INTRODUCTION

This manual covers service and repair procedures for Honda EM10000•ET12000 Generators.

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

SAFETY MESSAGES

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

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

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

  These signal words mean:

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

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

  ⚠ CAUTION — You CAN be HURT if you don't follow instructions.
- Instructions — how to service this generator correctly and safely.

Honda Motor Co., Ltd.
Service Publications Office

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1. SPECIFICATIONS

• DIMENSIONS AND WEIGHTS

Model	EM10000		ET12000	
Description code	EATJ		EAUJ	
Type	R	RG	R	RG
Overall length	973 mm (38.3 in)			
Overall width	552 mm (21.7 in)			
Overall height	637 mm (25.1 in)			
Dry weight	150 kg (331 lbs)			
Carb weight	175.2 kg (386 lbs)			

• ENGINE

Model	GX620K1
Description code	GCAD
Type	4-stroke, overhead valve, 90° V-twin
Displacement	614 cm^3 (37.5 cu in)
Bore x Stroke	77 x 66 mm (3.0 x 2.6 in)
Maximum horsepower	14.9 kW (20 PS) at 3,600 min^{-1} (rpm)
Max. torque	44.1 N·m (4.5 kgf·m, 32.5 lbf·ft) at 2,500 min^{-1} (rpm)
Compression ratio	8.3 : 1
Cooling system	Forced-air cooling
Ignition system	Transistorized magneto ignition
Ignition timing	20° BTDC (Fixed)
Spark plug	ZGR5A (NGK), J16CR-U (DENSO)
Carburetor	Horizontal, butterfly valve type
Air cleaner	Dual element type
Governor	Centrifugal type
Lubrication system	Forced lubrication
Engine oil capacity	Oil change without oil filter replacement: Approx. 1.1 ℓ (1.16 US qt, 0.97 Imp qt)
	Oil change with oil filter replacement: Approx. 1.4 ℓ (1.48 US qt, 1.23 Imp qt)
	After disassembly: Approx. 1.7 ℓ (1.80 US qt, 1.50 Imp qt)
Starting system	Starter motor
Stopping system	Ignition primary circuit ground
Fuel used	Automotive unleaded gasoline (minimum 86 octane)
Rotation direction	Counterclockwise (view from generator side)

• GENERATOR

Model	EM10000	ET12000
Type	2-pole, rotating field type	
Generator structure	Self-ventilation, drip-proof type	
Excitation method	Self-excitation and battery excitation	
Voltage regulation system	Transistorized A.V.R.	
Phase	Single phase	Three phase
Efficiency	80%	
Cooling system	Forced air cooled	
Rotating direction	Counterclockwise (viewed from generator)	
Fuel tank capacity	30.8 ℓ (8.14 US gal, 6.78 Imp gal)	

2. CHARACTERISTICS

• EM10000

Type		R	RG
Maximum output		9,000 VA	
Rated output		8,000 VA	
Rated frequency		50 Hz	
Rated voltage		220 V	230 V
Rated current		36.4 A	34.8 A
Power factor		1.0 cos ϕ	
Voltage variation rate	Momentary	15 % max.	
	Average	7 % max.	
	Average time	5 sec. max.	
Voltage stability		± 1 %	
Frequency variation rate	Momentary	15 % max.	
	Average	7 % max.	
	Average time	5 sec. max.	
Frequency stability		± 1 Hz	
Insulation resistance		10 MΩ min.	
AC circuit protector		40 A	38 A
Engine speed (rated)		3,000 min^{-1} (rpm)	
Fuel consumption (at rated)		5.0 ℓ/hr. (5.0 US qt/hr., 4.4 Imp qt/hr.)	
Maximum operating hour without refueling		6.1 hours	
Noise level (L_{WA})		101 dB	

• **ET12000**

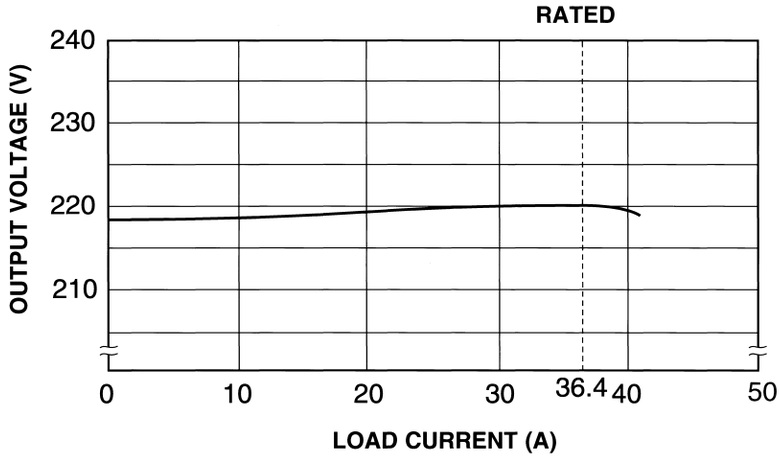
Type		R	RG
Maximum output (Three phase)		11,000 VA	
Rated output	Three phase	10,000 VA	
	Single phase	2,700 VA × 3	
Rated frequency		50 Hz	
Rated voltage	Three phase	380 V	400 V
	Single phase	220 V	230 V
Rated current	Three phase	15.2 A	14.4 A
	Single phase	12.1 A x 3	11.6 A × 3
Power factor	Three phase	0.8 cos ϕ	
	Single phase	1.0 cos ϕ	
Voltage variation rate (Three phase)	Momentary	15 % max.	
	Average	7 % max.	
	Average time	5 sec. max.	
Voltage stability (Three phase)		± 1 %	
Frequency variation rate (Three phase)	Momentary	15 % max.	
	Average	7 % max.	
	Average time	5 sec. max.	
Frequency stability (Three phase)		± 1 Hz	
Insulation resistance		10 MΩ min.	
AC circuit protector (Three phase)		17 A	16 A
Engine speed (rated)		3,000 min^{-1} (rpm)	
Fuel consumption (at rated)		5.0 ℓ/hr. (5.0 US qt/hr., 4.4 Imp qt/hr.)	
Maximum operating hour without refueling		6.1 hours	
Noise level (L_{WA})		101 dB	

3. PERFORMANCE CURVES

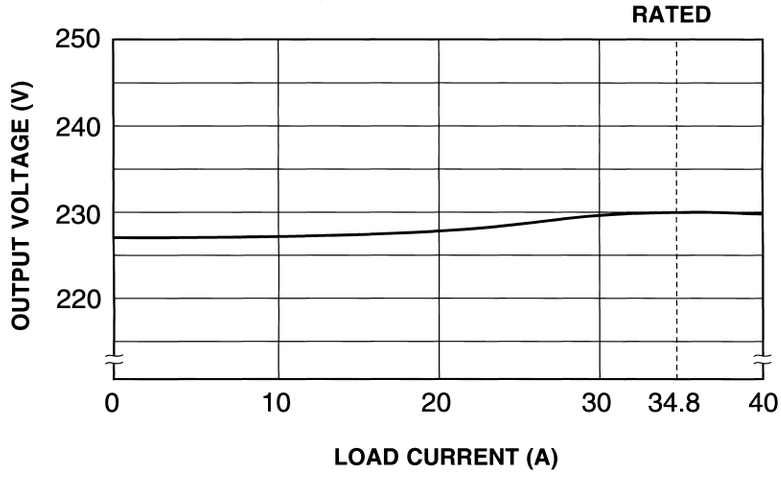
The curve shows performance of the generator under average condition.
Performance may vary to some degree depending on ambient temperature and humidity.
The output voltage will be higher than usual when the generator is still cold or immediately after the engine starts.

AC EXTERNAL CHARACTERISTIC CURVES

• EM10000 (R Type)

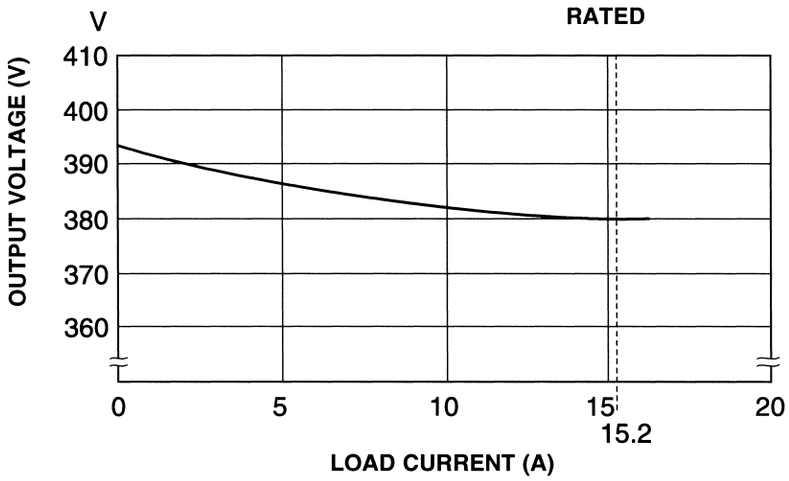


• EM10000 (RG Type)

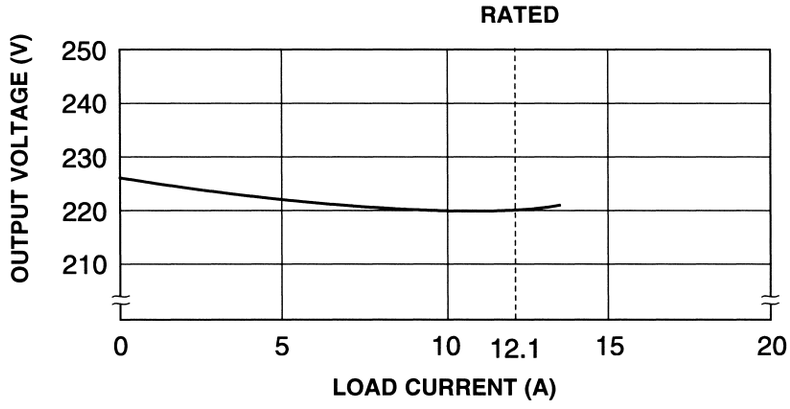


• ET12000 (R Type)

THREE PHASE OUTPUT

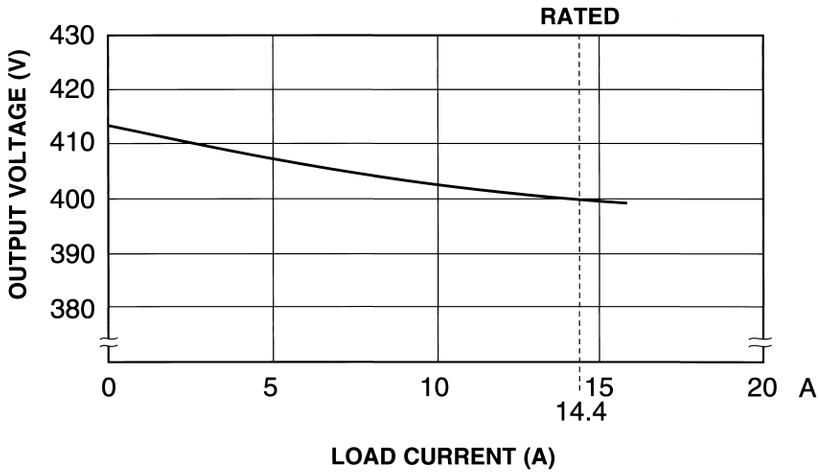


SINGLE PHASE OUTPUT

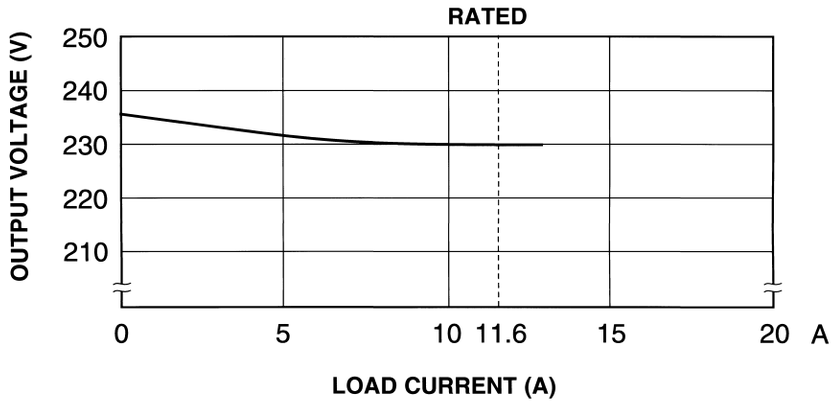


• **ET12000 (RG Type)**

THREE PHASE OUTPUT

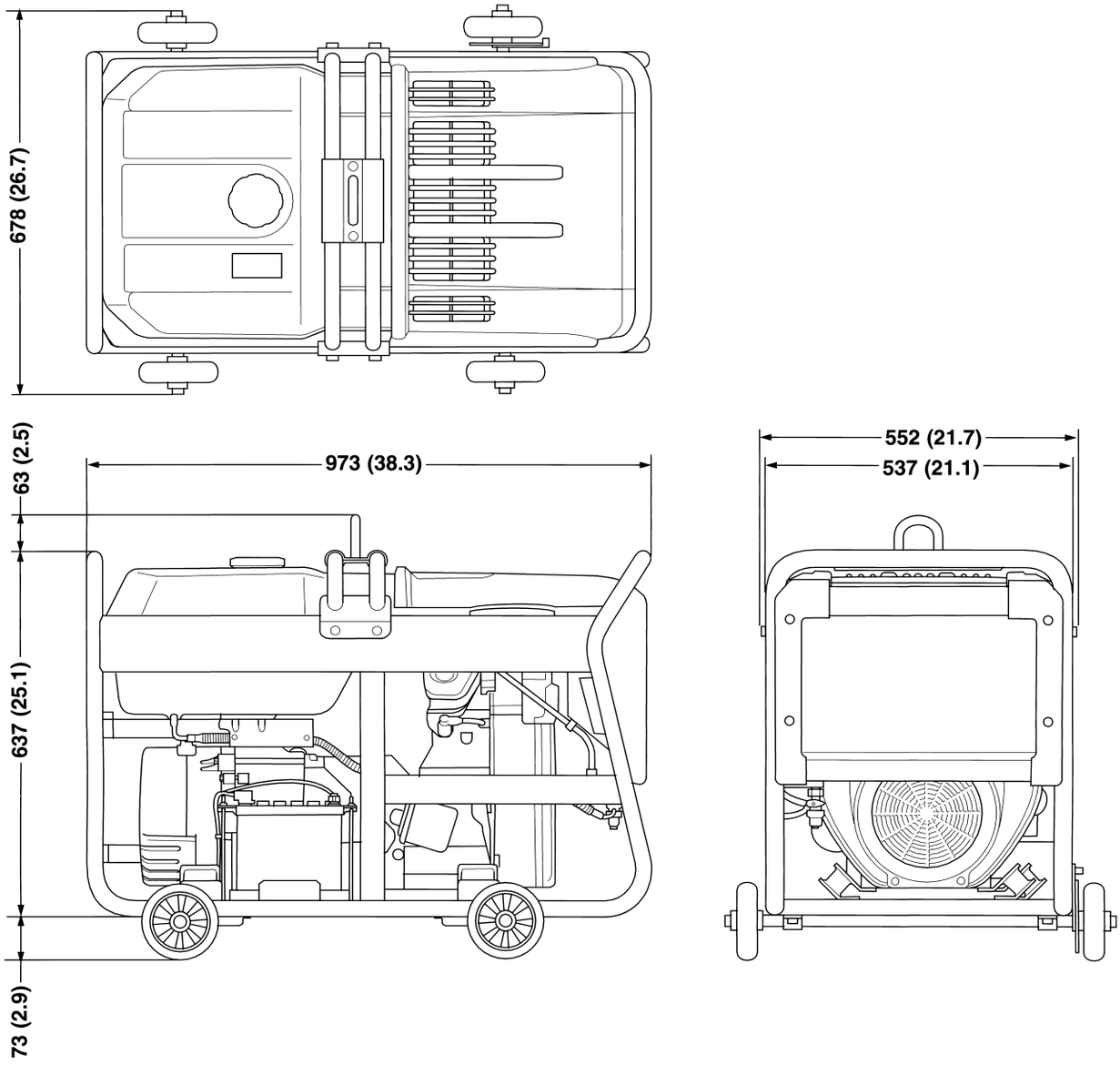


SINGLE PHASE OUTPUT



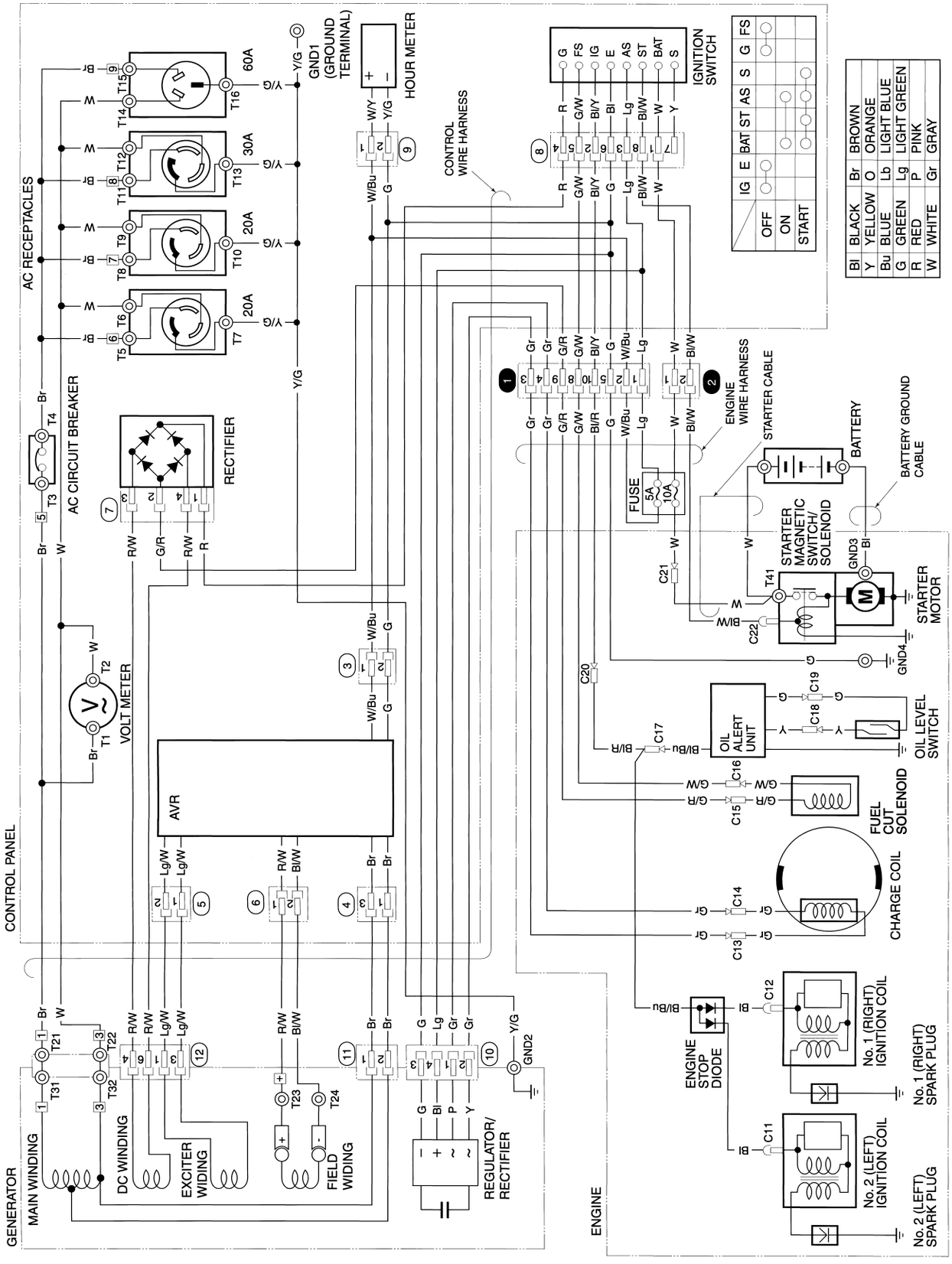
4. DIMENSIONAL DRAWING

Unit: mm (in)

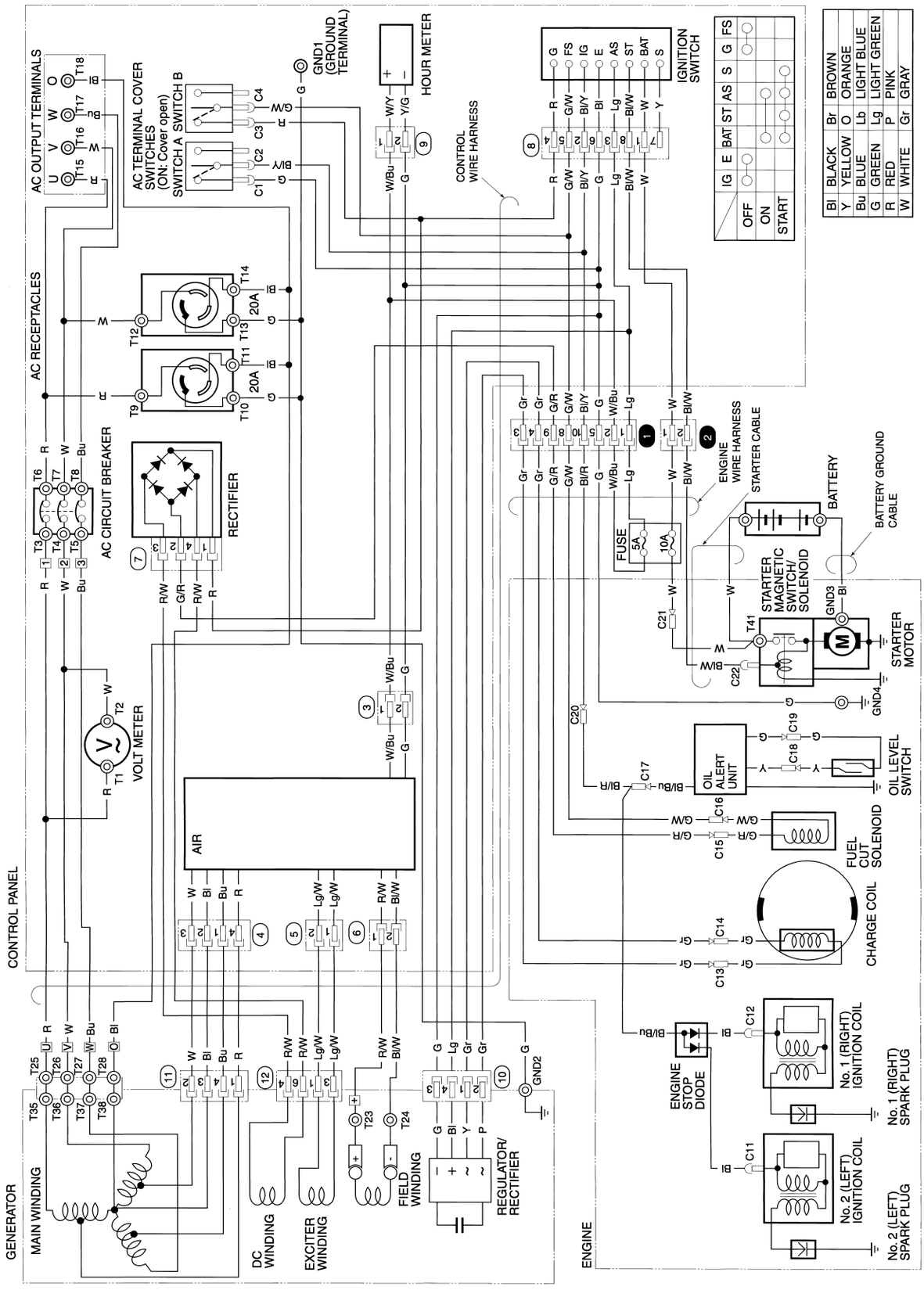


5. WIRING DIAGRAM

• EM10000



• **ET12000**


CONTROL PANEL
AC OUTPUT TERMINALS
AC TERMINAL COVER
SWITCHES
(ON: Cover open)
SWITCH A SWITCH B
GND1
(GROUND
TERMINAL)
HOUR METER
CONTROL
WIRE HARNESS
IGNITION
SWITCH
IG E BAT ST AS S G FS
OFF
ON
START
Bl BLACK
Y YELLOW
Bu BLUE
G GREEN
R RED
W WHITE
Br BROWN
O ORANGE
Lb LIGHT BLUE
Lg LIGHT GREEN
P PINK
Gr GRAY
AC RECEPTACLES
AC CIRCUIT BREAKER
RECTIFIER
VOLT METER
AIR
ENGINE
WIRE HARNESS
STARTER CABLE
FUSE
5A
10A
BATTERY
BATTERY GROUND
CABLE
STARTER
MAGNETIC
SWITCH/
SOLENOID
STARTER
MOTOR
OIL
ALERT
UNIT
OIL LEVEL
SWITCH
FUEL
CUT
SOLENOID
CHARGE COIL
ENGINE
STOP
DIODE
No. 1 (RIGHT)
IGNITION COIL
No. 1 (RIGHT)
SPARK PLUG
No. 2 (LEFT)
IGNITION COIL
No. 2 (LEFT)
SPARK PLUG
GENERATOR
MAIN WINDING
DC
WINDING
EXCITER
WINDING
FIELD
WINDING
REGULATOR/
RECTIFIER
ENGINE

2. SERVICE INFORMATION

1. THE IMPORTANCE OF PROPER SERVICING

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

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

Improper service or repairs can create an unsafe condition that can cause your customer or others to be seriously hurt or killed.

Follow the procedures and precautions in this manual and other service materials carefully.

⚠WARNING

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

Follow the procedures and precautions in this manual carefully.

2. IMPORTANT SAFETY PRECAUTIONS

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

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

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

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

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

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

3. SERVICE RULES

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

• ELECTRIC PRECAUTIONS

1. Hold the connector body to disconnect the connector. Do not disconnect by pulling the wire harness. To disconnect the locking connector, be sure to unlock first, then disconnect.
2. Check the connector terminals for bend, excessive extrusion, missing terminal, or other abnormalities before connecting the connector.
3. To connect, insert the connector as far as it goes. If the connector is a locking type, be sure that it is locked securely.
4. Check the connector cover for breakage and check whether the connector female terminal is not open excessively. Then, connect the connector securely. Check the connector terminal for rust. Remove the rust using an emery paper or equivalent material before connecting the connector.
5. Set the harness clips in the specified places of the frame securely, and secure the wire harnesses.
6. Clamp the cables securely.
7. Clamp the wire harnesses securely so that they do not interfere with the rotating parts, moving parts and the hot parts.
8. Route and connect the wire harnesses properly. Be sure that the harnesses are not slack, twisted or pulled taut.
9. Route the wire harnesses properly so that they do not contact with the sharp edges and corners, and the end of the bolts and screws on the body.
10. If a wire harness contacts the end of the bolts/screws or sharp edges and corners, protect the contact part of the harness with a tube or by winding with electrical insulating tape. If the wire harness has a grommet, set the grommet securely.
11. Take care not to pinch the wire harnesses during installation of a part. If a wire harness has damaged insulation, repair by winding with electrical insulating tape.
12. Use a tester that is equivalent to or higher than the performance specified;
    Internal resistance: 20 kΩ/VDC, 9 kΩ/VAC
13. Be careful not to touch the metallic part of the tester probe with your body, otherwise correct resistance value cannot be obtained
14. Read the tester manufacturer's operation instructions carefully before operation with a tester. Follow the instructions of the Service Manual. Be sure the tester's battery is fully charged and check the meter before using the tester.

4. SYMBOLS USED IN THIS MANUAL

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

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

GREASE — Apply grease.

OIL — Apply oil.

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

P. 1-1 Indicates the reference page.

CONNECTOR NUMBER AND TERMINAL ARRANGEMENT

❶ Indicates the connector No. connecting one wire harness to another.

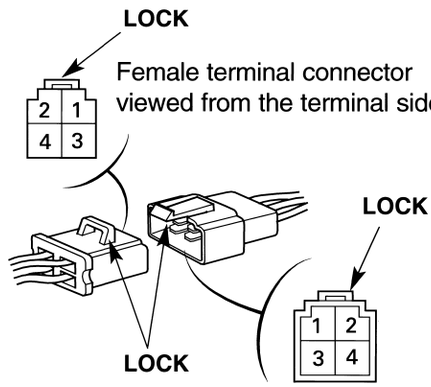
③ Indicates the connector No. connected to a part.

C11 Indicate the connector No.

GND3 Indicates the ground terminal No.

T12 Indicates the terminal No.

- See P. 2-27 thru. 2-35 CABLE & HARNESS ROUTING for the connector and terminal positions.
- The terminal No. on inspection shows the terminal arrangement by viewing the connector from the terminal side with the lock toward up as shown. Note that the double frame connector indicates a male terminal connector, while the single frame indicates a female terminal connector.

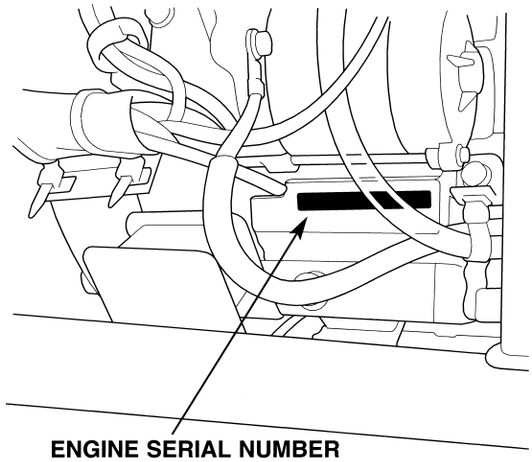


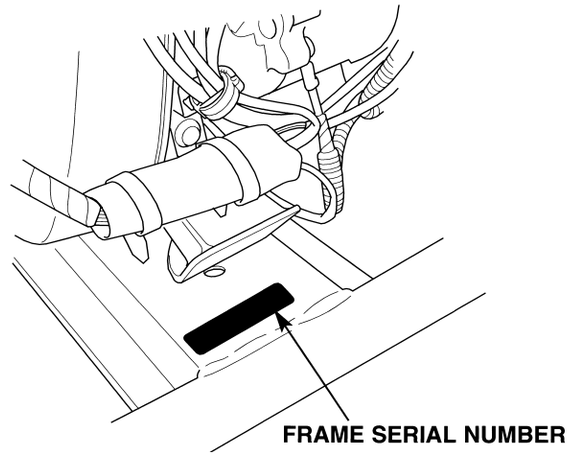
Female terminal connector viewed from the terminal side

Male terminal connector viewed from the terminal side

5. SERIAL NUMBER LOCATIONS

The engine serial number is located on the right side of the cylinder block and the frame serial number is located on the frame. 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.





6. MAINTENANCE STANDARDS

• ENGINE

Unit: mm (in)

Part	Item		Standard	Service limit
Engine	Standard engine speed (no load)		3,000±100 min^{-1} (rpm)	—
	Cylinder compression		0.59 - 0.83 Mpa (6.0 - 8.5 kgf/cm^2, 85 - 121 psi) at 600 min^{-1} (rpm)	—
	Oil pressure		196 kPa (2.0 kgf/cm^2, 28.4 psi)	—
Cylinder	Sleeve I.D.		77.000 - 77.017 (3.0315 - 3.0322)	77.17 (3.038)
Cylinder head	Warpage		—	0.10 (0.004)
	Seat width	IN/EX	1.1 (0.04)	2.0 (0.08)
Piston	Skirt O.D.		76.965 - 76.985 (3.0301 - 3.0309)	76.85 (3.026)
	Piston-to-cylinder clearance		0.015 - 0.052 (0.0006 - 0.0020)	0.12 (0.005)
	Piston pin bore I.D.		18.002 - 18.008 (0.7087 - 0.7090)	18.04 (0.710)
Piston pin	Pin O.D.		17.994 - 18.000 (0.7882 - 0.7087)	17.95 (0.707)
	Piston-to-piston pin bore clearance		0.002 - 0.014 (0.0001 - 0.0006)	0.08 (0.003)
Piston rings	Ring side clearance	Top/Second	0.030 - 0.060 (0.0012 - 0.0024)	0.15 (0.006)
	Ring end gap	Top/Second	0.2 - 0.4 (0.01 - 0.02)	1.0 (0.04)
		Oil (side rail)	0.2 - 0.7 (0.01 - 0.03)	1.0 (0.04)
	Thickness	Top/Second	1.975 - 1.990 (0.0778 - 0.0783)	1.90 (0.075)
Connecting rod	Small end I.D.		18.005 - 18.020 (0.7089 - 0.7094)	18.07 (0.711)
	Big end I.D.		40.025 - 40.041 (1.5758 - 1.5764)	—
	Big end oil clearance		0.030 - 0.056 (0.0012 - 0.0022)	0.12 (0.005)
	Big end side clearance		0.20 - 1.10 (0.008 - 0.043)	1.3 (0.05)
Crankshaft	Main journal O.D.		37.984 - 38.000 (1.4954 - 1.4961)	37.93 (1.493)
	Crank pin O.D.		39.985 - 39.995 (1.5742 - 1.5746)	39.92 (1.572)
	Crankshaft axial clearance		0.05 - 0.65 (0.002 - 0.026)	1.0 (0.04)
Valves, valve guides	Valve clearance	IN	0.15±0.02 (0.0059±0.0008)	—
		EX	0.20±0.02 (0.0079±0.0008)	—
	Stem O.D.	IN	6.575 - 6.590 (0.2589 - 0.2594)	6.44 (0.254)
		EX	6.535 - 6.550 (0.2573 - 0.2579)	6.40 (0.252)
	Guide I.D.	IN/EX	6.600 - 6.615 (0.2598 - 0.2604)	6.66 (0.262)
	Stem-to-guide clearance	IN	0.010 - 0.040 (0.0004 - 0.0016)	0.10 (0.004)
		EX	0.050 - 0.080 (0.0020 - 0.0031)	0.12 (0.005)
Valve springs	Spring free length	IN/EX	39.0 (1.54)	37.5 (1.48)
Valve lifter	Valve lifter shaft O.D.		5.982 - 6.000 (0.2355 - 0.2362)	5.95 (0.234)
	Valve lifter I.D.		6.010 - 6.030 (0.2366 - 0.2374)	6.06 (0.239)
	Valve lifter-to-shaft clearance		0.010 - 0.048 (0.0004 - 0.0019)	0.10 (0.004)
Camshaft	Cam height	IN/EX	29.865 (1.1758)	29.5 (1.16)
	Camshaft journal O.D.		16.975 - 16.995 (0.6683 - 0.6687)	16.92 (0.666)
Crankcase	Main journal I.D.		38.025 - 38.041 (1.4970 - 1.4977)	38.06 (1.498)
Crankcase cover	Camshaft holder I.D.		17.016 - 17.027 (0.6699 - 0.6704)	17.06 (0.672)
	Main journal I.D.		38.025 - 38.041 (1.4970 - 1.4977)	38.06 (1.498)
Thrust washer	Thickness		1.0 (0.04)	0.8 (0.03)

ENGINE (Cont.)

Unit: mm (in)

Part	Item		Standard	Service limit
Oil pump	Rotor tip clearance		0.14 (0.006)	0.30 (0.012)
	Outer rotor-to-body clearance		0.15 - 0.21 (0.006 - 0.008)	0.30 (0.012)
	Rotor-to-pump body clearance		0.04 - 0.11 (0.002 - 0.004)	0.13 (0.005)
Carburetor	Main jet		#105	—
	Float height		14.0 (0.55)	—
	Pilot screw opening		2-1/8 turns out	—
Spark plug	Gap		0.7 - 0.8 (0.028 - 0.031)	—
Spark plug cap	Resistance		7.5 - 12.5 kΩ	—
Ignition coil	Resistance	Primary	0.8 - 1.0 Ω	—
		Secondary	7.0 - 8.6 kΩ	—
	Air gap at flywheel		0.4 ± 0.2 (0.016 ± 0.008)	—
Starter motor	Brush length		10.0 (0.39)	6.0 (0.24)
	Mica depth		1.0 (0.04)	0.2 (0.008)
Charge coil	Resistance		0.19 - 0.25 Ω	—

• GENERATOR

Part	Item	Connector*1	Terminal number*1	Standard	Service limit
Stator EM10000	Main winding resistance	—	T31 (1) to T32 (2)	0.2 - 0.4 Ω	—
	Sensor winding resistance	⑪	No. 1 to No. 2	0.05 ΩMax.	—
	DC winding resistance	⑫	No. 4 to No. 6	0.3 - 0.5 Ω	—
	Exciter winding resistance	⑫	No. 1 to No. 3	1.6 - 2.0 Ω	—
Stator ET12000	Main winding resistance	—	T38 (O) to T35 (U)	0.6 - 0.8 Ω	—
			T38 (O) to T36 (V)	0.6 - 0.8 Ω	—
			T38 (O) to T37 (W)	0.6 - 0.8 Ω	—
	Sensor winding resistance	⑪	No. 1 to No. 3	0.08 ΩMax.	—
		⑪	No. 2 to No. 3	0.08 ΩMax.	—
		⑪	No. 4 to No. 3	0.08 ΩMax.	—
	DC winding resistance	⑫	No. 4 to No. 6	0.3 - 0.5 Ω	—
	Exciter winding resistance	⑫	No. 1 to No. 3	2.0 - 2.5 Ω	—
Rotor	Field winding resistance		Between slip rings	49 - 59 Ω	—
Brush holder	Brush length			15.5 (0.61)	9.5 (0.37)

*1: See page 2-24 for generator test points, terminal arrangement and connector location.

7. TORQUE VALUES

• ENGINE

Item	Thread dia. x pitch	Torque value		
		N·m	kgf·m	lbf·ft
Air cleaner case bolt	M5 x 1.0	5.4	0.6	4.0
Carburetor bolt	M6 x 1.0	9	0.9	6.6
Connecting rod bolt	M6 x 1.0 (Apply oil to threads)	12	1.2	9
Cylinder head bolt	M10 x 1.25 (Apply oil to threads)	34	3.5	25
Cylinder head cover bolt	M6 x 1.0	9	0.9	6.6
Cylinder head stud bolt (exhaust pipe)	M8 x 1.25	18	1.8	13
Fan cover bolt and nut	M6 x 1.0	9	0.9	6.6
Flywheel nut	M20 x 1.5 (Apply oil to threads)	196	20.0	145
Fuel pump cover screw	5 mm self-tapping screw	4	0.4	3.0
Fuel pump mount bolt	M6 x 1.0	9	0.9	6.6
Governor arm nut	M6 x 1.0	11	1.1	8
Intake manifold socket bolt	M8 x 1.25	27	2.8	20
Oil drain bolt	M14 x 1.5	39	4.0	29
Oil filter holder	M20 x 1.5	18	1.8	13
Oil filter cartridge	M20 x 1.5	22	2.2	16
Oil level switch joint nut	M10 x 1.25	10	1.0	7
Oil pump cover bolt	M6 x 1.0	10	1.0	7
Rocker arm pivot bolt	M8 x 1.25	24	2.4	18
Rocker arm pivot lock nut	M6 x 0.5	10	1.0	7
Sealing plug	PT 1/8	9	0.9	6.6
Spark plug	M14 x 1.25	18	1.8	13
Starter motor terminal nut	M8 x 1.25	9	0.9	6.6
Starter motor through bolt	M8 x 1.25	7	0.7	5.1
Starter magnetic switch terminal nut	M8 x 1.25	9	0.9	6.6
Valve lifter mounting bolt	M5 x 0.8	5.4	0.6	4.0

• **FRAME**

Item	Thread dia. x pitch	Torque value		
		N·m	kgf·m	lbf·ft
Bottom rubber mount nut	M10 x 1.25	34	3.5	25
Choke cable holder bolt	M5 x 0.8	2.5	0.3	1.8
Exhaust pipe mount nut (to cylinder head)	M8 x 1.25	24	2.4	18
Exhaust pipe mount nut (to muffler)	M8 x 1.25	24	2.4	18
Fuel valve nut	M14 x 1.0	13.5	1.35	10
Fuel gauge mount screw	M5 x 0.8	4	0.4	3.0
Rotor bolt	M10 x 1.25	55	5.6	41
Rear housing mount bolt	M8 x 1.25	20	2.0	15
Generator end cover bolt	M5 x 0.8	5.2	0.53	3.8

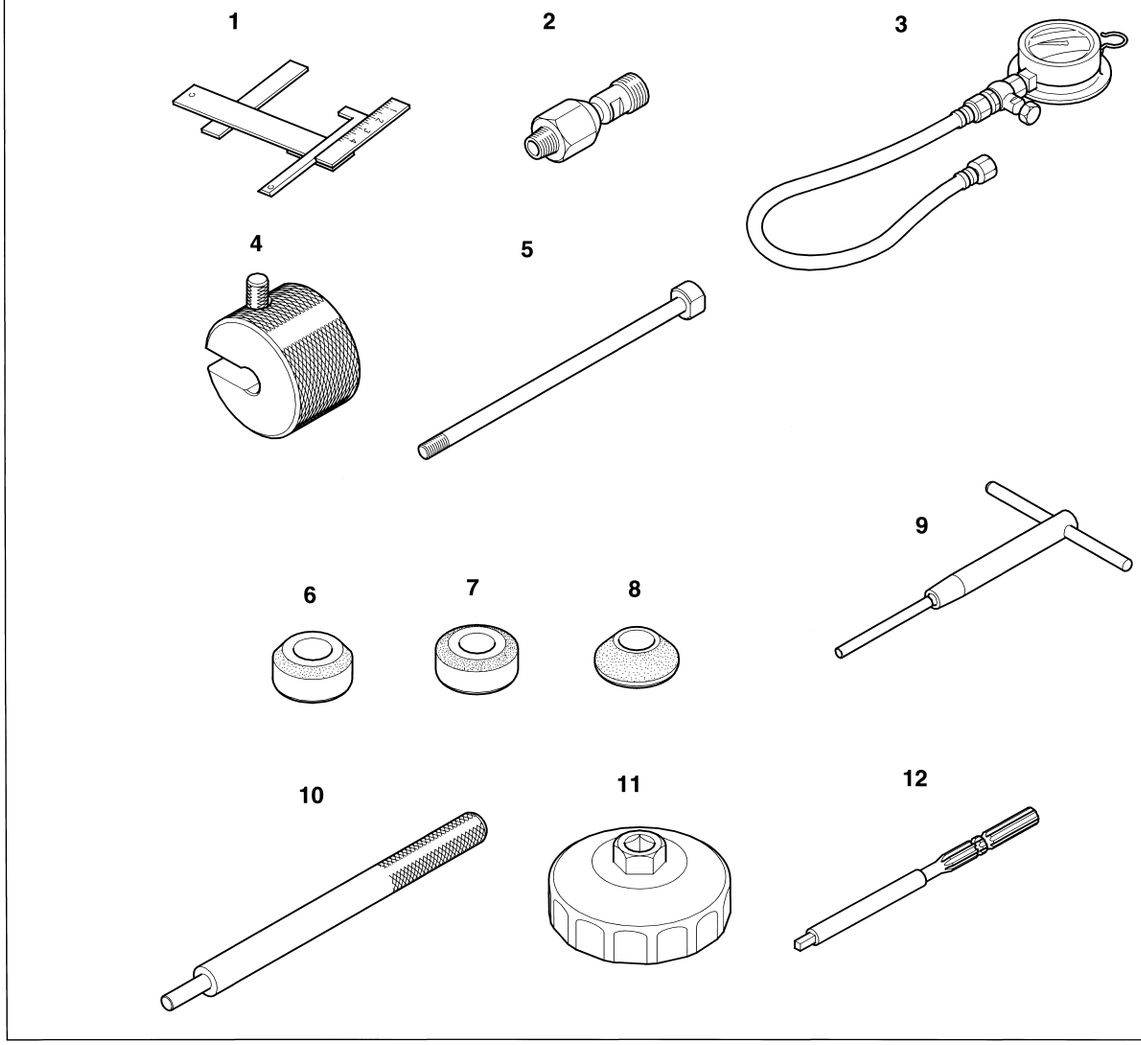
• Use the standard torque values for the bolts, nuts and screws that are not listed in this table.

STANDARD TORQUE VALUES

Item	Thread dia.	Torque value		
		N·m	kgf·m	lbf·ft
Screw	5 mm 6 mm	4.2 9	0.4 0.9	3.1 6.6
Bolt and nut	5 mm 6 mm 8 mm 10 mm 12 mm	5.2 10 21 34 54	0.5 1.0 2.2 3.5 5.5	3.8 7 15 25 40
Flange bolt and flange nut	6 mm 8 mm 10 mm	11.9 26.5 39	1.2 2.7 4.0	9 20 29
SH flange bolt	6 mm	9	0.9	6.6
CT flange bolt	6 mm	9.9	1.0	7.3

8. SPECIAL TOOLS

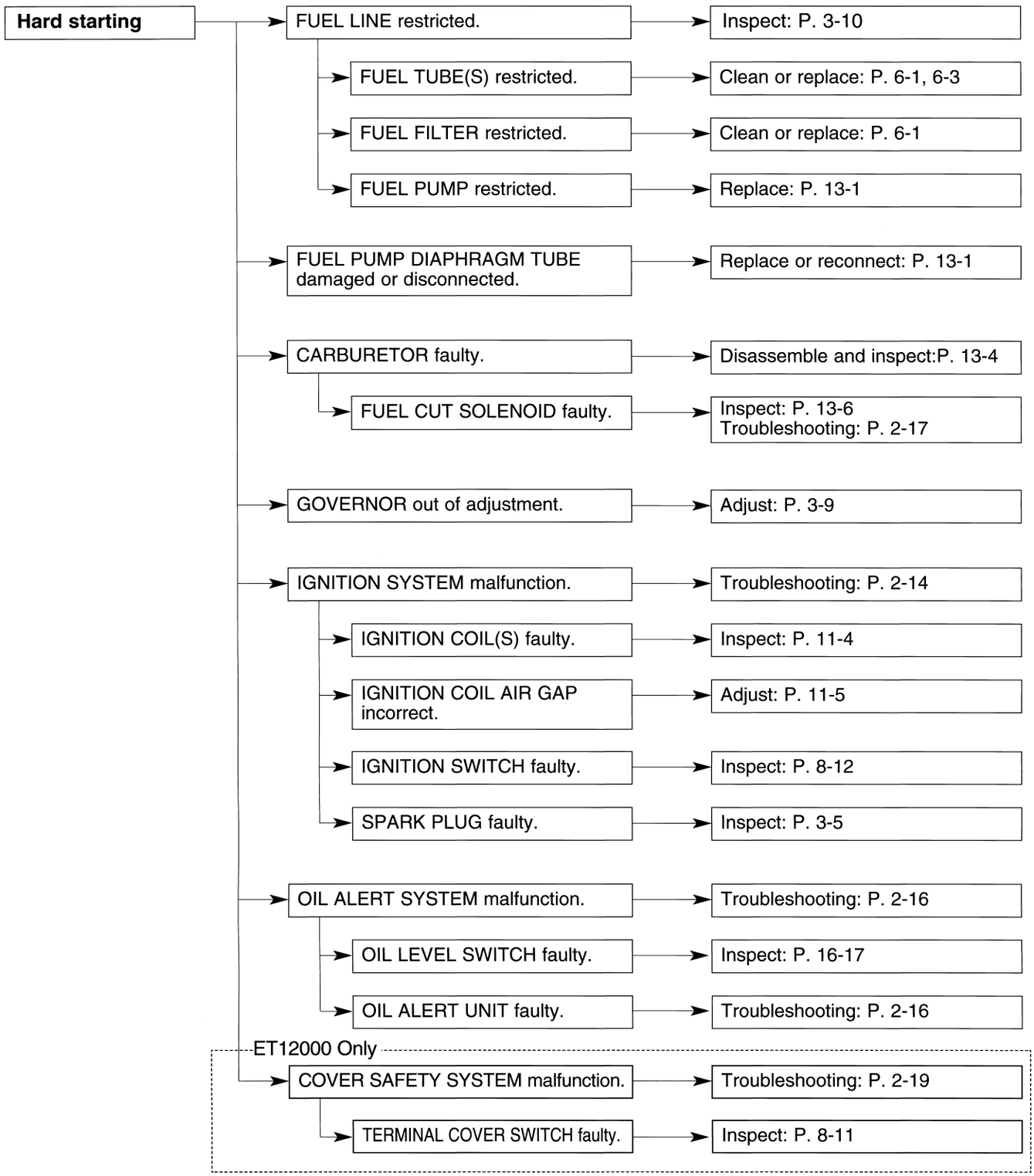
No.	Tool name	Tool number	Application
1	Float level gauge	07401-0010000	Carburetor float level inspection
2	Oil pressure gauge attachment	07406-0030000	Oil pressure inspection
3	Oil pressure gauge	07506-3000001	Oil pressure inspection
4	Sliding hammer weight	07741-0010201	Rotor removal
5	Sliding shaft, 12 mm	07736-0010101	Rotor removal
6	Valve seat cutter, 45° ϕ29	07780-0010300	Valve seat reconditioning (EX)
	Valve seat cutter, 45° ϕ33	07780-0010800	Valve seat reconditioning (IN)
7	Valve seat cutter, 32° ϕ30	07780-0012200	Valve seat reconditioning (EX)
	Valve seat cutter, 32° ϕ35	07780-0012300	Valve seat reconditioning (IN)
8	Valve seat cutter, 60° ϕ30	07780-0014000	Valve seat reconditioning (IN/EX)
9	Cutter holder, 6.6 mm	07781-0010202	Valve seat reconditioning
10	Valve guide driver, 6.6 mm	07942-6570101	Valve guide replacement
11	Oil filter wrench	07HAA-PJ70101	Oil filter replacement
12	Valve guide reamer, 6.6 mm	07984-ZE2000C or 07984-ZE2000D	Valve guide reaming

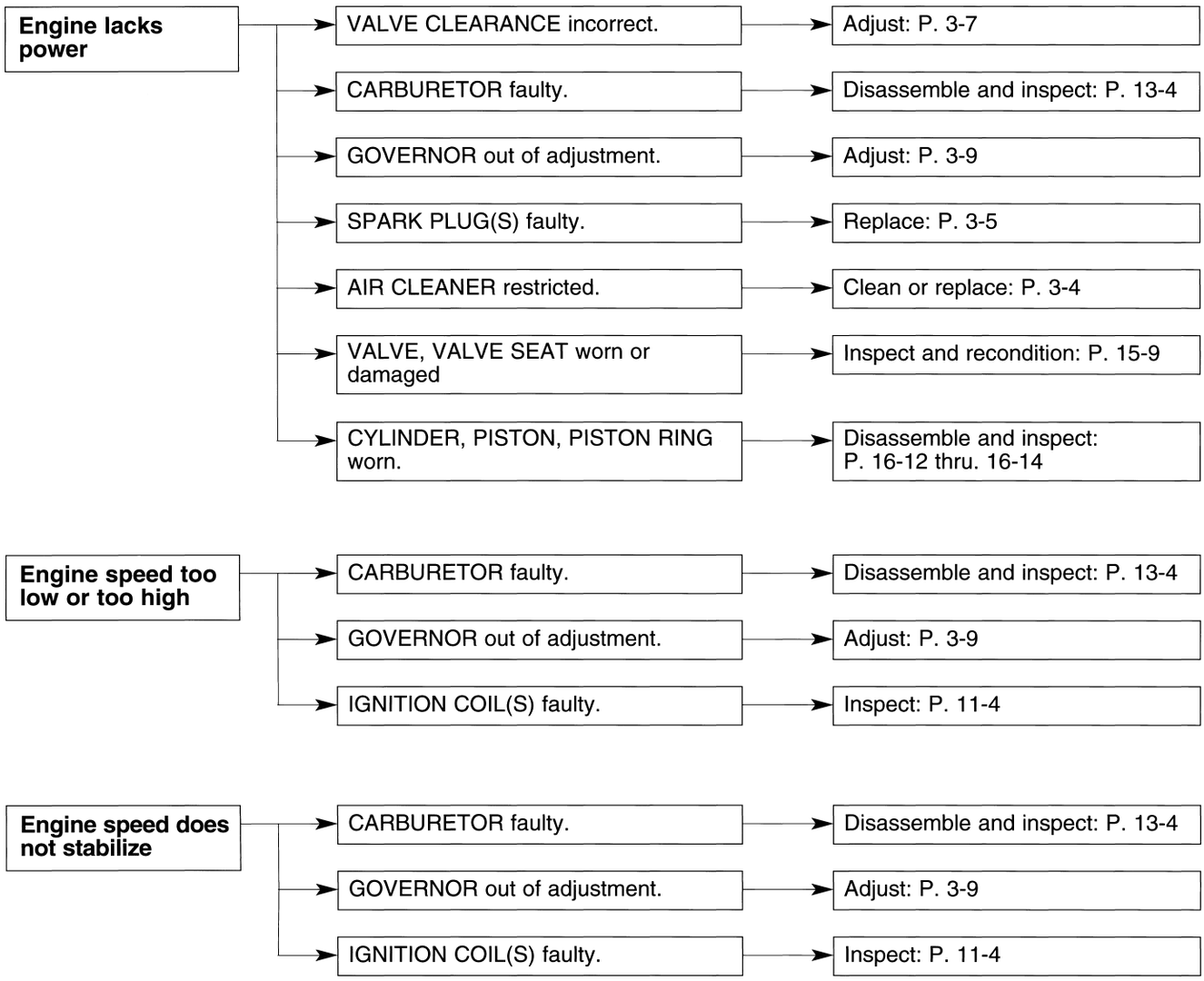


9. TROUBLESHOOTING

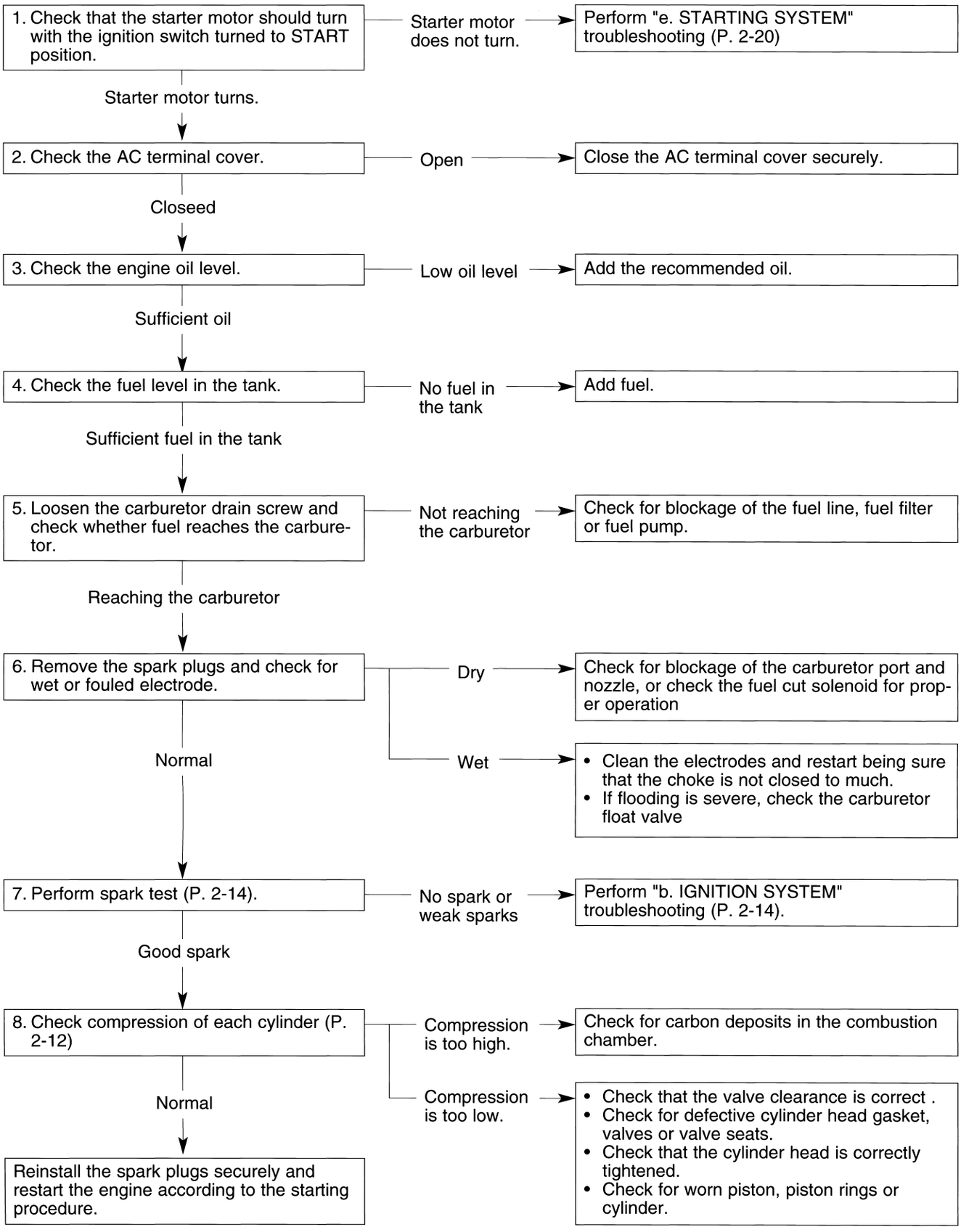
a. ENGINE

• General Symptoms and Possible Cause




Engine lacks power
VALVE CLEARANCE incorrect.
Adjust: P. 3-7
CARBURETOR faulty.
Disassemble and inspect: P. 13-4
GOVERNOR out of adjustment.
Adjust: P. 3-9
SPARK PLUG(S) faulty.
Replace: P. 3-5
AIR CLEANER restricted.
Clean or replace: P. 3-4
VALVE, VALVE SEAT worn or damaged
Inspect and recondition: P. 15-9
CYLINDER, PISTON, PISTON RING worn.
Disassemble and inspect: P. 16-12 thru. 16-14
Engine speed too low or too high
CARBURETOR faulty.
Disassemble and inspect: P. 13-4
GOVERNOR out of adjustment.
Adjust: P. 3-9
IGNITION COIL(S) faulty.
Inspect: P. 11-4
Engine speed does not stabilize
CARBURETOR faulty.
Disassemble and inspect: P. 13-4
GOVERNOR out of adjustment.
Adjust: P. 3-9
IGNITION COIL(S) faulty.
Inspect: P. 11-4

• Hard Stating



• Engine Start but Then Stalls.

1. Check the fuel level in the tank.
   - No fuel in the tank → Add fuel.
   - Sufficient fuel in the tank ↓
2. Loosen the carburetor drain screw and check whether fuel reaches the carburetor.
   - Not reaching the carburetor → Check for blockage of the fuel line, fuel filter or fuel pump.
   - Reaching the carburetor ↓
3. Check the fuel cut solenoid for proper operation (P. 13-6).
   - Abnormal → Perform "c. FUEL CUT SYSTEM" troubleshooting (P. 2-17).
   - Normal ↓
4. Inspect the carburetor and intake manifold mounting bolts for looseness, and carburetor gaskets and intake manifold gaskets for damage.
   - Loose bolts or damaged gaskets →
     - Retighten the carburetor mounting bolts or intake manifold mounting bolts, if they are loose.
     - Install the carburetor gaskets and intake manifold gaskets correctly.
     - Replace the carburetor gasket or intake manifold gasket, if they are damaged.
   - Normal ↓
5. Check compression of each cylinder.
   - Compression is too high. → Check for carbon deposits in the combustion chamber.
   - Compression is too low. →
     - Check that the valve clearance is correct .
     - Check for defective cylinder head gasket, valves or valve seats.
     - Check that the cylinder head is correctly tightened.
     - Check for worn piston, piston rings or cylinder.
   - Normal ↓

Reinstall the spark plugs securely and restart the engine according to the starting procedure.

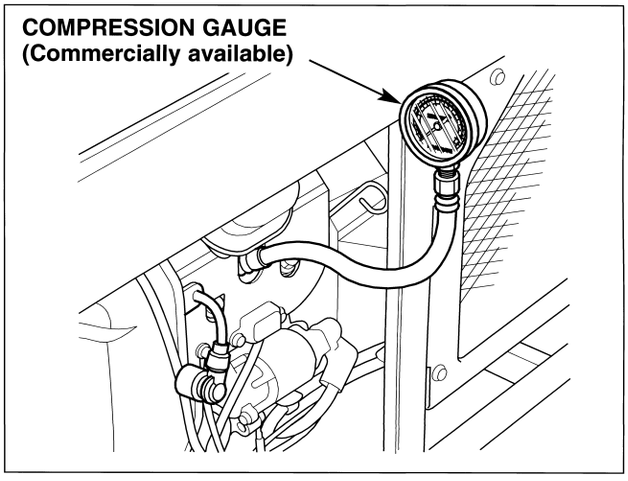
• Cylinder Compression Test

1) Remove the both spark plugs.

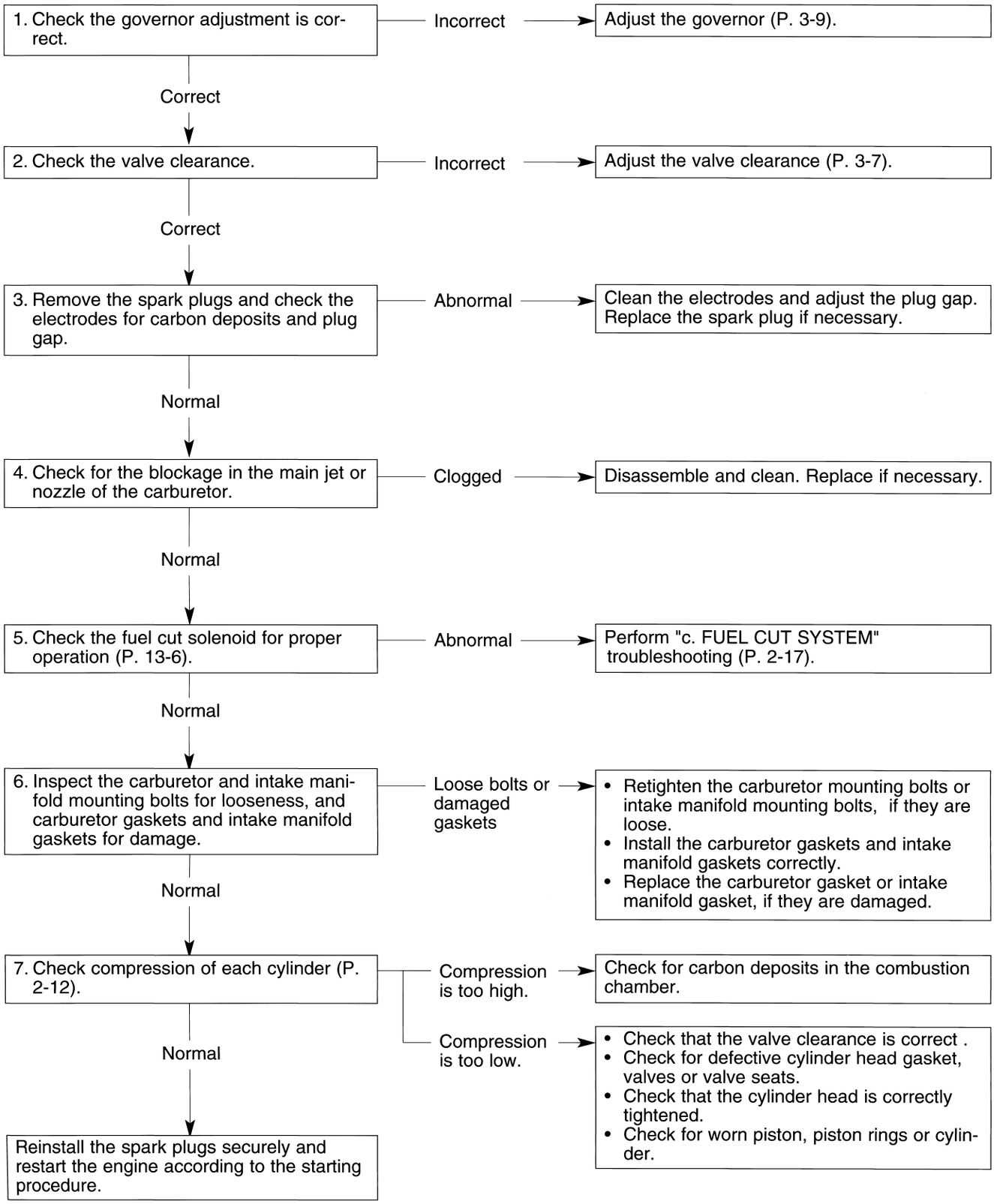
2) Install a compression gauge (commercially available) to the spark plug hole.

3) Turn the starter motor until stable compression obtained.
   - Do not operate the starter motor more than 5 seconds at one try. If stable compression is not obtained within 5 seconds, stop the starter motor and wait 10 - 20 seconds and repeat operation again.

Cylinder compression	0.59 - 0.83 MPa (6.0 - 8.5 kgf/cm², 85 - 121psi)

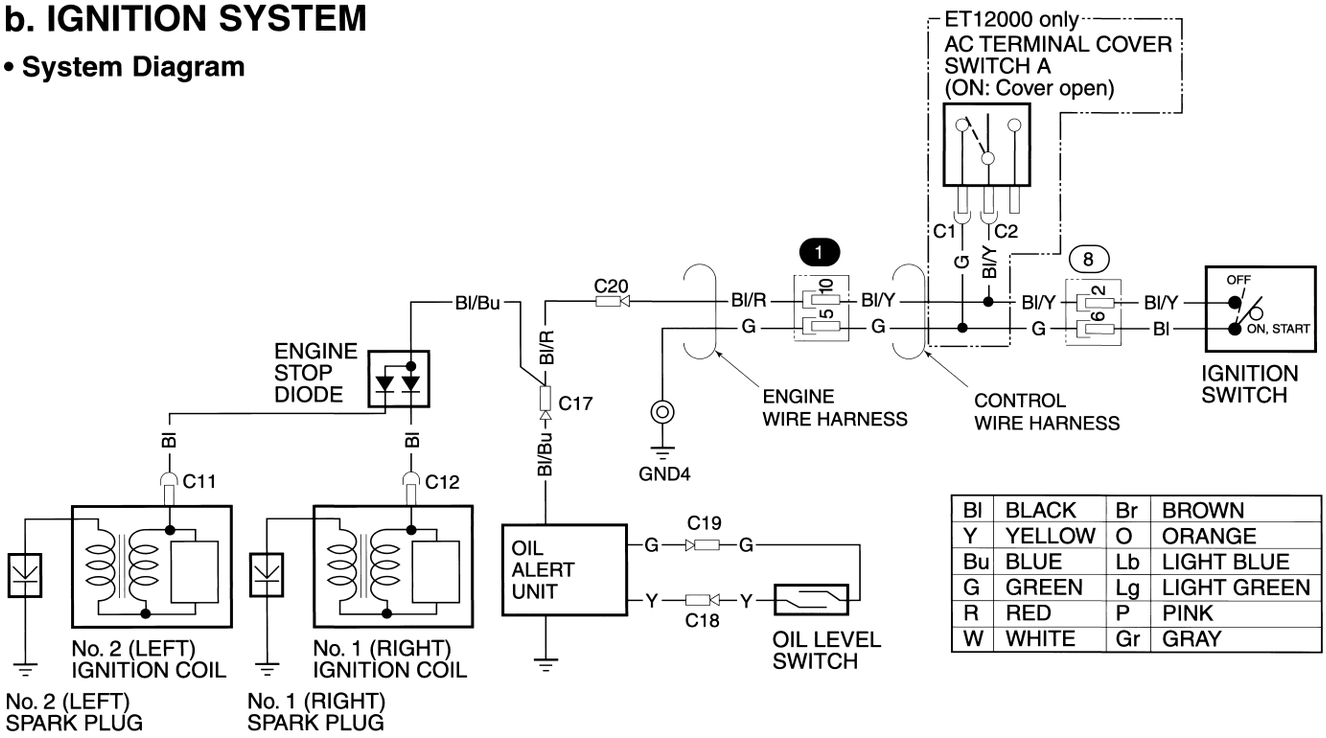


• Abnormal Engine Speed
(Engine Speed Too High, Too Low, or Not Stabilized)



b. IGNITION SYSTEM

• System Diagram



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

• Spark Test

1) Turn the fuel valve to the OFF position and drain the gasoline from the carburetor.

⚠WARNING

Gasoline is highly flammable and explosive.
If ignited, gasoline can burn you severely.
• Be sure there is no spilled fuel near the engine.

Unburnt gas can ignite if it is left in the cylinder.
• Release the unburnt gas from the cylinder before testing.
• Place the spark plug away from the spark plug hole.

