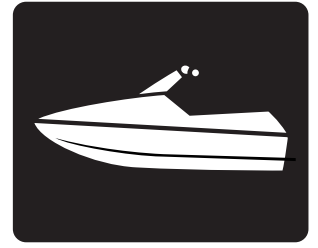




**YAMAHA**



# **WaveRunner GP1300R**










## **SERVICE MANUAL**



**LIT-18616-02-44**

**F1G-28197-1F-11**

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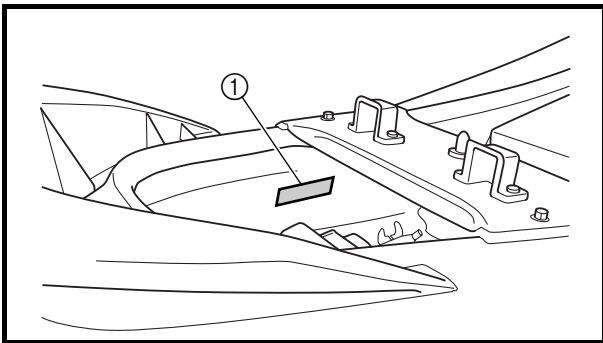
# CHAPTER 1 GENERAL INFORMATION



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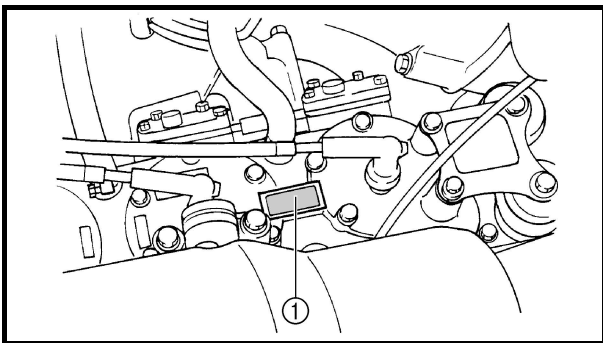


A60700-0\*

**IDENTIFICATION NUMBERS  
PRIMARY I.D. NUMBER**

The primary I.D. number is stamped on a label ① attached inside the engine compartment.

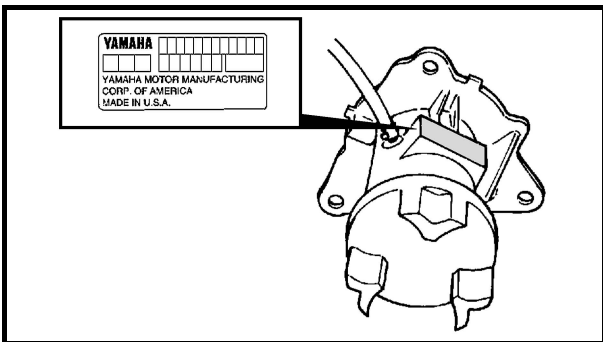
**Starting primary I.D. number:  
F1G: 800301**



**ENGINE SERIAL NUMBER**

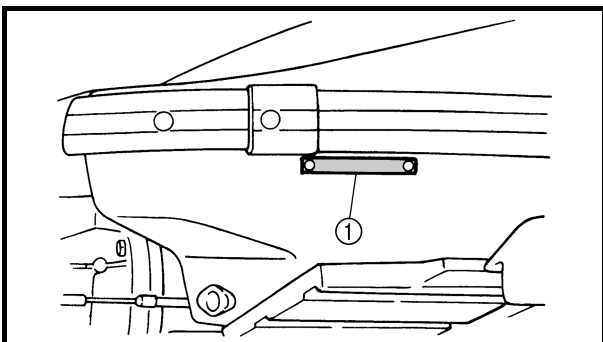
The engine serial number is stamped on a label ① attached to the engine unit.

**Starting serial number:  
60T: 1000001**



**JET PUMP UNIT SERIAL NUMBER**

The jet pump unit serial number is stamped on a label attached to the intermediate housing.

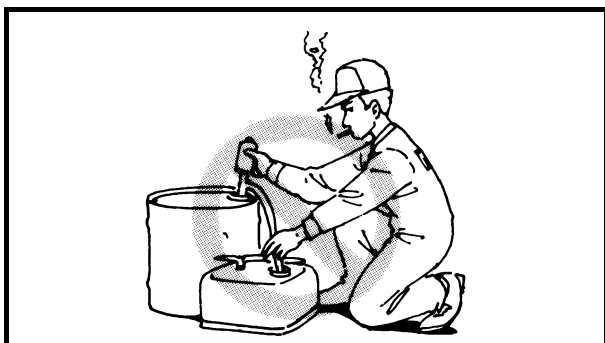


**HULL IDENTIFICATION NUMBER  
(H.I.N.)**

The H.I.N. is stamped on a plate ① attached to the hull on the aft, starboard (right) side.

**⚠ SAFETY WHILE WORKING**

To prevent an accident or injury and to ensure quality service, follow the safety procedures provided below.

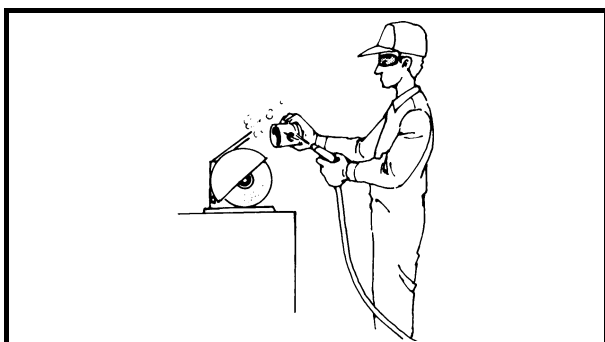


**FIRE PREVENTION**

Gasoline is highly flammable. Keep gasoline and all flammable products away from heat, sparks, and open flames.

**VENTILATION**

Gasoline vapor and exhaust gas are heavier than air and extremely poisonous. If inhaled in large quantities they may cause loss of consciousness and death within a short time. When test running an engine indoors (e.g., in a water tank), be sure to do so where adequate ventilation can be maintained.



**SELF-PROTECTION**

Protect your eyes by wearing safety glasses or safety goggles during all operation involving drilling and grinding, or when using an air compressor. Protect your hands and feet by wearing protective gloves or safety shoes when necessary.



**PARTS, LUBRICANTS, AND SEALANTS**

Use only genuine Yamaha parts, lubricants, and sealants or those recommended by Yamaha, when servicing or repairing the watercraft.

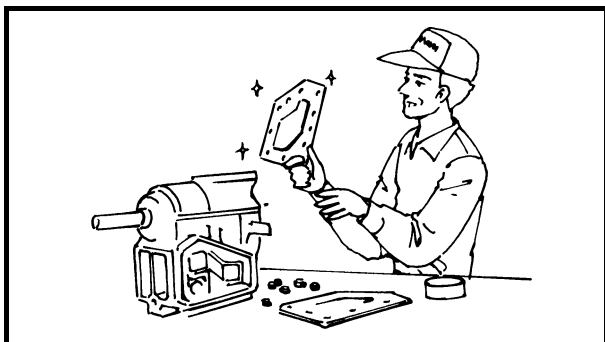
Under normal conditions, the lubricants mentioned in this manual should not harm or be hazardous to your skin. However, you should follow these precautions to minimize any risk when working with lubricants.

1. Maintain good standards of personal and industrial hygiene.
2. Change and wash clothing as soon as possible if soiled with lubricants.
3. Avoid contact with skin. Do not, for example, place a soiled rag in your pocket.
4. Wash hands and any other part of the body thoroughly with soap and hot water after contact with a lubricant or lubricant soiled clothing has been made.
5. To protect your skin, apply a protective cream to your hands before working on the watercraft.
6. Keep a supply of clean, lint-free cloths for wiping up spills, etc.

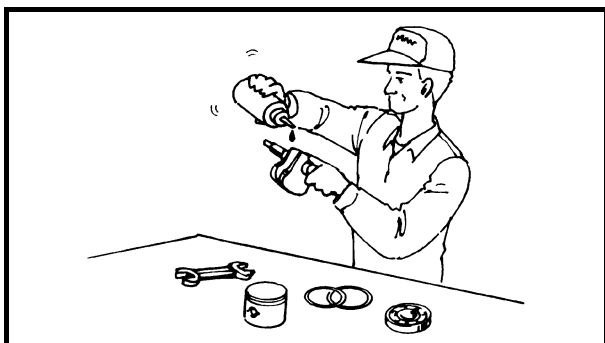


**GOOD WORKING PRACTICES**

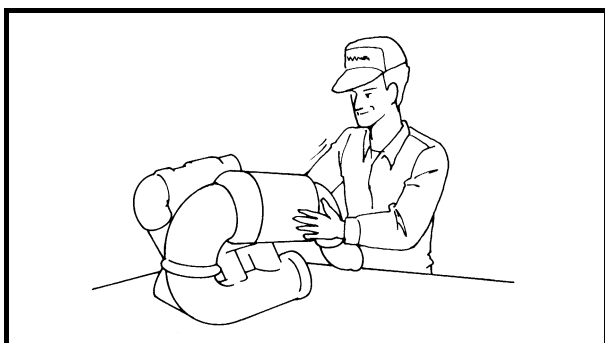
1. **The right tools**  
Use the recommended special service tools to protect parts from damage. Use the right tool in the right manner—do not improvise.
2. **Tightening torques**  
Follow the tightening torque specifications provided throughout the manual. When tightening nuts, bolts, and screws, tighten the large sizes first, and tighten fasteners starting in the center and moving outward.

**3. Non-reusable parts**

Always use new gaskets, seals, O-rings, oil seals, cotter pins, circlips, etc., when installing or assembling parts.

**DISASSEMBLY AND ASSEMBLY**

1. Use compressed air to remove dust and dirt during disassembly.
2. Apply engine oil to the contact surfaces of moving parts during assembly.



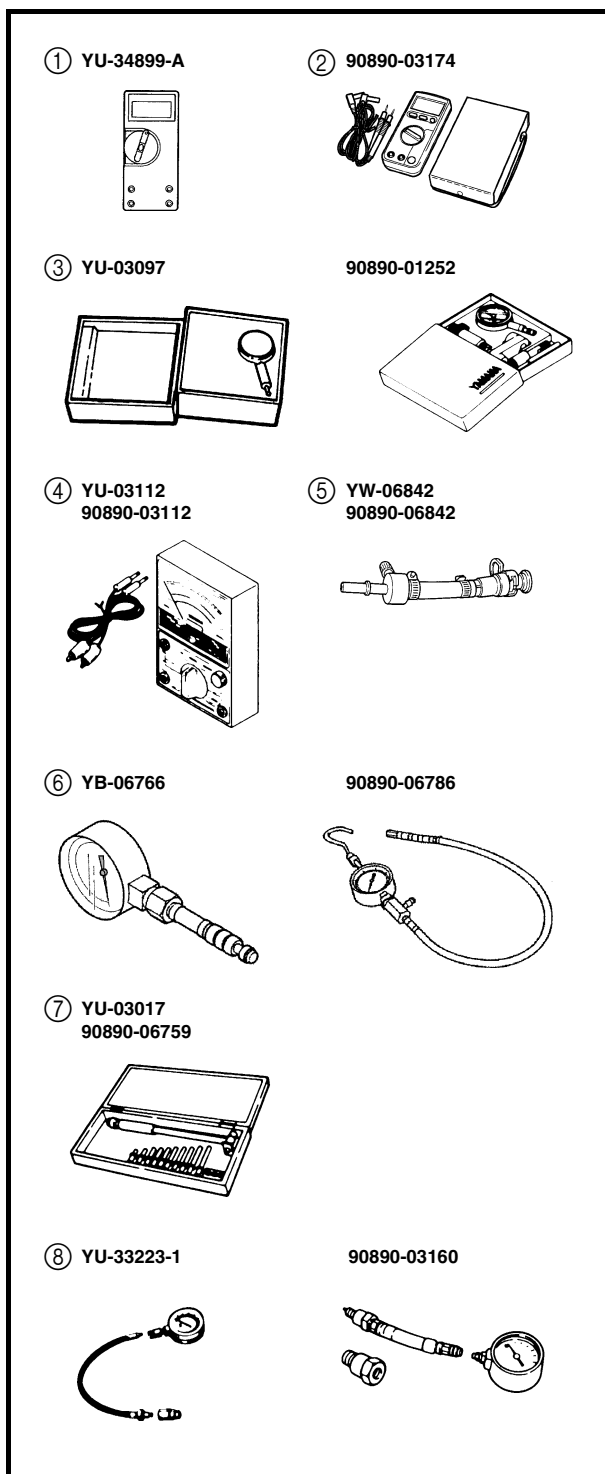
3. Install bearings with the manufacture identification mark in the direction indication in the installation procedure. In addition, be sure to lubricate the bearings liberally.
4. Apply a thin coat of water-resistant grease to the lip and periphery of an oil seal before installation.
5. Check that moving parts operate normally after assembly.

