

American Locomotive Company

ENGINEERING DEPARTMENT

STANDARD PRACTICE

IO S 2337 b

Aug. 4th, 1931

ASH PAN

Superseding
IO S 2337 a

APPROVED
ENGINEERING
COMMITTEE

1. **Air Openings:** Design Ash Pans to permit free admission of air. Make total unobstructed AIR OPENINGS equivalent to 14% of total grate area, if Purchaser's representatives will approve resulting reduction in slope of side sheets. In no case provide less than the following percentages of the total internal tube and flue area:

Road Engines and Wide Fire Box Switchers..... 100%

Narrow Fire Box Switchers..... 100% preferred, 60% minimum.

For engines working in high altitudes (5000 ft. and over above sea level) the above percentages should be increased from 15 to 20%.

NOMINAL INTERNAL AREA OF ONE TUBE OR FLUE IN SQ. INCHES FOR DIFFERENT DIAMETERS AND GAUGES (SWAGING OF BACK END NOT CONSIDERED).					
OUTSIDE DIA. OF TUBE OR FLUE	B. W. G. (AVG.)				
	No. 9	No. 10	No. 11	No. 12	No. 13
1½"	1.19	1.25	1.29	1.35
1¾"	1.72	1.77	1.84	1.91
2"	2.36	2.44	2.49	2.57
2¼"	3.08	3.17	3.26	3.33
2½"	3.91	4.00	4.09	4.19
3"	5.86	5.98	6.08	6.20
* 3¼"	4.87	5.00	5.13	.....
* 3½"	5.85	5.99	6.13	.....
* 5¾"	13.19	.....	.....	.....
* 5½"	14.20	.....	.....	.....

- * The areas given above for superheater flues were obtained by deducting from the internal area of the flue at its largest diameter, the external area of two or four pipes as follows:

O. D. FLUE	PIPES	
	NO.	O. D.
3¼"	2	1½"
3½"	2	1¾"
5¾" & 5½"	4	1½"

Arrange openings in the following order:

- 1st: For wide fireboxes provide openings on sides directly under firebox ring which will admit air and facilitate the removal of ashes from slope.
- 2nd: For deep ash pans provide side openings, preferably protected by netting and inclined plates.
- 3rd: Openings at front.
- 4th: Openings at back.

For pans of the "hoe-out" type consider the opening of one damper as forming part of air opening.

2. **Slide Guide Cores:** To facilitate cleaning sand from thawing-out passages, make cored passages at least 1" deep. Apply ¾" pipe plugs at end of longitudinal passages and 1" pipe plugs at ends of transverse passages.
3. **Wheel Pocket Clearances:** Allow clearances between pan and parts named below as follows:

Driving Wheel (top of flange).....	2¼" minimum.
Trailing " (" " ").....	4 " "
Underside of grate bar to top of pocket.....	6 " "
4. See Group 48.—Foreign Locomotives.
5. See Group 56.—Laws, Rules and Instructions, I. C. C., Public Service Commission, &c.
6. See Group 61.—Oil Burning, Attachments.

QUESTION: Duplicate engines.

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

American Locomotive Company

ENGINEERING DEPARTMENT

STANDARD PRACTICE

II S 2247 h

December 22nd, 1931

AXLES

Superseding
II S 2247 g

APPROVED
ENGINEERING
COMMITTEE

1. **Engine Truck Axles:** Use with enlarged wheel fits for Standard gauge engine trucks, per Standard drawings (see Index).
2. **Tender Trucks:** Use A. R. A. Standard axles for Standard gauge trucks per Standard drawings (see Index).
3. **Driving Axles:** Make diameter of wheel seats equal to journal diameter plus $\frac{1}{8}$ ".
Make diameter at center portion (between journals) not less than figures given below:

	MINIMUM DIAM. BETWEEN JOURNALS
Main Axles—Walschaert Gear.....	Journal diam. minus $\frac{1}{4}$ "
" " —Stephenson ".....	" " (no reduction)
Rear " —440 Type engines.....	" " minus $\frac{1}{4}$ "
Axles other than Main (except as noted above).....	" " " $\frac{1}{2}$ "

Make radius of fillets at shoulders as large as possible.
4. **Rough-turned Axles:** Allowances over the finished dimensions to be as follows:
 - $\frac{1}{8}$ " on all finished diameters. Provide smooth machine finish between journals.
 - $\frac{3}{16}$ " on each finished end surface including shoulders and collars, except outside ends of Tender Axles no allowance.
5. **Omit Collars** between wheel fits and journals of all inside-bearing Driving, Engine Truck and Trailing Truck Axles.
6. **Heat-Treating:** Hollow-bore all quenched and tempered axles of either carbon or alloy steel, as well as all normalized or annealed alloy steel axles, as follows:
 - All Driving Axles.
 - Engine Truck and Trailing Truck axles with finished journals 7" diameter and over.

Size of hole approximately 25 to 30 per cent of the corresponding journal diameter.

JOURNAL DIAMETER	HOLE DIAMETER
7 " to 8"	2 "
8 $\frac{1}{2}$ " to 10"	2 $\frac{1}{2}$ "
10 $\frac{1}{2}$ " & Over	3 "

(OVER)

7. Billets for Standard Driving and Engine Truck Axles: Use the following sizes and weights, each billet being figured to make two axles.

Driving Axle Billets are based on the maximum size required for Standard Gauge regular work, with enlarged wheel fits.

Weight of hammer used for forging Axles from billets 10' x 10' or over should not be less than 6000 lb.

Weight of hammer used for forging Axles from smaller size billets should not be less than 3500 lb.

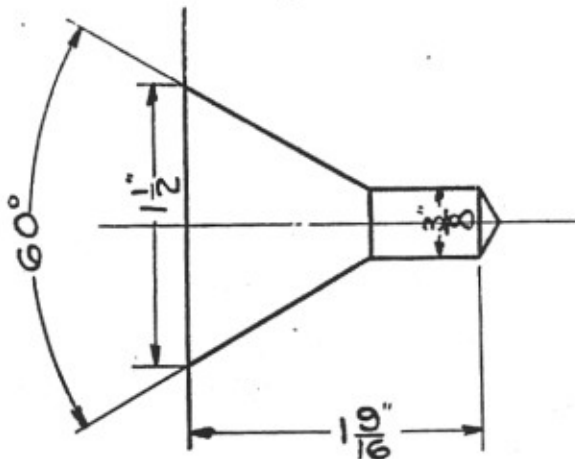
DRIVING AXLES							
JOURNAL DIA.	BILLET	WEIGHT LB.		JOURNAL DIA.	BILLET	WEIGHT LB.	
		NOT HEAT-TREATED	HEAT-TREATED			NOT HEAT-TREATED	HEAT-TREATED
7"	11" x 11"	2110	2200	10"	14" x 14"	4125	4310
7½"	11" x 11"	2350	2490	10½"	15" x 15"	4525	4730
8"	12" x 12"	2690	2810	11"	15" x 15"	4925	5150
8½"	12" x 12"	2990	3120	11½"	16" x 16"	5430	5680
9"	13" x 13"	3330	3480	12"	16" x 16"	5830	6100
9½"	13" x 13"	3680	3850	12½"	17" x 17"	6330	6620
				13"	17" x 17"	6830	7140

ENGINE TRUCK AXLES			
JOURNAL DIA.	BILLET	WEIGHT LB.	
		NOT HEAT-TREATED	HEAT-TREATED
5"	8" x 8"	1080	1130
5½"	9" x 9"	1300	1360
6"	9" x 9"	1500	1570
6½"	10" x 10"	1750	1830
7"	11" x 11"	2010	2100
7½"	11" x 11"	2260	2370
8"	12" x 12"	2570	2680

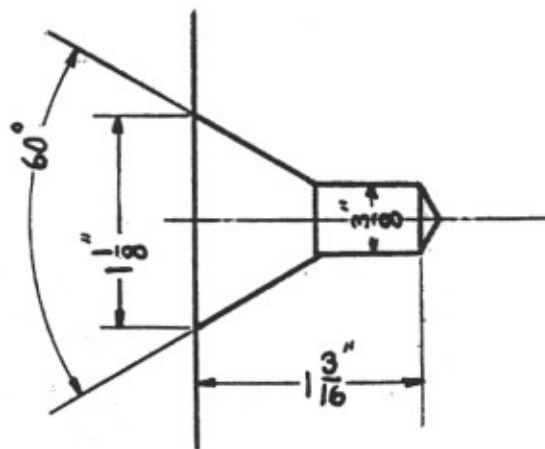
For method used in obtaining size of billets given above, see Group 99^s.

8. Lathe Centers for Turning Axles: Use sixty degree taper as per sketches below, except Hollow-bored driving axles—counterbore ends of central hole with sixty degree taper ½" deep.

Driving Axles.
Trailing Axles.



Engine Truck Axles.
Tender Truck Axles.



9. When Ends of engine truck, trailing truck or driving axles are polished, axles must project through wheel hubs at least ¼".
10. See Group 56—Laws, Rules and Instructions, I. C. C. Public Service Commission, &c.

QUESTION: Duplicate engines.

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

American Locomotive Company

ENGINEERING DEPARTMENT

June 27, 1938

STANDARD PRACTICE

11 S 2248d ✓

AXLES

Superseding

11 S 2248c

APPROVED
ENGINEERING
COMMITTEE

1. Use the following:

AXLE	Maximum allowable BEARING PRESSURE, POUNDS PER SQ. IN. OF PROJECTED AREA OF JOURNALS			
	Net Loads			
	Passenger	Fast Freight*	Freight	Switch.
Driving	† 175	† 175	200	200
Trailing, I.S.Brg.	225	225	250	-
" O.S.Brg.	250	250	250	-
Eng.Trk. I.S.Brg.	160	160	180	
" " O.S.Brg.	250	250	250	

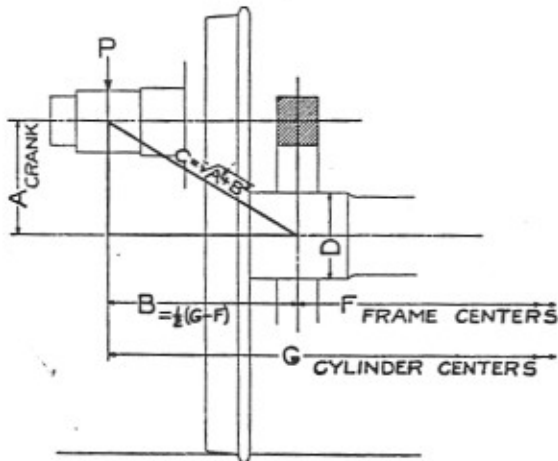
* Fast Freight is considered to be where the speed of engine in miles per hour approaches the diameter of the drivers in inches.

† Rubbing speed factor (product of bearing pressure times rubbing speed in feet per minute, based on 336 RPM or speed in MPH equal to the diameter of drivers in inches) not to exceed 200,000.

AAR STANDARD TENDER AXLES			Weight of one Axle
Size of Axle	Max. Load Limited by FIBRE STRESS Passenger and Freight Must not Exceed		
	Total per Axle	Per Sq. In. Projected Area of Journal	
3-3/4" x 7"	15000	285	390
4-1/4" x 8"	24000	352	493
5" x 9"	32000	355	655
5-1/2" x 10"	40000	363	780
6" x 11"	50000	379	950
6-1/2" x 12"	60000	385	1115

TENDER AXLES are limited by fibre stress and in no case should the AAR fibre stress limitations be exceeded.

c. Calculate MAIN DRIVING AXLE JOURNAL DIAMETER as follows:



P = Piston Thrust with full boiler pressure in pounds. See table, Group 99^B.
 M = Combined bending and twisting moment.

$$M = \frac{P(B + C)}{2}$$

S = Fibre Stress = $\frac{M}{R} = 23000$ lb. per sq. in. max. for steel axles.

R = Modulus of circular section with diameter equal to "d" = $.0982 d^3 = \frac{M}{S}$

See Table, Group 99^B.

