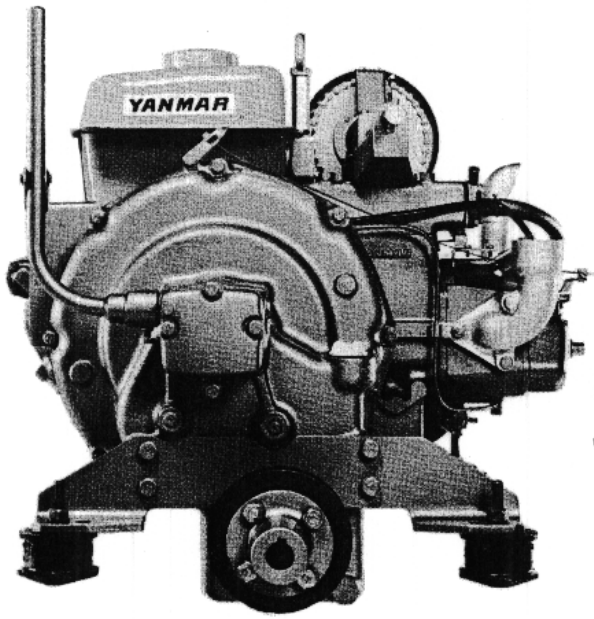
YT7511-249E2

SERVICE MANUAL

YSE

YANMAR
SERVICE MANUAL

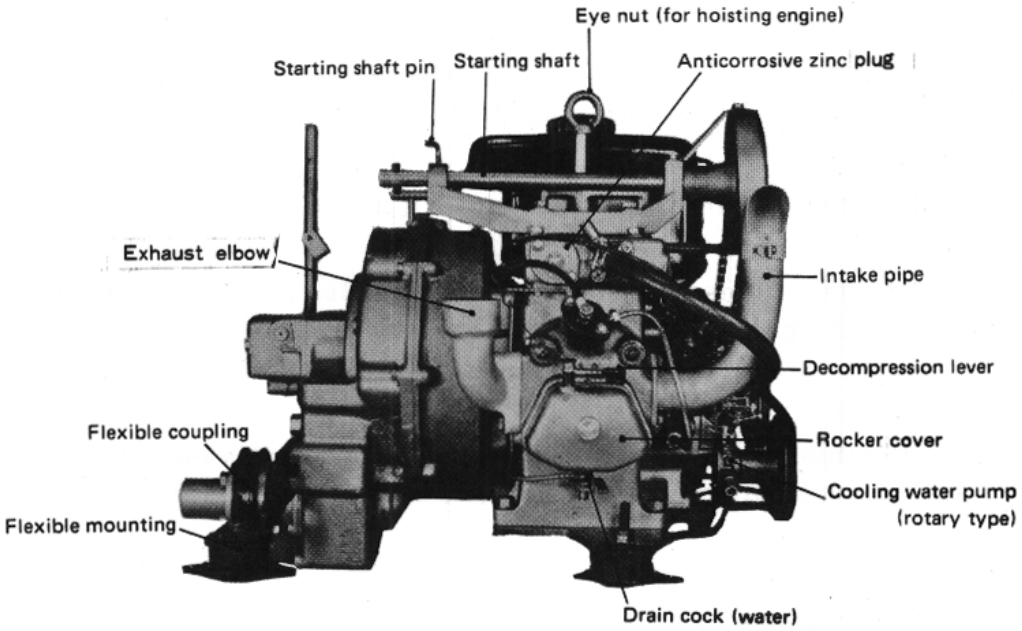
MARINE DIESEL ENGINE

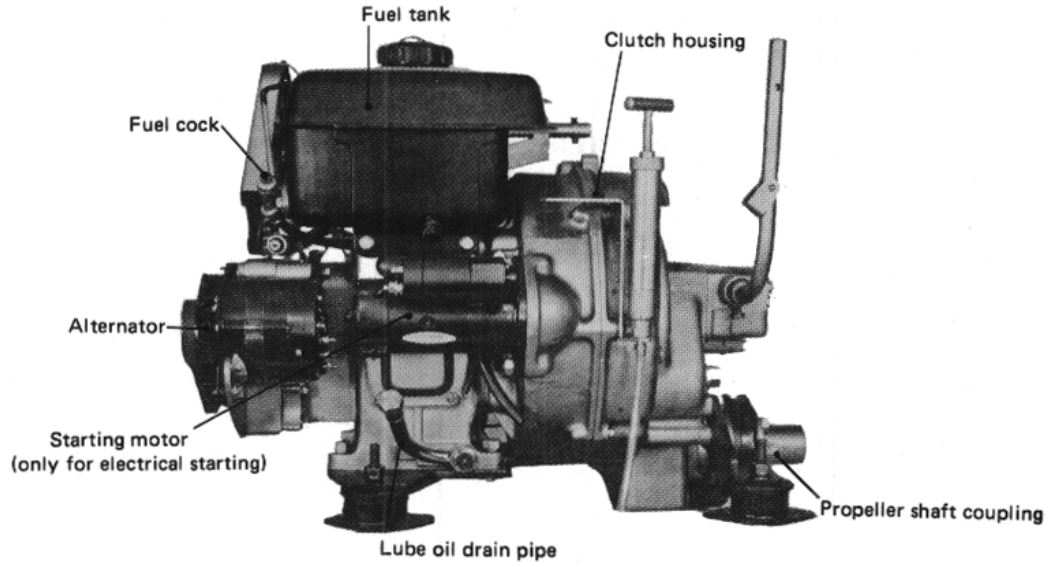


MODEL
YSE series

CONTENTS

1. ENGINE IN PHOTOGRARHS





2. OUTSTANDING FEATURES OF YSE SERIES

1. Its extra-compactness, light weight, and large output permit engine room to be miniaturized.

2. Wet type single-disc clutch, and reduction/reversing gear offer very light forward/backward change, easy and positive operation, and outstanding durability.

3. Selection of crankshaft-to-propeller shaft ratios: 2 : 1 and 3 : 1.

4. Selection of starting systems: electric starting, coupled also available with handle starting, and handle starting with speed-up chain gearing (available to install on either bow or stern side).

