

CHAPTER 45-12-05

POWER BOILERS - EXISTING INSTALLATIONS

Section

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45-12-05-01. Maximum allowable working pressure for standard boilers.

The maximum allowable working pressure for standard boilers must be determined in accordance with the applicable provisions of the edition of the American Society of Mechanical Engineers Code under which they were constructed and stamped.

History: Effective June 1, 1994.

General Authority: NDCC 26.1-22.1-14

Law Implemented: NDCC 26.1-22.1-14

45-12-05-02. Maximum allowable working pressure for nonstandard boilers.

1. The maximum allowable working pressure on the shell of a nonstandard boiler must be determined by the strength of the weakest section of the structure, computed from the thickness of the plate, the tensile strength of the plate, the efficiency of the longitudinal joint or tube ligaments, the inside diameter of the weakest course and the factor of safety allowed by this article.

$\frac{TS \cdot E}{RFS}$ = Maximum allowable working pressure, per square inch gauge where:

TS = Ultimate tensile strength of shell plates per square inch

t = Minimum thickness of shell plate, in weakest course, inches

E = Efficiency of longitudinal joint:

For tube ligaments and riveted construction, E shall be determined by the rules given in section I, part PR, of the American Society of Mechanical Engineers Code for power boilers. For seamless construction, E shall be considered one hundred percent.

R = Inside radius of the weakest course of the shell, in inches

FS = Factor of safety permitted

2. When the tensile strength of steel or wrought iron shell plate is not known, it must be taken as fifty-five thousand pounds per square inch [386.11 megapascals] for steel and forty-five thousand pounds per square inch [310.26 megapascals] for wrought iron.
3. The resistance to crushing of mild steel must be taken at ninety-five thousand pounds per square inch [655 megapascals] of the cross-sectional area.
4. When computing the ultimate strength of rivets in shear, the following values, in pounds per square inch [megapascals] of the cross-sectional area of the rivet shank must be used:

	POUNDS PER SQUARE INCH	MEGAPASCALS
Iron rivets in single shear	38,000	262.00
Iron rivets in double shear	76,000	524.00
Steel rivets in single shear	44,000	303.37
Steel rivets in double shear	88,000	606.69

When the diameter of the rivet holes in the longitudinal joints of a boiler is not known, the diameter and cross-sectional area of rivets, after driving, may be selected from the following table, or as ascertained by cutting out one rivet in the body of the joint.

SIZES OF RIVETS BASED ON PLATE THICKNESS

Thickness of plate, inches	1/4	9/32	5/16	11/32	3/8	13/32
Diameter of rivet after driving, inches	11/16	11/16	3/4	3/4	13/16	13/16
Thickness of plate, inches	7/16	15/32	1/2	9/16	5/8	
Diameter of rivet after driving, inches	15/16	15/16	15/16	1-1/16	1-1/16	

5. The following factors of safety must be increased by the inspector if the condition and safety of the boiler demand it:

The lowest factor of safety permissible on existing installations is four, except for horizontal-return-tubular boilers having continuous longitudinal lap seams more than twelve feet [3.66 meters] in length, when the factor of safety is eight; when this latter type boiler is removed from its existing setting, it may not be reinstalled for pressures in excess of fifteen pounds per square inch gauge [103 kilopascals].

Reinstalled or secondhand boilers must have a minimum factor of safety of six when the longitudinal seams are of lap-riveted construction, and a minimum factor of safety of five when the longitudinal seams are of butt-and-double-strap construction. Steam traction engines must be considered as secondhand boilers for purposes of determining their factors of safety.

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

General Authority: NDCC 26.1-22.1-14

Law Implemented: NDCC 26.1-22.1-14

45-12-05-03. Age limit of existing boilers.

