

SPECIFICATIONS

GENERAL MOTORS

1500 H.P. "LEAD" UNIT

DIESEL - ELECTRIC

LOCOMOTIVE



ELECTRO - MOTIVE DIVISION

GENERAL MOTORS CORPORATION

LA GRANGE ILLINOIS U. S. A.

Specification 8002

July 10, 1945

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GENERAL MOTORS
1500 H.P. "LEAD" UNIT
DIESEL-ELECTRIC
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SECTION 1

General Information and Identification

GENERAL MOTORS
LOCOMOTIVES

Model F3—"Lead"—1500 Horsepower Locomotive.

Type A.A.R. designation (B-B). Common designation (0440).

Arrangement The general arrangement of the locomotive is shown on Elevation and Floor Plan Drawing 8090261.

The locomotive consists of one unit complete with engine, generator, trucks and all necessary auxiliaries, with a control cab at the front which identifies it as a "Lead" unit.

Major Dimensions	Distance pulling face of front coupler to centerline of No. 1 truck..	10' 8"
	Distance between bolster centers.....	30' 0"
	Truck—rigid wheel base.....	9' 0"
	Distance, pulling face front coupler to rear coupler.....	50' 8"
	Width over body posts.....	9' 10"
	Width over handholds.....	10' 7"
	Height, top of rail to top of carlines.....	14' 0½"
Overall height, over horns.....	15' 0"	

Drive	Driving motors.....	Four
	Driving wheels.....	4 Pair
	Diameter wheels.....	40"

Weights and Supplies	Total loaded weight on rails.....	230,000 lbs.
	Carbody and Equipment.....	154,400 lbs.
	Truck—Total 2.....	75,600 lbs.
	Fuel.....	1200 gal.
	Sand.....	16 cu.ft.
	Cooling water.....	230 gal.
	Lubricating oil.....	200 gal.

Clearances EMD Clearance Diagram 8097194 illustrates clearance conditions for Body, Truck, Motors, Running Gear and miscellaneous underneath equipment. Truck swing designed for 21° curve or 274' radius, with 2¼" free lateral motion in the truck bolster and ⅜" in Hyatt journal boxes.

**Safety
Appliances** All steps, grab handles and other safety appliances cover EMD interpretation of Interstate Commerce Commission requirements.

SECTION 2

Carbody Construction

GENERAL MOTORS
LOCOMOTIVES

Framing Carbody framing designed to simulate bridge construction using a modified Howe truss arrangement. The underframe has center sills joined to the side framing through cross members and side sills. The upper or roof portion is tied together with arched frames and carlines to form a turtle back roof. Ample jacking pads are provided for blocking the locomotive. Front and rear framing is arranged to provide collision protection. The complete assembly is of welded construction throughout, with reinforcing plates used at joints, placed so that no transverse welds are used.

Hatches Hatches designed to blend with the contour of the turtle back roof and located to provide access for removal of equipment.

Outside Finish The outside finish consists of paneling, mounted by use of battens, with allowance for deflection of body without buckling of panels. The finish does not assist in the support of the carbody.

Roof sheets are welded directly to the carlines and framing.

Flooring Consists of plates welded to the underframe acting as a base for application of anti-skid flooring in aisles.

Body Center Plates Grade "B" steel casting, welded to body bolster assembly. Wear plates applied to bottom and outside surfaces.

Control Cab The control cab, an integral part of the body, is located ahead and above the locomotive floor, leaving an unobstructed view for the operating crew.

The cab is insulated where possible with 2" insulation, fire and moisture proof, and equipped with two upholstered swivel type seats having arm and back rests. The inside finish consists of ceiling lined acoustical treatment, while the cab floor is wood within steel framing, linoleum covered.

Cab Sash Windshield sash. Stationary $\frac{9}{16}$ " safety plate glass. Mounted in a frame at an approximate angle of 15° from vertical and also slanting toward outside of car from center to form a wide "V" which, in combination with the vertical slant, will tend to shed rain, offering better visibility.

Side Sash Retractable $\frac{1}{4}$ " safety plate glass in the doors and windows next to the operators, mechanically operated with a crank. Forward portion pivoted for controlled ventilation.

SECTION 2

Carbody Construction



Engine Compartment Sash	$\frac{1}{4}$ " safety plate glass. Round sash all stationary with the exception of one sash on each side of locomotive which is hinged, swinging out.
Gutters	Gutters are provided above doors and cab windows.
Centering Device	A centering device is used at each end of locomotive, preventing excessive offset with multiple unit operation.
Draft Gear	National Malleable type M-380 rubber draft gear (<i>front and rear</i>).
Yoke	Special EMD design for low overhang.
Draw Bar Carrier	Spring supported, part of centering device.
Uncoupling Device	Operated from both sides of locomotive.
Coupler Swing	Normal 13° swing.
Front and Rear Connections	Air brake and signal lines fitted with shut-off valves.
Pilots	Pilots are designed to withstand substantial shock, braced firmly laterally and longitudinally.
Anti-Climbers	An anti-climber is placed at the intersection of the pilot and underframe.
Body End and Side Doors	<p>All doors are hinged type.</p> <p>The cab doors are arranged so that the cab can be reached directly from the outside or engine compartment. The door locks are of special EMD design "L" handle, latched in horizontal position. Outside cab doors locked by inside latch, left and right hand doors of engine room provided with a lock and Railway Coach key.</p>
Weather Stripping	For sash—rubber of special design to provide good cushioning and water-tight assembly. For outside doors—rubberized canvas covered sponge rubber at sides, top and bottom. One extra rubber strip at bottom towards outside.
Signal Brackets	<p>Combination flag and oil marker light brackets located at rear of unit. Flags and marker lights furnished by railroad. Front classification light is built integral with the illuminated number box blending into the contour of the carbody. Classification light arranged for Red, Green, or White indication. Classification flag brackets located within arm's reach outside cab side windows.</p> <p>Blue flag brackets placed at end of anti-climber in plain view from cab.</p>
Diaphragms	Attached to body end posts, with standard EMD face plate.

