UL 733

STANDARD FOR SAFETY

Oil-Fired Air Heaters and Oil-Fired Direct-Fired Heaters

UL Standard for Safety for Oil-Fired Air Heaters and Oil-Fired Direct-Fired Heaters, UL 733

Fifth Edition, Dated May 2, 2019

Summary of Topics

This new edition of UL 733 dated May 2, 2019 includes the following changes:

Change to the title and scope of standard

Update to the glossary terms

Clarify assembly requirements

Clarify construction requirements

Clarify marking requirements

The new and revised requirements are substantially in accordance with Proposal(s) on this subject dated December 21, 2018

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Standard for Oil-Fired Air Heaters and Oil Fired Direct-Fired Heaters

The first through fourth editions were titled Oil-Fired Air Heaters and Direct-Fired Heaters

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Second Edition – May, 1973
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Fifth Edition

May 2, 2019

This UL Standard for Safety consists of the Fifth Edition.

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

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INTRODUCTION

1 Scope

1.1 These requirements apply to oil-fired air heaters and oil fired direct-fired heaters.

1.2 Requirements for the installation and use of oil-burning equipment are included in the Standard for the Installation of Oil-Burning Equipment, NFPA 31.

1.3 This standard is not intended for permanently installed heaters.

2 General

2.1 The term "appliance" refers to any equipment covered by this Standard.

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

2.3 Except as indicated in 2.4, a component of a product covered by this standard shall comply with the requirements for that component. See Appendix A for a list of standards covering components generally used in the products covered by this standard.

2.4 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b) Is superseded by a requirement in this standard.

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

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

3 Units of Measurement

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

4 Undated References

4.1 Any undated reference to a code or standard appearing in the requirements of this standard shall be interpreted as referring to the latest edition of that code or standard.

5 Glossary

5.1 For the purpose of this Standard the following definitions apply.

5.2 AIR HEATER – An appliance, manufactured for assembly as a complete unit, intended to supply heated air for space heating and other purposes, equipped with one or more oil burners, safety controls, electrical equipment as needed, and related equipment and provided with a flue collar designed so that

combustion products or flue gases are not mixed in the appliance with the medium to be heated. This definition does not include central furnaces, kerosene stoves, oil-burning stoves, or unit heaters..

5.3 AIR SHUTTER – An adjustable device for varying the size of the air inlet or inlets regulating primary and/or secondary air.

5.4 ANTIFLOODING DEVICE – A primary safety control which causes the fuel flow to be shut off upon a rise in fuel level or upon receiving excess fuel, and which operates before the hazardous discharge of fuel can occur.

5.5 APPLIANCE FLUE – The flue passages with in the appliance.

5.6 AUTOMATICALLY LIGHTED APPLIANCE – An appliance in which fuel to the main burner is normally turned on and ignited automatically.

5.7 BAFFLE – An object placed in an appliance to direct the flow of air or flue gases.

5.8 BURNER, MECHANICAL-ATOMIZING TYPE – A power-operated burner which prepares and delivers the oil and all or part of the air by mechanical process in controllable quantities for combustion. Some examples are air atomizing, high and low pressure atomizing, horizontal rotary, vertical rotary atomizing, and vertical rotary wall-flame burners.

5.9 BURNER, MECHANICAL DRAFT TYPE – A burner which includes a power-drive fan, blower, or other mechanism as the principal means for supplying air for combustion.

5.10 BURNER, NATURAL DRAFT TYPE – A burner which depends principally upon the natural draft created in the flue to induce into the burner the air required for combustion.

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

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

5.13 COMBUSTIBLE MATERIAL – Combustible material as pertaining to materials adjacent to or in contact with heat-producing appliances, chimney connectors and vent connectors, steam and hot-water pipes, and warm-air ducts means material made of or surfaced with 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.

5.14 COMBUSTION CHAMBER – The portion of an appliance within which combustion occurs.

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

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

5.17 CONTROL, SAFETY – Automatic controls, including relays, switches, and other auxiliary equipment used in conjunction therewith to form a safety control system, which are intended to prevent unsafe operation of the controlled equipment.

5.18 CONTROL, PRIMARY SAFETY – The automatic safety control intended to prevent abnormal discharge of oil at the burner in case of ignition failure of flame failure.

5.19 CONTROL, SAFETY COMBUSTION – A primary safety control responsive directly to flame properties; sensing the presence of flame and causing fuel to be shut off in event of flame failure.

5.20 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 the appliance or in the chimney connector.

5.21 DAMPER, AUTOMATICALLY OPERATED – A damper operated by an automatic control.

5.22 DAMPER, MANUALLY OPERATED – An adjustable damper manually set and locked in the desired position.

5.23 DIRECT-FIRED HEATER – A heater, equipped with one or more oil burners, safety controls, electrical equipment as needed, and related equipment, manufactured for assembly as a complete unit, in which combustion products or flue gases are mixed with the air being heated, such as a salamander.

5.24 DRAFT REGULATOR – A device which functions to maintain a desired draft in the appliance by automatically reducing the chimney draft to the desired value.

