

Standard for Safety

UL 1626

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Residential Sprinklers for Fire-Protection Service



Underwriters Laboratories Inc.®

Standard



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September 30, 1994

Standard for

Residential Sprinklers for Fire-Protection Service

UL 1626, Second Edition

Accompanying this transmittal notice is a copy of the Second edition of UL 1626.

THIS EDITION OF THE STANDARD IS NOW IN EFFECT.

Revised and/or additional pages may be issued from time to time.

SEPTEMBER 30, 1994

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UL 1626

Standard for

Residential Sprinklers for Fire-Protection Service

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Second Edition

September 30, 1994

An effective date included as a note immediately following certain requirements is one established by Underwriters Laboratories Inc.

Revisions of this standard will be made by issuing revised or additional pages bearing their date of issue. A UL Standard is current only if it incorporates the most recently adopted revisions, all of which are itemized on the transmittal notice that accompanies the latest published set of revision pages.

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FOREWORD

A. This Standard contains basic requirements for products covered by Underwriters Laboratories Inc. (UL) under its Follow-Up Service for this category within the limitations given below and in the Scope section of this Standard. These requirements are based upon sound engineering principles, research, records of tests and field experience, and an appreciation of the problems of manufacture, installation, and use derived from consultation with and information obtained from manufacturers, users, inspection authorities, and others having specialized experience. They are subject to revision as further experience and investigation may show is necessary or desirable.

B. The observance of the requirements of this Standard by a manufacturer is one of the conditions of the continued coverage of the manufacturer's product.

C. A product which complies with the text of this Standard will not necessarily be judged to comply with the Standard if, when examined and tested, it is found to have other features which impair the level of safety contemplated by these requirements.

D. A product employing materials or having forms of construction differing from those detailed in the requirements of this Standard may be examined and tested according to the intent of the requirements and, if found to be substantially equivalent, may be judged to comply with the Standard.

E. UL, in performing its functions in accordance with its objectives, does not assume or undertake to discharge any responsibility of the manufacturer or any other party. The opinions and findings of UL represent its professional judgment given with due consideration to the necessary limitations of practical operation and state of the art at the time the Standard is processed. UL shall not be responsible to anyone for the use of or reliance upon this Standard by anyone. UL shall not incur any obligation or liability for damages, including consequential damages, arising out of or in connection with the use, interpretation of, or reliance upon this Standard.

F. Many tests required by the Standards of UL are inherently hazardous and adequate safeguards for personnel and property shall be employed in conducting such tests.

INTRODUCTION

1 Scope

1.1 These requirements cover residential sprinklers intended for installation on sprinkler systems for fire-protection service. Requirements for the installation and use of residential sprinklers are included in the Standards for the Installation of Sprinkler Systems, NFPA 13, and Installation of Sprinkler Systems in One- and Two-Family Dwellings and Mobile Homes, NFPA 13D.

1.2 A product that contains features, characteristics, components, materials, or systems new or different from those covered by the requirements in this standard, and that involves a risk of fire, electric shock, or injury to persons shall be evaluated using the appropriate additional component and end-product requirements as determined necessary to maintain the acceptable level of safety as originally anticipated by the intent of this standard. A product whose features, characteristics, components, materials, or systems conflict with specific requirements or provisions of this standard cannot be judged to comply with this standard. Where considered appropriate, revision of requirements shall be proposed and adopted in conformance with the methods employed for development, revision, and implementation of this standard.

2 General

2.1 Components

2.1.1 Except as indicated in 2.1.2, a component of a product covered by this standard shall comply with the requirements for that component.

2.1.2 A component need not comply with a specific requirement that:

- a) Involves a feature or characteristic not needed in the application of the component in the product covered by this standard, or
- b) Is superseded by a requirement in this standard.

2.1.3 A component shall be used in accordance with its recognized rating established for the intended conditions of use.

2.1.4 Specific components are recognized as being incomplete in construction features or restricted in performance capabilities. Such components are intended for use only under limited conditions, such as certain temperatures not exceeding specified limits, and shall be used only under those specific conditions for which they have been recognized.

2.2 Units of measurement

2.2.1 If a value for measurement is followed by a value in other units in parentheses, the second value may be only approximate. The first stated value is the requirement.

2.3 Undated references

2.3.1 Any undated reference to a code or standard appearing in the requirements of this standard shall be interpreted as referring to the latest edition of that code or standard.

3 Glossary

3.1 General

3.1.1 For the purpose of this standard the following definitions apply.

3.1.2 DISCHARGE COEFFICIENT "K" – Coefficient of discharge in the formula,

$$Q = K\sqrt{p}$$

where:

Q is the flow in gallons per minute (L/s x 15.85), and p is the pressure in psig (MPa x 145).

3.1.3 HEAT RESPONSIVE ELEMENT – That portion of a sprinkler that breaks, melts, or otherwise functions to initiate the automatic operation of the sprinkler when exposed to sufficient heat.