SECTION 3

Trucks



Truck Assemblies

Two (2) four (4) wheel truck assemblies are provided per locomotive and are interchangeable. Improved riding qualities and greater stability are obtained by a new treatment of load suspension, strictly an EMD development.

The truck frame is supported on each of the four journal boxes by twin group coil springs. Bolster springs rest on each end of the spring plank which in turn is carried by swing hangers *pivoted from outside of truck frame*.

Each of the four motors is supported by the driving axle to which it is geared, and a special suspension on the truck transom provides a flexible support, dampening out the torque shocks of the motor.

Axles

Oversize ATEA E-12 with oversize wheel and gear seat and journals to suit Hyatt Roller Bearings. A.A.R. material specification M-104.

Wheels

Rolled steel heat treated, 40" diameter, 2½" rim. Wheel tread ground smooth and concentric after assembly on axle.

Journal Boxes

Locomotive equipped with Hyatt Roller Bearings 6½" journals of special EMD design. Lateral thrust is taken through a cushioning arrangement directly by the box. Journal box pedestal guides provided with spring steel wear plate.

Truck Frame and Bolster

Steel casting, heat treated, EMD design.

Pedestals

Lined with spring steel plates bolted to frame.

Pedestal Tie Bars

Fitted and applied at the lower end of the pedestal legs, held in position by bolts.

Truck Center Plates

Truck center plate provided with wear plates, dust guard, and lubricating arrangement.

Side Bearings

Friction type side bearings.

Interlocks

Body and truck interlocks provided each side of the center plate, serving as anti-sluing device in case of derailment.

Swing Hangers

Made from the same kind of steel as the axles.

Bolster Springs

Full elliptic.

SECTION 3

Trucks



Truck Brakes Clasp brake rigging provided on each wheel, operated by individual brake cylinders.

Brake Pins All pins and bushings hardened and ground, large size. All holes in brake rigging bushed.

Hand Brake Hand brake provided for the locomotive connected to one brake cylinder lever only. All trucks provided with lever for hand brake connection, making trucks interchangeable.

SECTION 4

Power Plant and Transmission

GENERAL MOTORS
LOCOMOTIVES

Engine G.M. Diesel sixteen (16) cylinder, 2 cycle, bore $8\frac{1}{2}$ " , stroke 10", unit injection Roots blower scavenging through cylinder wall intake, and multi-valve exhaust. Water cooled cylinder liners and heads, oil cooled pistons, ten (10) bearing crankshaft, drop forged connecting rods, double floating piston pin bushings, and full floating piston assembly. Isochronous governor speed control, separate overspeed trip, lubricating oil and water pumps.

Main Generator EMD forced ventilated, nominally 600 volt direct current. Single bearing direct connected to engine crankshaft through alternator rotor and flexible coupling. Capacity suitable to continuously transmit to traction motors the rated output of the engine under all conditions for which the locomotive is offered.

Alternator EMD A.C. 149V, 3 phase, 16 pole, built integral with main generator, to supply A.C. power to induction motors driving engine cooling fans and traction motor blowers.

Traction Motors Four EMD direct current, series wound, roller bearings forced ventilated, axle hung motors.

Auxiliary Generator Constant voltage, 10 K.W., provides current for control circuits, lighting and battery charging with automatic voltage regulator.

Load Regulator A load regulator is provided which automatically maintains a constant horsepower output, corresponding to each throttle position, over the entire range of locomotive speeds.

Engine Starting By motoring of the main generator through use of special starting fields energized by the locomotive storage battery.

Engine Cooling Consisting of two direct driven centrifugal water pumps on the engine, tube-finned type radiators and 4 A.C. motor driven cooling fans located in hatch above engine. Radiator tube-finned type, water cooled oil cooler and water tank, mounted as a unit directly in front of the governor end of engine. Automatic water temperature control and hot engine alarm.

Engine Lubrication Gear type main bearing and piston cooling pumps, pressure lubricate all bearings, rods, cams, rocker arms, and pistons, while the scavenging pump with a capacity in excess of the combined total of the two pressure pumps filters and cools the oil. Fine mesh screens protect the pumps. Low oil pressure and high suction protection provided.

Power Plant and Transmission



GENERAL MOTORS
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Engine Fuel System

Return flow, single D.C. motor driven gear pump, protected by suction filter in addition to discharge filters to insure clean fuel for the engine. An assembly of sight glasses and relief valves offers visual indication of any system trouble plus protection against excessive pressures.

Engine Exhaust

Dual fabricated chambers, each with independent exhaust.

Fuel Tank

Tank built of heavy gauge steel, with baffle plates.

Capacity 1200 gallons, located underneath the locomotive body. Filling station each side, vents equipped with flame arrestors. Double sumps with cleanout plugs and non-removable water drains located at bottom of tank.

Each fuel filling station has I.C.C. approved direct reading fuel gauge, indicating fuel level $4\frac{1}{2}$ " from top of tank. Tank is also supplied with a hydrostatic distant type level gauge, indicating levels to within 1" of the bottom.

I.C.C. Requirements

Each filling station fitted with pull ring for emergency fuel cut-off. Similar pull cords located at operators control station and in engine room.

Electrical Control Cabinet

Cabinet houses the locomotive high and low voltage control equipment.

