ELECTRO-MOTIVE

M.I. 1776

MAINTENANCE INSTRUCTION

SCHEDULED MAINTENANCE PROGRAM TURBOCHARGED GP & SD MODEL LOCOMOTIVES (645F3, F3A & F3B ENGINES)

INTRODUCTION

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

These recommendations are based on the following conditions:

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

2. Lubricating oil used will meet the specifications of Maintenance Instructions 1752, 1756, and 1764 and will be changed at the intervals specified in this M.I.

3. Engine coolant used will meet the specifications in Maintenance Instruction 1748.

4. Lubricating oil filters will be of a quality equal to original equipment and will be changed at the intervals specified in this M.I.

5. Procedures listed in M.I. 1705 or 1707 will be followed for new locomotives and newly installed replacement assemblies.

This Maintenance Instruction describes a program of locomotive maintenance to be performed on a "calendar period" basis or a "running mileage" basis, whichever occurs first.

INSTRUCTION REFERENCES

Abbreviations are used in this instruction to reference publications that contain information related to maintenance. The following examples are provided to aid in understanding the abbreviations used.

LSM means Locomotive Service Manual

EMM means Engine Maintenance Manual

M.I. means Maintenance Instruction

ETG means Electrical Troubleshooting Guide

ONE WEEK OR 3,500 MILES

LUBE OIL FILTERS

Check lube oil filter tank pressure.	LSM. Checks can be made weekly or oftener at fueling or turnaround points. Replace filter elements if tank pressure so indicates.

FUEL FILTER

Check pressure differential at rack mounted filter gauge.	LSM. Same note as immediately above. Use only pleated cotton-paper element.

TRACTION MOTOR SUPPORT BEARINGS

Check lubricant level.	Fill to overflow. M.I. 1756.

TRACTION MOTOR GEAR CASE

Maintain lubricant at sufficient level to provide full gear tooth dip into grease.	M.I. 1756

AUTOMATIC COOLING SYSTEM DRAIN (Where Used)

Check drain valve operation.	M.I. 582

ONE MONTH OR 15,000 MILES

LUBE OIL

Take sample for analysis.	The services of a competent laboratory may help to monitor the suitability of the oil for continued use according to M.I. 1752.

ENGINE PROTECTOR

Check operation.	EMM, LSM, or M.I. 260

GENERATOR PIT DRAIN ASPIRATOR

Inspect and clean, if needed.	LSM

AIR BOX DRAINS

Check operation and clean, if necessary.	EMM

BATTERY

Check electrolyte level.	
Check specific gravity.	
Wash out battery boxes.	

ONE MONTH OR 15,000 MILES (CONT'D)

MAIN GENERATOR

Inspect diode fuses, replace diodes and fuses as required.	M.I. 3317-2 or -3. Whenever generator air box panels are removed, clean the inspection windows, and inspect collector rings and brushes.

SOAK BACK PUMP AND MOTOR

Check operation.	EMM. With the engine shut down and soak back pump motor running, remove left rear handhole cover and check oil flow through gear train. Observe camshaft bearings. If lube oil flows from camshaft bearings with soak back pump running and engine shut down, inspect turbo filter outlet check valve for proper operation.

ENGINE AIR FILTER — PAPER OR FIBERGLASS TYPE (Where Used)

Check annunciator ENG AIR FLTR indicator. If tripped, take manometer readings and replace elements if necessary.	LSM

ANNUNCIATOR MODULE (Where Used)

Monitor annunciator and record lighted indicators. Perform checks or maintenance indicated by lights. Set annunciator test switch to test position and observe that all annunciator lamps are lighted. Place annunciator test switch to reset position.	ETG

JOURNAL BOX

Maintain to fill plug level.	M.I. 1756, M.I. 1552

TWO MONTHS OR 30,000 MILES

LUBE OIL FILTER — SEVEN ELEMENTS

Change filter elements.	LSM
Clean lube oil strainer.	EMM. Fill strainer housing with oil before starting engine.

