UL 127

STANDARD FOR SAFETY

Factory-Built Fireplaces

UL Standard for Safety for Factory-Built Fireplaces, UL 127

Tenth Edition, Dated November 21, 2024

Summary of Topics

This new Tenth Edition of ANSI/UL 127 dated November 21, 2024 incorporates editorial changes including renumbering and reformatting to align with current style.

The revised requirements are substantially in accordance with Proposal(s) on this subject dated August 23, 2024.

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Standard for Factory-Built Fireplaces

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The most recent designation of ANSI/UL 127 as an American National Standard (ANSI) occurred on November 21, 2024. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, and Title Page.

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

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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, the International Mechanical Code, and the Uniform Mechanical 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 involves a risk of fire, electric shock, or injury to persons shall be evaluated using the appropriate additional component and end-product requirements to determine that the level of safety as originally anticipated by the intent of this Standard is maintained. A product whose features, characteristics, components, materials, or systems conflict with specific requirements or provisions of this Standard shall not be judged to comply with this Standard. Where appropriate, revision of requirements shall be 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 97M.

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 General

3.1.1 A component of a product covered by this standard shall:

a) Comply with the requirements for that component as indicated in 3.2 – 3.12;

b) Be used in accordance with its rating(s) established for the intended conditions of use;

c) Be used within its established use limitations or conditions of acceptability;

d) Additionally comply with the applicable requirements of this end product standard; and

e) Not contain mercury.

Note: 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.

Exception No. 1: A component of a product covered by this standard is not required to comply with a specific component requirement that:

a) Involves a feature or characteristic not required in the application of the component in the product,

b) Is superseded by a requirement in this standard, or

c) Is separately investigated when forming part of another component, provided the component is used within its established ratings and limitations.

Exception No. 2: A component complying with a UL component standard other than those cited in 3.2 – 3.12 is acceptable if:

a) The component also complies with the applicable component standard of 3.2 – 3.12; or

b) The component standard:

1) Is compatible with the ampacity and overcurrent protection requirements NFPA 70, where appropriate;

2) Considers long-term thermal properties of polymeric insulating materials in accordance with UL 746B, and

3) Any use limitations of the other component standard is identified and appropriately accommodated in the end use application. For example, a component used in a household application, but intended for industrial use and complying with the relevant component standard may assume user expertise not common in household applications.

3.1.2 A component that is also intended to perform other functions, such as over current protection, ground-fault circuit-interruption, surge suppression, any other similar functions, or any combination

thereof, shall comply additionally with the requirements of the applicable UL standard(s) that cover devices that provide those functions.

Exception: Where these other functions are not required for the application and not identified as part of markings, instructions, or packaging for the appliance, the additional component standard(s) need not be applied.

3.1.3 A component not anticipated by the requirements of this standard, not specifically covered by the component standards of 3.2 – 3.12, and that involves a potential risk of electric shock, fire, or personal injury, shall be additionally investigated in accordance with the applicable UL standard, and shall comply with 3.1.1 (b) – (d).

3.1.4 With regard to a component being additionally investigated, reference to construction and performance requirements in another UL end product standard is appropriate where that standard anticipates normal and abnormal use conditions consistent with the application of this Standard.

3.2 Attachment plugs, receptacles, connectors, and terminals

3.2.1 Attachment plugs, receptacles, appliance couplers, appliance inlets (motor attachment plugs) shall comply with UL 498.

Exception No. 1: Attachment plugs and appliance couplers integral to cord sets or power supply cords are covered under the requirements of UL 817 and need not comply with UL 498.

Exception No. 2: Plugs, receptacles, connectors, and terminals for specialty applications (e.g. data processing or communications) and located in a low-voltage circuit, complying with Section 41, Separation of Circuits, and not involving the risk of fire or personal injury need not comply with UL 758.

3.2.2 Quick-connect terminals, both connectors and tabs, for use with one or two 22 – 10 AWG copper conductors, having nominal widths of 2.8, 3.2, 4.8, 5.2, and 6.3 mm (0.110, 0.125, 0.187, 0.205, and 0.250 inch), intended for internal wiring connections in appliances shall comply with UL 310.

Exception No. 1: Other sizes of quick-connect terminals shall be investigated with respect to crimp pull out, insertion-withdrawal, temperature rise, and all tests shall be conducted in accordance with UL 310.

Exception No. 2: Plugs, receptacles, connectors, and terminals for specialty applications (e.g. data processing or communications) and located in a low-voltage circuit, complying with Section 41, Separation of Circuits, and not involving the risk of fire or personal injury need not comply with UL 758.

3.2.3 Wire connectors shall comply with UL 486A-486B.

Exception: Plugs, receptacles, connectors, and terminals for specialty applications (e.g. data processing or communications) and located in a low-voltage circuit, complying with Section 41, Separation of Circuits, and not involving the risk of fire or personal injury need not comply with UL 758.

3.2.4 Splicing wire connectors shall comply with UL 486C.

Exception: Plugs, receptacles, connectors, and terminals for specialty applications (e.g. data processing or communications) and located in a low-voltage circuit, complying with Section 41, Separation of Circuits, and not involving the risk of fire or personal injury need not comply with UL 758.

3.2.5 Equipment wiring terminals for use with all alloys of copper, aluminum, or copper-clad aluminum conductors, shall comply with UL 486E.

Exception: Plugs, receptacles, connectors, and terminals for specialty applications (e.g. data processing or communications) and located in a low-voltage circuit, complying with Section 41, Separation of Circuits, and not involving the risk of fire or personal injury need not comply with UL 758.

3.2.6 Terminal blocks shall comply with UL 1059, and, if applicable, be suitably rated for field wiring.

Exception No. 1: A fabricated parts performing the function of a terminal block need not comply with UL 1059 if the part complies with the requirements of Section 36, Field Supply Connections; Section 40, Internal Wiring; and Section 44, Insulating Materials.

Exception No. 2: Plugs, receptacles, connectors, and terminals for specialty applications (e.g. data processing or communications) and located in a low-voltage circuit, complying with Section 41, Separation of Circuits, and not involving the risk of fire or personal injury need not comply with UL 758.

3.2.7 Female devices (such as receptacles, appliance couplers, and connectors) that are intended, or that may be used, to interrupt current in the end product, shall be suitably rated for current interruption of the specific type of load, when evaluated with its mating plug or connector. For example, an appliance coupler that can be used to interrupt the current of a motor load shall have a suitable horsepower rating when tested with its mating plug.

Exception: Plugs, receptacles, connectors, and terminals for specialty applications (e.g. data processing or communications) and located in a low-voltage circuit, complying with Section 41, Separation of Circuits, and not involving the risk of fire or personal injury need not comply with UL 758.

3.3 Boxes and raceways

3.3.1 Electrical boxes and the associated bushings and fittings, and raceways, of the types specified in Chapter 3 of NFPA 70 and that comply with the relevant UL standard (such as UL 514A, UL 514C, UL 514D) and 3.1 are considered to fulfill the requirements of this Standard.

Exception: Enclosures complying with Section 35, Enclosure, of this end product standard is considered to meet the intent of this requirement.

3.4 Capacitors and filters

3.4.1 The component requirements for a capacitor are not specified. A capacitor complying with UL 810, is considered to fulfill the requirements of 18.1.

3.4.2 Electromagnetic interference filters with integral enclosures that comply with UL 1283, are considered to fulfill the requirements of 18.1.

Exception: A capacitor that complies with Section 43, Capacitors, of this end product standard is considered to meet the intent of this requirement.

3.5 Controls

3.5.1 General

3.5.1.1 Auxiliary controls shall be evaluated using the applicable requirements of this end product standard.

3.5.1.2 Operating (regulating) controls shall be evaluated using the applicable component standard requirements specified in 3.5.2 – 3.5.5, and if applicable unless otherwise specified in this end product

standard. Operating controls that rely upon software for the normal operation of the end product where deviation or drift of the control may result in a hazard, such as a speed control unexpectedly changing its output, shall comply with the:

a) UL 991; and UL 1998; or

b) UL 60730-1.

3.5.1.3 Protective (limiting) controls shall be evaluated using the applicable component standard requirements specified in 3.5.2.2.

3.5.2 Electromechanical and electronic controls

3.5.2.1 An operating (regulating) control, other than as specified in 3.5.3 – 3.5.5, shall comply with the:

a) UL 244A;

b) UL 873; or

c) UL 60730-1.

3.5.2.2 Protective (limiting) controls shall comply with UL 353.

3.5.3 Motor and speed controls

3.5.3.1 A control used to start, stop, regulate or control the speed of a motor shall comply with the:

a) UL 244A;

b) UL 873;

c) UL 508;

d) UL 61800-5-1; or

e) UL 60730-1.

3.5.4 Temperature controls

3.5.4.1 A temperature control shall comply with the:

a) UL 244A;

b) UL 873;

c) UL 508; or

d) UL 60730-1 and UL 60730-2-9.

3.5.4.2 A temperature sensing positive temperature coefficient (PTC) or negative temperature coefficient (NTC) thermistor, that performs the same function as an operating or protective control shall comply with UL 1434.

3.5.4.3 A thermal cutoff shall comply with UL 60691.

3.5.5 Timer controls

3.5.5.1 A timer control shall comply with the:

a) UL 244A; or

b) UL 60730-1 and UL 60730-2-7.

3.6 Cords, cables, and internal wiring

3.6.1 A cord set or power supply cord shall comply with UL 817.

3.6.2 Flexible cords and cables shall comply with UL 62. Flexible cord and cables are considered to fulfill this requirement when preassembled in a cord set or power supply cord complying with UL 817.

3.6.3 Internal wiring composed of insulated conductors shall comply with UL 758.

Exception No. 1: Insulated conductors need not comply with UL 758 if they comply with one of the following:

a) UL 44;

b) UL 83;

c) UL 66; or

d) The appropriate UL standard(s) for other insulated conductor types specified in Chapter 3, Wiring Methods and Materials, of NFPA 70.

Exception No. 2: Insulated conductors for specialty applications (e.g. data processing or communications) and located in a low-voltage circuit, complying with Section 41, Separation of Circuits, and not involving the risk of fire or personal injury need not comply with UL 758.

3.7 Overcurrent protection

3.7.1 Fuses shall comply with UL 248-1; and the applicable UL 248 Part 2 (e.g. UL 248-5). Defined use fuses that comply with UL 248-1 and another appropriate UL standard for the fuse are considered to fulfill this requirement.

3.7.2 Fuseholders shall comply with UL 4248-1, and the applicable Part 2 (e.g. UL 4248-9).

3.7.3 Circuit breakers shall comply with UL 489.

Exception: Circuit breakers used in telecommunications circuitry that comply with UL 489A, need not comply with UL 489.

3.7.4 Circuit breakers having integral ground fault circuit interrupter capability for protection against electrical shock shall additionally comply with the UL 943.

3.7.5 Supplementary protectors shall comply with UL 1077.

3.7.6 Fusing resistors shall comply UL 1412.

3.8 Polymeric materials and enclosures

3.8.1 Unless otherwise specified in this end product standard, polymeric electrical insulating materials and enclosures shall comply with the applicable requirements of UL 746C.

3.8.2 Metallized or painted polymeric parts or enclosures shall comply with the applicable requirements of UL 746C. This requirement is not applicable to exterior surfaces of polymeric enclosure materials or parts provided that the metallized coating or paint does not offer a continuous path for an internal flame to propagate externally.

3.9 Power supplies

3.9.1 A Class 2 power supply shall comply with one of the following:

a) UL 1310; or

b) UL 60950-1, with an output marked "Class 2", or that complies with the limited power source (LPS) requirements and is marked "LPS"; or

c) UL 62368-1, marked “Class 2” or the equivalent.

3.9.2 A non-Class 2 power supply shall comply with one of the following:

a) UL 1012; or

b) UL 60950-1; or

c) UL 62368-1.

3.10 Printed wiring boards

3.10.1 Printed wiring boards, including the coatings, shall comply with UL 796.

Exception: A printed-wiring board in a Class 2 nonsafety circuit is not required to comply with the bonding requirements in UL 796 if the board is separated from parts of other circuits such that loosening of the bond between the foil conductor and the base material will not result in the foil conductors or components coming in contact with parts of other circuits of the control or of the end-use product.

3.11 Switches

3.11.1 Switches shall comply with one of the following, as applicable:

a) UL 61058-1;

b) UL 20; or

c) UL 773A.

Exception: Switching devices that comply with the appropriate UL standard for specialty applications (e.g. transfer switch equipment), industrial use (e.g. contactors, relays, auxiliary devices), or are integral to another component (e.g. switched lampholder) need not comply.

3.11.2 A clock-operated switch, in which the switching contacts are actuated by a clock-work, by a gear-train, by electrically-wound spring motors, by electric clock-type motors, or by equivalent arrangements shall comply with one of the following:

a) UL 917; or

b) UL 60730-1 and UL 60730-2-7.

3.11.3 A timer or time switch, incorporating electronic timing circuits or switching circuits, with or without separable contacts, shall comply with the requirements for an operating control with Type 1 action for 6000 cycles of operation, or as a manual control for 5000 cycles of operation, in accordance with the following:

a) UL 244A;

b) UL 60730-1 and UL 60730-2-7.

3.11.4 A timer or time switch, incorporating electronic timing circuits or switching circuits, with or without separable contacts, that functions as a protective control, shall comply with the requirements for a protective control; see 3.5.1.3.

3.12 Transformers

3.12.1 General-purpose transformers shall comply with UL 5085-1; and UL 5085-2.

Exception: A transformer that is completely enclosed within the end product enclosure, and that meets the applicable construction and performance requirements of this end product standard when tested in conjunction with the end product, meets the intent of this requirement.

3.12.2 Class 2 and Class 3 transformers shall comply with UL 5085-1; and UL 5085-3.

Exception: Transformers located in a low voltage circuit, and that do not involve a risk of fire or personal injury, need not comply with this requirement.

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 Referenced Publications

5.1 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.

5.2 The following publications are referenced in this Standard:

ASTM E230/E230M, *Standard Specification for Temperature-Electromotive Force (emf) Tables for Standardized Thermocouples*

ASTM A90, *Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles*

ASTM A463, *Aluminum Coated Type 1 Cold Rolled Steel Sheet*

ASTM A653, *Hot-Dip Process*

ASTM D2860, *Adhesion of Pressure-Sensitive Tape to Fiberboard at 90 Degree Angle and Constant Stress*

CSA/AM ANSI Z21.11.2, *Gas-fired room heaters, volume II, unvented room heaters*

Department of Housing and Urban Development (HUD) "Manufactured Home Construction and Safety Standards

International Mechanical Code

IAS/AGA Z21.11.2, *Unvented Room Heaters*

NFPA 70, *National Electric Code*

NFPA 90B, *Standard for Installation of Warm Air Heating and Air Conditioning Systems*

NFPA 211, *Standard for Chimneys, Fireplaces, Vents, and Solid Fuel Burning Appliances*

UL 20, *General-Use Snap Switches*

UL 44, *Thermoset-Insulated Wires and Cables*

UL 66, *Fixture Wire*

UL 73, *Motor-Operated Appliances*

UL 83, *Thermoplastic-Insulated Wires and Cables*

UL 103, *Factory-Built Chimneys for Residential Type and Building Heating Appliance*

UL 181, *Factory-Made Air Ducts and Air Connectors*

UL 244A, *Solid-State Controls for Appliances*

UL 248-1, *Low-Voltage Fuses – Part 1: General Requirements*

UL 248-5, *Low-Voltage Fuses – Part 2: Class C Fuses*

UL 310, *Electrical Quick-Connect Terminals*

UL 353, *Limit Controls*

UL 486A-486B, *Wire Connectors*

UL 486C, *Splicing Wire Connectors*

UL 486E, *Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors*

UL 489, *Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures*

UL 489A, *Circuit Breakers For Use in Communications Equipment*

UL 498, *Attachment Plugs and Receptacles*

UL 508, *Industrial Control Equipment*

UL 508C, *Industrial Control Equipment*

UL 514A, *Metallic Outlet Boxes*

UL 514C, *Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers*

UL 514D, *Cover Plates for Flush-Mounted Wiring Devices*

UL 746B, *Polymeric Materials – Long Term Property Evaluations*

UL 746C, *Polymeric Materials – Use in Electrical Equipment Evaluations*

UL 758, *Appliance Wiring Material*

UL 773A, *Nonindustrial Photoelectric Switches for Lighting Control*

UL 796, *Printed Wiring Boards*

UL 810, *Capacitors*

UL 817, *Cord Sets and Power-Supply Cords*

UL 873, *Temperature-Indicating and -Regulating Equipment*

UL 917, *Clock-Operated Switches*

UL 943, *Ground-Fault Circuit-Interrupters*

UL 991, *Tests for Safety-Related Controls Employing Solid-State Devices*

UL 1004-1, *Rotating Electrical Machines – General Requirements*

UL 1004-2, *Impedance Protected Motors*

UL 1004-3, *Thermally Protected Motors*

UL 1004-7, *Electronically Protected Motors*

UL 1012, *Power Units Other Than Class 2*

UL 1059, *Terminal Blocks*

UL 1077, *Supplementary Protectors for Use in Electrical Equipment*

UL 1283, *Electromagnetic Interference Filters*

UL 1310, *Class 2 Power Units*

UL 1412, *Fusing Resistors and Temperature-Limited Resistors for Radio- and Television-Type Appliances*

UL 1434, *Thermistor-Type Devices*

UL 1998, *Software in Programmable Components*

UL 4248-1, *Fuseholders – Part 1: General Requirements*

UL 4248-9, *Fuseholders – Part 9: Class K*

UL 5085-1, *Low Voltage Transformers – Part 1: General Requirements*

UL 5085-2, *Low Voltage Transformers – Part 2: General Purpose Transformers*

UL 5085-3, *Low Voltage Transformers – Part 3: Class 2 and Class 3 Transformers*

UL 60691, *Thermal-Links – Requirements and Application Guide*

UL 60730-1, *Automatic Electrical Controls – Part 1: General Requirements*

UL 60730-2-2, Automatic Electrical Controls for Household and Similar Use; Part 2 Particular Requirements for Thermal Motor Protectors

UL 60730-2-7, *Automatic Electrical Controls for Household and Similar Use; Part 2: Particular Requirements for Timers and Time Switches*

UL 60730-2-9, *Automatic Electrical Controls for Household and Similar Use; Part 2: Particular Requirements for Temperature Sensing Controls*

UL 60950-1, *Information Technology Equipment – Safety – Part 1: General Requirements*

UL 61058-1, *Switches for Appliances – Part 1: General Requirements*

UL 61800-5-1, *Adjustable Speed Electrical Power Drive Systems – Part 5-1: Safety Requirements – Electrical, Thermal and Energy*

UL 62368-1, *Audio/Video, Information and Communication Technology Equipment – Part 1: Safety Requirements*

Uniform Mechanical Code

6 Terms

6.1 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

7 Materials

7.1 General

7.1.1 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.

7.1.2 The minimum thickness of sheet metal, including any coatings, shall comply with Table 7.1 unless otherwise specified in these requirements.

Exception: Decorative metal parts are not required to comply with Table 7.1.

Table 7.1
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)

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

7.1.4 A flue-gas-conveying conduit of a chimney shall be of a material equivalent to that of a material specified in Table 7.2. Cast refractory, clay tile, and porcelain-coated steel shall comply with the requirements of the applicable tests described in Sections 22 – 26.

Table 7.2
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

7.1.5 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 7.3.

Table 7.3
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 1 of Table 11.1.

7.1.6 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 the Weight (Mass) of Coating Requirements table in ASTM A653, with not less than 40 % of the zinc on any side as determined by the minimum single spot test requirements of ASTM A653.

7.1.7 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 ASTM A463, with not less than 0.40 ounce of aluminum coating per square foot (0.12 kg/m^2) of steel or equivalent.

Exception: Galvanized steel with a zinc coating complying with the coating designation G90 is not prohibited from being used for parts of a chimney subjected to contact by flue gas or condensation, when evaluated during the Performance Testing of Section 9 and when the temperature limitations of this material shown in Table 11.1 are not exceeded.

7.1.8 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 the Weight (Mass) of Coating Requirements table in 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 zinc coating shall be established in accordance with ASTM A90.

7.1.9 An unreinforced outer casing of a fire chamber or chimney shall be of material equivalent to one of those specified in Table 7.4. 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 7.4
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)

7.1.10 Steel with a proprietary coating shall not be used unless it is determined to be equivalent to the coated steel as specified in 7.1.4 – 7.1.9.

7.1.11 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 7.1.8.

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

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

7.1.14 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).

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

7.2 Air duct system

7.2.1 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 7.5. See 8.12.1 and 8.12.2.

Exception: Lesser thickness materials classified as Class 0 or Class 1 air ducts, as defined in NFPA 90B, and in the requirements in 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 7.5
Minimum Thickness of Sheet Metal Ducts

Diameter or width	Galvanized steel			Aluminum		Tin plate
	Nominal thickness	Minimum thickness		Minimum thickness		Minimum weight per base box
inches	inches	inches	(mm)	inches	(mm)	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)	–

7.2.2 Asbestos material shall not be used.

7.2.3 Fibrous insulation materials used in an air handling compartment shall comply with the Erosion Test specified in the requirements in UL 181.

8 Assembly

8.1 General

8.1.1 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.

8.1.2 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.

8.1.3 To comply with the requirements of 8.1.1 and 8.1.2, 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.

8.1.4 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.

8.1.5 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.

8.2 Joints

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

8.2.2 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 8.1.1. 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.

8.2.3 A joint, fabricated in accordance with the manufacturer's instructions, shall limit the leakage of combustion by-products through the joint. With reference to 7.1.13, there shall be no leakage in areas where thermal insulation is installed. There shall also be no leakage from the exterior of the assembly.

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

8.2.5 A joint shall not retain condensation. Condensation also shall not flow from the interior to the exterior of the fuel-gas-conveying conduit.

8.3 Firestop spacers

8.3.1 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.

8.3.2 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 (25.4 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.

8.4 Support assembly

8.4.1 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.

8.4.2 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.

8.5 Radiation shield

8.5.1 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.

8.5.2 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.

8.5.3 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.

8.6 Flue damper

8.6.1 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 13 – 15), 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 13 – 15, 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 60.11.

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 11.1.

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.

8.7 Chimney caps

8.7.1 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 21.

8.7.2 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.

8.7.3 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.

8.8 Roof assemblies

8.8.1 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.

8.8.2 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 21.

8.8.3 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.

8.8.4 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 8.3.2 and 10.30, which apply to openings between the chimney and the flashing, and between the flashing and the test enclosure.) See Figure 8.1, 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.

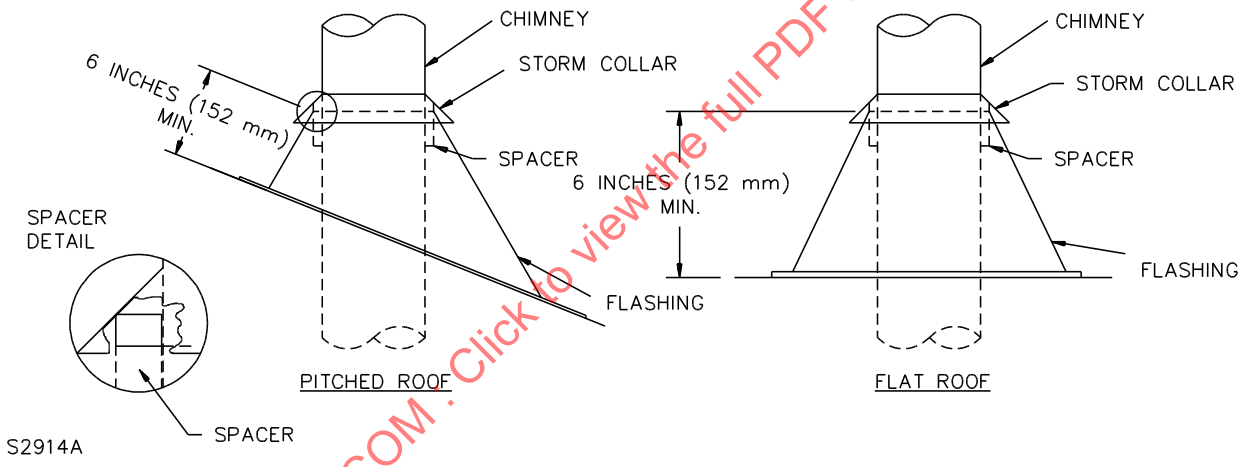
b) The lowest portion of the opening in the flashing shall not be less than 6 inches (152 mm) above the roof, measured perpendicular to the roof.

c) The assembly shall incorporate a storm collar.

d) The intended openings shall be maintained by means of spacers factory-attached to the flashing, or designed openings in the assembly.

Figure 8.1

Typical Roof Flashing Housing Assembly



8.9 Firescreens

8.9.1 A firescreen shall not permit entrance of a 1/4 inch (6.4 mm) diameter rod through any opening. The firescreen shall be capable of covering all fire chamber openings within 1/4 inch (6.4 mm) of each edge and shall be furnished by the manufacturer as part of the fireplace, even if doors are provided.

8.10 Chimney elbows

8.10.1 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.

8.11 Gas pipe provision

8.11.1 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.

8.12 Air duct system

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

8.12.2 The combustion air inlet shall prevent material from dropping into the inlet and also prevent rodents from entering from the outside by use of a minimum 20 gauge wire mesh having openings not larger than 1/4 by 1/4 inch (6.4 by 6.4 mm).

8.13 Handles

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

8.14 Integral grates

8.14.1 An integral grate that effectively reduces the hearth area as defined by 14.6 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."

8.15 Openings in chimney walls

8.15.1 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.

8.15.2 The openings specified in 8.15.1 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

9 General

9.1 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.

9.2 After being tested in accordance with the Thermal Shock Test (see 12.2.1 – 12.2.5); Temperature Test – 1700 °F Flue Gases (see 12.3.1 – 12.3.4) or Temperature Test – 2100 °F Flue Gases (see 12.4.1 – 12.4.5), as appropriate; Radiant Fire Test, Section 13; Brand Fire Test, Section 14; and Flash Fire Test, Section 15; 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 17; Fire Chamber Strength Test, Section 18; and Chimney Strength Test, Section 19.

9.3 Compliance with the requirements in 9.2 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.

9.4 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.

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

10 Test Installations

10.1 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.

10.2 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.

10.3 Fireplaces are to be tested as described in Radiant Fire Test, Section 13; Brand Fire Test, Section 14; and Flash Fire Test, Section 15, 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.

10.4 The fireplace is to be installed in a structure similar to that illustrated by Figure 10.1, Figure 10.2, and Figure 10.3 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.

Figure 10.1

Typical Test Structure Within Test Room

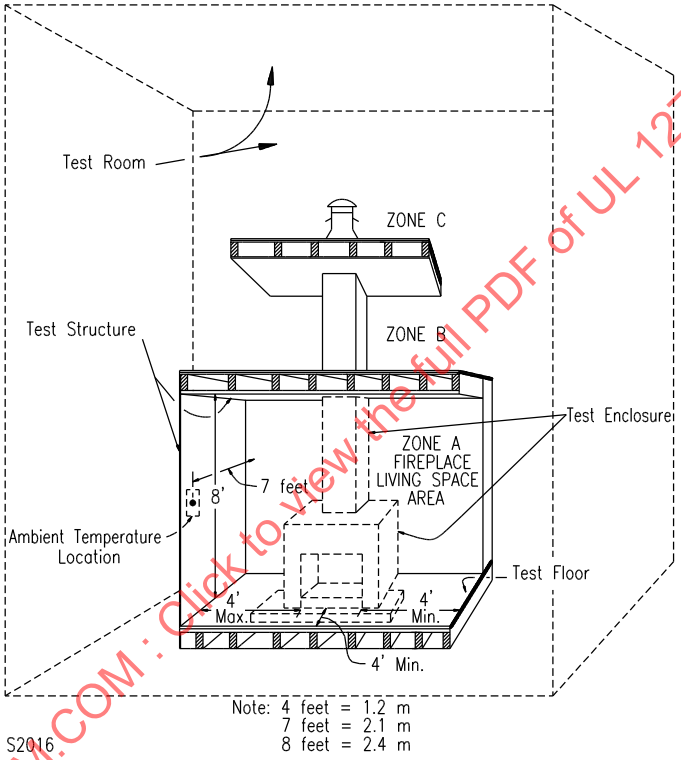
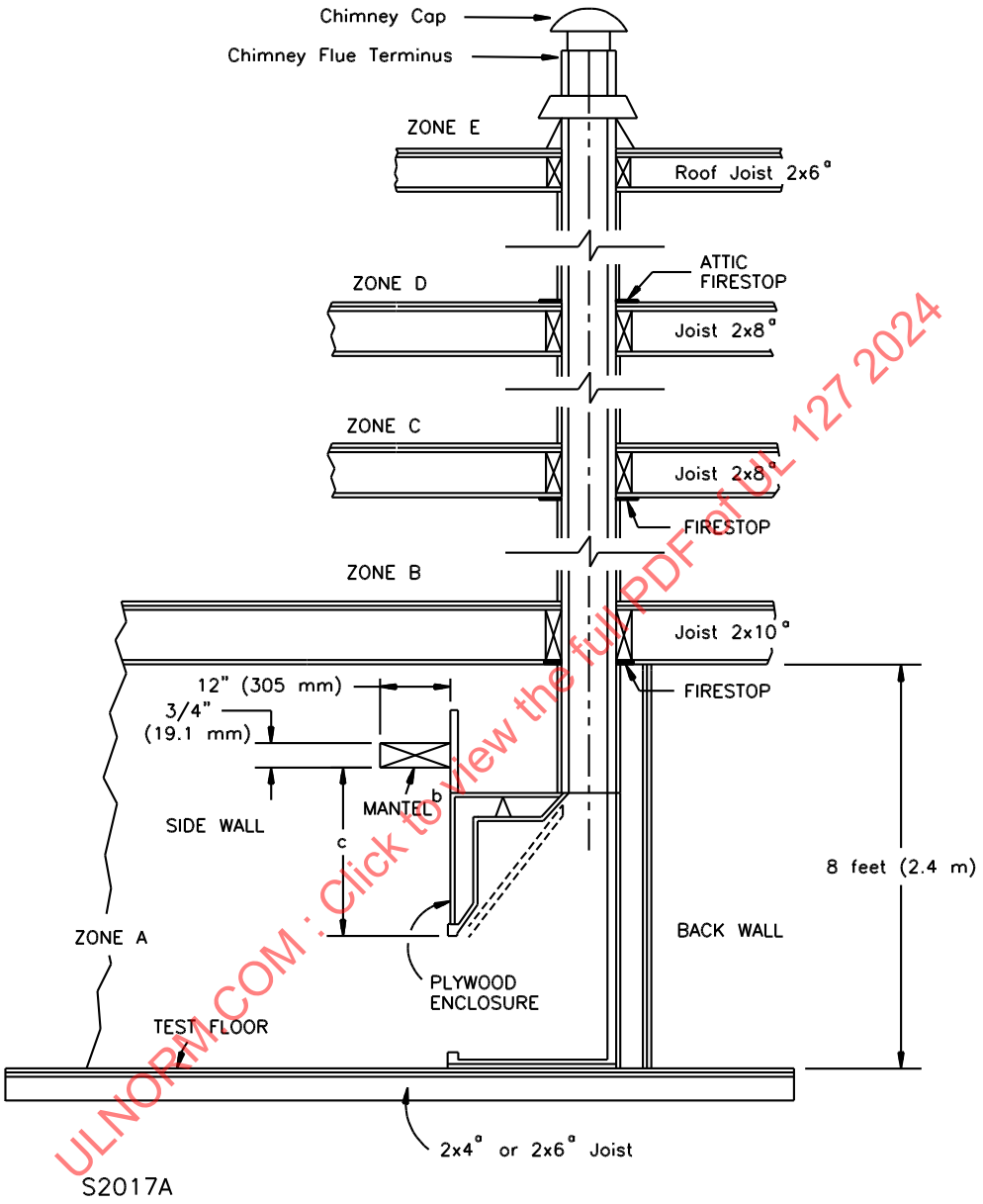


Figure 10.2

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.

