NFPA No. 31

STANDARDS

for the

Installation of OIL BURNING EQUIPMENTS

1951

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NATIONAL FIRE PROTECTION ASSOCIATION
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The National Fire Protection Association was organized in 1896 to promote the science and improve the methods of fire protection and prevention, to obtain and circulate information on these subjects and to secure the cooperation of its members in establishing proper safeguards against loss of life and property by fire. Its membership includes over a hundred and seventy-five national and regional societies and associations and over thirteen thousand individuals, corporations, and organizations. Membership in the National Fire Protection Association is open to any society, corporation, firm or individual interested in the protection of life or property against fire.

This pamphlet is one of a large number of publications on fire safety issued by the Association. All interests concerned have opportunity through the National Fire Protection Association to participate in the development of the standards and to secure impartial consideration of matters affecting them.

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The personnel shown above is that of the committee at the time of the last action on the present standard. Subsequently Mr. Miner has resigned as Chairman and Mr. H. E. Newell has been appointed Chairman.

STANDARDS FOR THE INSTALLATION OF OIL BURNING EQUIPMENTS

(No. 31)

These standards, adopted by the National Fire Protection Association on May 11, 1951 on recommendation of the Committee on Flammable Liquids, supersede the 1950 and previous editions published by the NFPA in the National Fire Codes, Vol. I, and by the National Board of Fire Underwriters in NBFU Pamphlet No. 31.

The changes incorporated herein have to do largely with provisions on oil storage to make the text of these standards consistent with the basic provisions on oil storage contained in the NFPA Suggested Ordinance on Flammable Liquids (No. 30L) as officially adopted at the 1951 annual meeting of the NFPA.

For a summary of the history of prior editions of these standards dating back to 1902, see the National Fire Codes, Vol. I, Flammable Liquids, Gases, Chemicals and Explosives.

Attention is directed to the fact that the present standards cover only the types of oil burning equipment specified. Other NFPA standards deal with flammable liquid storage and handling (No. 30L), kerosene or oil stoves (No. 310), range oil burners (No. 39L), and a suggested oil burner ordinance (No. 31L) designed to put the provisions of the present standard, No. 31, into form for legal adoption.

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The National Fire Protection Association does not "approve" individual items of equipment. The suitability of devices and materials for installation under the standards is indicated by the listings of nationally recognized testing laboratories, whose findings are customarily used as a guide to approval by enforcing authorities.

Units of Measurement used here are U. S. standard. 1 U. S. gallon=0.83 Imperial gallons=3.785 liters.

STANDARDS FOR THE INSTALLATION OF OIL BURNING EQUIPMENTS.

1. **Definition of Terms.** For the purpose of these installation standards the following terms shall be interpreted in accordance with the following definitions:

(a) "Approved" refers to approval by the authority having jurisdiction in the enforcement of the standards.

(b) "Fuel Oil" shall mean any hydrocarbon oil as specified by U. S. Department of Commerce Commercial Standard CS12 or A.S.T.M. D396.

(c) "Installation" shall mean the complete setting-in-place, ready for operation, of an oil-fired unit or oil burner and its accessories and appurtenances.

(d) "Oil Burner" shall mean any device designed or used for the purpose of burning oil, with the exception of the types excluded by Section 2.

(e) "Oil Burning Equipment" shall mean all oil burners of all types, except those excluded by Section 2, and the tanks, piping, wiring, pumps, controls, and other accessories or auxiliaries installed therewith.

(f) "Oil-Fired Unit" shall mean a unit that contains an oil burner, or has an oil burner applied or secured to it in such a way that each becomes part of the other.

(g) "Shall" is intended to indicate requirements.

(h) "Should" is intended to indicate recommendations, or that which is advised but not required.

2. **Application and Scope.** (a) These standards apply to stationary oil burning equipments except internal combustion engines, oil lamps, and portable devices such as blow torches, melting pots, and weed burners. Under this provision approved equipment is required.

For the installation of oil burning stoves and other small heating and cooking appliances and for the installation of oil burners in stoves and ranges originally designed for solid fuels, see separately published standards.

