UL 729

STANDARD FOR SAFETY

Oil-Fired Floor Furnaces

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UL Standard for Safety for Oil-Fired Floor Furnaces, UL 729

Sixth Edition, Dated August 29, 2003

Summary of Topics

This revision of ANSI/UL 729 is being issued to reaffirm approval as an American National Standard. No changes in requirements are involved.

The revisions are substantially in accordance with Proposal(s) on this subject dated September 30, 2016.

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Standard for Oil-Fired Floor Furnaces

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August 29, 2003

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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 floor furnaces.

1.2 Requirements for the installation and use of oil-burning equipment are included in the Standard for the Installation of Oil-Burning Equipment, ANSI/NFPA 31. Requirements for the installation of oil-burning equipment are also included in codes such as the International Mechanical Code and the Uniform Mechanical Code.

1.2 revised October 1, 2008

1.3 A product that contains features, characteristics, components, materials, or systems new or different from those covered by the requirements in this standard, and that involves a risk of fire or of electric shock or injury to persons shall be evaluated using appropriate additional component and end-product requirements 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 does not comply with this standard. Revision of requirements shall be proposed and adopted in conformance with the methods employed for development, revision, and implementation of this standard.

2 General

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

3 Glossary

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

3.2 AIR SHUTTER – An adjustable device for varying the size of the air inlet or inlets regulating primary or secondary air, or both.

3.3 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 excessive discharge of fuel can occur.

3.4 APPLIANCE FLUE – The flue passages within the appliance.

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

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

3.7 BASE – The main supporting frame or structure of the furnace, exclusive of legs.

3.8 BURNER – A device for the final conveyance of fuel and air to the combustion zone.

3.9 BURNER, MANUALLY LIGHTED – A burner in which fuel to the main burner is turned on only by hand and ignited under supervision.

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3.10 BURNER, MECHANICAL ATOMIZING – A power-operated burner that prepares and delivers the fuel 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 and vertical rotary atomizing, and vertical rotary wall-flame burners.

3.11 BURNER, MECHANICAL DRAFT – A burner that includes a power-driven fan, blower, or other mechanism as the principal means for supplying air for combustion.

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

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

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

3.15 CENTRAL HEATING APPLIANCE – A stationary indirect-fired vented appliance comprising the following categories: boilers, central furnaces, floor furnaces, and recessed heaters. A floor mounted unit heater to be connected to a duct system is categorized also as a central heating appliance.

3.16 CHIMNEY CONNECTOR – The pipe that connects a solid or liquid fuel-burning appliance to a chimney.

3.17 COMBUSTIBLE MATERIAL – Combustible material as pertaining to materials adjacent to or in contact with heat-producing appliances, chimney connectors and vent connectors, refers to material made of or surfaced with wood, compressed paper, plant fibers, or other material that will ignite and burn. Such material is to be considered as combustible even though flameproofed, fire-retardant treated, or plastered.

3.18 COMBUSTION – The rapid oxidation of fuel accompanied by the production of heat or heat and light.

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

3.20 COMBUSTION (FLAME) SAFEGUARD – A safety combustion control.

3.21 CONSTANT LEVEL VALVE – A device that maintains a constant level of fuel in a reservoir for delivery to the burner.

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

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

3.24 CONTROL, SAFETY – An automatic control, including a relay, switch, or other auxiliary equipment used in conjunction therewith to form a safety control system that is intended to reduce the likelihood of operation of the controlled equipment that may result in a risk of fire or injury to persons.

3.25 CONTROL, PRIMARY SAFETY – An automatic safety control intended to reduce the likelihood of abnormal discharge of fuel at the burner in case of ignition failure or flame failure.

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3.26 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.

3.27 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.

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

3.29 DAMPER, MANUALLY OPERATED – An adjustable damper manually set and locked in the position intended to be used.

3.30 DRAFT – The differential in static pressure available, between any two locations, to provide the energy potential for the moving of either air for combustion, products of combustion, or both through a fuel-burning heat-exchanging apparatus.

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

3.32 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 that involves a potential of not more than 30 volts rms alternating-current (42.4 volts peak) or direct current and supplied by:

1) A primary battery,

2) A Class 2 transformer, or

3) A combination of transformer and fixed impedance that, as a unit, complies with all the performance requirements for a Class 2 transformer.

A circuit derived from 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.

