

UL 1482

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Solid-Fuel Type Room Heaters





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February 16, 1996

Standard for

Solid-Fuel Type Room Heaters

UL 1482, Fifth Edition

Accompanying this transmittal notice is a copy of the Fifth edition of UL 1482.

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FOREWORD

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

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

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

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

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

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

INTRODUCTION

1 Scope

1.1 These requirements cover room heaters which are freestanding fire chamber assemblies of the circulating or direct radiation type. These products are for attachment to a residential type chimney intended for use with low-heat appliances and shall be used to burn solid fuels specified by the manufacturer. These products shall be manually or thermostatically controlled.

1.2 Room heaters 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 BOCA National Mechanical Code, the Standard Mechanical Code, and the Uniform Mechanical Code.

1.3 Room heaters intended for use in mobile homes are to be installed in accordance with the Mobile Home Construction and Safety Standards published by the Department of Housing and Urban Development (HUD).

1.4 The product shall include:

- a) A field-installed cord-connected or permanently-connected blower assembly; and
- b) Other field-installed electrical accessories, rated at 250 volts or less, and intended to be employed in locations in accordance with the National Electrical Code, NFPA 70.

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

2 General

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 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 recognized rating established for the intended conditions of use.

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

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

2.6 The term "product" as used in these requirements refers to all room heaters or any part thereof covered by these requirements unless specifically noted otherwise.

3 Glossary

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

3.2 CHIMNEY CONNECTOR – The flue pipe that connects a fuel-burning appliance to a chimney.

3.3 COMBUSTIBLE MATERIAL AND NONCOMBUSTIBLE MATERIAL – As used in this standard, these terms are defined in the Standard Glossary of Terms Relating to Chimneys, Vents, and Heat-Producing Appliances, NFPA 97M-1988.

3.4 DAMPER – A valve or plate that regulates draft or flow of flue gases or inlet combustion air. The damper shall be either manually or automatically operated.

3.5 GRATE – A frame for supporting the fuel within a room heater.

3.6 HEARTH – The floor area within the fire chamber of a room heater.

3.7 FLOOR PROTECTOR (STOVE MAT) – The noncombustible material applied to the combustible floor area located beneath the product and extending beyond the front and sides and to the rear of the product. The area is to be of the dimensions specified in the installation instructions.

3.8 ROOM HEATER, SOLID FUEL TYPE – A chimney-connected solid fuel burning room heater that is designed to be operated with the fire chamber closed.

ALL ROOM HEATERS

CONSTRUCTION

4 Materials

4.1 A room heater and a chimney connector, when provided, shall be made of noncombustible corrosion-resistant materials. Metals shall not be used in combinations that cause galvanic action at any location within the assembly.

4.2 The minimum thickness of metal, including any coatings, shall comply with Table 4.1.

Exception: Decorative metal parts are not required to comply with Table 4.1.

Table 4.1
Minimum metal thickness

	Inch	(mm)
Aluminum-coated steel Type T1-40 regular [0.40 oz per sq ft (0.12 kg/m ²)]	0.018	0.46
Aluminum alloys	0.016	0.41
Cast iron	0.125	3.17
Galvanized steel (G60 coating class)	0.018	0.45
Porcelain-enameled steel	0.032	0.81
Stainless steel	0.012	0.030
Steel (uncoated or painted)	0.042	1.07

4.3 Aluminum 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.

4.4 The fire chamber of the room heater, and other parts in contact with flue gases that are visible after installation, shall be of material having the durability and resistance to fire and heat equivalent to fireclay tile, Series 300 or 400 stainless steel, aluminum-coated steel, cast iron, or 0.042 inch (1.07 mm) thick unprotected or painted steel.

4.5 Cast iron and unprotected and painted sheet steel complying with the requirements of footnotes k and l of Table 9.1 comply with the requirements of 4.4.

4.6 Parts that are in contact with flue gases and that are not visible after installation shall be of a material having the durability and resistance to corrosion, fire, and heat equivalent to fireclay tile or Series 300 or 400 stainless steel.

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

4.8 Thermal insulation shall comply with the following conditions when the room heater 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) Insulating material shall remain in the intended position.
- c) Thermal conductivity of the insulation shall not increase.
- d) The insulation shall not show evidence of softening, melting, or deterioration.

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

4.10 Thermal insulation that is not self-supporting shall be applied to solid surfaces so that the insulation does not sag. An adhesive or cement used to attach such material shall retain its adhesive qualities at any temperature the adhesive attains when tested in accordance with these requirements and at 0°F (minus 17.8°C).

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

4.12 The combustion air duct system (when applicable) shall be made of sheet metal not less than 0.016 inch (0.41 mm) thick. See 5.9.1 and 5.9.2.

Exception: Thinner materials classified as Class 0 or Class 1 air ducts, as defined in the Standard for the Installation of Warm Air Heating and Air Conditioning Systems, NFPA 90B-1984, and in the requirements in the Standard for Factory-Made Air Ducts and Air Connectors, UL 181, shall not be used unless:

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

4.13 Asbestos material shall not be used.

5 Assembly

5.1 General

5.1.1 A room heater 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.

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

5.1.3 Each part or assembly shall be constructed for 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 shall not be provided unless means are furnished for joining any altered part to a companion part or assembly. All fasteners required to complete the assembly shall be provided with the product by the manufacturer. Drilling shall not occur unless:

- a) The drilling operation does not weaken the assembly or drill into the fire chamber; and*
- b) The size of the required drill bit is specified and the instructions clearly describe the locations to be drilled, such as by the use of templates, drawings, or descriptions.*

5.1.4 Insulating materials shall be an integral part of the assembly when required to protect combustible parts of the building when the room heater is installed in accordance with the manufacturer's instructions.

