YAMAHA

WaveRunner
FX High Output
FX Cruiser High Output

SERVICE MANUAL

LIT-18616-02-83

F1S-28197-1G-11

NOTICE

This manual has been prepared by Yamaha primarily for use by Yamaha dealers and their trained mechanics when performing maintenance procedures and repairs to Yamaha equipment. It has been written to suit the needs of persons who have a basic understanding of the mechanical and electrical concepts and procedures inherent in the work, for without such knowledge attempted repairs or service to the equipment could render it unsafe or unfit for use.

Because Yamaha has a policy of continuously improving its products, models may differ in detail from the descriptions and illustrations given in this publication. Use only the latest edition of this manual. Authorized Yamaha dealers are notified periodically of modifications and significant changes in specifications and procedures, and these are incorporated in successive editions of this manual.

A10001-0*

WaveRunner
FX High Output, FX Cruiser High Output
SERVICE MANUAL

1st Edition, February 2004

Printed in USA
LIT-18616-02-83

HOW TO USE THIS MANUAL

MANUAL FORMAT

All of the procedures in this manual are organized in a sequential, step-by-step format. The information has been compiled to provide the mechanic with an easy to read, handy reference that contains comprehensive explanations of all disassembly, repair, assembly, and inspection operations.

In this revised format, the condition of a faulty component will precede an arrow symbol and the course of action required will follow the symbol, e.g.,

- Bearings
  Pitting/scratches → Replace.

To assist you in finding your way through this manual, the section title and major heading is given at the top of every page.

ILLUSTRATIONS

The illustrations within this service manual represent all of the designated models.

CROSS REFERENCES

The cross references have been kept to a minimum. Cross references will direct you to the appropriate section or chapter.

IMPORTANT INFORMATION

In this Service Manual particularly important information is distinguished in the following ways.

⚠ The Safety Alert Symbol means ATTENTION! BECOME ALERT! YOUR SAFETY IS INVOLVED!

⚠ WARNING

Failure to follow WARNING instructions could result in severe injury or death to the machine operator, passenger(s), a bystander, or a person inspecting or repairing the watercraft.

CAUTION:

A CAUTION indicates special precautions that must be taken to avoid damage to the watercraft.

NOTE:

A NOTE provides key information to make procedures easier or clearer.

IMPORTANT:

This part has been subjected to change of specification during production.

HOW TO USE THIS MANUAL

① To help identify parts and clarify procedure steps, there are exploded diagrams at the start of each removal and disassembly section.

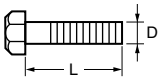
② Numbers are given in the order of the jobs in the exploded diagram.

③ Symbols indicate parts to be lubricated or replaced (see “SYMBOLS”).

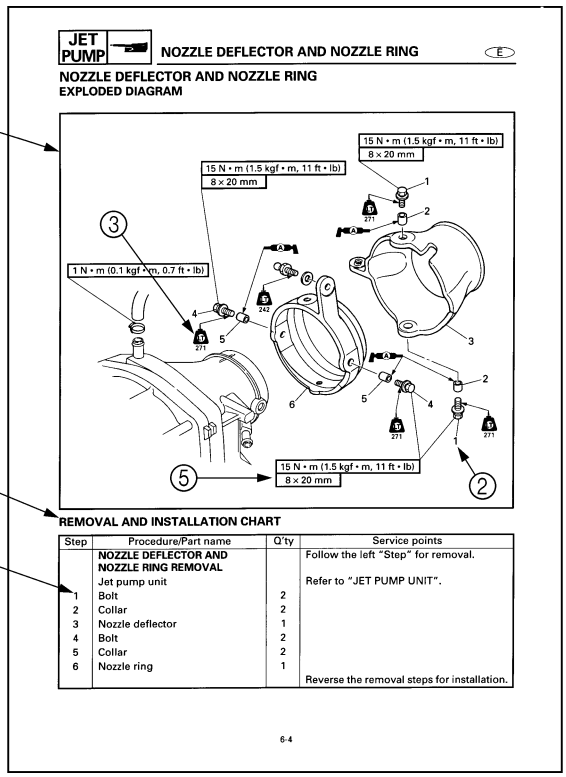
④ A job instruction chart accompanies the exploded diagram, providing the order of jobs, names of parts, notes in jobs, etc.

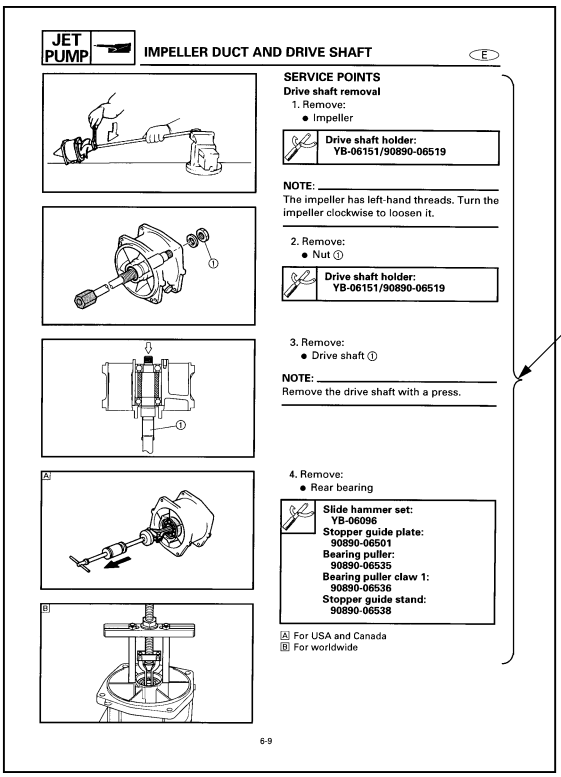
⑤ Dimension figures and the number of parts, are provided for fasteners that require a tightening torque.