**SPECIAL SERVICE TOOLS**

Using the special service tools recommended by Yamaha will aid service and enable accurate assembly and tune-up. Improvisations and using improper tools can damage the equipment.

**NOTE:**

- For USA and Canada, use the special service tools starting with part numbers “J-,” “YB-,” “YM-,” “YS-,” “YU-,” or “YW-.”
- For all other countries, use the special service tools starting with part number “90890-.”



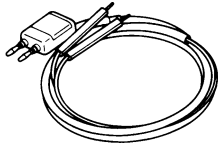
**MEASURING AND DIAGNOSIS**

- ① Digital multimeter  
YU-34899-A
- ② Digital circuit tester  
90890-03174
- ③ Dial gauge  
YU-03097  
90890-01252
- ④ Pocket tester  
YU-03112  
90890-03112
- ⑤ Fuel pressure gauge adapter  
YW-06842  
90890-06842
- ⑥ Fuel pressure gauge  
YB-06766  
90890-06786
- ⑦ Cylinder gauge set  
YU-03017  
90890-06759
- ⑧ Compression gauge  
YU-33223-1  
90890-03160

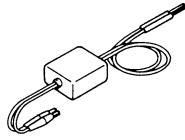




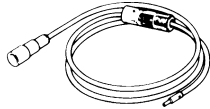
⑨ YU-39991



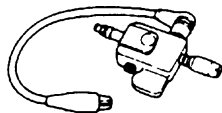
⑩ 90890-03172



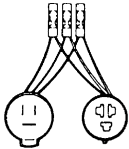
⑪ YM-34487



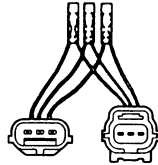
⑫ 90890-06754



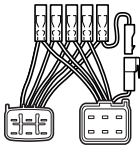
⑬ YB-06870  
90890-06870



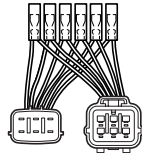
⑭ YB-06869  
90890-06869



⑮ YB-06848  
90890-06848



⑯ YB-06849  
90890-06849



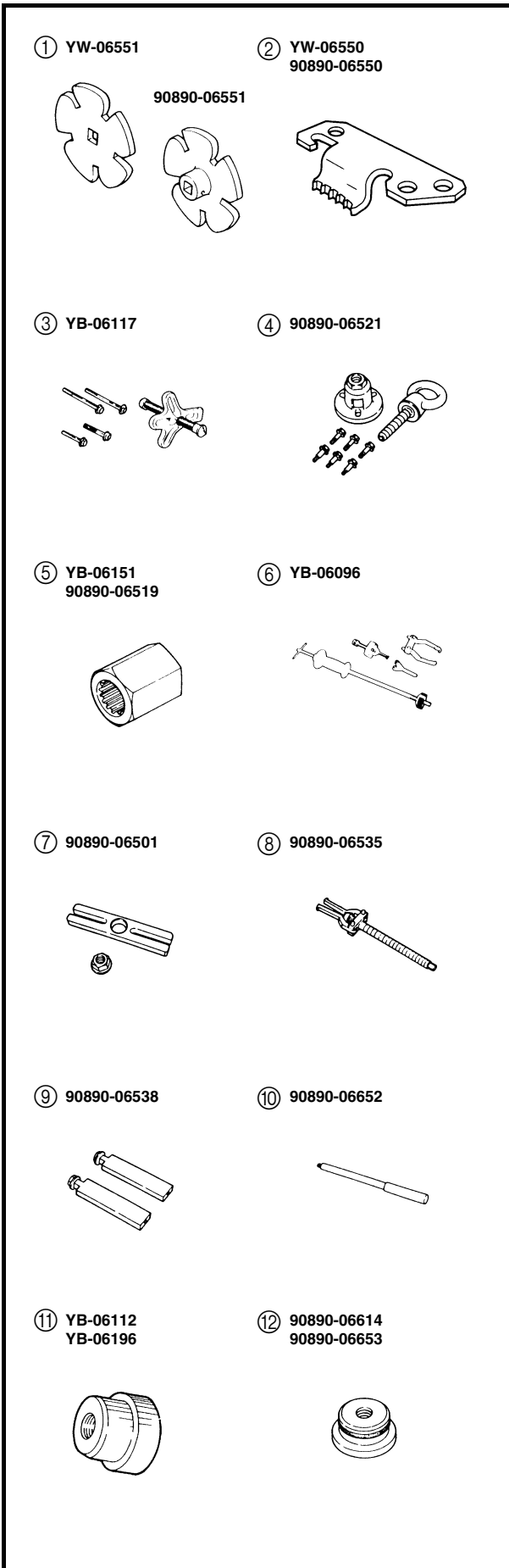
⑰ YB-35956-A  
90890-06756



⑱ 60V-WS853-01

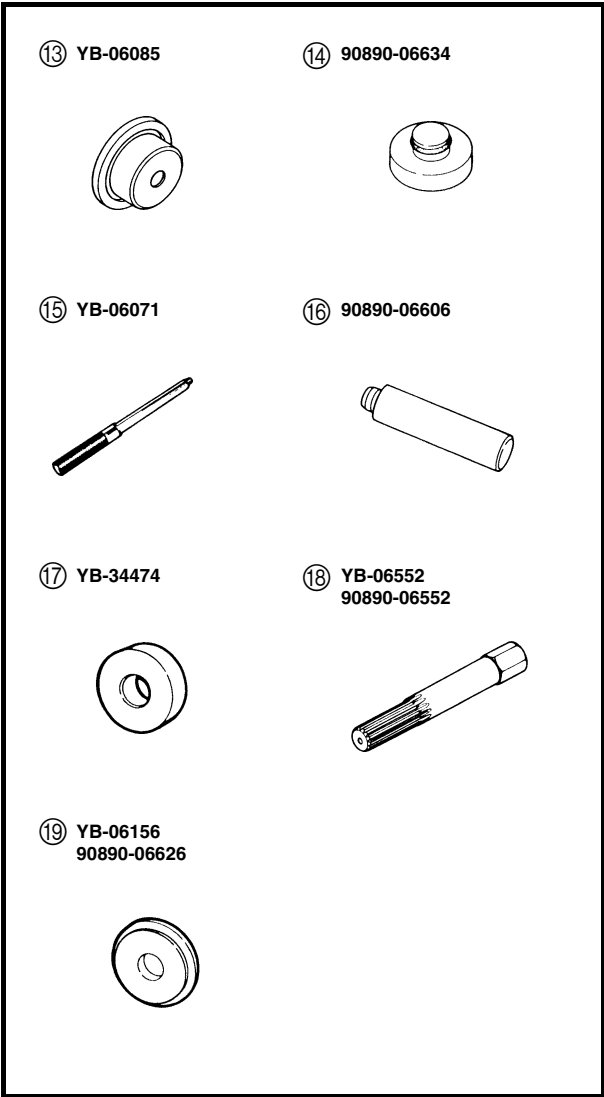


- ⑨ Peak volt meter adapter  
YU-39991
- ⑩ Peak voltage adapter B  
90890-03172
- ⑪ Spark gap tester  
YM-34487
- ⑫ Ignition tester  
90890-06754
- ⑬ Lighting coil tester (3 pins)  
YB-06870  
Test harness SMT250-3 (3 pins)  
90890-06870
- ⑭ Air pressure sensor tester (3 pins)  
YB-06869  
Test harness EJ-II-3 (3 pins)  
90890-06869
- ⑮ Test harness (6 pins)  
YB-06848  
Test harness FSW-6A (6 pins)  
90890-06848
- ⑯ Test harness (6 pins)  
YB-06849  
Test harness SM6195021-6 (6 pins)  
90890-06849
- ⑰ Lower unit pressure/vacuum tester  
YB-35956-A  
Vacuum/pressure pump gauge set  
90890-06756
- ⑱ Yamaha diagnostic system  
(CD-ROM only)  
60V-WS853-01



**REMOVAL AND INSTALLATION**

- ① Coupler wrench  
YW-06551  
90890-06551
- ② Flywheel holder  
YW-06550  
90890-06550
- ③ Universal puller  
YB-06117
- ④ Flywheel puller  
90890-06521
- ⑤ Drive shaft holder (impeller)  
YB-06151  
Drive shaft holder 5 (impeller)  
90890-06519
- ⑥ Slide hammer and adapters  
(jet pump bearing)  
YB-06096
- ⑦ Stopper guide plate (jet pump bearing)  
90890-06501
- ⑧ Bearing puller assembly  
(jet pump bearing)  
90890-06535
- ⑨ Stopper guide stand (jet pump bearing)  
90890-06538
- ⑩ Driver rod L3 (jet pump bearing)  
90890-06652
- ⑪ Bearing housing needle bearing remover  
(jet pump bearing)  
YB-06112  
Drive shaft needle bearing installer and  
remover (jet pump oil seal)  
YB-06196
- ⑫ Needle bearing attachment  
(jet pump bearing and oil seal)  
90890-06614, 90890-06653



- ⑬ Outer race installer—forward gear  
(jet pump oil seal)  
YB-06085
- ⑭ Ball bearing attachment (jet pump oil seal)  
90890-06634
- ⑮ Driver handle—large  
(intermediate shaft and jet pump)  
YB-06071
- ⑯ Driver rod LS  
(intermediate shaft and jet pump)  
90890-06606
- ⑰ Drive shaft needle bearing depth stop  
(jet pump bearing)  
YB-34474
- ⑱ Shaft holder (intermediate shaft)  
YB-06552  
Crankshaft holder 20 (intermediate shaft)  
90890-06552
- ⑲ Drive shaft taper roller bearing cup  
installer (intermediate shaft)  
YB-06156  
Bearing outer race attachment  
(intermediate shaft)  
90890-06626

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## **CHAPTER 2 SPECIFICATIONS**

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SPECIFIED TORQUES.....2-8

GENERAL TORQUE .....2-14

**CABLE AND HOSE ROUTING .....2-15**



**GENERAL SPECIFICATIONS**

Item	Unit	Model
		GP1300R
Model code		
Hull		F1G
Engine/jet		60T
Dimensions		
Length	mm (in)	2,930 (115.4)
Width	mm (in)	1,150 (45.3)
Height	mm (in)	1,020 (40.2)
Dry weight	kg (lb)	297 (653)
Maximum capacity	Person/kg (lb)	2/160 (353)
Performance		
Maximum output	kW (PS) at r/min	121.4 (165) at 7,000
Maximum fuel consumption	l/h (US gal/h, Imp gal/h)	63.0 (16.6, 13.9)
Cruising range	h	0.95
Engine		
Engine type		2-stroke
Number of cylinders		3
Displacement	cm <sup>3</sup> (cu. in)	1,297 (79.1)
Bore × stroke	mm (in)	84 × 78 (3.31 × 3.07)
Compression ratio		
#1, #2		5.9:1
#3		5.7:1
Intake system		Reed valve
Scavenging system		Loop charge
Exhaust system		Wet exhaust/YPVS
Lubrication system		Variable oil injection
Cooling system		Water cooled
Starting system		Electric starter
Ignition system		Digital CDI
Spark plug model (manufacturer)		BR8ES-11 (NGK)
Spark plug gap	mm (in)	1.0–1.1 (0.039–0.043)
Battery		
Voltage, capacity	V, Ah	12, 19
Generator output	A at r/min	15 at 6,000



Item	Unit	Model
		GP1300R
Drive unit		
Propulsion system		Jet pump
Jet pump type		Axial flow, single stage
Impeller rotation		Counterclockwise (viewed from rear)
Transmission		Direct drive from engine
Jet thrust nozzle horizontal angle	Degree	23 + 23
Jet thrust nozzle trim angle	Degree	-5, 0, 5, 10, 15
Trim system		Manual 5 positions
Reverse system		NA
Fuel and oil		
Fuel		Regular unleaded gasoline
Minimum fuel rating	PON <sup>*1</sup>	86
	RON <sup>*2</sup>	90
Oil		YAMALUBE 2-W <sup>*3</sup>
Fuel-oil ratio (wide open throttle)		30:1
Fuel tank capacity	L (US gal, Imp gal)	60 (15.9, 13.2)
Oil tank quantity	L (US qt, Imp qt)	5.5 (1.5, 1.2)

\*1 Pump Octane Number = (Motor Octane Number + Research Octane Number)/2

\*2 Research Octane Number

\*3 YAMALUBE 2-W has been developed for this watercraft and it is available at a Yamaha dealer.

