UL 103

STANDARD FOR SAFETY

Factory-Built Chimneys for Residential Type and Building Heating Appliances

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UL Standard for Safety for Factory-Built Chimneys for Residential Type and Building Heating Appliances, UL 103

Eleventh Edition, Dated October 15, 2010

Summary of Topics

This revision of ANSI/UL 103 dated September 24, 2021 is being issued to update the title page to reflect the most recent designation as a Reaffirmed American National Standard (ANS). No technical changes have been made.

Text that has been changed in any manner or impacted by UL's electronic publishing system is marked with a vertical line in the margin.

The requirements are substantially in accordance with Proposal(s) on this subject dated July 9, 2021.

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The most recent designation of ANSI/UL 103 as a Reaffirmed American National Standard (ANS) occurred on September 24, 2021. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, and Title Page.

The Department of Defense (DoD) has adopted UL 103 on September 16, 1991. 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 https://csds.ul.com.

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Documents
Document Sharing Hub

Full document details: UL 103 2021

CONTENTS

INTRODUCTION

1 Scope 5
2 Components 5
3 Units of Measurement 5
4 Undated References 5
5 Glossary 6

CONSTRUCTION

6 Materials 6
7 Assembly 8
8 Chimney Caps 9
9 Firestop-Spacers 9
10 Joints 10
11 Radiation Shields 11
12 Roof Assemblies 11
13 Roof Jacks 12
14 Support Assembly 13
15 Openings in Chimney Walls 13

PERFORMANCE

16 General 13
17 Test Installations 14
17.1 General 14
17.2 Enclosed chimney installations (residential type and building heating appliance chimney) 15
17.3 Unenclosed chimney installations (building heating appliance type chimney only) 29
18 Temperature Measurement 33
19 Thermal Shock Test 39
20 Temperature Test – 1000°F (538°C) Flue Gases 40
21 Temperature Test – 1400°F (760°C) Flue Gases 41
22 Temperature Test – 1700°F (927°C) Flue Gases 41
23 Temperature Test – 2100°F (1149°C) Flue Gases 41
24 Positive Pressure Applications Test 42
25 Draft Test 43
26 Vertical Support Test 43
27 Strength Test 43
27.1 General 43
27.2 Impact test 44
27.3 Longitudinal force test 46
27.4 Load test for chimney elbows 46
27.5 Chimney joint load test 47
27.6 Chimney joint torsion test 48
28 Wind Load Test 48
28.1 General 48
28.2 Roof assemblies 48
28.3 Lateral supports 49
29 Attic Insulation Shield Ventilation Opening Test 51
30 Rain Test 51
31 Crushing Test of Nonmetallic Flue-Gas Conduit 54
32 Resistance to Action of Acids Test of Nonmetallic Flue-Gas Conduit 54

AVA Documents
Document Sharing Hub
Full document details: UL 103 2021

33 Freezing and Thawing Test of Water-Absorptive Nonmetallic Materials....55
34 Cemented Joint Test of Flue-Gas Conduit 55
35 Sulfuric Acid Extraction Test for Porcelain-Coated Steel Used for Flue-Gas Conduit 56

MARKINGS

36 Marking 57

INSTRUCTIONS

37 Installation and Maintenance Instructions 58

Documents
Document Sharing Hub
Full document details: UL 103 2021

INTRODUCTION

1 Scope

1.1 These requirements cover factory-built chimneys intended for venting gas, liquid, and solid-fuel fired residential-type appliances and building heating appliances in which the maximum continuous flue-gas outlet temperatures do not exceed 1000°F (538°C). Factory-built chimneys are intended for installation in accordance with the Standard for Chimneys, Fireplaces, Vents, and Solid-Fuel Burning Appliances, NFPA 211, and in accordance with codes such as the International Mechanical Code, the International Residential Code, and the Uniform Mechanical Code. They are intended for installation inside or outside of buildings or both, in a manner that provides a vertical (30 degree maximum offset) conduit or passageway to transport flue gases to the outside.

