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August 4, 1995

Revision pages for

Standard for

Oil Burners

UL 296, Ninth Edition

Attached to this transmittal notice is a reprinted title page and a revision of the Ninth edition of UL 296.

THIS REVISION IS BEING ISSUED TO CORRECT TYPOGRAPHICAL ERRORS ON PAGES DATED AUGUST 4, 1995.

Attention is directed to the note on the title page of this standard outlining the procedure to be followed to retain the approved text of ANSI/UL 296-1995.

Attention is directed to the note on the title page of this standard identifying that the Department of Defense has adopted the text of UL 296.

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

With the inclusion of the accompanying material, the standard consists of pages dated as shown in the following checklist:

Page	Date
1	June 30, 1994(Reprinted August 4, 1995)
2 - 9	June 30, 1994
10	August 4, 1995
11 - 71	June 30, 1994
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Standard for

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Ninth Edition

June 30, 1994

Approval as an American National Standard (ANSI) covers the numbered paragraphs on pages dated June 30, 1994 and July 25, 1995. These pages should not be discarded when revised or additional pages are issued if it is desired to retain the ANSI approved text.

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

Approved as ANSI/UL 296-1980, June 6, 1980
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The Department of Defense (DoD) has adopted UL 296 on January 27, 1992. The publication of revised pages or a new edition of this Standard will not invalidate the DoD adoption.

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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4.38 **STRAINER, PRIMARY** – The strainer through which all oil first passes on way to burner, being upstream from any other strainer.

4.39 **STRAINER, SECONDARY** – A strainer downstream from the primary strainer, interposed in the fuel line between the primary strainer and the point at which fuel is delivered for combustion.

4.40 **UNATTENDED** – Lacking the presence of a person, not necessarily an electrician, capable of exercising responsible control of the motor under consideration. Such a person need not be in sight of the motor at all times but must be available for opening the motor circuit in the event of motor overheating. See 40.6.

4.41 **TRIAL-FOR-IGNITION PERIOD** – That period of time the main burner fuel is permitted to be delivered into the ignition zone before the main flame-sensing device is required to detect main flame.

4.42 **VALVE, MANUAL OIL SHUT-OFF** – A manually operated valve in the oil line for the purpose of completely turning on or shutting off the oil supply to the burner.

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

a) **Metering (Regulating) Valve.** An oil control valve for regulating burner input.

b) **Safety Valve.** A normally closed valve of the "on" and "off" type, without any bypass to the burner, that is actuated by a safety control or by an emergency device.

CONSTRUCTION – MECHANICAL

5 General

5.1 Fuel-confining parts or operating parts shall not sag, distort, melt, oxidize, show leakage of fuel, or reduce the likelihood of a safety device from functioning during any of the tests specified herein.

5.2 To conform to 5.1, a material shall have a melting point, solidus temperature, of not less than 950°F (510°C) and a tensile strength not less than 10,000 pounds per square inch (psi) (69 MPa) at 400°F (204°C).

5.3 Fuel-confining parts not conforming to 5.1 and 5.2 may be employed if a fusible-link valve or the equivalent is included in the assembly of the burner so as to shut off the fuel supply in the event of excessive temperature or fire in the vicinity of such parts.

5.4 A burner part intended for the handling of fluids under pressure shall withstand, without rupture, a hydrostatic pressure equivalent to five times the maximum working pressure.

5.5 Soft solder shall not be used on any fuel-handling parts if melting of the solder may allow leakage of fuel. Soft-soldered joints, where permitted, shall be made mechanically secure before soldering.

5.6 The burner shall function so as to reduce to a minimum the generation of unburned vapors, and shall not include chambers or pockets in which unburned vapors may accumulate. An oil-conveying pipe or passage shall not be exposed to such temperatures as may result in carbonization or clogging when the burner is tested in accordance with these requirements.

6 Servicing

6.1 The requirements of 36.1 are not applicable to mechanical service functions which are not normally performed with the equipment energized.

6.2 Moving parts such as fan blades, blower wheels, pulleys, or belts which may cause injury shall be enclosed or guarded.

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

- a) The opening or removal of the door, panel or shield shall require the use of tools;
- b) An interlocking device shall shut off the mechanism; or
- c) A marking, preceded by the word "DANGER," shall be displayed which reads essentially as follows:

To Avoid Injury From Moving Parts, Shut Off The (Equipment) Before (Removing- Opening)
This (Cover-Door).

6.4 The distance from an opening in a required guard or enclosure to the moving part mentioned in 6.1 shall be in accordance with Table 6.1, but the minor dimension of the opening shall not in any case exceed 3 inches (76.2 mm). For an opening having a minor dimension intermediate between two of the values included in the table, the distance from the opening to the moving part shall be not less than that found by appropriate interpolation between the corresponding values in the right-hand column of the table. The minor dimension of the opening is determined by the largest hemispherically tipped cylindrical probe that can be inserted through the opening with a force of 5 pounds (22 N).

6.5 A moving part is not to be considered when judging compliance with 6.2 and 6.4 if the part is unlikely to be contacted through the opening because of fixed components, including baffles.

Table 6.1
Dimensions of openings

Minor dimensions of openings ^a		Minimum distance from opening to moving part	
Inches	(mm)	Inches	(mm)
1/4	6.4	1/2	12.7
3/8	9.5	1-1/2	38.1
1/2	12.7	2-1/2	63.5
3/4	19.1	4-1/2	114.0
1	25.4	6-1/2	165.0
1-1/2	38.1	10-1/2	167.0
2	50.8	14-1/2	368.0
Over 2 inches	(over 50.8)	30	762.0

^a Openings less than 1/4 inch (6.4 mm) are not to be considered.

50.3.13 During the test period, daily observations and recordings are to be made of the draft on all operating fires, ignition and combustion characteristics, combustion chamber conditions, and any abnormal performance.

50.3.14 The fuel-burning rate and draft over fire are to be determined and smoke observation and flue-gas analyses are to be made on each operating fire and recorded at the beginning of the test, after each period of 50 hours of operation on high fire, and at the end of the test.

50.3.15 At the end of the tests described in 50.3.10 and 50.3.11, smoke observations as described in 50.3.7 and 50.3.8 are to be made.

50.3.16 Following the above test the voltage is to be adjusted to rated voltage and the total electrical input and the electrical input of each component, except those having a pilot duty rating, are to be measured.

51 Combustion Air Failure Test – Test No. 3

51.1 A mechanical draft burner not provided with a combustion air interlock shall operate in accordance with the requirements specified in 51.3 and 51.4 during interruption and upon restoration of the combustion-air supply.