**CAUTION:**

**Use only YAMALUBE 2-W oil. Using another oil can seriously damage the catalytic converter and other engine components.**



**MAINTENANCE SPECIFICATIONS  
ENGINE**

Item	Unit	Model
		GP1300R
Cylinder head Warpage limit	mm (in)	0.05 (0.002)
Minimum compression pressure* <sup>1</sup>	kPa (kgf/cm <sup>2</sup> , psi)	640 (6.4, 91)
Cylinders		
Bore size	mm (in)	84.000–84.018 (3.3071–3.3078)
Taper limit	mm (in)	0.080 (0.0031)
Out-of-round limit	mm (in)	0.050 (0.0020)
Wear limit	mm (in)	84.100 (3.3110)
Pistons		
Piston diameter	mm (in)	Red: 83.899–83.902 (3.3031–3.3032) Orange: 83.903–83.906 (3.3033–3.3034) Green: 83.907–83.910 (3.3034–3.3035) Purple: 83.911–83.914 (3.3036–3.3037)
Measuring point*	mm (in)	11 (0.43)
Piston-to-cylinder clearance	mm (in)	0.100–0.105 (0.0039–0.0041)
Wear limit	mm (in)	0.155 (0.0061)
Piston pin boss inside diameter	mm (in)	22.008–22.020 (0.8665–0.8669)
Piston rings		
Top		
Type		Keystone
Dimension (B)	mm (in)	1.47–1.49 (0.058–0.059)
Dimension (T)	mm (in)	3.0–3.2 (0.118–0.126)
End gap	mm (in)	0.45–0.60 (0.018–0.024)
Ring groove clearance	mm (in)	0.020–0.070 (0.0008–0.0028)
2nd		
Type		Keystone
Dimension (B)	mm (in)	1.47–1.49 (0.058–0.059)
Dimension (T)	mm (in)	3.0–3.2 (0.118–0.126)
End gap	mm (in)	0.45–0.60 (0.018–0.024)
Ring groove clearance	mm (in)	0.020–0.070 (0.0008–0.0028)
Piston pins		
Outside diameter	mm (in)	21.995–22.000 (0.8659–0.8661)
Wear limit	mm (in)	21.990 (0.8657)
Connecting rod		
Small end inside diameter	mm (in)	26.995–27.008 (1.0628–1.0633)

\*<sup>1</sup>Measuring conditions:

Engine temperature 48 °C (118 °F), wide open throttle, with spark plugs removed from all cylinders.

The figures are for reference only.



Item	Unit	Model
		GP1300R
Crankshaft assembly Crank width (A) Deflection limit (B) Deflection limit (C) Big end side clearance (D) Maximum small end axial play (E)	mm (in) mm (in) mm (in) mm (in) mm (in)	72.95–73.00 (2.872–2.874) 0.05 (0.002) 0.15 (0.006) 0.250–0.750 (0.0098–0.0295) 2.000 (0.0787)
Throttle body Model/quantity Manufacturer ID mark Trolling speed	r/min	60TA/3 SANSHIN 60T00 1,250–1,450
Reed valves Thickness Reed valve stopper height Reed valve warpage limit	mm (in) mm (in) mm (in)	0.6 (0.024) 10.5–10.9 (0.413–0.429) 1.5 (0.059)
Fuel pump Pump type Output pressure	kPa (kgf/cm <sup>2</sup> , psi)	Electrical 320.8–327.2 (3.21–3.27, 45.62–46.53)
Coupling clearance Vertical Horizontal	mm (in) mm (in)	0–0.5 (0–0.020) 2–4 (0.079–0.157)

**JET PUMP UNIT**

Item	Unit	Model
		GP1300R
Jet pump Impeller material Number of impeller blades Impeller pitch angle Impeller clearance Impeller clearance limit Drive shaft runout limit Nozzle diameter	Degree mm (in) mm (in) mm (in) mm (in)	Stainless steel 4 16.3 0.7–0.9 (0.028–0.035) 0.9 (0.035) 0.30 (0.0118) 85.0–85.6 (3.35–3.37)





**HULL AND HOOD**

Item	Unit	Model
		GP1300R
Free play		
YPVS cable slack	mm (in)	0.5–1.5 (0.02–0.06)
Throttle lever free play	mm (in)	4–7 (0.16–0.28)

**ELECTRICAL**

Item	Unit	Model
		GP1300R
Battery		
Type		Fluid
Voltage, capacity	V, Ah	12, 19
Specific gravity		1.28
ECM unit		
(B/R – Ground for cylinder #1)		
(B/W – Ground for cylinder #2)		
(B/Y – Ground for cylinder #3)		
Output peak voltage lower limit		
at cranking	V	0.8
at 2,000 r/min	V	174
at 3,500 r/min	V	156
Stator		
Pickup coil		
(W/R, W/B, W/Y – B)		
Output peak voltage		
at cranking 1	V	6.0
at cranking 2	V	6.0
at 2,000 r/min	V	24
at 3,500 r/min	V	40
Pickup coil resistance 1	Ω	459–561
(W/R – B)		
Pickup coil resistance 2	Ω	459–561
(W/B – B)		
Pickup coil resistance 3	Ω	459–561
(W/Y – B)		
Lighting coil		
(G – G)		
Output peak voltage		
at cranking 1	V	9.0
at cranking 2	V	7.5
at 2,000 r/min	V	12.5
at 3,500 r/min	V	12.5
Lighting coil resistance	Ω	0.54–0.66
(G – G)		

Cranking 1: unloaded

Cranking 2: loaded



Item	Unit	Model
		GP1300R
Ignition coil		
Minimum spark gap	mm (in)	10–11 (0.39–0.43)
Primary coil resistance (B/W – body)	Ω	0.26–0.36
Secondary coil resistance (B/W – spark plug lead terminal)	kΩ	3.5–4.7
Spark plug lead resistance		
#1	kΩ	6.1–14.3
#2	kΩ	4.5–10.9
#3	kΩ	3.3–8.2
Rectifier/regulator (R – B)		
Output peak voltage (unloaded) at 3,500 r/min	V	14.5
Starter motor		
Type		Bendix
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
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
Atmospheric pressure sensor		
output voltage (P/G – B/O)	V at kPa (kgf/cm <sup>2</sup> , psi)	4.00 at 101.3 (1.01, 14.4)
	V at kPa (kgf/cm <sup>2</sup> , psi)	1.97 at 50 (0.5, 7.1)
	V at kPa (kgf/cm <sup>2</sup> , psi)	0.79 at 20 (0.2, 2.8)



Item	Unit	Model
		GP1300R
Exhaust temperature sensor resistance		
at 300 °C (572 °F)	kΩ	73–241
at 600 °C (1,112 °F)	kΩ	0.86–1.58
at 900 °C (1,652 °F)	Ω	64–90
Cooling water temperature sensor resistance		
at 0 °C (32 °F)	kΩ	24.0–37.1
at 100 °C (212 °F)	kΩ	0.87–1.18
at 200 °C (392 °F)	Ω	104–153
Speed sensor		
Output voltage (on pulse)	V	11.6
Output pulse/one full turn		2
Throttle position sensor		
Output voltage (P – B/O) at trolling speed	V	0.793–0.807
Fuel sender		
Fuel sender resistance		
Position A	Ω	133.5–136.5
Position B	Ω	5–7
Fuel injector		
Fuel injector resistance *1	Ω	13.8
Oil level sensor		
Oil level sensor resistance		
Position A	Ω	292–308
Position B	Ω	97–103
Position C	Ω	0–3
Fuse		
Rating		
Main	V/A	12/20
Multifunction meter	V/A	12/3
Electrical bilge pump	V/A	12/3

\*1 The figures are for reference only.



## TIGHTENING TORQUES SPECIFIED TORQUES

Part to be tightened	Part name	Thread size	Q'ty	Tightening torques			Remarks
				N•m	kgf•m	ft•lb	
<b>Fuel system</b>							
Strap/fuel tank/oil tank – hull	Bolt	M8	4	16	1.6	11	
Oil filler hose screw clamp	—	—	1	0.6	0.06	0.4	
Retainer/fuel pump module – fuel tank	Nut	—	9	3.2	0.32	2.3	
				6.4	0.64	4.6	
Fuel filler hose screw clamp	—	—	2	3.7	0.37	2.7	
Cap screw clamp (fuel tank)	—	—	1	1.3	0.13	0.9	
Intake silencer screw clamp	—	—	1	2.5	0.25	1.8	
Intake silencer pipe screw clamp	—	—	2	2.5	0.25	1.8	
Intake duct – exhaust chamber bracket	Bolt	M8	1	9.0	0.9	6.5	
				18	1.8	13	
Intake duct – generator cover	Bolt	M8	2	9.0	0.9	6.5	
				18	1.8	13	
Throttle bodies assembly – throttle bodies bracket 1, 2	Bolt	M8	2	9.0	0.9	6.5	
				18	1.8	13	
Throttle cable locknut and adjuster (throttle bodies end)	—	—	1	11	1.1	8.0	
Intake air temperature sensor – intake silencer case cover	—	—	1	7.5	0.75	5.4	
Intake silencer case cover – intake silencer case	Tapping screw	ø6	13	1.8	0.18	1.3	
Flame arrester – intake silencer case	Screw	M5	6	0.8	0.08	0.6	
Fuel rail – throttle bodies	Bolt	M6	3	8.8	0.88	6.4	
Oil pump cable – oil pump lever	Bolt	M5	1	2.2	0.22	1.6	
				4.4	0.44	3.2	
Oil pump cable locknut and adjuster	—	—	1	11	1.1	8.0	
Bleed hose stay – exhaust chamber bracket	Bolt	M6	1	7.6	0.76	5.5	
Oil pump – generator cover	Bolt	M6	2	3.8	0.38	2.7	
				7.6	0.76	5.5	
Air bleed screw	—	—	1	3.4	0.34	2.5	
<b>Engine</b>							
Spark plug	—	—	3	25	2.5	18	
Muffler cover – muffler	Bolt	M6	3	12	1.2	8.7	
Outer exhaust joint screw clamp	—	—	2	2.5	0.25	1.8	
Inner exhaust joint screw clamp	—	—	2	1.5	0.15	1.1	
Exhaust joint screw clamp	—	—	2	2.5	0.25	1.8	
Eye – muffler	Nut	M10	2	39	3.9	28	
Eye – cylinder head	Bolt	M10	4	39	3.9	28	
Muffler stay – cylinder	Bolt	M10	2	39	3.9	28	



Part to be tightened	Part name	Thread size	Q'ty	Tightening torques			Remarks	
				N•m	kgf•m	ft•lb		
Muffler stay 2 – crankcase	Bolt	M10	2	39	3.9	28		
Muffler – muffler stay 2	Bolt	M10	1	39	3.9	28		
Exhaust temperature sensor	—	—	1	39	3.9	28		
Cooling water temperature sensor	—	—	1	20	2.0	14		
Muffler stay – catalytic converter housing	1st	Bolt	M10	2	15	1.5	11	
	2nd				39	3.9	28	
Cover/catalytic converter housing/catalytic converter – muffler	1st	Bolt	M8	6	15	1.5	11	
	2nd				33	3.3	24	
Mixing joint – muffler	1st	Bolt	M8	6	11	1.1	8.0	
	2nd				22	2.2	16	
Exhaust chamber assembly – exhaust manifold	Bolt	M10	4	39	3.9	28		
Exhaust chamber stay/ exhaust chamber assembly – exhaust chamber bracket	Bolt	M10	2	39	3.9	28		
Exhaust chamber joint – exhaust chamber	Bolt	M10	6	39	3.9	28		
Coupling cover – intermediate housing assembly	Bolt	M6	1	7.9	0.79	5.7		
Engine unit – engine mount	Bolt	M8	4	17	1.7	12		
Exhaust manifold – cylinder	1st	Bolt	M10	10	22	2.2	16	
	2nd				39	3.9	28	
	1st	Nut	M10	2	22	2.2	16	
	2nd				39	3.9	28	
Cooling water joint – exhaust manifold	Bolt	M6	6	12	1.2	8.7		
Throttle bodies bracket 1, 2/ throttle bodies joint/balance plate/plate/reed valve assembly – crankcase	1st	Bolt	M6	4	3.8	0.38	2.7	
	2nd				7.6	0.76	5.5	
Throttle bodies joint/ balance plate/plate/reed valve assembly – crankcase	1st	Bolt	M6	14	3.8	0.38	2.7	
	2nd				7.6	0.76	5.5	
Balance plate/plate/reed valve assembly – crankcase	1st	Bolt	M6	4	3.8	0.38	2.7	
	2nd				7.6	0.76	5.5	
Valve stopper/reed valve – reed valve base	Screw	M3	24	1.0	0.1	0.7		
YPVS cable holder/YPVS valve cover – cylinder	Bolt	M6	2	9.8	0.98	7.1		
YPVS valve cover – cylinder	Bolt	M6	10	9.8	0.98	7.1		
YPVS valve arm – shaft 1, 2, 3	Bolt	M4	3	2.8	0.28	2.0		
YPVS valve stopper bolt	—	M5	3	3.8	0.38	2.7		





