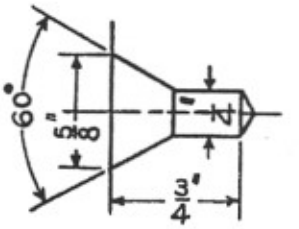
2. FRONT, BACK and INTERMEDIATE CRANK PINS:(cont.)
COLLARS and WASHERS: Make diameter larger than bore of rod for bushing as shown on Standard Drawings of Crank Pins (see index).
RECESSED WASHER: Apply single castle nut on outside end of front crank pins with RECESSED WASHER, with dowel under head of bolt and 3/8" dowel in washer and pin. Washer to bottom in pin recess. Raise question for duplicate engines which had single nut and cotter on inside end of pin.

CLEARANCES: Provide the following minimum clearances between crank pin collars and inside of crosshead or guides with all lateral taken up (cross-indexed in Group 30 and 50).

LOCOMOTIVES	WITHOUT LATERAL MOTION	WITH LATERAL MOTION
Heavy	1-1/8"	3/4"
Light (including narrow gauge)	7/8"	5/8"

3. LATHE CENTERS: Use sixty degree taper for turning Crank Pins as per sketch:



4. PRESSURES FOR FORCING IN: See Standard Drawing, Group 99.

5. HEAT TREATING: See Group 11.

6. HOLLOW BORING: See Group 11.

7. ROUGH TURNING: Make ALLOWANCES over finished dimensions as follows:
Wheel Fit ..... 1/4" dia.
Rod Journals ..... 1/8" dia.
Outer Ends ..... 1/16" dia.
Inner Ends ..... None

8. CRANK AXLES, INSIDE BEARING, TURNING: See Group 11.

QUESTION: Duplicate engines.
EXCEPTIONS: R. R. Co's drawings, specifications or instructions to contrary.

American Locomotive Company
ENGINEERING DEPARTMENT

STANDARD PRACTICE
30 S 2338
June 23rd, 1926

Superseding
30 S 1931b

APPROVED
ENGINEERING
COMMITTEE

CROSSHEADS

1. **Type:** Use alligator crossheads, per Standard drawings (see Index).
   Use the following depths of Crosshead **Shoe Flanges:**

   Guides up to and including 5" wide..... 1½"
   " over 5" wide..... 2 "

2. **Taper Fits:** Use taper of ¾" in 12 for all **Piston Rod Fits** in crosshead and **Crosshead Wrist Pin** fits in jaws.

3. **STRESS AND BEARING PRESSURE LIMITS.**

   Crosshead Keys: Maximum shearing stress per sq. in. for,
   Piston Thrusts of 65,280 lb. and under..... 17,000 lb.
   " " over 65,280 lb..... 15,000 lb.

   Reduction of shearing stress in larger sizes keeps bending stress approximately uniform in all sizes.

   Wrist Pin: Maximum bearing pressure per sq. in..... 4,800 lb.
   Shoes: " " " " " " ..... 100 lb.

   See Group 50—Formula for Calculating Upward Thrust on Guides.
   See Group 99[8]—Wrist Pin Sizes for Various Piston Thrusts.

4. **Key Material:** Use Chrome Vanadium heat-treated and drop-forged steel to Material Specification for Locomotive crosshead keys.

   Keys will be drop-forged and heat-treated at Schenectady under supervision of Test Department. After heat-treatment, all keys must be stamped with the Specification Number, followed by the letters "H. T.," before placing in stock. One key will be taken from each lot, treated and tested to see if it conforms to the necessary physical and chemical requirements.

5. **Clearances** between crank pin collars and inside of crosshead, see Group 29.

6. See **Group 48.—Foreign Locomotives.**

QUESTION: Duplicate engines.
EXCEPTIONS: R. R. Co.'s drawings, specifications or instructions to contrary.

American Locomotive Company

ENGINEERING DEPARTMENT

STANDARD PRACTICE

31 S 2263h

CYLINDERS

Superseding 31 S 2263g

APPROVED ENGINEERING COMMITTEE

1. TRANSVERSE CENTERS: See table in Group 99[8] for transverse centers for use with various Piston Thrusts.

2. CYLINDER and CYLINDER DETAILS: Use dimensions per Standard Drawings (see Index).

3. BUSHINGS: Apply to all cast steel cylinders.
   Apply only when specified in cast iron cylinders.
   Note: Individual cylinders, or set of cylinders may be bushed on account of slight defects in barrels, provided permission has been obtained from the Railroad Company. See Index for Standard Emergency Bushing Drawing.
   When used, make bushings from CYLINDER IRON and cast on end with dry sand core. Castings should be 4" longer than cylinder barrel. Force bushings into place with pressures per Standard Drawing (see Index). Bushings to be held in place by cast iron plugs.

4. FIBRE STRESS IN STUDS: Maximum at root of thread approximately 9000 lb. per sq. in. based on outside diameter of cylinder bushing or middle of grinding face (17" and 18" sizes slightly exceed this figure) using boiler pressure for simple and H.P. compound cylinders, and 45% of boiler pressure for L.P. compound cylinders.
   Groove FRONT cylinder head STUDS with round nose tool 1/4" wide, locating groove 1/2" from face of cylinder flange. Make diameter at bottom of groove as follows:

DIAMETER OF STUD	DIA. AT BOTTOM OF GROOVE
3/4"	9/16"
7/8"	5/8"
1"	3/4"
1-1/8"	7/8"
1-1/4"	15/16"

5. SHRINKAGE BAND: When width is specified in excess of that for which allowance is made on Standard drawings, make seats for same wide enough to provide bearing for full width of band.

6. PISTON VALVE STEAM CHEST, BUSHINGS and STUDS: Use for SIMPLE cylinders with INTERNAL ADMISSION, dimensions shown on Standard drawings (see Index).
   See GROUP 32 - BUSHING APPLICATION.

7. VALVE SETTING: Apply PEEP HOLES in center of steam ports of all PISTON VALVE cylinders to facilitate setting valves. Arrange holes in the most convenient manner possible for inspection and fit same with plugs 2-1/8", 12-threads, taper 3/4" in 12". Heads of plugs hexagon, 2-3/8" across flats, and extended thru cylinder jacket sufficiently to facilitate removal.

