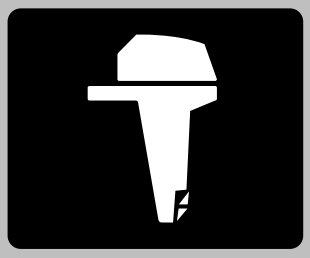
YAMAHA



F225A
FL225A

SERVICE MANUAL

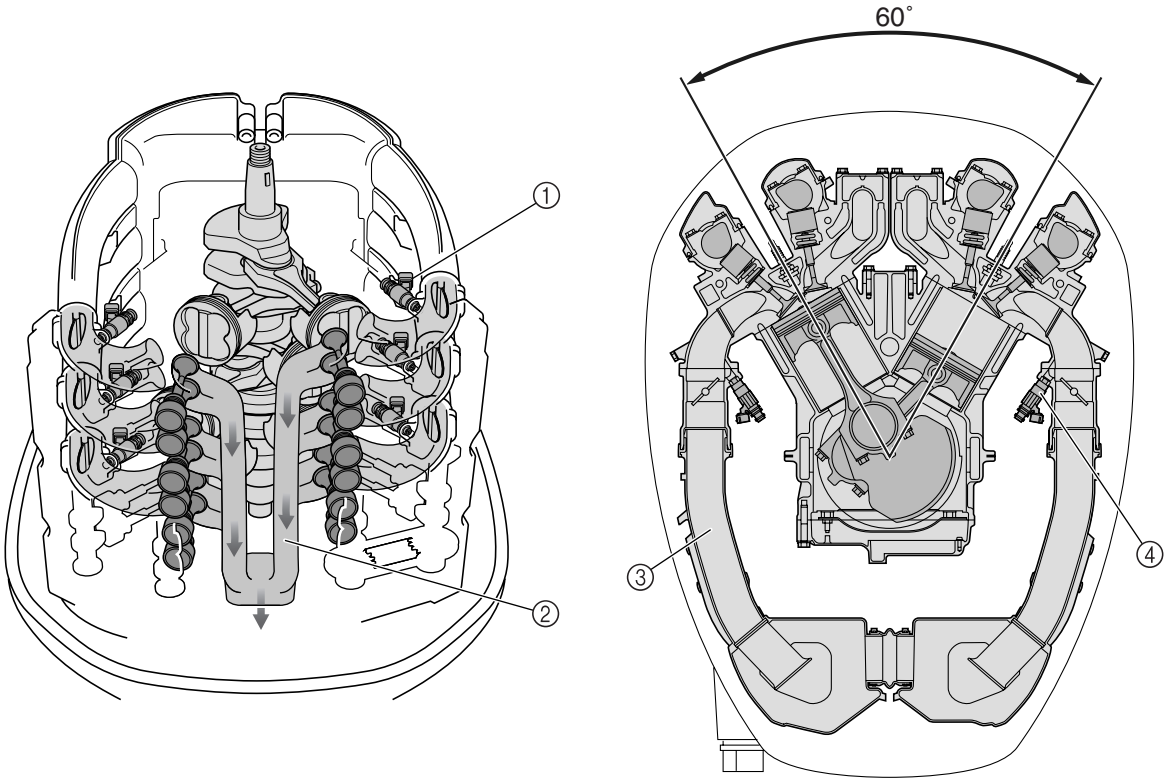
290435

69J-28197-3D-11

Features and benefits

Newly developed V6 4-stroke engine

The F225 is a newly developed 60-degree V6 4-stroke engine with a very compact and lightweight design. Its size and weight are almost the same as the V6 2-stroke engines that are in current use.
This F225 offers numerous advantages of a 4-stroke engine. Compared to conventional 2-stroke models, it emits much cleaner exhaust gases, offers a better fuel economy, and realizes lower noise levels at idle and full throttle.
Through the newly developed “In-bank exhaust system,” which discharges exhaust gases from the center of both banks, the engine block and the surrounding equipment have been made compact. In addition, the six independent intake passages help to achieve a high level of driveability and power output.



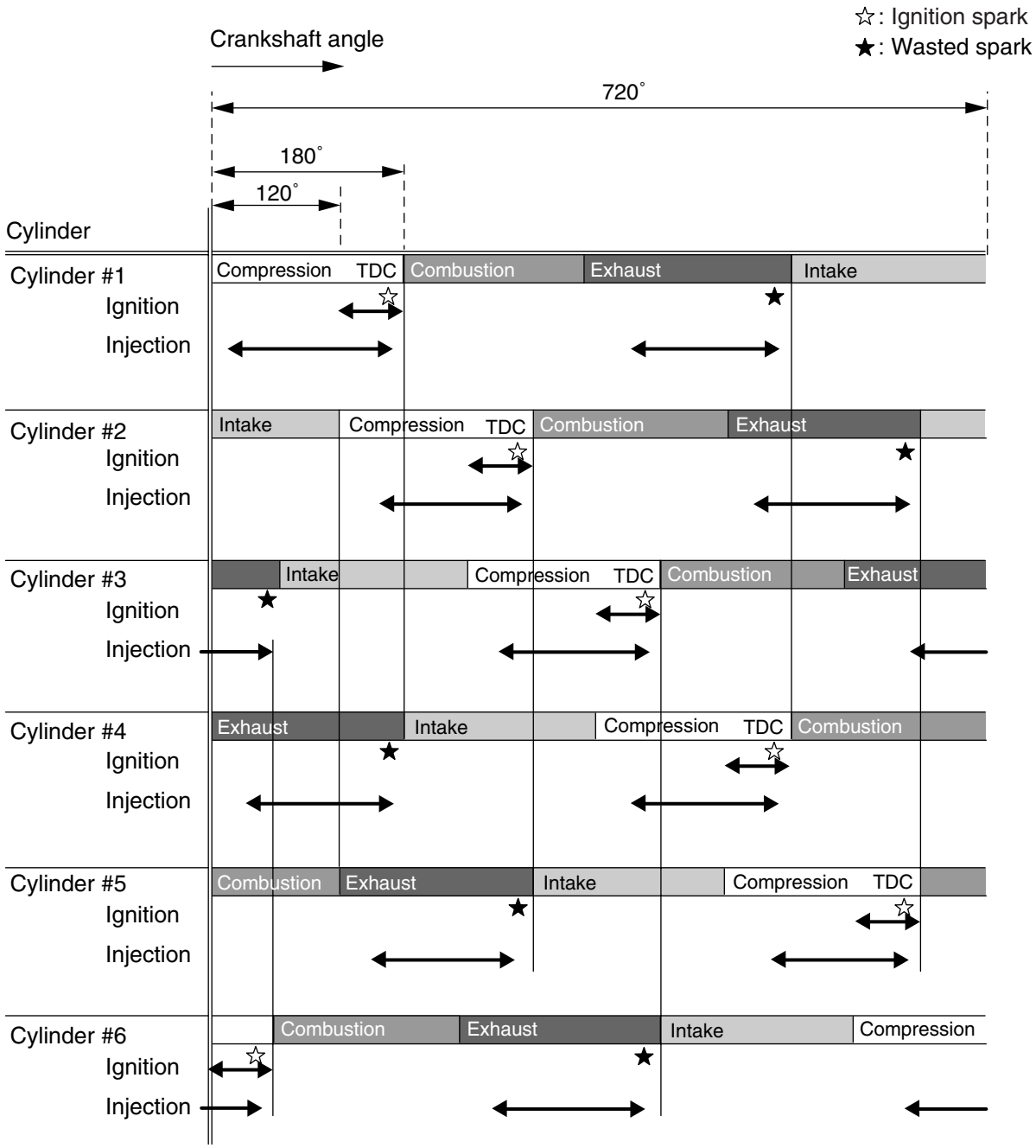
S69J1250

① Electronic Fuel Injection
② In-bank exhaust system
③ Pulse tuned long intake tracks
④ Individual inside track fuel injectors

Ignition and fuel injection timing

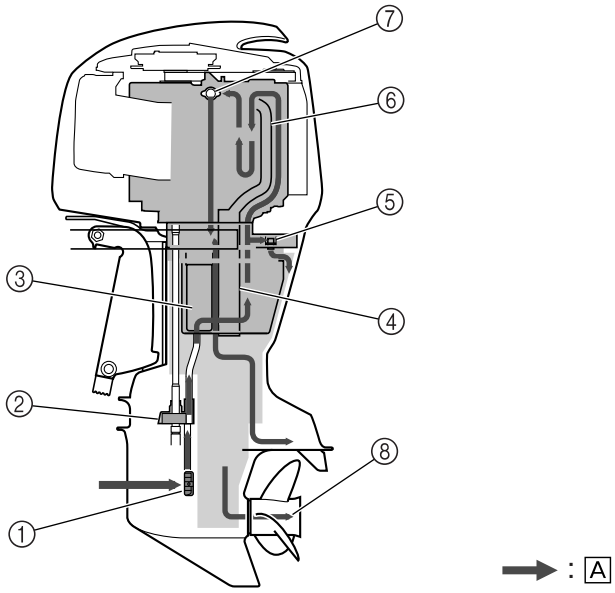
Firing order : #1, #2, #3, #4, #5, #6

Injection order : #1 and #4 → #2 and #5 → #3 and #6 (group injection)



S69J1370

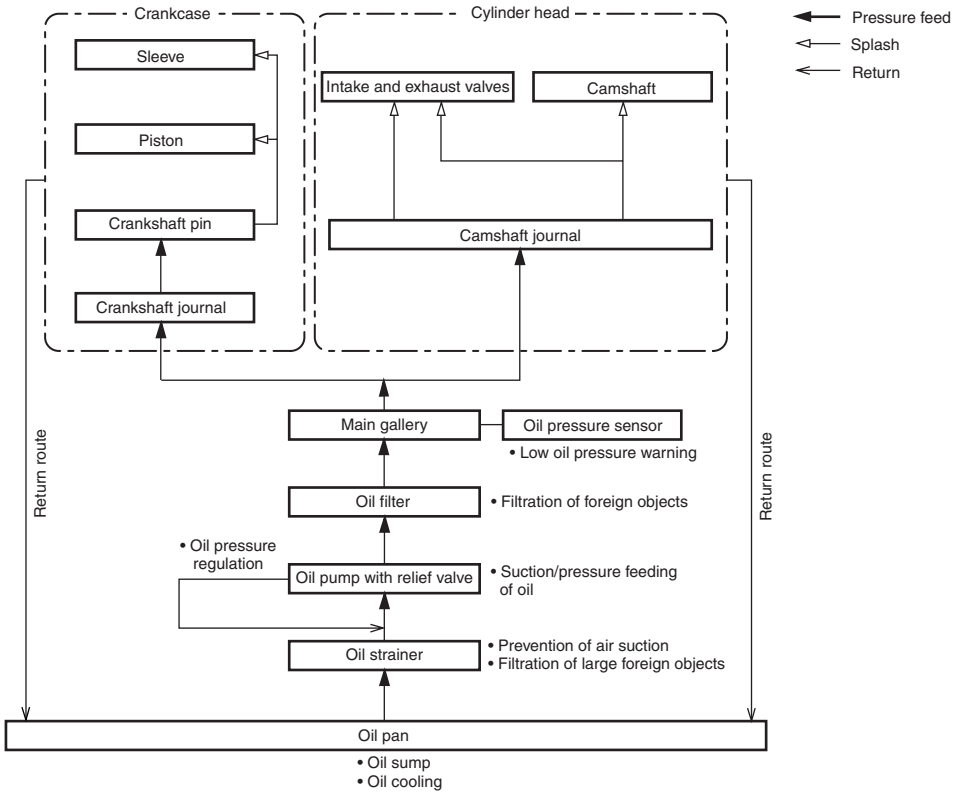
Cooling system



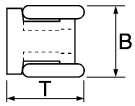
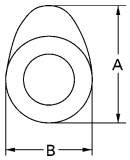
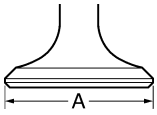
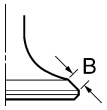
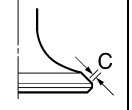
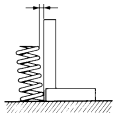
S69J1460

① Cooling water inlet
② Water pump
③ Oil pan
④ Exhaust pipe
⑤ PCV (Pressure control valve)
⑥ In-bank exhaust system
⑦ Thermostat
⑧ Propeller boss
A Water