D = Nominal diameter of journal

$$d = D - 3/8" \text{ allowance for wear} = \sqrt[3]{\frac{M}{.0982 S}}$$

All dimensions in inches.

3. OUTSIDE-BEARING TRAILING TRUCK AXLES: Make minimum diameter of central portion (for all track gauges) in accordance with table below:

SIZE OF JOURNAL	DIAMETER AT CENTER	MAXIMUM LOAD PER AXLE	
		PASSENGER	FREIGHT
5½" x 8"	6⅜"	19800	22000
5½" x 10"	6⅜"	24750	27500
6" x 12"	7½"	32400	36000
6" x 14"	7½"	37800	42000
* 7" x 12"	7⅞"	37800	42000
7" x 14"	7⅞"	44100	49000
7½" x 12"	8⅞"	40500	45000
7½" x 14"	8⅞"	47250	52500
8" x 12"	8¾"	43200	48000
8" x 14"	8¾"	50400	56000
8½" x 12"	8½"	45900	51000
8½" x 14"	8½"	53550	59500
9" x 14"	9"	56700	63000
9" x 16"	9"	61800	72000
9½" x 14"	9⅝"	59850	66500
9½" x 16"	9⅝"	68400	76000

* Use preferably 6" x 14" instead.

Journal length and use of collar on end of axle, as per Standard Drawing (see Index)

QUESTION: Duplicate engines,

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

AMERICAN LOCOMOTIVE COMPANY
ENGINEERING DEPARTMENT

OFFICE INFORMATION

11 S 2696h

March 18, 1927.

AXLES

Superseding

11 S 2696h

APPROVED

J.G.B.

1. CRANK AXLE DISC: Allow 3/8" finish on faces of disc as shown on Dwg. 112 S 2590-Revision Z.
Letter Mr. J.B.Ennis, V.P. 12-26-24.

3-18-27

L. Blunt

2. Paragraph 2 of Sheet 11 S 2696h is hereby cancelled.
Letter Mr. J.B.Ennis, V.P. 2-23-27.

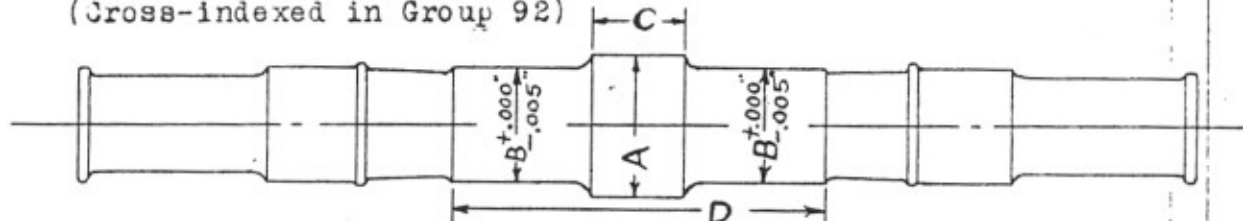
3. DELTA "B" COMMONWEALTH TRAILING TRUCKS: Use end collar 3/4" wide and 3/4" high as shown on Dwg. 952 S 31160, (See letter C.T.W. 10-30-20, order B-1542), N.Y.C. Lines excepted, for which use A.L.Co. Standard Practice.

3-18-27

L. Blunt

4. ~~CRANK~~ - ~~AND CRANK PIN~~ ALLOY STEEL FORGINGS - HOLLOW BORED: K 8-2-33
Raise question with V.P. Eng. when hollow boring is not specified for axle and crank pin forgings having finished journal diameters 7" and over. E.C. 3-1-27.
(Cross-indexed in Group 29)

5. BOOSTER GEAR FIT ON TRAILER AXLES: Make gear fit and bearings for application of Locomotive Booster in accordance with Franklin Railway Supply Co's Dwg. B-22261A, as follows:
(Cross-indexed in Group 92)



Axle gear pressed on with 90 to 120 tons pressure.

BOOSTER APPLICATION		A	B	C	D
FUTURE		11-1/8"	9"	8"	40"
ON ENGINES WHEN BUILT	ROUGH	11-1/8"	9-1/8"	8-1/8"	40-1/8"
	FINISHED	11"	9"	8"	40"

Letter Mr. J.B.Ennis, V.P. 8-3-22.

6. DRIVING AXLES: Modify Par.3 Of Standard Practice Sheet 11-S-2247h to call for wheel seats equal to journal diameter $\pm 1/2$ " wherever possible.
EC-1573-29 6-6-33.

J 6/28/33

AMERICAN LOCOMOTIVE COMPANY
ENGINEERING DEPARTMENT

OFFICE INFORMATION

11 S 2839d

~~March 15, 1928.~~

December-26,-1928

AXLES

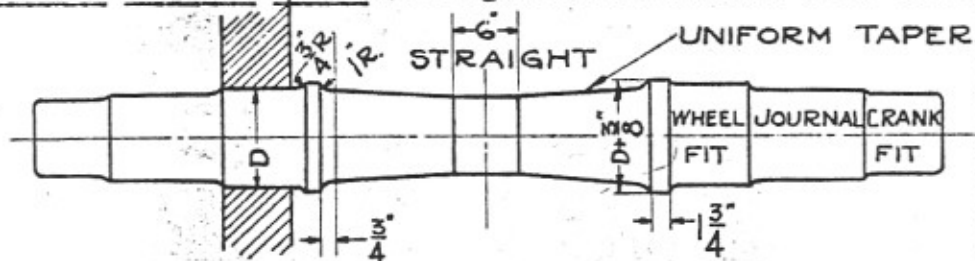
Superseding

11 S 2839d

APPROVED

JGB

1. OUTSIDE JOURNAL DRIVING AXLES: Design in accordance with sketch.



to insure strength at juncture of wheel fits and central portion of axle.

OUTSIDE JOURNAL LEADING AND TRAILING TRUCK AXLES: Design with collars and tapered central portion similar to A.R.A. Standard for Tender Axles of nearest corresponding journal size.

Let. J. B. E., V.P., 5-14-25.

2. THREE-CYLINDER ENGINES: Provide clearance between middle main rod and front or intermediate axle by increasing driving wheel base instead of using bent axles. EC-1370, 4-13-25.

3. TENDER TRUCK AXLES are to be purchased outside.

J. B. E. 4-19-26.

4. CRANK AXLES: Provide lathe centers for rough turning and finishing middle crank as shown on Drgs. 112 S 9206 and 113 S 2760. Use two dowels instead of single keys in mounting crank cheeks on middle crank pins. L. J.G.B., 7-13-26, and EC-1370, 5-3-27 & 11-27-28.

5. Paragraph 6 of 11 S 2839d has been transferred to Std. Practice.

6. TENDER AXLES: Supplementing Std. Practice, add the following to table of A.R.A. Std. tender axles:

Transferred to Printed Std. Prac

SIZE OF AXLE	MAXIMUM LOAD LIMITED BY FIBER STRESS				WT. ONE AXLE
	PRESSURE		PER SQ. IN. JOUR.		
	PASS.	FRT.	TOTAL AXLE		
8 1/2 x 12	45800	50700	60000	385	1115

Mr. J. G. Blunt, N.E., 3-15-29.

G 7/19/31

12-20-28

J.G. Blunt

3-15-29

J.G. Blunt

American Locomotive Company

ENGINEERING DEPARTMENT

October 23, 1936

STANDARD PRACTICE

12 S 1479-c

BELL

Superseding

12 S 1479-b

APPROVED
ENGINEERING
COMMITTEE

1. Use BELL AND DETAILS for Standard Gauge Locomotives having cylinders 17" diameter and over as per Standard Drawings, (see Index).
2. BELL MATERIAL: See Group 99¹.
3. BELL WEIGHT: 80# finished.
4. Cast RINGER BRACKET on right hand side of all bell frames. Use dimensions and location of brackets shown on Standard Drawing of bell frame.
5. Apply power operated BELL RINGER on engines equipped with air brake when under I.C.C. jurisdiction and on all other domestic engines with cylinders 18" and over in diameter.
6. Use 5/16" diameter cable-laid 4-ply India bell rope (about 40 ft. to the pound).
7. When bell is located ahead of stack, the front end of the bell rope is to be made of chain to prevent the rope being burnt by the heat of the smokebox.
8. Use brass BELL ROPE THIMBLES for wood and steel cabs, as per Standard Drawings, see Index).
9. See Group 56 - Laws, Rules and Instructions, I.C.C., Public Service Commission, etc

QUESTION: Duplicate engines.

EXCEPTIONS: R. R. Co's drawings, specifications or instructions to the contrary.

American Locomotive Company

ENGINEERING DEPARTMENT

Oct. 15, 1936

STANDARD PRACTICE

13-S-2249-1-g

Sheet 1

BOILER

Superseding
13-S-2249-f Par 5 14-S-2253-a Par 1 & 2
13-S-2250-c " 3 14-S-2254-f " 3
14-S-2252-g " 1, 2 & 12

APPROVED
ENGINEERING
COMMITTEE

1. **NAMES OF SHEETS:** Use the following for designating the different sheets used in boiler construction and upon all drawings and bills of material.

SHELL	FIREBOX
Smoke Box, Smoke Box Liner. Front Tube Sheet. First Ring, Second Ring, Third Ring. Conical Connection. Dome, Dome Base, Dome Ring, Dome Cap, Dome Liner. Roof Side, R. & L. } or Roof and Sides, when in one piece Throat. Backhead. Fire Hole Ring. Gusset Brace Plates, Liner Plates. Welt Strips: outside or inside; First, Second, Third, and Connection.	Crown Side, R. & L. } or Crown and Sides, when in one piece Tube Sheet. Back. Throat (inside) used with combustion Chamber or "D" tube sheet. Combustion Chamber.

2. **TUBES, FLUES, PIPES, ETC.:** For the sake of uniformity and to avoid confusion do not use the terms: "large and small superheater tubes " but refer to them as follows:

Boiler Tubes: Those tubes or flues not having superheater piping inserted.

Superheater Flues: Those tubes or flues into which superheater piping is inserted.

Superheater Pipes: The piping for the superheated steam, usually consisting of two or more pipes made up into a bundle or unit, having the ends bent for connection to the headers.

Fire Brick Tubes: The tubes of about 3", 3-1/2", and occasionally 4" O.D. inserted in the firebox to support the brick arch.

3. **SUPERHEATER FLUES AND PIPES:** Use the following sizes for Type A superheaters:

SERVICE	OUTSIDE DIAMETER		
	TUBES	FLUES	PIPES
Road	2" 2 1/4"	5 3/8" 5 1/2"	1 1/2" 1 1/2"
Switching	2" 2 1/4"	5 1/2" 5 1/2"	1 1/2" 1 1/2"

4. **THREADS:** All boiler Stays to have twelve (12) American National (U.S. Std.) threads per inch.

5. **TAPERED THREADS:** Use "V" threads, 12 per inch, on the following details screwed into boiler, or any part requiring steam tight connection. Taper of thread as noted:

DETAILS	TAPER OF THREADS IN 12 INCHES
Studs	3/4"
Plugs, Cocks, Valves and Brass Fittings (except as noted below).	3/4"

Use Standard Pipe Threads on shanks of safety valves and safety valve bushings screwed into boiler sheets 3/4" thick and over into turret.

(over)

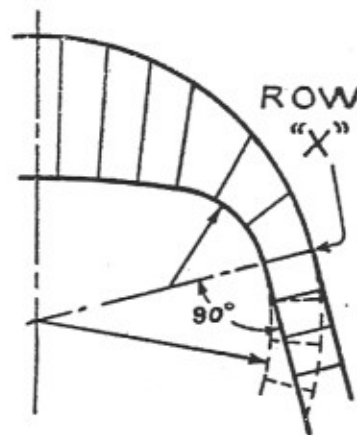
6. BOILER FIREBOX STAY CLASSIFICATION:

Water Space Stays: All stays in throat and back sheets, and in sides up to where inner sheets meet curves at sides of crown (row "X" included see sketch at right), also higher rows in sides when not exceeding 8" in length over sheets.