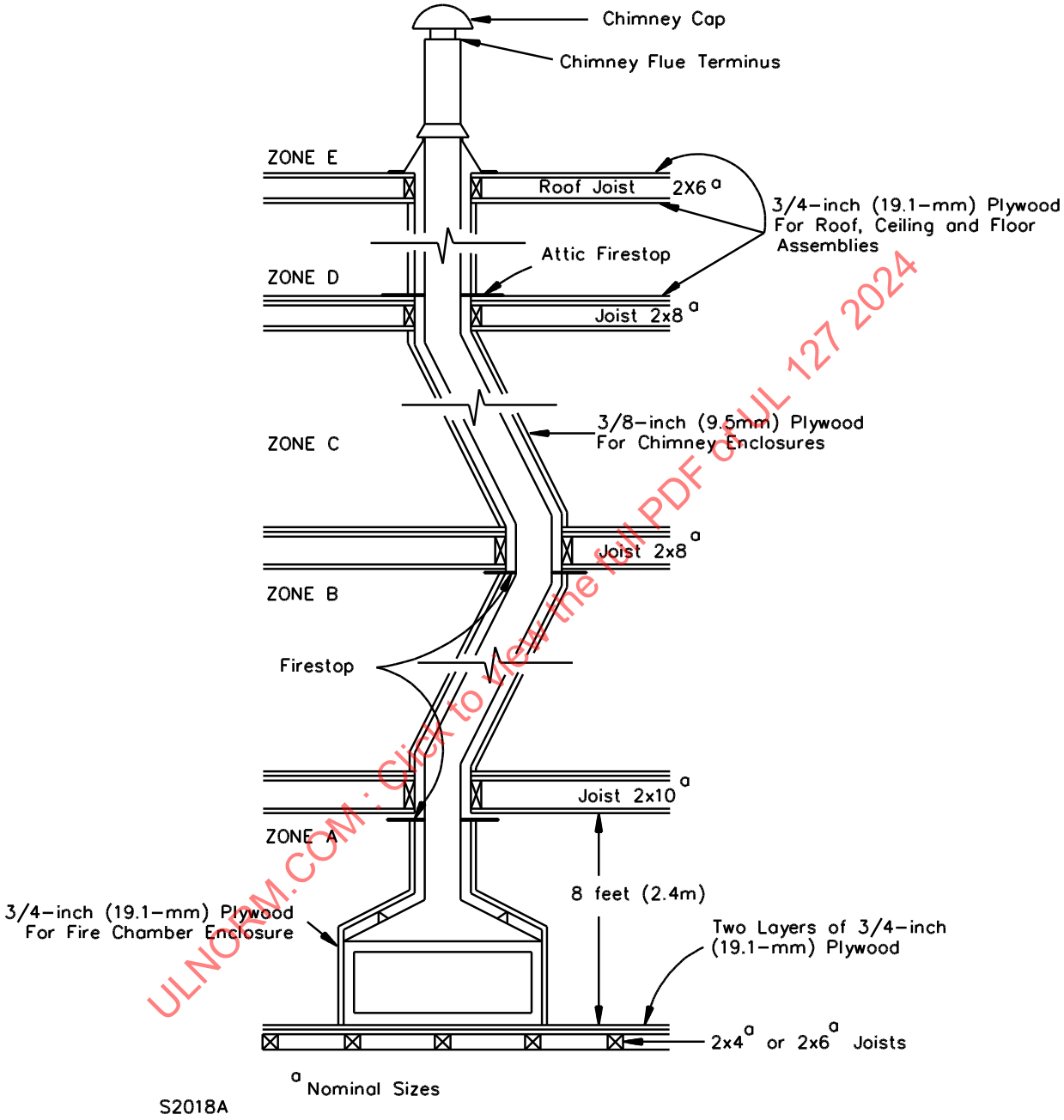
b Mantel is used only when fireplace is intended for use with a mantel.

c Minimum distance above fireplace opening specified in installation instructions.

d Mantel depth as specified in the installation instructions.

Figure 10.3

Test Structure Incorporating Chimney Elbows (Front View)



10.5 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 10.3.

10.6 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 10.1.

10.7 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.

10.8 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.

10.9 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.

10.10 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.

10.11 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.

10.12 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 10.1.

10.13 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.

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

10.15 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 10.2. 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.

10.16 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 (2.4 m) 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 (1.2 m) 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 (1.2 m) beyond the side of the fireplace opening which is opposite the side wall.

10.17 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.

10.18 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.

10.19 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.

10.20 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.

10.21 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.

10.22 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.

10.23 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 10.10 for typical configurations and thermocouple locations.

10.24 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 60.7.

10.25 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 Figure 10.5 to Figure 10.9, 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 Figure 10.2, Figure 10.5, and Figure 10.6.

10.26 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.

10.27 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 10.4. The chase extension is to be closed at the top by the method described in the manufacturer's installation instructions. Refer to Figure 10.4 for thermocouple locations.

Figure 10.4

Typical Thermocouple Locations Chase Top Termination Assembly

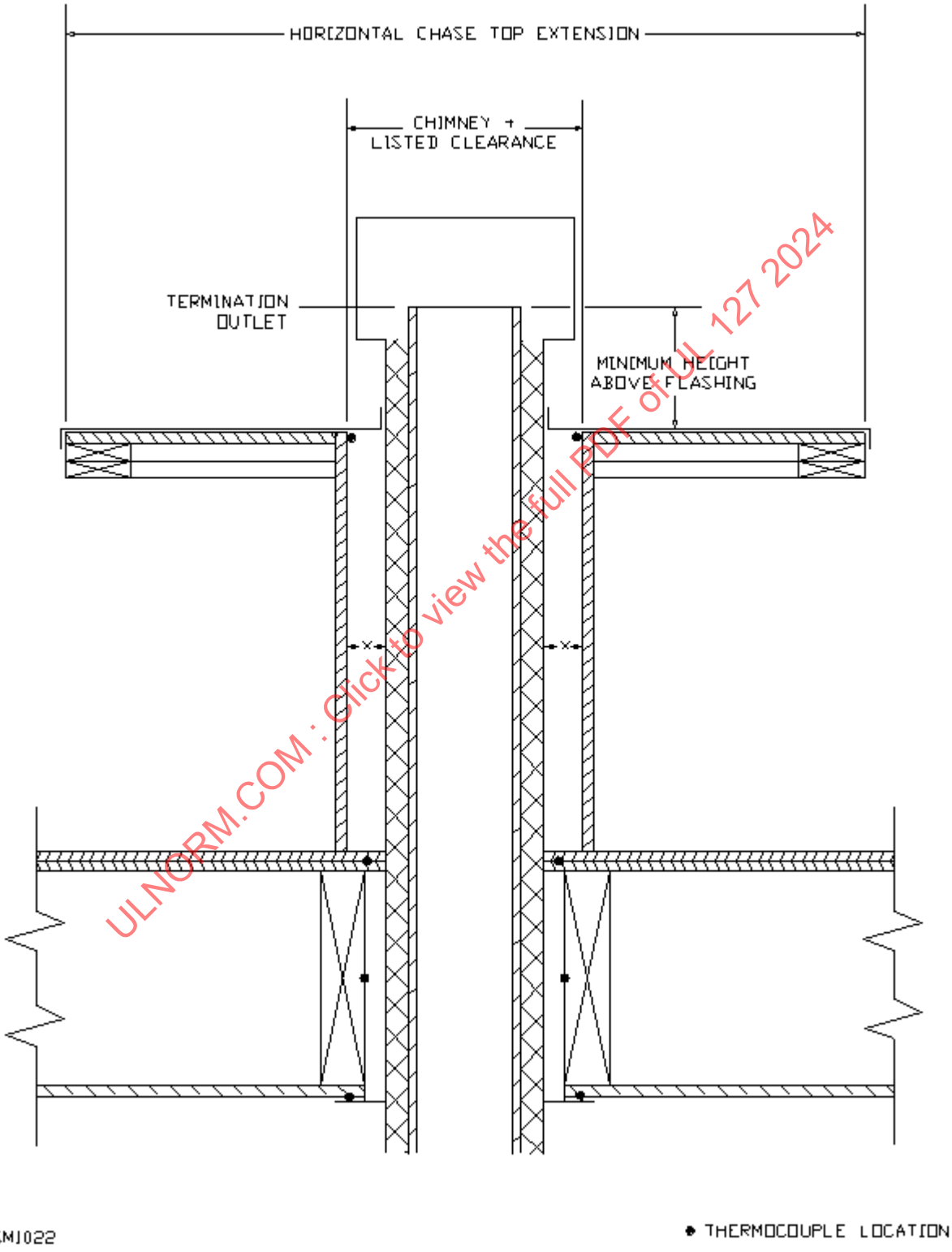


Figure 10.5

Test Structure Details for Firestop-Spacer Assembly

(Enclosure Shown at Specified Clearance Denoted by "X")

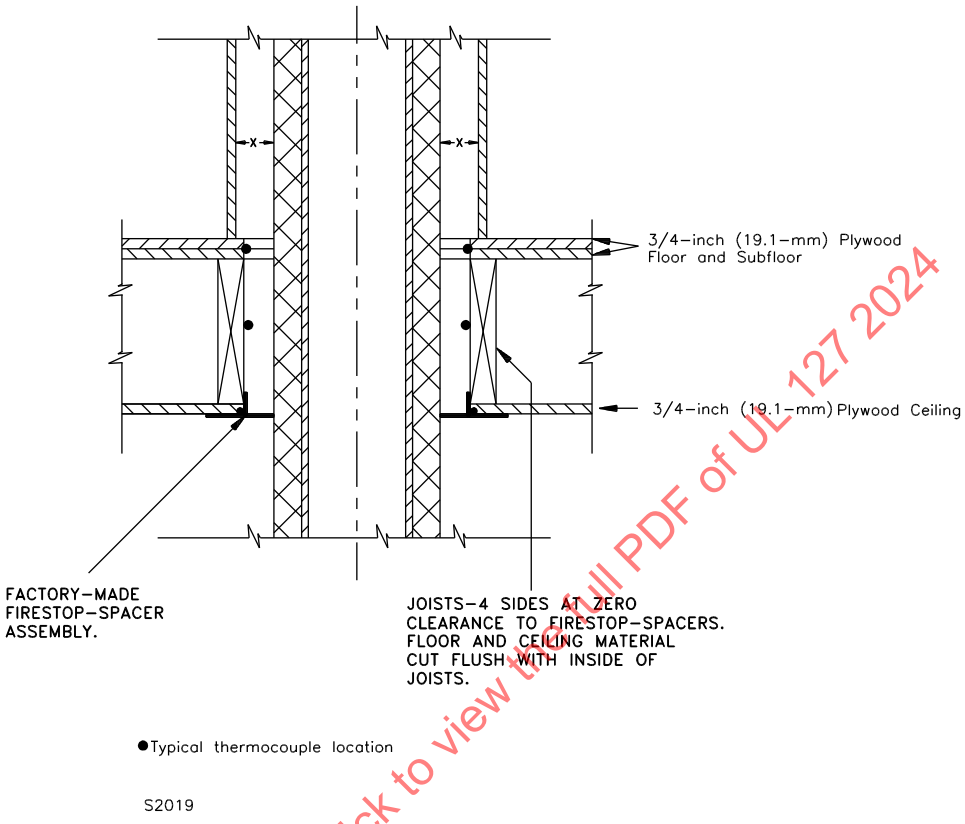
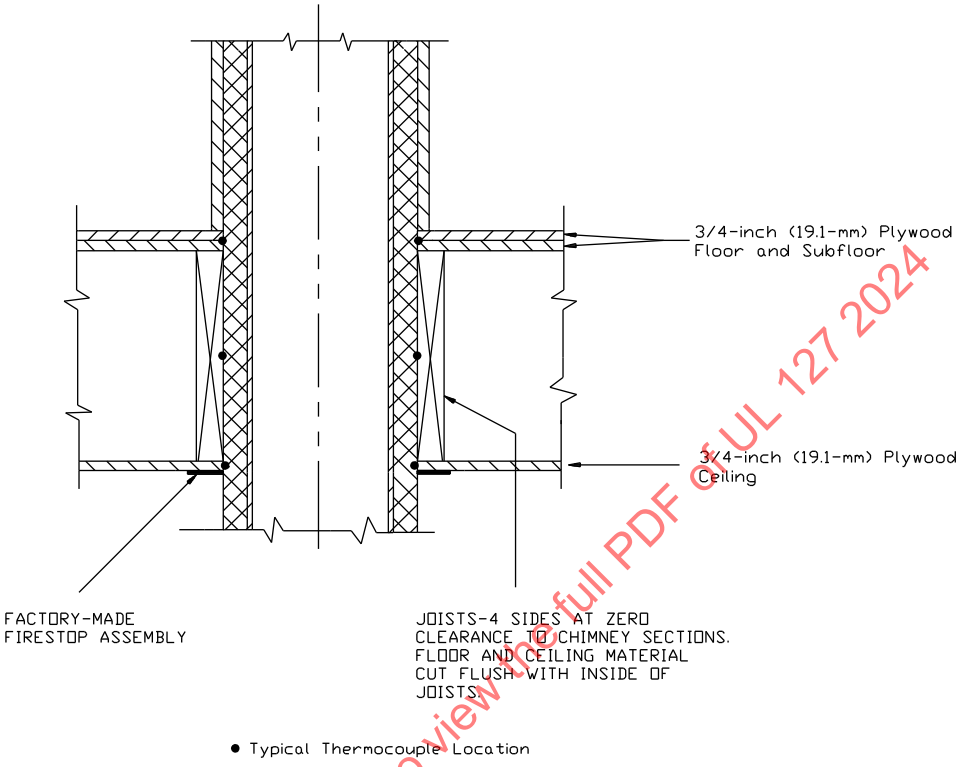


Figure 10.6

Test Structure Details for Firestop Assembly

(Enclosure Shown at Zero Clearance)



10.28 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 Figure 10.7 – Figure 10.9. All ceiling, floor, and roof material is to be cut flush with the inside of all framed joist openings.

Figure 10.7

Test Structure Details for Roof Assembly

(Roof Assembly Larger Than Roof Joist Area)

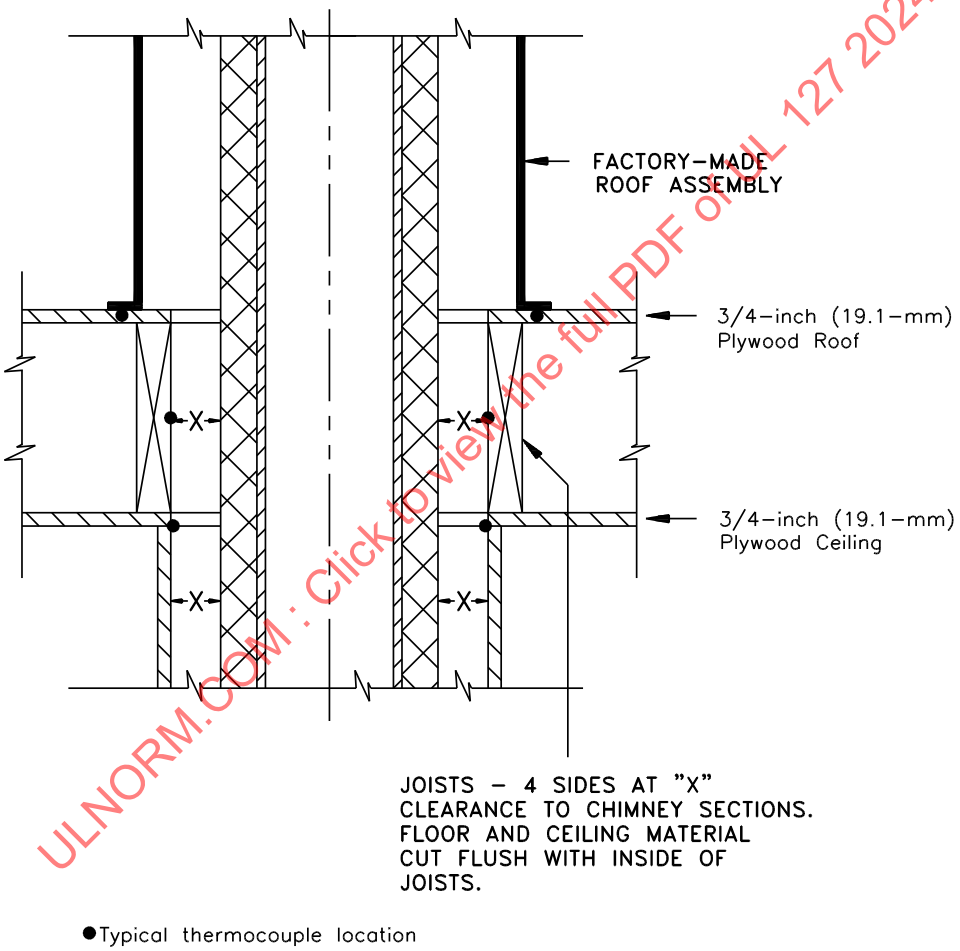


Figure 10.8

Test Structure Details for Roof Assembly

(Roof Assembly Smaller Than Enclosure Area)

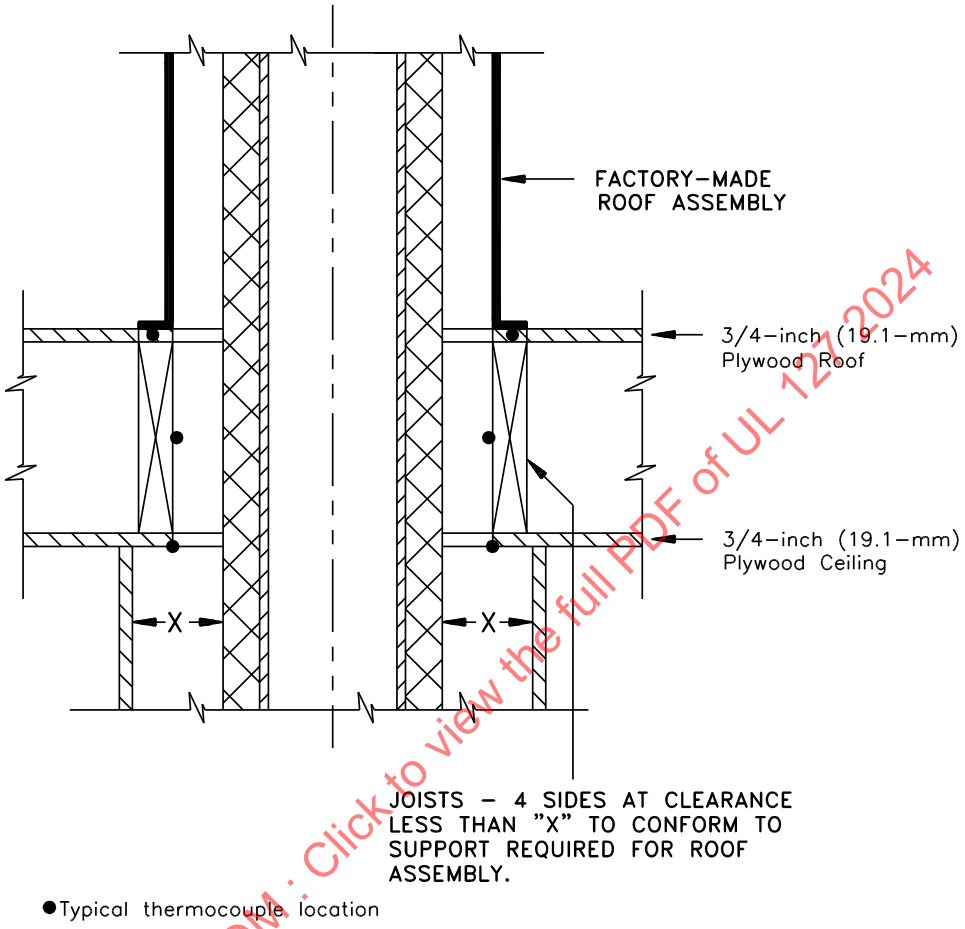


Figure 10.9

Test Structure Details for Roof Assembly

(Roof Assembly of Type Not Requiring Field Alteration to Conform to Roof Line)

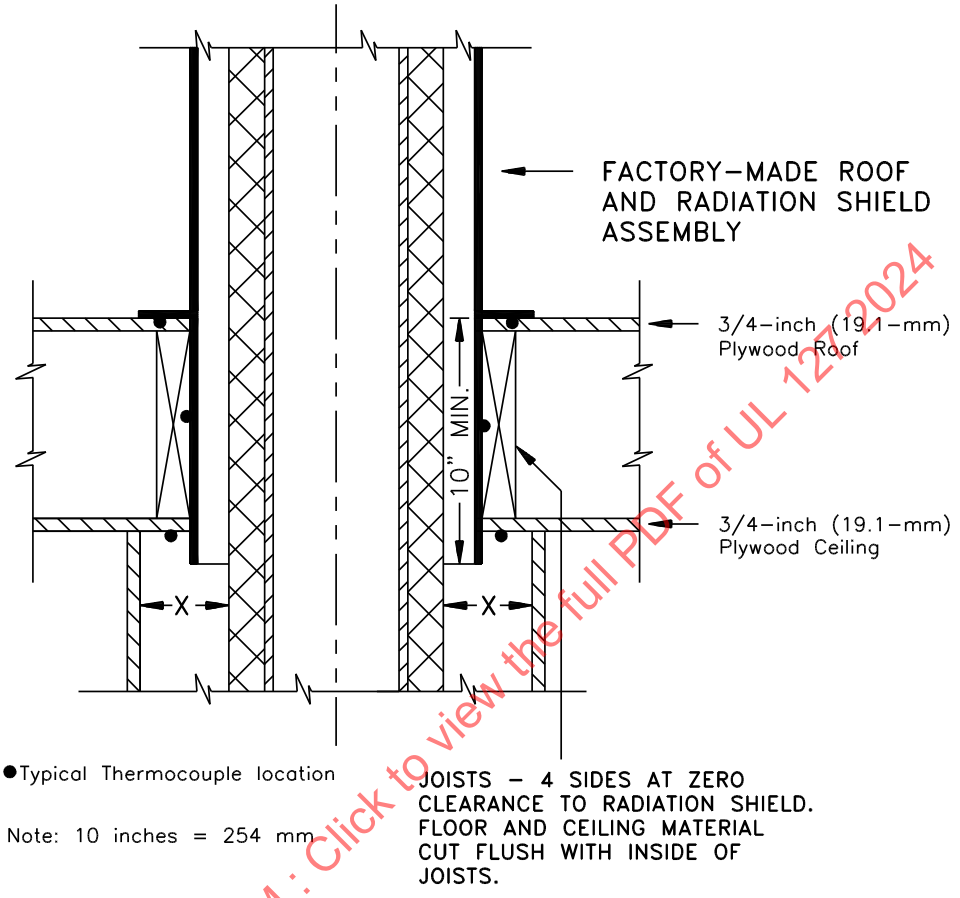
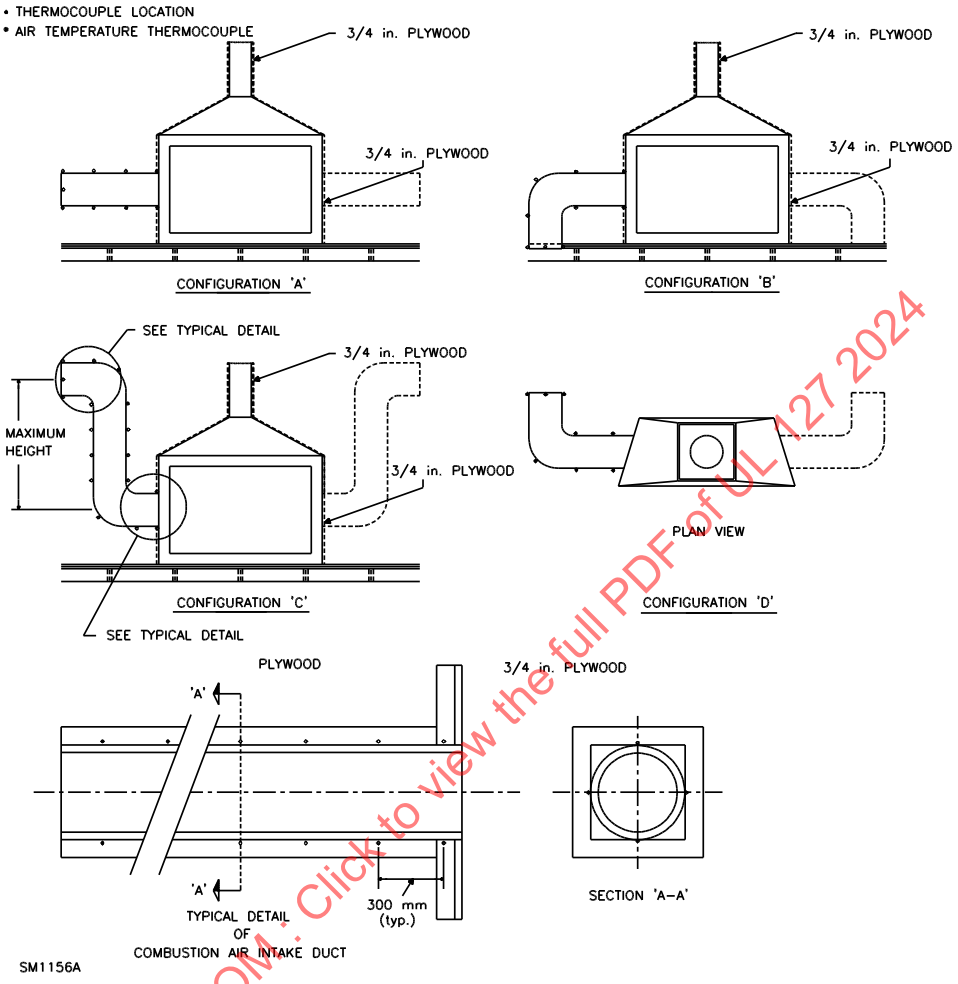


Figure 10.10

Typical Thermocouple Locations Combustion Outside Air Duct Fittings



10.29 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.

10.30 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 ASTM D2860, at elevated temperatures of 150 °F (66 °C).

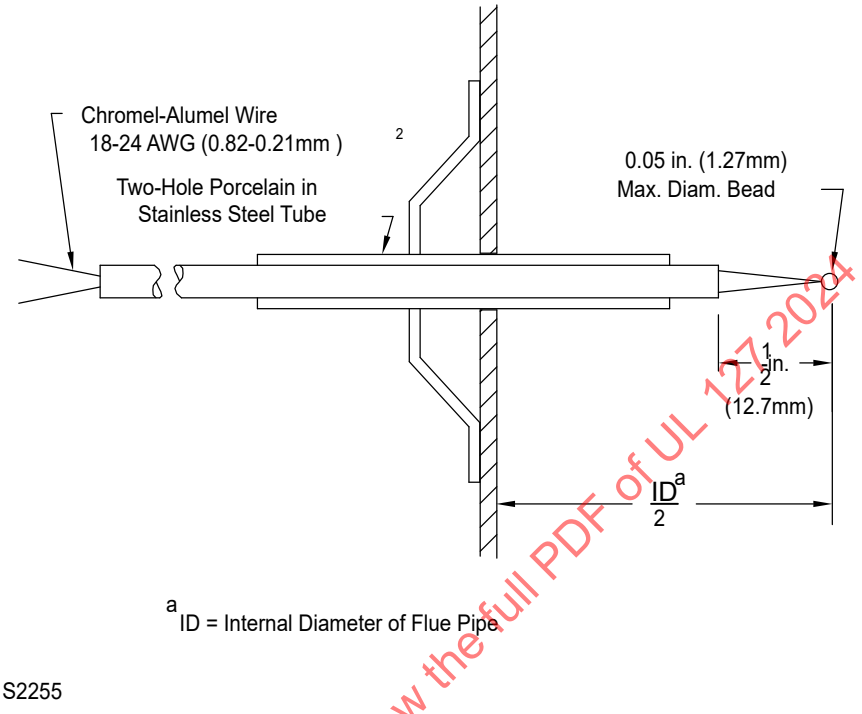
10.31 All wall surfaces, the floor surface, the ceiling surface, and the inside surface of the plywood enclosure facing the fireplace and chimney are to be painted flat black.

