HONDA

BF115A•130A Paper book Part no. 66ZW500

PREFACE

This manual covers the construction, function and servicing procedures of the Honda BF115A / BF130A outboard motors.

Careful observance of these instructions will result in better, safer service work.

HONDA MOTOR CO., LTD.
SERVICE PUBLICATIONS OFFICE

CONTENTS

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Abbreviations

Abbreviations	
ACG	Alternator
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
Comp.	Complete
CYL	Cylinder
ECT	Engine Coolant Temperature
ECM	Engine Control Module
EX	Exhaust
F	Front or Forward
GND	Ground
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 Light
O. D.	Outside Diameter
OP	Optional Part
PCV	Positive Crankcase Ventilation
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

Item \ Model	BF115AX			
Description code	BZBD	BZBG	BZBD	BZBG
Type	LD	LCD	XD	XCD
Overall length	825 mm (32.5 in)			
Overall width	550 mm (21.7 in)			
Overall height	1,650 mm (65.0 in)		1,775 mm (69.9 in)	
Dry weight (*1)	225 kg (496 lbs)	228 kg (503 lbs)	230 kg (507 lbs)	233 kg (514 lbs)
Operating weight (including oil)	231 kg (509 lbs)	234 kg (516 lbs)	236 kg (520 lbs)	239 kg (527 lbs)

*1: With propeller mounted.

Item \ Model	BF130AX			
Description code	BZBE	BZBH	BZBE	BZBH
Type	LD	LCD	XD	XCD
Overall length	825 mm (32.5 in)			
Overall width	550 mm (21.7 in)			
Overall height	1,650 mm (65.0 in)		1,775 mm (69.9 in)	
Dry weight (*1)	225 kg (496 lbs)	228 kg (503 lbs)	230 kg (507 lbs)	233 kg (514 lbs)
Operating weight (including oil)	231 kg (509 lbs)	234 kg (516 lbs)	236 kg (520 lbs)	239 kg (527 lbs)

*1: With propeller mounted.

FRAME

Item \ Model	BF115AX/BF130AX			
Type	LD	LCD	XD	XCD
Transom height (*1)	537 mm (21.1 in)		664 mm (26.1 in)	
Transom angle	5 stage adjustment (8°, 12°, 16°, 20°, 24°)			
Tilting angle	72°			
Tilting stage	Stageless			
Swivel angle	30° right and left			
Trim angle (*1)	–4° to 16°			
Remote control steering system	Motor-mounted			

*1: Transom angle is at 12°.

TYPES OF HONDA BF115A/BF130A OUTBOARD MOTORS

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

Model	Type	Shaft Length		Gear case		Remote Control	Control Panel	Power Trim/Tilt	Tachometer	Trimmeter
		Long	Extra-long	Standard Rotation	Counter Rotation					
BF115A/ BF130A	LD	○		○		(○)	(○)	○	(○)	(○)
	XD		○	○		(○)	(○)	○	(○)	(○)
	LCD	○			○	(○)	(○)	○	(○)	(○)
	XCD		○		○	(○)	(○)	○	(○)	(○)

L: Long shaft X: Extra-long shaft C: Counter rotation ( ): Optional part
The power trim/tilt type motors use an electric/hydraulic power cylinder to trim or tilt the motor.

ENGINE

Model	BF115AX	BF130AX
Type	4-stroke, O.H.C., 4-cylinder	
Displacement	2,254 cm^3 (137.5 cu in)	
Bore x stroke	86 x 97 mm (3.4 x 3.8 in)	
Rated power *1	84.6 kW (115 PS) at 5,000 – 6,000 min^{-1} rpm	95.6 kW (130 PS) at 5,000 – 6,000 min^{-1} (rpm)
Maximum torque	169 N•m (17.2 kgf•m, 124 lbf•ft)	180 N•m (18.4 kgf•m, 133 lbf•ft)
Compression ratio	8.8 : 1	
Fuel consumption ratio	310 g/kW•h (228 g/PS•h)	345 g/kW•h (254 g/PS•h)
Cooling system	Forced water circulation by impeller pump with thermostat	
Ignition system	Full transistorized, battery ignition	
Ignition timing	10° at 650 min^{-1} (rpm) B.T.D.C to 24° at 6,000 min^{-1} (rpm) B.T.D.C.	
Spark plug	ZFR7F (NGK), KJ22CR-L8 (DENSO)	
Fuel supply system	Programmed fuel injection (PGM-FI)	
Fuel injection system	Electronic control	
Fuel injection nozzle	Pintle type	
Fuel pipe	Steel pipe and rubber tubes	
Lubrication system	Pressure lubrication by trochoid pump	
Lubrication capacity	5.6 ℓ (5.9 US qt, 4.9 Imp qt) [with oil filter replacement: 6.5 ℓ (6.9 US qt, 5.7 Imp qt]	
Starter system	Electric starter	
Stopping system	Primary circuit ground	
Fuel	Automotive unleaded gasoline 91 research octane, 86 pump octane or higher.	
Optional fuel tank capacity	25 ℓ (6.6 US gal, 5.5 Imp gal)	
Fuel pump	Electric and mechanical plunger type	
Exhaust system	Underwater type	
Recommended oil	SAE 10W – 30/40	

