ELECTRO-MOTIVE

MAINTENANCE INSTRUCTION

M.I. 1721
*Rev. H

SCHEDULED MAINTENANCE PROGRAM MARINE PROPULSION (GM) AND GENERATING (MG) UNITS WITH BLOWER-TYPE ENGINES

INTRODUCTION

This Maintenance Instruction provides average recommendations which should ensure satisfactory engine 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 engine and associated equipment.

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 1760 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 quality equal to original equipment and will be changed at the intervals specified in this M.I.
5. Operating load limitations will be adhered to.
6. Torquing procedures contained in this M.I. will be followed for new engines and newly installed replacement assemblies.
7. Reduction gear maintenance to be performed in accordance with manufacturer's recommendations.

This Maintenance Instruction is divided into three sections. The first section is maintenance performed before and after each start, the second is performed on a "calendar period" basis, and the third section is performed on a "running time" basis. Because operating requirements for this equipment can vary from standby, to periodic, to continuous usage, the maintenance procedures must be modified to suit individual requirements.

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.

EMM	means Engine Maintenance Manual
M.I.	means Maintenance Instruction

*This bulletin is revised and supersedes previous issues of this number.
Areas of change are indicated by vertical bars.

BEFORE EACH START

LUBE OIL SYSTEM

Check for lube oil in pan and strainer box, if so equipped. Add oil if required.	EMM, M.I. 1760

NOTE
If engine required prelube, recheck lube oil level in pan, as a quantity will transfer to external system (cooler, filter, strainer and piping). Add oil if required.

COOLING SYSTEM

Check coolant level and add coolant if required.	EMM

NOTE
Do not continue to operate engine requiring periodic addition of coolant. Check for possible coolant leak and repair if required.

FUEL SYSTEM

Check fuel supply and open fuel supply valves.	
Prime system.	EMM

AIR SYSTEM

Drain condensate.	
Check system pressure.	EMM
Check oil supply in air line lubricator.	EMM

ENGINE

Check overspeed trip lever OST to ensure it is in the running "latched" position.	EMM
Open cylinder test valves and manually bar over engine one complete revolution, check for liquid ejected from valves, and close test valves.	EMM. If fluid discharge is observed from any cylinder, find the cause and make the necessary repairs prior to starting the engine.
On units with engine mounted lube oil strainer box (E6 models), prelube engine if unit has been shut down for over 48 hours.	EMM. Unless equipped with immersion heater system.
On units with in-line mounted lube oil strainers (E6A modified models with engine mounted raw water pump), prelube engine if unit has been shut down for over 2 hours.	EMM
Ensure exhaust stack is open.	

GOVERNOR

Check lube oil level. Add oil if necessary.	EMM, M.I. 1764

IMMEDIATELY AFTER EACH START

INSPECT FOR LEAKS

Cooling system
Fuel system
Lube oil system
Exhaust system

LUBE OIL SYSTEM

Check lube oil level in pan with engine at idle.	EMM
Check lube oil pressure at engine.	EMM

COOLING SYSTEM

Check operation of external cooling system.

FUEL SYSTEM

Check for proper fuel pressure.

ENGINE

Check cylinder test valves for leakage. Tighten if required.	EMM
Check handhole covers for leakage. Tighten if required.	EMM
Check air box drains for proper operation and clean, if necessary.	EMM. If drains are kept closed, drain every 4 hours.
Check for unusual noises or sound, or any fault indications (lights or alarm), as provided.	

PERFORM THE FOLLOWING ITEMS ON CALENDAR TIME BASIS

DAILY

INSPECT FOR LEAKS

Cooling system
Fuel system
Lube oil system
Exhaust system
Air system

LUBE OIL SYSTEM

Check lube oil level in pan.	EMM

DAILY (CONT'D)

COOLING SYSTEM

Check coolant level. — EMM

NOTE
Do not continue to operate engine requiring periodic addition of coolant. Check for possible coolant leak and repair, if required.

FUEL SYSTEM

Check fuel supply.

AIR SYSTEM

Drain condensate from lines and tanks.