11 Temperature Measurement

11.1 Flue-gas temperatures are to be measured by a thermocouple, such as illustrated by Figure 11.1, inserted to the center line of the flue pipe. The thermocouple is to be located as shown in Figure 12.2 or as described in 12.1.2.

Figure 11.1

Flue-Gas Thermocouple and Support Bracket



11.2 The thermocouple is to be a Type K (chromel-alumel) of 18 – 24 AWG (0.82 – 0.21 mm^2) wire with an untwisted welded bare lead junction of not more than 0.050 inch (1.27 mm) diameter.

11.3 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 24 AWG (0.21 mm^2).

11.4 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 18 AWG (0.82 mm) to 24 AWG (0.21 mm^2).

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

11.6 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.

11.7 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.

11.8 Ambient temperatures are to be determined by shielded thermocouples located within their respective zones (see 11.9 – 11.11) relative to parts of the fireplace, test structure, and flue-gas generator.

11.9 The ambient temperature for Zone A (Figure 10.1) 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.

11.10 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.

11.11 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.

11.12 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.

11.13 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.

11.14 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 11.9 – 11.11.

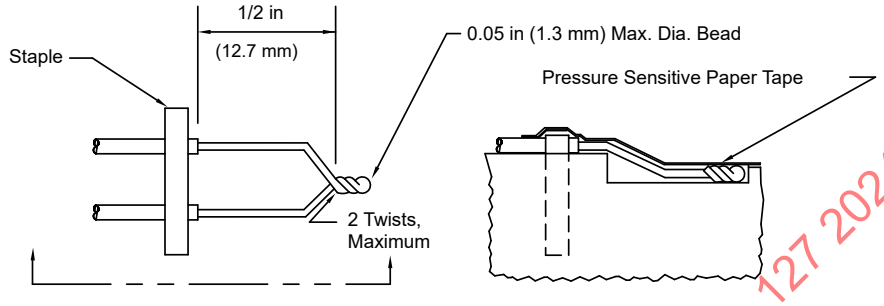
11.15 Recorded temperature rises on joists and rafters are to be referenced to the average of the recorded ambient temperatures above and below the involved joist or rafter areas.

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

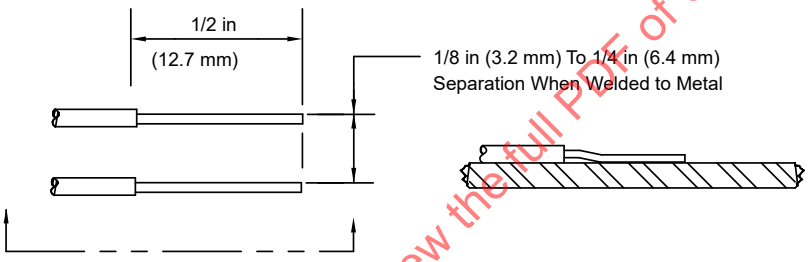
11.17 Recorded temperature rises on ceiling material are to be referenced to the recorded ambient temperature recorded below the involved ceiling area.

11.18 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 11.2.

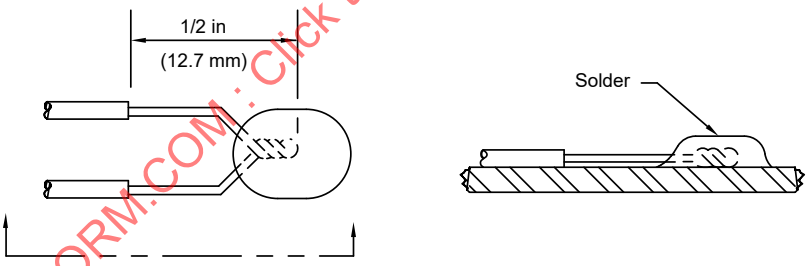
Figure 11.2
Thermocouple Installation Methods



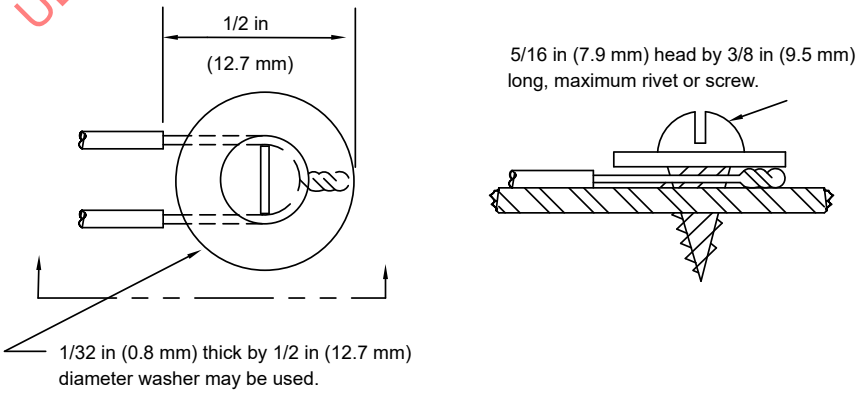
THERMOCOUPLE FOR WOOD SURFACES



THERMOCOUPLE WELDED TO METAL SURFACE



THERMOCOUPLE SOLDERED TO METAL SURFACES



TC-100 THERMOCOUPLE SECURED TO METAL SURFACES

11.19 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 11.2.

11.20 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.

11.21 Thermocouples are to be attached to surfaces other than those described in 11.18 – 11.20 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 11.1. Temperatures on electrical conductors are to be measured on the surfaces of the conductor insulation.

Table 11.1
Maximum Temperature Rises

Device or material	Column 1		Column 2	
	°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)

Table 11.1 Continued on Next Page

Table 11.1 Continued

Device or material	Column 1		Column 2	
	°C	(°F)	°C	(°F)
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)		
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	See note e			
D. Electrical Insulation – General[f,o]				
1. Class C electrical insulation material	Not specified			
2. Class (180) electrical insulation material	As determined by test			
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			

Table 11.1 Continued on Next Page

Table 11.1 Continued

Device or material	Column 1		Column 2	
	°C	(°F)	°C	(°F)
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)
2. Aluminum-coated steel, heat-resistant type[i]	572	(1030)	708	(1275)
3. Carbon steel – Coated with Type A19 ceramic	572	(1030)	628	(1130)
4. Galvanized steel[j]	267	(480)	350	(630)
5. Low-carbon steel, cast iron[k,i]	461	(830)	517	(930)
6. Stainless steel –				
a. Type 302, 303, 304, 321, 347	686	(1235)	767	(1380)
b. Type 316	667	(1200)	748	(1345)
c. Type 309S	867	(1560)	950	(1705)
d. Types 310, 310B	894	(1610)	975	(1755)
e. Type 430	728	(1310)	808	(1455)
f. Type 446	961	(1730)	1042	(1875)
F. Handles[n]				
1. Metallic	50	(122)	–	–
2. Glass	78	(172)	–	–
3. Plastic[m]	85	(185)	–	–
4. Wood	150	(302)	–	–

[a] The motor diameter is to be measured in the plane of the laminations of the circle circumscribing the stator frame, excluding lugs, and boxes, used solely for motor cooling, mounting, assembly, or connection.

[b] Ordinarily, coil or winding temperatures are to be measured by thermocouples unless the coil is inaccessible for mounting of these devices (for example, a coil immersed in sealing compound) or unless the coil wrap includes thermal insulation or more than 2 layers, 1/32 inch (0.8 mm) maximum, of cotton, paper, or rayon. For a thermocouple-measured temperature of a coil of an alternating-current motor, having a diameter of 7 inches (178 mm) or less, the thermocouple is to be mounted on the integrally applied insulation on the conductor. At a point on the surface of a coil where the temperature is affected by an external source of heat, the temperature rise measured by a thermocouple shall exceed the indicated maximum by the amount noted below, when the temperature rise of the coil, as measured by the resistance method, is not more than that specified in the table.

1. 5 °C (9 °F) for Class A insulation on coil windings of alternating-current motors having a diameter of 7 inches (178 mm) or less, open type.

2. 10 °C (18 °F) for Class B insulation on coil windings of alternating-current motors having a diameter of 7 inches (178 mm) or less, open type.

3. 15 °C (27 °F) for Class A insulation on coil windings of alternating-current motors having a diameter of more than 7 inches (178 mm), open type.

4. 20 °C (36 °F) for Class B insulation on coil windings of alternating-current motors having a diameter of more than 7 inches (178 mm), open type.

[c] For an electrolytic capacitor which is physically integral with or attached to a motor, the temperature rise on insulating material integral with the capacitor enclosure shall be not more than 65 °C (117 °F).

[d] A capacitor which operates at a temperature higher than a 65 °C (117 °F) rise shall be judged on the basis of its marked temperature rating.

[e] For standard insulated conductors other than those specified, reference shall be made to the National Electrical Code; the maximum temperature rise in any case is 25 °C or 77 °F less than the temperature rating of the insulation in question where

Table 11.1 Continued on Next Page

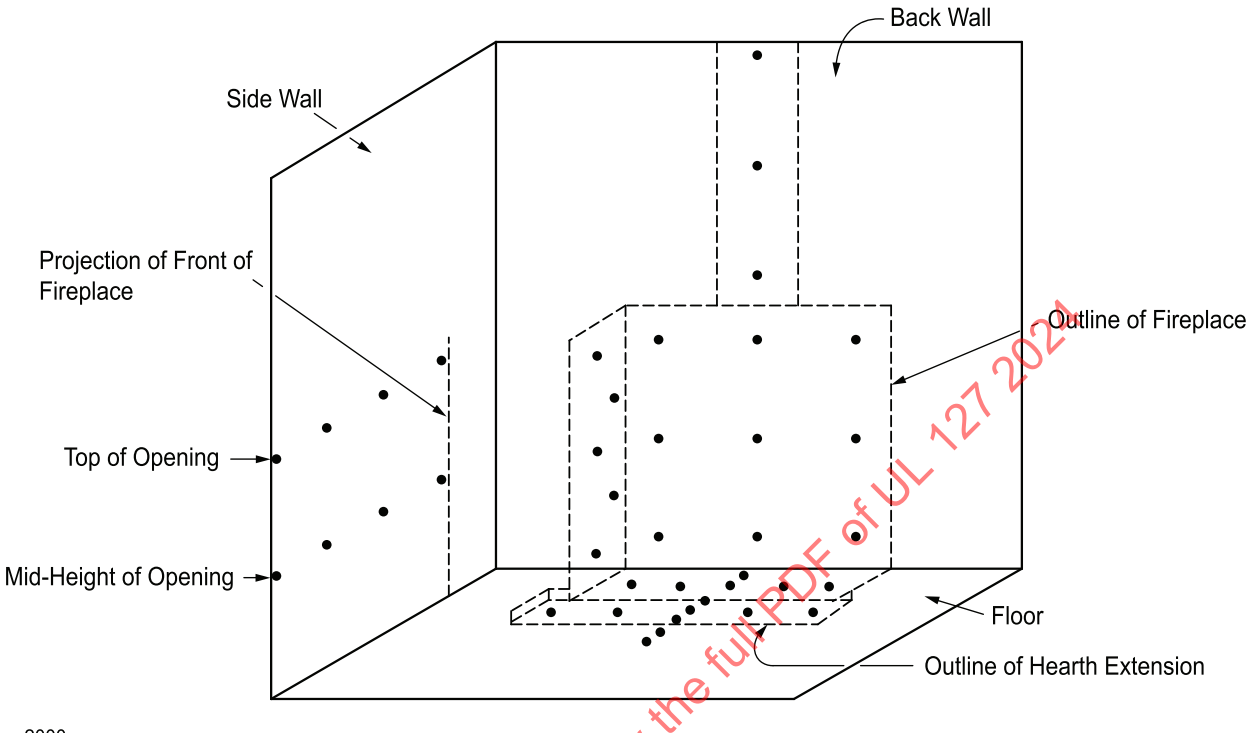
Table 11.1 Continued

Device or material	Column 1		Column 2	
	°C	(°F)	°C	(°F)
Column 1 temperature rises are specified, and the maximum temperature rise where Column 2 rises are specified is to be based on the heat-resistant properties of the insulation. Column 2 temperature rises are 15 °C (27 °F) above Column 1.				
[f] The limitations on phenolic composition and on rubber and thermoplastic insulation do not apply to compounds which have been investigated and found to have special heat-resistant properties.				
[g] The specified maximum temperature rises apply to parts whose malfunction shall result in the product to not be capable of use.				
[h] These and other alloys containing more than 1 % magnesium shall not be used when the reflectivity of the material is employed to reduce the risk of fire.				
[i] When the reflectivity of aluminum coated steel is employed to reduce the risk of fire, the maximum temperature rise is 830 °F (461 °C).				
[j] The specified maximum temperature rises shall apply when the galvanizing is required as a protective coating or the reflectivity of the surface is employed to reduce the risk of fire.				
[k] The specified maximum temperature rises shall not apply to parts of 0.152 inch (3.86 mm) thick or heavier steel and 3/16 inch (4.8 mm) thick or heavier cast iron employed for the hearth and to other parts of 0.093 inch (2.36 mm) thick or heavier steel, and 1/8 inch (3.2 mm) thick or heavier cast iron when: 1. The part is not the only enclosure, and 2. Malfunction of the part shall not expose adjacent combustible construction to the fire in the fire chamber.				
[l] The specified maximum temperature rise shall not apply to parts of 1/4 inch (6.4 mm) thick or heavier steel and 5/16 inch (7.9 mm) thick or heavier cast iron.				
[m] Includes plastic with a metal plating not more than 0.005 inch (0.13 mm) thick; and metal with a plastic or vinyl covering not less than 0.005 inch (0.13 mm) thick.				
[n] Handle temperatures are maximum temperatures, based on an ambient temperature of 70 °F or 21 °C.				
[o] Maximum temperature rises are based on an ambient temperature of 25 °C or 77 °F.				

11.22 A minimum number of typical thermocouple locations to be attached to wood surfaces of the fire chamber enclosure is shown in Figure 11.3.

Figure 11.3

Typical Thermocouple Locations (·) Back, Side, and Floor at Fireplace (Zone A)



11.23 A minimum number of typical thermocouple locations to be attached to the wood surfaces of a chimney enclosure not installed with an attic is shown in Figure 11.4.

11.24 A minimum number of typical thermocouple locations to be attached to the wood surfaces of a chimney enclosure having an attic is shown in Figure 11.5.

11.25 A minimum number of typical locations of thermocouples to be attached to the wood surfaces of a tall chimney enclosure are shown in Figure 11.6.

Figure 11.4

Typical Thermocouple Locations for Chimney Enclosure Without Attic

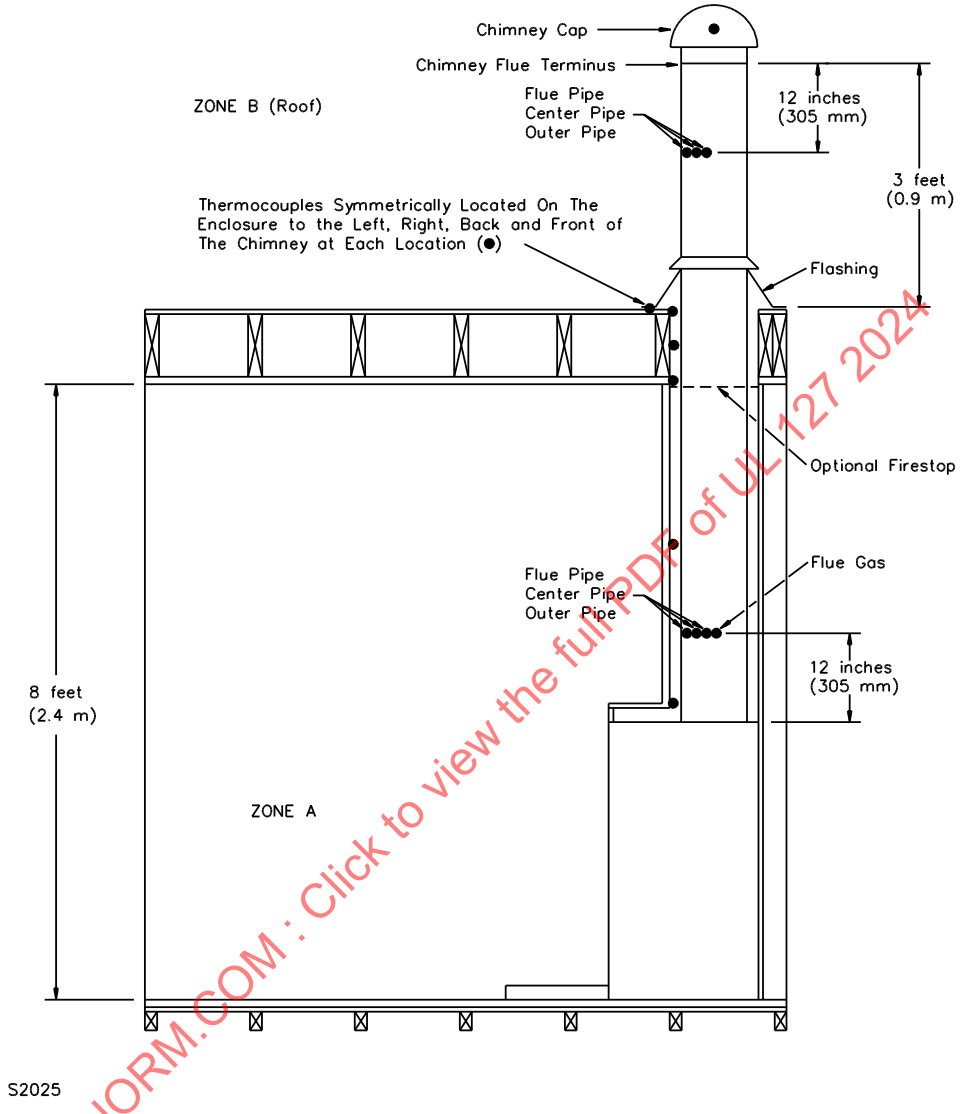


Figure 11.5

Typical Thermocouple Locations for Chimney Enclosure With Attic

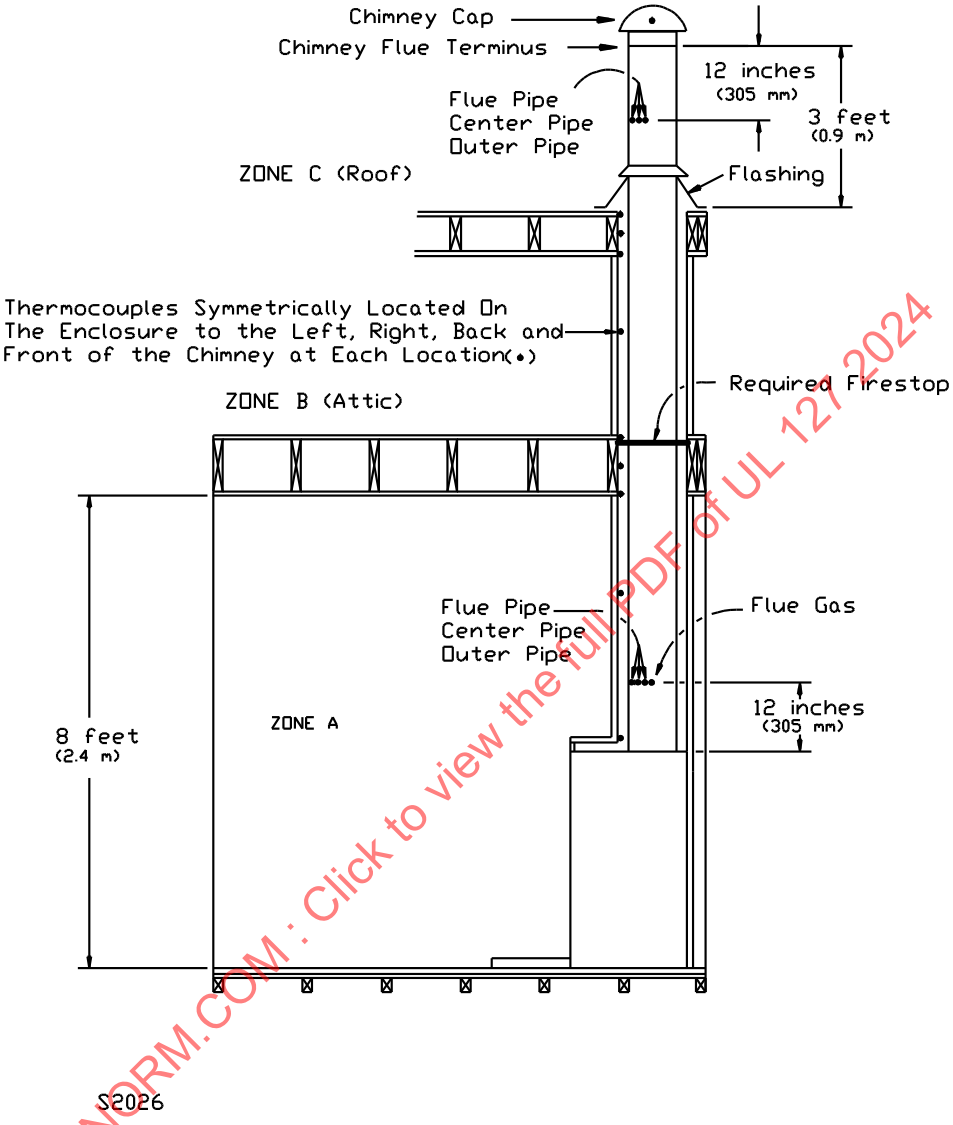
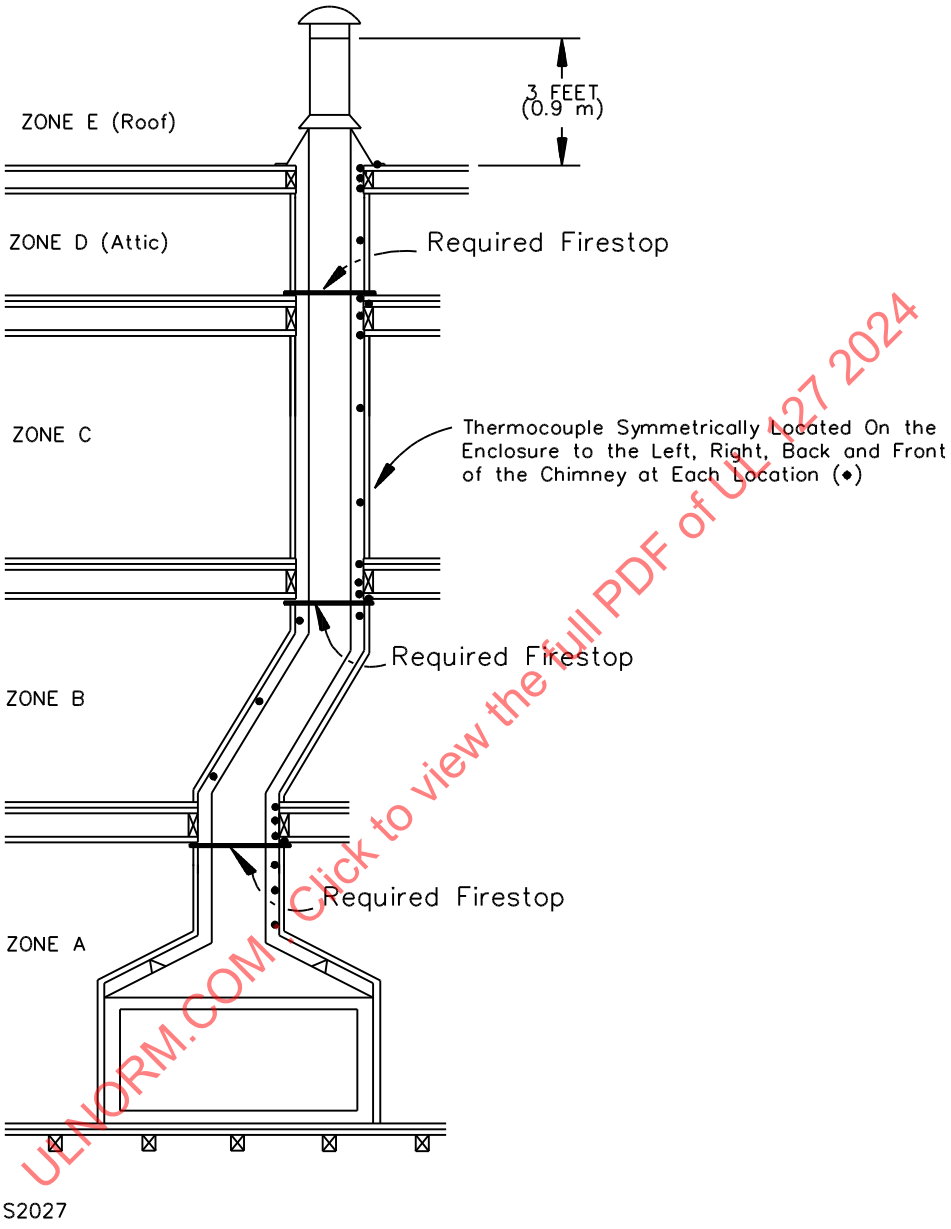


Figure 11.6

Typical Thermocouple Locations (Tall Chimney Height With Firestops)



11.26 For test enclosure elements in contact with fire chamber or chimney parts, junctions of thermocouples are to be placed on the fire chamber or chimney part surfaces.

Exception No. 1: Where a point or line contact of a spacer to an enclosure is not greater than 1/8 inch (3.2 mm) diameter or width, thermocouples are to be placed on the test enclosure at points 1/2 inch (12.7 mm) from the center line of such point or line contact.

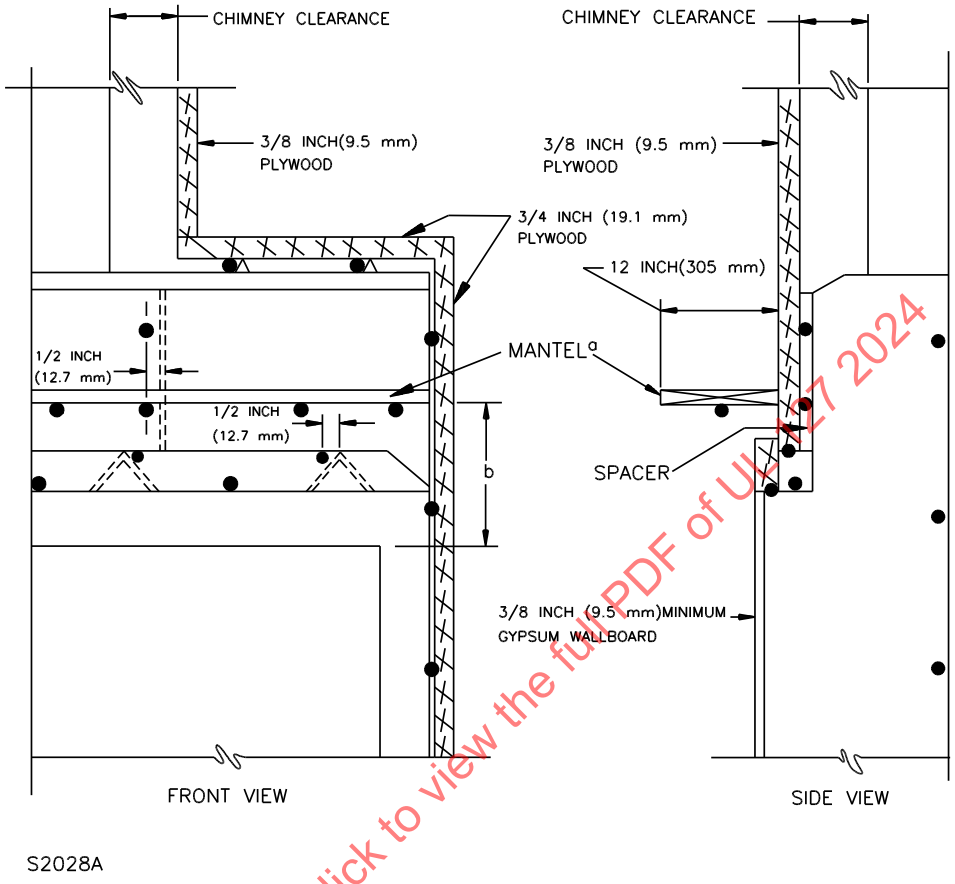
Exception No. 2: Thermocouples shall not be attached to a combustible floor unless the bottom of the fire chamber is in direct contact with the floor.

11.27 Thermocouples are to be attached to the plywood flooring under the fireplace, placed between the hearth extension material and the plywood flooring and on the plywood floor beyond the hearth extension. The two front center thermocouples under the hearth extension shown in Figure 11.3 are to be placed 1/2 inch (12.7 mm) and 1-1/2 inches (38.1 mm), respectively, from the front edge of the hearth extension. The front edge of the hearth extension is the exposed front away from the face of the fireplace, and not the edge that abuts the front of the fireplace surround. Two floor mounted thermocouples are to be placed beyond the center front edge of the hearth extension 3 inches (76.2 mm) and 6 inches (152.4 mm) respectively. See Figure 11.3.

11.28 Thermocouples are to be attached to the various surfaces of the fire chamber in at least the typical locations shown in Figure 11.7 and Figure 11.8.

