UL 555

STANDARD FOR SAFETY

Fire Dampers

UL Standard for Safety for Fire Dampers, UL 555

Seventh Edition, Dated July 12, 2006

Summary of Topics

This revision to ANSI/UL 555 is being issued to remove the reference to the withdrawal date of UL 873 and to address universal upkeep of UL Standards for Safety. These revisions are considered to be non-substantive and not subject to UL's STP process.

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UL 555

Standard for Fire Dampers

The third edition was titled Fire Dampers and Ceiling Dampers.

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Seventh Edition

July 12, 2006

This ANSI/UL Standard for Safety consists of the Seventh Edition including revisions through May 21, 2014.

The most recent designation of ANSI/UL 555 as an American National Standard (ANSI) occurred on November 5, 2013. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page, or effective date information.

The Department of Defense (DoD) has adopted UL 555 on July 29, 1994. The publication of revised pages or a new edition of this Standard will not invalidate the DoD adoption.

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 http://csds.ul.com.

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INTRODUCTION

1 Scope

1.1 These requirements cover fire dampers that are intended for use where air ducts penetrate or terminate at openings in walls or partitions; in air transfer openings in partitions; and where air ducts extend through floors as specified in the Standard for Installation of Air-Conditioning and Ventilating Systems, NFPA 90A. Fire dampers are intended for installation in accordance with codes such as the BOCA National Mechanical Code, SBCCI Standard Mechanical Code, ICBO Uniform Mechanical Code, and the International Mechanical Code.

1.2 Fire dampers are evaluated for use as either:

a) Fire Dampers for Static Systems – For HVAC systems that are automatically shut down in the event of a fire or for air transfer openings in walls or partitions,

b) Fire Dampers for Dynamic Systems – For HVAC systems that are operational in the event of a fire,

c) Combination Fire and Smoke Dampers – For locations in HVAC systems where a fire damper and a smoke damper are required at a single location, or

d) Corridor Dampers – For locations in HVAC Systems where air ducts penetrate or terminate at openings in the ceilings of interior corridors when permitted by authority having jurisdiction.

Revised 1.2 effective May 4, 2012

1.3 Under these requirements a fire damper is subjected to a standard fire exposure, controlled to achieve specified temperatures throughout a specified time period, followed by the application of a specified standard hose stream. This exposure by itself is not representative of all fire conditions; conditions vary with changes in the amount, nature, and distribution of fire loading, ventilation, compartment size and configuration, and heat sink characteristics of the compartment. These requirements provide a relative measure of fire performance of fire damper assemblies under these specified fire exposure conditions. Any variation from the construction or conditions that are tested such as method of installation and materials has the potential to substantially change the performance characteristics of the fire damper assembly.

1.4 Fire dampers for static systems (no air flow through the damper) are intended to close automatically upon the detection of heat by a heat responsive device.

1.5 Under these requirements combination fire and smoke dampers, corridor dampers and fire dampers for dynamic systems are exposed to standardized heat and airflow conditions and are evaluated for dynamic closure under these conditions.

Revised 1.5 effective May 4, 2012

1.6 Combination fire and smoke dampers and corridor dampers shall also comply with the applicable requirements in the Standard for Smoke Dampers, UL 555S.

Revised 1.6 effective May 4, 2012

1.7 Fire dampers for dynamic systems are intended for use where the airflow is operational at the time of fire, such as in a smoke control system, or from other situations in which the fan system is operational at the time of a fire.

1.8 Where fire dampers are required in ducts that penetrate fire barriers and where the duct is also used as part of a smoke control system, the system designer shall ascertain which type of fire damper is appropriate for the application. Fire dampers for dynamic systems are evaluated only for dynamic closure under heated airflow conditions. Combination fire and smoke dampers and corridor dampers that have an elevated temperature rating are evaluated for dynamic closure under heated airflow conditions and they are also evaluated to operate under heated air conditions.

Revised 1.8 effective May 4, 2012

1.9 Tests conducted in accordance with these requirements are intended to demonstrate the performance of fire dampers during the period of fire test exposure and are not intended to determine acceptability of fire dampers for use after exposure to fire.

1.10 It is the intent that tests conducted in accordance with the test methods described herein develop data to enable regulatory authorities to determine the acceptability of fire damper assemblies for use in locations where fire resistance of a specified duration is required.

1.11 Fire dampers are intended to close automatically upon the detection of heat by the use of a fusible link or other heat responsive device.

1.12 These requirements do not cover:

a) Performance of the fire damper assembly in walls, partitions, or floors constructed of materials other than those tested.

b) The performance of the fire damper assembly when installed using methods other than those fire tested.

c) Measurement of heat transmission through a fire damper assembly.

d) Measurement of the degree of control or limitation of the passage of smoke or products of combustion through the fire damper assembly.

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. See Appendix A for a list of standards covering components generally used in the products covered by this standard.

2.1.2 A component is not required to comply with a specific requirement that:

a) Involves a feature or characteristic not required 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 rating established for the intended conditions of use.

2.1.4 Specific components are 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.

2.2 Units of measurement

2.2.1 Values stated without parentheses are the requirement. Values in parentheses are explanatory or approximate information.

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 For the purpose of this Standard the following definitions apply.

3.1.1 CONTROLLED CLOSURE – The closure of a damper by means of electric, pneumatic, hydraulic, or other similar device that inhibits the rate of closure.

3.1.1 added May 16, 2011

3.2 DYNAMIC CLOSURE – The closure of a fire damper under conditions of airflow and heat upon activation of the heat responsive device.

3.3 HEAT RESPONSIVE DEVICE – A safety device responsive to changes in temperature in order to activate the closing mechanism of fire dampers.

3.4 HEATED AIR OPERATION – The operation of a smoke damper by means of the actuator when the damper is subjected to conditions of airflow and heat.

3.5 PRIMARY HEAT RESPONSIVE DEVICE – The heat responsive device with the lower temperature rating for fire dampers equipped with two heat responsive devices.

3.6 REOPENABLE FIRE DAMPER – A fire damper equipped with a primary and a secondary heat responsive device. The fire damper is operable after the primary heat responsive device activates, and not after the secondary device activates.

3.7 SECONDARY HEAT RESPONSIVE DEVICE – The heat responsive device with the higher temperature rating for reopenable fire dampers.

3.8 VOLUME CONTROL DAMPER – A fire damper employing position devices that enable the fire damper to remain in positions other than fully open or fully closed.

3.9 NON-CONTROLLED CLOSURE – The closure of a damper by means of spring operation, gravity or other similar device that does not inhibit the rate of closure. Non-controlled closure is also referred to as instantaneous closure, rapid closure or slam shut closure.

3.9 revised May 16, 2011

CONSTRUCTION

4 General

4.1 Fire dampers shall be constructed to restrict the passage of flame when in the closed position. Combination fire and smoke dampers, corridor dampers, and fire dampers for dynamic systems shall be constructed to close under the rated airflow and heat conditions. A heat responsive device provided with a combination fire and smoke damper shall have a temperature rating which is less than or equal to the temperature rating of the damper.

Revised 4.1 effective May 4, 2012

4.2 Through openings for operating clearances in fire dampers shall not exceed 3/8 in (9.5 mm) in the vertical plane (such as between blades and each side of the fire damper frame) at any location, and 1/32 in (0.8 mm) in the horizontal plane at any location (such as between blade-to-blade hinged joints in an interlocking curtain).

4.3 Any through opening between a fire damper and its sleeve shall be insufficient in size to enable the passage of a 1/8 in (3.5 mm) diameter rod through the entire depth of the opening. Any through opening in a multiple fire damper assembly where the corners of the two frames meet shall be insufficient in size to enable the passage of a 1/4 in (6.4 mm) diameter rod through the entire depth of the opening.

4.4 For the purpose of the requirements in 4.2 and 4.3, a through opening in a fire damper is a visible opening in the face of the fire damper when viewed on a plane perpendicular to the mounting plane.

4.5 Nonmetallic or organic components such as gaskets, sealants, limit switches, or blade position indicators used in the construction of a fire damper and exposed to the air stream shall comply with the requirements of the Fire Endurance and Hose Stream Test, Section 10.

4.6 A combination fire and smoke damper or corridor damper intended for reopening after the initial closing due to operation of the heat responsive device that incorporates a secondary heat responsive device is not prohibited by these requirements. The damper shall not be reopenable after the damper closes due to activation of the secondary heat responsive device.

Revised 4.6 effective May 4, 2012

5 Heat Responsive Devices

5.1 A fire damper for dynamic systems and a fire damper for static systems shall be equipped with one heat responsive device. A combination fire and smoke damper and corridor damper shall be equipped with either one heat responsive device or with a primary and secondary heat responsive device.

Revised 5.1 effective May 4, 2012

5.2 The temperature rating of the heat responsive device for fire dampers for static systems shall be a minimum of 160°F (71°C) and shall not exceed 212°F (100°C).

5.2.1 The temperature rating of the heat responsive device for the fire dampers for dynamic systems shall be a minimum of 160°F (71°C) and shall not exceed 350°F (177°C).

5.2.2 The temperature rating of the heat responsive device for nonreopenable combination fire and smoke dampers or corridor dampers shall be a minimum of 160°F (71°C), shall be less than or equal to the temperature rating of the damper as determined by the Standard for Smoke Dampers, UL 555S, and shall not exceed 350°F (177°C).