TWO MONTHS OR 30,000 MILES (CONT'D)

TURBOCHARGER AND SOAK BACK OIL FILTERS

Replace elements.	EMM. Filter elements must be of a quality equal to original equipment. The interval of change for turbocharger and soak back filter elements is influenced by load factor, kind of lubricating oil, type of operation, climatic conditions, and maintenance of main lube oil filters. Where these factors are favorable, it may be possible to extend the period to 3 months, but do not exceed this interval.

THREE MONTHS OR 45,000 MILES

FUEL FILTERS

Clean or replace suction strainer element.	LSM
Change engine mounted filter elements.	EMM. Use only elements equal to original equipment.
Change rack mounted primary filter(s).	LSM. Use only pleated cotton-paper elements.

COOLING SYSTEM

Check inhibitor concentration.	M.I. 1748
Check for proper cooling system drain operation (Where Used).	

FUEL TANK

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

TRACTION MOTORS

Replace brushes (in sets only).	M.I. 3900. Depending upon type of service and operating conditions, brush life will range from 3 to 6 months.
Clean creepage areas and blow out with clean dry air.	
Visually inspect support bearing wick lubricators for dirt plugging of the wick and for excessive wear.	Clean and replace as necessary.

INERTIAL FILTER BLOWER MOTOR

Check operation.	

THREE MONTHS OR 45,000 MILES (CONT'D)

ELECTRICAL CABINET PRESSURE TAPS

Check hoses and taps for leaks or obstructions.	

ENGINE AIR FILTERS — PAPER

Take manometer readings. Replace elements if necessary.	LSM

ENGINE AIR FILTERS — FIBERGLASS

Replace elements.	LSM

TURBOCHARGER EXHAUST DIFFUSER

Visually inspect for evidence of warpage or damage.	EMM

EDUCTOR TUBE

Inspect for carbon deposits and clean, if necessary.	EMM

BATTERY

Wash cell tops and apply petroleum jelly to terminals.	
Inspect battery boxes for damage or rust.	Repair and paint if necessary.

LOW VOLTAGE ELECTRICAL SYSTEM

Check for grounds.	LSM

ENGINE

Inspect air box.	EMM
Inspect crankcase.	EMM
Inspect crankshaft and connecting rods.	EMM
Inspect pistons and piston rings.	EMM
Inspect cylinder liners.	EMM
Inspect cylinder head mechanism with engine idling and at operating temperature.	EMM
Inspect engine fuel lines and connections for leaks.	EMM
Inspect engine water system for leaks.	EMM, LSM

THREE MONTHS OR 45,000 MILES (CONT'D)

SPEED RECORDER AND DRIVE CABLE	
Lubricate	This item is not required for grease lubricated recorders. Refer to speed recorder manufacturer's bulletins.
DOOR HARDWARE	
Lubricate hinges, latches, and linkage.	M.I. 1756

SIX MONTHS OR 90,000 MILES

OIL SYSTEM	
Change engine oil.	LSM, EMM. Evaluation of engine and oil condition should dictate the frequency of this item. Type of service, type of oil, quality of filter elements, and condition of engine will influence the frequency of oil change.
Clean oil suction screens.	EMM
Clean scavenging oil screens.	EMM. Fill strainer housing with oil before starting engine.
Clean oil pan.	
Clean filter housing.	
EXHAUST SYSTEM	
Check exhaust manifold base flange bolts for proper tightness.	
Remove inspection plate, clean trap and inspect screen for cracks.	EMM
RADIATORS	
Clean air passages.	LSM and M.I. 549. Operation in certain sections of the country and during certain seasons will require more frequent cleaning due to airborne seeds and leaves.
MAIN GENERATOR	
Inspect collector rings and brushes.	M.I. 3317-1
Reverse polarity of collector rings.	
MAIN RESERVOIR	
Replace air filter element.	LSM
Check operation of automatic drain valves.	LSM

