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**Underwriters Laboratories Inc.®**

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and committed to quality service

**May 30, 1996**

**Revision pages for**

**Standard for**

**Pumps for Oil-Burning Appliances**

**UL 343, Seventh Edition**

Attached to this distribution notice is a revision of the seventh edition of UL 343.

A CHANGE ON A PAGE DATED MAY 30, 1996 IS INDICATED BY A SMALL PRINT NOTE FOLLOWING THE AFFECTED ITEM, PRECEDED AND FOLLOWED BY AN ASTERISK.

THESE NEW AND REVISED REQUIREMENTS IN THIS STANDARD ARE NOW IN EFFECT EXCEPT FOR THOSE PARAGRAPHS, SECTIONS, TABLES, FIGURES, AND OTHER ELEMENTS OF THE STANDARD HAVING FUTURE EFFECTIVE DATES AS INDICATED IN THE NOTE FOLLOWING THE AFFECTED ITEM. TO RETAIN THE REQUIREMENTS IN EFFECT UNTIL THESE FUTURE EFFECTIVE DATES, DO NOT DISCARD THE PAGES REPLACED BY THOSE HAVING FUTURE EFFECTIVE DATES UNTIL THOSE DATES.

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, Recognition, and Follow-Up Services after the effective date and understanding of this should be signified in writing.

The new and revised requirements are substantially in accordance with UL's Bulletins on this subject dated January 5, 1996 and February 12, 1996. These bulletins are now obsolete and may be discarded.

As indicated on the title page (page 1), this UL Standard for Safety is an American National Standard. Attention is directed to the note on the title page of this Standard outlining the procedures to be followed to retain the text of this ANSI/UL Standard.

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:

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

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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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## INTRODUCTION

### 1 Scope

1.1 These requirements cover pumps that are intended to be used as part of oil-burning appliances or installed in fuel-oil piping systems serving such equipment. Oil-burning appliance pumps may be either automatic or power-operated.

1.2 Requirements for the installation and use of oil-burning appliance pumps are included in the Standard for the Installation of Oil-Burning Equipment, NFPA 31.

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 shall be proposed and adopted in conformance with the methods employed for development, revision, and implementation of this standard.

\*1.3 revised May 30, 1996\*

## 2 General

### 2.1 Components

2.1.1 Except as indicated in 2.1.2, a component of a product covered by this standard shall comply with the requirements for that component. See Appendix A for a list of standards covering components generally used in the products covered by this standard.

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

- a) Involves a feature or characteristic not needed in the application of the component in the product covered by this standard or
- b) Is superseded by a requirement in this standard.

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

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

### 2.2 Units of measurement

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

### 2.3 Undated references

2.3.1 Any undated reference to a code or standard appearing in the requirements of this standard shall be interpreted as referring to the latest edition of that code or standard.

### 3 Glossary

- 3.1 For the purpose of this standard, the following definitions apply.
- 3.2 **AUTOMATIC PUMPS** – Assemblies that automatically pump oil from the supply tank and deliver this oil by gravity under a constant head to an oil-burning appliance and that have automatic means to prevent the abnormal discharge of oil. These pumps are intended for installation at least 1 foot (305 mm) above the top of the supply tank and are arranged to stop pumping automatically in case of total breakage of the oil-supply line between the pump and the appliance.
- 3.3 **DIFFERENTIAL PRESSURE** – The difference in pressure, measured at the discharge port, between the value obtained with the pump operating and after shutdown.
- 3.4 **NORMAL OPERATING PRESSURE** – The pressure at which the pump is normally operated on the appliance.
- 3.5 **POWER-OPERATED PUMPS** – Pumps for use in the assembly of power-operated oil burners or for use as oil-transfer pumps.
- 3.6 **RATED PRESSURE** – The minimum and maximum operating pressures recommended by the manufacturer of the pump.
- 3.7 **REGULATED PRESSURE** – The minimum and maximum operating pressures obtainable by adjustment of the pressure-regulating valve.

### CONSTRUCTION

#### 4 Assembly

- 4.1 An automatic pump shall include all the components necessary for its intended function.
- 4.2 The construction of a pump shall be such that parts can be reassembled after being dismantled to the extent needed for servicing.
- 4.3 Means shall be provided for the purpose of making any necessary field adjustment.
- 4.4 Screws or bolts used to attach a part that is detached for servicing of the pump shall be capable of holding the part upon the application of the torques specified in Table 4.1 after removal and replacement.