Revised 5.2.2 effective May 4, 2012

5.2.3 For reopenable combination fire and smoke dampers and corridor dampers, the temperature rating of the primary heat responsive device shall be a minimum of 160°F (71°C) and shall not exceed 212°F (100°C). The temperature rating of the secondary heat responsive device shall be greater than the primary heat responsive device, shall not be less than the temperature rating of the damper as determined by the Standard for Smoke Dampers, UL 555S, and shall not exceed 350°F (177°C).

Revised 5.2.3 effective May 4, 2012

5.3 The load on a heat responsive device in a fire damper shall be within the design load limits of the device.

6 Sleeves

6.1 For fire dampers utilizing perimeter mounting angles, a sleeve shall be provided unless the fire damper has a frame wide enough to provide for direct attachment of the perimeter mounting angles. The thickness of the fire damper frame, when the sleeve is not to be provided, shall comply with the requirements for sleeves. See 6.5.

6.2 The sleeve intended for use with a fire damper shall be specified in the installation and operating instructions when it is to be field supplied. See Section 18.

6.3 The sleeve or frame shall be intended for connection to the ducts in accordance with the Sheet Metal and Air Conditioning Contractors National Association Inc. (SMACNA) Duct Construction Standards; HVAC Duct Construction Standards; or Fibrous Glass Duct Construction Standards.

6.4 The length of the sleeve or frame extending beyond the wall or floor opening for both the rigid and breakaway joints between the sleeve or frame and duct shall not exceed:

a) Six inches (152 mm) on each side for fire dampers intended to be installed in the plane of a fire barrier and for use without an actuator or a factory installed access door in the sleeve.

b) Six inches (152 mm) on one side and 16 in (406 mm) on the opposite side for fire dampers intended for use with an actuator and/or a factory installed access door on the longer side.

c) Sixteen inches (406 mm) on each side for fire dampers intended for use with an actuator on one side and a factory installed access door on the other side.

d) Six inches (152 mm) on one side and sixteen in (406 mm) on damper side for fire dampers intended to be installed outside of wall or floor plane.

Revised 6.4 effective July 26, 2011

6.5 For rigid joints between the sleeve and duct:

a) The maximum thickness for a sleeve shall be 0.135 in (3.43 mm) for uncoated steel and 0.138 in (3.51 mm) for coated steel, unless a larger sleeve thickness is tested.

b) The sleeve thickness shall be a minimum of 0.053 in (1.35 mm) for uncoated steel and 0.056 in (1.42 mm) for coated steel for fire dampers with dimensions not exceeding 24 in (610 mm) in height or 36 in (914 mm) in width, and a minimum of 0.067 in (1.70 mm) for uncoated steel and 0.070 in (1.78 mm) for coated steel for larger size fire dampers.

Exception: The sleeve thickness used shall not be less than that required by the Standard for the Installation of Air-Conditioning and Ventilating Systems, NFPA 90A. Sleeves of lesser thickness are not prohibited when:

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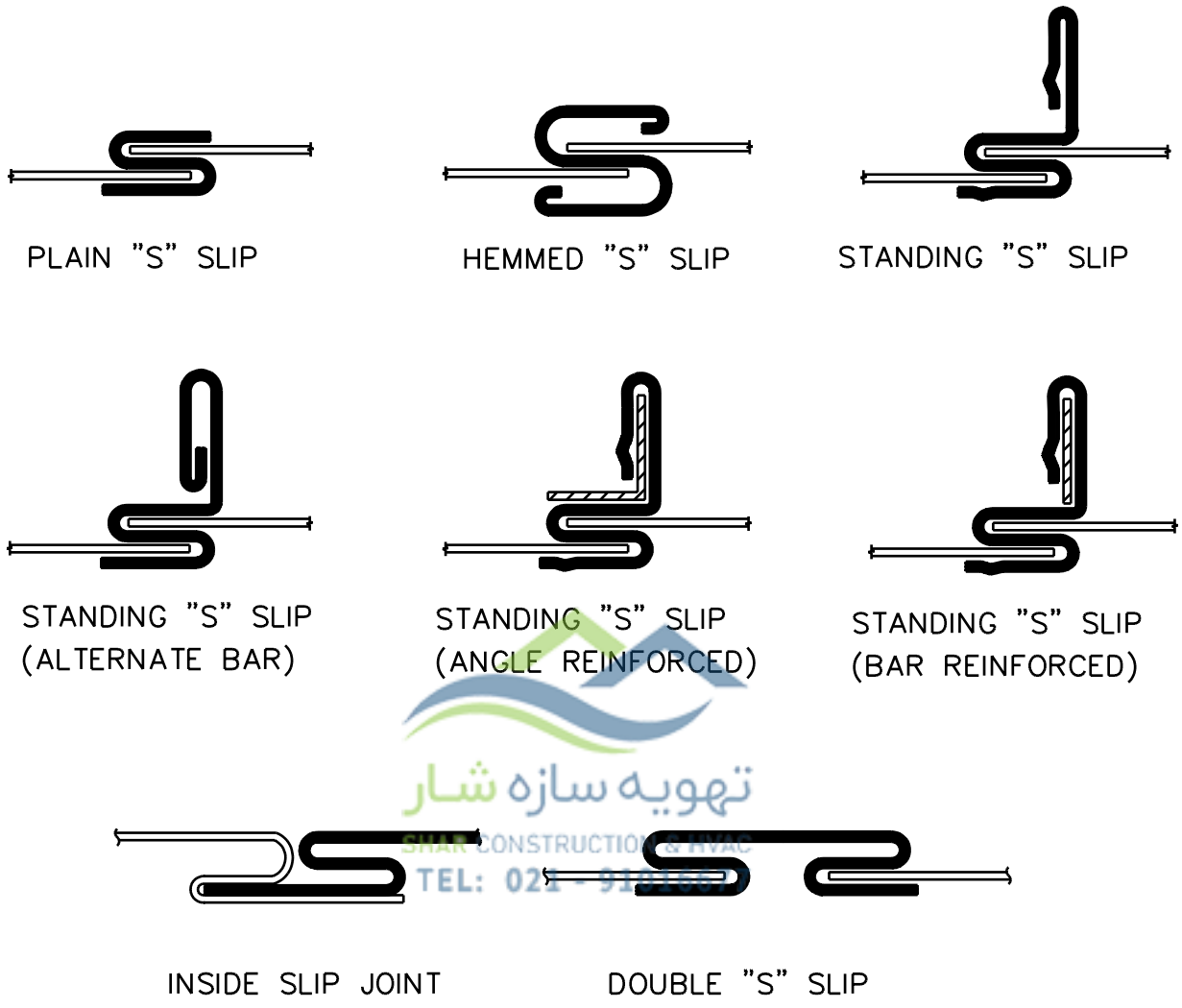
a) One or more breakaway joints of the types shown in Figures 6.1 – 6.3 are used as the connection between the sleeve and ducts, or

b) The breakaway joints comply with the Duct Impact Test, Section 15.

Figure 6.1
Duct-sleeve connections

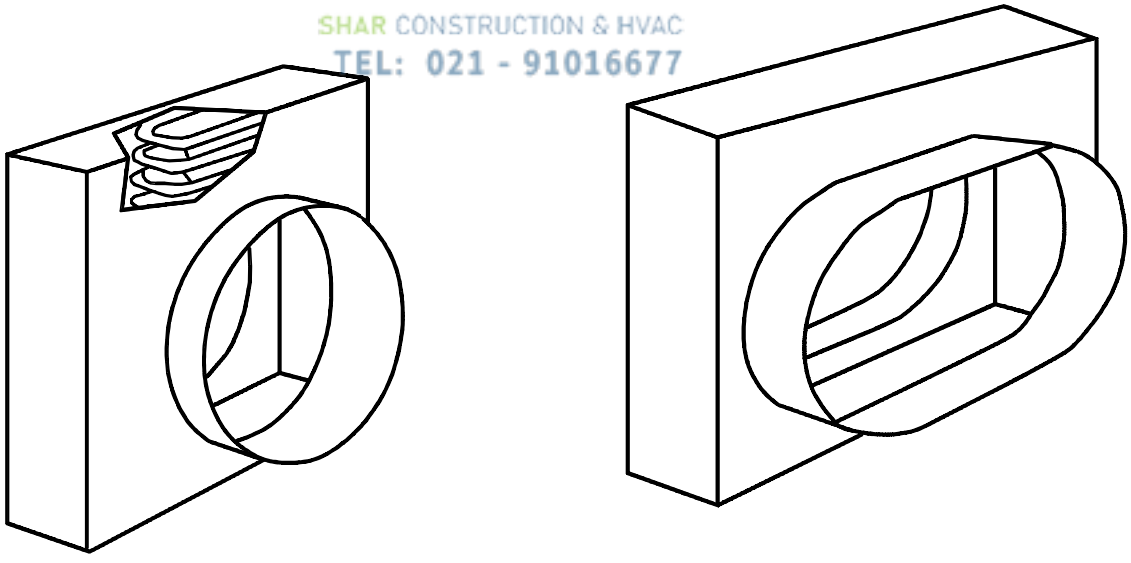


ED 110

Figure 6.2
Flat drive slip

SM230A

Figure 6.3
Fire damper/sleeve assemblies with collars for round and flat oval ducts



SM231

6.6 Breakaway joints of the types shown in Figure 6.1 shall have no more than two No. 10 (4.8 mm diameter) sheet metal screws on each side and on the bottom located in the center of the slip pocket and shall penetrate both sides of the slip pocket.

6.7 When provided, breakaway joints of the types shown in Figure 6.1 shall either be on the top and on the bottom of horizontal ducts (vertical fire dampers) and on the sides; or shall be provided on the top and bottom of the horizontal ducts with flat drive slips on the sides as illustrated in Figure 6.2. Flat drive slips shall not exceed 20 in (508 mm) in length.