SIX MONTHS OR 90,000 MILES (CONT'D)

MODULE TESTING (Where Used)	
Perform self-test on modules.	ETG
VR MODULE	
Check auxiliary generator output voltage.	ETG, LSM
TH MODULE (Where Used)	
Check output voltage of VRR section.	LSM
GROUND RELAY	
Check ground relay action.	LSM
HANDBRAKE	
Check operation and lubricate.	M.I. 1577
CAB SEATS	
Lubricate cab seat posts and guide rails.	Lubriplate 630-2 or equivalent.

ONE YEAR OR 180,000 MILES

ENGINE BOLT AND NUT RETORQUING	
Main lube oil and piston cooling oil pump shaft nut.	EMM
Head frame to crankcase bolts.	EMM
Turbocharger to air duct bolts, aftercooler to air duct bolts, air duct to crankcase bolts, and turbine inlet link bolts.	EMM
ENGINE	
Replace top deck cover seals and check latches.	EMM
Qualify injectors.	EMM
Set injector timing and injector rack length.	EMM
Check engine speed.	EMM
Check overspeed trip.	EMM
Check governor pilot valve setting.	EMM. If engine speed is changed, reset on governor stand.
Remove and clean oil separator element.	EMM
Check pressure drop across aftercooler.	EMM. Clean air passages if necessary.
Inspect crankshaft damping service.	EMM

ONE YEAR OR 180,000 MILES (CONT'D)

ENGINE (CONT'D)

Remove, clean, and inspect; replace if necessary. — EMM

Soak back check valve in the turbo filter inlet.

Soak back oil pressure relief valve in the soak back filter head.

Soak back filter bypass valve in the soak back filter head.

Turbo oil filter check valve in the turbo filter head.

EXHAUST SYSTEM

Inspect manifold sections for possible cracked leg baffles or expansion joints and replace, if necessary.

AIR COMPRESSOR

Clean air intake screen. (Where Used) — LSM

Clean air filter housing and replace air filter elements. Do not attempt to clean elements. — LSM

Change oil. — M.I. 1756

AIR FILTERS

Carbody (Inertial) — LSM

Measure pressure drop. Clean if necessary.

LUBE OIL FILTER

Remove oil filter bypass valve; clean, inspect, and test. — M.I. 926

MAGNET VALVES

Clean and replace seats. — M.I. 4707

ELECTRICAL CABINETS

Air Filter — LSM

Change filter elements.

Door Seals

Check for damage and leakage. Replace if necessary. Adjust lock keeper, if required.

ONE YEAR OR 180,000 MILES (CONT'D)

ELECTRICAL CABINETS (CONT'D)

Contact Tips	LSM and applicable M.I.
Visually inspect tips of all power contactors, reversers, and brake transfer switches. Replace as required.	
Check timing of time delay devices.	LSM and applicable settings chart drawing.

AUXILIARY GENERATOR

Inspect and replace brushes when required. Replace in sets.	Normal auxiliary generator brush life is between 21 and 24 months.

DYNAMIC BRAKE RHEOSTAT (Where Used)

Blow out with dry air. Inspect contact brush and replace if necessary.	M.I. 4334

LOAD REGULATOR — LINEAR TYPE RHEOSTAT

Blow out with dry air and clean windings, if necessary.	M.I. 4506
Check rheostat operation and replace if necessary.	

FUEL PUMP MOTOR

Inspect and clean with dry air.	M.I. 4101
Replace brushes.	M.I. 4101

STARTING MOTORS

Blow out with dry air.	EMM

CAB HEATER BLOWER MOTOR(S)

Replace brushes.	

AIR CONDITIONER (Where Used)

Inspect compressor motor brushes and replace if necessary.	M.I. 4122
Inspect blower motor brushes and replace if necessary.	
Clean evaporator return air filter.	
Clean condenser coils.	

