UL 307A

STANDARD FOR SAFETY

Liquid Fuel-Burning Heating Appliances for Manufactured Homes and Recreational Vehicles

UL Standard for Safety for Liquid Fuel-Burning Heating Appliances for Manufactured Homes and Recreational Vehicles, UL 307A

Ninth Edition, Dated July 24, 2018

Summary of Topics

This revision of ANSI/UL 307A is being issued to update the title page to reflect the most recent designation as a Reaffirmed American National Standard (ANS). No technical changes have been made.

The requirements are substantially in accordance with Proposal(s) on this subject dated August 10, 2018.

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.

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UL 307A

Standard for Liquid Fuel-Burning Heating Appliances for Manufactured Homes and Recreational Vehicles

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The most recent designation of ANSI/UL 307A as a Reaffirmed American National Standard (ANS) occurred on October 8, 2018. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, and Title Page.

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

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INTRODUCTION

1 Scope

1.1 These requirements apply to the following types of liquid fuel-burning appliances intended for installation in manufactured homes and recreational vehicles, including travel trailers, camping trailers, truck campers, motor homes, and park trailers.

a) Direct vent system type heating appliances that provide for complete separation between the indoor atmosphere and combustion system, including the air supplied for combustion by inherent design of the furnace and its venting system.

b) Vented heating appliances other than of the direct vent system type that provide for separation between the indoor atmosphere and combustion system, including the air supplied for combustion by an installation method. Such appliances can be used only in manufactured homes, not in recreational vehicles.

1.2 Requirements for the installation and use of these appliances are included in the following standards:

a) For Manufactured Homes – The Department of Housing and Urban Development Manufactured Home Construction and Safety Standards, Title 24 CFR, Part 3280, 1994.

b) For Recreational Vehicles – The National Fire Protection Association Standard for Fire Safety Criteria for Recreational Vehicles, NFPA 501C-1993.

1.3 An appliance constructed to burn liquid fuel or gas and a liquid fuel burning appliance constructed and designed so that it may be converted to burn gas by installation of a specific gas burner shall also comply with the applicable requirements in the Standard for Gas-Burning Heating Appliances For Manufactured Homes and Recreational Vehicles, UL 307B.

1.4 The term ″appliance″ as used in this standard refers to any heating appliance covered by this standard, such as a warm air central furnace, a wall furnace, a heating boiler, and a water heater.

2 Components

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

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

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

b) Is superseded by a requirement in this standard.

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

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

3 Units of Measurement

3.1 Unless otherwise indicated, all voltage and current values mentioned in this standard are rms values.

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

4 Glossary

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

4.2 ANTIFLOODING DEVICE – A primary safety control that causes fuel flow to be shut off upon a rise in fuel level. It is intended to operate to shut off the fuel flow before excessive fuel can be discharged into the appliance.

4.3 APPLIANCE FLUE – The flue passages within the appliance.

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

4.5 BURNER:

a) Automatically Lighted – One where fuel to the main burner is turned on and ignited by operation of an automatic control.

b) Manually Lighted – One where fuel to the main burner is turned on only by hand and ignited under supervision.

c) Mechanical-Atomizing Type – 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-rotary atomizing, vertical-rotary atomizing, and vertical-rotary wall-flame burners.

d) Mechanical-Draft Type – A burner that includes a power driven fan, blower or other mechanism as the principal means for supplying air for combustion.

e) Natural-Draft Type – A burner that depends principally upon the natural draft created in the chimney to induce into the burner the air required for combustion.

f) Vaporizing Type – 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 being used to vaporize the fuel, with provision for admitting air and mixing it with the fuel vapor in combustible proportions.

4.6 CENTRAL FURNACE – A self-contained appliance for heating air by transfer of heat of combustion through metal to the air, and designed to supply heated air through ducts to spaces remote from or adjacent to the appliance location.

4.7 CONTROL –

a) LIMIT – An automatic safety control responsive to changes in liquid level, pressure, or temperature and intended to be set beyond the operating range for limiting the operation of the controlled equipment.

b) OPERATING – A control, other than a safety control or interlock, to start or regulate burner firing according to demand and to stop or regulate firing on satisfaction of demand or upon reaching the intended temperature or pressure in the appliance being fired.

c) PRIMARY SAFETY – The automatic safety control intended to prevent abnormal discharge of fuel at the burner in case of ignition failure or flame failure.