**Table 4.1**  
**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   |

4.5 The pump shall incorporate a provision for support that is independent of piping, tubing, or conduit that may be connected to the pump.

4.6 A brazing material used for joining liquid-confining parts of a pump shall have a melting point (solidus temperature) not less than 538°C (1000°F).

## 5 Materials

5.1 Liquid-confining and operating parts of a pump, other than an automatic pump, shall be made of material having a melting point (solidus temperature) of not less than 510°C (950°F) and a tensile strength not less than 10,000 psi (68.9 MPa) at 204°C (400°F).

5.2 A part in contact with the liquid to be handled by a pump shall be resistant to the action of the liquid.

5.3 A synthetic rubber part shall not show excessive volume change when considered on the basis of its intended function, following immersion for 70 hours at a temperature of 23 ±2°C (73.4 ±3.6°F) in No. 3 Swelling Oil. The change in volume is to be determined in accordance with the Standard Test Method for Rubber Property-Effect of Liquids, ASTM D471-79(1991).

5.4 A change in volume of not more than 25 percent swelling or 1 percent shrinkage is considered to comply with the requirement in 5.3.

5.5 A part made of synthetic rubber that may be affected by aging shall not crack or show visible evidence of deterioration following exposure for 96 hours to oxygen at a pressure of 300 psig (2070 kPa), and at a temperature of 70°C (158°F).

5.6 Other parts shall be resistant to atmospheric corrosion and attack by the liquid they may contact in service if corrosion of such parts may result in external leakage. A ferrous material of the thickness specified in Table 5.1 is considered adequate for the preceding when uncoated and when intended for use with the designated liquid.

**Table 5.1**  
**Thickness of uncoated ferrous materials**

| Liquid in contact with material | Minimum thickness |      |           |     |
|---------------------------------|-------------------|------|-----------|-----|
|                                 | Sheet metal,      |      | Castings, |     |
|                                 | inch              | mm   | inch      | mm  |
| Fuel oils and kerosene          | 0.042             | 1.07 | 1/8       | 3.2 |

5.7 If atmospheric corrosion of a ferrous part will interfere with the intended function of a pump, the part shall be of a corrosion-resistant material or be provided with a corrosion-resistant protective coating.

5.8 A protective coating shall provide resistance against corrosion to a degree not less than that afforded sheet steel by the application of a uniform coating of zinc on each surface to an average thickness of not less than 0.0002 inch (0.005 mm) with a minimum thickness at any location of 0.00015 inch (0.0038 mm).

5.9 A part made of drawn brass or machined from brass rod stock shall withstand, without cracking, the 10-Day Moist Ammonia-Air Stress Cracking Test, Section 31A.

\*5.9 revised May 30, 1996\*

5.10 A gasket used in the assembly of a pump to seal flanged joints shall be impervious to fuel oil. For flat flanges, a plant-fiber gasket shall not be more than 1/32 inch (0.8 mm) thick.

## 6 Strength Of Parts

6.1 Parts of a pump, except mechanical shaft seals and vented tanks, that are subjected to pressure during usage shall be constructed to withstand, without bursting, a hydrostatic pressure equivalent to five times the maximum pressure to which they may be subjected. See Hydrostatic-Pressure Strength – Test No. 9, Section 30.

## 7 Bodies, Covers, And Heads

7.1 An opening threaded for pipe connections shall be threaded in accordance with the Standard for General Purpose Pipe Threads ANSI/ASME B1.20.1-1983.

7.2 Webs, shoulders, and other obstructions shall be removed from the inner ends of internally threaded openings in a body to permit making tight joints.

7.3 An inlet and an outlet connection threaded for attachment to pipe shall be constructed so that when a pipe that is threaded two threads beyond standard size is run into the threaded portion of the opening, it will not distort any portion of the body or adversely affect the operation of the pump.

7.4 A male thread for attachment to a pipe fitting shall have no shoulder within the distance specified in Table 7.1 from the beginning of the thread, including any chamfer, nor shall any shoulder prevent an additional turn being made within this distance as determined by assembling the pump into a fitting within a tolerance of plus or minus one thread.

