

M.I.1777A

MAINTENANCE INSTRUCTION



SCHEDULED MAINTENANCE PROGRAM 60-Series GP and SD Rail Freight Locomotive Models

**Equipped With 710-Series Engines
and DC Traction Components**

The Maintenance Schedule as outlined in this instruction supercedes M.I. 1777 dated 9/85. It is offered for planning purposes only. As written, this document reflects current GMLG product design and service experience for the 60-series class of rail freight locomotive models. The content of this M. I. reflects extended engine overhaul cycles based on time and/or megawatt-hrs. This recommendation is consistent with present fleet performance and remains within the GMLG experience envelope.

NOTICE

This Maintenance Instruction is intended to serve as a guide when establishing maintenance schedules to meet the particular requirements of individual operations and planned economic life of the locomotive. It provides average recommendations which should ensure satisfactory locomotive operation and economical maintenance costs where average load factors and climatic conditions are encountered.

The scheduled inspection and maintenance items defined herein are specific to GMLG freight locomotives as a general class of motive power, and to 60-Series GP/SD locomotives as a unique sub-set of that fleet. Component renewal provisions are consistent with traditional "In-Carbody" engine overhaul procedures. Customers wishing to schedule more extensive overhaul procedures including a UTEX engine can extend the overhaul period by 20%.

For planning purposes, EMD has established the following overhaul interval recommendations for 60-Series freight locomotives. These overhaul interval recommendations are based on whichever event occurs first: time, mileage, or megawatt hours.

60-Series GP/SD Freight Locomotives

Equipped With Prime Mover Engine:

* 12-710 Series: 6 years / 1,000,000 miles / 17,000 MWHRS.

* 16-710 Series: 6 years / 1,000,000 miles / 23,000 MWHRS.

NOTES:

Mileage and MWHR values referenced above are defined by Microprocessor Archive Data as accumulated by the locomotive control computer system.

As always, when specific operating conditions severely impact locomotive performance and or reliability, maintenance and overhaul schedules must be adjusted accordingly.

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INTRODUCTION

The recommendations contained in this Maintenance Instruction are based on the following:

1. Fuel oil will meet the specifications of Maintenance Instruction M.I. 1750.

NOTE

Fuel filter integrity can be checked periodically by measuring pressure differential at the rack mounted filter gauge.

Wayside fuel filtration should be recognized as an important consideration in meeting the specifications of M.I. 1750. Locomotive re-fueling at remote-site locations by transient fuel vendors must also consider provisions for wayside or pre-delivery filtration.

2. Lubricants will meet the specifications of Maintenance Instructions M.I. 1752, 1756, and 1764 with levels properly maintained for engine, journal boxes, traction motor support bearings, and gear cases.

NOTE

Periodic engine oil samples should be taken to monitor the suitability of the oil for continued use. Oil should be changed at the intervals specified in this M.I. or when laboratory analysis indicates fresh oil is required. Evaluation of engine and oil condition should dictate when more frequent oil changes are required. The type of service, selection of oil, quality of filter elements, and condition of engine will influence the frequency of oil change.

3. Lubricating oil filters will be of a quality equal to original equipment and will be changed at the intervals specified in this Maintenance Instruction.

NOTE

Lube oil filter tank pressure can be checked periodically as a means to monitor filter condition.

4. Engine coolant will meet the specifications in Maintenance Instruction M.I. 1748 and will be maintained to proper levels.

NOTE

Periodic engine coolant samples can be taken to ensure that the quality of the solution is maintained. The specific concentrations of corrosion inhibitor in the coolant should be monitored and, as a general rule, coolant solution should be changed at least annually.

5. Government mandated inspections are specifically not included in this Maintenance Instruction.

NOTE

Development of a comprehensive inspection and maintenance plan, including AAR and FRA inspections, and unique owner/operator requirements, is deemed the responsibility of the customer.

6. Maintenance requirements and service procedures for Customer specified locomotive options and equipment shall be provided separate from this document.

NOTE

Service information on specialty items will generally be provided by the original manufacturer and reflect their recommendations. Distribution of such information will be through GMLG at time of locomotive delivery.