Lubrication system

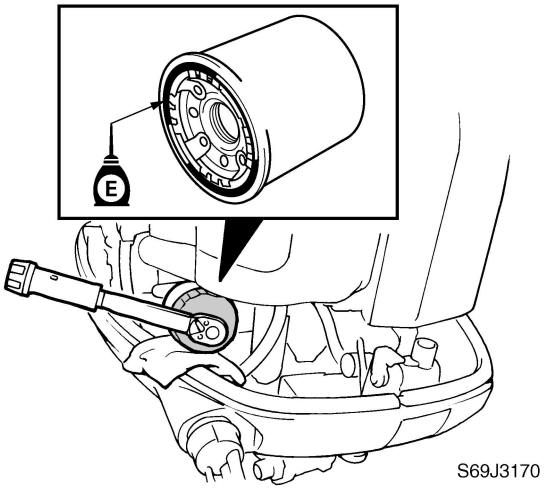


S69J1470

Item	Unit	Model	
		F225AET	FL225AET
Oil ring			
			
Dimension B	mm (in)	2.40–2.47 (0.0945–0.0972)	
Dimension T	mm (in)	2.3–2.7 (0.091–0.106)	
End gap	mm (in)	0.15–0.60 (0.0059–0.0236)	
Side clearance	mm (in)	0.04–0.13 (0.0016–0.0051)	
Camshafts			
			
Intake (A)	mm (in)	45.30–45.40 (1.7835–1.7874)	
Exhaust (A)	mm (in)	45.35–45.45 (1.7854–1.7894)	
Intake and exhaust (B)	mm (in)	35.95–36.05 (1.4154–1.4193)	
Camshaft journal diameter	mm (in)	24.96–24.98 (0.9827–0.9834)	
Camshaft journal oil clearance	mm (in)	0.02–0.06 (0.0008–0.0023)	
Camshaft runout limit	mm (in)	0.1 (0.004)	
Valves			
Valve clearance (cold)			
Intake	mm (in)	0.20 ± 0.03 (0.008 ± 0.001)	
Exhaust	mm (in)	0.34 ± 0.03 (0.013 ± 0.001)	
Head diameter (A)			
Intake	mm (in)	34.85–35.15 (1.3720–1.3839)	
Exhaust	mm (in)	29.85–30.15 (1.1752–1.1870)	
			
Face width (B)			
Intake	mm (in)	2.11 (0.0831)	
Exhaust	mm (in)	2.43 (0.0957)	
			
Seat contact width (C)			
Intake	mm (in)	1.1–1.4 (0.043–0.055)	
Exhaust	mm (in)	1.4–1.7 (0.055–0.067)	
			
Margin thickness (D)			
Intake	mm (in)	0.7 (0.028)	
Exhaust	mm (in)	1.0 (0.039)	
Stem diameter			
Intake	mm (in)	5.477–5.492 (0.2156–0.2162)	
Exhaust	mm (in)	5.464–5.479 (0.2151–0.2157)	
Guide inside diameter			
Intake and exhaust	mm (in)	5.51–5.52 (0.2169–0.2173)	
Stem-to-guide clearance			
Intake	mm (in)	0.01–0.02 (0.0004–0.0008)	
Exhaust	mm (in)	0.01–0.02 (0.0004–0.0008)	
Stem runout limit	mm (in)	0.01 (0.0004)	
Valve springs			
			
Free length	mm (in)	44.20 (1.740)	
Minimum free length	mm (in)	42.60 (1.677)	
Tilt limit	mm (in)	1.5 (0.06)	

Part to be tightened	Thread size	Tightening torques		
		N·m	kgf·m	ft·lb
Upper case mount nut	—	72	7.2	52
Engine oil drain bolt	M14	27	2.7	19
Apron stay	—	8	0.8	5.8
Pressure control valve	—	8	0.8	5.8
Upper exhaust guide bolt	M8	20	2.0	14
	M10	42	4.2	30
Oil strainer bolt	M6	10	1.0	7.2
Oil pan bolt	M8	20	2.0	14
Exhaust manifold bolt	M8	20	2.0	14
Muffler bolt	M8	20	2.0	14
Baffle plate screw	M6	4	0.4	2.9
Clamp bracket self-locking nut	—	22	2.2	16
Friction plate screw	M6	4	0.4	2.9
Trim stopper nut	—	36	3.6	25
Power trim and tilt unit				
Power trim and tilt unit bolt	M10	42	4.2	30
Reservoir bolt	M8	18	1.8	13
Reservoir cap	M12	7	0.7	5.1
Manual valve	—	2	0.2	1.4
Fluid pipe	—	15	1.5	11
Trim cylinder end screw	—	160	16	115
Trim piston bolt	M8	38	3.8	27
Tilt ram	—	55	5.5	40
Tilt cylinder end screw	—	90	9.0	65
Tilt piston bolt	M6	7	0.7	5.1
Gear housing bolt	M5	7	0.7	5.1
Gear housing bracket bolt	M5	7	0.7	5.1

5. Install the oil filter, and then tighten it to the specified torque using a 72.5 mm (2.9 in) oil filter wrench.



S69J3170

Oil filter: 18 N·m (1.8 kgf·m, 13 ft·lb)

6. Pour the specified amount of the recommended engine oil into the oil filler hole.

Recommended engine oil:
4-stroke motor oil
API: SE, SF, SG, or SH
SAE: 10W-30 or 10W-40
Oil quantity:
With oil filter replacement:
6.0 L (6.3 US qt, 5.3 Imp qt)

7. Install the oil filler cap and dipstick, and then start the engine and warm it up for 5 minutes.

8. Turn the engine off, and then check the oil level and correct it if necessary.

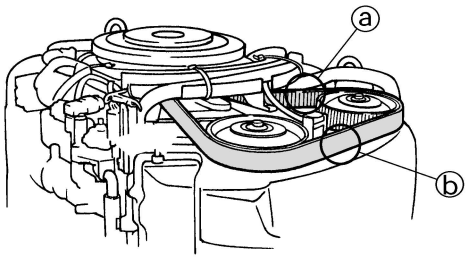
9. Install the oil filter cover.

Checking the timing belt

1. Remove the flywheel magnet cover.

2. While turning the flywheel magnet clockwise, check the interior ⓐ and the exterior ⓑ of the timing belt for cracks, damage, or wear. Replace if necessary.

3. Turn the crankshaft clockwise two turns to take up slack in the timing belt.



S69J3180

Replacing the timing belt

NOTE:
For replacement procedures, see Chapter 5, “Replacing the timing belt.”

Checking the valve clearance

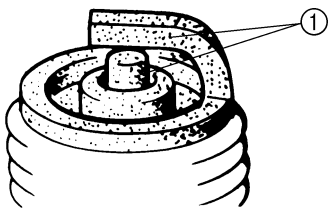
NOTE:
For checking procedures, see Chapter 5, “Checking the valve clearance.”

Checking the spark plugs

1. Remove the ignition coil cover.

2. Disconnect the spark plug wires, and then remove the spark plugs.

3. Clean the electrodes ① with a spark plug cleaner or wire brush. Replace the spark plug if necessary.

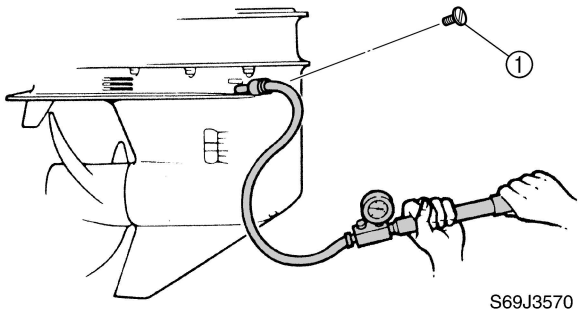


S69J3190

4. Check the electrodes for erosion and excessive carbon or other deposits, and the gasket for damage. Replace the spark plug if necessary.

Checking the lower unit (for air leakage)

1. Remove the check screw ①, and then install the special service tool.



S69J3570

Leakage tester: 90890-06762

2. Apply the specified pressure to check whether the lower unit can hold it for at least 10 seconds.

CAUTION:

Do not over pressurize the lower unit, otherwise the oil seals may be damaged.

NOTE:

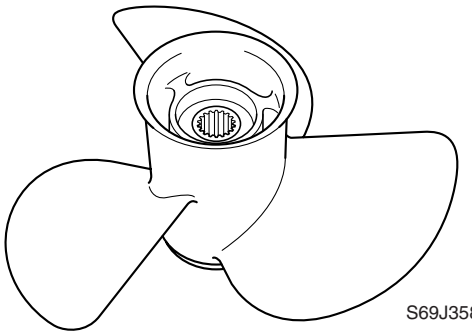
Cover the check hole with a rag when removing the pressure/vacuum tester from the lower unit.

Lower unit holding pressure:
100 kPa (1.0 kgf/cm^2, 14 psi)

3. If pressure drops below specification, check the drive shaft and propeller shaft oil seals for damage.

Checking the propeller

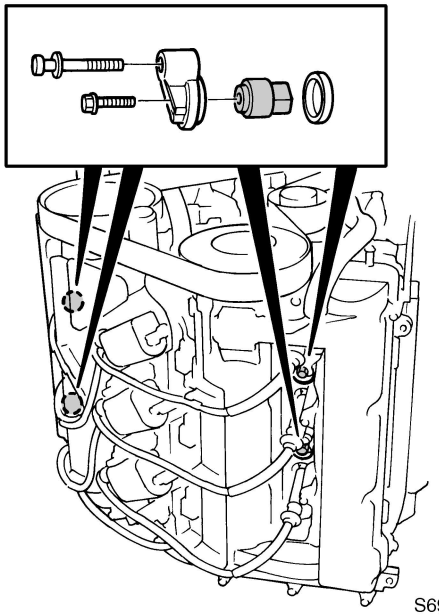
1. Check the propeller blades and splines for cracks, damage, or wear. Replace if necessary.

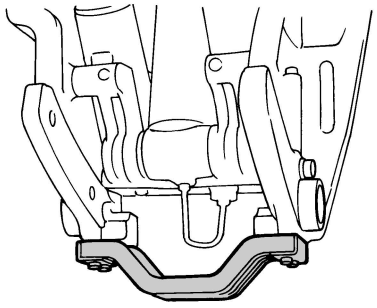

S69J3580

General

Checking the anodes

1. Check the anodes and trim tab for scales, grease, or oil. Clean if necessary.


S69J3590

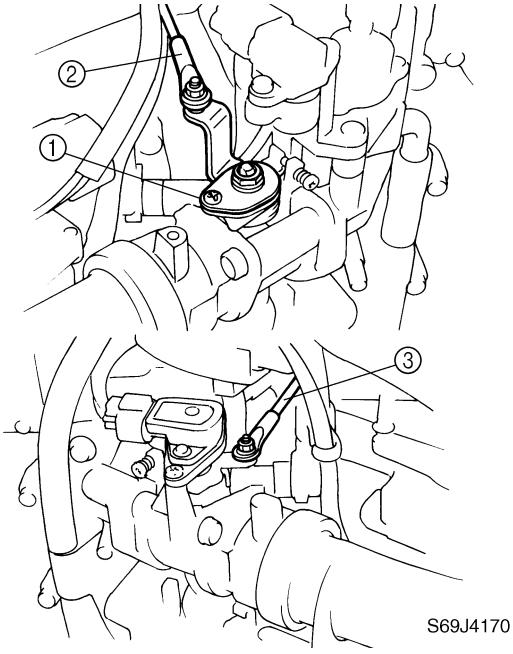

S69J3600

3

No.	Part name	Q'ty	Remarks
1	Float chamber	1	
2	Cover	1	
3	High-pressure fuel pump	1	
4	Float	1	
5	Water hose	1	
6	Fuel hose	3	
7	Joint	1	
8	Fuel cooler	1	
9	Washer	2	
10	Nut	2	
11	Water hose	1	
12	Bracket	1	
13	Bolt	3	M8 × 16 mm
14	Collar	6	
15	Bushing	4	
16	Bolt	4	M8 × 16 mm
17	Collar	1	
18	High-pressure fuel pump relay	1	
19	Washer	2	
20	Nut	1	
21	Hose	3	
22	Screw	7	M4 × 15 mm
23	Bracket	1	
24	Bolt	1	M6 × 10 mm
25	Gasket	1	**Not reusable**
26	Plate	2	
27	Grommet	1	
28	Screw	3	M4 × 8 mm
29	Plate	1	
30	Needle valve	1	
31	Pin	1	
32	Bracket	1	
33	Screw	1	
34	Gasket	1	
35	Drain screw	1	
36	Joint	1	
37	Filter	1	
38	Filter holder	1	