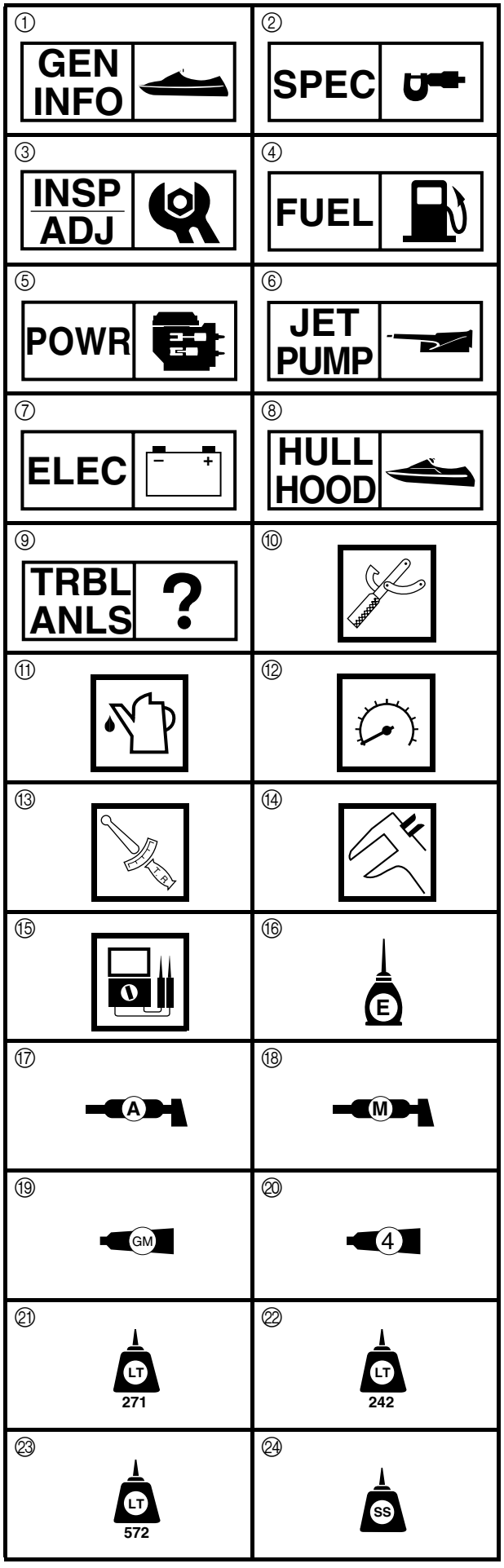
Example:
Bolt or screw size 10 × 25 mm : M10 (D) × 25 mm (L)



⑥ Jobs requiring more information (such as special tools and technical data) are described sequentially.







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SYMBOLS

Symbols ① to ⑨ are designed to indicate the content of a chapter.

① General Information
② Specifications
③ Periodic Inspection and Adjustment
④ Fuel System
⑤ Power Unit
⑥ Jet Pump Unit
⑦ Electrical System
⑧ Hull and Hood
⑨ Trouble Analysis

Symbols ⑩ to ⑮ indicate specific data.

⑩ Special tool
⑪ Specified oil or fluid
⑫ Specified engine speed
⑬ Specified tightening torque
⑭ Specified measurement
⑮ Specified electrical value (resistance, voltage, electric current)

Symbols ⑯ to ⑱ in an exploded diagram indicate the grade of lubricant and the lubrication point.

⑯ Apply Yamaha 4-stroke motor oil
⑰ Apply water resistant grease (Yamaha grease A, Yamaha marine grease)
⑱ Apply molybdenum disulfide grease

Symbols ⑲ to ㉔ in an exploded diagram indicate the type of sealant or locking agent and the application point.

⑲ Apply Gasket Maker
⑳ Apply Yamabond No. 4
㉑ Apply LOCTITE 271 (red)
㉒ Apply LOCTITE 242 (blue)
㉓ Apply LOCTITE 572
㉔ Apply silicone sealant

NOTE:

Additional symbols may be used in this manual.

A30000-0

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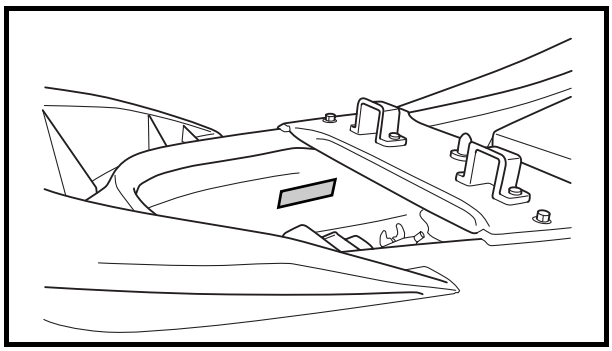
CHAPTER 1
GENERAL INFORMATION



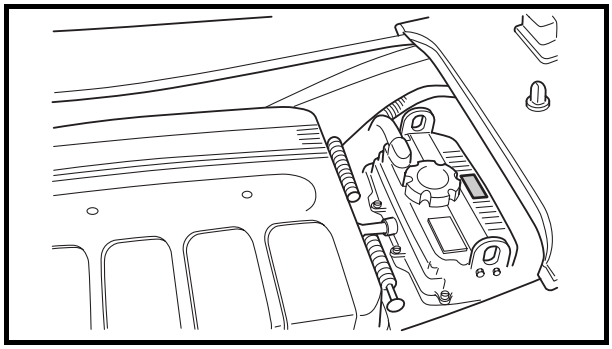
A60700-0*

IDENTIFICATION NUMBERS

PRIMARY I.D. NUMBER

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

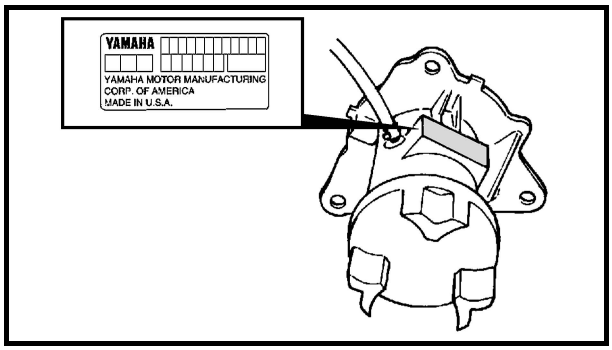
Starting primary I.D. number:
F1S: 800101



ENGINE SERIAL NUMBER

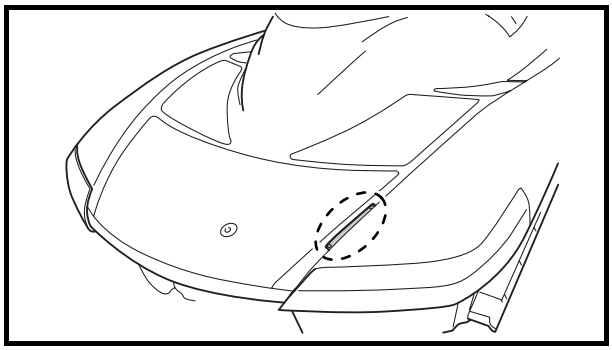
The engine serial number is stamped on a label attached to the engine unit.

Starting serial number:
6B6: 1000001



JET PUMP UNIT SERIAL NUMBER

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

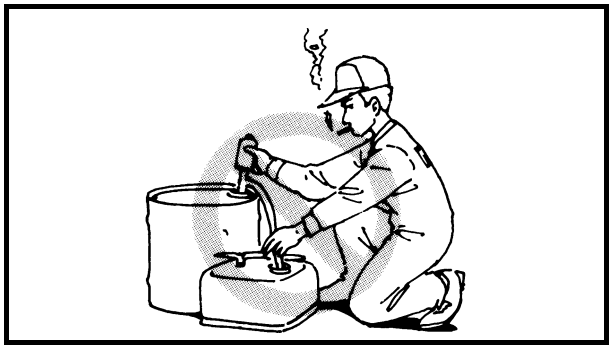


HULL IDENTIFICATION NUMBER (H.I.N.)

