



Underwriters Laboratories Inc.®

A not-for-profit organization dedicated to public safety
and committed to quality service

January 29, 1996

Revision pages for

Standard for

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

UL 307A, Seventh Edition

Attached to this transmittal notice is a revision of the Seventh edition of UL 307A.

A CHANGE ON A PAGE DATED JANUARY 29, 1996 IS INDICATED BY A SMALL PRINT NOTE FOLLOWING THE AFFECTED ITEM, PRECEDED AND FOLLOWED BY AN ASTERISK.

THIS REVISION IS CONSIDERED NON-SUBSTANTIVE AND IS BEING ISSUED TO ELIMINATE THE OXYGEN BOMB TEST. THE OXYGEN BOMB TEST IS NO LONGER APPROPRIATE IN MOST CASES DUE TO THE ADDITION OF ANTIOXIDANTS TO RUBBER AND POLYMERIC COMPOUNDS. THEREFORE, UL IS ELIMINATING THE OXYGEN BOMB TEST AND REPLACING IT WITH AN AIR OVEN AGING TEST WHICH IS USED FOR THERMOPLASTIC COMPOUNDS. THE REQUIREMENTS ARE NOW IN EFFECT.

Revised and/or additional pages may be issued from time to time.

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UL 307A

Standard for

**Liquid Fuel-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 "Liquid Fuel-Burning Heating Appliances for Mobile Homes and Travel Trailers." The Third – Fifth Editions were titled "Liquid Fuel-Burning Heating Appliances for Mobile Homes and Recreational Vehicles."

First Edition – May, 1958

Second Edition – October, 1965

Third Edition – June, 1973

Fourth Edition – October, 1976

Fifth Edition – September, 1978

Sixth Edition – May, 1990

Seventh Edition

January 26, 1995

An effective date included as a note immediately following certain requirements is one established by Underwriters Laboratories Inc.

Revisions of this standard will be made by issuing revised or additional pages bearing their date of issue. A UL Standard is current only if it incorporates the most recently adopted revisions, all of which are itemized on the transmittal notice that accompanies the latest published set of revision pages.

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Table 76.2
Accelerated aging conditions

Measured temperature rise degrees C	Material	Test program
35	Rubber or Neoprene	Air oven aging for 70 hours at 100°C
35	Thermoplastic	7 days in an air circulating oven at 87°C
50	Rubber or Neoprene	Air oven aging for 168 hours at 100°C
50	Thermoplastic	10 days in an air circulating oven at 100°C
55	Rubber, Neoprene or Thermoplastic	7 days in an air circulating oven at 113°C
65	Rubber or Neoprene	10 days in an air circulating oven at 121°C
65	Thermoplastic	7 days at 121°C or 60 days as (MPa)
80	Rubber, Neoprene or Thermoplastic	7 days in an air circulating oven at 136°C

Table 76.2 revised January 29, 1996

76.2 Foamed neoprene or rubber compounds forming gaskets to seal an electrical enclosure are to be subjected to accelerated aging under the conditions indicated in Table 76.2. The compounds shall not harden or otherwise deteriorate to a degree which will affect their sealing properties.

76.3 Thermoplastic materials forming gaskets to seal an electrical enclosure shall be subjected to accelerated aging under the conditions indicated in Table 76.2. Thermoplastic material shall not deform or melt, or otherwise deteriorate to a degree which will affect its sealing properties. Solid polyvinyl-chloride gasket material shall have physical properties as indicated in Table 76.1 before and after the accelerated aging.

76.4 The temperatures indicated in Table 76.2 correspond to the maximum temperature rise measured on the gasket during the Temperature Test, Section 54.

76.5 Gaskets of materials other than those mentioned in 76.1 – 76.3 shall be nonabsorptive and shall provide equivalent resistance to aging and temperatures.

76.6 Where gaskets are secured by adhesives, samples of the gasket adhesive and mounting surface shall be exposed for a period of 72 hours to each of the following conditions:

- a) 100°C (212°F),
- b) Immersion in distilled water, and
- c) Minus 10°C (plus 14°F).

The force required to peel the gasket from its mounting surface after exposure shall not be less than 75 percent of the value determined on as-received samples.

77 Metallic Coating Thickness Test

77.1 The solution to be used for this test is to be made from distilled water and is to contain 200 grams per liter of chemically pure chromic acid (CrO_3), and 50 grams per liter of chemically pure concentrated sulphuric acid (H_2SO_4). The latter is equivalent to 27 milliliters per liter of chemically pure concentrated sulphuric acid, specific gravity 1.84, containing 96 percent of H_2SO_4 .

77.2 The test solution is to be contained in a glass vessel such as a separatory funnel with the outlet equipped with a stopcock and a capillary tube of approximately 0.025 inch (0.64 mm) inside bore and 5.5 inches (140 mm) long. The lower end of the capillary tube is tapered to form a tip, the drops from which are about 0.025 milliliters each. To preserve an effectively constant level, a small glass tube is inserted in the top of the funnel through a rubber stopper and its position is to be adjusted so that, when the stopcock is open, the rate of dropping is 100 ± 5 drops per minute. If desired, an additional stopcock may be used in place of the glass tube to control the rate of dropping.

77.3 The sample and the test solution should be kept in the test room long enough to acquire the temperature of the room, which should be noted and recorded. The test is to be conducted at an ambient temperature of 21.1 – 32.2°C (70 – 90°F).

77.4 Each sample is to be thoroughly cleaned before testing. All grease, lacquer, paint, and other nonmetallic coatings are to be removed completely by means of suitable solvents. Samples are then to be thoroughly rinsed in water and dried. Care should be exercised to avoid contact of the cleaned surface with the hands or any foreign material.

77.5 The sample to be tested is to be supported from 0.7 – 1.0 inch (17.0 – 25.4 mm) below the orifice, so that the drops of solution strike the point to be tested and run off quickly. The surface to be tested should be inclined about 45 degrees from horizontal.

77.6 The stopcock is to be opened and the time in seconds is to be measured until the dropping solution dissolves the protective metallic coating, exposing the base metal. The end point is the first appearance of the base metal recognizable by the change in color at that point.

77.7 Each sample of a test lot is to be subjected to test at three or more points, excluding cut, stenciled, and threaded surfaces, on the inside surface and at an equal number of points on the outside surface, at places where the metallic coating may be expected to be the thinnest. On enclosures made from precoated sheets, the external corners that are subjected to the greatest deformation may have thin coatings.