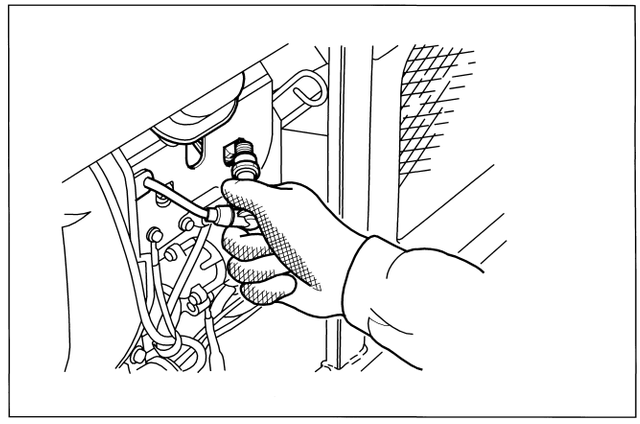
2) Remove the spark plug caps and spark plugs

3) Turn the starter motor for 5 seconds to release the unburned gas from the cylinders.

4) Attach a spark plug to the spark plug cap.

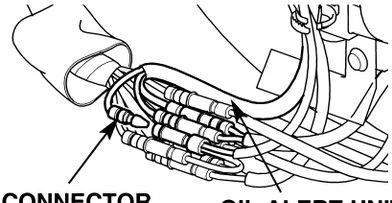
5) Turn the ignition switch to the ON position. Ground the negative (−) electrode (i.e. threaded part) of the spark plug against the cylinder head bolt and operate the electric starter to check whether sparks jump across the electrodes.

6) Remove the spark plug from the spark plug cap and install the spark plug to the spark plug cap of the other cylinder. Perform the spark test.



• No Spark at Spark Plug

1. Disconnect the C17 connector (Back/Blue) from the oil alert unit wire inside of the connector cover beside the starter motor and retest.



Spark → Perform troubleshooting "Oil Alert Malfunction" (P. 2-16).

No spark

2. Check the spark plug gap, and adjust if necessary. Perform the spark test.

Incorrect → Adjust the governor (P. 3-9).

No spark or weak spark

3. Perform spark test again using a new spark plug.

Good spark → Replace the spark plug(s).

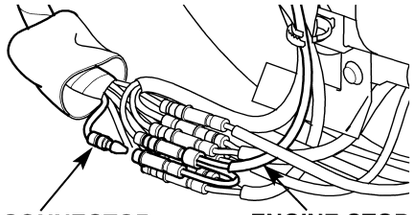
No spark

4. Check for voltage leakage caused by damaged high tension wire.

Abnormal → Replace the ignition coil (P. 11-2).

Normal

5. Disconnect the black/red wire C20 connector inside of the connector cover beside the starter motor and retest.



No spark → EM10000: Check the ignition switch. If the ignition switch is normal, replace or repair the wire harness.
ET12000: Perform the troubleshooting "d. COVER SAFETY SYSTEM" (P. 2-19)

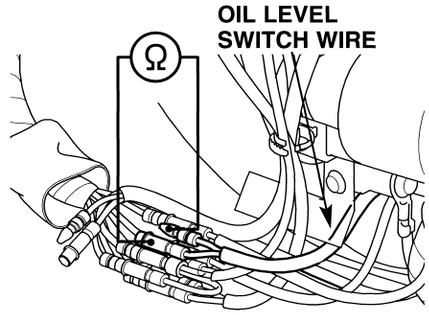
Spark

Check the engine stop diode (P. 11-5). If the engine stop diode is normal, check the ignition coils, and replace if necessary.

• Oil Alert Malfunction

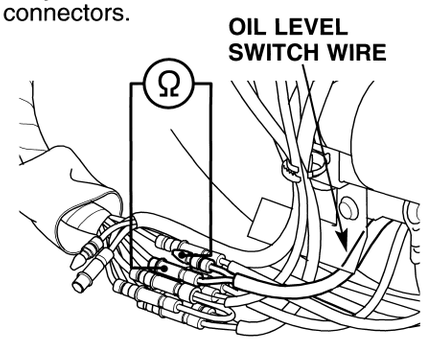
1. Check the engine oil level.
   - Low oil level → Add recommended oil (P. 3-2).
   - Sufficient oil ↓

2. Disconnect the oil level switch wire C18 (Yellow) and C19 (Green)) connectors. Check for continuity between the oil level switch wire connectors.
   - Continuity → Replace the oil level switch (P. 16-5).



   - No continuity ↓

3. Drain the engine oil and check for continuity between the oil level switch wire connectors.
   - No continuity → Replace the oil level switch (P. 16-5).

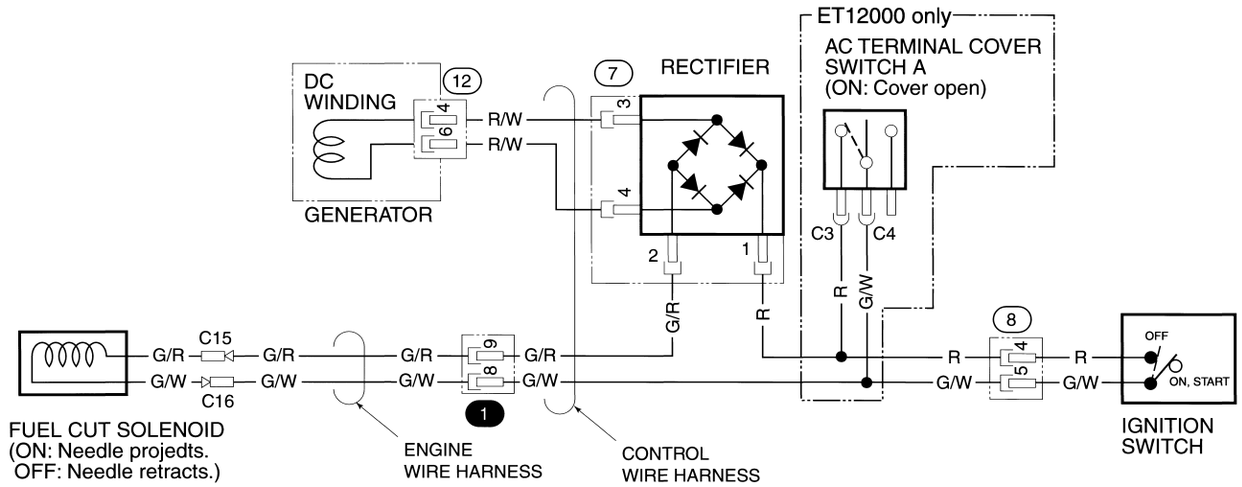


   - Continuity ↓

Replace the oil alert unit (P. 14-1).

c. FUEL CUT SYSTEM

• System Diagram



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

• Fuel Cut Solenoid Malfunction (After burn, Engine stall or does not start)

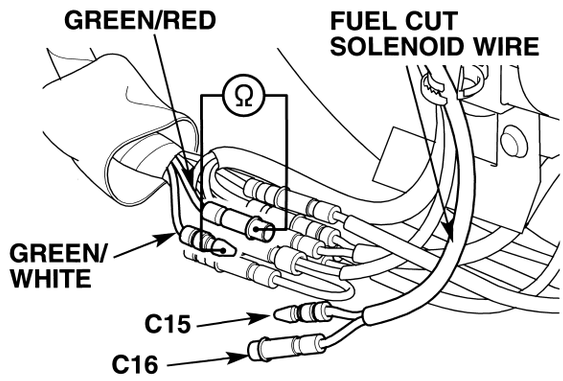
1. Check the fuel cut solenoid (P. 13-6). — Abnormal → Replace the fuel cut solenoid (P. 13-4).

Normal

2. Check the fuel cut solenoid circuit;
Disconnect the fuel cut solenoid connectors (C15 and C16).
Check for continuity between the Green/White and Green/Red wire terminals of the engine wire harness with the ignition switch OFF.

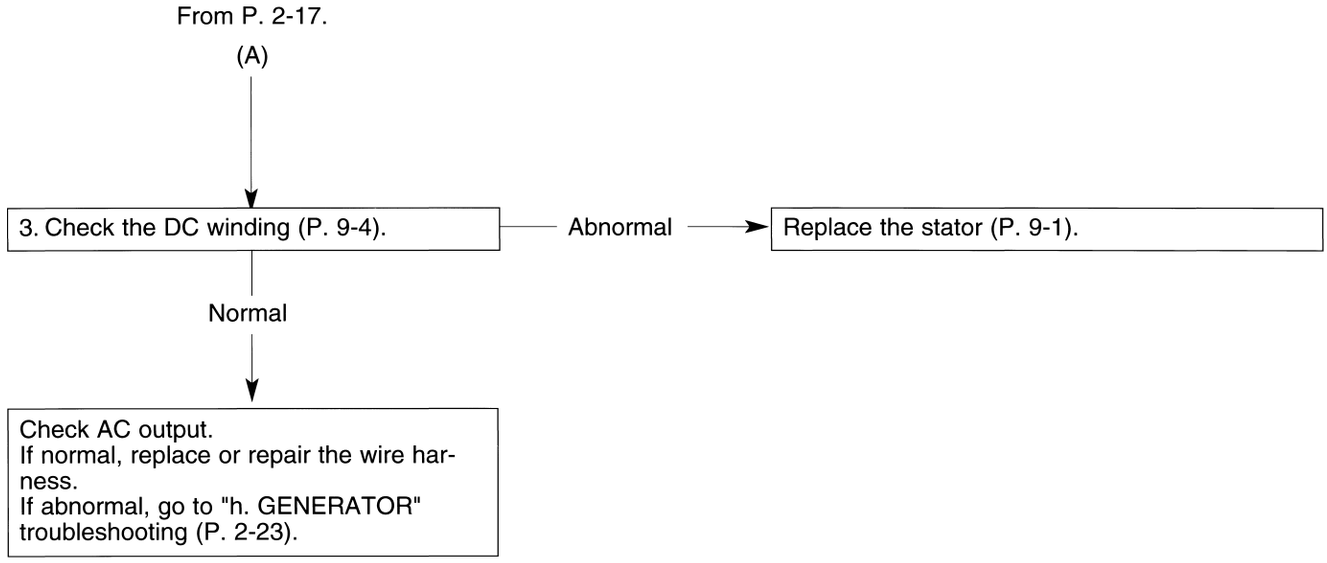
Positive probe / Negative probe	C15 Green/Red	C16 Gree/White
C15 Green/Red		Continuity
C16 Green/White	∞	

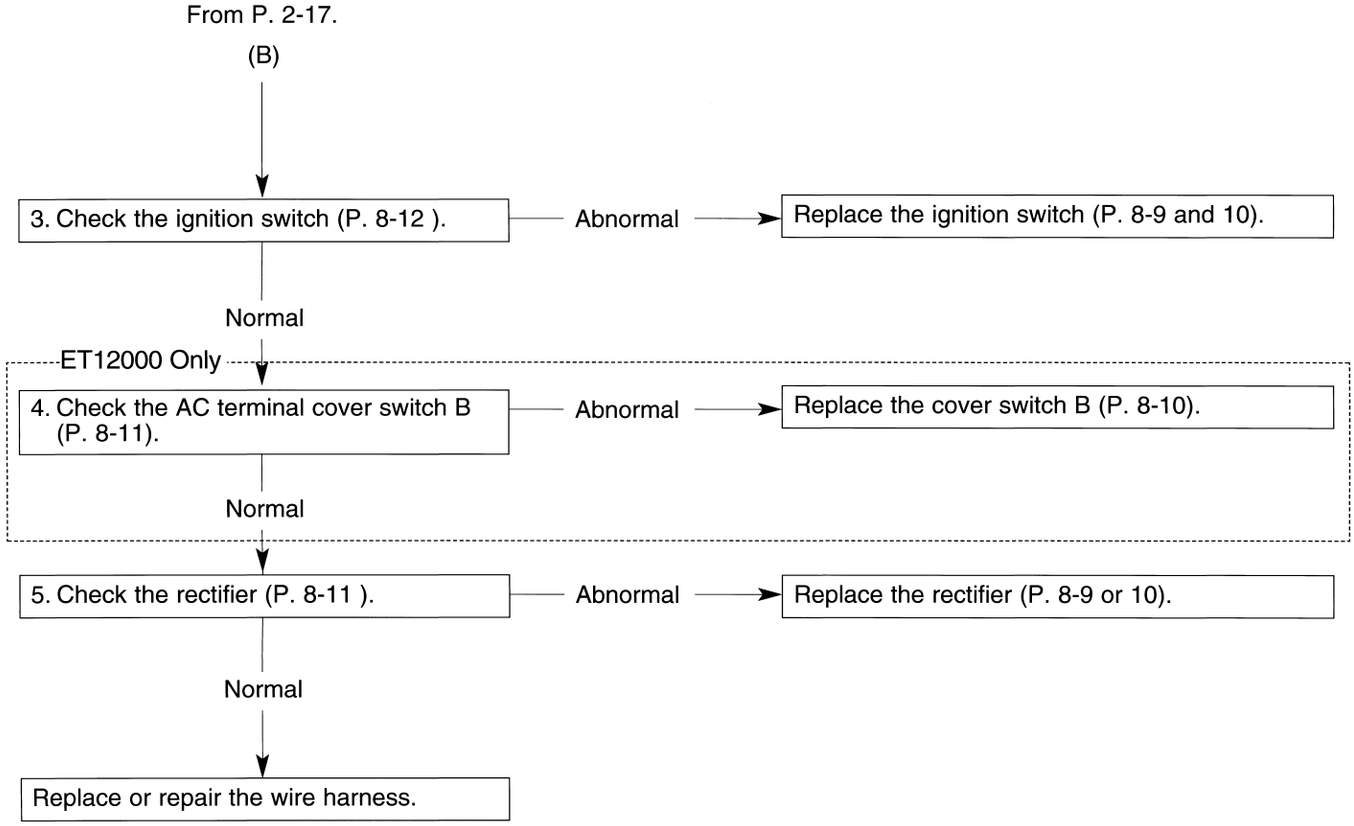
• Use a R x 1 scale of a commercially available multimeter and the meter shows current flow from negative (-) to positive (+).



Normal → (A) Go to P. 2-18.

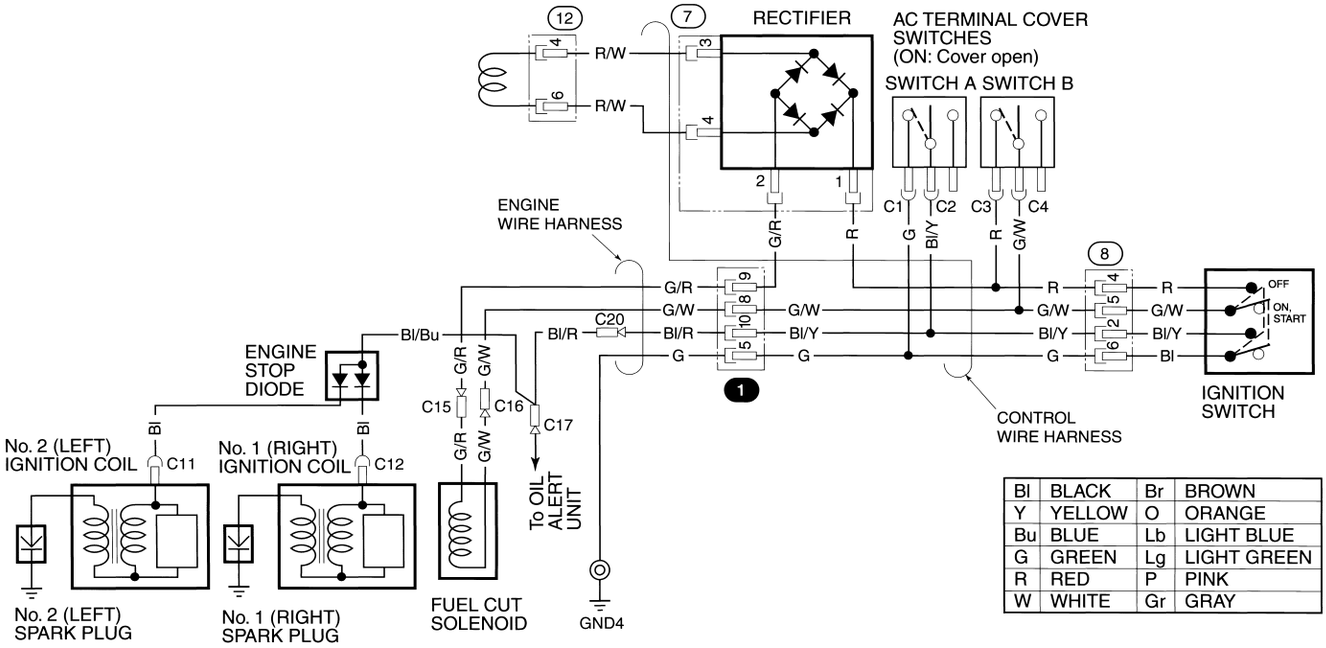
Abnormal → (B) Go to P. 2-18.


From P. 2-17.
(A)
3. Check the DC winding (P. 9-4).
Abnormal
Replace the stator (P. 9-1).
Normal
Check AC output.
If normal, replace or repair the wire harness.
If abnormal, go to "h. GENERATOR" troubleshooting (P. 2-23).


From P. 2-17.
(B)
3. Check the ignition switch (P. 8-12).
Abnormal
Replace the ignition switch (P. 8-9 and 10).
Normal
ET12000 Only
4. Check the AC terminal cover switch B (P. 8-11).
Abnormal
Replace the cover switch B (P. 8-10).
Normal
5. Check the rectifier (P. 8-11).
Abnormal
Replace the rectifier (P. 8-9 or 10).
Normal
Replace or repair the wire harness.

d. COVER SAFETY SYSTEM (ET12000 only)

• System Diagram

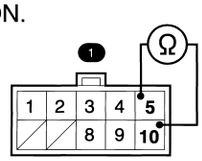


Bl	BLACK	Br	BROWN
Y	YELLOW	O	ORANGE
Bu	BLUE	Lb	LIGHT BLUE
G	GREEN	Lg	LIGHT GREEN
R	RED	P	PINK
W	WHITE	Gr	GRAY

• System Inspection

1. Turn the ignition switch to OFF and disconnect the ❶ connector.
   Check for continuity beyween the No. 10 (Black/Yellow) and No. 10 (Green) terminals of the ❶ connector of the control wire harness with the ignition switch ON.

   There should be continuity with the AC terminal cover closed and no continuity with the cover open.



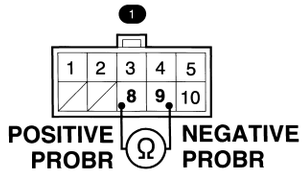
Viewed from terminal side

Abnormal → Check the AC terminal cover switch A (P. 8-11). If the cover switch is normal, replace or repaire the control wire harness.

Normal ↓

2. Check for continuity beyween the No. 8 (Gree/White connect positive terster probe) and No. 9 (Green/Red connect negative tester probe) terminals of the ❶ connector of the control wire harness with the ignition switch ON.
   • Use a R x 1 scale of a commercially available multimeter and the meter shows current flow from negative (-) to positive (+).

   There should be continuity with the AC terminal cover closed and no continuity with the cover open.



Viewed from terminal side

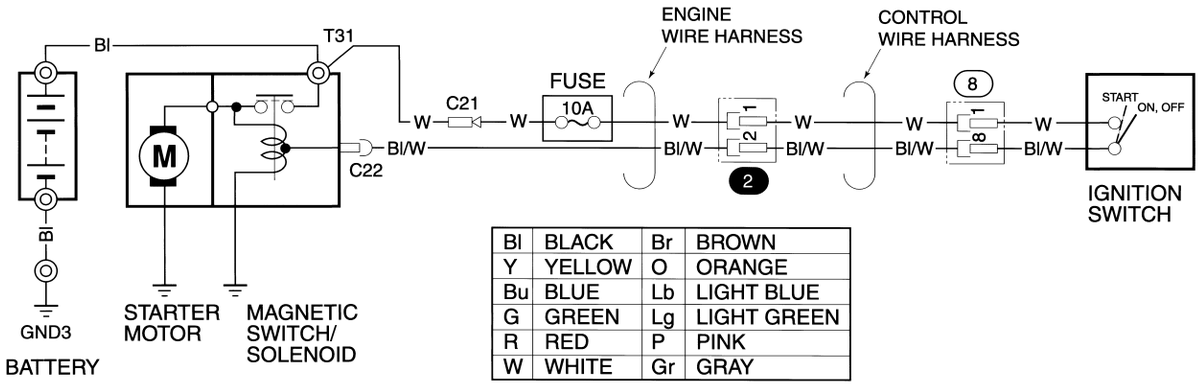
Abnormal → Check the AC terminal cover switch B (P. 8-11). If the cover switch is normal, check the rectifier and the control wire harness. Replace or repair if necessary.

Normal ↓

System is OK, test is complete

e. STARTING SYSTEM

• System Diagram



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

• Starter Motor Does Not Turn

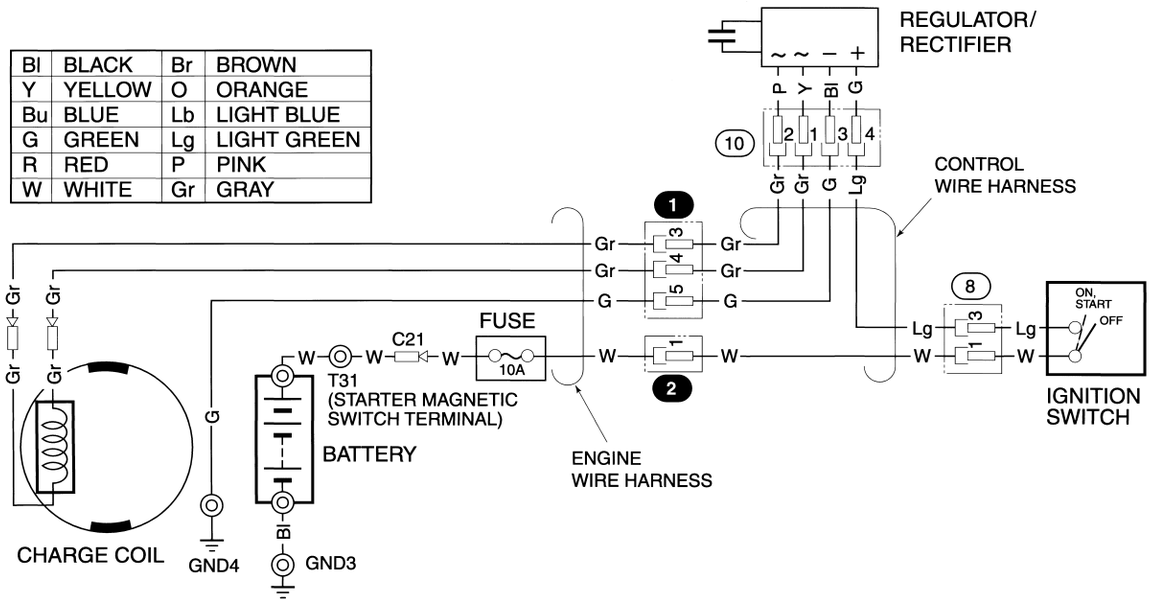
1. Check the fuse (10A).
   - Burnt out → Replace the fuse (10A).
   - Good ↓
2. Check the battery (P. 3-6).
   - Under charge → Recharge or replace the battery (P. 4-1).
   - Good ↓
3. Check the starter magnetic switch/ solenoid (P. 14-4).
   - Abnormal → Replace the magnetic switch/solenoid (P. 14-2).
   - Normal ↓
4. Check the starter motor (P. 14-1 for performance test).
   - Abnormal → Replace or repair the starter motor (P. 14-1 thru. 14-5).
   - Normal ↓
5. Check the ignition switch (P. 8-12).
   - Abnormal → Replace the ignition switch (P. 8-9 or 10).
   - Normal ↓

Replace or repair the wire harness.

f. CHARGING SYSTEM

• System Diagram

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



• Battery Under Charged

1. Check the fuse (10A).
   - Burnt out → Replace the fuse (10A).
   - Good ↓
2. Check the charge coil (P. 11-7).
   - Abnormal → Replace charge coil (P. 11-6).
   - Normal ↓
3. Check the ignition switch (P. 8-12).
   - Abnormal → Replace the ignition switch (P. 8-9 or 10).
   - Normal ↓
4. Check the regulator/rectifier (P. 9-5).
   - Abnormal → Replace the regulator/rectifier (P. 9-2).
   - Normal ↓

Replace or repair the wire harness.

g. LUBRICATION SYSTEM

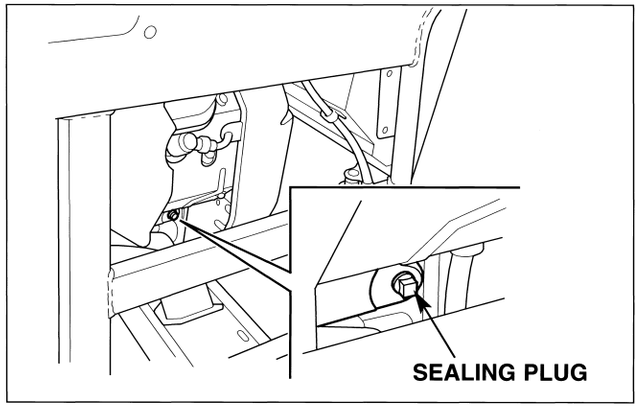
• Symptom and Possible Causes

Low oil pressure	OIL PUMP faulty.	Inspect: P. 16-4
	OIL FILTER SCREEN restricted.	Inspect: P. 16-3
	OIL FILTER CARTRIDGE restricted.	Replace: P. 3-3

• Oil Pressure Test

1) Make sure that the engine oil level is correct.

2) Remove the sealing plug.



3) Install the oil pressure gauge attachment to the sealing plug installed hole.

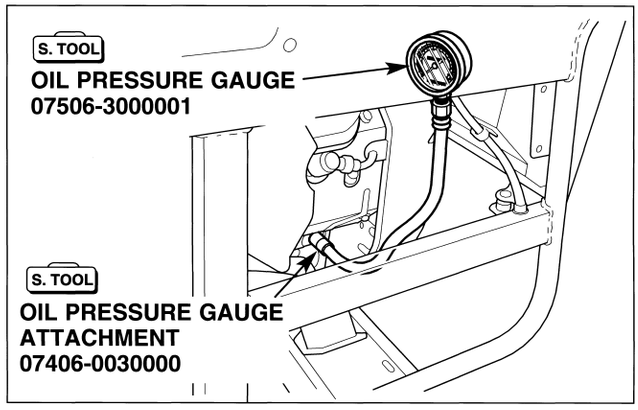
   TORQUE: 9 N·m (0.9 kgf·m, 6.6 lbf·ft)

   NOTICE
   Tighten the oil pressure gauge attachment to the specified torque. Do not overtighten the oil pressure gauge attachment to avoid damaging the threads of the crankcase.

4) Connect the oil pressure gauge to the oil pressure gauge attachment.

5) Start the engine and let it run approximately 10 minutes. Measure the oil pressure when the engine has reached normal operating temperature.

Standard oil pressure	196 kPa (2.0 kgf/cm², 28.4 psi)

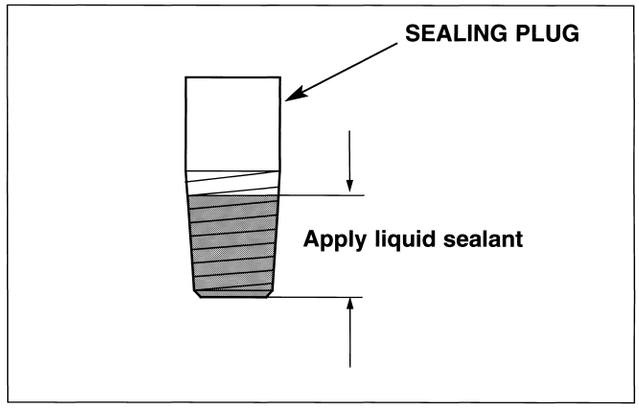


6) Remove the oil pressure gauge and attachment.

7) Clean the threads of the sealing plug and plug hole. Apply liquid sealant (Honda bond 4 or equivalent) and then tighten the sealing plug to the specified torque using a torque wrench.

   TORQUE: 9 N·m (0.9 kgf·m, 6.5lbf·ft)

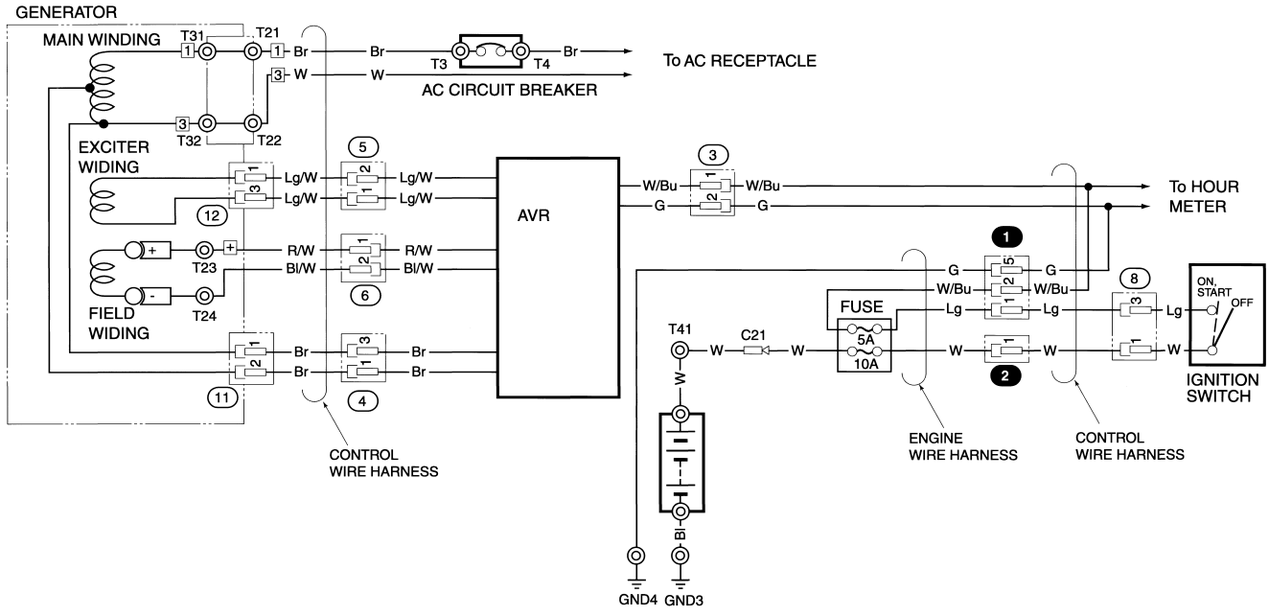
   NOTICE
   Tighten the sealing plug to the specified torque. Do not overtighten the sealing plug to avoid damaging the threads of the crankcase.



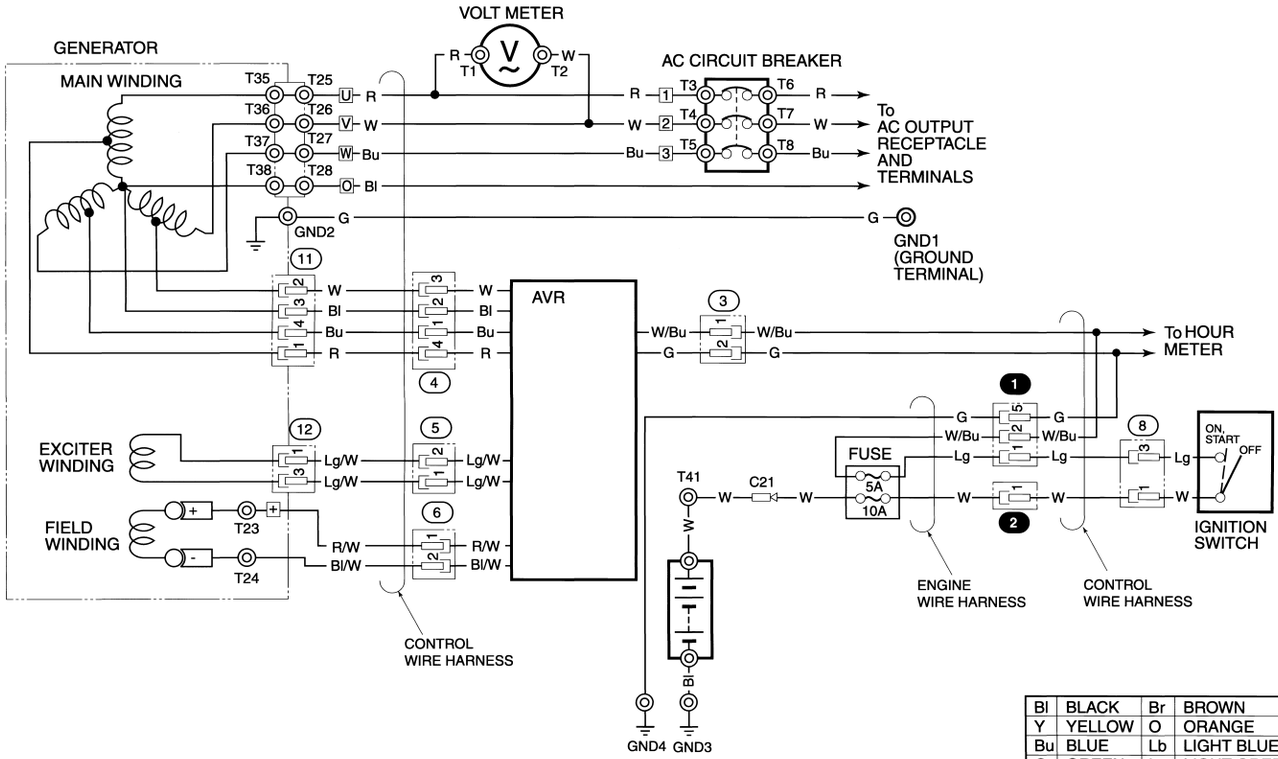
h. GENERATOR

• System Diagram

EM10000



ET12000



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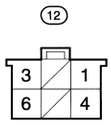
G	GREEN	Lg	LIGHT GREEN
R	RED	P	PINK
W	WHITE	Gr	GRAY

• Generator Test Points
EM10000

Stator side connector viewed from terminal side

Terminal arrangement:

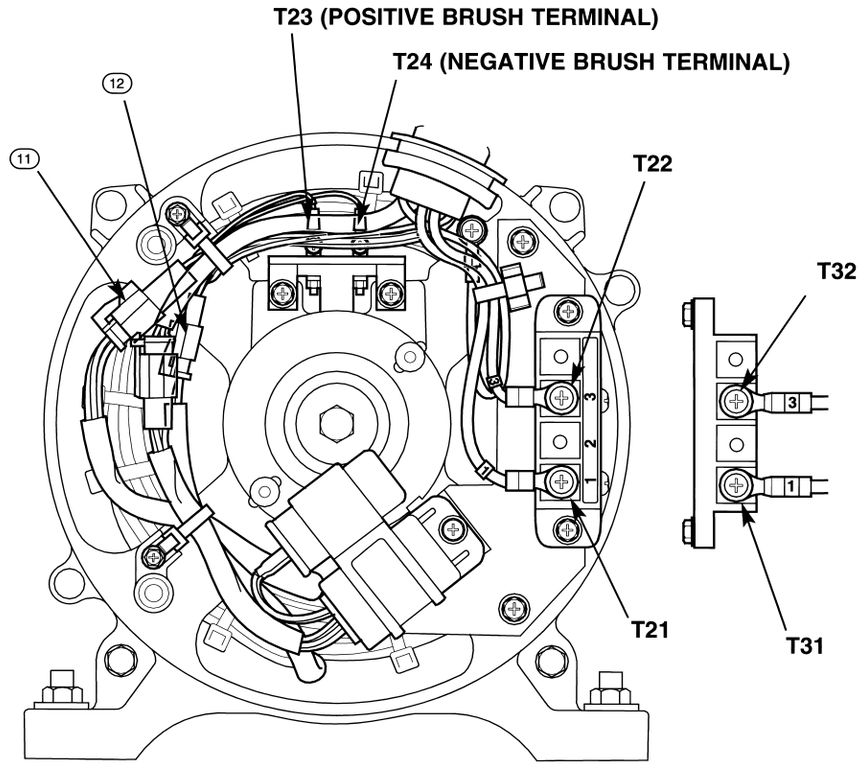
No.	Color	Remarks
1	Brown	Sensor winding
2	Brown	Sensor winding



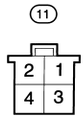
Stator side connector viewed from terminal side

Terminal arrangement:

No.	Color	Remarks
1	Light green/ White	Exciter winding
3	Light green/ White	Exciter winding
4	Red/White	DC winding
6	Red/White	DC winding



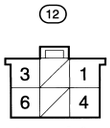
ET12000



Stator side connector viewed from terminal side

Terminal arrangement:

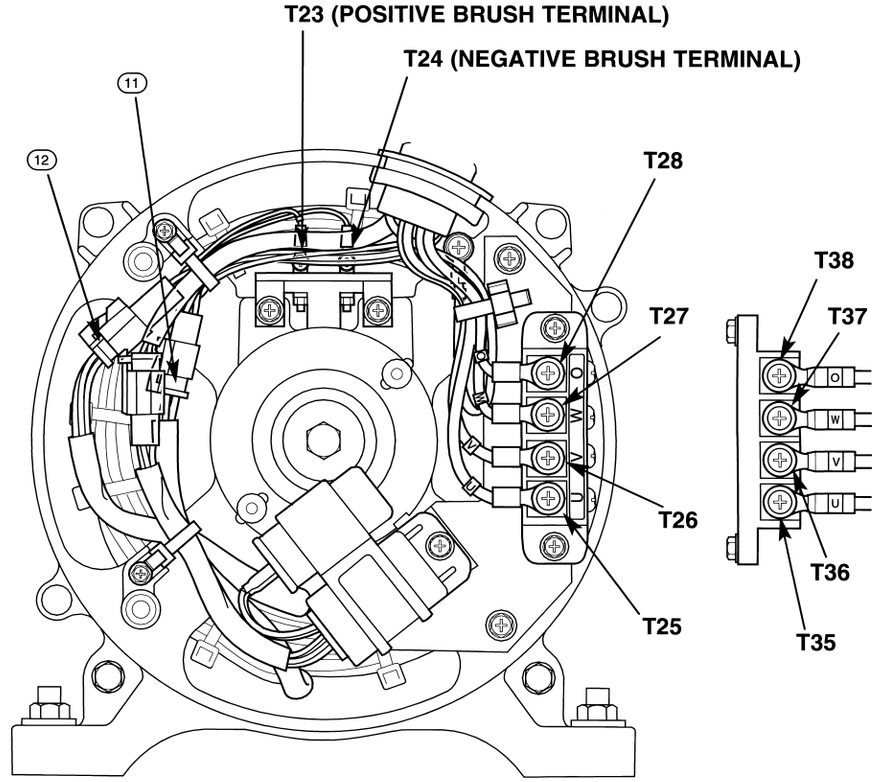
No.	Color	Remarks
1	Red	Sensor winding (U)
2	White	Sensor winding (V)
3	Black	Sensor winding (O)
4	Blue	Sensor winding (W)



Stator side connector viewed from terminal side

Terminal arrangement:

No.	Color	Remarks
1	Light green/ White	Exciter winding
3	Light green/ White	Exciter winding
4	Red/White	DC winding
6	Red/White	DC winding



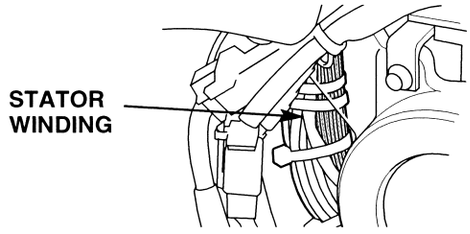
• Abnormal Output (none, low, or high) at Receptacle

⚠ WARNING

High voltage and electrical current present. Touching the non-insulated portions of the meter leads or generator wiring can cause shock or electrocution.
Wear insulated gloves and avoid handling non-insulated wiring.

Before troubleshooting, make sure that the circuit breaker is in the ON position.

1. Remove the generator end cover and inspect the stator winding for discoloration.



Discolored → Replace the stator (P. 9-2).

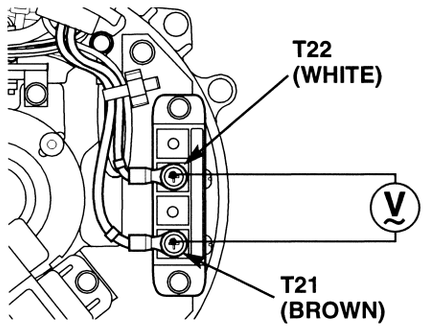
Normal ↓

2. Check the engine speed.
   Standard no load speed: 3,000±100 min^{-1} (rpm)

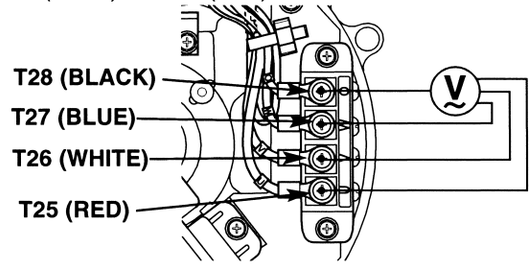
Abnormal → Adjust the governor (P. 3-9).

Normal ↓

3. EM10000:
   Check the main winding voltage between T21 and T22 terminals with the engine running at standard no load speed.
   Standard voltage:
   T22 (White) — T21 (Brown):
   RG type: 230±34 VAC
   R type : 220±33 VAC



ET12000:
Check the main winding output voltage between T28, T27, T26, and T25 terminals with the engine running at standard no load speed.
Standard voltage:
RG type:
T28 (Black) — T27 (Blue): 230±34 VAC
T28 (Black) — T26 (White): 230±34 VAC
T28 (Black) — T25 (Red): 230±34 VAC
R type:
T28 (Black) — T27 (Blue): 220±33 VAC
T28 (Black) — T26 (White): 220±33 VAC
T28 (Black) — T25 (Red): 220±33 VAC



Abnormal ↓

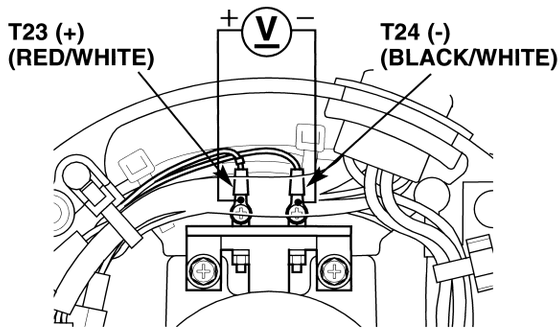
Go to P. 2-26

Normal ↓

Stop the engine and check for continuity between the generator and AC receptacles. Replace or repair as necessary.

From P. 2-25

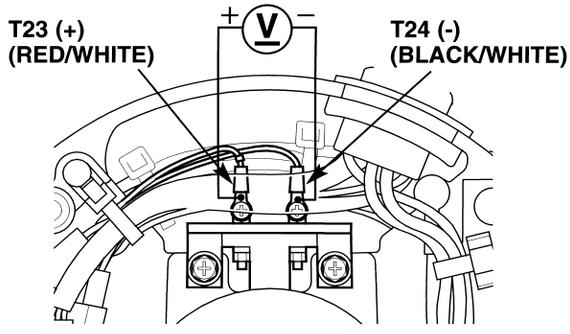
4. Check the brush voltage between T23 (+) and T24 (-) terminals with the engine running at standard no load speed.
   Standard voltage: 32±4 VDC



Normal → Go to step 9 (P. 2-29).

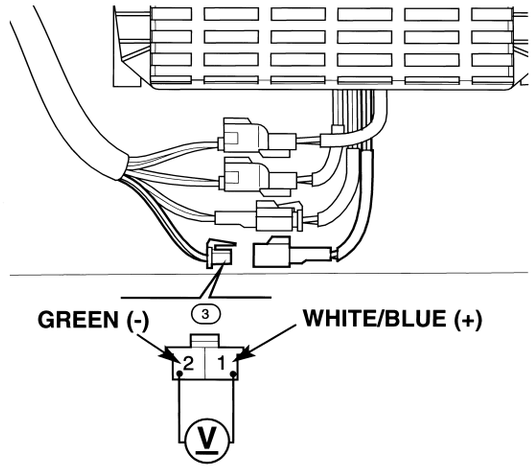
Abnormal

5. Stop the engine. Check the brush voltage with the ignition switch ON.
   Perform this check quickly because power is shut off approximately 15 seconds after the ignition switch turned OFF.
   Standard voltage: 11 - 14 V (battery voltage)



Abnormal →

Turn the ignition switch OFF. Remove the control panel. Check for voltage between the No. 1 (White/Blue +) and No. 2 (Green -) terminals of the ③ connector of the control wire harness with the ignition switch ON.
There should be battery voltage.



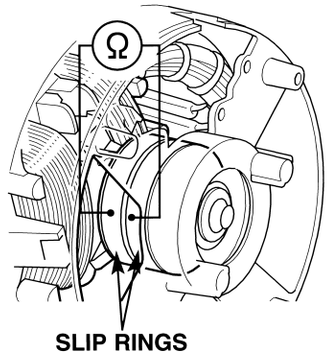
If there is battery voltage, go to step 10.
If there is no voltage, check the ignition switch, fuse and open circuit in wire harness. Replace or repair as necessary.

Normal

Go to P. 2-27.

From P. 2-26.

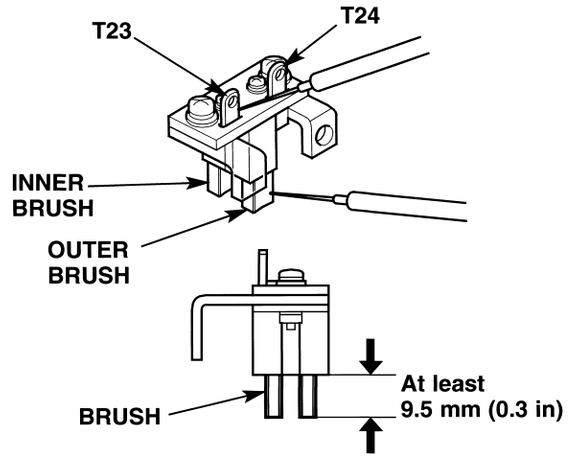
6. Turn the ignition switch OFF, disconnect the brush terminals and remove the brush holder. Clean and inspect the slip rings. Check for field winding resistance at the slip rings.
   Standard resistance: 49 - 59 Ω



Abnormal → Replace the rotor (P. 9-6).

Normal

7. Closely inspect the brushes for length, free movement, continuity between the brush tip and terminal, and for unusual wear.
   Brush length: At least 9.5 mm (0.3 in)
   There should be contiuity between the: outer brush and T23 terminal, and inner brush and T24 terminal



Abnormal → Replace the brush holder (P. 9-2).

Normal

Go to P. 2-28.

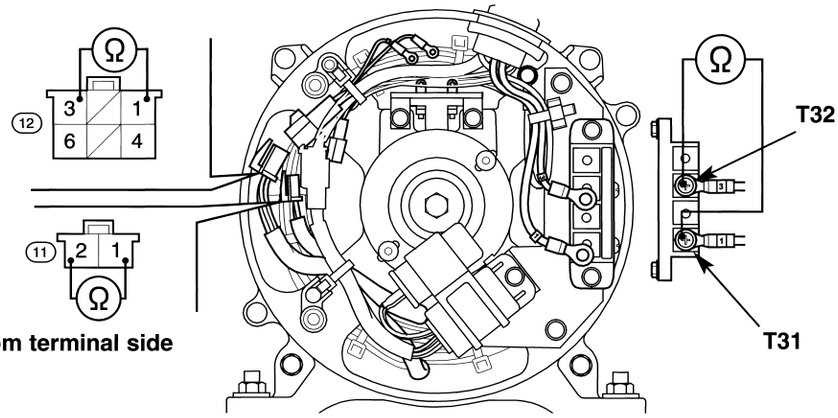
From P. 2-27.

8. EM10000:
Disconnect the ⑪ and ⑫ connectors and T21 and T22 terminals. Measure the resistance between the terminals of the stator winding.

Standard resistance:
Main winding
T31 — T32 terminals: 0.2 - 0.4 Ω

Sensor winding (⑪ connector):
No. 1 — No. 2 terminals: 0.05 Ω Max.

Exciter winding (⑫ connector):
No. 1 — No. 3 terminals: 1.6 - 2.0 Ω

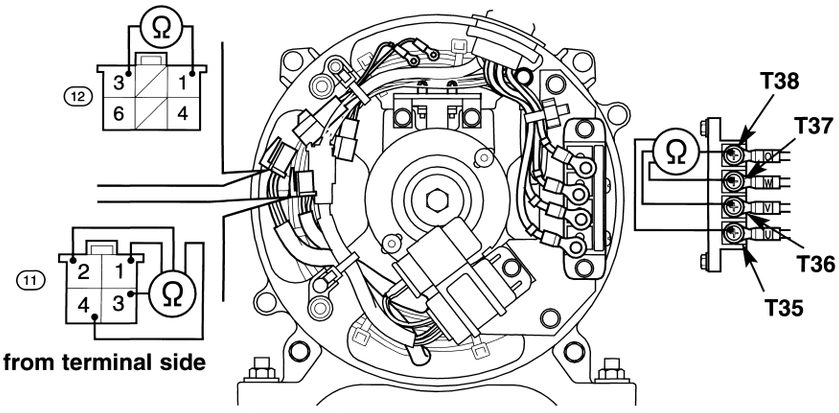


ET12000:
Disconnect the ⑪ and ⑫ connectors and T25, T26, T27 and T28 terminals. Measure the resistance between the terminals of the stator winding.

Standard resistance:
Main winding:
T38 — T35 terminals: 0.6 - 0.8 Ω
T38 — T36 terminals: 0.6 - 0.8 Ω
T38 — T37 terminals: 0.6 - 0.8 Ω

Sensor winding (⑪ connector):
No. 3 — No. 1 terminals: 0.08 Ω Max.
No. 3 — No. 2 terminals: 0.08 Ω Max.
No. 3 — No. 4 terminals: 0.08 Ω Max.

Exciter winding (⑫ connector):
No. 1 — No. 3 terminals: 2.0 - 2.5 Ω



Normal

Go to P. 2-29.

Abnormal

Replace the stator (P. 9-2).

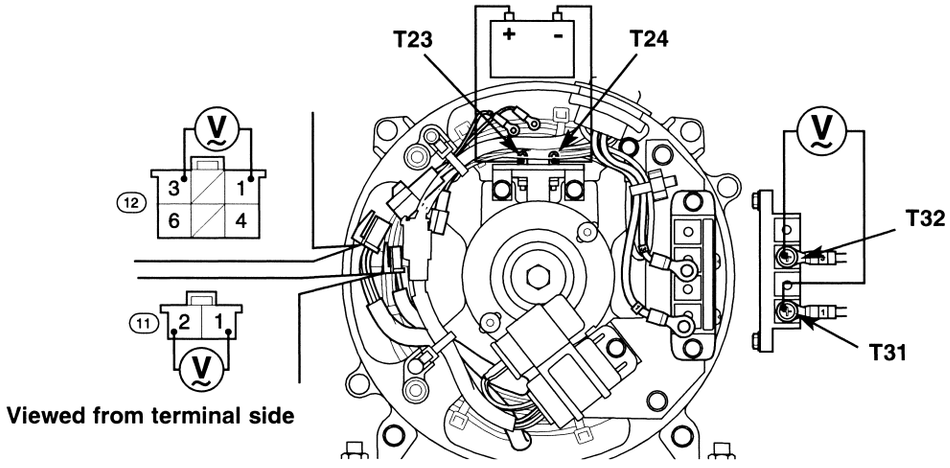
From P. 2-28.

9. Connect a known good 12V battery to the brush terminal (battery positive to T23 and negative to T24 terminals). Measure the voltage between the terminals of the stator winding with the engine running at no load speed.

Standard voltage:
EM10000:
Main winding:
T31 — T32 terminals:
RG type: 103±15 VAC
R type: 96±14 VAC

Exciter winding (⑫ connector):
No. 1 — No. 3 terminals: 33±5 VAC

Sensor winding (⑪ connector):
No. 1 — No. 2 terminals: 8±1 VAC

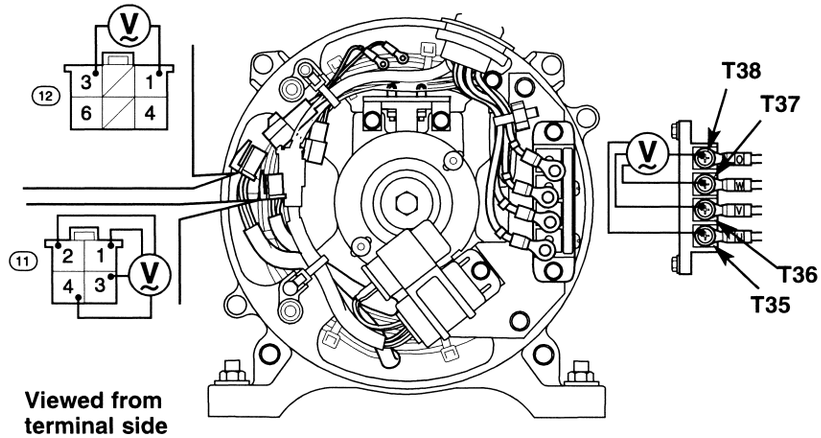


Viewed from terminal side

ET12000:
Main winding:
RG Type:
T38 — T35 terminals: 111±16 VAC
T38 — T36 terminals: 111±16 VAC
T38 — T37 terminals: 111±16 VAC
R Type:
T38 — T35 terminals: 105±15 VAC
T38 — T36 terminals: 105±15 VAC
T38 — T37 terminals: 105±15 VAC

Exciter winding (⑫ connector):
No. 1 — No. 3 terminals: 48±7 VAC

Sensor winding (⑪ connector):
No. 3 — No. 1 terminals: 6±1 VAC
No. 3 — No. 2 terminals: 6±1 VAC
No. 3 — No. 4 terminals: 6±1 VAC



Viewed from terminal side

Normal

Go to P. 2-30.

Abnormal

Replace the stator (P. 9-2).

From P. 2-29.

10. Connect the all terminals and connectors to the generator. Remove the control box. Disconnect the ④, ⑤ and ⑥ connectors from the AVR.
Measure the resistance of the stator winding at the wire harness side connectors.

EM10000:
Standard resistance:
Exciter winding (⑤ connector):
No. 1 — No. 3 terminals: 0.2 - 0.4 Ω

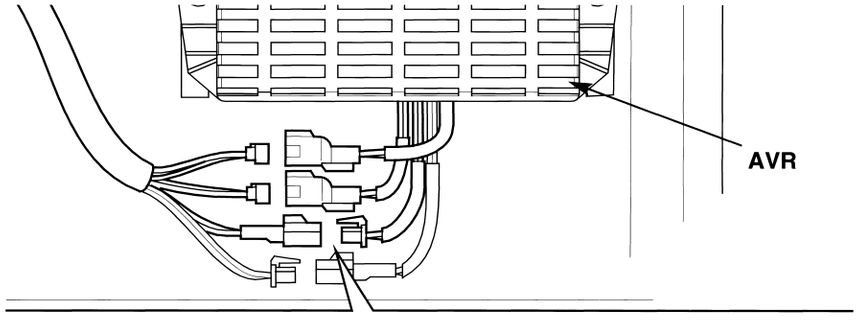
Sensor winding (④ connector):
No. 2 — No. 1 terminals: 0.05 Ω Max.

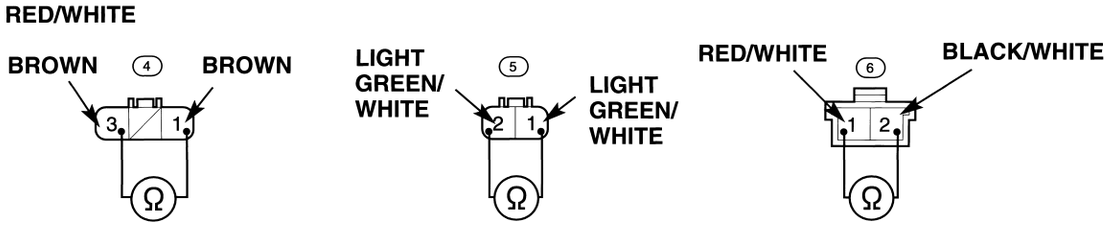
Field winding (⑥ connector):
No. 1 — No. 2 terminals: 49 - 59 Ω

ET12000:
Standard resistance:
Exciter winding (⑤ connector):
No. 1 — No. 3 terminals: 2.0 - 2.5 Ω

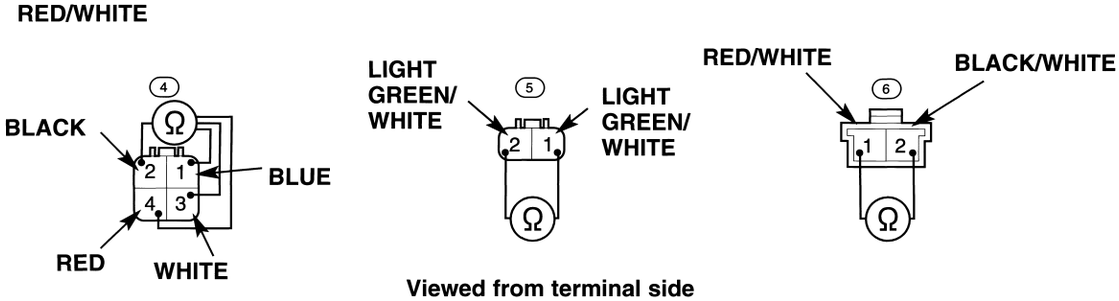
Sensor winding (④ connector):
No. 2 — No. 1 terminals: 0.08 Ω Max.
No. 2 — No. 3 terminals: 0.08 Ω Max.
No. 2 — No. 4 terminals: 0.08 Ω Max.

Field winding (⑥ connector):
No. 1 — No. 2 terminals: 49 - 59 Ω





Viewed from terminal side



Viewed from terminal side

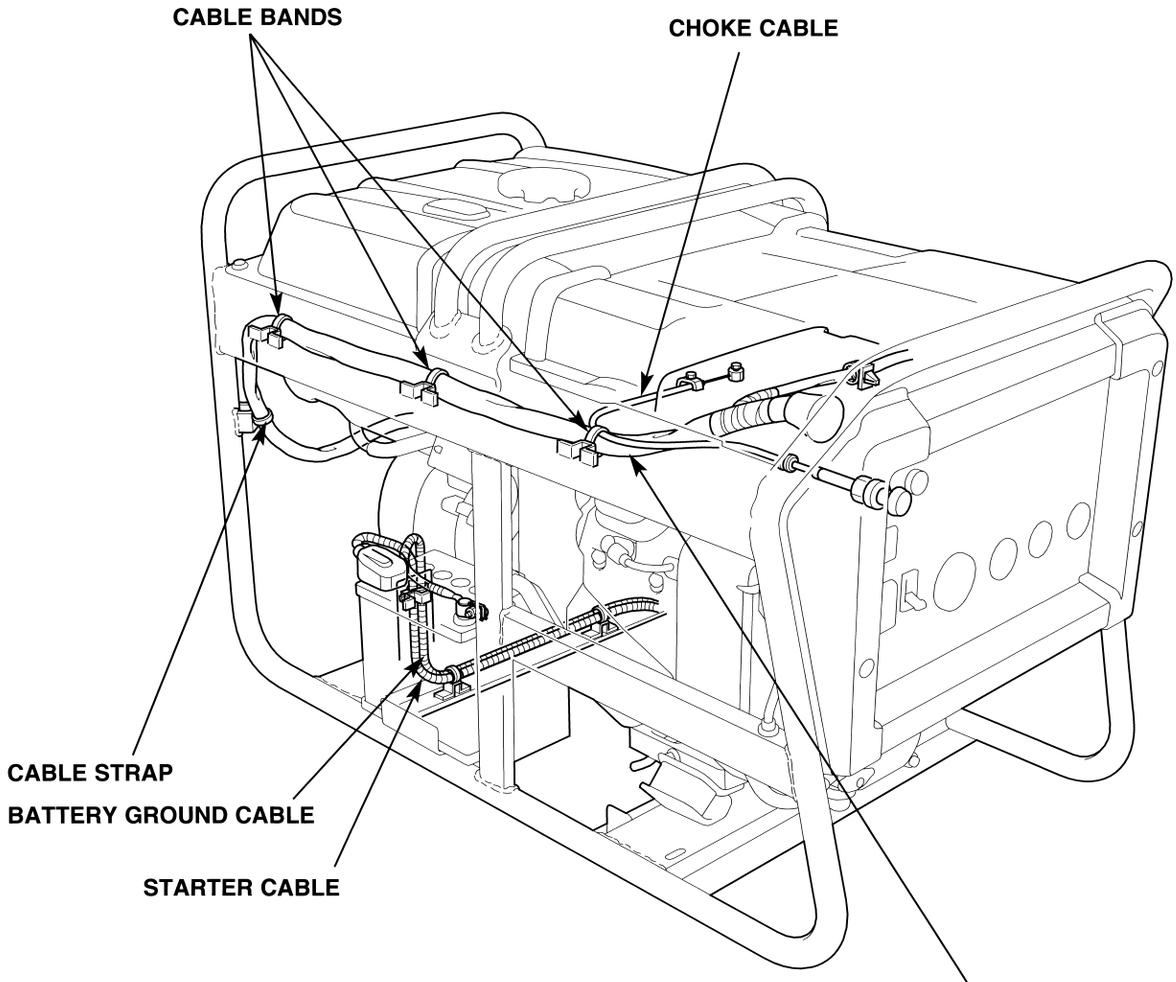
Normal

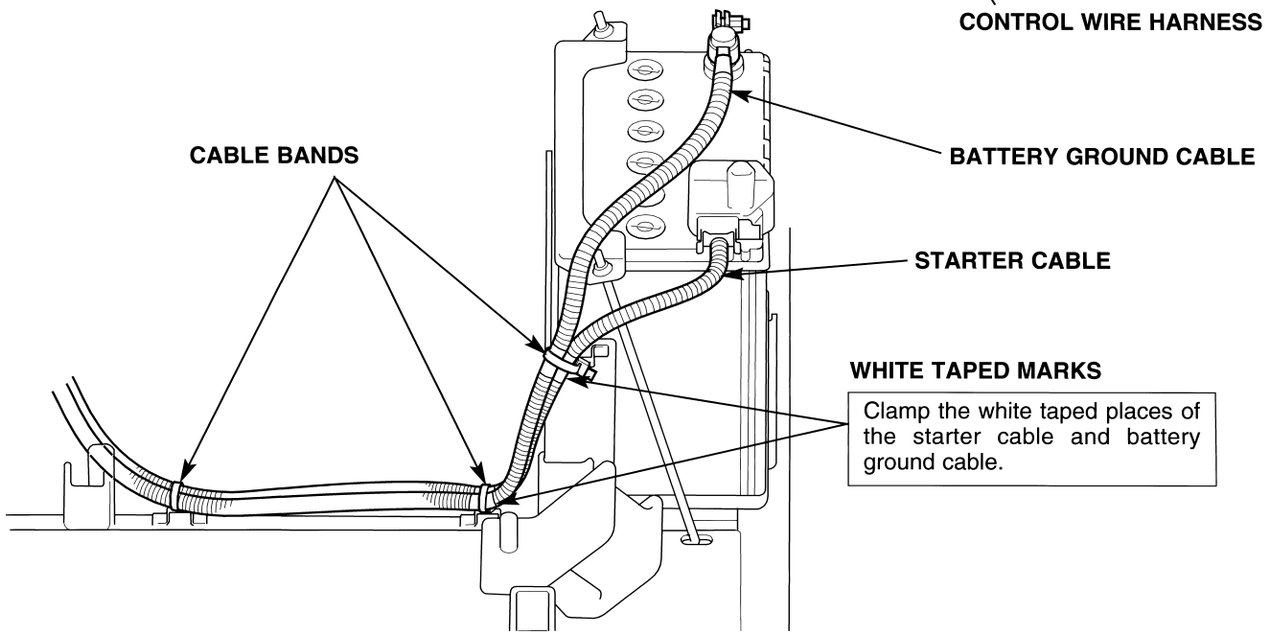
Replace the AVR and retest (P. 8-4 thru 8-6).

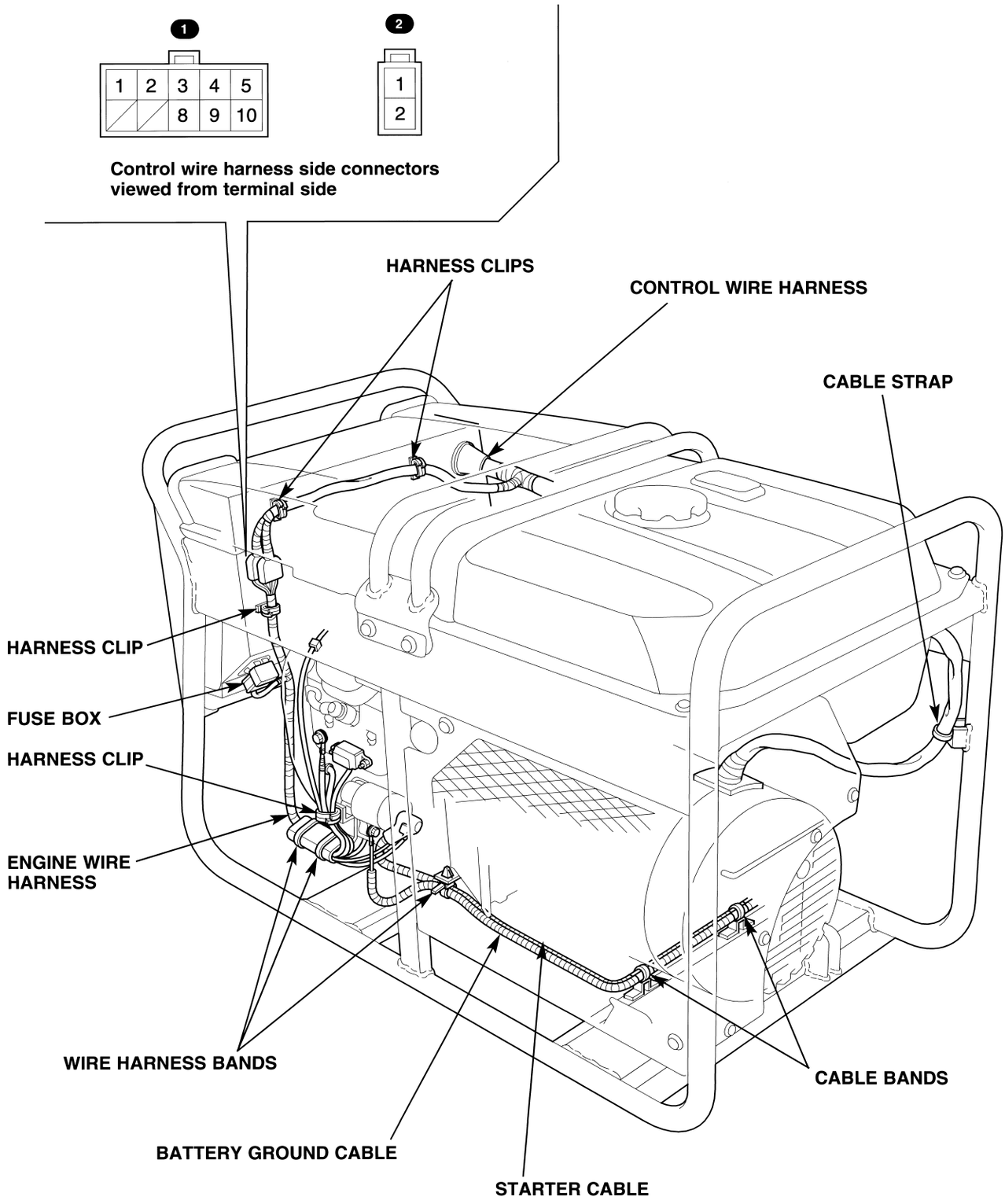
Abnormal

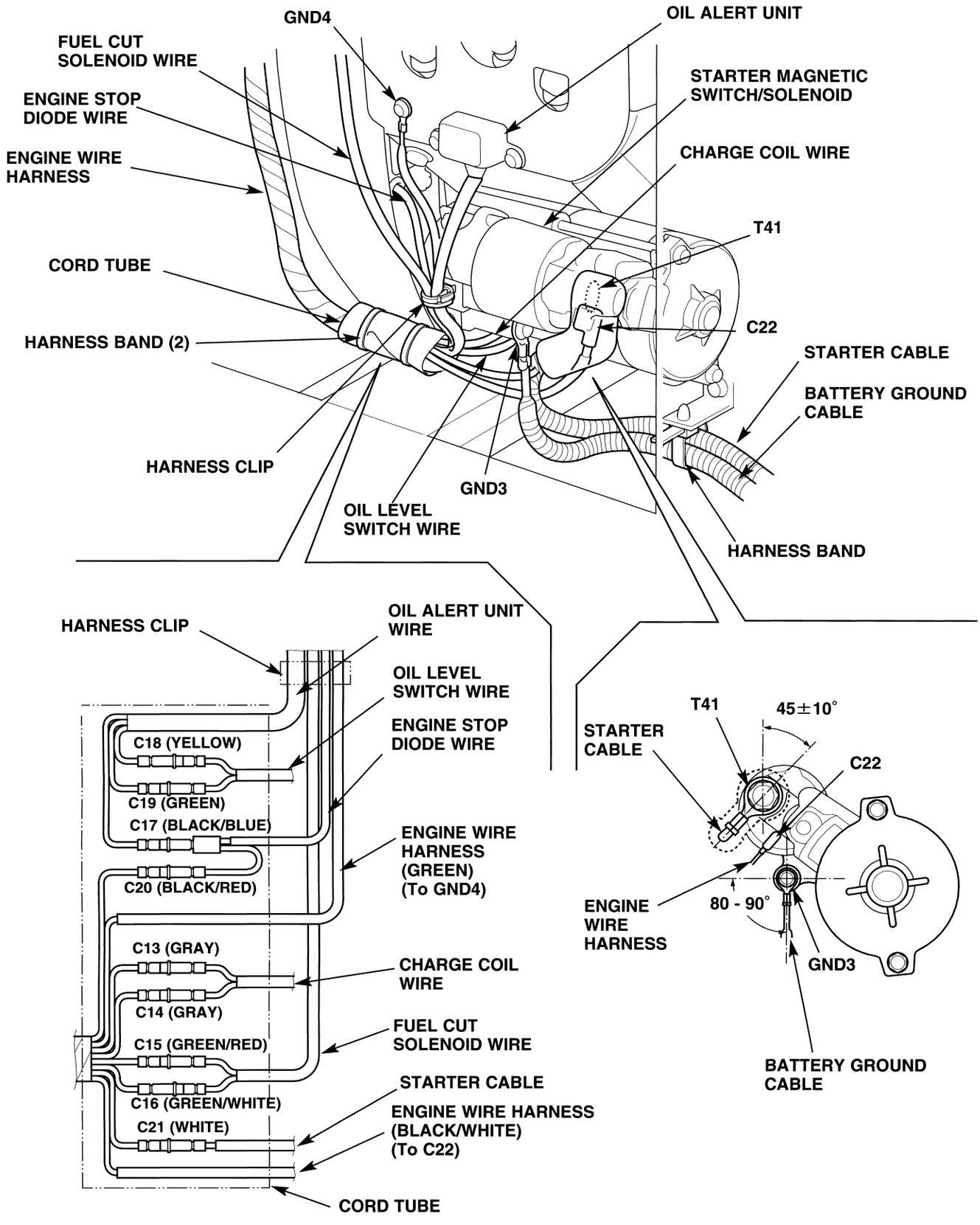
Replace or repair the wire harness.

