

SPECIFICATIONS RY-24147-H

**380-HP, 44-TON
DIESEL-ELECTRIC
RAILROAD
LOCOMOTIVE**

**For Yard Switching
and
Road Service**

APPARATUS DEPARTMENT

GENERAL  ELECTRIC

SCHENECTADY, N. Y.

PRINTED IN U.S.A.

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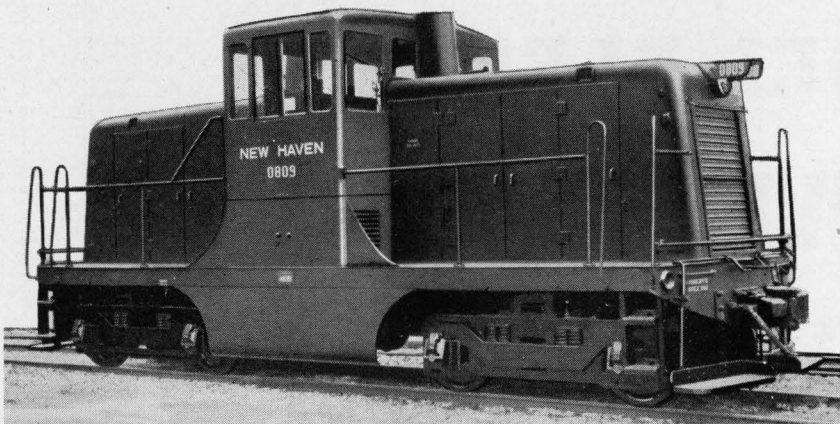
GENERAL  **ELECTRIC**

SCHENECTADY, N. Y.

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DIESEL-ELECTRIC RAILROAD LOCOMOTIVE

For Yard Switching and Road Service—Maximum Speed 35 mph



380 HP
44 TONS
4 AXLES

General Summary

RATED HORSEPOWER.....380 hp

WHEEL ARRANGEMENT.....B-B (404)

WEIGHT	Working Order	Maximum
Total locomotive.....	88000 lb	89000 lb
On drivers.....	88000 lb	89000 lb
Per driving axle.....	22000 lb	22250 lb

DIMENSIONS

Track gage.....	4 ft, 8½ in.
Length inside knuckles.....	33 ft, 5 in.
Height over-all.....	13 ft, 3 in.
Width over-all.....	10 ft, 1 in.
Length between truck centers.....	18 ft, 9 in.
Truck wheelbase.....	6 ft, 10 in.
Wheel diameter.....	33 in.
Axle diameter in motor suspension bearings.....	6¼ in.
Journal bearing.....	5 in. by 9 in.
Coupler height.....	34½ in.

TRACK CURVATURE

Minimum radius locomotive alone.....50 ft

RATINGS

Total input to generators for traction.....	330 hp
Tractive effort at 30 per cent adhesion.....	26400 lb
Tractive effort at hourly rating of motors.....	15500 lb
Tractive effort at continuous rating of motors.....	13000 lb
Maximum permissible speed.....	35 mph

ENGINES	Two Caterpillar D17000
Stroke cycle.....	4 cycle, Diesel
Number of cylinders.....	8 cylinder V
Bore and stroke.....	5¾ in. x 8 in.
Speed.....	1000 rpm

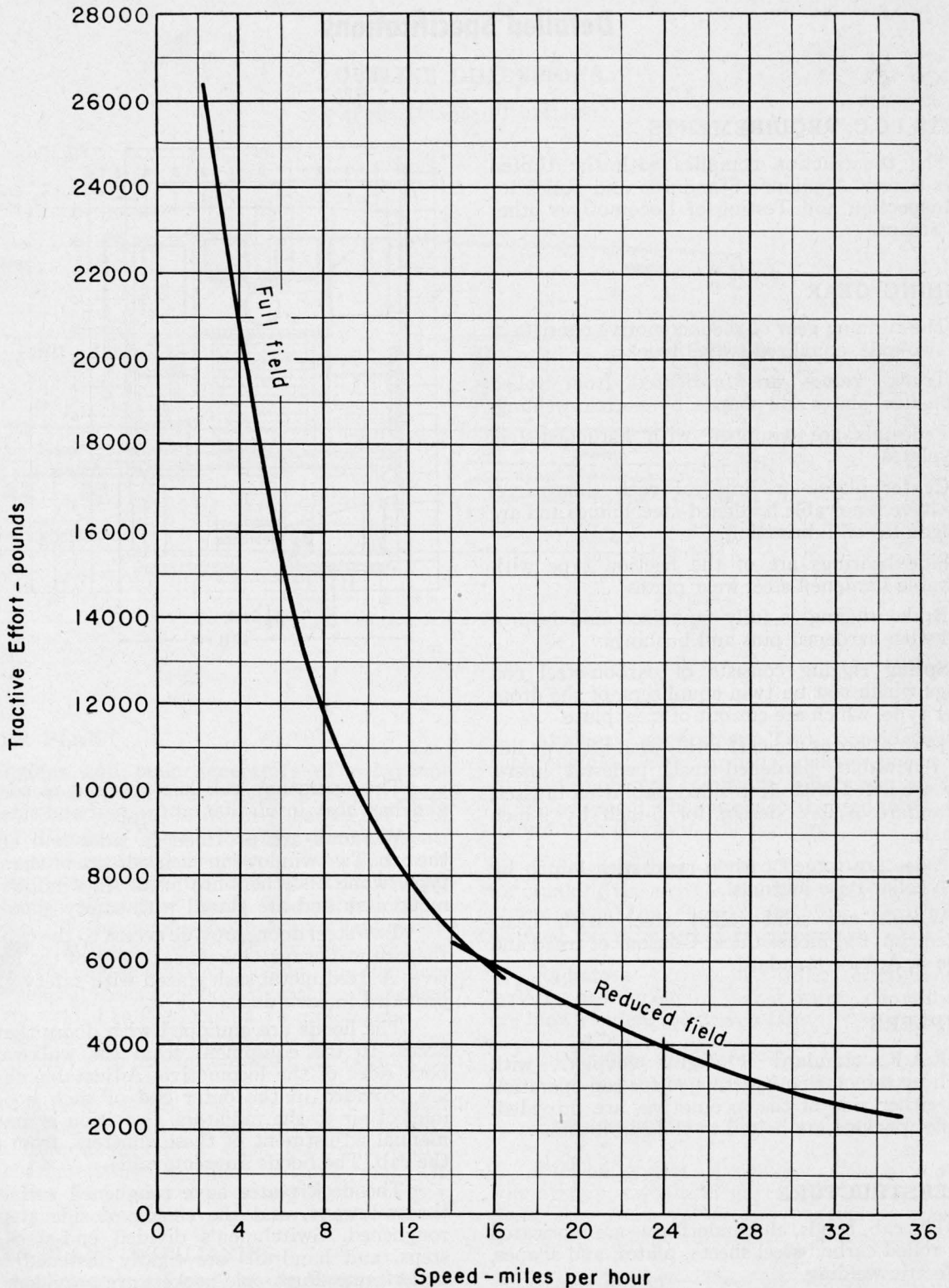
TRACTION MOTORS.....Four, GE-733

TRACTION GENERATORS.....Two, GT-555

AUXILIARY GENERATORS.....Two, GMG-140

The maximum speeds which can be attained, at various tractive efforts, are shown on the following curve, based on 165 hp to each generator for traction.

44-TON DIESEL-ELECTRIC RAILROAD LOCOMOTIVE



SPEED-TRACTIVE-EFFORT CURVE

From Drawing H-4786764

44-TON DIESEL-ELECTRIC RAILROAD LOCOMOTIVE

Detailed Specifications

MEETS I.C.C. REQUIREMENTS

The construction complies with the United States Safety Appliance Standards and Rules for the Inspection and Testing of Locomotives other than Steam.

RUNNING GEAR

The running gear of the locomotive consists of two, two-axle, equalized swivel trucks.

Truck frames are fabricated from rolled carbon-steel plates and shapes, by electric welding.

Pedestals are equipped with hardened-steel wear-plates.

Center plates are integral with the frame. They have renewable hardened-steel linings and are arranged for oil lubrication.

Side bearings are of the friction type with renewable hardened-steel wear plates.

Brake rigging is fully equalized and is provided with hardened pins and bushings.

Spring rigging consists of carbon-steel coil springs which rest on twin equalizers, of the drop-center type, which are cut out of steel plate.

Journal boxes are cast steel, with lift-type lids and renewable, hardened-steel, pedestal liners. They are fitted with deep-sided babbitted brasses, of standard A.T.A. design, for 5-inch by 9-inch journals.

Axles are forged carbon steel with 5-inch by 9-inch collar-type journals.