**Underwriters Laboratories Inc.®**A not-for-profit organization dedicated to public safety
and committed to quality service**November 7, 1995****Revision pages for****Standard for****Liquid Fuel-Burning Heating Appliances for Manufactured Homes and Recreational Vehicles****UL 307A, Seventh Edition**

Attached to this transmittal notice is a revision of the Seventh edition of UL 307A.

A CHANGE ON A PAGE DATED NOVEMBER 7, 1995 IS INDICATED BY A SMALL PRINT NOTE FOLLOWING THE AFFECTED ITEM, PRECEDED AND FOLLOWED BY AN ASTERISK.

THIS REVISION IS BEING ISSUED TO CORRECT TWO EQUATIONS THAT WERE INADVERTENTLY LEFT OUT. THESE REQUIREMENTS HAVE A PREVIOUSLY PUBLISHED EFFECTIVE DATE OF JANUARY 26, 1997.

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63.8 An appliance equipped with an optional draft booster and a natural draft burner is to be tested with and without the power supply connected to the draft booster.

63.9 If the appliance is equipped with a device to avoid pooling of the burner, and the device can be nullified by a malfunction of the device, the appliance is to be tested as specified above, except that the appliance is to be level. The burner is to be pooled to the extent allowed by the fuel level control with the antipooling device not functioning.

64 Direct Vent System Leakage Test

64.1 In direct vent systems of appliances having a separate air intake section and a separate combustion chamber-vent section:

- a) The leakage from the combustion chamber-vent section of the system shall not exceed 2.0 percent of the products of combustion and
- b) The leakage from the air intake section of the system shall not exceed 8.0 percent of the products of combustion. See 64.2 – 64.5.

64.1 effective January 26, 1997

64.2 The vent and air intake terminals are to be removed, and the entrance of the air intake section sealed at the point it enters the combustion chamber. The entire system, including the combustion air and flue gas connections between the appliance and the vent and air intake terminals, is to be installed and sealed in accordance with the manufacturer's instructions. Both the flue outlet and the air inlet is to then be sealed at the point of connection to the vent and air intake terminals. The sealing means is to include fittings for supplying air to both the air intake and combustion chamber-vent sections of the system and provisions for measuring the internal pressure in each section of the system.

64.2 effective January 26, 1997

64.3 The internal pressure in the system is to be measured by a water-filled manometer which may be read directly to 0.01 inch (0.25 mm) water column or equivalent means.

64.3 effective January 26, 1997

64.4 Clean air is to be permitted to flow through a metering device and into the section of the direct vent system being pressurized through the air supply fitting. The air supply fitting to the section of the system not being pressurized is to be open. The internal air pressure in the section of the system being pressurized is to be adjusted to:

- a) 0.1 inch water column (25 Pa) above the normal operating system pressure for forced draft systems operating at positive combustion chamber pressures and
- b) 0.1 inch water column for all other systems. The leakage rate is to be noted in cubic feet per hour for both the air intake and combustion chamber-vent sections of the direct vent system.

64.4 effective January 26, 1997

64.5 The leakage rate is to be determined by the following equations:

$$L_c = 0.02 \times V \times I$$

$$L_a = 0.08 \times V \times I$$

where:

L_c = Allowable leakage rate from combustion chamber-vent section of direct vent system, cubic feet per hour.

L_a = Allowable leakage rate from air intake section of direct vent system, cubic feet per hour.

V = 1960 cubic feet of flue products based on the formation of approximately 1276 cubic feet of dry flue products plus 684 cubic feet of excess air, when one gallon of ASTM D396 No. 2 fuel oil (nominal density 7.432 pounds per gallon) is burned.

I = Fuel oil input rating, in gallons per hour.

64.5 effective January 26, 1997

64.6 In a direct vent system of an appliance having all or part of the vent portion of the combustion chamber-vent section enclosed within the air intake section:

- a) The leakage from the combustion chamber-vent section of the system shall not exceed 2.0 percent of the products of combustion, as calculated in 64.5, and
- b) The leakage from the total system shall not exceed 8.0 percent of the products of combustion plus the leakage, in percent, determined for the combustion chamber-vent section. See 64.7 – 64.10.

64.6 effective January 26, 1997

64.7 A direct vent system in an appliance having all or part of the vent portion of the combustion chamber-vent section enclosed within the air intake section, the combustion chamber-vent section of the system shall be considered that portion of the combustion chamber-vent section not contained within the air intake section.

64.7 effective January 26, 1997

64.8 The vent/air intake terminal is to be removed, and the entrance of the air intake section sealed at the point it enters the combustion chamber. The entire system, including the combustion air and flue gas connections between the appliance and the vent/air intake terminal, is to be installed and sealed in accordance with the manufacturer's instructions. Any vent extension located within the air intake section need not be installed. The direct vent system is then to be sealed at the point of connection to the vent/air intake terminal. The sealing means is to include fittings for supplying air simultaneously to the air intake and combustion chamber-vent sections of the system and provisions for measuring the internal pressure.

64.8 effective January 26, 1997

64.9 Using the test apparatus and method of test outlined in 64.3 and 64.4, the total system is to be pressurized and the leakage rate noted in cubic feet per hour.

64.9 effective January 26, 1997



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August 14, 1995

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UL 307A, Seventh Edition

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THESE NEW AND REVISED REQUIREMENTS ARE NOW IN EFFECT.

The new and revised requirements are substantially in accordance with UL's bulletin on this subject dated May 22, 1995. The bulletin is now obsolete and may be discarded.

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FOREWORD

A. This Standard contains basic requirements for products covered by Underwriters Laboratories Inc. (UL) under its Follow-Up Service for this category within the limitations given below and in the Scope section of this Standard. These requirements are based upon sound engineering principles, research, records of tests and field experience, and an appreciation of the problems of manufacture, installation, and use derived from consultation with and information obtained from manufacturers, users, inspection authorities, and others having specialized experience. They are subject to revision as further experience and investigation may show is necessary or desirable.

B. The observance of the requirements of this Standard by a manufacturer is one of the conditions of the continued coverage of the manufacturer's product.

C. A product which complies with the text of this Standard will not necessarily be judged to comply with the Standard if, when examined and tested, it is found to have other features which impair the level of safety contemplated by these requirements.

D. A product employing materials or having forms of construction differing from those detailed in the requirements of this Standard may be examined and tested according to the intent of the requirements and, if found to be substantially equivalent, may be judged to comply with the Standard.