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

e) 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.

4.8 DIRECT VENT SYSTEM APPLIANCE – An appliance which is constructed so that all air supplied for combustion, the combustion system of the appliance, and all products of combustion are completely isolated from the atmosphere of the space in which it is installed.

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

4.10 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 power limited circuit.

b) LOW-VOLTAGE (POWER LIMITED) CIRCUIT – A circuit involving a potential of not more than 30 volts alternating current, rms 42.4 volts direct current or ac peak, and supplied by:

1) A Class 2 transformer, or by a battery, by a battery and fixed impedance, or by a 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.

4.11 FUEL OIL – Any hydrocarbon oil defined by Specifications for Fuel Oils, ASTM D396-1992.

4.12 FULL DRAIN – As applied to tanks, means the tank is emptied through its fuel-feed outlet at the bottom of the tank.

4.13 MANUFACTURED HOME – A factory built home constructed in accordance with the Department of Housing and Urban Development Manufactured Home Construction and Safety Standards, Title 24 CFR, Part 3280-1994.

4.14 PIPING – The word ″piping″ where used in this standard refers to either pipe or tubing or both.

a) PIPE – Refers to rigid metal pipe.

b) TUBING – Refers to semirigid metal tubing.

4.15 RECREATIONAL VEHICLE – A vehicular type unit primarily designed as temporary living quarters for recreational, camping, or travel use, that either has its own motive power or is mounted on or drawn by another vehicle. The basic types are:

a) Camping Trailer – A vehicular portable unit mounted on wheels and constructed with collapsible partial sidewalls that fold for towing by another vehicle and unfold at the campsite to provide temporary living quarters for recreational, camping, or travel use.

b) Motor Home – A vehicular unit designed to provide temporary living quarters for recreational, camping, or travel use, built on or permanently attached to a self-propelled motor vehicle chassis or on a chassis cab or van that is an integral part of the completed vehicle.

c) Park Trailer – A vehicular unit:

1) Built on a single chassis, mounted on wheels,

2) Designed to provide seasonal or temporary living quarters, and may be connected to utilities necessary for operation of installed fixtures and appliances,

3) Constructed to permit setup by user, using only hand tools, that may include lifting, pulling, and supporting devices, and

4) Having a gross trailer area not exceeding 400 square feet (37.2 m^2) when in the setup mode.

d) Travel Trailer – A vehicular portable unit, mounted on wheels, designed to provide temporary living quarters for recreational, camping, or travel use and of such a size or weight as not to require special highway movement permits when towed by a motorized vehicle, and with a living area of less than 220 square feet (20.4 m^2), excluding built-in equipment (such as wardrobes, closets, cabinets, kitchen units or fixtures) and bath and toilet rooms.

e) Truck Camper – A portable unit constructed to provide temporary living quarters for recreational, camping, or travel use, consisting of a roof, floor, and sides, and designed to be loaded onto and unloaded from the bed of a pickup truck.

4.16 ROOF JACK – A factory-made assembly for conveying flue gases through a roof and which includes a flue, insulating means, flashing, and cap.

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

f) Replacing or cleaning air filters.

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

4.19 VALVE –

a) BURNER-INPUT CONTROL – An automatic-control valve for regulating burner input.

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

c) MANUAL MAIN-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.

d) SAFETY SHUTOFF – A control valve that is automatically closed by the safety control system or by an emergency device. Such a valve may be of the automatic or manually opened type.

4.20 VENTED APPLIANCE – An indirect-fired appliance provided with means to accommodate a chimney or a roof-jack connector.

4.21 WATER HEATER – An appliance for supplying hot water for domestic or commercial purposes other than for space heating. Categories of water heaters are:

a) DOMESTIC STORAGE – A water heater that heats and stores water at a thermostatically controlled temperature for delivery on demand. Input rating may not exceed 200,000 British thermal units (Btu) per hour (59 kW).

b) COUNTER TYPE –

1) Flush Type – A vented automatic storage water heater with flat sides, top, front and back, which is primarily for flush installation in conjunction with or adjacent to a counter 36 inches (0.9 m) high, wherein the front and top of the heater casing are exposed.

2) Recessed Type – A vented automatic storage water heater with flat sides, top, front and back, which is for flush installation beneath a counter 36 inches (0.9 m) high, wherein the front of the heater casing is exposed.