8. CYLINDER CLEARANCE: 10% is preferred where:

$$\text{Per Cent Clearance} = \frac{\text{Clearance} \times 100}{\text{Area} \times \text{Stroke}}$$

(over)

9. PISTON VALVE STEAM CHEST PORTS and RIBS: Make net area through port approximately equal to 10% of piston area, and apply ribs having a thickness 1/8" greater than that of the side wall of the chest, leaving not more than 7" nor less than 5" clearance between them.

10. FRONT CYLINDER HEADS: Apply a stud to form a dowel to correctly position front cylinder heads. Locate dowel at the intersection of the vertical center line of the cylinder and the pitch circle of the studs, at the top. Cylinder heads to be drilled for this dowel and with their correct positions thus registered, may be used on either right or left sides without danger of blanking the cylinder steam port.

QUESTION: Duplicate engines.
EXCEPTIONS: R.R. Co's drawings, specifications,or instructions to contrary.

American Locomotive Company

ENGINEERING DEPARTMENT

May 5, 1938

STANDARD PRACTICE

32 S 2264e

Superseding 32 S 2264d

APPROVED ENGINEERING COMMITTEE

CYLINDER DETAILS

1. CYLINDER HEADS: Use as per Standard drawings (see Index).
When weight limitations require use of cast steel heads of design shown on Drawings 323 S 19260 and 323 S 19220 raise question with Vice President of Engineering before using.
Finish ALL cast cylinder heads all over inner face. Provide striking points on inner face of dished cylinder heads locating same in line with rim of piston.
Cast relief valve boss on all cylinder heads, using blind core when valves are not applied.

2. HEAD CASING: Make inside corner radii of all round cylinder and piston valve chamber head casings as follows:

INSIDE DIAMETER OF CASING	INSIDE FLANGE RADIUS
23" and under	3/4"
Over 23"	1-1/2"

For finished depths less than 3", order sufficient material to make 3" flange.
For 1/4" and 3/16" casings 3" deep and over, order plates exact diameter to suit flange, plus 3/8".
For 1/8" casings, order plates 3" larger diameter than for 1/4" casings, (Cross-indexed in Group 78).
CASING FIT: Use malleable cylinder head CASING CLAMPS per Standard drawing. (see Index).

3. PISTON VALVE STEAM CHEST BUSHINGS: Turn, bore and align chamber and bushings within 0.005" of a true cylinder. Force into place with pressures as per Standard drawing (see Index.)
Finish bore bushings after pressing in.
Make bridges and width of ports in piston valve bushings in accordance with Standard drawings (see Index).
See Group 31 - BUSHING DRAWINGS.

4. INDICATOR PLUGS: Apply as per Standard drawing (see Index, Group 66) only when requested by Railway Companies, or on new types of locomotives where this Company desires to consider testing.
Locate in counterbore of cylinder, and as high as possible, but not in steam port, this to avoid excessive length and sharp bends in indicator pipes.

QUESTION: Duplicate engines.
EXCEPTIONS: R. R. Co's drawings, specifications or instructions to contrary.

American Locomotive Company

ENGINEERING DEPARTMENT

March 7, 1938

STANDARD PRACTICE

34 S 2265c

CYLINDER

By-Pass, Vacuum and Relief Valves

Superseding

34 S 2265b

APPROVED ENGINEERING COMMITTEE

1. VACUUM VALVES: When specified, use the following sizes:

DIAM. CYLINDER	VACUUM VALVE
16"	2" ←
16-1/2" - 19"	2-1/2"
19-1/2" and up	3"

2. STEAM CHEST RELIEF: When vacuum valves are omitted, apply 1-1/4" plug cock valve in each steam chest.

3. DRIFTING VALVE: When specified, arrange to admit saturated steam thru manually operated drifting valve to outside steam pipes above oil spoon. Recommend the use of 2-1/2" vacuum valve when required in connection with drifting valve.

4. DRIFTING VALVE PIPING: Preferred arrangement is one line of 1-1/4" O.D. copper pipe under jacket when connections to branch pipes at front end are high enough to avoid a pocket between tee and steam pipes. When the use of a single line of pipe would form pockets at this point, use two lines of pipe, one each side of boiler and 3/4" iron pipe under jacket. Also arrange for an extension handle on valve controlling supply of saturated steam, such extension handle to be located within easy reach of engineman.

5. FOREIGN LOCOMOTIVES - See Group 48.

QUESTION: Duplicate engines.
EXCEPTIONS: R.R. Co's drawing,s specifications, or instructions to contrary.

American Locomotive Company

ENGINEERING DEPARTMENT

STANDARD PRACTICE

36 S 2266d

January 10, 1938

DOME

Superseding 36 S 2266c

APPROVED ENGINEERING COMMITTEE

1. DOME ARRANGEMENTS, RINGS AND CAPS: Use as per Standard Drawings (see Index).

2. ONE-PIECE DOME: Use, but raise question when no die is available.
Order flat plates of shell steel to A. L. Co. Standard Specification, using diameters and thicknesses (ordering sizes) as shown on Standard Drawings (see Index).

HEIGHT must not exceed 24" . If R. R. Co.'s specification requires one-piece dome of greater height, recommend three-piece construction.
After flanging, dome barrel must not be less than 1/2" thick, nor flange for dome cap less than 11/16" thick, and these minimum dimensions must be shown on all dome and boiler drawings covering one-piece dome.

3. THREE-PIECE DOMES: When applied, use RIVETED vertical SEAM. When WELDED vertical seam is specified, raise question with Vice-President Engineering or Railway Co's representatives before using.

4. DOME CAP STUDS: FIBRE STRESS must not exceed 6500 pounds calculated on load obtained from mean diameter of wire gasket.
PITCH must not exceed 3-1/2"
DIAMETER must not be less than 7/8" .