5. All-speed governor, insterlocked with easy-to-operate, durable Yanmar-Dickel type fuel injection pump, assures minimum load fluctuations and excellent low-speed operation.

6. Rotary type cooling water pump featuring ample circulating water and simple construction makes the engine seizure-free.

7. Flywheel enclosed in the clutch housing provides safety to the operator.

8. Full sealed forced lubrication system saves oiling labor during operational mode, and thereby increases working efficiency.

9. Constructional simplicity of component parts makes the engine very easy to operate, maintain, and inspect.

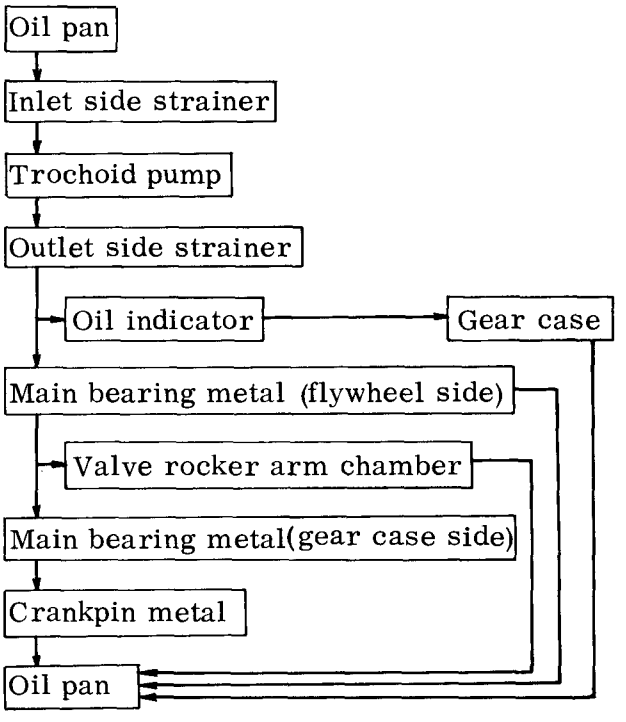
3. GENERAL DESCRIPTION

Each of Yanmar diesel engines, models YSE8 and YSE12, comes equipped with clutch reduction gear, which together with a flywheel is totally enclosed in the flywheel housing and the clutch housing. The propeller shaft is run from the flywheel side.

