PREFACE

This manual covers the construction, function and serving procedures for the Honda BF135A•BF150A outboard motors.

All information contained in this manual is based on the latest product information available at the time of printing. We reserve the right to make changes at anytime without notice.

As you read this manual, you will find information that is preceded by a **NOTICE** symbol. The purpose of this message is to help prevent damage to the outboard motor, other property, or the environment.

SAFETY MESSAGES

Your safety, and the safety of others, are very important. To help you make informed decisions, we have provided safety messages and other safety information throughout this manual. Of course, it is not practical or possible to warn you about all the hazards associated with servicing these outboard motors. You must use your own good judgment.

You will find important safety information in a variety of forms, including:

- **Safety Labels** –– on the engine cover.
- **Safety messages** –– Preceded by a safety alert symbol ⚠ and one of three signal words, DANGER, WARNING, or CAUTION.

  These signal words mean:

  ⚠DANGER You WILL be KILLED or SERIOUSLY HURT if you don't follow instructions.

  ⚠WARNING You CAN be KILLED or SERIOUSLY HURT if you don't follow instructions.

  ⚠CAUTION You CAN be HURT if you don't follow instructions.

- **Instructions** –– how to service this outboard motor correctly and safely.

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Service Publications Office

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BF135A·BF150A

Abbreviations

ACG	Alternator
A/F	Air Fuel Ratio
API	American Petroleum Institute
Approx.	Approximately
Assy.	Assembly
ATDC	After Top Dead Center
ATF	Automatic Transmission Fluid
ATT	Attachment
BAT	Battery
BDC	Bottom Dead Center
BTDC	Before Top Dead Center
BARO	Barometric Pressure
CKP	Crankshaft Position
Comp.	Complete
CMP	Camshaft Position
CYL	Cylinder
DLC	Data Link Connector
ECT	Engine Coolant Temperature
ECM	Engine Control Module
EOP	Engine Oil Pressure
EX	Exhaust
F	Front or Forward
GND	Ground
IAB	Intake Air Bypass
IAC	Idle Air Control
IAT	Intake Air Temperature
I.D.	Inside Diameter
IG or IGN	Ignition
IN	Intake
INJ	Injection
L.	Left
MAP	Manifold Absolute Pressure
MIL	Malfunction Indicator Lamp
O.D.	Outside Diameter
OP	Optional Part
PGM-FI	Programmed-Fuel Injection
P/N	Part Number
Qty	Quantity
R.	Right
SAE	Society of Automotive Engineers
SCS	Service Check Signal
STD	Standard
SW	Switch
TDC	Top Dead Center
TP	Throttle Position

Bl	Black	G	Green	Br	Brown	Lg	Light green
Y	Yellow	R	Red	O	Orange	P	Pink
Bu	Blue	W	White	Lb	Light blue	Gr	Gray

1. SPECIFICATIONS

• DIMENSIONS AND WEIGHTS

Model	BF135A						
Description code	BARJ		BASJ	BARJ		BASJ	
Types	LC	LD	LCD	XC	XD	XCC	XCD
Overall length	845 mm (33.3 in)						
Overall width	580 mm (22.8 in)						
Overall height	1,665 mm (65.6 in)			1,790 mm (70.5 in)			
Dry weight (*1)	220 kg (485 lbs)		223 kg (492 lbs)			226 kg (498 lbs)	
Operating weight (including oil)	228 kg (503 lbs)		231 kg (509 lbs)			234 kg (516 lbs)	

*1: With propeller mounted.

Model	BF150A						
Description code	BANJ		BAPJ	BANJ		BAPJ	
Types	LC	LD	LCD	XC	XD	XCC	XCD
Overall length	845 mm (33.3 in)						
Overall width	580 mm (22.8 in)						
Overall height	1,665 mm (65.6 in)			1,790 mm (70.5 in)			
Dry weight (*1)	220 kg (485 lbs)		223 kg (492 lbs)			226 kg (498 lbs)	
Operating weight (including oil)	228 kg (503 lbs)		231 kg (509 lbs)			234 kg (516 lbs)	

*1: With propeller mounted.

• FRAME

Model	BF135A•BF150A						
Types	LC	LD	LCD	XC	XD	XCC	XCD
Transom height (*1)	508 mm (20.0 in)			635 mm (25.0 in)			
Tilting angle	72°						
Tilting stage	Stageless						
Swivel angle	30° right and left						
Trim angle	– 4° to 16°						

*2: Transom angle is at 12°.

• TYPES OF Honda BF135A•BF150A OUTBOARD MOTORS

It may be necessary to refer to this chart for reference purposes when reading this manual.

Model	BF135A•BF150A						
Types	LC	LD	LCD	XC	XD	XCC	XCD
Shaft length type	L	L	L	XL	XL	XL	XL
Remote control	(•)	(•)	(•)	(•)	(•)	(•)	(•)
Control panel	(•)	(•)	(•)	(•)	(•)	(•)	(•)
Counter rotation			•			•	•
Power trim/tilt	•	•	•	•	•	•	•

L: Long shaft XL: Extra-long shaft (•): Optional part

• ENGINE

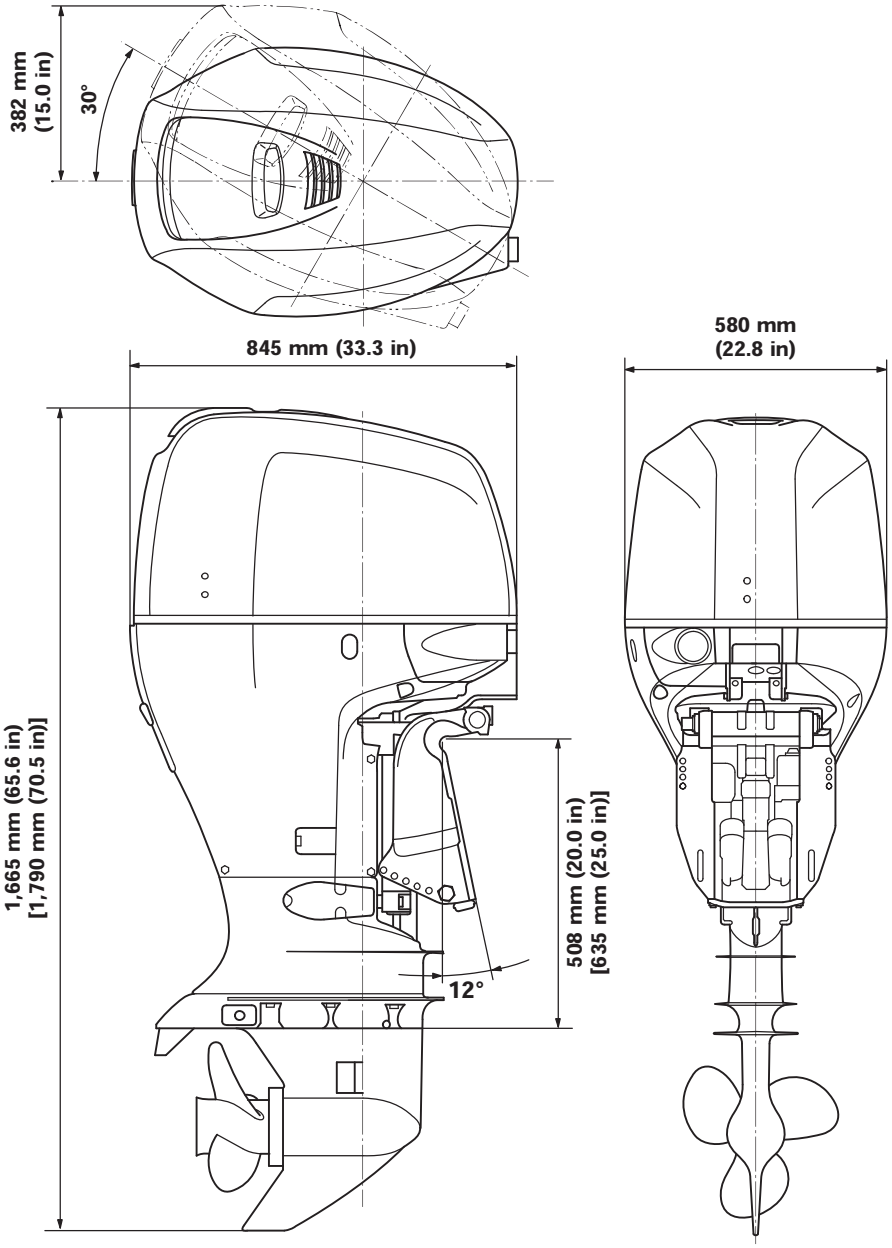
Model	BF135A	BF150A
Description code	BEARJ	BEANJ
Type	4-stroke, D.O.H.C., 4-cylinder	4-stroke, D.O.H.C., VTEC, 4-cylinder
Displacement	2,354 cm^3 (143.6 cu-in)	
Bore x stroke	87 x 99 mm (3.4 x 3.9 in)	
Rated power (Full throttle range)	100.7 kW (135 HP) at 5,000 – 6,000 min^{-1} (rpm)	111.9 kW (150 HP) at 5,000 – 6,000 min^{-1} (rpm)
Maximum torque	196 N·m (20.0 kgf·m, 145 lbf·ft)	202 N·m (20.6 kgf·m, 149 lbf·ft)
Compression ratio	9.6 : 1	
Fuel consumption ratio	350 g/kW·h (257 g/HP·h, 0.575 lb/HP·h)	320 g/kW·h (235 g/HP·h, 0.526 lb/HP·h)
Cooling system	Forced water circulation by impeller pump with thermostat	
Ignition system	Full transistorized, battery ignition	
Ignition timing	0° ± 2° at 750 min^{-1} (rpm) B.T.D.C.	
Spark plug	IZFR6K11 (NGK), SKJ20DR-M11 (DENSO)	
Fuel supply system	Programmed fuel injection	
Fuel injection system	Electronic control	
Fuel injection nozzle	Multi-hole type	
Fuel pipe	Rubber tubes	
Lubrication system	Pressure lubrication by trochoid pump	
Lubrication capacity	7.35ℓ (7.8 US qt, 6.5 Imp qt) [with oil filter replacement: 6.7ℓ (7.1 US qt, 5.9 Imp qt)] [without oil filter replacement: 6.5ℓ (6.9 US qt, 5.7 Imp qt)]	
Starting system	Electric starter	
Stopping system	Primary circuit ground	
Fuel used	Unleaded gasoline with a pump octane number 86 or higher	
Fuel pump	Electric and mechanical plunger type	
Exhaust system	Underwater type	
Recommended oil	SAE 10W-30	

• LOWER UNIT

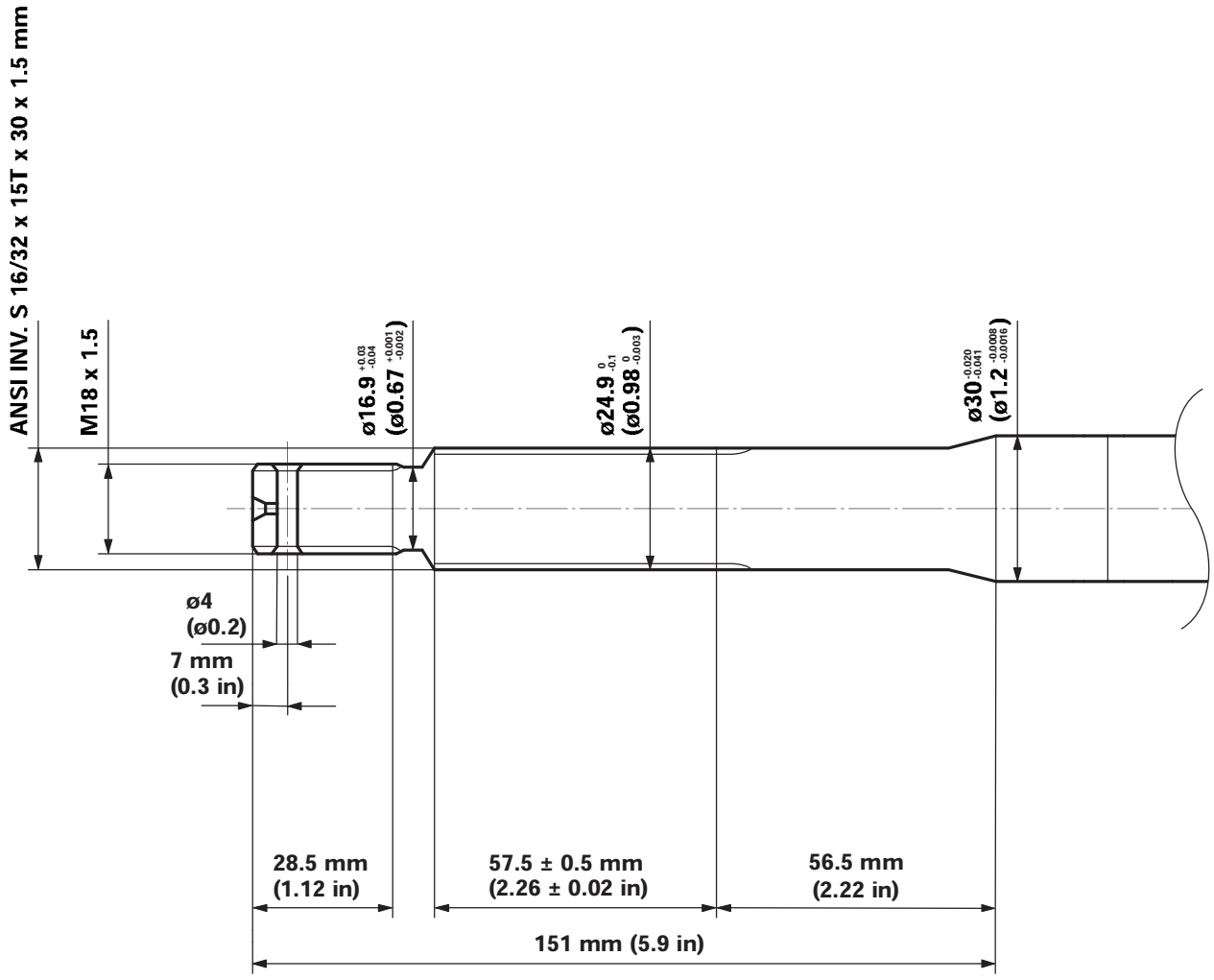
Clutch	Dog clutch (Forward – Neutral – Reverse)
Gear ratio	0.467 (14/30)
Reduction	Spiral bevel
Gear case oil capacity	0.98ℓ (1.04 US qt, 0.86 Imp qt)
Propeller rotating direction	Clockwise (viewed from rear): LC, LD, XC and XD types Counterclockwise (viewed from rear): LDC, XCC and XCD types
Propeller driving system	Spline

2. DIMENSIONAL DRAWINGS

[ ]: Extra-long shaft type



• PROPELLER SHAFT



2. SERVICE INFORMATION

1. THE IMPORTANCE OF PROPER SERVICING

Proper servicing is essential to the safety of the operator and the reliability of the outboard motor. Any error or oversight made by the technician while servicing can easily result in faulty operation, damage to the outboard motor or injury to the operator.