### 13 Strainers

13.1 A small orifice or other opening in an automatic fuel-oil pump shall be protected by a strainer.

13.2 A strainer shall be constructed to permit the removal and replacement of the straining element without disturbing any part of the pump assembly. The force necessary to open a strainer shall not permanently distort the assembly.

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

13.4 Pipe or other fuel conduit used to connect a float valve, safety valve, or safety device to the protecting strainer shall be free of dirt and scale.

### 14 Floats

14.1 A float intended to actuate a mechanism shall have a buoyancy not less than 50 percent greater than that required to operate the mechanism.

14.2 A float in fuel oil shall resist damage from contact with the fuel and any impurities that may be contained therein, such as sulfur compounds and water. A metal, if used, is to have corrosion resistance equivalent to that of brass. A nonmetallic float shall be of material resistant to aging or loss of buoyancy equivalent to that afforded by natural cork.

### 15 Control Application

15.1 An automatic pump shall incorporate a control or equivalent provision to maintain the fuel supply at a safe level.

15.2 Supplementary provision to the level control shall be made to prevent the accumulation of excessively high oil levels. Such provision shall consist of an overflow connection or equivalent separate means of the manually reset type. An overflow connection shall not be provided for an assembly that is intended to be vented into an adjoining space unless the vent area is restricted to that required for pump operation or fuel supply. An overflow connection for draining to the supply tank shall not be less than one pipe size larger than the supply-line connection to the pump.

15.3 An automatic pump shall be arranged to prevent the continuous discharge of fuel oil because of breakage of the pump discharge line.

### 16 Piping And Fittings

16.1 Standard full-weight wrought-iron or steel, or iron-pipe-size brass pipe with malleable-iron, steel, or brass fittings shall be used.

16.2 Pipe threads shall be in accordance with the Standard for General Purpose Pipe Threads, ANSI/ASME B1.20.1-1983.

16.3 Unions shall be of the metal-to-metal seat type.

## ELECTRICAL EQUIPMENT

### 17 General

17.1 Electrical equipment and wiring shall be arranged so that flammable liquids or water will not drip or run on them during intended use, or from a connection required to be uncoupled for servicing the pump.

17.2 A pump shall be constructed so that the enclosure, frame, and similar noncurrent-carrying parts of all high-voltage electrical equipment are bonded to the means provided for connecting the metal-clad cable or conduit of the supply circuit. An insulated conductor intended solely for grounding purposes shall be identified by a continuous green color with or without one or more yellow stripes.

17.3 Attachment plugs or separable connectors shall not be used in circuits if the breaking or making of the circuit by such devices may allow unintended operation of the pump.

17.4 Electrical circuits of each assembly to which connections are to be made in the field shall terminate in a box or enclosure in which connections to the circuit can be made. The box or enclosure shall permit the connection of metal-clad cable or conduit.

17.5 A box or enclosure included as part of the assembly and in which a branch circuit supplying power to the pump is to be connected shall not require that it be moved for care or servicing of the unit.

17.6 A box or enclosure in which field-installed conductors are to be connected shall be located so that the temperature of conductors within the box or surfaces of the box that will be in contact with the conductors will not exceed that specified for Type TW wire when the pump is tested in accordance with these requirements.

\*17.6 revised May 30, 1996\*

17.7 The size of a junction box in which field-installed conductors are to be connected by splicing shall not be less than that specified in Table 17.1. When the junction box is the terminal housing for the motor, the size of the compartment shall also comply with the requirements in the Standard for Electric Motors, UL 1004. A conductor passing through the box is counted as one conductor, and each conductor terminating in the box is also counted as one conductor. A field-furnished conductor for high-voltage circuits is determined to be not smaller than No. 14 AWG (2.1 mm<sup>2</sup>).

