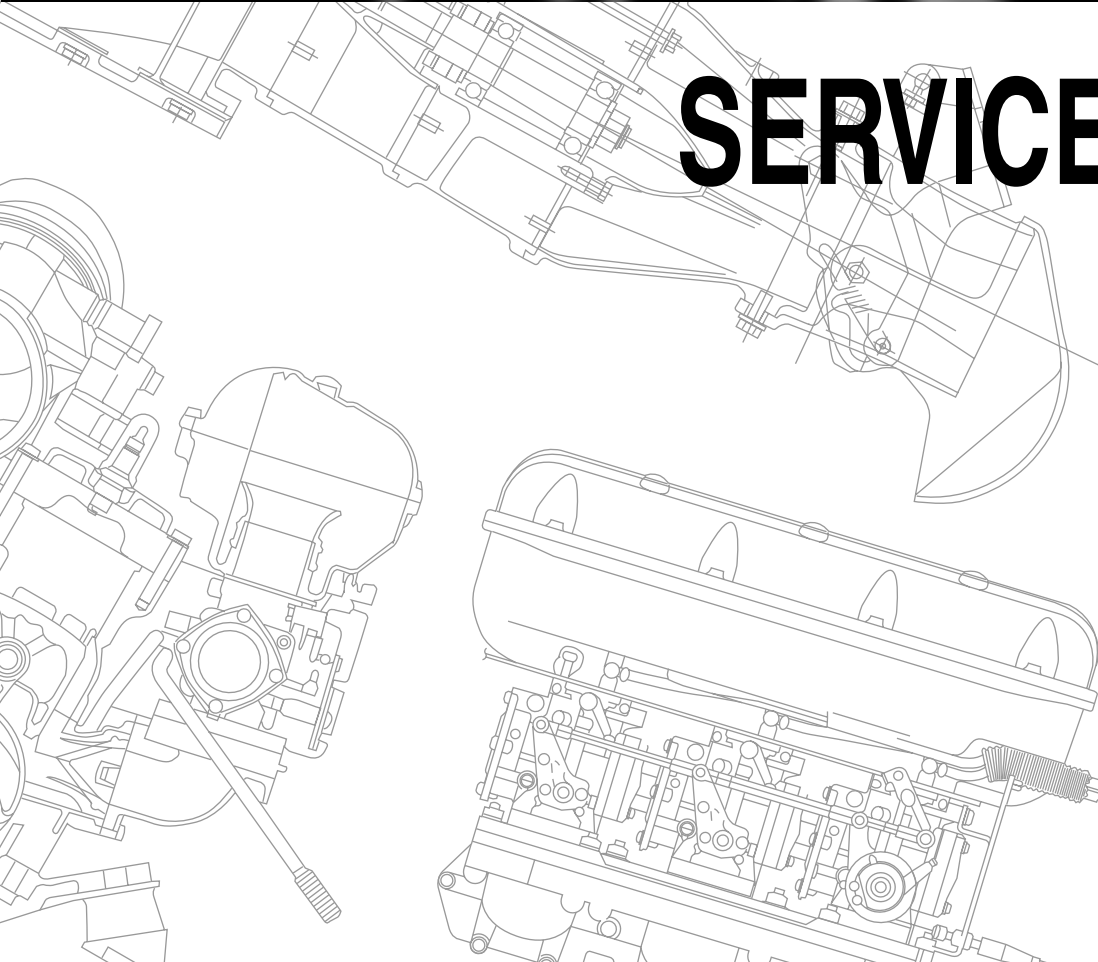




WaveRunner FX140



SERVICE GUIDE



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**WaveRunner FX140
SERVICE GUIDE
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PREFACE

This Service Guide has been prepared to provide Yamaha dealers with information about a new model (e.g., product concept, features, technical details).

The information contained in this guide is essential to Yamaha dealer service staff for their daily customer service.

It is our hope that you will use this guide to train your dealer service staff about this model and that it will help answer questions about this new model.

NOTE:

- The descriptions herein are based on the information officially announced by Yamaha Motor Company Limited as of the end of December 2001.
 - For detailed service information, refer to the appropriate service manual.
-

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OUTLINE OF FEATURES

The FX140 watercraft features:

- High-performance, 4-stroke, 4-cylinder engine (total displacement: 998 cc [60.9 cu. in.], maximum output: 103 kW [140 PS] at 10,000 r/min) with electronic fuel injection
- Low-pollution and low-noise engine conforming to 2006 U.S. Environmental Protection Agency (EPA) regulations
- Large hull to provide nimble handling and stability

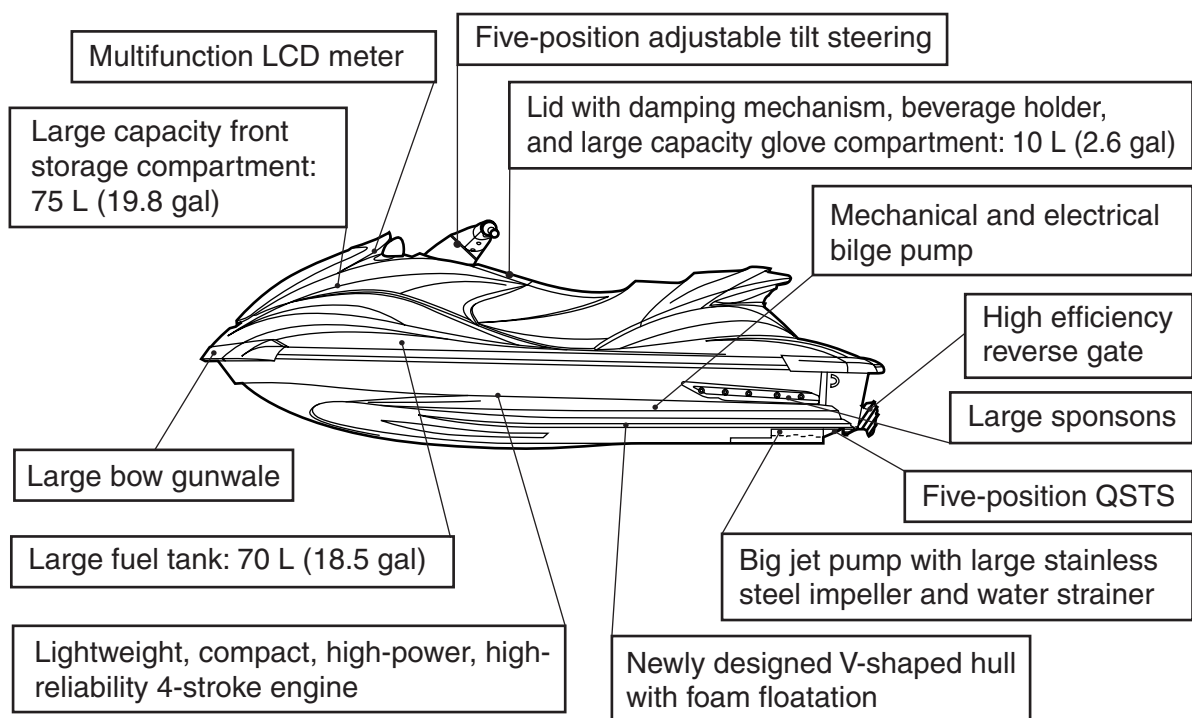


Fig. 1

FEATURES AND BENEFITS

POWER UNIT

The MR-1 engine is a newly developed 4-stroke, in-line 4-cylinder, DOHC, 20-valve engine. Based on the YZF-R1 engine, the optimum engine for watercraft has been designed to realize high performance, compactness, lightweight, and low noise.

With electronic fuel injection, this engine meets 2006 U.S. Environmental Protection Agency (EPA) emission regulations and is considerate to the environment.

The MR-1 engine employs a dry sump lubrication system. As a result, the oil pan is compact and the overall height of the engine is low.

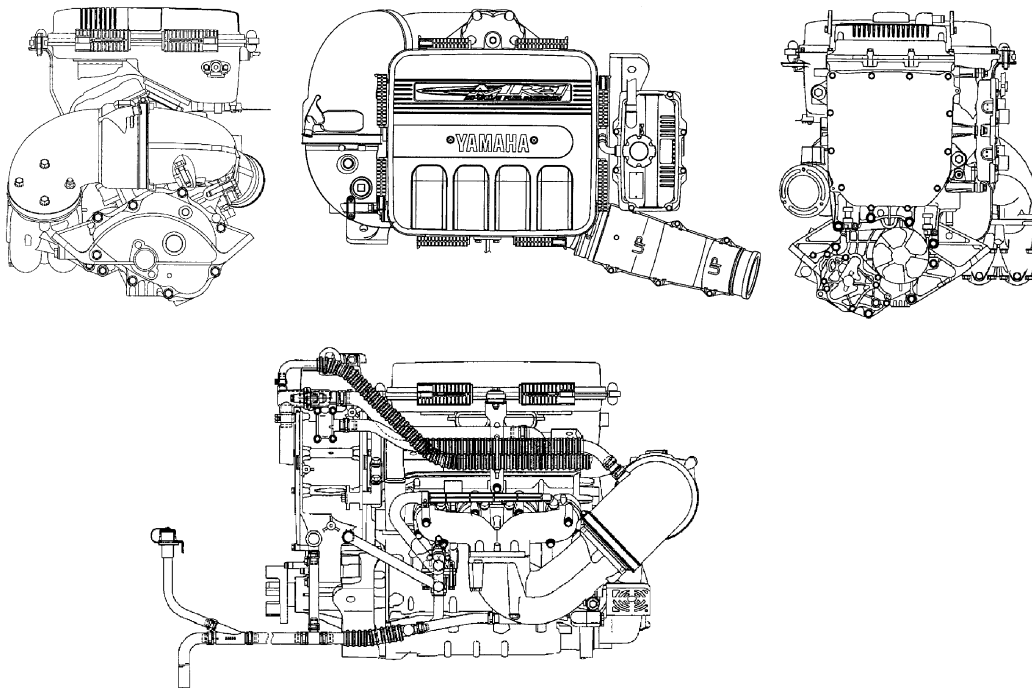


Fig. 2

CYLINDER HEAD

The cylinder head is based on the YZF-R1 for a compact design.

DOHC with 5 valves (intake: 3, exhaust: 2) per cylinder accomplishes a high combustion ratio and high performance.

A timing chain drives the intake and exhaust camshafts and a timing chain tensioner provides the optimum tension of the timing chain at all times. As a result, the camshafts open and close the valves with optimum timing.

A cam position sensor is installed to the cylinder head cover of cylinder #4 to distinguish each cylinder and to control the engine more precisely.

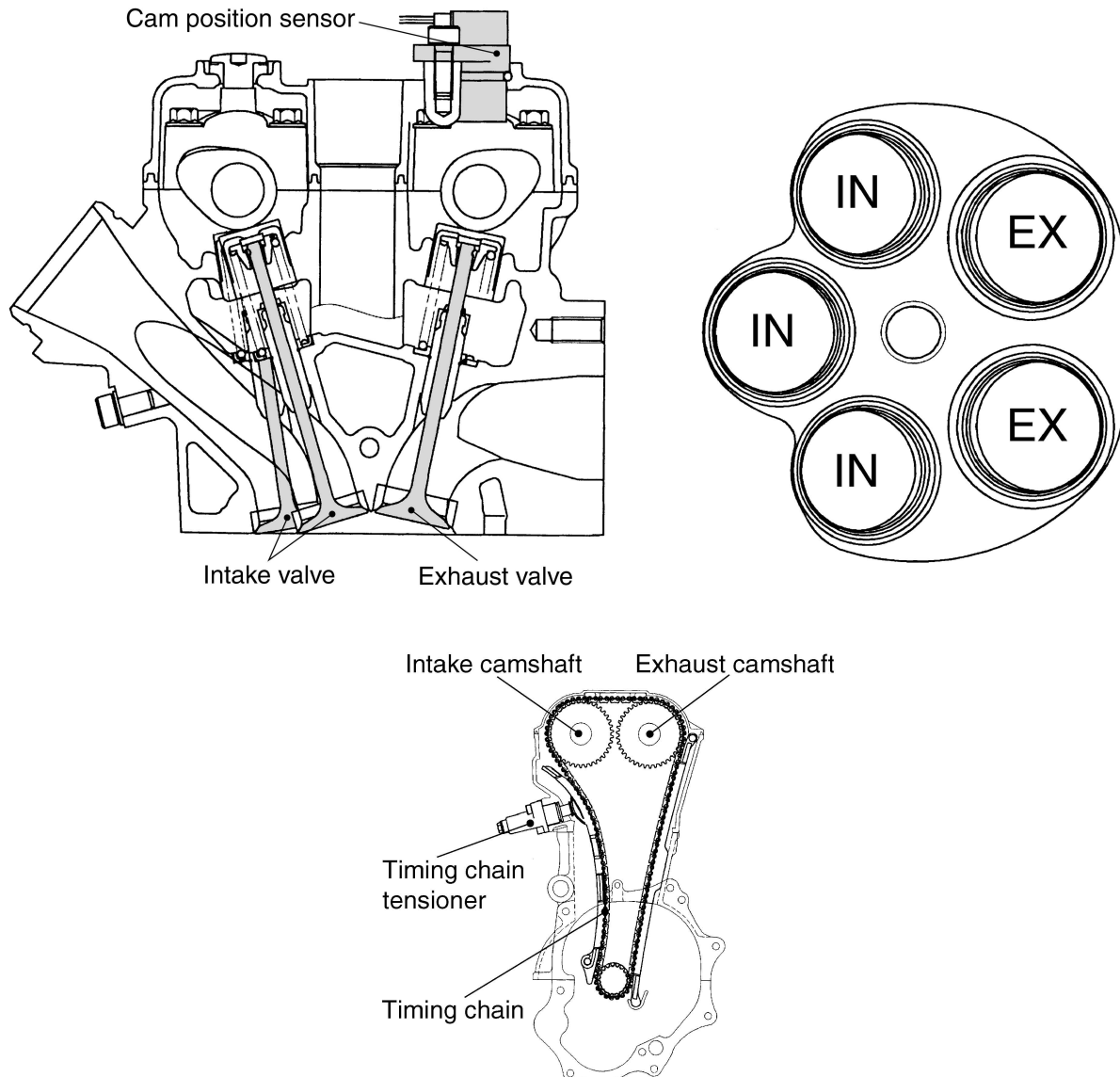


Fig. 3

PISTON AND CONNECTING ROD

The pistons, piston pins, and connecting rods have been made lightweight to reduce reciprocating mass for high performance.

The shape of the piston has been exclusively developed for watercraft.

Both ends of the piston pin are tapered to make the piston pin lightweight.

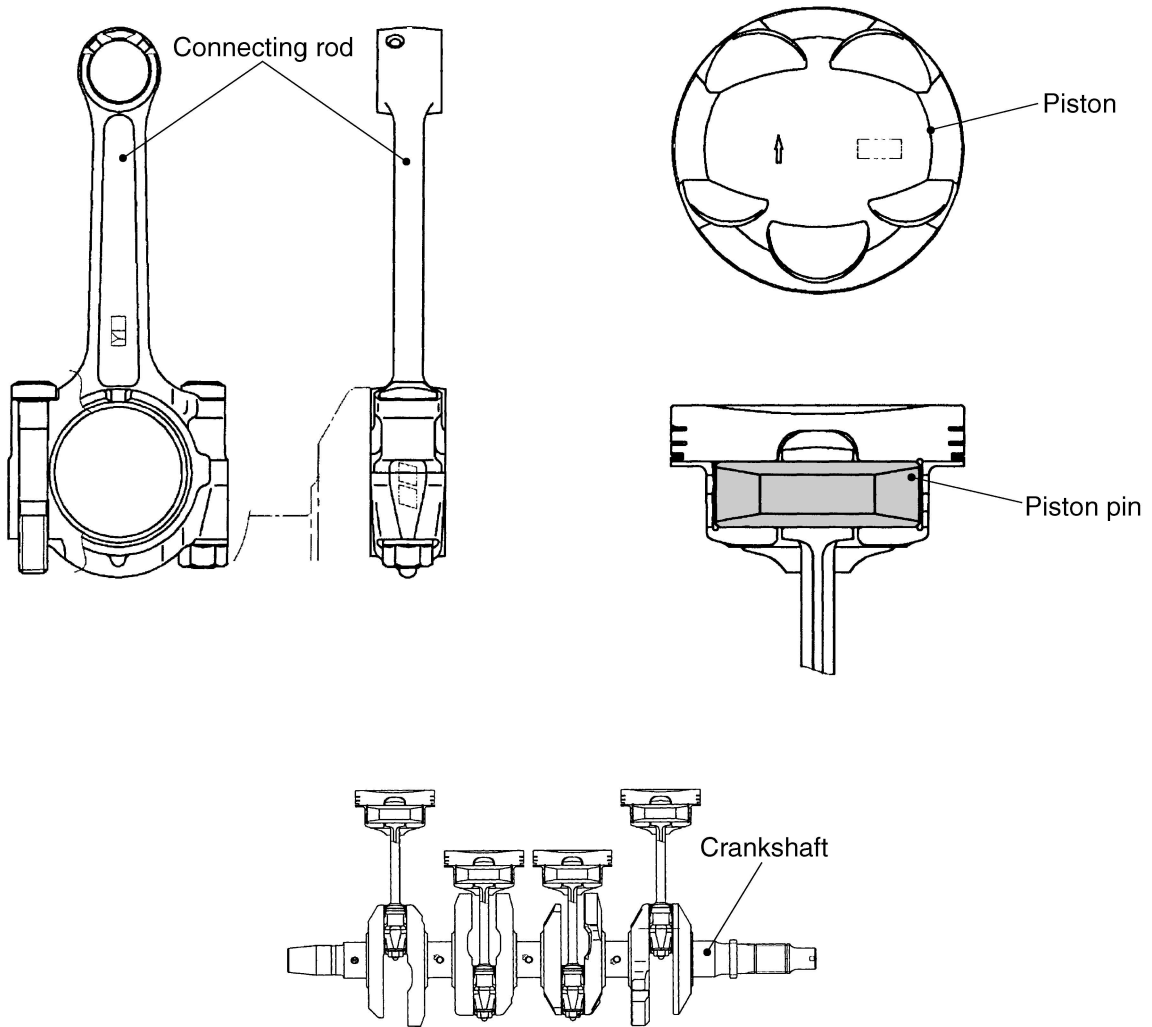


Fig. 4

CRANKCASE

Like the YZF-R1, the cylinder block and upper crankcase are cast in one piece. Integral casting reinforces the crankcase and makes it compact and lightweight. The crankcase body is aluminum, however, the cylinder sleeves are cast with cast iron.

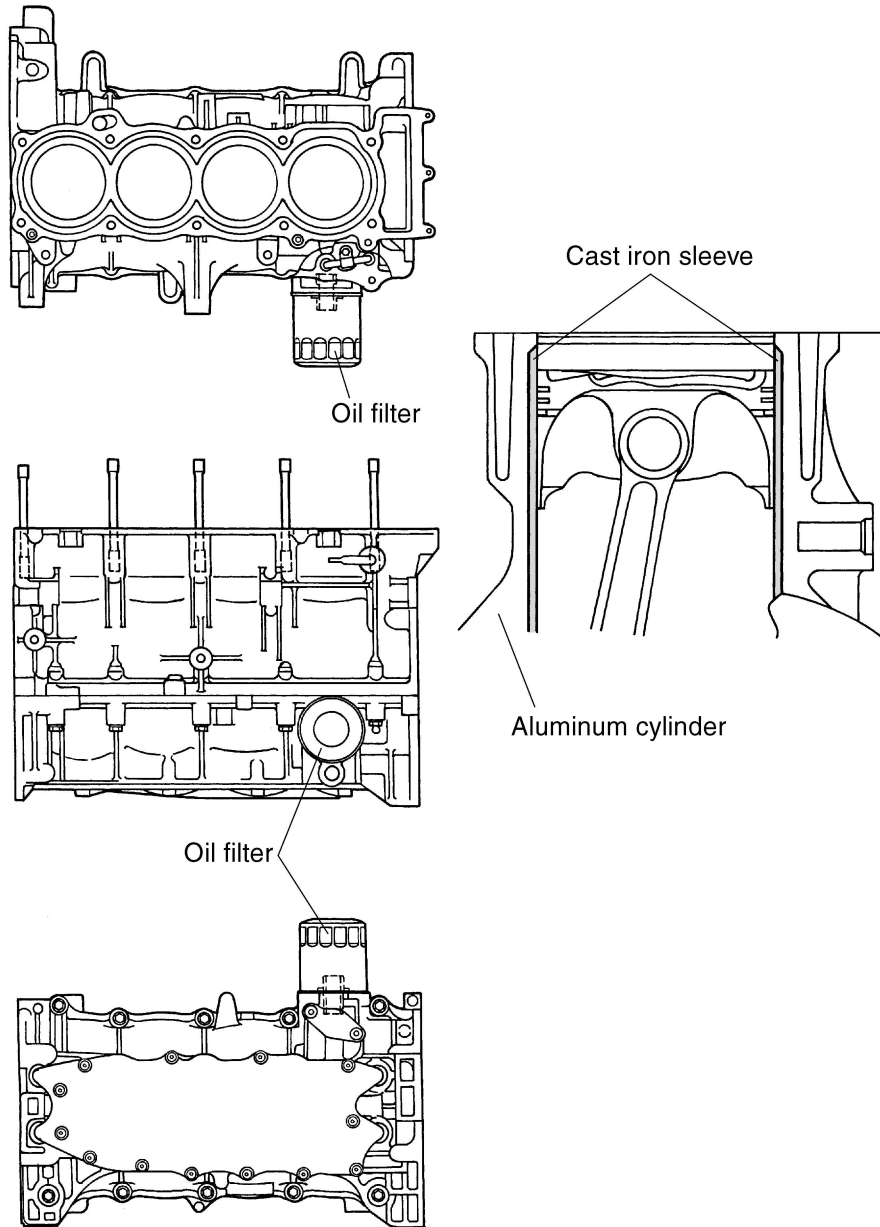


Fig. 5

INTAKE SYSTEM

This intake system is equipped with four independent throttle bodies and injectors.

The intake system supplies the optimum air-fuel mixture to each cylinder to obtain high performance and driveability.

A large air cleaner box and air filter allow large volumes of clean air intake with low noise.

A throttle position sensor, an intake air pressure sensor, and an intake air temperature sensor are installed to the throttle bodies. Signals transmitted from these sensors help to control the optimum fuel injection.