⚠WARNING

Improper servicing can cause an unsafe condition that can lead to serious injury or death.

Follow the procedures and precautions in this shop manual carefully.

Some of the most important precautions are given below. However, we cannot warn you of every conceivable hazard that can arise in performing maintenance or repairs. Only you can decide whether or not you should perform a given task.

⚠WARNING

Failure to properly follow maintenance instructions and precautions can cause you to be seriously hurt or killed.

Follow the procedures and precautions in this shop manual carefully.

2. IMPORTANT SAFETY PRECAUTIONS

Make sure you have a clear understanding of all basic shop safety practices and that you are wearing appropriate clothing and using safety equipment. When performing any service task, be especially careful of the following:

- Read all of the instructions before you begin, and make sure you have the tools, the replacement or repair parts, and the skills required to perform the tasks safely and completely.
- Protect your eyes by using proper safety glasses, goggles, or face shields any time you hammer, drill, grind, or work around pressurized air or liquids, and springs or other stored-energy components. If there is any doubt, put on eye protection.
- Use other protective wear when necessary, for example, gloves or safety shoes. Handling hot or sharp parts can cause severe burns or cuts. Before you grab something that looks like it can hurt you, stop and put on gloves.
- Protect yourself and others whenever you have engine-powered equipment up in the air.
  Any time you lift an outboard motor with a hoist, make sure that the hoist hook is securely attached to the outboard motor.

Make sure the engine is off before you begin any servicing procedures, unless the instruction tells you to do otherwise. This will help eliminate several potential hazards:

- Carbon monoxide poisoning from engine exhaust. Be sure there is adequate ventilation whenever you run the engine.
- Burns from hot parts. Let the engine and exhaust system cool before working in those areas.
- Injury from moving parts. If the instruction tells you to run the engine, be sure your hands, fingers, and clothing are out of the way.

Gasoline vapors and hydrogen gasses from batteries are explosive. To reduce the possibility of a fire or explosion, be careful when working around gasoline or batteries.

- Use only a nonflammable solvent, not gasoline, to clean parts.
- Never drain or store gasoline in an open container.
- Keep all cigarettes, sparks, and flames away from the battery and all fuel-related parts.

3. SERVICE RULES

1. Use genuine Honda or Honda-recommended parts and lubricants or their equivalents. Parts that do not meet Honda's design specifications may damage the unit.
2. Use the special tools designed for the product.
3. Install new gaskets, O-rings, etc. when reassembling.
4. When torquing bolts or nuts, begin with larger-diameter or inner bolts first and tighten to the specified torque diagonally, unless a particular sequence is specified.
5. Clean parts in cleaning solvent upon disassembly. Lubricate any sliding surfaces before reassembly.
6. After reassembly, check all parts for proper installation and operation.
7. Many screws used in this machine are self-tapping. Be aware that cross-threading or overtightening these screws will strip the threads and ruin the hole.
8. Use only metric tools when servicing this unit. Metric bolts, nuts and screws are not interchangeable with non-metric fasteners. The use of incorrect tools and fasteners will damage the unit.

4. SYMBOLS USED IN THIS MANUAL

As you read this manual, you may find the following symbols with the instructions.

S. TOOL — A special tool is required to perform the procedure.

GREASE — Apply grease.

GREASE
(Molybdenum disulfide oil) : Use molybdenum oil solution (mixture of the engine oil and molybdenum grease with the ratio 1 : 1).

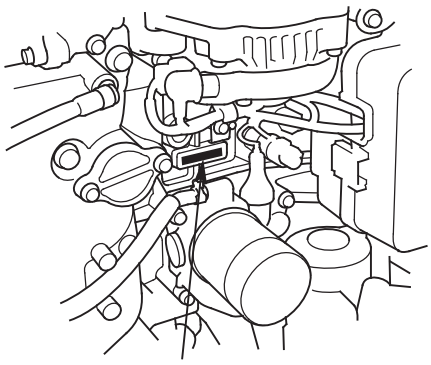
OIL — Apply oil.

• •x • •(•) Indicates the diameter, length, and quantity of metric flange bolts used.

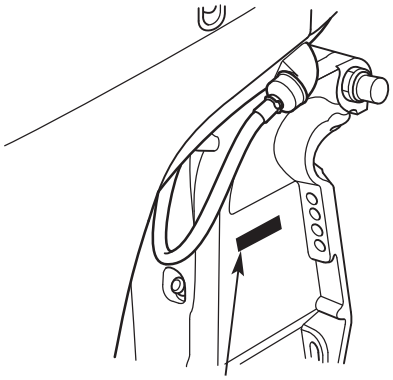
P. 1-1 Indicates the reference page.

5. SERIAL NUMBER LOCATIONS

The engine serial number is stamped on the right side of the cylinder block and the product identification number is located on the right side of the stern bracket. Always specify these numbers when inquiring about the engine or when ordering parts in order to obtain the correct parts for the outboard motor being serviced.



ENGINE SERIAL NUMBER



PRODUCT IDENTIFICATION NUMBER

6. MAINTENANCE STANDARDS

• ENGINE

Unit: mm (in)

Parts	Item		Standard	Service limit
Engine	Idle speed (in neutral)		750 ± 50 min^{-1} (rpm)	–
	Trolling speed		650 ± 50 min^{-1} (rpm)	–
	Cylinder compression [kPa (kgf/cm^2, psi) at 200 min^{-1} (rpm)]		1,532 – 1,728 (15.6 – 17.6, 222 – 250)	930 (9.5, 135)
	Compression gap between cylinders [kPa (kgf/cm^2, psi)]		–	200 (2.0, 28)
Spark plugs	Gap		1.0 – 1.1 (0.039 – 0.043)	1.3 (0.051)
Valves	Valve clearance	IN	0.21 – 0.25 (0.008 – 0.010)	–
		EX	0.28 – 0.32 (0.011 – 0.013)	–
	Overall length	IN	108.7 – 109.5 (4.28 – 4.31)	–
		EX	108.3 – 109.1 (4.26 – 4.30)	–
	Valve O.D.	IN	34.85 – 35.15 (1.372 – 1.384)	–
		EX	29.85 – 30.15 (1.175 – 1.187)	–
	Stem O.D.	IN	5.475 – 5.485 (0.2156 – 0.2159)	5.445 (0.2144)
		EX	5.450 – 5.460 (0.2146 – 0.2150)	5.420 (0.2134)
	Stem-to-guide clearance	IN	0.030 – 0.055 (0.0012 – 0.0022)	0.08 (0.003)
		EX	0.055 – 0.080 (0.0022 – 0.0031)	0.11 (0.004)
Valve seats	Seat width	IN/EX	1.25 – 1.55 (0.049 – 0.061)	2.0 (0.08)
	Seat installation height	IN/EX	44.0 – 44.6 (1.73 – 1.76)	–
Valve guides	Guide I.D.	IN/EX	5.51 – 5.53 (0.217 – 0.218)	5.55 (0.219)
	Guide extrusion amount	IN	15.2 – 16.2 (0.60 – 0.64)	–
		EX	15.5 – 16.5 (0.61 – 0.65)	–
Valve springs	Free length	IN	49.64 (1.954)	–
		EX	49.64 (1.954)	–
Rocker arms	Rocker arm I.D.	IN	17.019 – 17.035 (0.6700 – 0.6707)	–
		EX	17.012 – 17.039 (0.6698 – 0.6708)	–
	Rocker arm shaft O.D.	IN/EX	16.983 – 16.994 (0.6686 – 0.6690)	–
	Rocker arm-to-rocker arm shaft clearance	IN	0.025 – 0.052 (0.0010 – 0.0020)	0.08 (0.003)
		EX	0.018 – 0.056 (0.0007 – 0.0022)	0.08 (0.003)
Pistons	Skirt O.D.	A	86.98 – 86.99 (3.4244 – 3.4248)	86.93 (3.4224)
		B	86.97 – 86.98 (3.4240 – 3.4244)	86.92 (3.4220)
	Piston-to-cylinder clearance		0.02 – 0.04 (0.001 – 0.002)	0.05 (0.002)
	Piston pin bore I.D.		21.960 – 21.963 (0.8646 – 0.8647)	–

Unit: mm (in)

Parts	Item			Standard	Service limit
Pistons	Ring groove width		Top	1.23 – 1.24 (0.0484 – 0.0488)	1.25 (0.0492)
			Second	1.24 – 1.25 (0.0488 – 0.0492)	1.25 (0.0492)
			Oil	2.005 – 2.025 (0.0789 – 0.0797)	2.05 (0.081)
Piston pins	Pin O.D.			21.961 – 21.965 (0.8646 – 0.8648)	21.953 (0.8643)
	Pin-to-pin bore clearance			–0.005 – +0.002 (–0.0002 – +0.0001)	0.005 (0.0002)
Piston rings	Ring side clearance		Top	0.045 – 0.070 (0.0018 – 0.0028)	0.13 (0.005)
			Second	0.040 – 0.065 (0.0016 – 0.0026)	0.13 (0.005)
	Ring end gap		Top	0.20 – 0.35 (0.008 – 0.014)	0.6 (0.02)
			Second	0.50 – 0.65 (0.020 – 0.026)	0.75 (0.030)
			Oil	0.20 – 0.70 (0.008 – 0.028)	0.8 (0.031)
	Ring thickness		Top	1.170 – 1.185 (0.0461 – 0.0467)	–
			Second	1.175 – 1.190 (0.0463 – 0.0469)	–
Cylinder head	Warpage			–	0.05 (0.002) Min.
	Camshaft journal I.D.			29.000 – 29.024 (1.1417 – 1.1427)	–
	Head height			103.95 – 104.05 (4.093 – 4.096)	–
Cylinder block	Cylinder sleeve I.D.		A or I	87.01 – 87.02 (3.4256 – 3.4260)	87.07 (3.4279)
			B or II	87.00 – 87.01 (3.4252 – 3.4256)	87.07 (3.4279)
	Gap between upper and lower points – of sleeve I.D.			–	0.05 (0.002)
	Warpage			0.07 (0.003) Max.	0.10 (0.004)
Connecting rods	Small end I.D.			23.969 – 23.982 (0.9437 – 0.9442)	–
	Small end-to-piston pin clearance			0.005 – 0.015 (0.0002 – 0.0006)	0.02 (0.001)
	Big end axial clearance			0.15 – 0.35 (0.006 – 0.014)	0.4 (0.02)
	Connecting rod bearing oil clearance			0.032 – 0.066 (0.0013 – 0.0026)	0.077 (0.0030)
Crankshaft	Journal O.D.	Main	No. 1, 2, 4, 5	54.984 – 54.992 (2.1647 – 2.1650)	–
			No. 3	54.976 – 55.000 (2.1644 – 2.1654)	–
	Pin			47.976 – 48.000 (1.8888 – 1.8898)	–
	Journal cylindricity			0.005 (0.0002) Max.	0.010 (0.0004)
	Journal roundness			0.005 (0.0002) Max.	0.010 (0.0004)
	Crankshaft runout			0.03 (0.001) Max.	0.04 (0.002)
	Crankshaft axial clearance			0.10 – 0.35 (0.004 – 0.014)	0.45 (0.018)
	Main bearing oil clearance		No. 1, 2, 4, 5	0.017 – 0.041 (0.0007 – 0.0016)	0.05 (0.002)
			No. 3	0.025 – 0.049 (0.0010 – 0.0019)	0.055 (0.0022)
	Thrust metal side clearance			0.10 – 0.35 (0.004 – 0.014)	0.45 (0.018)

Unit: mm (in)