(b) These standards are intended to prescribe reasonable minimum requirements for safety to life and property from fire in the installation of oil burners and the equipment used in connection with them, including tanks, piping, pumps, control devices and accessories. Careful attention to

the maintenance and proper operation of the equipment is necessary for the continued safety of oil burning equipments.

(c) Where the circumstances or conditions of any particular installation are unusual and such as to render the strict application of these standards impracticable, the inspection authority having jurisdiction may permit such modifications as will provide a substantially equivalent degree of safety.

3. **Approval of Plans.** Before installing, or remodelling any industrial oil burning equipment, it is recommended that plans or sketches showing the relative location of burners, tanks, pumps, piping and elevation of buildings and their lowest floors or pits, relating to the proposed installation or alteration, be submitted for approval to the inspection authority having jurisdiction.

4. **Burners.** (a) Oil burners for which a competent attendant will not be constantly on duty in the room where the burner is located, while the burner is in operation, shall be arranged to prevent abnormal discharge of oil at the burner by automatic means specifically approved for the burner with which it is used.

NOTE: Burners so equipped are listed by Underwriters' Laboratories, Inc., as conversion oil burners or oil fired units with automatic safety controls.

(b) Oil burners for which a competent attendant will be constantly on duty in the room where the burner is located, while the burner is in operation, are not required to be equipped with automatic means for preventing abnormal discharge of oil at the burner. When automatic features are installed in connection with oil burners of this type such automatic devices shall be specifically approved for use with the burner to which they are attached.

NOTE: Oil burners of this type are listed by Underwriters' Laboratories, Inc., as industrial oil burners without automatic safety controls.

5. **Fuel Oil.** (a) The grade of fuel oil used with any burner shall be one which tests and experience have shown to be suitable for use with that burner.

NOTE: The list of inspected oil burners issued by Underwriters' Laboratories, Inc., gives, for each burner, the grade of fuel oil for which the burner is suitable.

6. **Gravity Feed to Burners.** (a) Gravity feed shall be used only with burners classified by Par. 4(a).

(b) Gravity supply tanks shall not exceed 275 gallons individual capacity nor exceed 550 gallons aggregate capacity.

7. **Pressure Tank Feed** shall be used only with burners arranged to prevent abnormal discharge of oil at the burner by automatic means specifically approved for the burner with which it is used.

Pressure tanks shall not exceed a capacity of 60 gallons, and shall not be operated at pressure exceeding 50 pounds per square inch. Pressure tanks shall be equipped with an approved pressure relief valve.

8. **Installation of Underground Tanks.** (a) Underground oil supply tanks should preferably be located outside of buildings and underground with top of tank below the level of all piping to which the tank is connected, to prevent discharge of oil through a broken pipe or connection by siphoning.

(b) Underground tanks shall be set on firm foundation and surrounded with soft earth or sand well-tamped in place. Tanks shall be covered with a minimum of 2 ft. of earth, or shall be covered with not less than 1 foot of earth on top of which shall be placed a slab of reinforced concrete not less than 4 inches thick. When subjected to traffic tanks shall be protected against damage from vehicles passing over them by at least 3 ft. of earth cover, or 18 inches of well-tamped earth, plus either 8 inches of asphaltic concrete or 6 inches of reinforced concrete. When asphaltic or reinforced concrete paving is used as part of the protection it must extend at least 1 ft. horizontally beyond the outline of the tank in all directions.

9. **Installation of Tanks Inside Buildings.** (a) Oil supply tanks larger than 60 gallons capacity shall not be located in buildings above the lowest story, cellar or basement.

(b) Unenclosed inside storage tanks and auxiliary tanks shall not be located within 5 feet, horizontally, of any fire or flame.

