

CHAPTER 45-12-09
HEATING, LOW PRESSURE, AND HOT WATER SUPPLY BOILERS - EXISTING
INSTALLATIONS

Section

45-12-09-01	American Society of Mechanical Engineers Code Boilers
45-12-09-02	Nonstandard Riveted Boilers
45-12-09-03	Nonstandard Welded Boilers
45-12-09-04	Nonstandard Cast Iron Boilers
45-12-09-05	Fired Radiators
45-12-09-06	General
45-12-09-07	Pressure-Relieving Devices
45-12-09-08	Steam Pressure Gauge
45-12-09-09	Water Gauge Glasses
45-12-09-10	Stop Valves and Check Valves
45-12-09-11	Feedwater Connections
45-12-09-12	Pressure or Altitude Gauges
45-12-09-13	Thermometers
45-12-09-14	Temperature Control
45-12-09-14.1	Pressure Control
45-12-09-15	Provisions for Thermal Expansion in Hot Water Systems
45-12-09-16	Return Pump
45-12-09-17	Repairs and Renewals of Fittings and Appliances
45-12-09-18	Low-Water Fuel Cutoff
45-12-09-19	Modular Hot Water Heating Boilers
45-12-09-20	Bottom Blowoff and Drain Valves
45-12-09-21	Emergency Shutoff Switches

45-12-09-01. American Society of Mechanical Engineers Code boilers.

The maximum allowable working pressure of a boiler built in accordance with the American Society of Mechanical Engineers Code may not exceed the pressure indicated by the manufacturer's identification stamped or cast upon the boiler or upon a plate secured to it.

History: Effective June 1, 1994.

General Authority: NDCC 26.1-22.1-14

Law Implemented: NDCC 26.1-22.1-14

45-12-09-02. Nonstandard riveted boilers.

The maximum allowable working pressure on the shell of a noncode riveted heating boiler must be determined in accordance with section 45-12-05-01 except that the maximum allowable working pressure of a steam heating boiler may not exceed fifteen pounds [103 kilopascals] and a hot water boiler may not exceed thirty pounds [206.85 kilopascals] at a temperature not exceeding two hundred fifty degrees Fahrenheit [120 degrees Celsius].

History: Effective June 1, 1994.

General Authority: NDCC 26.1-22.1-14

Law Implemented: NDCC 26.1-22.1-14

45-12-09-03. Nonstandard welded boilers.

The maximum allowable working pressure of a noncode steel or wrought iron heating boiler of welding construction may not exceed fifteen pounds [103 kilopascals]. For other than steam service, the maximum allowable working pressure must be calculated in accordance with section IV of the American Society of Mechanical Engineers Code.

History: Effective June 1, 1994.

General Authority: NDCC 26.1-22.1-14

Law Implemented: NDCC 26.1-22.1-14

45-12-09-04. Nonstandard cast iron boilers.

1. The maximum allowable working pressure of a noncode boiler composed principally of cast iron may not exceed fifteen pounds [103 kilopascals] for steam service or thirty pounds [206.85 kilopascals] for hot water service.
2. The maximum allowable working pressure of a nonstandard boiler having cast iron shell or heads and steel or wrought iron tubes may not exceed fifteen pounds [103 kilopascals] for steam service or thirty pounds [206.85 kilopascals] for water service.

History: Effective June 1, 1994.

General Authority: NDCC 26.1-22.1-14

Law Implemented: NDCC 26.1-22.1-14

45-12-09-05. Fired radiators.

A radiator in which steam pressure is generated at a pressure of fifteen pounds [103 kilopascals] or less is considered a low pressure boiler.

History: Effective June 1, 1994.

General Authority: NDCC 26.1-22.1-14

Law Implemented: NDCC 26.1-22.1-14

45-12-09-06. General.

If in the judgment of the inspector, a boiler is unsafe for operation at the pressure previously approved, the pressure must be reduced, proper repair made, or the boiler retired from service.

History: Effective June 1, 1994; amended effective January 1, 2014.

General Authority: NDCC 26.1-22.1-14

Law Implemented: NDCC 26.1-22.1-14

45-12-09-07. Pressure-relieving devices.

