

SERVICE MANUAL

# COMMERCIAL GENERATOR

PX7500 & PX7500e



Cummins **Onan**



# CONTENTS

<i>Section</i>	<i>Title</i>	<i>Page</i>
<b>1.</b>	<b>SPECIFICATIONS .....</b>	<b>1</b>
<b>2.</b>	<b>PERFORMANCE CURVES .....</b>	<b>2</b>
<b>3.</b>	<b>FEATURES .....</b>	<b>3</b>
3-1	A.V.R. ALTERNATOR .....	3
3-2	OIL SENSOR .....	3
3-3	QUIET OPERATION .....	3
3-4	NO RADIO NOISE .....	3
3-5	LARGE FUEL TANK .....	3
3-6	RUGGED TUBULAR FRAME .....	3
3-7	MINIMAL MAINTENANCE .....	3
3-8	LONG-LIFE DURABILITY .....	3
<b>4.</b>	<b>GENERAL DESCRIPTION .....</b>	<b>4</b>
4-1	EXTERNAL VIEW .....	4
4-2	CONTROL PANEL .....	5
4-3	LOCATION of SERIAL NUMBER and SPECIFICATION NUMBER .....	6
<b>5.</b>	<b>CONSTRUCTION AND FUNCTION .....</b>	<b>7</b>
5-1	CONSTRUCTION .....	7
5-2	FUNCTION .....	7
5-3	DESCRIPTION of GENERATOR OPERATION .....	11
5-4	OIL SENSOR .....	14
<b>6.</b>	<b>SAFETY PRECAUTIONS .....</b>	<b>17</b>
<b>7.</b>	<b>RANGE OF APPLICATIONS .....</b>	<b>18</b>
<b>8.</b>	<b>MEASURING PROCEDURES .....</b>	<b>21</b>
8-1	MEASURING INSTRUMENTS .....	21
8-2	AC OUTPUT MEASURING .....	24
8-3	DC OUTPUT MEASURING .....	24
8-4	MEASURING INSULATION RESISTANCE .....	25
<b>9.</b>	<b>CHECKING FUNCTIONAL MEMBERS .....</b>	<b>27</b>
9-1	VOLTMETER .....	27
9-2	AC RECEPTACLES .....	27
9-3	No-FUSE BREAKER .....	27

<i>Section</i>	<i>Title</i>	<i>Page</i>
9-4	STATOR .....	28
9-5	ROTOR ASSEMBLY .....	28
9-6	BRUSH .....	29
9-7	A.V.R. (AUTOMATIC VOLTAGE REGULATOR) .....	29
9-8	DIODE RECTIFIER .....	31
9-9	OIL SENSOR .....	32
9-10	EXCITING COIL .....	32
<b>10.</b>	<b>DISASSEMBLY AND ASSEMBLY .....</b>	<b>33</b>
10-1	PREPARATION and PRECAUTIONS .....	33
10-2	DISASSEMBLY PROCEDURES .....	34
10-3	ASSEMBLY PROCEDURES .....	42
10-4	CHECKING, DISASSEMBLY and REASSEMBLY of the FRONT PANEL .....	48
<b>11.</b>	<b>TROUBLESHOOTING .....</b>	<b>50</b>
11-1	NO AC OUTPUT .....	50
11-2	AC VOLTAGE IS TOO HIGH OR TOO LOW .....	51
11-3	AC VOLTAGE IS NORMAL AT NO-LOAD, BUT THE LOAD CANNOT BE APPLIED. ....	52
11-4	NO DC OUTPUT .....	53
<b>12.</b>	<b>WIRING DIAGRAM .....</b>	<b>54</b>

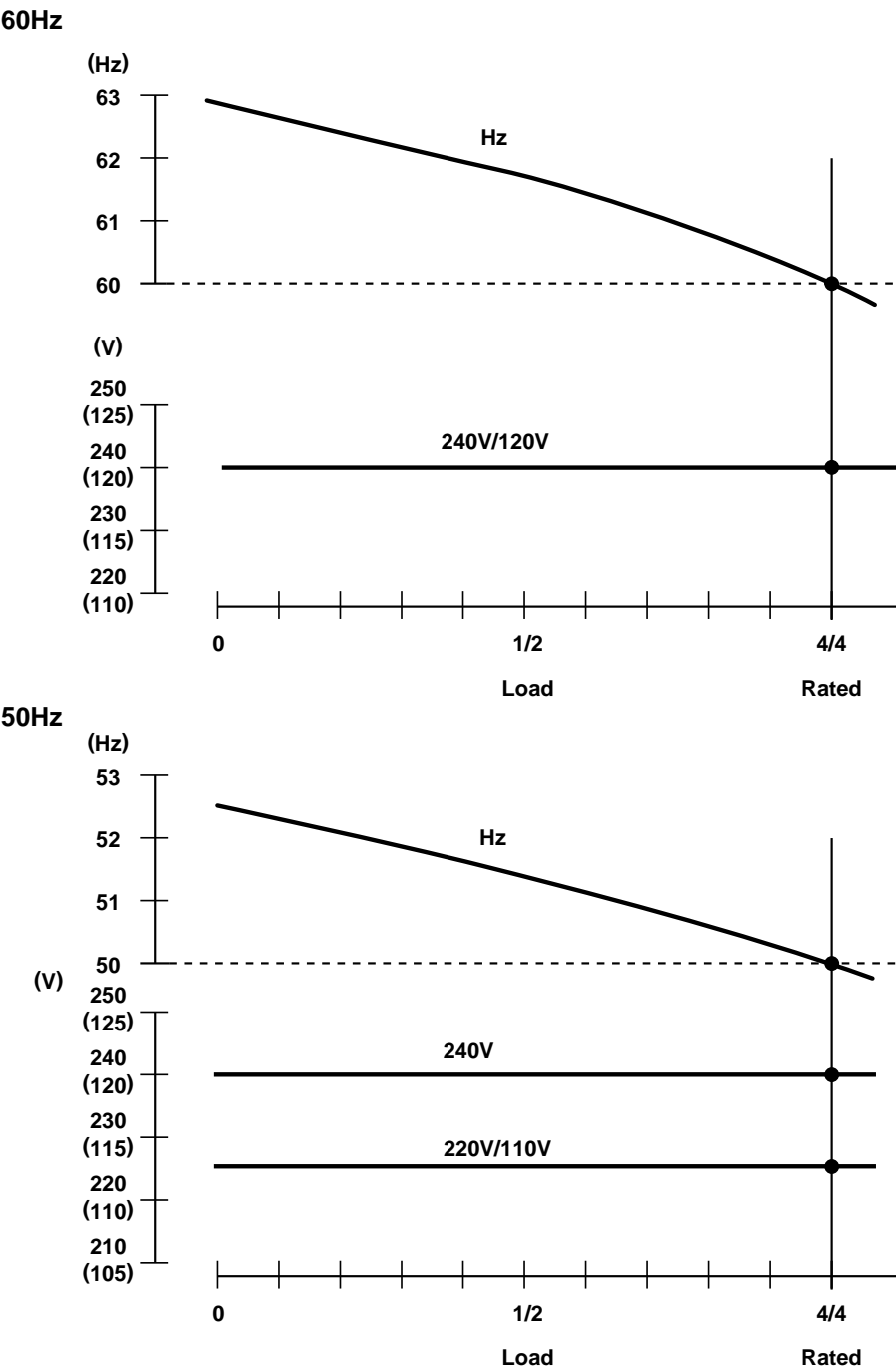
**NOTE :** As for the servicing information on engine portion, please refer to the EH41 engine service manual

# 1. SPECIFICATIONS

Model				PX7500	
Alternator	Type			Brush, Self Exciting, 2-Pole, Single Phase	
	AC	Frequency		50 Hz	60 Hz
		Maximum Output		6300 W	7300 W
		Rated Output		5500 W	6000 W
		Voltage	Rated Current	110V, 220V, 230V, 240V, 110V/220V	110V, 120V, 220V, 110V/220V, 120V/240V
	Power Factor		1.0		
	DC Output		12 V-8.3 A (100 W)		
	Voltage Regulator		A.V.R. Type		
	Engine	Type			Air-Cooled 4-Cycle, Overhead Valve Gasoline Engine
Model			EH41D		
Displacement			404 cm <sup>3</sup>		
Rated Output			9.5 HP / 3600 rpm		
Fuel			Automobile Gasoline		
Fuel Tank Capacity			27.5 liters		
Rated Coutinuous Operation			Approx. 9.0 hours	Approx. 7.0 hours	
Oil Capacity			1.2 liters		
Starting System			Recoil Starter and Optional Electric Starter		
Dimensions (L x W x H)				690 x 530 x 530 mm	
Dry Weight				90 kg (95 kg)*	

\* Electric starter motor is available as option.

## 2. PERFORMANCE CURVES



### DC OUTPUT

DC Voltage ..... 12 V  
DC Ampere ..... 8.3 A  
DC output ..... 100 W

The voltage curve shown in the left indicates the characteristic of DC output when charging a battery. The voltage may be decreased by 20% when the resistance load is applied.

*NOTE : It is possible to use both DC and AC outputs simultaneously up to the rated output in total.*

## **3. FEATURES**

### **3-1 AVR ALTERNATOR**

Output voltage becomes more stable due to A.V.R. system and water proof (1P23 level) / brush type alternator ensures trouble free operation.

### **3-2 OIL SENSOR**

Oil sensor automatically shuts off the engine whenever the oil level falls down below the lower limit to protect the engine from seizure.

### **3-3 QUIET OPERATION**

Cummins Onan PX7500 generator delivers a quiet operation with :

- \* High performance 4-stroke Cummins Onan OHV engine.
- \* Extra large muffler and large air cleaner provide remarkable quiet operation.

### **3-4 NO RADIO NOISE**

Noise suppressor spark plug is equipped standard to prevent radio frequency interference.

### **3-5 LARGE FUEL TANK**

Extra large fuel tank (27.5 L) allows more than 9 hours/ 50 Hz (7 hours/ 60 Hz) of continuous operation which is sufficient for a half day or one day work without refueling.

### **3-6 RUGGED TUBULAR FRAME**

Full cradle type rugged tubular frame protects the generator all around.

### **3-7 MINIMAL MAINTENANCE**

- \* A drip-proof alternator design.
- \* No-fuse circuit breakers.
- \* An electronic pointless ignition system.

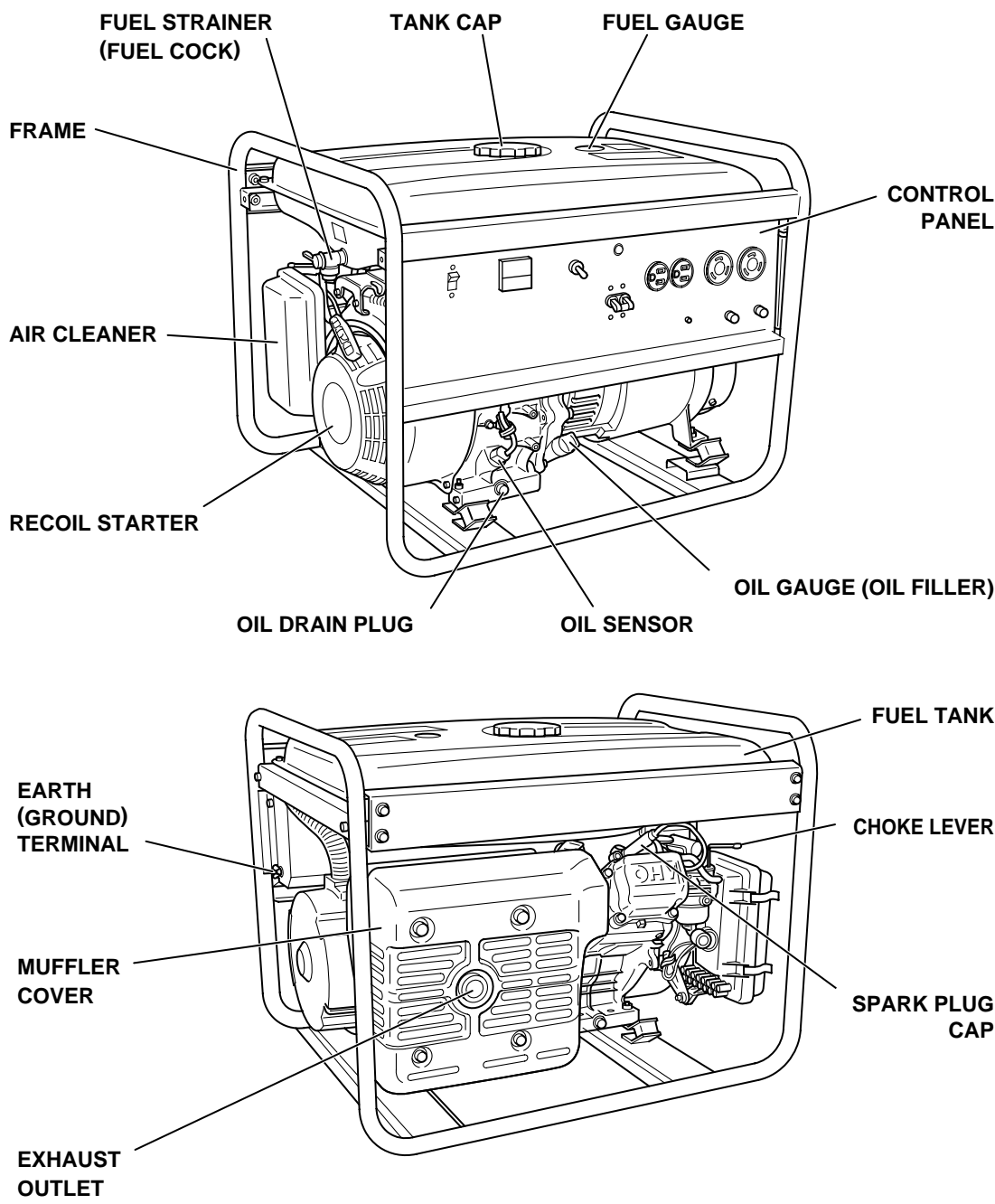
### **3-8 LONG-LIFE DURABILITY**

The heavy-duty 4 stroke Cummins Onan OHV engine :

- \* Full rubber mount in a sturdy tubular frame.
- \* A forged carbon steel crankshaft supported by two main ball bearings.
- \* A pointless electronic ignition system.
- \* A special cast-iron cylinder liner.

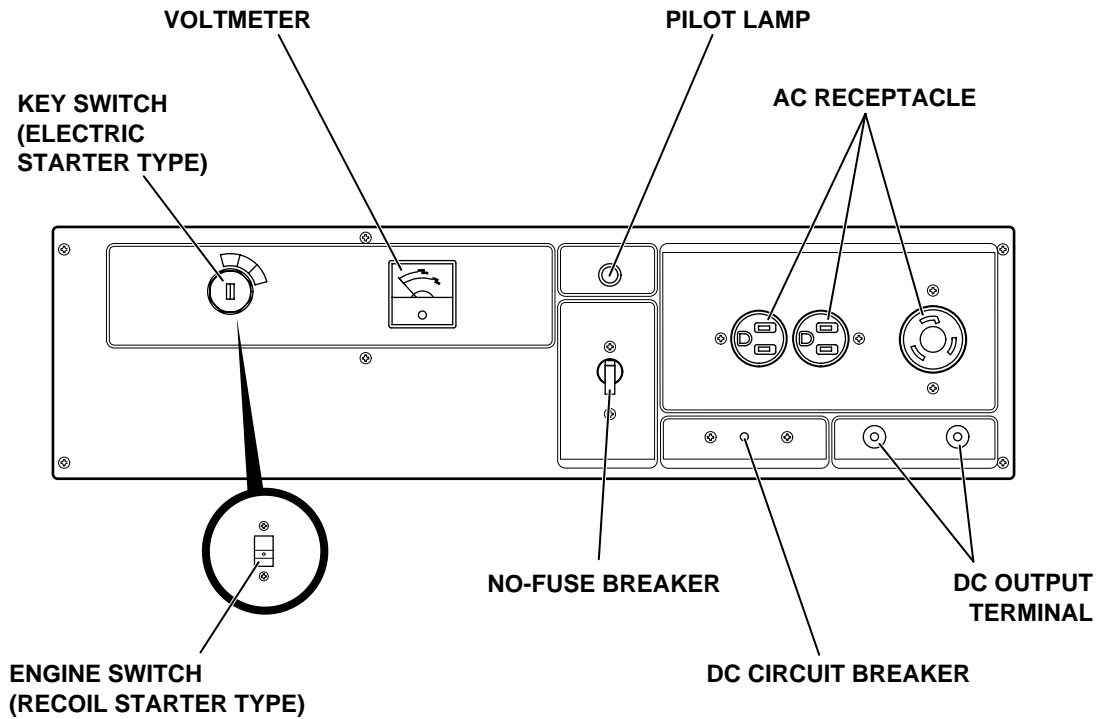
# 4. GENERAL DESCRIPTION

## 4-1 EXTERNAL VIEW

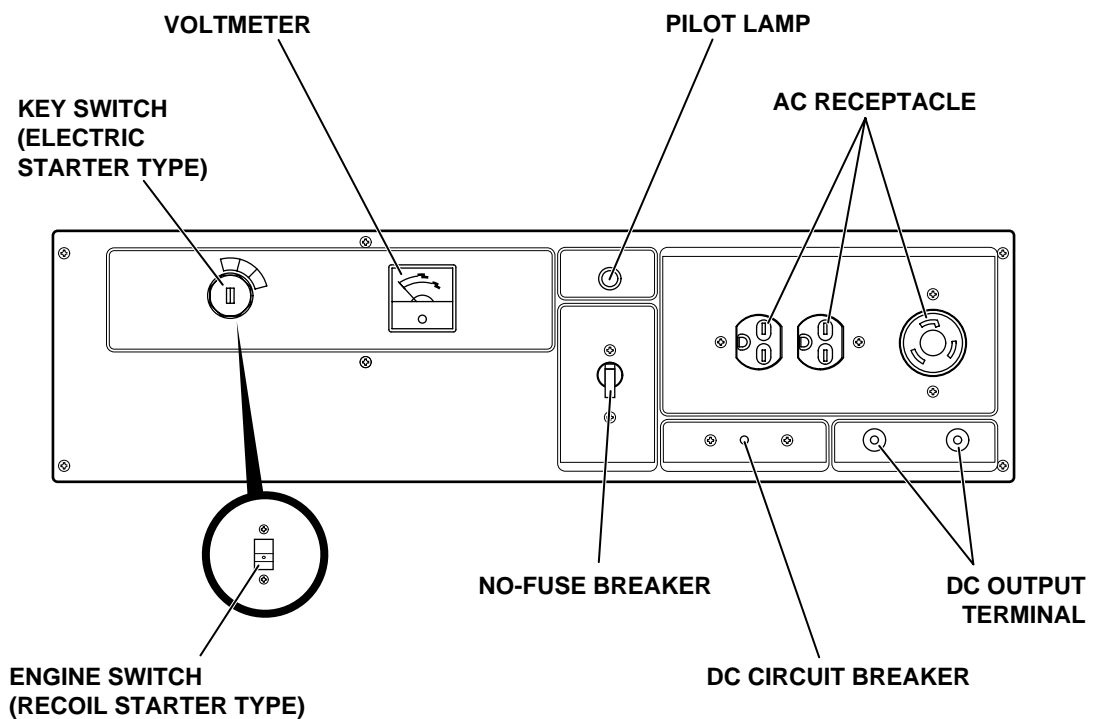


## 4-2 CONTROL PANEL

\* 50Hz-110V, 60Hz-110V, 60Hz-120V

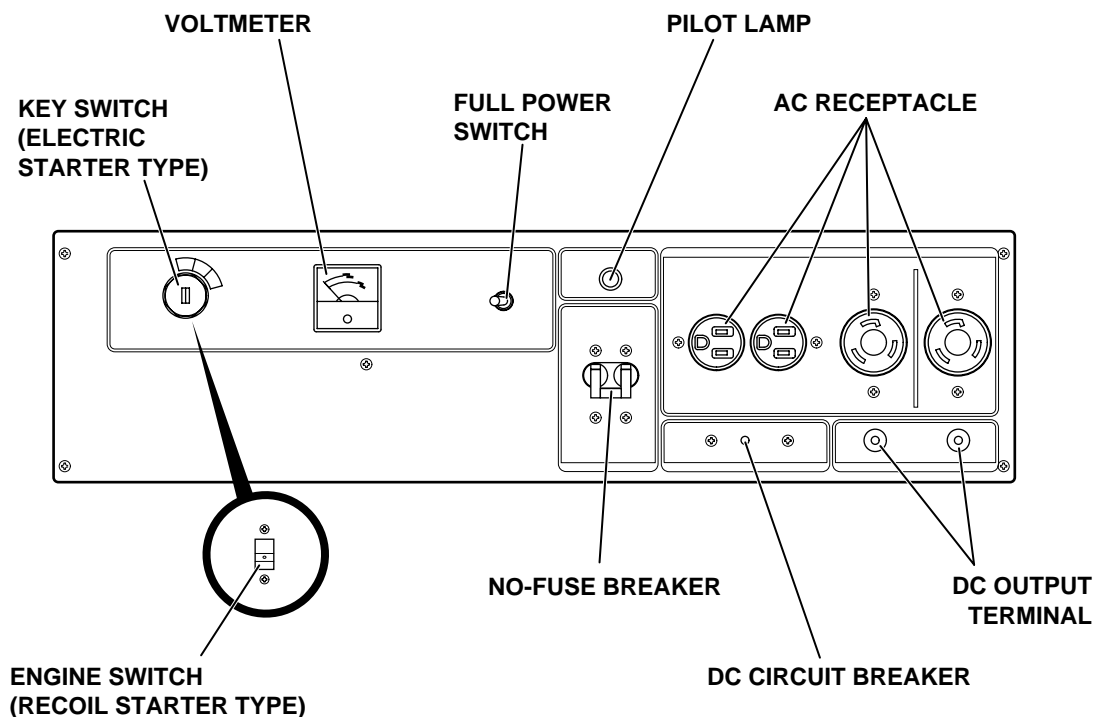


\* 50Hz-220V, 230V, 240V, 60Hz-220V





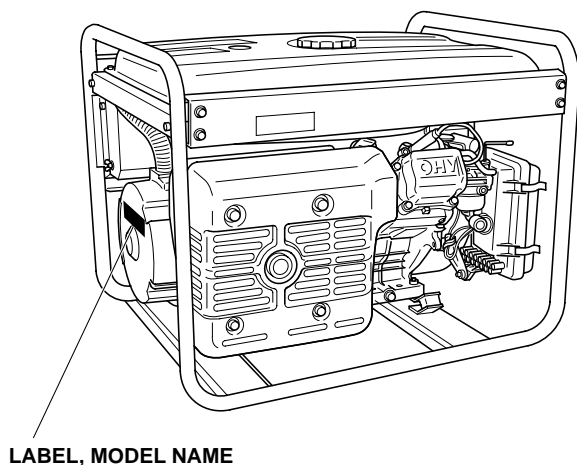
\* 50Hz, 60Hz-110/220V, 60Hz-120/240V



#### 4-3 LOCATION of SERIAL NUMBER and SPECIFICATION NUMBER

Serial number and specification number are stamped on the LABEL (MODEL NAME) stuck on the side wall of rear cover.