10. CABLE & HARNESS ROUTING

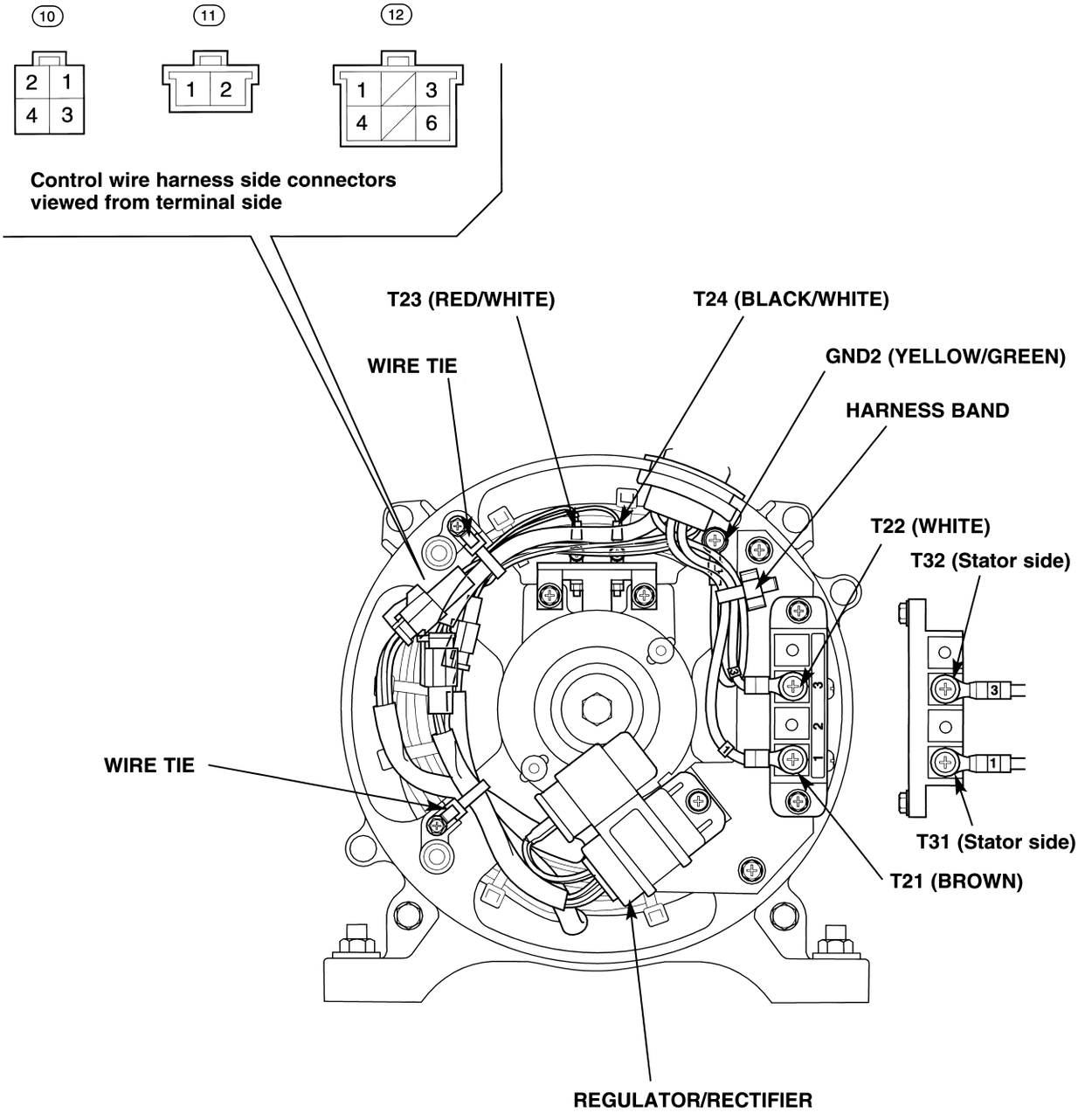




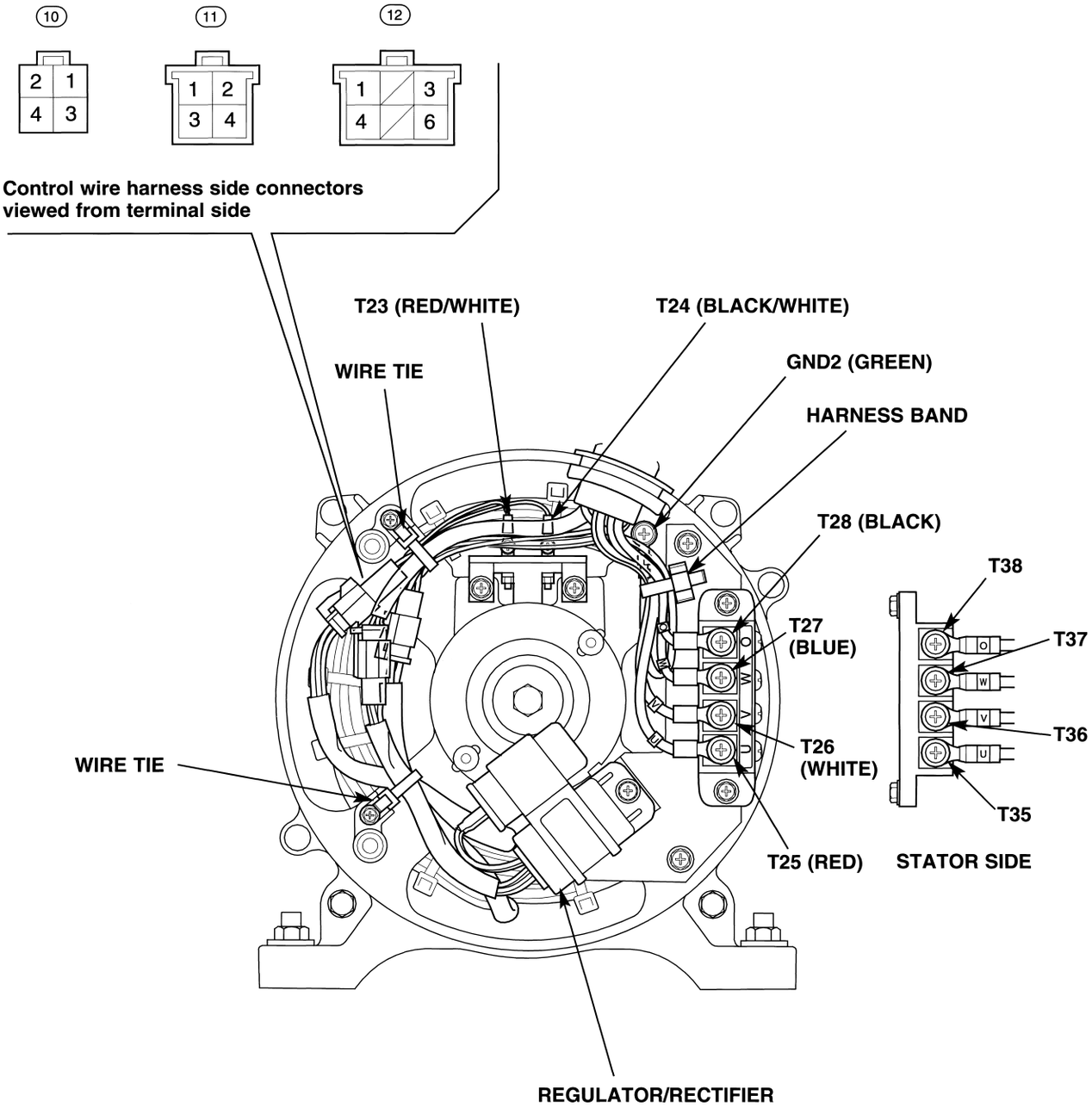

1
2
1 2 3 4 5
8 9 10
1
2
Control wire harness side connectors viewed from terminal side
HARNESS CLIPS
CONTROL WIRE HARNESS
CABLE STRAP
HARNESS CLIP
FUSE BOX
HARNESS CLIP
ENGINE WIRE HARNESS
WIRE HARNESS BANDS
CABLE BANDS
BATTERY GROUND CABLE
STARTER CABLE


GND4
OIL ALERT UNIT
FUEL CUT SOLENOID WIRE
STARTER MAGNETIC SWITCH/SOLENOID
ENGINE STOP DIODE WIRE
CHARGE COIL WIRE
ENGINE WIRE HARNESS
T41
CORD TUBE
C22
HARNESS BAND (2)
STARTER CABLE
BATTERY GROUND CABLE
HARNESS CLIP
GND3
OIL LEVEL SWITCH WIRE
HARNESS BAND
HARNESS CLIP
OIL ALERT UNIT WIRE
OIL LEVEL SWITCH WIRE
ENGINE STOP DIODE WIRE
C18 (YELLOW)
C19 (GREEN)
C17 (BLACK/BLUE)
ENGINE WIRE HARNESS (GREEN) (To GND4)
C20 (BLACK/RED)
C13 (GRAY)
CHARGE COIL WIRE
C14 (GRAY)
FUEL CUT SOLENOID WIRE
C15 (GREEN/RED)
STARTER CABLE
C16 (GREEN/WHITE)
ENGINE WIRE HARNESS (BLACK/WHITE) (To C22)
C21 (WHITE)
CORD TUBE
T41
45±10°
STARTER CABLE
C22
ENGINE WIRE HARNESS
80 - 90°
GND3
BATTERY GROUND CABLE

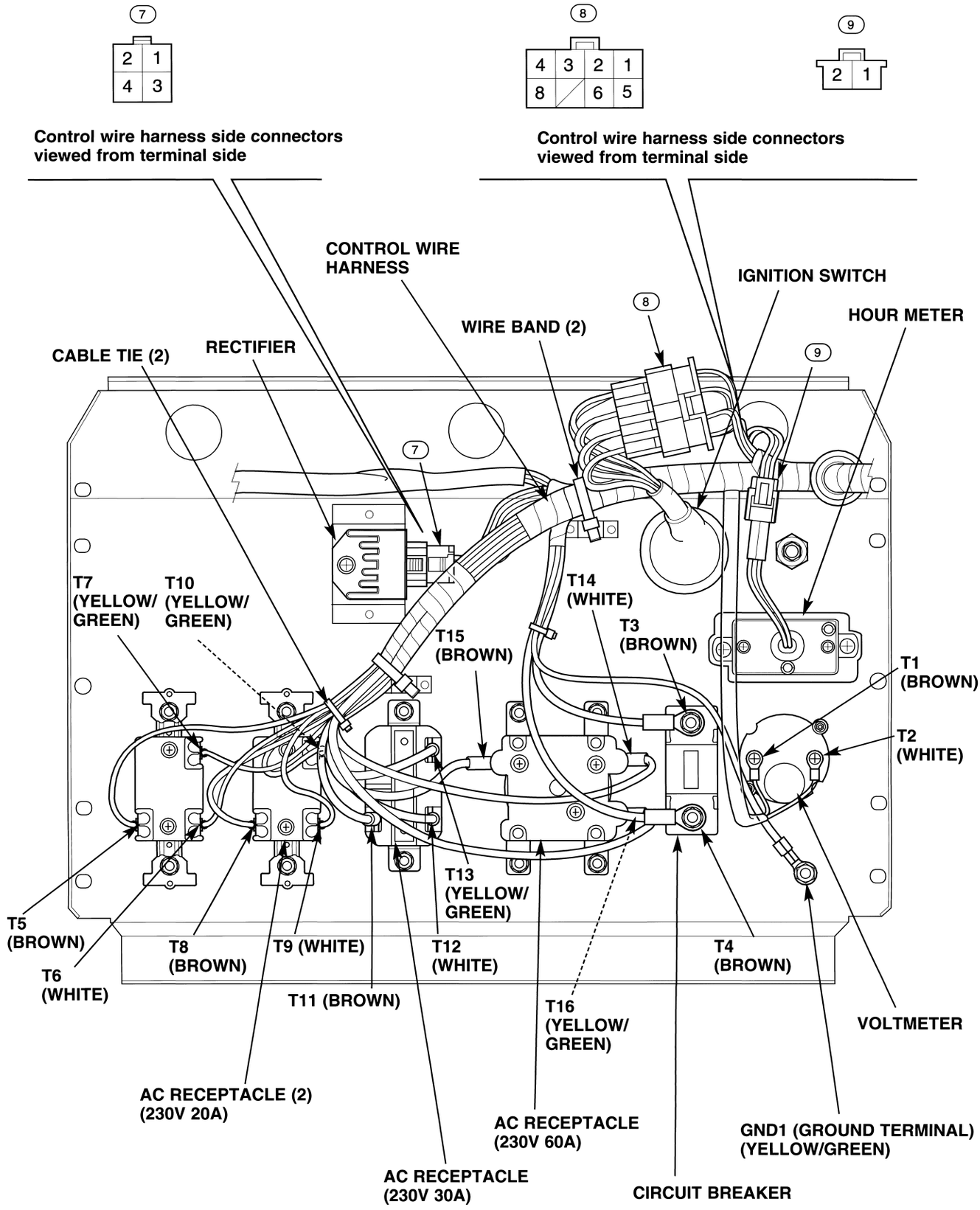
• EM10000


10
11
12
2 1
4 3
1 2
1 3
4 6
Control wire harness side connectors viewed from terminal side
T23 (RED/WHITE)
T24 (BLACK/WHITE)
WIRE TIE
GND2 (YELLOW/GREEN)
HARNESS BAND
T22 (WHITE)
T32 (Stator side)
WIRE TIE
T31 (Stator side)
T21 (BROWN)
REGULATOR/RECTIFIER

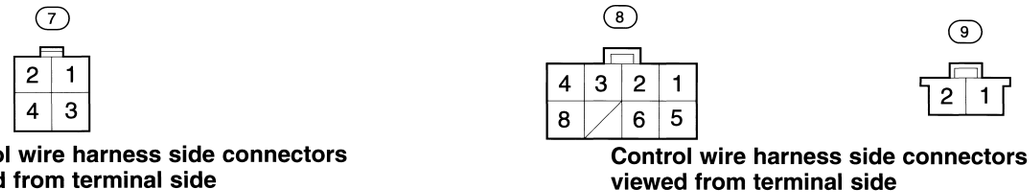
• ET12000


10
11
12
2 1
4 3
1 2
3 4
1 3
4 6
Control wire harness side connectors viewed from terminal side
T23 (RED/WHITE)
T24 (BLACK/WHITE)
WIRE TIE
GND2 (GREEN)
HARNESS BAND
T28 (BLACK)
T38
T27 (BLUE)
T37
T36
T26 (WHITE)
WIRE TIE
T35
T25 (RED)
STATOR SIDE
REGULATOR/RECTIFIER

• EM10000

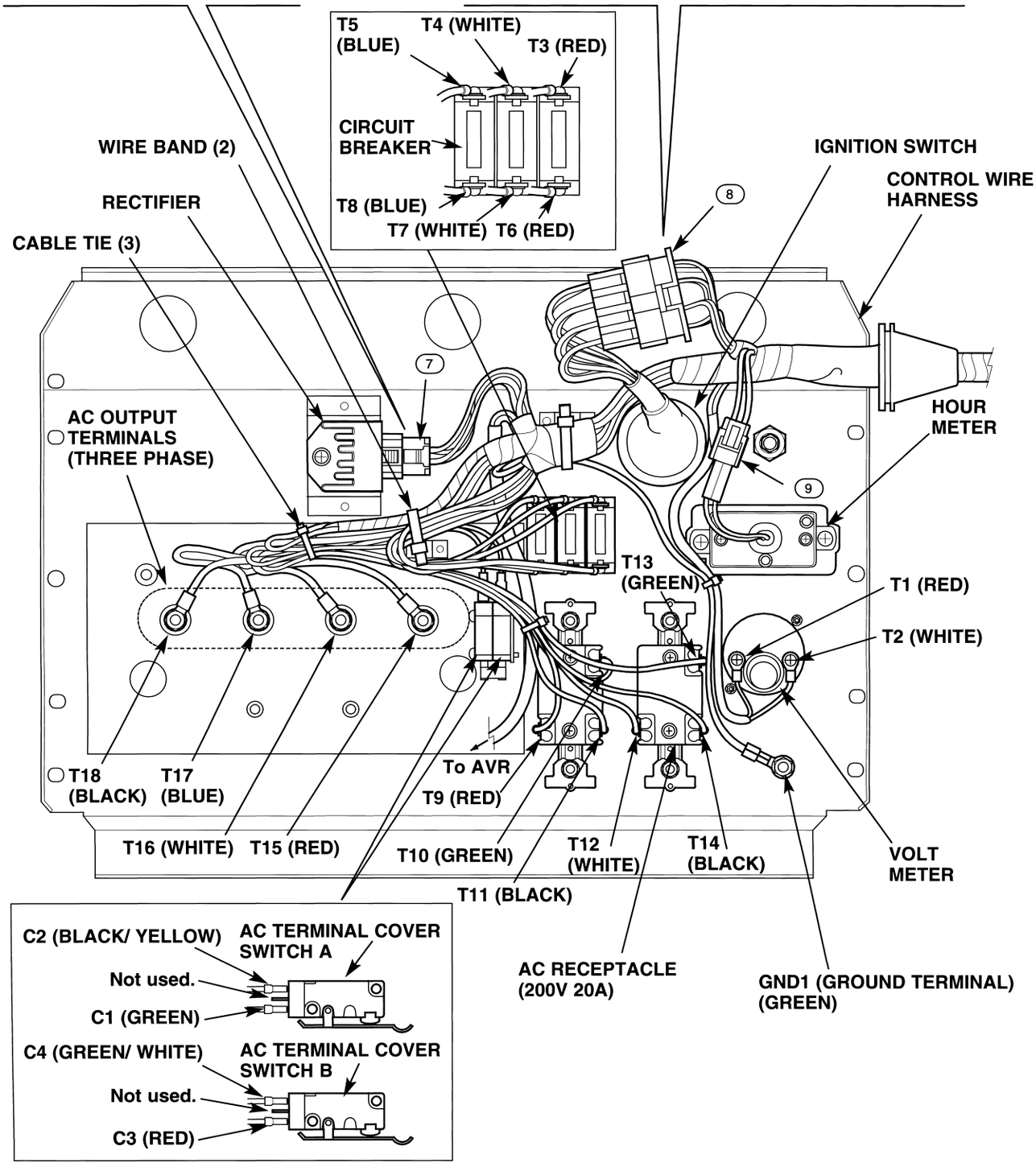

7
2 1
4 3
Control wire harness side connectors viewed from terminal side
8
4 3 2 1
8 6 5
9
2 1
Control wire harness side connectors viewed from terminal side
CONTROL WIRE HARNESS
IGNITION SWITCH
HOUR METER
WIRE BAND (2)
CABLE TIE (2)
RECTIFIER
T7 (YELLOW/ GREEN)
T10 (YELLOW/ GREEN)
T14 (WHITE)
T15 (BROWN)
T3 (BROWN)
T1 (BROWN)
T2 (WHITE)
T5 (BROWN)
T6 (WHITE)
T8 (BROWN)
T9 (WHITE)
T12 (WHITE)
T13 (YELLOW/ GREEN)
T4 (BROWN)
T11 (BROWN)
T16 (YELLOW/ GREEN)
VOLTMETER
AC RECEPTACLE (2) (230V 20A)
AC RECEPTACLE (230V 60A)
GND1 (GROUND TERMINAL) (YELLOW/GREEN)
AC RECEPTACLE (230V 30A)
CIRCUIT BREAKER

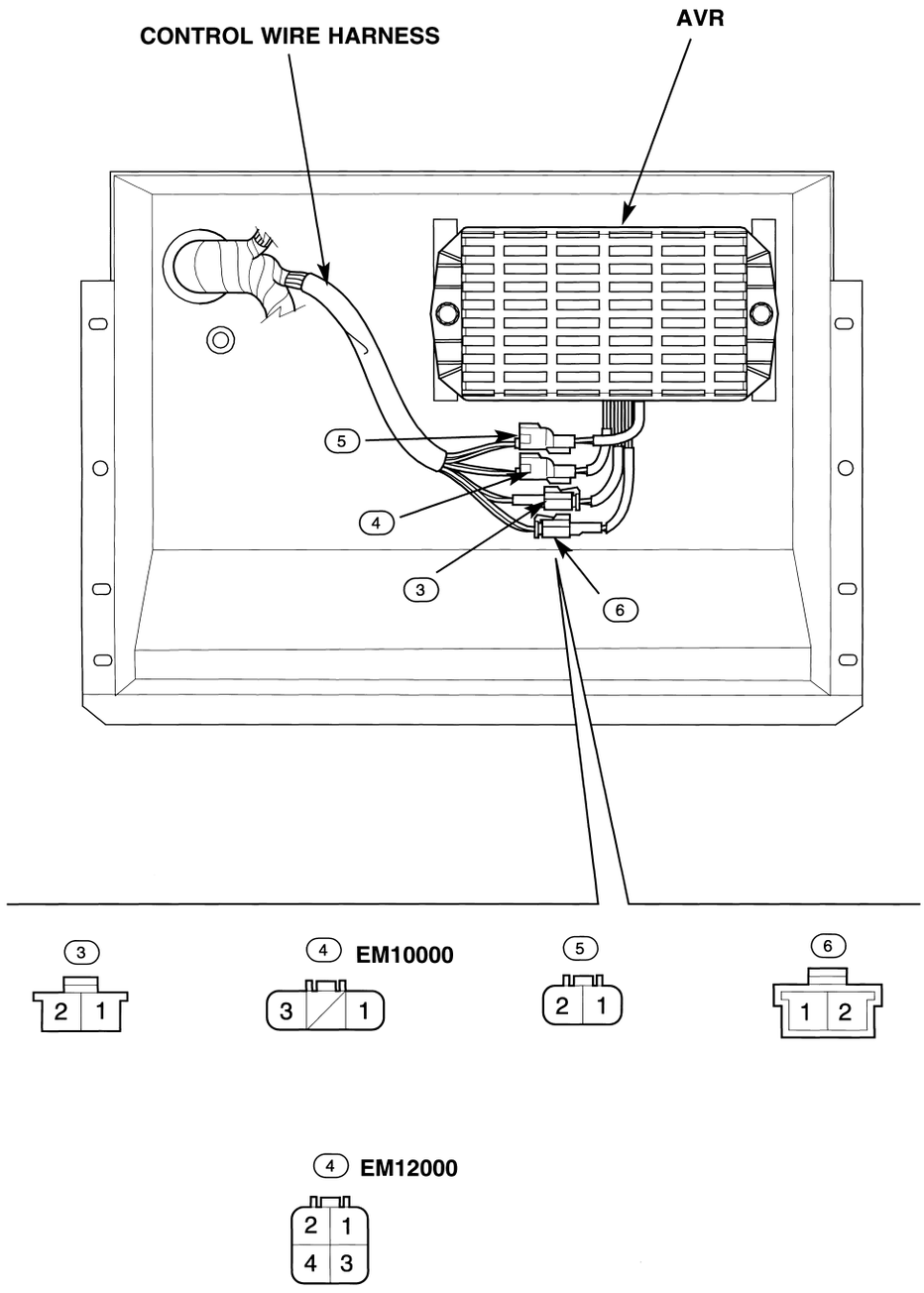
• ET12000



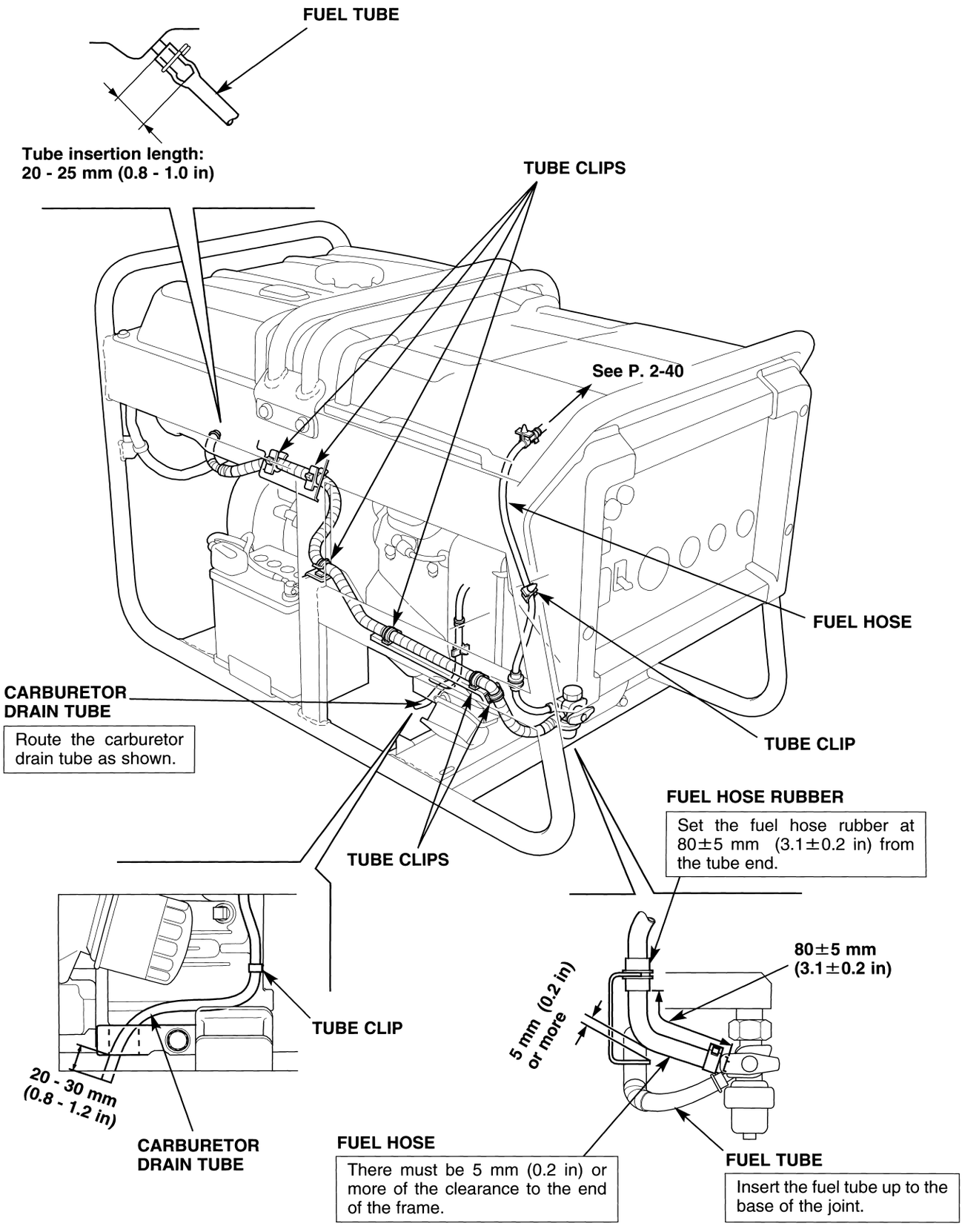
Control wire harness side connectors viewed from terminal side

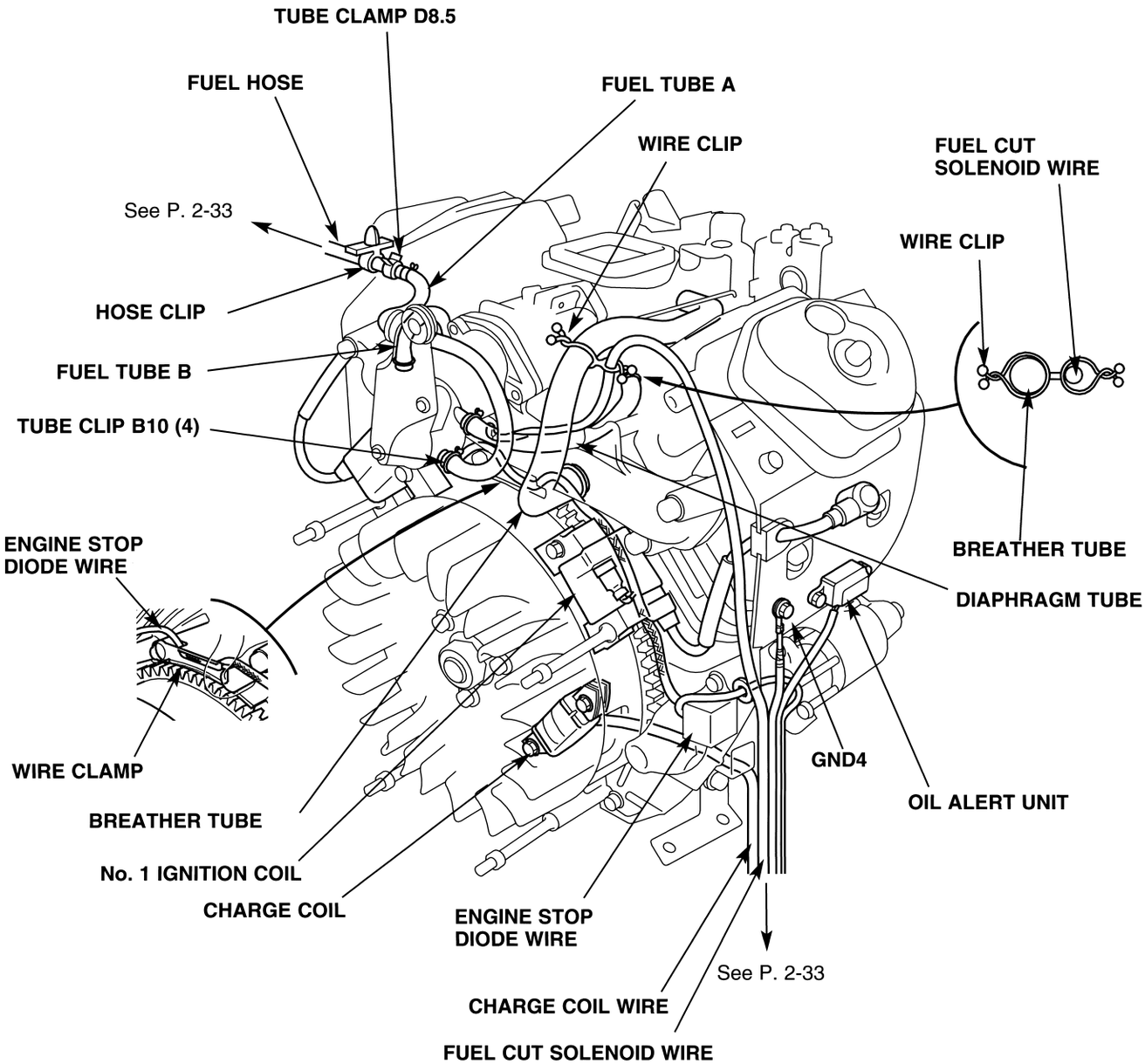
Control wire harness side connectors viewed from terminal side

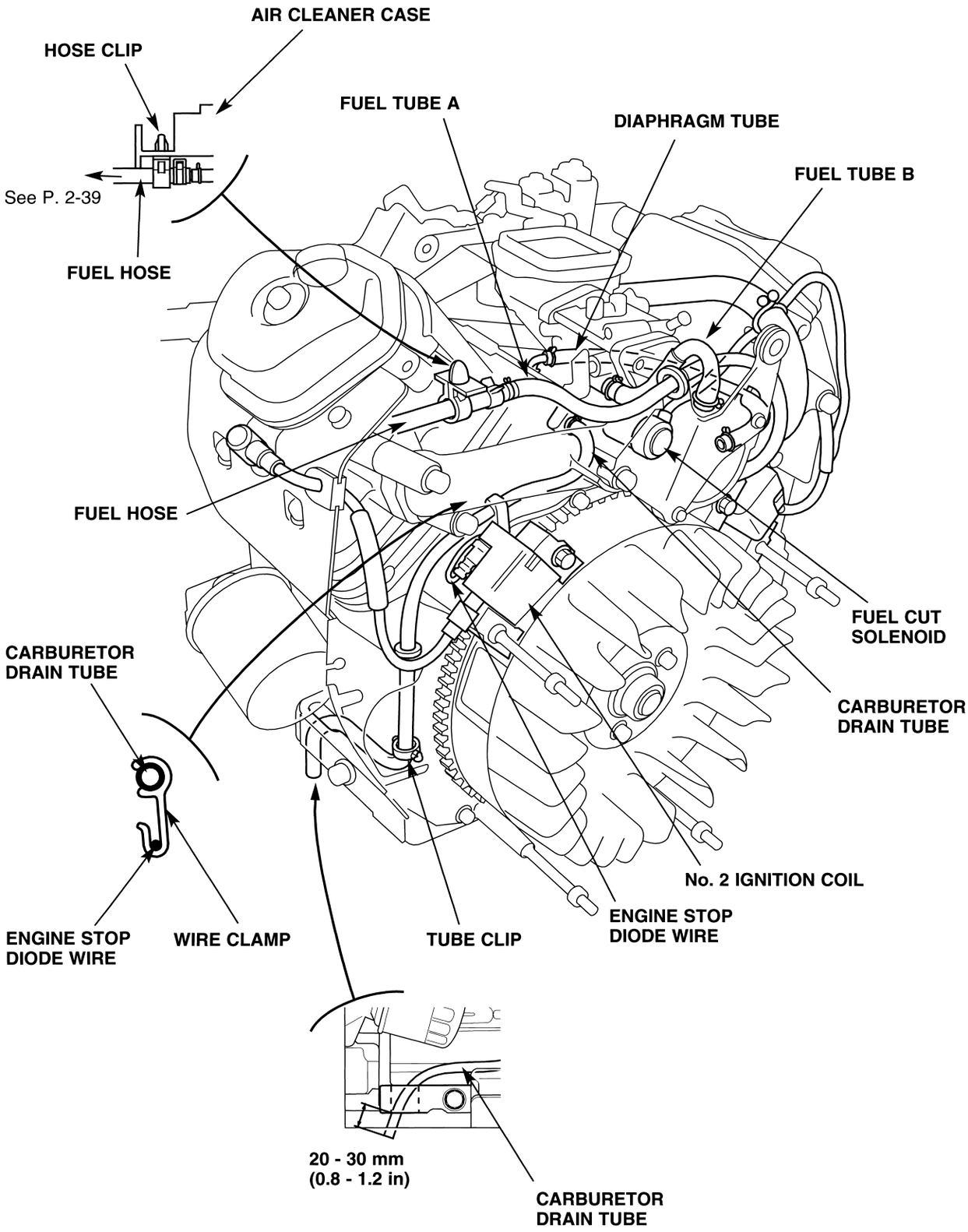




Control wire harness side connectors viewed from terminal side


FUEL TUBE
Tube insertion length:
20 - 25 mm (0.8 - 1.0 in)
TUBE CLIPS
See P. 2-40
FUEL HOSE
CARBURETOR
DRAIN TUBE
Route the carburetor drain tube as shown.
TUBE CLIP
FUEL HOSE RUBBER
Set the fuel hose rubber at 80±5 mm (3.1±0.2 in) from the tube end.
TUBE CLIPS
80±5 mm
(3.1±0.2 in)
5 mm (0.2 in) or more
TUBE CLIP
20 - 30 mm
(0.8 - 1.2 in)
CARBURETOR
DRAIN TUBE
FUEL HOSE
There must be 5 mm (0.2 in) or more of the clearance to the end of the frame.
FUEL TUBE
Insert the fuel tube up to the base of the joint.


TUBE CLAMP D8.5
FUEL HOSE
FUEL TUBE A
WIRE CLIP
FUEL CUT SOLENOID WIRE
See P. 2-33
WIRE CLIP
HOSE CLIP
FUEL TUBE B
TUBE CLIP B10 (4)
ENGINE STOP DIODE WIRE
BREATHER TUBE
DIAPHRAGM TUBE
WIRE CLAMP
GND4
OIL ALERT UNIT
BREATHER TUBE
No. 1 IGNITION COIL
CHARGE COIL
ENGINE STOP DIODE WIRE
See P. 2-33
CHARGE COIL WIRE
FUEL CUT SOLENOID WIRE


AIR CLEANER CASE
HOSE CLIP
FUEL TUBE A
DIAPHRAGM TUBE
FUEL TUBE B
See P. 2-39
FUEL HOSE
FUEL HOSE
FUEL CUT SOLENOID
CARBURETOR DRAIN TUBE
CARBURETOR DRAIN TUBE
No. 2 IGNITION COIL
ENGINE STOP DIODE WIRE
ENGINE STOP DIODE WIRE
WIRE CLAMP
TUBE CLIP
20 - 30 mm (0.8 - 1.2 in)
CARBURETOR DRAIN TUBE

1. MAINTENANCE SCHEDULE

Item / REGULAR SERVICE PERIOD (1) Perform at every indicated month or operating hour interval, whichever comes first.		Each use	First month or 20 hrs.	Every 3 months or 50 hrs.	Every 6 months or 100 hrs.	Every year or 300 hrs	Refer to page
Engine oil	Check level	○					3-2
	Change		○		○		
Engine oil filter	Replace	Every 200 hrs.					3-3
Air cleaner	Check	○					3-4
	Clean			○(2)			
	Replace					○(3)	
Spark plug	Check-adjust				○		3-5
	Replace					○	
Battery electrolyte	Check level	○					3-6
Valve clearance	Check-adjust					○	3-7
Sediment cup	Clean				○		3-9
Combustion chamber	Clean	After every 500 hrs.					15-3
Fuel tank and filter	Clean	Every year					6-1
Fuel tubes	Check	Every 2 years (Replace if necessary)					3-10

(1) For commercial use, log hours of operation to determine proper maintenance intervals.
(2) Service more frequently when used in dusty areas.
(3) Replace paper element type only.

2. ENGINE OIL

Oil Change

Drain the engine oil while the engine is warm. Warm engine oil drains quickly and completely.

1) Place a suitable container under the drain bolt.
   - Place wooden blocks under the generator to make clearance between the generator frame and ground for inserting an oil pan.

2) Remove the oil filler cap, drain bolt and sealing washer, and allow the oil to drain completely.

⚠CAUTION

Used engine oil contains substances that have been identified as carcinogenic. If repeatedly left in contact with the skin for prolonged periods, it may cause skin cancer.

Wash your hands thoroughly with soap and water as soon as possible after contact with used engine oil.

   - Please dispose of used engine oil in a manner that is compatible with the environment. We suggest that you take it in a sealed container to your local waster disposal site, or service station for reclamation. Do not throw it in the trash, pour it on the ground, drown a drain.

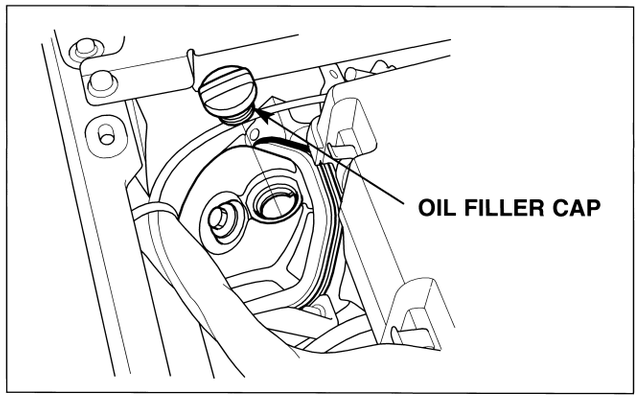
3) Make sure the sealing washer is in good condition and replace it with new one if necessary. Reinstall the drain bolt and sealing washer, and tighten the drain bolt to the specified torque.

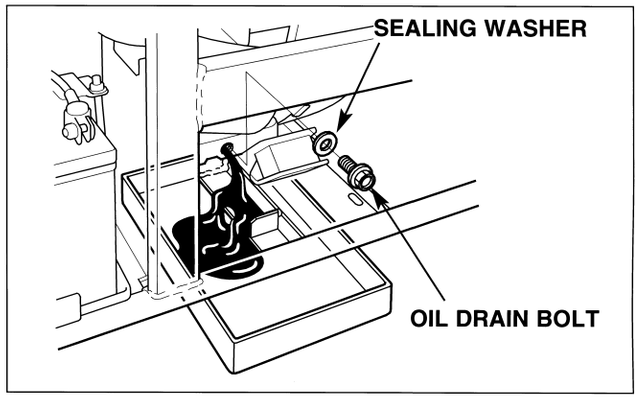
   TORQUE: 39 N·m (40 kgf·m, 29 lbf·ft)

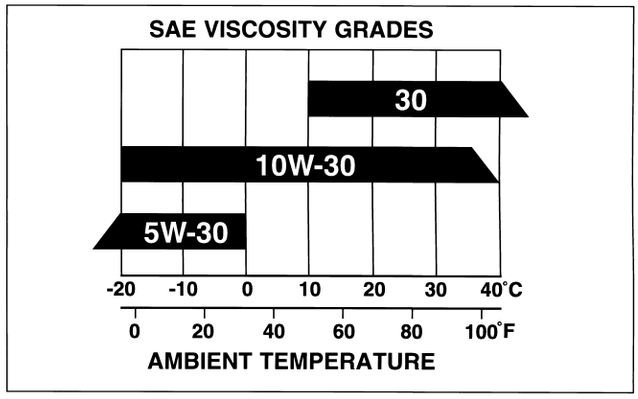
4) Fill the engine with the correct amount of the recommended oil.

Recommended engine oil:	Use a 4-stroke motor oil that meets or exceeds the requirements for API service classification SH or SJ.
Engine oil capacity	Without oil filter replacement: Approximately 1.1 ℓ (1.16 US qt, 0.97 Imp qt) With oil filter replacement: Approximately. 1.4 ℓ (1.48 US qt, 1.23 Imp qt)

   - SAE 10W-30 is recommended for general use. Other viscosities shown in the chart may be used when the average temperature in your area is within the recommended range.

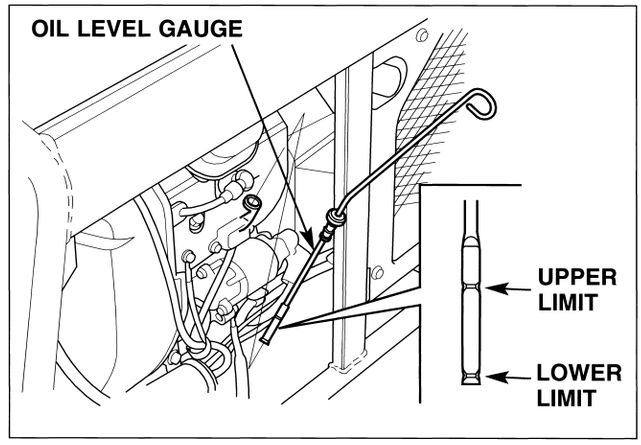






5) Remove the oil level gauge and wipe it clean with a cloth.

6) Reinstall the oil level gauge and check the oil level shown on the oil level gauge.
If near or below the lower limit mark, add to the upper limit mark with the recommended oil.



3. ENGINE OIL FILTER

Oil Filter Replacement

1) Drain the engine oil (P. 3-2).

2) Place a rag under the oil filter to trap oil leakage.

3) Remove the oil filter using the oil filter wrench and let the remaining oil drain out.
• Dispose of the oil filter in a manner that is compatible with the environment.

TOOL:
Oil filter wrench 07HAA-PJ70101

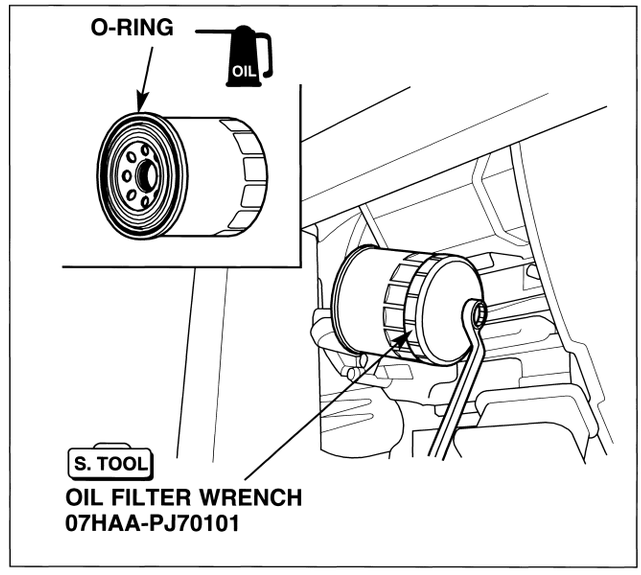
4) Apply a thin coat of engine oil to the oil filter O-ring.

5) Screw on the new oil filter until the O-ring contacts the oil filter base, then tighten the oil filter an additional 7/8 turns using the oil filter wrench.

TORQUE: 22 N·m (2.2 kgf·m, 16 lbf·ft)

6) Fill the engine with the specified amount of recommended engine oil (P. 3-2).

7) Start the engine and run it for a few minutes, then stop the engine and check for oil leaks in the oil filter cartridge area. Check the oil level and add the recommended engine oil to the upper limit mark if necessary.



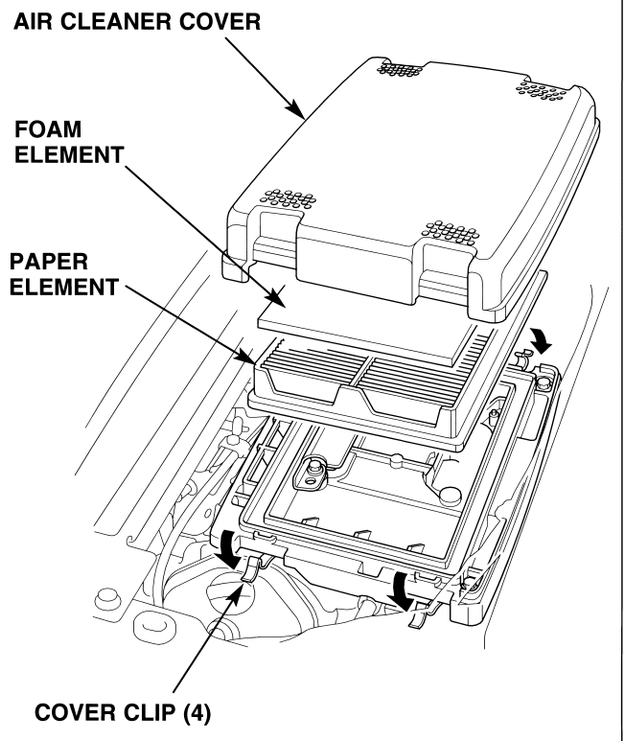
4. AIR CLEANER

Cleaning

A dirty air cleaner element restricts a flow to the carburetor, reducing engine performance. If the generator is operated in dusty areas, clean the air cleaner more often than specified in the MAINTENANCE SCHEDULE (P. 3-1).

NOTICE

Operating the engine without an air cleaner element or with a damaged air cleaner element, will allow dirt to enter the engine, causing rapid engine wear.



1) Remove the maintenance cover.

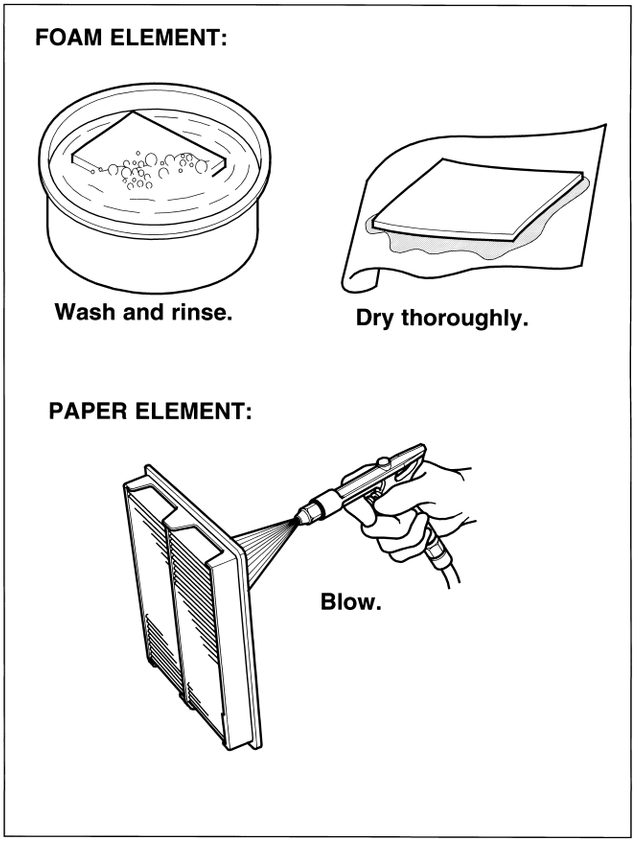
2) Unsnap the cover clips and then remove the air cleaner cover.

3) Remove the paper air cleaner element from the air cleaner case and remove the foam air cleaner element from the air cleaner cover.

4) Carefully check both elements for holes or tears and replace if necessary.

5) Clean both elements, if they are to be reused.
   Foam element: Clean in warm soapy water, rinse and allow it dry thoroughly, or clean with a high flash point solvent and allow it dry. Do not put oil to the foam element.

   Paper element: Tap the element several times on a hard surface to remove dirt, or blow compressed air (not exceed 207 KPa, 2.1 kgf/cm^2, 30 psi) through the element from the clean side that faces the engine. Never try to brush off dirt; brushing will force dirt into the fibers of the paper element.



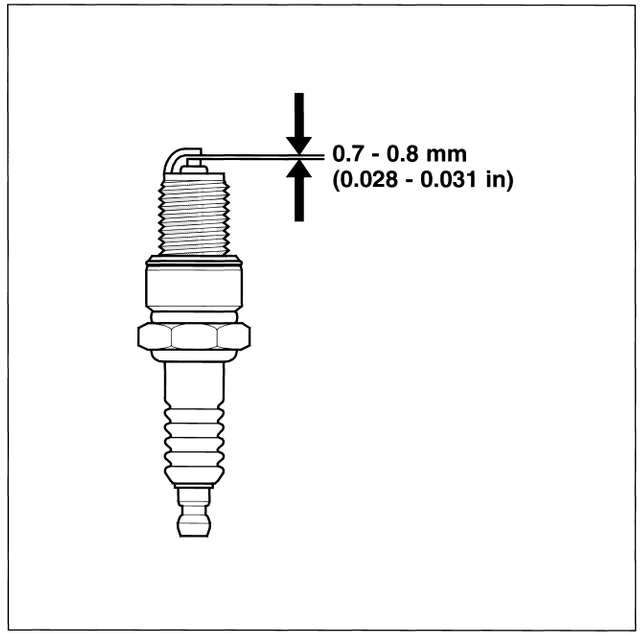
6) Wipe dirt from the inside of the air cleaner case using a moist rag. Be careful to prevent dirt from entering the air duct that leads to the carburetor.

7) Place the foam element onto the air cleaner cover.

8) Install the paper element on the air cleaner case and install the air cleaner cover. Set the cover clips securely.

9) Reinstall the maintenance cover.

5. SPARK PLUGS



Inspection

If the engine has been running, the engine is very hot. Allow it to cool before proceeding.

1) Remove the spark plug caps and remove the spark plugs using the spark plug wrench.

2) Visually inspect the spark plug. Discard the plug if the insulator is cracked, chipped or has excessive carbon builtup.

3) Measure the plug gaps with a wire type feeler gauge. If necessary, adjust the gap by bending the side electrode.

Standard spark plug	ZGR5A (NGK) J16CR-U (DENSO)
Spark plug gap	0.7 - 0.8 mm (0.028 - 0.031 in)

4) Make sure the sealing washers are in good condition and replace if necessary.

5) Install the spark plugs fingertight to seat the washer, then tighten with a spark plug wrench to compress the sealing washer.
   - If reinstall the used spark plug, tighten 1/8 - 1/4 turn after spark plug seats.
   - If install a new spark plug, tighten 1/2 turn after the spark plug seats.

   NOTICE
   - *The spark plugs must be securely tightened. An improper tightened spark plug can become very hot and may damage the engine.*
   - *Overtightening the spark plug can damage the threads in the cylinder head.*

6) Reinstall the spark plug caps.

6. BATTERY

⚠WARNING

Hydrogen gas from batteries are highly flammable and explosive.

• Keep heat, sparks, and flame away.

Inspection

1) Disconnect the battery negative (-) cable first. Then open the positive terminal cover and disconnect the positive (+) cable from the battery.

2) Loosen the 6 mm flange nuts and remove the battery setting plate.

3) Remove the battery and check the battery case for damage or cracks. Replace if necessary.

4) Check the electrolyte level in each cell. If the level is low, remove the battery and add distilled water to bring the level to the UPPER level.

NOTICE

Do not fill the battery above the UPPER level line. If overfilled, electrolyte may overflow and corrode the generator components. Immediately wash off any spilled electrolyte.

5) Check the electrolyte gravity of each cell with a hydrometer.

⚠CAUTION

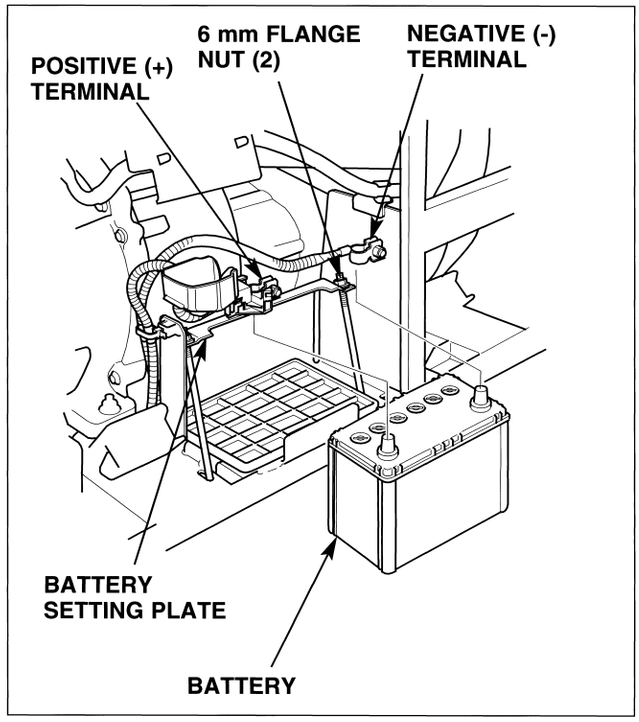
The battery electrolyte contains sulfuric acid. Avoid contact with skin, eyes or clothing. Always shield your eyes when working near batteries.

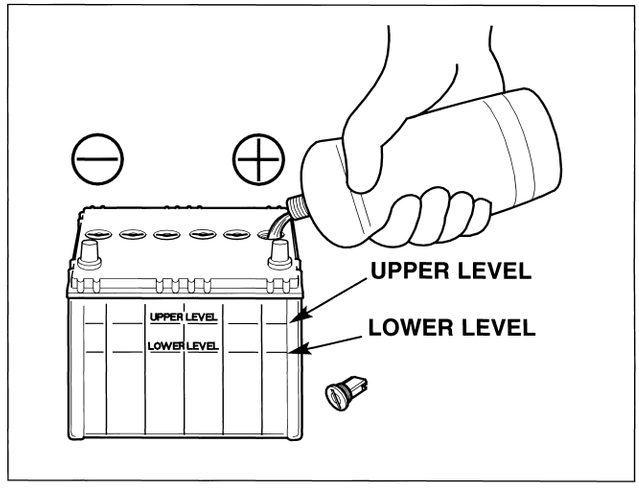
• Antidote:
EXTERNAL - Flush with water.
INTERNAL - Drink large quantities of water or milk. Follow with milk of magnesia, beaten egg, or vegetable oil. Call a physician immediately.
• Eyes:
Flush with water and get prompt medical attention.

Specific gravity	1.270 - 1.290 at 20° C (68° F)

6) Check the battery terminals for corrosion. Clean as necessary.

7) Install the battery and tighten the battery setting plate. Connect the battery positive (+) cable to the battery positive terminal, then connect the negative (-) cable to the battery negative terminal. Coat the battery terminals with grease.





7. VALVE CLEARANCE

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

Inspection

1) Remove the maintenance cover.

2) Remove the fuel hose from the tube clip.

3) Open the wire band and release the contro wire harness and choke cable.

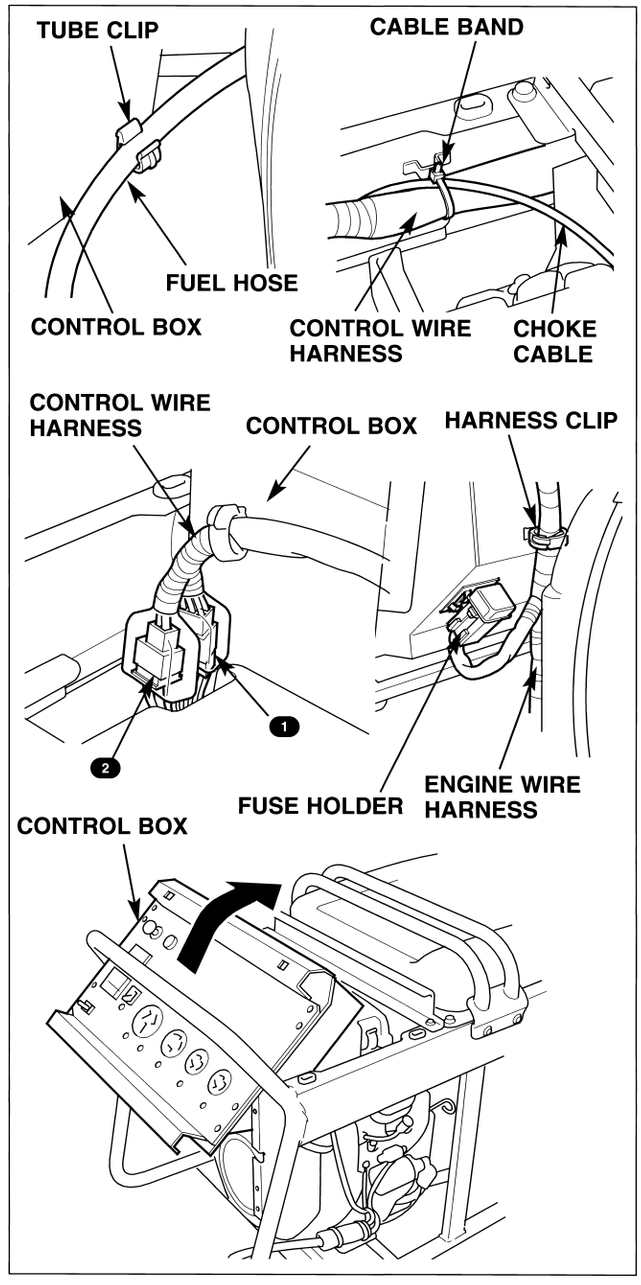
4) Disconnect the ❶ and ❷ connectors (engine wire harness and control panel wire harness connectors).

5) Open the harness clip and release the engine wire harness from the clip and remove the fuse holder from the control box.

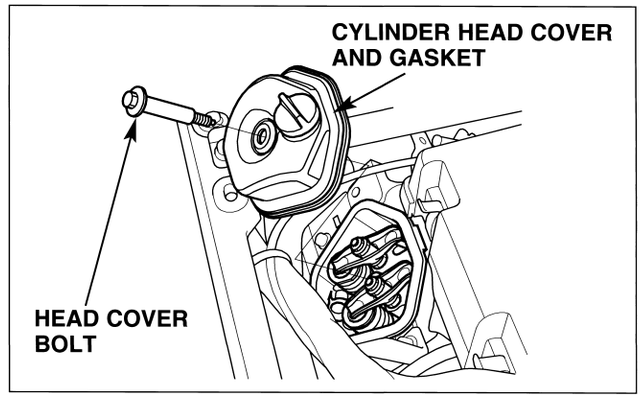
6) Remove the right and left side covers (P. 8-3).

7) Remove the control box mounting four 6 x 12 mm flange bolts, and slide the control box assembly through the front guard pipe and place it on the fuel tank as shown.

8) Remove the fan cover (P. 11-1).

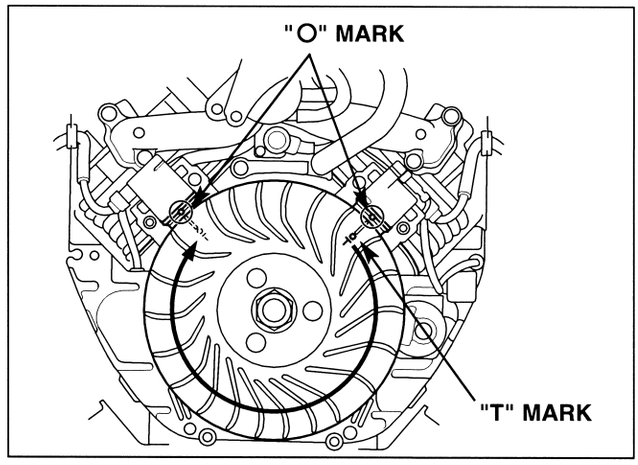


9) Remove the head cover bolt, and remove the cylinder head cover and gasket.



10) Remove the spark plugs.

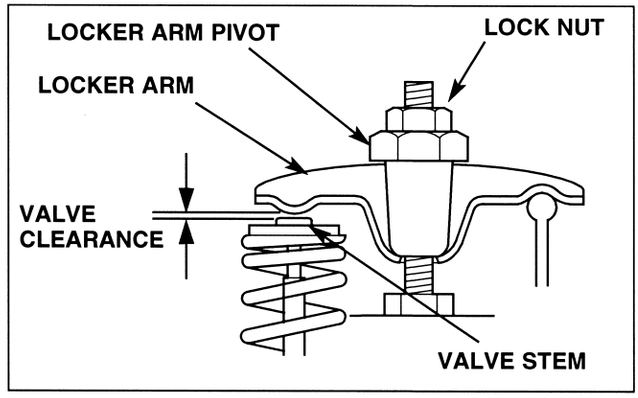
11) Turn the crankshaft until the No. 1 piston comes TDC at compression stroke (both valves closed).
- The "T" mark on the cooling fan should align with the "○" mark on the right cylinder.



12) Check the intake and exhaust valve clearances at No. 1 cylinder by inserting a feeler gauge between the valve stem and rocker arm.

Valve clearance	IN	0.15±0.02 mm (0.0059±0.0008 in)
	EX	0.20±0.02 mm (0.0079±0.0008 in)

13) Turn the crankshaft 270 degrees to put the No. 2 cylinder at TDC of compression stroke, and check the intake and exhaust valve clearances of the No. 2 cylinder.
- The "T" mark on the cooling fan should align with the "○" mark on the left cylinder.



Adjustment

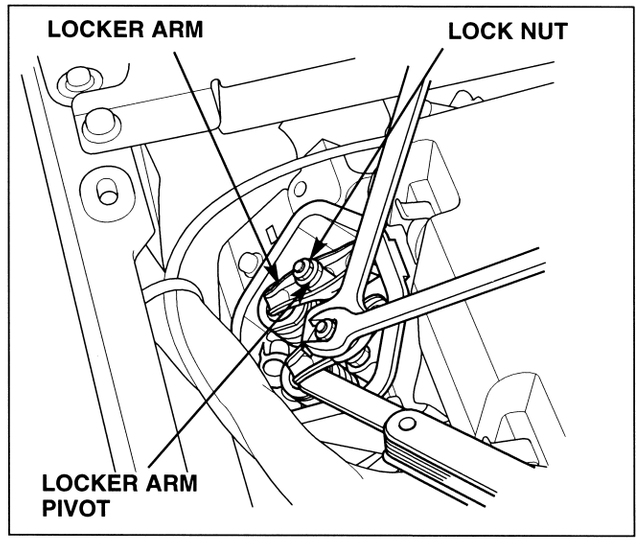
If adjustment is necessary, proceed as follows:

1) Hold the rocker arm pivot and loosen the pivot lock nut.

2) Turn the rocker arm pivot to obtain the specified valve clearance.

3) Hold the rocker arm pivot and tighten the lock nut to the specified torque.

   TORQUE: 10 N·m (1.0 kgf·m, 7 lbf·ft)



4) Recheck the valve clearance after tightening the lock nut.

5) After adjustment, reinstall the cylinder head cover and tighten the head cover bolt.

   TORQUE: 9 N·m (0.9 kgf·m, 6.6 lbf·ft)

6) Install the removed parts in the reverse order of removal.

8. SEDIMENT CUP

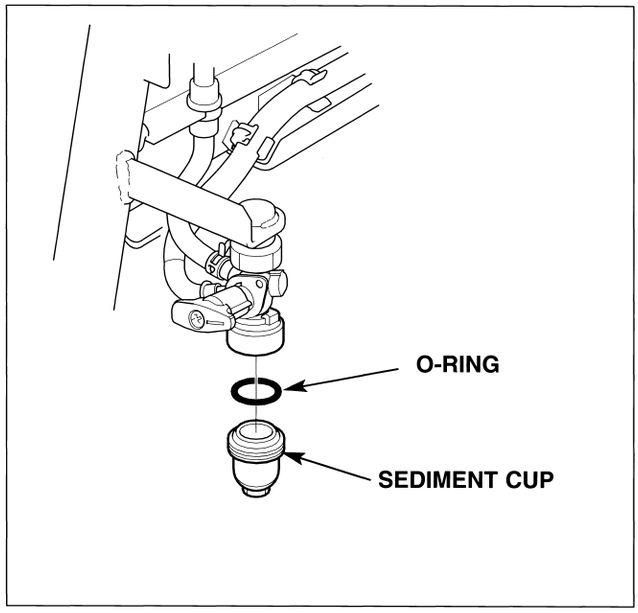
Cleaning

⚠ WARNING

Gasoline is highly flammable and explosive.
You can be burned or seriously injured when handling fuel.

