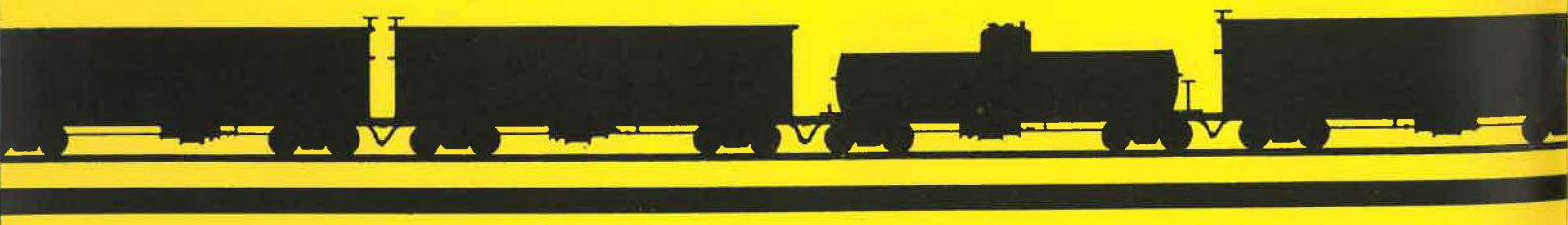
WESTINGHOUSE DIESEL ELECTRIC LOCOMOTIVES

CIRCULAR • 1994

C O N T E N T S

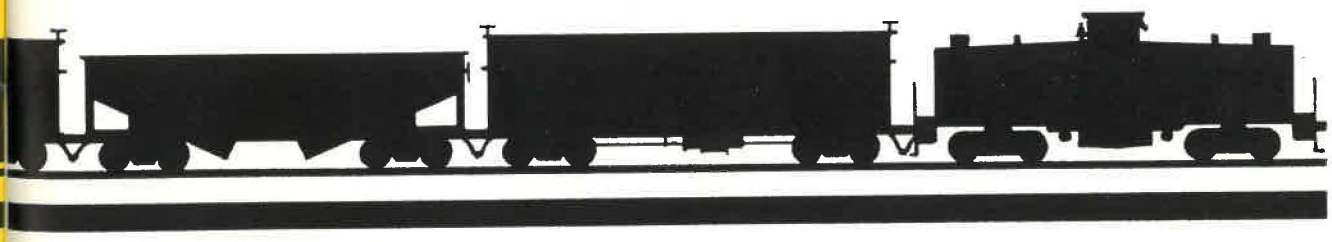


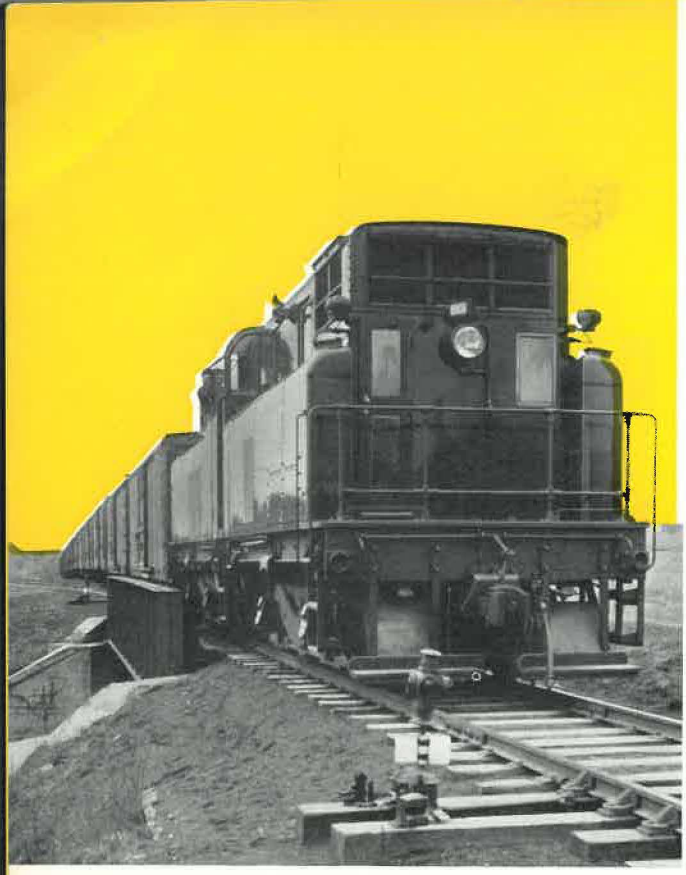
WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY

SOUTH PHILADELPHIA WORKS

LESTER BRANCH P.O., PHILADELPHIA, PA.

MODERN MOTIVE POWER





THE DIESEL ELECTRIC

There is nothing mysterious about the Diesel electric locomotive, or the fact that it operates economically and performs rail haulage most satisfactorily. The Diesel engine produces the power, a direct-connected generator converts the mechanical power to electrical, cables connect the generator to electric motors geared to the axles, and the motors propel the locomotive as they change the electric power back to mechanical and drive the axles. This type of motive power, therefore, has the flexibility of the steam locomotive in being self-contained, capitalizes the high efficiency of the Diesel engine since that is the prime mover, and has the advantageous operating features of the electric locomotive since the method of power application to the axles is the same.

FIELDS OF APPLICATION

The Diesel locomotive can be applied wherever motive power is required for rail haulage. At present it is used chiefly in switching operations, but it can be used also in light or heavy road service.

This publication contains data on Diesel locomotives whose weight on drivers ranges from 60 to 133 tons. These are arranged with engine horsepowers from 400 to 1600. They are available for any of the following services:

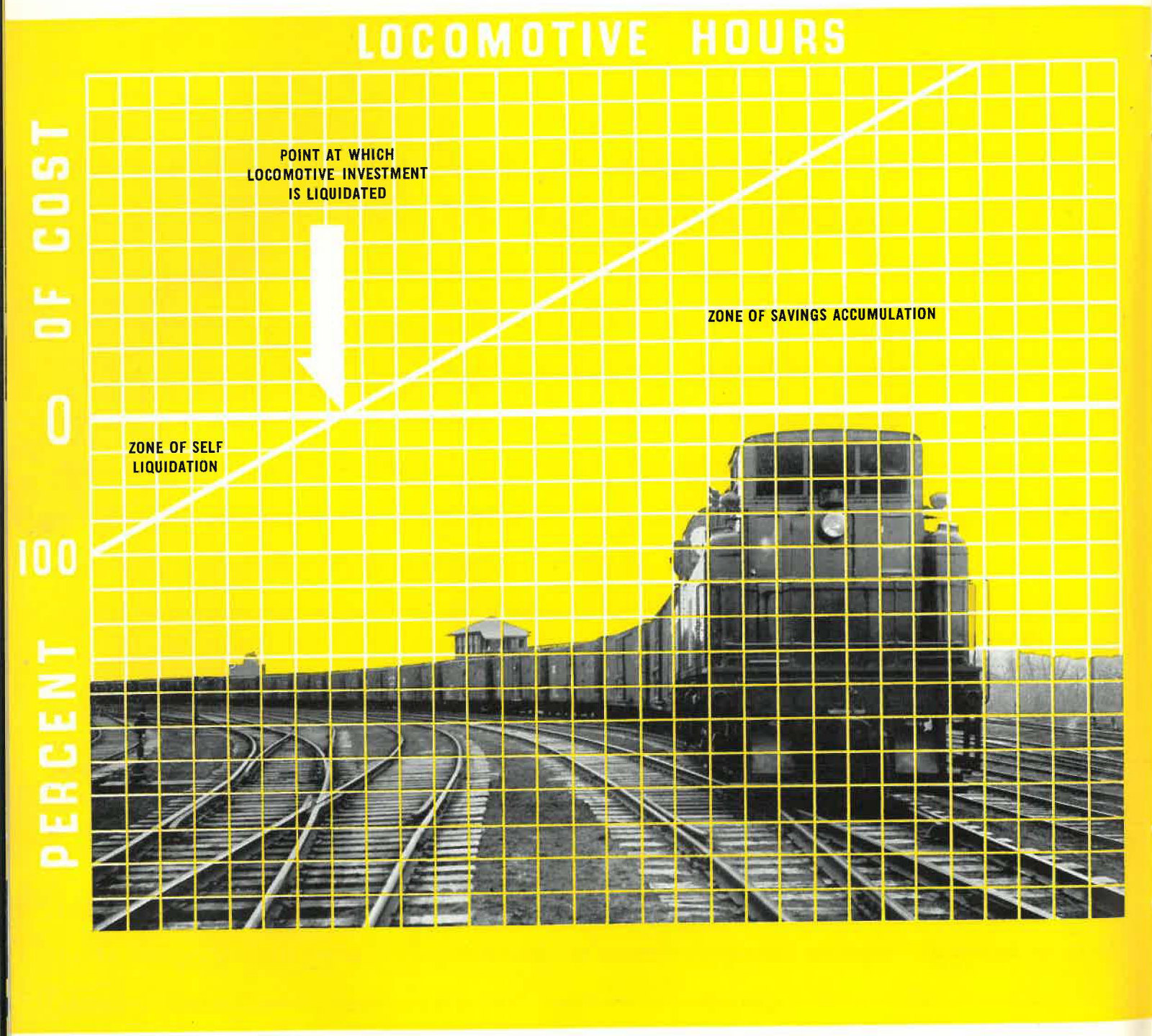
TRUNK LINE SWITCHING—Diesel locomotives are ideal for this class of service due to their low operating cost, smooth performance, availability for continuous service, snappy operation, good visibility, smoke and dirt elimination, flexibility for assignment and ease of expansion to meet changing conditions. Such service embraces passenger terminals, freight classification yards, hump yards, industrial switching, float haulage and light and heavy transfer work.

INDUSTRIAL HAULAGE—The advantages of the Diesel for trunk line switching, similarly, make it suitable for every kind of industrial haulage. In addition, its ability to negotiate curves of short radii, the reduced track wear incident to its use, accident reduction both to men and rolling stock equipment, fire hazard elimination, and ability to "fire up" or leave in a few minutes, make it particularly attractive for industrial haulage. Such haulage embraces the various services enumerated under trunk line switching, and the types of operation that can be handled are: ● Terminal companies ● All operations at steel mills ● Open-pit mining operations for coal, ore and other products ● Line haulage and switching for lumber mills and plantations ● Operations at any and all industrial plants.

Low operating cost and flexibility make the Diesel locomotive particularly suitable for combinations of switching and heavy transfer service, switching and light road haulage, or road haulage alone.

ECONOMIES

All Diesel locomotive installations to date have saved money for their operating companies. Usually, savings are figured by comparing the relative costs of tangible and easily obtained items of expense of old service with steam, and new service with Diesel locomotives. A similar practice is followed in making studies



The period of self-liquidation is short compared to the many hundreds of hours in which savings pile up.

to determine the economies to be gained by the use of Diesels on new applications. These tangible items can usually be estimated when an application study is made, and the correct size and type of locomotive determined for a particular service.

There are certain intangible items and other factors productive of savings that are not usually included in a comparative analysis. In general, all factors should be considered when studying each particular application, and each application should be regarded as an economic problem in its entirety.

The study of a road or heavy transfer application is an entirely different problem from that of a switching locomotive operation. The former has too many aspects to be discussed here other than to state that the Diesel has an extremely efficient fuel performance, low maintenance and high continuity of service.

One study of published data on Diesel and steam locomotive switching operations has indicated the following general conclusions:

- Diesel electric fuel cost per 100 ton-hours is approximately 25 per cent of steam fuel cost, with fuel oil at five cents per gallon, and coal at three dollars per ton.
- One gallon of fuel oil in switching service produces the approximate equivalent of 140 pounds of coal.
- Diesel engine lubrication requires 0.175 gallon of oil at 50 cents per gallon, for a total cost of 8.76 cents per 100 ton-hours of locomotive switching service.
- Other lubrication cost for Diesel locomotives is 35 per cent of steam locomotive lubrication cost.
- The total cost of fuel, engine lubrication, other lubrication, and other expenses for Diesel electric locomotives is 33 per cent of the corresponding steam locomotive operating costs.

A typical comparison of a Diesel switching locomotive installation against steam might be as follows:

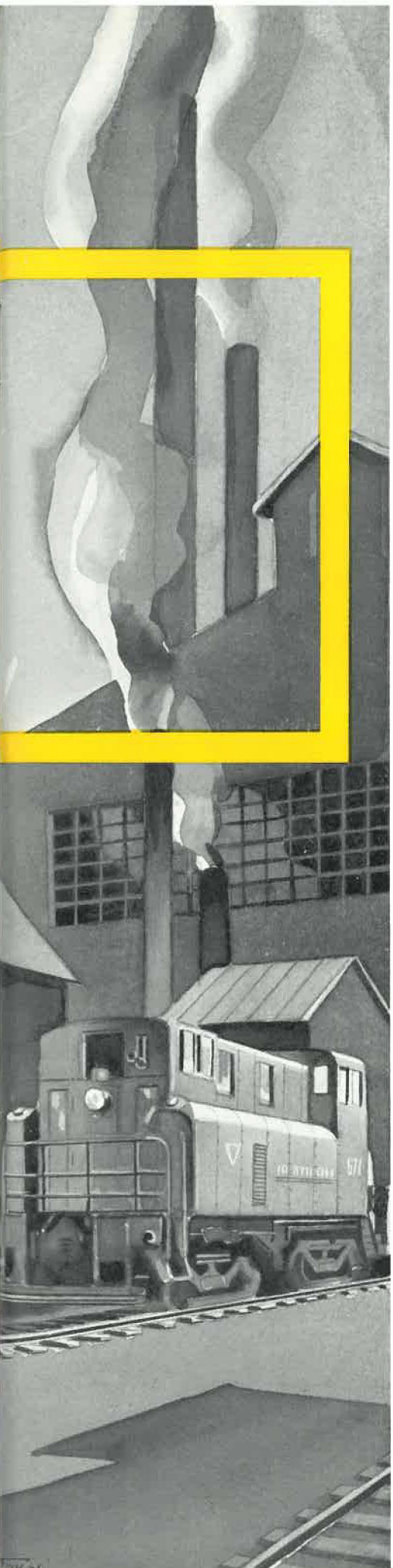
	Diesel	Steam	Diesel	Steam
Weight on drivers, tons	70	70	100	100
Fuel	0.35	1.40	0.50	2.00
Lubricating oil	0.06	0.02	0.09	0.03
Locomotive supplies and other lubrication	0.04	0.10	0.05	0.14
Enginehouse expense	0.15	0.40	0.15	0.40
Enginemen	0.75	1.45	0.75	1.45
Trainmen	1.89	1.89	1.89	1.89
Repairs	0.45	1.00	0.70	1.50
Total cost per hour	$3.69	$6.26	$4.13	$7.41
Annual hours to do assigned work	7200	8300	7200	8300
Possible hours per locomotive	7200	5000	7200	5000
Number of locomotives necessary	1	1.66	1	1.66
Annual operating cost	$26,568	$51,958	$29,730	$61,503
Savings of Diesel	$25,390		$31,773	

Every operating cost analysis should give consideration to the following:

FUEL COST—The cost of fuel for a Diesel locomotive is always lower than for a steam locomotive. This natural saving results from the high efficiency of the Diesel engine, the low unit cost of the fuel oil used, the negligible standby fuel consumption, and the use of fuel in quantities only when tractive effort is being exerted. The cost varies with the unit cost of fuel oil and the amount of work to be accomplished.

FUEL HANDLING—The handling of fuel for the Diesel locomotive is inexpensive, safe, and time saving in nature. In some cases expensive coal storage facilities can be eliminated, and the space used for more valuable purposes.

OPERATION—The operation of a Diesel locomotive is simplicity itself, and the duties of the engineman are only to operate the locomotive in accordance with ground crew signals. Close observation of the locomotive parts is unnecessary. The general structure of the locomotive lends itself to better visibility than can be obtained with steam locomotives so that one man can see all signals and at the same time perform all operations satisfactorily.



WATER SUPPLY—The Diesel locomotive only requires water to make up for evaporation, leakage, and periodic cleaning of the system. This, at the most, is only a small amount and negligible in comparison with the quantity used by the steam locomotive. Water treating plants and expensive pumping or water storage facilities are eliminated, and the expense of taking the "locomotive to water" reduced to zero.

HOSTLING ELIMINATED—The Diesel engine is a self-contained power plant that can be started and made ready for service within a few minutes, and having been shut down after a normal day's operation can be locked up at once without the necessity of an attendant to "clean fires", dump ashes, clean grates, and watch water levels.

ROUNDHOUSE EXPENSE REDUCED—This ordinarily includes Interstate Commerce Commission inspections which, at best, are very expensive for steam locomotives on account of the fire-box and boiler. These have no counterparts on the Diesel locomotive. The running gear of the Diesel is simple, and more easily maintained and inspected than that of the steam locomotive. Ash handling cost is reduced to zero as the Diesel has no waste.

MAINTENANCE COSTS REDUCED—The Diesel locomotive has no tender. Maintenance time and costs are reduced directly by this one factor. The steam locomotive with its boiler, fire-box, steam lines, injectors, etc., is subject to leaks, all of which incur an appreciable daily expense in running repairs. The unit construction of the Diesel locomotive lends itself to low maintenance cost with a minimum "time-out". Parts are easily handled, quickly inspected, and rapidly repaired. The Diesel has no parts such as the boiler and fire-box of the steam locomotive, an overhaul of which means complete dismantling of the locomotive.

HIGH AVAILABILITY—Actual service records show an inherently high availability for the Diesel locomotive. This is usually 90 per cent or better. Steam locomotive availability, due to frequent repairs and inspections, ranges from 50 per cent to a maximum of 70 per cent. The higher availability of the Diesel will in most cases permit it to replace more than one steam locomotive. This, in itself, tends to equalize unit fixed charges and reduces costs by requiring smaller shop space and attendant facilities for a sufficient number of locomotives to perform a definite duty cycle.

FLEXIBILITY—The Diesel locomotive is a very flexible unit. For instance, it can be large enough to perform heavy service and yet built with a short rigid wheel base in such a way that it can be used where only a small locomotive would ordinarily be needed. Some applications require two steam locomotives on account of space, wheel base, and clearance limitations, and yet one Diesel will do the work.

In the majority of cases where a true comparison can be made of a Diesel versus a steam locomotive the result will be in favor of the Diesel, and this is borne out by all installations to date as the Diesels are rapidly returning their first costs to the owning companies.

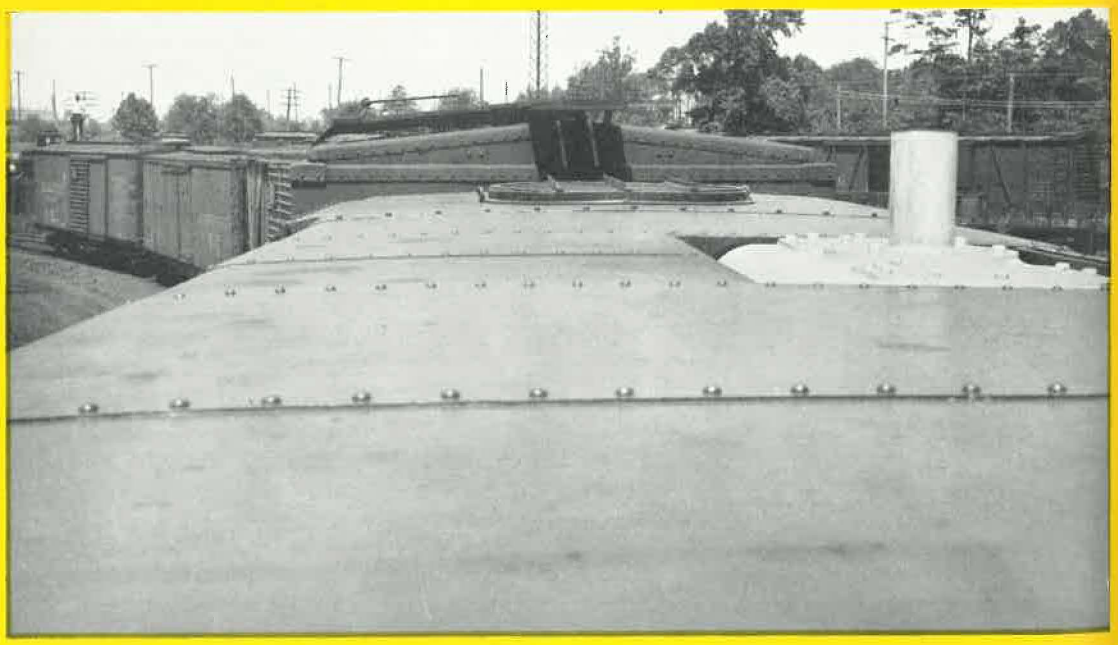
There are certain other savings that should be credited to the Diesel, but they are in some cases omitted since they are difficult to estimate. Where possible, such savings should be estimated and never entirely neglected. These intangible items are never included in any operating statistics and rarely in reports and yet they are economies. Some of these are as follows:

While no records are available it is reasonable to assume that since the Diesel has a 30 to 40 per cent higher availability, the number of detentions chargeable to it in service will be lower than for steam. This means fewer delays to production schedules, less idle time for workmen waiting for cars and hence a lower production cost.

The Diesel locomotive has no reciprocating parts in the running gear and hence no hammer blow is exerted on the track. In addition, the wheel base is of minimum length and, therefore, reduces the tendency for track spread and derailments. The torque exerted is uniform with a minimum tendency to slip. The steam locomotive is very deficient in these refinements, and as a result is harder on the track. The net result is that track wear is greater and road bed and road structure maintenance costs are much greater for steam. This is not easy to evaluate, but instances have been reported where track maintenance costs were reduced 66 per cent by Diesel locomotive installation.

The Diesel locomotive requires less time and less frequent fueling and watering than the steam locomotive. In some cases this results in a reduction in actual service hours and in all cases reduces the cost and time required. Rarely is this saving covered in a cost analysis and it is never included in a tabulation of accumulated operating data. The saving is real and appreciable, but due to the methods of cost analysis it is difficult to determine just what this saving totals except by direct observation on each property.

The Diesel increases the safety of operation. Safety or reduction of accidents can hardly be measured in dollars, and yet it is a material and important factor and one favoring the Diesel. The structure of the locomotive lends itself to better visibility. Operation of the locomotive is accomplished with little physical



Unusual Visibility for Engineer and Crew—

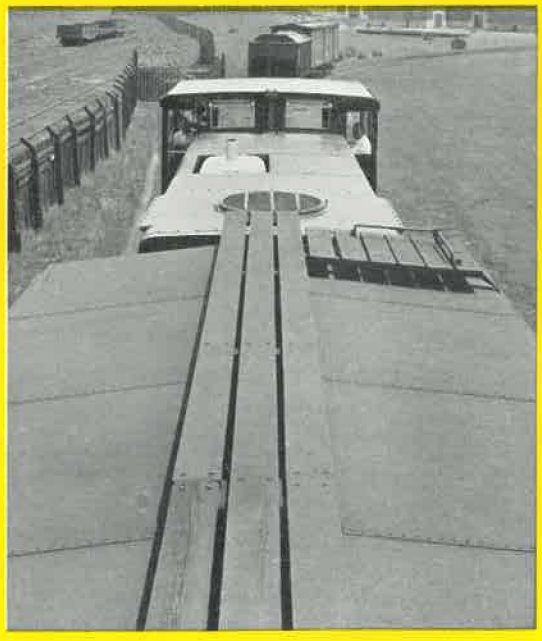
exertion so that the operator at the end of a day's work is not fatigued. The short wheel base produces an easy riding and tracking locomotive. There are no fire-box and boiler which are natural operating hazards. Safety for the plant, the crew, and the equipment, together with satisfactory operation are distinguishing features of Diesel locomotives.

The fire hazard is reduced to a minimum. The fuel is easily handled and stored at minimum cost. There are no sparks to ignite property adjacent to the tracks. This is of particular importance in some cases.

It has been previously mentioned that the Diesel locomotive reduces track maintenance costs. Hand in hand with this item goes fewer derailments with their consequent delays to service, delays to production schedules, and wasted operating hours.

Many Diesel installations have rid the terminal or plant of the dirt of the steam locomotive. The cleanliness of the Diesel results in improved working conditions, a higher labor efficiency, lower plant maintenance, and increased public goodwill.

By construction, the Diesel locomotive has all its weight on driving wheels with a uniform torque exerted by an electric motor at each wheel. This produces the most efficient use of each pound of material in



the locomotive and high starting tractive efforts are obtained. This characteristic is of tremendous advantage in switching service as it produces speed and snap. More work can be done in a given time than by a steam locomotive with the same weight on drivers. Few cost analyses or studies and practically no tabulations of operating data include this factor as records are hard to obtain except by direct observation. An actual study of the problem brings out some very interesting facts. Observations in a large classification yard op-

erating with steam locomotives showed that out of a total of 232 train movements, 210 were less than 600 feet in length. The longest and heaviest runs were: 1 run 900 tons trailing 1300 ft., 1 run 690 tons trailing 900 ft., 1 run 540 tons trailing 1100 ft., 1 run 450 tons trailing 1300 ft., 1 run 360 tons trailing 4000 ft.

A corresponding study of transfer service showed that out of 61 train movements, 42 were less than 600 feet in length. The longest and heaviest movements were: 1 run 1880 tons trailing 700 ft., 1 run 1650 tons trailing 2000 ft., 1 run 1400 tons trailing 2200 ft., 1 run 1350 tons trailing 2300 ft., 1 run 950 tons trailing 2400 ft.

In a comparative study of operation with a 110-ton 800 hp. Diesel locomotive and a standard steam locomotive developing a maximum of 1400 hp. and with 105.5 tons on drivers, it was found that the Diesel outperforms the steam locomotive on all runs shorter than the following: 500 tons trailing 403 ft., 1000 tons trailing 519 ft., 1500 tons trailing 625 ft.

In normal switching, runs are 200 to 300 feet in length and few are over 600 feet. The Diesel will actually do more work in the same time, or less time will be required for the same work. Actual experience on one property indicates a reduction of 23 per cent in the total operating time or a 23 per cent reduction in locomotive time per car movement with a Diesel locomotive installation.

SELECTION OF EQUIPMENT

The proper size of locomotive necessary for a particular service can be determined by an engineering study and if a cost analysis is made, the correct type for the installation can be definitely selected. The size of locomotive for a particular service is dependent upon two major factors: Weight on drivers or maximum tractive effort and installed horsepower.

In the determination of the weight on drivers it is the usual practice to assume a necessary Diesel locomotive weight the same or slightly less than the comparative steam locomotive. Where maximum grades, curves and trailing loads are known it is possible to calculate the maximum tractive effort necessary by using a general figure of ten pounds per ton for train resistance and 20 pounds per ton for each one per cent equivalent grade. The weight of the locomotive is then determined by assuming 22 to 25 per cent running adhesion and 30 per cent for starting.

The determination of the necessary engine horsepower is a more difficult problem. For road service it may be necessary to calculate performance over the profile with locomotives of several different horsepowers. A short cut before attempting this procedure is to calculate the necessary rail horsepower for the desired speed on the longest sustained grade or ruling grade and estimate the engine horsepower by assuming 80 per cent transmission efficiency. For example, a profile has 0.4 per cent grade for 5 miles over which it is desired to haul a 700-ton train at 17 miles per hour. The grade and train resistance are (20 x 0.4 + 10) or 18 pounds per ton. Assuming a locomotive weight of 100 tons the total train weight is 800 tons and the tractive effort necessary is 800 x 18 or 14,400 pounds. The rail horsepower is $\frac{14{,}400 \times 17}{375} = 650$ hp. The necessary engine horsepower is $650 \div 0.8 = 815$ hp.

The exact determination of the engine horsepower for a switching locomotive is a rather difficult procedure. In general it has been found that Diesel electric locomotives with engine capacities in the following table will equal or better the performance of a steam locomotive (in switching service) of the same weight on drivers.

Locomotive Weight in Tons	Engine Horsepower
60– 85	400– 530
90—100	800
110—120	800—1060

The guides given for determining the weight and horsepower of a locomotive for road service can be used in analyzing a switching service where there is some one outstanding severe haulage. In making an application study it is customary to give consideration to each of the following:

1. Grade conditions:
   (a) Principal grade trends of the yard.
   (b) Details of special ramps, trestles and depresses, grade length and curvature.
2. Trailing loads:
   (a) Average and maximum trailing loads which will be handled on the various grades.
   (b) Number of cars, and proportion of loads and empties.
   (c) Must the locomotive start these trains on the grade in question?
   (d) Type of cars that will be hauled, especially those having high train resistance, such as ladle cars and ingot buggies.
   (e) Daily average and maximum number of cars, with tonnages.
   (f) Gross ton-miles daily.
3. Average speeds required, and time allowed for any cycle which must be timed with other operations.
4. Number of hours yard is in operation daily. Hours of operation on Saturdays and Sundays.
5. Locomotive assignments including hours of haulage duty, number of locomotives, etc.
6. Special clearance conditions in buildings which must be met.
7. Compressor requirements other than braking, such as air dump-cars, number of cars, dimensions of air cylinders, air pressure, and allowable time for the operation.
8. Track gauge, rail weight, type of ballast, and general track condition.
9. Maximum curvature.
10. The rules for manning of trains with particular reference to the number of brakemen required for different train make-ups.
11. Complete data on steam locomotives in use are of value in a comparative analysis.

If a cost comparison is desired against existing service, the following data are necessary.

1. Cost of fuel oil per U.S. Gallon at the locomotive.
2. Cost of lubricating oil per U.S. Gallon at the locomotive.
3. Data on steam locomotives:
   (a) Type
   (b) Number of each class
   (c) Number in service
   (d) Spares required to protect the service
   (e) Spares required for shopping
   (f) Purchase price
   (g) Present salvage value or sale value of each locomotive
   (h) Locomotive assignments
4. Steam operating costs for steam service in detail in accordance with the System of Selected Accounts of the Interstate Commerce Commission, based on enough years of operation to insure complete overhaul costs and trends, and segregated for different locomotive classes and services if possible:
   (a) Superintendence
   (b) Engineer's wages
   (c) Fireman's wages
   (d) Fuel
   (e) Lubrication
   (f) Water
   (g) Supplies
   (h) Repairs
   (i) Enginehouse expense
   (j) Depreciation rate
5. Wage rates of firemen, engineers, brakemen, conductors, also minimum daily rates where such exist.
6. Time required during service hours for coaling and watering.
7. Wage agreements and State Crew Laws.
8. Cost of coal per U. S. Ton delivered on the tender of the locomotive.
9. Coal consumption per locomotive hour for each type of locomotive in different services.
10. Daily hours chargeable to returning to shop for inspections.
11. Overtime and possible reduction in service time.