7. Publications, as referenced in abbreviation examples listed below, will be followed for inspections, tightening, and maintenance procedures.

LOM means Locomotive Operator's Manual

LSM means Locomotive Service Manual

EMM means Engine Maintenance Manual

M.I. means Maintenance Instruction

CTG means Computer And Troubleshooting Guide

FRA means Federal Railway Administration standards Ref: Title 49 CFR-Transportation (parts 200 -399)

AAR means Association of American Railroads Manual of Standards and Recommended Practices.

Government mandated inspections are specifically not included in this Maintenance Instruction.

DAILY

LOCOMOTIVE CAB

- | | |
|---|--|
| Check operation of Integrated Cab Electronics.
Verify screen displays and Automatic Train Control signals. | LOM, LSM, CTG. |
| Check operation of electronic air brake system (if applied).
Verify screen displays and diagnostics. | LOM, LSM, Wabco |
| Monitor locomotive computer display panel messages.
Check for stored annunciator messages. | LOM, LSM, CTG.
See CTG for method. Perform checks or maintenance indicated by messages. |

ENGINE

- | | |
|---|-------------------|
| With engine idling: Check engine room for fuel, oil, or water leaks, unusual noises, or smoke. Also check other locomotive support systems (auxiliary generator, main alternator, traction motor blowers, air compressor, and cooling fans) for unusual noises. | LOM, LSM and EMM. |
| Check engine oil level. | |
| Check cooling system water level. | |

45 DAYS

- | | |
|---|---|
| Check traction motor gear case lubricant level on units equipped with grease-filled gear cases. | M.I.1756. Maintain at sufficient level to provide full gear tooth dip into grease |
| Check oil lubricated traction motor support bearing lubricant level (if applicable). | M.I. 1756. Fill to overflow. |

90 DAYS

CAB AND CONTROL SYSTEMS

- | | |
|---|----------------|
| Test functional operation of Integrated Cab Electronics (ICE), if applicable.
Verify all system diagnostic features through ICE screens.
Correct any system failures. | LOM, LSM, CTG. |
|---|----------------|

Test functional operation of electronic air brake system (if applicable).

LOM, LSM, Wabco.

Perform system diagnostics through ICE screens. Correct any system failures.

Check locomotive computer.

LOM, LSM, CTG.

Monitor computer display panel messages.
Check for stored annunciator messages.

See CTG for method. Perform checks or maintenance indicated by messages. Qualify fault indicating devices and systems.

Perform all locomotive self-test functions.

Download archive and running totals as required.

ENGINE (Running)

With engine idling and at operating temperature:

Inspect lines, connections, and equipment for leaks; fuel, oil, water, air, exhaust gas.

EMM.

Inspect cylinder head mechanisms for proper rocker arm and valve bridge operation.

EMM.

ENGINE (Stopped)

Renew all lube oil filter elements.

Ten (10) primary elements.

Turbocharger element.

EMM, LSM. Use elements equal to original equipment.

Renew primary fuel filter elements and engine mounted fuel filter elements.

EMM, LSM. Use elements equal to original equipment.

Renew fiberglass element engine air filters.

LSM. Use elements equal to original equipment.

Visually inspect crankcase and air box for leaks and condition of power assemblies. Clean airbox drains if necessary.

EMM.

Inspect eductor tube for carbon deposits.

EMM. Clean if necessary.

Check operation of engine protector.

EMM, LSM, or M.I. 260.

Check cooling system inhibitor concentration.

M.I. 1748

ELECTRICAL EQUIPMENT AND SYSTEMS

Inspect, check, and test all alarms, automatic controls, and protective devices.

LSM and EMM.

Renew ICE blower filter element.

LSM. Use elements equal to original equipment.

Check ground relay action.	LSM.
Check low voltage AC system for grounds.	
Check low voltage DC system for grounds.	
Inspect fuel pump motor brushes.	M.I. 4110. Renew brushes in sets, if required.
Inspect traction motor brushes.	M.I. 3900. Depending upon type of service and operating conditions, brush life will range from 3 to 9 months. Replace brushes in sets only.
Check battery electrolyte level and specific gravity.	Wash cell tops and complete battery box. Apply petroleum jelly to terminals.