Parts	Item		Standard	Service limit
Camshaft	Camshaft axial clearance		0.05 – 0.20 (0.002 – 0.008)	0.4 (0.02)
	Camshaft runout		0.03 (0.001) Max.	0.4 (0.02)
	Journal O.D.	No. 1	28.955 – 28.970 (1.1400 – 1.1405)	–
		No. 2 – No. 5	28.925 – 28.940 (1.1388 – 1.1394)	–
	Cam height	IN:PRI/SEC	32.626 – 32.931 (1.2845 – 1.2965)	–
		IN:MID	35.369 – 35.654 (1.3925 – 1.4037)	–
		EX	33.927 – 34.212 (1.3357 – 1.3469)	–
	Camshaft oil clearance	No. 1	0.030 – 0.069 (0.0012 – 0.0027)	0.15 (0.006)
		No. 2 – No. 5	0.060 – 0.099 (0.0024 – 0.0039)	0.15 (0.006)
Oil pump	Body I.D.		84.000 – 84.030 (3.3071 – 3.3083)	–
	Inner rotor-to-outer rotor clearance		0.04 – 0.16 (0.002 – 0.006)	0.20 (0.008)
	Outer rotor-to-oil pump body clearance		0.02 – 0.07 (0.001 – 0.003)	0.12 (0.005)
	Outer rotor height		9.480 – 9.500 (0.3732 – 0.3740)	–
	Pump body depth		9.520 – 9.550 (0.3748 – 0.3760)	–
	Outer rotor-to-oil body side clearance		0.14 – 0.19 (0.006 – 0.007)	0.20 (0.008)
Vapor separator	Float height		28.5 – 33.5 (1.12 – 1.32)	–
Fuel pump	Discharge volume [with pump operated for 2 sec. at 12V]		45 mℝ (1.5 Us oz, 1.6 Imp oz) or more	–
Fuel line	Fuel pressure [kPa (kgf/cm^2, psi)]		270 – 320 (2.8 – 3.3, 40 – 47)	–
Alternator	Brush length		10.5 (0.41)	8.4 (0.33)
	Brush spring pressure		3.2 N (0.33 kgf, 0.73 lbf)	–
	Rotor coil resistance		2.9 Ω	–
	Slip ring O.D.		14.4 (0.57)	14.0 (0.55)
	Belt tension Measured at the center of belt between the pulleys with belt tension gauge.	Used belt	392 – 490 N (40 – 50 kgf, 88 – 100 lbf)	–
		New belt	490 – 588 N (50 – 60 kgf, 110 – 132 lbf)	–
	Belt deflection Measured with 98 N (10 kgf, 22 lbf) of force applied to the center of belt between the pulleys)	Used belt	10.6 – 11.1 (0.42 – 0.44)	–
		New belt	10.1 – 10.6 (0.40 – 0.42)	–
Starter motor	Brush length		12.3 (0.48)	7.0
	Insulator length (Mica depth)		0.4 – 0.5 (0.016 – 0.020)	0.2 (0.008)
	Commutator O.D.		29.4 (1.16)	28.8 (1.13)
	Commutator runout		–	0.1 (0.004)

PRI: Primary, MID: Mid, SEC: Secondary

• FRAME

Unit: mm (in)

Parts	Item		Standard	Service limit
Propeller shaft	Shaft O.D.	At forward bevel gear (LC, LD, XC and XD types)	24.987 – 25.000 (0.9837 – 0.9843)	24.966 (0.9829)
		At reverse bevel gear (LCD, XCC and XCD types)	24.987 – 25.000 (0.9837 – 0.9843)	24.966 (0.9829)
		At needle bearing	30.007 – 30.020 (1.1814 – 1.1819)	29.990 (1.1807)
Vertical shaft	Shaft O.D. (at needle bearing)		28.556 – 28.575 (1.1242 – 1.1250)	28.545 (1.1238)

7. TORQUE VALUES

Item	Thread dia. (mm) and pitch (length)	Torque value		
		N·m	kgf·m	lbf·ft
• **ENGINE**				
Lower block bolt (*1)	M11 x 1.5	29	3.0	22
	M8 x 1.25	26	2.7	20
Crankcase bolt	M6 x 1.0	12	1.2	9
Oil case bolt	M10 x 1.25	34	3.5	25
Lower block orifice	M10 x 1.0	10	1.0	7
Oil jet bolt	M8 x 0.75 (Special bolt)	16	1.6	12
No.1 camshaft holder 10 mm sealing bolt	M10 x 1.0 (Special bolt)	20	2.0	14
Cylinder head bolt (*2)	M11 x 1.5	39	4.0	29
Cylinder head cover nut	M6 x 1.0	12	1.2	9
Spark plug	M14 x 1.25	18	1.8	13
Connecting rod bolt (*3)	M8 x 0.75 (Special bolt)	20	2.0	14
Crankshaft pulley bolt	M16 x 1.5	245	25.0	181
Balancer chain guide bolt	M6 x 1.0	12	1.2	9
Balancer driven sprocket bolt	M10 x 1.25	44	4.5	33
Balancer case assembly bolt (8 x 50 mm/8 x 75 mm)	M8 x 1.25	22	2.2	16
(8 x 55 mm)	M8 x 1.25	27	2.8	20
(10 x 105 mm)	M10 x 1.25	44	4.5	33
Balancer holder bolt	M6 x 1.0	12	1.2	9
	M8 x 1.25	27	2.8	20
Chain case special bolt	M6 x 1.0 (Special bolt)	12	1.2	9
Chain case bolt	M6 x 1.0	12	1.2	9
	M6 x 1.0 (SH bolt)	12	1.2	9
Chain case cover bolt	M6 x 1.0	12	1.2	9
Cam chain tensioner bolt	M6 x 1.0	12	1.2	9
Cam chain guide bolt	M6 x 1.0	12	1.2	9
Cam chain guide B bolt	M8 x 1.25	22	2.2	16
Cam chain tensioner arm bolt	M8 x 1.25 (Special bolt)	22	2.2	16
Exhaust camshaft sprocket bolt	M10 x 1.25	72	7.3	53
VTC flange bolt	M12 x 1.25 (Special bolt)	113	11.5	83
Camshaft holder bolt	M8 x 1.25	22	2.2	16
	M6 x 1.0	12	1.2	9
Camshaft collar bolt	M14 x 1.0 (Special bolt)	39	4.0	29
CMP pulse plate bolt	M14 x 1.0 (Special bolt)	39	4.0	29
Valve adjusting lock nut (IN side)	M7 x 0.75	20	2.0	14
Valve adjusting lock nut (EX side)	M7 x 0.75	14	1.4	10
Oil filter	M20 x 1.5	12	1.2	9
Oil drain plug bolt	M12 x 1.5	23	2.3	17
Throttle body bolt	M8 x 1.25	22	2.2	16
IAC valve bolt	M8 x 1.25	22	2.2	16
Injector base bolt, nut	M8 x 1.25	24	2.4	17
Fuel pipe bolt	M8 x 1.25	22	2.2	16
Pressure regulator nut	M18 x 1.0	27	2.8	20
IAB control valve bolt	M5 x 0.8	5.4	0.55	4.0

*1: Tighten the lower block bolts to 29 N·m (3.0 kgf·m, 22 lbf·ft) first, then tighten them to additional 56° (Angle method).
*2: Tighten the new cylinder head bolts to 39 N·m (4.0 kgf·m, 29 lbf·ft) (Snag torque), then tighten them to additional 278°. (Tighten to 90° at first, then to 90°, and to 98° in this order) (Angle method).
At assembly, tighten the lower block bolts to 39 N·m (4.0 kgf·m, 29 lbf·ft) (Snag torque), then tighten them to additional 180°. (Tighten to 90° at first, then to 90° in this order) (Angle method).
*3: Tighten the connecting rod bolts to 20 N·m (2.0 kgf·m, 14 lbf·ft) (Snag torque), then tighten them to additional 90° (Angle method).
• SH bolt: Small head bolt.

Item	Thread dia. (mm) and pitch (length)	Torque value		
		N·m	kgf·m	lbf·ft
• **ENGINE**				
Mounting case bolt	M12 x 1.25	64	6.5	47
	M10 x 1.25	44	4.5	33
	M8 x 1.25	26	2.7	20
Mounting case nut	M10 x 1.25	44	4.5	33
Plug hole coil bolt	M6 x 1.0	12	1.2	9
Flywheel boss bolt	M8 x 1.25	32	3.3	24
Flywheel bolt	M12 x 1.0	118	12.0	87
Alternator bolt	M10 x 1.25	44	4.5	33
nut	M8 x 1.25	26	2.7	20
Alternator pulley lock nut	M14 x 1.5	110	11.2	81
Starter motor bolt	M10 x 1.25	44	4.5	33
Starter motor front bracket screw	M5 screw	2.5	0.25	1.8
Starter motor bolt screw	M5	5	0.5	3.6
Starter solenoid switch screw	M6 screw	6	0.6	4.3
EOP switch (Low pressure side)	PT 1• 8	8	0.8	5.8
EOP switch (High pressure side)	M10 x 1.25	22	2.2	16
ECT sensor	M10 x 1.25	12	1.2	9
A/F sensor	M18 x 1.5	42	4.3	31
Knock sensor	M12 x 1.25	31	3.2	23
MAP sensor bolt	M5 x 0.8	3.4	0.35	2.5
ECM bolt	M6 x 1.0	5	0.5	3.6
Intake manifold bolt, nut	M8 x 1.25	26	2.7	20
Exhaust manifold bolt	M10 x 1.25	39	4.0	29
Exhaust guide bolt	M8 x 1.25	26	2.7	20
Water separator body screw	M5 screw	3.4	0.35	2.5
Fuel strainer body screw	M5 screw	3.4	0.35	2.5
Fuel pump (low pressure side) bolt	M6 x 1.0	12	1.2	9
Vapor separator assembly bolt	M8 x 1.25	26	2.7	20
Vapor separator stay bolt	M8 x 1.25	26	2.7	20
Service check bolt	M6 x 1.0	12	1.2	9
Vapor separator cover screw	M5 screw	3.4	0.35	2.5
Water jacket cover screw	M5 screw	3.4	0.35	2.5
Strainer cover screw	M5 screw	3.4	0.35	2.5
Pump cover screw	M5 screw	3.4	0.35	2.5
Pump harness assembly screw	M4 screw	2.1	0.21	1.5
Float pin screw	———	2.1	0.21	1.5
Fuel pump case bolt	M6 x 1.0	12	1.2	9
Plate stay A bolt	M6 x 1.0	12	1.2	9
• **GEAR CASE**				
Propeller shaft holder bolt	M10 x 1.25	34	3.5	25
18 mm castle nut (*1)	M18 x 1.5	1	0.1	0.7
Gear case bolt	M10 x 1.25	34	3.5	25
Oil level bolt	M8 x 1.25	3.4	0.35	2.5
Oil drain bolt	M8 x 1.25	3.4	0.35	2.5
Water screen screw	M5 x 0.8	1	0.1	0.7
Sensor nipple	M8 x 1.0	3	0.3	2.2
Bearing holder (LCD, XCC and XCD types only)	M100 x 2.0	191	19.5	141
Impeller housing bolt	M8 x 1.25	19.7	2.0	14
64 mm lock nut	M64 x 1.5	123	12.5	90
Pinion gear nut	M18 x 1.0	142	14.5	105
• **EXTENSION CASE/MOUNTING CASE**				
Extension case bolt	M10 x 1.25	39	4.0	29
Lower rubber mounting bolt	M12 x 1.25	83	8.5	61
Upper rubber mounting bolt	M12 x 1.25	83	8.5	61

*1: If the split pin cannot be set by tightening the 18 mm castle nuts to 1 N·m (0.1 kgf·m, 0.7 lbf·ft), tighten the 18 mm castle nut until the split pin can be set. Note that the maximum torque of the 18 mm castle nut is 44 N·m (4.5 kgf·m, 33 lbf·ft).

Item	Thread dia. (mm) and pitch (length)	Torque value		
		N·m	kgf·m	lbf·ft
• **STERN BRACKET**				
7/8-14 UNF self-locking nut	7/8-14 UNF	34	3.5	25
25 x 2.0 mm self-locking nut	M25 x 2.0	34	3.5	25
10 mm self-locking nut	M10 x 1.25	34	3.5	25
• **POWER TRIM/TILT ASSEMBLY**				
Cylinder cap comp.	———	162	16.5	119
Rod guide comp.	———	78	8.0	58
Manual valve	M14 x 1.5	3.5	0.35	2.5
Socket bolt A/B	———	8.5	0.85	6.1
Power tilt motor assembly bolt	1/4-20 UNF	5	0.5	3.6
Power tilt motor assembly code holder screw	M4 screw	1.4	0.14	1.0
Oil tank bolt	———	5	0.5	3.6
Oil tank cap	———	2.5	0.25	1.8
• **FRAME/ELECTRICAL**				
Grease fitting	M6 x 1.0	3	0.3	2.2
Neutral switch nut	M20 x 1.0	2.5	0.25	1.8
Starter motor B terminal washer-nut	M8 x 1.25	11	1.1	8
Alternator B terminal washer-nut	M6 x 1.0	8	0.8	5.8
Alternator fuse box B terminal washer-nut	M6 x 1.0	8	0.8	5.8
Alternator fuse box bolt	M6 x 1.0	5	0.5	3.6
Fuse box bracket bolt	M6 x 1.0	5	0.5	3.6
PGM-FI main relay bolt	M6 x 1.0	5	0.5	3.6
ECM bracket bolt	M6 x 1.0	5	0.5	3.6
L./R. engine under cover screw	M6 screw	4.5	0.45	3.3
Starter motor bolt	M10 x 1.25	44	4.5	33

• Use the standard torque values for the bolts, nuts and screws that are not listed in this table.