LOCOMOTIVE OPERATING COST ANALYSIS

It is customary in any cost comparison to give consideration to the following items and in addition to include all items listed under the section on Economies on which data can be obtained.

	STEAM	DIESEL
Motive Power		
Motive Power Investment	$	$
Depreciation Rate	3%	3%
Interest Rate	6%	6%
	DOLLARS PER HOUR	
Wages—Engineer		
Wages—Fireman		0
Wages—Ground Crew		
Sub-total		
Fuel		
Lubricants		25% of coal cost
Water		0
Miscellaneous Supplies		
Repairs, Running		
Class		
Enginehouse Expense		20% of steam cost
Storekeeping		
Superintendence		75% of steam cost
Service Expense for Fueling and Watering		
Overtime Costs		
Sub-total		
Interest		
Depreciation		
Sub-total		
Grand Total		
Hours per Year to Perform Service		
Total Dollars—Grand Total Times Hrs. Per Year		
Savings		
Return on Investment		%

WESTINGHOUSE STANDARD DIESEL ELECTRIC LOCOMOTIVES

The entire motive power apparatus of these locomotives is manufactured and assembled by the Westinghouse Electric and Manufacturing Company and mechanical parts are designed under the supervision of Westinghouse Engineers. Such an ideal locomotive manufacturing arrangement has permitted coordination of design and many other special advantages. The sizes of locomotives available are:

Total Weight in Tons	Total Engine Horsepower	Number of Engines	Maximum Tractive Effort in Pounds—30% Ad.	CONTIUNOUS RATING Tractive Effort in Pounds	CONTIUNOUS RATING Speed in Mph.
60	400	1	36000	12600	9.2
60	530	2	36000	12600	11.3
70	400	1	42000	14000	8.2
70	530	1	42000	14000	11.2
*70	530	2	42000	14000	10.4
80	530	1	48000	14000	11.4
*80	530	2	48000	14000	10.6
90	800	1	54000	14000	17.1
90	800	2	54000	14000	17.2
100	800	1	60000	20000	11.75
100	800	2	60000	20000	11.7
115	800	2	69000	23000	10.2
115	1060	2	69000	23000	13.8
133	1600	2	80000	24000	20.8
133	1600	2	80000	24000	20.8

*Power deducted for direct-driven auxiliaries.

These locomotives include Westinghouse Diesel engines designed especially for locomotive application, electrical apparatus of standard railway design, and mechanical parts manufactured by the oldest maker of such equipment in this country. Special features of these locomotives are:

1. High powered engines that permit a high horsepower per ton of locomotive weight.

2. Spacious engine rooms for power plant and apparatus that permit all running inspections and repairs to be made without shopping, and overhaul without disturbing the locomotive structure.

3. Engine and generator coupled directly with bedplate mounting.

4. Torque control that permits full utilization of engine power and keeps the engine ideally loaded, or the differential control that gives good utilization with a minimum of apparatus.

5. Variable engine speed control that gives flexible operation with maximum economy.

6. Adequate air capacity at idling and at full engine speeds.

7. Battery starting of the engine by means of the main generator.

8. Ample battery charging at all times.

9. Adequate mufflers, water and oil cooling for the engine, remote starting and stopping of the engines, and water temperature regulating devices.

10. Unusual visibility from the cab in either direction without sacrificing accessibility, and with provision where necessary for operating from either side of the locomotive.

STARTING AND RUNNING OPERATION

The preparation of a Diesel locomotive for service and its operation follows a definite sequence. Only a few minutes are required to place one in service for a full day's work and still less time to shut it down completely. The whole operation is so simple that it is the standard practice on some properties when standing

time is more than 10 to 15 minutes to shut down everything and not to start until movement is to be made.

Manual operation of a push button or small controller connects the battery to the main generator. The latter acts as a starting motor and brings the engine to firing speed. When firing occurs the starting circuit is released and the engine is permitted to idle for a few minutes to heat the parts and insure proper functioning. A small lever of the master controller is then placed in an operating position. This permits the compressor to pump air. The locomotive is ready to run as soon as sufficient air is available. The next movement is operation of the master controller handle which on being placed in the first running notch connects the traction motors to the generator and increases the engine speed slightly above idling. Successive controller engine notches increase still further the engine speed and the last notch gives the full rated engine speed and full power. Six available running notches give a very smooth flow of power. It is possible to change from the series motor connection to parallel at any time. The control is arranged so that every start is automatically in series. The generator field is automatically regulated in each running position to insure proper engine loading and, of course, in the last notch full power is taken, no matter what the locomotive speed, up to the slipping point of the drivers and to high locomotive speeds. Stopping the locomotive is accomplished simply by returning the one operating controller handle to the "off" position and applying the brakes. The locomotive is reversed by placing a small lever at the master controller in the forward or reverse position. The entire control and operation are very simple. This is possible since the generator, directly connected to the engine, automatically loads the engine properly and delivers to the traction motors the correct electrical power for each notch of the master controller. All auxiliaries are automatically controlled. Compressor operation with torque control is by an electric motor which has a full source of power whether the locomotive is standing with the engines idling or whether the locomotive is at full speed with the engine up to speed. Direct driven compressors are provided with differential control of adequate size to provide sufficient air at all engine speeds. Battery charging is automatic.

DIESEL ENGINES

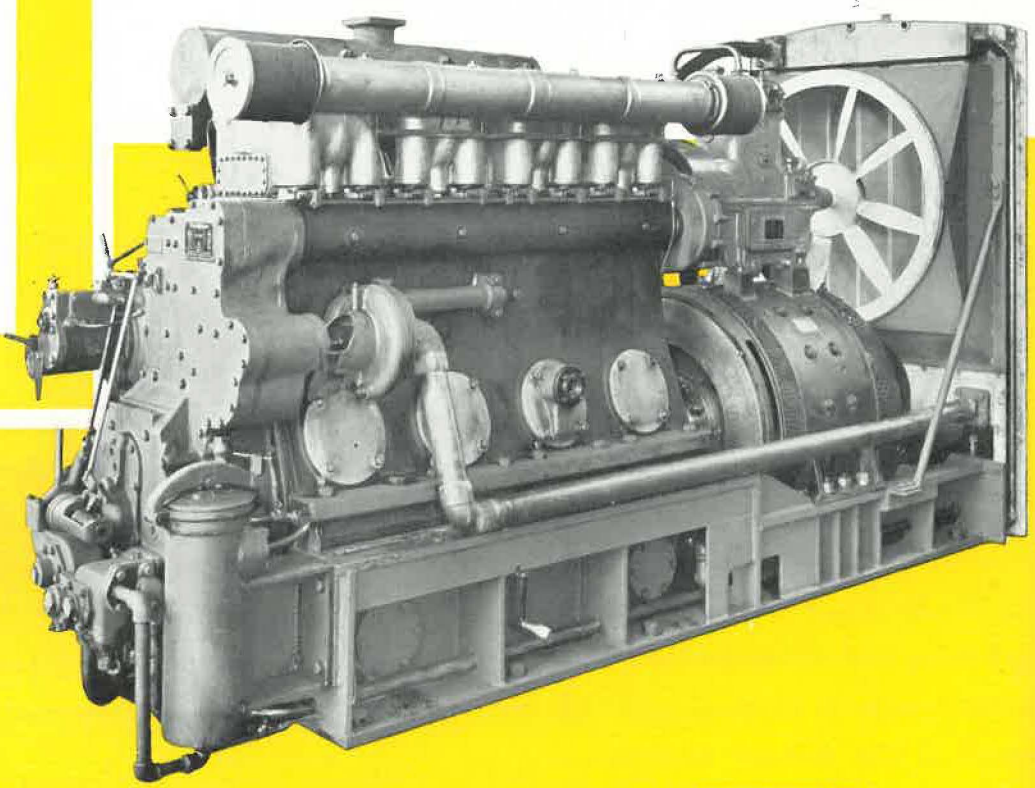
The standard locomotives use Westinghouse Diesel engines with 9 in. bore and 12 in. stroke. This size is used in assemblies of 4 to 12 cylinders which gives a line of engines suitable for 35 to 133-ton locomotives. Especial care has been exercised to make parts of the various cylinder assemblies interchangeable.

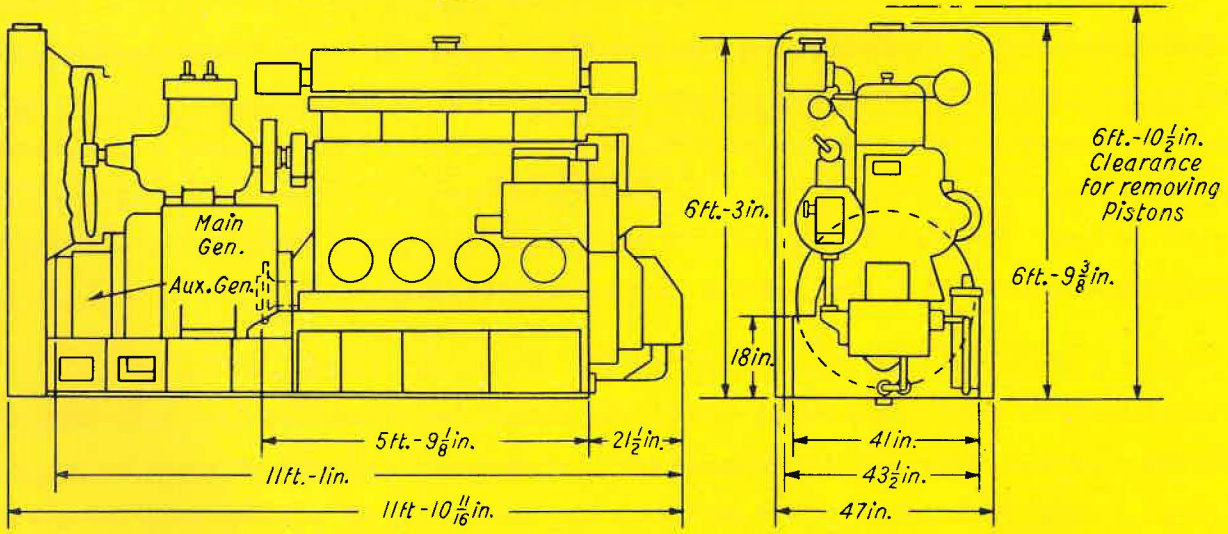
The engine design is primarily based upon application to locomotives. All parts are made readily available for inspection even in the crowded space of an engine room. Further, the parts are made to facilitate handling by man power rather than shop tool equipment. The engines are of rugged construction to give reliability in service and long life to parts, and yet develop the high horsepower per pound which permits a maximum power for a given locomotive weight. This last is necessary to obtain snap of performance in switching and reasonable operating speeds in heavy transfer or road service. The normal operating speed is 900 rpm. with a rating of 66.7 hp. per cylinder, which gives the conservative B.M.E.P. of 76.5 and a piston speed of 1800 feet per minute.

The four stroke cycle is used with solid injection of the fuel by means of a unit-constructed piston-type fuel pump mounted on the side of the engine and gear driven from the crankshaft. The pump meters the fuel to obtain the correct horsepower output and speed. The fuel injection timing is automatic and a hydraulic governor controls the fuel metering. Variable speed operation of the engine is obtained by changing the governor setting. The fuel is injected into the cylinders when full compression is reached through a spring-loaded atomizer located in the center of each cylinder head.

The engine is of conventional construction but has the unusual features of individual light weight cylinder heads, removable liners, dual valves, aluminum pistons, large counterbalanced crankshaft with large bearings between each cylinder and extra large bearings at each end, and variable speed governing with automatic timing. Special protective features such as a low lubricating oil pressure trip, overspeed governor, vibration damper, and many others are included. A patented crankcase construction is used that permits a minimum thickness of material with low weight and abundant strength. The weight per horsepower including flywheel, bedplate, and auxiliaries varies from approximately 30 to 38 pounds depending on the number of cylinders.

265 HP.
DIESEL POWER PLANT
TYPE 4-F-1



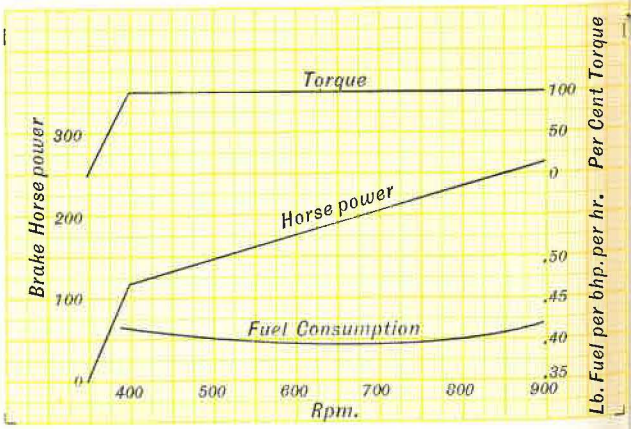


Length overall, approximate	11 ft. $10\frac{11}{16}$ in.
Width overall	3 ft. 11 in.
Weight, total, approximate	17,400 lb.

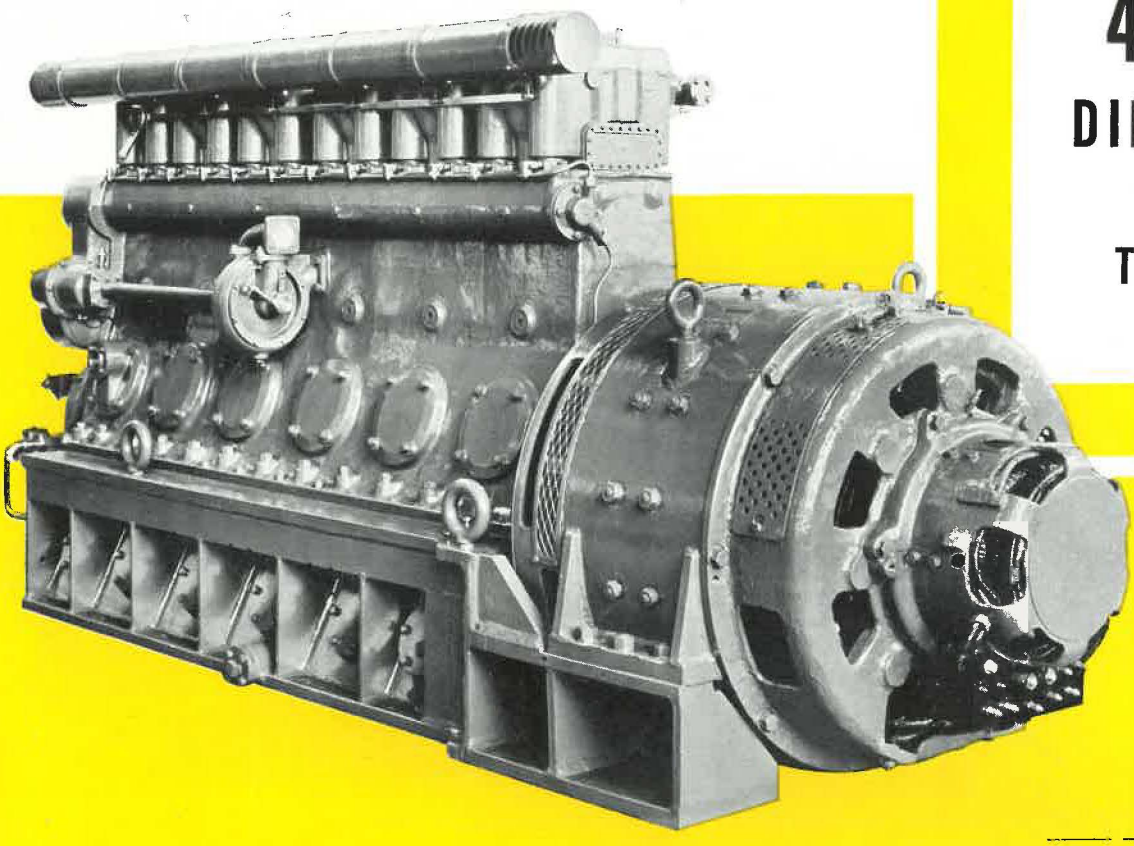
ENGINE SPECIFICATIONS

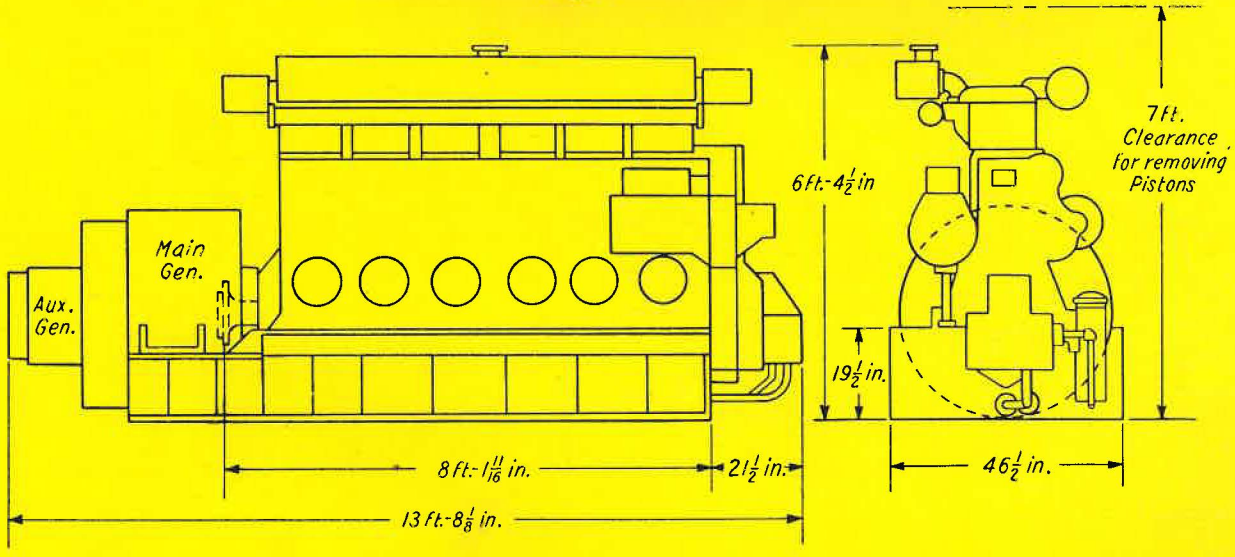
Type	4-F-1
Number of cylinders	4
Bore and stroke	9 in. x 12 in.
Piston displacement	3053.8 cu. in.
Rated bhp. at 900 rpm.	265
B. M. E. P.	76.5
Length over engine, approximate	7 ft. $6\frac{5}{8}$ in.
Width over engine, approximate	3 ft. 5 in.
Height, maximum, approximate	5 ft. 10 in.
Weight of engine and bedplate	10,600 lb.
Lubricating oil capacity	40 gallons
Class—solid injection	4 cycle

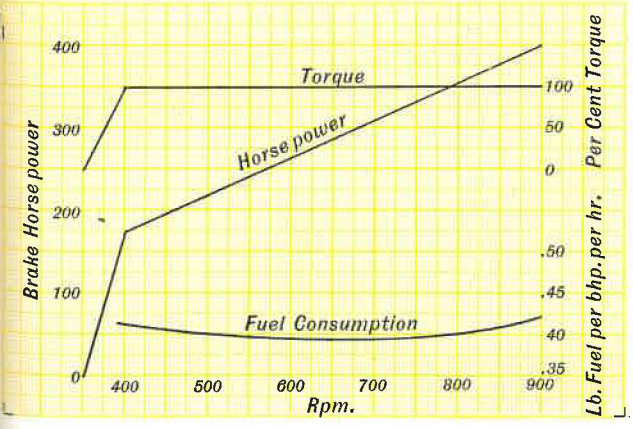
Performance Curve—The curve indicates the 100 per cent rating of 265 bhp. at which the engine can be operated continuously.



400 HP.
DIESEL POWER PLANT
TYPE 4-E-2







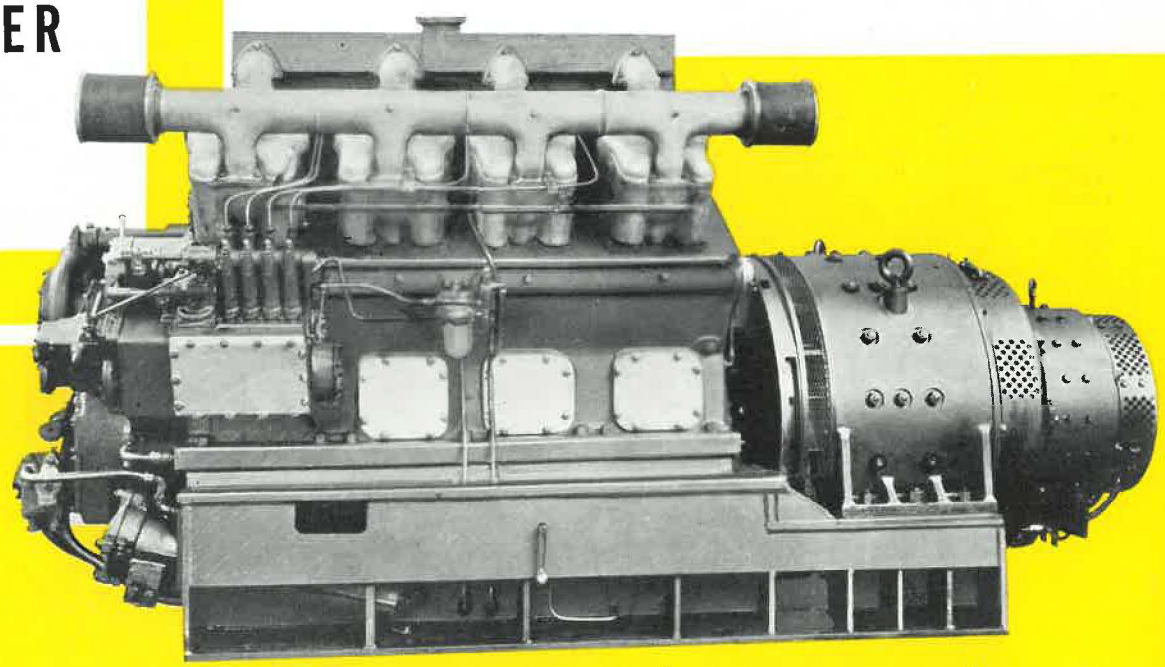
Length overall, approximate	13 ft. 8⅛ in.
Width overall, approximate	3 ft. 10½ in.
Weight, total	19,300 lb.

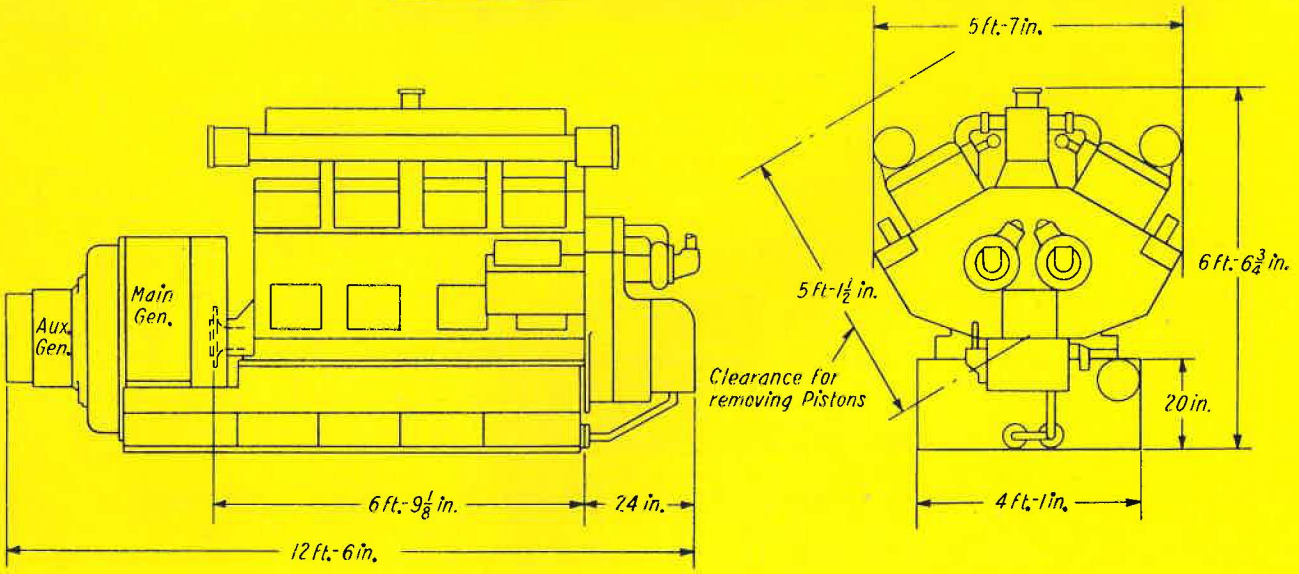
ENGINE SPECIFICATION

Type	4-E-2
Number of cylinders	6
Bore and stroke	9 in. x 12 in.
Piston displacement	4580.7 cu. in.
Rated bhp. at 900 rpm.	400
B. M. E. P.	76.5
Length over engine	9 ft. 11 3/16 in.
Width over engine	3 ft. 10½ in.
Height, maximum	5 ft. 11½ in.
Weight of engine and bedplate	13,000 lb.
Lubricating oil capacity	70 gallons
Class—solid injection	4 cycle

Performance Curve—The curve indicates the 100 per cent rating of 400 bhp. at which the engine can be operated continuously.

530 HP.
DIESEL POWER PLANT
TYPE 4-H



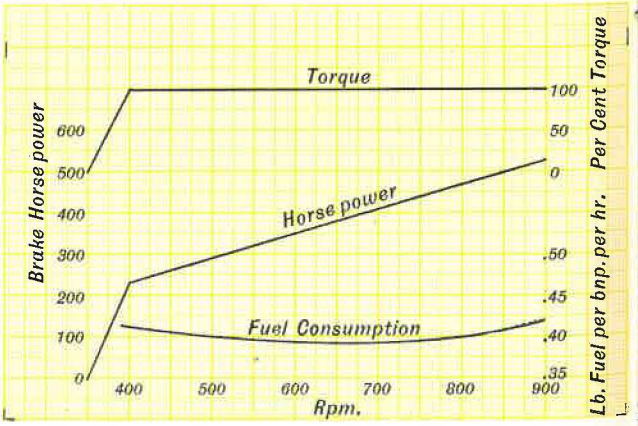


Length overall, approximate	12 ft. 6 in.
Width overall, approximate	5 ft. 7 in.
Weight, total, approximate	24,300 lb.

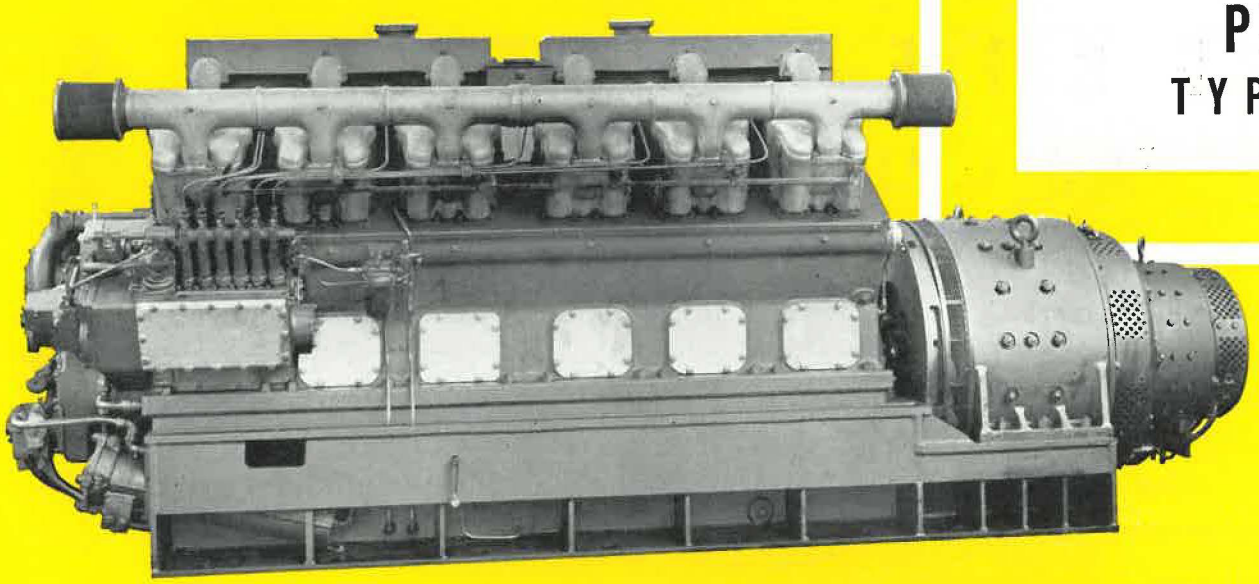
ENGINE SPECIFICATION

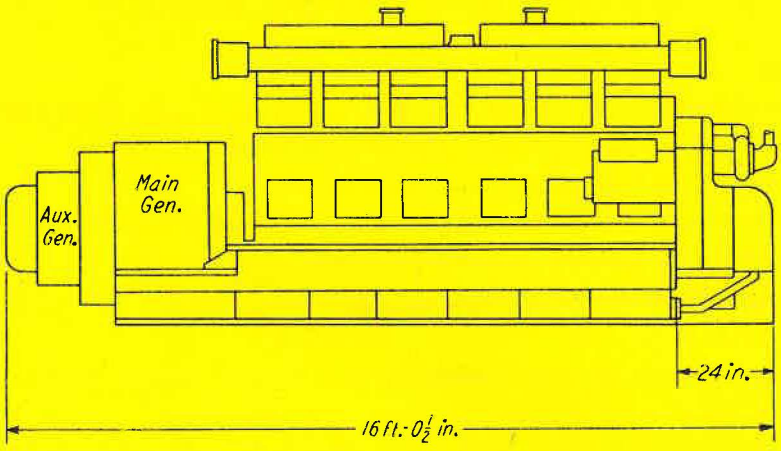
Type	4-H
Number of cylinders	8
Bore and stroke	9 in. x 12 in.
Piston displacement	5107.6 cu. in.
Rated bhp. at 900 rpm.	530
B. M. E. P.	76.5
Length over engine, approximate	8 ft. 9⅛ in.
Width over engine	5 ft. 7 in.
Height, maximum, approximate	6 ft. 7 in.
Weight of engine and bedplate	18,000 lb.
Lubricating oil capacity	70 gallons
Class—solid injection	4 cycle

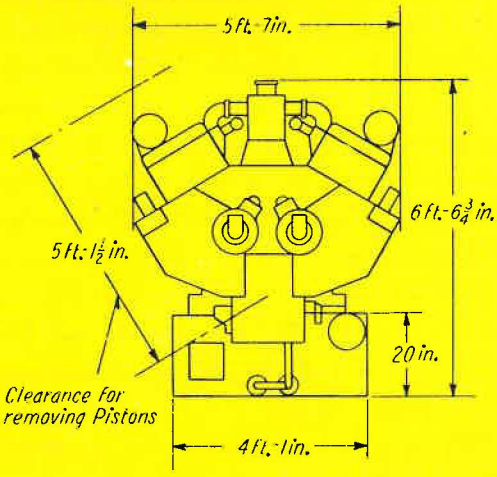
Performance Curve—The curve indicates the 100 per cent rating of 530 bhp. at which the engine can be operated continuously.