Figure 11.7

Typical Thermocouple Locations (Fire Chamber Surfaces)

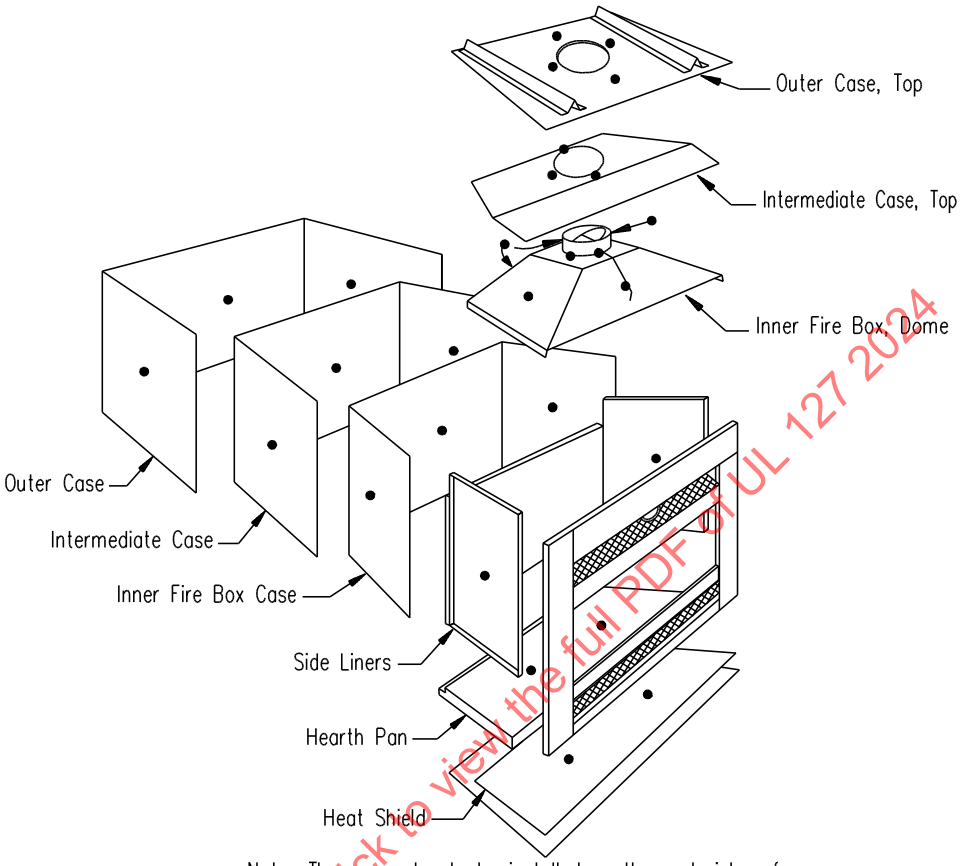


a. Mantel is used only when fireplace is intended for use with a mantel.

b. Minimum distance above fireplace opening specified in installation instructions. Thermocouples not required when mantel is at least 12 inches (305 mm) above fireplace opening.

Figure 11.8

Typical Thermocouple Locations (Fire Chamber Assembly)

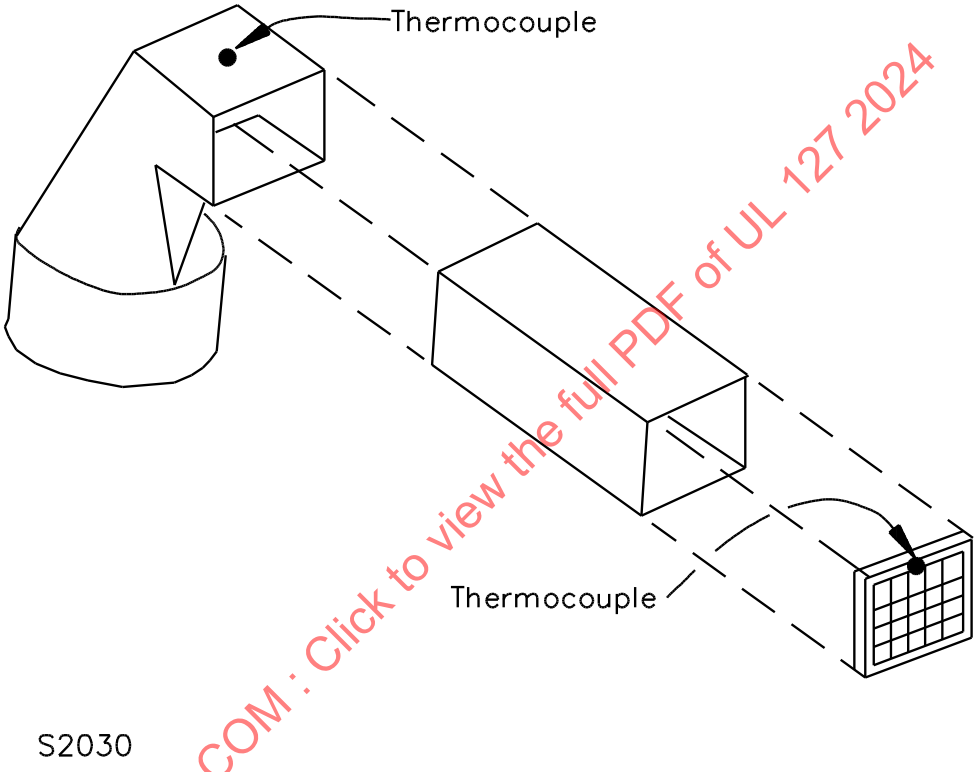


11.29 Thermocouples are to be attached to the chimney surfaces as shown in Figure 11.4 and Figure 11.5.

11.30 Thermocouples are to be attached to the air duct portions of circulating air type fireplaces as shown in Figure 11.9. One thermocouple is to be attached on the top of each elbow, and one thermocouple is to be attached on the face of each grille.

Figure 11.9

Typical Thermocouple Locations (Air Duct Fittings)

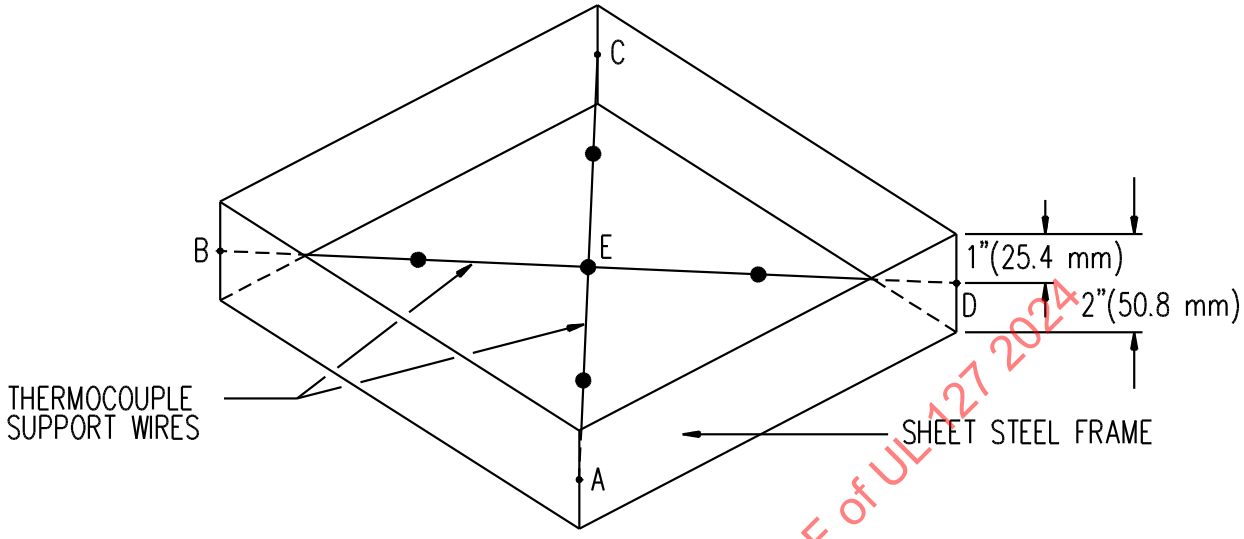


11.31 The outlet-air temperature of a circulating air type fireplace is to be determined by use of parallel connected bead-type thermocouples, having wire not larger than 24 AWG (0.21 mm^2), and located 1 inch (25.4 mm) from the outer face of the warm air grille or register.

11.32 The thermocouples are to be arranged and supported in a rectangular shield as illustrated in Figure 11.10. The length of the shield is to correspond to the width of the warm-air outlet opening.

Figure 11.10

Thermocouple Arrangement for Outlet Air Temperature



- Thermocouples, No. 18 to 24 AWG (0.82 to 0.21 mm²). One each located 2/3 of distance from point E to points A, B, C and D, and one at point E.

S2031

11.33 With reference to the requirement of 11.31, the thermocouple assembly is to be moved vertically over the face of the outlet opening to determine the maximum indicated temperature.

11.34 The surface temperature for the largest amount of material employed in a handle or knob used on a fireplace shall not exceed the temperature specified in Table 11.1 during the Radiant Fire Test and Brand Fire Test.

Exception: The temperature limitation does not apply to knobs used for adjusting combustion air inlets.

12 Preconditioning Tests

12.1 General

12.1.1 Prior to any Performance Tests, the fireplace is to be subjected to the Thermal Shock Test and either the Temperature Test – 1700 °F Flue Gases or Temperature Test – 2100 °F Flue Gases.

Exception: In lieu of the Thermal Shock Test and the Temperature Test – 1700 °F Flue Gases or Temperature Test – 2100 °F Flue Gases, the fireplace shall not be preconditioned as described in 12.1.2, unless:

a) The chimney complies with UL 103; or

b) The chimney has previously been investigated and found capable of being used for the intended fireplace application.

12.1.2 When the Thermal Shock Test and the Temperature Test – 1700 °F Flue Gases or Temperature Test – 2100 °F Flue Gases are not conducted (see 12.1.1), the fireplace is to be subjected to a preliminary wood firing that produces a nominal flue-gas temperature of 1000 °F (538 °C) for 5 hours. The temperature is to be measured by a thermocouple as described in Figure 11.1 at a point 12 inches (305 mm) vertically above the inlet of the chimney as shown in Figure 11.4 or Figure 11.5.

12.2 Thermal shock test

12.2.1 A gas-fired flue-gas generator as illustrated by Figure 12.1 is to be used to supply flue gases to the inlet of the chimney being tested. The generator shall produce flue gases at the specified test temperatures when fired at the test inputs specified hereafter.

12.2.2 The flue-gas generator outlet is to be connected directly to the inlet of the chimney to be tested by means of an uninsulated flue pipe having a diameter equal to that of the chimney inlet and the front of the fireplace opening is to be closed as shown in Figure 12.2.

Figure 12.1

Flue-Gas Generator

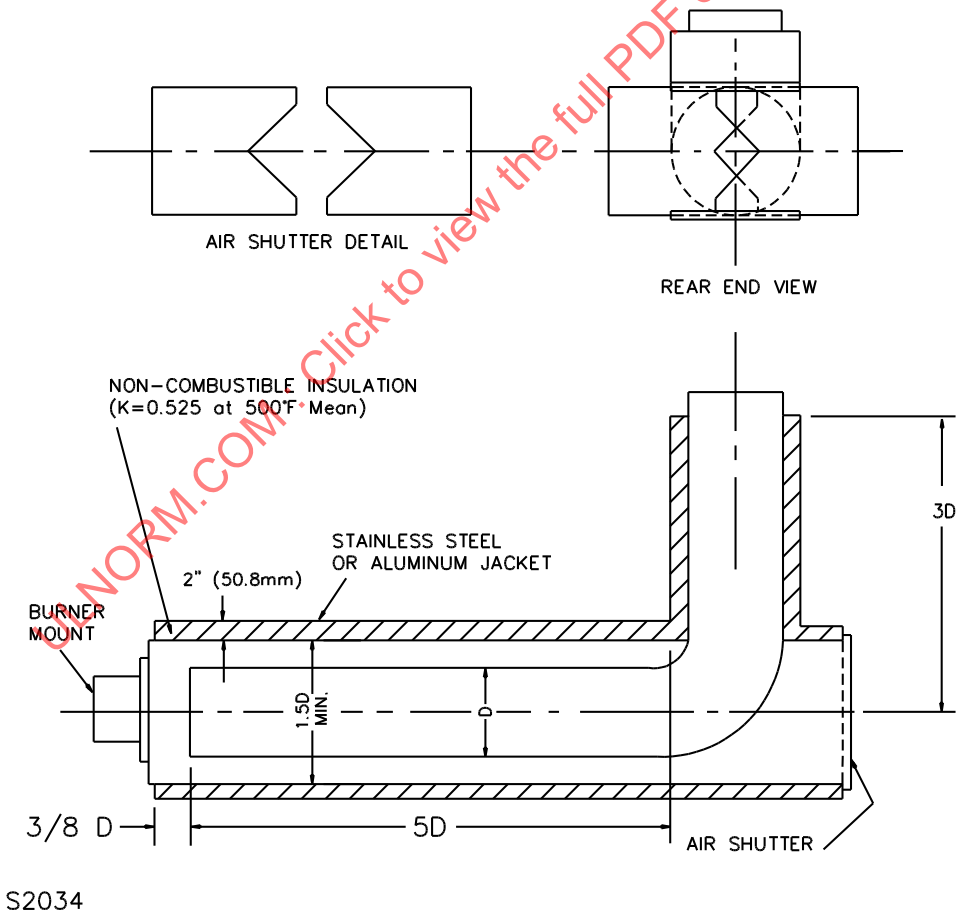
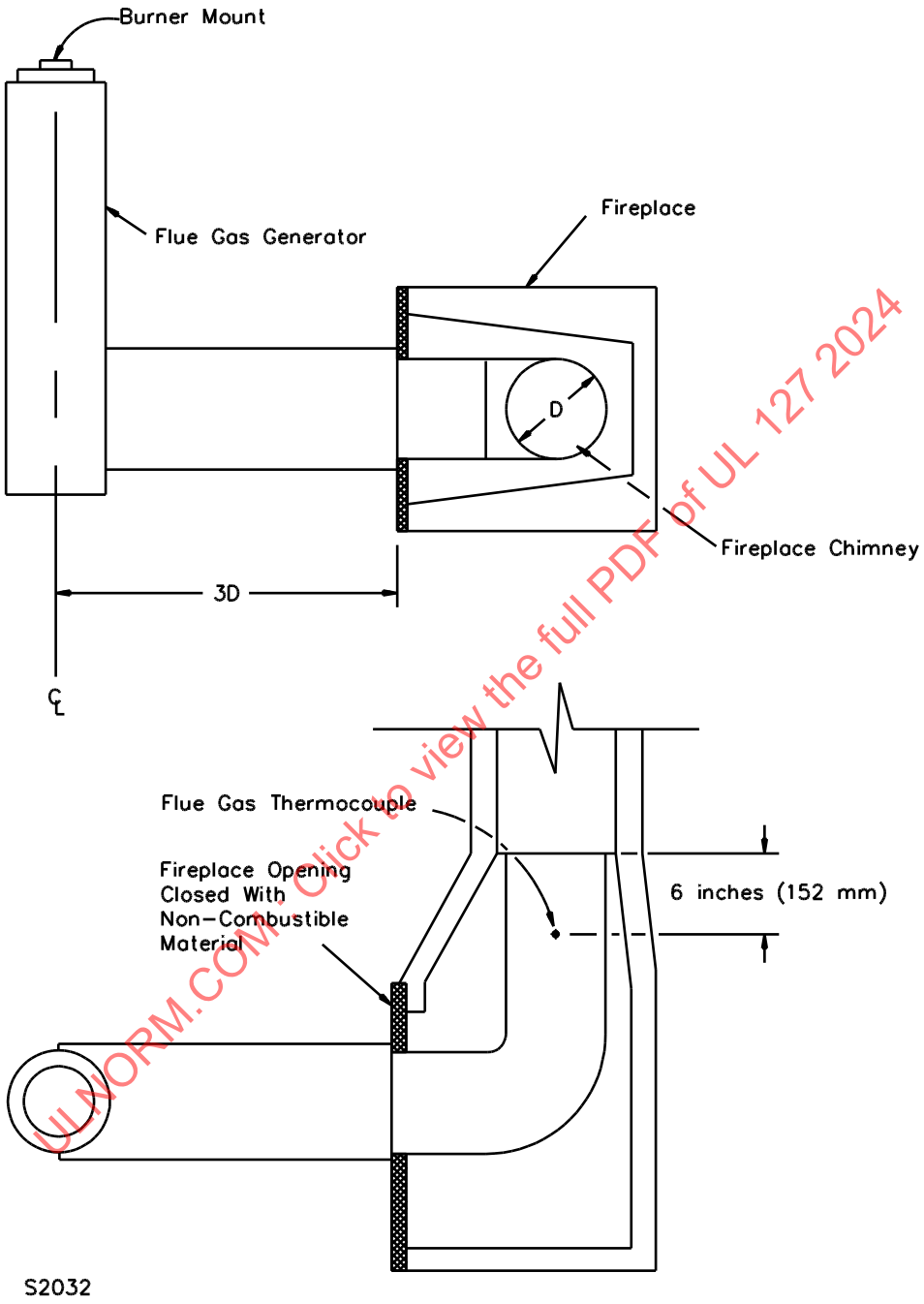


Figure 12.2

Flue Gas Generator Application for Temperature Test – 1700 °F Flue Gases



12.2.3 The test is to be started with the test chimney and the test structure at room temperature. The flue-gas generator is to be fired to at least the input specified in Column 1 of Table 12.1 and regulated to produce flue gases at a temperature of 1630 °F (906 °C) above room temperature at the flue-gas thermocouple location shown in Figure 12.2. The test is to be continued for a period of 10 minutes, at which time the burner is to be shut off.

Table 12.1
Flue-Gas Generator Inputs

Equivalent nominal diameter of chimney		Minimum input to flue-gas generator BTU/h (kW)					
		Column 1		Column 2		Column 3	
Inches	(mm)	Temperature test – 1700 °F (927 °C) flue gases		Temperature test – 1000 °F (538 °C) flue gases		Temperature test – 2100 °F (1149 °C) flue gases	
6	(152)	97,000	(28.4)	48,500	(14.2)	175,000	(51.2)
7	(178)	131,600	(38.6)	65,800	(19.3)	237,000	(69.4)
8	(203)	172,400	(50.5)	86,200	(25.3)	310,000	(91.0)
9	(229)	218,000	(63.9)	109,000	(31.9)	392,000	(115.0)
10	(254)	270,000	(79.1)	135,000	(39.6)	486,000	(142.4)
11	(279)	330,000	(96.7)	165,000	(48.4)	592,500	(173.6)
12	(305)	390,000	(114.0)	195,000	(57.2)	699,000	(205.0)

12.2.4 This test is to be conducted three times, and at the start of the first test the chimney is to be at room temperature. At the end of each test the chimney is to be cooled to room temperature or to cool for 4 hours, whichever occurs first, before the next trial.

12.2.5 No temperature readings other than flue-gas temperature is required to be recorded for the tests described in 12.2.4.

12.3 Temperature test – 1700 °F flue gases

12.3.1 The test is to be conducted using the same apparatus as designated for the Thermal Shock Test and is to be started with the test chimney and the test structure at room temperature.

12.3.2 The test conditions then are to be established using at least the gas input shown in Column 2 of Table 12.1. Input is to be maintained to produce flue gas at a temperature of 930 °F (517 °C) above room temperature at the location designated in Figure 12.2 and operation is to be continued until equilibrium temperatures are attained on surfaces of chimney parts and the test structure.

12.3.3 After equilibrium temperatures are attained as described in 12.3.2, the input to the flue-gas generator is to be increased to that given in Column 1 of Table 12.1, and regulated to produce a temperature of 1630 °F (906 °C) above room temperature at the location designated in Figure 12.2 and the test continued for 10 minutes, at which time the burner is to be shut off.

12.3.4 The maximum temperature attained on the test structure (ceilings, enclosures, floors, and joists) and on surfaces of the chimney assembly at points of zero clearance to the test structure shall be not more than 175 °F (97 °C) above room temperature while the flue-gas temperature is maintained as described in 12.3.3 and after the flue-gas generator is shut off.

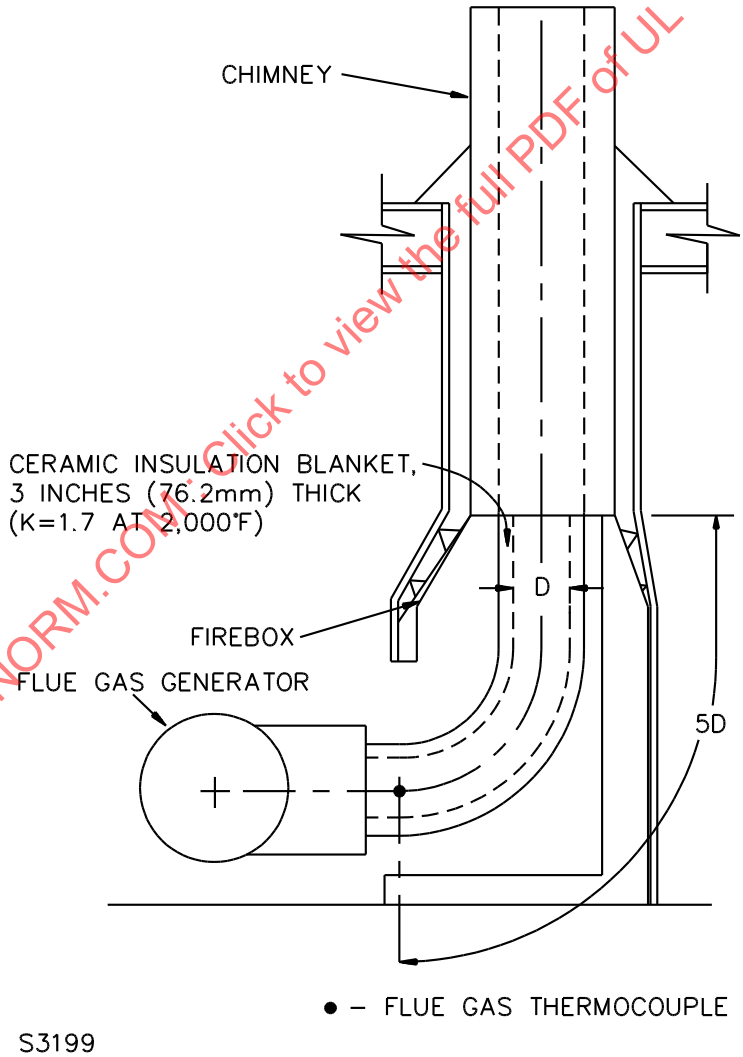
12.4 Temperature test – 2100 °F (1149 °C) flue gases

12.4.1 The test is to be conducted using the same apparatus as designated for the Thermal Shock Test and is to be started with the test chimney and the test structure at room temperature. Fireplaces using Type HT chimneys complying with the requirements specified in UL 103, are identified as complying with the requirements for the 2100 °F (1135 °C) test.

12.4.2 The test conditions then are to be established at the inputs shown in Column 2 of Table 12.1, and maintained to produce flue gas at a temperature of 930 °F (517 °C) above room temperature as measured by means of a flue-gas thermocouple located centrally in the flue-gas stream as shown in Figure 12.3. The operation is to be continued until equilibrium temperatures are attained on surfaces of fireplace parts and the test structure.

Figure 12.3

Flue Gas Generator Application for Temperature Test – 2100 °F Flue Gases



12.4.3 After equilibrium temperatures are attained under the test conditions described in 12.4.2, the input to the flue-gas generator is to be increased to that specified in Column 3 of Table 12.1 and regulated to produce a temperature of 2030 °F (1128 °C) above room temperature at the location designated in Figure 12.3. The test period shall be 10 minutes, exclusive of the time taken to reach the 2030 °F temperature rise above room temperature (which shall not exceed 15 minutes). At the end of the test period the flue-gas generator is to be shut off.

12.4.4 The test specified in 12.4.3 is to be conducted three times. The tests are to be conducted with the full length of the connector pipe insulated with a 3-inch (75-mm) thick layer of ceramic blanket insulation or equivalent insulation having a K factor of 1.7 at 2000 °F (1079 °C).

12.4.5 The maximum temperature attained on the test structure (enclosures and joists) and on surfaces of the fireplace assembly at points of zero clearance to the test structure shall be not more than 175 °F (97 °C) above room temperature while the flue-gas temperature is maintained as described in 12.4.3 and after the flue-gas generator is shut off.

13 Radiant Fire Test

13.1 A basket grate is to be constructed of 3/8 inch (9.5 mm) square steel bar stock spaced 1 inch (25.4 mm) apart on centers as illustrated in Figure 13.1. The basket is to be open at the back for placement against the back of the hearth. Figure 13.2 shows alternate grate configurations that shall be used to accommodate two typical shapes of hearths.

Figure 13.1

General Form of Charcoal Basket

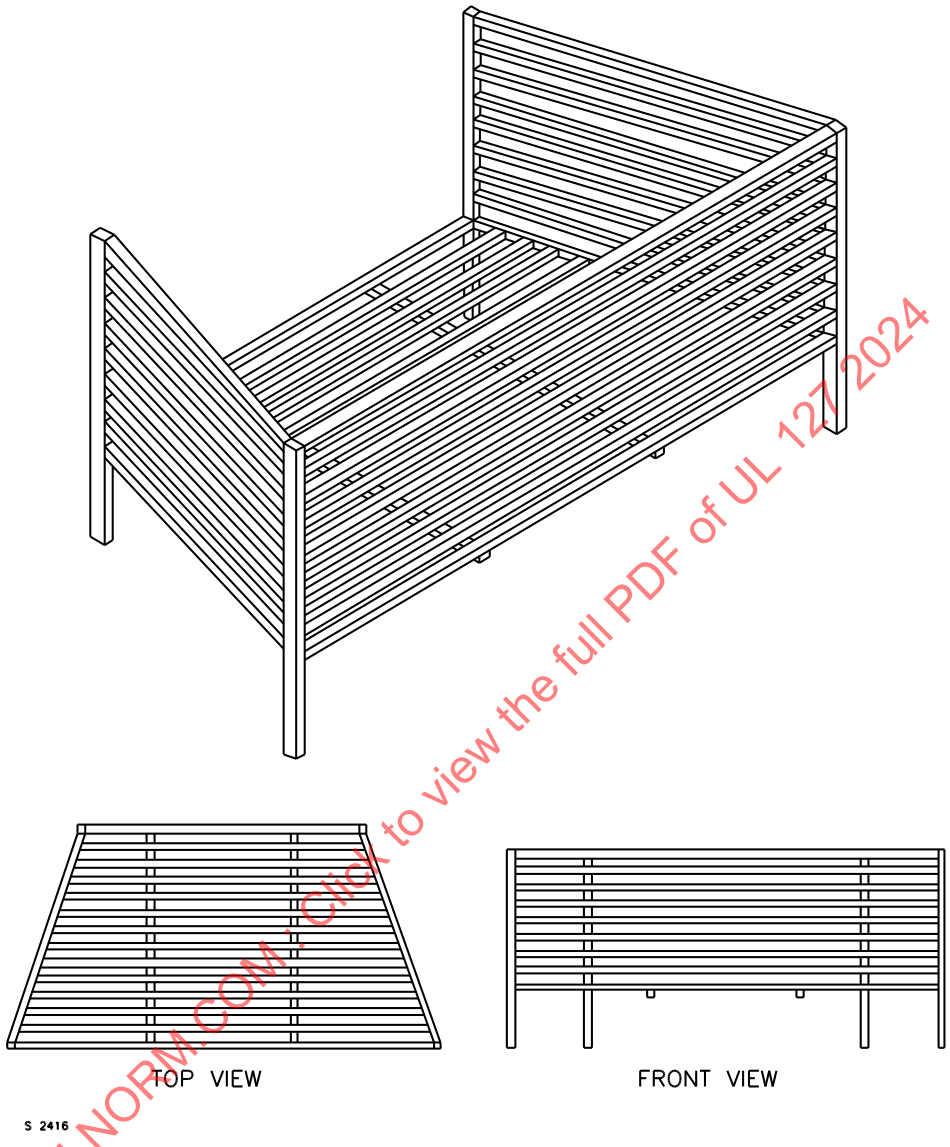
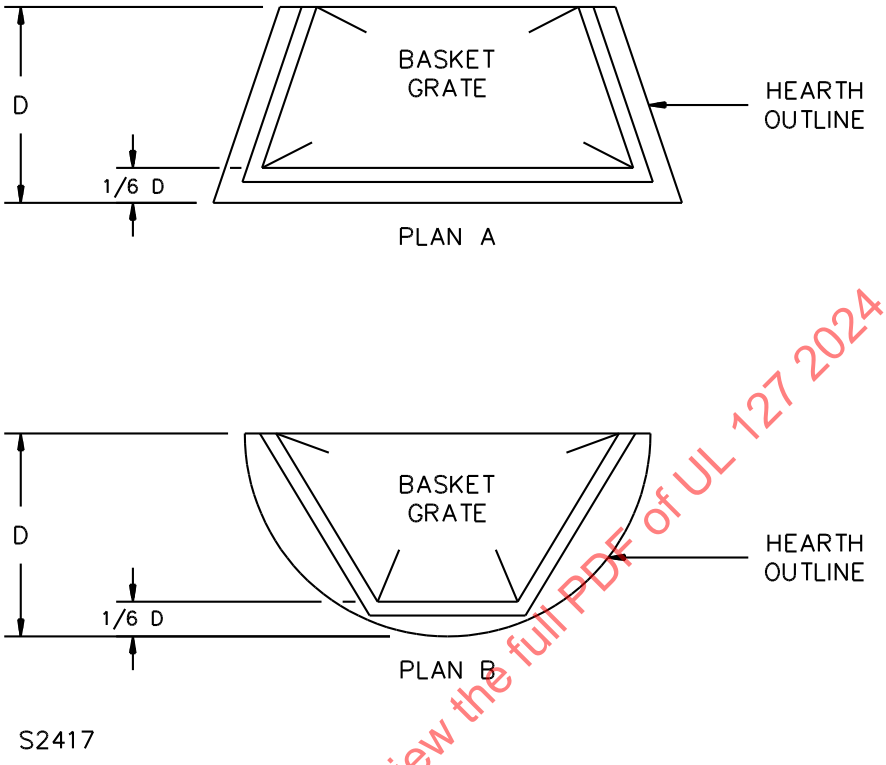


Figure 13.2

Typical Relation of Grate to Hearth



13.2 For a fireplace whose hearth incorporates raised ledges the basket grate is to have an inside area in the plan view equal to two-thirds of the total hearth area. See 13.4.