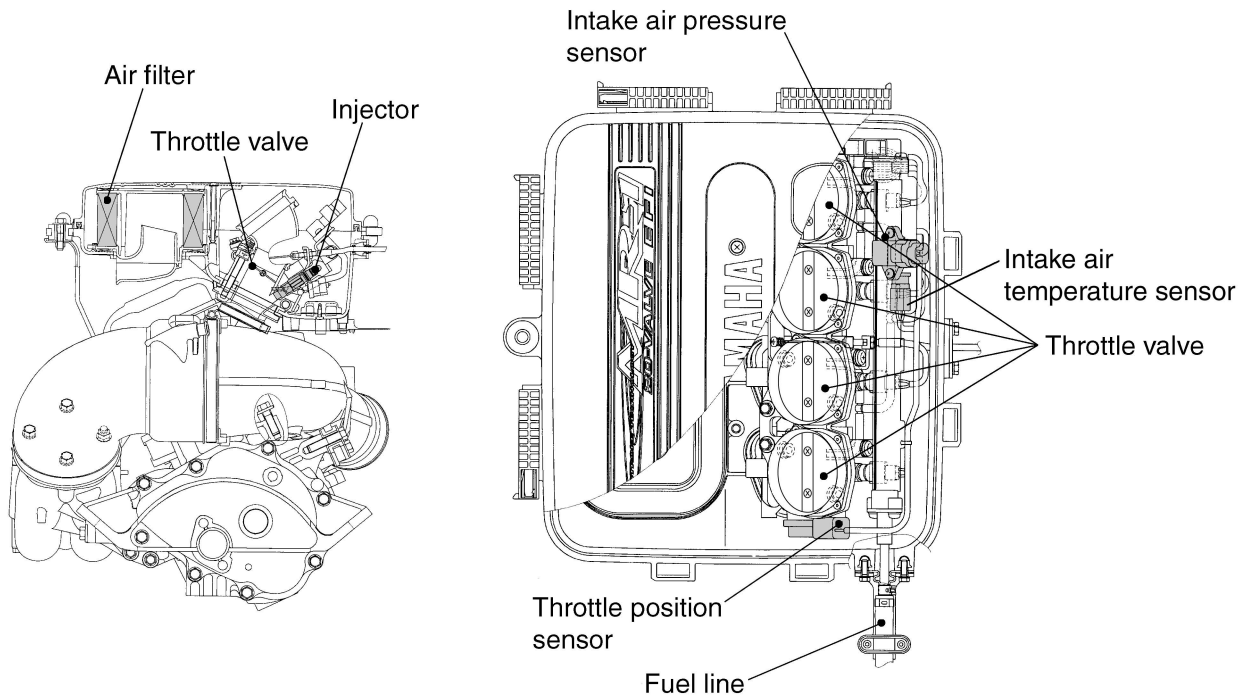


Fig. 6

EXHAUST SYSTEM

Four exhaust pipes of equal length are connected to each cylinder and are combined midway to form a single exhaust pipe. This pipe is called a “collecting pipe” and it contributes to high performance.

In addition, the exhaust pipes are the same length as those of the YZF-R1.

All the exhaust pipes utilize a double-pipe construction.

Cooling water passes around the exhaust pipes to cool the pipes and to prevent heat from transmitting to surrounding areas.

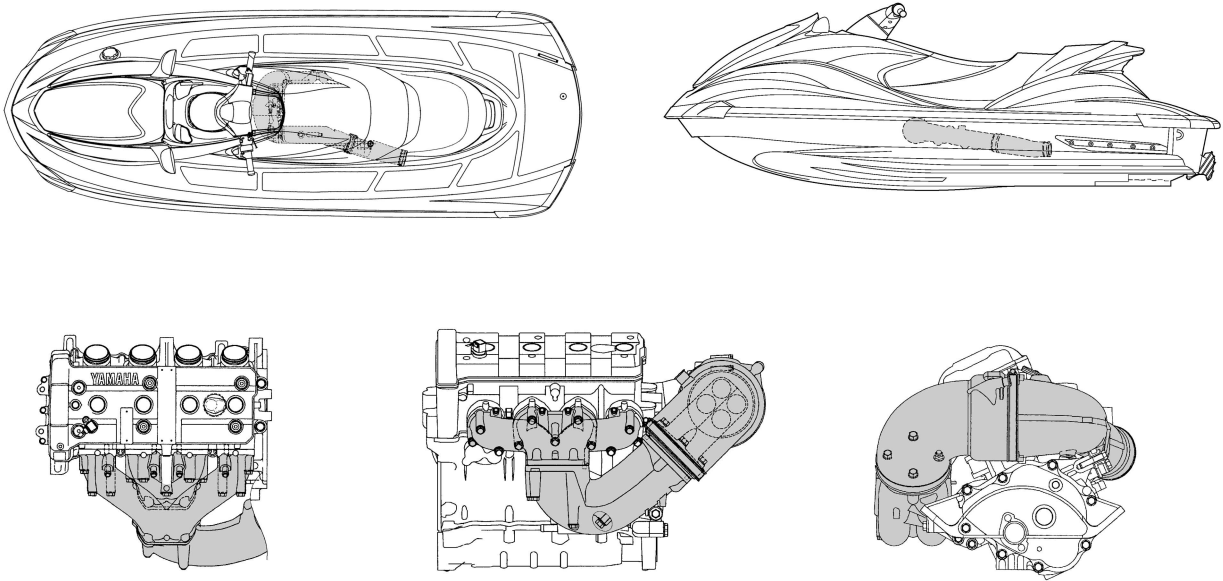


Fig. 7

ENGINE OIL PUMP

Because the MR-1 engine employs a dry sump lubrication system, it is equipped with two oil pumps: a scavenge oil pump and a feed oil pump.

The scavenge oil pump extracts oil from the engine and sends it to the oil tank.

The feed oil pump sends oil from the oil tank to the engine.

In addition, the same axle drives both oil pumps.

Cooling water circulates around the oil tank to cool the oil.

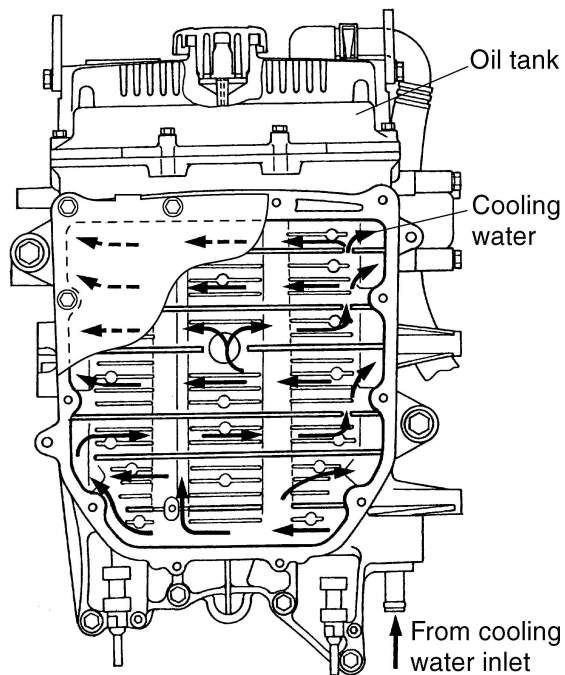
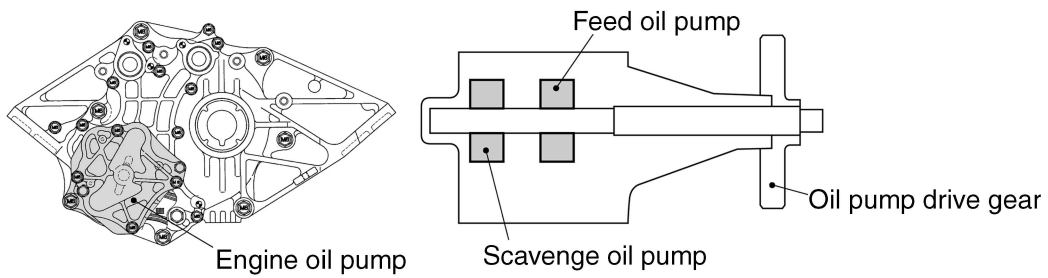


Fig. 9

REDUCTION GEAR

Because the maximum engine speed of the MR-1 engine is high, the impeller would over rotate. The reduction gear reduces the engine speed until the maximum speed of the impeller is in an efficient range.

The reduction ratio is 1.47:1.

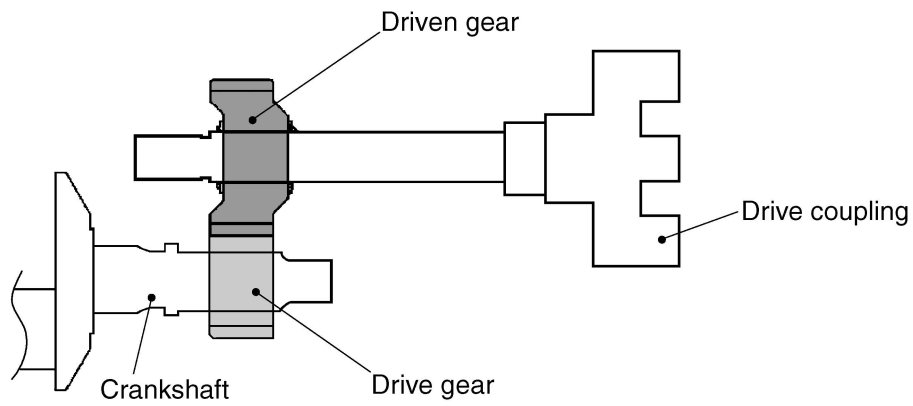


Fig. 10

JET PUMP

A large jet pump with a 155 mm (6.1 in) diameter, three-blade, stainless steel impeller provides more power and thrust.

With the jet pump mounted on the vertical plane of the hull, servicing is made easier.

A cooling water strainer is incorporated into the jet pump, which prevents the cooling water passages from clogging.

The jet thrust nozzle has a 5° trimmed up angle, which allows higher straight line cruising performance.

A newly designed reverse gate raises efficiency of water flow in the reverse position for easier handling when operating the watercraft in reverse.

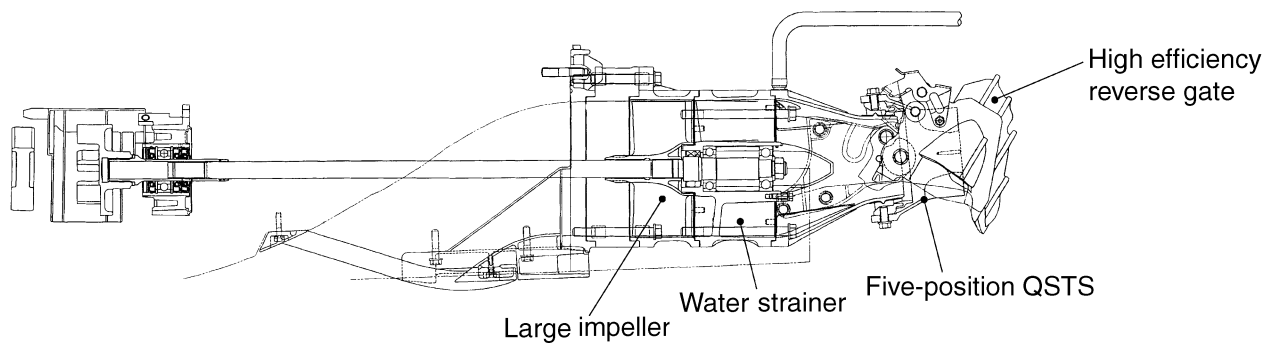


Fig. 11

HULL

A newly designed V-shaped hull provides excellent maneuverability and stability. Foam filling in the inner hull reinforces the hull and also serves as a flotation.

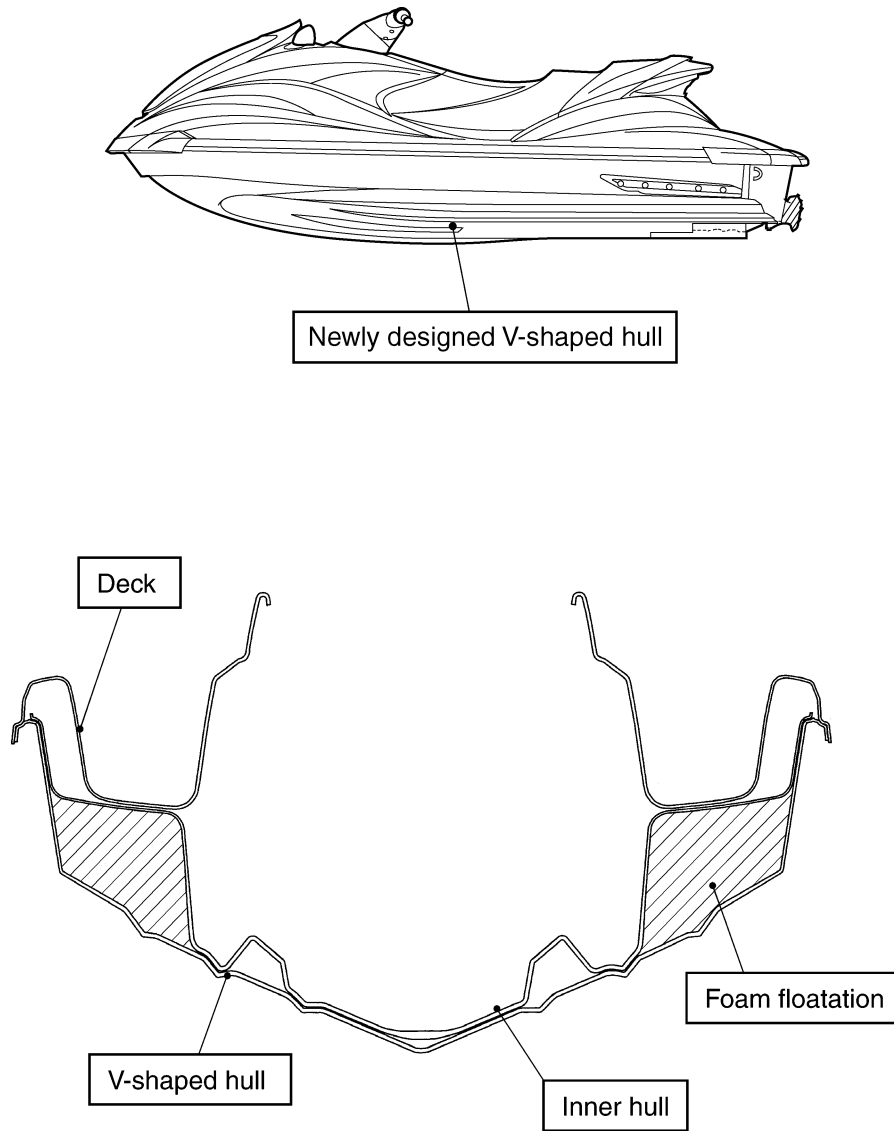


Fig. 12

YAMAHA SOUND SUPPRESSION SYSTEM (YSSS)

To reduce noise, the sound suppression system is installed to the intake and exhaust systems.

To reduce intake noise, intake boxes are equipped near the hood.

To reduce exhaust noise, a resonator is equipped to the exhaust system.

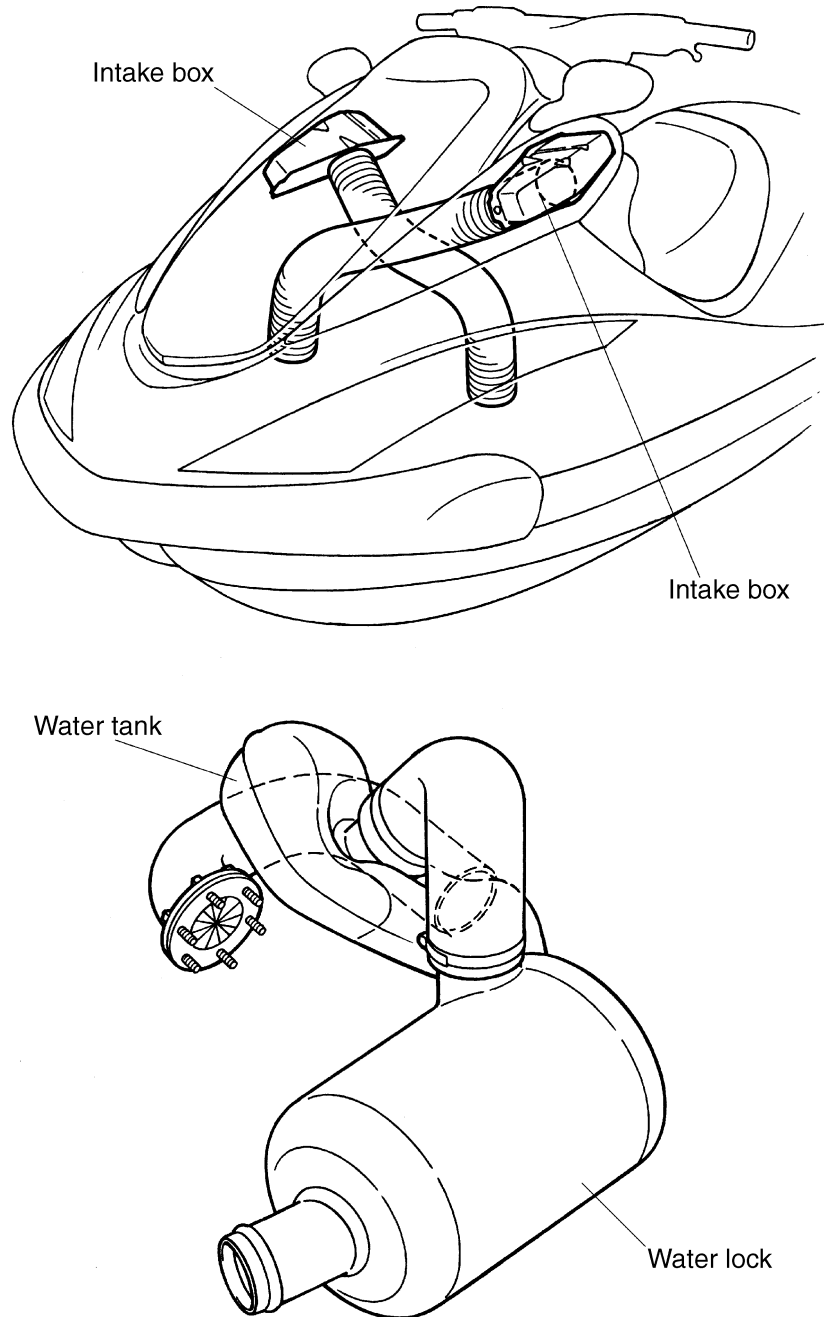


Fig. 13

DECK

LARGE CAPACITY STORAGE COMPARTMENTS

The deck of the FX140 is equipped with three storage compartments.

Front storage compartment: 75 L (19.8 gal)

Glove compartment: 10 L (2.6 gal)

Seat storage compartment: 15 L (3.6 gal)

About 100 L (26 gal) of storage space provide adequate storage.

The glove compartment is equipped with a removable beverage holder.

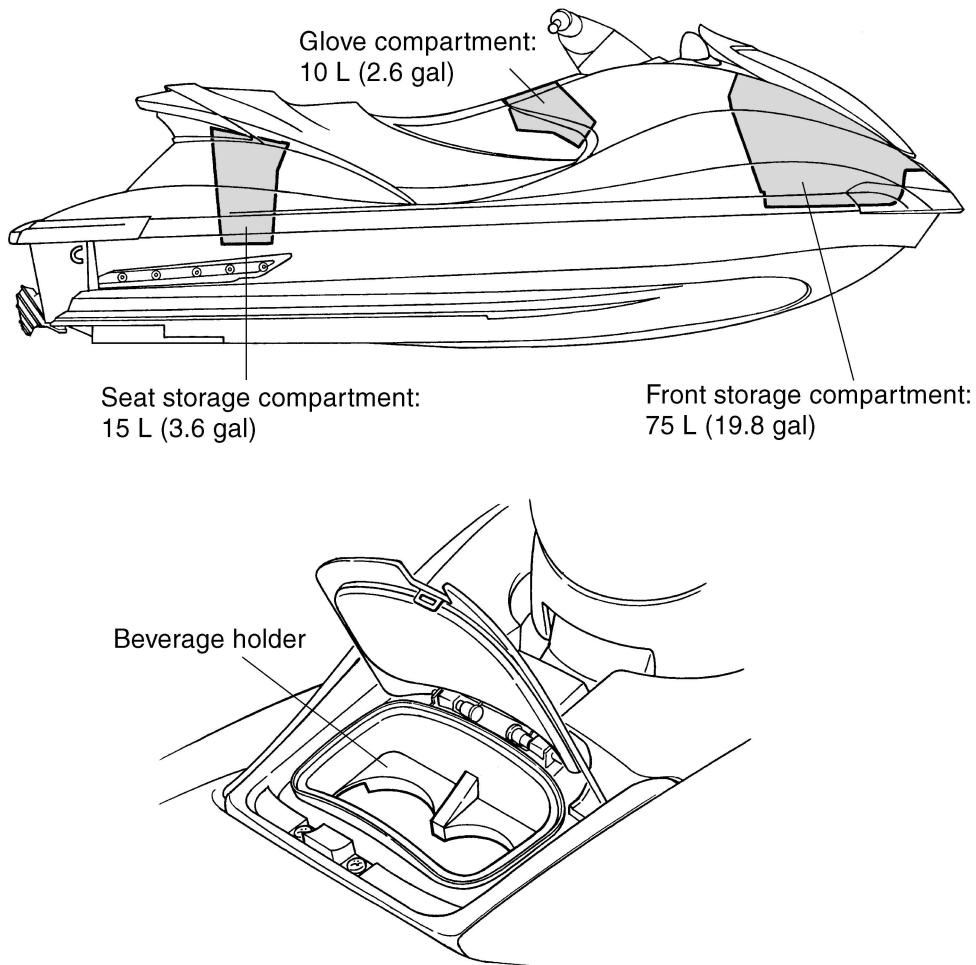


Fig. 14

NEWLY DESIGNED MULTIFUNCTION METER

A newly developed multifunction meter provides an easy-to-read and easy-to-operate design. The meter displays speed, engine speed (r/min), fuel level, battery voltage, hours of engine operation, oil pressure warning, fuel warning, overheat warning, and check engine warning.

The speedometer display can be switched between kilometers and miles. The battery voltage and hour meter displays can be switched as well.