- Keep heat, sparks, and flame away.
- Handle fuel only outdoors.
- Wipe up spills immediately.

1) Turn the fuel valve to the OFF position and remove the sediment cup.
2) Clean the sediment cup.
3) Check the O-ring for good condition and replace if necessary.
4) Install the O-ring and sediment cup. Tighten the sediment cup to the specified torque.
5) After installing the sediment cup turn the fuel valve to the ON position and check for fuel leaks.



9. GOVERNOR

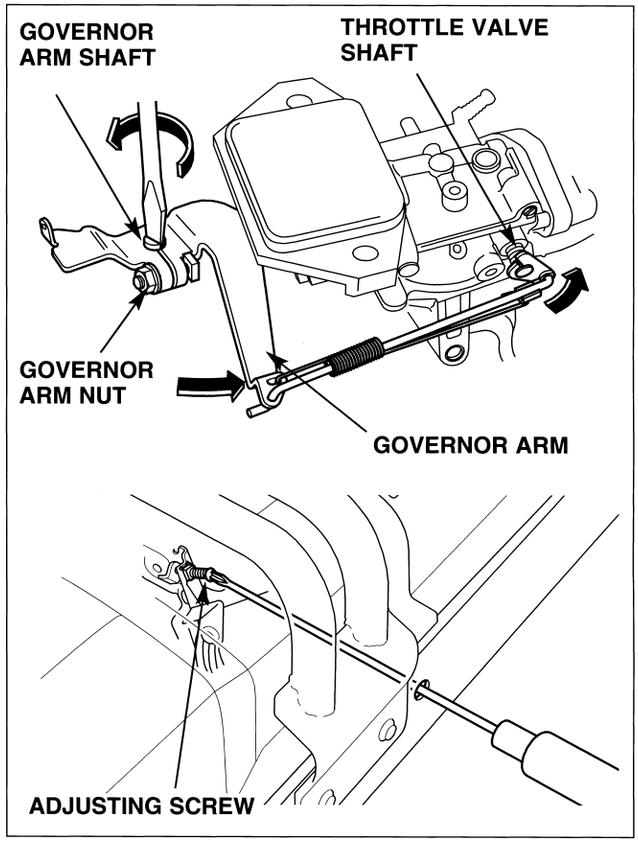
Adjustment

1) Remove the maintenance cover.
2) Remove the air cleaner case (P. 7-1).
3) Loosen the governor arm nut and move the governor arm to fully open the throttle.
4) Holding the carburetor throttle valve fully open, turn the governor arm shaft as far as it will go in the same direction as the governor arm moved to open the throttle (counterclockwise).
5) Tighten the governor arm nut to the specified torque.

   TORQUE: 11 N·m (1.1 kgf·m, 8 lbf·ft)
6) Install the air cleaner (P. 7-1). Start the engine and allow it to warmup to normal operating temperature. Check the engine speed at no load.

Standard engine speed	3,000±100 min^{-1} (rpm)

7) Adjust the engine speed if necessary by turning the adjusting screw.



10. FUEL TUBES

Inspection

⚠WARNING

Gasoline is highly flammable and explosive.
You can be burned or seriously injured when handling fuel.

- Keep heat, sparks, and flame away.
- Handle fuel only outdoors.
- Wipe up spills immediately.

1) Check the fuel tubes for deterioration, cracks or signs of leakage.
   For engine block fuel tubes, remove the the air cleaner and inspect the fuel tubes.

2) Replace the fuel tubes if necessary.

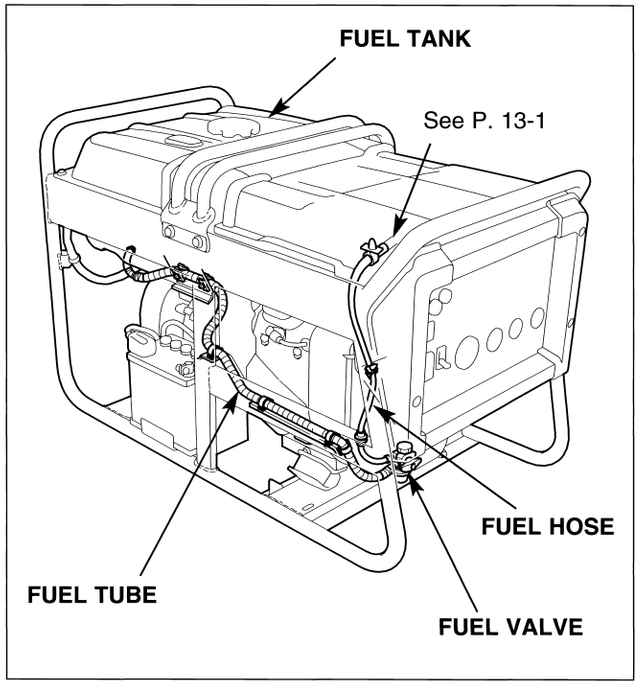
Replacement

• Between the fuel valve and the carburetor:
1) Turn the fuel valve to the OFF position and then replace the fuel hose.

2) After replacing the fuel hose, check for leaks and make sure the area is dry before starting the engine.

• Between the fuel tank and fuel valve:
1) Drain the gasoline from the fuel tank, and then replace the fuel tube.

2) After replacing the fuel tube, check for leaks and make sure the area is dry before starting the engine.



1. BATTERY

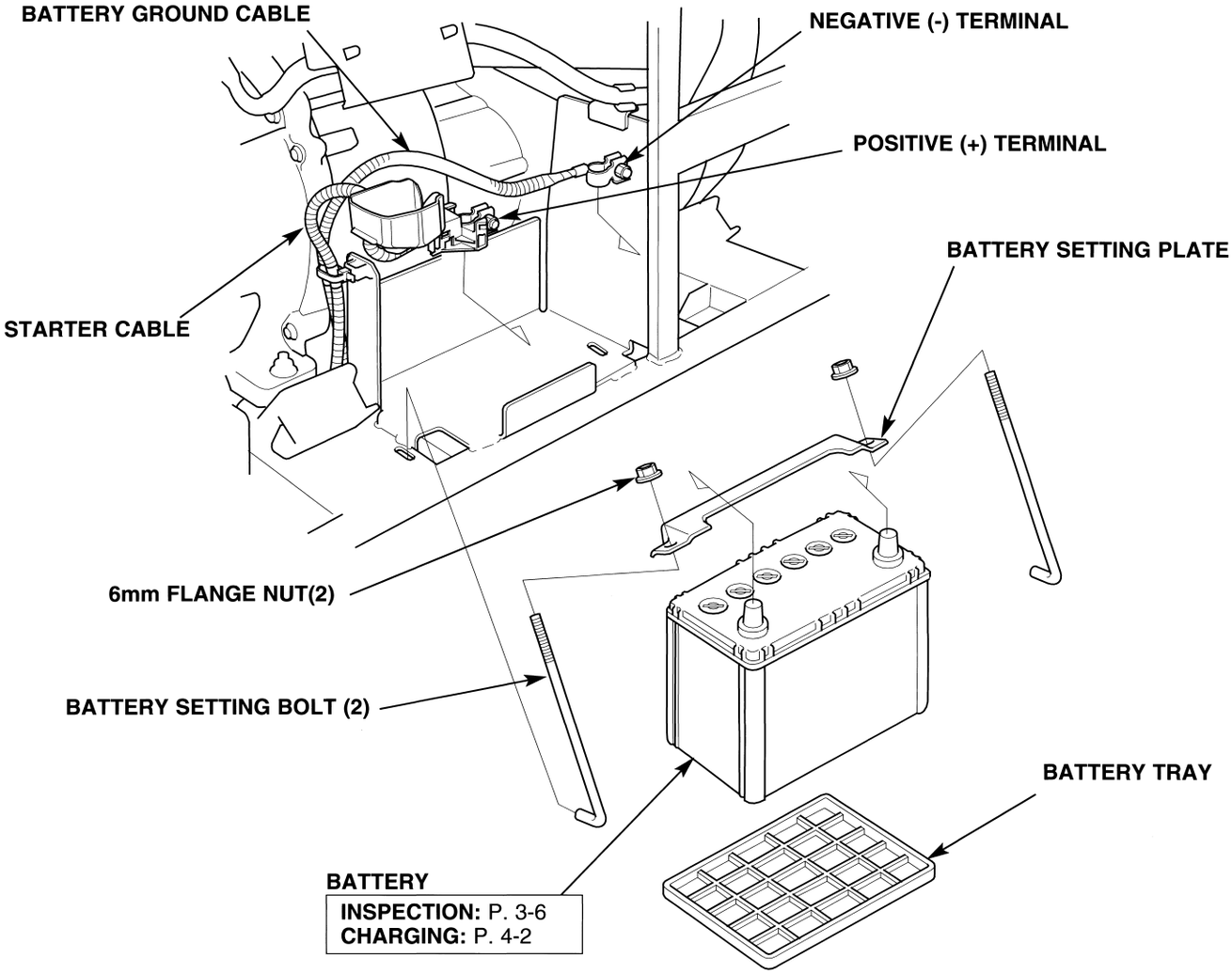
a. REMOVAL/INSTALLATION

⚠WARNING

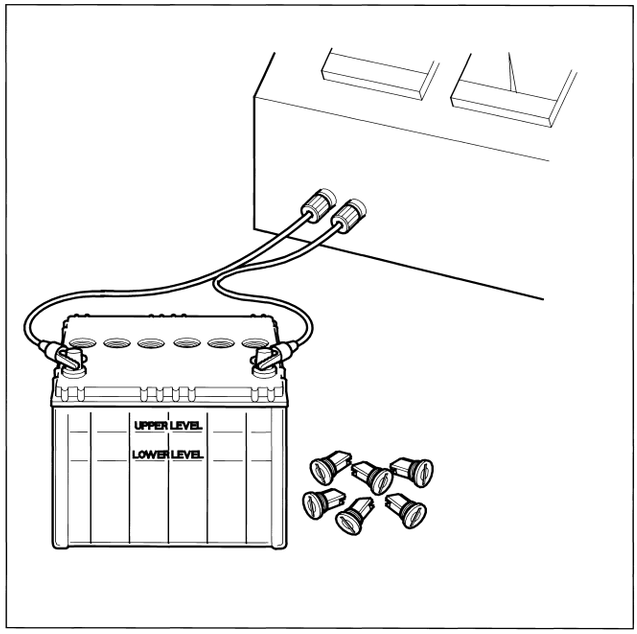
Hydrogen gases from batteries are highly flammable and explosive.

• Keep heat, sparks and flame away.

- When removing the battery, disconnect the negative (-) terminal first, then disconnect the positive (+) terminal.
- When installing the battery, connect the positive (+) terminal first, then connect the negative (-) terminal to the battery.
- Check the battery terminals for corrosion. Clean as necessary. Coat the battery terminals with grease.



2. BATTERY CHARGING



⚠WARNING

Hydrogen gases from batteries are highly flammable and explosive.

Yo can be burned or serious injured when charging battery.
• Keep heat, sparks and flame away.

1) Remove the battery (P. 4-1).

2) Remove the caps from each cell. Verify that the electrolyte level is between the upper and lower level marks.

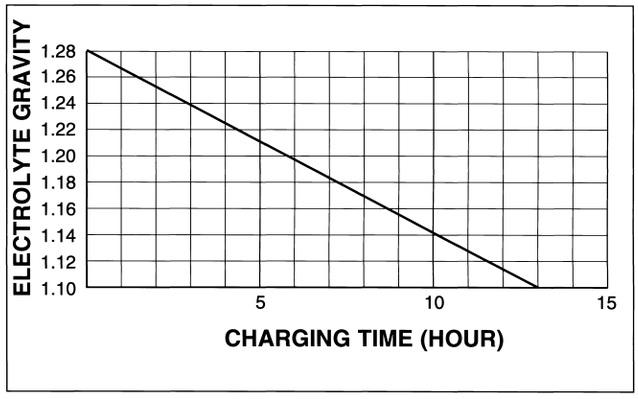
3) Connect the charger positive (+) cable to the battery positive (+) terminal and charger negative cable to the battery negative (-) terminal.

4) Charge the battery until the battery electrolyte gravity is 1.270 - 1.290 at 20° C (68° F).

⚠WARNING

The battery electrolyte contains sulfuric acid. Avoid contact with skin, eyes or clothing. Always shield your eyes when working near batteries.

• Antidote:
EXTERNAL - Flush with water.
INTERNAL - Drink large quantities of water or milk. Follow with milk of magnesia, beaten egg, or vegetable oil. Call a physician immediately.
• Eyes:
Flush with water and get prompt medical attention.



- Discontinue charging if the electrolyte temperature exceeds 45° C (117° F).
- Connect and disconnect the charging cables while power is turned OFF at the charger.
- Quickly charging should only be dune in an emergency; slow charging is preferred.

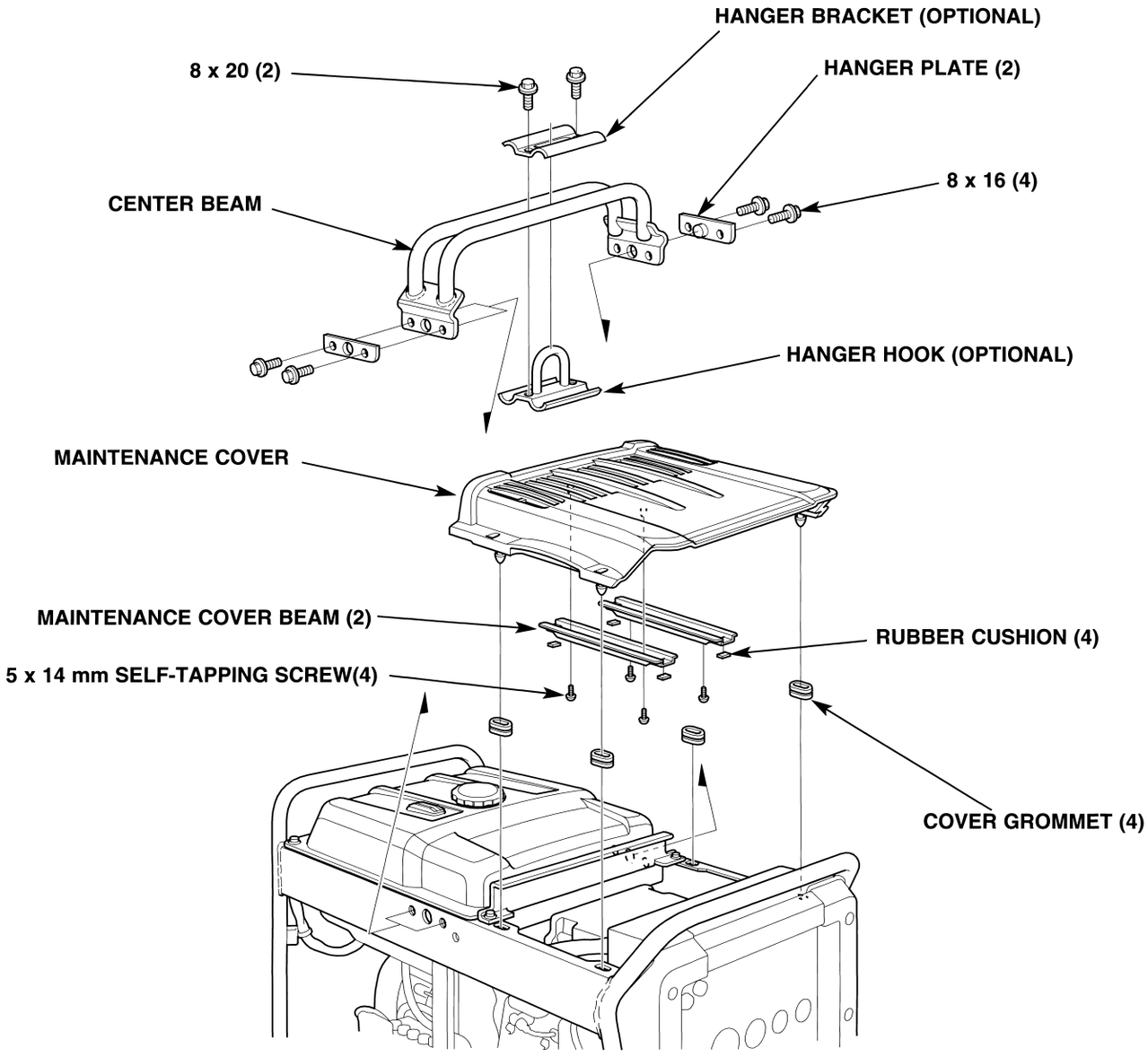
Charging current	2.6A
Charging time	13 hours

5) After charging the battery reinstall the caps.

6) Install the battery (P. 4-1).

1. MAINTENANCE COVER/CENTER BEAM

a. DISASSEMBLY/REASSEMBLY



1. FUEL TANK

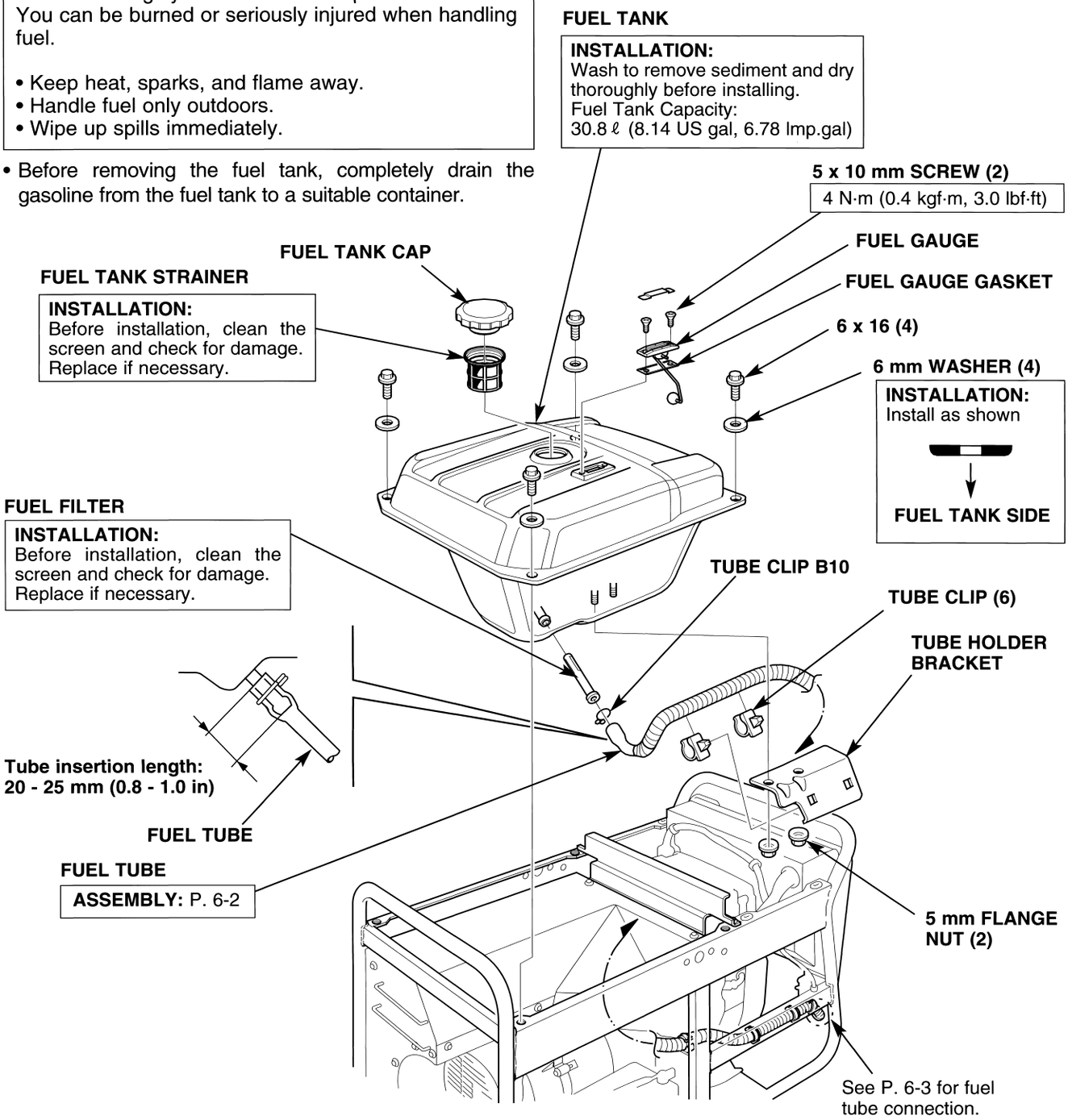
a. DISASSEMBLY/REASSEMBLY

⚠WARNING

Gasoline is highly flammable and explosive.
You can be burned or seriously injured when handling fuel.

- Keep heat, sparks, and flame away.
- Handle fuel only outdoors.
- Wipe up spills immediately.

- Before removing the fuel tank, completely drain the gasoline from the fuel tank to a suitable container.



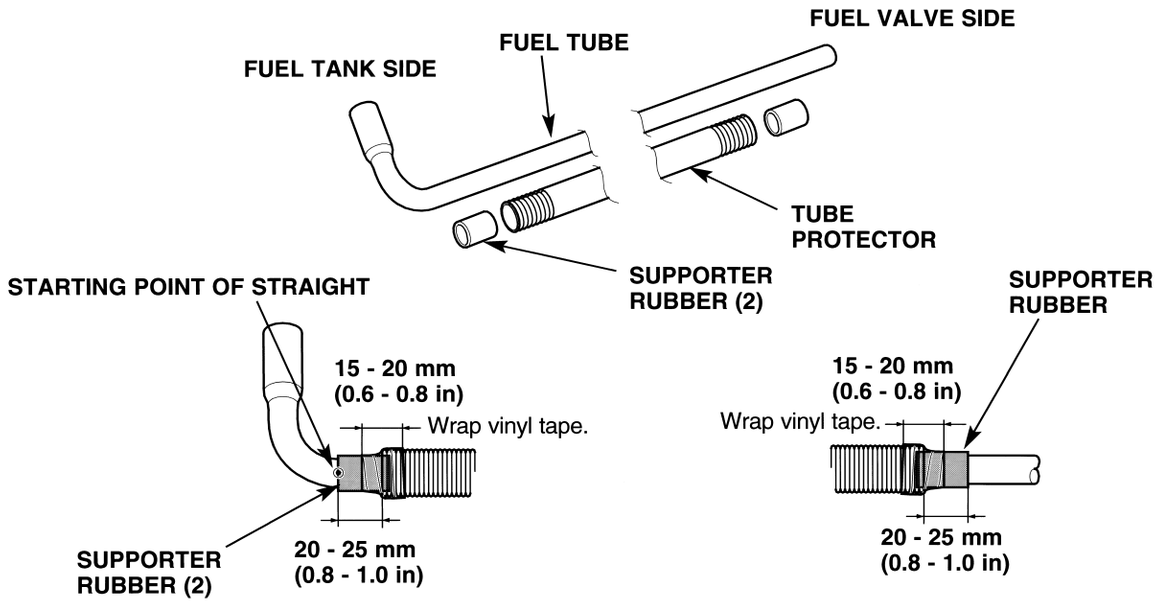
• SUPPORTER RUBBER INSTALLATION

1) Set the supporter rubber on the fuel tank side of the fuel tube by aligning the edge of the supporter rubber with the starting point of straight of the fuel tube as shown.

2) Install the tube protector as shown.

3) Wrap them with vinyl tape to hold them as shown.

4) Install the supporter rubber on the fuel valve side as shown and wrap the tube protector and supporter rubber with the vinyl tape as shown.



2. FUEL VALVE

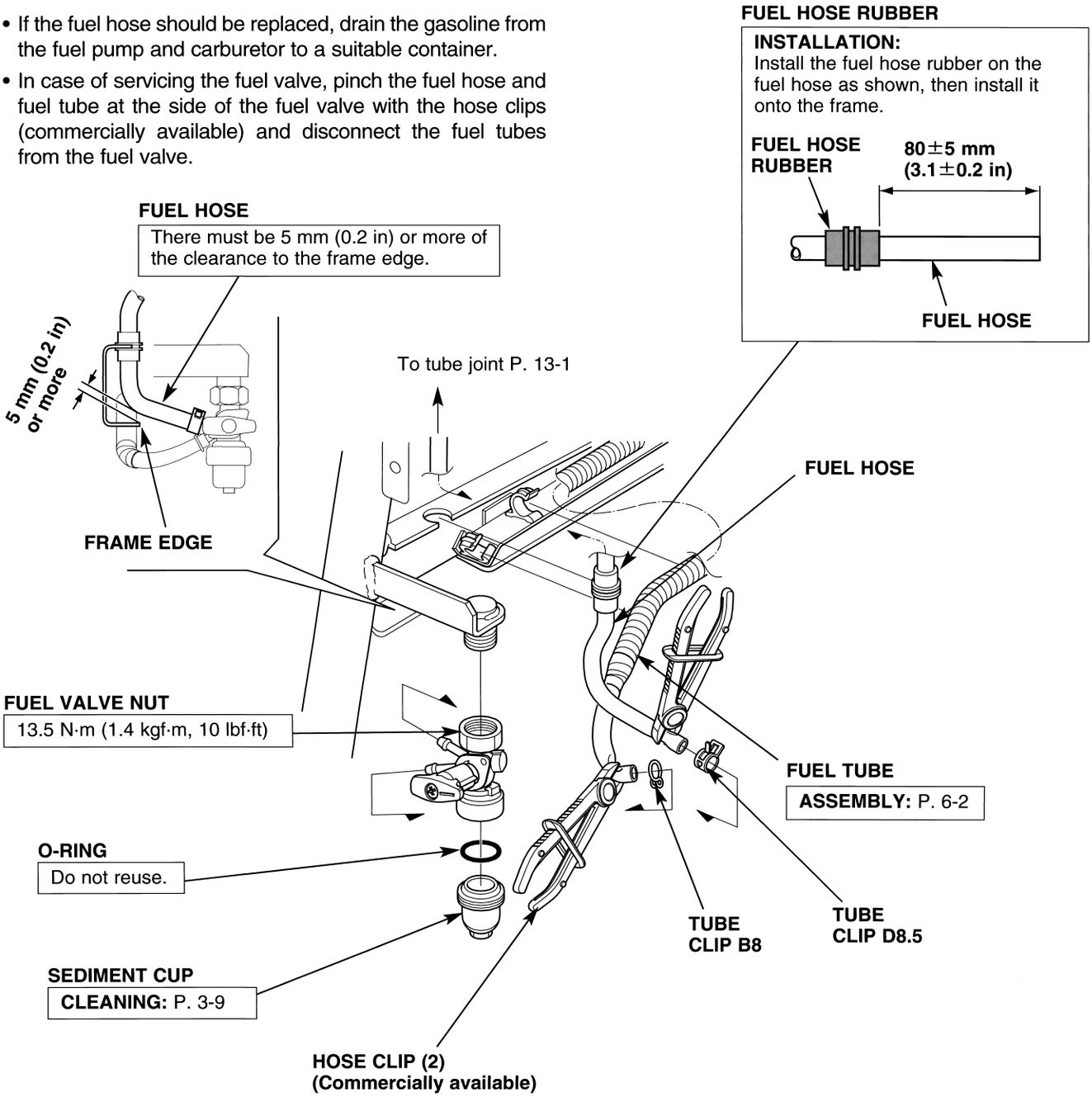
a. DISASSEMBLY/REASSEMBLY

⚠WARNING

Gasoline is highly flammable and explosive.
You can be burned or seriously injured when handling fuel.

- Keep heat, sparks, and flame away.
- Handle fuel only outdoors.
- Wipe up spills immediately.

- If the fuel hose should be replaced, drain the gasoline from the fuel pump and carburetor to a suitable container.
- In case of servicing the fuel valve, pinch the fuel hose and fuel tube at the side of the fuel valve with the hose clips (commercially available) and disconnect the fuel tubes from the fuel valve.



7. AIR CLEANER/MUFFLER

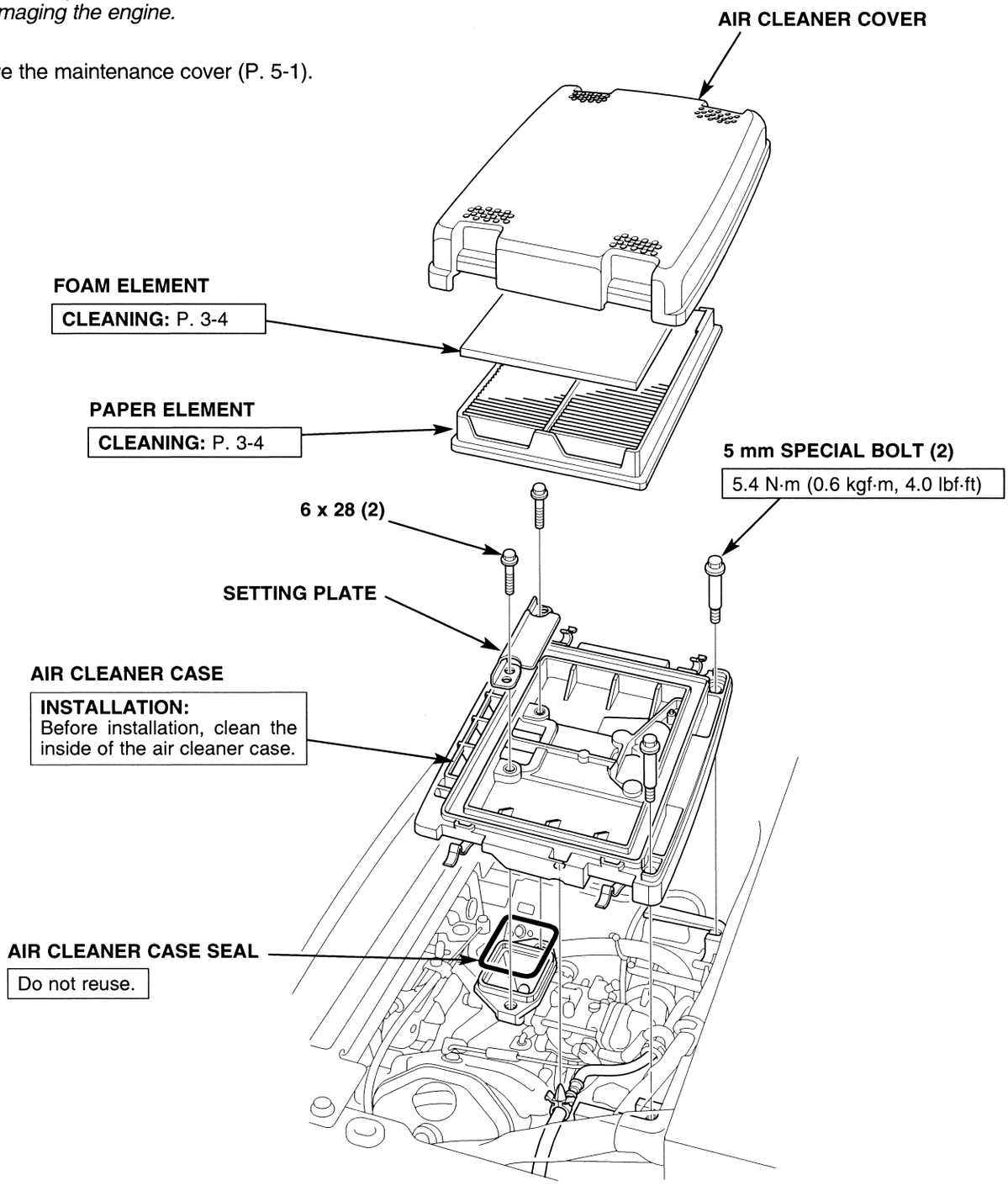
1. AIR CLEANER
2. AIR DUCTS
3. MUFFLER

1. AIR CLEANER

a. DISASSEMBLY/REASSEMBLY

NOTICE
If any air cleaner parts are left out, dirt will enter the intake system damaging the engine.

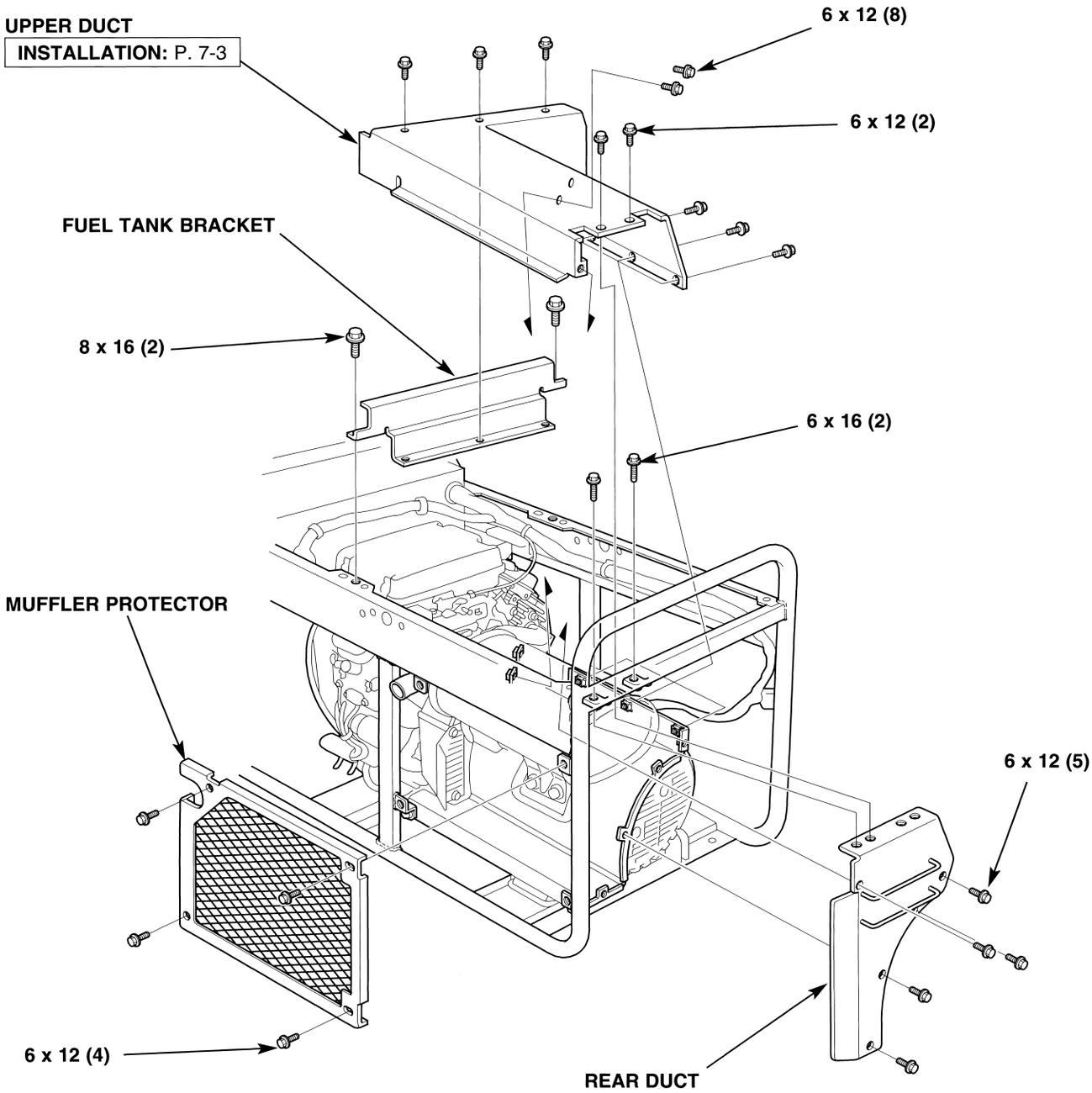
1) Remove the maintenance cover (P. 5-1).



2. AIR DUCTS

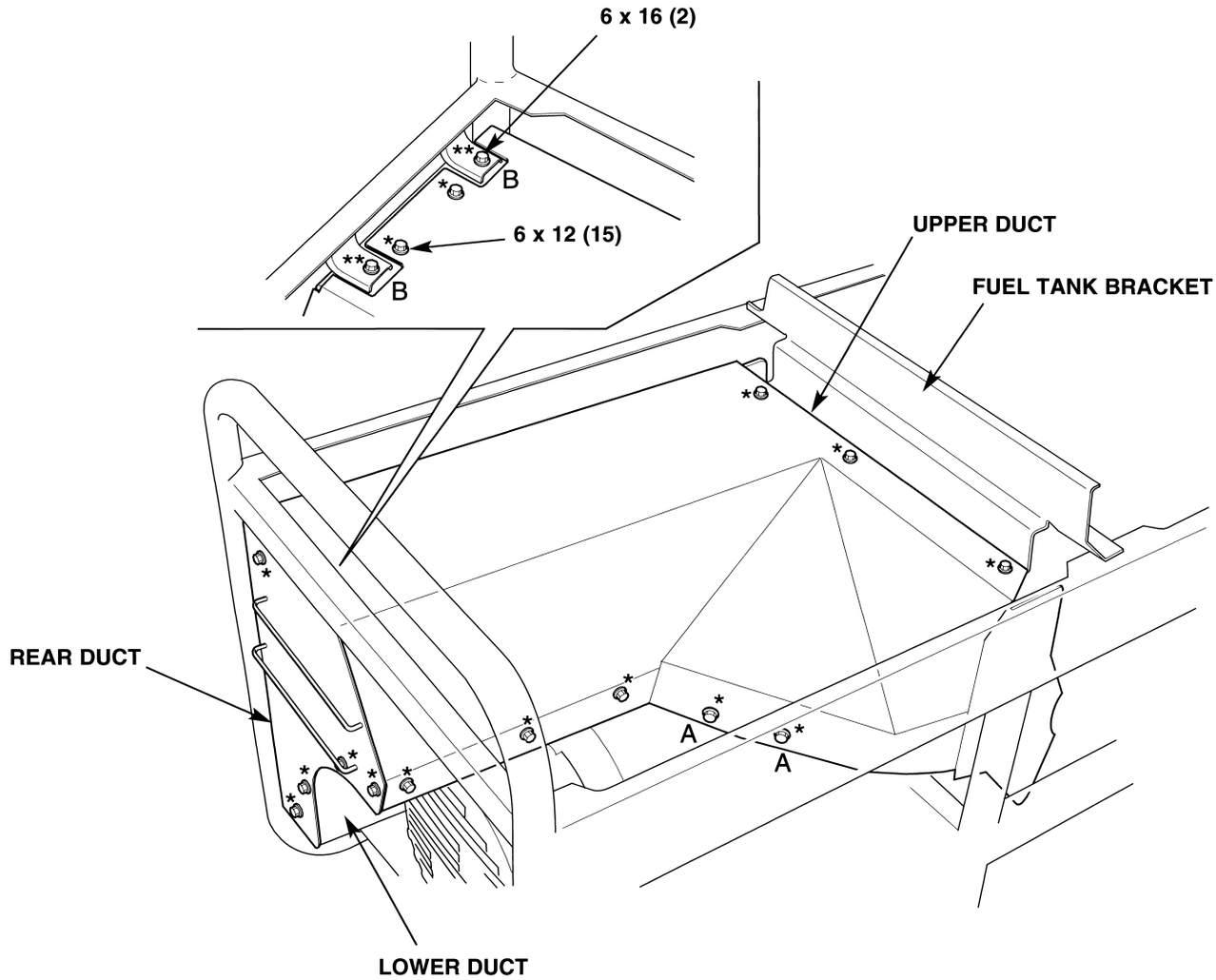
a. DISASSEMBLY/REASSEMBLY

1) Remove the following:
   - maintenance cover and center beam (P. 5-1).
   - fuel tank (P. 6-1).



• UPPER DUCT AND REAR DUCT INSTALLATION

1) Set the upper duct on the lower duct and fuel tank bracket and loosely install the two 6 x 12 mm flange bolts (* and A mark)
2) Loosely install the eight 6 x 12 mm flange bolts (* mark).
3) Install the rear duct and loosely install the seven 6 x 12 mm (* mark) and two 6 x 16 mm (** mark) flange bolts.
4) Tighten the two 6 x 16 mm flange bolts (** mark) securely.
5) Tighten all the other 6 x 12 mm (* mark) flange bolts securely.



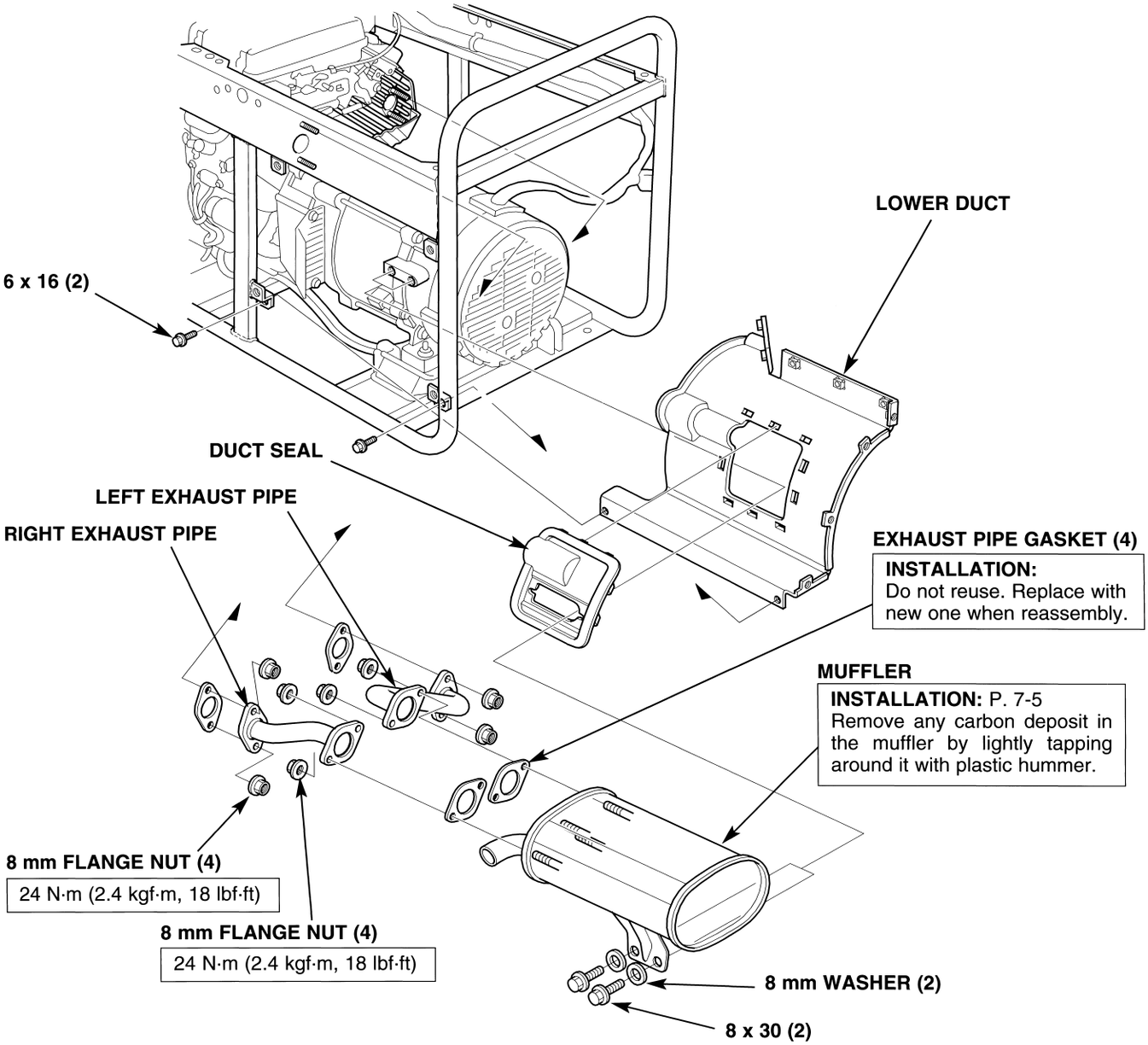
3. MUFFLER

a. DISASSEMBLY/REASSEMBLY

⚠CAUTION

The muffler becomes very hot during operation and remain hot for a while after stopping the engine. Be careful not to touch the muffler while it is hot. Allow it to cool before proceeding.

1) Remove the following:
   - maintenance cover and center beam (P. 5-1).
   - fuel tank (P. 6-1).
   - air ducts (P. 7-2).



• MUFFLER INSTALLATION

1) Loosely install the left and right exhaust pipes with new exhaust pipe gaskets.

2) Set the muffler/exhaust pipes assembly to the cylinder head using new exhaust pipe gaskets and loosely install the 8 mm flange nuts.

3) Install the two 8 x 30 mm flange bolts and 8 mm washers loosely.

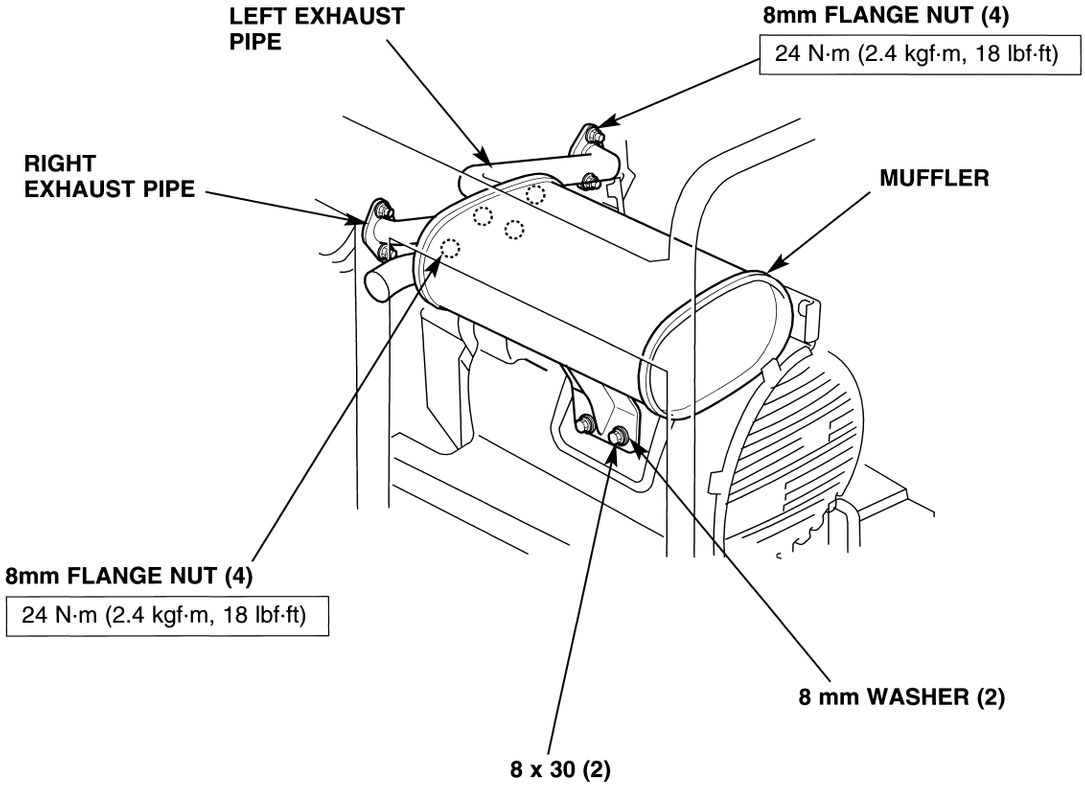
4) Tighten the 8 mm flange nuts mounting the exhaust pipes to the muffler to the specified torque.
   - Tighten the left or right exhaust pipe mounting nuts, then the other side pipe mounting nut.

   TORQUE: 24 N·m (2.4 kgf·m, 18 lbf·ft)

5) Tighten the 8 mm flange nut mounting the exhaust pipes to the cylinder head to the specified torque.

   TORQUE: 24 N·m (2.4 kgf·m, 18 lbf·ft)

6) Tighten the muffler mounting 8 x 30 mm flange bolt securely.



1. CONTROL BOX	2. CONTROL PANEL

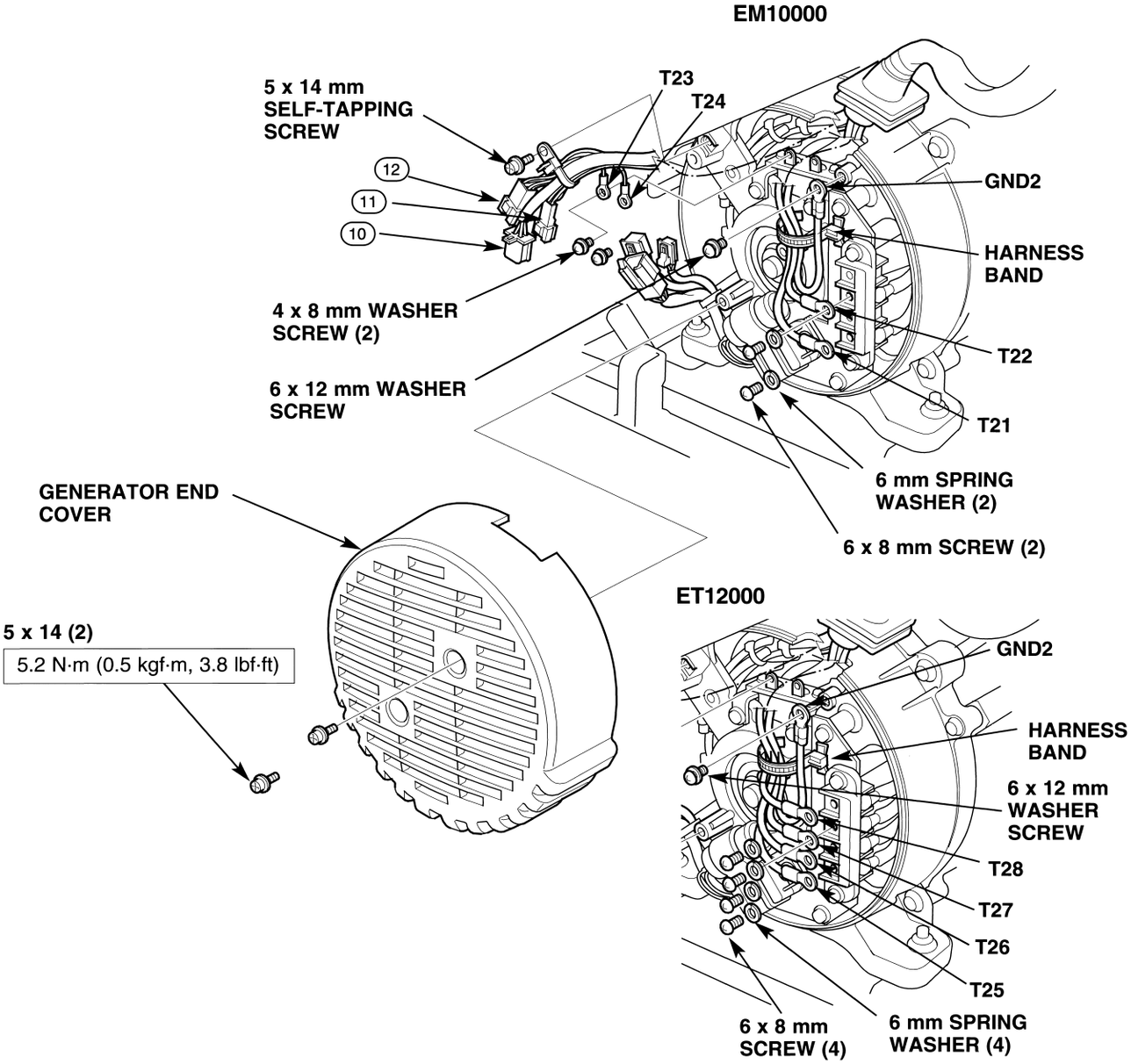
1. CONTROL BOX

a. REMOVAL

1) Remove the following:
   - maintenance cover and center beam (P. 5-1).
   - fuel tank (P. 6-1).
   - air cleaner case (P. 7-1). Cover the intake port with sealing tape not to allow dirt enter the carburetor.

2) Remove the generator end cover, and open the wire band.
   • Replace the harness band if it is cut.

3) Disconnect the connectors ⑩, ⑪ and ⑫, and terminals T21, T22, T23, T24 T25, T26, T27, T28 and GND2.



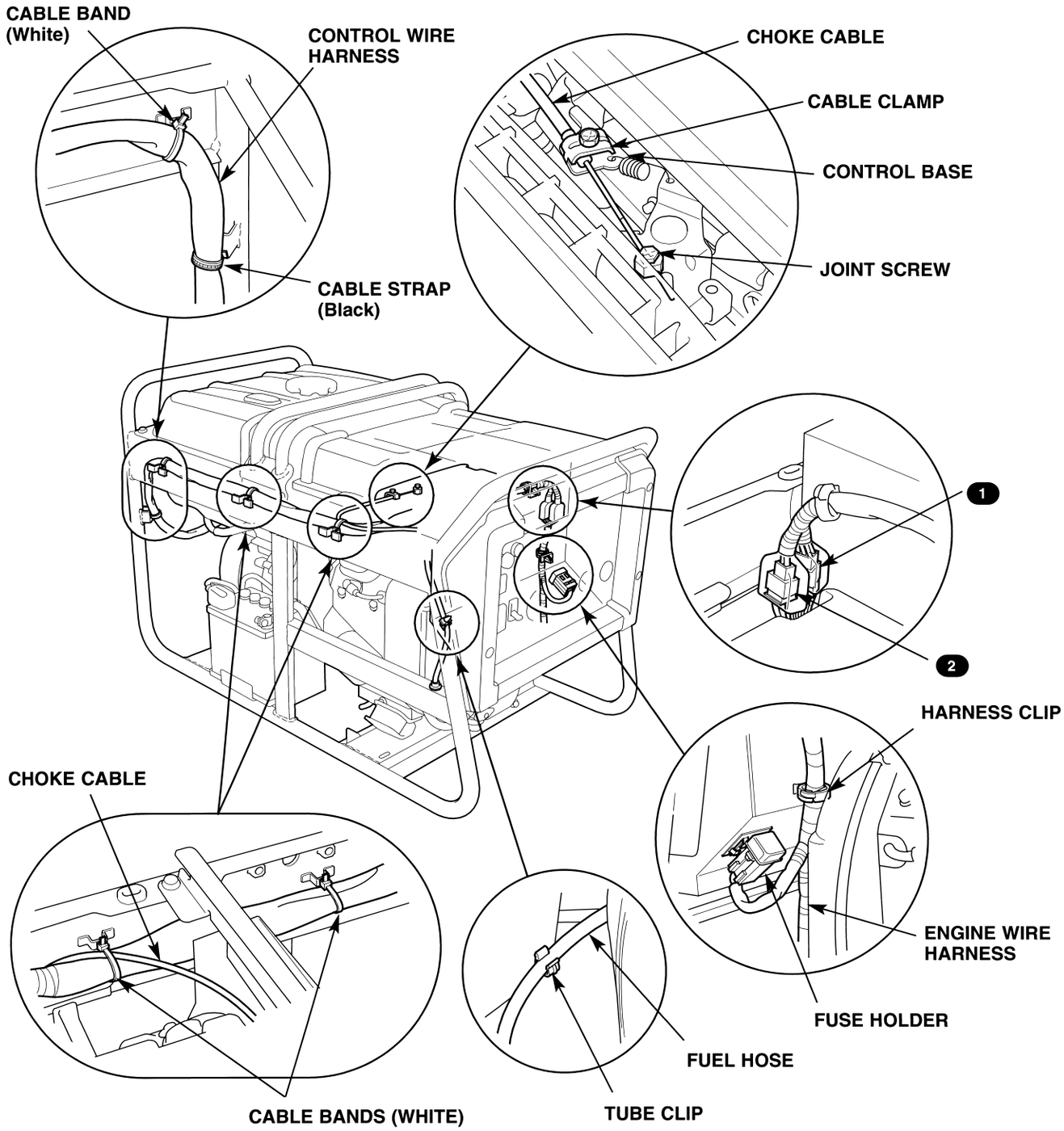
4) Open the three cable bands (White) and one cable strap (Black) and release the control wire harness and choke cable.

5) Loosen the cable clamp bolt and cable joint screw and disconnect the choke cable from the choke lever on the control base.

6) Remove the fuel tube from the hose clip on the control box.

7) Disconnect the connectors ❶ and ❷.

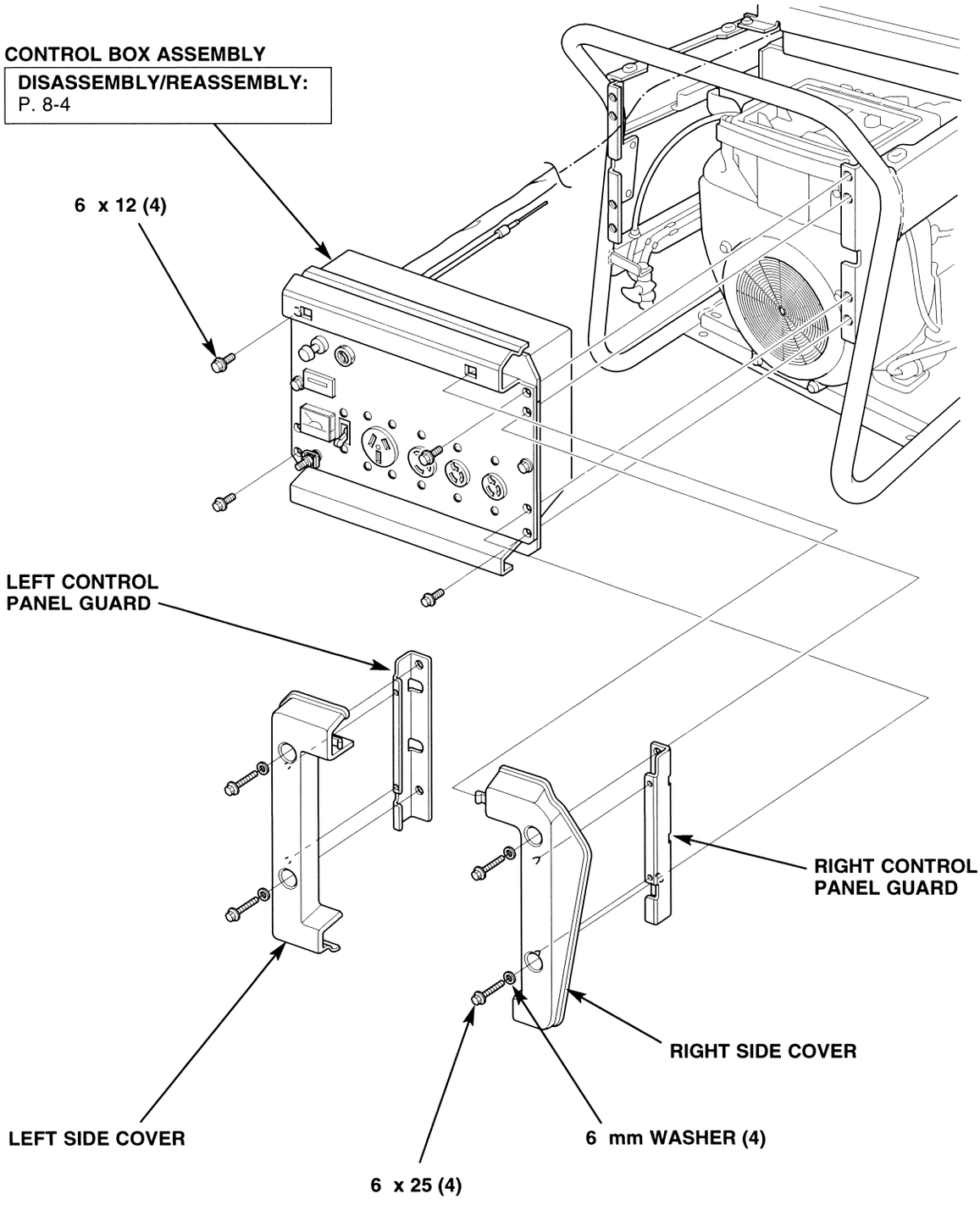
8) Remove the fuse box from the control box and open the harness clip and release the engine wire harness.



9) Remove the four 6 x 25 mm flange bolts and left and right side covers.

10) Remove the mounting bolts and remove the control box as an assembly with the control panel.

• EM10000 shown, ET12000 is similarly.



b. DISASSEMBLY

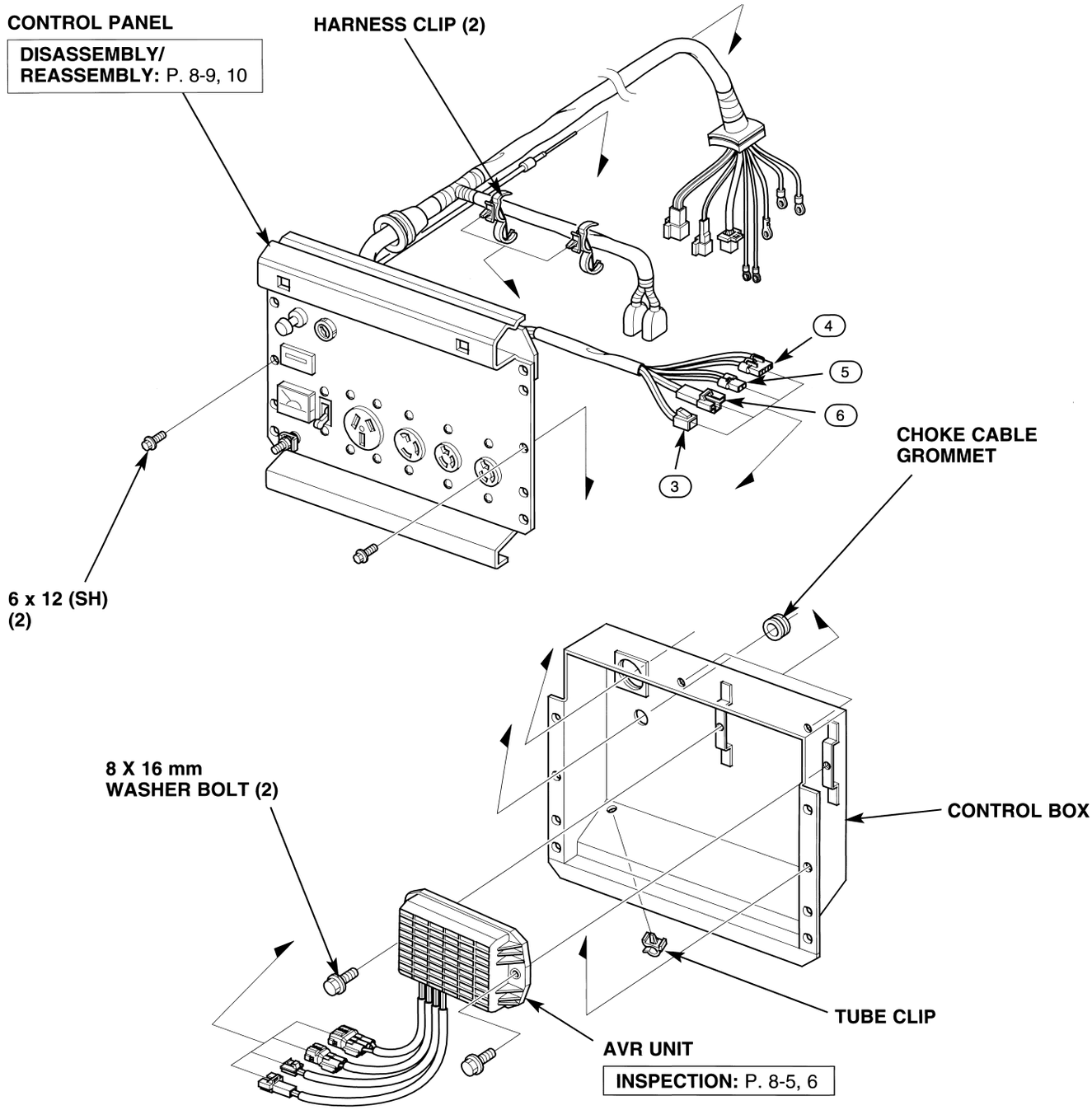
- See P. 8-1 thru. 8-3 for control box removal.
- EM10000 shown, ET12000 is similarly.

1) Open the harness clip and release the diverged wire harness connected to the engine wire harness.

2) Remove the two bolts and open the control box.

3) Disconnect the AVR connectors ③, ④, ⑤ and ⑥.

4) Pull the control wire harness and choke cable from the control box and remove the control box.

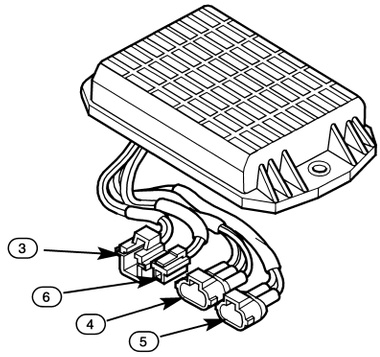


c. INSPECTION

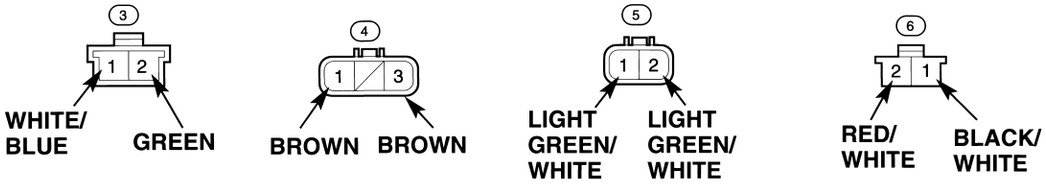
• AVR

Check the AVR by measuring the resistance between the terminals according to the table below.

- Use a R x 1 scale of a commercially available multimeter and the meter shows current flow from negative (–) probe to positive (+) probe.



• EM10000

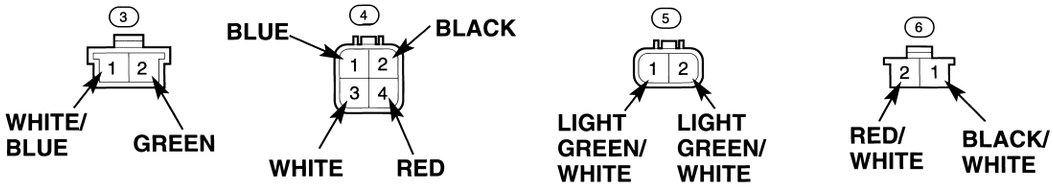


Viewed from terminal side

Measuring range: R x kΩ

			Positive probe (+)							
		Connector No.	③		④		⑤		⑥	
		Terminal No.	1	2	1	3	1	2	1	2
Negative probe (-)	Connector No. / Terminal No.	Wire color	White/ Blue	Green	Brown	Brown	Light green/ White	Light green/ White	Red/ White	Black/ White
	③ 1	White/Blue		55	∞	∞	80	80	6.5	60
	③ 2	Green	∞		∞	∞	8	8	16	7
	④ 1	Brown	∞	∞		26	∞	∞	∞	∞
	④ 3	Brown	∞	∞	26		∞	∞	∞	∞
	⑤ 1	Light green/White	∞	70	∞	∞		110	7.5	100
	⑤ 2	Light green/White	∞	70	∞	∞	110		7.5	100
	⑥ 1	Red/White	∞	47	∞	∞	70	70		60
	⑥ 2	Black/White	∞	5	∞	∞	100	100	5.5	

• **ET12000**



Viewed from terminal side

Measuring range: R x kΩ

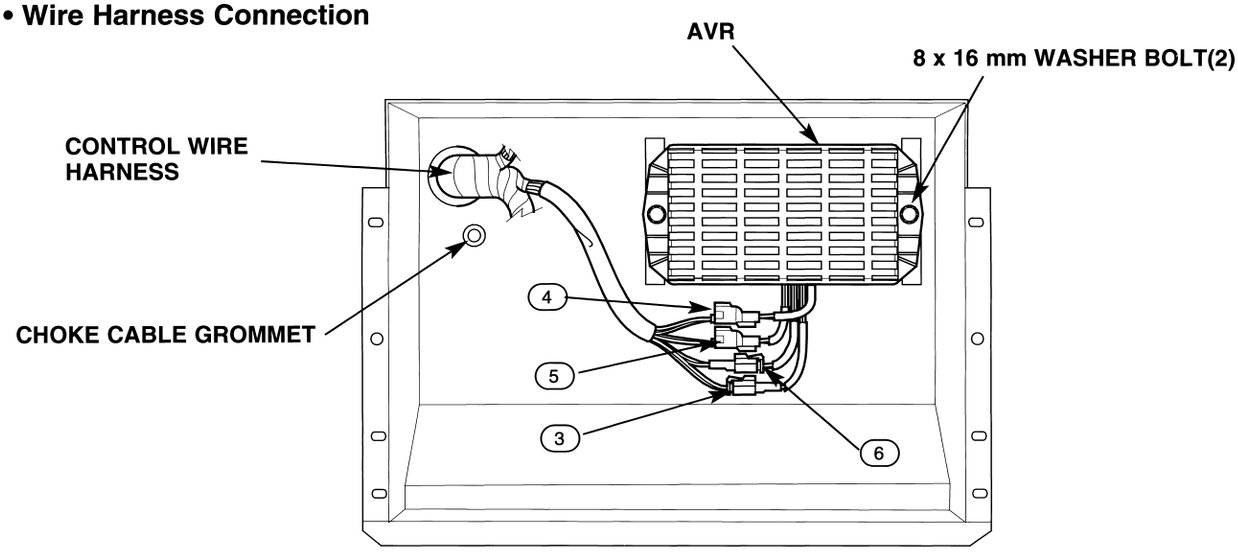
				Positive probe (+)									
			Connector No.	③		④				⑤		⑥	
			Terminal No.	1	2	1	2	3	4	1	2	1	2
Negative probe (-)	Connector No.	Terminal No.	Wire color	White/ Blue	Green	Blue	Black	White	Red	Light green/ White	Light green/ White	Red/ White	Black/ White
	③	1	White/Blue		30	∞	∞	∞	∞	70	70	4	90
		2	Green	∞		∞	∞	∞	∞	8	8	8.5	3.6
	④	1	Blue	∞	∞		8	80	80	∞	∞	∞	∞
		2	Black	∞	∞	50		50	50	∞	∞	∞	∞
		3	White	∞	∞	80	8		80	∞	∞	∞	∞
		4	Red	∞		80	8	80		∞	∞	∞	∞
	⑤	1	Light green/White	∞	90	∞	∞	∞	∞		130	4	100
		2	Light green/White	∞	90	∞	∞	∞	∞	130		4	100
	⑥	1	Red/White	∞	70	∞	∞	∞	∞	90	90		90
		2	Black/White	∞	90	∞	∞	∞	∞	100	100	3	

d. ASSEMBLY

Assembly is the reverse order of removal.