51.2 The initial conditions for the test are to be as for Test No. 1 (50.2.1 – 50.2.4), or Test No. 2 (50.3.1 – 50.3.4). The test may be conducted during the course of the Combustion Tests, Section 50. While the burner is being fired at any operating fire, the fan supplying air for combustion is to be stopped, that is, by disconnecting the fan motor only from the electrical circuit, by disconnecting any flexible coupling, or by removing any belt needed to drive the fan. Fuel to the main burner is to be shut off in accordance with 51.3 or combustion, if continued, is to be in accordance with 51.4.

51.3 If the main burner flame is extinguished following interruption of the air supply, the fuel is to be shut off due to the inherent design of the burner or by action of a safety control within the safety control timing period specified in Table 28.1. The burner is to require manual restart to fire the burner upon restoration of the air supply, or an automatically-lighted burner may restart automatically upon restoration of the air supply provided the intended automatic reignition is obtained.

51.4 If combustion is continued following interruption of the air supply, the burner is to be allowed to function as it will for at least 48 hours. At the end of that period, the combustion air supply is to be restored and the burner ignited if the flame has been extinguished. The performance of the burner is to be such that:

- a) During that portion of the test period beginning 3 hours immediately following interruption of the air supply, the combustion, if maintained, is to be such that the burner flame does not produce smoke in excess of that indicated on the Shell-Bacharach scale with the Model RDC smokemeter, as specified in 50.1.2(d).
- b) Flames are not expelled at any time from the burner or the heating appliance being fired for the test.
- c) Combustion is stable at all times during the test.
- d) The reignition of the main burner flame is effected completely and without backfire, flash or "puff."
- e) Soot does not accumulate in the appliance being fired for the test and in the flue pipe to such an extent that stable combustion cannot be obtained.

52 Interruption of Atomization Test – Test No. 4

52.1 A mechanical atomizing burner employing air, steam, or a mechanical device for atomizing fuel shall be arranged to shut off the delivery of fuel for combustion upon interruption of the atomizing media or the operation of the mechanical device.

52.2 The initial conditions for the test are to be as for Test No. 1 (50.2.1 – 50.2.4). The test may be conducted during the course of the Combustion Tests, Section 50. While the burner is being fired at any operating fire, the atomizing media or operation of the mechanical device is to be interrupted, that is, by disconnecting from the electrical circuit only the motor driving a device providing the atomizing means, by disconnecting any flexible coupling or removing any belt needed to drive such device, or by stopping the flow of an atomizing media furnished by a source other than the burner. Fuel to the main burner flame is to be shut off due to the inherent design of the burner or by action of the safety control timing period specified in Table 28.1. The burner is to require manual restart upon restoration of the atomizing means, or an automatically lighted burner may restart upon restoration of the atomizing means provided the intended automatic reignition is obtained.

53 Undervoltage Test – Test No. 5

53.1 A burner shall operate in accordance with the requirements specified in 53.2 when tested at an undervoltage as specified in Table 49.1.

53.2 The initial conditions for test are to be as for Test No. 1 (50.2.1 – 50.2.4) or Test No. 2 (50.3.1 – 50.3.4), except that the test voltage shall be regulated to maintain the appropriate undervoltage, as specified in Table 49.1. The test may be conducted during the course of the Combustion Tests, Section 50. The performance of the burner shall be such that:

- a) Ignition of the main burner flame is effected without backfire, flash, or "puff."
- b) Flames are not expelled from the burner or the heating appliance being fired for the test.
- c) Combustion is complete and stable.
- d) Flames at all allowable firing rates do not produce smoke in excess of that indicated on the Shell-Bacharach scale with the Model RDC smoke meter, as specified in 50.1.2(d).
- e) The burner is capable of operation without interruption.

54 Power Interruption Test – Test No. 6

54.1 A power-operated burner shall operate in accordance with the requirements of 54.3 or 54.4, during interruption and upon restoration of the power supply.

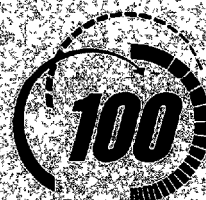
54.2 The initial conditions for test are to be as for Test No. 1 (50.2.1 – 50.2.4) or Test No. 2 (50.3.1 – 50.3.4). The test may be conducted during the course of the Combustion Tests, Section 50. While the burner is being fired at any operating fire, the power supply is to be interrupted. The power is then to be restored after being interrupted for any period of time. Fuel to the main burner is to be shut off immediately in accordance with 54.3, or combustion, if continued, is to be in accordance with 54.4.

Standard for Safety

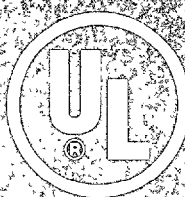
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Oil Burners



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1894-1994



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Standard



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June 30, 1994

Standard for

Oil Burners

UL 296, Ninth Edition

Accompanying this transmittal notice is a copy of the Ninth edition of UL 296.

THIS EDITION OF THE STANDARD IS NOW IN EFFECT.

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

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1

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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 cover oil burners intended for firing appliances and devices such as boilers; central, floor, wall, and special furnaces; storage tank water, air, and direct-fired air heater units; and ovens. These burners are required to be equipped with automatic primary safety controls to restrict abnormal discharge of oil at the burner in case of ignition failure or flame failure.

1.2 Requirements for the installation and use of oil-burning equipment are included in the National Fire Protection Association Standard for Oil-Burning Equipment, NFPA 31. These heaters are intended for installation in accordance with codes such as the BOCA National Mechanical Code, the Standard Mechanical Code, and the Uniform Mechanical Code.

1.3 A product that contains features, characteristics, components, materials, or systems new or different from those covered by the requirements in this Standard, and that 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 may be proposed and adopted in conformance with the methods employed for development, revision, and implementation of this Standard.

2 Units of Measurements

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.

3 Components

3.1 Except as indicated in 3.2, 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.

3.2 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.

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

3.4 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.