3) Concealed Type – A vented automatic storage heater which is for flush installation beneath a counter top 36 inches (0.9 m) high, wherein the entire heater is concealed.

CONSTRUCTION – ALL APPLIANCES

5 Materials

5.1 Fuel-confining parts or operating parts, if failure of the parts will allow unsafe leakage of fuel or unsafe operation or prevent a safety device from functioning, shall be of metal having a melting point (solidus temperature) of not less than 950°F (510°C) and a tensile strength of not less than 10,000 pounds per square inch (psi) (68.9 MPa) at 400°F (204°C). Parts shall not sag, distort, melt, or show leakage of fuel during any of the tests specified herein. Piping shall be made of iron, steel, copper, or brass.

6 Assembly

6.1 An appliance shall be factory built as a group assembly and shall include all the essential parts necessary for its intended function when installed as intended. An appliance may be shipped as two or more subassemblies. See 6.8.

6.2 Appliances for manufactured homes supplying a heating medium, that is, air, steam, or water, through ducts or pipes only may be constructed to provide complete separation of the combustion system from the atmosphere of the manufactured home when the appliances are installed as intended in accordance with the manufacturer's instructions furnished with the appliance. Other types of appliances for manufactured homes and all appliances for recreational vehicles shall provide for complete separation of the combustion system from the atmosphere of the manufactured home or recreational vehicle by inherent construction of the appliance. Air-intake assemblies and flue-gas outlet assemblies conforming to these requirements (see Sections 9 and 20, respectively) shall be provided as components of these appliances. See 83.3.

6.3 The complete separation of the combustion system of a fuel-burning appliance from the atmosphere of a manufactured home or recreational vehicle is obtained by the appliance being constructed and installed so that:

a) All air supplied for combustion,

b) The combustion system of the appliance, and

c) All products of combustion are completely isolated from the atmosphere of the manufactured home or recreational vehicle.

An appliance that provides such complete separation of the combustion system of the atmosphere of the manufactured home or recreational vehicle by inherent construction is referred to as a ″direct vent system appliance.″

6.4 If such isolation in a manufactured home only is obtained by installation of the appliance in a compartment isolated from the indoor atmosphere, doors, panels, and any other access openings serving the enclosure are to communicate only to the outdoors.

6.5 Conformance of a direct vent system appliance with 6.3 is not intended to preclude designs including parts which, when opened or removed, may permit the combustion system to communicate with the atmosphere of the manufactured home or recreational vehicle, provided:

a) The appliance is not operable when such part is opened or removed,

b)Compartment doors or access panels are hinged to the compartment in a manner not likely to permit or invite their removal, and an interlock switch is provided that will automatically open the circuit when the door or panel is opened and that will automatically close the circuit when the door or panel is closed – the construction of the interlock switch is such that service personnel can manually close the circuit for servicing but the switch will automatically return to its intended position when the door or panel is closed, that is, be in a position to automatically open the circuit when the door or panel is reopened – and the interlock switch is wired in the power circuit to the appliance or in the combustion-detector circuit of the primary safety control, or

c) A combination of two or more compartment doors or access panels and interlock switches that provide protection equivalent to the preceding are furnished, in which case only one of the doors or panels need be hinged to the compartment.

6.6 A burner compartment of an appliance intended to conform to the requirements of 6.3 or 6.4 by following the criteria outlined in 6.5 (a) and (c) shall include a marking that can be seen when the door or access panel is open. The marking shall be in contrasting colors and shall contain the word ″WARNING″ and the following or equivalent: ″Risk of Electric Shock – This Compartment Must Be Closed Except When Servicing.″ The word ″WARNING″ shall be in letters not less than 19/64 inch (7.5 mm) high, and the balance of the statement in letters not less than 7/32 inch (5.6 mm).

6.7 An appliance may include an opening, communicating with the combustion system, needed for the user to light or start the appliance, provided the opening does not exceed a 28 square inch (181 cm^2) cross-sectional area and has an attached cover plate. The cover plate is to be self-closing and equipped with a means such as a latch or spring to hold it firmly in the closed position. The cover plate shall be clearly marked with a statement equivalent to ″Keep Closed When Appliance Is In Service.″ The marking shall be in letters not less than 5/32 inch (3.9 mm) high. A manual reset shall be resettable without dismantling the appliance or removing any part of it if such dismantling or removal nullifies the complete separation of the combustion system from the atmosphere of the manufactured home or recreational vehicle.