Exception: Fire chamber materials shall be packaged and shipped with the heater when:

- a) The installation instructions provide for a description of method of placement of this material; and*
- b) The heater is marked with an adhesive-backed warning marking indicating that the material is to be installed before firing.*

5.1.5 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 requiring alteration or alignment and only in the correct relationship with each other; or
- b) Assembled and shipped from the factory as one element.

5.1.6 Parts of a room heater, such as support legs, chimney, chimney connector parts, and similar materials, that are required to limit temperatures on adjacent construction shall be factory-attached, or shall comply with all of the following:

- a) The parts shall be:
 - 1) Shipped with the room heater; or
 - 2) 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 heater 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.
- b) Assembly of the parts shall comply with the requirements of 5.1.3.
- c) The installation instructions shall define and illustrate the intended assembly of the parts.

5.1.7 The room heater shall have no edges, corners, or projections presenting a risk of a cut or puncture-type injury to persons.

5.2 Flue damper

5.2.1 A flue gas outlet damper operated through a linkage or other mechanism shall be constructed so that breakage of a part does not result in the damper partially or completely closing.

5.3 Flue collar

5.3.1 A flue collar shall be made of material not thinner than that required for the fire chamber, and shall provide for attachment and fastening of the chimney connector by at least two screws or other equivalent mechanical methods.

5.3.2 A flue collar shall be of a nominal whole-inch (mm) size diameter of 6 inches (152 mm) or greater or the heater shall be provided with an increasing adaptor to fit to the next larger whole-inch size diameter of 6 inches or greater.

5.4 Radiation shield and baffle

5.4.1 A radiation shield or a 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.

5.5 Thermostatic control

5.5.1 A thermostatically controlled air inlet damper shall be constructed so that breakage or malfunction of a part results in the combustion air inlet closing.

5.5.2 When the mechanism of the thermostat control is not accessible (see 9.12), and the thermostatic control is relied upon to limit maximum temperatures, the thermostatic control shall comply with the *Standard for Limit Controls*, UL 353.

5.6 Grate

5.6.1 A heater that is intended to burn coal only or both coal and wood shall have an integral grate constructed for burning coal.

Exception: A detachable grate constructed for burning coal shall not be provided and shipped separately unless the assembly complies with the requirements in 5.1.6.

5.7 Separable handle

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

5.7.2 Storage means shall be provided on the device for separable handles so that when the handle is stored as intended, during the Radiant Fire Test, Section 10 and Brand Fire Test, Section 11, the temperatures on the separable handle do not exceed the temperature limits shown in (f) of Table 9.1.

5.8 Barometric draft regulator

5.8.1 A barometric draft regulator used in conjunction with the flue of a room heater shall comply with the *Standard for Draft Equipment*, UL 378. It shall be adjusted and set at the heater manufacturer's factory to the maximum draft specified on the heater and shall be shipped with the product.

5.9 Combustion air duct system

5.9.1 The air inlet shall permit zero clearance to combustible construction.

5.9.2 The air inlet shall prevent material from dropping into the inlet or into the area beneath the dwelling, and also prevent rodents from entering from the outside [a wire mesh having openings not larger than 1/4 by 1/4 inch (6.4 by 6.4 mm) meets the intent of the requirement].

PERFORMANCE

6 General

6.1 When a room heater is tested in accordance with these requirements, temperatures on combustible construction adjoining the room heater, chimney connector, and floor area shall be maintained within the limits specified.

6.2 The draft created by the product during its intended operation shall not result in the spillage of the products of combustion from the product into the area served by the device.

6.3 After being tested in accordance with these requirements, the product shall be capable of being further used. After completion of the fire tests, the heater is to be allowed to cool to room temperature and then subjected to the Mechanical Tests, Section 15.

6.4 Results that verify compliance with the requirements of 6.3 include the following:

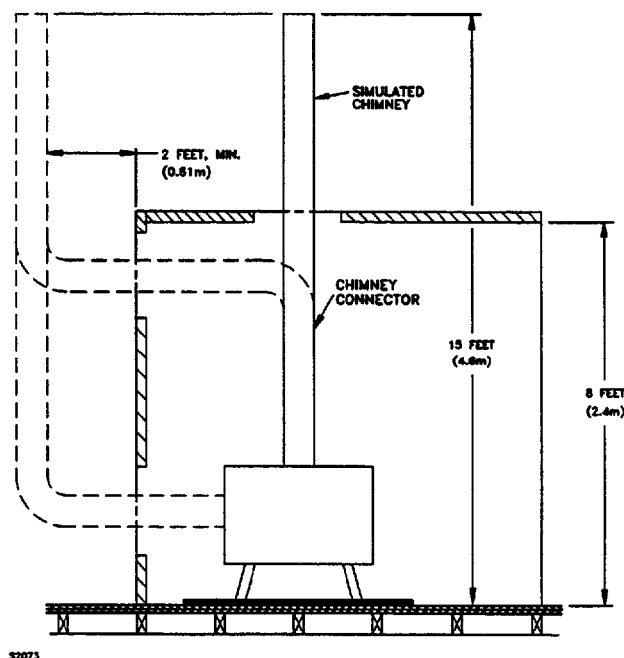
- a) No part has become damaged or permanently distorted so that it ceases to function as intended.
- b) Other than paint or porcelain enamel not intended to be a protective coating, the effectiveness of any required protective coating or finish on metal parts has not been impaired.
- c) A ceramic or refractory material does not show evidence of cracking, disintegration, or spalling to an extent that impairs the serviceability of the part or the assembly.
- d) Cracks are not observable in porcelain enamel used as required protective coating, see 5.1.4, when the surface is examined under a microscope of 60 magnification.
- e) The reflectivity of a surface has not been impaired when the reflectivity of such surface is employed to reduce the risk of fire.
- f) The effectiveness of insulating material has not been reduced.