• Pass the control wire harness and choke cable through the control box. Route the control wire harness and choke cable and connect the AVR connectors ③, ④, ⑤ and ⑥.

• **Wire Harness Connection**



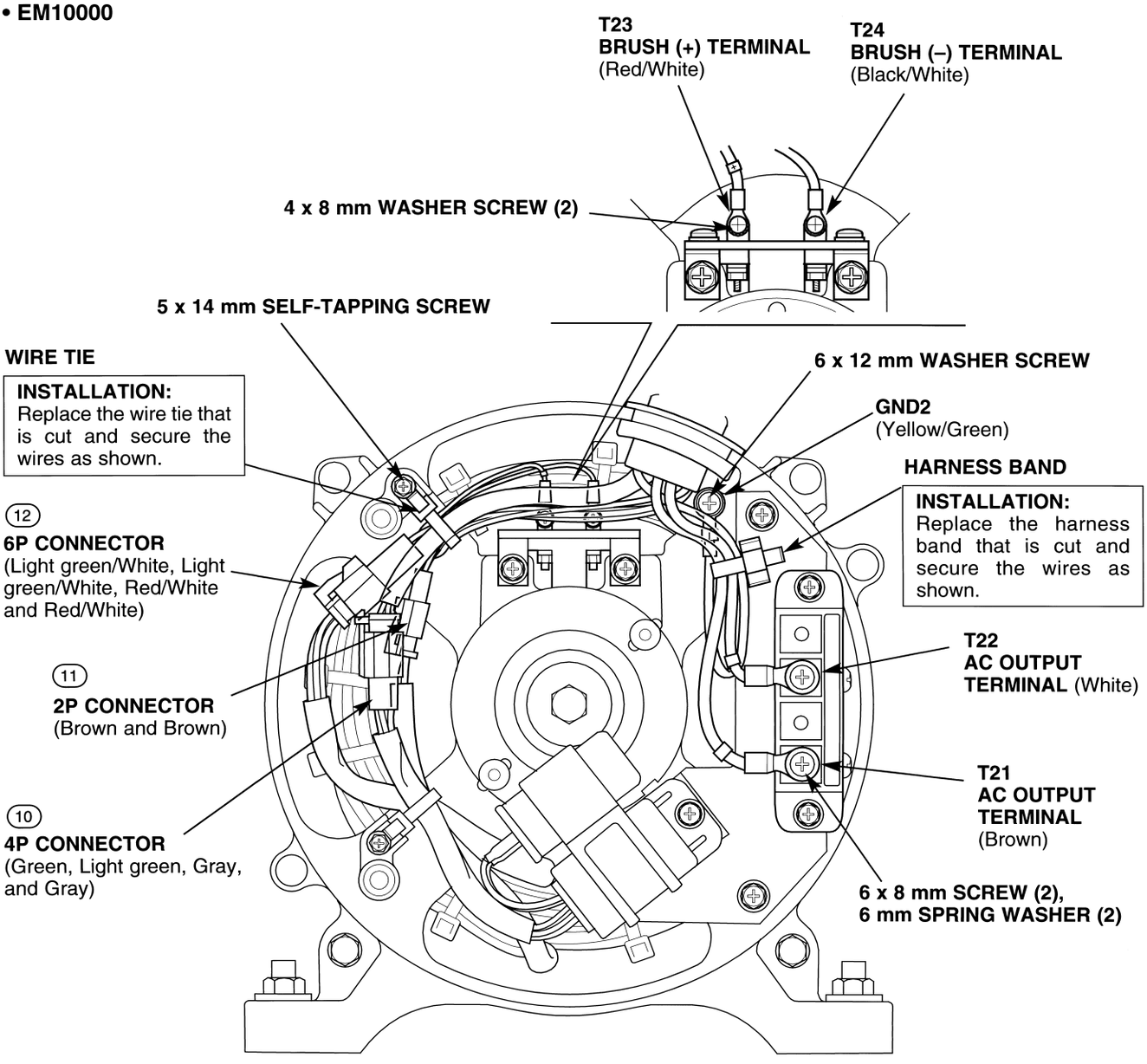
e. INSTALLATION

Installation is the reverse order of removal.

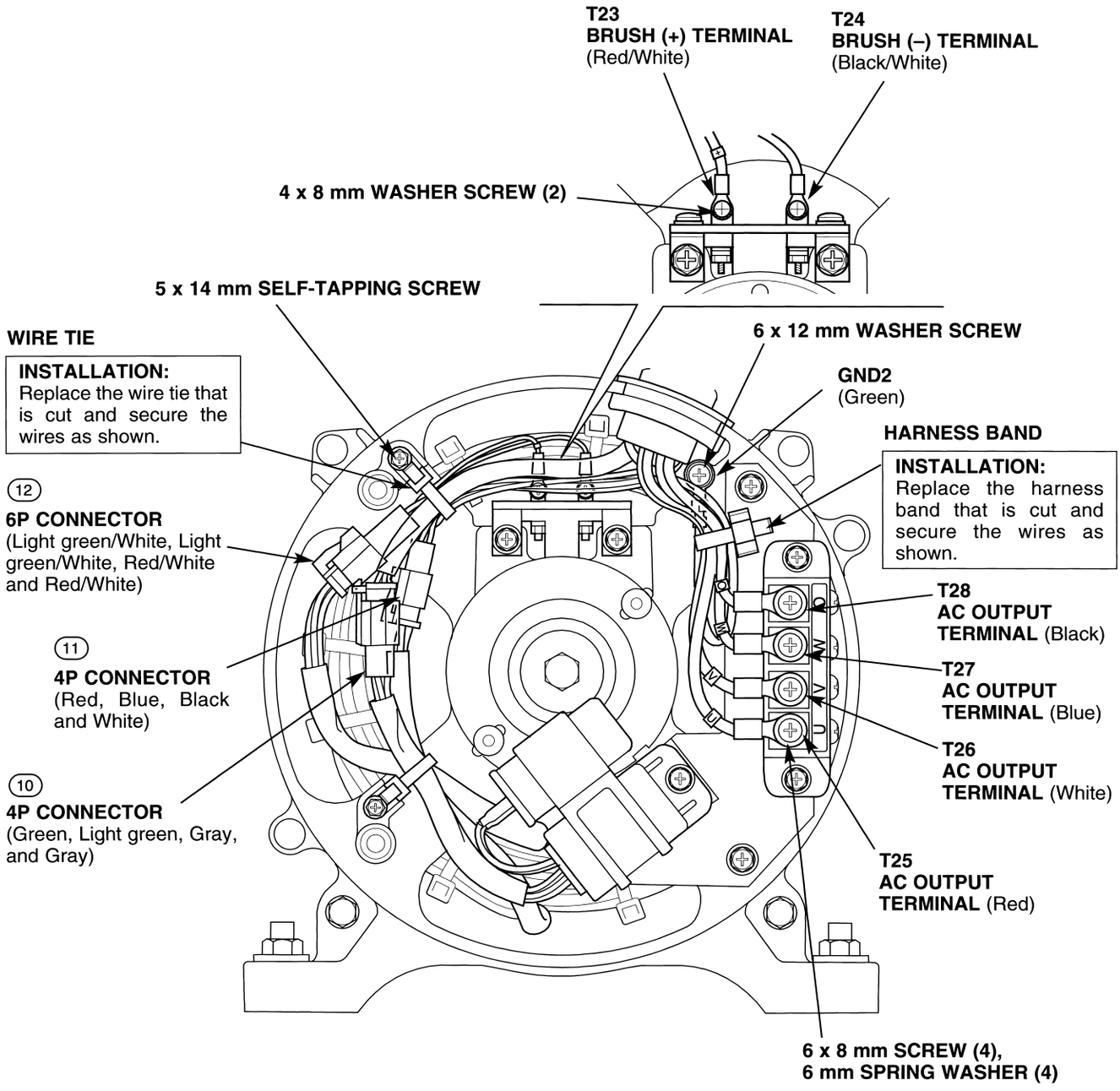
- Replace the wire tie and/or harness band with new ones, if they are cut when removal, and secure the wires.
- Clamp the wire harness, cable and fuel tube securely.

• Wire Connection To Generator

• EM10000



• **ET12000**


T23
BRUSH (+) TERMINAL
(Red/White)
T24
BRUSH (–) TERMINAL
(Black/White)
4 x 8 mm WASHER SCREW (2)
5 x 14 mm SELF-TAPPING SCREW
6 x 12 mm WASHER SCREW
WIRE TIE
INSTALLATION:
Replace the wire tie that is cut and secure the wires as shown.
GND2
(Green)
HARNESS BAND
INSTALLATION:
Replace the harness band that is cut and secure the wires as shown.
12
6P CONNECTOR
(Light green/White, Light green/White, Red/White and Red/White)
T28
AC OUTPUT TERMINAL (Black)
11
4P CONNECTOR
(Red, Blue, Black and White)
T27
AC OUTPUT TERMINAL (Blue)
T26
AC OUTPUT TERMINAL (White)
10
4P CONNECTOR
(Green, Light green, Gray, and Gray)
T25
AC OUTPUT TERMINAL (Red)
6 x 8 mm SCREW (4),
6 mm SPRING WASHER (4)

2. CONTROL PANEL

a. DISASSEMBLY

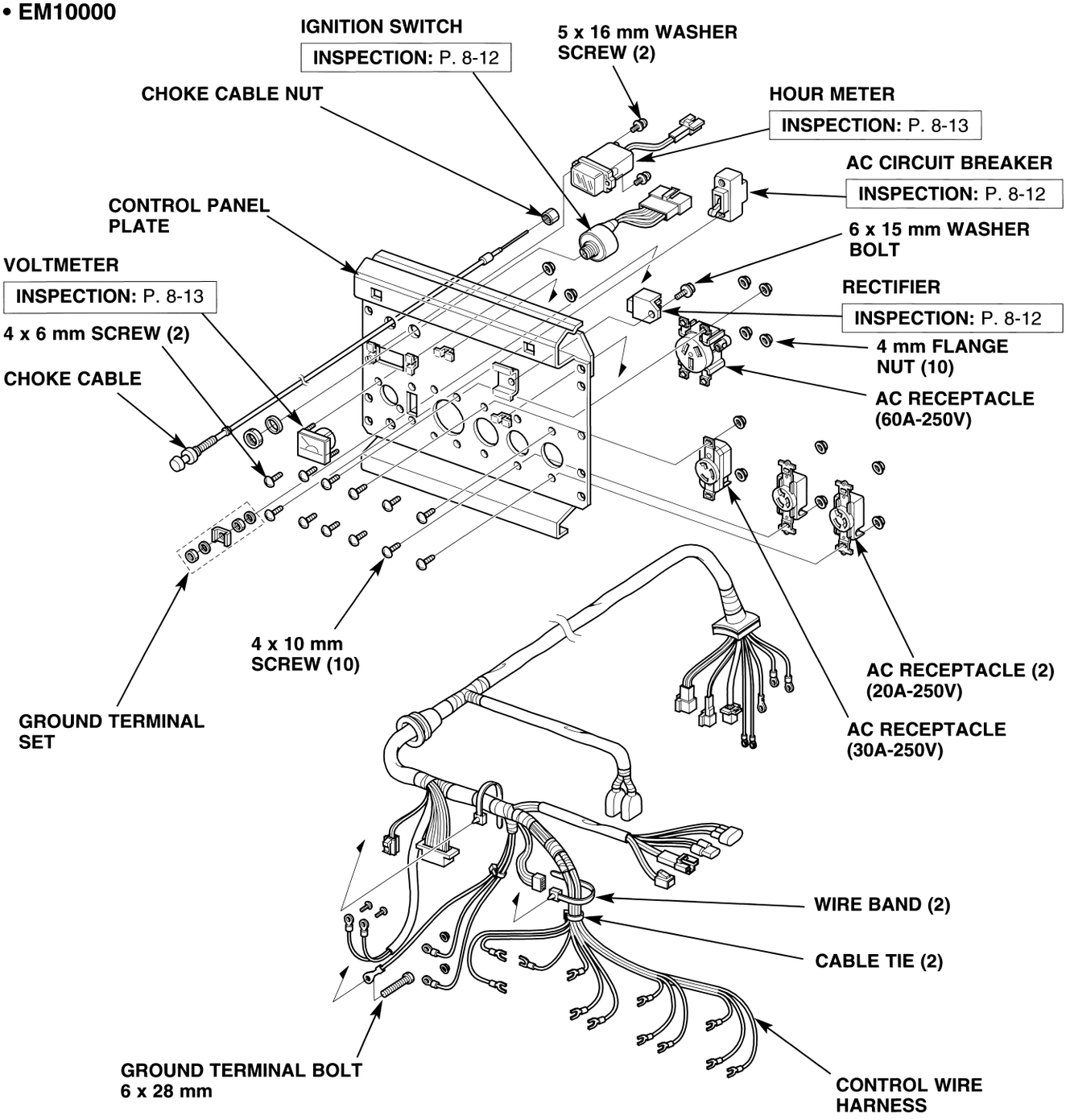
1) Remove the control box and control panel as an assembly (P. 8-1 thru. 8-3).

2) Remove the two 6 x 12 mm flange bolts and separate the control box from the control panel.

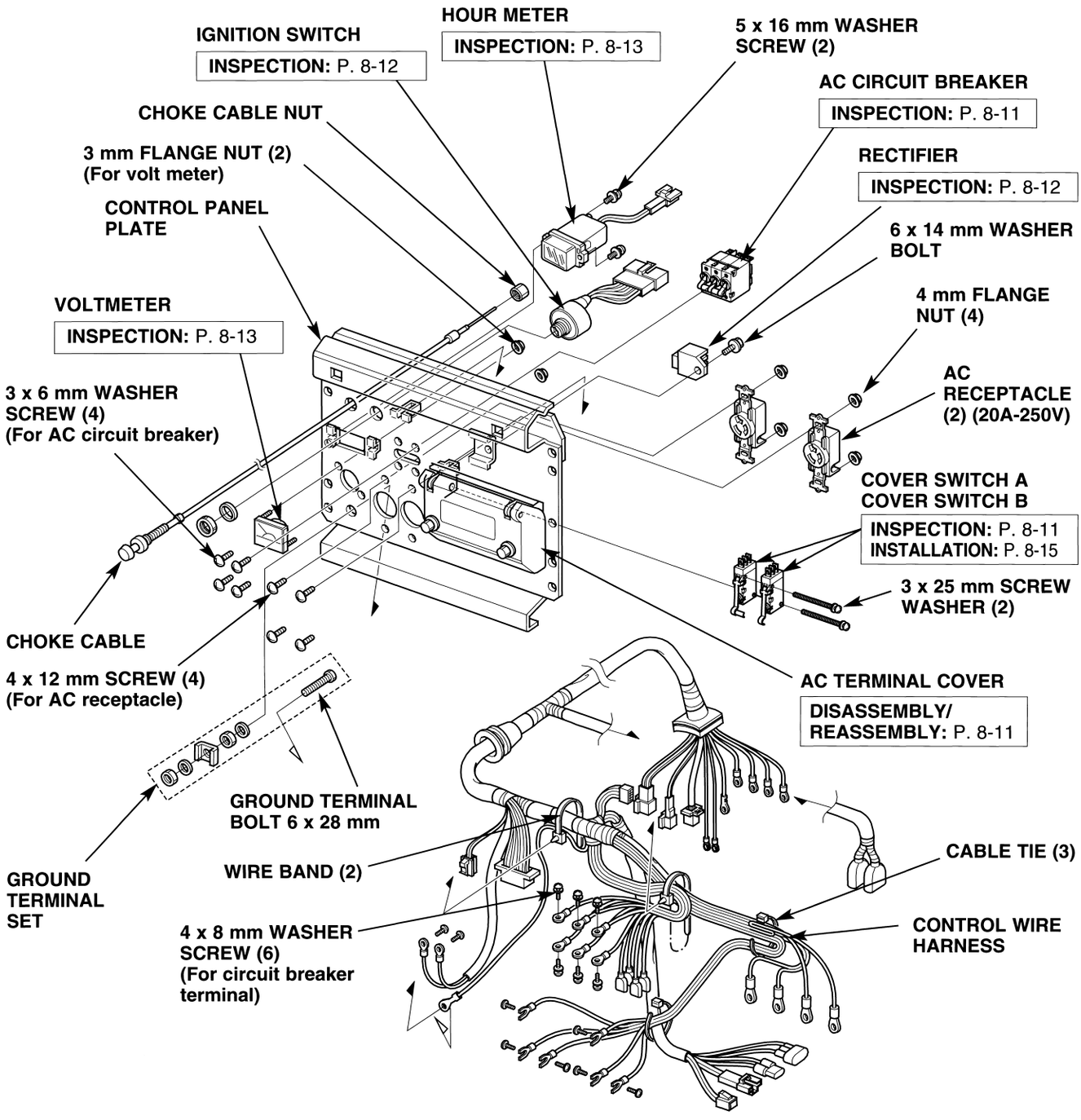
3) Disconnect the AVR connectors.

4) Pull out the control wire harness and choke cable from the control box and remove the control panel.

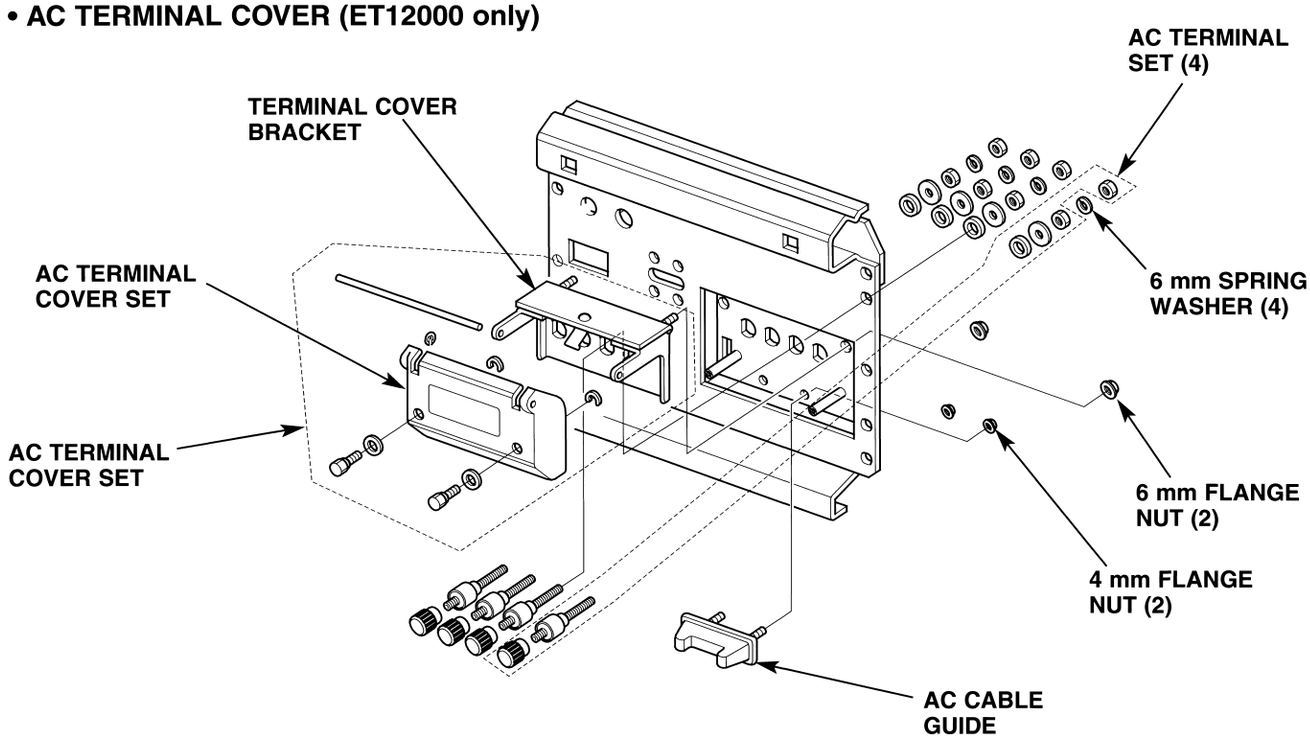
• EM10000



• ET12000


IGNITION SWITCH
INSPECTION: P. 8-12
HOUR METER
INSPECTION: P. 8-13
5 x 16 mm WASHER SCREW (2)
AC CIRCUIT BREAKER
INSPECTION: P. 8-11
CHOKE CABLE NUT
3 mm FLANGE NUT (2) (For volt meter)
RECTIFIER
INSPECTION: P. 8-12
CONTROL PANEL PLATE
6 x 14 mm WASHER BOLT
4 mm FLANGE NUT (4)
VOLTMETER
INSPECTION: P. 8-13
AC RECEPTACLE (2) (20A-250V)
3 x 6 mm WASHER SCREW (4) (For AC circuit breaker)
COVER SWITCH A
COVER SWITCH B
INSPECTION: P. 8-11
INSTALLATION: P. 8-15
3 x 25 mm SCREW WASHER (2)
CHOKE CABLE
4 x 12 mm SCREW (4) (For AC receptacle)
AC TERMINAL COVER
DISASSEMBLY/ REASSEMBLY: P. 8-11
GROUND TERMINAL BOLT 6 x 28 mm
WIRE BAND (2)
CABLE TIE (3)
GROUND TERMINAL SET
4 x 8 mm WASHER SCREW (6) (For circuit breaker terminal)
CONTROL WIRE HARNESS

• **AC TERMINAL COVER (ET12000 only)**

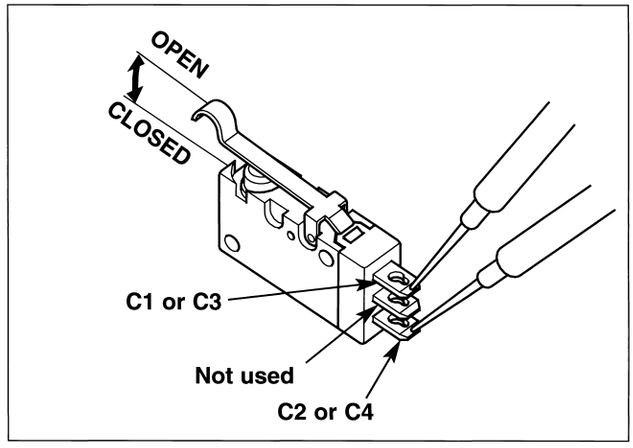


b. INSPECTION

• COVER SWITCHS (ET12000 only)

Check for continuity between the C1 and C2 (Switch A), C3 and C4 (switch B) terminals.
There should be continuity wi the AC terminal cover open and no continuity with the cover closed.

- The cover switch A is connected Green and Black/Yellow wires
- The cover switch B is connected Red and Gree/White wires

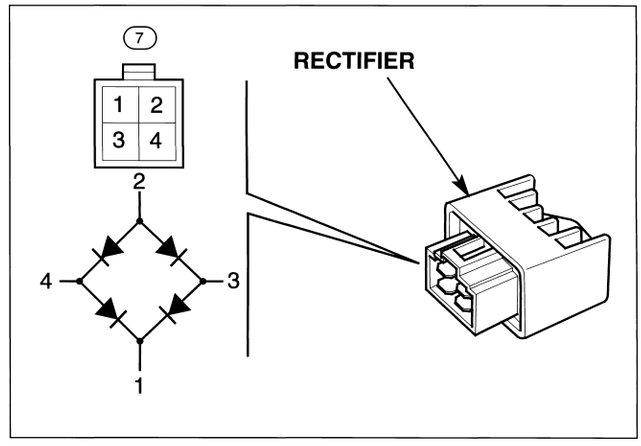


• RECTIFIER

Check for continuity between the terminals according to the table below.

Positive probe / Negative probe		Terminal No. 1	2	3	4
Terminal No.	1		∞	∞	∞
	2	Continuity		Continuity	Continuity
	3	Continuity	∞		∞
	4	Continuity	∞	∞	

- Use a R x 1 scale of a commercially available multimeter and the meter shows current flow from negative (–) to positive (+). If the meter shows current flowing one way and not the other way around, the diode is good.



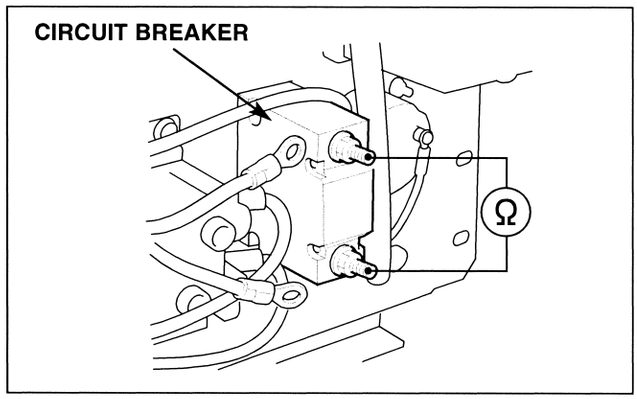
• AC CIRCUIT BREAKER

EM10000

1) Disconnect the wire terminals.

2) Check for continuity between the terminals.

   There should be continuity with ON and no continuity with OFF.

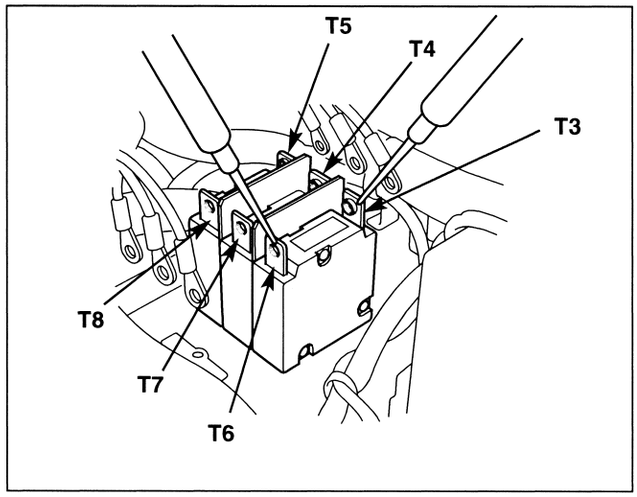


ET12000

1) Disconnect the wire terminals.

2) Check for continuity between the T3 and T6, T4 and T7, T5 and T8 terminals.

   There should be continuity with ON and no continuity with OFF.

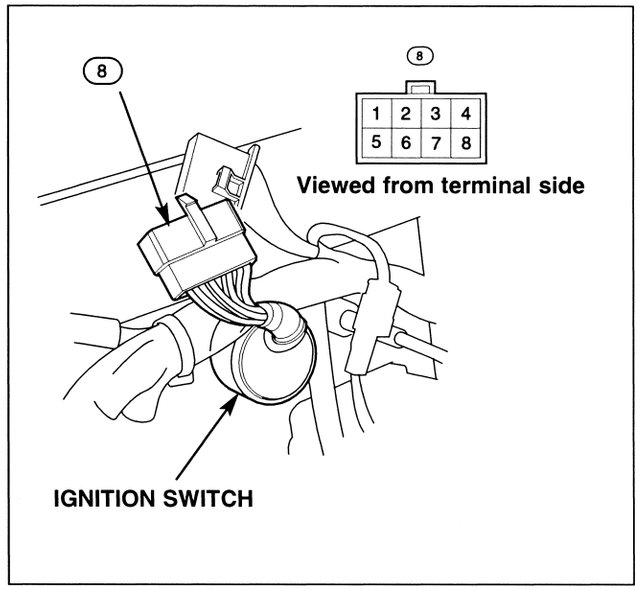


• IGNITION SWITCH

1) Disconnect the 8P connector ⑧.

2) Check for continuity between the terminals of the switch wire connecter according to the table below.
   ○—○: Continuity

Terminal No. / Wire color / Position	1	2	3	4	5	6	7	8
	White	Black/ Yellow	Light green	Red	Green/ White	Black	Yellow	Black/ White
OFF	○—○						○—○	
ON			○———○					
START			○—○—○—○					

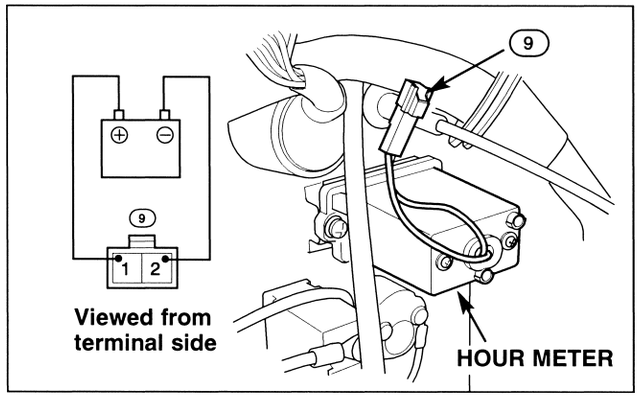


• HOUR METER

1) Disconnect the 2P connector (9).

2) Connect a 12 V battery positive (+) lead to the No. 1 (White/Yellow) and negative (–) lead to the No. 2 (Yellow/Green) terminals.

   The hour meter should operate. Replace the hour meter if necessary.



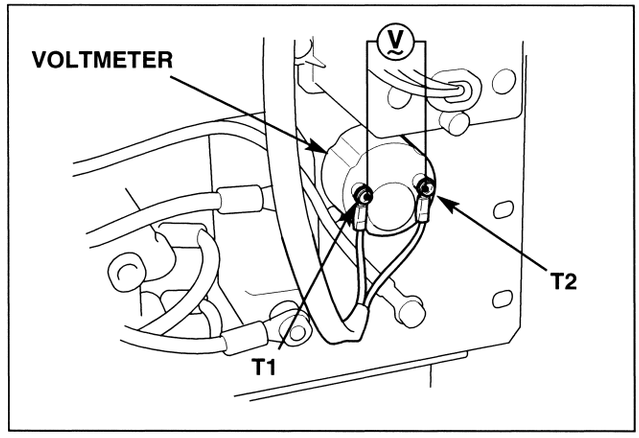
• VOLTMETER

• Output voltage is normal but voltmeter needle does not swing:

1) Start the engine and check whether there is voltage at the voltmeter terminal.

Standard voltage	RG type: 230±34 VAC R type: 220±33 VAC

2) If there is specified voltage at the terminal, replace the voltmeter.

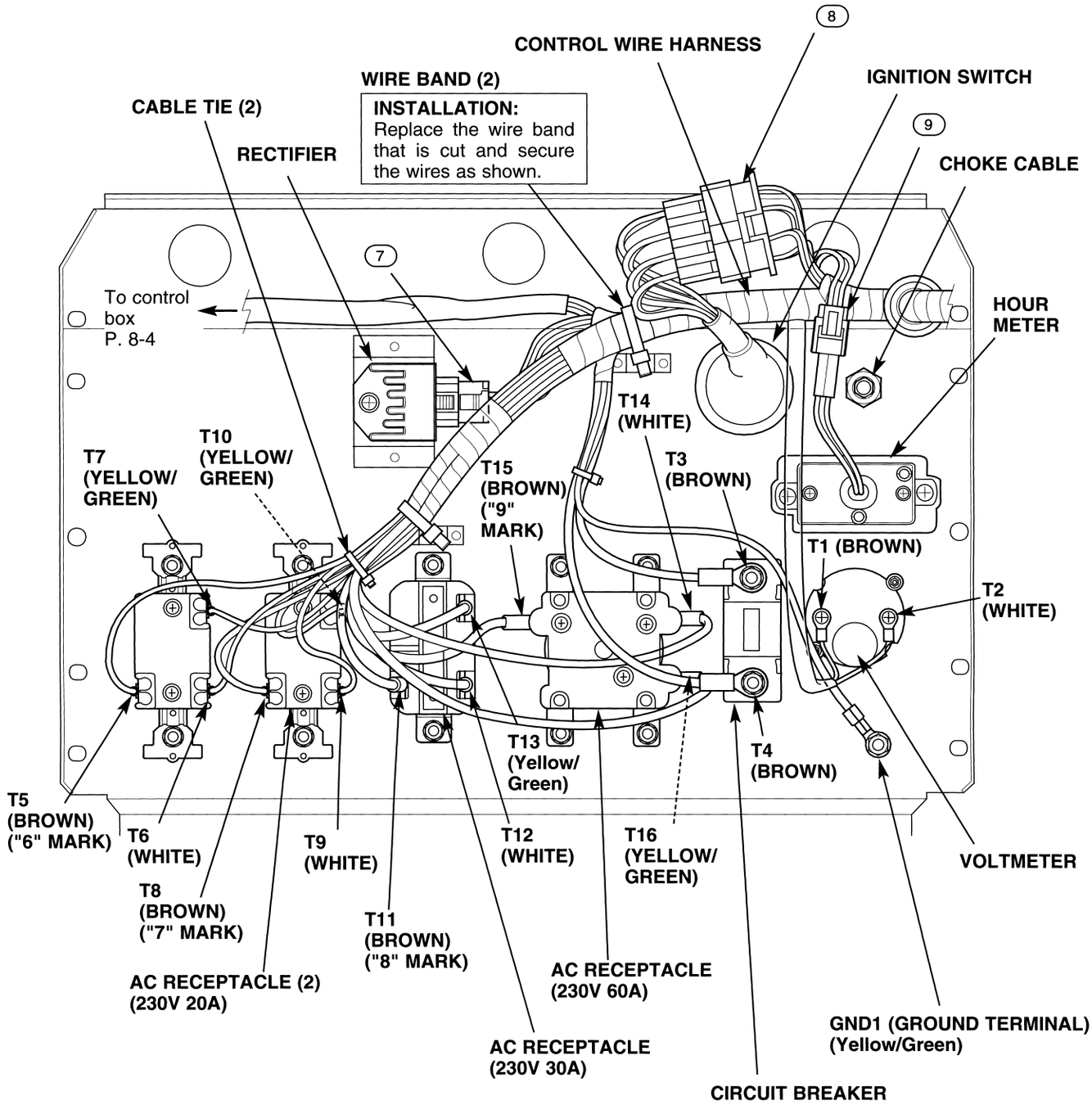


c. ASSEMBLY

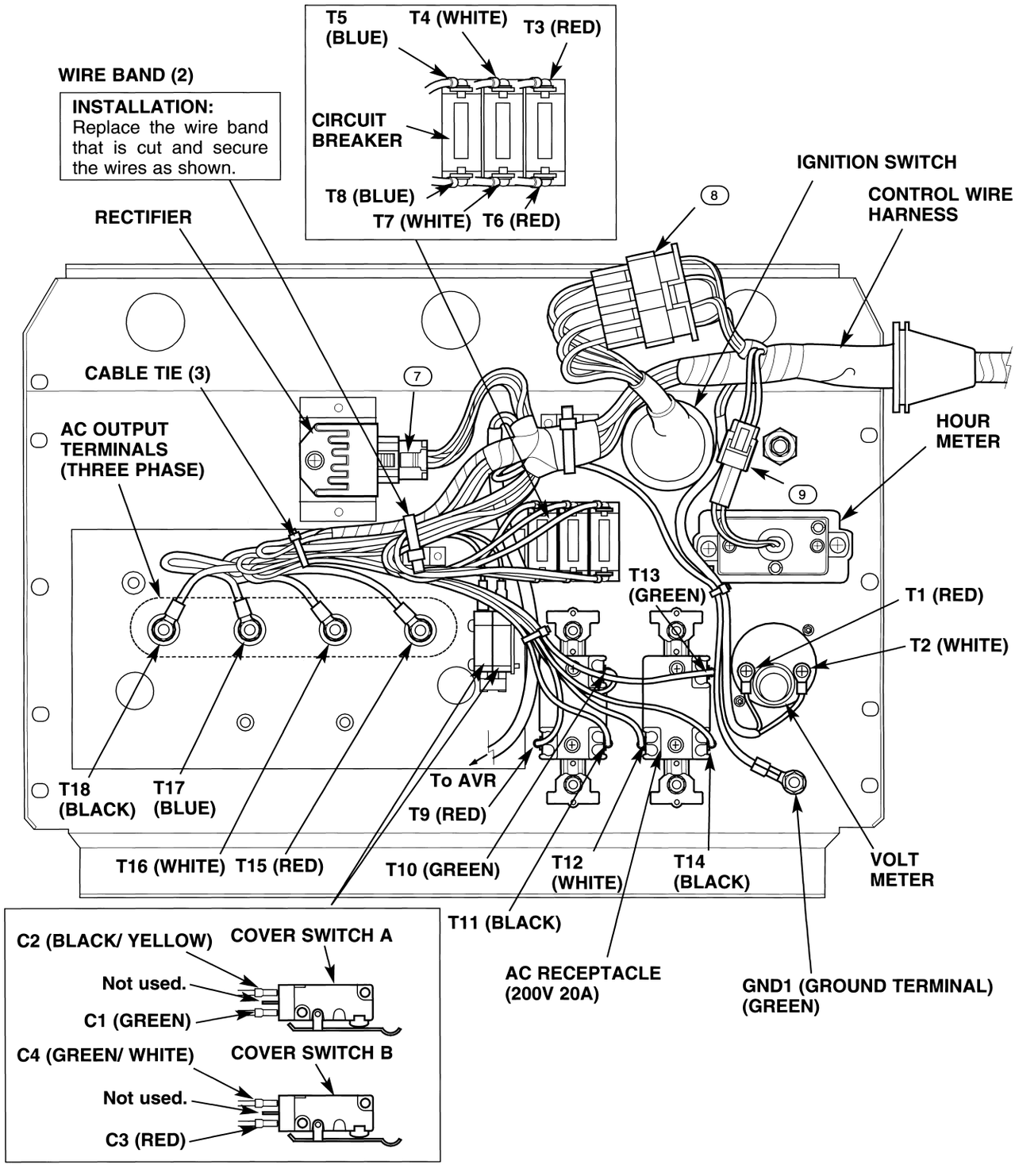
Assembly is the reverse order of disassembly.

• Wire Connection

• EM10000



• ET12000

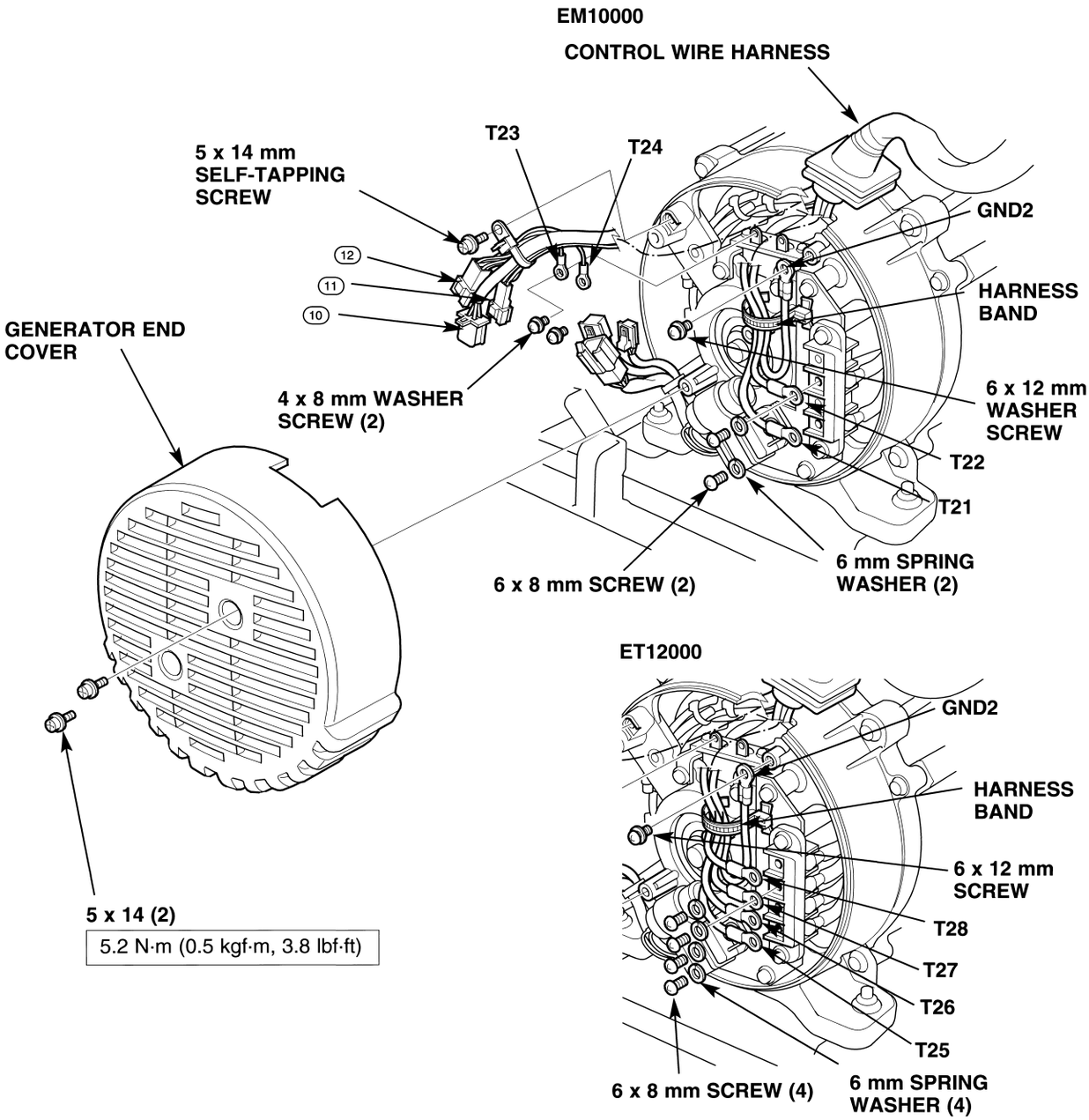

T5 (BLUE)
T4 (WHITE)
T3 (RED)
WIRE BAND (2)
INSTALLATION:
Replace the wire band that is cut and secure the wires as shown.
CIRCUIT BREAKER
T8 (BLUE)
T7 (WHITE)
T6 (RED)
IGNITION SWITCH
CONTROL WIRE HARNESS
RECTIFIER
8
CABLE TIE (3)
7
AC OUTPUT TERMINALS (THREE PHASE)
HOUR METER
9
T13 (GREEN)
T1 (RED)
T2 (WHITE)
To AVR
T18 (BLACK)
T17 (BLUE)
T9 (RED)
T16 (WHITE)
T15 (RED)
T10 (GREEN)
T12 (WHITE)
T14 (BLACK)
VOLT METER
T11 (BLACK)
C2 (BLACK/ YELLOW)
COVER SWITCH A
Not used.
C1 (GREEN)
C4 (GREEN/ WHITE)
COVER SWITCH B
Not used.
C3 (RED)
AC RECEPTACLE (200V 20A)
GND1 (GROUND TERMINAL) (GREEN)

1. REAR HOUSING/STATOR

a. DISASSEMBLY/REASSEMBLY

1) Remove the following parts:
   - battery (P. 4-1)
   - maintenance cover and center beam (P. 5-1).
   - fuel tank (P. 6-1)
   - air ducts and muffler (P. 7-2 thru. 7-4)

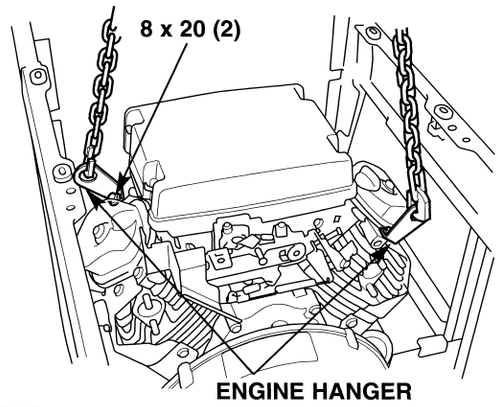
2) Remove the generator end cover and disconnect the control wire harness.

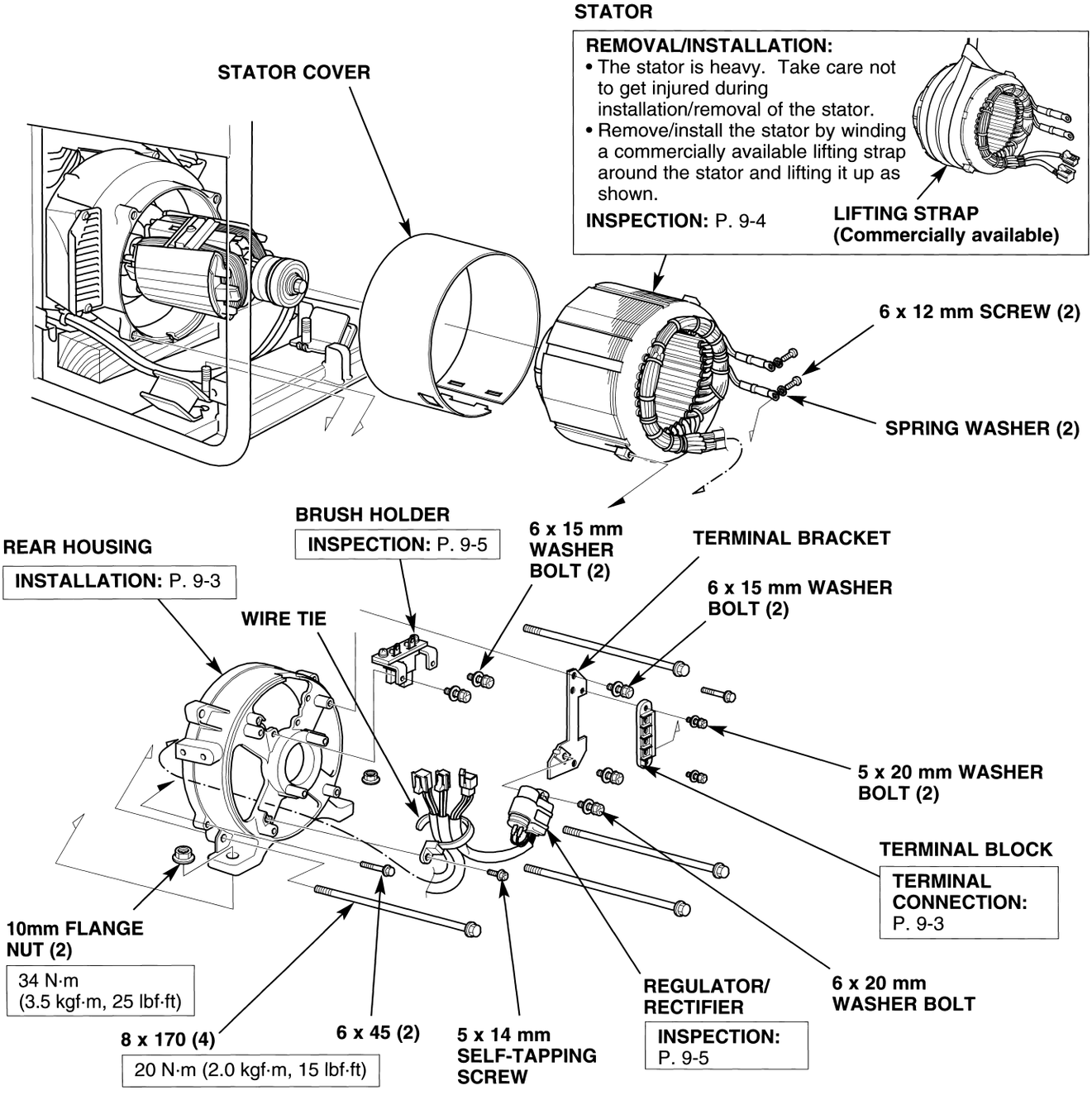


3) Install the engine hangers to the cylinder head as shown. Attach a chain hoist to the engine hangers and pull the chain tight to support the engine. Or place wooden blocks under the front housing to support the generator/engine assembly.

NOTICE

- *Always remove the brush holder before removing the rear housing. If the rear housing is removed with the brush holder attached, damage to the brush holder will occur.*
- *Place the stator with the core side down. Do not place with the coil side down.*

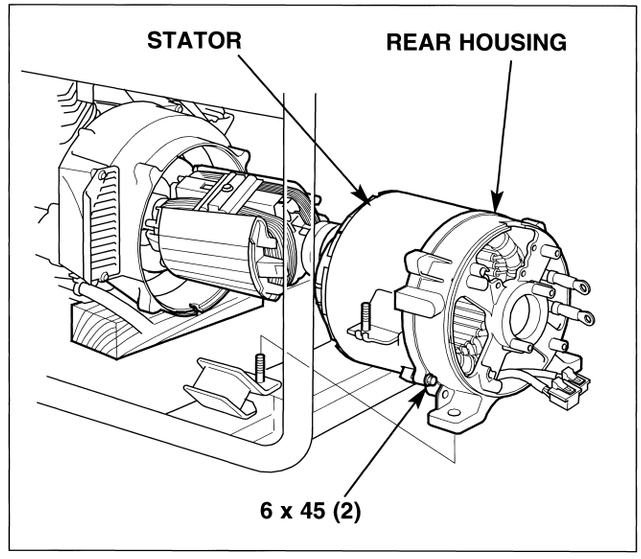




• REAR HOUSING/STATOR INSTALLATION

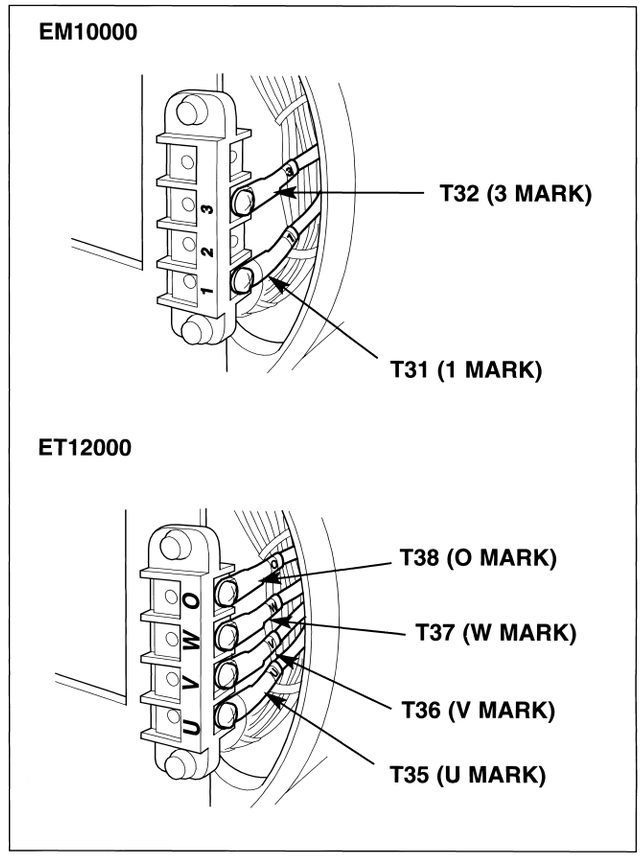
1) Assemble the rear housing and stator with the 6 x 45 mm flange bolt.

2) Install the stator and rear housing assembly to the front housing.
   • Take care not to damage the stator coil and rotor coil wires.



• MAIN COIL TERMINAL CONNECTION

Install the main coil terminals by aligning the marked numbers as shown.



b. INSPECTION

• STATOR

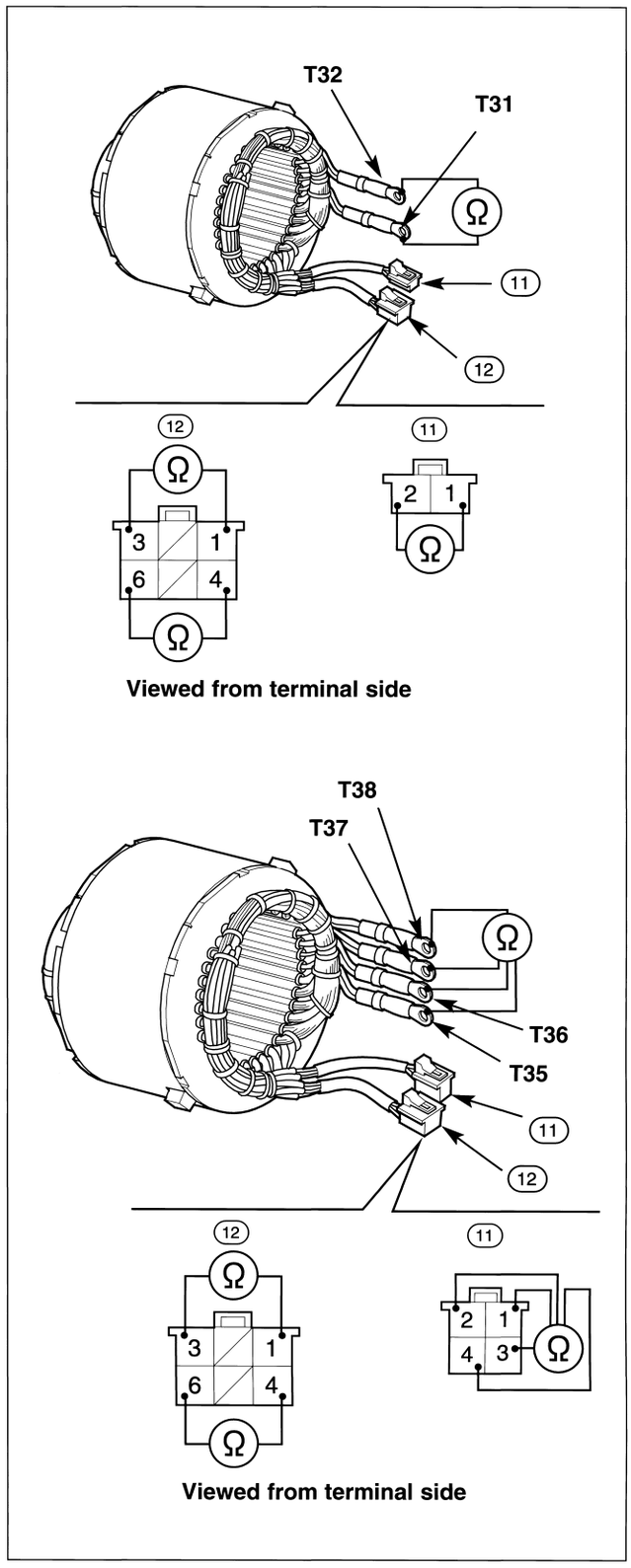
Check the stator coils. If the coils are burnt or discolored, replace the stator. Measure the resistance between the coil terminals.
This test can be performed with stator mounted.

Main winding:
Between the terminals:
EM10000:
T31 (1) — T32 (2): 0.2 - 0.4 Ω
ET12000:
T38(O) — T37 (W): 0.6 - 0.8 Ω
T38 (O) — T36 (V): 0.6 - 0.8 Ω
T38 (O) — T35 (U): 0.6 - 0.8 Ω

Sensor winding (⑪ connector):
Between the terminals:
EM10000:
No. 1 (Brown) — No. 2 (Brown): 0.05 Ω Max.
ET12000:
No. 3 (Black) — No. 1 (Red): 0.08 Ω Max.
No. 3 (Black) — No. 2 (White): 0.08 Ω Max.
No. 3 (Black) — No. 4 (Blue): 0.08 Ω Max.

Exciter winding (⑫ connector):
Between the terminals:
EM10000:
No. 1 (Light green/White) — No. 3 (Light green/White): 1.6 - 2.0 Ω
ET12000:
No. 1 (Light green/White) — No. 3 (Light green/White): 2.0 - 2.5 Ω

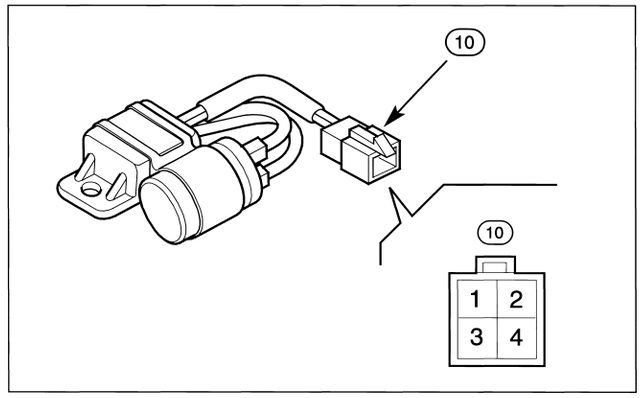
DC winding (⑫ connector):
Between the terminals:
No. 4 (Red/White) — No. 6 (Red/White): 0.3 - 0.5 Ω



• REGULATOR/RECTIFIER

Check for continuity between the terminals according to the table below.

Positive probe (+) / Negative probe (-)			⑩			
			1	2	3	4
			Pink	Yellow	Green	Black
⑩	1	Pink		5200 Ω	1800 Ω	1000 Ω
	2	Yellow	5200 Ω		1700 Ω	955 Ω
	3	Green	1010 Ω	990 Ω		450 Ω
	4	Black	1800 Ω	800 Ω	1800 Ω	



- Use a Rx1 scale of a commercially available multi meter, and the meter shows current flow from negative (–) to positive (+). If the meter shows current flowing one way and not the other way around, the diode is good.

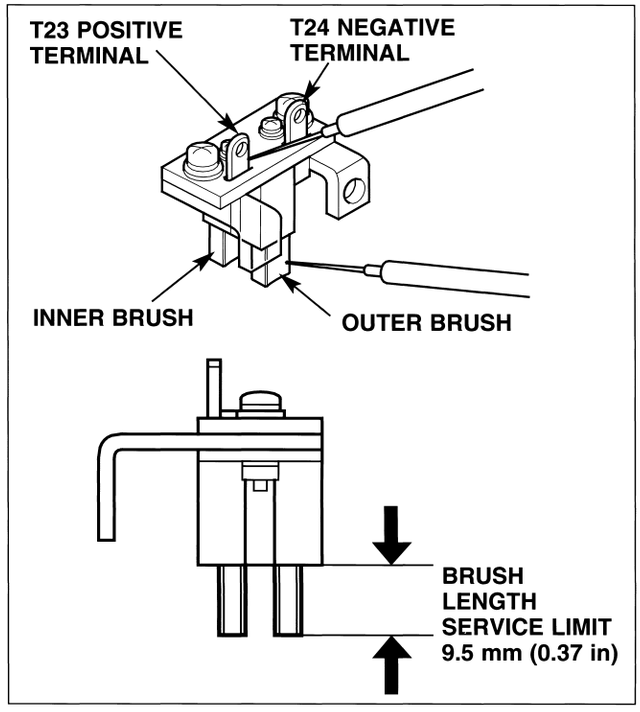
* This table shows reference values.

• BRUSH HOLDER

Check the brushes for free movement. Replace if necessary.
Measure the brush length.

Standard	Service limit
15.5 mm (0.61 in)	9.5 mm (0.37 in)

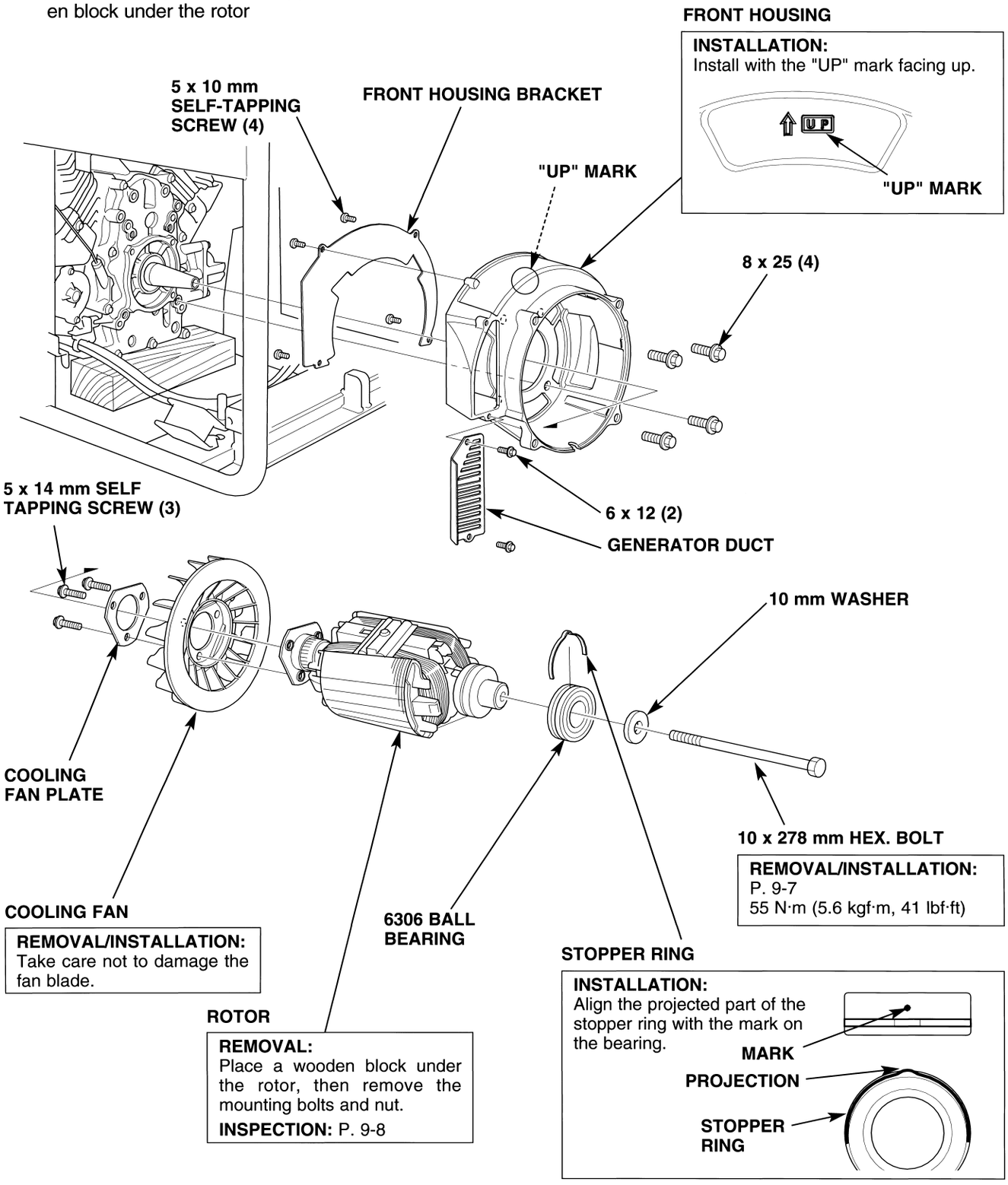
Check for continuity between the brush and terminal.
There should be continuity between the outer brush and T23 positive (+) terminal and between the inner brush and T24 negative (-) terminal.



2. ROTOR/FRONT HOUSING

a. DISASSEMBLY/REASSEMBLY

1) Remove the rear housing and stator (P. 9-1).
   • After removing the stator, support the rotor with wooden block under the rotor



• ROTOR REMOVAL

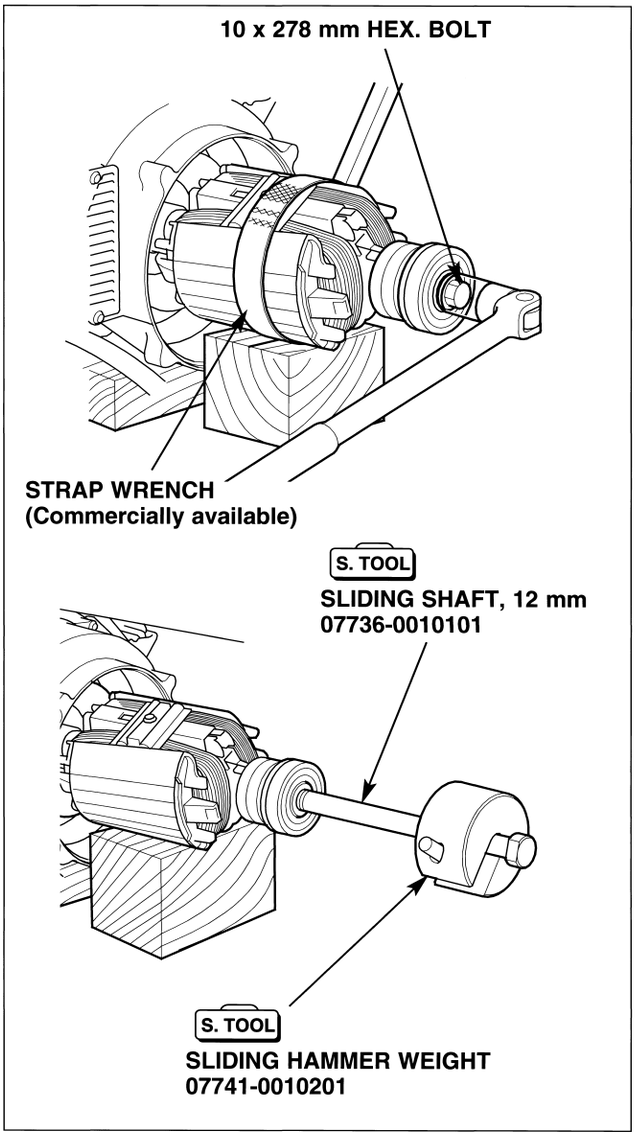
1) Wrap the rag around the rotor and hold the rotor using a commercially available strap wrench as shown. Loosen the 10 x 278 mm hex. bolt.

2) Remove the 10 x 278 mm hex. bolt and 10 mm washer.

3) Place a wooden block and shop towel under the rotor and remove the rotor using the sliding shaft and sliding hammer weight.

TOOLS:

Sliding shaft, 12 mm	**07736-0010101**
Sliding hammer weight	**07741-0010201**



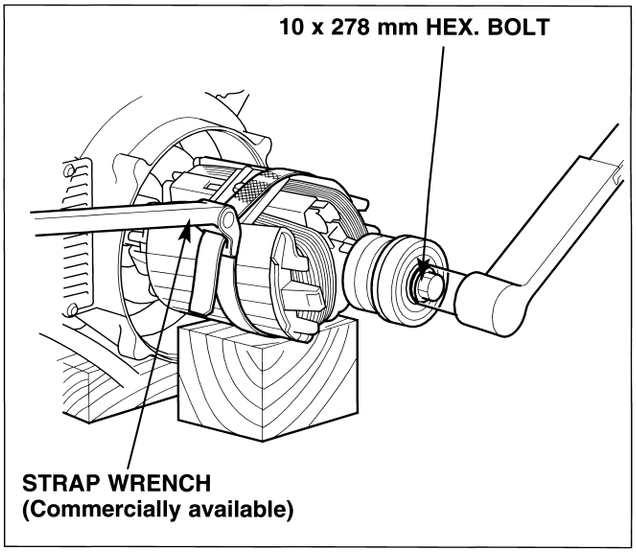
• ROTOR INSTALLATION

1) Clean off oil or grease from the taper of the crankshaft and the tapered hole in the rotor.

2) Install the rotor onto the crankshaft and loosely install the 10 x 278 mm hex. bolt and 10 mm washer.