E. UL, in performing its functions in accordance with its objectives, does not assume or undertake to discharge any responsibility of the manufacturer or any other party. The opinions and findings of UL represent its professional judgment given with due consideration to the necessary limitations of practical operation and state of the art at the time the Standard is processed. UL shall not be responsible to anyone for the use of or reliance upon this Standard by anyone. UL shall not incur any obligation or liability for damages, including consequential damages, arising out of or in connection with the use, interpretation of, or reliance upon this Standard.

F. Many tests required by the Standards of UL are inherently hazardous and adequate safeguards for personnel and property shall be employed in conducting such tests.

22.1.9 Stranded conductors at terminals shall be prevented from contacting other uninsulated live parts and from contacting dead-metal parts, such as by use of pressure-terminal connectors, soldering lugs, crimped eyelets, soldering all strands of the wire together, or equivalent means. Open slot-type connectors shall not be used unless they are designed to prevent disconnection resulting from loosening of the clamping means. The shanks of terminal connectors shall be protected by insulating tubing, or the equivalent, if the required spacings may be reduced as a result of loosening of the clamping means. The thickness of the insulation on the shanks shall be not less than 0.028 inch (0.71 mm).

22.1.10 Leads provided for spliced connections to an external high-voltage circuit shall not be connected to wire-binding screws or pressure terminal connectors located in the same compartment as the splice or shall not be visible to the installer unless the screws or connectors are rendered unusable for field-wiring connections or the leads are insulated at the unconnected ends.

22.1.11 Terminal parts by which field-wiring connections are made shall consist of soldering lugs or pressure terminal connectors, except that for No. 10 AWG (5.3 mm²) and smaller wires, the parts to which wiring connections are made may consist of clamps or wire-binding screws with cupped washers, terminal plates having upturned lugs, or the equivalent, to hold the wire in position.

22.1.12 A wire-binding screw at a high-voltage wiring terminal for field connection shall be not smaller than No. 10 (4.8 mm diameter) except that a No. 8 (4.2 mm diameter) screw may be used for the connection of a conductor not larger than No. 14 AWG (2.1 mm²) and a No. 6 (3.5 mm diameter) screw may be used for the connection of a No. 16 or No. 18 AWG (1.3 or 0.82 mm²) control circuit conductor.

22.1.13 A terminal plate for a wire-binding screw shall be of metal not less than 0.030 inch (0.76 mm) in thickness for a No. 14 AWG (2.1 mm²) or smaller wire, and not less than 0.050 inch (1.27 mm) in thickness for a wire larger than No. 14 AWG (2.1 mm²); and in either case, there shall be not less than two full threads in the metal.

22.1.14 A terminal plate formed from stock having the minimum required thickness may have the metal extruded at the tapped hole for the binding screw so as to provide two full threads.

22.1.15 A wire-binding screw shall thread into metal.

22.1.16 Field-wiring terminals shall be secured to their supporting surfaces by methods other than friction between surfaces so that they will be prevented from turning or shifting in position if such motion may result in reduction of spacings to less than those required. This may be accomplished by two screws or rivets; by square shoulders or mortices; by a dowel pin, lug, or offset; by a connecting strap or clip fitted into an adjacent part; or by some other equivalent method.

22.1.17 Conductors intended for connection to a grounded neutral line shall be identified, such as finished in a white or natural gray color. All other current-carrying conductors shall be finished in colors other than white, natural gray, or green. A terminal for connection of a grounded conductor shall be identified by a metallic-plated coating, substantially white in color and shall be readily distinguishable from other terminals, or it shall be identified in some other manner, such as on an attached wiring diagram.

22.1.18 A box or enclosure included as part of the assembly and in which a branch circuit supplying power to the furnace is to be connected, shall not require that it be moved for care of the unit. This requirement does not apply to separate limit controls and stack switches, where permitted, to which metal-clad cable or flexible metallic conduit is to be directly attached.

22.1.19 A box or enclosure in which field-installation conductors are to be connected as specified in 22.1.17 and 22.1.19 shall be located so that the temperature of conductors within the box or surfaces of the box likely to be in contact with the conductors will not exceed that specified for Type T wire when the appliance is tested in compliance with these requirements.

22.1.20 Wiring to be done in the field where permitted between the appliance and devices not attached to the appliance, or between separate devices which are field installed and located, shall comply with these requirements if done with Type T wire enclosed in conduit or with metal-clad cable.

22.2 Grounding

22.2.1 The equipment grounding terminal or lead shall be located in the field wiring compartment and shall be suitable for connection of an equipment-grounding conductor of at least the size required by the National Electrical Code, ANSI/NFPA 70-1993, for the rating of the power supply circuit to be connected.

22.2.2 A soldering lug, a push-in (screwless) connector, or a quick-connect or similar friction fit connector shall not be used for the terminal for the field-installed grounding conductor.

22.2.3 A wire-binding screw intended for the connection of an equipment-grounding conductor shall have a green colored head that is hexagonal, slotted, or both. A pressure wire connector intended for connection of such a conductor shall be identified by being marked G, GR, GROUND, GROUNDING, or by a marking on a wiring diagram provided on the equipment. The wire-binding screw or pressure wire connector shall be secured to the frame or enclosure and shall be located so that it is unlikely to be removed during servicing. At a wire-binding screw, upturned lugs, or the equivalent, shall be provided to retain the conductor. If a pressure connector is used adjacent to the connectors intended for the supply conductors and if it could be mistaken for the neutral of a grounded supply:

- a) A marking shall be additionally provided indicating EQUIPMENT GROUND, and
- b) The connector shall be identified by a green color, or both.

22.2.4 The surface of an insulated lead intended for the connection of an equipment-grounding conductor shall be finished a continuous green color or a continuous green color with one or more yellow stripes, and no other lead visible to the installer shall be so identified.

22.3 Cord connected appliances

22.3.1 An appliance intended for cord connection to the power supply shall be provided with a flexible cord and attachment plug of the grounding type, and of the type, voltage rating, ampacity, and current rating consistent with the rating and intended operation of the appliance.

22.3.1 added August 14, 1995

22.3.2 The marked current rating of a cord-connected appliance shall not exceed 80 percent of the current rating of the attachment plug.

22.3.2 added August 14, 1995

22.3.3 A cord-connected appliance shall employ a grounding-type attachment plug that complies with the ANSI/NEMA designations in Table 22.2.