7 Test Installation

7.1 Tests are to be conducted as described in 7.2 – 7.16 on each type of room heater. When the heater is manufactured in more than one size, tests are to be conducted on as many sizes as required to determine compliance with the requirements in 7.2 – 7.16.

7.2 The room heater to be tested is to be installed in a structure similar to that illustrated by Figure 7.1, constructed to accommodate the product as it is to be tested.

Figure 7.1
General form of test structure



7.3 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 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 shall not increase more than 20°F (11°C) above the value recorded at the beginning of the test.

7.4 The temperature of the room and the entire test structure within the room shall be between 60 and 90°F (15.6 and 32.2°C) at the beginning of the Radiant and Brand Fire Tests, Sections 10 and 11.

7.5 Ventilating, combustion, or cooling air openings into the room heater are to be sealed unless:

- a) The openings are more than 1-1/2 inches (40 mm) above the floor and are otherwise arranged to prevent unintentional closure.
- b) The openings are not capable of being blocked by the user to overcome a nuisance, such as downdrafts, a cold room, or an overheated room; and
- c) The air is drawn from the room in which the room heater is installed and is discharged into the same room or into the flue-gas passageway below the damper, or the air is drawn into the heater through the chimney at the cap which is an integral part of the heater assembly and discharged into the flue-gas passageway below the damper or separate discharge passageway of the chimney.

7.6 That part of the test structure representing the living-space area in which the room heater is to be installed is to consist of a back wall, one side wall, a ceiling, and a floor. See Figure 7.1.

7.7 The combustible floor below the room heater is to consist of two layers of 3/4 inch (19 mm) thick plywood over trade size 2- by 4-inch [nominal 1-1/2 by 3-1/2 inch (38- by 89-mm)] floor supports placed on 16 inch (405 mm) centers.

7.8 The floor under the room heater is to extend at least 4 feet (1.2 m) in front of the heater opening. The side wall is to be placed perpendicular to the back wall. The floor and walls are to extend at least 4 feet beyond the room heater.

7.9 The side, back walls, and ceiling are each to consist of one thickness of 3/4 inch (19 mm) thick plywood.

7.10 The test structure is to include a 3/4 inch (19 mm) thick plywood ceiling located 8 feet (2.4 m) above the floor and extending not less than 4 feet (1.2 m) beyond the room heater. The chimney connector is to connect to the simulated chimney at the ceiling or wall. Where the chimney pierces the ceiling or wall, an opening having a diameter 8 inches (205 mm) larger than the diameter of the chimney is to be cut and the chimney centered in the opening. The ring thus formed is to be sealed with gypsum wallboard or equivalent mineral board material at least 3/8 inch (9.5 mm) thick, placed on the exterior surface of the ceiling. The joint between the chimney connector and the ring shall not have a through opening (total eccentricity) greater than 1/8 inch (3.2 mm) wide. Temperatures on the surfaces surrounding the chimney connector are to be determined at points located 2 inches (50 mm) from the outer edge of the ring.

7.11 The room heater and chimney connector is to be installed in the test structure at the minimum clearances specified by the installation instructions. Legs or other support members are to be adjusted to position the room heater at the minimum allowable distance above the floor. For a room heater with a horizontal flue outlet at its rear, the installation that provides the specified clearance to the chimney connector or the back of the room heater determines the minimum clearance specified for its test installation.

7.12 The area to be covered by the floor protector is to be as specified in the installation instructions.

Exception: The unit is to be tested without a floor protector at the manufacturer's request, and the installation instructions shall describe the floor protector to be used in the final installation.

7.13 The room heater is to be connected to a simulated chimney by:

- a) A black or blued-steel chimney connector pipe of the same nominal diameter as the collar or adaptor provided on the room heater; or
- b) The chimney connector provided as part of the heater.

The thickness shall be 0.023 – 0.028 inch (0.58 – 0.71 mm). The chimney connector is to be run vertically or horizontally, or both, to the chimney at the clearances specified by the installation instructions.

7.14 The simulated chimney is to consist of black or blued-steel pipe of the same size as the chimney connector, and shall have a thickness of 0.023 – 0.028 inch (0.58 – 0.71 mm). The chimney is to originate at the point where the chimney connector exits the test structure and is to terminate 15 feet (4.6 m) above the floor of the test structure.