1.2 The chimneys covered by these requirements comply with either a limited duration 1700°F (927°C) flue-gas temperature test or a limited duration 2100°F (1149°C) flue-gas temperature test, at the manufacturer's option.

1.3 These requirements cover dual purpose residential type and building heating appliance type chimneys, and single purpose building heating appliance type chimneys. Dual purpose residential type and building heating appliance type chimneys are tested enclosed and intended to be installed unenclosed or enclosed with combustible construction. Single purpose building heating appliance type chimneys are tested unenclosed and intended to be installed unenclosed or enclosed in a noncombustible chase.

2 Components

2.1 Except as indicated in 2.2, a component of a product covered by this standard shall comply with the requirements for that component.

2.2 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.

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

2.4 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.

3 Units of Measurement

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

4 Undated References

4.1 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.

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Full document details: UL 103 2021

5 Glossary

5.1 For the purpose of this standard, the following definitions apply.

5.2 COMBUSTIBLE MATERIAL, NONCOMBUSTIBLE MATERIAL – As used in these requirements, these terms are defined in the Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances, NFPA 211.

CONSTRUCTION

6 Materials

6.1 A chimney part shall be made of noncombustible corrosion-resistant materials. Metals shall not be used in combinations at any location within the assembly that causes galvanic action.

6.2 The minimum thickness of sheet metal including any coatings and of other materials shall comply with Table 6.1.

6.3 A flue-gas conveying conduit of a chimney shall be of stainless steel, porcelain-coated steel or cast or fired refractory of the minimum thickness specified in Table 6.1. Porcelain-coated steel and cast or fired refractory shall comply with the requirements of the applicable tests described in Sections 31 – 35.

6.4 An unreinforced outer casing of a chimney shall be of galvanized steel, aluminum-coated steel, Series 300 or 400 stainless steel, or equivalent material. Minimum thickness of these materials shall be as specified in Table 6.1.

6.5 An outer casing reinforced by solid refractory not less than 2 inches (50.8 mm) thick shall be of galvanized steel, aluminum-coated steel, stainless steel or equivalent material. Minimum thickness of these materials shall be as specified in Table 6.1.

6.6 Parts of a chimney subject to contact by flue gases or flue-gas air mixtures at or beyond the terminus of the flue-gas conveying conduit shall be of a material equivalent to the flue-gas conveying conduit. See 6.3.

6.7 An outer casing or other structural part shall be of stainless steel, galvanized steel, or aluminum-coated steel when the part:

a) Is such that deterioration or corrosion of the part causes the chimney system to collapse or otherwise increase the risk of injury to persons;

b) Adjoins firestopping material; or

c) Is subject to condensation.

Galvanized steel or aluminum-coated steel shall comply with the requirements of 6.8. Stainless steel shall comply with Table 6.1.

Exception No. 1: This requirement does not apply to the flue-gas conveying conduit. See 6.3.

Exception No. 2: This requirement does not apply to parts subject to contact by flue-gas or flue-gas air mixtures at or beyond the terminus of the flue-gas conveying conduit. See 6.6.

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Full document details: UL 103 2021