STANDARD TORQUE VALUES

Item	Thread dia. (mm) and pitch (length)	Torque value		
		N·m	kgf·m	lbf·ft
Screw	5 mm	4.2	0.42	3.0
	6 mm	9	0.9	6.5
Bolt and nut	5 mm	5.2	0.52	3.8
	6 mm	10	1.0	7
	8 mm	21.5	2.15	16
	10 mm	34	3.5	25
	12 mm	54	5.5	40
Flange bolt and nut	6 mm (SH bolt)	9	0.9	6.5
	6 mm (CT bolt)	12	1.2	9
	6 mm	12	1.2	9
	8 mm	26	2.7	20
	10 mm	39	4.0	29

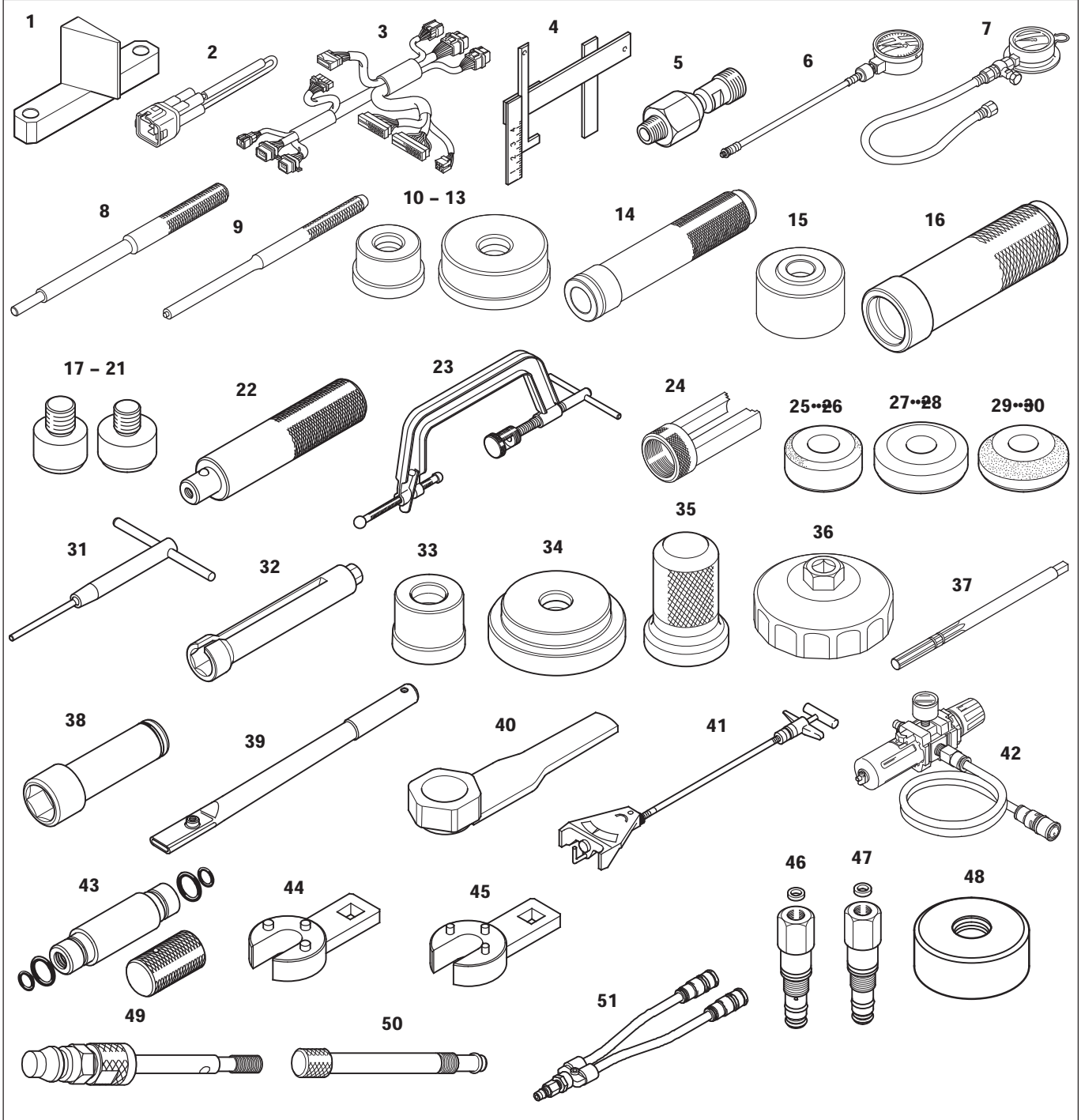
• CT bolt: Self-tapping bolt
• SH bolt: Small head bolt

8. SPECIAL TOOLS

• Special tools applicable to the parts except gear case

	Tool name	Tool number	Application
1	Ring gear holder	070PB-ZY60100	Flywheel boss, flywheel removal/installation
2	SCS service check connector	070PZ-ZY30100	ECU troubleshooting, idling adjustment
3	Test harness	070PZ-ZY60100	ECU troubleshooting
4	Float level gauge	07401-0010000	Vapor separator float level inspection
5	Oil pressure gauge attachment	07406-0030000	Oil pressure test
6	Fuel pressure gauge set	07406-0040003	Fuel pressure inspection
7	Oil pressure gauge set	07506-3000001	Oil pressure test
8	Valve guide driver, 5.5 mm	07742-0010100	Valve guide removal/installation
9	Pin driver, 6.0 mm	07744-0010500	Balancer shaft hold
10	Attachment, 32 x 35 mm	07746-0010100	22 x 35 x 7 mm water seal installation, Lower mount center hosing removal
11	Attachment, 37 x 40 mm	07746-0010200	Alternator front bearing installation
12	Attachment, 52 x 55 mm	07746-0010400	Alternator rear bearing, Chain case oil seal installation
13	Attachment, 24 x 26 mm	07746-0010700	Alternator front bearing removal, 14 x 26 x 8 mm water seal installation
14	Driver, 22 mm I.D.	07746-0020100	Alternator rear bearing installation
15	Attachment, 15 mm I.D.	07746-0020200	Alternator rear bearing installation
16	Driver, 40 mm I.D.	07746-0030100	Lower mount center housing installation
17	Pilot, 12 mm	07746-0040100	14 x 26 x 8 mm water seal installation
18	Pilot, 15 mm	07746-0040300	Alternator front bearing removal/installation
19	Pilot, 20 mm	07746-0040500	Mounting case needle bearing installation
20	Pilot, 30 mm	07746-0040700	Lower mount center housing removal
21	Pilot, 22 mm	07746-0041000	22 x 35 x 7 mm water seal installation
22	Driver	07749-0010000	Driver for 10 through 13, 17 through 21, 33 through 35 and 48
23	Valve spring compressor	07757-0010000	Valve keeper removal/installation
24	Valve spring compressor attachment	07757-PJ10100	
25	Valve seat cutter, 45° 35 mm	07780-0010400	Valve seat reconditioning (IN)
26	Valve seat cutter, 45° 33 mm	07780-0010800	Valve seat reconditioning (EX)
27	Valve seat cutter, 32° 38.5 mm	07780-0012400	Valve seat reconditioning (IN)
28	Valve seat cutter, 32° 33 mm	07780-0012900	Valve seat reconditioning (EX)
29	Valve seat cutter, 60° 30 mm	07780-0014000	Valve seat reconditioning (EX)
30	Valve seat cutter, 60° 37.5 mm	07780-0014100	Valve seat reconditioning (IN)
31	Cutter holder, 5.5 mm	07781-0010101	Valve seat reconditioning (IN/EX)
32	Sensor socket wrench, 22 x 150L	07906-PD10000	A/F sensor removal/installation
33	Attachment, 28 x 30 mm	07946-1870100	Mounting case needle bearing installation
34	Oil seal driver attachment, 72 mm	07947-6340201	Oil pump body oil seal installation
35	Oil seal driver	07947-SB00100	Oil pump cover oil seal installation
36	Oil filter wrench	07HAA-PJ70101	Oil filter removal/installation
37	Valve guide reamer, 5.525 mm	07HAH-PJ70100	Valve guide reaming
38	Socket wrench, 19 mm	07JAA-001020A	Crankshaft pulley bolt removal/installation
39	Handle	07JAB-001020B	
40	Pulley holder attachment, HEX 50 mm	07JAB-0010400	
41	Belt tension gauge	07JGG-0010101	Alternator belt tension inspection
42	Air supply	07LAJ-PR30102	VTEC system, VTEC valve inspection
43	Stem seal driver	07PAD-0010000	Valve stem seal A/B installation

	Tool name	Tool number	Application
44	Pin wrench, 6 mm	07SPA-ZW10100	Piston rod comp. removal/installation
45	Pin wrench, 4 mm	07SPA-ZW10200	Rod guide comp. removal/installation
46	Oil pressure gauge joint A	07SPJ-ZW10100	Power trim/tilt assembly blow pressure inspection
47	Oil pressure gauge joint B	07SPJ-ZW10200	
48	Oil seal driver attachment, 96	07ZAD-PNA0100	Crankshaft oil seal installation
49	VTEC air adapter	07ZAJ-PNA0101	VTEC system, VTEC valve inspection
50	VTEC air stopper	07ZAJ-PNA0200	
51	Air joint adapter	07ZAJ-PNA0300	



• Special tools applicable to all types of gear case

	Tool name	Tool number	Application
1	Outer driver attachment, 30 x 37	070PD-ZY60200	30 x 37 x 26 mm needle bearing installation
2	Gauge adapter, 110 mm	070PJ-ZY30100	Vertical shaft pinion gear shim adjustment
3	Attachment, 32 x 35 mm	07746-0010100	23 x 36 x 6 mm water seal installation
4	Attachment, 62 x 68 mm	07746-0010500	30 x 37 x 26 mm needle bearing installation
5	Pilot, 35 mm	07746-0040800	Needle bearing (outer race) removal
6	Driver	07749-0010000	Driver for 3 and 12
7	Lock nut wrench, 30/64 mm	07916-MB00002	Vertical shaft lock nut removal/installation
8	Remover weight	07741-0010201	30 x 37 x 26 mm needle bearing removal
9	Remover handle	07936-3710100	
10	Bearing remover, 30 mm	07936-8890300	
11	Oil seal driver	07947-SB00100	30 x 45 x 7 mm water seal installation
12	Oil seal driver attachment, 21 mm	07947-ZV00100	12 x 21 x 6 mm oil seal installation
13	Oil seal driver attachment, 27.5 x 44 mm	07948-9540000	Needle bearing installation
14	Driver handle, 15 x 280 mm	07949-3710001	Needle bearing (outer race) removal
15	Driver shaft, B	07964-MB00200	30 x 62 x 40 mm taper roller bearing installation
16	Attachment, 78 x 90 mm	07GAD-SD40101	Needle bearing installation
17	Vertical shaft holder	07SPB-ZW10200	Vertical shaft pinion gear nut removal/installation
18	Puller jaws	07SPC-ZW0010Z	Forward bevel gear backlash inspection
19	Puller bolt	07SPC-ZW0011Z	
20	Backlash indicator tool	07SPJ-ZW0030Z	
21	Backlash indicator attachment	07SPK-ZW10100	
22	Shaft installer, 15 x 370 mm	07VMF-KZ30200	Needle bearing installation
23	Bearing driver attachment, 37 mm	07ZMD-MBW0200	Needle bearing (outer race) removal

• Special tools applicable to LC, LD, XC and XD types of gear case

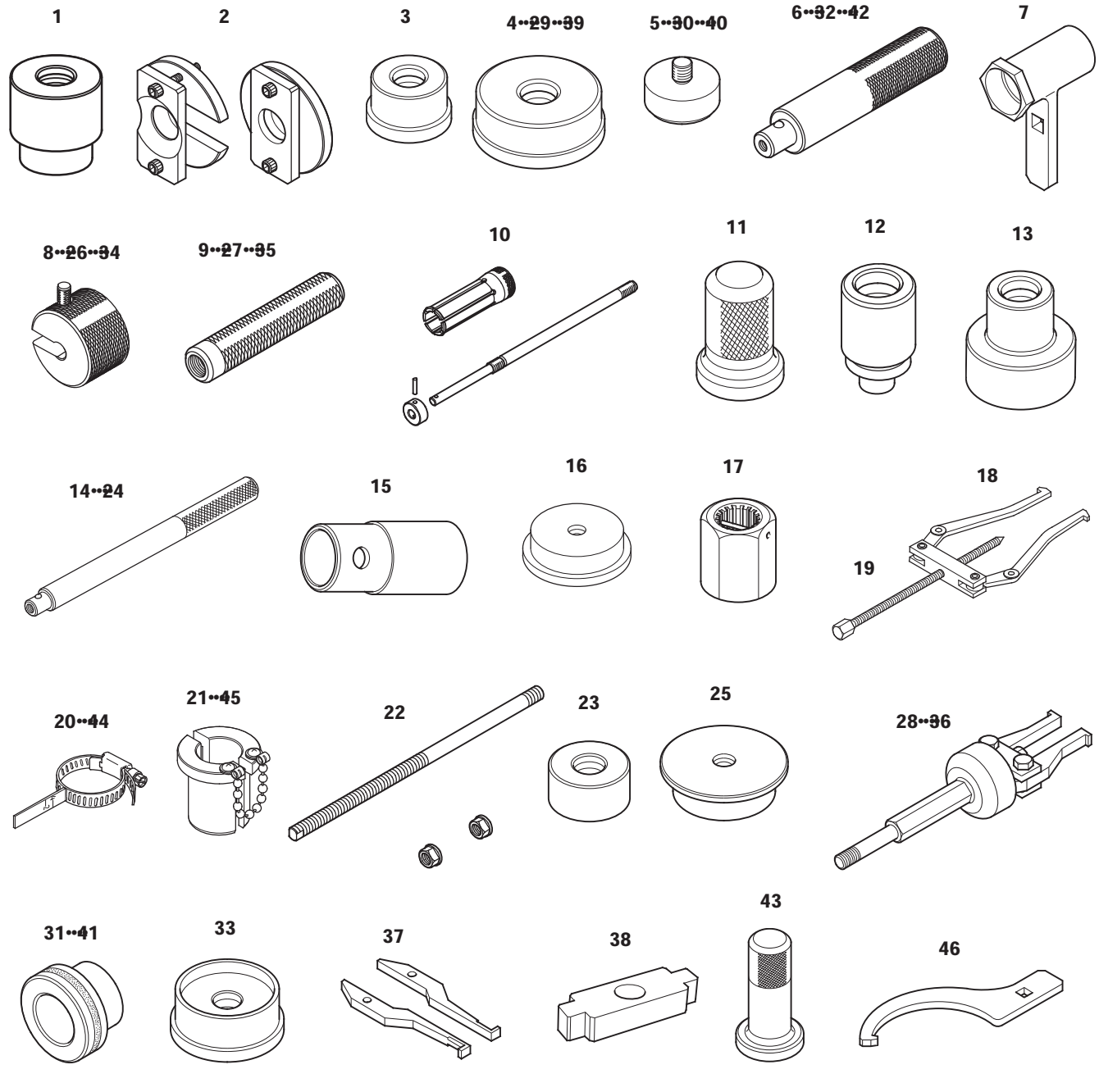
	Tool name	Tool number	Application
24	Driver handle, 480 mm	070GD-0010100	50 x 90 x 28 mm taper bearing (outer race) installation
25	Taper bearing installer attachment	070PF-ZY60100	
26	Remover weight	07741-0010201	50 x 90 x 28 mm taper bearing (outer race) removal
27	Remover handle	07936-3710100	
28	Bearing race puller	070PC-ZY3A100	
29	Attachment, 62 x 68 mm	07746-0010500	Reverse bevel gear installation
30	Pilot, 35 mm	07746-0040800	Reverse bevel gear removal/installation
31	Attachment, 27.2	07747-0010300	Reverse bevel gear removal
32	Driver	07749-0010000	Driver for 29, 30, 31 and 33
33	Oil seal driver, 52 x 55 mm	07NAD-P200100 or 07NAD-P20A100	50 x 90 x 28 mm taper bearing (inner race) installation