3) Wrap the rag around the rotor and hold the rotor using a commercially available strap wrench as shown. Tighten the 10 x 278 mm hex. bolt to the specified torque.

TORQUE: 55 N·m, (5.6 kgf·m, 41 lbf·ft)

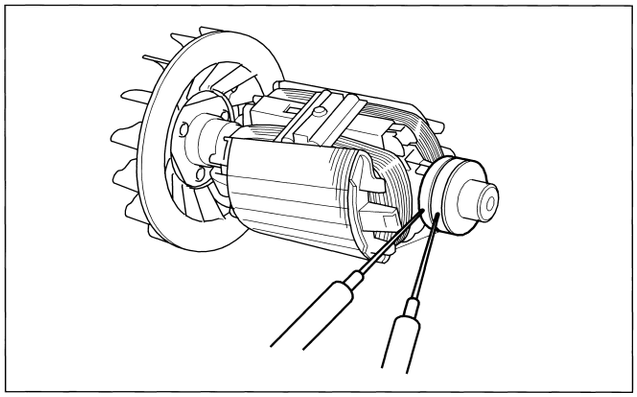


b. INSPECTION0N

• ROTOR

Check the rotor coils. If the coils are burnt or discolored, replace the rotor.Measure the field coil resistance between the slip rings.
This test can be performed with the rotor installed, after removing the brush holder.

Standard resistance	49 - 59 Ω

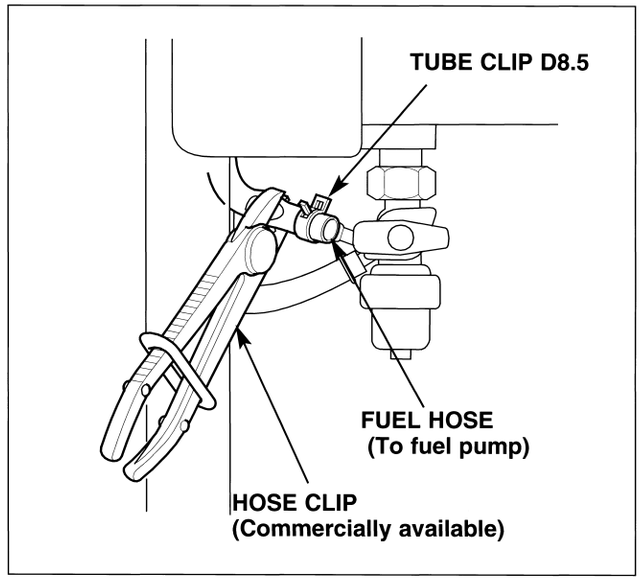


1. ENGINE REMOVAL

1) Disconnect the fuel tube (between fuel valve and engine) from the fuel valve and completely drain the gasoline into a suitable container. Drain the gasoline from the carburetor.

⚠ WARNING

Gasoline is highly flammable and explosive.
You can be burned or seriously injured when handling fuel.
- Keep heat, sparks, and flame away.
- Handle fuel only outdoors.
- Wipe up spills immediately.



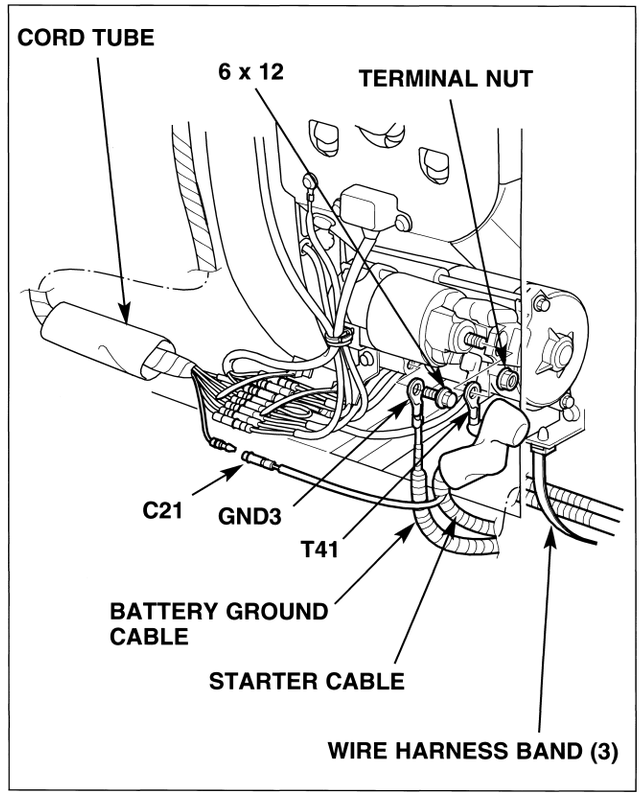
2) Remove the following parts :
- battery (P. 4-1).
- maintenance cover and center beam (P. 5-1).
- fuel tank (P. 6-1).
- air ducts and muffler (P. 7-2 and 7-4).
- control box (P. 8-1).
- rear housing and stator (P. 9-1 and 2).
- rotor and front housing (P. 9-6).

3) Open the wire harness bands, slide the cord tube and disconnect the white wire connector C21 of the starter cable.

4) Remove the terminal nut and disconnect the starter cable terminal T41 from the starter magnetic switch/solenoid.

5) Remove the 6 x 12 mm flange bolt and disconnect the battery ground cable terminal GND3 from the starter motor.

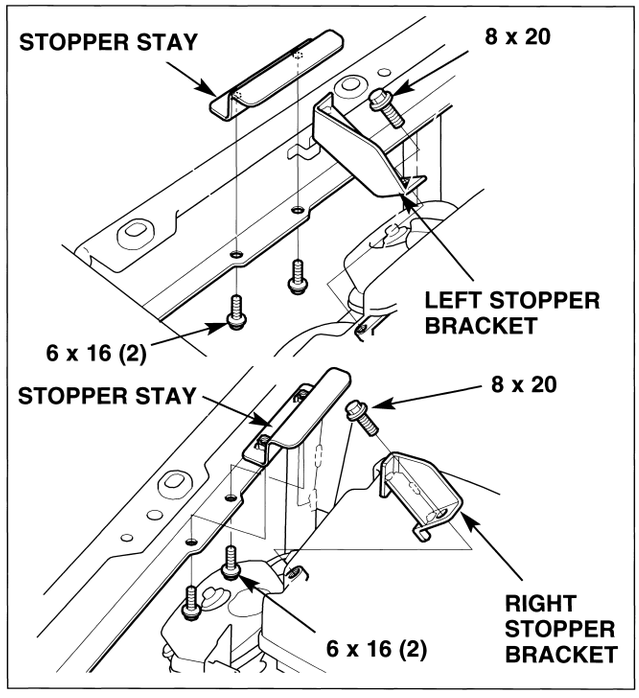
6) Open the wire harness band and release the starter cable and battery ground cable.



7) Unfasten the cover clips and remove the air cleaner cover.

8) Remove the 6 x 16 mm flange bolts and stopper stays at the left and right sides.

9) Remove the 8 x 20 mm flange bolts and left and right stopper brackets.

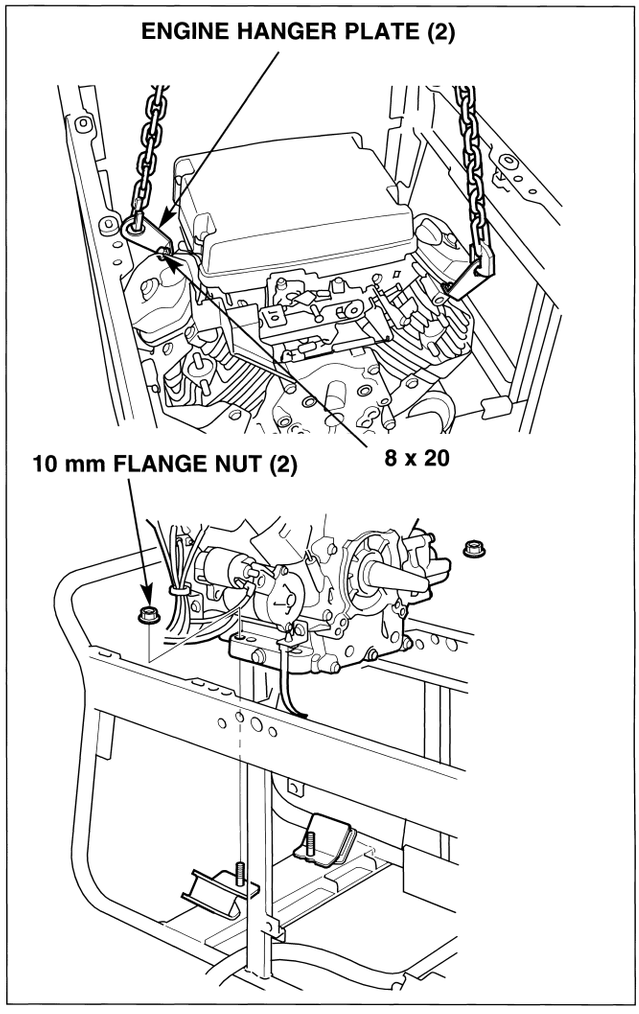


10) Install the engine hanger plates and tighten the bolt securely.
    - Install the engine hanger plates by using the stopper bracket mounting 8 x 20 mm flange bolts.

11) Attach a chain hoist to the engine hangers as shown.

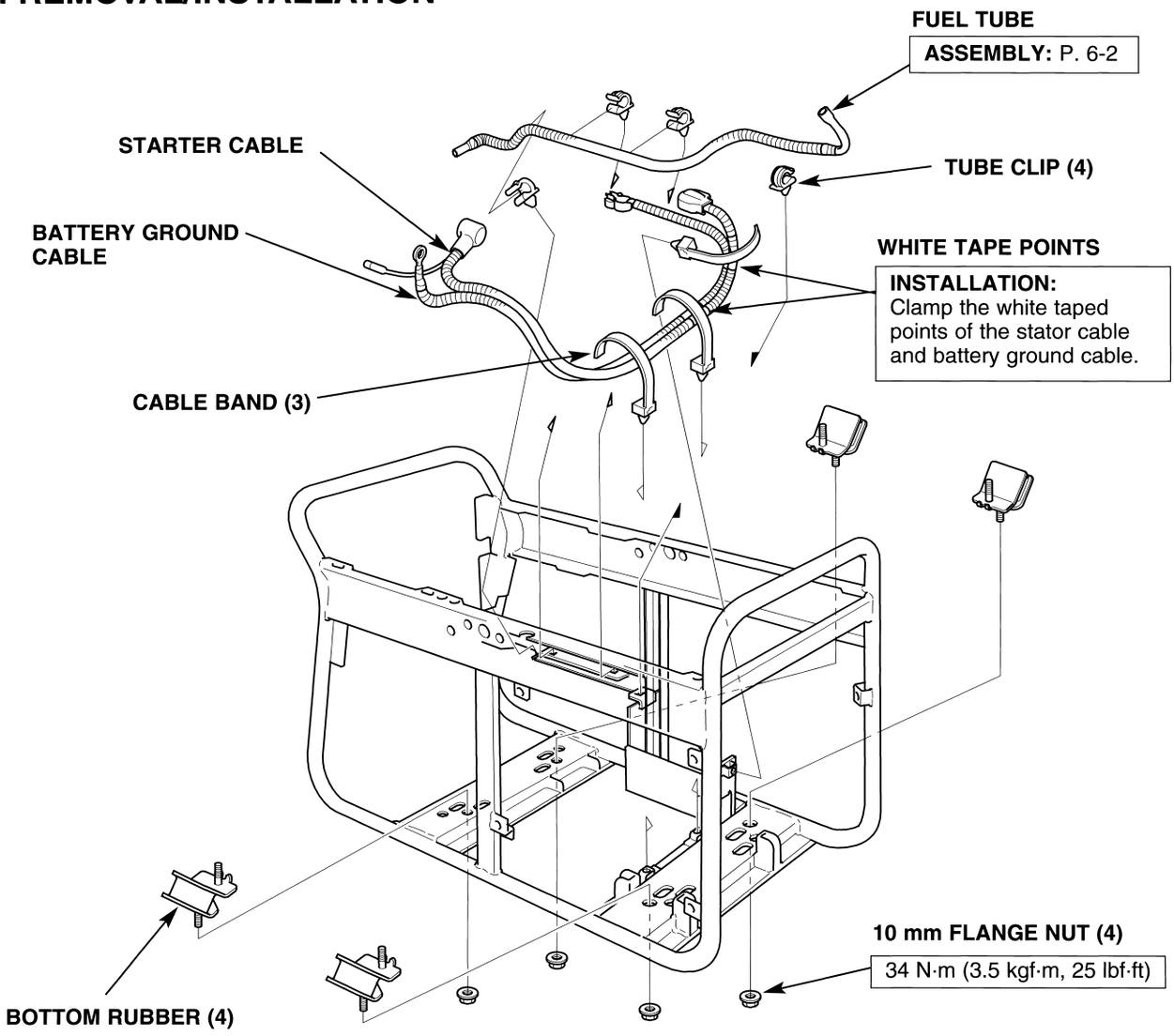
12) Remove the 10 mm flange nuts.

13) Raise and remove the engine from the frame.



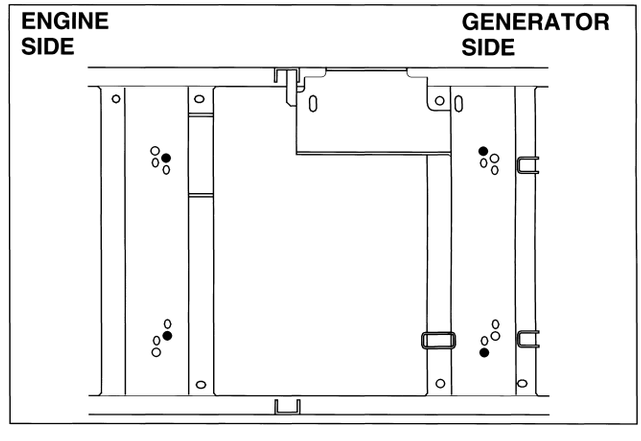
2. FRAME/BOTTOM RUBBERS

a. REMOVAL/INSTALLATION



• BOTTOM RUBBER INSTALLATION

Install the bottom rubbers onto the marked ● places shown.

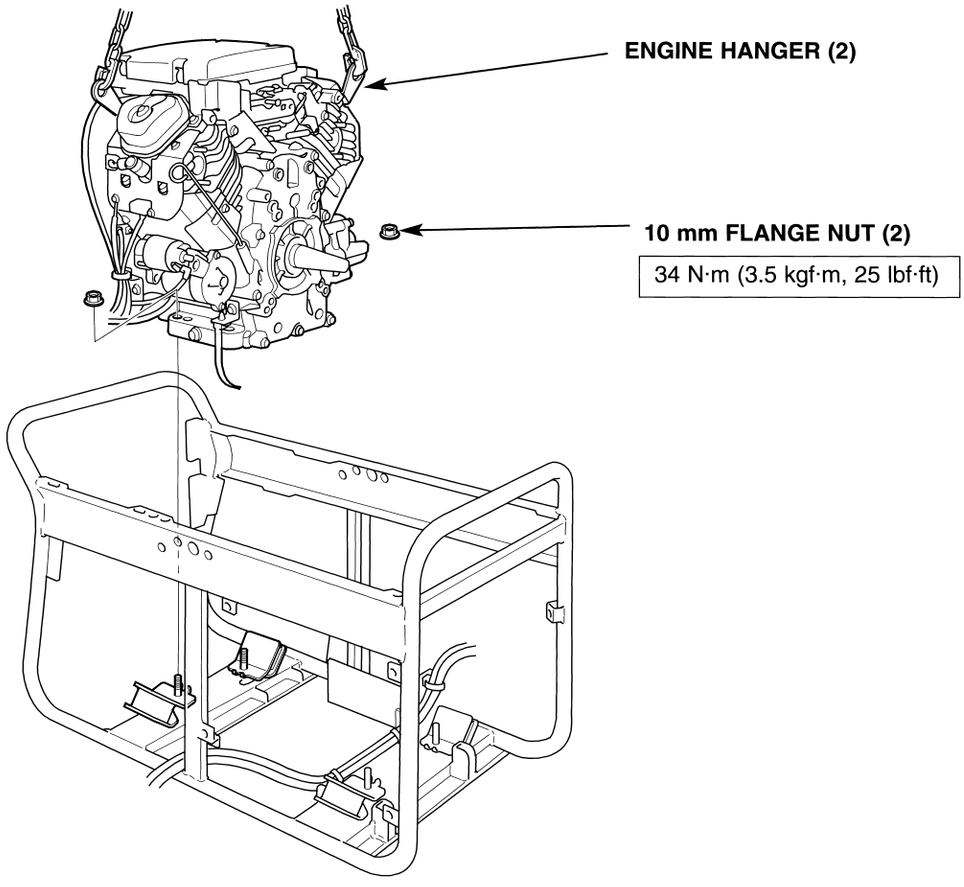


3. ENGINE INSTALLATION

1) Install the engine on the frame using a chain hoist taking care not to damage each parts of the engine.

2) Tighten the engine mount nuts to the specified torque.
   TORQUE: 34 N·m (3.5 kgf·m, 25 lbf·ft)

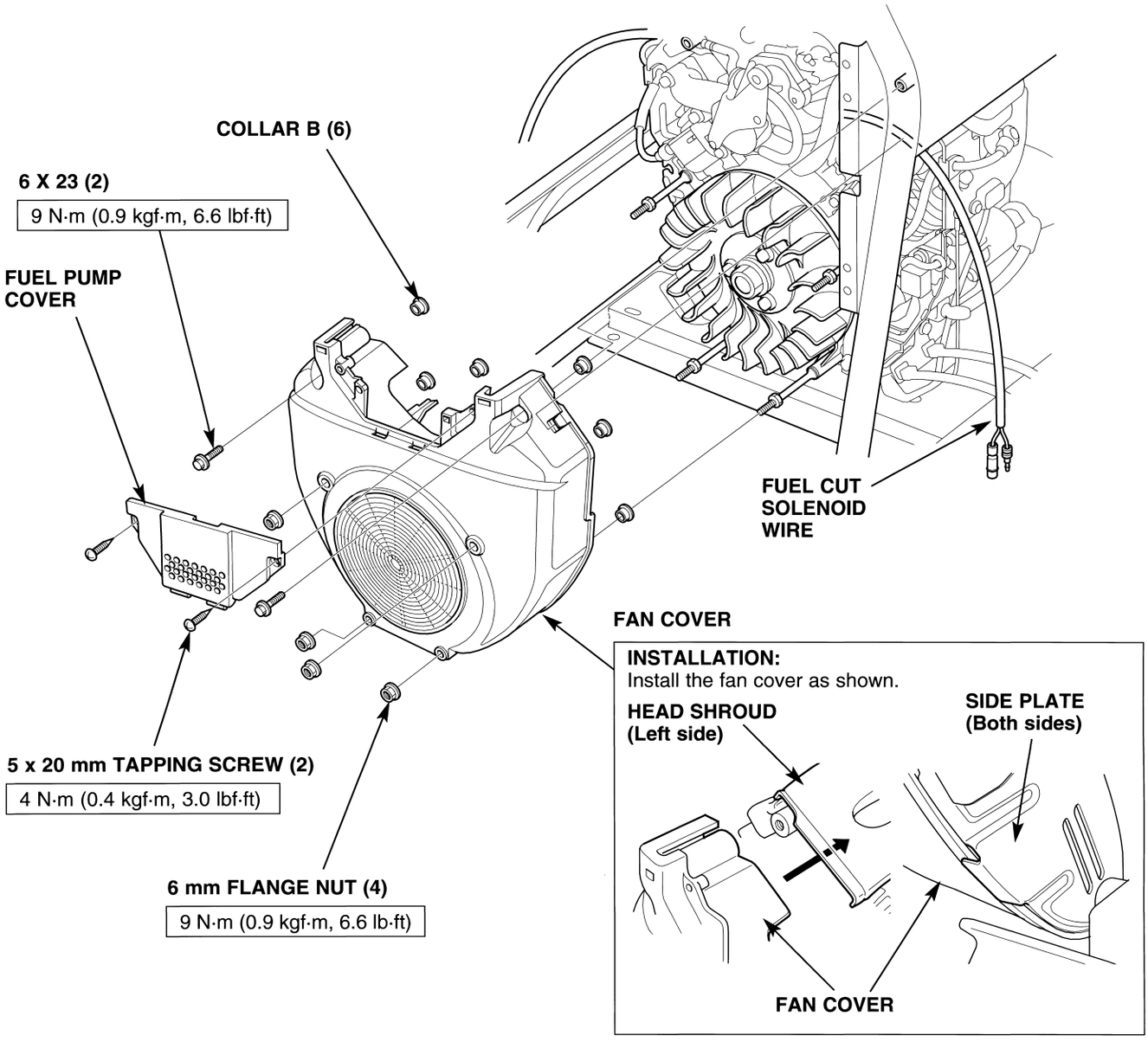
3) Install the removed parts in the reverse order of removal.
   - generator (Section 9).
   - air cleaner and muffler (Section 7).
   - control box (Section 8).
   - wire harness routing and connection (P. 2-31 thru. 35).



1. FAN COVER

a. REMOVAL/INSTALLATION

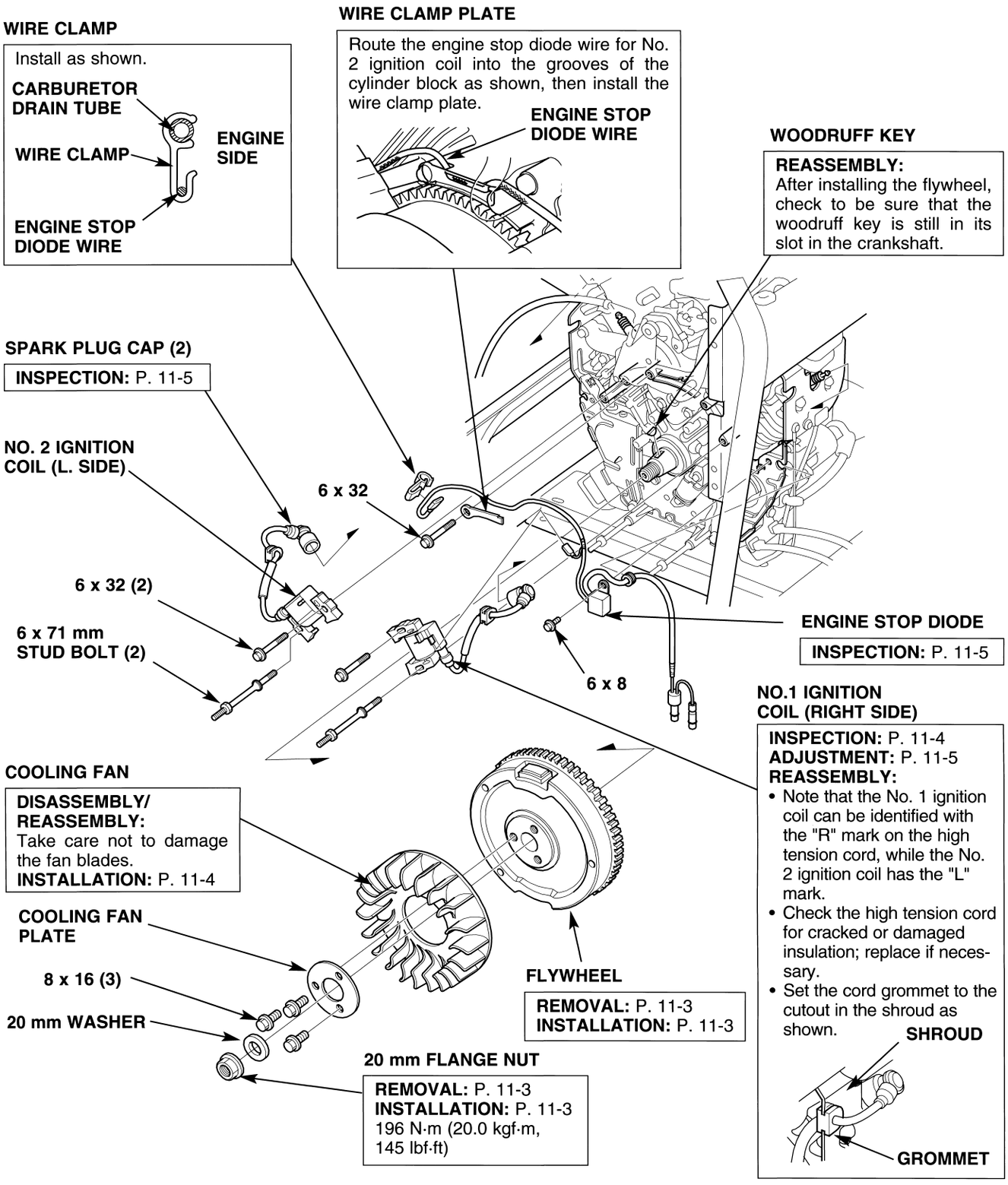
1) Remove the following:
   - air cleaner case (P. 7-1).
   - control box (P. 8-1).
   - The fan cover can be serviced with the control box placed on the fuel tank according to the procedures described on pages 3-7.



2. COOLING FAN/FLYWHEEL/IGNITION COILS

a. DISASSEMBLY/REASSEMBLY

1) Remove the fan cover (P. 11-1).

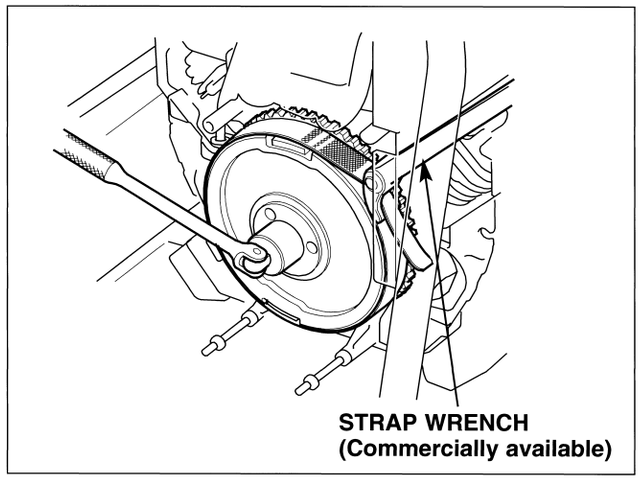


• FLYWHEEL REMOVAL

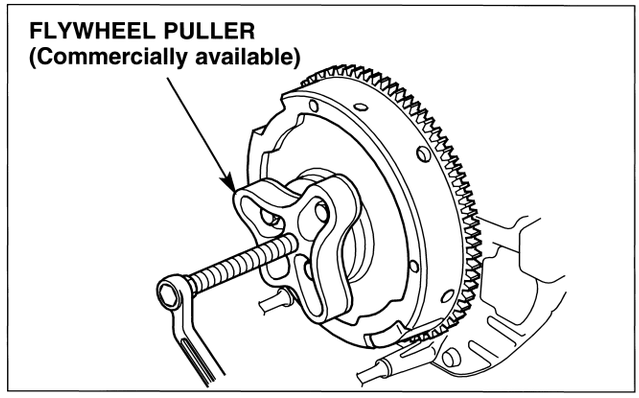
1) Remove the cooling fan with care not to damage the fan blades.

2) Remove the ignition coils (P.11-2).

3) Remove the 20 mm flange nut by holding the flywheel using a commercially available strap wrench.



4) Remove the flywheel using a commercially available flywheel puller as shown.
   • Do not hit the flywheel with a hammer.



• FLYWHEEL INSTALLATION

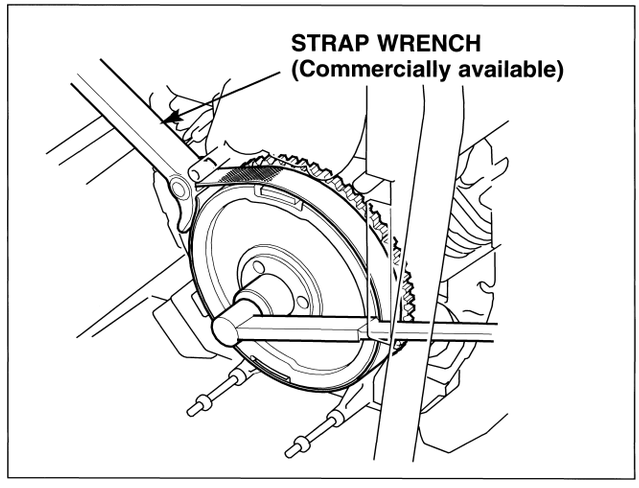
1) Clean off oil or grease from the taper of the crankshaft and the tapered hole in the flywheel.

2) Install the woodruff key in the key groove on the crankshaft.

3) Install the flywheel by aligning the key groove with the key on the crankshaft.
   • After installing the flywheel, check to be sure that the woodruff key is still in its slot of the flywheel.

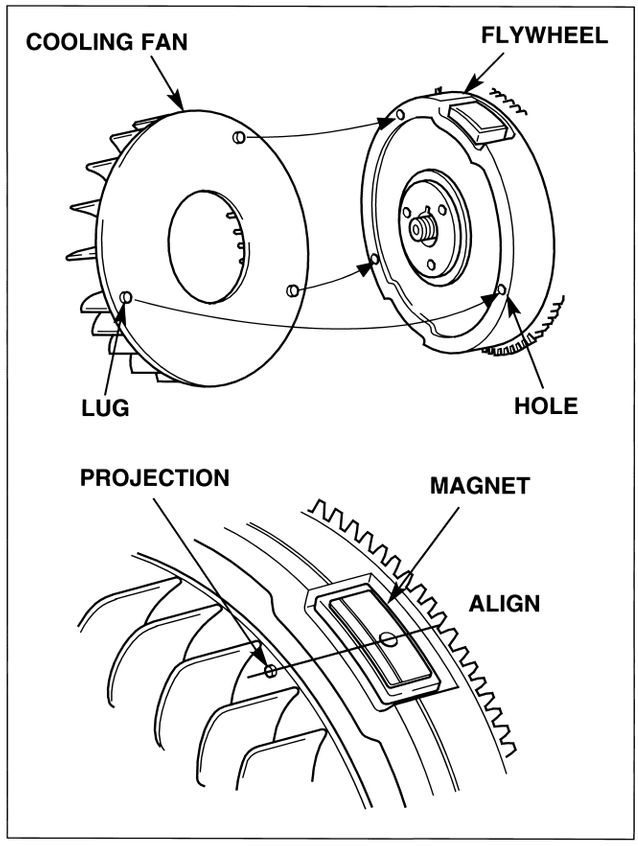
4) Apply oil to the threads of the 20 mm flange nut.

5) Hold the flywheel with a commercially available strap wrench, and tighten the 20 mm flange nut to the specified torque.
   TORQUE: 196 N·m (20.0 kgf·m, 145 lbf·ft)



• COOLING FAN INSTALLATION

Attach by aligning the three lugs on the rear side of the fan with the small holes in the flywheel, and make sure that the projection on the cooling fan aligns with the center of the flywheel magnet section.



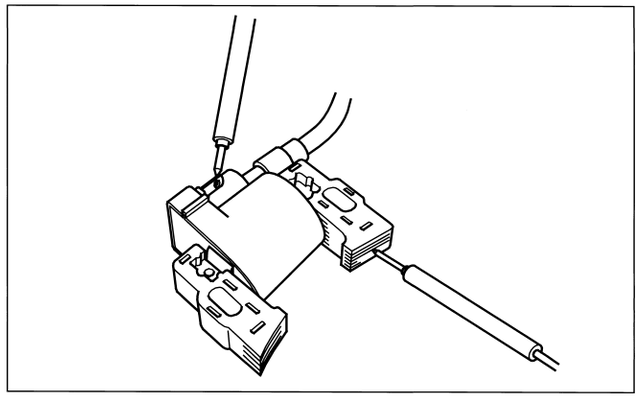
b. INSPECTION

• IGNITION COILS

<Primary side>

Measure the resistance of the primary coil by attaching one ohmmeter lead to the ignition coil's primary terminal while touching the other test lead to the iron core.

Standard resistance	0.8 - 1.0 Ω

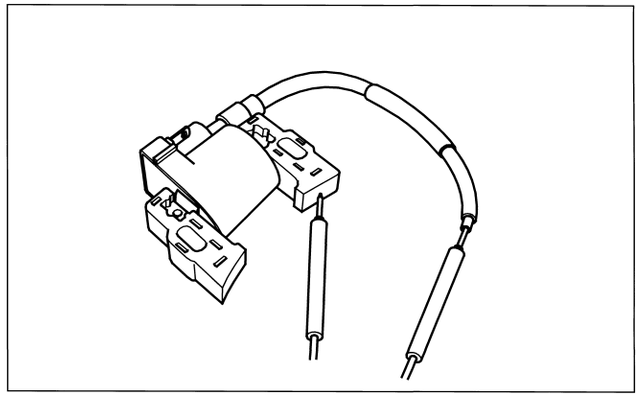


<Secondary side>

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	7.0 - 8.6 kΩ

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

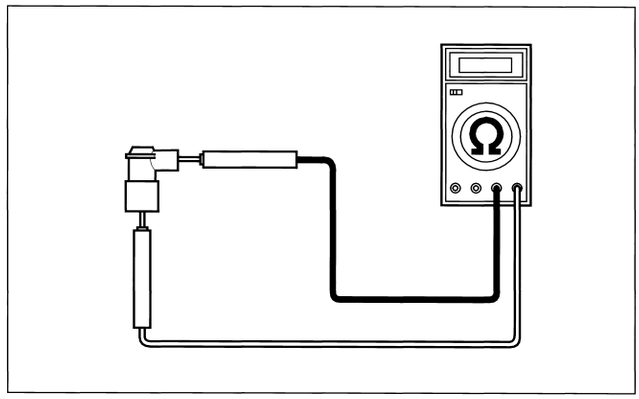


• SPARK PLUG CAPS

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 specified range.

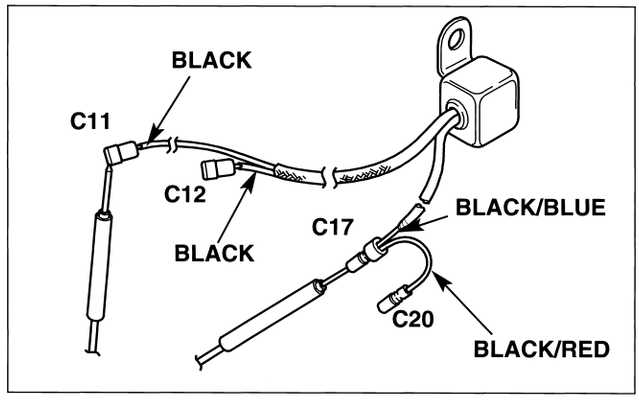


• ENGINE STOP DIODE

Check for continuity between the terminals.

Tester (+) probe / Tester (–) probe	C11 Black	C12 Black	C17 Black/Blue
C11 Black		∞	∞
C12 Black	∞		∞
C17 Black/Blue	Continuity	Continuity	

- Use a commercially available digital multi meter or the R x 1 scale of an analog meter, and the meter shows current flow from negative (–) to positive (+).
- Multi meter impedance: 10 MΩ/DCV minimum



c. ADJUSTMENT

• IGNITION COIL AIR GAP

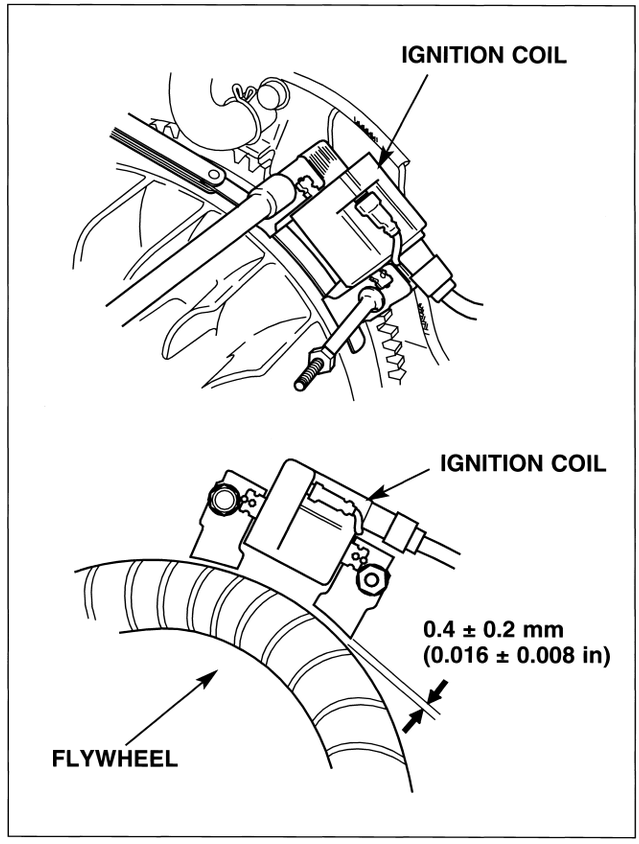
Adjustment is required only when the ignition coil or the flywheel has been removed.

1) Loosen the ignition coil mounting bolts.

2) Insert a long thickness gauge between the ignition coil and the flywheel.
   - Both gaps should be adjusted simultaneously.
   - Avoid the flywheel magnet when adjusting the ignition coil air gap.

3) Push the ignition coil firmly toward the flywheel and tighten the bolts securely.

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

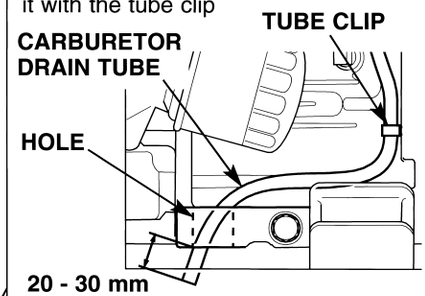


3. CHARGING COIL/SIDE PLATES

Remove the following:
- fan cover (P. 11-1).
- cooling fan, flywheel and ignition coils (P. 11-2).

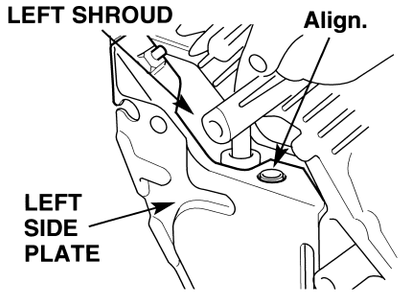
CARBURETOR DRAIN TUBE

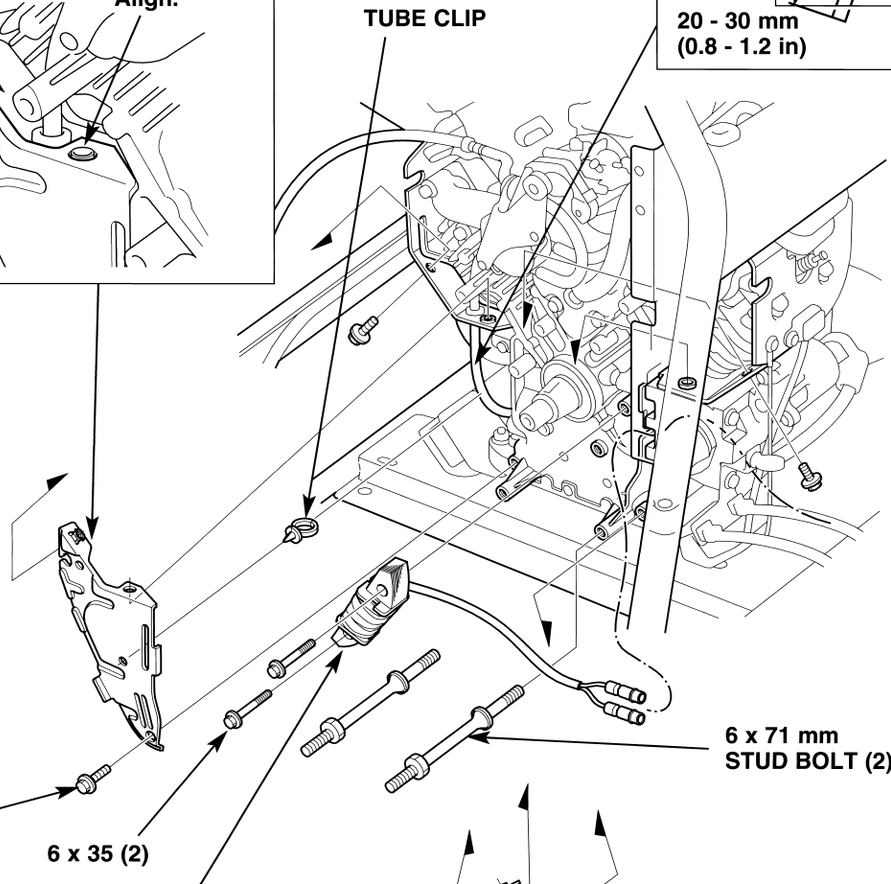
REASSEMBLY:
Route the drain tube as shown and secure it with the tube clip



LEFT SIDE PLATE

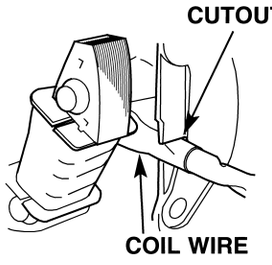
REASSEMBLY:
Set the projection on the left shroud into the hole in the left side plate.



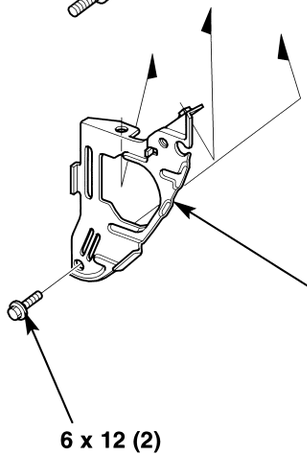


CHARGE COIL [12 V - 3 A]

REASSEMBLY:
Set the coil wire to the cutout of the cylinder block as shown.

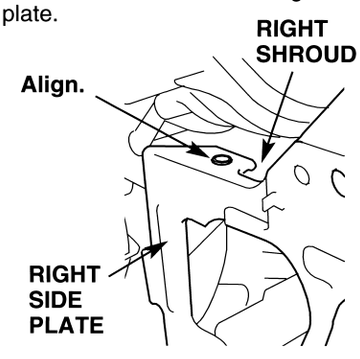


INSPECTION: P. 11-7



RIGHT SIDE PLATE

REASSEMBLY:
Set the projection on the right shroud into the hole in the right side plate.



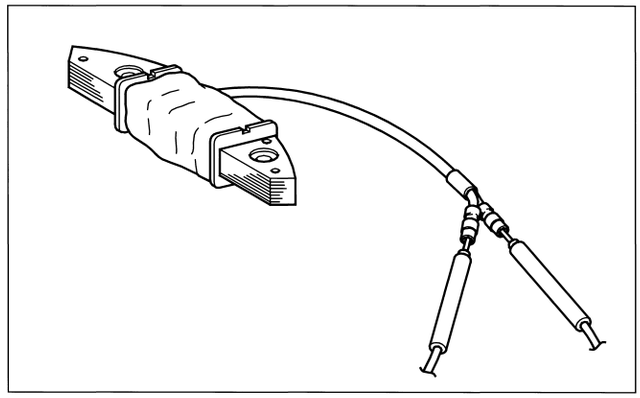
b. INSPECTION

• CHARGE COIL

Measure the resistance of the coil as shown.

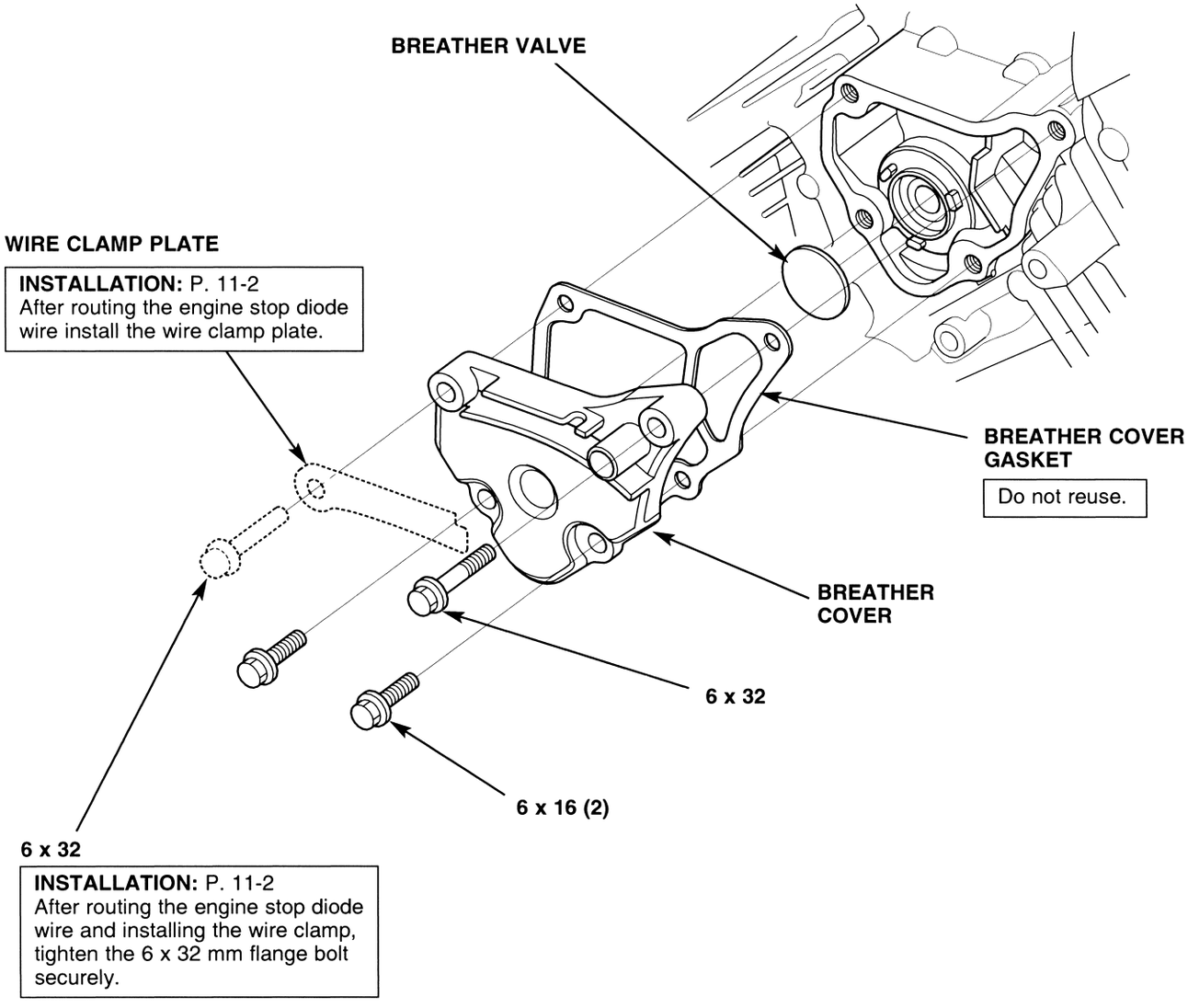
Standard resistance	0.19 - 0.25 Ω

Replace the charge coil(s) if the resistance is out of specification.



4. BREATHER COVER

Remove the following:
- fan cover (P. 11-1).
- cooling fan, flywheel and ignition coils (P. 11-2).
- fuel pump (P. 13-1) and intake manifold (P. 13-2).

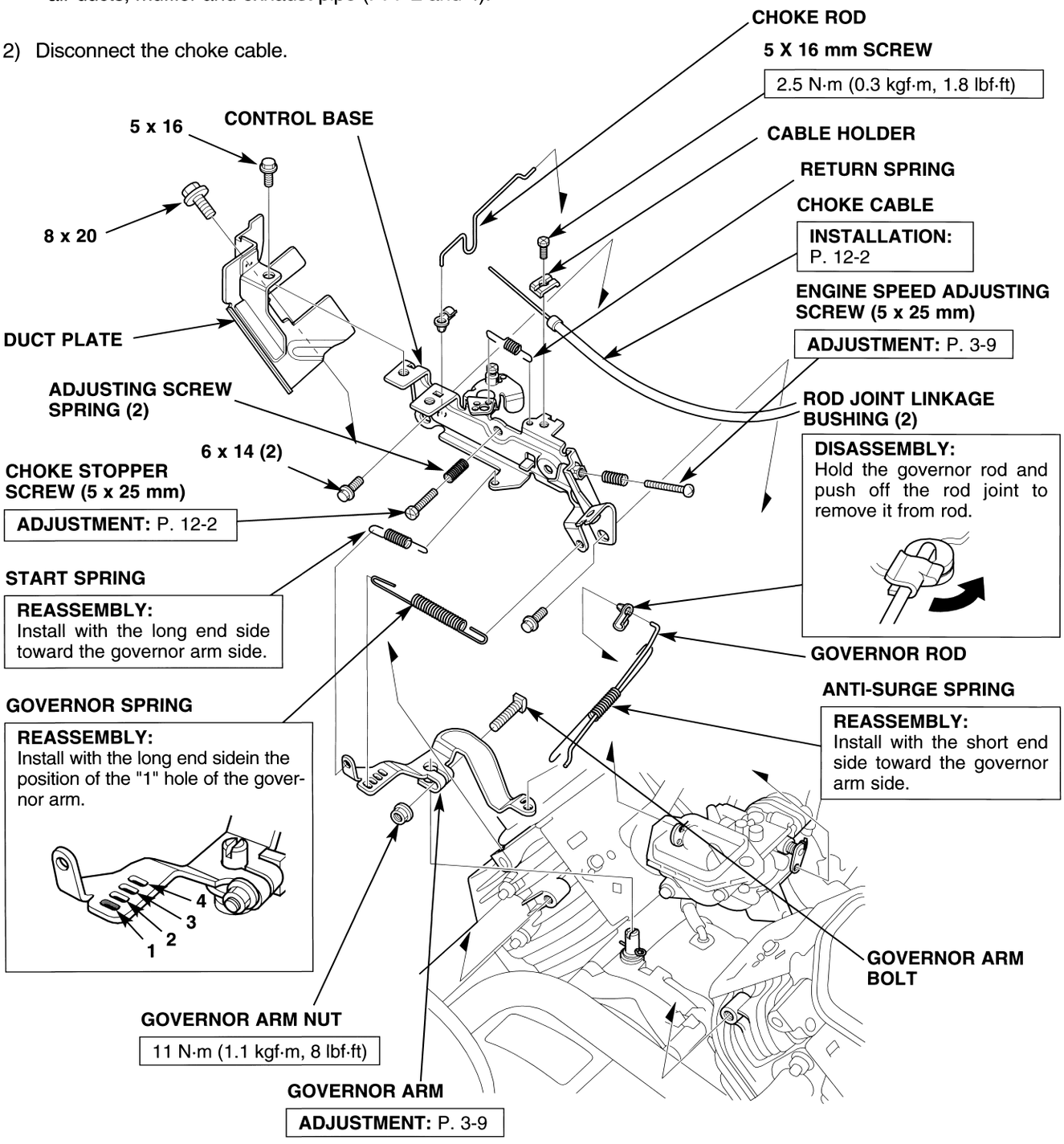


1. CONTROL BASE/GOVERNOR ARM

a. DISASSEMBLY/REASSEMBLY

1) Remove the following:
   - fuel tank (P. 6-1).
   - air cleaner (P. 7-1).
   - air ducts, muffler and exhaust pipe (P. 7-2 and 4).

2) Disconnect the choke cable.



• CHOKE CABLE INSTALLATION

1) Push the choke arm to the choke fully closed position.

2) Check that the choke adjusting screw just touches the stopper of the choke arm.

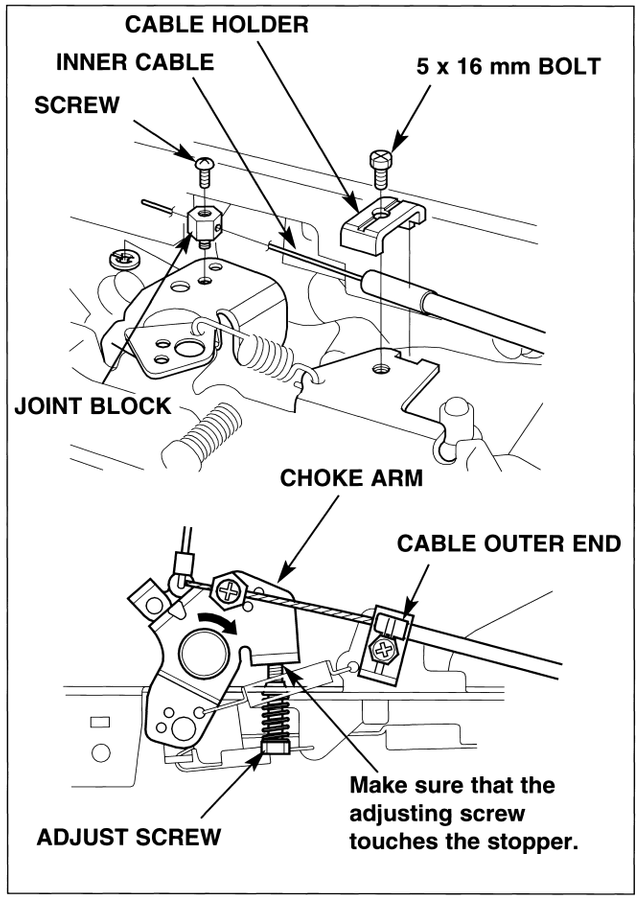
3) If there is clearance or the choke lever is not fully dosed, turn the stopper screw as required.

4) Return the choke arm to the full open position and push the choke knob completely.

5) Connect the cable inner wire to the joint block.

6) Secure the cable outer end with the cable holder and tighten the 5 x 16 mm bolt to the specified torque.
   TORQUE: 2.5 N·m (0.3 kgf·m, 1.8 lbf·ft)

7) Then tighten the screw securely.



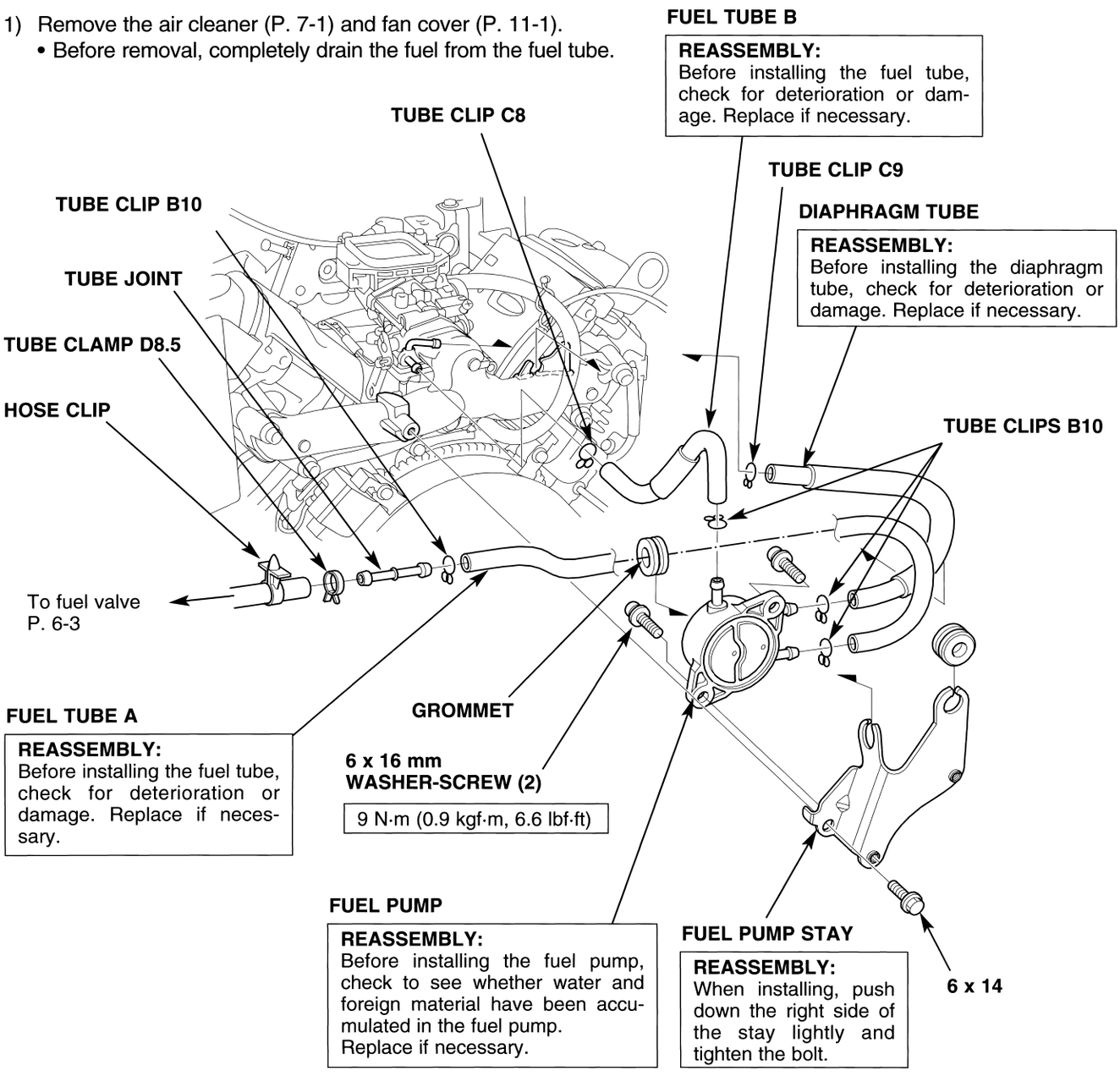
1. FUEL PUMP

a. REMOVAL/INSTALLATION

⚠WARNING

Gasoline is highly flammable and explosive.
You can be burned or seriously injured when handling fuel.
- Keep heat, sparks, and flame away.
- Handle fuel only outdoors.
- Wipe up spills immediately.

1) Remove the air cleaner (P. 7-1) and fan cover (P. 11-1).
   - Before removal, completely drain the fuel from the fuel tube.



2. CARBURETOR

a. REMOVAL/INSTALLATION

Before removal, completely drain the carburetor.

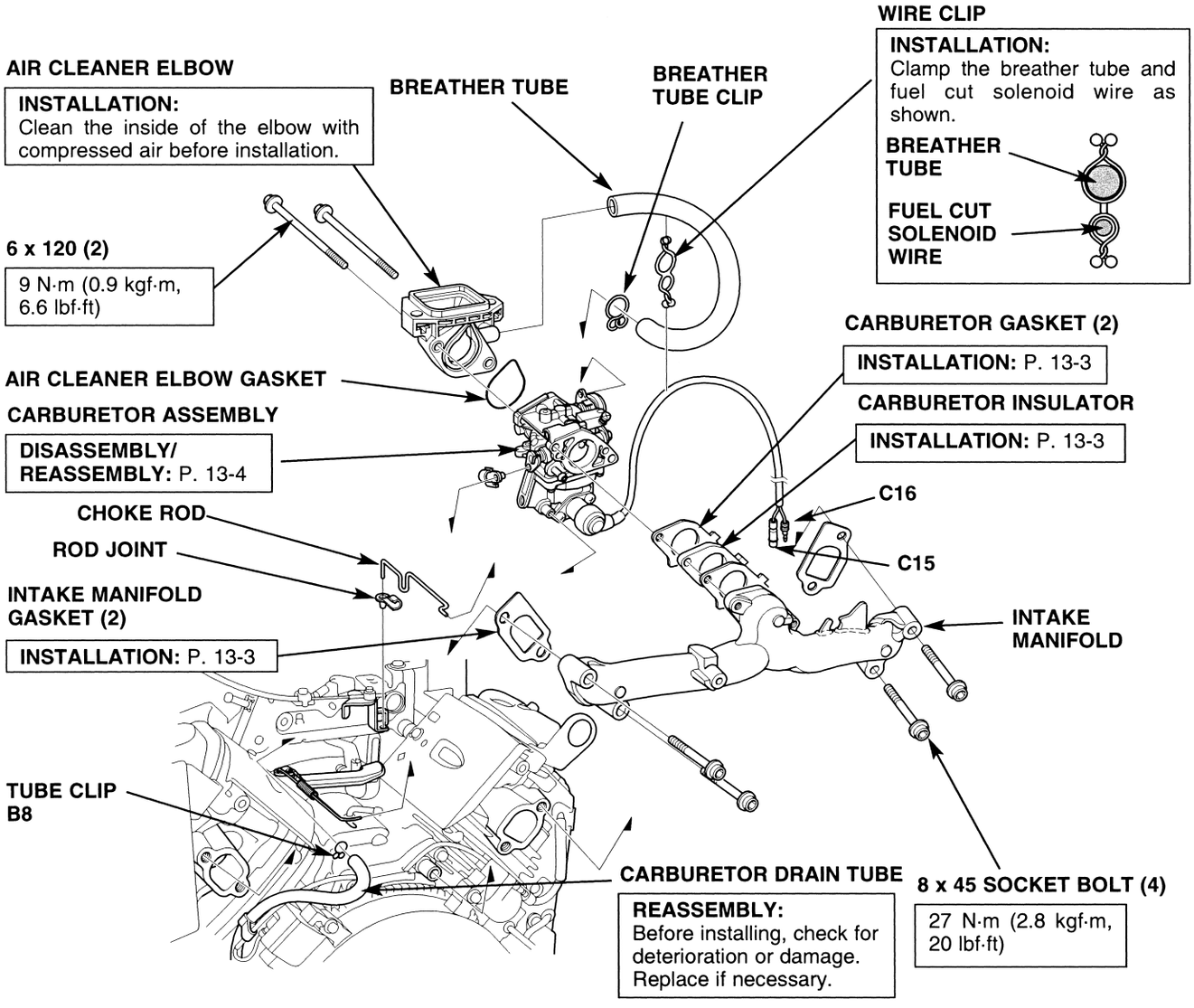
⚠WARNING

Gasoline is highly flammable and explosive.
You can be burned or seriously injured when handling fuel.
- Keep heat, sparks, and flame away.
- Handle fuel only outdoors.
- Wipe up spills immediately.

If the intake manifold is left out, dirt will enter the intake system damaging the engine. Cover the intake ports with clean shop towel or sealing tape.

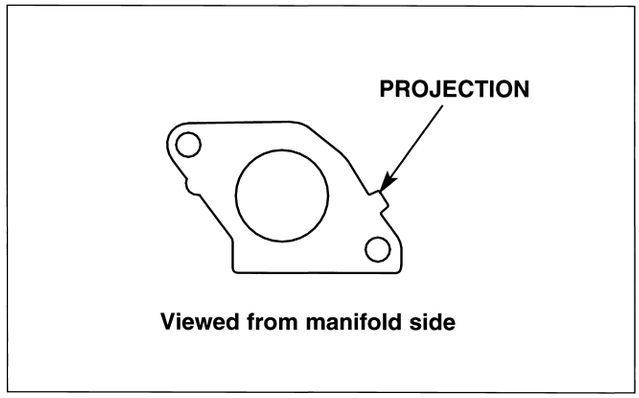
1) Remove the air cleaner case (P. 7-1), muffler (P. 7-4), fan cover (P. 11-1), control base and governor arm (P. 12-1).

2) Disconnect the fuel cut solenoid wire connectors C15 and C16.



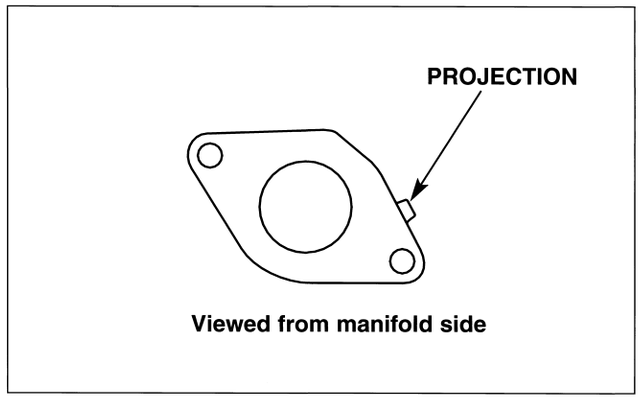
• CARBURETOR GASKET INSTALLATION

Install the carburetor gasket with the projection facing right as shown.



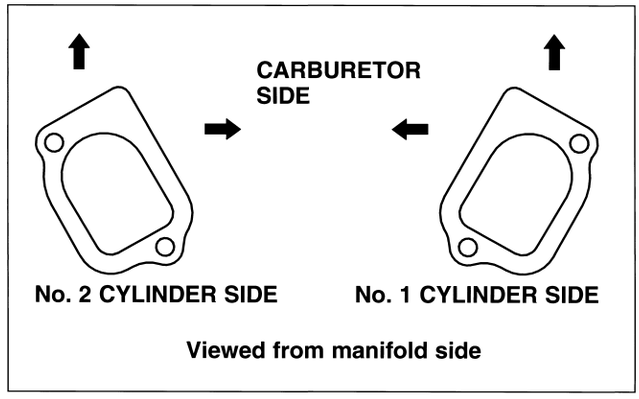
• CARBURETOR INSULATOR INSTALLATION

Install the carburetor insulator with the projection facing right as shown.



• INTAKE MANIFOLD GASKET INSTALLATION

Install the intake manifold gaskets as shown noting the installation direction.

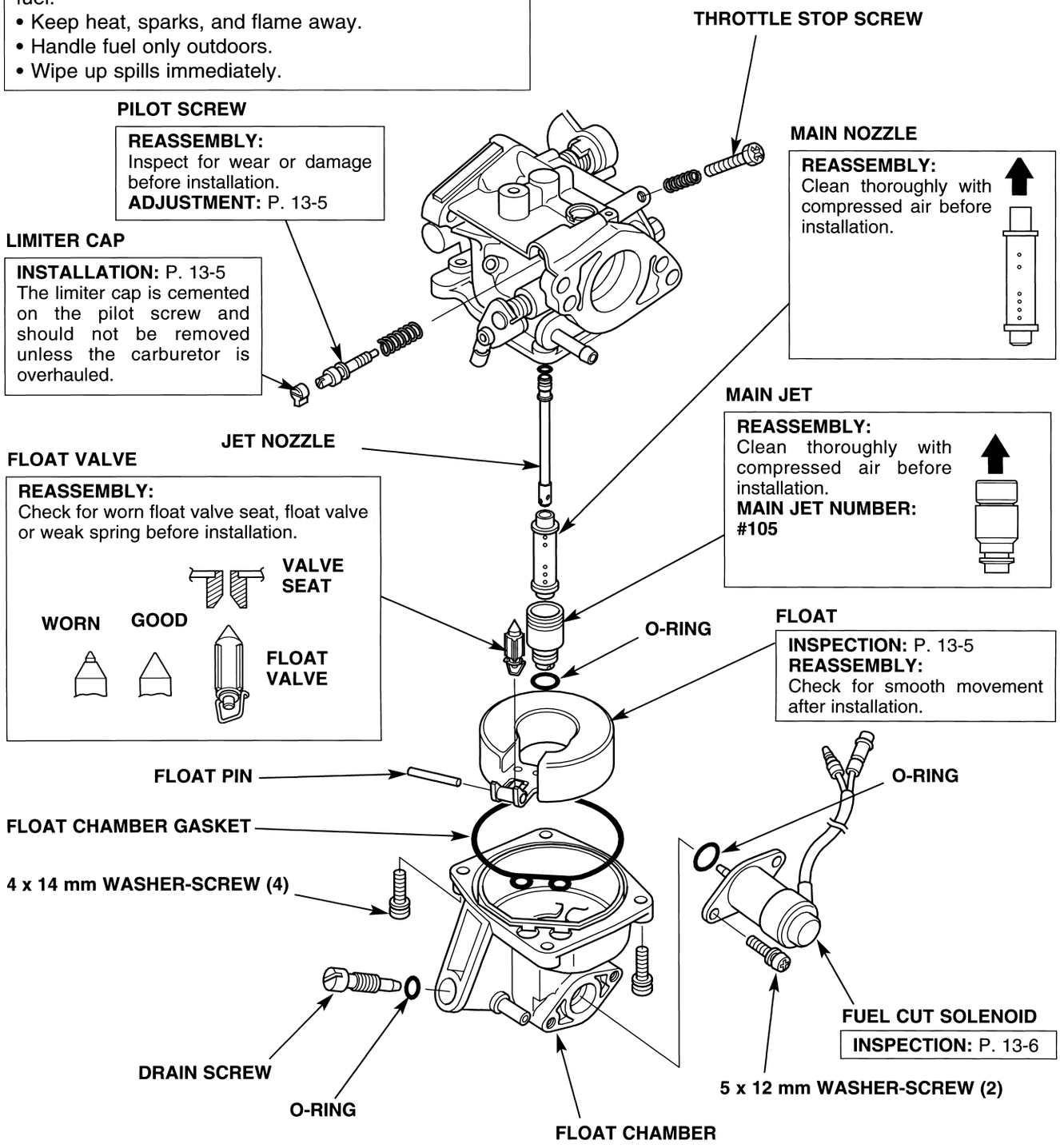


b. DISASSEMBLY/REASSEMBLY

• Before disassembly, loosen the drain screw and drain the carburetor. Clean the outside of the carburetor before disassembly.