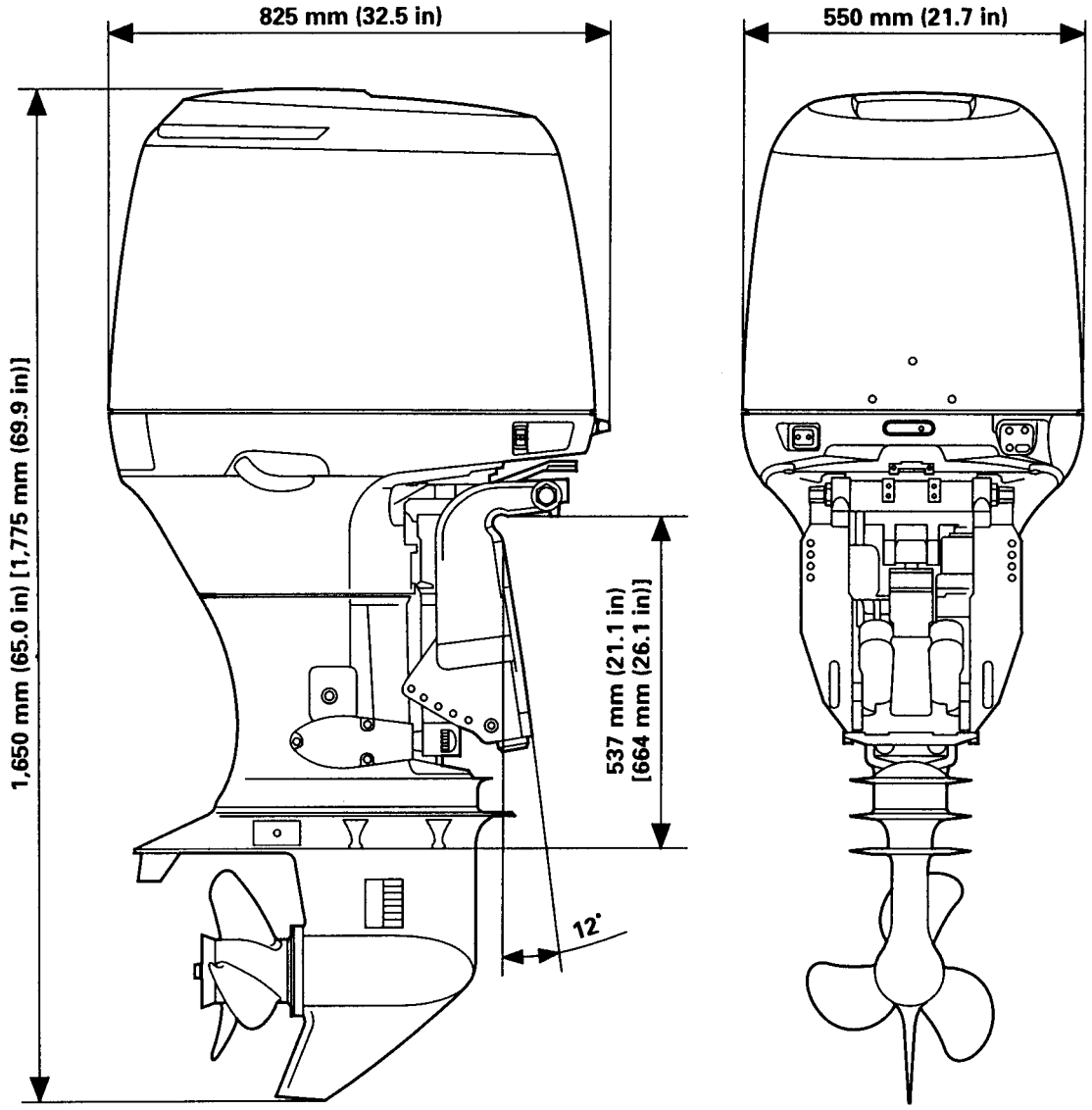
*1: Full throttle range.

LOWER UNIT

Clutch	Dog clutch (Forward – Neutral – Reverse)
Gear ratio	0.50 (14/28)
Reduction	Spiral bevel
Gear case oil capacity	1.0 ℓ (1.1 US qt, 0.9 Imp qt)
Propeller No. of blades-Dia. x Pitch	Optional part
Propeller rotating direction	Clockwise (viewed from rear): LD and XD types Counterclockwise (viewed from rear): LCD and XCD types
Propeller driving system	Spline

2. DIMENSIONAL DRAWING

[ ]: Extra-long shaft type



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 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

Be sure you have a clear understanding of all basic shop safety practices and that you are wearing appropriate clothing and safety equipment. When performing maintenance or repairs, be especially careful of the following:

- **Read the instructions before you begin, and be sure you have the tools and skills required to perform the tasks safely.**

  Be sure the engine is off before you begin any maintenance or repairs. This will reduce the possibility of several 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 cool before you touch it.

- **Injury from moving parts.**
  Do not run the engine unless the instruction tells you to do so. Even then, keep your hands, fingers, and clothing away.

To reduce the possibility of a fire or explosion, be careful when working around gasoline. Use only a nonflammable solvent, not gasoline, to clean parts. 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 assembling.
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 assembly.
6. After assembly, 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 female threads and ruin the hole.
8. Use only metric tools when servicing this unit. Metric bolts, nuts and screws are not interchangeable with nonmetric fasteners. The use of incorrect tools and fasteners will damage the unit.
9. Follow the instructions represented by these symbols when they are used:

: Apply oil. S. TOOL :Use special tool. 

:Apply grease

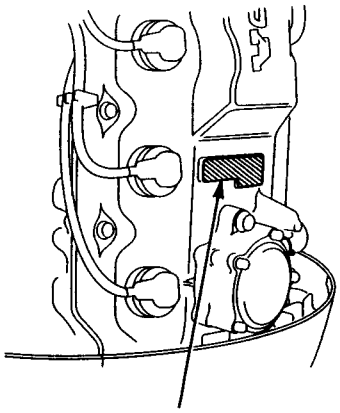
○x○(○) : Indicates the type, length, and number of the flange bolt used.

P. : Indicates the reference page.

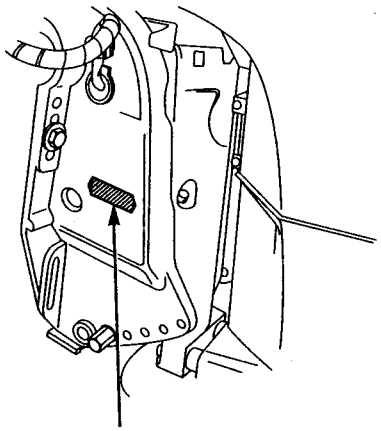
(Molybdenum disulfide oil) : Use molybdenum oil solution (mixture of the engine oil and molybdenum grease with the ratio 1 : 1).