The H.I.N. is stamped on a plate attached to the aft deck.

⚠ SAFETY WHILE WORKING

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



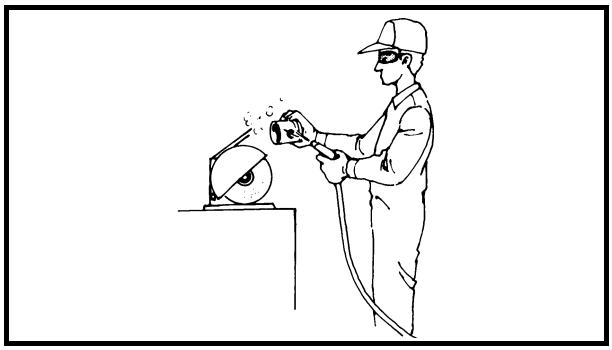
FIRE PREVENTION

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.

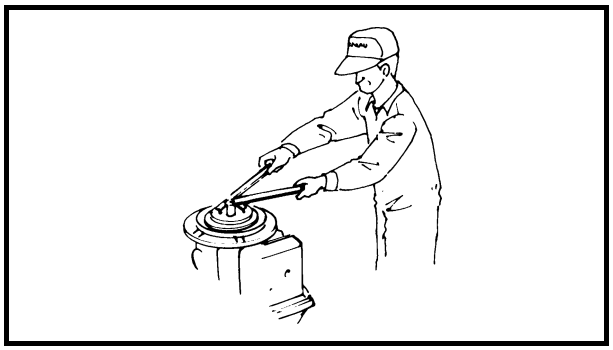
Protect your hands and feet by wearing protective gloves or safety shoes when necessary.

PARTS, LUBRICANTS, AND SEALANTS

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

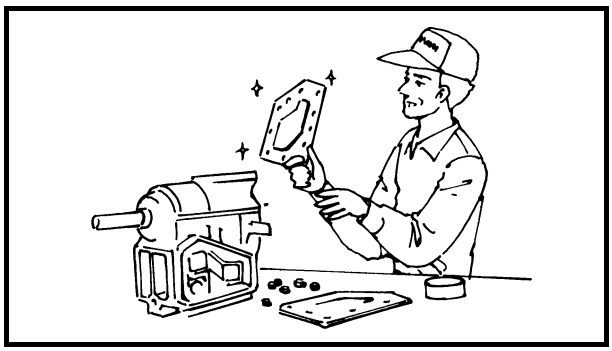
Under normal conditions, the lubricants mentioned in this manual should not harm or be hazardous to your skin. However, you should follow these precautions to minimize any risk when working with lubricants.

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.

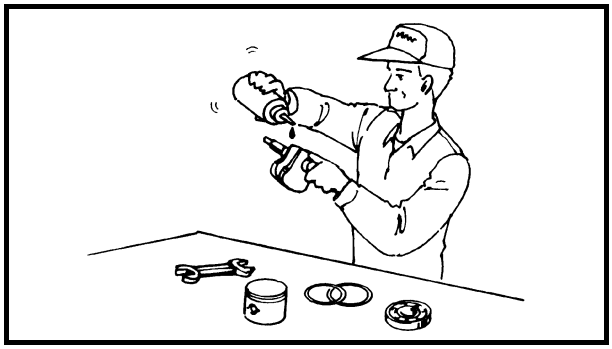


GOOD WORKING PRACTICES

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.

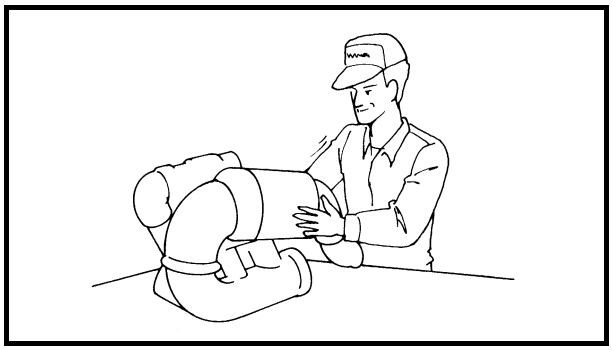


3. **Non-reusable parts**
   Always use new gaskets, seals, O-rings, oil seals, cotter pins, circlips, etc., when installing or assembling parts.



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.



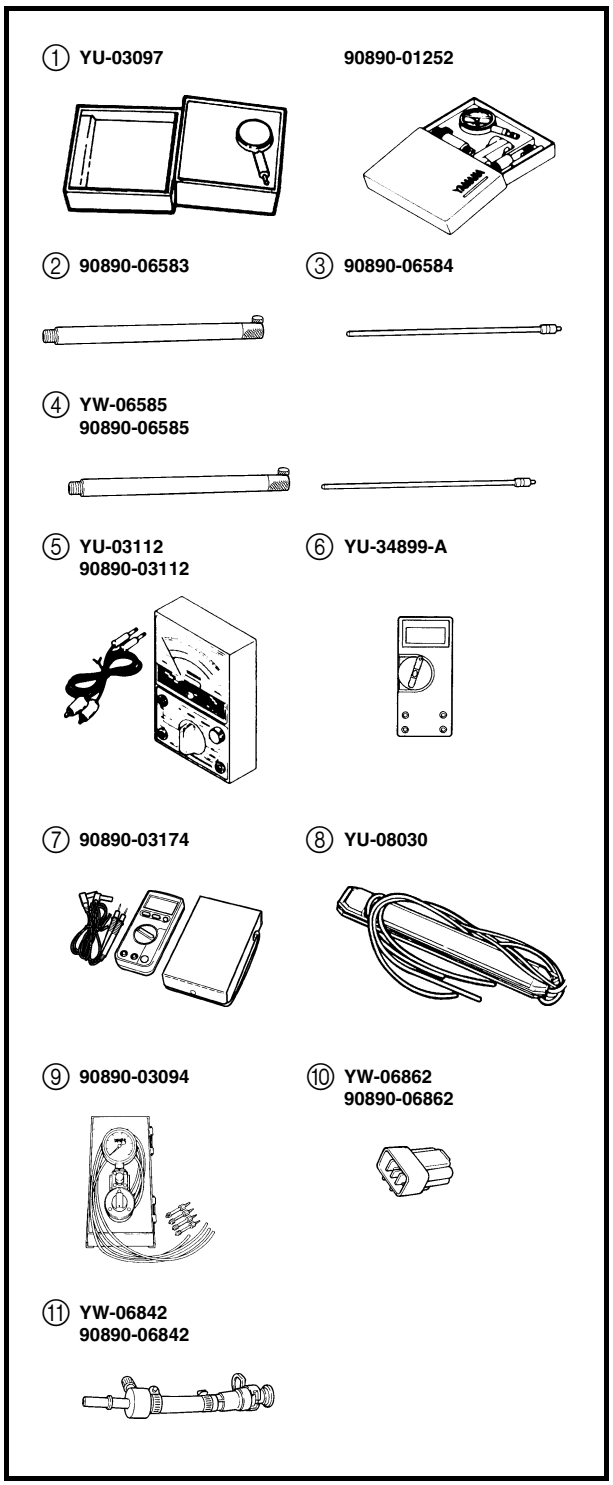
3. Install bearings with the manufacture identification mark in the direction indication in the installation procedure. In addition, be sure to lubricate the bearings liberally.
4. Apply a thin coat of water-resistant grease to the lip and periphery of an oil seal before installation.
5. Check that moving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