6.8 Air-intake assemblies and flue-gas outlet assemblies for direct vent system appliances shall be an integral part of the appliance, or each assembly shall be constructed for direct attachment to the appliance.

6.9 An appliance, if not assembled by the manufacturer as a unit, shall be arranged in as few subassemblies as practicable. Each subassembly shall be capable of being incorporated readily into the final assembly without requiring alteration, 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 appliance, shall be arranged and constructed to permit them to be incorporated into the final assembly, without need for alteration and alignment, only in the correct relationship with each other; or such subassemblies shall be assembled, tested, and shipped from the factory as one element.

6.10 A radiation shield or baffle employed for limiting temperatures shall be assembled as part of the appliance; or be part of a subassembly that must attach to the appliance for its intended operation; or be such that the appliance cannot be assembled for operation without first attaching a required shield or baffle in its intended position.

6.11 An appliance shall be such that, for any intended installation, the alteration or removal of a baffle, insulation, or a radiation shield needed to prevent unsafe temperatures is not required.

6.12 An appliance for recessed, horizontal, through-the-wall, alcove, or closet installation shall provide for maintaining the minimum clearance required between the bottom, sides and back of the appliance and between concealed surfaces of the wall or partition in which or to which the appliance is to be installed. Spacers shall be of such strength and bearing surface as to maintain required clearance from such construction.

6.13 Appliances for alcove or closet installation, such as upflow and downflow central furnaces, and boilers, are considered to conform to 6.12, if spacers are located at least at one level to provide essentially continuous interference with adjoining construction as done, for example, by an extended base or support. Appliances for recessed installation in an interior wall or through an outside wall may require spacers at more than one level, or more than one spacer on each surface of the appliance, to maintain the required clearance.

6.14 Integral spacers, where required on the appliance, shall be of such strength and bearing surface as to maintain the required clearance. A sheet steel spacer shall have a minimum thickness of 0.032 inch (0.81 mm) unless equivalent strength and rigidity are obtained with lesser thickness. A spacer shall be attached to the appliance by welding, riveting, or equally permanent means.

6.15 An appliance for recessed, alcove, or closet installation shall be such that no portion of the products of combustion nor any portion of the heated circulating air or air from the space being heated will be discharged into spaces within walls, floor, or ceiling. Openings in the jacket, top or sides through which the chimney or vent connector extend shall afford compliance with this requirement.

6.16 A constant level valve assembly, not enclosed within the appliance casing nor otherwise protected, shall withstand a load of 100 pounds (45 kg) when tested as described in 6.17, without altering its position by more than 3 degrees in any horizontal or vertical plane.

6.17 The valve is to be joined to the appliance as intended and fuel lines integral with the appliance attached. A 100 pound (45 kg) weight or load is to be applied uniformly without impact to the main body of the valve assembly. Successive applications of the load are to be made vertically and horizontally in any direction. Upon removal of the load after each application, the position of the valve assembly with respect to the appliance is to be within the limits specified in 6.16.

6.18 An appliance equipped with a vaporizing burner shall be such that, when the appliance is level, the minimum distance between the designed maximum oil level in the burner maintained by the primary safety control and the level of the lowest point at which overflow may occur is not less than 3/4 inch (19.1 mm).

6.19 Parts, when adjustable or movable, shall be provided with locking devices to prevent accidental shifting.

6.20 Screws or bolts used to attach parts which are detached for care or servicing of the appliance shall be capable of holding upon the application of the torques indicated in Table 6.1 after removal and replacement.

Table 6.1
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)

6.21 Parts of an appliance requiring attention, manipulation, or adjustment in usage shall be accessible.

6.22 Bolts, nuts, screws, except sheet-metal screws, and other threaded parts used in the general assembly of the appliance shall have threads conforming to the Standard for Unified Inch Screw Threads, ANSI B1.1-1989.

6.23 The construction of an appliance shall be such as to prevent products of combustion from coming in contact with thermal insulation.

6.24 Sheet steel parts of the appliance, except where otherwise specified in these requirements, shall have a minimum thickness of 0.013 inch (0.33 mm) if uncoated or 0.016 inch (0.41 mm) if galvanized. This applies to parts such as radiation shields and liners not exposed to combustion products, air intake tubes, and the like, unless greater strength and rigidity are required for the application.