*NOTE : Always specify these numbers when inquiring about the generator or ordering spare parts in order to get correct parts and accurate service.*



## 5. CONSTRUCTION AND FUNCTION

### 5-1 CONSTRUCTION

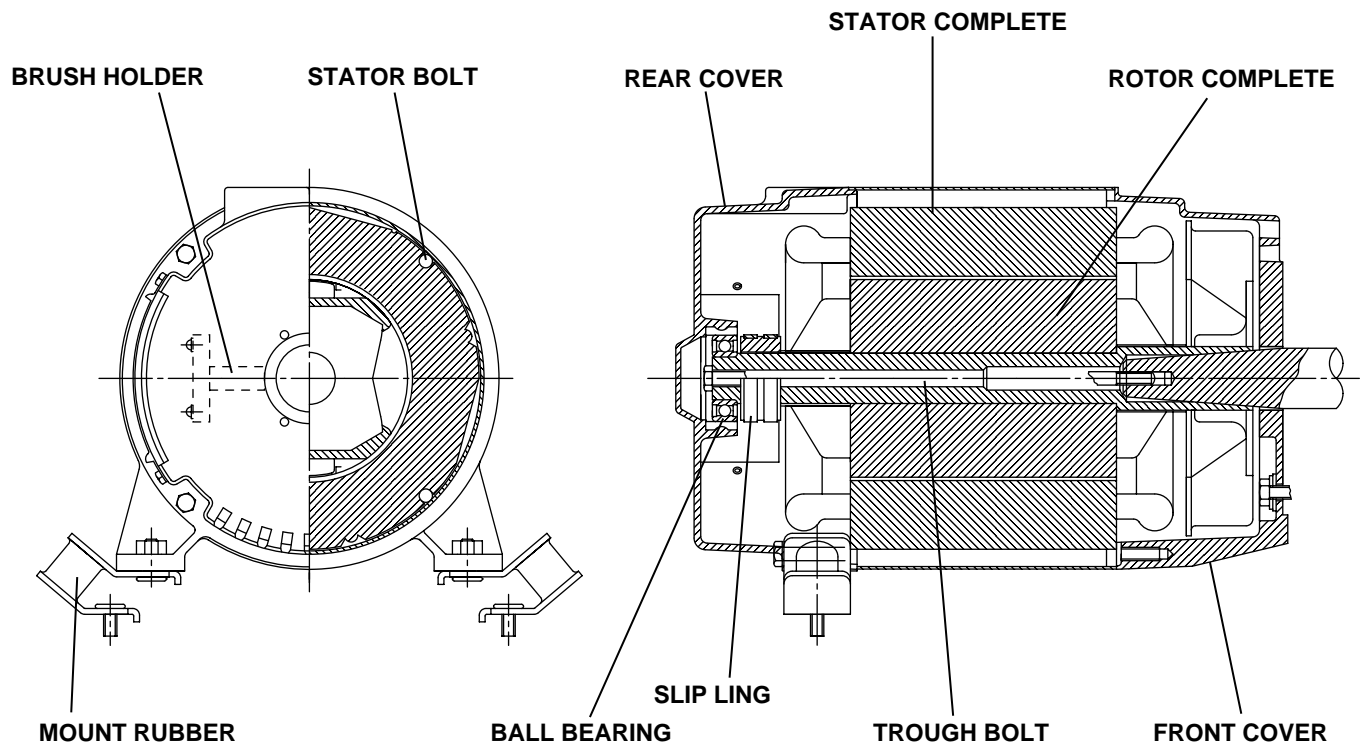


Fig. 5-1

### 5-2 FUNCTION

#### 5-2-1 STATOR

The stator consists of a laminated silicon steel sheet core, a main coil and a condenser coil which are wound in the core slots.

The condenser coil excites the rotor field coil which generates AC voltage in the main coil.

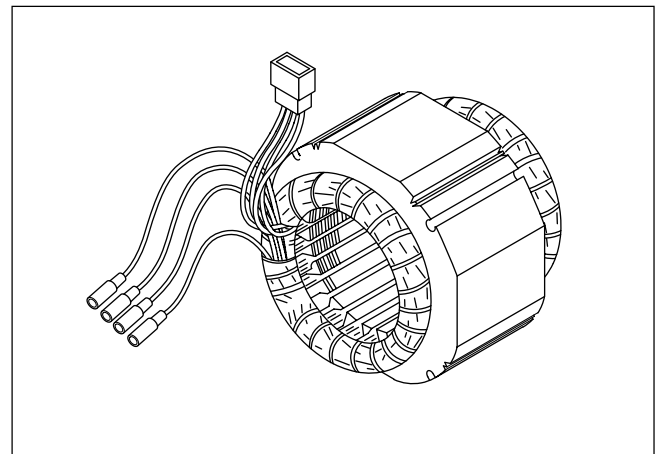


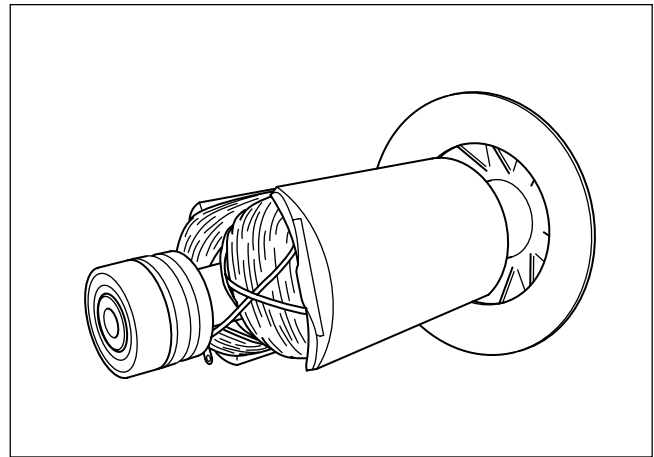
Fig. 5-2

### 5-2-2 ROTOR

The rotor consists of a laminated silicon steel sheet core and a field coil which is wound over the core.

DC current in the field coil magnetizes the steel sheet core. Two permanent magnets are provided for the primary exciting action.

Slip rings are provided on the rotor shaft to receive DC exciting current from A.V.R..

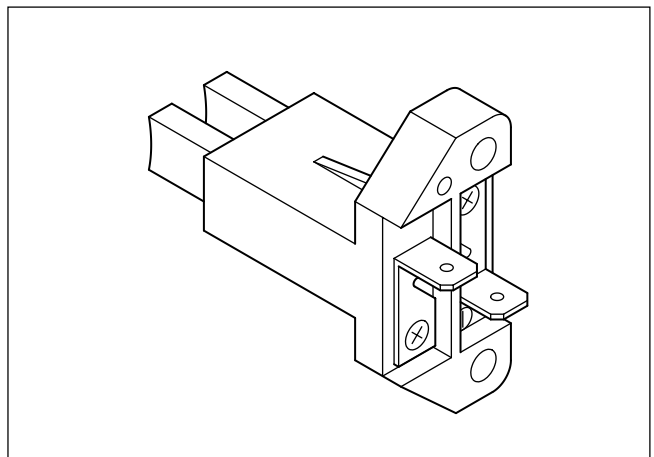


*Fig. 5-3*

### 5-2-3 BRUSH/ BRUSH HOLDER

An exciting current is supplied from the A.V.R to the rotor. The brushes are made of carbon and the brush-holder of plastic.

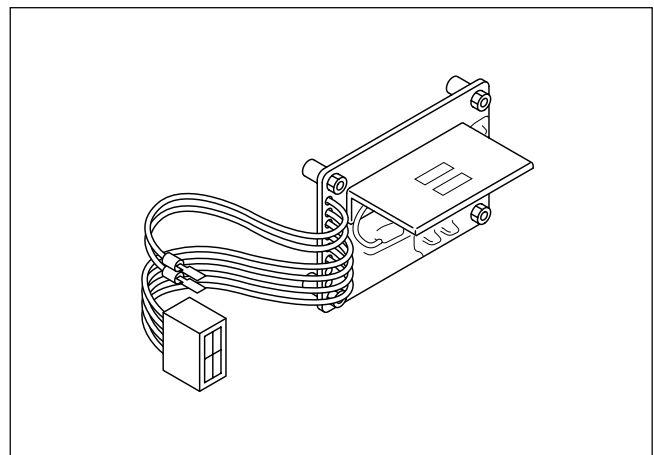
It is necessary to keep the contact pressure between the brushes and slip rings within specific limits. Thus, care must be taken of brush length.



*Fig. 5-4*

### 5-2-4 A.V.R. (AUTOMATIC VOLTAGE REGULATOR)

The automatic voltage regulator employs an electronic circuit to automatically regulate voltage.



*Fig. 5-5*

### 5-2-5 NO-FUSE BREAKER

The no-fuse breaker protects the generator from getting damage by overloading or short circuit in the appliance. Table 5-1 shows the capacity of no-fuse breaker by each spec. and their object of protection.

SPECIFICATION	NO-FUSE BREAKER	OBJECT of PROTECTION
50 Hz-220 V	25 A	Total output amperage
60 Hz-220 V	27 A	Total output amperage
50 Hz-240 V	23 A	Total output amperage
50 Hz-110 V/ 220V	25 A (2-Pole, 2-Element)	Total output amperage
60 Hz-110 V/ 220V	27 A (2-Pole, 2-Element)	Total output amperage
60 Hz-120 V/ 240V	25 A (2-Pole, 2-Element)	Total output amperage

Table. 5-1

### 5-2-6 DC CIRCUIT BREAKER

The 10 ampere DC circuit breaker mounted on the control panel protects whole DC circuit from getting damage by overload or short circuit.

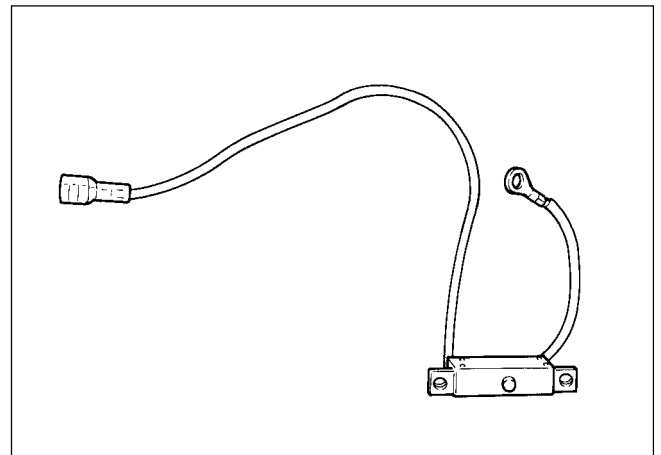


Fig. 5-6

### 5-2-7 RECEPTACLE and AC PLUG

These are used for taking AC output power from the generator. A total of six kinds of receptacles, each varying in rated voltage and current from another, are used. Each model has at least one receptacle to deliver the rated generator output. As many AC plugs as the receptacles, each matching the corresponding receptacle, are provided. Table 5-2 shows the rated current for each receptacle. Be careful not to use the receptacles and AC plugs beyond the specified amperage limits to prevent burning.

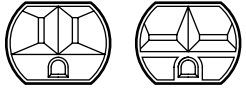
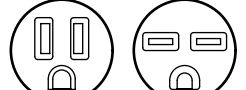


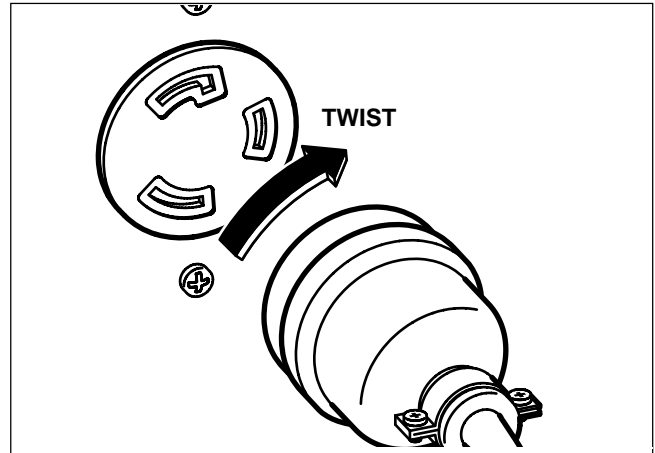
	up to total 15 amperes from two receptacles
	up to 15 amperes
	up to 20 amperes
	up to 30 amperes (See Caution.)

Table. 5-2



**Caution :** To connect the appliance to locking receptacle, insert the plug into the receptacle and turn it clockwise to lock.

Fig. 5-7

*NOTE :* If your generator has receptacles peculiar to your country, Table 5-2 does not apply.

## 5-3 DESCRIPTION of GENERATOR OPERATION

### 5-3-1 PRIMARY EXCITING ACTION

When the generator is started, the permanent magnet on the engine rotates to generate a voltage in the exciting coil. This voltage is regulated by a diode in the A.V.R. to feed a current to the generator field coil. (FC). (See Fig. 5-8)

The rotor is turned an electromagnet by that current and rotates so that voltage are generated in the stator coils (main coil and sub coil). The voltage generated in the sub coils is operated by the A.V.R. to feed a current to increase the field coil current. (See Fig. 5-9)

As a result, the rotor magnetism increases.

This operation is repeated to generate the rated voltage at 60 Hz in the main coil and DC coil.

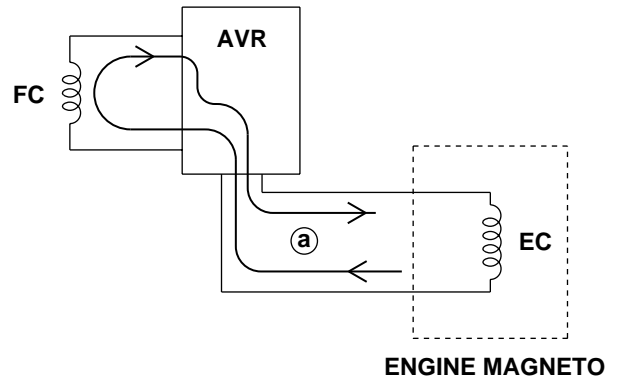


Fig. 5-8

### 5-3-2 VOLTAGE REGULATING MECHANISM

Connect a load to the AC output terminal and increase current. Output voltage varies as shown in Fig. 5-10 depending on whether an automatic voltage regulator is used or not.

The operation of the A.V.R. is explained below.

When an AC output is taken, the engine is loaded and its rpm falls, Also the AC voltage falls due to the voltage drop caused by the internal resistance of the coils. The A.V.R. detects this voltage drop and its built-in SCR automatically increase the current flows to the field coil. As a result, the rotor magnetism increase, the voltage fallen by the load current is raised, and the output voltage is kept constant. If the AC output is reduced, the SCR operates in the opposite way to similarly keep the output voltage constant. When current increases, the density of magnetic flux across the rotor core rises. As a result, the current flowing in the field coil increases and the generator output voltage is prevented from decreasing.

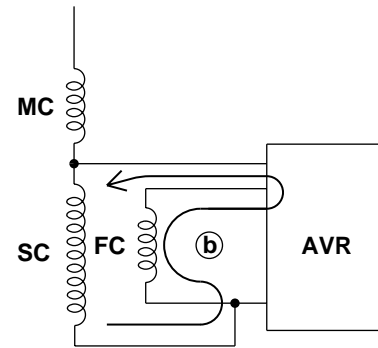


Fig. 5-9

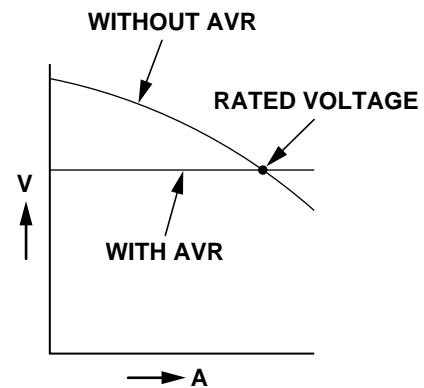


Fig. 5-10

### 5-3-3 FULL POWER SWITCH (Dual Voltage Type)

The full power switch is provided for the dual voltage type to take out the full rated power from one receptacle in each voltage.

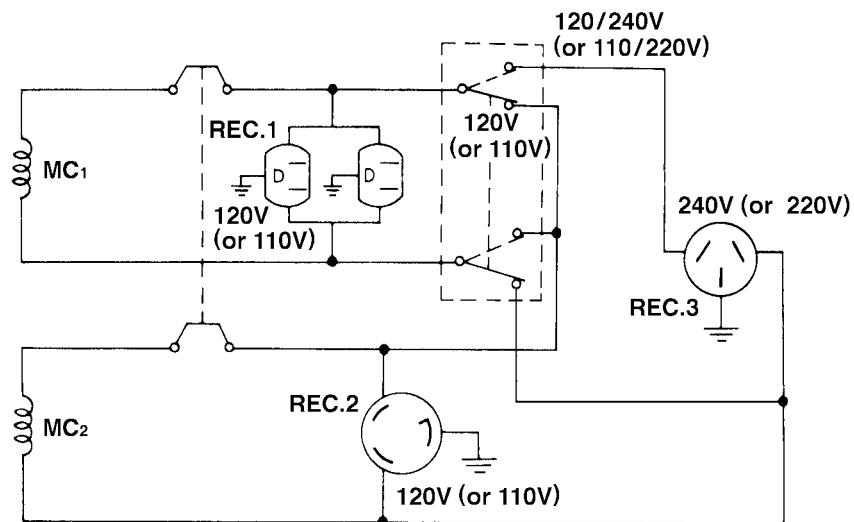


Fig. 5-11

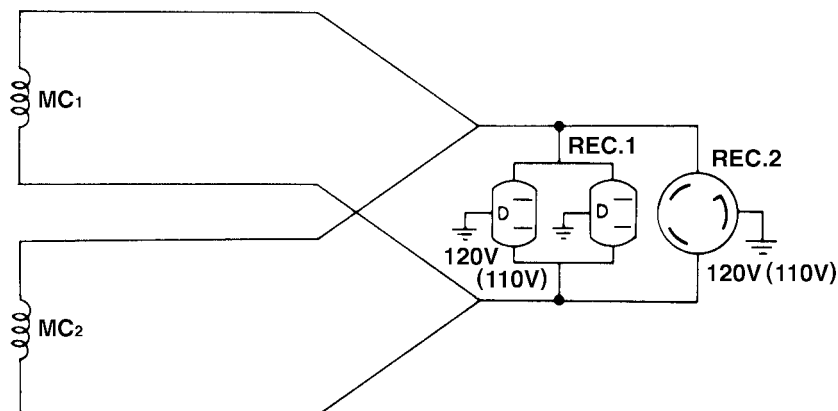


Fig. 5-12

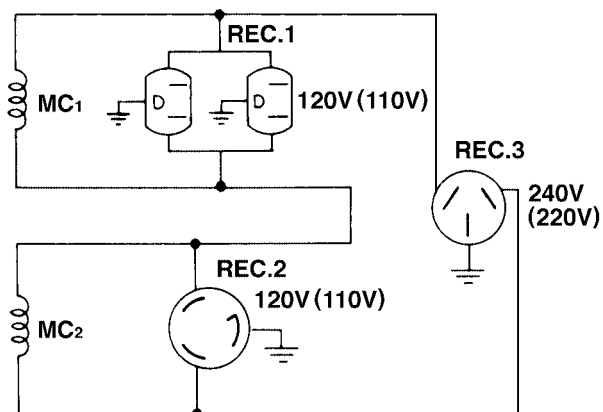


Fig. 5-13

Switch Position	LOWER VOLTAGE RECEPTACLE	HIGHER VOLTAGE RECEPTACLE
110 V or 120 V	Rated output	No output can be taken.
110/220 V or 120/240 V	Half of rated output	Rated output

Two main coils are wound over stator core. Each main coil outputs half the rated power at the lower voltage (110V or 120V). These main coils are wound to be in the same phase. The full power switch reconnects these main coils in parallel or in series.

Fig. 5-11 shows a circuit diagram. When the full power switch is set for single lower voltage indication (110V or 120V), the switch position is as indicated by the lower solid line in the diagram. Fig. 5-12 is a simplified representation of this circuit, showing the two main coils connected in parallel. In this case, the higher voltage (220V or 240V) at Rec. 3 cannot be taken out. Rec. 2 for the lower voltage can output up to the rated power (up to 30A if the rated current is over 30A), and Rec. 1 can output up to a total of 15A.

When the full power switch is set for double voltage indication (110V/220V or 120V/240V), the switch position is as indicated by the upper dotted line in Fig. 5-11. Fig. 5-13 is a simplified representation of this circuit, showing the two main coils connected in series. In this case, power can be taken simultaneously from the receptacles for the both voltages. Rec. 3 for the higher voltage can output up to the rated power, but Rec. 1 and Rec. 2 for the lower voltage can output only up to half the rated power each.

Table 5-4 is a summary of the above explanation. Select the proper output voltage by full power switch in accordance with the appliance to be used.



## 5-4 OIL SENSOR

### 5-4-1 DESCRIPTION

- \* The oil sensor mainly functions to detect position of the surface of engine oil in the crankcase of engines for general use and to stop the engine automatically when the oil level goes down below the lower limit specified. This prevents seizure of engine from occurring due to insufficient amount of oil in the crankcase.
- \* Since the sensor has been designed to consume a part of power supplied to the igniter to energize its electronics circuit, any other external power supply is not necessary so that it can be mounted at the oil filler port.

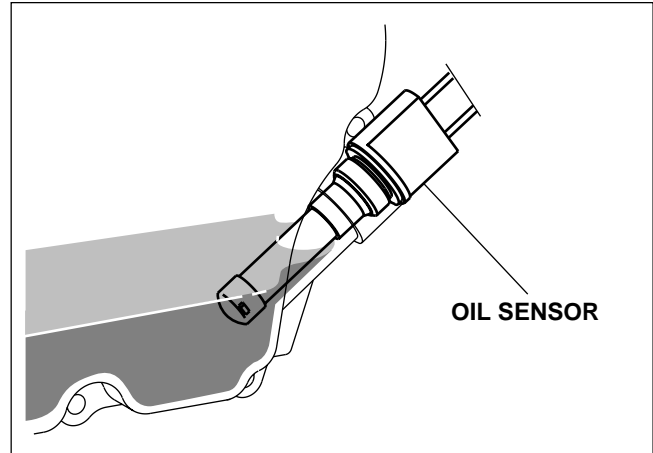


Fig. 5-14

Introduction of newly developed sensing principle features super durability and no change with the passage of time as it does not use any moving part.

Merits due to introduction of electrical conductivity detection are as follows ;

- ① It has resistance to mechanical shocks and property of no change with the passage of time as sensing element consists simply of electrodes having no moving parts.
- ② At the same time, it is capable of detecting the oil level stably as it is not influenced by engine vibrations.
- ③ No error occurs due to foam and flow of the oil.
- ④ Influence against the ignition system or the electronics units can be neglected because an electric current supplied to the sensor can be decreased.

### 5-4-2 PRINCIPLE OF SENSING OIL LEVEL

There is a great difference between electric resistance of air and that of oil. Since the resistance of air is far higher than that of oil, more electric current passes through the oil than through the air, although absolute value of the current is very small. The sensor detects this current difference and make use of it. The sensor judges the oil quantity, by comparing a current flowing across a pair of electrodes (inner and outer) with the reference, in such a way that if a current flows between the electrodes more than the reference, sufficient oil is in the crankcase, on the other hand, if a current flows less than the reference, oil is not sufficient. Since an electric current is flown to detect oil quantity, this is called the “electrical conductivity detection” type of sensor. The oil level to be detected is determined by the length of electrodes and their mounting positions with the engine.

### 5-4-3 HOW IT OPERATES

#### [Power supply]

The sensor makes use of a part of primary power source for ignition of the engine (igniter) to drive the sensor circuit. Power to the sensor can usually be derived from the “stop button” by branching wires out.