5.25 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 (42.4 peak) or direct current and supplied by:

1) A Class 2 transformer, or by a battery, by a battery and fixed impedance, or by transformer and fixed impedance, each of which, as a unit is in compliance with what is required for a Class 2 transformer; or

2) Is limited to a maximum of 100 volt-amperes. 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) Safety Control Circuit – A circuit involving one or more safety controls.

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

5.27 FLUE – A general term for the conduit or passageway through which flue gases pass from the combustion chamber to the outside air.

5.28 FLUE COLLAR – That portion of an appliance intended for attachment of the chimney or vent connector.

5.29 FLUE GASES – Combustion products and excess air.

5.30 FUEL OIL – Any hydrocarbon oil as defined by Commercial Standard CS12 or ASTM D396-1969, ANSI Z11.203-1970.

5.31 HEAT EXCHANGER, DIRECT – A heat exchanger in which heat generated in the combustion chamber of the appliance is transferred direct through walls of the appliance to the heating medium (such as air, stream, or water) held in close contact with the combustion chamber walls. It is a self-contained combustion and heat exchanger.

5.32 HEAT EXCHANGER, INDIRECT – A heat exchanger which encloses or contains a heating medium, such as air, steam, or water, the heat from which is transferred to another heating medium separately contained in close contact with or directed through the heat exchanger.

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

5.34 MANUALLY LIGHTED APPLIANCE – An appliance in which fuel to the main burner is turned on only by hand and ignited under supervision.

5.35 NORMAL CARE – The periodic tasks usually performed to operate and maintain an appliance, such as air, fuel, pressure, and temperature regulation, cleaning, lubrication, resetting of controls, etc. Repair and replacement of parts other than those expected to be renewed periodically is not considered to be normal care. Some examples of normal care are:

a) Cleaning or replacing nozzles, atomizers, and pilots.

b) Setting ignition electrodes.

c) Cleaning strainers or replacing strainer or filter elements.

d) Resetting safety control.

e) Replacing igniter cable.

5.36 PILOT – A flame, smaller than the main flame, which is utilized to ignite the fuel at the main burner(s).

5.37 PORTABLE APPLIANCE – A mobile appliance or one intended to be moved from place to place. The term indicates a temporary installation as opposed to a permanent installation.

5.38 PRIMARY AIR – The air introduced into a burner and which mixes with the fuel before it reaches the ignition zone.

5.39 RADIATION SHIELD OR LINER – A separate panel(s) interposed between heating surfaces and adjacent objects to reduce heat transmission by radiation.

5.40 RADIATOR – Auxiliary heat transfer surfaces within the casing, connected between the combustion chamber and the flue collar.

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

5.42 SECONDARY AIR – The air externally supplied to the flame at or beyond the point of ignition.

5.43 SPECIAL PARTS AND TOOLS – Those parts and tools that are not available on the open retail market.

5.44 THERMOSTAT – An automatic control actuated by temperature change to maintain temperatures between predetermined limits.

5.45 VALVE, MANUAL OIL SHUTOFF – A manually operated valve in the oil line for the purpose of completely turning on or shutting off the oil supply to the burner.

5.46 VALVE, OIL CONTROL – An automatically or manually operated device consisting essentially of an oil valve for controlling the fuel supply to a burner.

a) Metering (Regulating) Valve – An oil 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 safety control or by an emergency device.

6 Instructions

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

6.2 The instructions should include such directions and information as deemed by the manufacturer to be adequate for attaining proper and safe installation, maintenance, and use of the heater.

CONSTRUCTION

7 Assembly

7.1 A heater shall be factory-built as a group assembly and shall include all the essential components necessary for its normal function when installed as intended. A heater may be shipped as two or more major subassemblies.

7.2 An outdoor-use heater shall conform also to Sections 58 – 64.

7.3 The various parts of a heater shall be constructed and assembled in accordance with these requirements in a manner to ensure strength, rigidity, and durability.

7.4 A heater, if not assembled by the manufacturer as a unit, shall be arranged in major subassemblies. Each subassembly shall be capable of being incorporated readily into the final assembly without requiring alteration, cutting, drilling (except to the extent indicated in 7.5) threading, welding, or similar tasks by the installer. Two or more subassemblies, which must bear a definite relationship to each other for the proper and safe installation or operation of the heater shall be arranged and constructed to permit them to be incorporated into the complete assembly, only in the correct relationship with each other; without need for alternation or alignment; or such subassemblies shall be assembled, tested, and shipped from the factory as one element.

7.5 To be in accordance with 7.4 major subassemblies of a heater are deemed to be the burner; the heat exchanger, including its base, combustion chamber, casing, and safety controls; the blower assembly, including the base, filters, and casing; and the blower motor if not included as part of the blower assembly. A wiring harness may be packaged with one of the major subassemblies.

7.6 The base, frame, or housing of a heater shall be constructed to permit movement of the heater without damaging it. Parts of the heater shall not be damaged when any side of the heater is placed as close to a solid vertical wall as the base, frame, or housing will permit.

