm) waterway. A tapered adaptor shall be used between the $2^1/_2$-in. (65-mm) waterway and the $1^1/_2$-in. (38-mm) inlet to the nozzle. The maximum included angle of the adaptor shall be 30 degrees.

4-1.1.3 Flow meters used to establish the discharge referred to in this standard shall be calibrated volumetrically within 30 days prior to these tests to ensure their accuracy.

4-1.2 The nozzle shall be mounted such that the discharge rate through the nozzle and pressure at the inlet to the nozzle can be measured. With the shutoff fully open, the inlet pressure shall be adjusted to the rated pressure, plus or minus 2 percent.

4-1.2.1 Basic spray nozzles shall be tested and discharge measurement taken in both straight stream and wide angle spray pattern settings. Nozzle pressure shall be adjusted as specified in 4-1.2 for each of the pattern settings.

4-1.2.2 Constant gallonage nozzles shall be tested and the discharge monitored through the full range of pattern selection.

4-1.2.3 Constant/select gallonage nozzles shall be tested at each discrete discharge selection and monitored through the entire range of pattern selection. The nozzle pressure shall be adjusted as specified in 4-1.2 for each discrete discharge selected.

4-1.2.4 Constant pressure (automatic) spray nozzles shall be tested on the same equipment specified in 4-1.1. The discharge shall be increased to the minimum rated discharge. The pressure at this discharge shall be recorded. The discharge and nozzle pressure shall be monitored through the entire range of pattern selection from straight stream to wide angle spray. Any deviation greater than 2 percent in discharge or pressure shall be recorded. Slowly increase the discharge to the maximum rated discharge while monitoring the pressure. Record the minimum and maximum pressures throughout the discharge range. At the maximum rated discharge, monitor the discharge and pressure for the entire range of pattern selection.

4-2 Flush Test. 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 shall pass through the nozzle without changes in the control position. For discharges up to 60 gpm (230 L/min), a $^1/_8$-in. (3.18-mm) steel ball shall be used. For discharges 60 gpm–150 gpm (230 L/min–570 L/min), a $^3/_{16}$-in. (4.76-mm) steel ball shall be used. For discharges greater than 150 gpm (570 L/min), a $^1/_4$-in. (6.35-mm) steel ball shall be used.

4-3 Control Tests.

4-3.1 Lever-Type Controls.

4-3.1.1 The nozzle shall be mounted in the closed position with an inlet pressure of 100 psig (690 kPag). A dynamometer, which records the maximum force reading, shall be attached to the lever or handle, where it normally would be held during operation. The shutoff or pattern selection lever or handle shall be moved from the fully closed to fully open position for the full range of pattern adjustment. The maximum force shall be recorded. The inlet pressure shall be adjusted to 100 psig (690 kPag) while in the full discharge position. The dynamometer 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 recorded.

4-3.1.2 The nozzle shall be mounted without any pressure applied to it. The controlling lever shall be placed in the 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 dynamometer. The force required to move the lever shall be recorded.

4-3.2 Rotational Pattern Control.

4-3.2.1 Nozzles equipped with rotational pattern control shall be mounted on a rigid device, and the force required to rotate the pattern sleeve shall be measured while water is discharging at 100 psig (690 kPag).

4-3.2.2 A length of twine or string, not to exceed $^3/_{32}$ in. (2.9 mm) in diameter, shall be wrapped around the nozzle at the point where the nozzle normally would 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 shall overlap the starting end of the string, and the balance of the turns shall not overlap any other turn. A force gauge, which records the maximum force reading, shall 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 shall commence with the pattern sleeve in the straight stream or wide spray detent.

4-3.3 Full-Time Swivel.

4-3.3.1 Nozzles equipped with a full-time swivel shall be tested while water is discharging at 100 psig (690 kPag).

4-3.3.2 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 the point the dynamometer is attached shall be recorded for developing torque values from the force reading.

4-3.3.3 The pattern sleeve of the nozzle shall be rotated to the end of its travel in the wide spray direction. The force shall be applied tangentially with a dynamometer to determine the force required to rotate the nozzle. This force shall be recorded.

4-3.4 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 kPag) in both the closed position and the fully open position while flowing the rated discharge. 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 4-3.2.2. 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, any leakage shall be measured.

4-4 Hydrostatic Test. The nozzle shall be mounted in a closed position on a device capable of exerting a hydrostatic pressure of 1000 psig (6894 kPag) or five times the maximum rated pressure, whichever is higher. All air shall be bled out of the system. The pressure shall be increased by 50 psig (345 kPag) increments and held for 30 seconds at each pressure to the maximum pressure for which the nozzle is being tested. This maximum pressure shall be held for one minute without rupture of the nozzle. There shall be no leakage through any part of the nozzle other than the discharge orifice. Increase in leakage through the nozzle orifice shall be permitted beyond that allowed in Section 2-6.

4-5 High-Temperature Tests.

4-5.1 The nozzle shall be conditioned to 135°F (57°C) for 24 hours prior to the test.

4-5.2 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, discharge adjustment, or shutoff.