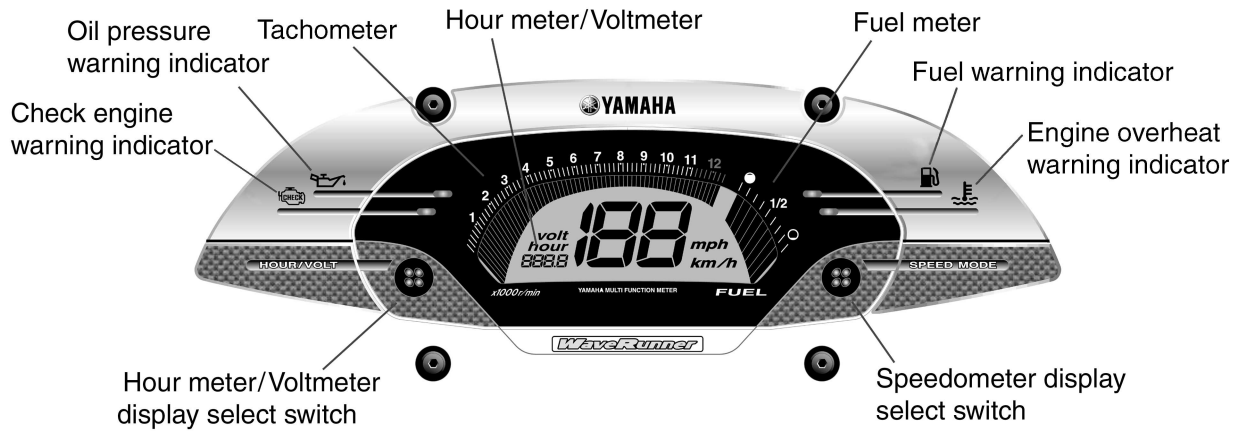


Fig. 15

ELECTRICAL SYSTEM YAMAHA DIAGNOSTIC SYSTEM (YDIS)

The Yamaha Diagnostic System (YDIS), which has already been introduced in the outboard motors market, is introduced to the watercraft market for the first time.

By connecting a computer to the ECM, quick detection of malfunctions and parts that are difficult to check such as the fuel injectors and fuel pump module can be checked easily.

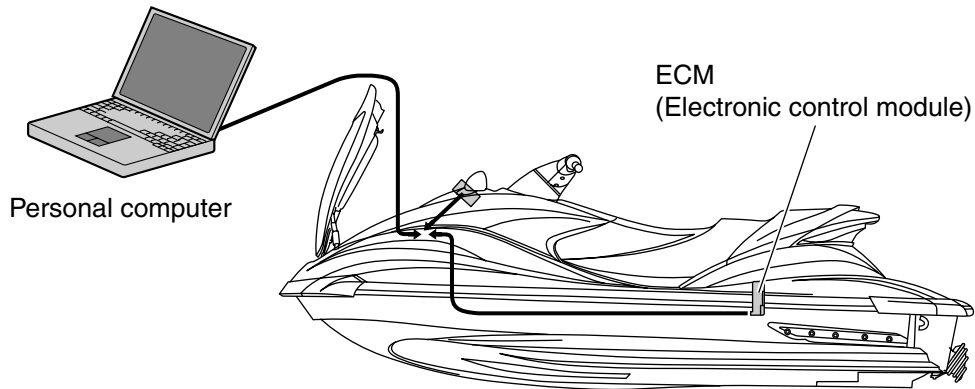


Fig. 16

ELECTRICAL BILGE PUMP

An electrical bilge pump is equipped to increase water discharge.

Electrical power from the ECM operates the bilge pump.

A conventional bilge pump is also equipped to discharge water from the bilge during watercraft operation or when it is trolling.

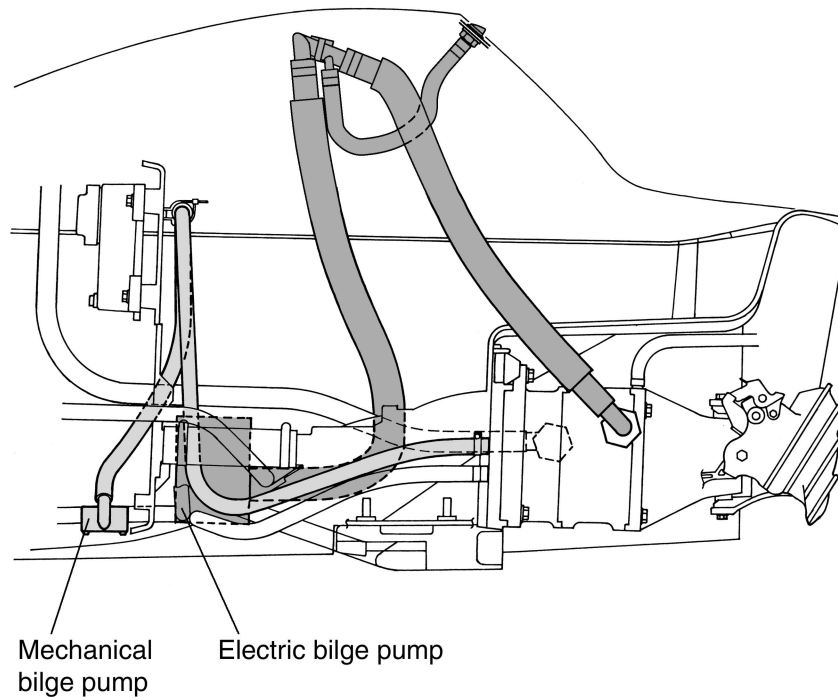


Fig. 17

SLANT DETECTION SWITCH

A slant detection switch is installed inside the electric box.

If the watercraft overturns 180°, the ring inside the slant detection switch moves to turn the switch on.

When the watercraft is overturned, the slant detection switch turns on and the ECM stops the engine to protect the engine.

If engine speed is less than 3,000 r/min, the engine is turned off. However, if engine speed exceeds 3,000 r/min, the engine is not turned off to prevent improper operation of the watercraft as in rough water condition or aggressive riding.

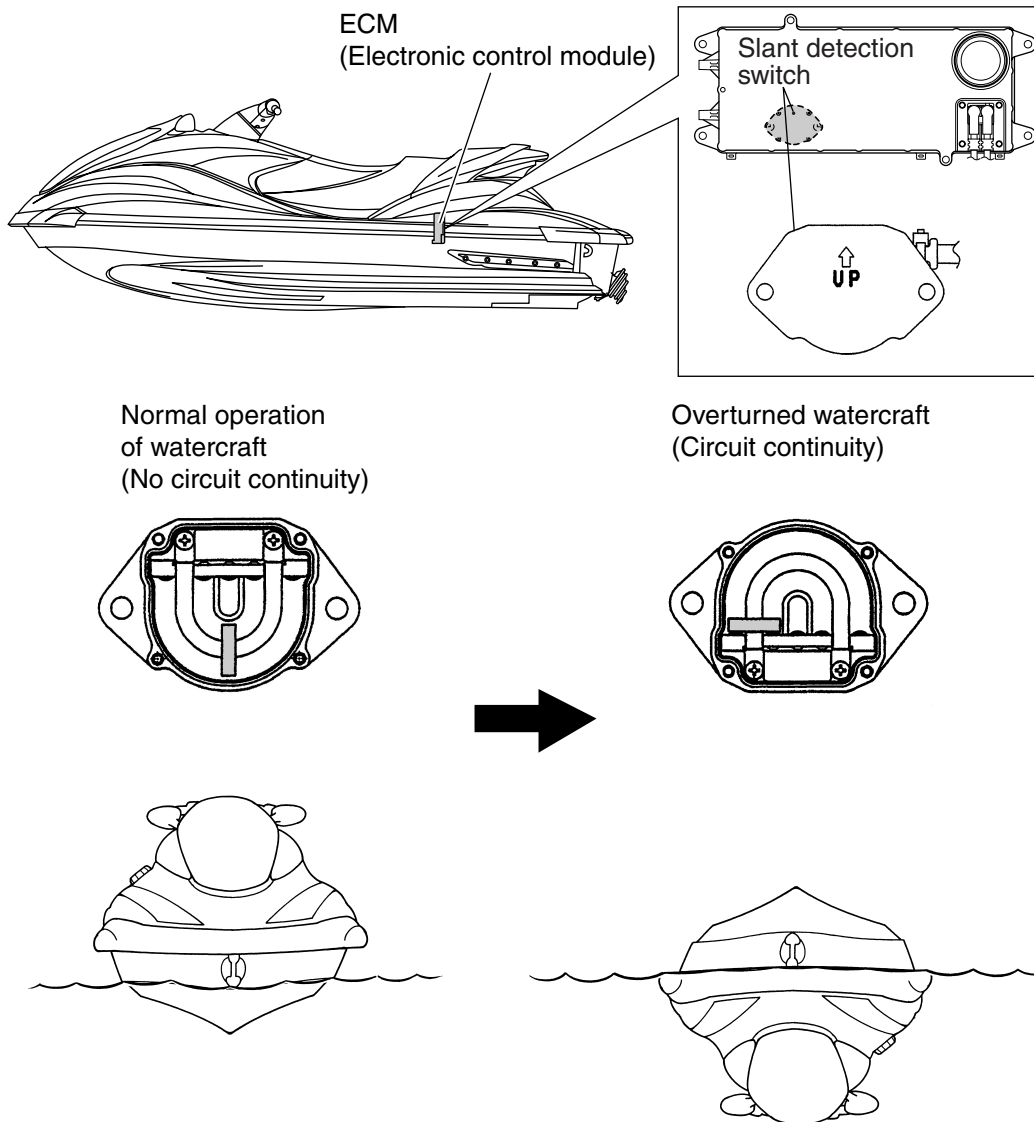


Fig. 18

TECHNICAL TIPS

ENGINE CONTROL

The engine control module (ECM) controls ignition timing and fuel injection with information received from six sensors and four switches installed on the engine and on the basis of the 3D map saved in the ECM.

The sensors installed on the engine include the cam position sensor, temperature sensor, pulser coil, throttle position sensor, intake air temperature sensor, and intake air pressure sensor.

The control switches include the slant detection switch, thermoswitch (engine), thermoswitch (exhaust), and engine stop switch.

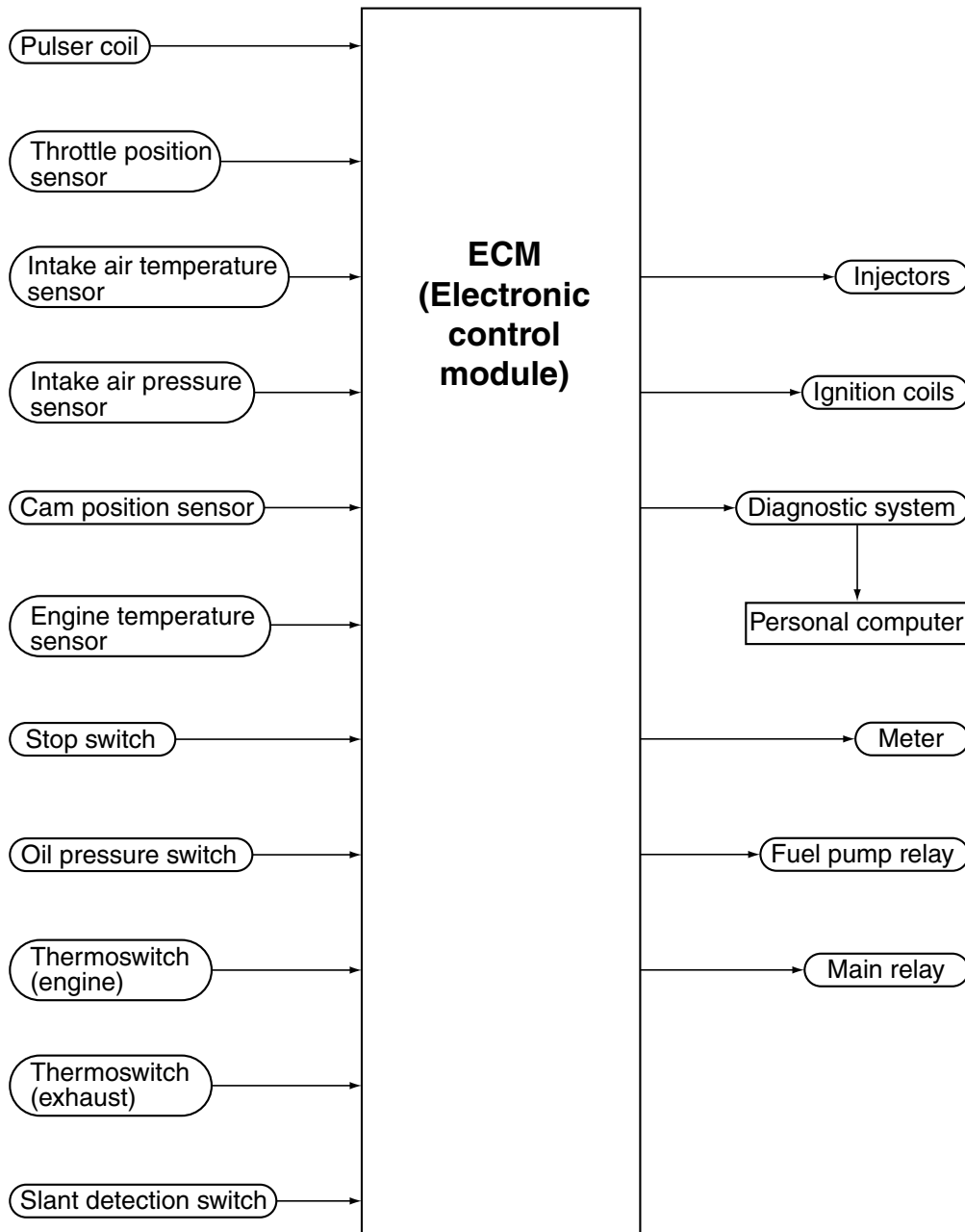


Fig. 19

Two pulser coils are used: one for cylinders #1 and #4 and one for cylinders #2 and #3. When the projection on the flywheel magnet passes over the pulser coil, the sensor transmits a signal to detect the standard position (BTDC 70°) and initial timing (BTDC 10°) of each cylinder.

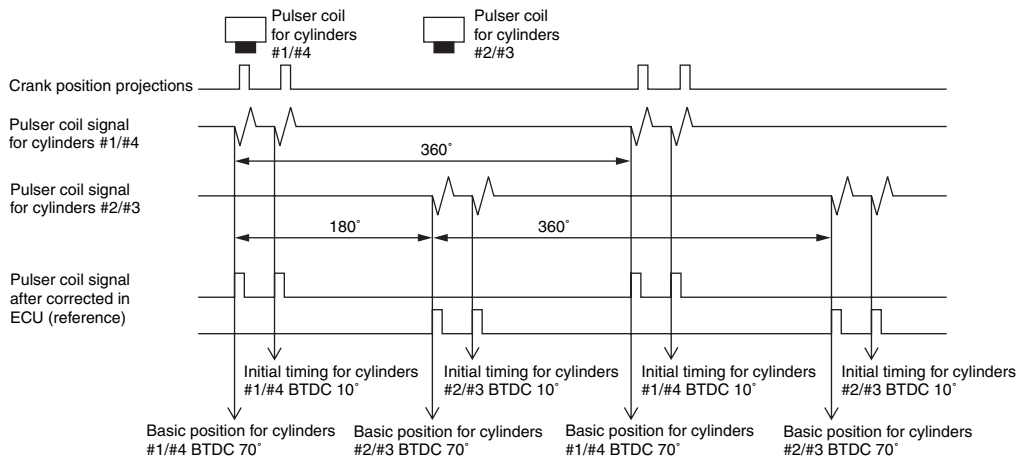


Fig. 20

The cam position sensor is installed on the exhaust camshaft of cylinder #4. When the exhaust camshaft passes the cam position sensor, the sensor transmits a signal to the ECM. After the engine is started, after this signal is input into the ECM twice and the second signal for cylinders #1 and #4 determines the standard position and initial timing of cylinder #4. After this, the input standard position and initial timing distinguish cylinders #3 → #1 → #2, respectively.

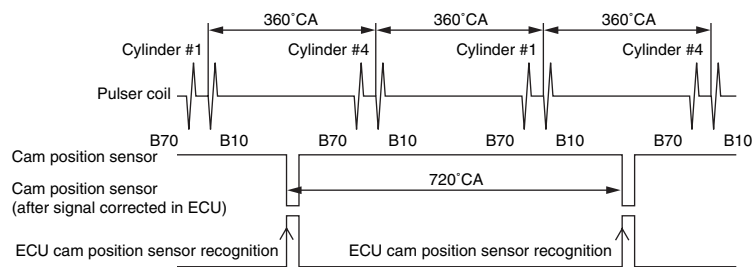


Fig. 21

ENGINE CONTROL MODE

The ECM changes the control modes mentioned below for optimum control according to the conditions of the engine.

Stopping mode

If engine speed is less than 50 r/min, fuel injection and ignition are stopped.

Starting mode

If engine speed is less than 500 r/min, fuel injection and ignition are controlled.

In this mode, fuel is injected simultaneously one time into all four cylinders after the engine is started. After this occurs, fuel is injected into cylinders pairs #1 and #4, and #2 and #3 until cylinder distinction is complete.

Ignition timing is fixed at 10° BTDC.

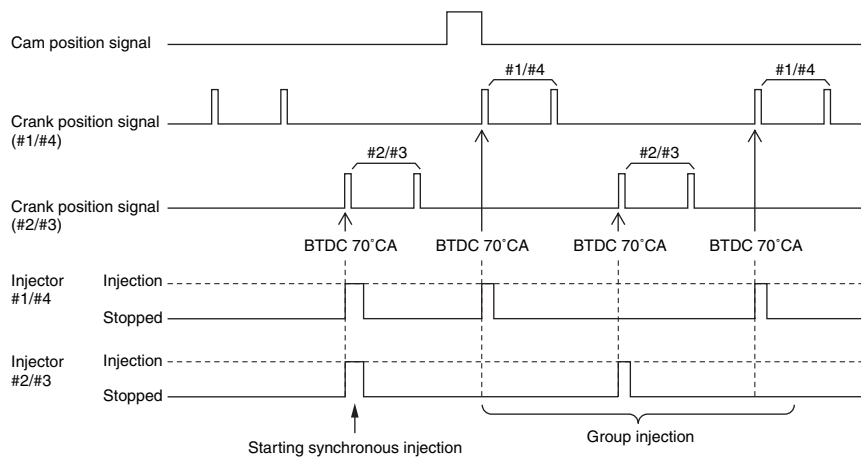


Fig. 22

Cutoff control mode

If any of the conditions listed below occur, fuel injection and ignition are stopped.

Over-revolution control

If engine speed is too high, each cylinder is controlled as indicated in the table.

Fuel injection cutoff

Level	Engine speed (r/min)	Injection cutoff cylinder			
		#1	#2	#3	#4
1	10,504	●			
2	10,563	●			●
3	10,997	●	●		●
4	11,503	●	●	●	●
Instantaneous	11,981	●	●	●	●

Ignition cutoff

Level	Engine speed (r/min)	Ignition cutoff cylinder			
		#1	#2	#3	#4
1	12,000	●	●	●	●

Fully closed cutoff

If engine speed exceeds 6,000 r/min and the throttle angle is near fully closed (below 2.4°), fuel injection is stopped.

Engine stop cutoff

- If the emergency stop switch is on.
- If the slant detection switch is on (i.e., engine speed is less than 3,000 r/min).
- When the engine is restarted, and if engine speed is less than 1,000 r/min and the throttle is open more than 10°, ignition and fuel injection are stopped to prevent the watercraft from accelerating suddenly.
Control is not activated over 1,000 r/min.

Quick acceleration mode

If engine speed is less than 4,400 r/min and the throttle is opened suddenly, ignition timing is advanced by quick acceleration advanced correction.

Fuel injection occurs four times at acceleration as non-synchronous injection.

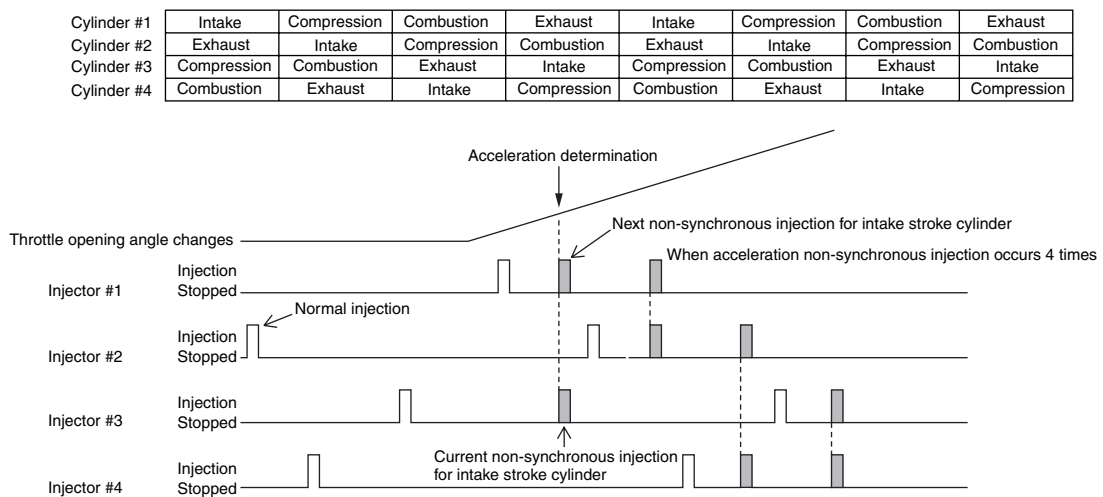


Fig. 23

Normal mode

Except for the controls mentioned earlier, fuel injection is normal sequential injection. Basic ignition timing and each correction value control ignition timing.

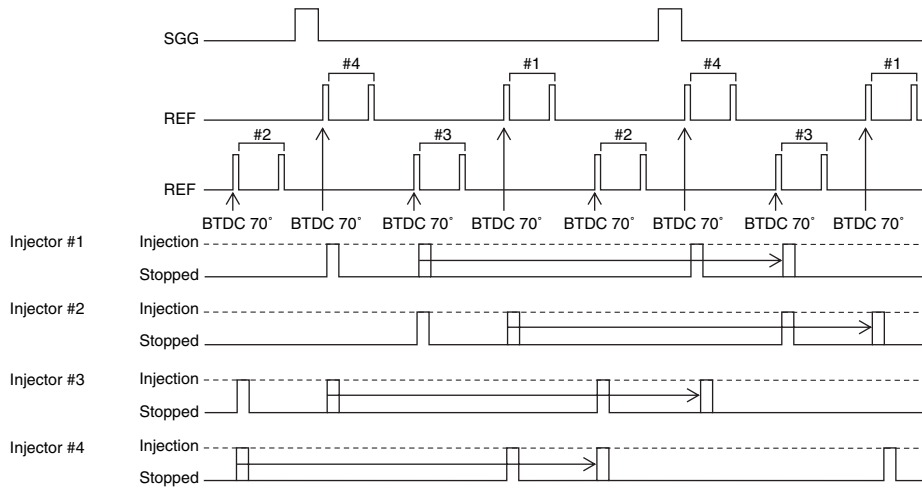


Fig. 24

FUEL INJECTION CONTROL

Basic fuel injection volume uses two control systems: The speed density system (D-Jetronic) 3D map, which is calculated from the intake air pressure and engine speed, and the speed throttle speed system (Alpha-N) 3D map, which is calculated from the throttle opening and engine speed.