ONE YEAR OR 180,000 MILES (CONT'D)

COOLING FANS AND ENGINE TEMPERATURE SWITCHES

Check for proper operation and setting.	LSM. M.I. 5511 or M.I. 5524
Replace or recondition shutter magnet valves.	M.I. 4707

DYNAMIC BRAKE GRIDS (Where Used)

Inspect and blow clean with dry air.	M.I. 1601 or M.I. 1602

DYNAMIC BRAKE BLOWER MOTOR (Where Used)

Inspect in place; renew brushes as necessary. (Replace brushes in sets.)	M.I. 4104

SOAK BACK PUMP MOTOR

Inspect and clean with dry air.	M.I. 4101
Replace brushes.	M.I. 4101

MAIN GENERATOR

Replace collector ring brushes.	M.I. 3317-1

TRACTION MOTOR

Check air duct bellows for alignment and leakage. Inspect wear plates and arm.	
Replace support bearing wick lubricators.	M.I. 3900

ALIGNMENT CONTROL COUPLER (Where Used)

Check for wear and alignment control engagement.	M.I. 2703

COOLING SYSTEM

Inspect and perform pressure test.	LSM
Replace pressure cap if defective.	
Clean or renew radiator header screens after first year of operation. Condition of screen at this inspection 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.

GOVERNOR

Change oil.	EMM. M.I. 1764

BRAKE SLACK ADJUSTER SCREWS

Coat threads, using graphite grease.	

ONE YEAR OR 180,000 MILES (CONT'D)

TRUCK CENTER BEARING

Add two quarts of oil. — LSM

AUTOMATIC MAIN RESERVOIR DRAIN VALVES

Clean and repair.

AUTOMATIC COOLING SYSTEM DRAIN (Where Used)

Recondition automatic drain valve. — M.I. 582

TWO YEARS OR 360,000 MILES

LUBE OIL COOLER

Check temperature differential between lube oil and cooling water into engine. — LSM, M.I. 927, M.I. 928. Clean cooler, if necessary.

HOT OIL DETECTOR

Remove and check for operation at proper temperature. — LSM

GOVERNOR

Renew diaphragm. — EMM

FUEL PUMP AND MOTOR

Replace coupling spider.

STARTING MOTORS

Disassemble, clean, and lubricate. — EMM

Inspect brushes and replace if necessary. — EMM

AIR COMPRESSOR (Gear Type Oil Pump)

Replace oil filter. — M.I. 1144

SOAK BACK PUMP

Replace coupling spider.

COOLING SYSTEM PRESSURE CAP

Replace cap. — LSM

Inspect filler neck for damage. Replace if damaged.

TWO YEARS OR 360,000 MILES (CONT'D)

ENGINE PROTECTOR

Replace or recondition and requalify.	M.I. 260. Qualify on test stand after renewing springs, "O" rings, and diaphragms. Replacement can be EMD Unit Exchange.

ELECTRICAL CONTROL CIRCUITS

Check settings and operation of non-modular protective and regulating devices and circuits.	LSM
On module equipped locomotives, qualify modules and related circuits.	ETG

FUEL OIL PREHEATER (Where Used)

Renew thermostatic valve element.	

THREE YEARS OR 540,000 MILES

ENGINE

Replace cylinder assemblies.	EMM
Replace injectors.	EMM. Replacement should be EMD Unit Exchange or eqivalent.
Inspect and qualify connecting rod bearings.	EMM
Inspect and qualify piston cooling tubes.	EMM
Install new thrust collars.	EMM
Install new lower main bearings.	EMM
Check rocker arms, rocker arm bushings, and cam followers.	EMM
Check lash adjusters.	EMM
Check exhaust valve timing.	EMM
Replace water pump seals and all worn parts.	EMM
Inspect lower liner inserts and replace if necessary.	EMM

AIR COMPRESSOR

Recondition valves.	M.I. 1144, LSM

TRACTION MOTORS

Replace.	Replacement motors should be EMD Unit Exchange or eqivalent. Refer to non-scheduled maintenance portion of this M.I.

