UL 647

Underwriters Laboratories Inc.

Standard for Safety

Unvented Kerosene-Fired Room Heaters and Portable Heaters

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UL Standard for Safety for Unvented Kerosene-Fired Room Heaters and Portable Heaters, UL 647

Second Edition, Dated May 3, 1993

Summary of Topics

These revisions to UL 647 are being issued to address universal upkeep of UL Standards for Safety. These revisions are considered to be non-substantive and not subject to UL's STP process.

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. Changes in requirements are marked with a vertical line in the margin and are followed by an effective date note indicating the date of publication or the date on which the changed requirement becomes effective.

A reference to UL 60730-1 and/or a Part 2 standard from that series has been added to this standard. The addition of this reference provides an alternate standard for investigating components currently covered by UL 873 until October 19, 2016. This added reference will facilitate the use of components that have been investigated to the UL 60730 series. Such components have been determined to fulfill the requirements of the legacy standards.

UL 60730-1 (4th Edition) becomes effective on October 19, 2016. All components that were previously investigated to the requirements in UL 873 will have to comply with the requirements in either UL 60730-1 and/or a Part 2 standard from that series in order to maintain UL Listing or Recognition, as appropriate. UL 873 legacy control standard will be withdrawn on October 19, 2016.

This is intended to provide end product manufacturers with sufficient time to a) address the impact of the standards changes during normal design changes over the intervening years, b) submit any modified products for investigation, and c) implement any necessary changes in production.

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The requirements in this Standard are now in effect, except for those paragraphs, sections, tables, figures, and/or other elements of the Standard having future effective dates as indicated in the note following the affected item. The prior text for requirements that have been revised and that have a future effective date are located after the Standard, and are preceded by a ″SUPERSEDED REQUIREMENTS″ notice.

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MAY 3, 1993
(Title Page Reprinted: April 16, 2010)

1

UL 647

Standard for Unvented Kerosene-Fired Room Heaters and Portable Heaters

First Edition – December, 1982

Second Edition

May 3, 1993

This UL Standard for Safety consists of the Second Edition including revisions through April 16, 2010.

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 http://csds.ul.com.

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CONTENTS

INTRODUCTION

1 Scope 5
2 General 5
3 Installation And Operating Instructions 6
4 Glossary 8A

CONSTRUCTION

GENERAL

5 Assembly 12
6 Protection Of Service Personnel 13
7 Accessibility For Servicing 16
8 Materials 17
8.1 General 17
8.2 Fuel confining parts 17
8.3 Polymeric materials 17
8.4 Material designation 18
8.5 Ignition sources 18
8.6 Material application 19
9 Base 20A
10 Casing 20A
11 Radiation Shields 20A
12 Primary Safety Control 21
13 External Manual Shutoff Devices 21
14 Burners 21
15 Fittings And Piping 22
16 Catalysts 23
17 Strainers 24
18 Stuffing Boxes 24
19 Sumps 25
20 Integral and Removable Fuel Tanks 25
21 Guards and Grilles 27
22 Valves 32
23 Cord-Connected Units 32
24 Grounding 33
25 Internal Wiring 34
25.1 General 34
25.2 Methods 34
26 Separation of Circuits 37
27 Bonding for Grounding 37

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ELECTRICAL COMPONENTS

28 General 39
29 Mounting of Electrical Components 39
30 Electrical Enclosures 40
31 Motors And Motor (Overload) Protection 47
32 Switches And Controllers 50A
33 Capacitors 50A
34 Electrical Insulating Material 50A

SPACINGS

35 High-Voltage Circuits 50A
36 Isolated-Limited-Secondary Circuits 52
36.1 Safety circuits 52
36.2 Other than safety circuits 52
37 Low-Voltage Circuits 53

PERFORMANCE

38 General 53
39 Instrumentation 54
39.1 Fuel input 54
39.2 Temperature measurement 54A
39.3 Power measurement 57
39.4 Flue-gas analysis 57
40 Test Installation 59
41 Tank-Capacity 60A
42 Fuel-Consumption-Rate Test 60A
43 Combustion Tests 61
44 Stability Test 63
45 Tank-Securement Test 64
46 Sump-Capacity Test 64
47 Normal Fuel-Level Test 64
48 Temperature Test 64A
48.1 General 64A
48.2 Room heater 65
48.3 Portable heater 65
48.4 Test method 69
48.5 Room heater 70
48.6 Portable heater 70
49 Kerosene-Temperature Test 71
50 Lighting Test 73
51 Abnormal Reduced Wick-Adjustment Test 74
52 Seepage and Burnoff Tests 75
53 External Manual Shutoff Mechanism Test 76
54 Tipover Test 76
55 Burner Access Door Securement Test 78
56 Tip-Over Mechanism Endurance Test 78
57 External Manual Flame-Shutoff Mechanical Endurance Test 79
58 Strength Test 79
59 Guard and Grille Strength Test 79
60 Strain-Relief Test 80

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61 Mercurous Nitrate-Immersion Test 80
61A 10-Day Moist Ammonia Air Stress Cracking Test 80
62 Leakage-Current Test 80A
63 Dielectric Voltage-Withstand Test 82
64 Gasket Tests 83
65 Vacuum-Tank Fuel-Indicator-Impact and -Drop Tests 85
65.1 Impact tests 85
65.2 Drop tests 85
65.3 Leakage test 86
66 Impedance-Protected Motors – Locked-Rotor Test 86
67 Permanence of Marking Tests 87

MANUFACTURING AND PRODUCTION TESTS

68 General 88
69 Production-Line Dielectric Voltage-Withstand Test 88
70 Production-Line Grounding-Continuity Test 89

MARKING

71 General 89
72 Cautionary Markings 90

APPENDIX A

Standards for Components. A1

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INTRODUCTION

1 Scope

1.1 These requirements apply to unvented kerosene-fired room heaters and portable heaters as defined herein. They are for use with Type 1-K Kerosene, and Synthetic Fuels complying with the Outline of Investigation for Synthetic Fuels for Listed Kerosene-Fired Portable Heaters and Kerosene-Fired Room Heaters, Subject 647A, in spaces that are well ventilated to provide the supply of air required for combustion and to reduce the risk of accumulation of carbon monoxide. These heaters are for attended or unattended use. These products are required to be equipped with automatic primary safety controls or to be inherently constructed to prevent abnormal discharge of fuel at the burner in case of ignition failure or premature flame extinguishment. They are not intended for use under the following conditions:

a) In spaces in which flammable vapors or gases may be present, or

b) As cooking appliances.

