

Standard for Safety

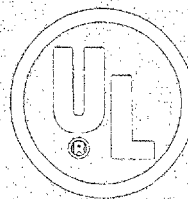
UL 127

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Factory-Built Fireplaces



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May 16, 1996

Standard for

Factory-Built Fireplaces

UL 127, Seventh Edition

Accompanying this transmittal notice is a copy of the Seventh edition of UL 127.

THIS EDITION OF THE STANDARD IS NOW IN EFFECT.

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

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1

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FOREWORD

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

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

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

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

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

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

INTRODUCTION

1 Scope

1.1 These requirements cover factory-built fireplaces, including the fire chamber, chimney, roof assembly, and other related parts that are entirely factory-made and that are intended for unit assembly in the field.

1.2 These requirements cover factory-built fireplaces having a fire chamber intended to be operated either open to a room or, when equipped with doors, operated with the doors either open or closed.

1.3 These requirements cover factory-built fireplaces intended for use with either solid wood or coal fuels.

1.4 The factory-built fireplaces covered by these requirements are intended for installation in accordance with the National Fire Protection Association Standard for Chimneys, Fireplaces, Vents and Solid-Fuel Burning Appliances, NFPA 211, and in accordance with codes such as the BOCA Basic/National Code, the Standard Mechanical Code, and the Uniform Building Code.

1.5 As covered by these requirements, an air duct system portion of a circulating warm air type fireplace is intended for installation in accordance with the National Fire Protection Association Standard for Warm Air Heating and Air Conditioning Systems, NFPA 90B.

1.6 These requirements also cover fixed blowers, and other electrical accessories for factory-built fireplaces, rated at 600 volts or less, and intended to be employed in specified locations in accordance with the National Electrical Code, NFPA 70.

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

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

2 Glossary

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

2.2 **CIRCULATING WARM AIR-DUCTED TYPE FIREPLACE** – A fireplace having a convection type air duct system attached to the fire chamber so that heated air is directed to areas or locations other than directly in front of or above the fire chamber opening.

2.3 **COMBUSTIBLE MATERIAL, NONCOMBUSTIBLE MATERIAL** – As used in these requirements, these terms are defined in the Standard Glossary of Terms Relating to Chimneys, Vents, and Heat-Producing Appliances, NFPA No. 97M-1992.

2.4 **CONVECTION SYSTEM** – An air heating system through which air is circulated by convection. It relies upon an integral fan or blower.

2.5 HEARTH – The floor area within the fire chamber of a fireplace upon which the fire is built.

2.6 HEARTH EXTENSION – The noncombustible surfacing applied to the exposed combustible floor area external to the hearth, as specified in the installation instructions.

3 Components

3.1 Except as indicated in 3.2, 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.

3.2 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.

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

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

4 Units of Measurement

4.1 If a value for measurement is followed by a value in other units in parentheses, the first stated value is the requirement.

5 Terms

5.1 As used in these requirements, the term "fireplace" refers to all factory-built fireplaces or any part thereof covered by these requirements, unless specifically noted otherwise.

CONSTRUCTION

6 Materials

6.1 General

6.1.1 A fire chamber or chimney part shall be made of noncombustible corrosion-resistant materials. Metals shall not be used in combinations that may cause galvanic action at any location within the assembly.

6.1.2 The minimum thickness of sheet metal, including any coatings, shall comply with Table 6.1 unless otherwise specified in these requirements.

Exception: Decorative metal parts are not required to comply with Table 6.1.

Table 6.1
Minimum metal thickness

	Inch	mm
Aluminum alloys	0.016	0.41
Steel (uncoated or painted)	0.042	1.07
Galvanized steel (G-90 coating class)	0.018	0.46
Galvanized steel (G-60 coating class)	0.025	0.64
Aluminum-coated steel Type T1-40 (regular)[0.40 ounce per square foot (0.12 kg/m ²)]	0.018	0.46
Stainless steel	0.012	0.30

6.1.3 Aluminum alloys containing more than 1.0 percent magnesium shall not be used when the reflectivity of the material is employed to reduce the risk of fire.

6.1.4 A flue-gas-conveying conduit of a chimney shall be of a material equivalent to that of a material specified in Table 6.2. Cast refractory, clay tile, and porcelain-coated steel shall comply with the requirements of the applicable tests described in Sections 20 – 24.

Table 6.2
Minimum thickness of flue-gas conduit material

Equivalent nominal inside diameter of chimney		Cast refractory or clay tile		Porcelain-coated steel-base metal		Series 300 and types 430 and 446 stainless steel	
Inches	mm	Inch	mm	Inch	mm	Inch	mm
12 or less	305 or less	0.40	10.2	0.026	0.66	0.012 ^a	0.30
Over 12 – 24	Over 305 – 610	0.65	16.5	0.032	0.81	0.016	0.41

^a 0.015 inch (0.33 mm) for chimneys evaluated to 2100°F

6.1.5 The combustion zone of the fireplace, and other parts in contact with flue gases, shall be of a material equivalent to that of a material specified in Table 6.3.

Table 6.3
Minimum thickness of combustion zone material

Cast refractory or clay tile		Porcelain-coated steel-base metal		Series 300 and types 430 and 446 stainless steel		Type I aluminum coated steel		Cast Iron ^a		Low carbon steel ^a	
Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm
0.400	10.16	0.026	0.66	0.012	0.30	0.018	0.46	1/8	3.2	0.093	2.36

^a See notes k and l of Table 10.1.

6.1.6 A firestop assembly, spacers or standoffs, a nonstructural part, such as the decorative front surround of a fire chamber, or other nonstructural parts not subjected to the effects of external atmospheric conditions, shall be of zinc coated (galvanized) steel not less than 0.018 inch (0.46 mm) thick. The zinc coating shall comply with the coating designation G60 in Table 1 of the Specifications for General Requirements for Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process, ASTM A525-93, with not less than 40 percent of the zinc on any side as determined by the minimum single spot test requirements of ASTM A525-86.

6.1.7 Other parts of a chimney subject to contact by flue gases or flue-gas air mixtures or subject to condensation, at locations beyond the terminus of the flue-gas-conveying conduit, shall be of aluminum-coated steel. The aluminum coating shall be designation Type T1-40 (regular) in Table 1 of Aluminum Coated Type 1 Cold Rolled Steel Sheet, ASTM A463-95, with not less than 0.40 ounce of aluminum coating per square foot (0.12 kg/m²) of steel or equivalent.

6.1.8 An outer casing or other structural part (exclusive of the flue-gas-conveying conduit):

- a) Whose malfunction or deterioration results in the fire chamber or chimney to collapse or otherwise increase the risk of injury to users; or
- b) That adjoins firestopping material;

shall be of galvanized steel. The galvanized steel shall have a zinc coating complying with the coating designation G90 (former coating Class 1.25 Commercial) in Table 1 of the Specifications for General Requirements for Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process, ASTM A525-93, with not less than 40 percent of the zinc on any side, based on the minimum single spot test requirement in this ASTM designation. The weight of zinc coating shall be established in accordance with the Tests for Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles, ASTM A90-95.

6.1.9 An unreinforced outer casing of a fire chamber or chimney shall be of material equivalent to one of those specified in Table 6.4. An outer casing reinforced by a solid refractory not less than 2 inches (50.8 mm) thick shall be:

- a) Galvanized steel or aluminum-coated steel not less than 0.018 inch (0.46 mm) thick; or
- b) Type 430 stainless steel not less than 0.012 inch (0.30 mm) thick.

Table 6.4
Minimum thickness of outer casing material

Nominal inside diameter of flue gas conduit		Galvanized steel				Type T1 – 40 (regular) aluminum coated steel		Series 300 and type 430 436 and 446 stainless steel	
		G-60 coating		G-90 coating					
Inches	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm
12 or less	305 or less	0.025	0.64	0.018	0.46	0.018	0.46	0.012	0.30
Over 12 – 24	Over 305 – 610	0.030	0.76	0.023	0.58	0.023	0.58	0.016	0.41

6.1.10 Steel with a proprietary coating shall not be used unless it is determined to be equivalent to the coated steel as specified in 6.1.4 – 6.1.9.

6.1.11 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 identified as having corrosion resistance equivalent to that required in 6.1.8.

6.1.12 Thermal insulation material shall be of metal or of a mineral base.

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

6.1.14 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 17.8°C).

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

6.2 Air duct system

6.2.1 The air duct system portion of:

- a) Circulating warm air ducts; and
- b) Combustion air inlet ducts

shall be constructed entirely of corrosion-resistant sheet metal having a minimum thickness as shown in Table 6.5. See 7.12.1 and 7.12.2.

Exception: Lesser thickness materials classified as Class 0 or Class 1 air ducts, as defined in the Standard for Installation of Warm Air Heating and Air Conditioning Systems, NFPA 90B-1993, and in the requirements in the Standard for Factory-Made Air Ducts and Connectors, UL 181, is used when:

- a) *They comply with the requirements of NFPA 90B and UL 181; and*
- b) *They have been investigated for the intended application.*

Table 6.5
Minimum thickness of sheet metal ducts

Diameter or width, Inches	Galvanized steel		Aluminum		Tin plate
	Nominal thickness, Inches	Minimum thickness, Inches (mm)	Minimum thickness, Inches (mm)		Minimum weight per base box, pounds
	(a) Round Ducts and Enclosed Rectangular Ducts:				
14 or less	0.016	0.013 (0.330)	0.016	(0.406)	135
Over 14	0.019	0.016 (0.406)	0.020	(0.508)	—
	(b) Exposed Rectangular Ducts:				
14 or less	0.019	0.016 (0.406)	0.020	(0.508)	—
Over 14	0.022	0.019 (0.483)	0.023	(0.584)	—

6.2.2 Asbestos material shall not be used.

6.2.3 Fibrous insulation materials used in an air handling compartment shall comply with the Erosion Test specified in the requirements in the Standard for Factory-Made Air Ducts and Connectors, UL 181.