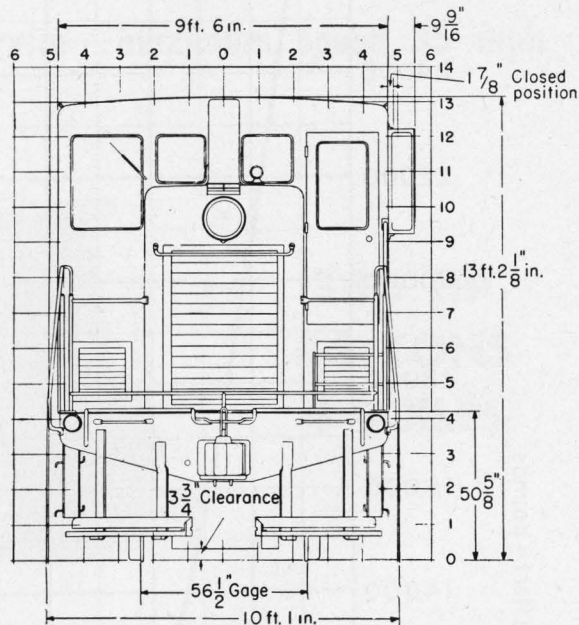
Wheels are solid rolled steel, with heat-treated rim, $2\frac{1}{2}$ inches thick. Contour of tread and flange is A.A.R. standard.

COUPLERS

A.A.R. standard E engine couplers, with 6-inch by 6-inch shank, arranged for top operation from either side of the locomotive, are provided. Coupler pockets are bolted to the end frame.

SUPERSTRUCTURE

The cab, hoods, and underframe are fabricated from rolled carbon-steel sheets, plates, and shapes, by electric welding.



The operator's cab has a raised wood floor, and has heat insulation on the roof and sides.

Windows are provided in sides and ends of the cab. Two windows in each side are of the sliding type, while all others are fixed. All windows have metal sash and are glazed with safety glass.

Two steel doors provide access to the cab, from the two walkways; one on each side of the locomotive. A fixed metal sash glazed with safety glass is provided in each door.

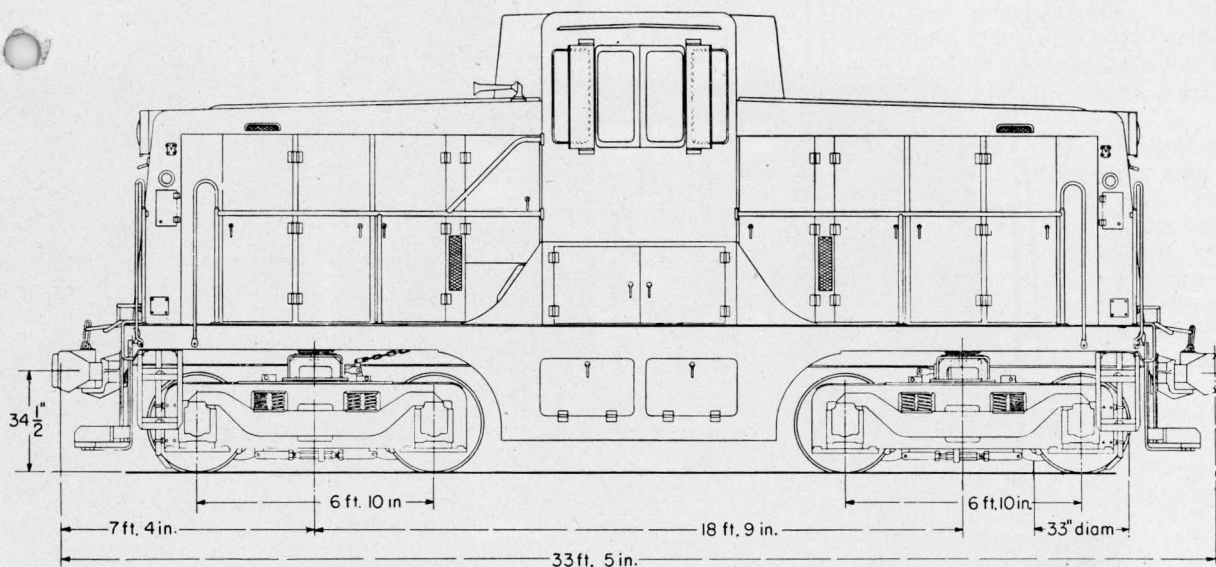
The hoods are equipped with doors that give access to the equipment, from the walkways on both sides of the locomotive. Adjustable shutters are provided in the outer end of each hood, for inlet of air to the radiators. Provision is made for manual adjustment of these shutters, from inside the cab. The hoods are removable.

The deck plates have roughened surfaces on the walkways, and the treads of side steps are roughened. Switchmen's divided end-steps, side steps, and handrails are rigidly fastened to the underframe. Push-pole pockets are provided.

44-TON DIESEL-ELECTRIC RAILROAD LOCOMOTIVE

OUTLINE DIMENSIONS

(From Drawing PP-6741178)



POWER PLANT

Engines and main generators—The locomotive has two Caterpillar, Type D-17000 diesel engines. Each engine is directly connected to a General Electric, Type GT-555, direct-current, shunt-wound generator. One end of the generator armature is supported by an antifriction bearing mounted in the frame head. The other end is connected to the engine flywheel by a laminated, steel-disk flexible coupling. The magnet frame is bolted to the engine flywheel housing. The complete engine-generator set is supported on three cushioned supports welded to the locomotive underframe.

The generators are equipped with windings which permit their use for cranking the engines by storage battery power.

An exciter of the split-pole type, to furnish excitation current for the generator field, is belt-driven from a sheave on each generator shaft. The characteristics of this machine make it possible for the generator to utilize the full output of the engine over a wide range of locomotive speed.

POWER-PLANT AUXILIARIES

Power-plant auxiliaries, of the General Electric Company's selection, are provided as follows:

Auxiliary generators—Two, one driven by each engine. These furnish auxiliary power at a constant potential, over the full operating range of engine speed. They are incorporated in the same frames with the split-pole exciters.

Storage battery—One, 32-cell, lead-acid type, for cranking the engines and for supplying auxiliary power when the engines are shut down. It is charged from the auxiliary generators.

Radiators—Two, flat-tube, continuous-fin type, for cooling engine-jacket water. The radiators are blown by engine-driven fans.

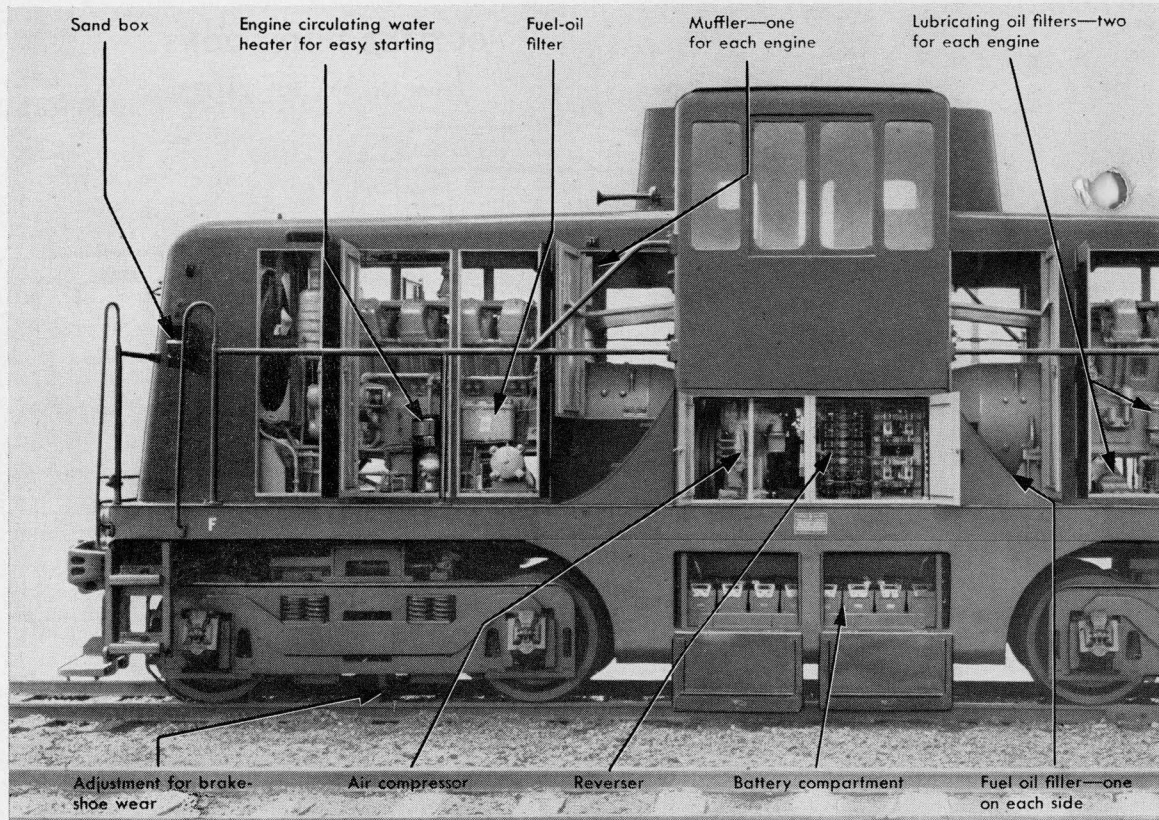
Lubricating-oil-filters—Four; one full-flow type, and one by-pass type, for each engine.

