UL 907

STANDARD FOR SAFETY

Fireplace Accessories

UL Standard for Safety for Fireplace Accessories, UL 907

Fourth Edition, Dated March 11, 2016

Summary of Topics

This revision of ANSI/UL 907 dated August 28, 2019 is being issued to update the title page to reflect the most recent designation as a Reaffirmed American National Standard (ANS). No technical changes have been made.

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

The requirements are substantially in accordance with Proposal(s) on this subject dated June 28, 2019.

No Text on This Page

MARCH 11, 2016
(Title Page Reprinted: August 28, 2019)

UL 907

Standard for Fireplace Accessories

First Edition – March, 1989
Second Edition – September, 1994
Third Edition – February, 2010

Fourth Edition

March 11, 2016

This ANSI/UL Standard for Safety consists of the Fourth edition including revisions through August 28, 2019.

The most recent designation of UL 907 as a Reaffirmed American National Standard (ANS) occurred on August 19, 2019. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, and Title Page.

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

No Text on This Page

CONTENTS

INTRODUCTION

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

CONSTRUCTION

7 Materials 7
8 Assembly 8
8.1 General 8
8.2 Separable handle 9
8.3 Firescreen 10

PERFORMANCE

9 General 10
10 Test Installation 11
11 Temperature Measurement 17
12 Fire Tests 24
13 Radiant Fire Test 25
14 Brand Fire Test 32
15 Flash Fire Test 35
16 Glazing Test 36
16.1 General 36
16.2 Impact test 36
16.3 Water shock test 37
17 Carbon Monoxide Monitoring Test 38

BLOWER ASSEMBLY

CONSTRUCTION

18 General 39
19 Enclosure 39
19.1 General 39
19.2 Mechanical protection 43
19.3 Electrical protection 44
19.4 Doors and covers 47
20 Mounting of Electrical Components 48
21 Field-Installed Blower Assemblies 49
22 Field Supply Connections 50
22.1 Permanently-connected products 50
22.2 Cord-connected products 52
23 Grounding 52
23.1 General 52
23.2 Permanently-connected products 53

23.3 Cord-connected products 54
24 Internal Wiring 54
24.1 General 54
24.2 Methods 55
25 Separation of Circuits 57
26 Bonding for Grounding 58
27 Capacitors 60
28 Insulating Material 61
29 Motors and Motor Overcurrent (Overload) Protection 61
30 Switches and Controllers 65
31 Transformers 65
32 Spacings 66

PERFORMANCE

33 Test Voltages 69
34 Temperature Measurements 70
34.1 Thermocouple method 70
34.2 Change-in-resistance method 70
35 Input Test 71
36 Temperature Test – Electrical Components 71
37 Dielectric Voltage-Withstand Test 71
38 Leakage Current Test 72
39 Stalled Motor Test 75
40 Strain Relief Test 75
40.1 Power supply cord 75
40.2 Field wiring leads 75
41 Push-Back Relief Test 75
42 Short-Circuit Test 76
43 Knockout Test 76

MANUFACTURING AND PRODUCTION TESTS

44 Production-Line Dielectric Voltage-Withstand Test 76
45 Production Line Grounding Continuity Test 77

MARKINGS

46 General 77
47 Installation and Operating Instructions 80
47.1 General 80
47.2 Installation instructions 80
47.3 Operating instructions 82

APPENDIX A

Standards for Components A1

INTRODUCTION

1 Scope

1.1 These requirements apply to fireplace accessories that are intended only for field installation into or attachment to existing masonry fireplaces. Fireplace accessories include items such as heat exchangers, glass door assemblies, and the like. For the purpose of these requirements, fireplace accessories do not include fireplace inserts or devices that incorporate a closed fire chamber.

1.2 Fireplace accessories as covered by these requirements are intended for installation in accordance with the Standard for Chimneys, Fireplaces, Vents and Solid Fuel Burning Appliances, NFPA 211, and in accordance with codes such as the International Building Code, International Mechanical Code, and related mechanical codes.

1.3 A fireplace accessory, as covered by these requirements, is intended for use with solid wood fuel, as specified by the manufacturer.

1.4 These accessories may include:

a) Field-installed cord-connected or fixed blower assemblies; and

b) Other field-installed electrical accessories rated at 250 volts or less to be employed in ordinary locations in accordance with the National Electrical Code, NFPA 70.

2 Components

2.1 Except as indicated in 2.2, a component of a product covered by this standard shall comply with the requirements for that component. See Appendix A for a list of standards covering components generally used in the products covered by this standard.

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

a) Involves a feature or characteristic not required in the application of the component in the product covered by this standard, or

b) Is superseded by a requirement in this standard.

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

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

3 Units of Measurement

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

4 Terminology

4.1 The term ″product″ as used in these requirements refers to all fireplace accessories or any part thereof covered by these requirements unless specifically noted otherwise.

5 Undated References

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.

6 Glossary

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

6.2 COMBUSTIBLE MATERIAL, NONCOMBUSTIBLE MATERIAL – These terms, as used in this standard, are defined in the Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances, NFPA 211.

6.3 DOOR ASSEMBLY – A factory-built device intended for field attachment to the front of a fireplace.

6.4 FIREPLACE, MASONRY – A field constructed assembly that is built in accordance with the Standard for Chimneys, Fireplaces, Vents and Solid Fuel Burning Appliances, NFPA 211, or other nationally recognized code requirements.

6.5 FIREPLACE ENCLOSURE – The combustible building materials adjacent to the masonry fireplace test fixture consisting of walls, ceiling, floor and the like.

6.6 FIRESCREEN – A device that attaches to the fireplace accessory, consisting of a mesh type screen, used to reduce the risk of sparks exiting the fire chamber.

6.7 GRATE – A metal frame for supporting fuel within a fireplace accessory.

6.8 HEARTH – The floor area within a fire chamber.

6.9 HEARTH EXTENSION – The floor area outside a fireplace fire chamber consisting of noncombustible material.

6.10 HEAT EXCHANGER – A factory-built device for use with a fireplace consisting of tubes or ducts that are intended to expel heated air into a room, zone or space to be heated. A device that incorporates a closed fire chamber is not considered a heat exchanger.

6.11 REFLECTOR – A product intended to reflect additional radiant heat from the fireplace.

6.12 REFRACTORY – A noncombustible material used in the construction of a fireplace or fireplace accessory.

6.13 REMOTE COMBUSTION AIR – Combustion air introduced into a fireplace that comes from a room, zone, or space other than that in which the fireplace is located.

CONSTRUCTION

7 Materials

7.1 A fireplace accessory or part shall be made of noncombustible corrosion-resistant materials. Metals shall be used in combinations that are galvanically compatible at any location within the assembly.

7.2 The minimum thickness of metal, including coatings where shown, shall comply with Table 7.1.

Exception No. 1: This requirement does not apply to electrical enclosures. See Enclosure, Section 19.

Exception No. 2: This requirement does not apply to decorative parts.

Table 7.1
Minimum metal thickness

Metal	Inch	(mm)
Aluminum alloys	0.016	(0.41)
Steel (uncoated, painted or plated)	0.042	(1.07)
Galvanized Steel (G90 coating class)	0.018	(0.46)
Galvanized steel (G60 coating class)	0.025	(0.64)
Aluminum-coated steel Type T1-40 (regular)		
[0.40 ounces per square foot (0.12 kg/m^2)]	0.018	(0.46)
Stainless steel	0.012	(0.30)

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

7.4 Thermal insulation shall comply with the following conditions when the fireplace accessory is tested in accordance with these requirements:

a) The products resulting from the combustion or volatilization of any combustible binder shall be discharged to the chimney;

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

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

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

7.5 Thermal insulation shall be protected against contact with the products of combustion.

7.6 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 may attain when tested in accordance with these requirements and at 0°F (minus 17.8°C).

7.7 A water-absorbing insulating material shall be protected against wetting by condensation or rain when installed as intended.

7.8 Asbestos and asbestos-containing material shall not be used.

8 Assembly

8.1 General

8.1.1 A fireplace accessory and related parts shall be constructed and assembled to have the strength, rigidity, and durability to withstand damage during tests in accordance with these requirements and during handling and installation.

8.1.2 A joint in a metal surface of a fire chamber or flue gas passageway shall be made tight by being welded, lock-seamed, riveted, bolted, or the like. A joint shall not depend primarily upon cement for tightness.

8.1.3 A fireplace accessory shall be provided with all the parts necessary for the intended installation of a complete unit. Each part or assembly shall be constructed for ready attachment of one to the other without requiring alteration, cutting, threading, drilling, welding, or similar task by the installer.

Exception: An assembly or component part intended to be cut to length or to be fitted by the installer may be provided if 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 is acceptable if:

a) The drilling operation does not weaken the assembly or drill into the fire chamber; and

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

8.1.4 Insulating materials shall be an integral part of the device if required to protect combustible parts of the building when the fireplace accessory is installed in accordance with the manufacturer's instructions.

Exception: Fire chamber insulating materials may be packaged and shipped with the fireplace accessory if:

a) The installation instructions include a description of the method of placement of this material; and

b) The fireplace accessory is provided with a marking indicating that the material is to be installed before firing.

The marking shall be located in an area visible to the user before firing the unit.

8.1.5 Two or more parts or subassemblies that must bear a definite relationship to each other shall be:

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

b) Assembled and shipped from the factory as one element.

8.1.6 If a part of a fireplace accessory is necessary to limit temperatures on adjacent construction:

a) The part shall be factory-attached; or

b) The fireplace accessory shall comply with all of the following:

1) The temperature-limiting part shall be:

i) Shipped with the fireplace accessory; or

ii) Marked with the name or trademark of the manufacturer or private labeler, with a catalog number or equivalent designation, and with the type of equipment with which it is intended to be used.

The associated fireplace accessory shall be marked to indicate the catalog number or equivalent designation of such a part, and the name of the manufacturer or private labeler of that part.

2) Assembly of the part shall be in accordance with the requirements in 8.1.3.

3) The installation instructions shall define and illustrate the intended assembly of the part.

8.1.7 The fireplace accessory shall have no edges, corners, or projections that present a risk of a cut or puncture-type injury to persons.

8.1.8 A radiation shield or baffle shall be constructed, formed, and supported to provide the intended positioning and to prevent distortion or sagging when tested in accordance with these requirements.

8.2 Separable handle

8.2.1 A separable handle, if provided, shall not remain in position when the user's hand is withdrawn following use.

8.2.2 Storage means shall be provided on the product for separable handles so that when the handle is stored as intended, during the Radiant Fire Test, Section 13, and Brand Fire Test, Section 14, the temperatures on the separable handle do not exceed the temperature limits shown in Table 13.1.

8.3 Firescreen

8.3.1 A firescreen shall be furnished by the manufacturer as part of the fireplace accessory if the existing firescreen cannot be used after installation of the fireplace accessory. Doors are considered a firescreen.

PERFORMANCE

9 General

9.1 When a fireplace accessory is tested in accordance with these requirements, specified temperatures on combustible construction shall be maintained.

9.2 The draft created by the fireplace during its intended operation shall not cause the spillage of the products of combustion from the fireplace or the fireplace accessory into the area served by the device.

9.3 After being tested in accordance with these requirements, the fireplace accessory assembly shall be acceptable for further use.

9.4 Test results indicating compliance with the requirements of 9.3 include the following:

a) No part of the fireplace accessory has become damaged or permanently distorted to an extent that it will not continue to function as intended.

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

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

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

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

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

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

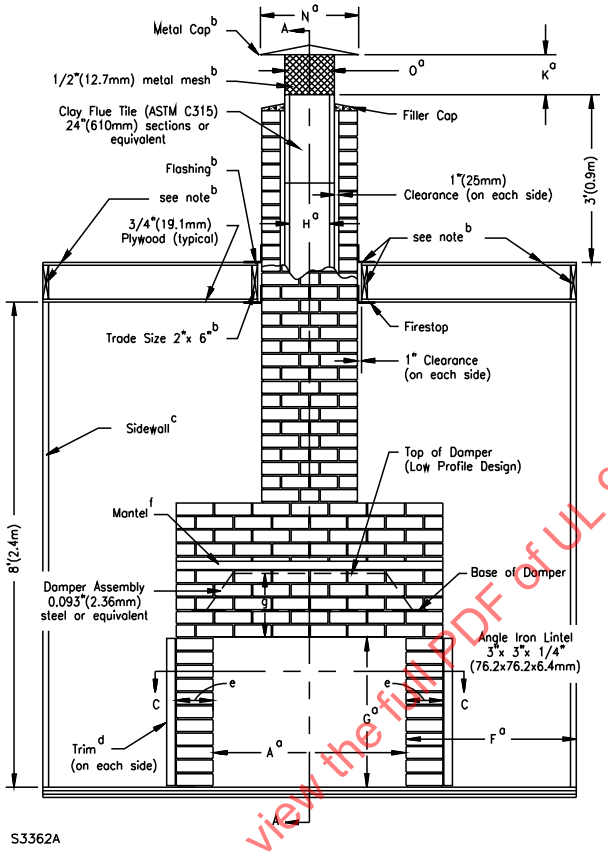
10 Test Installation

10.1 Tests are to be conducted as described in 10.2 – 10.14. If the fireplace accessory is manufactured in more than one size (for example, to accommodate various sizes of fireplaces), tests are to be conducted on as many sizes as may be deemed necessary to determine compliance with these requirements.

10.2 The sample is to be installed in a test fixture having a 36 inch (914 mm) wide opening unless the installation instructions specify installation in a larger fireplace, in which case the sample is to be installed in a test fixture having a 48-inch (1.22-mm) wide opening.

10.3 The test fireplace is to be constructed as specified in Figures 10.1 – 10.4.

Figure 10.1
Masonry fireplace – front elevation



Metric conversions, lumber		
Trade size, inches	**Nominal size**	
	inches	**(mm)**
2 x 6	1-1/2 x 5-1/2	(38 x 140)

[a] See Table 10.1 for dimension.

[b] Optional features.

[c] See Figure 11.4 for thermocouple locations.

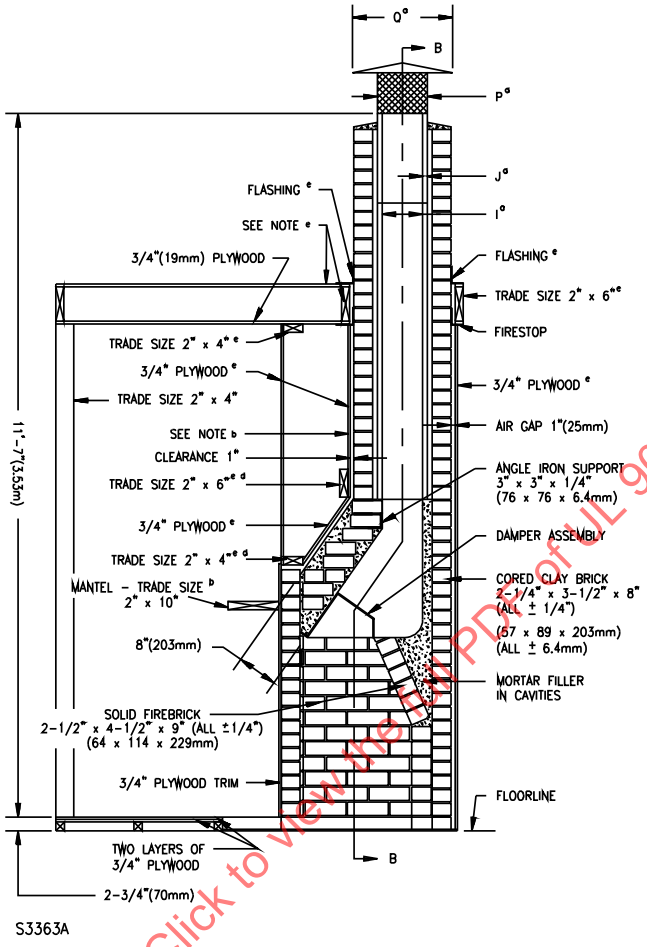
[d] See Figure 11.3 for thermocouple locations.

[e] Minimum distance from fireplace opening specified in installation instructions. Thermocouples not required when trim is at least 6 inches (152 mm) from the fireplace openings.

[f] See Figure 11.5 for thermocouple locations.