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

3.34 FLUE COLLAR – That portion of an appliance constructed for attachment of the chimney connector.

3.35 FLUE GASES – Combustion products and excess air.

3.36 FUEL OIL – Any hydrocarbon oil defined by Specifications for Fuel Oils, ANSI/ASTM D396.

3.36 revised October 1, 2008

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3.37 FURNACE, FLOOR – A completely self-contained, indirect-fired unit furnace having integral plenums, warm air outlet, and cold air return and intended to be inserted into and suspended from the floor of the space being heated. The furnace takes air for combustion from outside this space and has a means for observing the flame and lighting the appliance from such space.

a) Gravity Type Floor Furnace – A floor furnace depending primarily on circulation of air by gravity. This category also includes floor furnaces equipped with booster-type fans which do not materially restrict circulation of air by gravity flow when such fans are not in operation.

b) Fan Type Floor Furnace – A floor furnace equipped with a fan which provides the primary means for circulation of air.

3.38 HEAT EXCHANGER, DIRECT – A heat exchanger in which heat generated in the combustion chamber of the appliance is transferred directly through walls of the appliance to the heating medium, such as air, steam, or water, and held in close contact with the combustion chamber walls. A direct heat exchanger is a self-contained combustion and heat transfer device.

3.39 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.

3.40 HEATING SURFACES – A surface that transmits heat directly from flame or flue gases to the medium to be heated.

3.41 INDIRECT FIRED APPLIANCE – An appliance constructed so that combustion products or flue gases are not mixed in the appliance with the medium to be heated and provided with a flue collar.

3.42 LINER – See Radiation Shield – 3.48.

3.43 MAINTENANCE – The periodic tasks usually performed to operate and maintain an appliance, such as air, fuel, pressure, and temperature regulation, cleaning, lubrication, resetting of controls, and the like. Repair and replacement of parts other than those expected to be renewed periodically is not considered as maintenance. Some examples of maintenance 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.

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

3.45 OIL-FIRED FLOOR FURNACE – A heating furnace equipped with one or more oil burners, safety controls, electrical equipment, and related equipment, manufactured for assembly as a complete unit.

3.46 PILOT – A flame that is utilized to ignite the fuel at the main burner or burners.

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3.47 PRIMARY AIR – The air that is introduced into a burner and mixed with the fuel before it reaches the ignition zone.

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

3.49 RADIATOR – An auxiliary heat transfer surface within the casing, connected between the combustion chamber and the flue collar.

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

3.51 SAFETY CONTROL – See Control, Safety – 3.24.

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

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

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

3.55 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.

3.56 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 Shutoff 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.

3.57 VENTED APPLIANCE – An indirect fired appliance provided with a flue collar to accommodate a flue pipe for conveying flue gases to the outside air.

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3A Undated References

3A.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.

3A.1 added October 1, 2008

4 Components

4.1 Except as indicated in 4.2, a component of a product covered by this standard, including the oil burner and its primary safety control as assembled as part of a furnace assembly, 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.

4.2 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.

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

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

CONSTRUCTION – MECHANICAL

5 Assembly

5.1 A furnace shall be intended for installation as a single assembly and shall include all the essential components necessary for its intended function when installed. The furnace may be shipped as two or more subassemblies.

5.2 A floor furnace, if not assembled by the manufacturer as a unit, shall be arranged in major subassemblies. Except as indicated in 5.3, each subassembly shall be capable of being incorporated into the final assembly without requiring alteration, cutting, drilling, threading, welding, or similar tasks by the installer. Two or more subassemblies which must bear a definite relationship to each other for the intended installation or operation of the floor furnace shall be:

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

b) Assembled, tested, and shipped from the factory as a single assembly.

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5.3 In accordance with 5.2, major subassemblies of a floor furnace are considered to be the:

a) Burner;

b) Heat exchanger, including its base, combustion chamber, casing, and safety controls;

c) Blower assembly, including the base, filters, and casing; and

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d) Blower motor if not included as part of the blower assembly.

A wiring harness may be packaged with one of the major subassemblies. Cutting or drilling required for the attachment of a return air plenum, the installation of an optional filter rack, or the provision of a return air opening in the furnace casing is deemed to conform to 5.2. If a return air opening is to be cut in the casing panel by the installer, suitable instructions and a template shall be furnished with the furnace, or the corners of the opening shall be embossed in knockout form.