4. SERIAL NUMBER LOCATION

The engine serial number is stamped on the cylinder head cover and the product identification number is located on the L. 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

5. MAINTENANCE STANDARDS

• ENGINE

Unit: mm (in)

Part	Item		Standard	Service limit
Engine	Idle speed (in neutral)		750 ± 50 min^{-1} (rpm)	———
	Trolling speed		650 ± 50 min^{-1} (rpm)	———
	Cylinder compression		1,373–1,569 kPa (14–16 kgf/cm^2, 199–228 psi) at 300 min^{-1} (rpm)	———
Spark plugs	Gap		0.7 – 0.8 (0.028 – 0.031)	———
Valves	Valve clearance	IN	0.24 – 0.28 (0.009 – 0.011)	———
		EX	0.28 – 0.32 (0.011 – 0.013)	———
	Stem O.D.	IN	5.485 – 5.495 (0.2159 – 0.2163)	5.455 (0.2148)
		EX	5.450 – 5.460 (0.2146 – 0.2150)	5.420 (0.2134)
	Guide I.D.	IN/EX	5.515 – 5.530 (0.2171 – 0.2177)	5.55 (0.219)
	Guide extrusion amount	IN	21.20 – 22.20 (0.835 – 0.874)	———
		EX	20.63 – 21.63 (0.812 – 0.852)	———
	Stem-to-guide clearance	IN	0.020 – 0.045 (0.0008 – 0.0018)	0.080 (0.0031)
		EX	0.055 – 0.080 (0.0022 – 0.0031)	0.120 (0.0047)
	Seat width	IN/EX	1.25 – 1.55 (0.049 – 0.061)	2.0 (0.08)
	Seat installation height	IN	46.75 – 47.55 (1.841 – 1.872)	47.80 (1.882)
		EX	46.68 – 47.48 (1.838 – 1.869)	47.73 (1.879)
	Spring free length	IN	53.66 (2.113)	———
		EX	55.58 (2.188)	———
Rocker arms	Rocker arm I.D.	IN	20.012 – 20.030 (0.7879 – 0.7886)	———
		EX	18.012 – 18.030 (0.7091 – 0.7098)	———
	Rocker arm shaft O.D.	IN	19.972 – 19.993 (0.7863 – 0.7871)	———
		EX	17.976 – 17.994 (0.7077 – 0.7084)	———
	Rocker arm-to-rocker arm shaft clearance	IN	0.019 – 0.058 (0.0007 – 0.0023)	0.08 (0.003)
		EX	0.018 – 0.054 (0.0007 – 0.0021)	0.08 (0.003)
Pistons	Skirt O.D.		85.97 – 85.98 (3.3846 – 3.3850)	85.96 (3.384)
	Piston-to-cylinder clearance		0.020 – 0.045 (0.0008 – 0.0018)	0.050 (0.0020)
	Pin bore I.D.		21.960 – 21.963 (0.8645 – 0.8647)	———
	Pin O.D.		21.961 – 21.965 (0.8646 – 0.8648)	———
	Pin-to-pin bore clearance		-0.005 – +0.002 (-0.0002 – +0.0001)	———
	Ring groove width	Top/Second	1.220 – 1.230 (0.0480 – 0.0484)	1.25 (0.049)
		Oil	2.805 – 2.825 (0.1104 – 0.1112)	2.85 (0.112)

Unit: mm (in)

Part	Item			Standard	Service limit
Piston rings	Ring side clearance		Top	0.035 – 0.060 (0.0014 – 0.0024)	0.13 (0.005)
			Second	0.030 – 0.055 (0.0012 – 0.0022)	0.13 (0.005)
	Ring end gap		Top	0.20 – 0.35 (0.008 – 0.014)	0.6 (0.024)
			Second	0.40 – 0.55 (0.016 – 0.022)	0.7 (0.028)
			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 (0.0462 – 0.0469)	———
Cylinder head	Warpage			———	0.05 (0.002)
	Camshaft journal I.D.		No.1–No.5	28.000 – 28.024 (1.1024 – 1.1033)	———
	Head height			99.95 – 100.05 (3.935 – 3.939)	———
Cylinder block	Cylinder sleeve I.D.			86.00 – 86.015 (3.3858 – 3.3864)	86.07 (3.389)
	Warpage			0.07 (0.003) Max	0.10 (0.004)
	Gap between upper and lower parts of sleeve I.D.			———	0.05 (0.002)
Connecting rods	Small end I.D.			21.970 – 21.976 (0.8650 – 0.8652)	———
	Small end-to-piston pin clearance			0.005 – 0.015 (0.0002 – 0.0006)	———
	Big end axial clearance			0.15 – 0.30 (0.006 – 0.012)	0.4 (0.016)
	Connecting rod big end oil clearance			0.026 – 0.044 (0.0010 – 0.0017)	———
Crankshaft	Journal O. D.	Main	No.1/No.2	54.980 – 55.004 (2.1646 – 2.1655)	———
			No.3	54.976 – 55.000 (2.1644 – 2.1654)	———
			No.4	54.980 – 55.004 (2.1646 – 2.1655)	———
			No.5	54.992 – 55.016 (2.1650 – 2.1660)	———
		Pin		44.976 – 45.000 (1.7707 – 1.7717)	———
	Journal roundness (Main/Pin)			0.005 (0.0002) Max	0.006 (0.0002)
	Shaft runout			0.030 (0.0012) Max	0.040 (0.0016)
	Crankshaft main bearing oil clearance		No.1/No.2/ No.4	0.027 – 0.045 (0.0011 – 0.0018)	0.050 (0.0020)
			No.3	0.031 – 0.049 (0.0012 – 0.0019)	0.055 (0.0022)
			No.5	0.017 – 0.035 (0.0007 – 0.0014)	0.040 (0.0016)
	Crankshaft axial clearance			0.10 – 0.35 (0.004 – 0.014)	0.45 (0.018)

Unit: mm (in)