(c) Oil supply tanks located inside buildings shall not exceed 275 gallons individual capacity or 550 gallons aggregate capacity in an individual building, or in sections of a

building separated by fire walls, unless installed in an enclosure or casing constructed as follows:

The walls of the enclosure shall be constructed of reinforced concrete at least 6 in. thick or of brick of least 8 in. thick. Such enclosures shall be installed only on concrete or other fire-resistive floors and shall be bonded to the floors. Enclosures shall have tops of reinforced concrete at least 5 in. thick or equivalent fire-resistive construction, except that where floor or roof construction above the enclosure is concrete or other fire-resistive construction, the walls may be extended to and bonded to the underside of the construction above in lieu of the provision of a separate top. Any openings to such enclosures shall be provided with fire doors or other approved closures and six-inch noncombustible liquid tight sills or ramps. Provision shall be made for adequate ventilation of such enclosures prior to entering for inspection or repairs on tanks.

Instead of an enclosure as above described the tank may be encased in reinforced concrete not less than 6 inches in thickness, applied directly to the tank so as to completely eliminate any air space.

(d) In buildings of ordinary construction the nominal gross capacity of tanks shall not exceed 5,000 gallons.

(e) In fire-resistive buildings the nominal gross capacity of the tanks shall not exceed 15,000 gallons.

(f) In any building, if in a fire-resistive or detached room cut off vertically and horizontally in an approved manner, from other floors of the main building, the nominal gross capacity of tanks shall not exceed 50,000 gallons, with an individual tank capacity not exceeding 25,000 gallons.

10. **Installation of Outside Aboveground tanks.** (a) Except as hereafter provided outside aboveground tanks shall not be located in closely built up areas, provided, however, that inside storage tanks for oil burners, of capacity not exceeding 275 gallons may be installed outside of buildings in accordance with applicable requirements if suitably protected from the weather and mechanical damage incident to outside use.

(b) The distance from outside aboveground tanks to nearest line of adjoining property which may be built upon shall not be less than that set forth in the following:

MINIMUM DISTANCE OF OUTSIDE ABOVEGROUND TANKS TO LINE OF ADJOINING PROPERTY WHICH MAY BE BUILT UPON

Capacity of Tank	Minimum Distance
0 to 275 gals.	0 feet
276 to 750 gals.	5 feet
751 to 12,000 gals.	10 feet
12,001 to 24,000 gals.	15 feet
24,001 to 30,000 gals.	20 feet
30,001 to 50,000 gals.	25 feet

Tanks with capacities in excess of 50,000 gallons shall be located in accordance with the following provisions:

GROUP A TANKS. Any all-steel, gas-tight tank constructed in compliance with these or equivalent standards and equipped either with (1) an approved permanently attached extinguishing system or (2) an approved floating roof, which is to be used only for the storage of refined petroleum products or other flammable liquids not subject to boil-over, shall be so located that the distance from the line of adjoining property which may be built upon shall be not less than the greatest dimension of diameter or height of the tank, except that such distance need not exceed 120 feet.

GROUP B TANKS. Any all-steel, gas-tight tank constructed in compliance with these or equivalent standards but not equipped either with (1) an approved permanently attached extinguishing system or (2) an approved floating roof, which is to be used only for the storage of refined petroleum products or other flammable liquids not subject to boil-over, shall be so located that the distance from the line of adjoining property which may be built upon shall be not less than 1½ times the greatest dimension of diameter or height of the tank, except that such distance need not exceed 175 feet.

(c) The minimum distance between shells of all steel tanks shall be not less than 3 feet or one-half the diameter of smaller tanks, whichever is greater.

(d) Tanks shall be so located as to avoid possible danger from high water. When tanks are located on a stream without tide, they shall, where possible, be down stream from burnable property.

11. Embankments or Dikes. (a) Where individual tanks exceed 50,000 gallons in capacity, and for smaller tanks where deemed necessary on account of proximity to streams, character of topography, or nearness to structures of high value, aboveground storage tanks shall be diked or the entire yard provided with a curb or retaining wall or other suitable means taken to prevent the discharge of liquid onto other property in case of rupture of tank or piping.

(b) Where an impounding basin is required under this section, it shall have a capacity equal to that of the largest tank plus 10 per cent of the aggregate capacity of all other tanks so protected.

(c) Dikes or walls required under this section shall be of earth or masonry, so constructed as to afford adequate protection. Earthen dikes 3 feet or more in height shall have a flat section at the top of not less than 24 inches, and shall have a slope consistent with the angle of repose of the materials of which they are constructed. Dikes shall not be higher than one-half the tank height. The capacity of impounding basins shall be maintained.

