



February 15, 1939

AFE 210-38

Mr. R. I. Gloster:

Herewith Completion Report covering Purchase from Denver and Salt Lake Railway and re-condition Rotary Snow Plow. Renumbered WP 3. Built by American Locomotive Company, Spec. No. A-4113-B, in 1910. Width of cut 12 feet, under AFE 210-38.

Encl.

W. J. O'NEILL

CC--Mr. D. C. DeGraff Herewith statement of charges by months to A.F.E. 210-38. Company Freight statement mailed your office on January 13, 1939.

W J O'N

Wor B/Ve 44

BILL NO. **9693**
(QUOTE WHEN REMITTING)

Western Pacific Railroad Company,
Hills Building,
San Francisco, California

MONTH'S ACCOUNT **October 1938**

C. C. DIV. OR DEPT. NO. **513**

DATE MADE **10-22-38**

TO **The Denver and Rio Grande Western Railroad Company DR.**
Wilson McCarthy and Henry Swan, Trustees
MAKE REMITTANCES TO R. F. WATKINS, TREASURER, DENVER, COLORADO

For wages and expenses paid to *AW* carmen riding with *WAL* Rotary and servicing same, enroute Grand Junction, Colo. to Salt Lake City, Utah, for delivery to you September 18 to September 21, 1938.

<u>Wages</u>			
Carmen	33-3/4 hrs. @ .75	25.31	
Carmen	28-3/4 " @ .72	<u>20.70</u>	46.01
	Plus 10%		4.60
<u>Expenses</u>			
7 meals			3.35
R.R. Retirement and Fed. Soc. Sec. tax 5.75% of \$46.01			<u>2.65</u>
			\$56.61

DISTRIBUTION:

Ans 6pt
283-38
mm 6570

FOR FURTHER INFORMATION ADDRESS
T. A. THOMPSON, GENERAL AUDITOR,
DENVER, COLORADO

BINDING MARGIN

ROTARY SNOW PLOW No. 3

(Oil Burner)

Boiler No. 79

Built by American Loco. Co. 1910
Rebuilt by WP RR. December 1938

Purchased from D&SL Ry. Sept. 1938
AFE 210-38

278 2" tubes
12'-0" over tube sheets

Firebox:
Length inside 92"
Width 50"
Grate area 31.94 sq.ft.

Heating surface:
Tubes 1747 sq.ft.
Firebox 138 "

Engine:
Cyls. diam. 18"
" stroke 26"

Weight:

On front truck	105,000	lbs.
" back "	95,000	"
TOTAL	<u>200,000</u>	"

Boiler No. 79

MEMO

476 210-38
FILE: 414.018.3
W

WP Rotary #3

When Rotary Snow Plow No. 3 was purchased from D&SL Railway in 1938, it
was equipped with a Coal-burning Tender. Total cost of the secondhand rotary snow plow
and tender was ----- \$21,907.49

Because this rotary snow plow, WP #3, was to be stationed at Keddie,
and no coaling facilities available there, it was necessary to equip this rotary with
an oil-burning tender and appurtenances, therefore, oil-burning tender complete from re-
tired Locomotive No. 91 was placed on this rotary and the original coal-burning tender
from same was set aside.

In November 1952, it was decided to fit up tender from retired Locomo-
tive No. 481, with coupler on front end; ~~to~~ put a coupler on rear end of rotary No. 3,
so that the tender could be disconnected from the rotary and thus become a separate unit of
equipment which could be used elsewhere during seasons of the year when rotaries were not
standing by for snow protection; thus this 481 Class tender (now No. 81) will be consider-
ed as an M.W. Tender for general use and therefore not be considered a part of Rotary
Snow Plow No. 3.

Now in order to properly clear the accounts of the tender which was pur-
chased with Rotary Snow Plow No. 3, and which is now standing idle and is not in satis-
factorily good condition, it should therefore be retired and eliminated from being a part
of Rotary Snow Plow #3.

This tender has a light weight of approximately ----- 53,400 lbs.
The Rotary and its tender weighed approximately ----- 253,400 "
Total cost ----- \$21,907.49
at a price of ----- \$0.08645 per lb.