13.3 For a fireplace whose hearth incorporates an integral grate that is sized one-half the hearth area or larger, the basket grate is to have an inside area in the plan view equivalent to the effective burning area of the integral grate. For a fireplace whose hearth incorporates an integral grate that is sized less than one-half the hearth area, the basket grate is to have an area equivalent to one-half the hearth area. See 13.4.

13.4 For the basket grate referenced in 13.2 and 13.3, in the plan view, the shape of the basket grate is to conform closely to the shape of the hearth. When the grate is placed in position, the distance from the front inside edge of the grate to the front of the hearth is to be one-sixth of the maximum hearth depth as measured between the front and back edges of the hearth. The inside depth of the basket grate is to be 6 inches (152 mm) and the grate is to stand on legs that support the inside bottom of the grate 4 inches (102 mm) above the hearth. See Figure 13.2.

13.5 The basket grate is to be loaded to a depth of 6 inches (152 mm) with charcoal briquettes formed in the shape of 2.0- by 1.9-inch (50- by 48-mm) square pillows, each having rounded edges and a maximum thickness of 1.2 inches (30 mm). The briquettes are to have a count weight of 17 lb (38 kg), a heat content (dry basis) of 11,500 Btu/lb (26,750 J/g), and a moisture content of 5 %.[a]

[a] A briquette that is capable of being used for this test is manufactured by the Kingsford Chemical Company, Oakland, California 94623.

13.6 A damper intended to be adjustable between open and closed positions is to be regulated to produce severe conditions, and is not to be closed to the extent that flue gases spill into the living space.

13.7 After ignition, fuel is to be added at 7-1/2 minute intervals and at each interval the fire is to be poked or stirred in an effort to maintain a 6 inch (152 mm) bed of fuel burning at maximum intensity. Poking and stirring are to be accomplished by inserting a flat bar of steel at the midpoint of the basket at one end and sliding it through the fire bed, and then inserting the bar at the bottom of the basket at the other end and sliding it the opposite way through the fire bed. Ashes on the hearth are to be removed prior to each addition of fuel.

13.8 Temperatures at all points of measurement are to be recorded at intervals not exceeding 30 minutes until it is apparent the maximum temperatures have been attained. Maximum temperatures are identified to have been attained when three successive readings taken at 30-minute intervals show no change or show a decrease.

13.9 When the fireplace is fired as described in 13.5 – 13.7, the maximum temperature rise above ambient zone temperature shall not exceed:

a) 117 °F (65 °C) on exposed surfaces of the test enclosure and

b) 90 °F (50 °C) on concealed surfaces of the test enclosure, such as beneath the hearth (fire chamber), beneath the hearth extension, behind the wall-mounted shields, within the chimney enclosure and surrounding the fire chamber.

13.10 The temperature rise of any part of the fireplace and chimney shall not exceed the maximum values specified in Column 1 of Table 11.1 for the material employed.

13.11 The temperature rise of the outlet air at the outlet in an air duct system shall not exceed 250 °F (139 °C) above room ambient temperature.

13.12 The temperature rise of the surface grille of remote air outlets located in areas other than directly in front of and above the fire chamber opening shall not exceed:

a) 140 °F (78 °C) above ambient zone temperature for grilles located 36 inches (914 mm) or less above the floor.

b) 180 °F (100 °C) above ambient zone temperature for grilles located more than 36 inches (914 mm) above the floor.

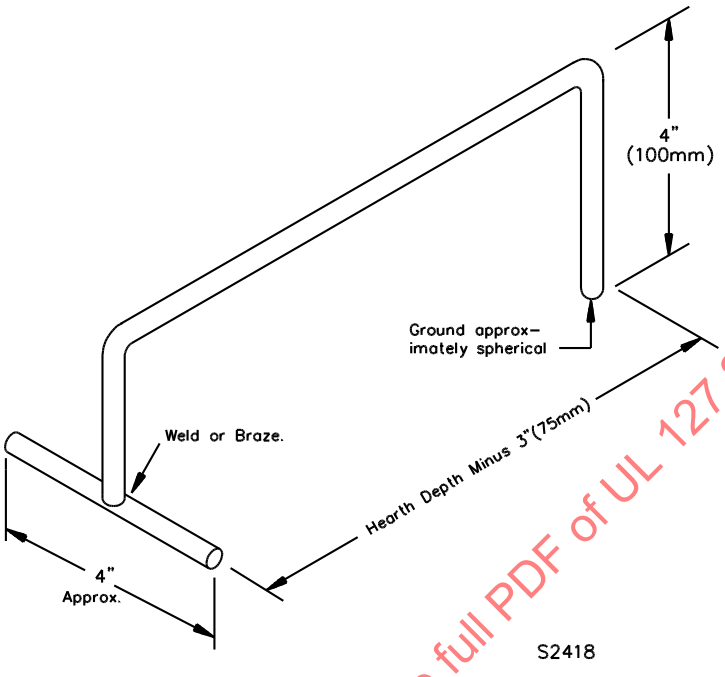
14 Brand Fire Test

14.1 Andirons to be used in this test are to be constructed as illustrated in Figure 14.1.

Exception: This requirement does not apply when integral grates are provided.

Figure 14.1

Andiron

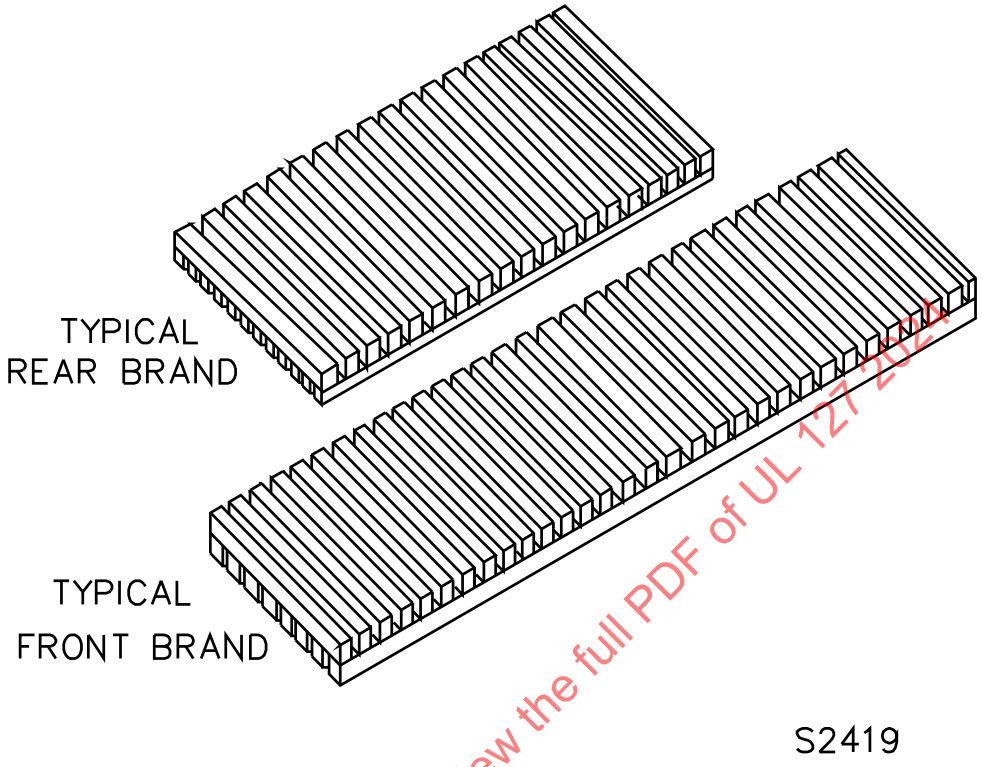


Material: 5/8 inch (15.9 mm) round or square steel bar stock. Two each required.

14.2 The brands are to be constructed as illustrated in Figure 14.2, and are to employ strips of dry (moisture content of 19 % or less) Douglas fir finished to 3/4 by 3/4 inch (19.1 by 19.1 mm), weighing 0.02 ±0.002 lb/in^3 (554.0 ±55.4 kg/m^3) and spaced 1 inch (25.4 mm) apart on centers. The brands are to be conditioned in an oven at 105 – 150 °F (40.5 – 66 °C) for at least 16 hours prior to being burned. Conditioned brands are to be used within 3 hours after their removal from the oven.

Figure 14.2

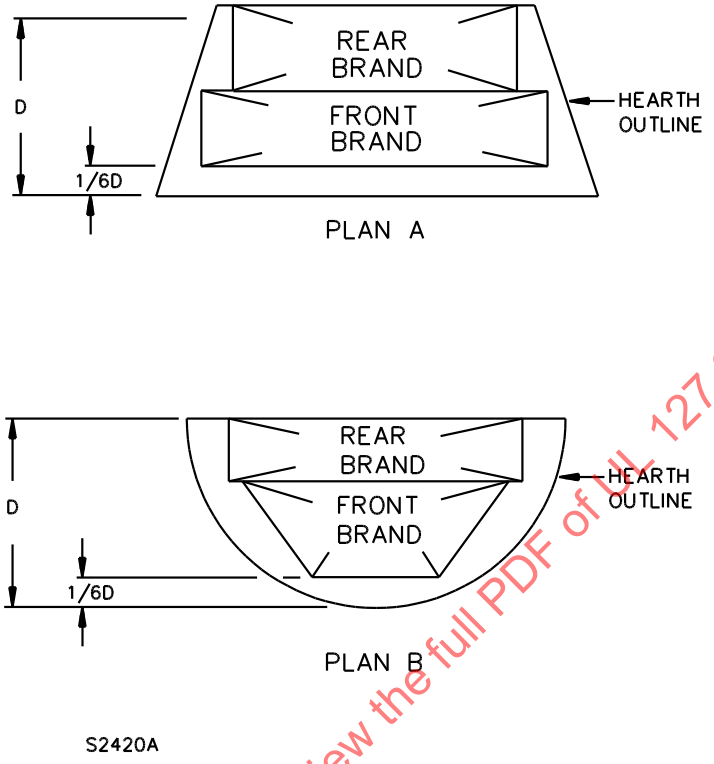
Brands



14.3 The brands are to be placed in the hearth area as illustrated in Figure 14.3 which shows two typical hearth shapes. Each front and rear brand is to have an area in the plan view equal to one-third of the total hearth area. When the brands are located as illustrated in Figure 14.3, the distance from the front edge of the front brand to the front of the hearth is to be one-sixth of the maximum hearth depth measured between the front and back edges of the hearth.

Figure 14.3

Typical Relation of Brands to Hearth



14.4 The hearth area is identified to be the effective area on which the fuel is to be burned, and consists of the area bordered by the back and side walls of the fireplace, and the plane of the front opening of the fireplace.

Exception No. 1: For a fireplace incorporating raised ledges, the hearth area is to be defined as specified in 14.5.

Exception No. 2: For a fireplace incorporating an integral grate, the hearth area is to be defined as specified in 14.6.

14.5 For a fireplace whose hearth area incorporates raised ledges, each brand is to have an area in the plan view equal to one-third of the hearth area as defined by the ledges. For the purpose of defining the hearth depth, the minimum ledge height above the hearth is to be identified as 1-1/2 inches (38.1 mm) at the front, and 6 inches (152 mm) at the sides and back and the maximum depth of the front ledge (regardless of actual depth) is identified not to exceed one-sixth of the depth of the hearth measured between the back wall of the fire chamber and the plane of the front opening (plane of door when used) of the fireplace.

14.6 When the fuel burning area is defined by the front of a log retainer with a minimum height of 4 inches (102 mm) and the sides and rear of the fireplace, each brand is to be one-half of the effective burning area of the hearth. When the fuel burning area is defined by an integral grate having a front with a minimum height of 4 inches (102 mm) and the sides and rear of the grate are a minimum of 6 inches (152 mm) high, each brand is to be one-half of the area of the integral grate. When the effective burning area of the integral grate is less than one-half the hearth area of the fireplace, each brand is to have an area equivalent to one-half of the hearth area of the fireplace.

14.7 A damper constructed to be adjustable between open and closed positions is to be regulated to produce severe conditions and is not to be closed to the extent that flue gases spill into the living space.

14.8 Throughout the test there shall be no evidence of spillage of products of combustion or flame from the fireplace. Intermittent or sporadic wisps of smoke (smoking not longer than 15 seconds at a time) is not to be regarded as spillage.

14.9 After ignition, one brand is to be added every 7-1/2 minutes, alternating front and rear, with the long strips placed downward and parallel to the face of the fire chamber opening. Embers are to be leveled; ashes are not to be removed from the hearth.

Exception No. 1: A slower feed rate is to be used when greater temperature rises are produced.

Exception No. 2: When embers build up to a level of one-half of the fire chamber opening height, a slower feed rate is to be used to maintain a fuel bed that does not exceed this height.

14.10 Temperatures at all points of measurement are to be recorded at intervals not exceeding 30 minutes until it is apparent that maximum temperatures have been attained. Maximum temperatures are identified to have been attained when three successive readings taken at 30-minute intervals show no change or show a decrease.

14.11 When the fireplace is fired as described in 14.2 – 14.9, the maximum temperature rise above ambient zone temperature shall not exceed:

a) 117 °F (65 °C) on exposed surfaces of the test enclosure; and

b) 90 °F (50 °C) on concealed surfaces of the test enclosure, such as beneath the hearth (fire chamber), beneath the hearth extension, behind the wall-mounted shields, within the chimney enclosure and surrounding the fire chamber.

14.12 The temperature rise of any part of the fireplace and chimney shall not exceed the maximum specified in Column 1 of Table 11.1 for the material employed.

14.13 The temperature rise of the outlet air at the outlet in an air duct system of a circulating warm-air ducted fireplace shall not exceed 250 °F (139 °C) above ambient zone temperature.

14.14 The temperature rise of the surface grille of remote air outlets located in areas other than directly in front of and above the fire chamber opening shall not exceed:

a) 140 °F (78 °C) above ambient zone temperature for grilles located 36 inches (914 mm) or less above the floor.

b) 180 °F (100 °C) above ambient zone temperature for grilles located more than 36 inches (914 mm) above the floor.

15 Flash Fire Test

15.1 This test is to be conducted as a continuation of the Brand Fire Test, Section 14. The embers remaining from the Brand Fire Test are to be removed to a plane level with the top of the andirons.

15.2 Eight brands are to be stacked on the andirons, four in front and four in the rear, with the long strips placed downward. Each stack of four brands are tied together with wire not larger than 18 AWG (0.04 inch diameter).

15.3 The flue-gas outlet damper is to be fully opened.

15.4 During the resultant fire, there shall be no evidence of spillage of products of combustion, or flame from the fireplace. Intermittent or sporadic wisps of smoke (smoking not longer than 15 seconds at a time) is not to be regarded as spillage.

15.5 Temperatures at all points of measurement are to be recorded at intervals not exceeding 5 minutes until it is apparent that the maximum temperatures have been attained.

15.6 When the fireplace is fired as described in 15.1 – 15.4, the maximum temperature rises shall not exceed 140 °F (78 °C) above ambient zone temperature on the following surfaces:

a) Test enclosure;

b) Fireplace, or chimney parts at points of zero clearance to the test structure; and

c) Beneath a hearth extension installed on the area specified for such an extension.

15.7 The temperature rise of any part of the fireplace and chimney shall not exceed the maximum value specified in Column 2 of Table 11.1 for the material employed.

15.8 The temperature rise of the surface grille of the air outlet is not to be recorded during this test.

16 Optional Unvented Decorative Log Temperature Test

16.1 This test shall be conducted upon completion of the Brand Fire Test, Section 14, and the Flash Fire Test, Section 15.

16.2 Unvented decorative log sets of the single and double burner type that comply with IAS/AGA Z21.11.2, are to be installed into the hearth of the previously investigated factory-built fireplace in accordance with the manufacturer's instructions. The unvented log set is to be of the largest size which fits into the hearth of the fireplace and is to employ an input rating of 40,000 Btu/h while fired with either natural or propane gas.

16.3 The unvented log sets are to be fired with the flue-gas outlet damper of the factory-built fireplace fully closed, the screen mesh doors drawn closed, and the fireplace glass doors (when provided) fully open. The chimney system is to remain installed on the fireplace during these tests.

16.4 The installation and operation of the unvented log sets are to be conducted in accordance with the log manufacturer's installation and operating instructions.

16.5 The temperatures at all points of measurement are to be recorded at intervals not exceeding 30 minutes until it is apparent the maximum temperatures have been attained. Maximum temperatures are considered to have been attained when three successive readings taken at 30-minute intervals show no change or show a decrease.

16.6 When the unvented log sets are fired as described in 16.2 and 16.3, the maximum temperature rise above ambient zone temperatures shall not exceed the temperature limits required by 14.11.

17 Support Test

17.1 Parts of the fireplace shall not be damaged or become distorted, nor shall the security of their attachment to a building structure be impaired, when tested as described in 17.2 and 17.3.

17.2 Parts of the fireplace required to support the chimney, hood, or other part above the fireplace opening are to be installed as described in the manufacturer's instructions, in a framework simulating a typical installation. A section of the chimney, hood, or other part is to be placed on the fireplace as intended and is to be loaded either by means of weights or by a machine.

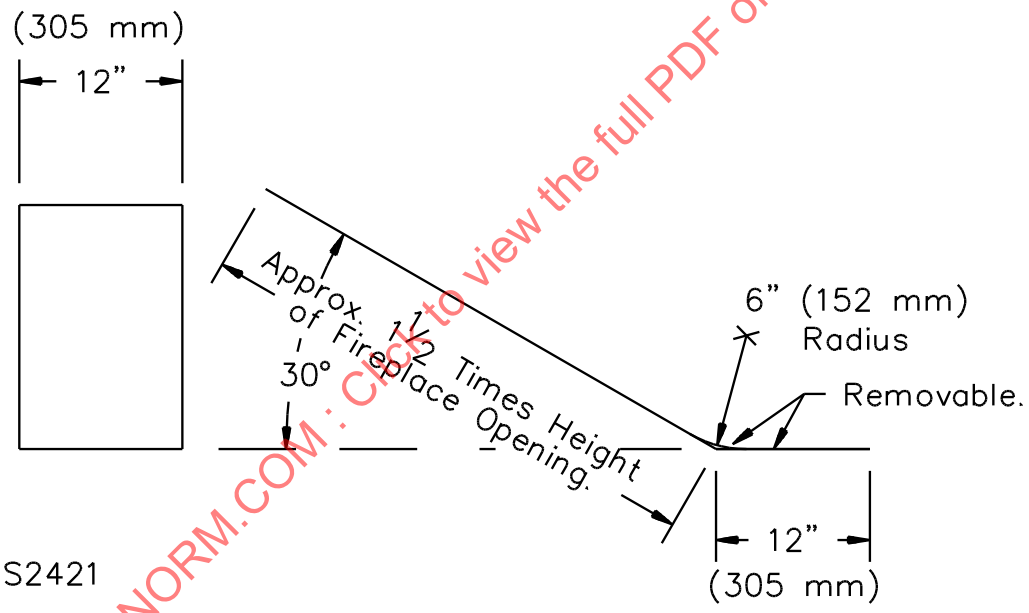
17.3 The maximum static load applied is to be equal to four times the load imposed by the heaviest chimney or by any other part that the fireplace is required to sustain in service. The load is to be applied for a minimum of 60 minutes.

18 Fire Chamber Strength Test

18.1 The fireplace, its hearth, and any factory-installed hearth extension are to be positioned and supported as intended with relation to a building structure. An inclined plane and a simulated log are to be prepared for use in this test. See Figure 18.1 and Figure 18.2.

Figure 18.1

Inclined Plane for Strength Test

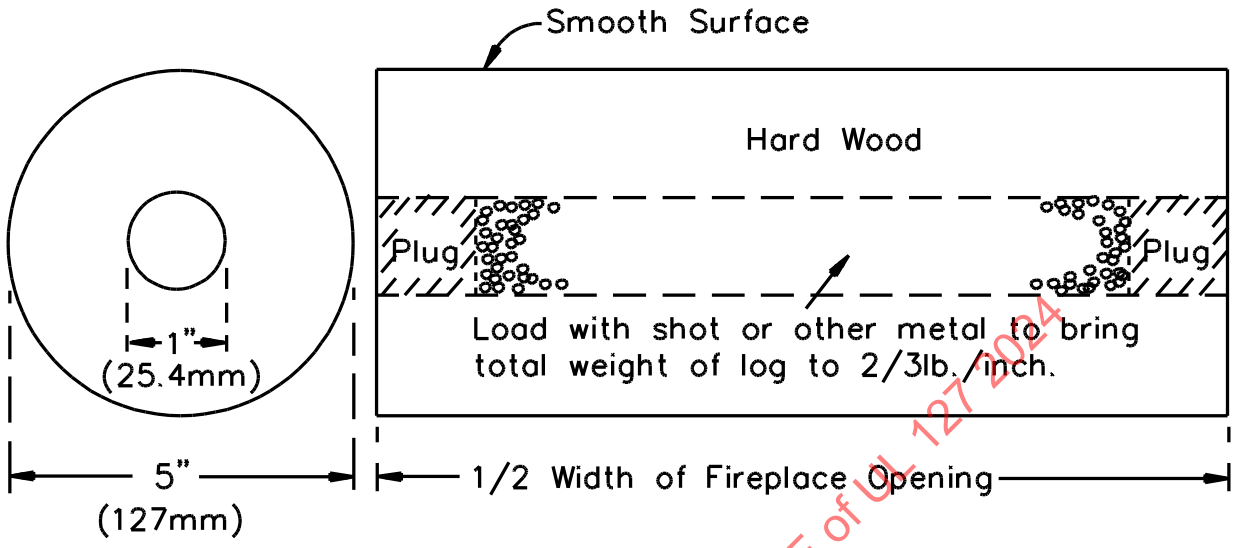


Material: Hardboard or other smooth surfaced material – sheet metal formed to radius as shown.

Support: As convenient.

Figure 18.2

Simulated Log



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18.2 The inclined plane is to be positioned with respect to the fireplace as illustrated in Figure 18.3 and Figure 18.4. The andirons shown in Figure 18.3 and Figure 18.4 are to be as illustrated in Figure 14.1.

Figure 18.3

Inclined Plane in Position for Strength Test of Back Wall

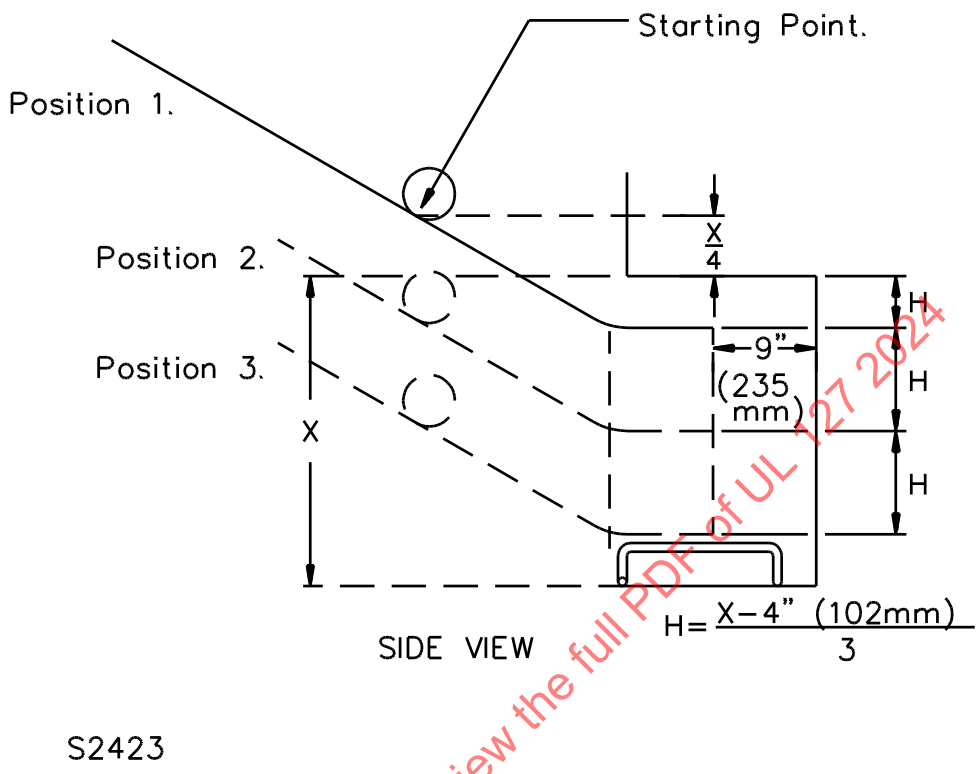

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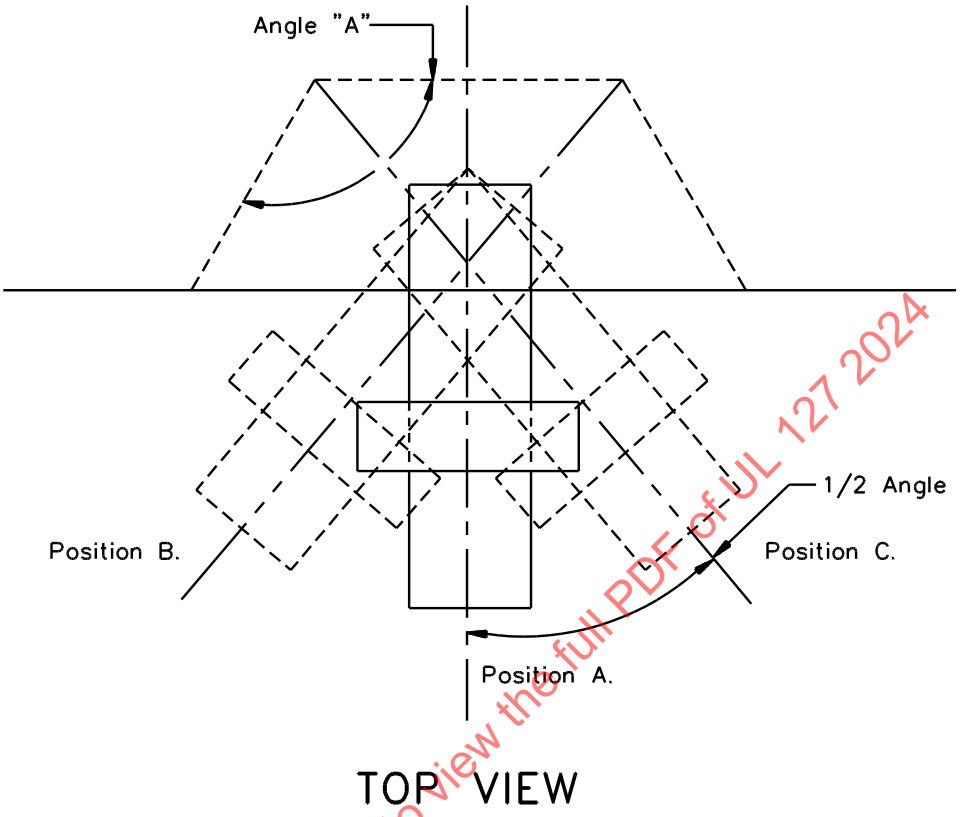
Figure 18.4

Inclined Plane in Position for Strength Test of Back and Side Walls



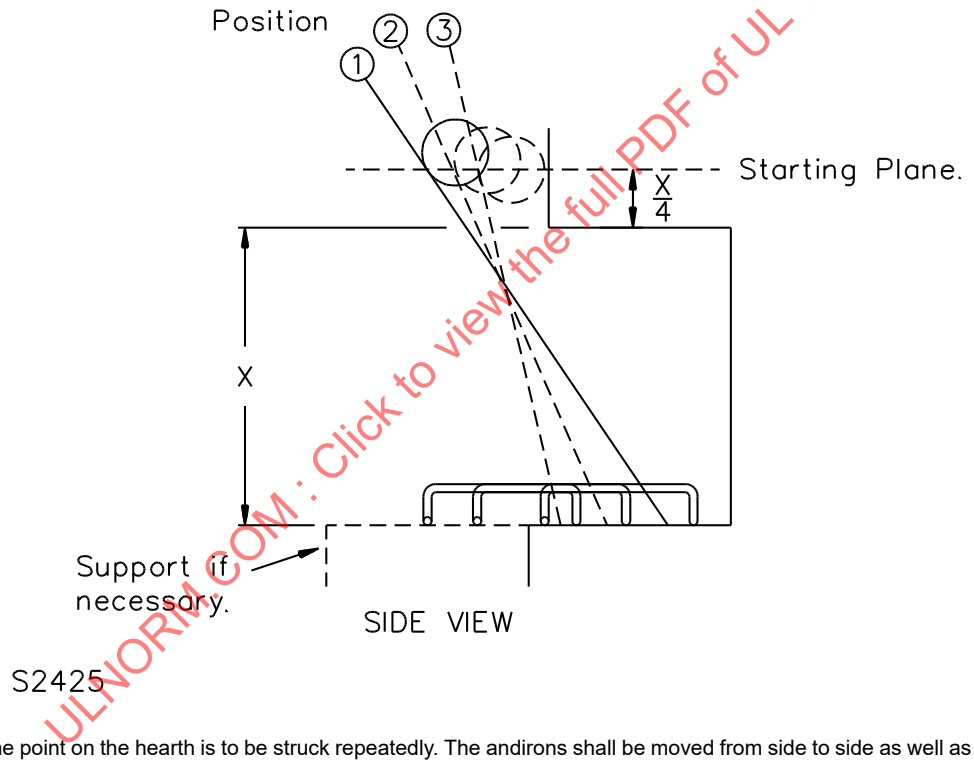
18.3 While remaining in position "A" as illustrated in Figure 18.4, the inclined plane is to be elevated successively to each of the three positions shown in Figure 18.3 and the simulated log is to be rolled down the plane once at each elevation of the plane, for a total of three impacts against the back wall of the fire chamber.