SPECIAL TOOLS

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

NOTE:

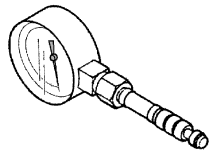
- For U.S.A. and Canada, use part numbers starting with "J-", "YB-", "YM-", "YS-", "YU-" or "YW-".
- For other countries, use part numbers starting with "90890-".

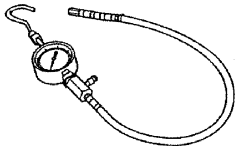


MEASURING

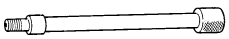
① Dial gauge
P/N. YU-03097
90890-01252
② Dial gauge stand
P/N. 90890-06583
③ Dial gauge needle
P/N. 90890-06584
④ Dial gauge stand set
P/N. YW-06585
90890-06585
⑤ Pocket tester
P/N. YU-03112
90890-03112
⑥ Digital multimeter
P/N. YU-34899-A
⑦ Digital circuit tester
P/N. 90890-03174
⑧ Carburetor synchronizer
P/N. YU-08030
⑨ Vacuum gauge
P/N. 90890-03094
⑩ Test connector
P/N. YW-06862
Test connector FMY-8
P/N. 90890-06862
⑪ Fuel pressure gauge adapter
P/N. YW-06842
90890-06842

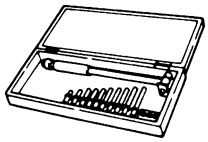
⑫ YB-06766 90890-06786



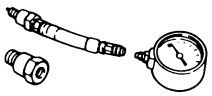


⑬ 90890-06582 ⑭ YU-03017 90890-06759

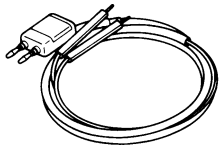


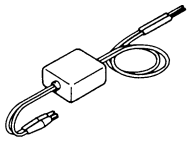


⑮ YU-33223-1 90890-03160

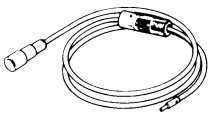


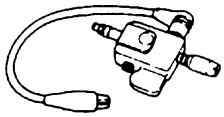
⑯ YU-39991 ⑰ 90890-03172



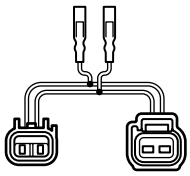


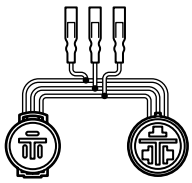
⑱ YM-34487 ⑲ 90890-06754



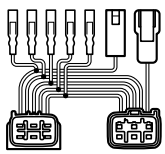


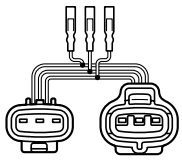
⑳ YB-06867 (-06767) 90890-06867 (-06767) ㉑ YB-06870 (-06770) 90890-06870 (-06770)





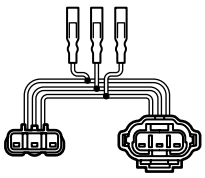
㉒ YB-06848 90890-06848 ㉓ YB-06793 90890-06793



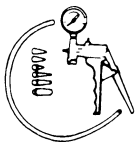


⑫ Fuel pressure gauge
P/N. YB-06766
90890-06786
⑬ Compression gauge extension
P/N. 90890-06582
⑭ Cylinder gauge set
P/N. YU-03017
90890-06759
⑮ Compression gauge
P/N. YU-33223-1
90890-03160
⑯ Peak volt meter adapter
P/N. YU-39991
⑰ Peak voltage adapter B
P/N. 90890-03172
⑱ Spark gap tester
P/N. YM-34487
⑲ Ignition tester
P/N. 90890-06754
⑳ Test harness (2 pins)
P/N. New: YB-06867
Current: YB-06767
Test harness FWY-2 (2 pins)
P/N. New: 90890-06867
Current: 90890-06767
㉑ Test harness (3 pins)
P/N. New: YB-06870
Current: YB-06770
Test harness SMT250-3 (3 pins)
P/N. New: 90890-06870
Current: 90890-06770
㉒ Test harness (6 pins)
P/N. YB-06848
Test harness FSW-6A (6 pins)
P/N. 90890-06848
㉓ Test harness (3 pins)
P/N. YB-06793
Test harness SMHW099-3 (3 pins)
P/N. 90890-06793

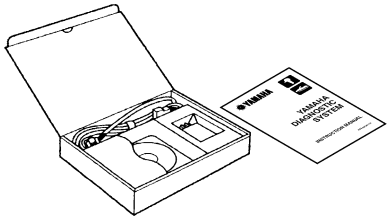
㉔ YB-06877 (-06777)
90890-06877 (-06777)



㉕ YB-35956-A
90890-06756



㉖ 60V-85300-02



㉗ 60V-WS853-02

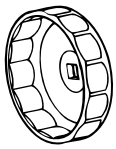
㉔ Test harness (3 pins)
P/N. New: YB-06877
Current: YB-06777
Test harness HM090-3 (3 pins)
P/N. New: 90890-06877
Current: 90890-06777

㉕ Lower unit pressure/vacuum tester
P/N. YB-35956-A
Vacuum/pressure pump gauge set
P/N. 90890-06756

㉖ Yamaha diagnostic system
P/N. 60V-85300-02

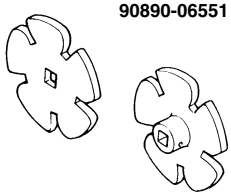
㉗ Yamaha diagnostic system
P/N. 60V-WS853-02

① YU-38411
90890-01426

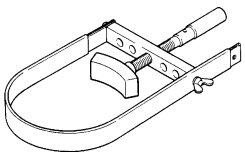


② YW-06551

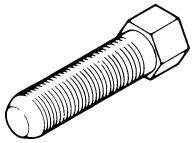
90890-06551



③ YS-01880-A
90890-01701



④ YM-01082
90890-01080



REMOVAL AND INSTALLATION

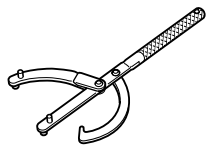
① Oil filter wrench
P/N. YU-38411
90890-01426