4 Glossary

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

- 4.2 AIR SHUTTER** – An adjustable device for varying the size of the air inlet or inlets regulating primary or secondary air.
- 4.3 ANTIFLOODING DEVICE** – A primary safety control that causes the fuel flow to be shut off upon a rise in fuel level or upon receiving excess fuel, and that operates before the hazardous discharge of fuel can occur.
- 4.4 BURNER, AUTOMATICALLY-LIGHTED** – One where fuel to the main burner is turned on and ignited automatically.
- 4.5 BURNER, MANUALLY-LIGHTED** – One where fuel to the main burner is turned on only by hand and ignited under supervision.
- 4.6 BURNER, MECHANICAL-ATOMIZING TYPE** – A power-operated burner that prepares and delivers the oil and all or part of the air by mechanical process in controllable quantities for combustion. Some examples are air and steam atomizing, high and low pressure atomizing, horizontal rotary, vertical rotary atomizing, and vertical rotary wall-flame burners.
- 4.7 BURNER, MECHANICAL-DRAFT TYPE** – A burner that includes a power-driven fan, blower, or other mechanism as the principal means for supplying air for combustion.
- 4.8 BURNER, NATURAL-DRAFT TYPE** – A burner that depends principally upon the natural draft created in the flue to induce into the burner the air required for combustion.
- 4.9 BURNER, VAPORIZING TYPE** – A burner consisting of an oil-vaporizing bowl or other receptacle to which liquid fuel may be fed in controllable quantities; the heat of combustion being used to vaporize the fuel, with provision for admitting air and mixing it with the oil vapor in combustible proportions.
- 4.10 CENTRAL HEATING APPLIANCE** – A stationary indirect-fired vented appliance comprising the following classes: boilers, central furnaces, floor furnaces, and recessed heaters. A floor-mounted unit heater to be connected to a duct system is classified also as a central heating appliance.
- 4.11 CONSTANT-LEVEL VALVE** – A device for maintaining within a reservoir a constant level of fuel for delivery to the burner.
- 4.12 CONTROL** – A device that functions to regulate the fuel, air, water, or electrical supply to the controlled equipment. It may be automatic, semiautomatic, or manual.
- 4.13 CONTROL, LIMIT** – A safety control responsive to changes in liquid level, pressure, or temperature, normally set beyond the intended operating range of the controlled equipment to limit its operation.
- 4.14 CONTROL, OPERATING** – A control, other than a safety control or interlock, to start or regulate input according to demand, and to stop or regulate input on satisfaction of demand. Operating controls may also actuate auxiliary equipment.
- 4.15 CONTROL, SAFETY** – An automatic control, such as a relay or switch used in conjunction with other auxiliary equipment to form a safety control system that is relied upon to reduce the risk of fire, electric shock, or injury to persons.

4.16 CONTROL, PRIMARY SAFETY – An automatic control that monitors the operation of a gas-fired or an oil-fired burner. It normally consists of the following sections that may be integrated into a common unit or may be separate units, interconnected by wiring:

Programming Unit – A device that programs the burner through start-up and shut-down operations in response to signals from regulating, limiting, and monitoring devices. It also provides the timings, as required, in proper sequence, for purging, flame establishing periods, and in case of flame failure, for safety shutdown (lockout).

Combustion Detector – A device that is responsive to flame properties. It monitors the flame at the point of flame supervision and transmits a signal to the programming unit, indicating absence or presence of flame.

4.17 CONTROL, SAFETY COMBUSTION – See Control, Primary Safety - 4.16.

4.18 DRAFT REGULATOR, BAROMETRIC (Automatic Damper) – A device that functions to maintain a desired draft in the appliance by automatically reducing excess chimney draft to the desired value.

4.19 ELECTRICAL CIRCUITS –

a) **High-Voltage Circuit** – A circuit involving a potential of not more than 600 volts and having circuit characteristics in excess of those of a low-voltage circuit.

b) **Low-Voltage Circuit** – A circuit involving a potential of not more than 30 volts rms alternating current (42.4 volts peak) or direct current and supplied by:

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

2) Is limited to a maximum of 100 volt-amperes. A circuit derived from a source of supply classified as a high-voltage circuit, by connecting resistance in series with the supply circuit as a means of limiting the voltage and current, is not considered to be a low-voltage circuit.

c) **Safety-Control Circuit** – A circuit involving one or more safety controls.

4.20 FUEL OIL – Any hydrocarbon oil as defined by Specifications for Fuel Oils, ANSI/ASTM D396-1992.

4.21 IGNITION, CONTINUOUS – Ignition by an energy source that is continuously maintained throughout the time the burner is in service, whether the main burner is firing or not.

4.22 IGNITION, INTERMITTENT – Ignition by an energy source that is continuously maintained throughout the time the burner is firing.

4.23 IGNITION, INTERRUPTED – An ignition system that is energized each time the main burner is to be fired and de-energized at the end of a timed trial for ignition period or after the main flame is proven to be established.

4.24 IGNITION, MANUAL – Ignition by an energy source that is manually energized and where the fuel to the pilot is lighted automatically when the ignition system is energized.

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

4.26 PILOT FLAME-ESTABLISHING PERIOD – The length of time fuel is permitted to be delivered to a proved pilot before the flame-sensing device is required to detect pilot flame.

4.27 PILOT, EXPANDING – A pilot that burns at a low turndown throughout the entire time the burner is in service whether the main burner is firing or not. Upon a call for heat, the pilot is automatically expanded so as to ignite the main burner as intended. This pilot may be turned down at the end of the trial-for-ignition period for the main burner.

4.28 PILOT, PROVED – A pilot flame supervised by a primary safety control which senses the presence of the pilot flame prior to permitting the main burner fuel to be delivered for combustion.

4.29 POST-PURGE PERIOD – The period of time after the fuel delivered to the burner is stopped and during which the burner motor or fan continues to run to supply air to the combustion chamber.

4.30 PREPURGE PERIOD – The period of time during the burner start-up in which air is introduced into the combustion chamber and the associated flue passages in such volume and manner as to completely replace the air or fuel-air mixture contained therein prior to initiating ignition.

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

4.32 PUMP, AUTOMATIC OIL – A pump, not an integral part of a burner, that automatically pumps oil from the supply tank and delivers the oil by gravity under a constant head to an oil-burning appliance. The pump is intended to stop pumping automatically in case of total breakage of the oil supply line between the pump and the appliance.

4.33 PUMP, OIL-TRANSFER – An oil pump, automatically or manually operated, that transfers oil through continuous piping from a supply tank to an oil-burning appliance or to an auxiliary tank, and which is not intended to stop pumping automatically in case of total breakage of the oil supply line between the pump and the appliance.

4.34 SAFETY SHUTDOWN – The action of shutting off all fuel and ignition energy to the device by means of a safety control or controls such that restart cannot be accomplished without a manual reset.

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

4.36 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 element.
- d) Resetting safety control.
- e) Replacing igniter cable.

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

4.38 **STRAINER, PRIMARY** – The strainer through which all oil first passes on way to burner, being upstream from any other strainer.

4.39 **STRAINER, SECONDARY** – A strainer downstream from the primary strainer, interposed in the fuel line between the primary strainer and the point at which fuel is delivered for combustion.

4.40 **UNATTENDED** – Lacking the presence of a person, not necessarily an electrician, capable of exercising responsible control of the motor under consideration. Such a person need not be in sight of the motor at all times but must be available for opening the motor circuit in the event of motor overheating. See 40.6.

