UL 307B

STANDARD FOR SAFETY

Gas-Burning Heating Appliances for Manufactured Homes and Recreational Vehicles

UL Standard for Safety for Gas-Burning Heating Appliances for Manufactured Homes and Recreational Vehicles, UL 307B

Fifth Edition, Dated October 31, 2006

Summary of Topics

This revision to UL 307B is being issued to remove the reference to the withdrawal date of UL 873 and to address universal upkeep of UL Standards for Safety. These revisions are considered to be non-substantive and not subject to UL's STP process.

Text that has been changed in any manner or impacted by UL's electronic publishing system is marked with a vertical line in the margin. Changes in requirements are marked with a vertical line in the margin and are followed by an effective date note indicating the date of publication or the date on which the changed requirement becomes effective.

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that have been revised and that have a future effective date are located after the Standard, and are preceded by a ″SUPERSEDED REQUIREMENTS″ notice.

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UL 307B

Standard for Gas-Burning Heating Appliances For Manufactured Homes and Recreational Vehicles

The First edition was titled ″Gas- and Oil-Fired Heating Appliances for Trailer Coaches″ and numbered UL 307. The Second edition was titled ″Gas-Heating Appliances for Mobile Homes and Travel Trailers.″ The Third Edition was titled ″Gas-Burning Heating Appliances for Mobile Homes and Recreational Vehicles.″

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This UL Standard for Safety consists of the Fifth Edition including revisions through September 17, 2013.

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

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INTRODUCTION

1 Scope

1.1 These requirements apply to the following gas fuel-burning heating appliances:

a) Direct-vent system appliances for manufactured homes and recreational vehicles; and

b) Vented appliances for manufactured homes other than the direct-vent system type that provide for separation of the combustion system from the atmosphere of the manufactured home by an installation method.

1.2 Requirements for the installation and use of heating appliances in manufactured homes and recreational vehicles are included in:

a) The Department of Housing and Urban Development Manufactured Home Construction and Safety Standards, Chapter II of 24 CFR, Part 3280-1994; and

b) The Standard for Recreational Vehicles, NFPA 501C-1993.

1.3 An appliance designed to burn either oil or gas, and a gas appliance designed to be converted to burn oil by the installation of an optional factory-furnished burner, shall also comply with the requirements in the Standard for Liquid Fuel-Burning Heating Appliances for Manufactured Homes and Recreational Vehicles, UL 307A.

1.4 A product that contains features, characteristics, components, materials, or systems new or different from those covered by the requirements in this Standard, and that involve a risk of fire, electric shock, or injury to persons shall be evaluated using the appropriate additional component and end-product requirements as determined necessary to maintain the acceptable 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 cannot be judged to comply with this Standard. Where considered appropriate, 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 Components

2.1.1 Except as indicated in 2.1.2, 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.

2.1.2 A component need not comply with a specific requirement that:

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

b) Is superseded by a requirement in this standard.

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

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

2.2 Units of measurement

2.2.1 If a value for measurement is followed by a value in other units in parentheses, the second value may be only approximate. The first stated value is the requirement.

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

2.3 Terminology

2.3.1 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.

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.

3.3 APPLIANCE FLUE – The flue passages within the appliance.

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

3.5 BOILER – A closed vessel in which water or some other liquid is heated or steam is generated or superheated, under pressure or vacuum, by direct application of heat.

3.6 BOILER, LOW PRESSURE HOT WATER – A boiler that furnishes hot water at a pressure not exceeding 160 psig (1103 kPa) and at a temperature not exceeding 250°F (121°C).

3.7 BOILER, LOW PRESSURE STEAM – A boiler in which steam is generated at a pressure not exceeding 15 psig (103 kPa).

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

a) Forced-Draft – (See Power Burner, (e)).

b) Induced-Draft – A burner that depends on the draft induced by a fan beyond the appliance for its proper operation.

c) Injection (Bunsen) Type – A burner employing the energy of a jet of gas to inject air for combustion into the burner and mix it with the gas.

1) Atmospheric Injection Type – A burner in which the air at atmospheric pressure is injected into the burner by a jet of gas.

d) Luminous or Yellow-Flame – A burner in which secondary air only is depended on for combustion of the gas.

e) Power – A burner in which either gas or air or both are supplied at pressure exceeding, for gas, the gas line pressure, and for air, atmospheric pressure; this added pressure being applied at the burner. A burner for which air for combustion is supplied by a fan ahead of the appliance is commonly designated as a forced-draft burner.

f) Premixing – A power burner in which all or nearly all of the air for combustion is mixed with the gas as primary air.

g) Pressure Burner – A burner that is supplied with an air-gas mixture under pressure [usually from 0.5 to 14.0 inches water column (124 – 4032 Pa) and occasionally higher].