GOVERNOR

Check oil level and add oil if required. — EMM

ENGINE AIR FILTER – PAPER OR FIBERGLASS TYPE

Monitor filter pressure indicator. If tripped, take manometer readings and replace elements if necessary. — EMM

EVERY MONTH

LUBE OIL SYSTEM

Take sample for analysis. — The services of a competent laboratory should be used to monitor the suitability of the oil for continued use according to M.I. 1760.

LUBE OIL CIRCULATING PUMP AND MOTOR (Where Used)

Check for proper operation. — EMM

IMMERSION HEATER (Where Used)

Check for proper operation. — EMM

EVERY TWO MONTHS

IN-LINE LUBE OIL STRAINER (Where Used)

Clean strainer screen.

EVERY YEAR

LUBE OIL CIRCULATING PUMP AND MOTOR (Where Used)

Inspect and clean with dry air.	
Replace brushes.	If equipped with DC motor.
Remove and clean check valve.	

ELECTRICAL CONTROL CABINET AND ASSOCIATED EQUIPMENT (Where Used)

Check operation of protective devices.	Protective switches, relays, and alarm indicators.
Visually inspect and clean:	
Voltage regulator.	M.I. 4523 or appropriate manufacturer's voltage regulator manual.
All relays, contactors, and circuit breakers.	EMM
Remove circuit breakers from compartments.	
Clean insulators.	
Lubricate linkage bearings.	
Check operation.	

COOLING SYSTEM

Check operation and setting of engine water temperature control(s).	
Check torque on flexible pipe coupling bolts.	
Take cooling water sample for lab analysis and corrosion test.	M.I. 1748. Unless 2000 hour sampling has occurred first.

LUBE OIL FILTERS

Change filter elements.	EMM. Unless the 1400 hour filter change has occurred first.
Clean lube oil strainers.	EMM. Fill strainer box with oil before starting engine. (E6 models.)

EVERY TWO YEARS

FUEL FILTERS

Change engine mounted filter elements.	EMM. Unless 2000 hour filter change has occurred first.
Clean or replace suction strainer element.	EMM. Unless 2000 hour maintenance has occurred first.

ENGINE PROTECTOR

Replace or recondition and requalify.	M.I. 259 or M.I. 260. Qualify on test stand after renewing spring, "O" rings, and diaphragms.

LUBE OIL CIRCULATING PUMP AND MOTOR (Where Used)

Replace.	Replacement can be EMD Unit Exchange.

EVERY THREE YEARS

COOLING SYSTEM THERMOSTATIC VALVE

Replace "O" rings and thermostatic elements.	EMM, M.I. 581

EVERY FOUR YEARS

COOLING SYSTEM PRESSURE CAP (Where Used)

Replace.	Unless 16,000 hour replacement has occurred first.

EVERY FIVE YEARS

FREQUENCY GENERATOR COUPLING SPIDER (Where Used)

Replace.	Unless 16,000 hour replacement has occurred first.

EVERY SIX YEARS

ENGINE

Replace top deck cover seals and check latches.	EMM. Unless 8000 hour replacement has occurred first.
Replace cylinder head grommets, inlet and outlet seals, and lower liner seals.	EMM. Unless 16,000 hour cylinder assembly replacement has occurred first.

MAIN GENERATOR (MG Models)

Remove bearing cover and inspect for grease contamination, excessive wear, and overheating. Apply new grease.	Unless 48,000 hour lubrication has occurred first. M.I. 3328 for EMD generator. If generator is other than EMD, refer to manufacturer's manual.

PERFORM THE FOLLOWING ITEMS ON RUNNING TIME BASIS

AFTER THE FIRST 350 HOURS OF OPERATION

ENGINE NUT AND BOLT TIGHTNESS CHECK	Torque to values specified in EMM.
Cylinder head crab nuts.	
Exhaust manifold flange bolts.	
Cylinder liner water inlet line nuts and bolts.	
Head frame to crankcase bolts.	
Engine mounting bolts.	
Miscellaneous nuts and bolts, and all piping connections.	