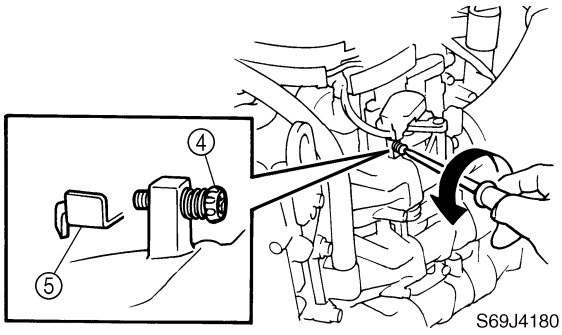
Synchronizing the throttle valve

1. Loosen the bank synchronizing screw ①.
2. Remove the port link rod ② and starboard link rod ③.



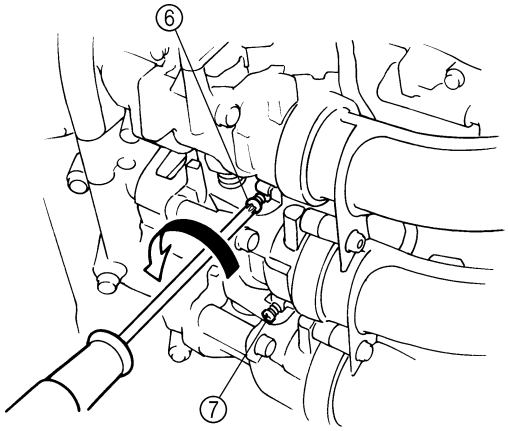
S69J4170

3. Loosen the starboard throttle stop screw ④ until it separates from the throttle body lever ⑤.



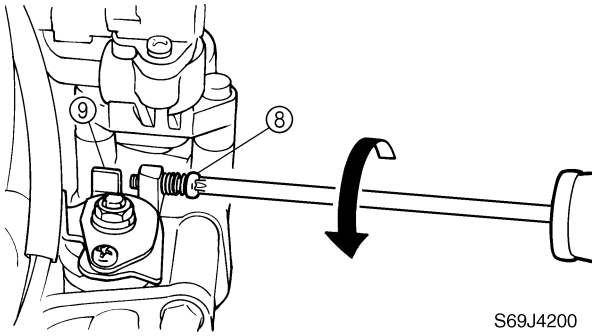
S69J4180

4. Loosen the synchronizing screw ⑥ of cylinder #3 to open throttle valve #3.
5. Loosen the synchronizing screw ⑦ of cylinder #5 to open throttle valve #5.



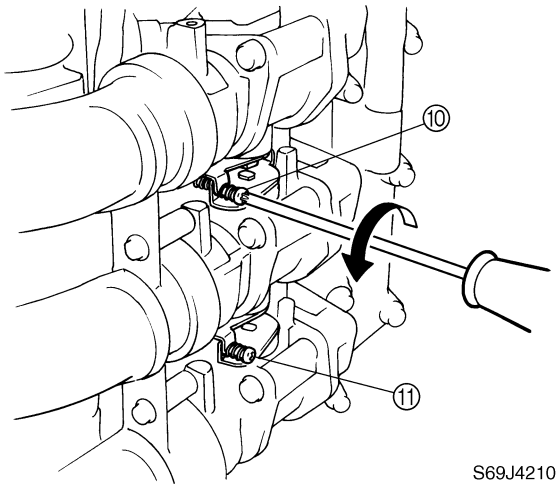
S69J4190

6. Loosen the port throttle stop screw ⑧ until it separates from the throttle body lever ⑨.



S69J4200

7. Loosen the synchronizing screw ⑩ of cylinder #4 to open throttle valve #4.
8. Loosen the synchronizing screw ⑪ of cylinder #6 to open throttle valve #6.



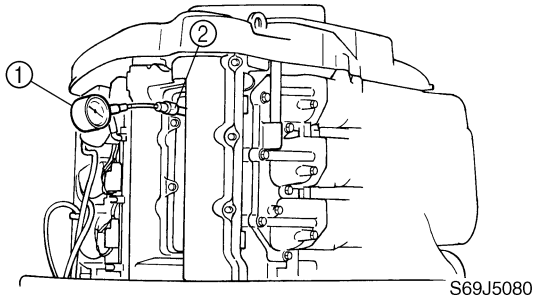
S69J4210

9. Connect the test harness (3 pins) to the throttle position sensor.

No.	Part name	Q'ty	Remarks
1	Power unit	1	
2	Screw	4	
3	Cover	1	
4	Dipstick	1	
5	Bolt	1	M6 × 20 mm
6	Dipstick guide	1	
7	O-ring	1	**Not reusable**
8	Plastic tie	2	**Not reusable**
9	Fuel hose	1	
10	Bolt	2	M6 × 10 mm
11	PTT motor lead	2	Sky blue, light green
12	Gasket	1	**Not reusable**
13	Clip	2	
14	Shift cable	1	
15	Throttle cable	1	
16	Cooling water pilot hose	1	
17	Dowel pin	2	
18	Upper case cover	1	
19	Bolt	7	M6 × 14 mm
20	Bolt	7	M9 × 35 mm
21	Bolt	6	M10 × 140 mm
22	Bolt	1	M6 × 30 mm
23	Starboard apron	1	
24	Port apron	1	
25	Grommet	6	
26	Nut	2	
27	Low-pressure fuel pump driver coupler	1	
28	Bolt	1	M6 × 20 mm
29	Holder	1	
30	Grommet	1	
31	Bolt	1	M6 × 30 mm
32	Holder	1	
33	Retaining plate	1	
34	PTT switch coupler	1	
35	Shift cut switch coupler	1	
36	Neutral switch coupler	1	
37	Clamp	1	
38	Flushing device hose	1	Flushing device model

Checking the compression pressure

1. Start the engine, warm it up for 5 minutes, and then turn it off.
2. Remove the clip from the engine shut-off switch on the remote control box.
3. Remove the ignition coil cover and all spark plugs, and then install the special service tools to each spark plug hole.



CAUTION:

Before removing the spark plugs, blow compressed air in the spark plug well to clear out any dirt or dust that may fall into the cylinder.

Compression gauge ①:
90890-03160
Compression gauge adapter ②:
90890-06563

4. Fully open the throttle, crank the engine until the reading on the compression gauge stabilizes, and then check the compression pressure.

Minimum compression pressure (reference data):
880 kPa (8.8 kgf/cm^2, 125 psi)

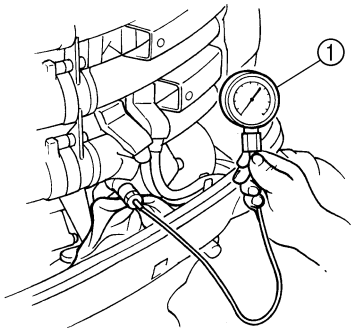
5. If the compression pressure is below specification and the compression pressure for each cylinder is unbalanced, add a small amount of engine oil to the cylinder, and then check the pressure again.

NOTE:

- If the compression pressure increases, check the piston and piston rings for wear. Replace if necessary.
- If the compression pressure does not increase, check the valve clearance, valve, valve seat, cylinder sleeve, cylinder head gasket, and cylinder head. Adjust or replace if necessary.

Checking the oil pressure

1. Place a rag under the oil pressure sensor.
2. Remove the intake silencer and oil pressure sensor, and then install an oil pressure gauge ① to the oil pressure sensor installation hole.



NOTE:

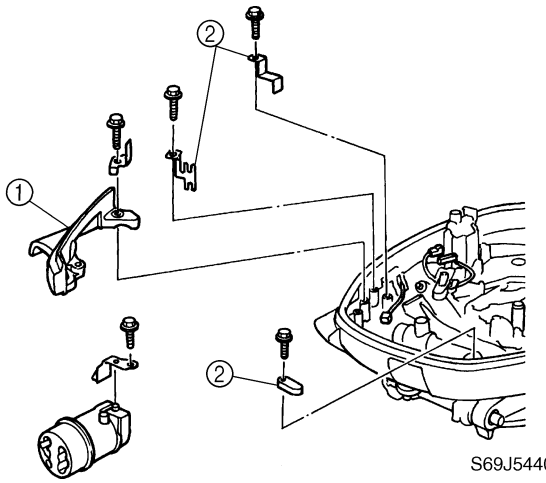
Use a pressure gauge with an adapter that has a 1/8 pitch thread.

3. Install the intake silencer.

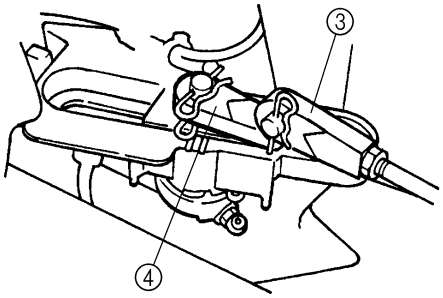
CAUTION:

Do not start the engine when the intake silencer is not installed.

4. Start the engine, warm it up for 5 minutes, and then turn it off.

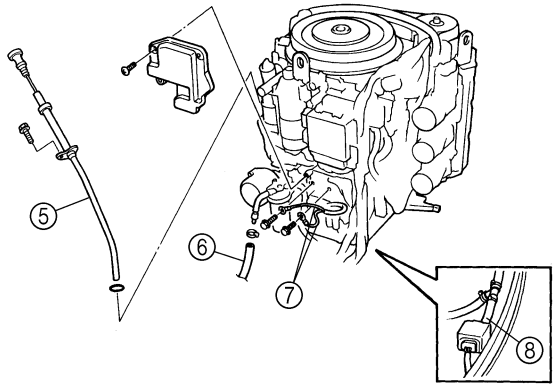


S69J5440



S69J5450

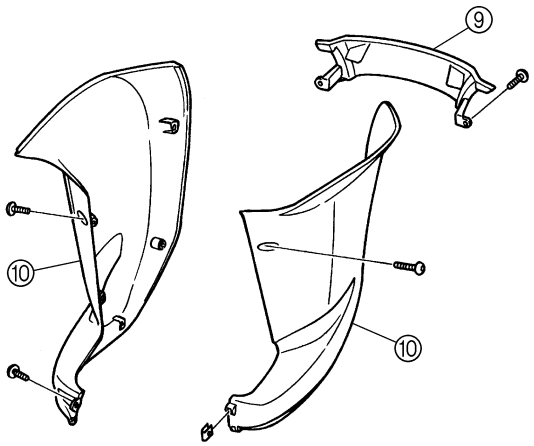
3. Remove the dipstick guide ⑤, and disconnect the fuel hose ⑥, PTT motor leads ⑦, and flushing device hose (flushing device model) ⑧.



S69J5460

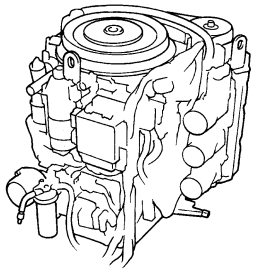
4. Disconnect the low-pressure fuel pump driver coupler, PTT switch coupler, shift cut switch coupler, neutral switch coupler, and cooling water pilot hose.

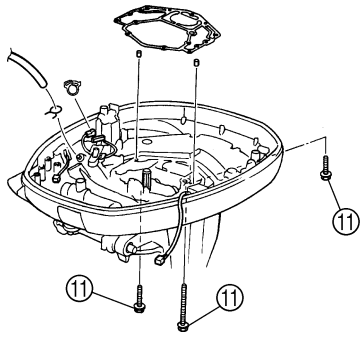
5. Remove the upper case cover ⑨ and aprons ⑩.



S69J5470

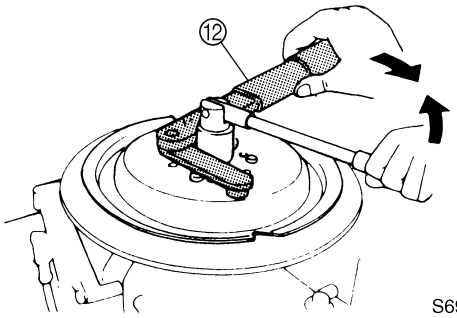
6. Remove the power unit by removing the bolts ⑪.





S69J5480

7. Remove the flywheel magnet.



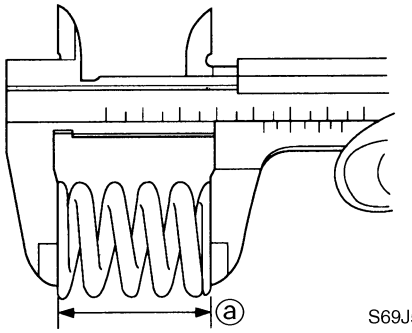
S69J5510

5

Valve spring compressor ④:
90890-04019
Valve spring compressor attachment ⑤:
90890-06320

Checking the valve springs

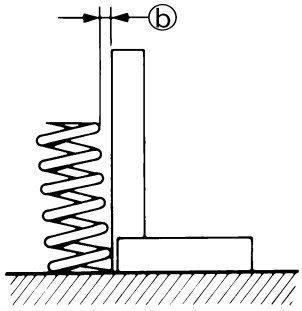
1. Measure the valve spring free length ⓐ. Replace if out of specification.