Table 6.1
Minimum thickness of chimney material

Type of material	Use of material	Paragraph reference	Equivalent nominal inside diameter of chimney					
			12 or less inches (305 or less mm)		Over 12 to 24 inches (over 305 to 610 mm)		Over 24 to 36 inches (over 610 to 914 mm)	
			Minimum material thickness					
			Inch	(mm)	Inch	(mm)	Inch	(mm)
Stainless steel – Series 300 or 400 or equivalent	Flue-gas conduit of chimneys evaluated to 1700°F; other parts exposed to flue gases or subject to condensation	6.3, 6.6	0.012[a]	(0.30)	0.016	(0.41)	0.020	(0.51)
Stainless steel – Series 300 or 400 or equivalent	Flue-gas conduit of chimneys evaluated to 2100°F	6.3	0.015	(0.33)	0.016	(0.41)	0.020	(0.51)
Stainless steel – Series 300 or 400 or equivalent	Outer casing, unreinforced	6.4	0.012	(0.30)	0.016	(0.41)	0.026	(0.66)
	Outer casing, reinforced	6.5	0.012	(0.30)	0.012	(0.30)	0.012	(0.30)
	Component or subassembly	6.9	0.012	(0.30)	0.012	(0.30)	0.012	(0.30)
Galvanized steel, G-90 coating designation or aluminum-coated steel – Type T1-40	Outer casing, unreinforced	6.4, 6.7	0.018	(0.46)	0.023	(0.58)	0.034	(0.86)
	Outer casing, reinforced	6.5	0.018	(0.46)	0.018	(0.46)	0.018	(0.46)
	Component or subassembly	6.9	0.018	(0.46)	0.023	(0.58)	0.034	(0.86)
Aluminum alloys or painted steel	Component or subassembly	6.9	0.016	(0.41)	0.016	(0.41)	0.016	(0.41)
Steel, painted	Outer casings or structural part	6.10	0.053	(1.35)	0.053	(1.35)	0.053	(1.35)
Porcelain-coated steel-base metal	Flue-gas conduit of chimneys evaluated to 1700°F	6.3	0.026	(0.66)	0.032	(0.81)	0.032	(0.81)
Cast iron	Outer casing or structural part	6.10	0.125	(3.18)	0.125	(3.18)	0.125	(3.18)
Cast or fired refractory, clay tile	Flue-gas conduit	6.3	0.40	(10.2)	0.65	(16.5)	1.00	(25.4)

[a] Flue-gas conduit employed for tee sections shall be of 0.015 inch (0.38 mm) minimum thickness.

6.8 Galvanized steel used for outer casings, structural parts, firestopping or other components or subassemblies shall have a zinc-coating complying with the coating designation G90 (former coating class 1.25 commercial) in the Weight (Mass) of Coating Requirements table of 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 percent of the zinc on any side, based on the minimum single spot test in the ASTM designation. The weight of zinc coating shall be established in accordance with the Standard Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings, ASTM A90. Aluminum-coated steel shall be of Type T1-40 (regular) [0.40 ounce per square foot (0.12 kg/m^2)].

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6.9 Components of a chimney, or subassemblies, which are not required to conform to the requirements for flue-gas conduits or outer casings, shall be of materials and thicknesses as specified in Table 6.1, or the equivalent.

6.10 A painted part made of steel not less than 0.053 inch (1.35 mm) thick, or of cast iron not less than 0.125 inch (3.18 mm) thick, and for use only in the interior of buildings, is determined as having corrosion resistance equivalent to that required by 6.8. Paint coatings shall remain intact at the maximum temperatures obtained on the part during the tests specified in these requirements.

6.11 Except for binder materials, thermal insulation material shall be noncombustible.

6.12 Thermal insulation shall not come into contact with the products of combustion.

6.13 Thermal insulation that is not self-supporting shall be applied to solid surfaces so that the insulation does not sag. An adhesive or cement used to attach such material shall retain its adhesive qualities at any temperature the adhesive attains when tested in accordance with these requirements and at 0°F (minus 18°C).

6.14 A water-absorbing insulating material shall not be subject to wetting by condensation or rain when installed as intended.

6.15 Asbestos material shall not be used.

7 Assembly

7.1 A chimney shall consist of all the essential parts required for the intended installation of a complete chimney assembly. Each part of the assembly shall be constructed for ready attachment of one to the other without requiring alteration by the installer, such as by cutting, threading, drilling, welding, or similar tasks.

Exception: An assembly or component part intended to be cut to length or to be fitted by the installer is provided when means are furnished for joining any altered part to a companion part or assembly. All fasteners required to complete the assembly shall be provided with the product by the manufacturer. Drilling shall not occur unless:

a) The drilling operation does not weaken the assembly or penetrate into the flue liner; and

b) The size of the required drill bit is specified and the instructions clearly describe the locations to be drilled, such as by the use of drawings, descriptions, or templates.