18.4 The test described in 18.3 is to be repeated with the inclined plane in position "B" (Figure 18.4) and then in position "C", for a total of six additional impacts.

18.5 With the inclined plane remaining in position "A" as illustrated in Figure 18.4, the andirons are to be positioned successively in the three positions shown in Figure 18.5. The slope of the inclined plane then is to be adjusted so that the simulated log to roll down the plane and impact the rear half of the andiron. There is to be one impact at each position of the andiron, for a total of three impacts.

Figure 18.5

Inclined Plane in Position for Strength Test of Hearth



NOTE – No one point on the hearth is to be struck repeatedly. The andirons shall be moved from side to side as well as in and out.

18.6 The back wall, side walls, and hearth of the fire chamber shall withstand the successive impacts on their surfaces resulting from the tests described in 18.3 – 18.5 without being damaged to the extent that the fireplace assembly is not capable for further use. Ceramic materials shall not break away, become dislodged, or show cracks opened more than 1/64 inch (0.4 mm) through the full depth of the material.

18.7 The hearth area within the combustion zone then is to be subjected to a uniform static load of 100 lb/ft^2 (489 kg/m^2) applied directly to the hearth area with the andirons removed. There shall be no permanent distortion or damage to the hearth area or to any part of the fireplace.

18.8 The area of a hearth extension furnished with the assembly then is to be subjected to a static load of 400 pounds (181.6 kg) applied to various 1/4 square foot (0.023 m^2) areas at different points on the extension. There shall be no permanent distortion or damage to the hearth extension area or to any part of the fireplace.

18.9 The outside edge of a fireplace hearth supported from a wall structure, or otherwise unsupported directly by the floor beneath the fire chamber, then is to be subjected to a static load of 300 pounds (136.2 kg) applied through the flat surface of a trade size 2- by 4-inch [nominal 1-1/2 by 3-1/2 inches (38.1 by 88.9 mm)] wood member laid perpendicular to the edge and on the center line of the fireplace opening. Ornamental or other trim that is damaged by this test is to be removed. There shall be no permanent distortion or damage to the hearth edge, to the fireplace or its support, or to the wall structure.

19 Chimney Strength Test

19.1 General

19.1.1 A chimney or its parts shall not break, disassemble, or become damaged to the extent that they are not capable for further use as a result of three impacts of a sand bag applied as described in 19.2.1 – 19.2.4.

19.1.2 Chimney parts shall not break, disassemble, or become damaged to the extent that they are not capable of further use when subjected to a longitudinal force of 100 lbf (445 N) applied as described in 19.3.1 and 19.3.2.

19.1.3 A support for an elbow shall sustain a load equivalent to four times the weight of the longest chimney section between adjacent supports. See 19.4.1.

19.1.4 A chimney joint of an offset chimney shall sustain a load equivalent to four times the weight of the vertical portion of the chimney length between the supports applied as described in 19.5.1.

19.1.5 Chimney parts shall not separate or disengage when subjected to torsional forces exerted by chimney cleaning brushes as described in 8.3.2.

19.2 Impact test

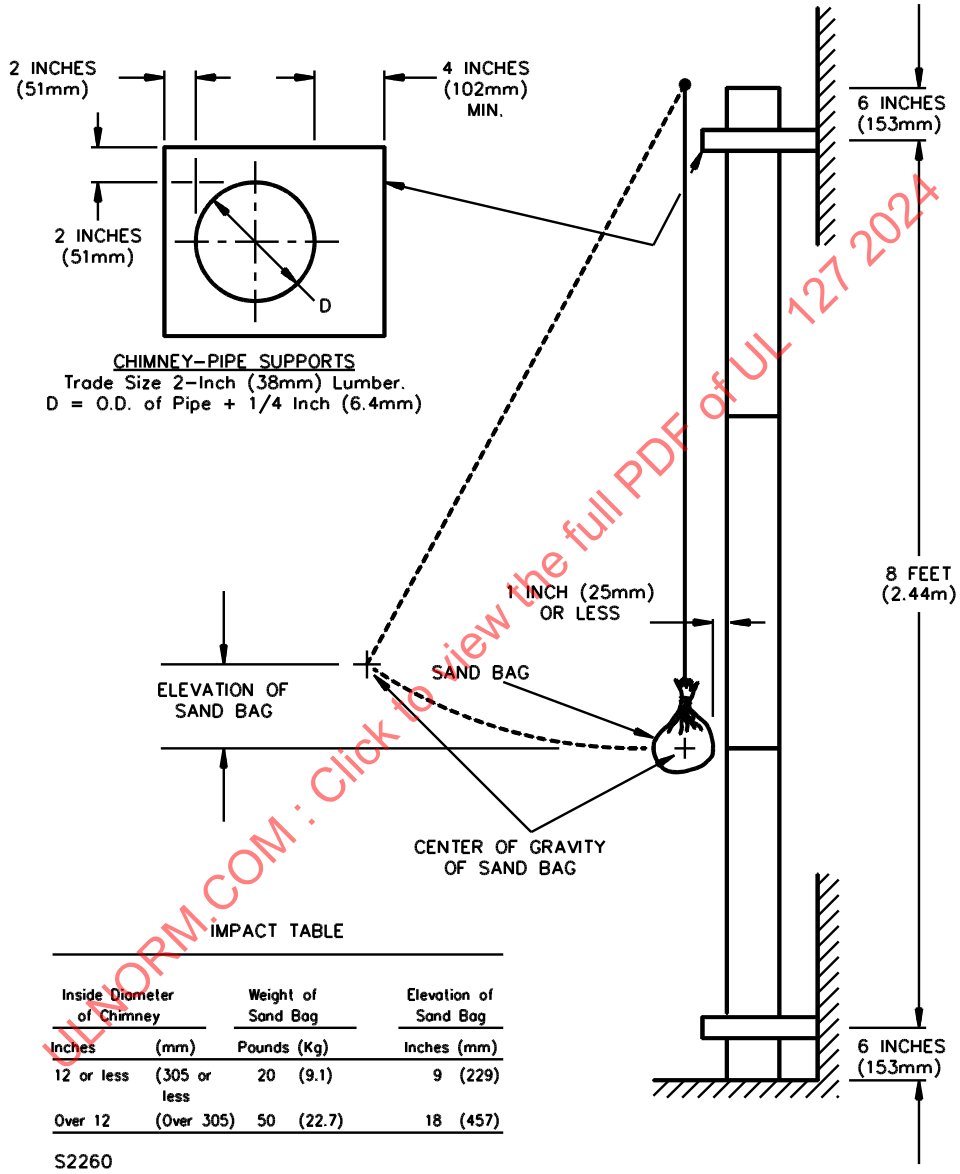
19.2.1 With reference to the requirements in 19.1.1, the impact is to be applied to an unenclosed chimney installed as shown in Figure 19.1. Tests shall be conducted on samples of each chimney size. Each section is to be joined together as specified by the manufacturer. When cemented joints are included in an assembly, the cement is to be dry before a test is conducted.

19.2.2 The impact is to be produced by a pendulum consisting of a rope suspending a cloth bag filled with sand and having the weight as shown in Figure 19.1. The bag is to be formed by tightly drawing up all sides and corners of a flat section of canvas around the sand and tying the excess canvas. The bag is to have an at-rest position with not more than 1 inch (25.4 mm) distance between the edge of the bag and the surface of the chimney. The point of impact is to be on the same horizontal plane as the center of gravity of

the bag at rest. The distance of swing is to be that required to raise the center of gravity of the bag to the elevation specified in Figure 19.1 above the center of gravity of the bag at its at-rest position.

Figure 19.1

Strength Test



IMPACT TABLE

Inside Diameter of Chimney		Weight of Sand Bag		Elevation of Sand Bag
Inches	(mm)	Pounds	(Kg)	Inches (mm)
12 or less	(305 or less	20	(9.1)	9 (229)
Over 12	(Over 305)	50	(22.7)	18 (457)

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19.2.3 The length of the pendulum varies, based upon the intended point of impact.

19.2.4 The three impacts are to be made successively at the following points:

a) At the level of a joint;

b) At the level halfway above the first joint tested and the next joint; and

c) At the same level as in (b), and rotated around the axis of the chimney by 90 degrees from the impact in (b).

19.3 Longitudinal force test

19.3.1 With reference to the requirements in 19.1.2, the longitudinal force is to be applied on a number of chimney assemblies, as required to provide for representative samples of each size of part intended to be field-joined together. The force is to be exerted on the assembly in a direction tending to pull the assembly apart. When cemented joints are included in an assembly, the cement is to be dry before a test is conducted.

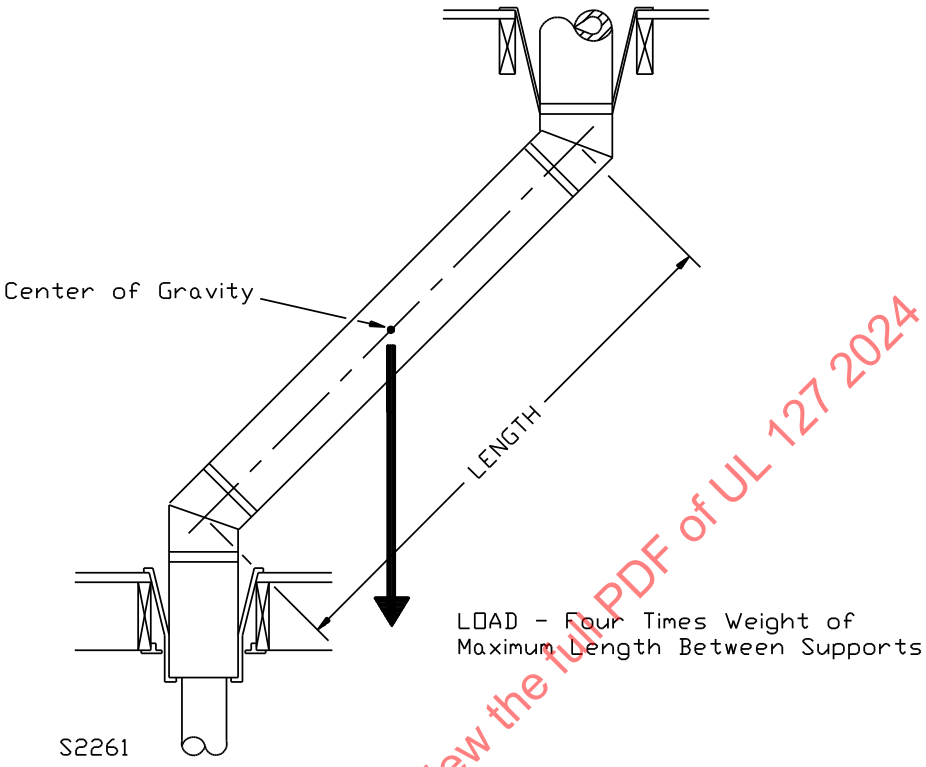
19.3.2 Two or more companion parts are to be joined in accordance with the manufacturer's instructions. A longitudinal force of 100 lbf (445 N) is to be applied first to the flue-gas-conveying conduit, then to the outer jacket or casing.

19.4 Load test for chimney elbows

19.4.1 The test to determine compliance with the requirements of 19.1.3 is to be performed as illustrated in Figure 19.2. Elbows are to be tested using an elbow chimney section having the greatest angle from the vertical specified by the manufacturer and installed directly on the chimney section. A vertical load, equivalent to four times the weight of the longest supported section of the chimney that is intended to be attached to the elbow, is to be applied through the center of gravity of the section. The load is to be sustained for 5 minutes.

Figure 19.2

Load Test for Chimney Elbows

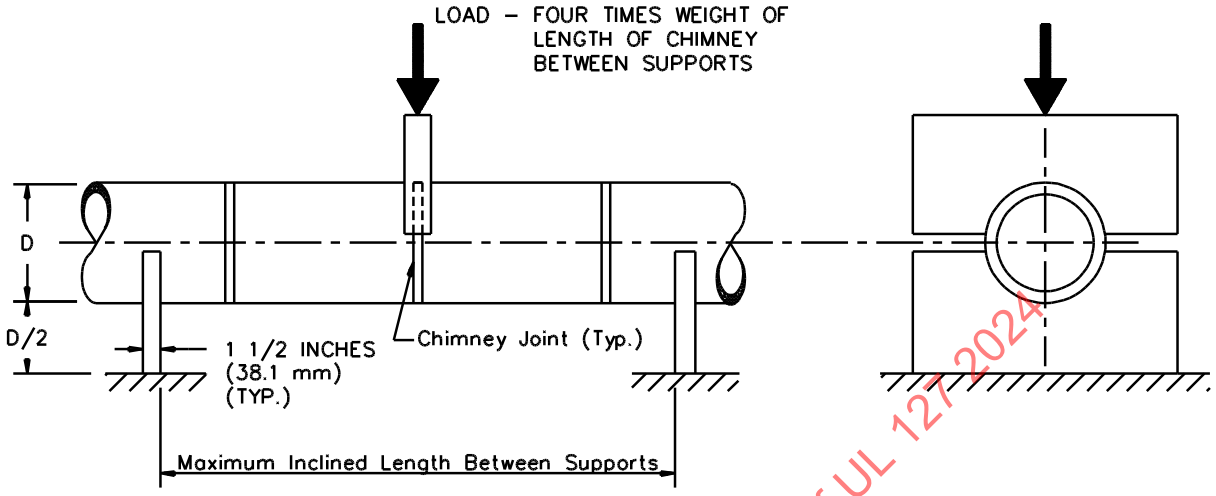


19.5 Chimney joint load test

19.5.1 The test to determine compliance with the requirements in 19.1.4 is to be performed as illustrated in Figure 19.3. The maximum inclined length of flue-pipe between supports is to be assembled and installed on supports as shown. A vertical load, equal to four times the weight of the length of the chimney between supports, is to be applied at the joint located centrally between the supports. The load is to be sustained for 5 minutes.

Figure 19.3

Chimney Joint Load Test Load



19.6 Chimney joint torsion test

19.6.1 With reference to the requirements in 19.1.5, the torsion is to be applied to a minimum of three chimney sections of the maximum length, secured to the support assembly. A metal chimney cleaning brush sized to fit the chimney flue is to be inserted to the midpoint of the top section and turned ten times to simulate cleaning methods. The chimney parts shall not separate or disengage.

20 Wind Load Test

20.1 A roof assembly shall resist, without damage or opening of joints, a load equivalent to 30 lb/ft^2 (146 kg/m^2) of exposed area applied to any surface extending above the roof, when tested as described in 20.2 – 20.4.

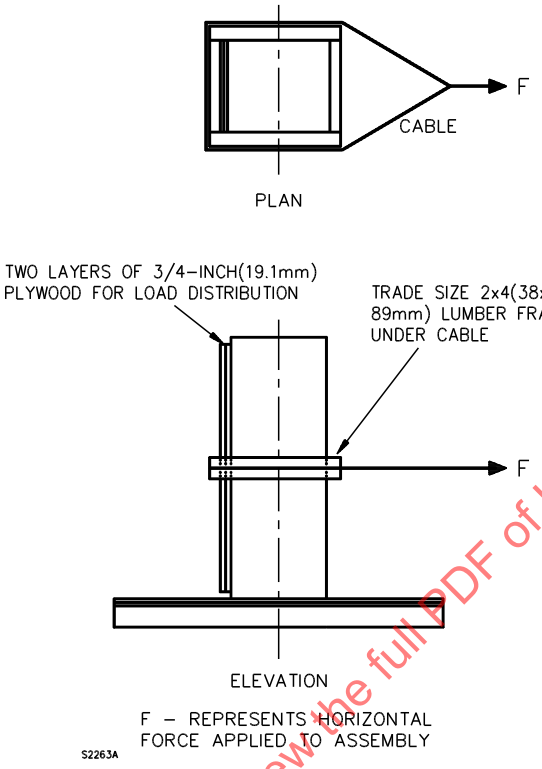
20.2 The test is to be made on the tallest roof assembly representative of each style furnished by the manufacturer. The assembly is to be installed in a flat roof deck as described in the manufacturer's installation instructions.

20.3 The projected area of the largest surface of the roof assembly exposed to wind is to be computed by multiplying the diameter or the widest average dimension of the roof assembly, whichever is greater, by the greatest height of the assembly measured from the roof to the top of the chimney.

20.4 A load equivalent to the product of the projected area multiplied by an assumed wind pressure of 30 lb/ft^2 (146 kg/m^2) is to be applied to the surface of the assembly in a horizontal direction. When a uniform surface load is not capable of being applied, the load is to be applied at the middle of the height used to calculate the projected area so that the load is evenly distributed over as much of the surface as required. See Figure 20.1. The load is to be sustained for a period of 1 hour as a static load.

Figure 20.1

Wind Load Test



21 Rain Test

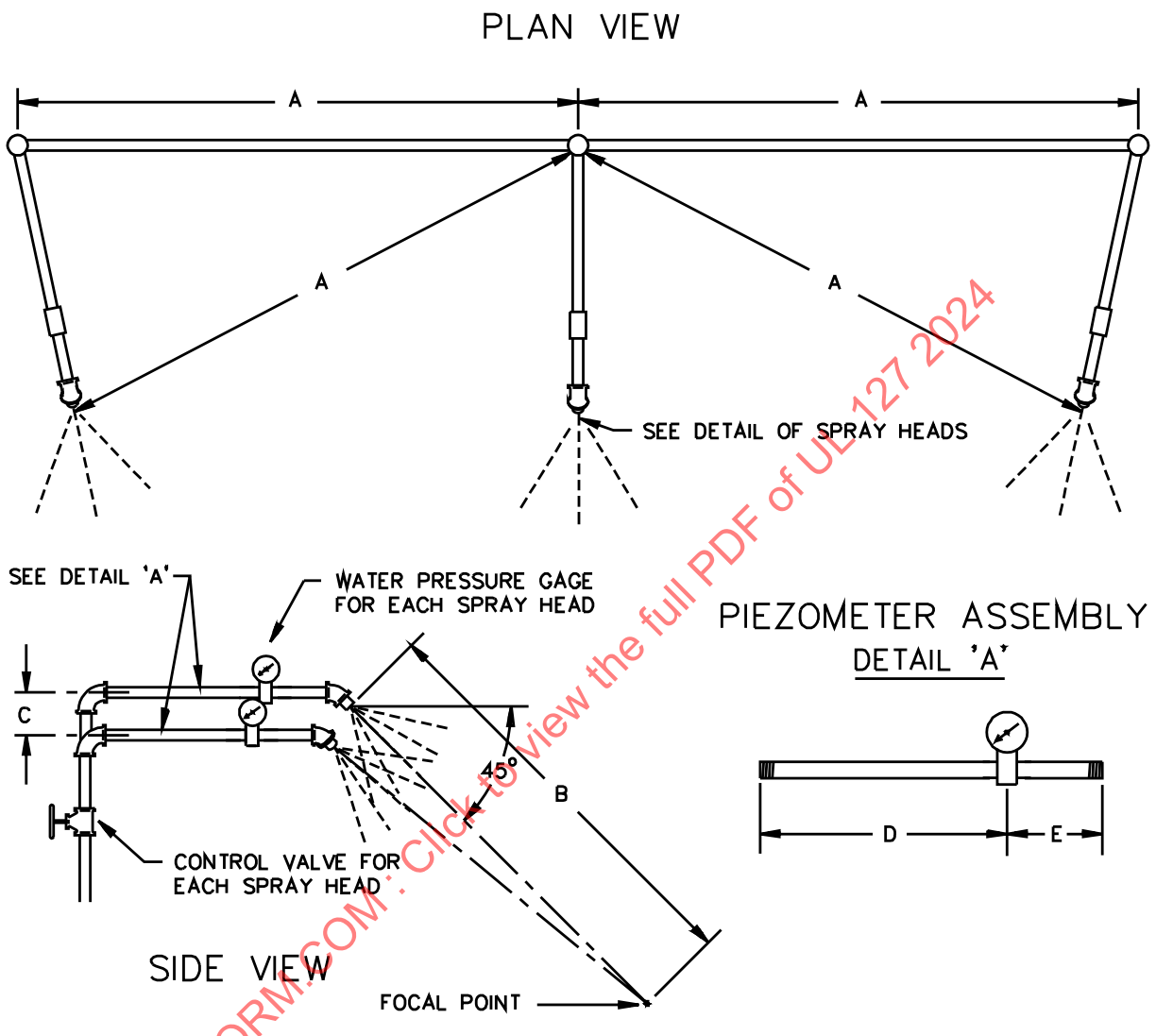
21.1 The quantity of water entering the flue-gas conduit, ventilation openings provided as part of a roof assembly, or any other individual passageway, shall not exceed 2 % of that which enters the conduit, ventilation openings, or passageway when unprotected by a cap or other means, when tested as described in 21.2 – 21.6.

21.2 Representative sizes and styles of caps, roof assemblies, and roof jacks are to be subjected to the tests described in 21.3 – 21.6. The chimney section, roof assembly, or roof jack is to be sealed or flashed into a roof section of watertight material that sheds the water spray away from the underside of the test assembly. In this arrangement, any water entering the test assembly from above is to be observed at the underside of the simulated roof and collected.

21.3 The rain test apparatus is to consist of three spray heads mounted in a water-supply pipe rack illustrated in Figure 21.1. Spray heads are to be constructed in accordance with the details illustrated in Figure 21.2. The water pressure for all tests is to be maintained at 5 psig (34.5 kPa) at each spray head. The spray is to be directed toward the top and side of the cap, roof assembly, or roof jack. The cap, roof assembly, or roof jack is to be centrally located within the spray pattern and the top of the cap, roof assembly, or roof jack under test is to be at least 3 feet (0.9 m) below the plane of the lower spray head outlet.

Figure 21.1

Rain-Test Spray-Head Piping



Item	inch	mm
A	28	710
B	55	1400
C	2–1/4	55
D	9	230
E	3	75

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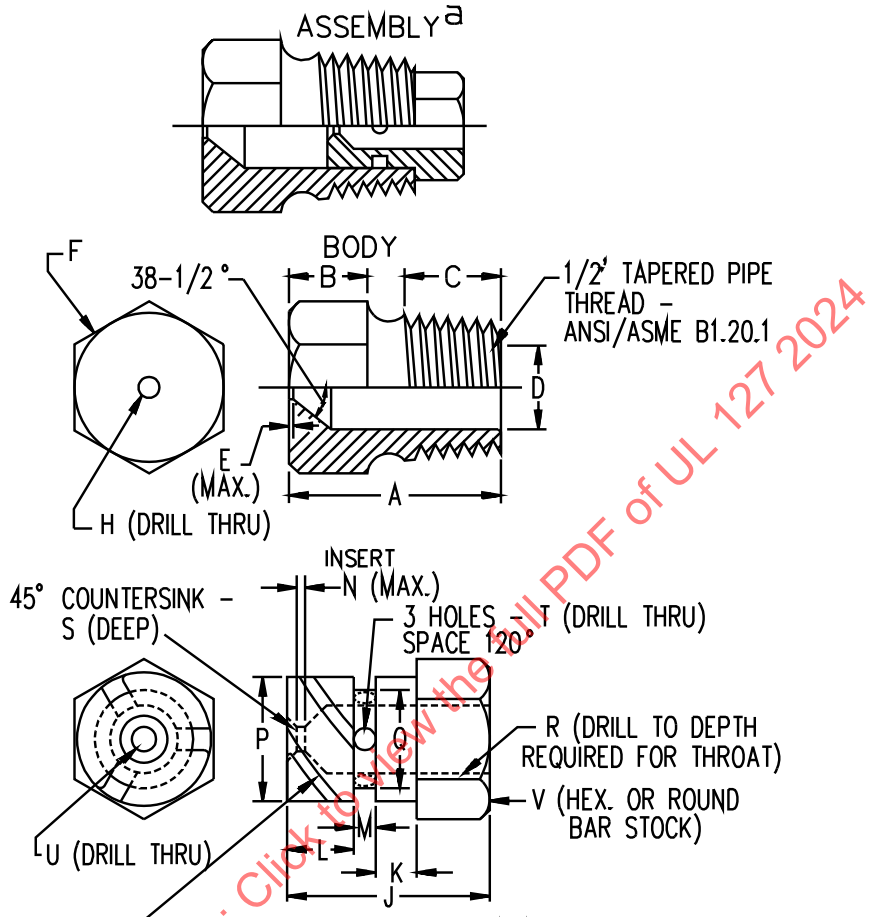
Figure 21.2

Rain-Test Spray Head



Item	inch	mm	Item	inch	mm
A	1-7/32	31.0	N	1/32	0.80
B	7/16	11.0	P	.575	14.61
C	9/16	14.0		.576	14.63
D	.578	14.68	Q	.453	11.51
	.580	14.73		.454	11.53
E	1/64	0.40	R	1/4	6.35
F	c	c	S	1/32	0.80
G	.06	1.52	T	(No. 35)[b]	2.80
H	(No.9)[b]	5.0	U	(No. 40)[b]	2.50
J	23/32	18.3	V	5/8	16.0
K	5/32	3.97	W	0.06	1.52
L	1/4	6.35			
M	3/32	2.38			

[a] Nylon Rain-Test Spray Heads are available from Underwriters Laboratories

[b] ANSI B94.11M Drill Size

[c] Optional - To serve as a wrench grip.

RT100E

21.4 The average rate of simulated rainfall in inches/h over an area 12 inches (305 mm) in diameter with the water pressure at 5 psig (34.5 kPa) is to be determined as follows. A 12-inch (305-mm) diameter cylindrical container, open at one end and 20 inches (508 mm) deep, is to be used to collect the rainfall for 30 minutes. The center of the end of the container is to be located at the same position as the center of the upper surface or plane of the cap or assembly to be tested. The inches of rainfall collected in 30 minutes is to be multiplied by two to determine the rainfall in inches/h.

21.5 For the rain test of an assembly, arrangements are to be made for collecting, in separate containers, any water entering the flue-gas conduit and any ventilation air passageway of a given configuration. The rain test is to cover a period of 1 hour.

21.6 The maximum amount of water collected in either the flue gas conduit or in any ventilation air passageway shall not exceed the value obtained by application of the formula:

$$Q \leq 0.02 \times R \times A$$

in which:

Q = Volume of water actually collected, inches^3/h;

R = Rainfall, inches/h; and

A = Area of conduit or passageway, inches^2.

22 Crushing Test of Nonmetallic Flue-Gas Conduit or Insulation

22.1 Each of eight full size chimney sections of each size of nonmetallic flue-gas conduit of insulation shall sustain without visible damage a load of not less than 450 lbs (204 kg) when tested as described in 22.2 – 22.5.

22.2 The samples used in this test are to be full-size sections, free of cracks. The face of each end of the samples is to be perpendicular to the axis of the chimney section and is to be ground smooth or capped with plaster to obtain uniform distribution of loading.

22.3 At least eight 4-inch (100-mm) long samples of each size are to be tested. Four samples of each size are to be tested in the as-received condition. The remaining four samples are to be placed in an electrically-heated oven whose temperature is initially at room temperature and then increased at the rate of 55 °C (131 °F)/min to 550 °C (1022 °F) and maintained at this temperature for 24 hours. The samples then are to be removed and cooled to room temperature prior to application of the load.

22.4 Any method that applies the load progressively or in increments not exceeding 5 % of the estimated total breaking load is used for this test. When the load is applied in increments, the samples are not to remain in any loaded condition longer than is required for observing and recording the load values.

22.5 The bed of the testing machine is to be used as the bottom bearing surface. The bed is to be made of flat steel. Pressure on the top of the sample is to be applied by a bearing block maintained parallel to the bed of the machine. The construction and operation of the bearing frames and bearing blocks are to maintain a uniform distribution of the applied load. The samples are to be placed so as to secure a symmetrical distribution of the loading.

23 Resistance to Action of Acids Test of Nonmetallic Flue-Gas Conduit

23.1 The percentage of acid-soluble matter in each sample of nonmetallic flue-gas conduit material shall not exceed 3.0 % by weight when tested as described in 23.2 and 23.3.

23.2 A sample of each nonmetallic flue-gas conduit material is to be subjected to this test. Each sample is to have a square face area and is to be the maximum thickness used in the conduit. The total surface area is to be measured. The samples are to be washed with hot water and dried to constant weight in a ventilated oven at a temperature between 105 and 110 °C.

23.3 Upon attaining constant weight, the samples are to be suspended and completely immersed in a 1/50 normal sulfuric acid solution [40 cubic centimeters of solution for each square inch (6.5 cm^2) of sample surface area] at a temperature between 21 and 32 °C (70 – 90 °F) for a period of 24 to 48 hours. The samples then are to be removed from the solution, washed with hot water, and dried to constant weight in a ventilated oven at a temperature between 105 and 110 °C (221– 230 °F). This weight then is to be compared with the weight obtained as described in 23.2.

24 Freezing and Thawing Test of Water-Absorptive Nonmetallic Materials

24.1 Parts of nonmetallic materials that absorb water shall not show disintegration, cracking, or spalling, or loss of weight of more than 5 % of the initial dry weight after being subjected to the freezing and thawing treatment described in 24.2 – 24.5.

24.2 The samples of each material to be tested are to be free of observable cracks, and shall not contain laminations and fissures unless they are representative of the material from which the samples are taken.

24.3 The samples are to be dried to constant weight in a ventilated oven at a temperature of 105 – 110 °C (221– 230 °F). The samples then are to be submerged for 24 hours in water at a temperature of 18 – 24 °C (64 – 75 °F). The water then is to be heated to boiling temperature, maintained at this temperature for 5 hours, and then cooled to a temperature of 18 – 24 °C. Each sample then is to be removed from the water, wiped dry with a cloth, and weighed immediately. The average water absorption by weight is to be calculated and recorded.