S69J5720

Valve spring free length ⓐ:
44.20 mm (1.740 in)

2. Measure the valve spring tilt ⓑ. Replace if out of specification.



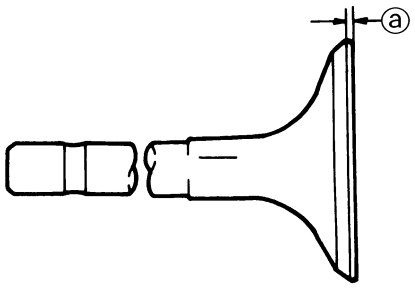
S69J5730

Valve spring tilt limit ⓑ:
1.5 mm (0.06 in)

Checking the valves

1. Check the valve face for pitting or wear. Replace if necessary.

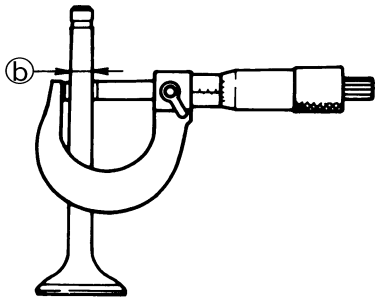
2. Measure the valve margin thickness ⓐ. Replace if out of specification.



S69J5740

Valve margin thickness ⓐ:
Intake: 0.7 mm (0.028 in)
Exhaust: 1.0 mm (0.039 in)

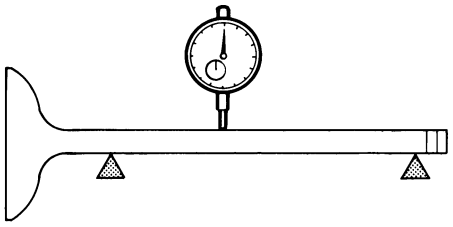
3. Measure the valve stem diameter ⓑ. Replace if out of specification.



S69J5750

Valve stem diameter ⓑ:
Intake:
5.477–5.492 mm
(0.2156–0.2162 in)
Exhaust:
5.464–5.479 mm
(0.2151–0.2157 in)

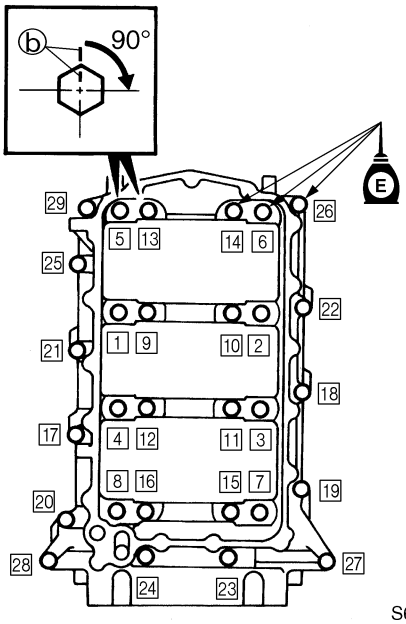
4. Measure the valve stem runout. Replace if out of specification.


S69J5760

No.	Part name	Q'ty	Remarks
1	Crankcase cover	1	
2	Bolt	17	M8 × 45 mm
3	Bolt	2	M6 × 20 mm
4	Engine hanger	1	
5	Plate	1	
6	Screw	14	M4 × 8 mm
7	Gasket	1	**Not reusable**
8	Nut	6	
9	Baffle plate	1	
10	Dowel pin	2	
11	Bolt	12	**Not reusable**
12	Connecting rod cap	6	
13	Connecting rod bearing	12	
14	Connecting rod	6	
15	Piston	6	
16	Clip	12	**Not reusable**
17	Piston pin	6	
18	Oil ring	6	
19	2nd piston ring	6	
20	Top ring	6	
21	Plug	1	
22	Gasket	1	**Not reusable**
23	Gasket	1	**Not reusable**
24	Engine temperature sensor	1	
25	Bolt	4	M6 × 25 mm
26	Cap	2	
27	Stopper	2	

Ⓐ Tightening sequence

9. Tighten the crankcase bolts to the specified torques in two stages and in the sequence shown.

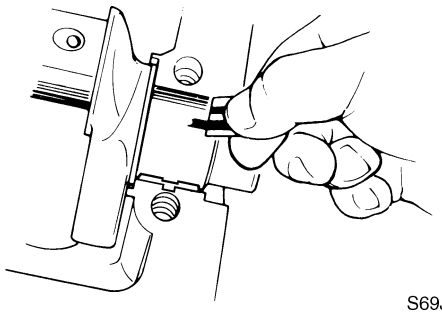


S69J5D80

NOTE:
- Crankcase bolts 1–16 can be reused five times.
- Do not move the crankshaft until the main journal oil clearance measurement has been completed.
- Tighten crankcase bolts 1–16 to the specified torques in two stages first, and then tighten crankcase bolts 17–29 to the specified torques in two stages.
- Make a mark ⓑ on the crankcase and crankcase bolts, and then tighten crankcase bolts 1–16 90° from the mark.

1–8 Crankcase bolt (M8):
1st: 25 N·m (2.5 kgf·m, 18 ft·lb)
2nd: 90°
9–16 Crankcase bolt (M10):
1st: 40 N·m (4.0 kgf·m, 29 ft·lb)
2nd: 90°
Crankcase bolt (M8):
1st: 14 N·m (1.4 kgf·m, 10 ft·lb)
2nd: 28 N·m (2.8 kgf·m, 20 ft·lb)

10. Remove the crankcase and measure the width of the compressed Plastigauge (PG-1) on each main journal. Replace the main bearing if out of specification.

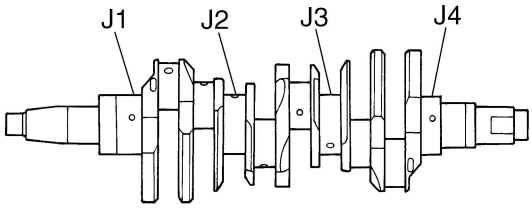

S69J5D90

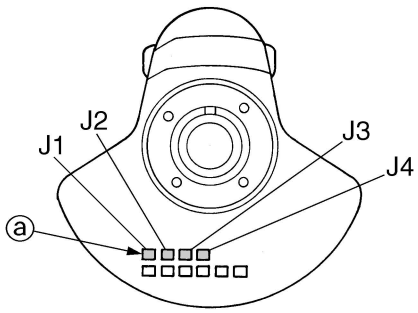
Crankshaft main journal oil clearance:
0.025–0.050 mm
(0.0010–0.0020 in)

Selecting the crankshaft main bearing

1. When replacing the main bearing, select the suitable bearing as follows.

2. Check the crankshaft journal mark ⓐ on the crankshaft and the cylinder block mark ⓑ on the cylinder block.

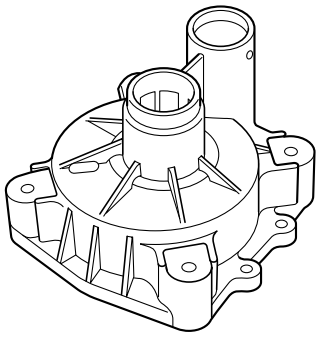




S69J5E00

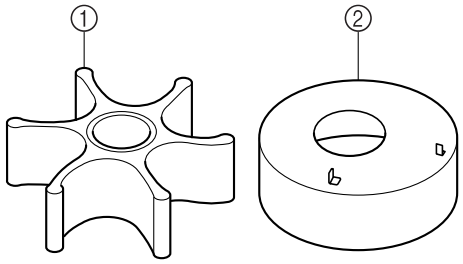
Checking the water pump and shift rod

1. Check the water pump housing for deformation. Replace if necessary.



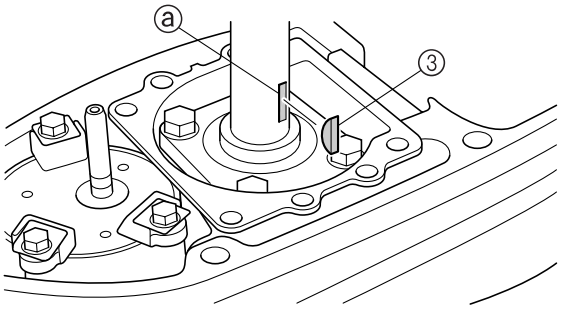
S69J6030

2. Check the impeller ① and insert cartridge ② for cracks or wear. Replace if necessary.



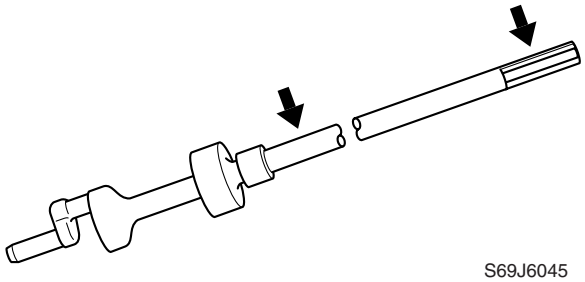
S69J6035

3. Check the Woodruff key ③ and the groove ⓐ on the drive shaft for wear. Replace if necessary.

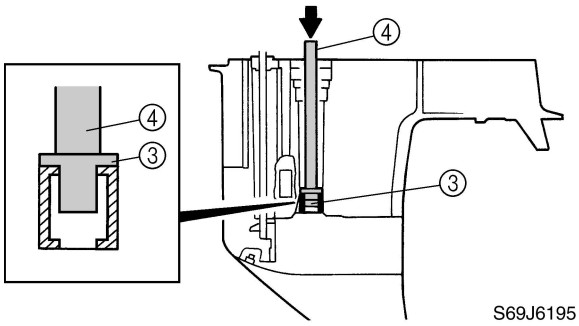


S69J6040

4. Check the shift rod for cracks or wear. Replace if necessary.



S69J6045

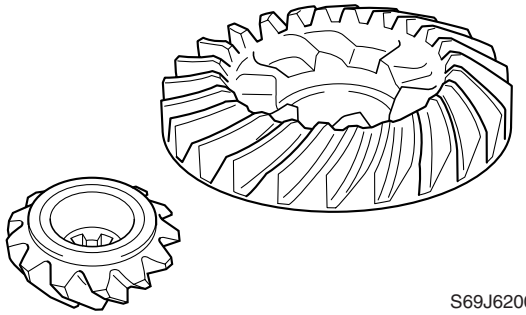


S69J6195

Ball bearing attachment ③:
90890-06636
Driver rod LL ④: 90890-06605

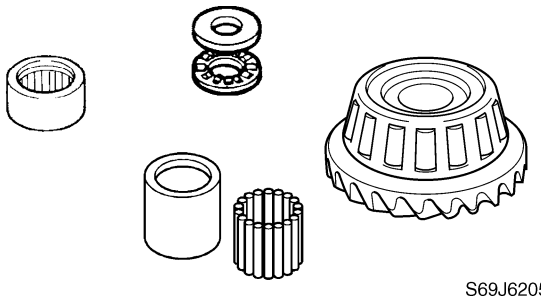
Checking the pinion and forward gear

1. Check the teeth of the pinion, and the teeth and dogs of the forward gear for cracks or wear. Replace if necessary.


S69J6200

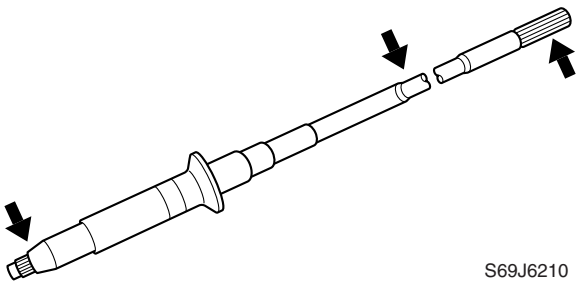
Checking the bearings

1. Check the bearings for pitting or rumbling. Replace if necessary.


S69J6205

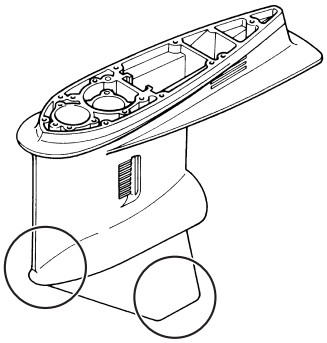
Checking the drive shaft

1. Check the drive shaft for bends or wear. Replace if necessary.


S69J6210

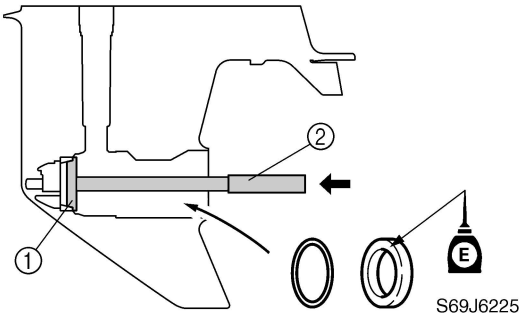
Checking the lower case

1. Check the skeg and torpedo for cracks or damage. Replace if necessary.


S69J6215

Assembling the lower case

1. Install the original shim(s) and taper roller bearing outer race.



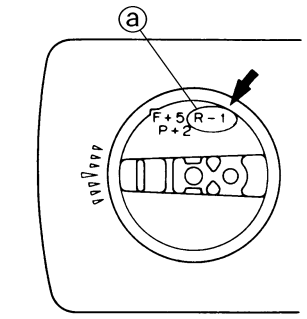
S69J6225

CAUTION:

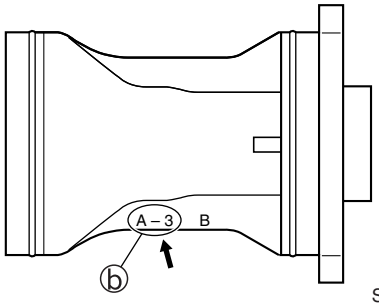
Add or remove shim(s), if necessary, when replacing the forward gear or lower case.