Because the rotary plow itself is more expensive to build than the
tender, we estimate that the tender only should be valued at .05 per lb., thus:
53,400 lbs. @ .05 per lb. equals ----- \$2,670.00

Therefore, we consider the Ledger Value of tender only, as purchased,
to be ----- \$2,670.00

M E M O

Sheet 2

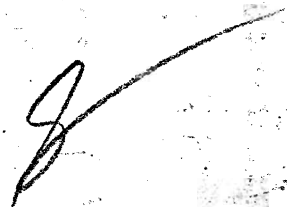
and then the Ledger Value of the Rotary Snow Flow ONLY would be - - - - - \$19,237.49

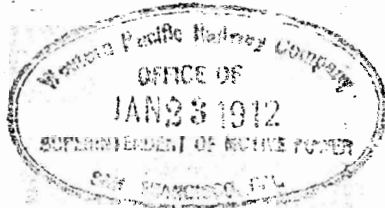
CMO Estimate 1673-53 is being made to retire, without replacement, the tender which was purchased secondhand with Rotary No. 3. This tender will be disposed of by placing it behind the engine portion of Locomotive WP No. 482 because the tender from engine 482 is being retained for final conversion by AFE to an M of W. Fuel and Water car, similar to the one already converted and now with Rotary Snow Flow No. 3 during Snow season only.

NOTE:- The actual tender from Rotary No. 3, after it was released when the tender from Engine 91 was put on No. 3, was disposed of behind Locomotive 42 on AFE C-6-50.

The oil-burning tender from Engine 42 was used behind Rotary No. 34, (now No. 4) because this rotary had never had a tender of its own. Up until then it was customary to remove a tender from one of the locomotives and use it behind Rotary No. 34 during snow season; thus tying up the locomotive from which the tender had been removed during this time.

dict. EEG-jwb
Feb. 16, 1953





Rotary #3

AMERICAN LOCOMOTIVE COMPANY

SPECIFICATION

No. A-4113-B

CODE WORD AMPHIPOLIS

FOR WESTERN PACIFIC R.WY. CO.

18" x 26", 12'.0" Cut Scoop Wheel Rotary Snow Plow

*See spec
A-4113-K
constr
plow
constructed*

AMERICAN LOCOMOTIVE COMPANY

NEW YORK, N. Y.

SPECIFICATION NO. **A-4113-B**

CODE WORD **AMPHIPOLIS**

DRAWING NO. _____ **October 10th 1911**

OF A ROTARY SNOW PLOW TYPE **Scoop Wheel**

FOR _____

GAUGE OF TRACK	CYLINDERS		TRUCK WHEELS DIAMETER	BOILER		FIRE BOX		TUBES			
	DIAM.	STROKE		DIAMETER	PRESSURE	LENGTH	WIDTH	NUMBER	DIAMETER	LENGTH	
4'8- $\frac{1}{2}$ "	18"	26"	35"	6'7- $\frac{3}{8}$ "	190 POUNDS	92"	50"	278	2"	12'0"	
WHEEL BASE				WEIGHT IN WORKING ORDER—POUNDS							
TRUCKS	TOTAL	FLOW & TENDER	FORWARD TRUCK		REAR TRUCK		TOTAL		TENDER		
4'6"	22'0"	--	105,000		95,000		200,000		-----		
FUEL	HEATING SURFACE—SQUARE FEET				GRATE AREA SQUARE FEET		WIDTH OF DRUM	WIDTH OF CUT	ROTARY WHEEL DIAMETER		
KIND	TUBES	FIRE BOX		TOTAL							
--	1746.69	138		1884.69		32.63		11'5"	12'0"	11'2 $\frac{1}{2}$ "	
LIMITATIONS											
WEIGHT PER AXLE	WEIGHT TOTAL		WIDTH		WHEEL BASE TOTAL		LENGTH OVER ALL		HEIGHT ABOVE RAIL		
			13'4"				Not to exceed 39 ft.		Not to exceed 15 ft.		

TENDER, TYPE _____ CAPACITY, WATER _____ GALS. FUEL _____

GENERAL DESIGN SHOWN BY photograph of C.M. & P.S. Ry. #12.