- 1) High and low voltage control for Main Generator, Alternator, Blower Motors and Traction Motors.
- 2) Battery charging control.
- 3) Engine starting.
- 4) Distribution panel.

The cabinet is ventilated and readily accessible for service or unit replacement.

Locomotive Control

Transition forward and backward, with four (4) motor connections—parallel series, parallel series shunt, parallel and parallel shunt. High voltage circuits are safeguarded by ground protective relays.

Storage Battery

32 cell, 64 volt, 426 ampere hour—(8 hour rating) battery located in two cabinets, one on each side of the locomotive directly in front of the fuel tank.

Engineer's Control Station

Engineer's control station located conveniently to the left of the engineer's seat, includes the engine speed throttle, transition and reverse levers. The lever arrangements are such that the throttle must be in "Idle" and transition in "Off" before the reverse lever can be removed to isolate the controller. Translucent illuminated dials indicate position of throttle and transition levers.

Engineer's Control Switch

Multiple button control and lighting switch located within reach of the engineer, having the branch circuits fused on the distribution panel in the control cabinet.

- | | |
|---------------------|--------------------------|
| 1) Attendant's call | 6) Number & Gauge lights |
| 2) Control | 7) Classification lights |
| 3) Generator field | 8) Headlight dim |
| 4) Fuel pump | 9) Headlight bright |
| 5) Defrosters | |

Power Plant and Transmission



Order Lights Separate order lights provided for the engineer and fireman.

Local Control Station A local control station located at the governor end of the engine on the cooling water tank is used to individually control the engine and includes the following apparatus:

- a) Engine start and stop buttons.
- b) Isolation switch.
- c) Master air valve for electro-pneumatic throttle.
- d) Fuel pump contactor, fuse and switch.
- e) Oil pressure and engine water temperature gauges.
- f) Fuel sight gauges and relief valves.

Signal Alarm System Alarm bell connected to hot engine and low oil switches with respective lights to indicate the circuit in trouble. No voltage, protection and alarm is provided for the alternator.

Engineer's Instrument Panel Directly in front of the engineer on the dash is located a panel having two air brake gauges, wheel slip light, transition meter, windshield wiper valve.

Speedometer A combination speedometer, recorder, and odometer located to the left of the engineer's instrument panel.

SECTION 5

Air Brakes

GENERAL MOTORS
LOCOMOTIVES

- Air Brakes** Automatic and independent brakes are provided on all wheels, with suitable end connections.
- Brake Piping** I.P.S. copper tubing and 300 lb. solder fittings except at end valves where wrought iron pipe with A.A.R. malleable iron fittings are used. All piping $\frac{5}{8}$ " O.D. and under uses nominal size copper tubing with S.A.E. tube fittings.
- All brake equipment mounted in a rack requiring a minimum amount of piping and readily accessible for inspection or replacement.
- Main Reservoir** Main reservoirs are carbon steel with all-welded seams and heads, $26\frac{1}{2}$ "x50", capacity 25,000 cubic inches.
- One reservoir is located under the cab floor while the second unit is mounted under the locomotive between the battery boxes in front of the fuel tank for a total capacity of 50,000 cubic inches. Reservoirs are fitted with drain cocks.
- Air Compressor** One Gardner Denver, two stage, three cylinder, air cooled direct coupled compressor, having displacement of 180 cu. ft. per min. at 800 RPM. Pro rata delivery in proportion to engine speed.
- Air compressor governor adjusted to provide constant main reservoir pressure with 5 to 10 lb. differential.
- Brake Cooling System** Finned type cooling coils placed between air compressor and first main reservoir.
- Sanding** Sanding controlled by manual operated valve provided for forward movement only.
- Sand Capacity** Four sand boxes, capacity 4 cu. ft. each, total 16 cubic feet.

SECTION 6

Equipment



- Cab Heaters** Two hot water cab heaters with fan driven air circulating system in each cab, hot water taken from engine cooling system. Each heater has a three speed switch for the fan.
- Defroster** Two defroster blowers—motor driven.
- Sun Visors** Four adjustable metal sun visors per cab.
- Warning Devices** Two large diaphragm type air horns, one pointing forward and the other towards the rear.
One 12" locomotive bronze bell with internal ringer.
- Fire Extinguisher** 1 quart carbon tetrachloride—in control cab.
1 gallon carbon tetrachloride—in engine room.
- Window Wipers** Two large size—pneumatic type, double wiper blades.
- Toilet** Coach type—double hopper, foot operated, with seat but without lid, independent water tank.

SECTION 7

Options

GENERAL MOTORS
LOCOMOTIVES

Gear Ratio:

Option	1	2	3	4	5	6
GEARS	62-15	61-16	60-17	59-18	58-19	57-20
RATIO	4.135	3.81	3.53	3.28	3.05	2.85
CONT. T. E.*	32,500	30,000	27,000	25,000	23,750	22,500
MAX. SPEED	65	70	75	80	89	95

*Continuous tractive effort is given per 1500 H.P. unit.

See *speed-tractive effort curve*,

- Special gearing of 65-12 is available as a modification, but involves special motors.

Brakes:

Two combinations are available.

- 9" cylinders, 2.9 levers, 14" shoes, 300,000 lb. @ 100 lb. cylinder pressure.
- 10" cylinders, 2.9 levers, 18" shoes, 370,000 lb. @ 100 lb. cylinder pressure.

Headlights:

The following headlights are available—

- 250 Watt—32V Medium—screw base—prefocused.
- 250 Watt—64V Medium—screw base—prefocused.
- 250 Watt—60V Medium—screw base—prefocused.
- 360 Watt—12V Mogul prefocused.
- 480 Watt—12V Bi-Post prefocused.
- 50 C.P.—7 cluster double contact bayonet.