Bearing outer race attachment ①:
90890-06658
Driver rod LL ②: 90890-06605

6



S69J6585



S69J6625

NOTE:

"R" is the deviation of the lower case dimension from standard, and "A" is the deviation of the propeller shaft housing from standard. The "R" mark ⓐ is stamped on the trim tab mounting surface of the lower case, and the "A" mark ⓑ is stamped on the propeller shaft housing in 0.01 mm units. If the "R" mark or "A" mark is unreadable, assume that "R" and "A" are zero and check the backlash when the unit is assembled.

Calculation formula:
Reverse gear shim thickness (T2) =
21.00 + R/100 – A/100 – M2

Example:
If "M2" is 19.92 mm and "R" is (+3) and "A" is (–5), then
T2 = 21.00 + (+3)/100 – (–5)/100 – 19.92 mm
= 21.00 + 0.03 + 0.05 – 19.92 mm
= 1.16 mm

3. Select the reverse gear shim(s) (T2) as follows.

Calculated numeral at 1/100 place	Rounded numeral
1, 2	0
3, 4, 5	2
6, 7, 8	5
9, 10	8

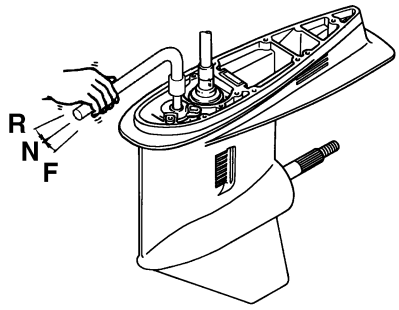
Available shim thicknesses:
0.10, 0.12, 0.15, 0.18, 0.30, 0.40, and 0.50 mm

Example:
If "T2" is 1.16 mm, then the reverse gear shim is 1.15 mm.
If "T2" is 1.20 mm, then the reverse gear shim is 1.18 mm.

Backlash (regular rotation model)

Measuring the forward and reverse gear backlash

1. Remove the water pump assembly.
2. Set the gearshift to the neutral position.



S69J6635

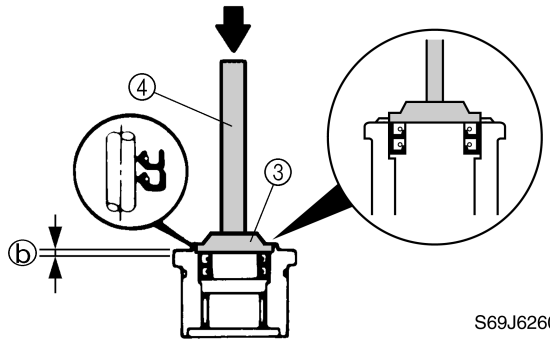
Shift rod push arm: 90890-06052

3. Install the special service tool so that it pushes against the propeller shaft.

6

No.	Part name	Q'ty	Remarks
1	Shift rod joint	1	
2	Ball	2	
3	Slider	1	
4	Shift plunger	1	
5	Dog clutch	1	
6	Cross pin	1	
7	Spring	1	
8	Forward gear	1	
9	Forward gear shim	—	As required
10	Ring nut	1	
11	Claw washer	1	
12	Bearing outer race	1	**Not reusable**
13	Taper roller bearing	1	**Not reusable**
14	Propeller shaft	1	
15	Thrust bearing	1	
16	Propeller shaft shim	—	As required
17	O-ring	1	**Not reusable** 3.1 × 110.6 mm
18	Propeller shaft housing	1	
19	Grease nipple	1	
20	O-ring	1	**Not reusable**
21	Needle bearing	1	
22	Oil seal	2	**Not reusable** 3.1 × 110.6 mm
23	Ring	1	
24	Bolt	2	M8 × 20 mm
25	Bolt	2	M8 × 30 mm
26	Cooling water inlet cover	2	
27	Nut	1	
28	Screw	1	

2. Apply grease to the new oil seals, and then install them into the drive shaft housing to the specified depth.



S69J6260

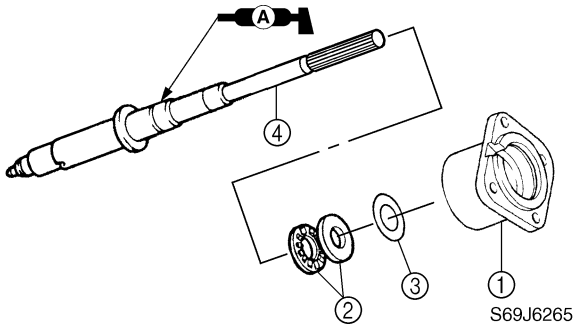
NOTE:
Install an oil seal halfway into the drive shaft housing, then the other oil seal.

Bearing outer race attachment ③: 90890-06628
Driver rod LS ④: 90890-06606

Depth ⓑ: 0.25–0.75 mm (0.01–0.03 in)

Installing the drive shaft

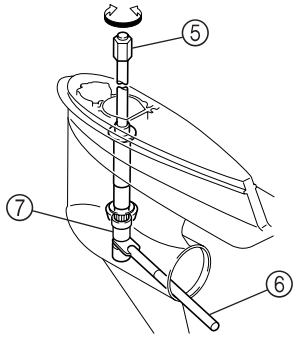
1. Install the forward gear to the lower case.
2. Install the drive shaft housing ①, thrust bearing ②, and original shim(s) ③ to the drive shaft ④.



S69J6265

CAUTION:
Add or remove shim(s), if necessary, when replacing the drive shaft housing or drive shaft.

3. Install the drive shaft, housing, pinion, and pinion nut, and then tighten the nut to the specified torque.



S69J6275

NOTE:
Install the drive shaft by lifting it up slightly, then aligning it with the pinion and the spline of the drive shaft.

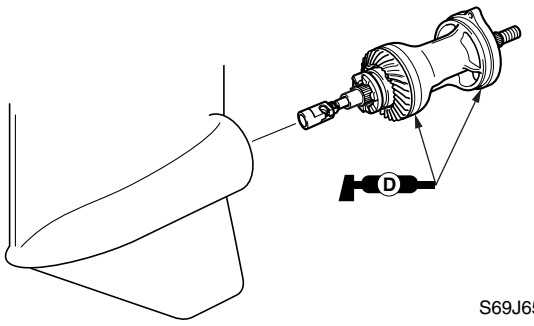
Drive shaft holder 6 ⑤: 90890-06520
Pinion nut holder ⑥: 90890-06505
Socket adapter 3 ⑦: 90890-06508

Pinion nut: 142 N·m (14.2 kgf·m, 103 ft·lb)

4. Tighten the housing bolts.

Installing the propeller shaft housing

1. Install the propeller shaft housing assembly into the lower case.



S69J6515

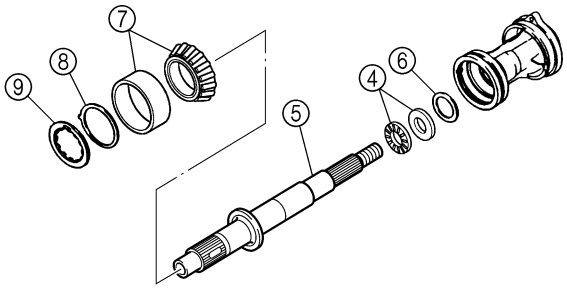
NOTE:
Apply grease to the new O-rings before installation.

6

Available shim thicknesses:
0.10, 0.12, 0.15, 0.18, 0.30, 0.40, and 0.50 mm

6. If the “A” mark or “B” mark is unreadable, measure the propeller shaft free play as shown.

7. Install the shim(s) ⑥, thrust bearing ④, propeller shaft ⑤, taper roller bearing ⑦, and claw washer ⑧, and then tighten the ring nut ⑨ to the specified torque.

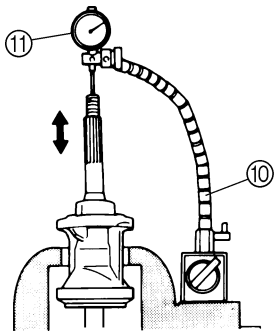


S69J6697

Ring nut wrench: 90890-06578

Ring nut ⑨:
108 N·m (10.8 kgf·m, 78 ft·lb)

8. Measure the propeller shaft free play. Reselect the propeller shaft shim(s) (T’4), if out of specification.



S69J6701

Propeller shaft free play:
0.25–0.35 mm (0.010–0.014 in)

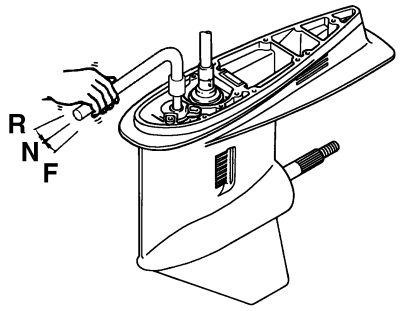
Magnet base ⑩: 90890-06705
Dial gauge set ⑪: 90890-01252

Backlash (counter rotation model)

Measuring the forward and reverse gear backlash

1. Remove the water pump assembly.

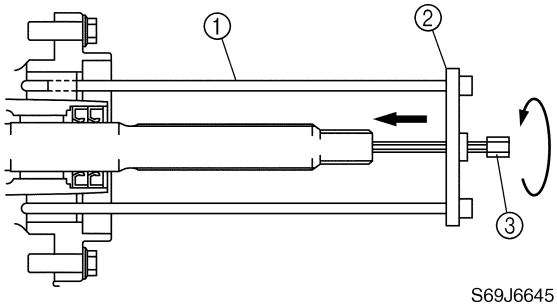
2. Set the gearshift to the neutral position.



S69J6635

Shift rod push arm: 90890-06052

3. Install the special service tool so that it pushes against the propeller shaft.



S69J6645

NOTE:
Tighten the universal puller or center bolt while turning the drive shaft until the drive shaft can no longer be turned.

Bearing housing puller claw L ①:
90890-06502
Stopper guide plate ②: 90890-06501
Center bolt ③: 90890-06504

4. Install the backlash indicator onto the drive shaft (22.4 mm [0.88 in] in diameter), then the dial gauge onto the lower unit.