7 Assembly

7.1 General

7.1.1 A fireplace shall consist of all the essential parts required for the intended installation of a complete fireplace and its chimney. 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 shall be 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 fire chamber; 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.*

7.1.2 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 meet the intent of the requirement to be incorporated into the complete assembly, without requirement of alteration or alignment, and only in the correct relationship with each other; or
- b) Be assembled and shipped from the factory as one unit.

7.1.3 To comply with the requirements of 7.1.1 and 7.1.2, 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 shall be constructed in two halves, and shall be packaged as one unit. In such cases, each separable part is to be completely formed, including the jointing of all seams.

7.1.4 The construction of a fireplace shall not void the firestopping required between spaces of a building when the fireplace and its chimney are installed in accordance with the manufacturer's instructions.

7.1.5 The fireplace shall not incorporate provisions for placing combustible materials, or for supporting a combustible mantel, at distances from the fireplace opening less than those dimensions specified in the installation instructions.

7.2 Joints

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

7.2.2 When screws are employed to join assemblies during installation, the assemblies to be joined shall provide for use of screws without having to be punched or drilled, except for parts as referenced in 7.1.1. 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.

7.2.3 A joint, fabricated in accordance with the manufacturer's instructions, shall limit the leakage of gas through the joint.

7.2.4 A joint shall not significantly reduce the capacity of the chimney.

7.2.5 A joint shall not retain condensation nor be free from condensation to flow from the interior to the exterior of the fuel-gas-conveying conduit.

7.3 Firestop spacers

7.3.1 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 strength and bearing surface to maintain the required clearance from chimney sections to joists and ceiling and floor material.

7.3.2 A firestop shall provide complete firestopping when the assembly is installed in a framed joist opening that is 1/2 inch (12.7 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.

7.4 Support assembly

7.4.1 A support assembly, such as a ceiling or floor jack, when furnished, shall establish and maintain the minimum required clearance between a chimney section and combustible construction. A chimney support assembly shall be provided at changes in chimney direction from diagonal to vertical and at intermediate points on diagonal runs, as specified in the installation instructions.

7.4.2 A support assembly intended to be secured by nails or screws shall be arranged so that such loads on the holding means are shear loads.

7.5 Radiation shield

7.5.1 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).

The assembly shall fit into a framed joist area not larger than the sum of 1/2 inch (12.7 mm) greater on each side than the outside diameter of the chimney and twice the dimension to be specified in the installation instructions for clearance between chimney sections and combustible enclosures.

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

7.5.3 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.

7.6 Flue damper

7.6.1 A fireplace flue-gas outlet damper operated by a linkage or other mechanism shall be constructed so that breakage of a part, after fire testing (see Sections 12 – 14), results in the damper to move to its designed open position. When the fireplace is provided with a flue-gas outlet damper that is placed in, and remains in, any position from open to closed, the following considerations apply:

- a) During the fire tests, see Sections 12 – 14, spillage of products of combustion (flame or smoke) or temperatures in excess of established requirements shall not occur while the damper is in the fully open position and the doors are open.
- b) During the fire tests, spillage of products of combustion or temperatures in excess of established requirements shall not occur while the damper is in the fully open position or at any intermediate position (other than fully closed) and the doors are closed.
- c) The unit shall be marked with a permanent marking located at or near the fuel feeding door advising users to open the damper before opening the doors. See 52.10.
- d) The damper control knob shall be located external to the fire chamber. The maximum temperature on the damper control knob(s) shall not exceed the value specified in Table 10.1.
- e) Doors shall be provided for use with the unit.

Exception No. 1: (c) and (d) do not apply when other means are utilized to open the damper before the doors are opened.

Exception No. 2: (c) and (d) do not apply when the unit does not spill products of combustion when the damper is in any position other than fully closed.

7.7 Chimney caps

7.7.1 A cap shall be provided to resist the entrance of debris and excess rain into the flue-gas-conveying conduit and into any cooling-air passage terminating exterior to the building. See Rain Test, Section 19.

7.7.2 A cap shall be constructed so that leaves and debris falling or blown onto it are not retained so as to obstruct flue-gas or cooling-air passages. A cap shall be constructed to resist accumulation of soot that obstructs flue-gas or cooling-air passages. An opening, other than one for flue gas passage, shall not have an entrance of a 1/2 inch (12.7 mm) diameter rod.

7.7.3 A cap shall be removable and replaceable, without bending or deforming the chimney or parts thereof, by the use of common hand tools, such as flat blade or Phillips head screwdrivers, hand pliers, wrenches, and other tools, to meet the intent of the requirement for chimney cleaning in accordance with the operating instructions.

7.8 Roof assemblies

7.8.1 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.

7.8.2 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 19.

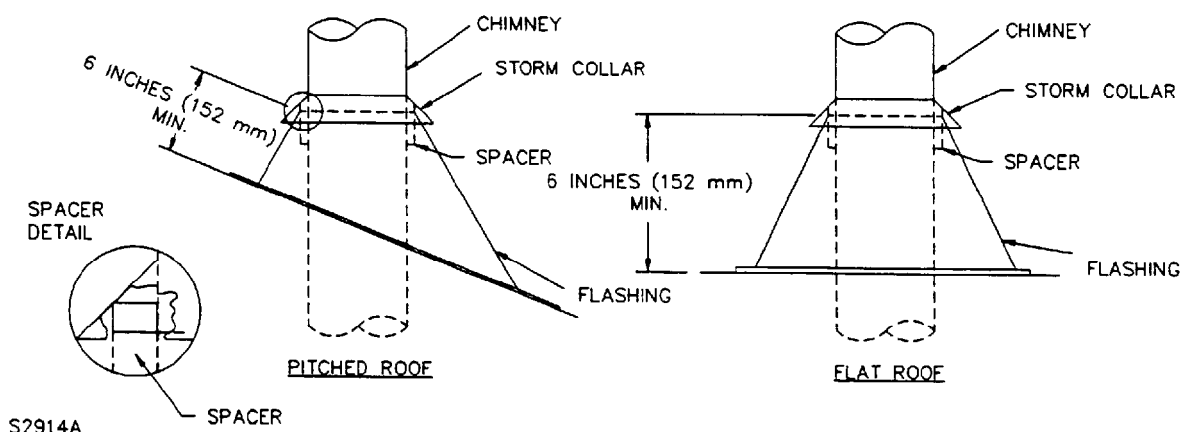
7.8.3 A roof assembly shall resist the accumulation of soot and debris therein when such accumulation obstructs flue-gas or cooling-air passages. An opening, other than one for flue gas passage, shall not have an entrance of a 1/2 inch (12.7 mm) diameter rod.

7.8.4 A roof assembly shall resist the accumulation of soot and debris therein when such accumulation obstructs flue-gas or cooling-air passages.

7.8.5 A roof flashing assembly that provides for ventilation shall be constructed so that soot or debris shall not accumulate on the assembly to the extent that ventilation openings intended to remain open are obstructed. (See also the requirements of 7.3.2 and 9.30, which apply to openings between the chimney and the flashing, and between the flashing and the test enclosure.) See Figure 7.1, 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:

- The openings shall not permit entrance of a 1/4 inch (6.4 mm) diameter rod.
- 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.
- The assembly shall incorporate a storm collar.
- The intended openings shall be maintained by means of spacers factory-attached to the flashing, or designed openings in the assembly.

Figure 7.1
Typical roof flashing housing assembly



7.9 Firescreens

7.9.1 A firescreen shall be furnished by the manufacturer as part of the fireplace, even when doors are provided.

7.10 Chimney elbows

7.10.1 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.

7.11 Gas pipe provision

7.11.1 A fireplace intended for connection to a decorative gas appliance shall incorporate a metal conduit sized to contain a 1/2 inch nominal diameter pipe. The conduit shall be arranged so that no field modification is required to the fireplace or related parts other than removal of a knockout and insulating material in the conduit.

7.12 Air duct system

7.12.1 The combustion air inlet system shall have zero clearance to combustible construction.

7.12.2 The combustion air inlet shall prevent material from dropping into the inlet and also prevent rodents from entering from the outside, such as by use of a wire mesh having openings not larger than 1/4 by 1/4 inch (6.4 by 6.4 mm).

7.13 Handles

7.13.1 Those portions of a handle or knob that are subject to contact shall not have sharp edges.

7.14 Integral grates

7.14.1 An integral grate that effectively reduces the hearth area as defined by 13.6 shall be constructed of 1/2 inch (12.7 mm) minimum steel bar stock or the equivalent, and the grate bottom shall be readily replaceable.

Exception: The grate bottom is not required to be readily replaceable when:

- a) The grate is unitary and attached in a manner requiring a tool for removal; and*
- b) The fireplace is marked with the word "WARNING" and the following or equivalent statement, "Risk of Fire Damage. Replace grate with (manufacturer's name) Model (manufacturer's model number) grate."*

7.15 Openings in chimney walls

7.15.1 Openings for air flow between air in a chimney chase and air located between chimney walls are not prohibited in the chimney walls; they shall not be provided in the flue-gas conduit wall. Such openings shall not impair the structural integrity of the chimney.

7.15.2 The openings specified in 7.15.1 shall be an integral part of the fireplace chimney transition. The fireplace chimney transition is the part of the fireplace where the first piece of the chimney is attached.

PERFORMANCE

8 General

8.1 When a fireplace is tested in accordance with these requirements, specified temperatures to combustible construction adjoining the fire chamber and its chimney, and in the hearth extension floor area, shall be maintained; no part shall attain a temperature that damages required corrosion protection or results in creeping, distortion, sagging, or similar damage; resistance to damage by wind, rain, and handling shall be demonstrated and the creation of draft by natural thermal effects shall prevent gas and flame from being drawn out of the fireplace.