Handwritten notes:

Without paint or oil...
 Safety Valves...
 Water Supply...
 278 in number...
 copper braze at fire box end, tubes and heads...
 12'0"
 per A. L. Co. standard...
 11'5"
 12'0"
 11'2 $\frac{1}{2}$ "

Large handwritten signature: **W. J. ...**

Design is an exact duplicate of plows
 Shop Nos. 48833-34, built for the Chicago
 Milwaukee and Puget Sound Ry. Co. and
 covers plows building for stock, Nos. 50660-61

6--RAH

GENERAL DESIGN SHOWN BY

DESCRIPTION OF THE PLANT

LEADER LABEL

SYMBOLS

UNIT

APPROXIMATE WEIGHT	APPROXIMATE LENGTH	APPROXIMATE WIDTH	APPROXIMATE HEIGHT	APPROXIMATE DIAMETER	APPROXIMATE AREA	APPROXIMATE VOLUME	APPROXIMATE SURFACE AREA
---	1440'00	100'00	100'00	38'00	171.00	18.00	171.00
41.00	38.00	---	172'000	30'000	500'000	---	---
41.00-74	18.00	38.00	38.00	100	38.00	100	38.00

DESCRIPTION OF THE PLANT

LEADER LABEL

SYMBOLS

UNIT

GENERAL DESIGN SHOWN BY

DESCRIPTION OF THE PLANT

BOILER AND BOILER FITTINGS.

Boiler

Boiler **Belpaire type**
 of waist at front end **67-3/8"**, largest course **68-3/4"**
 shell, homogeneous boiler steel.
 Shell thoroughly reinforced at opening.

, outside diameter
 diameter, material of
 Dome well

BOILER AND BOILER FITTINGS.

Boiler

Boiler **Belpaire type**, outside diameter of waist at front end **67-3/8"**, largest course **68-3/4"** diameter, material of shell, homogeneous boiler steel. Dome well secured to boiler. Shell thoroughly reinforced at opening.

Boiler well designed, thoroughly braced and stayed, of best workmanship, and capable of carrying, with an ample factor of safety, a working pressure of **190 lbs.** per square inch. Boiler tested, above working pressure, with steam to at least **40 lbs.** and hot water to **45 lbs.** per square inch.

Horizontal seams **butt** jointed, **sextuple** riveted, with welt strips inside and outside. Plates planed at edges and caulked with round-nose tool.

Rivet holes reamed, after plates are assembled, to insure uniform holes, and slightly countersunk under heads of rivets. Rivets driven by hydraulic or pneumatic pressure wherever possible.

Throat sheet sufficiently increased in thickness to maintain required section after flanging. All plates carefully flanged, and all hand-flanged plates carefully annealed after flanging.

Tube holes accurately reamed, and sharp corners rounded off to prevent cutting tubes.

Fire door to be located ~~XXXXXXXXXXXXXXXXXXXX~~ **48"** from bottom at the mud ring

Fire Box

Fire box of homogeneous fire box steel, length **92"** width **50"**, crown sheet **3/8"**, tube sheet **1/2"**, sides **3/8"**, back **3/8"**, water space front **4"**, sides **3"**, back **3-3/4"**

Mud Ring

Mud ring accurately fitted and substantially **double** riveted.

Staybolts

Staybolts of **wrot. iron** **1"** diameter, screwed and riveted to sheets, and spaced not over **4"** from center to center, with tell tale holes drilled in outer ends.

Crown sheet supported by **13 rows of staybolts, 19 in a row 15/16" body 1-1/8" ends** diameter, screwed through the crown and shell and riveted over, except the **7** center rows which have button heads under crown, and **2** front transverse rows which are expansion stays.

Tubes

Tubes of **charcoal iron** **#12** B. W. G. thick **278** in number **2"** outside diameter, **12' 0"** long, set with copper ferrules at fire box end, rolled and beaded as per A. L. Co.'s standard practice.

Cleaning Holes

Washout plugs provided at corners, sides and ends of fire-box, above fire door and crown sheet, and for washing shell of boiler. **Washout plugs as per C.M. & St.P. drawing #11486--A**

Blow-off Cock

Blow-off cock **one, on left side of firebox.**

Safety Valves

Safety valves **two 2-1/2" Coale open pops.**

Water Supply

Furnished by ~~XXXXXXXXXXXXXXXXXXXX~~ **One #9, Nathan Monitor lifting injector and one #9, Nathan Simplex non-lifting injector.** Cast iron locking bars suitable for fuel. **injector and double injector check located on right side of boiler.**

Ash Pan

Ash pan **of steel plate with hopper bottom**

Smoke Box

Smoke box ~~XXXXXXXXXXXX~~ fitted with **XXXX** and deflecting plates. Front and door carefully fitted.

