UL 10D

STANDARD FOR SAFETY

Fire Tests of Fire-Protective Curtain Assemblies

UL Standard for Safety for Fire Tests of Fire-Protective Curtain Assemblies, UL 10D

Second Edition, Dated September 29, 2017

Summary of Topics

This New Edition for the Standard for Safety for Fire Tests of Fire-Protective Curtain Assemblies, UL 10D, has been issued to merge horizontal and vertical requirements.

The requirements are substantially in accordance with Proposal(s) on this subject dated March 10, 2017 and August 4, 2017.

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Standard for Fire Tests of Fire-Protective Curtain Assemblies

First Edition – January, 2014

Second Edition

September 29, 2017

This ANSI/UL Standard for Safety consists of the First Edition.

The most recent designation of ANSI/UL 10D as an American National Standard (ANSI) occurred on September 29, 2017. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, and Title Page.

Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Proposals should be submitted via a Proposal Request in UL's On-Line Collaborative Standards Development System (CSDS) at https://csds.ul.com.

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INTRODUCTION

1 Scope

1.1 These requirements cover the evaluation of fire-protective curtain assemblies intended to provide supplemental, passive fire protection as part of an engineered fire protection system. Fire-protective curtain assemblies are horizontally or vertically oriented. Horizontally or vertically oriented fire-protective curtain assemblies provide nonstructural separation only, and are not intended to be substituted for structural hourly rated partitions or opening protectives that have been tested for fire endurance and hose stream performance.

Note: Fire-protective curtains do not include proscenium type (theater) curtains. This document does not apply to proscenium type curtains in assembly occupancies for legitimate stages.

1.2 Tests made in conformity with these test methods are intended to register performance during the test exposure. Such tests shall not be construed as determining suitability for use after exposure to fire.

1.3 It is the intent that tests made in conformity with these test methods allow for the development of data to enable regulatory bodies to determine the suitability of horizontally or vertically oriented fire-protective curtain assemblies for use in locations where fire protection of a specified duration is required.

1.4 These methods are intended to evaluate the ability of fire-protective curtain assemblies to remain in a horizontal or vertical opening during a predetermined test exposure.

1.5 The tests expose a specimen to a standard controlled fire exposure to achieve specified temperatures throughout a specified time period. The exposure, however, is not representative of all fire conditions, which vary with changes in ventilation, compartment size, and configuration. It does provide a relative measure of fire performance of horizontally or vertically oriented fire-protective curtain assemblies under these specified fire exposure conditions.

1.6 Any variation from the construction or conditions that are tested is capable of substantially changing the performance characteristics of the horizontally or vertically oriented fire-protective curtain assembly.

1.7 The test methods do not provide the following:

a) Full information as to performance of all horizontally oriented fire-protective curtain assemblies in walls or floors constructed of materials other than those tested.

b) Full information as to performance of all vertically oriented fire-protective curtain assemblies in walls constructed of materials other than those tested.

c) Evaluation of the degree by which the horizontally or vertically oriented fire-protective curtain assembly contributes to the risk of fire by generation of smoke, toxic gases, or other products of combustion.

d) A temperature limit on the unexposed side of the horizontally or vertically oriented fire-protective curtain assembly.

e) Measurement of the degree of control or limitation of the passage of smoke or products of combustion through the fire-protective curtain assembly.

Note: See limitations for the passage of smoke detailed in the Standard for Smoke Door Assemblies and Other Opening Protectives, NFPA 105.

2 General

2.1 Units of Measurement

2.1.1 When a value for measurement is followed by a value in other units in parentheses, the second value is approximate and for information purposes only.

2.2 Undated References

2.2.1 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 For the purpose of this Standard the following definitions apply:

3.2 HORIZONTALLY ORIENTED FIRE-PROTECTIVE CURTAIN – The fabric component used to span the opening of the horizontal fire-protective curtain assembly.

3.3 HORIZONTALLY ORIENTED FIRE-PROTECTIVE CURTAIN ASSEMBLY – A system inclusive of the fire-protective curtain and associated components. The system includes, but is not limited to, the fire-protective curtain, storage and deployment unit and the framing and anchoring system.