Exhaust mufflers—Two; one for each engine.

Fuel-oil system—Includes a 250-gallon reservoir system, two level gages, two filling connections, one drain valve, and one spring-operated emergency shutoff valve with remote-control trip.

Water heaters—Two, one for each engine, to facilitate starting.

44-TON DIESEL-ELECTRIC RAILROAD LOCOMOTIVE



Photograph 5001239

G-E diesel-electric 44-ton locomotive. Engine-cab and compartment doors open. View shows diesel engines and main generators, and compressor and auxiliary-generator compartments. Power plant and accessories are convenient and readily accessible.

TRACTION MOTORS

Four General Electric, Type GE-733, direct-current, series-wound, self-ventilated traction motors drive the four axles of the locomotive, individually (maximum speed, 35 mph). Each motor drives through double-reduction spur gearing and is carried on the housing which encloses this gearing. These motors are mounted on the axle by means of two sleeve-type suspension bearings. Each motor is spring-supported by a nose suspension on the truck frame. The armature bearings are of the antifriction type. The entire gearing is totally enclosed in a sealed, single gear housing. The motor ventilation is arranged to take cooling air from above the locomotive deck plate.

BRAKES AND COMPRESSORS

The air-brake equipment is combined straight and automatic, Schedule 14-EL, with one engi-

neer's valve, Type K-14. Four brake cylinders are mounted on the trucks, and operate fully equalized brake rigging which applies one shoe to each wheel. The brake-shoe pressure is approximately 65 per cent of the weight on the wheels, at a cylinder pressure of 50 lb per sq in.

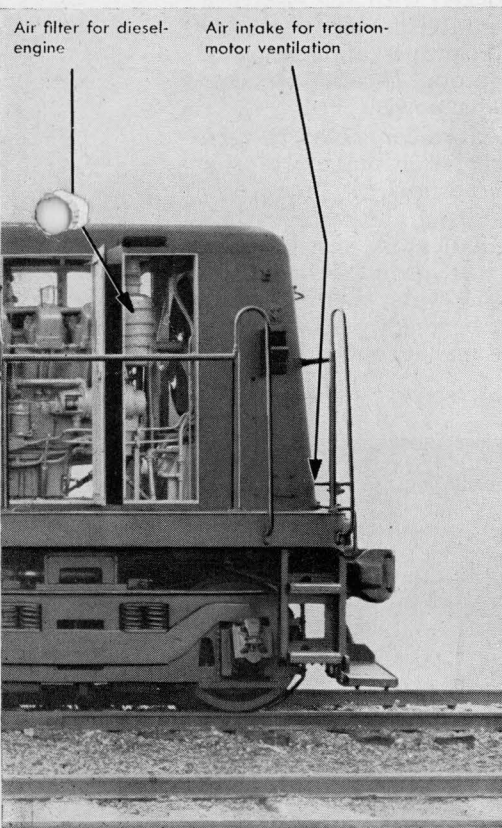
The feed valve and reducing valve are installed in the operator's cab.

A hand brake is provided for holding the locomotive at a standstill.

There are two air-cooled, two-stage, belt-driven, air compressors. They operate against a reservoir pressure of 130 lb per sq in. Each has a piston displacement of 48 cfm when operating at a speed corresponding to the full-load speed of the engine.

The capacity of the main air reservoirs is approximately 35,000 cubic inches.

44-TON DIESEL-ELECTRIC RAILROAD LOCOMOTIVE



ACCESSORIES AND AUXILIARY EQUIPMENT, of the General Electric Company's selection, are as follows:

Sanders—Four, air-operated, with one engineer's duplex valve.

Bell—One, nonswinging type, with air-operated ringer.

Horn—One, air-operated.

Headlights—Two, with 12-inch-diameter silvered-glass reflectors and 250-watt, 60-volt lamps.

Cab lights—For illuminating cab and gage panels; 25-watt, 70-volt.

Extension lamp—One, with guard and 25-foot cord.

Classification light brackets and plug receptacles—Four.

Window wipers—Two, air-operated.*

Cab heaters—One, fan-blown, hot-water-type, connected in the water-circulating system of one engine.

Seat—One, swiveling, upholstered, with back rest.

Arm rest—One, upholstered.

Fire extinguisher—One 1½-quart, carbon tetrachloride, pump-type.

Left-side vision mirrors—Two.†

Clothes locker and tool cabinet—One.

*An extra set of two window wipers is recommended whenever a two-man crew is required.

†When installed inside of cab, an extra set of window wipers is recommended.

PAINTING

Scale and rust are removed from all surfaces, after which a primer and surfacer are applied, and rough places are spot-puttied.

The interior of the cab is finished in green, the interior of the engine hoods and control compartment in gray, and the running gear in black.

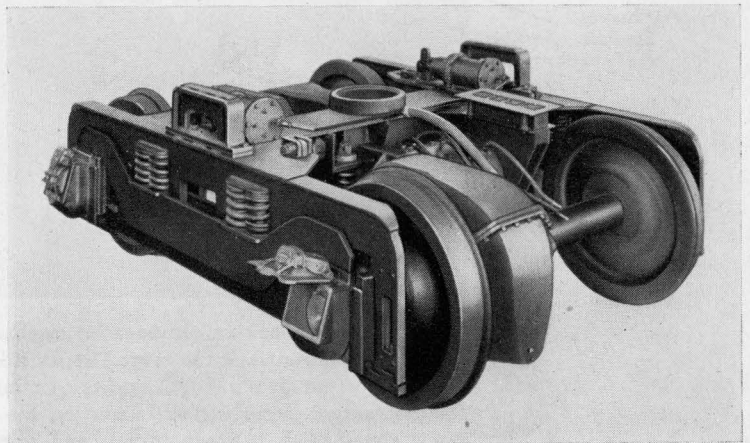
The color of the exterior coat is black and the lettering and numbering are in white paint, unless the purchaser specifies other colors.

TESTING

In addition to standard tests on the individual pieces of apparatus, the locomotive is given high-potential test, calibration tests, air-brake tests, and a running test to check mechanical features and adjustments.

Photograph 823614

Two-axle equalized swivel trucks. The loading of each axle, and the short, rigid wheel base enable locomotive to negotiate sharp curves without rail-climbing or rail-spreading. Steel plates are electric-welded to form a strong, rigid unit



44-TON DIESEL-ELECTRIC RAILROAD LOCOMOTIVE

CONTROL EQUIPMENT

The locomotive is equipped with General Electric single-station, single-unit control, with the operator's station placed on the right-hand side of the cab. Grouped at this station are the throttle lever, reversing lever, brake valve, sander valve, bell and horn controls, window-wiper controls, gage panel, and switches for controlling lights.

The direction of motion of the locomotive is selected by placing the reversing lever in the proper position while the throttle lever is in the idling position.

The locomotive speed is controlled by the throttle lever, which regulates the diesel-engine

output and is also interlocked with the electrical control. This interlocking establishes the necessary electric circuits, to provide proper application of power to the traction motors. It also prevents reversal of the motors, under power.

Two motors in parallel are connected to each generator. Provision is made for automatic transfer between full field and reduced field.

One illuminated gage panel at the operator's station contains the load indicators, the battery-charging indicator, air-brake gages, lubricating-oil-pressure gages, and cooling-water thermometers. All meters and gages can be readily seen by the operator when he is seated at his control station.