\*17.7 revised May 30, 1996\*

**Table 17.1**  
**Minimum size of junction boxes**

| Size of conductors, |                 | Free space within box for each conductor, |                 |
|---------------------|-----------------|-------------------------------------------|-----------------|
| AWG                 | mm <sup>2</sup> | cubic inches                              | cm <sup>3</sup> |
| 18                  | 0.8             | 1.5                                       | 24.6            |
| 16                  | 1.3             | 1.75                                      | 28.7            |
| 14                  | 2.1             | 2.0                                       | 32.8            |
| 12                  | 3.3             | 2.25                                      | 36.9            |
| 10                  | 5.3             | 2.5                                       | 41.0            |
| 8                   | 8.4             | 3.0                                       | 49.2            |

\*Table 17.1 revised May 30, 1996\*

17.8 Conductors intended for connection to a grounded neutral line shall be identified; that is, finished a white or natural gray color. Other conductors shall be finished in colors other than white or natural gray. A terminal for connection of a grounded conductor shall be identified by a metallic plated coating that is white in color and shall be distinguishable from other terminals or it shall be identified in some other manner, such as on an attached wiring diagram.

## 20 Wiring Methods

20.1 The wiring of high-voltage and safety-control circuits shall comply with the requirements in this section.

20.2 Insulated conductors having the necessary current capacity for the service shall be used. A conductor shall not be smaller than No. 18 AWG (0.82 mm<sup>2</sup>).

20.3 Electrical wiring to a part that must be moved for intended servicing shall be arranged so that the part may be moved without breaking soldered connections or disconnecting conduit. Conductors to be disconnected from terminals of such part shall terminate in eyelets or connectors. If the wiring to a part that also functions as an access plate or cover is not readily detachable, the assembly shall include provision for support of that part by means other than the wiring when the part is moved for servicing. Any allowable movement of such part shall not unduly twist, bend, or pull the wiring.

20.4 Conductors shall be enclosed within conduit, electrical metallic tubing, metal raceways or electrical enclosures, or metal-clad cable.

20.5 A splice in wiring shall be located only in an accessible junction box. A splice shall be made mechanically secure, soldered, and insulated with tape; or a fixture-type splicing connector may be employed.

20.6 At all points where conduit or metal-clad cable terminates, the conductor shall be protected from abrasion. If metal-clad cable is used, an insulating bushing or its equivalent shall be provided between the conductors and the cable tubing, and the connector or clamp shall be constructed so that the insulating bushing or its equivalent will be visible for inspection.

20.7 Unless supplied with insulation rated for the highest voltage involved, factory-wired insulated conductors of circuits of one voltage shall be separated by barriers or shall be segregated from conductors of circuits of another voltage; and shall be separated or segregated from uninsulated current-carrying parts connected to circuits of another voltage.

20.8 Segregation of insulated conductors may be accomplished by clamping, routing, or equivalent means that will maintain permanent separation in accordance with 20.7.

20.9 A hole in a metal wall through which insulated wires pass shall be provided with smooth, rounded bushings or shall have smooth, rounded surfaces to prevent abrasion of the insulation. A bushing shall be phenolic, porcelain, or hard fiber.

20.10 Field-installed conductors of a high-voltage circuit shall be segregated or separated by barriers from field-installation and factory-installed conductors connected to a circuit of another voltage, unless the conductors of both circuits are or will be insulated for the maximum voltage of either circuit.

20.11 Field-installed conductors of a low-voltage circuit shall be segregated or separated by barriers from uninsulated live parts to be connected to a high-voltage circuit, and from any safety-control circuit wiring terminals and any other uninsulated live parts the short-circuiting or grounding of which may result in the unintended operation of the pump.

## PERFORMANCE

### 21 General

21.1 In addition to the following tests, the pump shall be tested in accordance with the requirements of 5.3 – 5.5, 19.10, and 19.14.

21.2 Except as otherwise indicated, representative samples of a pump are to be subjected to the tests described in these requirements.

21.3 *Deleted May 30, 1996*

21.4 The investigation of a pump is to be limited to the service conditions for which it is to be recommended, such as speed, ambient and liquid temperature, and liquid pressure.

21.5 A pump having a stuffing box employing a take-up spring is to be prepared for the following tests in accordance with 8.5 and 8.6.

21.6 A pump assembly having a float-actuated mechanism is to be prepared for the following tests in accordance with 14.1. The float or its mechanism is to be loaded or arranged so as to displace 150 percent of the liquid normally in contact with the float.

### 22 Deformation – Test No. 1

22.1 A pump shall not leak nor shall there be evidence of distortion or other damage resulting from the turning effort exerted on openings threaded for piping when the pump is tested in accordance with 22.2.