3.9 BURNER HEAD – That portion of a burner beyond the outlet end of the mixer tube which contains the ports.

3.10 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.

3.11 COMBUSTIBLE MATERIAL – As pertaining to materials adjacent to or in contact with heat-producing appliances, chimney and vent connectors, steam pipes, and warm-air ducts, combustible material is that material made of or surfaced with wood, compressed paper, plant fibers, or other material that will ignite and burn. Such material is considered to be combustible even though flame-proofed, fire-retardant treated, or plastered.

3.12 CONDENSATE – The liquid which separates from the combustion by-products of a fuel (flue gases) due to a reduction in temperature below dew point.

3.13 CONTROL –

a) Fan – An automatic control intended to control the operation of the fan on forced air appliances.

b) 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.

c) Low Water – A control that automatically cuts off the fuel supply when the surface of the water falls to the lowest safe water level. This point should not be lower than the bottom of the water glass.

d) 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 intended temperature or pressure in the appliance being fired.

e) Primary Safety – An automatic control that monitors the operation of a gas-fired or an oil-fired burner that is responsive directly to flame properties, sensing the presence or absence of flame and, in event of ignition failure or unintentional flame extinguishment, causes safety shutdown (lockout).

f) 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 operation of the controlled equipment that could cause a risk of fire, explosion, or injury to persons.

3.14 DIRECT VENT SYSTEM APPLIANCE – An appliance which by its inherent design is constructed so that:

a) All air supplied for combustion;

b) The combustion system of the appliance; and

c) All products of combustion are isolated from the atmosphere of the space in which the appliance is installed.

3.15 DRAFT HOOD – A device built into a gas appliance, or made a part of the vent connector from a gas appliance, which is intended to:

a) Provide for the ready escape of the products of combustion in the event of no draft, backdraft, or stoppage beyond the draft hood;

b) Prevent a backdraft from entering the appliance; and

c) Neutralize the effect of stack action of the flue or vent upon the operation of the appliance.

3.16 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 or an isolated-limited-secondary circuit.

b) Low-Voltage Circuit – A circuit involving a potential of not more than 30 volts alternating current (42.4 volts peak or direct current) and supplied by a primary battery or by a standard Class 2 transformer, or by 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 source of supply classified as a high-voltage circuit using 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 nor an isolated limited secondary circuit.

c) Safety Control Circuit – A circuit involving one or more safety controls, in which failure due to grounding, opening, or shorting of any part of the circuit can cause operation of the controlled equipment that can cause a risk of fire, explosion, or injury to persons.

3.17 EXCESS AIR – Air that passes through the combustion chamber and the appliance flues in excess of that theoretically required for complete combustion.

3.18 HEAT EXCHANGER –

a) 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) held in close contact with the combustion chamber walls. It is a self-contained combustion and heat-transfer device, hence a direct heat-transfer device.

b) Indirect – A heat exchanger that 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.

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

3.20 HEATING VALUE, GAS – The (Total) number of British Thermal Units produced by the combustion at constant pressure of 1 cubic foot of gas when the products of combustion are cooled to the initial temperature of the gas and air, when the water vapor formed during combustion is condensed, and when all the necessary corrections have been applied.

3.21 IGNITION SOURCE –

a) Continuous – An ignition source that, once placed in operation, is intended to remain ignited or energized continuously until manually interrupted.

b) Intermittent – An ignition source that is automatically ignited or energized when an appliance is called on to operate and that remains continuously ignited or energized during each period of main burner operation. The ignition source is automatically extinguished or de-energized when each main burner operating cycle is completed.

c) Interrupted – An ignition source that is automatically ignited or energized when an appliance is called on to operate and that remains ignited or energized during the main burner flame-establishing period. The ignition source is automatically extinguished or de-energized when each main burner flame-establishing period is completed.

3.22 LINING – Those interior surfaces of a combustion chamber exposed to combustion during use of the appliance.

3.23 LIQUEFIED-PETROLEUM (LP) GAS – Fuel gases, including commercial propane, predominantly propane or propylene, or commercial butane, predominantly butane, isobutane, and/or butylene.

3.24 LP-GAS-AIR MIXTURE – Liquefied-petroleum gases distributed at relatively low pressures and normal atmospheric temperatures that have been diluted with air to produce desired heating value and utilization characteristic.

