1. SPECIFICATIONS

• DIMENSIONS AND WEIGHTS

Unit: mm (in)

Item \ Model / Description code	EM6000GN EZGM
Overall length	830 (32.7)
Overall width	510 (20.1) *655 (25.8)
Overall height	490 (19.3) *565 (22.2)
Dry weight	79.0 kg (174.2 lbs) *84.5 kg (186.3 lbs)
Operating weight	93.0 kg (205.0 lbs) *98.5 kg (217.2 lbs)

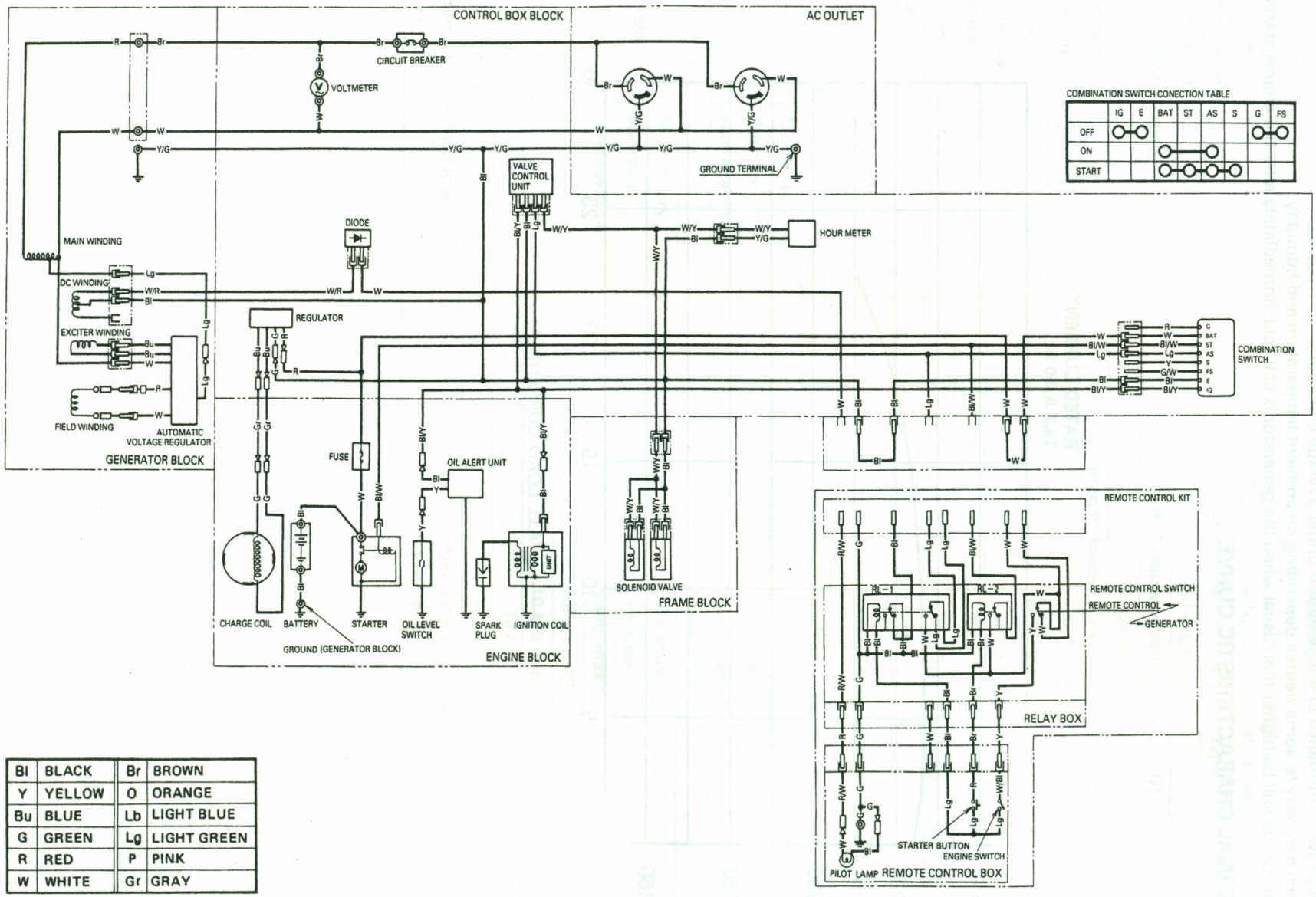
*With 4 wheels kit.

• ENGINE

Type		GX390 K1: 4-stroke, overhead valve single cylinder, inclined by 25°
Total displacement		389 cm^3 (23.7 cu in)
Bore x Stroke		88 x 64 mm (3.5 x 2.5 in)
Maximum horsepower		6.3 kW (8.5 PS) at 3,600 min^{-1} (rpm)
Maximum torque		
Compression ratio		8.0 : 1
Fuel consumption		0.42 Nm^3/kWh (0.31 Nm^3/PSh)
Cooling system		Forced air
Ignition system		Transistorized magneto ignition
Ignition timing		30° B.T.D.C. (Fixed)
Spark plug		BPR6ES (NGK)
Carburetor		Horizontal type, butterfly valve
Air cleaner		Semi-dry type
Governor		Centrifugal
Lubricating system		Splash type
Oil capacity		1.1 ℓ (1.16 US qt, 0.97 Imp qt)
Starting system		Electric starter
Stopping system		Primary circuit ground
Recommended fuel		Natural gas (8,800 ± 200 kcal/Nm^3)
Supply pressure		200 ± 50 mm H_2O (8 ± 2 inch W.C.)
Recommended gas hose	Inside diameter	13 mm (0.5 in)
	Length	6 m (19.7 ft) or below
Recommended oil		SAE 10W – 30 SG minimum
P.T.O rotational direction		Counterclockwise (viewed from the generator)

• GENERATOR

Item \ Model / Type		EM6000GN R
Generator type		2-pole, revolving magnetic field type
Generator structure		Self-ventilation, drip-proof type
Excitation method		Self-excitation
Voltage regulation system		AVR (Automatic Voltage Regulator)
Phase		Single phase
Rotating direction		Counterclockwise (Viewed from the generator)
Maximum output		4,500 VA
Rated output		4,000 VA
Rated frequency		50 Hz
Rated voltage		220 V
Rated current		18.2 A
DC output		———
DC voltage		———
DC current		———
Power factor (Cos ø)		1.0
Voltage variation rate	Momentary	15% max.
	Average	7% max.
	Average time	3 sec. max.
Voltage stability		Within ± 1%
Frequency variation rate	Momentary	15% max.
	Average	7% max.
	Average time	5 sec. max.
Frequency stability		Within ± 1%
Insulation resistance		10 MΩ min.
Circuit breaker		19.0 A
DC circuit protector		———
Fuel consumption (at rated load)		0.42 Nm^3/kWh (0.31 Nm^3/PSh)
Noise level		72 dB (A) at 7 m (23 ft)



COMBINATION SWITCH CONECTION TABLE

	IG	E	BAT	ST	AS	S	G	FS
OFF	○	○					○	○
ON			○		○			
START			○	○	○	○		

Bl	BLACK	Br	BROWN
Y	YELLOW	O	ORANGE
Bu	BLUE	Lb	LIGHT BLUE
G	GREEN	Lg	LIGHT GREEN
R	RED	P	PINK
W	WHITE	Gr	GRAY

2. SERVICE INFORMATION

1. GENERAL SAFETY

Pay attention to these symbols and their meanings:

⚠WARNING **Indicates a strong possibility of severe personal injury or death if instructions are not followed.**

CAUTION: Indicates a possibility of personal injury or equipment damage if instructions are not followed.

⚠WARNING

- **Stop the engine, and remove the spark plug cap and ignition key before servicing.**
- **If the engine must be running to do some work, make sure the area is well ventilated. Never run the engine in a closed area; the exhaust contains poisonous carbon monoxide gas.**
- **Natural gas is extremely flammable and is explosive under certain conditions. Check for leaks regularly by using detergent solution or trace by smell.**
  Do not smoke or allow flames or sparks in your working area.

CAUTION:

- **Keep away from rotating or hot parts and high voltage wires when the engine is running.**
- **Take care not to drop the bolts, etc. fall between the flywheel and cylinder barrel. Do not bend the governor link.**

2. MAINTENANCE STANDARDS

Part	Item	Standard	Service limit
Main winding	Resistance	0.8 – 1.0 Ω	———
Field winding	Resistance	55 – 65 Ω	———
Exciter winding	Resistance	1.0 – 1.2 Ω	———
Carbon brush	Brush length	9 mm (0.4 in)	5 mm (0.2 in)

3. TROUBLESHOOTING

a. ENGINE

• Use a fully charged 12 V battery.

Engine does not start or hard starting.

→ Check whether the gas is turned on at the main.

Turned off. → Turn the gas on at the main.

Turned on.

↓ Check the oil level.

Low → Fill with oil [P. 3-1 of base shop manual (62ZP000)].

Normal

↓ See OIL ALERT SYSTEM troubleshooting (P. 2-5).

↓ Check whether the gas is being supplied properly. Or, install a pressure gauge and check whether the gas pressure is 200 ± 50 mm H_2O (8 ± 2 inch W.C.) with the engine off. (*1)

Abnormal → Gas is not being supplied properly. Or, adjust the regulator on the supply side gas pipe. (*1)

Normal

↓ Check whether the correct gas is used. (*1)

Abnormal → Use the correct gas. (*1)

Normal

↓ Check for air in the hose or supply side pipe.
• Connect the hose to a gas appliance such as a stove and check ignition. (*1)

Abnormal → Purge air from the hose or supply side pipe. (*1)

Normal

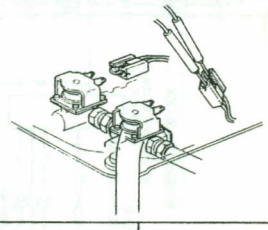
↓ Check the hose for disconnection, cracks and deterioration.

Abnormal → Replace the hose. (*1)

Normal

↓ Turn the combination switch ON and check the voltage between the terminals of the solenoid valve A/B. There must be 12 V between the terminals.
NOTE:

Note that the continuity is shut off in 4 seconds when the combination switch is turned ON without starting the engine. Be sure to check the voltage within 4 seconds after turning the combination switch ON.



Abnormal → Check the valve control unit (P. 6-2).

Abnormal → Replace: P. 6-1

Normal

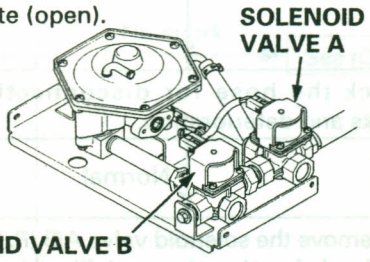
↓ Normal

Go to page 2-3

(*1): Have an authorized Honda gas Generator check and adjust the system/appliance.

From page 2-2

1. Remove the solenoid valve A/B (P. 5-2).
2. Connect the solenoid valve connectors from the solenoid valve A/B.
3. Turn the combination switch OFF. Turn the combination switch ON again and check whether the valves operate (open).



Abnormal → Replace: P. 5-2

Normal

Check whether the main jet is set in place securely.

Abnormal → Tighten the main jet (P. 5-8).

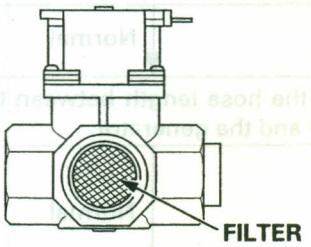
Normal

Check for the clogged main jet.

Clogged → Clean the main jet (P. 5-8).

Not clogged

1. Remove the solenoid valve A/B (P. 5-2).
2. Check for the clogged filter in the solenoid valve A/B.



Abnormal → Clean the filter and install the solenoid valve A/B securely (P. 5-3).

Normal

Replace the low pressure regulator assembly (P. 5-2).

Engine hunts.

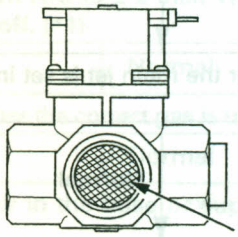
→ Check the gas pressure with the engine running at the rated load (at 4 kW). It must be 200 ± 50 mm H_2O (8 ± 2 inch W.C.). (*1)

- Abnormal → There can be pulsation or sharp drop in gas pressure because the gas pipe is connected to the other gas appliances as well as this generator. Use the thicker gas pipe or install the larger regulator for the generator. (*1)
- Normal ↓

Check the hose for disconnection, cracks and deterioration.

- Abnormal → Replace the hose. (*1)
- Normal ↓

1. Remove the solenoid valve A/B (P. 5-2).
2. Check for the clogged filter in the solenoid valve A/B.



- Abnormal → Clean the filter and install the solenoid valve A/B securely (P. 5-3).

No or light load

→ Check whether the excessive load is taken off from the generator at a time.

- Excessive load → Reduce the load.
- Normal ↓

Check the wire cable diameter and check the cable for loose connection.

- Abnormal → Replace the cable, or connect the cable securely.
- Normal ↓

Check the hose length between the gas supply and the generator.

- Too long → When the hose of 13 mm (0.5 in) in inside diameter is adopted, the length must be 6 m (19.7 ft) or below.
- Normal ↓

Check to see whether the gas hose is the hose that comes with the generator or the recommended hose. (*1)

- Abnormal → Change to the recommended hose that is 13 mm (0.5 in) in inside diameter.
- Normal ↓

Install the pressure gauge and check the gas pressure. It must be 200 ± 50 mm H_2O (8 ± 2 inch W.C.). (*1)

- Abnormal → Use the larger diameter gas pipe for the supply side, or install the large regulator. (*1)

(*1): Have an authorized Honda gas Generator check and adjust the system/appliance.

b. OIL ALERT SYSTEM

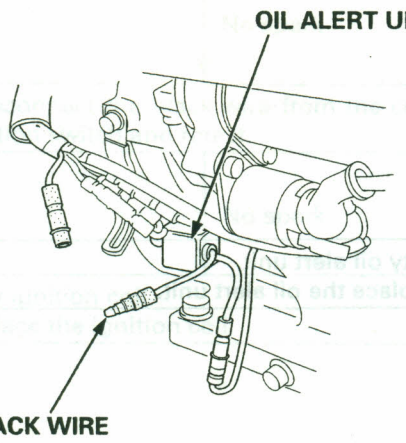
NOTE:

Never start the engine when the oil has been drained.

• Engine does not start with combination switch ON.

• Check oil level before proceeding. Add the recommended engine oil if necessary.

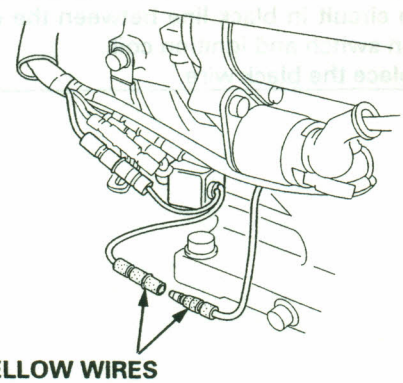
1. Disconnect the black wire of the oil alert unit. Perform spark test [P. 2-9 of base shop manual (62ZP000)].



No spark → See IGNITION SYSTEM troubleshooting (P. 2-7).

Sparks ↓

2. Reconnect the black wire and disconnect the yellow wire of the oil level switch. Perform spark test [P. 2-9 of base shop manual (62ZP000)].



Sparks → Faulty oil level switch.
• Replace the oil level switch [P. 12-1 of base shop manual (62ZP000)].

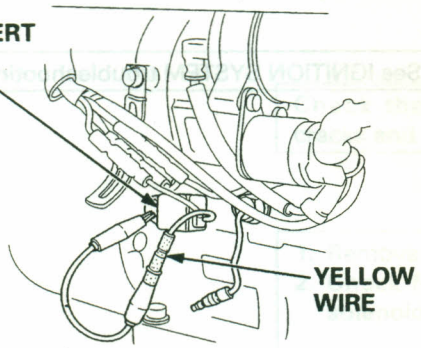
No spark ↓

Faulty oil alert unit.
• Replace the oil alert unit.

• Engine does not stop when the engine oil is insufficient.

• Before proceeding, drain the engine oil.

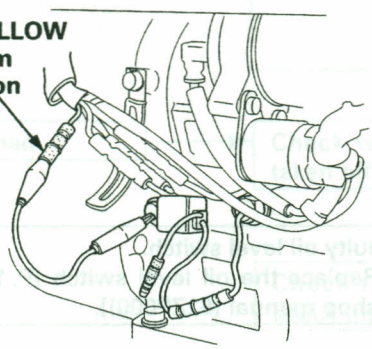
1. Connect the yellow wire of the oil alert unit side to the engine ground.
   Perform spark test [P.2-9 of base shop manual (62ZP000)].



No spark → Faulty oil level switch.
• Replace the oil level switch [P.12-1 of base shop manual (62ZP000)].

Sparks ↓

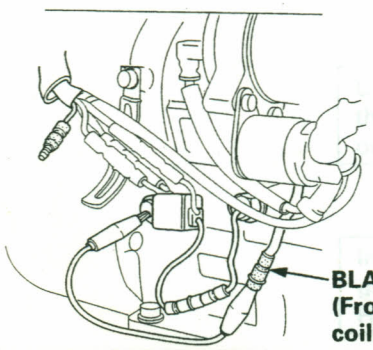
2. Connect the black/yellow wire of the combination switch to the engine ground.
   Perform spark test [P.2-9 of base shop manual (62ZP000)].



No spark → Faulty oil alert unit.
• Replace the oil alert unit.

Sparks ↓

3. Connect the black wire of the ignition coil to the engine ground.
   Perform spark test [P.2-9 of base shop manual (62ZP000)].



Sparks → Open circuit in black line between the combination switch and ignition coil.
• Replace the black wire.

No spark ↓

See IGNITION SYSTEM troubleshooting (P.2-7).

c. IGNITION SYSTEM

• Engine does not start with combination switch ON.

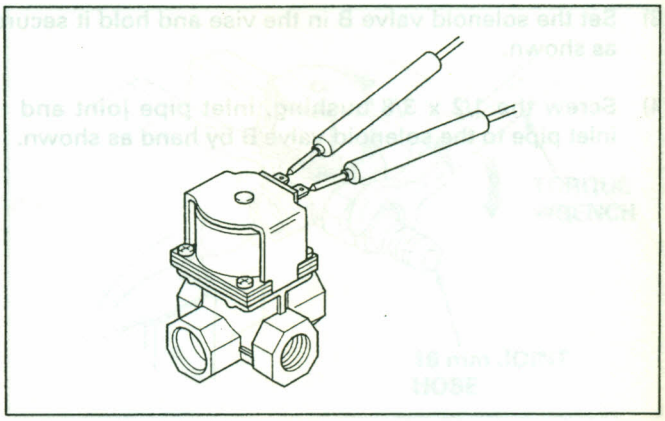
1. Perform spark test [P.2-9 of base shop manual (62ZP000)].
   - No spark → 2. Check again after replacing with a new spark plug.
     - Sparks → Faulty spark plug.
       • Replace the spark plug.
     - No spark → 3. Disconnect the black wire from the combination switch and retest.
       - Sparks → Faulty combination switch.
         • Replace the combination switch (P.6-1).
         Faulty oil alert system.
         • See OIL ALERT SYSTEM troubleshooting (P.2-5).
       - No spark → Faulty ignition coil.
         • Replace the ignition coil.

c. INSPECTION

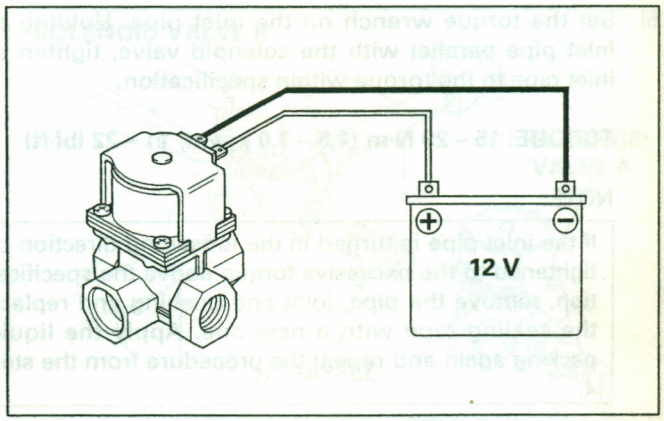
• SOLENOID VALVE

1) Using an ohmmeter, measure the resistance between the terminals.

Resistance	26.1 – 31.9 Ω



2) Connect the 12 V battery to the solenoid valve terminals and be sure that the valve operates.



d. REASSEMBLY

1) Remove the sealing tape or liquid packing thoroughly from the threaded parts of the pipe, joint, bushing, nipple and the valve.

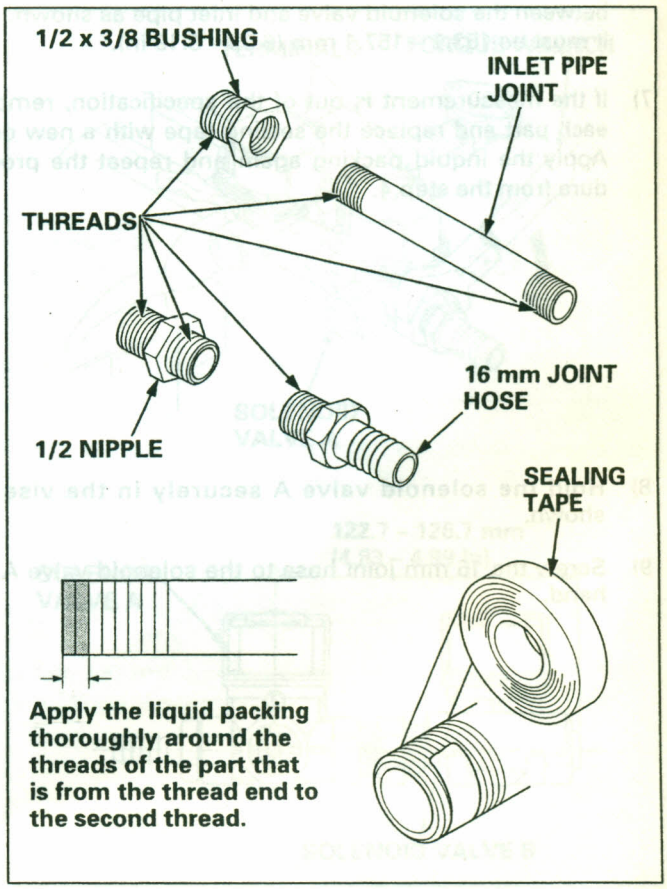
CAUTION:

Check inside of each part for the sealing tape or liquid packing. Remove even small pieces of the sealing tape or liquid packing if they remain inside the parts.