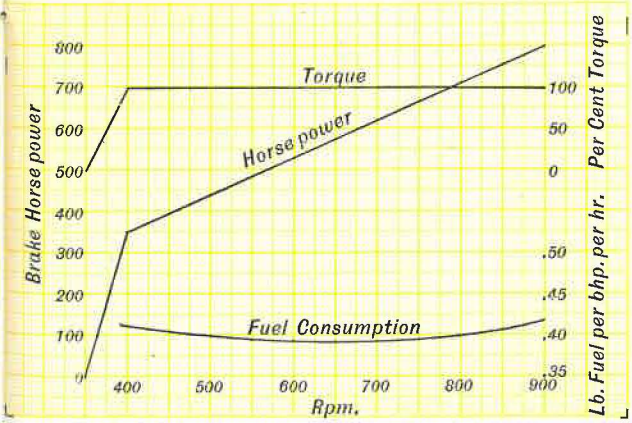


800 HP.
DIESEL POWER PLANT
TYPE 4-G









Length overall, approximate	16 ft.
Width overall, approximate	5 ft. 7 in.
Weight, total, approximate	32,500 lb.

ENGINE SPECIFICATION

Type	4-G
Number of cylinders	12
Bore and stroke	9 in. x 12 in.
Piston displacement	9161.4 cu. in.
Rated bhp. at 900 rpm.	800
B. M. E. P.	76.5
Length over engine, approximate	11 ft. 5 in.
Width over engine	5 ft. 7 in.
Height, maximum, approximate	6 ft. 7 in.
Weight of engine and bedplate	24,000 lb.
Lubricating oil capacity	85 gallons
Class—solid injection	4 cycle

Performance Curve—The curve indicates the 100 per cent rating of 800 bhp. at which the engine can be operated continuously.

SPECIFICATIONS

COMMON TO 265, 400, 530 AND 800 HP. ENGINES

These engines include a variable speed governor, automatic timing, coupling connection to generator, bedplate including mounting horns for generator, lubricating oil storage space in bedplate, water pump, fuel pumps, lubricating oil pressure pump and gauge, lubricating oil scavenging pump to circulate oil to the radiators, lubricating oil hand pressure pump, combination exhaust manifold and muffler, air filter and intake manifold, lubricating oil filter and screens, fuel oil strainers, special engine tools, overspeed safety governor, and safety low pressure oil trip.

CRANKCASE—Steel, rigid box type, single piece.

CRANKSHAFT—Chrome nickel steel forging with integral counterbalance.

CYLINDER LINERS—Individual removable liners.

CYLINDER HEADS—Removable, individual, cast aluminum, renewable valve seats, adequate provision for cleaning and inspection of water passages.

VALVES—Overhead, enclosed, dual exhaust and intake.

CAMSHAFT—Located in cored chamber in upper part of crankcase, cams forged integral.

ROCKER ARMS—Steel forgings mounted on brackets in cylinder head, pressure lubricated, ball ends and sockets.

GEARS—Mounted in gear case at front end of engine and driven from master gear on crankshaft.

VIBRATION DAMPER—Torsional damper fitted to front end of crankshaft of all engines. Dynamic balancer provided on 265 and 530 hp. only in addition to torsional damper.

BEDPLATE—Welded steel, supports engine and generator, lubricating oil storage.

PISTONS—Aluminum alloy.

PISTON PINS—Full floating, steel, bored out, aluminum end-caps, pressure lubricated.

RINGS—Pressure and scraper.

CONNECTING RODS—Forging with bronze piston pin bearing bushing; crank pin bearing babbitted, bronze-backed, split shell. Laminated shims provided for clearance adjustment.

MAIN BEARINGS—Babbitted steel-backed located between all cylinders and at each end of engine. End bearings extra large.

MAIN FUEL PUMP—Individual cylinder plunger type, unit construction, gear driven. Fuel metered. Injection timing controlled.

ATOMIZERS—One per cylinder, spring loaded.

GOVERNOR—Oil pressure type, variable speed engine operation with governing at all speeds.

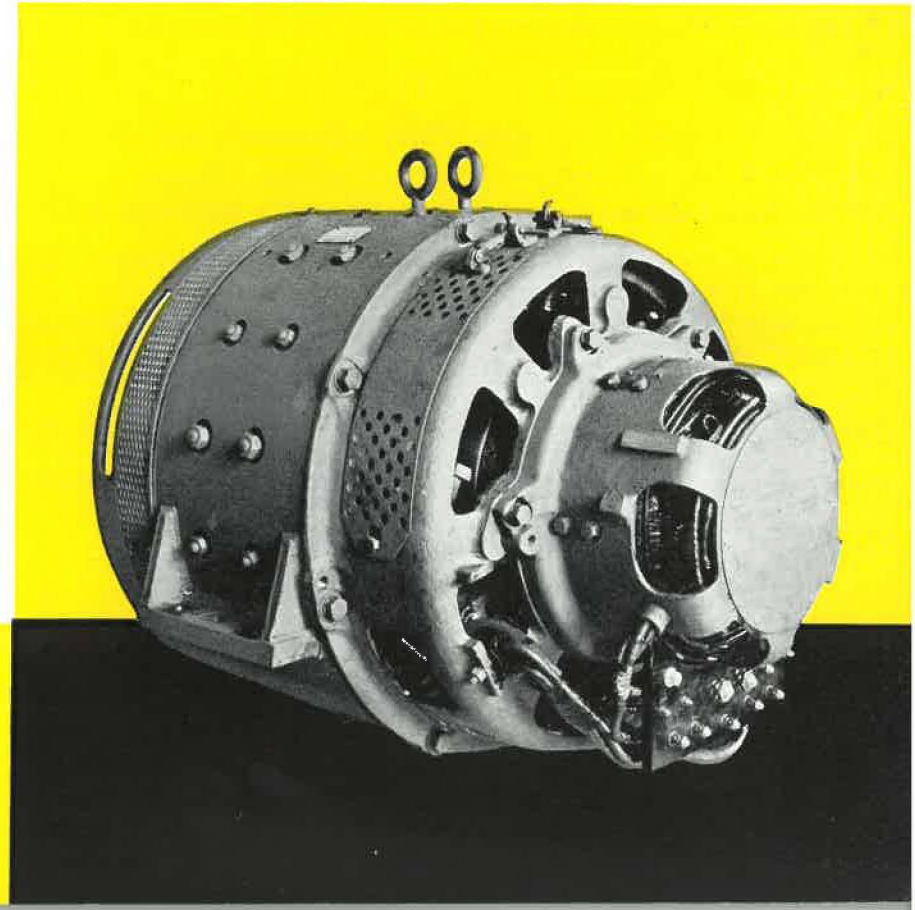
OIL LEVEL GAUGE—Bayonet type.

LUBRICATION SYSTEM—Pressure feed to crankshaft, connecting rod, piston pin and camshaft bearings, and to valve rocker mechanism. Gear type pump. Strainers and filter provided. Scavenging gear type pump circulates oil to radiators. Dry sump.
FUEL OIL—Viscosity 40 to 70 at 100°F. (S. U.) Flash 150°F. min., water and sediment 1% max., sulphur 1% max., carbon residue 1% max., pour test not above 0°F. Fuel oil shall be hydrocarbon oil free from grit, acid, fibrous, or other foreign material.
LUBRICATING OIL—Viscosity 600 to 900 at 100°F. (S.U.) and 60 to 90 at 210°F. (S.U.). Flash 375°F. min. Carbon residue not to exceed 1.0 (U. S. method 500.1). Pour test 40°F. or less (U. S. method 20.11). The oil shall be of refined petroleum and free from acid, grit, water or sulphur and mixtures of fatty oils, resins, soaps or such compounds not derived from petroleum. The oil shall not emulsify.
MUFFLER—Combination exhaust manifold and muffler.
WATER CIRCULATION—Centrifugal pump gear driven from front end of engine.
SAFETY DEVICES—Overspeed flyball governor that trips fuel, and low lubricating oil pressure trip.
*RADIATORS—Water and oil.
*FAN—Efficient type direct driven from cam shaft.
*COMPRESSOR—Water cooled type, direct driven, capacity to suit application.
*265 hp. engine only.

ELECTRICAL EQUIPMENT AND AUXILIARIES

GENERATOR—The generator is provided with one bracket which houses an anti-friction bearing at the rear end. A flanged shaft extension is provided for connection to the engine flywheel.

The frame is of steel with feet welded on to each side for bolting to the engine bedplate. The field coils are firmly held by spring washers and the wiring around frame is well supported to reduce the effect of vibration and shock. The armature is of conventional railway con-



Standard railway main and auxiliary generators. Compactness and ample capacity make the overall power plant a balanced design.

struction, but is especially designed for engine application. Class B insulation is used. The brushholders are of railway design and keep their adjustment under vibration. Shunted brushes are used.

A series winding is provided for use in starting the Diesel engine (generator used as a motor) from the storage battery. All necessary leads are brought out through the commutator end bracket or the exciter frame.

The generator ventilation is obtained by means of a fan mounted on the flywheel of the engine. The fan draws air through the front end housing and exciter, and exhausts it between the rear of the generator frame and the engine crankcase. Suitable screens over the fan are supplied for protection from personal injury.

AUXILIARY GENERATOR—The auxiliary generator has its stator mounted on the bracket at the commutator end of the main generator and is readily removable. The rotor is pressed on an extension of the generator shaft, and securely locked in place.

TRACTION MOTORS—Modern railway series-type direct-current traction motors of high efficiency and especially designed for Diesel locomotive application are used. They are arranged with axle bearings. Housings are fitted and securely bolted into large bored openings at each end of the frame.

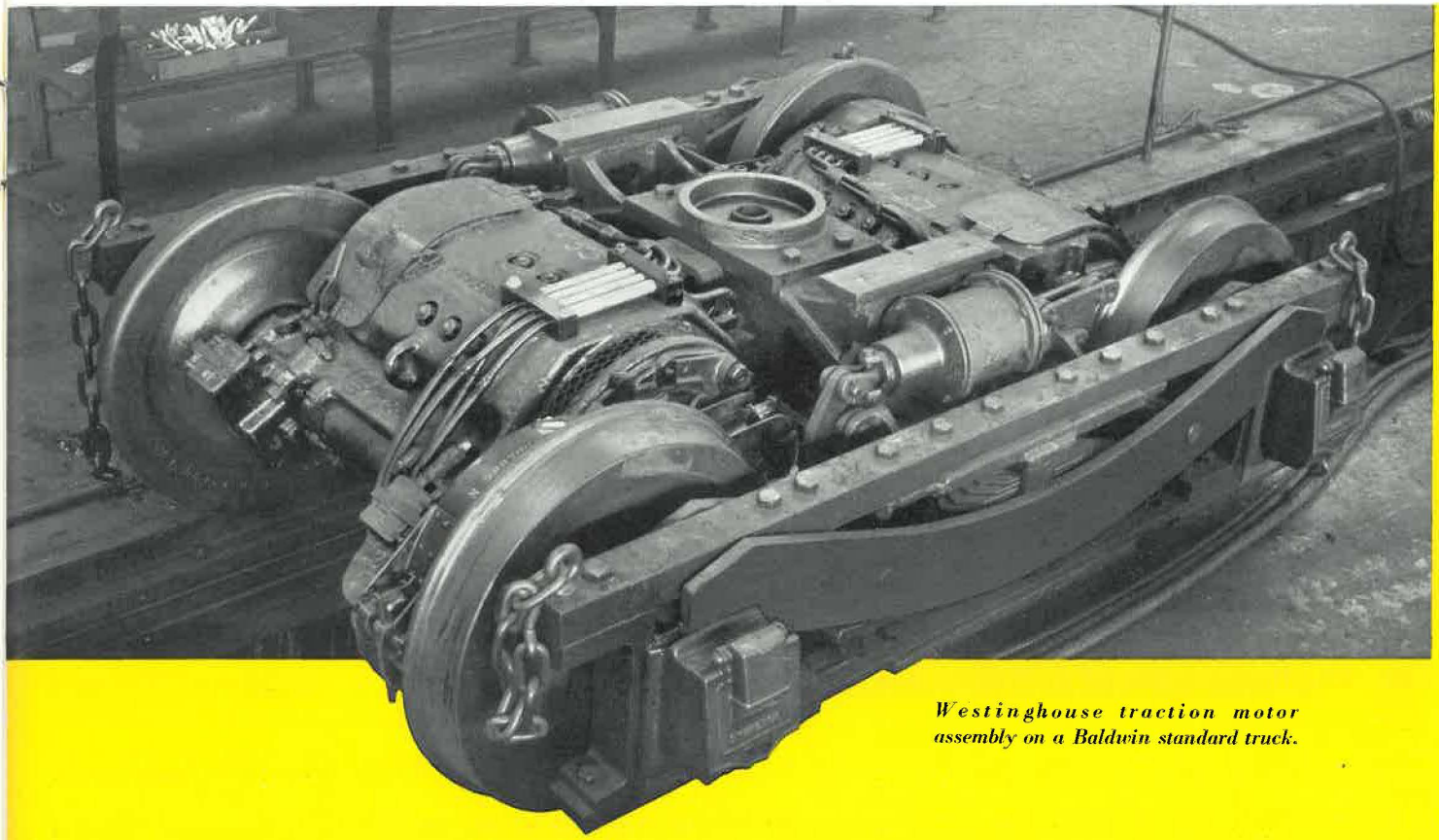
Access to the commutator and brushes is afforded by large openings at the top and bottom of the motor frame at the commutator end. The armature is of conventional railway construction. The brushholders are ruggedly built, and keep their adjustment under vibration.

The field coils are held rigidly against the pole tips by springs which prevent vibration and chafing.

Class B insulation is used throughout.

GEARING—Single reduction gears with Westinghouse BP treatment are used.

CONTROL—Remote, electro-pneumatic control apparatus mounted in built-in cabinet is used. Magnetic contactors are used for low voltage control circuits. Series, parallel control of the traction motors is provided. All wiring is in conduits.



Westinghouse traction motor assembly on a Baldwin standard truck.

ENGINE LOADING—Either Westinghouse differential or torque control is used. The latter provides uniform loading to maintain constant engine speed and permits the use of the auxiliary generator and main generator for furnishing auxiliary power to the compressor, battery and other circuits. The differential control applies a definite load to the engine. The generator characteristic is drooping, i.e., the voltage decreases as the current increases, due to a series winding. This prevents overloading the engine and insures uniform operation. Auxiliaries are driven either directly from the engine or supplied electrically from the generators.

MECHANICAL PARTS

TRUCKS—Two swivel type trucks with flanged wheels of Master Car Builders' contour and hammered steel axles are supplied. The boxes have bronze bearings. Equalizers are of wrought steel. All springs are oil tempered steel. The frame is built up of rolled steel and forgings, located outside of wheels. Truck cross-ties are cast steel.

CAB UNDERFRAME—The underframe is a built-up deck, except where cast steel is indicated, with center and side sills of structural steel securely braced with necessary cross-ties and bolsters. Lifting lugs are located near ends of the underframe. When forced ventilation of traction motors is used, built-in air ducts are provided.

BUMPERS—The bumpers are of steel plate and cast steel.

CAB—The cab is the Westinghouse visibility type with raised floor (except where otherwise indicated). It is substantially built of steel plate and structural steel, well finished, braced and riveted. Metal window sashes and frames are used. The doors have windows. A sliding window is located on each side of the cab. One window at each end of cab is arranged to open.

HOOD—The complete power plant is located under the hood. Windows are located on each side. A built-in radiator with fan is used. The aisle floor along each side of engine and generator is covered with non-skid steel plate.

BRAKE RIGGING—Westinghouse Air Brake is used on all wheels, giving a braking effort of approximately 85 per cent at 50 lb. per sq. in. cylinder pressure. An auxiliary hand brake is provided on one truck suitable for holding the idle locomotive.

MISCELLANEOUS

CONTROL STATION—Standard equipment includes one operator's control station on one side of the locomotive. The master controller has one handle which governs the motor connections and engine speed, and a separate reverser handle which determines the direction of operation. A standard brake valve is supplied.

A second control station can be supplied on the other side of the locomotive and mechanically connected to the other control station. This provides dual control.

MARKER-LIGHT BRACKETS—Brackets and connections are supplied at each corner of the locomotive.

WINDOWS AND WIPERS—Windows are supplied in each end of the cab. Wipers are supplied at windows in front of each control station.

SANDERS—"Leach" pneumatic type sanders are supplied.

HORN—A Westinghouse Air Brake Company pneuphonic air horn is provided except where otherwise indicated.

GONG—One air operated gong is standard equipment. Other warning devices can be supplied upon request.

RADIATORS—Radiators for cooling both water and lubricating oil are provided.

HEADLIGHT—A standard headlight at each end controlled from the operating station is supplied.

LOCKERS—A clothes locker and tool cabinet are standard equipment. A Pyrene fire extinguisher is provided.

PAINTING AND LETTERING—The finish is made to the specifications of each customer.

EXTRAS—The following equipment or changes can be included but are considered as extras:

Stove and coal box
Illumination for switchman's steps
Battery charging receptacle
Special sander equipment
Special windshield wipers
Cork dashing for cab
Wood ceiling for cab
Shatter-proof or plate glass for cab
Additional air capacity for special services
Special fire extinguishers

Draft gear except where standard. Special draft gear
Traction motor field shunting which gives higher speed operation.
Weight transfer compensation which makes possible greater starting tractive effort.
Marker lights
Bell or other warning devices
Ballast. The weight can be varied over a reasonable range to suit each application.

Radial drawbar. Couplers can be made suitable for shorter radius curves.
Second control station for "dual" control
Cast steel trucks frame or underframe except when standard
Special hand brakes
Apparatus for force ventilation of traction motors except when standard equipment.
Operator position indicator lights
Control for multiple operation

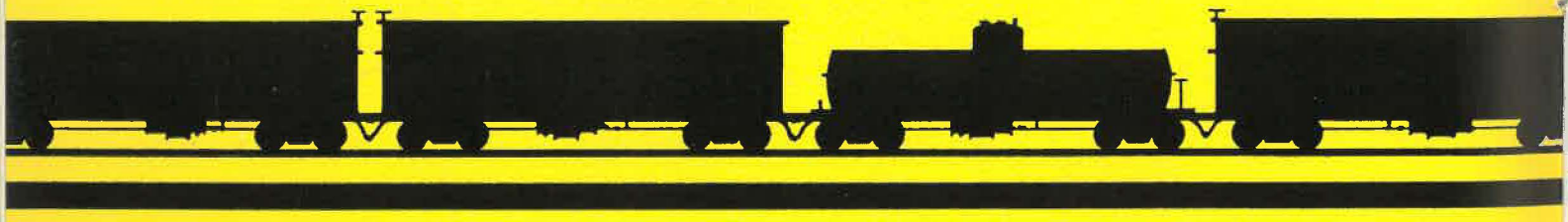
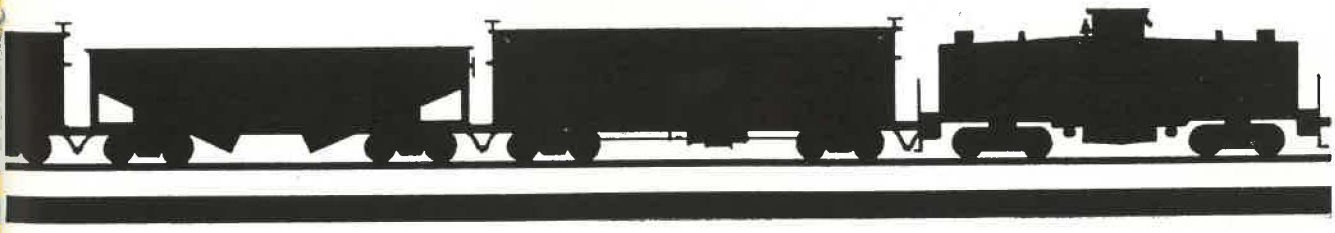
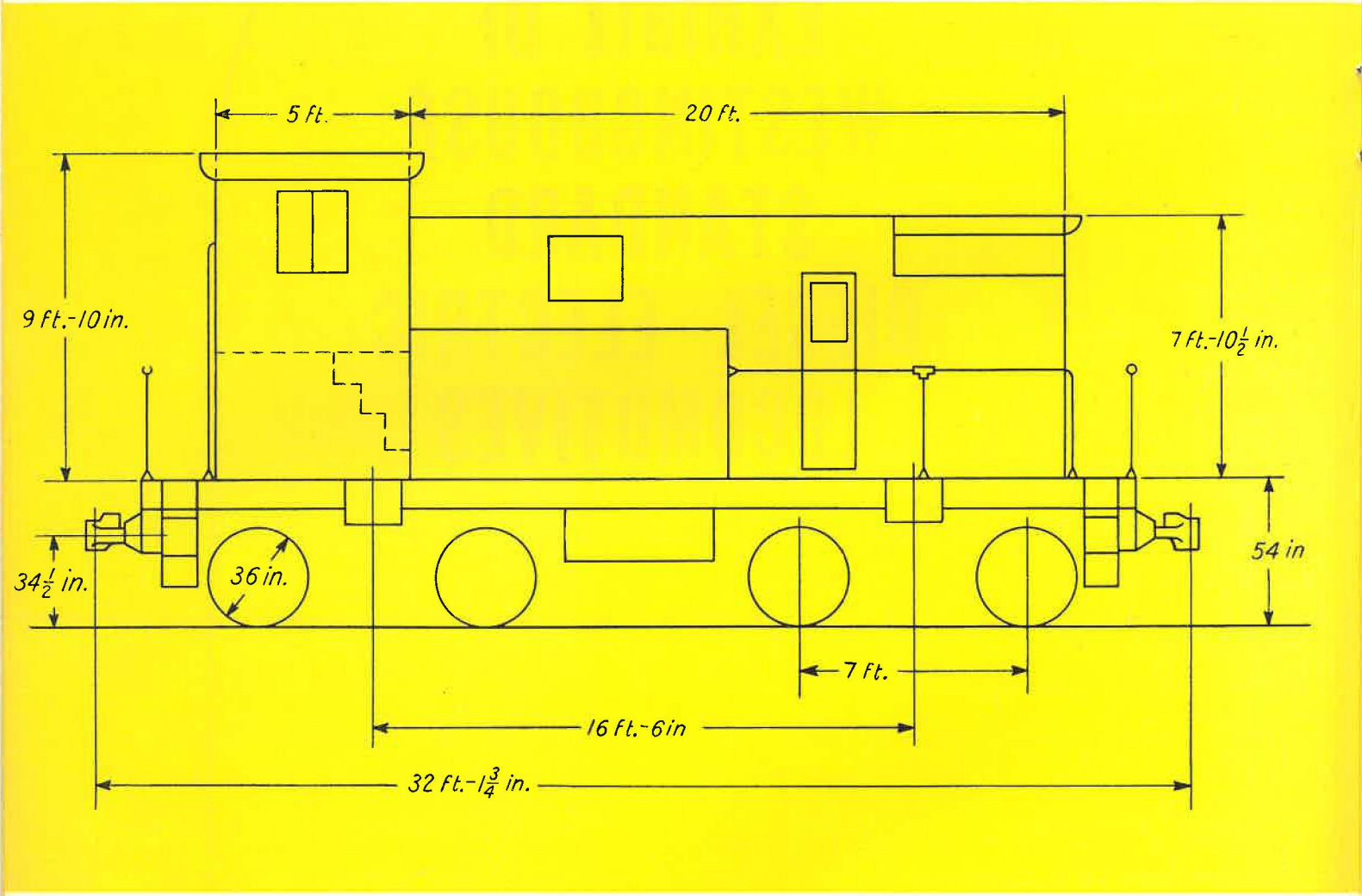


EXHIBIT OF WESTINGHOUSE STANDARD DIESEL ELECTRIC LOCOMOTIVES





60 TON • 400 HP.

SINGLE POWER PLANT

One 400 hp. engine delivers power to the wheels by electric transmission. All locomotive weight is on drivers.

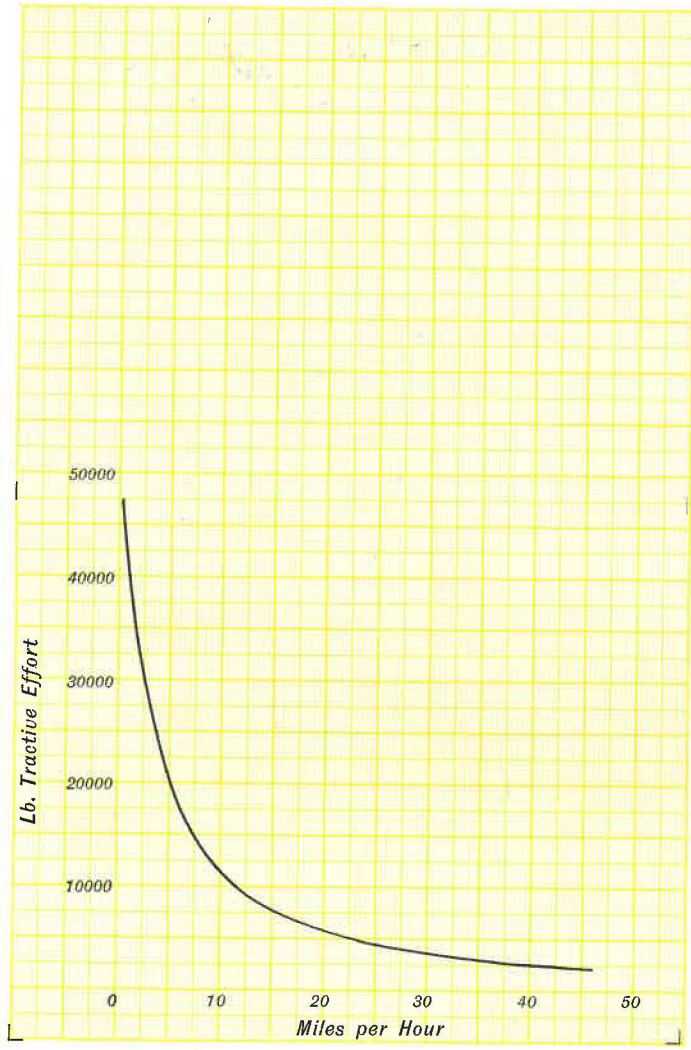
POWER EQUIPMENT

Engine . .	Type 4-E-2, 6-cylinder, 400 hp. at 900 rpm.
Generator .	Type 477 railway, Class B insulation, single bearing.
Auxiliary Gen. .	Railway type, Class B insulation, overhung on shaft of main generator.
Traction Motors	4—Type 560 standard railway, series type, 600 volts, Class B insulation.
Motor Gearing .	17:78 ratio, Westinghouse BP.
Control . . .	Magnetic and electro-pneumatic, single station, series-parallel, parallel, torque.

MECHANICAL PARTS

General . . .	Baldwin, Class B-B, fabricated, swivel trucks, visibility type raised cab, aisles around engine. End sheet removable for taking out power plant.

TRIC LOCOMOTIVES



SPEED-TRACTIVE EFFORT CURVE

PERFORMANCE

Tractive effort, starting, lb. (30 per cent adhesion)	36,000
Tractive effort, continuous, lb.	12,600
Speed at continuous tractive effort, mph.	9.2
Maximum safe speed, mph.	40
Minimum radius of curvature for locomotive alone, ft.	50
Minimum radius of curvature with trailing load, ft.	150

APPLICATION

This locomotive is suitable for general switching and light haulage. The following tabulation shows the trailing loads and speeds on various grades. Resistance is assumed as 10 pounds per ton.

Tractive Effort in Pounds	Speed in Miles per Hour	Trailing Load in Tons 0.25% Grade	0.5% Grade	1.0% Grade
23,250	4.3	1500	1100	710
18,500	6.0	1170	860	550
13,000	9.0	800	600	370
10,000	11.8	610	440	275

It is permissible, of course, to exert tractive efforts above the continuous rating of the electrical equipment. The only limitation is that the winding temperatures must not exceed safe maximum values.