MECHANICAL EQUIPMENT AND SYSTEMS

Inspect inlet guide vane assembly. Check for worn bushings and fork rods, loose nuts, and cracking (fatigue) of actuating rods.	Replace excessively worn items as needed.
Check functional operation of HVAC system. Operate both heating and air conditioning modes regardless of season. Renew condenser inlet filter element. Renew fresh air make-up filter element. Renew return air filter element.	LSM. Use elements equal to original equipment.
Inspect main generator pit drain aspirator.	LSM. Clean if necessary.
Check vertical and lateral shock absorbers for leaks and proper control. Replace if defects are evident.	LSM.
Check condition of wheels. Check for wear, sharp flanges, shelling, cracks, and flat spots. Check rim surface for pitting, crushing, or build-up of cracks.	LSM, FRA, and AAR.
Check wheels for wheel size mismatch. True wheels or change wheel sets as required.	M.I. 1518
Check retention tank for leaks or overflow discharge.	LSM. Drain tank as required.
Check traction motor gear case oil level on units equipped with oil-filled gear cases.	LSM. M.I. 1756. Fill to overflow.
Check air compressor clutch assembly (if applicable) for proper operation and note unusual operating noise(s). Measure friction plate wear.	Pointers Article 2L95.

SIX MONTHS

CAB AND CONTROL SYSTEMS

Check functional operation of emergency fuel cut-off and throttle stop. LOM and LSM.

Lubricate throttle and reverser handle pivot points.

ENGINE (Stopped)

Visually inspect crankcase and oil pan for external leaks. Check for air leaks around aftercooler duct mounting flanges. EMM.

Clean or renew fuel suction strainer element. LSM.

ELECTRICAL EQUIPMENT AND SYSTEMS

Visually inspect traction motor support bearing wick lubricators for dirt plugging of the wick and for excessive wear, where applied. M.I. 3900. Clean or renew as required.

Check electrical cabinet ventilation LSM.

Take manometer readings at high voltage cabinet

Take manometer readings at AC cabinet.

Check condition of traction alternator. Clean rectifier banks and inspection windows.

- Inspect diode fuses. M.I. 3317-3. Replace diodes and fuses as required and record failed diode locations.

- Inspect commutation capacitors and resistors and generator current transformers. M.I. 3317-3.

- Inspect collector rings and brushes. M.I. 3317-1. Renew if necessary.

MECHANICAL EQUIPMENT AND SYSTEMS

Renew main reservoir air filter elements. LSM. Use elements equal to original equipment.

Check operation of main reservoir automatic drain valves. LSM.

Check yaw dampers (where applicable) for leakage and proper control. Inspect rod surface for scoring, pitting or corrosion, and mounting bushings for deterioration. LSM.

ONE YEAR

ENGINE (Running)

Perform load test.	LSM and EMM. If tests indicate horsepower is out of specification, check/calibrate injectors.
Check engine speeds and governor balance point.	CTG, EMM, LSM. Reset governor on test stand, if necessary.
Check overspeed trip.	EMM.
Check air pressure drop across aftercoolers.	EMM. Clean aftercooler cores if necessary.

ENGINE (Stopped)

Drain and renew governor oil.	EMM and M.I. 1764.
Set injector timing and rack length.	EMM.
Perform complete power assembly inspection, including liners, pistons, piston rings, p-pipes, connecting rods, and crankshaft.	EMM.
Visually inspect air box for oil/water leaks, and proper air box drainage.	EMM. Clean drains as required.
Remove exhaust manifold inspection plate and inspect screen and trap.	EMM. If foreign objects are found in trap, remove screen to inspect turbine vanes. Also inspect power assemblies.
Remove and clean oil separator element.	EMM.
Check soak back oil system and turbocharger oil system for proper operation. Check soakback filter element.	EMM.
Retorque main lube oil and piston cooling oil pump shaft nut.	EMM.