The starter for electrical starting is directly mounted to the flywheel housing to drive the ring gear of the flywheel. For chain starting, the power take-off shaft is chain-connected to the starting shaft located immediately above the cylinder. The engine is started by clockwise rotation on the stern side and by counter-clockwise rotation on the bow side.

3.1 Construction

Part	Description & Specifications
1. Cyl. body	Monoblock casting of water jacket, crankcase and oil pan.
2. Cyl. liner	Wet type made of special cast iron and coated with special anticorrosive paint.
3. Main bearing	Side cover side: precision kelmet metal with thin back metal. Flywheel side: Thick metal.
4. Cyl. head	Gasket type, part of monoblock including valve guides.
5. Intake/exhaust valve	Mushroom type.
6. Intake pipe	Intake enertia type made of steel.
7. Exhaust silencer	Round, expansion type, or water injection type.
8. Valve drive system	Tappet & valve push rod type. Parabolic suction/ exhaust cam with approach ramp.
9. Crankshaft	Stamp forged, with induction hardened journal, pin and oil seal portions.
10. Flywheel	Mounted to clutch, enclosed in flywheel housing.
11. Piston	Made of aluminum alloy, oval shaped.
12. Piston rings	Three compression rings, one oil scraper ring.
13. Piston pin	Float type.

Part	Description & Specifications
14. Connecting rod	I-section, stamp forged.
15. Crankpin metal	Drum type
16. Lube oil pump	Trochoid pump, driven by camshaft.
17. Lube oil strainers	Inlet side: perforated steel type. Outlet side: auto-clean type, full-flow passing type.
18. Indicators	Electric starting: hydraulic lamp Manual starting: oil light
19. Lube oil circulation chart	
20. Cooling water pump	Rotary type (belt-driven from power take-off shaft)
21. Fuel injection pump	Yanmar-Dickel type pump
22. Fuel injection nozzle	Pintle nozzle
23. Fuel strainer	Filter paper
24. Fuel tank	Steel plate
25. Governor	Centrifugal, all-speed type

Part	Description & Specifications
26. Governor remote control device	Remote control wire, steel lever
27. Decompression remote control	Remote control wire, steel lever
28. Electric starting device	Starter (ring gear type) Output: 1.0 KW at 12 V (nominal) Battery: 40-70 AH
29. Manual starting device	Speed-up chain (on stern or bow side) Speed-up ratio: 2.07 (YSE8), 2.91 (YSE12)
30. Reversing clutch	Wet type single plate disc clutch
31. Reduction gear	Constant mesh spur gear type Reduction ratio: 2 : 1, 3 : 1
32. Power take-off shaft pulley	Spur gear-driven from crank gear with pulleys for alternator and for cooling water pump.

3.2 Power Take-off Shaft Pulleys

The outside pulley is for the alternator and the inside pulley for the cooling water. If the alternator is not attached, the outside pulley can be used as desired to drive a bilge pump, winch, etc.

(Remark) The flexible mounting being on engine, not using P.T.O. shaft.

Model	YSE8	YSE12
PTO shaft rotation speed/engine speed	4100/3200 rpm	3380/3000 rpm
Outside diameter of pulley	90 mm	110 mm
V belts	Single HM type	Single HM type
PTO max. permissible output power	1-1.5/3200 HP/rpm	2-3/3000 HP/rpm