Part	Item		Standard	Service limit
Camshaft	Camshaft axial clearance		0.05 – 0.15 (0.002 – 0.006)	0.5 (0.020)
	Shaft runout		0.03 (0.001) Max	0.04 (0.002)
	Journal O.D.	No.1–No.5	27.935 – 27.950 (1.0998 – 1.1004)	———
	Cam height	IN	38.274 – 38.359 (1.5068 – 1.5102)	———
		EX	37.651 – 37.756 (1.4823 – 1.4865)	———
	Shaft oil clearance	No.1–No.5	0.050 – 0.089 (0.0020 – 0.0035)	0.15 (0.006)
Balancer shaft	Journal O.D.	No.1 (EX side)	42.722 – 42.734 (1.6820 – 1.6824)	42.71 (1.681)
		No.1 (IN side)	20.938 – 20.950 (0.8243 – 0.8248)	20.92 (0.824)
		No.2	38.712 – 38.724 (1.5241 – 1.5246)	38.70 (1.524)
		No.3	34.722 – 34.734 (1.3670 – 1.3675)	34.71 (1.367)
	Journal roundness		0.005 (0.0002) Max	0.006 (0.0002)
	Shaft axial clearance	EX side	0.10 – 0.40 (0.004 – 0.016)	———
		IN side	0.04 – 0.15 (0.002 – 0.006)	———
	Shaft runout		0.02 (0.001) Max	0.03 (0.001)
	Journal oil clearance	No.1 (EX side)	0.066 – 0.098 (0.0026 – 0.0039)	0.12 (0.005)
		No.1 (IN side)	0.050 – 0.075 (0.0020 – 0.0030)	0.09 (0.004)
		No.2	0.076 – 0.108 (0.0030 – 0.0043)	0.13 (0.005)
		No.3	0.066 – 0.098 (0.0026 – 0.0039)	0.12 (0.005)
	Balancer shaft bearing I.D.	No.1 (EX side)	42.800 – 42.820 (1.6850 – 1.6858)	42.83 (1.686)
		No.1 (IN side)	21.000 – 21.013 (0.8268 – 0.8273)	21.02 (0.828)
		No.2	38.800 – 38.820 (1.5276 – 1.5283)	38.83 (1.529)
		No.3	34.800 – 34.820 (1.3701 – 1.3709)	34.83 (1.371)
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		0.10 – 0.18 (0.004 – 0.007)	0.20 (0.008)
	Outer rotor height		12.480 – 12.500 (0.4913 – 0.4921)	———
	Pump body depth		12.520 – 12.550 (0.4929 – 0.4941)	———
	Outer rotor-to-oil body side clearance		0.02 – 0.07 (0.001 – 0.003)	0.12 (0.005)
Fuel pump/ Fuel line	Discharge volume [with pump operated for 2 sec.]		45 m ℓ (1.5 US oz, 1.6 Imp oz) or more	———
	Fuel pressure [kPa (kgf/cm², psi)]		265 – 314 (2.7 – 3.2, 38 – 46)	———

Unit: mm (in)

Part	Item		Standard	Service limit
Vapor separator	Float height		29 – 34 (1.1 – 1.3)	———
Ignition coil	Resistance	Primary coil	0.60 – 0.72 Ω	———
		Secondary coil	25 – 38 kΩ	———
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 [N (kgf, lbf)] Measured between the pulleys with belt tension gauge.	Used belt	392 – 490 (40 – 50, 88 – 110)	———
		New belt	490 – 588 (50 – 60, 110 – 132)	———
	Belt deflection Measured with 98 N (10 kgf, 22 lbf) of force applied to the center of belt between the pulleys.	Used belt	7.7 – 9.0 (0.30 – 0.35)	———
		New belt	6.7 – 7.7 (0.26 – 0.30)	———
Starter motor	Brush length		12.3 (0.48)	7.0 (0.28)
	Insulation 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)
Pulser coil	Resistance		970 – 1,170 Ω	———

• FRAME

Unit: mm (in)

Part	Item		Standard	Service limit
Vertical shaft	Shaft O.D. (at needle bearing)		28.566 – 28.575 (1.1246 – 1.1250)	28.545 (1.1238)
Bevel gear	Gear I.D	Forward (LCD/XCD types only)	33.000 – 33.025 (1.2992 – 1.3002)	33.044 (1.3009)
Propeller shaft	Shaft O.D.	At needle bearing	30.007 – 30.020 (1.1814 – 1.1819)	29.990 (1.1807)
		At forward bevel gear (LD/XD types only)	24.987 – 25.000 (0.9837 – 0.9843)	24.966 (0.9829)
		At forward bevel gear (LCD/XCD types only)	32.904 – 32.920 (1.2954 – 1.2961)	32.883 (1.2946)
		At reverse bevel gear (LCD/XCD types only)	24.987 – 25.000 (0.9837 – 0.9843)	24.966 (0.9829)

6. TORQUE VALUES

Item	Thread Dia. (mm) and pitch (length)	Torque values		
		N•m	kgf•m	lbf•ft
• **Engine**				
Crankcase bolt (11 x 131 mm)	M11 x 1.5	51	5.2	38
(10 x 40 mm)	M10 x 12.5	47	4.8	35
(10 x 55 mm)	M10 x 1.25	39	4.0	29
Intake manifold nut	M10 x 1.25	39	4.0	29
12 mm bolt	M12 x 1.5	29	3.0	22
Oil filter	M22 x 1.5	21.6	2.2	16
Cylinder head bolt	M12 x 1.5 *1	44	4.5	33
Camshaft holder bolt	M8 x 1.25	22	2.2	16
Spark plug	M14 x 1.25	18	1.8	13
Connection rod bolt	M8 x 0.75 *2	20	2.0	14
Oil drain plug bolt	M12 x 1.5	23	2.3	17
Engine hanger bolt	M12 x 1.25	54	5.5	40
Timing belt adjusting spring bolt	M6 x 1.0	12	1.2	9
Crankshaft pulley bolt	M16 x 1.5	245	25.0	181
Balancer shaft thrust metal bolt	M6 x 1.0	20	2.0	14
Balancer belt driven pulley bolt	M8 x 1.25	29	3.0	22
Balancer driven gear bolt	M8 x 1.25	25	2.5	18
Balancer gear case Comp. bolt	M8 x 1.25	25	2.5	18
Balancer belt adjusting bracket bolt	M6 x 1.0	12	1.2	9
Timing belt adjusting bolt	M11 x 1.25	67	6.8	49
Tensioner adjusting nut	M10 x 1.25	44	4.5	33
Timing belt driven pulley bolt	M12 x 1.25	98	10.0	72
Valve adjusting lock nut	M7 x 0.75	20	2.0	14
Fuel pipe nut	M14 x 1.5	37	3.8	27
	M12 x 1.25	22	2.2	16
Fuel hose bolt	M12 x 1.25	33	3.4	25
Fuel pressure check nut	M12 x 1.25	22	2.2	16
Service check bolt	M6 x 1.0	12	1.2	9
Throttle body bolt, nut	M8 x 1.25	26	2.7	20
Engine mount bolt	M10 x 1.25	39	4.0	29
Flywheel bolt	M12 x 1.0	118	12.0	87
Flywheel boss bolt	M8 x 1.25	32	3.3	24
Alternator bracket bolt	M10 x 1.25	39	4.0	29
Alternator assembly bolt	M10 x 1.25	44	4.5	33
nut	M8 x 1.25	24	2.4	17
ECM bolt	M6 x 1.0	5	0.5	3.6
Oil pressure switch	PT 1/8	9	0.9	6.5
IAT sensor	M12 x 1.5	18	1.8	13
ECT sensor	M12 x 1.5	18	1.8	13
18 mm sealing bolt	M18 x 1.25	39	4.0	29
Oil pump cover screw	M6 x 1.0	7	0.7	5.1
30 mm sealing bolt	M30 x 1.5	78	8.0	58

*1: Tighten the cylinder head bolts to 44 N•m (4.5 kgf•m, 33 lbf•ft) first, then tighten them an additional 180° (Snag torque [Angle method]).