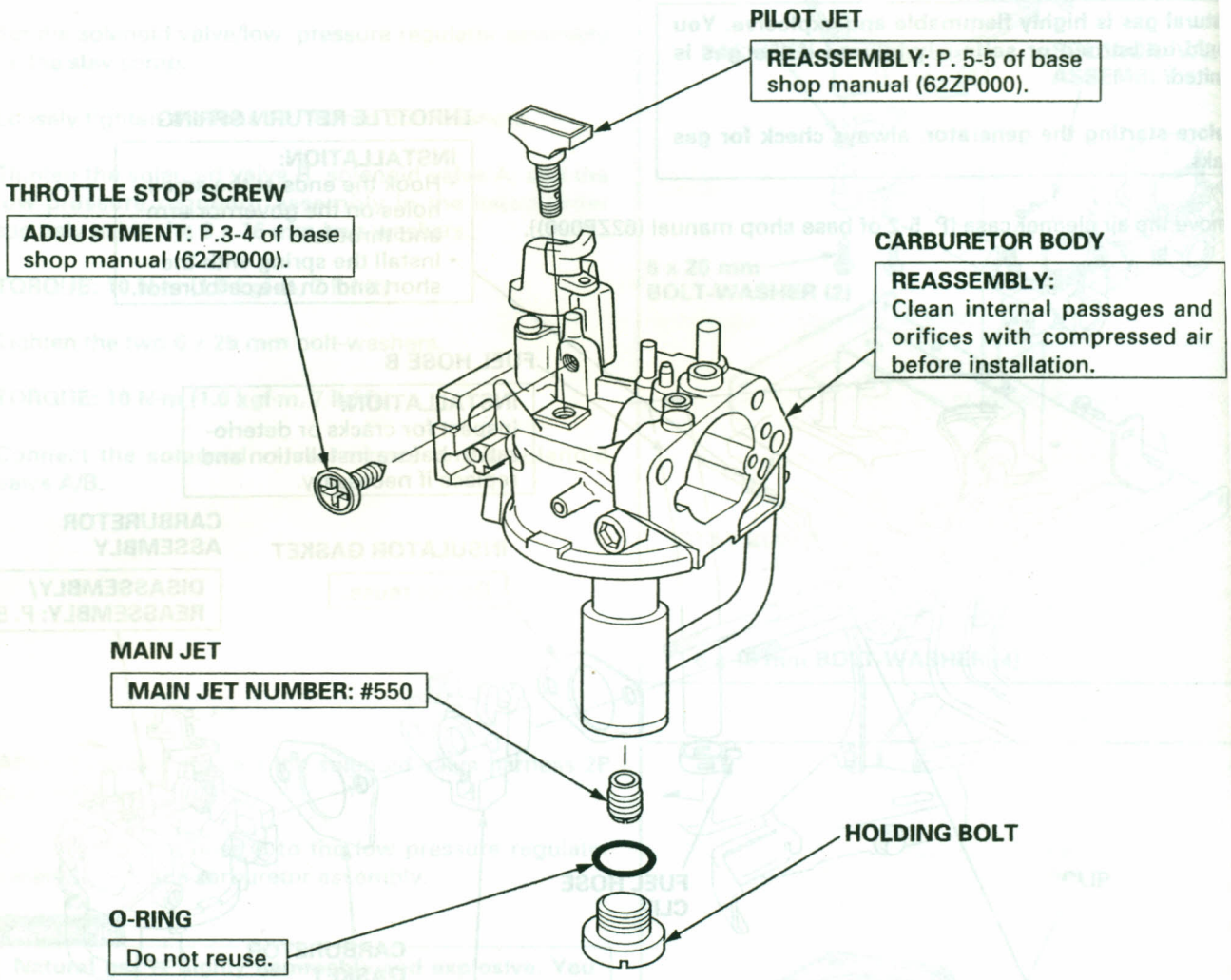
2) Wind the sealing tape 1-1/2 turns around the threaded parts of the joints, bushing and the nipple, and apply the liquid packing (HERME SEAL G-2 or equivalent) to the threads.

NOTE:

- Do not attach the sealing tape to the very end of the threaded part but leave one or two threads from the end untaped. Wind the tape 1-1/2 turns around the threads.
- Apply the liquid packing (HERME SEAL G-2 or equivalent) thoroughly around the threads of the part that is from the thread end to the second thread.



b. CARBURETOR DISASSEMBLY/REASSEMBLY

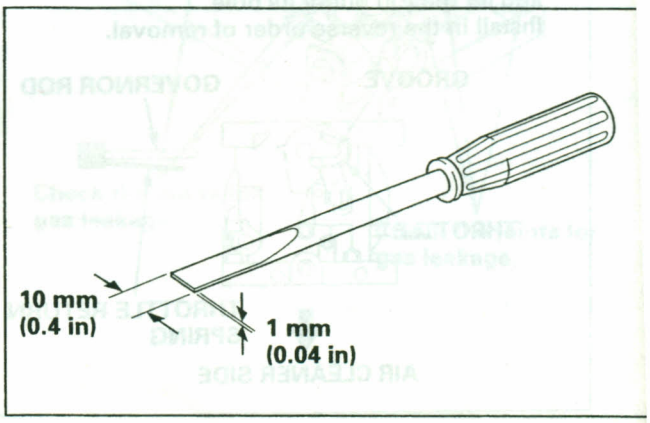


• MAIN JET

REMOVAL/INSTALLATION:

Main jet installation/removal should be made using the tool shown.

Clean the main jet thoroughly with compressed air before installation.



2. INSPECTION

• VALVE CONTROL UNIT

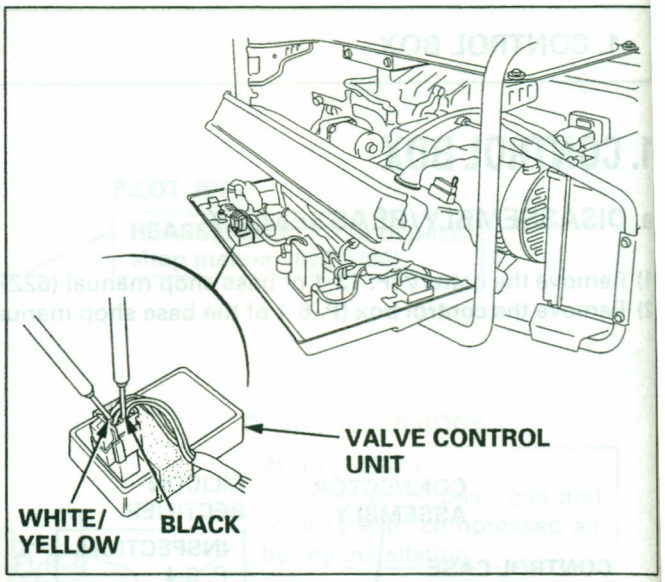
1) Remove the control box, but do not disconnect the harnesses that come from the control box this time. Open the control box.

2) Attach one tester lead to the white/yellow terminal and the other lead to the black terminal of the control unit 4P connector.

3) Turn the combination switch OFF and turn it ON again. There must be 12 V of the DC voltage between the white/yellow terminal and black terminal of the control unit 4P connector for 4 ± 2 seconds.

4) If the specified voltage is not available for 4 ± 2 seconds, replace the valve control unit.

5) If the specified voltage is available for 4 ± 2 seconds, proceed to the following step.

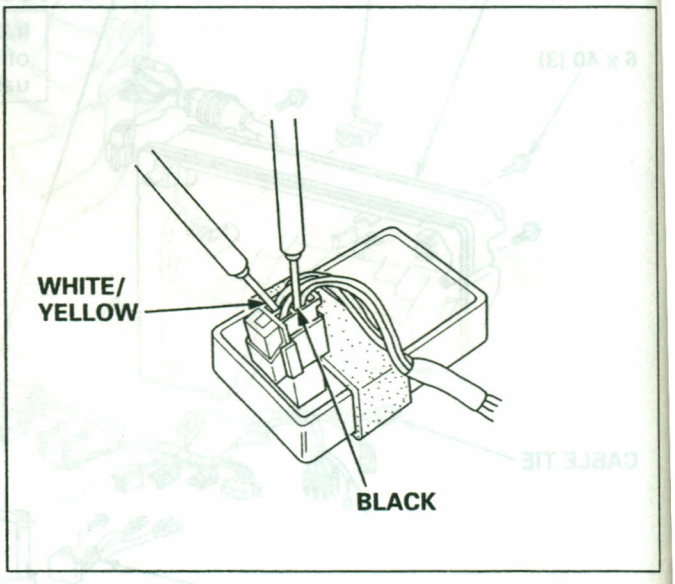


6) Turn the combination switch OFF once, then start the engine.

7) Check whether there is 12 V of the DC voltage between the white/yellow terminal and black terminal of the control unit 4P connector.

8) If the specified DC voltage is not available between the terminals, replace the valve control unit.

9) If the specified DC voltage is available, proceed to the following procedure.



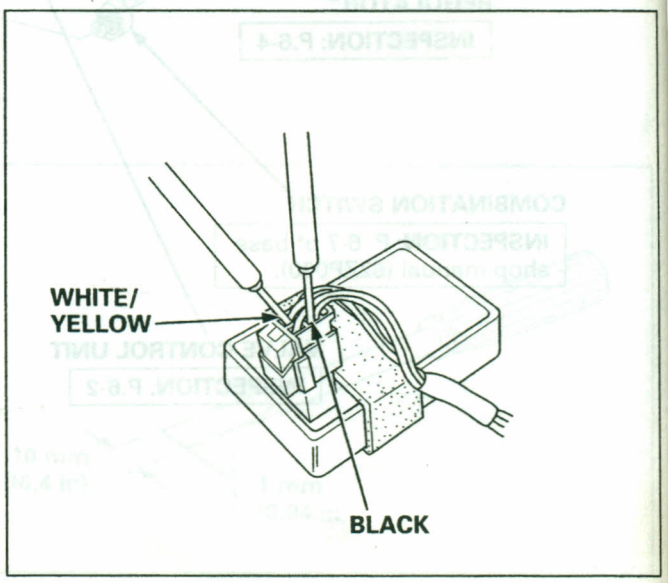
10) Attach one tester lead to the white/yellow terminal and the other tester lead to the black terminal of the valve control unit 4P connector.

11) Stop the engine.

12) Measure the voltage between the white/yellow and black terminals of the 4P connector within 0.5 seconds after the engine stop. It must be 0 V.

13) If the measurement is not 0 V, replace the valve control unit.

14) If the measurement is 0 V, proceed to the following procedure.



15) Start the engine again.

16) Attach one tester lead to the white/yellow terminal and the other tester lead to the black terminal of the valve control unit 4P connector.

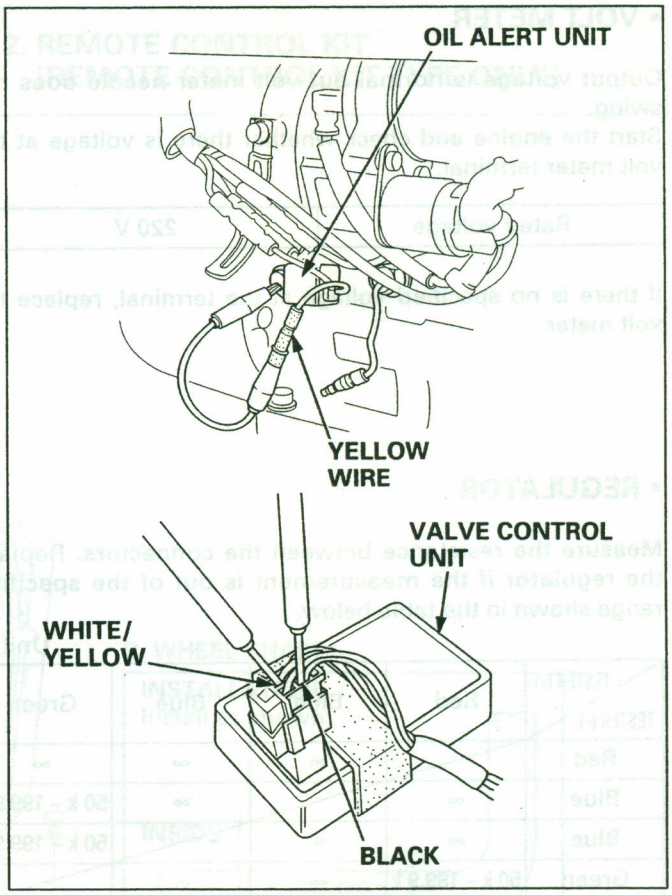
17) Disconnect the yellow connector from the oil alert unit and attach it to the engine to ground. Be sure that the engine stops.

18) Measure the voltage between the white/yellow and black terminals of the 4P connector within 0.5 seconds after the engine stop. It must be 0 V.

19) If the engine does not stop, check the oil alert unit. Replace the oil alert unit if necessary.

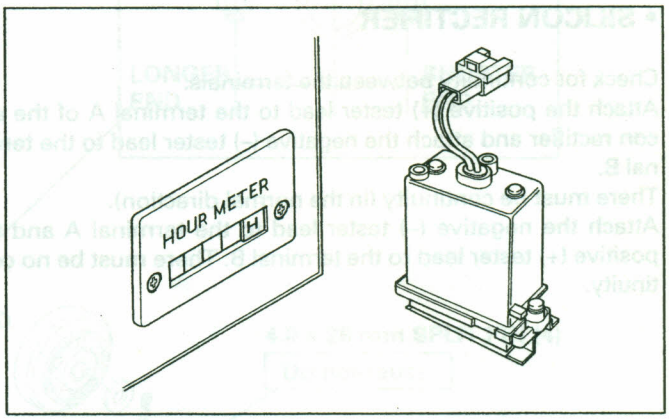
20) If the measured voltage is not 0 V within 0.5 seconds after the engine stop, replace the valve control unit.

21) The valve control unit is normal if the above procedures checked out all right.



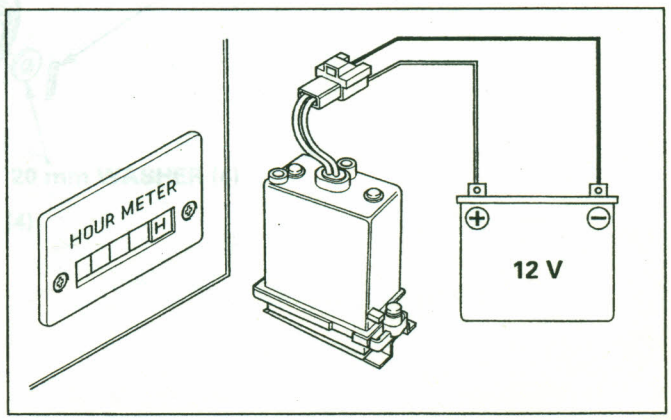
• HOUR METER

1) Check for continuity between the terminals of the hour meter 2P connector.
There should be continuity.



2) Connect the 12 V battery voltage between the white/yellow and yellow/green terminals of the hour meter 2P connector. The hour meter must start within 8 seconds.

3) The hour meter is normal if the step 1 and 2 checked out all right.

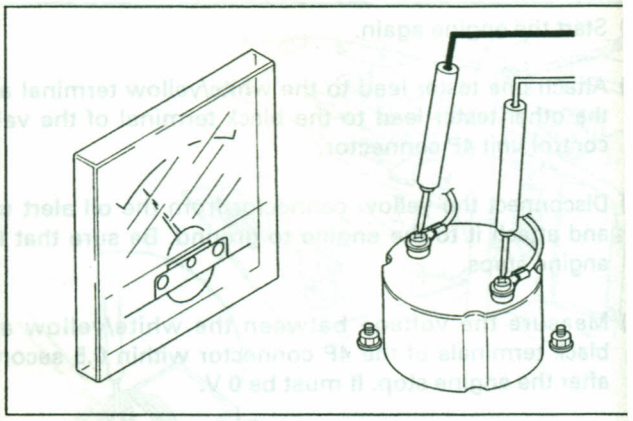


• VOLT METER

Output voltage is normal but volt meter needle does not swing:
Start the engine and check whether there is voltage at the volt meter terminal.

Rated voltage	220 V

If there is no specified voltage at the terminal, replace the volt meter.

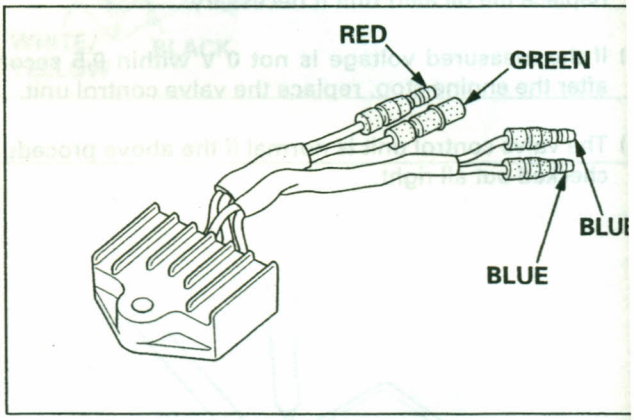


• REGULATOR

Measure the resistance between the connectors. Replace the regulator if the measurement is out of the specified range shown in the table below.

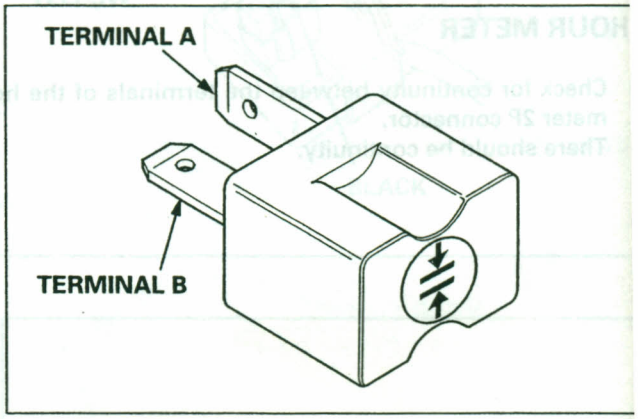
Unit: Ω

TESTER (+) / TESTER (–)	Red	Blue	Blue	Green
Red		∞	∞	∞
Blue	∞		∞	50 k – 199.9 k
Blue	∞	∞		50 k – 199.9 k
Green	50 k – 199.9 k	∞	∞	



• SILICON RECTIFIER

Check for continuity between the terminals.
Attach the positive (+) tester lead to the terminal A of the silicon rectifier and attach the negative (–) tester lead to the terminal B.
There must be continuity (in the normal direction).
Attach the negative (–) tester lead to the terminal A and the positive (+) tester lead to the terminal B. There must be no continuity.



4. MAINTENANCE STANDARDS

• ENGINE

Part	Item	EP5000		EP6500S	
		Standard	Service limit	Standard	Service limit
Engine	Maximum speed 50 Hz	3,150 ± 150 min⁻¹ (rpm)	———	3,150 ± 150 min⁻¹ (rpm)	———
	60 Hz	3,750 ± 150 min⁻¹ (rpm)	———	3,750 ± 150 min⁻¹ (rpm)	———
	Cylinder compression	6.0 – 8.5 kg/cm² (85 – 121 psi) at 600 min⁻¹ (rpm)	———	6.0 – 8.5 kg/cm² (85 – 121 psi) at 600 min⁻¹ (rpm)	———
Cylinder	Sleeve I.D.	82.00 mm (3.228 in)	82.17 mm (3.235 in)	88.00 mm (3.465 in)	88.17 mm (3.471 in)
Cylinder head	Warpage	———	0.10 mm (0.004 in)	———	0.10 mm (0.004 in)
Piston	Skirt O.D.	81.985 mm (3.2277 in)	81.85 mm (3.222 in)	87.985 mm (3.4640 in)	87.85 mm (3.459 in)
	Piston-to-cylinder clearance	0.015 – 0.052 mm (0.0006 – 0.0020 in)	0.12 mm (0.005 in)	0.015 – 0.052 mm (0.0006 – 0.0020 in)	0.12 mm (0.005 in)
	Piston pin bore I.D.	20.002 mm (0.7875 in)	20.042 mm (0.7891 in)	20.002 mm (0.7875 in)	20.042 mm (0.7891 in)
	Pin O.D.	20.00 mm (0.787 in)	19.95 mm (0.785 in)	20.00 mm (0.787 in)	19.95 mm (0.785 in)
	Piston-to-piston pin bore clearance	0.002 – 0.014 mm (0.0001 – 0.0006 in)	0.08 mm (0.003 in)	0.002 – 0.014 mm (0.0001 – 0.0006 in)	0.08 mm (0.003 in)
Piston rings	Ring side clearance: Top/second	0.030 – 0.060 mm (0.0012 – 0.0024 in)	0.15 mm (0.006 in)	0.030 – 0.060 mm (0.0012 – 0.0024 in)	0.15 mm (0.006 in)
	Ring end gap: Top/second	0.2 – 0.4 mm (0.01 – 0.02 in)	1.0 mm (0.04 in)	0.2 – 0.4 mm (0.01 – 0.02 in)	1.0 mm (0.04 in)
	Oil	0.2 – 0.7 mm (0.01 – 0.03 in)	1.0 mm (0.04 in)	0.2 – 0.7 mm (0.01 – 0.03 in)	1.0 mm (0.04 in)
	Ring width: Top/second	2.0 mm (0.08 in)	1.75 mm (0.069 in)	2.0 mm (0.08 in)	1.75 mm (0.069 in)
Connecting rod	Small end I.D.	20.005 mm (0.7876 in)	20.07 mm (0.790 in)	20.005 mm (0.7876 in)	20.07 mm (0.790 in)
	Big end I.D.	36.025 mm (1.4183 in)	36.07 mm (1.420 in)	36.025 mm (1.4183 in)	36.07 mm (1.420 in)
	Big end oil clearance	0.040 – 0.066 mm (0.0016 – 0.0026 in)	0.12 mm (0.005 in)	0.040 – 0.066 mm (0.0016 – 0.0026 in)	0.12 mm (0.005 in)
	Big end side clearance	0.1 – 0.7 mm (0.004 – 0.028 in)	1.0 mm (0.04 in)	0.1 – 0.7 mm (0.004 – 0.028 in)	1.0 mm (0.04 in)
Crankshaft	Crankshaft O.D.	35.985 mm (1.4167 in)	35.93 mm (1.415 in)	35.985 mm (1.4167 in)	35.93 mm (1.415 in)
Valves	Valve clearance IN	0.15 ± 0.02 mm (0.006 ± 0.001 in)	———	0.15 ± 0.02 mm (0.006 ± 0.001 in)	———
	EX	0.20 ± 0.02 mm (0.008 ± 0.001 in)	———	0.20 ± 0.02 mm (0.008 ± 0.001 in)	———
	Stem O.D. IN	6.59 mm (0.259 in)	6.44 mm (0.254 in)	6.59 mm (0.259 in)	6.44 mm (0.254 in)
	EX	6.55 mm (0.258 in)	6.40 mm (0.252 in)	6.55 mm (0.258 in)	6.40 mm (0.252 in)
	Guide I.D. IN/EX	6.60 mm (0.260 in)	6.66 mm (0.262 in)	6.60 mm (0.260 in)	6.66 mm (0.262 in)
	Stem clearance IN	0.010 – 0.040 mm (0.0004 – 0.0016 in)	0.11 mm (0.004 in)	0.010 – 0.040 mm (0.0004 – 0.0016 in)	0.11 mm (0.004 in)
	EX	0.050 – 0.080 mm (0.0020 – 0.0031 in)	0.13 mm (0.005 in)	0.050 – 0.080 mm (0.0020 – 0.0031 in)	0.13 mm (0.005 in)
	Seat width	1.1 mm (0.04 in)	2.0 mm (0.08 in)	1.1 mm (0.04 in)	2.0 mm (0.08 in)
	Spring free length	39.0 mm (1.54 in)	37.5 mm (1.48 in)	39.0 mm (1.54 in)	37.5 mm (1.48 in)
Camshaft	Cam height IN	31.85 – 32.25 mm (1.254 – 1.270 in)	31.10 mm (1.224 in)	32.40 – 32.80 mm (1.276 – 1.291 in)	32.25 mm (1.270 in)
	EX	31.57 – 31.97 mm (1.243 – 1.259 in)	30.80 mm (1.213 in)	31.89 – 32.29 mm (1.256 – 1.271 in)	31.75 mm (1.250 in)
	Camshaft O.D.	15.984 mm (0.6293 in)	15.92 mm (0.627 in)	15.984 mm (0.6293 in)	15.92 mm (0.627 in)
Crankcase cover	Camshaft holder I.D.	16.0 mm (0.63 in)	16.05 mm (0.632 in)	16.0 mm (0.63 in)	16.05 mm (0.632 in)
Carburetor	Main jet	# 98	———	# 102	———
	Float height	13.2 mm (0.52 in)	———	13.2 mm (0.52 in)	———
	Pilot screw opening	2-5/8 turns out	———	2-1/4 turns out	———
Spark plug	Gap	0.7 – 0.8 mm (0.028 – 0.031 in)	———	0.7 – 0.8 mm (0.028 – 0.031 in)	———
Spark plug cap	Resistance	7.5 – 12.5 kΩ	———	7.5 – 12.5 kΩ	———
Ignition coil	Resistance Primary coil	0.8 – 1.0 Ω	———	0.8 – 1.0 Ω	———
	Secondary coil	5.9 – 7.1 kΩ	———	5.9 – 7.1 kΩ	———
	Air gap (at flywheel)	0.4 ± 0.2 mm (0.016 ± 0.008 in)	———	0.4 ± 0.2 mm (0.016 ± 0.008 in)	———
Starter motor	Brush length	———	———	7.0 mm (0.28 in)	3.5 mm (0.14 in)
	Mica depth	———	———	1.0 mm (0.04 in)	0.2 mm (0.01 in)