The D-Jetronic and Alpha-N 3D map activity ratio changes according to the throttle opening angle.

If the throttle opening angle is less than 12° , D-Jetronic is used.

If the throttle opening angle is more than 12° , the activity ratio of D-Jetronic is gradually reduced and the activity ratio of Alpha-N is increased.

If the throttle opening angle is more than 14° , only Alpha-N is used.

After the basic fuel injection volume is determined, each correction value is added to determine the actual fuel injection volume.

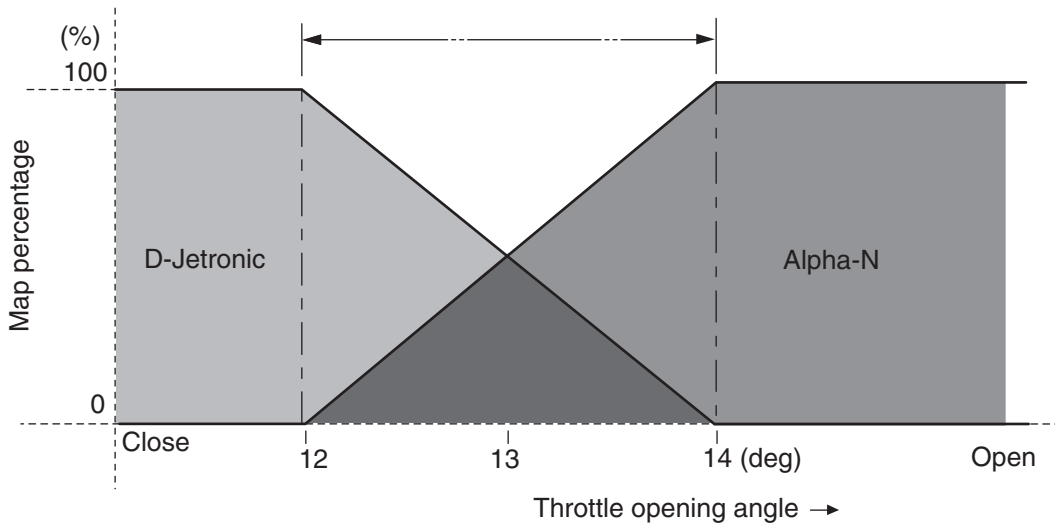


Fig. 25

IGNITION CONTROL

The 3D map of the throttle opening angle and engine speed determines basic ignition timing. Basic ignition timing and each correction value determine actual ignition timing. The ignition range is between 45° BTDC and 10° ATDC.

The starting time of ignition is controlled on the basis of 70° BTDC and 10° BTDC of each cylinder.

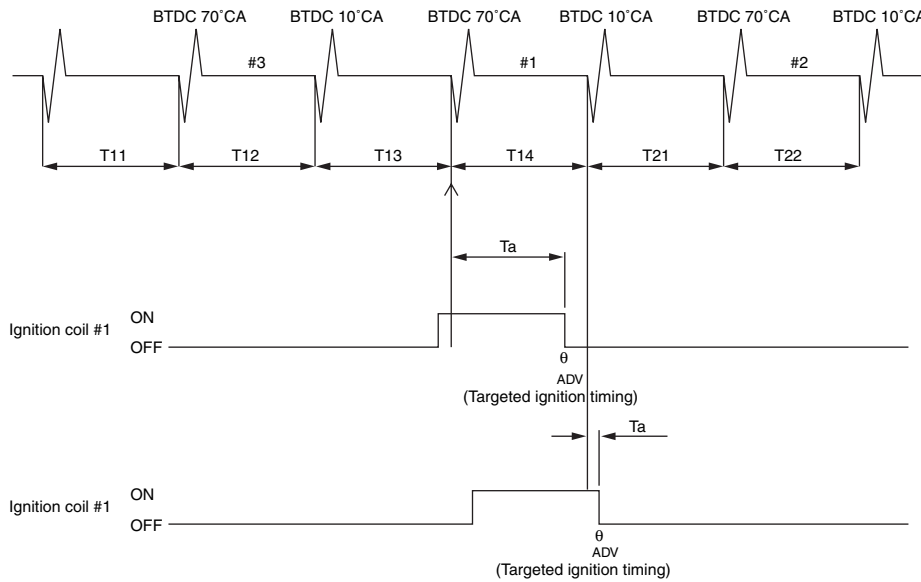


Fig. 26

IGNITION COIL LOCK CONTROL

If the engine is stopped and electricity flows to the ignition coil for approximately 1.3 seconds, the ECM stops the electricity flow.

WARNING CONTROL

Overheat warning control

The overheat warning control is activated under the following conditions.

- If the engine temperature increases from 75 °C (167 °F) to 90 °C (194 °F) within 10 seconds or if the engine temperature exceeds 130 °C (266 °F).
- If the thermostitch is on.

If the overheat warning control is activated, the overheat warning indicator comes on and the buzzer sounds.

In addition, fuel injection of cylinders #1 and #4 is cut to lower the engine speed below 3,000 r/min.

If the engine is turned off during overheat warning control, the engine can be restarted.

The overheat warning control is deactivated if the engine is turned off or if the engine temperature is below 120 °C (248 °F) with the thermostitch off and the throttle fully closed.

Oil pressure warning control

The oil pressure warning control is activated under the following conditions.

- If the engine speed exceeds 5,000 r/min.
- If the throttle opening angle exceeds 10°.
- If the oil pressure switch is on.

If the oil pressure warning control is activated, the oil pressure indicator on the multifunction meter comes on and the buzzer sounds.

In addition, fuel injection of cylinders #1 and #4 is cut to lower the engine speed below 3,000 r/min.

If the engine is turned off during oil pressure warning control, the engine can be restarted. When the engine is started again, engine speed does not exceed 3,000 r/min until the oil pressure warning control is deactivated.

The oil pressure warning is not deactivated until the engine is turned off and electric power of the ECU is stopped.

Slant detection control

The slant detection control is activated under the following conditions.

- If the engine speed is below 3,000 r/min.
- If the slant detection switch is on.

If the slant detection control is activated, ignition and fuel injection are cut to all cylinders and the engine is turned off.

If the slant detection control is activated, no indication is made on the multifunction meter.

The slant detection control is not deactivated until the engine is turned off.

FAIL-SAFE FUNCTION TABLE

Symptom	Ignition control	Fuel injection control	Backup
Incorrect pulser coil signal	<ul style="list-style-type: none"> • Only the cylinders inputting signals ignite initially in the starting mode • Normal control in normal mode 	All cylinders inject simultaneously based on cylinder receiving normal signal	Substitute with remaining sensors
Incorrect cam position sensor signal	Normal control	<ul style="list-style-type: none"> • An incorrect signal after cylinder distinction continues with cylinder distinction before fault occurred, and an incorrect signal before normal control cylinder distinction, conducts group injection. • However, if a signal is received during group injection from the cam position sensor, normal control is activated after cylinder distinction. 	None
Incorrect engine temperature sensor signal	Normal control with false engine temperature	Normal control with false engine temperature	False engine temperature is 50 °C (122 °F)
Incorrect throttle position sensor signal	Fix ignition timing in normal mode	Add fuel correction coefficient based on basic fuel injection volume	Cancel throttle position sensor control
Incorrect intake air temperature sensor signal	Normal control with false intake air temperature	Normal control with false intake air temperature	False intake air temperature is 45 °C (113 °F)
Incorrect intake air pressure sensor signal	Normal control	Add fuel correction coefficient based on basic fuel injection volume	Cancel intake air pressure control
			Do not renew atmospheric pressure
Incorrect slant detection switch signal	Normal control	Normal control	Cancel slant detection switch control
Battery voltage is below specified voltage	Normal control	Normal control	None

COOLING SYSTEM

For efficient and excellent cooling, this watercraft is equipped with multiple cooling water passages. Cooling water, which is drawn in by the jet pump, flows to the engine, oil tank, and exhaust pipes. Cooling water, which cools the engine oil in the oil tank, enters the exhaust joint. A pressure control valve limits cooling water pressure that enters the engine.

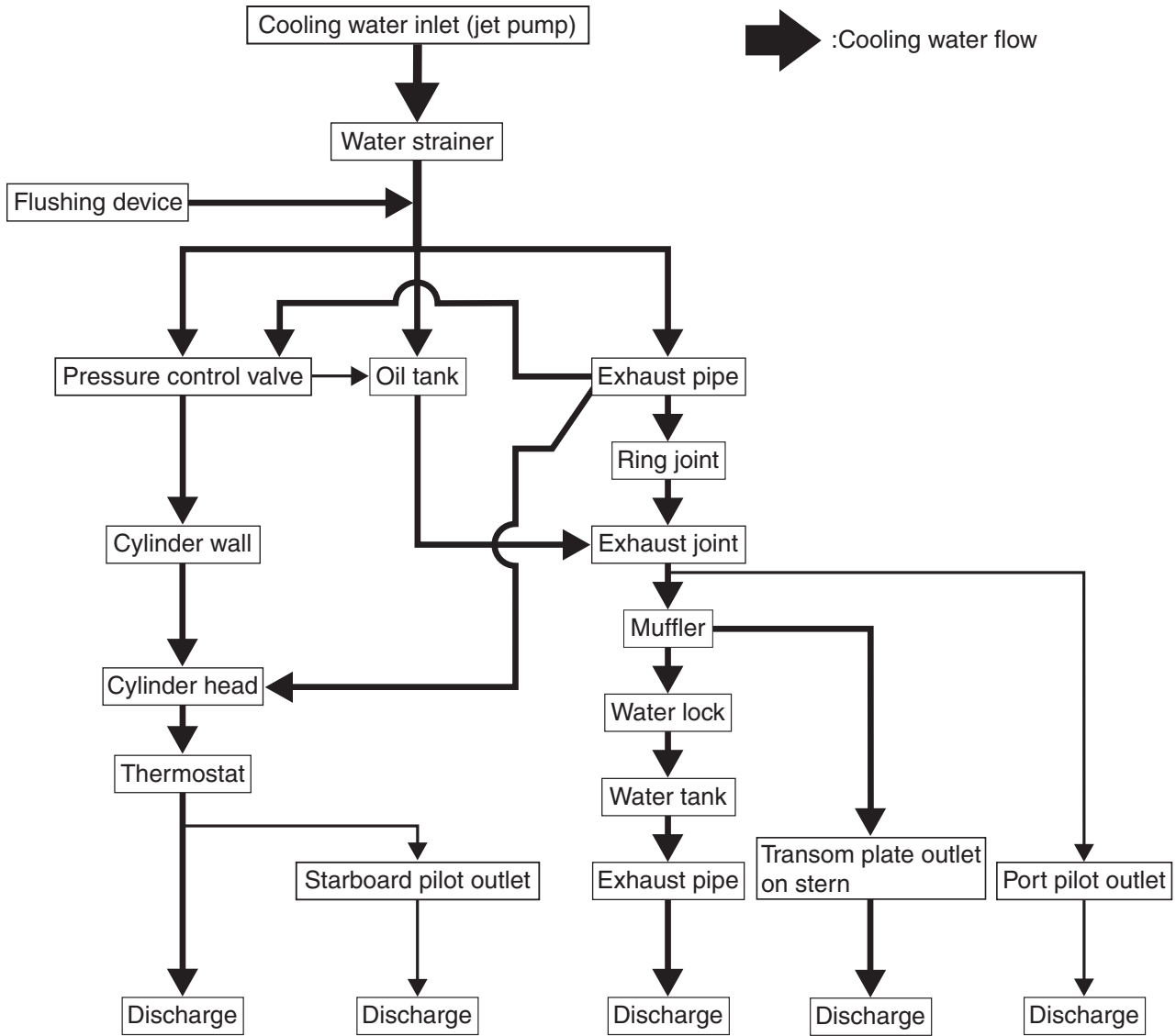


Fig. 27

LUBRICATION SYSTEM

The MR-1 engine employs a dry sump lubrication system.

A scavenge pump is used to collect oil from the engine and deliver it to the oil tank.

A feed oil pump is used to send oil from the oil tank to the various engine components.

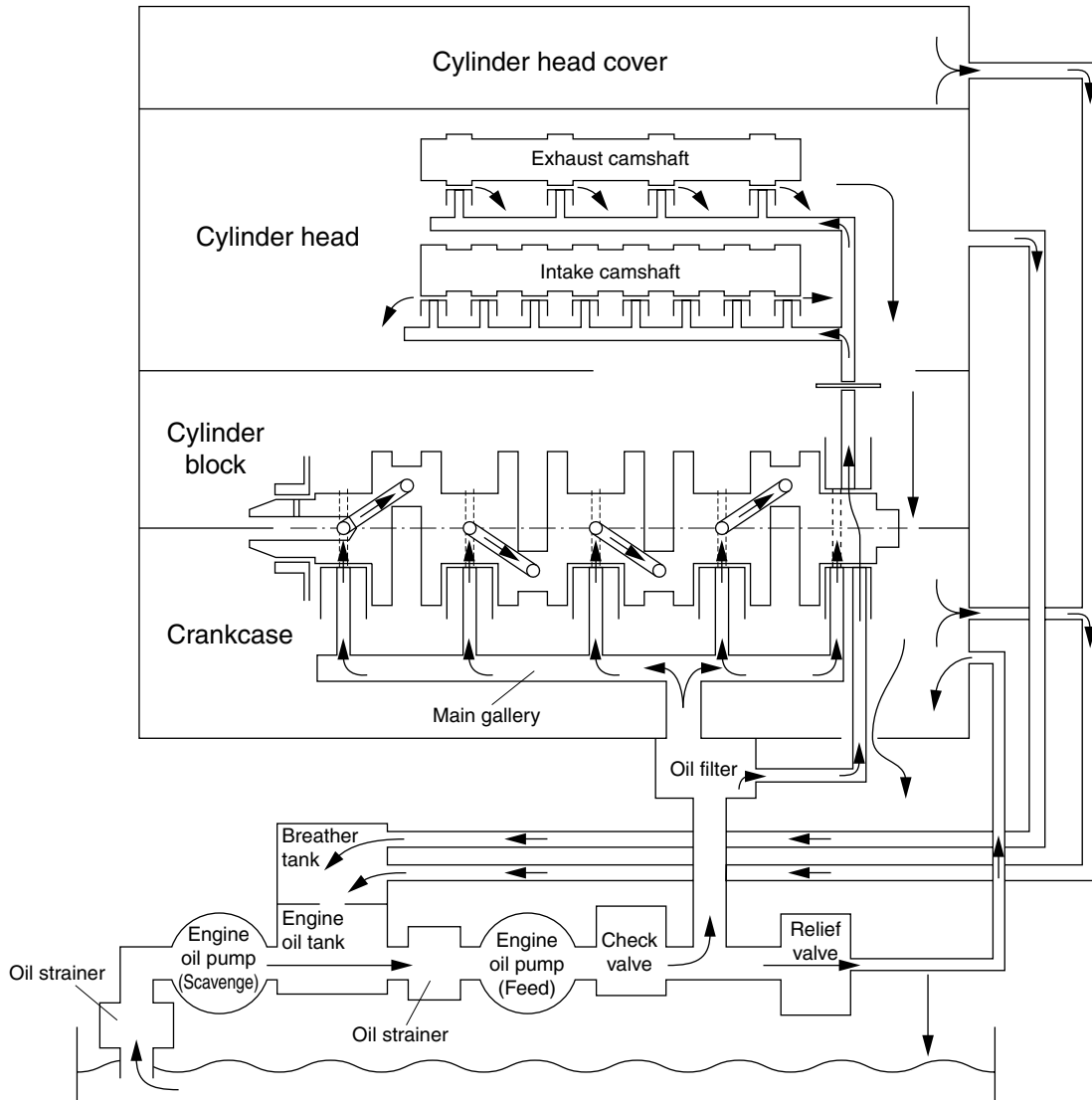


Fig. 28

SERVICE INFORMATION

PERIODIC SERVICE

Trolling speed check and adjustment

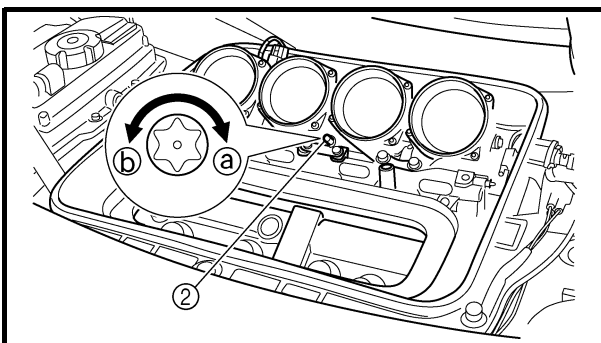
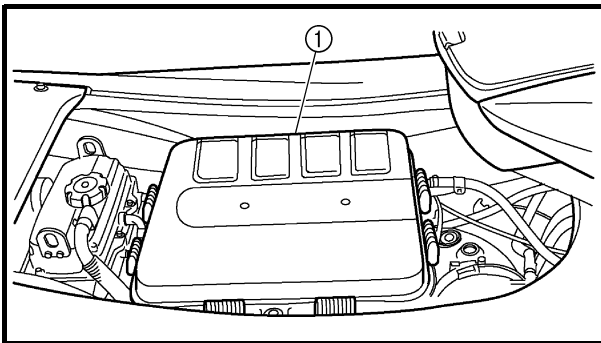
1. Measure:

- Trolling speed
Out of specification → Adjust.

	Trolling speed: 1,700 ± 100 r/min
---	--

Checking steps: (Watercraft on water)

- Start the engine and allow it to warm up for a 15 minutes.
- Check the engine trolling speed using the tachometer of the multifunction meter or using the Yamaha Diagnostic System.



2. Adjust:


- Trolling speed

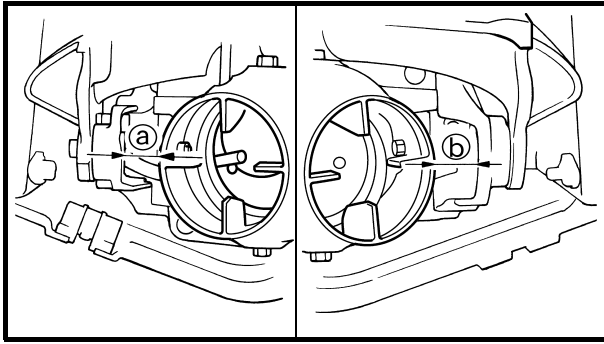
Adjustment steps:

- Remove the air filter case cover ①.
- Start the engine.
- Turn the throttle stop screw ② in or out until the specified speed is obtained.

Turn in (a)	Increase trolling speed.
Turn out (b)	Decrease trolling speed.

- Install the air filter case cover.

	Air filter case cover screw: 2.5 N • m (0.25 kgf • m, 1.8 ft • lb) LOCTITE® 572
---	--



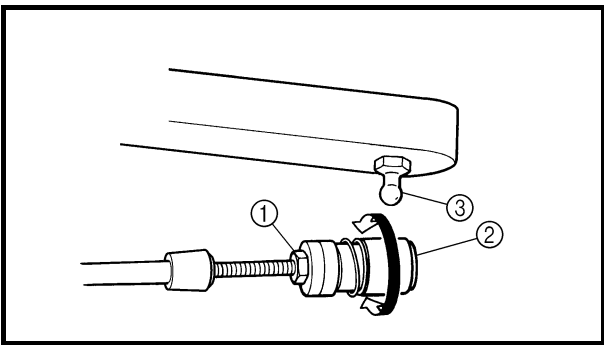
Steering cable inspection and adjustment

1. Check:

- Jet thrust nozzle clearance ①, ②
Difference → Adjust.

Checking steps:

- Set the control grip in the neutral position.
- Turn the handlebar lock to lock.
- Measure the clearances ① and ②.
- If ① and ② clearances are not even, adjust the cable joint.

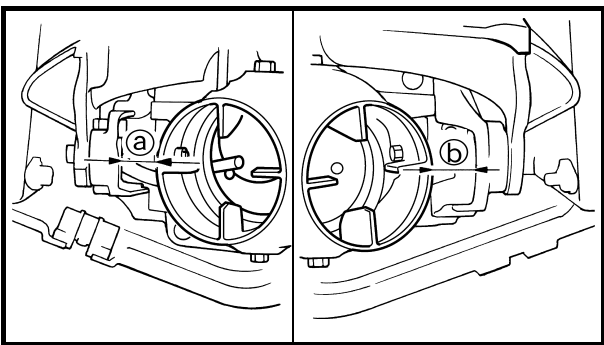


2. Adjust:

- Steering cable joint (handle end)

Adjustment steps:

- Set the control grip in the neutral position.
- Loosen the locknut ①.
- Disconnect the cable joint ② from the ball joint ③.
- Turn the cable joint ② in or out for adjusting clearances ① and ②.



Turn in	Clearance ① is increased.
Turn out	Clearance ② is increased.

⚠ WARNING

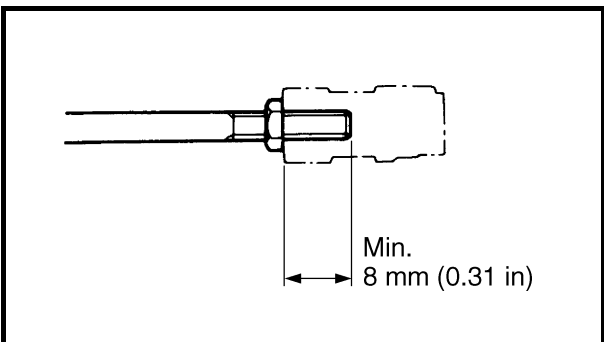
The cable joint must be screwed in more than 8 mm (0.31 in).