1.1 revised April 16, 2010

1.2 Requirements for the installation and use of kerosene-fired room heaters and portable heaters are included in the Standard for the Installation of Oil-Burning Equipment, NFPA 31 and in codes such as the BOCA National Mechanical Code, the SBCC Standard Mechanical Code, and the ICBO/IAPMO Uniform Mechanical Code.

1.3 The maximum fuel-input rating for kerosene-fired room heaters is 30,000 Btu per hour (31.65 MJ) and for kerosene-fired portable heaters is 25,000 Btu per hour (26.38 MJ).

1.4 These requirements cover kerosene-fired room heaters and portable heaters that may include electrical circuits rated 600 volts or less and are intended for installation as specified in the National Electrical Code, NFPA 70.

1.5 Deleted July 27, 2001

2 General

2.1 The term heater refers to all products covered by this standard unless specifically noted otherwise.

2.1.1 The term fuel refers to both Type 1-K Kerosene and Synthetic Fuels for all products covered by this standard, unless specifically noted otherwise.

2.1.1 added November 2, 1998

2.2 Except as indicated in 2.3, 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 revised July 27, 2001

2.3 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

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b) Is superseded by a requirement in this standard.

2.3 revised July 27, 2007

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

2.4 revised July 27, 2001

2.5 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.

2.5 revised July 27, 2001

2.6 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.

2.6 revised July 27, 2001

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

2.7 revised July 27, 2001

3 Installation And Operating Instructions

3.1 A copy of the manufacturer's installation and operating instructions shall be furnished with each heater. These instructions are to be used as a guide in the examination and test of the heater. For this purpose a printed edition is not required.

3.2 The instructions shall include such directions and information as deemed by the manufacturer to be adequate for attaining intended installation, maintenance, and use of the heater. For those heaters that are not intended for use with Synthetic Fuels, the instructions shall indicate that Synthetic Fuels shall not be used with the heater. At least the following information shall be included:

a) Initial setup and operating instructions, including minimum clearances to adjacent flammable materials while the heater is in operation. When further actions are required by the user to:

1) Complete installation of a guard or grille that is folded or telescoped, or

2) Attach a guard or grille that is not attached to the heater at the factory,

they shall be completely described in the instructions.

b) Method of adjustment of the burner flame with detailed instructions for wick-type heaters specifying that the heater should be operated only at the manufacturer's recommended burner settings.

c) When the heater is intended only for use with No. 1-K kerosene, instructions to use only clear or red colored No. 1-K kerosene (see the Specification for Kerosene, ASTM D3699-96). When the heater is intended for use with either kerosene or synthetic fuel, instructions to use only clear or red colored No. 1-K kerosene (see the Specification for Kerosene, ASTM D3699-96) or synthetic fuels for use with kerosene-fired portable heaters. For all heaters, instructions on how to fill the reservoir.

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c1) Information that the kerosene in the USA is sometimes dyed red due to tax laws and the red dyed kerosene should be translucent (able to be seen through) and not cloudy.

d) Lighting Instructions – The instructions for heaters equipped with burner mantles that may require manual adjustment shall include details on how to position the mantle as intended in the heater and how to seat the mantle after lighting heater.

e) Maintenance – When the burner is of the wick type, the following shall be included:

1) Identification of the manufacturer or private labeler and part number or equivalent of the recommended replacement wick or wicks.

2) Detailed instructions for wick replacement as follows:

a) Disassembly of the heater to remove old wick.

b) Installation of the replacement wick, including specification for the maximum wick height in millimeters and inches.

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c) Reassembly of the heater.

d) Instructions for the operator to recheck wick height after reassembly and to check that the wick adjuster and extinguishing device are operating as intended before using the heater.

f) The following or equivalent cautionary statement preceded by the word WARNING:

1) Risk of Explosion –

a) Never use any fuel other than the fuels specifically identified for use in the heater. Never use gasoline.

b) Never refill heater fuel tank when heater is operating or still hot.

c) Never fill heater fuel tank in living space. Fill heater tank outdoors.

d) Never use heater in areas where flammable vapors or gas may be present.

e) Never store or transport the fuel in other than a metal or plastic container that is:

1) Acceptable for use with the specific fuel,

2) Nonred in color,

3) For 1-K Kerosene clearly marked, ″kerosene,″ or

4) Is in the original container for the Synthetic Fuel.

f) Never store fuel in the living space.

2) Due to high surface temperatures, keep children, clothing, and furniture away.

3) Risk of Indoor Air Pollution – Use heater only in well-ventilated areas. People with breathing problems should consult a physician before using the heater.

4) Do not use heater to heat or boil water or use as a cooking appliance.

g) The following or equivalent information for provision of combustion and ventilating air for unvented heaters: ″In a house of typical construction, that is, one that is not of unusually tight construction due to heavy insulation and tight seals against air infiltration, an adequate supply of air for combustion and ventilation is provided through infiltration. However, if the heater is used in a small room where less than 200 cubic feet (5.7 m^3) of air space is provided for each 1000 Btu per hour of heater rating (considering the maximum burner adjustment), the door(s) to adjacent room(s) should be kept open or a window to the outside should be opened at least 1 inch (25.4 mm) to guard against potential buildup of indoor air pollution. Do not use the heater in a bathroom or any other small room with the door closed.″

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h) For a heater that requires further actions by the user to:

1) Attach a disassembled guard or grille, or

2) Complete installation of a guard or grille that is folded or telescoped and is not provided with an interlock that would prevent heater operation unless the guard or grille is attached to the heater in its final intended position,

the following or equivalent cautionary statement preceded by the word ″CAUTION″:

″Risk of burns. Do not operate the heater without the guard or grille completely attached.″

i) Periodic Service – Details on the items that require periodic service, recommended intervals for such service, and instructions for performing the service.

1) The information mentioned in subitems a – g shall be included for all heaters, as applicable.

a) Cleaning of heater combustion surfaces, including the burner glass chimney.

b) Replacement of burner glass chimney when cracked or broken.

c) Adjustment and replacement of ignition device.

d) Cleaning and/or replacement of air filter.

e) Checking operation of external manual shutoff device and tip-over device.

f) Replacement of battery.

g) Preparation of heater for storage.