[g] 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 10.2
Section A – A of Figure 10.1



Metric conversions, lumber		
Trade size, inches	Nominal size	
	inches	(mm)
2 x 4	1-1/2 x 3-1/2	(38 x 89)
2 x 6	1-1/2 x 5-1/2	(38 x 140)
2 x 10	1-1/2 x 9-1/2	(38 x 241)

[a] See Table 10.1 for dimension

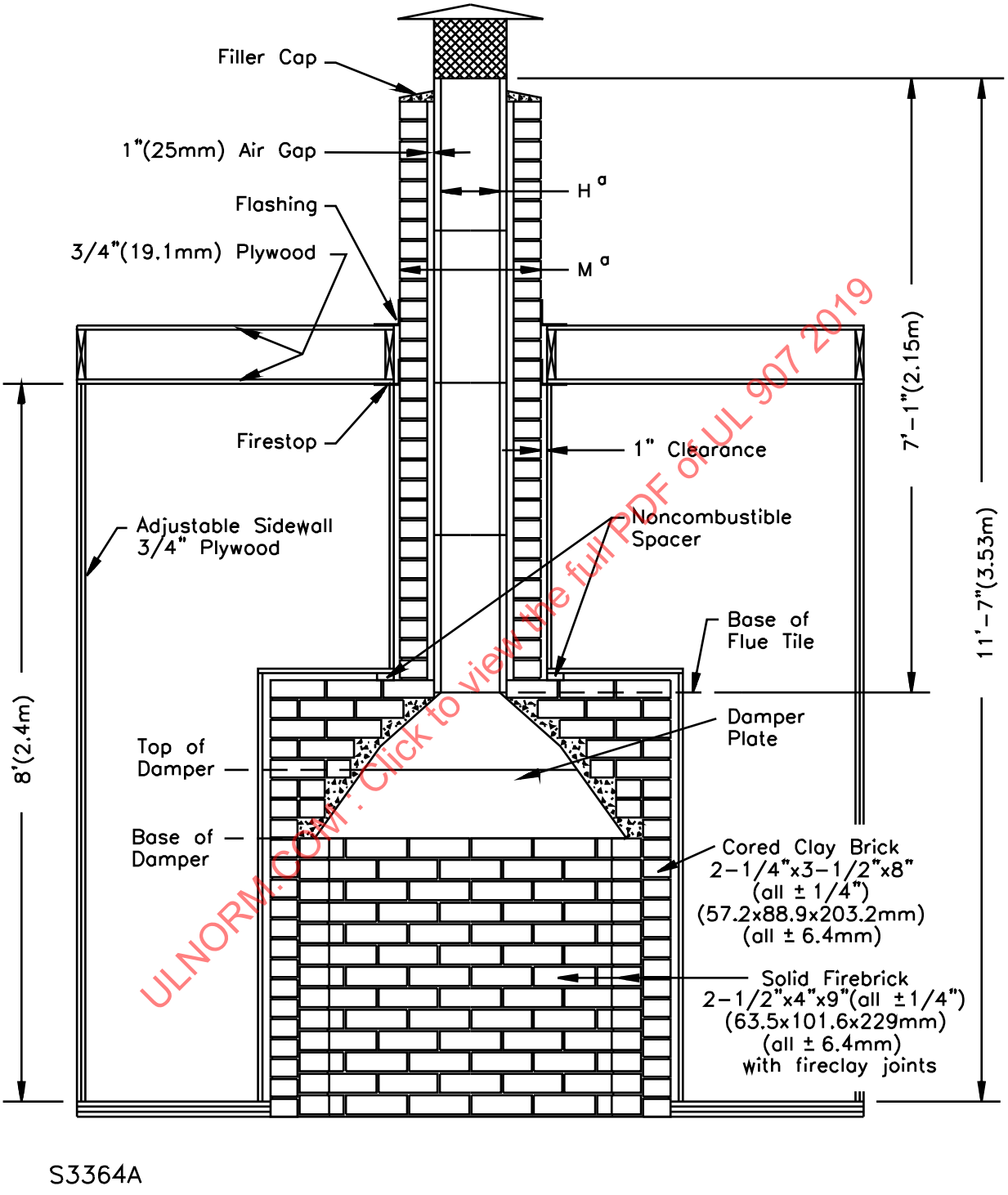
[b] See Figure 11.5 for thermocouple locations

[c] See Figure 11.3 for thermocouple locations

[d] 1 inch air space to be maintained between masonry and plywood, 2 x 4 inches and 2 x 6 inches. Ends of headers may be supported with noncombustible spacers to maintain clearance.

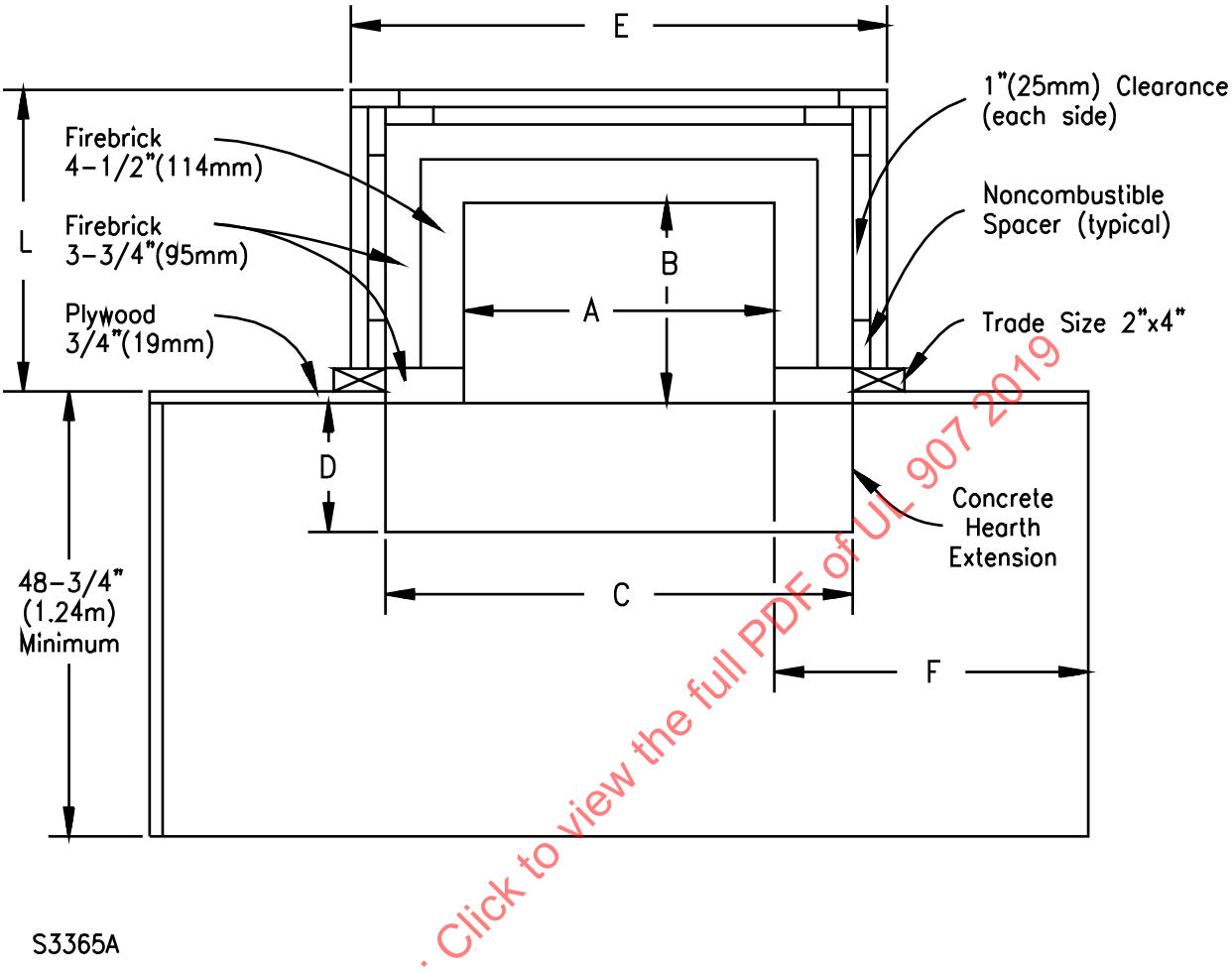
[e] Optional features

Figure 10.3
Section B – B of Figure 10.2



[a] See Table 10.1 for dimension

Figure 10.4
Section C – C of Figure 10.1



Metric conversions, lumber		
Trade size	Nominal size	
	Inches	(mm)
2 x 4	1-1/2 x 3-1/2	(38 x 89)

Table 10.1
Test fireplace and enclosure dimensions[a]

Item	36-inch (914-mm) wide fireplace		48-inch (1.2-m) wide fireplace	
	Inches	(m)	Inches	(m)
A	36	(0.91)	48	(1.22)
B	24	(0.61)	24	(0.61)
C	52	(1.32)	72	(1.82)
D	16	(0.41)	20	(0.51)
E	55-1/2	(1.41)	68	(1.73)
F	36	(0.91)	36	(0.91)
G	28	(0.71)	28	(0.71)
H	11-1/2	(0.30)	16-3/4	(0.42)
I	11-1/2	(0.30)	11-1/2	(0.30)
J	3/4	(0.02)	1	(0.02)
K	7-1/4	(0.18)	8-1/2	(0.21)
L	32-3/4	(0.84)	32-3/4	(0.84)
M	22-1/2	(0.57)	27-1/2	(0.70)
N	20	(0.51)	24	(0.61)
O	12	(0.30)	16	(0.41)
P	12	(0.30)	12	(0.30)
Q	20	(0.51)	20	(0.51)

[a] As appropriate for maximum size fireplace in which the accessory is to be used. All dimensions ±1/2 inch (12.7 mm).

10.4 The test structure is to be erected within a room having ventilation capable of maintaining the buildup of carbon monoxide to less than 50 parts per million (ppm) throughout the period of any test. The room is to be free of drafts and the chimney is to exhaust into the same space, or into a space freely communicating with the space, from which the combustion air is taken. During any one test the room temperature is not to increase more than 20°F (11°C) above the value recorded at the beginning of the test.

10.5 Ventilating air, combustion air, or cooling air openings into the fireplace accessory are to be sealed unless the openings are located in the same zone or space as the fireplace accessory and are so arranged that closure is unlikely.

10.6 That part of the test structure representing the living-space area in which the fireplace accessory is to be installed is to consist of a back wall, one side wall, a ceiling, and a floor. See Figures 10.1 and 10.2. The fireplace enclosure is to be constructed as specified in Figures 10.1 – 10.4.

10.7 The combustible floor in front of and adjacent to the fireplace hearth extension is to consist of two layers of 3/4-inch (19.1-mm) thick plywood over 1-1/4-inch (31.7-mm) high floor supports placed on 16 inch (406 mm) centers so that the floor is level with the hearth extension.

10.8 The side, back walls, and ceiling are each to consist of one thickness of 3/4-inch (19.1-mm) thick plywood as shown in Figures 10.3 and 10.4. The back wall is to be even with the front of the masonry fireplace and is to include trim and a mantel located in accordance with the minimum clearances recommended by the manufacturer's installation instructions.

10.9 The floor is to extend at least 4 feet (1.2 m) in front of the fireplace accessory front. The side wall is to be placed perpendicular to and extend at least 4 feet (1.2 m) from the front plane of the fireplace accessory. The ceiling is to extend at least 4 feet (1.2 m) in front of the fireplace accessory. The floor and back wall are to join the side wall.

10.10 A fireplace accessory is to be installed at the minimum clearance specified by the manufacturer's installation instructions. Legs or other support members (if provided) are to be adjusted to place the fireplace accessory at the distance above the floor (hearth) which produces the highest temperatures on combustible materials.

10.11 The masonry fireplace is to include a hearth extension of noncombustible material as specified in the Standard for Chimneys, Fireplaces, Vents and Solid Fuel Burning Appliances, NFPA 211. NFPA 211 requires that the minimum hearth extension size extend 16 inches (406 mm) in front of and at least 8 inches (203 mm) beyond each side of the fireplace opening.

10.12 The temperature of the room and the entire test structure within the room is to be between 60 and 90°F (15.6 and 32.2°C) at the beginning of the tests.

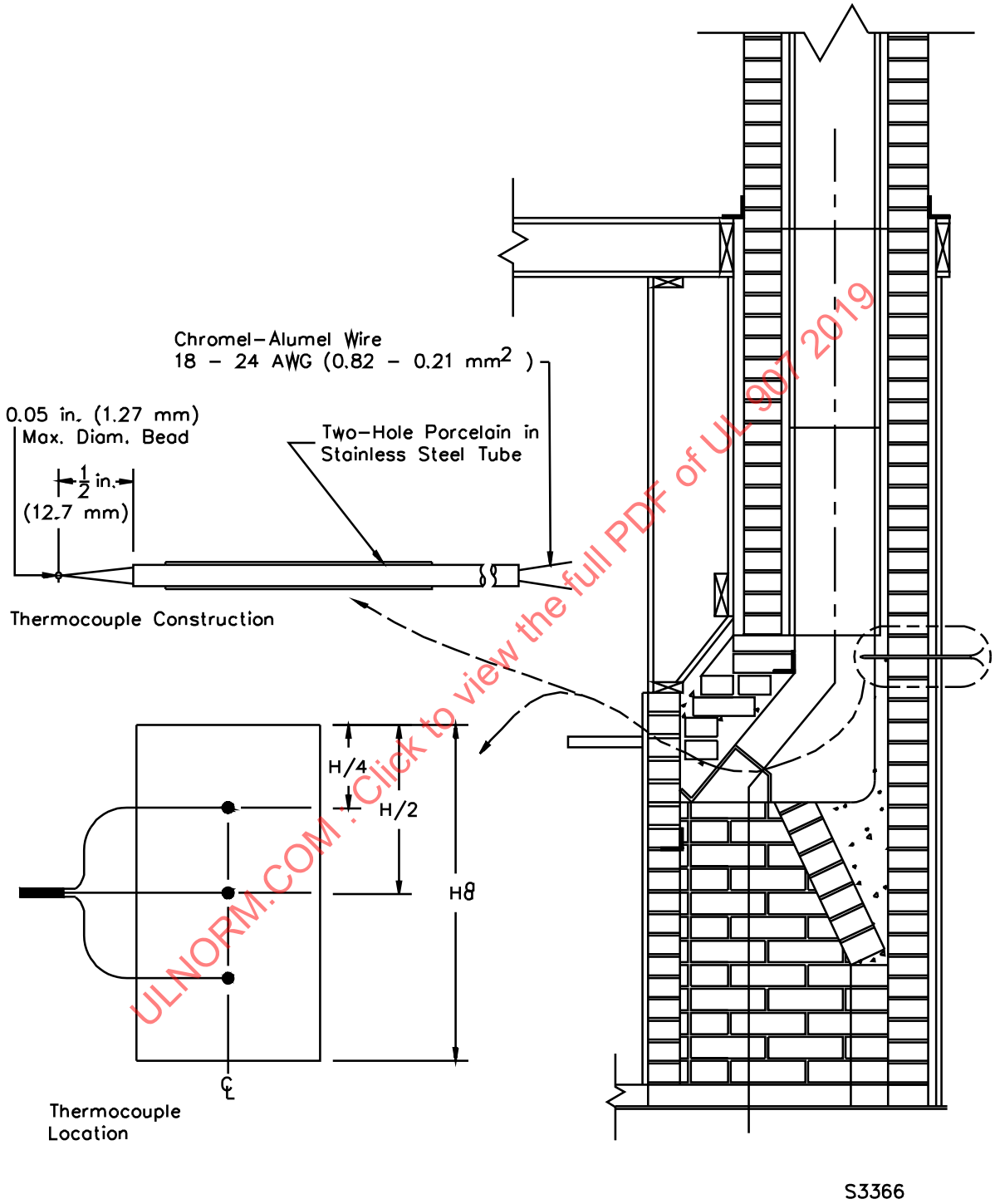
10.13 All wall surfaces, the floor surface, the ceiling surface, and the inside surface of the plywood enclosure facing the fireplace are to be painted flat black.

10.14 All joints and openings between spacers or supports and the test enclosure, all joints in a test enclosure, and all joints intended to be sealed for field installation are to be sealed. The test enclosure joints 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. The peel adhesion characteristics of the tape on fibrous (wood) combustible enclosure materials is to comply with the Standard for Adhesion of Pressure-Sensitive Tape to Fiberboard at 90 Degree Angle and Constant Stress, ASTM D2860, at elevated temperatures of 150°F (66°C).

11 Temperature Measurement

11.1 The inlet flue-gas temperature to the chimney section is to be measured during all tests of fireplace accessories by three thermocouples, each as illustrated by Figure 11.1, inserted up to the center line of the intersection of the chimney and fireplace. The three thermocouples are to be electrically connected so as to average the flue gas temperature. Each thermocouple is to be a Type K (chromel-alumel), and is to be of a size no smaller than 24 AWG (0.21 mm^2) and no larger than 18 AWG (0.82 mm^2) having an untwisted welded bare lead junction of maximum size not over 0.050 inch (1.27 mm).

Figure 11.1
Thermocouple location for flue gas temperature measurement



[a] See Table 10.1 for dimensions

11.2 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).

11.3 Temperatures of metal surfaces other than handles and electrical components are to be measured using either Type J (iron-constantan) or Type K (chromel-alumel) thermocouples of 18 to 24 AWG (0.82 to 0.21 mm^2) wire.