Smoke Stack
A-4113-B

Smoke stack **sheet steel, pressed steel** **base** designed to give maximum draft.

FRAMES, MACHINERY, ETC.

Frame

Frame to consist of **2-15"** steel "I" beams, and of two **12"** steel channels. Beams and channels to be well tied and braced, and to be framed also with transom having center plates secured to same. Holes for bolts, securing frame, bed plates, cylinders, etc., to be reamed out and bolts turned for same to insure a true parallel driving fit.

Bed Plate

Bed plate to be made of cast steel in two sections, accurately planed and fitted on frame. Front section to have seat for gussets accurately planed. Holes in ribs to be drilled. Back section to be accurately planed and fitted to front section and to frame. Sections of bed plate must be in true line and bearings of crank and main shafts at perfect right angles to each other.

**Cylinders and
Cylinder Heads**

Cylinders, diameter **18"** stroke, **26"** of close-grained iron as hard as can be worked. Cylinders to be set horizontally and to be counterbored beyond wearing surfaces.

Each cylinder cast in one piece with its saddle, accurately planed and fitted, and the saddles bolted together. All bolt holes to be reamed, and bolts to be turned to insure a true parallel fit.

Valve seat and steam chest seat raised to allow for wear.

Pistons

Pistons of cast steel ~~XXXXX~~ made with removable followers ~~XXXXX~~ and fitted with approved form of cast iron packing rings. Piston rods of best hammered steel **3-1/2"** diameter, properly fitted and securely fastened to pistons and cross-head.

Guides

Guides **Two bar type** of steel.

Guides securely bolted to cylinder heads and to guide yoke.

Crosshead

Crosshead **Alligator type**, of cast steel, with ample bearings.

Valve Motion

Walschaert valve gear arranged to cut off equally at all points of the stroke. Links, sliding blocks, plates, lifting links, pins and rod jaws, of the best steel or hammered iron thoroughly case-hardened. Combination link and rocker with rocker arm made of best cast steel. Reverse shaft to have arm forged on. Bushing to be made of steel. The motion to be finished in the most workmanlike manner.

Crank Disc

Crank disc to be made of cast steel, and to be pressed on shaft a smooth parallel fit at a pressure of not less than 35 tons nor more than 40 tons.

Crank Pins

Crank pins of hammered steel, and pressed into disc a true parallel fit at a pressure of not less than 35 tons nor more than 40 tons. Eccentric cranks of hammered steel. Eccentric pins to be made of hammered steel and pressed into cranks a true parallel fit at a pressure from 10 to 20 tons.

Valves

Steam chest valves. **Richardson balanced.**

Valve yoke and stem to be of hammered iron

Rod Packing

Metallic packing on piston rods and valve stem: **U.S. metallic**

Connecting Rods

Rods of hammered steel, forged solid, with necessary straps, keys, bolts and bearings, fitted and finished in the most workmanlike manner.

Shafts

Main and crank shafts to be of hammered steel.

Gears

Bevel gears of cast steel and to be bored perfectly true and central. Teeth of gear wheels **to be accurately cut.**

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Steam Pipes

Steam pipes of copper 7/32" in thickness with brass flange brazed on at each end. Lower flange connected by ball joint, and secured to steam chest flange. Upper flange to be also connected by a ball joint and secured to branch pipe. Steam pipes to be covered with asbestos 2" thick and well wrapped with canvas, properly sewed.

Throttle Pipe

Throttle pipe of cast iron, and to have double seated valve with top inlet only.

Drum

DRUM.
Drum to be of steel to dimensions given and to have hydraulic riveting wherever possible. Drum to be carried by six 5/8" steel gussets, rigidly secured to back of drum and to ribs of front bed plate. To be rigidly braced from frame to lower corners. Drum to be made in halves. Rim of drum and all cutting edges to be properly beveled inwardly. Drum to have two widening strips of 1/2" steel plate, properly fitted and bolted with countersunk bolts to front edge of drum. Lower corner of drum to be arranged to suit R. R. Co.'s limitations. Drum to have reversible hood, operated by

Side Wings

Plow is to be arranged with side wings so that cut may be extended to 13' 4".

ROTARY WHEEL.