7.2 Two or more parts or subassemblies that bear a definite relationship to each other in the intended application shall:

a) Be arranged and constructed to permit them to be incorporated into the complete assembly without alteration or alignment and only in the correct relationship with each other; or

b) Be assembled and shipped from the factory as one unit.

7.3 Each part, such as a chimney-pipe section or length, cap, firestop-spacer, support element, roof assembly, or jack shall be completely assembled by the manufacturer at the factory.

7.4 To comply with the requirements of 7.3, a chimney-pipe section comprised of a flue-gas conveying conduit, formed insulation or other intermediate assembly, and an outer jacket, which are separable, shall be preassembled and packaged as one unit. A firestop-spacer assembly constructed in two halves shall

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be packaged as one unit. In such cases, each separable part shall be completely formed, including the joining of all seams.

7.5 After being installed in accordance with the manufacturer's instructions, a chimney shall be positioned securely and resistant to wind damage. See Vertical Support Test, Section 26; Strength Test, Section 27; and Wind Load Test, Section 28.

7.6 A chimney shall be capable of attachment to chimney connectors having diameters of integral inches.

7.7 The construction of a chimney shall not void the firestopping required between spaces of a building when the chimney is installed in accordance with the manufacturer's instructions.

7.8 When a chimney assembly incorporates elbows, no part of the chimney shall be at an angle of more than 30 degrees from the vertical at any point in the assembly, and the chimney shall not include more than two offsets (four elbows).

8 Chimney Caps

8.1 A cap shall be provided.

Exception: A chimney designated as a building heating appliance type only and that does not incorporate unprotected ventilation openings terminating exterior to the building is not required to be provided with a cap.

8.2 A cap shall resist the entrance of debris and rain into the flue gas conveying conduit and into any unprotected ventilation openings terminating exterior to the building. Protection devices intended to protect only ventilation air openings terminating exterior to the building shall resist the entrance of debris and rain into such ventilation openings. See Rain Test, Section 28.

8.3 A cap shall be constructed so that leaves and debris fallen or blown onto it are not retained so as to obstruct flue-gas or cooling-air passages. A cap shall be constructed to resist the accumulation of soot that will obstruct the flue-gas or cooling-air passages.

8.4 A cap shall be removable and replaceable by the use of simple hand tools (screwdriver, wrench, pliers, or similar tools) to allow for chimney cleaning in accordance with the installation and maintenance instructions without bending or deforming the chimney or parts thereof.

9 Firestop-Spacers

9.1 A chimney intended to pass through a floor or ceiling of a building shall be provided with an assembly constructed to provide firestopping at the framed joist opening and to establish and maintain required minimum clearances between chimney sections and combustible construction in this area. Spacers shall have the strength and bearing surface to maintain the required clearance from chimney sections to joists and ceiling and floor material.

9.2 A firestop shall provide complete firestopping when the assembly is installed in a framed joist opening that is 1/2 inch (13 mm) greater on each side than the opening for which the assembly is intended. A spacer shall provide for continuous interference around the perimeter of the construction for a height of not less than 1 inch (25 mm). The inside diameter of the firestop opening shall not be more than 1/8 inch (3.2 mm) greater than the outside diameter of the chimney pipe, including chimney joints and raised projections.

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9.3 An attic insulation shield shall be provided to restrict loose fill or other insulation from contacting the chimney section. The attic insulation shield assembly shall maintain an air space clearance not less than the air space clearance marked on the chimney sections. The vertical height of the shield above attic construction material shall be not less than 10 inches (254 mm). The spacer shall extend to the chimney above the 10 inches at an angle of not greater than 45 degrees from a vertical coinciding with the perimeter of the shield.

9.4 The attic insulation shield required by 9.3 shall be separate from the firestop-spacer when the shield is intended to be removed. Also, the removal of the shield, or any part of the shield, shall not affect the firestop-spacer assembly. When the shield is not intended to be removed, the attic insulation shield is integral with the firestop-spacer. The spacer assembly includes the attic insulation shield above the attic floor and the firestop-spacer below the attic joist.