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

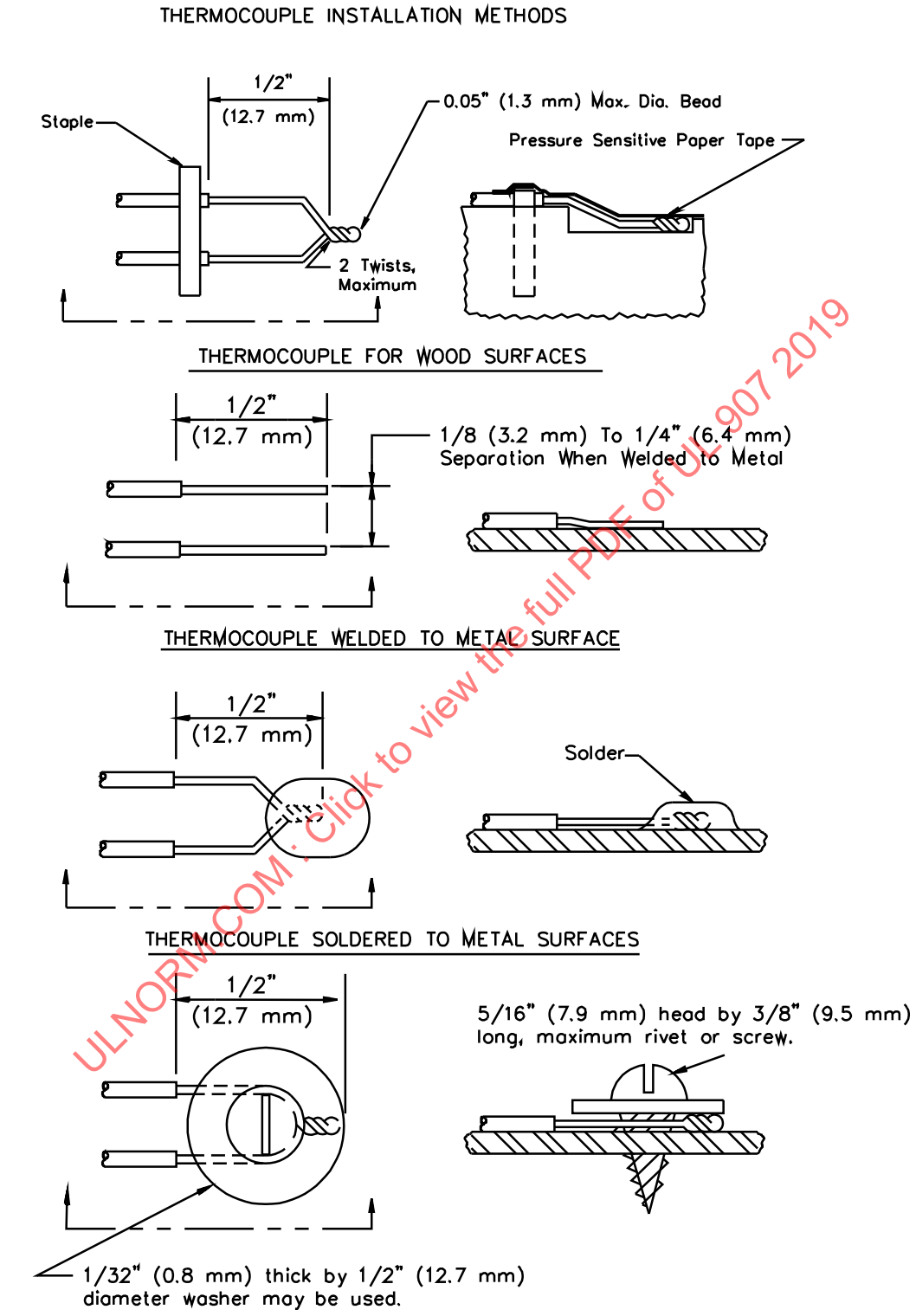
11.5 The ambient temperature is to be determined by using a shielded thermocouple located centrally within a vertically oriented 6 inch (152 mm) length of aluminum-painted 2 inch trade size steel pipe (ANSI B36.10M), open at both ends.

11.6 The ambient temperature for the test enclosure (Figure 10.1) is to be determined by means of a shielded thermocouple located 6 inches (152 mm) away from the side wall, 4 feet (1.2 m) above the floor, and 3 feet (0.9 m) from the front of the unit at the fuel loading location.

11.7 The measurements of temperature rises on the fireplace accessory and on the test structure are to be referenced to the recorded ambient temperatures as determined by 11.6.

11.8 Thermocouples are to be attached to metal surfaces by screws, rivets, or by silver soldering or brazing or welding of the tip to the metal surface as illustrated by Figure 11.2.

Figure 11.2
Thermocouple installation methods



11.9 Thermocouples are to be secured to wood surfaces by 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 pressure-sensitive paper tape.

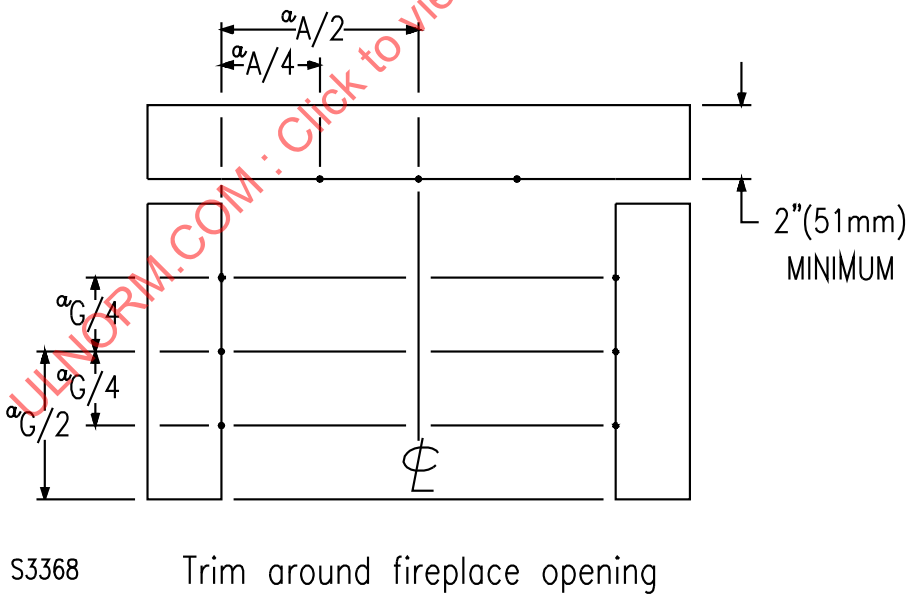
11.10 Thermocouples are to be attached to cement-like material surfaces by having the 1/2 inch (12.7 mm) tip and at least 1 inch (25.4 mm) of the lead wires embedded into the material so as to be flush with the surface of the material. Furnace cement is to be smoothed over such indentations to maintain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

11.11 Thermocouples are to be attached to surfaces and electrical components in ways other than as described in 11.8 – 11.10 by being cemented or taped to the surface in a manner that maintains thermal contact with the surface. Materials or parts whose temperatures are to be measured are included in Table 13.1. Temperatures of electrical conductors are to be measured on the surfaces of the conductor insulation. See Figure 11.2.

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

11.13 Thermocouples are to be placed on surfaces of the test enclosure at various locations as may be required to measure maximum temperatures during tests. Typical thermocouple locations are shown in Figures 11.3 – 11.5.

Figure 11.3
Thermocouple locations, trim



a See Table 10.1 for values of A and G.

Figure 11.4
Thermocouple locations, left adjustable side wall

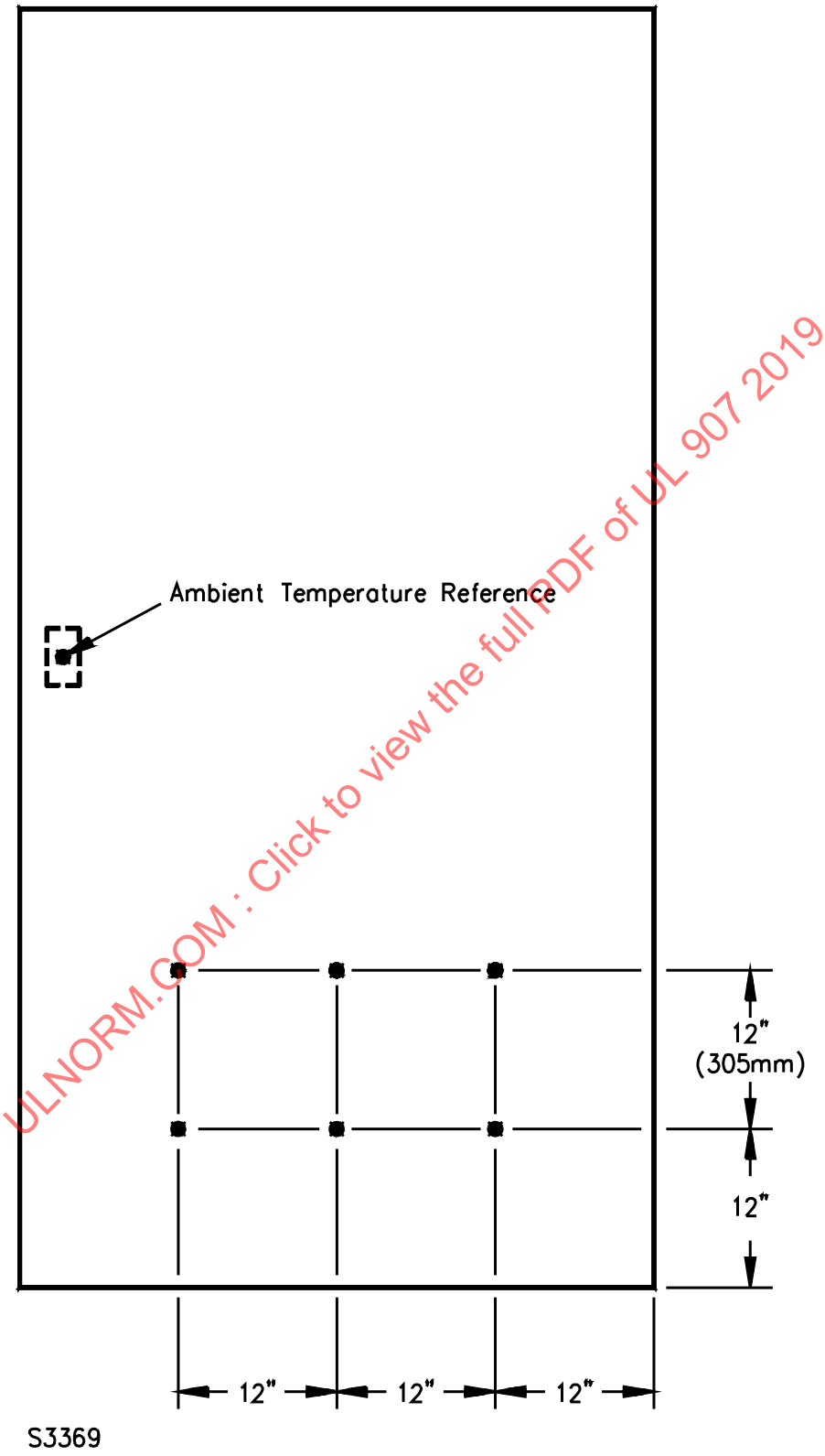
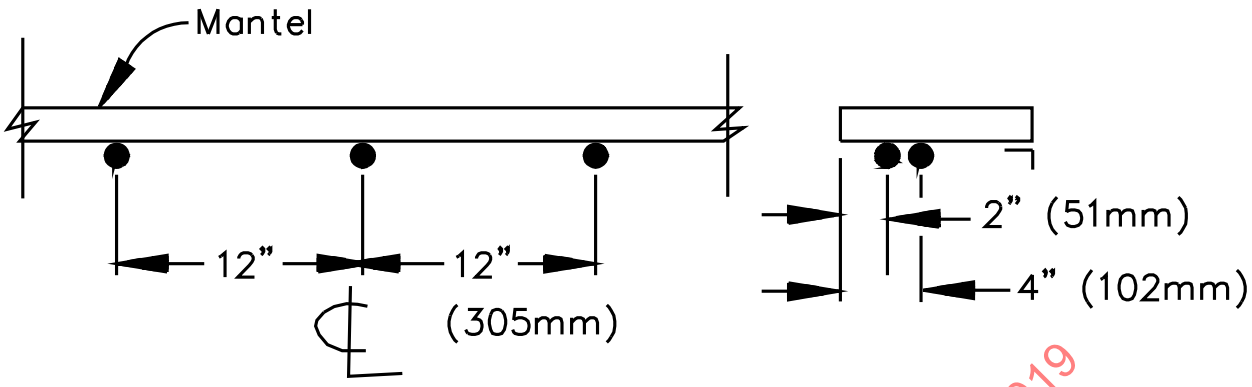


Figure 11.5
Thermocouple locations, mantel



S3370

11.14 If test enclosure elements are in contact with the fireplace accessory, thermocouples are to be placed on the fireplace accessory surfaces at representative points of contact.

Exception: If a point or line contact of a spacer with 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 the point or line contact.

11.15 Thermocouples are to be attached to the fireplace accessory assembly at various locations as may be required to measure maximum temperatures during the tests. Typical locations include the following (as applicable for the type of accessory being tested):

a) Sides, top, bottom, and back of that part of the product in the fire chamber;

b) Doors;

c) Handles and knobs (door opening, blower assembly control); and

d) Blower assembly components (motor case and windings, switch case, leads, internal wiring and metal parts in contact with wiring, power supply cord, and other electrical components).

12 Fire Tests

12.1 If a fireplace accessory incorporates a door, or doors, to close off the fire in the fireplace, fire tests are to be conducted both with the door(s) in the open position and in the closed position. If a fireplace accessory may be used with doors (the use of doors is not specifically prohibited in the instructions) the fire tests are to be conducted both without a door assembly and with a solid metal closure panel of minimum 1/8 inch (3.2 mm) thick steel or equivalent. The closure panel is to have an air inlet area equal to one-tenth of the fireplace opening area located across the bottom of the closure panel.

Exception: Fire tests with the door in the open position are not required if the product bears the marking specified in 46.15.

12.2 A fireplace accessory shall comply with the requirements of the Radiant Fire Test, Section 13; Brand Fire Test, Section 14; and Flash Fire Test, Section 15. A fireplace accessory that incorporates an integral grate is to be tested with the grate installed in its intended location during these tests.

12.3 If a fireplace accessory does not incorporate a grate, the Radiant Fire Test, Section 13, is to be conducted using a basket grate (see 13.2 – 13.5) and the Brand Fire Test, Section 14, and Flash Fire Test, Section 15, are to be conducted using andirons (see 14.2).

12.4 The surface temperature for the largest amount of material employed in a handle or knob for use on a fireplace accessory shall not exceed the temperature specified in Table 13.1 during the Radiant Fire Test and Brand Fire Test.

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

12.5 Temperatures of the flue gases are to be recorded at regular intervals not exceeding 1 minute for the duration of the temperature tests.

12.6 If the fireplace accessory is provided with an ash door, the accessory is to be operated during the Radiant Fire Test, Brand Fire Test, and Flash Fire Test with the ash door in the position, including an open position, that develops the maximum temperatures.

Exception No. 1: The ash door may be closed during the tests if the fireplace accessory is provided with an interlock arrangement that closes the ash removal door when:

a) The fuel loading door is closed; or

b) The outer enclosure door is closed.

Exception No. 2: The ash door may be closed during these tests if the fireplace accessory bears the marking specified in 46.16.

12.7 During the Radiant Fire Test and Brand Fire Test, thermostatic controls, heat discharge ducts or dampers, air inlets, and the like, that are accessible are to be adjusted through their full operating range to determine the setting that produces the maximum temperatures. The setting, or combination of settings, that produces the maximum temperatures are to be used during the Flash Fire Test.

12.8 If the mechanism of the thermostatic control is accessible, the control is to be bypassed if bypassing produces higher temperatures.

12.9 With reference to 12.7 and 12.8, a control is considered accessible if:

a) Access to the control may be gained with the use of simple hand tools, such as flat blade or Phillips head screwdrivers, hand pliers, wrenches, or the like; or

b) The control can be modified or its purpose defeated by mechanical means such as by connection of a piece of wire to alter its operating characteristics.

12.10 Throughout the fire tests, there shall be no evidence of spillage of the products of combustion (flame or smoke) from the fireplace or fireplace accessory with the flue gas damper fully open. Intermittent or sporadic wisps of smoke (smoking not over 15 seconds at a time) are not to be regarded as spillage.

12.11 With reference to 12.10, spillage of flame from the fireplace or fireplace accessory incorporating one or more doors is to be observed as follows:

a) Any time a door is opened for fueling the unit for the Brand Fire Test and Flash Fire Test.

b) When the maximum temperatures have been attained during the Brand Fire Test. The air inlets are to be adjusted to that point of their operating range most likely to create maximum flame spillage. The feed door then is to be opened at a moderate rate 2 minutes after fuel is added and similarly reopened 2 minutes after every subsequent fuel loading until it is evident that there is no spillage of flame from the unit.