7.7 The chassis or frame of a mobile heater intended to be hauled by a vehicle shall be constructed of channel-iron framework or of formed-steel members not less than 0.134 inch (3.40 mm), or the equivalent, adequately cross-braced, and of sufficient strength to support safely, with a factor of not less than five, the framework and equipment when in transit. The hitching yoke which extends in front of the assembly and to which the coupling mechanism is attached shall be an integral part of the chassis.

7.8 The chassis should be equipped with springs, wheels, and brakes of a strength and construction to ensure safety while the heater is in transit.

7.9 A radiation shield or baffle employed to prevent excessive temperature shall be assembled as part of the heater; or be part of a subassembly that must be attached to the heater for its normal operation; or be such that the heater cannot be assembled for operation without first attaching a required shield or baffle in its proper position.

7.10 A heater shall afford convenient operation by the user of those parts requiring attention or manipulation in intended usage.

7.11 Parts, when adjustable or movable, shall be provided with locking devices to reduce the risk of unintentional shifting.

7.12 Screws or bolts used to attach parts that are detached for intended care or servicing of the appliance shall be capable of holding upon the application of the torques indicated in Table 7.1 after removal and replacement.

Table 7.1
Maximum torque requirements for screws

Screw size (mm)		Torque, pound-inches	(N·m)
No. 8	(4.2)	20	(2.3)
No. 10	(4.8)	25	(2.8)
1/4 inch	(6.4)	100	(11.3)
5/16 inch	(7.9)	200	(22.6)
3/8 inch	(9.5)	350	(39.5)
7/16 inch	(11.1)	550	(62.1)
1/2 inch	(12.7)	800	(90.3)
9/16 inch	(14.3)	1200	(135.5)

7.13 Any external door providing access into the combustion chamber of a heater shall be self-closing.

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

7.15 A heater equipped with an antiflooding device shall be constructed so that, when the heater is level, the minimum distance between the intended maximum oil level maintained by the oil control device and the level of the lowest point at which overflow may occur is not less than 3/4 inch (19.1 mm).

8 Accessibility for Servicing

8.1 A heater shall be built to allow cleaning of parts such as interior surfaces of vaporizing burners, heating surfaces in contact with combustion products, oil inlet pipes, and oil strainers, without major dismantling of the heater or removal of parts required by 7.3 to be factory-assembled.

8.2 The removal of access panels, burners, blowers, caps, plugs, and the like, specifically constructed to permit ready removal and replacement for servicing, and the detachment of the chimney connector are not considered major dismantling as defined by 8.1.

8.3 Accessibility shall be afforded for intended cleaning, inspection, repair, and replacement of all burners, operating controls, and safety controls. The disposition of parts in the assembly removed for intended care shall be such that their restoration following removal will not necessitate their realignment to secure their intended relationship with other parts of the assembly. Special tools or parts required for intended care to be done by the operator shall accompany the heater to the user.

9 Disposal of Combustion Products

9.1 The construction of a heater shall not allow the products of combustion to become mixed with the circulating air.

10 Casing

10.1 The outer casing or jacket shall be made of steel or equivalent material, reinforced or formed if necessary, so that it is not likely to be damaged through handling in shipment, installation, and use. Sheet metal casings shall be made of steel having a minimum thickness of 0.032 inch (0.81 mm) (No. 20 MSG).

10.2 Access panels needed to be removed for normal service and accessibility shall be constructed to permit removal and replacement repeatedly without causing damage or impairing any required insulating value.

10.3 A removable panel through which air is drawn for combustion shall be so constructed as to reduce the risk of its being attached in a manner that may result in a risk of fire, electric shock, or injury to persons.

10.4 A removable panel shall be so constructed that it will not be interchangeable with other panels on the same heater when interchange may result in a risk of fire, electric shock, or injury to persons.

10.5 The casing or base of a heater shall completely close the bottom or be constructed to provide an effective partition between the heat exchanger and the floor or ground.

10.6 Connection between the heat exchanger and the casing which encloses circulating air shall be constructed to reduce the risk of leakage of combustion products into the circulating air.

11 Radiation Shields or Liners and Materials in Air Handling Compartments

11.1 A radiation shield or liner shall be so constructed, formed, and supported so that it cannot be improperly positioned and so that distortion or sagging in service cannot occur. A shield or liner shall be protected against corrosion if its deterioration may cause temperatures in excess of those specified in Table 44.1 when the heater is tested in accordance with these requirements. Any finish intended to obtain the required resistance to corrosion shall not be damaged by heat when the heater is tested under these requirements.

11.2 Exposed unimpregnated asbestos material shall not be used in an air handling compartment. The unprotected edge of a gasket sandwiched between two parts is considered to be exposed.

11.3 Insulating material that is not self-supporting, employed as a radiation shield, shall be applied to solid surfaces in a manner to prevent sagging. The insulating material shall not have a flame spread rating over 25 nor a smoke developed rating over 50 when tested in accordance with the tests for surface burning characteristics of building materials, UL 723, and its insulating value shall be unimpaired by heat