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

EVERY 350 HOURS

FUEL FILTER

Check fuel pressure gauge with engine at rated RPM.	On units where gauge is connected to filter input side, change filter elements if pressure is greater than 345 kPa (50 psi). On units where gauge is connected on filter output side, change filter elements if pressure is less than 83 kPa (12 psi).

EVERY 350 HOURS (CONT'D)

LUBE OIL FILTER

Check lube oil filter pressure gauges with engine at rated RPM.	On units with rack mounted oil filter, change filter elements if input pressure is greater than 172 kPa (25 psi). On units where filter is not rack mounted, and has external 138 kPa (20 psi) bypass valve, change filter elements if pressure differential between input and output exceeds 103 kPa (15 psi). On units where filter is not rack mounted and has external 207 kPa (30 psi) bypass valve, change filter elements if pressure differential between input and output exceeds 138 kPa (20 psi).

RAW WATER PUMP – BELT DRIVEN

Inspect drive belt for signs of slipping or chafing.	EMM

EVERY 700 HOURS

ENGINE PROTECTOR

Check operation.	EMM, M.I. 259, or M.I. 260

ENGINE AIR FILTER – REMOTE MOUNT OIL BATH (Where Used)

Check oil level.	M.I. 442

ENGINE AIR FILTER – PANEL TYPE OIL BATH (Where Used)

Check oil level.	EMM, M.I. 440

ENGINE AIR FILTER – TUB TYPE OIL BATH (Where Used)

Check oil level.	EMM

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

Check indicator. If tripped take manometer readings, and replace elements if necessary.	EMM

HEAT EXCHANGER

Inspect corrosion zinc electrodes.	EMM

RAW WATER PUMP – BELT DRIVEN

Lubricate shaft bearing.	EMM
Check drive belt tension.	EMM

EVERY 1400 HOURS

LUBE OIL FILTERS

Change filter elements.	
Clean lube oil strainers	Fill strainer housing with oil before starting engine. (E6 models.)

PROTECTIVE DEVICES

Check operation.	EMM

EVERY 2000 HOURS

FUEL FILTERS

Clean or replace suction strainer element.	EMM
Change engine mounted filter elements.	EMM. Use only elements equal to original equipment.

COOLING SYSTEM

Take cooling water sample for lab analysis and corrosion test.	M.I. 1748. Unless the yearly sampling has occurred first.

ENGINE AIR FILTER - PAPER TYPE (Where Used)

Take manometer readings. Replace elements if necessary.	EMM

ENGINE AIR FILTER - FIBERGLASS TYPE (Where Used)

Replace element.	

ENGINE AIR FILTER - REMOTE MOUNT OIL BATH (Where Used)

Change oil. Drain and fill only.	M.I. 442

ENGINE AIR FILTER - PANEL TYPE OIL BATH (Where Used)

Change oil. Drain and fill only.	EMM, M.I. 440

ENGINE

Inspect air box.	EMM
Inspect crankcase.	EMM
Inspect crankshaft and connecting rods.	EMM
Inspect pistons and piston rings.	EMM

EVERY 2000 HOURS (CONT'D)

ENGINE (CONT'D)

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

EVERY 4000 HOURS

ENGINE AIR FILTER – TUB TYPE OIL BATH (Where Used)

Change oil. Drain and fill only.	EMM

LUBE OIL SYSTEM

Change engine oil.	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 pan.	EMM
Clean filter housing.	EMM
Clean oil suction screens.	EMM
Clean scavenging oil screens.	Fill strainer box with oil before starting engine. (E6 models.)

ENGINE

Check exhaust manifold base flange bolts for proper tightness.	EMM

GOVERNOR

Change oil.	EMM, M.I. 1764
Lubricate linkage moving parts.	EMM
Lubricate governor synchronizing motor, motor bearings. (Where used.)	EMM

