CHAPTER 94
STEAM HEATING BOILERS, HOT WATER HEATING BOILERS AND HOT WATER SUPPLY BOILERS

[Prior to 9/24/86, Labor, Bureau of [530]]
[Prior to 1/14/98, see Labor Services[347] Ch 46]
[Prior to 8/16/06, see 875—Ch 207]

Chapter rescission date pursuant to Iowa Code section 17A.7: 3/26/30

875—94.1(89) Scope. This chapter applies to:

94.1(1) Steam boilers for operation at pressures not exceeding 15 psig;

94.1(2) Hot water heating boilers for operation at pressures not exceeding 160 psig or temperatures not exceeding 250 degrees F at or near the boiler outlet;

94.1(3) Hot water supply boilers.

[**ARC 8890C**, IAB 2/19/25, effective 3/26/25]

875—94.2(89) Codes adopted by reference. The codes listed in 481—Chapter 91 apply to objects covered by this chapter.

[**ARC 8890C**, IAB 2/19/25, effective 3/26/25]

875—94.3(89) General requirements. This rule applies to all objects covered by this chapter and installed prior to September 20, 2006.

94.3(1) *Instruments, fittings and controls mounted inside boiler jackets.* Any or all instruments, fittings and controls required by this chapter may be installed inside of boiler jackets provided the water gage and pressure gage on a steam boiler or the thermometer and pressure gage on a water boiler are visible through an opening or openings at all times.

94.3(2) *Electrical code compliance.*

a. Wiring. All wiring for controls, heat-generating apparatus and other appurtenances necessary for the operation of the boiler or boilers will be in accordance with the National Electric Code (1992). All boilers supplied with factory-mounted and factory-wired controls, heat-generating apparatus and other appurtenances necessary for the operation of the boilers will be installed in accordance with the provisions of nationally recognized standards.

b. Circuitry. The control circuitry will be grounded and will operate at 150 volts or less. One of the two following systems may be employed to provide the control circuit:

(1) Two-wire, nominal 120-volt system with separate equipment ground conductor as follows:

1. This system will consist of the line, neutral and equipment ground conductors. The control panel frame and associated control circuitry metallic enclosures will be electrically continuous and be bonded to the equipment ground conductor.

2. The equipment ground conductor and the neutral conductor will be bonded together at their origin in the electrical system for objects installed prior to September 20, 2006.

3. The line side of the control circuit will be provided with a time delay fuse sized as small as practicable.

(2) Two-wire, nominal 120-volt system obtained by using an isolation transformer as follows:

1. The two-wire control circuit will be obtained from the secondary side of an isolation transformer, will be electrically continuous and will be bonded to a convenient cold water pipe. All metallic enclosures of control components will be securely bonded to this ground control circuit wire. The primary side of the isolation transformer will normally be a two-wire source with a potential 230, 208 or 440 volts.

2. Both sides of the two-wire primary circuit will be fused. The hot leg on the load side of the isolation transformer will be fused as small as practicable, and will not be fused above the rating of the isolation transformer.

94.3(3) *Safety and safety relief valve discharge piping.* When a discharge pipe is used, its internal cross-sectional areas will not be less than the full area of the valve outlet or of the total of the valve outlets discharging therein and will be as short and straight as possible and so arranged as to avoid undue stress on

the valve or valves. When an elbow is placed on a safety valve or safety relief valve discharge pipe, the elbow will be located close to the valve outlet.

94.3(4) *Expansion and contraction.* Provisions will be made for the expansion and contraction of steam and hot water mains connected to boilers.

94.3(5) *Return pipe connections.* The return pipe connections of each boiler supplying a gravity-return steam heating system will be so arranged as to form a loop so that the water in each boiler cannot be forced out below the safe water level.

94.3(6) *Feed water connections.*

a. Feed water, makeup water or water treatment will be introduced into a boiler through the return piping system. Alternatively, makeup water or water treatment may be introduced through an independent connection. The water flow from the independent feed water connection will not discharge against parts of the boiler exposed to direct radiant heat from the fire. Makeup water or water treatment will not be introduced through openings or connections provided for inspection, cleaning, safety valves, safety-relief valves, blowoffs, water columns, water gage glasses, pressure gages or temperature gages.

b. The makeup water pipe will be provided with a check valve near the boiler and a stop valve or cock between the check valve and the boiler or between the check valve and the return pipe system.