*2: Tighten the connection rod bolts to 20 N•m (2.0 kgf•m, 14 lbf•ft) first, then tighten them an additional 90° (Snag torque [Angle method]).

Item	Thread Dia. (mm) and pitch (length)	Torque values		
		N•m	kgf•m	lbf•ft
• GEAR CASE				
18 mm castle nut *1	M18 x 1.5	1	0.1	0.7
Propeller shaft holder bolt	M10 x 12.5	34	3.5	25
Gear case bolt	M10 x 1.25	34	3.5	25
nut (XD and XCD types only)	M10 x 1.25	34	3.5	25
Extension separator stud bolt (XD and XCD types only)	M10 x 1.25	15	1.5	11
Oil drain bolt	M8 x 1.25	3.4	0.35	2.5
Oil level bolt	M8 x 1.25	3.4	0.35	2.5
Wash bolt	M8 x 1.25	3.4	0.35	2.5
Trim tab bolt	M8 x 1.25	22	2.2	16
Anode metal nut	M6 x 1.0	9.8	1.0	7
64 mm lock nut	M64 x 1.5	123	12.5	90
Pinion gear nut	M16 x 1.5	132	13.5	98
Impeller housing bolt	M8 x 1.25	19.7	2.0	14
Water screen screw	M5 x 0.8	1	0.1	0.7
Bearing holder	M90 x 2.0	103	10.5	76
• EXTENSION/MOUNT				
Lower rubber motor mount nut	M12 x 1.25	83	8.5	61
Lower rubber motor mount housing bolt	M8 x 1.25	22	2.2	16
Extension case bolt	M10 x 1.25	34	3.5	25
Undercover screw	M6 x 1.0	4.5	0.45	3.3
	M5 x 0.5	3	0.3	2.2
Upper rubber mount nut	M12 x 1.25	83	8.5	61
Oil drain plug cover screw	M6 x 1.0	6.4	0.65	4.7
• STERN BRACKET				
Stern bracket nut	M25 x 2.0	34	3.5	25
	7/8 – 14 UNC	34	3.5	25
	M10 x 1.25	34	3.5	25
• POWER TRIM/TILT ASSEMBLY				
Cylinder cap	———	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	———	8.3	0.85	6.1
Power tilt motor assembly bolt	1/4 – 20 UNC	5	0.5	3.6
Oil tank bolt	———	5	0.5	3.6
Oil tank cap	———	2.5	0.25	1.8

*1: If the split pin cannot be set by tightening the 18 mm castle nut to the specified torque, tighten the castle nut additionally 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 lgf•ft)

Item	Thread Dia. (mm) and pitch (length)	Torque values		
		N•m	kgf•m	lbf•ft
• **FRAME/ELECTRICAL**				
Separate top cover bolt	M6 x 1.0 (Flange)	12	1.2	9
	(Hex.)	10	1.0	7
Steering rod bolt/nut	3/8 – 24 UNF	22	2.2	16
Starter motor bolt	M10 x 1.25	39	4.0	29
Starter solenoid switch screw	M6 x 1.0	6	0.6	4.3
nut	M8 x 1.25	10.8	1.1	8
Alternator pulley nut	M14 x 1.0	110	11.2	81
Starter motor terminal nut	M8 x 1.25	10.8	1.1	8
Starter magnetic switch terminal nut	M6 x 1.0	4.9	0.5	3.6
Alternator terminal nut	M6 x 1.0	7.9	0.8	5.8
Ignition switch nut	M22 x 1.0	4.8	0.49	3.5
Emergency stop switch nut	M16 x 1.0	1.5	0.15	1.1
Neutral switch nut	M20 x 1.0	2.5	0.25	1.8
Grease fitting	M6 x 1.0	3	0.3	2.2

• Use standard torque values for fasteners that are not listed in this table.