4.41 **TRIAL-FOR-IGNITION PERIOD** – That period of time the main burner fuel is permitted to be delivered into the ignition zone before the main flame-sensing device is required to detect main flame.

4.42 **VALVE, MANUAL OIL SHUT-OFF** – A manually operated valve in the oil line for the purpose of completely turning on or shutting off the oil supply to the burner.

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

a) **Metering (Regulating) Valve.** An oil control valve for regulating burner input.

b) **Safety Valve.** A normally closed valve of the "on" and "off" type, without any bypass to the burner, that is actuated by a safety control or by an emergency device.

CONSTRUCTION – MECHANICAL

5 General

5.1 Fuel-confining parts or operating parts shall not sag, distort, melt, oxidize, show leakage of fuel, or reduce the likelihood of a safety device from functioning during any of the tests specified herein.

5.2 To conform to 5.1, a material shall have a melting point, solidus temperature, of not less than 950°F (510°C) and a tensile strength not less than 10,000 pounds per square inch (psi) (69 MPa) at 400°F (204°C).

5.3 Fuel-confining parts not conforming to 5.1 and 5.2 may be employed if a fusible-link valve or the equivalent is included in the assembly of the burner so as to shut off the fuel supply in the event of excessive temperature or fire in the vicinity of such parts.

5.4 A burner part intended for the handling of fluids under pressure shall withstand, without rupture, a hydrostatic pressure equivalent to five times the maximum working pressure.

5.5 Soft solder shall not be used on any fuel-handling parts if melting of the solder may allow leakage of fuel. Soft-soldered joints, where permitted, shall be made mechanically secure before soldering.

5.6 The burner shall function so as to reduce to a minimum the generation of unburned vapors, and shall not include chambers or pockets in which unburned vapors may accumulate. An oil-conveying pipe or passage shall not be exposed to such temperatures as may result in carbonization or clogging when the burner is tested in accordance with these requirements.

6 Servicing

6.1 The requirements of 36.1 are not applicable to mechanical service functions which are not normally performed with the equipment energized.

6.2 Moving parts such as fan blades, blower wheels, pulleys, or belts which may cause injury shall be enclosed or guarded.

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

- a) The opening or removal of the door, panel or shield shall require the use of tools;
- b) An interlocking device shall shut off the mechanism; or
- c) A marking, preceded by the word "DANGER," shall be displayed which reads essentially as follows:

To Avoid Injury From Moving Parts, Shut Off The (Equipment) Before (Removing- Opening)
This (Cover-Door).

6.4 The distance from an opening in a required guard or enclosure to the moving part mentioned in 6.1 shall be in accordance with Table 6.1, but the minor dimension of the opening shall not in any case exceed 3 inches (76.2 mm). For an opening having a minor dimension intermediate between two of the values included in the table, the distance from the opening to the moving part shall be not less than that found by appropriate interpolation between the corresponding values in the right-hand column of the table. The minor dimension of the opening is determined by the largest hemispherically tipped cylindrical probe that can be inserted through the opening with a force of 5 pounds (22 N).

6.5 A moving part is not to be considered when judging compliance with 6.2 and 6.4 if the part is unlikely to be contacted through the opening because of fixed components, including baffles.

Table 6.1
Dimensions of openings

Minor dimensions of openings ^a		Minimum distance from opening to moving part	
Inches	(mm)	Inches	(mm)
1/4	6.4	1/2	12.7
3/8	9.5	1-1/2	38.1
1/2	12.7	2-1/2	63.5
3/4	19.1	4-1/2	114.0
1	25.4	6-1/2	165.0
1-1/2	38.1	10-1/2	167.0
2	50.8	14-1/2	368.0
Over 2 inches	(over 50.8)	30	762.0
^a Openings less than 1/4 inch (6.4 mm) are not to be considered.			

7 Assembly

7.1 Except as indicated in 7.2 – 7.6, a burner shall be factor-built and shipped as an unit assembly and shall include all the essential parts necessary for its intended function when installed as intended. The equipment may be shipped as two or more subassemblies.

Exception: The equipment necessary to supply atomizing burner need not be provided with the assembly if the burner is marked in accordance with 73.19.

7.2 The burner may incorporate individual assemblies which are installed remotely from the burner. Such individual assemblies shall be marked in accordance with 73.4.

7.3 A strainer needed to protect small orifices need not be provided with the burner. See 14.1.

7.4 In accordance with 7.1 the complete primary safety control shall be furnished with each burner by the burner manufacturer except that an oil burner having an input not in excess of 3 gallons per hour (gph) (11.4 liters per hour) and intended for use with separate interchangeable primary safety controls may be furnished less the control if the burner is marked to indicate the appropriate type to be used.

7.5 Parts of a safety control that are required to be burner-mounted shall be factory-attached. If the combustion detector is burner-mounted but the safety switch is not, the burner shall be marked to declare the safety switch with which it is to be used.

7.6 The burner equipment, if not assembled by the manufacturer as unit assemblies, shall be arranged in as few subassemblies as practicable. Each subassembly shall be capable of being incorporated into the final assembly without requiring alteration, cutting, threading, welding, or similar tasks by the installer. Two or more subassemblies, which must bear a definite relationship to each other for the intended operation of the equipment, shall be arranged and constructed to permit them to be incorporated into the complete assembly, without need for alteration or alignment, only in the correct relationship with each other; or such assemblies shall be assembled, tested, and shipped from the factory as part of the burner assembly.

7.7 If the abnormal discharge of oil is restricted by the establishment and maintenance of a definite maximum level of oil in the burner, the parts required to maintain that oil level shall be assembled and fixed upon a common base in the correct relationship with one another by the burner manufacturer. The minimum distance between the designed maximum normal oil level in the burner and the level of the lowest point at which overflow may occur shall be not less than 3/4 inch (19.1 mm).

7.8 The burner shall provide a uniform and definite supply of fuel and air for combustion when installed and adjusted in accordance with the manufacturer's installation instructions. The means for regulating the supply of air and oil shall be arranged so that the adjustments may be fixed or restricted in a manner to prevent accidental changes in settings.

7.9 All parts requiring adjustment or manipulation by the user in the course of operation of the burner shall be accessible and easily moved. Any part that may normally come in contact with the operator's hand during usage shall be free from sharp edges or projections and projecting sharp screw ends.

7.10 Accessibility shall be afforded to all burner parts, controls, and safety devices requiring servicing. The disposition of parts in the assembly removed for servicing shall be such that their restoration, following removal, will not necessitate their realignment to secure their intended relationship with other parts of the assembly. Special facilities that may be required for servicing to be performed by the operator shall accompany the burner to the user.