Part to be tightened		Part name	Thread size	Q'ty	Tightening torques			Remarks
					N•m	kgf•m	ft•lb	
Ground lead – cylinder head	1st	Bolt	M6	1	3.8	0.38	2.7	
	2nd				7.6	0.76	5.5	
Exhaust chamber stay/ cylinder head – cylinder	1st	Bolt	M8	2	15	1.5	11	
	2nd				35	3.5	25	
Cylinder head – cylinder	1st	Bolt	M8	16	22	2.2	16	
	2nd				22	2.2	16	
	3rd				35	3.5	25	
Anode – cylinder head		Screw	M5	2	4.4	0.44	3.2	
Engine temperature sensor – cylinder		—	—	1	15	1.5	11	
Cylinder – crankcase	1st	Bolt	M10	12	22	2.2	16	
	2nd				39	3.9	28	
Generator cover – crankcase	1st	Bolt	M10	7	15	1.5	11	
	2nd				50	5.0	36	
Generator cover/ground lead – crankcase	1st	Bolt	M10	1	15	1.5	11	
	2nd				50	5.0	36	
Exhaust chamber bracket – crankcase		Bolt	M10	4	39	3.9	28	
Cable holder – generator cover		Bolt	M6	2	14	1.4	10	
Pickup coil – generator cover		Bolt	M5	6	4.9	0.49	3.5	
Lighting coil – generator cover		Bolt	M6	3	14	1.4	10	
Drive coupling – crankshaft assembly		Drive coupling	—	1	36	3.6	25	
Flywheel magneto – crankshaft assembly		Bolt	M10	1	74	7.4	53	
Starter motor/negative battery lead – crankcase	1st	Bolt	M8	1	9.0	0.9	6.5	
	2nd				18	1.8	13	
Starter motor – crankcase	1st	Bolt	M8	1	9.0	0.9	6.5	
	2nd				18	1.8	13	
Mount bracket – lower crankcase	1st	Bolt	M8	6	15	1.5	11	
	2nd				27	2.7	19	
Upper crankcase – lower crankcase	1st	Bolt	M8	17	15	1.5	11	
			M8		27	2.7	19	
	2nd	M6	10	11	1.1	8.0		
<b>Jet pump unit</b>								
Steering cable joint – jet thrust nozzle		Nut	—	1	6.8	0.68	4.9	
Ride plate – hull		Bolt	M8	4	17	1.7	12	
Intake duct – hull		Bolt	M8	4	17	1.7	12	
Intake grate – hull		Bolt	M6	4	7.4	0.74	5.4	
Speed sensor – ride plate		Screw	M5	4	3.7	0.37	2.7	
Jet pump unit assembly/impeller housing 2 – transom		Bolt	M10	4	40	4.0	29	
			M6	1	7.8	0.78	5.6	
Nozzle ring – nozzle		Bolt	M8	2	15	1.5	11	



Part to be tightened	Part name	Thread size	Q'ty	Tightening torques			Remarks
				N•m	kgf•m	ft•lb	
Jet thrust nozzle – nozzle ring	Bolt	M8	2	15	1.5	11	
Spout hose screw clamp	—	—	1	1.2	0.12	0.9	
Nozzle/impeller duct assembly – impeller housing 1	Bolt	M10	4	40	4.0	29	
Water inlet cover/water inlet strainer – impeller duct	Bolt	M6	4	6.6	0.66	4.8	
Drive shaft nut – drive shaft	Nut	—	1	74	7.4	53	
Impeller (left-hand threads) – drive shaft	Impeller	M22	1	75	7.5	54	
Transom plate – hull	Nut	—	4	26	2.6	19	
Intermediate housing – bulkhead	Bolt	M8	3	17	1.7	12	
Driven coupling – shaft	Driven coupling	M24	1	36	3.6	25	
Grease nipple – intermediate housing	Nipple	—	1	5.4	0.54	3.9	
<b>Hull and hood</b>							
Handlebar cover – handlebar cover stay	Screw	M6	4	1.1	0.11	0.8	
Handlebar cover stay – steering column	Screw	M6	4	2.9	0.29	2.1	
Upper handlebar holder/lower handlebar holder – steering column	Bolt	M8	4	16	1.6	11	
QSTS converter – hull	Nut	M6	2	5.4	0.54	3.9	
QSTS cable 1, 2 locknut	—	—	2	16	1.6	11	
Throttle lever assembly – handlebar	Screw	M5	2	3.4	0.34	2.5	
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	
QSTS cable housing – cover	Screw	M4	1	1.0	0.1	0.7	
Plate/steering column assembly – deck	Nut	M8	2	16	1.6	11	
Steering column assembly – deck	Nut	M8	2	16	1.6	11	
Steering arm – steering column	Nut	M8	1	16	1.6	11	
Magnet – steering arm	Screw	M5	1	2.0	0.2	1.4	
Steering cable ball joint – steering arm	Nut	M6	1	5.0	0.5	3.6	
Handlebar stopper – steering column housing	Nut	M10	1	26	2.6	19	
QSTS cable locknut (nozzle ring side)	—	—	1	3.8	0.38	2.7	
QSTS cable – hull	Nut	—	1	5.9	0.59	4.3	
QSTS cable end – pin – QSTS converter	Nut	M6	1	3.8	0.38	2.7	



Part to be tightened	Part name	Thread size	Q'ty	Tightening torques			Remarks
				N•m	kgf•m	ft•lb	
Steering cable locknut (jet thrust nozzle end)	—	—	1	6.5	0.65	4.7	
Steering cable – hull	Nut	—	1	5.9	0.59	4.3	
Steering cable holder – bracket	Bolt	M6	1	6.4	0.64	4.6	
Speed sensor lead – hull	Nut	—	1	5.9	0.59	4.3	
Hinge assembly – hood	Bolt	M6	2	12	1.2	8.7	
Visor – hood	Screw	M5	8	1.0	0.1	0.7	
Hood lock – hood	Bolt	M6	2	5.4	0.54	3.9	
Hinge assembly – deck	Nut	M8	2	16	1.6	11	
Steering console cover assembly – deck	Nut	M6	2	5.4	0.54	3.9	
	Bolt	M6	4	2.9	0.29	2.1	
	Screw	M5	2	2.0	0.2	1.4	
	Nut	M8	2	16	1.6	11	
Multifunction meter – holder	Nut	M5	2	1.8	0.18	1.3	
Steering console cover – side cover	Screw	M6	4	2.9	0.29	2.1	
Steering console cover – glove compartment	Screw	M5	4	1.3	0.13	0.9	
Steering cable bracket – deck	Bolt	M6	1	6.4	0.64	4.6	
Buzzer bracket/deck – steering cable bracket	Bolt	M6	2	6.4	0.64	4.6	
Hood lock assembly – deck	Nut	M6	2	6.4	0.64	4.6	
Seat lock assembly – seat	Bolt	M6	2	6.4	0.64	4.6	
Bracket/deck – projection	Nut	M10	1	26	2.6	19	
Bracket/deck – handgrip	Bolt	M8	2	5.2	0.52	3.8	
Handgrip – deck	Nut	M8	2	5.2	0.52	3.8	
Seat bracket – deck	Nut	M8	2	15	1.5	11	
Battery box/stay – holder	Nut	M6	2	8.9	0.89	6.4	
Battery box – deck/bracket	Nut	M8	2	13	1.3	9.4	
Battery box – electrical box	Bolt	M8	1	13	1.3	9.4	
Battery box/stay – electrical box	Nut	M8	2	13	1.3	9.4	
Extension bolt – negative battery terminal	—	M6	1	6.4	0.64	4.6	
Exhaust outlet – hull	Bolt	M6	3	6.4	0.64	4.6	
Hose screw clamp	—	—	3	3.7	0.37	2.7	
Sponson – hull	Bolt	M8	6	18	1.8	13	
Spout – hull	Nut	M24	1	5.4	0.54	3.9	
Rope hole – hull	Nut	M24	2	5.4	0.54	3.9	
Bow eye – hull	Bolt	M6	2	13	1.3	9.4	
Flap – hull	Bolt	M6	8	7.4	0.74	5.4	
Drain plug/packing – hull	Nut	—	4	2.0	0.2	1.4	
Engine mount – hull	Bolt	M8	8	17	1.7	12	
Engine damper – hull	Bolt	M6	4	6.4	0.64	4.6	





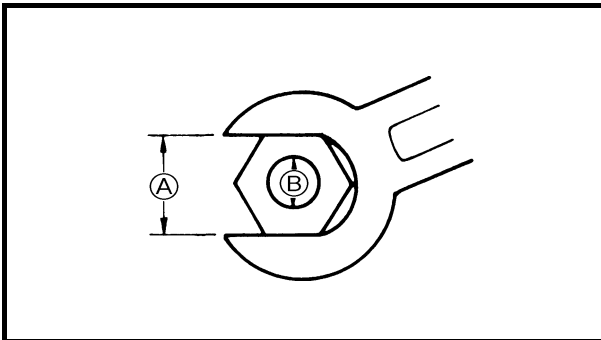
Part to be tightened	Part name	Thread size	Q'ty	Tightening torques			Remarks
				N•m	kgf•m	ft•lb	
<b>Electrical</b>							
Cover – electrical box	Tapping screw	ø6	11	4.9	0.49	3.5	
Lead retainer – electrical box	Tapping screw	ø6	2	4.9	0.49	3.5	
Positive battery lead – starter relay	Bolt	M6	1	3.4	0.34	2.5	
Starter motor lead – starter relay	Bolt	M6	1	3.4	0.34	2.5	
Rectifier/regulator – electrical box	Tapping screw	ø6	2	3.9	0.39	2.8	
Coupler bracket – electrical box	Tapping screw	ø6	2	3.4	0.34	2.5	
Wire harness retainer – electrical box	Tapping screw	ø6	2	4.9	0.49	3.5	
Ignition coil #1, # 2, #3 – electrical box	Tapping screw	ø6	6	3.9	0.39	2.8	
Fuse holder stay – electrical box	Tapping screw	ø6	1	3.4	0.34	2.5	
Main and fuel pump relay – electrical box	Tapping screw	ø6	1	3.9	0.39	2.8	
Ground leads – electrical box	Bolt	M6	2	7.6	0.76	5.5	
ECM – hull	Nut	—	2	5.4	0.54	3.9	
Slant detection switch – hull	Nut	—	2	5.4	0.54	3.9	
Nut/spring washer/washer (starter motor lead terminal) – starter motor	Nut	—	1	8.8	0.88	6.4	
Starter motor rear cover/starter motor yoke – starter motor front cover	Bolt	M5	2	6.4	0.64	4.6	
YPVS servomotor bracket – deck	Nut	—	3	15	1.5	11	
YPVS servomotor/ throttle cable plastic tie bracket – YPVS servomotor bracket	Nut	—	2	5.4	0.54	3.9	



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

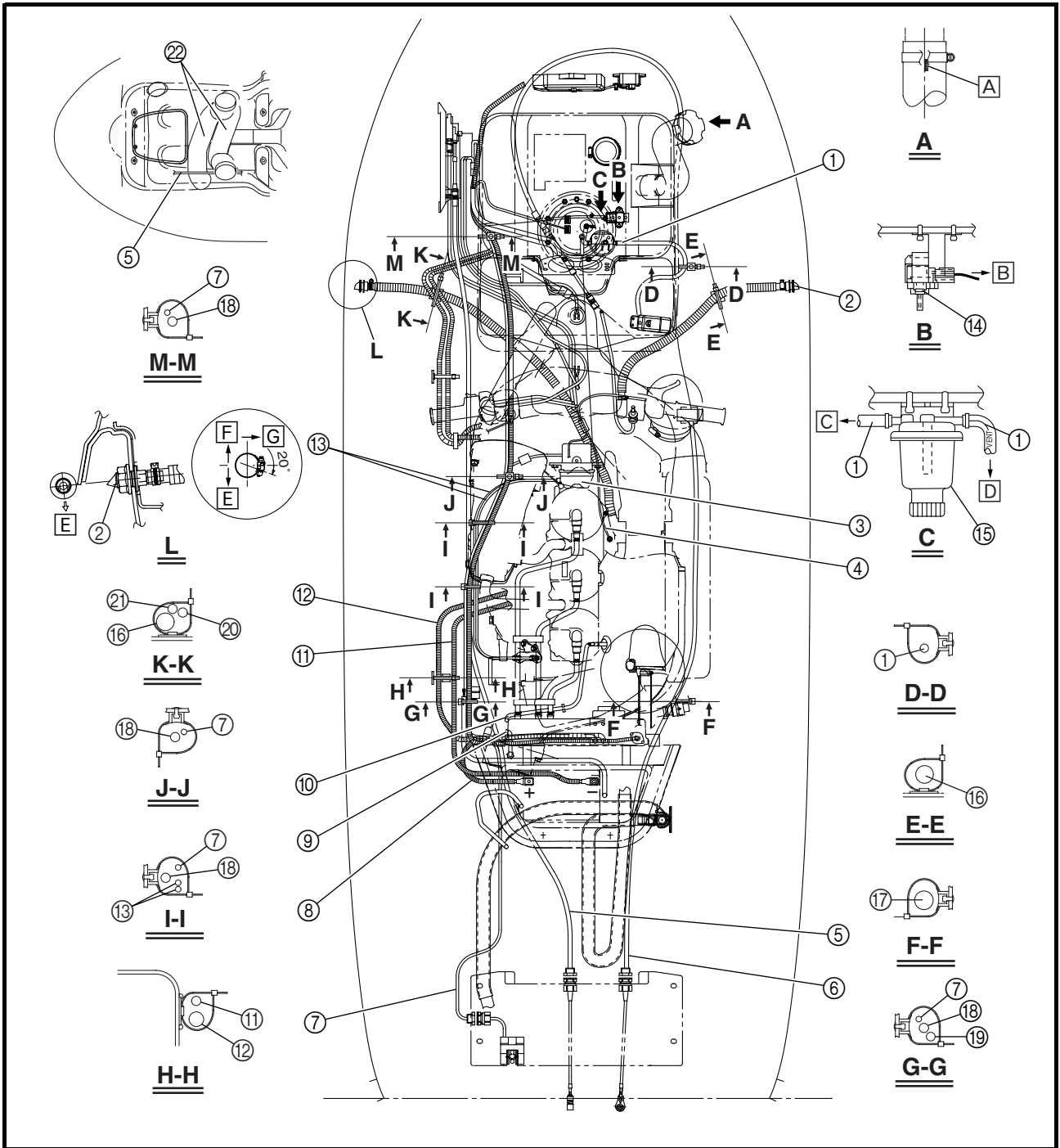
**GENERAL TORQUE**

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.