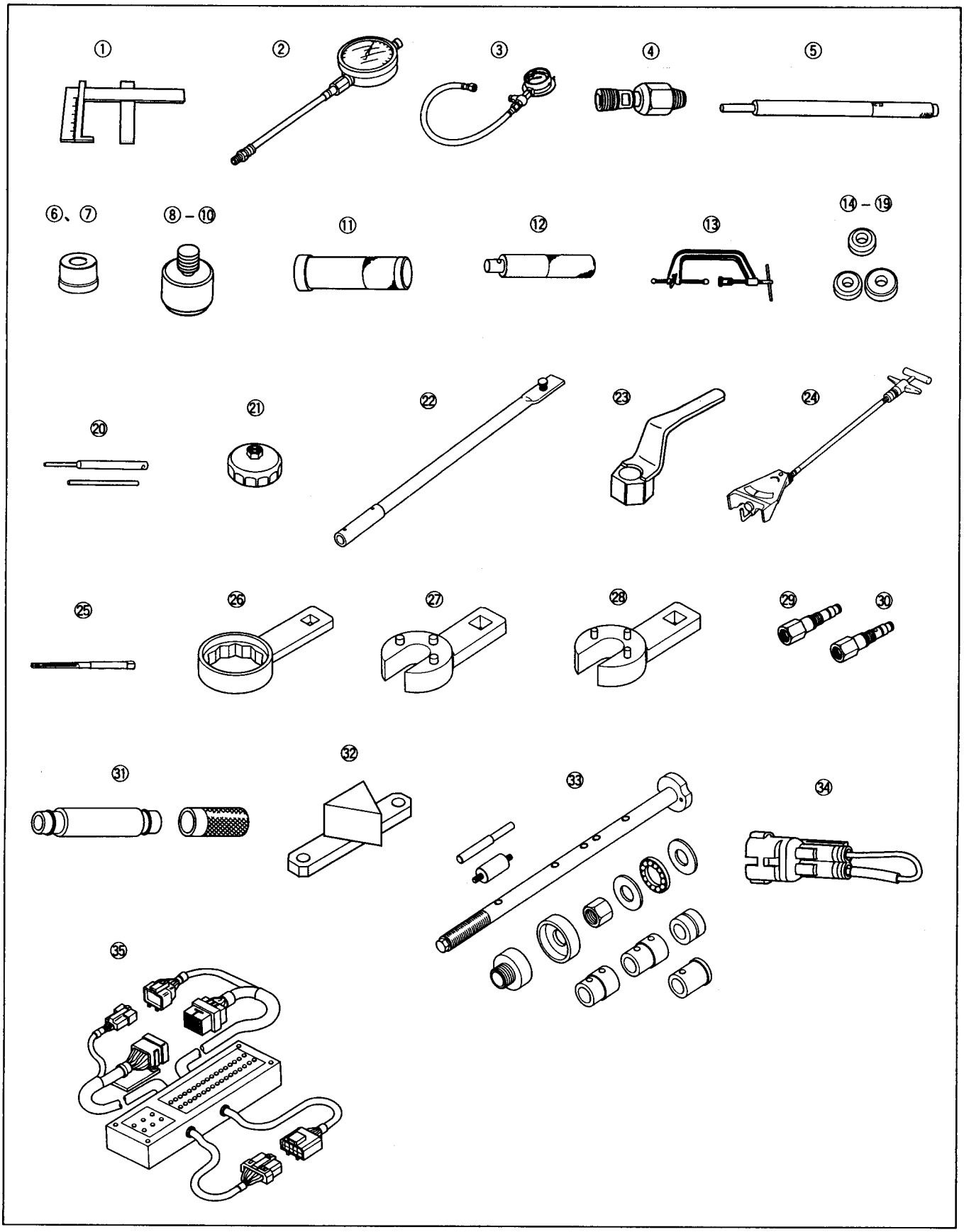
STANDARD TORQUE VALUES

Item	Thread Dia. (mm) and pitch (length)	Torque values		
		N•m	kgf•m	lbf•ft
Bolt and nut	5 mm	5.2	0.52	3.8
	6 mm	10	1.0	7
	8 mm	21.5	2.15	15.6
	10 mm	34	3.5	25
	12 mm	54	5.5	40
Flange bolt and nut	6 mm (SH Flange bolt)	9	0.9	6.5
	6 mm	12	1.2	9
	8 mm	26	2.7	20
	10 mm	39	4.0	29
Screw	5 mm	4.2	0.42	3.0
	6 mm	9	0.9	6.5

7. SPECIAL TOOLS

• Special tool applicable to the parts except gear case

	Tool name	Tool number	Application
1	Float level gauge	07401-0010000	Vapor separator float level inspection
2	Fuel pressure gauge set	07406-0040002	Fuel pressure inspection
3	Oil pressure gauge set	07506-3000000	┐ Oil pressure test
4	Oil pressure gauge attachment	07404-0030000	┘
5	Valve guide driver, 5.5 mm	07742-0010100	Valve guide removal/installation
6	Attachment, 32 x 35 mm	07746-0010100	22 x 35 x 7 mm water seal installation, lower mount center housing removal/installation
7	Attachment, 24 x 26 mm	07746-0010700	14 x 26 x 6 mm water seal installation
8	Pilot, 12 mm	07746-0040200	14 x 26 x 6 mm water seal installation
9	Pilot, 30 mm	07746-0040700	Lower mount center housing removal/installation
10	Pilot, 22 mm	07746-0041000	22 x 35 x 7 mm water seal installation
11	Driver, 40 mm I.D.	07746-0030100	Lower mount center housing installation
12	Driver	07749-0010000	Driver for 6, 7 ,8, 9 and 10
13	Valve spring compressor	07757-0010000	Valve cotter removal/installation
14	Valve seat cutter, 45° 35 mm	07780-0010400	Valve seat reconditioning (IN)
15	Valve seat cutter, 45° 33 mm	07780-0010800	Valve seat reconditioning (EX)
16	Valve seat cutter, 32° 35 mm	07780-0012300	Valve seat reconditioning (IN)
17	Valve seat cutter, 32° 33 mm	07780-0012900	Valve seat reconditioning (EX)
18	Valve seat cutter, 60° 37 mm	07780-0014100	Valve seat reconditioning (IN)
19	Valve seat cutter, 60° 30 mm	07780-0014000	Valve seat reconditioning (EX)
20	Cutter holder, 5.5 mm	07781-0010101	Valve seat reconditioning (IN/EX)
21	Oil filter wrench	07912-6110001	Oil filter removal/installation
22	Holder handle	07JAB-001020B	┐ Crankshaft pulley bolt (16 x 49 mm bolt-washer)
23	Holder attachment, 50 mm, offset	07MAB-PY30100	┘ removal/installation
24	Belt tension gauge	07JGG-0010101	Alternator belt tension inspection
25	Valve guide reamer, 5.525 mm	07HAH-PJ70100	Valve guide reaming
26	Lock nut wrench, 56 mm	07LPA-ZV30200	Timing belt driven pulley bolt removal/installation
27	ø6 pin type wrench	07SPA-ZW10100	Piston rod comp. removal/installation
28	ø4 pin type wrench	07SPA-ZW10200	Rod guide comp. removal/installation
29	Oil pressure gauge joint A	07SPJ-ZW10100	┐ Power trim/tilt assembly blow pressure inspection
30	Oil pressure gauge joint B	07SPJ-ZW10200	┘
31	Stem seal driver	07PAD-0010000	Valve stem seal A/B installation
32	Ring gear holder	07WPB-ZW50100	Flywheel boss removal/installation, flywheel removal/installation
33	Balancer bearing replacement tool	07WPF-ZW50100	Balancer bearing removal/installation
34	SCS short connector	07WPZ-0010100	ECM troubleshooting, idling adjustment
35	Test harness	07WPZ-ZW50100	ECM troubleshooting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• Special tool applicable to all types of gear case