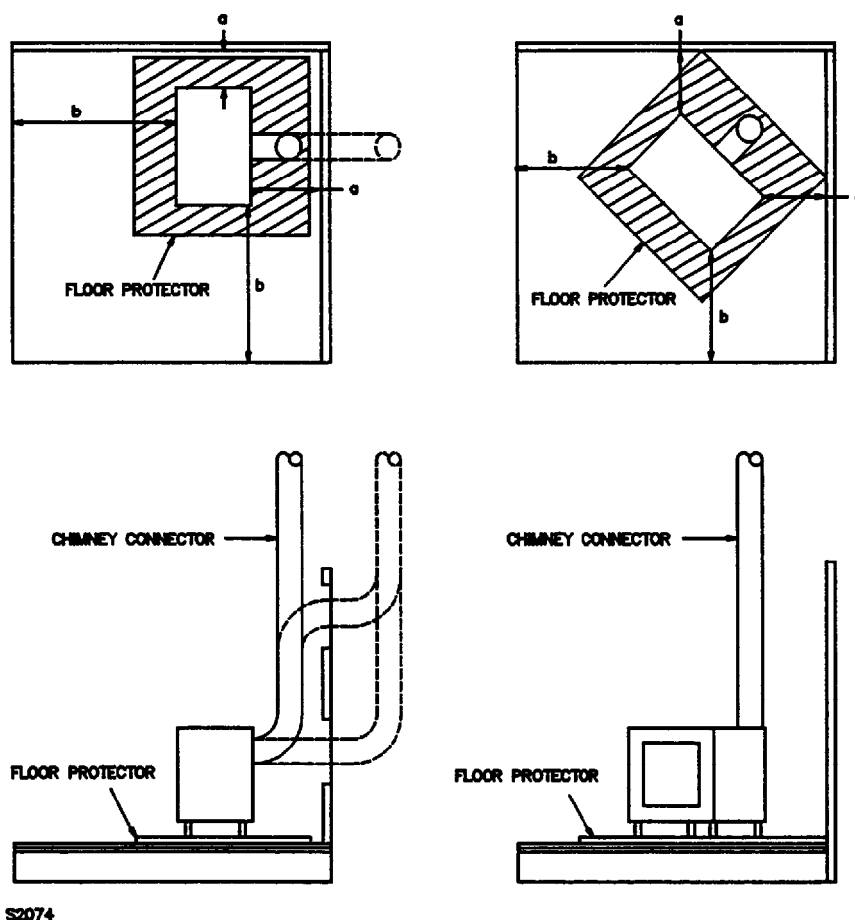
Exception: In lieu of the simulated chimney, and at the option of the manufacturer, the room heater is to be tested with a factory-built chimney and ceiling support specified by the manufacturer, when:

- a) *The chimney complies with the Standard for Factory-Built Chimneys for Residential Type and Building Heating Appliances, UL 103, and*
- b) *Both the installation instructions and marking on the product specify the chimney with which the room heater is to be used.*

7.15 The room heater is to be installed and tested with the feed door opening either parallel or perpendicular to the rear wall of the test structure or in a corner when such installation produces higher temperatures on the test structure. See Figure 7.2.

7.16 All wall, floor, and ceiling surfaces of the test structure are to be painted flat black.

Figure 7.2
Typical fire test installations



S2074

8 Temperature Measurement

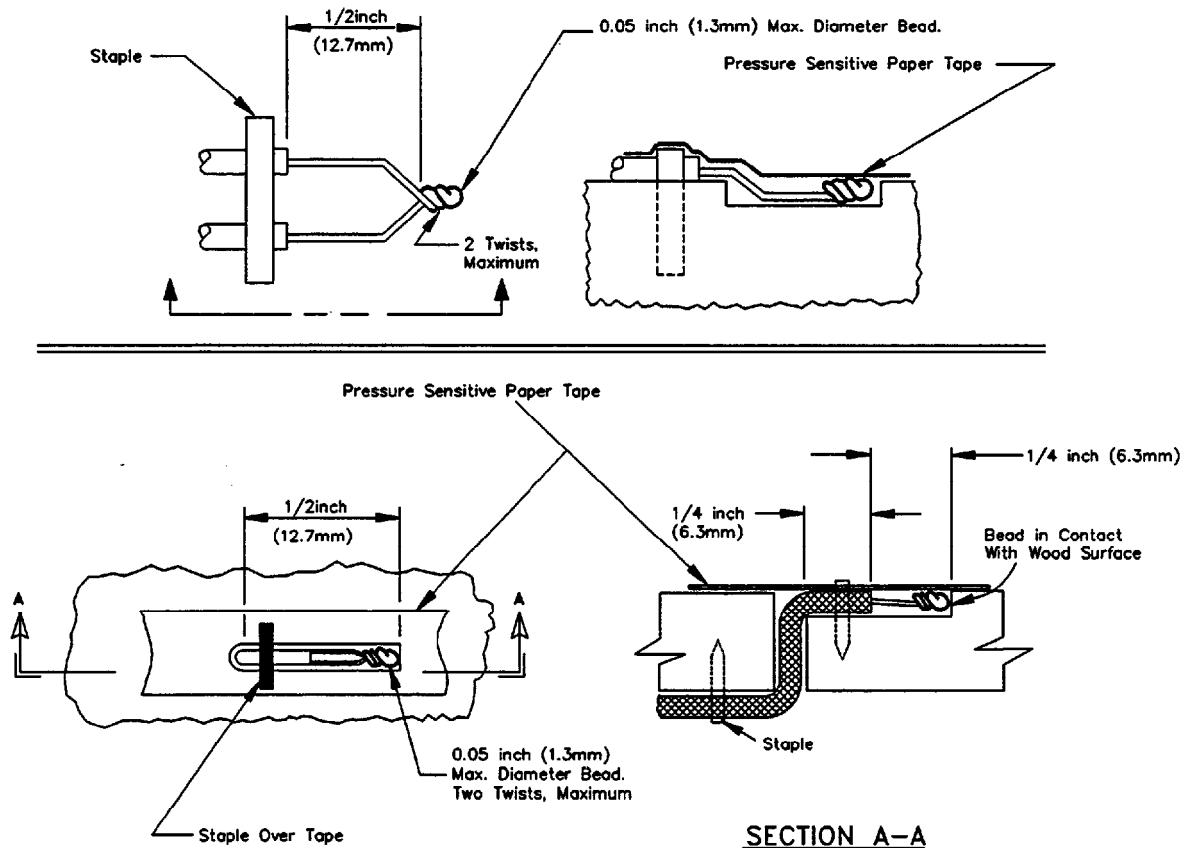
8.1 During all tests the inlet flue-gas temperature to the simulated chimney section is to be determined by a thermocouple, such as illustrated by Figure 8.1. The thermocouple is to be a Type K (chromel-alumel) of No. 24 AWG (0.21 mm²) to No. 18 AWG (0.82 mm²) wire, and with an untwisted welded bare lead junction not more than 0.050 inch (1.27 mm) in diameter. The thermocouple is to be positioned in the center line of the chimney connector, 6 inches (152 mm) below the connection to the simulated chimney.