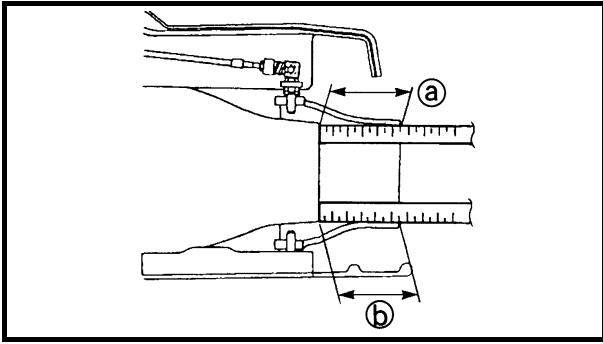
- Connect the cable joint and tighten the locknut.



Locknut:

6.4 N • m (0.64 kgf • m, 4.6 ft • lb)





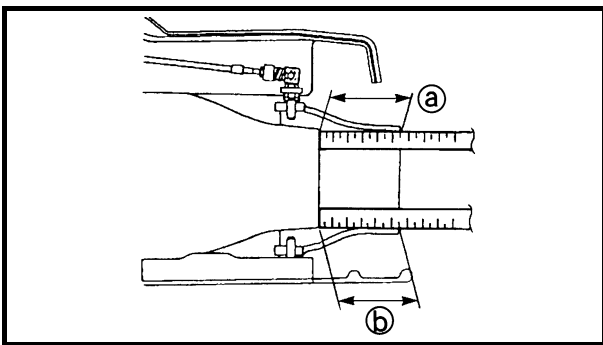
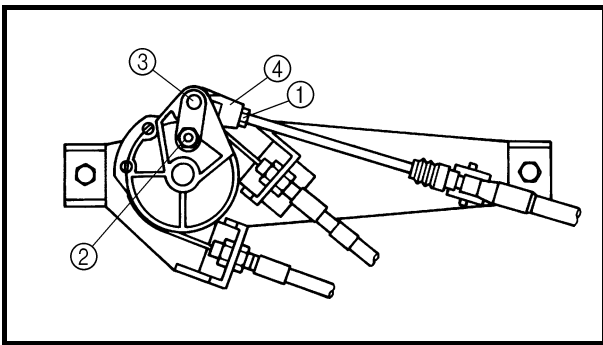
QSTS cable inspection and adjustment

1. Measure:

- Jet thrust nozzle set length ①, ②
Difference → Adjust.

Measurement steps:

- Set the control grip in the neutral position.
- Set the jet thrust nozzle in the center position.
- Measure the jet thrust nozzle set length ① and ②.
- If ① and ② lengths are not even, adjust the cable joint.



2. Adjust:

- QSTS cable

Adjustment steps:

- Set the control grip in the neutral position.
- Loosen the locknut ①.
- Remove the nut ② and pivot pin ③.
- Set the jet thrust nozzle in the center position.
- Turn the cable joint ④ in or out for adjusting lengths ① and ②.

Turn in	Length ② is increased.
---------	------------------------

Turn out	Length ① is increased.
----------	------------------------

⚠ WARNING

The cable joint must be screwed in more than 8 mm (0.31 in).

- Connect the cable joint ④ and pivot pin ③ and tighten the nut ②.



Nut:
3.8 N • m (0.38 kgf • m, 2.7 ft • lb)

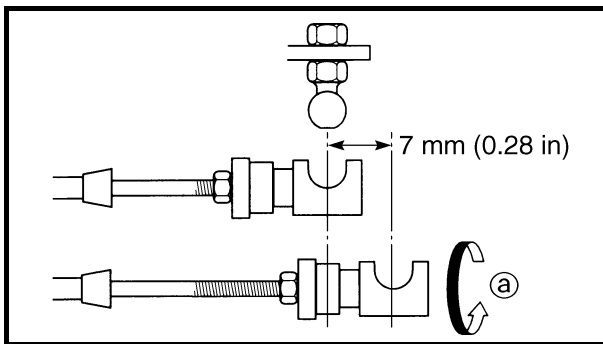
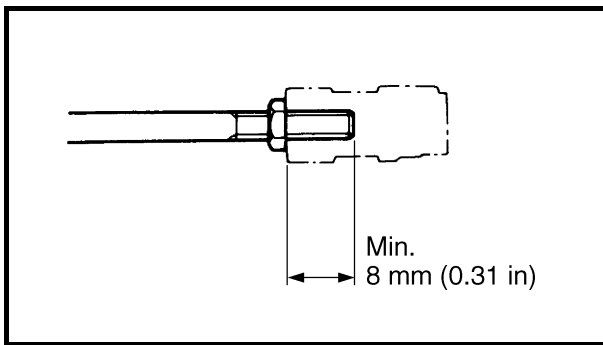
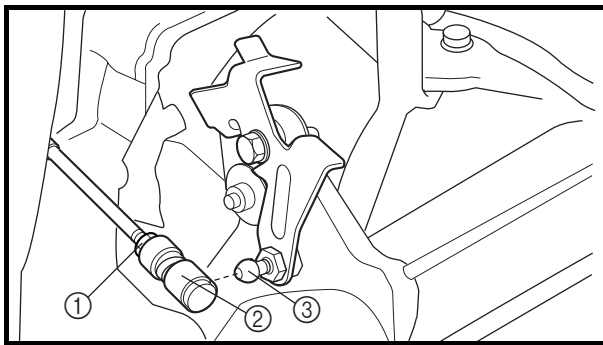
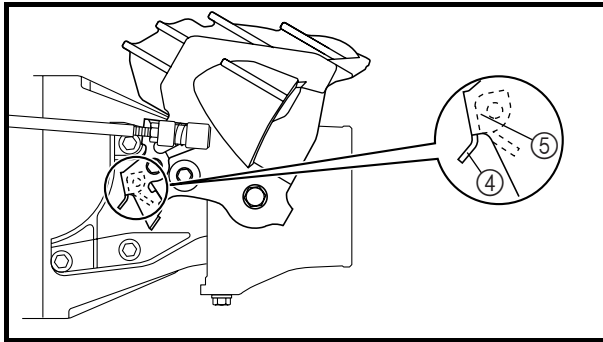
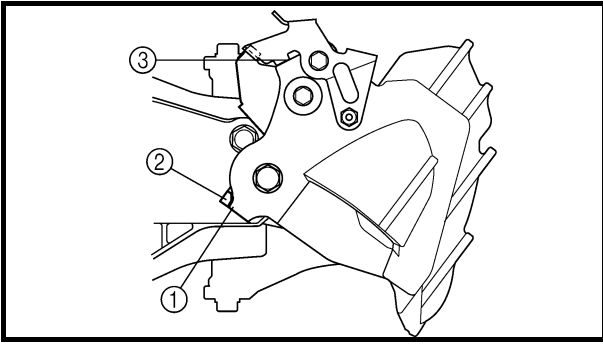
- Tighten the locknut ①.



Locknut:
3 N • m (0.3 kgf • m, 2.2 ft • lb)

NOTE:

If the QSTS cable cannot be properly adjusted by the cable joint at the QSTS converter end, adjust the cable joint at the jet pump end so that the same lengths are obtained.



Shift cable inspection and adjustment

1. Check:

- Reverse gate stopper lever position
Incorrect → Adjust.

Checking steps:

- Set the shift lever to the reverse position.
- Check that the reverse gate ① contacts the stopper ② on the bracket and the lever ③ contacts the reverse gate.
- Set the shift lever to the forward position.
- Check that the lever ④ has been shifted over the bracket ⑤.

2. Adjust:

- Shift cable joint

Adjustment steps:

- Loosen the locknut ①.
- Disconnect the cable joint ② from the ball joint ③.
- Situate the reverse gate to the stopper on the bracket and the lever to the reverse gate.
- Turn the cable joint to align it with the ball joint.

Turn in

Shortens.

Turn out

Lengthens.

- Turn out the cable joint nine times ④ to extend cable 7 mm (0.28 in) from the aligned position.

⚠ WARNING

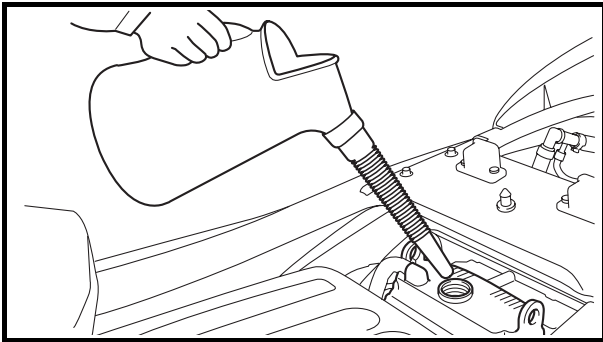
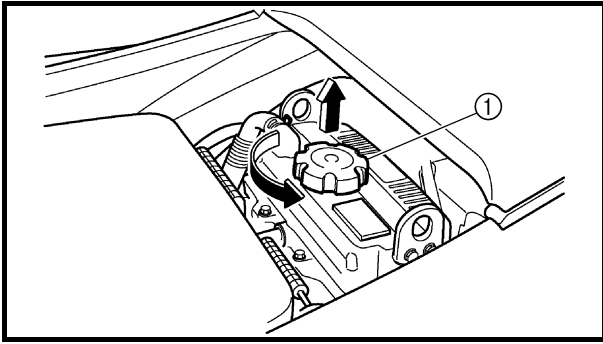
The cable joint must be screwed in more than 8 mm (0.31 in).

- Connect the cable joint and tighten the locknut.



Locknut:

2.9 N • m (0.29 kgf • m, 2.1 ft • lb)



Engine oil inspection

1. Remove:
 - Oil filler cap ①
2. Fill:
 - Oil tank
(with the specified amount of the recommended engine oil)



Recommended oil:

SAE 10W-30

API SE, SF, SG, SH, SJ

Oil quantity:

2.0 L (2.1 US qt, 1.8 Imp qt)

CAUTION:

When starting the engine make sure the dipstick is securely fitted into the oil tank.

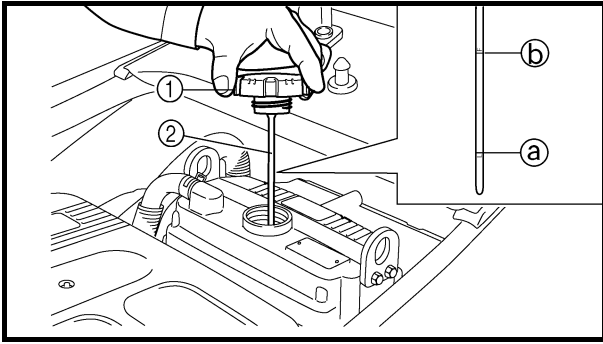
3. Install:
 - Oil filler cap
4. Check:
 - Engine oil level

Checking steps:

CAUTION:

- When checking the oil level in water, stay clear of other boats. The watercraft could be drifted away by the current or wind.
- Do not run the engine for more than 15 seconds without supplying water, when checking the oil level on land. The engine could overheat.
- Do not run the engine with too much or not enough oil in the oil tank. Oil could spray out or the engine could be damaged.

- Place the watercraft in a horizontal position.
- Remove the front seat.



- Remove the oil filler cap ① and check for oil on the dipstick ②.
- If there is no oil on the dipstick, pour enough oil so that the tip of the dipstick comes into contact with the oil, and then install the filler cap.
- To warm up the engine perform one of the following two ways.
- **In water**
 - a. Place the watercraft in water, and then start the engine.
 - b. Run the engine at 7,000 r/min or more for more than 5 minutes.
 - c. Run the engine at trolling speed for 2–3 minutes.
 - d. Stop the engine.
- **On land**
 - a. Connect the flushing hose connector to the watercraft.
 - b. Start the engine, and then turn on the water supply.
 - c. Run the engine at trolling speed for 6–8 minutes.
 - d. Turn the water supply off, and then stop the engine.

CAUTION: _____

When checking the oil level on land, be sure to connect a garden hose to the watercraft for proper water supply.

NOTE: _____

If the ambient temperature is less than 15 °C (59 °F), run the engine for an additional 5 minutes.

- Remove the oil filler cap ①, wipe the dipstick ② clean, insert it back into the filler hole, and then remove it again to check the oil level.

NOTE: _____

The engine oil should be between the minimum level mark ① and maximum level mark ②.

- If the engine oil is below the minimum level mark ②, add sufficient oil of the recommended type to raise it to the correct level.
- If the engine oil is above the maximum level mark ①, extract sufficient oil using an oil changer to lower it to the correct level.

NOTE: _____
If the oil temperature is low, the reading on the dipstick will be low, and if the temperature is high, the reading on the dipstick will be high.

SPECIFICATIONS

GENERAL SPECIFICATIONS

Item	Unit	Model
		FX140
Model code		
Hull		F1B
Engine/jet		60E
Dimensions		
Length	mm (in)	3,340 (131.5)
Width	mm (in)	1,230 (48.4)
Height	mm (in)	1,160 (45.7)
Dry weight	kg (lb)	362 (798)
Maximum capacity	Person/kg (lb)	3/240 (530)
Performance		
Maximum output	kW (PS) @ r/min	103 (140) @ 10,000
Maximum fuel consumption	l/h (US gal/h, Imp gal/h)	44 (11.6, 9.7)
Cruising range	h	1.59
Engine		
Engine type		4-stroke, DOHC
Displacement	cm ³ (cu. in)	998 (60.9)
Bore × stroke	mm (in)	74.0 × 58.0 (2.91 × 2.28)
Compression ratio		11.4:1
Exhaust system		Wet exhaust
Lubrication system		Dry sump
Cooling system		Water cooled
Starting system		Electric starter
Ignition system		TCI
Ignition timing	Degree	BTDC 35–ATDC 5
Spark plug model (manufacturer)		CR9EB (NGK)
Battery capacity	V/Ah	12/19
Generator output	A @ r/min	14–16 @ 6,000
Drive unit		
Propulsion system		Jet pump
Jet pump type		Axial flow, single stage
Impeller rotation (from rear)		Counterclockwise
Transmission		Direct drive from engine
Gear ratio		19/28 (0.68)
Jet thrust nozzle horizontal angle	Degree	24 + 24
Jet thrust nozzle trim angle	Degree	–10, –5, 0, 5, 10
Trim system		Manual 5 positions
Reverse system		Reverse gate

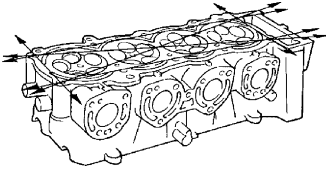
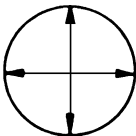
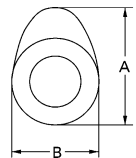
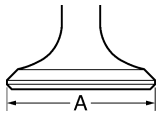
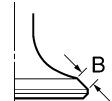
Item	Unit	Model
		FX140
Fuel and oil		
Fuel type		Regular unleaded gasoline
Minimum fuel rating	PON*	86
	RON*	90
Fuel tank capacity	l (US gal, Imp gal)	70 (18.5, 15.4)
Engine oil type		4-stroke motor oil
Engine oil grade	API	SE, SF, SG, SH, or SJ
	SAE	10W-30
Engine oil capacity	l (US qt, Imp qt)	4.3 (4.5, 3.8)
(without oil filter replacement)	l (US qt, Imp qt)	2.0 (2.1, 1.8)
(with oil filter replacement)	l (US qt, Imp qt)	2.2 (2.3, 1.9)

PON*: Pump Octane Number = (Motor Octane Number + Research Octane Number)/2

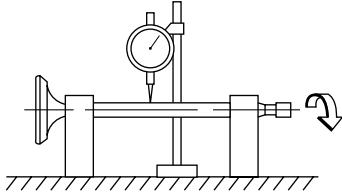
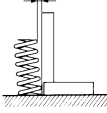
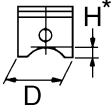
RON*: Research Octane Number

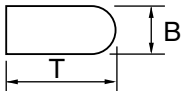
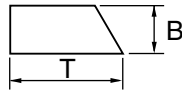
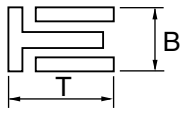
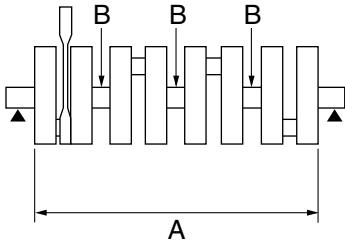
MAINTENANCE SPECIFICATIONS

ENGINE

Item	Unit	Model
		FX140
Cylinder head Warpage limit  Compression pressure*1	mm (in) kPa (kg/cm ² , psi)	0.1 (0.004) 1,350 (13.5, 192)
Cylinder Bore size Taper limit Out-of-round limit Wear limit 	mm (in) mm (in) mm (in) mm (in)	74.060–74.075 (2.9157–2.9163) 0.08 (0.003) 0.05 (0.002) 74.2 (2.9213)
Camshaft Drive system Intake (A) Exhaust (A) Intake and exhaust (B) Camshaft cap inside diameter Camshaft journal diameter Camshaft-journal-to-camshaft-cap clearance Max.camshaft runout 	mm (in) mm (in) mm (in) mm (in) mm (in) mm (in) mm (in)	Chain drive 32.25 (1.270) 32.65 (1.285) 25.00 (0.984) 24.5 (0.9646) 24.44–24.45 (0.9622–0.9626) 0.05–0.06 (0.0020–0.0024) 0.03 (0.0012)
Timing chain Model/number of links		DID SCR-0412SV/130
Valves, valve seats, valve guides Valve clearance (cold) Intake Exhaust Valve dimensions Valve head diameter A Intake Exhaust Valve face width B Intake Exhaust  	mm (in) mm (in) mm (in) mm (in) mm (in) mm (in)	0.11–0.20 (0.0043–0.0079) 0.25–0.34 (0.0098–0.0134) 22.9–23.1 (0.9016–0.9094) 24.4–24.6 (0.9606–0.9685) 1.76–2.90 (0.0693–0.1142) 1.76–2.90 (0.0693–0.1142)

*1: At 760 mmHg and 20 °C (68 °F)

Item	Unit	Model
		FX140
Valve seat width C Intake Exhaust Valve margin thickness D Intake Exhaust Valve stem diameter Intake Exhaust Valve guide inside diameter Intake Exhaust Valve-stem-to-valve-guide clearance Intake Exhaust Valve stem runout 	mm (in) mm (in) mm (in) mm (in) mm (in) mm (in) mm (in) mm (in) mm (in) mm (in) mm (in) mm (in)	0.9–1.1 (0.0354–0.0433) 0.9–1.1 (0.0354–0.0433) 0.5–0.9 (0.0197–0.0354) 0.5–0.9 (0.0197–0.0354) 3.975–3.990 (0.1565–0.1571) 4.460–4.475 (0.1756–0.1762) 4.000–4.012 (0.1575–0.1580) 4.500–4.512 (0.1772–0.1776) 0.010–0.037 (0.0004–0.0015) 0.025–0.052 (0.0010–0.0020) 0.01 (0.0004)
Valve spring Free length Intake Exhaust Installed length Intake Exhaust Spring limit Intake Exhaust 	mm (in) mm (in) mm (in) mm (in) Degree/mm (in) Degree/mm (in)	38.90 (1.53) 40.67 (1.60) 34.50 (1.36) 35.00 (1.38) 2.5/1.7 (0.067) 2.5/1.8 (0.071)
Piston Piston-to-cylinder clearance Piston diameter Measuring point H* Wear limit Piston pin boss inside diameter 	mm (in) mm (in) mm (in) mm (in) mm (in)	0.10–0.11 (0.0039–0.0043) 73.955–73.970 (2.9116–2.9121) 5 (0.2) 0.17 (0.0067) 17.002–17.013 (0.6693–0.6698)
Piston pins Outside diameter Wear limit	mm (in) mm (in)	16.991–17.000 (0.6689–0.6693) 16.971 (0.6681)

Item	Unit	Model
		FX140
Piston ring Top ring  Type Dimension (B × T) End gap (installed) Ring groove clearance 2nd ring  Type Dimensions (B × T) End gap (installed) Ring groove clearance Oil ring  Dimensions (B × T) End gap (installed) Ring groove clearance	mm (in) mm (in) mm (in) mm (in) mm (in) mm (in) mm (in) mm (in) mm (in) mm (in)	Barrel 0.90 × 2.75 (0.04 × 0.11) 0.19–0.31 (0.0075–0.0122) 0.030–0.065 (0.0012–0.0026) Taper 0.80 × 2.80 (0.03 × 0.11) 0.30–0.45 (0.0118–0.0177) 0.020–0.055 (0.0008–0.0022) 1.50 × 2.60 (0.06 × 0.10) 0.10–0.35 (0.0039–0.0138) 0.040–0.160 (0.0016–0.0063)
Connecting rod Big end oil clearance Bearing color code Small end inside diameter	mm (in) mm (in)	0.016–0.040 (0.0006–0.0016) 1. Brown 2. Black 3. Blue 4. Green 17.005–17.018 (0.6694–0.6699)
Crankshaft  Crank width A Deflection limit B Crankshaft journal oil clearance Bearing color code	mm (in) mm (in) mm (in)	304.8–306.0 (12.00–12.05) 0.03 (0.0012) 0.020–0.057 (0.0008–0.0022) 1. Brown 2. Black 3. Blue 4. Green 5. Yellow
Throttle body Type/quantity Manufacturer ID mark Trolling speed	r/min	40EIS/4 Mikuni 60E00 1,600–1,800

Item	Unit	Model
		FX140
Fuel pump		
Pump type		Electrical
Output pressure	kPa (psi)	320.8–327.2 (45.6–46.5)
Oil filter		
Oil filter type		Cartridge type
Oil pump		
Oil pump type		Trochoid
Rotor tip clearance	mm (in)	0.09–0.15 (0.004–0.006)
Oil pump housing clearance		
Rotor (feed pump)	mm (in)	0.09–0.17 (0.0035–0.0067)
Rotor (scavenge pump)	mm (in)	0.09–0.19 (0.0035–0.0075)

JET PUMP UNIT

Item	Unit	Model
		FX140
Jet pump		
Impeller material		Stainless steel
Number of impeller blades		3
Impeller pitch angle	Degree	16.3
Impeller clearance	mm (in)	0.35–0.45 (0.01384–0.0177)
Impeller clearance limit	mm (in)	0.6 (0.0236)
Drive shaft runout limit	mm (in)	0.3 (0.0118)
Nozzle diameter	mm (in)	86.5–87.1 (3.41–3.43)

HULL AND HOOD

Item	Unit	Model
		FX140
Free play		
Throttle lever free play	mm (in)	4–7 (0.16–0.28)