(d) Embankments or dikes shall be continuous with no openings for piping or roadways. Piping should preferably be laid over or under embankments.

12. **Setting of Tanks.** (a) Underground tanks shall be set on a firm foundation and surrounded with soft earth or sand well tamped in place. Where necessary to prevent floating they shall be securely anchored or weighted.

(b) Inside storage and auxiliary tanks shall be securely supported by substantial noncombustible supports to prevent settling, sliding or lifting.

(c) It is recommended that inside storage tanks be provided with draw-off or drain openings. When draw-off or drain openings are provided the tanks shall be installed with the bottom pitched to the draw-off or drain opening with a slope of not less than ¼ inch per foot of length. The draw-off or drain opening shall be provided with suitable pipe connections in a form to provide a sump from which water or sediment can be readily drained at regular intervals.

(d) Outside aboveground tanks shall be set on a firm foundation. Those more than one foot above the ground shall have supports of masonry or protected steel, except that wooden cushions may be used. No combustible material shall be stored under or within 10 feet of outside aboveground tanks.

13. **Construction of Tanks.** (a) Underground tanks and tanks inside buildings shall be constructed of steel or wrought iron of a minimum gauge (U. S. Standard) in accordance with the following table.

Table 3—Underground and Encased Storage Tanks

CAPACITY Gallons	MINIMUM THICKNESS OF MATERIAL NOT GALVANIZED U. S. Standard Gauge	Pounds per Square Foot	GALVANIZED U. S. Standard Gauge	Pounds per Square Foot*
1 to 285	14	3.125	16	2.50
286 to 560	12	4.375	14	3.125
561 to 1100	10	5.625	12	4.375
1101 to 4000	7	7.50		
4001 to 12000	¼ inch	10.00		
12001 to 20000	5/16 inch	12.50		
20001 to 30000	⅜ inch	15.00		

* Before galvanizing

If adequate internal bracing is provided, tanks of 12,001 to 30,000 gallons capacity may be built of ¼ inch plate.

NOTE: For tanks larger than 1,100 gallons capacity, a tolerance of 10 per cent in capacity is permitted.

(b) Tanks shall be thoroughly coated on the outside with tar, asphaltum, or other suitable rust-resisting paint. Where placed in corrosive soil special protection may be required.

(c) Outside aboveground tanks, including tops shall be constructed of steel or wrought iron of a thickness in accordance with the following requirements:

1. Horizontal or Vertical Tanks not over 1,100 Gallons Capacity.

HORIZONTAL OR VERTICAL TANKS NOT OVER 1100 GALLONS CAPACITY

Capacity (gallons)	Minimum Thickness of Material
1 to 60	18 gauge, U. S. Standard
61 to 275	14 gauge, U. S. Standard
276 to 550	12 gauge, U. S. Standard
551 to 1100	10 gauge, U. S. Standard

2. Horizontal Tanks over 1,100 Gallons Capacity.

Tanks having a diameter of not over 6 feet shall be made of at least 3/16 inch steel or wrought iron.

Tanks having a diameter of over 6 feet and less than 11½ feet shall be of at least ¼ inch steel or wrought iron.

NOTE: Tanks labeled by Underwriters' Laboratories, Inc., have been tested and examined for compliance with these standards and also detailed standards covering the design and construction of such tanks.

3. Vertical Tanks over 1,100 Gallons Capacity.

The minimum thickness of shell shall be 3/16 inch

and bottom ¼ inch. The minimum thickness of roof shall be 3/16 inch. Riveted tanks shall be constructed in accordance with A.P.I. specifications No. 12-A for standard tanks with riveted shells, and 12-C for welded tanks.

(d) Joints shall be riveted and calked, welded or made tight by some equally satisfactory process. Tanks shall be tight and sufficiently strong to bear without injury the most severe strains to which they may be subjected in practice. Shells of tanks shall be properly reinforced where connections are made. All connections to storage tanks other than outside aboveground storage tanks, shall be made through the top of the tank above the liquid level, except that tanks of not over 275 gallons capacity may have one bottom connection for gravity feed and one opening for an approved key stem gate valve to facilitate cleaning or for a scavenging line to be run to the outside and capped oil tight when not in use.