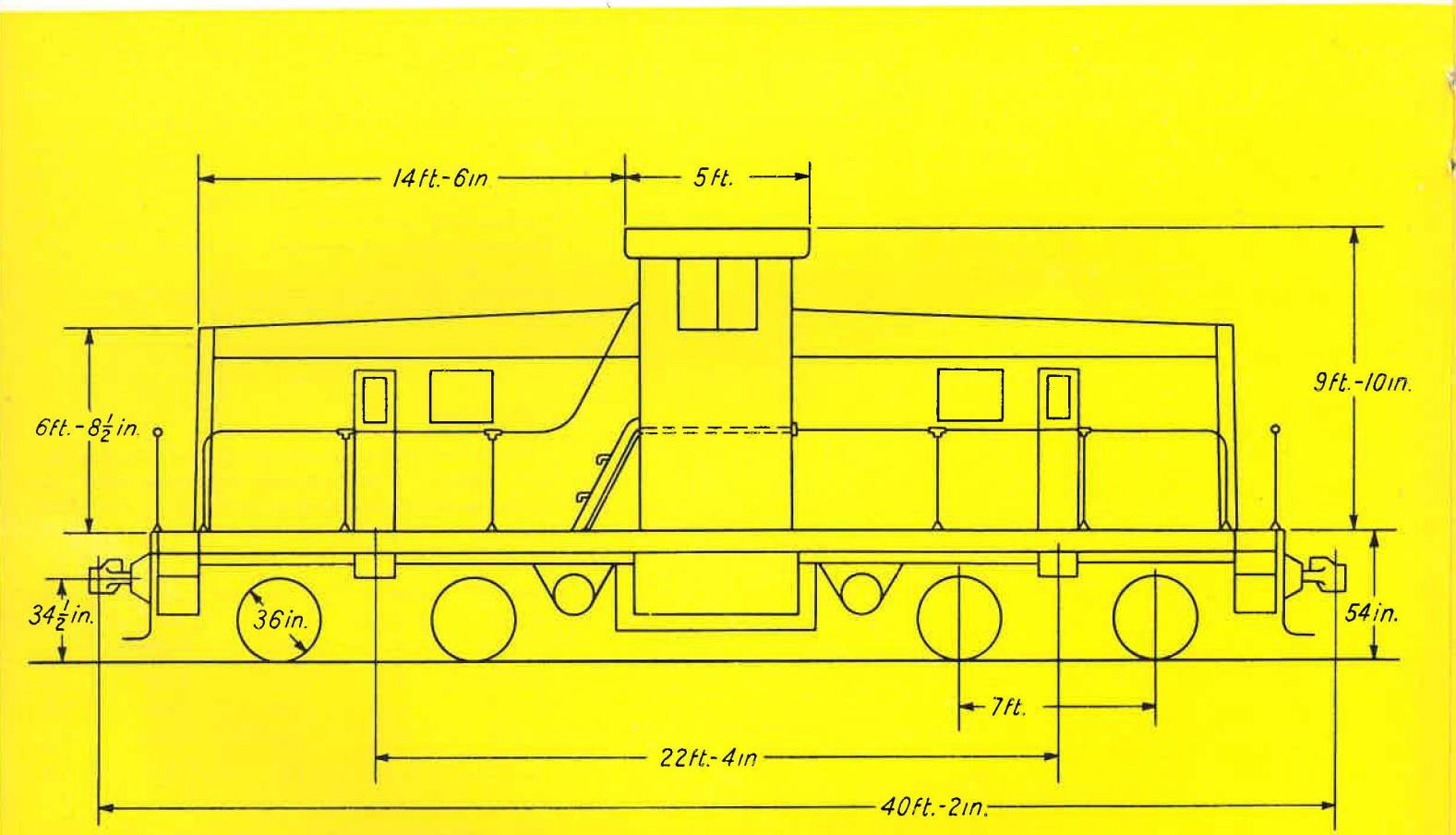
Wheel	Rolled steel, rims 2½ in x 5½ in. section, Master Car Builders' contour.
Axles	Hammered steel, 8 in. diameter at motor gear seat, 7 in. diameter at motor bearing, journals 5½ in. x 10 in.
Couplers	Standard Master Car Builders' short shank, mounted in cast steel pocket.

AUXILIARIES

Air Brakes	Westinghouse schedule 14-EL with quick application and release features.
Compressor	Electric driven, 85 cubic foot displacement.
Radiators	Water and lubricating oil, full force ventilated by motor-driven fan.
Battery	Exide, 32 cell, 204 ampere-hour.

DIMENSIONS

Length inside coupler knuckles	32 ft. 1¾ in.
Width overall	10 ft. 2 in.
Width inside sheet	10 ft.
Height overall	14 ft. 4 in.
Height, rail to hood	12 ft. 1½ in.
Wheel base, rigid	7 ft.
Wheel base, total	23 ft. 6 in.
Truck center	16 ft. 6 in.
Track gauge	4 ft. 8½ in.
Diameter of drivers	36 in.



60 TON • 530 HP.

DOUBLE POWER PLANT

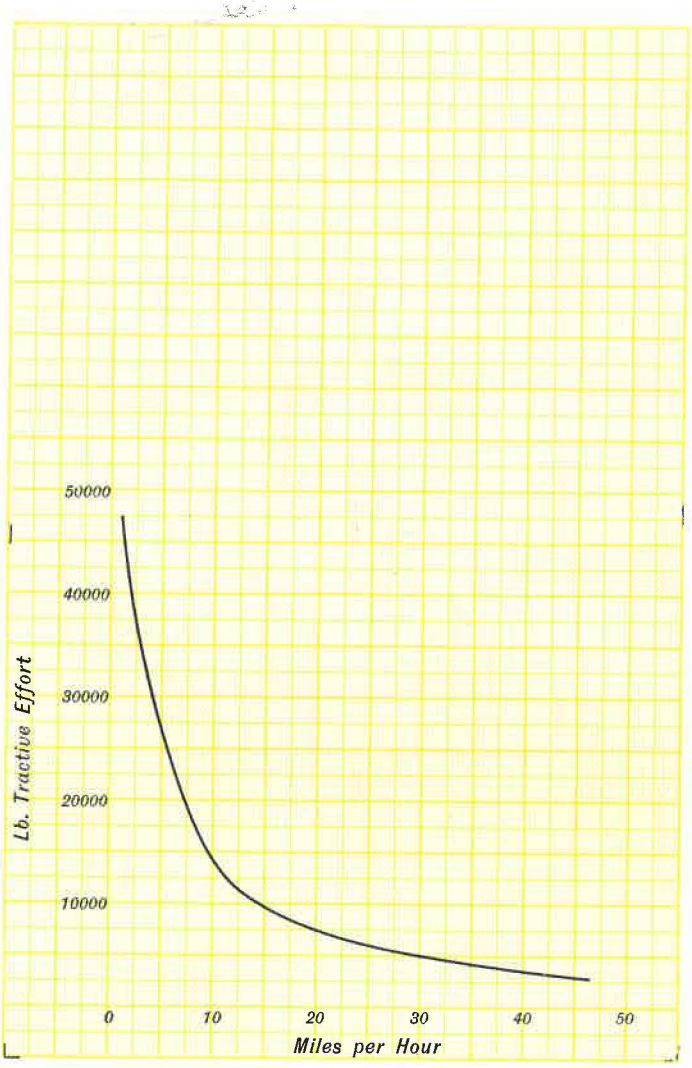
Two 265 hp. engines deliver power to the wheels by electric transmission. All locomotive weight is on drivers.

POWER EQUIPMENT

Engine . .	2—Type 4-F-1, 4-cylinder, 265 hp. each at 900 rpm.
Generator .	2—Type 182 standard railway, Class B insulation, single bearing.
Auxiliary Gen. .	Railway type, Class B insulation, overhung on shaft of main generator.
Traction Motors	4—Type 560 standard railway, series type, 600 volts, Class B insulation.
Motor Gearing	17:78 ratio, Westinghouse BP.
Control . . .	Magnetic and electro-pneumatic, single station, series, parallel, differential.

MECHANICAL PARTS

General . . .	Baldwin, Class B-B, fabricated, swivel trucks, visibility type raised cab, aisles around engine. Power plant removed as unit.



SPEED-TRACTIVE EFFORT CURVE

PERFORMANCE

Tractive effort, starting, lb. (30 per cent adhesion)	36,000
Tractive effort, continuous, lb.	12,600
Speed at continuous, tractive effort, mph.	11.3
Maximum safe speed, mph.	40
Minimum radius of curvature for locomotive alone, ft.	50
Minimum radius of curvature with trailing load, ft.	165

APPLICATION

This locomotive is suitable for general switching and light haulage. The following tabulation shows the trailing loads and speeds on various grades. Resistance is assumed as 10 pounds per ton.

Tractive Effort in Pounds	Speed in Miles per Hour	Trailing Load in Tons — 0.25% Grade	0.5% Grade	1.0% Grade
28,200	4.5	1885	1345	910
22,500	6.3	1435	1060	685
15,000	9.8	935	685	435
10,200	14.5	615	450	280

It is permissible, of course, to exert tractive efforts above the continuous rating of the electrical equipment. The only limitation is that the winding temperatures must not exceed safe maximum values.

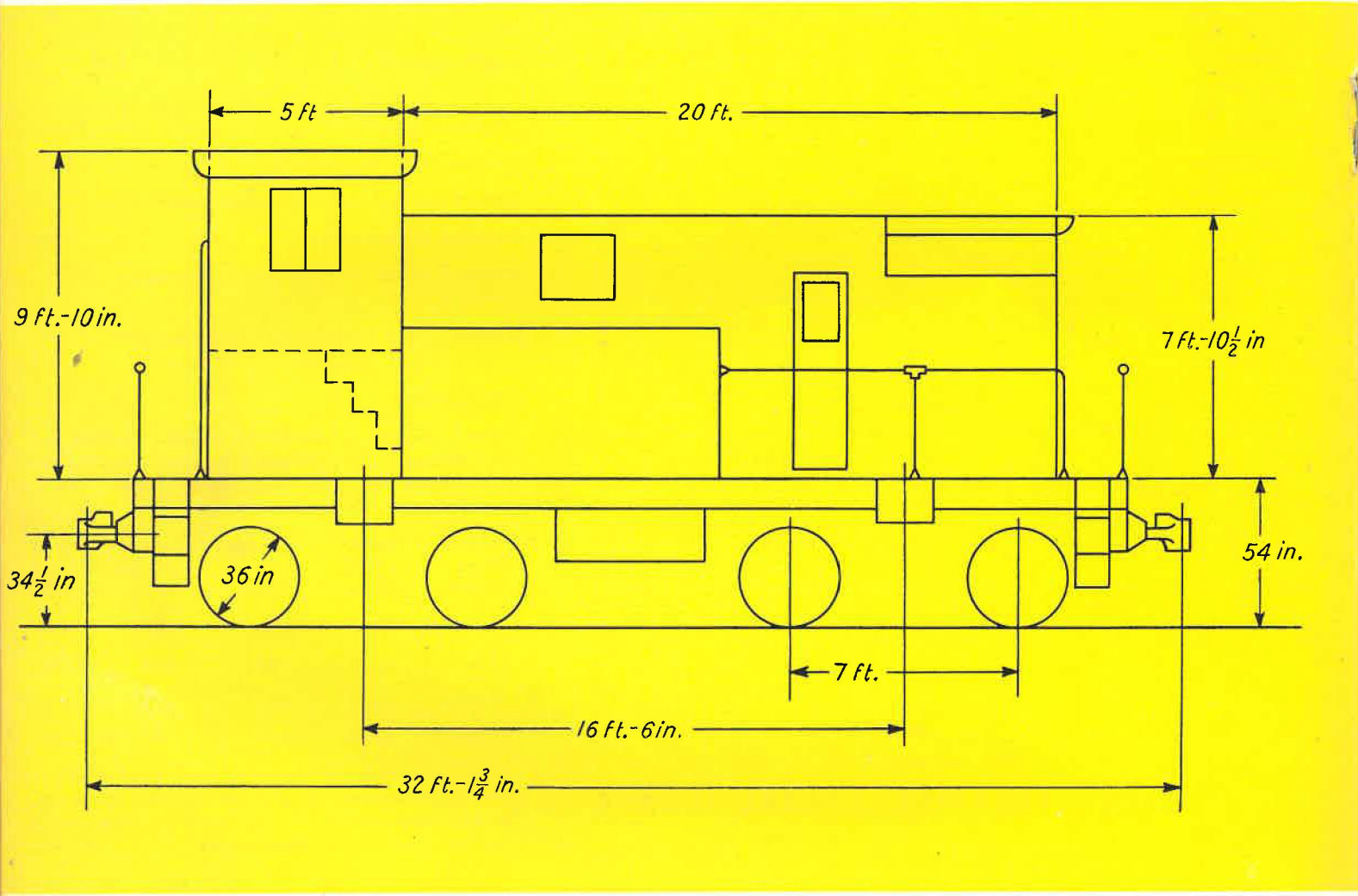
Wheel	Rolled steel, rims 2½ in. x 5½ in. section, Master Car Builders' contour.
Axles	Hammered steel, 8 in. diameter at motor gear seat, 7 in. diameter at motor bearing, journals 5½ in. x 10 in.
Couplers	Standard Master Car Builders' short shank, mounted in cast steel pocket.

AUXILIARIES

Air Brakes	Westinghouse schedule 14-EL with quick application and release features.
Compressor	Two direct driven, 148 cubic foot displacement total at full engine speed.
Radiators	Water and lubricating oil, full force ventilation, direct drive.
Battery	Exide, 32 cell, 204 ampere-hour.

DIMENSIONS

Length inside coupler knuckles	40 ft. 2 in.
Width overall	10 ft. 2 in.
Width inside sheet	10 ft.
Height overall	14 ft. 4 in.
Height, rail to hood	12 ft. 3 in.
Wheel base, rigid	7 ft.
Wheel base, total	29 ft. 4 in.
Truck center	22 ft. 4 in.
Track gauge	4 ft. 8½ in.
Diameter of drivers	36 in.



70 TON • 400 HP.

SINGLE POWER PLANT

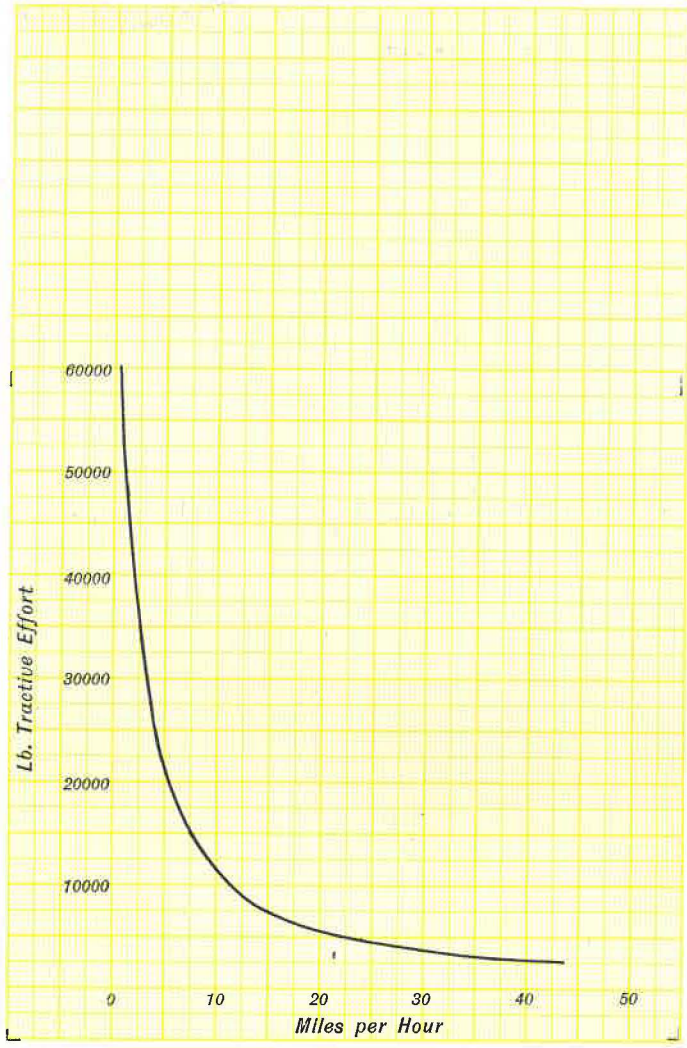
One 400 hp. engine delivers power to the wheels by electric transmission. All locomotive weight is on drivers.

POWER EQUIPMENT

Engine . . .	Type 4-E-2, 6-cylinder, 400 hp. at 900 rpm.
Generator . .	Type 477 standard railway, Class B insulation, single bearing.
Auxiliary Gen. .	Railway type, Class B insulation, overhung on shaft of main generator.
Traction Motors .	4—Type 571, standard railway, series type, 600 volts, Class B insulation.
Motor Gearing .	16:79 ratio, Westinghouse BP.
Control . . .	Magnetic and electro-pneumatic, single station, series-parallel, parallel, torque.

MECHANICAL PARTS

General . . .	Baldwin, Class B-B, fabricated, swivel trucks, visibility type raised cab, aisles around engine.
Wheel . . .	Rolled steel, rims 2½ in. x 5½ in. section, Master Car Builders' contour.



SPEED-TRACTIVE EFFORT CURVE

PERFORMANCE

Tractive effort, starting lb. (30 per cent adhesion)	42,000
Tractive effort, continuous, lb.	14,000
Speed at continuous tractive effort, mph.	8.2
Maximum safe speed, mph.	40
Minimum radius of curvature for locomotive alone, ft.	50
Minimum radius of curvature with trailing load, ft.	150

APPLICATION

This locomotive is suitable for general switching and light haulage. The following tabulation shows the trailing loads and speeds on various grades. Resistance is assumed as 10 pounds per ton.

Tractive Effort in Pounds	Speed in Miles per Hour	—Trailing Load in Tons— 0.25% Grade	0.5% Grade	1.0% Grade
24,500	4.5	1565	1155	750
19,500	6.0	1230	905	580
13,500	8.5	830	605	380
10,000	11.8	600	430	265

It is permissible, of course, to exert tractive efforts above the continuous rating of the electrical equipment. The only limitation is that the winding temperatures must not exceed safe maximum values.

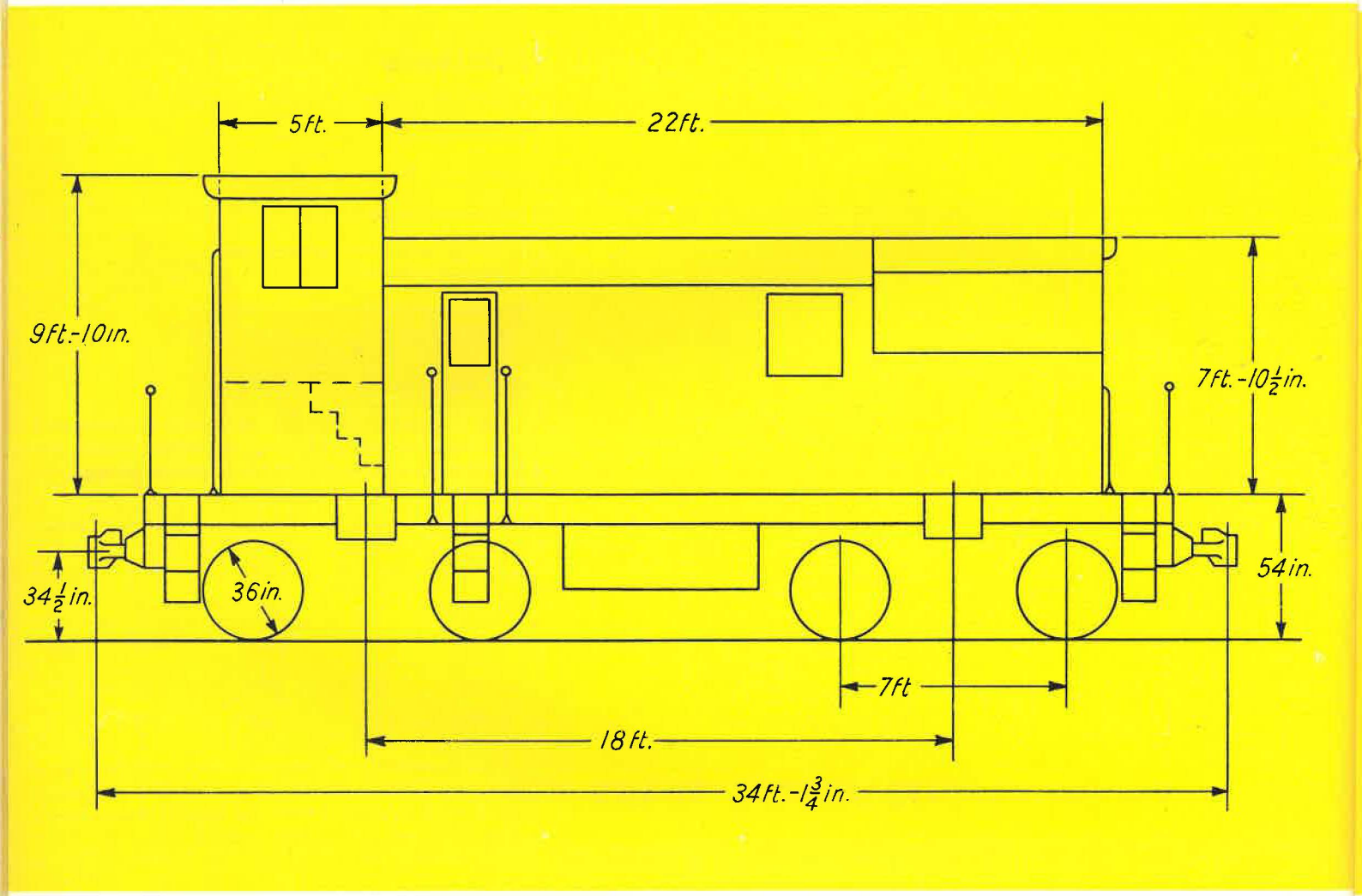
Axles	Hammered steel, 8 in. diameter at motor gear seat, 7 in. diameter at motor bearing, journals 5½ in. x 10 in.
Couplers	Standard Master Car Builders' short shank, mounted in cast steel pocket.

AUXILIARIES

Air Brakes	Westinghouse schedule 14-EL with quick application and release features.
Compressor	Electric driven, 85 cubic foot displacement.
Radiators	Water and lubricating oil, full force ventilated by motor-driven fan.
Battery	Exide, 32 cell, 204 ampere-hour.

DIMENSIONS

Length inside coupler knuckles	32 ft. 1¾ in.
Width overall	10 ft. 2 in.
Width inside sheet	10 ft.
Height overall	14 ft. 4 in.
Height, rail to hood	12 ft. 4½ in.
Wheel base, rigid	7 ft.
Wheel base, total	23 ft. 6 in.
Truck center	16 ft. 6 in.
Track gauge	4 ft. 8½ in.
Diameter of drivers	36 in.



70 TON • 530 HP.

SINGLE POWER PLANT

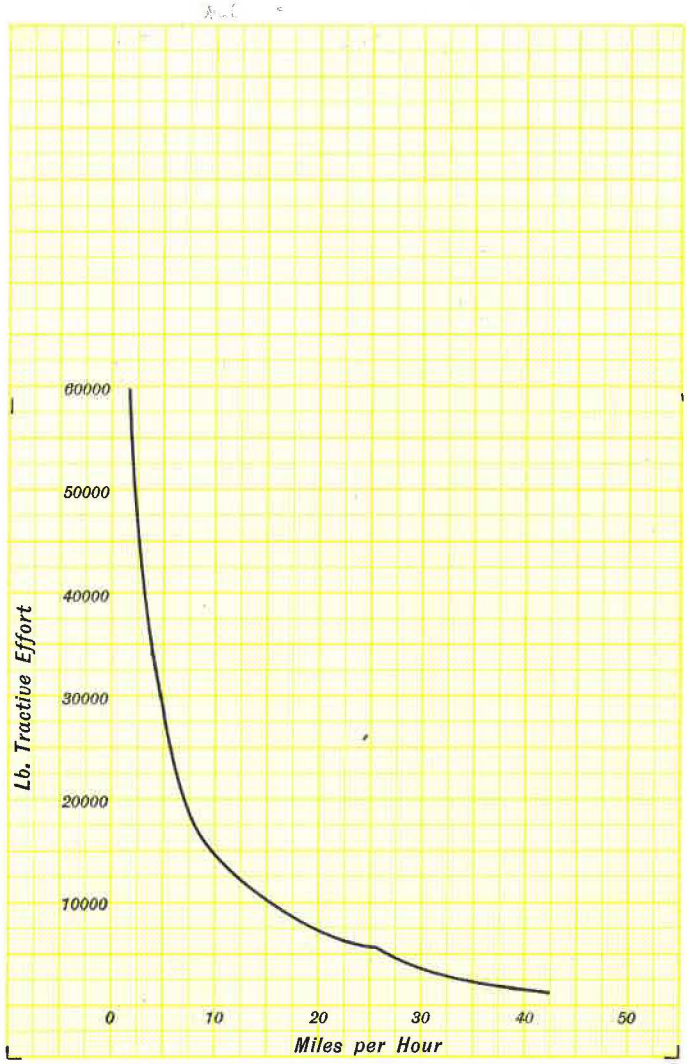
One 530 hp. engine delivers power to the wheels by electric transmission. All locomotive weight is on drivers.

POWER EQUIPMENT

Engine . . .	Type 4-H, 8-cylinder, 530 hp. at 900 rpm.
Generator . .	Type 477, standard railway, Class B insulation, single bearing.
Auxiliary Gen. .	Railway type, Class B insulation, overhung on shaft of main generator.
Traction Motors	4—Type 570, standard railway, series type, Class B insulation.
Motor Gearing .	16:79 ratio, Westinghouse BP.
Control . . .	Magnetic and electro-pneumatic, single station, series parallel, parallel, torque.

MECHANICAL PARTS

General . . .	Baldwin, Class B-B, fabricated, swivel trucks, visibility type raised cab, aisles around engine.
Wheel . . .	Rolled steel, rims 2½ in. x 5½ in. section, Master Car Builders' contour.



SPEED-TRACTIVE EFFORT CURVE

PERFORMANCE

Tractive effort, starting, lb. (30 per cent adhesion)	42,000
Tractive effort, continuous, lb.	14,000
Speed at continuous tractive effort, mph.	11.2
Maximum safe speed, mph.	40
Minimum radius of curvature for locomotive alone, ft.	50
Minimum radius of curvature with trailing load, ft.	150

APPLICATION

This locomotive is suitable for general switching and light haulage. The following tabulation shows the trailing loads and speeds on various grades. Resistance is assumed as 10 pounds per ton.

Tractive Effort in Pounds	Speed in Miles per Hour	Trailing Load in Tons — 0.25% Grade	0.5% Grade	1.0% Grade
30,500	4.5	1960	1455	950
24,500	6.0	1565	1155	750
17,500	8.7	1100	805	515
13,000	12.0	800	580	365

It is permissible, of course, to exert tractive efforts above the continuous rating of the electrical equipment. The only limitation is that the winding temperatures must not exceed safe maximum values.

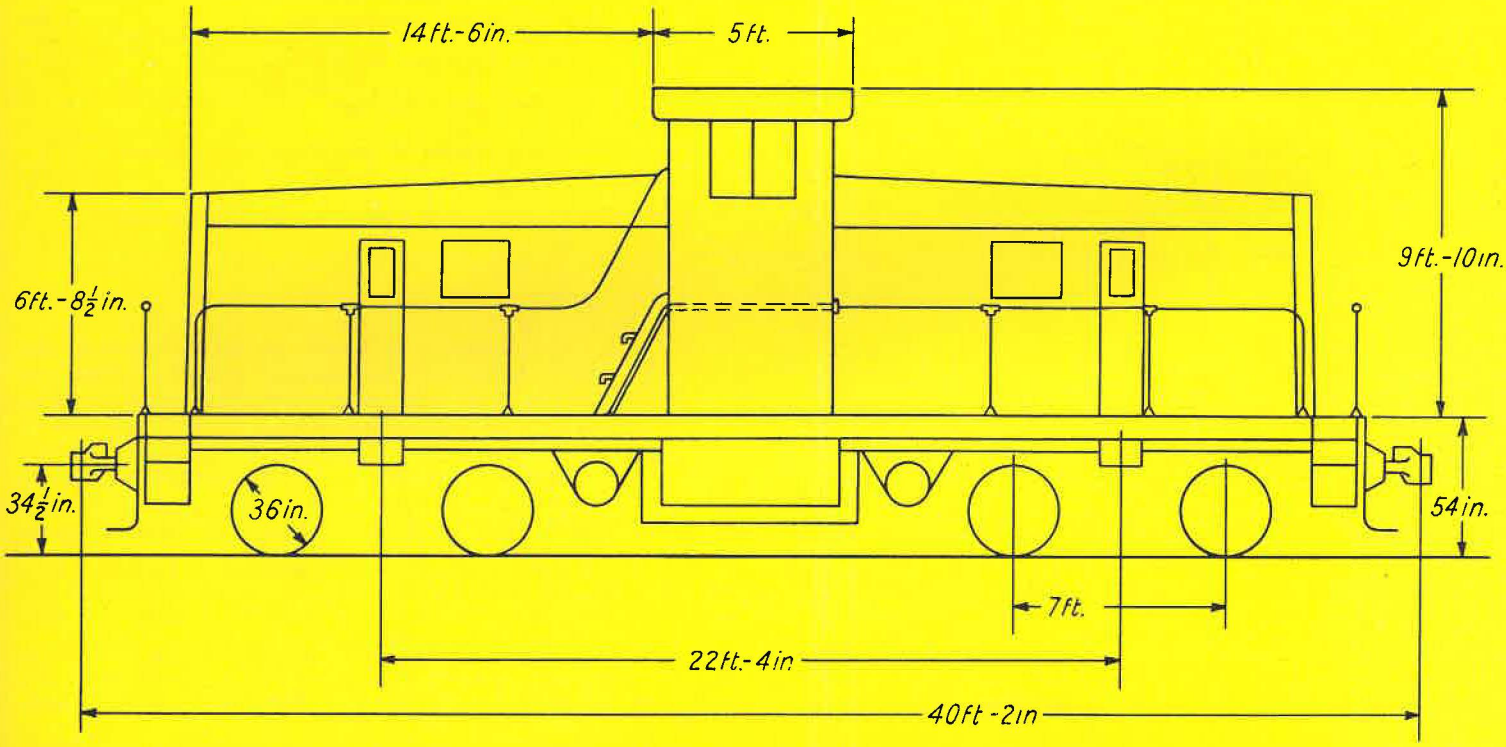
Axles	Hammered steel, 8 in. diameter at motor gear seat, 7 in. diameter at motor bearing, journals 5½ in. x 10 in.
Couplers	Standard Master Car Builders' short shank, mounted in cast steel pocket.