22.3.3 added August 14, 1995

Table 22.2
Attachment plugs

Attachment plug rating, amperes, volts	ANSI/NEMA designation ^a
15, 125	5-15P
20, 125	5-20P
15, 250	6-15P
20, 250	6-20P
^a As part of the Standard for Wiring Devices – Dimensional Requirements, ANSI/NEMA WD6-1988.	

Table 22.2 added August 14, 1995

22.3.4 A cord-connected appliance shall employ a Type SJ, SJO, SJT, or SJTO power-supply cord rated for use at a voltage not less than the rated voltage of the appliance. The ampacity of the cord as specified in the National Electrical Code, ANSI/NFPA 70-1993 shall not be less than what is required by the appliance.

22.3.4 added August 14, 1995

22.3.5 The length of a power-supply cord shall not be less than 6 feet (1.82 m) and not more than 7 feet (2.13 m). The length is to be measured between the point at which the cord exits the appliance and the attachment plug.

22.3.5 added August 14, 1995

22.3.6 The power-supply cord shall be provided with a strain relief means so that stress of the cord will not be transmitted to terminals, splices, or internal wiring. If a metallic cord rip is provided, it shall not contact uninsulated live parts or reduce spacings within the enclosure if the cord is moved inward. The cord shall not be subject to damage by moving parts if it can be moved inward. See Strain Relief Test, Section 67A.

22.3.6 added August 14, 1995

22.3.7 The edges of the entry hole for the power-supply cord, including the cord entry hole in a bushing, shall be smooth and rounded, and without burrs, fins or sharp edges that may damage the cord insulation. The power-supply cord shall be routed to reduce the risk of damage to the cord insulation.

22.3.7 added August 14, 1995

22.3.8 The power-supply cord shall be attached to the appliance in a manner and location where it cannot be run through holes in walls, ceilings, and floors when it is connected to the manufactured home or recreational vehicle's power supply outlet.

22.3.8 added August 14, 1995

22.3.9 The power-supply cord shall be attached to the appliance in a manner and location where it cannot be concealed behind the walls, ceilings, and floors when it is connected to the manufactured home or recreational vehicle's power supply outlet.

22.3.9 added August 14, 1995

23 Factory Wiring

23.1 The wiring of high-voltage and safety-control circuits shall comply with the requirements of 23.2 – 23.27.

23.2 Wiring shall be done with insulated conductors having current-carrying capacity, voltage, and temperature ratings consistent with their use. A conductor, other than an integral part of a component, shall be not smaller than No. 18 AWG (0.82 mm²).

23.3 The wiring for all appliance circuits shall be furnished by the manufacturer as part of the appliance. If the appliance is not assembled and wired at the factory, such wiring shall be furnished as a harness with each appliance and be arranged to facilitate attachment when the appliance is assembled, in which case a pictorial diagram showing the exact arrangement of the wiring shall be included with each appliance.

Table 54.1
Maximum temperature rises

Materials and components	Column 1		Column 2	
	Degrees		Degrees	
	C	F	C	F
A. Motors^{a,b}				
1. Class A insulation systems on coil windings of alternating-current motors having a frame diameter of 7 inches (178 mm) or less in diameter (not including universal motors):				
a. In open motors;				
Thermocouple or resistance method	75	135	115	208
b. In totally enclosed motors;				
Thermocouple or resistance method	80	144	115	208
2. Class A insulation systems on coil windings of alternating-current motors having a frame diameter of more than 7 inches (178 mm) and of direct-current and universal motors:				
a. In open motors;				
Thermocouple method	65	117	115	208
Resistance method	75	135	115	208
b. In totally enclosed motors;				
Thermocouple method	70	126	115	208
Resistance method	80	144	115	208
3. Class B insulation systems on coil windings of alternating-current motors having a frame diameter of more than 7 inches (178 mm) or less (not including universal motors):				
a. In open motors;				
Thermocouple or resistance method	95	171	140	252
b. In totally enclosed motors;				
Thermocouple or resistance method	100	180	140	252
4. Class B insulation systems on coil windings of alternating-current motors having a frame diameter of more than 7 inches (178 mm) and of direct-current and universal motors:				
a. In open motors;				
Thermocouple method	85	153	140	252
Resistance method	95	171	140	252
b. In totally enclosed motors;				
Thermocouple method	90	162	140	252
Resistance method	100	180	140	252

(Continued)

Table 54.1 (Cont'd)
Maximum temperature rises

Materials and components		Column 1		Column 2	
		Degrees		Degrees	
		C	F	C	F
B. Components					
1.	Capacitors:				
a.	Electrolytic type ^d	40	72	(Not specified)	
b.	Other types ^e	65	117		
2.	Field wiring	35	63	60	108
3.	Relay, solenoid, and other coils with: ^b				
a.	Class 105 insulated winding; Thermocouple method	65	117	115	208
b.	Class 130 insulated winding; Thermocouple method	85	153	140	252
4.	Sealing compounds	40°C(72°F) less than its melting point			
5.	Transformer enclosures ^b				
a.	Class 2 transformers	60	108	85	153
b.	Power and ignition transformers	65	117	90	162
C. Wiring					
1.	Insulated Conductors	25°C(45°F) less than the temperature rating		10°C(18°F) less than the temperature rating ^f	
2.	Flexible cords – Types SJ, SJO, SJT including surfaces of the appliance which the cord may contact ⁱ	35	63	60	108
D. Electrical Insulation – General^{f,g}					
1.	Class C electrical insulation material	Not specified			
2.	Class (180) electrical insulation material	As determined by test			
3.	Fiber used as electrical insulation or cord bushings	65	117	90	162
4.	Phenolic composition used as electrical insulation or as parts where malfunction will result in a risk of fire or electrical shock	125	225	150	270
5.	Thermoplastic material	25°C(45°F) less than its temperature rating			
6.	Varnished cloth insulation	60	108	85	153
E. Metals					
1.	Aluminum alloys –				
a.	1100	183	330	239	430
b.	3003	239	430	294	530
c.	2014, 2017, 2024, 5052	294	530	350	630

(Continued)