6.25 A removable cover for an access opening that maintains, with the cover closed, required separation between the combustion system and the atmosphere of the manufactured home or recreational vehicle, and a removable flue collector box, shall fit tightly and shall, together with any gasket material:

a) Be made of a material rated for the temperature to which it is exposed,

b) Show no evidence of deterioration or damage as a result of tests of the appliance, and

c) Be formed and cut to prevent parts from blocking air openings of the burner(s) and pilot.

7 Accessibility for Servicing

7.1 An appliance shall be constructed to afford accessibility to those parts and controls requiring attention, manipulation, or adjustment in usage.

7.2 An appliance shall be built to allow cleaning of parts such as interior surfaces of burners, heating surfaces in contact with combustion products, fuel inlet, and oil strainers, without major dismantling of the appliance or removal of those parts required by 6.9 to be factory assembled.

7.3 The removal of access panels, burners, caps, plugs, and the like, specifically constructed to permit ready removal and replacement for servicing, are not considered major dismantling as described by 7.2.

7.4 Accessibility achieved with the use of simple tools shall be afforded for cleaning, inspection, repair, and replacement of all burners, controls, and safety devices when the appliance is installed as recommended by the manufacturer. The arrangement of parts in the assembly removed for servicing shall be such that their restoration, following removal, will not necessitate realignment to secure their proper relationship with other parts of the assembly. Special equipment that may be required for servicing to be done by the operator shall accompany the appliance to the user.

7.5 A forced air heating appliance intended to be connected to a supply duct(s) may include means for measuring static pressure developed within the appliance casing. Such connection shall consist of a pipe or tubing connector fitting with a removable cap or plug and shall be located in the warm air outlet end of the appliance and be accessible after the appliance is installed in accordance with the manufacturer's instructions.

Exception: The cap or plug need not be provided if the orifice in the appliance casing is 0.040 inch (1.02 mm) in diameter or less. See Figure 47.1.

7.6 The heads and nuts of bolts, and the threads of screws, which must be removed to permit the removal of clean-out plates shall not be placed where they are in contact with flue-gases.

Exception: Bolts made of Type 430 stainless steel or material equally resistant to heat and corrosion and brass nuts are exempt from this requirement.

7.7 The flue-gas passageways of air-heating appliances shall be accessible for cleaning when:

a) The products of combustion are drawn below the level of the burner.

b) The temperature of the combustion products is less than 250°F (121°C) when the appliance is operated within ±2 percent of the manufacturer's Btu per hour (W) input rating, or

c) The width of any flue-gas passage is less than 1-1/2 inches (38.1 mm).

8 Burner Equipment

8.1 An oil burner for a liquid fuel-burning appliance shall conform to the applicable requirements included in the Standard for Oil Burners, UL 296.

8.2 A burner or part that at any time contains an open pool of fuel, a semienclosed valve, or an integral tank shall be of splash-proof construction. The burner or part shall be such that, when at rest, fuel will not under conditions of use (with flame burning or extinguished) discharge from such burner or part when the appliance is tilted in any direction to an angle of not more than 3 degrees from the horizontal. Oil fuel may be discharged below the floor of a manufactured home or recreational vehicle. Under such circumstances, if such an assembly or part is subject to variations in fuel flow rate or to changes in combustion characteristics when off level, it shall function in the intended manner.

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

9 Air-Intake Assemblies

9.1 The requirements in this section are applicable to all types of appliances, that is, direct vent system appliances and appliances that provide for separation of the combustion system from the indoor atmosphere (isolation) by an installation method.

Exception: 9.3 and 9.12 are applicable only to appliances intended for installation in manufactured homes that provide for isolation by an installation method.

9.2 An appliance shall be provided with a combustion air intake. The intake for an appliance equipped with a draft regulator shall also provide air for draft regulator dilution. An intake shall communicate with the outside atmosphere.

9.3 If two intakes are employed to provide air as required by 9.2, both shall be located in the same floor, roof, or wall of the manufactured home, or both shall terminate in the same pressure zone in an appliance enclosure inside the manufactured home.

9.4 An air-intake assembly to the underside of a manufactured home or recreational vehicle shall extend at least 7 inches (177.8 mm) below the upper surface of the floor. An air-intake assembly through the roof of a manufactured home or recreational vehicle shall be such that, when the assembly is installed as intended, the air entrance will be at least 6 inches (152.4 mm) above the top surface of the roof and the exit will be at least 6 inches below the top surface of the roof.