Hub and Spider

Hub and spider of cast iron properly bored and pressed on shaft.

Scoops

Ten rotary scoops to be of steel plate 3/8" thick. Back of scoops to be riveted to 5" x 3" Tee irons riveted to back of wheel and to arms on spider part of hub. Back of wheel to be of 3/8" steel plates.

Scoop Knives

Scoop knives of cast steel and to be interchangeable. Hinges to be of cast steel.

Cone

Cone to be of cast iron and keyed on main shaft.

Forward Truck

Truck to be of the best materials and workmanship throughout. Wheel base 4 feet 6 inches. Wheels, number 4, diameter 33" steel tired.

Rear Truck

Truck to be of the best materials and workmanship throughout. Wheel base 4 feet 6 inches. Wheels, number 4-33" diameter steel tired.

Journal Box and Bearing

Axles of best hammered steel. Journals, diameter 7-1/4" length 10". Journal box of mall. iron planed and accurately fitted to truck frame. Journal bearings of bronze.

Springs

Springs to be of best steel, coil type.

Ice Cutter

Ice cutter frame to be hung on forward end of front truck and to be operated by air cylinder located in pilot house, and also to have hand operating attachment.

Flanger

Flanger to be hung on rear end of front truck and to be connected to axle. Flanger to be operated by air cylinder and arranged so as to have an auxiliary steam connection for use in case of emergency.

Brakes.

Plow to be equipped with Westinghouse Brake Co's automatic and straight air brake, schedule E.T.10" tender brake cylinder, 9-1/2" air pump. Diamond special brake beams. 1-1/4" brake pipe and fittings.

Two air gauges, one for engineer and one in pilot house connected to main reservoir. Engineer's valve to be located in pilot house and conductor's valve to be located within reach of engineer. Hand brake attachment provided for use in case of emergency.

House

Boiler and machinery to be entirely covered with a well made and suitable house. Frame to be made of best seasoned material. Roof to be supported with combination wood and iron rafters securely bolted to upper frame plate. Roof to be covered with galvanized iron No. 24 w. g. Each sheet connected by standing joints bent over. Sheets to be tacked as close as possible to the joints, and tacks soldered over before joints are turned over and soldered at edges. Siding to be of narrow sheathing, of seasoned pine or white wood. Glass to be double thick in all sashes. All sashes in pilot house to be provided with double lights of glass with air space between. Door frames to be made of ash, hung on malleable iron rollers. Doors of 1/8" sheet steel opposite motion work and disc, properly hinged and fastened by suitable latches.

Fittings Around Openings

Space between fire box and rear end of house to be neatly closed in with sheet steel. All spaces between drum and front end of house, around bed plate, etc., to be made sufficiently tight to prevent snow getting into house. Openings through roof to be carefully flashed.

Floors, etc.

House to have a main floor of 1-7/8" Norway pine tongued and grooved, and arranged in sections so as to be readily removed where necessary and secured at the rear of cylinder to angle irons on frame braces by 3/8" carriage bolts. Trap doors above all bearings and discs in pilot house. Engineer's stand to be arranged so as to form a tool box. Space under boiler to cylinder saddle to be arranged also as a tool box. All tool boxes to be fitted with hinged covers, fastened with suitable brass padlocks. Hinged seats for engineer and fireman, supported by hinged brackets, also same kind of seat on each side of pilot house. False floor to be made in sections of wood and iron. Partition across the house in front of smoke box to have a door on each side.

Lagging

Boiler lagged with sectional magnesia.

Cylinders lagged with sectional magnesia.

Jacket

Boiler jacket of planished iron neatly secured by bands.

PAINING.

House

House inside to receive one coat of priming color, two coats of green and one coat of varnish. House outside to receive one coat of filler, two coats of standard color and varnish. Flooring and tool boxes to receive two coats of mineral paint.

Lettering and Numbering

Lettering and numbering to suit purchaser.

Drum and Wheel

Outside of drum, inside and front of wheel except outside knives and cone, to receive one coat of mineral paint and one coat of black. Inside of drum and back of wheel to have two coats of mineral paint.

Knives and Machinery

Outside knives and cone to receive one coat of mineral paint and two coats of black. All rough iron work on trucks and machinery to receive two coats of black.

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Lubricator and Oil Cups

Cylinder lubricator to be located within convenient reach of engineer.