2) The information mentioned in subitems a and b shall be included for heaters with a wick type burner.

a) Wick replacement.

b) Wick cleaning.

j) For a heater provided with a minimum wick stop in accordance with 14.3(a), the following or equivalent statement preceded by the word ″WARNING″:

″Risk of indoor air pollution and fire. Do not operate heater at wick setting lower than minimum wick-stop setting.″ [See 3.2(b)].″

Revised 3.2 effective July 27, 2002

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4 Glossary

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

4.2 ANTIFLOODING DEVICE – A primary safety control that causes the fuel flow to be shut off upon a rise in fuel level or upon receiving excess fuel, and that operates before the unintended discharge of fuel can occur. A wick, vacuum breaker, or other automatic device may be considered an antiflooding device.

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4.3 APPLIANCE FLUE – The flue passages within the heater.

4.4 BAFFLE – An object placed in a heater to direct or to retard the flow of air of flue gases.

4.5 BASE – The main supporting frame or structure of an assembly.

4.6 BURNER – A device for the final conveyance of fuel or a mixture of fuel and air to the combustion zone.

4.7 BURNER, VAPORIZING TYPE – A burner consisting of an oil-vaporizing bowl or other receptacle to which liquid fuel may be fed in controllable quantities with provision for admitting air and mixing it with the fuel vapor in combustible proportions. The heat of combustion is used to vaporize the fuel.

4.8 BURNER, WICK TYPE – A burner consisting of a receptacle and wick to which liquid fuel may be fed in controllable quantities. The wick carries the fuel to the combustion zone where air is introduced for combustion.

4.9 CASING – An enclosure forming the outside of the heater, no parts of which are likely to be subjected to intense heat.

4.10 CATALYST – A material that speeds the oxidation of hydrocarbons and carbon monoxide into water vapor and carbon dioxide.

4.11 COMBUSTIBLE MATERIAL – As pertaining to materials adjacent to or in contact with heaters, a material made of or having surfaces of wood, compressed paper, plant fibers, or other material that will ignite and burn. Such material shall be considered as combustible even though flameproofed, fire-retardant treated, or plastered.

4.12 COMBUSTION – The rapid oxidation of fuel accompanied by the production of heat, or heat and light. Complete combustion of a fuel is possible only in the presence of an adequate oxygen supply.

4.13 COMBUSTION CHAMBER – The portion of the heater within which combustion occurs and that is usually part of the heat exchanger.

4.14 CONSTANT-LEVEL VALVE – A device for maintaining within a reservoir a constant level of fuel for delivery to the burner.

4.15 CONTROL – A device used to regulate the fuel, air, water or electrical supply to the controlled equipment. It may be automatic, semiautomatic, or manual.

4.16 CONTROL, LIMIT – An automatic safety control responsive to changes in liquid level, pressure, or temperature; for limiting the operation of the controlled equipment.

4.17 CONTROL, PRIMARY SAFETY – The automatic safety control intended to prevent abnormal discharge of fuel at the burner in case of ignition failure or premature flame extinguishment.

4.18 DAMPER – A valve or plate for regulating draft or flow of flue gases. A damper is generally considered as being located on the downstream side of the combustion chamber, usually in a flue passage of a heater or in the flue pipe.

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4.19 DEVICE, SAFETY – Automatic controls and interlocks (including relays, switches, and other auxiliary equipment used in conjunction therewith to form a safety-control system) that are intended to prevent operation of the controlled equipment that could cause a risk of fire, electric shock, or injury to persons.

4.20 ELECTRICAL CIRCUITS:

a) High-Voltage Circuit – A circuit involving a potential of not more than 600 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 rms (42.4 peak or direct current) and supplied by a primary battery or by a standard Class 2 transformer or other transforming device, or by a combination of transformer and fixed impedance having output characteristics in compliance with what is required for a Class 2 transformer. A circuit derived from a source of supply classified as a high-voltage circuit by connecting resistance in series with the supply circuit as a means of limiting the voltage and current is not considered to be a low-voltage circuit.

c) Isolated-Limited-Secondary Circuit – A circuit of limited energy derived from an isolated secondary winding of a transformer having a maximum capacity of 1000 volt-amperes and open-circuit secondary-voltage rating not exceeding 1000 volts.

d) Safety (Control) Circuit – A circuit involving one or more safety devices.

4.21 EXCESS AIR – Air that passes through the combustion area and the appliance flues in excess of that which is theoretically required for complete combustion.

4.22 FLUE GASES – Combustion products and excess air.

4.23 FULL DRAIN – As applied to tanks, a construction in which the tank is emptied through its normal feed outlet at the bottom of the tank.

4.24 HEATER, CIRCULATING – A room heater intended to convert energy in the fuel to convected heat by the circulation of air heated by contact with the heating surfaces.

4.25 HEATER, DIRECT-FIRED – A heater in which combustion products or flue gases are mixed with the air being heated.

4.26 HEATER, RADIANT – A heater intended primarily to convert energy in the fuel to radiant heat, such as with openings in the outer jacket to permit direct radiation from the heating surface.

4.27 HEATER, ROOM – A stationary, self-contained, freestanding, air-heating appliance intended for installation in the space being heated and not intended for duct connection.

4.28 HEATING SURFACES – All surfaces that transmit heat directly from flame or flue gases to the medium to be heated.

4.29 KEROSENE – A hydrocarbon oil defined by the Standard Specification for Kerosene, ASTM D3699-96. Kerosene is either clear or dyed translucent (i.e. not cloudy) red in color.

Revised 4.29 effective July 27, 2002

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4.30 MANUALLY LIGHTED HEATER – A heater in which fuel to the main burner is turned on only by hand and ignited under supervision.

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4.31 PORTABLE HEATER – A direct-fired heater that:

a) Is intended to burn kerosene,

b) Is not flue connected,

c) Can be carried from one location to another,

d) Is self-supporting and self-contained, and

e) Includes either an integral or a removable fuel tank.

4.32 RADIATION SHIELD – A separate panel or panels interposed between heating surfaces and adjacent objects to reduce heat transmission by radiation.

4.33 READILY ACCESSIBLE – Capable of being reached easily and quickly for operation, adjustment, and inspection.

4.34 SAFETY SHUT-DOWN – The action of shutting off all fuel and ignition energy to the burner by a safety control, or controls, such that restart cannot be accomplished without a manual restart.

4.35 SUMP (FOUNT) – The receptacle employed with a vacuum tank.

4.35.1 SYNTHETIC FUEL – A fuel that is the result of a process consisting of refining crude oil in combination with chemical reactions producing a specific liquid fuel meeting the requirements of No. 1-K Kerosene referenced in ASTM D3699-96, Standard Specification for Kerosene.