Switch Panel
Control
Cab light
Gage lights
Headlights
Cab heaters
Classification marker

Engine-compartment-ventilator handle

Gage Panel
Water temperature
Air brakes
Oil pressure
Battery charging

Whistle cord

Engine-starting buttons

Air brakes
Straight
Automatic

Throttle

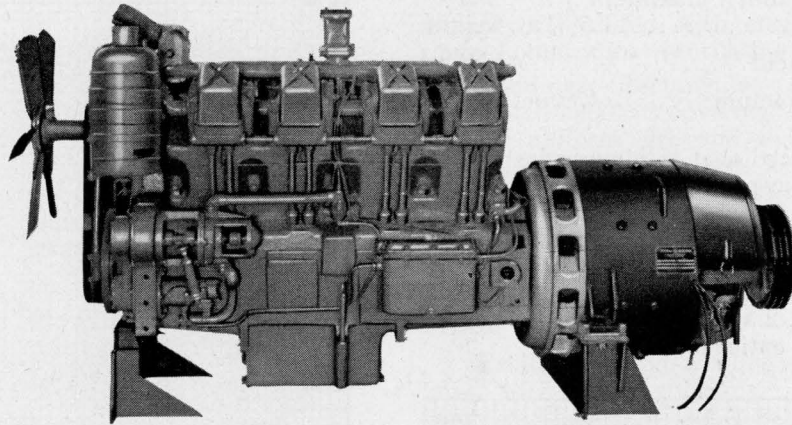
Reverse handle



The engineer's position provides an unobstructed view of the tracks to the front and the rear. The controls are grouped conveniently within arm's length and the engineer can easily read the instrument panel without diverting his attention from the track ahead. Cab is clean, quiet, and comfortable—insulated to keep heat in during cold weather and out in hot weather.

CATERPILLAR DIESEL ENGINE

TYPE D-17000



Photograph 822912

Power-plant assembly consisting of Caterpillar diesel engine, Type D-17000, direct-connected to G-E traction generator, Type GT-555

SPECIFICATIONS

Number of cylinders.....	8
Stroke cycle.....	4
Bore and stroke.....	5 ³ / ₄ in. by 8 in.
Piston displacement (cu in.).....	1662
Full-load speed range (rpm).....	550-1000
Low-idle speed (rpm).....	400
Piston speed, at 1000 rpm (fpm).....	1333
Speed regulation.....	10%
Output, at 1000 rpm (with full equipment, but without radiator fan).....	190 bhp

WEIGHT

Engine, fan to flywheel, dry (approximate) ..6750 lb

CRANKSHAFT BEARINGS

Five main bearings, diameter 4 in.; total projected area, 61.75 sq in. Crankpin bearings, diameter 4 in.

LUBRICATING SYSTEM

Full Pressure—Protected sump oil pan, to specifically fit engine, for use with large capacity external oil system (provides for long periods of operation between oil changes). Dual pumps, one for engine oil supply, and one for external circuit. Oil cooler (air-cooled type). Engine-mounted lubricating oil filters are metal-edge and absorbent type.

Oil Capacity—Pan, engine oil lines, and oil cooler—14¹/₂ gallons; complete system, including external tank and filter—50 gallons.

COOLING SYSTEM

Built-in, gear-driven pumps circulating 75-80 gpm of water at 1000-rpm engine speed, with thermostats open. Belt-drive fan. Water capacity—engine only, 27 gallons; complete system, including radiator—40 gallons.

FUEL SYSTEM

Individual injection pumps and single-orifice type injection valves. Replaceable-element, absorbent-type fuel filter with jacket-water-heat exchanger. Fuel transfer pump. All designed, manufactured, and serviced by "Caterpillar."

AIR CLEANERS

Two, oil-bath type.

GOVERNOR

Mechanical fly-ball type. Governs through entire speed range of engine.

FUEL OIL RECOMMENDATIONS

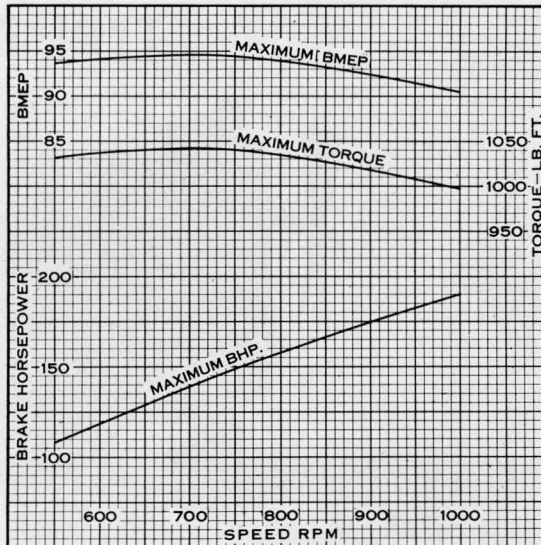
The engine operates satisfactorily on a wide range of fuels, including the lower grades, such as No. 3 furnace oil. When it becomes necessary to refer to a definite specification for purchasing purposes, the following specifications based on the A.S.T.M. classification No. 3-D (rearranged and abridged) may be used.

Flash point, minimum.....	125 F or 150 F
Water and sediment, maximum.....	0.1% by volume
Viscosity, minimum.....	33 seconds (S.U. at 100 F)
Carbon residue, maximum.....	0.5% by weight

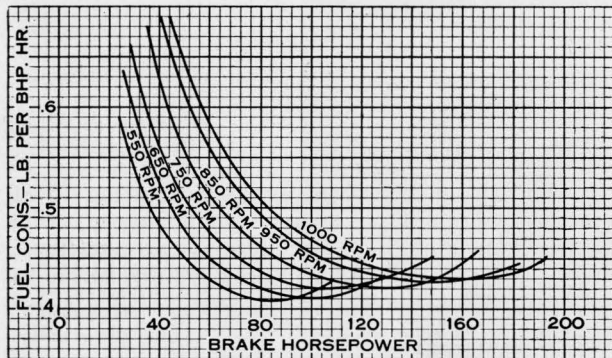
CATERPILLAR DIESEL ENGINE, TYPE D-17000

Ash, maximum 0.02% by weight
 Pour point, maximum 35 F
 Sulphur (suggested limit), maximum
 1.5% by weight
 Alkali and mineral acid None
 Ignition quality, minimum Cetane No. 35

It should be noted that minimum flash point is not important, except as required by local fire regulations, fire underwriters, or state laws. It should be noted also that lower pour point and lower viscosity may be specified, whenever required by local low-temperature conditions, to facilitate storage and use. No. 2 and No. 3 domestic burner oils can be used with entire satisfaction.



Performance of D-17000 engine with full equipment but *without radiator fan*. The curves show the maximum output which the engine can develop with a clear exhaust in intermittent service such as locomotive



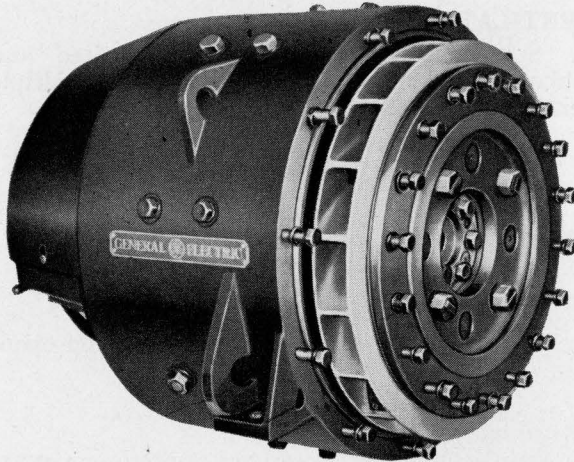
Fuel consumption of D-17000 engine with full equipment but *without radiator fan*. Fuel consumption shown, was obtained with fuel oils having 45-50 Cetane No. 30-34 A.P.I. gravity (at 60 F), 33-42 viscosity (S.U. at 100 F), and a total (gross) heat value of 19,000 Btu per pound

LUBRICATING OIL RECOMMENDATIONS

Considerable experience has indicated that specifications alone are not always a suitable guide when purchasing lubricating oils for internal combustion engines. It has been found that service tests provide the best means of determining whether or not a lubricating oil will provide satisfactory performance.

Extensive work, carried out between the various oil companies and "Caterpillar" has resulted in the development and approval of lubricants which will give the most satisfactory performance in this engine. These oils, known as "Superior All Purpose Lubricants for Caterpillar Diesel Engines" are compounded with metallic soaps which reduce the tendency for gums and lacquers to be deposited in the piston-ring grooves, reduce sludge deposits in the engine and filters, improve the film strength of the oil, and in so doing, reduce piston-ring and liner wear. Further, they have been found to have less tendency to sludge and clog filters. These oils permit 2000 hours' operation between oil changes. Only 500 hours should be allowed when using other oils. In all temperatures above freezing, an SAE No. 20 viscosity oil should prove satisfactory. Below freezing, an SAE No. 10 viscosity oil should be used.

TRACTION GENERATOR TYPE GT-555



Coupler end—Photograph 816792

Type GT-555 four-pole, direct-current, separately excited shunt-wound, commutating-pole traction generator, designed for operation directly connected through a flexible disk-type coupling to a diesel engine. It is provided with series winding for engine-cranking purposes

CONTINUOUS RATING—Self-ventilated

Volts (Approx)	Amperes	Nominal Rpm	Temperature Rise by Resistance
130 to 265	840 to 420	1000	Armature.... 120 C Field..... 85 C *Exciter..... 85 C

* GMG-140—exciter end.