3.4 SUBASSEMBLY – The ceiling, wall, or partition construction on to which the horizontally or vertically oriented fire-protective curtain assembly is installed.

3.5 TEST ASSEMBLY – The fire-protective curtain, its components and any structure used to support the fire-protective curtain assembly during the fire endurance test. Horizontally oriented test assembly components include curtain material, rails, head boxes, foot boxes, and motor operators as stipulated by the manufacturer. Anchors, when used, are to be suitable for the construction to which it is attached.

3.6 VERTICALLY ORIENTED FIRE-PROTECTIVE CURTAIN – The fabric component used to span the opening of the vertically oriented fire-protective curtain assembly.

3.7 VERTICALLY ORIENTED FIRE-PROTECTIVE CURTAIN ASSEMBLY – A system inclusive of the fire-protective curtain and associated components. The system includes, but is not limited to, the fire-protective curtain, storage and deployment unit and the framing and anchoring system.

4 Components

4.1 Except as indicated in Section 4.2, a component of a product covered by this Standard shall comply with the requirements for that component.

4.2 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.

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

4.4 For performance limited components, incomplete in construction features or restricted in performance capabilities, such components are intended for use only under such limited conditions.

For example, components with specified temperature limits shall be used only under those specific conditions.

5 Special Features

5.1 A releasing device that is used to initiate closure of the horizontally or vertically oriented fire-protective curtain shall comply with the Standard for Heat Responsive Links for Fire-Protection Service, UL 33, or shall meet the applicable requirements of the Standard for Control Units and Accessories for Fire Alarm Systems, UL 864.

5.2 Horizontally or vertically oriented fire-protective curtain assemblies that utilize a motor operator to facilitate motorized operation of the fire-protective curtain shall meet the applicable requirements of the Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems, UL 325, or where applicable, the Standard for Control Units and Accessories for Fire Alarm Systems, UL 864.

5.3 When the operator is used to govern the closing speed of the horizontally or vertically oriented fire-protective curtain, the operator shall be installed prior to the conduct of the operation tests described in the Operational Tests, Section 13.

5.4 Samples of the fire-protective curtain assembly tested shall be subjected to physical property tests or chemical analysis, or both, for follow-up service purposes. Fabric type curtains shall be exposed to a minimum of tensile strength and infrared tests. Rigid type curtains shall be exposed to a minimum of hardness and infrared tests.

CONTROL OF FIRE TESTS

6 Furnace Construction

6.1 Furnace size

6.1.1 The furnace shall accommodate the full-sized sample. Small-scale size furnaces are capable of being used for testing small but full-sized samples or representative features of full-sized samples. The furnace face shall be greater in area than the exposed face of the sample by at least 20 percent. The additional area between the sample and the furnace shall be filled by the subassembly comprised of ceiling, wall, or partition construction.

6.1.2 The furnace shall have a chamber depth, i.e. the distance between the exposed face of the specimen and the face of the furnace lining immediately opposite the specimen, of not less than 23 inch (584 mm) and not more than 51 inch (1296 mm).

6.1.3 Curtains shall operate clear of any furnace components for vertically oriented fire curtain assemblies.

6.1.4 The furnace shall have a chamber depth, i.e. the distance between the exposed face of the specimen and the face of the furnace lining immediately opposite the specimen, of not less than 23 inch (584 mm). The specimen shall operate clear of any furnace components for horizontally oriented fire curtain assemblies.

6.2 Furnace construction materials

6.2.1 The furnace shall be constructed of materials which have a greater resistance to heat flow through the other five sides than through the test sample.

6.3 Furnace burners

6.3.1 The furnace shall be heated with burners that are fired using either natural gas or liquefied petroleum gases.

6.3.2 The heat output of the burners shall be controllable and shall expose the specimen to a uniform heating as specified in Section 7.1.1.

6.3.3 The burners shall function so that the fuel gas is introduced into the furnace where the gas mixes with air present in the furnace and then burns; or, as an alternate, the fuel gas is mixed with air prior to its ignition in the furnace.