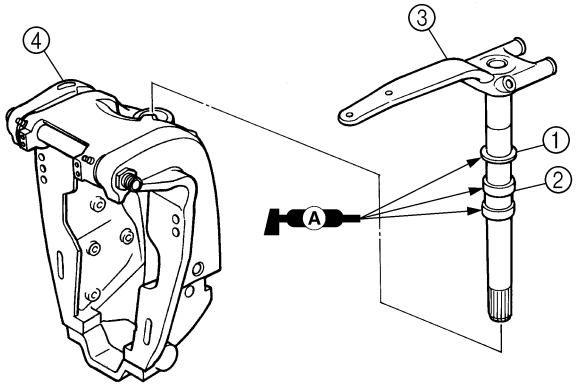
6

No.	Part name	Q'ty	Remarks
1	Bottom cowling	1	
2	Rubber seal	1	
3	Cowling lock lever	2	
4	Bushing	6	
5	Plate	2	
6	Bolt	6	M6 × 30 mm
7	Wave washer	3	
8	Lever	2	
9	Washer	3	
10	Bolt	3	M6 × 20 mm
11	Spring	3	
12	Hook	3	
13	Bolt	3	M6 × 20 mm
14	Bracket	1	
15	Bolt	2	M6 × 25 mm
16	Plate	2	
17	Grommet	2	
18	Grommet	1	
19	Grommet	2	
20	Collar	4	
21	Grommet	8	
22	Bolt	4	M6 × 30 mm
23	Cooling water pilot hole	1	
24	Bolt	2	M6 × 20 mm
25	Bracket	2	
26	Trailer switch	1	
27	Bolt	1	M6 × 18 mm
28	Low-pressure fuel pump driver	1	
29	Bracket	1	
30	Bolt	2	M6 × 20 mm
31	Cover	1	
32	Gasket	1	
33	Cowling lock lever	1	
34	Plate	1	
35	Lever	1	

Installing the steering arm

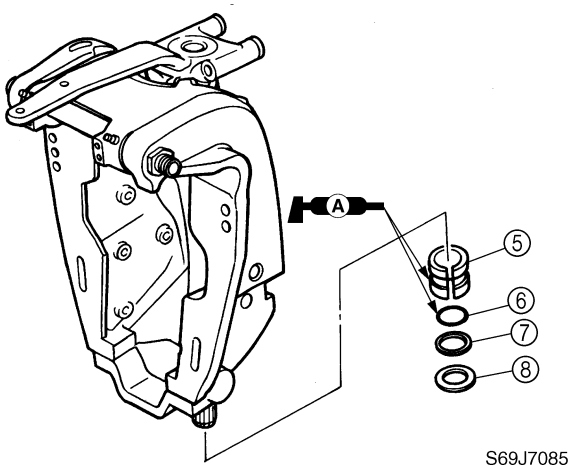
1. Install the washer ① and bushing ② onto the steering arm ③.

2. Place the swivel bracket ④ in an upright position, and then install the steering arm onto the swivel bracket.



S69J7080

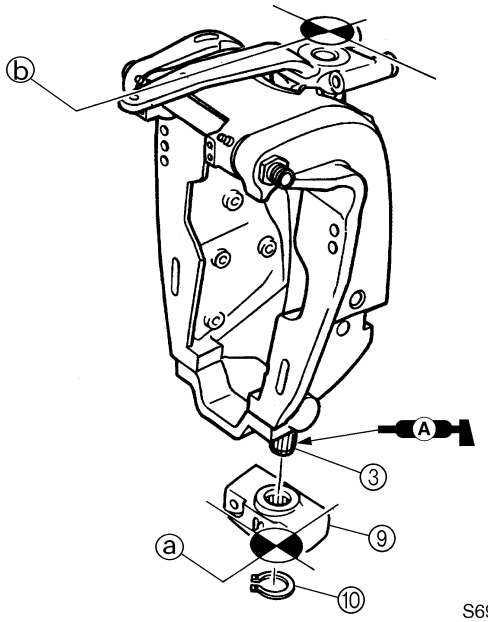
3. Install the bushing ⑤, O-ring ⑥, bushing ⑦, and washer ⑧ onto the swivel bracket.



S69J7085

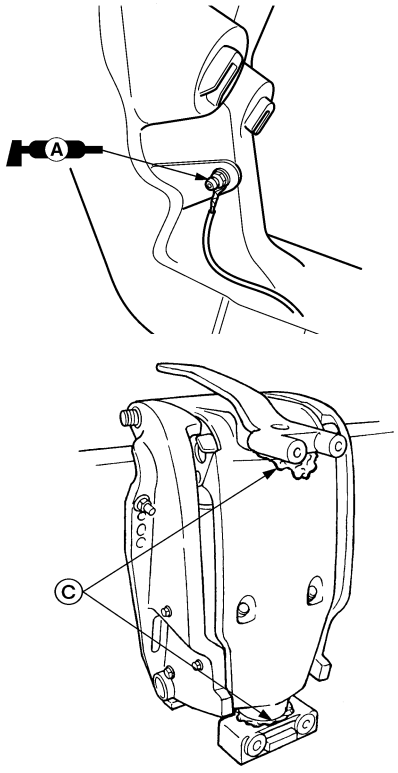
4. Install the steering arm ③ into the steering yoke ⑨ by aligning the center ⓐ of the yoke with the center ⓑ of the steering arm.

5. Install the circlip ⑩.



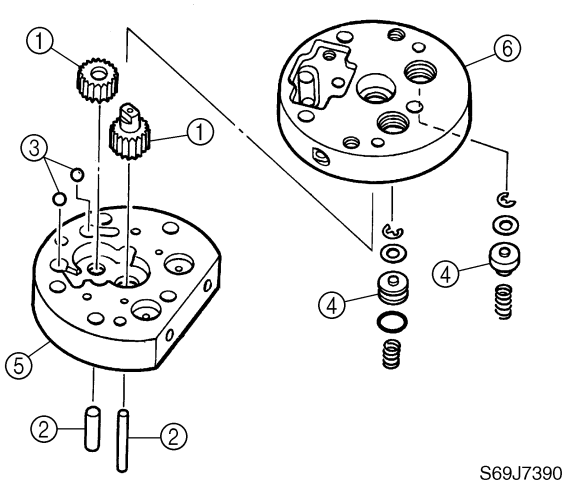
S69J7090

6. Inject grease into the grease nipple until grease comes out from both the upper and lower bushings ⓒ.



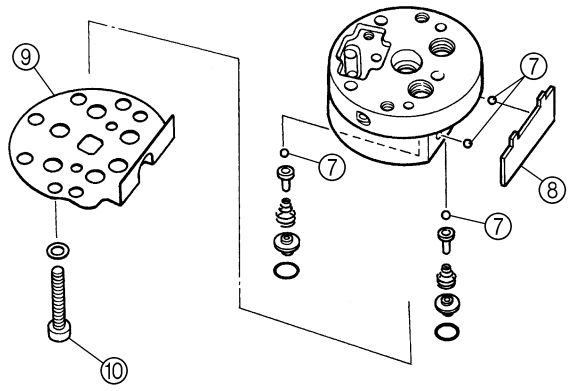
S69J7095

No.	Part name	Q'ty	Remarks
1	Gear housing 1	1	
2	Bolt	3	M5 × 40 mm
3	Plate	1	
4	Filter	1	
5	Valve lock screw	2	
6	Down-relief spring	1	
7	Valve support pin	1	
8	Relief valve seal	1	
9	Up-relief spring	1	
10	Valve support pin	1	
11	O-ring	1	**Not reusable** 1.8 × 11.35 mm
12	Ball	1	
13	Circlip	2	
14	Main valve seal	2	
15	Shuttle piston	1	
16	O-ring	1	**Not reusable**
17	Return spring	2	
18	Shuttle piston	1	
19	Drive gear	2	
20	Ball	2	
21	Gear housing 2	1	
22	Ball	2	
23	Manual release spring	1	
24	Dowel pin	1	
25	Ball	2	
26	Pin	2	
27	Spring	2	
28	Spacer	2	
29	O-ring	2	**Not reusable** 1.9 × 9.6 mm
30	Dowel pin	2	
31	Bracket	1	
32	Washer	2	
33	Bolt	2	M5 × 25 mm
34	O-ring	2	**Not reusable** 1.9 × 9.6 mm
35	Spacer	2	
36	Filter	2	



S69J7390

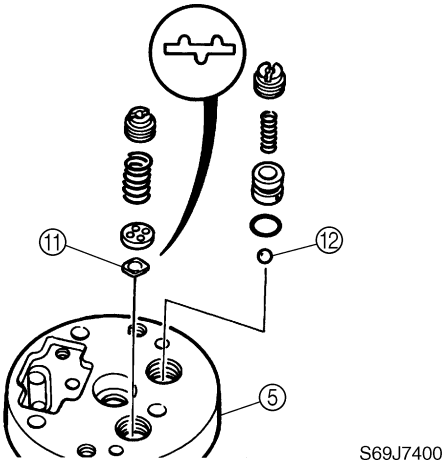
3. Install the balls ⑦, manual release spring ⑧, and bracket ⑨ by installing the bolts ⑩, then tightening them to the specified torque.



S69J7395

	Gear pump bracket bolt ⑩: 7 N·m (0.7 kgf·m, 5.1 ft·lb)

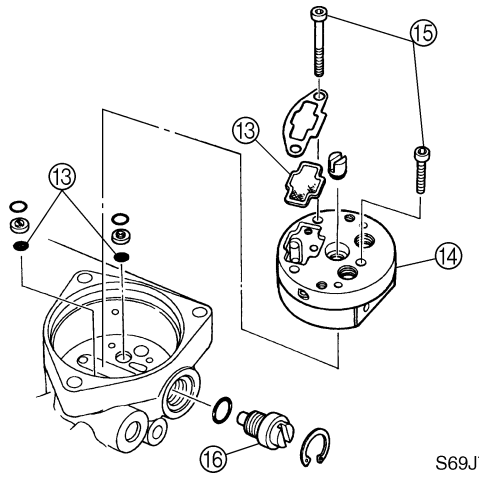
4. Install the relief valve seal ⑪ and ball ⑫ into the gear housing 1 ⑤.



S69J7400

5. Install the filters ⑬ and gear pump ⑭ by installing the bolts ⑮, then tightening them to the specified torque.

6. Install the manual valve ⑯.



S69J7405

	Gear pump bolt ⑮: 7 N·m (0.7 kgf·m, 5.1 ft·lb)