WEIGHT.....approximately 3675 lb
Complete with fan and flexible coupling.

FLEXIBLE COUPLING

Steel-disk type. High torsional rigidity permits armature to serve as engine flywheel.

FRAME

Cylindrical, rolled and welded steel plate, arranged for bolting to the engine flywheel housing. Inspection openings with removable cover are provided at the commutator end.

ARMATURE

Shaft—Can be replaced without disturbing windings or commutator.

Core—Low-loss, silicon-steel laminations;

annealed, insulated with enamel, and keyed to shaft. Longitudinal ventilating ducts are provided.

Windings—Rectangular copper conductors with felted-asbestos covering. Assembled in poly-coils of uniform size and shape, insulated from ground with paper-backed, flexible mica suitably reinforced. Armature dipped and baked.

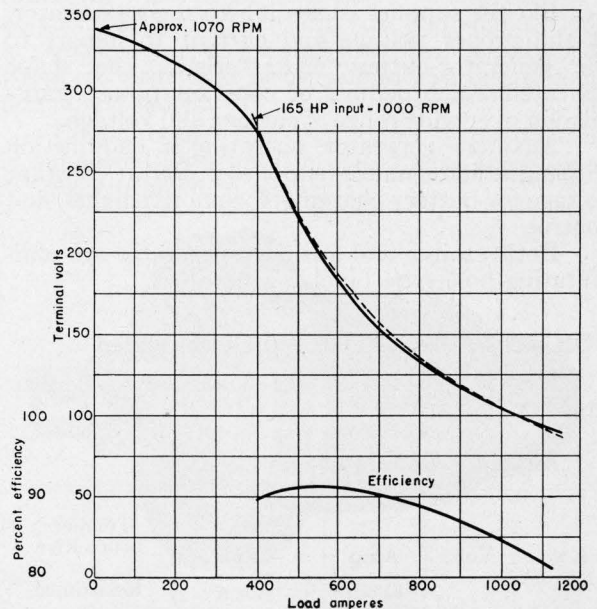
Commutator—Hard drawn-copper segments, insulated with mica which is undercut between segments.

FIELD COILS

Exciting—Shunt-winding conductors are insulated with felted asbestos. They are insulated from ground with paper-backed flexible mica. Coils are hot-treated by the vacuum process. Cranking winding is of wide ribbon copper, insulated between turns with asbestos paper.

Commutating—Edgewise-wound copper bar, formed and pressed to size, with asbestos-paper insulation between turns. They are insulated from ground with paper-backed flexible mica, suitably reinforced. Assembled poles and coils are varnish-dipped and baked.

CHARACTERISTICS



From Drawing H-4786613

Generator separately excited, direct-connected to engine which delivers 165 hp for traction at 1000 rpm

TRACTION GENERATOR, TYPE GT-555

BRUSH HOLDERS

Four per generator, each supported by twin stud insulators; adjustable radially. Coiled-ribbon spring levers, protected with copper shunts, are adjustable for correct pressure on brushes.

Brushes are provided with stranded copper shunts.

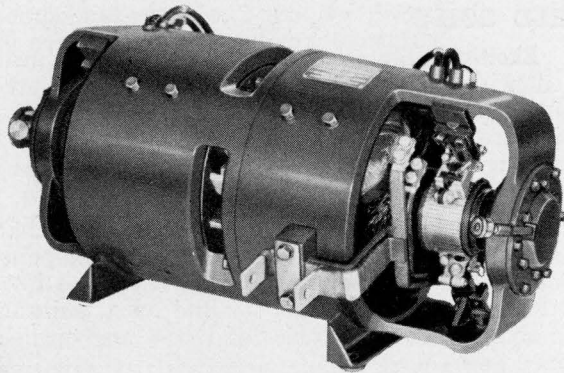
BEARING

The single bearing at the commutator end, is of antifriction type, self-aligning, grease-lubricated, and provided with all-metal labyrinth seals.

VENTILATION

Supplied by a one-piece fan, bolted and rabbetted to coupling. Fan provides multiple ventilation of armature and stator.

EXCITER-AUXILIARY GENERATOR, TYPE GMG-140



Photograph 816790

G-E direct-current exciter-auxiliary generator set, Type GMG-140. View shows exciter end

Exciter supplies excitation to main generator, at the proper voltage and current to impart to the generator-output characteristic, the shape indicated which permits of constant power transmission over wide range of current and voltage.

Auxiliary generator, operating in conjunction with suitable regulator, supplies power at constant voltage for battery charging, locomotive lights, and control.

Both exciter and auxiliary-generator are commutating-pole-type bipolar generators.

CONTINUOUS RATING—Self-ventilated

Exciter: Refer to GT-555 main generator capacity.

Auxiliary Generator:

Kw	Volts	Amp	RPM	Temperature Rise by Resistance
1.75	76	23	2060	85 C

WEIGHT.....approximately 575 lb

FRAME

Cylindrical, fabricated steel. Inspection openings at each end.

ARMATURES

Cores—Low loss nonaging silicon-steel laminations; annealed; enamel insulated. Auxiliary generator end keyed to shaft. Exciter end keyed to a spider.

Windings—Round section copper conductors, formex and glass insulated. Ground insulation of heavy paper. Armature dipped and baked.

Commutator—Diameter 4½ inches. Deep copper segment firmly supported by mica insulated-steel vee rings. Segment mica undercut.

FIELD COILS

Series winding of exciter is of copper strip, insulated between turns with asbestos paper. Shunt windings are of round-section copper, formex insulated, and commutating coils are of rectangular-section copper, cotton insulated. Ground insulation is of flexible mica sheet, varnished-cambic paper, and cotton tape.

BRUSH HOLDERS

Two at each end, each supported by herkolite studs; adjustable radially. Brushes are provided with stranded copper shunts.

Brush pressure obtained by adjustable coiled-ribbon springs.

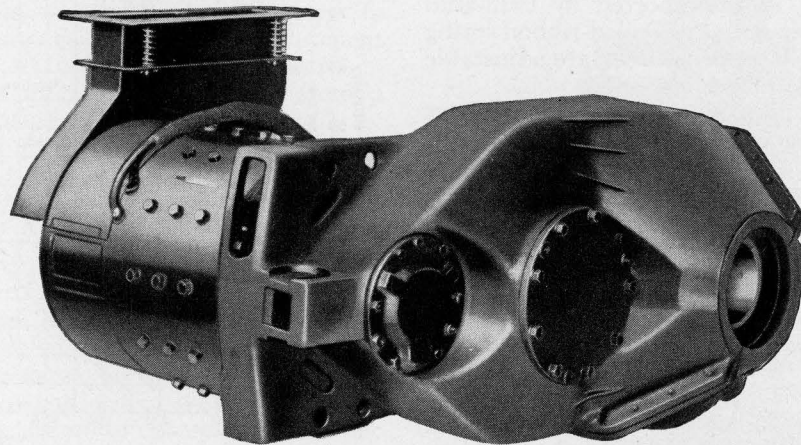
BEARINGS

Ball bearings both ends, grease lubricated. All-metal labyrinth seals; cartridge type housings.

VENTILATION

Ventilating air, drawn into set at both ends, passes through air gaps and between field coils; is ejected by fan through exhaust openings near center of set. Fan can be replaced without disturbing windings or commutators.

TRACTION MOTOR TYPE GE-733



Photograph 820347

Type GE-733, six-pole, direct-current, commutating-pole traction motor, designed for use with an engine-driven generator, and to be operated with full or shunted series field

RATINGS ON FULL FIELD—Self-ventilated

	Amperes	TEMPERATURE RISE BY RESISTANCE	
		Armature	Field
Hourly	375	120 C	130 C
Continuous	325	120 C	130 C

Ratings are in accordance with AIEE Standards dated March, 1937.

WEIGHT 2500 lb

SPEED, MAXIMUM PERMISSIBLE . . . 4010 rpm

FRAME

Cylindrical. Inspection openings with removable covers are provided at the commutator end.

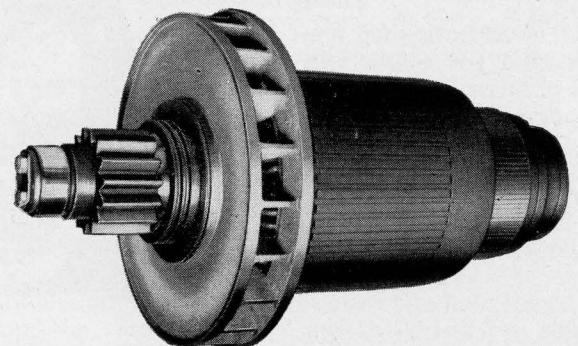
ARMATURE

Shaft—Can be replaced without disturbing windings or commutator.