6.8 When provided, breakaway joints of the types shown in Figure 6.1 shall either be on all sides of vertical ducts (horizontal fire dampers); or shall be on one pair of opposite sides of vertical ducts with flat drive slips as illustrated in Figure 6.2 on both other opposite sides. Flat drive slips shall not exceed 20 in (508 mm) in length.

6.9 Round or flat oval spiral ducts attached to round or oval collars which are part of a fire damper sleeve as shown in Figure 6.3 used as breakaway joints shall be attached with No. 10 (4.8 mm diameter) sheet metal screws spaced equally around the circumference of the duct as follows in (a) and (b). For flat oval ducts, the diameter is determined to be the largest (major) dimension of the duct.

a) Duct diameters 22 in (559 mm) and smaller shall have three screws.

b) Duct diameters greater than 22 in up to and including 36 in (914 mm) shall have five screws.

7 Protection Against Corrosion

7.1 A ferrous metal part used in the fire damper shall be one of the 300 Series of stainless steel or shall have one of the following corrosion-protection systems or the equivalent:

a) A coating of hot-dipped mill galvanized sheet steel complying with the coating Designation G60 or A60 in the Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process, ASTM A653, with not less than 40% of the zinc on any side, based on the minimum single spot test requirement in this ASTM Designation. The weight of the zinc coating shall be established in accordance with the test method in the Standard Test Method for Weight (Mass) of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings, ASTM A90. An A60 (alloyed) coating shall also comply with the requirements in 7.4.

b) A zinc coating, other than that provided on hot-dipped mill galvanized sheet steel, uniformly applied to an average thickness of not less than 0.00041 in (0.0104 mm) on each surface with a minimum thickness of 0.00034 in (0.00864 mm). The thickness of the coating is to be established in accordance with the test method in the Guide for Measurement of Electrodeposited Metallic Coating Thicknesses by the Dropping Test, ASTM B555. An annealed coating shall also comply with the requirements in 7.4.

c) A cadmium coating not less than 0.0005-in (0.0127-mm) thick on both surfaces. The thickness of coating is to be established in accordance with the test method in the Guide for Measurement of Electrodeposited Metallic Coating Thicknesses by the Dropping Test, ASTM B555.

d) Two coats of an organic finish of the epoxy or alkyd-resin type or other outdoor paint on each surface. The acceptability of the paint shall be determined by its composition or by corrosion tests as specified in the requirements for Organic Coatings for Steel Enclosures for Outdoor Use Electrical Equipment, UL 1332.

7.2 Coated or uncoated metals used in the assembly of fire dampers shall be galvanically compatible.

7.3 Component springs and bearings used in the assembly of fire dampers shall be of material having resistance to atmospheric corrosion equivalent to brass or bronze.

7.4 A hot-dipped, mill-galvanized A60 (alloyed) coating or an annealed zinc coating that is bent or similarly formed after annealing and that is not otherwise required to be painted shall be painted in the bent or formed area as specified in 7.1(d) when the bending or forming process damages the zinc coating as described in 7.5.

7.5 When flaking or cracking of the zinc coating at the outside radius of the bent or formed section is visible at 25 power magnification, the zinc coating is identified as damaged. Simple sheared or cut edges and punched holes are not to be defined as formed. Extruded and rolled edges and holes shall comply with the requirements in 7.4.

8 Actuators

8.1 An actuator shall be formed and assembled to have the strength and rigidity required to resist the abuses to which it is subjected without the loosening or displacement of any parts or other serious defects.

8.2 Actuators shall be factory mounted securely in position. Bolts, screws, or other parts used for mounting an actuator shall be independent of those used to secure components of the actuator to the frame, base, or panel.

8.3 A pneumatic actuator shall comply with the Hydrostatic Strength Test for Pneumatic Actuators, Section 16.

8.4 An electric actuator, a position indicator switch and other electrical components shall comply with the applicable requirements of the Standard for Temperature-Indicating and -Regulating Equipment, UL 873, or the Standard for Automatic Electrical Controls for Household and Similar Use, Part 1: General Requirements, UL 60730-1, and the Standard for Automatic Electrical Controls for Household and Similar Use; Part 2: Particular Requirements for Electric Actuators, UL 60730-2-14, for their intended use.

8.4 revised May 21, 2014

PERFORMANCE

9 General

9.1 Representative samples of each fire damper design or design variation shall be subjected to the tests specified in Table 9.1.

Table 9.1
Tests for fire dampers

Revised Table 9.1 effective May 4, 2012

Test	Section or standard	Type of fire damper			
		Static fire damper	Dynamic fire damper	Combination fire and smoke damper	Corridor damper
1. Fire Endurance and Hose Stream	10	X	X	X	X
2. Cycling	11	X	X	X	X
3. Salt-Spray Exposure	12	X	X	X	X
4. Spring Closing Force	13	X	–	–	–
5. Dynamic Closure	14	–	X	X	X
6. Operation	UL 555S	–	–	X	X
7. Leakage	UL 555S	–	–	X	X

X – Test applicable
– – Test not applicable

9.2 The dynamic closure test, when applicable, is to be conducted on the sample used for the cycling test. The spring closing force test, when applicable, is to be conducted on the samples used for the cycling test.

9.3 The overall size of the sample used for the salt spray exposure test, including the actuator, is not to exceed 42-in high by 46-in wide (1.07-m by 1.15-m) for vertical fire dampers and 46-in long by 28-in wide (1.15-m by 0.71-m) for horizontal fire dampers.

9.4 Additional samples are required to evaluate the fire damper for features such as most critical closing force, blade width, blade length, and other similar features.

9.5 The salt spray exposure test is intended to simulate the dust and other debris that accumulates on a fire damper mounted in a duct or opening within a building and to investigate the performance of the fire damper while subjected to such accumulations.

9.6 The duct impact test is intended to simulate falling debris on an HVAC duct in a building fire and to investigate the performance of the fire damper installed in such an HVAC duct system while subjected to an impact of such falling debris.

9.7 Dampers to be identified and labeled as corridor dampers are required to comply with the requirements specified in Table 9.1.

Added 9.7 effective May 4, 2012

10 Fire Endurance and Hose Stream Test

10.1 Conditions of acceptance

10.1.1 General

10.1.1.1 The damper assembly shall remain in the opening during the fire endurance test for the fire-exposure period for which it is to be rated and during the hose stream test.

10.1.1.2 All fire dampers in the test assembly shall completely close and latch automatically (when a latch is provided) upon activation of the heat responsive device.

10.1.1.3 Latching mechanisms, blade shafts in their bearings, interlocking-type fire damper blades and blade guides shall remain engaged and secure during the test.

10.1.1.4 During the fire exposure, there shall be no flaming of the fire damper assembly materials on the unexposed side.

Exception No. 1: Flaming of nonmetallic or organic components used in a fire damper assembly is not prohibited on the unexposed side when the flames do not exceed 6 in (152 mm) in length.

Exception No. 2: This requirement does not apply to nonmetallic or organic components used in a damper assembly when the total exposed surface area of the nonmetallic or organic components is 25 in^2(161 cm^2) or less.

Exception No. 3: This requirement does not apply to materials used in a fire damper assembly which are classified as to surface burning characteristics and which have a flame spread value of 25 or less and a smoke developed value of 50 or less when tested as specified in the Standard for Test for Surface Burning Characteristics of Building Materials, UL 723.

Exception No. 4: This requirement does not apply to components of a fire damper assembly with nonmetallic enclosures which are classified when tested as specified in the Standard for Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces, UL 2043.

10.1.1.4 revised May 15, 2012

10.1.1.5 An actuator shall be mounted outside the duct unless it has been evaluated for mounting inside the duct.

10.1.2 Secondary heat responsive devices

10.1.2.1 The secondary heat responsive device shall operate and the fire damper shall completely close and latch automatically (when a latch is provided) when subjected to the fire endurance test.

10.1.3 Fire damper assemblies

10.1.3.1 Movement or warping of any part of the fire damper assembly during the test shall not result in any of the following:

a) Visible through openings in excess of 3/8 in (9.5 mm) between the damper blade edges and the frame members perpendicular to the axis of motion of the damper blade on rectangular dampers.

b) Visible through openings in excess of 1/8 in (3.2 mm) between the damper blade edges and the frame members parallel to the axis of motion of the damper blade on rectangular dampers.

c) Visible through openings in excess of 1/32 in (0.8 mm) between adjacent damper blades for all dampers.

d) Visible through openings in excess of 3/8 in (9.5 mm) between the blade and the adjacent sleeve on round dampers.

e) Visible through openings between the frame and the sleeve, or the sleeve and the mounting angle, in excess of 1/8 in (3.2 mm).

f) Clearance between parts exceeding 3/4 in (19.1 mm) during or after the fire-endurance test and 1 in (25.4 mm) during or after the hose-stream test.

10.1.4 Dampers mounted outside the plane of the wall

Added 10.1.4 effective July 26, 2011

10.1.4.1 For dampers intended to be mounted outside the plane of the wall, the average temperature rise above the damper on the unexposed surface of the fire barrier shall be compared to the average temperature rise above a control sample. The control sample shall be of the same construction as the sample being evaluated and shall be mounted such that the blades are in the plane of the wall when the damper is closed. The thermal couple array shown in Figure 10.1 shall be used to measure the temperature rise above both samples. At the end of the test the average temperature rise above the sample mounted outside the plane of the wall shall not exceed the average temperature rise above the control sample by more than 5%.