Table 54.1 (Cont'd)
Maximum temperature rises

Materials and components		Column 1		Column 2	
		Degrees		Degrees	
		C	F	C	F
2.	Aluminum-coated steel ^h	656	1180	767	1380
3.	Carbon Steel Sheet, Cast Iron	517	930	683	1230
4.	Carbon steel – Coated with Type A19 ceramic	572	1030	628	1130
5.	Galvanized steel ^c	267	480	350	630
6.	Stainless steel –				
	Types 302, 303, 304, 316, 321, 347	767	1380	878	1580
	Type 309	961	1730	1072	1930
	Type 310	1017	1830	1128	2030
	Type 405	683	1230	795	1430
	Type 403, 409, 410, 416	572	1030	683	1230
	Type 430	711	1280	822	1480
	Type 442	877	1580	933	1680
	Type 446	961	1730	1072	1930
7.	Zinc Castings	89	160	145	260
F.	General				
1.	Air Filter	50	90	97	175
2.	Flue gases	517	930	738	1330
3.	Oil in constant level valve or tank	14	25	22	40
4.	Surfaces of heater at points of zero clearance to test structure	50	90	97	175
5.	Surface of floor beneath and within 3 feet (0.91 m) of heater to be classified for installation on combustible floors	50	90	97	175
6.	Surfaces of test enclosure (ceiling, walls, and the like)	50	90	97	175

^a The motor diameter is to be measured in the plane of the laminations of the circle circumscribing the stator frame, excluding lugs, boxes, or the like, used solely for motor cooling, mounting, assembly, or connection.

^b Coil or winding temperatures are to be measured by thermocouples unless the coil is inaccessible for mounting of these devices (such as a coil immersed in sealing compound) or unless the coil wrap includes thermal insulation or more than 2 layers, 1/32 inch (0.8 mm) maximum, of cotton, paper, rayon, or the like. For a thermocouple-measured temperature of a coil of an alternating-current motor, other than a universal motor, having a diameter 7 inches (178 mm) or less, the thermocouple is to be mounted on the integrally applied insulation on the conductor. At a point on the surface of the coil (not including universal motors) where the temperature is affected by an external source of heat, the temperature rise measured by a thermocouple may exceed the indicated maximum by the following amounts, provided that the temperature rise of the coil, as measured by the resistance method, is not more than that specified in the table.

- 5°C (9°F) for Column 1 limits for Class A insulation on coil windings of alternating-current motors having a diameter of 7 inches (178 mm) or less, open type.
- 10°C (18°F) for Column 1 limits for Class B insulation on coil windings of alternating-current motors having a diameter of 7 inches (178 mm) or less, open type.

(Continued)

Table 54.1 (Cont'd)

3. 15°C (27°F) for Column 1 limits for Class A insulation on coil windings of alternating-current motors having a diameter of more than 7 inches (178 mm), open type.

4. 20°C (36°F) for Column 1 limits for Class B insulation on coil windings of alternating-current motors having a diameter of more than 7 inches (178 mm), open type.

^c The specified maximum temperature rises apply if the galvanizing is required as a protective coating, or the reflectivity of the surface is utilized to reduce the risk of fire.

^d For an electrolytic capacitor which is physically integral with or attached to a motor, the temperature rise on insulating material integral with the capacitor enclosure may be not more than 65°C (117°F).

^e A capacitor which operates at a temperature higher than a 65°C (117°F) rise may be evaluated on the basis of its marked temperature rating.

^f For conductors having a temperature rating of 200°C (392°F) or higher, the rise may be equal to the temperature rating.

^g The limitations on phenolic composition and on rubber and thermoplastic insulation do not apply to compounds which have been investigated and found to have special heat-resistant properties.

^h When the reflectivity of aluminum-coated steel is utilized to reduce the risk of fire, the maximum allowable temperature rise is 830°F (461°C).

ⁱ For standard insulated conductors other than those mentioned, reference should be made to the National Electrical Code, ANSI/NFPA 70-1990. The maximum allowable temperature rise in any case is 25°C (45°F) less than the temperature limit of the wire in question where Column 1 temperature rise are specified, and the maximum allowable temperature rise where Column 2 temperature rises are specified is to be based on the heat resistant properties of the insulation.

Table 54.1 revised August 14, 1995

55 Continuous Operation Temperature Test – Central Heating Appliances

55.1 The limit control is to be bypassed to permit continued operation during this test. The appliance is to be fired at rated input.

55.2 The outlet-air temperature of a central furnace is to be:

a) 88°F (48.9°C) above inlet-air temperature for central furnaces equipped with a limit control that does not permit an outlet-air temperature in excess of 165°F (73.9°C).

b) 123°F (68.4°C) above inlet-air temperature for central furnaces equipped with a limit control that permits an outlet-air temperature in excess of 165°F (73.9°C), but not more than 200°F (93.3°C).

55.3 The outlet-air temperature of central furnaces is to be established by gradually restricting the circulating air flow until the outlet-air temperature reaches the applicable value specified in 55.2, $\pm 5^\circ\text{F}$ ($\pm 2.8^\circ\text{C}$). The static pressure in the supply plenum of a forced-air appliance is to be not more than twice the appropriate value specified in Table 47.2. Any restriction of a return air inlet grille, not intended to be connected to a return air duct system, is to be accomplished by layers cheesecloth applied progressively. The cloth is attached to a frame such as specified in 57.5.

[illegible]

67.3.1 A nonmetallic dip tube shall not collapse, as evidenced by a reduction in internal diameter of more than 1/8 inch (3.2 mm), when immersed in water at a temperature of 225 plus 5 minus 0°F (107 plus 3 minus 0°C) under the conditions described in 67.3.2 – 67.3.6.

67.3.2 The internal diameter of a 49-inch (1.24-m) long dip tube sample is to be determined before the conditioning described in 67.3.3 – 67.3.6.

67.3.3 The sample is to be installed in the hot-water outlet of a representative test appliance. A quick-acting valve is to be installed at the outlet connection of the storage vessel. The minimum cross-sectional area through this valve is to be equal to or greater than that of a Schedule 40, 1/4 inch pipe having an internal diameter of 0.364 inch (9.25 mm) as specified in Welded and Seamless Wrought Steel Pipe, ANSI B36.10M-1985. A flow-restricting device adjusted or constructed so as to maintain a flow rate of 5 gallons (18.9 L) per minute during the test is to be connected to the inlet of the test appliance.

67.3.4 A mercury thermometer graduated to 1°F (0.5°C), or a thermocouple for connection to a potentiometer, is to be installed in the storage vessel within the top 6 inches (152.4 mm) of the tank. A water-pressure regulator is to be located between the inlet connection to the storage vessel and the water supply line and adjusted so that, at a steady flow rate of 5 gallons (18.9 L) per minute, the pressure at the inlet connection will be 40 psig (276 kPa).