Couplers:

The following couplers are available.

- Type "E"
- Tightlock
- Links

Note: Solid links used at No. 2 end of "Lead" unit only if operated with another unit, thereby allowing the omission of the end doors and some modifications not otherwise possible.

Transition:

- Manual
- Automatic
- Combination of Automatic and Manual

SECTION 8

Locomotive Modifications

GENERAL MOTORS
LOCOMOTIVES

- Dynamic Brake:** Infinitely variable type, using traction motors as generators. The power thus generated is dissipated through forced ventilated grid resistors.
- Steam Generator:**
- a) 1600 lb. Steam Generator with 200 gallons of water if dynamic brakes are used. Possible total of 800 gallons capacity without Dynamic Brake.
 - b) 300 lb. Steam Generator.
300 gallons water capacity.
Stand-by service only.
- Diaphragm Clamps:** Studs for retracting diaphragms furnished on locomotives to be used in freight service.
- Maximum Speed Control:** Maximum Speed Control provided when required.

SECTION 9

Painting



General Only the best quality materials available are used, with special attention given to both the selection of materials and methods of application to insure a maximum of protection and durability.

Cab Inside finished in Suede Grey Dulux, trimmed in black.

Engine Room Inside finished in Suede Grey Dulux, trimmed in black.
All air, fuel, water and lube oil piping color coded at points of connection.

Outside Finish Color arrangement and design to agree with Railroad's requirement. To be finished in standard lacquer finish as follows:

- a) Special primer.
- b) Surfacer.
- c) Knife glaze.
- d) Wet-sand entire surface.
- e) Spot surface.
- f) Dry-sand and thoroughly clean.
- g) Lacquer finish (7 to 10 coats).

Under Carriage Black Dulux unless otherwise specified.

Trucks & Tanks Black enamel unless otherwise specified.

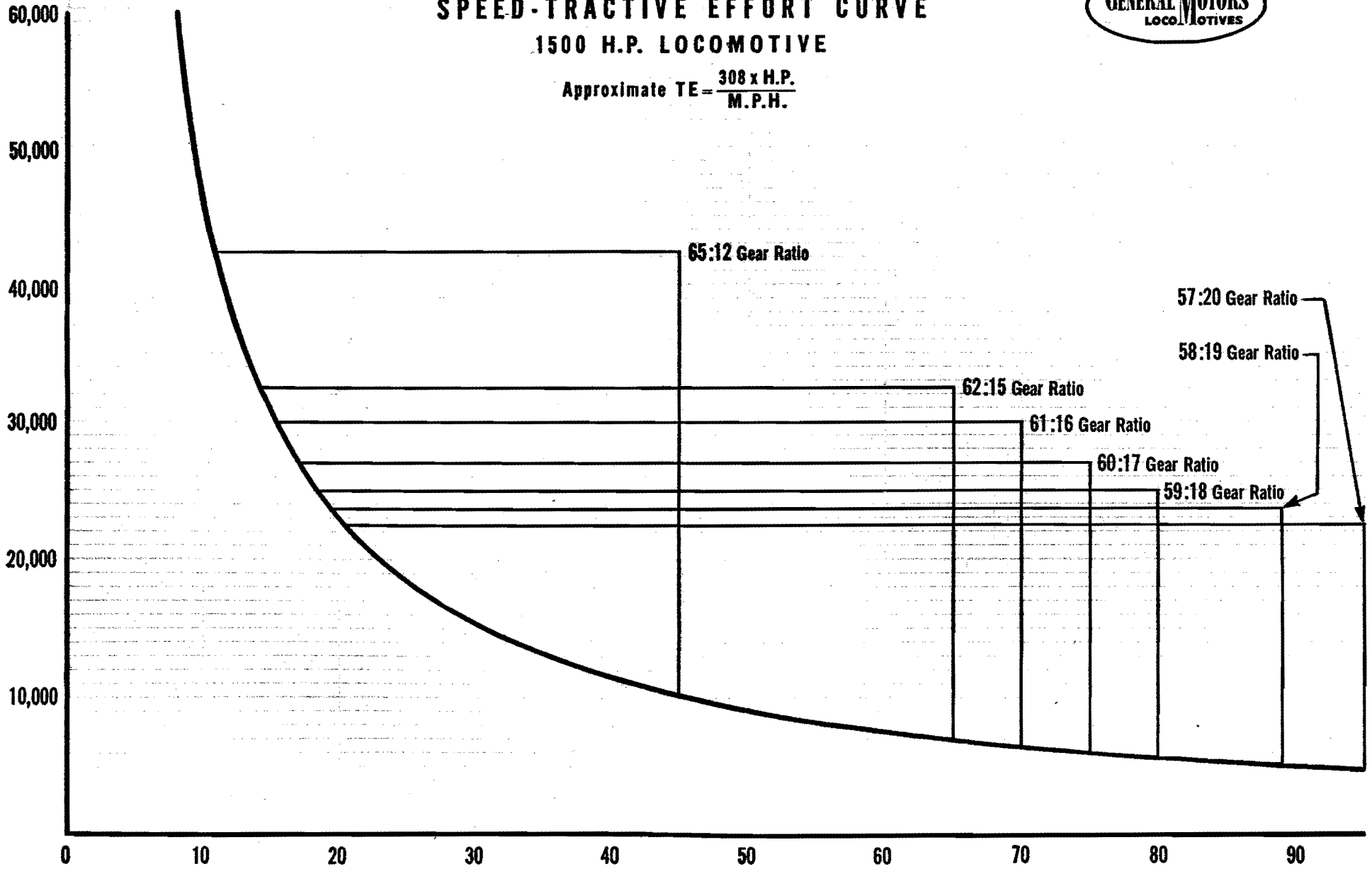
ELECTRO-MOTIVE DIVISION
GENERAL MOTORS CORPORATION
LA GRANGE, ILLINOIS



SPEED-TRACTIVE EFFORT CURVE 1500 H.P. LOCOMOTIVE

$$\text{Approximate TE} = \frac{308 \times \text{H.P.}}{\text{M.P.H.}}$$

TRACTIVE EFFORT—POUNDS



SECTION 11

Warranty and Patents



Warranty:

