ELECTRO-MOTIVE

MAINTENANCE INSTRUCTION

M.I. 1732
*Rev. A

SCHEDULED MAINTENANCE PROGRAM MARINE DRILLING UNITS WITH TURBOCHARGED ENGINES

INSTRUCTIONS

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 1763 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. 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.

This Maintenance Instruction is divided into three sections. The first section is maintenance performed before and after each start, the second section 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
OM	means Operating Manual
M.I.	means Maintenance Instruction

*This bulletin is revised and supersedes previous issues of this number.

BEFORE EACH START

LUBE OIL SYSTEM

Check for lube oil in pan and strainer housing. Add oil if required.	EMM, M.I. 1763

COOLING SYSTEM

Check coolant level. Add coolant if required.	OM, M.I. 1748

FUEL SYSTEM

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

AIR SYSTEM

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

ENGINE

Open cylinder test valves and manually bar over engine one complete revolution, check for liquid ejected from valves, and close test valves.	OM. If fluid discharge is observed from any cylinder, find the cause and make necessary repairs prior to starting the engine.
Prelube engine if unit has been shut down for over 48 hours.	EMM
Check racks.	EMM. Move injector control lever to check for freedom of movement with no binding of injectors.

GOVERNOR

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

IMMEDIATELY AFTER EACH START

INSPECT FOR LEAKS

Cooling system
Fuel oil system
Lube oil system
Exhaust system
Air system

LUBE OIL SYSTEM

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

IMMEDIATELY AFTER EACH START (CONT'D)

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.

PERFORM THE FOLLOWING ITEMS ON CALENDAR TIME BASIS

DAILY

INSPECT FOR LEAKS

Cooling system
Fuel oil system
Lube oil system
Exhaust system
Air system

LUBE OIL SYSTEM

Check lube oil level in pan. Add oil if required.	EMM, M.I. 1763

COOLING SYSTEM

Check coolant level. Add coolant if necessary.	OM, M.I. 1748

FUEL SYSTEM

Check fuel supply.

AIR SYSTEM

Drain condensate from lines and tanks.

GOVERNOR

Check oil level. Add oil if required.	EMM, M.I. 1764

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. 1763.

LUBE OIL CIRCULATING PUMP AND MOTOR (Where Used)

Check for proper operation.	OM

EVERY MONTH (CONT'D)

IMMERSION HEATER (Where Used)

Check for proper operation.	OM

EVERY TWO MONTHS

AUXILIARY TURBOCHARGER FILTER (Where Used)

Replace element.	EMM

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.

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.

EVERY YEAR (CONT'D)

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.

LUBE OIL COOLER

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

TURBOCHARGER AND SOAK BACK OIL FILTERS

Replace filter elements.	EMM. Unless 1400 hour filter change has occurred first.

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

Recondition and qualify.	M.I. 259. Qualify on test stand after renewing spring, "O" rings, and diaphragms.

LUBE OIL CIRCULATING PUMP AND MOTOR (Where Used)

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

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

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 — Check that the following nuts and bolts are tightened to the correct values specified in the EMM.

- Cylinder head crab nuts.
- Exhaust manifold flange bolts.
- Cylinder liner water inlet line nuts and bolts.
- Head frame to crankcase bolts.
- Turbocharger to air duct bolts, aftercooler to air duct bolts, and air duct 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

AFTER THE FIRST 350 HOURS OF OPERATION (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 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).

LUBE OIL FILTER

Check lube oil pressure at filter input with engine at rated RPM.	OM. Replace filter elements if tank pressure so indicates.

EVERY 700 HOURS

ENGINE PROTECTOR

Check operation.	EMM, M.I. 259

SOAK BACK PUMP AND MOTOR

Check operation.	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 turbo lube pump running and engine shut down, inspect turbo filter outlet check valve for proper operation.