5.4 A radiation shield or baffle employed to reduce the likelihood of excessive temperature shall be:

a) Assembled as part of the furnace;

b) Part of a subassembly that must be attached to the furnace for its intended operation; or

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

5.5 The construction of a floor furnace shall be such that, for any typical installation, the alteration or removal of a baffle, insulation, or a radiation shield needed to reduce the likelihood of excessive temperatures is not required.

5.6 Parts of a floor furnace which must be removed for installation shall be assembled to the furnace in a manner to permit easy removal, without dismantling factory wiring, and replacement. See 5.2 – 5.5.

5.7 A floor furnace shall be constructed to provide a constant circulation of heated air at all times during intended operation.

5.8 A floor furnace with a single warm air register shall not be equipped with a shutter to restrict the flow of warm air from the furnace.

5.9 A floor furnace having two warm air registers equipped with a shutter shall be such that only one or a fraction of one warm air register may be closed at one time.

5.10 Except for the attachment of a return air duct, there shall be no opening in the casing of a floor furnace for admission of circulating air below the floor level unless applicable performance requirements are met with such an opening closed or open.

5.11 A furnace shall be constructed so that parts requiring attention or manipulation by the user during typical use can be easily operated.

5.12 Adjustable or movable parts should be provided with locking devices to reduce the risk of shifting.

5.13 Any external door providing access into the combustion chamber of a furnace is to fit tightly and be constructed in a manner to resist displacement by a jarring or pressure created during intended use. A door shall be self-closing or arranged so that it must be closed to replace the floor register.

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

5.15 A floor furnace equipped with an antiflooding device shall be constructed so that, when the furnace is level, the minimum distance between the intended maximum normal 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).

6 Servicing

6.1 A floor furnace shall be constructed so that parts such as interior surfaces of vaporizing burners, heating surfaces in contact with combustion products, oil inlet pipes, and oil strainers can be cleaned, without major dismantling of the furnace or removal of parts required by 5.2 to be factory assembled.

6.2 The removal of an access panel, burner, blower, cap, plug, or the like, intended to permit removal and replacement for servicing and the detachment of the chimney connector, is not considered major dismantling with regard to the requirement in 6.1.

6.3 Burners, controls, and safety devices shall be accessible for cleaning, inspection, repair, and replacement when the furnace is installed as recommended by the manufacturer. The arrangement of parts in the assembly that may be removed for maintenance shall be such that their replacement, following removal, will not necessitate their realignment to maintain their intended relationship with other parts of the assembly. Specific tools required for maintenance to be done by the operator shall be provided with the furnace.

7 Moving Parts

7.1 A moving part such as a fan blade, blower wheel, pulley, belt, and the like, that may cause injury to persons shall be enclosed or guarded.

7.2 If the removal of doors, panels, or shields will expose such moving parts:

a) The opening or removal of the door, panel, or shield shall require the use of tools; or

b) An interlocking device shall shut off the mechanism; or

c) A warning marking shall be provided as specified in 61.18.

7.3 The distance from an opening in a required guard or enclosure to the moving parts mentioned in 7.1 shall be as specified in Table 7.1, but the minor dimension of the opening shall not exceed 3 inches (76.2 mm). For an opening having a minor dimension intermediate between two of the values specified in the table, the distance from the opening to the moving part shall not be less than that determined by 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 that can be inserted through the opening with a force of 5 pounds (22 N).

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Table 7.1
Dimensions of openings

Minor dimensions of opening[a]		Minimum distance from opening to moving part	
Inches	(mm)	Inches	(mm)
1/4	(6.4)	1/2	(12.7)
3/8	(9.5)	1-1/2	(38.1)
1/2	(12.7)	2-1/2	(63.5)
3/4	(19.1)	4-1/2	(114)
1	(25.4)	6-1/2	(165)
1-1/2	(38.1)	10-1/2	(267)
2	(50.8)	14-1/2	(368)
Over 2 inches	(over 50.8)	30	(762)

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

7.4 A moving part is not to be considered when evaluating compliance with 36.1 and 7.1 if the part is unlikely to be contacted through the opening because of fixed components, including baffles.

8 Disposal of Combustion Products

8.1 A furnace shall be constructed so that the products of combustion are not mixed with the circulating air.

9 Casing

9.1 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:

a) Steel not less than 0.020 inch (0.51 mm) thick if uncoated, or 0.023 inch (0.58 mm) thick if galvanized, or

b) Nonferrous sheet metal not less than 0.029 inch (0.74 mm) thick.