5. DOME LINERS: Use the following thicknesses when dome collar or dome flange is not less than 1" thick.

THICKNESS OF SHELL PLATE	THICKNESS OF DOME LINERS
½" and under	.....
9/16"	3/8"
5/8"	3/8"
11/16"	3/8"
3/4"	1/2"
13/16"	9/16"
7/8"	5/8"
15/16"	3/4"
1 "	15/16"
1 1/16"	15/16"
1 1/8"	1 "

When shell plates are ordered in 32nds of an inch, use thickness of liner shown for next even 16th.

6. OPENING IN SHELL UNDERNEATH DOME: For Alco Dome Type Throttles, follow Standard Drawing (see Index).

QUESTION: Duplicate engines.
EXCEPTIONS: R.R. Co's drawings, specifications or instructions to contrary.

American Locomotive Company

ENGINEERING DEPARTMENT

STANDARD PRACTICE

37 S 2267 c

June 20th, 1933

DRAW GEAR—ENGINE

Superseding 37 S 2267 b

APPROVED ENGINEERING COMMITTEE

1. Use straight **Draw-Bars** forged without welds. Use Standard drawings (see Index).
Obtain size of body from table below, which is based on one square inch of area per 3000 lb. tractive power or 18000 lb. total weight.
Use larger size indicated by either the tractive power or total weight of the given engine.

MAXIMUM TRACTIVE POWER (Comp. when Mallet)	MAXIMUM TOTAL WEIGHT	SIZE OF BODY	PIN DIAMETER	MAXIMUM TRACTIVE POWER (Comp. when Mallet)	MAXIMUM TOTAL WEIGHT	SIZE OF BODY	PIN DIAMETER
11250	67500	3 " x 1¼"	2 "	63000	378000	7 " x 3 "	4 "
15750	94500	3½" x 1½"	2¼"	72000	432000	8 " x 3 "	4½"
21000	126000	4 " x 1¾"	2½"	84000	504000	8 " x 3½"	5 "
27000	162000	4½" x 2 "	3 "	96000	576000	8 " x 4 "	5 "
30000	180000	5 " x 2 "	3 "	108000	648000	8 " x 4½"	5½"
37500	225000	5 " x 2½"	3½"	121500	.....	9 " x 4½"	5½"
45000	270000	5 " x 3 "	3½"	135000	.....	9 " x 5 "	6 "
54000	324000	6 " x 3 "	4 "	150000	.....	10 " x 5 "	6 "

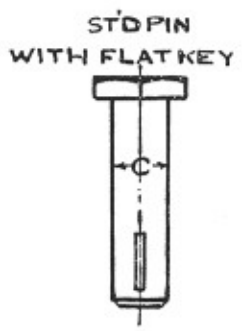
In laying out new engine and tender designs, figure draw bar pocket on engine 1" above tender pocket. These relative heights apply as well to decks and chafing plates. Use drawbars "Style No. 1" on Standard Drawbar drawings, when pockets are in line or as noted above. For all other conditions, use "Style No. 2".

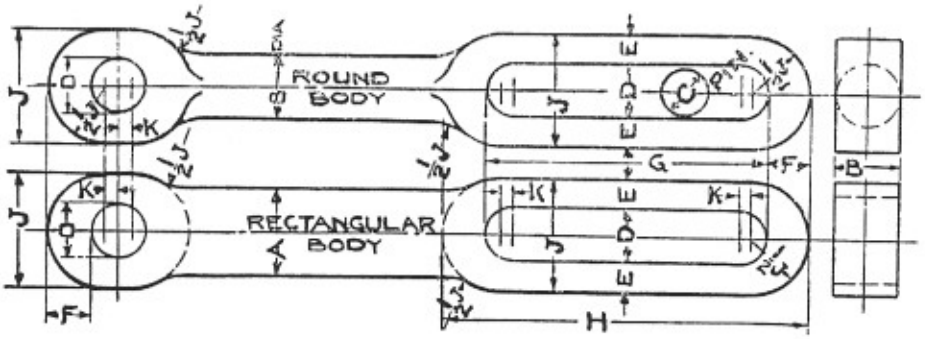
Chamfer edges of **Pin Holes** in all **Drawbars** with ¼" radius.

Use draw pins as follows:

DIAMETER OF BODY	MATERIAL	BODY FINISH	DRAW PIN HOLES IN FOOT PLATES AND TENDER DRAW CASTINGS	
			Diam. of Cored Hole	Cored Hole Bored out to
4" and under	Bar Iron or Steel, head formed in die	Not turned, fins removed by grinding	Pin Diam. — ½"	Pin Diam. + ⅛"
4½" to 5½"	Bar Iron or Steel, head formed in die	Not turned fins removed by grinding	Pin Diam. — ½"	Pin Diam. + 1/16"
6" and over	Hammered Iron or Steel	Turned	Pin Dia. — ½"	Pin Diam. + 1/16"

2. Use straight **Safety Bars** between engine and tender, forged without welds.
Use round or rectangular body according to size, with holes and slots drilled and machined, as shown below.
The size of body is based on one sq. in. of area for 12,500 lb. tractive power or 75,000 lb. total weight.
Use largest size indicated by either the tractive power or total weight of the given engine.