AUXILIARIES

Air Brakes	Westinghouse schedule 14-EL with quick application and release features.
Compressor	Electric driven, 85 cubic foot displacement.
Radiators	Water and lubricating oil, full force ventilation by motor driven fan.
Battery	Exide, 32-cell, 272 ampere-hour.

DIMENSIONS

Length inside coupler knuckles	34 ft. 1¾ in.
Width overall	10 ft. 2 in.
Width inside sheet	10 ft.
Height overall	14 ft. 4 in.
Height, rail to hood	12 ft. 4½ in.
Wheel base, rigid	7 ft.
Wheel base, total	25 ft.
Truck center	18 ft.
Track gauge	4 ft. 8½ in.
Diameter of drivers	36 in.



70 TON • 530 HP.

DOUBLE POWER PLANT

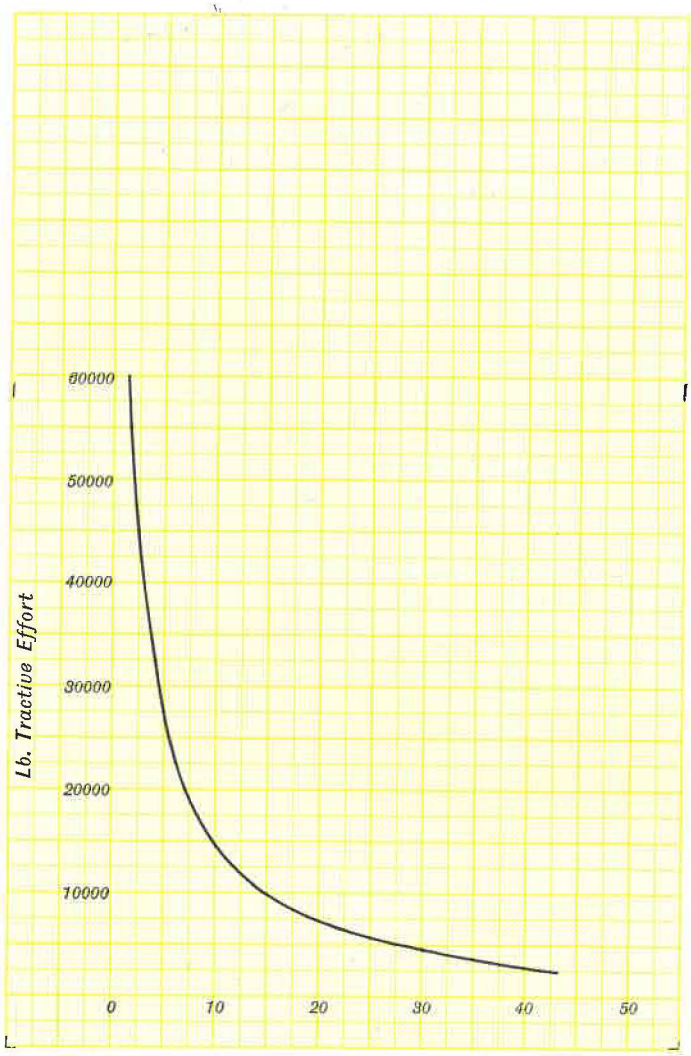
Two 265 hp. engines deliver power to the wheels by electric transmission. All locomotive weight is on drivers.

POWER EQUIPMENT

Engine . .	2—Type 4-F-1, 4-cylinder, 265 hp. each at 900 rpm.
Generator .	2—Type 182, railway, Class B insulation, single bearing.
Auxiliary Gen. .	Railway type, Class B insulation, overhung on shaft of main generator.
Traction Motors	4—Type 571, standard railway, series type, Class B insulation.
Motor Gearing .	16:79 ratio, Westinghouse BP.
Control . . .	Magnetic and electro-pneumatic, single station, series, parallel, differential.

MECHANICAL PARTS

General . . .	Baldwin, Class B-B, fabricated, swivel trucks, visibility type raised cab, aisles around engine. Power plant removable as unit.
Wheel . . .	Rolled steel, rims 2½ in. x 5½ in. section, Master Car Builders' contour.



SPEED-TRACTIVE EFFORT CURVE

PERFORMANCE

Tractive effort, starting, lb. (30 per cent adhesion)	42,000
Tractive effort, continuous, lb.	14,000
Speed at continuous tractive effort, mph.	10.4
Maximum safe speed, mph.	40
Minimum radius of curvature for locomotive alone, ft.	50
Minimum radius of curvature with trailing load, ft.	165

APPLICATION

This locomotive is suitable for general switching and light haulage. The following tabulation shows the trailing loads and speeds on various grades. Resistance is assumed as 10 pounds per ton.

Tractive Effort in Pounds	Speed in Miles per Hour	Trailing Load in Tons 0.25% Grade	0.5% Grade	1.0% Grade
30,500	4.5	1960	1455	950
24,500	5.6	1565	1155	750
17,500	8.2	1100	805	515
13,000	11.0	800	580	365

It is permissible, of course, to exert tractive efforts above the continuous rating of the electrical equipment. The only limitation is that the winding temperatures must not exceed safe maximum values.

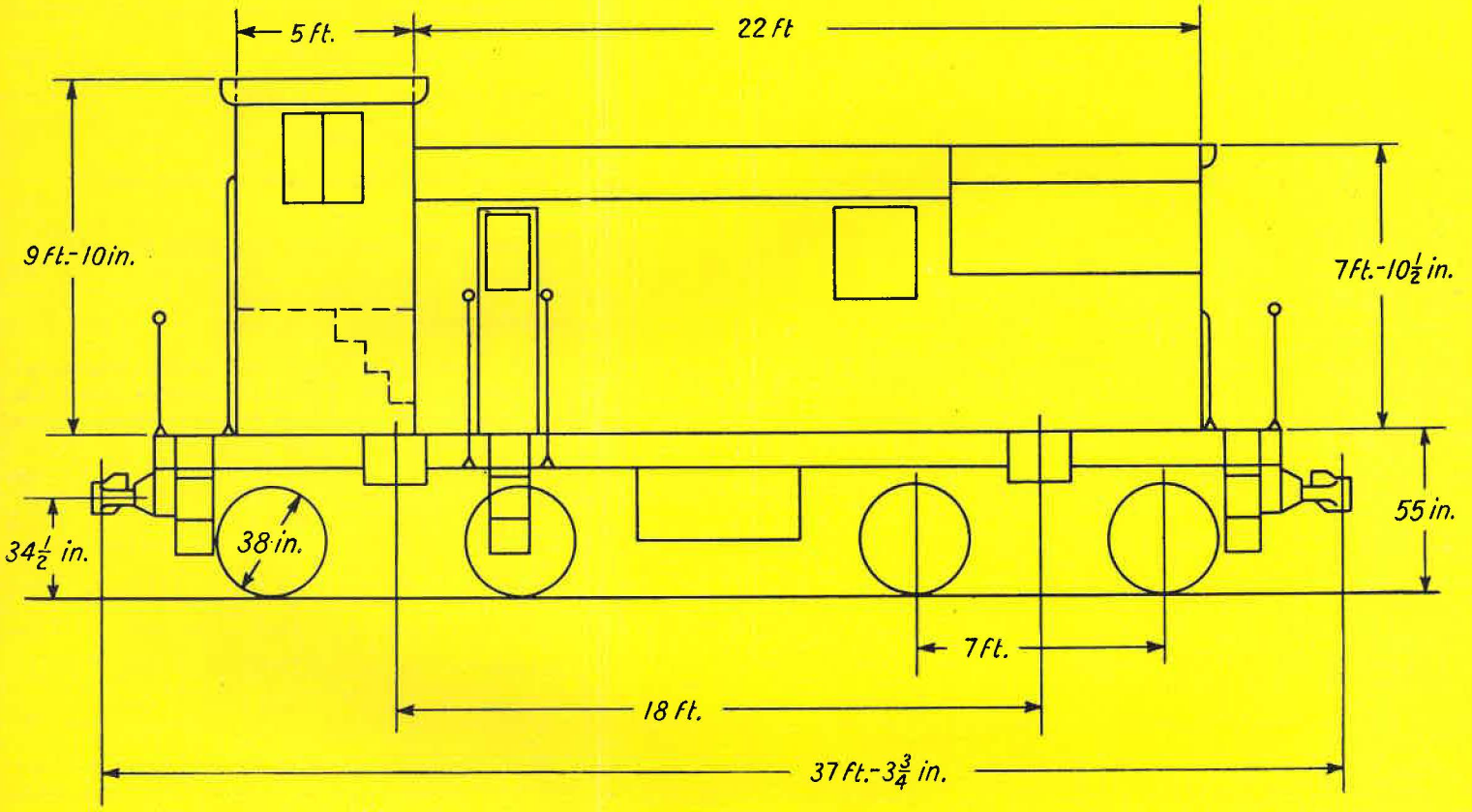
Axles	Hammered steel, 8 in. diameter at motor gear seat, 7 in. diameter at motor bearing, journals 5½ in. x 10 in.
Couplers	Standard Master Car Builders' short shank, mounted in cast steel pocket.

AUXILIARIES

Air Brakes	Westinghouse schedule 14-EL with quick application and release features.
Compressor	Two direct driven, 148 cubic foot displacement total at full engine speed.
Radiators	Water and lubricating oil, full force ventilation, direct drive.
Battery	Exide, 32-cell, 204 ampere-hour.

DIMENSIONS

Length inside coupler knuckles	40 ft. 2 in.
Width overall	10 ft. 2 in.
Width inside sheet	10 ft.
Height overall	14 ft. 4 in.
Height, rail to hood	12 ft. 4 in.
Wheel base, rigid	7 ft.
Wheel base, total	29 ft. 4 in.
Truck center	22 ft. 4 in.
Track gauge	4 ft. 8½ in.
Diameter of drivers	36 in.



80 TON • 530 HP.

SINGLE POWER PLANT

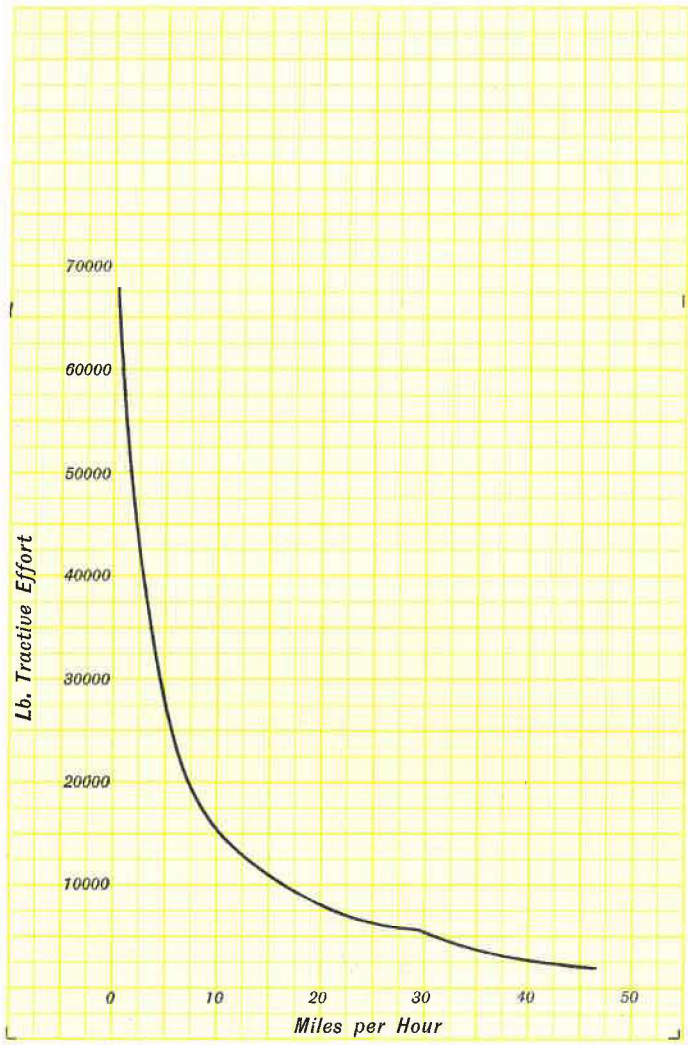
One 530 hp. engine delivers power to the wheels by electric transmission. All locomotive weight is on drivers.

POWER EQUIPMENT

Engine	Type 4-H, 8-cylinder, 530 hp. at 900 rpm.
Generator	Type 477, standard railway, Class B insulation, single bearing.
Auxiliary Gen.	Railway type, Class B insulation, overhung on shaft of main generator.
Traction Motors	4—Type 584, standard railway, series type, 600 volt, Class B insulation.
Motor Gearing	16:70 ratio, Westinghouse BP.
Control	Magnetic and electro-pneumatic, single station, series parallel, parallel, torque.

MECHANICAL PARTS

General	Baldwin, Class B-B, fabricated, swivel trucks, visibility type raised cab, aisles around engine.
Wheel	Rolled steel, rims 2½ in. x 5½ in. section, Master Car Builders' contour.



SPEED-TRACTIVE EFFORT CURVE

PERFORMANCE

Tractive effort, starting, lb. (30 per cent adhesion)	48,000
Tractive effort, continuous, lb.	14,000
Speed at continuous tractive effort, mph.	11.4
Maximum safe speed, mph.	40
Minimum radius of curvature for locomotive alone, ft.	50
Minimum radius of curvature with trailing load, ft.	165

APPLICATION

This locomotive is suitable for general switching and haulage. The following tabulation shows the trailing loads and speeds on various grades. Resistance is assumed as 10 pounds per ton.

Tractive Effort in Pounds	Speed in Miles per Hour	Trailing Load in Tons — 0.25% Grade	0.5% Grade	1.0% Grade
30,500	4.6	1950	1445	940
24,500	6.1	1555	1145	740
17,500	8.8	1090	795	505
13,000	12.4	790	570	355

It is permissible, of course, to exert tractive efforts above the continuous rating of the electrical equipment. The only limitation is that the winding temperatures must not exceed safe maximum values.

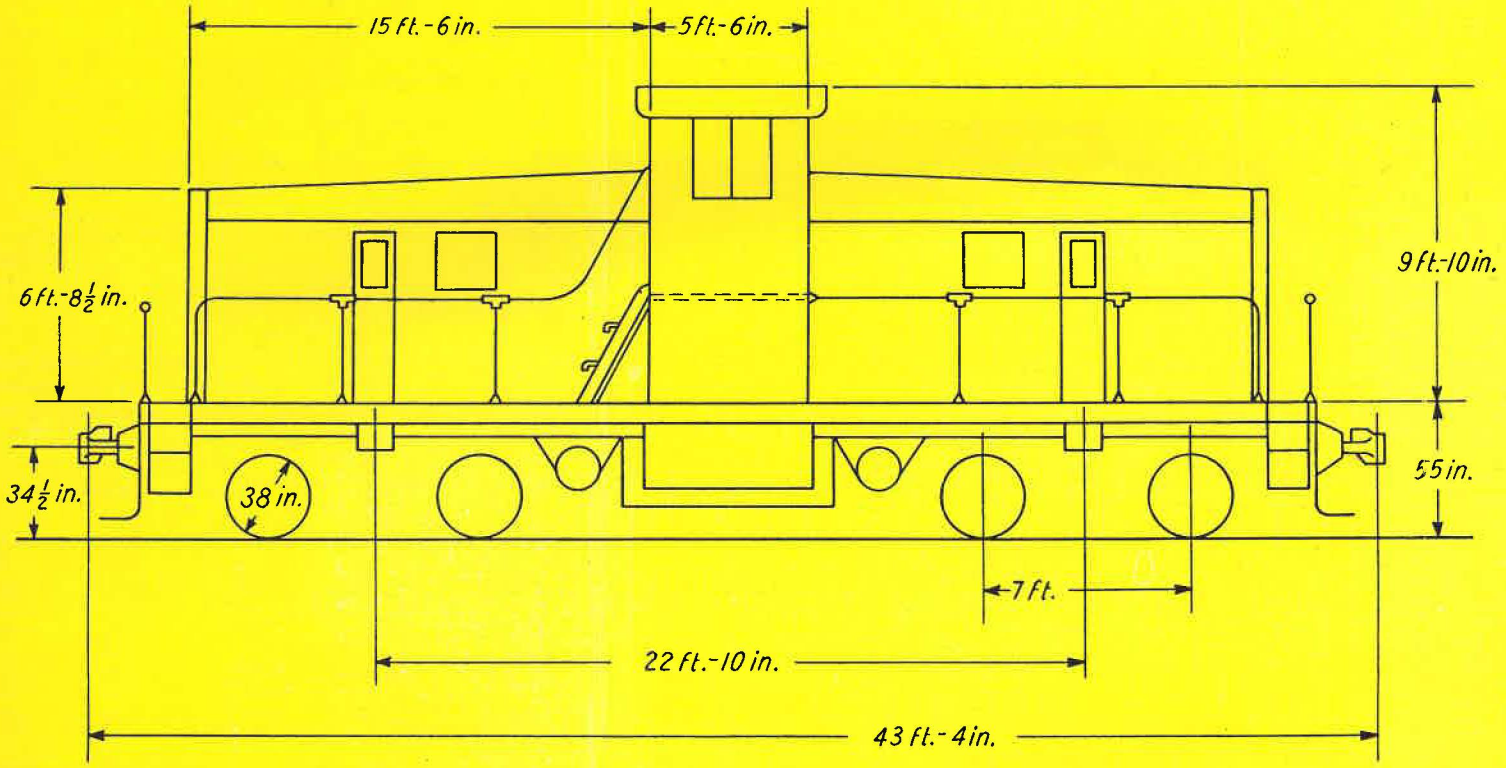
Axles	Hammered steel, 8½ in. diameter at motor gear seat, 7½ in. diameter at motor bearing, journals 6½ in. x 12 in.
Couplers	A.R.A. type, long shank with friction draft gear.

AUXILIARIES

Air Brakes	Westinghouse schedule 14-EL with quick application and release features.
Compressor	Electric driven, 85 cubic foot displacement.
Radiators	Water and lubricating oil, full force ventilation by motor driven fan.
Battery	Exide, 32 cell, 272 ampere-hour.

DIMENSIONS

Length inside coupler knuckles	37 ft. 3¾ in.
Width overall	10 ft. 2 in.
Width inside sheet	10 ft.
Height overall	14 ft. 5 in.
Height, rail to hood	12 ft. 5½ in.
Wheel base, rigid	7 ft.
Wheel base, total	25 ft.
Truck center	18 ft.
Track gauge	4 ft. 8½ in.
Diameter of drivers	38 in.



80 TON • 530 HP.

DOUBLE POWER PLANT

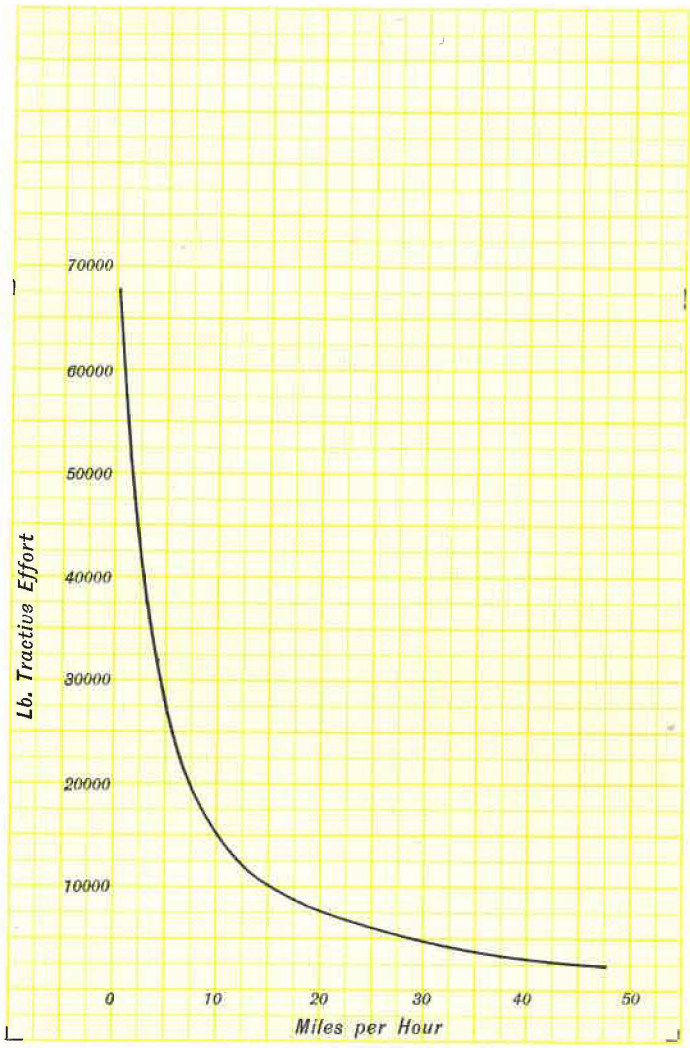
Two 265 hp. engines deliver power to the wheels by electric transmission. All locomotive weight is on drivers.

POWER EQUIPMENT

Engine . .	2—Type 4-F-1, 4-cylinder, 265 hp. each at 900 rpm.
Generator .	2—Type 182 standard railway, Class B insulation, single bearing.
Auxiliary Gen. .	Railway type, Class B insulation, overhung on shaft of main generator.
Traction Motors .	4—Type 584, standard railway, series type, 600 volt, Class B insulation.
Motor Gearing ·	16:70 ratio, Westinghouse BP.
Control . . .	Magnetic and electro-pneumatic, single station, series, parallel, differential.

MECHANICAL PARTS

General . . .	Baldwin, Class B-B, fabricated, swivel trucks, visibility type raised cab, aisles around engine. Power plant removable as unit.
Wheel . . .	Rolled steel, rims 2½ in. x 5½ in. section, Master Car Builders' contour.



SPEED-TRACTIVE EFFORT CURVE

PERFORMANCE

Tractive effort, starting, lb. (30 per cent adhesion)	48,000
Tractive effort, continuous, lb.	14,000
Speed at continuous tractive effort, mph.	10.6
Maximum safe speed, mph.	40
Minimum radius of curvature for locomotive alone, ft.	50
Minimum radius of curvature with trailing load, ft.	175

APPLICATION

This locomotive is suitable for general switching and haulage. The following tabulation shows the trailing loads and speeds on various grades. Resistance is assumed as 10 pounds per ton.

Tractive Effort in Pounds	Speed in Miles per Hour	Trailing Load in Tons		
		0.25% Grade	0.5% Grade	1.0% Grade
30,500	4.5	1950	1445	940
24,500	6.0	1555	1145	740
17,500	8.2	1090	795	505
13,000	11.6	790	570	355

It is permissible, of course, to exert tractive efforts above the continuous rating of the electrical equipment. The only limitation is that the winding temperatures must not exceed safe maximum values.

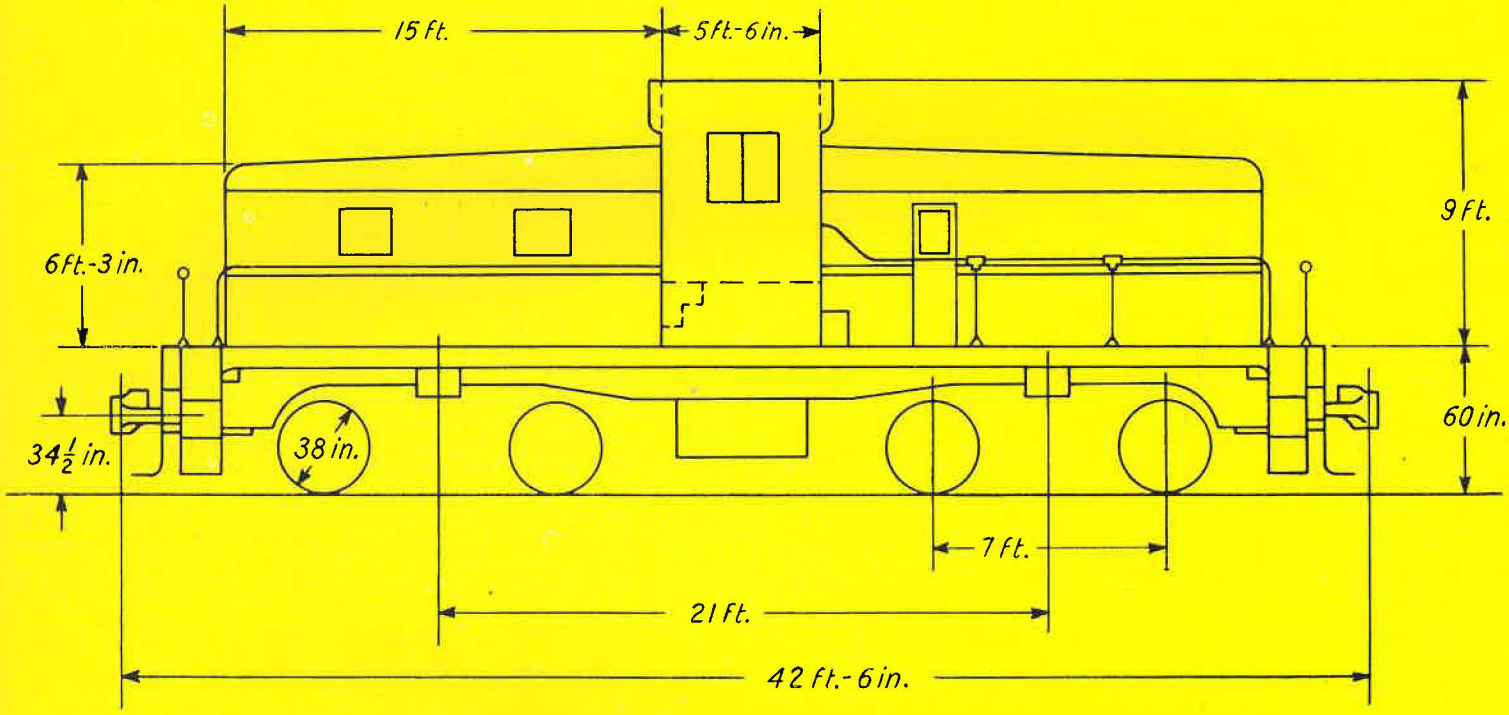
Axles	Hammered steel, 8½ in. diameter at motor gear seat, 7½ in. diameter at motor bearing. Journals 6½ in. x 12 in.
Couplers	A.R.A. type, long shank with friction draft gear.

AUXILIARIES

Air Brakes	Westinghouse schedule 14-EL with quick application and release features.
Compressor	Two direct driven, 148 cubic foot displacement total at full engine speed.
Radiators	Water and lubricating oil, full force ventilation, direct drive.
Battery	Exide, 32 cell, 204 ampere-hour.

DIMENSIONS

Length inside coupler knuckles	43 ft. 4 in.
Width overall	10 ft. 2 in.
Width inside sheet	10 ft.
Height overall	14 ft. 5 in.
Height, rail to hood	12 ft. 5 in.
Wheel base, rigid	7 ft.
Wheel base, total	29 ft. 10 in.
Truck center	22 ft. 10 in.
Track gauge	4 ft. 8½ in.
Diameter of drivers	38 in.



90 TON • 800 HP.

SINGLE POWER PLANT

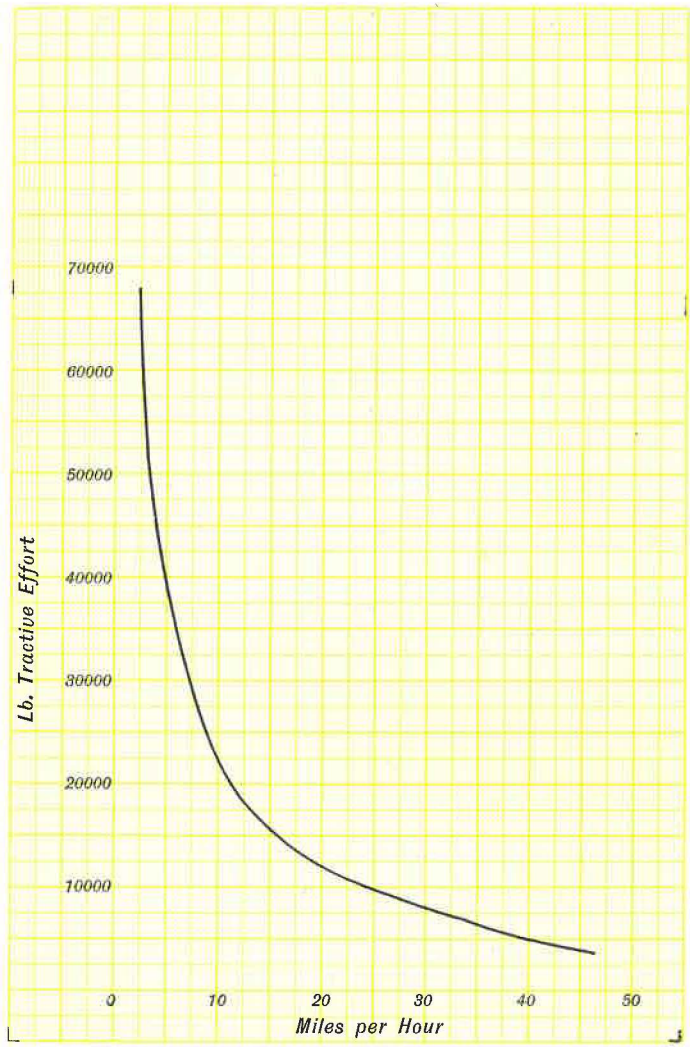
One 800 hp. engine delivers power to the wheels by electric transmission. All locomotive weight is on drivers.