All surfaces shall be protected against corrosion. A finish required for corrosion protection shall not be damaged by heat during any of the tests specified in these requirements.

9.2 A coating provided on sheet metal as corrosion protection shall be equivalent to:

a) Hot-dipped mill galvanized sheet steel conforming with the coating Designation G90 in Table I of the Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process, ASTM A653.

b) Terne sheet having a coating of not less than 8 – 12 pounds (3.6 – 5.4 kg) per double base box, 112 sheets, 20 by 28 inches (508 by 711 mm).

c) Aluminum coated steel suitable as determined by test.

d) Durable coating of outdoor paint, such as one of the organic alkyd resin types.

9.2 revised October 1, 2008

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9.3 The casing of a floor furnace shall be constructed to provide access for servicing and cleaning of parts within the enclosure. If these operations cannot be performed readily from the floor level, access doors shall be provided for this purpose. The bottom of a casing shall be provided with a drain opening to reduce the risk of accumulation of liquids.

9.4 A floor furnace shall be constructed to provide control and operation from above the floor level, including the manipulation of any reset devices.

9.5 Access panels that need to be removed for service and accessibility shall be constructed to provide repeated removal and replacement without causing damage or reducing any required insulating value.

9.6 A removable panel through which air is drawn for combustion shall be constructed to reduce the risk of it being attached in a manner that may result in a risk of fire or injury to persons.

9.7 A removable panel shall be so constructed that it cannot be interchanged with other panels on the same furnace if interchange may result in a risk of fire or injury to persons.

9.8 The casing of a forced-air type furnace shall have no uncovered openings communicating with the circulating air compartments unless such openings are intended to be always connected to a return air duct.

9.9 The furnace shall be constructed so that the negative pressure created by an air circulating fan cannot affect the combustion air supply or draw products of combustion into the circulating air.

9.10 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.

9.11 An access opening to a return air compartment shall be completely covered.

10 Support

10.1 A floor furnace shall incorporate features to provide support when installed as intended.

10.2 A floor furnace shall be supported independently of the register.

10.3 A support provided in accordance with 10.2 may be accomplished by providing substantial flanges at least 3/4 inch (19.1 mm) wide at the top of the furnace casing or reinforced openings in the casing which will accommodate screws for attachment to the floor framing. Reinforced openings are to be located approximately 3-1/2 inches (89 mm) below the top of the casing. The total thickness of metal surrounding the reinforced opening is to be not less than 0.032 inch (0.8 mm). At least twelve such holes, uniformly distributed, are to be provided. Where this method is employed, the necessary wood screws are to be supplied with each furnace. The practice of driving nails through the casing does not meet the intent of this requirement.

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11 Radiation Shield

11.1 A radiation shield or liner shall be constructed, formed, and supported to provide for its intended positioning and to reduce the likelihood of distortion or sagging in service. See 12.4 and 12.5. 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 furnace is tested as specified in Sections 44 – 51. Any finish used to obtain the required resistance to corrosion shall not be damaged by heat when the furnace is tested as specified in Sections 44 – 51.

12 Materials in an Air Handling Compartment

12.1 Materials in a compartment handling conditioned air for circulation shall have a flame spread rating of not more than 25 and a smoke developed rating of not more than 50 when tested as specified in the Standard for Tests for Surface Burning Characteristics of Building Materials, UL 723.

Exception: This requirement does not apply to the following:

a) An air filter, drive belt, wire insulation, paint applied for corrosion protection, or tubing of material equivalent to one of the types of wire insulation permitted by this standard.

b) A gasket forming an air or water seal between metal parts.

c) A miscellaneous small part such as a resilient or vibration mount, wire tie, clamp, label, and the like.

d) An adhesive that, when tested in combination with the specific insulating material, complies with the requirement of this paragraph.

e) Molded or formed polymeric-material components (not liners) in such quantity that their total exposed surface area within the compartment does not exceed 10 square feet (0.9 m^2). See 12.6.

12.2 The supporting surface to be used in the test for adhesives as specified in the Standard for Tests for Surface Burning Characteristics of Building Materials, UL 723, is to be of asbestos-cement board or metal. Other materials requiring support may be supported using metal rods or bars or 2-inch (50.8-mm) hexagonal mesh wire with metal bars or rods.

12.3 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.