4.35.1 added November 2, 1998

4.36 TANK, GRAVITY – A fuel tank from which the fuel is delivered directly to the burner by gravity.

4.37 TANK, INTEGRAL – A fuel tank that is permanently attached to a heater.

4.38 TANK, REMOVABLE – A fuel tank that can be separated from a heater, without the use of a tool, for filling.

4.39 TANK VACUUM – A fuel tank that maintains a definite level of fuel in a sump or similar receptacle by barometric feed. Fuel is delivered from the sump to the burner by gravity.

4.40 TRACER FLAME – Small flickers or a trickle of flame at or above the wick of a wick-type burner that may continue to burn due to presence of kerosene vapors after the main burner flame has been extinguished.

4.41 VALVE, FUEL-CONTROL – An automatically or manually operated device consisting essentially of a fuel valve for controlling the fuel supply to a burner.

a) Metering (Regulating) Valve – A fuel-control valve for regulating burner input.

b) Safety Valve – A normally closed valve of the On and Off type (without any bypass to the burner) that is actuated by a primary safety control or by an emergency device.

4.42 VALVE, MANUAL FUEL-SHUTOFF – A manually operated valve in the fuel line for the purpose of completely turning on or shutting off the fuel supply to the burner.

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CONSTRUCTION

GENERAL

5 Assembly

5.1 Each heater shall include all the essential components necessary for its intended function when installed as intended.

5.2 The various parts of a heater shall be constructed and assembled in accordance with these requirements to provide the strength, rigidity, and durability required.

5.3 The various parts of a heater shall be assembled or jointed as intended. Soft solder shall not be used on any fuel-handling parts if melting of the solder may allow leakage of fuel, except as indicated in 20.14. Soft-soldered joints, where acceptable, shall be made mechanically secure before soldering.

5.4 The heater shall be completely assembled by the manufacturer before shipment from the factory.

Exception No. 1: Subassemblies (such as a completely assembled burner or chimney section of a wick-type heater), minor parts, or accessories may be shipped unassembled with clear and precise instructions for their assembly in the field, provided that:

a) The heater cannot be operated without correctly installing the parts, subassemblies, or accessories; or

b) A risk of fire or injury to persons is not caused when the heater is operated without using the parts, subassemblies, or accessories.

Exception No. 2: A tray or subbase that complies with the requirements in 9.2 may be furnished without being assembled on the heater.

Exception No. 3: A heater that incorporates a guard or grille may be shipped with the guard or grille unassembled, provided the heater is marked in accordance with 3.2(h).

5.5 If a functional part of a heater is rendered inoperative (nonfunctional) in the factory by packaging materials used for shipment purposes, the packing materials shall be arranged so that they have to be removed and so that all essential parts, the function of which is required to comply with the requirements in this standard, are functional before the heater can be operated.

5.6 A constant-level valve or sump assembly shall be secured in position and mounted independently of the fuel piping.

5.7 A hinge provided for the joining of the upper and lower sections of a portable heater, together with any latching device, the malfunctioning of which could cause a spillage of fuel or other risk of fire, shall be:

a) Of permanently attached and assembled parts, and

b) Resistant to distortion.

A latch shall engage as intended automatically from the weight of the upper section.

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5.8 A bail or carrying handle of a portable heater shall be equivalent in strength and rigidly to steel wire of 0.162-inch nominal diameter. It shall be provided with a nonflammable handle grip arranged to be not closer than 1 inch (25.4 mm) to any heating surface when the bail is at rest and not less than 6 inches (152 mm) from the top of the heater when in the raised position.

5.9 A substantial sheet-metal drip pan or base coated to retard corrosion shall be provided below all burners to retain drippings and char. It shall be an integral part of the heater and shall be readily cleanable.

5.10 If a heater includes a mechanism to extinguish the flame in the event the heater is tipped over, the mechanism shall not include any means external to the heater by which the mechanism can be rendered ineffective. See 56.1.

5.11 A door, guard, or grille that provides access to the burner and that is large enough to permit the burner to fall out during heater tipover shall:

a) Be secured in the closed position by a positive means (for example, by a spring-loaded clip, quarter-turn thumbscrew, or the like) and

b) Comply with the Burner Access Door Securement Test, Section 55, and with 54.2(d).

If the opening the access door, guard, or grille is necessary for intended operation, except for replacement or cleaning of the wick, the latching means shall not require the use of tools. A friction-type clip alone is not acceptable.

Exception: A heater constructed so that the burner does not dislodge from its intended position during heater tipover need not comply with this requirement.

6 Protection Of Service Personnel

6.1 An uninsulated high-voltage live part and moving parts that may cause injury to persons shall be located, guarded, or enclosed to reduce the risk of unintentional contact by personnel performing service functions that may have to be performed with the equipment energized.

6.2 Service functions that may have to be performed with the equipment energized include the following:

a) Adjusting the setting of temperature controls with or without marked dial settings,

b) Resetting a control trip mechanism,

c) Operating manual switches, or

d) Adjusting air-flow dampers.

A factory set and sealed control is not considered to be adjustable.

6.3 The requirement in 6.1 is not applicable to mechanical service functions that are not normally performed with the equipment energized. Such functions include cleaning and replacement of strainers and filters.

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6.4 An adjustable or resettable electrical control or manual switching device may be located or oriented with respect to uninsulated high-voltage live parts so that manipulation of the mechanism for adjustment, resetting, or operation can be accomplished in the intended direction of access if uninsulated high-voltage live parts or moving parts likely to cause injury to persons are:

a) Not located in front, in the direction of access, of the mechanism, and

b) Not located within 6 inches (152 mm) on any side or behind the mechanism, unless guarded.

6.5 An electrical control component that may require examination, adjustment, servicing, or maintenance while energized, excluding voltage measurement except for jacks or terminals specifically intended for that purpose, shall be located and mounted with respect to other components and with respect to grounded metal parts so that it is accessible for electrical service functions without subjecting the serviceman to a risk of electric shock from adjacent uninsulated live parts or to a risk of injury to persons from adjacent moving parts.

