

for the reverse gear, it shall be provided with means to automatically prevent loss of pressure in event of failure of the main reservoir air pressure.

(c) *Power reverse gear reservoirs.* Power reverse gear reservoirs, if provided, must be equipped with the means to automatically prevent the loss of pressure in the event of a failure of main air pressure and have storage capacity for not less than one complete operating cycle of control equipment.

#### DRAW GEAR AND DRAFT SYSTEMS

##### § 230.90 Draw gear between steam locomotive and tender.

(a) *Maintenance and testing.* The draw gear between the steam locomotive and tender, together with the pins and fastenings, shall be maintained in safe and suitable condition for service. The pins and drawbar shall be removed and tested for defects using an appropriate NDE method at every annual inspection. Where visual inspection does not disclose any defects, an additional NDE testing method shall be employed. Suitable means for securing the drawbar pins in place shall be provided. Inverted drawbar pins shall be held in place by plate or stirrup.

(b) *Safety bars and chains generally.* One or more safety bar(s) or two or more safety chains shall be provided between the steam locomotive and tender. The combined strength of the safety chains or safety bar(s) and their fastenings shall be not less than 50 percent of the strength of the drawbar and its connections. These shall be maintained in safe and suitable condition for service, and inspected at the same time draw gear is inspected.

(c) *Minimum length of safety chains or bars.* Safety chains or safety bar(s) shall be of the minimum length consistent with the curvature of the railroad on which the steam locomotive is operated.

(d) *Lost motion.* Lost motion between steam locomotives and tenders not equipped with spring buffers shall be kept to a minimum and shall not exceed  $\frac{1}{2}$  inch.

(e) *Spring buffers.* When spring buffers are used between steam locomotives and tenders the spring shall be applied with not less than  $\frac{3}{4}$  inch compression,

and shall at all times be under sufficient compression to keep the chafing faces in contact.

##### § 230.91 Chafing irons.

Chafing irons that permit proper curving shall be securely attached to the steam locomotive and tender, and shall be maintained to permit lateral and vertical movement.

##### § 230.92 Draw gear and draft systems.

Couplers, draft gear and attachments on steam locomotives and tenders shall be securely fastened, and maintained in safe and suitable condition for service.

#### DRIVING GEAR

##### § 230.93 Pistons and piston rods.

(a) *Maintenance and testing.* Pistons and piston rods shall be maintained in safe and suitable condition for service. Piston rods shall be inspected for cracks each time they are removed, and shall be renewed if found defective.

(b) *Fasteners.* Fasteners (keys, nuts, etc.) shall be kept tight and shall have some means to prevent them from loosening or falling out of place.

##### § 230.94 Crossheads.

Crossheads shall be maintained in a safe and suitable condition for service, with not more than  $\frac{1}{4}$  inch vertical or  $\frac{5}{16}$  inch lateral clearance between crossheads and guides.

##### § 230.95 Guides.

Guides shall be securely fastened and maintained in a safe and suitable condition for service.

##### § 230.96 Main, side, and valve motion rods.

(a) *General.* Main, side or valve motion rods developing cracks or becoming otherwise defective shall be removed from service immediately and repaired or renewed.

(b) *Repairs.* Repairs, and welding of main, side or valve motion rods shall be made in accordance with an accepted national standard. The steam locomotive owner and/or operator shall submit a written request for approval to the FRA Regional Administrator prior to welding defective main rods, side rods, and valve gear components.

**§ 230.97**

(c) *Bearings and bushings.* Bearings and bushings shall so fit the rods as to be in a safe and suitable condition for service, and means shall be provided to prevent bushings from turning in the rod. Straps shall fit and be securely bolted to rods. Floating bushings need not be provided with means to prevent bushings from turning.

(d) *Side motion of rods.* The total amount of side motion of each rod on its crank pin shall not exceed ¼ inch.

(e) *Oil and grease cups.* Oil and grease cups shall be securely attached to rods, and grease cup plugs shall be equipped with a suitable fastening that will prevent them from being ejected.

(f) *Main rod bearings.* The bore of main rod bearings shall not exceed pin diameters more than ⅜ inch at front or back end. The total lost motion at both ends shall not exceed ⅜ inch.

(g) *Side rod bearings.* The bore of side rod bearings shall not exceed pin diameters more than ⅝ inch on main pin nor more than ⅜ inch on other pins.

**§ 230.97 Crank pins.**

(a) *General provisions.* Crank pins shall be securely applied. Securing the fit of a loose crank pin by shimming, prick punching, or welding is not permitted.

(b) *Maintenance.* Crank pin collars and collar fasteners shall be maintained in a safe and suitable condition for service.

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**RUNNING GEAR**

**§ 230.98 Driving, trailing, and engine truck axles.**

(a) *Condemning defects.* Driving, trailing, and engine truck axles with any of the following defects shall be removed from service immediately and repaired (see appendix A of this part for inspection requirements):

- (1) Bent axle;
- (2) Cut journals that cannot be made to run cool without turning;
- (3) Transverse seams in iron or steel axles;
- (4) Seams in axles causing journals to run hot;
- (5) Axles that are unsafe on account of usage, accident or derailment;
- (6) Any axle worn ½ inch or more in diameter below the original/new journal diameter, except as provided in paragraph (a)(7) of this section;
- (7) Any driving axles other than main driving axles with an original or new diameter greater than 6 inches that are worn ¼ inch or more in diameter below the original/new diameter.

(b) *Journal diameter stamped.* For steam locomotives with plain bearings, the original/new journal diameter shall be stamped on one end of the axle no later than January 18, 2005.

**§ 230.99 Tender truck axles.**

The minimum diameters of axles for various axle loads shall be as follows:

Axle load (in pounds)	Minimum diameter of journal (in inches)	Minimum diameter of wheel seat (in inches)	Minimum diameter of center (in inches)
50000 .....	5½	7⅜	6⅞
38000 .....	5	6¾	5⅞
31000 .....	4½	6¼	5⅝
22000 .....	3¾	5	4⅝
15000 .....	3¼	4⅝	3⅞

**§ 230.100 Defects in tender truck axles and journals.**

(a) *Tender truck axle condemning defects.* Tender truck axles with any of the following defects shall be removed from service immediately and repaired:

- (1) Axles that are bent;
- (2) Collars that are broken, cracked, or worn to ¼ inch or less in thickness;

(3) Truck axles that are unsafe on account of usage, accident, or derailment;

(4) A fillet in the back shoulder that is worn out; or

(5) A gouge between the wheel seats that is more than ⅛ of an inch in depth.

(b) *Tender truck journal condemning defects.* Tender truck journals with any