67.3.5 The storage vessel is to be filled and the test appliance placed in operation with the thermostat and limit control bypassed. When the temperature indicated by the thermometer or thermocouple in the top of the storage vessel is 225 plus 5 minus 0°F (107 plus 3 minus 0°C), the quick acting valve is to be opened and water allowed to flow until the outlet-water temperature is the same as the inlet-water temperature.

67.3.6 The dip tube is then to be removed from the test appliance and examined.

67A Strain-Relief Test

67A.1 A strain-relief means on the power-supply cord of a cord-connected appliance is to be subjected for 1 minute to the test described in 67A.2. There shall be no movement transmitted to the cord that would indicate that stress would have resulted on the cord connections.

67A.1 added August 14, 1995

67A.2 A 35-pound (15.9 Kg) mass is to be suspended on the cord and supported by the appliance so that the strain-relief means will be stressed from any angle that the design of the heating appliance permits.

67A.2 added August 14, 1995

67B Leakage-Current Test

67B.1 The leakage current of a cord-connected appliance shall not be more than:

- a) 0.5 milliamperes for a cord-connected appliance having a nominal 120 volt rating; and
- b) 0.75 milliamperes for a cord-connected appliance having a nominal 208 or 240 volt rating.

67B.1 added August 14, 1995

67B.2 Leakage current refers to all currents, including capacitively coupled currents, that may be conveyed between exposed conductive surfaces of an appliance and ground or other exposed conductive surfaces of an appliance.

67B.2 added August 14, 1995

67B.3 All exposed conductive surfaces are to be tested for leakage currents. The leakage currents from the surfaces are to be measured to the ground supply conductor individually as well as collectively where simultaneously accessible and from one surface to another where simultaneously accessible. Parts are considered to be exposed surfaces unless guarded by an enclosure considered acceptable for protection against risk of electric shock as defined in 28.1 and 28.22. Surfaces are considered to be simultaneously accessible where they can be contacted by one or both hands of a person at the same time.

67B.3 added August 14, 1995

67B.4 If a conductive surface other than metal is used for the enclosure or part of the enclosure, the leakage current is to be measured using a metal foil with an area of 4 by 8 inches (10 by 20 centimeters) in contact with the surface. Where the surface is less than 4 by 8 inches (10 by 20 centimeters), the metal foil is to be the same size as the surface. The metal foil is not to remain in place long enough to effect the temperature of the appliance.

67B.4 added August 14, 1995

67B.5 The measurement circuit for leakage current is to be as illustrated in Figure 67B.1. The measurement instrument is defined in (a) – (d). The meter which is actually used for a measurement need only indicate the same numerical value for a particular measurement as would the defined instrument. The meter used need not have all the attributes of the defined instrument.

- a) The meter is to have an input impedance of 1500 ohms resistive shunted by a capacitance of 0.15 microfarad.
- b) The meter is to indicate 1.11 times the average of the full-wave rectified composite wave form of voltage across the resistor or current through the resistor.
- c) Over a frequency range of 0 - 100 kilohertz, the measurement circuitry is to have a frequency response (ratio of indicated to actual value of current) equal to the ratio of the impedance of a 1500-ohm resistor shunted by a 0.15 microfarad capacitor to 1500 ohms. At an indication of 0.5 or 0.75 milliamperes, the measurement is to have error of not more than 5 percent at 60 hertz.
- d) Unless the meter is being used to measure leakage from one part of a heating appliance to another, the meter is to be connected between the accessible parts and the grounding supply conductor.

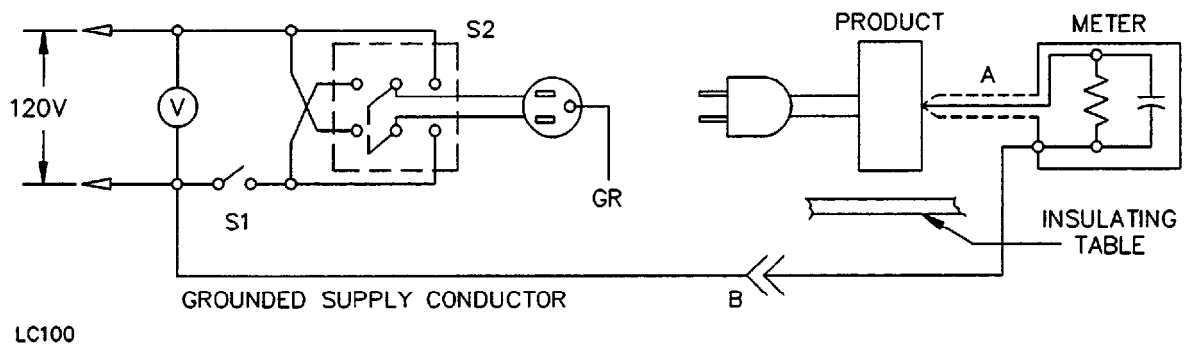
67B.5 added August 14, 1995

67B.6 A sample of the appliance is to be tested for leakage current starting with the as-received condition with all switches and thermostats closed, but with its grounding conductor, opened at the attachment plug cap. The as-received condition is without prior energization, except as may occur as part of the production line testing. The supply voltage is to be 120 or 240 volts, depending upon the voltage rating of the appliance. The test sequence, with reference to the measuring circuit, Figure 67B.1, is to be as follows:

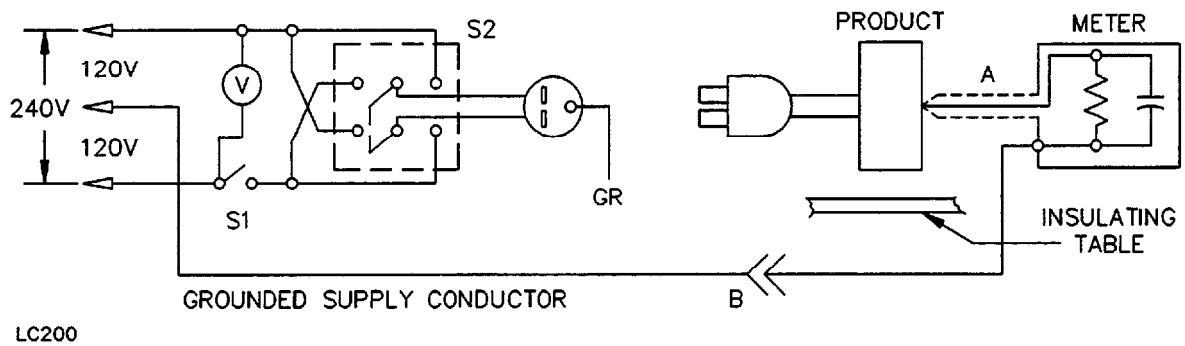
- a) With switch S1 opened, the appliance is to be connected to the measuring circuit. Leakage current is to be measured using both positions of switch S2.
- b) Switch S1 is then to be closed, energizing the appliance, and within 5 seconds, the leakage current is to be measured using both positions of switch S2 and with the heating appliance operated at the maximum heat setting of the controls.
- c) Leakage current is to be monitored until thermal stabilization under the maximum heat condition. Both positions of switch S2 are to be used. If any adjustable thermostat does not cycle at the maximum heat setting, it is to be adjusted until it does cycle before the final measurements at thermal stabilization are taken. Measurements are to be made with the thermostat, if any, open and closed, normally following the 5 second measurements, item B, the first monitoring reading will be taken 10 minutes after energizing. Upon evidence of stabilizing readings, monitoring periods may be increased.
- d) If the appliance employs a single-pole switch or a control thermostat for adjusting temperatures, then monitoring of leakage current is to continue until the leakage current stabilizes or decreases after the appliance is turned off.

