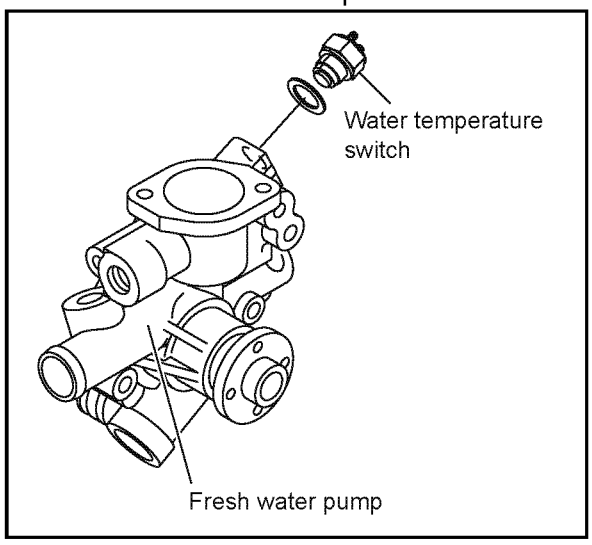
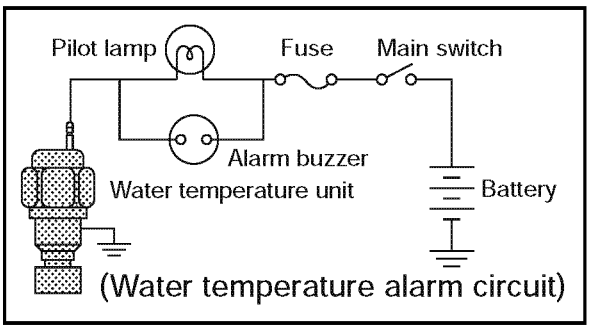
Inspection

Problem	Inspection Item	Inspection method	Corrective action
Lamp not illuminated when main switch set to ON.	1. Oil pressure lamp blown out.	(1) Visual inspection. (2) Lamp not illuminated even when main switch set to ON position and terminals of oil pressure switch grounded.	Replace lamp.
	2. Operation of oil pressure switch.	Lamp illuminated when checked as described in (2) above.	Replace oil pressure switch.
Lamp not extinguished while engine running.	1. Oil level low.	Stop engine and check oil level with dipstick.	Add oil.
	2. Oil pressure low.	Measure oil pressure.	Repair bearing wear and adjust regulator valve.
	3. Oil pressure faulty.	Switch faulty if abnormal at (1) and (2) above.	Replace oil pressure switch.
	4. Wiring between lamp and oil pressure switch faulty.	Cut the wiring between the lamp and switch and wire with separate wire.	Repair wiring harness.

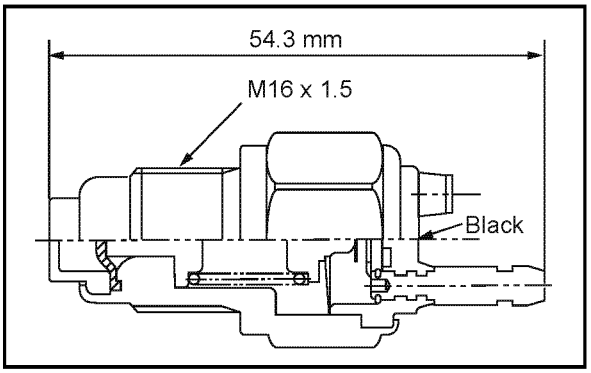
12.7.2 Cooling water temperature alarm

A water temperature lamp and a water temperature switch (thermo switch), backed up by an alarm in the instrument panel, are used to monitor the temperature of the engine cooling water. A high thermal expansion material is set on the end of the water temperature unit. When the cooling water temperature reaches a specified high temperature, the contacts are closed, and an alarm lamp and buzzer are activated at the instrument panel.





(Water temperature alarm circuit)