All lubricator pipes to be of copper.

One 1/2" lubricating cup for flanger cylinder. Suitable oil cups on engine. Large oil cup on flanger axle bearings.

For rods and all moving parts, oil cups to have screwed covers. Oil wells in all bed plate caps to have galvanized iron covers.

Gauges and Lamps

Two steam gauges, 6-3/4" dial with lamps, one on back of boiler and one for engineer.

One large cab lamp.

Boiler Fittings

Three gauge cocks with dripper and drain pipe. One water glass gauge to be conveniently located.

One four way cock for flanger cylinder.

One 1" globe valve screwed in dome cover, with 30 feet of six-ply rubber steam hose with union coupling connection.

Two 3/4" globe valves with four-ply rubber steam hose, 25 feet long, one of the globe valves with union coupling connection to be located in pilot house.

All pipes to have stop globe valves next to dome.

Whistle and Signals

One steam whistle. One small air signal whistle. One 10" gong arranged to be operated from both sides of pilot house by suitable pulls.

A suitably arranged indicator in pilot house to be connected to flanger.

MATERIAL AND WORKMANSHIP.

All screw threads to be U. S. standard, and all boiler fittings 12 threads per inch.

All materials furnished and workmanship performed to be first-class in all respects.

TOOLS, ETC.

Tools, etc.

Two 25 ton engine jack screws with levers

One 6" jack screw, with lever for same (for journal bearings)

One pinch bar

One 10 lb. cast steel wedge

One steel hammer

One copper hammer

One 14" monkey wrench

One air brake spanner wrench

One injector wrench

One complete set of wrenches to fit all nuts on rotary

One hoe

One poker

One screw for cleaning flues

One grate lever

Two ice picks for rotary wheel

One torch

One four gallon iron pail

One two gallon tin pail

One five gallon tin oil can with spout

One two gallon tin oil can with spout for truck journals

One tallow can

One squirt oil can

Two long spout oil cans

Two extra truck brasses

One packing hook for truck boxes

One packing iron for truck boxes

Four extra flanger points with bolts

AMERICAN LOCOMOTIVE COMPANY.

SPECIFICATIONS FOR MATERIAL.

General

Material applied on this contract, unless otherwise noted, to meet fully the respective requirements adopted by the American Society for Testing Material and of the Standard Specifications of the American Locomotive Company, as prescribed below. All materials will be carefully inspected and tested either at the place of manufacture, or the Works of the American Locomotive Company; any material failing to meet these tests, showing defects, lack of uniformity, or developing injurious defects in the working, will be rejected.

Boiler and Fire Box Steel

Boiler and fire box plates to be Open Hearth Steel. All plates to be true to gauge and free from seams, laminations and other defects. Test pieces cut from each plate must bend 180° flat when hot, cold or cherry red and must also meet the following requirements:

Boiler shell steel, tensile strength not less than 55,000 nor more than 65,000 lbs. per square inch; elongation not less than 25 per cent. in 8 inches; Phosphorus not more than .04 per cent.; Sulphur not more than .05 per cent.

Fire box steel, tensile strength not less than 52,000 nor more than 62,000 lbs., per square inch; elongation not less than 26 per cent. in 8 inches; Phosphorus not more than .04 per cent.; Sulphur not more than .04 per cent.

Tank Steel

Tank plates to be soft steel, uniform in thickness, smooth in finish, free from pitting and bad buckling. Samples cut from plates to bend double, when cold, over a mandrel one and one-half times the thickness of the plate, without sign of fracture.

Soft Steel

Universal plates and miscellaneous shapes to be Open Hearth Steel, tensile strength not less than 52,000 nor more than 62,000 lbs. per square inch; elongation not less than 25 per cent. in 8 inches. Where thickness is greater than $\frac{3}{4}$ -inch, reduction of 1 per cent. to be made for each $\frac{1}{8}$ -inch increase in thickness.

Spring Steel

Spring steel to be of the following chemical analysis: Carbon not less than .90 per cent. nor more than 1.10 per cent.; Phosphorus not more than .05 per cent.; Manganese not more than .50 per cent.; Silicon not more than .25 per cent.; Sulphur not more than .05 per cent.