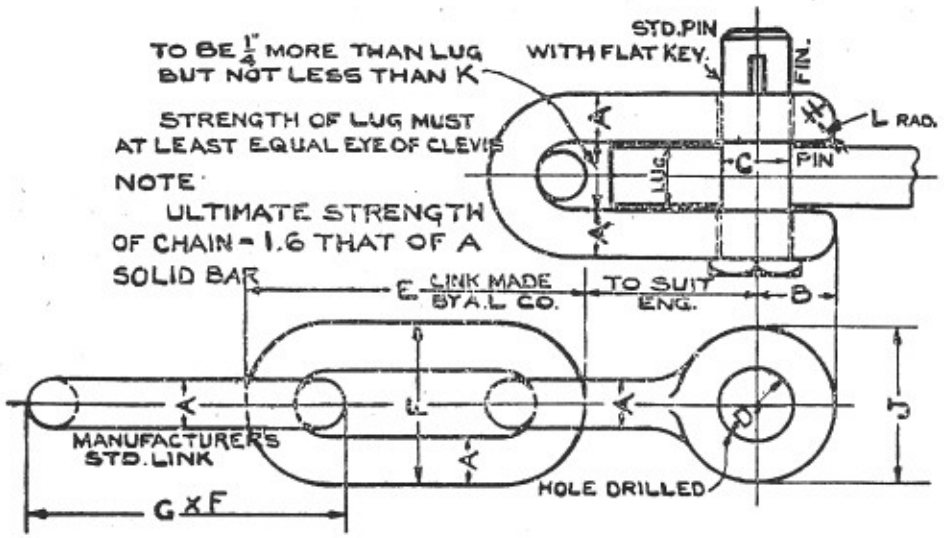




MAXIMUM TRACTIVE POWER LBS.	MAXIMUM TOTAL WT. OF ENGINE LBS.	A	B	PIN C	D	E	F	G	H	J	K
22,100	132,600	—	1½"	1¾"	1⅞"	1 13/16"	⅞"	8 "	9¾"	3½"	1/16"
30,000	180,000	—	1¾"	1¾"	1⅞"	1 15/16"	1 1/16"	8¼"	10⅜"	3¾"	⅛"
39,200	235,200	—	2 "	2 "	2⅛"	1 1/16"	1 3/16"	8½"	10⅞"	4¼"	⅛"
46,900	281,400	3 "	1¼"	2 "	2⅛"	1 15/16"	2¼"	8¾"	13¼"	6 "	5/16"
65,600	393,600	3½"	1½"	2¼"	2⅜"	2 3/16"	2⅝"	9 "	14¼"	6¾"	3/16"
87,500	525,000	4 "	1¾"	2½"	2⅝"	2 5/16"	3 1/16"	9½"	15⅝"	7¾"	½"
112,500	675,000	4½"	2 "	3 "	3⅛"	2 13/16"	3⅜"	10 "	16¾"	8¾"	9/16"

(OVER)

3. **Safety Chains** of dimensions given based below, on one square inch of area (considering both sides of the link) for 10,000 lb. tractive power or 60,000 lb. total weight, may be used for small engines and for tractive powers under 48,000 lb. or total weight under 288,600 lb., but **Safety Bars** are preferred for tractive powers of 22,000 lb. or over, and total weight of 132,000 lb. or over. Make minimum length equall to "true" length between attachments with engine and tender on maximum curve for which they are designed, plus 2'.



MUST NOT EXCEED EITHER		A	B	PIN C	D	E	F	G	H	J	K	L
Maximum Tractive Power Lbs	Maximum Total Weight Of Engine Lbs.											
15,700	94,200	1 "	1⅜"	1½"	1⅝"	7 "	3½"	4⅝"	⅝"	3 "	1½"	5/16"
24,600	147,600	1¼"	1⅜"	1¾"	1⅞"	8 "	4¼"	5¾"	¾"	3½"	1¾"	⅜"
35,400	212,400	1½"	2¼"	2 "	2⅛"	9½"	5⅛"	6⅞"	⅞"	4¼"	2 "	7/16"
43,100	288,600	1¾"	2 9/16	2¼"	2⅜"	11 "	5⅞"	8½"	1 "	4¾"	2¼"	½"

4. Use the following diameters of short-shank pilot **Coupler Draw Pins.** These sizes are based on one sq. in. of area (double shear) for 12,000 lb. tractive power (compound when Mallet) or 65,000 lb. total weight. Use largest size indicated by either the tractive power or total weight of the given engine.

DIAMETER OF PIN	LIMITATIONS	
	TRACTIVE POWER	TOTAL WEIGHT
2 "	37700	204100
2¼"	47800	258700
2½"	58900	319200
2¾"	71300	386100
3 "	84800	459600
3¼"	99600	539500
3½"	115400	625300

5. Design **Hinge** for articulated engines in accordance with Standard drawing (see Index). Cast hinge solid with tail casting of front engine. Provide 2" vertical play between tongue of hinge and jaw on rear engine, 1¼" above and ¾" below tongue. Omit washers in all cases.

Arrange pin bushings so that replacement can be made without disconnecting engine. Apply bushings from below, pressed in with pressure as per Standard drawing (See Index).

Use the following diameters of hinge **Pins:**

L. P. CYLINDER DIA.	PIN
Under 23"	3 "
23"–24"	3½"
25"–27"	4 "
28"–30"	4½"
31"–33"	5 "
34"–39"	6 "
40"–45"	7 "

6. See **Group 56.—Laws, Rules and Instructions, I. C. C., Public Service Commission, &c.**

7. See **Group 15.—Draw Casting Bolts.**

QUESTION: Duplicate engines.
EXCEPTIONS: R. R. Co.'s drawings, specifications or instructions to contrary.

American Locomotive Company

ENGINEERING DEPARTMENT

April 15, 1938

STANDARD PRACTICE

39 S 2336c

ECCENTRICS	Superseding 39 S 2336b	APPROVED ENGINEERING COMMITTEE

1. ECCENTRIC CRANKS: Use as per Standard drawings (see Index). Use OPEN-END type unless solid type is required by clearance limitations, in which case, raise question with Purchaser. Raise question with V. P. Engineering when solid end type is specified, or shown on Purchaser's drawing.

   KEYWAY: Provide fillets in bottom corners of keyway as follows:

KEY WIDTH	FILLET RADIUS
Less than 1"	1/16"
1" and over	1/8"

2. ECCENTRIC CRANK PINS: Mount in eccentric crank with pressures as per Standard drawing (see Index).

3. ECCENTRIC RODS: Use channel section on passenger locomotives designed to operate at higher than diameter speed.

QUESTION: Duplicate engines.
EXCEPTIONS: R. R. Co's drawings, specifications or instructions to contrary.

