2. The necessity for Arranging Locomotive Detail Parts for easy access and roundhouse repairs cannot be too strongly emphasized.
See that parts requiring frequent renewal, such as Springs, Piston Valves and Piston Packing, or removal such as Wheels or Tires, Staybolts, Washout Plugs, etc. are accessible and not covered up by other details.
Particular attention is directed to the desirability of arranging the springs on inside journal trailing trucks and rear driving wheels of ten-wheel engines so that they can be easily and quickly renewed without unnecessary work in removing other parts. Piping should be carefully arranged. Do not cover up important parts requiring inspection or renewal with piping.
Put yourself in the place of the man doing the repair job and help him wherever you can.

3. FOREIGN LOCOMOTIVES - See Group 48.

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

American Locomotive Company

ENGINEERING DEPARTMENT

STANDARD PRACTICE

99⁶ S 2320a

March 5th, 1929

MISCELLANEOUS
Clearances and Curvature

Superseding 99⁶ S 2320

APPROVED ENGINEERING COMMITTEE

1. **Height and Width Limitations:** Observe carefully figures given in specifications and clearance diagrams.
   Send Standard Clearance and Wheel Base Diagram to New York Office showing contour in outline, using drawing dimensions plus allowances shown on Standard Drawing (see Index) for each Order of engines shipped on their own wheels.
   Make engine and tender **drawings** under loaded conditions at least 2½" vertically and ½" each side horizontally, inside specified limitations. If for any reason, this allowance cannot be obtained, the Railroad Company's approval must be secured before proceeding.
   Pay special attention to ventilators, whistles, safety valves, etc.
   Widths must come well inside clearance limitations, special attention being given to handrails, steps, etc.
   For **Western roads** having large limitations of clearance, care must be taken to see that non-removable parts of engine will clear transportation limitations of Roads over which they are to be shipped.

INSPECTION.

The first engine in each order of locomotives must be checked before leaving erecting shop, for limitations of height and width, and record kept thereof.
In case of interference with, or close approximation to clearance on first engine measured, subsequent engines must be measured to ascertain that clearance is correct.

2. **Curvature:** Design locomotives so that spacing of tires, lateral play, swing of trucks, etc., will allow curves to be easily passed, as follows:

Road Engines (except Articulated and Narrow Gauge)	16° 359 ft. rad.
Articulated	22° 262 ft. "
Narrow Gauge	22° 262 ft. "
Switching Engines (except 10-Coupled)	25° 231 ft. "
" " (10-Coupled)	Raise question if curve is unspecified.

On all new designs, and on duplicate designs where changes are made which require it, make **Layout** of engine and tender on **Maximum Curve** for which the locomotive is designed, and of engine on curve with tender on tangent. Under either of these conditions the minimum allowable clearances are as follows:

Cab Handle and any part of tender above top of deck	16"
" " " " " " " " below " " "	3"
Cab Apron edge and any part of tender	5"

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.
Check also clearance and length of drawbars, safety bars, safety chains and any other parts affected by the relative movement of engine and tender.

3. **Total Wheel Base** of engine and tender must not exceed length of **turntable**, less 30 inches.
   NOTE: Length given for table is exact length of rail on table, and not diameter of pit.

4. **Working Clearances:** Lay out on each new engine drawing, half-plan of engine, to see that proper clearances from all moving and swinging parts, such as clearance between guide yoke and counterbalance, are provided for.
   Make this half-plan view as complete as elevation and sectional view.

5. See Group 48. Foreign Locomotives.

QUESTION: Duplicate engines.
EXCEPTIONS: R. R. Co.'s drawings, specifications or instructions to contrary, covering curves of shorter radius than the above.

American Locomotive Company

ENGINEERING DEPARTMENT

STANDARD PRACTICE

99[8] S 2321

February 22nd, 1918

MISCELLANEOUS
Rules, Formulæ and Tables.

Superseding
99[3] A 1186a
99[3] S 1461
99[3] S 1424

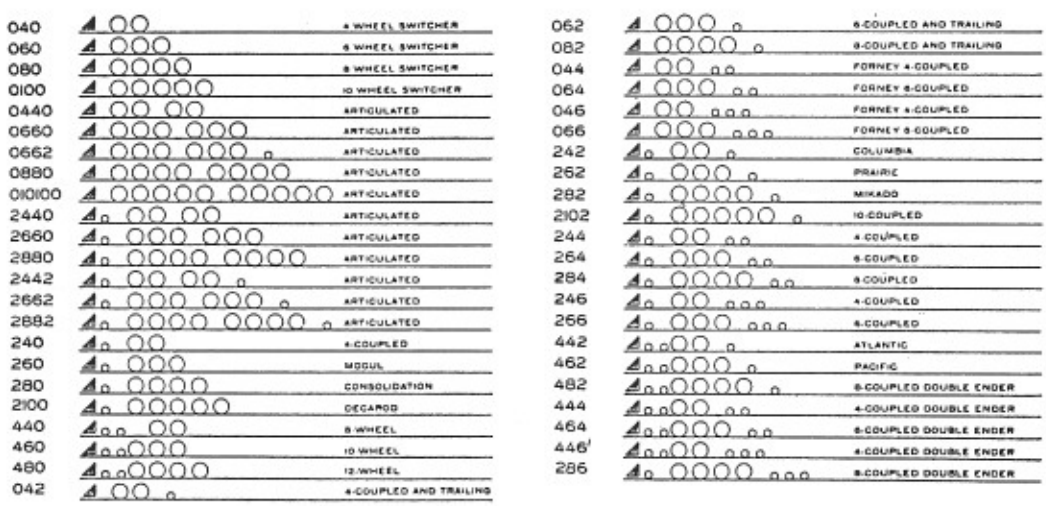
APPROVED ENGINEERING COMMITTEE

1. The **Locomotive Classification** adopted by the American Locomotive Co. is based on the representation by numerals of the number and arrangement of the wheels, commencing at the front. Thus: 260 means a Mogul and 460 a Ten-wheel engine, the cipher denoting that no trailing truck is used.

   Total weight is expressed in 1000 of pounds. Thus: an Atlantic locomotive weighing 176000 lbs. would be classified as a 442-176 type. If the engine is Compound the letter C should be substituted for the dash thus: 442 C 176. If equipped with superheater, the letter S should be used—thus a Mallet locomotive having six pairs of drivers, with Superheater, would be classified: 0660 C S 334 if Compound, or 0660 S 334 if Simple. When tanks are used in place of separate Tender the letter T should be used in place of the dash. Thus a double-end suburban locomotive with two-wheeled leading truck, six drivers and six-wheeled rear truck, weighing 214000 lbs. would be a 266 T 214 type.

   See diagram below showing classification and names of different types.

AMERICAN LOCOMOTIVE COMPANY.
ENGINEERING DEPARTMENT.
CLASSIFICATION OF LOCOMOTIVES.
WHYTE'S SYSTEM



2. As fast as **Calculations** are made for an engine order, enter same on Form E. D. 97. In case the sizes for any of the details covered by Form E. D. 97 are determined by an Assistant Engineer from standard practice or office information sheets, the drawing of the detail must be submitted to the Calculating Department for checking and proper entry made on Form E. D. 97. One of the purposes of this form is to show the Chief Calculator when all the calculations for an order are completed, and it shall be his duty to inspect these Forms from time to time to assure himself that complete calculations for engine orders are being made.

3. Make **Estimates** of **Weight** of each order of locomotives when new designs or extensive changes are required, from time to time in the Drawing Room, either before or after work is started, to keep a check on changes and additions involving additional weight, which may be made either by Railroad Companies or the American Locomotive Company.

   Send reports of weight estimates to New York Office, so that any discrepancies can be followed up, and if it is decided to make changes involved, the subject can be taken up with the Railroad Company to obtain their acceptance.

   Make out appendix sheets, Form E. D. 1031, giving the official weight immediately after the first engine in each order is weighed. Attach these appendix sheets to the original specification to show corrections in weight.

   Weights given on Railroad Companies' specifications must be carefully checked before drawing room work has progressed too far, and if any discrepancy is found, report it at once. It often happens the weights are estimated and locomotives cannot be constructed to the dimensions specified within limitations of weight given.

   Use Form A. 1057 for estimates of changes in weight.

(OVER)

4. **Official Total and Distributed Weights** for all engines will be entered on Form E. D. 1 by the General Drawing Room and approved by Mechanical Engineer.

Actual Total and Distributed Weights of the first locomotive in each order must be reported by the local Chief Draftsman on form E. D. 1, to the General Drawing Room, and shipment of engines by the Local Works must be delayed until the weights have been approved by the Mechanical Engineer. This report must be mailed to General Drawing Room the same day engine is weighed, Local Drawing Room retaining copy for record. If the weights covered by any report are unsatisfactory the Mechanical Engineer will order such re-weighing as may be necessary to secure accurate weights.

NOTE: The first engine of any lot of engines in same order, differing from others in design or construction, such as Valve Gear, Superheater, Compound, etc., must be weighed also.

All engines must be weighed by, or in presence of, an inspector from the Local Drawing Room. All weights must be entered at time of weighing, on Form E. D. 1, and no corrections of any kind in original figures must be made by Local Works.

Give ACTUAL loaded weight (total and distributed), in working order, including coal fire (or its equivalent), two gauges of water, and two men in cab, but not including ashes or sand.

Boiler should show water and steam in second gauge cock. Water level in boiler must be determined accurately by personal observation of man weighing engine. If boiler shows water in second gauge cock and steam in third gauge cock, the estimated height above second gauge cock should be given as follows:

2 scant, 2 full, 2½, etc

Water level should be checked by water glass gauge, if possible, and must be taken only when the engine is on the Platform scales, or over the scale pit in the case of individual scales.

Weight report for engines weighed with two (2) gauges of cold water or with two (2) gauges of hot water and no steam will not be accepted (except as authorized by the Engineering Department in special cases).

All wedges must be down, so that the boxes will be free in pedestals.

Tender Engines: To have tender uncoupled before weighing.

Include half the weight of drawbar in weight of engine.

Tank Engines: (Total and distributed), weigh with tanks two-thirds full of water, and coal bunker two-thirds full of fuel (or its equivalent).