9.5 An attic insulation shield shall be provided with a permanent marking, visible after installation, as specified in 36.3, when the shield is:

a) Intended for installation in an unoccupied attic space;

b) Specified in the installation instructions in accordance with 37.5 (t); and

c) Tested in accordance with the Exception to 17.2.9.

9.6 When openings for ventilation in an attic insulation shield intended for installation in an unoccupied attic space are provided, the openings shall not be located less than 10 inches (254 mm) above the attic construction material and shall be constructed to restrict:

a) Entrance of insulation into the area between the chimney and the shield; and

b) Accumulation of the insulation in or near the openings, as determined by the attic insulation ventilation opening test described in Section 29, Attic Insulation Shield Ventilation Opening Test.

10 Joints

10.1 Parts of a chimney shall be joined and secured so that they do not disengage when tested in accordance with these requirements.

10.2 When screws are employed to join assemblies during installation, the assemblies to be joined shall provide for use of screws without being punched or drilled, except as referenced in 7.1. When cement is employed for this purpose, the cement shall be a quick-setting type. Cement, screws, and instructions shall be furnished. A screw shall not extend into a flue-gas passage.

10.3 A joint shall not retain condensation nor permit condensation to flow from the interior to the exterior of the flue-gas conveying conduit.

10.4 A joint between sections of flue-gas conduit, fabricated in accordance with the manufacturer's instructions, shall not permit passage of a 1/32 inch (0.81 mm) diameter rod.

10.5 A joint shall not reduce the capacity of the chimney to the extent that it interferes with venting.

10.6 A chimney joint shall be constructed to resist the entrance of rain such that condensation does not flow from the exterior of a chimney section to the interior of a lower section.

10.7 A chimney intended for use in positive internal pressure applications shall be of a design such that the seal (resistance to leakage) is created at or between joints of the flue gas passageway. Supplemental

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sealing methods at the outer wall shall not be relied upon to comply with the Positive Pressure Applications Test, Section 24.

11 Radiation Shields

11.1 A radiation shield provided to comply with the maximum temperature limits of these requirements for floor or ceiling structures shall:

a) Be an integral part of a firestop-spacer or support assembly; and

b) Provide a continuous barrier for a vertical distance, referenced to the ceiling or floor level, of not less than 10 inches (254 mm).

11.2 The assembly described in 11.1 shall fit into a framed joist area not larger than the sum of:

a) 1/2 inch (12.7 mm) greater on each side than the outside diameter of the chimney; and

b) Twice the dimension specified in the installation instructions for clearance between chimney sections and combustible enclosures.

11.3 Parts of a firestop-spacer or support assembly that are not intended to provide shielding from radiation to combustible construction are not radiation shields.

11.4 A radiation shield provided to obtain compliance with the maximum temperature limits of these requirements for roof structures shall not be employed in a roof or other terminating assembly intended to be altered in the field when such alteration requires the shifting or relocation of the shield.

12 Roof Assemblies

12.1 The height of a roof assembly shall be such that the flue-gas exit is not less than 3 feet (0.9 m) above the highest point where the chimney passes through the roof.

12.2 A roof assembly installed in accordance with the installation instructions shall resist the entrance of excess water and debris into the building. See Rain Test, Section 30.

12.3 A roof assembly shall resist the accumulation of soot and debris therein when such accumulation obstructs flue-gas or cooling-air passages. See Sections 20 – 23.

12.4 A section of a roof assembly that gives access to the chimney flue shall be removable and replaceable by the use of simple hand tools (screwdriver, wrench, pliers, or similar tools) to allow for chimney cleaning in accordance with the maintenance instructions without bending or deforming of the chimney or roof assembly section.

12.5 A roof flashing assembly that provides for ventilation shall be constructed so that soot or debris does not accumulate on the assembly to the extent that ventilation openings intended to remain open are obstructed. (See also the requirements of 9.2 and 17.2.13, which apply to openings between the chimney and the flashing, and between the flashing and the test enclosure.) See Figure 12.1, which illustrates a typical roof flashing housing assembly. The ventilation shall be provided by one or more fixed openings surrounding the chimney and the assembly shall comply with all of the following:

a) The openings shall not permit entrance of a 1/4 inch (6.4 mm) diameter rod.

b) The lowest portion of the opening in the flashing shall not be less than 6 inches (152 mm) above the roof, measured perpendicular to the roof.