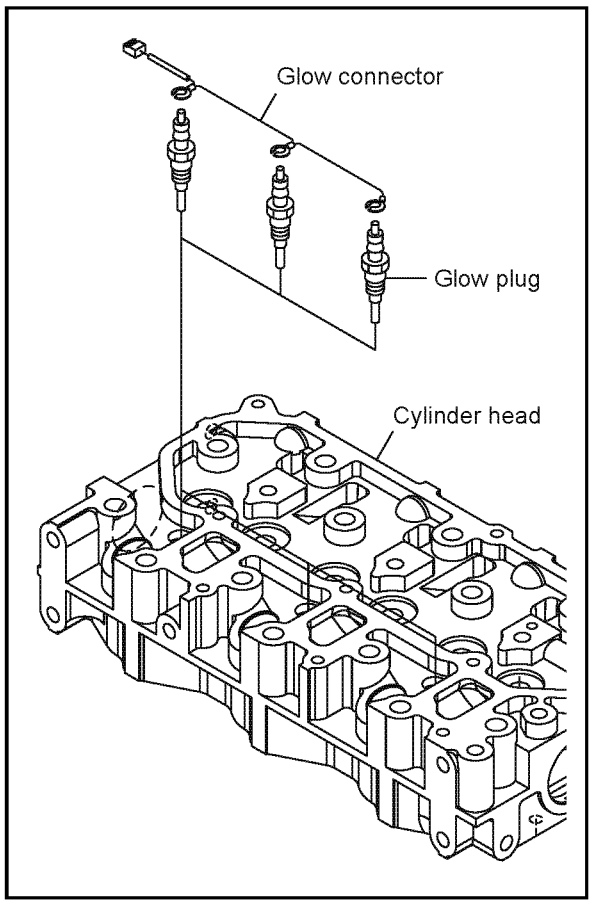


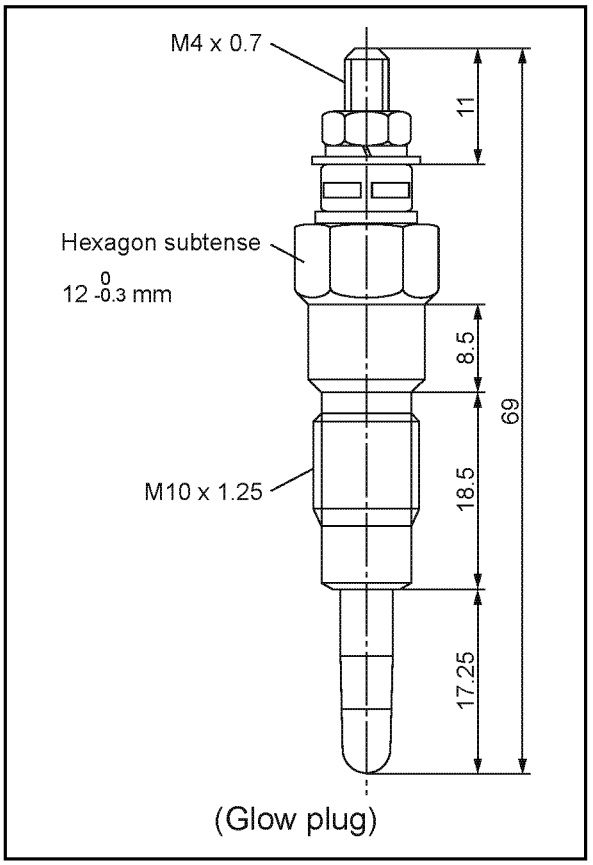
Operating temperature	ON	93-97 deg. C
Electric capacity		DC 12V, 1A
Response time		within 60 sec.
I.D. color		Black
Tightening torque		23.54-31.38 N•m (2.40-3.20 kgf-m)

12.8 Glow plug

A glow plug is available for warming intake air when starting in cold areas in winter. The glow plug is mounted to the cylinder head. The device is operated by the glow switch on the instrument panel.

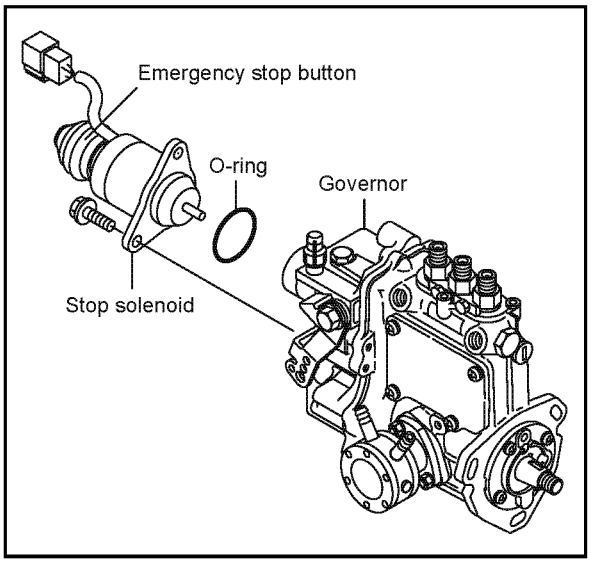
Rated current	8-10A
Rated voltage	DC11V





12.9 Electric engine stopping device

The electric engine stop device is fitted to the governor. The device is operated by the stop switch on the instrument panel.
The emergency stop button is integrated with the solenoid. When pushing the stop button, the engine will shut down.