Core—Low-loss, silicon-steel laminations; annealed and insulated. Laminations are keyed to spider. Longitudinal ventilating ducts.

Windings—Rectangular copper conductors insulated with felted asbestos and assembled in polycoils formed to uniform size and shape. Coils are insulated from ground with flexible-mica slot wrapper. Armature is dipped in insulating compound and baked.

Commutator—Has deep copper segments firmly supported by a mica-insulated steel shell. Mica is undercut between segments.



Photograph 816833

A multiple-blade fan on the end of the armature opposite the commutator furnishes clean ventilating air, because it is drawn from above the locomotive platform level and enters through the commutator end

TRACTION MOTOR, TYPE GE-733

FIELD COILS

Strip copper conductor, insulated between turns with asbestos paper. Insulated from ground with mica and asbestos. Coils are treated with varnish, and baked.

BRUSH HOLDERS

Six per motor, each supported by twin-stud insulators, adjustable radially. Coiled-ribbon spring levers, protected with copper shunts, are adjustable for correct pressure on brushes.

Brushes are equipped with stranded-copper shunts.

BEARING

Armature (Commutator End)—Antifriction type, grease lubricated. All-metal labyrinth seals.

VENTILATION

Multiple fan on armature. Air intake through air duct connection at commutator end.

GEAR UNIT

Special steel gearing of long-and-short-addendum tooth form. Low-speed reduction, diametral pitch, $2\frac{1}{2}$; face $4\frac{3}{8}$ in. High-speed reduction, diametral pitch, $3\frac{1}{2}$; face 3 in.

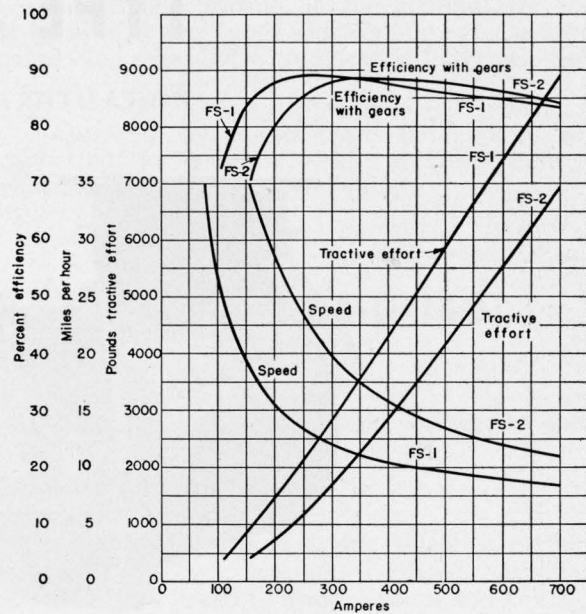
Both pinions are straddle-mounted.

Antifriction gear-train bearings.

Axle and end-thrust bearings are of bronze split-sleeve type; one on each side of axle gear.

Gearing, gear-train bearings, axle bearings, and

CHARACTERISTICS



From Drawing H-4786765

Motor operating on 250 volts—gear reduction 11.25 to 1—wheel diameter 33 inches

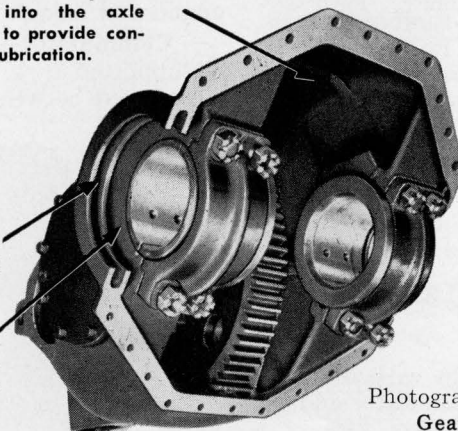
pinion-end motor bearing are lubricated from the reservoir of oil in the gear housing.

Gear housing is a one-piece steel casting which has a bolted-on, oiltight cover over the axle bearings. Oil seals are of the all-metal labyrinth type.

Trough drains the splashing oil into the axle bearings to provide continuous lubrication.

Outer groove of labyrinth seal keeps out dirt and water.

Inner groove of labyrinth seal keeps the lubricant in.



Photograph 816835
 Gear unit

CONTROL EQUIPMENT

TYPE M

GENERAL DESCRIPTION

The control equipment consists of the master controller, switches, contactors, and relays to control the operation of the electrical equipment on the locomotive. It provides for the control of the locomotive as an independent unit from a single operating station.

The schematic diagram (on page 218) shows the main electrical circuits but, for the sake of simplicity, does not show the control circuits by which the switches and contactors are actuated.

MASTER CONTROLLER

The controller consists of three contacts operated by a single handle with three positions: forward, off, and reverse. It is used to select the direction of motion of the locomotive and to provide means of energizing the motor control circuits when the controller is in the forward or reverse position. It is interlocked with the main throttle handle so that the controller cannot be moved from any position unless the throttle handle is in the idling position.

CONTACTORS

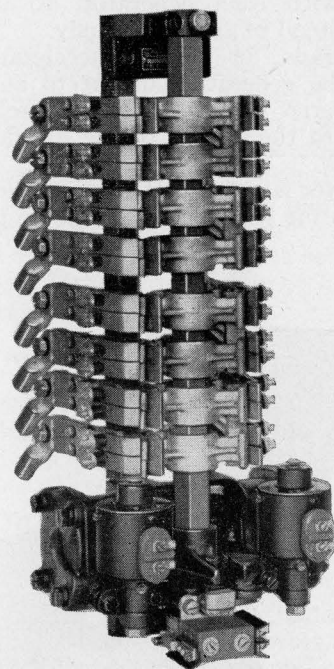
Contactors are used to open and close the circuits which carry heavy currents and which must be opened and closed during the operation of the locomotive. They are shown in the schematic diagram, by the symbols P1, P2, P3, P4, M1, M2, M3, M4, GS1, GS21, EF1, EF21, A1, and A21.

All these contactors are lightweight, single pole, magnetically operated, with a bent-up frame construction using a straight armature with rocker bearing. They are provided with blowout coils and arc chutes to assist in rupturing the arc. The arc chutes are easily removed, thus making the contact tips readily accessible.

Where necessary, control interlocks are attached to and operated by the contactors to make or break necessary control circuits.

REVERSER

The reverser is a drum switch, for reversing the traction motor fields, operated by a double-cylinder air engine controlled by two magnet valves. It includes a control interlock so connected that the motor line contactors cannot be closed unless the position of the reverser corresponds with the position of the master controller.



Photograph 349228

G-E electropneumatic reverser. A single reverser reverses all four traction motors

The reverser can be operated only when all the motor contactors are open. It is, therefore, never called on to open current. This results in long life of fingers and contacts.

FIELD SHUNTING RELAY

The motors across each generator have their fields shunted automatically under the influence of a current relay. This relay has a series coil in the generator circuit and a pick-up coil connected to the throttle control switch, and has a contact which is closed when the relay is dropped out. This contact controls the contactors M1, M2, M3, and M4.

When the throttle is opened, the shunt coil of the shunting relay is energized to pick up the relay and avoid immediate motor-shunting. As soon as enough series current is built up to hold the relay up, the throttle control switch causes the shunt coil to be disconnected. When the generator current later drops to about 425 amperes, the relay drops out and causes the field shunting to take place. A slight time delay on pickup prevents the relay's

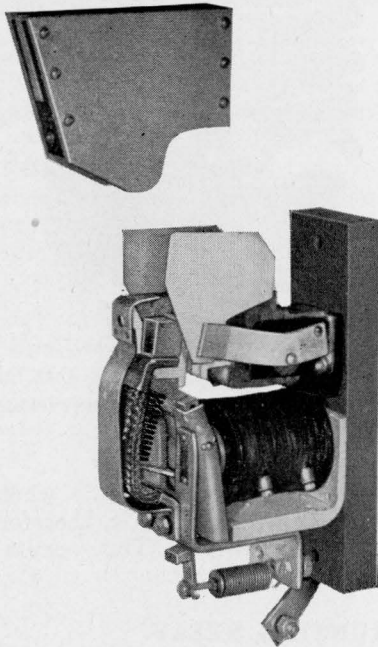
CONTROL EQUIPMENT, TYPE M

FIELD-SHUNTING RELAYS (Cont'd)

picking up again on the first surge of current when shunting is established. The operation is also smoothed, by causing the two field shunt contactors, associated with each generator, to pick up in sequence instead of simultaneously.

If a grade, or further acceleration, again builds up the generator current to an undesired value, the series coil will cause the relay to pick up and return the motors to the full field connection.