1. Safety valve requirements for steam boilers are:
 - a. Each steam boiler must have one or more American society of mechanical engineers approved safety valves of the spring-pop type adjusted and sealed to discharge at a pressure not to exceed fifteen pounds per square inch [103 kilopascals]. Seals must be attached in a manner to prevent the valve from being taken apart without breaking the seal. The safety valves must be arranged so that they cannot be reset to relieve at a higher pressure than the maximum allowable working pressure of the boiler. For iron-and-steel-bodied valves exceeding two-inch [50.8-millimeter] pipe size, the drain hole or holes must be tapped not less than three-eighths-inch [9.53-millimeter] pipe size.
 - b. Each safety valve three-fourths inch [10.05 millimeters] diameter or over used on a steam boiler must have a substantial device that will positively lift the disk from its seat at least one-sixteenth inch [1.59 millimeters] when there is no pressure in the boiler. The seats and disks must be of suitable material to resist corrosion.
 - c. A safety valve for a steam boiler may not be smaller than three-fourths inch [19.05 millimeters] unless the boiler and radiating surfaces consist of a self-contained unit. A

safety valve may not be larger than four and one-half inches [114.3 millimeters]. The inlet opening must have an inside diameter equal to, or greater than, the seat diameter.

- d. The minimum relieving capacity of valve or valves is governed by the capacity marking on the boiler.
- e. The minimum valve capacity in pounds per hour is the greater of that determined by dividing the maximum British thermal units output at the boiler nozzle obtained by the firing of any fuel for which the unit is installed by one thousand, or is determined on the basis of the pounds of steam generated per hour per square foot of boiler heating surface. (One British thermal unit equals 1.055×10^6 joules.)

MINIMUM POUNDS OF STEAM PER HOUR
PER SQUARE FOOT OF HEATING SURFACE

	Firetube Boilers	Watertube Boilers
Boiler Heating Surface		
Hand-fired	5	6
Stoker-fired	7	8
Oil, gas, or pulverized fuel-fired	8	10

- f. Safety valves must be installed with the valve spindle in the vertical position. Discharge piping, to a safe location, may be required by the inspector.
2. When a boiler is fired only by a gas having a heat value not in excess of two hundred British thermal units per cubic feet [745.58×10^6 joules per cubic meter], the minimum safety valve or safety relief valve relieving capacity may be based on the values given for hand-fired boilers above.
 3. The safety valve or safety relief valve relieving capacity for electric boilers is three and one-half pounds [3692.5 joules] per hour per kilowatt input.
 - a. The safety valve capacity for each steam boiler must be such that with the fuel-burning equipment installed and operated at maximum capacity the pressure cannot rise more than five pounds per square inch [34.47 kilopascals] above the maximum allowable working pressure.
 - b. When operating conditions are changed, or additional boiler heating surface is installed, the valve capacity must be increased, if necessary, to meet the new conditions, the additional valves required, on account of changed conditions, may be installed on the outlet piping provided there is no intervening valve.
 4. Safety relief valve requirements for hot water boilers are:
 - a. Each hot water heating boiler must have at least one American society of mechanical engineers approved pressure relief valve set to relieve at or below the maximum allowable working pressure of the boiler. Each hot water supply boiler must have at least one officially rated safety relief valve or at least one American society of mechanical engineers approved pressure-temperature relief valve of the automatic-reseating type set to relieve at or below the maximum allowable working pressure of the boiler. Pressure relief valves officially rated as to capacity must have pop action when tested by steam. When more than one safety relief valve is used on either hot water heating or hot water supply boilers, the additional valve or valves must be officially rated and may be set within a range not to exceed six pounds per square inch [41.47 kilopascals] above the

maximum allowable working pressure of the boiler up to and including sixty pounds per square inch [413.69 kilopascals] and ten percent for those having a maximum allowable working pressure exceeding sixty pounds per square inch [413.69 kilopascals]. Safety relief valves must be spring loaded without disk guides on the pressure side of the valve. Safety relief valves must be arranged so that they cannot be reset to relieve at a higher pressure than the maximum permitted by this subdivision.