1. The age limit of any boiler of nonstandard construction is thirty years except that after a thorough internal and external inspection and a hydrostatic pressure test of one and one-half times the allowable working pressure held for a period of at least thirty minutes during which no distress or leakage develops, any boiler having other than a lap-riveted longitudinal joint may be continued in operation without reduction in working pressure. The age limit of any boiler having lap-riveted longitudinal joints and operating at a pressure in excess of fifty pounds per square inch [344.74 kilopascals] is twenty years; this type of boiler, when removed from an existing setting, may not be reinstalled for a pressure in excess of fifteen pounds per square inch [103 kilopascals]. A reasonable time for replacement, not to exceed one year, may be given at the discretion of the chief boiler inspector.
2. The shell or drum of a boiler in which a typical lap seam crack is discovered along a longitudinal riveted joint for either butt seam or lap joints must be permanently discontinued for use under steam pressure. "Lap seam crack" means the typical crack frequently found in lap seams extending parallel to the longitudinal joint and located either between or adjacent to rivet holes.
3. The age limit of boilers of standard construction installed prior to the date this law becomes effective is dependent on thorough internal and external inspection and hydrostatic pressure test of one and one-half times the allowable working pressure for a period of thirty minutes. If the boiler under these test conditions exhibits no distress or leakage, it may be continued in operation at the same working pressure.

History: Effective June 1, 1994.

General Authority: NDCC 26.1-22.1-14

Law Implemented: NDCC 26.1-22.1-14

45-12-05-04. Welded boilers.

Boilers that have either longitudinal or circumferential seams of fusion welded construction must have been constructed and stamped in accordance with the rules and regulations of the American Society of Mechanical Engineers Code or must have the standard stamping of another state that has adopted a standard of construction equivalent to the standards 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

45-12-05-05. Pressure on old boilers.

The maximum working pressure of an old boiler may not be increased to a greater pressure than would be allowed for a new boiler of the same construction.

History: Effective June 1, 1994.

General Authority: NDCC 26.1-22.1-14

Law Implemented: NDCC 26.1-22.1-14

45-12-05-06. Cast iron headers and mud drums.

The maximum allowable working pressure on a watertube boiler, the tubes of which are secured to a cast iron or malleable iron header, or which have cast iron mud drums, may not exceed one hundred sixty pounds per square inch gauge [1103.17 kilopascals].

History: Effective June 1, 1994.

General Authority: NDCC 26.1-22.1-14

Law Implemented: NDCC 26.1-22.1-14

45-12-05-07. Pressure on cast iron boilers.

The maximum allowable working pressure for any cast iron boiler, except hot water boilers, is fifteen pounds per square inch gauge [103 kilopascals].

History: Effective June 1, 1994.

General Authority: NDCC 26.1-22.1-14

Law Implemented: NDCC 26.1-22.1-14

45-12-05-08. Safety valves and safety relief valves.

Safety valves and safety relief valves must meet the requirements of the edition of the American Society of Mechanical Engineers Code, section 1, referenced in this article or the requirements of the edition of the American Society of Mechanical Engineers Code, section 1, to which the boiler they are installed was constructed.

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

45-12-05-09. Superheater safety valve requirements.

Superheater safety valves must meet the requirements of the edition of the American Society of Mechanical Engineers Code section referenced in this article or the requirements of the edition of the American Society of Mechanical Engineers Code section to which the superheater they are installed was constructed.

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

45-12-05-10. Capacity.

The minimum safety valve or safety relief valve relieving capacity for all high-pressure boilers other than steam traction engines must be determined by the edition of the American Society of Mechanical Engineers Code, section 1, referenced in this article or by the requirements of the American Society of Mechanical Engineers Code, section 1, to which the boiler they are installed was constructed.

The minimum safety valve relieving capacity for steam traction engines must be determined using the edition of the National Board Inspection Code referenced in this article.

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

45-12-05-11. Mounting.

The mounting of safety valves and safety relief valves must meet the requirements of the edition of the American Society of Mechanical Engineers Code, section 1, referenced in this article or by the requirements of the edition of the American Society of Mechanical Engineers Code, section 1, to which the boiler they are installed was constructed.

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

45-12-05-12. Operation.

The operation of safety valves and safety relief valves must meet the requirements of the edition of the American Society of Mechanical Engineers Code, section 1, referenced in this article or by the requirements of the edition of the American Society of Mechanical Engineers Code, section 1, to which the boiler they are installed was constructed.

If the operating conditions of a valve are changed so as to require a new spring for a different pressure, the valve must be adjusted by the manufacturer, the manufacturer's authorized representative, or by a holder of a valid national board "VR" certificate who shall furnish and install a new nameplate.

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

General Authority: NDCC 26.1-22.1-14

Law Implemented: NDCC 26.1-22.1-14

45-12-05-13. Steam stop valves.