POWER EQUIPMENT

Engine . . .	Type 4-G, 12-cylinder, 800 hp. at 900 rpm. Bedplate cast integral with underframe.
Generator . .	Type 482, standard railway, Class B insulation, single bearing.
Auxiliary Gen. .	Railway type, Class B insulation, overhung on shaft of main generator.
Traction Motors	4—Type 584, standard railway, series type, 600 volts, Class B insulation.
Motor Gearing .	16:70 ratio, Westinghouse BP.
Control . . .	Magnetic and electro-pneumatic, single station, series parallel, parallel, torque.

MECHANICAL PARTS

General . . .	Baldwin, Class B-B, fabricated swivel trucks, visibility type raised cab, cast steel underframe, aisles around engine.
Wheels . . .	Rolled steel, rims 2½ in. x 5½ in. section, Master Car Builders' contour.



SPEED-TRACTIVE EFFORT CURVE

PERFORMANCE

Tractive effort, starting, lb. (30 per cent adhesion)	54,000
Tractive effort, continuous, lb.	14,000
Speed at continuous tractive effort, mph.	17.1
Maximum safe speed, mph.	45
Minimum radius of curvature for locomotive alone, ft.	50
Minimum radius of curvature with trailing load, ft.	175

APPLICATION

This locomotive is suitable for general switching and light haulage. The following tabulation shows the trailing loads and speeds on various grades. Resistance is assumed as 10 pounds per ton.

Tractive Effort in Pounds	Speed in Miles per Hour	Trailing Load in Tons 0.25% Grade	0.5% Grade	1.0% Grade
46,000	4.2	2970	2210	1445
36,500	5.8	2340	1735	1125
25,500	8.8	1610	1185	760
20,000	11.6	1245	910	575

It is permissible, of course, to exert tractive efforts above the continuous rating of the electrical equipment. The only limitation is that the winding temperatures must not exceed safe maximum values.

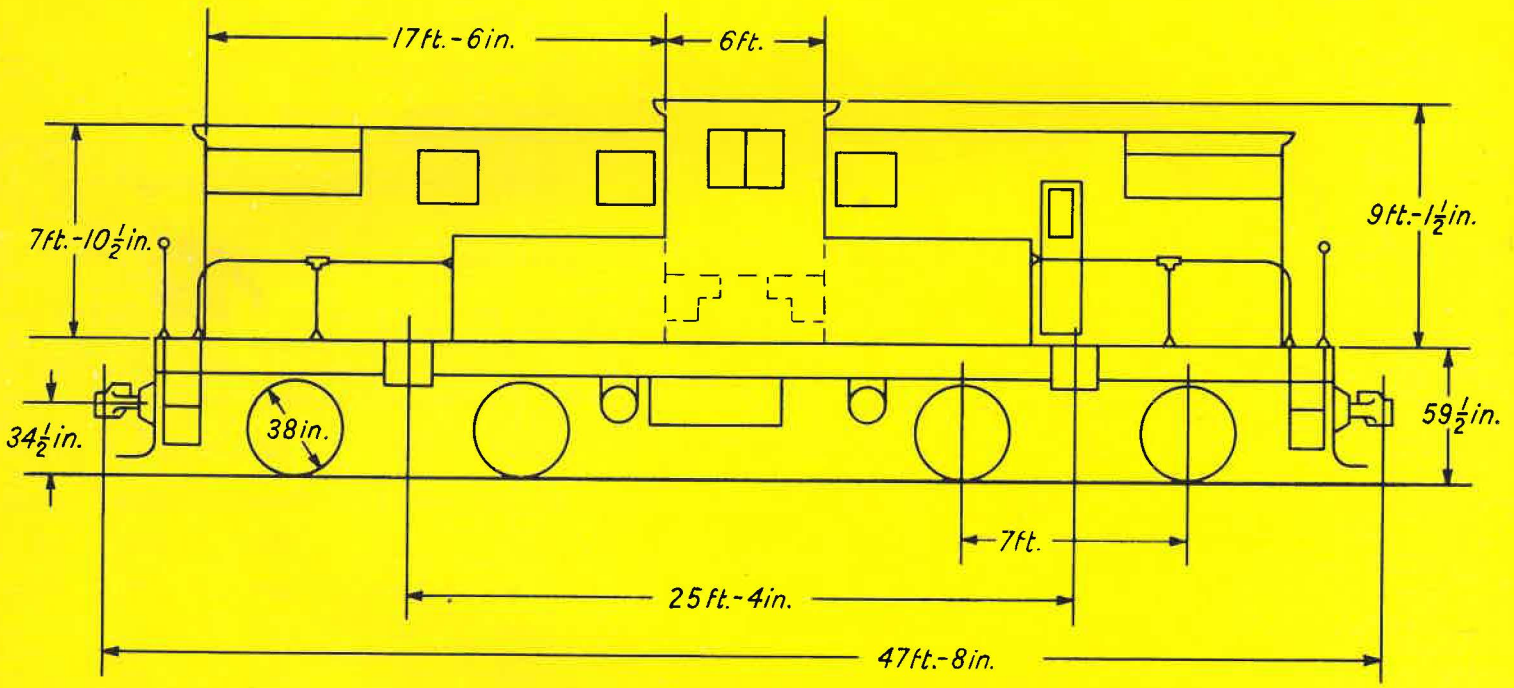
Axles	Hammered steel, 8½ in. diameter at motor gear seat, 7½ in. diameter at motor bearing. Journals 6½ in. x 12 in.
Couplers	A.R.A. type, long shank with friction draft gear.

AUXILIARIES

Air Brakes	Westinghouse schedule 14-EL with quick application and release features.
Compressor	Electric driven, 120 cubic foot displacement.
Radiators	Water and lubricating oil, full force ventilated by motor-driven fan.
Battery	Exide, 54 cell, 204 ampere-hour.

DIMENSIONS

Length inside coupler knuckles	42 ft. 6 in.
Width overall	10 ft. 2½ in.
Width inside sheet	10 ft.
Height overall	14 ft.
Height, rail to hood	11 ft. 11 in.
Wheel base, rigid	7 ft.
Wheel base, total	28 ft.
Truck center	21 ft.
Track gauge	4 ft. 8½ in.
Diameter of drivers	38 in.



90 TON • 800 HP.

DOUBLE POWER PLANT

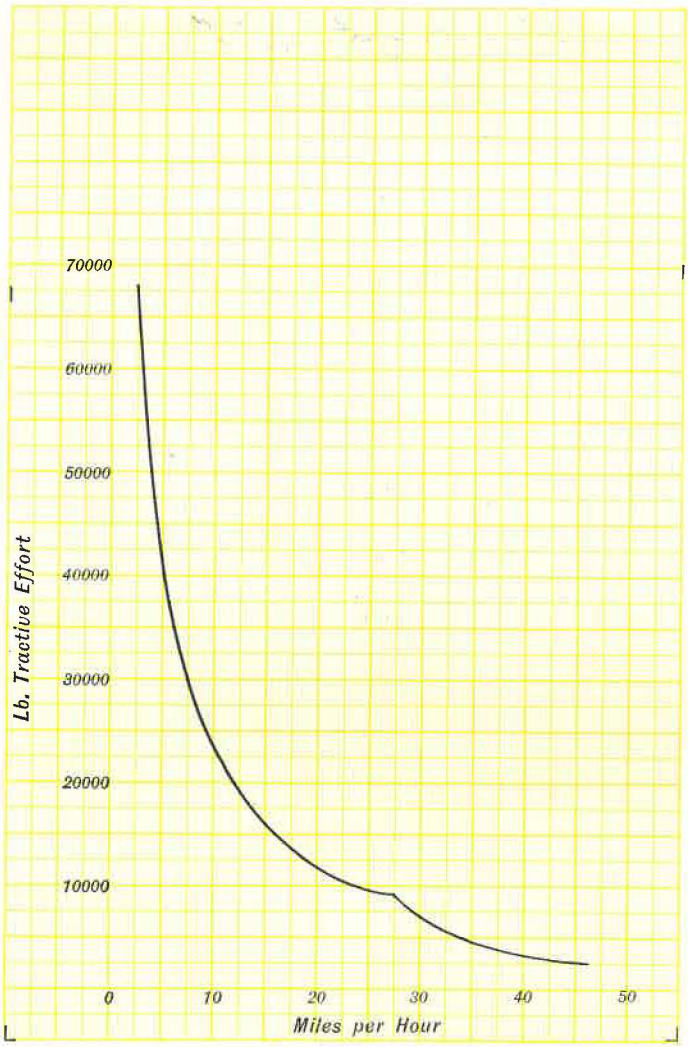
Two 400 hp. engines deliver power to the wheels by electric transmission. All locomotive weight is on drivers.

POWER EQUIPMENT

Engine	2—Type 4-E-2, 6-cylinder, 400 hp. each at 900 rpm.
Generator	2—Type 477 standard railway, Class B insulation, single bearing.
Auxiliary Gen.	Railway type, Class B insulation, overhung on shaft of main generator.
Traction Motors	4—Type 584, standard railway, series type, 600 volts, Class B insulation.
Motor Gearing	16:70 ratio, Westinghouse BP.
Control	Magnetic and electro-pneumatic, single station, series parallel, parallel, torque.

MECHANICAL PARTS

General	Baldwin, Class B-B, fabricated, swivel trucks, visibility type raised cab, aisles around engine.
Wheel	Rolled steel, rims 2½ in. x 5½ in. section, Master Car Builders' contour.



SPEED-TRACTIVE EFFORT CURVE

PERFORMANCE

Tractive effort, starting, lb. (30 per cent adhesion)	54,000
Tractive effort, continuous, lb.	14,000
Speed at continuous tractive effort, mph.	17.2
Maximum safe speed, mph.	45
Minimum radius of curvature for locomotive alone, ft.	50
Minimum radius of curvature with trailing load, ft.	175

APPLICATION

This locomotive is suitable for general switching and haulage. The following tabulation shows the trailing loads and speeds on various grades. Resistance is assumed as 10 pounds per ton.

Tractive Effort in Pounds	Speed in Miles per Hour	—Trailing Load in Tons— 0.25% Grade	0.5% Grade	1.0% Grade
46,000	4.2	2970	2210	1445
36,500	5.8	2340	1735	1125
25,500	9.0	1610	1185	760
20,000	12.0	1245	910	575

It is permissible, of course, to exert tractive efforts above the continuous rating of the electrical equipment. The only limitation is that the winding temperatures must not exceed safe maximum values.

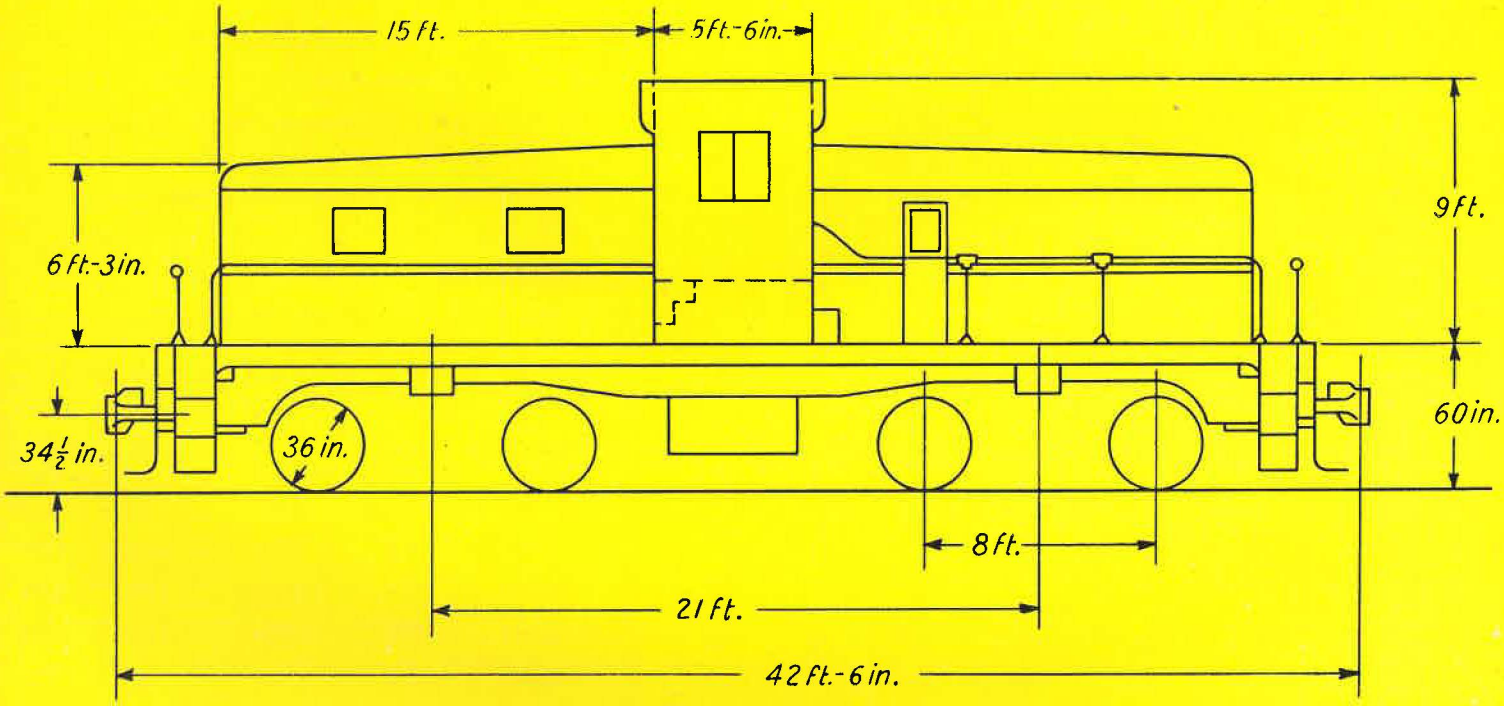
Axles	Hammered steel, 8½ in. diameter at motor gear seat, 7½ in. diameter at motor bearing. Journals 6½ in. x 12 in.
Couplers	A.R.A. type, long shank with friction draft gear.

AUXILIARIES

Air Brakes	Westinghouse schedule 14-EL with quick application and release features.
Compressor	2—Electric driven, 170 cubic foot displacement total.
Radiators	Water and lubricating oil, full force ventilated by motor-driven fan.
Battery	Exide, 32 cell, 204 ampere-hour.

DIMENSIONS

Length inside coupler knuckles	47 ft. 8 in.
Width overall	10 ft. 2 in.
Width inside sheet	10 ft.
Height overall	14 ft. 1 in.
Height, rail to hood	12 ft. 10 in.
Wheel base, rigid	7 ft.
Wheel base, total	32 ft. 4 in.
Truck center	25 ft. 4 in.
Track gauge	4 ft. 8½ in.
Diameter of drivers	38 in.



100 TON • 800 HP.

SINGLE POWER PLANT

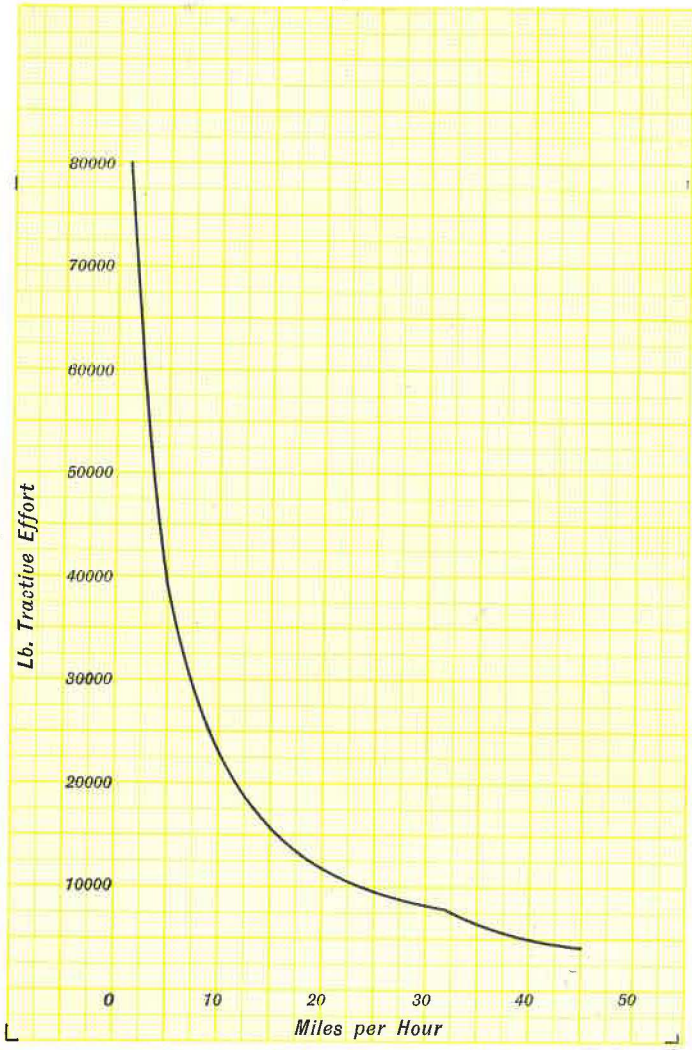
One 800 hp. engine delivers power to the wheels by electric transmission. All locomotive weight is on drivers.

POWER EQUIPMENT

Engine . . .	Type 4-G, 12-cylinder 800 hp. at 900 rpm. Bedplate cast integral with underframe.
Generator . .	Type 482, standard railway, Class B insulation, single bearing.
Auxiliary Gen. .	Railway type, Class B insulation, overhung on shaft of main generator.
Traction Motors.	4—Type 588, standard railway series type. Class B insulation.
Motor Gearing .	16:60 ratio, Westinghouse BP.
Control . . .	Magnetic and electro-pneumatic, single station, series, series parallel, torque.

MECHANICAL PARTS

General . . .	Baldwin, Class B-B, fabricated swivel trucks, cast steel underframe, visibility type raised cab, aisles around engine.
Wheel . . .	Rolled steel, rims 2½ in. x 5½ in. section, Master Car Builders' contour.



SPEED - TRACTIVE EFFORT CURVE

PERFORMANCE

Tractive effort, starting, lb. (30 per cent adhesion)	60,000
Tractive effort, continuous, lb.	20,000
Speed at continuous tractive effort, mph.	11.75
Maximum safe speed, mph.	45
Minimum radius of curvature for locomotive alone, ft.	60
Minimum radius of curvature with trailing load, ft.	175

APPLICATION

This locomotive is suitable for general switching, transfer operations, and haulage. The following tabulation shows the trailing loads and speeds on various grades. Resistance is assumed as 10 pounds per ton.

Tractive Effort in Pounds	Speed in Miles per Hour	Trailing Load in Tons — 0.25% Grade	0.5% Grade	1.0% Grade
43,000	4.5	2770	2050	1335
36,500	5.8	2330	1725	1120
26,000	9.0	1635	1200	770
19,500	12.0	1200	875	550

It is permissible, of course, to exert tractive efforts above the continuous rating of the electrical equipment. The only limitation is that the winding temperatures must not exceed safe maximum values.

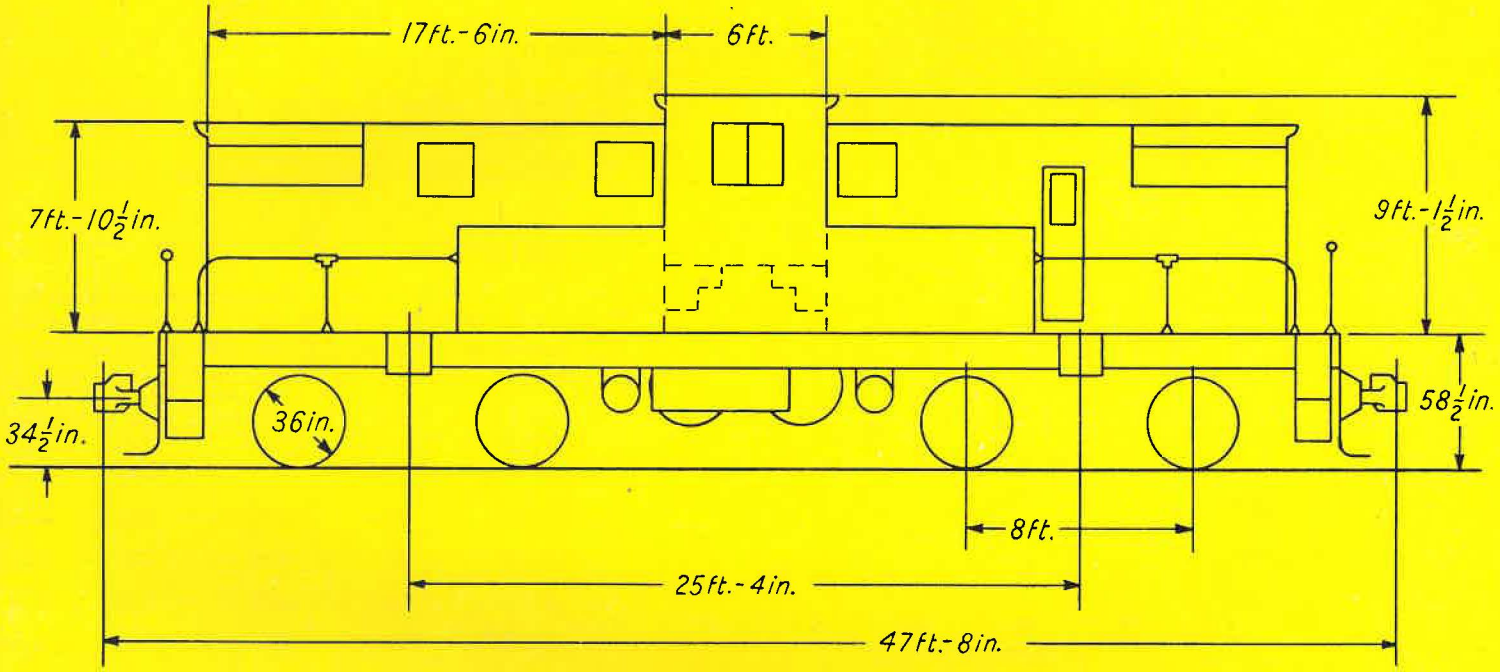
Axles	Hammered steel, 9⅜ in. diameter at motor gear seat, 8 in. diameter at motor bearings. Journals 7 in. x 13 in.
Couplers	A.R.A. type, long shank with friction draft gear.

AUXILIARIES

Air Brakes	Westinghouse schedule 14-EL with quick application and release features.
Compressor	Electric driven, 120 cubic foot displacement.
Radiators	Water and lubricating oil, full force ventilated by motor-driven fan.
Battery	Exide, 54 cell, 204 ampere-hour.

DIMENSIONS

Length inside coupler knuckles	42 ft. 6 in.
Width overall	10 ft. 2½ in.
Width inside sheet	10 ft.
Height overall	14 ft.
Height, rail to hood	11 ft. 11 in.
Wheel base, rigid	8 ft.
Wheel base, total	29 ft.
Truck center	21 ft.
Track gauge	4 ft. 8½ in.
Diameter of drivers	36 in.



100 TON • 800 HP.

DOUBLE POWER PLANT

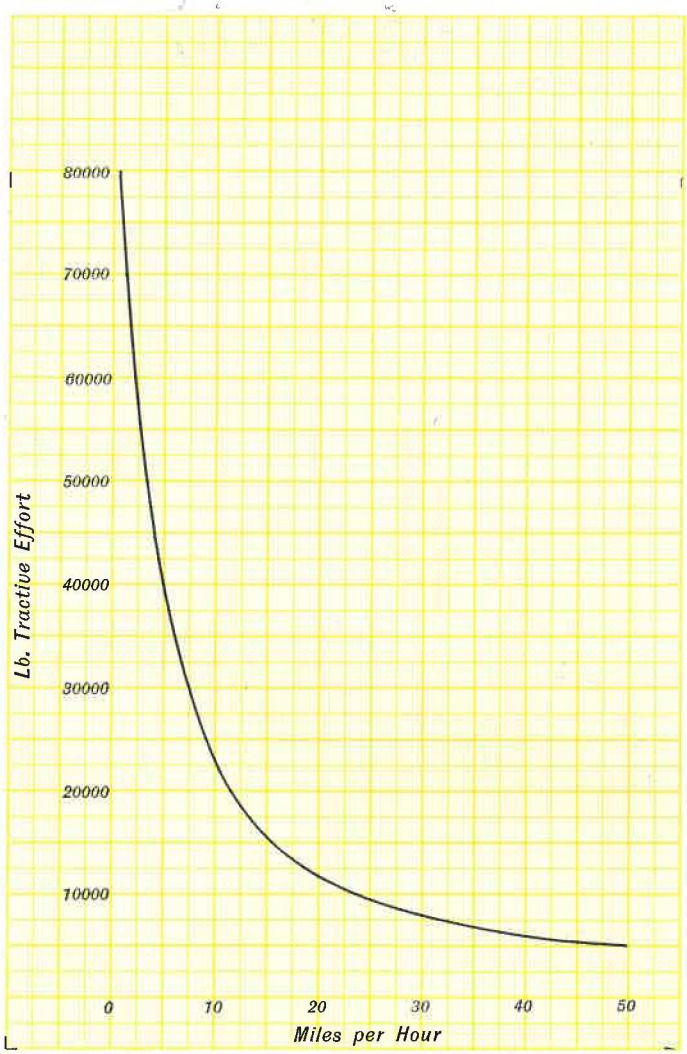
Two 400 hp. engines deliver power to the wheels by electric transmission. All locomotive weight is on drivers.

POWER EQUIPMENT

Engine	2—Type 4-E-2, 6-cylinder, 400 hp. each at 900 rpm.
Generator	2—Type 477, standard railway, Class B insulation, single bearing.
Auxiliary Gen.	Railway type, Class B insulation, overhung on shaft of main generator.
Traction Motors	4—Type 588, standard railway, series type, Class B insulation.
Motor Gearing	16:60 ratio, Westinghouse BP.
Control	Magnetic and electro-pneumatic, single station, series, parallel, torque.

MECHANICAL PARTS

General	Baldwin, Class B-B, fabricated, swivel trucks visibility type raised cab, aisles around engine.
Wheel	Rolled steel, rims 2½ in. x 5½ in. section, Master Car Builders' contour.



SPEED-TRACTIVE EFFORT CURVE

PERFORMANCE

Tractive effort, starting, lb. (30 per cent adhesion)	60,000
Tractive effort, continuous, lb.	20,000
Speed at continuous tractive effort, mph.	11.70
Maximum safe speed, mph.	45
Minimum radius of curvature for locomotive alone, ft.	60
Minimum radius of curvature with trailing load, ft.	175

APPLICATION

This locomotive is suitable for general switching, transfer operations, and haulage. The following tabulation shows the trailing loads and speeds on various grades. Resistance is assumed as 10 pounds per ton.

Tractive Effort in Pounds	Speed in Miles per Hour	Trailing Load in Tons — 0.25% Grade	0.5% Grade	1.0% Grade
43,000	4.5	2770	2050	1335
36,500	5.8	2330	1725	1120
26,000	9.0	1635	1200	770
19,500	12.0	1200	875	550

It is permissible, of course, to exert tractive efforts above the continuous rating of the electrical equipment. The only limitation is that the winding temperatures must not exceed safe maximum values.

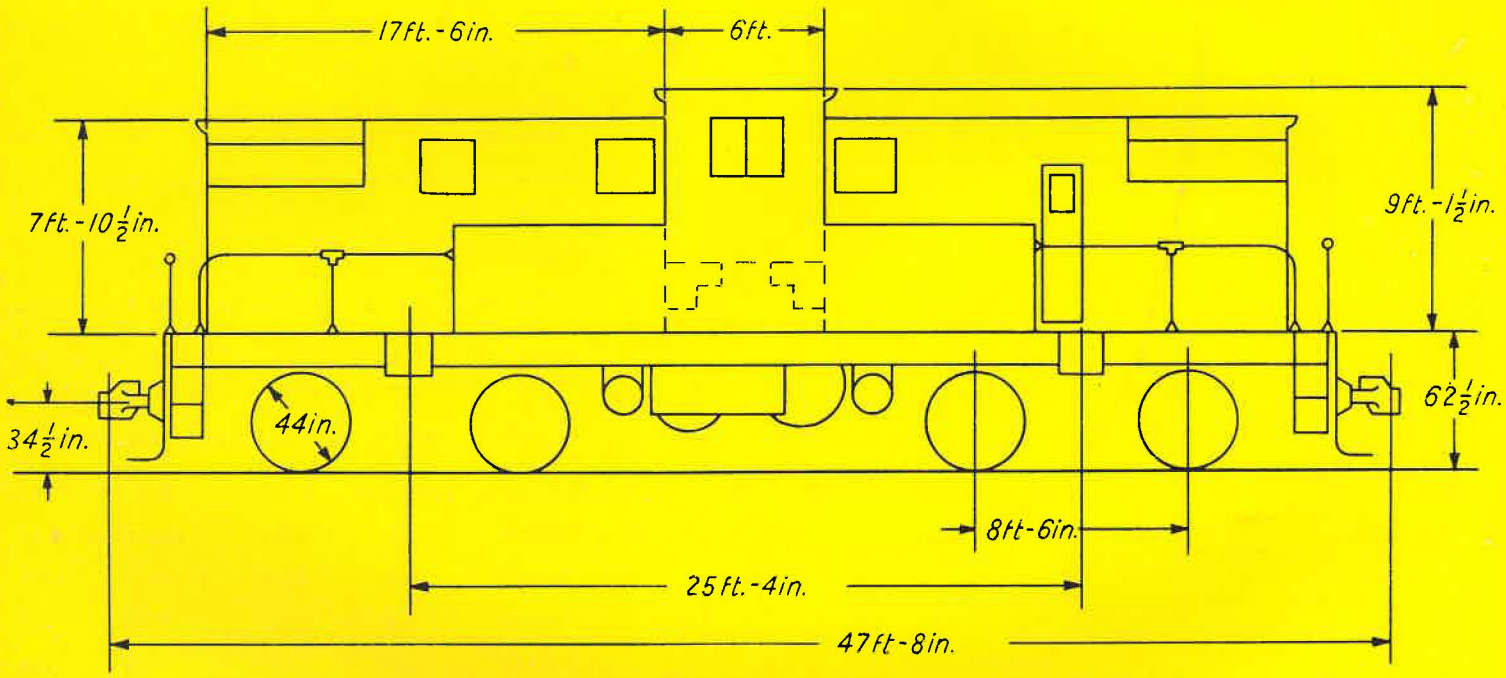
Axles	Hammered steel, 9⅜ in. diameter at motor gear seat, 8 in. diameter at motor bearing. Journals 7 in. x 13 in.
Couplers	A.R.A. type, long shank with friction draft gear.