ELECTRICAL













Item	Unit	Model
		FX140
Battery Type Capacity	V/Ah	Fluid 12/19
ECM unit (B/R – Ground for cylinder #1 and #4) (B/W – Ground for cylinder #2 and #3) Output peak voltage lower limit @cranking @2,000 r/min @3,500 r/min	V V V	7 258 258
Stator Pulser coil (W – B, R – B) Output peak voltage @cranking 1 @cranking 2 @2,000 r/min @3,500 r/min Lighting coil (G – G) Output peak voltage @cranking 1 @cranking 2 @2,000 r/min @3,500 r/min Pulser coil resistance Pulser coil resistance 2 Lighting coil resistance Minimum charging current	V V V V V V V V Ω (color) Ω (color) Ω (color) A @ r/min	4 4 23 38 9 8 11 12 459–561 (W – B, R – B) 459–561 (W – B, R – B) 0.54–0.66 (G – G) 14 @ 6,000
Ignition coil Minimum spark gap Primary coil resistance Secondary coil resistance Spark plug lead resistance #1 #2 #3 #4	mm (in) Ω (color) kΩ kΩ kΩ kΩ	7–8 (0.28–0.31) 1.53–2.07 (B/W – R) 12.5–16.9 6.4–14.9 5.9–13.8 4.7–11.1 4.4–10.5












Cranking 1: unloaded



















Cranking 2: loaded

Item	Unit	Model
		FX140
Rectifier/regulator (R – B) Output peak voltage (loaded) @3,500 r/min	V	14.5
Starter motor Type		Constant mesh
Output	kW	0.8
Rating	Seconds	30
Brush length	mm (in)	12.5 (0.49)
Wear limit	mm (in)	6.5 (0.26)
Commutator undercut	mm (in)	0.7 (0.03)
Limit	mm (in)	0.2 (0.01)
Commutator diameter	mm (in)	28.0 (1.10)
Limit	mm (in)	27.0 (1.06)
Starter relay Rating	Seconds	30
Thermoswitch ON temperature (Engine)	°C (°F)	84–90 (183–194)
OFF temperature (Engine)	°C (°F)	70–84 (158–183)
ON temperature (Exhaust)	°C (°F)	94–100 (201–212)
OFF temperature (Exhaust)	°C (°F)	80–94 (176–201)
Engine temperature sensor Engine temperature sensor resistance (B/Y – B/Y) at 20 °C (68 °F)	kΩ	54.2–69.0
at 100 °C (212 °F)	kΩ	3.12–3.48
Intake air temperature sensor Intake air temperature sensor resistance at 0 °C (32 °F)	kΩ	5.4–6.6
at 80 °C (176 °F)	kΩ	0.29–0.39
Speed sensor Output voltage (on pulse)	V	11.6
Output pulse/one full turn		2
Fuse Rating Main	V/A	12/20
Multifunction meter	V/A	12/3
Electrical bilge pump	V/A	12/3




























TIGHTENING TORQUES SPECIFIED TORQUES










Part to tightened	Part name	Thread size	Q'ty	Tightening torque			Remarks	
				N•m	kgf•m	ft•lb		
Fuel system								
Retainer/fuel pump assembly – fuel tank	1st	Nut	—	9	3.2	0.32	2.3	
	2nd				6.4	0.64	4.6	
Fuel filler neck/rubber seal – deck	Nut	—	1	5.9	0.59	4.3		
Fuel tank belt/fuel tank – hull	Bolt	M8	4	16	1.6	11		
Air filter case cover – air filter case	Screw	M5	2	2.5	0.25	1.8		
Flame arrester – throttle bodies	1st	Bolt	M6	4	3.3	0.33	2.4	
	2nd				6.5	0.65	4.7	
Throttle cable holder – air filter case	1st	Bolt	M6	2	3.8	0.38	2.7	
	2nd				7.6	0.76	5.5	
Fuel hose holder – fuel hose bracket	1st	Bolt	M4	2	1.7	0.17	1.2	
	2nd				3.3	0.33	2.4	
Throttle bodies – throttle body joint	1st	Bolt	M8	8	11	1.1	8.0	
	2nd				22	2.2	16	
Air filter case – air filter case stay 1/ air filter case stay 2	1st	Bolt	M8	3	8.8	0.88	6.4	
	2nd				18	1.8	13	
Wire harness bracket 1/ wire harness – air filter case	1st	Bolt	M6	2	3.8	0.38	2.7	
	2nd				7.6	0.76	5.5	
Fuel hose bracket/wire harness bracket 2 – air filter case	1st	Bolt	M6	2	3.8	0.38	2.7	
	2nd				7.6	0.76	5.5	
Wire harness bracket 2 – air filter case	Screw	M5	1	2.5	0.25	1.8		
Air filter case stay 1 – exhaust pipe 3	1st	Bolt	M8	2	15	1.5	11	
	2nd				39	3.9	28	
Air filter case stay 2 – cylinder head	1st	Bolt	M8	1	15	1.5	11	
	2nd				39	3.9	28	
Fuel rail – throttle bodies	Screw	M6	3	5.0	0.5	3.6		
Intake air pressure sensor – bracket 1	Screw	M5	2	3.5	0.35	2.5		
Intake air temperature sensor – bracket 1	Nut	—	1	15	1.5	11		
Bracket 1 – fuel rail	Screw	M6	1	5.0	0.5	3.6		
Fuel pipe – fuel rail	Screw	M5	2	3.5	0.35	2.5		
Bracket 2 – fuel rail	Screw	M5	2	3.5	0.35	2.5		
Throttle stop guide – throttle bodies	Screw	M6	2	5.0	0.5	3.6		
Throttle stop screw bracket – throttle bodies	Screw	M6	2	5.0	0.5	3.6		
Throttle position sensor – throttle bodies	Screw	M4	2	2.0	0.2	1.4		















Part to tightened	Part name	Thread size	Q'ty	Tightening torque			Remarks	
				N•m	kgf•m	ft•lb		
Engine								
Engine unit – engine mount	Bolt	M8	4	17	1.7	12	 572	
Oil filter	—	—	1	17	1.7	12		
Coupling cover	Bolt	M6	1	7.9	0.79	5.7		
Thermoswitch (exhaust) – exhaust pipe 3	Bolt	M6	2	7.6	0.76	5.5	 572	
Outer exhaust joint clamp – exhaust pipe 3/exhaust pipe 2	1st	—	—	2	4.4	0.44	3.2	
	2nd				4.4	0.44	3.2	
Inner exhaust joint clamp – exhaust pipe 3/exhaust pipe 2	1st	—	—	2	4.4	0.44	3.2	
	2nd				4.4	0.44	3.2	
Exhaust pipe 3 – crankcase	1st	Bolt	M10	1	2.0	0.2	1.4	 242
	5th				15	1.5	11	
	9th				39	3.9	28	
	2nd	Bolt	M10	1	2.0	0.2	1.4	 242
	6th				15	1.5	11	
	10th				39	3.9	28	
	3rd	Bolt	M10	1	2.0	0.2	1.4	 242
	7th				15	1.5	11	
	11th				39	3.9	28	
	4th	Bolt	M10	1	2.0	0.2	1.4	 242
	8th				15	1.5	11	
	12th				39	3.9	28	
Exhaust pipe end – exhaust pipe 3	1st	Bolt	M6	4	3.7	0.37	2.7	 572
	2nd				7.6	0.76	5.5	
Exhaust pipe stay – crankcase	1st	Bolt	M8	2	15	1.5	11	 242
	2nd				42	4.2	30	
Exhaust pipe 1 – exhaust pipe stay	1st	Bolt	M10	1	15	1.5	11	 242
	2nd				42	4.2	30	
Exhaust pipe 2 – exhaust pipe 1	1st	Nut	—	1	39	3.9	28	
	6th				39	3.9	28	
	2nd	Nut	—	1	39	3.9	28	
	7th				39	3.9	28	
	3rd	Nut	—	1	39	3.9	28	
	8th				39	3.9	28	
	4th	Nut	—	1	39	3.9	28	
	9th				39	3.9	28	
	5th	Nut	—	1	39	3.9	28	
	10th				39	3.9	28	
Exhaust pipe 1 – exhaust manifold 1/ exhaust manifold 2	1st	Bolt	M8	10	22	2.2	16	 242
	2nd				22	2.2	16	
	3rd				35	3.5	25	




Part to tightened		Part name	Thread size	Q'ty	Tightening torque			Remarks
					N•m	kgf•m	ft•lb	
Exhaust manifold 1 – cylinder head	1st	Bolt	M8	6	22	2.2	16	
	2nd				22	2.2	16	
	3rd				35	3.5	25	
Exhaust manifold 2 – cylinder head	1st	Bolt	M8	5	22	2.2	16	
	2nd				22	2.2	16	
	3rd				35	3.5	25	
Water jacket – oil tank	1st	Bolt	M6	4	3.7	0.37	2.7	
	2nd				7.6	0.76	5.5	
Oil tank stay/reduction drive gear case – oil separator	1st	Bolt	M6	3	3.7	0.37	2.7	
	2nd				7.6	0.76	5.5	
Cover (ground lead) – oil tank		Bolt	M6	3	7.6	0.76	5.5	
Ground lead – oil tank		Bolt	M6	2	7.6	0.76	5.5	
Oil tank – reduction drive gear case	1st	Bolt	M8	4	2.0	0.2	1.4	
	2nd				15	1.5	11	
	3rd				28	2.8	20	
Oil tank – oil tank stay	1st	Nut	—	2	2.0	0.2	1.4	
	2nd				15	1.5	11	
	3rd				39	3.9	28	
Oil tank stay – cylinder head	1st	Bolt	M10	2	2.0	0.2	1.4	
	2nd				15	1.5	11	
	3rd				39	3.9	28	
Bracket (coupling cover) – oil tank	1st	Bolt	M6	2	3.7	0.37	2.7	
	2nd				7.6	0.76	5.5	
Hanger – oil tank cover	1st	Bolt	M6	4	3.7	0.37	2.7	
	2nd				7.6	0.76	5.5	
Oil tank cover – oil tank	1st	Bolt	M6	8	3.7	0.37	2.7	
	2nd				7.6	0.76	5.5	
Oil breather plate 1/ oil breather plate 2 – oil tank cover	1st	Bolt	M5	10	1.9	0.19	1.4	
	2nd				4.4	0.44	3.2	
Baffle plate – oil tank	1st	Bolt	M5	3	1.9	0.19	1.4	
	2nd				4.4	0.44	3.2	
Oil strainer – oil tank	1st	Bolt	M6	2	3.7	0.37	2.7	
	2nd				7.6	0.76	5.5	
Oil cooler cover – oil tank	1st	Bolt	M6	24	3.7	0.37	2.7	
	2nd				7.6	0.76	5.5	
Oil pump assembly – reduction drive gear case	1st	Bolt	M6	12	1.4	0.14	1.0	
	2nd				10	1.0	7.2	
Drain plug (engine oil)		Bolt	M8	1	7.9	0.79	5.7	
Oil pump housing cover 1/oil pump housing – oil pump housing cover 2		Bolt	M6	2	7.9	0.79	5.7	
Drive coupling – drive shaft		—	—	1	28	2.8	20	

Part to tightened		Part name	Thread size	Q'ty	Tightening torque			Remarks
					N•m	kgf•m	ft•lb	
Reduction drive gear case – crankcase	1st	Bolt	M6	2	3.7	0.37	2.7	
	2nd				7.6	0.76	5.5	
	1st	Bolt	M8	7	15	1.5	11	
	2nd				28	2.8	20	
Holder (relief valve) – reduction drive gear case		Bolt	M6	1	10	1.0	7.2	
Bearing housing – reduction drive gear case	1st	Bolt	M8	4	15	1.5	11	
	2nd				28	2.8	20	
Battery negative lead – starter motor		Nut	—	1	18	1.8	13	
Starter motor lead – starter motor		Bolt	M8	1	4.9	0.49	3.5	
Starter motor – crankcase		Bolt	M8	1	18	1.8	13	
Generator cover – crankcase	1st	Bolt	M10	8	15	1.5	11	
	2nd				50	5.0	36	
Rotor – crankshaft		Bolt	M10	1	75	7.5	54	
Rotor – starter clutch		Bolt	M6	6	24	2.4	17	
Washer/pulser coil lead and lighting coil lead – generator		Bolt	M5	3	4.9	0.49	3.5	
Pulser coil – generator cover		Bolt	M5	4	4.9	0.49	3.5	
Holder (wire harness) – generator cover		Bolt	M6	2	14	1.4	10	
Lighting coil – generator cover		Bolt	M6	3	14	1.4	10	
Spark plug		—	—	4	13	1.3	9.4	
Camshaft position sensor		Bolt	M6	1	10	1.0	7.2	
Cooling water pipe – cylinder	1st	Bolt	M6	1	3.7	0.37	2.7	
	2nd				7.6	0.76	5.5	
Cylinder head cover – cylinder head		Bolt	M6	6	12	1.2	8.7	
Timing chain tensioner cap bolt		Bolt	M6	1	10	1.0	7.2	
Timing chain tensioner – cylinder head		Bolt	M6	2	10	1.0	7.2	
Exhaust camshaft cap – cylinder head		Bolt	M6	10	10	1.0	7.2	
Intake camshaft cap – cylinder head		Bolt	M6	18	10	1.0	7.2	
Exhaust camshaft sprocket – exhaust camshaft		Bolt	M7	2	24	2.4	17	
Intake camshaft sprocket – intake camshaft		Bolt	M7	2	24	2.4	17	
Hanger – cylinder head		Bolt	M8	2	40	4.0	29	
Cylinder head – crankcase		Bolt	M6	3	10	1.0	7.2	
	1st	Nut	—	2	20	2.0	14	
	2nd				64	6.4	46	
	1st	Nut	—	8	20	2.0	14	
2nd	49				4.9	35		
Plug (vacuum pressure)		Bolt	M6	4	10	1.0	7.2	

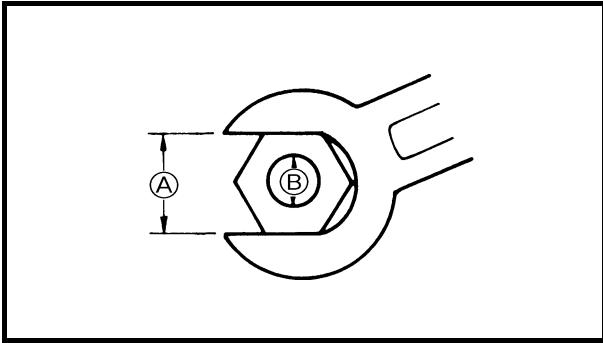
Part to tightened	Part name	Thread size	Q'ty	Tightening torque			Remarks	
				N•m	kgf•m	ft•lb		
Engine temperature sensor – crankcase	—	—	1	15	1.5	11		
Thermoswitch (engine) – crankcase	Bolt	M6	2	7.6	0.76	5.5	 572	
Oil pressure switch	—	—	1	8.4	0.84	6.1	 572	
Anode cover – anode	Bolt	M6	1	12	1.2	8.7	 571	
Anode cover – cylinder head	Bolt	M8	1	20	2.0	14		
Oil pan – lower crankcase	Bolt	M6	13	12	1.2	8.7	 572	
Lower crankcase – upper crankcase	Bolt	M6	10	12	1.2	8.7	 572	
	1st	Bolt	M9	10	7.8	0.78	5.6	 E
	2nd				15	1.5	11	
	3rd				49°			
Oil pipe – lower crankcase	Bolt	M6	1	12	1.2	8.7	 E	
Cover – lower crankcase	Screw	M6	2	12	1.2	8.7	 572	
Oil filter bolt – lower crankcase	—	—	1	35	3.5	25	 E	
Connecting rod cap	1st	Nut	—	8	20	2.0	14	
	2nd				120°			
Thermostat housing cover – Thermostat housing	1st	Bolt	M6	2	3.7	0.37	2.7	 572
	2nd				7.6	0.76	5.5	
Pressure control valve – upper crankcase	1st	Bolt	M6	3	3.7	0.37	2.7	 572
	2nd				7.6	0.76	5.5	
Collar/pressure control valve housing cover – pressure control housing	1st	Bolt	M6	2	3.7	0.37	2.7	 572
	2nd				7.6	0.76	5.5	
Jet pump unit								
Steering cable joint – jet thrust nozzle	Nut	—	1	6.8	0.68	4.9	 242	
Ride plate – hull	Bolt	M8	4	17	1.7	12	 572	
Intake duct – hull	Bolt	M8	4	20	2.0	14	 242	
Intake grate – hull	Bolt	M6	4	7.8	0.78	5.6	 242	
Speed sensor – ride plate	Screw	M5	4	3.7	0.37	2.7	 242	
Jet pump unit assembly/impeller housing 2 – transom	Bolt	M10	4	40	4.0	29	 572	
	Bolt	M6	1	7.8	0.78	5.6		
Rubber plate – bracket	Bolt	M6	2	6.8	0.68	4.9		
Roller – reverse gate stay	Bolt	M8	1	8.3	0.83	6.0	 271	
	Nut	—	1	26	2.6	19		
Reverse gate stay – jet pump	Bolt	M6	6	7.8	0.78	5.6	 242	
Reverse gate – reverse gate stay	Bolt	M8	2	20	2.0	14	 242	
Lever 1 – Reverse gate stay	Bolt	M6	1	7.8	0.78	5.6	 242	
Lever 2– Reverse gate stay	Nut	—	1	7.8	0.78	5.6	 242	
Nozzle ring – nozzle	Bolt	M8	2	15	1.5	11	 271	
Jet thrust nozzle – nozzle ring	Bolt	M8	2	15	1.5	11	 271	
Nozzle/impeller duct assembly – impeller housing 1	Bolt	M10	4	40	4.0	29	 572	
Water inlet cover/water inlet strainer – impeller duct	Bolt	M6	4	6.6	0.66	4.8	 572	

Part to tightened	Part name	Thread size	Q'ty	Tightening torque			Remarks
				N•m	kgf•m	ft•lb	
Drive shaft nut – drive shaft	Nut	—	1	69	6.9	50	
Impeller (left-hand threads) – drive shaft	Impeller	M22	1	27	2.7	19	 572
Transom plate – hull	Nut	—	4	26	2.6	19	
Bilge strainer holder – bulkhead	Screw	M5	1	3.7	0.37	2.8	
Intermediate housing – bulkhead	Bolt	M8	3	17	1.7	12	 572
Driven coupling – shaft	Driven coupling	M24	1	36	3.6	25	 572
Grease nipple – intermediate housing	Nipple	—	1	5.4	0.54	3.9	 572
Hull and hood							
Handlebar holder – steering master	Bolt	M8	4	20	2.0	14	 242
Handlebar cover stay – steering master	Bolt	M6	2	1.1	0.11	0.8	 271
Handlebar cover – handlebar cover stay	Screw	M6	4	1.1	0.11	0.8	 242
Handle boss cover – steering master	Screw	M6	4	0.9	0.09	0.7	 242
QSTS converter – hull	Nut	—	2	5.4	0.54	3.9	
Throttle lever assembly – handlebar	Screw	M5	2	3	0.3	2.2	
Handlebar switch assembly – handlebar	Screw	M5	2	3.4	0.34	2.5	
QSTS grip assembly – handlebar	Screw	M6	1	3.4	0.34	2.5	
Grip end – handlebar	Bolt	M5	2	1.2	0.12	0.9	 242
Cable housing – QSTS grip assembly	Screw	M4	1	1	0.1	0.7	
Steering master – deck	Nut	—	4	20	2.0	14	
Steering cable ball joint – steering arm	Nut	—	1	6.8	0.68	4.9	
QSTS cable locknut (QSTS converter side)	Nut	—	1	3	0.3	2.2	
QSTS cable locknut (nozzle ring side)	Nut	—	1	3.8	0.38	2.7	
QSTS cable grommet – hull	Nut	—	1	5.9	0.59	4.3	
QSTS cable end pin – QSTS converter	Nut	—	1	3.8	0.38	2.7	
Shift cable locknut (reverse gate side)	Nut	—	1	2.9	0.29	2.1	
Shift cable grommet – hull	Nut	—	1	5.9	0.59	4.3	
Shift cable holder – shift lever base	Nut	—	2	5.4	0.54	3.9	
Steering cable locknut (steering arm side)	Nut	—	1	6.4	0.64	4.6	
Steering cable locknut (jet thrust nozzle side)	Nut	—	1	6.5	0.65	4.7	
Steering cable grommet – hull	Nut	—	1	5.9	0.59	4.3	

Part to tightened	Part name	Thread size	Q'ty	Tightening torque			Remarks	
				N•m	kgf•m	ft•lb		
Steering cable bracket – steering cable holder	Nut	—	2	5.4	0.54	3.9		
Steering cable bracket – deck	Nut	—	2	5.4	0.54	3.9		
Speed sensor lead grommet – hull	Nut	—	1	5.9	0.59	4.3		
Front hood assembly – deck	Nut	—	4	5.4	0.54	3.9		
Service lid 1 – deck	Bolt	M6	4	5.4	0.54	3.9	 271	
Service lid 2– deck	Screw	M4	4	1.5	0.15	1.1		
Panel – steering console cover	Bolt	M5	4	3.9	0.39	2.8	 242	
Multifunction meter – steering console cover	Bolt	M5	4	3.9	0.39	2.8	 242	
Mirror – steering console cover	Nut	—	4	6.9	0.69	5.0		
Side cover – deck	Bolt	M6	8	5.4	0.54	3.9	 271	
Bracket (side cover) – deck	Bolt	M6	4	5.4	0.54	3.9		
Steering console cover – glove box	Bolt	M6	2	5.4	0.54	3.9	 242	
Hood lock assembly	Bolt	M6	2	5.4	0.54	3.9		
Steering console cover – deck	Nut	—	2	5.4	0.54	3.9		
Glove box – deck	Nut	—	2	20	2.0	14		
Shift lever handle – shift lever	Bolt	M6	2	5.4	0.54	3.9	 271	
Latch – glove box	Screw	M6	2	5.4	0.54	3.9	 271	
Pilot water outlet – hull	Nut	—	1	4.2	0.42	3.0		
Shift lever plate – deck	Screw	M6	3	5.4	0.54	3.9		
Shift lever plate – deck/shift lever base assembly	Screw	M6	3	5.4	0.54	3.9	 242	
Shift lever – base assembly	Bolt	M6	1	5.4	0.54	3.9	 271	
Hand grip – deck	Nut	—	4	5.2	0.52	3.8		
Front seat stay – deck	Nut	—	2	15	1.5	11		
Seat lock notch – deck beam	Nut	—	1	26	2.6	19		
Seat lock notch – deck	Nut	—	1	26	2.6	19		
Rear seat stay – deck	Nut	—	4	5.2	0.52	3.8		
Seat lock assembly – seat	Bolt	M6	4	6.4	0.64	4.6	 271	
Deck beam – deck	Nut	—	4	18	1.8	13		
Plate/rubber hose/exhaust valve – hull	Nut	—	6	5.4	0.54	3.9		
Exhaust joint protector 1 – Exhaust joint protector 2	1st	Bolt	M6	6	3.7	0.37	2.7	 572
	2nd				12	1.2	8.8	
Sponson – hull	Bolt	M8	10	16	1.6	12		
Cleat – deck	Nut	—	2	15	1.5	11		
Cleat – hull	Nut	—	4	15	1.5	11		
Spout – hull	Nut	—	1	5.4	0.54	3.9		
Protector (bow) – hull	Bolt	M6	4	5.4	0.54	3.9	 271	
	Nut	—	3	5.4	0.54	3.9		
Drain plug/packing – hull	Bolt	M5	4	2.0	0.2	1.4		
Engine mount – hull	Bolt	M8	8	17	1.7	12	 572	
Engine damper – hull	Bolt	M6	4	6.4	0.64	4.6	 271	