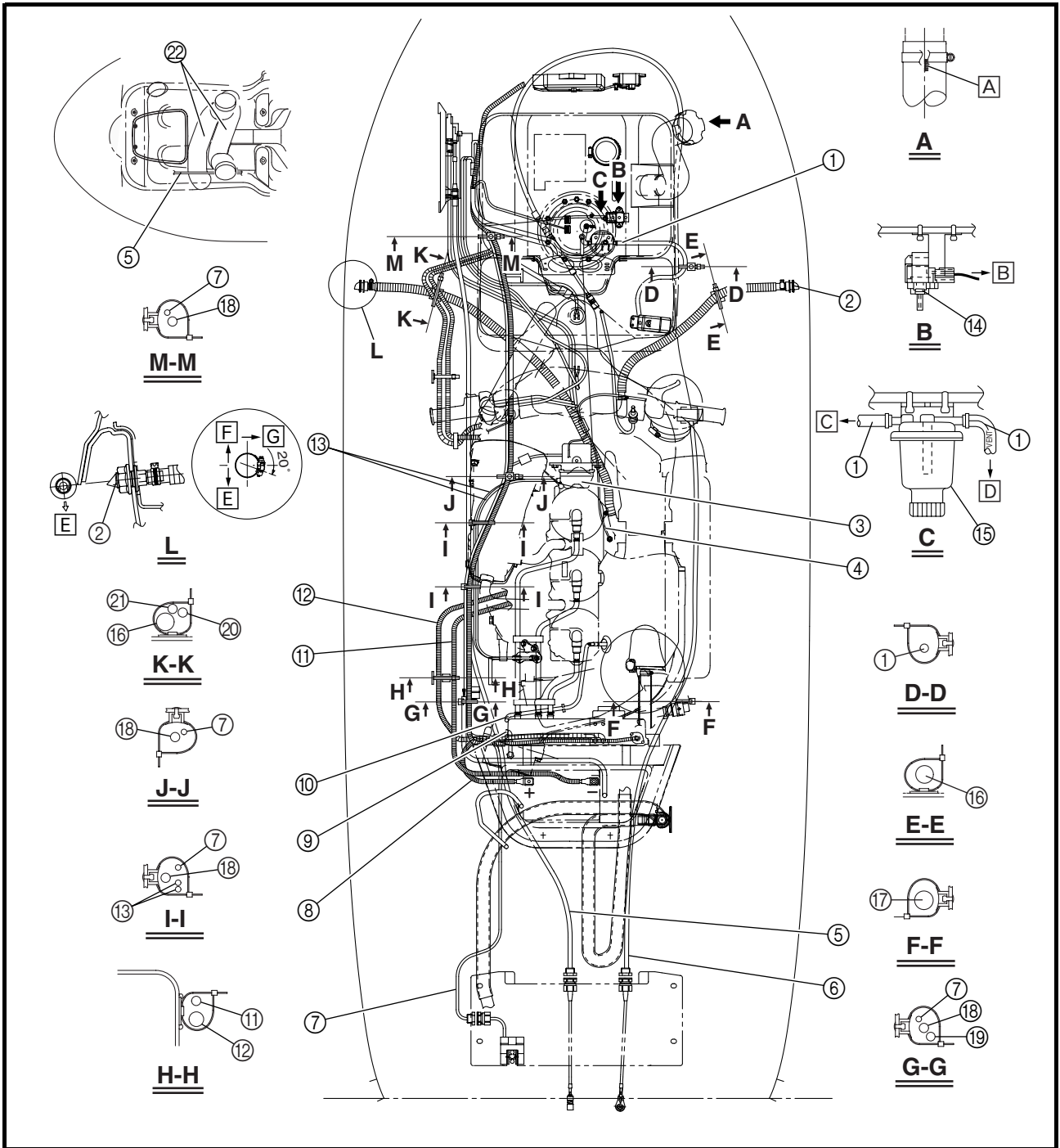




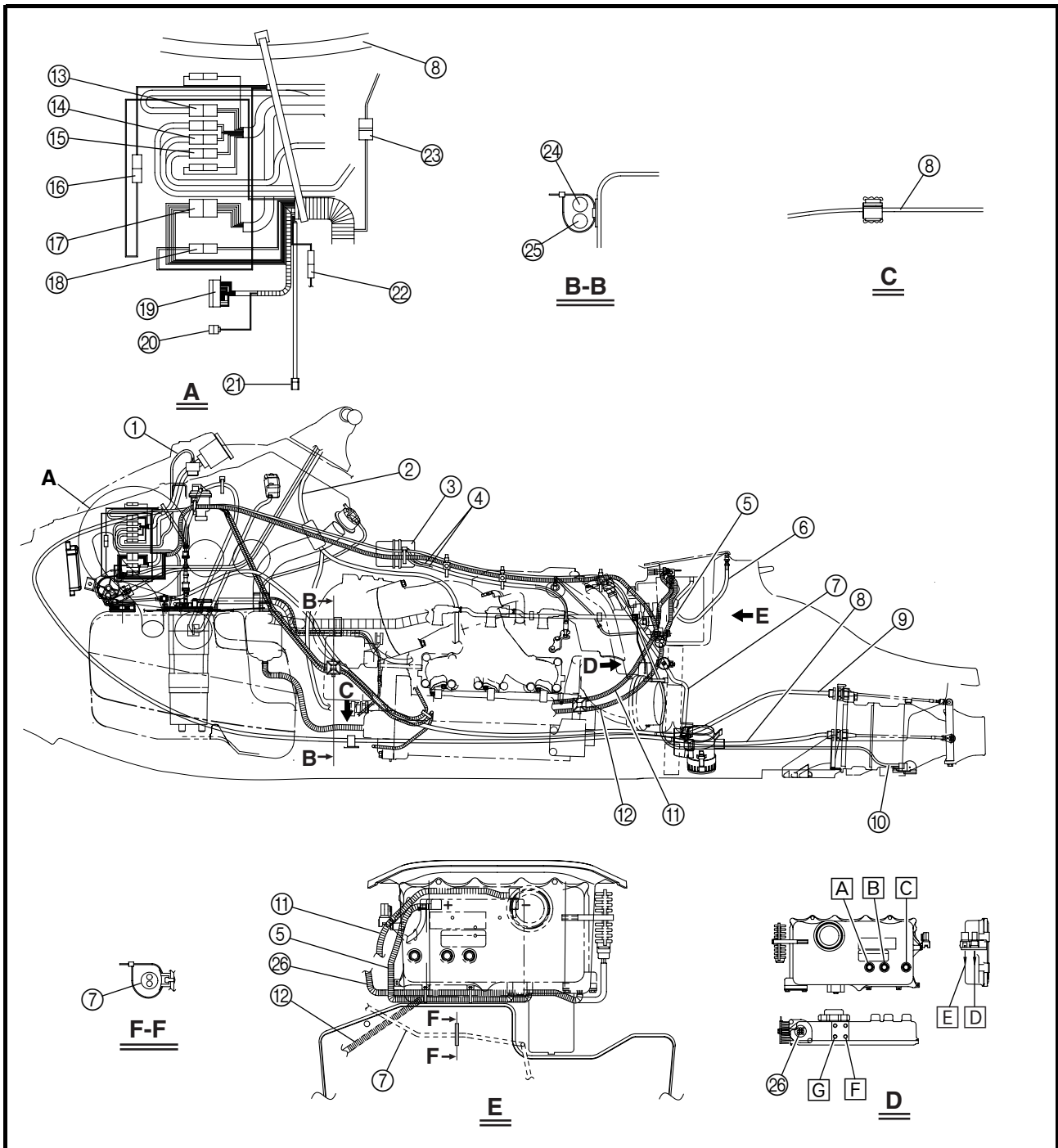
**CABLE AND HOSE ROUTING**



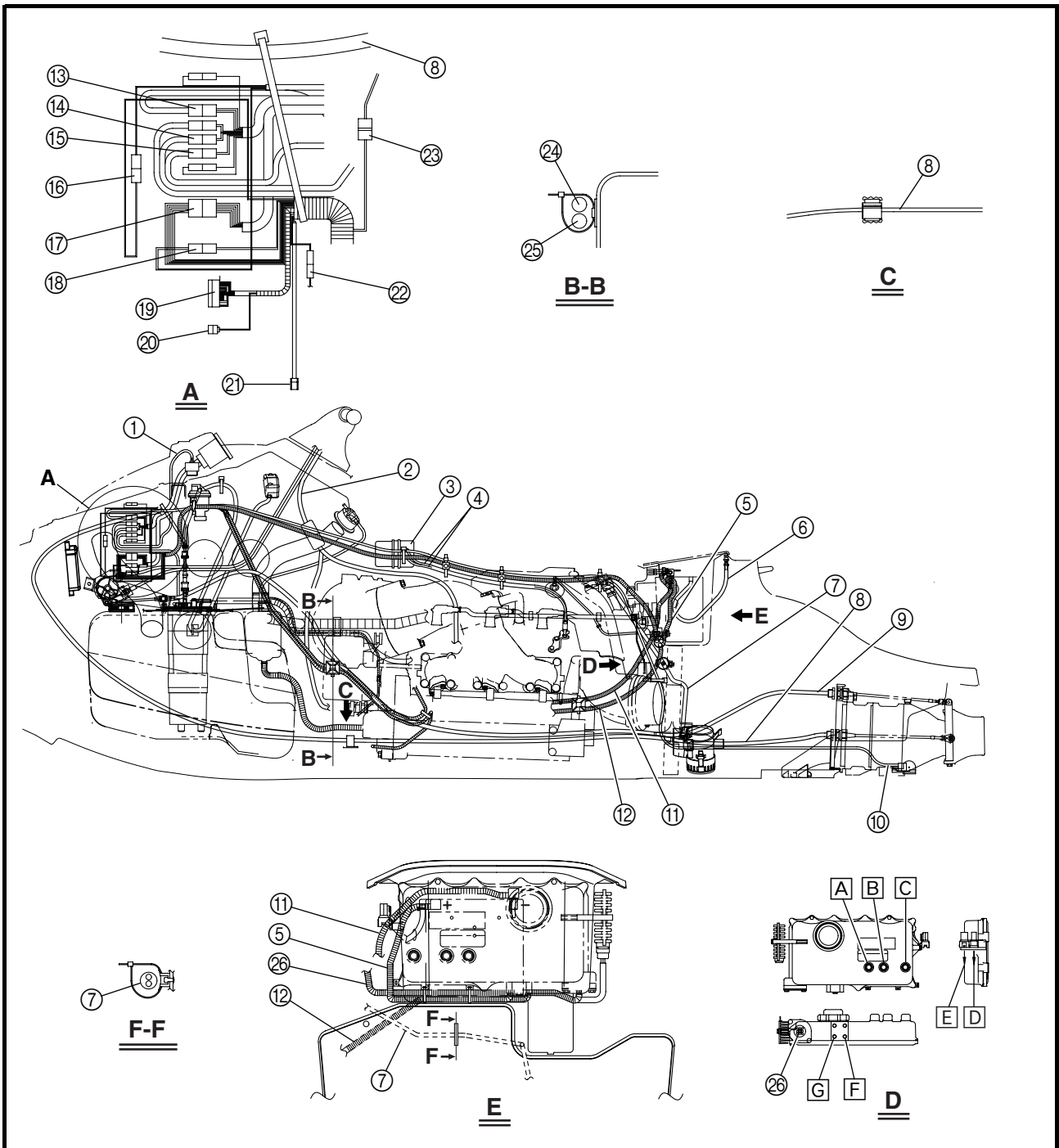
- |   |                                   |                                  |
|---|-----------------------------------|----------------------------------|
| ① Fuel tank breather hose               | ⑩ Exhaust temperature sensor lead | ⑲ Electrical bilge pump lead     |
| ② Cooling water pilot outlet            | ⑪ Negative battery lead           | ⑳ Wire harness (generator)       |
| ③ YPVS servomotor                       | ⑫ Starter motor lead              | ㉑ Wire harness (throttle bodies) |
| ④ Throttle cable                        | ⑬ YPVS cables                     | ㉒ Ventilation hose               |
| ⑤ QSTS cable                            | ⑭ Atmospheric pressure sensor     |                                  |
| ⑥ Steering cable                        | ⑮ Water separator                 |                                  |
| ⑦ Speed sensor lead                     | ⑯ Cooling water pilot outlet hose |                                  |
| ⑧ Positive battery lead                 | ⑰ Cooling water outlet hose       |                                  |
| ⑨ Cooling water temperature sensor lead | ⑱ Wire harness                    |                                  |