4. PERIODICAL MAINTENANCE

No.	Item	Checkpoints	Hours of operation			
			Every day	Every 100 hours	Every 250 hours	Every 500 hours
1	Fuel Oil	1. Check fuel oil level, and supply fuel, if necessary.	●			
		2. Discharge drainage from the fuel tank.	●			
		3. Clean fuel strainers.		●		
		4. Renew the fuel strainer filter elements.				●
2	Lube. Oil	1. Check lube oil levels in crankcase and reduction gear case, and supply lube oil, if necessary.	●			
		2. Lubricate the starting shaft, chain, and other parts.	●			
		3. Turn the lube oil strainer handles.	●			
		4. Overhaul the lube oil strainers.		●		
		5. Renew crankcase lube oil.		●		
		6. Renew clutch case lube oil.			●	
3	Cooling Water	1. Discharge cooling water after operation in cold season.	●			
		2. Check the recirculated condition of cooling water.	●			
4	Fuel Injection Pump & Valve	1. Check fuel injection (injection noise).	●			
		2. Adjust the governor.			●	
		3. Check fuel injection timing.				●
		4. Clean the nozzle.				●
5	Cylinder Head	1. Retighten the cylinder head bolts.		●		
		2. **Adjust the intake/exhaust valve clearance.**			●	
		3. Clean the internal surfaces of combustion chamber.				●
		4. Clean the pre-combustion chamber.				●
		5. **Check the intake/exhaust valve seat.**				●
		6. Check valve rocker arm and valve guides.				●
6	Breather, Belt, Anticorrosive Zinc, Piston & Ring	1. Wash the breather valve.		●		
		2. Check the belt tensions (cooling water pump, generator).		●		
		3. Renew the anticorrosive zinc.				●
		4. Check the piston and the ring.				●

5. FUEL AND LUBRICATING OILS

To the engine, fuel oil is food and lubricating oil is blood. Mis-handling might cause unexpected engine trouble. The efficiency of the Yanmar engine will depend upon strict adherence to these instructions and recommendations.

It is the salesman's or serviceman's duty and mission to urge the user to follow them.

5.1 Fuel Oils

5.1.1 Property requirements

(1) High cetane rating

Poor ignitability of fuel oil results in a ignition lag, causing difficult starting or knocking.

(2) Low sulphur content

Sulphur contained in fuel oil when burned is combined with water to produce sulphuric acid which corrodes metallic parts.

(3) No dust or moisture content

Dust and moisture contained in fuel oil can cause faster wear or sticking of the plunger of fuel injection pump and injection nozzle.

(4) Appropriate viscosity

Fuel viscosity has a relation to the condition of injection. It should be such that the plunger and the nozzle valve will be properly lubricated.

5.1.2 Recommended brands

Supplier	Brand
SHELL	Shell Diesoline (or local equivalent)
CALTEX	Caltex Diesel Oil
MOBIL	Mobil Diesel Oil
ESSO	Esso Diesel Oil
B.P. (British Petroleum)	B.P. Diesel Oil

5.2 Lubricating Oils

5.2.1 Functions

(1) Lubrication--reduces friction and wear on sliding surfaces.

(2) Cooling--carries away combustion and friction heat.

(3) Air-tightening--keeps the cylinder air-tight, prevents escape of compressed air and operating gas.

(4) Cleaning--carries away carbon (combustion product) and internal dust.

(5) Rust prevention--keeps parts from rust.

Today, improved engines call for high-quality lubricating oils. Oil companies are now using a number of additives to improve the properties of their lubricating oils.

5.2.2 Classification by viscosity

Lube oil viscosity should be so selected as to suit the ambient temperature.

SAE-Viscosity Table

	SAE No.	0°F (−17.8°C)		210°F (98.9°C)	
		Saybolt universal viscosity, sec.	Kinematic viscosity, CSt	Saybolt universal viscosity, sec.	Kinematic viscosity, CSt
below 10°C	5W	below 4,000	below 869	–	–
	10W	6,000a-12,000	1,303a-2,606	–	–
	20W	12,000b-48,000	2,606b-10,423	–	–
10 −20°C	20	–	–	45-58	5.73-9.62
	30	–	–	58-70	9.62-12.93
over 30°C	40	–	–	70-85	12.92-16.77
	50	–	–	85-110	16.77-22.68