To obtain accurate weights in working order (both total and distributed) direct from scales, place 50-pound weights, equivalent to weight of fuel to be added, on runboards, alongside firebox, equally distributed and weight on footplate equal to one-half weight of draw-bar; also weights in proper locations, equivalent to any and all parts (exceeding the total of 100 pounds in weight) that may be missing from the engine at the time of weighing. Total weight of missing parts must not exceed 1000 pounds.

The actual condition of each engine when weighed must be noted on weight sheet, giving amount of water, boiler pressure, and amount of fire, parts missing and equivalent weights added for each item.

Give position of engine on springs, by measurements from top of front and rear driving boxes (highest part underneath frame), to top of frame and height from rail to bottom of pilot; also note any tilting of springs or equalizers. When there are two (2) or more holes in forward or trailing equalizer fulcrums, location of pin must be given.

Weights Loaded: (Total and distributed). Give weights by running the engine on and off scales in both directions, one group of equalized wheels at a time, indicating groups of wheels weighed by dimension lines on blank, when platform scales are used.

When individual scales are used, give scale weights on each pair of wheels on blank.

Weight, Empty: All engines must be weighed light and total light weight noted on original form E. D. 1 furnished General Drawing Room. Engines should be weighed in running order conditions first, and then light weight taken as soon as boiler can be blown off. Details such as main rods, should not be removed until light weight is taken.

Weights, Official: In space provided, give loaded and empty (official) weights, correction being made for difference in amount or temperature of water, lack of fire, missing parts, etc.

Under "Distributed Weights (Official)" give the corrected weights on each different pair of wheels.

Fuel: Use following allowance per square foot grate area, for full coal fire:

Firebox, between frames, or over frames between wheels, ...50 lb.
Firebox, wide, or over wheels (Bituminous) .... 37 "
Firebox, wide, or over wheels (Anthracite) .....25 "

Water: If engines are weighed with cold water, make the following adjustments per cubic foot of water contained in boiler, (two gauges):

Cold water.....	62.50	lb.	Hot water,	125	lb.	pressure....	55.69	lb.
Hot water,	25	lb.	pressure	58.28	"	"	"	150	"	"	....55.29	"
"	"	50	"	"	....57.32	"	"	"	175	"	"	....54.93	"
"	"	75	"	"	... 56.69	"	"	"	200	"	"	....54.60	"
"	"	100	"	"	....56.18	"							

Tender: For each order, give total weight and weight on each truck, both empty and full of water, to check tank capacity.

In sending weight report to General Drawing Room, do not delay same for tender weights; if tender has not been weighed when engine weights are ready, forward same as soon as obtained. Tenders for New York Central Lines engines must be weighed with tank full of water and with the specified tonnage of coal, and total and distributed weight on each truck be obtained.

In obtaining distributed weights, end wheels on scales must be placed as far from edge of platform as clearance of first wheel on solid track will permit.

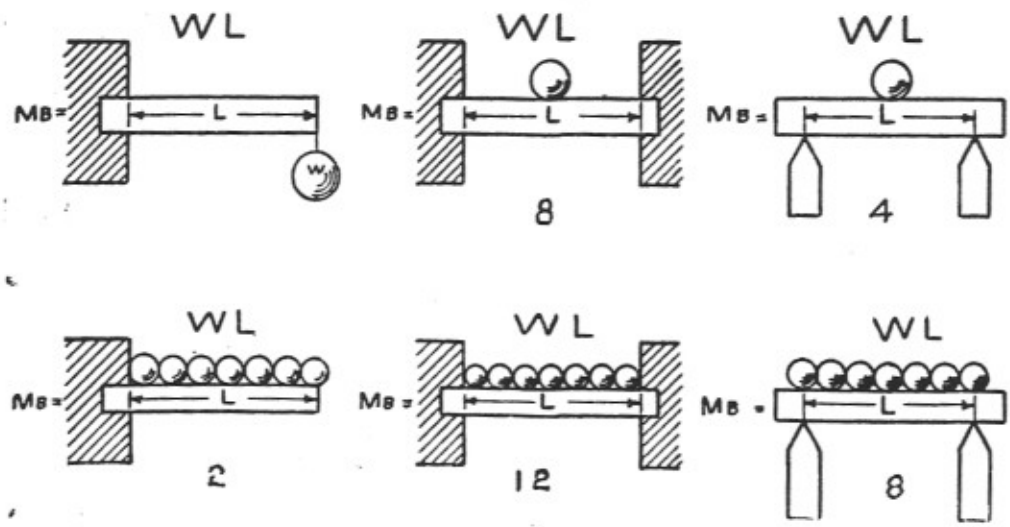
QUESTION: Duplicate engines.
EXCEPTIONS: R. R. Co.'s drawings, specifications or instructions to contrary.

MISCELLANEOUS
Rules, Formulæ and Tables.

Superseding 99s S 2322

APPROVED ENGINEERING COMMITTEE

1. **Rectangular Beams—Bending Moments:** To find the safe size multiply the load in pounds by the length in inches, and divide by the figure given under the beam in the cases illustrated below, selecting the one which shows the exact given conditions of support and the location of load (=Mb). In the table of safe bending moments following, on the line of proposed thickness and given fibre stress find the moment nearest the one obtained above, when proper depth can be read at the top of the column.
Mb = Bending moment in inch—lb. W = Load in lb. L = Length between supports, in inches.



2. **Rectangular Beams:** Maximum Safe **Moments of Resistance** (in inch—lb.)

Fibre Stress	Thick	DEPTH OF BEAM, (Ins.)												
		2	2½	3	3½	4	4½	5	5½	6	6½	7	7½	8
12000 lb.	½	4000	6250	7500	12250	16000	20200	25000	30200	36000	42200	49000	56200	63800
	⅝"	5000	7800	11200	15200	20000	25400	31200	37700	45000	52800	61200	70200	80000
	¾"	6000	9400	13500	18400	24000	30400	37500	45400	54000	63300	73500	84600	96000
	⅞"	7000	10900	15700	21400	28000	35400	43800	52900	63000	73800	85600	98300	112000
	1"	8000	12500	18000	24500	32000	40500	50000	60500	72000	84500	98000	112500	128000
	1⅛"	9000	14100	20200	27500	32650	45600	56300	68000	81000	95000	110200	126500	144000
	1¼"	10000	15600	22500	30600	40000	50600	62500	75500	90000	105500	122500	140500	160000
	1⅜"	11000	17200	24700	33600	44000	55600	68700	83200	99000	116100	135000	154500	176000
	1½	12000	18800	27000	36700	48000	60700	75000	90700	108000	127000	147000	168700	192000
	1¾"	14000	21900	29700	42800	56000	70800	87500	105700	126000	147800	171200	196800	224000
14000 lb.	½"	4650	7250	10500	14250	18650	23600	29150	35250	42000	49250	57150	65600	74650
	⅝"	5800	9100	13100	17850	23300	29500	36450	44100	52500	61600	71450	82000	93300
	¾"	7000	10900	15750	21400	28000	35400	43750	52900	63000	73900	85750	98400	112000
	⅞"	8150	12750	18350	25000	32660	41300	51000	61750	73500	86250	100000	114800	130600
	1"	9300	14550	21000	28550	37300	47250	58300	70550	84000	98550	114300	131200	149300
	1⅛"	10500	16400	23600	32150	42000	53150	65600	79400	94500	110900	128600	147600	168000
	1¼"	11650	18200	26250	35700	46650	59050	72900	88200	105000	123200	142900	164000	186600
	1⅜"	12800	20050	28850	39300	51300	64950	80200	97050	115500	135500	157200	180400	205300
	1½"	14000	21850	31500	42850	56000	70850	87500	105800	126000	147800	171500	196800	224000
	1¾"	16300	25500	36750	50000	65300	82650	102000	123500	147000	172500	200000	229600	261300

3. **Moduli of Circular Sections (Solid).**

INS.	DIAMETER IN 8TH INCHES							
	———	⅛	¼	⅜	½	⅝	¾	⅞
1	0.098	0.139	0.191	0.255	0.331	0.421	0.526	0.647
2	0.785	0.942	1.12	1.31	1.53	1.77	2.04	2.33
3	2.65	2.99	3.37	3.77	4.20	4.67	5.18	5.71
4	6.28	6.89	7.53	8.22	8.94	9.71	10.53	11.37
5	12.27	13.27	14.21	15.25	16.33	17.47	18.66	19.90
6	21.21	22.56	23.96	25.43	26.96	28.55	30.00	31.91
7	33.68	35.52	37.31	39.38	41.34	43.53	45.71	47.95
8	50.27	52.70	55.14	57.68	60.30	63.00	65.78	68.64
9	71.58	74.52	77.71	80.90	84.18	87.55	90.91	94.55
10	98.20	101.90	105.70	109.60	113.60	117.80	122.00	126.30

R = Modulus of Resistance: Sf = Fibre Stress (lb. per sq. in.) : Mb = Bending Moment (in.—lb.)

$$R = 0.0982d^3 \qquad R = \frac{Mb}{Sf} \qquad RSf = Mb \qquad Sf = \frac{Mb}{R}$$

(OVER)

4. **Moduli of Rectangular Sections.**

Depth	THICKNESS IN INCHES										
	½	⅝	¾	⅞	1	1⅛	1¼	1⅜	1½	1¾	2
2	0.3333	0.4167	0.5000	0.5833	0.6667	0.7500	0.8333	0.9167	1.0000	1.1667	1.3333
2½	0.5208	0.6510	0.7813	0.9115	1.0417	1.1714	1.3021	1.4323	1.5625	1.8229	2.0833
3	0.7500	0.9375	1.1250	1.3125	1.5000	1.6875	1.8750	2.0625	2.2500	2.4750	3.0000
3½	1.0284	1.2760	1.5312	1.7865	2.0417	2.2877	2.5521	2.8073	3.0625	3.5729	4.0833
4	1.3333	1.6667	2.0000	2.3333	2.6667	3.0000	3.3333	3.6667	4.0000	4.6667	5.3333
4½	1.6875	2.1094	2.5313	2.9495	3.3750	3.7969	4.2188	4.6406	5.0625	5.9063	6.7500
5	2.0833	2.6042	3.1250	3.6458	4.1667	4.6875	5.2083	5.7292	6.2500	7.2917	8.3333
5½	2.5208	3.1510	3.7813	4.4115	5.0417	5.6719	6.2921	6.9322	7.5625	8.8229	10.0833
6	3.0000	3.7500	4.5000	5.2500	6.0000	6.7500	7.5000	8.2500	9.0000	10.5000	12.0000
6½	3.5208	4.4010	5.2813	6.1615	7.0417	7.9219	8.8031	9.6823	10.5625	12.3229	14.0833
7	4.0833	5.1042	6.1250	7.1458	8.1667	9.1875	10.2083	11.2292	12.2500	14.2917	16.3333
7½	4.6875	5.8594	7.0313	8.2031	9.3750	10.5469	11.7188	12.8906	14.0625	16.4063	18.7500
8	5.3333	6.6667	8.0000	9.3333	10.6667	12.0000	13.3333	14.6667	16.0000	18.6667	21.3333

R = Modulus of Resistance: Sf = Fibre Stress (lb. per sq. in.): Mb = Bending Moment (in. lb.)

$$R = \frac{bd^2}{6} \qquad R = \frac{Mb}{Sf} \qquad RSf = Mb \qquad Sf = \frac{Mb}{R}$$

5.