8.2 After being tested in accordance with the Thermal Shock Test (see 11.2.1 – 11.2.5); Temperature Test – 1700°F Flue Gases (see 11.3.1 – 11.3.4) or Temperature Test – 2100°F Flue Gases (see 11.4.1 – 11.4.5), as appropriate; Radiant Fire Test, Section 12; Brand Fire Test, Section 13; and Flash Fire Test, Section 14; a fireplace and chimney shall be capable of being further used. After completion of these tests, the fireplace is to be permitted to cool to room temperature and then be subjected to the Support Test, Section 15; Fire Chamber Strength Test, Section 16; and Chimney Strength Test, Section 17.

8.3 Compliance with the requirements in 8.2 include the following:

- a) No part of the chimney shall become damaged or permanently distorted to an extent that the part or the chimney assembly does not continue to function as intended.
- b) The effectiveness of any required protective coating or finish on metal parts shall not be reduced.
- c) A ceramic material shall show no evidence of cracking, disintegration, or spalling to the extent that the serviceability of any part of an assembly is impaired.
- d) Cracks shall not be observable in porcelain enamel used as a required protective coating when the surface is examined under a microscope of 60 magnification.
- e) The reflectivity of a surface shall not be impaired when the reflectivity is utilized to reduce the risk of fire.
- f) Burning or scaling of metal parts shall not be evident upon visual observation.
- g) The effectiveness of insulating material shall not be reduced.

8.4 Thermal insulation, as employed, shall comply with the following requirements during and following tests on the fireplace and its chimney in accordance with the requirements in this standard.

- a) The products resulting from the combustion or volatilization of any combustible binder shall not be discharged to the living area.
- b) The insulating material shall remain in its intended position.
- c) The thermal conductivity of the insulating materials shall not be increased.
- d) The thermal insulation shall not show evidence of softening, melting, or other evidence of malfunction or deterioration.

8.5 During these tests, temperatures are to be determined with fireplace screens withdrawn (open).

9 Test Installations

9.1 Tests are to be conducted as described herein on each type of fireplace. When a fireplace is manufactured in more than one size, tests are to be conducted on as many representative sizes as required to determine compliance of all sizes with these requirements.

9.2 Fireplaces having doors shall be tested with the doors fully open and fully closed. During the tests, the fireplace shall be operated with any draft control (inlet air) dampers adjusted to yield maximum temperatures.

9.3 Fireplaces are to be tested as described in Radiant Fire Test, Section 12; Brand Fire Test, Section 13; and Flash Fire Test, Section 14, using the maximum and minimum chimney height specified by the manufacturer. Tests are also to be conducted using an intermediate height chimney, when the assembly having an intermediate height develops higher temperatures.

9.4 The fireplace is to be installed in a structure similar to that illustrated by Figures 9.1, 9.2, and 9.3 and constructed to accommodate the fireplace to be tested. Combustible enclosure materials and a mantel (when applicable) are to be placed in proximity to the fireplace in accordance with the minimum distances specified in the installation instructions.

9.5 When the manufacturer's installation instructions specify the use of elbows in a chimney run (a chimney run shall not exceed an angle of 30 degrees from the vertical), the assembly shall be erected to represent severe elbow configuration(s) specified in the manufacturer's installation instructions. A typical test structure with elbows is shown in Figure 9.3.

9.6 The test structure is to be free of extraneous drafts and the fireplace chimney is to exhaust into the same space, or into a space freely communicating with the space, from which the combustion air is taken. A typical room with a test structure is shown in Figure 9.1.

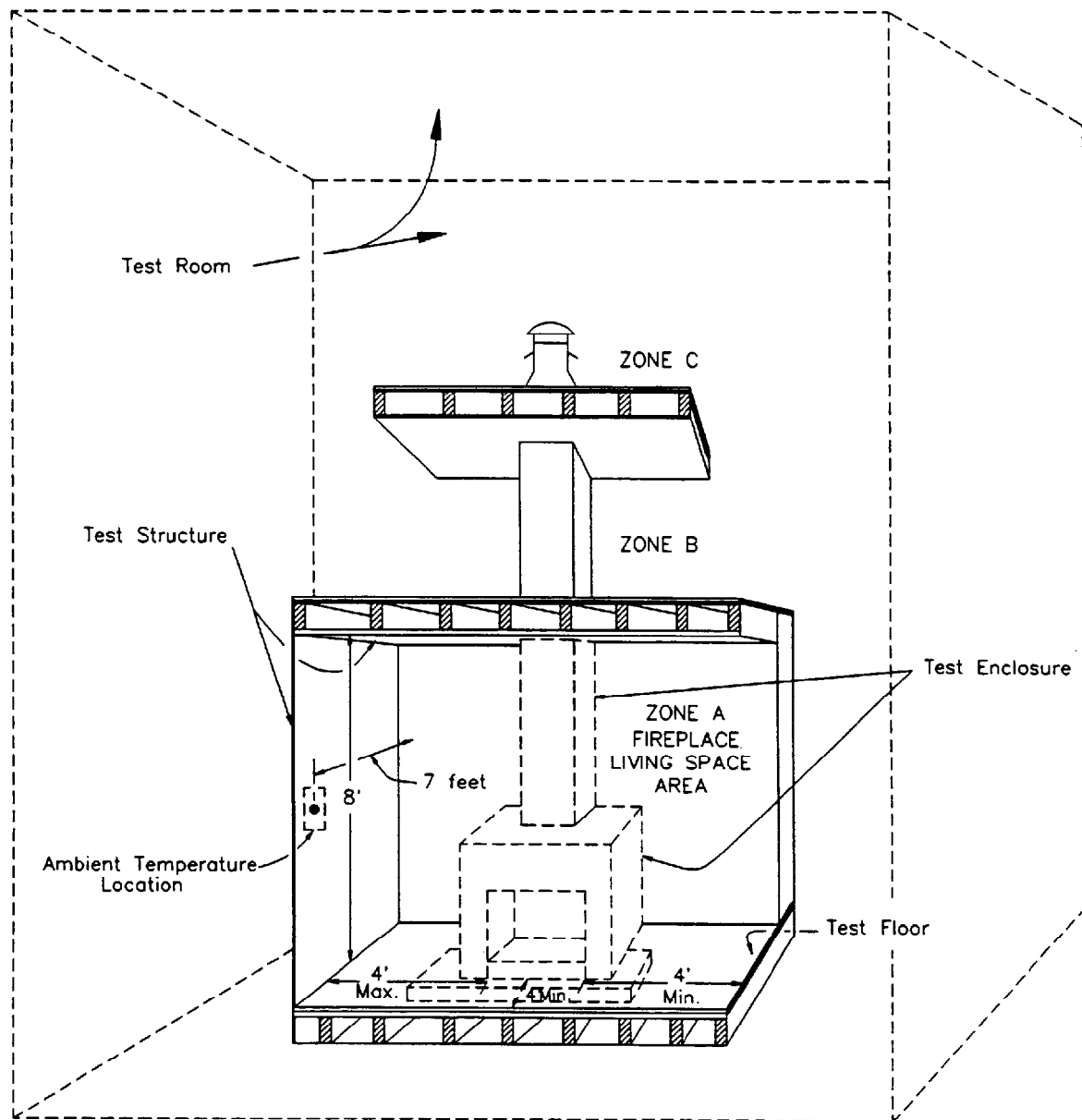
9.7 The temperature of the entire test structure shall be between 60 and 90°F (16 and 32°C) at the beginning of the Radiant and Brand Fire Tests.

9.8 The room in which the test structure is erected is to be such that during any one test the room temperature does not increase by more than 20°F (11°C) above the room temperature recorded at the beginning of the test.

9.9 Ventilating, combustion, or cooling-air openings into the fireplace assembly are to be sealed unless the openings comply with all of the following when such openings are incorporated into the fireplace assembly:

- a) The openings are more than 1-1/2 inches (38.1 mm) above the floor and are otherwise arranged so that unintentional closure does not occur;
- b) The openings are blocked by the user to overcome a nuisance (such as downdrafts, a cold room, or an overheated room);
- c) The air is drawn from the room in which the fireplace is installed and is discharged into the same room or into the flue-gas passageway below the damper; and
- d) The air is drawn into the fireplace through the chimney at the cap and discharged into a separate discharge passageway of the chimney, or the fire chamber assembly or flue-gas passageway, or both, prior to the first chimney section.

