Sec. 29-232-55. Maximum allowable working pressure of nonstandard boilers

The maximum allowable working pressure of the shell or drum of a non standard boiler shall be determined by the strength of the weakest section of the structure, computed from the tensile strength of the plate, the thickness of the plate, the efficiency of the longitudinal joint or tube ligament, the inside diameter of the outside course and the factor of safety required by these regulations.

$$\frac{TS \times t \times E}{R \times FS} = \text{maximum allowable working pressure psig.}$$

where:

TS = ultimate tensile strength of shell plates, lb/in^2.

t = minimum thickness of shell plate, in weakest course, in inches.

E = efficiency of longitudinal joint or tube ligament.

For riveted construction, E shall be determined by rules given in section I, part PR of the "Rules of Construction of Power Boilers," 1971 edition. For tube ligaments, E shall be determined by rules in paragraph PG52 and PG53, section I, of the "Rules of Construction of Power Boilers" latest edition. For seamless construction, E shall be considered one hundred per cent.

R = one half of the inside diameter of the weakest course of shell or drum in inches.

FS = factor of safety permitted.

(a) **Tensile strength.** When the tensile strength of steel or wrought iron shell plates is not known it shall be taken as 55,000 lbs. per sq. in. for steel and 45,000 lbs. per sq. in. for wrought iron.

(b) **Crushing strength of mild steel.** The resistance of crushing of mild steel shall be taken at 95,000 lbs. per sq. in. of cross sectional area.

(c) **Strength of rivets in shear.** When computing the ultimate strength of rivets in shear, the following values in pounds per square inch of the cross sectional area of the rivet shank shall be used:

Iron rivets in single shear	38,000
Iron rivets in double shear	76,000
Steel rivets in single shear	44,000
Steel rivets in double shear	88,000

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

Table I

Sizes of Rivets Based on Plate Thickness

Thickness of plate:

1/4”	9/32”	5/16”	11/32”	3/8”	13/32”
Diameter of rivet after driving:					
11/16”	11/16”	3/4”	3/4”	13/16”	13/16”
Thickness of plate:					
7/16”	15/32”	1/2”	9/16”	5/8”	
Diameter of rivet after driving:					
15/16”	15/16”	15/16”	17/16”	17/16”	

(d) The lowest factor of safety permissible on existing installations shall be five. For horizontal return tubular boilers having continuous lap seams more than twelve feet in length, the factor of safety shall be eight. When this latter type of boiler is removed from its existing setting, it shall not be reinstalled for pressures in excess of fifteen psig. Reinstalled or second hand boilers shall 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.

(Effective August 25, 1987)