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## THE BALDWIN-WESTINGHOUSE CHICAGO, MILWAUKEE & ST. PAUL ELECTRIC LOCOMOTIVES

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### REQUIREMENTS

**I**N the summer of 1917, the Chicago, Milwaukee & St. Paul Railway Company issued specifications covering the apparatus necessary for the electrification of their line from Othello to Seattle and Tacoma. The following were the principal requirements for passenger locomotives as finally determined by the Railway Company:

*Power Supply.* To be 3000 volts direct-current.

*Route.* Either the line between Harlowton and Avery, or the newly electrified line from Othello to Tacoma and Seattle.

*Grades.* The limiting grades are 2 per cent compensated for a distance of 20 miles from Piedmont to Donald on the east slope of the Rocky Mountains, and 2.2 per cent compensated for 17.8 miles from Beverly Junction to Boylston on the western division.

*Alignment.* The sharpest curve on the main line is 10 deg., but the locomotive must negotiate a 16 deg. curve in the yards satisfactorily.

*Load.* Twelve steel coaches weighing 950 tons.

*Speed.* The locomotive to be designed for a speed of approximately 25 mi. per hr. up a 2 per cent grade, about 35 mi. per hr. on 1 per cent grade, and to have a maximum speed of 65 mi. per hr.

*Mechanical Design.* The locomotive to have a four-wheel guiding truck at each end, of the "Woodard" type.

The driving wheels to be not less than 60 in. in diameter.

*Regeneration.* Trains to be held on down grades by regenerative braking.

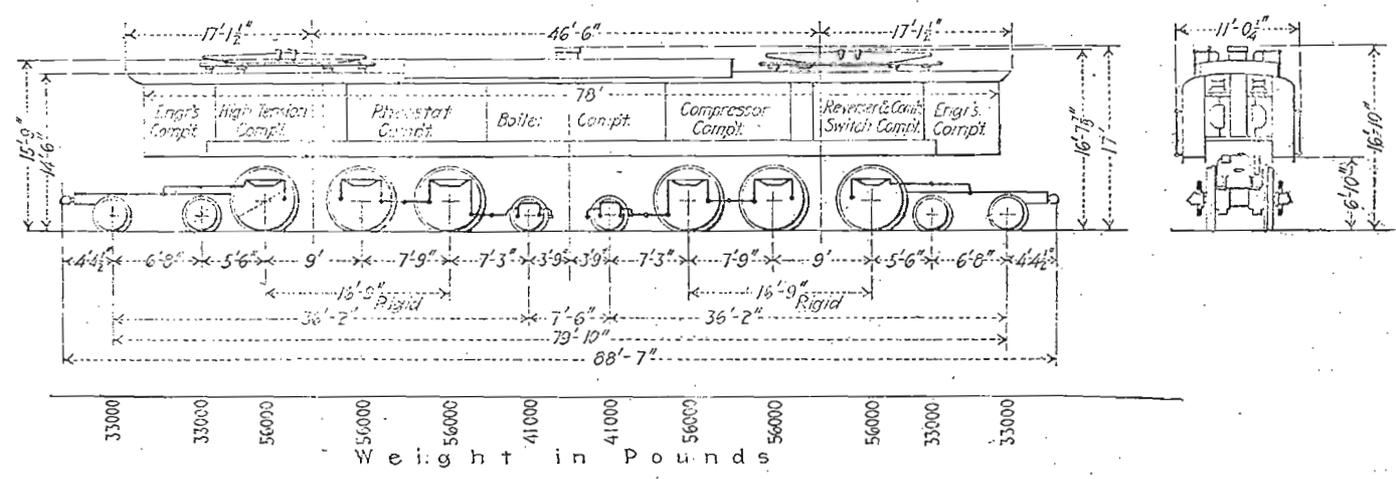


FIG. 2—OUTLINE SHOWING EQUALIZATION SCHEME, WEIGHT DISTRIBUTION AND WHEEL BASE

*Train Lighting.* Current to be supplied from the locomotive for lighting the train and charging the train storage batteries at a voltage of 60 to 85.

*Train Heating.* The locomotive to be equipped with an oil-fired boiler, to be supplied by the Railway Company, to furnish steam for heating the train.

Storage capacity to be provided for 30,000 lb. of water and 750 gallons of fuel oil.