7.11 A firing assembly, atomizer and nozzle assemblies, and the like, intended to be removed and replaced for servicing shall be constructed so that, upon replacement, the assembly will self-restore the atomizer or nozzle to its correct position.

7.12 The burner and/or subassemblies shall incorporate provisions for support, adjustment, and attaching to the heating plant or to the foundation on which it rests in order that installation can be so made as to prevent its twisting, sliding, or dropping out of the intended position.

7.13 A burner intended to be installed with a special combustion chamber or hearth shall be constructed and arranged to facilitate its installation. Where necessary, such a burner shall be provided with means to support the combustion chamber or hearth in its intended position.

Table 7.1
Torque requirements for screws or bolts

American standard screw size		Torque		I.S.O. screw size	Torque	
No.	mm	Lb-In	N•m	mm	N•m	Lb-In
—	—	—	—	4	1.6	14
8	4.2	18	2.0	4.5	2.6	23
10	4.8	30	3.4	5	4.2	37
Inch	mm					
1/4	6.4	100	11.3	6	8.7	77
—	—	—	—	7	15.0	133
5/16	7.9	200	22.6	8	23.5	208
—	—	—	—	9	33.6	297
3/8	9.5	350	39.6	10	45.2	400
7/16	11.1	575	65.0	12	81.0	715
1/2	12.7	850	96.0	14	128.0	1130
9/16	14.3	1200	136.0	—	—	—
5/8	15.9	1600	181.0	16	185.0	1640

7.14 A burner of the "swing-type" shall be provided with means for locking the burner in the firing position and, for an automatically-lighted burner, to restrain it from discharging fuel when in other than the firing position.

7.15 An adjusted or movable part shall be provided with a locking device to restrict accidental shifting.

7.16 Screws or bolts used to attach parts which are detached for servicing of the burner shall be capable of holding upon the application of the torques indicated in Table 7.1 after removal and replacement.

8 Bases

8.1 The base or frame on which burner parts are mounted shall consist of noncombustible material.

8.2 Each base or frame shall incorporate provisions for installing the assembly, and shall include securing and adjusting means for leveling and alignment where such are necessary.

9 Fan Housings and Air Tubes

9.1 A fan housing and an air duct shall be made of noncombustible material having the strength and durability to not be damaged during test under these requirements.

9.2 A housing in which oil leaking from any oil-handling part of the assembly may accumulate shall be provided with an open drain, that is, an inverted fan housing on a gun-type burner.

9.3 An air tube of a gun-type oil burner shall prevent the accumulation of oil within it. Any drippage from the nozzle shall drain to the fire box. A drain shall be located to avoid blockage by refractory or cement.

9.4 The exterior portion of a firing head within 6 inches (152 mm) measured parallel to its axis, from the firing end and all parts which may be in contact with masonry when the burner is installed as intended, shall be made of iron or steel. Interior parts shall be made of materials conforming with 5.1 – 5.5.

9.5 An outer shell of a blast tube or firing head, if made of sheet metal, shall be such as to assure strength, rigidity, durability, resistance to corrosion, and other physical properties equivalent to sheet steel having a thickness of not less than 0.053 inch (1.35 mm) or Type 309 stainless steel having a thickness of not less than 0.026 inch (0.66 mm).

10 Fire Pots and Vaporizers

10.1 A fire pot or vaporizer shall be constructed of ferrous materials and shall reduce the likelihood of splashing or seepage of fuel from it during tests under these requirements.

10.2 If sheet metal is used in the construction of a fire pot or vaporizer, the metal shall be such as to provide strength, rigidity, durability, resistance to corrosion, and other physical properties equivalent to sheet steel having a thickness of not less than 0.042 inch (1.07 mm) for oil-retaining parts and having a thickness of not less than 0.032 inch (0.81 mm) for other parts. Drawn parts shall be made of steel possessing drawing qualities.

10.3 A vaporizing burner shall be constructed so that, when installed, the oil-inlet piping to the fire pot or vaporizers may be cleaned.

10.4 An air duct shall be so arranged with respect to a fire pot or vaporizer as to reduce the risk of the discharge of liquid fuel through it when the oil in the fire pot is at the maximum level permitted by the oil control.

11 Combustion Air Controls

11.1 An air shutter shall be capable of being adjusted to any intended setting and be provided with means for reducing the risk of unintentional change in setting.

11.2 The air inlet arrangement shall be capable of supplying sufficient air for complete combustion under the specified draft condition and at the maximum rate of firing when the burner is installed as intended. All the air required for complete combustion shall be introduced in a manner so as to maintain thorough mixing of the fuel and air in order to complete the combustion within the combustion zone.

11.3 An air shutter shall provide a smooth surface between the shutter and the matching face.

11.4 Sheet metal air shutters shall be of a thickness not less than 0.0254 inch (0.65 mm). If sheet metal air shutters are of a thickness less than 0.0508 inch (1.29 mm), they shall have the outer edge turned at right angles or be reinforced in an equivalent manner.

11.5 An air shutter shall by its construction or assembly and selection of materials be guarded against sticking or corroding in position. Screws or bolts used for attaching or adjustment shall be of corrosion-resistant material.

11.6 An adjustable part shall be guided to restrain its movement from its intended path during adjustment, and the means for adjusting the part shall be accessible for servicing.

11.7 A burner arranged to change the firing rate automatically shall automatically proportion the air supply with the fuel, if necessary to produce stable combustion at all firing rates allowed by the automatic control.

11.8 Linkage for operating air and fuel controls shall maintain the intended fuel-air ratio and shall resist unintentional damage and disengagement.

11.9 A burner having an input in excess of 20 gph (76 L/h) shall be provided with an interlock which shuts off the burner and causes safety shutdown upon loss of combustion air, so that a manual reset is required to restore the burner operation when the combustion air is reestablished. See 11.12.

11.10 For a burner having an input not in excess of 20 gph (76 L/h) for which combustion air is supplied by a forced or induced draft fan which is not integral with the burner motor shaft, the loss of combustion air shall result in shutting off the fuel. The burner operation may be resumed automatically when the combustion air is reestablished.

11.11 For requirements for mechanical draft burners not equipped with a combustion air interlock in regard to operation during the interruption and restoration of the combustion air supply see Section 51, Combustion Air Failure Test.

11.12 With respect to 11.9, loss of air during prepurge or any time at start-up prior to delivery of fuel, need not result in safety shutdown. However, no delivery of fuel shall be initiated before the combustion air flow has been reestablished and the required prepurge has been completed. See 12.1.

11.13 A burner having an input rating in excess of 20 gph (75.7 L/h) shall employ a low oil pressure interlock switch that shall cause safety shutdown when the oil pressure falls below the predetermined limit.

Exception No. 1: A low pressure interlock is not required for rotary cup type burners.