Steel Forgings

Steel forgings for Driving and Engine Truck Axles, Crank Pins, Piston Rods, Connecting Rods, Guides, etc., to be Open Hearth Steel. Forgings will be represented by one test per melt taken from forging or full size prolongation thereof, midway between center and outside tensile strength not less than 80,000 lbs. per square inch; elongation not less than 20 per cent. in 2 inches. Forgings to be free from seams, pipes or other noticeable defects.

Iron Castings

Ordinary iron castings to be tough gray iron, free from cold shuts, blow holes and other defects. Cylinder casting to be tough, strong iron, close grained and as hard as can be worked. Test pieces cast with cylinders to give a tensile strength of not less than 24,000 lbs. per square inch.

Steel Castings

Steel castings to be Open Hearth Steel, tensile strength not less than 60,000 lbs. per square inch; elongation not less than 22 per cent. in 2 inches. Two tests per melt to be furnished for miscellaneous castings, engine frames and driving wheel centers to have test from each casting. All bearing surfaces must be solid and no porosity allowed where the value of the castings will be seriously affected.

Bar Iron

Bar iron to be free from steel scrap; sections not exceeding 2 square inches area; tensile strength not less than 48,000 lbs. per square inch; elongation not less than 20 per cent. in 8 inches; sections exceeding 2 square inches area, tensile strength not less than 46,000 lbs. per square inch and elongation not less than 20 per cent.

Staybolts

Staybolts to be best quality double refined iron, free from seams and blisters, true to gauge and capable of taking a good, sharp thread; tensile strength not less than 48,000 lbs. per square inch; elongation not less than 28 per cent. in 8 inches; bend double cold, and hammer down without flaw; fractures to be wholly fibrous.

Charcoal Iron Boiler Tubes

Boiler tubes to be charcoal iron of first-class quality, lap welded, showing no imperfections, smooth in finish and true to gauge. Tubes to be tested by manufacturer to an internal hydraulic pressure of 500 lbs per square inch.

Pieces 1 1/4 inches long to hammer down vertically without showing transverse cracks when flattened. Tubes to expand in boiler without flaw.

Steel Boiler Tubes

Of soft openhearth steel. Tubes to be tested by manufacturer to an internal hydraulic pressure of 750 lbs. per square inch. A test piece 6" long, when flattened lengthwise cold until the sides are separated by a distance equal to the gauge of the tube, must not show any splits or cracks.

Engine and Truck Bearings

Engine bearings to be of the following composition: Copper 77 per cent., Tin not less than 7 per cent., Lead not more than 16 per cent., Impurities, including Zinc, not more than 1 1/2 per cent.

Truck bearings to be of the following composition: Copper 75 per cent., Tin not less than 6 per cent., Lead not more than 20 per cent., Impurities, including Zinc, not more than 3 per cent.

All bearings to be free from segregation, oxidation, dirt, and other injurious defects.

Brass and Copper Pipes and Boiler Tubes

Brass and copper pipes to be solid drawn, of uniform thickness, perfectly round, to stand an internal hydraulic pressure of 400 lbs. per square inch.

Test pieces 4 inches long annealed and sawn lengthwise, to double inside out without cracking. Annealed tubes 2 inches in diameter to withstand forming a flange 5/8-inch broad without cracking. Tubes of other sizes to flange proportionately. Copper tubes to flange hot as well as cold.

Pieces 30 inches long, filled with rosin, when annealed, to bend without flaw, until the extremities touch, and when not annealed, to deflect 3 inches, when placed on supports 20 inches apart.

Copper Fire Box Copper Staybolts

Copper fire box plates to be best quality Lake Superior copper, free from defects, and containing not more than 1 per cent. of impurities.

Copper stays to be made from the best soft rolled bars.

Tensile strength of copper sheets and stays to be not less than 30,000 lbs. per square inch; elongation not less than 30 per cent. in 8 inches; reduction in area not less than 50 per cent. Samples to bend double, without flaw, when cold.

Chilled Wheels

Chilled wheels must conform to specifications of the Master Car Builders and American Railway Master Mechanics Association and be guaranteed 40,000 miles for 28-inch wheels, 45,000 miles for 30-inch wheels, 50,000 miles for 33-inch wheels. Wheels which fail to meet guarantee, and for which replacement is desired, must be held for inspection by manufacturer.

Steel Tires.

Conforming to Bulletin No. 14, American Society for Testing Materials. Drop test not required.