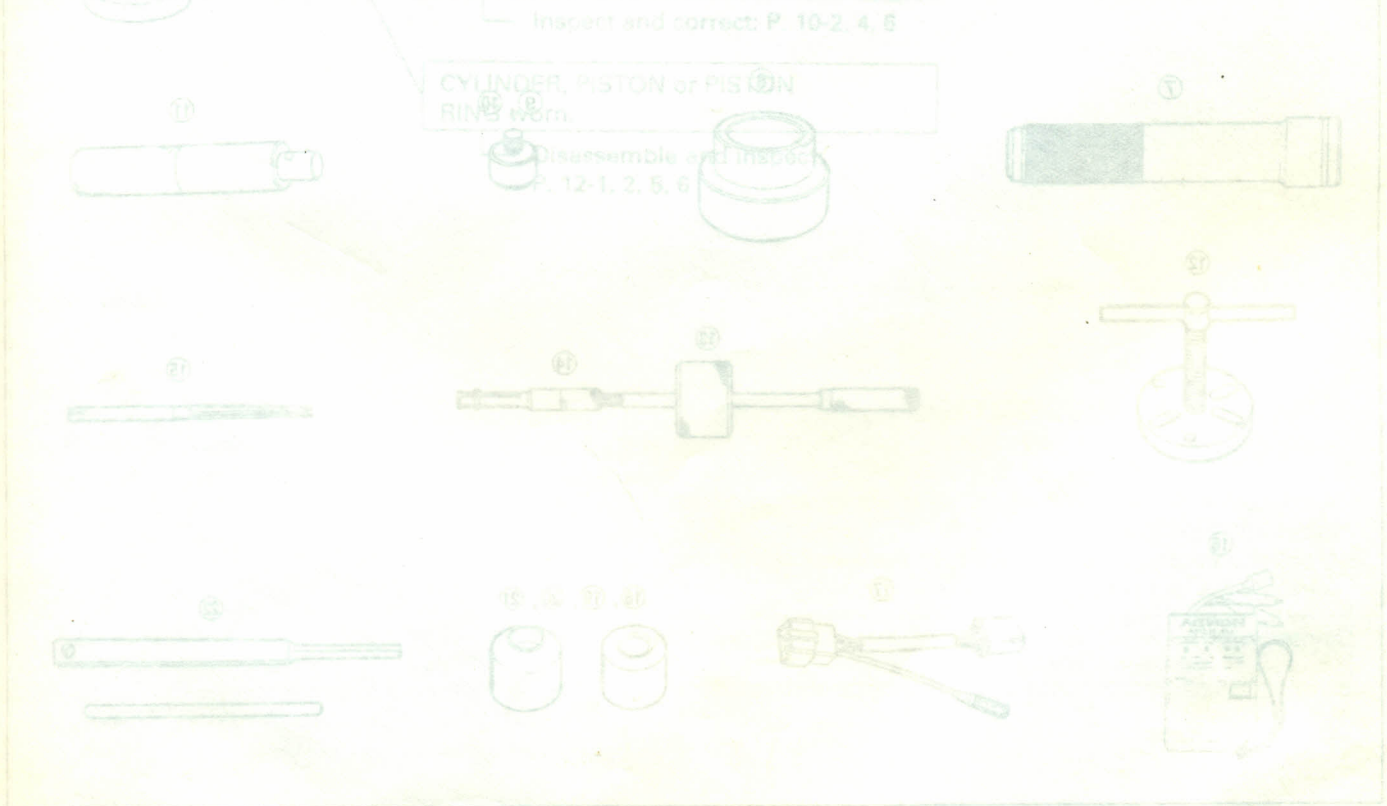
• GENERATOR

Part	Item			Standard	Service lim
Main winding	Resistance	EP5000	R type	0.8 – 1.0 Ω	———
			S type	0.6 – 0.9 Ω	———
			L type	0.1 – 0.3 Ω (120 V)/ 0.7 – 0.9 Ω (240 V)	———
		EP6500S	R type	0.5 – 0.7 Ω	———
			S type	0.3 – 0.4 Ω	———
			L type	0.1 – 0.2 Ω (120 V)/ 0.5 – 0.7 Ω (240 V)	———
Field winding	Resistance	EP5000	R type	55 – 65 Ω	———
			S type	55 – 65 Ω	———
			L type	55 – 65 Ω	———
		EP6500S	R type	57 – 67 Ω	———
			S type	57 – 67 Ω	———
			L type	57 – 67 Ω	———
Exciter winding	Resistance	EP5000	R type	1.0 – 1.2 Ω	———
			S type	0.8 – 1.0 Ω	———
			L type	0.8 – 1.0 Ω	———
		EP6500S	R type	1.1 – 1.3 Ω	———
			S type	0.9 – 1.1 Ω	———
			L type	0.9 – 1.1 Ω	———
DC winding	Resistance	EP5000	R type	0.4 – 0.5 Ω	———
			S type	0.3 – 0.5 Ω	———
			L type	0.3 – 0.5 Ω	———
		EP6500S	R type	0.3 – 0.5 Ω	———
			S type	0.3 – 0.4 Ω	———
			L type	0.3 – 0.4 Ω	———
Carbon brush	Brush length			9 mm (0.4 in)	5 mm (0.2
Battery (EP6500S type only)	Specific gravity of electrolyte			1.270 – 1.290	———

5. TORQUE VALUES

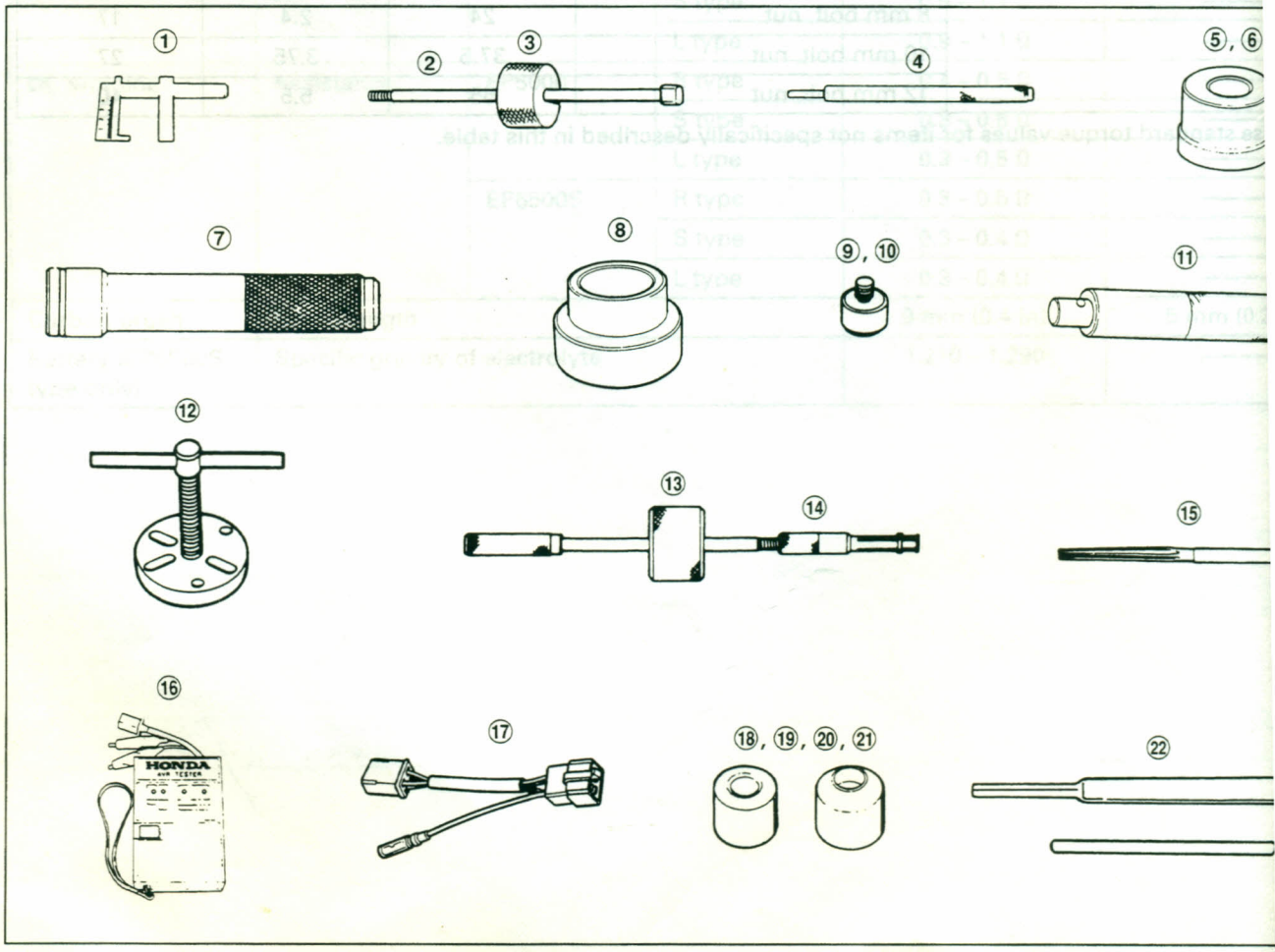
Item	Thread (mm)	Torque		
		N·m	kg-m	ft-lb
Connecting rod bolt	M8 x 1.25 (special bolt)	14	1.4	10
Cylinder head bolt	M10 x 1.25	35	3.5	25
Flywheel nut	M16 x 1.5 (Special nut)	115	11.5	83
Rocker arm pivot lock nut	M6 x 0.5	10	1.0	7
Rocker arm pivot bolt	M8 x 1.25 (Special bolt)	24	2.4	17
Crankcase cover bolt	M8 x 1.25	24	2.4	17
Oil level switch joint nut	M10 x 1.25	10	1.0	7
Fuel valve joint nut	M10 x 1.25	24	2.4	17
Muffler mounting bolt	M8 x 1.25	24	2.4	17
Air cleaner separator nut	M6 x 1.0	7.5	0.75	5.4
Oil drain bolt	M12 x 1.5	23	2.3	17
Fuel tank bolt	M6 x 1.25	10	1.0	7
Air cleaner mounting nut	M6 x 1.0	8.5	0.85	6.1
Starter solenoid terminal nut (EP6500S model)	M6 x 1.0	3.8	0.38	2.2
Standard torque values	5 mm bolt, nut	5.5	0.55	4.0
	6 mm bolt, nut	10	1.0	7
	8 mm bolt, nut	24	2.4	17
	10 mm bolt, nut	37.5	3.75	27
	12 mm bolt, nut	55	5.5	40

NOTE: Use standard torque values for items not specifically described in this table.



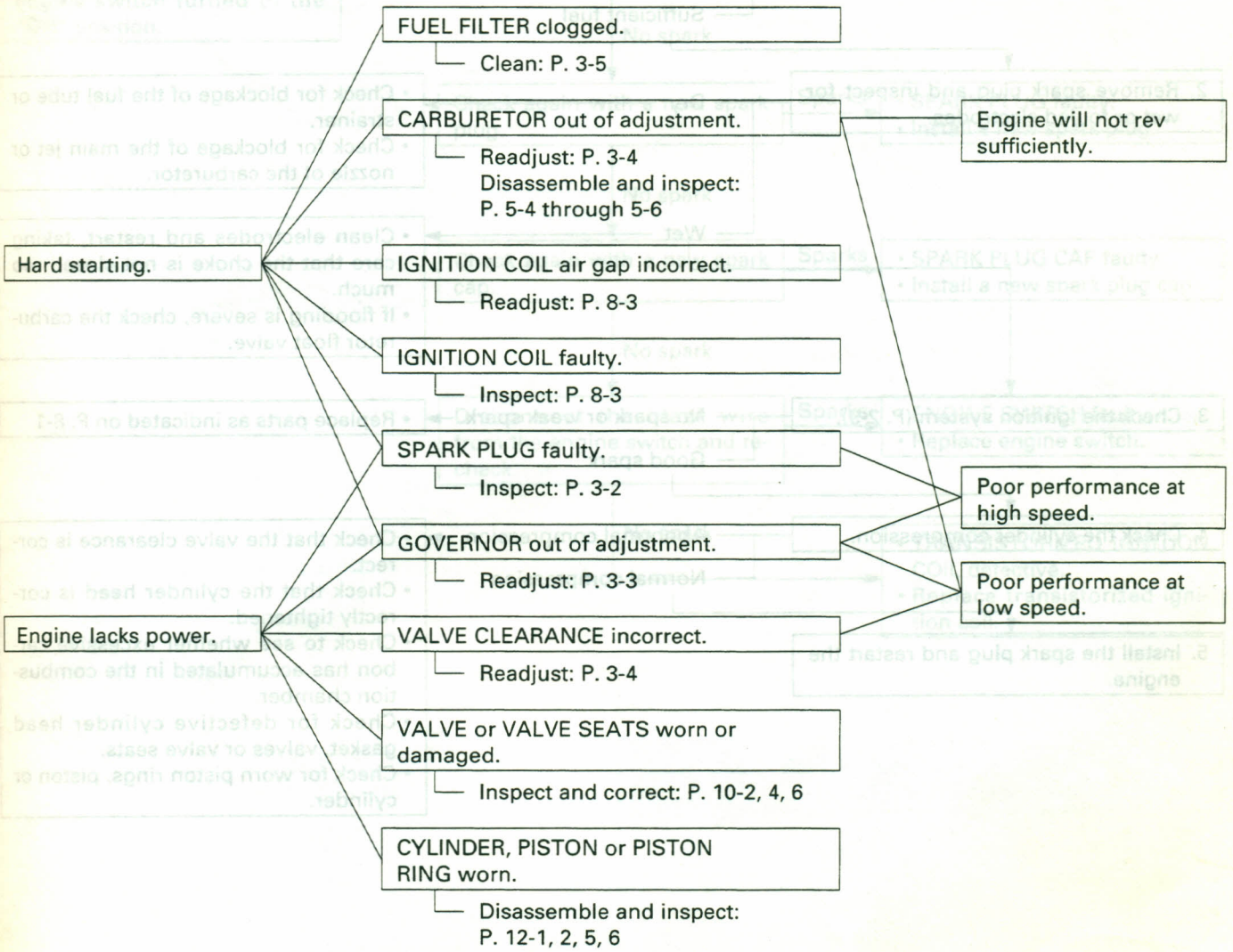
6. SPECIAL TOOLS

No.	Tool name	Tool number	Application
1	Float level gauge	07401 – 0010000	Carburetor float level inspection
2	Sliding shaft	07736 – 0010100	Rotor removal
3	Sliding weight	07741 – 0010201	Rotor removal
4	Valve guide driver, 6.6 mm	00742 – 0010200	Valve guide removal/installation
5	Attachment, 32 x 35 mm	07746 – 0010100	Balancer bearing 6202 installation
6	Attachment, 72 x 75 mm	07746 – 0010600	Crankshaft bearing 6207 (crankcase side) insta
7	Driver	07746 – 0030100	Driver for tool 8
8	Attachment, 35 mm I.D.	07746 – 0030400	Crankshaft bearing 6207 (crankshaft side), tim gear installation
9	Pilot, 15 mm	07746 – 0040300	Balancer bearing 6202 installation
10	Pilot, 35 mm	07746 – 0040800	Crankshaft bearing 6207 (crankcase side) insta
11	Driver	07749 – 0010000	Driver for tools 9 and 10
12	Flywheel puller	07935 – 8050003	Flywheel removal
13	Weight	07936 – 3710200	Use with bearing remover, 15 mm (tool 18)
14	Bearing remover, 15 mm	07936 – KC10500	Balancer bearing 6202 removal
15	Valve guide reamer, 6.6 mm	07984 – ZE20000	Valve guide ID reaming
16	AVR tester	07KPJ – 0010000	AVR inspection
17	AVR tester adaptor	07FPJ – ZB40100	AVR inspection
18	Valve seat cutter, 45° 40.0 mm	07780 – 0010500	Intake valve seat reconditioning
19	Valve seat cutter, 45° 33.0 mm	07780 – 0010800	Exhaust valve seat reconditioning
20	Valve seat cutter, 32° 38.5 mm	07780 – 0012400	Intake valve seat reconditioning
21	Valve seat cutter, 32° 33.0 mm	07780 – 0012900	Exhaust valve seat reconditioning
22	Valve seat cutter holder, 6.6 mm	07781 – 0010201	Holder for tools 18, 19, 20 and 21



7. TROUBLESHOOTING

a. GENERAL SYMPTOM AND POSSIBLE CAUSES



b. HARD STARTING

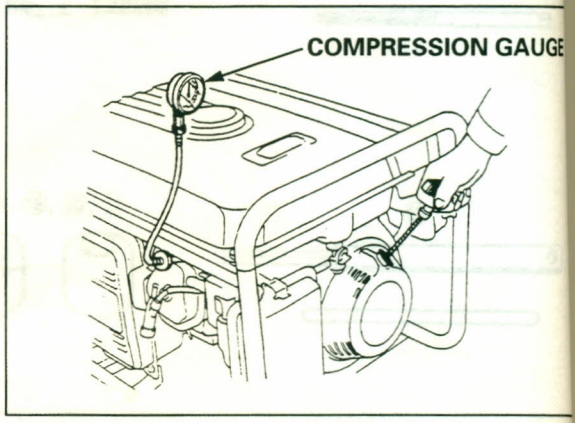
1. First, check the fuel level in the tank.
   - No fuel → • Fill with fuel and start again.
   - Sufficient fuel
2. Remove spark plug and inspect for wet or fouled electrodes.
   - Dry → • Check for blockage of the fuel t strainer. • Check for blockage of the main nozzle of the carburetor.
   - Wet → • Clean electrodes and restart, t care that the choke is not close much. • If flooding is severe, check the c retor float valve.
3. Check the ignition system (P. 2-9).
   - No spark or weak spark → • Replace parts as indicated on P.
   - Good spark
4. Check the cylinder compression.
   - Abnormal compression → • Check that the valve clearance is rect. • Check that the cylinder head is rectly tightened. • Check to see whether excessive bon has accumulated in the com tion chamber. • Check for defective cylinder gasket, valves or valve seats. • Check for worn piston rings, pist cylinder.
   - Normal compression
5. Install the spark plug and restart the engine.

CYLINDER COMPRESSION CHECK

(Mechanical decompressor engaged)

1) Remove the spark plug and install a compression gauge in the spark plug hole.
2) Crank the engine several times with the recoil starter and measure the compression.

Compression	6.0 – 8.5 kg/cm² (85 – 121 psi) at 600 min⁻¹ (rpm)



c. IGNITION SYSTEM

Engine does not start with the engine switch turned to the "ON" position.

→ Test the spark plug.

No spark ↓

Check again with a new spark plug. → Sparks → • SPARK PLUG faulty. • Install a new spark plug.

No spark ↓

Check again with a new spark cap. → Sparks → • SPARK PLUG CAP faulty. • Install a new spark plug cap.