7 Time-Temperature Curve

7.1 General

7.1.1 The fire exposure of the horizontally or vertically oriented fire-protective curtain assembly shall be controlled to conform to the applicable portion of the standard time-temperature curve shown in Appendix A. The points on the curve that determine its character are:

1000°F (538°C) at 5min

1300°F (704°C) at 10min

1462°F (795°C) at 20min

1550°F (843°C) at 30min

1638°F (892°C) at 45min

1700°F (927°C) at 1h

1792°F (978°C) at 1-1/2h

1850°F (1010°C) at 2h

7.2 Uniformity of temperature distribution

7.2.1 At any time after the first 10min of fire exposure, the temperature rise indicated by any of the thermocouples used to determine the furnace temperature shall not differ from each other by more than 270°F (150°C). With test constructions where either the test sample or any associated construction incorporates combustible materials that produce flaming within the furnace or where excess air drawn into the furnace is identified as causing localized heating or cooling of one or more of the furnace thermocouple hot junctions, the deviation of temperature rise from each other recorded by the thermocouples so affected shall not exceed 450°F (250°C).

8 Furnace Temperatures

8.1 The temperatures of the test exposure shall be deemed by a minimum of three thermocouples and no fewer than nine thermocouples per 100 square feet of test assembly symmetrically disposed within the furnace and distributed to show the temperature near all parts of the test assembly. The thermocouples shall be protected by a sealed porcelain tube having a 3/4 inch (19.1 mm) outside diameter and 1/8 inch (3.2 mm) wall thickness or, as an alternate, in the case of base-metal thermocouples, protected by a 1/2 inch (12.7 mm) wrought-steel or wrought-iron pipe of standard weight.

8.2 The junction of the thermocouples shall be initially located 6 inch (152 mm) from the exposed face of the test assembly or from the subassembly in which the test assembly is installed. During the fire exposure, if the movement of the test sample causes the sample's distance to the thermocouple junction to vary, the location of the junction shall be reset to 6 inch (152 mm) at intervals not exceeding 10min during the first 30min of the test. Thereafter, the intervals are to be increased to not more than 30min.

8.2.1 Thermocouples shall not touch the test assembly as a result of deflection of the test assembly.

8.3 The temperatures shall be read at intervals not exceeding 1min.

8.4 The accuracy of the furnace control shall be such that the area under the time-temperature curve, obtained by averaging the results from the thermocouple readings, is within 10 percent of the corresponding area under the standard time-temperature curve for fire tests of 1h or less duration, within 7.5 percent for those over 1 hour and not more than 2 hours, and within 5 percent for tests exceeding 2h in duration.