9.5 An air-intake assembly for installation through an outside wall of a manufactured home shall be capable of being extended from 2 inches (50.8 mm) to 4-3/4 inches (121 mm) beyond the inside face of the wall and shall not project beyond the outside wall more than 3 inches (76.2 mm).

9.6 An air-intake assembly for an appliance intended only for installation through an outside wall of a recreational vehicle shall be capable of being extended at least 2 inches (50.8 mm) beyond the inside face of the wall and shall not project beyond the outside wall more than 3 inches (76.2 mm). The appliance shall be marked in compliance with 73.1(m).

9.7 If a telescoping slip-fit connection is used in the air-intake tube to provide for installation in walls of varying thickness, the minimum overlap shall be 1-1/4 inches (31.8 mm).

9.8 If a slip-fit is used at the connection of an air-intake tube with the appliance, the minimum overlap shall be 1/2 inch (12.7 mm), and means shall be provided to position the tube with respect to the wall structure.

9.9 The air entrance of an air-intake assembly shall be guarded, shielded, or located to exclude rain, snow, debris, and birds. A screen, if used, shall have a mesh of not less than 1/4 inch (6.4 mm).

9.10 An air entrance located beneath the floor and having a free area of at least 10 square inches (65 cm^2) with no cross-sectional dimensions less than 1-1/2 inches (38.1 mm) is considered to comply with 9.9 without additional guarding or shielding.

9.11 The design and path of an air intake shall provide the intended amounts of combustion air to burners and of dilution air to any draft regulator.

9.12 The free area of openings to the outdoors in combustion air and dilution air-intake assemblies to be installed in the wall of an enclosure of a manufactured home in which an appliance, other than a direct vent system appliance, is to be installed shall not be less than 1 square inch (645 mm^2) for each 5000 Btu per hour (1464 W) of the total input rating of all appliances to be in the enclosure.

9.13 The minimum cross-sectional dimension of an internal air passage in an air-intake assembly shall be not less than 1/2 inch (12.7 mm).

9.14 The top or plane of any concealed combustion air or ventilation opening(s) shall be not less than 2 inches (50.8 mm) above the floor level. The bottom of such openings shall be not less than 1 inch (25.4 mm) above the floor level unless all performance provisions can be met with the bottom of the opening blocked to a distance 1 inch (25.4 mm) above the floor.

9.15 Openings in perforated or expanded metal panels provided over openings for combustion air, circulating air, or draft hood relief shall be not less than 1/4 inch (6.4 mm) diameter. If the openings in such panels are other than circular in shape, they shall be of such size that will permit entrance of a No. 3 DMS (5.4102 mm) drill.

10 Base

10.1 The base of an appliance shall be constructed to provide for the support of the appliance. A base or frame shall be constructed of metal or material which provides strength, durability, and flame retardancy equivalent to metal.

10.2 An appliance shall be provided with facilities to permit secure and ready attachment to the floor or structure of the manufactured home or recreational vehicle. If unique bolts, screws, or other parts are needed for that purpose, they shall be furnished with the appliance.

10.3 If means are required for leveling and alignment, they shall be included with the appliance.

10.4 If subbase is furnished as a separate assembly, it shall be marked to indicate the correct position of the appliance with respect to the subbase. A separate subbase which cannot be assembled incorrectly with respect to the appliance need not be marked.

10.5 The base, subbase, or duct connector of a downflow appliance shall be constructed for installation on flammable flooring material and shall establish and maintain not less than the required clearance between vertical surfaces of the plenum or duct to be attached thereto and the floor construction. A spacer shall extend at least 3/4 inch (19.1 mm) below the upper surface of the floor on which the appliance is to be installed.

10.6 The use of spacers in the form of separate blocks or shims is not considered to be in compliance with 10.5.

11 Drip Pan or Tray

11.1 An oil-fired appliance having a burner or part which at any time contains an open pool of oil or a semienclosed valve, or integral tank, even though considered splash-proof, shall be provided with a drip pan or tray. Such drip pan or tray shall be designed to collect oil discharged from such parts and shall retain or drain such oil to the underside of the mobile home or recreational vehicle when the appliance is tilted in any direction to an angle of not more than 3 degrees from the horizontal.