13. Service standards

13.1 Engine tuning

No.	Inspection item			Standard	Limit	Reference page
1	Intake/exhaust valve clearance mm			0.15-0.25	-	2.2.2(5)
2	V-belt tension at 98N (10kgf) mm	Between alternator and F.W. pump	Used part	8-10	-	2.2.2(4)
			New part	6-8	-	
3	Fuel injection pressure MPa (kgf/cm^2)			12.3-13.28 (125-135)	-	2.2.7(2)
4	Compression pressure (at 250 min^{-1}) MPa (kgf/cm^2)		3YM30	3.43±0.1 (35±1)	2.75±0.1 (28±1)	3.4
			3YM20 2YM15	3.23±0.1 (33±1)	2.55±0.1 (26±1)	
5	Cooling water Capacity Liter (quart)	Engine	3YM30	4.9 (5.2)	-	2.2.1(5)
			3YM20	4.1 (4.3)	-	
			2YM15	3.0 (3.2)		
		Coolant recovery tank		0.8 (0.8)	-	
6	Lube oil capacity (full)	3YM30 Liter (quart) (at rake angle 8 degree)		2.8 $^{0}/_{-0.2}$ (3.0)	-	2.2.2.(2) 2.2.2.(3)
		3YM20 Liter (quart) (at rake angle 8 degree)		2.7 $^{0}/_{-0.2}$ (2.9)	-	
		2YM15 Liter (quart) (at rake angle 8 degree)		2.0 $^{0}/_{-0.2}$ (2.1)	-	
		Marine gear KM2P-1 Liter (pint)		0.30 (0.64)	-	
		3YM30C Liter (quart) (at rake angle 0 degree)		2.5 $^{0}/_{-0.2}$ (2.6)	-	
		3YM20C Liter (quart) (at rake angle 0 degree)		2.4 $^{0}/_{-0.2}$ (2.5)	-	
		2YM15C Liter (quart) (at rake angle 0 degree)		1.8 $^{0}/_{-0.2}$ (1.9)	-	
		Sail drive SD20 Liter (pint)		2.2 (4.7)	-	
7	Lubricating oil pressure MPa (kgf/cm^2)	at rated speed		0.29-0.44 (3.0-4.5)	-	-
		at low idle speed		0.06(0.6) or above	-	8.2.5
8	Oil pressure switch operating pressure MPa (kgf/cm^2)			0.05±0.01 (0.5±0.1)	-	12.7.1
9	Thermostat	valve opening temperature deg. C		69.5-72.5	-	2.5
		Full opening lift (mm) (temperature)		8 or above (85 deg. C)	-	
10	Thermo switch actuating temperature (deg. C)		ON	93-97	-	2.4.2 12.7.2

13.2 Engine body

13.2.1 Cylinder head

(1) Cylinder head

Inspection item			Standard	Limit	Reference page
Combustion surface distortion mm			0.05 or less	0.15	5.2.1(1)
Valve sink mm		Intake Exhaust	0.4-0.6	0.8	5.2.3(3)
Valve seat	Seat angle deg.	Intake	120	-	5.2.1(3)
		Exhaust	90	-	

(2) Intake/exhaust valve and guide

mm

Inspection item		Standard	Limit	Reference page
Intake	Guide inside diameter	6.000-6.012	6.08	5.2.3
	Valve stem outside diameter	5.960-5.975	5.90	
	Clearance	0.025-0.052	0.16	
Exhaust	Guide inside diameter	6.000-6.012	6.08	
	Valve stem outside diameter	5.945-5.960	5.90	
	Clearance	0.040-0.067	0.17	
Valve guide projection from cylinder head		9.8-10.0	-	5.2.3(4)
Valve guide driving-in method		Cold-fitted	-	

(3) Valve spring

mm

Inspection item	Standard	Limit	Reference page
Free length	37.8	36.3	5.2.4(1)
Inclination	-	1.3	

(4) Rocker arm and shaft

mm

Inspection item	Standard	Limit	Reference page
Arm shaft hole diameter	12.000-12.020	12.07	5.2.7(1)
Shaft outside diameter	11.966-11.984	11.94	
Clearance	0.016-0.054	0.13	

(5) Tappet and push rod

mm

Inspection item	Standard	Limit	Reference page
Tappet outside diameter	20.927-20.960	20.907	5.6.2(2)
Tappet guide hole inside diameter (cylinder block)	21.000-21.021	21.041	
Tappet oil clearance	0.040-0.094	0.134	
Push rod bend	Less than 0.03	0.03	5.6.2(3)