- b. Each safety relief valve must have a substantial device that will positively lift the disk from its seat at least one-sixteenth inch [1.59 millimeters] when there is no pressure on the boiler.
- c. Materials subject to deterioration or vulcanization when subject to saturated steam temperature corresponding to capacity test pressure may not be used for any part.
- d. A safety relief valve may not be smaller than three-fourths inch [19.05 millimeters] nor larger than four and one-half-inch [114.3-millimeter] standard pipe size, except that boilers having a heat input not greater than fifteen thousand British thermal units per hour [15.38 x 10 to the 7th power joules] may be equipped with a rated safety relief valve of one-half-inch [12.7-millimeter] standard pipe size. The inlet opening must have an inside diameter approximately equal to, or greater than, the seat diameter. The minimum opening through any part of the valve may not be less than one-fourth inch [6.35 millimeters] diameter or its equivalent area.
- e. The required steam-relieving capacity, in pounds per hour, of the pressure-relieving device or devices on a boiler must be determined by dividing the maximum output in British thermal units at the boiler nozzle obtained by the firing of any fuel for which the unit is designed by one thousand or by multiplying the square feet of heating surface by five. In every case, the requirements of subdivision g must be met. (One British thermal unit equals 1.055 x 10 to the 3rd power joules.)
- f. When operating conditions are changed, or additional boiler heating surface is installed, the valve capacity must be increased, if necessary, to meet the new conditions and be in accordance with subdivision g. The additional valves required, on account of changed conditions, may be installed on the outlet piping provided there is no intervening valve.
- g. Safety relief valve capacity for each boiler must be such that with maximum heat input the pressure cannot rise more than six pounds per square inch [41.37 kilopascals] above the maximum allowable working pressure for pressures up to and including sixty pounds per square inch [413.69 kilopascals] and ten percent for maximum allowable working pressures over sixty pounds per square inch [413.69 kilopascals].
- h. Safety relief valves must be installed with the spindle in the vertical position. Discharge piping, to a safe location, must be installed.

History: Effective June 1, 1994.

General Authority: NDCC 26.1-22.1-14

Law Implemented: NDCC 26.1-22.1-14

45-12-09-08. Steam pressure gauge.

1. Each steam boiler must have a steam gauge or a compound steam gauge connected to its steam space or to its water column or to its steam connections. The gauge or connection must contain a siphon or equivalent device that will develop and maintain a water seal that will prevent steam from entering the gauge tube. The connection must be arranged so that the gauge cannot be shut off from the boiler except by a cock placed in the pipe at the gauge and provided with a tee or a lever handle arranged to be parallel to the pipe in which it is located

when the cock is open. The connections to the boiler must be not less than one-fourth-inch [6.35-millimeter] standard pipe size, but where steel or wrought iron pipe or tubing is used, they must be not less than one-half-inch [12.7-millimeter] standard pipe size. The minimum size of a siphon, if used, must be one-fourth inch [6.35 millimeters] inside diameter. Ferrous and nonferrous tubing having inside diameters at least equal to that of standard pipe sizes listed above may be substituted for pipe.

2. The scale on the dial of a steam boiler gauge must be graduated to not less than thirty pounds per square inch [206.84 kilopascals] nor more than sixty pounds per square inch [413.69 kilopascals]. The gauge must be provided with effective stops for the indicating pointer at the zero point and at the maximum pressure point. The travel of the pointer from zero to thirty pounds per square inch [206.84 kilopascals] pressure must be at least three inches [76.2 millimeters]. On a compound gauge, effective stops must be set at the limits of the gauge readings on both the pressure and vacuum sides of the gauge.

History: Effective June 1, 1994.

General Authority: NDCC 26.1-22.1-14

Law Implemented: NDCC 26.1-22.1-14

45-12-09-09. Water gauge glasses.

1. Each steam boiler must have one or more water gauge glasses attached to the water column or boiler by means of valved fittings not less than one-half-inch [12.70-millimeter] pipe size, with the lower fitting provided with a drain valve of the straight type with opening not less than one-fourth inch [6.35 millimeters] diameter to facilitate cleaning. Gauge glass replacement must be possible under pressure. Water glass fittings may be attached directly to a boiler.
2. The lowest visible part of the water gauge glass must be at least one inch [25.4 millimeters] above the lowest permissible water level recommended by the boiler manufacturer. With the boiler operating at this lowest permissible water level, there must be no danger of overheating any part of the boiler. Transparent material other than glass may be used for the water gauge provided that the material will remain transparent and has proved suitable for the pressure, temperature, and corrosive conditions expected in service.