11.2 The drip pan or tray shall be provided with a conduit or passageway arranged to drain any collected oil. It shall be supplied as part of the appliance or as a separate single subassembly. The conduit or passageway shall have an internal diameter of not less than 5/16 inch (7.9 mm).

12 Casing

12.1 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 0.020 inch (0.51 mm) if uncoated, or 0.023 inch (0.58 mm) if galvanized, or of nonferrous sheet metal having an average thickness of not less than 0.029 inch (0.74 mm).

12.2 Access panels which need to be removed for service and accessibility shall be constructed to permit repeated removal and replacement without causing damage or impairing any required insulating value.

12.3 A removable panel through which air is drawn for combustion shall be constructed so as to prevent it being attached in a manner that may cause a risk of fire or injury to persons.

12.4 A removable panel shall be constructed so that it will not be interchangeable with other panels on the same appliance when interchange may cause a risk of fire or injury to persons.

12.5 The casing shall completely close the bottom or be constructed to provide an effective radiation barrier between the heat exchanger and the floor.

Exception: An opening is permitted if it is intended to be permanently connected to a circulating air distribution duct or to an intake assembly.

12.6 An appliance and its return air system shall be constructed so that the negative pressure created by an air circulating fan cannot affect the combustion air supply or act to draw products of combustion into the circulating air.

13 Radiation Shields

13.1 A radiation shield or liner shall be constructed, formed, and supported to provide for its intended positioning and to prevent distortion or sagging in service. A shield or liner shall be protected against corrosion by heat-resistant paint, galvanizing, or the like if its deterioration may cause excessive temperature when the appliance is tested in compliance with these requirements. Any finish to obtain the required resistance to corrosion shall not be damaged by heat when the appliance is tested under these requirements.

14 Materials In Air Handling Compartments

14.1 General

14.1.1 Materials in a compartment handling air for circulation through a duct system shall not have a flame spread rating of more than 25 nor a smoke developed rating of more than 50 when tested in accordance with the test method for fire hazard classification of building materials in the Standard for Test for Surface Burning Characteristics of Building Materials, UL 723. This requirement does not apply to the following:

a) Air filters, drive belts, wire insulation, and paint as applied for corrosion protection.

b) Gaskets forming air or water seals between metal parts.

c) Miscellaneous small parts such as resilient or vibration mounts, wire ties, clamps, or labels.

d) An adhesive which, when tested in combination with the specific insulating material, complies with the requirement.

e) Molded or formed components made of polymeric materials, not liners, in such quantity that the total surface area of such materials in the compartment does not exceed 10 square feet (0.9 m^2). See 14.1.7.

14.1.2 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.

14.1.3 The supporting surface to be used in the fire hazard classification test of adhesives 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.

14.1.4 Thermal or acoustic insulating material shall be securely positioned if loosening may reduce or block air flow to cause temperatures or pressures in excess of those acceptable in the temperature tests or if loosening will result in reduction of electrical spacings below the required values, short-circuiting, or grounding. Leading edges of insulation shall be protected against damage from the effects of the velocity of the moving air.

14.1.5 A mechanical fastener for each square foot (929 cm^2) of exposed surface is considered to securely position insulating liners. Mechanical fasteners may be bolts, metal clamps, wire rods, or the equivalent. Butting edges of insulation against bulkheads may be used to provide protection for leading edges against damage from effects of the velocity of moving air. Rigid or semirigid sheets of insulating material may not require fastening to the extent needed for less rigid material or protection of leading edges if the material possesses inherent resistance to damage.

14.1.6 An adhesive required for securing insulation shall retain its adhesive qualities at any temperature attained by the adhesive when the unit is tested under the performance requirements of this standard and at minus 17.8°C (0°F) or minus 29°C (minus 20°F) for outdoor-use equipment.

14.1.7 Polymeric materials exempted by 14.1.1(e) shall not have a flame spread rating of more than 25 or shall conform to the requirements of the flammability test in 41.1 – 41.5.

14.2 Air filters

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

14.2.2 Means shall be provided to retain and support an air filter in the intended position in or on the appliance.

15 Combustion Chamber

15.1 The combustion chamber and flueways of an air-heating appliance shall be constructed of cast iron or sheet steel. Sheet steel, if used, shall be such as to assure strength, rigidity, durability, resistance to corrosion, and other physical properties equivalent to ANSI C1010 hot-rolled sheet steel having a minimum thickness of 0.032 inch (0.81 mm), except that an air-heating appliance having a maximum rated input not in excess of 50,000 Btu per hour (14.6 kW) may have a minimum thickness of 0.026 inch (0.66 mm).