### [Judgement of oil level]

When sufficient oil is in the crankcase, both of inner and outer electrodes are immersed in the oil through which current flows across the electrodes. The sensor judges that oil in the crankcase is sufficient. When oil level goes down and the inner electrode is exposed to the air due to consumption of oil, no current flow between the electrodes as air is considered to be electrically nonconductive. The sensor in this case judges that oil is insufficient.

### [Decision of oil shortage]

Oil level at the electrodes may go down momentarily probably due to the engine being slanted or affected by vibration even if a sufficient oil is in the crankcase. For that reason, the sensor has an electronic timer circuit to prevent it from interpreting as short of oil when amount of oil is sufficient. The sensor has been designed so that the engine is to be stopped only when oil-shortage is detected for 5 seconds uninterrupted. The timer employs an integration circuit and it is to be reset when the inner electrode is soaked in the oil again before the sensor decides it as oil-shortage. The oil level where the sensor decides as oil-shortage, when oil level goes down gradually, is called “threshold level”.

### [Automatic stop of engine]

When the sensor decides as oil-shortage, it makes the engine to stop running automatically for protection of engine. Once the stopping circuit is activated, it keeps functioning until it confirms that the engine has made a complete stop, then the circuit stops functioning automatically.

#### 5-4-4 BLOCK DIAGRAM OF THE CIRCUIT

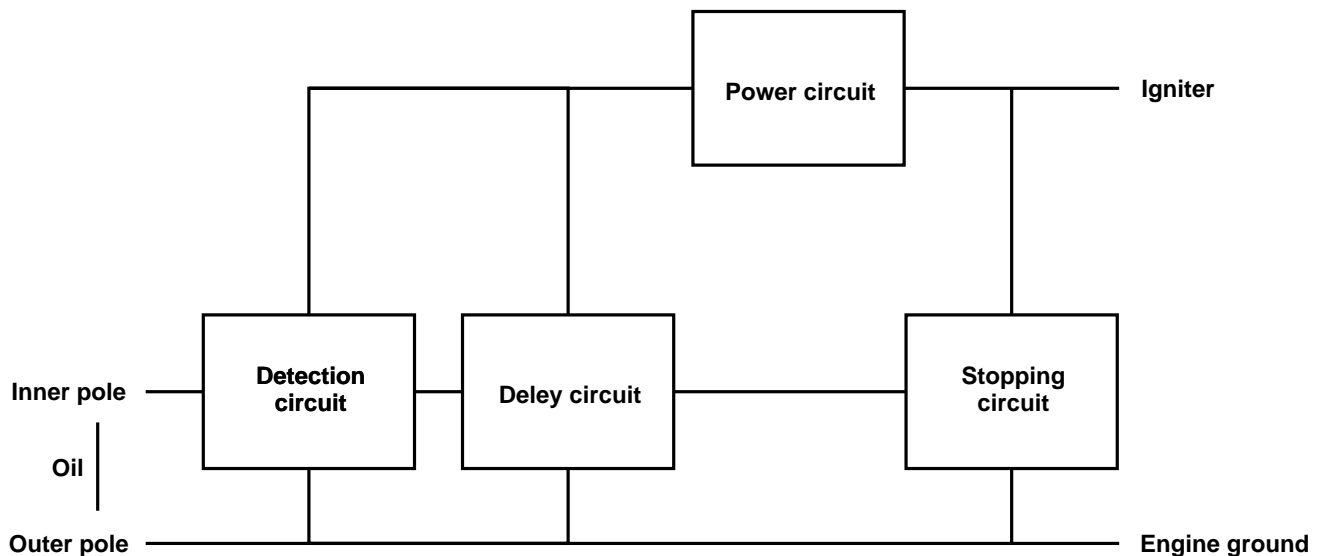


Fig. 5-15

- ① Power circuit ..... This rectifies a part of power to the igniter and regulates it to supply the stabilized power to necessary circuits.

- ② Detection circuit ..... This detects quantity of oil, sufficient or not, according to difference of electric resistance across inner and outer electrodes.
- ③ Delay circuit ..... This prevents the sensor from making an unnecessary stop of the engine by momentary lowering of the oil level due to the engine being slanted or affected by vibration in spite of sufficient oil in the crankcase.
- ④ Stopping circuit ..... This automatically stops the engine running.

#### **5-4-5 CAUTIONS TO BE TAKEN ON HANDLING THE SENSOR**

##### **(1) Oil sensor unit**

- ① Be sure not to damage each wire. Broken or short-circuited power supply wires and/or a grounding wire in particular may lead to malfunction or breakdown.
- ② The sensor is not interchangeable from engine to engine because the sensor is to be exclusively installed individually in each engine employed.

##### **(2) Mounting and wiring of oil sensor unit**

- ① Although this has been designed to have enough antinoise properties in practical use, do not route the sensor wirings in the vicinity of noise-generating sources such as ignition plugs or high voltage cords. This may cause malfunction or breakdown.
- ② Since capacity of power source is limited, current flown in the electronic circuit of the sensor is kept as low as possible. Be sure to use terminals with a high contact reliability of more than that of tinned terminals.

##### **(3) Operation of oil sensor**

- ① If operating with the engine kept tilted, oil surface inside of the engine varies and the correct oil level can not to be detected which in turn obstructs the preventing function of engine seizure. Operate the engine by keeping it level.
- ② When starting the engine with an insufficient oil in the crankcase, engine starts once then it stops automatically after it runs for 5 seconds.
- ③ When the engine has been stopped by the oil sensor, voltage remained in the electronic circuit prevents the sensor from being restarted for 3 seconds after the engine stop. Try to restart the engine after 3 seconds or more.

## 6. SAFETY PRECAUTIONS

### 1. Use extreme caution near fuel. A constant danger of explosion or fire exists.

Do not fill the fuel tank while the engine is running. Do not smoke or use open flame near the fuel tank. Be careful not to spill fuel when refueling. If spilt, wipe it and let dry before starting the engine.

### 2. Do not place inflammable materials near the generator.

Be careful not to put fuel, matches, gunpowder, oily cloth, straw, and any other inflammables near the generator.

### 3. Do not operate the generator in a room, cave or tunnel. Always operate in a well-ventilated area.

Otherwise the engine may overheat and also, the poisonous carbon monoxide contained in the exhaust gases will endanger human lives. Keep the generator at least 1 m (4 feet) away from structures or facilities during use.

### 4. Operate the generator on a level surface.

If the generator is tilted or moved during use, there is a danger of fuel spillage and a chance that the generator may tip over.

### 5. Do not operate with wet hands or in the rain.

Severe electric shock may occur. If the generator is wet by rain or snow, wipe it and thoroughly dry it before starting. Don't pour water over the generator directly nor wash it with water. If the generator is wet with water, the insulations will be adversely affected and may cause current leakage and electric shock.

### 6. Do not connect the generator to the commercial power lines.

This may cause a short-circuit or damage to the generator. Use a transfer switch (Optional parts) for connecting with indoor wiring.

*NOTE : The parts numbers of the transfer switches and of the plastic box to store them are as shown in Table 6-1.*

Part No.	Part Name	Q'ty	Phase	Allowable Current
365-45604-08	Transfer Switch	1	1	15 A
367-45605-08	Transfer Switch	1	1	30 A
340-45606-08	Transfer Switch	1	1	60 A
367-43008-08	Plastic Box	1	1	30 A
348-43009-08	Plastic Box	1	1	60 A

Table. 6-1

### 7. Be sure to check and remedy the cause of circuit breaker tripping before resetting it.

**CAUTION :** If the circuit breaker tripped off as a result of using an electrical appliance, the cause can be an overload or a short-circuit. In such a case, stop operation immediately and carefully check the electrical appliance and AC plugs for faulty wiring.

## 7. RANGE OF APPLICATIONS

Generally, the power rating of an electrical appliance indicates the amount of work that can be done by it. The electric power required for operating an electrical appliance is not always equal to the output wattage of the appliance. The electrical appliances generally have a label showing their rated voltage, frequency, and power consumption (input wattage). The power consumption of an electrical appliance is the power necessary for using it. When using a generator for operating an electrical appliance, the power factor and starting wattage must be taken into consideration.

In order to determine the right size generator, it is necessary to add the total wattage of all appliances to be connected to the unit.

Refer to the followings to calculate the power consumption of each appliance or equipment by its type.

### **(1) Incandescent lamp, heater, etc. with a power factor of 1.0**

Total power consumption must be equal to or less than the rated output of the generator.

**Example :** A rated 3000W generator can turn thirty 100W incandescent lamps on.

### **(2) Fluorescent lamps, motor driven tools, light electrical appliances, etc. with a smaller power factor**

Select a generator with a rated output equivalent to 1.2 to 2 times of the power consumption of the load. Generally the starting wattage of motor driven tools and light electrical appliances are 1.2 to 3 times larger than their running wattage.

**Example :** A rated 250 W electric drill requires a 400 W generator to start it.

*NOTE1 : If a power factor correction capacitor is not applied to the fluorescent lamp, the more power shall be required to drive the lamps.*

*NOTE2 : Nominal wattage of the fluorescent lamp generally indicates the output wattage of the lamp. Therefore, if the fluorescent lamp has no special indication as to the power consumption, efficiency should be taken into account as explained in Item (5) on the following page.*

### **(3) Mercury lamps with a smaller power factor**

Loads for mercury lamps require 2 to 3 times the indicated wattage during start-up.

**Example :** A 400 W mercury lamp requires 800 W to 1200 W power source to be turned on. A rated 3000 W generator can power two or three 400 W mercury lamps.

### **(4) Initially loaded motor driven appliances such as water pumps, compressors, etc.**

These appliances require large starting wattage which is 3 to 5 times of running wattage.

**Example :** A rated 900 W compressor requires a 4500 W generator to drive it.

*NOTE1 : Motor-driven appliances require the aforementioned generator output only at the starting. Once their motors are started, the appliances consume about 1.2 to 2 times their rated power consumption so that the excess power generated by the generator can be used for other electrical appliances.*

*NOTE2 : Motor-driven appliances mentioned in items (3) and (4) vary in their required motor starting power depending on the kind of motor and start-up load. If it is difficult to determine the optimum generator capacity, select a generator with a larger capacity.*

### (5) Appliances without any indication as to power consumption

Some appliances have no indication as to power consumption; but instead the work load (output) is indicated. In such a case, power consumption is to be worked out according to the numerical formula mentioned below.

$$\frac{(\text{Output of electrical appliance})}{(\text{Efficiency})} = (\text{Power consumption})$$

Efficiencies of some electrical appliances are as follows :

Single-phase motor ..... 0.6 to 0.75  
Fluorescent lamp ..... 0.7 to 0.8

( The smaller the motor, the  
lower the efficiency. )

**Example 1:** A 40W fluorescent lamp means that its luminous output is 40W. Its efficiency is 0.7 and accordingly, power consumption will be  $40 \div 0.7 = 57\text{W}$ . As explained in Item (2), multiply this power consumption value of 57 W by 1.2 to 2 and you will get the figure of the necessary capacity of a generator. In other words, a generator with a rated output of 1000W capacity can light nine to fourteen 40 W fluorescent lamps.

**Example 2 :** Generally speaking, a 400 W motor means that its work load is 400 W. Efficiency of this motor is 0.7 and power consumption will be  $400 \div 0.7 = 570\text{ W}$ . When this motor is used for a motor-driven tool, the capacity of the generator should be multiple of 570 W by 1.2 to 3 as explained in the Item (3).  $570\text{ (W)} \times 1.2\text{ to }3 = 684\text{ (W) to }1710\text{ (W)}$

Frequency	50 Hz	60 Hz
Incandescent lamp, heater, etc.	5500 W	6000 W
Fluorescent lamp, Motor-driven tool, general-purpose	approx. 2800 W	approx. 3000 W
Mercury lamp, etc.	approx. 1800 W	approx. 2000 W
Pump, compressor, etc.	approx. 1300 W	approx. 1400 W

Table. 7-1

**NOTES : Wiring between generator and electrical appliances**

**1. Allowable current of cable**

Use a cable with an allowable current that is higher than the rated input current of the load (electrical appliance). If the input current is higher than the allowable current of the cable used, the cable will become excessively heated and deteriorate the insulation, possibly burning it out. Table 7-2 shows cables and their allowable currents for your reference.

**2. Cable length**

If a long cable is used, a voltage drop occurs due to the increased resistance in the conductors decreasing the input voltage to the load (electrical product). As a result, the load can be damaged. Table 7-2 shows voltage drops per 100 meters of cable.

Sectional area / mm <sup>3</sup>	Allowable current / A	Gauge No./ wire element No./ mm	Resistance Ohm / 100 m	Voltage drop per 100 m						
				1 A	3 A	5 A	8 A	10 A	12 A	15 A
0.75	7	30 / 0.18	2.477	2.5 V	8 V	12.5 V				
1.25	12	50 / 0.18	1.486	1.5 V	5 V	7.5 V	12 V	15 V	18 V	
2.0	17	37 / 0.26	0.952	1.0 V	3 V	5.0 V	8 V	10 V	12 V	15 V
3.5	23	45 / 0.32	0.517		1.5 V	2.5 V	4 V	5 V	6.5 V	7.5 V
5.5	35	70 / 0.32	0.332		1 V	2 V	2.5 V	3.5 V	4 V	5 V

Table. 7-2

Voltage drop indicates as  $V = \frac{1}{100} \times R \times I \times L$

R means resistance ( / 100 m) on the above table.

I means electric current through the wire (A).

L means the length of the wire (m).

The length of wire indicates round length, it means twice the length from generator to electrical tools.

## 8. MEASURING PROCEDURES

### 8-1 MEASURING INSTRUMENTS

#### 8-1-1 CUMMINS ONAN GENERATOR TESTER

The Cummins Onan generator tester is exclusively designed for fast, easy diagnosis and repair of Cummins Onan generators. The Cummins Onan generator test has the following features :

- (1) Functions of voltmeter, frequency meter, megger tester, capacitance meter and circuit tester are combined in one unit.
- (2) Fast and easy readout by digital indicator.
- (3) Built-in automatic battery checker indicates the time to change batteries.
- (4) Tester and accessories are installed in a handy, sturdy case for easy carrying.

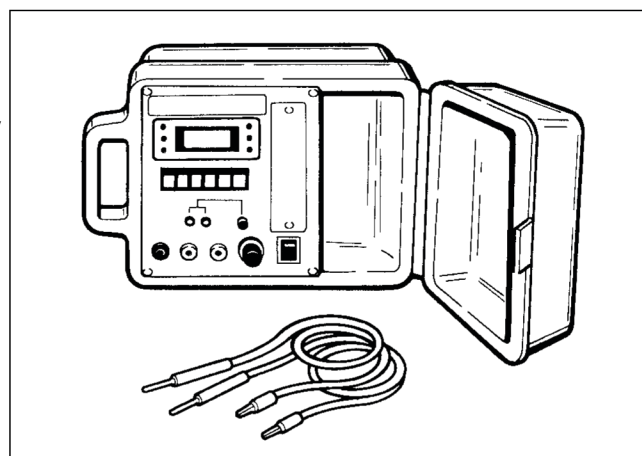


Fig. 8-1

#### \* SPECIFICATIONS

MODEL		Tester
Part Number		388-47565-08
Measuring Range	Voltage	0 to 500 V AC
	Frequency	25 to 70 Hz
	Resistance	0.1 to 1.999 $\Omega$
	Condenser Capacity	10 to 100 $\mu$ F
	Insulation Resistance	3M $\Omega$
Circuit Protector		Fuse
Power Source		2 x 6F44P (006P) Dry Cell Battery
Accessories		Test leads with needle probes . . . 1 set Test leads with jack plugs . . . 1 set
Dimensions (L x W x H)		285 mm x 200 mm x 110 mm
Weight		1.6 kg

Table. 8-1

The Cummins Onan generator tester can be ordered from Cummins Onan generator distributors by the following part number.

**Cummins Onan Part Number : 388-47565-08**

If you do not have a Cummins Onan generator tester, use the instruments described in the following section for checking generator parts.



## 8-1-2 INSTRUMENTS

### (1) VOLTMETER

AC voltmeter is necessary. The approximate AC voltage ranges of the voltmeters to be used for various types of generators are as follows:

0 to 150V : Type with an output voltage of 110 or 120V

0 to 300V : Type with an output voltage of 220, 230 or 240V

0 to 150V, 0 to 330V : Dual voltage type

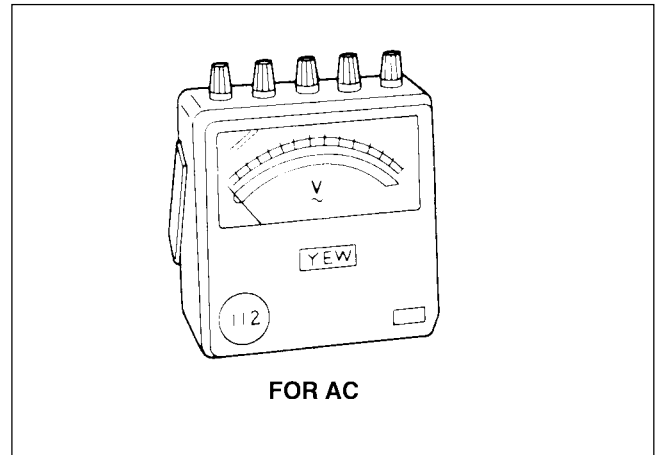


Fig. 8-2

### (2) AMMETER

AC ammeter is necessary. An AC ammeter with a range that can be changed according to the current rating of a given generator is most desirable. (About 10A, 20A, 100A)

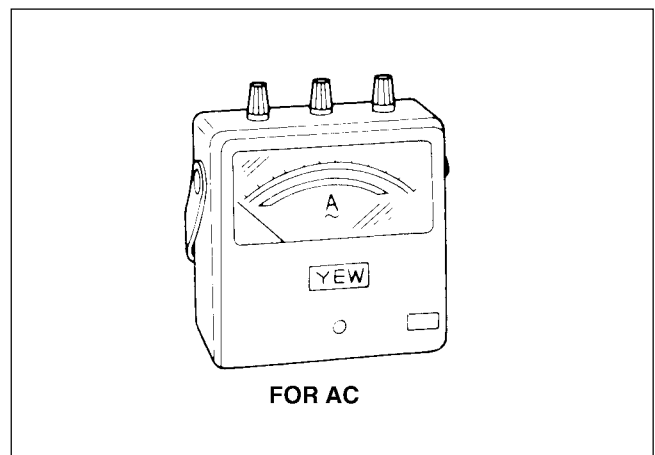


Fig. 8-3

### (3) FREQUENCY METER

Frequency range : About 45 to 65Hz

*NOTE : Be careful of the frequency meter's input voltage range.*

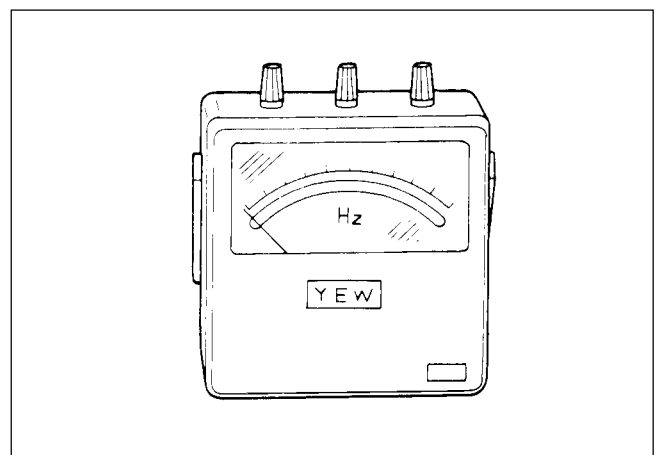
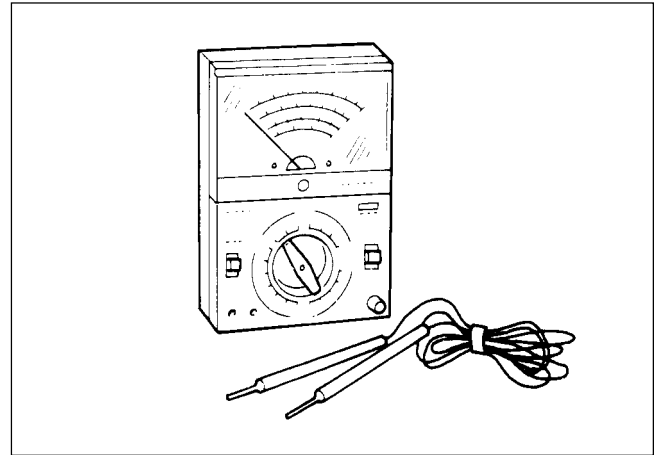


Fig. 8-4

(4) CIRCUIT TESTER

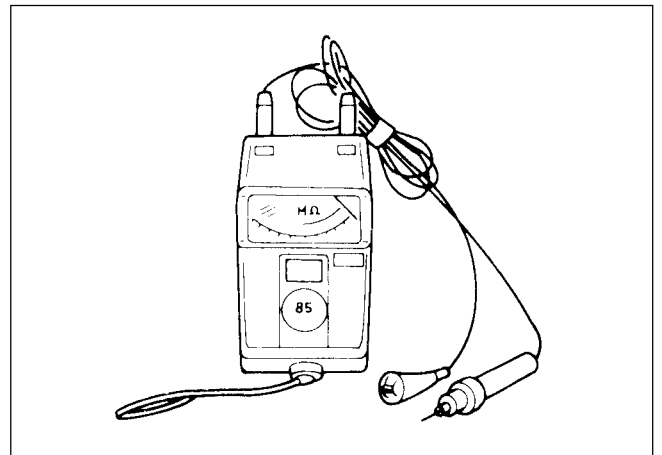
Used for measuring resistance, etc.



*Fig. 8-5*

(5) MEGGER TESTER

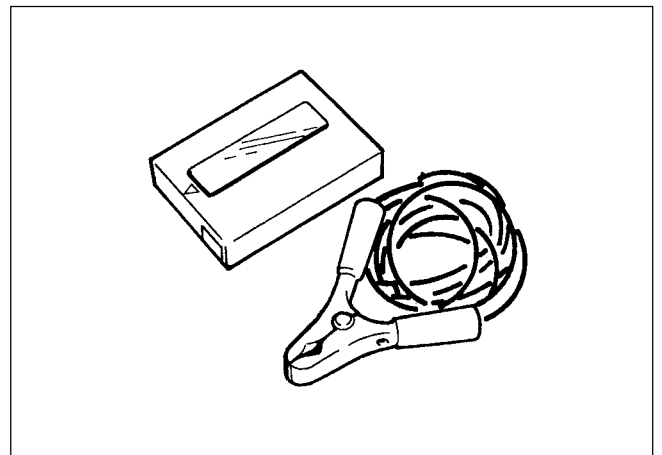
Used for measuring generator insulation resistance. Select one with testing voltage range of 500V.



*Fig. 8-6*

(6) TACHOMETER

Use the contactless type tachometer.



*Fig. 8-7*

## 8-2 AC OUTPUT MEASURING

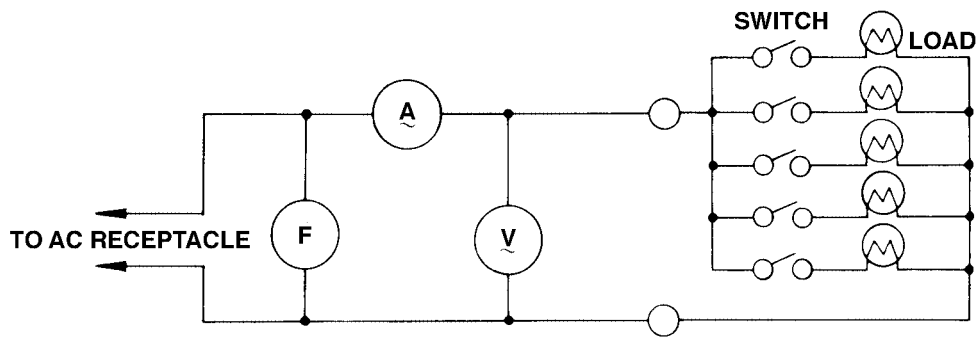


Fig. 8-8

Use a circuit like the one shown in Fig.8-8 for measuring AC output. A hot plate or lamp with a power factor of 1.0 may be used as a load. Adjust the load and rpm. and check that the voltage range is as specified in Table 8-2 at the rated amperage and rated rpm.