24.4 Representative samples of complete parts then are to be required to be free of observable cracks or shattered edges. The samples shall not contain laminations and fissures unless they are representative of the material from which the samples are taken.

24.5 The samples are to be dried to constant weight in a ventilated oven at a temperature between 105 and 110 °C (221– 230 °F) and the weights recorded. The samples then are to be immersed for 72 hours in water at a temperature of 18 – 24 °C (64 – 75 °F), then removed from the water and drained for not more than 1 minute. The superficial moisture is to be removed with a towel or blotting paper and the samples immediately subjected to ten conditioning cycles. Each conditioning cycle is to consist of exposure to a temperature of minus 18 °C for 16 hours, followed by exposure to a temperature of 110 °C for 7 hours, and then followed by immersion in water for 1 hour. These cycles are to be continued for 240 hours, except that once during the test the samples are to remain at the temperature of minus 18 °C for 64 consecutive hours. At the end of the test period, the samples are to be dried to constant weight, and the weight recorded.

25 Cemented Joint Test of Flue-Gas Conduit

25.1 There shall be no evidence of softening or leaching of the cement used for joining sections of flue-gas conduit following the tests described in 25.2 and 25.3.

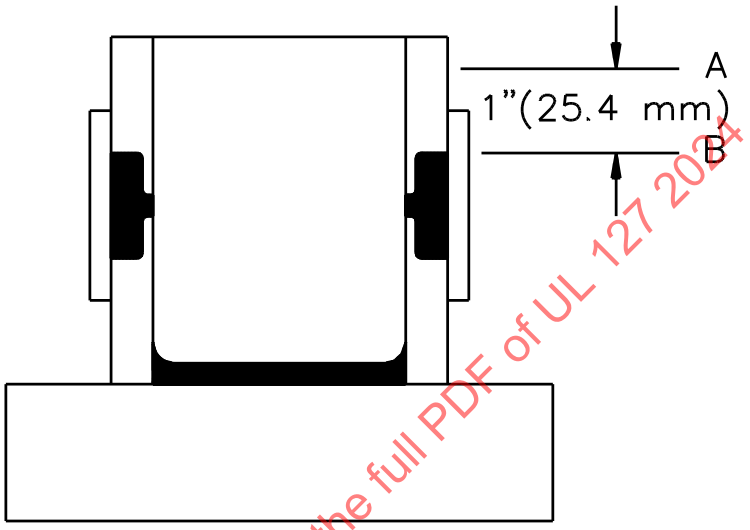
25.2 Four samples are to be prepared of each style of joint used between two sections of the flue-gas conduit. The length of the test assembly shall be no longer than required to include the complete joint.

25.3 The samples are to be dried to constant weight in a ventilated oven at a temperature between 105 and 110 °C (221– 230 °F). Each sample then is to be placed in an ambient temperature between 21 and 32 °C (70 – 90 °F), and mounted with the axis of the assembly in a vertical position. The bottom of the

assembly is to be sealed to retain liquid, and the assembly is to be filled with a 1/50 normal sulfuric acid solution to a level 1 inch (25.4 mm) above any cemented portion of the joint. The solution is to be maintained at that level for 72 hours. The solution then is to be removed and the test repeated, except that water is to be used in place of the sulfuric acid solution. See Figure 25.1.

Figure 25.1

Test of Cemented Joints



A – Liquid level
B – Highest level of cement

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26 Sulfuric Acid Extraction Test for Porcelain-Coated Steel Used for Flue-Gas Conduit

26.1 The loss in weight of porcelain-coated steel used for flue-gas conduit shall be not greater than 0.30 % following the tests described in 26.2 and 26.3.

26.2 Two samples are to be tested, each 2- by 2-inches (50- by 50-mm) in face area. When seams are incorporated in the product, each sample is to include the conduit seam. The samples are to be weighed and the thickness of the base metal determined. The sample weights are to be adjusted to a base metal thickness of 0.026 inch (0.66 mm). The edges of the samples are to be coated with wax.

26.3 The samples are to be suspended completely immersed in a solution containing 20 % by weight sulfuric acid, and at a temperature between 21 and 32 °C (70 – 90 °F), for a period of 44 hours. After removal from the solution, the samples are to be cleaned, dried, and weighed; and the loss of weight is to be calculated and recorded as a percent of the original adjusted dry weight.

27 Glazing Test

27.1 General

27.1.1 Glazing shall not crack, break, become dislodged, or sustain a loss of strength when the fireplace is subjected to the Radiant Fire Test, Section 13; Brand Fire Test, Section 14; and Flash Fire Test, Section 15.

27.1.2 When the glazing material is shielded from the room by a screen or wire mesh having openings less than 1/4 by 1/4 inch (6.4 by 6.4 mm) and the screen is secured to the frame, the glazing shall not crack or break when subjected to the Radiant Fire Test, Section 13; Brand Fire Test, Section 14; Flash Fire Test, Section 15; and tested as described in 27.2.1 – 27.3.1, unless the screen is not damaged (torn, dislodged or punctured) by these tests. When the glazing cracks or breaks, the fireplace is to be subjected to these tests with the glazing material both in place (intact) and with one glazing panel removed.

27.2 Impact test

27.2.1 Glazing shall withstand, without cracking or breaking, the impact described in 27.2.2:

a) Prior to the Radiant Fire Test, Section 13, or Brand Fire Test, Section 14 (whichever test is conducted first), while at room temperature;

b) During the Radiant Fire Test, while at the maximum temperature developed during that test;

c) Following the Radiant Fire Test, after being cooled to room temperature;

d) During the Brand Fire Test, while at the maximum temperature developed during that test;

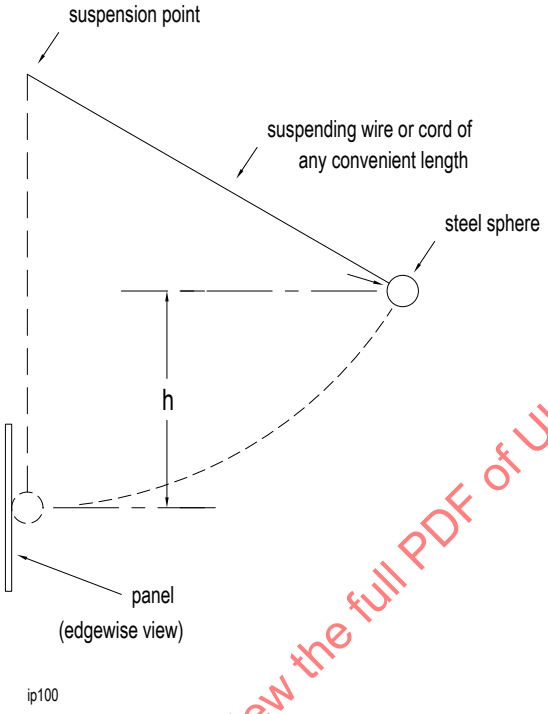
e) Following the Flash Fire Test, Section 15, after being cooled to room temperature; and

f) For outdoor fireplaces, during the hot and cold exposure conditioning test, 30.2.

27.2.2 An impact is to be applied to the center of the glazing panel by means of a 1.18 lb (0.54 kg), 2 inch (50.8 mm) diameter steel sphere swung through a pendulum arc from a height (h) of 16.25 inches (413 mm). The at-rest suspension point of the steel sphere is to be 1 inch (25.4 mm) in front of the plane of the panel. See Figure 27.1.

Figure 27.1

Impact Test



27.3 Water shock test

27.3.1 While at the maximum temperature developed during the Radiant Fire Test, Section 13, each glazing panel shall withstand, without cracking or breaking, the application of:

a) A wet cloth, fully saturated with water at room temperature, wiped across the surface of each glazing panel; and

b) Three misted water sprays projected across the surface of each glazing panel from a household cleaning bottle with a gun-type nozzle, applied after the panel is dried and again attains the maximum temperature under the heated condition.

OUTDOOR FIREPLACES

28 General

28.1 Fireplaces intended for outdoor use shall comply with Sections 29 – 32, in addition to the requirements of Sections 1 – 27 and 34 – 62.

29 Construction

29.1 The unit assembly shall be fabricated from Type 430 stainless steel or G-90 coated galvanized steel for the outer unit wrap only to reduce the effects of corrosion. Additionally, all fastening means shall be able to withstand the conditions anticipated during outdoor use. In order to facilitate water runoff, the hearth pan shall have a pitch of a minimum of 1/4 inch per foot forward.

30 Performance

30.1 General

30.1.1 A fireplace intended for outdoor use shall be subjected to the hot and cold conditioning test, freezing and thawing tests for refractory materials, and the wind test described in 30.2 – 30.4.

30.2 Hot and cold conditioning test

30.2.1 The following tests and conditioning operations for fireplaces intended for outdoor use are to be repeated for three cycles. The first and second cycle are to consist of the requirements specified in 30.2.2 – 30.2.6. The third cycle is to consist of the requirements specified in 30.2.2 – 30.2.5 and 30.2.7. Upon completion of the three cycles, a fireplace intended for outdoor use shall not exhibit a cracked refractory, broken glass panels, deformed metal panels, broken welds or fasteners, or any other condition which potentially increases the risk of injury or fire.

30.2.2 Prior to beginning each cycle of tests and conditioning operations, the fireplace is to be at room temperature.

30.2.3 All fireplace doors are to be opened and the fireplace front face and hearth area, including the hearth refractory, are to be subjected to a water spray using the rain test apparatus as described in Section 21, Rain Test, for 5 minutes.

30.2.4 Following completion of the water conditioning, all fireplace doors are to be closed and the fireplace placed in a cold chamber that is maintained at 0 °F(-18 °C). The fireplace is to remain in the cold chamber for 24 hours, then removed.

30.2.5 Within 2 minutes of removal from the cold chamber, any glass panels which the fireplace is provided with are to be subjected to the impact test of 27.2. Following the impact test, the fireplace doors are to be fully opened and the Fire Chamber Strength Test of Section 18 is to be conducted on the fireplace refractory.

30.2.6 During the first and second cycles of testing and conditioning following the Fire Chamber Strength Test, the Flash Fire Test of Section 15 is to be performed. After the Flash Fire Test is complete, the fireplace is to cool for 30 minutes, after which any remaining coals are to be removed. The next cycle of testing and conditioning is to then begin.

30.2.7 During the third cycle of testing and conditioning, the fireplace is to be installed into the temperature test enclosure used for the Brand and Flash Fire Tests of Sections 14 and 15, respectively. The fireplace is then to be subjected to the Brand and Flash Fire Tests. The fireplace shall perform in accordance with the requirements specified in Sections 14 and 15.

30.3 Freezing and thawing tests for refractory materials

30.3.1 Prior to undergoing the tests and conditionings described in 30.3.2 – 30.3.5, representative samples of the fireplace's refractory material are to be free from cracks that can be observed unaided. The samples are able to contain laminations and fissures when the laminations and fissures are representative of the overall refractory material. When subjected to the tests and conditionings described in 30.3.2 and 30.3.3, refractory samples shall not disintegrate, crack, nor exhibit spalling. Additionally, the samples shall not lose more than 5 % of their initial dry weight. As a result of the conditionings described in 30.3.4 and 30.3.5, refractory samples shall neither break nor crack.

30.3.2 Three refractory samples are to be dried to constant weight in a ventilated oven at a temperature of 212 – 221 °F (100 – 105 °C) and the weights measured. The samples are then to be submerged for 24

hours in water at a temperature of 64 – 75 °F (18 – 24 °C). The water is then to be heated to boiling temperature, maintained at this temperature for 5 hours, then allowed to cool to a temperature of 64 – 75 °F (18 – 24 °C). Each sample then is to be removed from the water, wiped dry with a cloth, and weighed immediately. The water absorption by weight is to be calculated and recorded.

30.3.3 Following the conditioning of 30.3.2, the samples are to be dried to constant weight in a ventilated oven at a temperature between 212 and 221 °F (100 and 105 °C) and the weights recorded. The samples are then to be immersed for 72 hours in water at a temperature of 64 – 75 °F (18 – 24 °C), and then removed from the water and allowed to drain for not more than 1 minute. The superficial moisture is to be removed with a towel or blotting paper and the samples immediately subjected to three conditioning cycles. Each conditioning cycle is to consist of exposure to a temperature of -40 °F (-40 °C) for 16 hours, followed by exposure to a temperature of 212 °F (100 °C) for 7 hours, and then followed by immersion in water for 1 hour. At the end of the test period, the samples are to be dried to constant weight, and the weight measured. The samples are to be inspected for cracking, disintegration, and spalling.

30.3.4 Three previously untested samples of the refractory are to be immersed in water for 24 hours and then placed in a -40 °F (-40 °C) cold chamber for 24 hours. The samples are then to be removed and allowed to reach room ambient temperature. The samples are then to be inspected for breakage and cracking.

30.3.5 One previously untested set of refractory samples is to be submerged into water at room temperature for a period of 24 hours. The refractory samples are to be removed from the water after 24 hours and reinstalled into the fireplace. The fireplace is to then be subjected to the Flash Fire Test specified in Section 15. The samples are then to be inspected for breakage and cracking.

30.4 Wind test

30.4.1 The Brand Fire Test, specified in 14.2 – 14.9, is to be performed while the wind test specified in 30.4.2 and 30.4.3, is performed. The fireplace is to be installed in the test enclosure used to perform the Brand Fire Test. The maximum temperature rise of the test enclosure surfaces above ambient temperature shall conform to the requirements of 14.11.

30.4.2 During the Brand Fire Test as described in 14.2 – 14.9, the fireplace is to be subjected to a wind starting at 5 mph rising in 5 mph increments to 40 mph. At each increment, the fireplace doors are to be open, the wind is to impinge on the opening first at 90° to the hearth opening, then 45° to the hearth opening. The fireplace doors are then to be closed, and the wind again made to impinge at 90° and then 45° to the hearth opening. The equilibrium temperatures of the test enclosure surfaces are to be measured at each wind impingement.

30.4.3 When a wind speed of 40 mph is reached and the equilibrium temperatures of the test enclosure surfaces are found to be still increasing with wind speed, the wind speed is to continue to be increased in 5 mph increments. This process is to continue until the equilibrium temperature no longer increases with wind speed.

31 Marking

31.1 In addition to the applicable marking requirements in Section 60, the fire chamber of a fireplace intended for outdoor use shall be marked with the following statements:

a) "OUTDOOR FIREPLACE" or equivalent and;

b) “WARNING” then the following or equivalent statement: “TO AVOID THE RISK OF DAMAGING FIREPLACE MATERIALS AND INCREASING THE RISK OF SPREADING A FIRE, DO NOT USE THE FIREPLACE TO COOK OR WARM FOOD.”

32 Operating Instructions

32.1 In addition to the applicable operating instruction requirements in 62.3, the operating instructions for a fireplace intended for outdoor use shall include the word “WARNING” and the following or equivalent statement: “TO AVOID THE RISK OF DAMAGING FIREPLACE MATERIALS AND INCREASING THE RISK OF SPREADING A FIRE, DO NOT USE THE FIREPLACE TO COOK OR WARM FOOD.”

FIREPLACES FOR USE IN MANUFACTURED HOMES

33 General

33.1 Installation

33.1.1 Fireplace for use in manufactured homes are intended for installation in accordance with the requirements of the Department of Housing and Urban Development (HUD) "Manufactured Home Construction and Safety Standards."

33.1.2 A fireplace for use in manufactured homes shall comply with all requirements elsewhere in this standard unless otherwise specified in this section.

33.1.3 Means shall be provided for securing the fireplace to the floor of the manufactured home.

33.1.4 A spark arrester and combustion air inlet shall be shipped with the fireplace from the factory, and the fireplace shall be tested with the spark arrester installed.

33.1.5 With its chimney installed, the configuration of a fireplace shall not void the required firestopping between spaces of a manufactured home when the fireplace, chimney, and the combustion air inlet are installed in accordance with the manufacturer's instructions.

33.1.6 A fireplace shall be shipped from the factory with an integral door(s) or shutter(s) provided and constructed to close off the fire chamber from the living space.

33.2 Chimney

33.2.1 The chimney shall extend at least 3 feet (0.9 m) above the part of the roof through which it passes. The top of the chimney is to be at least 2 feet (0.6 m) above the highest required elevation of any part of the manufactured home located within 10 feet (3 m) of the chimney.

33.2.2 All roof-chimney terminations shall be able to be readily removed at or below an elevation of 13-1/2 feet (4.1 m) above ground level and reinstalled without the use of special tools or instructions.

33.2.3 When the chimney exits the manufactured home at a location other than through the roof, and exits at a point 7 feet (2.1 m) or less above the ground level on which the manufactured home is positioned, a guard or method of enclosing the chimney shall be provided at the point of exit so that the chimney is guarded or enclosed up to a height of 7 feet.

33.2.4 With reference to the requirements of 33.2.3, openings in a chimney guard shall not permit:

a) The entrance of a 3/4 inch (19.1 mm) diameter rod; and

b) Contact with the chimney of a 1/2 inch (12.7 mm) diameter rod inserted through the opening a distance of 4 inches (102 mm).

33.3 Spark arrester

33.3.1 The chimney shall be provided with a spark arrester secured to the chimney. The net free area of the arrester above the chimney outlet shall be not less than four times the net area of the chimney outlet, and the vertical height of the arrester above the chimney outlet shall be not less than one-half the diameter of the chimney flue. Openings shall prohibit the passage of a sphere having a diameter larger than 1/2 inch (12.7 mm), and shall let the passage of a sphere having a diameter of 3/8 inch (9.6 mm).

33.4 Combustion air inlet

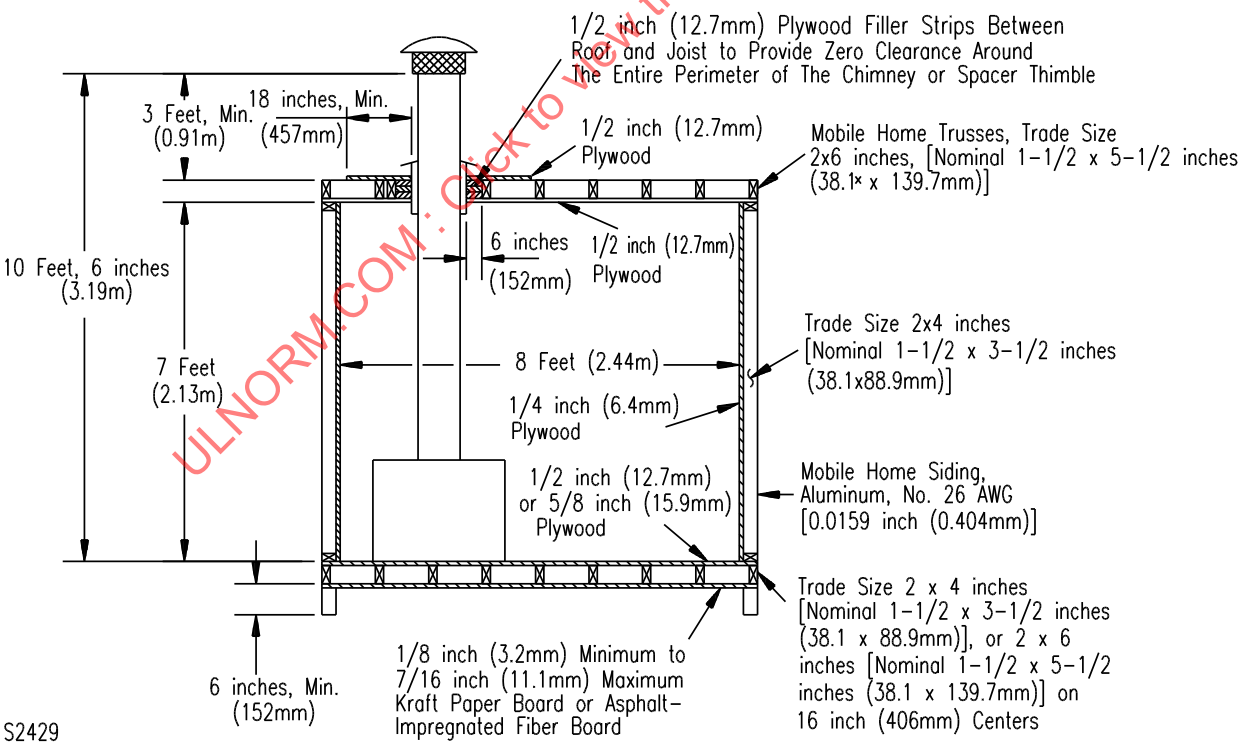
33.4.1 The cross sectional area of the combustion air inlet shall be not less than 50 % of the cross sectional flue area or 25 square inches (161 cm^2), whichever is smaller. This inlet shall conduct the combustion air directly from outside the manufactured home to the connection to the draft inlet of the fire chamber assembly.

33.5 Test structure

33.5.1 The test structure is to consist of three walls, a floor and a ceiling and is to have inside dimensions of 7 feet (2.1 m) high by 8 feet (2.4 m) wide by 8 feet deep. Interior surfaces of walls, ceiling and floor are to be painted flat back. See Figure 33.1 for structural details.

Figure 33.1

Manufactured Home Test Enclosure



33.6 Test method

33.6.1 The chimney of the fireplace is to pass through the ceiling/roof or wall of the manufactured home test structure at zero clearance. This is accomplished by a thimble or through the inherent construction of

the chimney or fireplace. The construction shall not void the firestopping required for a concealed space when installed in accordance with the manufacturer's installation instructions.

33.6.2 When the unit is equipped with an air inlet that penetrates the floor, a 3/8 inch (9.5 mm) thick plywood bottom board extending at least 8 inches (193 mm) from each side of the air inlet is to be applied to the bottom of the floor joist.

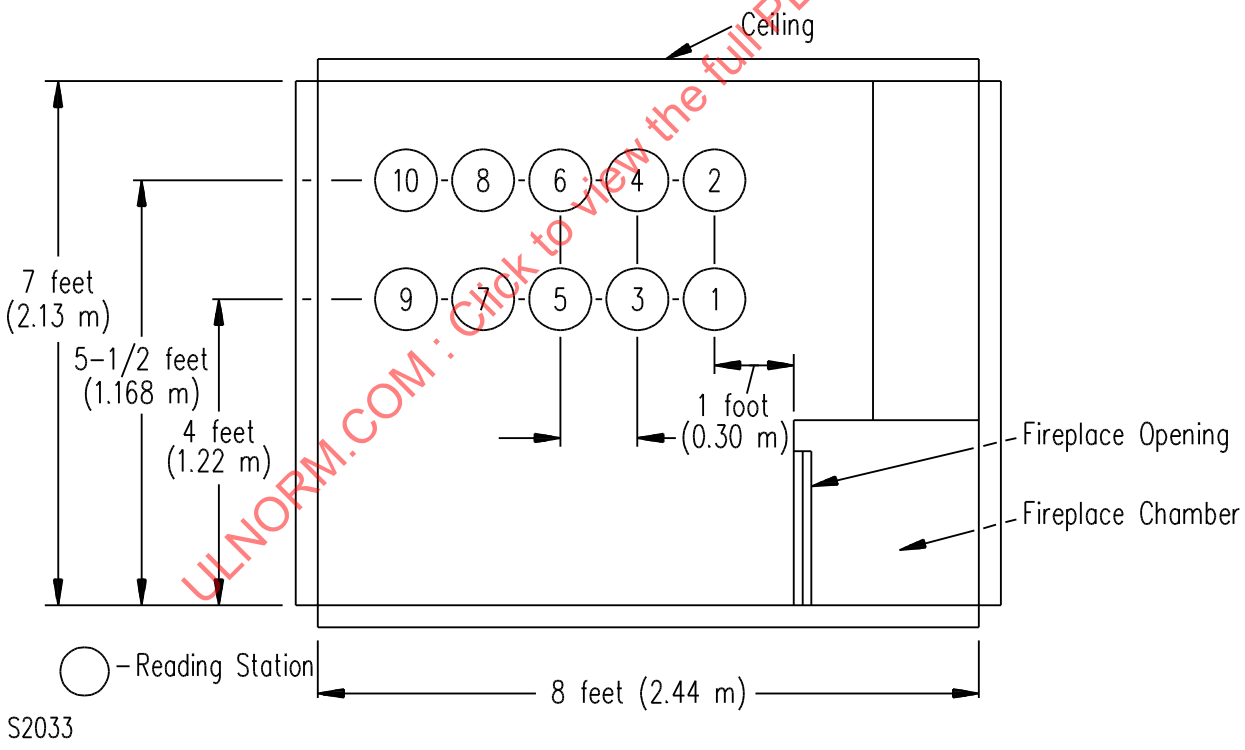
33.6.3 A fireplace intended for use in manufactured homes shall comply with the requirements in Sections 12 – 27.

33.6.4 As a continuation of the Radiant Fire Test, Section 13, the test structure is to be closed and sealed on all sides. Reading stations for monitoring CO concentration are to be located in a vertical plane perpendicular to and horizontally centered in relation to the plane of the fireplace.

33.6.5 The CO concentration during the test shall not exceed 50 ppm at any reading station during the entire test. See Figure 33.2.

Figure 33.2

Location of Carbon Monoxide Reading Stations



33.7 Drop test

33.7.1 At the conclusion of the fire tests, see Sections 13 – 15, the fireplace shall withstand the successive impacts described in 33.7.2. Ceramic materials shall not break away, become dislodged or show cracks more than 1/64 inch (0.4 mm) wide; welds shall not break and the fireplace assembly shall not be damaged to an extent that it is not capable of further use.

33.7.2 The fireplace chamber shall be raised 1 inch (25.4 mm) and dropped on a 3/4 inch (19.1 mm) thick sheet of plywood laid over a concrete floor. This test shall be repeated ten times.

BLOWER ASSEMBLY

GENERAL

34 General

34.1 A fireplace that includes a blower assembly shall comply with the requirements of the preceding sections of this standard and shall, in addition, comply with the requirements hereafter.

34.2 The construction and use of the blower assembly shall introduce a positive pressure into the fireplace.

34.3 Electrical circuits are classified as follows:

a) High-Voltage Circuit – A circuit involving a potential of not more than 250 volts and having circuit characteristics in excess of those of a low-voltage circuit.

b) Low-Voltage Circuit – A circuit involving a potential of not more than 30 volts ac (42.4 peak or direct current) and supplied by a primary battery or by a standard Class 2 transformer or other transforming device, or by a combination of transformer and fixed impedance having output characteristics in compliance with what is required for a Class 2 transformer. A circuit derived from a source of supply classified as a high-voltage circuit, by connecting resistance in series with the supply circuit as a means of limiting the voltage and current, is not identified to be a low-voltage circuit.

CONSTRUCTION

35 Enclosure

35.1 General

35.1.1 An electrical enclosure shall be formed and assembled so that it has the strength and rigidity required to resist the abuses to which it is subjected in intended use without total or partial collapse and subsequent reduction of spacings, loosening or displacement of parts, or other conditions that render it not capable of further use. An enclosure for individual electrical components, an outer enclosure, and combinations of the two are to be evaluated in determining compliance with this requirement.

35.1.2 Among the factors to be taken into consideration when evaluating an enclosure are mechanical strength, resistance to impact, moisture-absorptive properties, flammability, resistance to distortion at temperatures to which the material is subjected under conditions of use, and resistance to corrosion. For a nonmetallic enclosure or part of an enclosure all of these factors are to be identified with respect to aging.

35.1.3 The enclosure shall be constructed to reduce the risk of mechanical damage to wiring and electrical components.

35.1.4 The enclosure shall be constructed to reduce the risk of the emission of molten metal, burning insulation or flaming particles through openings onto flammable material, including surfaces over which the fireplace or blower assembly is mounted.

35.1.5 Unless malfunction of an electrical component does not result in a risk of fire, components, such as controls, solenoids, relays, and switches shall be individually enclosed except at terminals. See 35.1.6 for Exception.

35.1.6 Electrical parts within the outer cabinet are not required to be individually enclosed when the assembly complies with the following:

a) Their construction and their location with respect to openings in the outer cabinet does not result in the emission of flame or molten metal through openings in the cabinet or the malfunction of the component shall not result in a risk of fire;

b) There are no openings in the bottom of the compartment (in which the part is located) where there is dropping of molten metal on flammable material; and

c) The part is not in proximity to flammable material other than electrical insulation.

35.1.7 Sheet metal complying with Table 35.1 and Table 35.2, whichever applies, is capable of being used for the individual enclosure of electrical components.

35.1.8 When the construction and location of components and the strength and rigidity of the outer cabinet warrant, an individual enclosure thinner than specified in Table 35.1 and Table 35.2, whichever applies, shall be employed.