Expansion Stays: Transverse rows of flexible or sling stays at front of crown.

Crown Stays: Central longitudinal rows supporting crown and having tapered threads, button-heads, or nuts on lower end.

Radial Stays: Longitudinal rows of stays above water space stays, other than expansion or crown stays.



7. CROWN, EXPANSION and RADIAL STAYS: Apply in firebox, with lower ends riveted over, or with button-heads or nuts to suit different conditions as tabulated below.

CLASS OF STAY		FIREBOX MATERIAL AND TYPE					
		STEEL				COPPER (Domestic)	
		COAL-BURNING (EXCEPT PULVERIZED COAL)		OIL OR PULVERIZED COAL-BURNING		COAL, OIL OR PULVERIZED COAL-BURNING	
		RADIAL	BELPAIRE	RADIAL	BELPAIRE	RADIAL	BELPAIRE
CROWN STAYS	RIGID	Riveted over, Taper Threads 1½" in 12"		Riveted over, Taper Threads 1½" in 12"		Button Heads, Taper Threads ½" in 12" *	
	EXPANSION	Riveted over, Straight Threads					
RADIAL STAYS	RIGID	Riveted over, Straight Threads	Riveted over, Taper Th'ds 1½" in 12"	Riveted over, Straight Threads	Riveted over, Taper Th'ds 1½" in 12"	Riveted over, Straight Threads	Button H'ds, Taper Th'ds ½" in 12" *
	EXPANSION	Riveted over, Straight Threads					

* Tap straight hole in sheet, same diameter as small end of taper threads on stays.

EXPANSION STAYS	
I. D. FIRST BOILER COURSE	NUMBER OF ROWS
Under 60"	2
60" and over	3

CROWN STAYS	
O. D. LARGEST BOILER COURSE	NUMBER OF ROWS
75" and under	6
Over 75" and including 90"	8
Over 90"	10

Do not cut off squares on lower end of button-head stays after application to boiler.

For Copper fireboxes when A. L. Co. Flexible Expansion Stays are used and taper fit in crown is called for, use Style "Y" with threaded ball on top.

8. SCARFING: Scarf firebox sheet flanges as shown on Standard drawing (see Index. Group 14). Scarf flange of combustion chamber inside throat sheet as shown on this drawing down to within 6" of top of mud ring.

American Locomotive Company

ENGINEERING DEPARTMENT

January 8, 1938

STANDARD PRACTICE

13-S-2249-2-h

BOILER

Superseding

13-S-2249-2-g

APPROVED
ENGINEERING
COMMITTEE

9. WELDING: Apply sealing weld along edges of plates at firebox ring corners inside and outside, extending about 4" beyond radius at front and back, about 4" beyond seam lap on sides and about 10" up from bottom of ring on all corners. Also, on narrow fireboxes, weld caulking edges along ring and up seams wherever access is known to be obstructed by frames or driving wheels.

On OIL BURNING locomotives, seal weld the bottom caulking edge of the inside firebox sheets, back of the oil pan which is lined with fire brick.

QUESTION: Duplicate engines.

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

American Locomotive Company

ENGINEERING DEPARTMENT

April 15, 1938

STANDARD PRACTICE

13-S-2250-1-e

BOILER

Superseding

13 S 2250-1-d

APPROVED
ENGINEERING
COMMITTEE

1. CODE: Designs for all new boilers must conform to the requirements of Section 3, of the ASME Construction Code for Locomotive Boilers, except as modified by the following items which provide a construction equivalent to the requirements of the Code.
2. FIREBOX RINGS: To be of cast steel in one piece.
3. MINIMUM THICKNESS OF DOME PLATES AFTER FLANGING: See Group 36.
4. MINIMUM GAUGE THICKNESS OF WALLS OF FIRE TUBES OR FLUES: Maximum allowable working pressures for steel or wrought iron tubes or flues, for fire tube boilers, for different diameters and gauges of tubes conforming to the requirements of ASME material specifications.
For pressures below those given in the table, the gauge thickness shall not be less than the minimum given in the table.

Out side Diam.	MINIMUM GAUGE B. W. G.									
	13	12	11	10	9	8	7	6	5	4
1"	470	690	860							
1-1/2"	320	460	570	720	860					
1-3/4"	270	400	490	620	740	890				
2"	240	350	430	540	650	780	900			
2-1/4"	210	310	380	480	580	690	800	960		
2-1/2"	190	280	350	430	520	630	720	860	970	1080
3"	160	230	290	360	430	520	600	720	810	900
3-1/4"		210	270	330	400	480	550	660	750	830
3-1/2"		200	250	310	370	450	520	620	690	770
3-3/4"		180	220	280	340	410	470	570	640	710
4"		180	220	270	330	390	450	540	610	680
4-1/2"		160	190	240	290	350	400	480	540	600
5"			180	220	260	320	360	430	490	540
5-3/8"			160	200	240	290	340	400	450	500
5-1/2"				200	240	290	330	390	440	490
6"				180	220	260	300	360	410	450

MINIMUM THICKNESS OF TUBES AND FLUES BWG (Based on Length)		
Outside Diam.	Thickness B.W.G.	Maximum Allowable Length
2"	12	19' - 0"
	13	16' - 0"
2-1/4"	12	24' - 0"
	13	18' - 0"
2-1/2"	11	30' - 0"
	12	24' - 0"

B.W.G.	THICKNESS	
	In.	B.W.G.
4	.238	10
5	.220	11
6	.203	12
7	.180	13
8	.165	14
9	.148	

5. BRICK ARCH TUBES: See Group 45.

6. SEAMS:**Longitudinal and Circumferential Seams:**

Use seams shown on Standard drawings (see Index).

Cut welt strips crosswise of plate as rolled, so that longitudinal laminations in plate will not reduce circumferential strength of seam.

Sextuple, octuple and decuple longitudinal seams must have at least four longitudinal rows of rivets through outer welt. In figuring factor of safety of boiler courses having welds in longitudinal seams, do not allow any value for weld in figuring efficiency of joint.

Throat: Use seams shown on Standard Drawings, (see Index).

Dome Seams: See Group 36 and Standard Dome Drawings (see Index).

7. **TELLTALE HOLES:** Allow iron water space stays to project through inner and outer sheets $3/16"$ at closest point, to allow for heading over, and drill telltale holes at least $3/16"$ (0.1875) but not more than 0.24" diameter, in outer ends. When holes are multiple-drilled the maximum size of hole referred to is that left after cutting off and heading over stay. In water space stays, and when required in other stays, holes must extend at least $5/8"$ inside inner face of sheet (and welts, if any) through which rigid stays pass; holes in reduced body stays must extend into body beyond fillet between body and threaded portion.

8. **HOLLOW STAYBOLTS:** All fireboxes having rigid stays or flexible stays without removable caps, coming behind the following or similar attachments, which are not removable for inspection of stayed inner end, apply hollow staybolts in such location with hole throughout their length; minimum diameter of hole $3/16"$, maximum 0.24", to facilitate inspection.

COAL BURNING ENGINES

Grate Side Frames

" Dead "

Gaines Brick Arch - Vertical wall

Brick Arch

OIL BURNING ENGINES

Firebrick

Brick Arch

9. **SPACING AT CORNERS, ETC.** Pay particular attention to spacing of stays at corners adjacent to seams, irregular rows, etc., so that limiting stress is not exceeded. Where unusually large water spaces are used at back and front of firebox, and distance from end row of stays to the beginning of radius in outer sheet exceeds maximum pitch given in Paragraph 11, corresponding to the thickness of outer sheet and maximum pressure used, raise question to consider whether back head radius should be increased, water space decreased or what remedy should be adopted. Locate water space stays as far as practicable in continuous horizontal and vertical rows.

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10. PITCH: Determine maximum pitch of Water Space by the two methods given below, and use the minimum value thus obtained.

(a) Do not exceed a maximum stress of 7500 lb. per square inch of net area when stays are made of iron.

In calculating stress, use supported area less area of stay at root of thread, multiplied by maximum pressure for which the boiler is designed, divided by net area of stay. Net area of stay means least cross-sectional area at any part, usually at the root of the thread less tell-tale hole, but may be at center, in case it is reduced below bottom of thread.

(b) Do not exceed the maximum pitch given in table.

Limit maximum pitch of stays for thickness of steel plate, in accordance with table, based on the following (ASME Boiler Code) formula:

$$P = \frac{CT^2}{p}$$

Where:

P = Maximum allowable working pressure, lb. per sq. in.

C = 125 for plates 7/16" thick and under,
135 " " over 7/16" thick.

T = Thickness of plate, in sixteenths of an inch.

p = Maximum pitch, in inches.

MAXIMUM PRESSURE (P)	MAXIMUM PITCH (p)						
	THICKNESS OF PLATE (T)						
	5/16"	3/8"	7/16"	1/2"	9/16"	5/8"	11/16"
150	4 9/16	5 7/16	6 3/8	7 1/16	8 1/2		
160	4 3/8	5 5/16	6 3/16	7 1/8	8 1/4		
170	4 1/4	5 1/8	6	7 1/8	8	8 3/8	
180	4 1/8	5	5 3/4	6 7/8	7 3/4	8 3/8	
190	4	4 13/16	5 5/8	6 11/16	7 3/4	8 3/8	
200	3 15/16	4 11/16	5 1/2	6 9/16	7 3/8	8 3/16	9
210	3 13/16	4 5/8	5 5/8	6 5/8	7 3/8	8	8 13/16
220	3 3/4	4 1/2	5 1/4	6 1/4	7	7 13/16	8 13/16
230	3 11/16	4 3/8	5 1/8	6 1/8	6 7/8	7 5/8	8 3/4
240	3 9/16	4 3/16	5	6	6 3/4	7 1/2	8 1/4
250	3 1/2	4 3/16	4 15/16	5 13/16	6 5/8	7 5/8	8 1/2
260	3 1/16	4 1/8	4 13/16	5 3/4	6 1/2	7 3/8	7 7/8
270	3 3/8	4 1/16	4 3/4	5 5/8	6 3/8	7 1/8	7 3/4
280	3 1/8	4	4 5/8	5 9/16	6 1/4	6 13/16	7 5/8
290		3 15/16	4 3/8	5 1/16	6 1/8	6 13/16	7 1/2
300		3 7/8	4 1/2	5 3/8	6	6 11/16	7 3/8
310		3 13/16	4 1/16	5 1/4	5 13/16	6 9/16	7 1/4
320		3 3/4	4 3/8	5 3/16	5 13/16	6 7/16	7 1/8
330		3 11/16	4 1/4	5 1/16	5 3/4	6 3/8	7

11. IRON CROWN and RADIAL STAYS (except FLEXIBLE STAYS): Determine maximum pitch for lower ends in accordance with tables of maximum area below when least section of stay is thru body. Make stays to Standard Drawings (see Index).