8.2 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 No. 24 AWG (0.21 mm²).

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

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

Figure 8.1
Flue-gas thermocouple and support bracket



S2256

8.5 The ambient temperature is to be determined by using a thermocouple that is shielded by being located centrally within a vertically oriented 6 inch (152 mm) length of aluminum-painted 2 inch (50 mm) steel pipe complying with the Standard for Welded and Seamless Wrought Steel Pipe, ANSI B36.10-1979, open at both ends.

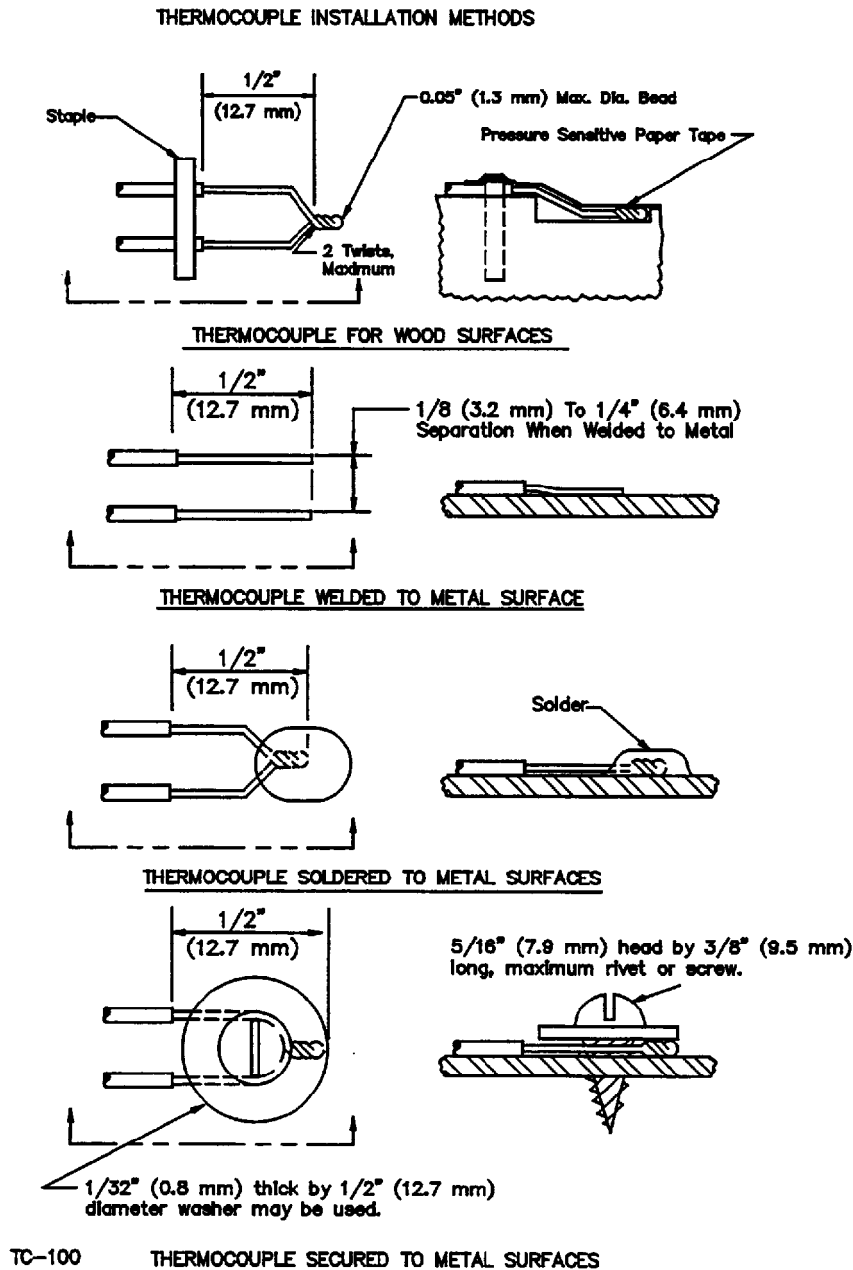
8.6 The shielded thermocouple described in 8.5 is to be located 6 inches (152 mm) away from the side wall, 4 feet (1.2 m) above the floor, and a distance in front of the unit that is equal to at least the minimum clearance of the unit from the back wall (as specified by the manufacturer) and not less than 7 feet (2.1 m) from the back wall.

