

**M.I. 1792**

# **Maintenance Instruction**

**EMISSIONS-RELATED MAINTENANCE**  
**for**  
**EMD GP15D and GP20D Locomotives**  
**equipped with**  
**170 Series (Caterpillar 3500B Series) Engines**

**92.211(b)(1) Statement: Maintenance, replacement, or repair of the emissions control devices and systems on EMD locomotives may be performed by any locomotive or locomotive engine repair establishment or individual.**

## **Notice**

This Maintenance Instruction is intended to serve as a guide when establishing engine maintenance schedules to meet the particular requirements of individual operations. It provides average recommendations which should ensure satisfactory locomotive engine 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 yard and mainline Road Switcher locomotives as a general class of motive power. Component renewal provisions are consistent with traditional "In-Carbody" engine overhaul procedures.

Nothing in this Maintenance Instruction or in the engine and locomotive service publications referenced herein is to be construed as requiring the use of a service facility employed by or under the control of General Motors to maintain in force an emissions warranty in violation of Section 92.211(b)(1) and (2) or Section 92.1103(a)(4)(iv) of 40 CFR 92.

### **Notes:**

Megawatt-hour (MW-hr) values shown in this document are recorded by the Microprocessor Archive Data as accumulated by the locomotive EM2000 control computer system.

Operating hour values shown in this document are recorded by the Engine Microprocessor Control (ADEM control) and displayed on the Engine Monitoring System (EMS) display.

# Introduction

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

- 1) Fuel Oil will meet the specifications of Maintenance Instruction M.I. 1750. Fuel that meets #2-D under ASTM test D975 generally meets the specifications.

Note: Diesel fuel with 0.05% sulfur content can be used in the engine with no detrimental effects.

### Note

Fuel filter integrity or plugging can be determined periodically by reading the fuel filter pressure drop on the Engine Monitoring System panel while operating at full speed.

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

### Note

Both 10 micron and 2 micron secondary fuel filters are available for the engine. The 2 micron high efficiency elements are recommended for maximum injector life.

- 2) Lubricants used will meet the specifications of Operations and Maintenance Manual (OMM) SEBU7179-01 and M.I. 1752.

Engine Oil API rated **CG-4** oil is acceptable.

Oil API rated **CH-4** oil is preferred.

### Viscosity recommendations:

API	Ambient temperature	
	<u>Minimum</u>	<u>Maximum</u>
SAE 0W20	-40 °F	50 °F
SAE 0W30	-40 °F	86 °F
SAE 0W40	-40 °F	104 °F

SAE 5W30	-22 °F	86 °F
SAE 5W40	-22 °F	104 °F
SAE 10W30	-4 °F	104 °F
SAE 15W40	+5 °F	122 °F

Proper lubricant level must be maintained in the engine crankcase.

### Note

Periodic engine oil samples should be taken to monitor the suitability of the oil and to check for oil oxidation, metallic wear particle concentrations, soot concentration, total base number, silica or dirt presence, fuel dilution and presence of glycol and water.

Normal oil change period is every 92 days or 1000 service hours.

The type of service, grade of oil, quality of the filtration and load factor on the engine will determine when the oil should be changed. If the load factor is low it may be possible to extend the oil change period beyond the normal change point if scheduled oil sampling is performed and indicates there is sufficient performance margin remaining in oxidation capacity, total base number and soot concentration.

- 3) Lubricating oil and fuel filters will be original OEM quality and changed as specified in this Maintenance Instruction.

### Lubricating Oil Refill capacities:

V-12	170 US Gallons
V-16	220 US Gallons

### Note

3500 Engines are not fitted with an EMD style turbocharger 'soak back' pump so the engine should be allowed to operate at idle for 10 minutes minimum to allow the turbocharger to cool down and prevent oil coking before

shutting engine down after extended operation at notch 8 (full load).

- 4) For long life of the engine it is important the Engine coolant meets the specifications in OMM SEBU7179-01 and is maintained at the proper level.

#### Note

Periodic engine coolant samples should be taken to ensure that the quality of the solution is maintained. Additives get depleted during normal operation and must be replaced periodically.

#### Coolant:

Preferred- Commercial Extended Life Coolant (ELC) meeting Caterpillar's EC-1 specification.

Acceptable- Heavy Duty Diesel Engine low silicate Antifreeze/Coolant (DEAC) meeting ASTM D4985 or ASTM D5345 specification.

**DO NOT** use coolant which meets ASTM D3306 or D4656 specification!

#### Note

Most new commercial heavy duty coolants containing antifreeze have less than the desired SCA concentration and need treatment with a Supplemental Cooling Additive (SCA) at initial fill. Recommendation at initial fill is to add 4.5% (min. 3% - max. 6%) by volume of SCA. Presence of an adequate concentration of SCA (1200 ppm minimum) in coolant is needed to inhibit cooling system corrosion and liner cavitation erosion.

Use a coolant tester such as (Caterpillar) Test Kit #8T5296 or equivalent to determine SCA concentration. A typical SCA needs to provide sodium nitrite.

SCA's are oxidized as a function of time and temperature, concentration should be checked regularly and when indicated the system should be re-dosed with SCA equal to 1.4% of the cooling system volume.

Note if antifreeze is not used then the minimum concentration of SCA is doubled at 2.4% or 2400 ppm.