67B.6 added August 14, 1995

Figure 67B.1
Leakage current measurement circuit(s)



Product intended for connection to a 120 V power supply.



Product intended for connection to 208 V or 240 V power supply.

NOTES:

A – Probe with shielded lead.

B – Separated and used as a clip when measuring current from one part of a product to another.

Figure 67B.1 added August 14, 1995

MANUFACTURING AND PRODUCTION TESTS – ALL APPLIANCES

68 General

68.1 In order to ensure compliance with these requirements in production, the manufacturer of appliances shall check, inspect, and test the components and the assemblies of each as indicated below.

68.2 Factory inspections and tests shall include the following:

- a) Inspection of raw materials.
- b) Check of relationship between a constant level device and a vaporizing fuel burner of each appliance. Distance from maximum normal level of fuel to be maintained by the primary safety control in burner to lowest opening through which fuel can overflow the burner is required to be not less than 3/4 inch (19.1 mm).
- c) Examination of all vaporizing burners to ensure that they are free from defects. If of cast iron, the burner is to be tested for porosity and leakage by filling it with No. 1 fuel and allowing it to stand for at least 1/2 hour, or with mineral spirits for at least 5 minutes.
- d) Inspection of combustion chambers and heat exchangers to determine conformance with manufacturing specifications.
- e) Flow-test, fuel-metering devices which are employed as the sole means for limiting input to the intended value, to determine that at maximum adjustment the flow does not exceed the specified amount. All valves are to be so tested unless it can be established that they meet the requirement in 2.1.1 in which case 3 percent of each lot picked at random are to be tested.
- f) Dielectric voltage withstand tests on each appliance incorporating high-voltage electrical circuit(s). The test shall consist of the application of a 60 Hz potential between high-voltage, current-carrying parts and the casing frame and similar noncurrent-carrying parts of the appliance with any switch contacts open or closed. The potential shall be applied for 1 second, except that if the time of application is 1 minute the test potential may be reduced to 5/6 (83-1/3 percent) of the values specified below. The test potential shall be:
 - 1) 1200 volts for an appliance rated 250 volts or less, with or without a motor rated 1/2 horsepower-output (373 W-output) or less.
 - 2) 120 percent of the sum of 1000 volts plus twice the rated voltage for an appliance (a) rated for more than 250 volts, or (b) employing motor rated at more than 1/2 horsepower-output (373 W-output).
- g) Test of fuel tanks with air at 1 psig (6.9 kPa) while immersed in water. This may be accomplished with atmospheric tanks by inverting each tank so as to trap air in it and submerging the tank in water to a depth of 30 inches (762 mm), measured from the surface of the water to the surface of the tank. In the case of tanks obtained from outside sources (and which have previously been tested 100 percent), see 2.1.1, the appliance manufacturer need test only 3 percent of each lot picked at random.

h) In the case of power-operated burners not separately inspected, each burner or its essential components is to be tested to reveal or eliminate the following:

- 1) Oil leaks.
- 2) Electrical defects.
- 3) Misalignment.
- 4) Proper oil pressure.
- 5) Total motor input.
- 6) Proper adjustment of igniters.

68.3 The test equipment used for the test in 68.2(f) is to include a visible indication of application of the test potential and an audible and/or visible indication of breakdown. In the event of breakdown, manual reset of an external switch is to be required, or an automatic reject of the unit under test is to result. Other arrangements may be considered and accepted if found to achieve the results contemplated.

68A Production-Line Grounding Continuity Test

68A.1 The manufacturer shall test each product provided with a power-supply cord to verify the electrical continuity between the device and the grounding blade of the attachment plug. See Bonding for Grounding, Section 25.

68A.1 added August 14, 1995

68A.2 This test is also required for permanently-connected units or sections and accessories of such units that device power by means of a cord and plug connection.

68A.2 added August 14, 1995

68A.3 An indicating device, such as an ohmmeter, low-voltage battery-and-buzzer-combination, or the like, may be employed in establishing compliance with these requirements.

68A.3 added August 14, 1995

68A.4 If internal parts, as referred to in the requirements for Bonding for Grounding, Section 25, are determined in the investigation of the device to be bonded to the frame and enclosure of the unit, a test that determines the electrical continuity between the grounding blade and the frame or enclosure is sufficient for establishing compliance with the requirement in 68A.1.

68A.4 added August 14, 1995

MARKING – ALL APPLIANCES

69 General

69.1 The following information shall appear on each appliance:

- a) Name of the manufacturer or private labeler or their identifying symbol and catalog designation of the appliance.