Exception No. 2: A low pressure interlock switch is not required if the oil pump is secured directly on the burner motor shaft.

11.14 A burner having an input rating in excess of 3 gph (11.4 L/h) shall be provided with a low pressure interlock switch for the atomizing media that shall cause safety shutdown when the pressure falls below the predetermined limit.

Exception: A low pressure interlock switch is not required provided the air pump is secured directly on the burner motor shaft and the input does not exceed 20 gph (75.7 L/h).

11.15 High and low temperature interlocks shall be provided for systems that fire preheated oil. An oil temperature in excess of the limit established by the burner manufacturer shall result in safety shutdown. If the oil temperature falls below the predetermined low limit, the interlock shall operate to stop fuel delivery to the burner and allow circulation of the oil until the temperature increases to permit firing.

12 Prepurge and Post-Purge

12.1 The following types of mechanical draft burners shall include a prepurge period in accordance with 12.2 and 12.3 before the ignition and fuel deliver are initiated:

- a) A burner having an input in excess of 20 gph (76 L/h).
- b) A burner having an input in excess of 7 gph (26.5 L/h) when the oil pump operates independently of the burner.

12.2 The prepurge shall be performed in accordance with one of the following. During the prepurge the air flow and the damper position shall be proven. See also 12.3.

- a) A period of 30 seconds during which time the air flow is at a rate equivalent to that provided for combustion at the maximum rated high-fire input.
- b) A period of 60 seconds during which time the air flow is at a rate at least equivalent to that provided for combustion at 60 percent of the maximum rated high-fire input.

12.3 A prepurge of a shorter time than specified in 12.2 is acceptable for a burner that is designated by a marking on the burner for use only on a specific appliance and it is determined that the shorter time provides at least four complete air changes for the combustion chamber, heat exchanger and the flue passages of the appliance. However, the purging shall be accomplished with the air flow at a rate not less than equivalent to that provided for combustion at 60 percent of the maximum rated high-fire input. During the purge the air flow and the damper position shall be proven.

12.4 A mechanical draft burner having an input in excess of 20 gph (7.6 L/h) shall provide a post-pruge period of not less than 15 seconds.

13 Draft Regulators

13.1 Regulation of draft within an oil-fired appliance over the ranges specified in Combustion Tests, Section 50, shall be anticipated in the construction of an oil burner.

14 Strainers

14.1 A small orifice or other opening in an oil-supply system shall be protected by a strainer in accordance with the requirements of 14.2 – 14.12. The strainer need not be provided with the burner if the marking on the burner or the installation instructions furnished with burner specify that a strainer suitable for the maximum fuel input and grade of oil marked on the burner shall be provided by the installer.

14.2 The largest opening of the strainer element shall be of such size that its larger dimension will not be greater than 90 percent of the smaller dimension of the smallest fixed opening protected by the screen.

14.3 For the purpose of these requirements, a metering valve, a float valve, and an automatic safety valve shall be considered as a fixed opening, having a diameter of 0.03125 (1/32) inch (0.79 mm) when Nos. 1 and 2 oils are used, and 0.0625 (1/16) inch (1.59 mm) when Nos. 4, 5, and 6 oils are used.

14.4 A primary strainer shall be based on the maximum firing rate of the burner and the heaviest grade of fuel for which the burner is intended.

14.5 The effective area of a screen (total area of screen openings), shall not be less than as indicated in Figures 14.1 – 14.3. A strainer shall be applied so that there will be no air trapped therein to affect rate of fuel flow to the burner or reduce the effective area of the straining element.

14.6 The effective area of a screen is not required to be greater than the maximum value shown in Figures 14.1 – 14.3, regardless of the burner firing rate, but in any case the strainer is not to impair the flow of fuel supplied to fire the burner at maximum rated input.

14.7 A strainer employing an element other than a screen shall have a rated capacity not less than the maximum firing rate of the burner to which it is applied.

14.8 When two strainers installed in series are provided instead of a single primary strainer, each shall be of approximately equivalent size, and the screen area or rated capacity of each shall be 1.4 times that required for a single strainer. The strainer downstream from the other shall be equipped with a screen or element in which the size of the individual straining opening is not larger than 90 percent of the size of the straining opening in the element of the other strainer.

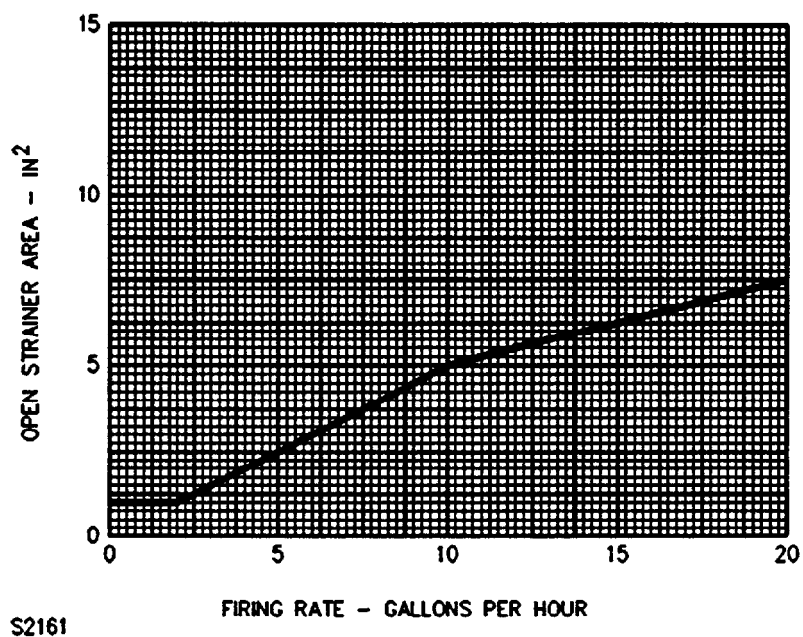
14.9 A secondary strainer, one supplementary to the main strainer, smaller in area than required in 14.5 may be used in the fuel line, downstream from the primary strainer.

14.10 A strainer shall be applied to permit the removal and replacement of the straining element. The force necessary to open a strainer shall not permanently distort the lines or assembly to which it is attached.

14.11 A strainer required for the protection of an automatic safety valve or a float valve shall be furnished as part of the assembly incorporating such a valve.

14.12 Pipe or other fuel conduit used to connect a float valve, metering valve, or safety valve to the protecting strainer shall be free of dirt and scale at the time of assembly.