#### Antifreeze:

Recommendation is for use of 1:1 solution of ethylene or propylene glycol and water because it:

- inhibits freezing
- increases boiling point
- helps prevent water pump cavitation/erosion

	<u>Freeze</u> <u>Protection</u>	<u>Boil</u> <u>Protection</u>
		(at atmospheric psi)
Ethylene 50%	-33 °F	223 °F
Ethylene 60%	-60 °F	232 °F
Propylene 50% max.	-20 °F	223 °F

Check antifreeze concentration with a refractometer.

#### Coolant service life:

Commercial heavy duty coolant/ Antifreeze meeting ASTM D5345	2 years
Commercial heavy duty coolant/ Antifreeze meeting ASTM D4985	1 year

#### Cooling System Capacity:

V-12	138 US Gallons
V-16	133 US Gallons

#### 5) Air filtration system:

Use only high efficiency style fiberglass filter elements.

- 6) 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.

7) Maintenance requirements and service procedures for customer specified locomotive options and equipment shall be provided separate from this document.

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

- OM- Operator's Manual
- OMM- Operation & Maintenance Manual
- LSM- Locomotive Service Manual
- ESM- Engine Service Manual
- M.I.- Maintenance Instruction
- HRM- Heavy Repair Manual

# Periodic Maintenance

## 92 Day or 1,000 Hour Intervals

**NOTE:** valve lash and injector timing height should be checked and adjusted at the first oil change and then annually. Also perform this operation after valve / seat re-surfacing.

Clean engine crankcase breathers.

OMM

Check air cleaner differential pressure (max. 25" water) at full load using load box or Dynamic brake grids.

OM

Replace air cleaner elements if excessive restriction. Use high-efficiency elements equivalent to original installation

Check fuel filter differential pressure (max. 15 psi).

OM

Replace primary fuel filter element(s).

OM

Replace secondary fuel filter elements (2 micron rating).

OMM

Visually inspect air system for leakage and clamps for tightness.

OM

Check engine ADEM-2 controller for active and logged fault codes

Correct faults, clear codes.

ADEM troubleshooting

Check Engine Monitoring System (EMS) for active or logged fault codes,

clear logged faults, correct active faults, clear codes.

OMM, ESM

## 184 Day or 2,000 Hour Intervals

Clean crankcase breather elements.

ESM

Magnetic pickups- remove, examine, clean, reinstall.

OMM, ESM

## **One Year or 4,500 Hour Intervals**

Perform load test- Check horsepower.	LSM, ESM
Engine Valve lash- Check, Adjust.	ESM
Fuel injector timing height- Check, Adjust.	ESM
Check injector calibration codes (should not be generic #1100).	ESM
Measure pressure drop across carbony inertial filters during load test, Clean if necessary.	LSM
Inspect radiator air passages, clean as necessary.	LSM, M.I.549
Flush cooling system and replace coolant if ASTM 5345 coolant not used.	OMM
Drain fuel tank of water and sediment. Drain more frequently during periods of high humidity or rapid temperature change.	LSM

## **Two Year or 9,000 Hour Intervals**

Check for aftercooler restriction, clean core if necessary.	ESM
Replace water temperature regulators.	OMM, ESM
Flush cooling system and replace ASTM 5345 coolant.	OMM

## **Four Year or 20,000 Hour Intervals**

Replace fuel injectors with new or remanufactured units.	ESM
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Install remanufactured turbocharger cartridges or clean turbocharger rotating assemblies, replace bearings, install new seals, check for cracks, check balance. ESM

Check engine mounted components and wiring harnesses for damage. ESM, LSM

General inspection - (with boroscope)

Inspect camshafts, lifters, springs, cylinder head passages.

Check valve sealing surface, seat condition.

Check valve stem seals, replace if oil collecting on valve stems.

Check liner surface for cross hatch (honing marks present).

(If liner bore is polished, ring wear may be excessive caused by poor air filtration)

Check for liner scoring.

Based on the checks above determine if all cylinders require rework and or cleaning, valve/seat re-surfacing, and or liner honing.

Inspect one main bearing, one lower connecting rod bearing for wear, condition. ESM

Check engine mounted components and wiring harnesses for damage. ESM, LSM



**At End of EPA Useful Life**

Minor overhaul (in-frame): HRM

Install new or remanufactured fuel injectors.

Install remanufactured cylinder heads or rebuild cylinder heads, grind valves, replace seats, springs, all seals.

Check rocker arm bushings, bridges, pushrods.

Replace ring sets, check piston ring grooves for wear/reuseability and deposits.

Replace liners with remanufactured liners, use new seals.

Rebuild turbochargers.

Check camshaft lobes, bearings, camshaft followers for reusability.

Check main bearings, rod bearings, thrust bearings for reusability.

Check, clean, reseal aftercoolers, pressure test.

Check, clean oil cooler, pressure test.

Rebuild oil pump

Rebuild water pump

Rebuild fuel transfer pump, relief valves, downstream fuel relief valve.

Clean oil suction screen, oil pan bottom.

Reseal exhaust manifolds.

Inspect, replace exhaust bellows as required.

Rebuild front & rear gear trains, replace bearings.

Install remanufactured damper.

Rebuild starters.

Check oil relief and priority valves.

Replace water temperature regulators.