CYLINDER		PISTON THRUST—Pounds.							
		BOILER PRESSURE—Pounds							
DIAMETER INS.	AREA SQ. IN.	180	185	190	200	210	220	225	250
17	226.98	40855	41990	43125	45395	47665	49935	51070	56745
17½	240.53	43295	44500	45700	48105	50510	52915	54120	60130
18	254.47	45805	47080	48350	50895	53440	55985	57260	63620
18½	268.80	48385	49730	51070	53760	56450	59135	60480	67200
19	283.53	51035	52455	53870	56705	59540	62375	63795	70880
19½	298.65	53755	55250	56745	59730	62715	65705	67195	74660
20	314.16	56550	58120	59690	62830	65975	69115	70685	78540
20½	330.06	59410	61060	62710	66010	69310	72615	74265	82515
21	346.36	62345	64075	65810	69270	72735	76200	77930	86590
21½	363.05	65350	67165	68980	72610	76240	79870	81685	90760
22	380.13	68425	70325	72225	76025	79825	83630	85530	95030
22½	397.61	71570	73560	75545	79520	83500	87475	89460	99400
23	415.48	74785	76865	78940	83095	87250	91405	93485	103870
23½	433.74	78075	80240	82410	86750	91085	95425	97590	108440
24	452.39	81430	83690	85955	90480	95000	99525	101790	113100
24½	471.44	84860	87215	89575	94290	99000	103715	106070	117860
25	490.87	88355	90810	93265	98175	103085	107990	110450	122720
25½	510.71	91930	94480	97035	102140	107250	112355	114910	127680
26	530.93	95565	98220	100875	106185	111495	116805	119460	132730
26½	551.55	99280	102040	104795	110310	115825	121340	124100	137890
27	572.56	103060	105920	108785	114510	120235	125960	128830	143140
27½	593.96	106910	109880	112850	118790	124730	130670	133640	148490
28	615.75	110835	113920	116995	123150	129310	135465	138540	153940
28½	637.94	114830	118020	121210	127590	133965	140345	143540	159490
29	660.52	118895	122200	125500	132105	138710	145315	148620	165130
29½	683.49	123030	126450	129865	136700	143535	150370	153790	170870
30	706.86	127235	130770	134305	141370	148440	155510		
30½	730.62	131510	135170	138815	146125	153430	160735		
31	754.77	135860	139630	143405	150955	158500	166050		
31½	779.31	140275	144170	148070	155860	163655	171450		
32	804.25	144765	148790	152810	160850	168890	176935		
32½	829.58	149325	153470	157620	165915	174210	182510		
33	855.30	153955	158230	162510	171060	179615	188165		
33½	881.41	158655	163060	167470	176280	185095	193910		
34	907.92	163425	167970	172505	181585	190660	199740		
34½	934.82	168265	172940	177615	186965	196310	205660		
35	962.11	173180	177990	182800	192420	202045	211665		

American Locomotive Company

ENGINEERING DEPARTMENT

STANDARD PRACTICE

99⁰ S 2324 f

October 21st, 1931

MISCELLANEOUS

Superseding

[redacted]

99⁰ S 2324 e

APPROVED ENGINEERING COMMITTEE

1. All **Standard Practice** relating to construction, covers construction of locomotives having simple cylinders 17" diameter and over, or their compound equivalent (except where otherwise specified and applicable to smaller engines).
   Standard Practice in Group 99 cover engines of all sizes and types, wherever applicable.

2. **Locomotives Shipped on their own Wheels** should have side rods in place, to reduce to a minimum injurious effects of driving wheel counterbalance on track.
   Use crank pin block shown on Standard drawing (see Index, Group 93) on main rod bearings to keep side rods in place.
   Where eccentric straps are easily accessible for attention during transit, straps and rods may be left in place so that straps will be worn down to good bearing when engines arrive at destination.

3. **Tenders, Shipped Separately** from locomotives, on their own wheels, are to be arranged for shipment as follows (see drawing 992 S 904900) :
   EVEN NUMBERS OF TENDERS: Ship in pairs, couple front end to front end with temporary draw-bar.
   SINGLE TENDERS: Provide **Coupler** and **Uncoupling Shaft** at front end arranged to meet requirements of Interstate Commerce Commission covering similar parts at rear end. Where possible, use coupler of Railway Company's standard design, which can then be covered in estimate of cost of tender and retained by the Road.

   On tenders equipped with "ET", or other similar **Brake**, which is inoperative when tender is detached from engine, apply the following additional parts necessary to operate tender brake in conjuction with train brakes:

   1 Auxiliary Reservoir
   1 " " Drain Cock } To suit size of brake cylinder
   1 Plain Triple Valve
   1 " " " Nipple
   1 Triple Valve Cut-out Cock
   1 Centrifugal Dirt Collector.

   Include these parts in estimates covering such tenders.

   Apply safety valve, set at not less than 25% nor more than 30% in brake cylinder head or pipe, when braking power as arranged for separate shipment is higher than that for freight cars.

   Apply **hand brake** to all tenders shipped separately.
   No other safety appliances need be applied in addition to those required for tenders attached to locomotives.

4. **Working Allowances:** Use the following:

DETAILS		LATERAL CLEARANCE	PART MADE EVEN SIZE
§Crosshead,	Guide,	1/32"	Crosshead, (Shims 1/8" F. 1/4" B. bet. top and bottom guide and support, for vertical alignment).
Eccentric (Stephenson)	Strap,	1/16"	Eccentric,
Eccentric Rod, " "	Eccentric Crank,	1/32"	Eccentric Rod,
	Link,	1/32"	Link.
Link,	Link Block F. & B.	0 "	Block fitted to slide freely.
"	Radius Bar,	1/16"	Link,
" Block,	" "	1/64"	Inside of Rad. Bar = width of Link plus 1/16"
Radius Bar,	Slide Block,	1/16"	Radius Bar,
" "	Combination Lever,	1/32"	Allowance made in Jaw,
" "	Rad. Bar Lifter (Link),	1/16"	Radius Bar Lifter,
Reverse Lever,	Rev. Cyl. Conn. Rod,	1/16"	Reverse Lever,
" Cyl. Piston Rod,	" " " "	1/16"	" Cylinder Piston Rod,
" Shaft Arm,	Slide Block,	1/16"	" Shaft Arm,
Combination Lever,	Valve Rod Crosshead,	1/32"	Male Part,
Reverse Lever,	Rev. Lever Fulcrum,	1/32"	Reverse Lever Fulcrum,
" "	Reach Rod Jaw,	1/32"	" "
" Shaft Arm,	" " "	1/32"	" Shaft Arm,
Combination Lever,	Combination Link,	1/32"	Combination Lever,
" Link,	Crosshead Arm,	1/32"	Crosshead Arm,
*Main Rod, Front Stub,	Crosshead,	1/16"	" Bore Brasses 1/128" large in diam.
* " " Back "	Crank Pin, Make end radius of bearings 1/8 inch greater than fillet radius on pin.	1/16"	Crank Pin (up to 6" long) Insert No. 22 liner between halves of Back End Main Brass and bore out for journals under 8" diam. 1/32" large in diam., and those 8" diam. and over, 3/64" large in diam. Bore others than Main 1/32" large in diameter.
* " " " "	" "	3/32"	" " over 6" to 8" ")
* " " " "	" "	1/8"	" " (" 8" ")
*S. Rod, F. B. & Int. Stubs	" "	1/16"	" "
*" " Main Stub,	" "	0 "	" " and Stub.
Knuckle Joint Jaw,	Tongue,	1/32"	Knuckle Joint Jaw,
Mallet Hinge Bushings,	Pin,	1/32" dia	Pin,
" " Ball (Baldwin)	"	1/32" "	"
" " " "	Ball Seat.	1/64" "	Ball Seat.
3-Cyl. Middle Main Rod Bearing	Crank Checks (total)	1/16"	Distance between Crank Cheeks.
Rod, Float, Bush l. D.	Crank Pin,	1/64" dia.	Crank Pin,
" " " O. D.	Outer Bushing.	1/64" "	Outer Bushing.

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

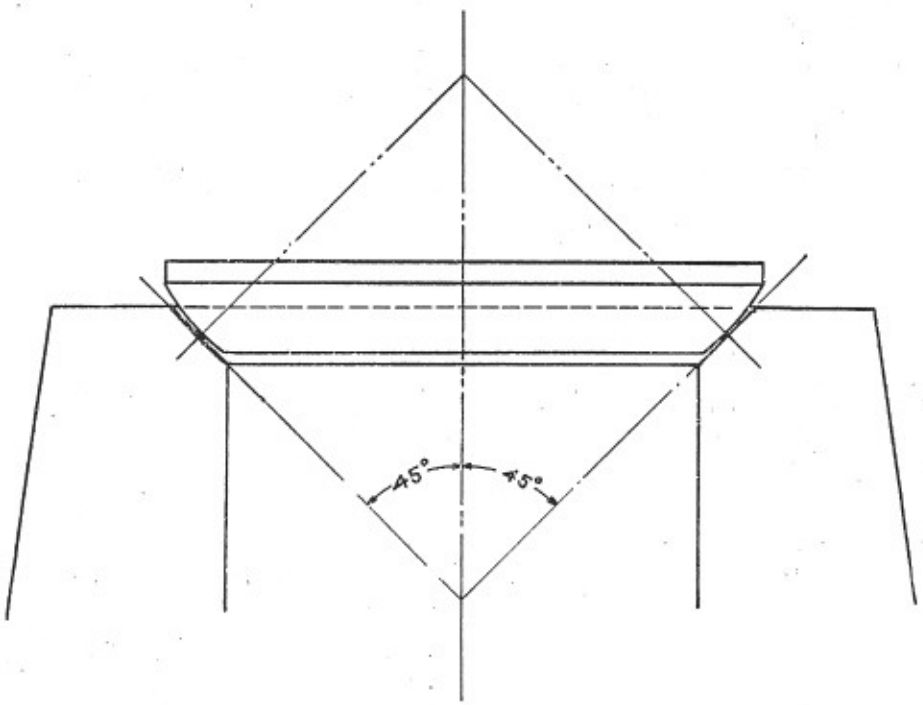
(OVER)

§For alligator crossheads only, and after obtaining Ry. Co.'s approval, make total lateral clearance between crosshead shoes and guides 1/16" for shoes 26" and over in length or having flanges more than 1½" in depth.
Allow 1/32" total vertical clearance between crosshead shoes and guides. Show this on guide drawings and make distance over shoes an even figure.