3.25 MANIFOLD – The conduit of an appliance that supplies gas to the individual burner.

3.26 MANUFACTURED HOME – A manufactured or mobile home, or other housing factory-built in accordance with The Department of Housing and Urban Development Manufactured Home Construction and Safety Standards.

3.27 MIXER, GAS – The combination of mixer head, mixer throat, and mixer tube.

a) Mixer Head – That portion of an injection (Bunsen) type burner, usually enlarged, into which primary air flows to mix with the gas stream.

b) Mixer Throat – That portion of the mixer that has the smallest cross-sectional area and that lies between the mixer head and the mixer tube.

c) Mixer Tube – That portion of the mixer that lies between the throat and the burner head.

3.28 ORIFICE – The opening in a cap, spud, or other device whereby the flow of gas is limited and through which the gas is discharged to the burner.

3.29 ORIFICE CAP (HOOD) – A movable fitting having an orifice that permits adjustment of the flow of gas by the changing of its position with respect to a fixed needle or other device.

3.30 ORIFICE SPUD – A removable plug or cap that contains an orifice and that permits adjustment of the flow of gas either by substitution of a spud with a different sized orifice or by the motion of a needle with respect to it.

3.31 PILOT – A small flame utilized to ignite the fuel at the main burner or burners.

a) Continuous – A pilot that burns without turndown throughout the entire time the burner is in service, whether the main burner is firing or not.

b) Proved – A pilot flame supervised by a primary safety control that senses the presence of the pilot flame prior to permitting the main burner fuel to be delivered for combustion.

3.32 PIPING – Either pipe or tubing or both.

a) Pipe – Refers to rigid metal pipe.

b) Tubing – Refers to semirigid metal tubing.

3.33 PLENUM – An air compartment, part of a distributing system, to which one or more ducts are connected.

a) Furnace Supply – A furnace plenum attached directly to, or an integral part of, the supply outlet of the furnace.

b) Furnace Return – A furnace plenum attached directly to, or an integral part of, the return inlet of the furnace.

3.34 PORT – Any opening in a burner head through which fuel or an air-fuel mixture is discharged for ignition.

3.35 PRIMARY AIR – The air introduced into a burner that mixes with the fuel before it reaches the ignition zone.

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

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

a) Camping Trailer – A vehicular portable unit mounted on wheels and constructed with collapsible partial side walls which fold for towing by another vehicle and unfold at the camp site 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 which is an integral part of the completed vehicle.

c) Travel Trailer – A vehicular unit, mounted on wheels, designed to provide temporary living quarters for recreational, camping, or travel use and of such size or weight as not to require special highway movement permits when towed by a motorized vehicle, and of gross trailer area less than 320 square feet (29.7 m^2).

d) Truck Camper – A portable unit consisting of a roof, floor, and sides, designed to be loaded onto and unloaded from the bed of a pickup truck.

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

3.39 THERMOELECTRIC CIRCUIT – A circuit which receives its electrical energy by a conversion of heat to electricity by means of a thermocouple or thermopile.

3.40 VALVES –

a) Automatic – A device consisting essentially of a valve and operator that controls the fuel supply to the burner or burners during intended operation of the appliance. The operator may be actuated by application of fuel pressure on a flexible diaphragm, by electrical, mechanical, or other means.

b) Burner-Input Control – An automatic-control valve for regulating burner input.

c) Lubricated-Plug Type – A valve of the plug and barrel type designed to maintain a lubricant between the bearing surfaces.

d) Manual Gas Shutoff – A manually operated valve in the fuel line for completely turning on or shutting off the fuel supply to the appliance.

e) Safety Shutoff – A valve that is automatically closed by the safety control system or by an emergency device. This type of valve may be of the automatic or manually opened type.

3.41 VENT/AIR INTAKE TERMINAL – The device used with a direct vent system appliance which is located on the outside of the building through which the air for combustion is taken from the outside atmosphere and from which products of combustion are discharged.

a) Air Intake Terminal – The fitting at the inlet of the air intake pipe that allows entrance of the outside atmosphere to the air intake pipe.

b) Vent Terminal – The fitting at the end of the vent pipe that directs the flue products into the outside atmosphere.

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

3.43 VENT LIMITER – A means that limits the flow of air from the atmospheric diaphragm chamber of a gas pressure regulator to the atmosphere. This may be either a limiting orifice or a limiting device.

3.44 WALL FURNACE – A self-contained appliance, complete with grills or equivalent, intended for incorporation or permanent attachment to the structure of a manufactured home or recreational vehicle in furnishing heated air circulated by gravity or by a fan directly into the space to be heated through openings in the casing. Such appliances are not provided with duct extensions beyond the vertical and horizontal limits of the casing, except that boots not to exceed 10 inches (254 mm) beyond the horizontal limits of the casing for extensions through walls of nominal thicknesses may be permitted. When such boots are provided, they are supplied by the manufacturer as an integral part of the appliance and tested as such in accordance with these requirements.