• Special tools applicable to LCD, XCC and XCD types of gear case

	Tool name	Tool number	Application
34	Remover weight	07741-0010201	Reverse bevel gear, 50 x 90 x 28 mm radial ball bearing removal [Puller jaws of the bearing race puller (07LPC-ZV30100) are removed and replaced with the puller jaws of part number 07WPC-ZW50100.]
35	Remover handle	07936-3710100	
36	Bearing race puller	070PC-ZY3A100	
37	Puller jaws, 25 mm	07WPC-ZW50100	
38	Taper bearing driver attachment	070PD-ZY60100	50 x 90 x 28 mm taper bearing (outer race) removal
39	Attachment, 62 x 68 mm	07746-0010500	50 x 90 x 28 mm taper bearing (inner race/outer race) installation

• Special tools applicable to LCD, XCC and XCD types of gear case

	Tool name	Tool number	Application
40	Pilot, 35 mm	07746-0040800	Forward bevel gear removal
41	Attachment, 27.2	07747-0010300	Forward bevel gear removal
42	Driver	07749-0010000	Driver for 38, 39, 40 and 41
43	Oil seal driver, 65 mm	07JAD-PL90100 or 07JAD-PL9A100	50 x 90 x 20 mm radial ball bearing installation
44	Backlash indicator tool	07SPJ-ZW0030Z	Reverse bevel gear backlash inspection
45	Backlash indicator attachment	07SPK-ZW10100	
46	Pin spanner wrench, 110 mm	07WAA-S1G0100	Bearing holder assembly removal/installation

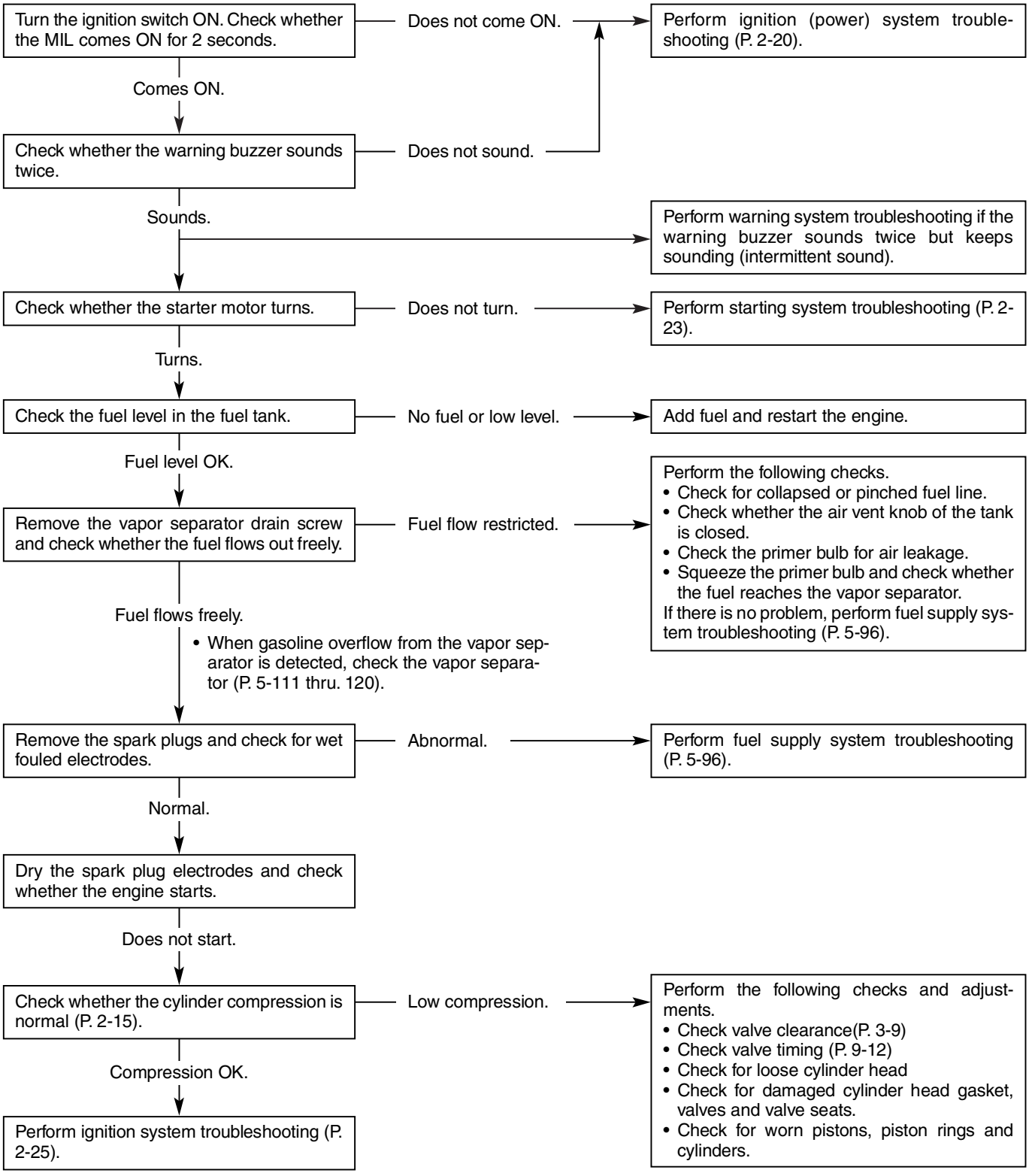


9. TROUBLESHOOTING

a. ENGINE

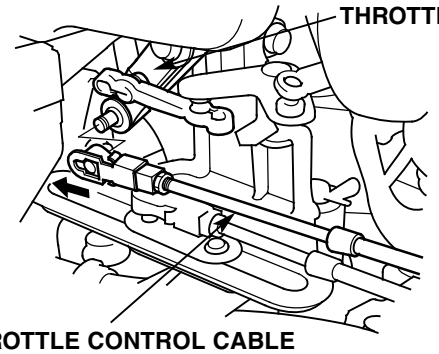
• HARD STARTING

• Use a known-good battery for troubleshooting.



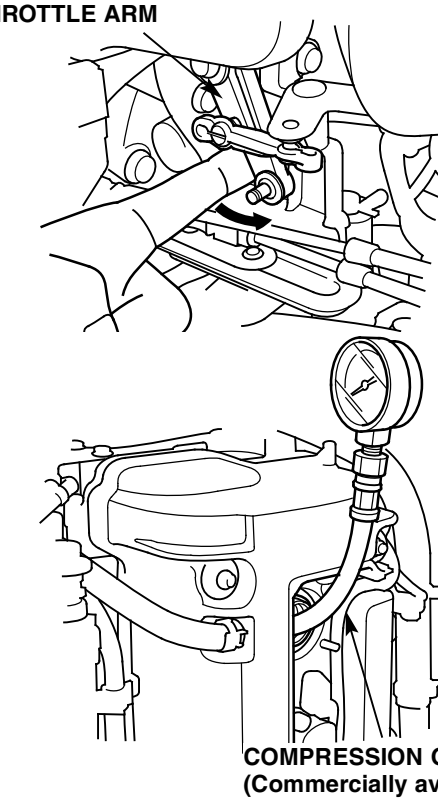
• CYLINDER COMPRESSION TEST

1) Move the remote control lever to the “N” (Neutral) position.
2) Remove the clip of the emergency stop switch.
3) Remove the engine cover and disconnect the fuel injector connectors of each cylinder.
4) Disconnect the ignition coil connector of each cylinder and remove the spark plugs.



5) Disconnect the throttle control cable from the throttle arm.
6) Install a compression gauge in the No. 1 plug hole.
7) Set the throttle in the full throttle position by pulling the throttle arm against the full throttle stopper with hand as shown.
8) Set the ignition switch in the “START” position and turn the starter motor. Measure the cylinder compression.
9) Check the compression on all cylinders.

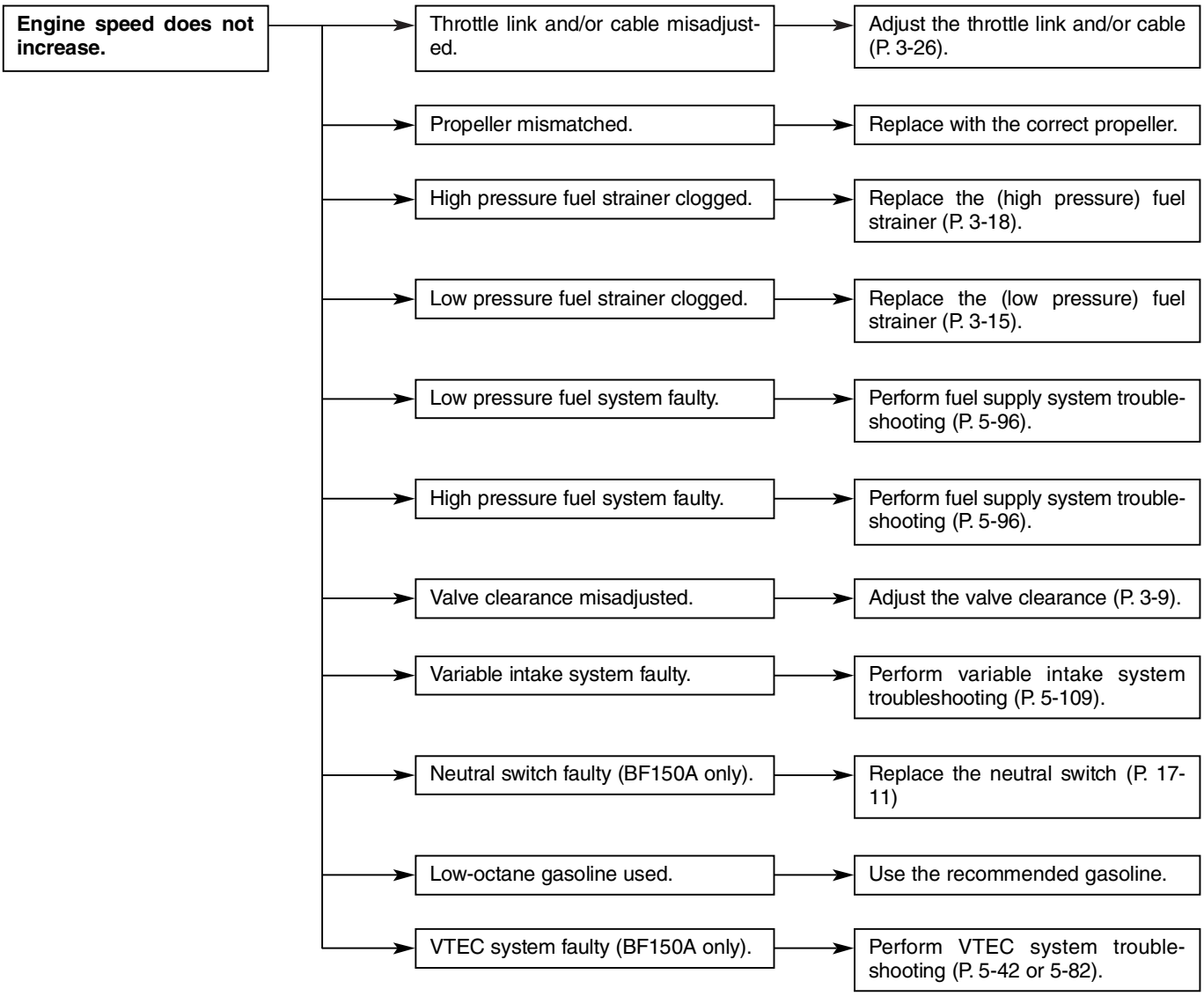
Cylinder compression	1,352 - 1,728 kPa (15.6 - 17.6 kgf/cm^2, 222 - 250 psi) at 200 min^{-1} (rpm)

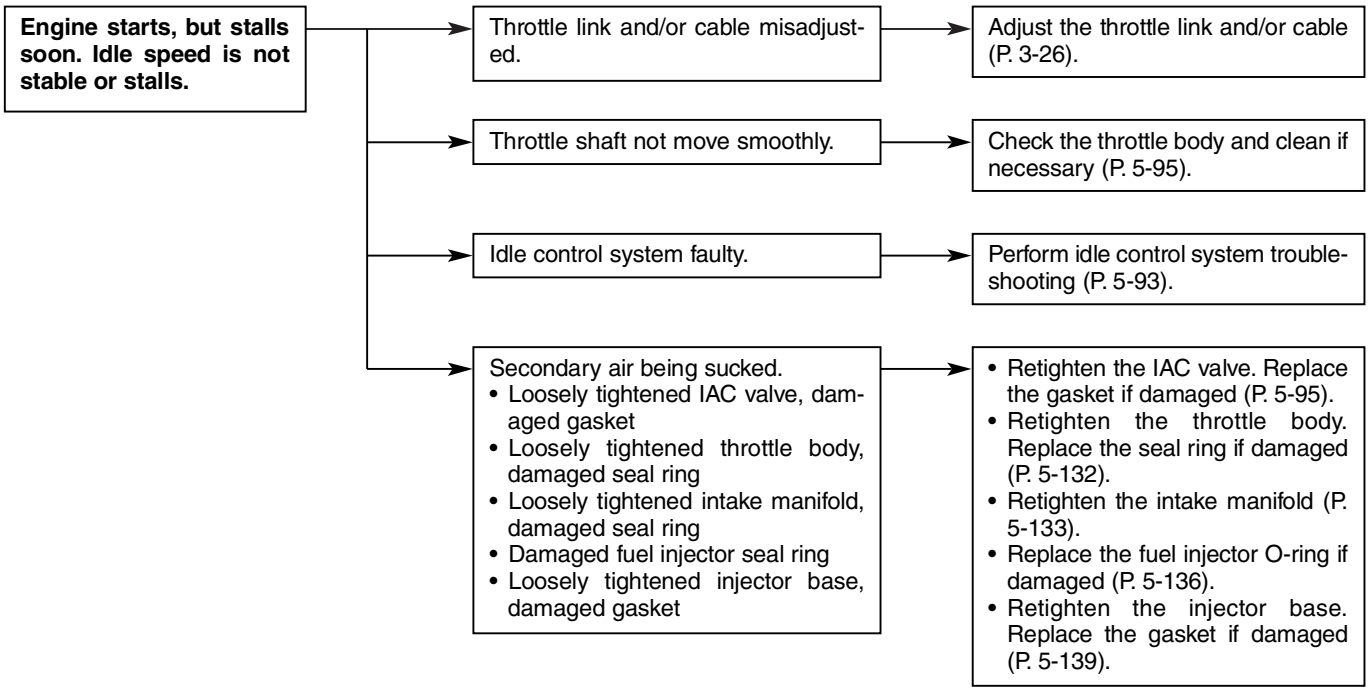


• ENGINE DOES NOT RUN SMOOTHLY

• Perform “g. ALERT SYSTEM” (P. 2-32) troubleshooting when the warning buzzer sounds.
Perform the following troubleshooting when the warning buzzer does not sound but the engine does not run smoothly.