② Coupler wrench
P/N. YW-06551
90890-06551

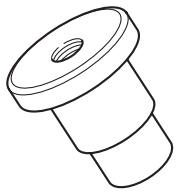
③ Sheave holder
P/N. YS-01880-A
90890-01701

④ Rotor puller
P/N. YM-01082
90890-01080

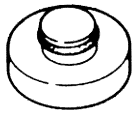
⑤ **YU-01235**
90890-01235



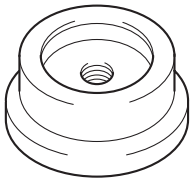
⑥ **YB-06111**



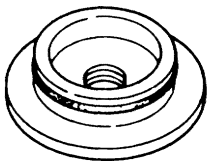
⑦ **90890-06631**



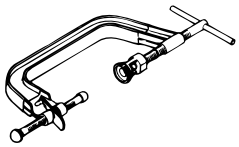
⑧ **YB-06726-B**



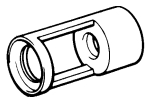
⑨ **90890-06657**



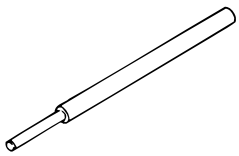
⑩ **YM-01253**
90890-04019



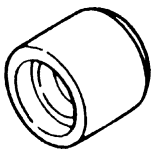
⑪ **YM-4114 (ø19 mm)**
90890-04114 (ø19 mm)
YM-4108 (ø22 mm)
90890-04108 (ø22 mm)



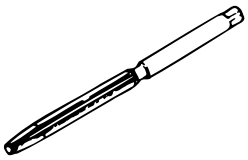
⑫ **YM-04111 (ø4.0 mm)**
90890-04111 (ø4.0 mm)
YM-04116 (ø4.5 mm)
90890-04116 (ø4.5 mm)



⑬ **YM-04112 (ø4.0 mm)**
90890-04112 (ø4.0 mm)
YM-04117 (ø4.5 mm)
90890-04117 (ø4.5 mm)

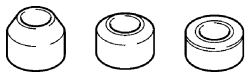


⑭ **YM-04113 (ø4.0 mm)**
90890-04113 (ø4.0 mm)
YM-04118 (ø4.5 mm)
90890-04118 (ø4.5 mm)

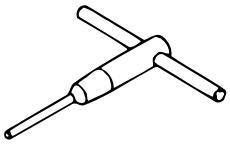


⑤ Universal magneto and rotor holder
P/N. YU-01235
Rotor holder
P/N. 90890-01235
⑥ Bearing housing needle bearing installer (reduction drive gear)
P/N. YB-06111
⑦ Ball bearing attachment (reduction drive gear)
P/N. 90890-06631
⑧ Forward gear bearing cup installer (reduction drive gear)
P/N. YB-06726-B
⑨ Ball bearing attachment (reduction drive gear)
P/N. 90890-06657
⑩ Valve spring compressor
P/N. YM-01253
90890-04019
⑪ Valve spring compressor attachment
P/N. YM-4114 (ø19 mm)
90890-04114 (ø19 mm)
YM-4108 (ø22 mm)
90890-04108 (ø22 mm)
⑫ Valve guide remover
P/N. YM-04111 (ø4.0 mm)
90890-04111 (ø4.0 mm)
YM-04116 (ø4.5 mm)
90890-04116 (ø4.5 mm)
⑬ Valve guide installer
P/N. YM-04112 (ø4.0 mm)
90890-04112 (ø4.0 mm)
YM-04117 (ø4.5 mm)
90890-04117 (ø4.5 mm)
⑭ Valve guide reamer
P/N. YM-04113 (ø4.0 mm)
90890-04113 (ø4.0 mm)
YM-04118 (ø4.5 mm)
90890-04118 (ø4.5 mm)

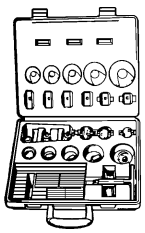
⑮ 90890-06813 (60°)
90890-06814 (45°)
90890-06815 (30°)
90890-06315 (60°)
90890-06312 (45°)
90890-06328 (30°)



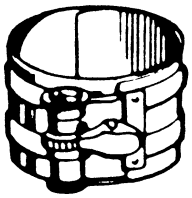
⑯ 90890-06811 (ø4.0 mm)
90890-06812 (ø4.5 mm)



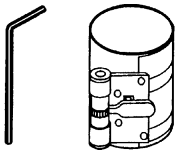
⑰ YM-91043-C



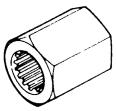
⑱ YM-08037



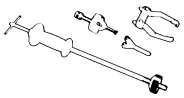
90890-05158



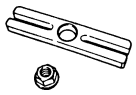
⑲ YB-06151
90890-06519



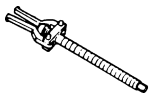
⑳ YB-06096



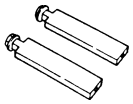
㉑ 90890-06501



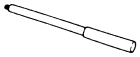
㉒ 90890-06535



㉓ 90890-06538



㉔ 90890-06652



⑮ Valve seat cutter
Intake
P/N. 90890-06813 (60°)
90890-06814 (45°)
90890-06815 (30°)
Exhaust
P/N. 90890-06315 (60°)
90890-06312 (45°)
90890-06328 (30°)

⑯ Valve seat cutter holder
P/N. 90890-06811 (ø4.0 mm)
90890-06812 (ø4.5 mm)

⑰ Valve seat cutter set
P/N. YM-91043-C

⑱ Piston ring compressor
P/N. YM-08037
90890-05158

⑲ Drive shaft holder (impeller)
P/N. YB-06151
Drive shaft holder 5 (impeller)
P/N. 90890-06519

⑳ Slide hammer and adapters
(jet pump bearing and reduction drive gear)
P/N. YB-06096

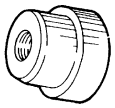
㉑ Stopper guide plate (jet pump bearing)
P/N. 90890-06501

㉒ Bearing puller assembly
(jet pump bearing and reduction drive gear)
P/N. 90890-06535

㉓ Stopper guide stand
(jet pump bearing and reduction drive gear)
P/N. 90890-06538

㉔ Drive rod L3
(jet pump bearing and reduction drive gear)
P/N. 90890-06652

㉕ YB-06112
YB-06196



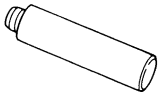
㉖ 90890-06614
90890-06653

㉗ YB-06085

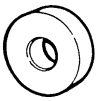
㉘ 90890-06631

㉙ YB-06071

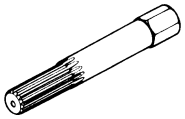
㉚ 90890-06606



㉛ YB-34474



㉜ YB-06552
90890-06552



㉝ YB-06156 90890-06624
90890-06626

㉕ Bearing housing needle bearing remover (jet pump bearing)
P/N. YB-06112
Drive shaft needle bearing installer and remover (jet pump oil seal)
P/N. YB-06196