History: Effective June 1, 1994.

General Authority: NDCC 26.1-22.1-14

Law Implemented: NDCC 26.1-22.1-14

45-12-09-10. Stop valves and check valves.

1. If a steam boiler may be closed off from the heating system by closing a steam stop valve, there must be a check valve in the condensate return line between the boiler and the system.
2. If any part of a steam heating system may be closed off from the remainder of the system by closing a steam stop valve, there must be a check valve in the condensate return pipe from that part of the system.
3. If more than one boiler is connected to a system, they must each be equipped with main stops on the discharge and return side, in such a manner not affecting operation of any other boiler.
4. When single boilers are located above the system and can be drained without draining the system, stop valves are optional.

History: Effective June 1, 1994.

General Authority: NDCC 26.1-22.1-14

Law Implemented: NDCC 26.1-22.1-14

45-12-09-11. Feedwater connections.

1. Feedwater connections must be independent of any water gauge connections and be made to the condensate return pipe or reservoir of the condensate return tank.
2. Alternatively, makeup water or water treatment may be introduced through an independent connection. The water flow from the independent connection may not discharge directly against parts of the boiler exposed to direct radiant heat from the fire. Makeup water or water treatment may not be introduced through openings or connections provided for inspection or cleaning, safety valve, safety relief valve, blowoff, water column, water gauge glass, pressure gauge, or temperature gauge.
3. When there is more than one boiler connected to a system, each boiler must have an independent feedwater line.
4. There must be a stop valve and a check valve in the feedwater line at the boiler. For hot water heating boilers, the check valve must be a backflow preventer approved by the state plumbing board.
5. Hot water heating boilers, not equipped with an approved low-water fuel cutoff, must be equipped with an automatic feeding device or pressure reducing valve method of feeding, in addition to a manual bypass capable of feeding the boiler at a pressure of six percent above safety relief valve setting.

History: Effective June 1, 1994; amended effective January 1, 2000; October 1, 2002; July 1, 2012; January 1, 2014.

General Authority: NDCC 26.1-22.1-14

Law Implemented: NDCC 26.1-22.1-14

45-12-09-12. Pressure or altitude gauges.

1. Each hot water boiler must have a pressure or altitude gauge 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 gauge. The handle of the cock must be parallel to the pipe in which it is located when the cock is open.
2. The scale on the dial of the pressure or altitude gauge must be graduated to not less than one and one-half nor more than three and one-half times the pressure at which the safety relief valve is set. The gauge must be provided with effective stops for the indicating pointer at the zero point and at the maximum pressure point.
3. Piping or tubing for pressure or altitude gauge connections must be of nonferrous metal when smaller than one-inch [25.4-millimeter] pipe size.

History: Effective June 1, 1994; amended effective January 1, 2000.

General Authority: NDCC 26.1-22.1-14

Law Implemented: NDCC 26.1-22.1-14

45-12-09-13. Thermometers.

Each hot water boiler must have a thermometer located and connected so that it is easily readable when observing the water pressure or altitude. The thermometer must be located so that it will at all times indicate the temperature in degrees Fahrenheit [Celsius] of the water in the boiler at or near the outlet.

History: Effective June 1, 1994.

General Authority: NDCC 26.1-22.1-14

Law Implemented: NDCC 26.1-22.1-14

45-12-09-14. Temperature control.

Each automatically fired hot water boiler must be protected from over temperature by two temperature-operated controls.

1. Each individual automatically fired water boiler must have a safety limit control that will cut off the fuel supply to prevent water temperature from exceeding the maximum allowable temperature at the boiler outlet. The water temperature safety control must be constructed to prevent a temperature setting above the maximum allowable temperature and be of the manual reset type.
2. Each individual hot water boiler or each system of commonly connected boilers without intervening valves must have a control that will cut off the fuel supply when the water temperature reaches an operating limit, which must be less than the maximum allowable temperature.