EVERY 8000 HOURS

ENGINE NUT AND BOLT RETORQUING	Torque to values specified in EMM.
Cylinder head crab nuts.	
Main lube oil and piston cooling oil pump shaft nut.	
Head frame to crankcase bolts.	
Engine mounting bolts.	
Miscellaneous nuts and bolts, and all piping connections.	
ENGINE	
Replace top deck cover seals and check latches.	EMM
Qualify injectors.	EMM
Check injector timing and injector rack length.	EMM
Check engine speed.	EMM
Check overspeed trip.	EMM
Remove and clean oil separator element.	EMM
Inspect crankshaft damping device.	EMM
EXHAUST SYSTEM	
Inspect manifold sections for possible cracked leg baffles or expansion joints and replace, if necessary. Tighten bands connecting manifold sections.	EMM
MAIN GENERATOR (MG Models)	
Visually inspect and clean.	M.I. 3328
ENGINE AIR FILTER - REMOTE MOUNT OIL BATH (Where Used)	
Change oil. Clean sump and filter media.	M.I. 442
ENGINE AIR FILTER - PANEL TYPE OIL BATH (Where Used)	
Change oil. Clean sump and filter media.	M.I. 440

EVERY 8000 HOURS (CONT'D)

ENGINE AIR FILTER – TUB TYPE OIL BATH (Where Used)

Change oil. Clean sump and filter media. EMM

COOLING SYSTEM (Pressurized System Only)

Inspect and perform pressure test.

Replace pressure cap if defective.

LUBE OIL COOLER (Tube Bundle Type)

Replace floating header seal.

MAIN LUBE OIL PUMP BYPASS VALVE (Where Used)

Remove, clean, inspect, and test. EMM

LUBE OIL FILTER

Remove internal oil filter bypass valve; clean, inspect, and test (where used). M.I. 926

LUBE OIL FILTER AND OIL COOLER BYPASS VALVES (Where Used)

Remove, clean, inspect, and test. EMM

STARTING MOTORS

Disassemble, clean, inspect and lubricate.

Renew parts if necessary. EMM

EVERY 16,000 HOURS

FUEL PUMP

Replace coupling spider.

COOLING SYSTEM

Replace pressure cap (where used).

Inspect filler neck for damage. Replace if damaged (where used).

EVERY 16,000 HOURS (CONT'D)

ENGINE

Replace cylinder assemblies.	EMM
Replace injectors.	EMM. Replacement should be EMD Unit Exchange or equivalent.
Inspect and qualify connecting rod bearings.	EMM
Inspect and qualify piston cooling tubes.	EMM
Check rocker arms, rocker arm bushings, and cam followers.	EMM
Check lash adjusters.	EMM
Check exhaust valve timing.	EMM
Inspect lower liner inserts, and replace if required.	EMM

EVERY 24,000 HOURS

ENGINE

Install new thrust collars.	EMM
Install new lower main bearings.	EMM
Replace water pump seals and all worn parts.	EMM

COOLING SYSTEM

Replace flexible coupling seals.	

LUBE OIL COOLER

Inspect, clean, and test.	M.I. 927

HEAT EXCHANGER

Inspect, clean, and test.	EMM

RAW WATER PUMP

Replace ball bearings and bearing seals.	EMM
Replace pump seal and gaskets.	EMM
Replace drive belt (where used).	EMM

EVERY 32,000 HOURS

ENGINE BLOWERS

Replace.	Replacement should be EMD Unit Exchange or equivalent.

BLOWER-TO-FILTER AIR DUCTS (Where Used)

Replace.	

GOVERNOR

Replace.	Replacement should be EMD Unit Exchange or equivalent.

GOVERNOR BOOSTER SERVO (Where Used)

Disassemble, clean, inspect, and replace O-ring seals.	EMM

FUEL PUMP

Replace or recondition.	M.I. 4110. Replacement can be EMD Unit Exchange.

EVERY 48,000 HOURS

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.	

PEDESTAL BEARING ASSEMBLY (Belt driven raw water pump)

Replace bearing.	

MAIN GENERATOR (MG UNITS)

Remove bearing cover and inspect for grease contamination, excessive wear, and overheating. Apply new grease.	M.I. 3328 for EMD generator. If generator is other than EMD, refer to manufacturer's manual.

EVERY 72,000 HOURS

ENGINE

Replace crankshaft damping device.	EMM. Recondition and requalify.

EVERY 96,000 HOURS

ENGINE

Unit Exchange.

MAIN GENERATOR (MG Units)

Unit Exchange.