THREE YEARS OR 540,000 MILES (CONT'D)

MAIN GENERATOR

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

M.I. 3317-2 or -3

CAUTION
Never use a caustic solution.

COOLING SYSTEM

Replace flexible coupling seals.

BATTERY BOXES

Clean and paint.

SHUTTER AIR CYLINDERS

Replace piston, piston rod, and cylinder seals.

Air test cylinder after seal replacement.

TRUCKS

Replace shock absorbers.

FOUR YEARS OR 720,000 MILES

DYNAMIC BRAKE BLOWER

Replace.

Replacement should be EMD Unit Exchange or equivalent.

TURBOCHARGER

Unit exchange.

EMM. Average individual operating conditions will determine frequency.

TURBOCHARGER-TO-FILTER AIR DUCT

Replace.

GOVERNOR

Replace.

Replacement should be EMD Unit Exchange or equivalent.

FUEL PUMP AND MOTOR

Recondition.

M.I. 4101, M.I. 4110

SOAK BACK PUMP AND MOTOR

Recondition.

M.I. 4101, M.I. 4110

FOUR YEARS OR 720,000 MILES (CONT'D)

AUXILIARY GENERATOR

Replace.	M.I. 1753. Replacement should be EMD Unit Exchange or equivalent.
Replace drive couplings.	M.I. 1753

INERTIAL AIR FILTER MOTOR

Replace.	Replacement should be EMD Unit Exchange or equivalent.

COOLING FANS

Replace.	Replacement should be EMD Unit Exchange or equivalent.

SIX YEARS OR 1,080,000 MILES

AIR COMPRESSOR

Recondition.	M.I. 1144
Recondition drive coupling.	M.I. 1753

ENGINE

Replace or recondition oil pumps.	EMM. Replacement can be EMD Unit Exchange.
Remove oil pressure relief valve; clean, inspect, and test.	EMM
Replace lower liner inserts.	EMM
Inspect injector control linkage. Replace links, seals, and bearings if required.	EMM

MAIN GENERATOR

Remove bearing cover and inspect for grease contamination, excessive wear, and overheating. Apply new grease.	M.I. 3317-I

MAIN RESERVOIR SYSTEM

Clean system and recondition valves.	

NINE YEARS OR 1,620,000 MILES

ENGINE

Replace crankshaft damping device.	EMM. Replace with new or recondi[illegible] damper.

TWELVE YEARS OR 2,160,000 MILES

ENGINE

Replace. — Replacement should be EMD Unit Exchange or equivalent.

MAIN GENERATOR

Replace. — Replacement should be EMD Unit Exchange or equivalent.

HIGH VOLTAGE CABLING

Renew. — It is recognized that this work may not be required at this particular time or mileage. However, shop efficiency may require this operation at time of engine and generator Unit Exchange.

LOW VOLTAGE WIRING

Renew. — Same remark as immediately above.

NON-SCHEDULED MAINTENANCE

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

The following work is to be performed at wheel change time or when truck is removed for reconditioning.

PINION

Check for involute profile wear.	
Magnaflux.	M.I. 1518

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 not less than 1500 RPM.
Jigstone commutator and clean slots.	M.I. 3900. Restore smooth and concentric surface when inspection indicates need. **CAUTION** Do not stone commutator by hand.

JOURNAL BOXES/JOURNAL BEARINGS

Clean and recondition.	M.I. 1552

TRUCK ASSEMBLIES

Inspect, test, and repair or replace the following items as necessary; frame, bolster, wear plates, liners, springs, spring seats, snubbers, brake rigging, rubber bolster springs, shock absorbers, and sander guides.	M.I.'s 1501, 1506, or 1509.