History: Effective June 1, 1994; amended effective January 1, 2000; January 1, 2006.

General Authority: NDCC 26.1-22.1-14

Law Implemented: NDCC 26.1-22.1-14

45-12-09-14.1. Pressure control.

Each automatically fired steam boiler must be protected from overpressure by two pressure-operated controls.

1. Each automatically fired steam boiler must have a safety limit control that will cut off the fuel supply to prevent steam pressure from exceeding the fifteen pounds per square inch [103 kilopascals] maximum allowable working pressure of the boiler. Each control must be constructed to prevent a pressure setting above fifteen pounds per square inch [103 kilopascals] and be of the manual reset type.
2. Each individual steam boiler or each system of commonly connected steam boilers must have a control that will cut off the fuel supply when the pressure reaches an operating limit, which must be less than the maximum allowable pressure.
3. Shutoff valves of any type may not be placed in the steam pressure connection between the boiler and the controls described in subsections 1 and 2. These controls must be protected with a siphon or equivalent means of maintaining a water seal that will prevent steam from entering the control.

History: Effective June 1, 1994; amended effective January 1, 2006.

General Authority: NDCC 26.1-22.1-14

Law Implemented: NDCC 26.1-22.1-14

45-12-09-15. Provisions for thermal expansion in hot water systems.

1. All hot water heating systems incorporating hot water tanks or fluid relief columns must be so installed as to prevent freezing under normal operating conditions.
2. Systems with open expansion tank. If the system is equipped with an open expansion tank, an indoor overflow from the upper portion of the expansion tank must be provided in addition to an open vent, the indoor overflow to be carried within the building to a suitable plumbing fixture or to the basement.

3. Closed-type systems. If the system is of the closed type, an airtight tank or other suitable air cushion must be installed that will be consistent with the volume and capacity of the system, and must be suitably designed for a hydrostatic test pressure of two and one-half times the allowable working pressure of the system. Expansion tanks for systems designed to operate above thirty pounds per square inch [206.85 kilopascals] must be constructed in accordance with the American Society of Mechanical Engineers Code, section VIII, division 1. Except for prepressurized tanks, provisions must be made for draining the tank without emptying the system. Provisions must also be made for changing of all tanks without emptying the system.
4. Expansion tank capacities for gravity hot water systems. Based on two-pipe system with average operating water temperature one hundred seventy degrees Fahrenheit [76.7 degrees Celsius], using cast iron column radiation with heat emission rate one hundred fifty British thermal units per hour per square foot [158.25 x 10 to the 3rd power joules per .0929 square meter] equivalent direct radiation.

Square Feet 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

5. Expansion tank capacities for forced hot water systems. Based on average operating water temperature one hundred ninety-five degrees Fahrenheit [90 degrees Celsius], a fill pressure twelve pounds per square inch gauge [82.74 kilopascals] and a maximum operating pressure thirty pounds per square inch gauge [206.84 kilopascals].

System Volume, Gallons	Nonpressurized Tank Capacity Gallons	Prepressurized Tank Capacity Gallons
100	15	9
200	30	17
300	45	25
400	60	33
500	75	42
1,000	150	83
2,000	300	165

Note: System volume includes volume of water in boiler, radiation, and piping, not including the expansion tank.

6. Expansion tanks for hot water supply systems must be constructed in accordance with the American society of mechanical engineers code, section VIII, division 1 if over five gallons in size of water and air.

History: Effective June 1, 1994; amended effective January 1, 2016.

General Authority: NDCC 26.1-22.1-14

Law Implemented: NDCC 26.1-22.1-14

45-12-09-16. Return pump.

Each condensate return pump where practicable must be provided with an automatic water level control set to maintain the water level within the limits of two gauge cocks.

History: Effective June 1, 1994.

General Authority: NDCC 26.1-22.1-14

Law Implemented: NDCC 26.1-22.1-14

45-12-09-17. Repairs and renewals of fittings and appliances.

Whenever repairs are made to fittings or appliances or it becomes necessary to replace them, all work must comply with all requirements for new installations.

History: Effective June 1, 1994.