94.3(7) *Oil heaters.*

a. A heater for oil or other liquid harmful to boiler operation will not be installed directly in the steam or water space within a boiler.

b. Where an external-type heater for such service is used, means will be provided to prevent the introduction into the boiler of oil or other liquid harmful to boiler operation.

94.3(8) *Bottom blowoff or drain valve.*

a. Each boiler will have a bottom blowoff or drain pipe connection fitted with a valve or cock connected with the lowest water space practicable, with the minimum size of blowoff piping and valves as specified below:

Minimum Required Safety or Safety-Relief Valve Capacity (Pounds of Steam Per Hour)	Size of Blowoff Valves (Inches)
Up to 500	¾
501 to 1250	1
1251 to 2500	1¼
2501 to 6000	1½
6001 and larger	2

NOTE: Multiply 1,000 by the relieving capacity in pounds of steam per hour to determine the Btu of safety relief valve discharge capacity.

b. Any discharge piping connected to bottom blowoff or bottom drain connections will be full size to the point of discharge.

94.3(9) *Low-water fuel cutoff.*

a. Each automatically fired hot water heating boiler will have an automatic low-water fuel cutoff that has been designed for hot water service, and it will be so located as to automatically cut off the fuel supply when the surface of the water falls to the level established.

b. As there is no normal waterline to be maintained in a hot water heating boiler, any location of the low-water fuel cutoff above the lowest safe permissible water level established by the boiler manufacturer is satisfactory.

c. A coil-type boiler or a watertube boiler requiring forced circulation to prevent overheating of the coils or tubes will have a flow-sensing device installed in the outlet piping in lieu of the low-water fuel cutoff to automatically cut off the fuel supply when the circulating flow is interrupted.

[**ARC 8890C**, IAB 2/19/25, effective 3/26/25]

875—94.4(89) Steam heating boilers installed before July 1, 1960—requirements. All steam heating boilers installed before July 1, 1960, shall be constructed and installed in accordance with this rule.

94.4(1) Safety valves.

a. Each steam boiler will have one or more safety valves bearing the National Board "HV" stamp of the spring-pop type adjusted and sealed to discharge at a pressure not to exceed 15 psig. Seals will be attached in a manner to prevent the valve from being taken apart without breaking the seal. The safety valves will be arranged so that they cannot be set to relieve at a higher pressure than the maximum allowable working pressure of the boiler. For iron and steel bodied valves exceeding 2-inch pipe size, the drain hole or holes will be tapped not less than 3/8-inch pipe size.

b. The safety valves will be located in the top or side of the boiler. They will be connected directly to a tapped or flanged opening in the boiler, to a fitting connected to the boiler by a short nipple, to a Y-base, or to a valveless header connecting steam or water outlets on the same boiler. Coil or header type boilers will have the safety valve located on the steam outlet end. Safety valves will be installed with their spindles vertical. The opening or connection between the boiler and any safety valve will have at least the area of the valve inlet.

c. Safety valves ½-inch or more in diameter that are installed on a steam boiler will have a hand-lifted device that will positively lift the disk from its seat at least 1/16 inch when there is no pressure in the boiler. The seats and disks will be of noncorrosive material.

d. Safety valves for a steam boiler will be at least ½ inch unless the boiler and radiating surfaces consist of a self-contained unit. Safety valves will not be larger than 4½ inches. The inlet opening will have an inside diameter equal to or greater than the seat diameter.

e. The minimum relieving capacity of the valve or valves will be governed by the capacity marking on the boiler.

f. The minimum valve capacity in pounds per hour will be equal to the steam generation as specified in 481—subrules 92.6(9) and 92.6(10).

g. The safety valve capacity for each steam boiler will be such that with the fuel burning equipment operated at maximum capacity the pressure will not rise more than 5 percent above the maximum allowable working pressure.

h. When operating conditions are changed or additional boiler heating surface is installed, the valve capacity will meet the new conditions.