ENGINE AIR FILTER - PAPER OR FIBERGLASS TYPE

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

HEAT EXCHANGER

Inspect zinc electrode corrosion inhibitors.	EMM

EVERY 1400 HOURS

LUBE OIL FILTERS

Change filter elements.	OM
Clean lube oil strainer.	EMM. Fill strainer housing with oil before restarting engine.

TURBOCHARGER AND SOAK BACK OIL FILTERS

Replace elements.	Filter elements must be of a quality equal to original equipment. The intervals 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.

AUXILIARY TURBOCHARGER FILTER (Where Used)

Replace element.	EMM

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

Check inhibitor concentration.	M.I. 1748

ENGINE AIR FILTERS - PAPER TYPE (Where Used)

Take manometer readings. Replace elements if necessary, or whenever the annunciator light indicates plugged filters.	OM

ENGINE AIR FILTERS - FIBERGLASS TYPE (Where Used)

Replace elements.	OM

EVERY 2000 HOURS (CONT'D)

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 4000 HOURS

EXHAUST SYSTEM

Remove exhaust manifold-to-turbocharger adapter assembly.	EMM. Clean screen and trap box. Observe recommendations found in EMM concerning checking for cracks.

EDUCTOR TUBE
(Exhaust Stack Mounted)

Inspect for carbon deposits and clean, if necessary.	EMM

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 suctions screens.	EMM
Clean scavenging oil screens.	EMM. Fill strainer housing with oil before restarting engine.
Clean oil pan.	EMM
Clean filter housing.	EMM

ENGINE

Check exhaust manifold base flange bolts for proper tightness.	EMM

EVERY 4000 HOURS (CONT'D)

GOVERNOR

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

EVERY 8000 HOURS

ENGINE NUT AND BOLT RETORQUING

Cylinder head crab nuts.	Follow torquing procedures as outlined in the EMM.
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, and air duct to crankcase bolts.	EMM

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
Check pressure drop across aftercooler.	EMM. Clean air passages if necessary.
Inspect crankshaft damping device.	EMM
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	

EVERY 8000 HOURS (CONT'D)

EXHAUST SYSTEM

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

MAIN GENERATOR

Visually inspect and clean.	M.I. 3328

SOAK BACK PUMP MOTOR

Inspect and clean with dry air.

Replace brushes.

COOLING SYSTEM

Inspect and perform pressure test.	OM

Replace pressure cap if defective.

LUBE OIL FILTER

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

STARTING MOTORS

Disassemble, clean, inspect and lubricate.	EMM

EVERY 16,000 HOURS

FUEL PUMP

Replace coupling spider.

SOAK BACK PUMP

Replace coupling spider.

FREQUENCY GENERATOR (Where Used)

Replace coupling spider.

COOLING SYSTEM

Replace pressure cap.	OM
Inspect filler neck for damage. Replace if damaged.	OM

Take cooling water sample for lab analysis and corrosion test.

EVERY 16,000 HOURS (CONT'D)

TURBOCHARGER (Manufactured prior to 71D serial number)	
Unit Exchange.	EMM
ENGINE	
Replace cylinder assemblies.	EMM
Replace injectors.	EMM
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

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
TURBOCHARGER (Manufactured with 71D or later serial number)	
Unit Exchange.	EMM. Average individual operating conditions will determine frequency.
COOLING SYSTEM	
Replace flexible couplings seals.	
LUBE OIL COOLER	
Inspect, clean, and test.	M.I. 927
HEAT EXCHANGER	
Inspect, clean, and test.	EMM

EVERY 32,000 HOURS

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

Recondition.	M.I. 4110

SOAK BACK PUMP AND MOTOR

Recondition.	M.I. 4101, 4110

EVERY 48,000 HOURS

ENGINE

Replace oil pumps.	EMM
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.	

MAIN GENERATOR

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. Replace with new or reconditioned gear type damper.

EVERY 96,000 HOURS

ENGINE

Unit Exchange.

GENERATOR

Unit Exchange