locomotive boilers under their control. The steam locomotive owner shall establish the safe working pressure for each steam locomotive boiler, after giving full consideration to the general design, workmanship, age, and overall condition of the complete boiler unit. The condition of the boiler unit shall be determined by, among other factors, the minimum thickness of the shell plates, the lowest tensile strength of the plates, the efficiency of the longitudinal joint, the inside diameter of the course, and the maximum allowable stress value allowed. The steam locomotive operator shall not place the steam locomotive in service before ensuring that the steam locomotive's safe working pressure has been established.

ALLOWABLE STRESS

### § 230.24 Maximum allowable stress.

(a) *Maximum allowable stress value.* The maximum allowable stress value on any component of a steam locomotive boiler shall not exceed ¼ of the ultimate tensile strength of its material.

(b) *Safety factor.* When it is necessary to use the code of original construction in boiler calculations, the safety factor value shall not be less than 4.

### § 230.25 Maximum allowable stress on stays and braces.

The maximum allowable stress per square inch of net cross sectional area on fire box and combustion chamber stays shall be 7,500 psi. The maximum allowable stress per square inch of net cross sectional area on round, rectangular, or gusset braces shall be 9,000 psi.

STRENGTH OF MATERIALS

### § 230.26 Tensile strength of shell plates.

When the tensile strength of steel or wrought-iron shell plates is not known, it shall be taken at 50,000 psi for steel and 45,000 psi for wrought iron.

### § 230.27 Maximum shearing strength of rivets.

The maximum shearing strength of rivets per square inch of cross sectional area shall be taken as follows:

| Rivets | Pounds per square inch |
|---|---|
| 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 |

### § 230.28 Higher shearing strength of rivets.

A higher shearing strength may be used for rivets when it can be shown through testing that the rivet material used is of such quality as to justify a higher allowable shearing strength.

INSPECTION AND REPAIR

### § 230.29 Inspection and repair.

(a) *Responsibility.* The steam locomotive owner and/or operator shall inspect and repair all steam locomotive boilers and appurtenances under their control. They shall immediately remove from service any boiler that has developed cracks in the barrel. The steam locomotive owner and/or operator shall also remove the boiler from service whenever either of them, or the FRA inspector, considers it necessary due to other defects.

(b) *Repair standards.* (1) All defects disclosed by inspection shall be repaired in accordance with accepted industry standards—which may include established railroad practices, or NBIC or API established standards—before the steam locomotive is returned to service. The steam locomotive owner and/or operator shall not return the steam locomotive boiler or appurtenances to service unless they are in good condition and safe and suitable for service.

(2) Any welding to unstayed portions of the boiler made pursuant to § 230.33 shall be made in accordance with an accepted national standard for boiler repairs. The steam locomotive owner and/or operator shall not return the steam locomotive boiler or appurtenances to service unless they are in good condition and safe and suitable for service.

### § 230.30 Lap-joint seam boilers.

Every boiler having lap-joint longitudinal seams without reinforcing plates