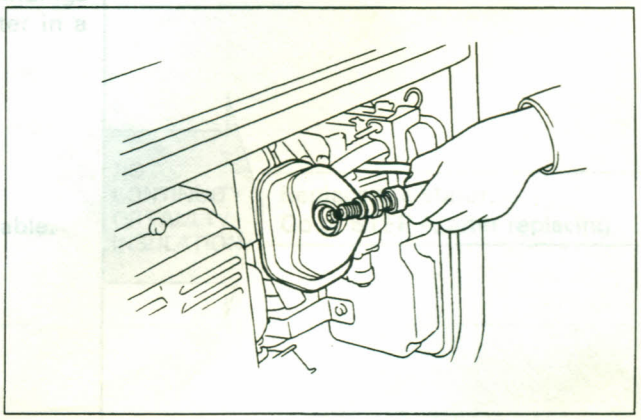
No spark ↓

Disconnect the black wire from the engine switch and re-check. → Sparks → • ENGINE SWITCH faulty. • Replace engine switch.

No spark → • TRANSISTORIZED IGNITION COIL defective. • Replace transistorized ignition coil.

SPARK TEST

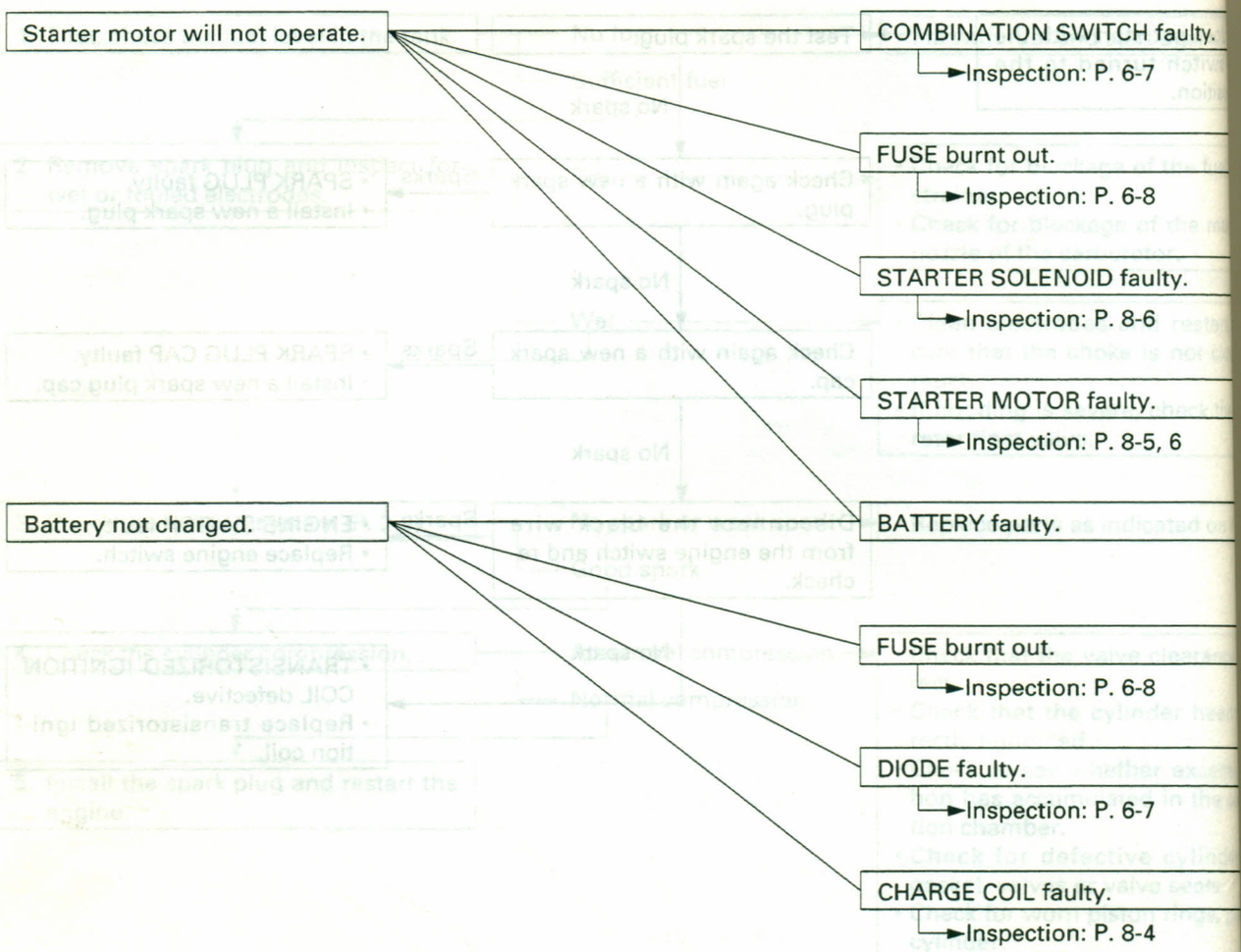
1) Remove the spark plug.
2) Install the spark plug to the spark plug cap and ground the side electrode against the cylinder head cover.
3) Turn the engine switch to the "ON" position, pull the recoil starter and check to see if sparks jump across the electrodes.



⚠WARNING

- **Never hold the spark plug lead with wet hands while performing this test.**
- **Make sure that no fuel has been spilled on the engine and the plug is not wet with fuel.**
- **To avoid fire hazards, do not allow sparks near the plug hole.**

d. STARTER MOTOR



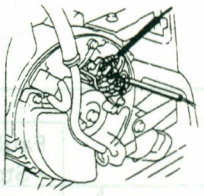
• GENERATOR

A. No AC output voltage

NOTE: Is the circuit breaker on?
Is the engine speed correct?
50 Hz: 3,150 ± 150 min^{-1} (rpm) [No load]
60 Hz: 3,750 ± 150 min^{-1} (rpm) [No load]

Engine running

1. Remove the generator end cover and start the engine.
Make sure that there is AC output at the AC output terminals under no load.
Approx. 220 V (R, S types)
Approx. 120/240 V (L type)

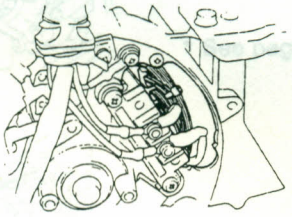


NORMAL OUTPUT → Trouble is in control panel.
Check receptacles, circuit breakers and each lead.

LOW AC OUTPUT

Engine stopping

2. Inspect if the stator winding is discolored.



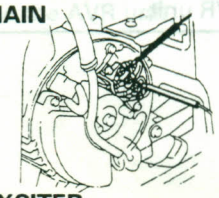
DISCOLORED → Replace the stator.
Go to STEP 4. after replacing.

NORMAL

Engine stopping

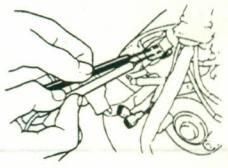
3. Check continuity and insulation between the stator windings and the stator core using a multimeter or ohmmeter in a minimum range.

MAIN



* See page 2-14 for continuity table.

EXCITER

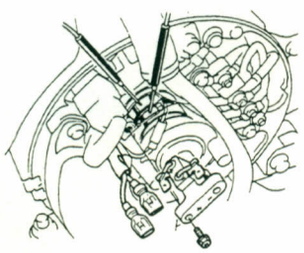


NO CONTINUITY OR FAULTY INSULATION → Replace the stator.
Go to STEP 4. after replacing.

NORMAL

Engine stopped

4. Remove the brush holder and measure the resistance between the slip rings.



EP5000:
55 – 65 Ω

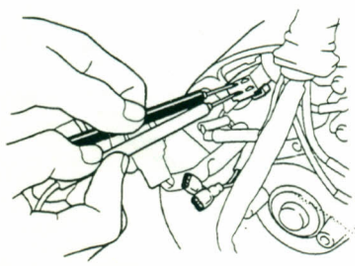
EP6500S:
57 – 67 Ω

ABNORMAL RESISTANCE → Faulty rotor coil.
• Replace the rotor.
Go to STEP 6. after replacing.

NORMAL RESISTANCE

Engine running

5. Inspect magnets in the rotor.
• Disconnect the 3P or 4P connector and the brush terminals from the AVR unit. Start the engine and measure AC voltage at the exciter winding.



1 – 2 V

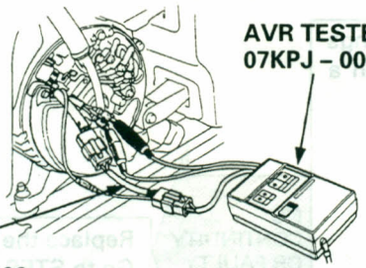
NO OR LOW VOLTAGE → Faulty magnets in the rotor.
• Stop the engine, disconnect the 3
connector and the brush termina
connect the 12 V battery to the
terminals to magnetize the mag
the rotor.

Go to STEP 6. after magnetizing.

NORMAL VOLTAGE

Engine stopped

6. Inspect the AVR unit using a AVR tester and adapter.



AVR TESTER
07KPJ – 0010000

ADAPTER
07FPJ – ZB40100

ABNORMAL → Faulty AVR unit.
• Replace the AVR unit.

NORMAL

Engine running

7. Reassemble all parts to the generator, start the engine and check the AC output voltage 30 minutes or more after starting the engine.

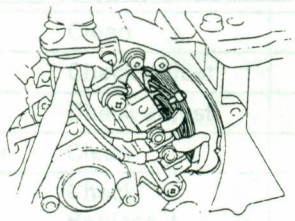
ABNORMAL → Faulty AVR unit.
• Replace the AVR unit.

B. Low (10 – 80%) AC output voltage.
C. High (more than 120%) AC output voltage

Is the engine speed correct?
50 Hz: 3,150 ± 150 min^{-1} (rpm) [No load]
60 Hz: 3,750 ± 150 min^{-1} (rpm) [No load]

Engine stopped

1. Inspect if the stator winding is discolored.



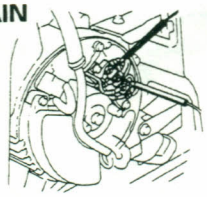
DISCOLORED → Replace the stator.

NORMAL

Engine stopped

2. Check continuity and insulation between the stator windings and the stator core using a multimeter or ohmmeter in a minimum range.

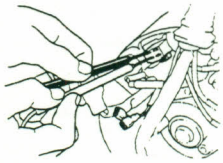
MAIN



* See page 2-14 for continuity table.

NO CONTINUITY OR FAULTY INSULATION → Replace the stator.

EXCITER



NORMAL

Faulty AVR unit.
Replace the AVR unit.

D. Generator will not deliver rated output

Is the engine speed correct?
50 Hz: 3,150 ± 150 min^{-1} (rpm) [No load]
60 Hz: 3,750 ± 150 min^{-1} (rpm) [No load]

↓

Engine running

1. Connect the rated load (power factor = 1.0) to the generator and check the engine speed.
   50 Hz: 3,000 min^{-1} (rpm)
   60 Hz: 3,600 min^{-1} (rpm)

→ LOW ENGINE SPEED → Engine power is dropped.
• Overhaul the engine.

↓ NORMAL ENGINE SPEED

Faulty matching between the generator and the electrical load.

• Continuity table
EP5000:

		Main		Exciter		Stator core
		Red	White	Blue	Blue	
Stator core		∞	∞	∞	∞	
Exciter	Blue	∞	∞	continuity		
	Blue	∞	∞			
Main	White	continuity				
	Brown					

EP6500S:

		Main				Exciter		Signal		Stator core
		White	Red	Blue	Green	Blue	Blue	Brown	Borwn	
Stator core		∞	∞	∞	∞	∞	∞	∞	∞	
Signal	Brown	continuity	continuity	∞	∞	∞	∞	continuity		
	Brown	continuity	continuity	∞	∞	∞	∞			
Exciter	Blue	∞	∞	∞	∞	continuity				
	Blue	∞	∞	∞	∞					
Main	Gray	∞	∞	continuity						
	Blue	∞	∞							
	Red	continuity								
	White									

* See the standard resistance in page 2-4.

8. MAINTENANCE SCHEDULE

REGULAR SERVICE PERIOD / Operating hour interval, whichever comes first. / ITEM		Each use	First month or 20 hrs	Every 3 months or 50 hrs	Every 6 months or 100 hrs	Every year or 300 hrs
Engine oil	Check level	○				
	Change		○		○	
Air cleaner	Check	○				
	Clean			○ (1)		
Sediment cup	Clean				○	
Spark plug	Check-adjust				○	
Valve clearance	Check-adjust					○
Fuel tank & filter	Clean					○
Fuel line	Check Replace if necessary	Every 2 years				

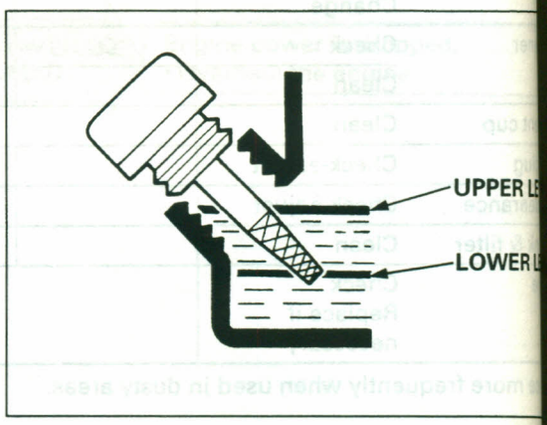
(1) Service more frequently when used in dusty areas.

3. MAINTENANCE

1. ENGINE OIL

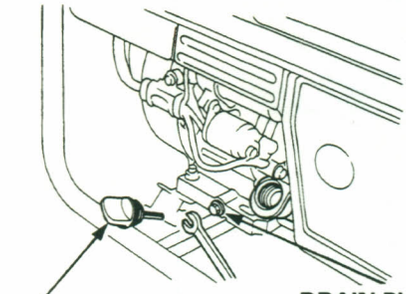
⚠WARNING

- **Used engine oil may cause skin cancer if repeatedly left in contact with the skin for prolonged periods. Although this is unlikely unless you handle used oil on a daily basis, it is still advisable to thoroughly wash your hands with soap and water as soon as possible after handling used oil. KEEP OUT OF REACH OF CHILDREN.**



NOTE

- Dispose of used motor oil in a manner that is compatible with the environment. We suggest that you take it in sealed container to your local waste disposal site, or service station for reclamation.
- Do not throw it in the trash or pour it onto the ground, down sewers or drains.
- Draining can be performed rapidly and completely when the engine is still warm.
- Drain the engine oil with the engine warm and in a horizontal position to assure complete and rapid draining.



1) Remove the oil filler cap and oil drain bolt. Allow the oil to drain completely.
2) Reinstall the drain bolt, and tighten it securely.

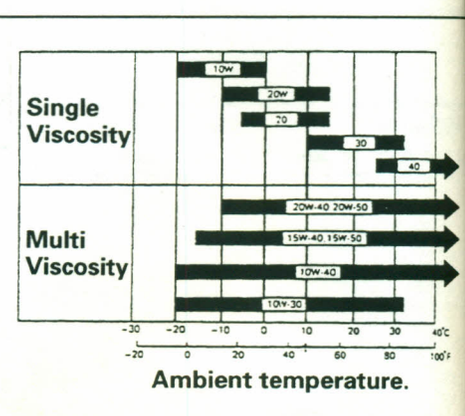
TORQUE: 23 N·m (2.3 kg-m, 17 ft-lb)

3) Fill the crankcase with the recommended engine oil to the lower edge of the oil filler neck.

Engine oil capacity	1.1 ℓ (1.16 US qt, 0.97 Imp qt)

Recommended engine oil	SAE 10 W – 30 Service classification SG. SF.

4) Reinstall the oil filler cap.

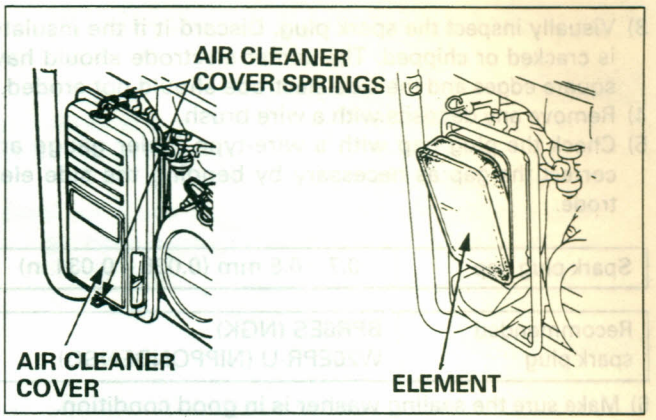


2. AIR CLEANER

⚠WARNING

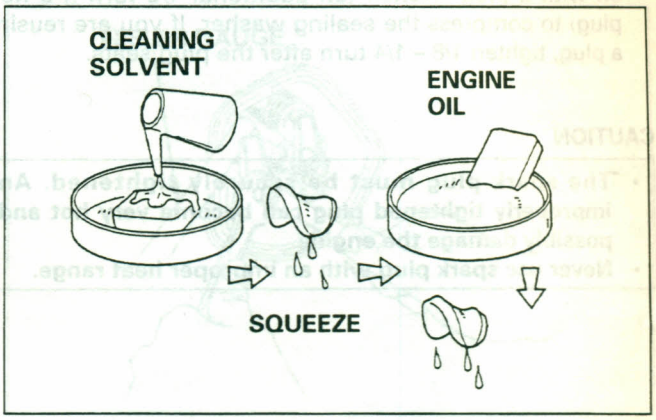
- **Never use gasoline or low flash point solvents for cleaning the air cleaner element. A fire or explosion could result.**

1) Unsnap the air cleaner cover springs and remove the air cleaner cover.
2) Remove the air cleaner element.
   Carefully check the element for holes or tears and replace if damaged.
   Clean the element.
3) Clean in warm soapy water, rinse and allow to dry thoroughly. Or clean in nonflammable solvent and allow to dry. Dip the element in clean engine oil and squeeze out all excess oil.
4) Wipe dirt from the inside of the air cleaner case and cover, using a moist rag. Be careful to prevent dirt from entering the air duct that leads to the carburetor.
5) Reinstall the element and cover. Tighten the air cleaner bolt securely.



CAUTION

- **Carefully check the element for holes or tears and replace as required. Damaged element will allow dirt to pass into the engine, causing rapid wear. Always clean the filter housing and air passages before installing clean element.**

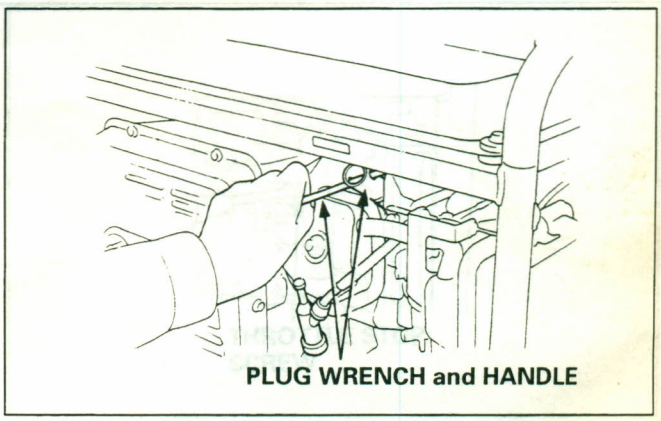


NOTE

- The engine will run poorly when the air cleaner needs maintenance. If it runs better without the air cleaner than it does with the elements, or if the length of time between needed cleanings keeps getting shorter, replace the elements. Under extremely dusty conditions such as volcanic ash, silt, etc., the system may need daily maintenance.

3. SPARK PLUG

1) Clean any dirt from around the spark plug.
2) Remove the plug cap, and use a spark plug wrench to remove the plug.

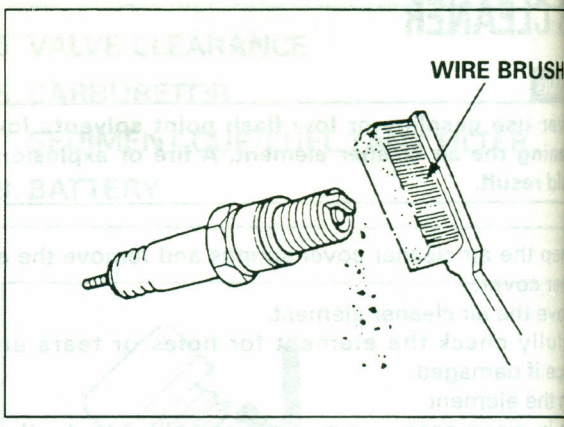


3) Visually inspect the spark plug. Discard it if the insulator is cracked or chipped. The center electrode should have square edges and the side electrode should not eroded.
4) Remove any deposits with a wire brush.
5) Check the plug gap with a wire-type feeler gauge and correct the gap as necessary by bending the side electrode.

Spark plug gap	0.7 – 0.8 mm (0.028 – 0.031 in)

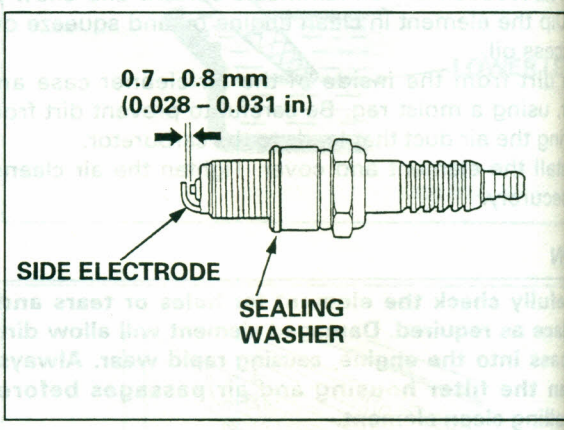
Recommended spark plug	BPR6ES (NGK) W20EPR-U (NIPPONDENSO)

6) Make sure the sealing washer is in good condition.
7) Install the plug fingertight to seat the washer, then tighten with a plug wrench (an additional 1/2 turn if a new plug) to compress the sealing washer. If you are reusing a plug, tighten 1/8 – 1/4 turn after the plug seats.