Engine starts, but stalls soon. Idle speed is not stable or stalls.	Faulty spark plug.	Replace or clean (P. 3-8).
	Secondary air being sucked. • Loosely tightened IAC valve, damaged gasket • Loosely tightened throttle body, damaged seal ring • Loosely tightened intake manifold, damaged seal ring • Damaged fuel injector seal ring • Loosely tightened injector base, damaged gasket	• Retighten the IAC valve. Replace the gasket if damaged (P. 5-95). • Retighten the throttle body. Replace the seal ring if damaged (P. 5-131). • Retighten the intake manifold (P. 5-132). • Replace the fuel injector O-ring if damaged (P. 5-136). • Retighten the injector base. Replace the gasket if damaged (P. 5-139).
	Low pressure fuel system faulty.	Perform fuel supply system troubleshooting (P. 5-96).
	High pressure fuel system faulty.	Perform fuel supply system troubleshooting (P. 5-96).
	Idle control system faulty.	Perform idle control system troubleshooting (P. 5-93).

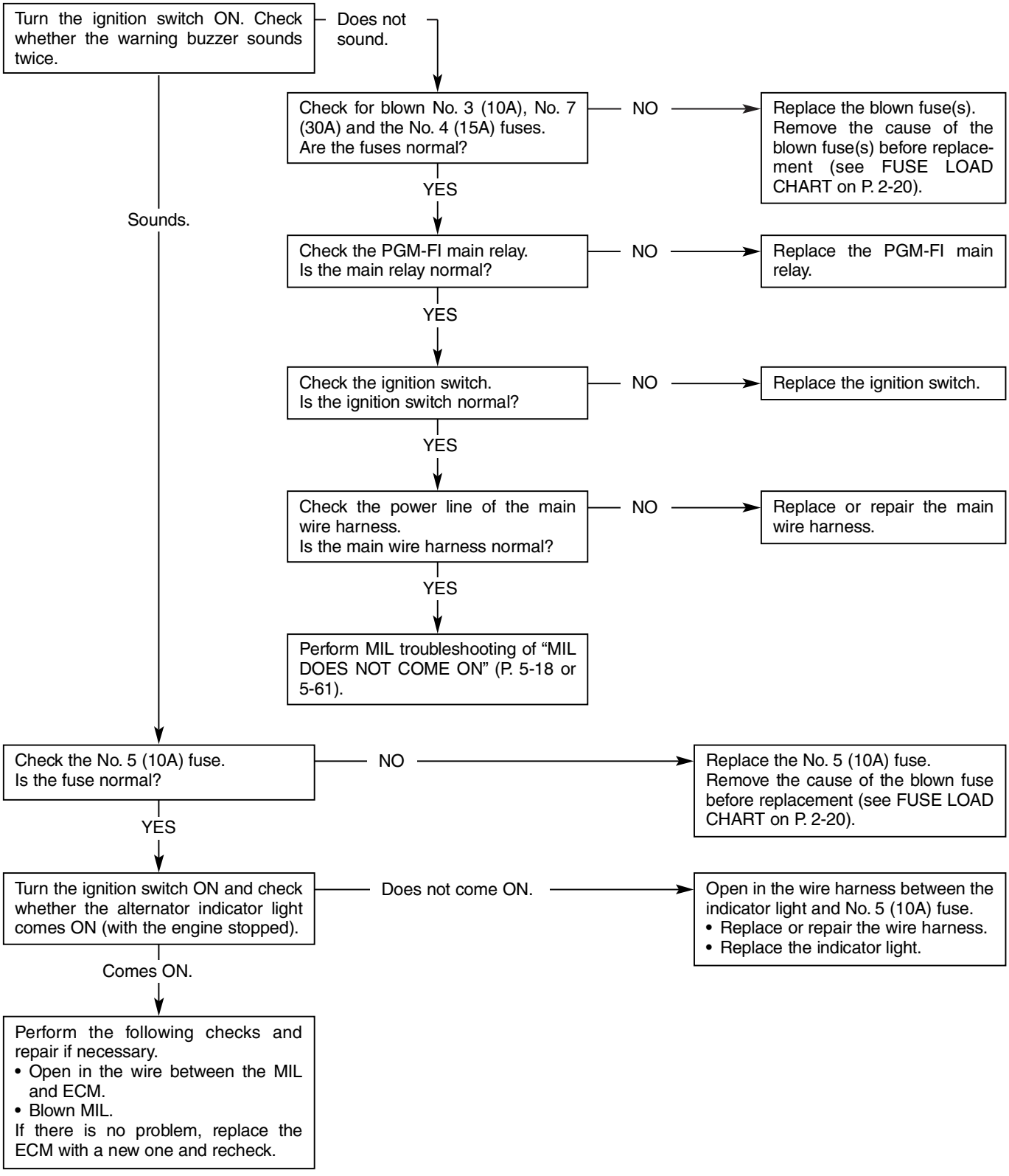

Engine speed does not increase.
Throttle link and/or cable misadjusted.
Adjust the throttle link and/or cable (P. 3-26).
Propeller mismatched.
Replace with the correct propeller.
High pressure fuel strainer clogged.
Replace the (high pressure) fuel strainer (P. 3-18).
Low pressure fuel strainer clogged.
Replace the (low pressure) fuel strainer (P. 3-15).
Low pressure fuel system faulty.
Perform fuel supply system troubleshooting (P. 5-96).
High pressure fuel system faulty.
Perform fuel supply system troubleshooting (P. 5-96).
Valve clearance misadjusted.
Adjust the valve clearance (P. 3-9).
Variable intake system faulty.
Perform variable intake system troubleshooting (P. 5-109).
Neutral switch faulty (BF150A only).
Replace the neutral switch (P. 17-11)
Low-octane gasoline used.
Use the recommended gasoline.
VTEC system faulty (BF150A only).
Perform VTEC system troubleshooting (P. 5-42 or 5-82).


Engine starts, but stalls soon. Idle speed is not stable or stalls.
Throttle link and/or cable misadjusted.
Adjust the throttle link and/or cable (P. 3-26).
Throttle shaft not move smoothly.
Check the throttle body and clean if necessary (P. 5-95).
Idle control system faulty.
Perform idle control system troubleshooting (P. 5-93).
Secondary air being sucked.
• Loosely tightened IAC valve, damaged gasket
• Loosely tightened throttle body, damaged seal ring
• Loosely tightened intake manifold, damaged seal ring
• Damaged fuel injector seal ring
• Loosely tightened injector base, damaged gasket
• Retighten the IAC valve. Replace the gasket if damaged (P. 5-95).
• Retighten the throttle body. Replace the seal ring if damaged (P. 5-132).
• Retighten the intake manifold (P. 5-133).
• Replace the fuel injector O-ring if damaged (P. 5-136).
• Retighten the injector base. Replace the gasket if damaged (P. 5-139).

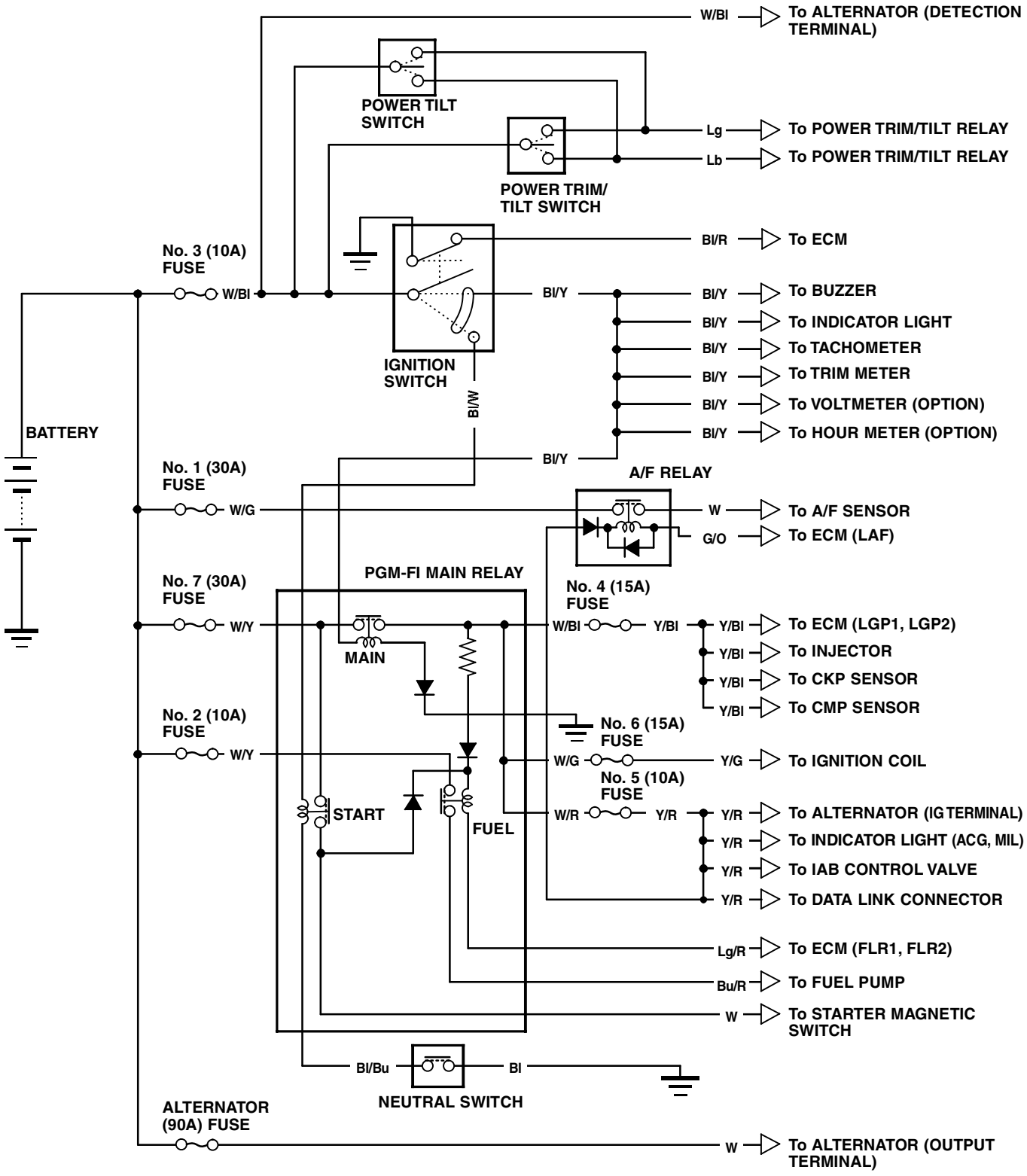
Engine sometimes misfires or stalls.	Water in the fuel.	• Check for water in the low pressure fuel strainer. Replace if necessary (P. 3-15). • Check for water in the water separator and drain if necessary (P. 3-19). • Check for water in the fuel tank and drain if necessary.
	High pressure fuel strainer clogged.	Replace the (high pressure) fuel strainer (P. 3-18).
	Low pressure fuel strainer clogged.	Replace the (low pressure) fuel strainer (P. 3-15).
	Fuel tube faulty.	• Check for pinched or collapsed tube line and correct if necessary. • Check the air vent knob of the tank. Open the air vent knob if it is closed. • Check the primer bulb for air leakage. Replace if necessary.
	High pressure fuel system faulty.	Perform fuel supply system troubleshooting (P. 5-96).
Excessive engine speed	Propeller mismatched.	Replace with the correct propeller.
	Propeller faulty.	Replace the propeller.
	Outboard installation setting incorrect (e.g. transom height, tilt angle, etc.)	Adjust the installation setting.