6.6 Accessibility and reduction of the risk of electric shock and unintentional contact with moving parts that may cause injury to persons may be obtained by mounting the control components in an assembly so that unimpeded access is provided to each compartment through an access cover or panel in the outer cabinet and the cover of the control assembly enclosure with the following arrangement. (see Figure 6.1):

a) The components are located with respect to the access opening in the outer cabinet so that the farthest component in the control assembly is not more than 14 inches (356 mm) from the plane of the access opening.

b) Uninsulated live parts outside the control assembly projected clear space (except for live parts within a control panel) or unguarded moving parts likely to cause injury are located not closer than 6 inches (152 mm) from any side of the access area. The projected clear space is considered to be bounded on the sides by the projection of the smallest rectangular perimeter surrounding the outside edge of the component or control enclosure when provided. The access area is considered to be bounded on the sides by the projection of the perimeter of the access opening in the outer cabinet to the closest rectangular perimeter surrounding the outside edge of the component or control enclosure.

c) The volume generated by the projected clear space of the control assembly to the access opening in the outer cabinet (within the access area) is completely free of obstructions, including wiring.

d) Access to the components in the control assembly is not impeded in the direction of access by other components or by wiring in this assembly.

e) Extractor-type fuseholders and snap switches mounted through the control assembly enclosure are to be located so that:

1) There is unimpeded access to these components through the access opening in the outer cabinet, and

2) So that they are not immediately adjacent to uninsulated live parts outside the control assembly enclosure, unless guarded. See 6.4.

6.7 Components in a low-voltage circuit shall comply with the requirements of 6.5 in their relation to uninsulated live parts in a high-voltage circuit and to moving parts that may cause injury to persons.

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6.8 The following are not considered to be uninsulated live parts:

a) Coils of controllers;

b) Relays and solenoids;

c) Transformer windings, if the coils and windings are provided with insulating overwraps;

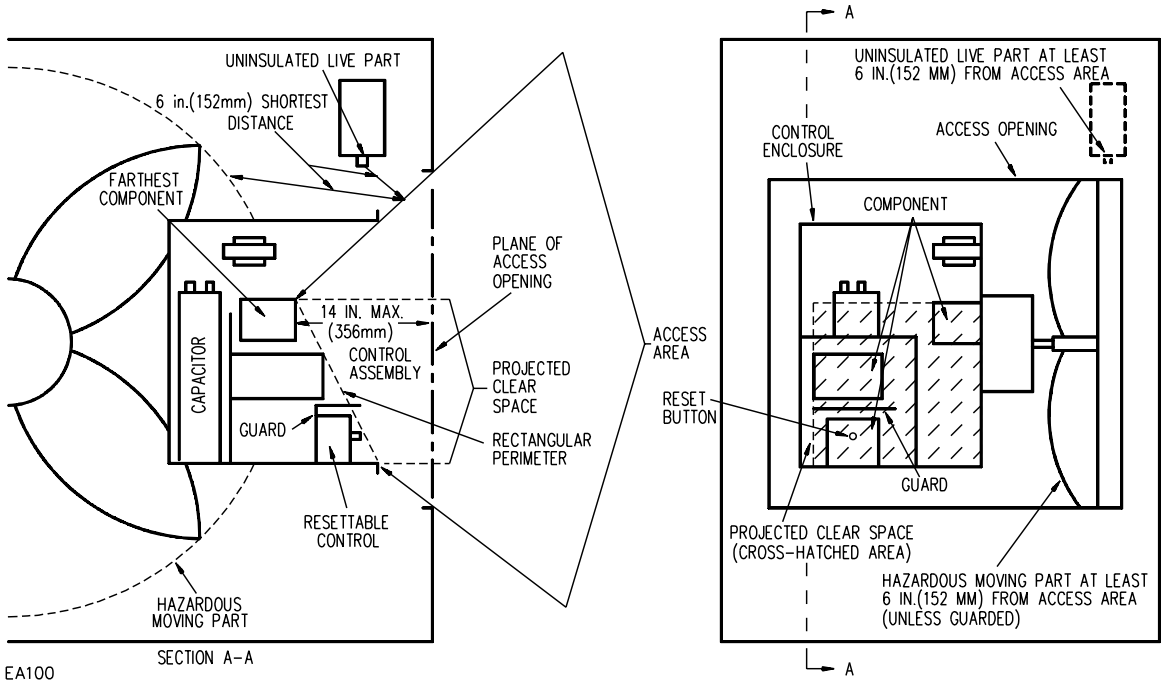
d) Enclosed motor windings;

e) Insulated terminals and splices; and

f) Insulated wire.

Figure 6.1
Accessibility and protection from live parts and moving parts

Figure 6.1 revised November 2, 1998



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6.9 Moving parts that may present a risk of injury to persons, such as fan blades, blower wheels, belts, and the like, shall be guarded or enclosed so that the minor dimension of any opening will not exceed the values indicated in 6.10. A part required for guarding shall be secured by means dependent upon tools for removal unless functioning of the heater requires the part to be in place.

6.10 The distance from an opening to a moving part shall be as specified in Table 6.1, but the minor dimension of the opening shall not in any case exceed 1 inch (25.4 mm). For an opening having a minor dimension intermediate between two of the values included in the table, the distance from the opening to the moving part shall not be less than that found by appropriate interpolation between the corresponding values in the right-hand column of the table. The minor dimension of the opening is determined by the largest hemispherically tipped cylindrical probe than can be inserted through the opening with a force of 5 pounds (22.3 N).

Table 6.1
Distance from opening to moving part

Minor dimensions of opening[a]		Minimum distance from opening to moving part	
Inches	mm	Inches	mm
1/4	6.4	1/2	13
3/8	9.5	1-1/2	38
1/2	12.7	2-1/2	64
3/4	19.0	4-1/2	114
1	25.4	6-1/2	165

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

6.11 The requirements in 6.9 and 6.10 do not apply if:

a) a moving part is unlikely to be contacted through the opening because of fixed components, including baffles, or

b) the part is made inoperative when exposed, through the use of an interlocking device.

7 Accessibility For Servicing

7.1 A heater shall be constructed to provide access for cleaning of parts, such as interior surfaces of vaporizing burners, wicks, heating surfaces in contact with combustion products, fuel inlet pipes, and fuel strainers, without major dismantling of the heater or removal of parts required to be factory-assembled.

7.2 With respect to 7.1, removal of an access panel, burner, cap, plug, or the like, specifically designed to permit removal or replacement for servicing, is not considered major dismantling.

7.3 Accessibility shall be provided for cleaning, inspection, repair, and replacement of all burners and controls when the heater is installed as intended by the manufacturer. The disposition of parts in the assembly removed for servicing shall be such that their restoration, following removal, will not necessitate their realignment to secure their intended relationship with other parts of the assembly. Tools other than common household tools required for servicing to be performed by the operator shall be provided with the heater.

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8 Materials

8.1 General

8.1.1 A heater shall be constructed of materials having the necessary strength and durability to provide intended service of the parts and the assembly. Parts shall not sag, distort, melt, oxidize, or show leakage of fuel during any of the tests specified herein.