5.2.3 Recommended brands (for crankcase and gear box)

Supplier	Brand	SAE No.			
		below 10°C	10 - 20°C	20 - 35°C	over 35°C
SHELL	Shell Rotella Oil	10W 20/20W	20/20W	30 40	50
	Shell Talona Oil	10W	20	30 40	50
	Shell Rimula Oil	20/20W	20/20W	30 40	50
CALTEX	RPM Delo Marine Oil	10W	20	30 40	50
	RPM Delo Multi-Service Oil	10W 20/20W	20	30 40	50
MOBIL	Delvac Special	10W	20	30 40	
	Delvac 20W-40	20W-40	20W-40		
	Delvac 1100 Series	20-20W 10W	20-20W	30 40	50
	Delvac 1200 Series	20-20W 10W	20-20W	30 40	50
ESSO	Estor HD	10W	20	30 40	
	Esso Lube HD		20	30 40	50
	Standard Diesel Oil	10W	20	30 40	50
B.P. (British Petroleum)	B.P. Energol B.P. Venellus* B.P. Diesel S3 B.P. Venellus**	20W, 30	20W, 30	30 40	50

* API grade CB
** API grade CD

6. TROUBLESHOOTING

The best engine will come to malfunction if not properly handled day after day or after a prolonged period of service.

Locating the trouble is the first consideration. Pinpointing the trouble cause is to be done next. Then comes a proper remedy therefore. If careless handling is the case, the operator may be instructed not to cause the same trouble.

The following lists the troubles, check points, possible causes, and remedies.

6.1 Engine Does Not Start

Check point	Possible cause	Remedy	Ref. page
1. Intake/exhaust valve	1. No valve clearance.	Adjust to 0.2 mm.	39
	2. Carbon or wear on valve seat.	Fit valve with quick successive movements.	25
	3. Worn valve guide.	Renew cylinder head.	24
	4. Intake/exhaust valve stuck.	Clean or renew.	
2. Fuel injection nozzle	1. Loose or unsymmetrically tightened nozzle guard.	Retighten.	
	2. Faulty or lost packing.	Repair or renew.	
3. Cylinder liner & piston	1. Unsuitable lube oil.	Change oil.	8
	2. Gasoline overcharged at start-up.		
	3. Stuck or worn piston ring.	Renew.	27
	4. Seized or worn piston and cylinder liner.	Renew.	27 30
4. Gasket	1. Gasket damaged (loose or unsymmetrically tightened head).	Renew or retighten	
5. Fuel oil	1. Fuel failure.	Supply fuel.	
	2. Tank cock in closed position.	Open cock.	21
6. Fuel injection pump	1. Air in pump.	Purge.	
	2. Dirty, scratched or worn delivery valve.	Clean or renew.	
	3. Dirty, scratched or worn regulator needle.	Clean or renew.	18
	4. Stuck or worn plunger.	Clean or renew.	18

Check point	Possible cause	Remedy	Ref. page
7. Fuel injection nozzle	1. Stuck or worn nozzle.	Clean or renew.	19
	2. Hight or low injection pressure.	Adjust to 160 kg/cm^2.	20
8. Main bearing	1. Stuck or seized.	Clean or renew.	33
9. Crankpin metal	1. Stuck or seized.	Clean or renew.	26
10. Starter operation	1. Battery discharge.	Recharge up to 1.26 (S.G.) at 20°C.	
	2. Key switch fault.	Renew.	
	3. Magnet switch fault.	Correct or renew.	
	4. Motor brush fault.	Renew.	35
	5. Motor unit fault.	Renew.	
11. Battery	1. Battery discharge.	Recharge up to 1.26 (S.G.) at 20°C.	
	2. Voltage drop (under no load).	Renew if below 12V.	
12. Governor lever	1. Not properly adjusted.	Readjust.	38

6.2 Difficult Start-up

Check point	Possible cause	Remedy	Ref. page
1. Temperature	1. Low.	Select suitable lube oil. Use start-up accelerator.	
2. Fuel oil	1. Unsuitable quality.	Change fuel oil	7
3. Injection	1. Stuck or worn nozzle valve.	Clean or renew.	19
	2. Low injection pressure.	Adjust to 160 kg/cm^2.	20
	3. Worn plunger.	Renew.	18
4. Intake/exhaust valve	1. Misadjusted.	Readjust.	39
5. Compression			
6. Electric equipment			35
7. Heavy manual turning	1. Stuck or seized piston, liner.	Correct or renew.	26 30
	2. Stuck or seized main bearing metal.	Correct or renew.	33
	3. Stuck or seized crankpin metal.	Correct or renew.	26
	4. Unsuitable lube oil.	Change oil.	8