CAUTION

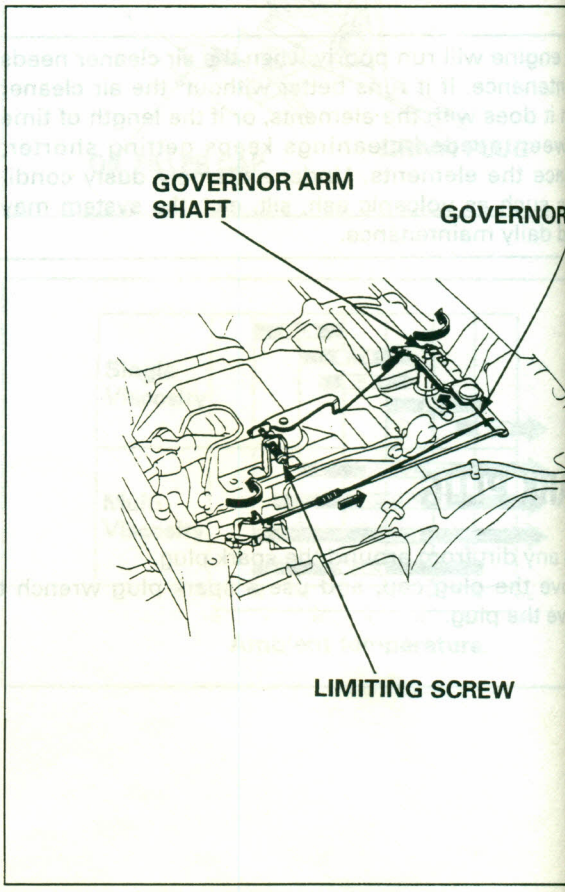
- **The spark plug must be securely tightened. An improperly tightened plug can become very hot and possibly damage the engine.**
- **Never use spark plug with an improper heat range.**



4. GOVERNOR

1) Loosen the nut on the governor arm pinch bolt, and move the governor arm to fully open the throttle.
2) Rotate the governor arm shaft as far as it will go in the same direction the governor arm moved to open the throttle.
3) Start the engine and allow it to warm up to normal operating temperature. Move the throttle lever to run the engine at the standard maximum speed, and adjust the throttle lever limiting screw so the throttle lever cannot be moved past that point.

Standard maximum speed	50 Hz: 3,150 ± 150 rpm 60 Hz: 3,750 ± 150 rpm



5. VALVE CLEARANCE

Valve clearance inspection and adjustment must be performed with the engine cold.

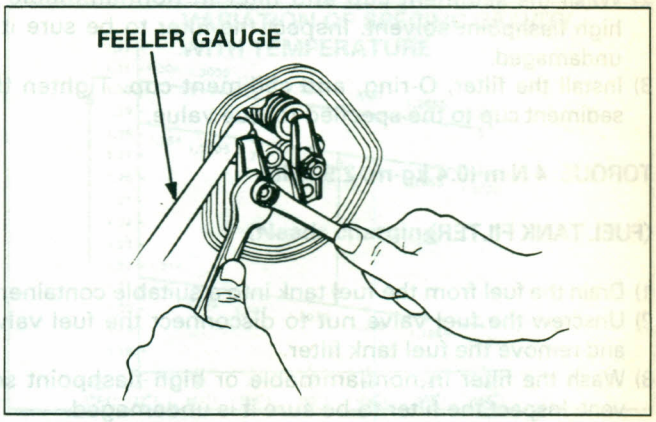
1) Remove the spark plug cap.
2) Remove the cylinder head cover bolt, cylinder head cover and gasket.

NOTE

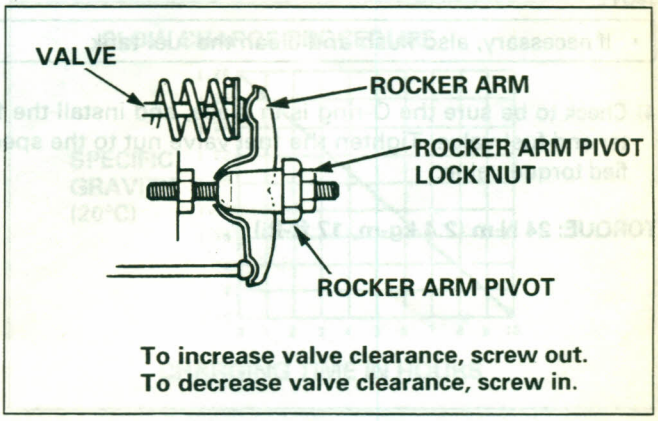
- After the cylinder head cover is removed, engine oil may flow.
  Be sure to wipe up any flowed oil.

3) Remove the recoil starter.
4) Set the piston at top dead center of the compression stroke (both valves fully closed). The triangular mark on the starter pulley will align with the top hole on the fan cover when the piston is at top dead center of the compression or exhaust stroke.
5) Insert a feeler gauge between the rocker arm and valve to measure valve clearance.

Standard valve clearance	IN	0.15 ± 0.02 mm (0.006 ± 0.001 in)
	EX	0.20 ± 0.02 mm (0.008 ± 0.001 in)



6) If adjustment is necessary, proceed as follows:
   a. Hold the rocker arm pivot and loosen the rocker arm pivot lock nut.
   b. Turn the rocker arm pivot to obtain the specified clearance.
   c. Retighten the rocker arm pivot lock nut while holding the rocker arm pivot.
   d. Recheck valve clearance after tightening the rocker arm pivot lock nut.

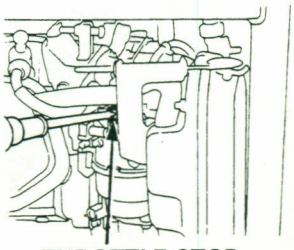


To increase valve clearance, screw out.
To decrease valve clearance, screw in.

6. CARBURETOR

1) Start the engine and allow it to warm up to normal operating temperature.
2) With the engine idling, turn the pilot screw in or out to the setting that produces the highest idle rpm. The correct setting will usually be obtained at approximately the following number of turns out from the fully closed (lightly seated) position.

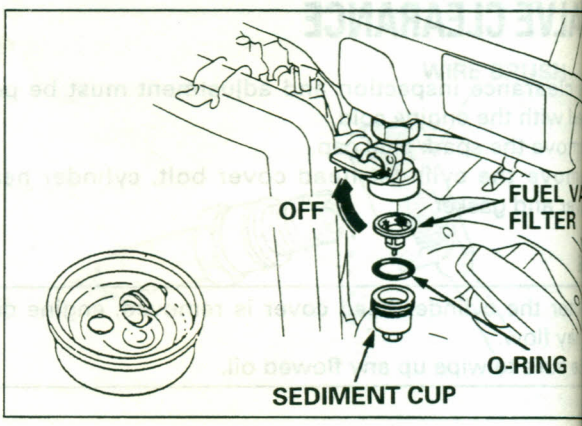
Pilot screw opening	EP5000	2 – 5/8 turns out
	EP6500S	2 – 1/4 turns out



7. SEDIMENT CUP/FUEL TANK FILTER

⚠WARNING

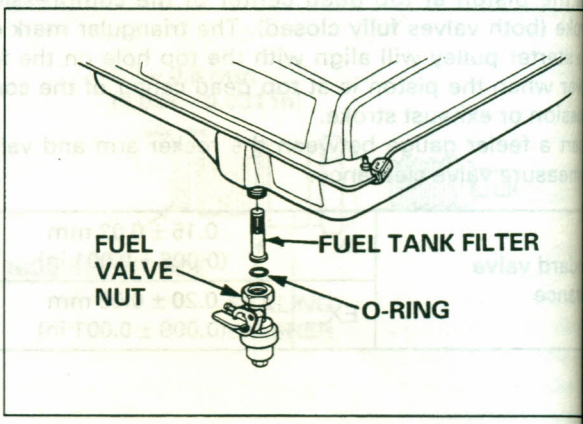
- **Gasoline is extremely flammable and is explosive under certain conditions. Do not smoke or allow flames or sparks in the area.**
- **After installing the fuel strainer cup, check for leaks, and make sure the area is dry before starting the engine.**



〈SEDIMENT CUP〉

1) Turn the fuel valve to the OFF position. Remove the sediment cup, O-ring, and fuel valve filter.
2) Wash the sediment cup and filter in nonflammable or high flashpoint solvent. Inspect the filter to be sure it is undamaged.
3) Install the filter, O-ring, and sediment cup. Tighten the sediment cup to the specfied torque value.

TORQUE: 4 N·m (0.4 kg-m, 2.9 ft-lb)



〈FUEL TANK FILTER〉

1) Drain the fuel from the fuel tank into a suitable container.
2) Unscrew the fuel valve nut to disconnect the fuel valve, and remove the fuel tank filter.
3) Wash the filter in nonflammable or high flashpoint solvent. Inspect the filter to be sure it is undamaged.

NOTE

- If necessary, also flush and clean the fuel tank.

4) Check to be sure the O-ring is in place, and install the filter and fuel valve. Tighten the fuel valve nut to the specified torque value.

TORQUE: 24 N·m (2.4 kg-m, 17 ft-lb)

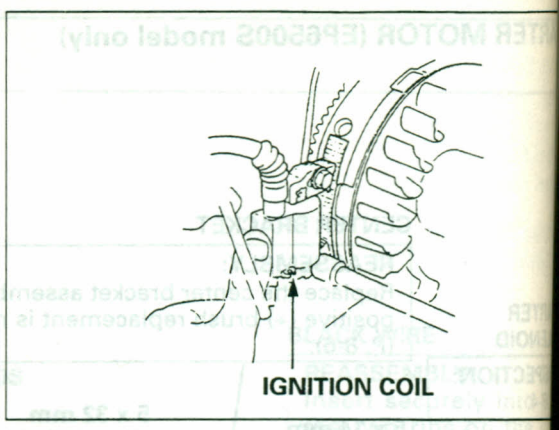
c. ADJUSTMENT

• IGNITION COIL AIR GAP

Adjustment is required only when the ignition coil or the flywheel has been removed.

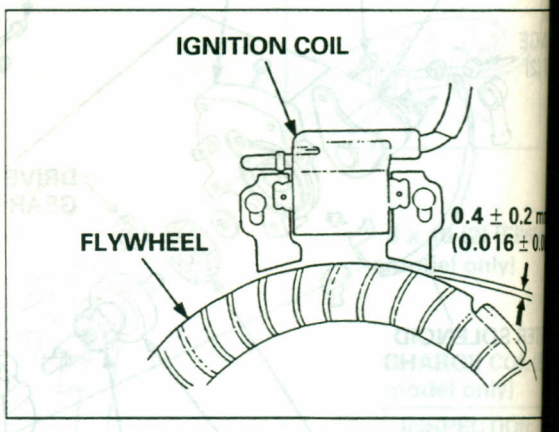
1) Loosen the ignition coil bolts.
2) Insert a long thickness guage or a piece of paper of the proper thickness between the ignition coil and the flywheel. Both gaps should be adjusted simultaneously.
3) Push the ignition coil firmly toward the flywheel and tighten the bolts.

Specified clearance	0.4 ± 0.2 mm (0.016 ± 0.008 in)



NOTE

- Avoid the magnet part of the flywheel when adjusting.

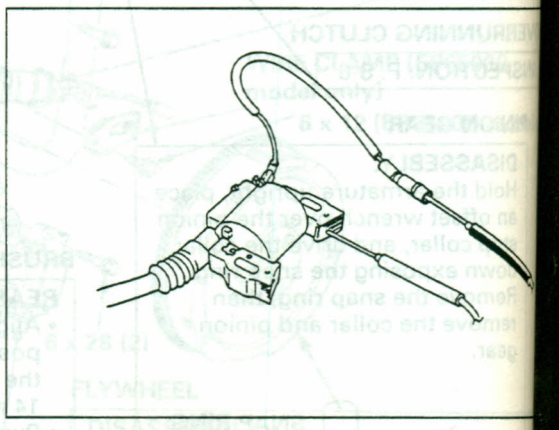


d. INSPECTION

• IGNITION COIL

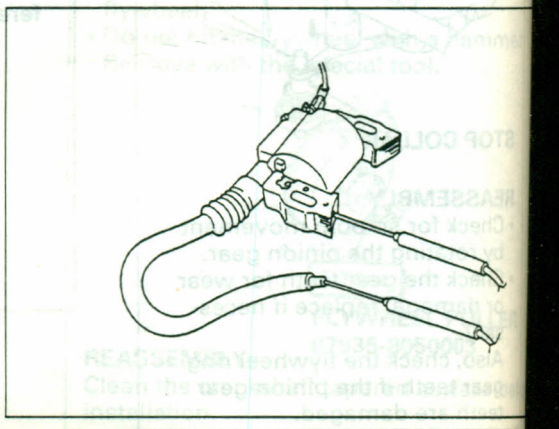
<Primary side>
Measure the resistance of the primary coil by attaching one ohmmeter lead to the ignition coil's primary (black) lead while touching the other test lead to the iron core.

Primary side resistance value	0.8 – 1.0 Ω



<Secondary Side>
Measure the resistance of the secondary side of the coil by removing the spark plug cap and touching one test lead to the spark plug lead wire while touching the other lead to the coil's iron core.

Secondary side resistance value	5.9 – 7.1 kΩ



NOTE

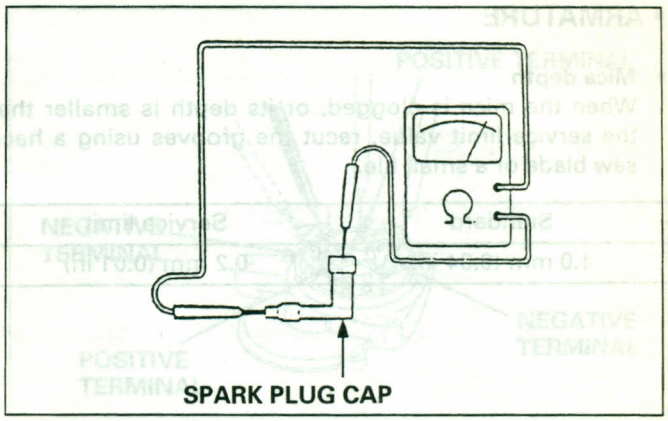
- A false reading will result if the spark plug cap is not removed.

• SPARK PLUG CAP

Measure the resistance of the spark plug cap by touching one test lead at the wire end of the cap and the other at the spark plug end.

Resistance	7.5 – 12.5 kΩ

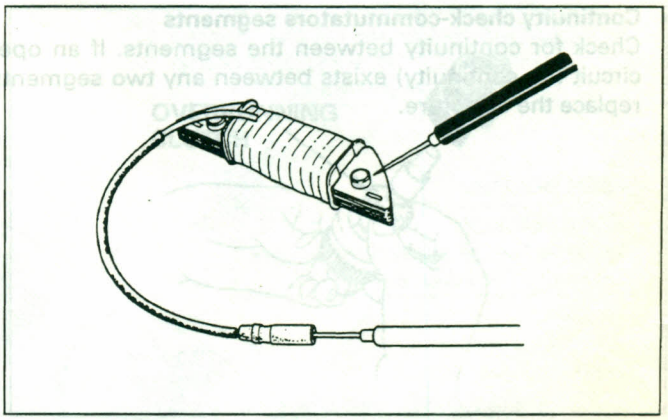
Replace the spark plug cap if the resistance is not within the range specified.



• CHARGE COIL (EP6500S model only)

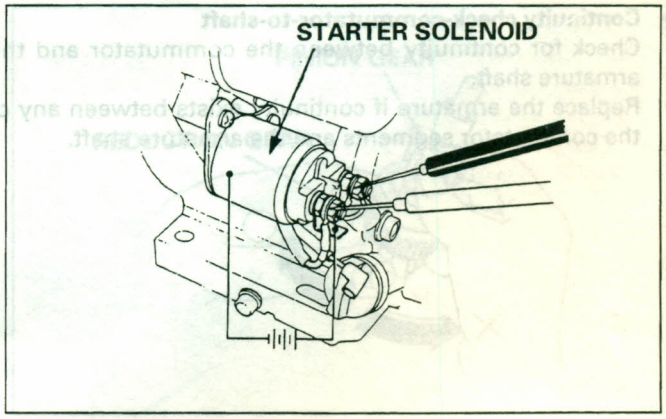
Measure the resistance between the wire terminal and ground.

Resistance	3.0 – 4.0 Ω



• STARTER SOLENOID

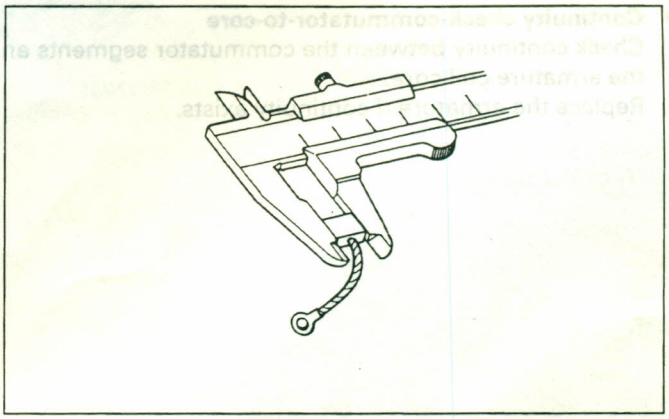
Connect a 12 V battery between the starter terminal and the solenoid body and check for continuity between the terminals. Continuity should exist when the battery is connected and not exist when battery is disconnected.



• BRUSH LENGTH

Measure the brush length.
If brush length is less than service limit, replace the brush and brush holder plate.

Standard	Service limit
7.0 mm (0.28 in)	3.5 mm (0.14 in)

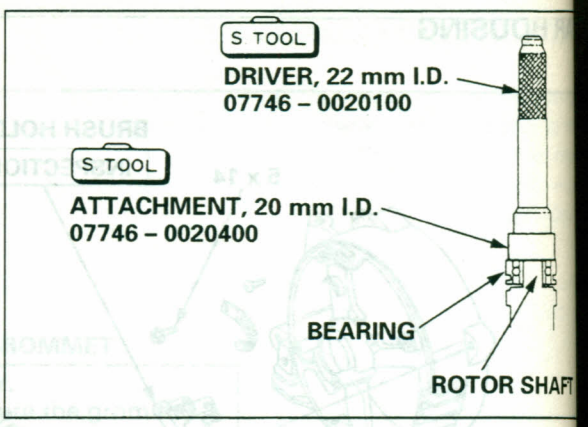


• 6204 BEARING/BEARING CLIP

DISASSEMBLY:
Remove the 6204 bearing with a commercially available 2-jaw puller, or with a bearing splitter and hydraulic press.

CAUTION

- **Be careful not to damage the slip rings. Avoid contact with the slip ring area while removing the bearing.**
- **When replacing the 6204 bearing, always use a new-style replacement bearing with a clip; otherwise, premature rear housing wear may result.**

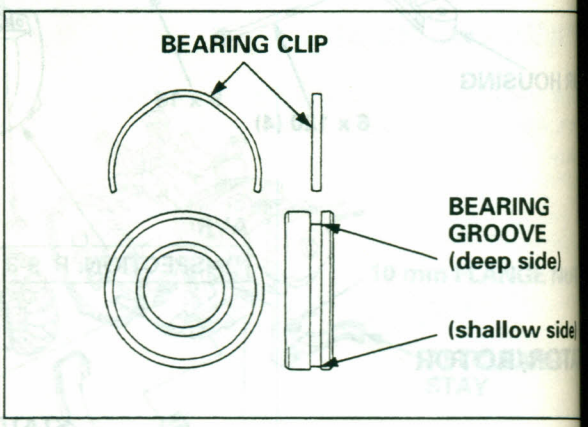


REASSEMBLY:
1) Install the bearing with the grooved end towards the rotor, using a special tools.

TOOLS:

Driver, 22 mm I.D.	**07746 – 0020100**
Attachment, 20 mm I.D.	**07746 – 0020400**

2) Install the bearing clip in the bearing groove, so the gap is at the shallow part of the groove, and the raised area of the clip is centered in the deepest part of the groove.



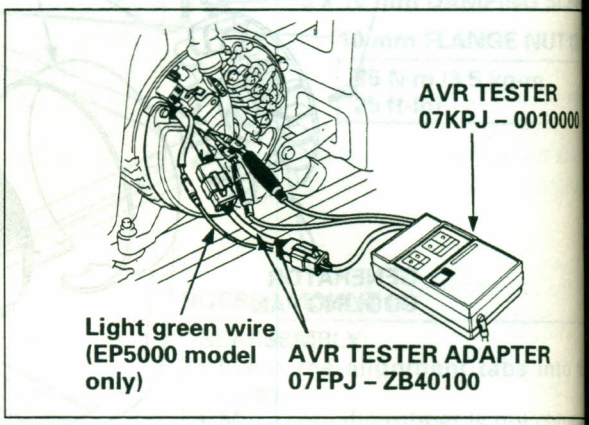
b. INSPECTION

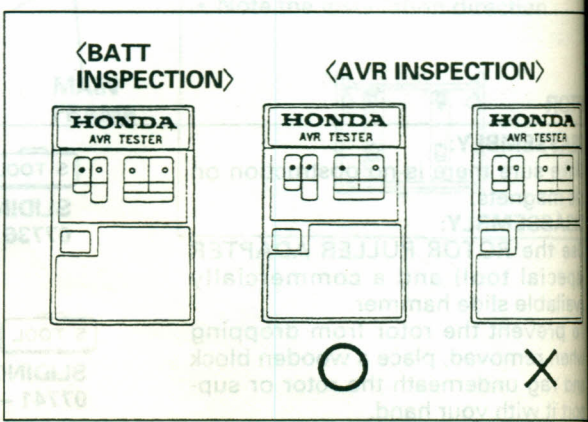
Use the special tools of AVR tester and adapter.

1) Connect the AVR tester and adapter to the AVR.
Connect the red aligator clip to Red wire terminal, and black aligator clip to White wire terminal.
Connect the 4P connector of AVR and adapter.
Connect the Light green wire of AVR and adapter. (EP500 model only)

2) Ensure the Tester has a dry cell battery.
Press the Red power button and check the BATT lamp (yellow) turns on.

3) Press the Red power button for 5 seconds twice for the CHECK END lamp to turn on.
Then:
Normal if the GOOD lamp turns on.
Abnormal if the NO GOOD lamp turns on.
Abnormal if both the GOOD and NO GOOD lamps turn on. Replace the AVR.
* Due to the pole characteristics of the AVR, ignore short flashes of the NO GOOD lamp.

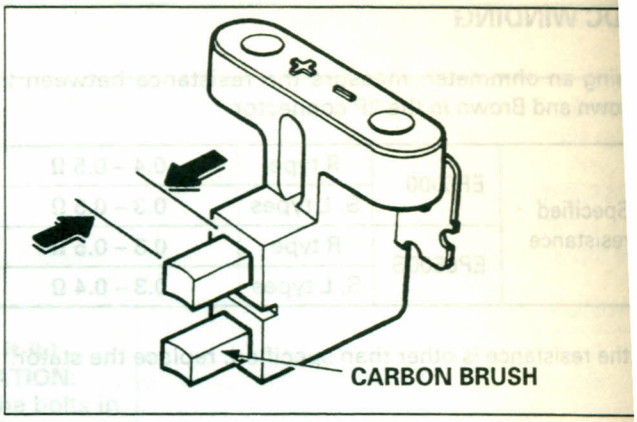




• CARBON BRUSH/SLIP RING

1) Remove the brush holder. Check the brush for length, wearing condition or any other defect. Replace if the length is less than 5 mm (0.2 in).