b. IGNITION (POWER) SYSTEM

• ENGINE DOES NOT START

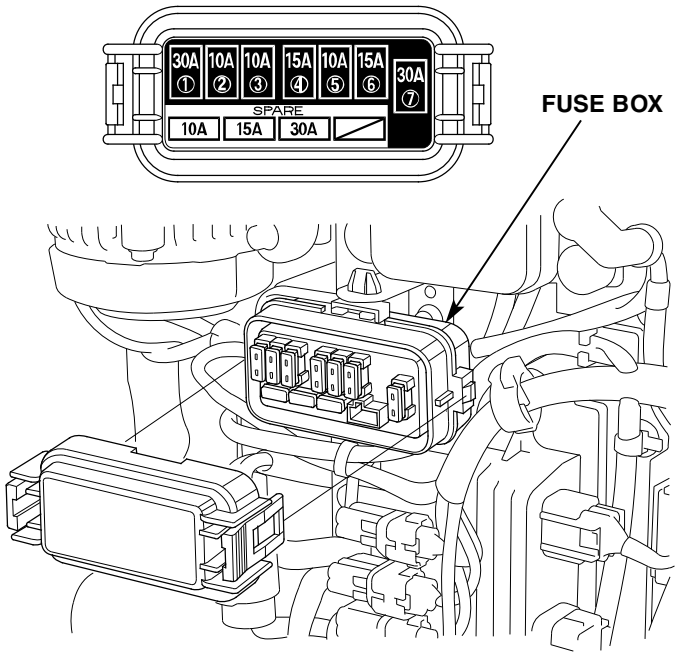


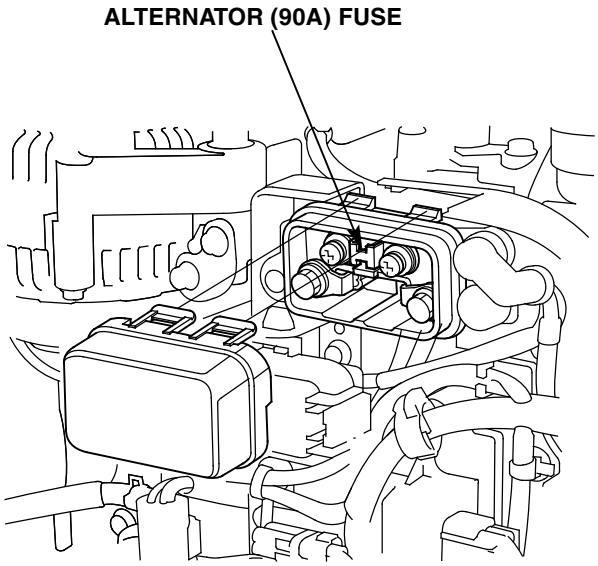
• FUSE LOAD CHART



• FUSE BOX CONNECTION TABLE

Fuse No.	Fuse capacity	Connect to
1	30A	A/F sensor heater
2	10A	High pressure side fuel pump
3	10A	Power trim/tilt relay, Alternator (detection terminal), Ignition switch, PGM-FI main relay, Warning buzzer, Indicator light (oil, overheat), Meters
4	15A	ECM, Fuel injector, CMP sensor, CKP sensor
5	10A	Alternator (IG terminal), A/F relay, Indicator light (MIL, ACG), IAB control valve, data link connector
6	15A	Ignition coil
7	30A	PGM-FI main relay

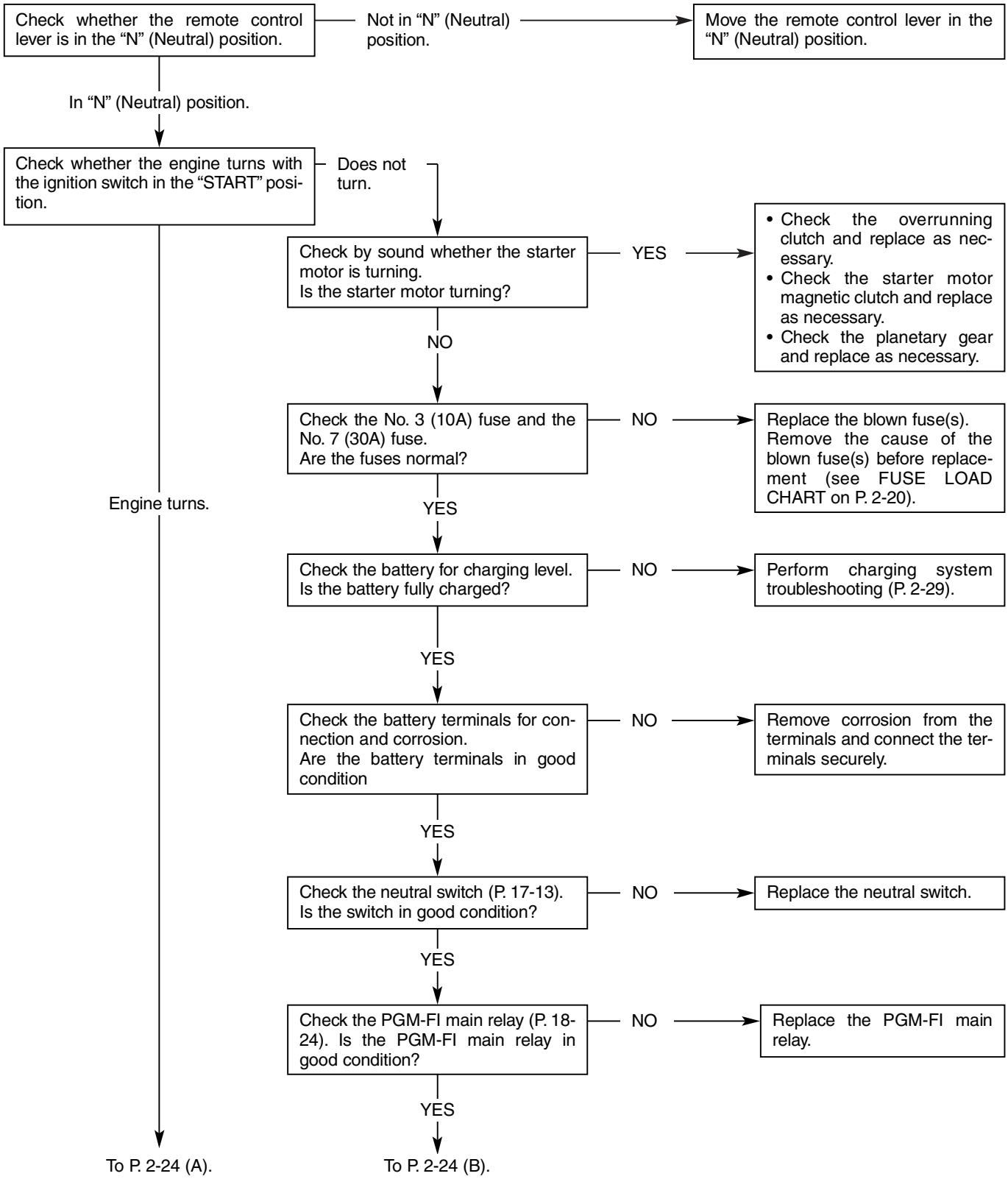


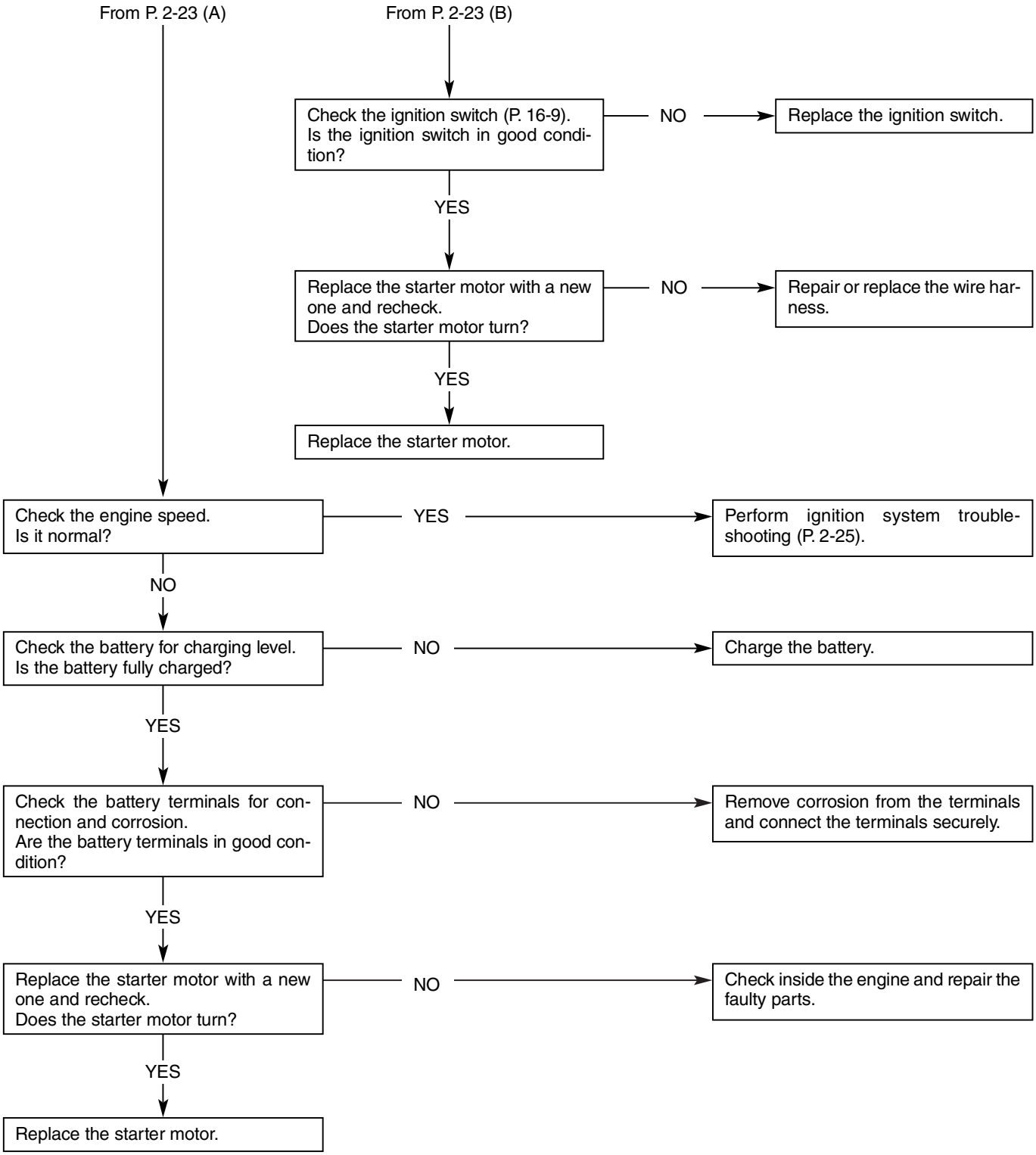


c. STARTING SYSTEM

• ENGINE DOES NOT START

• Before starting troubleshooting, check each wire for connection and correct as necessary.



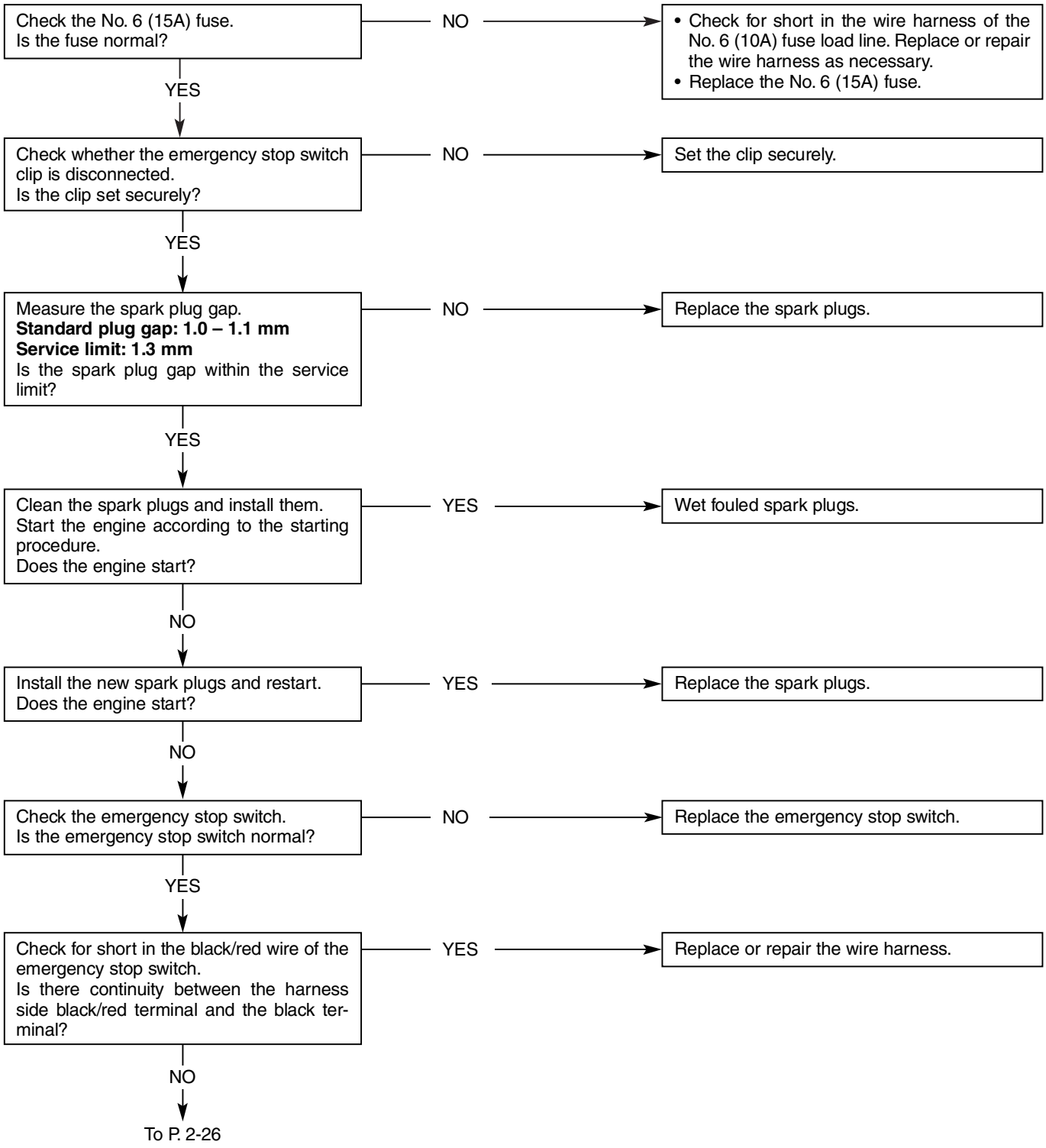

From P. 2-23 (A)
From P. 2-23 (B)
Check the ignition switch (P. 16-9).
Is the ignition switch in good condition?
NO
Replace the ignition switch.
YES
Replace the starter motor with a new one and recheck.
Does the starter motor turn?
NO
Repair or replace the wire harness.
YES
Replace the starter motor.
Check the engine speed.
Is it normal?
YES
Perform ignition system troubleshooting (P. 2-25).
NO
Check the battery for charging level.
Is the battery fully charged?
NO
Charge the battery.
YES
Check the battery terminals for connection and corrosion.
Are the battery terminals in good condition?
NO
Remove corrosion from the terminals and connect the terminals securely.
YES
Replace the starter motor with a new one and recheck.
Does the starter motor turn?
NO
Check inside the engine and repair the faulty parts.
YES
Replace the starter motor.

d. IGNITION SYSTEM

• ENGINE IS HARD TO START

* Before troubleshooting, turn the ignition switch ON and check whether the MIL comes ON for 2 seconds and the warning buzzer sounds twice intermittently.