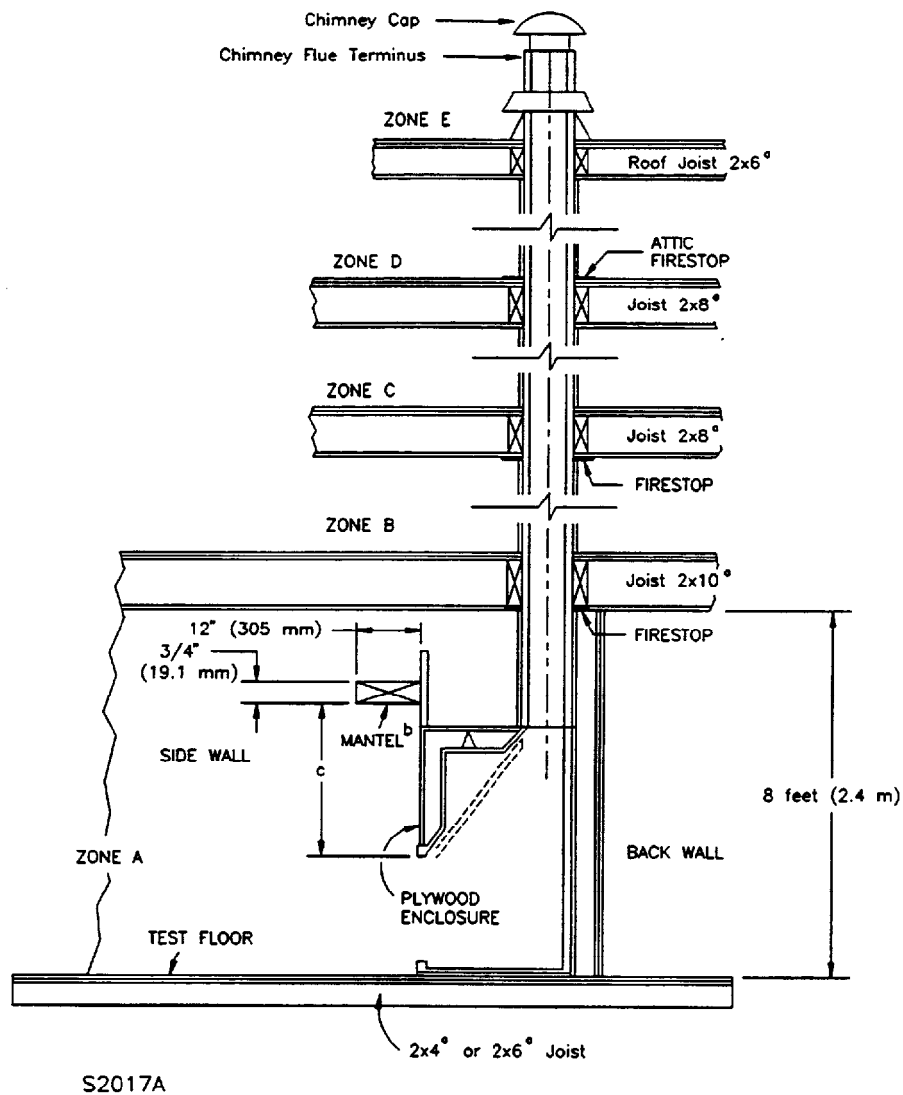
Figure 9.1
Typical test structure within test room



S2016

Note: 4 feet = 1.2 m
7 feet = 2.1 m
8 feet = 2.4 m

Figure 9.2
Typical test structure details (side view)



All floor and roof joists are to be framed four sides at chimney opening.

All ceiling, floor, and roof material is to be cut flush with inside of all framed joist openings.

Chimney shown totally enclosed at zero clearance.

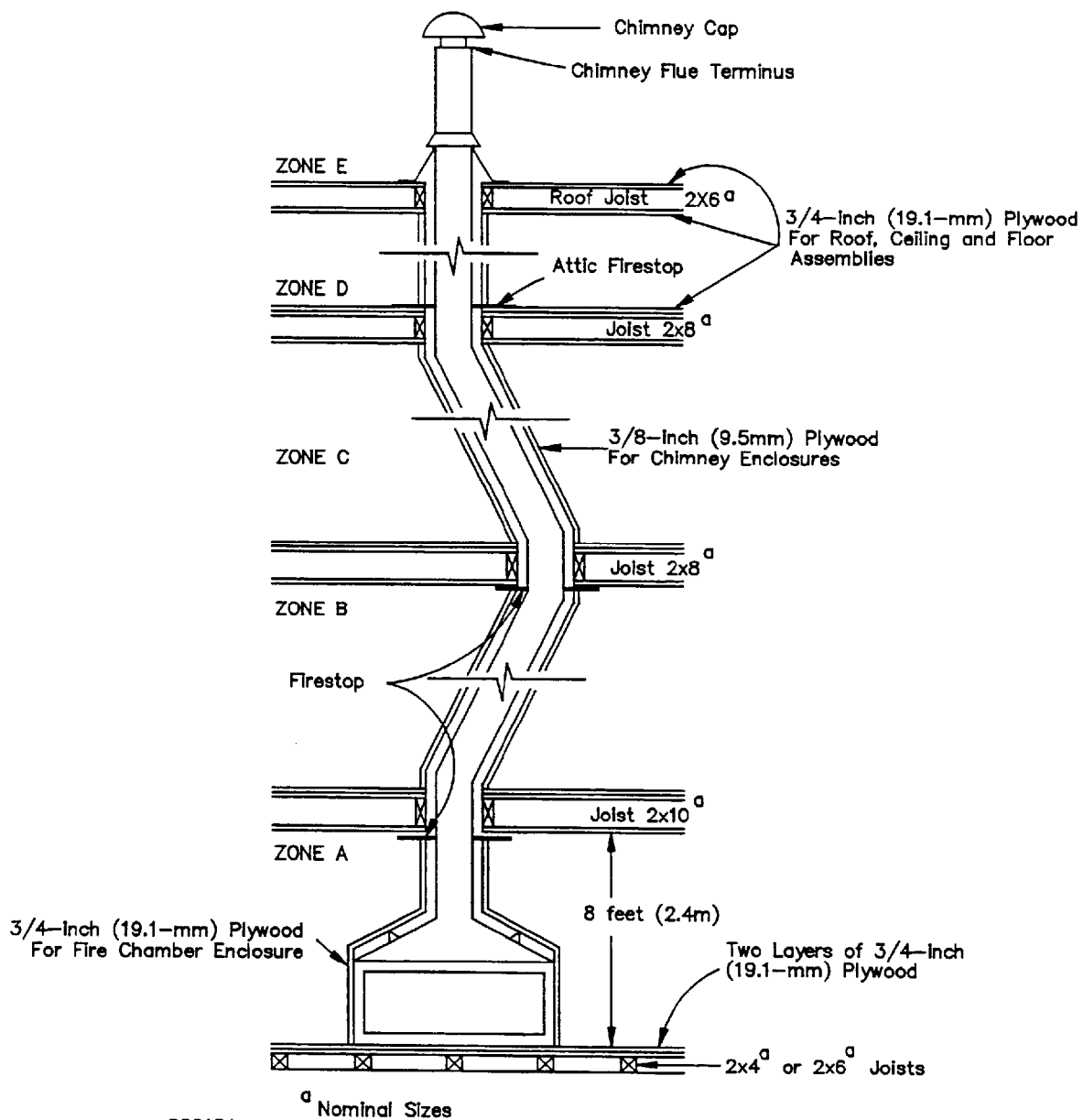
a Nominal sizes.

b Mantel is used only when fireplace is intended for use with a mantel.

c Minimum distance above fireplace opening specified in installation instructions.

d Mantel depth as specified in the installation instructions.

Figure 9.3
Test structure incorporating chimney elbows
(front view)



S2018A

9.10 When a fire chamber and chimney are intended to draw air from the outside of a building to cool the assembly, the test structure is to provide means for maintaining the temperature of such air between 60 and 90°F (21 and 32°C) during all temperature tests.

9.11 The test chimney of the fireplace is to consist of a vertical assembly composed of standard chimney sections and other furnished parts erected according to the manufacturer's installation instructions. The top of the test chimney is to be terminated by the roof assembly and cap when these are provided as a functional part of the chimney. The flue outlet of the test chimney is to terminate 3 feet (0.9 m) above the roof. Other functional parts of the chimney, such as a support, firestop-spacer, are to be used during the test.

9.12 That part of the test structure representing the living-space area in which the fireplace is to be installed is to consist of a back wall, one side wall, a combustible floor, and a typical ceiling and floor construction. A typical test installation is shown in Figure 9.1.

9.13 The combustible floor below the fireplace is to consist of two layers of 3/4-inch (19.1-mm) thick plywood over trade size 2- by 4-inch [nominal 1-1/2 by 3-1/2 inches (38.1 by 89 mm)] or trade size 2- by 6-inch [nominal 1-1/2 by 5-1/2 inches (38.1 by 140 mm)] floor supports placed on 16-inch (406-mm) centers.

9.14 The side wall and back wall are to consist of one thickness of 3/4 inch (19.1 mm) plywood.

9.15 The ceiling and floor constructions immediately above the fireplace are to be constructed with trade size 2- by 10-inch [nominal 1-1/2 by 9-1/2 inches (38.1 by 241 mm)] joists. Joists at intermediate floors and at the roof are to be as indicated in Figure 9.2. A ceiling is to consist of one thickness of 3/4-inch (19.1-mm) plywood. Flooring over the joists is to consist of two layers of 3/4-inch plywood. Roofing is to consist of one layer of 3/4-inch plywood.

9.16 The floor under, and the ceiling above, the fireplace are to be 8 feet (2.4 m) apart and are to extend at least 4 feet (1.2 m) in front of the fireplace opening and at least 8 feet in front of the back wall. The side wall is to be perpendicular to the back wall and located at the minimum distance specified by the manufacturer and not more than 4 feet from the nearest side of the fireplace opening. The floor, ceiling, and back wall are to join the side wall. The floor, ceiling, and back wall are to extend at least 4 feet beyond the side of the fireplace opening which is opposite the side wall.

9.17 The fireplace is to be located in relation to the back wall of the test structure in accordance with the minimum clearances specified by the installation instructions. Other areas of the fireplace in contact with combustible construction, when the fireplace is recessed or enclosed, such as the sides, bottom, and top, are to be enclosed with one layer of 3/4-inch (19.1-mm) plywood at the minimum clearances specified by the installation instructions.

9.18 When installation instructions specify areas not to be in contact with combustible material, those areas are to be fully exposed to the living space in which the fireplace is located.

9.19 The face areas of a fireplace that are intended to be covered with decorative materials, such as slate, tile, or marble are to be covered with such materials when provided with the fireplace, otherwise, with noncombustible material having a 3/8-inch (9.5-mm) minimum thickness.