8.7 When a room heater is intended to take combustion or cooling air from the outside of a building, the ambient temperature of the space outside of the test structure, and within the test room, is to be measured by means of a shielded thermocouple located on the same horizontal plane as the opening provided for the admission of outside combustion or cooling air and 3 feet (0.9 m) from the opening. This temperature is to be maintained between 60 and 90°F (16 and 32.2°C) during all temperature tests.

8.8 The measurement of temperature rises on the room heater and chimney connector parts and on the test structure is to be referenced to the recorded ambient temperatures measured as described in 8.6.

8.9 Thermocouples are to be attached to metal surfaces by screws, rivets, or by silver soldering, brazing or welding of the tip to the metal surface as illustrated by Figure 8.2.

Figure 8.2
Thermocouple installation methods



8.10 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. See Figure 8.2.

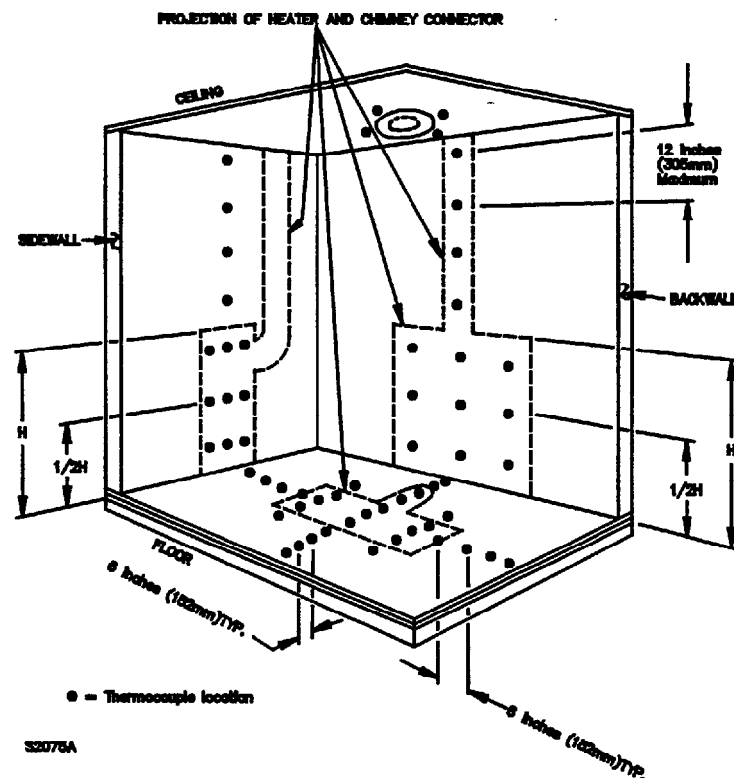
8.11 Thermocouples are to be attached to cement-like material surfaces by having the 1/2 inch (12.7 mm) tip and at least 1 inch (25.4 mm) of the lead wires embedded into the material so as to be flush with the surface of the material. Furnace cement is to be smoothed over such indentations to maintain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

8.12 Thermocouples are to be attached to surfaces and electrical components, other than those described in 8.9 – 8.11, by being cemented or taped to the surface in a manner to maintain thermal contact with the surface. Materials and parts whose temperatures are to be measured are included in Table 9.1. Temperatures on electrical conductors are to be measured on the surfaces of the conductor insulation.

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

8.14 Thermocouples are to be placed on surfaces of the test structure at various locations as required to measure maximum temperatures during tests. A minimum number of typical thermocouple locations are shown in Figure 8.3.

Figure 8.3
Typical thermocouple locations, walls and floor of test structure



8.15 When test enclosure elements are in contact with the room heater or chimney connector parts, thermocouples are to be placed on the heater or on chimney part surfaces at representative points of contact.

Exception: When 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 of the point or line contact.

8.16 Thermocouples are to be placed between the floor protector and the plywood flooring. Additional thermocouples are to be attached to the plywood flooring beyond the floor protector as shown in Figure 8.3.

8.17 Thermocouples are to be attached to the room heater and chimney connector at various locations as required to measure maximum temperatures during the tests. A minimum number of locations include the following:

- a) Hearth and refractory material.
- b) Fire chamber – Bottom, sides, back, front, and top.
- c) Flue collar.
- d) Feed and ash doors.
- e) Outer cabinet – Bottom, sides, back, front, and top.
- f) Door and control handles or knobs.
- g) Legs or support stands.