㉖ Needle bearing attachment (jet pump bearing, oil seal, and reduction drive gear)
P/N. 90890-06614, 90890-06653

㉗ Outer race installer—forward gear (jet pump oil seal and reduction drive gear)
P/N. YB-06085

㉘ Ball bearing attachment (jet pump oil seal and reduction drive gear)
P/N. 90890-06631

㉙ Driver handle—large (intermediate shaft, jet pump, and reduction drive gear)
P/N. YB-06071

㉚ Driver rod LS (intermediate shaft, jet pump, and reduction drive gear)
P/N. 90890-06606

㉛ Bearing inner/outer race attachment (jet pump bearing)
P/N. YB-34474

㉜ Shaft holder (intermediate shaft)
P/N. YB-06552
Crankshaft holder 20 (intermediate shaft)
P/N. 90890-06552

㉝ Drive shaft taper roller bearing cup installer (intermediate shaft and reduction drive gear)
P/N. YB-06156
Bearing outer race attachment (intermediate shaft and reduction drive gear)
P/N. 90890-06624, 90890-06626

CHAPTER 2
SPECIFICATIONS

GENERAL SPECIFICATIONS

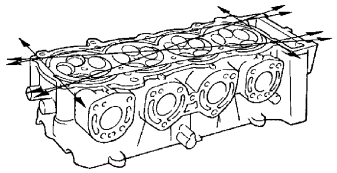
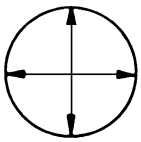
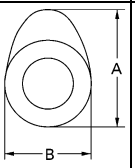
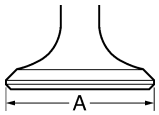
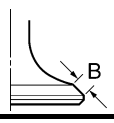
Item	Unit	Model	
		FX High Output	FX Cruiser High Output
Model code			
Hull		F1S	
Engine/jet		6B6	
Dimensions			
Length	mm (in)	3,340 (131.5)	
Width	mm (in)	1,230 (48.4)	
Height	mm (in)	1,160 (45.7)	
Dry weight	kg (lb)	350 (772)	
Maximum capacity	Person/kg (lb)	3/240 (530)	
Performance			
Maximum output	kW (PS) @ r/min	117.7 (160) @ 10,000	
Maximum fuel consumption	l/h (US gal/h, lmp gal/h)	45 (11.9, 9.9)	
Cruising range	h	1.56	
Engine			
Engine type		4-stroke, L4, DOHC	
Displacement	cm^3 (cu. in)	1,052 (64.2)	
Bore × stroke	mm (in)	76.0 × 58.0 (2.99 × 2.28)	
Compression ratio		11.9:1	
Exhaust system		Wet exhaust	
Lubrication system		Dry sump	
Cooling system		Water cooled	
Starting system		Electric starter	
Ignition system		TCI	
Ignition timing	Degree	BTDC 5–BTDC 32	
Spark plug model (manufacturer)		CR9EB (NGK)	
Spark plug gap	mm (in)	0.7–0.8 (0.028–0.031)	
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		Counterclockwise (viewed from rear)	
Transmission		Constant mesh 1-speed	
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	
		FX High Output	FX Cruiser High Output
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, SJ, SL	
	SAE	10W-30	
Engine oil quantity	L (US qt, Imp qt)	4.5 (4.8, 4.0)	
(without oil filter replacement)	L (US qt, Imp qt)	2.1 (2.2, 1.8)	
(with oil filter replacement)	L (US qt, Imp qt)	2.3 (2.4, 2.0)	

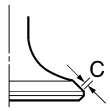
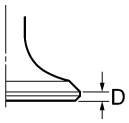
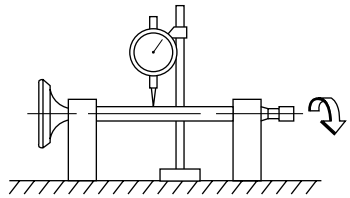
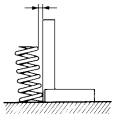
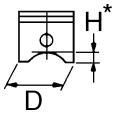
PON*: Pump Octane Number = (Motor Octane Number + Research Octane Number)/2
RON*: Research Octane Number

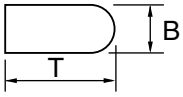
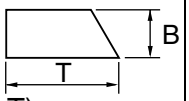
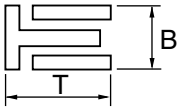
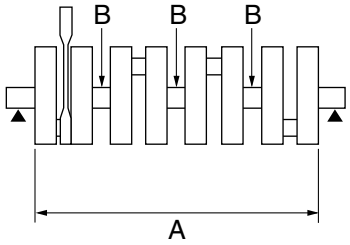
MAINTENANCE SPECIFICATIONS

ENGINE

Item	Unit	Model	
		FX High Output	FX Cruiser High Output
Cylinder head			
Warpage limit	mm (in)	0.1 (0.004)	
			
Compression pressure*1	kPa (kgf/cm^2, psi)	1,150 (11.5, 164)	
Cylinder			
Bore size 	mm (in)	76.000–76.015 (2.9921–2.9927)	
Taper limit	mm (in)	0.08 (0.003)	
Out-of-round limit	mm (in)	0.05 (0.002)	
Wear limit	mm (in)	76.100 (2.9961)	
Camshaft			
Drive system 		Chain drive	
Intake A	mm (in)	32.55 (1.281)	
Exhaust A	mm (in)	33.00 (1.299)	
Intake and exhaust B	mm (in)	25.00 (0.984)	
Camshaft cap inside diameter	mm (in)	24.5 (0.9646)	
Camshaft journal diameter	mm (in)	24.46–24.47 (0.9630–0.9634)	
Camshaft-journal-to-camshaft-cap clearance	mm (in)	0.03–0.06 (0.0012–0.0024)	
Maximum camshaft runout	mm (in)	0.03 (0.0012)	
Timing chain			
Model/number of links		DID SCR-0412SV/130	
Tensioning system		Automatic	
Valves, valve seats, valve guides			
Valve clearance (cold)			
Intake	mm (in)	0.11–0.20 (0.0043–0.0079)	
Exhaust	mm (in)	0.25–0.34 (0.0098–0.0134)	
Valve dimensions			
Valve head diameter A			
Intake 	mm (in)	22.9–23.1 (0.9016–0.9094)	
Exhaust	mm (in)	24.4–24.6 (0.9606–0.9685)	
Valve face width B 			
Intake	mm (in)	1.76–2.90 (0.0693–0.1142)	
Exhaust	mm (in)	1.76–2.90 (0.0693–0.1142)	

*1 Measuring conditions:
Ambient temperature 20 °C (68 °F), wide open throttle, with spark plugs removed from all cylinders.
The figures are for reference only.