Figure 14.1
Strainer area for* No. 1 Fuel oil



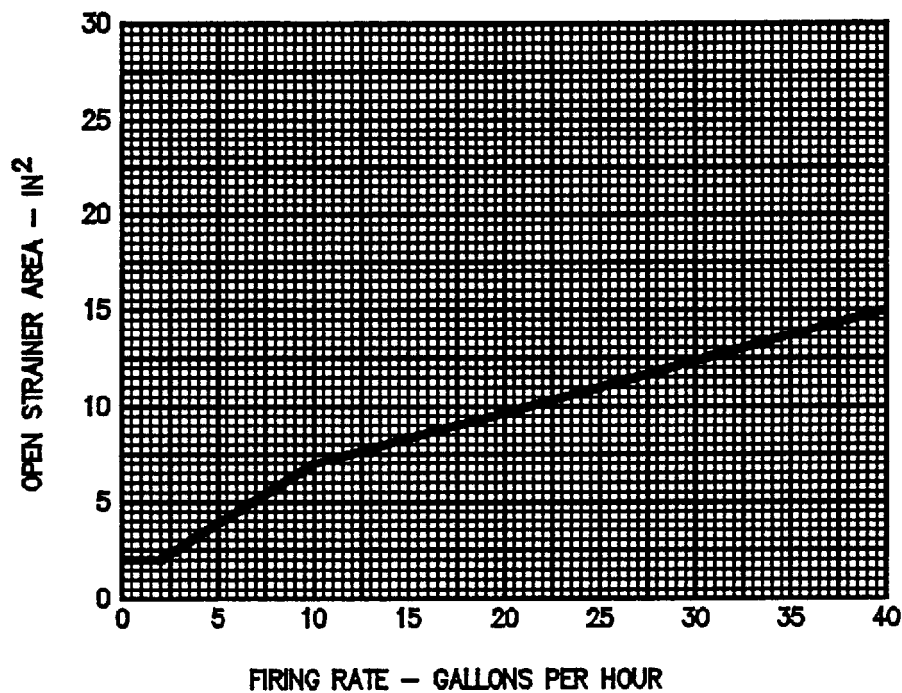
No. 1 Oil
Gallons Per Hour Firing Rate

*As designated by Specifications for Fuel Oils, ANSI/ASTM D396-1992

NOTES

1. 1 square inch = 6.45 cm²
2. 1 gallon = 3.79 L

Figure 14.2
Strainer area for * No. 2 Fuel oil



S2162

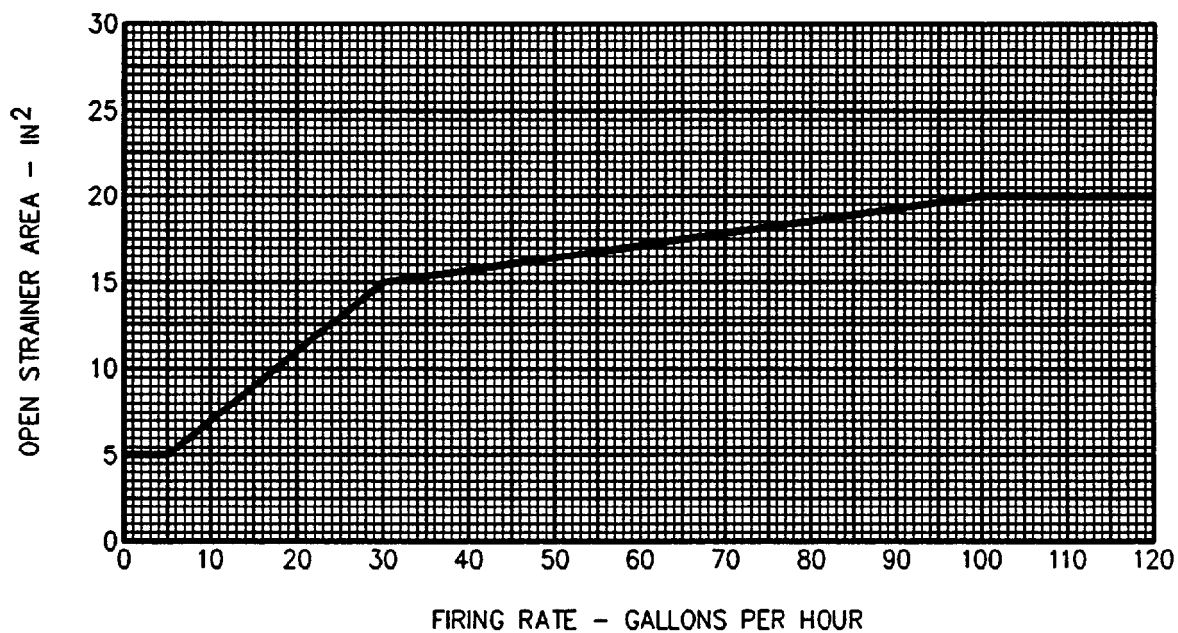
No. 2 Oil
Gallons Per Hour Firing Rate

*As designated by Specifications for Fuel Oils, ANSI/ASTM D396-1992

NOTES

1. 1 square inch = 6.45 cm²
2. 1 gallon = 3.79 L

Figure 14.3
Strainer area for* Nos. 4, 5, 6 Fuel oil



S2163

Nos. 4, 5, 6 Oil Gallons Per Hour Firing Rate

*As designated by Specifications for Fuel Oils, ANSI/ASTM D396-1992

NOTES

1. 1 square inch = 6.45 cm²
2. 1 gallon = 3.79 L

15 Constant-Level Devices

15.1 A constant-level valve included in the burner assembly shall be mounted and secured in place independently of the fuel piping and shall incorporate an antiflooding device.

15.2 A burner that requires the fuel oil to be supplied to it by gravity, and which is intended for installation with a constant-level device to be provided and installed in the oil supply line at the storage tank or with an automatic pump to maintain a uniform flow of fuel, may be furnished less such pump or device.

16 Floats

16.1 A float in a fuel-oil control or safety device shall conform to the requirements of 16.2 – 16.4.

16.2 The submerged part of a float in a float-actuated mechanism shall provide a buoyancy equivalent to 150 percent of that required to operate the mechanism with which it is related.

16.3 A float in fuel oil is to resist damage because of contact with the fuel and any impurities that may be contained therein, such as sulphur compounds and water. A metal, if used, is to have corrosion resistance equivalent to brass.

16.4 A float arranged to reduce the risk of the discharge of oil at the burner shall be used only when an acceptable auxiliary means is provided to guard against float or float valve failure, such as an automatic shutoff device.

17 Fittings, and Piping and Tubing

17.1 An opening threaded for pipe connection shall be threaded in accordance with the Standard for General Purpose (Inch) Pipe Threads (Except Dryseal), ANSI/ASME B1.20.1-1983(R1992).