2) Visually inspect the slip rings for freedom from dust, rust or other damage. If necessary, wipe them with a clean lint-free cloth. If they are rusted or damaged, remove the rotor and dress with fine emery cloth (No. 500 – 600).



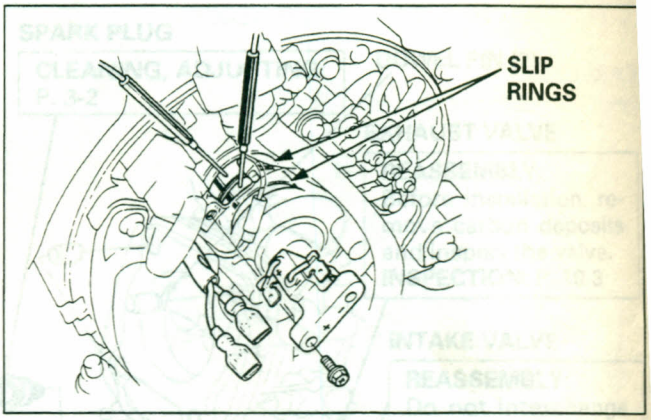
• FIELD WINDING

Remove the brushes and measure resistance between the slip rings.

If the specified resistance is obtained at the slip rings, but

Specified resistance	EP5000	55 – 65 Ω
	EP6500S	57 – 67 Ω

not at the brush terminals, clean or replace the brushes.
If the specified resistance is not obtained at the slip rings, clean or replace the rotor.



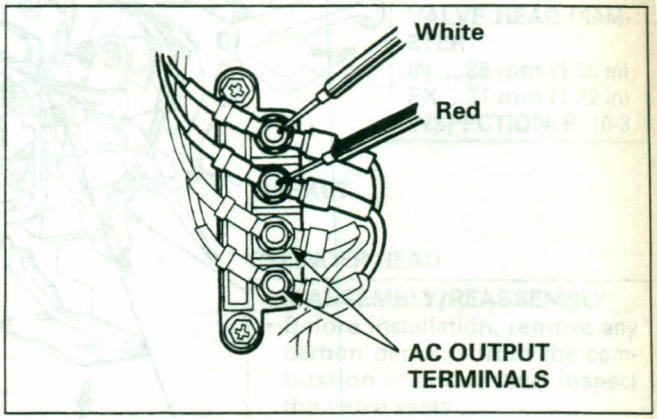
• MAIN WINDING (AC)

Using an ohmmeter, measure the resistance between the AC output terminals.

Specified resistance	EP5000	R type	0.8 – 1.0 Ω
		S type	0.6 – 0.9 Ω
		L type	0.1 – 0.3 Ω (120 V)/ 0.7 – 0.9 Ω (240 V)
	EP6500S	R type	0.5 – 0.7 Ω
		S type	0.3 – 0.4 Ω
		L type	0.1 – 0.2 Ω (120 V)/ 0.5 – 0.7 Ω (240 V)

NOTE

- Set the voltage selector switch to 120 V position (L type only).

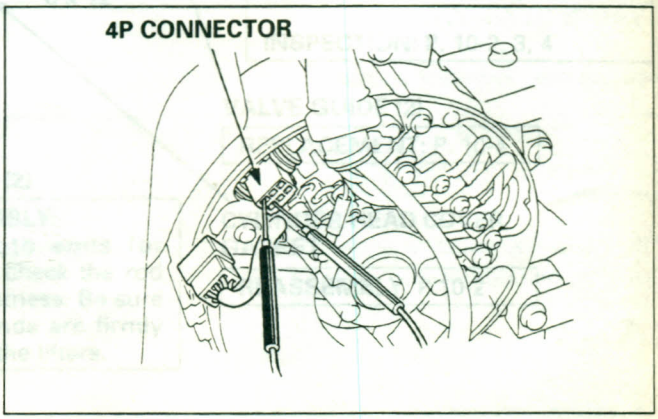


If the resistance is zero or infinity, replace the stator.

• EXCITER WINDING

Using an ohmmeter, measure the resistance between the Blue and Blue in the 4P connector.

Specified resistance	EP5000	R type	1.1 – 1.2 Ω
		S, L types	0.8 – 1.0 Ω
	EP6500S	R type	1.1 – 1.3 Ω
		S, L types	0.9 – 1.1 Ω

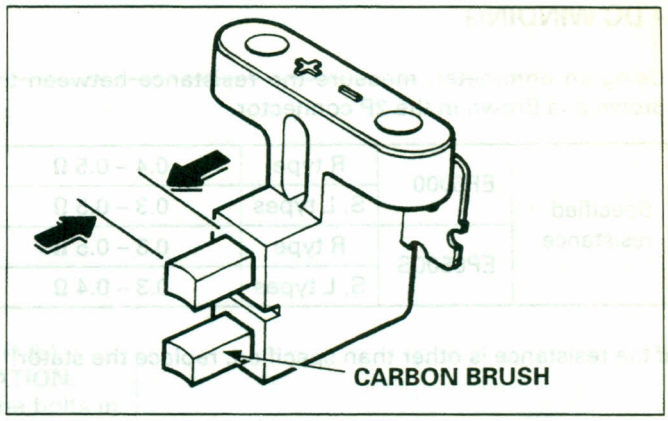


If the resistance is zero or infinity, replace the stator.

• CARBON BRUSH/SLIP RING

1) Remove the brush holder. Check the brush for length, wearing condition or any other defect. Replace if the length is less than 5 mm (0.2 in).

2) Visually inspect the slip rings for freedom from dust, rust or other damage. If necessary, wipe them with a clean lint-free cloth. If they are rusted or damaged, remove the rotor and dress with fine emery cloth (No. 500 – 600).



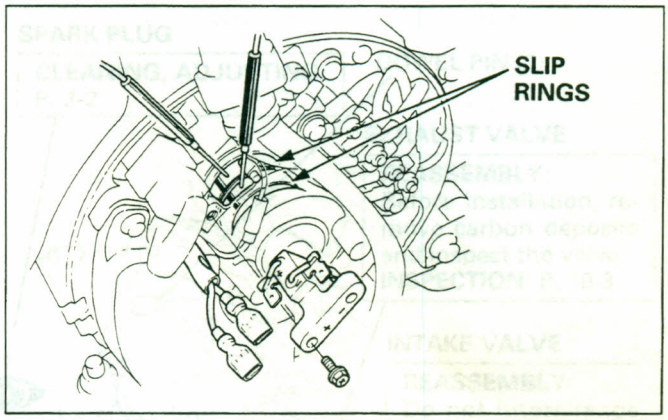
• FIELD WINDING

Remove the brushes and measure resistance between the slip rings.

If the specified resistance is obtained at the slip rings, but

Specified resistance	EP5000	55 – 65 Ω
	EP6500S	57 – 67 Ω

not at the brush terminals, clean or replace the brushes.
If the specified resistance is not obtained at the slip rings, clean or replace the rotor.



• MAIN WINDING (AC)

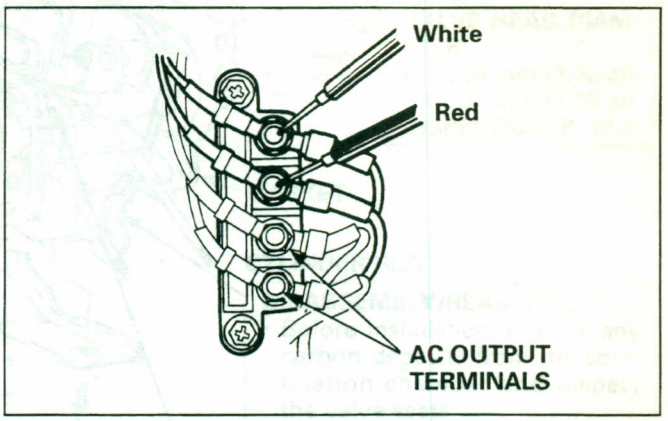
Using an ohmmeter, measure the resistance between the AC output terminals.

Specified resistance	EP5000	R type	0.8 – 1.0 Ω
		S type	0.6 – 0.9 Ω
		L type	0.1 – 0.3 Ω (120 V)/ 0.7 – 0.9 Ω (240 V)
	EP6500S	R type	0.5 – 0.7 Ω
		S type	0.3 – 0.4 Ω
		L type	0.1 – 0.2 Ω (120 V)/ 0.5 – 0.7 Ω (240 V)

NOTE

- Set the voltage selector switch to 120 V position (L type only).

If the resistance is zero or infinity, replace the stator.

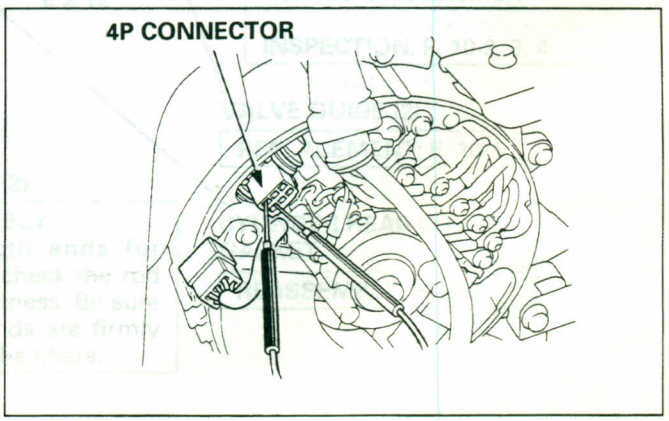


• EXCITER WINDING

Using an ohmmeter, measure the resistance between the Blue and Blue in the 4P connector.

Specified resistance	EP5000	R type	1.1 – 1.2 Ω
		S, L types	0.8 – 1.0 Ω
	EP6500S	R type	1.1 – 1.3 Ω
		S, L types	0.9 – 1.1 Ω

If the resistance is zero or infinity, replace the stator.

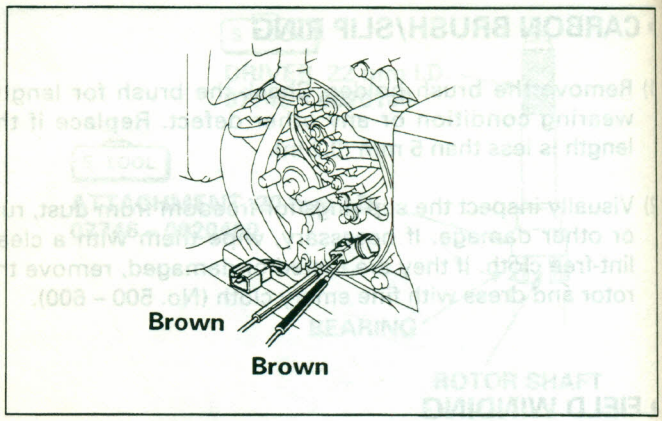


• DC WINDING

Using an ohmmeter, measure the resistance between the Brown and Brown in the 2P connector.

Specified resistance	EP5000	R type	0.4 – 0.5 Ω
		S, L types	0.3 – 0.5 Ω
	EP6500S	R type	0.3 – 0.5 Ω
		S, L types	0.3 – 0.4 Ω

If the resistance is other than specified, replace the stator.



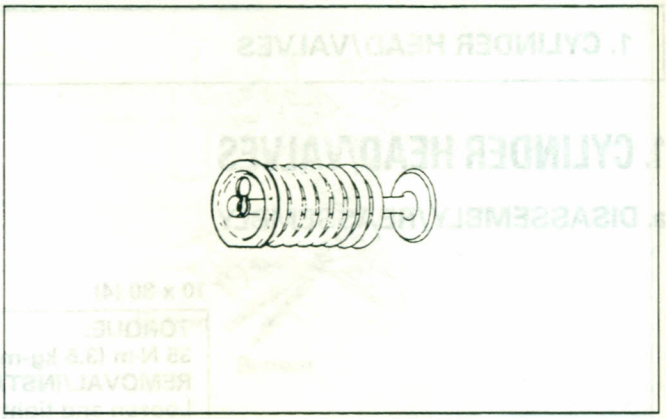
• VALVE SPRING RETAINER

DISASSEMBLY:
Push down and slide the retainer to the side, so the valve stem slips through the hole at the side of the retainer.

REASSEMBLY:
The exhaust valve retainer has a larger center recess than the intake valve retainer, so it can accept the valve rotator.

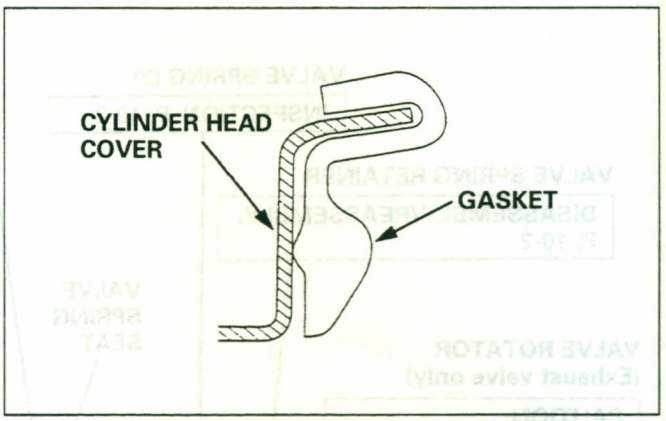
CAUTION

- **Do not remove the valve spring retainers while the cylinder head is installed, or the valves will drop into the cylinder.**



• CYLINDER HEAD COVER GASKET

REASSEMBLY:
Install the gasket as shown.



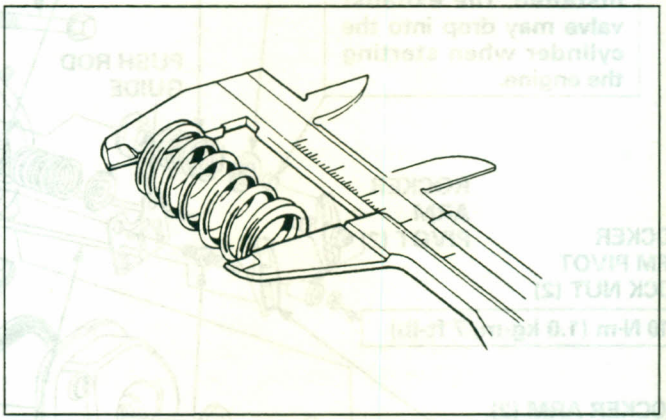
b. INSPECTION

• VALVE SPRING FREE LENGTH

Measure the free length of the valve springs.

Standard	Service limit
39.0 mm (1.54 in)	37.5 mm (1.48 in)

Replace the springs if they are shorter than the service limit.

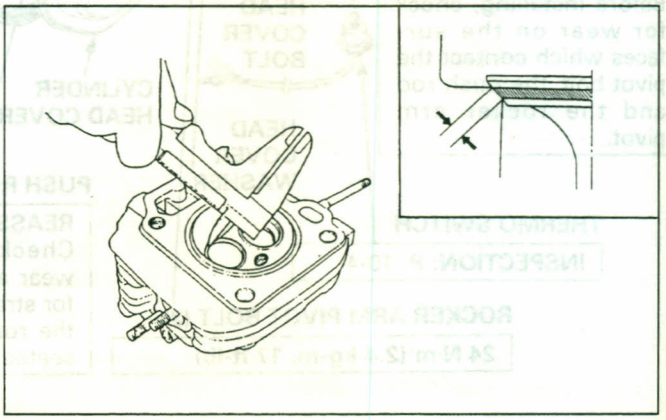


• VALVE SEAT WIDTH

Measure the valve seat width.

Standard	Service limit
1.1 mm (0.04 in)	2.0 mm (0.08 in)

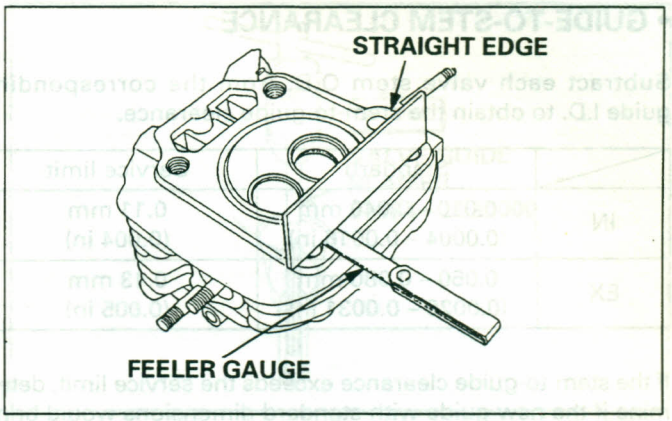
If the valve seat width is under the standard, or over the service limit, recondition the valve seat. (P. 10-5)

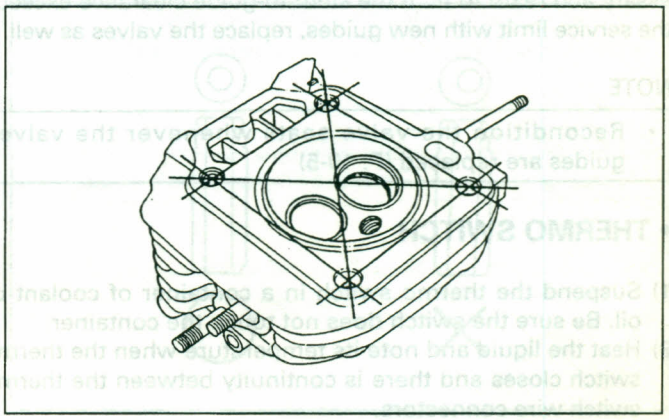


• CYLINDER HEAD

Remove carbon deposits from the combustion chamber. Clear off any gasket material from the cylinder head surface. Check the spark plug hole and valve areas for cracks. Check the cylinder head for warpage with a straight edge and a feeler gauge.

Service limit	0.10 mm (0.004 in)



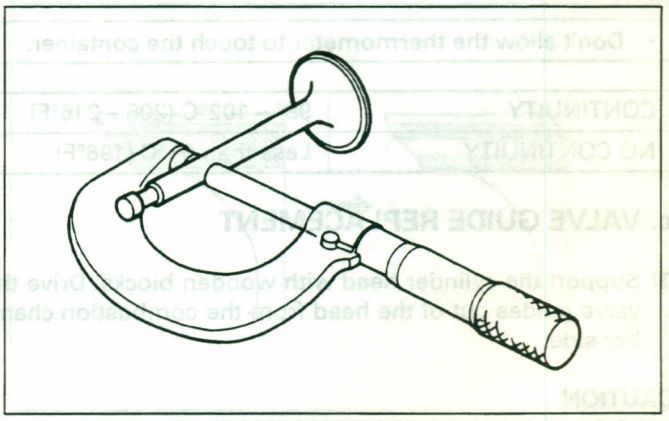


• VALVE STEM O.D.

Inspect each valve for face irregularities, bending or abnormal stem wear. Replace the valve if necessary. Measure and record each valve stem O.D.

	Standard	Service limit
IN	6.59 mm (0.259 in)	6.44 mm (0.254 in)
EX	6.55 mm (0.258 in)	6.40 mm (0.252 in)

Replace the valves if their O.D. is smaller than the service limit.



• VALVE GUIDE I.D.

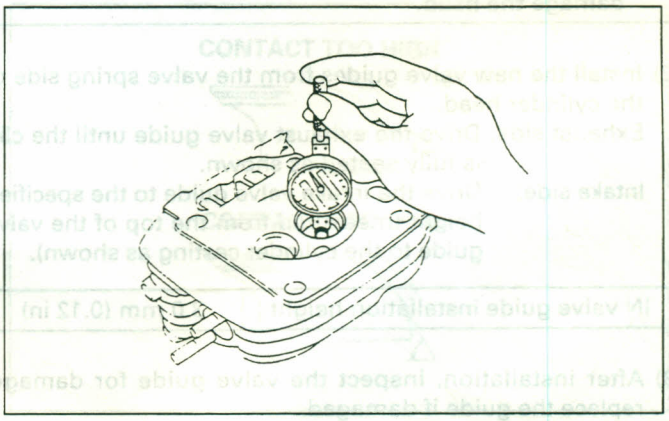
NOTE

- Clean the valve guides to remove any carbon deposits before measuring.

Measure and record each valve guide I.D.

Standard	Service limit
6.60 mm (0.260 in)	6.66 mm (0.262 in)

Replace the guides if they are over the service limit. (P. 10-4).



• GUIDE-TO-STEM CLEARANCE

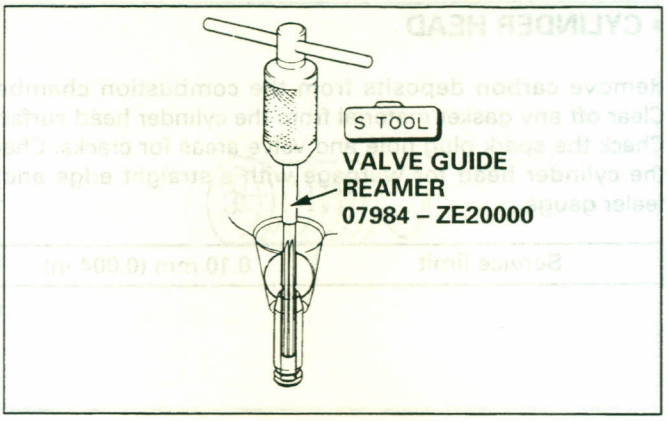
Subtract each valve stem O.D. from the corresponding guide I.D. to obtain the stem-to-guide clearance.

	Standard	Service limit
IN	0.010 – 0.040 mm (0.0004 – 0.0016 in)	0.11 mm (0.004 in)
EX	0.050 – 0.080 mm (0.0020 – 0.0031 in)	0.13 mm (0.005 in)

If the stem-to-guide clearance exceeds the service limit, determine if the new guide with standard dimensions would bring the clearance within tolerance. If so, replace any guide as necessary and ream to fit. If the stem-to-guide clearance exceeds the service limit with new guides, replace the valves as well.