Rated voltage	110 V	120 V	220 V	240 V
Voltage range	103 -117 V	112 -128 V	(50Hz) 210 -240 V (60Hz) 205 -235 V	224 - 256 V

Table. 8-2

## 8-3 DC OUTPUT MEASURING

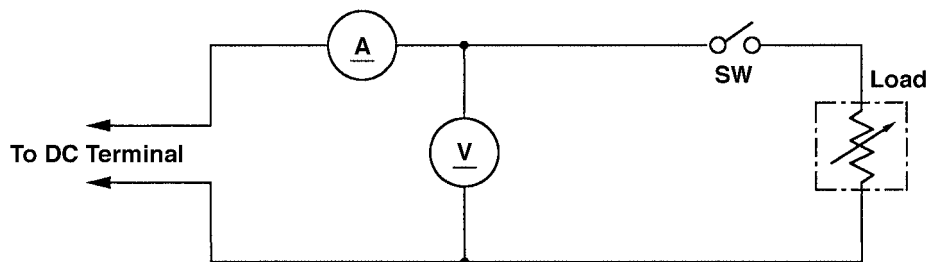


Fig. 8-9

Measurement of DC output is executed with the switch turned ON while the current is regulated at 8.3A by adjusting the load to the generator. If the voltage is within the range from 6V to 14V, the voltage output is normal.

*NOTE : If a battery is connected as a load to the generator, the DC output voltage will increase by approximately 1 to 2 V. Therefore, carefully observe the electrolyte level and do not overcharge the battery.*

## 8-4 MEASURING INSULATION RESISTANCE

Use a Cummins Onan generator tester in megger tester mode or use a megger tester to check the insulation resistance. Remove the control panel, and disconnect the connector of GREEN lead for ground. Connect a megger tester to one of receptacle output terminals and the ground terminal, then measure the insulation resistance. An insulation resistance of 1 megohm or more is normal. (The original insulation resistance at the time of shipment from the factory is 10 megohm or more.) If it is less than 1 megohm, disassemble the generator and measure the insulation resistance of the stator, rotor and control panel individually.

*NOTE : Turn on the no-fuse breaker before measurement.*

### \* STATOR

- (1) Measure the insulation resistance between BLUE lead and the core.
- (2) Measure the insulation resistance between WHITE lead and the core.
- (3) Measure the insulation resistance between BROWN lead and the core.

### \* ROTOR

Measure the insulation across one of the soldered terminals of the rotor and the core.

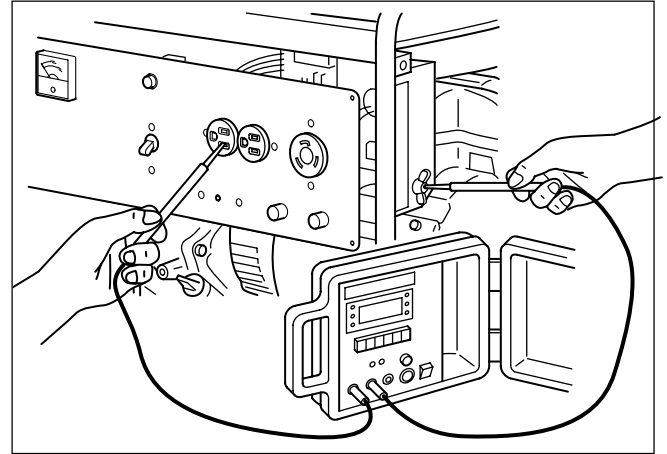


Fig. 8-10

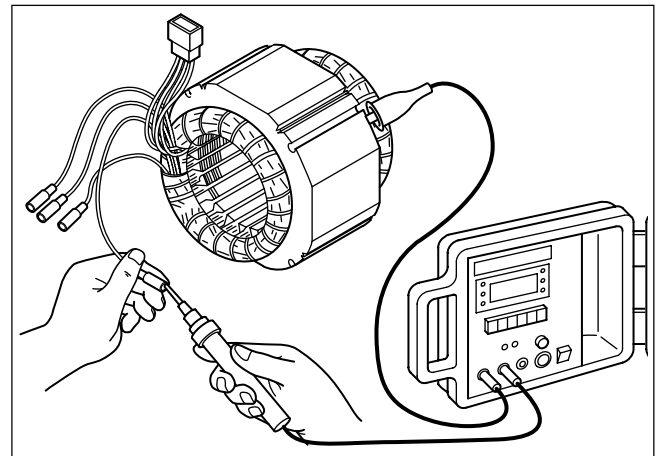


Fig. 8-11

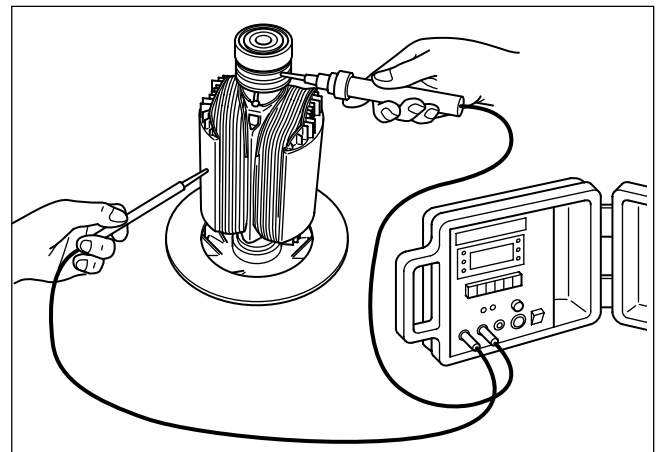
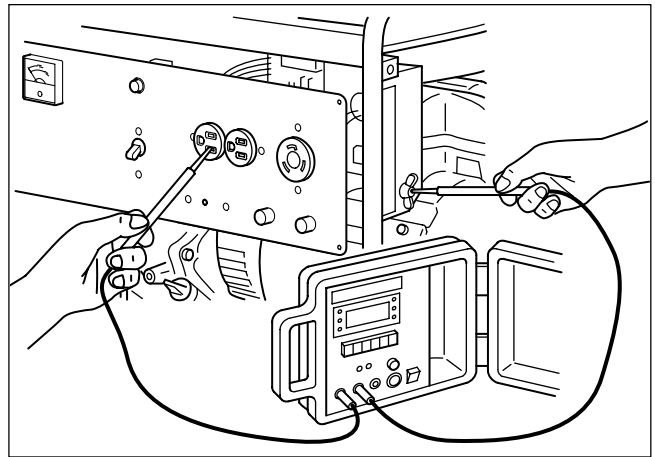


Fig. 8-12

**\* CONTROL PANEL**

Measure the insulation resistances between the live parts and the grounded parts.



*Fig. 8-13*

Any part where the insulation resistance is less than 1M has faulty insulation, and may cause electric leakage and electric shock.

Replace the faulty part.

## 9. CHECKING FUNCTIONAL MEMBERS

### 9-1 VOLTMETER

Check the voltmeter if it is turned on by applying specific voltage. Voltmeter cannot be checked with circuit tester because its resistance is too large.

- ① Check that no disconnection nor short-circuit occurs with a tester, and the internal resistance is around 00k ohms normally.
- ② Turn on the commercial power supply input and check the indication.

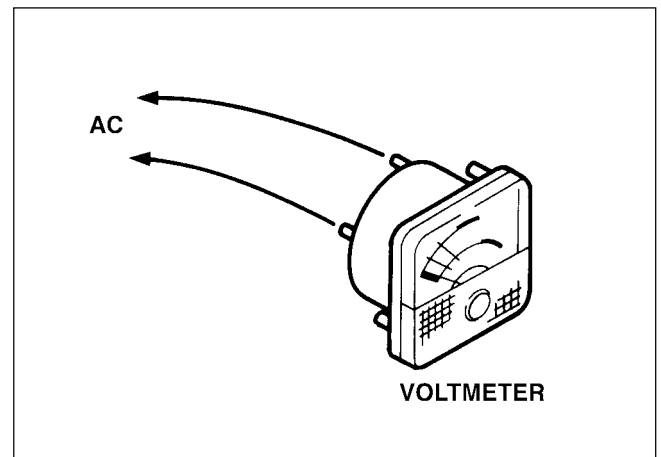


Fig. 9-1

### 9-2 AC RECEPTACLES

Using a Cummins Onan or a circuit tester, check continuity between the two terminals at the rear of the AC receptacles while the receptacle is mounted on the control panel. When continuity is found between the output terminals of the receptacle with a wire connected across these terminals, the AC receptacle is normal. When the wire is removed and no continuity is found between these terminals, the receptacles are also normal.

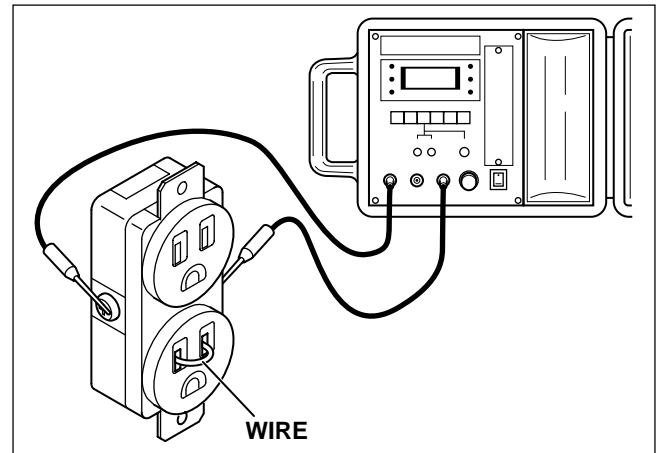


Fig. 9-2

### 9-3 No-FUSE BREAKER

Check continuity between each of two terminals at the rear of the no-fuse breaker while it is mounted on the control panel. Normally, there is continuity between each of the two when the no-fuse breaker is on while there is no continuity when the no-fuse breaker is off.

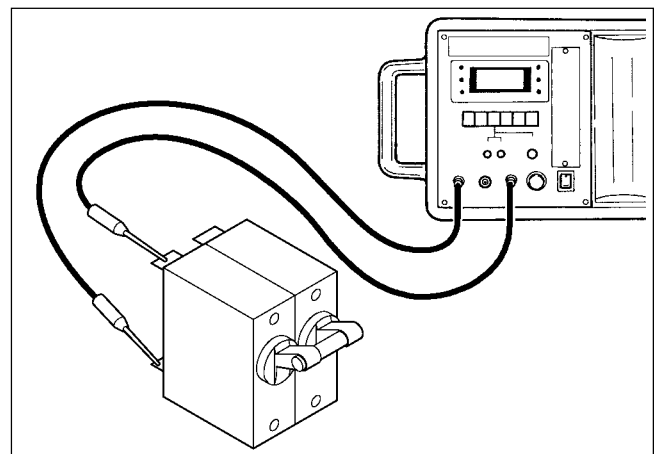


Fig. 9-3

9-4 STATOR

Disengage connectors on the wires from stator and check the resistance between wires with a Cummins Onan or a circuit tester referring to the following table.

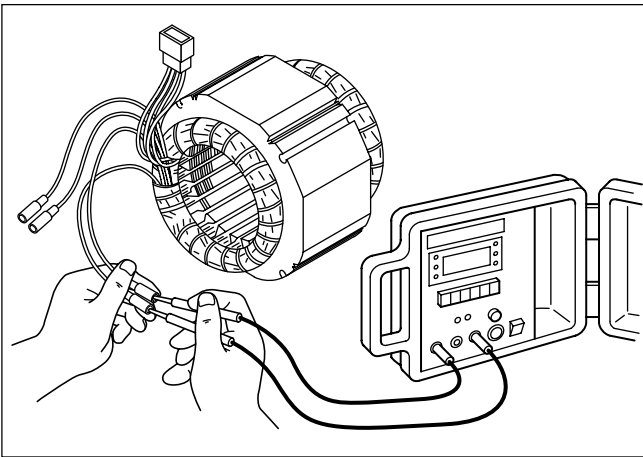


Fig. 9-4

Hz-Voltage	Stator coil			DC coil
	Red-White	Black-Blue	White/Light green	Brown/Brown
50-110 ~ 240	0.22	0.21	0.79	0.13
60-120 / 240	0.16	0.16	0.61	0.11

Table. 9-1

*NOTE : If the circuit tester is not sufficiently accurate, it may not show the values given and may give erroneous readings. Erroneous readings will also occur when there is a wide variation of resistance among coil windings or when measurement is performed at ambient temperatures different from 20 °C (68 °F).*

9-5 ROTOR ASSEMBLY

1) Field coil

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

Resistance
7.26

*NOTE : If the circuit tester is not sufficiently accurate, it may not show the values given and may give erroneous readings.*

*Erroneous reading will also occur when there is a wide variation of resistance among coil windings or when measurement is performed at ambient temperatures different from from 20 °C (68 °F).*

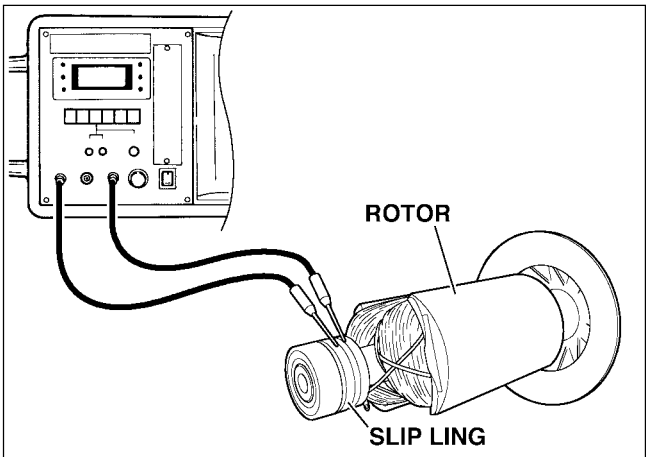


Fig. 9-5

## 2) Cleaning Slip Rings

The slip ring surfaces must be uniformly bright. Slip rings showing black spots, excessive wear, or uneven wear must be repaired. A stained slip ring lowers generator efficiency and output voltage. Polish the slip rings with fine sandpaper while turning the rotor until rough spots disappear. Care should be taken not to touch the rotor coils with the sandpaper.

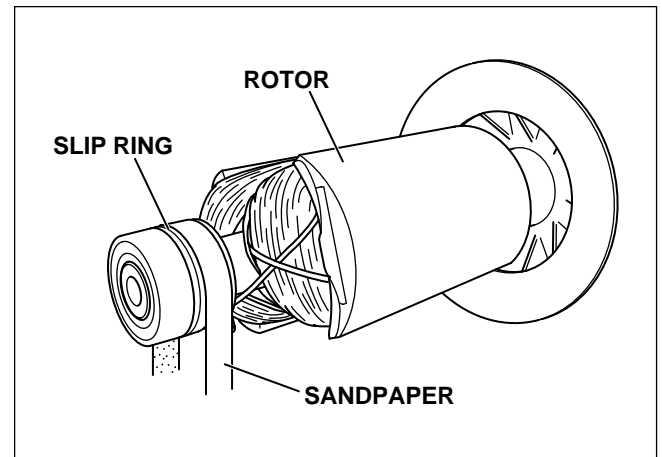


Fig. 9-6

## 9-6 BRUSH

The brushes must be smooth where they contact the slip rings. If not, polish smooth the brushes with sandpaper. A brush that is not smooth produces arcs between the brush and slip ring leading to possible damage. Usable brush lengths are from 5 mm to 15 mm (0.2 " to 0.6").

A brush shorter than 5 mm must be replaced because decreased contact pressure between the brush and slip ring lowers generator efficiency and output voltage.

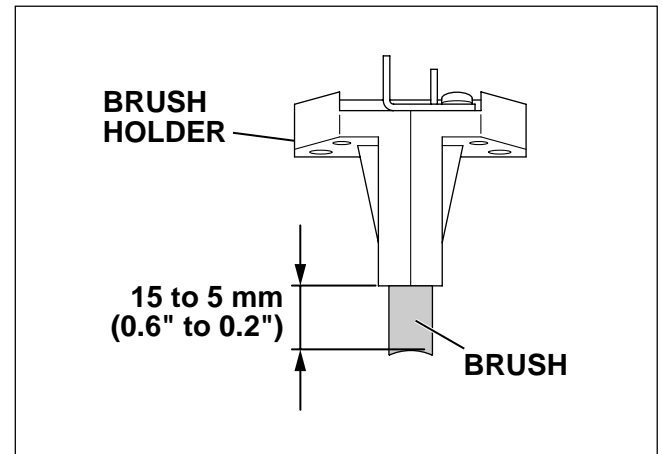


Fig. 9-7

## 9-7 A.V.R (AUTOMATIC VOLTAGE REGULATOR)

### 1) Features

This AVR operates to control the field current in order to maintain the output voltage for the AC current, which generated by the magnetic flux by the field coil.

2) A.V.R. trouble may be identified by simply looking at the A.V.R., or by the inter-lead resistance with a tester, or actually mounting it in the generator and operating it.

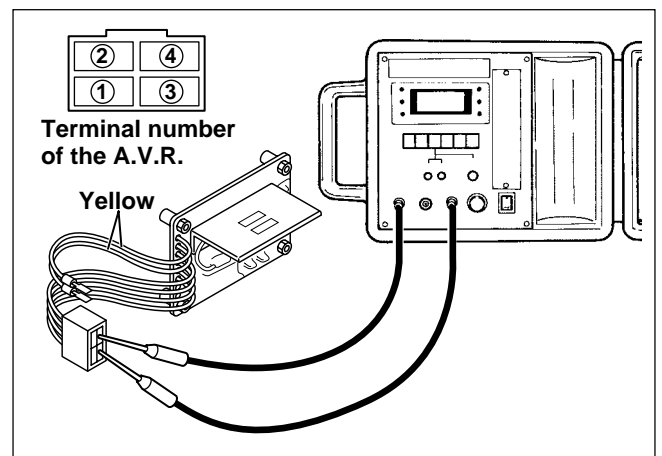


Fig. 9-8



(a) A.V.R. TROUBLE IDENTIFICATION by APPEARANCE

If an A.V.R. electronic part is burnt dark, or the surface epoxy resin melted, it often indicates A.V.R. trouble.

(b) IDENTIFYING A.V.R. TROUBLE by CHECKING INTER-LEAD RESISTANCE

Check the inter-lead resistance of the A.V.R. with a tester, referring to the following table.

If the tester readings vary greatly from the values specified in the table on next page, the A.V.R. is faulty.

*NOTE : Take tester inaccuracy into account in reading the tester*

(c) IDENTIFYING A.V.R. TROUBLE by MOUNTING and OPERATING in THE GENERATOR

SCR or transistor damage cannot be detected by simply looking at the A.V.R. or checking the lead resistance. Check it by mounting the suspectedly faulty A.V.R. in a normal generator, or mount a normal A.V.R. in a generator which fails to generate voltage.

**\* Checking table for analogue circuit tester.**

Analogue circuit tester		Apply black (minus) needle of the circuit tester				
		Yellow	Red	White	Light green	Brown or Yellow
Apply red (plus) needle of the circuit tester	Yellow	—	$\infty$	$\infty$	$\infty$	$\infty$
	Red	$\infty$	—	105 k $\Omega$	$\infty$	200 k $\Omega$
	White	$\infty$	46 k $\Omega$	—	$\infty$	100 k $\Omega$
	Light green	7.5 k $\Omega$	250 k $\Omega$	130 k $\Omega$	—	6 k $\Omega$
	Brown or Yellow	$\infty$	200 k $\Omega$	100 k $\Omega$	$\infty$	—

Table. 9-2

# 9-8 DIODE RECTIFIER

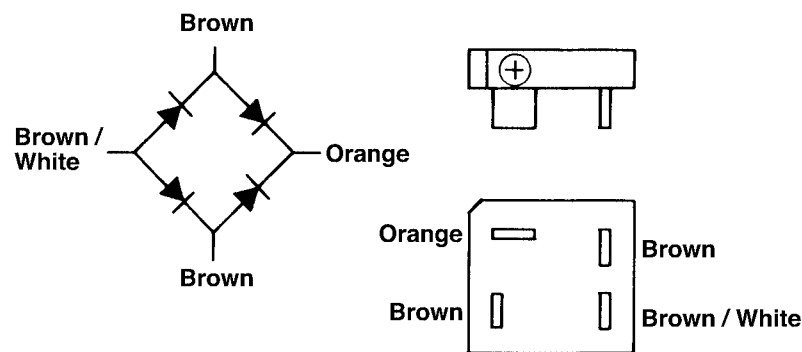


Fig. 9-9

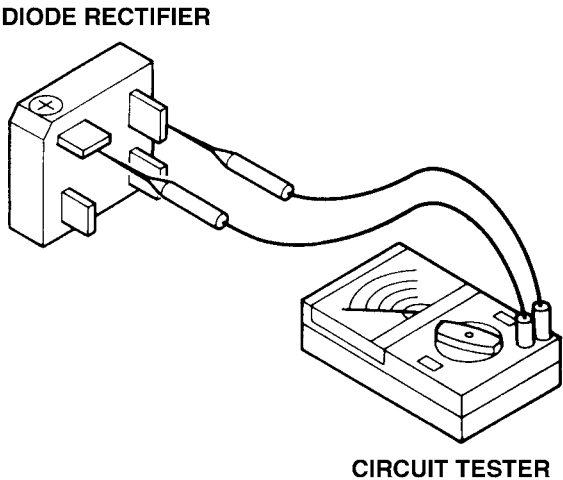


Fig. 9-10

Circuit inside of the diode rectifiers is as shown in Fig. 9-10. Check continuity between each terminal by using a circuit tester as shown in Fig. 9-11. The rectifier is normal when conditunity is as follows:

\* Checking table for analogue circuit tester.

Analogue circuit tester		Apply black (minus) needle of the circuit tester			
		Brown	Brown	Orange	Brown / White
Apply red (plus) needle of the circuit tester	Brown	—	No continuity	No continuity	Continuity
	Brown	No continuity	—	No continuity	Continuity
	Orange	Continuity	Continuity	—	Continuity
	Brown / White	No continuity	No continuity	No continuity	—

Table. 9-3-1

\* Checking table for digital circuit tester.

Digital circuit tester		Apply red (plus) needle of the circuit tester			
		Brown	Brown	Orange	Brown / White
Apply black (minus) needle of the circuit tester	Brown	—	No continuity	No continuity	Continuity
	Brown	No continuity	—	No continuity	Continuity
	Orange	Continuity	Continuity	—	Continuity
	Brown / White	No continuity	No continuity	No continuity	—

Table. 9-3-2

*NOTE 1 : Because of the difference of measuring method between the analogue circuit tester and the digital circuit tester, polarity of tester needles should be reversed.*

*NOTE 2 : "Continuity" means forward direction characteristics of the diode, and different from short circuit condition (in which a pointer of the tester goes out of its normal scale), shows resistance to some extent. When results of the checking indicates failure even in one section, replace with a new one.*

*NOTE 3 : Simpson brand analogue testers have the characteristics as same as the digital circuit tester.*

## 9-9 OIL SENSOR

- (1) Disconnect two (2) wires coming from the sensor at the connection.
- (2) Loosen the sensor to remove it from the engine.
- (3) Plug the opening of oil filler hole (created after sensor is removed) with suitable means such as oil gauge.
- (4) Connect the removed wires again with the oil sensor.
- (5) Start the engine with the oil sensor removed and confirm if ;
  - a. Engine stops after 5 seconds which is normal, or
  - b. Engine does not stop after more than 10 seconds which is unusual.