4-5.3 Within three minutes after being removed from the heating chamber, the nozzle shall be subjected to the rough usage tests in accordance with Section 4-7.

4-6 Low-Temperature Tests.

4-6.1 A dry nozzle shall be conditioned to -25°F (-32°C) for 24 hours prior to the test.

4-6.2 Immediately after being removed from the cooling chamber, the nozzle shall be tested for proper function of all adjustments and controls. There shall be no binding of any function such as pattern selection, flush, discharge adjustment, or shutoff.

4-6.3 Within three minutes after being removed from the cooling chamber, the nozzle shall be subjected to the rough usage tests identified in Section 4-7.

4-7 Rough Usage Test. (Each nozzle shall be subject to all tests.)

4-7.1 The nozzle shall be attached to a length of hose at least 10 ft (3 m) long. The hose shall not be charged. The nozzle shall be dropped from a height of 6 ft (2 m) onto a concrete surface so that it impacts directly or squarely on the discharge end.

4-7.2 The nozzle shall be attached to a length of hose at least 10 ft (3 m) long. The hose shall not be charged. The nozzle shall then be dropped twice from a height of 6 ft (2 m) onto a concrete surface such that the points of impact are on two different sides of the nozzle. 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.

4-7.3 The nozzle shall be attached to a length of hose at least 10 ft (3 m) long. With the nozzle shut off, the hose line shall be charged with water to a pressure of 100 psig (690 kPag). The nozzle shall be dropped twice from a height of 6 ft (2 m) onto a concrete surface such that the points of impact are on two different sides of the nozzle. 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.

4-8 Salt Spray Test. Test samples shall be supported vertically and exposed to salt spray (fog) for 120 hours, as specified by ASTM B117, *Standard Test Method of Salt Spray (Fog) Testing*.

4-9 Ultraviolet Light and Water Test.

4-9.1 Sample nozzles shall be exposed to ultraviolet light and water for 720 hours. They shall be inspected for cracking and crazing after 360 hours. If no cracking or crazing is apparent, the exposure shall continue for the full 720 hours.

4-9.2 Ultraviolet light shall be obtained from two stationary enclosed carbon-arc lamps. The arc of each lamp shall be formed between two vertical carbon electrodes, 1/2 in. (12.7 mm) in diameter, located at the center of a revolvable vertical meter cylinder 31 in. (787 mm) in diameter and 17 3/4 in. (451 mm) in height. Each arc shall be enclosed with a number PX clear Pyrex™ glass globe. The samples shall be mounted vertically on the inside of the revolvable cylinder, arcing the lamps, and the cylinder shall revolve continuously around the stationary lamps at one revolution per minute. A system of nozzles shall be provided so that each sample in turn is sprayed with water as the cylinder revolves. During each operating cycle, each sample shall be exposed to the light and water spray for three minutes and to only light for 17 minutes (total 20 minutes). The air temperature within the revolving cylinder of the apparatus during operations shall be 63°C ± 5° (145°F ± 9°).

4-10 Air-Oven Aging Tests.

4-10.1 Aging tests shall be performed prior to the rough usage, leakage, and hydrostatic pressure tests.

4-10.2 Samples of the nozzles shall be subjected to air-oven aging for 180 days at 70°F (158°C) and then allowed to cool at least 24 hours in air at 23°F (74°C) at 50 percent relative humidity.

4-11 Handholds, Handgrips, and Ladder Hooks.

4-11.1 The sample nozzle shall be mounted in a fixture to simulate intended use. A force of 300 lb (136 kg) shall be applied to the nozzle for 5 minutes to simulate the nozzle reaction force.

4-11.2 The sample nozzle shall then be subjected to the rough usage test as described in 4-7.2 and 4-7.3, except that the point of impact shall be on the handhold, handgrip, or ladder hook.

4-12 Tensile Strength, Ultimate Elongation, and Tensile Set Tests.

4-12.1 Tensile strength, ultimate elongation, and tensile set shall be determined in accordance with ASTM D412, *Standard Test Methods for Rubber Properties in Tension*, Method A, except that, for tensile set determinations, the elongation shall be maintained for only three minutes, and the tensile set shall be measured three minutes after release of the specimen. The elongation of a specimen for a tensile set determination shall be such that the 1-in. (25-mm) spacing of the bench marks increases to 3 in. (76 mm).

4-12.2 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 shall be tested, and those results shall be considered final. Results of tests for specimens that break in the curved portion just outside the bench marks shall be permitted to be accepted if the measured strength and elongation values are within the minimum requirements.

4-13 Compression Set Test. Type I specimens of the material shall be prepared and the test conducted in accordance with ASTM D395, *Standard Test Methods for Rubber Property - Compression Set*, Method B. The specimens shall be exposed for 22 hours at 70°F ± 2° (21°C ± 1°).

4-14 Accelerated Aging Test. Specimens shall be prepared in the same manner as for tensile strength and ultimate elongation tests, except that bench marks spaced 1 in. (25 mm) apart shall be stamped on the specimens after the test exposure. Specimens shall be tested at 212°F (100°C) for 70 hours in accordance with ASTM D573, *Standard Test Method for Rubber Deterioration in an Air Oven*.