- b) A direct vent system appliance shall be so designated on the marking plate. Other appliances shall carry the statement: "For Installation Only in Compartment Completely Closed Off from Living Quarters and Accessible Only from the Outdoors."
- c) The voltage rating, frequency, and total current in amperes or watts of the appliance. If the appliance includes more than one circuit to be supplied by individual external supply circuits, the current of each circuit shall be indicated.
- d) The kind of fuel and the firing rate.
- e) Identification and direction to install individual subassemblies or parts not factory assembled on the appliance.
- f) Instructions for replacing an air filter with like material, permanently pasted or imprinted upon the filter service panel or adjacent thereto. Such marking is to be evident during replacement. Also, explicit directions for locating an air filter when not factory-located, if safe operation in accordance with these requirements is obtained only when the filters are so located.
- g) If a forced-air appliance is tested without circulating air filters for compliance with these requirements, an appropriate statement that the appliance is not to be used with air filters. (The construction of the appliance shall incorporate no provision for mounting air filters.)
- h) The minimum clearances to adjacent construction to be provided when installed. The location and size of ventilation openings to be provided in closest doors or panels.
- i) The designed maximum outlet-air temperature of the appliance, if 200°F (93.3°C) or less. Appliances equipped with a limit control that functions to limit the outlet air temperature between 165°F (73.9°C) and 200°F (93.3°C) shall be marked: "DESIGNED MAXIMUM OUTLET-AIR TEMPERATURE – 200°F (93.3°C) OR LESS." Appliances equipped with a limit control that functions to limit the outlet-air temperature to 165°F (73.9°C) or less shall be marked: "DESIGNED MAXIMUM OUTLET-AIR TEMPERATURE – 165°F (73.9°C) OR LESS."
- j) Static pressures as determined by the following measurements:
- 1) The maximum static pressure developed within the casing on a central furnace as measured at the connector on the appliance, if a connector is provided, during the Continuity of Operation Test, Section 53, and
 - 2) The maximum designed static pressure at which the furnace was tested as measured in the warm-air supply plenum.

UL 307A

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



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**Underwriters Laboratories Inc.®**A not-for-profit organization dedicated to public safety
and committed to quality service**January 26, 1995****Standard for****Liquid Fuel-Burning Heating Appliances for Manufactured Homes and Recreational Vehicles****UL 307A, Seventh Edition**

Accompanying this transmittal notice is a copy of the Seventh edition of UL 307A.

A CHANGE IS INDICATED BY A SMALL PRINT NOTE FOLLOWING THE AFFECTED ITEM.

THIS EDITION OF THE STANDARD IS NOW IN EFFECT EXCEPT FOR PARAGRAPHS 69.18 AND 79.6, AND SECTION 64, AND FIGURE 69.1, WHICH BECOME EFFECTIVE JANUARY 26, 1997 AS INDICATED IN THE SMALL PRINT NOTE FOLLOWING THE AFFECTED ITEMS.

THE CURRENT REQUIREMENTS IN EFFECT FOR THE REQUIREMENTS HAVING FUTURE EFFECTIVE DATES ARE LOCATED IN THE BACK OF THE STANDARD.

New product submittals made prior to a specified future effective date will be judged under all of the requirements in this standard unless the applicant specifically requests that the product be judged under the current requirements. However, should the applicant elect this option, it should be noted that compliance with all the requirements in this standard will be required as a condition of continued Listing and Follow-Up Services after the effective date and understanding of this should be signified in writing.

The requirements in this standard are substantially in accordance with UL's bulletin on this subject dated June 22, 1994. This bulletin is now obsolete and may be discarded.

Revised and/or additional pages may be issued from time to time.

JANUARY 26, 1995

1

UL 307A

Standard for

**Liquid Fuel-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 "Liquid Fuel-Burning Heating Appliances for Mobile Homes and Travel Trailers." The Third – Fifth Editions were titled "Liquid Fuel-Burning Heating Appliances for Mobile Homes and Recreational Vehicles."

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Seventh Edition

January 26, 1995

An effective date included as a note immediately following certain requirements is one established by Underwriters Laboratories Inc.

Revisions of this standard will be made by issuing revised or additional pages bearing their date of issue. A UL Standard is current only if it incorporates the most recently adopted revisions, all of which are itemized on the transmittal notice that accompanies the latest published set of revision pages.

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FOREWORD

A. This Standard contains basic requirements for products covered by Underwriters Laboratories Inc. (UL) under its Follow-Up Service for this category within the limitations given below and in the Scope section of this Standard. These requirements are based upon sound engineering principles, research, records of tests and field experience, and an appreciation of the problems of manufacture, installation, and use derived from consultation with and information obtained from manufacturers, users, inspection authorities, and others having specialized experience. They are subject to revision as further experience and investigation may show is necessary or desirable.

B. The observance of the requirements of this Standard by a manufacturer is one of the conditions of the continued coverage of the manufacturer's product.

C. A product which complies with the text of this Standard will not necessarily be judged to comply with the Standard if, when examined and tested, it is found to have other features which impair the level of safety contemplated by these requirements.

D. A product employing materials or having forms of construction differing from those detailed in the requirements of this Standard may be examined and tested according to the intent of the requirements and, if found to be substantially equivalent, may be judged to comply with the Standard.

E. UL, in performing its functions in accordance with its objectives, does not assume or undertake to discharge any responsibility of the manufacturer or any other party. The opinions and findings of UL represent its professional judgment given with due consideration to the necessary limitations of practical operation and state of the art at the time the Standard is processed. UL shall not be responsible to anyone for the use of or reliance upon this Standard by anyone. UL shall not incur any obligation or liability for damages, including consequential damages, arising out of or in connection with the use, interpretation of, or reliance upon this Standard.

F. Many tests required by the Standards of UL are inherently hazardous and adequate safeguards for personnel and property shall be employed in conducting such tests.

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-Heating Appliances for Mobile 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.

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

2.2.2 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.

3 Glossary

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

3.2 **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.

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 turned on and ignited automatically.

3.5 **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.

3.6 **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.

3.7 **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.

3.8 **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.

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

3.10 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.

3.11 **FUEL OIL** — Any hydrocarbon oil defined by Specifications for Fuel Oils, ASTM D396-1992.

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

3.13 **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.

3.14 **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.

3.15 **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 m²) 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 m²), 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.

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

3.17 **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.

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

3.19 **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.

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

3.21 **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

4 Materials

4.1 **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.

5 Assembly

5.1 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 5.8.

5.2 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 8 and 19, respectively) shall be provided as components of these appliances. See 79.3.

5.3 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."

5.4 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.

5.5 Conformance of a direct vent system appliance with 5.3 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.

5.6 A burner compartment of an appliance intended to conform to the requirements of 5.3 or 5.4 by following the criteria outlined in 5.5(a) and (c) shall include a warning 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).

5.7 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 cm²) 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.

5.8 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.

5.9 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.

5.10 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.

5.11 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.

5.12 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.

5.13 Appliances for alcove or closet installation, such as upflow and downflow central furnaces, and boilers, are considered to conform to 5.12, 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.

5.14 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.

5.15 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.

5.16 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 5.17, without altering its position by more than 3 degrees in any horizontal or vertical plane.

5.17 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 5.16.

5.18 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).

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

5.20 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 5.1 after removal and replacement.

Table 5.1
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)

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

5.22 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.

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