3.45 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 Water Heater – A water heater that heats and stores water at a thermostatically controlled temperature for delivery on demand. Input rating may not exceed 75,000 Btu per hour (22 kW).

b) Counter Type –

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

2) Flush Type – A vented automatic storage water heater with flat sides, top, front and back, and 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.

3) 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 high; wherein the front of the heater casing is exposed.

CONSTRUCTION

GENERAL

4 Assembly

4.1 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.

4.2 An appliance that provides for separation of the combustion system from the indoor atmosphere of the manufactured home by an installation method shall be provided with an air-intake assembly conforming to these requirements. See 104.1.6.

4.3 A direct vent system appliance shall be constructed so that:

a) All air supplied for combustion;

b) The combustion system of the appliance; and

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

Doors, panels, and any other access openings serving an enclosure required for such isolation of a fuel-burning appliance are to communicate only to the outdoors.

4.4 Compliance with 4.3 is not intended to preclude constructions 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 a serviceman can manually close the circuit for servicing but the switch will automatically return to its normal 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 equivalent protection to the preceding are furnished, in which case only one of the doors or panels need be hinged to the compartment.

4.5 A boiler shall be constructed, equipped, inspected, tested, and marked in accordance with the ASME Boiler Pressure Vessel Code, Section IV, Heating Boilers.

4.6 An appliance may include an opening, communicating with the combustion system, needed for the user to light or start the appliance, provided that the opening does not exceed a 28 square inch (181 cm^2) cross-sectional area and has an attached cover plate. The cover plate shall 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 marked as described 101.17

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

4.8 If an appliance is not assembled by the manufacturer as a unit, it 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, such as cutting, drilling, threading, welding, or similar tasks, by the installer. Two or more subassemblies, that must bear a definite relationship to each other for the intended installation or operation of the appliance, shall be arranged and constructed to permit them to be incorporated into the complete assembly, without need for alteration or alignment, only in the intended relationship with each other; or such subassemblies shall be assembled, tested, and shipped from the factory as one element.

4.9 A radiation shield or baffle employed to prevent excessive temperature shall be:

a) Assembled as part of the appliance;

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

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

4.10 The construction of an appliance shall not, for any intended installation, require the alteration or removal of a baffle, insulation, or a radiation shield needed to prevent temperatures that can cause risk of fire or injury to persons.

4.11 The inherent construction of an appliance for recessed, 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 have the strength and bearing surface necessary to maintain required clearance from such constructions.

4.12 Appliances for alcove or closet installation, such as upflow and downflow furnaces, boilers, and the like, are considered to comply with the requirements of 4.11, if spacers are located at no less than one level to provide essentially continuous interference with adjoining construction as provided, for example, by an extended base or support. Appliances for recessed installation in an interior wall under a cabinet, 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.

4.13 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.

4.14 An appliance for recessed, alcove, or closet installation shall permit no portion of the products of combustion nor any portion of the heated circulating air or air from the space being heated to 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 be sufficiently close-fitting to comply with this requirement.

4.15 Adjustable or movable parts shall be provided with locking devices to prevent unintentional shifting.

4.16 Screws or bolts used to attach parts that are detached during normal care or servicing of the appliance shall function as intended upon the application of the torques indicated in Table 4.1 after removal and replacement.

Table 4.1
Maximum torque requirements for screws

Screw size	Torque, pound-inches
No. 8	20
No. 10	25
1/4 inch	100
5/16 inch	200
3/8 inch	350
7/16 inch	550
1/2 inch	800
9/16 inch	1200

4.17 An appliance shall afford convenient operation by the user of those parts requiring attention or manipulation by him in intended usage.

4.18 Bolts, nuts, screws, except sheet-metal screws, and other threaded parts used in the general assembly of the appliance shall have threads in accordance with the requirements for Unified Inch Screw Threads, ANSI/ASME B1.1-1989.

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

4.20 Sheet steel parts of the appliance, except where otherwise specified in these requirements, shall be at least thick of 0.021 inch (0.53 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, and intake tubes, and the like, unless greater strength and rigidity are required for the application.

4.21 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 a burner or pilot.

4.22 The construction of an appliance for furnishing heated air, circulated by gravity or by a fan, directly into the space to be heated through openings in the casing shall provide continuous circulation of heated air at all times during intended operation. Such an appliance having a single warm-air register shall not be equipped with a shutter to restrict the flow of warm air from the appliance. Such an appliance having more than one warm-air register may be equipped with a shutter, if the construction of the appliance permits at least one warm-air register to be open at any position of the shutter.

