

Maintenance schedule

Maintenance operation



Note:

Maintenance operations are to be performed after the corresponding number of operating hours has been reached or at least once per year, see the Maintenance Schedule, page 10.
Those maintenance operations which have reached their deadlines first are to be performed.

Maintenance operations according to operating hours

according to operating hours	Scope of maintenance operations					
	M1	M2	M3	M4.1	M4.2	M5
20-60 or after initial operation	x	x				
400	x	x	x	x	x	
800	x	x	x	x	x	
1200	x	x	x		x	
1600	x	x	x	x	x	
2000	x	x	x		x	
2400	x	x	x	x	x	
2800	x	x	x		x	
3200	x	x	x	x	x	
3600	x	x	x		x	
4000	x	x	x	x	x	
4400	x	x	x		x	
4800	x	x	x	x	x	x
5200	x	x	x		x	
5600	x	x	x	x	x	
6000	x	x	x		x	
6400	x	x	x	x	x	
6800	x	x	x		x	
7200	x	x	x	x	x	
7600	x	x	x		x	
8000	x	x	x	x	x	
8400	x	x	x		x	
8800	x	x	x	x	x	
9200	x	x	x		x	
9600	x	x	x	x	x	x
10000	x	x	x		x	
10400	x	x	x	x	x	
10800	x	x	x		x	
11200	x	x	x	x	x	
11600	x	x	x		x	
12000	x	x	x	x	x	

Maintenance schedule

Scope of maintenance operations

M1	Check	
	<ul style="list-style-type: none"> ● Outside of engine for oil and coolant leaks¹⁾ ● Coolant level ● Concentration of antifreeze/anticorrosion agent ● Engine oil level/transmission oil level¹⁾ ● Engine alarms ● Operation of instruments¹⁾ ● Coolant hose for leaks ● Fuel lines for leaks ● Condition of impeller ● Removable fasteners (screws/bolts, hose clamps, pipe connections) and tighten if necessary ● Alignment of the shaft system (abnormal vibrations are due to the settling properties of the elastic engine mounts) ● Test drive/engine speed test with ship fully loaded²⁾ 	
	M2	Clean
		<ul style="list-style-type: none"> ● Fuel prefilter ● Drain water from additional fuel filter
	M3	Change
		<ul style="list-style-type: none"> ● Engine oil³⁾ ● Engine oil filter cartridges ● Fuel filter cartridges⁴⁾ ● Air filter <p>Read out</p> <ul style="list-style-type: none"> ● Diagnosis system memory
M4.1	Only for heavy and medium operations:	
	<p>Check/set</p> <ul style="list-style-type: none"> ● Valve clearance 	
M4.2	Only for light operation:	
	<p>Check/set</p> <ul style="list-style-type: none"> ● Valve clearance 	
M5	Check	
	<ul style="list-style-type: none"> ● Run-up test 	
A	Change	
	<ul style="list-style-type: none"> ● Coolant ● All hoses for coolant and sea water <p>Clean</p> <ul style="list-style-type: none"> ● Heat exchanger (heat exchanger plates) ● Charge air cooler (tube cluster) 	

- 1) Daily visual inspection to be performed by the captain as part of the board routine
- 2) Fully loaded means: water tank and fuel tank are filled, all ship equipment including life boats
- 3) The engines may only be operated with high-performance diesel engine oil according to plant standard M3277.
- 4) The fuel filters are to be changed out earlier if the fuel is dirty or contains a high proportion of water

The above mentioned maintenance operations M1 to M5 are to be performed when the corresponding number of operating hours has been reached or once per year (see page 9) by a MAN authorised workshop.

Maintenance operation according to time intervals

According to time intervals	Scope of maintenance operations				
	M1	M2	M3	M5	A
Yearly	x	x	x	x	
After every 4 years					x

General overhaul of the engine

Operating time before general overhaul (TBO)

The life span of the engine depends on many different factors. For this reason a time period cannot be given for a general overhaul without taking into account the various operating conditions of the engine.

The following categories have a large impact on the life span of the engine:

- Correct performance setting according to type of use
- Proper installation
- Final approval of installation by authorised personnel
- Regular maintenance according to the maintenance schedule
- Selection and quality of lube oil, fuel and coolant according to "Fluids and Lubricants for MAN Diesel Engines"

Taking the engine apart or performing a complete overhaul is inappropriate if the cylinder compression measurements are still good and if the following operating values have not considerably changed from the values at the time of initial operation:

- Boost pressure
- Engine power
- Fuel consumption
- Exhaust temperature
- Coolant and lube-oil temperature
- Oil pressure and oil consumption
- Smoke characteristics

If engine is operated outside above mentioned operating conditions, or operated values have considerably changed from initial operation, than below time intervals can serve as a guide only.

Operating mode	Time interval before general overhaul (TBO) in operating hours	Operating hours per year	Full load portion in %
Heavy operation	12000-15000	Unlimited	100
Medium operation	8000-10000	< 3000	< 50
Light operation	5000.	< 1000	< 20

General overhaul of the engine

Work to be performed for a general overhaul

The general overhaul of an engine requires it to be completely disassembled so that all of the components can be checked and tested and, if necessary, repaired or replaced.

This work can usually only be performed after the engine has been completely and properly removed from the ship.

**Note:**

The general overhaul of an engine may only be performed by a MAN authorised workshop.

The general overhaul includes the following operations:

- Check crankcase for wear (measure protrusion at cylinder liner)
- Check cylinder liners
- Measure pistons, piston rings
- Measure connecting rods and connecting rod bearings
- Check crankshaft and crankshaft bearings
- Check camshaft and camshaft bearings
- Check/replace roller tappets
- Replace gear drive for coolant pump/oil pump
- Replace coolant pump
- Check/replace oil pump
- Replace complete oil module
- Check/replace oil spray nozzles
- Replace gear drive for high-pressure pumps/sea water pump/hydraulic pump
- Replace high-pressure pumps
- Replace complete cylinder heads
- Replace injectors, high-pressure lines and pressure pipes (rails)
- Replace rail
- Replace turbocharger
- Replace charge air cooler
- Replace heat exchanger plates
- Check/replace starter, check/replace starter ring gear
- Replace alternator

In addition, all of the regular maintenance interval operations are to be performed (M1-M4 and A). Observe the "General Notes on Care and Maintenance Work", see page 7.

**Caution:**

After the engine has had a general overhaul, the engine is to be filled with pressurised oil (see repair instructions).