5. **Thickness of Flanges** for bolts having nuts on the inside, as in the case of engine foot plates and differen forms of cross braces, should not be less than 1½ times diameter of bolt, to afford a proper fit and to provide for loss of bearing by threaded portion.

Use solid flanges on crossties, etc., instead of coring out flange on frame side, and provide bosses on outside to give bearing for bolts equal to at least 1½ times diameter of bolt.

6t Make the seat for **Ball Joint Rings** with a straight sided reamer at an angle of 45 degrees from the center. This makes a satisfactory joint and avoids the use of a large number of different diameters of ball reamers. See sketch below:



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

99⁹ S 2325 b

October 6th, 1931

MISCELLANEOUS

Superseding 99⁹ S 2325 a

APPROVED ENGINEERING COMMITTEE

1. **Photograph** one engine in every order; number, size, etc., as per table below, except that negatives for framed photographs and photo-pasters must be made only when covered by appendix sheet from New York Office.

USE	NEGATIVES				TRIMMED SIZE OF PRINT	MATT SIZE		SIZE OF FRAME (INSIDE)	SIZE OF GLASS
	Size	No. Required	View	Length of Image		Outside	Opening		
Framing	10" x 24"	1	R.Side on R.H. drive engines	22"	.....	13" x 27"	9" x 23"	12½" x 26½"	13" x 27"
Photo-Pasters	8" x 10"	1	L.Side on L.H. drive engines	7½"	3" x 8"	....	.....	.....	.....
Works' Reference	8" x 10"	1 1 1	R. Side L. Side B. Head	9½"	7¾" x 9¾"	.....	.....	.....	.....
Elev. Tracings, for Form 1007.	6½" x 8½"	1	.....	7¾" over border lines	6" x 8"	.....	.....	.....	.....

Take all side views on line at right angles with front of smoke box. Back head view to show as nearly as possible all cab fittings. Develop negatives and forward same promptly to General Drawing Room.

Prints of all photographs referred to above will be furnished from General Drawing Room to local Works for duplicate orders as part of engine record, and must be filed in standard albums according to engine orders.

Preparation. No preparation needed for shop photographs. Prepare locomotives photographed for publication thus:-

Kalsomine right side of engine and tender with following preparation:

1 pound lamp black, 1 quart warm water, 1 tablespoonful molasses. Put molasses in warm water and mix well; then put in lamp black and it will break up at once. Mix thoroughly and reduce to proper consistency for spreading with cold water.

The letters, numbers and edges of tires to be painted white.

Do not cover any lettering or striping when applying Kalsomine.

When **Duco** finish is applied, omit Kalsomine and line the following up in white—running board edges, rods, motion work, tires and lettering and numbering.

On account of the various uses made of them, pictures must not only be distinct, but present an artistic appearance, and with this in view, the following must be observed:

Remove glass from cab sash on the side photographed.
Reverse lever to stand in central position.
Bell to hang vertically—remove rope.
Crank pins to stand on bottom quarter in vertical line through center of axles.
All drip pipes for injector checks, bell ringer, sanders, etc., if in view to be removed.

Time. Take photographs early in the morning or late in the afternoon to get horizontal lighting and avoid strong high lights on top, and deep shadows under boiler around running gear and under tender. If this is not observed, the parts beneath the running board will not be properly illuminated and good results cannot be obtained.

2. When new devices or articles on which **Patent** rights may be involved are called for on R. R. Co.'s drawings and not distinctly covered in contract specification, raise question as to their use, before making same in our shops or ordering outside.

All drawings showing patented details must be plainly marked **"Patented"** at top near title, followed by the name of patentee or assignee.

Do not make changes, alterations or additions in **drawings** of Patented Devices or those for which patents have been applied for, without first submitting the matter to the patentee for his approval.

QUESTION: Duplicate engines.

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

American Locomotive Company

ENGINEERING DEPARTMENT

February 10, 1936

STANDARD PRACTICE

99^{8} S 4027

MISCELLANEOUS
RULES, FORMULAE AND TABLES

Superseding
13 S 2249 Par. 1 & 2
13 S 2253 Par. 4

APPROVED ENGINEERING COMMITTEE

1. Evaporating Heating Surfaces: Calculate as follows:

   (a) Tubes and Flues: Use wetted (outside) surface between tube sheets.
   (b) Arch Tubes: Use wetted (inside) surface, length measured on center line between sheets.
   (c) Firebox: Use wetted (outside) surface, from top of foundation ring. Deduct fire door hole and tube and flue holes.

   In calculating superheating surface, use wetted (inside) surface of pipes including ends and return bends, but not header or steam pipes to cylinders. Do not include superheating surface in evaporating heating surface, but show in separate item.

2. Ratio of Tube Length to Sectional Area of Tube Outside: For bituminous-coal-burning engines the preferred ratio is from 70 to 73. See table below:

O. D. OF TUBE	LENGTH CORRESPONDING TO RATIO OF:	
	70	73
1½"	10'-4"	10'- 9"
1¾"	14'-0"	14'- 8"
2 "	18'-4"	19'- 1"
2¼"	23'-2"	24'- 2"
2½"	28'-7"	29'-10"

3. STRESSES IN BOILERS AND BOILER DETAILS: To conform to the requirements of Section 3 of the A.S.M.E. Construction Code for Locomotive Boilers.

American Locomotive Company

ENGINEERING DEPARTMENT

March 15, 1937

STANDARD PRACTICE

99^{1} S 4030-1-b

MISCELLANEOUS
Materials - Kinds, Sizes & Spec'ns. for GENERAL

Superseding
99^{1} S 4030-1-a

APPROVED ENGINEERING COMMITTEE

1. A.L. Co's Standard Material Specifications for Domestic work are A.A.R., for Export work, A.S.T.M. unless otherwise noted.

   Materials ordered to A.A.R. Specifications will, in practically all cases, meet A.S.T.M. Specifications, but materials ordered to A.S.T.M. Specifications, will not, in all cases, meet A.A.R. Specifications.

   The last column shows the A.S.T.M. equivalent of A.A.R. Specifications.

   References to Grades and Classes do not apply to A.S.T.M. Specification, unless listed in the A.S.T.M. column.

   When ordering to any specification, it is understood that the latest revision of such specification is contemplated.

   Follow the International Nickel Co.'s specifications for all nickel materials where they have a specification, the Vanadium Corporation of American Specifications for Vanadium except as otherwise listed, and where they have a specification, the Canadian National Specification M-80 for High Tensile Silico-Manganese Plates.

2. For details made from Billets, Bars, Castings, Forgings, Plates and Sheets, Structural Steel Shapes, Pipe and Miscellaneous materials, see separate sheets.

3. Use the following:

DETAIL	SPECIFICATIONS			
	ALCO	A.A.R.	A.S.T.M.	A.S.T.M. EQUIV. OF AAR SPEC'NS.
Group 11. QUENCHED and TEMPERED CARBON STEEL AXLES CRANK PINS and PISTON RODS			A-19	
ANNEALED CARBON STEEL AXLES, CRANK PINS and PISTON RODS - Grade 3, (see Note 1)		M-102		A-20
NORMALIZED and TEMPERED CARBON STEEL AXLES, CRANK PINS and PISTON RODS (Class "A", see Note 1)		M-104		A-20
CHROME VANADIUM DRIVING AXLES Quenched and Tempered	80			
CARBON STEEL TENDER & TRUCK AXLES All tapered axles 6-1/2" nominal dia. at center and under, Grade A		M-101		A-21
Not tapered of this same size, order untreated, Grade 3		M-102		A-20
Tapered or straight over this size, order annealed, Grade 3.		M-102		A-20

over

DETAIL	SPECIFICATIONS ALCO	A.A.R.	A.S.T.M.	A.S.T.M. EQUIV. OF A.A.R. SPEC'NS
14. BOILER and FIREBOX STEEL PLATES Engine Orders, Domestic,(except ASME Boilers) specify, Grade A for firebox plates.		M-115		A-30
Engine orders, Export			A-30	
Extra work orders, Domestic - (If not ASME, follow regular practice for each customer, otherwise ASME)				
Extra work orders, Export			A-30	
Engine orders and extra work orders, Domestic. (If ASME, follow ASME) For stock orders to ASME. See separate sheet on PLATES & SHEETS				
COPPER PLATES for LOCO. FIREBOXES Order ANNEALED For Domestic, order non-arsenical, For Export, order arsenical.			B-11	
STEEL BOILER BRACES	37			
Brace Feet, see Group 14.				
BOILER BRACE IRON (where used) See Separate sheet on Bar Materials.				
STAYBOLT IRON, Water Space and Radial Stay, both solid and hollow drilled. (If ASME, follow ASME) Staybolt Iron, see Group 14.		M-305		A-84
HOLLOW STAYBOLT IRON (if hollow rolled)		M-304		A-86
COPPER BARS for LOCO. STAYBOLTS and RIVETS (order annealed) For Domestic, order non-arsenical,for Export,arsenical.			B-12	
LAP WELDED and SEAMLESS STEEL and LAP WELDED IRON BOILER TUBES,S.H. FLUES, S.H. PIPES, SAFE ENDS & ARCH TUBES If ASME, follow ASME.		M-108		A-83, Grade A steel,Grade B,iron
For classification and gauges of tubes, see Group 14.				