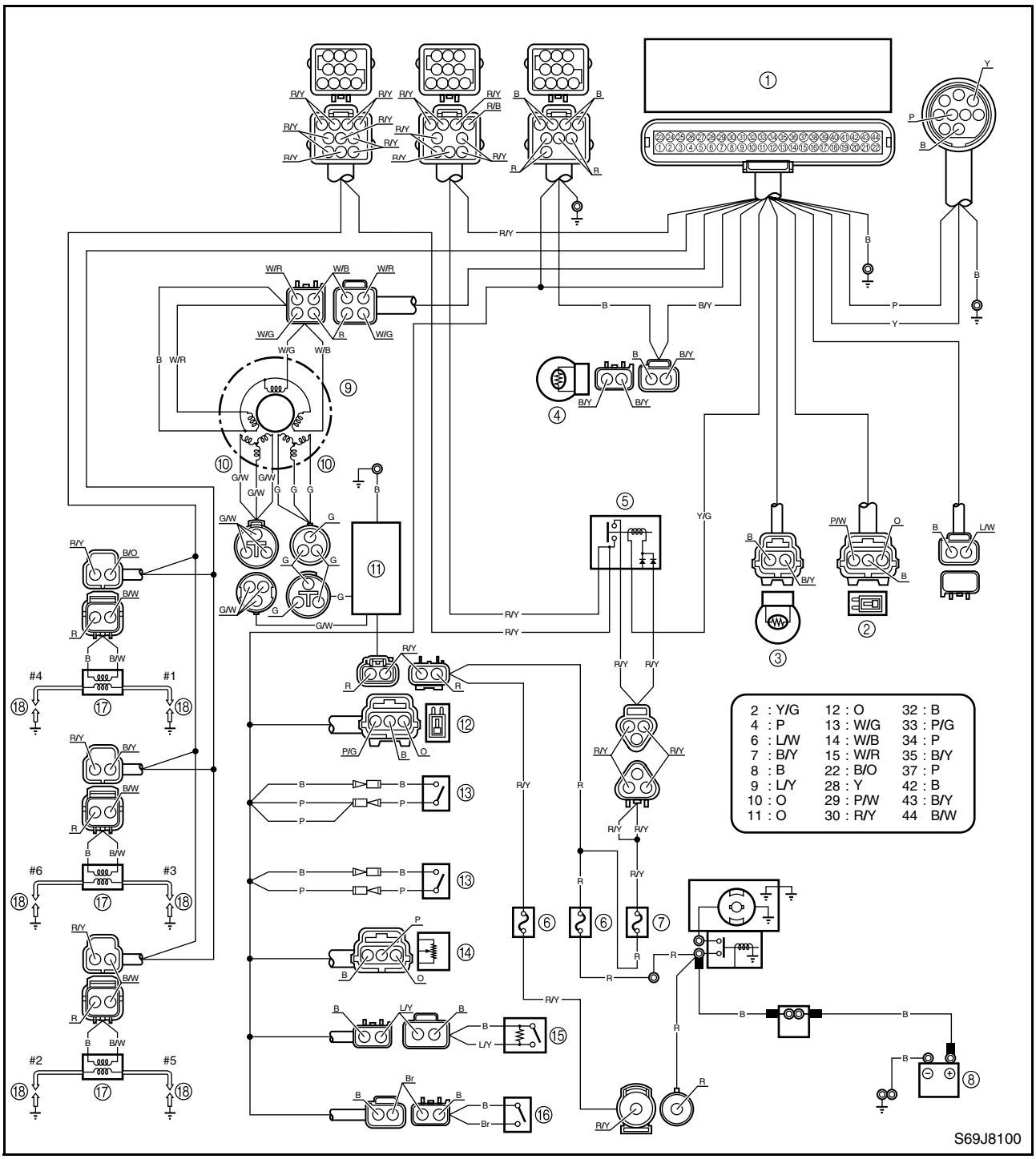
Assembling the tilt ram

1. Install the new dust seal ①, O-rings ② and ③, and backup ring ④ into the tilt cylinder end screw ⑤.

7

Electrical systems

Ignition and ignition control system



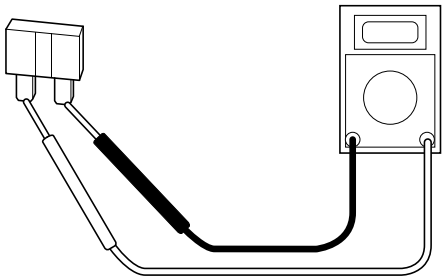
① ECM
② Oil pressure sensor
③ Intake air temperature sensor
④ Engine temperature sensor
⑤ Main relay
⑥ Fuse (30 A)
⑦ Fuse (20 A)
⑧ Battery
⑨ Pulser coil
⑩ Stator coil
⑪ Rectifier Regulator
⑫ Intake air pressure sensor
⑬ Thermoswitch
⑭ Throttle position sensor
⑮ Shift cut switch
⑯ Neutral switch
⑰ Ignition coil
⑱ Spark plug

B	: Black	B/W	: Black/white
Br	: Brown	B/Y	: Black/yellow
G	: Green	L/Y	: Blue/yellow
O	: Orange	P/G	: Pink/green
P	: Pink	P/W	: Pink/white
R	: Red	R/Y	: Red/yellow
Y	: Yellow	W/B	: White/black
B/O	: Black/orange	W/G	: White/green
		W/R	: White/red
		Y/G	: Yellow/green

8

Checking the fuse

1. Check the fuse for continuity. Replace if there is no continuity.



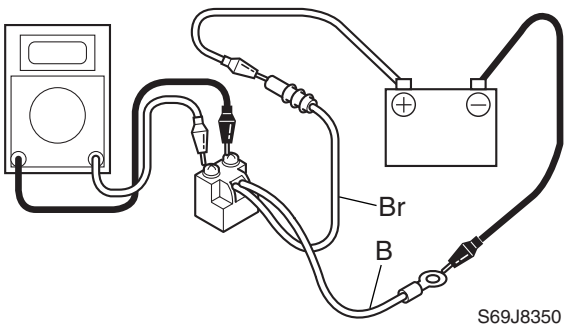
S69J8340

Checking the wiring harness (10 pins)

1. Check the wiring harness for continuity. Replace if there is no continuity.

Checking the starter relay

1. Connect the digital circuit tester leads to the starter relay terminals.
2. Connect the brown (Br) lead to the positive battery terminal.
3. Connect the black (B) lead to the negative battery terminal.
4. Check for continuity between the starter relay terminals. Replace if there is no continuity.
5. Check that there is no continuity between the starter relay terminals after disconnecting the brown or black lead. Replace if there is continuity.



S69J8350

8

Yamaha Diagnostic System

Introduction

Features

The newly developed Yamaha Diagnostic System provides quicker detection and analysis of engine malfunctions for quicker troubleshooting procedures than traditional methods.
By connecting your laptop computer to the ECM (Electronic Control Module) of an outboard motor using the communication cable, this software can be used to display sensor data and data stored in the ECM on a laptop computer's monitor.
If this software is run on Microsoft Windows® 95, Windows 98, Windows Me, or Windows 2000 the information can be displayed in colorful graphics. Also, the software can be operated using either a mouse or a keyboard.
In addition, the data for the main functions (Diagnosis, Diagnosis record, Engine monitor, and Data logger) can be saved on a disk or printed out.

Functions

1. **Diagnosis:** With the engine start switch set to ON, each sensor's status and each ECM diagnosis code or item is displayed. This enables you to find malfunctioning parts and controls quickly.

2. **Diagnosis record:** Sensors that had been activated and ECM diagnostic codes that have been recorded are displayed. This allows you to check the outboard motor's record of malfunctions.

3. **Engine monitor:** Each sensor status and the ECM data are displayed while the engine is running. This enables you to find malfunctioning parts quickly.

4. **Stationary test:** With the engine off, the ignition, fuel injection, electric fuel pump, electric oil pump, electric fuel feed pump, and ISC valve are checked. These tests can be performed quickly.

5. **Active test:** With the engine running the ISC valve is checked as well. These tests can be performed quickly.

6. **Data logger:** From the data stored in the ECM, at least two items of 13 minutes of recorded data are displayed on a graph. In addition, the operating time as compared to the engine speed and the total operating time are displayed. This allows you to check the operating status of the engine.

7. **ECM No.:** The ECM part number is displayed.

Contents

1. Software (1)
2. Adapter (1)
3. Communication cable (1)
4. Instruction Manual (1)
5. Installation Manual (1)

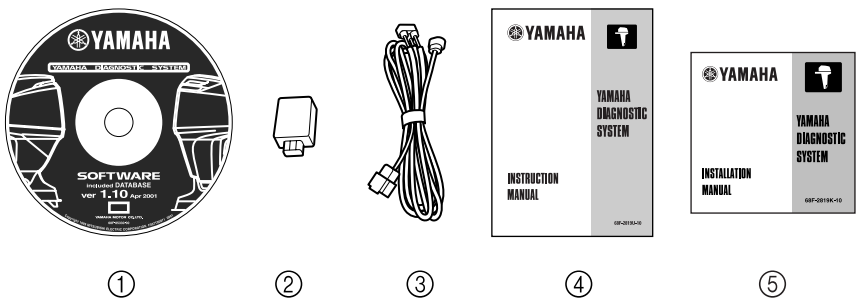


Fig. 1

9

Save

By selecting the **Save** command in the Diagnosis, Diagnosis record, Engine monitor, or Data logger mode, the corresponding data can be saved on a disk.

Operating procedure:

1. Click the **Save [F2]** button or press the F2 key on your keyboard. The **Save As** dialog box is displayed. (Fig. 13)

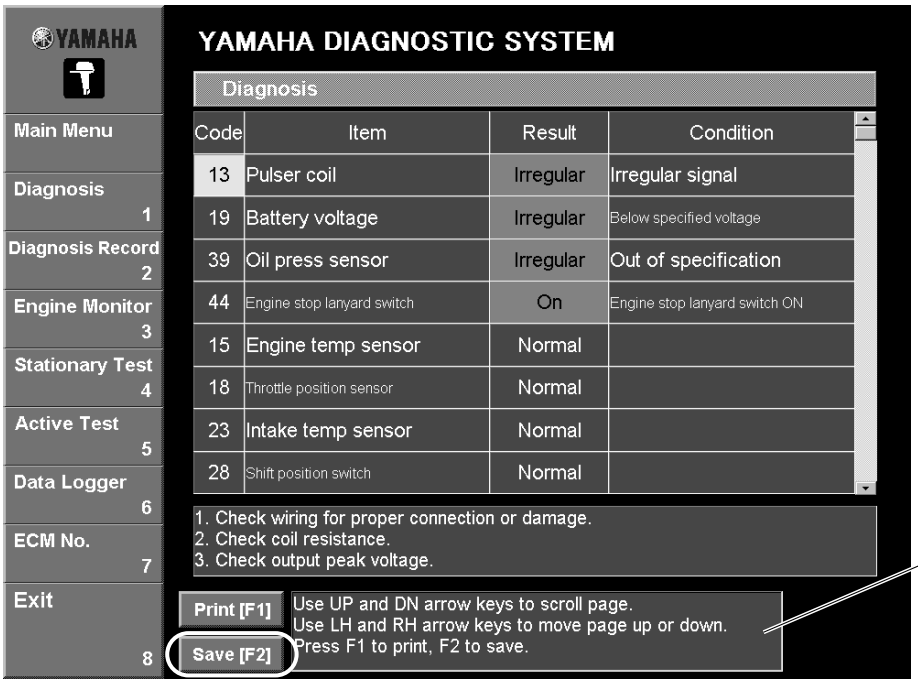


Fig. 13

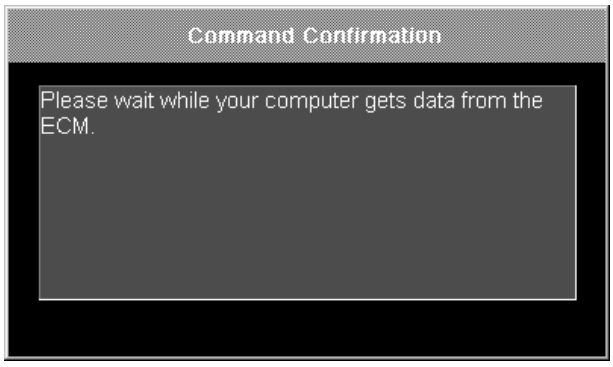


Fig. 14

NOTE:
If the engine is running an error message is displayed. Follow the instructions that appear. (Fig. 26)

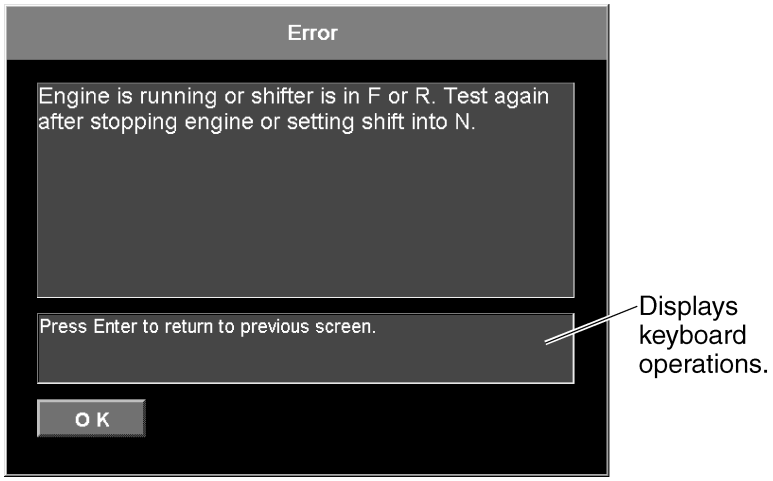


Fig. 26

6. While checking the information that appears in the **Test situation** column, follow the test instructions in the messages that are displayed. (See fig. 25.)