NOTE: While correct design and use of proper materials are essential, regardless of the type of construction employed, where tanks are welded the safeness and suitability of the completed container for the purpose intended will also equally depend upon the skill and competence of the welder. For this reason it is urged that the inspection department having jurisdiction assure itself of the integrity and responsibility of the firm or individual doing the work, the degree to which welders are qualified, and the character of supervision maintained while welding is in process.

(e) Pressure tanks shall be designed in accordance with the A.S.M.E. or the joint A.P.I.-A.S.M.E. Code for Unfired Pressure Vessels and so stamped or marked.

NOTE: Tanks labeled by Underwriters' Laboratories, Inc., have been tested and examined for compliance with these regulations and detail standards covering their design and construction.

(f) For fuel oil heavier than 40° A.P.I., tanks may be made of concrete. (See National Fire Protection Association standards for the Design and Construction of Concrete Fuel Oil Tanks.)

14. **Tank Vents.** (a) Storage tanks shall be equipped with an open vent or an approved automatically operated vent, arranged to discharge to the open air. Vent openings and vent pipes shall be of ample size to prevent abnormal pressure in the tank during filling but not smaller than

1¼-inch pipe size as specified in the following table:

Capacity of Tank Gallons	Diameter of Vent Iron Pipe Size
0 to 500	1¼ inch
501 to 3,000	1½ "
3,001 to 10,000	2 "
10,001 to 25,000	2½ "
25,001 to 50,000	3 "
50,001 to 100,000	3½ "
100,001 to 150,000	4 "
150,001 to 400,000	5 "
400,001 to 1,000,000	6 "

NOTE: Where storage tanks are filled by the use of a pump through tight connections special consideration should be given to the size of the vent pipe to insure that it is adequate to prevent the development of abnormal pressure in the tank during filling. This may be accomplished by providing a vent pipe not less in size than the discharge of the pump.

(b) Vent pipes shall be arranged to drain to the tank. The lower end of the vent pipe shall not extend through the top into the tank for a distance of more than one inch.

(c) Vent pipes shall terminate outside of buildings at a point not less than 2 feet measured vertically or horizontally from any window or other building opening. Outer ends of vent pipes shall be provided with a weatherproof hood. Vent pipes should terminate sufficiently above the ground to prevent their being obstructed with snow and ice. Vent pipes of tanks containing heaters shall be extended to a location where oil vapors discharging from the vent will be readily diffused without danger of ignition. The static head with a vent pipe filled with oil should not exceed the tested pressure of the tank.

(d) Vent pipes shall not be cross-connected with fill pipes or return lines from burners.

(e) Pressure tanks shall be equipped with an automatic relief valve piped to discharge outside of buildings.

(f) Emergency Pressure Reliefs. With the exception of vertical, cone-roof tanks having a roof slope less than 2½ inches in 12 inches and in which the strength of the joint between roof and shell is no greater than that of the weakest joint in the shell, all aboveground tanks shall have some form of relief for preventing the development of excessive internal pressure in case of exposure fire surrounding the tank. The method of relief shall be acceptable to the inspection authority having jurisdiction.

15. **Tank Fill and Overflow Pipes.** (a) Storage tanks, other than outside aboveground tanks, shall be filled only through fill pipes terminating outside of buildings at a point at least 2 feet from any building opening at the same or lower level. Fill terminals shall be closed tight, when not in use, by a metal cover designed to prevent tampering.

NOTE: In tanks containing heaters the tank end of the fill pipe should be sealed by a trap or should be extended to a point below the lower end of the suction pipe.

(b) Auxiliary tanks shall be filled by pumping from storage tanks.

(c) Cross connections, except between two storage tanks not exceeding 275 gallons individual capacity permitting gravity flow from one tank to another shall be prohibited. This, however, shall not be construed as prohibiting the filling of an outside service tank by gravity, providing filling is through an open connection located within a dike surrounding the service tank, and provided further that such dike shall have a capacity equal to 1½ times the capacity of the tank being filled.