17.2 An opening for field attachment to pipe larger than nominal 3 inch ANSI/ASME B1.20.1 pipe size shall be provided with a flanged pipe connection conforming to the Standard for Cast Iron Pipe Flanges and Flanged Fittings, ANSI B16.1-1975.

17.3 A fitting, other than one conforming with the appropriate American National Standard, having openings threaded for pipe connections, shall be capable of withstanding, without damage or leakage, the turning effort (torque), see Table 17.1, exerted as if to screw the fitting onto a pipe or into a pipe fitting.

Table 17.1
Torque requirements for pipe connections

Pipe Size ANSI/ASME B36.10M	Outside diameter		Torque	
	Inch	(mm)	Pound-Inches	N•m
1/8	0.405	10.3	150	17
1/4	0.540	13.7	250	28
3/8	0.675	17.1	450	51
1/2	0.840	21.3	800	90
3/4	1.050	26.7	1000	113
1	1.315	33.4	1200	137
1-1/4	1.660	42.2	1450	164
1-1/2	1.900	48.3	1550	175
2	2.375	60.3	1650	186
2-1/2	2.875	73.0	1750	198
3	3.500	88.9	1800	203
4	4.500	114.3	1900	215

17.4 A tool which fits snugly about the fitting, or to a section of the shank shaped for a wrench, if such section is provided, is to be utilized to apply the turning force. The turning force is to be applied to the hex of the fitting adjacent to where it is attached to piping or, if no hex is provided in this position, to the body of the fitting. The measured torque specified in Table 17.1 is to be applied to the fitting to screw it onto an extra-heavy pipe or into a pipe fitting of appropriate size. After the force has been applied, the fitting is not to leak when subjected to a hydrostatic pressure equivalent to one and one-half times the maximum working pressure.

17.5 Pipe and pipe fittings shall be wrought iron or steel, or iron-pipe-size brass or copper conforming with the appropriate American National Standard. Unions, where used, shall be the ground-joint type or the equivalent.

17.6 Tubing shall be arranged to reduce the risk of being physically damaged, such as by following the contour of the burner assembly.

17.7 Seamless drawn aluminum or copper tubing and steel tubing of the seamless, brazed, or welded type employed in the fabrication of factory-assembled equipment shall have a wall thickness of not less than that specified in Table 17.2.

Table 17.2
Wall thickness for aluminum, copper, and steel tubing

Outside Inches	Diameter, (mm)	Minimum wall thickness, inches ^a (mm)			
		Aluminum and copper		Steel	
1/8	(3.2)	0.029	(0.74)	0.028	(0.71)
3/16	(4.8)	0.029	(0.74)	0.028	(0.71)
1/4	(6.3)	0.029	(0.74)	0.028	(0.71)
5/16	(7.9)	0.029	(0.74)	0.028	(0.71)
3/8	(9.5)	0.032	(0.81)	0.028	(0.71)
7/16	(11.1)	0.032	(0.81)	0.028	(0.71)
1/2	(12.7)	0.035	(0.89)	0.028	(0.71)
9/16	(14.2)	0.038	(0.96)	—	—
5/8	(15.9)	0.038	(0.96)	0.035	(0.89)
3/4	(19.1)	0.045	(1.14)	0.035	(0.89)
7/8	(22.2)	0.045	(1.14)	0.049	(1.24)
1	(25.4)	0.049	(1.24)	0.049	(1.24)
1-1/8	(28.6)	0.049	(1.24)	0.049	(1.24)
1-1/4	(31.7)	0.055	(1.40)	0.049	(1.24)
1-3/8	(34.9)	0.055	(1.40)	—	—
1-1/2	(38.1)	—	—	0.065	(1.65)

^a Nominal wall thickness of tubing will have to be greater than the thickness indicated to maintain the minimum wall thickness.

17.8 Aluminum tubing shall not be exposed to condensate or to temperatures in excess of 700°F (371°C) and shall not be acceptable for use where it passes through insulating material of other than neutral reaction unless the tubing is protected from the insulation.

17.9 Steel tubing having a wall thickness of 0.053 inch (1.35 mm) or less shall be constructed of corrosion-resistant material such as stainless steel or shall be plated, dipped, coated, or otherwise treated to resist external corrosion.

17.10 Cadmium plating shall have a thickness of not less than 0.0003 inch (0.008 mm), and zinc plating shall have a thickness of not less than 0.0005 inch (0.013 mm), except on parts where threads constitute the major portion of the area, in which case the thickness of the cadmium or zinc plating shall be not less than 0.00015 inch (0.0038 mm).

17.11 Flexible-metallic hose shall not be used as a substitute for rigid piping or tubing as ordinarily employed. Its use shall be confined to applications where rigid piping or tubing is impractical and where flexible connections cannot be avoided. It shall not be subjected to torsional, tensile, or bending stresses or to abrasion. It shall not be used in conjunction with safety devices or where bending is caused by automatic operation.

17.12 A fuel line shall terminate in a manner that will permit connection to the burner. A fuel-line opening shall be plugged or capped to restrict the entrance of foreign material prior to installation.

17.13 A coupling or union which is disconnected for service shall be located so that any oil dripping from the connection will not drip or run onto electrical parts.

18 Valves

18.1 The pressure rating of a valve shall be not less than the maximum operating pressure of the burner.

18.2 An oil burner having an input in excess of 3 gph (11.4 L/h) shall be provided with two oil safety shut-off valves or one safety shut-off valve and a nozzle cut-off valve. The closing times of the shut-off valves shall not exceed the timings as follows:

- a) For inputs above 3 gph (11.4 L/h) but not exceeding 20 gph (75.7 L/h) – 5 seconds maximum.
- b) For inputs exceeding 20 gph (75.7 L/h) – 1 second maximum.

18.3 An automatic safety valve shall be constructed so that it may not be restrained or blocked in the open position.

18.4 A safety valve shall close upon being de-energized, regardless of the position of an operating lever or reset handle.

18.5 An electrically-operated safety valve shall not depend on electricity to shut off the oil flow.

18.6 A safety valve responding to pressure variations in a hydraulic or pneumatic remote control system shall close upon failure of pressure in the control system.

18.7 A manually-operated fuel-metering valve shall be provided with a means that may be set by the installer or manufacturer to restrict the maximum amount of fuel delivered to the burner to an amount which can be consumed as intended, or the means for adjustment shall be enclosed or shielded to discourage tampering after adjustment has been made by the installer. This does not apply to a burner intended only for commercial or industrial installations not open to the public.

18.8 A plug or rotating-disc type valve, employing the bearing surface of the plug or disc as the liquid seal to the exterior of the valve body, shall not be used in a fuel oil line.

18.9 A petcock or valve which, when open, will permit the discharge of fuel oil into the room shall not be used.