Part to tightened	Part name	Thread size	Q'ty	Tightening torque			Remarks
				N•m	kgf•m	ft•lb	
Electrical							
Battery box – hull	Bolt	M6	2	5.4	0.54	3.9	 572
Battery box/spacer – hull	Bolt	M6	2	5.4	0.54	3.9	 571
Electrical box – bulk head	Bolt	M8	4	17	1.7	12	 572
Terminal cover – electrical box	Tapping screw	M5	4	4.9	0.49	3.5	
Cover – electrical box	Tapping screw	ø5	18	4.9	0.49	3.5	
Starter motor lead– electrical box	Screw	M6	1	7.6	0.76	5.5	
Battery positive lead – electrical box	Screw	M6	1	7.6	0.76	5.5	
Fuse holder stay – electrical box	Tapping screw	ø6	1	3.9	0.39	2.8	
ECM – electrical box	Tapping screw	ø6	4	3.9	0.39	2.8	
Bracket (coupler) – electrical box	Tapping screw	ø6	1	3.9	0.39	2.8	
Lean angle cut-off switch – electrical box	Tapping screw	ø6	2	3.9	0.39	2.8	
Main and fuel pump relay	Tapping screw	ø6	1	3.9	0.39	2.8	
Rectifier/regulator	Tapping screw	ø6	2	3.9	0.39	2.8	
Ignition coil – oil tank	Tapping screw	ø6	3	7.6	0.76	5.5	
Ignition coil cover – ignition coil case	Tapping screw	ø6	10	4.9	0.49	3.5	
Ignition coil – ignition coil case	Tapping screw	ø6	4	4.9	0.49	3.5	

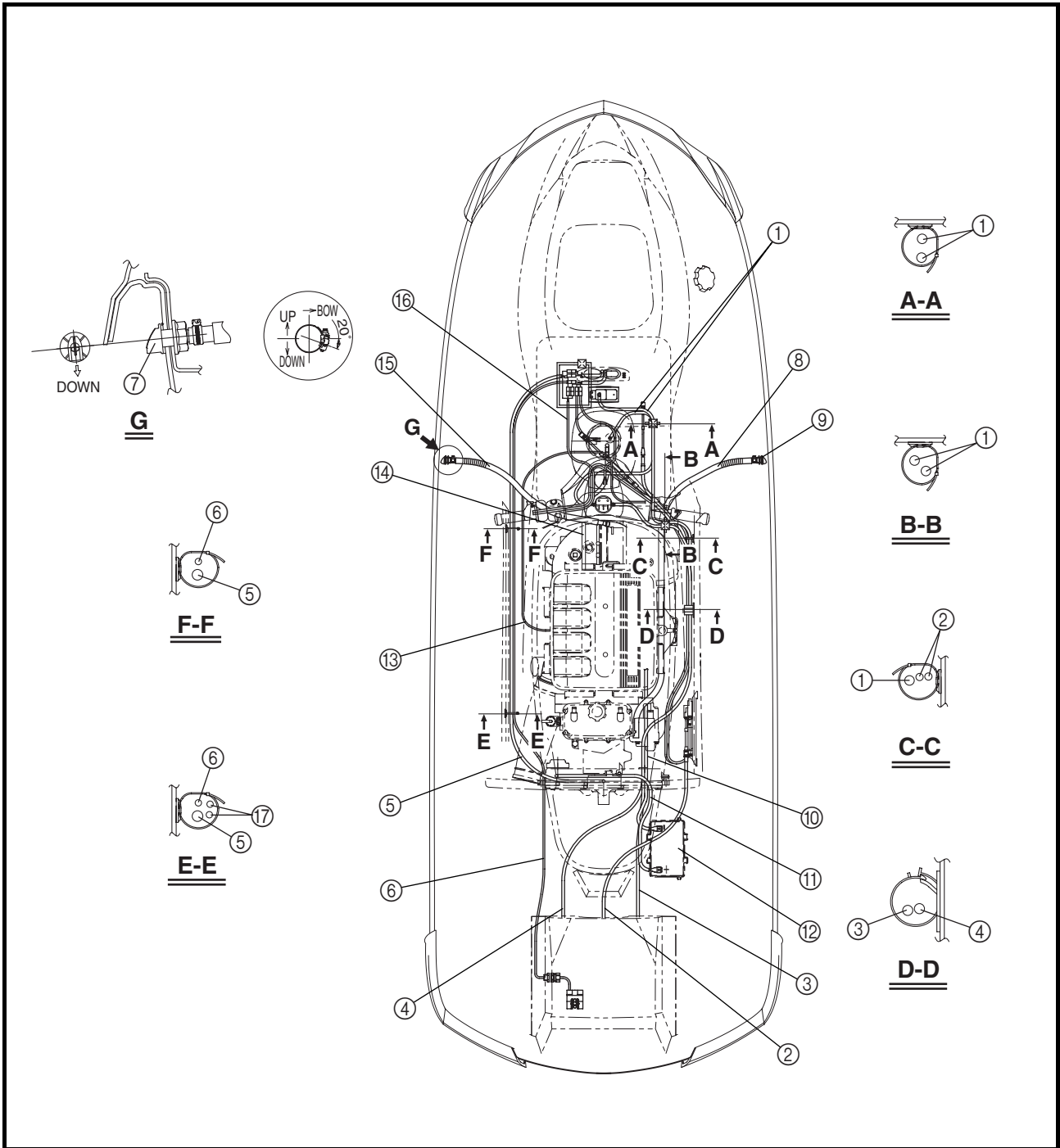
Nut (A)	Bolt (B)	General torque specifications		
		N•m	kgf•m	ft•lb
8 mm	M5	5.0	0.5	3.6
10 mm	M6	8.0	0.8	5.8
12 mm	M8	18	1.8	13
14 mm	M10	36	3.6	25
17 mm	M12	43	4.3	31



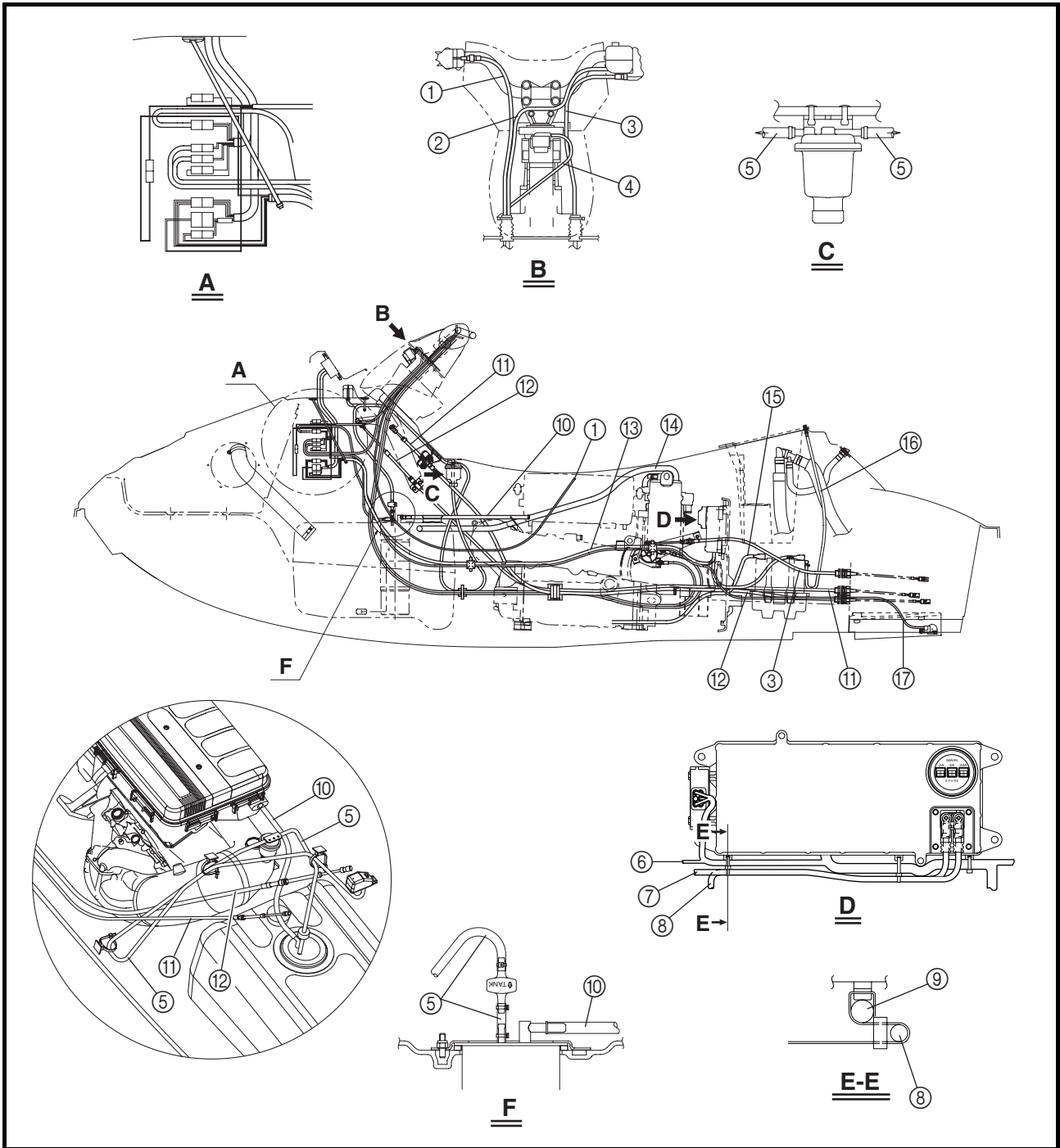
GENERAL TORQUE

This chart specifies tightening torques for standard fasteners with a standard ISO thread pitch. Tightening torque specifications for special components or assemblies are provided in applicable sections of this manual. To avoid warpage, tighten multi-fastener assemblies in a crisscross fashion and progressive stages until the specified tightening torque is reached. Unless otherwise specified, tightening torque specifications require clean, dry threads. Components should be at room temperature.

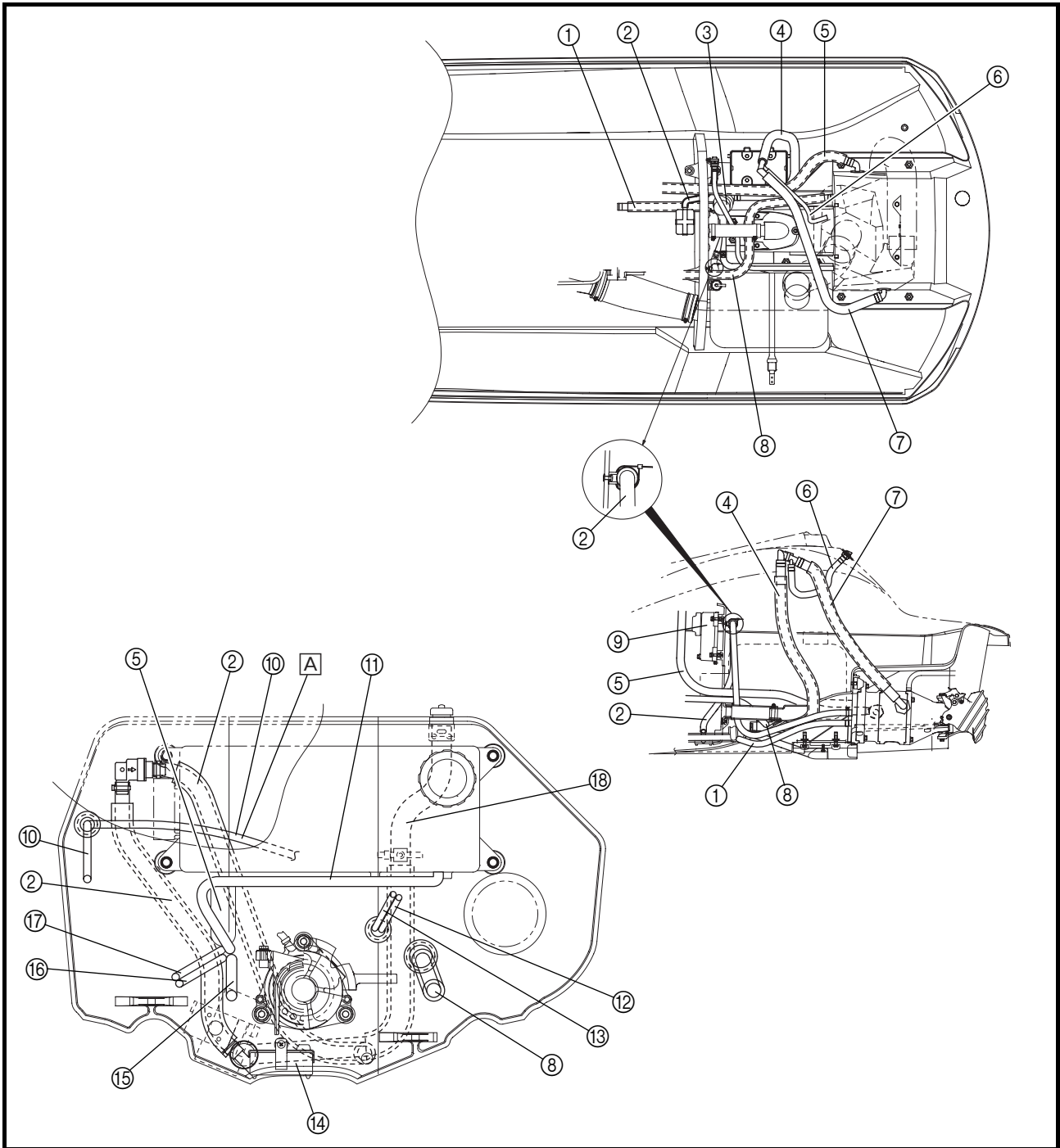
CABLE AND HOSE ROUTING



- | | |
|-----------------------------------|-----------------------------------|
| ① Fuel tank breather hose | ⑪ Battery positive lead |
| ② QSTS cable | ⑫ Battery |
| ③ Steering cable | ⑬ Throttle cable |
| ④ Shift cable | ⑭ Fuel hose |
| ⑤ Electrical box lead | ⑮ Cooling water pilot outlet hose |
| ⑥ Speed sensor lead | ⑯ Handlebar switch lead |
| ⑦ Cooling water pilot outlet | ⑰ Electrical bilge pump lead |
| ⑧ Cooling water pilot outlet hose | |
| ⑨ Cooling water pilot outlet | |
| ⑩ Battery negative lead | |



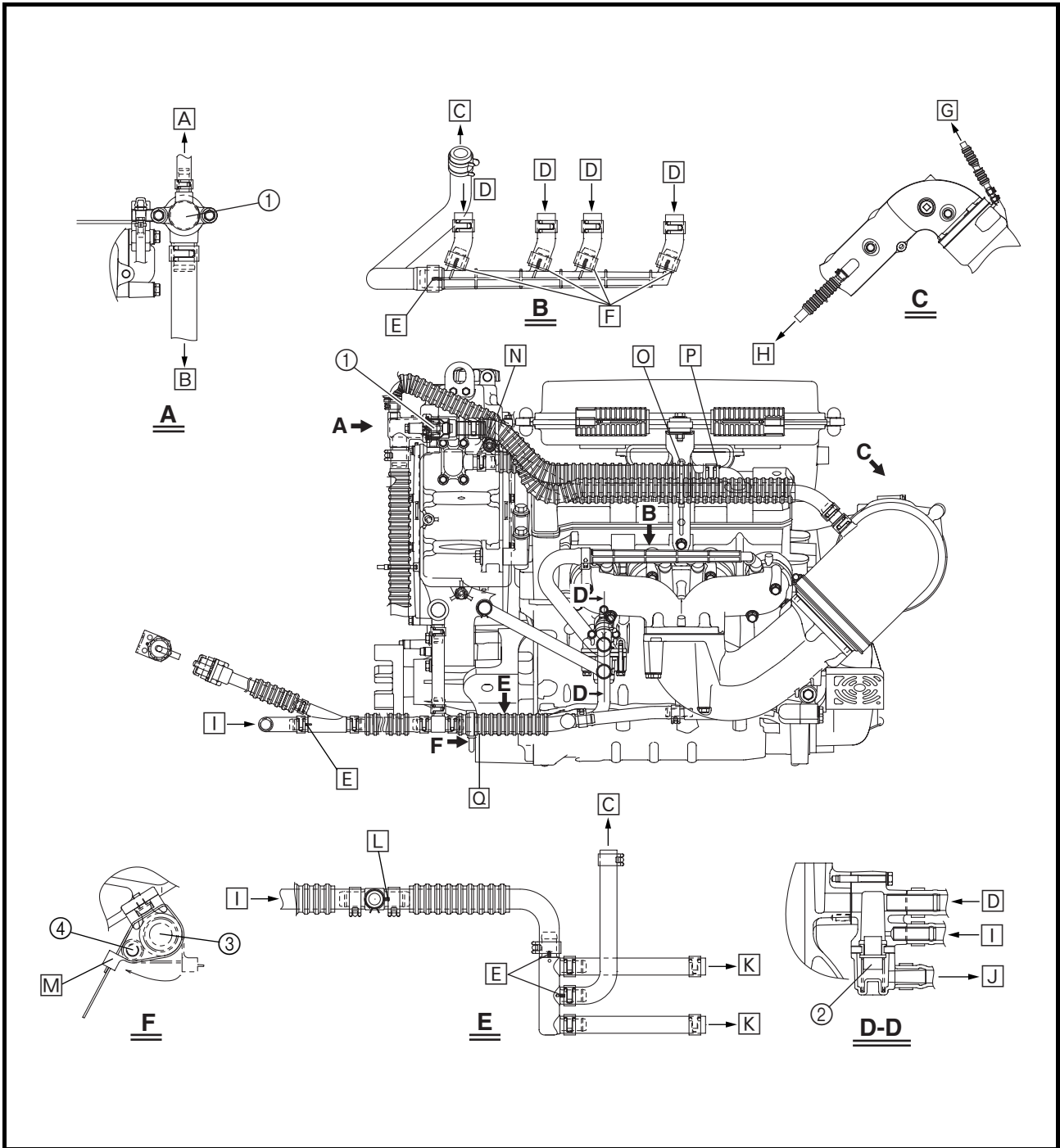
- | | |
|---------------------------|-----------------------------------|
| ① Throttle cable | ⑪ Shift cable |
| ② Handlebar switch lead | ⑫ Steering cable |
| ③ QSTS cable | ⑬ Electrical box lead |
| ④ Buzzer lead | ⑭ Cooling water pilot outlet hose |
| ⑤ Fuel tank breather hose | ⑮ Battery negative lead |
| ⑥ Ignition coil lead | ⑯ Battery breather hose |
| ⑦ Battery positive lead | ⑰ Speed sensor lead |
| ⑧ Starter motor lead | |
| ⑨ Wire harness | |
| ⑩ Fuel hose | |



- ① Cooling water hose (cooling water inlet)
- ② Bilge hose 1
- ③ Electric bilge pump
- ④ Bilge hose 4
- ⑤ Cooling water hose (from thermostat)
- ⑥ Bilge hose 3
- ⑦ Bilge hose 2
- ⑧ Cooling water hose (from exhaust pipe)
- ⑨ Electrical box
- ⑩ QSTS cable

- ⑪ Battery positive lead
- ⑫ Speed sensor lead
- ⑬ Electric bilge pump lead
- ⑭ Bilge strainer
- ⑮ Battery negative lead
- ⑯ Steering cable
- ⑰ Shift cable
- ⑱ Flushing hose

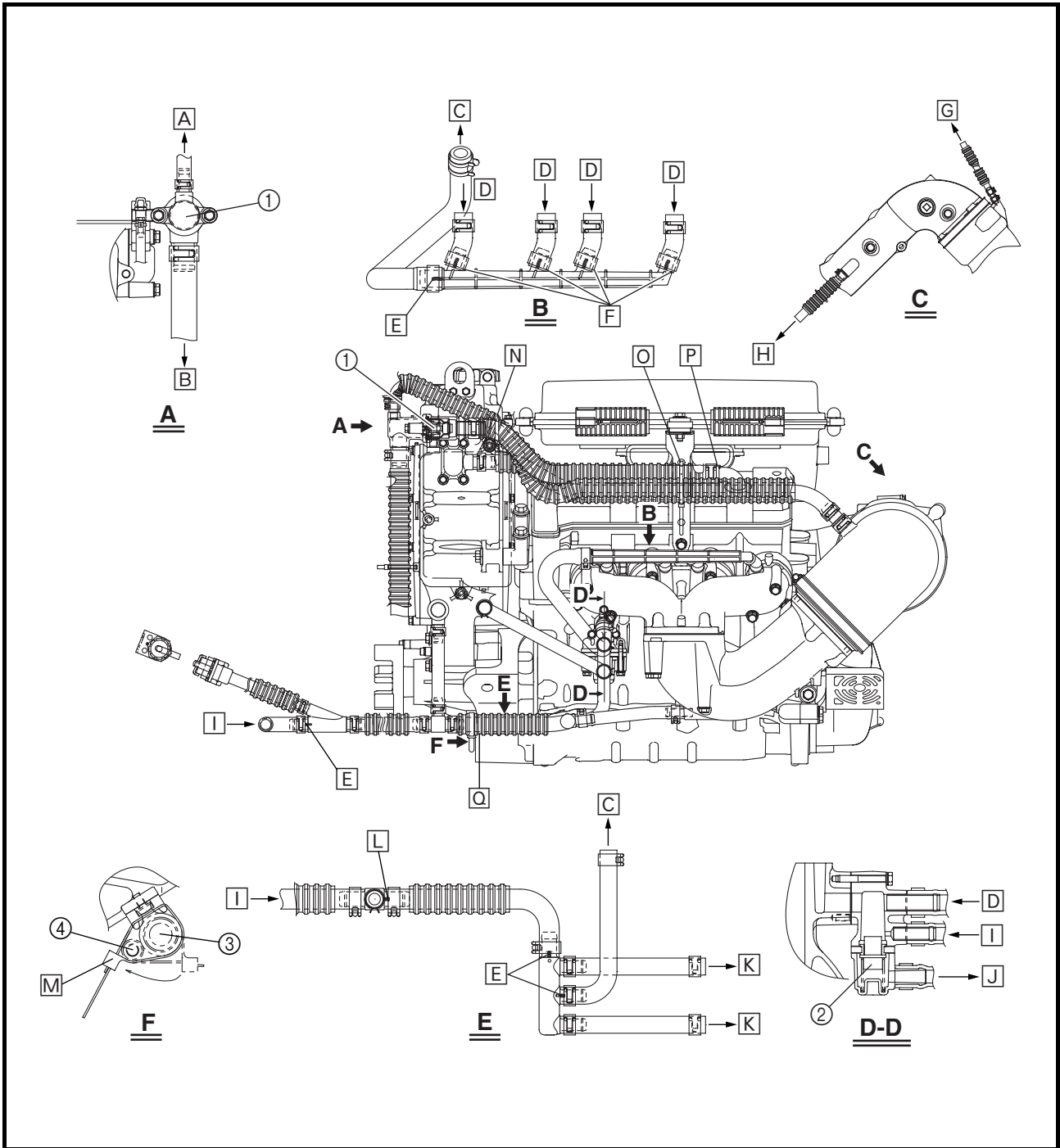
Ⓐ Pass the QSTS cable between in bilge hose.