8.5 For a summary of the accuracies for the various rating periods, see Appendix A.

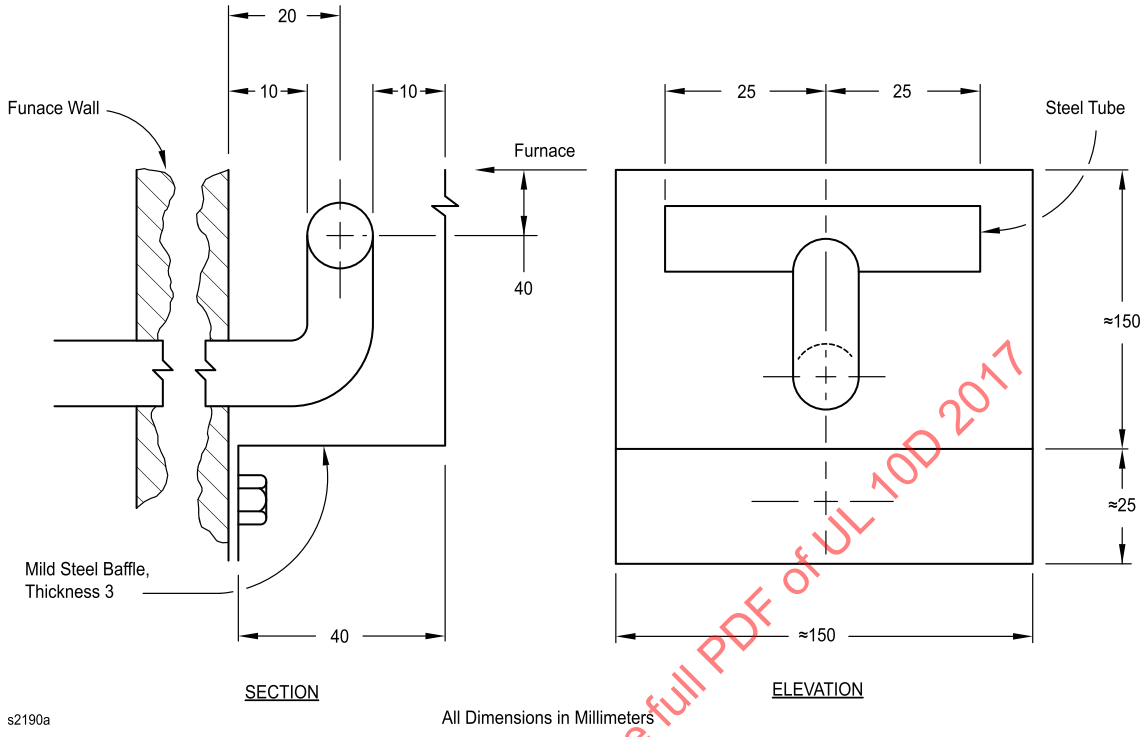
9 Furnace Pressure

9.1 For horizontally oriented fire-protective curtain assemblies the pressure in the furnace, relative to atmosphere, is to be measured by a probe not more than 12 inch below the horizontal oriented fire-protective curtain assembly to allow for deflection of the curtain assembly. The probes are to be positioned vertically in the furnace.

9.2 For vertically oriented fire-protective curtain assemblies the pressure in the furnace, relative to atmosphere, is to be measured by a probe at the top of the fire-protective curtain assembly and a probe at a location 40 in (1 m) above the sill. The probes are to be positioned horizontally in the furnace without a change in vertical elevation of the probes or tubing within the furnace.

9.3 Each pressure probe is to be either as described in Figure 9.1 or constructed from 1/2 inch (12.7 mm) diameter stainless steel tube with a welded, closed end, and incorporating nine radial, 1/16 inch (1.6 mm) diameter holes spaced equidistance around the tube's perimeter. Each probe is to be located so that the center line of the sensing holes are positioned 6 ±1 inch (152 ±2.5 mm) from the surface of the exposed face of the test assembly and a minimum of 18 inch (457 mm) from the edges of the furnace. Data recording is to provide monitoring of the output of an electric pressure transducer in the range of ±0.25 inch H_2O (66 Pa) with an accuracy of ±1 percent. The pressure transducers are to be located within 3 ft (914 mm) vertically, and 10 ft (3048 mm) horizontally from the static probes outside the furnace.

Figure 9.1
Pressure measurement probe



9.4 Data recording is to provide monitoring of the output of an electric pressure transducer in the range of ±0.25 inch H_2O (66 Pa) with an accuracy of ±1 percent. The pressure transducers are to be located within 3 ft (914 mm) vertically, and 10 ft (3048 mm) horizontally from the static probes outside the furnace.

9.5 Pressures are to be read at intervals not exceeding 1min.

TEST ASSEMBLIES

10 Construction and Size

10.1 The design, construction, materials and size of the test assembly, consisting of the horizontally or vertically oriented fire-protective curtain, assembly and subassembly, shall be representative of that for which the rating is desired. A minimum test assembly size of 10 X 10 ft (3048 X 3048 mm) shall be used in testing unless a smaller sized opening protective approval is desired.

10.2 For horizontally oriented fire-protective curtain assemblies a floor/ceiling structure shall be provided as part of the opening to be protected, except where such floor/ceiling interferes with the operation of the curtain. The floor/ceiling segment shall be of noncombustible material and shall be sized to accommodate the horizontally oriented fire-protective curtain assembly during the fire endurance test.

10.2.1 Materials required to be noncombustible shall be tested in accordance with the Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C, ASTM E 136. Composite materials having a structural base of noncombustible material as determined by the Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C, ASTM E 136 and consistent with the International Building Code requirements in Section 703.5.2 shall be acceptable as noncombustible material.