(d) Auxiliary tanks other than vacuum tanks shall be equipped with an overflow pipe draining to the storage tank, at least one size larger than the supply pipe.

(e) Overflow pipes of auxiliary gravity tanks shall have no valves or obstructions. Overflow pipes of auxiliary pressure tanks shall be provided with interconnected valves or other means for automatically venting the tank during filling.

16. **Oil Gauging.** (a) All tanks in which a constant oil level is not maintained by an automatic pump shall be equipped with an approved method of determining the oil level.

(b) Test wells shall not be installed inside buildings and where permitted for outside service shall be closed tight, when not in use, by a metal cover designed to prevent tampering.

NOTE: The gauging of inside tanks by means of measuring sticks is a pronounced hazard and should not be permitted.

(c) Gauging devices such as liquid level indicators or signals shall be installed so that oil or vapor will not be discharged into the building from the fuel supply system.

17. **Oil Pumps.** (a) Oil pumps shall be of approved type, secure against leaks and shall be rigidly fastened in place.

(b) Automatic pumps not an integral part of the burner shall be arranged to stop automatically in case of total breakage of the supply line to the burner.

Positive displacement pumps which automatically shut off the oil supply when stopped should be used. Means shall be provided for shutting down the pumps from a conveniently located point a safe distance from the burner except where a quick closing valve outside the area is provided.

(c) In isolated locations, where fire protection equipment is dependent upon a heating plant fired by an oil burner, oil pumps supplying the burner shall be installed in duplicate.

(d) Pumps used in connection with the supply and discharge of outside aboveground storage tanks shall be located outside of the embankments or dikes surrounding the tanks, and at such a point that they will be accessible at all times, even if the oil in the tank is on fire.

18. **Piping.** (a) All piping shall be standard full weight wrought iron, steel or brass pipe with standard fittings or brass or copper tubing with approved fittings, except that approved flexible metal hose may be used for reducing the effects of jarring and vibration or where rigid connections are impracticable.

NOTE: Aluminum tubing shall not be used between the fuel oil tank and the burner unit.

(b) Pipe used in the installation of domestic type burners shall not be smaller than ¼-inch iron pipe size; pipe used in the installation of industrial type burners shall not be smaller than ½-inch iron pipe size. Copper or brass tubing shall not be smaller in size than the equivalent of the iron pipe sizes mentioned above with 0.035 nominal and 0.032 minimum wall thickness. Flexible metal hose shall be installed strictly in accordance with the limitations of its approval.

(c) Piping shall be rigidly secured in place and protected from injury in a workmanlike manner, and where necessary, shall be protected against corrosion. Oil piping preferably should not be located close to other piping or

in the same trench with other piping, except steam or hot water lines intended for heating the oil.

(d) Pipe joints and connections shall be made tight in a workmanlike manner. Unions and tubing fittings shall be of approved type. Unions requiring gaskets or packing, and right and left couplings shall not be used in oil lines.

(e) Proper allowance shall be made for expansion, contraction, jarring and vibration. Pipe lines, other than tubing, connected to underground tanks, except fill lines and test wells, shall be provided with double swing joints arranged to permit the tank to settle without impairing the efficiency of the pipe connections.

(f) Where storage tanks are set below the level of the burner the oil piping should preferably be so laid as to pitch toward the storage tank without traps.

(g) Openings for pipes through outside walls below the ground level shall be made oil tight by securely packing with flexible material.

(h) Each installation shall be provided with an approved strainer for the fuel supply.

19. **Valves.** (a) Readily accessible shut-off valves of approved type shall be installed near each tank and at other points where required to avoid oil spillage during servicing.

(b) Where a shut-off is installed in the discharge line of an oil pump, an approved pressure relief valve shall be connected into the discharge line between the pump and the shut-off valve and arranged to return surplus oil to the storage tank or to bypass it around the pump.

NOTE: For large industrial and commercial installations it is recommended that approved automatically operated valves designed to shut off the oil supply in case of fire in the immediate vicinity of the burner, or to shut off the oil supply in case of breakage of the oil supply piping, be installed where burners are not equipped with approved automatic devices for preventing abnormal discharge of oil at the burner.

