THE PENNSYLVANIA RAILROAD

Locomotive Maintenance Instructions No. L-47-B

ISSUED PHILADELPHIA, PA.
FEBRUARY 28, 1940

SIDE RODS

(Supersedes Locomotive Maintenance Instructions No. L-47-A, dated November 20, 1931)

1. These instructions apply to all new and repaired side rods.

2. Where other circulars of instructions or tracings are referred to herein, the latest issue of same is intended.

3. Side Rods may be welded and straightened only under conditions prescribed in Locomotive Maintenance Instructions No. L-26.

4. Side Rod bushings and knuckle joint pins must be applied and maintained in accordance with practice specified herein, and stock sizes of knuckle joint pins and knuckle joint bushings shall be in accordance with standard tracings for stock sizes.

5. **FLOATING AND FIXED BUSHINGS AT CRANK PINS:**

(a) The maximum bore in rods for fixed steel bushings where floating bushings are used is shown on tracings D-93790 and D-413801.

(b) The maximum bore "D" in rods for fixed bronze bushings is shown on tracing E-92539.

(c) The outside diameter of fixed bushings must be turned at time of application to suit the bore in rod, and pressed into rod with total pressure in tons as specified in table No. 2 and Paragraph No. 11.

(d) As diameter of main pin journal is decreased the internal diameter "B" of floating bronze bushing (Fig. 2) should be reduced to pin diameter plus .015" plus or minus .003."

(e) The bore of fixed steel bushings must be checked for taper and out of round with a suitable gauge, and maintained within the following limits:

	Limit of Taper and Out of Round
New bushings	.004"
Existing Bushings at class repairs	.010"

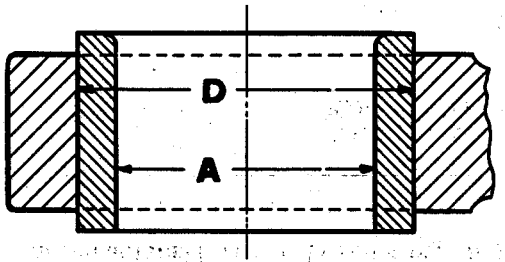

Fig. 1.

FIXED BRONZE CRANK PIN BUSHING.

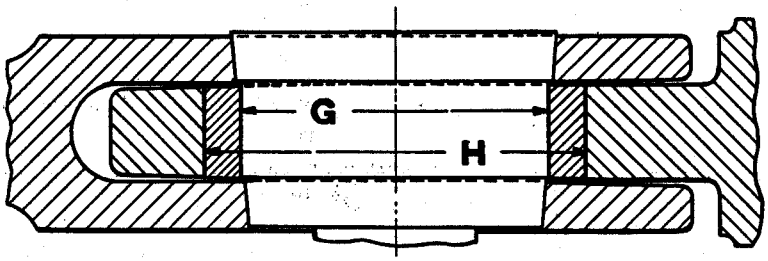

Fig. 3.

KNUCKLE JOINT.

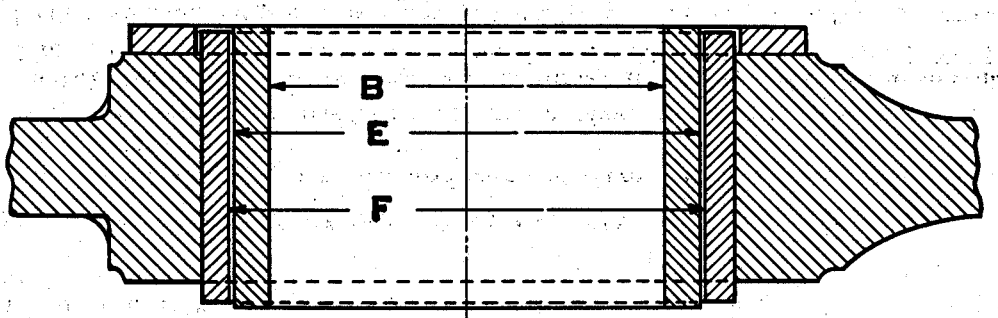

Fig. 2.

FLOATING BRONZE AND FIXED STEEL BUSHINGS.

TABLE No. 1—LIMITS

SUBJECT			NEW WORK AND RENEWALS	RENEWAL OR REPAIRS MUST BE MADE WHEN PARTS ARE WORN TO THE FOLLOWING LIMITS	
				CLASSIFIED REPAIRS	RUNNING REPAIRS
FIXED BRONZE CRANK PIN BUSHING FIG. 1	Bore in Bushing	A	Pin Diameter +.025″ Tolerance ±.005″	When exceeding pin Dia. by more than .040″	When exceeding pin Dia. by more than .090″
	Bore in Rod	D	See Paragraphs 5d & 11		
FLOATING BRONZE & FIXED STEEL BUSHINGS FIG. 2	Bore in Bushing	B	Pin Diameter +.015″ Tolerance ±.003″	When exceeding pin Dia. by more than .025″	
	Outside Dia. of of Bushing	E	Bore F in Fixed Steel Bushing —.025″ Tolerance ±.003″	When bore in fixed Steel Bushing exceeds by more than .030″	
	Total Clearance Both Bores			When sum of clearance between pin and bushing and fixed steel bushing exceeds .055″	.090″
	Bore in Fixed Steel Bushing	F	Tracing size ±.003″		
KNUCKLE JOINT FIG. 3	Bore in Bushing	G	Pin Diameter +.012″ Tolerance .003″ —.000″ See Paragraph 9c	When exceeding pin Dia. by more than .025″	When exceeding pin Dia. by more than .060″
	Bore in Rod	H	See Paragraphs 9d and 11	See Paragraphs 7d and 9d	See Paragraphs 7d and 9d
	Knuckle Joint		See Paragraphs 8a, 8b, 8c		

6. SIDE LINERS:

When renewing side liners to take up side play of rods with floating bushings, the thickness of liner will have to be governed by the wear, so that main and side rods will be maintained approximately on center lines, and so that the total side play shall not exceed *3/16"* after liners have been renewed.