9.20 Unless the manufacturer's installation instructions specify that the fire chamber hood or chimney section above the fire chamber and within the living space in which the fireplace is located are to be fully exposed, the chimney section is to be enclosed with 3/8-inch (9.5-mm) thick plywood, and the chamber hood section is to be enclosed with 3/4-inch (19.1-mm) thick plywood extending to the back of the test structure.

9.21 When a fireplace is provided with air ducts, the fireplace is to be tested with the ducts installed and with the specified air space provided above the fire chamber. This installation method, for example, "chase installation," shall be illustrated in the installation instructions.

9.22 When installation of air ducts is not required, the fireplace is to be tested as follows:

- a) Air ducts are to be installed and the specified air space is to be provided above the fire chamber; and
- b) Air outlets on the fire chamber are to be capped with capping devices provided with the fireplace and the fireplace is to be tested both with and without the manufacturer's specified air space above the fire chamber.

9.23 Combustion outside air kits, when provided, shall be installed and tested in each configuration illustrated in the manufacturer's installation instructions. Each configuration shall be investigated with the fireplace doors (when provided) fully open and closed. The combustion outside air damper control and termination shall be sealed and open during the investigation of each configuration. Each configuration shall be investigated until it is demonstrated that the maximum temperatures have been attained. Refer to Figure 9.5 for typical configurations and thermocouple locations.

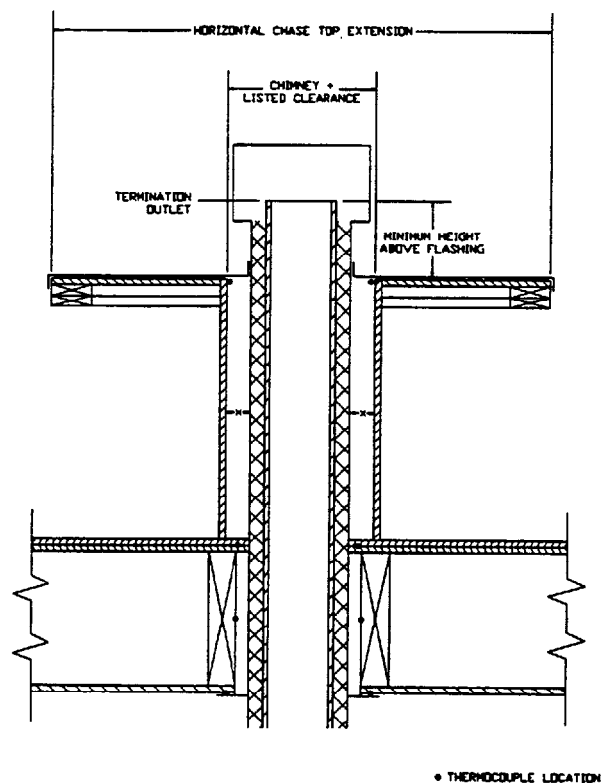
9.24 Plywood enclosure material for the chimney section is to be placed vertically, horizontally, and diagonally to provide clearance to the enclosure of 0, 1/2, 1, 1-1/2, or 2 inches (0, 12.7, 25.4, 38.1, or 50.8 mm) as specified by the manufacturer's installation instructions. These specified clearances are to be measured between the outer surfaces of the chimney section and the interior surfaces of the enclosing material. The plywood enclosure material for the fire chamber is to be placed vertically and horizontally against points of intended contact, or at the minimum air space clearance at the back and sides as marked on the fire chamber. See 52.6.

9.25 The chimney of the fireplace is to be totally encased for its full height within all stories and attic space. Fireplace chimneys are to be tested on the basis of clearance from the enclosure of 0, 1/2, 1, 1-1/2, or 2 inches (0, 12.7, 25.4, 38.1, or 50.8 mm) as specified by the manufacturer's installation instructions, and measured between the outer surface of the chimney-pipe sections and the interior surfaces of the enclosing material. These clearances are designated by the dimensions "X" in Figures 9.6 to 9.10, inclusive. The chimney enclosure material is to be 3/8-inch (9.5-mm) thick plywood and is to be closed at each floor-joist level by the installation of a manufacturer's firestop or firestop-spacer assembly. Such assemblies are to be placed at the ceiling line of each floor-joist level except that at the joist level serving the attic space the assembly is to be placed on top of the attic-space floor material. See Figures 9.2, 9.6, and 9.7.

9.26 For test purposes, the inside diameter of the firestop opening shall not be more than 1/8 inch (3.17 mm) greater than the minimum outside diameter of the chimney pipe.

9.27 When the installation instructions specify the use of a combustible chase enclosure for the chimney sections installed above the roof, the fireplace chimney is to be encased in a plywood enclosure above the roof. The plywood enclosure material for the chimney sections is to be placed vertically to provide clearance to the enclosure as marked on the chimney sections. The specified clearances are to be measured between the outer surface of the chimney section and the interior surface of the enclosing material. The chimney enclosure material is to be 3/8 inch (9.5 mm) thick plywood with flat black paint on the inside surfaces. A horizontal chase extension consisting of a double layer of trade size 2 by 4 inch [nominal 1 1/2 by 3 1/2 inches (38.1 mm by 89 mm)] joists covered with 3/8 inch (9.5 mm) plywood material, and located within the vertical chase enclosure as illustrated by Figure 9.4. The chase extension is to be closed at the top by the method described in the manufacturer's installation instructions. Refer to Figures 9.4 and 9.5 for thermocouple locations.

Figure 9.4
Typical thermocouple locations
chase top termination assembly



SM1022

9.28 The test enclosure material at each floor-joist level is to be of trade size 2- by 10- or 8-[nominal 1-1/2 by 9-1/4 or 7-1/4 inches (38.1 by 235 or 184 mm)] lumber, forming a box placed at zero clearance to the chimney sections or to a manufacturer's support or firestop-spacer assembly. The test-enclosure material at the roof-joist level is to be of trade size 2- by 6-inch [nominal 1-1/2 by 5-1/2 inches (38.1 by 140 mm)] lumber forming a box placed at the clearance specified by the manufacturer for enclosures or at the lesser clearance required to provide support means for a roof assembly. See Figures 9.8 – 9.10. All ceiling, floor, and roof material is to be cut flush with the inside of all framed joist openings.

Figure 9.5
Typical thermocouple locations
chase top termination assembly

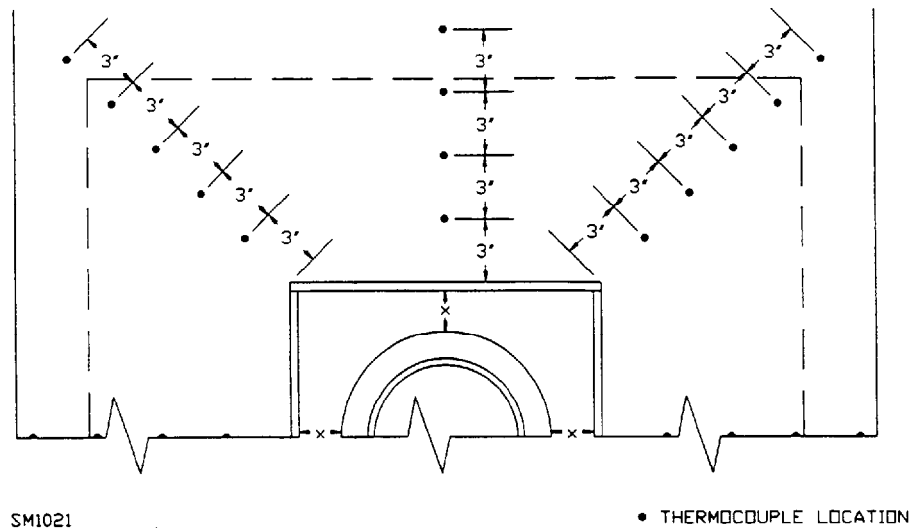


Figure 9.6
Test structure details for firestop-spacer assembly
(Enclosure shown at specified clearance denoted by "X")