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c) The assembly shall incorporate a storm collar.

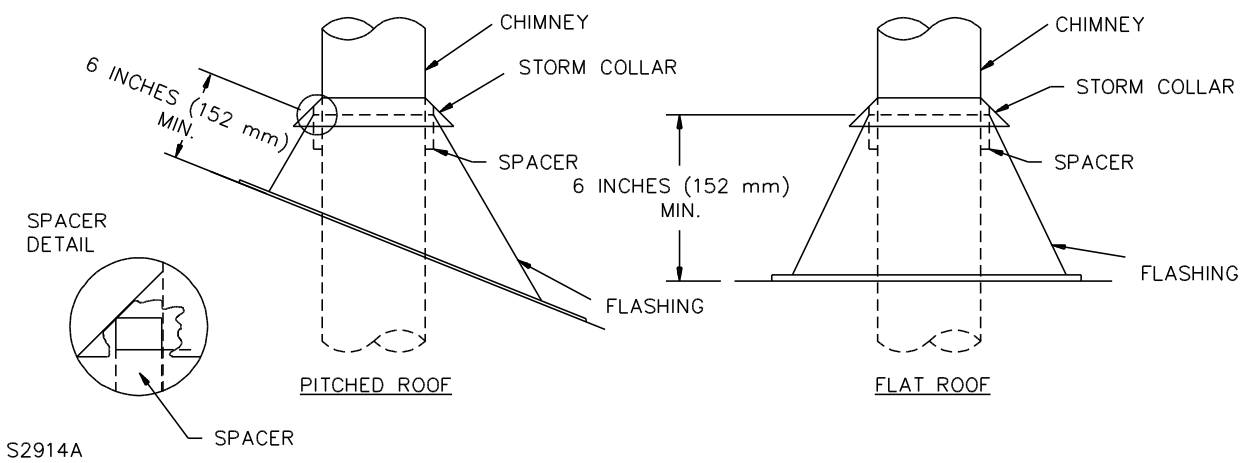
d) The intended openings shall be maintained by means of:

1) Spacers factory attached to the flashing; or

2) Designed openings in the assembly.

Figure 12.1

Typical roof flashing housing assembly



13 Roof Jacks

13.1 A roof jack constructed for placement in contact with combustible roof, rafter, insulation, and ceiling material shall provide a continuous surface or barrier for a vertical distance, measured from the roof line, of at least 6 inches (150 mm).

13.2 When installed in accordance with the manufacturer's instructions, a roof jack shall protect against the entrance of water and debris into the building where the chimney passes through the roof. See Rain Test, Section 30.

13.3 A roof jack shall be constructed so that soot or debris does not accumulate therein when such accumulation obstructs flue-gas or cooling-air passages.

13.4 A section of a roof jack that gives access to the chimney flue shall be removable and replaceable by the use of simple hand tools (screwdriver, wrench, pliers, or similar tools) to allow for chimney cleaning in accordance with the installation instructions without bending or deforming of the chimney or roof jack section.

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14 Support Assembly

14.1 A support assembly (such as a ceiling or floor support) shall establish and maintain the minimum required clearance between a chimney section and combustible construction. A support for installation in a joist area shall constitute a complete firestop when tested in accordance with these requirements.

14.2 A support assembly shall sustain a load equivalent to four times the weight imposed upon it by all chimney parts it is intended to support. See Vertical Support Test, Section 26.

14.3 A support assembly intended to be secured by nails or screws shall be arranged so that the load on such holding means is a shear load.

14.4 A chimney assembly intended for exterior installation shall be provided with support assemblies. See Sections 26, Vertical Support Test, and 28, Wind Load Test.

14.5 An offset chimney section shall be supported at or immediately above the vertical return elbow at the first floor or roof above the offset section.