6.3 Bad Exhaust Color

Check point	Possible cause	Remedy	Ref. page
1. Operating conditions	1. Overloaded operation.	Reduce load.	
2. Output decrease			13
3. Fuel oil	1. Unsuitable quality.	Change fuel oil.	7
4. Injection	1. Stuck or worn nozzle.	Correct or renew.	19
	2. Low injection pressure.	Adjust to 160 kg/cm^2.	20
5. Injection timing	1. Injection lag.	Set to 10 ± 2° before T.D.C., listening to injection noise.	40
6. Carbon deposit (Sticky)	1. Stuck or worn piston ring or oil ring.	Correct or renew.	27
	2. Worn cylinder liner or piston. (Burning oil)	Renew.	27 30

6.4 Momentary High-speed Revolution

Check point	Possible cause	Remedy	Ref. page
1. Regulator handle	1. Sudden operation.	Do not move it suddenly.	
2. Governor system	1. Misadjusted lever.	Readjust.	38
	2. Stuck regulator spindle.	Clean and correct.	

6.5 Hunting

Check point	Possible cause	Remedy	Ref. page
1. Governor system	1. Misadjusted lever.	Readjust.	38
	2. Stuck regulator spindle.	Clean and correct.	
	3. Malfuction of No. 1 lever shaft.	Correct.	
2. Injection	1. Stuck or worn nozzle.	Correct or renew.	
	2. High or low pressure.	Adjust to 160 kg/cm^2.	20
3. Fuel oil	1. Inferior quality.	Change fuel oil.	
4. Injection timing	1. Injection advance or lag.	Set to 10 ± 2° before T.D.C., listening to injection noise.	40
5. Crankshaft side gap	1. Large gap. (worn main bearing)	Renew.	33

6.6 Output Decrease

Check point	Possible cause	Remedy	Ref. page
1. Compression			
2. Intake/exhaust valve	1. Over/under clearance.	Adjust to 0.2 mm.	39
3. Injection	1. Stuck or worn nozzle.	Correct or renew.	19
	2. Pressure drop.	Adjust to 160 kg/cm^2.	20
	3. Worn plunger.	Renew.	18
	4. Scratched or worn delivery valve.	Correct or renew.	18
	5. Misadjusted governor lever.	Readjust.	38
4. Fuel oil	1. Unsuitable quality.	Change fuel oil.	7
5. Combustion chamber	1. Carbon deposit.	Remove.	
6. Moving parts	1. Stuck or seized cylinder liner and piston.	Correct or renew.	27 30
	2. Stuck or seized crankpin metal.	Correct or renew.	26
	3. Stuck or seized main bearing metal.	Correct or renew.	32
	4. Stuck or seized piston pin and pin metal.	Correct or renew.	27

6.7 Knocking during Operation

Check point	Possible cause	Remedy	Ref. page
1. Tightening parts	1. Loose end nut.	Retighten.	
	2. Loose connecting rod bolts and nuts.	Retighten.	
	3. Other tightening parts loose.	Retighten.	
2. Moving parts	1. Worn or seized crankpin metal.	Renew.	26
	2. Worn or seized main bearing metal.	Renew.	32
	3. Worn or seized piston pin and pin metal.	Renew.	27
3. Intake/exhaust valve	1. Large clearance.	Adjust to 0.2 mm.	39

Check point	Possible cause	Remedy	Ref. page
4. Fuel oil.	1. Unsuitable quality.	Change fuel oil.	7
5. Injection.	1. Stuck or worn nozzle.	Correct or renew.	19
	2. High or low pressure.	Adjust to 160 kg/cm^2.	20

6.8 Sudden Engine Stop

Check point	Possible cause	Remedy	Ref. page
1. Heavy manual turning.	1. Seized main bearing metal.	Renew.	32
	2. Seized crankpin metal.	Renew.	26
	3. Seized piston and cylinder liner.	Renew.	27 30
2. Injection			
3. Compression.			
4. Fuel oil.	1. Fuel failure.	Supply fuel oil.	
	2. Unsuitable quality.	Change fuel oil.	
5. Load.	1. Overload.	Reduce load.	