1. Each discharge outlet, except safety valve, safety relief valves, reheater inlet and outlet, or superheater inlet connections, must be fitted with a stop valve located at an accessible point in the steam-delivery line and as near the boiler nozzle as is convenient and practicable. When such outlets are over two-inch [50.8-millimeter] pipe size, the valve or valves used on the connection must be of the outside-screw-and-yoke-rising-spindle type so as to indicate from a distance by the position of its spindle whether it is closed or open, and the wheel may be carried either on the yoke or attached to the spindle. A plug-cock-type valve may be used provided the plug is held in place by a guard or a gland, the valve is equipped to indicate from a distance whether it is closed or open, and the valve is equipped with a slow-opening mechanism. In the case of a single boiler and prime mover installation, the stop valve required herein may be omitted provided the prime mover throttle valve is equipped with an indicator to show whether the valve is open or closed and is designed to withstand the required hydrostatic pressure test of the boiler.
2. When the boilers are connected to a common header, the connection from each boiler having a manhole opening must be fitted with two stop valves having an ample free-blow drain between them. The discharge of this drain must be visible to the operator while manipulating the valve. The stop valves must consist preferably of one automatic nonreturn valve (set next to the boiler) and a second valve of the outside-screw-and-yoke type must be used. Where intercommunicating systems of different pressures are installed, every boiler on each system must be equipped with an automatic nonreturn valve set next to the boiler.
3. When more than one stop valve is required, it shall have a pressure rating at least equal to that required for the expected steam temperature and pressure at the valve, or the pressure rating at least equal to eighty-five percent of the lowest set pressure of any safety valve on the boiler drum and for the expected temperature of the steam at the valve, whichever is greater.

4. All valves and fittings on steamlines shall have a pressure rating of at least one hundred pounds per square inch [689.48 kilopascals] in accordance with the applicable American national standards institute standard.

History: Effective June 1, 1994.

General Authority: NDCC 26.1-22.1-14

Law Implemented: NDCC 26.1-22.1-14

45-12-05-14. Feedwater valves and piping.

1. Except for high temperature water boilers, the feedpipe must be provided with a check valve near the boiler and a valve or cock between the check valve and the boiler. When two or more boilers are fed from a common source, there must also be a globe or regulating valve on the branch to each boiler located between the check valve and the source of supply. Whenever globe valves are used on feedpiping, the inlet must be under the disk of the valve. On single boiler-turbine unit installations, the boiler feed shutoff valve may be located upstream from the boiler feed check valve.
2. When the supply line to a boiler is divided into branch feed connections and all such connections are equipped with stop and check valves, the stop and check valves in the common source may be omitted.
3. If a boiler is equipped with duplicate feed arrangements, each such arrangement must be equipped as required by these rules.
4. A combination stop-and-check valve in which there is only one seat and disk and a valve stem is provided to close the valve when the stem is screwed down must be considered only as a stop valve, and a check valve must be installed as otherwise provided.
5. Where an economizer or other feedwater-heating device is connected directly to the boiler without intervening valves, the feed valves and check valves required must be placed on the inlet of the economizer or feedwater-heating device.
6. The recirculating return line for a high temperature water boiler must be provided with the same stop valve, or valves, required by subsection 1 of section 45-12-05-13 for the main boiler and the required stop valve or valves is optional. A check valve may not be a substitute for a stop valve.
7. Except as provided for in subsections 8 and 10, boilers having more than five hundred square feet [46.45 square meters] of water-heating surface must have at least two means of feeding water. Each source of feeding must be capable of supplying water to the boiler at a pressure of six percent higher than the highest setting of any safety valve on the boiler. For boilers that are fired with solid fuel not in suspension, and for boilers whose setting or heat source can continue to supply sufficient heat to cause damage to the boiler if the feed supply is interrupted, one such means of feeding must not be subject to the same interruption as the first method.
8. Except as provided for in subsection 7, boilers fired by gaseous, liquid, or solid fuel in suspension may be equipped with a single means of feeding water provided means are furnished for the immediate shut off of heat input if the water feed is interrupted.
9. For boilers having a water-heating surface of not more than one hundred square feet [9.29 square meters], the feedpiping and connection to the boiler may not be smaller than one-half-inch [12.7-millimeter] pipe size. For boilers having a water-heating surface more than one hundred square feet [9.29 square meters], the feedpiping and connection to the boiler may not be less than three-quarter-inch [19.05-millimeter] pipe size.