ELECTRICAL EQUIPMENT AND SYSTEMS

Inspect all visible insulation and connections on traction motor leads and carbody boots.	LSM.
Inspect condition of traction alternator collector rings. Reverse polarity and replace brushes.	LSM and M.I. 3317-2.
Inspect dynamic brake blower motor brushes. Renew brushes as complete set, if required.	LSM and M.I. 4104.

ONE YEAR (cont.)

Visually inspect dynamic brake grids, grid shorting contactors, and cables.

LSM and M.I. 1602.

Check operation of all contactors. Inspect arc chutes and interlock plunger bolts.

CTG and LSM.

Renew electrical cabinet air filters.

LSM. Use elements equal to original equipment.

Change high voltage cabinet filter element.

Change AC cabinet filter element.

Visually inspect DC motors and renew brushes in complete sets.

- Soak back pump, M.I. 4110

- Cab heater blower, M.I. 4101.

Inspect starting motor brushes.

LSM, EMM, M.I. 3900. Blow out motors with low pressure air. Renew brushes in sets, if required.

MECHANICAL EQUIPMENT AND SYSTEMS

Clean air compressor air filter housing and renew air filter elements.

LSM. Do not attempt to clean elements.

Change air compressor oil and renew oil filter.

M.I. 1756 and M.I. 1144.

Replace DL filter elements in air brake system (if equipped).

LSM. Use elements equal to original equipment.

Inspect radiator air passages and clean if necessary.

LSM, M.I. 549. Operation in areas and in periods of airborne seeds and leaves can require more frequent cleaning.

Clean radiator header screens after first year of operation. Condition of screens at this time can provide a basis for future cleaning.

M.I. 549 and M.I. 550. The presence of metal chips at first cleaning or after engine parts have been renewed is not an abnormal condition.

Inspect and test cooling system pressure cap and filler neck.

LSM. Renew cap or filler neck if defective.

Check for proper cooling system automatic drain operation (where used).

M.I. 582. Frequency of this check can be seasonally adjusted.

Drain engine coolant solution and refill with new.

LSM and M.I. 1748.

Measure pressure drop across carbody inertial filters.

LSM. Perform during scheduled load test. Clean if necessary.

Clean HVAC condenser coils.

LSM.

Drain condensate from fuel tank.

LSM. Drain more frequently during periods of high humidity or rapid temperature change.

ONE YEAR (cont.)

Lubricate door hardware; hinges, latches, and linkages.	M.I. 1756
Lubricate handbrake chain and check operation. Inspect chain snubber.	LSM and M.I. 1577.
Add two quarts of oil to truck center bearing.	LSM and M.I. 1756.

TWO YEARS

ENGINE

Replace or recondition engine protector and requalify functional operation.	M.I. 260. Qualify on test stand after renewing springs, "O" rings, and diaphragms. Replacement can be EMD Unit Exchange.
Remove hot oil detector and check for operation at proper temperature.	LSM.

MECHANICAL EQUIPMENT AND SYSTEMS

Check temperature differential between lube oil and cooling water into engine.	LSM. Perform during scheduled load test. Clean oil cooler if necessary. M.I. 927 and M.I. 298.
Renew thermostatic valve element of fuel oil preheater.	LSM.
Renew cooling system pressure cap.	LSM.
Inspect and requalify vertical and lateral truck shock absorbers.	LSM. Replace as necessary.
Apply grease to traction motor roller support bearings, if applicable.	M.I. 3912.

THREE YEARS

ENGINE

Inspect and qualify lower connecting rod bearings for reuse.	EMM.
Install new upper connecting rod bearings.	EMM.
Install new lower main bearings.	EMM.
Inspect crankshaft gear damper.	EMM. Check for free movement.
Inspect and qualify piston cooling tubes.	EMM.
Check exhaust valve timing.	EMM.

THREE YEARS (cont.)

Check rocker arms, rocker arm bushings, and cam followers.	EMM.
Renew valve bridge and lash adjuster assemblies.	EMM.
Renew injectors.	EMM. Replacement should be EMD Unit Exchange.
Renew governor.	EMM. Replacement should be EMD Unit Exchange.
Renew top deck cover seals and check latches.	EMM.
Renew water pumps.	EMM. Rebuild or replace with EMD Unit Exchange or equivalent.