13.2.2 Camshaft and gear train

(1) Camshaft

mm

Inspection item		Standard	Limit	Reference page
Side gap		0.05-0.15	0.25	5.6.1(1)
Bending (1/2 the dial gage reading)		0.02 or less	0.05	5.6.1(4)
Cam height	3YM30	34.135-34.265	33.89	5.6.1(2)
	3YM20/2YM15	34.535-34.665	34.29	
Shaft outside diameter / Metal inside diameter				
Gear side	Bushing inside diameter	40.000-40.075	40.150	5.6.1(3)
	Camshaft outside diameter	39.940-39.960	39.905	
	Clearance	0.040-0.135	0.245	
Intermediate	Bushing inside diameter	40.000-40.025	40.100	
	Camshaft outside diameter	39.910-39.935	39.875	
	Clearance	0.065-0.115	0.225	
Flywheel side	Bushing inside diameter	40.000-40.025	40.100	
	Camshaft outside diameter	39.940-39.960	39.905	
	Clearance	0.04-0.085	0.195	

(2) Idle gear shaft and bushing

mm

Inspection item	Standard	Limit	Reference page
Shaft outside diameter	36.950-36.975	36.900	5.7.1(3)
Bushing inside diameter	37.000-37.025	37.075	
Clearance	0.025-0.075	0.175	

(3) Backlash of each gear

mm

Inspection item	Standard	Limit	Reference page
Crank gear, cam gear, idle gear and fuel injection pump gear	0.06-0.12	0.14	5.7.1(1)

13.2.3 Cylinder block

(1) Cylinder block

mm

Inspection item		Standard	Limit	Reference page
Cylinder inside diameter	3YM30	76.000-76.030	76.200	5.1.5
	3YM20/2YM15	70.000-70.030	70.200	
Cylinder bore	Roundness	0.01 or less	0.03	
	Inclination			

(2) Crankshaft

mm

Inspection item		Standard	Limit	Reference page
Bending (1/2 the dial gauge reading)		-	0.01	5.5.1(2)
Crank pin 3YM30	Pin outside diameter	41.952-41.962	41.902	5.4.2(1) 5.5.1(3)
	Metal inside diameter	41.982-42.010	-	
	Metal thickness	1.503-1.509	-	
	Clearance	0.020-0.058	0.120	
Crank pin 3YM20/2YM15	Pin outside diameter	37.952-37.962	37.902	
	Metal inside diameter	37.982-38.010	-	
	Metal thickness	1.503-1.509	-	
	Clearance	0.020-0.058	0.120	
Crank journal (Selective pairing) All models	Journal outside diameter	46.952-46.962	46.902	
	Metal inside diameter	46.982-47.002	-	
	Metal thickness	2.009-2.014	-	
	Clearance	0.020-0.050	0.120	

(3) Thrust bearing

mm

Inspection item	Standard	Limit	Reference page
Crankshaft side gap	0.111-0.250	0.30	5.5.1(4)

(4) Piston and ring

1) Piston

mm

Inspection item		Standard	Limit	Reference page
Piston outside diameter (Measure in the direction vertical to the piston pin.)	3YM30	75.965-75.975	75.920	5.3.1(1)
	3YM20/2YM15	69.970-69.980	69.925	
Piston diameter measure position (Upward from the bottom end of the piston)		22	-	
Clearance between piston and cylinder	3YM30	0.035-0.055	-	
	3YM20/2YM15	0.030-0.050	-	
Piston pin hole inside diameter		22.000-22.009	22.039	5.3.2
Piston pin outside diameter		21.995-22.000	21.965	
Clearance		0.000-0.014	0.074	

2) Piston ring

3YM30

mm

Inspection item		Standard	Limit	Reference page
Top ring	Groove width	1.550-1.570	-	5.3.3(1)
	Ring width	1.470-1.490	1.450	
	Side clearance	0.060-0.100	-	
	Ring gap	0.15-0.30	0.390	
Second ring	Groove width	1.580-1.595	1.695	
	Ring width	1.430-1.450	1.410	
	Side clearance	0.013-0.165	0.285	
	Ring gap	0.18-0.33	0.420	
Oil ring	Groove width	3.010-3.030	3.130	
	Ring width	2.970-2.990	2.950	
	Side clearance	0.020-0.060	0.180	
	Ring gap	0.20-0.45	0.540	