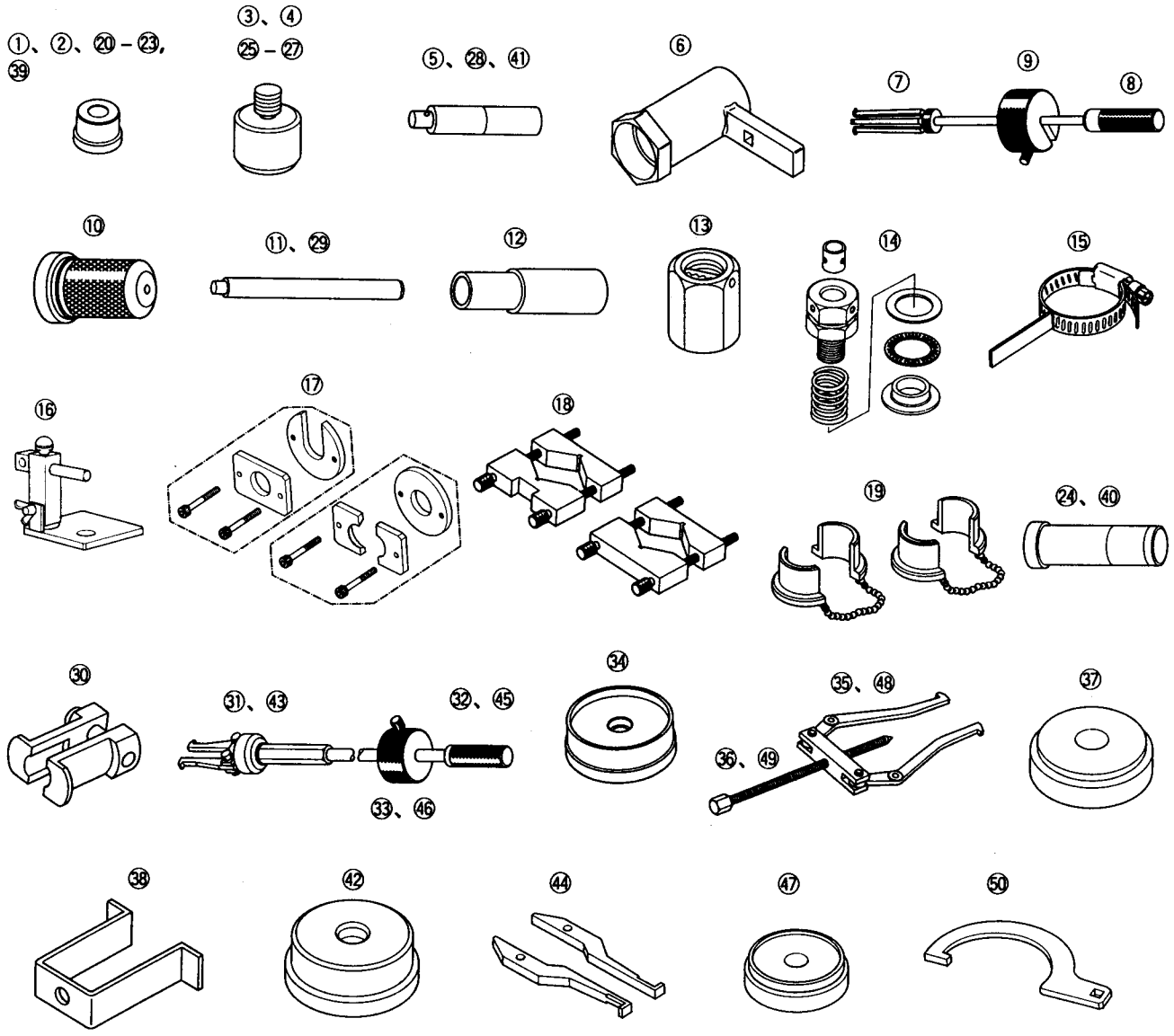
	Tool name	Tool number	Application
1	Attachment, 32 x 35 mm	07746-0010100	23 x 36 x 6 mm water seal installation, 1–1/8 x 1–1/2 x 1–1/4 needle bearing removal/installation
2	Attachment, 37 x 40 mm	07746-0010200	30 x 37 x 26 mm needle bearing installation
3	Pilot, 30 mm	07746-0040700	30 x 37 x 26 mm needle bearing installation
4	Pilot, 28 mm	07746-0041100	1–1/8 x 1–1/2 x 1–1/4 needle bearing removal/installation
5	Driver	07749-0010000	Driver for 1, 2 and 3
6	Lock nut wrench, 64 mm	07916-MB00002	64 mm lock nut removal/installation
7	Bearing remover, 30 mm	07936-8890300	┐
8	Remover handle	07936-3710100	├ 30 x 37 x 26 mm needle bearing removal
9	Remover weight	07741-0010201	┘
10	Oil seal driver	07947-SB00100	30 x 45 x 7 mm water seal installation
11	Driver	07949-3710001	1–1/8 x 1–1/2 x 1–1/4 needle bearing removal/installation
12	Drive shaft B	07964-MB00200	30 x 62 x 21.25 taper roller bearing (inner race) installation
13	Vertical shaft holder	07SPB-ZW10200	Vertical shaft pinion gear nut removal/installation
14	Bearing preload tool	07SPJ-ZW0010Z	Forward/reverse bevel gear backlash inspection
15	Backlash indicator tool	07SPJ-ZW0030Z	Forward/reverse bevel gear backlash inspection
16	Dial indicator adapter kit	07SPJ-ZW0040Z	Forward/reverse bevel gear backlash inspection
17	Gauge adapter, 80 mm	07WPJ-ZW50100 or	Vertical shaft pinion gear shim adjustment
18	Vertical shaft gauge	07TPJ-ZW10100	
19	Vertical shaft indicator attachment	07WPK-ZW50100	Forward/reverse bevel gear backlash inspection (LD and LCD types only)