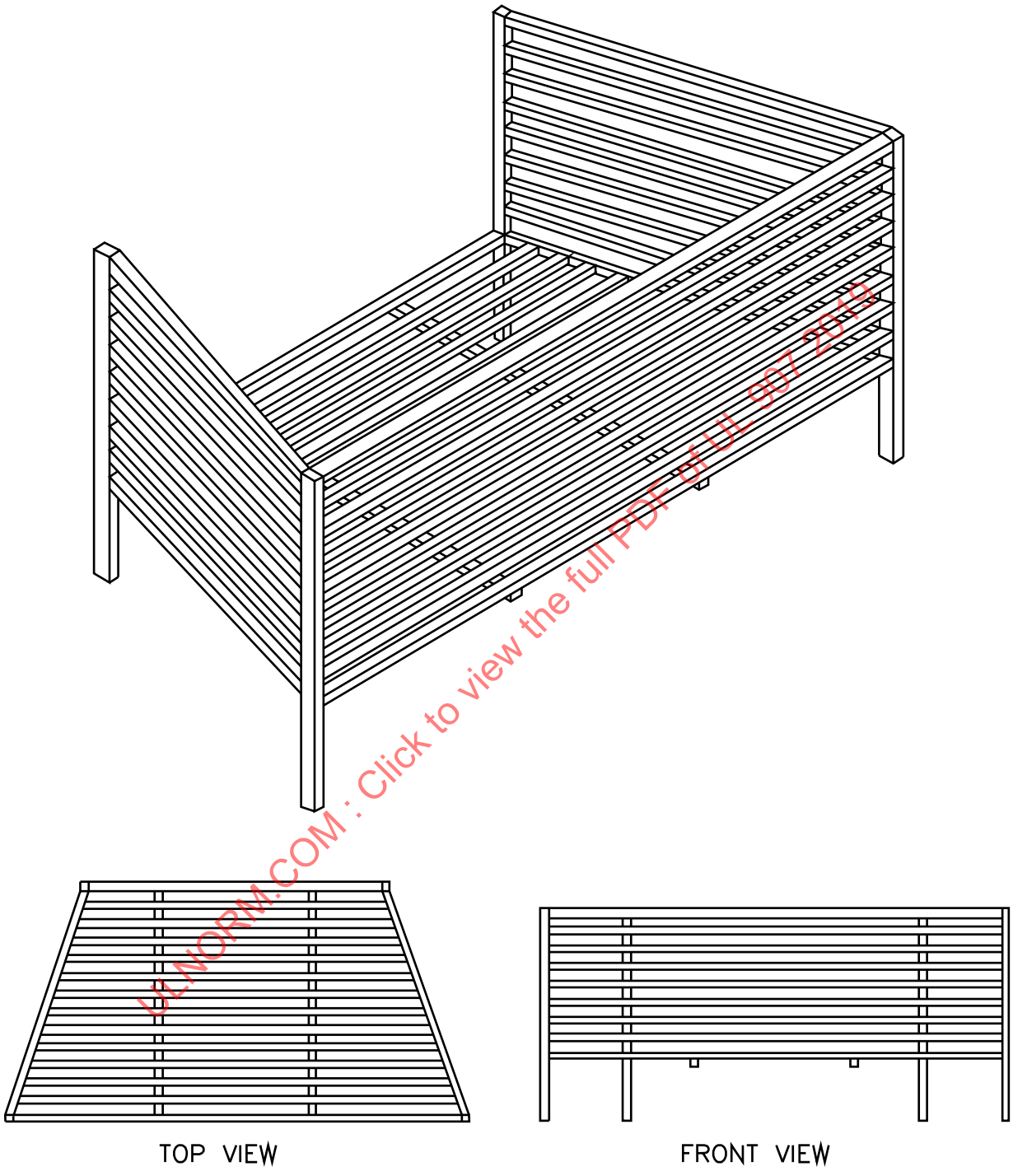
c) When the door(s) is opened at a moderate rate after the air supply has been shut off for 10 minutes. This condition is to be checked after the Flash Fire Test has created maximum temperature rises and a new brand has been added.

13 Radiant Fire Test

13.1 When tested as described in 13.2 – 13.8, a fireplace accessory shall comply with the requirements in 13.9 – 13.11.

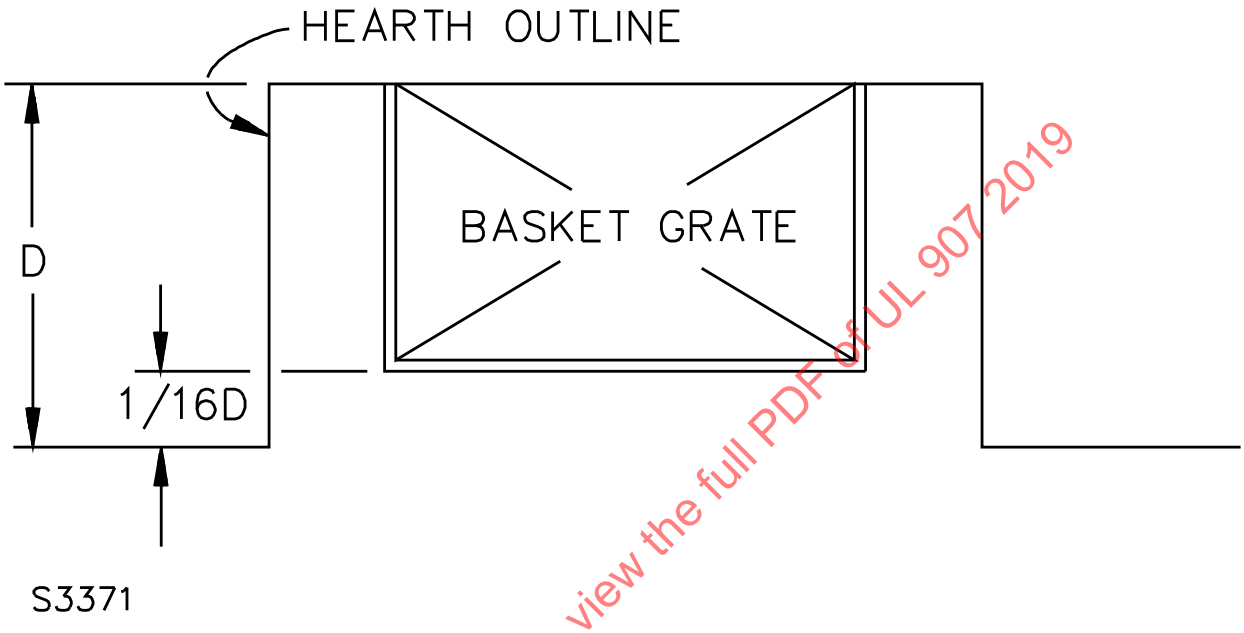
13.2 If an integral grate is not provided, a basket grate is to be constructed of 3/8 inch (9.5 mm) square steel bar stock spaced 1 inch (25.4 mm) apart on centers as illustrated in Figure 13.1.

Figure 13.1
General form of basket grate



13.3 The basket grate is to have an inside surface area in the plan view equal to two-thirds of the total hearth area. In the plan view, the shape of the basket grate is to conform closely to the shape of the hearth, as shown in Figure 13.2. The inside depth of the basket grate is to be 6 inches (152 mm) and the basket grate is to stand on legs that support the inside bottom of the basket grate 4 inches (100 mm) above the hearth.

Figure 13.2
Typical relationship of grate to hearth



13.4 With reference to 13.3, should the configuration or size of the fireplace accessory so require, the height of both the legs and the fuel-containing portion of the basket grate may be reduced in equal proportions as necessary to obstruct no more than 75 percent of the fireplace opening.

13.5 If the grate is an integral part of the fireplace accessory, the entire area of the grate or hearth is to be loaded to the fuel depth prescribed for the Radiant Fire Test. For purposes of the Radiant Fire Test, a separate front retaining grate constructed of 3/8 inch (10 mm) square steel bar stock spaced 1 inch (25 mm) apart on centers may be constructed to maintain the 6 inch (152 mm) fuel depth.

13.6 The integral or basket type grate is to be loaded to a depth of approximately 6 inches (152 mm) with charcoal briquettes[a] formed in the shape of a 2.0- by 1.9-inch (50- by 48-mm) square pillow having rounded edges and a maximum thickness of 1.2 inches (30 mm). The briquettes shall have a count weight of 17 per pound (17/0.45 kg), a heat content (dry basis) of 11,500 Btu per pound (26,750 J/g), and a moisture content of 5 percent.

[a]A type suitable for this test is manufactured by the Kingsford Company, P. O. Box 493, Pleasanton, California 94566.

13.7 The charcoal fuel is to be ignited and the time recorded. After ignition, additional briquettes are to be added at 7-1/2 minute intervals and at each interval the fire is to be poked or stirred prior to the addition of the fuel 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 grate at one end and sliding it through the fire bed, and then inserting the bar at the bottom of the grate at the other end and sliding in the opposite direction through the fire bed. Ashes in the ash pan or on the hearth underneath a basket grate are to be removed after 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 that the maximum temperature rises have been attained. Maximum temperature rises are considered 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 accessory is fired as described in 13.6 – 13.8, the maximum temperature rise above room temperature shall not exceed:

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

b) 90°F (50°C) on unexposed surfaces of the test enclosure, such as beneath the fireplace accessory floor protector.

13.10 The temperature rise of any part of a fireplace accessory shall not exceed the maximum value specified in Column 1 of Table 13.1 for the material employed.

Table 13.1
Maximum temperature rises

Materials and components	Column 1		Column 2	
	Degrees		Degrees	
	C	(F)	C	(F)
A. MOTORS[a,b,m]				
1. Class A 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	75	(135)	115	(207)
b. In totally enclosed motors;				
Thermocouple or resistance method	80	(144)	115	(207)
2. Class A insulation systems on coil windings of alternating-current motors more than 7 inches (178 mm) in diameter and of direct-current motors and universal motors.				
a. In open motors;				
Thermocouple method	65	(117)	115	(207)
Resistance method	75	(135)	115	(207)
b. In totally enclosed motors;				
Thermocouple method	70	(126)	115	(207)
Resistance method	80	(144)	115	(207)
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)

Table 13.1 Continued on Next Page

Table 13.1 Continued

Materials and components	Column 1		Column 2	
	Degrees		Degrees	
	C	(F)	C	(F)
b. In totally enclosed motors;				
Thermocouple or resistance method	100	(180)	140	(252)
4. Class B insulation systems on coil windings of alternating-current motors more than 7 inches (178 mm) in diameter and of direct-current and universal motors:				
a. In open motors;				
Thermocouple method	85	(153)	140	(252)
Resistance method	95	(171)	140	(252)
b. In totally enclosed motors;				
Thermocouple method	90	(162)	140	(252)
Resistance method	100	(180)	140	(252)
B. COMPONENTS[m]				
1. Capacitors:				
a. Electrolytic types[c]	40	(72)	Not specified	
b. Other types[d]	65	(117)	Not specified	
2. Relay, solenoid, and other coils with:				
a. Class 105 insulation systems;				
Thermocouple method	65	(117)	115	(207)
Resistanced method	85	(153)	115	(207)
3. Transformer enclosure:[b]				
a. Class 2 transformers	60	(108)	85	(153)
b. Power and ignition transformers	65	(117)	90	(162)
C. INSULATED CONDUCTORS[e,f,m]				
1. Appliance wiring material				
75°C rating	50	(90)	65	(117)
85°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	(405)	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		e	e	
D. ELECTRICAL INSULATION – GENERAL[f,m]				
1. Class C electrical insulation materials		Not specified		
2. Class 180 electrical insulation or cord bushings		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 will result in a risk of fire or electric shock	125	(225)	150	(270)
5. Thermoplastic material	25°C or 77°F less than its temperature rating			
6. Varnished cloth insulation	60	(108)	85	(153)
E. METALS[g]				
1. Aluminum alloys:				

Table 13.1 Continued on Next Page

Table 13.1 Continued

Materials and components	Column 1		Column 2	
	Degrees		Degrees	
	C	(F)	C	(F)
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. Types 302, 303, 304, 321, 347	686	(1235)	767	(1380)
b. Types 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. GENERAL				
1. Operating knobs, handles, and levers[o]				
a. Metallic	50	(122)	Not specified	
b. Glass	78	(172)	Not specified	
c. Plastic[n]	85	(185)	Not specified	
d. Wood	150	(302)	Not specified	

[a] The motor diameter is to be measured in the plane of the laminations of the circle circumscribing the stator frame, excluding lugs, boxes, and the like, 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 two layers, 1/32 inch (0.8 mm) maximum, of cotton, paper, rayon, or the like. 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 may exceed the indicated maximum by the amount noted below, provided that 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 that is physically integral with or attached to a motor, the temperature rise on insulating material integral with the capacitor enclosure may be not more than 65°C (117°F).

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

Table 13.1 Continued on Next Page

Table 13.1 Continued

Materials and components	Column 1		Column 2	
	Degrees		Degrees	
	C	(F)	C	(F)

[e] For standard insulated conductors other than those mentioned, reference should be made to the National Electrical Code; the maximum allowable temperature rise in any case is 25°C or 77°F less than the temperature rating of the insulation in question where Column 1 temperature rises are specified, and the maximum allowable 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 that have been investigated and found to have special heat-resistant properties.

[g] The specified maximum temperature rises apply to parts whose malfunction may cause the product to be unacceptable for use.

[h] These and other alloys containing more than 1 percent 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 allowable 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 temperatures do not apply to:

1. Steel at least 0.152 inch (3.86 mm) thick and cast iron at least 3/16 inch (4.8 mm) thick used for the hearth;

2. Steel at least 0.093 inch (2.36 mm) thick and cast iron at least 1/8 inch (3.2 mm) thick if the part is not the only enclosure and when malfunction of the part will not expose living space to products of combustion (see Carbon Monoxide Monitoring Test, Section 17); or

3. Readily replaceable heat exchanger tubes.

[l] The specified maximum temperature rise does not apply to parts of 1/4 inch (6.4 mm) or heavier steel and 5/16 inch (7.9 mm) thick or heavier cast iron.

[m] Maximum temperature rises are based on an ambient temperature of 25°C or 77°F.

[n] 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.

[o] Temperatures are maximum temperatures, based on an ambient temperature of 70°F or 21°C.

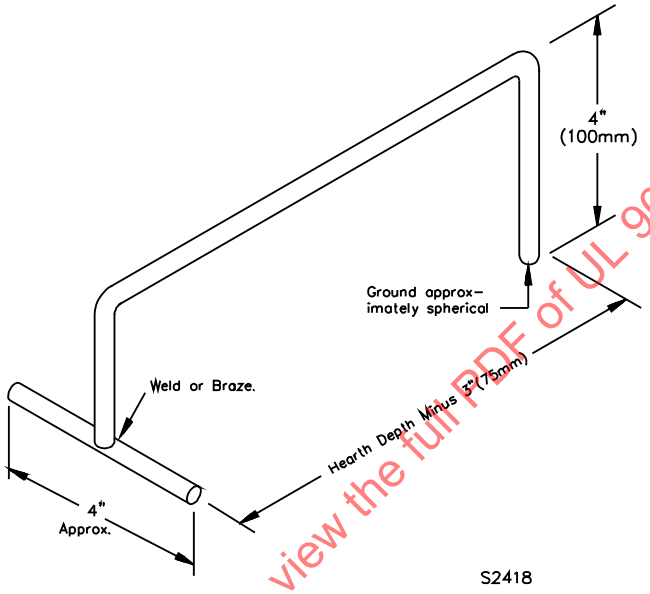
13.11 The temperature rise of any part of the electrical components and of operating knobs, handles, and levers employed in the fireplace accessory shall not exceed the maximum specified in Column 1 of Table 13.1 for the materials employed.

14 Brand Fire Test

14.1 When tested as described in 14.2 – 14.7, a fireplace accessory shall comply with the requirements in 14.8 – 14.10.

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

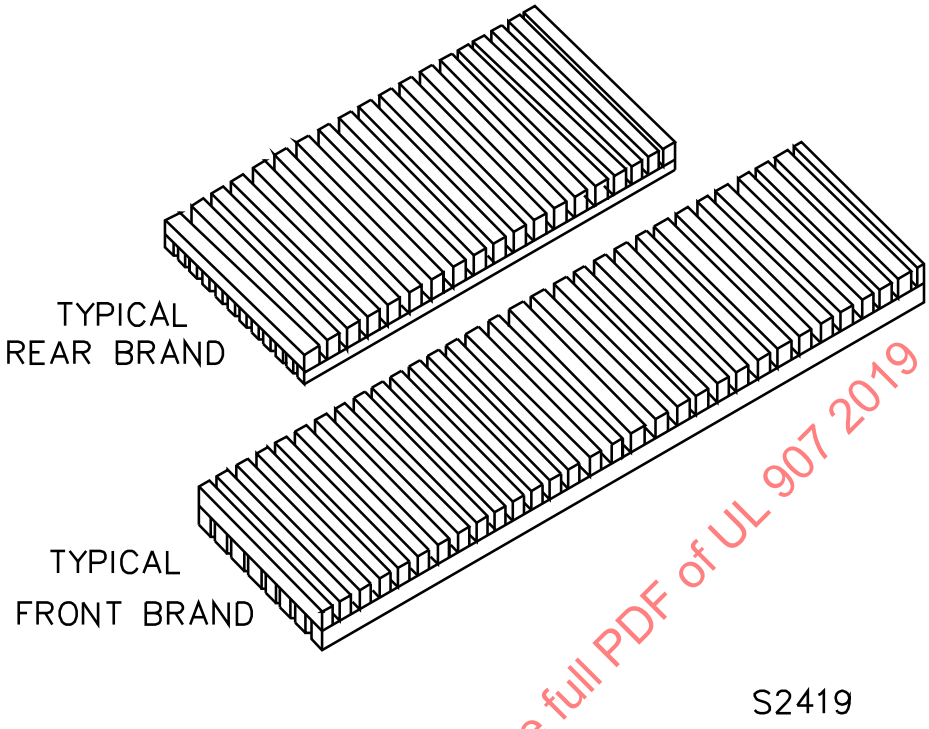
Figure 14.1
Andiron



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

14.3 Firebrands are to be constructed as illustrated in Figure 14.2, and are to employ strips of dry (moisture content of 19 percent or less) Douglas fir finished to 3/4 by 3/4 inch (19 by 19 mm), weighing 0.020 ±0.002 pound per cubic inch (554.0 ±55.4 kg/m^3) and spaced 1 inch (25 mm) apart on centers, providing a 1/4 inch (6 mm) space between strips. 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 removal from the oven.