10.2 Test assemblies

10.2.1 General

10.2.1.1 The fire damper is to be installed in a test assembly in its intended position and in accordance with the manufacturer's installation instructions. When a fire damper is intended for use in both wall and floor openings, both installations are to be tested.

Exception: Horizontal testing of dampers mounted outside the plane of the floor is not required as long as the damper design has successfully met the requirements of Sections 10.2.2, 10.2.3, and 10.2.5. The sizes of the largest dampers to successfully meet the requirements of Sections 10.2.2 and 10.2.5 shall be compared. The maximum allowable size will be the smaller of the two.

Revised 10.2.1.1 effective July 26, 2011

10.2.1.2 For fire dampers utilizing perimeter mounting angles the minimum overlap of the angles on all four sides of one or both faces of the wall or floor specified in the manufacturer's installation instructions is to be tested. The perimeter mounting angles are to be positioned against the face of the wall and/or floor as specified.

10.2.1.3 The fire damper is to be set in its intended open position at the start of the fire exposure. A fire damper relying on an actuator for closure is to be equipped with the actuator specified by the manufacturer.

10.2.1.4 CAUTION – Precautions are to be taken when testing with actuators that present a risk of explosion or fire when exposed to high temperature.

10.2.1.5 A cover shall not be prohibited from being placed over the fire damper during the initial period of the fire endurance test to reduce the influence of cooling air being drawn through the open fire damper. The cover is to be removed immediately following activation of the heat responsive device.

10.2.2 Horizontal fire damper assemblies intended to be mounted with the blades in the plane of the floor when the damper is closed

10.2.2 revised February 23, 2009 effective January 26, 2010

10.2.2.1 Horizontal fire damper assemblies are to be installed in a representative floor assembly as specified by the manufacturer's installation instructions and tested on a furnace in their intended position.

10.2.2.2 When tested in a concrete slab, the concrete is to cure at least 28 days before the fire test, and until the moisture content of the concrete is reduced to 75% or less relative humidity at 73 ±5°F (23 ±3°C).

10.2.3 Vertical fire damper assemblies intended to be mounted either in the plane of the wall or outside the plane of the wall

10.2.3 revised February 23, 2009 effective January 26, 2010

10.2.3.1 Vertical fire dampers are to be installed in a representative wall assembly as specified by the manufacturer's installation instructions.

10.2.3.2 Vertical fire damper assemblies are to be installed in the following manner:

a) When a single fire damper assembly is to be tested, two samples are to be installed. One sample is to be installed with the upstream side facing the furnace and the other sample is to be installed with the downstream side facing the furnace.

b) When a multiple fire damper assembly is to be tested, one sample is to be installed. Half of the fire dampers in this sample are to be installed with the upstream side facing the furnace and the other half are to be installed with the downstream side facing the furnace. When the assembly has an odd number of fire dampers, the upstream side is to have one additional fire damper.

10.2.3.3 When tested in a masonry wall, masonry settings are to cure at least 3 days before a 1-1/2 h fire test and 5 days before a 3 h fire test.

10.2.4 Horizontal fire damper assemblies intended to be mounted with the blades outside of the plane of the floor when the damper is closed

Added 10.2.4 effective July 26, 2011

10.2.4.1 Dampers meeting requirements of Section 10.2.5 are permitted to be used as horizontal fire damper assemblies with blades outside floor plane if the damper design has successfully passed Section 10.2.2. The maximum allowable size will be the smallest size to successfully pass Sections 10.2.2 and 10.2.5.

10.2.5 Vertical fire damper assemblies intended to be mounted with the blades outside of the plane of the wall when the damper is closed

Added 10.2.5 effective July 26, 2011

10.2.5.1 Vertical fire dampers are to be installed in a representative wall assembly as specified by the manufacturer's installation instructions.

10.2.5.2 Vertical fire damper assemblies with the blades mounted outside plane of the wall are to be installed in the following manner:

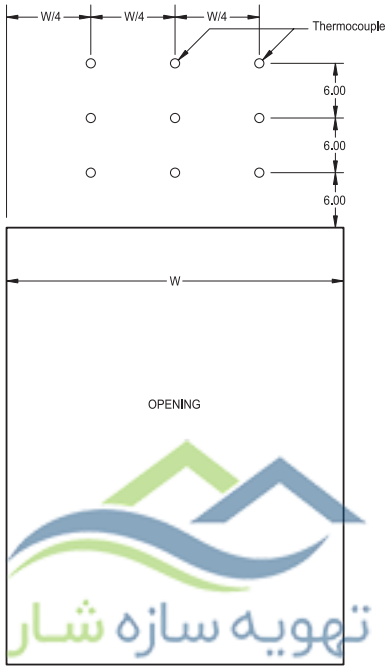
a) Dampers are to be installed in a representative wall assembly as specified by the manufacturer's installation instructions for out of wall plane applications. One sample with damper mounted outside of wall plane facing towards exposed side (the furnace), one sample with damper mounted outside of wall plane facing towards non exposed side (non-furnace) and a control sample installed in accordance with the manufacturer's installation instructions for applications of blades within the wall plane.

b) A grid of 9 equally spaced thermocouples as shown in Figure 10.1 is installed above the reference sample (damper mounted in the wall plane/assembly when blades are closed) and over the sample that extends out of the plane away from the furnace. The thermocouples are to

be attached via staples over the insulated portion. The tips of the thermocouples are to be depressed in the wall so as to be flush to the surface of the wall. The thermocouples are to be held in thermal contact with the surface with pressure-sensitive paper tape.

Figure 10.1
Thermocouple grid

Added Figure 10.1 effective July 26, 2011



10.2.6 Corridor damper assemblies

Added 10.2.6 effective May 4, 2012

10.2.6.1 Two corridor damper are to be installed in representative corridor-ceiling assemblies as specified by the manufacturer's installation instructions. One assembly shall be tested in its intended position and one tested in the inverted position.

10.3 Control and conduct of fire test

10.3.1 The fire exposure of fire damper assemblies is to be controlled to be in accordance with the Standard Time-Temperature Curve shown in Figure 10.2. For a more precise definition of the time-temperature curve, see Appendix B. The points on the curve that determine its character are:

1000°F (538°C).....at 5 min

1300°F (704°C).....at 10 min

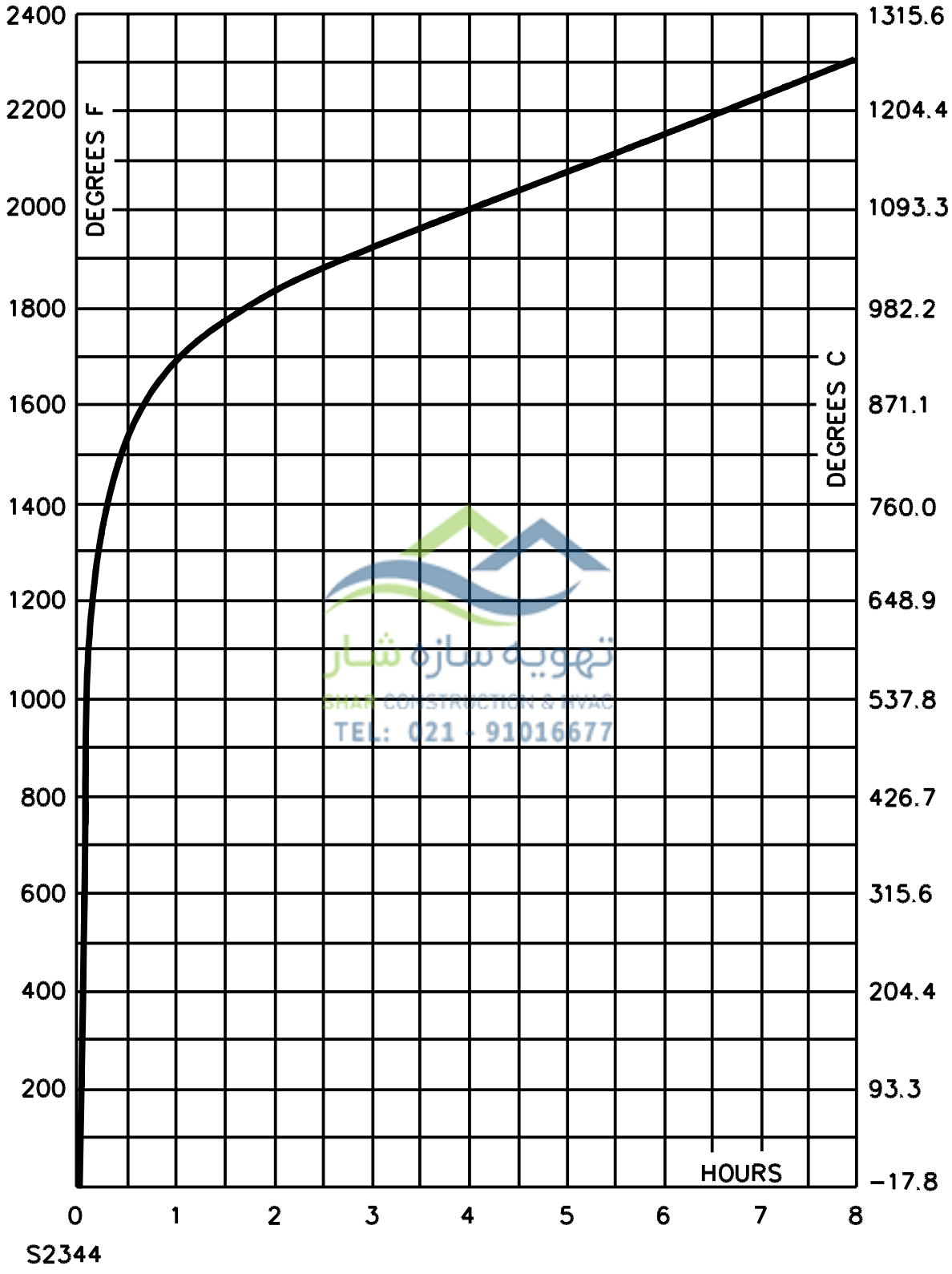
1550°F (843°C).....at 30 min

1700°F (927°C).....at 1 h

1792°F (978°C).....at 1-1/2 h

1925°F (1052°C).....at 3 h

Figure 10.2
Time-temperature curve



10.3.2 The measured temperature to be compared with the standard time-temperature curve is to be the average temperature obtained from the readings of not less than nine thermocouples symmetrically disposed and distributed to show the temperature near all parts of the test assembly.