IRON CROWN & RADIAL STAYS (UPSET ENDS) 12 THREADS PER INCH																		
BODY			MAXIMUM AREA IN SQ. IN. SUPPORTED BY ONE STAY AT PRESSURE OF															
DIAM.	AREA	Max. Load at 7500 lb.	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330
1 3/16"	.5185	3888	.....	.....	.....	.....	18.19	17.43	16.72	16.07	15.48	14.92	14.41	13.93	13.48	13.06	12.67	12.30
1 5/16"	.6903	5177	.....	.....	26.58	25.34	24.22	23.20	22.26	21.40	20.60	19.87	19.18	18.54	17.95	17.39	16.87	16.38
1 7/16"	.8866	6650	.....	.....	.....	.....	.....	29.80	28.60	27.49	26.47	25.52	24.64	23.82	23.05	22.34	21.67	21.04

12. CROSS-SECTIONAL AREAS OF WATER SPACE STAYS: Together with limiting loads and maximum supported areas are given in tables below:

IRON WATER SPACE STAYS— U. S. STANDARD THREADS, 12 PER INCH													
DIAMETER		AREA—SQ. IN.			Max. Load at 7500 lb.	MAXIMUM AREA IN SQ. IN. SUPPORTED BY ONE STAY AT PRESSURE OF							
Outside	At Root	At Root	Net Cross-Sectional	160		170	180	190	200	210	220	230	240
3/8"	.7667	.4617	.4165	3124	19.99	18.84	17.82	16.91	16.08	15.34	14.66	14.05	13.48
1"	.8917	.6245	.5793	4345						20.37	19.51	18.73	
1 1/16"	.9542	.7151	.6699	5024								21.65	
1 3/8"	1.0167	.8118	.7666	5750								24.77	

IRON WATER SPACE STAYS— U. S. STANDARD THREADS, 12 PER INCH													
DIAMETER		AREA—SQ. IN.			Max. Load at 7500 lb.	MAXIMUM AREA IN SQ. IN. SUPPORTED BY ONE STAY AT PRESSURE OF							
Outside	At Root	At Root	Net Cross-Sectional	250		260	270	280	290	300	310	320	330
3/8"	.7667	.4617	.4165	3124	12.96	12.48	12.03	11.62	11.23	10.88	10.54	10.22	9.93
1"	.8917	.6245	.5793	4345	18.00	17.34	16.72	16.14	15.61	15.11	14.64	14.20	13.79
1 1/16"	.9542	.7151	.6699	5024	20.81	20.04	19.33	18.66	18.04	17.46	16.92	16.42	15.94
1 3/8"	1.0167	.8118	.7666	5750	23.81	22.92	22.11	21.34	20.64	19.98	19.36	18.78	18.24

(over)

13. **HOLES FOR SCREW STAYS:** Stays or staybolts passing thru outer sheet at an angle, drill sufficiently small to insure a smooth hole for perfect thread. Locate all crown and radial stays radial with crown sheet. When necessary to locate any rows of button head stays at an angle, make enlarged view of same on boiler drawing, showing crown sheet spot-faced not over 1/32" on under side to give a fair bearing. If angle requires more than 1/32" raise question. On all boilers where angularity of flexible radial stays or flexible expansion stays is such as not to provide three continuous threads in the roof sheet, raise question with V.P. Engineering whether welded bosses or sleeves are to be used.

HOLES FOR	Punch Holes Only When Not Equipped for Drilling		Hole after Reaming or Redrilling Equals Dia. of:
	Drilled Hole Equals Dia. of:	Punched Hole Equals Dia. of:	
Staybolts & Crown Stays	Thread - 5/32"	Thread - 1/4"	Hole for tapping

Holes for Button head and Riveted Crown Stays for oil-burning engines to be tapped through crown and outer sheet with parallel taps. Retap from fire side through crown with taper tap gauged to obtain exact nominal diameter of thread - 1/32".

14. **FEET FOR BRACES TO BACK HEAD and FRONT TUBE SHEET:** Should be distributed so as not to concentrate the stress on any one section. Preferably locate a portion of the brace feet on the second course from the back head or front tube sheet. Usually the diagonal should within 10 or 12 degrees. The increased stress due to the diagonal of bracing need not be considered when angle does not exceed 15 degrees. Stiffness of sheet neglected.
15. **LONGITUDINAL BRACES and TIES:** Use as shown on Standard Drawings (see Index). Jaws and brace lugs to be forged.
16. **TUBE and FLUE SETTING:** Follow method shown on Standard Drawings, using Standard Tools (see Index). Electric weld tube and flue ends only when specified, as shown on Standard Drawings. Ferrules: Use on firebox end only copper ferrules 1/16" thick, with diameter and length as follows:

OUTSIDE DIAMETER		
Tubes and Flues		Ferrules
Tubes	1-3/4"	1-3/4"
"	2"	2"
"	2-1/4"	2-1/4"
"	2-1/2"	2-1/2"
"	3-1/2"	3-1/8"
Flues	5-3/8" & 5-1/2"	4-5/8"

TUBE SHEET THICKNESS	LENGTH OF FERRULES
1/2" and 9/16"	5/8"
5/8" and 11/16"	3/4"

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BOILER

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ORDERING LENGTH (except when safe-ended) to be as follows:
 Under 15 feet, 1" longer than distance over tube sheets.
 15 feet and over, 1-1/2" longer than distance over tube sheets.
 When R.R. Co's specify setting which requires longer tubes or flues, with relation to distance over sheets than our Standard Practice, make ordering length equal to distance over sheets plus the sum of projections of ends before setting, plus 1" allowance.

17. ARCH TUBE SETTING: See Group 45.

18. HOLES FOR RIVETS:

HOLES FOR	PUNCH HOLES ONLY WHEN NOT EQUIPPED FOR DRILLING	
	Drilled Hole Equals Dia. of	Punched Hole Equals Dia. of
Smokebox Rivets	Riv. before driving - 1/16"	Riv. before driving - 3/16"
Rivets in Longitudinal Seams	" " " - 5/16"	" " " - 5/16"
Rivets in Firebox Seams	" " " - 1/16"	" " " - 1/16"
" " all other seams"	" " " - 1/16"	" " " - 1/16"

HOLES FOR	Hole after Reaming or Re-drilling Equals Dia. of:
Smokebox Rivets	Riv. before driving +1/16"
Rivets in Longitudinal Seams	" " " +1/16"
" " Firebox Seams	" " " +1/32"
" " all other seams	" " " +1/16"

The die side of all punched holes to be taken as the punched size. Reaming to be done after plates are assembled.

Chamfer edge of all rivet holes under head 1/16" radius.

(over)

19. RIVETS:

RIVETS	HEADS (SEE NOTE BELOW)		
	OUTSIDE	WATER SIDE	FIRE SIDE
Shell Plates and Brace Rivets--Except front tube sheet brace rivets	Button	Button	---
Front Tube Sheet Braces	Crown Csk.	Button	---
Firebox (steel) } Drive from fire side Plate edges scarfed (except tube sheet flange in combustion chamber over 24' long).	---	Button	Crown Csk. (except tube sheet in comb. chambers over 24' long--Button)
	Roof and sides to Backhead { 1st Choice 2nd "	Button Steeple	Button Cone
Firebox Ring	Button	---	Special Csk.
Waist Sheet Angles or Tees	Button	Button	---

All rivets must fill holes completely.

Use countersunk rivets other than those noted above, only where necessary or specified.

Use steel rivets to A. L. Co. Standard Material Specification, whether power or hand-driven, and in accordance with Standard drawings (see Index).

IRON RIVETS- See Group 15.

20. CALKING: Calk longitudinal seams on outside of boiler only. Calk circumferential shell seams and firebox seams both inside and outside. Calk seam between smoke-box and first shell course on outside only. Where ring is used, calk smokebox to ring and ring to shell on outside only. Bevel calking edges of all plates to 75 degrees. Do not plane inside welts.
21. WASHOUT PLUGS: See Group 66.
22. HOLES FOR INJECTOR CHECKS, ETC.: Reinforce all holes over 3-1/4" diameter in boiler, when diameter of hole exceeds 4-1/2 times thickness of plate. Also, where necessary to obtain at least 3/4" of thread, reinforce all holes for injector checks, whistle and safety valves when screwed into boiler extending threads through reinforcement. For reinforcement, use an internal liner not less than 75% of the plate in thickness, conforming closely to shell, and riveted in such manner that the shear of rivets gives added strength of not less than 82% of metal removed by hole. All heavy blow-off cocks having large overhang should be studded when applied to side sheets. Make all dome liners (including inspection dome liner) of shell steel of the same grade and maker as that specified for the shell plates.
23. SAFETY VALVES: See Groups 56 and 79.

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BOILERS

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13-S-2249-f Par 3 & 4

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24. WATER GAUGE and GAUGE COCKS: See Groups 27 and 56.

Steam Space: Design boilers for 1% grades where heavier grades are not specified and it is definitely known that the heaviest grades do not exceed 1%. Determine height of roof or shell sheet above top of crown at front approximately as follows:

To figure given in table for height above bottom gauge cock, add distance from bottom gauge cock to crown as given on Standard Water Gauge Location drawing (see Index, Group 27).

O. D. LARGEST COURSE	HEIGHT FROM BOTTOM GAUGE COCK TO ROOF	O. D. LARGEST COURSE	HEIGHT FROM BOTTOM GAUGE COCK TO ROOF	O. D. LARGEST COURSE	HEIGHT FROM BOTTOM GAUGE COCK TO ROOF
40	12.0	67	16.1	94	20.1
41	12.1	68	16.2	95	20.3
42	12.3	69	16.4	96	20.4
43	12.4	70	16.5	97	20.6
44	12.6	71	16.7	98	20.7
45	12.8	72	16.8	99	20.9
46	12.9	73	16.9	100	21.0
47	13.1	74	17.1	101	21.1
48	13.2	75	17.3	102	21.3
49	13.4	76	17.4	103	21.4
50	13.5	77	17.6	104	21.6
51	13.7	78	17.7	105	21.8
52	13.8	79	17.9	106	21.9
53	13.9	80	18.0	107	22.1
54	14.1	81	18.1	108	22.2
55	14.3	82	18.3	109	22.4
56	14.4	83	18.4	110	22.5
57	14.6	84	18.6	111	22.7
58	14.7	85	18.8	112	22.8
59	14.9	86	18.9	113	22.9
60	15.0	87	19.1	114	23.1
61	15.1	88	19.2	115	23.3
62	15.3	89	19.4	116	23.4
63	15.4	90	19.5	117	23.6
64	15.6	91	19.7	118	23.7
65	15.8	92	19.8	119	23.9
66	15.9	93	19.9	120	24.0

Note: In the above table, distance from water level at top gauge cock to roof is made approximately 0.15 of the outside diameter of largest course; the surface for escape of steam is thus proportional to boiler diameter, and steam space area to cubical contents of boiler. Vertical distance between top and bottom gauge cocks is 6".

25. STEAM GAUGE: See Group 79.

26. INJECTORS: See Group 55.

(over)

27. TEST all boilers in the following manner:

(a) Fill boiler with warm water (not over 150 degrees F.) and raise pressure (by use of injector or pump) to 25% above working pressure.

Note: The term "working pressure" wherever used on this card is the maximum working pressure for which the boiler is designed.

(b) Fire up boiler and test under its own steam to 25% above working pressure.

(c) Blow out boiler entirely, let stand until thoroughly cooled through, and refill with warm water (not over 150 degrees F.).

(d) Fire up and test under steam a second time to 20% above working pressure.

When boilers are repaired or rebuilt, follow Interstate Commerce Commission rules.

See Groups 48 and 56.

28. STAMPING: See Group 56. A.S.M.E. Stamp applied only on boilers specified to be built to the Code.

29. See Group 99^B.

QUESTION: Duplicate engines.

EXCEPTIONS: R.R. Co's drawings, specifications or instructions to the contrary.

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ENGINEERING DEPARTMENT

May 17, 1938

STANDARD PRACTICE

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BOILER DETAILS

Superseding

14 S 2254-g

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1. REAR CYLINDER SADDLES and BOILER BEARING SADDLES FOR ARTICULATED LOCOMOTIVES, DESIGN AS FOLLOWS:

REAR CYLINDER SADDLES

Shape of flange, elliptical longitudinally. Make flange long enough for four rows of bolts (staggered) F. and B. when possible.

Width of flange (crosswise of boiler) = width of cylinder saddle + a 6 inch radius + sufficient space for two rows of bolts staggered.

To provide clearance for bolts, the vertical distance between flanges of saddle must not be less than three times the diameter of bolts securing same to cylinder + 1/4" when liner is used, and + 1-1/4" when no liner is used, to allow for future application of liner.

Bolt saddle to boiler, as shown on Standard Drawings (see Index) Group 15. Make Boiler Course to which saddle is bolted, short as possible, to secure benefit of stiffness of circumferential seams and of normal thickness. Use outside liner. Do not caulk saddle flanges or liner.

Tap hole for 1/2" pipe thru liner on center line of boiler between saddle and first row of rivets, front or back. Run a pipe from this hole so as to discharge on the ground and extended below the cylinder saddle. Bend lower end of pipe toward rear of engine so as not to collect dust and dirt while running forward.