American Locomotive Company

ENGINEERING DEPARTMENT

STANDARD PRACTICE

40 S 2268a

April 15, 1938

ENGINE TRUCKS

Superseding 40 S 2268

APPROVED ENGINEERING COMMITTEE

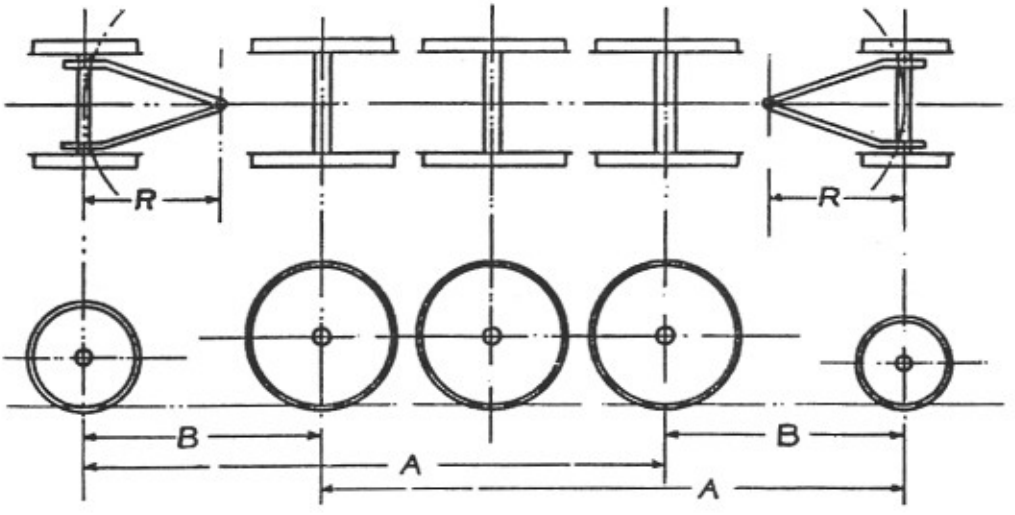
1. RADIUS BAR for two-wheel leading and trailing trucks to be obtained by the formula:

$$R = \frac{A \times B}{A + B} \times .85$$

where A = distance from truck to farthest driver.
B = distance from truck to nearest driver.
R = radius (see sketch below).

For RADIAL BAR trucks, radius to be figured tangent to center line of axle and in nearest even multiple of 3 inches greater than formula.

For RADIAL AXLE BOX trucks, radius to be figured intersecting center line of axle and journal and in nearest even multiple of 6 inches greater than formula.



2. All LEADING TRUCKS to have swing center, except 4-4-0 type, upon which the use of swing or rigid center is optional.

Show on all engine truck drawings the MAXIMUM SWING of bolster each side of center and check designs not A.L. Co. Standard to see that with this swing the resultant of center pin weight and lateral thrust falls inside of outer rail.

3. Use OUTSIDE-bearing, swing-yoke type TRAILING TRUCKS as follows:

JOURNALS	BRAKES	TRUCK TYPE
Up to and including 8" x 14"	None	Built-up radius bar, with cast steel back.
	Hung from Engine Frame	
	Hung from Truck Frame	Cast Steel Radius Bar.
Over 8" x 14"	None	Cast Steel Radius Bar.
	Hung from Engine Frame	
	Hung from Truck Frame	

Where reduction of weight is imperative, the BUILT-UP Construction should be considered for journals over 8" x 14" only to be used for special purposes.

Refer to the following prints:

Built-up radius bar ..... 404 S 3620
Cast steel radius bar .... 404 S 3730

(over)

3. continued.

but make size of journal and sections of frame to suit dimensions and weight of engine.

Use cast steel back frame section upon the BUILT-UP RADIUS BAR type of truck to eliminate the use of bolted-on brackets for the centering spring.

QUESTION: Duplicate engines.
EXCEPTIONS: R.R. Co's drawings, specifications or instructions to contrary.

American Locomotive Company

ENGINEERING DEPARTMENT

STANDARD PRACTICE

41 S 2269b

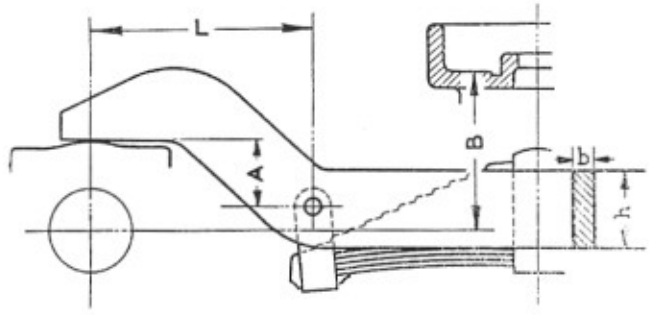
December 3rd, 1926

ENGINE TRUCK DETAILS

Superseding 41 S 2269a

APPROVED ENGINEERING COMMITTEE

1. **Equalizers:** Use the following method to determine the size for four-wheel engine trucks having four equalizers.



P = Total load on truck above boxes.
L = Lever arm for bending (see sketch above). Length between journals need not be considered.
M = Bending moment, is a maximum from center to center of spring hanger pin holes and $= \frac{PL}{8}$ (for one equalizer).
S = Fibre stress $= \frac{M}{R} =$ 14000 lb. per sq. in. maximum for engine truck equalizers of soft steel or wrought iron.
R = Modulus of section of equalizer, $= \frac{bh^2}{6} = \frac{PL}{112000}$ (when S = 14000).
All dimensions in inches.
After finding modulus of section as outlined above, select from table of Moduli of Rectangular Sections, Group 99[8], a section whose modulus is at least equal to that required.
Dimensions "A" and "B" must always be given on engine truck drawings.
Great care must be taken in figuring height from center of axle to center pin: figure up through box and clearance between it and frame and then check by figuring up through spring.

2. **Radius Bar Brace:** Use two bolts spaced at least 2½" centers, in connection to radius bar, with one nut on each bolt and end of bolt riveted over.

3. **Wearing surfaces** of engine truck **box** and **pedestal** to be cast iron, chilled.
Finish wearing surfaces of cast steel or wrot iron boxes and pedestals, but wearing surfaces of cast iron chilled boxes and pedestals need not be finished (regardless of material or finish of adjacent wearing surface) providing they are ground smooth where necessary. Cross-Indexed in Group 17.