AUXILIARIES

Air Brakes	Westinghouse schedule 14-EL with quick application and release features.
Compressor	Electric driven, 170 cubic foot displacement total at full engine speed.
Radiators	Water and lubricating oil, full force ventilation by motor driven fan.
Battery	Exide, 32 cell, 204 ampere-hour.

DIMENSIONS

Length inside coupler knuckles	47 ft.	8 in.
Width overall	10 ft.	2 in.
Width inside sheet	10 ft.	
Height overall	14 ft.	
Height, rail to hood	12 ft.	9 in.
Wheel base, rigid	8 ft.	
Wheel base, total	33 ft.	4 in.
Truck center	25 ft.	4 in.
Track gauge	4 ft.	8½ in.
Diameter of drivers		36 in.



115 TON • 800 HP.

DOUBLE POWER PLANT

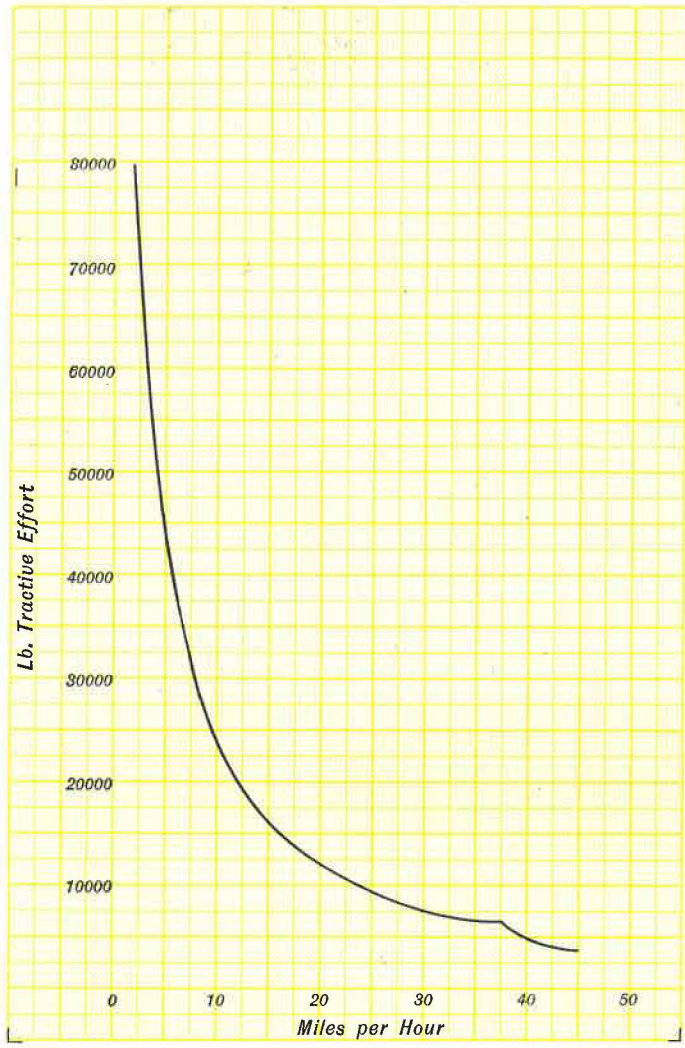
Two 400 hp. engines deliver power to the wheels by electric transmission. All locomotive weight is on drivers.

POWER EQUIPMENT

Engine . . .	2—Type 4-E-2, 6-cylinder, 400 hp. each at 900 rpm.
Generator . .	2—Type 477 standard railway, Class B insulation, single bearing.
Auxiliary Gen. . .	2—Railway type, Class B insulation, overhung on shaft of main generator.
Traction Motors.	4—Type 360, standard railway, series type, Class B insulation, force ventilated.
Motor Gearing .	16:67 ratio, Westinghouse BP.
Control . . .	Magnetic and electro-pneumatic, single station, series parallel, parallel, torque.

MECHANICAL PARTS

General . . .	Baldwin, Class B-B, fabricated, swivel trucks, visibility type raised cab, aisles around engine.
Wheel . . .	Steel tire with cast steel center, tire 3 in. x 5½ in. section, Master Car Builders' contour.



SPEED - TRACTIVE EFFORT CURVE

PERFORMANCE

Tractive effort, starting, lb. (30 per cent adhesion)	69,000
Tractive effort, continuous, lb.	23,000
Speed at continuous tractive effort, mph.	10.2
Maximum safe speed, mph.	45
Minimum radius of curvature for locomotive alone, ft.	75
Minimum radius of curvature with trailing load, ft.	175

APPLICATION

This locomotive is suitable for general switching heavy transfer work and haulage. The following tabulation shows the trailing loads possible and speeds on various grades. Resistance is assumed as 10 pounds per ton.

Tractive Effort in Pounds	Speed in Miles per Hour	Trailing Load in Tons 0.25% Grade	0.5% Grade	1.0% Grade
46,500	4.5	2995	2210	1435
37,500	6.0	2385	1755	1135
25,500	9.0	1585	1160	735
20,000	12.0	1218	885	552
12,500	20.0	720	510	300

It is permissible, of course, to exert tractive efforts above the continuous rating of the electrical equipment. The only limitation is that the winding temperatures must not exceed safe maximum values.

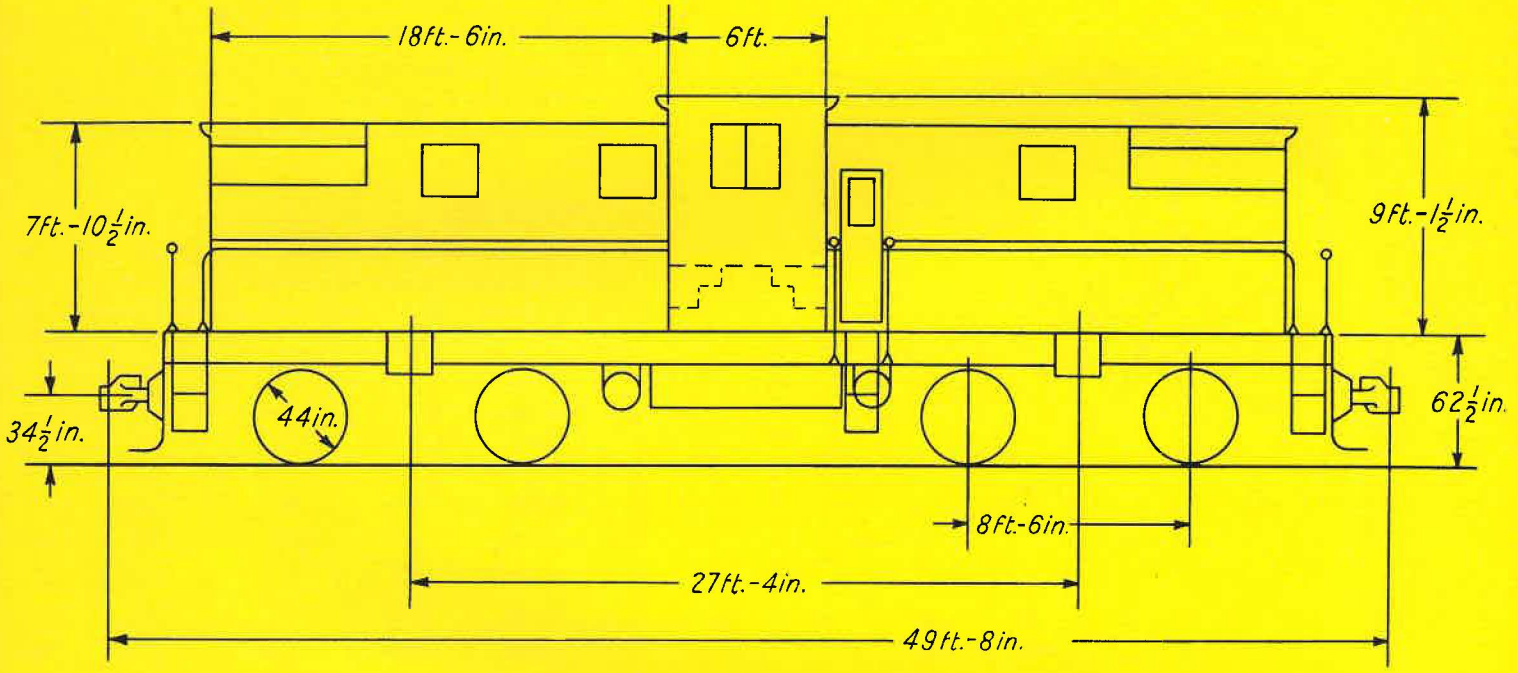
Axles	Hammered steel, 9⅜ in. diameter at motor gear seat, 8 in. diameter at motor bearings. Journals 7 in. x 13 in.
Couplers	A.R.A. type, long shank with friction draft gear.

AUXILIARIES

Air Brakes	Westinghouse schedule 14-EL with quick application and release features.
Compressor	2—Electric driven, 170 cubic foot displacement total.
Radiators	Water and lubricating oil, full force ventilated by motor-driven fan.
Battery	Exide, 32 cell, 204 ampere-hour.

DIMENSIONS

Length inside coupler knuckles	47 ft. 8 in.
Width overall	10 ft. 2 in.
Width inside sheet	10 ft.
Height overall	14 ft. 4 in.
Height, rail to hood	13 ft. 1 in.
Wheel base, rigid	8 ft. 6 in.
Wheel base, total	33 ft. 10 in.
Truck center	25 ft. 4 in.
Track gauge	4 ft. 8½ in.
Diameter of drivers	44 in.



115 TON • 1060 HP.

DOUBLE POWER PLANT

Two 530 hp. engines deliver power to the wheels by electric transmission. All locomotive weight is on drivers.

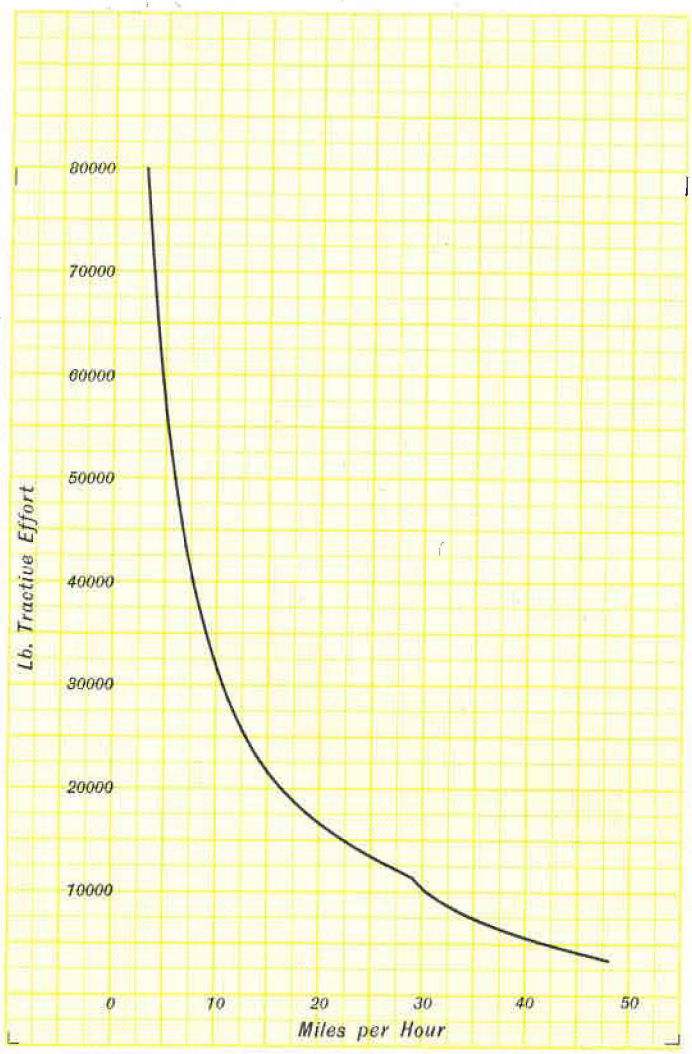
POWER EQUIPMENT

Engine	2—Type 4-H, 8-cylinder, 530 hp. each at 900 rpm.
Generator	2—Type 477, standard railway, Class B insulation, single bearing.
Auxiliary Gen.	Railway type, Class B insulation, overhung on shaft of main generator.
Traction Motors	4—Type 360, standard railway, series type, Class B insulation.
Motor Gearing	16:67 ratio, Westinghouse BP.
Control	Magnetic and electro-pneumatic, single station, series, parallel, torque.

MECHANICAL PARTS

General	Baldwin, Class B-B, fabricated, swivel trucks, visibility type raised cab, aisles around engine.
Wheel	Steel tire with cast steel center, tire 3 in. x 5½ in. section, Master Car Builders' contour.

TRIC LOCOMOTIVES



SPEED - TRACTIVE EFFORT CURVE

PERFORMANCE

Tractive effort, starting, lb. (30 per cent adhesion)	69,000
Tractive effort, continuous, lb.	23,000
Speed at continuous tractive effort, mph.	13.8
Maximum safe speed, mph.	45
Minimum radius of curvature for locomotive alone, ft.	75
Minimum radius of curvature with trailing load, ft.	175

APPLICATION

This locomotive is suitable for general switching, heavy transfer work, and haulage. The following tabulation shows the trailing loads and speeds on various grades. Resistance is assumed as 10 pounds per ton.

Tractive Effort in Pounds	Speed in Miles per Hour	Trailing Load in Tons — 0.25% Grade	0.5% Grade	1.0% Grade
46,500	6.5	2995	2210	1435
37,500	8.2	2385	1755	1135
25,500	12.5	1585	1160	735
20,000	16.0	1218	885	552
12,500	26.0	720	510	300

It is permissible, of course, to exert tractive efforts above the continuous rating of the electrical equipment. The only limitation is that the winding temperatures must not exceed safe maximum values.

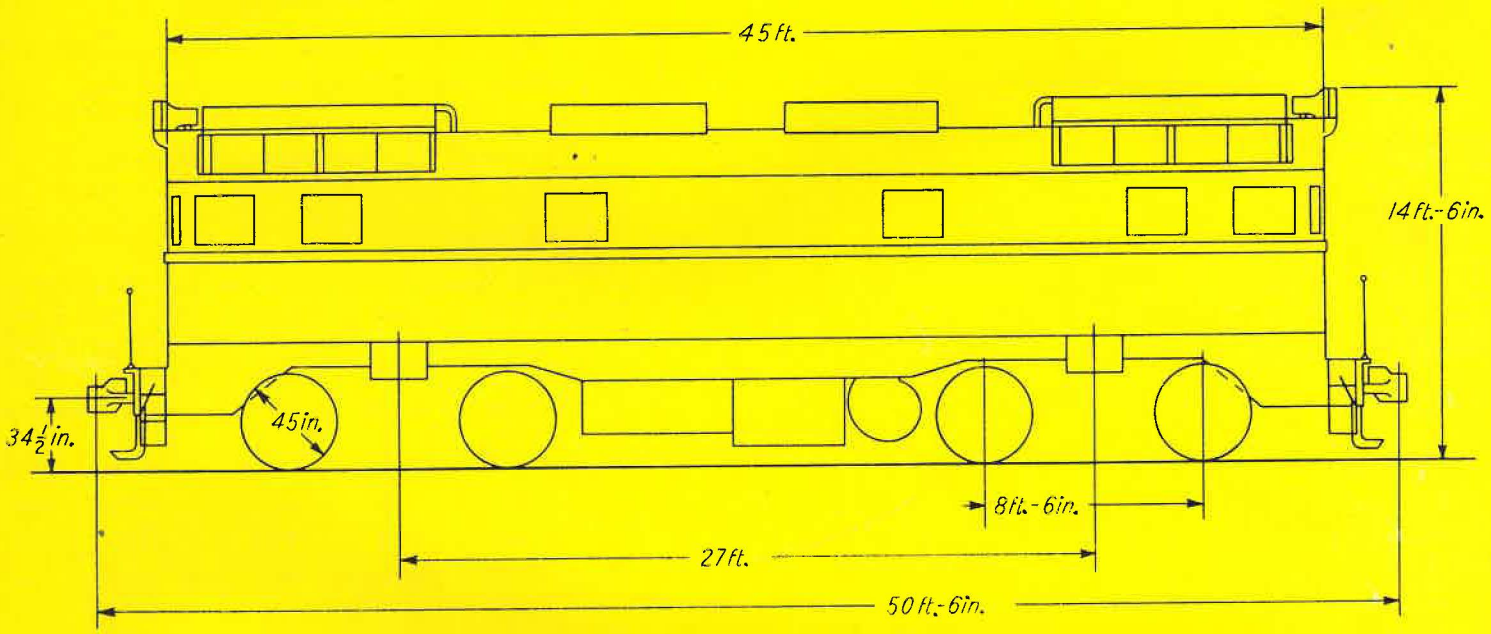
Axles	Hammered steel, 9⅜ in. diameter at motor gear seat, 8 in. diameter at motor bearing. Journals 7 in. x 13 in.
Couplers	A. R. A. type, long shank with friction draft gear.

AUXILIARIES

Air Brakes	Westinghouse schedule 14-EL with quick application and release features.
Compressor	2—Electric driven, 170 cubic foot displacement total.
Radiators	Water and lubricating oil, full force ventilation by motor driven fan.
Battery	Exide, 32 cell, 272 ampere-hour.

DIMENSIONS

Length inside coupler knuckles	49 ft.	8 in.
Width overall	10 ft.	2 in.
Width inside sheet	10 ft.	
Height overall	14 ft.	4 in.
Height, rail to hood	13 ft.	1 in.
Wheel base, rigid	8 ft.	6 in.
Wheel base, total	35 ft.	10 in.
Truck center	27 ft.	4 in.
Track gauge	4 ft.	8½ in.
Diameter of drivers		44 in.



133 TON • 1600 HP.

DOUBLE POWER PLANT

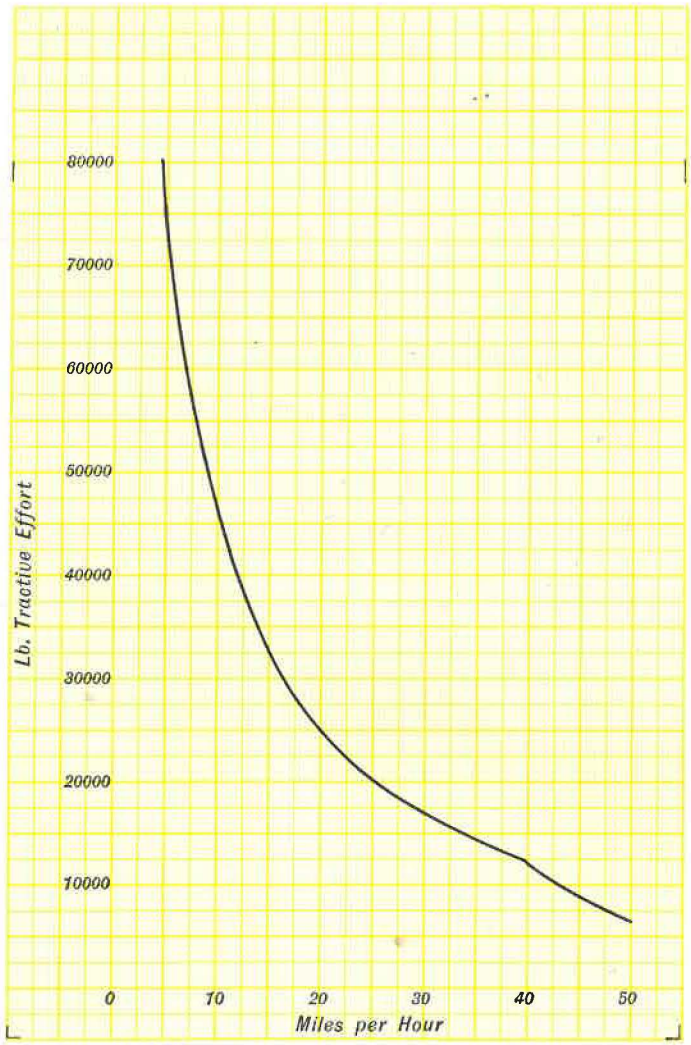
Two 800 hp. engines deliver power to the wheels by electric transmission. All locomotive weight is on drivers.

POWER EQUIPMENT

Engine . . .	2—Type 4-G, 12-cylinder, 800 hp. each at 900 rpm.
Generator . .	2—Type 482, standard railway, Class B insulation, single bearing.
Auxiliary Gen. .	Railway type, Class B insulation, overhung on shaft of main generator.
Traction Motors.	4—Type 360-BN, standard railway series type, Class B insulation, force ventilated.
Motor Gearing .	17:66 ratio, Westinghouse BP.
Control . . .	Magnetic and electro-pneumatic, series parallel, parallel, torque, double end.

MECHANICAL PARTS

General . . .	Baldwin, Class B-B, fabricated swivel trucks, cast steel integral type underframe, box type double end cab, aisles around engine.
Wheel . . .	Steel tire with cast steel center, tire 3½ in. x 5½ in. section, Master Car Builders' contour.



SPEED - TRACTIVE EFFORT CURVE

PERFORMANCE

Tractive effort, starting, lb. (30 per cent adhesion)	80,000
Tractive effort, continuous, lb.	24,000
Speed at continuous tractive effort, mph.	20.8
Maximum safe speed, mph.	50
Minimum radius of curvature for locomotive alone, ft.	75
Minimum radius of curvature with trailing load, ft.	200

APPLICATION

This locomotive is suitable for general switching, heavy transfer work, and main line haulage. The following tabulation shows the trailing loads and speeds on various grades. Resistance is assumed as 10 pounds per ton.

Tractive Effort in Pounds	Speed in Miles per Hour	—Trailing Load in Tons— 0.25% Grade	0.5% Grade	1.0% Grade
60,000	7	3867	2867	1867
46,000	10	2937	2167	1402
32,500	15	2037	1492	952
25,000	20	1532	1117	700
20,000	25	1200	867	533
17,000	30	1000	717	433
12,500	40	702	492	284

It is permissible, of course, to exert tractive efforts above the continuous rating of the electrical equipment. The only limitation is that the winding temperatures must not exceed safe maximum values.

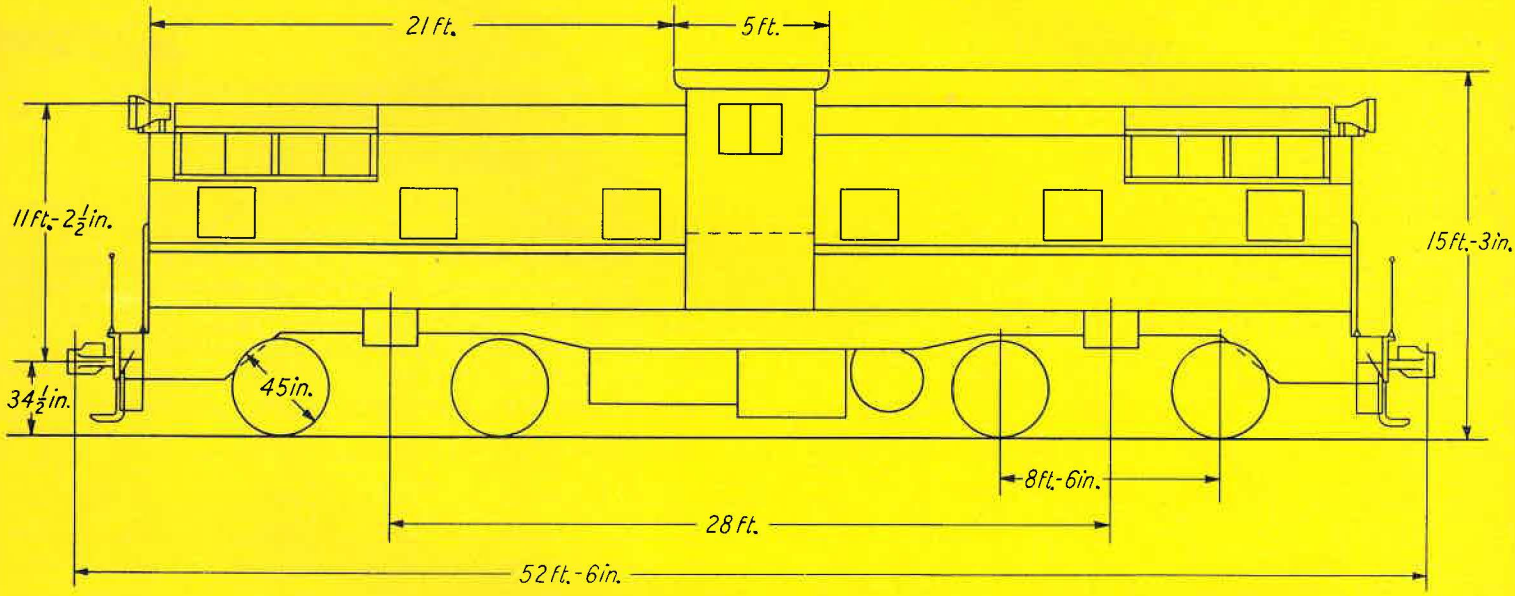
Axles	Hammered steel, 9½ in. diameter at motor gear seat, 9 in. diameter at motor bearings. Journals 8 in. x 14 in.
Couplers	A.R.A. type, swivel butt shank with friction draft gear.

AUXILIARIES

Air Brakes	Westinghouse schedule 8-ET double end.
Compressor	2—Electric driven, 240 cu. ft. displacement total.
Radiators	Water and lubricating oil, full force ventilated by motor-driven fan.
Battery	Exide, 54 cell, 204 ampere-hour.
Miscellaneous	One pneuphonic air horn supplied at each end, one standard bell.

DIMENSIONS

Length inside coupler knuckles	50 ft.	6 in.
Width overall	10 ft.	7 in.
Width inside sheet	10 ft.	
Height overall	14 ft.	6 in.
Height, rail to hood	13 ft.	2 in.
Wheel base, rigid	8 ft.	6 in.
Wheel base, total	35 ft.	6 in.
Truck center	27 ft.	
Track gauge	4 ft.	8½ in.
Diameter of drivers		45 in.



133 TON • 1600 HP.

DOUBLE POWER PLANT

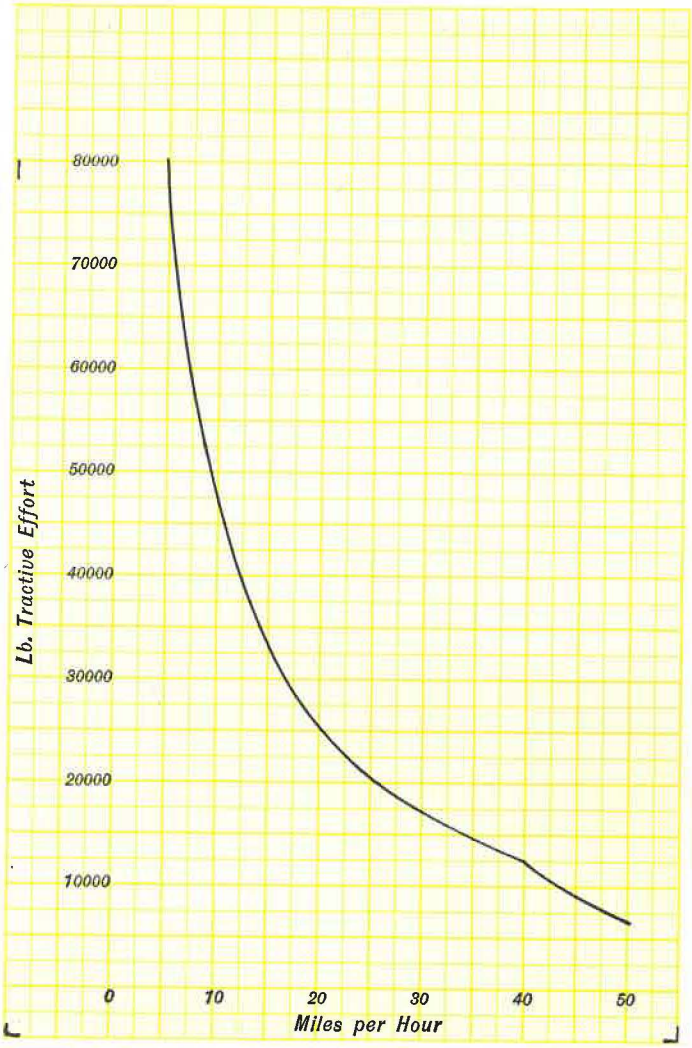
Two 800 hp. engines deliver power to the wheels by electric transmission. All locomotive weight is on drivers.

POWER EQUIPMENT

Engine	2—Type 4-G, 12-cylinder, 800 hp. each at 900 rpm.
Generator	2—Type 482, railway, Class B insulation, single bearing.
Auxiliary Gen.	Railway type, Class B insulation, overhung, on shaft of main generator.
Traction Motors	4—Type 360-BN, standard railway, series type, Class B insulation, force ventilated.
Motor Gearing	17:66 ratio, Westinghouse BP.
Control	Magnetic and electro-pneumatic, single station, series parallel, parallel, torque.

MECHANICAL PARTS

General	Baldwin Class B-B, fabricated swivel trucks, cast steel integral underframe, visibility type raised cab, aisles around engine. Power plant removable through roof.
Wheel	Steel tire with cast steel center, tire 3½ in. x 5½ in. section, Master Car Builders' contour.