Key saddle to rear cylinder casting to relieve bolts of shear.

BOILER BEARING SADDLES

Shape of flange, elliptical, width same as Rear Cylinder Saddle. Use liner as required.

Use bolts to secure boiler bearing saddle to smokebox per Standard Drawing, (see Index).

DIAM. OF CYL.	CYLINDER SADDLE BOLTS		BOILER BEARING BOLTS or STUDS		DIAM. OF CYL.	CYLINDER SADDLE BOLTS		BOILER BEARING BOLTS or STUDS	
	Min. No.	Diam.	Min. No.	Diam.		Min. No.	Diam.	Min. No.	Diam.
11"	36		12		19-1/2"	74		26	
11-1/2"	40		12		20"	78		26	
12"	44	1"	14	1"	20-1/2"	82	1-1/4"	28	1-1/4"
12-1/2"	48		14		21"	86		28	
13"	52		16		21-1/2"	90		30	
13-1/2"	46		16		22	78		30	
14"	50		16		22-1/2"	82		30	
15"	54	1-1/8"	18	1-1/8"	23"	86	1-3/8"	30	1-3/8"
15-1/2"	58		18		23-1/2"	88		30	
16"	62		20		24"	90		32	
16-1/2"	54		20		25"	92		32	
17"	58		22		25-1/2"	94		34	
17-1/2"	62	1-1/4"	22	1-1/4"	26"	96	1-3/8"	34	1-3/8"
18"	66		24		26-1/2"	98		36"	
19"	70		24		27	100		36"	

(over)

GUIDE YOKE and WAIST SHEET ANGLES: Use arrangement shown on Standard drawing in Group 99. (see Index) with angle sections as follows:

Cylinders under 22" (approx.) 6" x 4" x 1/2" angles
 " 22 " and over 6" x 6" x 5/8" "

For details of angles see Standard drawings.

Angles to be arranged with 6" side up and where possible to face the same as braces attached to frames. Guide yoke angle to be riveted to outer liner with rivets spaced from back of flange to first row, 2-1/2"; between rows, 2"; from outside row to edge, 1-1/2".

Space bolts in vertical flange of angles as follows;

6" x 6" angles (2 rows) : back of flange to first row 3-1/2"; between rows 1-1/4"; outside row to edge 1-1/4".

6" x 4" angles (single row): from back of flange 2-3/4"; from outer edge 1-1/4".

Cross-indexed in Group 47.

3. BRASS or COPPER BOILER TUBES and FLUES: Use minimum thickness given in table below:

OUT-SIDE DIAM.	MINIMUM THICKNESS OF TUBES AND FLUES B. W. G.									
	MAXIMUM ALLOWABLE WORKING PRESSURE, LB. PER SQ. IN.									
	150	160	170	180	190	200	210	225	235	250
1 1/2"	13	13	13	13	13	12	..	..	..	..
1 3/4"	13	13	13	12	12	12	..	..	..	..
2 "	13	12	12	12	12	12	11	11	11	11
2 1/4"	12	12	12	12	12	12	11	11	11	11
2 1/2"	12	11	11	11	11	11	10	10	10	10
3 "	11	10	10	10	10	10	10	9	9	9
3 1/2"	10	9	9	9	9	9	9	8	8	8
4 "	9	9	9	9	8	8	8	7	7	7
4 1/2"	9	8	8	8	7	7	7	7	7	7
5 "	8	8	8	7	7	7	6	6	6	6
5 1/2"	7	7	7	6	6	6	6	5	5	5
6 "	6	6	6	6	5	5	5	5	4	4

Thicknesses in above table apply to the bodies of tubes 1-1/2" to 3-1/2" O.D. It is customary to thicken the firebox end gages for 10" or 12" in length. Flues 4" to 6" O.D. inclusive do not require thickening because the firebox ends are usually swaged.

QUESTION: Duplicate engines.

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

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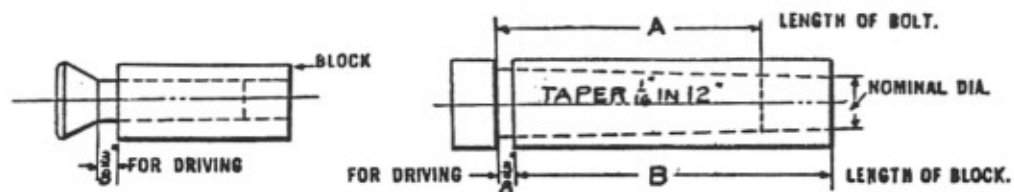
BOLTS, PINS AND BUSHINGS

Superseding

15 S 2255b-1

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1. BOLTS: Use U. S. Standard sizes for rough and finished bolt heads and nuts. Finish on heads and nuts to be obtained for grinding and buffing, without machining. Complete dimensions for hexagon, cheese head and countersunk bolts, thick and thin nuts, pins, cotter ends and cotters, key ends and flat keys, are given on Standard Drawings (see Index).
2. TENDER TRUCK BOX BOLTS: See Group 17.
3. ARTICULATED LOCOMOTIVE CYLINDER SADDLE AND BEARING SADDLE BOLTS AND STUDS: See Group 14.
4. RADIUS BAR BRACE BOLTS: See Group 41.
5. PEDESTAL CAP AND BINDER BOLTS: See Group 46.
6. FOOT PLATE AND FRAME BOLTING: See Group 47.
7. PISTON FOLLOWER BOLTS: See Group 65.
8. TAPER BOLTS: TAPER for BOLTS in rods, frames, etc. is $1/16"$ in $12"$. Gauges to be made and bolts fitted as shown by sketch below. Nominal diameter of bolt is taken at small end of gauge.



A		B
OVER	TO AND INCLUDING	
—	6'	6'
6'	9'	9'
9'	12'	12'
12'	15'	15'
15'	18'	18"
18'	21'	21'
21'	24'	24'

Use Taper Bolts for securing the Eccentric Crank to the Main Crank Pin. Use also for securing Guides to their supports, and for bolting the halves of multiple-bearing guides together.

9. THROUGH BOLTS: Use through bolts to secure Engine Truck CENTER PIN or EQUALIZER FULCRUM CASTINGS to cylinder. Do not use studs or tap bolts.

Continued on Sheet 2

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Sheet 2

BOLTS, PINS and BUSHINGS

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continued from Sheet 1

10. **BOILER STUDS:** (except jacket studs) must be at least $3/4$ " diameter. Jacket studs must be at least $5/8$ " diameter.
Use taper threads, 12 per inch, on all studs tapped into FIREBOX RING. For taper of studs, see Group 14.
To insure BOILER STUDS entering sheet a sufficient distance, make inner end of studs at least flush with inner surface of single sheet, or liner when such liner is used. When applied in outside welt strips of seams, studs must extend in a distance at least equal to the stud diameter. In all cases, hole to be gauged so that not less than one nor more than three full threads remain outside of sheet after stud is screwed in.
11. **CYLINDER HEAD STUDS:** See Group 31.
12. **CASTLE NUTS** shown on Standard Drawing (see Index)
Lock nuts are not to be used in connection with castle nuts.
Dimensions of castl nuts, cotters, taper pins and bolt ends on above drawing are in accordance with A.A. R. standards.
13. **DOUBLE NUTS:** Apply on all bolts used in attaching the following:
Running Board Steps, Handrails on Switcher Bumpers,
Grab Irons on Bumpers, All Engine Steps,
Switcher Step Hangers, Engine and Tender Draw Castings, (F. & B.)
Trailing Truck Fulcrum on Frame Crosstie with bolts riveted over.
14. **PINS:** Miscellaneous pins, such as brake rigging, spring rigging pins, etc. from $3/4$ " to $4-1/2$ " dia. (except crank pins, wrist pins, knuckle pins, valve motion pins) are to be made $1/32$ " under nominal size, altho drawings will be dimensioned nominal size. For drawbar pins, see Group 37. Bushings to be nominal size.
JAWS: Make male end to nominal size and allow clearance on inside of jaw.
15. **TAPER PINS:** Use the following:
Single-ended pins taper $3/16$ " in 12", with single thin plain nuts and round cotters. Threads to be United States Standard.
Jaw pins taper $3/4$ " in 12", with single thin plain nuts end round cotters for pins $3/4$ " and $7/8$ " diameter, and standard thin slotted nuts with round cotters for pins 1" to $2-1/2$ " diameter. Threads on pins up to and including 2" diameter to be United States Standard, above 2" as tabled.
SIDE ROD KNUCKLE PINS taper $1-1/2$ " in 12" with special slotted nuts and round cotters as tabled (See Group 72).
Jaw Pins with double fit to have taper intersect center of parallel bearing surface.
All nuts, cotters, keys and bolt ends, except for side rod knuckle pins, to be A.L. Co. standard.
Keys for jaw pins, up to and including 2" diameter, to be made from square steel bars, keys for pins above 2" diameter to be drop-forged.
- NOTE:** The above pins are shown in detail on Standard Drawing, (see Index).

continued on Sheet 3

American Locomotive Company

ENGINEERING DEPARTMENT

Nov. 14, 1935.

STANDARD PRACTICE

15 S 2255b-3

Sheet 3

Superseding
15 S 2255a

APPROVED
ENGINEERING
COMMITTEE

BOLTS, PINS AND BUSHINGS

continued from Sheet 2

16. CASEHARDENED STEEL BUSHINGS: Use standard diameters and thickness as follows:

Up to	and including	1" I.D.	.....	thickness	1/8"
Over 1"	"	"	2-1/4"	"	3/16"
" 2-1/4"	"	"	3-1/4"	"	1/4"
" 3-1/4"	"	"	4-1/4"	"	5/16"
" 4-1/4"	"	"	5"	"	3/8"

1/8" Thick		3/16" Thick		1/4" Thick		5/16" Thick		3/8" Thick	
I.D.	O.D.	I.D.	O.D.	I.D.	O.D.	I.D.	O.D.	I.D.	O.D.
<u>5/8"</u>	<u>7/8"</u>	<u>1-1/8"</u>	<u>1-1/2"</u>	<u>2-3/8"</u>	<u>2-7/8"</u>	<u>3-1/2"</u>	<u>4-1/8"</u>	<u>4-1/2"</u>	<u>5-1/4"</u>
<u>3/4"</u>	<u>1"</u>	<u>1-1/4"</u>	<u>1-5/8"</u>	<u>2-1/2"</u>	<u>3"</u>	<u>3-3/4"</u>	<u>4-3/8"</u>	<u>4-3/4"</u>	<u>5-1/2"</u>
<u>7/8"</u>	<u>1-1/8"</u>	<u>1-3/8"</u>	<u>1-3/4"</u>	<u>2-5/8"</u>	<u>3-1/8"</u>	<u>4"</u>	<u>4-5/8"</u>	<u>5"</u>	<u>5-3/4"</u>
<u>1"</u>	<u>1-1/4"</u>	<u>1-1/2"</u>	<u>1-7/8"</u>	<u>2-3/4"</u>	<u>3-1/4"</u>	<u>4-1/4"</u>	<u>4-7/8"</u>		
		<u>1-5/8"</u>	<u>2"</u>	<u>2-7/8"</u>	<u>3-3/8"</u>				
		<u>1-3/4"</u>	<u>2-1/8"</u>	<u>3"</u>	<u>3-1/2"</u>				
		<u>1-7/8"</u>	<u>2-1/4"</u>	<u>3-1/8"</u>	<u>3-5/8"</u>				
		<u>2"</u>	<u>2-3/8"</u>	<u>3-1/4"</u>	<u>3-3/4"</u>				
		<u>2-1/8"</u>	<u>2-1/2"</u>						
		<u>2-1/4"</u>	<u>2-5/8"</u>						

Preferred sizes given underlined should be used where possible. Whenever necessary to use inside diameter not given in table, use standard outside diameter of nearest approximate size.