10.3.3 The thermocouples are to be enclosed in sealed porcelain tubes, 3/4 in (19 mm) in outside diameter and 1/8 in (3.2 mm) in wall thickness or, as an alternative in the case of base-metal thermocouples, enclosed in sealed, standard-weight 1/2 in [0.84 in (21 mm) outside diameter] black wrought-steel or black wrought-iron pipe. See the Standard for Welded and Seamless Wrought Steel Pipe, ANSI/ASME B36.10M-1996. The exposed length of the pyrometer tube and thermocouple in the furnace chamber is not to be less than 12 in (305 mm). Other types of protecting tubes or pyrometers that, under test conditions, give the same indications as those specified within the limit of accuracy that applies for furnace temperature measurements are not prohibited from being used.

10.3.4 The distance of the thermocouple junctions, from the exposed face of the test assembly or from the masonry or concrete in which the assembly is installed, is to be:

a) 6 in (152 mm) for vertically installed dampers, or

b) 12 in (305 mm) for horizontally installed dampers.

10.3.5 The temperatures are to be read at intervals not exceeding 5 min during the first 2 h; the intervals thereafter are increased to not more than 10 min.

10.3.6 The accuracy of the furnace control is to be such that the area under the Standard Time-Temperature Curve (Figure 10.2), obtained by averaging the results from the thermocouple readings, is within:

a) 10% of the corresponding area under the Standard Time-Temperature Curve for fire tests of 1 h or less duration,

b) 7.5% for tests longer than 1 h and not longer than 2 h, and

c) 5% for tests exceeding 2 h in duration.

10.3.7 The pressure in the furnace chamber during the fire test is to be maintained as nearly equal to atmospheric pressure as possible throughout the test for combination fire and smoke dampers, fire dampers for dynamic systems, and fire dampers for static systems. For corridor dampers the air flow will be initially drawn through at a rate of 150 fpm through duct work connected to the sleeve of the damper while it is subjected to the fire exposure test. After the damper has closed, ductwork will be removed from the test assembly and the fire test will continue as normal. The pressure in the furnace chamber during the remainder of fire test is to be maintained as nearly equal to atmospheric pressure as possible.

Revised 10.3.7 effective May 4, 2012

10.3.8 The fire test is to be continued until the exposure period for which the fire damper is to be rated is reached, or until the fire damper fails to comply with the conditions of acceptance specified in 10.1.

10.3.9 Immediately following the fire-exposure portion of the test, the test assembly is to be subjected to the impact, erosion, and cooling effects of a hose stream directed first at the middle and then at all parts of the exposed surface of the damper assembly with changes in direction being made slowly.

10.3.10 The hose stream is to be delivered through a 2-1/2 in (64 mm) hose discharging through a National Standard playpipe or corresponding size equipped with a 1-1/8 in (29 mm) discharge tip of the standard-taper smooth-bore pattern without shoulder at the orifice. The water pressure at the base of the nozzle and the duration of application in seconds per square foot (per 0.093 m^2) of exposed area of the damper assembly is to be as specified in Table 10.1.

Table 10.1
Hose stream test

Rating	Water pressure at base of nozzle		Duration of application, s/ft^2(s/m^2) of exposed area[a]	
	Psi	(KPa)		
3-h	45	(310)	3.0	32
1- 1/2- h	30	(207)	1.5	16
1- h	30	(207)	0.9	10
Less than 1 h	30	(207)	0.6	6

[a] The exposed area is calculated using the outside dimensions of the test specimen, including a frame, hangers, tracks and other parts of the assembly when provided. The exposed area does not include the wall into which the specimen is mounted. When multiple test specimens are mounted in the same wall, the rectangular or square wall area encompassing all of the specimens is the exposed area since the hose stream must traverse this area during its application.

10.3.11 The nozzle orifice is to be 20 ft (6.1 m) from the center of the exposed surface of the test sample when such location results in the nozzle's axis being normal to the surface of the test sample. When the nozzle is unable to be so located, it is to be on a line deviating not more than 30° (0.51 radians) from the line normal to the center of the test sample. When so located, its distance from the center is to be less than 20 ft (6.1 m) by an amount equal to 1 ft (0.3 m) for each 10° (0.17 radians) of deviation from the normal.

11 Cycling Test

11.1 A fire damper or multiple fire damper assembly intended for controlled closure with an actuator (that is, the electric, pneumatic, or hydraulic device used to operate the fire damper) shall function as intended after being mechanically operated for 20,000 full-stroke (that is, close and reopen) operations, or 100,000 full-stroke operations when the fire damper is also intended for use as a volume control damper, while using the specified fire damper actuator and while operating without duct system pressure. The closing time shall not exceed 75 seconds nor shall the reopening time of the damper exceed 75 seconds. All dampers are to be cycled while mounted in the position intended for installation.

11.1 revised May 16, 2011

11.1A Alternately when the damper is intended for use as a volume control damper it is permitted to be cycled 20,000 full-stroke cycles as described in 11.1 and then perform 100,000 repositioning cycles. A ″repositioning cycle″ is a minimum rotation of the damper actuator of 5 degrees (±2 degrees) or 10% in one direction and in the reversed direction. The repositions shall be achieved in one of two ways:

a) The actuator on the damper shall be moved forward 10 degrees (±2 degrees) and then moved back 5 degrees (±2 degrees). This sequence of movements shall be considered one reposition. Once the damper and actuator reach the full-open position the same series of movements shall be performed to move the damper and actuator back to the full close position. This shall be repeated until 100,000 repositions have been achieved.

b) The actuator on the damper shall be moved from the 0% position (full-closed) to the 10% position and then back to the 0% position. This sequence of movements shall be considered one reposition. That same series of movements shall be performed for 10,000 repositions. Another 10,000 repositions shall then be performed between the 10% and 20% positions, the 20% and 30% positions, the 30% and 40% positions, the 40% and 50% positions, the 50% and 60% positions, the 60% and 70% positions, the 70% and 80% positions, the 80% and 90% positions, and finally the 90% and 100% positions for a total of 100,000 repositions.

11.1A added February 23, 2009 effective January 26, 2010

11.2 For a fire damper intended for non-controlled closure without an actuator, the number of full-stroke operations is to be 250 and the fire damper is to be cycled manually.

11.2 revised May 16, 2011

11.3 All fire dampers are to be cycled at an ambient temperature between 50°F (10°C) and 104°F (40°C) while oriented in the position intended for installation.

12 Salt-Spray Exposure Test

12.1 Representative samples of a fire damper shall completely close and latch automatically (when a latch is provided) following exposure to salt spray for a period of 5 days when tested as described in 12.2 – 12.4.

12.2 Prior to the test, all grease or oil is to be removed from the fire damper using organic solvents. Also, in cases where the salt creates interfering buildup of zinc chloride, galvanized steel parts are to be painted prior to the test.

12.3 The fire damper is to be installed in a test chamber with the fire damper open and supported in the position of intended use and then exposed to salt spray for 120 h, in accordance with the Standard Practice for Operating Salt Spray (Fog) Apparatus, ASTM B117, except that the salt solution is to consist of 20% by weight of common salt (sodium chloride) and distilled water. The pH value of this solution as collected after spraying in the test apparatus is to be between 6.5 and 7.2 and the specific gravity between 1.126 and 1.157 at 95°F (35°C).

12.4 At the conclusion of the exposure, the fire damper is to be removed from the chamber and dried at a temperature of 75 ±10°F (23.9 ±5.5°C) for a minimum of 24 h. It is then to be placed in its intended mounting position and tested for closing and latching (when a latch is provided).

13 Spring Closing Force Test

13.1 A spring-operated fire damper for static systems shall employ a spring or springs capable of exerting a force of 2-1/2 times that required to close the damper and automatically latch when a latch is provided. The fire damper used for the spring closing force test is to be the fire damper previously subjected to the Cycling Test, Section 11.

13.2 All springs are to be disconnected and the fire damper placed in the intended operating position.

13.3 The force required to close and latch the fire damper is to be measured at each of a series of positions assumed by the fire damper from fully open to closed (latched). The force is to be applied through, and at the point of connection of, the spring to the fire damper blade or operating arm.

13.4 Three samples of each spring employed for closing and latching are to be tested for force exerted over the range of extension or compression required for the motion involved in the fire damper. The force available from the action of the spring or springs is to be 2-1/2 times that required for the closing and latching of the fire damper at any position of travel from fully open to latched.