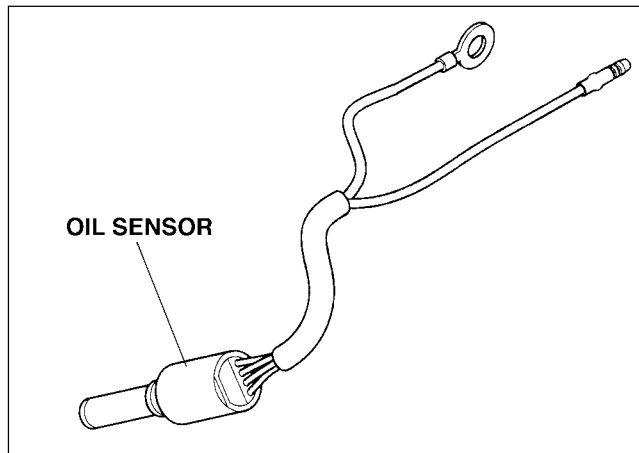


Fig. 9-11

*NOTE : The sensor will not operate properly when wire is broken or poorly connected. Check the wires for correct connection. If it fails to stop within 5 seconds after the wirings have been checked, the sensor is wrong. Replace the sensor with new one.*

## 9-10 EXCITING COIL

- (1) Disconnect two (2) yellow wires which come out from the exciting coil through the hole of the crankcase and connected with AVR in the control box .
- (2) Check the resistance between these two (2) yellow wires with a circuit tester.

Resistance
2.4

## **10. DISASSEMBLY AND ASSEMBLY**

### **10-1 PREPARATION and PRECAUTIONS**

- 1) Be sure to memorize the location of individual parts when disassembling the generator so that the generator can be reassembled correctly. Tag the disassembled part with the necessary information to facilitate easier and smoother reassembly.
- 2) For more convenience, divide the parts into several groups and store them in boxes.
- 3) To prevent bolts and nuts from being misplaced or installed incorrectly, replace them temporarily to their original position.
- 4) Handle disassembled parts with care; clean them before reassembly using a neutral cleaning fluid.
- 5) Use all disassembly/assembly tools properly, and use the proper tool for each specific job.

## 10-2 DISASSEMBLY PROCEDURES

Step	Part to remove	Description	Remarks	Tool
1	Control box	(1) Take off the eight screws and remove the control panel from the control box. (See Fig. 10-1.) 5 x 12 mm screw and washer Ass'y (black) . . . 8 pcs.		Screw driver (+)
		(2) Disconnect the connectors on the wiring from the control box to the alternator.		
		(3) Take off the bushing from the back of the control box. (See Fig. 10-2.)	Press the upper end of the bushing and pull out.	

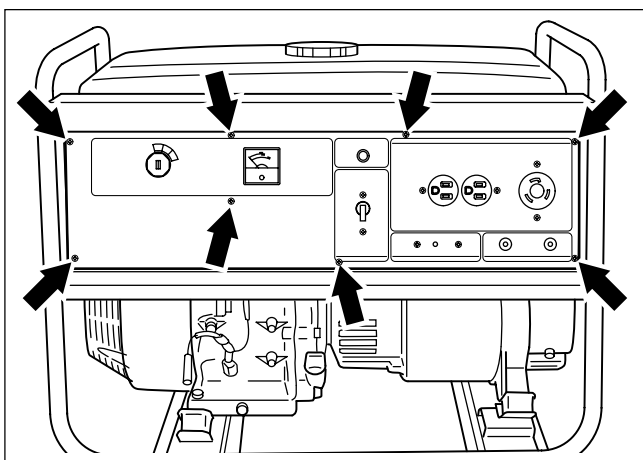


Fig. 10-1

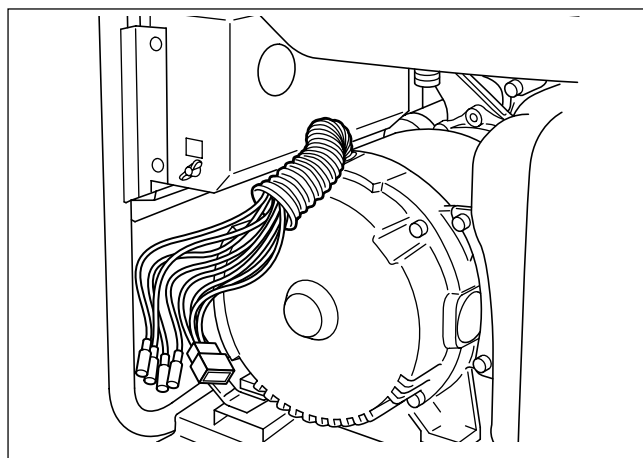


Fig. 10-2

- (4) Take off the flange four bolts and remove the control box from the frame. (See Fig. 10-3-1.)  
(5) Disconnect the connectors on the wiring between from the control box and the engine. (See Fig. 10-3-2.)

10 mm box wrench

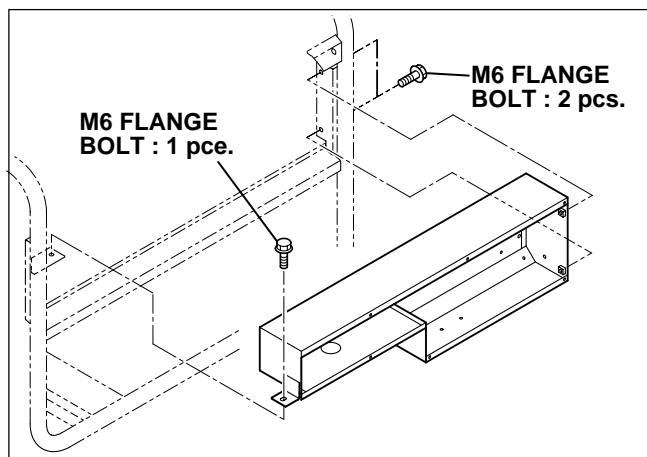


Fig. 10-3-1

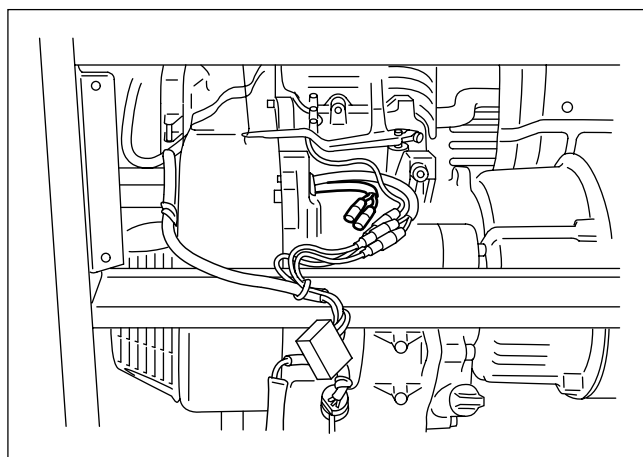
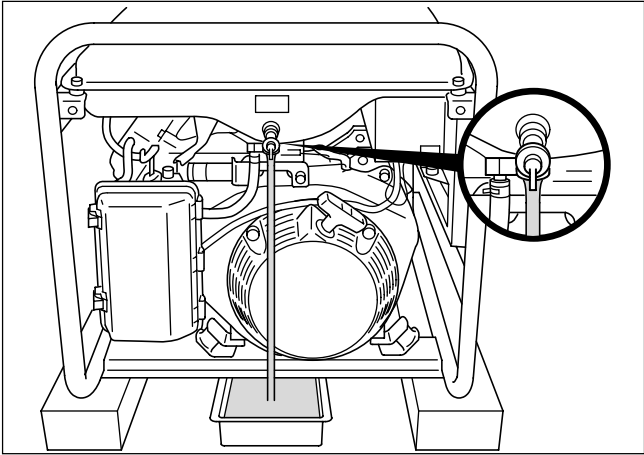
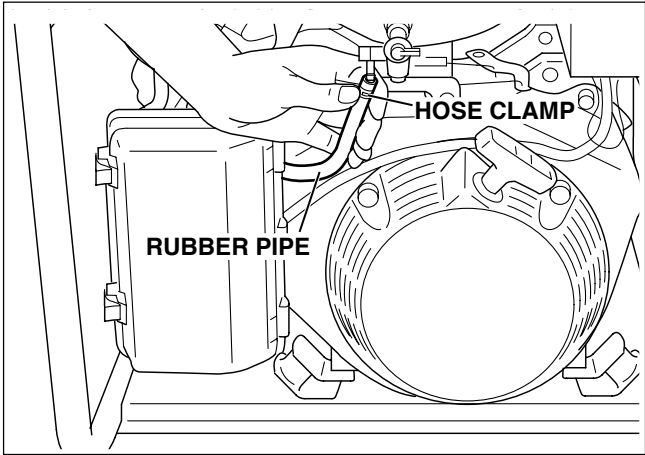
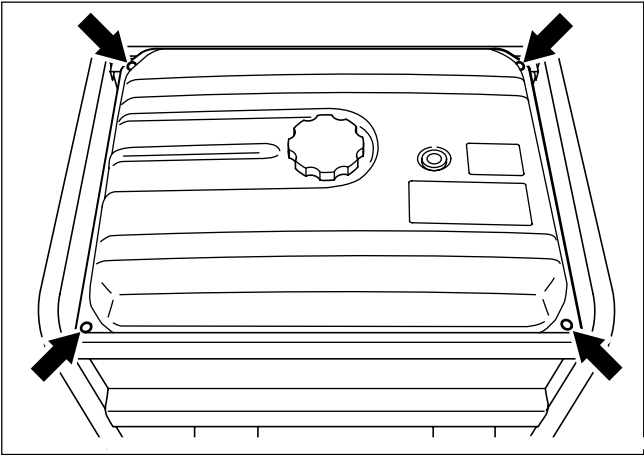


Fig. 10-3-2

Step	Part to remove	Description	Remarks	Tool
2	Fuel Tank	<p>(1) Discharge fuel from the tank.</p> <p>1. Shut the fuel strainer.</p> <p>2. Remove the strainer cup.</p> <p>3. Put a vessel to receive fuel under the strainer and open the fuel cock to discharge fuel. (See Fig. 10-4.)</p> <p>4. Attach the strainer cup to the strainer body.</p>	<p>Use utmost care about fire hazard.</p> <p>Wipe off split fuel thoroughly.</p> <p>Do not lose the filter screen.</p>	
		 <p><i>Fig. 10-4</i></p>		
		<p>(2) Disconnect rubber pipe from the strainer. Loosen the hose clamp on the top of the strainer and pull out the rubber pipe from the strainer.</p>		Pliers
		<p>(3) Remove the rear plate.</p>		12 mm spanner or box wrench
		<p>(4) Take off the four bolts and rubber (fuel tank) and then remove the fuel tank. (See Fig. 10-6.)</p>		10 mm spanner or box wrench
<div style="display: flex; justify-content: space-around; align-items: flex-end;"> <div style="text-align: center;">  <p><i>Fig. 10-5</i></p> </div> <div style="text-align: center;">  <p><i>Fig. 10-6</i></p> </div> </div>				

Step	Part to remove	Description	Remarks	Tool
3	Muffler and Muffler cover	<p>(1) Remove the muffler cover from the muffler.</p> <p>6 x 10 mm bolt and washer Ass'y . . . 4 pcs. (See Fig. 10-7.)</p>		12 mm spanner or box wrench
		<p>(2) Remove the two bolts which fix the muffler to the rear cover. Loosen the two bolts on the muffler flange and remove the muffler from the engine.</p> <p>8 x 20 mm bolt and washer Ass'y . . . 2 pcs. 8 mm spring washer . . . 2 pcs. Muffler gasket . . . 1 pce.</p>		10 mm spanner or box wrench

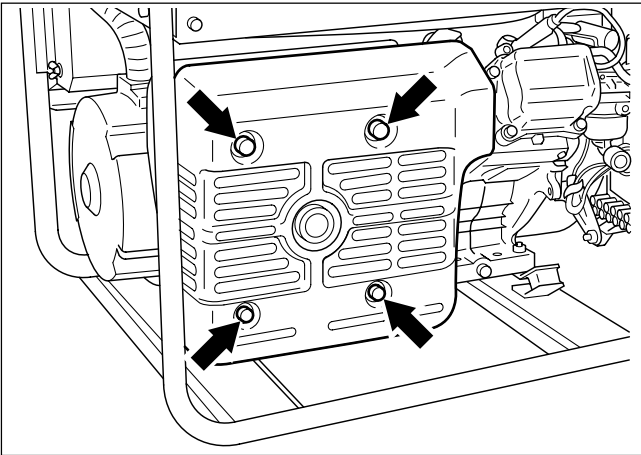


Fig. 10-7

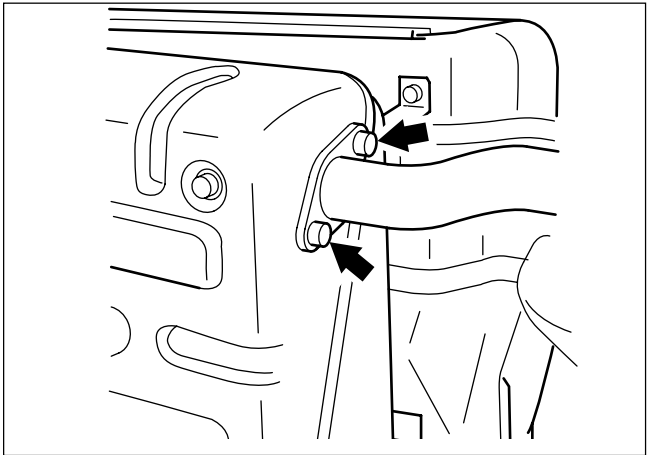


Fig. 10-8

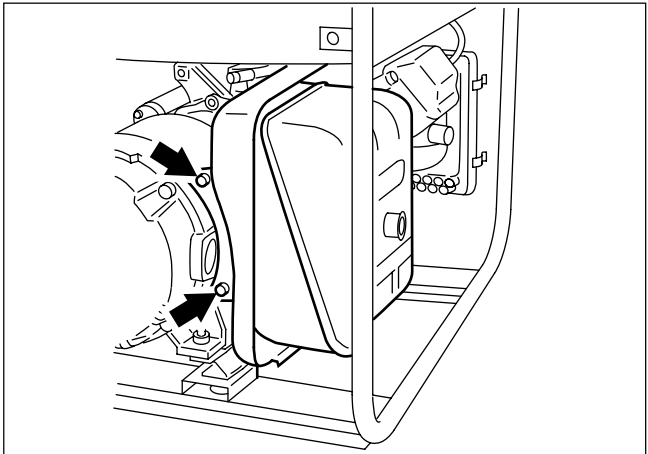
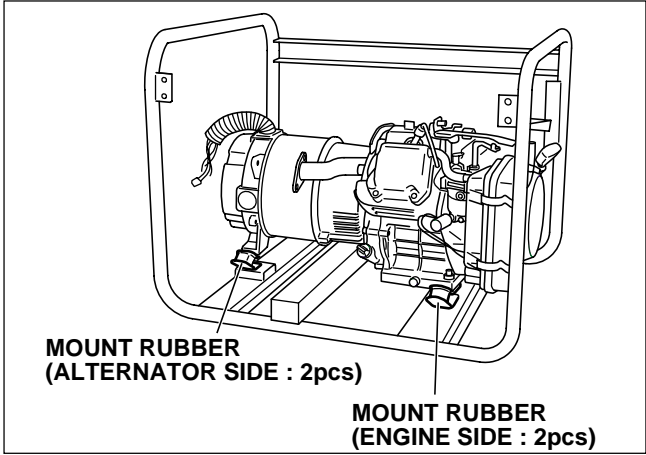
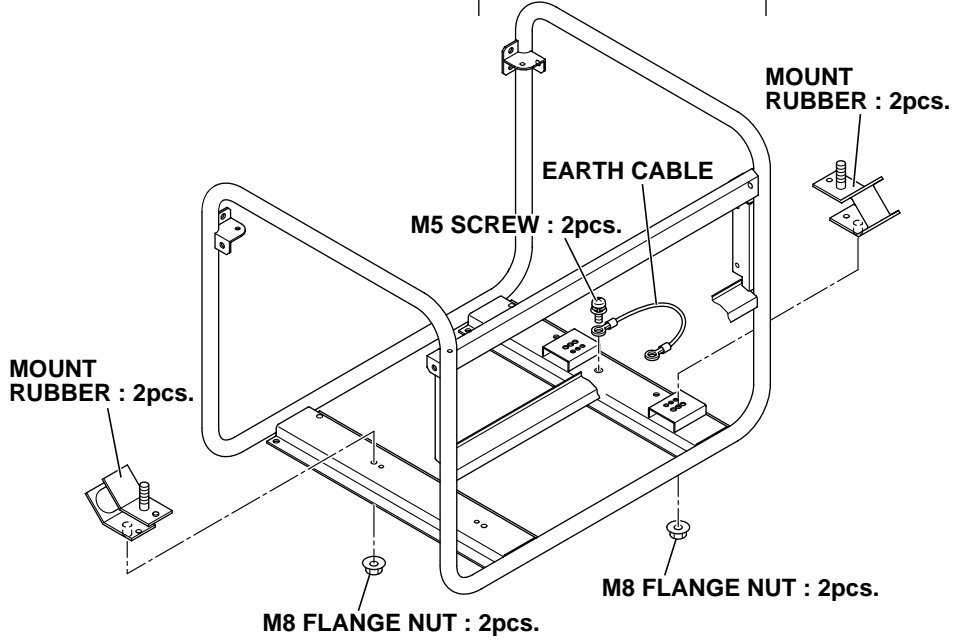


Fig. 10-9

Step	Part to remove	Description	Remarks	Tool
4	Pipe Frame	(1) Remove the nuts which are fixing engine and alternator to the mount rubbers. (See Fig. 10-10.)		12 mm spanner
		(2) Using a chain-block, sling up the engine and alternator and dismount from the frame.   <i>Fig. 10-10</i>	Remove the air cleaner cover for dismounting.	
		(3) Remove the mount rubbers from the frame. Loosen the nuts on the bottom side of the frame. (See Fig. 10-11.)  M8 flange nut . . . 4 pcs.		12 mm spanner or socket wrench
		 <i>Fig. 10-11</i>		



Step	Part to remove	Description	Remarks	Tool
5	Brush and Rear cover	(1) Remove the brush holder. (See Fig. 10-12.) 6 screw . . . 2 pcs.		
		(2) Remove the four bolts which fasten the rear cover to the front cover. (See Fig. 10-13.) 6 bolt . . . 4 pcs.		10 mm spanner or box wrench

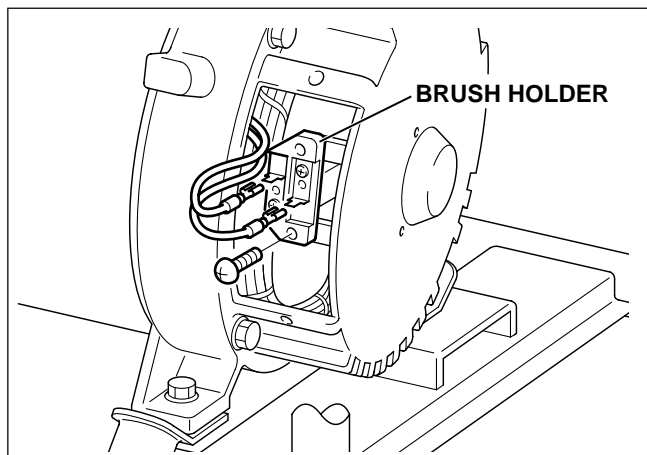


Fig. 10-12

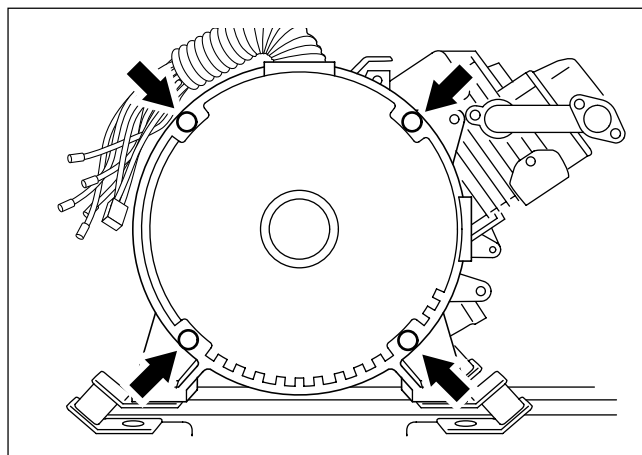


Fig. 10-13

(3) Remove the rear cover by hitting on the legs of rear cover with a plastic hammer to loosen.

Do not give a strong hit on the boss or legs.