17. BRASS BUSHINGS: Miscellaneous (other than side rod). Use the following sizes:

INSIDE DIAM.	OUTSIDE DIAM.	THICKNESS	INSIDE DIAM.	OUTSIDE DIAM.	THICKNESS	INSIDE DIAM.	OUTSIDE DIAM.	THICKNESS
1-1/2"	2"	1/4"	3"	3-7/8"	7/16"	4-1/2"	5-3/4"	5/8"
1-3/4"	2-3/8"	5/16"	3-1/4"	4-1/8"	7/16"	4-3/4"	6"	5/8"
2"	2-5/8"	5/16"	3-1/2"	4-1/2"	1/2"	5"	6-1/4"	5/8"
2-1/4"	2-7/8"	5/16"	3-3/4"	4-3/4"	1/2"	5-1/4"	6-1/2"	5/8"
2-1/2"	3-1/4"	3/8"	4"	5"	1/2"	5-1/2"	7"	3/4"
2-3/4"	3-5/8"	7/16"	4-1/4"	5-1/4"	1/2"	5-3/4"	7-1/4"	3/4"

18. HARD BRONZE BUSHINGS: Use in the following Walschaert link motion parts:

Link Support,	Crosshead Arm,
Lower End of Link,	Valve Rod Crosshead,
All Bushings in Combination Lever,	Radius Bar Lifter.
Wrist Pin End of Combination Link.	

SEE GROUP 48.- FOREIGN LOCOMOTIVES.

continued on Sheet 4

American Locomotive Company

ENGINEERING DEPARTMENT

Nov. 14, 1935

STANDARD PRACTICE

15 S 2255b-4

Sheet 4

BOLTS, PINS AND BUSHINGS

Superseding

15 S 2255a

APPROVED
ENGINEERING
COMMITTEE

Continued from Sheet 3

19. RIVETS: Boiler Rivets; see Group 14.

Use STEEL, whenever rivets are required to be HOT DRIVEN in locomotive and tender construction. Wherever WROT IRON rivets are specified, question must be raised to see if rivet material cannot be changed to STEEL.

Order all WROT IRON rivets with swell neck under head.

Question: Duplicate engines.

Exceptions: R.R.Co's drawings, specifications or instructions to contrary.

American Locomotive Company

ENGINEERING DEPARTMENT

STANDARD PRACTICE

16 S 2256 e

December 2nd, 1931

DRIVING BOXES

Superseding
16 S 2256 d

APPROVED
ENGINEERING
COMMITTEE

1. **Driving Box Journals:** Use the following dimensions:

NOMINAL LENGTH OF JOURNALS	CENTERS OF FRAMES	ACTUAL LENGTH OF OXES FROM FRAME CENTER		DIAMETER AND LENGTH	
		Outside Next Hub	Inside		
8"	47"	3 $\frac{1}{8}$ "	4 $\frac{1}{8}$ "	7" x 8"	8 $\frac{1}{2}$ " x 12"
9"	46"	4 $\frac{3}{8}$ "	4 $\frac{9}{8}$ "	7 $\frac{1}{2}$ " x 8"	9" x 12"
10"	45"	4 $\frac{7}{8}$ "	5 $\frac{1}{8}$ "	7 $\frac{1}{2}$ " x 9"	9 $\frac{1}{2}$ " x 12"
11"	44"	5 $\frac{1}{8}$ "	5 $\frac{5}{8}$ "	8" x 9"	10" x 12"
12"	43"	5 $\frac{7}{8}$ "	6 $\frac{1}{8}$ "	8" x 10"	10 $\frac{1}{4}$ " x 12"
13"	42"	6 $\frac{3}{8}$ "	6 $\frac{5}{8}$ "	8 $\frac{1}{2}$ " x 10"	11" x 12"
14"	42"	6 $\frac{7}{8}$ "	7 $\frac{3}{8}$ "	8 $\frac{3}{8}$ " x 11"	
				9 $\frac{1}{2}$ " x 13"	10 $\frac{1}{2}$ " x 14"
				10" x 13"	11" x 14"
				10 $\frac{1}{2}$ " x 13"	11 $\frac{1}{2}$ " x 14"
				11" x 13"	12" x 14"
				11 $\frac{1}{2}$ " x 13"	

Preferred sizes in full-faced type.

Distance between driving wheel hubs, see Group 99*.

Centers of frames in even inches.

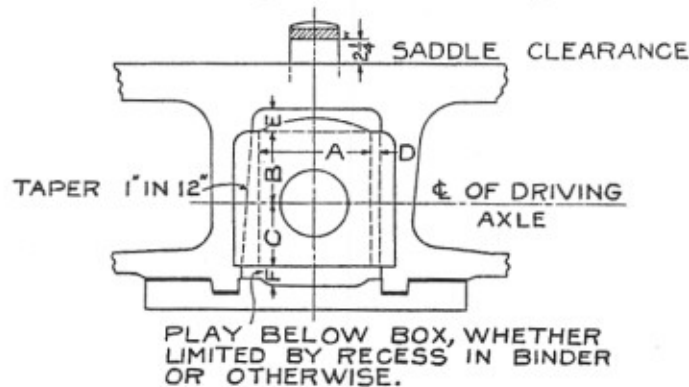
End play in boxes ($\frac{1}{8}$ " each side, $\frac{1}{4}$ " total) to be made by reducing side next to hub.

Driving boxes 8" to 13" must be central except for end play.

14" Boxes out of center to use 42" frame centers.

Spring supports must be substantially central on all boxes.

- Driving Box Bearings:** Accurately fit to boxes and force in place by hydraulic pressure as per Standard drawing (see Index).
- Driving Box Flanges:** Use taper $\frac{3}{8}$ " in 12", leave 2" straight portion in center and allow $\frac{1}{16}$ " total clearance at straight portion for shoes and wedges.
Where Railroad Companies' drawings or specifications require less taper, raise question and unless they are very insistent, or in cases of doubt, use the standard taper.
Do not use less taper than $\frac{3}{8}$ " in 12" for driving boxes over 14" in length, under any circumstances.
- Hub Face:** Apply babbit face to Cast Steel Driving Boxes used with Cast Iron driving wheel centers having plain hub face, or with wheels having cast iron hub liners, per Standard drawings (see Index, Group 95).
- Working Clearances, &c.:** Use the following on new elevation drawings.



DIAM. OF JOURNAL	A	B	C	D	PLAY		
					E	F	TOTAL
7"	11"	8"	6 $\frac{1}{2}$ "	$\frac{3}{4}$ "	2 $\frac{1}{4}$ "	1 $\frac{3}{4}$ "	4"
7 $\frac{1}{2}$ "	11 $\frac{1}{2}$ "	8"	6 $\frac{1}{2}$ "	$\frac{3}{4}$ "	2 $\frac{1}{4}$ "	1 $\frac{3}{4}$ "	4"
8"	12"	8 $\frac{1}{2}$ "	7 $\frac{1}{2}$ "	$\frac{3}{4}$ "	2 $\frac{3}{4}$ "	1 $\frac{3}{4}$ "	4 $\frac{1}{2}$ "
8 $\frac{1}{2}$ " x 10"	13"	8 $\frac{1}{2}$ "	7 $\frac{1}{2}$ "	$\frac{3}{4}$ "	2 $\frac{3}{4}$ "	1 $\frac{3}{4}$ "	4 $\frac{1}{2}$ "
8 $\frac{1}{2}$ " x 12"	13"	9"	8"	$\frac{7}{8}$ "	3"	1 $\frac{3}{4}$ "	4 $\frac{1}{2}$ "
9"	13 $\frac{1}{2}$ "	9"	8"	$\frac{7}{8}$ "	3"	1 $\frac{3}{4}$ "	4 $\frac{3}{4}$ "
9 $\frac{1}{2}$ "	14"	9 $\frac{1}{2}$ "	8 $\frac{1}{2}$ "	$\frac{7}{8}$ "	3"	1 $\frac{3}{4}$ "	4 $\frac{3}{4}$ "
10"	14 $\frac{1}{2}$ "	9 $\frac{1}{2}$ "	8 $\frac{1}{2}$ "	1"	3"	1 $\frac{3}{4}$ "	4 $\frac{3}{4}$ "
10 $\frac{1}{2}$ "	15"	9 $\frac{1}{2}$ "	8 $\frac{1}{2}$ "	1"	3"	1 $\frac{3}{4}$ "	4 $\frac{3}{4}$ "
11"	16"	10"	9 $\frac{1}{2}$ "	1"	3"	1 $\frac{3}{4}$ "	4 $\frac{3}{4}$ "
11 $\frac{1}{2}$ "	16 $\frac{1}{2}$ "	10"	9 $\frac{1}{2}$ "	1 $\frac{1}{8}$ "	3"	1 $\frac{3}{4}$ "	4 $\frac{3}{4}$ "
12"	17"	10 $\frac{1}{2}$ "	10"	1 $\frac{1}{8}$ "	3"	1 $\frac{3}{4}$ "	4 $\frac{3}{4}$ "

QUESTION: Duplicate engines.

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

American Locomotive Company

ENGINEERING DEPARTMENT

STANDARD PRACTICE

17 S 2257 d

May 20th, 1924

BOXES, TRUCK

Superseding
17 S 2257 c

APPROVED
ENGINEERING
COMMITTEE

1. Use Bearings and Cast Iron Truck Boxes for two and four-wheel Engine Trucks per Standard drawings (see Index).

Distance between Engine Truck Wheel Hubs 52'.

Transverse centers of Truck Frames and pedestals 42' for boxes 10' long and 40' for boxes 12' long.

Pedestal jaws central with boxes except for end play.

All engine truck box bearings babbitt lined.

Use Plain or Babbitt face on engine truck boxes, as per table in paragraph 2.

Gauges to be made for inside of boxes and crown of bearings, to exact dimensions given on drawings.

Patterns of boxes and bearings made so that all castings therefrom will accurately conform to gauges.

2. Arrange Box Face and wheel Hub Liner as per table below:

INSIDE-BEARING LEADING TRUCKS						
TYPE OF ENGINE	TRAILING TRUCK	LEADING TRUCK SWING HANGERS	WHEEL		BOX FACE	
			MATERIAL	HUB LINER	CAST IRON BOX (STANDARD)	CAST STEEL BOX (SPECIAL)
Other than 2-10-2	None, or Different from leading Truck	Swing Links	Cast Iron	None (Standard)	Plain	Babbitted
				Bronze (Special)	Plain	Plain
			Cast Steel or Rolled Steel	None (Standard)	Babbitted	Babbitted
				Bronze (Special)	Plain	Plain
Other than 2-10-2	None, or Different from Leading Truck	Constant-Resistance Rockers	Cast Iron, Cast Steel, or Rolled Steel	Bronze	Plain	Plain
2-10-2	Any Type	Any Type				
Any Type with Trailing Truck	Similar to Leading Truck	Any Type	Cast Iron, Cast Steel or Rolled Steel	Use Hub Liner in Wheel and Box Face same as on trailing truck.		

TRAILING TRUCKS								
TYPE OF ENGINE	TYPE OF TRUCK	INSIDE-BEARING				OUTSIDE-BEARING		
		WHEEL		BOX FACE		WHEEL		BOX FACE
		MATERIAL	HUB LINER	CAST IRON BOX	CAST STEEL BOX	MATERIAL	HUB LINER	
Other than 2-10-2	Other than Constant-Resistance	Cast Iron	None	Plain	—	Cast Iron, Cast Steel or Rolled Steel	None	¾" Removable Bronze Liner, Style per Card 173 S 30030, secured by bolts and fitted with grease cups
			½" Bronze	—	Plain			
		Cast Steel or Rolled Steel	½" Bronze	Plain	Plain			
Other than 2-10-2	Constant-Resistance	Cast Iron, Cast Steel or Rolled Steel	½" Bronze	Plain	Plain			
2-10-2	Any Type							

(OVER)

3. Use the following clearances between truck boxes and wheel hubs:

Leading Truck..... $\frac{1}{8}$ " each side, $\frac{1}{4}$ " total
 Trailing " inside-bearing (radial box)..... $\frac{1}{16}$ " " " $\frac{1}{8}$ " "
 " " outside-bearing..... $\frac{1}{8}$ " " " $\frac{1}{4}$ " "

Distance between all wheel hubs to be an even dimension, clearance to be obtained by reducing or offsetting boxes.