14 Dynamic Closure Test

14.1 General

14.1.1 Combination fire and smoke dampers, corridor dampers and fire dampers for dynamic systems shall be subjected to the dynamic closure test. The fire dampers (including actuators) used for the dynamic closure test are to be those previously subjected to the Cycling Test, Section 11.

Revised 14.1.1 effective May 4, 2012

14.1.2 Under conditions of the specified airflow and heat, representative samples of fire dampers for dynamic systems, corridor dampers and combination fire and smoke dampers shall completely close and latch automatically (when a latch is provided) without damage to the fire damper or its components.

Revised 14.1.2 effective May 4, 2012

14.1.3 Fire dampers are to be tested with airflow in both directions. First, one test sample is to be tested in one direction. Another test sample is then to be mounted such that the airflow is in the opposite direction and tested. The temperature rating for combination fire and smoke dampers and corridor dampers shall be ″250°F″ or ″350°F″.

Revised 14.1.3 effective May 4, 2012

14.1.4 The minimum airflow and closure pressure rating for fire dampers for dynamic systems, corridor dampers, and for combination fire and smoke dampers shall be 2000 fpm (10.2 m/s) and 4 inches of water (1.0 kPa). Airflow and pressure ratings higher than the minimum are established in increments of 1000 fpm (5.1 m/s) and in increments of 2 inches of water (0.5 kPa).

Revised 14.1.4 effective May 4, 2012

14.1.5 The airflow and closure pressure rating for combination fire and smoke dampers and corridor dampers shall be the same as the airflow and closure pressure rating determined by the Operation Test in the Standard for Smoke Dampers, UL 555S.

Revised 14.1.5 effective May 4, 2012

14.1.6 For fire dampers equipped with primary and secondary heat responsive devices, the heated airflow test is to be first conducted to determine closure of the fire damper with the primary heat responsive device. Once the fire damper has closed due to activation of the primary heat responsive device, the heat source is to be shut down and the fire damper opened with the fire damper actuator. The heat source is then to be reestablished and the secondary heat responsive device shall close the fire damper. The fire damper actuator shall be inoperable after activation of the secondary heat responsive device.

14.1.7 Fire dampers that are to be qualified at sizes exceeding their single section maximum shall be evaluated via one of the four following methods:

Option 1 – Conduct dynamic closure testing as described in Section 14.2 on the full scale multiple section assembly.

Option 2 – Conduct dynamic closure test as described in Section 14.2 on a single section at twice the rated velocity plus 400 fpm (2.0 m/s) for a two section damper, three times the rated velocity plus 400 fpm (2.0 m/s) for a three section damper and so forth. For example, to achieve a rated velocity of 2,000 fpm and 4 inches of water for a two section damper assembly, a single damper section shall be tested at 4,400 fpm and 4.5 inches of water.

Option 3 – Conduct dynamic closure testing on a single section of the multiple section assembly as described in Section 14.2 at the minimum test airflow and pressure corresponding to the desired rated airflow and pressure of the multiple section assembly (reference Table 14.1). This method is only applicable for controlled closure type multiple section dampers employing a single temperature response device and which are either driven by a common drive mechanism, such as a jackshaft, or have demonstrated that the assembly closes in unison.

Option 4 – Conduct dynamic closure testing as described in Section 14.3, Velocity Profile Testing for Multiple Section Assembly. This method is applicable only when it cannot be determined that all of the damper sections close in unison.

14.1.7 revised September 22, 2011

14.2 Method

14.2.1 A representative fire damper sample shall be mounted, as intended, inside the duct of the test chamber.

14.2.2 Fire dampers provided with an electric actuator are to be connected to the appropriate power supply. The test voltage is to be the minimum specified on the electric motor actuator. Fire dampers provided with a pneumatic actuator are to be connected to the appropriate air supply line. The supply line pressure is to be at the minimum pressure specified on the actuator manufacturer's pneumatic device.

14.2.3 All airflow measurements are to be taken at ambient conditions and the tests are to be conducted at an ambient temperature between 50°F (10°C) and 104°F (40°C) prior to introduction of heat into the system.

14.2.4 The fire dampers are to be tested to the in-duct procedure, using the airflow measuring equipment, instruments, apparatus, and setups specified in the Air Movement and Control Association, Inc. (AMCA) Laboratory Methods of Testing Dampers for Rating, AMCA 500-D.

14.2.5 The airflow generating equipment is to be capable of producing the prescribed airflow and pressure conditions without the use of pressure relief devices.

14.2.6 With the fire damper in the open position, the airflow velocity is to be established at the rate indicated in Table 14.1. The fire damper is to be closed three times under the airflow and pressure conditions indicated in Table 14.1 at ambient temperature prior to the conduct of the dynamic closure test.

14.2.7 Fire dampers are not prohibited from being manually released for this ambient airflow preconditioning test. After closing the airflow is to be shut down and the fire damper reopened. With the fire damper in the open position, the airflow is to be reestablished. This sequence is to be conducted for three successive closures.

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Table 14.1
Test airflow and pressure conditions

Rated airflow and pressure		Minimum test airflow and pressure	
Airflow, fpm (m/s)	Pressure, inches of water (kPa)	Airflow, fpm (m/s)	Pressure, inches of water (kPa)
2000 (10.2)	4 (1.0)	2400 (12.2)	4.5 (1.12)
3000 (15.2)	4 (1.0)	3400 (17.3)	4.5 (1.12)
4000 (20.3)	4 (1.0)	4400 (22.3)	4.5 (1.12)
2000 (10.2)	6 (1.5)	2400 (12.2)	6.5 (1.62)
3000 (15.2)	6 (1.5)	3400 (17.3)	6.5 (1.62)
4000 (20.3)	6 (1.5)	4400 (22.3)	6.5 (1.62)
2000 (10.2)	8 (2.0)	2400 (12.2)	8.5 (2.12)
3000 (15.2)	8 (2.0)	3400 (17.3)	8.5 (2.12)
4000 (20.3)	8 (2.0)	4400 (22.3)	8.5 (2.12)

14.2.8 For airflow and pressure ratings higher than those indicated in Table 14.1, the test airflow is to be 400 fpm (2.0 m/s) higher than the rated airflow and the test pressure is to be 0.5 inches of water (0.12 kPa) higher than the rated pressure.

14.2.9 The test apparatus for the generation of airflow and heat is to be of open loop construction. It is anticipated that a natural gas flame is to be used as the heat source; or another heat source corrected such that the total mass flow rate across the fire damper is equivalent to that which occurs using a natural gas flame as the heat source.

14.2.10 Fire dampers equipped with a mechanical actuator are to be closed by the appropriate action of the mechanical actuator.

14.2.11 After the conduct of the three closing cycles at ambient temperature, the test damper is to be returned to the open position and the ambient temperature airflow through the open fire damper is to be reestablished. Heat is to then be introduced to the system at an average temperature rise rate of 30 to 50°F (17 to 28°C) per minute until the heat responsive device activates. The temperature is to be recorded at least as frequently as every 10 s from the time heat is introduced into the system until the heat responsive device activates.

14.2.12 The measured temperature is to be the average temperature obtained from the readings of not less than nine 0.04 to 0.06 in (1.0 to 1.6 mm) outside diameter sheathed-junction thermocouples symmetrically disposed and distributed. The distance of the thermocouple junctions from the damper blades, as measured with the damper in the closed position, is to not be greater than 12 in (305 mm) upstream from damper.

14.3 Velocity profile testing for multiple section assembly

14.3 revised November 5, 2013

14.3.1 General

14.3.1.1 As an alternative to dynamic testing of a multiple section damper assembly, the velocity profile method is permitted to be used to establish a multiple assembly rating. The velocity profile method allows for a single section damper to be tested at a velocity that has been adjusted by a velocity factor. A single section velocity factor shall be determined by using one of the two methods listed in Sections 14.3.2 and 14.3.3 below. Dynamic closure testing can then be performed at the required velocity on a single section damper as described in Section 14.2.

14.3.1.2 Conduct the dynamic closure testing as described in Section 14.2 on a single section damper of the same construction as tested, setting the system air flow to the value recorded in 14.3.2.3 or 14.3.3.5.

Note: The profile for a four section damper does not cover a multiple assembly of a smaller number of sections. The profile of a three section damper can yield a higher velocity than that of the four section damper. The closing sequence that yields the highest velocity shall be used to conduct the dynamic closure test.

14.3.2 Velocity profile method 1

14.3.2.1 Place the maximum desired size multiple section damper assembly on the outlet of an air flow measuring chamber. Reference AMCA 500D, Figure 5.5.

14.3.2.2 With all sections of the damper open, establish the appropriate test air flow through the damper as stated in Table 14.1 for the desired rating of the multiple section assembly. The system pressure with the damper sections fully closed is also to be established as stated in Table 14.1. For example, if the rated velocity and static pressure desired is 2,000 fpm at 4 inches of water, then the test airflow is 2,400 fpm and the static pressure shall be 4.5 inches of water.

14.3.2.3 Once the airflow parameters are established, close the damper sections one at a time and record the velocity through the remaining open sections. Continue this process until there is a single section that remains open. Record the velocity through the final section. The maximum measured airflow velocity as the sections are closed shall be recorded.

14.3.2.4 With the system running, release the final damper section in a manner that mimics closure by the heat responsive device intended for use with this damper and assure that the multiple section assembly closes and latches in a manner consistent with its original design.

14.3.3 Velocity profile method 2

14.3.3.1 Conduct a pressure drop test per AMCA 500D, Figure 5.5 on a single damper section of the maximum size multiple section damper assembly that is to be evaluated. Determine the pressure drop coefficient (C_o) for the damper section:

$$C_o = \Delta P / (V/4005)^2 \text{ IP-Units}$$

$$(C_o = \Delta P / (V^2)) \text{ SI-Units}$$

Where:

ΔP is the pressure drop across the damper section.