4. **Safety Chains, Four-Wheel Trucks:** Use at front of all four-wheel leading trucks two chains with the following dimensions, making length equal to "true" length between attachments to truck and frame, with truck swung over on maximum curve for which engine is designed; plus 4":

ENGINE TRUCK JOURNAL	DIAMETER OF SAFETY CHAIN	DIAMETER OF EYE-BOLT
5 " and 5½" x 10"	⅞"	1¼"
5½" and 6 " x 12"	1 "	1½"
6½" and 7 " x 12"	1⅛"	1¾"

QUESTION: Duplicate engines.
EXCEPTIONS: R. R. Co.'s drawings, specifications or instructions to contrary.

American Locomotive Company

ENGINEERING DEPARTMENT

STANDARD PRACTICE

44 S 2270 c

February 3rd, 1930

EXHAUST PIPE

Superseding 44 S 2270 b

APPROVED ENGINEERING COMMITTEE

1. **EXHAUST NOZZLE:** For **Simple** superheated engines burning **Soft Coal** use one plain circular nozzle per engine, of diameter given in the following table:

CYL. DIAM.	SIMPLE TWO-CYLINDER BOILER PRESSURE				SIMPLE THREE-CYLINDER BOILER PRESSURE			
	210 & UNDER	OVER 210 TO 230	OVER 230 TO 250	OVER 250 TO 275	210 & UNDER	OVER 210 TO 230	OVER 230 TO 250	OVER 250 TO 275
17	3¾				4¾	4⅞	5⅛	5¼
18	4				5	5⅛	5⅜	5⅝
19	4¼				5¼	5½	5⅝	5⅞
20	4½				5½	5¾	6	6¼
21	4¾	5			5¾	6	6¼	6½
22	5	5⅛	5⅜		6	6⅜	6⅝	6¾
23	5⅛	5⅜	5⅝	5⅞	6⅜	6⅝	6⅞	7⅛
24	5⅜	5⅝	5⅞	6⅛	6⅝	6⅞	7⅛	7⅜
25	5⅝	5⅞	6⅛	6⅜	6⅞	7⅛	7½	7¾
26	5⅞	6⅛	6⅜	6½	7⅛	7½	7¾	8
27	6⅛	6⅜	6½	6¾	7⅜	7¾	8	8⅜
28	6⅜	6½	6¾	7				
29	6½	6¾	7	7¼				
30	6¾	7	7¼	7½				
31	7	7¼						
32	7¼							

For soft coal-burning simple engines having cylinder diameters or cylinder arrangement not given above, make area through circular nozzle in ratio to total piston area relieved by such nozzle, as given in the first line of the following table.

For soft coal-burning **Compound** engines make area through nozzle in ratio to total high pressure piston area as given in the second line of the following table:

BOILER PRESSURE	210 & UNDER	OVER 210 TO 230	OVER 230 TO 250	OVER 250 TO 275
Simple	.025	.027	.030	.032
Compound (H. P. Piston)	.043	.046	.049	.052

For **Oil**-burning engines, use nozzles from ⅛" to ¼" larger than table size.

For **Hard Coal**-burning engines, use double circular nozzles having a combined area approximately 85% of that of the corresponding single nozzle for soft coal.

For **Lignite**-burning engines, raise question as to proper size of nozzle.

For **Saturated** steam engines, make nozzle area 23% greater than that required for superheated steam.

If **Bridge** is specified without giving nozzle diameter, make net area equal to that of plain circular nozzle given in table.

If **Finger** type is specified without design, use arrangement similar to Drg. 442 S 30670, making net area 15% greater than that of plain circular nozzle.

Make all nozzle diameters in multiples of ⅛"

2. Use on all **Mallet** compound engines the style of **Exhaust Nozzle** and blower arrangement shown on drawing 443 S 92180.

QUESTION: Duplicate engines.
EXCEPTIONS: R. R. Co.'s drawings, specifications or instructions to contrary-

American Locomotive Company

ENGINEERING DEPARTMENT

STANDARD PRACTICE

45 S 2271e

Aug. 20th, 1931

FIRE BOX DOORS, ARCHES, ETC.

Superseding 45 S 2271 d

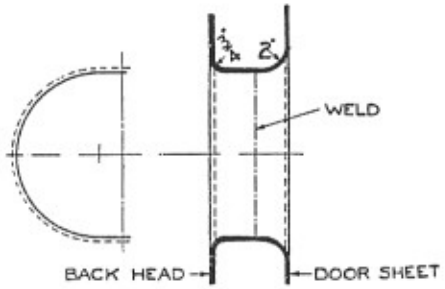
APPROVED ENGINEERING COMMITTEE

1. **Height** from top of **deck** to bottom of **Fire Box Door opening** should not be less than 19″ nor more than 21″. (By "height" is meant the actual **vertical** distance from the surface on which the fireman stands to the bottom of the clear opening when the fire box door frame is in place).

   Height for **fire** from top of **grate** to underside of fire box door opening should not be less than 14″.

2. **Fire Box Door opening;** use one 14″ x 18″ opening with semi-circular ends, on all fire boxes up to and including 75¼″ wide and one 16″ x 20″ opening on fire boxes wider than 75¼″

   Use form of opening shown by sketch below, with welded seam uniting flanges. Locate weld with relation to width of water space so as to reduce to a minimum the thinning of sheets in flanging.



   When solid ring riveted between inner and outer sheets of steel fireboxes is specified, raise question with V. P. Eng. before using.

3. **Fire Brick Arch** supported on **Tubes;** use arch tubes of seamless steel to A. L. Co. Standard Material Specifications; outside diameter and thickness as follows:

LENGTH	O. D.	THICKNESS B. W. G.
11′-0″ and under	3 ″	No. 8 } see
over 11′-0″	3½″	No. 8 } note