4. When R. R. Companies' drawings show Engine Truck Box hub face larger in diameter than wheel hub liner, or drawings of wheels (particularly rolled steel) or liners with hub face smaller than box face, question using our Standard with diameter of hub face and box face equal. A. L. Co. Standard engine truck wheel hub diameters are as follows (see Cards 952 A 4020-29):

JOURNAL DIAM.	WHEEL FIT DIAM.	HUB FACE DIAM.
5 "	5½"	12½"
5½"	6 "	12½"
6 "	6½"	13½"
6½"	7 "	13½"
7 "	7½"	14 "

5. Use Tender Truck Box Bearings and Wedges per Standard drawings (see Index).
 6. Use Box Bolts of the following sizes on all A. R. A. Tender Truck Boxes for Arch Bar Trucks:

JOURNAL BOX	BOX BOLTS
3¾" x 7"	1 " dia.
4¼" x 8"	1½" "
5 " x 9"	1½" "
5½" x 10"	1½" "
6 " x 11"	1¾" "
6½" x 12"	1½" "

In ordering tender truck boxes of outside manufacturers, care should be taken to specify correct size of bolt.

7. 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

18 S 1169 b

May 20th, 1924

BRACKETS, STANDS, ETC. Supports—Attachment to Boiler

Superseding
18 A 1169 a

APPROVED
ENGINEERING
COMMITTEE

1. **Cab Fitting Supports:** To facilitate removal of lubricator, engineer's valve, and the other fittings inside cab without disturbing jacket, use cast iron cup washer between boiler and jacket wherever practicable, cutting holes in jacket for supporting studs only. Where overhang is excessive, as shown on Card 182 S 11720, apply bracket directly to boiler, using washers under brace feet only.

QUESTION: Duplicate engines.

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

American Locomotive Company

ENGINEERING DEPARTMENT

April 27, 1938

STANDARD PRACTICE

19 S 2258-1-c

Sheet 1

BRAKE EQUIPMENT

Superseding

19 S 2258b

APPROVED
ENGINEERING
COMMITTEE

1. SHOE FRICTION: Use coefficient = 30 per cent of direct pressure applied to shoes; same for all speeds, location of shoes, material in shoes, and angularity of hangers.

NOTE: Coefficient of friction actually varies from 15 per cent to 35 per cent according to speed, location of shoes, angularities of hangers and material in shoes. At very low speeds, and soft iron shoes, this reaches 35 per cent but for ordinary practice, 30 per cent should be used.

2. BRAKING POWER: Following are the Westinghouse Air Brake Co's recommended braking power percentages. Driver, Engine Truck and Trailer braking powers are based on weights in running order. For TANK engines, use the same percentages as for engines with separate tender, but use weight in running order minus water in tank and coal in bunkers. Tender braking power is based on weight of tender empty:

FOR SPEEDS UNDER 80 MILES PER HOUR

KIND	OPERATING SCHEDULE	BRAKING POWER	
		PASSENGER	FREIGHT SWITCH and ARTICULATED
Driver	6 ET - 8 ET	60%	50%
	A-1, Shoes F.	75%	65%
	A-1, Shoes B.	68%	65%
Engine Truck and Trailer	D(used with 6-ET)	45%	45%
	6 ET - 8 ET	45%	45%
Tender	6 ET - 8 ET	+100%	75%
	HK and PK (Q-A. triple)	85%	80%
	FL (plain triple)	+100%	100%

For speeds 80 miles per hour and above, raise question.. When grade exceeds 3% raise question, giving percentage and length of grade.

+ Raise question with R. R. Co. whether to use 100% as recommended by Brake Co., or 90% as recommended by A.A. R.

3. CYLINDER PRESSURES: Use 50 lbs. in calculations of braking power in all cases. For strength of brake rigging, use cylinder pressure in emergency as given in the following table.

BRAKE CC.	SERVICE	SCHEDULE	CYLINDER PRESSURE EMERGENCY	
			DRIVERS and ENGINE TRK.	TENDERS EMPTY
Westinghouse	Passenger	A-1, HK and PK	50	60
	"	High Speed, old style	85	85
	Frnt. & Sw.	A-1 and FL	50	50
	Pass., Frnt. and Sw.	6 ET and 8 ET	95	95
New York	Passenger	High Speed	85	85
	Pass., Frnt. and Sw.	Plain Triples	50	50
	Pass. and Freight	All with QA trip-les except H.S.	50	50
	Passenger	LT	95	95
	Frnt. & Sw.	LT	70	70

(over)

3. Continued.

BRAKE CO.	SERVICE	SCHEDULE	CYLINDER PRESSURE EMERGENCY	
			DRIVERS and ENGINE TRUCK	TENDERS EMPTY
New York	Passenger	8 ET-M Feed Valve	83	83
		8 ET-F Feed Valve	98	98
	Freight and Switch	8 ET-M " "	70	70
		8 ET-F " "	77	77

4. BRAKE PISTON THRUST:

CYLINDER PRESSURE POUNDS	CYLINDER DIAMETER						
	6"	8"	10"	12"	14"	16"	18"
50	1400	2500	3930	5650	7700	10050	12723
60	1700	3000	4700	6790	9240	12050	15268
70	1980	3250	5500	7920	10780	14070	17813
77	2177	3870	6047	8708	11853	15482	19594
83	2347	4172	6519	9387	12777	16688	21121
85	2400	4280	6670	9610	13080	17090	21630
95	2690	4780	7460	10740	14620	19100	24175
98	2771	4926	7697	11083	15086	19704	24938

5. DRIVER BRAKE CYLINDER: The maximum weights given below for various diameters of brake cylinders correspond to a maximum leverage ratio of 6.1 which must not be exceeded without first taking up question with Brake Company.

Note: These tables are for cylinders with 10" or 12" stroke (10" preferred). Raise question when stroke is less than 10", also when 12" is specified, as when the leverage is restricted to 6.1, there is no advantage gained by the use of a longer stroke than 10".

SIX and EIGHT COUPLED:					
DIA. OF CYL.	MAX. WT. on BRAKED WHEELS - 2 cys.				
	50% B.P.	60% B.P.	65% B.P.	68% B.P.	75% B.P.
10"	94300	78600	72500	69400	62850
12"	135600	113000	104300	99700	90400
14"	184800	154000	142150	135850	123200
16"	241200	201000	185500	177350	160800
18"	305300	254400	234800	224450	203500

TEN COUPLED						
DIA. OF CYLS. TWO ON		MAX. WT. on DRIVERS TOTAL				
2 pairs	3 pairs	50% B.P.	60% B.P.	65% B.P.	68% B.P.	75% B.P.
12"	14"	308000	256700	236940	226500	205320
14"	16"	402000	335000	309180	295560	267960
16"	18"	508800	424000	391380	374100	339180

American Locomotive Company

ENGINEERING DEPARTMENT

STANDARD PRACTICE

19 S 2258-2-c

Sheet 2

Superseding

19 S 2258b

APPROVED
ENGINEERING
COMMITTEE

BRAKE EQUIPMENT

6. TENDER CYLINDERS: Braking power is based on a nominal cylinder pressure of 50 lbs. per sq. in. and a maximum leverage of 9 to 1. Use percentage of weight empty shown below:

CYL.	WEIGHT OF TENDER EMPTY			
	75% Braking Power	80% Braking Power	85% Braking Power	100% Braking Power
8"	12000- 29000	15000- 28000	15000- 26000	15000- 22000
10"	over 29000- 46000	over 28000- 44000	over 26000- 41000	over 22000- 35000
12"	" 46000- 66000	" 44000- 63000	" 41000- 59000	" 35000- 50000
14"	" 66000- 92000	" 63000- 86000	" 59000- 81000	" 50000- 69000
16"	" 92000-129000	" 86000-113000	" 81000-106000	" 69000- 90000
18"	" 129000-152000	" 109000-142500	" 103000-134000	" 88000-114000

7. MAIN RESERVOIRS: Use reservoirs having at least 18-1/2" diameter when possible, preferred diameters being 18-1/2", 20-1/2", 22-1/2" and 24-1/2". Suspend main reservoirs under runboard from two cast steel runboard brackets, to Standard Drawings (see Index) obtaining 5" clearance between boiler jacket and reservoir where possible, and located about 8" from end of drum to center line of brackets.

Alter or reconstruct old patterns to provide at least 1/4" clearance over rivet heads in drum side seams.

8. BRAKE VALVE HANDLE: Locate as follows:(when brake pedestal is not used):
 Automatic Brake Valve 36" above runboard,
 Independent " " 42" " "

9. See Group 48 - Foreign Locomotives.

10. See Group 64 - Brake Piping.

QUESTION: Duplicate engines.

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

AMERICAN LOCOMOTIVE COMPANY

ENGINEERING DEPARTMENT

OFFICE INFORMATION

19 S 24124r
March-19-1927.

July 8th, 1927.

BRAKE EQUIPMENT

Superseding
19 S 24124e

APPROVED
J.G.B.

3-1-27

J.G.B.

7-8-27

1. AIR PUMP BRACKETS: Make of cast steel of design shown on Dwg. 193 S 36010, except where new pattern would be required on orders of less than 5 engines use plate design shown on Dwg. 193 S 34910. Supporting studs to be ~~parallel~~ in either case.
E.C. 3/1/27. radial ✓ Let. J.B.E., 7-7-27.
2. MAIN RESERVOIRS: When located lengthwise between frames, provide ample longitudinal bracing and secure to supports with 7/8" round iron straps with double nuts on each end. See Dwg. 420 S 2920.
3. WESTINGHOUSE "ET" DISTRIBUTING VALVE: When used locate crosswise of engine 5" below runboard and attach to same by bracket. Do not locate on reverse lever fulcrum or rear frame.
4. VACUUM BRAKE CYLINDERS: Arrange trunnion bearings to permit ready removal of cylinder, using parted bearings with caps when necessary.
5. MAIN RESERVOIR BRACKETS: Do not rivet brackets to reservoir. See Dwg. 192 S 21050.
6. MAIN RESERVOIRS: Use reservoirs having at least 18-1/2" diameter when possible, preferred diameters being 18-1/2", 20-1/2", 22-1/2" and 24-1/2".
Letter J.B.E., V.P. 9-3-19.
7. BRAKING POWER PERCENTAGES - HEAVY GRADES: When grade exceeds 3%, raise question with V.P. Engineering, who will furnish Westinghouse Air Brake Co. with information as to percentage, length of grade, etc., and obtain from them proper braking power percentage for use in ordering brake equipment.
Letter Mr. J.B. Ennis, V.P. 9-1-25.
8. DRIVER BRAKE CYLINDER: The maximum weights given below for various diameters of driver brake cylinders correspond to a maximum leverage ratio of 6:1, which must not be exceeded without first taking up question with Brake Company.
NOTE: These tables are for cylinders with 10" or 12" stroke (10" preferred). Raise question when stroke is less than 10", also when 12" stroke is specified, as when the leverage is restricted to 6:1, there is no advantage gained by the use of a longer stroke than 10".

SIX & EIGHT COUPLED		
Dia. of Cyl.	Max. Wt. on Braked Wheels - 2-cyls.	
	60% B.P.	50% B.P.
10"	78600	94300
12"	113000	135600
14"	154000	184800
16"	201000	241200
18"	254400	305300

TEN COUPLED			
Dia. of Cyls. Two on		Max. Wt. on Drivers TOTAL	
2 Pairs	3 Pairs	60% B.P.	50% B.P.
12"	14"	256700	308000
14"	16"	335000	402000
16"	18"	424000	

Mr. J.G. Blunt, M.E. 9-25-16.