Figure 14.2
Brands

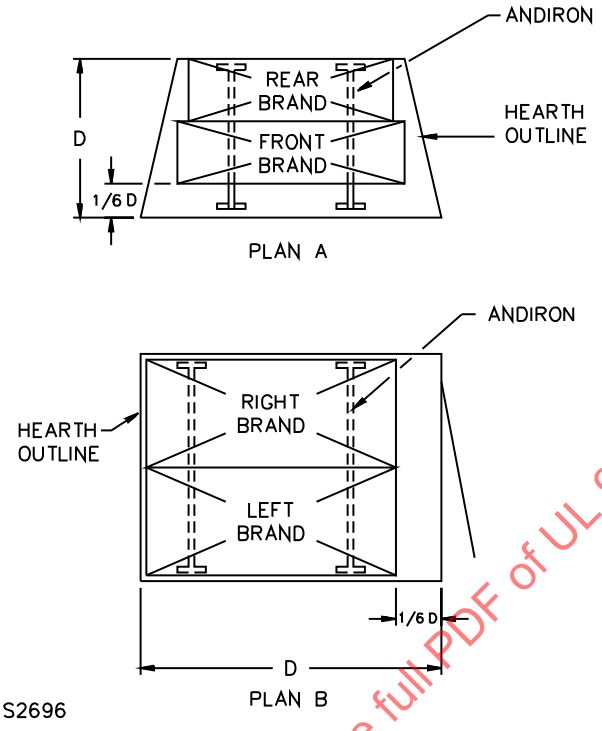


14.4 Each brand is to have an area in the plan view equal to one-third of the total grate or hearth area. Brand dimensions are to be such that the front edge of the brand, when located as illustrated in Figure 14.3, will be approximately one-sixth of the maximum grate or hearth depth back from the:

a) Feed door of the fireplace accessory; or

b) Fireplace opening, as applicable. If required by the configuration of the product, two individual brands having a total area equal to one-third of the grate or hearth area may be used.

Figure 14.3
Typical relation of brands to grate or hearth



14.5 The brands are to be placed on the andirons as illustrated in Figure 14.3.

14.6 The test brand is to be ignited and the time recorded. After ignition, one brand is to be added every 7-1/2 minutes, alternating front and rear, with the long strips placed downward. If a build-up of embers occurs within the product during the test, the embers are to be leveled prior to the addition of the next brand, but ashes are not to be removed from the hearth.

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

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

14.7 Temperatures at all points of measurement are to be recorded at intervals not exceeding 30 minutes until it is apparent that 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.

14.8 When the fireplace accessory is fired as described in 14.3 – 14.7, the maximum temperature rise above room temperature on the test enclosure shall not exceed:

a) On exposed surfaces – 117°F (65°C); and

b) On unexposed surfaces such as beneath the floor protector – 90°F (50°C).

14.9 The temperature rise of any part of the fireplace accessory shall not exceed the maximum values specified in Column 1 of Table 13.1.

14.10 The temperature rise of any part of the electrical components and of operating knobs, handles, and levers employed in the fireplace accessory shall not exceed the maximum values specified in Column 1 of Table 13.1.

15 Flash Fire Test

15.1 When tested as described in 15.2 – 15.4, a fireplace accessory shall comply with the requirements in 15.5 – 15.7.

15.2 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.

15.3 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 may be tied together with wire not larger than 18 AWG (0.82 mm^2).

15.4 Temperatures at all points of measurement are to be recorded at intervals not exceeding 5 minutes until maximum temperatures have been attained.

15.5 When the fireplace accessory is fired as described in 15.2 – 15.4, the maximum temperatures shall be not more than 140°F (77.8°C) above room temperature on surfaces:

a) Of the test enclosure; and

b) Of the fireplace accessory parts at points of zero clearance to the test enclosure.

15.6 The temperature rise of any part of the fireplace accessory shall not exceed the maximum specified in Column 2 of Table 13.1 for the material employed.

15.7 The temperature rise of any part of the electrical components and of operating knobs, handles and levers employed in the fireplace accessory shall not exceed the maximum specified in Column 2 of Table 13.1.

16 Glazing Test

16.1 General

16.1.1 Glazing employed in a fireplace accessory intended to burn wood shall not crack, break, become dislodged, or sustain a loss of strength when the heater is subjected to the Radiant Fire Test, Section 13; Brand Fire Test, Section 14; and Flash Fire Test, Section 15.

16.1.2 If 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 may crack or break when:

a) Subjected to the Radiant Fire Test, Section 13; Brand Fire Test, Section 14; and Flash Fire Test, Section 15; and

b) Tested as described in 16.2 and 16.3 provided the screen is not damaged (torn, dislodged, punctured, or the like) by these tests.

If the glazing cracks or breaks, the fireplace accessory is to be subjected to these tests with the glazing material both in place (intact) and with one glazing panel removed.

16.2 Impact test

16.2.1 Glazing shall withstand, without cracking or breaking, the impact described in 16.2.2:

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 the test.

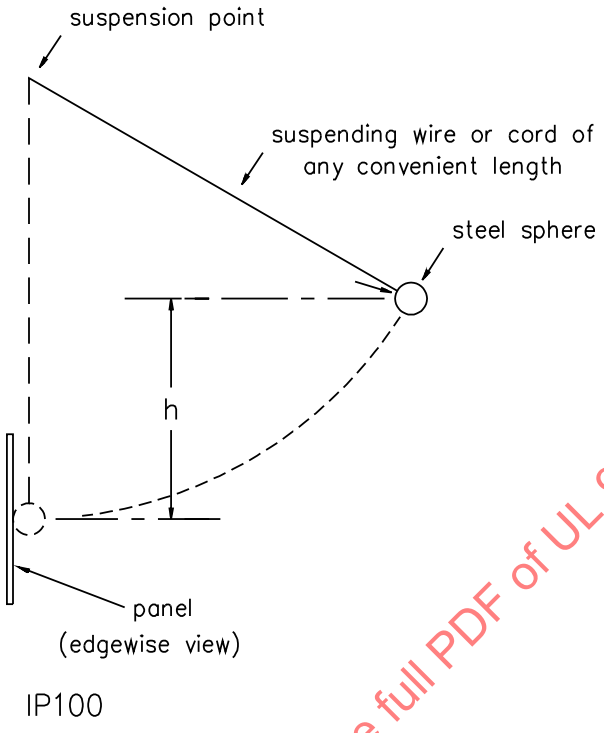
c) Following the Radiant Fire Test, after being permitted to cool to room temperature.

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

e) Following the Flash Fire Test, after being permitted to cool to room temperature.

16.2.2 An impact is to be applied to the center of the glazing panel by means of a 1.18 pounds-mass (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 16.1.

Figure 16.1
Impact test



16.3 Water shock test

16.3.1 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.

17 Carbon Monoxide Monitoring Test

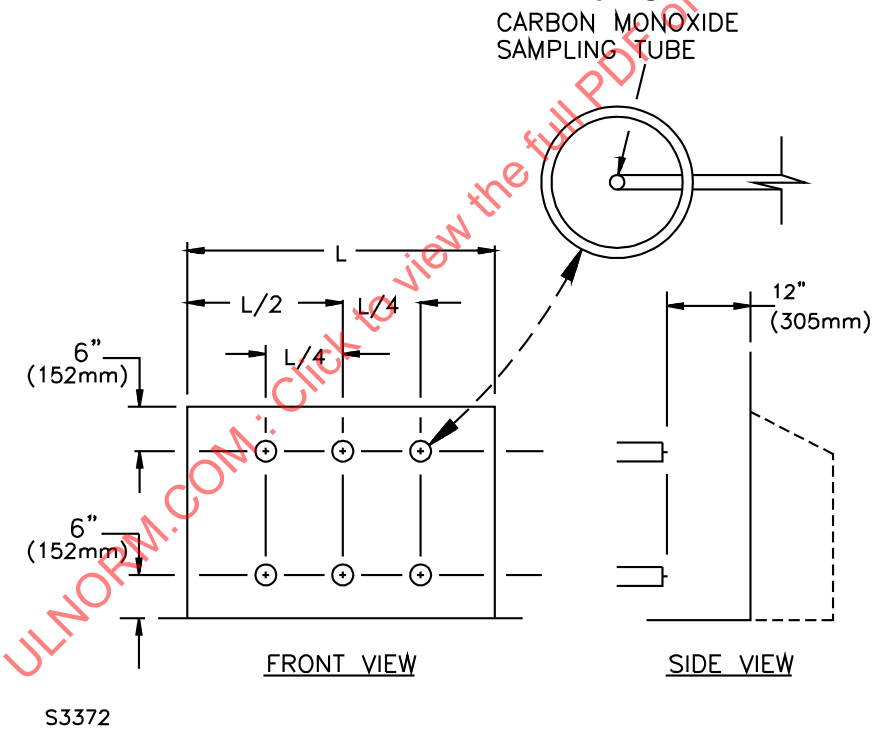
17.1 The carbon monoxide monitoring test is to be conducted on all heat exchanger type fireplace accessories.

17.2 The total cross-sectional area of the air outlet(s) of the fireplace accessory is to be determined. The fireplace accessory part is to be modified by drilling or otherwise removing an area equal to 10 percent of the total air outlet area from the test sample, at a location most likely to result in products of combustion being mixed with heated air directed to the living space.

17.3 The carbon monoxide concentration is to be measured during a second Radiant Fire Test.

17.4 The reading stations for monitoring carbon monoxide (CO) are to consist of six horizontally oriented aluminum-painted 2 inch steel pipe (ASME B36.10M). Each pipe is to be 6 inches (152 mm) long, open at both ends, and contain a carbon monoxide sampling tube as shown in Figure 17.1.

Figure 17.1
Location of carbon monoxide sampling tubes



17.5 The test is to be conducted in each mode of operation (such as doors open, doors closed, blower on/off, and the like) of the fireplace accessory until ultimate results are obtained.

17.6 The CO concentration during the test shall not exceed 50 ppm at any reading station during the entire test series.

BLOWER ASSEMBLY

CONSTRUCTION

18 General

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

18.2 The positioning of the blower shall not produce a negative pressure at joints in the heating chamber, flues, or combustion air passages.

Exception: A blower may be positioned such that a negative pressure is produced if the joints are permanently-sealed such as by being welded or the equivalent.

18.3 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 alternating-current (42.4 peak or direct current) and supplied by a primary battery or by a standard NEC 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 considered to be a low-voltage circuit.

19 Enclosure

19.1 General

19.1.1 An electrical enclosure shall be formed and assembled so that it has the strength and rigidity necessary to resist the abuses to which it may be subjected in intended use without total or partial collapse and subsequent reduction of spacings, loosening or displacement of parts, or other conditions that will render it unacceptable for further use. An enclosure for individual electrical components, an outer enclosure, and combinations of the two are to be considered in determining compliance with this requirement.

19.1.2 Among the factors to be taken into consideration when evaluating an enclosure are:

a) Mechanical strength;

b) Resistance to impact;

c) Moisture-absorptive properties;

d) Flammability;

e) Resistance to distortion at temperatures to which the material may be subjected under conditions of use; and

f) Resistance to corrosion.

For a nonmetallic enclosure or part of an enclosure all of these factors are to be considered with respect to aging.

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

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

19.1.5 Except at terminals and as noted in 19.1.6, and unless it can be determined that malfunction of an electrical component will not result in a risk of fire, components such as controls, solenoids, relays, and switches shall be individually enclosed.

19.1.6 Electrical parts within the outer cabinet need not be individually enclosed if the assembly complies with the following:

a) The construction and location of electrical parts with respect to openings in the outer cabinet will not result in the emission of flame or molten metal through openings in the cabinet or it can be demonstrated that malfunction of the components would not result in a risk of fire;

b) There are no openings in the bottom of the compartment in which the parts are located that would permit dropping of molten metal and the like onto flammable material; and

c) The parts are not in proximity to flammable material other than electrical insulation.

19.1.7 Sheet metal complying with Tables 19.1 and 19.2, whichever applies, is acceptable for the individual enclosure of electrical components.

Table 19.1
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, inch (mm)			
Maximum width[b]		Maximum length[c]		Maximum width[b]		Maximum length					
Inches	(cm)	Inches	(cm)	Inches	(cm)	Inches	(cm)	Uncoated		Metal Coated	
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)				
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)				
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)				
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)				
18.0	(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)				

Table 19.1 Continued on Next Page

Table 19.1 Continued

Without supporting frame[a]				With supporting frame or equivalent reinforcing[a]				Minimum thickness, inch (mm)			
Maximum width[b]		Maximum length[c]		Maximum width[b]		Maximum length					
Inches	(cm)	Inches	(cm)	Inches	(cm)	Inches	(cm)	Uncoated		Metal Coated	
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)				
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)				
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)				
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)				
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)				
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)				

[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 essentially the same outside dimensions as the enclosure surface and that has sufficient torsional rigidity to resist the bending moments that may be applied via the enclosure surface when it is deflected. Constructions are considered to have equivalent reinforcing if they produce a structure that is as rigid as one built with a frame of angles or channels. Constructions considered to be without supporting frame include:

1) A single sheet with single formed flanges (formed edges);

2) A single sheet that is corrugated or ribbed; and

3) 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 may 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 continuous flange at least 1/2 inch (12.7 mm) wide.

Table 19.2
Minimum thickness of sheet metal for electrical enclosures – aluminum, copper, or brass

Without supporting frame[a]				With supporting frame or equivalent reinforcing[a]				Minimum thickness Inches (mm)
Maximum width[b]		Maximum length[c]		Maximum width[b]		Maximum length		
Inches	(cm)	Inches	(cm)	Inches	(cm)	Inches	(cm)	
3.0	(7.6)	Not limited		7.0	(17.8)	Not limited		0.023 (0.58)
3.5	(8.9)	4.0	(10.2)	8.5	(21.6)	9.5	(24.1)	
4.0	(10.2)	Not limited		10.0	(25.4)	Not limited		0.029 (0.74)
5.0	(12.7)	6.0	(15.2)	10.5	(26.7)	13.5	(34.3)	
6.0	(15.2)	Not limited		14.0	(35.6)	Not limited		0.036 (0.91)
6.5	(16.5)	8.0	(20.3)	15.0	(38.1)	18.0	(45.7)	
8.0	(20.3)	Not limited		19.0	(48.3)	Not limited		0.045 (1.14)
9.5	(24.1)	11.5	(29.2)	21.0	(53.3)	25.0	(63.5)	
12.0	(30.5)	Not limited		28.0	(71.1)	Not limited		0.058 (1.47)
14.0	(35.6)	16.0	(40.6)	30.0	(76.2)	37.0	(94.0)	
18.0	(45.7)	Not limited		42.0	(106.7)	Not limited		0.075 (1.91)
20.0	(50.8)	25.0	(63.5)	45.0	(114.3)	55.0	(139.7)	
25.0	(63.5)	Not limited		60.0	(152.4)	Not limited		0.095 (2.41)
29.0	(73.7)	36.0	(91.4)	64.0	(162.6)	78.0	(198.1)	
37.0	(94.0)	Not limited		87.0	(221.0)	Not limited		0.122 (3.10)
42.0	(106.7)	53.0	(134.6)	93.0	(236.2)	114.0	(289.6)	
52.0	(132.1)	Not limited		123.0	(312.4)	Not limited		0.153 (3.89)
60.0	(152.4)	74.0	(188.0)	130.0	(330.2)	160.0	(406.4)	

[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 essentially the same outside dimensions as the enclosure surface and that has sufficient torsional rigidity to resist the bending moments that may be applied via the enclosure surface when it is deflected. Constructions are considered to have equivalent reinforcing if they produce a structure that is as rigid as one built with a frame of angles or channels. Constructions considered to be without supporting frame include:

1) A single sheet with single formed flanges (formed edges);

2) A single sheet that is corrugated or ribbed; and

3) 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 may 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 continuous flange at least 1/2 inch (12.7 mm) wide.

19.1.8 If the construction and location of components and the strength and rigidity of the outer cabinet warrant, an individual enclosure thinner than specified in Tables 19.1 and 19.2, whichever applies, may be employed.

19.1.9 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) if uncoated steel, not less than 0.034 inch (0.86 mm) if galvanized steel, and not less than 0.045 inch (1.14 mm) if nonferrous.

19.1.10 If threads for the connection of conduit are tapped through a hole in an enclosure wall, or if an equivalent construction is employed, there shall be not less than three or more than five threads in the metal, and the construction shall permit a conduit bushing to be attached as intended. If threads for the connection of conduit are not tapped all the way through a hole in an enclosure wall, conduit hub, or the like, 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 that:

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

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

19.1.11 A knockout in a sheet metal enclosure shall be secured in place, but shall be able to be removed without deformation of the enclosure to the extent that would cause damage to electrical components or reduction in electrical spacings.

19.1.12 A knockout or hole for connection of conduit or the like 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 likely to be used during installation will not result in reduction of spacings between uninsulated live parts and the bushing to less than those required by this standard.

19.1.13 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.