Plastic hammer

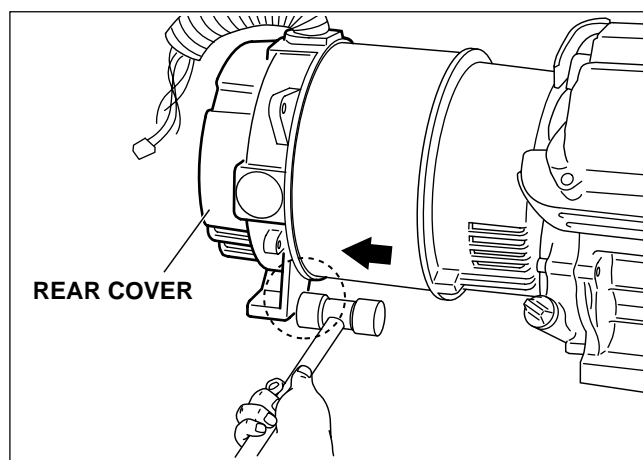
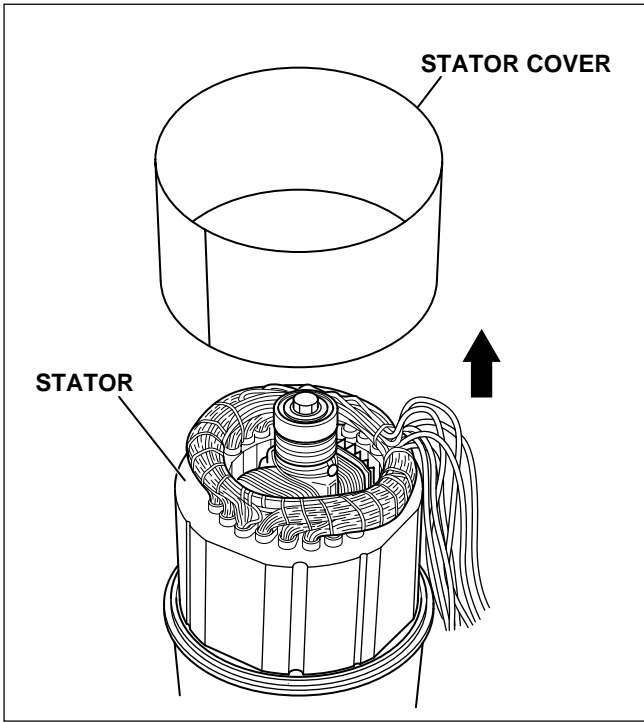
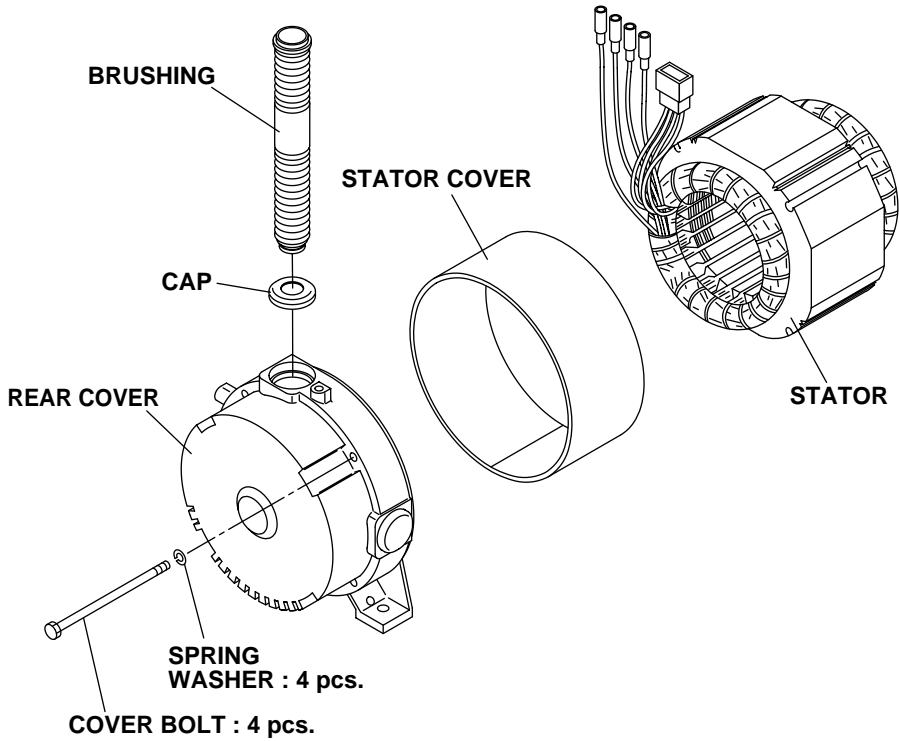
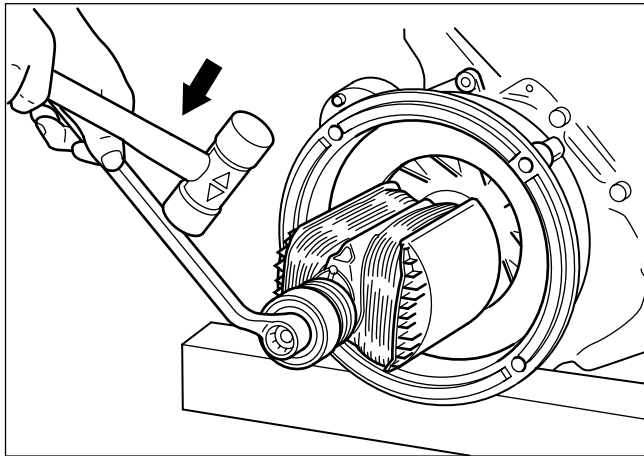
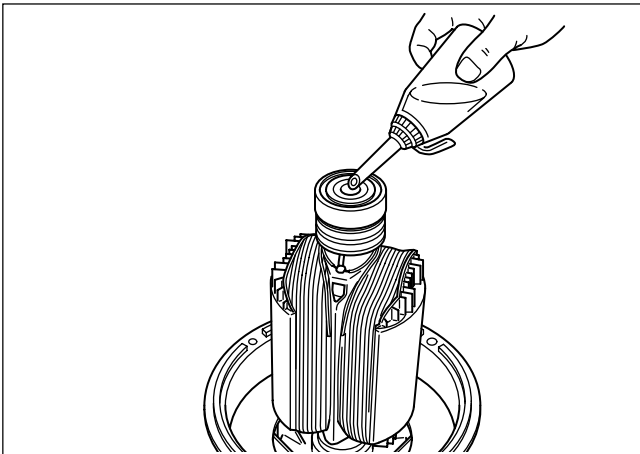
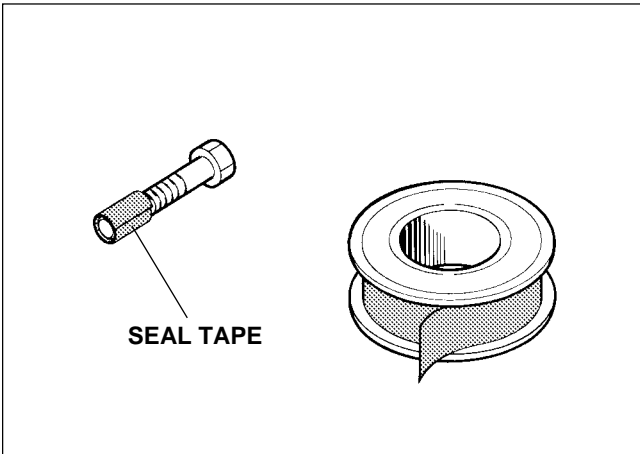


Fig. 10-14

Step	Part to remove	Description	Remarks	Tool
6	Stator	<p>(1) Remove the stator cover.</p>  <p>Fig. 10-15</p>  <p>Fig. 10-16</p>		

Step	Part to remove	Description	Remarks	Tool
7	Rotor	(1) Take off the through bolt. Apply a box wrench on the head of through bolt. Hit the wrench handle with a hammer counter-clockwise to loosen.		Box wrench Plastic hammer
		 <i>Fig. 10-17</i>		
		(2) Put the engine on the working table recoil starter side down.		
		(3) Use a bolt and oil as a tool for pulling out rotor in the following procedures : 1. Pour engine oil into the center hole of rotor shaft. Fill with oil to the shaft end. (See Fig. 10-18.) 2. Prepare a bolt with the following thread size : M12 x P 1.5 3. Apply a few turns of seal tape around the tip of the bolt. (See Fig. 10-19.)		

  
*Fig. 10-18*

  
*Fig. 10-19*

Step	Part to remove	Description	Remarks	Tool
7	Rotor	<p>4. Screw the bolt into the thread of the rotor shaft.</p> <p>5. Torque the bolt using a socket wrench until the rotor comes off loose.</p> <p><b>* The hydraulic pressure inside the rotor shaft takes apart the rotor from the engine shaft.</b></p>	Do not stick out your face over the rotor. It may jump up on separation.	Socket wrench
		<p>(4) Wipe off oil thoroughly from rotor shaft and engine PTO shaft.</p> <div data-bbox="500 600 1136 1052" data-label="Image"> </div> <p><i>Fig. 10-20</i></p>		
8	Front Cover	<p>(1) Remove the front cover. Loosen the four bolts and remove the front cover.</p> <p>M8 x 20mm bolt and washer Ass'y . . . 4 pcs.</p> <div data-bbox="506 1350 1144 1801" data-label="Image"> </div> <p><i>Fig. 10-21</i></p>		12 mm socket wrench

## 10-3 ASSEMBLY PROCEDURES

### 10-3-1 ENGINE and FRAME

- (1) Attach the mount rubbers to the frame. Insert the setting tongue of mount rubber into the hole on the frame and tighten the nut from the bottom of the frame.

M8 flange nut . . . 4 pcs.

Tightening torque
<b><u>11.8 - 13.7 N-m</u></b>
120 - 140 kg-cm
8.7 - 10.8 ft-lb

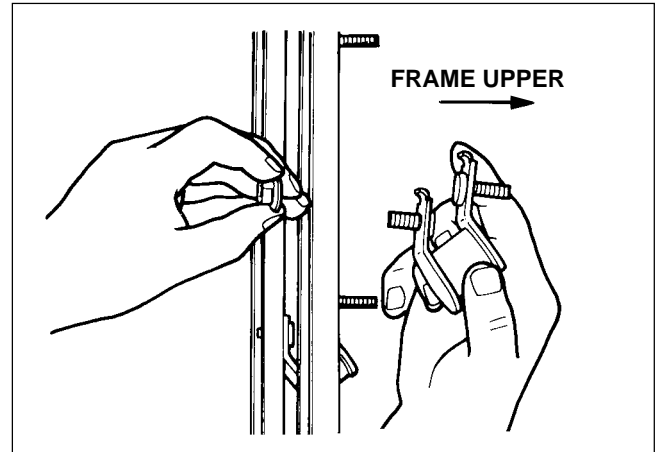


Fig. 10-22

*NOTE : The mount rubbers are selected to reduce vibration most effectively by model. Be sure to use the correct mount rubber for your generator. Although mount rubbers have the same appearance, their characteristics are different.*

- (2) Install the engine into the frame from the side of it. Tighten the nuts over the mount rubber bolts to fix.

M8 nuts . . . 2 pcs.

Tightening torque
<b><u>11.8 - 13.7 N-m</u></b>
120 - 140 kg-cm
8.7 - 10.8 ft-lb

*NOTE : Remove the air cleaner cover for easier installation.*

*NOTE : When tightening the nuts, slightly lift the engine so that the weight is not applied to the mount rubbers.*

### 10-3-2 FRONT COVER

Attach the front cover to the engine main bearing cover. Match the faucet joint and tighten the bolts.

M8 x 20 mm bolt . . . 4 pcs.

M8 spring washer . . . 4 pcs.

Tightening torque
<b><u>11.8 - 13.7 N-m</u></b>
120 - 140 kg-cm
8.7 - 10.1 ft-lb

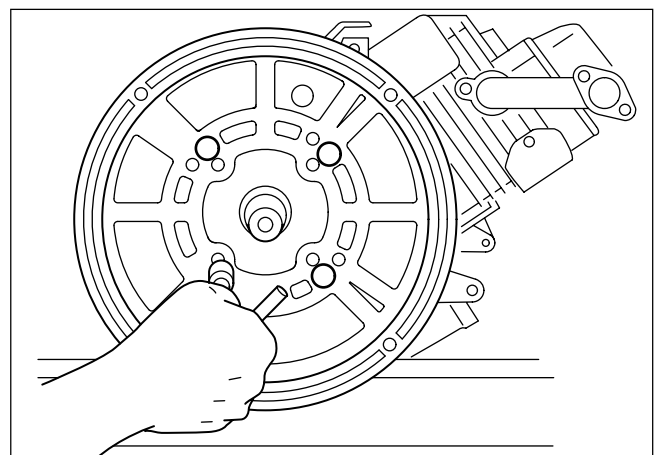


Fig. 10-23

### 10-3-3 ROTOR

- (1) Wipe off oil, grease and dust from the tapered portion of engine shaft and matching tapered hole of rotor shaft.
- (2) Mount the rotor to the engine shaft. Tighten the through bolt. Apply a wrench on the through bolt and hit wrench handle clockwise with a hammer to tighten. If an impact wrench is available, use it.

Tightening torque :

Tightening torque
<b><u>22.5 - 24.5 N-m</u></b>
230 - 250 kg-cm
16.6 - 18.5 ft-lb

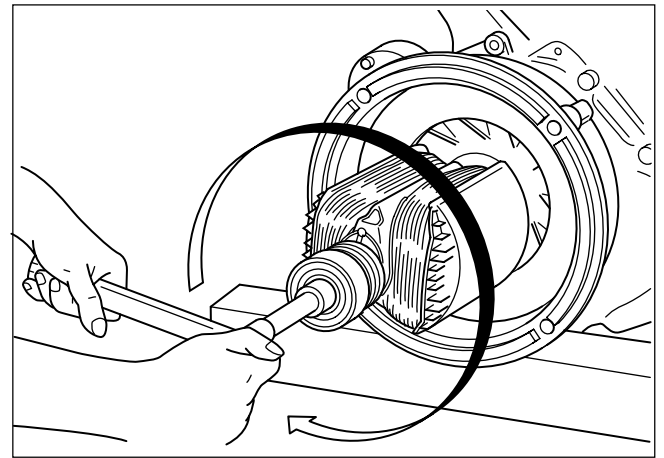


Fig. 10-24

### 10-3-4 STATOR

- (1) Put the stator in the rear cover setting the four grooves on the side of stator with thread holes of the rear cover.
- (2) Attach the stator cover around the stator.

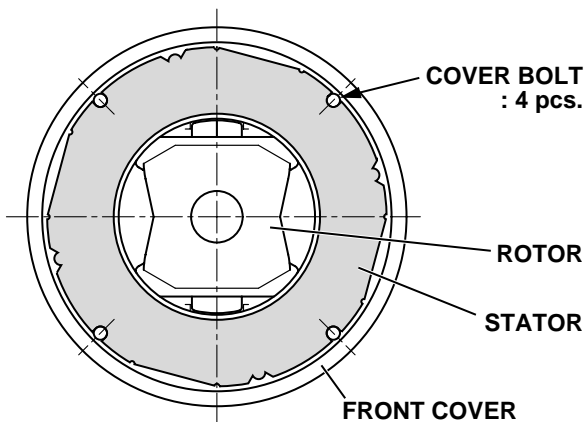


Fig. 10-25a

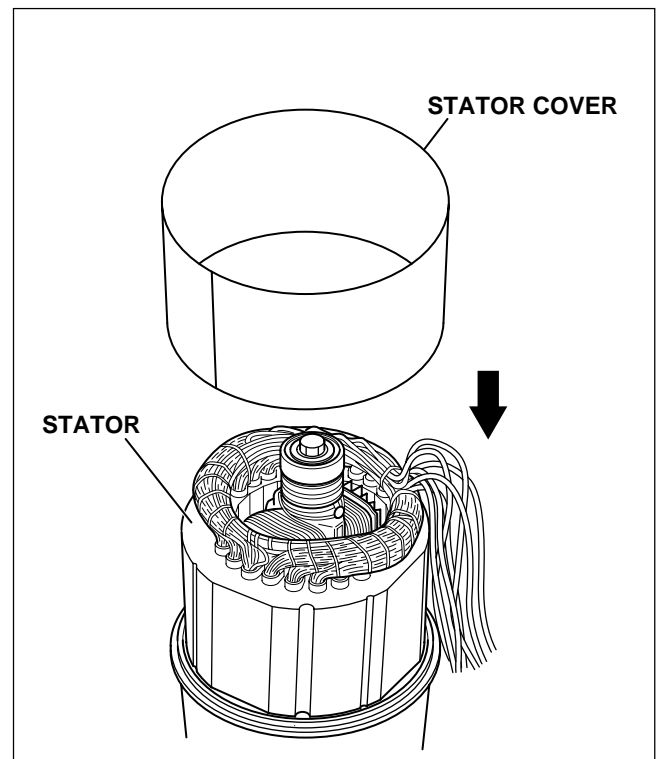


Fig. 10-25b

### 10-3-5 REAR COVER

- (1) Put the rear cover with stator over the rotor.  
Tap on the rear cover evenly with a plastic hammer to press the rotor bearing into the rear cover.
- (2) Fix the rear cover to the adaptor with four bolts, spring washers, and washers.

M6 x 160 mm bolt . . . 4 pcs.

M6 spring washer . . . 4 pcs.

M6 washer . . . 4 pcs.

Tightening torque
<b><u>4.5 - 5.9 N-m</u></b>
50 - 60 kg-cm
3.6 - 4.3 ft-lb

- (3) Attach the bushing over the lead wire drawn out from the rear cover. Press the smaller end of the bushing into the window of the rear cover.
- (4) Attach the 5 mm terminal of the grounding wires (green / yellow) to the unpainted thread hole of the frame base plate using a 5 mm brass screw.
- (5) Install the alternator assembly into the frame  
Tighten the nuts over the mount rubber bolts to fix.

M8 nuts . . . 2 pcs.

Tightening torque
<b><u>11.8 - 13.7 N-m</u></b>
120 - 140 kg-cm
8.7 - 10.8 ft-lb

*NOTE : When tightening the nuts, slightly lift the alternator assembly so that the weight is not applied to the mount rubber.*

- (6) Fasten the other earth cable with 5 mm terminal to the unpainted bolt hole on the frame.  
(See Fig.10-28.)

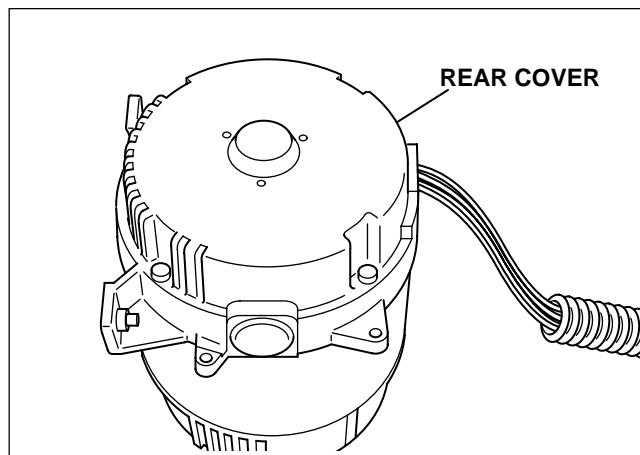


Fig. 10-26

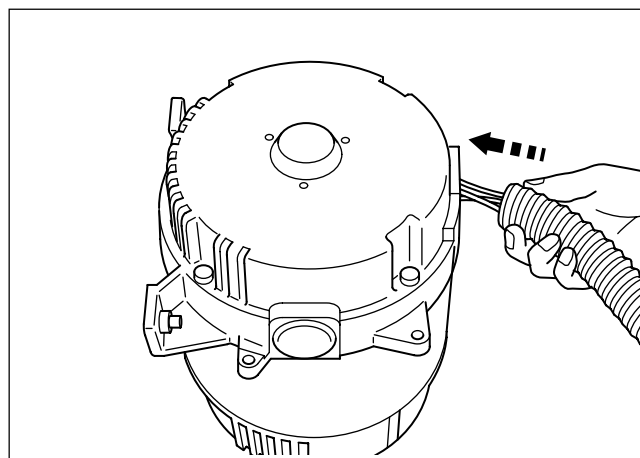


Fig. 10-27

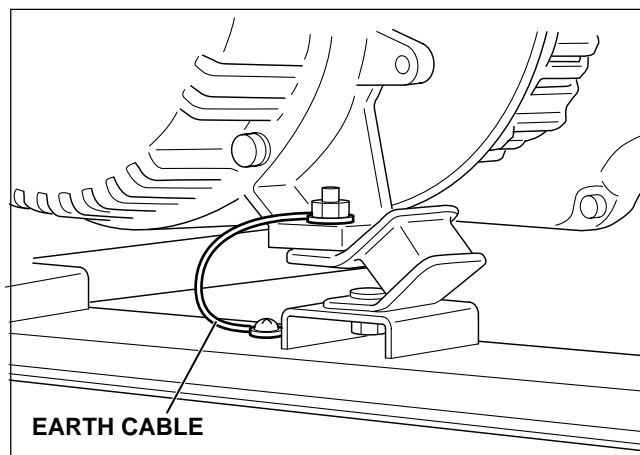


Fig. 10-28

### 10-3-6 BRUSH / BRUSH HOLDER

- (1) Install the brush holders in the rear cover. Pass the mounting screws through the brush holders, push the brush holders so that the brushes will be perpendicular to the slip rings, and tighten the screws.

*NOTE : There are two kinds of brush holders. If a brush is installed oblique to the slip ring, the brush holder can break when the screw is tightened ; or the brush may break when the generator of started. After installing the brush holders, measure the resistances across the brushes and terminals with a tester if they are from 5 ohms to 7.5 ohms. If so, the brush holders are correctly mounted.*

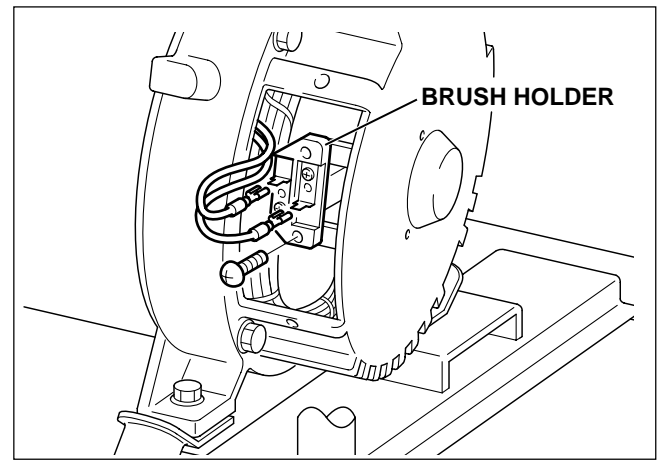


Fig. 10-29

- (2) Attach the connectors to the brush holders. Connect the green wire to the stator end and the brown wire to the bearing end.
- (3) Fix the brush cover with two bolt and washer Ass'y.

### 10-3-7 MUFFLER and MUFFLER COVER

- (1) Assemble the exhaust pipe to engine.  
M8 nuts . . . 2 pcs.

Tightening torque
<b><u>22.5 - 26.5 N-m</u></b>
230 - 270 kg-cm
16.6 - 19.5 ft-lb

- (2) Assemble the muffler bracket to the muffler.  
(See Fig.10-30.)  
M8 flange nuts . . . 4 pcs.
- (3) Assemble the muffler cover (rear) to the muffler. (See Fig.10-30.)  
M6 x 12 mm flange bolts . . . 2 pcs.



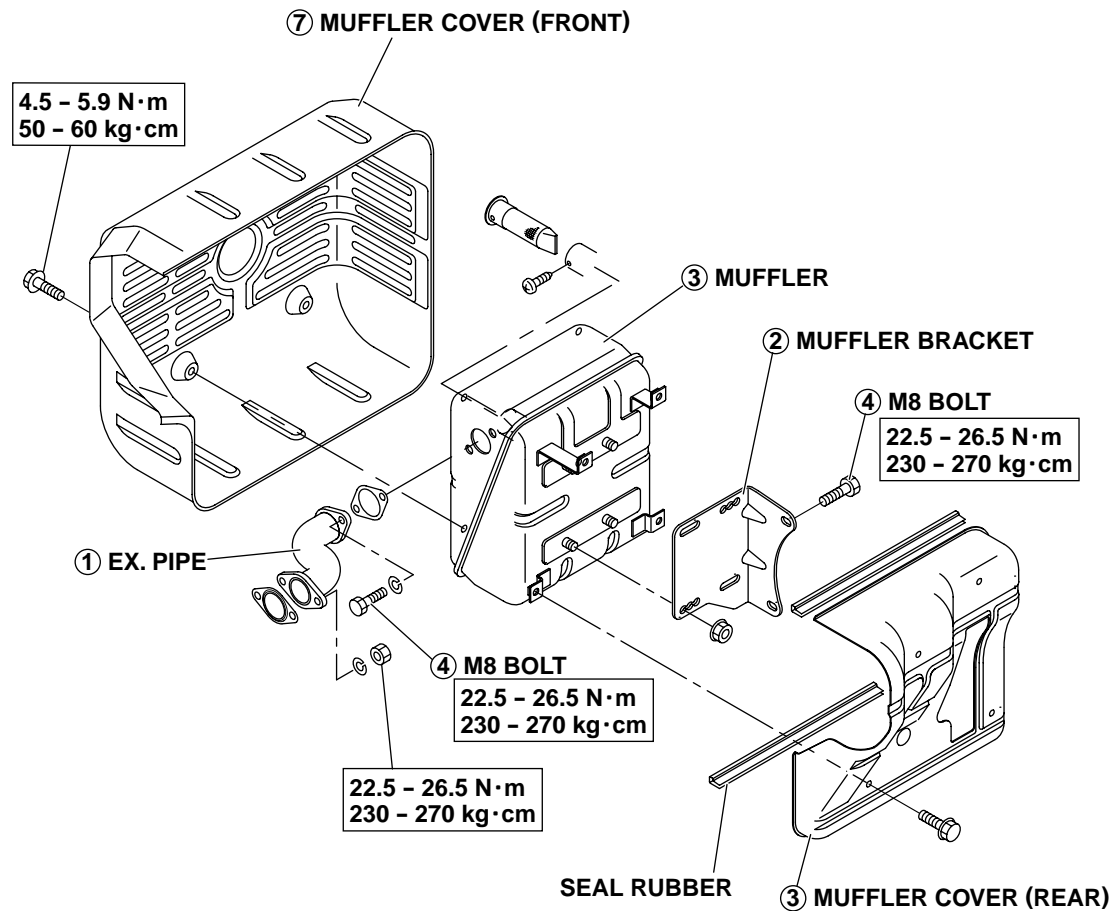


Fig. 10-30

(4) Attach the muffler to the exhaust pipe and generator rear cover without tightening.