4.23 A horizontal furnace intended for suspended installation shall be provided with brackets or hangers to support the furnace from its basic frame or structure.

4.24 Neither gas piping nor gas controls shall be located within circulating air passageways, except on an appliance for recreational vehicle installation without provision for connecting return air ducts. No filters shall be permitted and service accessibility of gas piping and gas controls shall be accomplished without disrupting the integrity of the direct vent system.

5 Accessibility for Servicing

5.1 An appliance shall be constructed so that parts and controls requiring attention, manipulation, or adjustment in usage are accessible.

5.2 An appliance shall be constructed to allow cleaning of parts such as interior surfaces of burners, heating surfaces in contact with combustion products, without major dismantling of the appliance or removal of parts required by 4.8 to be factory assembled.

5.3 The removal of access panels, burners, caps, manifold assemblies, and the like, specifically constructed to permit ready removal and replacement for servicing, are not considered major dismantling as defined by 5.2.

5.4 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 intended 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.

5.5 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 need not comply with this requirement.

5.6 The flue-gas passageways of an air-heating appliance shall be accessible for cleaning if:

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).

5.7 A forced air heating appliance intended to be connected to a supply duct or ducts shall 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 51.1.

5.8 A forced air heating appliance shall be constructed to permit:

a) Replacement of each filter and blower belt, when provided;

b) Removal of the blower assembly; and

c) Oiling the motor, blower or fan bearings, which require that lubricant be added, without dismantling or removing any portion of the vent/air intake system, unless the construction is such that removal and replacement can be accomplished without the necessity of resealing the vent/air intake system.

6 Air-Intake Assemblies

6.1 An appliance shall be provided with a combustion air intake. The intake for an appliance equipped with a draft hood shall also provide air for draft hood dilution. An intake shall communicate with the outdoors.

6.2 If two intakes are employed to provide air as required by 6.1, both shall be designed for location in the same floor, roof, or wall of the manufactured home or recreational vehicle, or both shall terminate in the same pressure zone in an appliance enclosure inside the manufactured (mobile) home or recreational vehicle.

6.3 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 constructed so 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 at least 6 inches below the top surface of the roof.

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

6.5 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 more than 3 inches (76.2 mm) beyond the outside wall. The appliance shall be marked as specified in 101.31.

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

6.7 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.

6.8 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).

6.9 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 dimension less than 1-1/2 inches (38.1 mm) is considered as complying with 6.8 without additional guarding or shielding.

6.10 The construction of an air intake and the path of intake air shall provide adequate combustion air to burners and adequate dilution air to any draft hood.

6.11 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 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 (14.64 W) of the total input rating of all appliances to be in the enclosure.

6.12 The minimum cross-sectional dimension of an internal air passage in an air-intake assembly shall be at least 1/2 inch (12.7 mm).

6.13 The top or plane of any concealed combustion air or ventilation opening shall be at least 2 inches (50.8 mm) above the floor level. The bottom of such openings shall be at least 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.

6.14 Openings in perforated or expanded metal panels, provided over combustion air, circulating air, or draft relief openings shall not be 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 (drill mean size) (5.4102 mm) drill.

7 Base

7.1 General

7.1.1 The base or frame of an appliance shall be constructed to provide for the support of the appliance. A base or frame shall be constructed of noncombustible material in a manner to provide strength and durability.

7.1.2 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 special bolts, screws, or other parts are needed for that purpose, they shall be furnished with each appliance.

7.1.3 Means for leveling and alignment, if required, shall be included.

7.1.4 A subbase, if furnished as a separate assembly, shall be marked to indicate the correct position of the appliance with respect to the subbase. A separate subbase that cannot be assembled incorrectly with respect to the appliance need not be marked.

7.2 Warm air appliances

7.2.1 The base, subbase, or duct connector of a downflow appliance shall be acceptable for installation on a combustible floor 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.

7.2.2 The use of spacers in the form of separate blocks, shims, and the like, is not considered to be in accordance with 7.2.1.

8 Casing

8.1 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.

8.2 A sheet-metal casing made of steel having a minimum thickness of 0.021 inch (0.53 mm) if uncoated, or 0.023 inch (0.58 mm) if galvanized, or of nonferrous sheet metal having an average thickness of 0.029 inch (0.74 mm) is considered to comply with 8.1 thinner materials may be used if adequate reinforcement is provided.