V is the face area velocity going through the damper.

The pressure drop coefficient shall be based on the average pressure drop coefficient measured at 1,000 fpm (5.1 m/s), 1,500 fpm (7.65 m/s), and 2,000 fpm (10.2 m/s).

14.3.3.2 Using a variable position orifice, such as a round damper, conduct a pressure drop test per AMCA 500D, Figure 5.5. Adjust the position of the variable orifice such that its average pressure drop coefficient when tested at 1,000 fpm (5.1 m/s), 1,500 fpm (7.65 m/s), and 2,000 fpm (10.2 m/s), meets the following criteria:

a) The variable orifice pressure drop coefficient shall not exceed the pressure drop coefficient of the single section damper determined in Section 14.3.3.1.

b) The variable orifice pressure drop coefficient shall not be more than 5% below the pressure drop coefficient of the single section damper determined in Section 14.3.3.1.

14.3.3.3 Place the number of variable position orifices corresponding to the number of damper sections in the multiple section damper assembly being evaluated on the outlet of an air flow measuring chamber. Reference AMCA 500D, Figure 5.5. Each variable orifice shall be individually tested to confirm compliance with the criteria described in section 14.3.3.2.

14.3.3.4 With each of the variable orifices set to the position determined in Section 14.3.3.2, establish the appropriate test air velocity through the orifices as stated in Table 14.1 for the desired rating of the multiple section damper assembly. The system pressure with the orifices fully closed is also to be established as stated in Table 14.1. For example, if the rated velocity and static pressure desired is 2,000 fpm at 4 inches of water, then the test airflow is 2,400 fpm and the static pressure shall be 4.5 inches of water.

14.3.3.5 Once the airflow parameters are established, close the orifices one at a time and record the velocity through the remaining open orifices. Continue this process until there is a single orifice remaining open. Record the velocity through the final orifice. The maximum measured airflow velocity as the orifices are closed shall be used in Section 14.3.1.2.

14.3.3.6 When using velocity determination method 2, the following test shall be conducted to evaluate the strength of the frames of the individual sections of the multiple section damper assembly.

a) The full multiple section damper assembly being evaluated shall be mounted on an air chamber in AMCA 500D, Figure 5.4 or 5.5. The individual sections of the multiple assembly shall be fastened together using the same fastening schedule used during the fire endurance and hose stream test.

b) With each section of the multiple assembly in the closed position pressurize the assembly to the minimum test pressure corresponding to the desired rated pressure of the multiple assembly as listed in Table 14.1.

c) The test shall not result in the failure of any fasteners or the development of any clearances or through openings that exceed the limits established in Section 10.1.3.1. The multiple section damper assembly shall be evaluated in both directions of airflow.

15 Duct Impact Test

15.1 A fire damper or fire damper/sleeve assembly intended to be installed within the fire barrier when the blades are closed (see 6.1) and with the sleeve of a thickness less than specified in 6.5 and that is intended for connection to a duct using a breakaway joint of a type not illustrated in Figure 6.1 is to be subjected to this test.

Revised 15.1 effective July 26, 2011

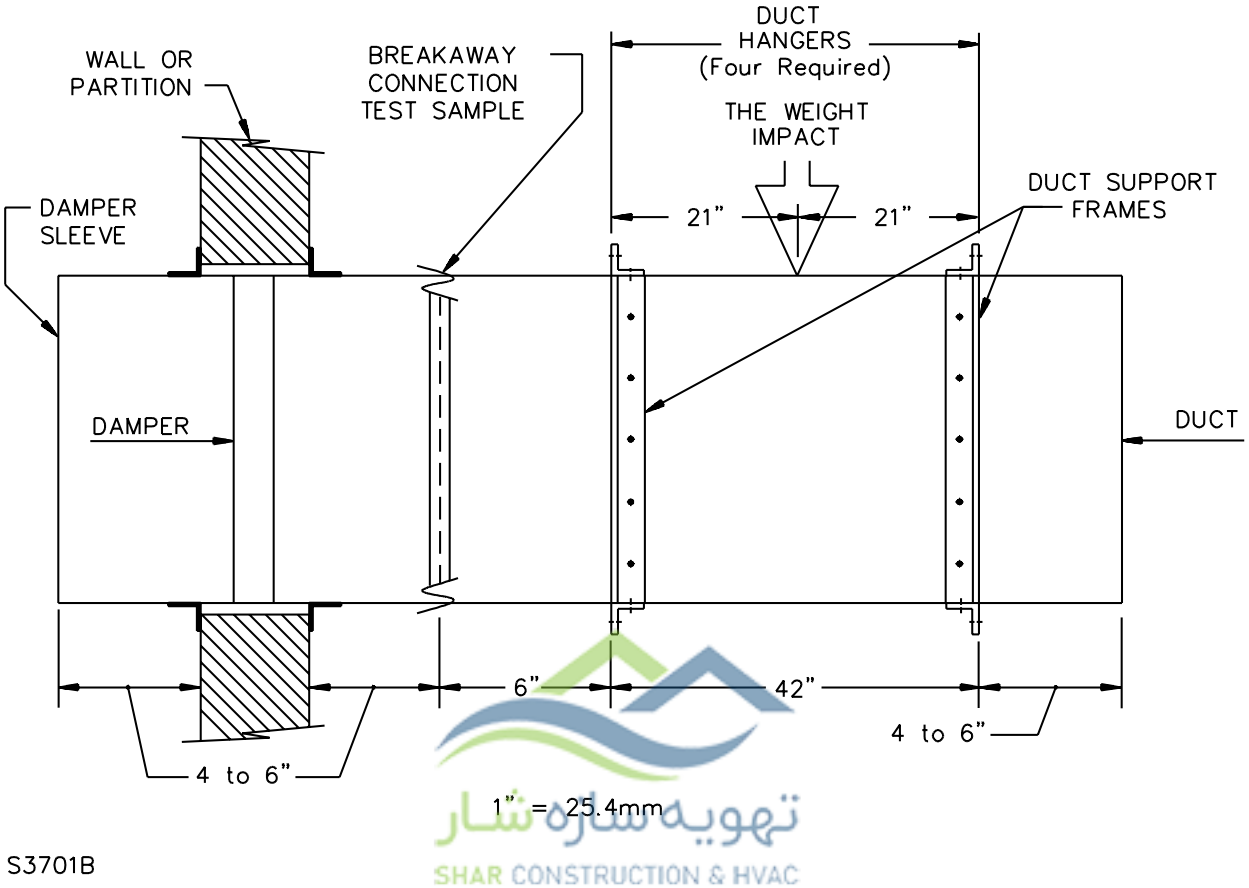
15.1.1 Vertical fire damper assemblies outside wall plane when blades are closed are to be tested per the Duct Impact Test , Section 15:

a) The maximum size damper to successfully pass 10.2.3 and 10.2.5 is installed in the thinnest gauge sleeve classified and installed per the manufacturers installation instructions, then attached to a duct with a standing “S” slip connection of the same gauge.

b) The maximum size damper to successfully pass 10.2.3 and 10.2.5 is installed in the thickest gauge sleeve classified and installed per the manufacturers installation instructions, then attached to a duct with a standing “S” slip connection of the same gauge.

Added 15.1.1 effective July 26, 2011

Figure 15.1
Duct impact test setup



Duct Support Frame – 1-1/2 by 1-1/2 by 1/8-in steel angles; joined at corners with 1/4-20 steel bolt and nut; attached to duct with 1/4-20 bolts and nuts, 12 in maximum on center 3 in maximum from duct corners.

Duct Hanger – 1-in wide, 20 gauge steel; attached with one 1/4-20 bolt and nut at top and bottom.

Duct – Constructed of the same gauge materials as the fire damper sleeve; provided with Pittsburgh lock-type or continuously welded longitudinal seam.

15.2 After duct impact as specified in this test, representative samples of a fire damper assembly shall remain within a wall or partition, as intended, and shall completely close and open during each of three closing and opening cycles. Also, movement or twisting of any part of the fire damper assembly during the test shall not result in the development of any visible through openings in or around the fire damper assembly. See 4.2 – 4.4.

15.3 A test fire damper assembly is to be installed in a wall or partition in accordance with the manufacturer's installation and operating instructions. The fire damper or fire damper/sleeve assembly is to be connected to a duct section using the breakaway joint(s) to be tested. See Figure 15.1.

15.4 The test fire damper is to be cycled three times to ensure that it operates as intended prior to the test and then set in the full open position. A 55 gallon (0.21 m^3) drum is to be filled with:

a) 275 lbm (125 Kg) of sand for fire dampers sized 24 by 24 in (610 by 610 mm) or less or having a diameter of 24 in or less, and

b) 400 lbm (181 Kg) of sand for larger fire dampers.

15.5 The filled drum is to be raised to a height of 10 ft (3.04 m) over the top of the duct and centered over the duct section as shown in Figure 15.1. The filled drum is then to free-fall onto the duct, to simulate debris falling in a building fire.

15.6 Following the weight drop, the fire damper is to be checked for compliance with 15.2.

16 Hydrostatic Strength Test for Pneumatic Actuators

16.1 When tested as described in 16.2 the sample shall withstand the test pressure for 1 min without leakage or rupture.

Exception: Leakage at a gasket or fitting during the hydrostatic pressure test shall not occur unless it occurs at a pressure more than 50% of the required test pressure.