3.1.4 OPERATING TEMPERATURE – The temperature at which the heat responsive element of a sprinkler operates when subjected to a 1°F (0.5°C) per minute temperature rise while immersed in a liquid bath.

3.1.5 ORIFICE – The opening that controls the amount of water discharged from a sprinkler at a given pressure.

3.1.6 RESIDENTIAL SPRINKLER – A sprinkler intended to be installed in residential occupancies and that opens automatically by operation of a heat-responsive releasing mechanism that maintains the discharge orifice closed. Upon operating at a specified temperature, a discharge of water is distributed in a specific pattern and quantity over a designated area.

3.2 Residential sprinkler types

3.2.1 FLUSH CEILING SPRINKLER – A sprinkler having only a minimum of parts that project below the ceiling.

3.2.2 COATED, PAINTED, OR PLATED SPRINKLER – A sprinkler that has factory applied coatings, paint, or platings for decorative purposes.

3.2.3 CONCEALED CEILING SPRINKLER – A recessed sprinkler assembly having a cover plate installed approximately flush with the ceiling material for aesthetic purposes.

3.2.4 PENDENT SPRINKLER – A sprinkler intended to be installed so that its deflector is located below the orifice and the water flows downward through the orifice.

3.2.5 RECESSED SPRINKLER – A sprinkler assembly in which all or part of the sprinkler body or frame, other than the shank thread, is mounted within a housing that is recessed within a wall or ceiling.

3.2.6 SIDEWALL SPRINKLER – A sprinkler intended for installation on or near the wall and near the ceiling, and intended to discharge water onto the walls and outward in a quarter-spherical pattern.

3.2.7 UPRIGHT SPRINKLER – A sprinkler intended to be installed so that its deflector is located above the orifice and the water flows upward through the orifice.

4 Design Parameters and Installation Instructions

4.1 Each package of residential sprinklers shall be provided with design parameter and installation instructions that shall include the following:

- a) Coverage area dimensions,
- b) Minimum water discharge rate (see 4.2),
- c) "K" factor,
- d) Minimum distance between sprinklers when the minimum distance exceeds 8 feet (2.4 m),
- e) Installation position, and
- f) Distance of sprinkler deflector from ceiling and/or wall.

4.2 The minimum specified water discharge rates in 4.1(b) for single sprinkler operation and multiple sprinkler operation shall be indicated such that the water discharge rate for the second sprinkler is between 0.7 and 1.0 of the minimum water discharge rate for single sprinkler operation.

CONSTRUCTION

5 General

5.1 A residential sprinkler shall be constructed to effect closure of its water seat for extended periods of time without leakage and to open as intended and release all parts at pressures of 5 – 175 psig (0.034 – 1.21 MPa).

5.2 A sprinkler shall be chemically or mechanically staked to maintain the manufacturer's assembly load. The assembly load shall be incapable of being changed by the use of common hand tools without causing visible damage to the sprinkler.

5.3 The diameter of a discharge orifice or any internal passage of a sprinkler shall be at least 0.21 inch (5.3 mm).

5.4 Stampings shall show no cracking or splitting and shall be uniformly smooth and clean cut.

5.5 The operation and distribution characteristics of a sprinkler shall not be impaired by the application of any factory applied coating or plating when the sprinkler is tested in accordance with these requirements.

6 Inlet Threads

6.1 Inlet pipe threads, if provided, shall comply with the Standard for Pipe Threads, General Purpose (Inch), ANSI/ASME B1.20.1–1983(R1992).

Exception: Sprinklers intended for use in installations where sprinkler fittings incorporate pipe threads other than NPT-type may be provided with threads complying with a national pipe thread standard compatible with those fittings.

6.2 Threads shall be clean cut and true and free from burrs, scoring, chatter marks, or the like.

7 Temperature Ratings

7.1 The temperature rating of a residential sprinkler shall be as specified in Table 7.1. The frame arms or glass bulb heat responsive element shall be colored according to the color code specified in Table 7.1.

Table 7.1
Temperature classification ratings
and color coding

Temperature classification	Temperature rating		Color code		Maximum ceiling temperature	
	Degrees F	(Degrees C)	Frame arms	Glass bulb	Degrees F	(Degrees C)
Ordinary	135–170	(57–77)	Uncolored or black	Orange or red	100	(38)
Intermediate	175–225	(79–107)	White	Yellow or green	150	(66)

8 Nominal Orifice Sizes

8.1 The dimensional tolerance for a specific nominal orifice size shall provide single "K" factor values that are within ± 5 percent of the average "K" factor determined at a specific pressure.

Exception: A small orifice sprinkler may have single "K" factor values that are not within ± 5 percent of the average "K" factor if the single "K" factor value is within ± 0.2 units of the average "K" factor value.

8.2 The diameter of a discharge orifice or any internal passage of a sprinkler shall be at least 0.21 inch (5.3 mm).

8.3 When the nominal orifice size is to be marked on the sprinkler in accordance with 40.1(c), the "K" factor value shall be as specified in Table 8.1.