Item	Unit	Model	
		FX High Output	FX Cruiser High Output
Valve seat width C			
Intake 	mm (in)	0.9–1.1 (0.0354–0.0433)	
Exhaust	mm (in)	0.9–1.1 (0.0354–0.0433)	
Valve margin thickness D			
Intake 	mm (in)	0.5–0.9 (0.0197–0.0354)	
Exhaust	mm (in)	0.5–0.9 (0.0197–0.0354)	
Valve stem diameter			
Intake	mm (in)	3.975–3.990 (0.1565–0.1571)	
Exhaust	mm (in)	4.465–4.480 (0.1758–0.1764)	
Valve guide inside diameter			
Intake	mm (in)	4.000–4.012 (0.1575–0.1580)	
Exhaust	mm (in)	4.500–4.512 (0.1772–0.1776)	
Valve-stem-to-valve-guide clearance			
Intake	mm (in)	0.010–0.037 (0.0004–0.0015)	
Exhaust	mm (in)	0.020–0.047 (0.0008–0.0019)	
Valve stem runout 	mm (in)	0.01 (0.0004)	
Valve spring			
Free length			
Intake	mm (in)	38.90 (1.53)	
Exhaust	mm (in)	40.67 (1.60)	
Installed length			
Intake	mm (in)	34.50 (1.36)	
Exhaust	mm (in)	35.00 (1.38)	
Spring limit 			
Intake	Degree/mm (in)	2.5/1.7 (0.067)	
Exhaust	Degree/mm (in)	2.5/1.8 (0.071)	
Piston			
Piston-to-cylinder clearance	mm (in)	0.10–0.11 (0.0039–0.0043)	
Piston diameter 	mm (in)	75.895–75.910 (2.9880–2.9886)	
Measuring point H*	mm (in)	5 (0.2)	
Wear limit	mm (in)	0.17 (0.0067)	
Piston pin boss inside diameter	mm (in)	17.002–17.013 (0.6693–0.6698)	
Piston pins			
Outside diameter	mm (in)	16.991–17.000 (0.6689–0.6693)	
Wear limit	mm (in)	16.98 (0.67)	

Item	Unit	Model	
		FX High Output	FX Cruiser High Output
Piston ring			
Top ring 			
Type		Barrel	
Dimension (B × T)	mm (in)	0.90 × 2.75 (0.04 × 0.11)	
End gap (installed)	mm (in)	0.32–0.44 (0.0126–0.0173)	
Ring groove clearance	mm (in)	0.030–0.065 (0.0012–0.0026)	
2nd ring 			
Type		Taper	
Dimensions (B × T)	mm (in)	0.80 × 2.80 (0.03 × 0.11)	
End gap (installed)	mm (in)	0.43–0.58 (0.0169–0.0228)	
Ring groove clearance	mm (in)	0.020–0.055 (0.0008–0.0022)	
Oil ring 			
Dimensions (B × T)	mm (in)	1.50 × 2.60 (0.06 × 0.10)	
End gap (installed)	mm (in)	0.10–0.35 (0.0039–0.0138)	
Ring groove clearance	mm (in)	0.040–0.160 (0.0016–0.0063)	
Connecting rod			
Big end oil clearance	mm (in)	0.016–0.040 (0.0006–0.0016)	
Bearing color code		1. Brown 2. Black 3. Blue 4. Green	
Small end inside diameter	mm (in)	17.005–17.018 (0.6694–0.6699)	
Crankshaft 			
Crank width A	mm (in)	304.8–306.0 (12.00–12.05)	
Deflection limit B	mm (in)	0.03 (0.0012)	
Crankshaft journal oil clearance	mm (in)	0.004–0.028 (0.0002–0.0011)	
Bearing color code		1. Brown 2. Black 3. Blue 4. Green 5. Yellow	
Throttle body			
Type/quantity		42EIS/4	
Manufacturer		Mikuni	
ID mark		6B600	
Trolling speed	r/min	1,550–1,750	
Fuel pump			
Pump type		Electrical	
Fuel pressure	kPa (kgf/cm^2, psi)	310–330 (3.1–3.3, 45–47)	

Item	Unit	Model	
		FX High Output	FX Cruiser High Output
Oil filter			
Oil filter type		Cartridge type	
Oil pump			
Oil pump type		Trochoid	
Rotor tip clearance (scavenge pump)	mm (in)	0.09–0.15 (0.0035–0.0059)	
Oil pump housing clearance			
Rotor (feed pump)	mm (in)	0.09–0.17 (0.0035–0.0067)	
Rotor (scavenge pump)	mm (in)	0.09–0.15 (0.0035–0.0059)	

JET PUMP UNIT

Item	Unit	Model	
		FX High Output	FX Cruiser High Output
Jet pump			
Impeller material		Stainless steel	
Number of impeller blades		3	
Impeller pitch angle	Degree	16.8	
Impeller clearance	mm (in)	0.35–0.45 (0.0138–0.0177)	
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	
		FX High Output	FX Cruiser High Output
Free play			
Throttle lever free play	mm (in)	4–7 (0.16–0.28)	

ELECTRICAL

Item	Unit	Model	
		FX High Output	FX Cruiser High Output
Battery			
Type		Fluid	
Capacity	V/Ah	12/19	
Specific gravity		1.28	
ECM unit (B/R – R/Y, B/W – R/Y, B/Y – R/Y, B/L – R/Y)			
Output peak voltage lower limit			
@cranking (loaded)	V	87	
@2,000 r/min (loaded)	V	86	
@3,500 r/min (loaded)	V	85	
Stator			
Pickup coil (W – B, R – B)			
Output peak voltage			
@cranking (unloaded)	V	5.2	
@cranking (loaded)	V	4.7	
@2,000 r/min (loaded)	V	26.1	
@3,500 r/min (loaded)	V	41.3	
Lighting coil (G – G)			
Output peak voltage			
@cranking (unloaded)	V	9.2	
@2,000 r/min (unloaded)	V	38.5	
@3,500 r/min (unloaded)	V	63.2	
Pickup coil resistance (W – B)	Ω (color)	459–561	
Pickup coil resistance (R – B)	Ω (color)	459–561	
Lighting coil resistance (G – G)	Ω (color)	0.54–0.66	
Minimum charging current	A @ r/min	14 @ 6,000	
Ignition coil			
Primary coil resistance	Ω	1.19–1.61	
Secondary coil resistance	kΩ	8.5–11.5	
Rectifier/regulator (R – B)			
Output peak voltage			
@3,500 r/min (unloaded)	V	15.0	
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)	

Item	Unit	Model	
		FX High Output	FX Cruiser High Output
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)			
@ 20 °C (68 °F)	kΩ	54.2–69.0	
@ 100 °C (212 °F)	kΩ	3.12–3.48	
Speed sensor			
Output voltage (on pulse)	V	11.6	
Output pulse/one full turn		2	
Throttle position sensor			
Output voltage (P – B/O)			
@ trolling speed	V	0.756 ± 0.016	
Cam position sensor			
Output voltage (G/O – B/O)			
Position A	V	More than 4.8	
Position B	V	Less than 0.8	
Position C	V	More than 4.8	
Fuel sender			
Fuel sender resistance			
Position A	Ω	133.5–136.5	
Position B	Ω	5–7	
Oil pressure switch			
Oil pressure switch continuity pressure	kPa (kgf/cm^2, psi)	128 (1.28, 18.2)–166 (1.66, 23.6)	
Fuel injector			
Fuel injector resistance*1	Ω	11.5–12.5	
Fuse			
Rating			
Main	V/A	12/20	
Remote control unit	V/A	12/3	
Electrical bilge pump	V/A	12/3	

*1 The figures are for reference only.