16.2 A pneumatic actuator is to be subjected to a hydrostatic test at a pressure 5 times its maximum rated pressure. The sample is to be filled with water to exclude air and is to be connected to a hydraulic pump. The pressure is to be raised gradually to the required test pressure.

MARKING

17 General

17.1 Each fire damper shall be legibly marked with:

a) The manufacturer's name, trade name, trademark or other descriptive marking by which the organization responsible for the fire damper is identified;

Exception: The manufacturer's identification is capable of being in a traceable code when the fire damper is identified by the brand or trademark owned by a private labeler.

b) A distinctive (catalog or model) number or the equivalent; and

c) The date or other dating period of manufacture not exceeding any three consecutive months.

Exception: The date of manufacture is capable of being abbreviated; or in a nationally accepted conventional code or in a code affirmed by the manufacturer when the code or abbreviation:

a) Does not repeat in less than 20 years, and

b) Does not require reference to the production records of the manufacturer to determine when the product was manufactured.

17.2 Each fire damper or each factory assembled multiple fire damper assembly shall be marked with:

a) The words ″Fire Damper for Static Systems″, ″Fire Damper for Dynamic Systems″, ″Combination Fire and Smoke Damper″, or ″Corridor Damper″ as appropriate;

b) The hourly fire resistance rating established on the basis of the fire test specified in Fire Endurance and Hose Stream Test, Section 10;

c) For a fire damper for dynamic systems, for a combination fire and smoke damper and a corridor damper, the airflow and closure pressure rating as established by the Dynamic Closure Test, Section 14;

d) The intended mounting position (vertical, horizontal, or both);

e) The top or bottom of the fire damper, or both;

f) The statement ″See (manufacturer's or private labeler's name) Installation and Operating Instructions for this model″; and

g) Fire damper actuators shall be marked with their electrical ratings, when electrical, or the maximum and minimum pressure ratings, when pneumatic, as specified by the manufacturer of the actuator.

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17.3 All labels shall be located on an internal surface of the fire damper.

17.4 When a manufacturer produces fire dampers at more than one factory, each fire damper shall have a distinctive marking to identify it as the product of a particular factory.

INSTALLATION AND OPERATING INSTRUCTIONS

18 General

18.1 A copy of the installation and operating instructions shall be used as a reference in the examination and test of the fire damper. For this purpose, a final printed copy is not required.

18.2 Each shipping container that contains a fire damper(s) shall be provided with legible instructions pertaining to the installation and operation of the fire damper. Illustrations are used with the required instructions to clarify the intent. Fire dampers shipped in a common container are required to be provided with one copy of the installation and operating instructions only.

18.3 The instructions shall specify:

a) The type of wall or partition (masonry or gypsum wallboard) or floor, as applicable;

b) The clearances required for expansion of the fire damper, as applicable;

c) The type and thickness of the sleeve material when the sleeve is field assembled;

d) The type and size of fasteners and the spacing of the fasteners used in attaching the fire damper frame to the sleeve (when a sleeve is to be used and is to be field supplied), and perimeter mounting angles to the fire damper frame or the sleeve;

e) The length of the sleeve or frame extending beyond the wall or floor opening (see 6.2);

f) The type of material, size, thickness, and minimum wall/floor overlap of the perimeter mounting angles, and whether or not they are to be welded (or fastened using other means) to each other at the corners;

g) That the connecting ducts shall not be continuous, and shall terminate at the sleeve or frame;

h) The type of duct-sleeve connections (see Figure 6.1 and Duct Impact Test, Section 15) when sleeve of thickness less than No. 16 or 14 gauge steel is used (see 6.5);

i) Information on connecting the actuator to the power (electric or pneumatic) supply; and

j) Any other specific features required for the installation and operation.

18.4 For multiple assembly of the fire dampers, the instructions shall also specify:

a) The method of attaching individual sections together;

b) When any mullions are required, their materials, sizes, locations, and the method of attaching them to the fire dampers;

c) The maximum size of the multiple fire dampers assembly that is assembled; and

d) The maximum size of the individual sections that are attached together. For fire dampers to be used in dynamic systems, all sizes of individual sections that are attached together.

18.5 Instructions for mounting and joining with the duct shall be included and shall be in accordance with the Standard for the Installation of Air-Conditioning and Ventilating Systems, NFPA 90A.

18.6 When the sleeves are field supplied, the instructions shall require the use of wall sleeves (vertically mounted fire dampers) or floor sleeves (horizontally mounted fire dampers) with perimeter mounting angles attached to the sleeve on both sides of the wall or floor openings. Mounting angles are field supplied.

Exception No. 1: The manufacturer's installation instructions covering a fire damper having a frame wide enough for direct attachment of perimeter mounting angles on each side of a wall or floor opening are not required to indicate the use of sleeves when the thickness of the fire damper frame complies with the requirements for sleeves. See 6.5.

Exception No. 2: Perimeter mounting angles are not required to be attached to the sleeve on both sides of the wall or floor openings when other specific tested variations demonstrate equivalent structural integrity.

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APPENDIX A

Standards for Components

Standards under which components of the products covered by this standard are evaluated include the following:

Title of Standard − UL Standard Designation

Controls for Household and Similar Use, Part 1: General Requirements, Automatic Electrical – UL 60730-1
Controls for Household and Similar Use, Part 2: Particular Requirements for Electric Actuators, Automatic Electrical – UL 60730-2-14
Door, Drapery, Gate, Louver, and Window Operators and Systems – UL 325
Heat Responsive Links for Fire-Protection Service – UL 33
Organic Coatings for Steel Enclosures for Outdoor Use Electrical Equipment – UL 1332
Rotating Electrical Machines – General Requirements – UL 1004-1
Temperature-Indicating and -Regulating Equipment – UL 873[1)]
Test for Surface Burning Characteristics of Building Materials – UL 723

[1)] Note: Compliance with the UL 60730-1, and/or the applicable Part 2 standard from the UL 60730 series fulfills these requirements.

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APPENDIX B

Standard Time-Temperature Curve for Control of Fire Tests

Time, hr: min	Temperature, °F	Area above 68°F base		Temperature, °C	Area above 20°C base	
		°F, min	°F, hr		°C, min	°C, hr
0:00	68	00	0	20	00	0
0:05	1000	2330	39	538	1290	22
0:10	1300	7740	129	704	4300	72
0:15	1399	14150	236	760	7860	131
0:20	1462	20970	350	795	11650	194
0:25	1510	28050	468	821	15590	260
0:30	1550	35360	589	843	19650	328
0:35	1584	42860	714	862	23810	397
0:40	1613	50510	842	878	28060	468
0:45	1638	58300	971	892	32390	540
0:50	1661	66200	1103	905	36780	613
0:55	1681	74220	1237	916	41230	687
1:00	1700	82330	1372	927	45740	762
1:05	1718	90540	1509	937	50300	838
1:10	1735	98830	1647	946	54910	915
1:15	1750	107200	1787	955	59560	993
1:20	1765	115650	1928	963	64250	1071
1:25	1779	124180	2070	971	68990	1150
1:30	1792	132760	2213	978	73760	1229
1:35	1804	141420	2357	985	78560	1309
1:40	1815	150120	2502	991	83400	1390
1:45	1826	158890	2648	996	88280	1471
1:50	1835	167700	2795	1001	93170	1553
1:55	1843	176550	2942	1006	98080	1635
2:00	1850	185440	3091	1010	103020	1717
2:10	1862	203330	3389	1017	112960	1882
2:20	1875	221330	3689	1024	122960	2049
2:30	1888	239470	3991	1031	133040	2217
2:40	1900	257720	4295	1038	143180	2386
2:50	1912	276110	4602	1045	153390	2556
3:00	1925	294610	4910	1052	163670	2728
3:10	1938	313250	5221	1059	174030	2900
3:20	1950	332000	5533	1066	184450	3074
3:30	1962	350890	5848	1072	194940	3249
3:40	1975	369890	6165	1079	205500	3425
3:50	1988	389030	6484	1086	216130	3602
4:00	2000	408280	6805	1093	226820	3780
4:10	2012	427670	7128	1100	237590	3960
4:20	2025	447180	7453	1107	248430	4140
4:30	2038	466810	7780	1114	259340	4322
4:40	2050	486560	8110	1121	270310	4505
4:50	2062	506450	8441	1128	281360	4689
5:00	2075	526450	8774	1135	292470	4874
5:10	2088	546580	9110	1142	303660	5061

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Table Continued

Time, hr: min	Temperature, °F	Area above 68°F base		Temperature, °C	Area above 20°C base	
		°F, min	°F, hr		°C, min	°C, hr
5:20	2100	566840	9447	1149	314910	5248
5:30	2112	587220	9787	1156	326240	5437
5:40	2125	607730	10129	1163	337630	5627
5:50	2138	628360	10473	1170	349090	5818
6:00	2150	649120	10819	1177	360620	6010
6:10	2162	670000	11167	1184	372230	6204
6:20	2175	691010	11517	1191	383900	6398
6:30	2188	712140	11869	1198	395640	6594
6:40	2200	733400	12223	1204	407450	6791
6:50	2212	754780	12580	1211	419330	6989
7:00	2225	776290	12938	1218	431270	7188
7:10	2238	797920	13299	1225	443290	7388
7:20	2250	819680	13661	1232	455380	7590
7:30	2262	841560	14026	1239	467540	7792
7:40	2275	863570	14393	1246	479760	7996
7:50	2288	885700	14762	1253	492060	8201
8:00	2300	907960	15133	1260	504420	8407