American Locomotive Company

ENGINEERING DEPARTMENT

January 18, 1938

STANDARD PRACTICE

20 S 2259a

BRAKES, ENGINE

Superseding

20 S 2259

APPROVED
ENGINEERING
COMMITTEE

1. See Group 56 - Laws, Rules and Instructions, ICC, Public Service Commission, etc.

2. FOUNDATION BRAKE SCHEDULES: Use the following:

Schedule is made up of a letter to designate the number of pairs of wheels braked and two numbers.

The letters are:

BRAKES	LETTER	PAIRS BRAKED	BRAKES	LETTER	PAIRS BRAKED
Driver	Y	2	Driver	Z	8
	M	3	"	T	10
	N	4	Trailer	V	1
	U	5	"	O	2
	X	6	Eng. Trk.	D	2

The first number following the letter gives the weight on such braked wheels (in thousand pounds).

The second number gives the maximum braking power percentage to be provided for (expressed in whole numbers) in accordance with the following table:

CONVENTIONAL BRAKING POWER PERCENTAGES
(For speeds under 80 miles per hour)

Brake Co.	Schedule	Service	Brake	Cyl. Press. 95# Emergency For Stress Max. Pressure	Cyl. Press. 50# For Braking Power % Service
Westinghouse	6ET-8ET	Pass.	Driver	114	See Group 19
		"	Trucks	86	
		Frt. or Switch	Driver Trucks	80 72	

Examples of Schedules

Pass. Loco., 4-6-4 type, 190,000# on drivers, 110,000# on trailer, 75,000# on engine truck, usual braking percentages. Schedules M-190-114 and O-110-86 and D-75-86.

Freight or Switch. Loco. 2-8-0 type, 131,000# on drivers, braked at 64% on 50# (Max. cylinder pressure 70#) Schedule N-131-90

$$90 = \frac{64 \times 70}{50}$$

Switching Loco. 0-8-0 type, 280,000# on drivers, Schedule N-280-80.

To complete the schedule designation, include the proper information relative to the use of Bushed and Casehardened and Ground or Unground Pins and Bushings.

QUESTION: Duplicate engines.

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

7. ROOF BRACES: Apply to boiler backhead on PASSENGER engines only.
8. CURTAINS: Use No. 6 duck.
9. CARD HOLDERS: Supply all engines subject to the ICC Boiler Inspection Law with a HOLDER for the 6" x 9" BOILER INSPECTION CERTIFICATE, Form ED-365 (boiler form #3). Use Drawing 242 S 9392.
The 3" x 5" QUARTERLY INSPECTION CARD, Form ED-364 (boiler form #2) is usually placed in the same holder, but if a separate holder is required, use Drawing 242 S 9393.
10. LOCATION OF CAB FIXTURES: Before locating cab fixtures on first engine of an order, Manager will request railroad to send a representative for that purpose, or to authorize their inspector at our plant to do so, or if railroad does neither, a Committee composed of our Local Chief Draftsman, Resident Inspector, Erecting and Pipe Shop Foremen will locate the fixtures, with the understanding that it will be acceptable to the Railroad.
11. CAB SEATS: Provide upholstered back rest on engineer's side of all cabs.
12. AUXILIARY RUNBOARD ALONG SIDE OF CAB: See Group 71.
13. FOREIGN LOCOMOTIVES: See Group 48.
14. LAWS, RULES and INSTRUCTIONS: See Group 56.

QUESTION: Duplicate engines

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

American Locomotive Company

ENGINEERING DEPARTMENT

STANDARD PRACTICE

21 S 1408 b

October 10th, 1921

BUMPERS.

Superseding
21 S 1408 a

APPROVED
ENGINEERING
COMMITTEE

1. Apply **Push Pole Pockets** at front of engine and rear of tender of engines with separate tender, and on front and back ends of tank engines.
2. See **Group 48.**—Foreign Locomotives.
3. **Cross-Indexed** in **Group 85.**

QUESTION: Duplicate engines.

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

American Locomotive Company

ENGINEERING DEPARTMENT

March 25, 1938

STANDARD PRACTICE

22,23,24 S 2260f

CAB, DETAILS AND FITTINGS

Superseding

22,23,24 S 2260e

APPROVED
ENGINEERING
COMMITTEE

1. CAB DIMENSIONS: All Cabs should conform to the following:

Length outside 72", 84", 90".
Width " 112", 116", 118", 120", 122".
Projection of roof at back 36", 42".
Preferred sizes underlined

To facilitate observations of signals make length of Cab, outside, 72" wherever possible.

ROOF CONTOUR: Make to Standard Drawings (see Index).

When space between boiler and side of cab is insufficient to allow passage to runboard, use window on each side in front wall of cab instead of door.

2. CAB MATERIAL: Make all cabs of steel.

Use 3" radius on corners, front and back, and line inside roof with 5/8" white wood tongue and groove ceiling. All rivets to have button-heads.

3. CAB FRONT DOORS: To afford the best possible sight for the observation of signals from engines having very large boilers, especially where the clearance at the eaves is limited, the top of the front door should be made as high as possible. Make doors swing inwardly and hinged to outside post.

4. WINDOW OPENING: Use single rectangular opening (top not rounded) with two sliding sashes and blind panel at front.

HEIGHT from top of floor to under side of side plate at center of window and to bottom of window opening should preferably be:

TYPE	PREFERRED HEIGHT TO		MINIMUM HEIGHT TO	
	Plate	Window	Plate	Window
Passenger	67	32	63	32
Freight	71	34	63	32
Switcher	71	34	67	34

Use "A" quality glass, except use 3/16" thickness for PLATE glass when specified. When circular or other shape having curved outline is required, order same cut to shape by manufacturers.

SAFETY GLASS: Apply to Front Doors, Storm Windows and Side Wind Shields of all locomotives. Raise question regarding application of safety glass to other windows in the cab.

5. DETAILS and FITTINGS: Use the following as shown on Standard Drawings (see Index).

Storm Window and Fixtures,
Cab Apron Hinge,
Door Fixtures,
Ventilator Fixtures,
Ventilator for steel cabs.

Locate VENTILATOR directly over cab turret, when located inside of cab, to provide for regrinding valves or removing turret.

6. CAB APRON must lap tender deck at least 3" when slack in safety chains or safety bars is fully taken up.

Extend center portion of apron over engine deck, using 2" x 2" angles to limit side motion and avoid breaking hinges.

(over)

American Locomotive Company

ENGINEERING DEPARTMENT

STANDARD PRACTICE

25, 26, 27 S 2261c

January 23rd, 1928

COCKS AND VALVES

Superseding
25, 26, 27 S 2261b

APPROVED
ENGINEERING
COMMITTEE

1. Shanks of all Cocks, Valves and Fittings, screwed into boiler, must have 12 threads per inch, taper $\frac{3}{4}$ " in 12".
2. **Injector Steam Valves:** For sizes and material of injector steam pipes see Group 55.
3. **Blow-off Cocks:** Use per Standard drawings (see Index), and arrange to operate from runboard of engine.
4. Use the following **Cylinder and Port Cocks:**

For all cylinders under 23" diam.,	$1\frac{3}{16}$ "	Cylinder Cock Drawing 272 A 3030,	Shank threaded 1 "	pipe.
" " " 23" to 35" "	1 "	" " " 272 A 3010,	" " "	$1\frac{1}{4}$ " "
" " " above 35" "	$1\frac{1}{4}$ "	" " " 272 A 3050,	" " "	$1\frac{1}{2}$ " "

Bodies—Malleable Iron preferred. Valves—Drop-Forgings from Schenectady dies. Die numbers are given on drawings.
Locate Cylinder Cocks to drain all water out of cylinders, and so that drip from discharge and rod slot will clear the rail on either curves or straight track.
Provide cylinder steam (not exhaust) passages, when not self-draining, with Drain Cocks operated from cab in connection with Cylinder Cock Rigging, using Cylinder Cock Drawing 272 A 3030.
5. **Gauge Cocks, Water Gauges and Water Column:** Apply per Standard Drawings (see Index).

Drawings: Show and figure location of all water gauges and gauge cocks on a separate detail location drawing. Indicate position of these cocks on boiler and elevation drawings by circles only, omitting dimensions, but noting which fitting is indicated by each circle.

Special Water Levels: For engines designed to operate under conditions which would reduce dimension "Z" on Standard Water Gauge and Gauge Cock Location Drawing 273 S 27500 below 9 inches, make layout of water levels on level and maximum grade, following drawing 273 S 27501, and submit to Ry. Co. for approval. On final Water Gauge Location Drawing show required water level marker plates with instructions to attach same to backhead or water column (not to jacket).

Gauge Location, Forward of Backhead: When required, and Standard Drawing 273 S 27500 can be followed, locate gauge cocks and bottom water column connection at same height as those on backhead. When these conditions cannot be met, make special layout and obtain approval of Ry. Co. as above.

When gauge cocks are tapped directly into boiler, take special care to measure height to lowest point of cock.

Test: Test accuracy of location of water gauges and cocks, in the presence of the Resident Inspector when first filling boilers with water as follows:
While engine is leveled on blocks, admit water to boiler until it runs out of lowest gauge cock hole, then measure height of water over crown by means of a stick through hole for the test gauge fitting in roof.
6. **Blower Valve.** See Group 64.
7. **Laws, Rules and Instructions.** See Group 56.

QUESTION: Duplicate engines.

EXCEPTIONS; R. R. Co.'s drawings, specifications or instructions to contrary.

American Locomotive Company

ENGINEERING DEPARTMENT

January 10, 1938

STANDARD PRACTICE

29 S 2262f

CRANK PINS

Superseding

29 S 2262e

APPROVED
ENGINEERING
COMMITTEE

1. MAIN CRANK PIN - MAIN JOURNAL: Diameter not to exceed length; preferably less. Maximum allowable bearing pressure per square inch of projected area, 1600 lbs. except that in no case may the bearing pressure exceed $\frac{12,500}{\text{pin diameter in inches}}$

this will limit product of bearing pressure and rubbing speed in feet per minute at "diameter speed" of engine (336 RPM) to 1,100,000.

On HIGH SPEED road service locomotives, check inertia stresses of MAIN CRANK PINS, MAIN and SIDE RODS and DRIVING WHEEL COUNTERBALANCE on the basis of 400 RPM instead of 336. If found to be too high, consider reducing the weight of the reciprocating parts.

MAIN SIDE ROD JOURNAL: Calculate diameter as follows:

P = Piston Thrust with full boiler pressure in pounds.
M = Bending moment in inch pounds = PL.

S = Fibre Stress = $\frac{M}{R}$ = 16000 lb. per sq.in.
maximum for steel Crank Pins.

R = Modulus of circular section with diameter equal to!

$$"D" = 0.982 D^3 = \frac{M}{S}$$

$$D = \sqrt[3]{\frac{M}{0.982 S}}$$

All dimensions in inches.

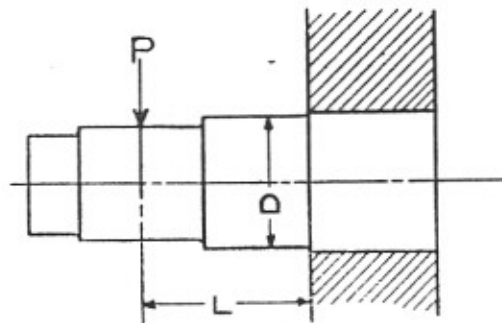
ECCENTRIC CRANK FIT: Provide fillets in bottom corners of keyway as follows:

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

See Group 99^B for the following:

Piston Thrust with full Boiler Pressure.
Moduli of Circular Sections.

WHEEL FIT: Make 1/2" larger in diameter than side rod journal, wherever possible. Inner ends to be riveted over.



22 FRONT, BACK and INTERMEDIATE CRANK PINS:

SIDE ROD JOURNALS: Maximum allowable bearing pressure 1900 lb. per square inch of projected area, using the following piston thrust proportions:

TYPE OF ENGINE	PROPORTION OF PISTON THRUST
4-coupled	0.6
6 "	0.5
8 "	0.4
10 "	0.35

WHEEL FIT: Make 1/4" larger in diameter than side rod journals, without collar. Inner ends to come flush with inside of hub without riveting.

(over)