THIS IS TO CERTIFY that we, ELECTRO-MOTIVE DIVISION, GENERAL MOTORS CORPORATION, LaGrange, Illinois, warrant all new equipment manufactured by us to be free from defects in material and workmanship under normal use and service; our obligation under this Warranty being limited to making good at our factory any part or parts thereof, which shall within one (1) year after delivery of such equipment to the original purchaser, or before such equipment has been 100,000 miles in scheduled service, whichever event shall first occur, be returned to us with transportation charges prepaid, and which our examination shall disclose to our satisfaction to have been thus defective.

This Warranty being expressly in lieu of all other Warranties expressed or implied and of all other obligations or liabilities on our part, and we neither assume nor authorize any person to assume for us any other liability in connection with the sale of our equipment.

This Warranty shall not apply to any equipment which shall have been repaired or altered unless repaired or altered by us or by our authorized service representatives, if, in our judgment, such repairs or alterations affect the stability or reliability of the equipment, or if the equipment has been subject to misuse, negligence or accident.

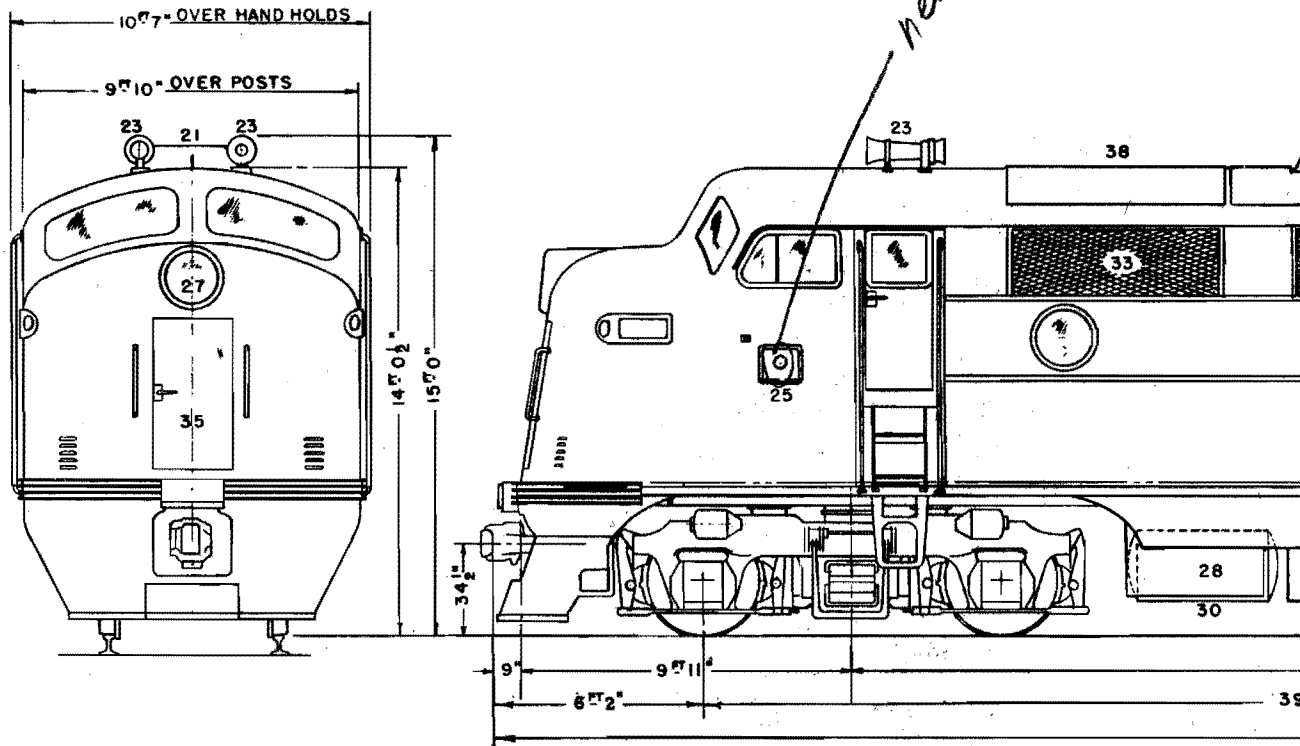
We reserve the right to make changes in design or add any improvements on equipment at any time without incurring any obligation to install same on equipment previously purchased.