10.3 For vertically oriented fire-protective curtain assemblies a floor structure shall be provided as part of the opening to be protected, except where such floor interferes with the operation of the curtain. The floor segment shall be of noncombustible material and shall be sized to accommodate the fire-protective curtain assembly during the fire endurance test.

11 Mounting for Test Purposes

11.1 Horizontally Oriented Fire-Protective Curtain Assembly

11.1.1 The horizontally oriented fire-protective curtain assembly shall be mounted to the subassembly for conditions representative of the intended final use and installation and for which the rating is desired.

11.1.2 The horizontally oriented fire-protective curtain assembly shall be installed in accordance with manufacturer's installation instructions using recommended hardware.

11.2 Vertically Oriented Fire-Protective Curtain Assembly

11.2.1 The vertically oriented fire-protective curtain assembly shall be mounted to the subassembly for conditions representative of the intended final use and installation and for which the rating is desired.

11.2.2 The vertically oriented fire-protective curtain assembly shall be installed in accordance with the manufacturer's installation instructions using the recommended hardware.

11.2.3 Clearances for vertically oriented fire-protective curtains not mounted within guides are to be as follows: with a ±1/8 inch (3.2 mm) tolerance, 1/2 inch (12.7 mm) between fire-protective curtain and subassembly, and 3/8 inch (9.5 mm) between fire-protective curtain and floor structure.

CONDUCT OF TESTS

12 Time of Testing

12.1 The test assembly construction shall have the strength to retain the horizontally or vertically oriented fire-protective curtain assembly securely in position after the Operational Test, Section 13 and throughout the Fire Endurance Test, Section 14.

13 Operational Tests

13.1 Prior to the conduct of the fire endurance test, the horizontally or vertically oriented fire-protective curtain assembly is to be cycled through three closing operations causing the mechanism to activate the closing release of the fire-protective curtain. Each cycle shall consist of the curtain being closed from the full open position. The average closing speed of the horizontally or vertically oriented fire-protective curtain shall not exceed 24 inch/s and shall not be less than 6 inch/s. The horizontally or vertically oriented fire-protective curtain is to close in one continuous motion without interruption.

14 Fire Endurance Test

14.1 The pressure in the entire furnace chamber at the beginning of the test is to be maintained nearly equal to the atmospheric pressure.

14.2 Within 5min of elapsed time into the fire endurance test, the neutral plane of the furnace is to be established at a maximum of 40 inch (1016 mm) up from the bottom of the fire-protective curtain assembly. The exposed area of the test assembly required to be in the positive pressure zone shall be at a positive pressure for the full duration of the fire endurance test.

14.3 For horizontally oriented fire-protective curtain assemblies the pressure that is maintained over or under the test assembly is not to exceed 0.08 inch H_2O (20 Pa) over any portion of the test sample.

14.4 For vertically oriented fire-protective curtain assemblies the pressure that is maintained over the top one third of the test assembly is not to exceed 0.08 inch H_2O (20 Pa) over any portion of the test sample.

14.5 The test is to be continued until the fire endurance period of the classification or rating being evaluated is reached.

15 Cotton Pad Test for Vertically Oriented Fire-Protective Curtain Assemblies

15.1 The passage of flames and gases that may be hot enough to ignite combustibles through cracks, holes, or other openings in or around a fire-protective curtain assembly shall be determined by applying a cotton pad to such openings at regular intervals during the test. The cotton pad shall not be in contact with the element but shall be held for not less than 10s and not more than 30s between 1 ±1/4 inch (25 ±5 mm) away from and centrally opposite any cracks, holes, or other openings in or around the fire-protective curtain assembly. The cotton pad shall not be re-used if it has absorbed any moisture or become charred during a previous application.

15.2 The cotton pad, measuring 4 inch (100 mm) square by 3/4 inch (20 mm) thick, shall consist of new undyed and soft cotton fibers without any admixture of artificial fibers, and shall have a mass between 3 and 4 grams. The cotton pad shall be conditioned by drying in an oven at 212°F (100°C) for at least 30min. The cotton pad shall be attached by wire clips to a 4 inch by 4 inch (100 mm by 100 mm) frame of 0.04 inch (1 mm) diameter wire.