22.2 The sample pump is to be used in any of the following tests is to be rigidly anchored or otherwise supported. A length of Schedule 80 pipe is to be connected to a female pipe-threaded section of the pump after the male threads have been lubricated with SAE No. 10 machine oil. Each pipe is then to be tightened to the torque specified in Table 22.1.

### 23 Operation Of Pressure-Regulating And Nozzle Shutoff Valves Combined With A Pump Assembly – Test No. 2

23.1 The maximum regulated pressure that can be established in the discharge line by adjustment of air or oil pressure-regulating valves shall not be more than 133 percent of the maximum rated pressure of the pump or the pump and compressor unit.

23.2 If a nozzle shutoff valve is separated from the pressure-regulating valve and a fixed shutoff pressure is to be established, the pressure in the discharge line at the time of shut off shall not be less than 80 percent of the intended operating pressure. This differential pressure shall be effective at the minimum regulated pressure.

**Table 22.1**  
**Torque requirements for pipe connections**

| Pipe size ANSI/ASME B36.10,<br>nominal inches | Outside diameter, |        | Torque, |     |
|-----------------------------------------------|-------------------|--------|---------|-----|
|                                               | inch              | mm     | lb.-in. | N-m |
| 1/8                                           | 0.405             | 10.29  | 150     | 17  |
| 1/4                                           | 0.540             | 13.72  | 250     | 28  |
| 3/8                                           | 0.675             | 17.15  | 450     | 51  |
| 1/2                                           | 0.840             | 21.34  | 800     | 90  |
| 3/4                                           | 1.050             | 26.67  | 1000    | 113 |
| 1                                             | 1.315             | 33.40  | 1200    | 136 |
| 1-1/4                                         | 1.660             | 42.16  | 1450    | 164 |
| 1-1/2                                         | 1.900             | 48.26  | 1550    | 175 |
| 2                                             | 2.375             | 60.33  | 1650    | 186 |
| 2-1/2                                         | 2.875             | 73.03  | 1750    | 198 |
| 3                                             | 3.500             | 88.90  | 1800    | 203 |
| 4                                             | 4.500             | 114.30 | 1900    | 215 |

23.3 If the pressure-regulating valve and nozzle shutoff valve are adjusted as a unit, the pressure in the discharge line at the time of shut off shall not be less than 80 percent of the intended operating pressure. This differential pressure shall be effective at all regulated pressures.

23.4 A nozzle shutoff valve shall operate promptly to stop oil flow and prevent afterdrip from a nozzle upon stopping the pump following operation at the intended operating pressure and at the minimum rated pressure.

23.5 A pump and motor assembly is to be connected to a system of piping similar to that illustrated in Figure 24.1. The low tank part of the system is to be used for this test. The liquid fuel oil used is to be the heaviest grade and highest viscosity for that grade specified by the manufacturer. Additional tests are allowed to be conducted with the lightest grade of fuel oil and lowest viscosity for that grade as well.

\*23.5 revised May 30, 1996\*

23.6 The viscosity of the specified grade of fuel oil employed in the test is to be consistent with the highest viscosity that will be encountered under service conditions.

\*23.6 revised May 30, 1996\*

23.7 Nozzle shutoff pressure is to be determined by a pressure gauge installed in place of the nozzle. Other tests are to be conducted using a nozzle of the maximum size consistent with the rating of the pump as used in oil-burner service.

23.8 The tests for compliance with Test No. 2 are to be conducted both before and after Test No. 6, Endurance. See Section 27.

## 24 Operation Of Combination Pump And Compressor Assemblies – Test No. 3

24.1 A combination oil pump and air compressor assembly mixing oil and air within the assembly or intended to discharge the air and oil through separate conduits to an internal mixing atomizing nozzle shall not create excessive pressures of air or oil, or external leakage of fuel oil when the assembly is tested in accordance with 24.2 and 24.3.