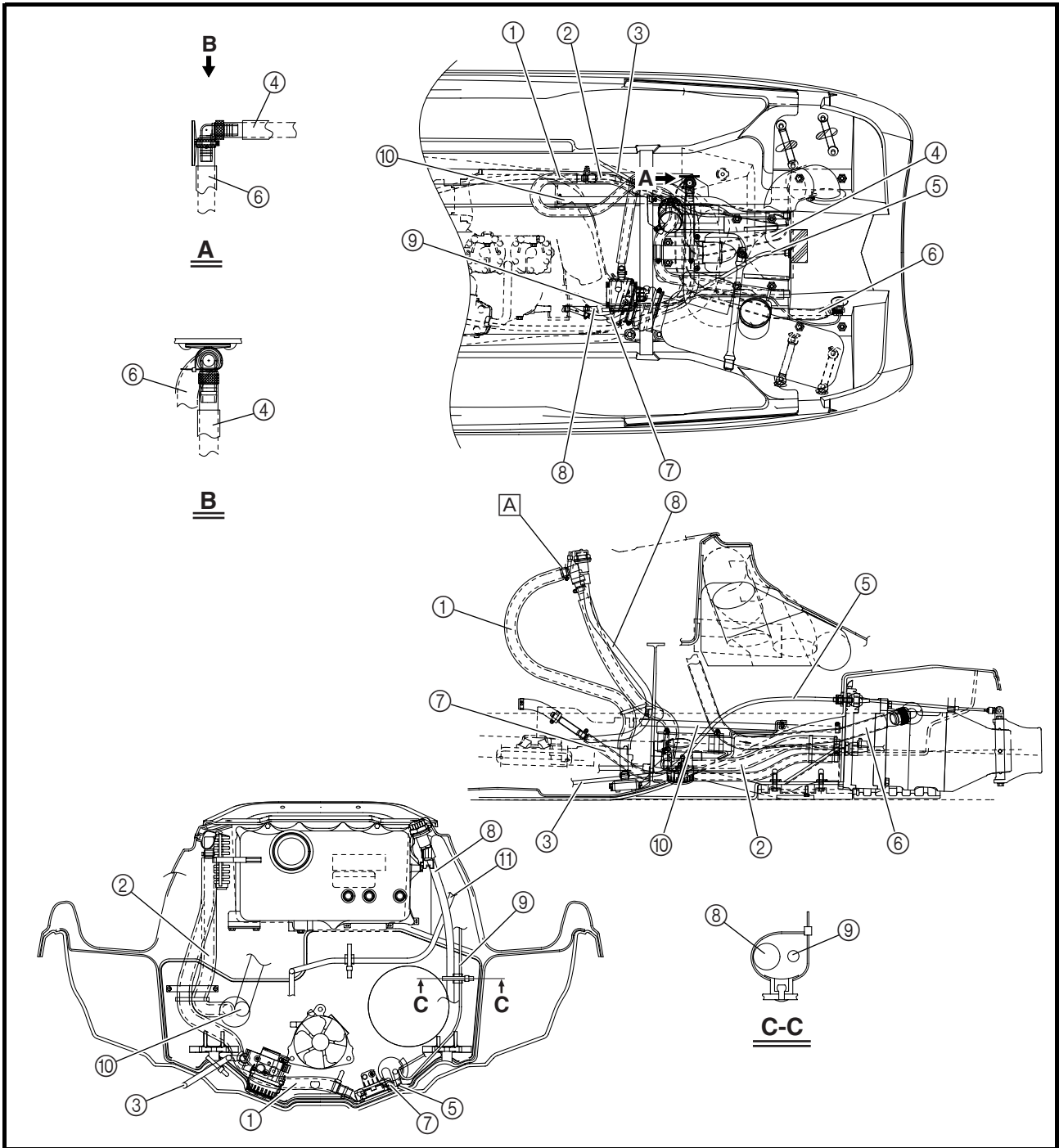
- A** Align the parting line on the fuel filler neck with the lot mark on the fuel filler hose.
- B** To wire harness
- C** To ventilation socket
- D** To fuel tank
- E** Down
- F** Up
- G** Bow



- |                              |                               |                                       |
|------------------------------|-------------------------------|---------------------------------------|
| ① Buzzer lead                | ⑪ Negative battery lead       | ⑳ Fuel pump coupler                   |
| ② Throttle cable             | ⑫ Starter motor lead          | ㉑ Atmospheric pressure sensor coupler |
| ③ YPVS servomotor            | ⑬ Speed sensor coupler        | ㉒ Steering switch coupler             |
| ④ YPVS cables                | ⑭ Oil level sensor coupler    | ㉓ Wire harness (generator)            |
| ⑤ Positive battery lead      | ⑮ Buzzer coupler              | ㉔ Wire harness (throttle bodies)      |
| ⑥ Battery breather hose      | ⑯ Engine stop switch coupler  | ㉕ Wire harness                        |
| ⑦ Electrical bilge pump lead | ⑰ Multifunction meter coupler |                                       |
| ⑧ Steering cable             | ⑱ Start switch coupler        |                                       |
| ⑨ QSTS cable                 | ⑲ ECM coupler                 |                                       |
| ⑩ Speed sensor lead          | ㉐ Slant detection switch      |                                       |



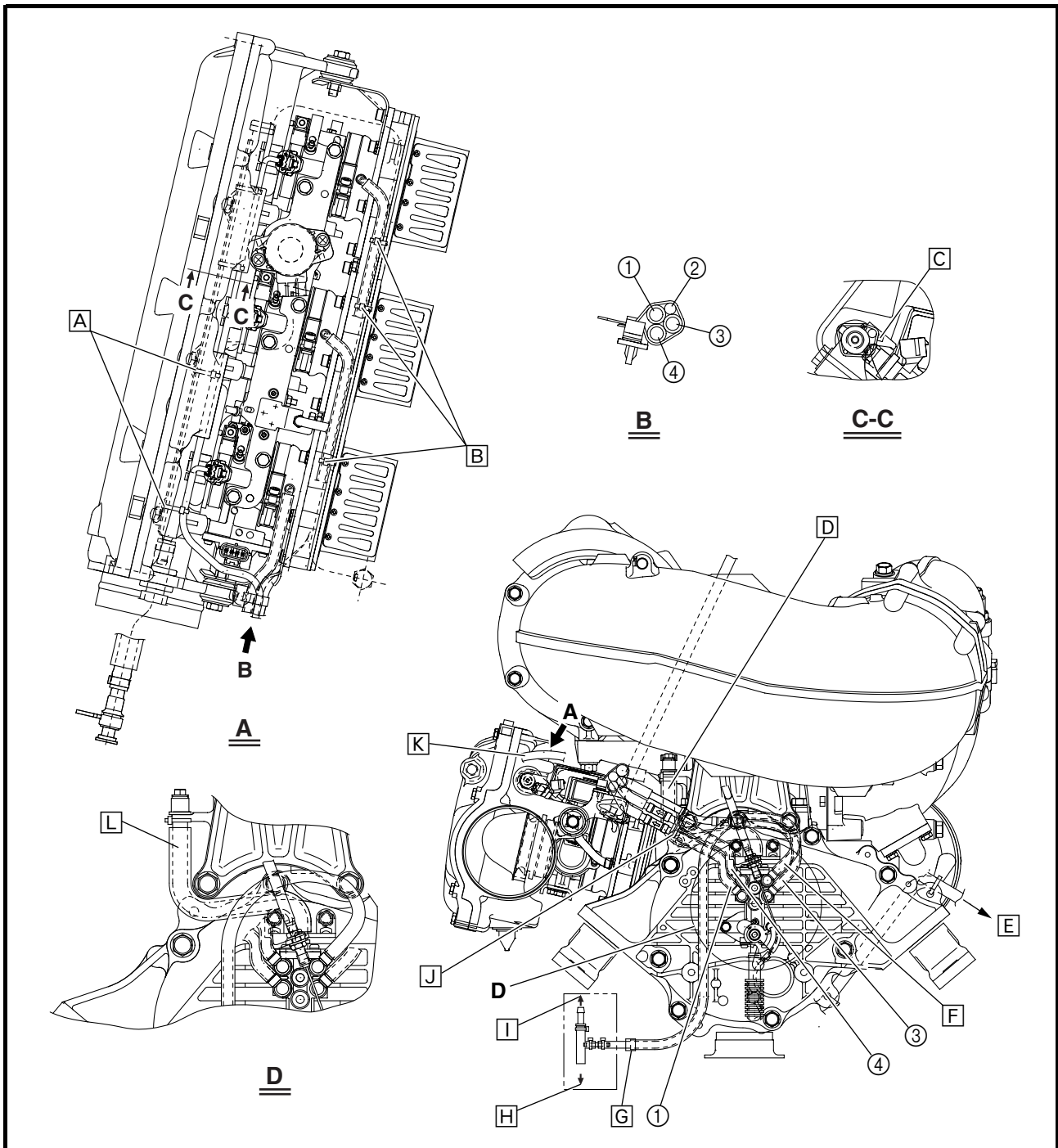
- A** To cylinder #3
- B** To cylinder #2
- C** To cylinder #1
- D** Cooling water temperature sensor
- E** Exhaust temperature sensor
- F** To positive battery terminal
- G** To starter motor



- ① Bilge hose 1
- ② Bilge hose 2
- ③ Steering cable
- ④ Bilge hose 3
- ⑤ QSTS cable
- ⑥ Bilge hose 4
- ⑦ Cooling water hose (cooling water inlet)
- ⑧ Flushing hose
- ⑨ Speed sensor lead
- ⑩ Cooling water hose (cooling water outlet)