*Thermostats.* Thermostats to be provided that will automatically start the blowers for cooling the main motors when the motor temperature reaches a pre-

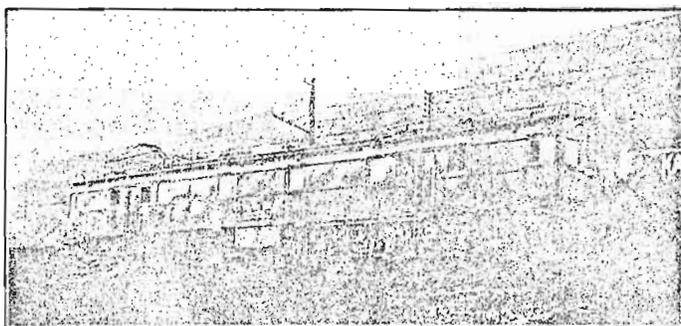


FIG. 1—BALDWIN-WESTINGHOUSE 3000-VOLT D-C. 275-TON PASSENGER LOCOMOTIVE FOR CHICAGO, MILWAUKEE & ST. PAUL RAILWAY CO.

determined value, in order to limit their operation to that time when they are actually needed.

#### DESCRIPTION

A portion of the order for locomotives was secured by the Westinghouse Electric & Manufacturing Company, and this paper covers the brief description of the Baldwin-Westinghouse locomotive as furnished.

*General.* A view of the complete locomotive is shown in Fig. 1, and a diagram showing the wheel arrangement, axle loading and equalization, in Fig. 2.

The locomotive is built in a single unit, having one long cab, carried on running gear of the 4-6-2-2-6-4 type.

The locomotive weighs 275 tons.

*Main Running Gear.* The running gear consists

essentially of two Pacific type running gears, coupled back to back. One-half of the running gear is shown in Fig. 3. This shows the running gear complete with the motors mounted and the air conduit carried on top of the motors.

The side frames are steel castings, joined over the four-wheel trucks by a heavy "A" frame casting; also by heavy cross-ties between the drivers which also support the motors, carry the center pin and carry the coupling between the two running gears.

Each half running gear has six spring-supported plungers on which the cab rests. There are two supports at each end and two in line with the center pin.

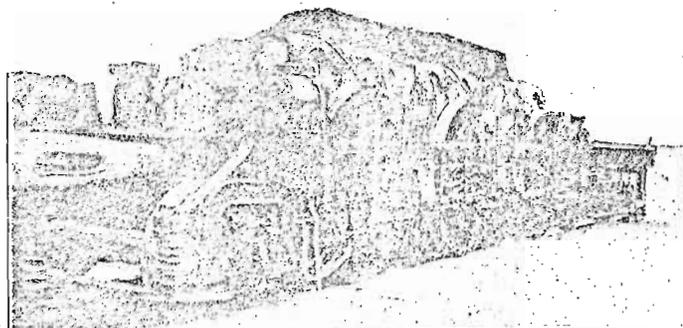


FIG. 3--ONE-HALF LOCOMOTIVE RUNNING GEAR, SHOWING DRIVING MOTORS, COUPLING BAR AND AIR CONDUIT

By the use of shims, the distribution of weight between the two ends of each running gear may be adjusted as desired.

The equalization, as shown in Fig. 2, is of the standard three-point type; the leading bogie being cross equalized with the leading pair of drivers and the pony axle being equalized with the two adjacent driving axles on the sides.

Extra points are provided in the equalizing levers so that practically any distribution of weight that is desired can be attained.

The driving wheels are 68 in. in diameter; the journals  $8\frac{1}{2}$  in. by  $14\frac{1}{2}$  in., located outside of the wheels.

The drawbars, with Minor fraction draft gears, are

carried in the "A" frame casting, previously mentioned.

The coupling between halves of the running gear consists of a long bar of a box section. This is shown in Fig. 3. The coupling pins are 10 in. in diameter and are located well inside the pony axles. The pins are hollow, filled with oil-soaked waste and have oil holes provided that keep the pins well lubricated.

*Bogie Trucks.* The four-wheel trucks are of the "Woodard" type with outside journals; 36-in. rolled steel wheels and cast steel side frames. The journals are 6½ in. by 14 in.

*Pony Trucks.* The two-wheel truck is of the well known "Rushton" side-bearing type, also with outside journals and 36-in. wheels. The journals are 6½ in. by 14 in.

*Brakes.* Brake shoes are provided on all drivers. A modified form of the 14-EL Westinghouse Air-Brake Company equipment is used.

*Cab.* The cab is 78 ft. 0 in. long, 10 ft. 2 in. wide; is strong and rigid so that it can be lifted at the ends. The main strength lies in the two bridge girders extending from end to end. The heavy cross-braces and the side members and top of the raised deck down the middle of the cab, form a construction that is light, but stiff. The cab is divided by cross partitions into compartments, one at each end for the engineer, and the others for the various parts of the cab equipment.

*Locomotive Capacity.* The total motor rating of the locomotive is 4200 h. p. on the one-hour basis. The continuous rating is 3400 h. p. The tractive effort and the speed are given on the nameplate of the locomotive as follows:

Rating	Tractive effort		Speed	
	Full field	Short field	Full field	Short field
1-hour rating.....	66,000	57,000	23.8	27.2
Continuous rating.....	49,000	40,800	26.0	30.4
Weight on drivers	168 tons			