Chapter 5 Compliance Testing

5-1* Certification. Ratings of nozzle designs shall be certified by a testing laboratory, or by the manufacturer if suitable test facilities are available.

5-2 Sample Selection. To comply with this standard, three randomly selected nozzles of the same design, type, and model shall pass all the requirements of this standard. The manufacturer shall be permitted to certify the nozzle if its design, type, and model meet these tests.

Any nozzle or nozzle components that have been subjected to the destructive tests to prove compliance with the requirements of this standard shall be considered unsuitable for in-service use.

5-3 Test Equipment. All gauges used for testing pressures required by this standard shall have been be calibrated within the previous 30 days with test equipment traceable to the National Institute of Science and Technology.

5-4 Test Results. The test results shall be kept on file by the manufacturer. Copies shall be provided when requested by the purchaser.

5-5 Design Changes. Any changes to the design of the nozzle or in the materials of construction shall be cause for retesting.

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 Publication. National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

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

6-1.2 Other Publications.

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

ASTM B117-1990, *Standard Test Method of Salt Spray (Fog) Testing*

ASTM D395-1989, *Standard Test Methods for Rubber Property - Compression Set*

ASTM D412-1987, *Standard Test Methods for Rubber Properties in Tension*

ASTM D573-1988, *Standard Test Method for Rubber Deterioration in an Air Oven*

6-1.2.2 UL Publication. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062.

UL 969-1989, *Standard for Safety Marking and Labeling Systems*

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

While nozzles meeting the requirements of this standard are designed to be used in fire suppression, including hose lines on standpipe systems, the nozzle cannot be expected to provide satisfactory performance if adequate water pressure and volume are not available. Pressures available in standpipe systems are often controlled by pressure-reducing devices. Fire departments planning to use spray nozzles with standpipe systems should ensure the standpipe system can supply the necessary pressure and volume.

A-2-3 In order for the fire fighter to be effective in combating fire with fire nozzles, the nozzle must be opened and shut off and adjustments made to the discharge and pattern without excessive exertion. Conversely, the controls should 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 discharge-limiting "dead man" controls designed to reduce or shut off the water discharge when force is released from the control or to limit pattern over-travel 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 believed to be extremely important for fire ground operations involving multiple jurisdictions to use a common type of thread. 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 Connection Screw Thread. The goal of NFPA 1963 is uniformity and interchangeability of fire hose coupling threads.

A-3-1 The nozzle and the hose with which it is used should be carefully matched. The pressure rating on the nozzle should be at least five times the service test pressure of the corresponding hose so the hose will fail before the nozzle does.

A-3-4 The purpose of the salt spray test is to ensure nozzles will perform under the normal exposure to mild corrosive conditions such as those found in the atmosphere near oceans or caused by chemicals used to treat road surfaces in icy conditions. When the nozzle is expected to be exposed to corrosive conditions on a long- term basis, or to be used where strong corrosives are present, the purchaser should ensure the nozzle is designed for such exposure.

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 B154, *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.

A-5-1 When acceptance tests are desired on delivery, they should include the following items:

(a) Nozzle discharge performance as defined in Section 2-1

(b) Discharge patterns as defined in Section 2-2

(c) Field evaluation of the controls only (*Section 2-3*)

(d) Confirmation of the threads (*Section 2-4*)

(e) Confirmation of markings as defined in Section 2-9.

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 Publication. American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM B154-1992, *Standard Test Method for 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.

Note: All proposals must be received by 5:00 p.m. E.S.T./E.D.S.T. on the published proposal closing date.

INSTRUCTIONS

Use a separate proposal form for submitting each proposed amendment.

1. Type or print legibly in black ink.

2. Indicate the number, edition year, and title of the document. Also indicate the specific section or paragraph that the proposed amendment applies to.

3. Check the appropriate box to indicate whether this proposal recommends adding new text, revising existing text, or deleting text.

4. In the space identified as "Proposal" indicate the exact wording you propose as new or revised text, or the text you propose be deleted.

5. 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. Include copies of test results, research papers, fire experience, or other materials that substantiate your recommendation.

6. Check the appropriate box to indicate whether or not this proposal is original material, and if it is not, indicate the source of the material.

7. Sign the proposal.

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. The technical committee is authorized to abstract the "Statement of Problem and Substantiation for Proposal" if it exceeds 200 words for publication in the Technical Committee Reports.

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, 1 Batterymarch Park, Quincy, Massachusetts 02269-9101
Fax No.: 617-770-3500

Note: All proposals must be received by 5:00 p.m. E.S.T./E.D.S.T. on the published proposal closing date.

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)

FOR OFFICE USE ONLY
Log #: _____
Date Rec'd: _____
Proposal #: _____

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 hereby grant NFPA the non-exclusive, royalty-free rights, including non-exclusive, royalty-free rights in 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 (Required)

PLEASE USE SEPARATE FORM FOR EACH PROPOSAL