Continued on Sheet 2

American Locomotive Company

ENGINEERING DEPARTMENT

January 4, 1937

STANDARD PRACTICE

99[1] S 4030-2-a

Sheet 2

MISCELLANEOUS
Materials - Kinds, Sizes & Spec'ns for GENERAL

Superseding 99[1] S 4030-2

APPROVED ENGINEERING COMMITTEE

Continued from Sheet 1 DETAIL	SPECIFICATIONS ALCO	A.A.R.	A.S.T.M.	A.S.T.M. EQUIV. OF A.A.R. SPEC'NS.
Group 14 continued BRASS TUBES for LOCO. BOILERS			B-14	
HIGH TENSILE SHELL PLATES, see separate sheet on PLATES & SHEETS				
15. ENGINE BOLT IRON, round, hex. & rect. bars See separate sheet on Bar Materials				
Hard Bronze Bushings, see separate sheet on Castings.				
BOILER RIVET STEEL and BOILER RIVETS Carbon .12 to .20%. Tensile test for record only. Waive tensile properties of specification. Order 10% excess to cover replacements.		M-110		A-31
STRUCTURAL RIVET STEEL and STRUCTURAL RIVETS		M-110		A-31
17. BRONZE BEARING METALS Domestic engine bearings " tender "	35	M-501		B-67
Export engine bearings " tender "			B-66 B-67	
The following items only need to be considered as bearings and ordered outside when any special make or brand of bearing metal is specified. Driving box journal bearings, Engine truck " " Trailing " " " Tender " " " Ecc. Rod Back End " Rod Bearings on crank pins only, also front end of main rod. Middle Main Rod Bearing Metal (Copper 82-84 Lead 0.5-0.75 (Tin 11-12 Zinc 3.5				

over

DETAIL	SPECIFICATIONS			
	ALCO	A.A.R.	A.S.T.M.	A.S.T.M. EQUIV. OF A.A.R. SPEC'NS
Group 17 Continued				
BABBITT LINING for BEARINGS - except trucks	32			
Engine, Trailer, Tender & Motor trucks		M-501		B-67
NON-FERROUS INGOT METALS	30			
JOURNAL BOX LIDS		M-120		
29. CRANK PINS - See Groups 11 and 72				
30. CROSSHEADS - P.R.R.Type - use pure tin lining	30			
31. CYLINDERS, Ordinary Locos. Cast Iron			A-45	
37. DRAWBARS and EQUALIZERS, Wrot Iron order 25% excess		M-307		A-73 Class A
LOW CARBON STEEL DRAWBARS and SAFETY BARS, order 15% excess	102			
COUPLER KNUCKLE PIVOT PINS and SWIVEL PIN for SWIVEL SHANK COUPLER		M-118		
For purchase and acceptance of AAR Std. "E" Couplers, Knuckles, Locks and other parts.		M-204		
COUPLER YOKES, Design Test Requirements for		M-205		
41. EQUALIZERS - See Group 37				
45. ARCH TUBES - See Group 14				
63. WELDED and SEAMLESS STEEL PIPE	see separate sheet on PIPE			
WELDED WROT IRON PIPE	"	"	"	" "

Continued on Sheet 3

American Locomotive Company

ENGINEERING DEPARTMENT

Nov. 30, 1936.

STANDARD PRACTICE

99^{1} S 4030-3

Sheet 3

MISCELLANEOUS
Materials - Kinds, Sizes & Spec'ns. for GENERAL

Superseding 99^{1} S 2313-h

APPROVED ENGINEERING COMMITTEE

Continued from Sheet 2 DETAIL	SPECIFICATIONS			
	ALCO	A.A.R.	A.S.T.M.	A.S.T.M. EQUIV. OF A.A.R. SPEC'NS
Group 63 continued UNIONS and PIPE FITTINGS, 300 lb. pressure		M-404		
65. PISTON RODS, See Groups 11 and 72				
72. QUENCHED and TEMPERED CARBON STEEL MAIN and SIDE RODS and STRAPS			A-19	
ANNEALED CARBON STEEL MAIN and SIDE RODS and STRAPS, Grade 3, (see Note 1)		M-102		A-20
QUENCHED and TEMPERED CHROME VANADIUM MAIN and SIDE RODS, STRAPS, PISTON RODS and CRANK PINS	86			
NORMALIZED and TEMPERED CARBON STEEL MAIN and SIDE RODS and STRAPS Class "A" (see Note 1)		M-104		A-20
76. CARBON STEEL HELICAL SPRINGS, If unspecified.			A-61	
CARBON STEEL ELLIPTICAL SPRINGS: If unspecified; If method of testing unspecified, call for release method. Advise customer. "Dead-soft" O.H. steel for spring bands, should be specified.			A-62	
HEAT TREATED CARBON STEEL HELICAL				

DETAIL	SPECIFICATIONS			
	ALCO	A.A.R.	A.S.T.M.	A.S.T.M. EQUIV. OF A.A.R.SPEC'NS
77. EQUALIZERS - See Group 37				
80. SUPERHEATER PIPES, - See Group 14				
82. HOSE, TENDER TANK		M-606		
86. See Group 37				
89. EQUALIZERS - See Group 37				
TRUCK BOLSTERS, Design Test Requirements for		M-202		
TRUCK SIDE FRAMES, Design Test Requirements for		M-203		
95. STEEL TIRES, CARBON STEEL Specify grade according to service. Specify tensile test required.		M-106		A-26
WROT SOLID CARBON STEEL WHEELS Multiple Wear		M-107		A-57
WHEELS, CAST IRON for LOCOS. TENDERS & CARS		M-403		A-46

Note 1 - Follow A.A.R. specification M-104, Class A, normalized and tempered forgings for all locomotives, including Diesel Locomotives, except locomotives for contracting service and locomotives based on contractor's designs.
Axles, Crank Pins and Piston Rods on locomotives for contracting service and locomotives based on contractor's designs may be made from medium carbon bar steel, meeting S.A.E. Specification 1050, except Man. .60 to .80%. These parts must be annealed to meet A.A.R. Specification, M-102, Grade 3.

Question: Duplicate engines.
Exceptions: R. R. Co's drawings, specifications or instructions to the contrary.

American Locomotive Company

ENGINEERING DEPARTMENT

Nov. 30, 1936.

STANDARD PRACTICE

99[1] S 4031

MISCELLANEOUS

Materials - Kinds, Sizes & Spec'ns for BILLETS

Superseding 99[1] S 2313-h

APPROVED ENGINEERING COMMITTEE

1. A.L.Co's Standard Material Specifications for BILLETS are as follows:
   Medium Carbon Steel, Carbon .45 to .55%, for Eng. Axles, Crank Pins, Guides, Piston Rods, Main and Side Rods and Straps, ALCO 10, Class A.
   Mild Carbon Steel, Carbon .12 to .18%, for Forgings subject to casehardening and welding and miscellaneous mild steel Forgings, ALCO 10, Class B.
   Chrome Vanadium Steel Forgings, ALCO 81.
   Wrot Iron Forgings, for Domestic work, A.A.R. M-307, for Export work, ASTM, A-73, Class A.
   See Standard Material Specifications- General.

2. STEEL FORGING BILLETS of standard sizes and to A.L.Co's regular specifications for carbon steel will be kept in stock. Except where special steel is required or verylarge orders involved, this material will be taken out of stock and applied to order.

   Enter in the material books for the use of the Stock and Accounting Depts., the size and weight of billets required for driving, trailing and engine truck axles, (if forged in Company's shops), crank pins, piston rods, guides, main and side rods, for one engine only. See Group 11 - AXLE BILLETS.

   Billets will be ordered for stock in standard sizes and weights (see below) and cut as required to exact lengths, preferably by sawing, to avoid unnecessary waste.

   Use the standard sizes and weights of forging billets given in tables below, preferably those indicated in heavy-faced type, in order to facilitate deliveries.

   In order to reduce the amount of cold sawing required, the 8-1/2" x 6" billets used for forging motion work and small miscellaneous parts may be ordered in 1000 lb. weights.

   Manufacturers should be notified that billets, especially the smaller sections must be reasonably straight before shipping.

FOR PISTON RODS, CRANK PINS, DRIVING, TRAILING AND ENGINE TRUCK AXLES			
SIZE	WEIGHT	SIZE	WEIGHT
7" x 7"	2000-3000	14" x 14"	4500
8" x 8"	3000-3500	14" x 14"	4900
9" x 9"	3500-4000	15" x 15"	5400
10" x 10"	4500-5000	15" x 15"	5800
11" x 11"	4500-5000	16" x 16"	6300
12" x 12"	5000	16" x 16"	6800
13" x 13"	4100		

FOR MAIN AND SIDE RODS, GUIDES, ETC.			
SIZE	WEIGHT	SIZE	WEIGHT
10" x 6"	3000-3500	16" x 7"	4000-5000
16" x 6"	4000-5000	18" x 7"	4000-5000
12" x 7"	4000-5000	20" x 8"	4000-5000
14" x 7"	4000-5000		

FOR AXLES	
SIZE	WEIGHT
12" x 12"	6000- 7000
13" x 13"	9000-10000
14" x 14"	9000-10000
15" x 15"	10000-11000
16" x 16"	10000-11000

FOR PISTON RODS, EQUALIZERS, ETC. CONTRACTOR ENGINES	
SIZE	WEIGHT
6" x 6"	1000-1500

FOR MOTION WORK, AND SMALL MISCELLANEOUS PARTS	
SIZE	WEIGHT
8½" x 6"	2500-3000

Question: Duplicate engines.
Exceptions: R.R. Co's drawings, specifications or instructions to the contrary

American Locomotive Company

ENGINEERING DEPARTMENT

January 4, 1937

STANDARD PRACTICE

99[1] S 4032-a

MISCELLANEOUS
Materials - Kinds, Sizes & Spec'ns. for BARS

Superseding 99[1] S 4032

APPROVED ENGINEERING COMMITTEE

1. A.L. Co's. Standard Material Specifications for Bars are as follows;
For Domestic work, use A.A.R.: for Export work, use A.S.T.M.
See— Standard Material Specifications - General.