8.2 Fuel confining parts

8.2.1 A fuel-confining part of a heater or an operating part, if malfunction of the part would allow leakage of fuel, risk of fire, or prevent a safety device from functioning, shall have the necessary strength, durability, and resistance to fire to provide intended service of the parts and the assembly. Parts formed from drawn- or machined-brass rod or bar stock shall comply with the 10-Day Moist Ammonia Air Stress Cracking Test, Section 61A.

8.2.1 revised April 5, 1994

8.2.2 A fuel tank shall comply with the corrosion protection requirements for Integral and Removable Fuel Tanks, Section 20. All other fuel-confining parts as mentioned in 8.2.1 shall be protected against corrosion by painting, plating, or other equivalent means.

8.2.3 To comply with the requirements in 8.2.1, a material having a melting point (solidus temperature) of not less than 950°F (510°C) and a tensile strength of not less than 10,000 psi (68.9 MPa) at 400°F (204.4°C) is to be used if otherwise acceptable for the service.

8.2.4 A material used for gaskets and seals to confine kerosene shall be compatible with kerosene as determined by tests in accordance with Gasket Tests, Section 64.

8.3 Polymeric materials

8.3.1 These requirements apply to polymeric materials used to form outer enclosures, structural or functional parts, thermal and acoustical insulation, and miscellaneous parts of the heater. They do not apply to materials used as electrical insulation, nor to small parts, such as control knobs, buttons, insulating bushings, resilient mounts, clamps, and wiring straps.

8.3.2 The acceptability of polymeric material shall be determined for each application.

8.3.3 Among the factors that are taken into consideration when judging the acceptability of a polymeric material are:

a) Flame resistance,

b) Mechanical strength,

c) Resistance to impact,

d) Moisture absorptive properties, and

e) Resistance to distortion at temperatures to which the materials may be subjected under conditions of normal or abnormal usage.

All of these factors are considered with respect to aging. See Table 8.1 for properties to be evaluated depending on use of the material.

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8.3.4 A polymeric material that serves as an electrical enclosure or as a guard to reduce the risk of contact with moving parts that may cause injury to persons shall be evaluated in accordance with the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

8.3.5 A functional part shall not be exposed to temperatures higher than the temperature rating of the material from which it is formed or fabricated, as established in accordance with the Standard for Polymeric Materials – Long Term Property Evaluations, UL 746B. The maximum exposure temperature shall be determined in accordance with the Temperature Test, Section 48.

Table 8.1
Evaluation of properties of polymeric materials

Characteristics to be evaluated	Enclosures	Structural parts	Thermal and acoustical insulation	Functional parts
Flammability				
Source of Ignition				
External	Yes	Yes		
Internal	Yes	Yes	Yes	Yes
Heat Deflection	Yes	Yes		
Water Absorption	Yes	Yes[a]		
Environmental Exposure	Yes	Yes[a]		
Air Oven Aging	Yes	Yes		
Mechanical				
Tensile and Flexural Strength	Yes	Yes		Yes
Izod or Tensile Impact Strength	Yes	Yes		
Impact	Yes	Yes		
Volume Resistivity	Yes[a]	Yes[a]	Yes[a]	Yes[a]

[a] When Applicable

8.4 Material designation

8.4.1 Materials are designated with respect to flammability characteristics and are identified as 5V, V-1, or V-2; HF-1 or HF-2; B and HBF materials. See the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94.

8.4.1 revised November 2, 1998

8.5 Ignition sources

8.5.1 As used in 8.6.1 – 8.6.7, possible ignition sources within the product, in addition to the burner flame, are considered to be wiring and any electrical component, such as a switch, relay, transformer, motor winding, and the like, not enclosed in metal or 5V material.

8.5.1 revised November 2, 1998

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8.6 Material application

8.6.1 A part formed of polymeric material that supports or isolates electrical components, or that is exposed to ignition sources within the product, shall be of 5V material.

8.6.1 revised November 2, 1998

8.6.2 A polymeric material shall have a flammability rating of V-0, V-1, or V-2. Under the following conditions:

a) It does not support or isolate electrical components,

b) It is not exposed to ignition sources within the product, or

c) It is not enclosed in metal as specified in 8.6.7.

8.6.2 revised November 2, 1998

8.6.3 A V-1 material may be used if it is not exposed to ignition sources. See 8.6.4 and 8.6.5. A V-2 material may be used if, in addition to being isolated from ignition sources in the same manner as a V-1 material, there are no flammable materials or openings or both in the enclosure below the V-2 material within a volume defined by Space A of Figure 8.1.