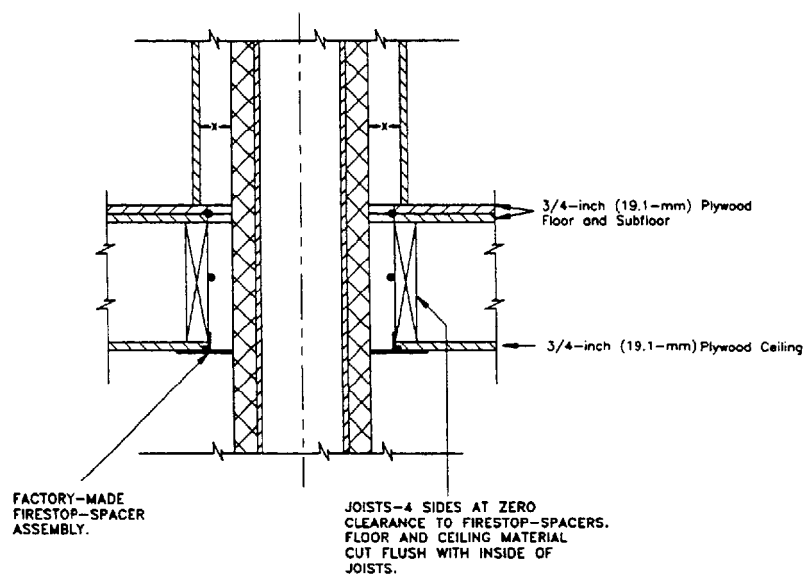
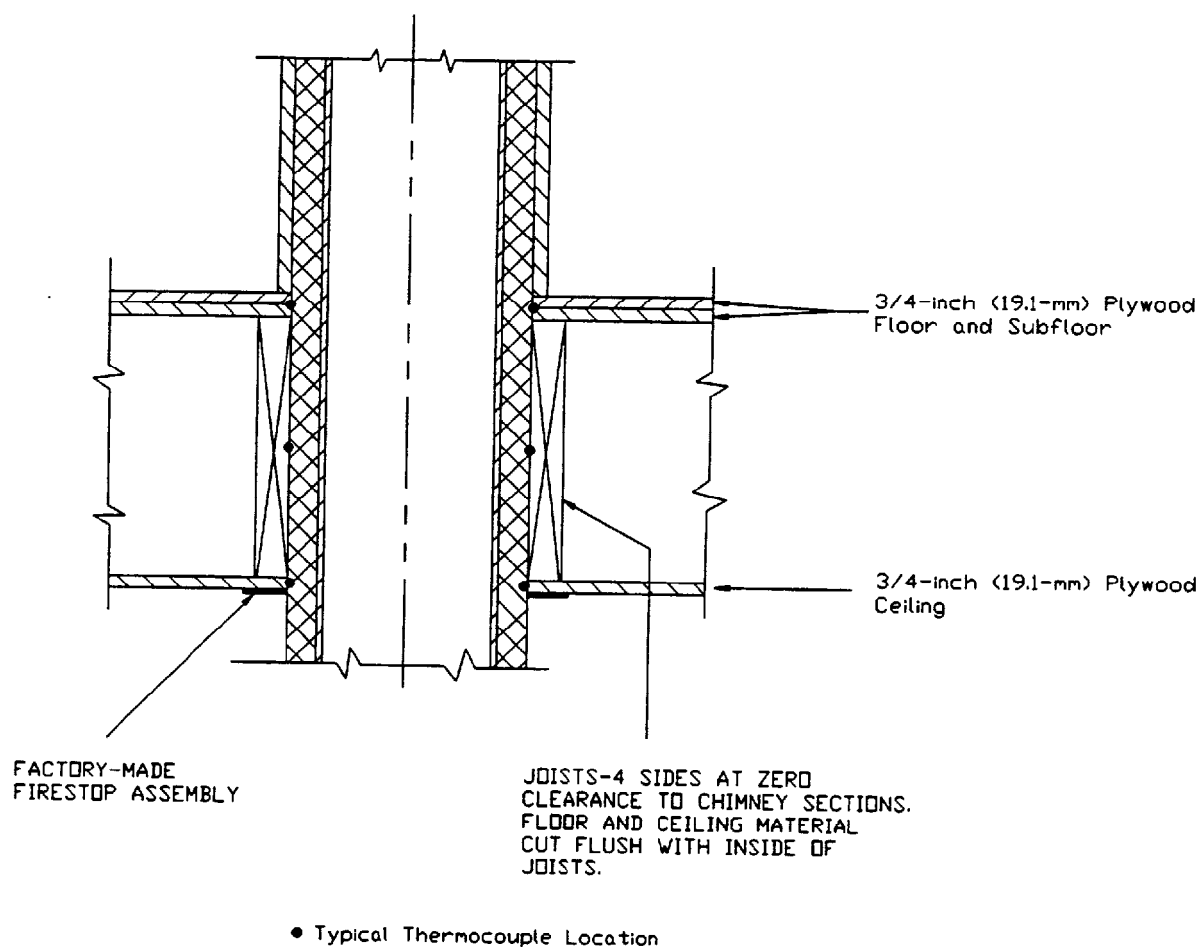
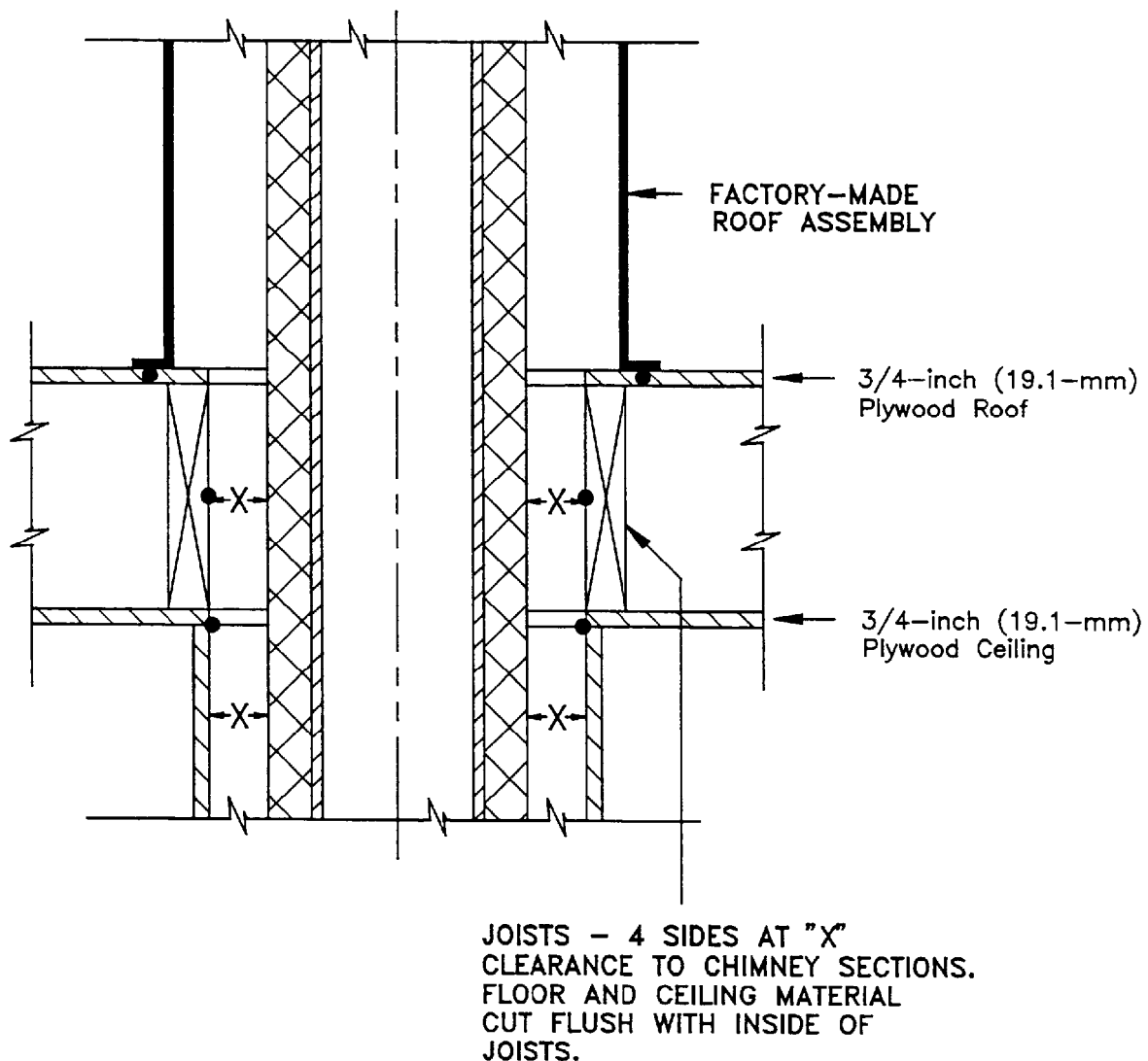


Figure 9.7
Test structure details for firestop assembly
(Enclosure shown at zero clearance)



S2020

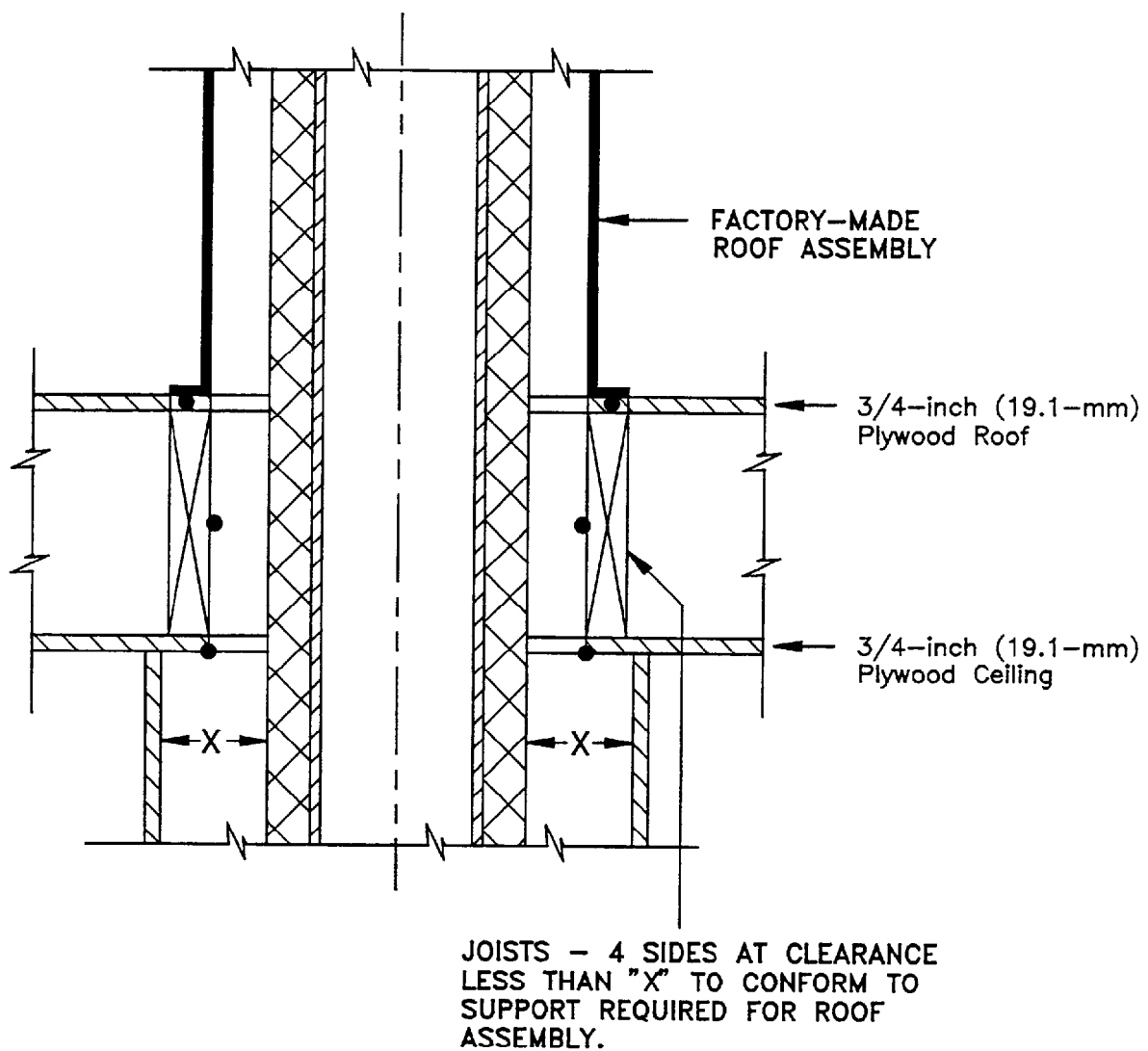
Figure 9.8
Test structure details for roof assembly
(Roof assembly larger than roof joist area)