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

19.2 Mechanical protection

19.2.1 Moving parts, such as fan blades, blower wheels, pulleys, belts, or the like, that may cause injury to persons shall be enclosed or guarded so that the minor dimension of any opening does not exceed the values indicated in 19.2.3. Parts required for guarding shall be secured by means dependent upon tools for removal unless functioning of the fireplace accessory requires the guard to be in place. Also see 46.7.

19.2.2 Louvers and other openings in the enclosure shall be constructed and located to reduce the risk of unintentional contact with moving parts that may cause 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.

19.2.3 The distance from an opening to the moving part shall be as indicated in Table 19.3, but the minor dimension of the opening shall not, in any case, exceed 1 inch (25 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 can be inserted through the opening with a force of 5 pounds (22.3 N).

Table 19.3
Dimensions of openings

Minor dimensions of opening[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 considered.

19.2.4 A moving part is not to be considered when determining compliance with 19.2.1 if:

a) The part is unlikely to be 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 accessory to expose the moving part.

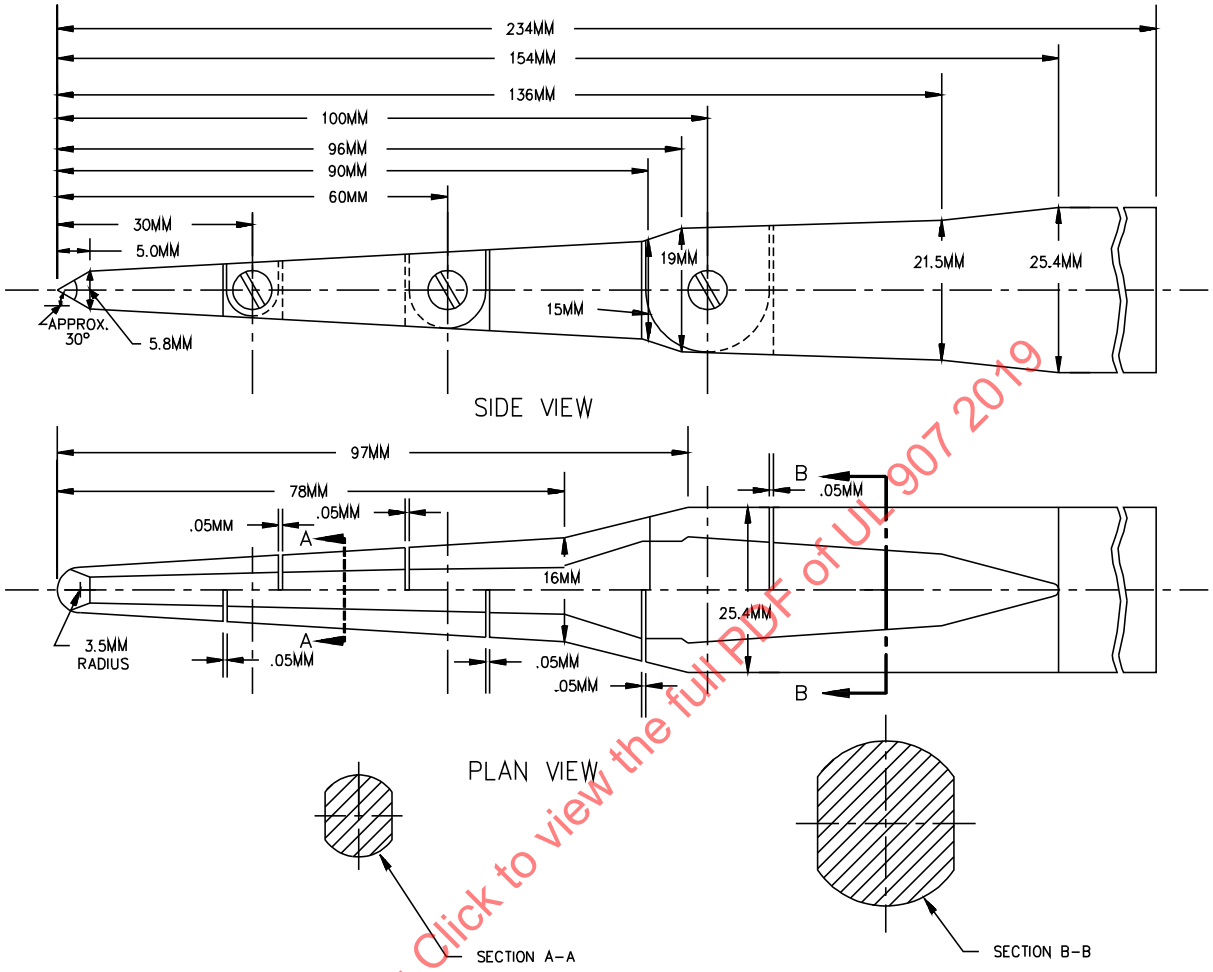
19.3 Electrical protection

19.3.1 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.

19.3.2 Uninsulated high-voltage live parts of a fireplace accessory shall be located, guarded or enclosed in accordance with the requirements in 19.3.3 – 19.3.5.

19.3.3 An opening in the enclosure of the product that will not permit entrance of a 1 inch (25 mm) diameter rod is acceptable if a probe as illustrated in Figure 19.1, inserted into the opening, cannot be made to touch any part that involves the risk of electric shock.

Figure 19.1
Articulated accessibility probe



PA100

19.3.4 With respect to the requirement in 19.3.3, the probe may be articulated into any configuration and may be rotated or angled to any position before, during, or after insertion into the opening, and the penetration may be to any depth allowed by the opening size, including minimal depth combined with maximal articulation.

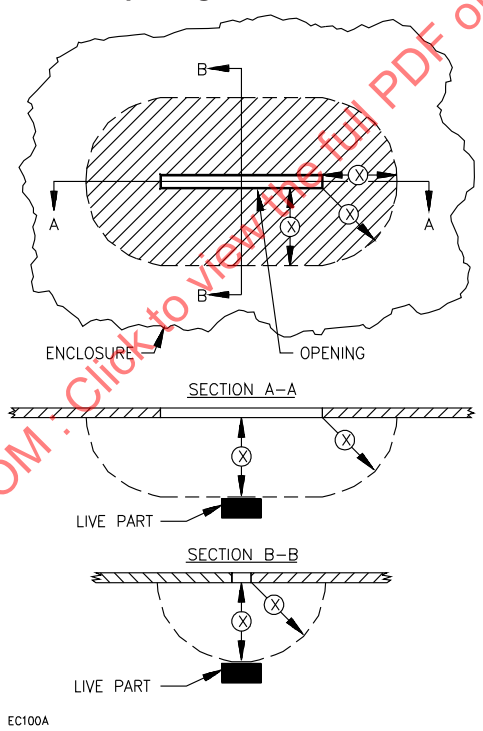
19.3.5 With reference to Figure 19.2, an opening is acceptable if uninsulated live parts and film-coated wire inside the enclosure are:

a) X inches (mm) or more from the perimeter of the opening; and

b) Outside the volume generated by projecting the perimeter X inches (mm) normal to the plane.

X equals five times the diameter of the largest-diameter rod that can be inserted through the opening but not less than 6-1/16 inches (154 mm).

Figure 19.2
Opening in enclosure



19.3.6 In addition to the requirements in 19.3.2 – 19.3.5, uninsulated live parts inside the enclosure that are likely to be 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 46.7.

19.3.7 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, will 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 considered adjacent.

19.4 Doors and covers

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

19.4.2 An interlocking mechanism that:

a) Must be engaged in the closed position of the cover in order that parts will be energized; and

b) Will secure the cover in the closed position when engaged is considered to comply with the requirements in 19.4.1.

19.4.3 A hinged panel or cover shall be positioned or arranged so that while in an open position it will not be subjected to falling or swinging due to gravity or vibration so as to cause risk of:

a) Injury to persons from the panel or cover or from moving parts, or

b) Electric shock from uninsulated live parts.

19.4.4 The assembly shall be arranged so that an overcurrent protective device can be replaced or reset without removing parts other than a service cover(s) or panel(s), and the cover or door enclosing the device.

19.4.5 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 may project outside the enclosure.

19.4.6 An opening in an outer enclosure around a handle, reset button, or other control member is acceptable if 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.

19.4.7 Covers for enclosures of fuses in high-voltage circuits shall be hinged, see 19.4.8. Covers for manual-reset overload protective device enclosures shall be hinged if it is necessary to open the cover to reset the device.

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

19.4.8 A hinged cover shall not depend solely upon screws or other similar means to hold it closed, but shall be provided with a latch or the equivalent. A cover interlocking mechanism as described in 19.4.2 is acceptable as the sole means for securing the cover or panel.

19.4.9 A spring latch, a magnetic latch, a dimple, or any other mechanical arrangement that will hold the door in place and will require some effort on the user's part to open it is considered to be a means for holding the door in place as required in 19.4.1.

19.4.10 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 by not less than 1/2 inch (12.7 mm). A construction such as a fuse enclosure located within an outer enclosure or a flange and rabbet combination which affords the equivalent protection is acceptable.

20 Mounting of Electrical Components

20.1 Except as noted in 20.2 and 20.3, a switch, an attachment-plug receptacle, a strain relief bushing, or similar component shall be secured in position and shall be restrained from turning. See 20.4.

20.2 The requirement that a switch be restrained from turning will be waived if 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 considered 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 unlikely that operation of the switch will loosen it.

c) The spacings are not reduced below the minimum required values if the switch rotates.

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

20.3 A lampholder of a type in which the lamp cannot be replaced, such as a neon pilot or indicator light in which the lamp is sealed in a nonremovable jewel, need not be prevented from turning if rotation cannot reduce spacings below the minimum acceptable values. See Spacings, Section 32.

20.4 The means for preventing rotation mentioned in 20.1 is to consist of more than friction between surfaces. A toothed lock washer that provides both spring take-up and an interference lock is acceptable as means for restaining a small stem-mounted switch or other device having a single-hole mounting means from turning.

20.5 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 will be prevented from turning or shifting in position if such motion may result in a reduction of spacings below the minimum acceptable values. See Spacings, Section 32. Friction between surfaces is not acceptable as a means to prevent shifting or turning of a live part, but a lock washer as described in 20.4 is acceptable.

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

21 Field-Installed Blower Assemblies

21.1 A fireplace accessory having provision for the use of blower assemblies to be attached in the field shall be constructed so that the use of these accessories will not introduce a risk of fire, electric shock, or contact with moving parts which may cause injury to persons.

21.2 The fireplace accessory shall comply with the requirements of this standard with or without the field-installed blower assembly installed.

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

Exception: A low-voltage accessory may be connected by other means, provided that the installation does not require rearrangement of components or wiring, cutting or splicing of existing wiring, or soldering of connections.

21.4 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.

21.5 With reference to the requirements in 21.4, any installation that requires the cutting of wiring or the soldering of connections by the installer is not acceptable. Installations that require cutting, drilling, or welding are not acceptable in electrical enclosures and in other areas where such operations may damage electrical or fireplace accessory components and wiring within the enclosure.

21.6 Strain-relief means shall be provided for the wiring in the field-installed blower assembly if stress may be transmitted to the terminal connections during installation.

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

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

21.9 All mounting brackets, supports, and fasteners required to install the blower assembly shall be provided.

21.10 As part of the investigation, the blower assembly is to be trial-installed to determine that its installation is feasible, 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 may cause injury to persons.

22 Field Supply Connections

22.1 Permanently-connected products

22.1.1 Fireplace accessories of the following types shall have provision for permanent connection to the power supply:

a) Products requiring plumbing connections unless such products are intended to be moved from one place to another in end-use, or if removal of the product does not require the disturbance of plumbing connections.

b) Products intended for duct or plenum connection.

c) Products requiring field-wired control.

22.1.2 As described in 22.1.3 – 22.1.15, field wiring terminals are to be considered as the terminals to which power supply, control, or equipment grounding connections will be made in the field when the fireplace accessory is installed as intended.

22.1.3 A blower assembly intended for permanent connection shall have provision for connection of one of the wiring systems that would be acceptable for it in accordance with the National Electrical Code, NFPA 70.

22.1.4 The location of the required terminal box or compartment in which power supply connections are to be made shall permit these connections to be inspected after the unit is installed. 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.

22.1.5 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.

22.1.6 A blower assembly shall be provided with field wiring terminals for the connection of field wiring conductors of at least the size required by the National Electrical Code, NFPA 70, corresponding to the rating of the assembly or with leads not less than 6 inches (152 mm) long except as noted in 22.1.16. It is to be assumed that branch circuit conductors rated 60°C (140°F) will be used.

22.1.7 A field wiring terminal shall be restrained from turning or shifting in position by means other than friction between surfaces. This may be 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.

22.1.8 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 may consist of pressure wire connectors, clamps or wire binding screws with cupped washers, terminal plates, or the equivalent to hold the wire in position.

22.1.9 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 may be used for the connection of one 14 AWG (2.1 mm^2) conductor, and a No. 6 (3.5 mm diameter) screw may be used for the connection of a 16 or 18 AWG (1.3 or 0.82 mm^2) control circuit conductor.

22.1.10 It should be noted that according to the National Electrical Code, NFPA 70, 14 AWG (2.1 mm^2) is the smallest conductor that the installer may use for branch circuit wiring and thus is the smallest conductor that may be anticipated at a terminal for the connection of a power supply wire.

22.1.11 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 (2.1 mm^2). In either case, there shall be not less than two full threads in the metal.

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

Exception: Two full threads are not required if a lesser number of threads results in a connection in which the threads will not strip with normal tightening torque in accordance with the values indicated in the Standard for Wire Connectors, UL 486A-486B.

22.1.13 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 washer. A conductor used for the field wiring leads shall be not smaller than 14 AWG (2.1 mm^2).

22.1.14 A wire binding screw shall thread into metal.

22.1.15 A field wiring terminal intended for the connection of a grounded conductor shall be 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 a white or gray color, shall be readily distinguishable from other leads, and no other lead shall be so identified.

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

Exception: The lead may be less than 6 inches (152 mm) long if it is evident that the use of a longer lead might result in a risk of fire or electric shock.

22.1.17 Leads intended for connection to an external circuit shall be provided with strain relief if stress on the lead may be transmitted to terminals, splices or internal wiring. See Strain Relief Test, Section 40.

22.1.18 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.

22.2 Cord-connected products

22.2.1 The marked rating of a cord-connected fireplace accessory shall not exceed 80 percent of the rating of the attachment plug.

22.2.2 A cord-connected fireplace accessory shall employ a grounding-type attachment plug that is:

a) Rated 125 volts, 15 amperes minimum;

b) Rated for the device; and

c) One of the configurations covered in the Standard for Wiring Devices – Dimensional Requirements, ANSI/NEMA WD 6.

22.2.3 A cord-connected fireplace accessory shall employ a power supply cord acceptable for at least hard usage (Type SJ or the equivalent) and the cord shall be rated for use at a voltage not less than the rated voltage of the fireplace accessory. The current rating of the cord as given in the National Electrical Code, NFPA 70, shall be not less than the marked rating of the blower assembly.

22.2.4 The length of a power supply cord measured between any point at which the cord exits the blower assembly or fireplace accessory cabinet and the attachment plug face shall be not less than 6 feet (1.8 m) nor greater than 8 feet (2.4 m).

22.2.5 The power supply cord shall be provided with strain relief means so that a stress on the cord will not be transmitted to terminals, splices, or internal wiring. If a metallic strain relief means is provided, it shall not contact uninsulated live parts or reduce spacings within the enclosure if the cord is moved inward. The cord shall not be subject to damage by moving parts if it can be moved inward. See Strain Relief Test, Section 42.

22.2.6 The edges of the entry hole for the power supply cord, including the cord entry hole in a bushing, shall be smooth and rounded without burrs, fins, or sharp edges that might damage the cord insulation. The power supply cord shall be routed to reduce the likelihood of damage to the cord insulation.

23 Grounding

23.1 General

23.1.1 A grounding means shall be provided for all equipment-containing parts that require grounding, see Bonding for Grounding, Section 26.

23.1.2 The following are considered to constitute means for grounding:

a) An equipment grounding terminal in a fireplace accessory that is intended to be permanently connected.

b) An equipment grounding conductor in the cord of a cord-connected fireplace accessory.

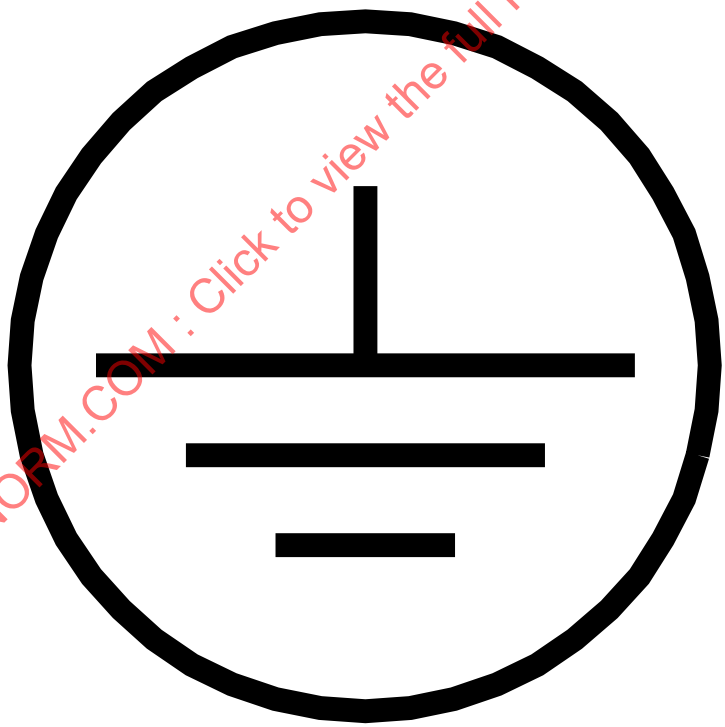
23.2 Permanently-connected products

23.2.1 The equipment grounding terminal shall be capable of securing a conductor of the size acceptable for the particular application in accordance with the National Electrical Code, NFPA 70.