12.4 Thermal or acoustic insulating material shall be securely positioned if loosening may reduce or block air flow to cause temperatures in excess of those intended during tests as specified in Sections 44 – 51 or if loosening will result in short-circuiting, grounding, or reduction of electrical spacings below the required values. Leading edges of insulation shall be protected against damage caused by moving air.

12.5 A mechanical fastener for each square foot (0.09 m^2) of exposed surface is considered to securely position insulating liners to comply with 12.3. A mechanical fastener may be a bolt, metal clamp, wire rod, or the equivalent. Butting the edges of insulation against bulkheads may be employed to protect leading edges against damage caused by moving air. For rigid or semirigid sheets of insulating material, fastening is not required to the extent needed for less rigid material nor is protection of leading edges required.

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12.6 Polymeric materials exempted by the Exception to 12.1(e) shall have a flame spread rating of not more than 25 or shall comply with the requirements of the Flammability Tests for Materials in Air Handling Compartments, Section 56.

13 Air Filter

13.1 A filter, if supplied as a part of the furnace, shall be accessible for inspection or replacement without the use of special tools and without dismantling the furnace.

14 Combustion Chamber

14.1 A combustion chamber and flueway within the air handling compartment shall be constructed of cast iron, sheet steel, or other equivalent material. Sheet steel, if used, shall have the strength, rigidity, durability, resistance to corrosion, and other physical properties equivalent to sheet steel not less than 0.032 inch (0.81 mm) thick.

14.2 A combustion chamber (fire box) lining material shall be durable, secured in place, and accessible for replacement with equivalent material.

15 Radiator

15.1 A radiator shall be made of a material that complies with the requirement specified in 14.1 for a combustion chamber and shall be capable of being cleaned as intended.

16 Heating Surface Joints

16.1 Joints in heating surfaces shall be mechanically secure and tight, for example, welded, lock-seamed, machined and bolted, riveted, or the like. A joint shall not depend primarily on cement for tightness. A slip or lap joint shall not depend solely upon friction of the joint itself for strength.

16.2 Examples of some acceptable lock-seams are illustrated in Figure 16.1.

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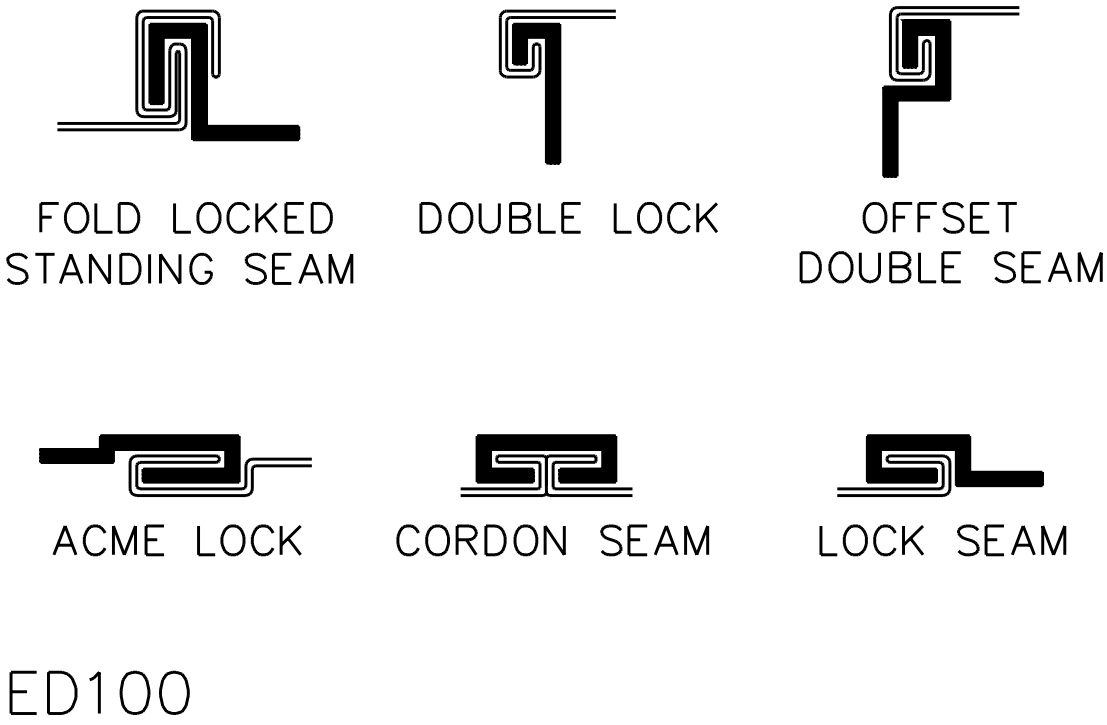
Figure 16.1
Types of acceptable lock-seams



17 Baffles

17.1 A baffle in a flue gas passage or otherwise exposed to combustion products shall be constructed and arranged to remain in its intended position.