10. High temperature water boilers must be provided with means of adding water to the boiler or system while under pressure.
11. The feedwater must be introduced into a boiler in such a manner that the water will not be discharged directly against surfaces exposed to gases of high temperature or to direct radiation from the fire or close to any riveted joints of the furnace sheets or of the shell. For pressures of four hundred pounds [2757.92 kilopascals] or over, the feedwater inlet through the drum must be fitted with shields, sleeves, or other suitable means to reduce the effects of temperature differentials in the shell or head. If necessary, the discharge end of a feedpipe must be fitted with a baffle to divert the flow from riveted joints. Feedwater may not be introduced through the blowoff.

History: Effective June 1, 1994.

General Authority: NDCC 26.1-22.1-14

Law Implemented: NDCC 26.1-22.1-14

45-12-05-15. Blowoff valves and piping.

1. A "blowoff" means a pipe connection provided with valves through which the water in the boiler may be blown out under pressure, excepting drains such as are used on water columns, gauge glasses, or piping of feedwater regulators, etc., used for the purpose of determining the operating condition of such equipment. Piping connections used primarily for continuous operation, such as deconcentrators on continuous blowdown systems, are not classed as blowoffs but the pipe connections and all fittings up to and including the first shutoff valve must be equal at least to the pressure requirements for the lowest set pressure of any safety valve on the boiler drum and with the corresponding saturated-steam temperature.
2. A surface blowoff may not exceed two and one-half-inch [63.5-millimeter] pipe size, and the internal and external pipes, when used, must form a continuous passage, but with clearance between their ends and arranged so that the removal of either will not disturb the other.
3. Each boiler, except high temperature water boilers, must have a bottom blowoff pipe fitted with a valve or cock in direct connection with the lowest water space practicable.
4. All waterwalls and water screens which do not drain back into the boiler, and all integral economizers must be equipped with blowoff valves.
5. Except as permitted for miniature boilers, the minimum size of pipe and fittings is one inch [25.4 millimeters], and the maximum size is two and one-half inches [63.5 millimeters], except that for boilers with one hundred square feet [9.29 square meters] of heating surface or less, the minimum size of pipe and fittings is three-fourths inch [19.05 millimeters].
6. Condensate return connections of the same size or larger than the size herein specified may be used, and the blowoff may be connected to them. In such case the blowoff must be so located that the connection may be completely drained.
7. A bottom blowoff pipe when exposed to direct furnace heat must be protected by firebrick or other heat-resisting material which is so arranged that the pipe may be inspected.
8. An opening in the boiler setting for a blowoff pipe must be arranged to provide free expansion and contraction.
9. On a boiler having multiple blowoff pipes, a single master valve may be placed on the common blowoff pipe from the boiler, in which case only one valve on each individual blowoff is required. In such a case either the master valve or the individual valves or cocks must be of the slow-opening type.

10. Two independent slow-opening valves, or a slow-opening valve and a quick-opening valve or cock, may be combined in one body and may be used provided the combined fitting is the equivalent of two independent slow-opening valves, or a slow-opening valve and a quick-opening valve or cock and provided further that the failure of one to operate cannot affect the operation of the other.
11. The bottom blowoff pipes of every traction or portable boiler must have at least one slow-opening or quick-opening blowoff valve or cock conforming to the requirements of section 45-12-05-15.
12. Only one blowoff valve, which must be of a slow-opening type, is required on forced circulation and electric boilers having a normal water content not exceeding one hundred gallons [378.54 liters].

History: Effective June 1, 1994.

General Authority: NDCC 26.1-22.1-14

Law Implemented: NDCC 26.1-22.1-14

45-12-05-16. Factors of safety.

The minimum factor of safety may not be less than four for existing installations. The commissioner authorizes an inspector to increase the factor of safety if the condition of the boiler or pressure vessel warrants it. If the owner or user does not concur with the inspector's decision, the owner or user may appeal to the commissioner who may request a joint inspection by the chief boiler inspector and the deputy inspector or special inspector. Each inspector shall render the inspector's report to the commissioner, and the commissioner shall render the final decision, based upon the data contained in all the inspector's reports.

History: Effective June 1, 1994; amended effective January 1, 2008.