6.9 Lube Oil Leak

Check point	Possible cause	Remedy	Ref. page
1. Contact surfaces of parts.	1. Loose bolts and nuts.	Retighten.	
	2. Scratched packings.	Renew.	
2. Sliding parts.	1. Scratched or worn oil seals or shafts.	Renew.	
3. Lube oil tube.	1. Loose bolts or scratched.	Retighten or renew.	

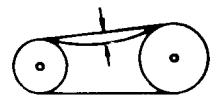
6.10 Fuel Oil Leak

Check point	Possible cause	Remedy	Ref. page
1. Fuel tank cock retainer.	1. Loose bolts and nuts, or scratched packings.	Retighten, or renew.	
2. Fuel oil pipe.	1. Loose or scratched bolts.	Retighten, or renew.	
3. Oil reservoir.	1. Defective plunger tightening nuts, loose setbolts, damaged packings, or scratched contact surfaces.	Retighten, or renew.	23

6.11 Water Leak

Check point	Possible cause	Remedy	Ref. page
1. Rocker cover	1. Loose bolts and nuts.	Retighten.	
	2. Damaged packings.	Renew.	
2. Cylinder head.	1. Crack caused by freezing.	Renew.	
	2. Loose bolts.	Retighten.	24
	3. Damaged gaskets.	Renew.	
3. Cylinder body.	1. Crack caused by freezing.	Renew.	
4. Inside of crank-case.	1. Scractched liner packing.	Renew.	

6.12 Cooling Water Failure

Check point	Possible cause	Remedy	Ref. page
1. Kingston cock.	1. Dirty mouth.	Clean.	
	2. Cock in closed position.	Open cock.	
2. Cooling water pipe flange.	1. Scratched packings.	Renew.	22
	2. Loose tightening parts.	Retighten.	22
3. Pump drive V belt.	1. Slack belt.	Tighten. Adjust finger-depressed deflexion to 5-7 mm. 	
4. Cooling water pump.	1. Scratched or worn impeller.	Renew.	22

6.13 Clutch Slip

Check point	Possible cause	Remedy	Ref. page
1. Friction disc.	1. Worn disc.	Renew if total wear on both sides exceeds 2 mm.	43
2. Spring.	1. Weakened or broken.	Renew.	

7. WEAR LIMIT OF EACH MAIN PART

	Description		YSE8		YSE12	
			std. dim., mm	wear limit, mm	std. dim., mm	wear limit, mm
Clear Limitance	Clearance between cylinder liner and piston		0.109	0.38	0.208	0.43
	Clearance between piston pin and piston pin metal		0.0375	0.30	0.0375	0.30
	Clearance between crankpin and crankpin metal		0.036	0.14	0.036	0.17
	Clearance between crankshaft journal and crank metal	Flywheel side	0.057	0.17	0.059	0.18
		Gear case side	0.07	0.18	0.068	0.21
	Clearance between **intake/** exhaust valve and valve guide		0.0525	0.3	0.0525	0.3
	Piston ring end clearance		0.3	1.5	0.4	1.5
Wear Limitance	Cylinder liner top I.D.		75	+0.30	85	+0.34
	Piston skirt O.D.		75	-0.23	85	-0.26
	Piston pin O.D.		23	-0.10	28	-0.11
	Piston pin metal I.D.		23	+0.10	28	+0.11
	Crankshaft pin O.D.		42	-0.13	46	-0.14
	Crankshaft journal O.D.		44	-0.13	52	-0.16
	Crankpin metal I.D.		42	+0.11	46	+0.12
	Main bearing metal I.D.		44	+0.11	52	+0.13
	Top piston ring (chrome-plated)	Breadth	2.0	-0.15	2.5	-0.15
		Thick-ness	3.3	-0.33	3.7	-0.37
	2nd & 3rd piston rings	Breadth	2.0	-0.15	2.5	-0.15
		Thick-ness	3.3	-0.33	3.7	-0.37
	Oil ring	Breadth	4.0	-0.15	4.0	-0.15
		Thick-ness	3.3	-0.33	3.7	-0.37
	Intake/exhaust valve spring	Free length	36.5	-1.5 to -2.0	39.5	-1.5 to -2.0