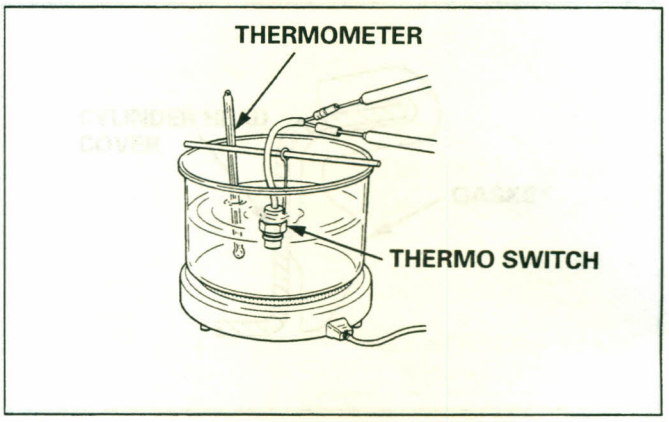
NOTE

- Recondition the valve seats whenever the valve guides are replaced (P. 10-5)



• THERMO SWITCH

1) Suspend the thermo switch in a container of coolant or oil. Be sure the switch does not touch the container.
2) Heat the liquid and note its temperature when the thermo switch closes and there is continuity between the thermo switch wire connectors.



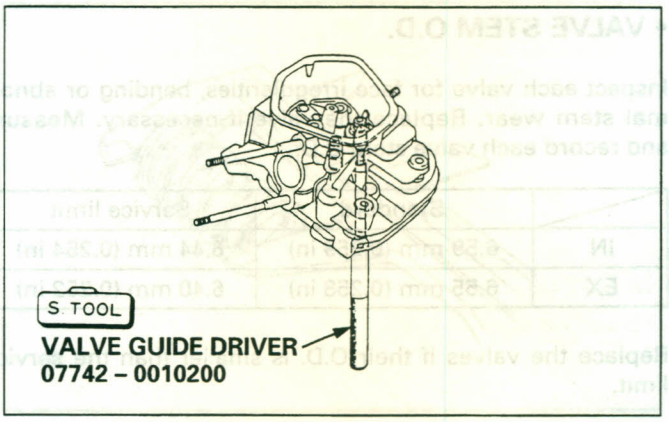
NOTE

- Don't allow the thermometer to touch the container.

CONTINUITY	98° – 102°C (208 – 216°F)
NO CONTINUITY	Less than 91°C (196°F)

c. VALVE GUIDE REPLACEMENT

1) Support the cylinder head with wooden blocks. Drive the valve guides out of the head from the combustion chamber side.

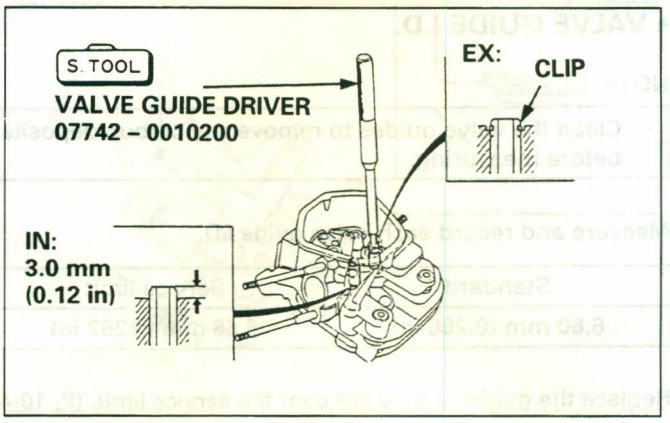


CAUTION

- **When driving the valve guides out, be careful not to damage the head.**

2) Install the new valve guides from the valve spring side of the cylinder head.
   Exhaust side: Drive the exhaust valve guide until the clip is fully seated as shown.
   Intake side: Drive the intake valve guide to the specified height (measured from the top of the valve guide to the cylinder casting as shown).

IN valve guide installation height	3.0 mm (0.12 in)



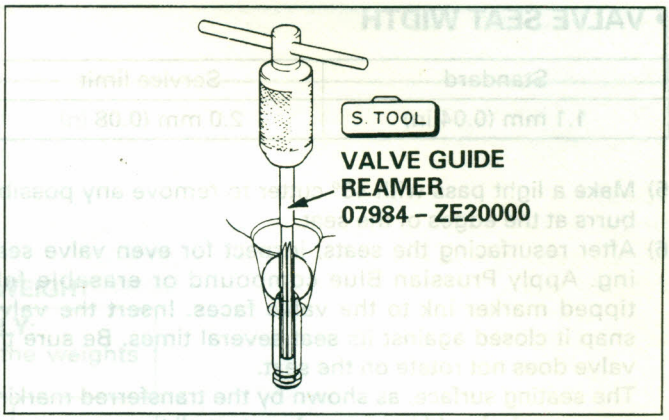
3) After installation, inspect the valve guide for damage; replace the guide if damaged.

• VALVE GUIDE REAMING

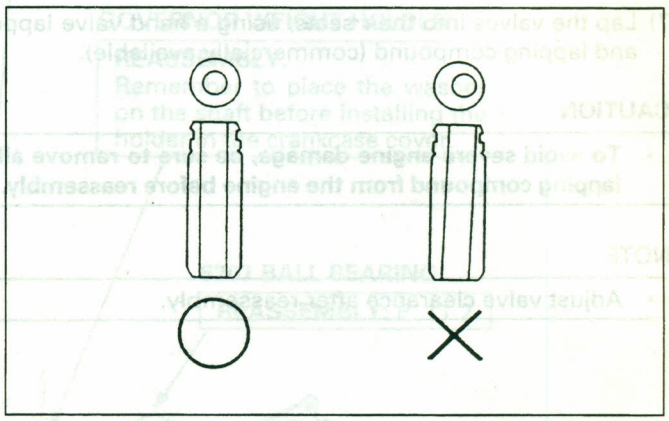
NOTE

- For best results, be sure the cylinder head is at room temperature before reaming valve guides.

1) Coat the reamer and valve guide with cutting oil.
2) Rotate the reamer clockwise through the valve guide the full length of the reamer.
3) Continue to rotate the reamer clockwise while removing it from the valve guide.

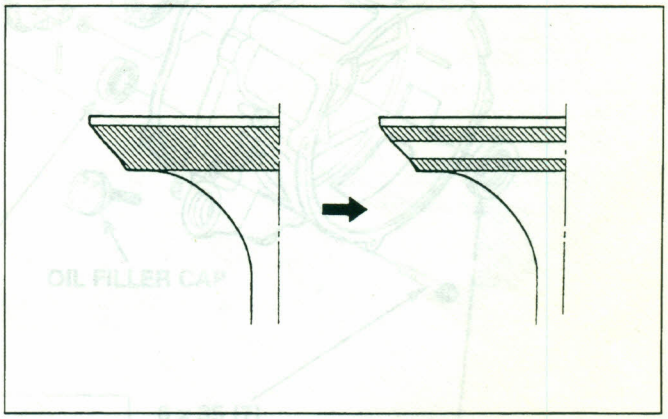


4) Thoroughly clean the cylinder head to remove any cutting residue.
5) Check the valve guide bore; it should be straight, round and centered in the valve guide. Insert the valve and check operation. If the valve does not operate smoothly, the guide may have been bent during installation. Replace the valve guide if it is bent or damaged.
6) Check the Valve Guide-to-Stem Clearance (P. 10-4).



d. VALVE SEAT RECONDITIONING

1) Thoroughly clean the combustion chamber and valve seats to remove carbon deposits.
Apply a light coat of Prussian Blue or erasable felt-tipped marker ink to the valve face.
2) Insert the valve, and snap it closed against its seat several times. Be sure the valve does not rotate on the seat. The transferred marking compound will show any area of the seat that is not concentric.

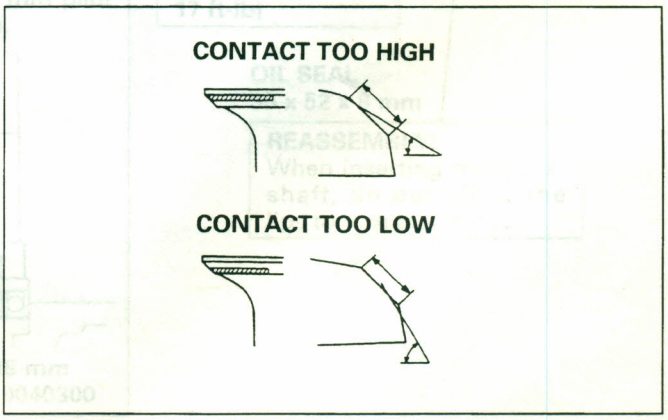


NOTE

- Follow the instructions of the valve seat cutter manufacturer.

3) Using a 45° cutter, remove enough material to produce a smooth and concentric seat.
Turn the cutter clockwise, never counterclockwise.
Continue to turn the cutter as you lift it from the valve seat.

4) Use the 30° – 32° and 60° cutters to narrow and adjust the valve seat so that it contacts the middle of the valve face. The 30° – 32° cutter removes material from the top edge (contact too high). The 60° cutter removes material from the bottom edge (contact too low). Be sure that the width of the finished valve seat is within specification.

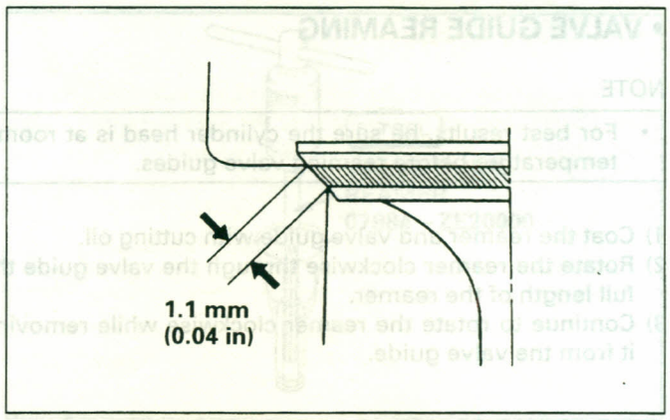


• VALVE SEAT WIDTH

Standard	Service limit
1.1 mm (0.04 in)	2.0 mm (0.08 in)

5) Make a light pass with 45° cutter to remove any possible burrs at the edges of the seat.
6) After resurfacing the seats, inspect for even valve seating. Apply Prussian Blue compound or erasable felt-tipped marker ink to the valve faces. Insert the valve, snap it closed against its seat several times. Be sure the valve does not rotate on the seat.
   The seating surface, as shown by the transferred marking compound, should have good contact all the way around.

7) Lap the valves into their seats, using a hand valve lapper and lapping compound (commercially available).

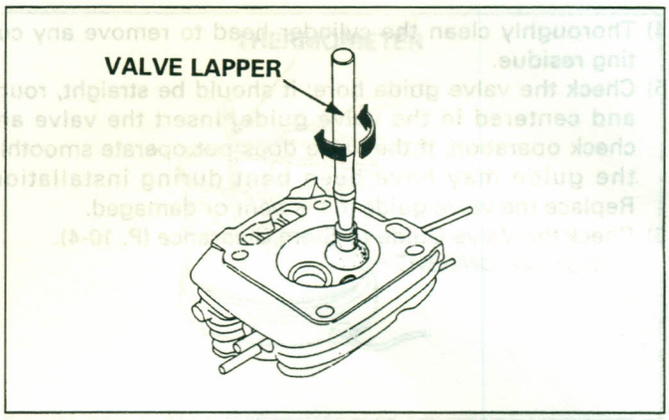


CAUTION

- **To avoid severe engine damage, be sure to remove all lapping compound from the engine before reassembly.**

NOTE

- Adjust valve clearance after reassembly.



1. CRANKCASE COVER/GOVERNOR

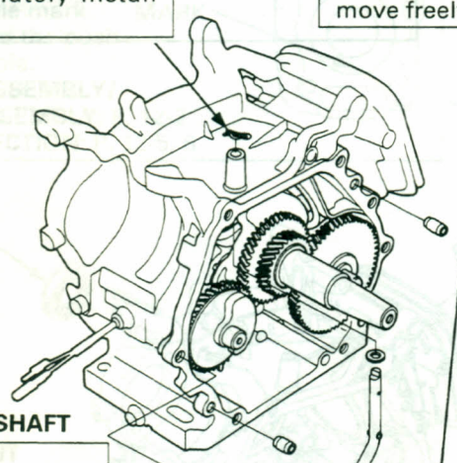
a. DISASSEMBLY/REASSEMBLY

LOCK PIN

REASSEMBLY:
After installing the governor shaft, immediately install the lock pin.

GOVERNOR WEIGHT

REASSEMBLY:
Check that the weights move freely.



GOVERNOR WEIGHT HOLDER

REASSEMBLY:
Remember to place the washer on the shaft before installing the holder in the crankcase cover.

6207 BALL BEARING

REASSEMBLY: P. 11-2

GOVERNOR ARM SHAFT

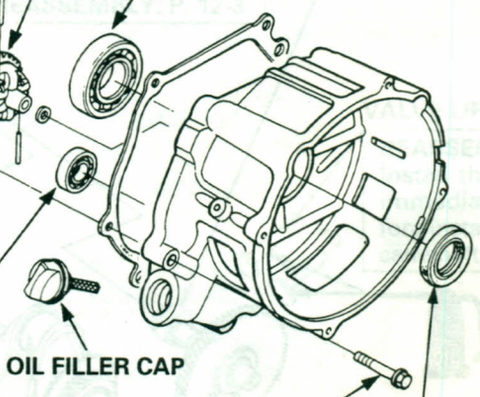
REASSEMBLY:
After installing, rotate the shaft to the side as shown.

GOVERNOR SLIDER

REASSEMBLY:
After installation, check for smooth operation.

CLIP

REASSEMBLY:
Open the governor weights, and install the clip, washer, and slider on the shaft. Be sure the clip is seated in the shaft groove.



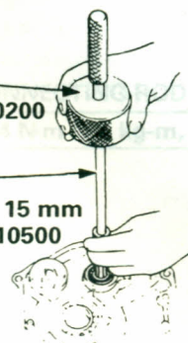
OIL FILLER CAP

6202 BALL BEARING

DISASSEMBLY:
Remove the bearing using the 15 mm bearing remover (special tool).

S TOOL
WEIGHT
07936 – 3710200

BEARING REMOVER, 15 mm
07936 – KC10500

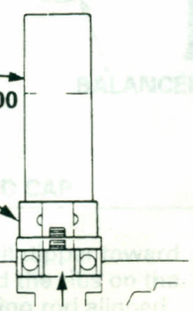


REASSEMBLY:
Drive the bearing in using the 32 x 35 mm attachment, 15 mm pilot and driver (special tools).

S TOOL
DRIVER
07749 – 0010000

ATTACHMENT, 32 x 35 mm
07746 – 0010100

PILOT, 15 mm
07746 – 0040300



6 x 35 (7)

24 N·m (2.4 kg-m, 17 ft-lb)

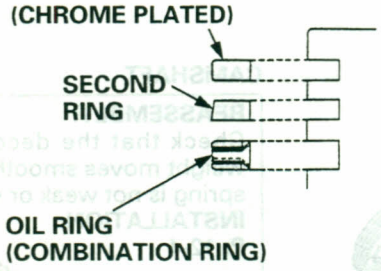
OIL SEAL
35 x 52 x 8 mm

REASSEMBLY:
When inserting the crankshaft, do not allow the lips to turn inside out.

• PISTON

PISTON RING

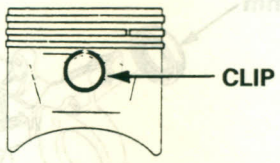
REASSEMBLY:
- Install all rings with the marking facing upward.
- Be sure that the top and second rings are not interchanged.
- Check that the rings rotate smoothly after installation.
- Space the piston ring end gaps 120 degrees apart, and do not align the gaps with the piston pin bore.

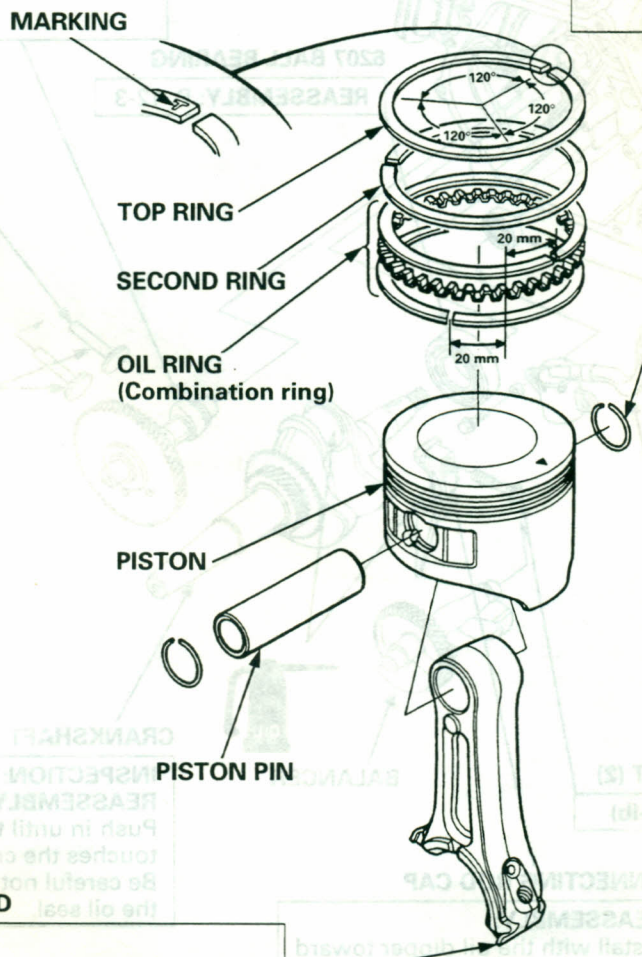


INSPECTION: P. 12-5, 6

PISTON PIN CLIP (2)

REASSEMBLY:
Install by setting one end of the clip in the piston groove, holding the other end with long-nosed pliers, and rotating the clip in.
Do not align the end gap of the clip with the cutout in the piston pin bore.





CONNECTING ROD

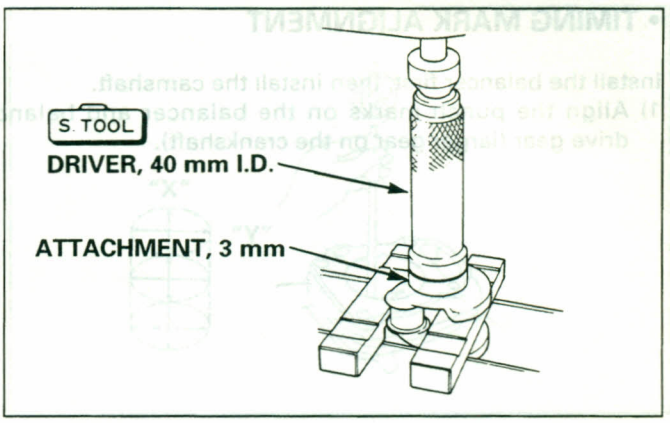
REASSEMBLY:
Install the connecting rod with the long end toward the triangle marked side of the piston.

• CRANKSHAFT BEARING (6207)

REASSEMBLY:
Apply oil to inside of the bearing and install it with following tools.

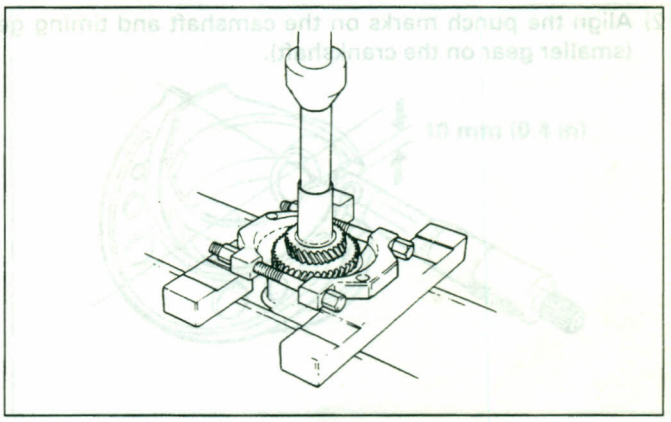
TOOLS:

Driver, 40 mm I.D.	**07746 – 0030100**
Attachment, 35 mm I.D.	**07746 – 0030400**

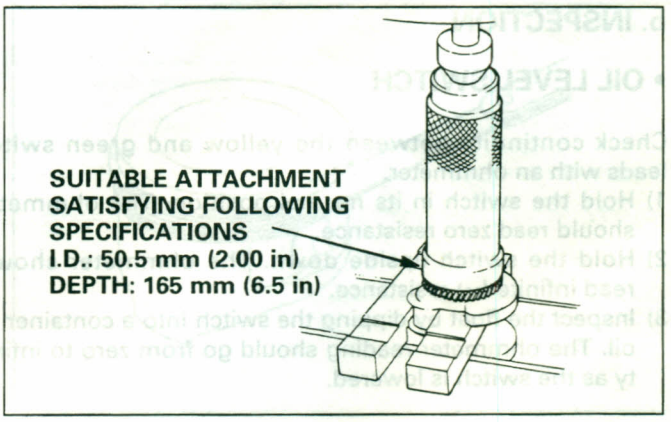


• TIMING GEAR/BALANCER GEAR

DISASSEMBLY:
Make a mark on the crankshaft, balancer gear and timing gear, then press the timing or balancer gear out of the crankshaft using a commercially available bearing puller and hydraulic press.



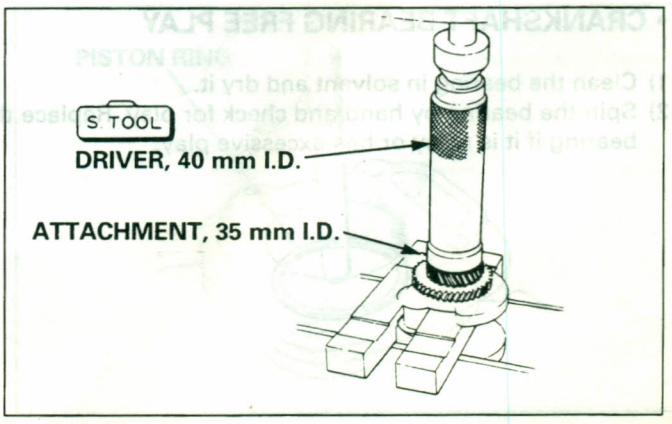
REASSEMBLY:
1) BALANCER DRIVE GEAR OR GOVERNOR DRIVER GEAR
Using the old gear for reference, make a mark at the same position on the new gear.
Using a hydraulic press, driver and suitable attachment, press the new gear onto the crankshaft.



2) TIMING GEAR
Using the old gear for reference, make a mark at the same position on the new gear.
Using a hydraulic press and following tools, press onto the crankshaft.