- ⑪ Electrical bilge pump lead

**A** Contact the corrugated tube (bilge hose 1) to the hose screw clamp.

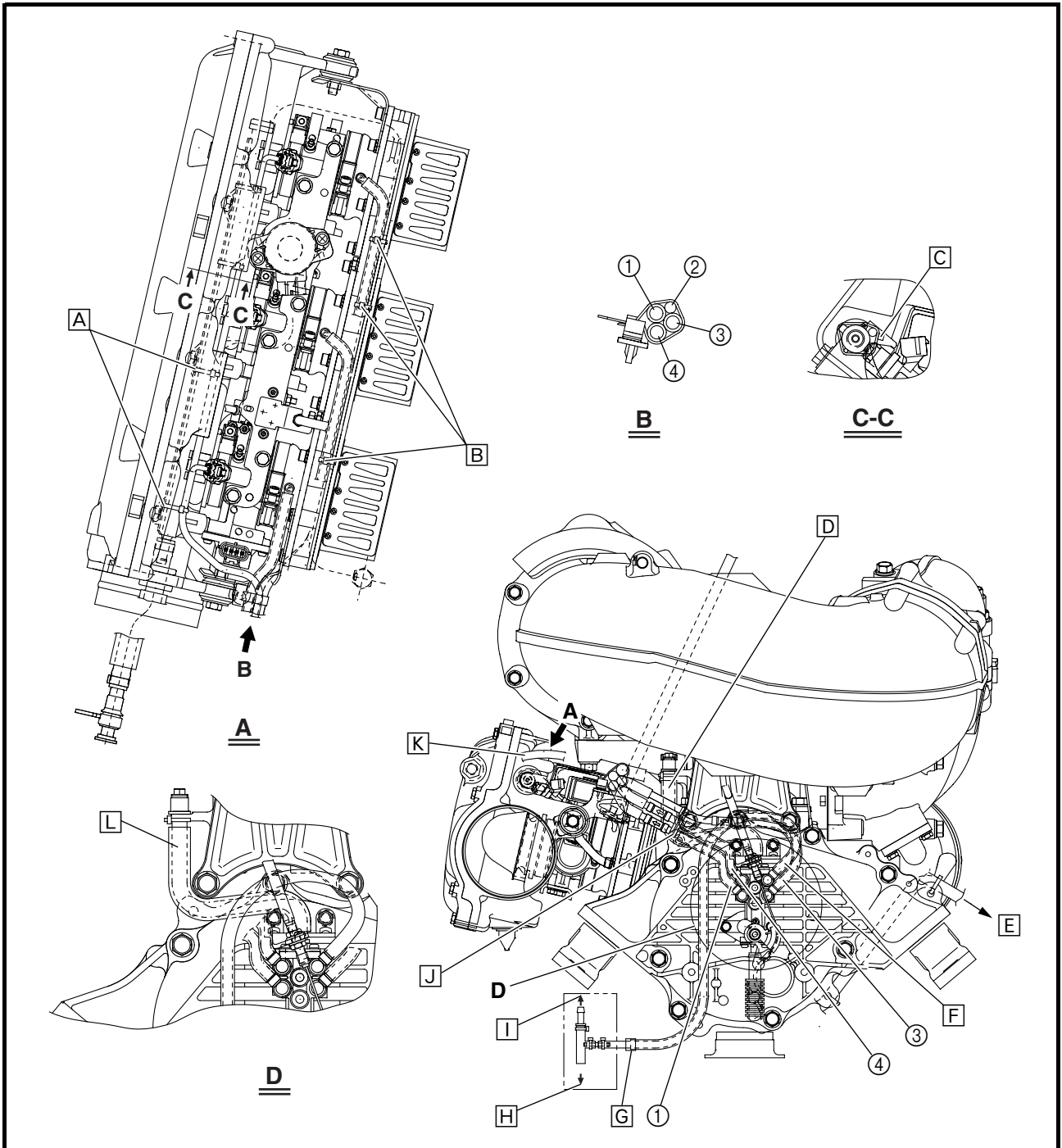


- ① Oil delivery hose #1
- ② Sub-wire harness
- ③ Oil delivery hose #3
- ④ Oil delivery hose #2

- [A] Pass the plastic tie through the holes of the rib on the fuel rail.
- [B] Fasten oil delivery hoses #2 and #3 and the engine temperature sensor lead with a plastic tie.

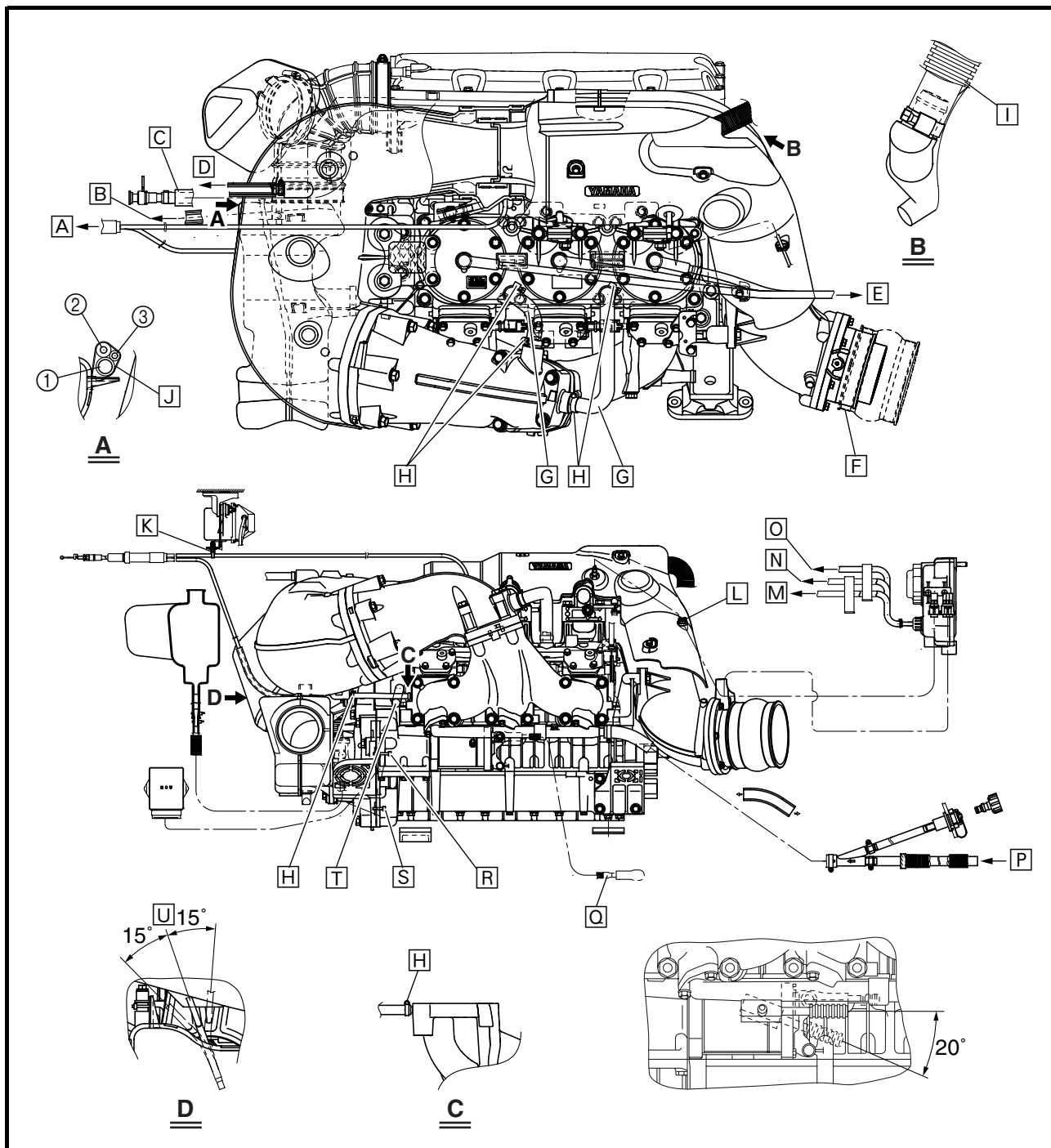
- [C] Fasten the sub-wire harness with the plastic tie on the rib of the fuel rail. Be sure to position the plastic tie so that the fastener is visible from the outside.
- [D] Pass the oil bleed hose on the inside of the oil pump cable.
- [E] To ECM
- [F] Pass the oil return hose on the outside of the oil pump cable.





- G** Push the corrugated tube toward the oil pump, and then tape it.
- H** To oil tank
- I** To check valve
- J** Install the oil hoses into the hose holders so that the holders do not cover the check valve clips.
- K** Pass the intake air temperature sensor lead over the fuel hose.

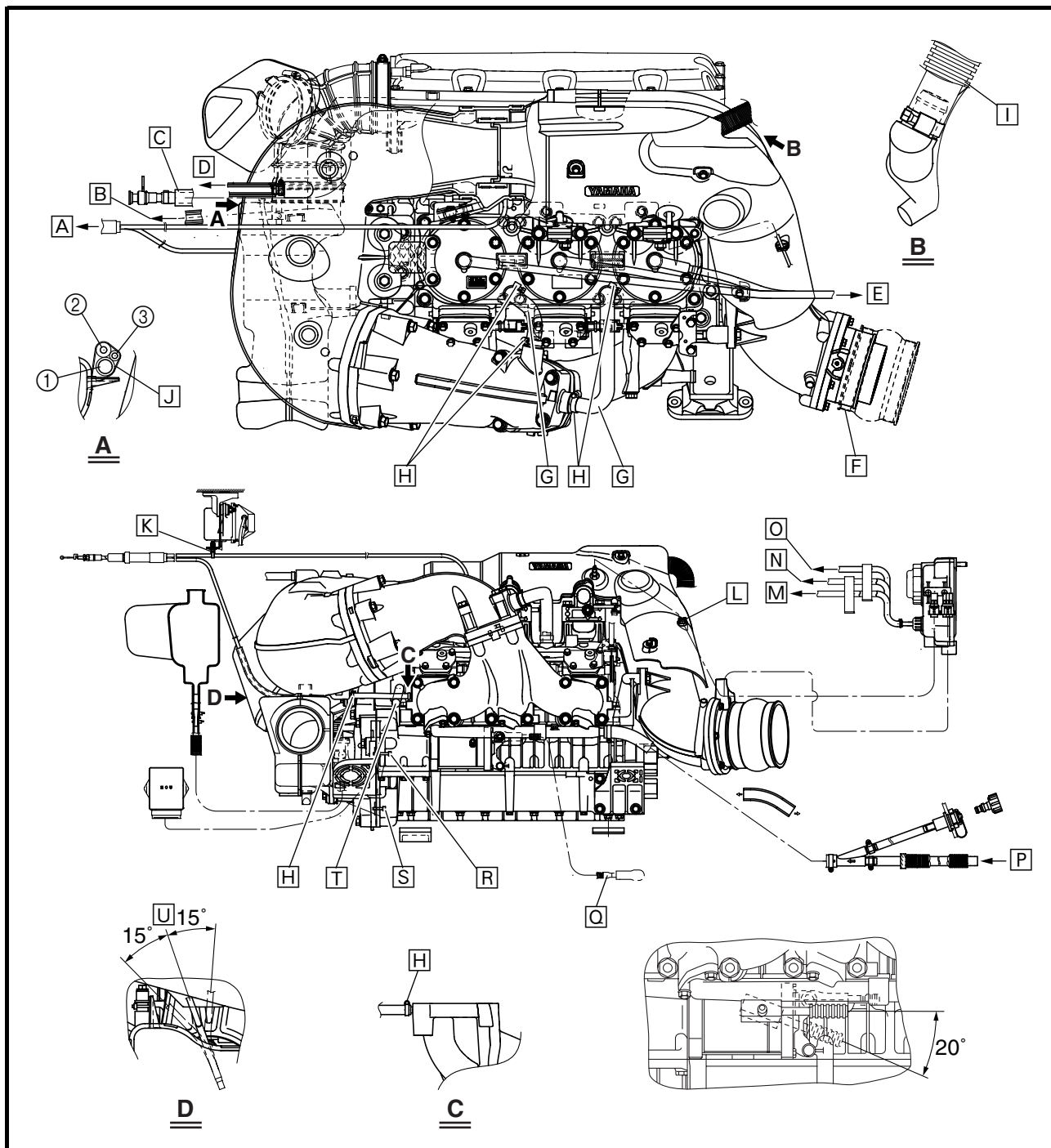
- L** Pass the bleed hose under the exhaust chamber bracket. Be sure to install the L-shaped bleed hose toward the oil pump.



- ① Cooling water hose  
(cooling water pilot outlet on port side)
- ② Fuel hose
- ③ Oil return hose

- A** To throttle lever
- B** To cooling water pilot outlet on port side
- C** When fastening the corrugated tube of the fuel hose to the intake silencer, slide it toward the fuel pump, and then tighten it with a plastic tie.

- D** To cooling water pilot outlet on starboard side
- E** To electrical box
- F** Install the exhaust joint so that it contacts the stoppers on the muffler assembly.
- G** Face the red mark end of the cooling hose toward the cylinder head cover, and then install the hose.
- H** Install the hose screw clamps in the direction shown.



- [I] Contact the corrugated tube to the hose screw clamp (muffler assembly end).
- [J] Strongly pull the plastic tie.
- [K] After installing the YPVS servomotor, fasten the throttle cable.
- [L] Fasten the exhaust temperature sensor lead.
- [M] To cylinder #1
- [N] To cylinder #2
- [O] To cylinder #3
- [P] Cooling water inlet

- [Q] Install the white tape end of the negative battery lead to the battery.
- [R] Fasten the sub-wire harness and wire harness (generator).
- [S] Fasten the wire harness (generator).
- [T] Route the sub-wire harness under the cooling water hose.
- [U] Install the oil pump cable to the angle shown in the illustration.

## CHAPTER 3

### PERIODIC INSPECTION AND ADJUSTMENT

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## MAINTENANCE INTERVAL CHART

Use the following chart as a guide to general maintenance.

Adjust the maintenance intervals according to the operating conditions of the watercraft.