⚠ WARNING

Gasoline is highly flammable and explosive.
You can be burned or seriously injured when handling fuel.
• Keep heat, sparks, and flame away.
• Handle fuel only outdoors.
• Wipe up spills immediately.



• PILOT SCREW REPLACEMENT

- Leave the pilot screw and limiter cap in place during carburetor cleaning. Remove only if necessary for carburetor repair.
- Removal of the limiter cap requires breaking the pilot screw. A new pilot screw and limiter cap must be installed.

1) When the limiter cap has been broken off, remove the broken pilot screw.

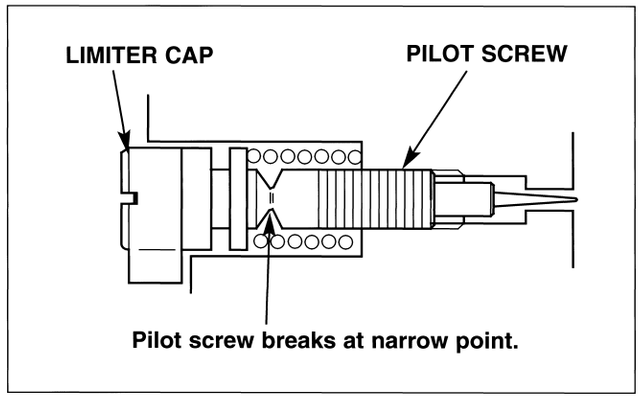
2) Place the spring on the replacement pilot screw, and install it on the carburetor.

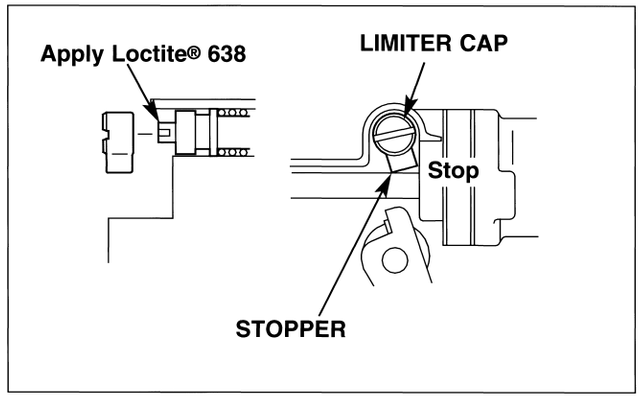
3) Turn the pilot screw in until it is fully seated, then turn the screw out the required number of turns.

Pilot screw opening	2-1/8 turns out

4) Apply Loctite® 638 to the inside of the limiter cap, then install the cap so its stopper prevents the pilot screw from turning counterclockwise.

   Be careful to avoid turning the pilot screw while installing the limiter cap. The pilot screw must stay at its required setting.





c. INSPECTION

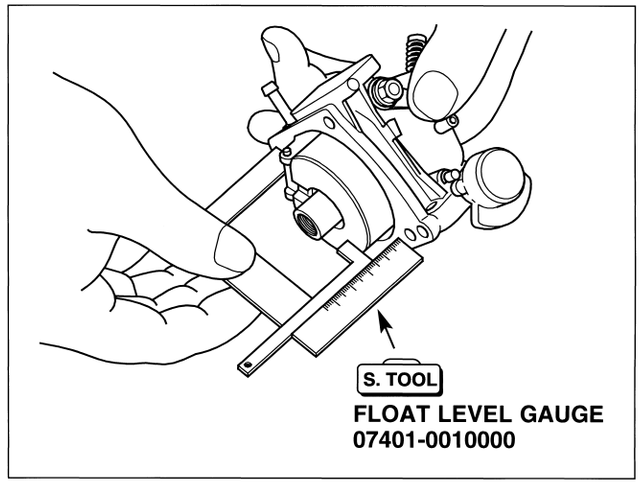
• FLOAT LEVEL HEIGHT

Place the carburetor in the position shown and measure the distance between the float top and carburetor body when the float just contacts the seat without compressing the valve spring.

Standard float height	14.0 mm (0.55 in)

If the height is out of specification, replace the float and/or the float valve. Recheck the float height.

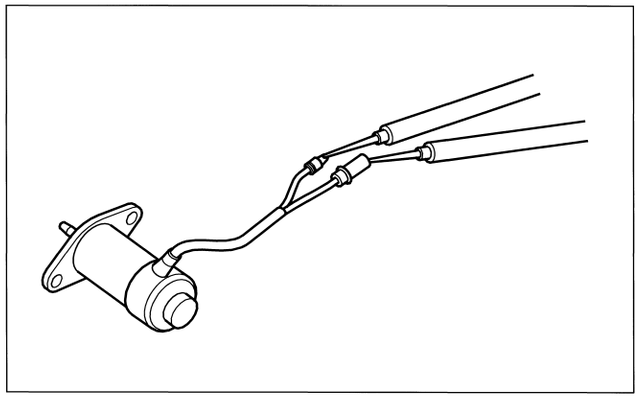
TOOL:
Float level gauge **07401-0010000**



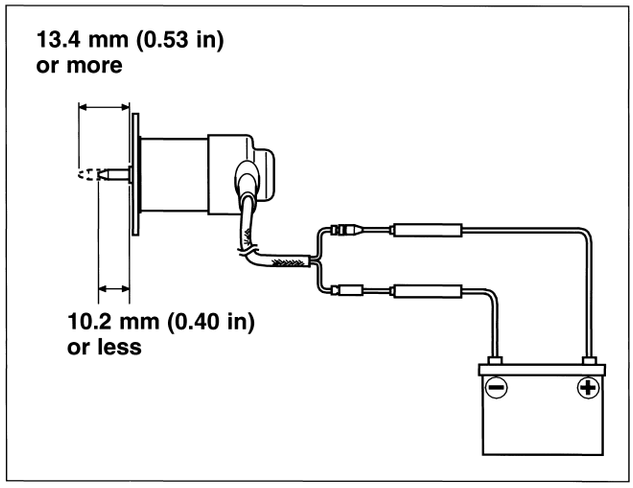
• FUEL CUT SOLENOID

1) Measure the resistance between the solenoid wire terminals.

Standard resistance	6.2 - 9.2 Ω



2) Connect the 12 V battery to the fuel cut solenoid wire connectors as shown. The needle of the solenoid should project, and the needle should retract with the battery disconnected.
   - Be sure the battery is in good condition before performing this test.
   - The needle of the valve should measure 13.4 mm (0.53 in) or more when the valve is ON (projected), and it should measure 10.2 mm (0.40 in) or less when the valve is OFF (retracted).



1. STARTER MOTOR

a. PERFORMANCE TEST

Measure starter motor performance while cranking the engine.
If the performance is not within service limits, disassemble and inspect as described on pages 14-2 through 14-5.

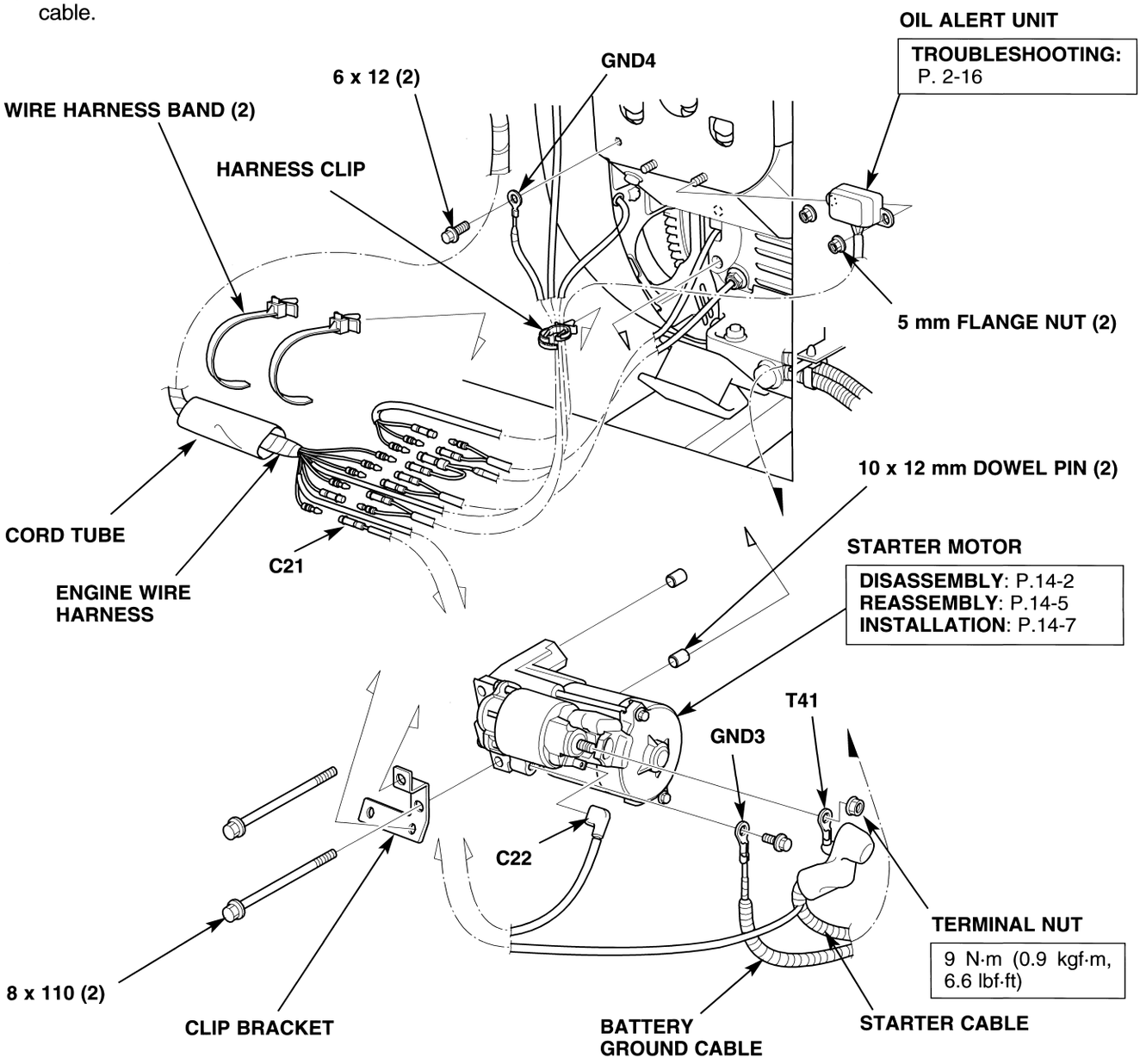
- To get accurate results, the test must be made in the normal ambient temperature.

Starter Motor Performance

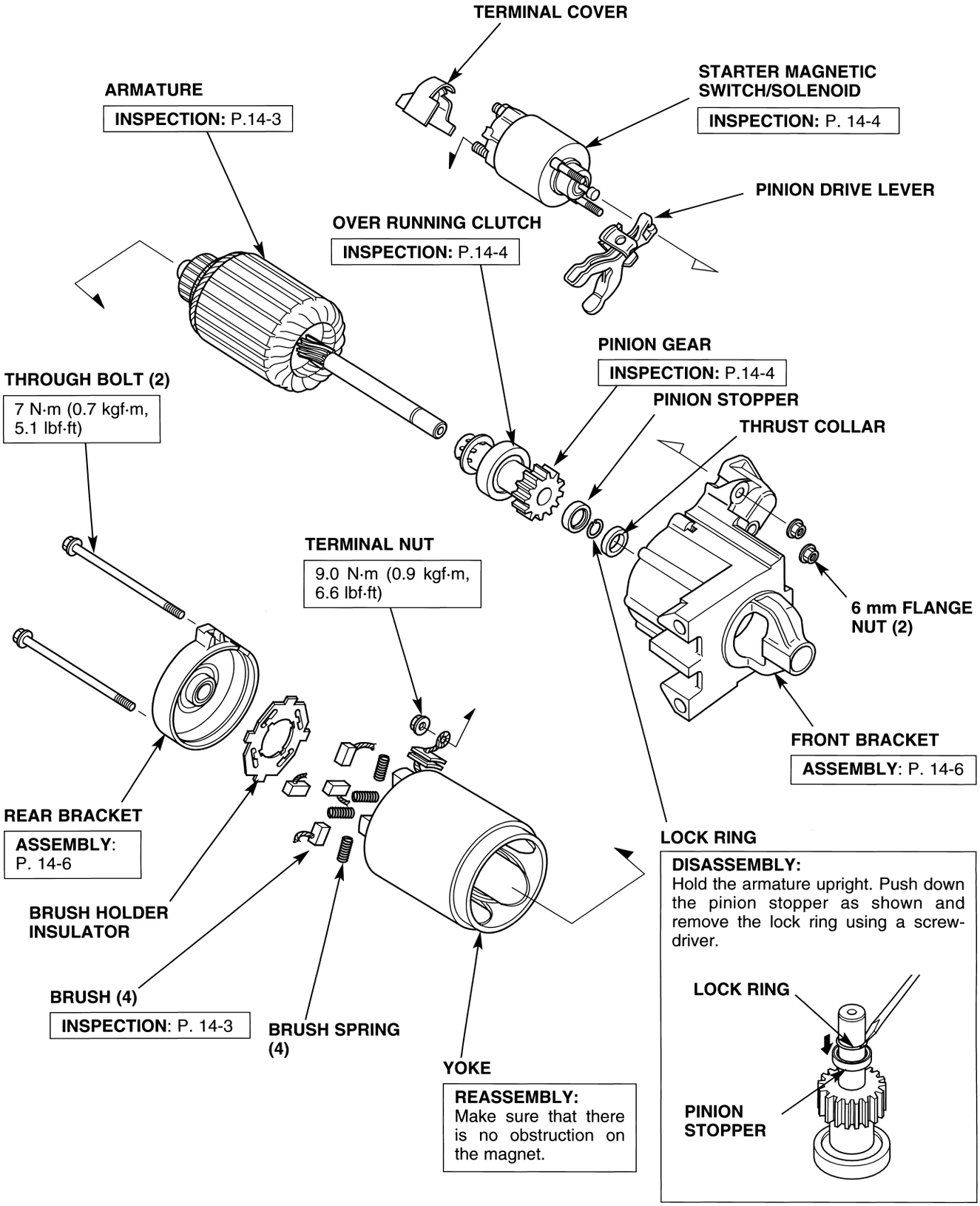
	Under load	No load
Cranking voltage	11.4 V DC	11.5 V DC
Cranking current	Approx.80 A	Below 50 A
Engine cranking speed	More than 600 rpm	—

b. REMOVAL

1) Disconnect the battery negative cable first, then positive cable.



c. DISASSEMBLY



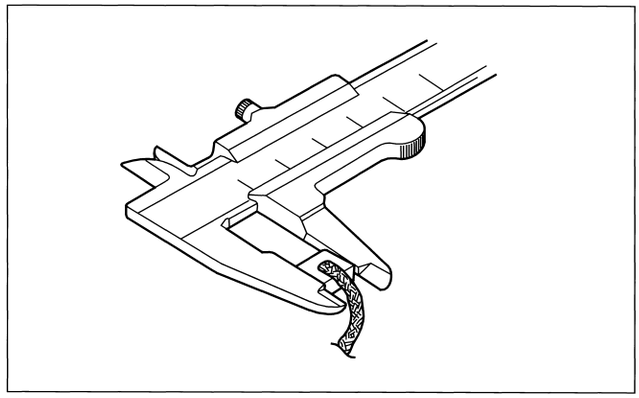
d. INSPECTION

• BRUSH LENGTH

Measure the brush length.

If brush length is less than service limit, replace the brush (P. 14-5).

Standard	Service limit
10.0 mm (0.39 in)	6.0 mm (0.24 in)

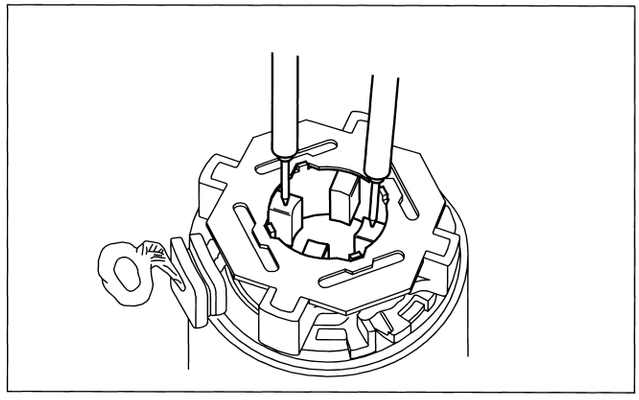


• BRUSH CONTINUITY CHECK

Check for continuity between the pair of negative brushes and pair of positive brushes.

- There should be continuity between both the positive brushes.
- There should be continuity between both the negative brushes.
- There should be no continuity between the positive and negative brushes.

Replace the yoke assembly if necessary.

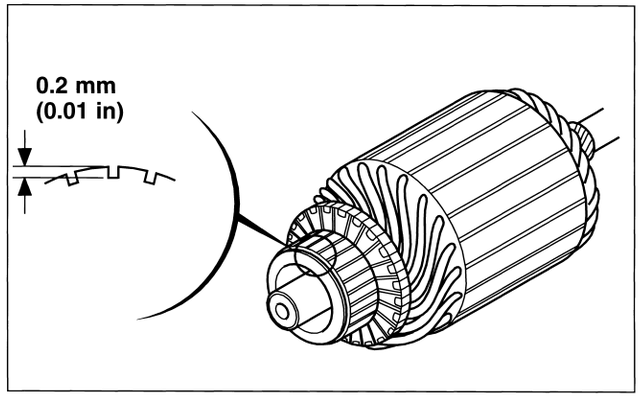


• MICA DEPTH

Measure the mica depth. If the grooves are clogged, clean the grooves and measure the depth again.

If the measurement is less than the service limit, replace the armature.

Service limit	0.2 mm (0.008 in)

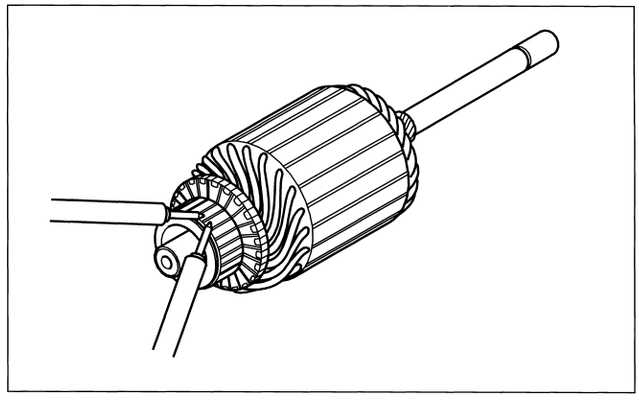


• ARMATURE

<SEGMENT CONTINUITY CHECK>

Check for continuity between each segment.

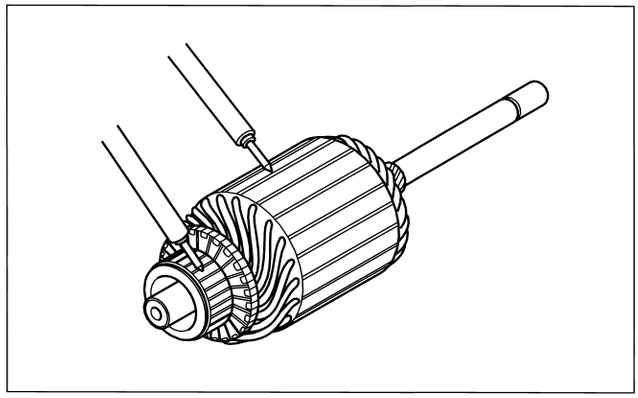
If an open circuit exists between any two segments, replace the armature.



<CORE-TO-COMMUTATOR SHORT CIRCUIT TEST>

Check for continuity between the commutator and armature coil core.

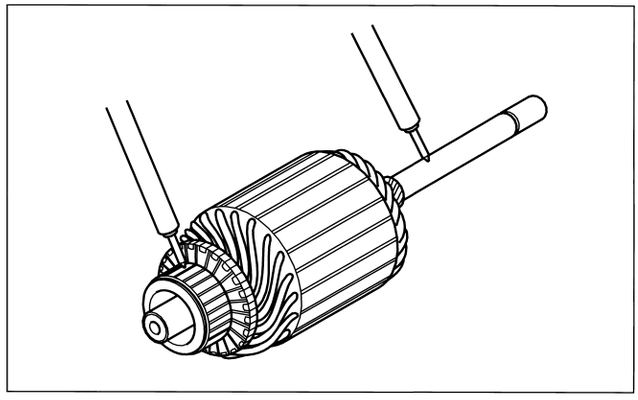
If continuity exists, replace the armature.



<SHAFT-TO-COMMUTATOR SHORT CIRCUIT TEST>

Check for continuity between the commutator and armature shaft.

If there is continuity, replace the armature.



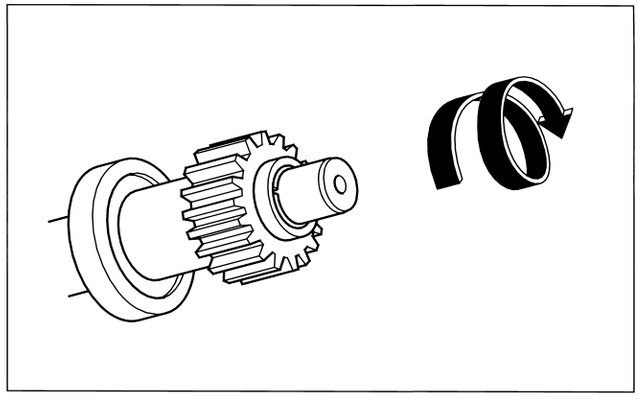
• OVER RUNNING CLUTCH

1) Check the pinion gear set for smooth axial movement.

   Apply SAE #10 gear oil or replace the pinion gear set if necessary.

2) Check the pinion gear for wear or damage and replace if necessary.

   If the pinion gear is worn or damaged, the flywheel ring gear must be inspected.

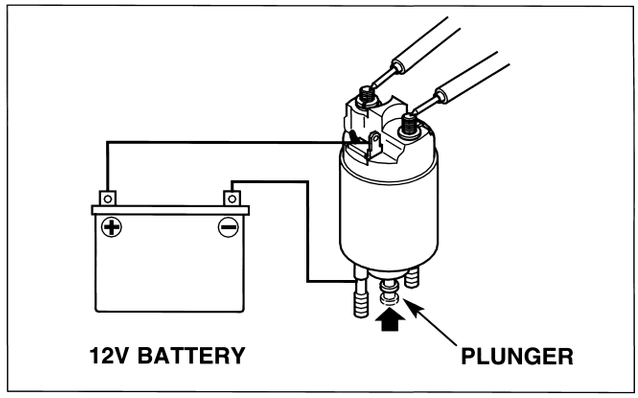


• STARTER MAGNETIC SWITCH/SOLENOID

Connect a known good 12 V battery to the magnetic switch terminal (+) and body ground (-) as shown.

- The plunger should retract and there should be continuity between the terminals.
- There should be no continuity when the battery is disconnected.

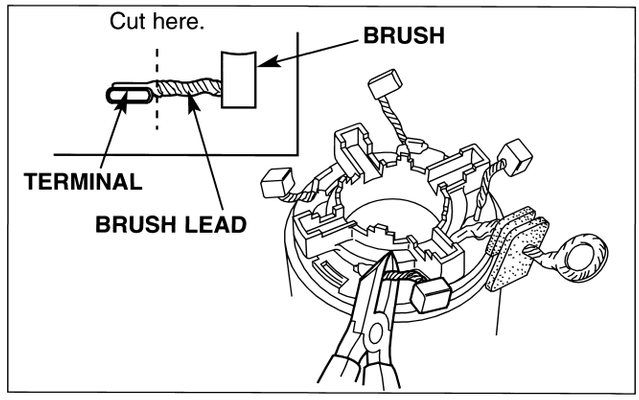
  Be sure the battery is in good condition before performing this test.



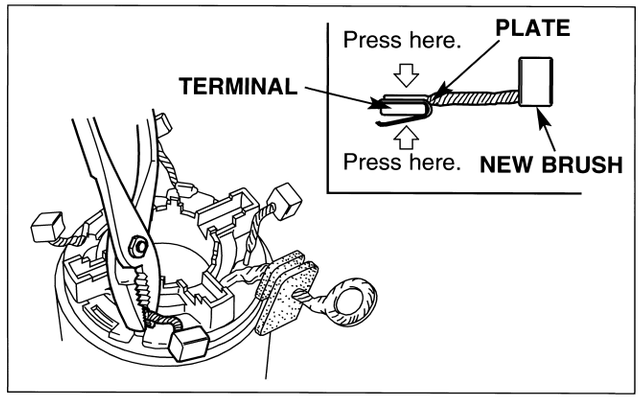
e. BRUSH REPLACEMENT

1) Cut off the brush lead at the point shown and remove the brush.

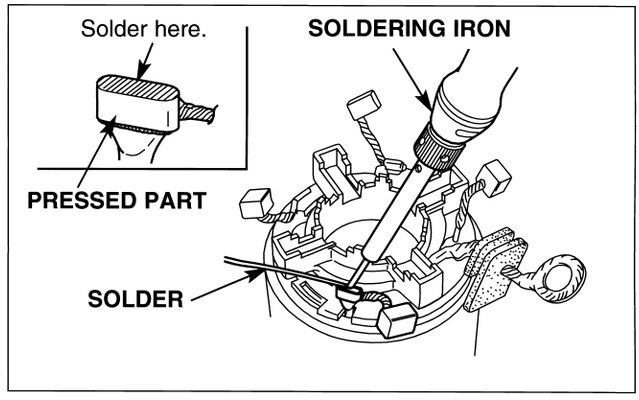
2) Remove the remaining brush lead and deposited solder from the terminal.



3) Hold a new brush in the same direction of the removed brush and put a plate of the new brush on the terminal and press it using a pair of pliers as shown.



4) Solder the place on the terminal.
   - Before soldering, heat the pressed part of the plate well to make solder reach the end of the pressed part.
   - Do not allow solder to flow down onto the brush lead.
   - Do not allow solder to run down onto the field winding of the yoke.

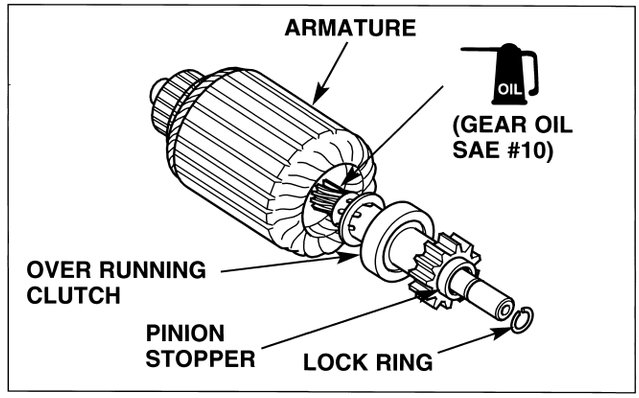


f. REASSEMBLY

1) Apply gear oil to the over running clutch sliding surface of the armature shaft.

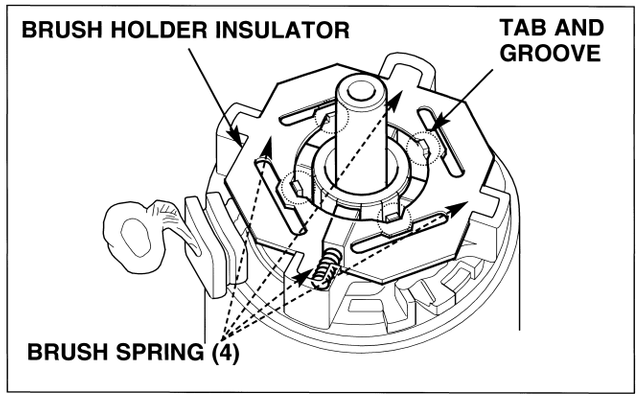
2) Assemble the over running clutch and lock ring onto the armature shaft.

3) Install the lock ring.

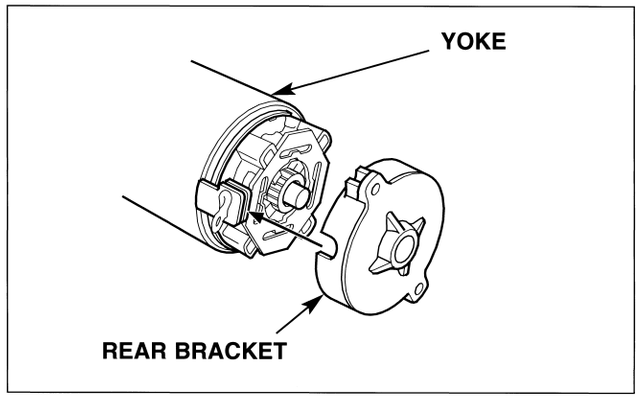


4) Install the armature in the yoke.

5) Install the brushes and brush springs, and install the brush insulator by aligning the tabs with the grooves of the yoke as shown.



6) Align the cutout of the rear bracket with the brush terminal grommet and install the rear bracket.



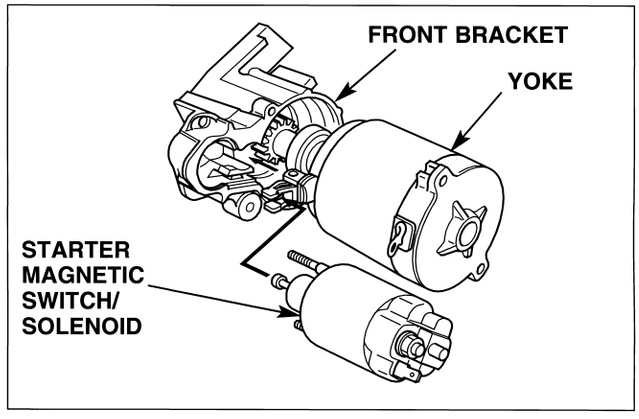
7) Install the pinion drive lever to the pinion gear, then install the yoke assembly to the front housing.

8) Install the through bolts and tighten them to the specified torque.

TORQUE: 7 N·m (0.7 kgf·m, 5.1 lbf·ft)

9) Set the starter magnetic switch/solenoid by aligning the solenoid pin with the pinion drive lever, then tighten the two 6 mm flange nuts securely.

10) Connect the brush terminal to the starter magnetic switch terminal and tighten the terminal nut securely, then install the terminal cover.

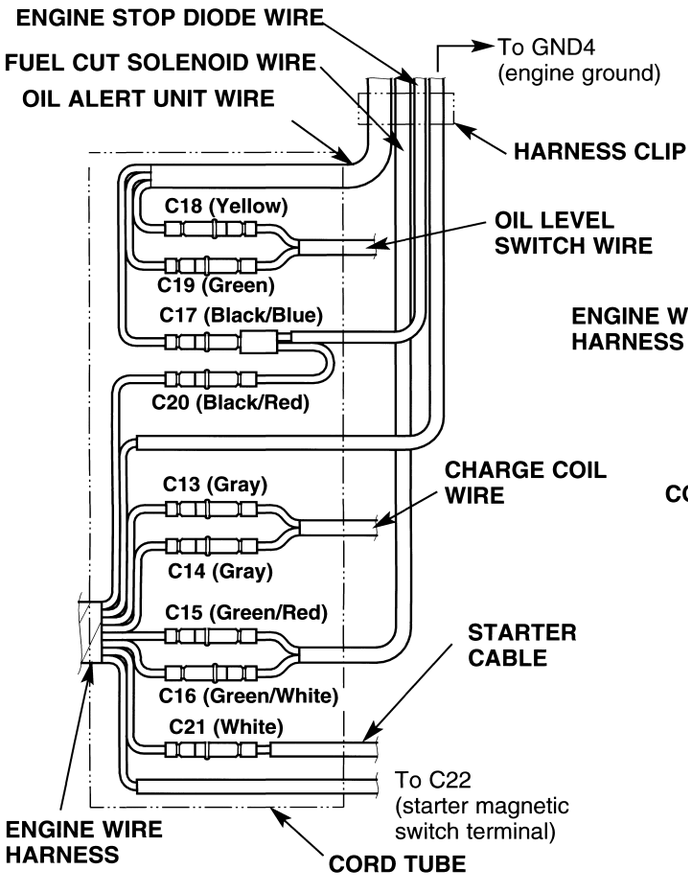


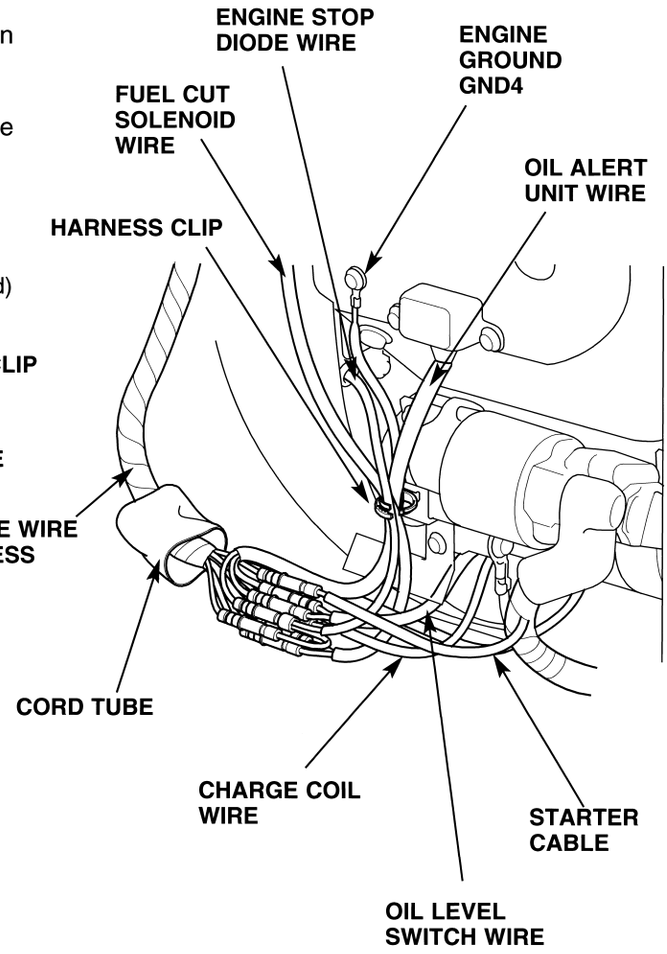
g. INSTALLATION

1) Install the starter motor in the reverse order of removal.

2) Install the cord tube over the engine wire harness, then connect the connectors as shown.

3) Secure the engine ground wire, oil alert wire and the engine stop diode wire with the harness clip.

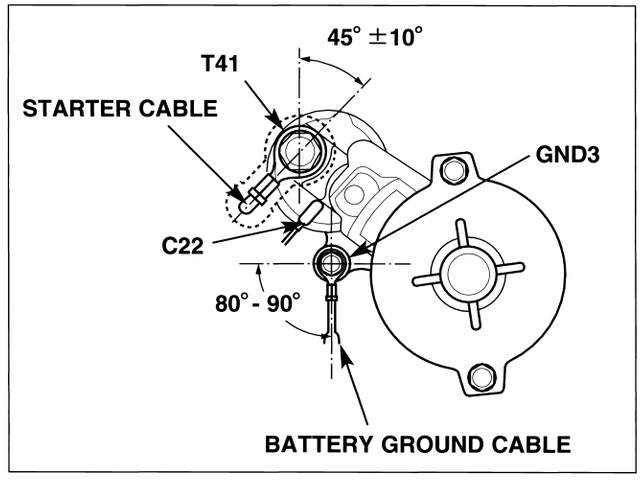




4) Install the starter cable and battery ground cable as shown.

5) Tighten the starter cable terminal nut to the specified torque.

TORQUE: 9 N·m (0.9 kgf·m, 6.6 lbf·ft)



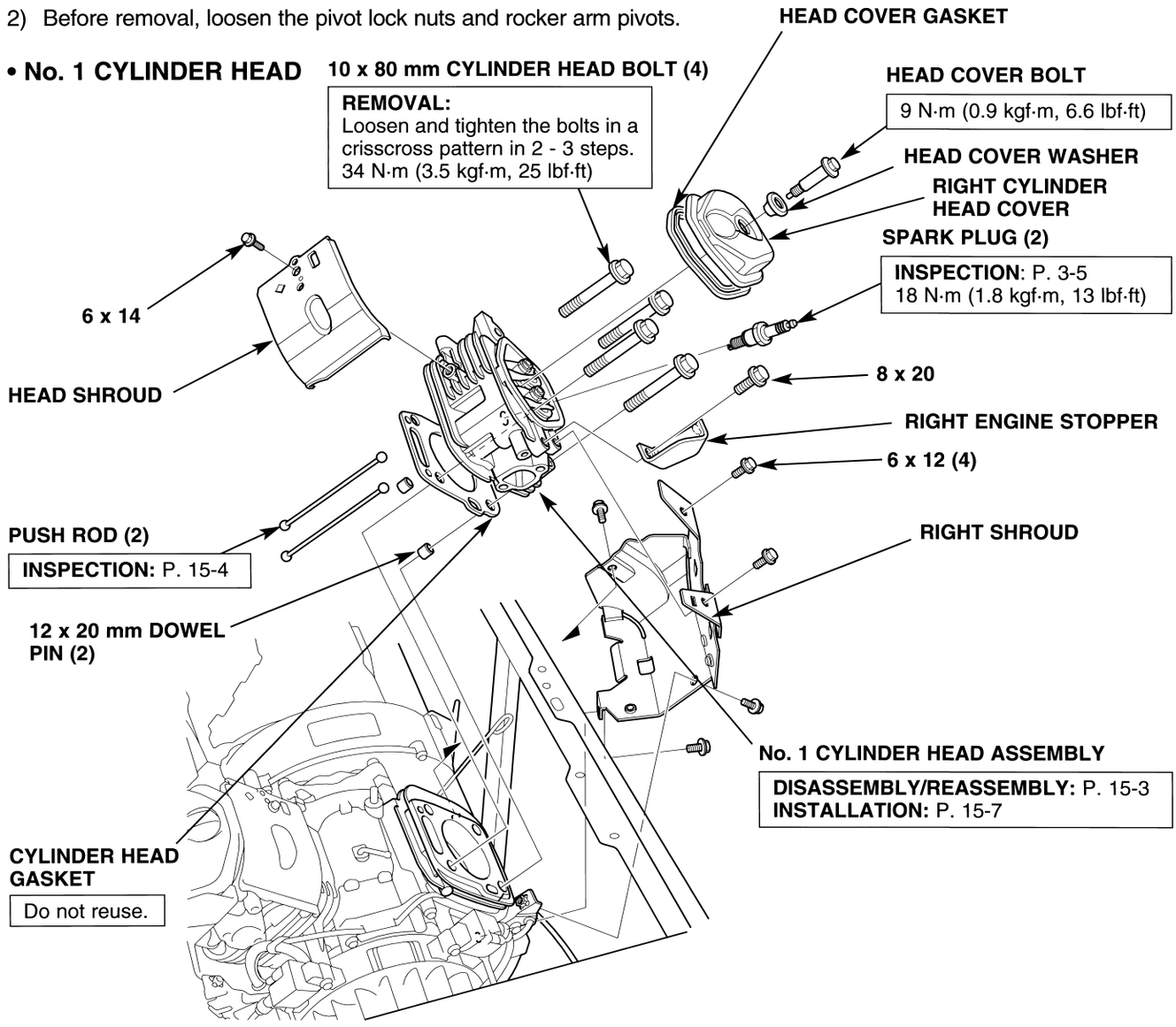
1. CYLINDER HEADS

• The cylinder head servicing can be done with the engine installed in the frame.

a. REMOVAL

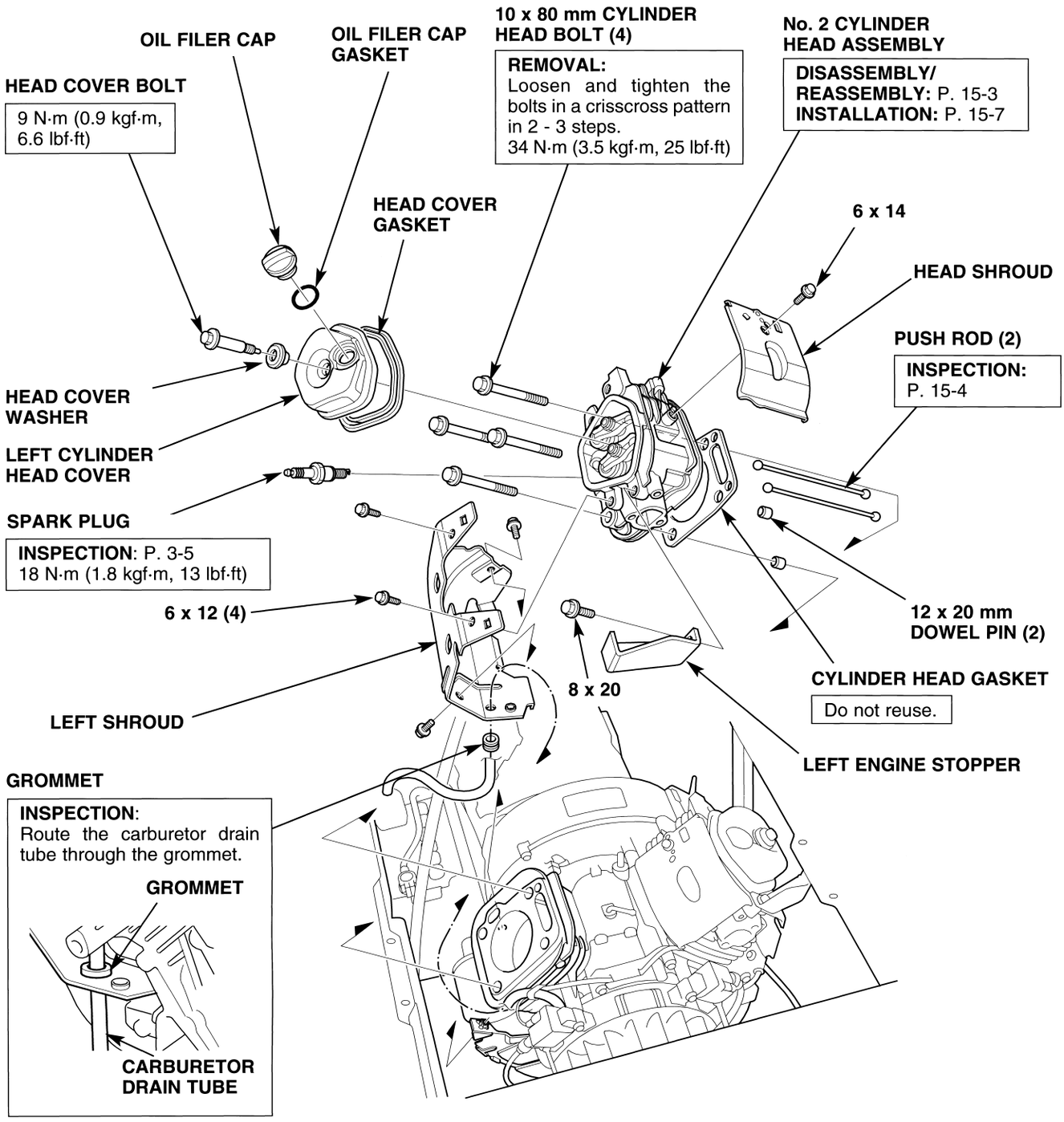
1) Remove the following:
   - maintenance cover and center beam (P. 5-1).
   - fuel tank (P. 6-1).
   - air cleaner (P. 7-1) and muffler (P. 7-2 and 7-4).
   - control box (P. 8-1).
   - fan cover (P. 11-1).
   - control base/governor arm (P. 12-1).
   - fuel pump (P. 13-1), intake manifold and carburetor (P. 13-2).

2) Before removal, loosen the pivot lock nuts and rocker arm pivots.



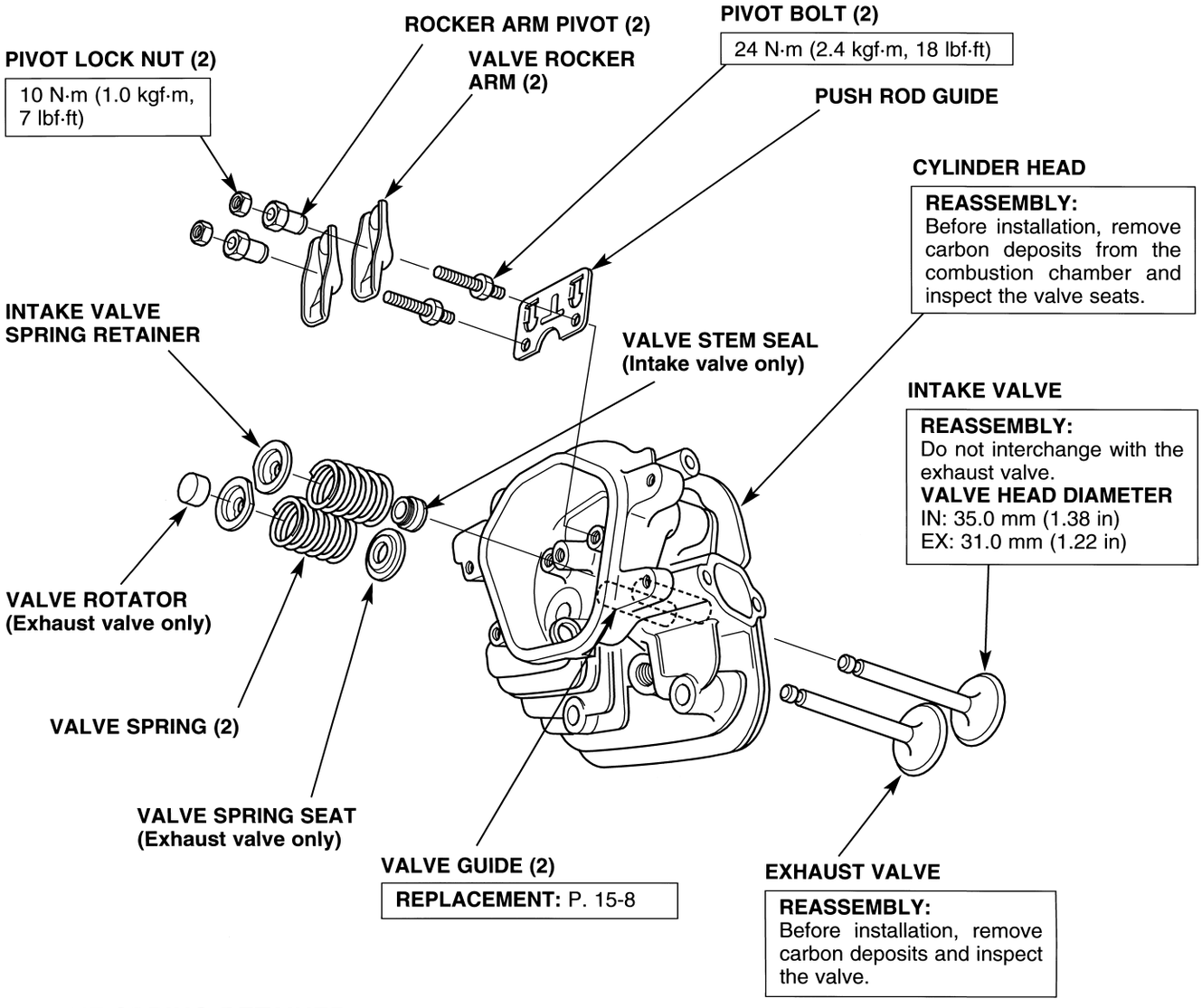
• No. 2 CYLINDER HEAD

• The oil filer cap is only on the left head cover.



b. DISASSEMBLY/REASSEMBLY

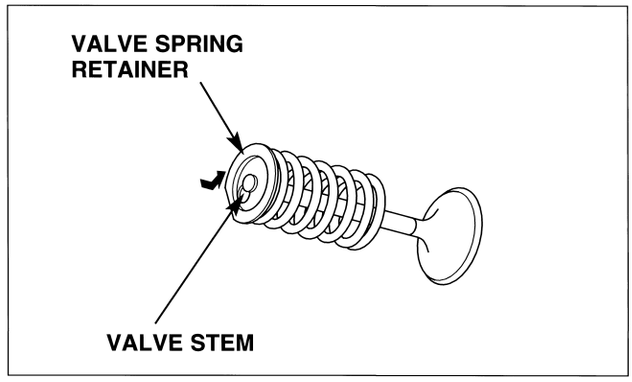
- Refer to page 15-8 for the valve guide replacement.
- When reassembly, coat the engine oil to the following:
  - valve rocker arms.
  - valve springs.
  - intake and exhaust valves.
  - valve stem seal.



• VALVE SPRING RETAINER

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

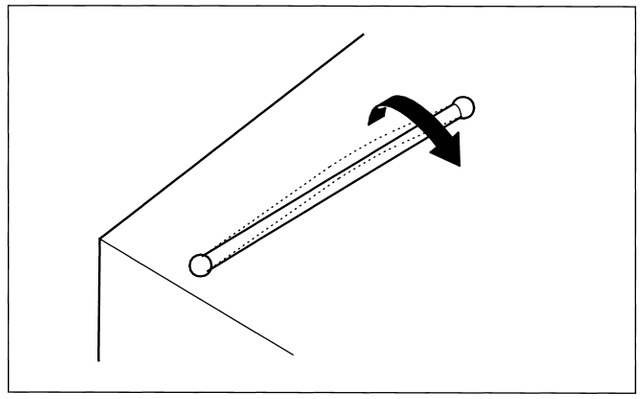
- Do not remove the valve spring retainer while the cylinder head is installed, or the valves will drop into the cylinder.



c. INSPECTION

• PUSH ROD

Check both ends for wear and check the push rod for straightness.

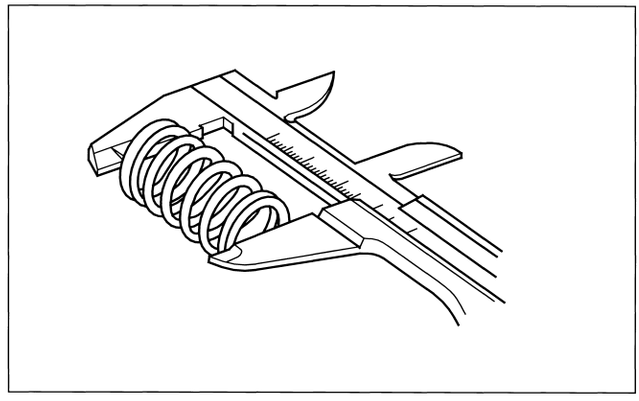


• VALVE SPRING FREE LENGTH

Measure the free length of the valve springs.

	Standard	Service limit
IN/EX	39.0 mm (1.54 in)	37.5 mm (1.48 in)

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



• VALVES

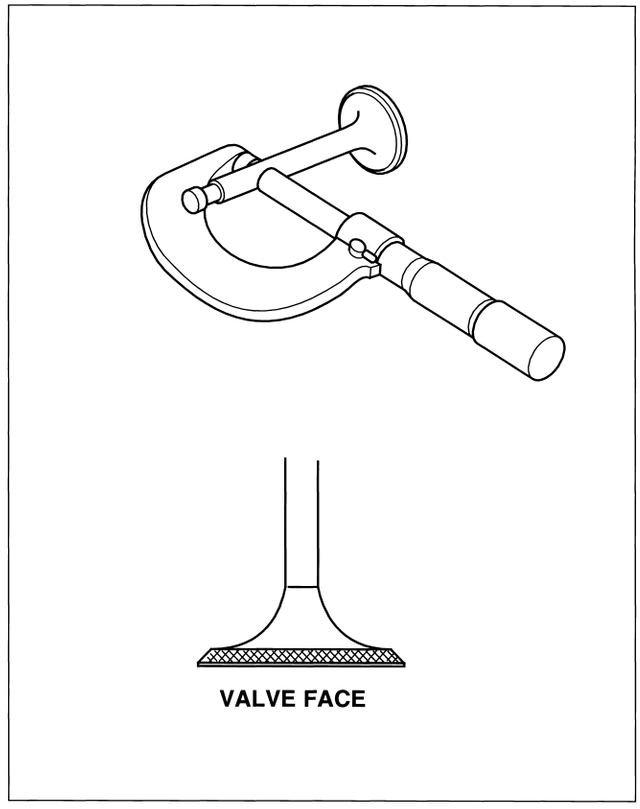
Inspect each valve face for pitting or wear irregularities.
Inspect each valve stem for bending or abnormal stem wear.

Replace the valve if necessary.

Measure and record each valve stem O.D.

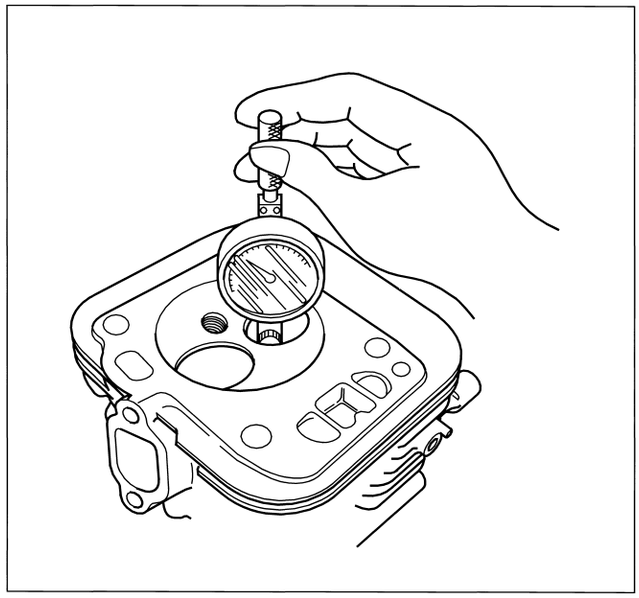
	Standard	Service limit
IN	6.575 - 6.590 mm (0.2589 - 0.2594 in)	6.44 mm (0.254 in)
EX	6.535 - 6.550 mm (0.2573 - 0.2579 in)	6.40 mm (0.252 in)

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



• VALVE GUIDES

• Ream the valve guides to remove any carbon deposits before measuring.



Measure and record each valve guide I.D.

	Standard	Service limit
IN/ EX	6.600 - 6.615 mm (0.2598 - 0.2604 in)	6.66 mm (0.262 in)

Replace the valve guides (P. 15-8) if they are over the service limit.

Subtract each valve stem O.D. from the corresponding guide clearance.

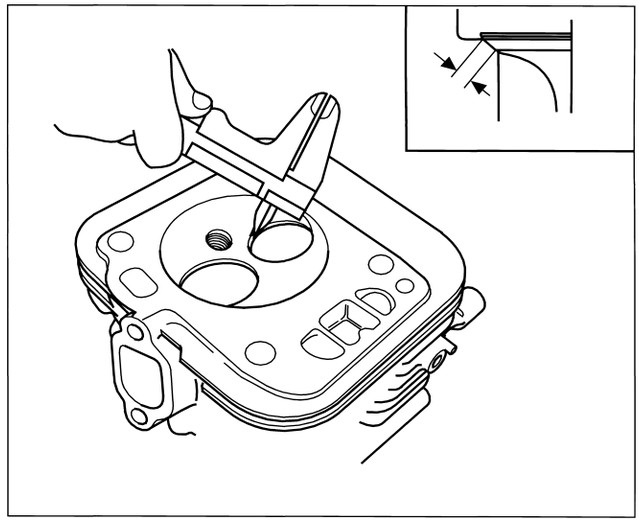
	Standard	Service limit
IN	0.010 - 0.040 mm (0.0004 - 0.0016 in)	0.10 mm (0.004 in)
EX	0.050 - 0.080 mm (0.0020 - 0.0031 in)	0.12 mm (0.005 in)

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.

Recondition the valve seats whenever the valve guides are replaced (P. 15-9).

• VALVE SEAT WIDTH

Measure the valve seat width.



	Standard	Service limit
IN/EX	1.1 mm (0.04 in)	2.0 mm (0.08 in)

If the valve seat width is over the service limit, recondition the valve seat (P. 15-9).

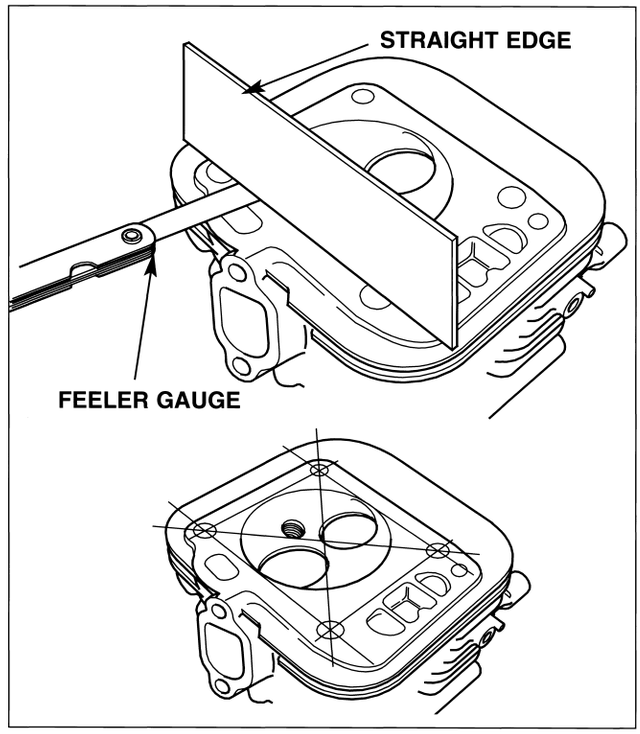
• CYLINDER HEAD WARPAGE

Remove carbon deposits from the combustion chamber. Clean off any gasket material from the cylinder head surface.

Check the spark plug holes 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)



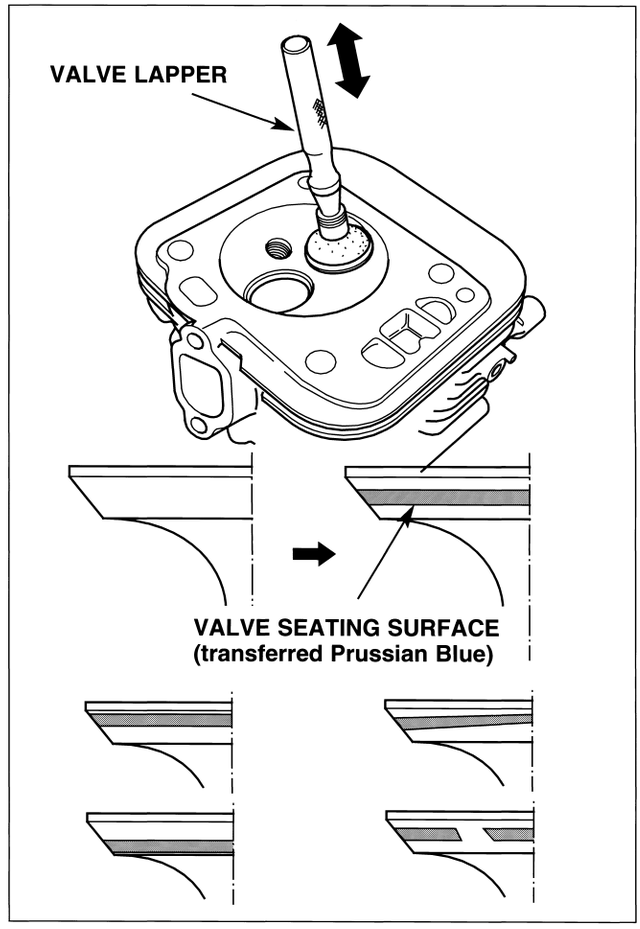
• VALVE SEATING SURFACE

1) Thoroughly clean the combustion chamber and valve seats to remove carbon deposits. Apply a light coat of Prussian Blue compound or erasable felt-tipped marker ink to the valve seat.

2) Insert the valves into the valve guide, and then lift them and snap them closed against their seats several times.
   • Be sure the valve dose not rotate on the seat.

3) Check the valve seats for the pattern of the transferred Prussian Blue compound.
   They must show concentric even pattern in the center of the valve seats.

   Recondition the valve seat (P. 15-9) if it shows either of the following patterns.
   • Contact too high
   • Contact too low
   • Uneven contact
   • Rough contact on the seat



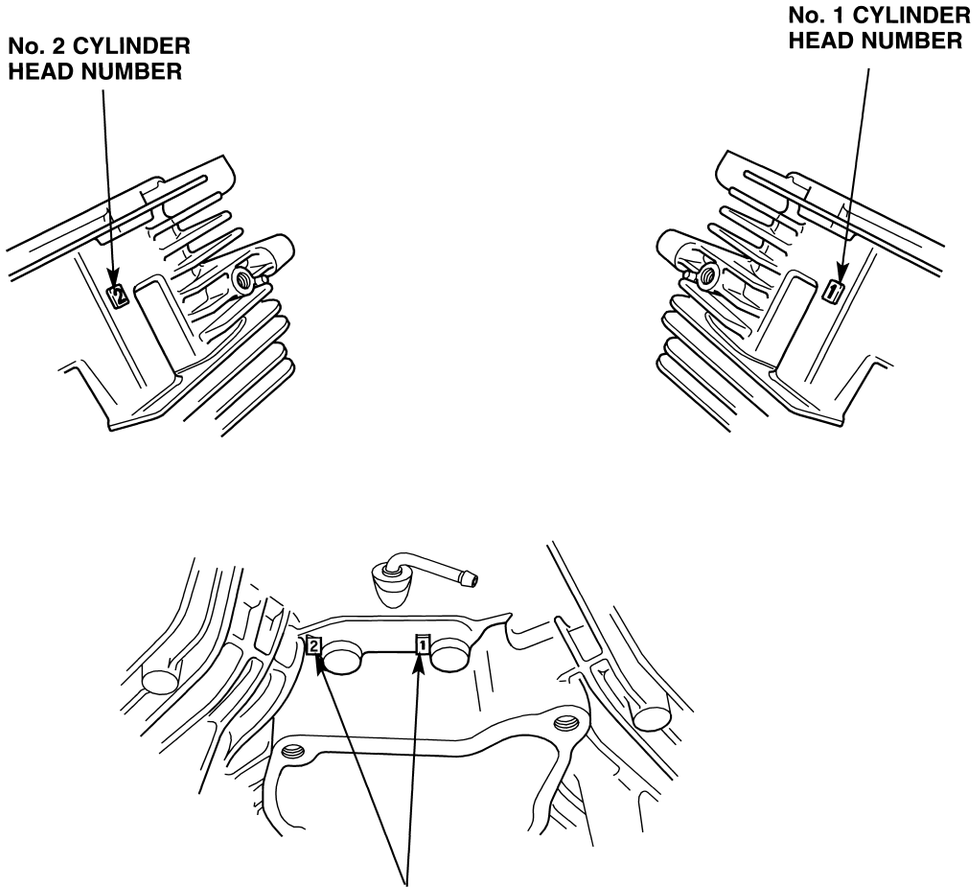
d. INSTALLATION

The cylinder head installation is the revers order of removal. Note the following:

- Cylinder head numbers and cylinder numbers are embossed on the cylinder heads as shown. Check the numbers on the cylinder head and cylinder block. Install the cylinder head on the cylinder block with the corresponding number.
- Before installation, remove any carbon deposits from combustion chamber and inspect the valve seats.
- Install the cylinder head on the cylinder block with the head inlet side facing the flywheel side.
- Loosen the rocker arms completely, then install the cylinder head using new cylinder head gaskets.
- Make sure that the push rod ends are firmly seated in the valve lifter and rocker arm.
- Apply oil to the cylinder head bolts and tighten them in a crisscross pattern in 2 or 3 steps to the specified torque.

  TORQUE: 34 N·m (3.5 kgf·m, 25 lbf·ft)

- Check the cylinder compression after reassembly (P. 2-12).



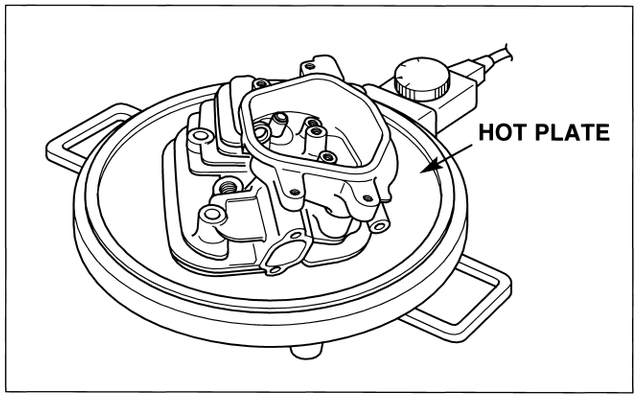
2. VALVE GUIDE REPLACEMENT

1) Chill the replacement valve guides in the freezer section of a refrigerator for about an hour.

2) Use a hot plate or oven to heat the cylinder head evenly to 150°C (300°F).
Check the temperature with a temperature indicating stick (available at welding supply stores) or equivalent.

NOTICE

- *Do not use a torch to heat the cylinder head: warpage of the cylinder head may result.*
- *Do not get the head hotter than 150°C (300°F); excessive heat may loosen the valve seats.*

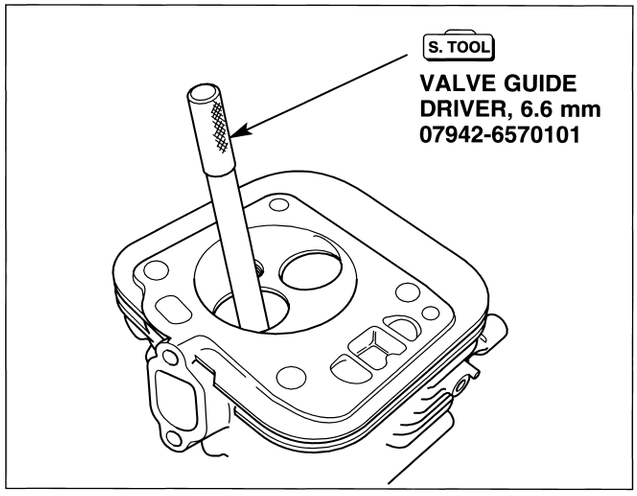


3) Put on heavy gloves and remove the heated cylinder head from the hot plate and support it with wooden blocks. Drive the valve guides out of the head from the combustion chamber side.

NOTICE

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

TOOL:
Valve guide driver, 6.6 mm 07942-6570101

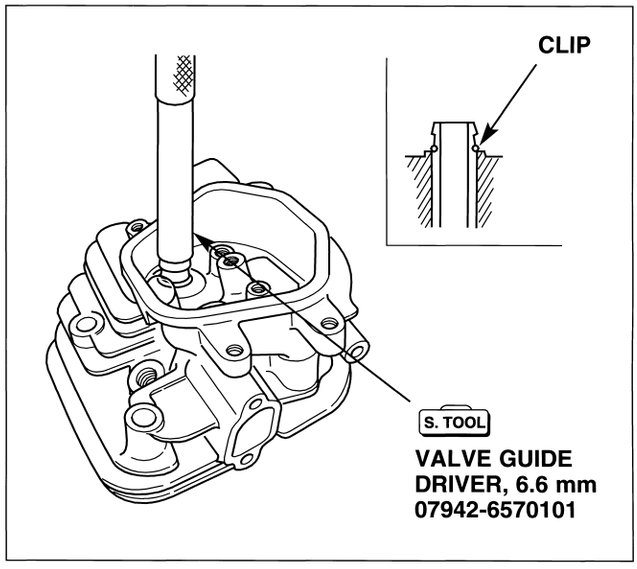


4) Remove the new valve guides from the refrigerator one at a time as needed.

5) Install the new valve guides from the valve spring side of the cylinder head.

6) Drive the valve guides until the clips are fully seated as shown.

TOOL:
Valve guide driver, 6.6 mm 07942-6570101



7) After installation, inspect the valve guide for damage. Replace the guide if damaged.

8) After driving the valve guide, ream the new valve guide and then recondition the valve seat (P. 15-9).

• VALVE GUIDE REAMING

• 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.