BARS	SPECIFICATIONS				
	ALCO	A.A.R.	S.A.E.	A.S.T.M.	A.S.T.M. EQUIV. OF AAR SPEC'NS.
Refined Wrot Iron				A-41	
Engine Bolt Iron		(M-302 (Grade A			A-189, Grade A
Boiler Braces, Iron, where used		"			"
Extra Refined Wrot Iron		(M-302 (Grade B (Order (Ref. iron			A-189, Grade B order Ref. Iron
Double Refined Wrot Iron		M-302 Grade A			A-189, Grade A
Miscellaneous Mild Steel and for Casehardening & Welding	37				
Steel Boiler Braces, where used	37				
Chrome Vanadium for Crosshead Keys			6125		
Chrome Nickel Steel			3130		
Mild Steel for Bolts			1020		
.30 to .40% Carbon Steel			1035		
.45 to .55% Meduim Carbon Steel Crosshead Pins, Rod Knuckle Pins, etc.			1050 except Man. .60 to .80%		
Spring Steel		M-112			A-14, Grade A

2. Make details from Bar Material as given in table below;

DETAIL	SPECIFICATION
16. LATERAL MOTION, Drg. 164-S-90850, Shaft	S.A.E. 1050 except Man..60 to .80%
Rollers	" " " " " " "
Roller Pins	" " " " " " "
Spring Bolt, if bars are used	ALCO 37
30. CROSSHEAD Wrist Pin	S.A.E. 1050 except Man..60 to .80%
" " " Washer for Comb. Link	" " " " "
39. ECCENTRIC CRANK PIN	" " " " "
41. ENGINE TRUCK PEDESTAL CAP	ALCO 37. See Group 89
46. PEDESTAL CAP	ALCO 37. Order bars of dimensions approximating as closely as possible the finished dimensions of the cap, in multiples of the finished length of cap, plus saw cut allowances for sawing to length. If hammered caps are specified, raise question, as they require finish all over.

over

DETAIL	SPECIFICATION
72. ROD KNUCKLE PINS	S.A.E. 1050, except Man..60 to .80%
76. SPRING END CLIPS	Steel bars Spec. SAE 1035, 1/2" thick in the following widths, are kept in stock: 3"-3½" -4"-4½" - 5"-5½" -6"-6½"
77. SPRING HANGERS & LINKS	When of special material, make truck spring hangers and links of the same material, order square bars of sufficient size to drop forge boss for hangers having round body portion, like Drg. 772 S 46390. For Links, use bars 1-3/4" thick and of same width as hanger.
89. TENDER TRUCK PEDESTAL CAP	ALCO 37. See Group 89.

2. Use the following Standard sizes of BAR IRON or STEEL whenever practicable:
P = Preferred Sizes,
X = Optional Sizes.

	¾"	1"	1¼"	1½"	1¾"	2"	2¼"	2½"	2¾"	3"	3¼"	3½"	4"	4½"	5"	5½"	6"	6½"	7"
1/16"		P		X		X													
1/8 "		X		P		P													
1/4"	P	P	X	P	X	P	X	X		P			X	X					
3/8"	P	P	P	P	P	P	X	P	X	P		X	X	X					
1/2"		X	X	P	X	P	X	P	X	P		X	P	X	X		X		
5/8"			X	X		P	X	P		X		X	X	X	X				
3/4"				X		P	X	P	X	X		X	X	X	X	X	X	X	
7/8"				X		X	X	X	X	X		X	X	X			X		
1"				X		P	X	X		P	X	X	P	X	X	P	X	X	X
1-1/8"						X							X	X		X	X		
1-1/4"						X	X	X		P		P	P	X	P	X	X	X	X
1-3/8"													X	X	X				
1-1/2"						X		X		X		P	P	X	P	X	X	X	
1-5/8"										X									
1-3/4"										X		X	X	X	X		P		
2"								X		X		X	X	X			P		
2-1/4"										X			X						
2-1/2"										X		X	X		X				
3"												X							
3-1/2"													X						

ROUNDS
Preferred - ½",5/8",¾",7/8",1",1-1/8",1-1/4",1½",1-5/8",1-3/4",1-7/8",2", 2-1/8",2-1/4",2-3/8",2½",2¾", 3",4".
Optional - 3/8",1-3/8",2-5/8",3-1/4",3-1/2",3-3/4".

SQUARES
Preferred - 1" 1-1/8", 1-1/4", 1-3/8",1-1/2",1-3/4",2",2-1/4",2-1/2",3-1/4" 3-1/2"
Optional - 1/2", 5/8", 3/4", 2-3/4", 3".

Half Oval,1-1/2" x 7/16" Half Round, 1" x 1/2", 1-1/4" x 5/8"

Question: Duplicate engines
Exceptions: R. R. Co's drawings, specifications or instructions to the contrary

American Locomotive Company

ENGINEERING DEPARTMENT

March 15, 1937

STANDARD PRACTICE

99^{1} S 4033-a

MISCELLANEOUS

Materials - Kinds, Sizes Spec'ns. for CASTINGS

Superseding 99^{1} S 4033

APPROVED ENGINEERING COMMITTEE

1. A.L. Co' s Standard Material Specifications for CASTINGS are as follows:
   For Domestic work, use A.A.R.; for Export work, use A.S.T.M.
   See Standard Material Specifications - General.

CASTINGS	SPECIFICATIONS		
	ALCO	A.A.R.	A.S.T.M. EQUIVALENT OF A.A.R. SPEC'NS.
Carbon Steel, Grade B		M-201	A-87 Grade B
Brass (except S.H. Steam Castings)	29		
Brass S.H. Steam Castings	29with Min 1% Nickel		
Hard Bronze Bushings		M-503	B-66
Miscel.Brass Bushings	35		
Miscel. Grey Iron	98		
Malleable Iron		M-402	A-47, Specify 35018

2. Use MATERIALS for CASTINGS given in table below;

Group	DETAIL	MATERIAL
12.	BELL	82% Copper and 18% Tin
14.	FIREBOX RING,when cast	Cast steel
16.	LATERAL MOTION,Drg. 164 S 90850,	
	Lever	" "
	Shaft Bearing	" "
	Spring Housing	" "
	Spring Seat	" "
	LATERAL CUSHIONING DEV.Spring Seat	ALCO Ni-Iron
17.	BEARING METALS	see Standard Material Specifications-Gen.
25.	COCKS & VALVES	Brass
26.	" "	"
27.	" Guage, Water & Special	"
30.	CROSSHEAD SHOES	Cylinder Iron
31.	CYLINDERS	see Standard Mat'l. Spec.-Gen. If Vanadium, see Group 31.
32.	CYLINDER BUSHINGS	Cylinder Iron
	Valve Chamber Bushings	" "
	" " "	
	when cylinder bushings are ALCO Ni-Iron or equivalent	ALCO Ni-Iron or equivalent
46.	PEDESTAL CAPS	Make of Cast steel only when required by high tensile strength or by weight limitations. Onaccount of machine limiations, raise question when length exceeds 52".

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MISCELLANEOUS
Materials - Castings

STANDARD PRACTICE

99[1] S 4033-a

Group	DETAIL	MATERIAL
47.	CENTERING DEV. Spring Casings, Art. Locos. Boiler Wear Plate Center Pin Guide Bushing Chafing Plates between Eng. & Tend.	See Group 47 " " " " " " " " "
58.	VALVE GEAR Transmission Lever Three Cylinder Engs.	Cast Steel
65.	PISTONS Piston Bull Rings " Packing Rings	Cylinder Iron " " " "
70.	ROCKERS	See Group 70
72.	RODS, Floating Bushings	" " 72
79.	SAFETY VALVE Extension Cab Turrets	" " 79 " " "
80.	STEAM PIPE " " Joint Ring	" " 80 " " "
89.	TENDER TRUCK Bolsters " " Side Frames	see Standard Mat'l. Spec.-Gen. " " " " "
94.	PISTON VALVE, Follower " " Bull Ring " " Packing Ring, Saturated steam " " " " S.H. Steam	see Group 94 Cylinder Iron " " ALCO Ni-Iron or equivalent
99.	MISCELLANEOUS Cast Iron Packing Rings 8" diameter and over " " under 8" diameter	Cylinder Iron ALCO Ni-Iron or equivalent

Standard length of patterns for Cast iron and Gun Iron packing and ball-joint rings of all diameters is 12". Castings of this length will make the number of rings given in table below of the various finished widths.

FINISHED WIDTH OF RING	NO. OF RINGS FROM ONE CASTING	FINISHED WIDTH OF RING	NO. OF RINGS FROM ONE CASTING
1/2"	12	1-1/4" - 1-3/8"	6
5/8"	10	1-1/2" - 1-5/8"	5
3/4"	9	1-3/4" - 2-1/4"	4
7/8	8	2-3/8" - 3"	3
1 - 1-1/8"	7	3-1/8" - 4"	2

Question: Duplicate engines

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

American Locomotive Company

ENGINEERING DEPARTMENT

March 15, 1937

STANDARD PRACTICE

99[1] S 4034-1-a

MISCELLANEOUS
Materials - Kinds, Sizes & Spec'ns. for FORGINGS

Superseding
99[1] S 4034-1

APPROVED ENGINEERING COMMITTEE

1. A.L.Co's Standard Material Specifications for FORGINGS are as follows:
For Domestic work, use AAR, for Export work, use ASTM.
See Standard Material Specifications - General.