7. KNUCKLE JOINTS:

(a) The taper fit holes in rod shall be checked for out of round and for the alignment of taper hole in one jaw with that in the other jaw by use of taper reamer as a cylindrical gauge and feeler or thickness gauge between the cutting edges of reamer and fits in rod, or a shop taper cylindrical gauge may be used in lieu of reamer. Taper fits must be reamed to just true up, when found out of round .015" at running repairs to locomotives, except when rods are removed for general overhauling or, if out of round .005" when locomotive is undergoing classified repairs or when rods are removed for general overhauling.

(b) Rods that have jaws spread not to exceed *5/32"* at end of jaw shall have jaws drawn together by clamp until in proper alignment with one another while being reamed with taper reamer.

Heat treated rods with jaws spread more than *5/32"* shall be sent to Juniata Shops for repairs in accordance with Locomotive Maintenance Instructions No. L-26.

Non-heat treated rods with jaws spread more than *5/32"* shall have spread jaws closed in accordance with Locomotive Maintenance Instructions No. L-26.

(c) The maximum size of tapered reamed hole in the rod for knuckle joint pin shall be governed by the maximum size of pin shown on standard tracing titled "Side Rod Knuckle Joints, Limit of Wear"—No. E-75525.

(d) The maximum bore in rod for knuckle joint bushing shall be governed by the maximum size of bushing shown on standard tracing, titled "Side Rod Knuckle Joints, Limit of Wear"—No. E-75525.

8. KNUCKLE JOINT PINS:

(a) Knuckle joint pins shall be manufactured at Altoona Works and Columbus Shops and only in the standard and step stock sizes shown on standard tracings. They shall be manufactured with excess material on taper fits, as shown on tracing, column "before carbonizing." They shall then be carbonized *1/16"* deep on journal fit, but threaded portion shall not be carbonized. The excess material on taper fits shall then be turned off, after which pins shall be heated and quenched and the journal fit thus hardened. Journal fit shall then be ground to proper step size, column "stock size," as shown on standard tracing titled "Knuckle Joint Pins—Stock Sizes"—No. F-92093.

(b) Taper fits shall be turned to proper size to fit rod at time of application.

Any hard spots found in taper fits may readily be softened with oxy-acetylene torch, but care must be taken that flame is applied only to the hard spot.

(c) For finishing hollow pins expanding mandrel shown on tracing D-83527 has been designed.

(d) The maximum size pin that may be applied shall be governed by the maximum size of pin shown on standard tracing.

(e) Pins removed from service shall be shipped to Altoona Works and Columbus Shop to be finished to smaller sizes.

(f) Pins returned to Altoona Works and Columbus Shops shall be annealed and machined to step size and then carbonized *1/16"* deep, but threaded portion must not be carbonized, pins shall be heated and quenched. Journal fit shall then be ground to proper step size.

(g) As Altoona Works and Columbus Shops are best equipped for grinding the reclaimed pins with hard taper fits, the reclaimed pins should be used at these two points in making repairs to rods.

(h) The minimum limit for total length of taper fit on reclaimed pins shall be 1/8" less than tracing size. The minimum limit for length of taper fit on large end of reclaimed pins shall be *1/16"* less than tracing size.

9. KNUCKLE JOINT BUSHINGS:

(a) Knuckle Joint Bushings shall be manufactured at Altoona Works and Columbus Shops and only in standard and step stock sizes shown on standard tracings. Oil hole shall be drilled and oil groove machined in bushing, after which, the inside or journal fit shall be case hardened *1/16"* deep and journal fit ground to proper step size as shown on standard tracings No. F-92094 and F-408399 entitled "Knuckle Joint Pin Bushings—Stock Sizes."

(b) The outside diameter of bushings must be turned at time of application to suit the bore in rod and pressed into rod with total pressure in tons as specified in table No. 2 and Paragraph No. 11.

Any hard spots found in outside diameter of bushing may readily be softened with oxy-acetylene torch, but care must be taken that flame is applied only to the hard spot.

(c) The maximum bore "G" in bushing that may be applied shall be governed by the maximum size shown on standard tracings No. E-75525, F-92094 and F-408399.

(d) The maximum outside diameter "H" of bushing that may be applied is shown on standard tracing No. E-75525.

10. APPLICATION OF KNUCKLE JOINT PINS AND KNUCKLE JOINT BUSHINGS:

When necessary to apply either a new knuckle joint pin or knuckle joint bushing, new knuckle joint pin and new knuckle joint bushing matched as to journal sizes shall be used.

No grinding of journals of knuckle joint pin or knuckle joint bushing other than provided for in step sizes in this circular will be permitted.

11. MOUNTING PRESSURE FOR FIXED BUSHINGS AND KNUCKLE JOINT BUSHINGS:

The mounting pressure "P" in tons per inch length of rod fit for the diameter of fit "D" as shown in table No. 2 shall be used when mounting bushings. The total pressure "PL" in tons to be used is "P" multiplied by the length of the rod fit "L" in inches. A maximum variation of 15 percent above or below the required pressure is allowed.

TABLE No. 2

D Diameter of Fit in inches.	P Pressure in Tons per inch length of rod fit.	D Diameter of Fit in inches.	P Pressure in Tons per inch length of rod fit.
2	3	9	9
3	4½	10	9½
4	6	11	10
5	6¾	12	10⅜
6	7⅜	13	10¾
7	8	14	11⅛
8	8½	15	11½

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