• Special tool applicable to LD and XD types of gear case

	Tool name	Tool number	Application
20	Attachment, 37 x 40 mm	07746-0010200	Reverse bevel gear/6208 radial ball bearing removal
21	Attachment, 42 x 47 mm	07746-0010300	50 x 82 x 21.5 taper bearing (inner race) removal
22	Attachment, 52 x 55 mm	07746-0010400	50 x 82 x 21.5 taper bearing (outer race) installation
23	Attachment, 24 x 26 mm	07746-0010700	Reverse bevel gear/6208 radial ball bearing removal
24	Driver, 40 mm I.D.	07746-0030100	Reverse bevel gear/6208 radial ball bearing installation
25	Pilot, 17 mm	07746-0040400	Reverse bevel gear/6208 radial ball bearing removal
26	Pilot, 25 mm	07746-0040600	50 x 82 x 21.5 taper bearing (outer race) installation
27	Pilot, 30 mm	07746-0040700	Reverse bevel gear/6208 radial ball bearing removal
28	Driver	07749-0010000	Driver for 20, 21, 23, 25, 27 and 34
29	Driver	07949-3710001	50 x 82 x 21.5 taper bearing (outer race) installation
30	Bearing remover	07HMC-MR70100	Reverse bevel gear/6208 radial ball bearing removal
31	Bearing race puller	07LPC-ZV30100	┐
32	Remover handle	07936-3710100	├ 50 x 82 x 21.5 taper bearing (outer race) removal
33	Remover weight	07741-0010201	┘
34	Bearing driver	07NAD-P200100	50 x 82 x 21.5 taper bearing (inner race) installation
35	Puller jaws	07SPC-ZW0010Z	Forward bevel gear backlash inspection
36	Puller bolt	07SPC-ZW0011Z	Forward bevel gear backlash inspection
37	Mandrel	07SPD-ZW0010Z	50 x 82 x 21.5 taper bearing (outer race) installation
38	Propeller shaft holder	07TPB-ZW10100	Reverse bevel gear backlash inspection

• Special tool applicable to LCD and XCD types of gear case

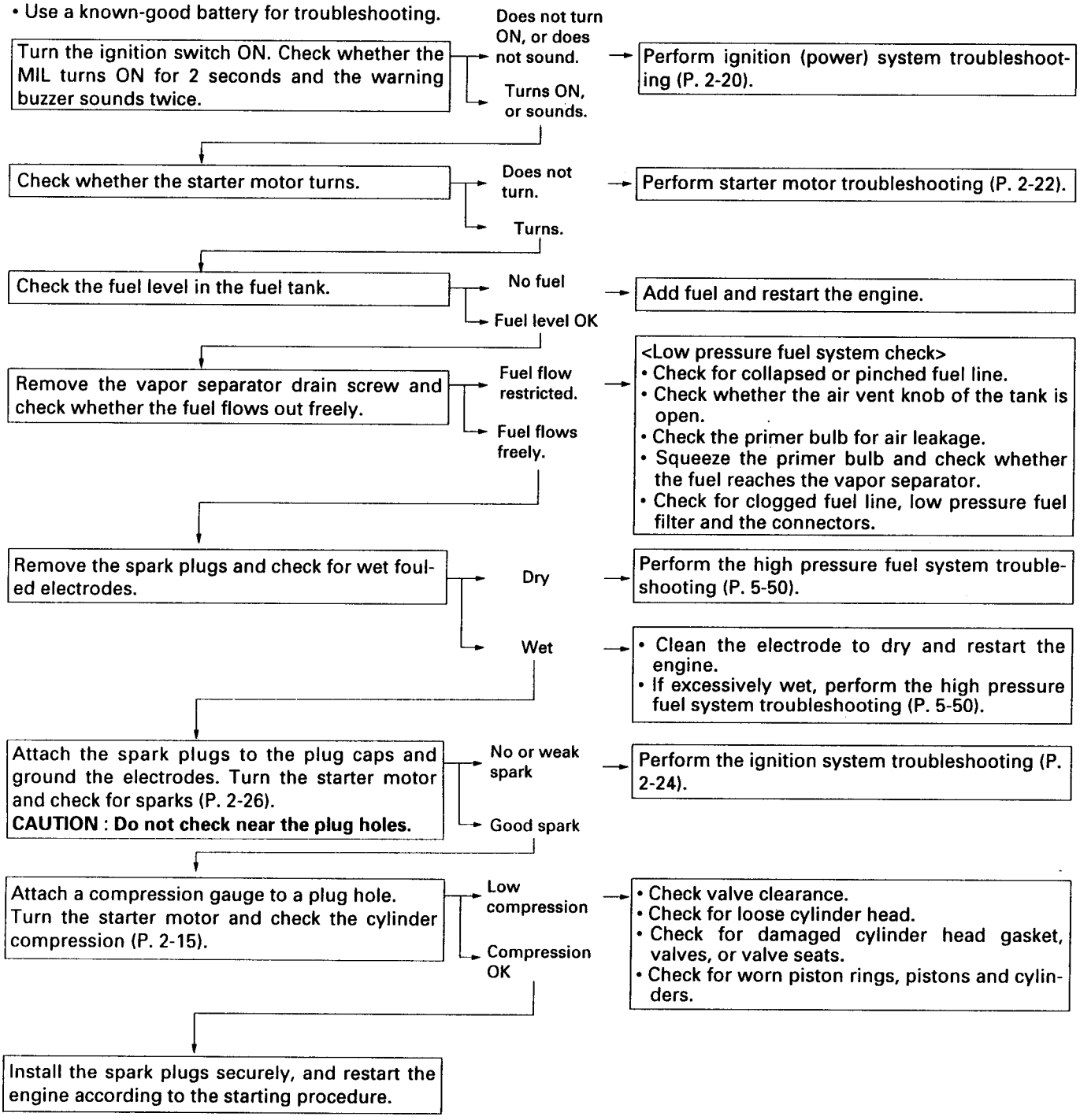
	Tool name	Tool number	Application
39	Attachment, 42 x 47 mm	07746-0010300	Forward bevel gear removal
40	Driver, 40 mm I.D.	07746-0030100	40 x 82 x 18 radial ball bearing installation
41	Driver	07749-0010000	Driver for 39, 42 and 47
42	Attachment, 78 x 90 mm	07GAD-SD40100	50 x 82 x 21.5 taper bearing (outer race) installation
43	Bearing race puller	07LPC-ZV30100	Reverse bevel gear/40 x 82 x 18 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.]
44	Puller jaws, 25 mm	07WPC-ZW50100	
45	Remover handle	07936-3710100	
46	Remover weight	07741-0010201	
47	Attachment, 78 x 80 mm	07NAD-PX40100	50 x 82 x 21.5 taper bearing (outer race) installation
48	Puller jaws	07SPC-ZW0010Z	Forward/reverse bevel gear backlash inspection
49	Puller bolt	07SPC-ZW0011Z	Forward/reverse bevel gear backlash inspection
50	Pin type wrench, 103 mm	07WPA-ZW50100	Bearing holder assembly removal/installation



8. TROUBLESHOOTING

• ENGINE

a. HARD STARTING



***: When the gasoline overflow is detected, check the vapor separator (P. 5-64).**