MAINTENANCE INTERVAL  ITEM		INITIAL			THEREAFTER EVERY		PAGE
		10 hours	50 hours	100 hours	100 hours	200 hours	
			6 months	12 months	12 months	24 months	
Spark plug	Inspect, clean, adjust	○		○	○		3-9
Lubrication points	Lubricate			○	○		3-17
Intermediate housing	Lubricate	○ <sup>*1</sup>		○ <sup>*2</sup>	○ <sup>*2</sup>		3-19
Fuel system	Inspect			○	○		3-7
Fuel tank	Clean					○	3-7
Oil injection system	Inspect, clean	○				○	3-8
Throttle shaft	Inspect			○	○		—
Cooling water passages	Flush	○ <sup>*3</sup>					—
Water inlet strainer	Inspect, clean			○	○		3-15
Bilge strainer	Clean			○	○		3-16
Electric bilge pump strainer	Inspect, clean			○	○		3-16
Impeller	Inspect	○ <sup>*4</sup>		○	○		3-15
Jet thrust nozzle angle	Inspect			○	○		3-2
QSTS mechanism	Inspect, adjust	○ <sup>*4</sup>		○	○		3-4
Throttle lever	Check operation	○ <sup>*4</sup>					3-3
Throttle cable	Inspect, adjust			○	○		3-3
Stern drain plugs	Inspect, replace	○ <sup>*4</sup>		○	○		3-17
Battery	Inspect	○ <sup>*5</sup>		○	○		3-12
Rubber coupling	Inspect					○	—
Engine mount	Inspect					○	5-15
Nuts and bolts	Inspect	○		○	○		—

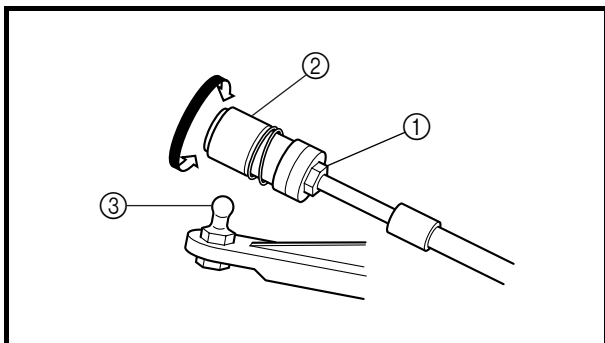
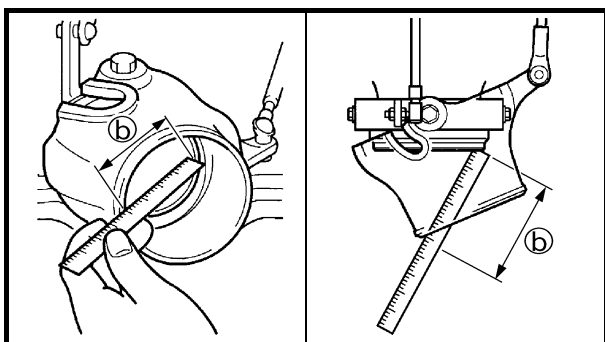
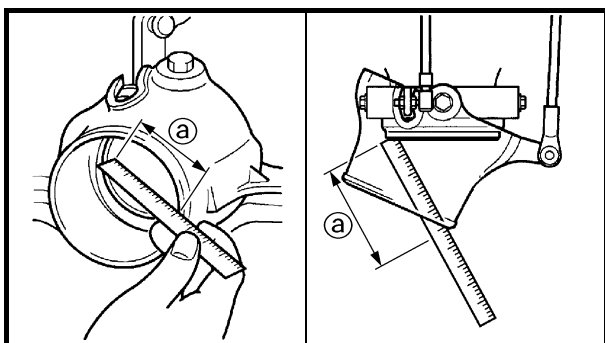
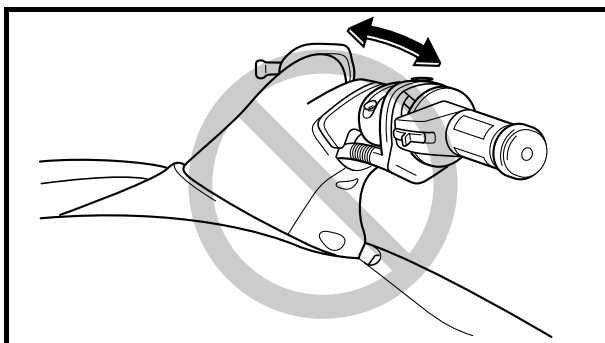
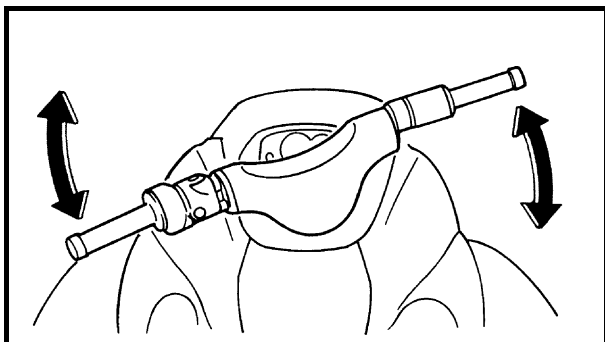
<sup>\*1</sup> Grease quantity: 33.0–35.0 cm<sup>3</sup> (1.11–1.18 oz)

<sup>\*2</sup> Grease quantity: 6.0–8.0 cm<sup>3</sup> (0.20–0.27 oz)

<sup>\*3</sup> After each use

<sup>\*4</sup> Before each use

<sup>\*5</sup> Check the electrolyte level before each use.



**PERIODIC SERVICE**  
**CONTROL SYSTEM**

**Steering column inspection**

1. Check:
  - Steering column  
Excessive play → Replace the steering column.  
Refer to “STEERING COLUMN” in Chapter 8.

**Checking steps:**

- Move the handlebar up and down and back and forth.
- Check the excessive play of the handlebar.

**Steering cable inspection and adjustment**

1. Measure:
  - Jet thrust nozzle distances ① and ②  
Difference → Adjust.

**Difference of distances ① and ②:**  
**Maximum 5 mm (0.2 in)**

**Measurement steps:**

- Set the control grip to the neutral position.
- Turn the handlebar lock to lock.
- Measure distances ① and ②.
- If the difference of distances ① and ② is not within specification, adjust the cable joint.

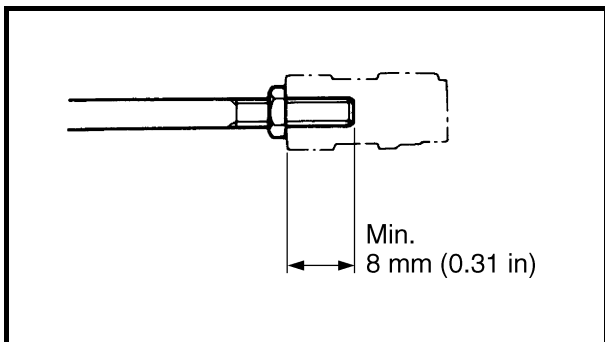
2. Adjust:

- Steering cable joint  
(steering column end)

**Adjustment steps:**

- Set the control grip to the neutral position.
- Loosen the locknut ①.
- Disconnect the steering cable joint ② from the ball joint ③.
- Turn the cable joint in or out to adjust distances ① and ②.

<b>Turn in</b>	<b>Distance ① is increased.</b>
<b>Turn out</b>	<b>Distance ② is increased.</b>



**⚠ WARNING**

The cable joint must be screwed in a minimum of 8 mm (0.31 in).

- Connect the cable joint, and then tighten the locknut.

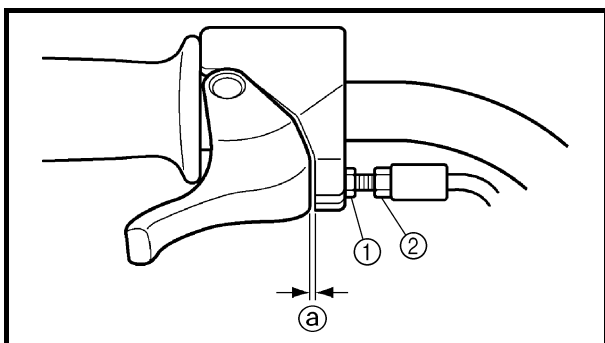


**Locknut:**

**6.8 N • m (0.68 kgf • m, 4.9 ft • lb)**

**NOTE:**

If the steering cable cannot be properly adjusted by the cable joint at the steering column end, adjust the cable joint at the jet pump end so that the specified distance is obtained. Refer to “REMOTE CONTROL CABLES AND SPEED SENSOR LEAD” in Chapter 8.



**Throttle cable inspection and adjustment**

1. Measure:

- Throttle lever free play **a**  
Out of specification → Adjust.



**Throttle lever free play:**

**4–7 mm (0.16–0.28 in)**

2. Adjust:

- Throttle lever free play

**Adjustment steps:**

- Loosen the locknut ①.
- Turn the adjuster ② in or out until the specified free play is obtained.

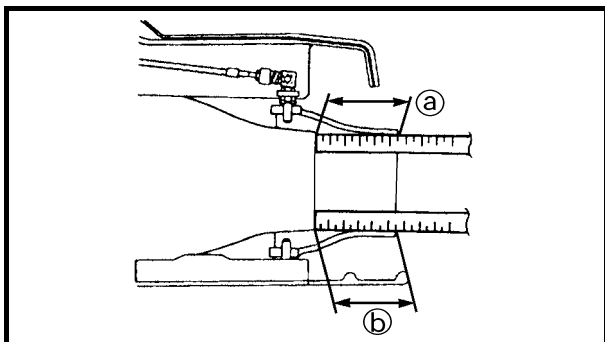
Turn in	Free play is increased.
---------	-------------------------

Turn out	Free play is decreased.
----------	-------------------------

- Tighten the locknut.

**⚠ WARNING**

After adjusting the free play, turn the handlebar to the right and left and make sure that the trolling speed does not increase.



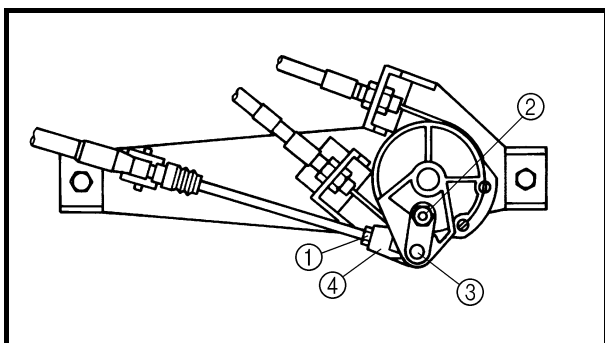
**QSTS cable inspection and adjustment**

1. Measure:

- Jet thrust nozzle set lengths ① and ②
- Out of specification → Adjust.

**Measurement steps:**

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



2. Adjust:

- QSTS cable

**Adjustment steps:**

- Set the control grip to 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 to adjust lengths ① and ②.

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

**⚠ WARNING**

The cable joint must be screwed in a minimum of 8 mm (0.31 in).

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



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

- Tighten the locknut ①.



**Locknut:**  
4 N • m (0.4 kgf • m, 2.9 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. Refer to “REMOTE CONTROL CABLES AND SPEED SENSOR LEAD” in Chapter 8.

**Trolling speed check**

**NOTE:**

The trolling speed of this model is adjusted automatically by the ECM according to the operating conditions of the watercraft. Therefore, it is not necessary to adjust the trolling speed.

1. Measure:

- Trolling speed  
Out of specification → Proceed to step 2.

	<b>Trolling speed:</b> <b>1,250–1,450 r/min</b>
--	--

**Checking steps: (watercraft in water)**

- Start the engine and warm it up for a few minutes at 4,000–4,500 r/min to stabilize the trolling speed.
- Measure the trolling speed.

2. If the trolling speed is out of specification, check the following.

If no malfunctions are found after performing all of the checks, replace the throttle bodies.

- Check the spark plugs.  
Refer to “Spark plug inspection.”
- Check the throttle cable and oil pump cable.  
Refer to “Throttle cable inspection and adjustment.”  
Refer to “OIL PUMP” in Chapter 4.
- Check the intake passages.  
Refer to “INTAKE DUCT AND INTAKE SILENCER” in Chapter 4.  
Refer to “REED VALVES” in Chapter 5.  
Refer to “HOSES” in Chapter 8.

- Check the exhaust passages.  
Refer to “MUFFLER ASSEMBLY” in Chapter 5.  
Refer to “EXHAUST CHAMBER ASSEMBLY” in Chapter 5.  
Refer to “EXHAUST MANIFOLD” in Chapter 5.  
Refer to “EXHAUST SYSTEM” in Chapter 8.
- Measure the fuel pressure.  
Refer to “Fuel pressure measurement” in Chapter 4.
- Check the fuel for deterioration, the fuel tank for water accumulation, the fuel lines for clogs or kinks, and the fuel injectors for clogs.  
Refer to “FUEL SYSTEM.”  
Refer to “FUEL TANK AND FUEL PUMP MODULE” in Chapter 4.  
Refer to “FUEL INJECTION SYSTEM” in Chapter 4.
- Measure the compression pressure.  
Refer to “COMPRESSION PRESSURE MEASUREMENT” in Chapter 5.
- Check the jet pump and impeller.  
Refer to “JET PUMP UNIT” in Chapter 6.
- Check the diagnostic codes in the “Diagnosis Record” and check for any malfunctions using the “Static Test” and “Active Test” of the Yamaha Diagnostic System.  
Refer to “INTRODUCTION” in Chapter 9.



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