SPEED-TRACTIVE EFFORT CURVE

PERFORMANCE

Tractive effort, starting, lb. (30 per cent adhesion)	80,000
Tractive effort, continuous, lb.	24,000
Speed at continuous tractive effort, mph.	20.8
Maximum safe speed, mph.	50
Minimum radius of curvature for locomotive alone, ft.	75
Minimum radius of curvature with trailing load, ft.	200

APPLICATION

This locomotive is suitable for general switching, heavy transfer and main line haulage. The following tabulation shows the trailing loads and speeds on various grades. Resistance is assumed as 10 pounds per ton.

Tractive Effort in Pounds	Speed in Miles per Hour	Trailing Load in Tons— 0.25% Grade	0.50% Grade	1.0% Grade
60,000	7	3867	2867	1867
46,000	10	2937	2167	1402
32,500	15	2037	1492	952
25,000	20	1532	1117	700
20,000	25	1200	867	533
17,000	30	1000	717	433
12,500	40	702	492	284

It is permissible, of course, to exert tractive efforts above the continuous rating of the electrical equipment. The only limitation is that the winding temperature must not exceed safe maximum values.

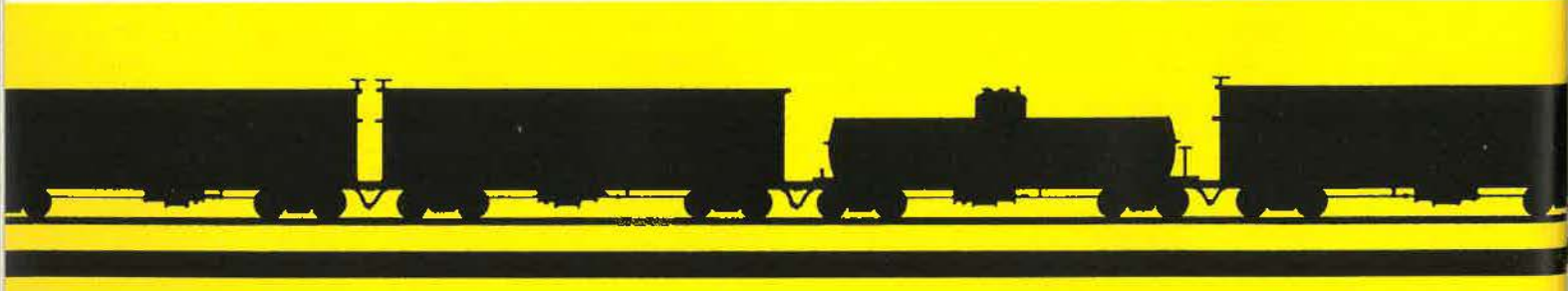
Axles	Hammered steel, 9½ in. diameter at motor gear seat, 9 in. diameter at motor bearing. Journals 8 in. x 14 in.
Couplers	A.R.A. type, swivel butt shank with friction draft gear.

AUXILIARIES

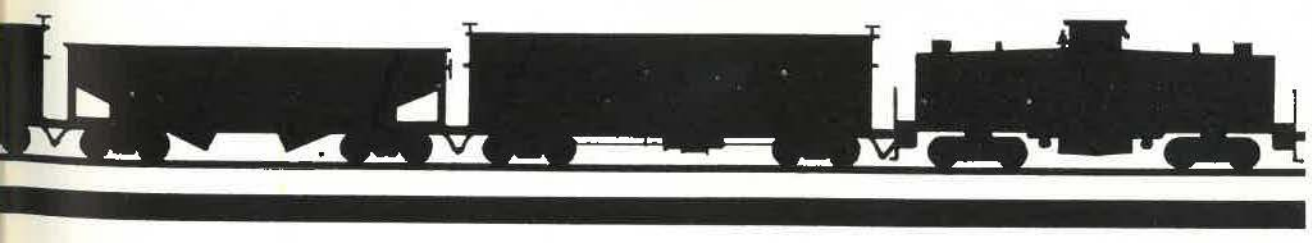
Air Brakes	Westinghouse schedule 14-A.
Compressor	2—Electric-driven, 240 cu. ft. displacement total.
Radiators	Water and lubricating oil, full force ventilated by motor-driven fan.
Battery	Exide, 54 cell, 204 ampere-hour.
Miscellaneous	One pneuphonic air horn supplied at each end, one standard bell.

DIMENSIONS

Length inside coupler knuckles	52 ft.	6 in.
Width overall	10 ft.	7 in.
Width inside sheet	10 ft.	
Height overall	15 ft.	3 in.
Height, rail to hood	14 ft.	1 in.
Wheel base, rigid	8 ft.	6 in.
Wheel base, total	36 ft.	6 in.
Truck center	28 ft.	
Track gauge	4 ft.	8½ in.
Diameter of drivers		45 in.



WESTINGHOUSE DIESEL ELECTRIC LOCOMOTIVES IN SERVICE



The first Westinghouse Diesel Electric Locomotives were placed in service in 1928 on the Long Island Railroad, and in yard service at the Westinghouse Plant at East Pittsburgh. Many other locomotives have been built since then by the Westinghouse Electric and Manufacturing Company, and these have enviable records of reliable low cost performance.

The following pages illustrate and list the most important data on these locomotives. Among the various types of service in which Westinghouse locomotives have operated are:

- Steel mill general switching, open hearth charging, transfer, ingot handling, mill switching, blast furnace material handling and slag dumping.
- General switching at cement mills, classification service, material handling, and heavy short road haulage.
- Passenger terminal switching as an adjunct to electrified terminal operation.
- General switching at large industrial manufacturing plants.
- Freight classification and general yard switching.
- Freight transfer work.
- Switching such as operations at produce terminals.

RELIABLE LOW-COST MOTIVE POWER

55 TON • 300 HP.
DIESEL ELECTRIC LOCOMOTIVE

WESTINGHOUSE ELECTRIC, PHILADELPHIA, PA.

DESCRIPTION OF OPERATION

Placed in service in 1931. Switches at large manufacturing plant specializing in heavy steam electric power plant apparatus, marine equipment and locomotives.

PERFORMANCE

Tractive effort, starting, lb. (30 per cent adhesion)	33,000
Tractive effort, continuous, lb.	9,800
Speed at continuous tractive effort, mph.	9.3
Maximum safe speed, mph.	40
Minimum radius of curvature for locomotive alone, ft.	50
Minimum radius of curvature with trailing load, ft.	150

WESTINGHOUSE POWER EQUIPMENT

Engine	1—6 cylinder, Diesel, 8¼ x 12, 300 hp., 800 rpm.
Generator	1—Type 183-B-2, 210 kw., 500 volts d-c.
Auxiliary Generator	1—Type YG-15-A-2
Traction Motors	4—Type 562-E-6, 600 volts
Motor Gearing	16:61 ratio
Control	Electro-pneumatic, dual, series-parallel, parallel, torque.

MECHANICAL PARTS	Westinghouse	Class B-B, fabricated, welded, visibility type raised cab, aisles around engine.
AUXILIARIES		
Air Brakes	Westinghouse	Schedule 14-EL, straight and automatic.
Compressors	Westinghouse	2—Type DH-25, displace, 25 cu. ft. per min each.
Radiators		Water and lubricating oil, force ventilated by motor driven fan, automatic control.
Battery	Exide	32 cells, 204 ampere-hour.

DIMENSIONS

Track gauge	4 ft. 8½ in.
Length inside coupler knuckles	31 ft. 11¾ in.
Width, overall	10 ft. 2 in.
Height, overall	14 ft. 4 in.
Wheel base, rigid (truck)	6 ft. 8 in.
Wheel base, total	22 ft. 8 in.
Wheel diameter	33 in.

58 TON • 300 HP.
DIESEL ELECTRIC LOCOMOTIVE

WESTERN ELECTRIC COMPANY, BALTIMORE, MARYLAND

DESCRIPTION OF OPERATION

Placed in service in 1929. General switching at large manufacturing plant.

PERFORMANCE

Tractive effort, starting, lb. (30 per cent adhesion)	34,800
Tractive effort, continuous, lb.	9,800
Speed at continuous tractive effort, mph.	9.2
Maximum safe speed, mph.	40
Minimum radius of curvature for locomotive alone, ft.	50
Minimum radius of curvature with trailing load, ft.	225

WESTINGHOUSE POWER EQUIPMENT

Engine	1—6 cylinder, Diesel, 8¼ x 12, 300 hp., 800 rpm.
Generator	1—Type 477-B, 210 kw., 600 volts d-c.
Auxiliary Generator	1—Type YG-15
Traction Motors	4—Type 562-E-6, 600 volts
Motor Gearing	16:61 ratio
Control	Electro-pneumatic, double end, series-parallel, parallel, torque governor.

MECHANICAL PARTS	Baldwin	Class B-B, fabricated, swivel trucks, box type cab, engine room with aisles.

AUXILIARIES

Air Brakes	Westinghouse	Schedule 14-EL, straight and automatic.
Compressors	Westinghouse	2—Type DH-20, displace 20 cu. ft. per min. each.
Radiators		Water and lubricating oil, force ventilated by motor driven fan, automatic control.
Battery	Exide	32 cell, 204 ampere-hour.

DIMENSIONS

Track gauge	4 ft. 8½ in.
Length inside coupler knuckles	30 ft. 2 in.
Width, overall	10 ft. 9½ in.
Height, overall	13 ft. 8½ in.
Wheel base, rigid (truck)	6 ft. 8 in.
Wheel base, total	22 ft. 8 in.
Wheel diameter	33 in.

63 TON • 300 HP.
DIESEL ELECTRIC LOCOMOTIVE

OPERATED BY LARGE STEEL PLANT, SOUTH CHICAGO, ILLINOIS

DESCRIPTION OF OPERATION

Locomotive placed in service in 1930. Large steel plant switching.

PERFORMANCE

Tractive effort, starting, lb. (30 per cent adhesion)	37,800
Tractive effort, continuous, lb. 17,700 force ventilated 6,200 self ventilated	
Speed at continuous tractive effort mph. 4.7 (f.v.)	14 (s.v.)
Maximum safe speed, mph.	27.5
Minimum radius of curvature for locomotive alone, ft.	50
Minimum radius of curvature with trailing load, ft.	50

WESTINGHOUSE POWER EQUIPMENT

Engine	1—6 cylinder Diesel, 8¼ x 12, 300 hp., 800 rpm.
Generator	1—Type 183-B-2, 210 kw., 500 volts d-c.
Auxiliary Generator	1—Type YG-15-A-2
Traction Motors	4—Type 939-CHF, 500 volts.
Motor Gearing	14:79 ratio
Control	Electro-pneumatic, dual, series-parallel, parallel, torque.

MECHANICAL PARTS	Baldwin	Class B-B, fabricated, swivel trucks, visibility type center cab, close hoods around engine.

AUXILIARIES

Air Brakes	Westinghouse	Schedule SM-3, straight air.
Compressors	Westinghouse	2—Type D-3-F, displace 5 cu. ft. per min. each.
Radiators		Water and lubricating oil, force ventilated by motor driven fan, automatic control.
Battery	Exide	32 cells, 204 ampere-hour.

DIMENSIONS

Track gauge	3 ft. 0 in.
Length over bumper	32 ft. 5 in.
Width, overall	7 ft. 4 in.
Height, overall	10 ft. 10 in.
Wheel base, rigid (truck)	7 ft. 6 in.
Wheel base, total	24 ft. 0 in.
Wheel diameter	38 in.

70 TON • 300 HP.
DIESEL ELECTRIC LOCOMOTIVE

GREAT LAKES STEEL CORPORATION, ECORSE, MICHIGAN

DESCRIPTION OF OPERATION

Two locomotives placed in service in 1930. General switching in large steel plant and on blast and open hearth furnace operations.

PERFORMANCE

Tractive effort, starting, lb. (30 per cent adhesion)	42,000
Tractive effort, continuous, lb.	18,600
Speed at continuous tractive effort, mph.	4.3
Maximum safe speed, mph.	40
Minimum radius of curvature for locomotive alone, ft.	100
Minimum radius of curvature with trailing load, ft.	225

WESTINGHOUSE POWER EQUIPMENT

Engine	1—6 cylinder Diesel, 9 x 12, 300 hp., 800 rpm.
Generator	1—Type 477-B, 210 kw., 500 volts d-c.
Auxiliary Generator	1—Type YG-15-A-2
Traction Motors	4—Type 582-VE-6, 600 volts.
Motor Gearing	16:70 ratio
Control	Electro-pneumatic, dual, series-parallel, parallel, torque, multiple unit.

MECHANICAL PARTS	Baldwin	Class B-B, fabricated, swivel trucks, visibility type raised cab, engine room with aisles.

AUXILIARIES

Air Brakes	Westinghouse	Schedule 14-EL, straight and automatic.
Compressors	Westinghouse	2—Type D-3-F, displace 35 cu. ft. per min. each.
Radiators		Water and lubricating oil, force ventilated by motor driven fan, automatic control.
Battery	Exide	32 cell, 204 ampere-hour.

DIMENSIONS

Track gauge	4 ft. 8½ in.
Length inside coupler knuckles	38 ft. 0 in.
Width, overall	9 ft. 6 in.
Height, overall	14 ft. 9 in.
Wheel base, rigid (truck)	7 ft. 6 in.
Wheel base, total	24 ft. 8 in.
Wheel diameter	38 in.

73 TON • 300 HP.
DIESEL ELECTRIC LOCOMOTIVE

AMERICAN ROLLING MILL COMPANY, BUTLER, PENNSYLVANIA

DESCRIPTION OF OPERATION

Placed in service in 1930. Switching at blast and open hearth furnaces in large steel mill.

PERFORMANCE

Tractive effort, starting, lb. (30 per cent adhesion)	43,800
Tractive effort, continuous, lb.	20,000
Speed at continuous tractive effort, mph.	4.0
Maximum safe speed, mph.	40
Minimum radius of curvature for locomotive alone, ft.	100
Minimum radius of curvature with trailing load, ft.	225

WESTINGHOUSE POWER EQUIPMENT

Engine	1—6 cylinder Diesel, 8¼ x 12, 300 hp., 800 rpm.
Generator	1—Type 477-B, 210 kw., 600 volts d-c.
Auxiliary Generator	1—Type YG-15.
Traction Motors	4—Type 582-FE-6, 600 volts.
Motor Gearing	15:70 ratio.
Control	Electro-pneumatic, dual, series-parallel, parallel, torque governor, multiple unit.

MECHANICAL PARTS	Baldwin	Class B-B, fabricated swivel trucks, visibility type raised cab, engine room with aisles.
AUXILIARIES		
Air Brakes	Westinghouse	Schedule 14-EL, straight and automatic.
Compressors	Westinghouse	2—Type D-3-F, displace 35 cu. ft. per min. each.
Radiators		Water and lubricating oil, force ventilated by motor driven fan, automatic control.
Battery	Exide	32 cell, 204 ampere-hour.

DIMENSIONS

Track gauge	4 ft. 8½ in.
Length inside coupler knuckles	36 ft. 7 in.
Width, overall	10 ft. 2 in.
Height, overall	14 ft. 9 in.
Wheel base, rigid (trucks)	8 ft. 0 in.
Wheel base, total	25 ft. 8 in.
Wheel diameter	38 in.

74.5 TON • 300 HP.

DIESEL ELECTRIC LOCOMOTIVE

AMERICAN ROLLING MILL COMPANY, BUTLER, PENNSYLVANIA

DESCRIPTION OF OPERATION

Placed in service in 1929. Switching service at open hearth and blast furnaces.

PERFORMANCE

Tractive effort, starting, lb. (30 per cent adhesion)	44,700
Tractive effort, continuous, lb.	20,000
Speed at continuous tractive effort, mph.	4.0
Maximum safe speeds, mph.	40
Minimum radius of curvature for locomotive alone, ft.	100
Minimum radius of curvature with trailing load, ft.	225

WESTINGHOUSE POWER EQUIPMENT

Engine	1—6 cylinder Diesel, 8¼ x 12, 300 hp., 800 rpm.
Generator	1—Type 477-B, 210 kw., 600 volts d-c.
Auxiliary Generator	1—Type YG-15.
Traction Motors	4—Type 582-FE-6, 600 volts.
Motor Gearing	15:70 ratio.
Control	Electro-pneumatic, single end with two stations, series-parallel, parallel, torque governor, multiple unit.

MECHANICAL PARTS	Baldwin	Class B-B, fabricated, swivel trucks, box type cab, end platform, aisles around engine.
AUXILIARIES		
Air Brakes	Westinghouse	Schedule 14-EL, straight and automatic.
Compressors	Westinghouse	2—Type D-3-F, displace 35 cu. ft. per min. each.
Radiators		Water and lubricating oil, force ventilated by motor driven fan, automatic control.
Battery	Exide	32 cell, 204 ampere-hour.

DIMENSIONS

Track gauge	4 ft. 8½ in.
Length inside coupler knuckles	35 ft. 2 in.
Width, overall	10 ft. 7 in.
Height, overall	14 ft. 2½ in.
Wheel base, rigid (truck)	8 ft. 0 in.
Wheel base, total	25 ft. 8 in.
Wheel diameter	38 in.

70 TON • 400 HP.

DIESEL ELECTRIC LOCOMOTIVE

OPERATED BY LARGE STEEL COMPANY, CLEVELAND, OHIO

DESCRIPTION OF OPERATION

Placed in service in 1930. Continuous switching in large steel and wire plant.

PERFORMANCE

Tractive effort, starting, lb. (30 per cent adhesion)	42,000
Tractive effort, continuous, lb.	13,000
Speed at continuous tractive effort, mph.	8.5
Maximum safe speed, mph.	40
Minimum radius of curvature for locomotive alone, ft.	100
Minimum radius of curvature with trailing load, ft.	150

WESTINGHOUSE POWER EQUIPMENT

Engine	1—6 cylinder Diesel, 9 x 12, 400 hp., 900 rpm.
Generator	1—Type 477-B-8, 270 kw., 500 volts d-c.
Auxiliary Generator	1—Type YG-15-A-2.
Traction Motors	4—Type 582-E-6, 600 volts.
Motor Gearing	16:70 ratio.
Control	Electro-pneumatic, dual, series-parallel, parallel, torque.

MECHANICAL PARTS	Baldwin	Class B-B, fabricated, swivel trucks, visibility type raised cab, engine room with aisles.
AUXILIARIES		
Air Brakes	Westinghouse	Schedule 14-EL, straight and automatic.
Compressors	Westinghouse	2—Type D-3-F, displace 35 cu. ft. per min. each.
Radiators		Water and lubricating oil, force ventilated by motor driven fan, automatic control.
Battery	Exide	32 cell, 204 ampere-hour.

DIMENSIONS

Track gauge	4 ft. 8½ in.
Length inside coupler knucklers	38 ft. 0 in.
Width, overall	10 ft. 2 in.
Height, overall	14 ft. 9 in.
Wheel base, rigid (truck)	7 ft. 6 in.
Wheel base, total	24 ft. 8 in.
Wheel diameter	38 in.

70 TON • 400 HP.
DIESEL ELECTRIC LOCOMOTIVE

WESTINGHOUSE ELECTRIC, EAST PITTSBURGH, PA.

DESCRIPTION OF OPERATION

Two locomotives placed in service in 1930, switching in large electrical manufacturing plant. Operation in and out of buildings. Four steam locomotives replaced by these two.

PERFORMANCE

Tractive effort, starting, lb. (30 per cent adhesion)	42,000
Tractive effort, continuous, lb.	13,000
Speed at continuous tractive effort, mph.	8.5
Maximum safe speed, mph.	40
Minimum radius of curvature for locomotive alone, ft.	100
Minimum radius of curvature with trailing load, ft.	225

WESTINGHOUSE POWER EQUIPMENT

Engine	1—6 cylinder Diesel, 9 x 12, 400 hp., 900 rpm.
Generator	1—Type 477-B-8, 270 kw., 500 volts d-c.
Auxiliary Generator	1—Type YG-15-A-2
Traction Motors	4—Type 582-E-6, 600 volts.
Motor Gearing	16:70 ratio.
Control	Electro-pneumatic, dual, series-parallel, parallel, torque.

MECHANICAL PARTS	Baldwin	Class B-B, fabricated, swivel trucks, visibility type raised cab, engine room with aisles.

AUXILIARIES

Air Brakes	Westinghouse	Schedule 14-EL, straight and automatic.
Compressors	Westinghouse	2—Type D-3-F, displace 35 cu. ft. per min. each.
Radiators		Water and lubricating oil, force ventilated by motor driven fan, automatic control.
Battery	Exide	32 cell, 204 ampere-hour.

DIMENSIONS

Track gauge	4 ft. 8½ in.
Length inside coupler knuckles	38 ft. 0 in.
Width, overall	10 ft. 2 in.
Height, overall	14 ft. 9 in.
Wheel base, rigid (truck)	7 ft. 6 in.
Wheel base, total	24 ft. 8 in.
Wheel diameter	38 in.

65 TON • 530 HP.
DIESEL ELECTRIC LOCOMOTIVE

OPERATED BY SHORT LINE RAILROAD, WESTERN PENNSYLVANIA

DESCRIPTION OF OPERATION

Locomotive placed in service in 1933. Main line haul 3 miles. Traffic handled principally coal. Also performs switching duty for industry served.

PERFORMANCE

Tractive effort, starting, lb. (30 per cent adhesion)	39,000
Tractive effort, continuous, lb.	10,000
Speed at continuous tractive effort, mph.	12.2
Maximum safe speed, mph.	40
Minimum radius of curvature for locomotive alone, ft.	50
Minimum radius of curvature with trailing load, ft.	225

WESTINGHOUSE POWER EQUIPMENT

Engine	2—4 cylinder Diesel, 9x12, 265 hp. each, 900 rpm.
Generator	2—Type 183-D-2, 170 kw. each, 500 volts d-c.
Auxiliary Generator	2—Type YG-16-D-4.
Traction Motors	4—Type 562-E-6, 600 volts.
Motor Gearing	16:61 ratio.
Control	Electro-pneumatic, parallel, dual, series-parallel, differential.

MECHANICAL PARTS	Baldwin	Class B-B, fabricated, swivel trucks, visibility type raised center cab, aisles around engines.

AUXILIARIES

Air Brakes	Westinghouse	Schedule 14-EL, straight and automatic.
Compressors	Gardner-Denver	2—Class AA Duplex; direct drive, displacement 74 cu. ft. per minute each at 900 engine rpm.
Radiators		Water and lubricating oil, force ventilated by motor driven fan, automatic control.
Battery	Exide	32 cells, 204 ampere-hour.

DIMENSIONS

Track gauge	4 ft. 8½ in.
Length inside coupler knuckles	40 ft. 4 in.
Width, overall	10 ft. 2 in.
Height, overall	14 ft. 2½ in.
Wheel base, rigid (truck)	6 ft. 8 in.
Wheel base, total	29 ft. 0 in.
Wheel diameter	33 in.

87 TON • 600 HP.

DIESEL ELECTRIC LOCOMOTIVE

LONG ISLAND RAILROAD, LONG ISLAND CITY, NEW YORK

DESCRIPTION OF OPERATION

Placed in service in 1928. Switching at passenger terminal and at industrial plants adjacent to electrified railway zone.

PERFORMANCE

Tractive effort, starting, lb. (30 per cent adhesion)	52,200
Tractive effort, continuous, lb.	6,500
Speed at continuous tractive effort, mph.	26
Maximum safe speed, mph.	30
Minimum radius of curvature for locomotive alone, ft.	100
Minimum radius of curvature with trailing load, ft.	100

WESTINGHOUSE POWER EQUIPMENT

Engine	2—6 cylinder Diesel, 8¼x12, 300 hp. each, 800 rpm.
Generator	2—Type 477, 210 kw. each, 600 volts, d-c.
Auxiliary Generator	2—Type YG-9
Traction Motors	4—Type 308-H, 600 volts.
Motor Gearing	16:66 ratio.
Control	Electro-pneumatic, double end, multiple unit, series, parallel, torque governor.

MECHANICAL PARTS — Baldwin — Class B-B, articulated cab, fabricated, rigid truck box type cab, aisles around engine.

AUXILIARIES

Air Brakes	Westinghouse	Schedule 14-EL, straight and automatic.
Compressors	Westinghouse	4—Type DH-20, displace 20 cu. ft. per min. each.
Radiators		Water and lubricating oil, force ventilated by motor driven fan, automatic control.
Battery	Exide	32 cells, 272 ampere-hour.

DIMENSIONS

Track gauge	4 ft. 8½ in.
Length, inside coupler knuckles	46 ft. 8½ in.
Width, overall	9 ft. 7 in.
Height, overall	14 ft. 11 in.
Wheel base, rigid (truck)	9 ft. 6 in.
Wheel base, total	9 ft. 6 in.
Wheel diameter	38 in.

115 TON • 800 HP.

DIESEL ELECTRIC LOCOMOTIVE

NORTHAMPTON AND BATH RAILROAD, NORTHAMPTON, PENNSYLVANIA

DESCRIPTION OF OPERATION

Placed in service in 1932. Main line haul, trains up to 2500 tons. Also general switching, and inter-plant haulage for large industrial works.

PERFORMANCE

Tractive effort, starting, lb. (30 per cent adhesion)	69,000
Tractive effort, continuous, lb.	23,000
Speed at continuous tractive effort, mph.	10.2
Maximum safe speed, mph.	45
Minimum radius of curvature for locomotive alone, ft.	100
Minimum radius of curvature with trailing load, ft.	175

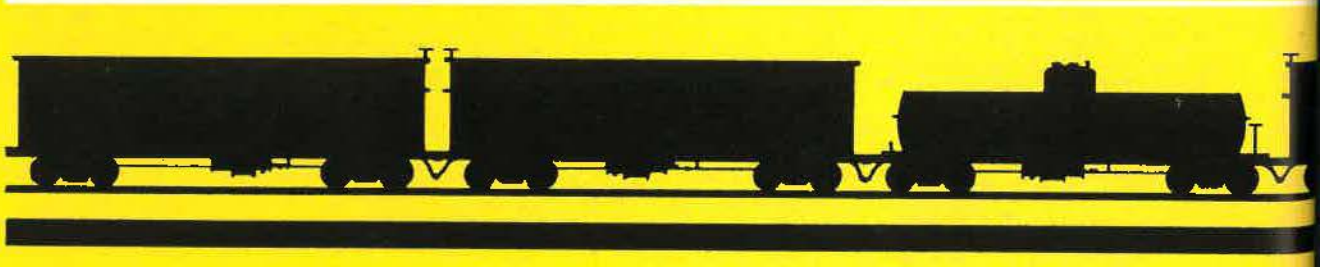
WESTINGHOUSE POWER EQUIPMENT

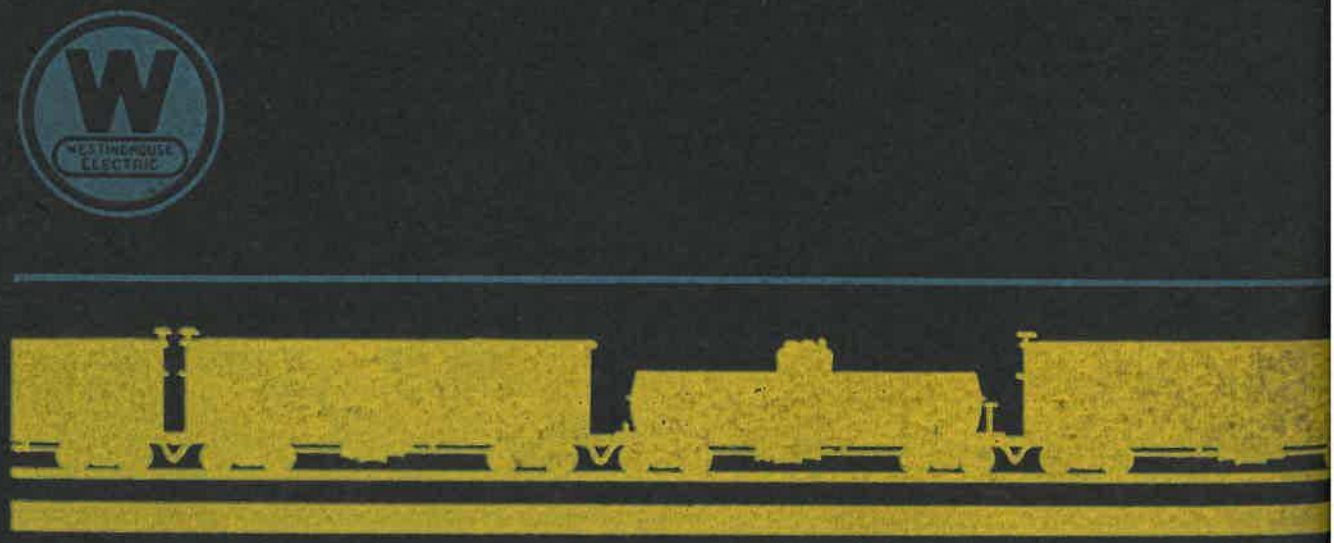
Engine	2—6 cylinder Diesel, 9 x 12, 400 hp., each 900 rpm.
Generator	2—Type 477-B-8, 270 kw. each, 500 volts d.c.
Auxiliary Generator	2—Type YG-15-A-2.
Traction Motors	4—Type 360-A, 600 volts.
Motor Gearing	16:67 ratio
Control	Electro-pneumatic, dual, series, parallel, field shunt, torque.

MECHANICAL PARTS	Baldwin	Class B-B, fabricated, swivel trucks, visibility type raised center cab, aisles around engines.
AUXILIARIES		
Air Brakes	Westinghouse	Schedule 14-EL, straight and automatic.
Compressors	Westinghouse	2—Type D-3-F, displace 35 cu. ft. per min. each.
Radiators		Water and lubricating oil, force ventilated by motor driven fan, automatic control.
Battery	Exide	32 cell, 204 ampere-hour.

DIMENSIONS

Track gauge	4 ft. 8½ in.
Length inside coupler knuckles	47 ft. 8 in.
Width, overall	10 ft. 7 in.
Height, overall	14 ft. 8 in.
Wheel base, rigid (truck)	8 ft. 6 in.
Wheel base, total	33 ft. 10 in.
Wheel diameter	44 in.





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