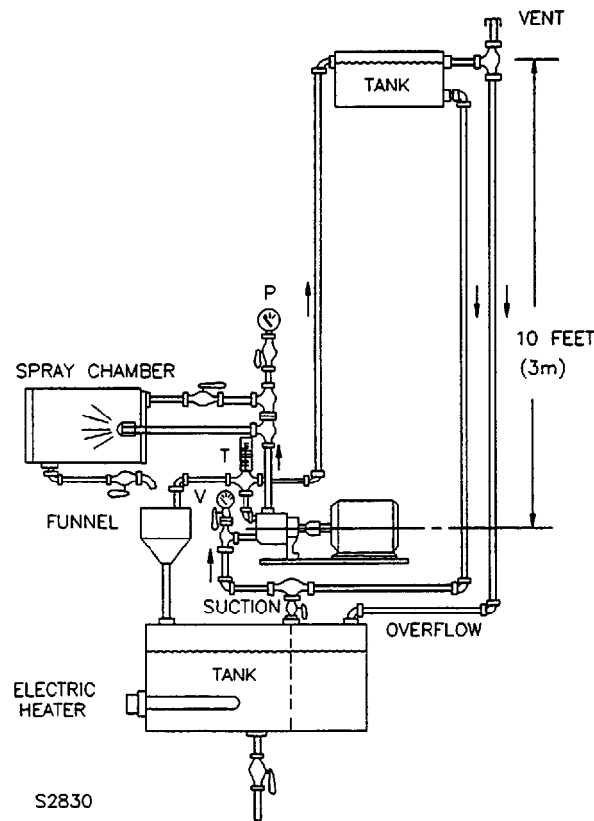
24.2 The pump and compressor assembly is to be operated with a pressure gauge and gate valve installed in the air-oil mixture discharge line. An assembly intended to deliver air and oil to an internal mixing nozzle through separate conduit is to be equipped with a nozzle providing means for restricting the mixture outlet orifice as a substitute for the valve, and pressure gauges are to be installed in the separate air and oil lines leading to the mixing nozzle.

24.3 The valve or nozzle restricting means is to be closed sufficiently to cause an increase in the air-oil mixture pressure or the separate air and oil pressures to 1-1/2 times and then to twice the maximum rated pressure valves recommended by the manufacturer. There is to be no evidence of stalling or overloading of the compressor and its integral or specified motor at 1-1/2 times, and no external leakage of oil is to occur at twice the specified pressure.

**Table 24.1**  
**Maximum viscosity for test**

\*Table 24.1 deleted May 30, 1996\*

**Figure 24.1**  
**Test apparatus for power-operated pumps**

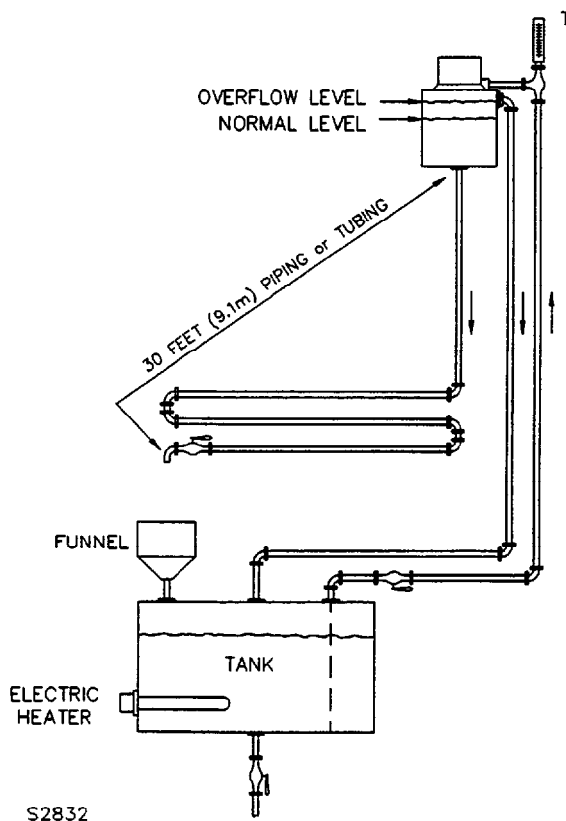


## 25 Operation Of Automatic Fuel Oil Pumps – Test No. 4

25.1 An automatic oil pump shall not discharge more than 2 gallons (7.6 L) of oil from the discharge line in the event of a total break in such line when tested in accordance with 25.2 – 25.7. The oil level maintained in the pump reservoir for gravity discharge shall not vary more than a total of 5 percent of the lowest height recommended for the installation of the pump above the burner connection. An overflow connection or equivalent shall prevent any oil from reaching a level within 3/4 inch (19.1 mm) of any opening that allows external leakage from the assembly.