- ① Thermostat
- ② Pressure control valve
- ③ Cooling water hose (cooling water inlet)
- ④ Battery negative lead

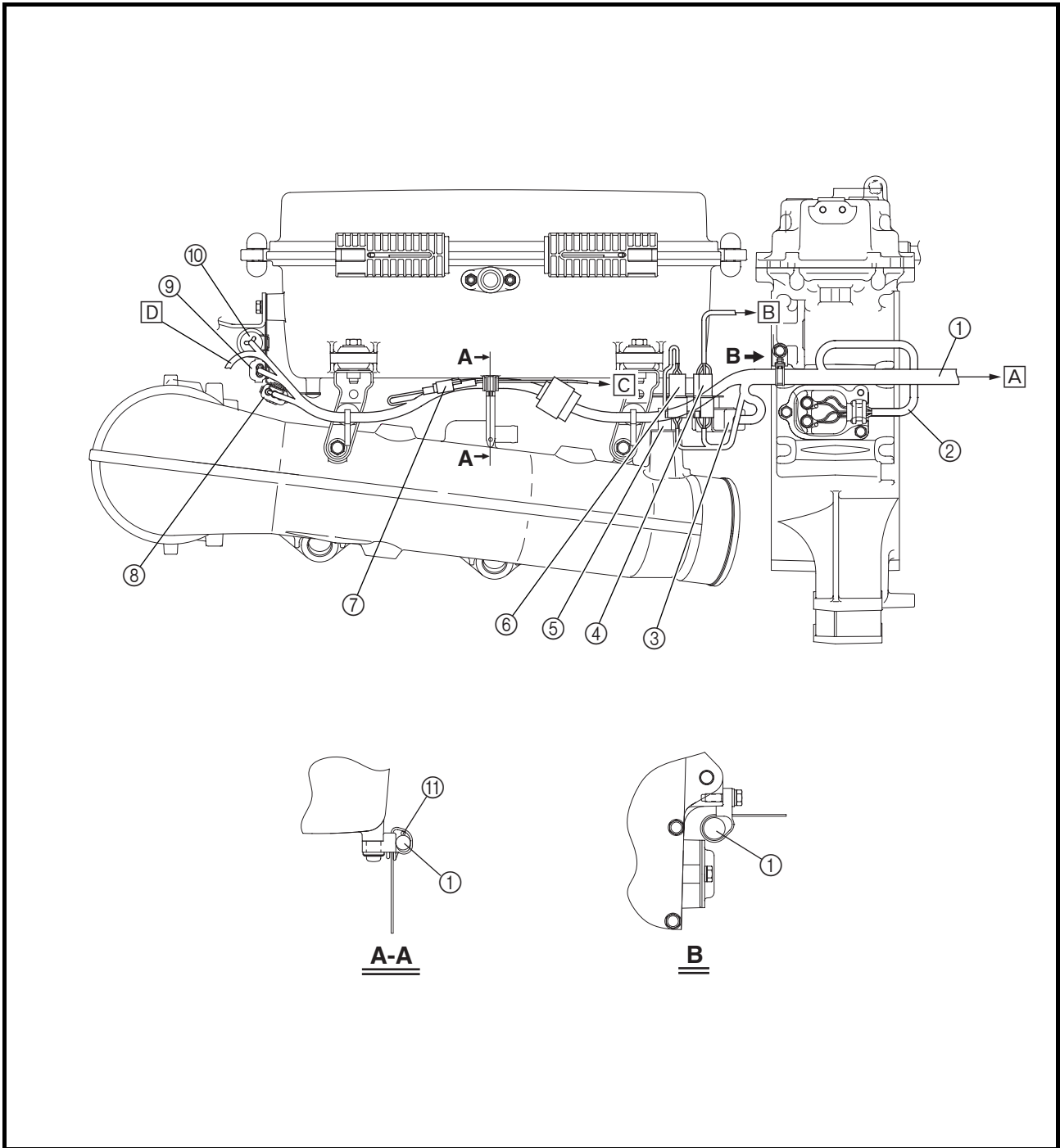
- A To cooling water pilot outlet on starboard side
- B To cooling water outlet on starboard side of stern
- C To pressure control valve
- D From exhaust manifold

- E To install the hose, align the white paint mark on the cooling water hose with the projection of hose joint.
- F Insert the cooling water hose until it contacts the joint.
- G To cooling water pilot outlet on port side
- H To cooling water outlet at stern
- I Cooling water inlet
- J To oil tank
- K To exhaust pipe

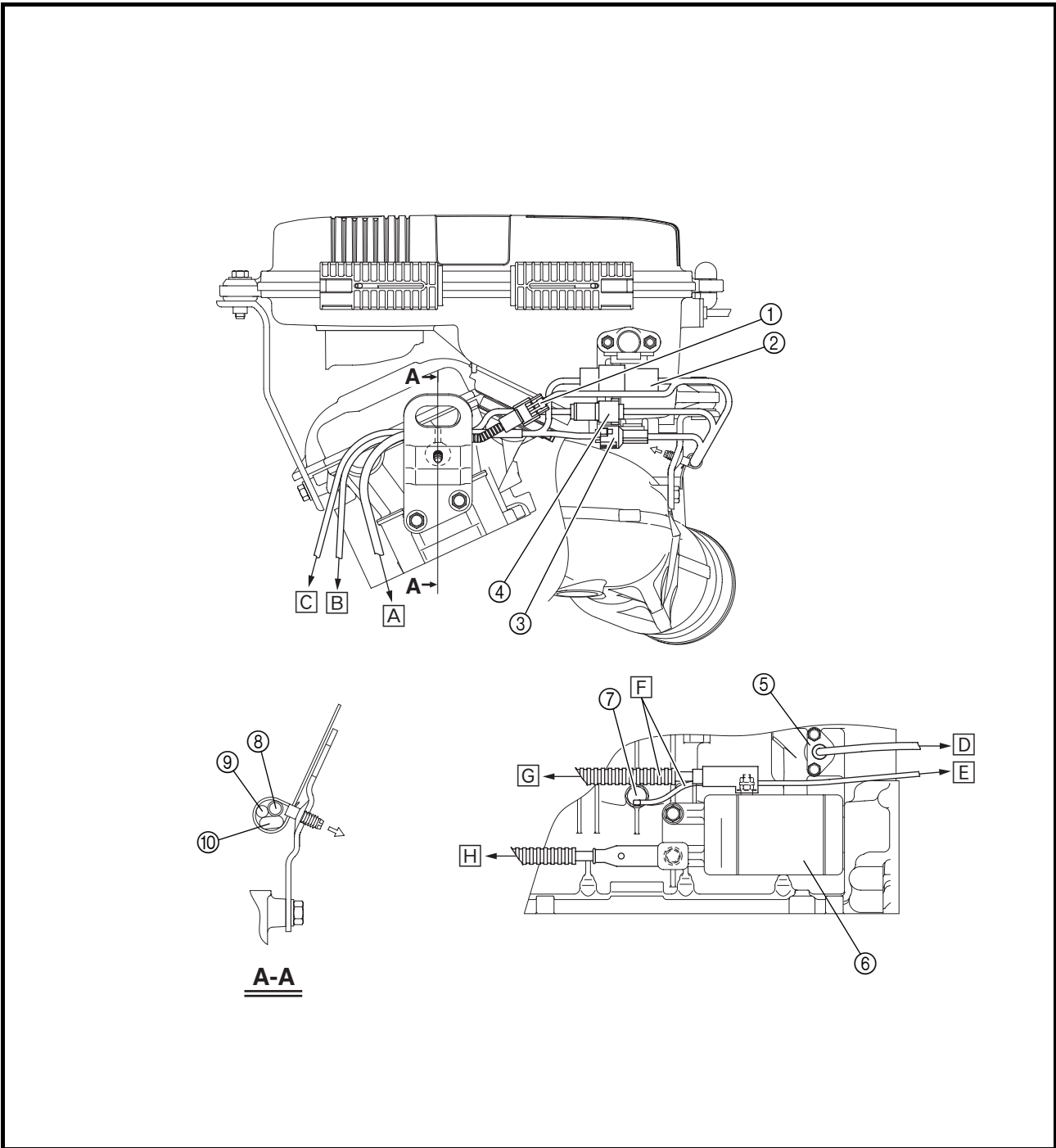


- L** To install the hose, align the white paint mark on the cooling water hose with the parting line on the hose joint.
- M** Fasten the cooling water hose and battery negative lead. Slide the tie in the direction shown.
- N** Bundle the cooling water pilot outlet hose and cooling water hose, and then fasten them together with the oil tank boss with a plastic locking tie.

- O** Bundle the cooling water pilot outlet hose and the cooling water hoses, pass a plastic locking tie through the stay hole, and then fasten the tie.
- P** Insert the cooling water hose to the paint mark.
- Q** Fasten the cooling water hose tube contacting the hose joint.



- | | |
|----------------------------------|--------------------------------|
| ① Wire harness | ⑪ Oil pressure switch lead |
| ② Ground lead | Ⓐ To electrical box |
| ③ Wire harness coupler | Ⓑ To cam position sensor |
| ④ Cam position sensor coupler | Ⓒ To oil pressure switch |
| ⑤ Thermoswitch (exhaust) | Ⓓ To engine temperature sensor |
| ⑥ Thermoswitch (exhaust) coupler | |
| ⑦ Oil pressure switch coupler | |
| ⑧ Pulser coil coupler | |
| ⑨ Thermoswitch (engine) coupler | |
| ⑩ Lighting coil coupler | |



- ① Engine temperature sensor coupler
- ② Lighting coil coupler
- ③ Pulser coil coupler
- ④ Thermoswitch (engine) coupler
- ⑤ Thermoswitch (engine)
- ⑥ Starter motor
- ⑦ Engine temperature sensor
- ⑧ Engine temperature sensor lead
- ⑨ Thermoswitch (engine) lead
- ⑩ Lighting coil lead

- [A] To generator
- [B] To engine temperature sensor
- [C] To thermoswitch (engine)
- [D] To thermoswitch (engine) coupler
- [E] To engine temperature sensor coupler
- [F] Route the starter motor lead to the outside of the engine temperature sensor.
- [G] To starter relay
- [H] To battery negative terminal

WIRING DIAGRAM

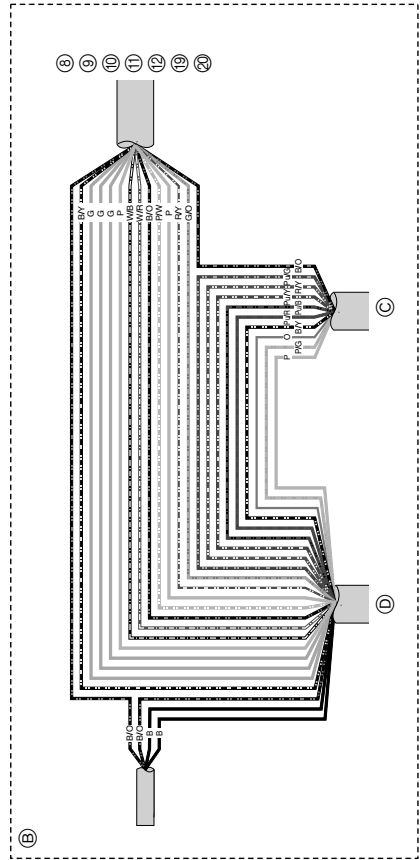
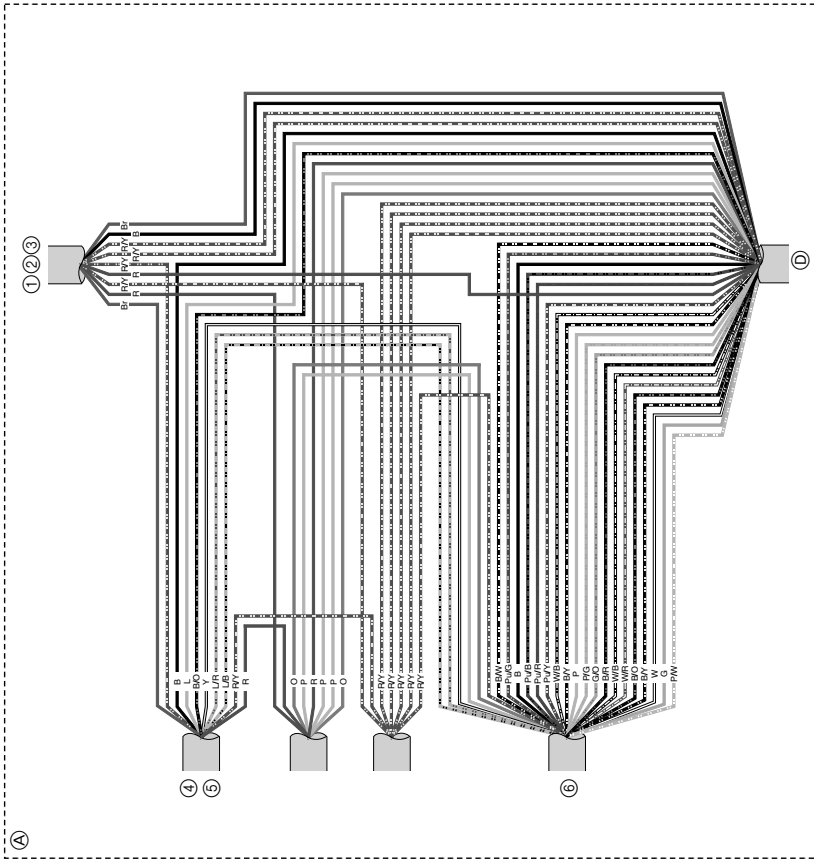
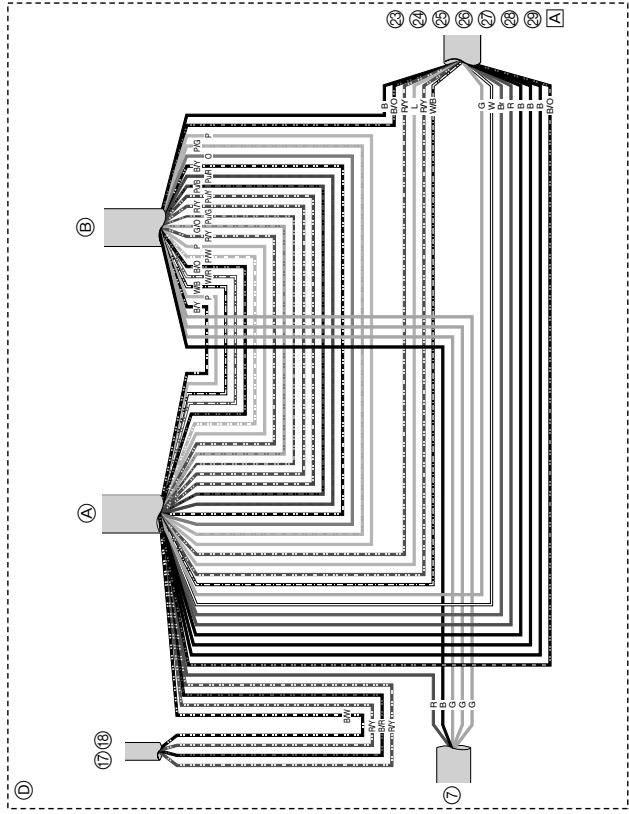
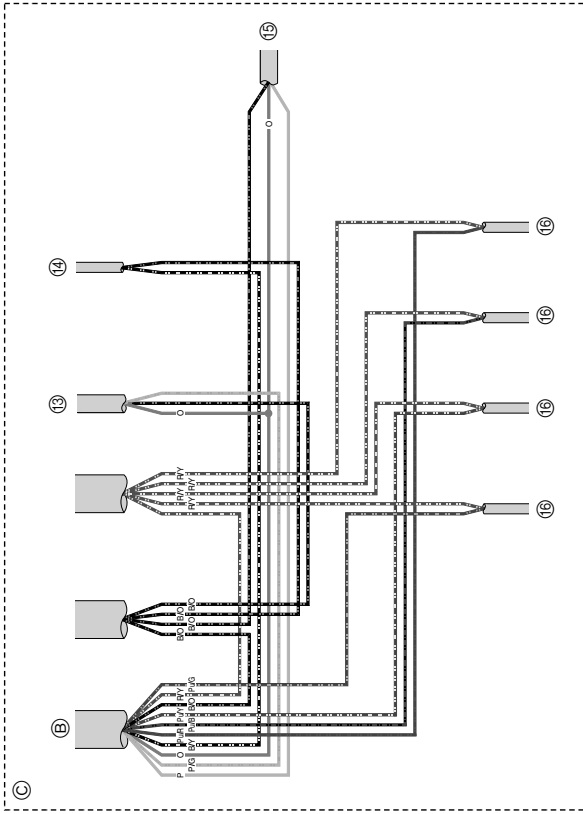
FX140

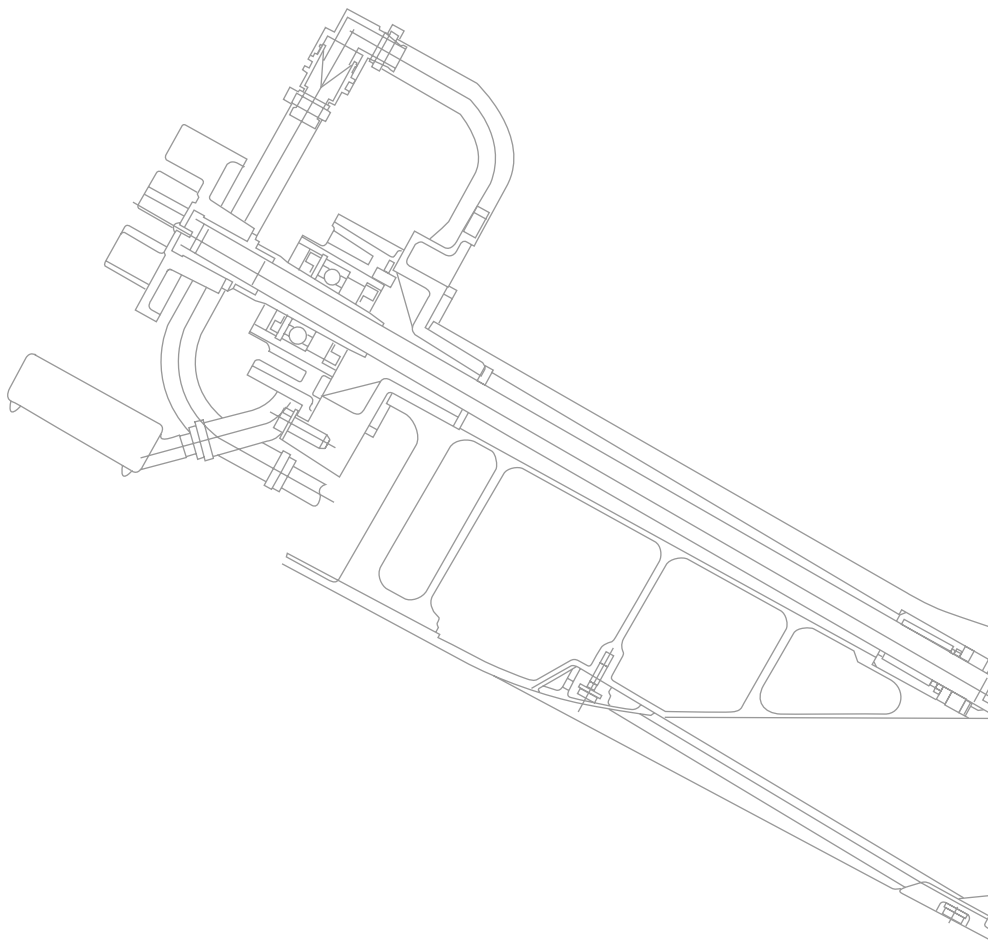
- ① Fuse (20A)
- ② Fuse (3A)
- ③ Starter relay
- ④ Slant detection switch
- ⑤ Main and fuel pump relay
- ⑥ ECM
- ⑦ Rectifier Regulator
- ⑧ Cam position sensor
- ⑨ Thermoswitch (exhaust)
- ⑩ Oil pressure switch
- ⑪ Thermoswitch (engine)
- ⑫ Engine temperature sensor
- ⑬ Intake air pressure sensor
- ⑭ Intake air temperature sensor
- ⑮ Throttle position sensor
- ⑯ Fuel injector
- ⑰ Ignition coil
- ⑱ Spark plug
- ⑲ Pulser coil
- ⑳ Lighting coil
- ㉑ Battery
- ㉒ Starter motor
- ㉓ Electrical bilge pump
- ㉔ Fuel pump
- ㉕ Fuel sender
- ㉖ Engine stop switch
- ㉗ Engine shut-off switch
- ㉘ Start switch
- ㉙ Meter
- ㉚ Speed sensor
- ㉛ Buzzer

Ⓐ To tachometer

Color code

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





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