Table 8.1
Orifice sizes

Nominal orifice size, inch	Discharge coefficient "K"
1/4	1.3–1.5
5/16	1.8–2.0
3/8	2.6–2.9
7/16	4.0–4.4
1/2	5.3–5.8
17/32	7.4–8.2

PERFORMANCE

9 General

9.1 To determine compliance with these requirements, the various types of a sprinkler shall be subjected to the performance tests described in Sections 11 – 37.

9.2 When a recessed or concealed sprinkler is tested with an escutcheon during the performance tests, the sprinkler is to be recessed to the maximum depth allowed by the sprinkler/escutcheon combination.

10 Samples

10.1 The number of samples required for investigation may vary for different sprinkler types. The number of samples required for examination and test are to be determined following a review of detailed drawings, examination of a preliminary sample, or both.

11 Load on Heat Responsive Element Test

11.1 The average and maximum design loads exerted on the heat responsive element, and the overall load tolerance based on the design load for the assembly, are to be determined. If the application of a 175 psig (1.21 MPa) pressure to the inlet end of the sprinkler increases the assembly load by more than 10 percent, the additional load is to be added to the measured load on the heat responsive element. The information developed is to be used for Strength of Heat Responsive Element Test, Section 12.

11.2 At least 25 sprinklers are to be tested to determine the average load. An arrangement for measuring the load on the heat responsive element is to be developed for each specific design.

12 Strength of Heat Responsive Element Test

12.1 Fusible-alloy types

12.1.1 A fusible-alloy heat responsive element of a residential sprinkler shall either:

- a) Sustain a load of 15 times its maximum design load for 100 hours, or
- b) Demonstrate the ability to sustain the maximum design load when tested in accordance with 12.1.2 and 12.1.3.

12.1.2 Compliance with 12.1.1(b) is to be determined by subjecting sample heat-responsive elements to loads in excess of the maximum design load. A minimum of ten samples are to be loaded at various values as required up to 15 times the design load. At least one heat responsive element shall sustain a load for a time greater than 1000 hours. These load and time values shall then be used to derive a least-square, full logarithmic regression curve of load as a function of time, from which the loads at 1 hour and 1000 hours are to be determined. The design load shall comply with the following:

$$L_d \leq 1.02L_m^2 / L_o$$

in which:

L_d is the maximum design load,

L_m is the load at 1000 hours, and

L_o is the load at 1 hour.

12.1.3 The load tests are to be conducted at an ambient temperature of $70 \pm 5^{\circ}\text{F}$ ($21 \pm 3^{\circ}\text{C}$).

12.2 Frangible-bulb types

12.2.1 The lower tolerance limit for bulb strength, based on calculations with a degree of confidence of 0.99 for 99 percent of samples, shall exceed two times the upper tolerance limit for sprinkler assembly load based on calculations with the same degree of precision as for bulb strength. Calculations are to be based on the Normal or Gaussian Distribution except where another distribution can be shown to be more applicable due to manufacturing or design factors. The bulb strength is to be measured by applying a steadily increasing load, utilizing a compression testing machine, until the bulb breaks. This test is to be conducted with the bulb mounted in the seating parts used in the sprinkler and at a rate of loading not exceeding 55 pounds-force load per second (25 kg/s), or at a rate of loading that deflects the bulb 0.02 inch (0.51 mm) per minute, whichever measurement is convenient for the test apparatus being used. Bulb seatings may be reinforced circumferentially so as not to interfere with the bulb breakage. A minimum of 15 samples of each temperature rating and each bulb type are to be tested. See Appendix A.

12.2.2 A sprinkler having a frangible bulb shall withstand the thermal shock of rapid temperature changes below its operating temperature. At least five samples of the sprinkler are to be conditioned for 5 minutes in a liquid bath at 20°F (11°C) less than their rated operating temperature. The samples then are to be removed and immediately submerged in another liquid bath at 50°F (10°C). There shall be no breakage or fracture of the glass bulb.

13 Leakage Test

13.1 A residential sprinkler shall not exhibit any leakage at any pressure from 0 – 500 psig (0 – 3.45 MPa) when tested as described in 13.2 and 13.3.

13.2 At least 20 samples are to be individually tested. The samples are to be filled with water and vented of air.

13.3 The pressure is to be increased from 0 to 500 psig (0 to 3.45 MPa) at a rate not exceeding 300 psig (2.07 MPa) per minute and held for 1 minute. There shall be no visible leakage in any sample.

14 Hydrostatic Strength Test

14.1 A residential sprinkler shall withstand, for 1 minute, without rupture, an internal hydrostatic pressure of 700 psig (4.8 MPa).

14.2 The samples from the Leakage Test, Section 13, are to be used for this test.

14.3 The pressure is to be increased from 0 to 700 psig (0 to 4.8 MPa) at a rate not exceeding 300 psig (2.07 MPa) per minute. The pressure is to be maintained at 700 psig and held for 1 minute. The sample shall not rupture, operate, or release any of its operating parts during the pressure increase nor while being maintained at 700 psig for 1 minute.