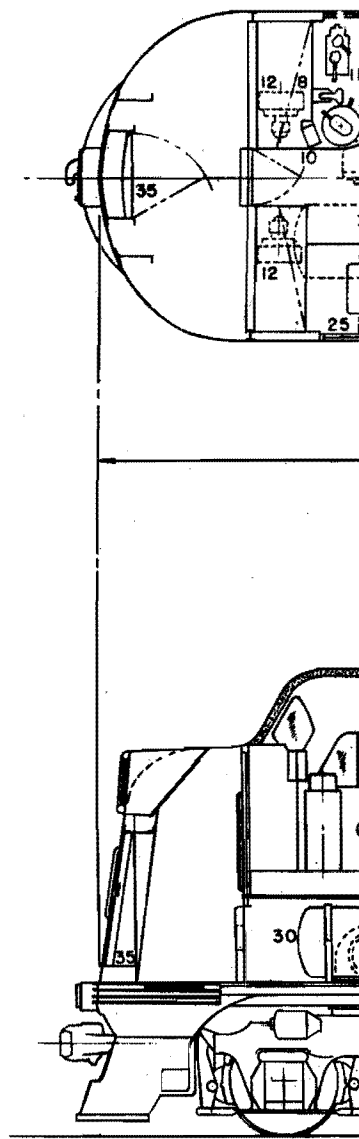
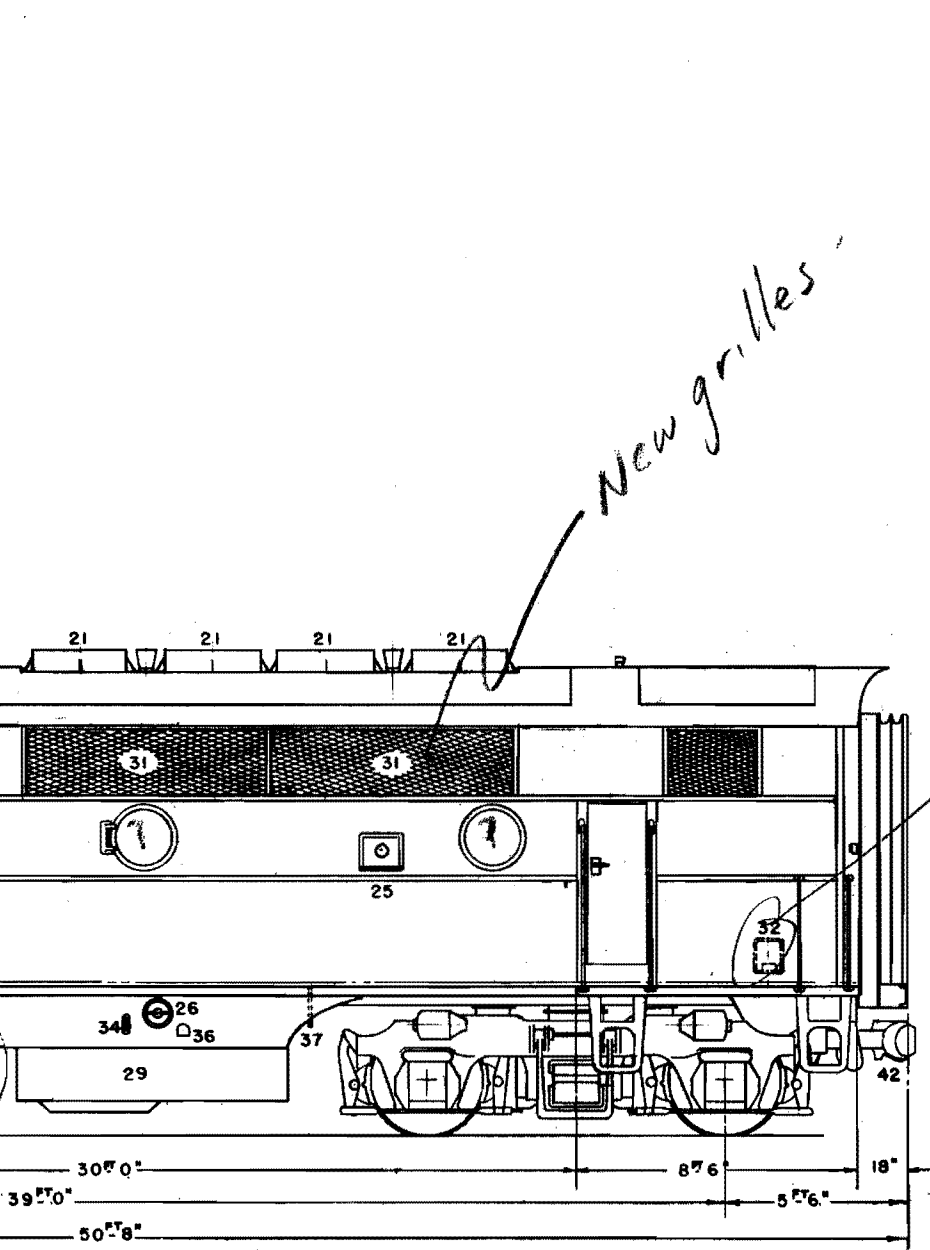
Patents:

The Electro-Motive Division, General Motors Corporation, will not assume liability for patent infringement by reason of purchase, manufacture, sale, or use of devices or equipment not included in and covered by this Specification.