FORGINGS	SPECIFICATIONS		
	A.A.R.	A.S.T.M.	A.S.T.M. EQUIV. OF A.A.R. SPEC'NS.
Medium Carbon Steel, Annealed, (see Note 1 on Standard Mat'l. Spec.- Gen.)	M-102 Grade 3		A-20
Medium Carbon Steel, Normalized & Tempered, Class A, (see Note 1 on Standard Mat'l. Spec. - Gen.)	M-104		A-20
Medium Carbon Steel, Quenched & Tempered		A-19	
Truck Axles	see Standard Mat'l. Spec. - Gen.		
Drawbars and Safety Bars	" " " " "		
Chrome Vanadium Steel, Quenched & Tempered Driving Axles	" " " " "		
Chrome Vanadium Steel, Quenched & Tempered Main and Side Rods, Straps, Piston Rods, and Crank Pins	" " " " "		

2. Use MATERIALS for FORGINGS given in Table below:
Steel is preferred for items specifying both wrot iron and steel.

GROUP	DETAIL	SPECIFICATIONS	
		Domestic	Export
11.	ENGINE AXLES, Billets	see Standard Mat'l. Spec. - Gen.	
	" " Forgings	" " " " "	
	Crank Axle Arms, Norm. & Temp.	AAR, M-104, Class A	ASTM, A-20
	Crank Axle Ends, Billets, Norm. & Temp.	same as Axle Billets	
	" " " Forgings " "	AAR, M-104, Class A	ASTM, A-20
	Trailing & Tender Axles	see Standard Mat'l. Spec. - Gen.	
14.	BOILER STAYS, Water Space, Rigid & Flexible	" " " " "	
	Crown, Radial and Expansion	" " " " "	
	Crown Stays, Sling Stay Links	ALCO 37	
	Boiler Braces, longitudinal, not welded	ALCO 37	
	" " " , welded	AAR, M-302, Grade A	ASTM, A-84 Grade B, with AAR step test
	" Brace Pins	SAE 1020 or ALCO 37	
	Firebox Ring	ALCO 37 or ALCO 10, Class B	
15.	BUSHINGS (Miscellaneous)	" " "	
	BOLTS, except as follows:	SAE 1020	
	Cyl. Saddle Bolts	SAE 1035	
	" Together & Frame Bolts	"	
	Guide Bolts	"	
	STUDS, except as follows:	SAE 1020	
	Tube Sheet Studs for Header	SAE 1035	
	Boiler Check Studs	" "	
	Cab Turret Studs	" "	

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	DETAIL	SPECIFICATIONS Domestic	Export
	Group 15 continued.		
	S.H. Turret Studs to Header or S'box	SAE 1035	
	PINS, Miscellaneous, except Link Motion Pins	SAE 1020 ALCO 37 or ALCO 10, Class B	
	Arch Tube Cover Plate Studs	SAE 1020 ALCO 37 or ALCO 10, Class B	
	Mallet Saddle Bolts	SAE 3130	
	Nuts, finished, removable	ALCO 37	
16.	LATERAL MOTION, like Drg. 164-S-90850		
	Shaft	see Bar Material	
	Rollers	" " "	
	Roller Pins	" " "	
	Spring Bolt	if bars, see Bar Material ALCO 10, Class B, if billets	
28.	BLOW-OFF COCK RIGGINGS, Forgings	ALCO 37	
29.	CRANK PINS, Billets	see Standard Mat'l. Spec. - Gen.	
	" " , Forgings	" " " " "	
	" " Collar & Washer	If made from flat stock, use boiler plate. If cannot be made from flat stock, use ALCO 10, Class A	
30.	CROSSHEAD, Wrist Pin	see Bar Material	
	" " Washer	ALCO 37	
	" " " for Comb. Link	see Bar Material	
	" Keys	SAE 6125, Quenched and Tempered to ALCO 86. Physical requirements same as for Piston Rods and Crank Pins.	
37.	DRAWBARS & SAFETY BARS	see Standard Mat'l. Spec. - Gen.	
	" " " Forgings	" " " " "	
	" " " Pins, Steel	ALCO 37 or ALCO 10, Class B	
	DRAWBARS & SAFETY BARS	When WROT IRON is specified, order Billets if they can be obtained of the proper size, otherwise built up bars. Where specifications differ from above, raise question.	
	" " " Iron	When BAR IRON is specified, and permission cannot be obtained from purchaser for substitution of SOFT STEEL forgings must be made by piling 1" x 8" or 1" x 4" iron bars, all of which must be full length of pile, with no cross piling. Allow 25% excess material when ordering to cover loss in forging, except when EQUALIZERS are bent up at ends, allow 35%	
	Safety Chains	see Standard Mat'l. Spec.-Misc.	

Continued on Sheet 2

American Locomotive Company

ENGINEERING DEPARTMENT

March 15, 1937

STANDARD PRACTICE

99^{1} S 4034-8-a

MISCELLANEOUS

Materials - Kinds, Sizes & Spec'ns. for FORGINGS

Superseding 99^{1} S 4034-2

APPROVED ENGINEERING COMMITTEE

Continued from Sheet 1

	DETAILS	SPECIFICATIONS Domestic	Export
	Group 37 Cont. Safety Chain End Links & Clevises made by A.L. Co.	SAE 1020 or ALCO 37	
	Mallet Hinge Pins	ALCO 10, Class A	
39.	ECCENTRIC CRANK	" " " B	
	" " Pin	see Bar Materials	
	" " Bolts	ALCO 10, Class A, annealed	
	" Rod, Stephenson	" 37, or ALCO 10, Class B	
	" " , Walschaerts	" 10, Class B	
	" " Keys	Cold rolled steel	
41.	ENG. & TRAIL. TRUCK, Details	ALCO 37 or ALCO 10, Class B	
	" " " " Safety Chains	see Standard Mat'l. Spec. --Misc.	
	" " " " " End Links & Clevises made by ALCO	SAE 1020 or ALCO 37	
	Equalizers	see Standard Mat'l. Spec. -Gen. see Group 37.	
46.	ENGINE FRAME, Rails	ALCO 10, Class B	
	" " Slabs, not welded	" " "	
	Frame Pedestal Caps	see Bar Materials	
	Frame Keys	ALCO 37 B	
	" Crossties	" " or ALCO 10, Class	
50.	GUIDE, Billets	ALCO 10, Class A annealed to AAR M-104 Class A	
	" Yoke	ALCO 37 or ALCO 10, Class B	
	" Knees	ALCO 10, Class B	
	" Clamp "Blunt" Flexible Guide Support	ALCO 37	
52.	GRATE RIGGINGS, Forgings	ALCO 37	
58.	LINK & Link Cheek	ALCO 10 Class B	
	" Lifter & Saddle	" "	
	Block & Plate	" 37	
	Trans. Bar and Hanger	" 10, " "	
	Radius Bar, Slide, and Lifter	" " " "	
	Comb. Lever and Link	" " " "	
	Link Motion Pins	" 37	
65.	PISTON ROD	see Standard Mat'l. Spec.-Gen.	
	" " Nut	ALCO 37 or ALCO 10, Class B	
	" " Follower and Head Bolts	SAE 1020	
68.	REVERSE LEVER	ALCO 37 or ALCO 10, Class B	
	" " Quadrant	" "	
	" " Latch	" "	
	" Screw	" 10, Class A	
69.	" Shaft and Reach Rod	" 37	
	" " Pins	" "	
70.	ROCKER PINS	" "	
71.	RUNBOARD Bracket	" "	
72.	RODS and STRAPS - See Standard Mat'l. Spec.-Gen. When special material is specified for rods, make straps of same material, except on middle rod of three-cylinder engines, use AAR Spec. M-104, Class A, regardless of materials used for rod.		

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	DETAILS	SPECIFICATIONS	
		Domestic	Export
Group 72 continued.			
	Rod Strap and Wedge Bolts	SAE 1035	
	Middle Main Rod and Wedge Bolts	SAE 3130	
	Rod Knuckle Pins	see Bar Material	
74.	SMOKEBOX Ring	ALCO 37	
76.	SPRING END CLIPS	see Bar Material	
77.	SPRING RIG. Hangers, Links and Gibs	ALCO 37, see Bar Mat'ls.	
	" " Pins	SAE 1020 or ALCO 37	
	" Hanger Wear Plates	ALCO 37	
	Equalizers	see Standard Mat'l. Spec. see Group 37	
	" Seats	ALCO 37	
	Driving Box Saddles	" "	
	" " " Pins	" "	
80.	SUPERHEATER Unit Bolts	SAE 3130	
84.	TENDER Brake Lever	ALCO 37	
85.	" Frame Bolster	see Plates & Sheets	
	" Draw-Gear Details	ALCO 37	
	" " " Followers	SAE 1050 except Man. .60 to .80%	
	" Safety Chains	see Stan. Mat'l. Spec. - Misc.	
	" " " End Links and Clevises made by A. L. Co.	SAE 1020 or ALCO 37	
89.	TENDER TRUCK Arch Bar	ALCO 37	
	" " Side Frame	ALCO 37 or ALCO 10, Class B	
	" " Equalizers	see Stan. Mat'l. Spec.-Gen.Group 37	
	" " Tie Bars (Ped. Cap)	see Bar Materials	
	" " Swing Links	ALCO 37	
	" " Spring Hangers	" "	
	" " Safety Chain	see Stan. Mat'l. Spec. - Misc.	
	" " " " End Links and Clevises made by A.L. Co.	SAE 1020 or ALCO 37	
90.	WATER SCOOP Work	ALCO 37	
91.	THROTTLE LEVER and Details	" "	
	" " Quadrant	" "	
	" " Latch	" "	
	" " Backhead Type	Cold Rolled Steel	
	" " Latch, B.H. Type	" " "	
	" " Link, " "	" " "	
94.	VALVE Yoke and Rod	ALCO 37	
	" Stem, Piston Valve	" "	
	" " Key	AAR M-112	ASTM A-14, Grade A
95.	DRIVING WHEEL Key	Cold Rolled Steel	
	Tire Retaining Rings	ALCO 37	
96.	WHISTLE RIGGING, Forgings	ALCO 37	
99.	ROUND or SQUARE SHAFTS No machining required on bearing surfaces	Cold Rolled Steel	

Question: Duplicate engines.
Exceptions: R.R. Co's drawings, specifications or instructions to the contrary.

American Locomotive Company

ENGINEERING DEPARTMENT

STANDARD PRACTICE

99[1] S 4035-1-a

March 15, 1937

Sheet 1

MISCELLANEOUS
Materials - Kinds, Sizes & Spec'ns. for PLATES & SHEETS

Superseding
99[1] S 4035-1

APPROVED ENGINEERING COMMITTEE

1. A.L. Co's Standard Material Specifications for PLATES & SHEETS are as follows:
   for Domestic work, use A.A.R., for Export work, use A.S.T.M.
   See Standard Material Specifications - General.