23.2.2 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.

23.2.3 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 such as by being marked G, GR, GROUND, or GROUNDING, the grounding symbol illustrated in Figure 23.1, or by a marking on a wiring diagram provided on the fireplace accessory. The wire binding screw or pressure wire connector shall be secured to the frame or enclosure of the fireplace accessory and shall be located so that it is unlikely to be 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 capable of retaining the equipment grounding conductor in place.

Figure 23.1
Grounding symbol



23.2.4 If a pressure wire connector intended for grounding is located where it could be 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.

23.3 Cord-connected products

23.3.1 For a cord-connected fireplace accessory, the grounding conductor of the flexible cord shall be finished with a continuous green color or with a continuous green color with one or more yellow stripes, and no other conductor shall be so identified.

23.3.2 The grounding conductor shall be secured to the frame or enclosure of the fireplace accessory by a positive means, such as described in 26.8, that is not likely to be removed during any servicing operation not involving the power supply cord. The grounding conductor shall be connected to the grounding blade of the attachment plug.

24 Internal Wiring

24.1 General

24.1.1 For the purpose of these requirements, internal wiring is to be considered as all the interconnecting wiring beyond the wiring terminals or leads for field wiring connections, and is not to include the power supply cord even though some of it:

a) May not be completely enclosed; or

b) May be in the form of flexible cord.

24.1.2 The internal wiring of a blower assembly shall consist of wires of adequate size for the particular application when considered with respect to:

a) The temperature and voltage to which the wiring may be subjected;

b) Its exposure to oil or grease; and

c) To other conditions of service to which it may be subjected. A conductor, other than an integral part of a component, shall be not smaller than 18 AWG (0.8 mm^2).

24.1.3 There is no temperature limit applicable to a conductor (except as noted in Table 13.1) provided with beads of noncarbonizable material or the equivalent.

24.1.4 Insulated wire employed for internal wiring shall be standard building wire, fixture wire, flexible cord, or appliance wiring material adequate for the particular application as described by these requirements.

24.1.5 Wire types acceptable for internal wiring include rubber insulated conductors, such as Types RH, RHH, and RHW; and thermoplastic insulated conductors, such as Types TW, THHN, THW, THWN, and MTW.

24.1.6 Fixture wires acceptable for internal wiring include rubber insulated conductors, such as Types RFH-2, SF-2, SFF-2, FF-2, and FFH-2; and thermoplastic insulated conductors, such as Types TF, TFF, TFN, and TFFN.

24.1.7 Flexible cords acceptable for internal wiring include Types HPN, HS, HSJ, HSJO, HSO, S, SJ, SJO, SJT, SJTO, SO, ST, STO, SP-2, SP-3, SPT-2, and SPT-3.

24.1.8 Appliance wiring material having thermoplastic insulation not less than 2/64 inch (0.8 mm) thick for 18 – 10 AWG (0.82 – 5.3 mm^2), 3/64 inch (1.2 mm) thick for 8 AWG (8.3 mm^2), and 4/64 inch (1.6 mm) thick for 6 – 2 AWG (13.3 – 33.6 mm^2) is acceptable for internal wiring.

24.1.9 Appliance wiring material having rubber, neoprene, or thermoplastic insulation with properties equivalent to the jacket of Types SJ, SJO, SJTO, or SJT cord, with an insulation thickness not less than 4/64 inch (1.59 mm) for 18 – 16 AWG (0.82 – 1.31 mm^2), and 5/64 inch (1.93 mm) for 14 – 10 AWG (2.08–5.3 mm^2), is acceptable for internal wiring under the conditions described in 24.2.6.

24.1.10 Parallel-conductor appliance wiring material of the integral type shall not be ripped more than 3 inches (76 mm) unless the minimum wall thickness of the conductor insulation after ripping is at least 0.058 inch (1.47 mm) thick. If the material has conductor insulation not less than 0.028 inch (0.71 mm) after ripping and is within a separate metal enclosure, the length of rip is not limited.

24.2 Methods

24.2.1 The wiring and connections between separate sections of a blower assembly shall be protected or enclosed, except that a flexible cord may be employed for external interconnections, or for internal connections that may be exposed during servicing if flexibility of the wiring is essential for servicing.

24.2.2 Internal wiring that is exposed through an opening in the enclosure of a fireplace accessory is considered to be protected as required in 24.2.1 if, when judged as though it were film-coated wire, the wiring complies with the requirements in 19.3.1 – 19.3.5. Internal wiring within an enclosure is acceptable, even though it can be touched with the probe, if it is protected or guarded so that it cannot be grasped or hooked in a manner that would subject the wire to stress.

24.2.3 If the wiring of a blower assembly is located so that it may be in proximity to combustible material or may be subjected to mechanical damage, it shall be in metal-clad cable, rigid metal conduit, electrical metallic tubing, metal raceway, or shall otherwise be protected.

24.2.4 Except as indicated in 24.2.5 – 24.2.7, wiring in a compartment through which air to or from the heated space is circulated shall be in metal-clad cable, rigid metal conduit, flexible metal conduit, electrical metallic tubing, metal raceway, or shall otherwise be protected.

24.2.5 Lengths not exceeding 4 inches (102 mm), except as noted in 24.2.6, of unenclosed wiring of the types mentioned in 24.1.5, 24.1.6, and 24.1.8, or equivalent, may be employed if they are enclosed within the product enclosure and if they are supported to prevent damage from air movement.

24.2.6 Flexible cords, Types SJO, SJT, SJTO, SO, ST, STO, or SPT-3, or equivalent appliance wiring material, see 24.1.9, without limitation on length, may be employed when protected as described in 24.2.5.

24.2.7 Neoprene or thermoplastic insulated appliance wiring material having 1/32 inch (0.33 mm) thick minimum conductor insulation need not be provided with protective enclosures or additional insulation as indicated in 24.2.4, if all of the following conditions are met:

a) Wiring is not subject to movement by air or vibration.

b) Individual leads are bunched together to form a cable to the degree practicable.

c) Wiring is secured to fixed panels or other surfaces at frequent intervals to provide proper routing and to reduce the likelihood of hooking of slack during routine service, such as replacing air filters, oiling motors, replacing fuses, adjusting the settings of controls, and the like.

d) Wiring is located in a compartment which is provided with a complete base pan or similar bottom closure.

e) Wiring cannot be contacted through openings in the outer enclosure or cabinet when evaluated in accordance with 19.3.1 – 19.3.5.

24.2.8 Wiring shall be protected from sharp edges (including male screw threads), burrs, fins, moving parts, and other features that might abrade the insulation on conductors. Clamping means shall have smooth, rounded surfaces.

24.2.9 A hole in a sheet metal wall within the overall enclosure of a blower assembly, through which insulated wires pass, shall be provided with a smooth, rounded bushing or shall have smooth, rounded surfaces upon which the wires may bear, to prevent abrasion of the insulation. Bushings shall be fabricated from materials such as ceramic, phenolic, cold molded composition or fiber. A flexible cord used for external interconnection as mentioned in 24.2.1 shall be provided with bushings and strain relief in accordance with 24.2.11 – 24.2.14, unless the construction protects the cord from stress or motion.

24.2.10 Insulated wires may be bunched and passed through a single opening in a metal wall within the enclosure of a blower assembly.

24.2.11 Strain relief shall be provided to prevent a mechanical stress on a flexible cord from being transmitted to terminals or splices.

24.2.12 Means shall be provided to prevent the flexible cord or lead from being pushed into the enclosure through the cord-entry hole when such displacement results in:

a) Stress being transmitted to terminals, splices, or other internal wiring;

b) Live uninsulated parts being contacted;

c) Reducing the spacings within the enclosure;

d) The cord being subjected to damage from moving parts or to temperatures greater than its temperature rating, when moved inward; or

e) Subjecting the supply cord, lead, or other internal connections or components to mechanical damage.

To determine compliance, the supply cord or lead shall be tested in accordance with Section 42, Push-Back Relief Test.

24.2.13 At a point where a flexible cord passes through an opening in a wall, barrier, or enclosing case, there shall be a bushing or the equivalent secured in place, and the bushing shall have a smooth, rounded surface against which the cord may bear. The heat and moisture-resistant properties of the bushing material shall be acceptable for the particular application.

24.2.14 A smoothly rounded hole in the wall or barrier is acceptable in lieu of a separate bushing.

24.2.15 A splice or connection shall be mechanically secure. A soldered connection shall be made mechanically secure before being soldered.

24.2.16 A splice shall be located within the product enclosure. It shall be secured to a fixed member or located in a separate enclosure if it is subject to flexing, motion, or vibration due to air movement or is likely to be moved during service operations, such as replacing fuses or oiling motors.

24.2.17 A splice shall be provided with electrical insulation equivalent to that of the conductors if permanence of spacing between the splice and other metal parts is not inherent in the construction. Thermoplastic tape wrapped over the sharp ends of the wires is not acceptable.

24.2.18 The means of connecting stranded internal wiring to a wire binding screw shall prevent loose strands of wire from contacting:

a) Other live parts that are not always of the same polarity as the wire; and

b) Dead metal parts. This may be accomplished by use of pressure terminal connectors, soldering lugs, crimped eyelets, soldering all strands of the wire, or other similar means.

24.2.19 A splicing device such as a pressure-type wire connector may be employed if it complies with the Standard for Wire Connectors, UL 486A-486B.

24.2.20 A quick-connecting assembly shall form a secure electrical connection, such as by detents in the mating parts, and shall be able to carry the current involved. Securement of connections may be determined by engagement/disengagement tests as specified in the Standard for Electrical Quick-Connect Terminals, UL 310.

25 Separation of Circuits

25.1 Unless provided with insulation rated for the highest voltage involved, insulated conductors of different circuits, that is, internal wiring including wires in a wiring compartment, shall be separated from each other by barriers or shall be physically segregated, and shall be separated or segregated from uninsulated live parts connected to different circuits.

25.2 Segregation of insulated conductors may be accomplished by clamping, routing or other means to provide for separation from insulated or uninsulated live parts of a different circuit.

25.3 Field-installed conductors of any circuit shall be segregated or separated by barriers from field-installed and factory-installed conductors connected to any other circuit, unless the conductors of both circuits are insulated for the maximum voltage of either circuit.

25.4 Except at wiring terminals, field-installed conductors of a high-voltage circuit or a low-voltage circuit with Class 1 National Electrical Code, NFPA 70, wiring shall be segregated or separated by barriers:

a) From uninsulated live parts connected to a different circuit; and

b) From any uninsulated live parts of electrical components, such as a motor overload protective device, or other protective device, where short-circuiting or grounding may result in impaired operation of the fireplace accessory.

25.5 Field-installed conductors of a low-voltage circuit with Class 2 National Electrical Code, NFPA 70, wiring shall be segregated or separated by barriers as follows:

a) From uninsulated live parts connected to a high-voltage circuit,; and

b) From wiring terminals and any other uninsulated live parts of low-voltage electrical components, such as a motor overload protective device, or other protective device, where short-circuiting or grounding may result in operation of the fireplace accessory that increases the risk of fire or electric shock.

25.6 If a barrier is used to provide separation between the wiring of different circuits, it shall be of metal or of a rigid insulating material secured in place.

26 Bonding for Grounding

26.1 Exposed or accessible noncurrent-carrying metal parts that may become energized and that may be contacted by the user or by service personnel during service operations that are likely to be performed while the equipment is energized shall be electrically connected to the point of connection of an equipment ground.

26.2 Except as indicated in 26.3, uninsulated metal parts of cabinets, electrical enclosures, motor frames and mounting brackets, controller mounting brackets, capacitors and other electrical components, or the like, are to be bonded for grounding if they may be contacted by the user or service person.

26.3 The following metal parts as described below need not be grounded:

a) Adhesive-attached metal-foil markings, screws, handles, or the like, located on the outside of enclosures or cabinets and isolated from electrical components or wiring by grounded metal parts.

b) Isolated metal parts, such as magnet frames and armatures, small assembly screws, or the like, that are separated from wiring and uninsulated live parts.

c) Panels and covers that do not enclose uninsulated live parts if insulated parts and wiring are separated from the panel or cover.

d) Panels and covers that are insulated from electrical components and wiring by an attached insulating barrier of vulcanized fiber, varnished cloth, phenolic composition, or similar material not less than 1/32 inch (0.8 mm) thick.

26.4 If a component, such as a switch, is likely to become separated from its intended grounding means during testing or adjustment while the equipment is energized, it shall be provided with a grounding conductor not requiring removal for such service.

26.5 Splices shall not be employed in wire conductors used for bonding.

26.6 Metal-to-metal hinge bearing members may be considered as a means for bonding a door for grounding.

26.7 A separate bonding conductor shall be of material rated for use as an electrical conductor. Ferrous metal parts in the grounding path shall be protected against corrosion by enameling, galvanizing, plating, or equivalent means. A separate bonding conductor or strap shall:

a) Be protected from mechanical damage, such as by being located within the confines of the outer enclosure or frame, and

b) Not be secured by a removable fastener used for any purpose other than bonding for grounding, unless the bonding conductor is unlikely to be omitted after removal and replacement of the fastener.

26.8 The bonding shall be by a positive means, such as by clamping, riveting, bolted or screwed connection, or by welding, soldering, or brazing with materials having a softening or melting point greater than 454°C (850°F). The bonding connection shall penetrate nonconductive coatings, such as paint or vitreous enamel. Bonding around a resilient mount shall not depend on the clamping action of rubber or similar material, except as indicated in 26.10.

26.9 A bolted or screwed connection that incorporates a star washer or serrations under the screwhead is acceptable for penetrating nonconductive coatings where required for compliance with the requirements in 26.8.

26.10 A connection that depends upon the clamping action exerted by rubber or similar materials is acceptable if it complies with the requirements in 26.12 under any degree of compression permitted by a variable clamping device, and if the results are acceptable after exposure to the effects of oil, grease, moisture, and thermal degradation likely to occur in service. The effect of assembling and disassembling such a clamping device for maintenance purposes is to be considered with respect to the likelihood of the clamping device being reassembled in its intended position.

26.11 If bonding depends on screw threads, two or more screws or two full threads of a single screw shall engage the metal.

26.12 If the adequacy of a bonding connection cannot be determined by examination, or if a bonding conductor is smaller than required by 26.13 – 26.15, it shall be considered acceptable if the connecting means does not open while carrying for 2 minutes a current equal to twice the rating of the branch circuit overcurrent device required to protect the equipment.

26.13 The size of a conductor or strap employed to bond an electrical enclosure or motor frame shall be based on the rating of the branch circuit overcurrent device to which the equipment will be connected. Except as indicated in 26.12, the size of the conductor or strap shall be in accordance with Table 26.1.

Table 26.1
Bonding wire conductor size

Rating of overcurrent device, amperes	Size of bonding conductor[a]			
	Copper wire		Aluminum wire	
	AWG	(mm^2)	AWG	(mm^2)
15	14	(2.1)	12	(3.3)
20	12	(3.3)	10	(5.3)
30	10	(5.3)	8	(8.4)

[a] Or equivalent cross-sectional area.

26.14 A bonding conductor to a component or electrical enclosure is not required to be larger than the size of the conductors supplying power to the component or components within the enclosure.

26.15 All exposed dead metal parts that may become energized shall be electrically connected to the bonding conductor of the power supply cord(s).

26.16 The grounding conductor of a power supply cord shall be attached to the grounding blade of an attachment plug of the grounding type and shall be connected within the confines of the frame or enclosure of the blower assembly by means of a screw not likely to be removed during ordinary servicing not involving the power supply cord. The grounding conductor shall be arranged so that an external pull on the power supply cord will not transmit stress to the grounding connection on the frame or enclosure before the high-voltage connections are broken.

27 Capacitors

27.1 A motor starting or running capacitor shall be housed within an enclosure or container to reduce the risk of:

a) Mechanical damage of the plates, and

b) The emission of flame or molten material resulting from malfunctioning of the capacitor.

The container shall be of metal providing the strength and protection not less than that of uncoated steel having a thickness of 0.020 inch (0.51 mm).

Exception: The individual container of a capacitor may be of sheet metal having a thickness less than 0.020 inch (0.51 mm) or may be of material other than metal if the capacitor is mounted within the enclosure of the blower assembly or within an enclosure that houses other parts of the blower assembly.

27.2 If the container of an electrolytic capacitor is metal, the container shall be considered as a live part and shall be provided with moisture-resistant electrical insulation to isolate it from dead metal parts and to reduce the risk of a person contacting it during servicing operations. The insulating material shall be not less than 1/32 inch (0.8 mm) thick.