MECHANICAL EQUIPMENT AND SYSTEMS

Renew HVAC system, if equipped.	LSM. Replacement should be EMD Unit Exchange or equivalent.
Recondition air compressor valves. Inspect compressor and related piping for air, water, and/or oil leaks. Verify functional operation of intercooler pressure relief valve.	M.I. 1144 Replace valve, if required.
Renew flexible coupling seals in cooling and lube oil piping.	
Renew shutter air cylinder piston, piston rod, and cylinder seals. Air test after seal renewal.	LSM
Renew sanding magnet valves.	LSM and M.I. 4707.
Renew shutter magnet valves.	LSM and M.I. 4707.
Remove primary lube oil filter bypass valve. Clean, inspect, and test.	M.I. 926
Recondition or replace horn air valve.	LSM.
Recondition main reservoir drain valves.	LSM.
Recondition fuel pump and renew coupling spider.	M.I. 4110.

ELECTRICAL EQUIPMENT AND SYSTEMS

Recondition or replace electric starting motors.	EMM. Replacement should be EMD Unit Exchange.
Check electrical cabinet door seals for leakage due to damage or deterioration.	LSM. Replace seals, if necessary. Adjust lock keeper, if required.

THREE YEARS (cont.)

Replace battery on ARC 101 module.

LSM. Use EMD battery or equivalent.

Recondition or replace fuel pump motor.

M.I. 4110. Replace with EMD Unit Exchange.

SIX YEARS

ENGINE

Drain lubricating oil. Replace with fresh charge of oil after overhaul work is completed.

LSM, EMM and M.I. 1752.

Renew power assembly components.

EMM.

- Apply new heads, liners, pistons, and rings
- Apply new head seat rings
- Apply new lower liner inserts
- Apply new rocker arms and rocker arm bushings
- Apply new valve bridges and lash adjusters.

Install new upper and lower connecting rod bearings

EMM.

Visually inspect and requalify crankshaft
Install new lower main bearings
Install new thrust collars.

EMM.

Visually inspect and requalify all components of the front and rear gear trains.

EMM.

Renew or recondition crankshaft damping device.

EMM. Check for free movement. If required, replace with new or reconditioned gear-type damper.

Unit Exchange turbocharger.

EMM.

Renew turbocharger external clutch assembly.

EMM.

Recondition auxiliary generator drive assembly.

EMM.

Clean or renew aftercooler cores.

EMM.

Inspect exhaust manifold sections.
Renew base gaskets
Renew expansion joints.

EMM.

Renew or recondition oil pumps.

EMM. Replacements should be EMD Unit Exchange.

Remove oil pressure relief valve; clean, inspect, and test.

EMM.

Remove lube oil soakback filter assembly.
Disassemble, clean, inspect, and replace by-pass ball valves.

EMM.

Remove turbocharger lube oil filter assembly. Disassemble, clean, inspect, and replace check valves. EMM.

ELECTRICAL EQUIPMENT AND SYSTEMS

Remove rectifier assemblies from generator air box. Remove fuses and thoroughly wash heat sink and diodes.

M. I. 3317-2 or -3

CAUTION:

Never use a caustic cleaner solution.

Requalify all fuses for reuse.

Pointers Article 2L97.

Remove main generator bearing cover. Inspect for grease contamination, excessive wear and overheating. Apply new grease.

M.I. 3317-1.

Check operation of all fan/blower motor contactors. Inspect interlocks and fuses.

LSM, M.I. 5364-B.

- Renew cooling fan contactor tips.
- Renew braking contactor tips.
- Renew grid shorting contactor tips.

Renew dynamic brake cooling fan assembly.

LSM, M.I. 4104. Replace with EMD Unit Exchange.

Renew radiator cooling fan assemblies.

LSM, M.I. 4105. Replace with EMD Unit Exchange.

Renew auxiliary generator.

LSM, M.I. 3707. Replace with EMD Unit Exchange.

Renew inertial filter blower motor assembly.