  If the MIL does not come ON or the warning buzzer does not sound, perform power system troubleshooting (P. 2-20).



From P. 2-25

Check the CKP sensor connector.
Is the connector connected securely?

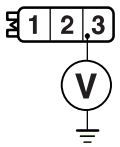
No → Connect the CKP sensor connector properly and recheck.

Yes

Check for open circuit in the ignition coil's power line.

1 Disconnect the 3P connectors from each of the ignition coils.
2 Turn the ignition switch ON. Measure the voltage between the No. 3 (Yellow/Green) terminal of each harness side 3P connector and the engine ground.

Ignition coil harness side 3P connector Viewing from terminal side



Is there the battery voltage?

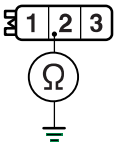
No → Replace or repair the wire harness. (Open circuit in the wire between the No. 6 (15A) fuse and the ignition coil.)

Yes

Check for open circuit in the ignition coil's ground line.

1 Turn the ignition switch OFF.
2 Check for continuity between the No. 2 (Black/White) terminal of the respective harness side 3P connectors and the engine ground.

Ignition coil harness side 3P connector Viewing from terminal side



Is there continuity?

No →
- Replace or repair the wire harness. (Open circuit in the wire harness between the ignition coil and the engine ground.)
- Check the engine ground and repair as necessary.

Yes

To P. 2-27

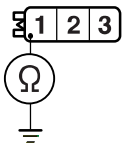
From P. 2-26

Check for short circuit in the ignition coil's signal line.

1 Turn the ignition switch OFF. Check for continuity between the No. 1 (Blue, Blue/Black, White/Green, Blue/Red) terminal of the respective harness side 3P connectors and the engine ground.

No. 1 ignition coil: Blue
No. 2 ignition coil: Blue/Black
No. 3 ignition coil: White/Green
No. 4 ignition coil: Blue/Red

Ignition coil harness side 3P connector Viewing from terminal side



Is there continuity?

Yes → Replace or repair the wire harness (Short circuit in the wire harness between the ignition coil and the ECM).

No

Replace the ignition coil and recheck. Does the engine start?

Yes → Replace the ignition coil.

No

Substitute a known-good ECM and recheck.

e. FUEL SYSTEM

• ENGINE IS HARD TO START

• When the gasoline is flowing out of the vapor separator, check the vapor separator (P. 5-112 thru. 5-120).

Turn the ignition switch ON and check the fuel pump operation.
Is there the operation sound for 2 seconds after the ignition switch is ON?

NO

Check the No. 2 (10A) fuse.
Is the fuse normal?

NO

- Check for short in the wire harness between the No. 2 (10A) fuse and the fuel pump. Replace or repair the wire harness as necessary.
- Replace the No. 2 (10A) fuse.

YES

Yes

Check the PGM-FI main relay.
Is the PGM-FI main relay normal?

NO

Replace the PGM-FI main relay.

YES

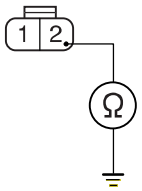
Check for open circuit in the fuel pump ground line.

1 Turn the ignition switch OFF and disconnect the fuel pump 2P connector.
2 Check for continuity between the No. 2 (Black/White) terminal of the harness side 2P connector and the engine ground.

NO

Replace or repair the wire harness (Open circuit in the ground line).

Fuel pump harness side 2P connector Viewing from terminal side



Is there continuity?

YES

To P. 2-29 (A)

To P. 2-29 (B)

From P. 2-28 (A)

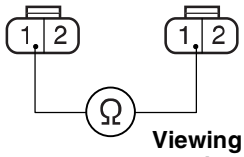
From P. 2-28 (B)

Check for open circuit in the fuel pump power line.

1 Disconnect the main relay 2P connector.
2 Check for continuity between the No. 1 (Blue/Red) terminal of the harness side main relay 2P connector and the No. 1 (Blue/Red) terminal of the fuel pump 2P connector.

Fuel pump harness side 2P connector

PGM-FI main relay harness side 2P connector



Viewing from terminal side

Is there continuity?

NO → Replace or repair the wire harness (Open circuit in the fuel pump power line).

YES

Check the (high pressure) fuel pump (P. 5-107).
Is the fuel pump normal?

NO → Replace the (high pressure) fuel pump.

YES

Substitute a known-good ECM and recheck.

Check the low pressure fuel system (P. 5-96).
Is the low pressure fuel system normal?

NO → Repair the faulty part.

YES

Check the high pressure fuel system (P. 5-96).
Is the high pressure fuel system normal?

NO → Repair the faulty part.

YES

Perform idle control system troubleshooting. If it is normal, Substitute a known-good ECM and recheck

f. CHARGING SYSTEM

• BATTERY UNDER CHARGED

Is the alternator belt tension correct (Inspection: P. 3-29)?

NO → Adjust the alternator belt tension (P. 3-29).

YES ↓

Start the engine and let it idle to warm up.
Measure the voltage between the battery terminals when the engine speed is 3,000 min^{-1} (rpm).
Is the voltage between the terminals 13.5V or above?

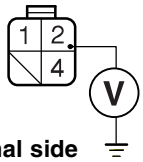
YES → Replace the battery.

NO ↓

Check for open circuit in the IG line.

1 Turn the ignition switch OFF and disconnect the alternator 4P connector.
2 Measure the voltage between the No. 2 (Yellow/Red) terminal of the alternator 4P connector and the engine ground.

Alternator harness side 4P connector



Viewing from terminal side

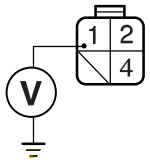
Is there the battery voltage with the ignition switch ON?

NO → Replace or repair the wire harness (Open in the wire between the alternator and No. 5 fuse).

Yes ↓

Check for open circuit in the BAT line.

1 Turn the ignition switch OFF and disconnect the alternator 4P connector.
2 Measure the voltage between the No. 1 (White/Black) terminal of the alternator 4P connector and the engine ground.



Alternator harness side 4P connector

Viewing from terminal side

Is there the battery voltage with the ignition switch ON?

NO → Replace or repair the wire harness (Open in the wire between the alternator and the ignition switch).

Yes ↓

Disassemble and service the alternator (P. 6-9).

• ALTERNATOR INDICATOR LINE INSPECTION

Turn the ignition switch ON. Does the alternator indicator lightcome ON?
— YES → Start the engine. Does the alternator indicator light go OFF?
— Yes → End of inspection (Good)

NO

No

Check for short circuit in the L line.
1 Stop the engine and disconnect the alternator 4P connector.
Does the alternator indicator light come ON with the ignition switch ON?
— YES → Replace or repair the wire harness (Short in the wire between the ECM and the alternator).

NO

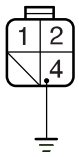
Disassemble and service the alternator.

Check the No. 5 (15A) fuse. Is the fuse normal?
— NO → • Check for short circuit in the wire harness of the No. 5 (10A) fuse load line. Replace or repair the main harness if necessary.
• Replace the No. 5 (15A) fuse.

YES

Check for open circuit in the L line.
1 Stop the engine and disconnect the alternator 4P connector.
2 Connect the No. 4 (White/Blue) terminal of the alternator 4P connector to the body to short using a jumper wire.

Alternator harness side 4P connector Viewing from terminal side



Does the alternator indicator light come ON with the ignition switch ON?
— NO → Check for open circuit in the wire harness (White/Blue) between the ECM and the alternator. Is the wire harness normal?
— NO → Replace or repair the wire harness (Open in the wire between the ECM and alternator).

YES

Check the alternator indicator light. Is the alternator indicator light normal?
— NO → • Check the alternator indicator light bulb. Replace the bulb as necessary.
• If the bulb is normal, replace the alternator indicator light.

YES

Substitute a known-good ECM and recheck.

YES

Disassemble and service the alternator (P. 6-9).

g. ALERT SYSTEM

• OIL ALERT SYSTEM

When the oil pressure switch (low pressure side) detects low oil pressure, the ECM receives the signal from the oil pressure switch and decreases the engine speed gradually to 1,800 min^{-1} (rpm). The warning buzzer sounds and the oil indicator light goes OFF this time. When the problem is removed, the engine speed increases gradually and the engine is restored to the normal running.

• OVERHEAT ALERT SYSTEM

When the ECM detects overheat by receiving the signal from the thermo sensor, it decreases the engine speed gradually to 1,800 min^{-1} (rpm). The warning buzzer sounds and the overheat indicator light comes ON. When the problem is not removed within 20 seconds, the ECM decreases the engine speed further until it stops. When the problem is removed during this control, the ECM increases the engine speed gradually until the engine is restored to the normal running.

• ALTERNATOR WARNING SYSTEM

The IC regulator is equipped in the alternator to detect the disconnected sensor terminal, disconnected output terminal, overcharge and undercharge when generation stops. When a problem is detected, the IC regulator turns the alternator indicator lightON and the ECM sounds the warning buzzer (intermittent prolonged sound) by receiving the signal from the IC regulator.

• FULL WATER (IN WATER SEPARATOR) WARNING SYSTEM

When the water level in the water separator is above the specified level, the water level sensor detects the condition and transmits the signal to the ECM to sound the warning buzzer.

• MIL WARNING SYSTEM

The MIL indicator light comes ON and the buzzer sounds (intermittent prolonged sound) when the ECM detects a problem by its diagnostic function.

• WARNING SYSTEM

Condition	Indicator light		Warning indicator light		Warning buzzer
	Oil indicator light (Green)	Overheat indicator light (Red)	ACG indicator light (Red)	MIL (Red)	
Ignition switch ON (Initial check)	ON for 2 sec.	ON for 2 sec.	ON	ON for 2 sec.	Sounds twice
2 sec. after turning ignition switch ON	OFF	OFF	ON	OFF	Stop
Normal operation	ON	OFF	OFF	OFF	Stop
Engine oil pressure dropped	OFF	OFF	OFF	OFF	Continuous sound
Overheat	ON	ON	OFF	OFF	Continuous sound
MIL faulty	ON*1	OFF*2	OFF	ON	Intermittent prolonged sound
Alternator faulty	ON	OFF	ON	OFF	Intermittent prolonged sound
Water separator full	ON	OFF	OFF	OFF	Intermittent short sound

When two or more problems occur simultaneously, warning for each problem is indicated simultaneously.

When a problem occurred simultaneously with the malfunction of the MIL:

*1: The oil indicator light blinks when a problem with the high pressure oil pressure switch is detected.

*2: The overheat indicator light blinks when a problem with the overheat sensor is detected.

The warning buzzer of the prolonged sound takes precedence over the short sound.

Example: When the problems with the alternator and full water separator are detected simultaneously, the warning buzzer is the intermittent prolonged sound.

Example: When the overheat and a problem with the alternator are detected simultaneously, the warning buzzer is the continuous sound.

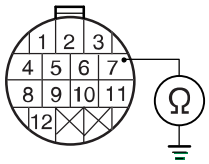
• WARNING BUZZER SOUNDS CONTINUOUSLY

Check the indicator light.
Is the overheat indicator light ON?
— YES → To P. 2-36
NO (OFF) ↓

Is the oil indicator light OFF?
— NO (ON) → Check the oil indicator light.
Is the oil indicator light normal?
— NO → Replace the oil indicator light.
YES ↓

Check the warning buzzer.
Is the warning buzzer normal?
— NO → Replace the buzzer.
YES ↓

Check for short in the buzzer line.
1 Turn the ignition switch OFF and disconnect the remote control cable 14P connector.
2 Check for continuity between the No. 7 (Yellow/Green) terminal and the engine ground



Remote control cable 14P connector Viewing from terminal side

Is there continuity?
— YES → Replace or repair the wire harness (Short in wire harness between the buzzer and ECM).
NO ↓

Substitute a known-good ECM and recheck.

YES (OFF) ↓

Stop the engine and check the oil level.
Is the oil level correct?
— No → Add the oil to the correct level.
Yes ↓
To P. 2-34

From P. 2-33

Start the engine.
Is the oil indicator light ON with the engine idling?

YES → Snap the engine (4,000 min^{-1} /rpm or above under no load) and check the oil indicator and warning buzzer.
Do the oil indicator light come ON and the buzzer stop sounding?

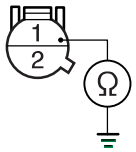
YES → Normal (End of inspection)

NO → Disconnect the high pressure side oil pressure switch 2P connector.
Do the oil indicator light come ON and the buzzer stop sounding?

YES → Replace the oil pressure switch.

NO → Check for short in the high pressure side oil pressure switch line.
1 Turn the ignition switch OFF.
2 Check for continuity between the No. 1 (Green/Red) terminal of the harness side oil pressure switch 2P connector and the engine ground.

Oil pressure switch 2P connector Viewing from terminal side



Is there continuity?

YES → Replace or repair the wire harness (Short in the wire harness between the high pressure side oil pressure switch and ECM).

NO → Substitute a known-good ECM and recheck.

NO → Disconnect the low pressure side oil pressure switch wire.
Do the oil indicator light come ON and the warning buzzer stop sounding?

NO → Check for short in the low pressure side oil pressure switch line.
1 Turn the ignition switch OFF.
2 Check for continuity between the oil pressure switch terminal and the engine ground.
Is there continuity?

NO → Replace or repair the wire harness (Short in the wire harness between the low pressure side oil pressure switch and ECM).

YES → Substitute a known-good ECM and recheck.

YES → To P. 2-35