(5) Tighten the muffler to the exhaust pipe.  
(See Fig.10-31.)

M8 x 20 mm bolts . . . 2 pcs.

(6) Tighten the muffler bracket to the generator cover. (See Fig.10-32.)

M8 x 20 mm bolt and washer Ass'y . . . 2 pcs.

**Tightening torque**

**22.5 - 26.5 N·m**  
230 - 270 kg·cm  
16.6 - 19.5 ft·lb

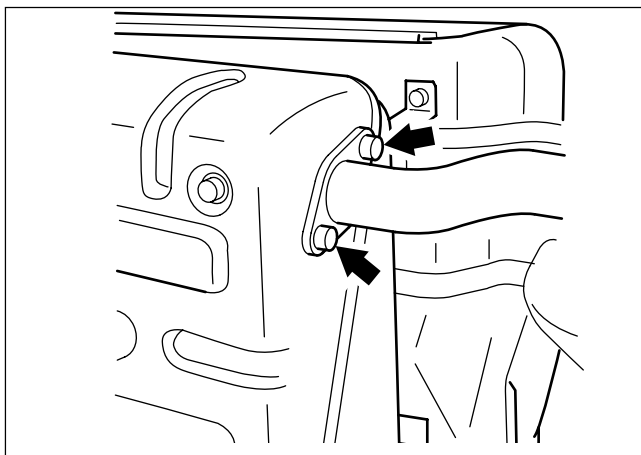


Fig. 10-31

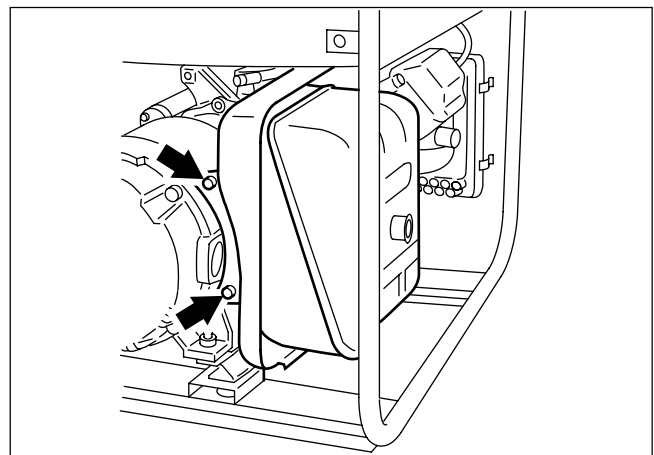


Fig. 10-32

(7) Assemble the muffler cover (front).

(See Fig. 10-33)

M6 x 12 mm flange bolt . . . 2 pcs.

Tightening torque
<b>4.5 - 5.9 N-m</b>
50 - 60 kg-cm
3.6 - 4.3 ft-lb

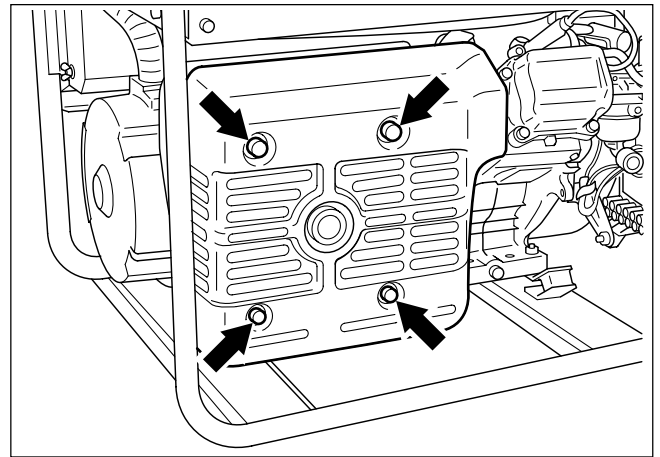


Fig. 10-33

### 10-3-8 FUEL TANK

(1) Hand tighten the strainer screw as far as it will go, loosen it again by one or two rotations (fuel outlet faces down), then tighten the lock nut.

Tightening torque
<b>4.5 - 6.9 N-m</b>
50 - 70 kg-cm
3.6 - 5.1 ft-lb

(2) Mount the fuel tank on the frame with rubber washers between the tank flange and the frame.

M6 x 20 mm bolt (black) . . . 4 pcs.

Rubber washer . . . 4 pcs.

*NOTE : For easy tank assembly, glue the rubber washers over the mounting holes of the frame.*

(3) Connect the rubber pipe.

First, fit the hose clamps on the rubber pipe and connect it to the strainer and the carburetor. Then fasten it with the hose clamps.

*NOTE : Apply a drop of oil to the rubber pipe for easier connection.*

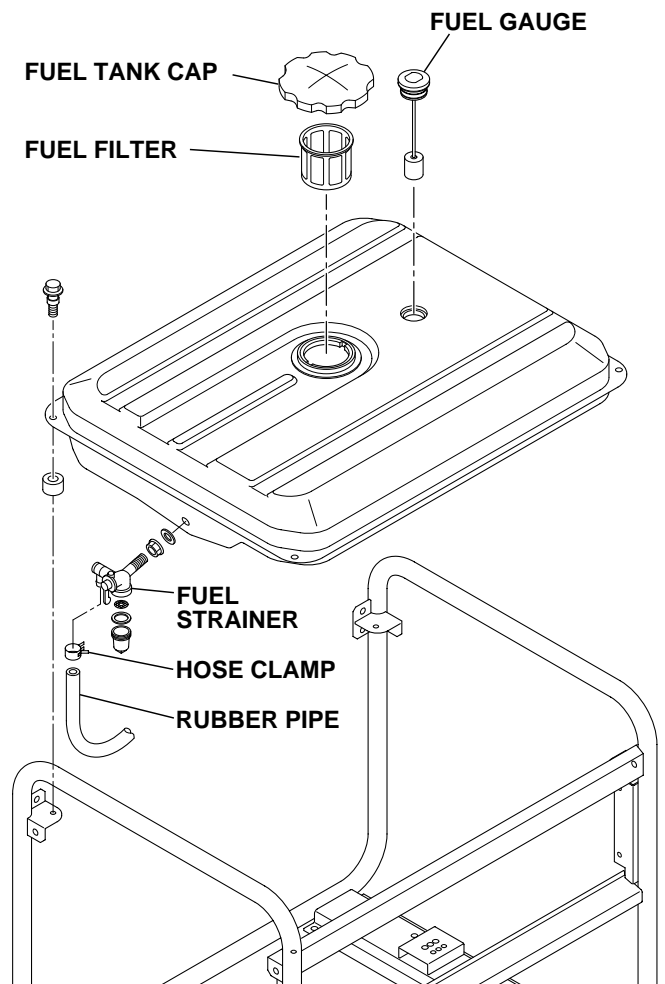


Fig. 10-34

### 10-3-9 CONTROL PANEL

Mount the control panel assembly to the control box.

Refer to Section 10-4 for disassembly, checking and reassembly procedures of the control panel.

- (1) Connect the wires from the control panel and the engine.
- (2) Connect the wires drawn out from the stator to the wires from the control panel.

*NOTE : Connect the wires of the same color.*

- (3) Press the upper end of the bushing into the bottom window of the control panel.
- (4) Mount the control panel to the control box.

M5 x 12 mm bolt and washer Ass'y . . . 8 pcs.

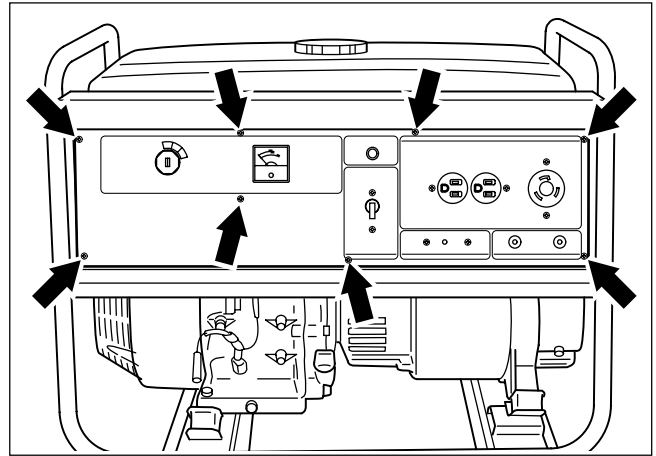


Fig. 10-35

## 10-4 CHECKING, DISASSEMBLY and REASSEMBLY of the CONTROL PANEL

### 10-4-1 CHECKING OF THE CONTROL PANEL

Dismount the control panel from frame. Remove the control panel and check each components and wiring. Refer to Section 9 for the detail of checking procedure for the components in the front panel.

### 10-4-2 DISASSEMBLY

- (1) Remove the control panel from the control box.  
M4 screw . . . 8 pcs.
- (2) Disconnect the connectors on the wires to detach the control panel.
- (3) After disconnecting individual wires, remove the control panel components.

*NOTE : Full power switch and pilot lamp have their wires soldered. Unsolder them to remove those parts if necessary.*

### 10-4-3 REASSEMBLY

(1) Install the receptacles, no-fuse breaker, terminals, switches, etc. on the control panel and wire them.

*NOTE : Circuit diagrams are shown in Section 12. Colored wires are used for easy identification, and are of the correct capacity and size. Use heat-resistant type wires (permissible temperature range 75°C or over) in the specified gauge shown in the circuit diagrams.*

(2) Connect the wires of control panel components.

(3) Attach the control panel to the control box.

M4 screw . . . 8 pcs.

Tightening torque
<b><u>1.2 - 1.5 N-m</u></b>
12 - 15 kg-cm
8.7 - 10.9 ft-lb

# 11. TROUBLESHOOTING

## 11-1 NO AC OUTPUT

### 11-1-1 CHECKING STATOR

- (1) Remove control panel and disconnect stator wires at the connectors.
- (2) Measure the resistance between terminals on stator leads. (See Fig.11-1) Refer to Table 9-1 of Section 9-4 STATOR for normal resistance.  
If stator is faulty, replace it with a new one.
- (3) Check the insulation resistance between stator core and each stator lead using a Cummins Onan generator tester in megger tester mode or a megger tester. (Fig. 11-3)  
If insulation is bad, replace stator with a new one.

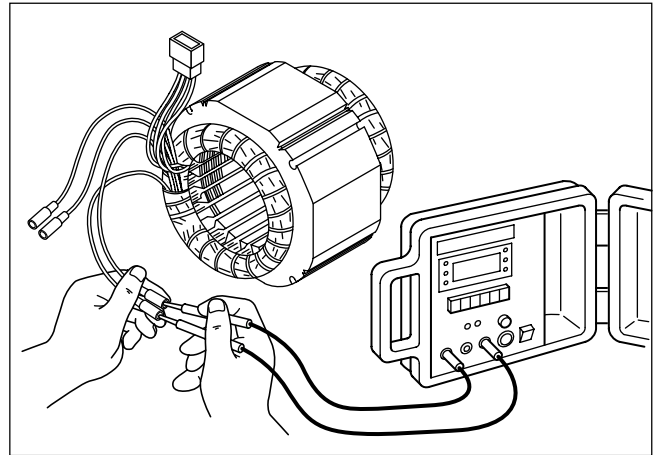


Fig. 11-1

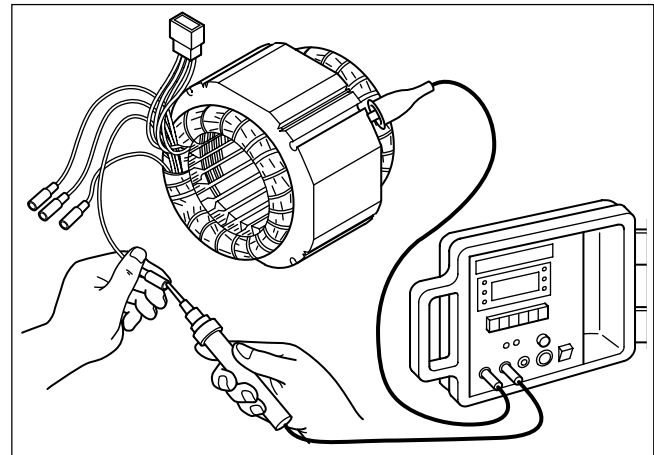


Fig. 11-2

### 11-1-2 CHECKING ROTOR

#### 1) Field coil

Remove the brush holder and measure resistance between the slip rings. Refer to Section 9-5 ROTOR ASSEMBLY for normal resistance.

*NOTE : If the circuit tester is not sufficiently accurate, it may not show the values given and may give erroneous readings.*

*Erroneous reading will also occur when there is a wide variation of resistance among coil windings or when measurement is performed at ambient temperatures different from 20 °C (68 °F).*

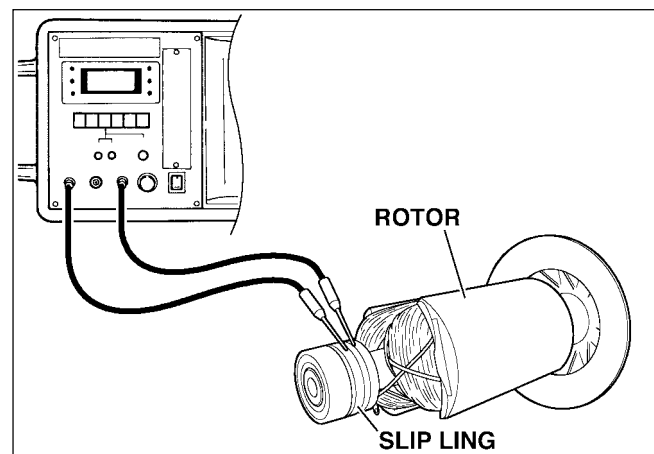


Fig. 11-3

## 2) Cleaning Slip rings

The slip ring surfaces must be uniformly bright. Slip rings showing black spots, excessive wear, or uneven wear must be repaired. A stained slip ring lowers generator efficiency and output voltage. Polish the slip rings with fine sandpaper while turning the rotor until rough spots disappear. Care should be taken not to touch the rotor coils with the sandpaper.

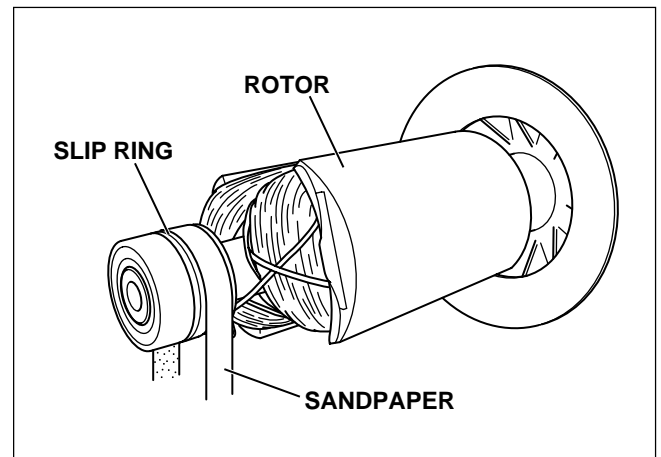


Fig. 11-4

## 11-2 AC VOLTAGE IS TOO HIGH OR TOO LOW

### 11-2-1 CHECKING ENGINE SPEED

If the engine speed is too high or too low, adjust it to the rated r.p.m.

#### [How to adjust engine r.p.m.]

- \* Loosen the lock nut on the adjusting screw.
- \* Turn the adjusting screw clockwise to decrease engine speed or counterclockwise to increase engine speed.

Normal engine speed at no load
3100 to 3150 rpm for 50Hz type
3700 to 3750 rpm for 60Hz type

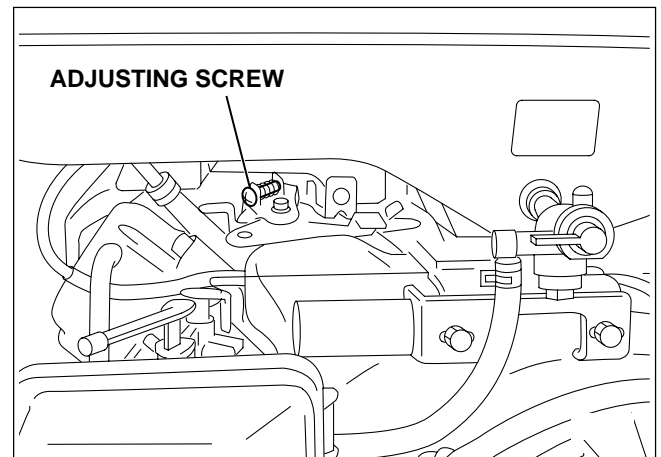


Fig. 11-5

### 11-2-2 CHECKING STATOR

Check stator referring to Step 11-1-1.

### 11-2-3 CHECKING ROTOR

Check rotor referring to Step 11-1-2.

### 11-3 AC VOLTAGE IS NORMAL AT NO-LOAD, BUT THE LOAD CANNOT BE APPLIED.

#### 11-3-1 CHECK THE ENGINE SPEED.

If the engine speed is low, adjust it to the rated r.p.m.

\*Refer to Step 11-2-1 for engine speed adjustment.

#### 11-3-2 CHECK THE TOTAL WATTAGE OF APPLIANCES CONNECTED TO THE GENERATOR.

Refer to Section 7 "RANGE OF APPLICATIONS" for the wattage of the appliances.

If the generator is overloaded, reduce the load to the rated output of the generator.

#### 11-3-3 CHECK THE APPLIANCE FOR TROUBLE.

If the appliance is faulty, repair it.

#### 11-3-4 CHECK IF THE ENGINE IS OVERHEATED.

If the cooling air inlet and/or cooling air outlet is clogged with dirt, grass, chaff or other debris, remove it.

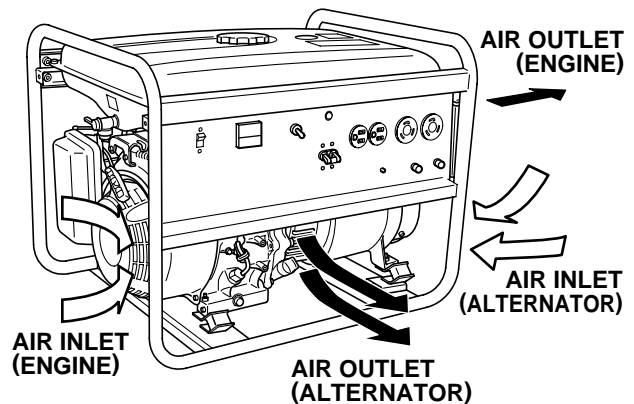


Fig. 11-6

#### 11-3-5 CHECK THE INSULATION OF THE GENERATOR.

- (1) Stop the engine. Remove the control panel, and disconnect the connector of GREEN lead for ground.
- (2) Measure the insulation resistance between the live terminal of the receptacle and the ground terminal.

If the insulation resistance is less than  $1M$  , disassemble the generator and check the insulation resistance of the stator, rotor and the live parts in the control box. (Refer to Section 8-3.)

Any part where the insulation resistance is less than  $1M$  , the insulation is faulty and may cause electric leakage.

Replace the faulty part.

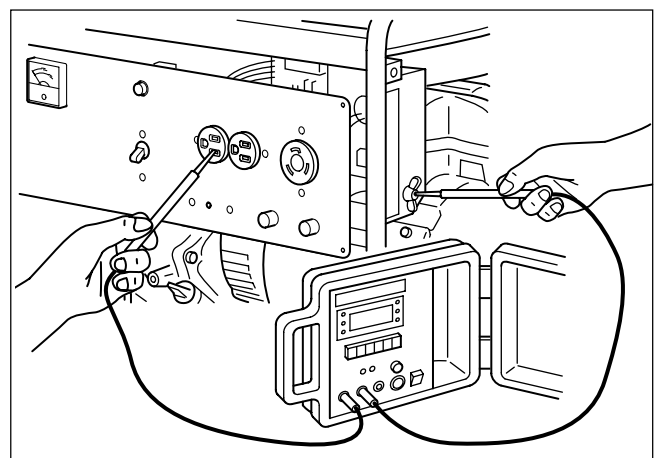


Fig. 11-7

## 11-4 NO DC OUTPUT

### 11-4-1 CHECK THE AC OUTPUT.

Check the generator by following Step 11-1-1 through Step 11-1-2.

### 11-4-2 CHECK THE DC BREAKER.

If the DC breaker turned off while charging a battery, check the cables for short-circuit or connection in reverse polarity before resetting it on.

*NOTE : If the DC output is used to charge a large capacity battery or an over-discharged battery, an excessive current may flow causing.*

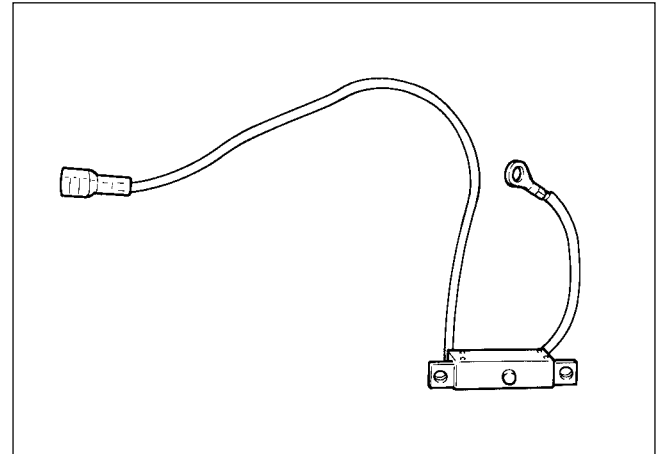


Fig. 11-8

### 11-4-3 CHECK THE WIRING.

Check all the wires to be connected correctly.

### 11-4-4 CHECK THE DIODE RECTIFIER.

Remove the control panel and check the diode rectifier with a circuit tester.

Refer to Section 9-7 “DIODE RECTIFIER” for the checking procedure.

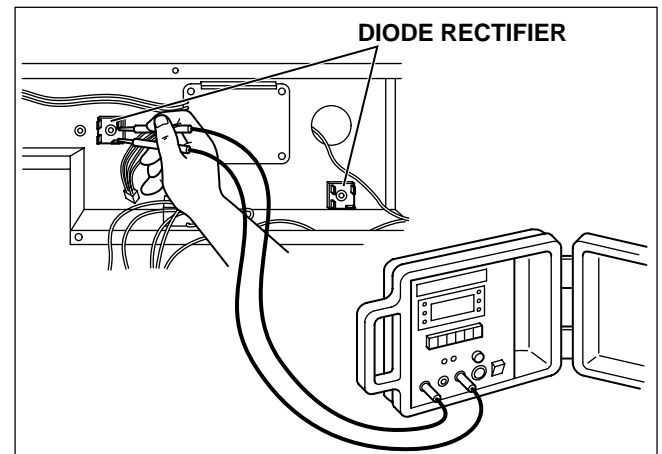


Fig. 11-9

### 11-4-6 CHECK THE DC COIL

Check the resistance between two brown leads from stator with a circuit tester.