   NOTE: For pressures over 250 lb.,or No. 8 B. W. G. or thinner arch tubes with length over 150″, combined fiber stress (S) due to steam pressure and arch brick loading must not exceed 7000 lb. per sq. in., calculated by the following formula:

$$S = \frac{PD}{2E} + \frac{AB^2}{2W}\left\{1 - \frac{B}{2L}\right\}^2$$

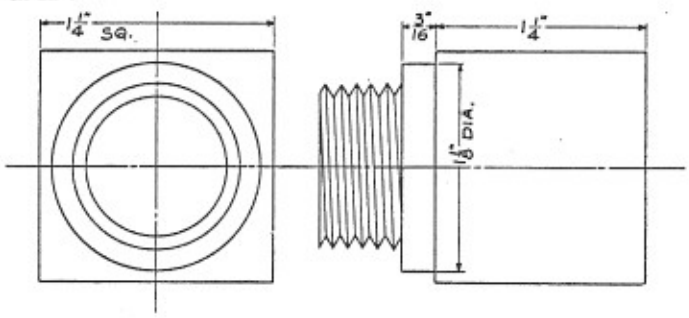
   Where

   P = Steam Pressure; lb per sq. in.
   D = Outside Diameter of Tubes; inches.
   E = Tube Wall Thickness; inches.
   A = Max. Weight of Brick Between Two Adjacent Tubes, per 1″ of Arch L ength; pounds.
   B = Length of Arch; inches.
   W = Section Modulus of Tube; inches³.
   L = Length of Arch Tubes Between Supports; inches.

   Set both ends of **tubes** as shown on Standard Cards (see Index).

   A report must be sent to the Resident Inspector for every boiler, certifying that the work is in accordance with these instructions, or in accordance with R. R. Co.'s prints when tube setting is special.

4. **Fire Brick Arch** supported on **Studs;** use studs of 1¼″ square bar steel as per sketch below, with ⅞″—12 Treads, Taper ⅝″ in 12″.



   Arch tube cover plates must be secured to boiler by studs not less than ⅞″ in diameter. When Railroad Company's drawing show smaller studs raise question before using.

5. See **Group 48. Foreign Locomotives.**

   QUESTION: Duplicate engines.
   EXCEPTIONS: R. R. Co.'s drawings, specifications or instructions to contrary.

American Locomotive Company

ENGINEERING DEPARTMENT

April 27, 1938

STANDARD PRACTICE

46 S 2272h

FRAME

Superseding 46 S 2272g

APPROVED ENGINEERING COMMITTEE

1. PROPORTIONING: Use the following approximate rules for cast steel frames:

$$S = \frac{T}{C}$$ Where S = sectional area of frame.
T = piston thrust = area of frame multiplied by boiler pressure.

SECTIONAL AREA OF FRAME IN SQUARE INCHES (S)	C			
	FROM CYLINDERS TO MAIN PEDESTAL (INCLUDING TOP RAIL OVER MAIN PED.)		BACK OF MAIN PEDESTAL	
	Non-Artic. Artic.B.Eng.	Artic.F. Eng.	Non-Artic. Artic B.Eng.	Artic.F. Eng.
Top of Pedestals	2500-2700	2100-2300	2900-3200	2500-2800
Top Rail between pedestals	3000-3200	2600-2800	3500-3800	3000-3300
Lower Rail between pedestals	4300-4500	3700-3900	5100-5300	4400-4600
Integral Single Rail at Back of Cyl. Keying lug	1600-1800	1400-1600		

This method gives sectional areas back of main pedestal approximately 15% less than similar areas at or ahead of main pedestal.

Depth of top rail ahead of front pedestals must not be less than that of top rail over front pedestals.

2. BACK FRAME SECTIONS: Design in accordance with Standard Drawing (see Index).

3. FRAME CENTERS: See Group 99^{8}.

4. PEDESTALS: Taper rear face of jaw 1" in 12". Give dimensions for opening between jaws in even 1/8" at bottom of taper.
Design Pedestals for plain bearing driving boxes in accordance with Standard Drawings (see Index).
Make toes and vertical draw to dimensions given on Standard Drawings (see Index.
See also Group 16.

5. PEDESTAL CAPS: Drill holes in caps 1/16" larger than diameter of bolts to frame.
COLLAR BOLTS: When used, provide 1/16" fillets above and below collar. Round off shoulder in hole in frame to fit fillet at top of collar. Chamfer hole in pedestal cap 1/8" deep at an angle of 45°.

(over)

6. SHOES and WEDGES: Provide 1/4" fillet on inside corners and 9/32" radius on frame pedestal legs. Allow 1/16" maximum clearance between shoe and pedestal cap. Place wedges at back of box, set 3/4" above pedestal tie or lock nuts. Taper 1" in 12". Thickness at bottom in even sixteenths.
Do not use horizontal SET SCREWS to secure Shoes and Wedges to pedestal.
Use WEDGE BOLTS to Standard Drawings (see Index) as follows:

FRAME WIDTH	BINDER TYPE	WEDGE BOLTS, SINGLE DIAMETER
Under 4"	Cap	1"
4" and over	Cap	1-1/4"

7. CYLINDER FIT: In double front rail frames use keys in top rail at both front and back of cylinders, and in bottom rail at front only. In single front rail frames use key at front only.
On new designs with cylinders 22" diameter and over, use 1" radius at back end of cylinder fit, making total depth of fit 2-1/2" for frames 4" wide and under, and 3" for frames over 4" wide.
Frames to be delivered to the erecting floor fitted up complete except holes for cylinder bolts, which will be reamed when cylinders are fitted and keyed in the frames.

8. SPRING HANGER LUGS must not be cast in corners of pedestals. Use separate cast iron blocks to avoid shrinkage cracks.

QUESTION: Duplicate engines.
EXCEPTIONS: R. R. Co's drawings, specifications or instructions to contrary.

American Locomotive Company

ENGINEERING DEPARTMENT

STANDARD PRACTICE

48 S 2689 c

March 8th, 1922

FOREIGN LOCOMOTIVES.

For Countries other than Canada or Mexico.
" Cuba (Main Line Service Only).

Superseding 48 S 2689 b

APPROVED ENGINEERING COMMITTEE

GROUP 99⁵. MISCELLANEOUS. FINISH, &c.