If a motor is cut out, the circuits are arranged so field shunting will not take place on the remaining motors.



Photograph 820527

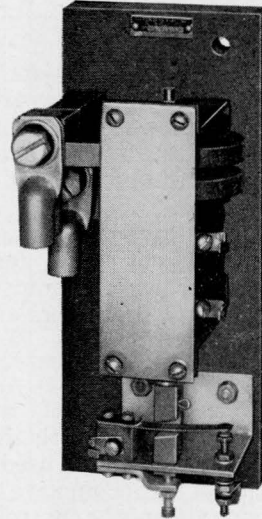
G-E magnetic contactor. Arc chutes removed to show contacts. Designed for use as line contactor on diesel-electric locomotives

FIELD-SHUNTING DROPOUT RELAY

This relay is used to prevent the operation of the locomotive in the field-shunting connection when the locomotive speed exceeds 35 mph.

The relay armature is operated by a series coil which carries the current of one traction motor and a pick-up coil which is energized as long as the traction motors are operating in the full-field connection. When the field-shunt contactors close, an interlock de-energizes the pick-up coil, thus causing the relay to be held closed by the series coil alone. If the locomotive speed exceeds 35 mph, the motor current drops below the value which will hold the relay closed. The relay main contacts then open and drop out all of the field-

shunt contactors. Field shunting cannot be re-established until the locomotive speed is reduced below 35 mph.



Photograph 818904

G-E relay, designed as field-shunting relay for diesel-electric locomotive

REVERSE-CURRENT RELAYS

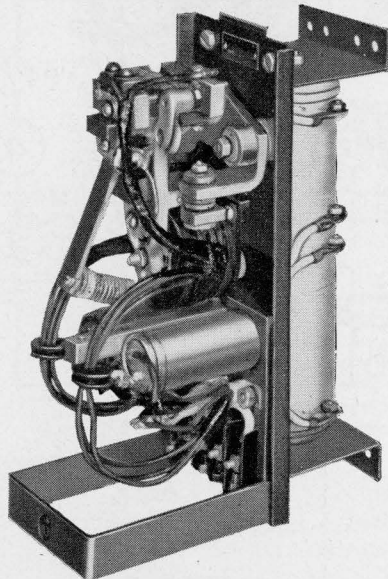
These relays are used to control the battery-charging contactors A1 and A2. Each relay has three operating coils, a shunt coil which is connected through a resistor across the auxiliary generator armature, a series coil which carries the generator load current, and a differential coil which is connected through a resistor across the contacts of the charging contactor A1 or A2. When the contactor is open, the current in the differential coil is proportional to the difference between the generator and battery voltages.

The magnetic circuits of the shunt and differential coils are so arranged that when the generator voltage is less than the battery voltage, the relay contacts are held open. When the generator voltage exceeds the battery voltage by about 3 volts, the relay contacts close, thus closing the charging contactor. When the contactor closes, an interlock inserts additional resistance in series with the shunt coil which raises the normal dropout voltage of the relay, thus requiring less reverse current through the series coil to open the relay contacts. The series coil is so connected that while current is flowing from the generator to the battery, it will aid the shunt coil in holding the relay armature in the closed position. However, when the generator voltage decreases below the battery voltage, the current in the series coil reverses, thus reducing the armature holding flux. A small amount of reverse current will cause the relay contacts to open, thus opening the battery-charging contactor.

CONTROL EQUIPMENT, TYPE M

VOLTAGE-CONTROL RELAY

Each charging generator is controlled by its individual voltage-control relay. One resistor is



Photograph 818087

G-E voltage-control relay (without cover) for use on diesel-electric locomotive

permanently connected in series with the generator field, and another resistor is connected in parallel with the first, through the relay contacts, when de-energized. As the generator voltage builds up to the relay setting, the relay operating coil causes the first contact to open, disconnecting one of the parallel resistors and reducing the generator field current. As the generator voltage falls, the contact again closes.

This action is repeated with great rapidity and barely perceptible travel, so that an effective generator field current is maintained to hold the generator at 74 volts.

Should the generator speed increase to a point

where the voltage is not limited to 74, with the first contact open, the relay armature travels further and closes a second contact which shunts the generator field with another resistor. The relay then works against this contact, to hold 74 volts.

For every speed and load current within the operating range, the voltage-control relay will maintain the field current necessary to hold 74 volts except for a slight variation due to a "bias" coil. Because two generators in parallel are charging the battery, and should divide the load equally, a bias coil is incorporated in each relay, so that if the two generators unbalance slightly, the relays slightly cut down the voltage of the heavier loaded generator and increase the other to limit the unbalance to a small value.

BATTERY VOLTMETER

One battery voltmeter is supplied, which has a colored band above the scale to indicate the battery charge.

LOAD INDICATORS

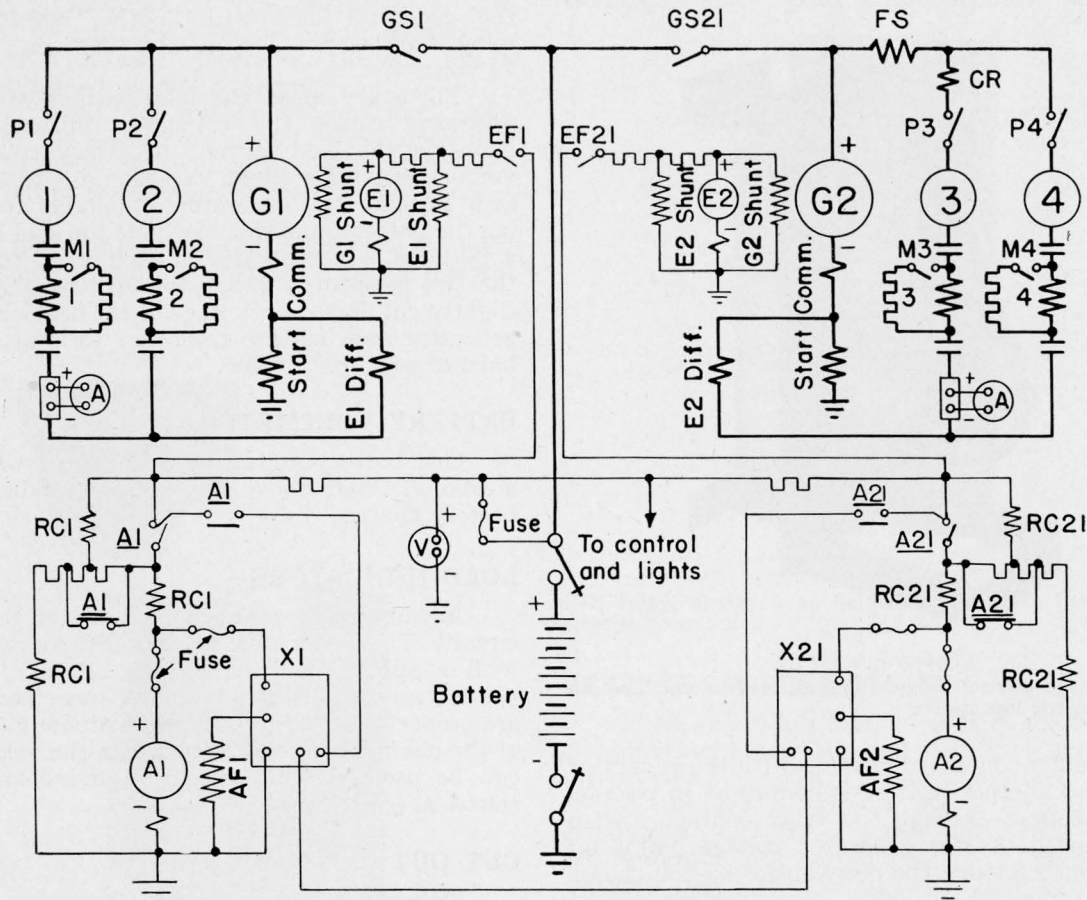
A load indicator is connected in each generator circuit. This indicator is actually an ammeter with a special dial marked in bands of green, yellow, and red, instead of amperes. The colors are proportioned to give an approximate indication of the character of service in which the locomotive can be used without danger of overheating the electrical equipment.

CUT OUT

Either power plant may be shut down in case of trouble, thereby isolating two traction motors. Battery charging will still function, though the amount of charge will be small if many lights are in use.

In case of traction motor failure, any individual motor may be cut out, leaving three motors in use and both battery-charging generators functioning.