94.4(2) Steam gages.

a. Each steam boiler will have a steam gage or a compound steam gage connected to its steam space, its water column, or to its steam connection. The gage or connection will contain a siphon or equivalent device that will develop and maintain a water seal that will prevent steam from entering the gage tube. The connection will be so arranged that the gage cannot be shut off from the boiler except by a cock placed in the pipe at the gage and provided with a tee or lever-handle arranged to be parallel to the pipe in which it is located when the cock is open. The connections to the boiler will be not less than ¼-inch standard pipe size, but where steel or wrought-iron pipe or tubing is used, it will be not less than ½-inch standard pipe size. The minimum size of a siphon, if used, will be ¼-inch inside diameter. Ferrous and nonferrous tubing having inside diameters at least equal to that of standard pipe size listed above may be substituted for pipe.

b. The scale on the dial of a steam boiler gage will be graduated to not less than 30 psig nor more than 60 psig. The travel of the pointer from zero to 30 psig pressure will be at least 3 inches on a compound gage, and effective stops will be set at the limits of the gage readings on both the pressure and vacuum sides of the gage.

94.4(3) Water gage glasses.

a. Each steam boiler will have one or more water gage glasses attached to the water column or boiler by means of valved fittings not less than ½-inch pipe size with the lower fittings provided with a drain valve having an unrestricted drain opening not less than ¼-inch diameter to facilitate cleaning. Gage glass replacement will be possible under pressure. Water gage glass fittings may be attached directly to a boiler.

b. The lowest visible part of the water gage glass will be at least 1 inch above the lowest permissible water level recommended by the boiler manufacturer. With the boiler operating at this lowest permissible water level, there will be no danger of overheating any part of the boiler.

c. Transparent material other than glass may be used for the water gage provided that the material will remain transparent and has proved suitable for the pressure, temperature and corrosive conditions expected in service.

94.4(4) Water column and water level control pipes.

a. The minimum size of ferrous or nonferrous pipes connecting a water column to a steam boiler will be 1 inch. No outlet connections, except for damper regulator, feedwater regulator, steam gages or apparatus that does not permit the escape of any steam or water, except for manually operated blowdowns, will be attached to a water column or the piping connecting a water column to a boiler. If the water column, gage glass, low-water fuel cutoff or other water level control device is connected to the boiler by pipe and fittings, no shutoff valves of any type will be placed in such pipe, and a cross or equivalent fitting to which a drain valve and piping may be attached will be placed in the water piping connection at every right angle to facilitate cleaning. The water column drainpipe and valve will be not less than ¾-inch pipe size.

b. The steam connections to the water column of a horizontal firetube wrought boiler will be taken from the top of the shell or the upper part of the head, and the water connection will be taken from a point not above the center line of the shell. For a cast iron boiler, the steam connection to the water column will be taken from the top of an end section or the top of the steam header, and the water connections will be made on an end section not less than 6 inches below the bottom connection to the water gauge glass.

94.4(5) Pressure control.

a. In addition to the operating control for normal boiler operation, each individual, automatically fired steam heating boiler will have a high-limit, pressure-actuated combustion control that will cut off the fuel supply to prevent the pressure from rising over 15 psig. The separate controls may have a common connection to the boiler. Upon replacement of the high-limit, pressure-actuated combustion control, controls with manual reset will be installed.

b. In a multiple boiler installation where the operating pressure control may be installed in a header or other point common to all boilers and could be isolated from any or all of the boilers, there will be at least one high-limit, pressure-actuated combustion control mounted on each boiler.

c. No shutoff valve of any type will be placed in the connection to the high-limit, pressure-actuated control. The control or connections will contain a siphon or equivalent device that will develop and maintain a water seal that will prevent steam from entering the control. The connections to the boiler will not be less than ¼-inch standard pipe size, but where steel or wrought-iron pipe or tubing is used, the fittings will be not less than ½-inch standard pipe size. The minimum size of a siphon, if used, will be ¼-inch inside diameter. Ferrous and nonferrous tubing having inside diameters at least equal to that of standard pipe size listed above may be substituted for pipe where a manifold is used for a multiple control. The connection to the boiler will not be less than ¼-inch standard pipe size.