25.2 The pump is to be installed with a system of piping as illustrated in Figure 25.1. Suction, overflow, and discharge connections and conduits are to be assembled using the size and kind of materials recommended by the manufacturer. The pump is to be set so that the height of the intended oil level in the pump reservoir is at the minimum distance above the end of the discharge line or burner connection recommended by the manufacturer. The discharge-line conduit is to include at least 30 linear feet (9.1 linear m) of material from the pump connection to the end. A shutoff valve is to be installed at the end of this line, and a reservoir is to be supplied at that point for measuring the oil discharged.

**Figure 25.1**  
**Test apparatus for automatic pumps**



25.3 Mechanisms depending upon electrical current to monitor the operation of the pump are to be energized at 85 percent of rated voltage.

25.4 Fuel oil in the system is to be the heaviest grade and the highest viscosity for that grade specified by the manufacturer.

\*25.4 revised May 30, 1996\*

25.5 The pump is to be operated and oil allowed to accumulate in the pump reservoir up to the highest normal oil level. At this time, the valve at the end of the discharge line is to be opened wide. Not more than 2 gallons (7.6 L) of oil are to be discharged as the result of this action, including the drainage of all fuel from the pump assembly and the discharge line.

25.6 The automatic pump control is to be made inactive. With the pump running, the overflow line or other means is to prevent the oil reaching a level higher than that specified.

25.7 Observations of oil level variations during pump operation are to be made under conditions of minimum oil discharge.

## 26 Vacuum And Capacity Of Power-Operated Pumps – Test No. 5

26.1 A pump shall create a vacuum at its suction line connection of 10 inches (254 mm) of mercury when discharging at maximum rated pressure. The capacity of the pump is to be recorded.

26.2 Vacuum tests are to be made using the lightest grade of fuel oil and the lowest viscosity for that grade specified by the manufacturer. The oil is to be circulated through the low tank part of the pump system illustrated in Figure 24.1.

\*26.2 revised May 30, 1996\*

**Table 26.1**  
**Maximum viscosity for test**

\*Table 26.1 deleted May 30, 1996\*

26.3 The capacity of the pump to deliver oil, and the capacity for rating purposes are to be measured with the pump operating continuously and with the vacuum adjusted by increasing the resistance in the suction line by means of a flooded valve or the equivalent. The capacity is that rate capable of being delivered at the nozzle while the pump is maintaining the intended operating pressure. The test is to be conducted both before and after Test No. 6, Endurance, Section 27. The before and after capacity, for rating purposes under similar conditions, shall be within 5 percent.

26.4 The pump capacity for oil burner rating purposes for those pumps embodying built-in strainers is to be the capacity as determined by the rating of the strainer or the capacity of the pump as determined in this test, whichever is the lesser.

## **27 Endurance – Test No. 6**

27.1 A power-operated pump and its auxiliary parts shall not seize or show evidence of external leakage during operation when tested in accordance with 27.2 – 27.5.

27.2 Endurance tests are to be conducted under the same condition and with the same system employed for Vacuum And Capacity of Power-Operated Pumps – Test No. 5, Section 26. When a pump is also intended for use with No. 5 or 6 fuel oil at elevated temperatures, an additional identical sample is to be subjected to an endurance test conducted with the heaviest fuel oil specified by the manufacturer at the maximum specified temperature. A pump is to be operated continuously for 15 days at maximum rated pressure. Following this interval, the pump is to be operated for 15 days intermittently 1 minute on and 1 minute off.

\*27.2 revised May 30, 1996\*

27.3 A pump sample is to be equipped with a motor that is capable of operating without overheating under the conditions of test described in 27.2. An automatic pump is to be operated intermittently at the approximate time intervals described in 27.2 by controlling the rate of discharge.

27.4 A pump equipped with pressure-regulating and nozzle shutoff valves is to be arranged to operate conventionally employing the largest capacity nozzle recommended for use with the pump.

27.5 Following the 15-day intermittent test or using separate samples concurrently, moving parts such as pressure-regulating and nozzle shutoff valves, float mechanisms, control switches, and devices are to be operated 100,000 times without breakdown or failure. Parts used in this test if previously used in the 15-day intermittent test may be credited with the cycles of operation that have accumulated during that test.