PLATES & SHEETS	SPECIFICATIONS		
	A.A.R.	A.S.T.M.	A.S.T.M. EQUIV. OF AAR SPEC'NS.
Boiler and Firebox	see Standard Mat'l. Spec. - Gen.		
TANK and MISCELLANEOUS CARBON STEEL 3/16" thick and over Order "Structural Steel" except where plates are cold pressed, in which case, order, "Plates for Cold Pressing" grade.	M-116		A-113, Struct. Loco. Grade, except when cold pressed.
Tender Frame Bolster	M-116	---	---
Carbon Steel, Uncoated under 3/16" thick	M-117	---	---
Copper for Locomotive Fireboxes	see Standard Mat'l. Spec.-Gen.		
Carbon Steel for Welding only except UM Plates	---	A-78 GradeB	---
" Steel, if flanged & welded except UM Plates		A-89 GradeB	---

Order plates when over 6" to 48" wide, and .250" and over in thickness.
Order plates over 48" in width and .1875" and over in thickness.
Order hot rolled sheets 24" to 48" in width and .249 to .059" (16 gauge) in thickness.
Order hot rolled sheets over 48" wide and .1874" to .059" (16 gauge) in thickness.
Order hot rolled annealed sheets various widths and .058" (17 gauge) and under in thickness.

2. Order CIRCULAR plates for the following and rectangular plates (instead of sketch plates) for other details of engine and tender.

DOME (one piece)
" BASE
" RING
" CAP (if flanged)
" CASING TOP
FRONT TUBE SHEET
INSPECTION DOME RING AND COVER
MAIN RESERVOIR HEADS
CYLINDER HEADS
" HEAD CASING
SAND BOX TOP (when circular)
SMOKE BOX FRONT
" " " DOOR
" " LINER (when complete circle)
STEAM CHEST HEAD CASING
VANDERBILT TANK HEADS, VANDERBILT TANK

3. When WIDTH of any BOILER or FIREBOX plate (except cylindrical or conical shell courses and welt strips) is greater than length and exceeds 100", enter width dimension on boiler bill in length column and length dimension in width column.

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4. When special material is NOT required, order the following:
#8 to #12 U.S.S.G. - Hot Rolled Steel Sheets,
#13 to #20 U.S.S.G. - Hot Rolled Annealed Steel Sheets,
If wanted extra smooth or pickeled, or if copper-bearing is required material book entry should so state.

5. CAB PLATES: Order Cold Rolled, Patent Levelled Steel Sheets, not resquared for Electric and Oil-Electric locomotive cab sides and ends. If copper-bearing is required, material book entry should so state.

6. Order TANK STEEL and MISCELLANEOUS PLATES for any purpose EXCEPT FOR PRESSURE VESSELS, by weight per square foot, instead of by thickness in inches, unless otherwise indicated in table.

THICKNESS	WIDTH	ORDER BY
1/8" to 1/4"	Over 6" and including 72"	Weight per sq. ft.
1/8" to 1/4"	Over 72	Thickness in inches
Over 1/4"	Any	Weight per sq. ft.

THICKNESS INCHES	WEIGHT PER SQ. FT. (LB)	THICKNESS INCHES	WEIGHT PER SQ. FT. (LB.)
1/8	5.1	5/8	25.5
5/32	6.375	11/16	28.05
3/16	7.65	3/4	30.6
7/32	8.925	13/16	33.15
1/4	10.2	7/8	35.7
5/16	12.75	15/16	38.25
3/8	15.3	1	40.8
7/16	17.85	1-1/16	43.30
1/2	20.4	1-1/8	45.9
9/16	22.95	1-3/16	48.45
		1-1/4	51.0

For Structures other than locomotives, using Plate Material 3/16" or less in thickness and over 36" wide, raise question with Mfg. Dept. if Tank, Hot Rolled, Hot Rolled Annealed or Patent Levelled steel plates must be ordered to secure proper flatness.

7. STEEL PLATES: Use thickness and material given below, for the following details,

NAME	THICKNESS AND MATERIAL
ASH PAN (except engs. with firebox bet. frames)	1/4" Tank Steel
" " engs. with firebox between frames, all plates	3/16" " "
" " Wheel Pockets (when flanged)	1/4" " "
BUMPER Top Plate	No. 10 " "
" " " " (forming deck or step)	3/16" " "
" Scroll	No. 12 " "
CAB, All Plates & Ventilator f	No. 10 " "
" Vent. Cover (flanged)*	3/16" " "
" Tool Box	No. 12 " "
" Bracket	1/4" " "
" Apron	3/16" " " (roughened)
	Diamohd or checkered plate may be used.

Continued on Sheet 2

American Locomotive Company

ENGINEERING DEPARTMENT

March 15, 1937

STANDARD PRACTICE

99[1] S 4037-a

MISCELLANEOUS PIPE AND
Materials - Kinds, Sizes & Spec'ns. for MISCEL.

Superseding
99[1] S 4037

APPROVED ENGINEERING COMMITTEE

1. A. L. Co's Standard Material Specifications for PIPE are as follows:
For Domestic work, use A.A.R., for Export work, use A.S.T.M.
See Standard Material Specifications - General.

PIPE	SPECIFICATION	
	A.A.R.	A.S.T.M. EQUIVALENT OF A.A.R. SPEC'NS.
Steel, Weldless and Seamless	M-111	A-53
Wrot Iron, welded	M-306	A-72
Dry Pipe, if Iron, applicable parts of Spec.	M-306	A-72
if Carbon Steel, applicable parts of Spec. See Group 91	M-111	A-53

2. A.L. Co's Standard Material Specifications for Miscellaneous Materials are as follows: For Domestic work, use A.A.R., for Export work, use A.S.T.M.
See Standard Material Specifications - General.

DETAIL	SPECIFICATIONS		
	ALCO	A.A.R.	A.S.T.M. EQUIVALENT OF A.A.R. SPEC'NS.
BABBITT LINING for BEARINGS	see Standard Mat'l. Spec. - Gen.		
BRAKE SHOES		M-401	
HARD BRONZE BUSHINGS	see separate sheet on Castings		
CHAIN		M-301	
GLASSES, Water Gauge & Lubricator		M-909	
HOSE, Air Brake and Train Signal		M-601	
" " " " Gaskets		M-602	
" Air, Gas, Oxygen, Wrapped and Braided		M-603	
" Cold Water, Wrapped and Braided		M-604	
" Tender Tank	see Standard Mat'l. Spec.-Gen.		
INGOTS, Copper, Tin, Lead, Zinc and Antimony	30		
PACKING, Exhaust Pipe Ball Joint	see Group 44		
" Steam Pipe, Expansion Joint	see Group 80		
PIG IRON	24		
RUBBER GOODS, Gen'l. Inst. on Standard Methods of Test for		M-607	D-15
TUBES, for Power House Boilers	11		
TURPENTINE	26		
Waste		M-905	

3. Use retort CEMENT in making all bolted connections to smokebox, except for joint between smokebox front and ring, use Buttonhole type tape.

Question: Duplicate engines
Exceptions: R. R. Co's drawings, specifications or instructions to the contrary.

American Locomotive Company

ENGINEERING DEPARTMENT

STANDARD PRACTICE

99[1] S 4038-a

April 15, 1938

MISCELLANEOUS — CASE-
Materials - Kinds, Sizes & Spec'ns. for HARDENING

Superseding 99[1] S 4038

APPROVED ENGINEERING COMMITTEE

1. CASE-HARDEN the following as regular practice:

GROUP	DETAILS	GROUP	DETAILS
28	Cylinder Cock Rigging Pins.	58	Link Pins, Nuts and Bushings.
29	Crank Pin Nuts.		Link Block and Plate.
30	Crosshead Wrist Pin Nuts.		" Saddle Pin and Nuts.
39	Eccentric Rod Jaw Nuts and Pins.	65	Piston Rod Nuts—back end with Thomas type Crosshead only.
41	Engine Truck Swing Link Pins—lower.	68	Reverse Lever Fulcrum Pin, Nuts & Bushings.
	" " Spring Hanger Pins.		" " Quadrant.
	" " Equalizer Pins.		" " Latch, Bolts and Nuts.
47	Foot Plate Bushing (for draw bar).	69	Reach Rod End Pins and Nuts.
50	Guides when wrought Iron.		Reverse Shaft Arm Pins, Nuts and Bushings.
	STEPHENSON.	72	Rod Knuckle Pin Nuts.
58	Transmission-Bar-and-Hanger Pins, Nuts and Bushings.		" Wedge Bolt Nuts.
70	Rocker Pins, Nuts and Bushings.		" Strap Bolt Nuts.
	WALSCHAERT.	77	Spring Hanger Gib when made of soft steel.
39	Eccentric Crank Pin Nuts and Bushings.		" " Pins.
58	Radius Bar Slide, and Hanger Pins, Nuts and Bushings.		Driving Box Saddle Pins.
	Combination-Lever-and-Link Pins, Nuts and Bushings.		Equalizer Pins.
			" Bushings.
	Link Bracket Bushings.	91	Throttle Crank Pins.
	STEPHENSON AND WALSCHAERT.		" Lever Bolts, Pins and Bushings.
	Link—Ends protected to avoid cracking in corners.	94	Valve Rod Pins, Nuts and Bushings.

Note: Use an approved surface hardening process for throttle lever quadrant and latch. Grind accurately to guage all valve motion pins and bushings after case-hardening. Bushings preferably to be forced in place before grinding.
All nuts and bolts to have threaded portion protected.

In addition to the above include the following for FULL case-hardened engine for which extra charge is made.

GROUP	DETAILS	GROUP	DETAILS
20	Driver Brake Hanger Pins and Bushings.	84	Tender Frame Brake Details, Jaws, Pins and Bushings.
	" " Beam Bushings.		Tender Truck Brake Details, Jaws, Pins and Bushings.
	Brake Rod Jaws.	85	Tender Spring Hangers and Seats (for 6-wheel Tenders only).
	Brake Articulations.		Tender Frame Spring Equalizers, Pins and Bushings (for 6-wheel Tenders only).
37	Draw Bar Pins and Bushings.	91	Throttle Lever Link.
41	Engine Truck Swing Link Pins, Top	99	Speed Indicator Rigging.
	" " " " Bushings.		
	Radius Bar End Bushings.		
	Engine Truck Equalizer Bushings.		
45	Fire Door Latch and Catch.		
69	Reach Rod Guide Slide Plate.		
77	Equalizer Seat.		
	Spring Hanger Ends.		
	" Rigging Bushings (when used).		

Question: Duplicate engines
Exceptions : R. R. Co's drawings, specifications or instructions to the contrary