14.6 An exterior support assembly shall be constructed to maintain specified clearances to adjacent combustible construction.

15 Openings in Chimney Walls

15.1 Openings for air flow provided in the chimney's walls shall not be located in the flue gas conduit wall. Such openings shall not impair the structural integrity of the chimney.

15.2 The openings for air flow specified in 15.1 shall be located within the chimney support assembly. Those openings made at chimney joints that are intended for fastening adjoining chimney sections together only are not air flow openings and are not required to be located within the chimney support assembly.

PERFORMANCE

16 General

16.1 When a chimney is tested in accordance with these requirements, specified temperatures on combustible construction shall be maintained.

16.2 After being subjected to the tests specified in Sections 19 – 23, as applicable, a chimney shall be capable of being used further.

16.3 Test results indicating compliance with the requirement of 16.2 include the following:

a) No part of the chimney has become damaged or permanently distorted to an extent that it or the chimney assembly does not continue to function as intended.

b) The effectiveness of any required protective coating or finish on metal parts has not been reduced.

c) A ceramic material shows no evidence of cracking, disintegration, or spalling to the extent that serviceability of any part of an assembly has been impaired.

d) Cracks are not observable in porcelain enamel used as a required protective coating when the surface is examined under a microscope of 60 magnification.

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e) The reflectivity of a surface has not been impaired when the reflectivity is utilized to reduce the risk of fire.

f) Burning or scaling of metal parts is not evident upon visual observation.

Exception: Scaling of chimney flue liner material that does not impair the function of the chimney is permitted after exposure to the temperature test specified in Section 23.

g) The effectiveness of insulating material has not been reduced.

16.4 Thermal insulation shall comply with the following requirements during and following tests on the chimney:

a) The products resulting from the combustion or volatilization of any combustible binder shall be discharged to the chimney terminus outside of the building.

b) The insulating material shall remain in its intended position.

c) The thermal conductivity of the insulating material shall not be increased.

d) The thermal insulation shall not show evidence of softening, melting, or other evidence of malfunction or deterioration.

17 Test Installations

17.1 General

17.1.1 The following factors are to form the basis of the performance tests of a factory-built chimney:

a) For a chimney intended to be enclosed by combustible construction:

1) Size and type of chimney.

2) Height in feet (m) of chimney.

3) Minimum clearance to combustible construction.

b) For an unenclosed chimney installation:

1) Size and type of chimney.

2) Height in feet (m) of chimney.

3) Installation with or without a roof jack.

17.1.2 An insulated chimney is to be preconditioned by subjecting chimney sections filled with the minimum weight insulation specified by the manufacturer to vibration for two 1-hour periods. The vibration is to consist of a vertical displacement of 1/64 inch (0.4 mm) at a frequency of 60 hertz. The chimney sections are to be mounted vertically on a vibration table, first inverted for 1 hour and then mounted in the intended installation position for 1 hour.

17.1.3 During the temperature tests, thermocouples are to be located on each chimney section and test enclosure adjacent to any voids in the chimney that result from settling of insulation during the vibration specified in 17.1.2.

Documents
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17.2 Enclosed chimney installations (residential type and building heating appliance chimney)

17.2.1 The general form of a test structure for a chimney is illustrated in Figure 17.1. The height and arrangement of the structure for various designs is illustrated in Figure 17.2. Test structure details for various arrangements of support, firestop-spacers, and roof assemblies are illustrated in Figure 17.3 – Figure 17.9.

17.2.2 Chimneys are to be tested using the chimney arrangement illustrated in sketch No. 3 of Figure 17.2. When the design indicates that in one or more tests higher temperatures are developed with a chimney of another height (chimney arrangement), tests are to be conducted with the height producing the highest temperature condition; a height greater than that specified by the manufacturer shall not be employed. See sketch Nos. 2 and 4 of Figure 17.2. When the chimney arrangement is limited to that illustrated in sketch No. 1 of Figure 17.2, or when the maximum height of the chimney is limited to be consistent with the arrangement illustrated in sketch No. 2 of Figure 17.2, the chimney shall be so tested.