9 Fire Tests

9.1 A room heater intended to burn wood shall comply with the requirements of the Radiant Fire Test, Section 10; Brand Fire Test, Section 11; and Flash Fire Test, Section 12. A room heater that incorporates an integral grate shall be tested with the grate installed in its intended location during these tests.

9.2 A room heater intended to burn coal shall comply with the requirements of the Fire Tests for Coal Heaters, Section 13.

9.3 When a room heater intended to burn wood does not incorporate a grate, the Radiant Fire Test, Section 10, is to be conducted using a basket grate (see 10.1 – 10.4) and the Brand Fire Test, Section 11, and Flash Fire Test, Section 12, are to be conducted using andirons (see 11.1).

9.4 When a room heater is intended to be used with wood only, the Brand Fire Test, Section 11, and Flash Fire Test, Section 12, are to be conducted with the brands on the hearth when the unit bears the visible marking, "DO NOT USE GRATE OR ELEVATE FIRE – BUILD WOOD FIRE DIRECTLY ON HEARTH."

9.5 The surface temperature on the largest amount of material employed in a handle or knob for use on a room heater shall not exceed the temperature specified in Table 9.1 during the Radiant and Brand Fire Tests, Sections 10 and 11.

Exception: The temperature limitation does not apply to knobs used for adjusting combustion air inlets or damper handles that do not require adjustment during operation.

Table 9.1
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 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
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

(Continued)

Table 9.1 (Cont'd)
Maximum temperature rises

Materials and components	Column 1		Column 2	
	Degrees		Degrees	
	C	F	C	F
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
Resistance method	85	153	115	207
b. Class 130 insulation systems				
Thermocouple method	85	153	140	252
Resistance method	105	189	140	252
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
80°C rating	55	99	70	126
90°C rating	65	117	80	144
105°C rating	80	144	95	171
200°C rating	175	315	200	360
250°C rating	225	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			See note ^e	

(Continued)

Table 9.1 (Cont'd)
Maximum temperature rises

Materials and components	Column 1		Column 2	
	Degrees		Degrees	
	C	F	C	F
D. ELECTRICAL INSULATION – GENERAL^{f,m}				
1. Class C electrical insulation material			Not specified	
2. Class (180) electrical insulation material			As determined by test	
3. Fiber used as electrical insulation or cord bushings	65	117	90	162
4. Phenolic composition used as electrical insulation or as parts where malfunction results in a risk of fire or electric shock	125	225	150	270
5. Thermoplastic material			25°C or 77°F less than its temperature rating	
6. Varnished cloth insulation	60	108	85	153
E. METALS^g				
1. Aluminum alloys –				
a. 1100 (2S)	183	330	239	430
b. 3003 (3S)	239	430	294	530
c. 2014, 2017, 2024, 5052 ^h	294	530	350	630
2. Aluminum-coated steel, heat-resistant type ⁱ	572	1030	708	1275
3. Carbon steel – Coated with Type A19 ceramic	572	1030	628	1130
4. Galvanized steel ^j	267	480	350	630
5. Low-carbon steel, cast iron ^{k,l}	461	830	517	930
6. Stainless steel –				
a. Types 302, 303, 304, 321, 347	686	1235	767	1380
b. Type 316	667	1200	748	1345
c. Type 309S	867	1560	950	1705
d. Types 310, 310B	894	1610	975	1755
e. Type 430	728	1310	808	1455
f. Type 446	961	1730	1042	1875
F. 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	

(Continued)

Table 9.1 (Cont'd)

- ^a The motor diameter is to be measured in the plane of the laminations of the circle circumscribing the stator frame, excluding lugs and boxes used solely for motor cooling, mounting, assembly, or connection.
- ^b Coil or winding temperatures are to be measured by thermocouples unless the coil is inaccessible for mounting of these devices (for example, a coil immersed in sealing compound) or unless the coil wrap includes thermal insulation or more than 2 layers, 1/32 inch (0.8 mm) maximum, of cotton, paper, 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 is not prohibited from exceeding the indicated maximum by the amount noted below, when the temperature rise of the coil, as measured by the resistance method, is not more than that specified in the table.
- 1) 5°C (9°F) for Class A insulation on coil windings of alternating-current motors having a diameter of 7 inches (178 mm) or less, open type.
 - 2) 10°C (18°F) for Class B insulation on coil windings of alternating-current motors having a diameter of 7 inches (178 mm) or less, open type.
 - 3) 15°C (27°F) for Class A insulation on coil windings of alternating-current motors having a diameter of more than 7 inches (178 mm), open type.
 - 4) 20°C (36°F) for Class B insulation on coil windings of alternating-current motors having a diameter of more than 7 inches (178 mm), open type.
- ^c For an electrolytic capacitor which is physically integral with or attached to a motor, the temperature rise on insulating material integral with the capacitor enclosure is to be not more than 65°C (117°F).
- ^d A capacitor that operates at a temperature higher than a 65°C (117°F) rise is to be judged on the basis of its marked temperature rating.
- ^e For standard insulated conductors other than those specified, reference shall be made to the National Electrical Code; the maximum 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 causes the product to be not capable of 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 temperature rises shall not apply to parts of 0.152 inch (3.86 mm) thick or heavier steel and 3/16 inch (4.8 mm) thick or heavier cast iron employed for the hearth and to other parts of 0.093 inch (2.36 mm) thick or heavier steel, and 1/8 inch (3.2 mm) thick or heavier cast iron when:
- 1) The part is not the only enclosure; and
 - 2) Malfunction of the part does not expose adjacent combustible construction to the fire in the fire chamber.