If the resistance reading is much larger or smaller than the specified value, the DC coil of the stator is faulty. Replace stator with a new one.

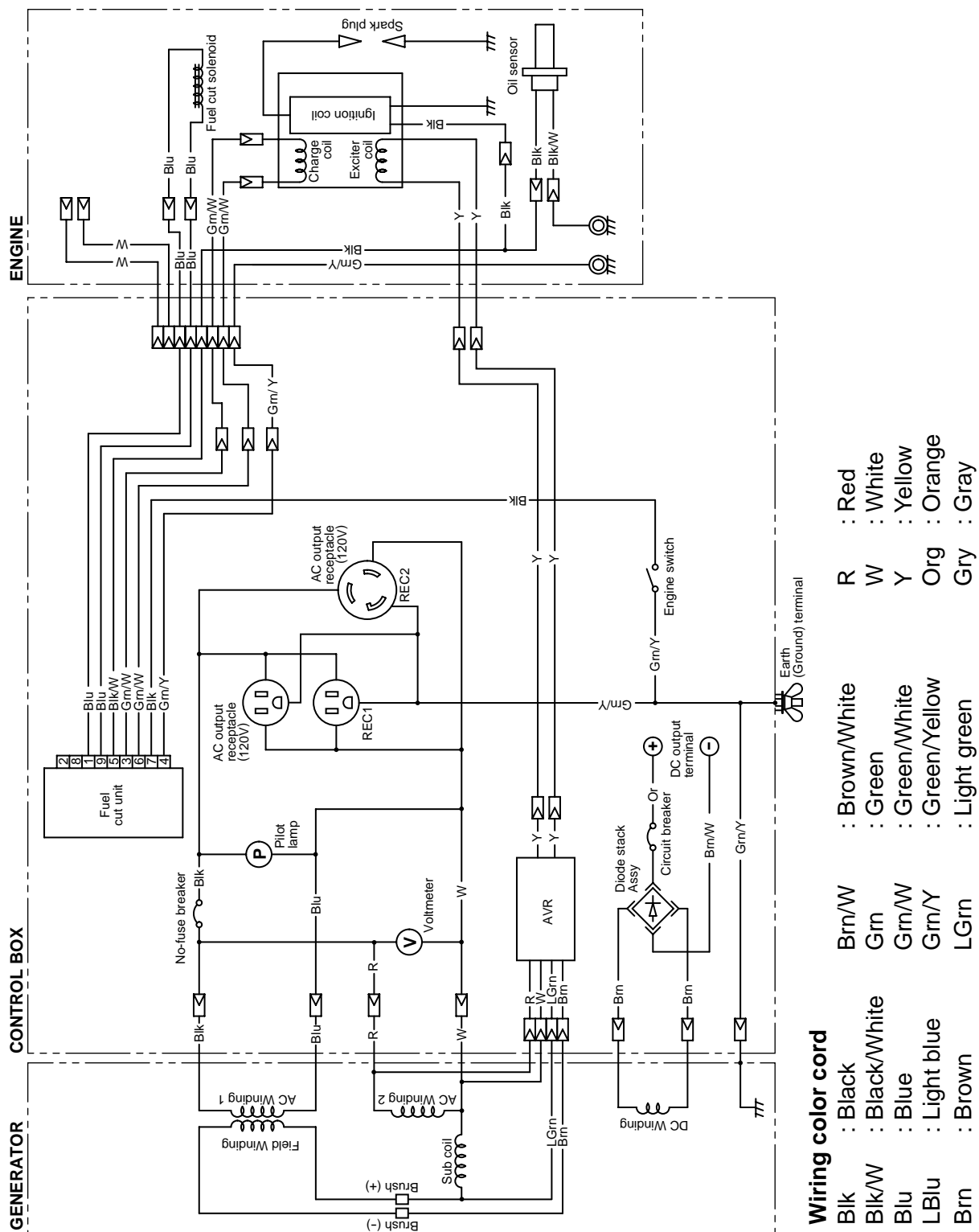
Hz-Voltage	DC coil
	White/Light green
50-110 ~ 240	0.79
60-120 / 240	0.61

Table. 11-3

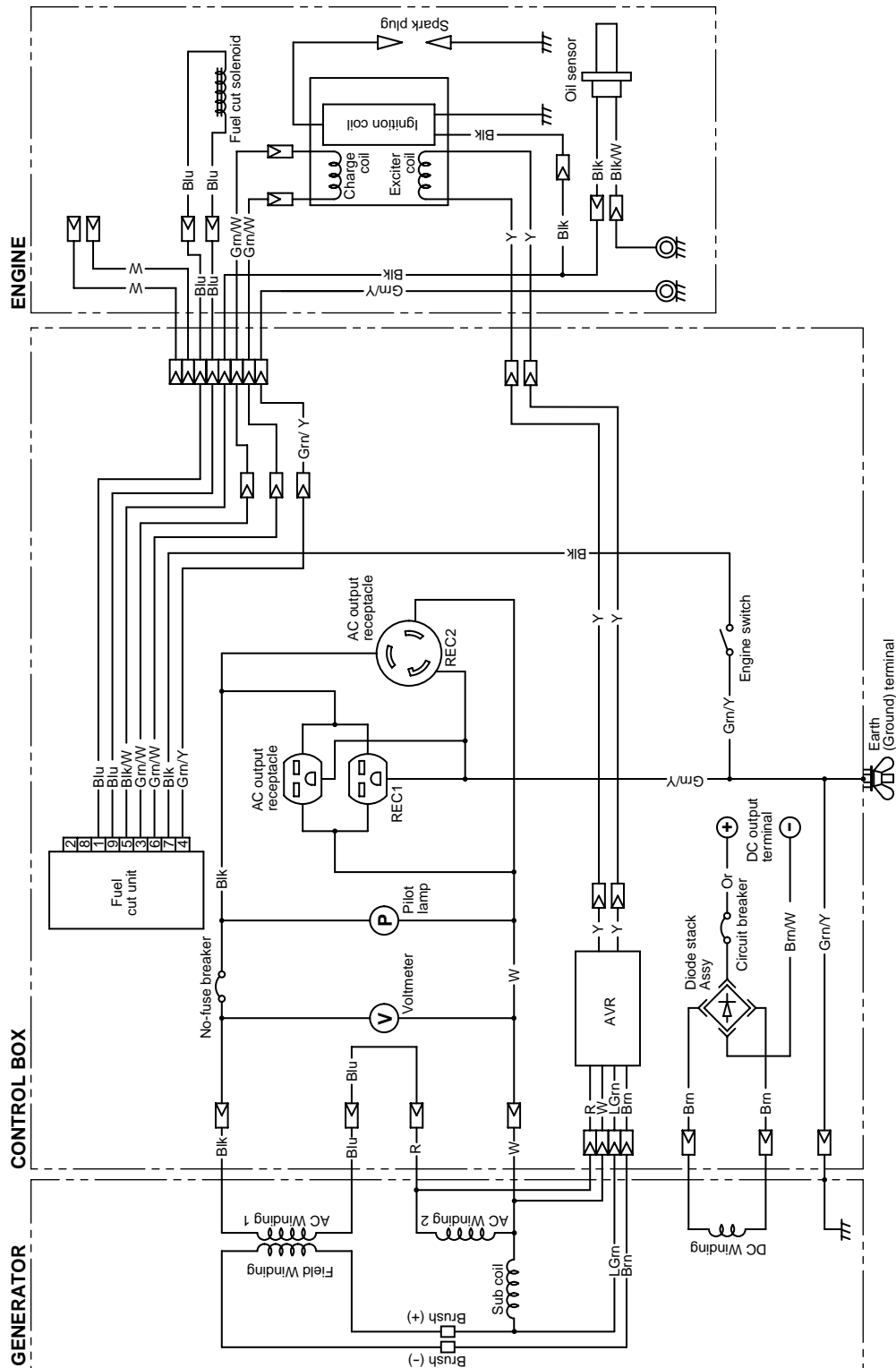


## 12. WIRING DIAGRAM

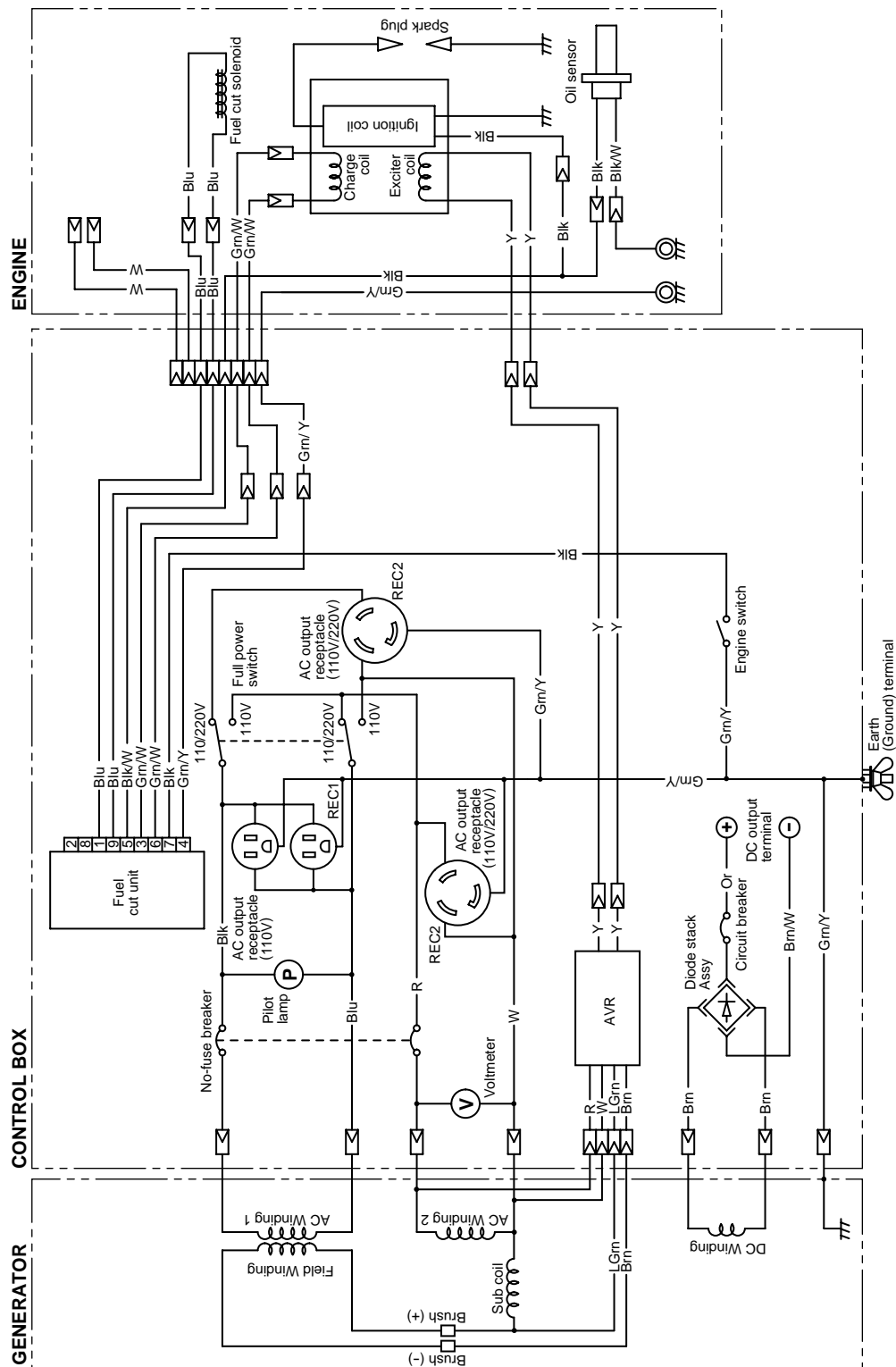
Recoil starter model (50Hz-110V, 60Hz-110V, 60Hz-120V)



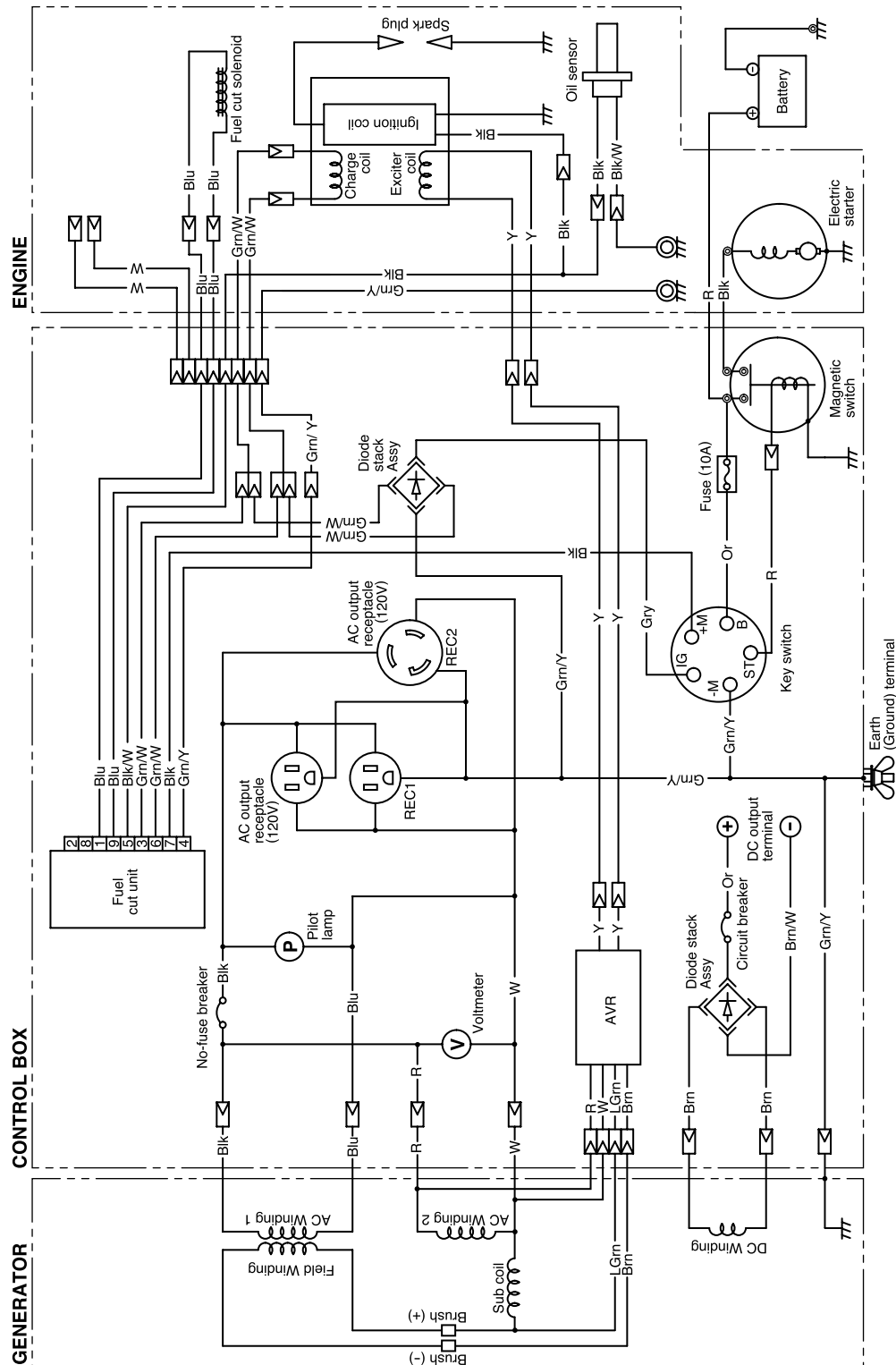
# Recoil starter model (50Hz-220V, 230V, 240V, 60Hz-220V)



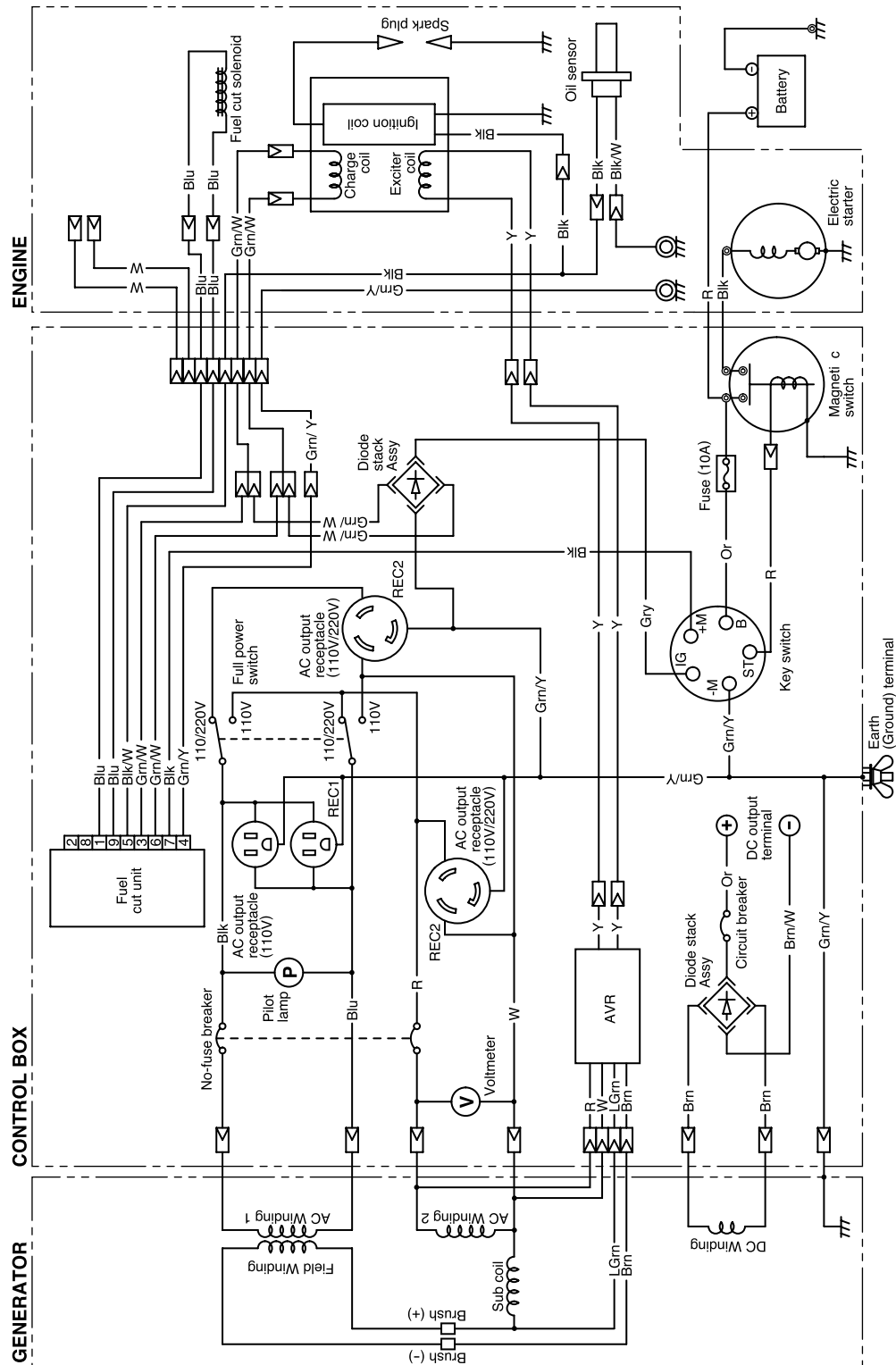
Recoil starter model (50Hz, 60Hz-110/220V, 60Hz-120/240V)



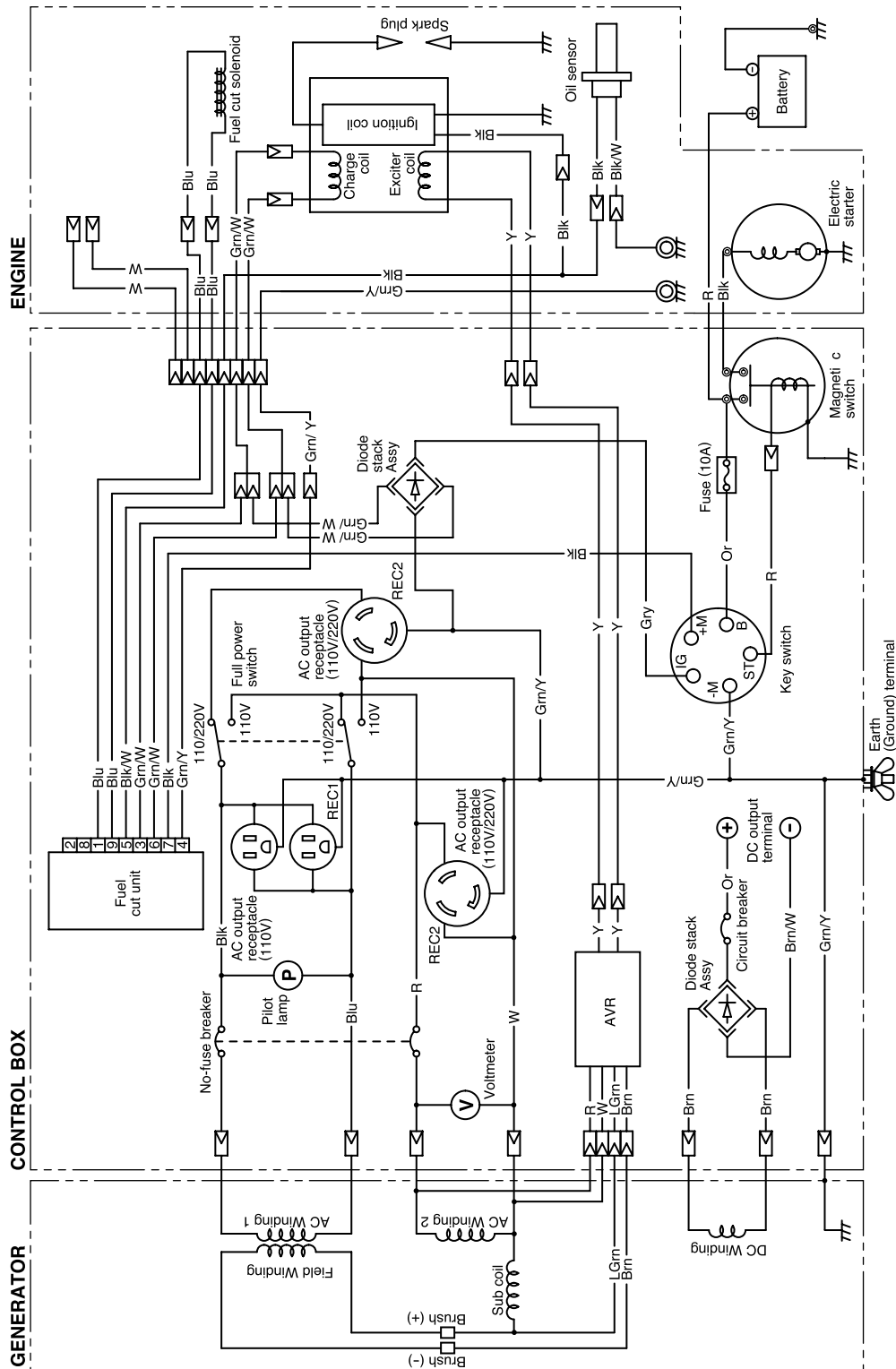
**Electric starter model (50Hz-110V, 60Hz-110V, 60Hz-120V)**



## Electric starter model (50Hz-220V, 230V, 240V, 60Hz-220V)



## Electric starter model (50Hz, 60Hz-110/220V, 60Hz-120/240V)



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