8.6.3 revised November 2, 1998

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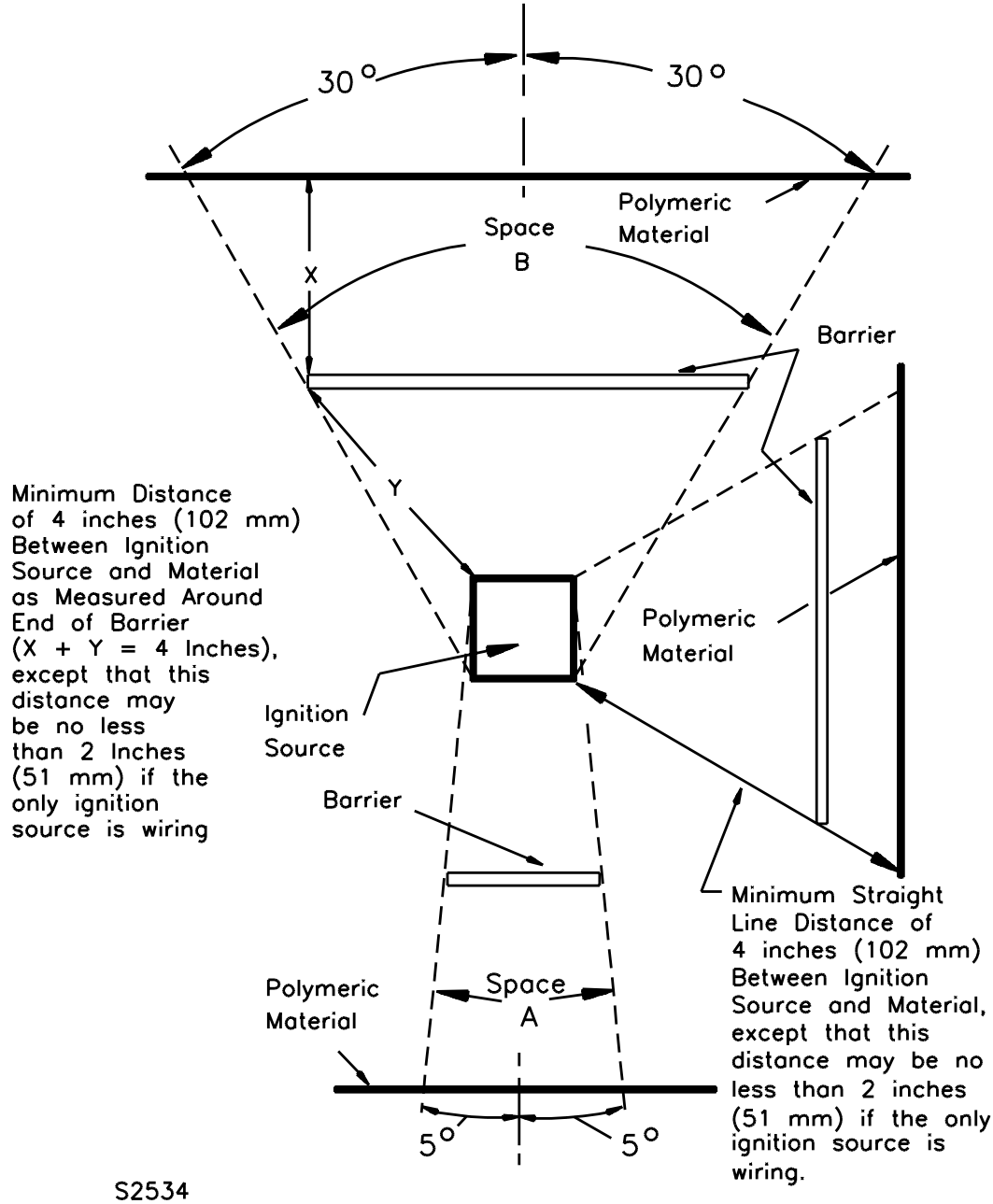
Figure 8.1
Exposure to ignition source

Figure 8.1 revised November 2, 1998



Space A – Represents the volume below the ignition source determined by a straight line that moves about the ignition source while remaining at an angle of 5° from the vertical and is always so oriented that the volume is a maximum.

Space B – Represents the volume above the ignition source determined in the same manner as Space A, except that the angle is 30° from the vertical.

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8.6.4 A material located below the ignition source and within Space A of Figure 8.1 may be isolated by means of a horizontal barrier extending at least to the boundary surface of the space. A material located above the ignition source and within Space B of Figure 8.1 may be isolated by means of a barrier, extending at least to the boundary surface of the space, and so located that the minimum distance between the material and ignition source is 2 inches (50.8 mm) for wiring and 4 inches (102 mm) for electrical components.

8.6.5 A material located essentially in the vertical plane and adjacent to an ignition source is considered isolated from the ignition source if it is separated from wiring by a distance of 2 inches (50.8 mm) and from electrical components by a distance of 4 inches (102 mm). A barrier may be used for isolation provided the size of the barrier is such that the minimum straight-line distance between the material and ignition source is 2 inches for wiring and 4 inches for electrical components. See Figure 8.1.

8.6.6 A barrier used to isolate materials as described by 8.6.4 or 8.6.5 shall be formed of metal or of a 5V material and shall be mechanically secured in place.

8.6.6 revised November 2, 1998

8.6.7 The requirements in 8.6.2 – 8.6.5 do not apply to:

a) A polymeric material completely enclosed in metal that is at least 0.010 inch (0.25 mm) thick, or

b) A material classed as HB, V-1, V-2, HB-2, or HBF that is laminated between two metal surfaces if:

1) The thickness of the metal of each surface is 0.010 inch or more, and

2) The exposed vertical surface of the material has a width of not more than 3/8 inch (9.5 mm).

8.6.7 revised November 2, 1998

9 Base

9.1 The base of a heater shall be constructed of metal or fabricated of other nonflammable material in a manner that provides equivalent strength and durability.

9.2 A subbase or tray, if furnished as a separate assembly, shall be arranged for attachment to the heater in the intended position only and in a manner that will establish and maintain the intended position of the heater with respect to the subbase or the tray.

10 Casing

10.1 The casing or jacket shall be made of steel or material of equivalent strength and durability so that it is not likely to be damaged by handling in shipment, installation, and use.

10.2 The upper drum or casing of a heater shall be provided with a sufficient number of permanent openings so that the heater complies with the Combustion Test, Section 43.

11 Radiation Shields

11.1 A radiation shield or liner shall be constructed, formed, and supported so that it can be positioned as intended and so that it cannot distort or sag in service. A shield or liner shall be protected against corrosion if its deterioration may cause:

a) Temperatures higher than specified in Table 48.1 when the heater is tested in accordance with this standard, or

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b) Improper combustion as determined by the Combustion Test, Section 43.

Any finish to obtain the required resistance to corrosion shall not be damaged by heat when the heater is subjected to the performance tests.

11.2 A radiation shield or baffle employed to prevent temperatures in excess of those specified in Table 48.1 shall be:

a) Assembled as part of the heater, or

b) Constructed so that the heater cannot be assembled for operation without first attaching the required shield or baffle in its intended position.

12 Primary Safety Control

12.1 A heater shall be equipped with means to limit discharge of fuel at the burner in case of no ignition or premature flame extinguishment.

12.2 A heater equipped with a vaporizing burner may be provided with a constant-level valve incorporating an automatic shutoff device or with a barometric tank and sump assembly arranged to maintain a level of oil complying with 47.1.

12.3 The primary input to a safety-control circuit shall be a 2-wire, 1-side grounded system, having a voltage rating of a nominal 120 volts. A switch or protective device shall be in the circuit electrically connected to the ungrounded supply conductor.

13 External Manual Shutoff Devices

13.1 A heater shall be equipped with an external manual-shutoff device to extinguish the burner flame. The device shall be operable by a motion in one direction, such as pushing a button or lever. Rotation of a knob is not considered to comply with this requirement. The shutoff device may actuate the mechanism intended to extinguish the burner flame in the event the heater is tipped over (see 5.10).

Exception: On a heater equipped with a vaporizing burner, the manual shutoff device may be located behind a hinged door.

13.2 The external manual-shutoff device shall be marked as specified in 71.7.

13.2 revised January 26, 2000

14 Burners

14.1 A burner shall be of the wick, lighting ring, wickless, or equivalent type that inherently or by use of a primary safety control will limit the discharge of fuel.