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 module – 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	572
Fuel tank cap screw clamp – fuel tank cap/fuel tank		—	—	1	1.3	0.13	0.9	
Fuel filter hose clamp – fuel filter hose/fuel tank/fuel filter neck		—	—	2	4.2	0.42	3.0	
Air filter case cover – air filter case		Screw	M5	2	2.5	0.25	1.8	572
Ribbon sub assembly – throttle bodies		Bolt	M6	4	6.5	0.65	4.7	242
Throttle cable holder – air filter case		Bolt	M6	2	7.6	0.76	5.5	572
Fuel hose holder – fuel hose bracket		Bolt	M4	2	3.3	0.33	2.4	572
Throttle bodies – throttle body joint		Bolt	M8	8	22	2.2	16	E
Air filter case – air filter case stay 1/ air filter case stay 2	1st	Bolt	M8	3	8.8	0.88	6.4	242
	2nd				18	1.8	13	
Wire harness bracket 1/sub wire harness – air filter case		Bolt	M6	2	7.6	0.76	5.5	572
Fuel hose bracket/wire harness bracket 2 – air filter case		Bolt	M6	2	7.6	0.76	5.5	242
Wire harness bracket 2 – air filter case		Screw	M5	1	1.3	0.13	0.9	572
Air filter case stay 1 – exhaust pipe 3	1st	Bolt	M8	2	15	1.5	11	271
	2nd				39	3.9	28	
Air filter case stay 2 – cylinder head	1st	Bolt	M8	1	15	1.5	11	271
	2nd				39	3.9	28	
Band – air filter case		Screw	M5	1	1.3	0.13	0.9	
Breather cover – air filter case		Screw	M5	3	1.8	0.18	1.3	
Fuel rail – throttle bodies		Bolt	M6	4	5.0	0.5	3.6	
Sensor assembly – fuel rail		Screw	M5	2	3.5	0.35	2.5	
Bracket – throttle bodies		Screw	M6	3	5.0	0.5	3.6	
Bracket – bypass valve motor		Nut	—	2	13	1.3	9.4	
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	

TIGHTENING TORQUES

E

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	271
Oil filter		—	—	1	17	1.7	12	E
Coupling cover – intermediate housing		Bolt	M6	1	7.8	0.78	5.6	572
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*1	1st	Bolt	M10	4	2.0	0.2	1.4	242
	2nd				15	1.5	11	
	3rd				39	3.9	28	
Exhaust pipe end – exhaust pipe 3	1st	Bolt	M6	3	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*1	1st	Nut	—	5	39	3.9	28	E
	2nd				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	
Exhaust manifold 1 – cylinder head	1st	Bolt	M8	6	22	2.2	16	242
	2nd				22	2.2	16	
	3rd				35	3.5	25	
Exhaust manifold 2 – cylinder head	1st	Bolt	M8	5	22	2.2	16	242
	2nd				22	2.2	16	
	3rd				35	3.5	25	
Water jacket – oil tank	1st	Bolt	M6	4	3.7	0.37	2.7	572
	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	572
	2nd				7.6	0.76	5.5	
Cover (ground lead) – oil tank		Bolt	M6	3	7.6	0.76	5.5	572
Ground lead – oil tank		Bolt	M6	2	7.6	0.76	5.5	E
Oil tank – reduction drive gear case	1st	Bolt	M8	5	15	1.5	11	572
	2nd				39	3.9	28	

*1 For details, refer to the tightening procedures in this manual.

Part to tightened		Part name	Thread size	Q'ty	Tightening torque			Remarks
					N•m	kgf•m	ft•lb	
Oil tank – oil tank stay	1st	Nut	—	2	2.0	0.2	1.4	572
	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	572
	2nd				15	1.5	11	
	3rd				39	3.9	28	
Band/collar – oil tank		Bolt	M6	1	7.6	0.76	5.5	572
Bracket (coupling cover) – oil tank	1st	Bolt	M6	2	3.7	0.37	2.7	572
	2nd				7.6	0.76	5.5	
Hanger – oil tank cover	1st	Bolt	M6	4	3.7	0.37	2.7	572
	2nd				7.6	0.76	5.5	
Oil tank cover – oil tank	1st	Bolt	M6	8	3.7	0.37	2.7	572
	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	E
	2nd				4.4	0.44	3.2	
Baffle plate – oil tank	1st	Bolt	M5	3	1.9	0.19	1.4	E
	2nd				4.4	0.44	3.2	
Oil strainer – oil tank	1st	Bolt	M6	2	3.7	0.37	2.7	E
	2nd				7.6	0.76	5.5	
Oil cooler cover – oil tank	1st	Bolt	M6	24	3.7	0.37	2.7	572
	2nd				7.6	0.76	5.5	
Anode – oil tank		Screw	M4	1	3.7	0.37	2.7	E
Oil pump assembly – reduction drive gear case		Bolt	M6	5	10	1.0	7.2	572
	1st		M8	4	15	1.5	11	
	2nd				28	2.8	20	
Drain plug (engine oil)		Bolt	M8	1	20	2.0	14	
Strainer – reduction drive gear case	1st	Bolt	M6	2	3.7	0.37	2.7	
	2nd				7.6	0.76	5.5	
Oil pump housing cover 1 – oil seal housing 1		Bolt	M8	1	20	2.0	14	
Oil pump housing cover 1/oil seal housing 1/oil pump housing cover 2 – oil pump housing 2		Bolt	M8	3	20	2.0	14	
Oil pump housing cover 2 – oil seal housing 1		Screw	M4	1	2.0	0.2	1.4	
Drive coupling – drive shaft		—	—	1	28	2.8	20	572
Reduction drive gear case – crankcase	1st	Bolt	M6	2	3.7	0.37	2.7	572
	2nd				7.6	0.76	5.5	
	1st	Bolt	M8	5	15	1.5	11	572
	2nd				28	2.8	20	
Starter motor lead – starter motor		Nut	—	1	4.9	0.49	3.5	A
Starter motor – crankcase		Bolt	M8	2	18	1.8	13	