NOTE:
If an error occurs while the test is being performed, an error message is displayed. Follow the instructions that appear in the error message. (Fig. 27)

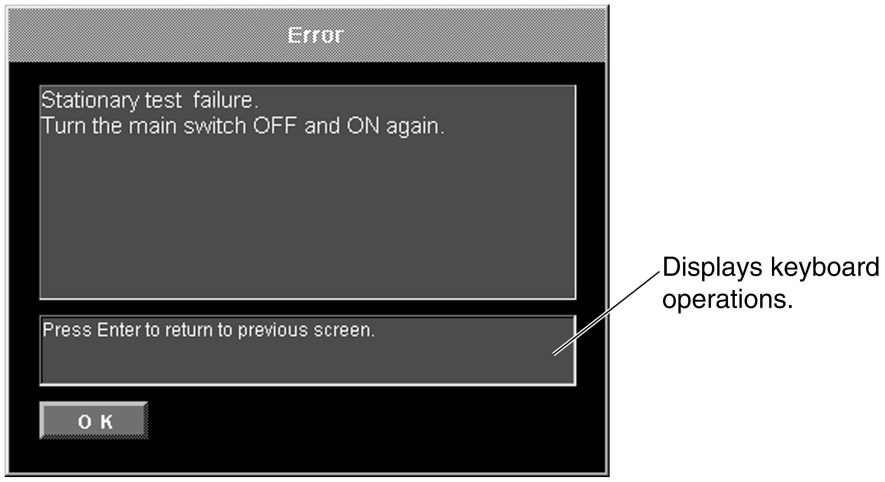


Fig. 27

7. To stop the stationary test, click the **Cancel** button. (See fig. 25.)

8. Observe the spark through the discharge window of the spark gap tester.

3. Listen to the operating sound of the fuel feed pump.

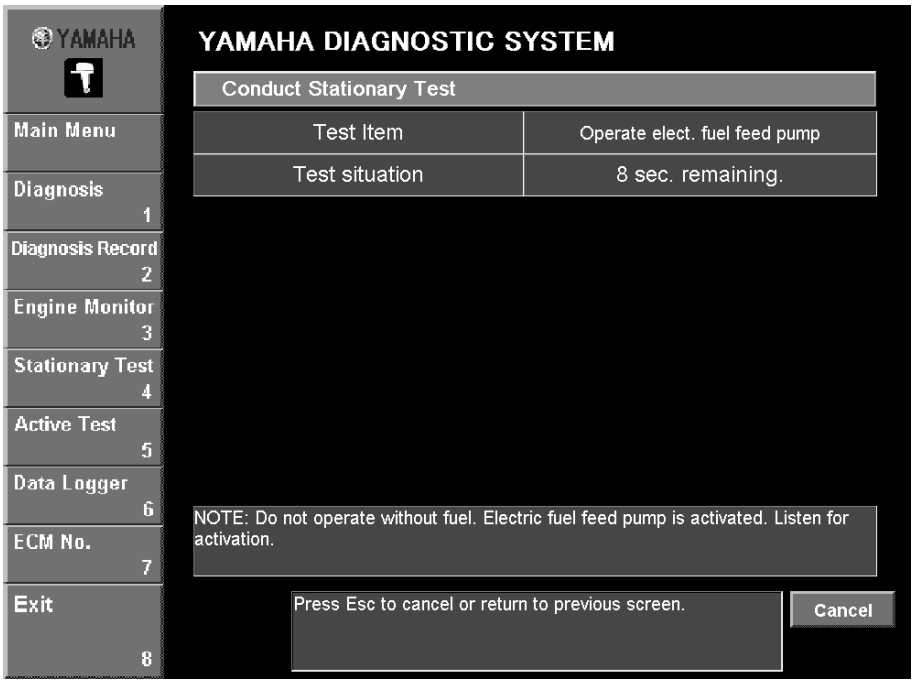


Fig. 38

4. To test again, click the **Execute** button or press the Enter key on your keyboard. To perform a different test, click the **Return** button or return to the test selection menu or press the ESC key on your keyboard.

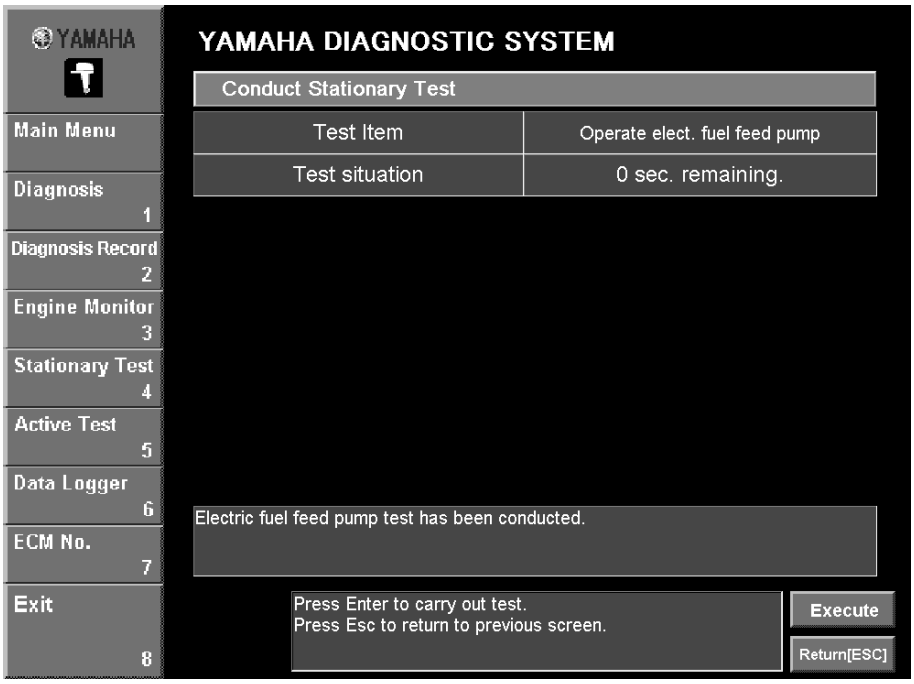


Fig. 39

9

Data comparison graph

A line graph appears with the items selected in the **Data display item selection** window on the vertical axes and the **Time before engine stop** on the horizontal axis. (Fig. 55)

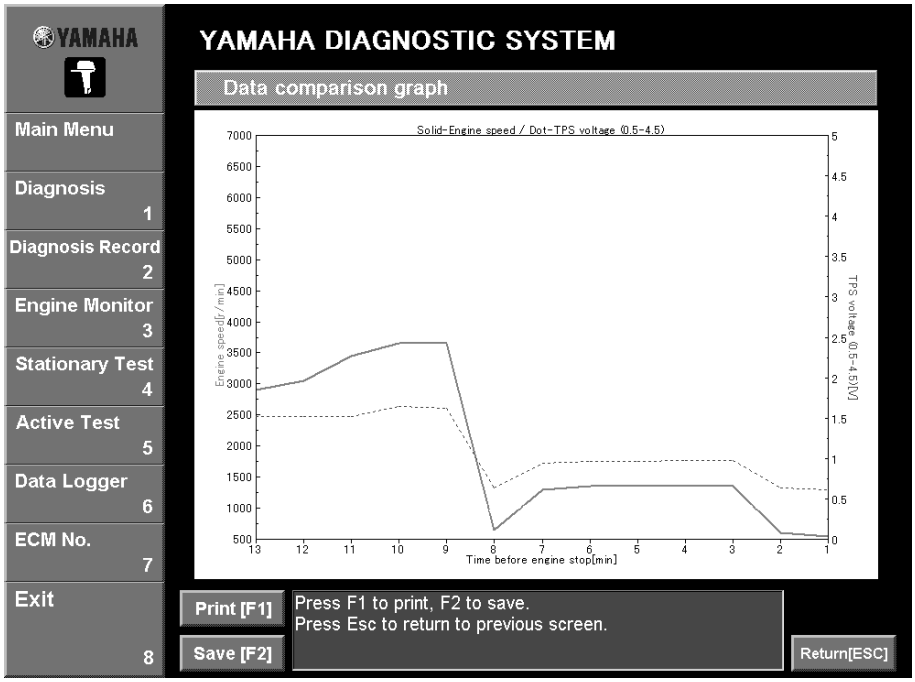
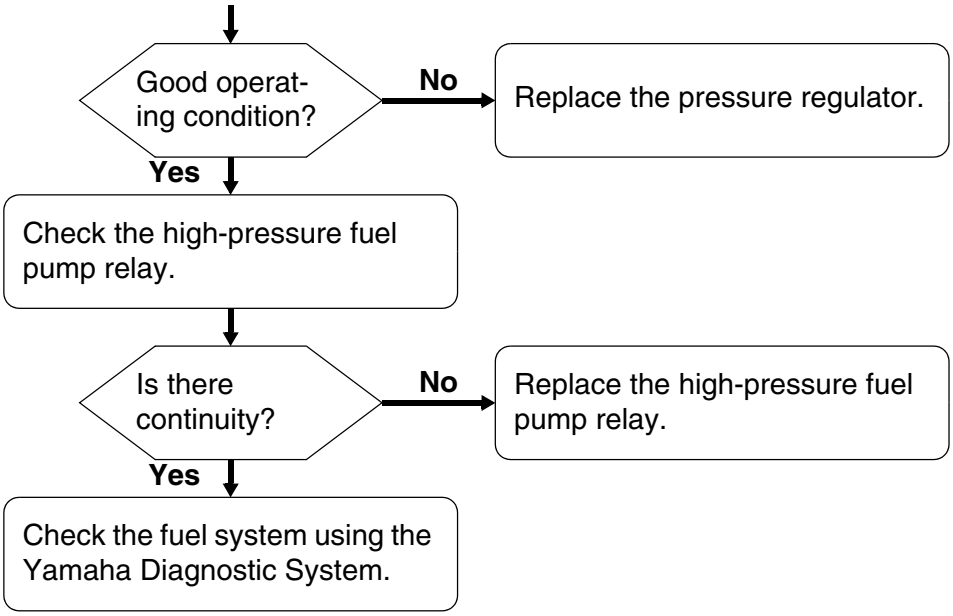


Fig. 55

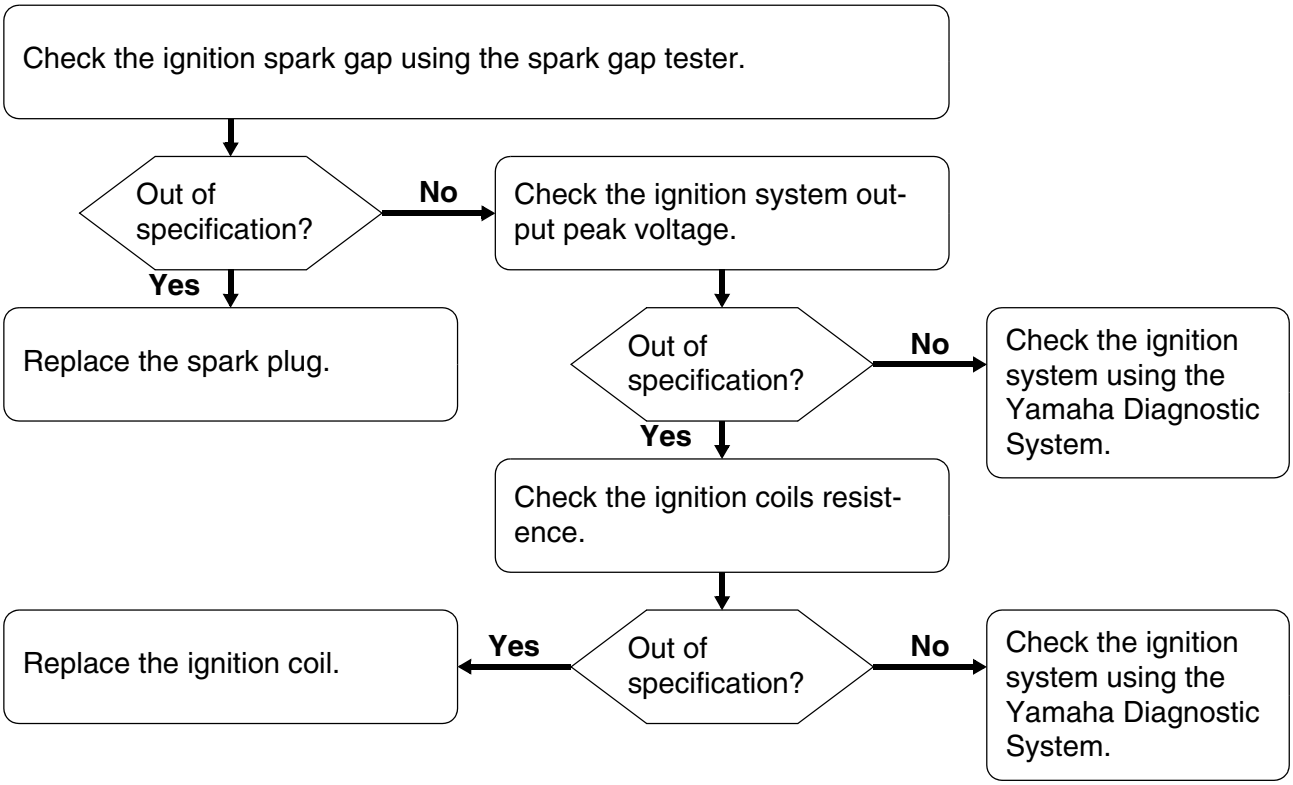
NOTE:

- The item on the left vertical axis is graphed with a solid line and the item on the right vertical axis is graphed with a dotted line.
- Although the engine is running, graphs do not show the present engine condition. It displays the value at the time the Enter key on your keyboard was pressed in the **Monitor item selection**.

9



Ignition system



Code	Symptom
1	Normal
13	Incorrect pulser coil signal
15	Incorrect engine temperature sensor signal
18	Incorrect throttle position sensor signal
19	Incorrect battery voltage
23	Incorrect intake air temperature sensor signal
28	Incorrect neutral switch signal
29	Incorrect intake air pressure sensor signal
37	Incorrect idle speed control signal
39	Incorrect oil pressure sensor signal
45	Incorrect shift cut switch signal
46	Incorrect thermoswitch signal
44	Incorrect engine stop switch signal