LSM, M.I. 3614. Replace with EMD Unit Exchange.

Recondition or replace soak back pump motor.

M.I. 4110. Replace with EMD Unit Exchange.

Renew ICE blower motor assembly.

LSM. Replace with EMD Unit Exchange.

MECHANICAL EQUIPMENT AND SYSTEMS

Recondition air compressor.

M.I. 1144.

Renew turbocharger-to-filter air duct.

Clean main reservoir system.

Recondition soak back pump and renew coupling spider.

M.I. 4110

Recondition air compressor drive shaft coupling.

LSM and M.I. 1753.

Renew auxiliary generator drive coupling.
Renew axle generator.

LSM and M.I. 1753.

EIGHTEEN YEARS

ENGINE

Renew engine.

Replacement should be EMD Unit Exchange or equivalent.

ELECTRICAL EQUIPMENT AND SYSTEMS

Renew main traction alternator and companion alternator.

Replacement should be EMD Unit Exchange.

NON-SCHEDULED MAINTENANCE

A definite time schedule for items listed below cannot be established due to variations in wear and component life related to operating conditions.

ELECTRICAL COMPONENTS

HIGH VOLTAGE CABLING

Renew.

LOW VOLTAGE CABLING

Renew.

CAB ELECTRONICS (if equipped)

LSM

ICE system:

Replace CCB module as required.

Replace ICE Train Situation Indicator screen(s) as required.

Verify seal between cooling air housing and ICE screen at time of screen replacement.

ELECTRONIC AIR BRAKE (if equipped):

Replace battery in ICE/Wabco memory module at 10 years.

HIGH VOLTAGE CABINET:

Replace control system computer modules as required.

LSM

Inspect connectors and cables for signs of fatigue at time of component replacement.

Check fast-on connectors for solid connection in electrical cabinet.

Replace power contactors, reverser contactors and motors as required.

Clean inside of HVC/LVC. Remove dust.

MECHANICAL COMPONENTS

TRUCK ASSEMBLIES

Actual overhaul frequency of the truck assembly needs to be consistent with service life and the scheduled maintenance of other locomotive components as reflected in this M.I.

At overhaul; inspect, test, and repair or replace the following items as necessary; frame, bolster, wear plates, liners, springs, spring seats, snubbers, brake rigging, rubber secondary springs, and sander guides.

LSM and M.I. 1501, 1504, 1506, 1509, 1511 and 1512, as applicable.

*The following work should be performed at each **wheel truing** event, or when one or more truck assemblies are removed for reconditioning.*

SHOCK ABSORBERS

Inspect and qualify vertical truck shock absorbers.

LSM. Replace as necessary.

*The following work should be performed at each **wheel change** event, or when one or more truck assemblies are removed for reconditioning.*

YAW DAMPERS

Inspect and qualify primary and secondary yaw dampers (if applicable).

LSM. Replace as necessary.

PINION

Check for involute profile wear.

Magnaflux.

M.I. 1518.

Replace at wheel change.

AXLE GEAR

Check for involute profile wear.

Magnaflux.

M.I. 1518.

AXLE

Magnaflux with wheels and inner races removed.

M.I. 1518.

TRACTION MOTOR

Check bearings using heat and noise test.

M.I. 3900. Whenever truck assembly is removed from locomotive, check traction motors for unusual bearing noise or heat at maximum 1500 RPM.

Jigstone commutator and clean slots.

M.I.3900. Restore smooth and concentric surface when inspection indicates need.

Replace traction motors at second wheel change.

M.I. 3900. Replacement should be EMD Unit Exchange.

TRACTION MOTOR ROLLER SUSPENSION BEARINGS

Re-grease and adjust roller bearing end play.

M.I. 3912.

Renew roller bearing assemblies at second wheel change.

M.I. 3912. Replacements should be EMD Unit Exchange or equivalent.

JOURNAL BEARINGS

Renew at each wheel change.

M.I. 1553. Replacements should be EMD Unit Exchange or equivalent.

BRAKE RIGGING

Check condition of brake rigging. Remove, disassemble, and replace hardware with new parts as required.

LSM.