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

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

8.5 A removable panel shall be constructed so that it is not interchangeable with another panel on the same appliance if operation of the appliance with the panel interchanged could cause a risk of fire or injury to persons.

8.6 The casing shall completely close the bottom or be constructed to provide an effective radiation barrier between the heat exchanger and the floor except for an opening intended to be permanently connected to a circulating air distribution duct.

8.7 The casing shall be provided with an opening for the installation of a gas supply line. The edges of the opening against which the connected supply line is likely to bear, including any internal parts of the appliance, shall be free of sharp edges.

8.8 With reference to 8.7, protection of sharp edges may be provided by hemming or forming the edges of the opening, or by providing a grommet of metal or other material having the necessary aging properties, temperature and strength characteristics, and durability for the purpose.

9 Radiation Shields

9.1 A radiation shield or liner shall be constructed, formed, and supported for intended positioning and to prevent distortion or sagging in service. A shield or liner shall be protected against corrosion if its deterioration may cause excessive temperature when the appliance is tested in accordance with these requirements. Any finish provided to obtain the required resistance to corrosion shall not be damaged by heat when the appliance is tested as specified in this standard.

10 Combustion Chamber

10.1 A combustion chamber and flueway shall be constructed of sheet steel, or other equivalent material that has the strength, rigidity, durability, resistance to corrosion, and other physical properties equivalent to AISI C1010 sheet steel having a minimum thickness of 0.026 inch (0.66 mm) for an appliance having a maximum rated input not in excess of 50,000 Btu per hour (14.6 kW) and of 0.032 inch (0.81 mm) for all other sizes.

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

11 Radiator

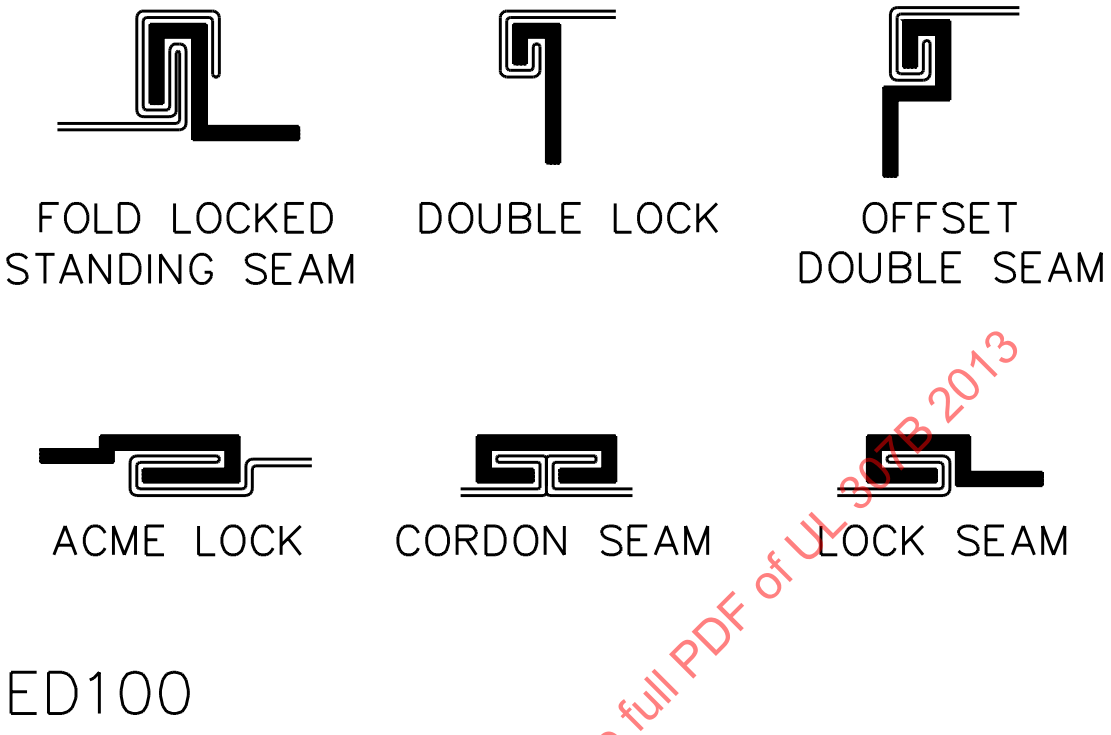
11.1 A radiator of an air heating appliance shall be made of material not lighter than that designated in 10.1 for a combustion chamber.

12 Heating-Surface Joints

12.1 Joints in heating surfaces shall be substantial and reasonably 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 for strength.