● Typical thermocouple location

S2021

Figure 9.9
Test structure details for roof assembly
(Roof assembly smaller than enclosure area)

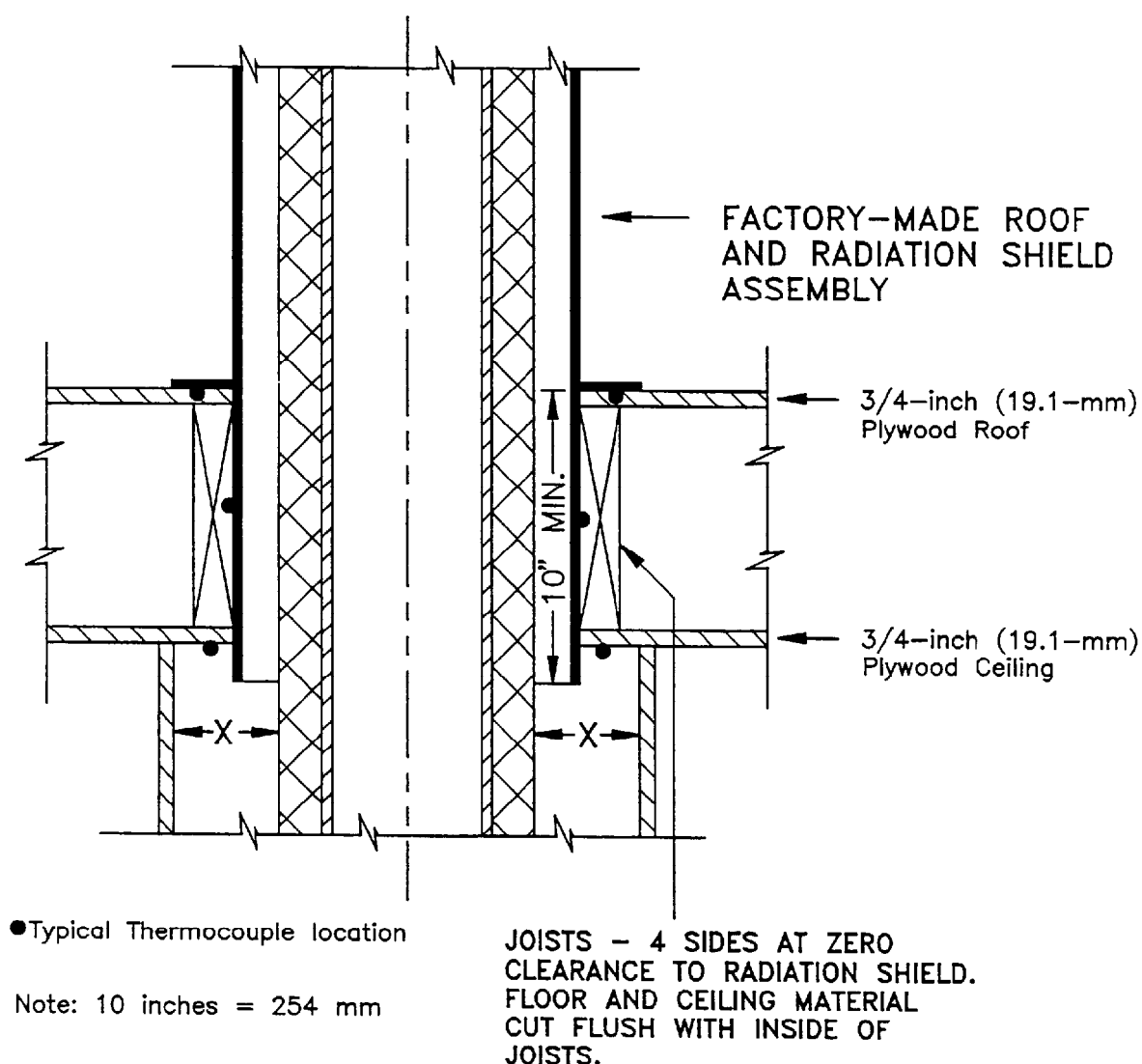


● Typical thermocouple location

S2022

Figure 9.10
Test structure details for roof assembly

(Roof assembly of type not requiring field alteration to conform to roof line)



S2023

9.29 The hearth-extension floor area for a fireplace not provided with a factory-built hearth extension is to be covered with the material specified by the manufacturer's installation instructions, and painted flat black.

9.30 The following are to be sealed with plastic-coated or film-faced pressure-sensitive tape lapping the joint by a minimum of 1 inch (25.4 mm) on each side:

- a) Openings between spacers or supports (including firestops) and the test enclosure;
- b) Openings between the flashing and the roof;
- c) Openings between flashing and the chimney;

Exception: The flashing openings are not required to be taped when the opening between the attic firestop and the chimney is sealed.

- d) All joints and openings in the test enclosure; and
- e) All joints intended to be sealed for field installation.

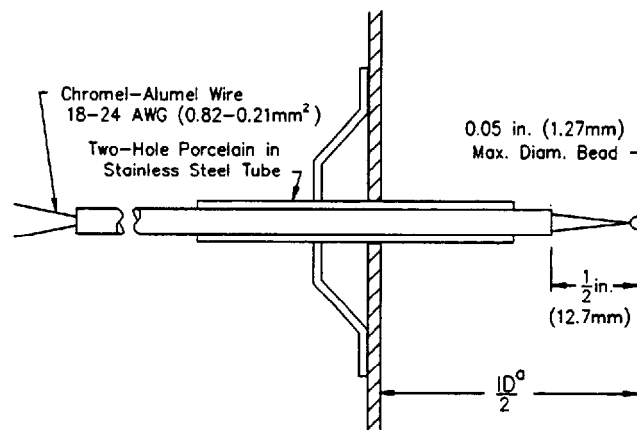
The peel adhesion characteristics of the tape on fibrous (wood) combustible enclosure materials shall comply with the Standard for Test Method for Adhesion of Pressure-Sensitive Tape to Fiberboard at 90 Degree Angle and Constant Stress, ASTM D2860-90, at elevated temperatures of 150°F (66°C).

9.31 All wall surfaces, the floor surface, the ceiling surface, and the inside surface of the plywood enclosure facing the fireplace and chimney are to be painted flat black.

10 Temperature Measurement

10.1 Flue-gas temperatures are to be measured by a thermocouple, such as illustrated by Figure 10.1, inserted to the center line of the flue pipe. The thermocouple is to be located as shown in Figure 11.2 or as described in 11.1.2.

Figure 10.1
Flue-gas thermocouple and support bracket



^aID = Internal Diameter of Flue Pipe

S2255

10.2 The thermocouple is to be a Type K (chromel-alumel) of Nos. 18 – 24 AWG (0.82 – 0.21 mm²) wire with an untwisted welded bare lead junction of not more than 0.050 inch (1.27 mm) diameter.

10.3 Temperatures of other than flue gases and metal surfaces are to be measured using either Type K (chromel-alumel) or Type J (iron-constantan) thermocouples of wire not larger than No. 24 AWG (0.21 mm²).

10.4 Temperatures of metal surfaces other than handles and electrical components are to be measured using Type J (iron-constantan) or Type K (chromel-alumel) of No. 18 AWG (0.82 mm) to No. 24 AWG (0.21 mm²).

10.5 The thermocouple wire insulation is to have a temperature use rating higher than the temperatures to which it is subjected during these tests.

10.6 The wiring methods for thermocouple circuitry, including junctions, terminals, switches, plugs, and jacks are to be designed and constructed to provide independent continuous routing of both thermocouple leads to the recording equipment.

10.7 The ambient temperature of a zone is to be determined by a thermocouple located centrally within a vertically oriented 6 inch (152 mm) length of 2 inch steel pipe, aluminum painted, and open at both ends.

10.8 Ambient temperatures are to be determined by shielded thermocouples located within their respective zones (see 10.9 – 10.11) relative to parts of the fireplace, test structure, and flue-gas generator.

10.9 The ambient temperature for Zone A (Figure 9.1) is to be determined by use of a shielded thermocouple located 6 inches (152 mm) away from the side wall, 7 feet (2.1 m) from the back wall, and 4 feet (1.2 m) above the floor.

10.10 The ambient temperatures for Zones B, C, and other zones above Zone A, are to be determined by use of shielded thermocouples located 2 feet (610 mm) away from the front center line of the chimney enclosure and at the midpoint between the floor and ceiling.