Table 35.1
Minimum Thickness of Sheet Metal for Electrical Enclosures – Carbon Steel or Stainless Steel

Without supporting frame[a]				With supporting frame or equivalent reinforcing[a]				Minimum thickness in inches (mm)			
Maximum width[b]		Maximum length[c]		Maximum width[b]		Maximum length					
Inches	(cm)	Inches	(cm)	Inches	(cm)	Inches	(cm)	Uncoated (MSG)		Metal coated (GSG)	
4.0	(10.2)	Not limited		6.25	(15.9)	Not limited		0.020	(0.51)	0.023	(0.58)
4.75	(12.1)	5.75	(14.6)	6.75	(17.1)	8.25	(21.0)	(24)		(24)	
6.0	(15.2)	Not limited		9.5	(24.1)	Not limited		0.026	(0.66)	0.029	(0.74)
7.0	(17.8)	8.75	(22.2)	10.0	(25.4)	12.5	(31.8)	(22)		(22)	
8.0	(20.3)	Not limited		12.0	(30.5)	Not limited		0.032	(0.81)	0.034	(0.86)
9.0	(22.9)	11.5	(29.2)	13.0	(33.0)	16.0	(40.6)	(20)		(20)	
12.5	(31.8)	Not limited		19.5	(49.5)	Not limited		0.042	(1.07)	0.045	(1.14)
14.0	(35.6)	18.0	(45.7)	21.0	(53.3)	25.0	(63.5)	(18)		(18)	
18.0	(45.7)	Not limited		27.0	(68.6)	Not limited		0.053	(1.35)	0.056	(1.42)
20.0	(50.8)	25.0	(63.5)	29.0	(73.7)	36.0	(91.4)	(16)		(16)	
22.0	(55.9)	Not limited		33.0	(83.8)	Not limited		0.060	(1.52)	0.063	(1.60)
25.0	(63.5)	31.0	(78.7)	35.0	(88.9)	43.0	(109.2)	(15)		(15)	
25.0	(63.5)	Not limited		39.0	(99.1)	Not limited		0.067	(1.70)	0.070	(1.78)
29.0	(73.7)	36.0	(91.4)	41.0	(104.1)	51.0	(129.5)	(14)		(14)	
33.0	(83.8)	Not limited		51.0	(129.5)	Not limited		0.080	(2.03)	0.084	(2.13)
38.0	(96.5)	47.0	(119.4)	54.0	(137.2)	66.0	(167.6)	(13)		(13)	
42.0	(106.7)	Not limited		64.0	(162.6)	Not limited		0.093	(2.36)	0.097	(2.46)
47.0	(119.4)	59.0	(149.9)	68.0	(172.7)	84.0	(213.4)	(12)		(12)	

Table 35.1 Continued on Next Page

Table 35.1 Continued

Without supporting frame[a]				With supporting frame or equivalent reinforcing[a]				Minimum thickness in inches (mm)			
Maximum width[b]		Maximum length[c]		Maximum width[b]		Maximum length					
Inches	(cm)	Inches	(cm)	Inches	(cm)	Inches	(cm)	Uncoated (MSG)		Metal coated (GSG)	
52.0	(132.1)	Not limited		80.0	(203.2)	Not limited		0.108	(2.74)	0.111	(2.82)
60.0	(152.4)	74.0	(188.0)	84.0	(213.4)	103.0	(261.6)	(11)		(11)	
63.0	(160.0)	Not limited		97.0	(246.4)	Not limited		0.123	(3.12)	0.126	(3.20)
73.0	(185.4)	90.0	(228.6)	103.0	(261.6)	127.0	(322.6)	(10)		(10)	

[a] A supporting frame is a structure of angle or channel or a folded rigid section of sheet metal that is rigidly attached to and has the same outside dimensions as the enclosure surface and that has torsional rigidity to resist the bending moments which shall be applied via the enclosure surface when it is deflected. Construction that is determined to have equivalent reinforcing shall be accomplished by designs that produces a structure that is as rigid as one built with a frame of angles or channels. Construction determined to be without supporting frame includes a single sheet with single formed flanges (formed edges), a single sheet that is corrugated or ribbed, and an enclosure surface loosely attached to a frame, for example, with spring clips.

[b] The width is the smaller dimension of a rectangular sheet metal piece that is part of an enclosure. Adjacent surfaces of an enclosure shall have supports in common and be made of a single sheet.

[c] For panels that are not supported along one side, for example, side panels of boxes, the length of the unsupported side shall be limited to the dimensions specified unless the side in question is provided with a flange at least 1/2 inch (12.7 mm) wide.

Table 35.2
Minimum Thickness of Sheet Metal for Electrical Enclosures – Aluminum, Copper, or Brass

Without supporting frame[a]				With supporting frame or equivalent reinforcing[a]				
Maximum width[b]		Maximum length[c]		Maximum width[b]		Maximum length		Minimum thickness inches (mm)
Inches	(cm)	Inches	(cm)	Inches	(cm)	Inches	(cm)	
3.0	(7.6)	Not limited		7.0	(17.8)	Not limited		0.023
3.5	(8.9)	4.0	(10.2)	8.5	(21.6)	9.5	(24.1)	(0.58)
4.0	(10.2)	Not limited		10.0	(25.4)	Not limited		0.029
5.0	(12.7)	6.0	(15.2)	10.5	(26.7)	13.5	(34.2)	(0.74)
6.0	(15.2)	Not limited		14.0	(35.6)	Not limited		0.036
6.5	(16.5)	8.0	(20.3)	15.0	(38.1)	18.0	(45.7)	(0.91)
8.0	(20.3)	Not limited		19.0	(48.3)	Not limited		0.045
9.5	(24.1)	11.5	(29.2)	21.0	(53.3)	25.0	(63.5)	(1.14)
12.0	(30.5)	Not limited		28.0	(71.1)	Not limited		0.058
14.0	(35.6)	16.0	(40.6)	30.0	(76.2)	37.0	(94.0)	(1.47)
18.0	(45.7)	Not limited		42.0	(106.7)	Not limited		0.075
20.0	(50.8)	25.0	(63.5)	45.0	(114.3)	55.0	(139.7)	(1.91)
25.0	(63.5)	Not limited		60.0	(152.4)	Not limited		0.095
29.0	(73.7)	36.0	(91.4)	64.0	(162.6)	78.0	(198.1)	(2.41)
37.0	(94.0)	Not limited		87.0	(221.0)	Not limited		0.122
42.0	(106.7)	53.0	(134.6)	93.0	(236.2)	114.0	(289.6)	(3.10)
52.0	(132.1)	Not limited		123.0	(312.4)	Not limited		0.153
60.0	(152.4)	74.0	(188.0)	130.0	(330.2)	160.0	(406.4)	(3.89)

Table 35.2 Continued on Next Page

Table 35.2 Continued

Without supporting frame[a]				With supporting frame or equivalent reinforcing[a]				
Maximum width[b]		Maximum length[c]		Maximum width[b]		Maximum length		Minimum thickness inches (mm)
Inches	(cm)	Inches	(cm)	Inches	(cm)	Inches	(cm)	

[a] A supporting frame is a structure of angle or channel or a folded rigid section of sheet metal that is rigidly attached to and has the same outside dimensions as the enclosure surface and that has torsional rigidity to resist the bending moments that shall be applied via the enclosure surface when it is deflected. Construction that is determined to have equivalent reinforcing shall be accomplished by designs that produces a structure that is as rigid as one built with a frame of angles or channels. Construction determined to be without supporting frame includes single sheet with single formed flanges (formed edges), a single sheet which is corrugated or ribbed, and an enclosure surface loosely attached to a frame, for example, with spring clips.

[b] The width is the smaller dimension of a rectangular sheet metal piece that is part of an enclosure. Adjacent surfaces of an enclosure shall have supports in common and be made of a single sheet.

[c] For a panel that is not supported along one side, for example, side panels of boxes, the length of the unsupported side shall be limited to the dimensions specified unless the side in question is provided with a flange at least 1/2 inch (12.7 mm) wide.

35.1.9 Sheet metal to which a wiring system is to be connected in the field shall have a thickness not less than 0.032 inch (0.81 mm) when uncoated steel, not less than 0.034 inch (0.86 mm) when galvanized steel, and not less than 0.045 inch (1.14 mm) when nonferrous.

35.1.10 When threads for the connection of conduit are tapped through a hole in an enclosure wall, or when an equivalent construction is employed, there shall be not less than three or more than five threads in the metal, and a conduit bushing shall be attached as intended. When threads for the connection of conduit are not tapped all the way through a hole in an enclosure wall or conduit hub, there shall be not less than 3-1/2 threads in the metal and there shall be a smooth, rounded inlet hole for the conductors which:

a) Shall afford protection to the conductor equivalent to that provided by a standard conduit bushing; and

b) Shall have an internal diameter the same as that of the corresponding trade size of rigid conduit.

35.1.11 A knockout in a sheet metal enclosure shall be secured in place, and shall be capable of being removed without deformation of the enclosure to the extent that results in damage to electrical components or reduction in electrical spacing. See 35.1.12.

35.1.12 A knockout or hole for connection of conduit shall be provided with a flat surrounding surface for seating of a conduit bushing and shall be located so that installation of a bushing at any knockout or opening used during installation does not result in reduction of spacings between uninsulated live parts and the bushing to less than those required by this standard.

35.1.13 In measuring a spacing between an uninsulated live part and a bushing installed in a knockout, it is to be assumed that a bushing is in place, in conjunction with a single locknut installed on the outside of the enclosure.

35.1.14 A steel enclosure shall resist corrosion by metallic or nonmetallic coatings, such as plating or painting.

35.2 Mechanical protection

35.2.1 Moving parts, such as fan blades, blower wheels, pulleys, or belts, which results in injury to persons shall be enclosed or guarded so that the minor dimension of any opening does not exceed the values indicated in 35.2.3. Parts required for guarding shall be secured by means dependent upon tools for removal unless functioning of the fireplace requires the guard to be in place. Also see 60.25.

35.2.2 Louvers and other openings in the enclosure shall be constructed and located to reduce the risk of unintentional contact with moving parts which results in injury to persons. In determining compliance with these requirements, parts such as covers, panels or grilles used as part of the enclosure are to be removed unless tools are required for their removal.

35.2.3 The distance from an opening to the moving part shall be as indicated in Table 35.3, the minor dimension of the opening shall not, in any case, exceed 1 inch (25.4 mm). For an opening having a minor dimension intermediate between two of the values included in the table, the distance from the opening to the moving part shall be not less than that found by appropriate interpolation between the corresponding values in the right column of the table. The minor dimension of the opening is to be determined by the largest hemispherically tipped cylindrical probe that is capable of being inserted through the opening with a force of 5 lbs (22.3 N).

Table 35.3
Dimensions of Openings in Enclosure

Minor dimensions of openings[a]		Minimum distance from opening to moving part	
Inches	(mm)	Inches	(mm)
1/4	6.4	1/2	12.7
3/8	9.5	1-1/2	38.1
1/2	12.7	2-1/2	63.5
3/4	19.1	4-1/2	114.0
1	25.4	6-1/2	165.0

[a] Openings less than 1/4 inch (6.4 mm) are not to be determined.

35.2.4 A moving part is not to be evaluated in determining compliance with 35.2.1 when:

a) The part is incapable of being contacted through the opening because of the location of fixed components, including baffles;

b) The part is made inoperative, when exposed, through the use of interlocking devices; or

c) The blower assembly must be withdrawn from the enclosure of the fireplace to expose the moving part.

35.3 Electrical protection

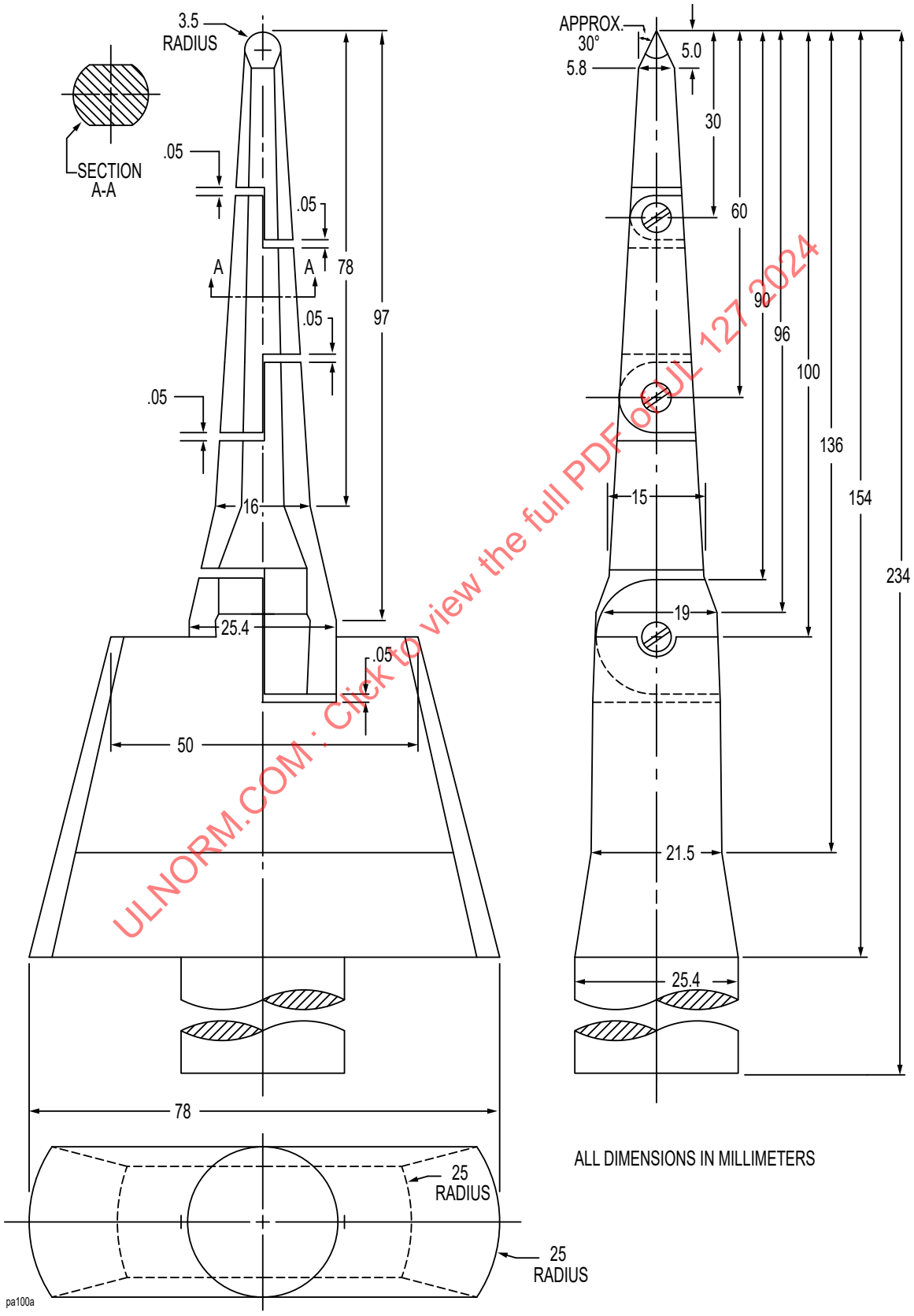
35.3.1 Louvers and other openings in the enclosure shall be constructed and located to reduce the risk of unintentional contact with uninsulated live parts. In determining compliance with this requirement, parts such as covers, panels and grilles used as part of the enclosure are to be removed unless tools are required for their removal or an interlock is provided.

35.3.2 Uninsulated high-voltage live parts shall be located, guarded or enclosed in compliance with the requirements of 35.3.3 – 35.3.5.

35.3.3 An opening in the enclosure of the product that does not have an entrance of a 1 inch (25.4 mm) diameter rod is required when a probe as illustrated in Figure 35.1, inserted into the opening, is not capable of being made to touch any part that involves the risk of electric shock.

Figure 35.1

Accessibility Probe

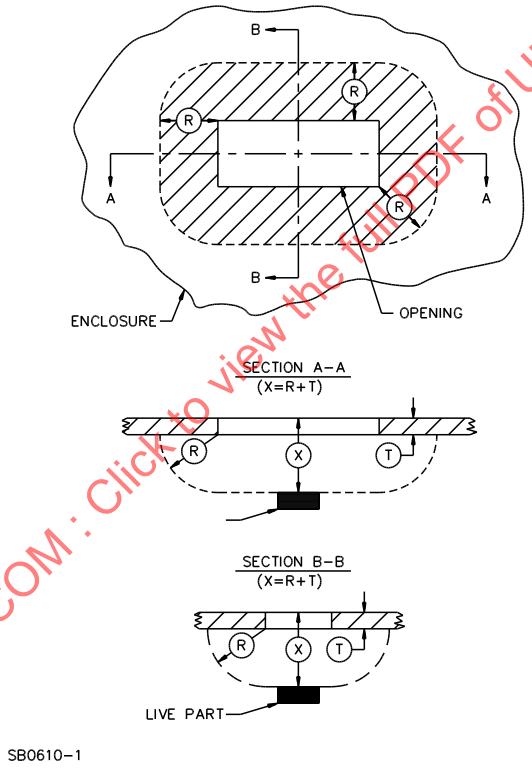


35.3.4 With respect to the requirement of 35.3.3, the probe is to be articulated into any configuration and is to be rotated or angled to any position before, during or after insertion into the opening, and the penetration is to be to any depth intended by the opening size, including minimal depth combined with maximal articulation.

35.3.5 An opening in an enclosure, as illustrated in Figure 35.2, that where an entrance of a 1 inch (25.4 mm) diameter round rod is required when, within the enclosure, there is no uninsulated live part or film-coated wire less than R distance from the inside edge of the perimeter of the opening and X distance from the plane of the opening. T equals the enclosure thickness, R equals X minus T, and X equals five times the diameter of the largest round rod that is capable of being inserted through the opening and not less than 6-1/16 inches (154 mm).

Figure 35.2

Opening in Enclosure



35.3.6 In addition to the requirements of 35.3.2 – 35.3.5, uninsulated live parts inside the enclosure that are capable of being contacted by persons performing operations such as replacing fuses, resetting manual-reset devices, replacing air filters, oiling motors, or other such service operations shall be located, guarded or enclosed to reduce the risk of contact unless tools are required to expose the live part. See 60.25.

35.3.7 A fuseholder shall be constructed, installed or guarded so that adjacent uninsulated high-voltage live parts, other than the screw shell of a plug fuseholder, cartridge fuse clips or wiring terminals to the fuseholder, shall not be exposed to contact by persons removing or replacing fuses. A barrier of vulcanized fiber or similar material employed as a guard for uninsulated high-voltage live parts shall be not less than 1/32 inch (0.8 mm) thick. A separation of less than 4 inches (102 mm) is to be identified as adjacent.

35.4 Doors and covers

35.4.1 Service covers or panels in the outer enclosure shall require the use of tools for removal or shall be provided with an interlocking mechanism when they give access to unenclosed uninsulated live parts or moving parts that result in injury to persons.

35.4.2 An interlocking mechanism that must be engaged in the closed position of the cover before parts are energized and secures the cover in the closed position when engaged is evaluated to comply with the requirements in 35.4.1.

35.4.3 A hinged panel or cover shall be positioned or arranged so that when it is in an open position it is not subjected to falling or swinging due to gravity or vibration so as to result in risk of injury to persons from the panel or cover, moving parts, or risk of electric shock from uninsulated live parts.

35.4.4 The assembly shall be arranged so that an overcurrent protective device is capable of being placed or reset without removing parts other than a service cover(s) or panel(s), and the cover or door enclosing the device.

35.4.5 A required protective device shall be inaccessible from outside the enclosure without requiring the opening of a door or cover.

Exception: The operating handle of a circuit breaker, the reset button of a manually resettable motor protector, and similar parts are not prohibited from projecting outside the enclosure.

35.4.6 An opening in an outer enclosure around a handle, reset button, or other control member unless the clearance between the control member and the edge of the opening is not more than 1/8 inch (3.2 mm) for any setting or position of the control member.

35.4.7 Covers for enclosure of fuses in high-voltage circuits shall be hinged, see 35.4.8. Covers for manual-reset overload protective device enclosures shall be hinged when it is required to open the cover to reset the device.

Exception: A hinged cover is not required for extractor type fuses.

35.4.8 A hinged cover shall not depend solely upon screws or other similar means to hold it closed, and shall be provided with a latch or the equivalent. A cover interlocking mechanism as described in 35.4.2 is capable of being used as the sole means for securing the cover or panel.

35.4.9 A spring latch, a magnetic latch, a dimple, or any other mechanical arrangement that holds the door in place and requires some effort on the user's part to open it is identified to be a means for holding the door in place as required in 35.4.1.

35.4.10 A door or cover giving direct access to fuses in other than low-voltage circuits shall shut closely against a 1/4 inch (6.4 mm) rabbet or shall have either turned flanges for the full length of four edges or angle strips fastened to it. Flanges or angle strips shall fit closely with the outside of the wall of the box and shall overlap the edges of the box not less than 1/2 inch (12.7 mm). Constructions include construction such as a fuse enclosure located within an outer enclosure or a flange and rabbet combination which affords the equivalent protection.

36 Mounting of Electrical Components

36.1 A switch, an attachment-plug receptacle, a strain relief bushing, or similar component shall be secured in position and shall be prevented from turning. See 36.4. See 36.2 and 36.3 for Exception.

36.2 The requirement that a switch be prevented from turning is not required when all of the following conditions are met:

a) The switch is of a plunger or other type that does not tend to rotate when operated. A toggle switch is identified to be subject to forces that tend to turn the switch during the operation of the switch;

b) Means of mounting the switch make it so that operation of the switch does not loosen it;

c) The spacings are not reduced below the minimum required values when the switch rotates;

d) Operation of the switch is by mechanical means rather than direct contact by persons.

36.3 A lampholder of a type in which the lamp is not capable of being replaced, such as a neon pilot or indicator light in which the lamp is sealed in a nonremovable jewel, is not required to be prevented from turning when rotation does not reduce spacings below the minimum required values. See Spacings, Section 48.

36.4 The means for preventing rotation specified in 36.1 shall consist of more than friction between surfaces. A toothed lock washer that provides both spring take-up and an interference lock is capable of being used as means for preventing the turning of a small stem-mounted switch or other device having a single-hole mounting means.

36.5 An uninsulated current-carrying part and a part that supports a live part shall be secured to the base or mounting surface so that it is prevented from turning or shifting in position when such motion results in a reduction of spacings below the minimum required values. See Spacings, Section 48. Friction between surfaces shall not be relied on as a means to prevent shifting or turning of a live part, and a lock washer as described in 36.4 is capable of being used.

36.6 Flammable or electrically conductive thermal or acoustical insulation shall not contact uninsulated live parts.

37 Field-Installed Blower Assemblies

37.1 A fireplace having provision for the use of a blower assembly to be attached in the field shall be constructed so that the use of the assembly does not introduce a risk of fire, electric shock, or contact with moving parts that results in injury to persons.

37.2 The fireplace shall comply with the requirements of this standard with and without the field-installed blower assembly installed.

37.3 Installation of the field-installed blower assembly by the user shall be restricted to an arrangement that is capable of being accomplished by means of receptacles and plug-in connectors.

Exception: Low-voltage accessories shall not be connected by other means unless the installation does not require rearrangement of components or wiring, cutting or splicing of existing wiring, or soldered connections.

37.4 The installation of a field-installed blower assembly by service personnel shall be by means of receptacles, plug-in connectors, insulated wire connectors, or by connection to existing wiring terminals.

37.5 With reference to the requirements in 37.4, any installation shall not require the cutting of wiring or the soldering of connections by the installer. Installations shall not require cutting, drilling or welding in electrical enclosures or in other areas where such operations damage electrical or fireplace components and wiring within the enclosure.

37.6 Strain-relief means shall be provided for the wiring in the field-installed blower assembly when stress is transmitted to the terminal connections during installation.

37.7 All terminals and wiring intended to be field connected shall be identified on the field-installed blower assembly, on the fireplace when connections are made between the blower assembly and the fireplace, and on the wiring diagram(s).

37.8 Except where it is obvious, the mounting location of the field-installed blower assembly shall be indicated on the fireplace. When the mounting location is obvious due to the function of the blower assembly and arrangement of the fireplace, and instructions are provided covering the installation and location for the blower assembly, the mounting location of the blower assembly are not required to be indicated on the fireplace.

37.9 All mounting brackets, supports, and fasteners required to install the blower assembly shall be provided with the blower or as part of the fireplace.

37.10 As part of the investigation, the blower assembly is to be trial-installed to determine that its installation is capable, that the instructions are detailed and accurate, and that the use of the blower assembly does not introduce a risk of electric shock or unintentional contact with moving parts that result in injury to persons.

38 Field Supply Connections

38.1 Fireplaces shall have provision for permanent connection to the power supply.

38.2 As described in 38.3 – 38.16, field wiring terminals are determined to be the terminals to which power supply, control, or equipment grounding connections are made in the field when the fireplace is installed as intended.

38.3 A blower assembly shall have provision for connection of one of the wiring systems that are required for it in accordance with NFPA 70.

38.4 The location of the field supply connections terminal box or compartment shall be such that inspection of the wiring is possible after installation. The connections shall be accessible without removing parts other than a service cover or panel and the cover of the outlet box or compartment in which the connections are made.

38.5 Space shall be provided in the field wiring compartment or outlet box for installation of the number and size of conductors required in the installation, when at least 6 inches (152 mm) length of each conductor is brought into the wiring compartment. A trial installation using three 12 AWG, Type THW conductors and all clamps and receptacles is to be made to determine compliance with these requirements.

38.6 A terminal compartment intended for the connection of a supply raceway shall be secured in position and shall not turn under conditions of intended use.

38.7 A blower assembly shall be provided with field wiring terminals for the connection of field wiring conductors of at least the size required by NFPA 70, corresponding to the rating of the assembly or with leads not less than 6 inches (152 mm) long except as noted in 38.17. It is assumed that branch circuit conductors rated 60 °C (140 °F) are used.

38.8 A field wiring terminal shall be prevented from turning or shifting in position by means other than friction between surfaces. This is accomplished by means such as two screws or rivets; by square

shoulders or mortices; by a dowel pin, lug, or offset; or by a connecting strap or clip fitted into an adjacent part.

38.9 For 8 AWG (8.4 mm^2) and larger conductors, pressure wire connectors shall be used. For 10 AWG (5.3 mm^2) and smaller conductors, the parts to which wiring connections are made consist of pressure wire connectors, clamps or wire binding screws with cupped washers, terminal plates, or the equivalent to hold the wire in position.

38.10 A wire binding screw at a field wiring terminal shall be not smaller than No. 10 (4.8 mm diameter).

Exception: A No. 8 (4.2 mm diameter) screw is to be used for the connection of one 14 AWG (2.1 mm^2) and a No. 6 (3.5 mm diameter) screw is to be used for the connection of a 16 AWG (1.3 mm^2) or 18 AWG (0.82 mm^2) control circuit conductor.

38.11 It shall be noted that according to NFPA 70, 14 AWG (2.1 mm^2) is the smallest conductor which the installer uses for branch circuit wiring and thus is the smallest conductor that is anticipated at a terminal for the connection of a power supply wire.

38.12 A terminal plate for a wire binding screw shall be of metal not less than 0.030 inch (0.76 mm) thick for a 14 AWG (2.1 mm^2) or smaller wire and not less than 0.050 inch (1.27 mm) thick for a wire larger than 14 AWG. In either case, there shall be not less than two full threads in the metal.

38.13 A terminal plate formed from stock having the minimum required thickness shall have the metal extruded at the tapped hole for the binding screw to provide two full threads.

Exception: Two full threads are not required when a lesser number of threads results in a connection in which the threads do not strip with tightening torque in accordance with the values indicated in UL 486A-486B.

38.14 Upturned lugs or a cupped washer shall be able to retain a conductor of the size used for the field wiring leads under the head of the screw or the washer. A conductor used for the field wiring leads shall be not smaller than 14 AWG (2.1 mm^2).

38.15 A wire binding screw shall thread into metal.

38.16 A field wiring terminal intended for the connection of a grounded conductor shall be of a metal, or plated with a metal, substantially white in color and shall be readily distinguishable from the other terminals, or correct identification of that terminal shall be shown in some other manner, such as on an attached wiring diagram. A lead intended for the connection of a grounded conductor shall be finished to show a white or gray color, shall be readily distinguishable from other leads, and no other lead shall be so identified.

38.17 The length of a lead inside an outlet box or wiring compartment shall be 6 inches (152 mm) or more when the lead is intended for field connection to an external circuit.

Exception: The lead shall not be less than 6 inches (152 mm) in length unless it is evident that the use of a longer lead results in a risk of fire or electric shock.

38.18 Leads intended for connection to an external circuit shall be provided with strain relief when stress on the lead is transmitted to terminals, splices or internal wiring. See Strain Relief Test, Section 55.

38.19 Leads provided for spliced connections to an external high-voltage circuit shall not be connected to wire binding screws or pressure wire connectors located in the same compartment as the splice unless

the screws or connectors are rendered unusable for field wiring connections or the leads are insulated at the unconnected ends.

39 Grounding

39.1 A grounding means shall be provided for all equipment containing parts which require grounding, see Bonding for Grounding, Section 42.

39.2 An equipment grounding terminal is identified to constitute means for grounding.

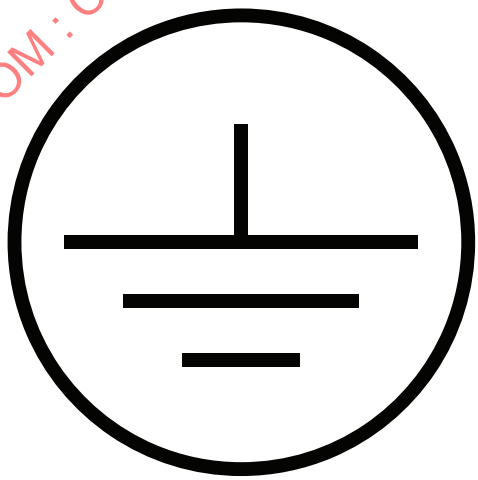
39.3 The equipment grounding terminal shall be able to secure a conductor of the size required for the particular application in accordance with NFPA 70.

39.4 A soldering lug, a push-in connector, a screwless connector, or a quick-connect or similar friction fit connector shall not be used for the grounding terminal intended for the connection of field supply connections or for the grounding wire in a supply cord.

39.5 A wire binding screw intended for the connection of an equipment grounding conductor shall have a green-colored head that is hexagonal, slotted or both. A pressure wire connector intended for connection of such a conductor shall be plainly identified by being marked "G," "GR," "GROUND" or "GROUNDING," the grounding symbol illustrated in Figure 39.1, or by a marking on a wiring diagram provided on the fireplace. The wire binding screw or pressure wire connector shall be secured to the frame or enclosure of the fireplace and shall be located so that it is not removed during intended service operations such as replacing fuses, resetting manual-reset devices or oiling motors. The wire binding screw or pressure wire connector shall be provided with a cupped head or cupped washer, or equivalent, of a size adequate to retain the equipment grounding conductor in place.

Figure 39.1

Grounding Symbol



39.6 When a pressure wire connector intended for grounding is located where it is capable of being mistaken for a neutral conductor of a grounded supply, it shall be identified by a marking EQUIPMENT GROUND or with a green color identification or both.