General Authority: NDCC 26.1-22.1-14

Law Implemented: NDCC 26.1-22.1-14

45-12-09-18. Low-water fuel cutoff.

1. Each automatically fired hot water heating boiler must have an automatic low-water fuel cutoff that has been designed for hot water service and which can be tested without draining the system or the boiler. It must be so located as to automatically cut off the fuel supply prior to the surface of the water falling below the lowest safe water level as established by the boiler manufacturer.
2. A coil-type or watertube boiler requiring forced circulation to prevent overheating of the coils or tubes must have a flow-sensing device installed in the boiler or piping in lieu of the required low-water fuel cutoff that will cut off the fuel supply when the circulation flow is interrupted. Functioning of the low-water fuel cutoff due to a low water condition must cause safety shutdown and lockout. Where a reset device is separate from the low-water fuel cutoff, a means shall be provided to indicate actuation of the low-water fuel cutoff. The manual reset may be the instantaneous type, or may include a time delay of not more than three minutes after the fuel has been cut off.
3. Low-water fuel cutoff requirements for steam boilers are addressed by section 45-12-03-07.

History: Effective June 1, 1994; amended effective January 1, 2006.

General Authority: NDCC 26.1-22.1-14

Law Implemented: NDCC 26.1-22.1-14

45-12-09-19. Modular hot water heating boilers.

1. Individual modules must be limited to a maximum input of four hundred thousand British thermal units [4.22 x 10 to the 8th power joules] per hour (gas), three gallons [11.36 liters] per hour (oil), or one hundred fifteen kilowatt-hours (electricity).
2. Each module of a modular hot water heating boiler must be equipped with the following:
 - a. Pressure/altitude gauge (see section 45-12-09-12).

- b. Thermometer (see section 45-12-09-13).
 - c. Operating temperature control (see subsection 2 of section 45-12-09-14).
 - d. Safety relief valve (see section 45-12-09-07).
 - e. Drain valve (see section 45-12-09-20).
3. The assembled modular hot water heating boiler must be equipped with the following:
- a. High-limit temperature control (see subsection 1 of section 45-12-09-14).
 - b. Low-water fuel cutoff (see section 45-12-09-18).
 - c. Makeup feedwater connection (see section 45-12-09-11).
 - d. Expansion tank provisions (see section 45-12-09-15).
 - e. Stop valves (see section 45-12-09-10).

History: Effective June 1, 1994; amended effective October 1, 2002.

General Authority: NDCC 26.1-22.1-14

Law Implemented: NDCC 26.1-22.1-14

45-12-09-20. Bottom blowoff and drain valves.

1. Each steam boiler having a capacity over twenty-five gallons [94.6 liters] must have a bottom blowoff connection fitted with a valve or cock connected to the lowest water space practicable with a minimum size as shown below:

Minimum Required Safety Valve Capacity in Pounds of Steam/Hour				Steam Boiler Blowoff Piping Valve Size, Inches (Min.)
Up	to	500		3/4
501	to	1,250		1
1,251	to	2,500		1 1/4
2,501	to	6,000		1 1/2
6,001	and	larger		2

2. Each hot water boiler and each steam boiler having a capacity not exceeding twenty-five gallons [94.6 liters] must have a drain valve connected to the lowest water space practicable. The minimum size of this drain valve is three-quarter inch [1.9 centimeters].

History: Effective June 1, 1994.

General Authority: NDCC 26.1-22.1-14

Law Implemented: NDCC 26.1-22.1-14

45-12-09-21. Emergency shutoff switches.

- 1. A manually operated emergency shutoff switch or circuit breaker must be located just outside the boiler room door and marked for easy identification. Consideration should be given to the type and location of the switch to safeguard against tampering. If the boiler room door is on the building exterior, the switch must be located just inside the door. If there is more than one door to the boiler room, there must be a switch located at each door.
- 2. The emergency switch or circuit breaker must disconnect all power to the burner controls.

3. This requirement is limited to single and modular boilers exceeding 400,000 Btu/hr input installed after January 1, 2006.

History: Effective January 1, 2006.

General Authority: NDCC 26.1-22.1-14

Law Implemented: NDCC 26.1-22.1-14