12.2 Examples of some acceptable lock seams are illustrated in Figure 12.1.

Figure 12.1
Types of acceptable lock seams



13 Baffles

13.1 General

13.1.1 A flue baffle shall be fixed in position and shall be accessible for cleaning. A flue baffle that 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 10.1 for a combustion chamber.

13.1.2 A baffle in a flue-gas passage or otherwise exposed to combustion products, whose malfunction would not cause a risk of fire or injury to persons and if considered replaceable, shall be observable and replaceable without dismantling the appliance.

13.2 Water heaters

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

14 Flue Collar

14.1 A flue collar shall be arranged to permit secure attachment of a vent connector or draft hood, as required for the type of appliance.

14.2 A flue collar, or flue connector parts within the air handling compartment of a warm air appliance, shall have the rigidity, heat, and corrosion resistance at least equivalent to that of sheet steel having a thickness of not less than 0.032 inches (0.81 mm).

15 Flue-Gas Outlet Assembly

15.1 A flue-gas outlet assembly intended to convey flue gases to the outdoors shall be furnished with each appliance. A connector shall be furnished, if required, to connect the flue collar of the appliance to the flue-gas inlet of the outlet assembly.

15.2 A connector to a roof jack shall be of adequate length for the purpose when the appliance is installed in a manufactured home having at least a 7 foot (2.1 m) ceiling height.

15.3 A flue-gas outlet for an appliance shall not terminate beneath a manufactured home or recreational vehicle.

15.4 The flue-gas conveying conduit of a flue-gas outlet assembly for a gas-fired appliance exhausting flue gases at a temperature of 500°F (260°C) or less measured at the inlet to the flue-gas outlet assembly during the continuous operation test, and that is not constructed to be converted to utilize oil fuel, shall be made of material having durability and resistance to corrosion, fire, and heat equivalent to that of No. 1100 aluminum alloy, 0.016 inch (0.41 mm) thick.

15.5 The flue-gas conveying conduit of a flue-gas outlet assembly for appliances exhausting flue gases at a temperature greater than 550°F (260°C) but not greater than 1000°F (538°C) measured at the inlet to the flue-gas outlet assembly during the continuous operation test, shall be made of material having durability and resistance to corrosion, fire, and heat equivalent to that of Type 430 stainless steel, 0.012 inch (0.305 mm) thick.

15.6 A flue-gas conveying conduit of a connector, if shielded or encased or otherwise hidden when the appliance is installed, shall be made of material equivalent to that required on the flue-gas conveying conduit of the flue-gas outlet assemblies.

15.7 Type B gas-vent pipe is considered acceptable for a vent connector of a draft hood equipped gas appliance exhausting flue gases at a temperature not in excess of 500°F (260°C).

15.8 An outer casing or other structural part of a flue-gas outlet assembly or connector exposed to the weather (exclusive of flue-gas conveying conduit) shall be made of material having durability and resistance to corrosion, fire, and heat equivalent to that of galvanized steel, 0.018 inch (0.46 mm) thick. The material shall have a coating of zinc conforming with the coating Designation G90 in Table I of ASTM A653/A653M, Specifically for Sheet Steel, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process with not less than 40 percent of the zinc on any side, based on the minimum single spot test requirement in this ASTM Designation. The weight of zinc coating may be determined by any acceptable method; however, in case of question, the weight of coating shall be established in accordance with the test method of ASTM A90-81(1991), Test Method for Weight of Coating. Such parts that are always inside the structure shall comply with the requirements in 9.1.

15.8 revised March 16, 2010

15.9 Parts of flueways shall be joined in a manner to prevent disengagement and shall be tight when tested in accordance with these requirements.

15.10 If a slip-fit is used at the connection of a connector with the appliance, the overlap shall be at least 1-1/4 inches (31.8 mm), and the construction at the outer ends of the connector shall result in a secure and gas-tight connection at the time of installation.

15.11 The assembly shall be provided with a cap to prevent the entrance of debris or rain into the flue-gas conveying pipe and into any air passages terminating exterior to the manufactured home or recreational vehicle.

15.12 A cap shall be constructed so that flue-gas or air passages are not likely to be obstructed by soot accumulation, by leaves or debris falling or blown onto it, or by birds.

15.13 A flue-gas outlet assembly intended for installation through the outside wall of a manufactured home or recreational vehicle shall be acceptable for varying thicknesses of wall construction as specified in 6.4 and 6.5.

16 Draft Hoods

16.1 A draft hood shall be furnished with each appliance except:

a) When the appliance is supplied with a power burner.

b) With a direct vent appliance which operates under forced or induced draft.