(c) Control valves shall be of approved type provided with stuffing box of liberal size, containing a removable cupped gland designed to compress the packing against the valve stem and arranged so as to facilitate removal. Valve shall be designed to close against the supply, and to prevent withdrawal of stem by continued operation of the handwheel. Packing affected by the oil or by heat shall not be used.

(d) Where oil is supplied to a burner requiring uniform flow by gravity feed and a constant level valve is not incorporated in the burner assembly or in an auxiliary tank used in connection with an automatic pump, an approved constant level valve shall be installed in the oil feed line at the gravity tank or as close thereto as practicable, to insure uniform delivery of oil to the burner. The vent opening of such constant level valve shall be connected by piping or tubing to the outside of the building, unless the constant level valve is provided with an anti-flooding device. Vent piping or tubing of constant level valves shall not be connected to tanks or tank vents.

20. **Preheating of Oil.** Where heavy oils are used, provisions should be made for maintaining the oil at the proper atomizing temperature. Automatically operated burners requiring the preheating of oil shall be arranged so that no oil can be delivered to the burner for combustion until the oil is at a suitable atomizing temperature.

21. **Tests of Underground Tanks and Piping.** After installation and before being covered tanks and piping shall be tested hydrostatically, or with equivalent air pressure not less than 1½ times the maximum working pressure but not less than 5 pounds per square inch at the highest point of the system. Instead of a pressure test, suction lines may be tested under a vacuum of not less than 20 inches of mercury.

Tests should continue for at least 60 minutes without a noticeable drop in pressure or vacuum.

22. **Controls for Oil Burners.** (a) Oil burners, as classified under Par. 4(a), used in conjunction with hot water, steam, or warm-air heating systems shall be provided with approved automatic devices to shut down the burner in the event of undue pressure or low water in a steam boiler or overheating within a hot-water boiler or warm-air furnace.

NOTE: Oil fired units labeled by Underwriters' Laboratories, Inc., conform to the above requirements.

(b) Limiting controls and low-water shut-offs intended to prevent unsafe operation of heating equipment by interrupting the electric power supply to the burner shall be so arranged as to effect the opening of the burner circuit, whether the switching mechanism is integral with

the sensing element or remote from same, by directly disconnecting the burner circuit from its power supply.

(c) Controls for preventing the abnormal discharge of oil on burners as classified under Par. 4(a), listed by Underwriters' Laboratories, Inc., are acceptable. Controls for other burners shall be required as follows:

(d) A combustion responsive means should be installed to stop the flow of oil in the event of an accidental flame failure. The method of safeguarding the burner shall be acceptable to the inspection authority having jurisdiction.

(e) In systems where either steam or air is used for atomizing the oil where air for combustion is supplied by a source which may be interrupted without shutting off the oil supply, the oil and atomizing or air supply shall be interlocked in an approved manner to immediately shut off the oil supply upon failure of the atomizing or air supply.

NOTE: This does not apply to vaporizing pot-type burners listed by Underwriters' Laboratories, Inc.

(f) When automatically operated burners are used in installations equipped with forced or induced draft fans or both, means shall be provided to immediately shut off the oil supply upon fan failure.

(g) For oil burners not equipped to provide safe automatic restarting after shut down, any control which functions to shut off the oil supply shall require manual reset.

(h) Electric motor-driven industrial oil burners with integral oil pumps and electric motor-driven pump sets for use with industrial burners not equipped with integral pumps, shall be provided with an approved motor controller incorporating no-voltage protection to be wired into the power supply to the motor.

NOTE: On failure of voltage, such controllers cause and maintain the interruption of the power from the main circuit. These controllers are included in Underwriters' Laboratories, Inc., List of Inspected Gas, Oil, and Miscellaneous Appliances under the heading "Industrial Control Equipment."

23. **Electric Wiring and Equipment** in connection with oil burning equipments shall be installed in accordance with the National Electrical Code.

24. **Installation of the Burner.** (a) Oil burners shall be securely installed in a workmanlike manner, in accord-