94.4(6) Automatic low-water fuel cutoff or water-feeding device.

a. Each automatically fired steam or vapor system boiler will have an automatic low-water fuel cutoff so located as to automatically cut off the fuel supply when the surface of the water falls to the lowest visible part of the water gage glass. If a water-feeding device is installed, it will be so constructed that the water inlet valve cannot feed water into the boiler through the float chamber and so located as to supply requisite feedwater.

b. A fuel cutoff or water-feeding device may be attached directly to a boiler or in the tapped openings available for attaching a water glass directly to a boiler. Connections in the tapped openings will be made to the boiler with nonferrous tees or "Ys" not less than ½-inch pipe size between the boiler and the water glass so that the water glass is attached directly and as closely as possible to the boiler. The run of the tee or "Y" will take the water glass fittings, and the side outlet or branch of the tee or "Y" will take the fuel cutoff or water-feeding device. The ends of all nipples will be reamed to full-size diameter.

c. Fuel cutoffs and water-feeding devices embodying a separate chamber will have a vertical straightway drainpipe and a blowoff valve not less than ¾-inch pipe size located at the lowest point in the water equalizing pipe connections so that the chamber and the equalizing pipe can be flushed and the device tested.

94.4(7) Stop valves for single steam heating boilers. When a stop valve is used in the supply pipe connection of a single steam boiler, there will be one used in the return pipe connection.

94.4(8) Stop valves for multiple steam heating boilers. A stop valve will be used in each supply and return pipe connection of two or more boilers connected to a common system.

[**ARC 8890C**, IAB 2/19/25, effective 3/26/25]

875—94.5(89) Hot water heating boilers installed before July 1, 1960—requirements. Hot water heating boilers installed before July 1, 1960, shall be constructed and installed in accordance with this rule.

94.5(1) Safety relief valves.

a. Each hot water heating boiler will have at least one safety relief valve bearing the National Board "HV" stamp of the automatic-resetting type set to relieve at or below the maximum allowable working pressure of the boiler. The safety relief valve will have pop action when tested by steam. When more than one safety relief valve is used on a hot water heating boiler, the additional valve or valves must bear the National Board "HV" stamp and may be set within a range not to exceed 6 psig above the maximum allowable working pressure of the boiler up to and including 60 psig and 5 percent for those having a maximum allowable working pressure exceeding 60 psig. Safety relief valves will be so arranged that they cannot be reset to relieve at a higher pressure.

b. No safety relief valve will be smaller than ¾-inch nor larger than 4½-inch standard pipe size, except those boilers having a heat input not greater than 15,000 Btu per hour may be equipped with a safety relief valve of ½-inch standard pipe size bearing the National Board "HV" stamp. The inlet opening will have an inside diameter equal to or greater than the seat diameter. In no case will the minimum opening through any part of the valve be less than ½-inch diameter.

94.5(2) Temperature and pressure gage.

a. Each hot water boiler will have a temperature and pressure gage properly calibrated to the altitude connected to it or to its flow connection in such a manner that it cannot be shut off from the boiler except by a cock with tee or lever handle placed on the pipe near the gage. The handle of the cock will be parallel to the pipe in which it is located when the cock is open.

b. The scale on the dial of the temperature and pressure gage will be graduated approximately to not less than one and one-half nor more than three times the pressure at which the safety relief valve is set. The gage will be provided with effective stops for the indicating pointer at the zero point and at the maximum pressure point.

c. The temperature gage will be so located and connected that it will be easily readable. The thermometer will be so located that it will at all times indicate the temperature in degrees Fahrenheit of the water in the boiler at or near the outlet.

d. Piping or tubing for temperature and pressure gage connections will be of nonferrous metal when smaller than 1-inch pipe size.

94.5(3) Temperature control.

a. In addition to the operating control used for normal boiler operation, each individual, automatically fired hot water boiler will have a separate high-limit, temperature-actuated combustion control that will cut off the fuel supply to prevent the temperature of the water from rising over 250 degrees F. Separate controls may have a common connection to the boiler.

b. In a multiple boiler installation where the operating temperature actuated control may be installed in a header or other point common to all boilers and can be isolated from any or all of the boilers, there will be at least one high-limit, temperature-actuated combustion control mounted on each boiler.

94.5(4) Stop valves.

a. On single hot water heating boilers, stop valves will be located at an accessible point in the supply and return pipe connections as near the boiler nozzle as is convenient and practicable to permit draining the boiler without emptying the system.

b. Where two or more boilers are connected in a common system, a stop valve will be used in each boiler's supply and return pipe connection.