10.11 The ambient temperature for the space above a roof line is to be determined by use of a shielded thermocouple located 2 feet (610 mm) away from the front center line of the chimney or roof assembly and 1 foot (305 mm) above the roof.

10.12 When a fireplace assembly is intended to take air from the outside of a building to cool the device, the ambient temperature of the space into which the chimney exhausts is to be measured by use of a shielded thermocouple located on a horizontal plane with the opening provided for the admission of outside air and 3 feet (0.9 m) from the opening. This temperature is to be maintained between 60 and 90°F (16 and 32.2°C) during all temperature tests.

10.13 When a fireplace assembly is intended to take air from the outside of a building for combustion air purposes, the ambient temperature of the space outside of the test assembly enclosure and within the test structure is to be measured by use of a shielded thermocouple located on a horizontal plane with the inlet air opening provided for the admission of outside combustion air and 3 feet (0.9 m) from the opening. This temperature is to be maintained between 60 and 90°F (16 and 32.2°C) during all temperature tests.

10.14 The measurements of temperature rises on the fire chamber, on chimney parts, and on the enclosures and test structure are to be referenced to the recorded ambient temperatures determined as indicated in 10.9 – 10.11.

10.15 Recorded temperature rises on joists and rafters are to be referenced to the average of the recorded ambient temperatures above and below the involved joist or rafter areas.

10.16 Recorded temperature rises on floor or roof material are to be referenced to the ambient temperature recorded above the involved floor or roof areas.

10.17 Recorded temperature rises on ceiling material are to be referenced to the recorded ambient temperature recorded below the involved ceiling area.

10.18 Thermocouples are to be attached to metal surfaces by screws, rivets, silver soldering, brazing, or welding of the tip to the metal surface. See Figure 10.2.

10.19 Thermocouples are to be secured to wood surfaces by the use of staples placed over the insulated portion of the wires. The thermocouple tip is to be depressed into the wood so as to be flush with the wood surface at the point of measurement and held in thermal contact with the surface at that point by the use of pressure-sensitive paper tape. See Figure 10.2.

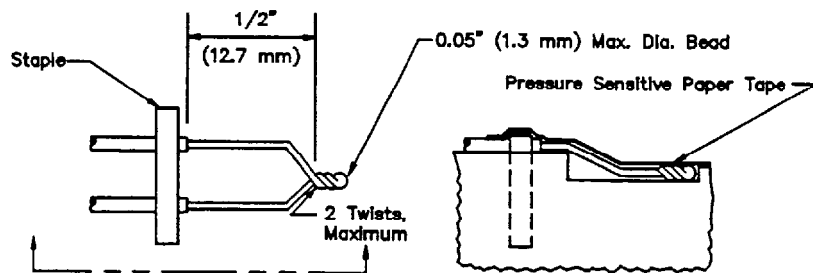
10.20 Thermocouples are to be attached to nonmetallic or nonwood material surfaces by having the 1/2 inch (12.7 mm) tip and at least 1 inch (25.4 mm) of the lead wires embedded into the material so as to be flush with the surface of the material. Furnace cement is to be smoothed over such indentations to maintain thermal contact.

10.21 Thermocouples are to be attached to surfaces other than those described in 10.18 – 10.20 by being cemented or taped to the surface to maintain thermal contact with the surface. Materials or parts whose temperatures are to be measured are included in Table 10.1. Temperatures on electrical conductors are to be measured on the surfaces of the conductor insulation.

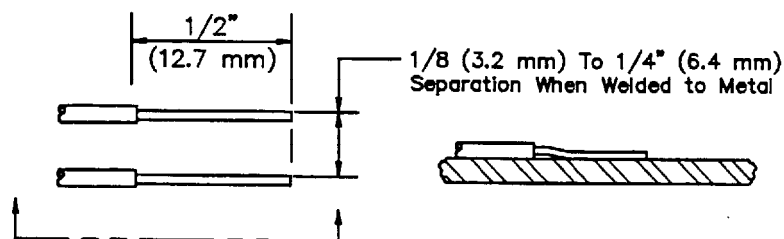
10.22 A minimum number of typical thermocouple locations to be attached to wood surfaces of the fire chamber enclosure is shown in Figure 10.3.

Figure 10.2
Thermocouple installation methods

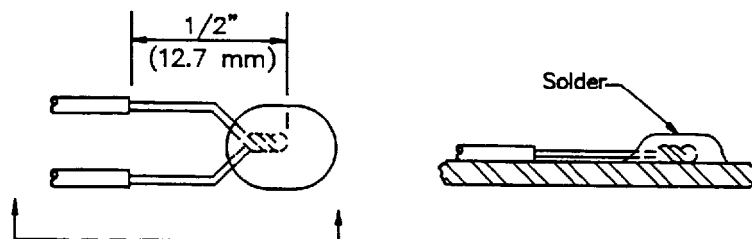
THERMOCOUPLE INSTALLATION METHODS



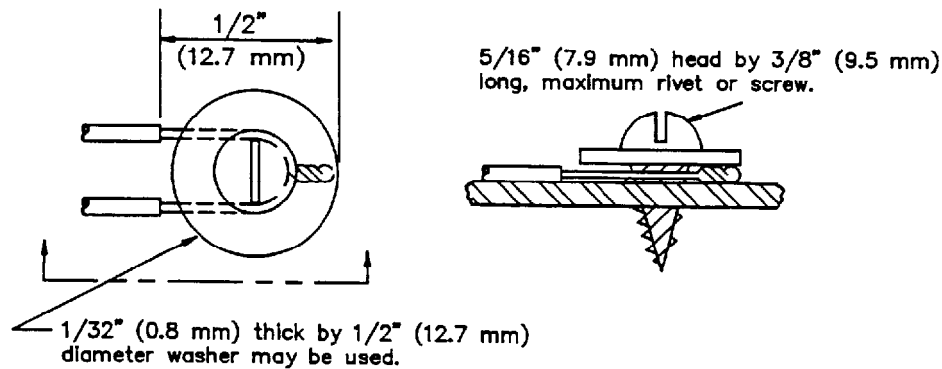
THERMOCOUPLE FOR WOOD SURFACES



THERMOCOUPLE WELDED TO METAL SURFACE



THERMOCOUPLE SOLDERED TO METAL SURFACES



TC-100

THERMOCOUPLE SECURED TO METAL SURFACES

Table 10.1
Maximum temperature rises

Device or material		Column 1		Column 2	
		Degrees		Degrees	
		C	F	C	F
A. Motor^{a,b,c}					
1.	Class A insulation systems on coil windings of alternating-current motors having 7 inches (178 mm) or less in diameter (not including universal motors):				
a.	In open motors;				
	Thermocouple or resistance method	75	135	115	208
b.	In totally enclosed motors;				
	Thermocouple or resistance method	80	144	115	208
2.	Class A insulation systems on coil windings of alternating-current motors more than 7 inches (178 mm) in diameter and of direct-current and universal motors:				
a.	In open motors;				
	Thermocouple method	65	117	115	208
	Resistance method	75	135	115	208
b.	In totally enclosed motors;				
	Thermocouple method	70	126	115	208
	Resistance method	80	144	115	208
3.	Class B insulation systems on coil windings of alternating-current motors 7 inches (178 mm) or less in diameter (not including universal motors):				
a.	In open motors;				
	Thermocouple or resistance method	95	171	140	252
b.	In totally enclosed motors;				
	Thermocouple or resistance method	100	180	140	252
4.	Class B insulation systems on coil windings of alternating-current motors more than 7 inches (178 mm) in diameter and of direct-current and universal motors.				
a.	In open motors;				
	Thermocouple method	85	153	140	252
	Resistance method	95	171	140	252
b.	In totally enclosed motors;				
	Thermocouple method	90	162	140	252
	Resistance method	100	180	140	252
B. Components^o					
1.	Capacitors:				
a.	Electrolytic types ^c	40	72	(Not specified)	
b.	Other types ^d	65	117		

(Continued)

Table 10.1 (Cont'd)
Maximum temperature rises

Device or material		Column 1		Column 2	
		Degrees		Degrees	
		C	F	C	F
2.	Relay, solenoid, and other coils with:				
a.	Class 105 insulated systems;				
	Thermocouple method	65	117	115	207
	Resistance method	85	153	115	207
b.	Class 130 insulated systems;				
	Thermocouple method	85	153	140	252
	Resistance method	105	189	140	252
3.	Transformer enclosures ^b with:				
a.	Class 2 transformers	60	108	85	153
b.	Power and ignition transformers	65	117	90	162
C.	Insulated Conductors ^{e,f,o}				
1.	Appliance wiring material				
	75°C rating	50	90	65	117
	80°C rating	55	99	70	126
	90°C rating	65	117	80	144
	105°C rating	80	144	95	171
	200°C rating	175	315	200	360
	250°C rating	225	406	250	450
2.	Flexible cord – Types SO, ST, SJO, SJT, HSJ, HSJO				
	60°C rating	35	63	60	108
	75°C rating	50	90	65	117
	90°C rating	65	117	80	144
	105°C rating	80	144	95	171
3.	Other types of insulated wires				
D.	Electrical Insulation – General ^{f,o}				
1.	Class C electrical insulation material				
2.	Class (180) electrical insulation material				
3.	Fiber used as electrical insulation or cord bushings	65	117	90	162
4.	Phenolic composition used as electrical insulation or as parts where malfunction results in a risk of fire or electric shock	125	225	150	270
5.	Thermoplastic material				
		25°C or 77°F less than its temperature rating			
6.	Varnished cloth insulation	60	108	85	153
E.	Metals ^g				
1.	Aluminum alloys –				
a.	1100 (2S)	183	330	239	430
b.	3003 (3S)	239	430	294	530
c.	2014, 2017, 2024, 5052 ^h	294	530	350	630

(Continued)