15.2 Combustion chamber (fire box) lining material, if used, shall be durable, supported in place, and accessible for replacement with equivalent materials.

16 Radiator

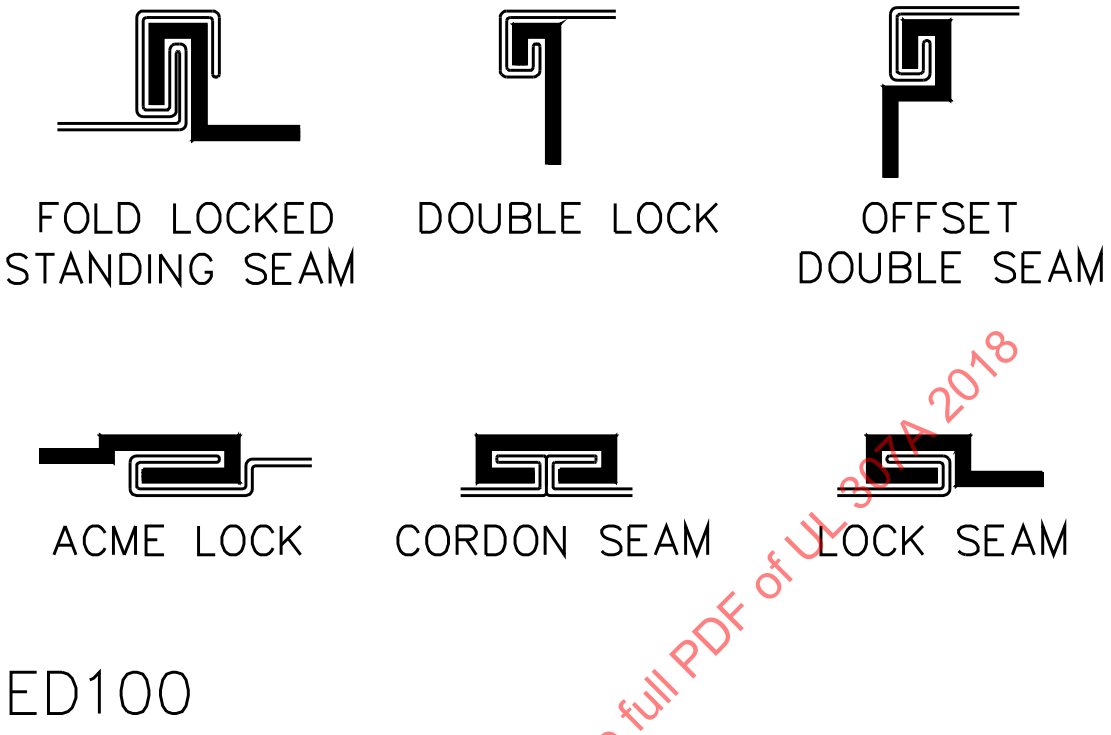
16.1 A radiator of an air-heating appliance shall be made of material not lighter than that designated in 15.1 for a combustion chamber.

17 Heating-Surface Joints

17.1 Joints in heating surfaces shall be substantially tight, as attained by being welded, lock-seamed, machined and bolted, or riveted. 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.

17.2 Examples of some acceptable lock seams are illustrated by Figure 17.1.

Figure 17.1
Types of acceptable lock-seams



18 Baffles

18.1 A flue baffle shall be fixed in position and shall be accessible for cleaning. A flue baffle which is removable for cleaning shall be of such construction as will facilitate its removal and permit replacement only in its intended position. It shall be made of material not lighter than that designated in 15.1 for a combustion chamber.

18.2 A baffle located in a flue-gas passage or other passage exposed to combustion products, the failure of which would not cause hazardous operation, yet is considered replaceable, shall be observable and subject to replacement without dismantling of the appliance.

18.3 Where it is necessary to remove a flue baffle to clean the flueway, the flue baffle of an internal-flue type water heater shall be designed for removal within a clearance above the floor of 6-1/2 feet (2.0 m), or 2 feet (610 mm) above the flue collar on a heater taller than 4-1/2 feet (1.3 m).