TOOLS:

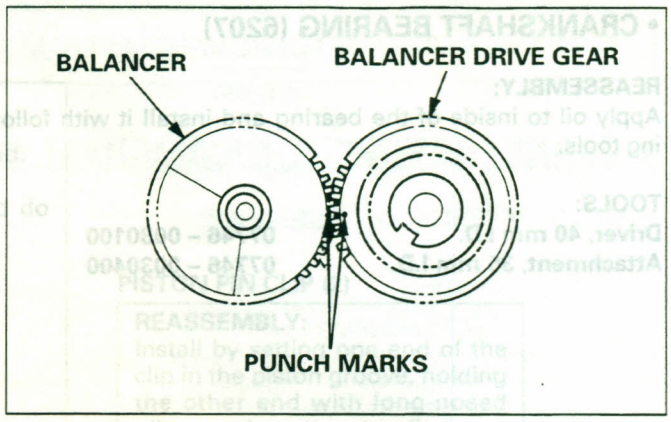
Driver, 40 mm I.D.	**07746 – 0030100**
Attachment, 35 mm I.D.	**07746 – 0030400**



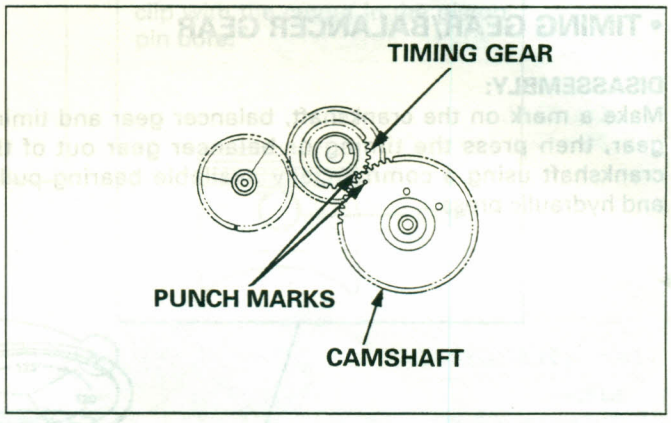
• TIMING MARK ALIGNMENT

Install the balancer first, then install the camshaft.

1) Align the punch marks on the balancer and balancer drive gear (larger gear on the crankshaft).



2) Align the punch marks on the camshaft and timing gear (smaller gear on the crankshaft).

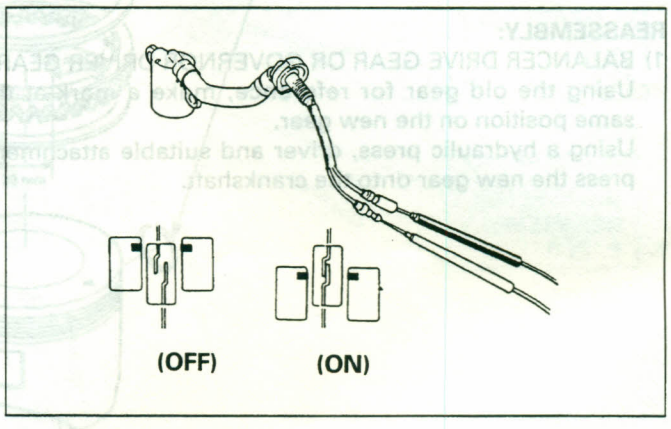


b. INSPECTION

• OIL LEVEL SWITCH

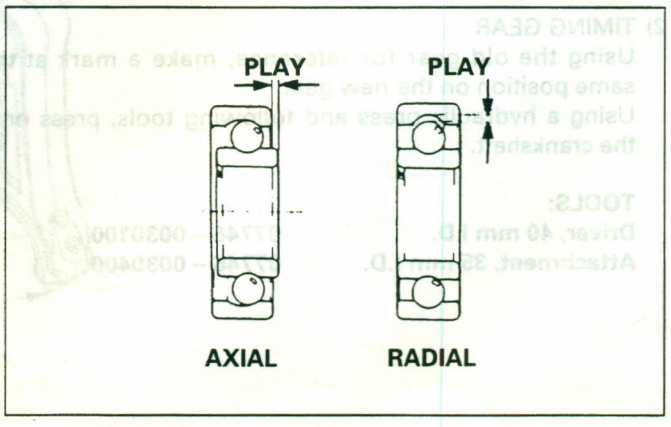
Check continuity between the yellow and green switch leads with an ohmmeter.

1) Hold the switch in its normal position. The ohmmeter should read zero resistance.
2) Hold the switch upside down. The ohmmeter should read infinite (∞) resistance.
3) Inspect the float by dipping the switch into a container of oil. The ohmmeter reading should go from zero to infinity as the switch is lowered.



• CRANKSHAFT BEARING FREE PLAY

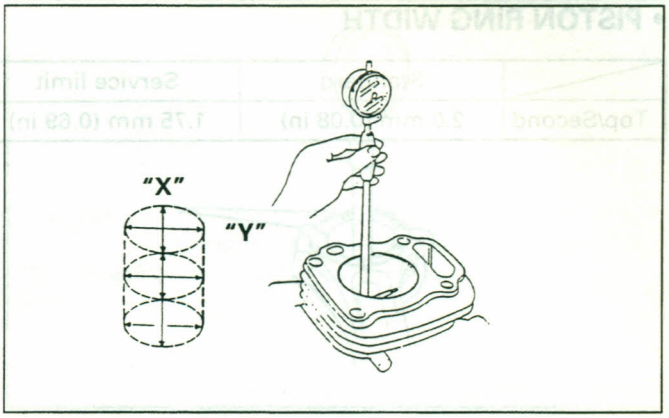
1) Clean the bearing in solvent and dry it.
2) Spin the bearing by hand and check for play. Replace the bearing if it is noisy or has excessive play.



• CYLINDER I.D.

Measure and record the cylinder I.D. at three levels in both "X" axis (perpendicular to crankshaft) and "Y" axis (parallel to crankshaft). Take the maximum reading to determine cylinder wear and taper.

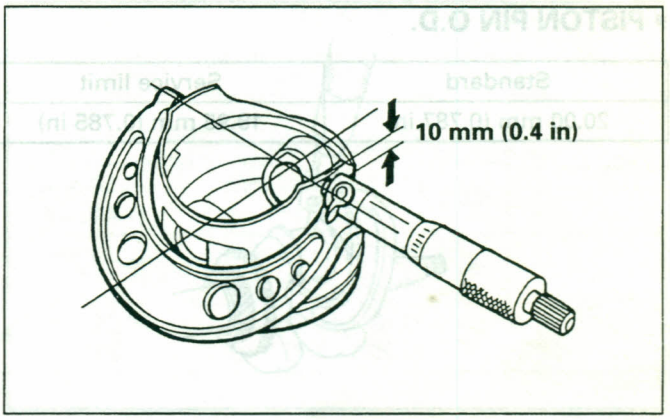
	Standard	Service limit
EP5000	82.00 mm (3.228 in)	82.17 mm (3.235 in)
EP6500S	88.00 mm (3.465 in)	88.17 mm (3.471 in)



• PISTON SKIRT O.D.

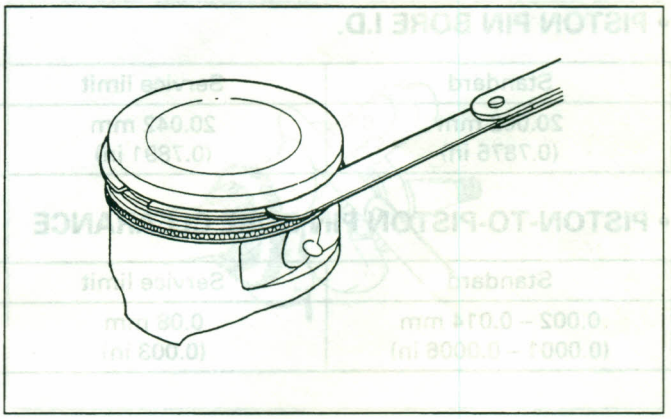
Measure and record the piston O.D. at a point 10 mm (0.4 in) from the bottom of the skirt and 90° to the piston pin bore.

	Standard	Service limit
EP5000	81.985 mm (3.2277 in)	81.85 mm (3.222 in)
EP6500S	87.985 mm (3.4640 in)	87.85 mm (3.459 in)



• PISTON-TO-CYLINDER CLEARANCE

Standard	Service limit
0.015 – 0.052 mm (0.0006 – 0.0020 in)	0.12 mm (0.005 in)



• PISTON RING SIDE CLEARANCE

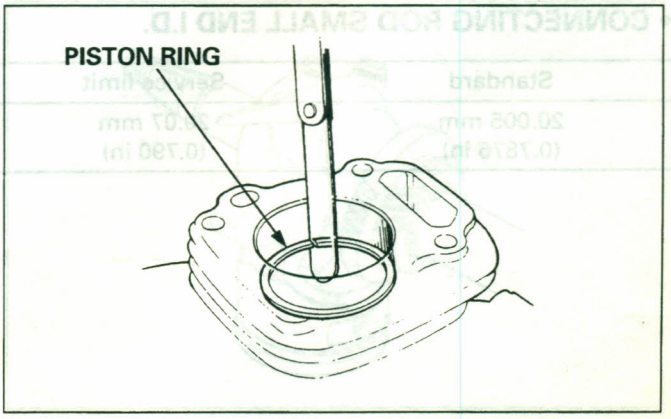
	Standard	Service limit
Top/Second	0.030 – 0.060 mm (0.0012 – 0.0024 in)	0.15 mm (0.006 in)

• PISTON RING END GAP

	Standard	Service limit
Top/Second Oil	0.2 – 0.7 mm (0.01 – 0.03 in)	1.0 mm (0.04 in)

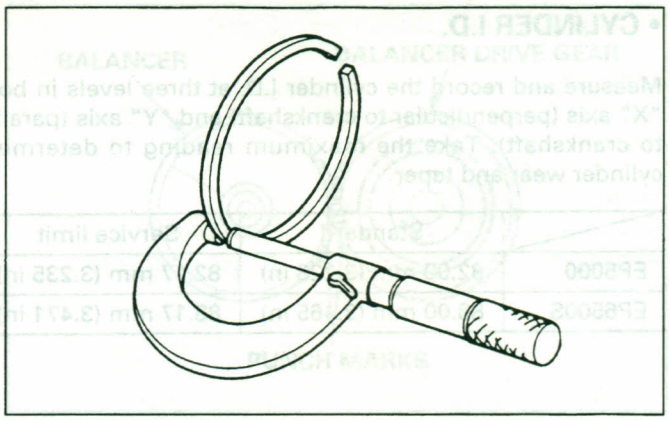
NOTE

- Use the top of the piston to position the ring horizontally in the cylinder.



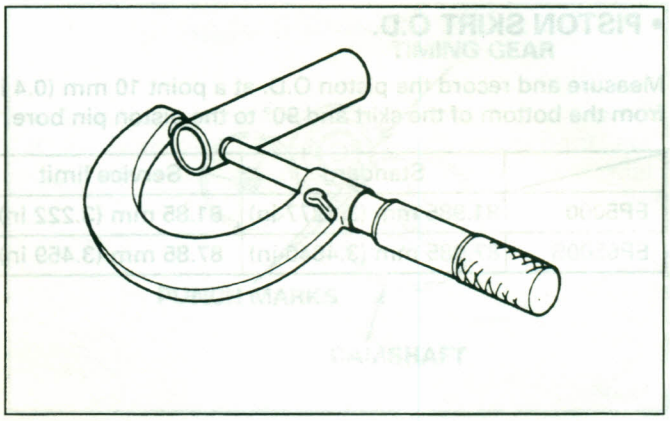
• PISTON RING WIDTH

	Standard	Service limit
Top/Second	2.0 mm (0.08 in)	1.75 mm (0.69 in)



• PISTON PIN O.D.

Standard	Service limit
20.00 mm (0.787 in)	19.95 mm (0.785 in)

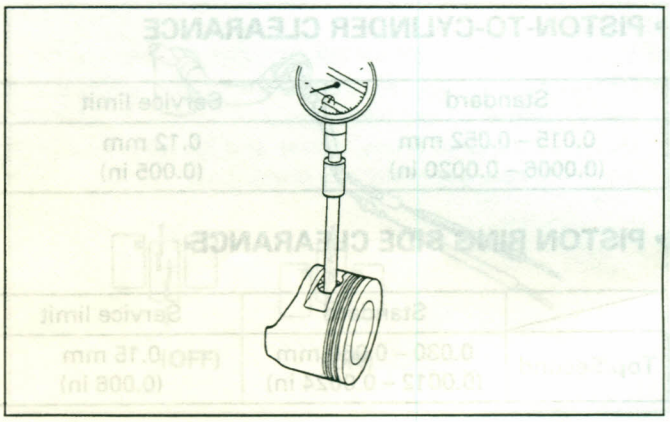


• PISTON PIN BORE I.D.

Standard	Service limit
20.002 mm (0.7875 in)	20.042 mm (0.7891 in)

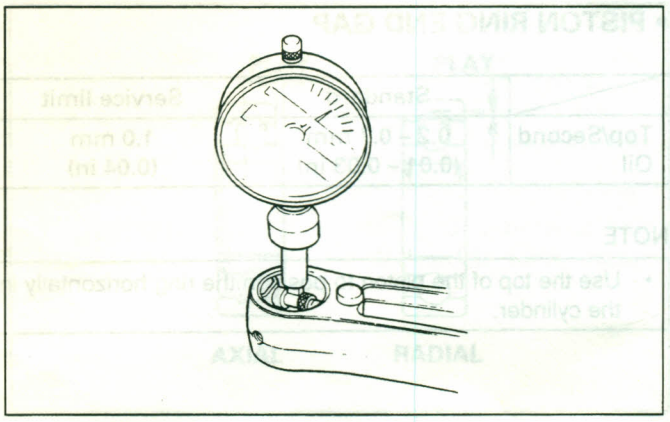
• PISTON-TO-PISTON PIN BORE CLEARANCE

Standard	Service limit
0.002 – 0.014 mm (0.0001 – 0.0006 in)	0.08 mm (0.003 in)



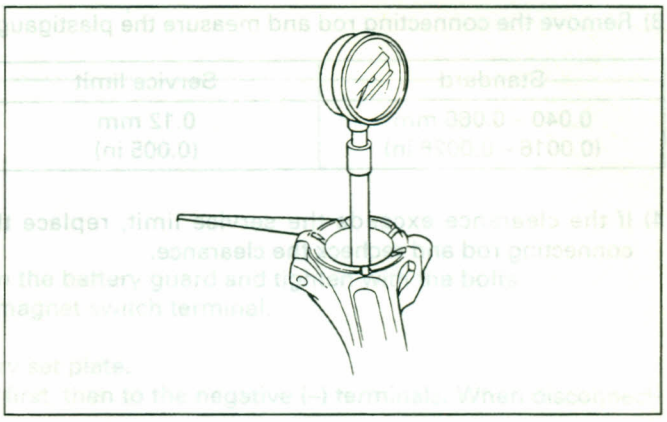
• CONNECTING ROD SMALL END I.D.

Standard	Service limit
20.005 mm (0.7876 in)	20.07 mm (0.790 in)



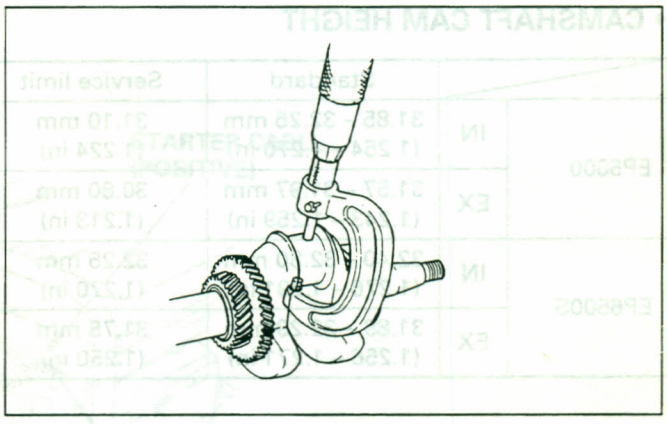
• CONNECTING ROD BIG END I.D.

Standard	Service limit
36.025 mm (1.4183 in)	36.07 mm (1.420 in)



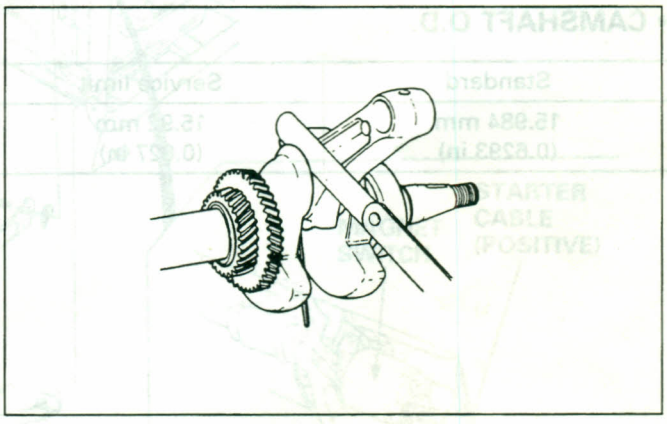
• CRANK PIN O.D.

Standard	Service limit
35.985 mm (1.4167 in)	35.93 mm (1.415 in)



• CONNECTING ROD BIG END SIDE CLEARANCE

Standard	Service limit
0.1 – 0.7 mm (0.004 – 0.028 in)	1.0 mm (0.04 in)



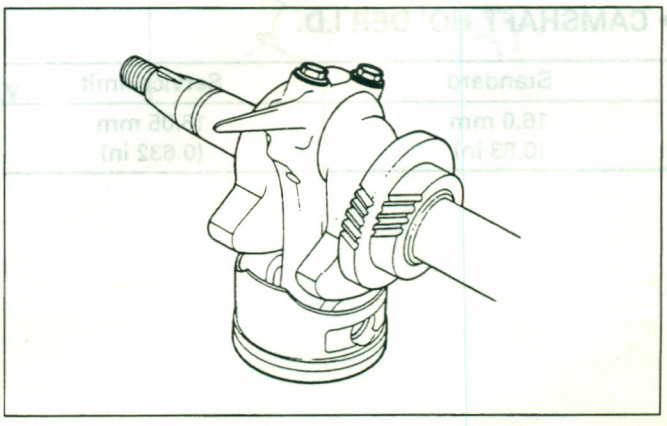
• CONNECTING ROD BIG END OIL CLEARANCE

1) Clean all from the crankpin and connecting rod big end surfaces.
2) Place a piece of plastigauge on the crankpin, install the connecting rod and cap, and tighten the bolts to the specified torque.

TORQUE: 14 N·m (1.4 kg-m, 10 ft-lb)

NOTE

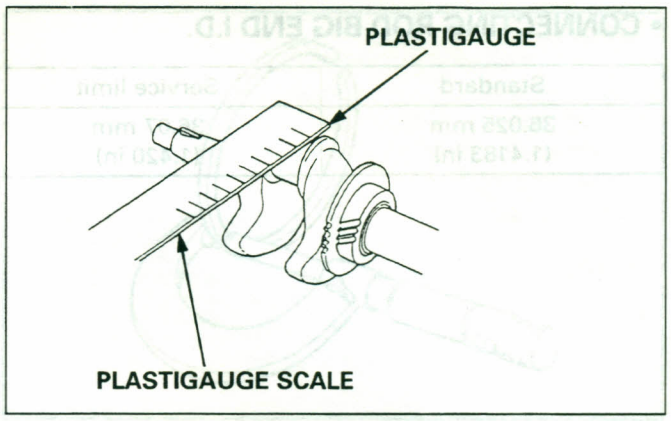
- Do not rotate the crankshaft while the plastigauge is in place.



3) Remove the connecting rod and measure the plastigauge.

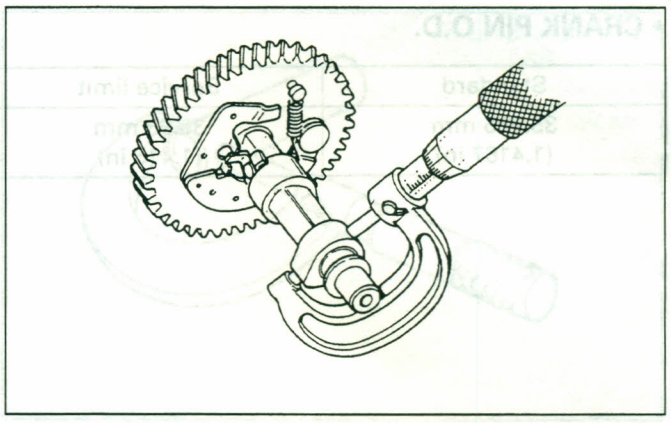
Standard	Service limit
0.040 – 0.066 mm (0.0016 – 0.0026 in)	0.12 mm (0.005 in)

4) If the clearance exceeds the service limit, replace the connecting rod and recheck the clearance.



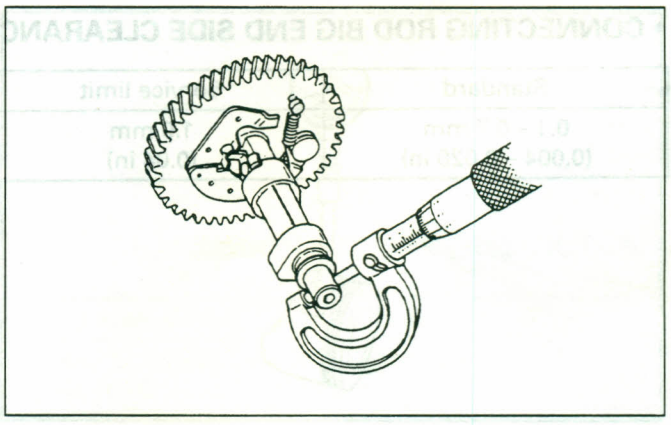
• CAMSHAFT CAM HEIGHT

		Standard	Service limit
EP5000	IN	31.85 – 32.25 mm (1.254 – 1.270 in)	31.10 mm (1.224 in)
	EX	31.57 – 31.97 mm (1.243 – 1.259 in)	30.80 mm (1.213 in)
EP6500S	IN	32.40 – 32.80 mm (1.276 – 1.291 in)	32.25 mm (1.270 in)
	EX	31.89 – 32.29 mm (1.256 – 1.271 in)	31.75 mm (1.250 in)



• CAMSHAFT O.D.

Standard	Service limit
15.984 mm (0.6293 in)	15.92 mm (0.627 in)



• CAMSHAFT HOLDER I.D.

Standard	Service limit
16.0 mm (0.63 in)	16.05 mm (0.632 in)