94.5(5) Provisions for thermal expansion in hot water heating system.

a. All hot water heating systems incorporating hot water tanks or fluid relief columns will be so installed as to prevent freezing under normal operating conditions.

b. Systems with open expansion tanks require an indoor overflow from the upper portion of the expansion tank in addition to an open vent. The indoor overflow is to be carried within the building to a suitable plumbing fixture or to the basement.

c. An expansion tank adequate for the volume and capacity of the system will be installed. If the system is designed for a working pressure of 30 psi or less, the tank will be suitably designed for a

minimum hydrostatic test pressure of 75 psi. Expansion tanks for systems designed to operate above 30 psi will be constructed in accordance with ASME Code, Section VIII, Division I, in effect when installed. Provisions will be made for draining the tank without emptying the system, except for prepressurized tanks.

d. The expansion tank capacities for gravity hot water heating systems will be as follows:

Sq. Ft. of Installed Equivalent Direct Radiation	Tank Capacity, Gallons
Up to 350	18
Up to 450	21
Up to 650	24
Up to 900	30
Up to 1,100	35
Up to 1,400	40
Up to 1,600	2-30
Up to 1,800	2-30
Up to 2,000	2-35
Up to 2,400	2-40
2,400 and up	1 additional gallon per 33 square feet of additional equivalent direction radiation

e. The expansion tank capacities for forced hot water heating systems will be based on an average operating water temperature of 195 degrees F, a fill pressure of 12 psig, and a maximum operating pressure of 30 psig as follows:

System Volume, Gallons	Tank Capacity, Gallons
100	15
200	30
300	45
400	60
500	75
1,000	150
2,000	300

In calculating, include the volume of water in boiler, radiation and piping but not the expansion tank.
[**ARC 8890C**, IAB 2/19/25, effective 3/26/25]

875—94.6(89) Hot water supply boilers installed before July 1, 1960—requirements.

94.6(1) *Scope.* This rule establishes minimum requirements for installation, operation, and inspection of hot water supply boilers installed before July 1, 1960, when any of the following limitations are exceeded:

a. Heat input of 200,000 Btu per hour.

b. Water temperature of 210 degrees F.

c. A water containing capacity of 120 gallons.

94.6(2) *Safety relief valves.* Each hot water supply boiler must have at least one pressure and temperature relief valve bearing the National Board "HV" stamp installed on the hot water outlet line.

94.6(3) *Safety valves and safety relief valves for tanks and heat exchangers.*

a. When a hot water supply vessel is heated indirectly by steam in a coil or pipe, the pressure of the steam used will not exceed the safe working pressure of the tank. A safety relief valve at least 1 inch in diameter will be installed on the tank and will be set to relieve at or below the maximum allowable working pressure of the tank.

b. When water over 160 degrees F is circulated through the coils or tubes of a heat exchanger to warm the water for space heating or hot water supply, the heat exchanger will be equipped with one or more safety relief valves bearing the National Board "HV" stamp of sufficient rated capacity to prevent the heat exchanger pressure from rising more than 10 percent above the maximum allowable working pressure of the vessel. The valves will be set to relieve at or below the maximum allowable working pressure of the heat exchanger.

c. When water over 160 degrees F is circulated through the coils or tubes of a heat exchanger to generate low-pressure steam, the heat exchanger will be equipped with one or more safety valves bearing the National Board "HV" stamp of sufficient rated capacity to prevent the heat exchanger pressure from rising more than 5 psig above the maximum allowable working pressure of the vessel. The valves will be set to relieve at a pressure not to exceed 15 psig.

94.6(4) *Gages.* Temperature and pressure gages will be installed in accordance with 94.5(2).

94.6(5) *Temperature controls.* Temperature controls will be installed in accordance with 94.5(3).

94.6(6) *Stop valves.*

a. Stop valves will be placed in the supply and return pipe connections of a single hot water supply boiler installation to permit draining the boiler without emptying the system.

b. Where two or more boilers are connected in a common system, a stop valve will be used in each boiler's supply and return pipe connection.

94.6(7) *Thermal expansion.* If a system is equipped with a check valve or pressure-reducing valve in the cold water inlet line, an airtight expansion tank or other suitable air cushion will be installed. When an expansion tank is provided, it will be constructed in accordance with the ASME Code, Section VIII, Division 1, in effect when installed, for a maximum allowable working pressure equal to or greater than the water heater. Except for prepressurized tanks, provisions will be made for draining the tank without emptying the system.

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