14.2 The wick of a wick-type burner shall be provided with means to maintain its shape, to facilitate even travel, and for adjustment.

14.3 A wick-type burner shall be provided with a wick stop to control the wick travel between the maximum and minimum limits. The wick stop at the minimum limit shall be self-latching. The self-latching means shall consist of either of the following or the equivalent:

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a) A construction requiring at least two different simultaneous or sequenced actions to override the minimum stop (see 14.4), or

b) A mechanical stop that will not permit operating of the heater below the minimum recommended burner setting.

Revised 14.3(a) effective August 19, 1994

14.4 A heater that incorporates a minimum wick stop that can be overridden in accordance with 14.3(a) shall be marked with a warning statement to not operate the heater at lower than the minimum wick stop setting. See 72.2.

Added 14.4 effective August 19, 1994

14.5 A burner shall be secured so that it will not twist, slide, or drop out of position.

Exception: A wick type burner that seats in a well and is engaged by a flange to retain the burner in its intended position need not be further secured, provided it is marked with a cautionary statement instructing that it be properly seated each time the heater is used. See 72.3.

Added exception to 14.5 effective August 19, 1994

15 Fittings And Piping

15.1 Pipe and fittings shall be standard full-weight wrought iron or steel, or iron-pipe size brass or copper pipe. Unions, if used, shall be the ground-joint type or the equivalent.

15.2 Tubing incorporated in the assembly of the heater at the factory shall be arranged to reduce the likelihood of being mechanically damaged, such as by closely following the contour of the assembly. Seamless drawn aluminum or copper tubing employed in the fabrication of factory-assembled equipment shall have the wall thickness specified in Table 15.1.

Table 15.1
Aluminum and copper tubing

Outside diameter,		Wall thickness,		Wall tolerance, plus or minus	
Inches	(mm)	Inches	(mm)	Inches	(mm)
1/4	(6.35)	0.030	(0.76)	0.0035	(0.89)
5/16	(7.94)	0.030	(0.76)	0.0035	(0.89)
3/8	(9.53)	0.030	(0.76)	0.0035	(0.89)
1/2	(12.70)	0.035	(0.89)	0.0035	(0.89)
5/8	(15.88)	0.040	(1.02)	0.0035	(0.89)
3/4	(19.05)	0.042	(1.07)	0.0035	(0.89)

15.3 Steel tubing of the seamless, brazed, or welded type employed in the fabrication of factory-assembled equipment shall have a wall thickness of not less than that specified in Table 15.2.

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Table 15.2
Steel tubing

Outside diameter,		Minimum wall thickness,	
Inches	(mm)	Inches	(mm)
1/4	(6.35)	0.028	(0.71)
5/16	(7.94)	0.028	(0.71)
3/8	(9.53)	0.028	(0.71)
1/2	(12.70)	0.028	(0.71)
5/8	(15.88)	0.035	(0.89)
3/4	(19.05)	0.035	(0.89)

15.4 Steel tubing used for confinement of kerosene shall be composed of corrosion-resistant material, such as stainless steel, or shall be plated, dipped, coated or otherwise treated to resist external corrosion.

15.5 Flexible metal hose, if used, shall be of a type acceptable for the purpose and be used in a manner that it is not likely to be damaged.

15.6 All pipe ends and openings in fittings for pipe connections shall be threaded in accordance with American Standard for Taper Pipe Threads, unless other acceptable forms of construction are provided.

15.7 Care shall be observed to remove webs, shoulders, and other obstructions from the inner ends of internally threaded openings in fittings to permit making tight joints.

15.8 Fuel line shall terminate in a manner that will permit ready connection to the heater.

15.9 Piping and tubing for fuel lines shall be of size and arrangement to avoid air traps.

15.10 An opening into fuel-handling parts shall be covered or encased to prevent entrance of foreign material prior to installation.

16 Catalysts

16.1 A catalyst, if used to eliminate odors caused by heater operation, shall be cleanable, nontoxic, and be used within the temperature rating of the materials.

16.2 A heater equipped with a catalyst shall comply with the Combustion Test, Section 43, when the catalyst is removed from the heater.

16.3 A catalyst shall be field replaceable by use of ordinary tools, such as a screwdriver, pliers, wrench, and the like.

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16.4 A catalyst shall be arranged in the heater so that the burner flames will not impinge on the catalyst.

17 Strainers

17.1 A small orifice or other opening in fuel-supply systems likely to become clogged shall be protected by strainers.

17.2 Individual screening openings of the straining element of a primary strainer shall not be larger than those of a 50-mesh screen.

17.3 The primary strainer element shall provide at least 1/2 square inch (161.3-mm^2) effective area of screen opening per gallon (3.8 L) of fuel consumed per hour by the burner, but not less than 1 square inch (645.2-mm^2) total.

17.4 A metal screen more than 60 mesh shall be made of monel or the equivalent, and one of 60 mesh or less shall be made of brass or the equivalent.

17.5 A secondary strainer (one supplementary to the primary strainer) smaller in area than required by 17.3 may be used in the fuel line if its openings are considered as orifices and, when used, shall be protected by strainers of finer mesh.

17.6 A primary strainer shall be located to permit the ready removal of the screen without breaking the fuel line or disturbing any part of the heater assembly. The force necessary to open the strainer shall not permanently distort the assembly as installed on the heater.

17.7 A float valve, metering valve, and automatic regulating and shutoff valve shall be protected by a strainer of not less than 50 mesh.

18 Stuffing Boxes

18.1 If packing is used to prevent leakage of kerosene around a shaft or stem, a stuffing box complying with the requirements in 18.2 – 18.7 shall be used if the construction is such that it is necessary for the user to adjust or renew the packing to prevent leakage during intended usage or as wear occurs.

18.2 A stem or part shall have sufficient strength so that it cannot be twisted off or distorted by intended operation. A stem or part made of metal subject to corrosion shall engage or seat onto corrosion-resistant material only.

18.3 A stuffing box shall be provided with a removable, shouldered, unthreaded follower gland and with a nut, take-up, or other means for adjusting the gland to maintain pressure on the packing as wear occurs.

18.4 A stuffing box gland shall be made of corrosion-resistant material. The assembly of parts shall be such as to result in compressing the packing against the stem when the stuffing-box nut or yoke is tightened.

18.5 Before shipment, a stuffing box shall be fully packed with pliable packing material, the impregnation of which is not impaired by contact with kerosene.

18.6 The construction shall permit repacking the stuffing box without requiring the assembly to be dismantled.

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