17.2 A flue baffle shall be made of material having rigidity, heat and corrosion resistance equivalent to AISI 1010 sheet steel not less than 0.032 inch (0.81 mm) thick unless its deterioration will not cause temperatures in excess of those specified when the furnace is tested as specified in the Temperature Test, Section 44; Maximum Register Temperature Test, Section 45, and Continuous-Operation Temperatures Test, Section 46.

17.3 A flue baffle shall be accessible for cleaning. A flue baffle that is removable for cleaning shall be constructed so that it can be removed and replaced only in its intended position.

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18 Flue Collar

18.1 A flue collar shall be constructed and arranged to permit the secure attachment of the chimney connector.

18.2 A flue collar, flue collector part, or extensions exterior to the air handling compartment shall have rigidity, heat, and corrosion resistance equivalent to sheet steel not less than 0.016 inch (0.41 mm) thick.

18.3 A flue collar or flue collector part within the air handling compartment shall have rigidity, heat, and corrosion resistance equivalent to sheet steel not less than 0.032 inch (0.81 mm) thick.

18.4 The top of the flue collar shall be located not less than 20-1/2 inches (520 mm) below the intended floor level (upper surface of finished floor) to provide the required clearance between the flue pipe and floor joists.

19 Damper and Draft Regulator

19.1 A floor furnace equipped with a natural draft burner shall be provided with an automatic draft regulator.

19.2 An adjustable damper shall be equipped with minimum and maximum operating stops. The minimum operating stop for such a damper shall be located to obtain sufficient air for complete combustion at minimum burner input.

19.3 An automatically operated damper shall maintain the intended damper opening at all times and be arranged to reduce the risk of starting of the burner unless the damper is in the intended position for starting.

19.4 A furnace to be equipped with a barometric draft regulator shall be assembled so as not to require the regulator to be installed in a false ceiling, in a different room, or in any manner that will permit a difference in pressure between the air in the vicinity external to the regulator and the combustion air supply.

20 Field Wiring System Connections

20.1 Sheet metal to which a wiring system is to be connected in the field shall not be less than 0.032 inch (0.81 mm) thick if uncoated steel, not less than 0.034 inch (0.864 mm) thick if galvanized steel, and not less than 0.045 inch (1.14 mm) thick if nonferrous.

20.2 If threads for the connection of conduit are tapped all the way through a hole in an enclosure wall, or if an equivalent construction is employed, there shall not be less than three nor more than five threads in the metal and the construction of the device shall be such that a conduit bushing can be attached. If threads of the connection of conduit are not tapped all the way through a hole in an enclosure wall, conduit hub, or the like, there shall not be less than 3-1/2 threads in the metal and there shall be a smooth, rounded inlet hole for the conductors that provides protection to the conductors equivalent to that provided by a standard conduit bushing and that has an internal diameter approximately the same as that of the corresponding trade size of rigid conduit.

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20.3 In an enclosure intended to be supported by rigid conduit, the threaded opening for connection to the conduit shall be provided with at least five full threads.

20.4 A knockout in a sheet metal enclosure shall be secured but shall be capable of being removed without deformation of the enclosure.

20.5 A knockout shall be provided with a flat surrounding surface for seating of a conduit bushing, and shall be located so that installation of a bushing at any knockout likely to be used during installation will not result in spacings between uninsulated live parts and the bushing of less than those required.

20.6 A plate or plug for an unused conduit opening or other hole in the enclosure shall not be less than:

a) 0.014 inch (0.36 mm) thick if steel or 0.019 inch (0.48 mm) thick if nonferrous metal for a hole having a 1/4-inch (6.4-mm) maximum dimension; and

b) 0.027 inch (0.69 mm) thick if steel or 0.032 inch (0.81 mm) thick if nonferrous metal for a hole having a 1-3/8-inch (34.9-mm) maximum dimension.