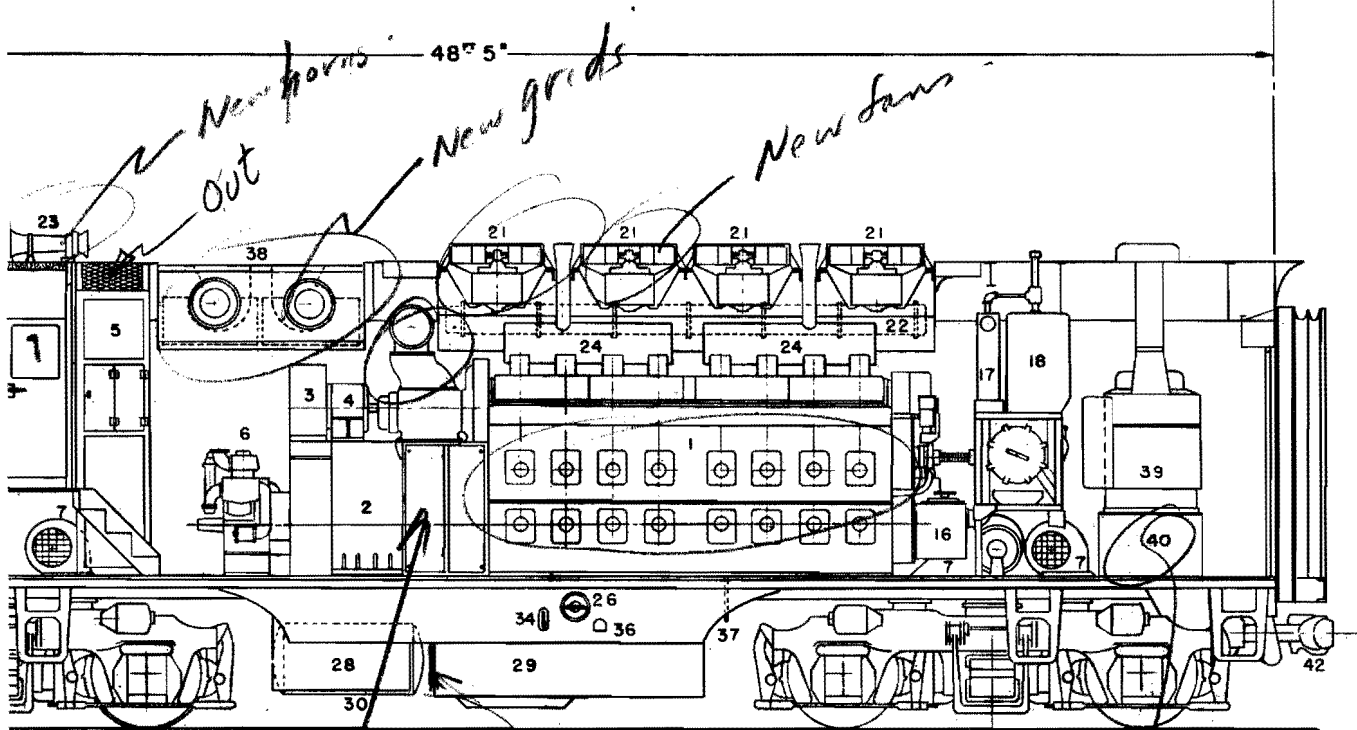
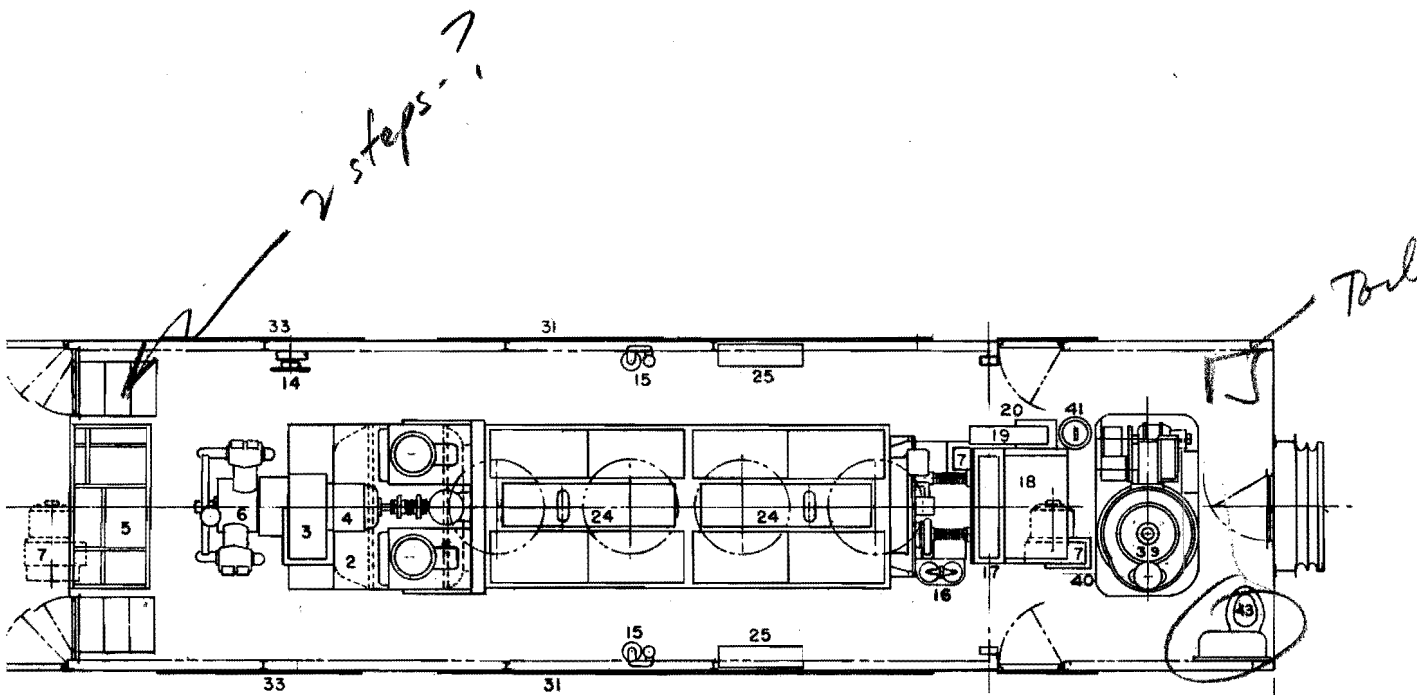
SUPPLIES

FUEL	1200 GAL.
LUB. OIL	200 GAL.
COOLING WATER	230 GAL.
SAND	16 CU. FT.
☆ BOILER WATER	200 OR 800 GAL.