General Authority: NDCC 26.1-22.1-14

Law Implemented: NDCC 26.1-22.1-14

45-12-05-17. Inspection of inaccessible parts.

If in the opinion of the inspector, as the result of conditions disclosed at the time of inspection, it is advisable to remove the interior or exterior lining, covering, or brickwork to expose certain parts of the vessel not normally visible, the owner or user shall remove such material to permit proper inspection and the drilling of any part of the vessel to ascertain thickness.

History: Effective June 1, 1994.

General Authority: NDCC 26.1-22.1-14

Law Implemented: NDCC 26.1-22.1-14

45-12-05-18. Repairs and renewals of fittings and appliances.

Whenever repairs are made to fittings and appliances or it becomes necessary to replace them, the work must comply with the 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

45-12-05-19. Fusible plugs.

1. Fire-actuated fusible plugs, if used, must conform to the requirements of the American society of mechanical engineers code for power boilers.

2. They may be replaced by steel plugs if the boiler is gas-fired or oil-fired and is equipped with a low water fuel cutoff.

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

45-12-05-20. Water columns, gauge glasses, and gauge cocks.

1. Outlet connections (except for damper regulator, feedwater regulator, low water fuel cutoff, drains, steam gauges, or such apparatus that does not permit the escape of an appreciable amount of steam or water therefrom) may not be placed on the piping that connects the water column to the boiler. The water column must be placed on the piping that connects the water column to the boiler. The water column must be provided with a valved drain of at least three-fourths-inch [19.05-millimeter] pipe size, the drain to be piped to a safe location.
2. Each boiler constructed prior to 1999 must have three or more gauge cocks located within the visible length of the water glass, except when the boiler has two water glasses located on the same horizontal lines. Boilers not over thirty-six inches [.914 meters] in diameter, in which the heating surface does not exceed one hundred square feet [9.29 square meters] need have but two gauge cocks.
3. For all installations where the water gauge glass or glasses are more than thirty feet [9.14 meters] from the boiler operating floor, it is recommended that water level indicating or recording gauges be installed at eye height from the operating floor.

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

45-12-05-21. Steam pressure gauge.

1. Each steam boiler must have a steam gauge, with dial range not less than one and one-half times the pressure at which the safety valve is set, connected to the steam space or to the steam connection to the water column. The steam gauge must be connected to a siphon or equivalent device of sufficient capacity to keep the gauge tube filled with water and so arranged that the gauge cannot be shut off from the boiler except by a cock placed near the gauge 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.
2. When a steam pressure gauge connection longer than eight feet [2.44 meters] becomes necessary, a shutoff valve may be used near the boiler provided the valve is of the outside-screw-and-yoke type and is locked open. The line must be ample size with provision for free blowing. Each boiler must be provided with a one-fourth-inch [6.35-millimeter] nipple and globe valve connected to the steam space for the exclusive purpose of attaching a test gauge when the boiler is in service so that the accuracy of the boiler steam gauge may be ascertained.

History: Effective June 1, 1994.

General Authority: NDCC 26.1-22.1-14

Law Implemented: NDCC 26.1-22.1-14

45-12-05-22. Pressure on nonstandard steam traction engines.

All steam traction engines that are of nonstandard boiler construction are limited to a maximum allowable working pressure of one hundred pounds per square inch [690 kilopascals], unless a thorough ultrasonic thickness survey, engineering analysis, and other inspections, approved by the

chief boiler inspector, determine that a different pressure is appropriate. The maximum allowable working pressure may not be greater than that permitted by the original manufacturer. Boilers herein described are not subject to the age limits of section 45-12-05-03.

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

45-12-05-23. Duties of owners.

1. It is the duty of the owner or user of any steam traction engine on wheels to notify the chief boiler inspector of sale or other disposition of steam traction engines.
2. Within ten days of purchase, any person purchasing any steam traction engine shall notify the chief boiler inspector where it will be located and operated.

History: Effective June 1, 1994.

General Authority: NDCC 26.1-22.1-14

Law Implemented: NDCC 26.1-22.1-14

45-12-05-24. Inspection and repair of standard and nonstandard steam traction engines.

The National Board Inspection Code referenced in this article must be used for the inspection and repair of all steam traction engines unless otherwise noted in this article.

History: Effective January 1, 2014.

General Authority: NDCC 26.1-22.1-14

Law Implemented: NDCC 26.1-22.1-14