3YM20/2YM15 mm

Inspection item		Standard	Limit	Reference page
Top ring	Groove width	1.550-1.570	-	5.3.3(1)
	Ring width	1.470-1.490	1.450	
	Side clearance	0.060-0.100	-	
	Ring gap	0.15-0.30	0.390	
Second ring	Groove width	1.540-1.560	1.660	
	Ring width	1.470-1.490	1.450	
	Side clearance	0.050-0.090	0.210	
	Ring gap	0.18-0.33	0.420	
Oil ring	Groove width	3.010-3.030	3.130	
	Ring width	2.970-3.010	2.950	
	Side clearance	0.020-0.060	0.180	
	Ring gap	0.15-0.35	0.44	

(5) Connecting rod

1) Rod big end

mm

Inspection item	Standard	Limit	Reference page
Side clearance	0.20-0.40	0.55	5.4.1(2)

2) Rod small end

mm

Item	Standard	Limit	Reference page
Bushing inside diameter	22.025-22.038	22.068	5.4.3(1)
Pin outside diameter	21.991-22.000	21.963	
Clearance	0.025-0.047	0.105	

13.3 Lubricating oil system (Trochoid pump)

(1) Outside clearance of outer rotor

mm

Standard	Limit	Reference page
0.12-0.21	0.30	8.2.4(1)

(2) Tip clearance between outer rotor and inner rotor

mm

Standard	Limit	Reference page
-	0.16	8.2.4(1)

(3) Side clearance of outer rotor

mm

Standard	Limit	Reference page
0.02-0.07	0.12	8.2.4(2)

(4) Outside diameter clearance of inner rotor centering location part

mm

Inspection item	Standard	Limit	Reference page
Gear case cover I.D.	46.13-46.18	-	8.2.4(3)
Inner rotor O.D.	45.98-46.00	-	
Rotor clearance	0.13-0.20	0.25	

14. Tightening torque for bolts and nuts

14.1 Main bolt and nut

No	Name	Thread diameter x pitch	Lube oil application (thread portion and seat surface)	Torque N•m(kgf•m)
1	Head bolt	M9 x 1.25	Coat with lube oil	53.9-57.9 (5.5-5.9)
2	Rod bolt	M7 x 1.0	Coat with lube oil	22.6-27.5 (2.3-2.8)
3	Flywheel retainer bolt	M10 x 1.25	Coat with lube oil	80.4-86.4 (8.2-8.8)
4	Metal cap retainer bolt	M10 x 1.25	Coat with lube oil	75.5-81.5 (7.7-8.3)
5	Crankshaft pulley bolt (FC250 pulley)	M10 x 1.25	Coat with lube oil	83.3-93.3 (8.5-9.5)
6	Fuel pump gear nut	M12 x 1.75	Coat with lube oil	58.8-68.8 (6.0-7.0)
7	Nozzle fastening nut	M20 x 1.5	No lube oil	49-53 (5.0-5.4)
8	Fuel injection pipe joint nut	M12 x 1.25	No lube oil	29.4-34.4 (3.0-3.5)
9	Glow plug	M10 x 1.25	No lube oil	14.7-19.6(1.5-2.0)
10	Governor weight support fastening nut	M12 x 1.25	Coat with lube oil	68.7-73.7(7.0-7.5)

14.2 Standard bolts and nuts (without lube oil)

N•m (kgf•m)

Name	Screw dia. x pitch	Tightening torque	Remarks
Hexagon bolt (7T) and nut	M6 x 1	9.8-11.8(1.0-1.2)	Use 80% of the value at left when the tightening part is aluminum. Use 60% of the value at left for 4T bolts and lock nuts.
	M8 x 1.25	22.5-28.5(2.3-2.9)	
	M10 x 1.5	44-54(4.5-5.5)	
	M12 x 1.75	78.2-98.2(8.0-10.0)	
PT plug	1/8	9.8 (1.0)	-
	1/4	19.6 (2.0)	
	3/8	29.4 (3.0)	
	1/2	58.8 (6.0)	
Pipe joint bolt	M8	12.7-16.7(1.3-1.7)	-
	M10	19.5-25.5 (2.0-2.6)	
	M12	24.4-34.4 (2.5-3.5)	
	M14	39.1-49.1 (4.0-5.0)	
	M16	48.9-58.9 (5.0-6.0)	

MARINE DIESEL ENGINE

3YM30/3YM20/2YM15
SERVICE MANUAL

Code No. M9961-03E101
First Edition : March 2004
2nd Edition : April 2005

YANMAR CO.,LTD.

Published by : Quality Control Dept.
Marine Factory
Large Power Products Operations Division.

Edited by : YANMAR TECHNICAL SERVICE CO., LTD.

YANMAR CO.,LTD.

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