   TOOL:
   Valve guide reamer, 6.6 mm **07984-ZE2000C or 07984-ZE2000D**

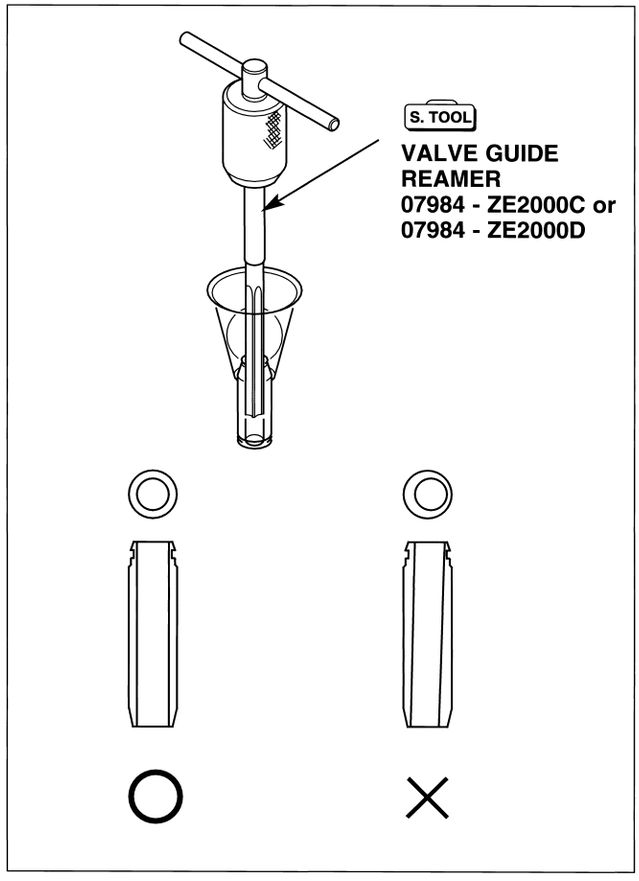
2) Rotate the reamer the full length of the reamer clockwise through the valve guide.

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 dose 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. 15-5).



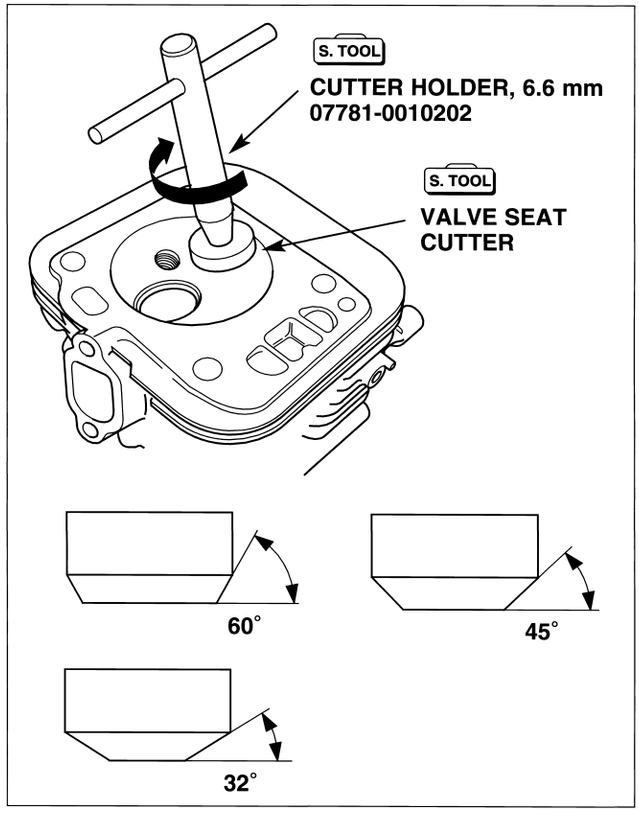
3. VALVE SEAT RECONDITIONING

Recondition the valve seat. Follow the valve seat cutter manufacturer's instructions.

• Turn the cutter clockwise, never counterclockwise. Continue to turn the cutter as you lift it from the valve seat.

TOOLS:

Cutter holder, 6.6 mm	**07781-0010202**
Seat cutters:	
For Intake	
Valve seat cutter, 45° ϕ33	**07780-0010800**
Valve seat cutter, 32° ϕ35	**07780-0012300**
Valve seat cutter, 60° ϕ30	**07780-0014000**
For Exhaust	
Valve seat cutter, 45° ϕ29	**07780-0010300**
Valve seat cutter, 32° ϕ30	**07780-0012200**
Valve seat cutter, 60° ϕ30	**07780-0014000**

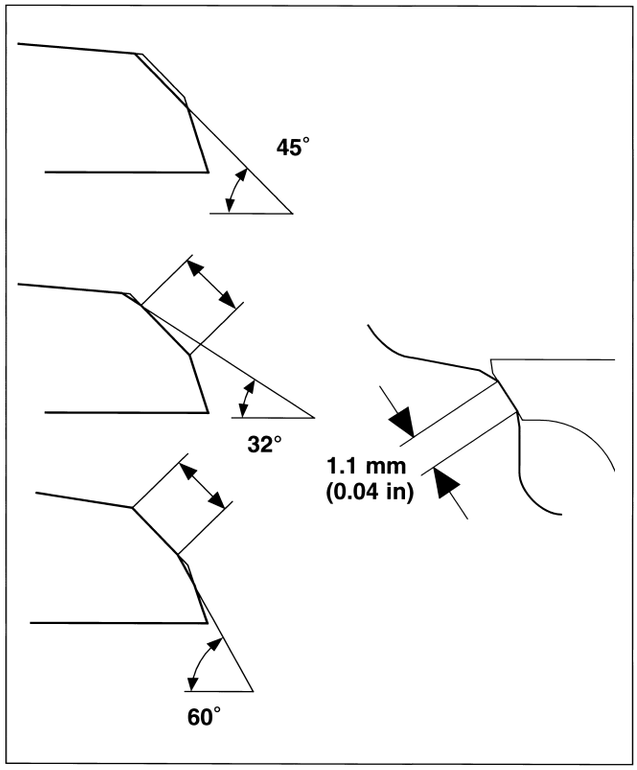


1) Using a 45° cutter, remove enough material to produce a smooth and concentric seat.

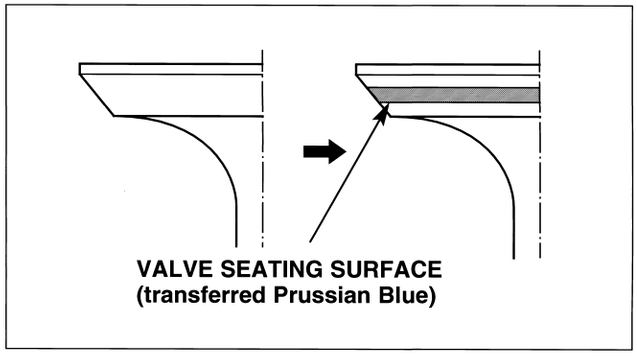
2) Use the 32° and 60° cutter to narrow and adjust the valve seat so that it contacts the middle of the valve face.
   • The 32° cutter removes material from the top edge.
   • The 60° cutter removes material from the bottom edge.

3) Be sure that the width of the finished valve seat is within specification.

4) Make a light pass with 45° cutter to remove any possible burrs at the edges of the seat.



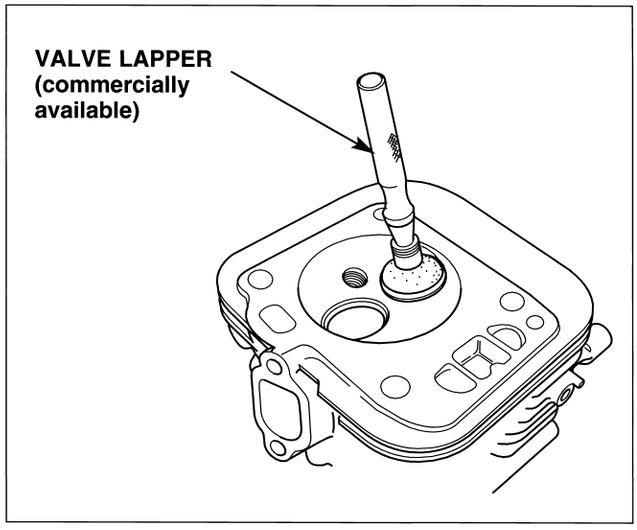
5) After reconditioning the seats, inspect for even valve seating:
   Apply Prussian Blue compound or erasable felt tipped marker ink to the valve faces. Insert the valves, and then lift them and snap them closed against their seats several times. Be sure the valve dose not rotate on the seat. The seating surface, as shown by the transferred marking compound, should have good contact all the way around.



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

   NOTICE
   To avoid severe engine damage, be sure to remove all lapping compound from the cylinder head before assembly.

7) Check valve clearance after assembly.

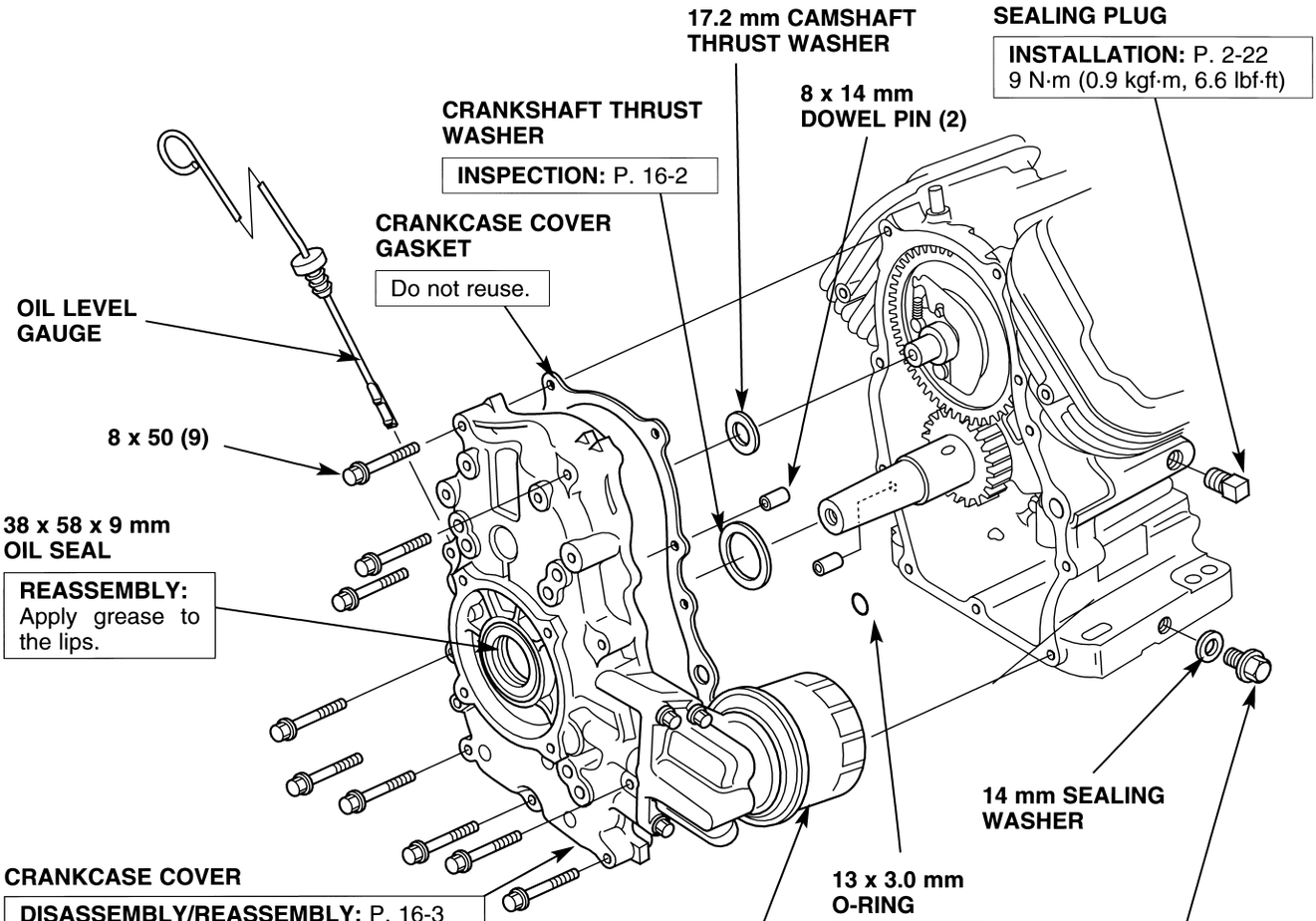


1. CRANKCASE COVER

a. REMOVAL/INSTALLATION

• Before removing the crankcase cover, check the crankshaft axial clearance (P. 16-2).

1) Remove the engine from the frame (see section 10) and then remove the following:
   – fan cover, flywheel, ignition coils (P. 11-1 and 2).
   – air cleaner (P. 7-1).
   – fuel pump (P. 13-1), carburetor (P. 13-2).
   – starter motor (P. 14-1).

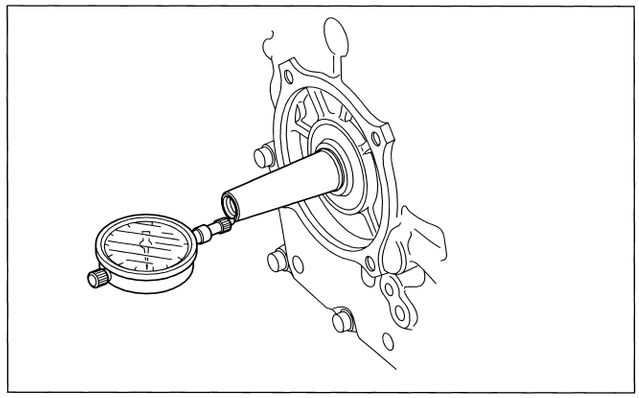


b. INSPECTION

• CRANKSHAFT AXIAL CLEARANCE

Standard	Service limit
0.05 – 0.65 mm (0.002 – 0.026 in)	1.0 mm (0.04 in)

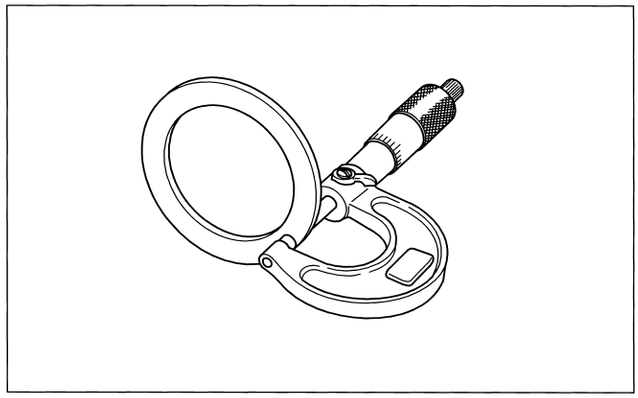
If the crankshaft axial clearance is over the service limit, check the crankshaft thrust washer.



• CRANKSHAFT THRUST WASHER THICKNESS

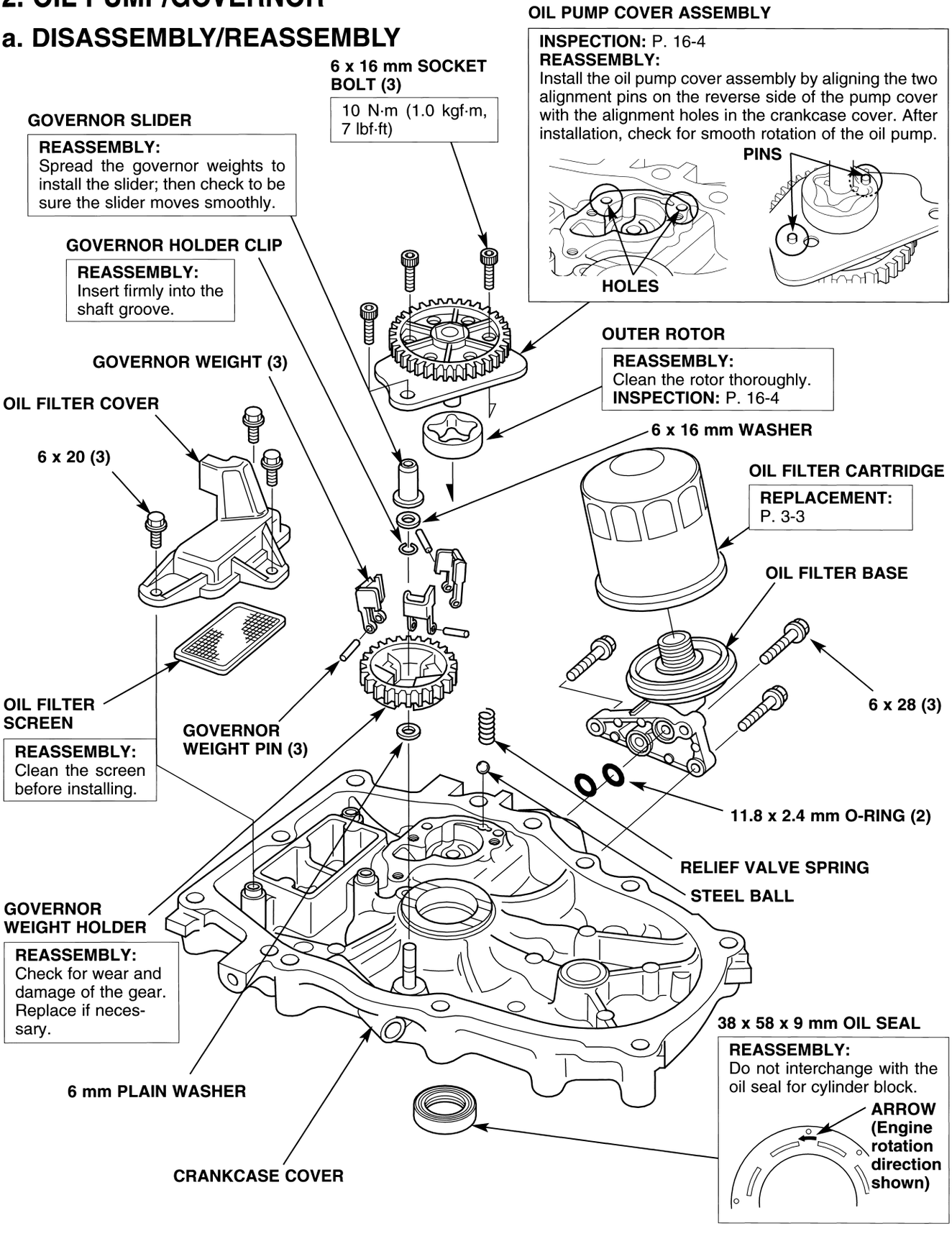
Standard	Service limit
1.0 mm (0.04 in)	0.8 mm (0.03 in)

If the crankshaft thrust washer thickness is under the service limit, replace the thrust washer and recheck the crankshaft axial clearance.
If the axial clearance is over the service limit, replace the crankcase cover with new one.



2. OIL PUMP/GOVERNOR

a. DISASSEMBLY/REASSEMBLY

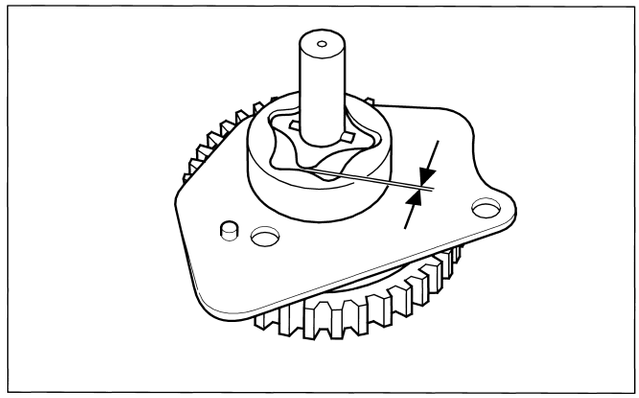


b. INSPECTION

• OIL PUMP

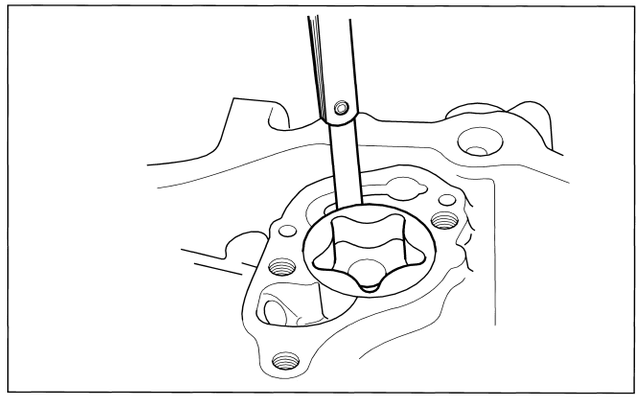
ROTOR TIP CLEARANCE

Standard	Service limit
0.14 mm (0.006 in)	0.30 mm (0.012 in)



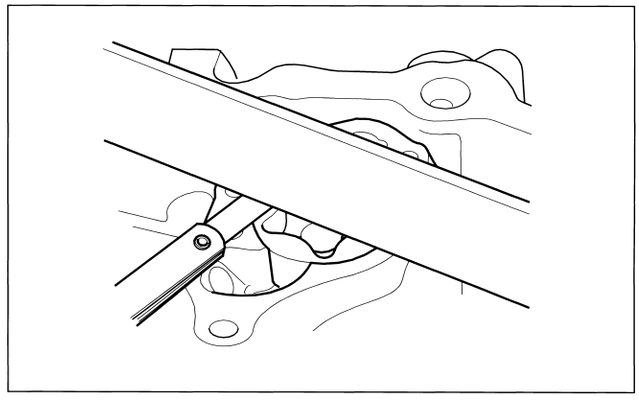
OUTER ROTOR-TO-BODY CLEARANCE

Standard	Service limit
0.15 – 0.21 mm (0.006 – 0.008 in)	0.30 mm (0.012 in)



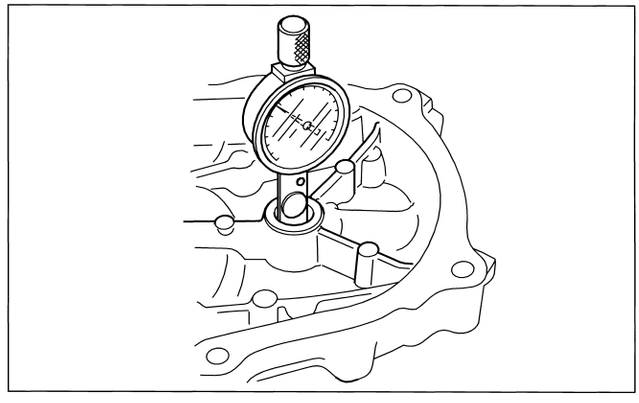
ROTOR-TO-COVER CLEARANCE

Standard	Service limit
0.04 – 0.11 mm (0.002 – 0.004 in)	0.13 mm (0.005 in)



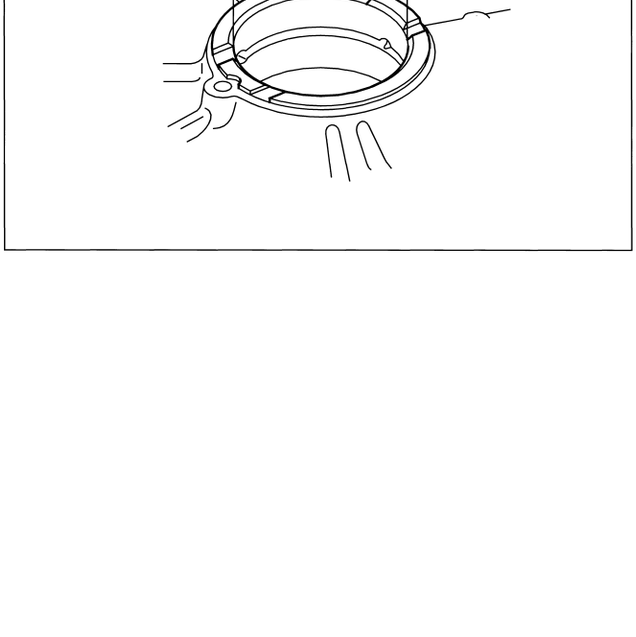
• CAMSHAFT HOLDER I.D.

Standard	Service limit
17.016 -17.027 mm (0.6699 - 0.6704 in)	17.06 mm (0.672 in)



• CRANKCASE COVER MAIN JOURNAL I.D.

Standard	Service limit
38.025 - 38.041 mm (1.4970 - 1.4977 in)	38.06 mm (1.498 in)



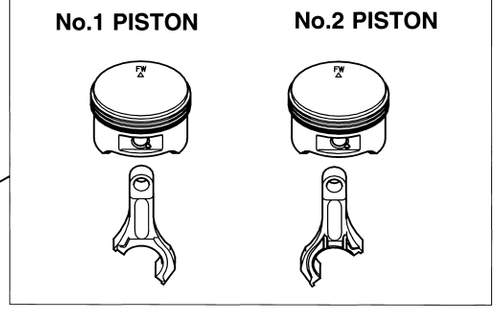
3. CRANKSHAFT/CAMSHAFT/CYLINDER BLOCK

a. DISASSEMBLY/REASSEMBLY

- When assembling, apply molybdenum disulfied oil or spray ThreeBond® 1910 to the connecting rod big end bore. Apply oil to the crankshaft crank pin only. Do not apply oil to the connecting rod.

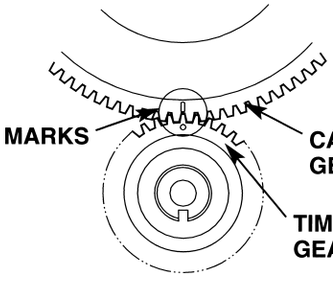
No.1 PISTON

DISASSEMBLY/REASSEMBLY: P. 16-12
INSTALLATION: P. 16-7



CAMSHAFT

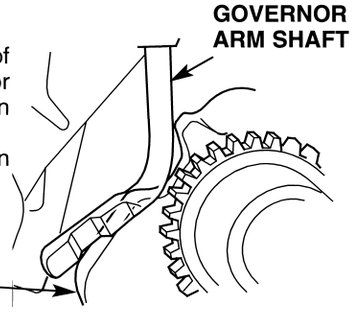
INSPECTION: P. 16-10
INSTALLATION:
Install the camshaft by aligning the punch mark on the timing gear with the rib on the cam gear.



INSTALLATION: P. 16-7
Do not interchange with the other connecting rod cap.

12 N·m (1.2 kgf·m, 9 lbf·ft)

INSPECTION: P. 16-9
REMOVAL/INSTALLATION:
- Turn the crankshaft until the hollow of crank weight aligns with the governor arm shaft curve point as shown, then remove or install the crankshaft.
- Be careful not to damage the oil seal on the cylinder block.



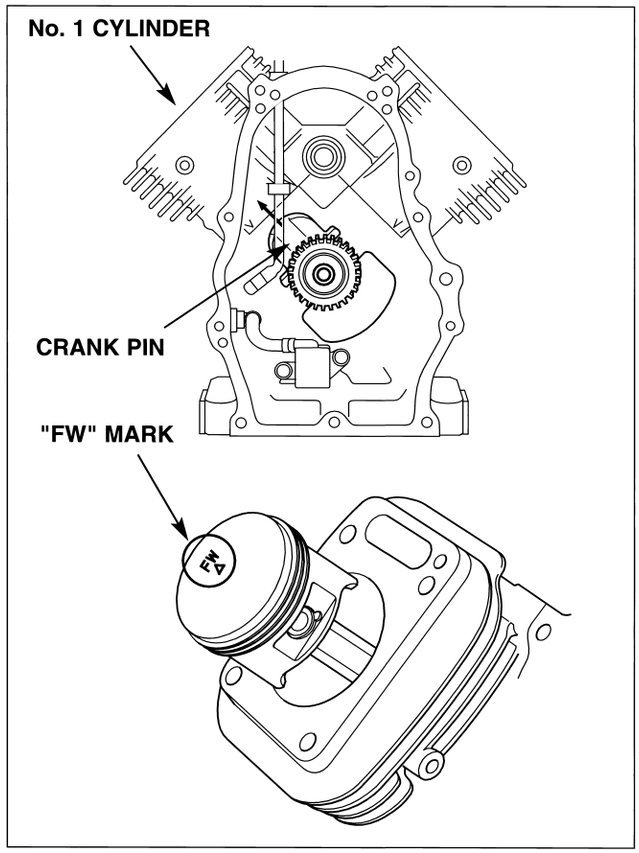
• PISTON/CONNECTING ROD INSTALLATION

1) Install the crankshaft in the cylinder block.

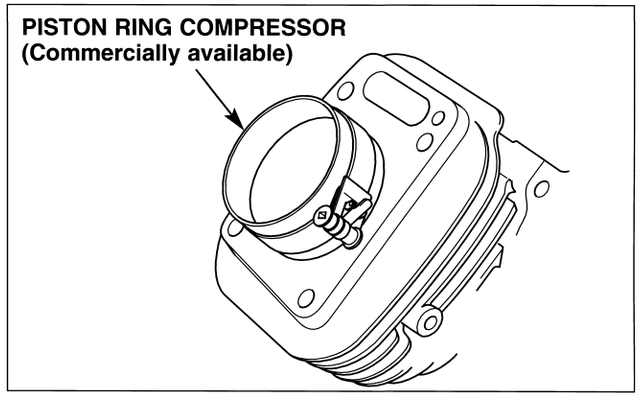
2) Set the crank pin in the position that brings the No.1 cylinder piston to its top dead center.

3) Apply molybdenum disulfied oil or Three Bond 1910 to the connecting rod big end I.D.

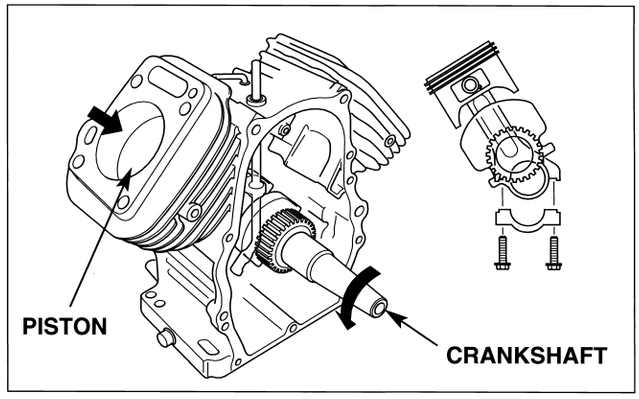
4) Set the piston assembly in the No.1 cylinder so that the groove in the connecting rod and the “FW” mark on the top of the piston are toward the flywheel.



5) Install the piston assembly using a commercially available piston ring compressor.



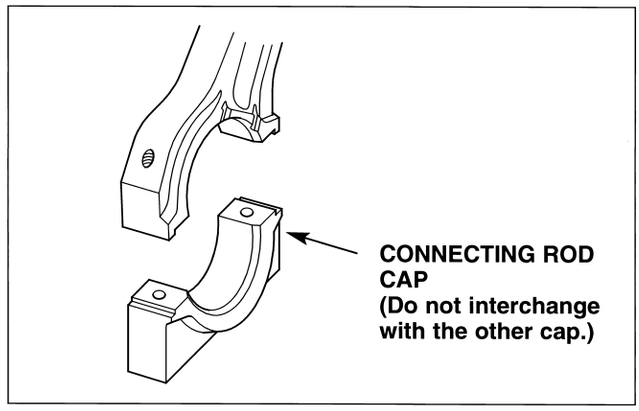
6) Set the connecting rod big end on the crank pin. Pushing the top of piston, turn the crankshaft counterclockwise until the crank pin comes to the position shown.



7) Install the connecting rod cap aligning the mating surface of the connecting rod and the cap.
   Connecting rod caps are not interchangeable because the connecting rod and the connecting rod cap are processed as a matched pair.

8) Tighten the connecting rod bolts to the specified torque.

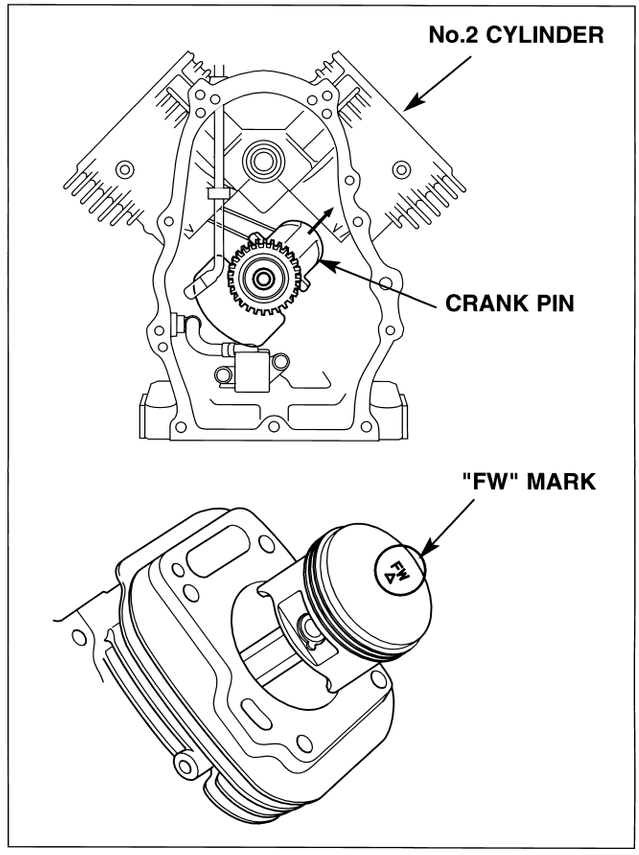
   TORQUE: 12 N·m (1.2 kgf·m, 9 lbf·ft)



9) Turn the crankshaft counterclockwise again until the crank pin comes to the top dead center of the No.2 cylinder.

10) Set the piston assembly in the No. 2 cylinder so that the groove in the connecting rod is toward P.T.O. shaft (the "FW" mark on the top of the piston is toward the flywheel).

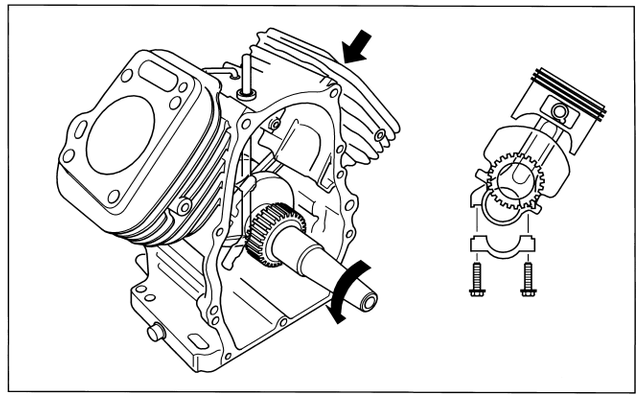
11) Install the piston assembly using a commercially available piston ring compressor.



12) Set the connecting rod big end on the crank pin.
   Pushing the top of the piston, turn the crankshaft counterclockwise until the crank pin is in the position shown.

13) Tighten the connecting rod bolts to the specified torque.

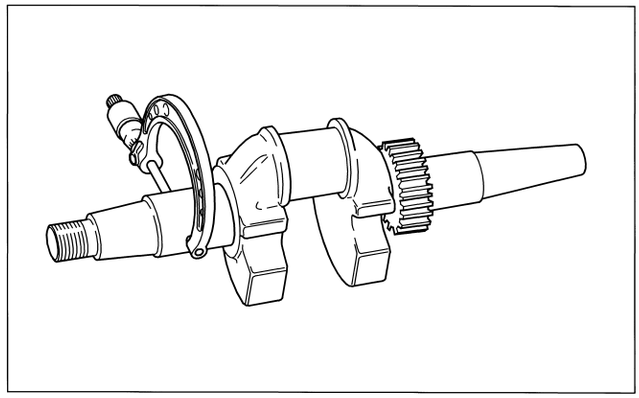
   TORQUE: 12 N·m (1.2 kgf·m, 9 lbf·ft)



b. INSPECTION

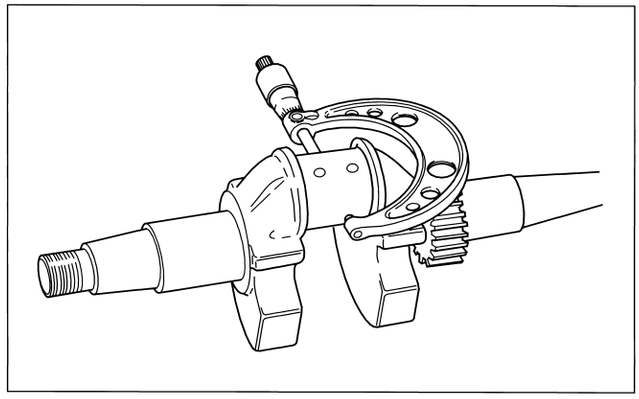
• CRANKSHAFT MAIN JOURNAL O.D.

Standard	Service limit
37.984 - 38.000 mm (1.4954 - 1.4961 in)	37.93 mm (1.493 in)



• CRANK PIN O.D.

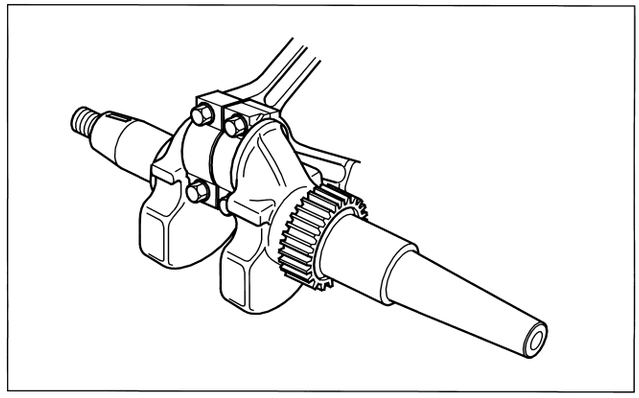
Standard	Service limit
39.985 - 39.995 mm (1.5742 - 1.5746 in)	39.92 mm (1.572 in)



• CONNECTING ROD BIG END OIL CLEARANCE

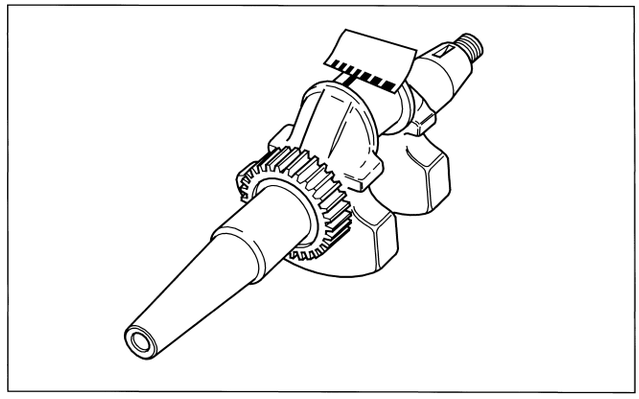
1) Clean oil from the crank pin and connecting rod bearing surfaces.
2) Place a piece of plastigauge on the crank pin, install the connecting rod and cap and tighten the bolts.
   • Do not rotate the crankshaft while the plastigauge is in place.

   TORQUE: 12 N·m (1.2 kgf·m, 9 lbf·ft)



3) Remove the connecting rod and measure the plastigauge at its widest portion.

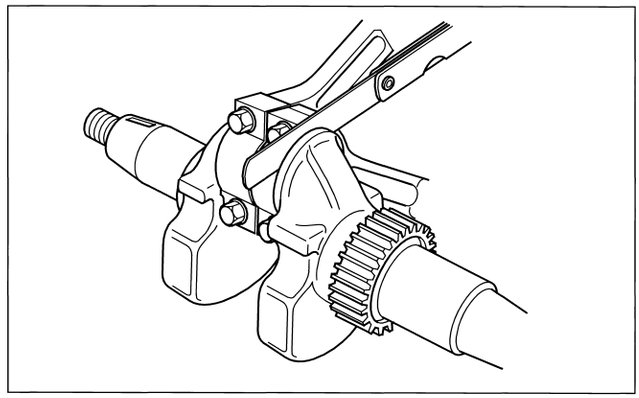
Standard	Service limit
0.030 - 0.056 mm (0.0012 - 0.0022 in)	0.12 mm (0.005 in)



• CONNECTING ROD BIG END SIDE CLEARANCE

Measure the clearances with a feeler gauge.

Standard	Service limit
0.20 - 1.10 mm (0.008 - 0.043 in)	1.3 mm (0.05 in)

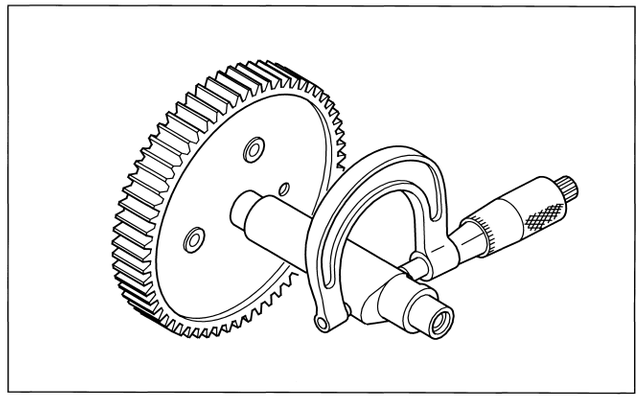


• CAM HEIGHT

Measure the cam lobe height.

Standard		Service limit
IN/EX	29.865 mm (1.1758 in)	29.5 mm (1.16 in)

Replace the camshaft if the cam lobe height is lower than the service limit.

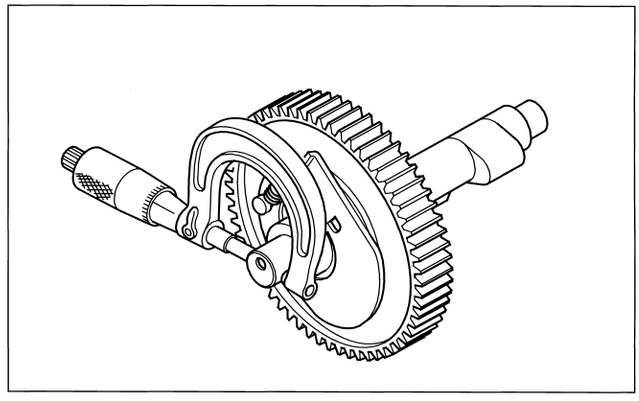


• CAMSHAFT JOURNAL O.D.

Measure the camshaft O.D.

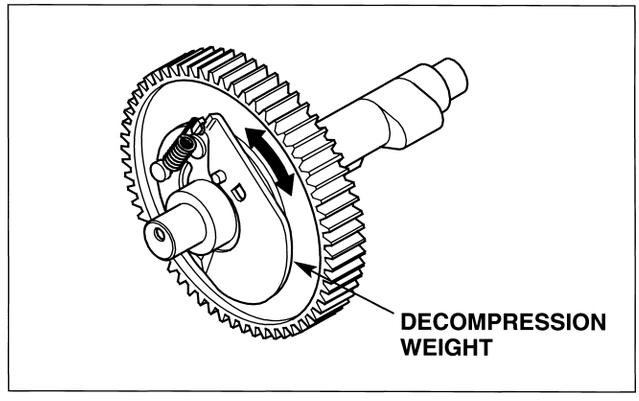
Standard	Service limit
16.975 - 16.995 mm (0.6683 - 0.6687 in)	16.92 mm (0.666 in)

Replace the camshaft if its O.D. is smaller than the service limit.



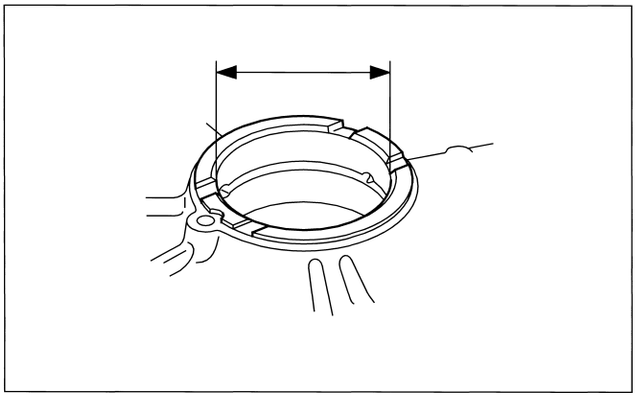
• MECHANICAL DECOMPRESSION WEIGHT

Check that the decompression weight moves smoothly, and the spring is not weak or worn.



• CYLINDER BLOCK MAIN JOURNAL I.D.

Standard	Service limit
38.025 - 38.041 mm (1.4970 - 1.4977 in)	38.06 mm (1.498 in)

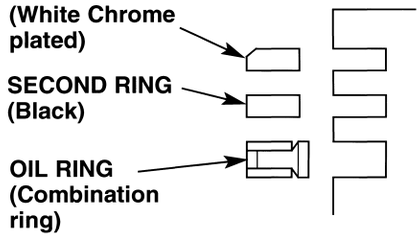


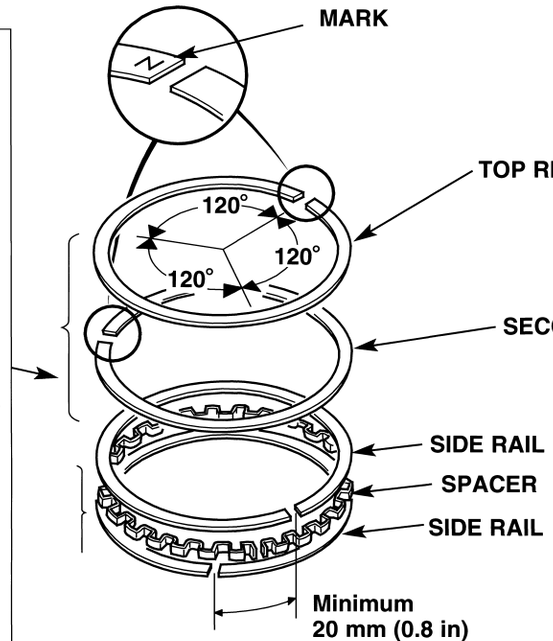
4. PISTONS

a. DISASSEMBLY/REASSEMBLY

PISTON RINGS

INSPECTION: P. 16-14
REASSEMBLY:
- Install the rings with the marks facing up.
- Do not interchange the top ring and second ring.
- After installation, check for smooth movement of the piston ring.
- Stagger the ring end gaps 120° apart. Do not align with the piston pin or thrust sides.



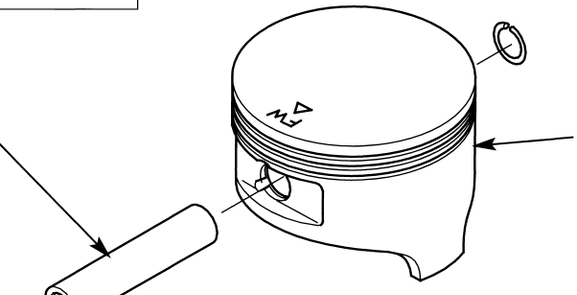


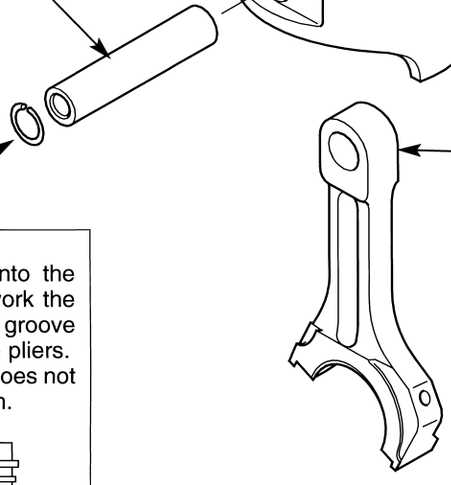
COMBINATION OIL RING

REASSEMBLY:
Space the side rail end gaps at least 20 mm (0.8 in) apart.
Coat the oil ring with oil after assembly.

PISTON PIN

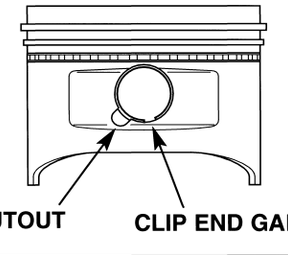
INSPECTION: P. 16-13



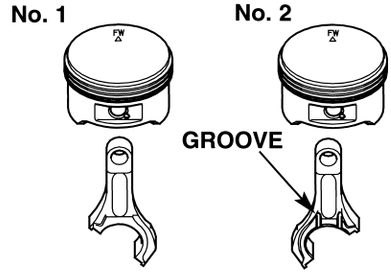


PISTON PIN CLIP (2)

REASSEMBLY:
Set one end of the clip into the groove in the piston and work the other end around in the groove using a pair of needle nose pliers. Install so that the end gap does not face the cutout in the piston.



INSPECTION: P. 16-14
REASSEMBLY:
For No. 1 cylinder:
Install the piston/connecting rod so that the groove in the connecting rod and the "FW" mark on the top of the piston are set in the same direction.
For No. 2 cylinder:
Install the piston/connecting rod so that the groove in the connecting rod and the "FW" mark on the top of the piston are set in the opposite direction.

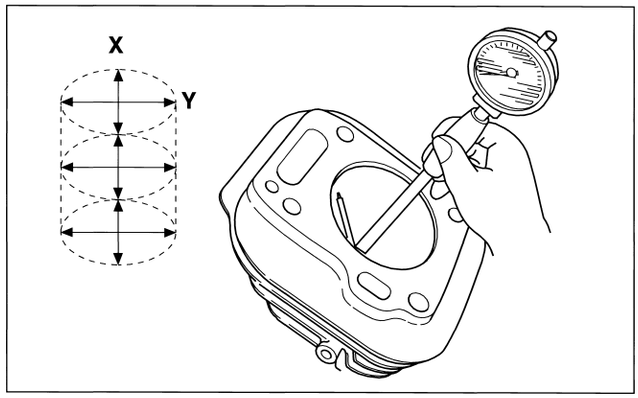


b. INSPECTION

• CYLINDER I.D.

Measure and record the cylinder I.D. at three levels in both X and Y axes. Take the maximum reading to determine the cylinder wear and taper.

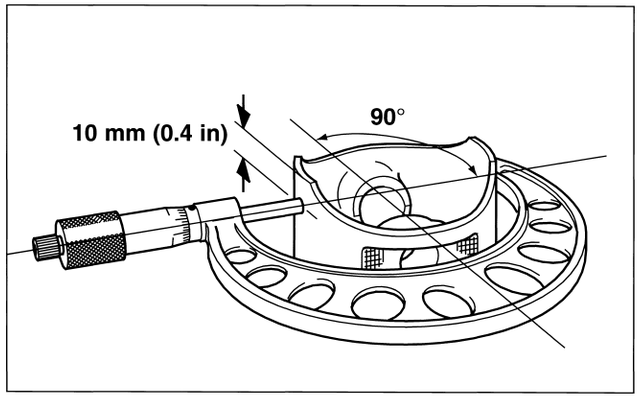
Standard	Service limit
77.000 - 77.017 mm (3.0315 - 3.0322 in)	77.17 mm (3.038 in)



• PISTON SKIRT O.D.

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

Standard	Service limit
76.965 - 76.985 mm (3.0301 - 3.0309 in)	76.85 mm (3.026 in)

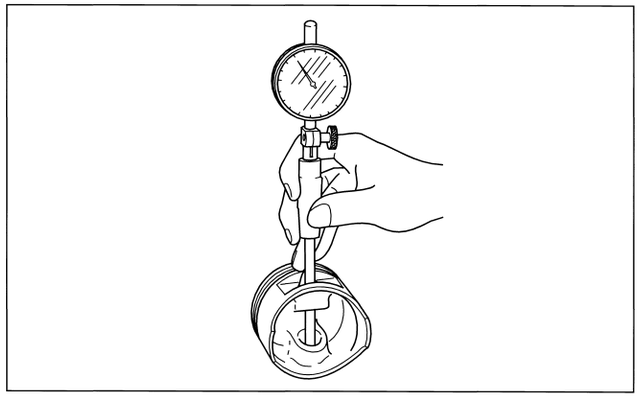


• PISTON-TO-CYLINDER CLEARANCE

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

• PISTON PIN BORE I.D.

Standard	Service limit
18.002 - 18.008 mm (0.7087 - 0.7090 in)	18.04 mm (0.710 in)

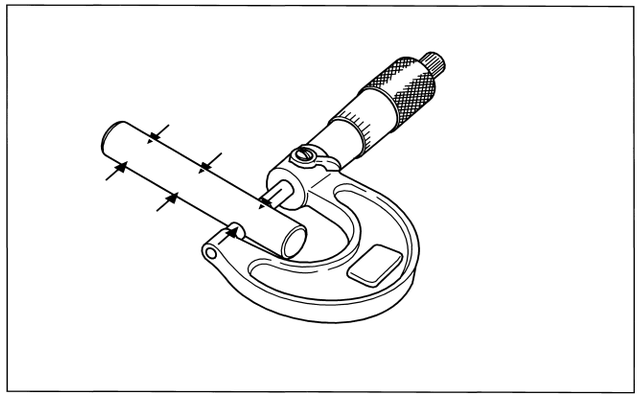


• PISTON PIN O.D.

Standard	Service limit
17.994 - 18.000 mm (0.7872 - 0.7087 in)	17.95 mm (0.707 in)

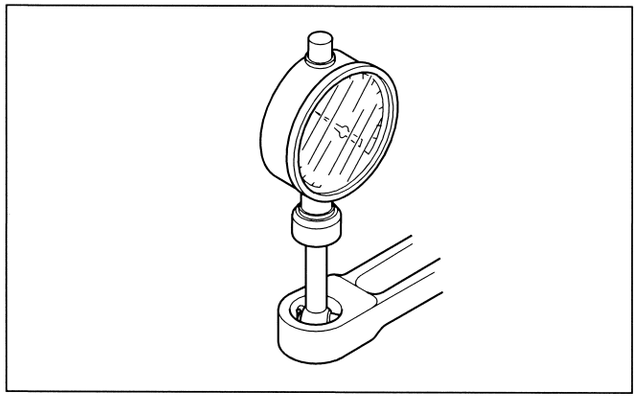
• PISTON-TO-PISTON PIN CLEARANCE

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



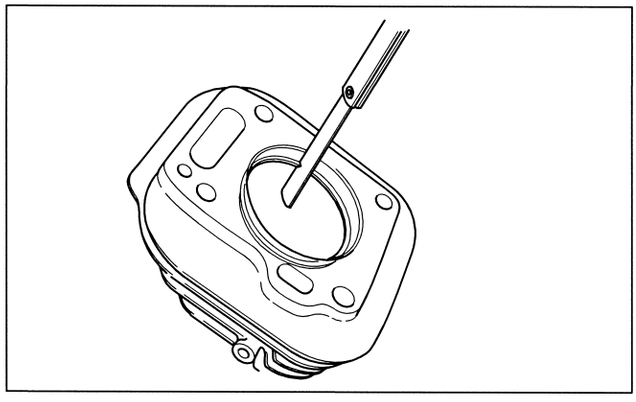
• CONNECTING ROD SMALL END I.D.

Standard	Service limit
18.005 - 18.020 mm (0.7089 - 0.7094 in)	18.07 mm (0.711 in)



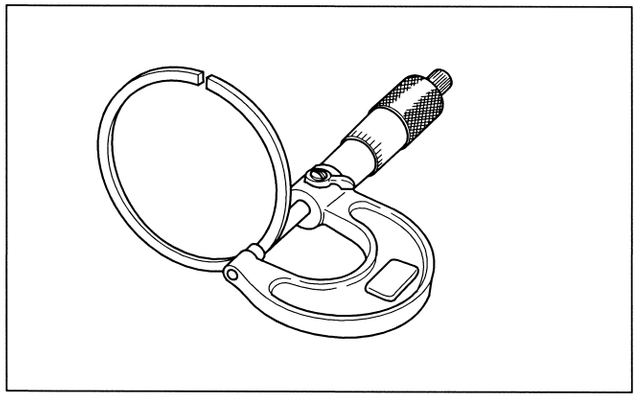
• PISTON RING END GAP

Standard		Service limit
TOP/ SECOND	0.2 - 0.4 mm (0.01 - 0.02 in)	1.0 mm (0.04 in)
OIL (Side rail)	0.2 - 0.7 mm (0.01 - 0.03 in)	1.0 mm (0.04 in)



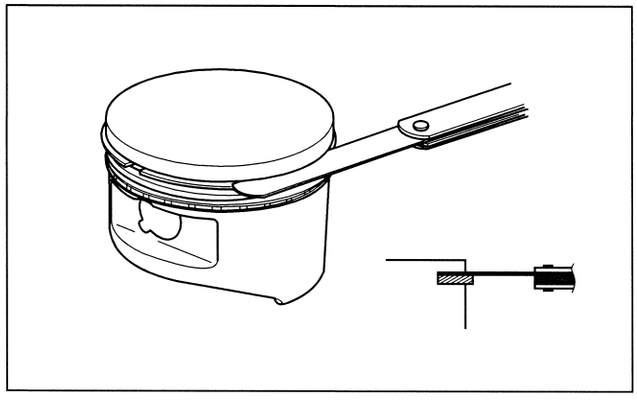
• PISTON RING THICKNESS

Standard		Service limit
TOP/ SECOND	1.975 - 1.990 mm (0.0778 - 0.0783 in)	1.90 mm (0.075 in)



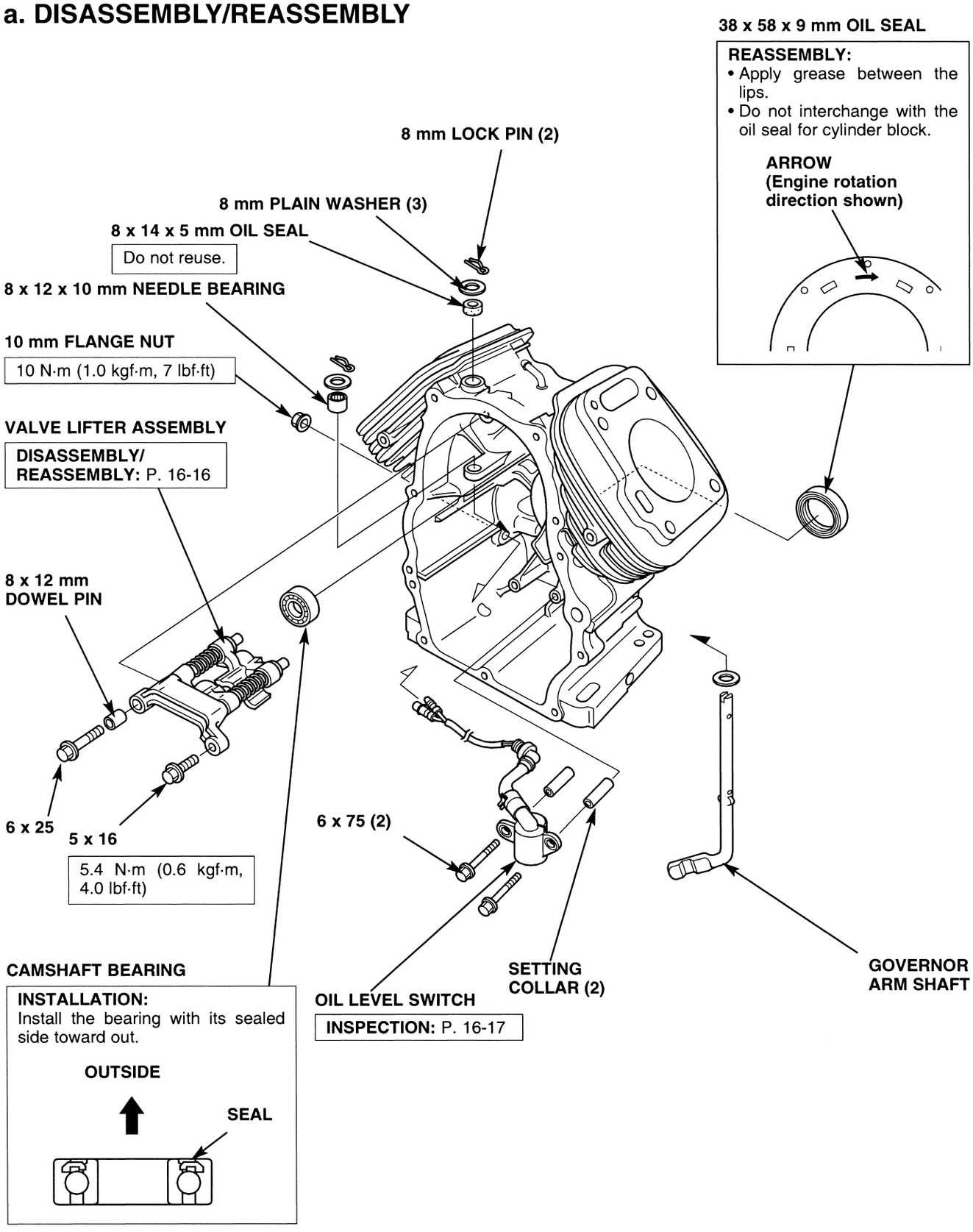
• PISTON RING SIDE CLEARANCE

Standard		Service limit
TOP/ SECOND	0.030 - 0.060 mm (0.0012 - 0.0024 in)	0.15 mm (0.006 in)



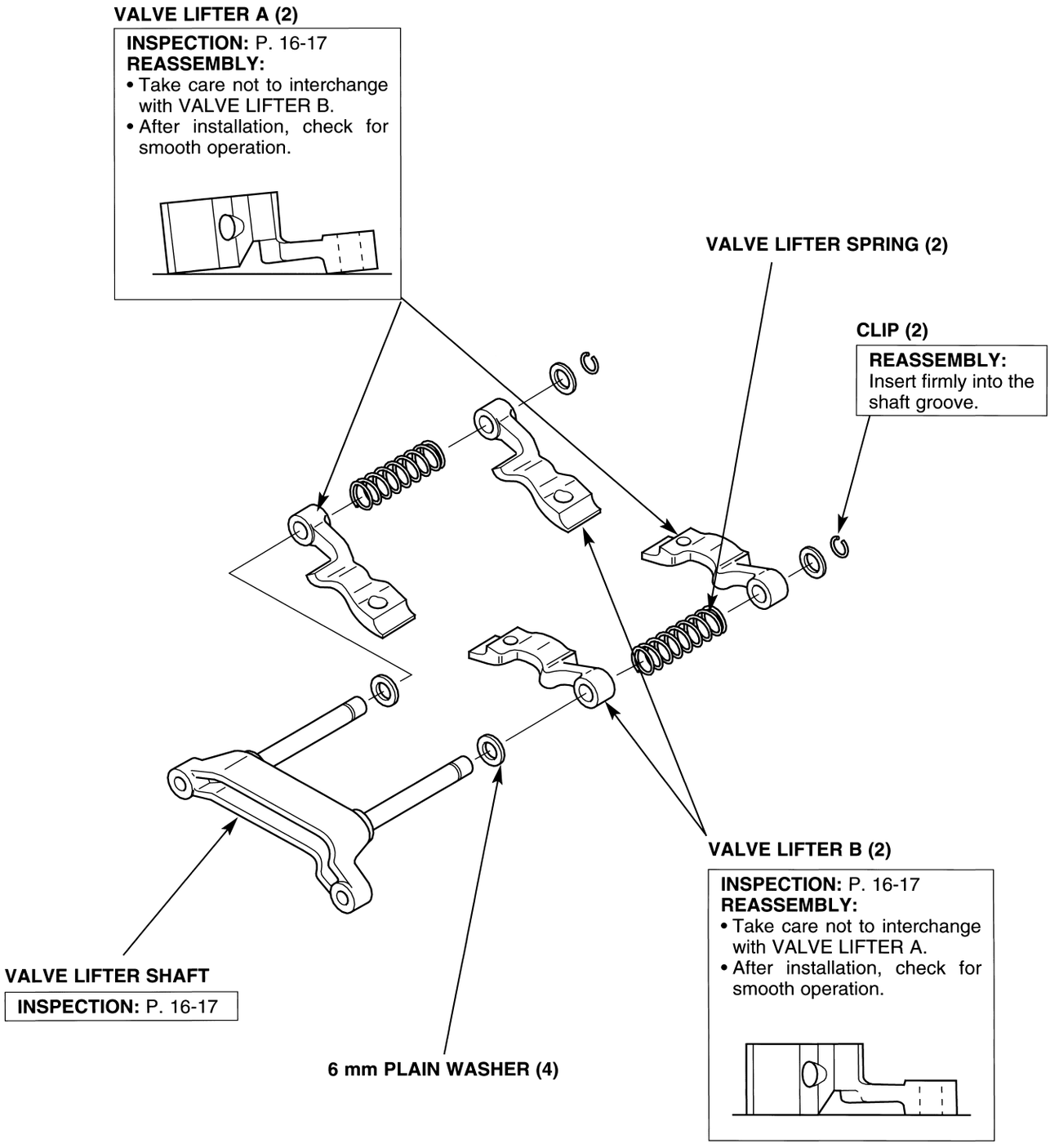
5. VALVE LIFTER/OIL LEVEL SWITCH

a. DISASSEMBLY/REASSEMBLY



• VALVE LIFTER

- To avoid confusion during reassembly, use a felt-tipped marker or equivalent and mark valve lifter A and B before disassembly. Valve lifter A has a smaller offset than valve lifter B.
- After reassembly, make sure that the valve lifters move smoothly.



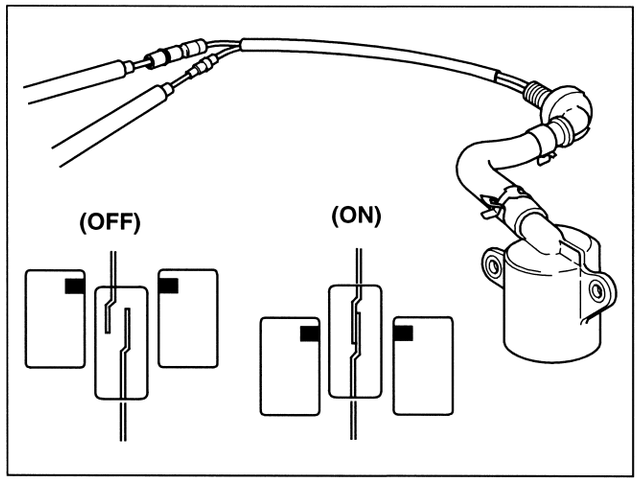
• OIL LEVEL SWITCH

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.

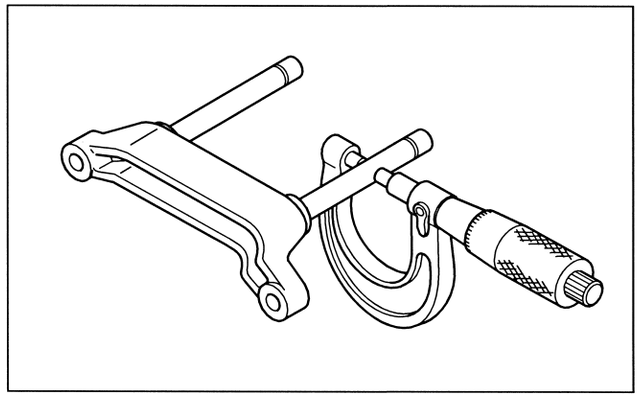
2) Hold the switch upside down. The ohmmeter should read infinity (Ω) resistance.

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.



• VALVE LIFTER SHAFT O.D.

Standard	Service limit
5.982 - 6.000 mm (0.2355 - 0.2362 in)	5.95 mm (0.234 in)

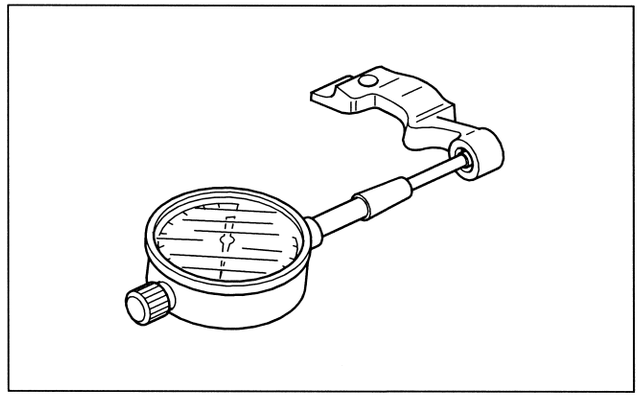


• VALVE LIFTER I.D.

Standard	Service limit
6.010 - 6.030 mm (0.2366 - 0.2374 in)	6.06 mm (0.239 in)

• VALVE LIFTER-TO-AHAFT CLEARANCE

Standard	Service limit
0.010 - 0.048 mm (0.0004 - 0.0019 in)	0.10 mm (0.004 in)



1. WHEEL (OPTIONAL PART)

a. DISASSEMBLY/REASSEMBLY

1) Raise the generator and place the wooden blocks under the frame to get the clearance for the wheel servicing.

2) Remove the battery (P. 4-1).