27.3 A capacitor employing a liquid dielectric medium more combustible than askarel shall be protected against expulsion of the dielectric medium when tested in accordance with the applicable performance requirements of this standard, including faulted overcurrent conditions based on the circuit in which it is used. See Short-Circuit Test, Section 43.

Exception: If the available fault current is limited by other components in the circuit, such as a motor start winding, the capacitor may be tested using a fault current less than the test current specified in Table 42.1, but not less than the current established by dividing the circuit voltage by the impedance of the other component(s).

28 Insulating Material

28.1 Material for the mounting of uninsulated live parts shall be porcelain, phenolic composition or like material.

28.2 Vulcanized fiber may be used for insulating bushings, washers, separators, and barriers, but not as the sole support for uninsulated live parts where shrinkage, current leakage, or warpage may introduce a risk of electric shock. Plastic materials may be acceptable for the sole support of uninsulated live parts if found to have adequate mechanical strength and rigidity, resistance to heat, resistance to flame propagation, dielectric withstand, and other factors involved with conditions of actual service. All of these factors are to be considered with respect to thermal aging.

29 Motors and Motor Overcurrent (Overload) Protection

29.1 All motors shall be protected by self-impedance, an integral thermal protector, overcurrent protective devices, or by combinations thereof.

29.2 Overcurrent protective devices as referred to in 29.1 are to be considered as those complying with the requirements in the National Electrical Code, NFPA 70, as follows:

a) A separate overcurrent device responsive to motor current and rated or selected to trip at no more than the following percent of the motor full-load current rating:

1) Motors with a marked service factor not less than 1.15 – 125 percent

2) Motors with a marked temperature rise not over 40°C – 125 percent

3) All other motors – 115 percent

Each winding of a multispeed motor is to be considered separately and the motor is to be protected at all speeds.

b) If the values specified for motor running overcurrent protection do not correspond to the standard sizes or ratings of fuses or magnetic or thermal overload protective devices, the next higher size of rating may be used, but not higher than the following percent of motor full-load current rating:

1) Motors with a marked service factor not less than 1.15 – 140 percent

2) Motors with a marked temperature rise not over 40°C – 140 percent

3) All other motors – 130 percent

29.3 An integral thermal protective device shall comply with the Standard for Thermally Protected Motors, UL 1004-3.

29.4 Separate overcurrent devices, except when included as part of a magnetic motor controller, shall be assembled as part of the blower assembly, and shall be readily identifiable as such after assembly to the fireplace accessory. Such protection shall not include means for manually interrupting the motor circuit if such interruption may allow operation of the blower assembly that increases the risk of fire or electric shock.

29.5 Motors, such as direct-drive fan motors, that are not normally subjected to overloads and that are determined to be protected against overheating due to locked-rotor current by a thermal or overcurrent protective device are acceptable provided it is determined that the motor will not overheat under conditions of intended use.

29.6 Impedance protected motors shall comply with the Standard for Impedance Protected Motors, UL 1004-2.

29.7 Fuses shall not be used as motor overload protective devices unless the motor is acceptably protected by the largest size fuse which can be inserted in the fuseholder.

29.8 A fan or blower motor shall be constructed for continuous duty.

29.9 Motors having openings in the enclosure or frame shall be installed or shielded to reduce the risk of particles falling out of the motor onto combustible material located within or under the assembly.

29.10 The requirement in 29.9 will necessitate the use of a barrier of noncombustible material under an open type motor unless one of the following apply:

a) The structural parts of the motor of the blower assembly, such as the bottom closure, provide the equivalent of such a barrier.

b) The motor overload protection device provided with a single-phase motor is such that no burning insulation or molten material falls to the surface that supports the blower assembly when the motor is energized under each of the following fault conditions, as applicable to the particular type of motor:

1) Open main winding;

2) Open starting winding;

3) Starting switch short-circuited; and

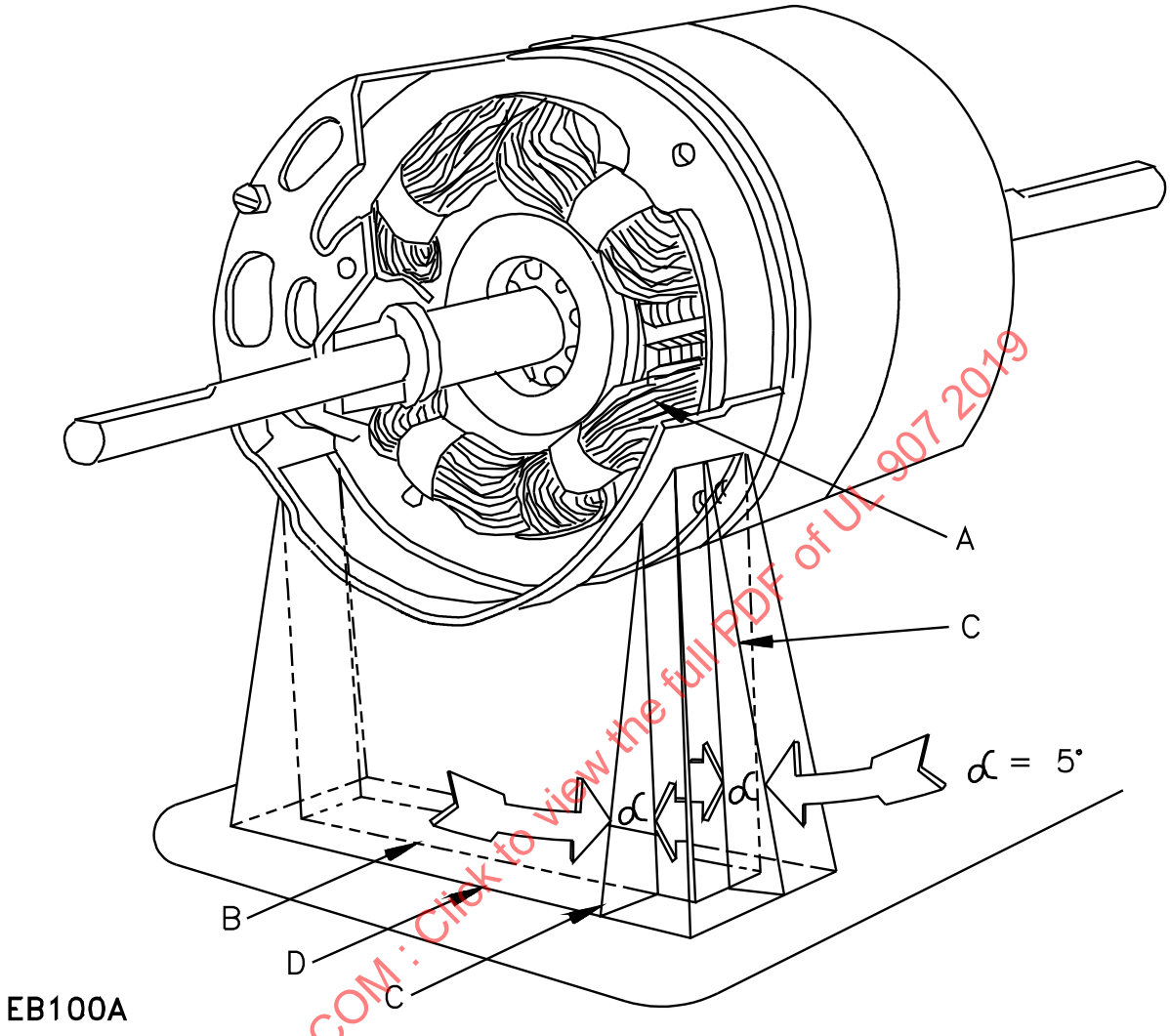
4) Capacitor shorted, permanent split capacitor type motor.

c) The motor is provided with a thermal motor protector (a protective device that is sensitive to temperature and current) that will prevent the temperature of the motor windings from becoming higher than 125°C (257°F) under the maximum load under which the motor will run without causing the protector to cycle and from becoming higher than 150°C (302°F) with the rotor of the motor locked. See Stalled Motor Test, Section 33.

d) The motor complies with the requirements for impedance-protected motors, and the temperature of the motor winding does not exceed 150°C during the first 72 hours of operation with the rotor of the motor locked. See Stalled Motor Test, Section 33.

29.11 The barrier mentioned in 29.10 shall be horizontal, shall be located as indicated in Figure 29.1, and shall have an area not less than that described in that illustration. Openings for drainage, ventilation, and the like, may be employed in the barrier, provided that such openings do not permit molten metal, burning insulation, or the like, to fall on combustible material.

Figure 29.1
Location and extent of barrier



A – Motor winding to be shielded by barrier. This is to consist of the entire motor winding if it is not otherwise shielded, and is to consist of the unshielded portion of a motor winding which is partially shielded by the motor enclosure or equivalent.

B – Projection of outline of motor winding on horizontal plane.

C – Inclined line which traces out minimum area of the barrier. When moving, the line is to be always:

1) Tangent to the motor winding;

2) 5 degrees from the vertical; and

3) So oriented that the are traced out on a horizontal plane is maximum.

D – Location (horizontal) and minimum area for barrier. The area is to be that included inside the line of intersection traced out by the inclined line C and the horizontal plane of the barrier.

30 Switches and Controllers

30.1 A switch or controller shall have a current, frequency, and voltage rating not less than that of the load that it controls when the blower is operated while connected to a supply circuit of rated voltage. The effects of the output waveform of motor speed controllers shall not cause harmful effects on the motor during all conditions of intended and unintended motor operation.

30.2 A switch subjected to a temperature higher than 65°C (149°F) is to be evaluated with respect to the temperature limitations of the materials employed.

30.3 If a blower assembly is intended to be connected to the conductor identified as the grounded conductor of a power supply circuit, a lampholder with a screw shell base shall be wired so that the screw shell will be connected to that conductor.

30.4 A plug fuseholder in a blower assembly intended to be connected to a 120 volt or 120/240 volt, three-wire circuit shall be wired in an ungrounded conductor with the screw shell connected towards the load.

30.5 A single-pole switching device shall not be connected to the grounded conductor.

30.6 A switch shall be located or protected so that it will not be subjected to mechanical damage from items such as logs and the like.

30.7 When a switching device having a marked ″off″ position or equivalent is open, the device shall disconnect all ungrounded conductors of the power supply circuit.

31 Transformers

31.1 A power transformer shall have a secondary rating not less than the connected load, except the load may be greater than the marked rating if the temperature of the transformer does not exceed the maximum acceptable temperature during the Temperature Test – Electrical Components, Section 36.

31.2 A power transformer that supplies a motor load shall not cause a risk of fire if the motor locks or fails to start. A power transformer is considered to comply with this requirement if the primary circuit is protected by an overcurrent device rated or set at not more than 250 percent of the full-load primary current of the transformer.

31.3 A transformer that furnishes power to a low-voltage circuit shall be of the two-coil insulated type.

32 Spacings

32.1 The spacing between field wiring terminals of opposite polarity, and between a wiring terminal and any other uninsulated metal part (dead or live) not of the same polarity, shall be not less than that specified in Table 32.1. See 22.1.2. See Figure 32.1.

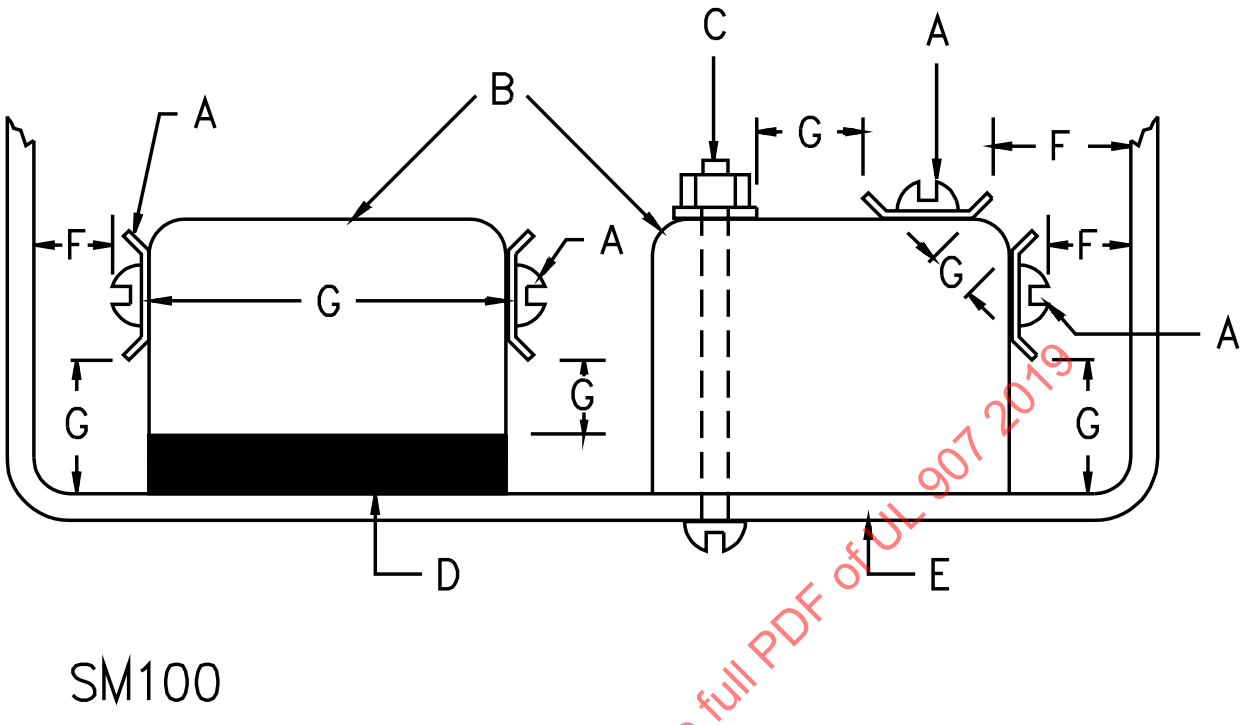
Exception: The spacing requirements in Table 32.1 do not apply to the inherent spacings of a component of a blower assembly, such as a switch. Such spacings shall comply with the requirements for the component in question.

Table 32.1
Minimum acceptable spacings at field-wiring terminals

Potential involved, volts	Minimum spacings, inch (mm)		
	Between field-wiring terminals, through air or over surface	Between field-wiring terminals and other uninsulated metal parts not always of the same polarity[a]	
		Over surface	Through air
250 or less	1/4 (6.4)	1/4 (6.4)	1/4 (6.4)

[a] Applies to the sum of the spacings involved where an isolated dead part is interposed.

Figure 32.1
Component spacings



A – Uninsulated live parts of a component.

B – Insulating material of a component.

C – Mounting screw of a component.

D – Dead metal part of a component.

E – Dead metal parts of the product.

F – Spacings to which the requirements of this standard apply unless specifically noted otherwise.

G – Spacings to which the requirements of this standard do not apply.

32.2 Spacings other than at field-wiring terminals, between uninsulated live parts of opposite polarity, and between an uninsulated live part and a dead metal part, shall be not less than the value specified in Table 32.2. If an uninsulated live part is not rigidly fixed in position by means other than friction between surfaces, or if a movable dead metal part is in proximity to an uninsulated live part, the construction shall maintain the minimum required spacing.

Exception: The spacing requirements in Table 32.2 do not apply to the inherent spacings of a component of a blower assembly, such as a switch. Such spacings are to comply with the requirements for the component in question.

Table 32.2
Minimum acceptable spacings at other than field-wiring terminals

Potential involved, volts	Minimum spacings, inch[a]			
	An appliance employing a motor having a diameter of 7 inches or less[b]		An appliance employing a motor having a diameter of more than 7 inches[b]	
	Over surface	Through air	Over surface	Through air
0 – 125	3/32[c]	3/32[c]	1/4[d]	1/8[d]
126 – 250	3/32	3/32	1/4[d]	1/4[d]

[a] Metric equivalents of the dimensions in this table are:

Inches	Millimeter
1/16	(1.6)
3/32	(2.4)
1/8	(3.2)
1/4	(6.4)
3/8	(9.5)
1/2	(12.7)
7	(178)

[b] This is the diameter, measured in the plane of the laminations, of the circle circumscribing the stator frame, excluding lugs, fins, boxes, and the like, used solely for motor mounting, cooling, assembly, or connection.

[c] For an appliance employing only motors rated 1/3 horsepower or less, these spacings may be not less than 1/16 inch (1.6 mm).

[d] Film-coated wire is considered to be an uninsulated live part. However, a spacing of not less than 3/32 inch (2.4 mm) over surface and through air between film-coated wire, rigidly supported and held in place on a coil, and a dead metal part is acceptable.

32.3 An uninsulated rotor conductor or a rotor circuit is to be considered as a dead metal part with respect to the stator circuit, and the applicable minimum spacing shall be provided between uninsulated stator and rotor conductors.

32.4 In the application of 32.2 and 37.1 and Table 32.2 to a blower assembly employing a motor not rated in horsepower, the appropriate table of the National Electrical Code, NFPA 70, is to be used to determine the relationships between horsepower and full-load current for motors.

32.5 At terminal screws and studs to which connections may be made in the field by wire connectors, eyelets, and the like, spacings shall be not less than those specified in Table 32.2 with the connectors, eyelets, and the like, in such position that minimum spacings are created between parts of opposite polarity and to dead metal.