(Continued)

Table 9.1 (Cont'd)

^l	The specified maximum temperature rise shall not apply to parts of 1/4 inch (6.4 mm) or heavier steel and 5/16 inch (7.9 mm) thick or thicker 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.

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

9.7 When a room heater is provided with an ash drawer, the heater is to be operated during the Radiant, Brand, and Flash Fire Tests, Sections 10 – 12, with the ash door in any position, including an open position, that develops the maximum temperatures.

Exception No. 1: The ash door is to be closed during the tests when the heater is provided with an interlock arrangement that closes the ash removal door when the fuel loading door is closed.

Exception No. 2: The ash door is to be closed during these tests when a marking as follows is provided on the ash door: "CAUTION" and the following or equivalent wording: "Risk of Excessive Temperatures. Keep Ash Door Closed During Firing of the Heater."

9.8 During the Radiant, Brand, and Flash Fire Tests, Sections 10 – 12, thermostatic controls, adjustable flue-gas dampers, air inlets, and similar devices, are to be adjusted to produce the maximum temperatures.

9.9 For a coal burning heater, the draft at the flue collar is to be established at the maximum draft specified in the manufacturer's instructions.

9.10 A barometric draft regulator used in conjunction with a coal burning heater is to be permitted to operate during the fire tests.

9.11 When the mechanism of the thermostatic control is accessible, the control is to be bypassed when bypassing produces higher temperatures.

9.12 With reference to the requirements of 9.11, a control is determined accessible when:

- a) Access to the control mechanism is gained by the use of simple hand tools, such as flat blade or Phillips head screwdrivers, hand pliers, wrenches, and similar tools; or
- b) The control is modified or its purpose defeated by mechanical means such as by connection of a piece of wire to bypass its operating characteristics.

9.13 Throughout the fire tests, there shall be no evidence of spillage of products of combustion, or flame from the room heater. Intermittent or sporadic wisps of smoke (smoking not over 15 seconds at a time) is not to be regarded as spillage.

Exception: When the unit is fueled through an opening in the top of the unit that is intended to be open only when fuel is added, light intermittent or sporadic flickers of flame not exceeding 6 inches (152 mm) above the opening are permitted.

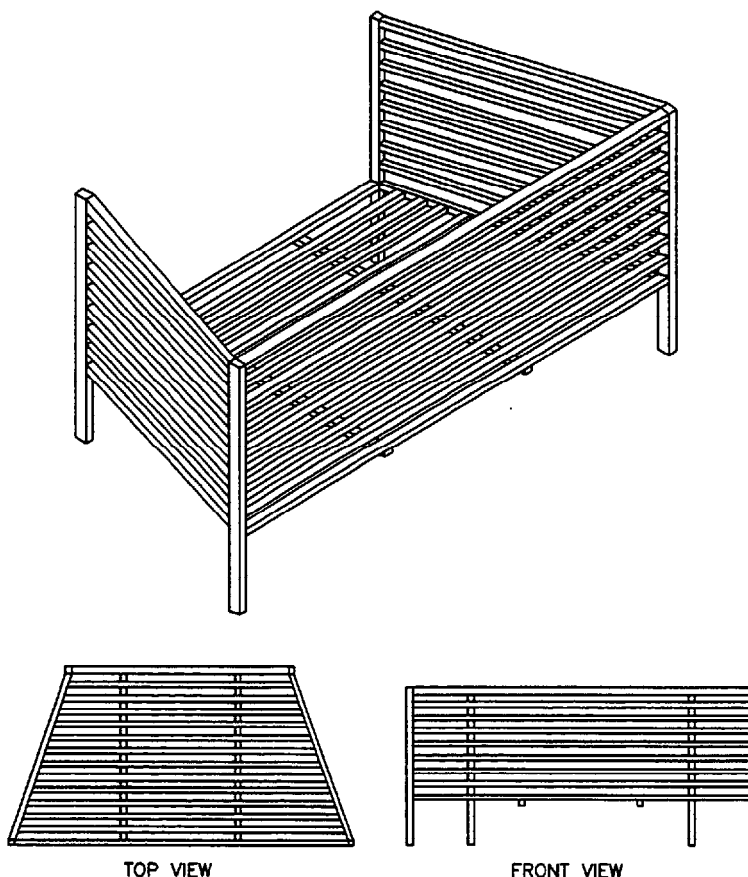
9.14 With reference to the requirements of 9.13, the following method is to be used in observing spillage of flame from room heaters other than the top loading type:

- a) Any time the door is opened for fueling the unit for the Brand and Flash Fires Tests, Sections 11 and 12, flame spillage is to be observed.
- b) When the maximum temperatures have been attained during the Brand Fire Test, Section 12, the air inlets are to be adjusted to that point of their operating range that creates 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.

10 Radiant Fire Test

10.1 When 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 10.1. The grate is to be open at the back for placement within the fire chamber as illustrated in Figure 10.2.

Figure 10.1
General form of charcoal basket grate



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