REPORT

16 General

16.1 Results shall be reported in accordance with the performance in the tests prescribed in this test method. The report shall show the performance under the desired fire endurance period chosen from the following: 30min, 45min, 1h, 1-1/2h, or 2h.

16.2 The report shall include the temperature measurements of the furnace, including their deviation from the specified time-temperature curve. See Section 8.

16.3 The report shall also contain a record of all observations having a bearing on the performance of the test assembly.

16.4 Any flaming on the unexposed surface of the horizontally or vertically oriented fire-protective curtain assembly shall be recorded. The record shall show the approximate size of the flame, the location in the test assembly, the time at which the flame occurred and the duration the flame lasted.

16.5 The amount of movement of any portion of the edges of the horizontally or vertically oriented fire-protective curtain assembly adjacent to any type of installation frame or the wall or ceiling from the original position shall be recorded. See Conditions of Acceptance, General, Section 16, and Specific, Section 18.

16.6 The materials and construction of the horizontally or vertically oriented fire-protective curtain assembly, including the frame, and wall or partition, and the details of the installation (including mounting orientation), hardware and wall anchors, trim, finish, and clearance shall be recorded or appropriately referenced to provide positive identification or duplication in all respects.

16.7 Pressure measurements made in the furnace and the location of such measurements relative to the neutral plane of the horizontally or vertically oriented fire-protective curtain assembly and the plane at the top of the horizontally or vertically oriented fire-protective curtain assembly shall be recorded.

CONDITIONS OF ACCEPTANCE

17 General

17.1 A horizontally or vertically oriented fire-protective curtain assembly shall be determined to comply with the requirements for performance when it remains in the opening during the Fire Endurance Test, Section 14, within the limitations specified in 16.2, 16.3, and 16.4.

17.2 The horizontally or vertically oriented fire-protective curtain assembly shall withstand the Fire Endurance Test, Section 14, without developing openings anywhere through the assembly.

Exception: An opening between the bottom edge of a vertically oriented fire-protective curtain assembly and sill within the limits specified in 18.2 is permitted.

17.3 An opening as applied to the requirement in 17.2, is defined as a through-hole in the assembly that is capable of being seen from the unexposed side when viewed from the direction perpendicular to the plane of the horizontally or vertically oriented fire-protective curtain assembly at the location of the suspected opening.

17.4 Horizontally or vertically oriented fire-protective curtains mounted in guides or rails shall not release from guides or rails more than the vertical through openings specified in 18.2.1 and guides shall not loosen such that passage of flames occurs.

18 Specific

18.1 No flaming shall occur on the unexposed surface of a horizontally or vertically oriented fire-protective curtain assembly. Sustained visible flaming shall constitute a failure. For vertically oriented fire-protective curtain assemblies the sample shall not permit the passage of hot gases sufficient to ignite the cotton pad.

18.2 The movement of a vertically oriented fire-protective curtain assembly during or after the fire endurance test shall not be more than the clearances described in 18.2.1 through 18.2.3.

18.2.1 Vertical through openings between the edge of the vertically oriented fire-protective curtain and a fixed curtain track (if employed) are limited to 3/8 inch (9.5 mm) wide maximum.

18.2.2 Vertical through openings between the vertically oriented fire-protective curtain track (if employed) and the subassembly are limited to 3/8 inch (9.5 mm) wide maximum.

18.2.3 Horizontal through openings between the bottom of the vertically oriented fire-protective curtain assembly and the simulated floor of the subassembly are limited to 3/4 inch (19 mm) wide maximum.

18.3 Vertical through openings between the edge of the horizontally oriented fire protective curtain and a fixed curtain track (if employed) are limited to 3/8 inch (9.5 mm) wide maximum.

18.4 Vertical through openings between the horizontally oriented fire-protective curtain track (if employed) and a subassembly are limited to 3/8 inch (9.5 mm) wide maximum.