MACHINERY. Polish the following:

Crosshead and Guides (all over).
Eccentric Crank.
" Rod Jaws. (Stephenson).
" " —all over. (Walschaert).
Link Lifter, Block and Plate.
Transmission Bar and Hanger.
Radius Bar and Lifter. (Walschaert).
Combination Lever. "
" Link. "
Reverse Lever Quadrant and Latch.
Reach Rod and Guide, machined parts only.
Reverse Gear (Alco Power), outside edges of guide to be ground and all painted parts filled in smooth and painted by the Works building engines.
Reverse Shaft—parts outside frame and ends of arms between frames.
Reverse Shaft Arms (outside)—design so that they can be machined all over and ground.
Rocker.
Throttle Lever Quadrant and Latch.
Main and Side Rods including Channels.
Valve Rod.
Force-Feed Lubricator Rigging.
All Bolt and Pin Heads, Nuts and Washers used in connection with finished surfaces.
Crossties located so that ends are visible between wheels, grind-finish outside edges.

COCKS, VALVES AND FITTINGS, ETC. Polish outside machined parts only:

Bell.
Blower Valve.
Lubricator Steam Valve.
Steam Heat Valve.
Injector Steam Valve.
Air Pump Steam Valve.
Gauge Cocks.
Water Gauge and Connection.
Injector Line Check.
" Check Valve.
Steam Chest Vacuum and Pressure Relief Valves, when of brass.
Cylinder Head Relief Valve, when of brass.
Feed Pipe Coupling.
Tank Cock—exposed parts only.
Steam Gauge Cock and Fittings.
Cylinder Oil Pipe Fittings.
Cylinder Oil Stud.
Piston Rod and Valve Stem Packing Oil Cups.
All other Brass Fittings for steam and air connections.

PIPES, HANDRAILS, ETC. Polish the following:

All Grab Irons, Handles and Handrails about engine and tender, together with ornaments for same.
Steam Gauge Pipe.
Air Gauge Pipe.
Copper Pipes for Brake Connection.
Injector Suction, Steam and Delivery Pipes, when of copper.
All other Copper or Brass pipes inside of cab or exposed on engine.

MISCELLANEOUS. Polish the following,

Cab Window Frames when of Brass.
Cylinder Head Casing.
Valve Chamber Head Casing—piston valve.
Bands around Steam Chest Casing (slide valve).
Chamber Covers for By-Pass Exhaust and Intercepting Valves when contained in cylinder castings.
Headlight Shelf Edge. (Only when specified.)
Run Board Plate Edge.
Rim of Brake Hand Wheel.
Face of Disc Buffer.
Name and Number Plates, machine finish outside face when of brass.
Relief Valve Boss on Cylinder, machine finish on top.

GENERAL FINISH.

Machine off Driving Tires all over.
Machine off outside vertical face of Driving Wheel Rims.
Driving, Engine Truck, Trailing and Tender Wheel Centers must be made smooth and free from surface imperfections before painting.
Cab, Cab Turret, Dome Casing, Sand Box, Bell Stand, Smoke Stack, Boiler Jacket, Cylinder and Steam Chest Casings must have neat close-fitting joints and a smooth even surface before painting.
Cylinder Cock, Blow-Off Cock, Sand Box, and Whistle Rigging must have Rods and Pipes smooth, free from kinks and carefully placed as to alignment. The various fittings and attachments about engine and tender must be arranged to give a neat and pleasing effect.
Locate Vacuum Brake Ejector Exhaust Pipe inside of Boiler.

See **Group 56.**—Laws, Rules and Instructions.
Indexed in detail groups.

FOREIGN LOCOMOTIVES
General.

GROUP 99[6]. **CLEARANCES AND CURVATURE:** Design locomotives so that spacing of tires, lateral play, swing of trucks, etc., will allow curves to be easily passed, as follows:

SERVICE	UNITED STATES		METRIC	
	CURVE DEGREES	RADIUS FEET	CURVE DEGREES	RADIUS METERS
Road engines (except Articulated & Narrow Gauge) ...	16	359	10½	110
" " for South America ...	22	262	14½	80
" " Articulated ...	22	262	14½	80
" " Narrow Gauge ...	22	262	14½	80
Switching engines ...	25	231	16½	70

South American engines to provide for 20% in addition to specified curvature, but in no case to be less than 22° (U. S.).

Check relation of engine and tender when on maximum curve (especially switching engines) to provide sufficient movement of cab apron and a minimum clearance of 16" between cab and tank handles.

When curvature is specified in metric Degrees divide by .6562 to obtain approximate equivalent curvature in United States Degrees.

The following table is based on the use of 20 Meter and 100 foot chords in measuring Metric and U. S. Curves, respectively:

UNITED STATES		METRIC	
CURVE DEGREES	RADIUS FEET	CURVE DEGREES	RADIUS METERS
1	5730	½	1746
1½	3760	1	1145
2	2865	1½	873
3	1910	2	582
4	1433	2½	437
4½	1252	3	382
5	1146	3½	349
6	955	4	291
7	819	4½	250
8	717	5	218
9	637	6	194
10	574	6½	175
11	522	7	159
12	478	8	146
13	442	8½	135
14	410	9	125
15	383	10	117
16	359	10½	110
17	338	11	103
18	320	12	97
19	303	12½	92
20	288	13	88
21	274	14	83
22	262	14½	80
23	251	15	76
24	240	15½	73
24½	236	16	72
25	231	16½	70
26	222	17	68
27	214	17½	65
28	207	18	63
29	200	19	61
30	193	19½	59
30½	189	20	53

See **Group 56.**—Laws, Rules and Instructions.

Cross-Indexed in detail groups.

QUESTION: Duplicate engines.
EXCEPTIONS: R. R. Co.'s drawings, specifications or instructions to contrary.

American Locomotive Company

ENGINEERING DEPARTMENT

STANDARD PRACTICE

49 S 1045\b

March 16th, 1920

GAUGES, TEMPLATES AND JIGS
Wire Gauge

Superseding 49 A 1045a

APPROVED ENGINEERING COMMITTEE

The **Birmingham** or **Stubs** wire gauge is the Standard of the American Locomotive Co., and must be used for gauging the thickness of sheet metal, pipes, tubes, wire and netting, except iron or steel plates thinner than No. 12 gauge, for which the **United States Standard** gauge must be used. On drawings, records and material orders the gauge must be designated as either B. W. G. or U. S. S. G. in accordance with the above.

QUESTION: Duplicate engines.
EXCEPTIONS: R. R. Co.'s drawings, specifications or instructions to contrary.