16.2 A detachable draft hood, when provided, shall comply with the applicable construction requirements of the Standard for Draft Hoods, ANSI Z21.12-1990.

16.3 A detachable draft hood shall be designed so that removal and replacement in normal use will not permanently deform any part or alter the relative position of any part with respect to another.

16.4 All parts of a nondetachable or built-in draft hood, if constructed of sheet steel, shall have a minimum thickness not less than the combustion chamber.

16.5 A built-in draft hood shall be constructed to provide adequate support for a vent connector or the flue outlet of the appliance. A collar on a horizontal outlet shall be at least 1 inch (25.4 mm) for outlets, 5 inches (127 mm) diameter or less, and a minimum 1-1/4 inches (31.8 mm) for outlets greater than 5 inches (127 mm) diameter.

17 Warm Air Appliance Air Handling System

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

17.2 The warm-air outlet of an appliance for alcove or closet installation shall extend to the exterior of the alcove or closet. The warm air outlet of an appliance for recessed installation shall extend to the interior of the counter or structure.

17.3 An integral plenum of an appliance for alcove or closet installation shall have no more than one outlet-air opening unless each additional opening is provided with a means supplied at the factory to close the openings in the casing and in any insulation or liner.

18 Warm Air Handling System for Installation Downstream From a Cooling System

18.1 A furnace intended for installation in the cooled-air path, downstream from a cooling coil, shall conform to the following:

a) All interior surfaces of the heat exchanger, combustion chamber including its bottom, radiators, and flues shall be resistant to corrosion by moisture.

b) The fire-box liner shall resist deterioration from moisture condensation.

c) Condensation shall not drip on burner parts or other corrodible parts if corrosion of any such parts is likely to cause hazardous operation.

d) The heat exchanger and appliance flue shall contain no traps or pockets in which condensation may collect.

18.2 A furnace containing a cooling coil parallel to the heating section shall have dampers or other means to prevent chilled air from entering the furnace section. If the dampers are manually operated, means shall be provided to prevent operation of either the furnace or the cooling unit unless the damper is in the full heat or cool position. Means shall be provided for disposal of condensate and to prevent dripping of condensate on the heating element.

18.3 Connections between the heat exchanger and the casing which encloses circulating air shall be constructed to prevent leakage of combustion products into the circulating air.

19 Materials In Air Handling Compartments of Warm Air Appliance

19.1 General

19.1.1 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 Tests for Surface Burning Characteristics of Building Materials, UL 723.

Exception: 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 19.1.7.

19.1.2 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.

19.1.3 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.

19.1.4 Thermal or acoustic insulating material shall be securely positioned if loosening:

a) May reduce or block air flow to cause temperatures in excess of those acceptable in the temperature tests; or

b) 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.

19.1.5 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.

19.1.6 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 for outdoor-use equipment at minus 29°C (minus 20°F).

19.1.7 Polymeric materials exempted by 19.1(e) shall have a flame spread rating of not more than 25 or shall comply with the requirements of the Vertical Burning Test for Classifying Materials 5V in accordance with the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94.

19.1.7 revised September 17, 2013

19.2 Air filters

19.2.1 An air filter shall be of a type acceptable for the purpose.

19.2.2 The temperature of any portion of a filter shall not exceed the maximum values specified in this standard when the appliance is tested as specified in this standard.

19.2.3 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.

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

20 Water Heater Storage Vessels

20.1 A nonmetallic material in contact with water shall comply with the requirements in the National Sanitation Foundation Standard for Plastic Piping System Components and Related Materials, NSF No. 14-1990, with regard to toxicity, taste, color, solubility, and odor.

20.2 The water vessel storage tank shall withstand a hydrostatic test pressure of 300 psig (2.1 MPa), or its rated hydrostatic test pressure, whichever is greater, without developing leakage or visible permanent distortion, or the tank shall carry the symbol of the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1. The working pressure shall be not more than 50 percent of the hydrostatic test pressure. If the vessel is of steel, the inside surfaces shall be protected against corrosion by galvanizing, porcelain enameling, or the equivalent.

20.3 A storage tank shall be equipped with a valve to facilitate emptying the tank.

20.4 Hot and cold water connections shall be clearly identified.

20.5 A storage tank shall have an opening for installation of a temperature-and-pressure relief valve. The opening:

a) Shall be located:

1) In the top of the tank; or

2) With its centerline in the upper 6 inches (152.4 mm) of the side.

b) Shall be separate from the openings for water connections.

c) Shall be threaded in conformity with the Standard for Pipe Threads, General Purpose (Inch), ANSI/ASME B1.20.1-1983(R1992).

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