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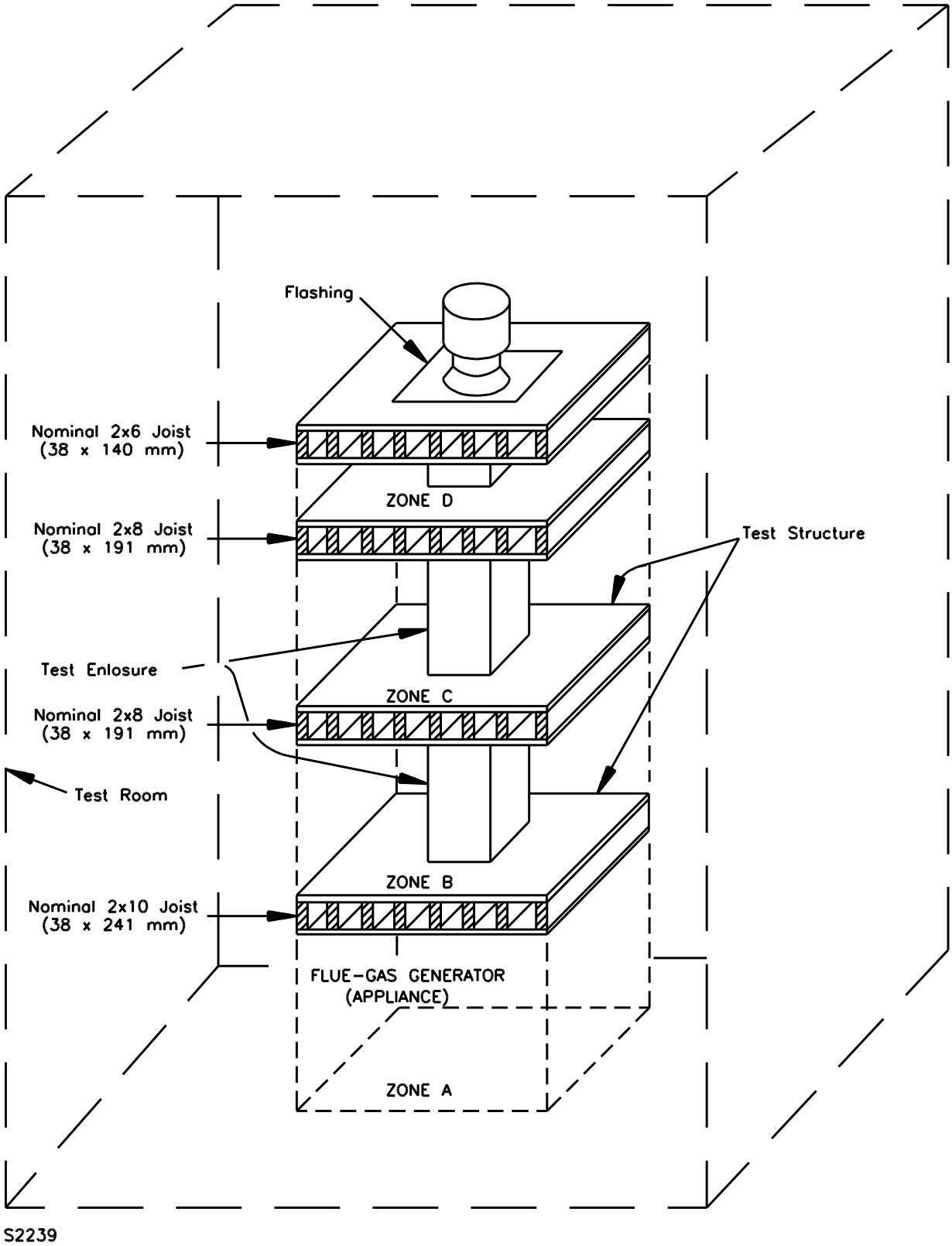
Figure 17.1

Typical test structure for chimneys tested enclosed within test room



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