CONTROL EQUIPMENT, TYPE M



Symbols and Abbreviations


- | | |
|-----------------------------------|---------------------------------|
| A- Auxiliary Generator | M - Motor Field-shunt Contactor |
| A - Auxiliary Generator Contactor | P - Motor Line Contactor |
| AF- Auxiliary Generator Field | - - Reverser |
| CR- Field-shunt Dropout Relay | RC - Reverse-current Relay |
| E- Exciter | X- Voltage Regulator |
| EF- Excitor Field Contactor | V Voltmeter |
| FS- Field-shunt Relay | A Load Indicator |
| G- Main Generator | |
| GS- Engine-starting Contactor | |

From Drawing K-6728103

Simplified connection diagram showing main circuits of G-E diesel-electric 44-ton locomotive for switching and road service

Note—While it is the intention to furnish locomotives in exact accordance with the foregoing specification, General Electric reserves the right to use alternate equipment or material when, as a result of war rationing, the equipment or material specified cannot be obtained in time to make scheduled deliveries.

44-TON DIESEL-ELECTRIC RAILROAD LOCOMOTIVE

*On Railroads***FROM COAST TO COAST**


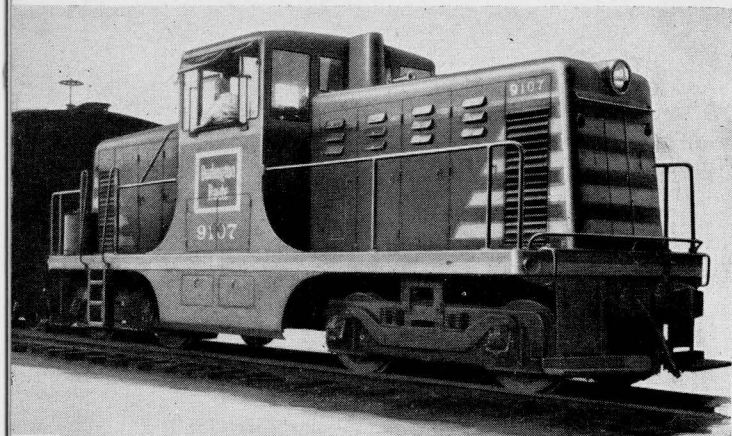
"To say that we are pleased with our 44-tonners is expressing it mildly—they have given us entire satisfaction," says the Vice President and General Manager of the Washington and Old Dominion Railroad.

Here are railroads that are slashing the cost of road work, transfer service, and yard switching with G-E 44-ton diesel-electric locomotives.

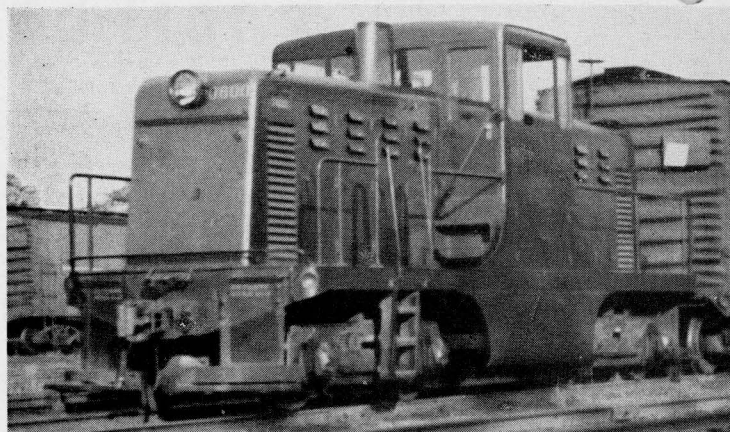
Alexander R. R.
 Almanor R. R.
 Amador Central
 Am. R. R. of Puerto Rico
 Arcade & Attica
 Aroostook Valley
 Atchison, Topeka and Santa Fe
 Atlantic and East Carolina
 Boston and Maine
 Central California Traction
 Chicago, Burlington & Quincy
 Chicago, Milwaukee, St. Paul and Pacific
 Chilean State Railways
 Denver & Rio Grande Western
 Fernwood, Columbia & Gulf

Guayaquil & Quito
 Grafton & Upton
 Great Northern
 Greater Winnipeg Water District Ry.
 High Point, Thomasville & Denton
 Laurinburg & Southern
 Lehigh Valley
 Maine Central
 Mexican Government Railways
 Middletown & Unionville
 Minneapolis and St. Louis
 Minneapolis, St. Paul & Sault Ste. Marie
 Mississippi Export Railway
 Missouri & Illinois Bridge & Belt
 Missouri Pacific
 New York, New Haven and Hartford
 New York, Ontario and Western
 Northern Pacific
 Oahu Railway & Land Company
 Quincy R. R.
 Sacramento Northern
 St. Louis-San Francisco
 St. Paul Union Depot
 San Francisco and Napa Valley
 Southern Pacific Lines
 Pacific Electric Ry.
 Southern Pacific Co.
 Visalia Electric Ry.
 Southern Railway System
 Alabama Great Southern
 Chattanooga Traction
 Cincinnati, New Orleans & Texas
 Pacific
 New Orleans & Northeastern
 Petaluma and Santa Rosa R. R.
 Southern Ry. Co.
 Springfield Suburban
 Tidewater Southern
 Union Freight R. R.
 Washington and Old Dominion
 Western Maryland
 Winona R. R.

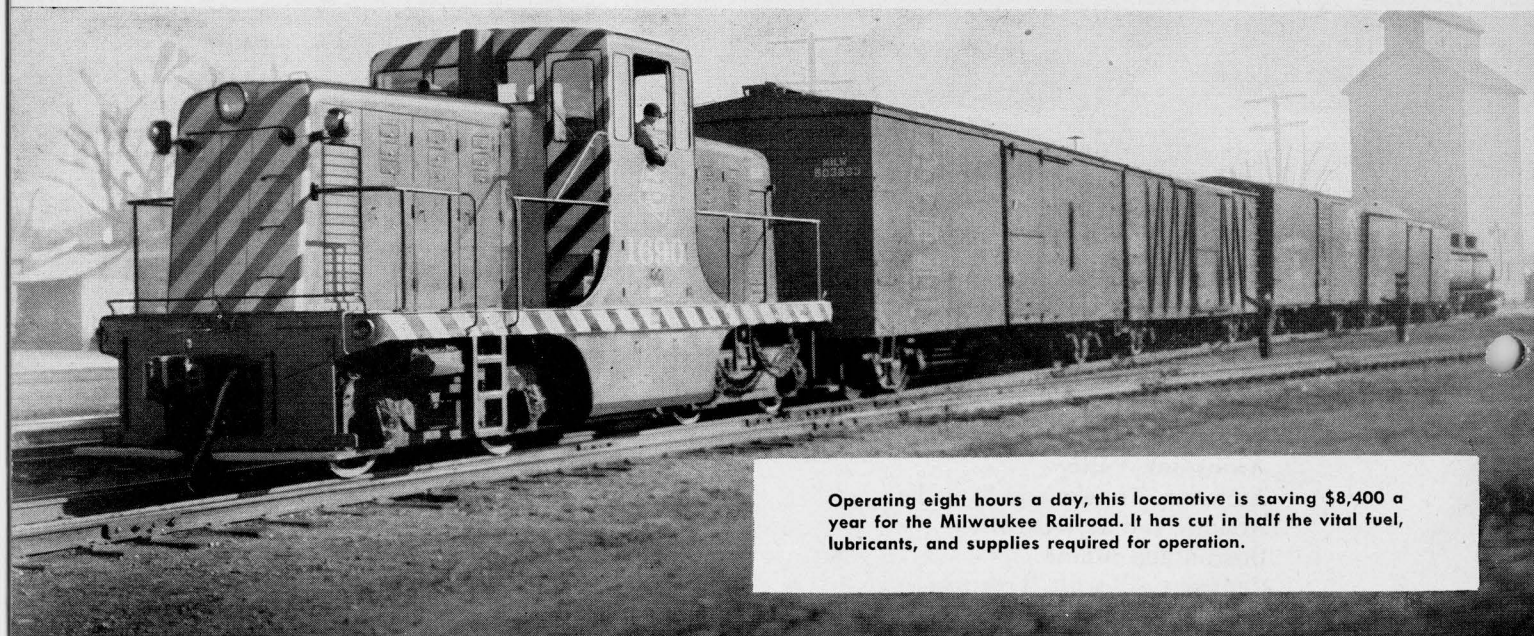
44-TON DIESEL-ELECTRIC RAILROAD LOCOMOTIVE



First G-E 44-tonner went into service on the Burlington in 1940. Busy 18 hours a day, its superior performance quickly won a place for four more, which are used in light road service.



New Haven placed its first 44-tonner in service in 1940. In operation 16 hours a day, this locomotive made such a fine record on availability, maintenance, and fuel consumption, that they obtained sixteen more.



Operating eight hours a day, this locomotive is saving \$8,400 a year for the Milwaukee Railroad. It has cut in half the vital fuel, lubricants, and supplies required for operation.