1500 H.P. MODEL F3 LOCOMOTIVE "LEAD"



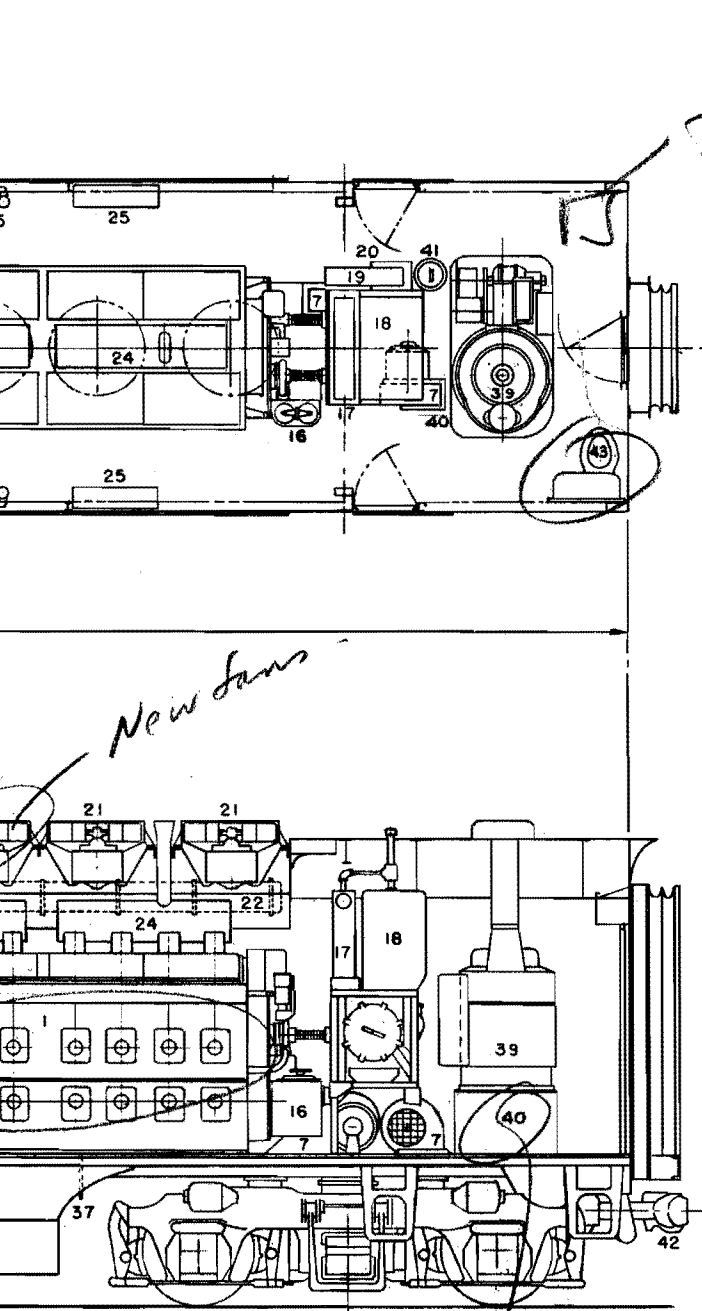
Box out

FULL LENGTH
SHEET GLASS

☆ MODIFICATIONS

⊕ OPTIONS

Tank out.



Toilet here

New fans

Tank out.

- 43 TOILET
- ⊕ 42 COUPLER BETWEEN UNITS
- ☆ 41 BOILER WATER SOFTENER
- ☆ 40 BOILER WATER TANK, 200 GAL.
- ☆ 39 BOILER
- ☆ 38 DYNAMIC BRAKE GRIDS & BLOWERS
- 37 ENGINE WATER FILLER
- 36 EMERGENCY FUEL CUT-OFF
- 35 DOOR, (PLAIN)
- 34 FUEL TANK GAUGE
- 33 AIR INTAKE FOR GRIDS & ENGINE ROOM
- ☆ 32 BOILER WATER FILLER
- 31 AIR INTAKE & SHUTTERS
- 30 MAIN AIR RESERVOIR
- 29 FUEL TANK, 1200 GAL.
- 28 BATTERIES
- 27 HEAD LIGHT, (FIXED BEAM)
- 26 FUEL FILLER
- 25 SAND BOX
- 24 EXHAUST MANIFOLD
- 23 HORN
- 22 RADIATOR
- 21 34" FAN & MOTOR 36
- 20 LOAD REGULATOR
- 19 ENGINE CONTROL & INSTRUMENT PANEL
- 18 ENGINE WATER TANK
- 17 LUB. OIL COOLER
- 16 LUB. OIL FILLER
- 15 FUEL TANK VENT WITH FLAME ARRESTOR
- 14 HAND BRAKE
- 13 SEAT
- 12 CAB HEATER
- 11 AIR BRAKE VALVE
- 10 SPEEDOMETER RECORDER
- 9 CONTROL STAND
- 8 INSTRUMENT BOARD
- 7 TRACTION MOTOR BLOWER
- 6 AIR COMPRESSOR
- 5 CONTROL CABINET
- 4 AUX. GENERATOR
- 3 GENERATOR BLOWER
- 2 MAIN GENERATOR & ALTERNATOR
- 1 ENGINE E.M.D. MODEL 16-567 B.

☆ MODIFICATIONS
⊕ OPTIONS

L LENGTH
HT GLASS



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