A closure for a larger hole shall have a thickness equal to that required for the enclosure of the device or a standard knockout seal shall be used. Such a plate or plug shall be securely mounted.

CONSTRUCTION – ELECTRICAL

21 Controls

21.1 Application

21.1.1 A safety control circuit shall be two-wire, one side grounded, having a nominal rating of 120 volts. A safety control or protective device shall interrupt the ungrounded conductor.

21.1.2 A short circuit or combination of short circuits to ground shall not render a safety control or protective device inoperative. Safety control circuit arrangements other than described in 21.1.1 may be considered if they accomplish the intent of this requirement.

21.1.3 The requirement in 21.1.1 does not apply to a supervised circuit within a safety control or to the extension of such circuit to a separate element of the control, such as a flame-sensing device.

21.1.4 A control circuit shall be arranged so that it may be connected to a power supply branch circuit that can be fused at not more than the value intended for the rating of any control included in the circuit.

21.1.5 A safety control shall be accessible.

21.1.6 A safety control shall be supported in such a manner that the control and its sensing element will remain in their intended position. It shall be possible to determine by observation or test whether or not each control is in its intended location.

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21.1.7 Nothing shall be provided for the purpose of rendering any safety control ineffective or to allow firing of the furnace without the protection of each of the required safety controls.

21.1.8 A burner not equipped to provide for automatic restarting shall be constructed to require manual restart after any control functions to cause the fuel supply to be shut off and following restoration of an interrupted power supply.

21.2 Limit control

21.2.1 A floor furnace shall be provided with a limit control to reduce the likelihood of temperatures in excess of those specified in Sections 47 – 51.

21.2.2 The maximum setting of a limit control allowed by a fixed stop shall not permit an outlet air temperature more than that indicated in 42.1.

21.2.3 An automatically lighted furnace shall be provided with an automatic-reset type limit control. An auxiliary limit control may be of the manual-reset type.

21.2.4 A furnace equipped with a limit control that throttles the oil supply to produce a pilot fire shall be constructed to furnish air for combustion when the floor register is completely covered.

21.2.5 A limit control that functions to interrupt the delivery of fuel for combustion by opening an electrical circuit shall be arranged to effect the direct opening of that circuit, whether the switching mechanism is integral with or remote from the sensing element.

21.2.6 The requirement specified in 21.2.5 is intended to reduce the likelihood of interposing in the limit control circuit other controls, the malfunction of which may create a condition that the limit control is intended to preclude. However, a limit control may interrupt the pilot circuit of a magnetic-type motor controller that, in turn, directly opens the safety circuit when it is necessary to interrupt a single-phase circuit carrying a load greater than the capacity of available limit controls, or to interrupt a multi-phase circuit.

21.2.7 A furnace equipped with a vaporizing burner shall be constructed to reduce the likelihood of pooling of the burner upon functioning of the limit control.

21.2.8 The limit control or controls shall be factory installed on the furnace or its location shall be factory predetermined.

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21.3 Primary safety control

21.3.1 A furnace shall be equipped with a primary safety control.

22 Field Wiring

22.1 General

22.1.1 A furnace shall have provision for connection of a power supply wiring system in accordance with the National Electrical Code, ANSI/NFPA 70.

22.1.1 revised October 1, 2008

22.1.2 The location of an outlet box or compartment in which field-wiring connections are to be made shall permit these connections to be inspected after the equipment is installed as intended.

22.1.3 The connections are to be accessible without removing parts other than a service cover or panel and the cover of the outlet box or compartment in which the connections are made. A component intended for such use may serve as a cover.

22.1.4 The size of a junction box in which field-installed conductors are to be connected by splicing shall not be less than that specified in Table 22.1. A conductor passing through the box is counted as one conductor, and each conductor terminating in the box is also counted as one conductor. A field-furnished conductor for high-voltage circuits is considered to be not smaller than 14 AWG (2.1 mm^2).

22.1.4 revised October 1, 2008

22.1.5 A knockout for connection of a field-wiring system to a terminal box or compartment shall accommodate conduit of the trade size specified in Table 22.2.

Table 22.1
Size of junction boxes

Size of conductors AWG (mm^2)	Free space within box for each conductor, cubic inches	(cm^3)
16 or smaller (1.3 or less)	1.5	(24.6)
14 (2.1)	2.0	(32.8)
12 (3.3)	2.25	(36.9)
10 (5.3)	2.5	(41.0)
8 (8.3)	3.0	(49.2)

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