

AIRMAN

SG

INSTRUCTION MANUAL

ENGINE GENERATOR

SDG25S-3A8

Please be sure to read this manual
before using this machine.

N

HOKUETSU INDUSTRIES CO., LTD.

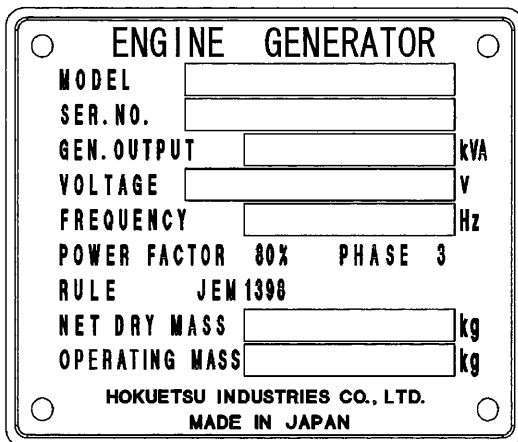
Preface

Thank you for having selected our "AIRMAN" product.

- ◆ This manual explains about the proper operation and daily inspection and maintenance of this machine.
- ◆ In order to use a machine safely, people with sufficient knowledge and sufficient technology need to deal with it.
- ◆ Before operating the machine, read the manual carefully, fully understand its operation and maintenance requirement. Maintain "SAFETY OPERATION AND PROPER MAINTENANCE OF THE MACHINE".

Be sure to follow safety warnings and cautions given in the manual.
Unsafe operation could cause serious injury or death.

- ◆ For details of handling, maintenance and safety of the engine, see the Engine Operation Manual.
- ◆ Keep the manual available at all times for the operator or safety supervisor.
- ◆ When this manual is missing or damaged, order it from our office nearby or distributor.
- ◆ Be sure that the manual is included with the machine when it is handed over to another user.
- ◆ There may be some inconsistency in detail between the manual and the actual machine due to improvements of the machine. When you have anything unclear or you want to advise us, contact our office nearby or distributor.
- ◆ If you have any questions about the machine, please inform us the model and serial number. A plate stamped with the model and serial number is attached to side of the machine.



A040491

- ◆ Each illustrated figure (Fig.) has a number (for instance, A040491) at the right bottom. This number is not a part number, but it is used only for our reference number.


Table of Contents

1. Safety	1-1
1.1 Caution before Operation	1-2
1.2 Caution during Operation	1-4
1.3 Caution during Inspection and Maintenance	1-6
1.4 Safety Warning Labels	1-8
2. Part Names	2-1
2.1 Internal Components	2-1
3. Installation	3-1
3.1 Transporting Unit	3-1
3.2 Conditions of Unit Installation	3-2
3.3 Leakage Protection Device and Grounding Method	3-5
3.4 Selecting Cable	3-7
4. Operation	4-1
4.1 Instrument panel	4-1
4.2 Protection device	4-2
4.3 Connecting Load	4-6
4.4 Engine Oil • Coolant • Fuel	4-9
4.5 Check before Starting the Machine	4-10
4.6 Operation and Stopping	4-13
5. Failure cause and measures	5-1
5.1 Troubleshooting	5-1
6. Periodic Inspection/Maintenance	6-1
6.1 Important items at Periodic inspection and Maintenance or after Maintenance	6-1
6.2 Daily Inspection and keeping Operation Log	6-2
6.3 Periodic Replacement of Parts	6-2
6.4 Periodic Inspection List	6-3
6.5 Maintenance	6-4
6.6 Periodical Load Operation to be Performed	6-12
7. Disposal of products and storage of the machine	7-1
7.1 Preparation for Long-term Storage	7-1
7.2 Disposal of products	7-1
8. Specifications	8-1
8.1 Specifications	8-1
8.2 Outline drawing	8-2
9. Wiring Diagram	9-1
9.1 Generator Wiring Diagram	9-1
9.2 Engine Wiring Diagram	9-2
10. Piping Diagram	10-1
10.1 Fuel piping	10-1

1.Safety

This manual explains and illustrates general requirements for safety and cautions for safety.

Please read these safety requirements carefully and fully understand the contents before starting the machine.

For your better recognition, according to the degree of potential danger, safety messages are classified into three hierarchical categories, namely, "DANGER", "WARNING" and "CAUTION" with a caution symbol -attached to each message.

When one of these messages is found, please take preventive measures for safety to carry out "SAFETY OPERATION AND PROPER MAINTENANCE OF THE MACHINE".



DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. This signal word is to be limited to the most extreme situations.



WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.



IMPORTANT indicates important caution messages for the performance or durability of the machine, which has no concern to injury or accident of or to a human body.

Follow warnings mentioned in this manual. This instruction manual does not describe all safety items. We, therefore, advise you to pay special attention to all items (even though they may not be described in the manual) for your safety.

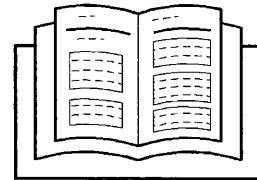
1.Safety

1.1 Caution before Operation

WARNING

Follow the safety instructions

- Read each instruction plate which is displayed in the manual or on the machine carefully, understand its content and follow the indications thereof.
- Keep the Safety Warning labels clean. When they are damaged or missing, apply new ones.
- Do not modify the machine without prior approval. The safety may be compromised, functions may be deteriorated, or machine life may be shortened.
- Never use the machine for the other purposes than power supply. Otherwise, serious accidents may occur.

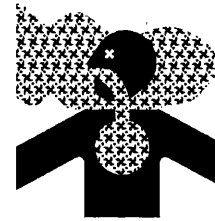


TR0086

WARNING

Ventilation

- Exhaust gas from the engine is poisonous, and could cause casualties when it is inhaled.
Avoid using the machine in an insufficiently ventilated building or a tunnel.



PC002

WARNING

Handling battery

- Keep flames away from battery.
Battery may generate hydrogen gas and may explode.
- Battery electrolyte is dilute sulfuric acid.
In case of mishandling, it could cause skin burning.
- Wear protective gloves and safety glasses when handling a battery.
- Dispose of battery, observing local regulations.



D004



TR0093

1.Safety

CAUTION

- When handling machine, do not wear;
- loose clothes
- clothes with unbuttoned sleeves
- hanging tie or scarf
- dangling jewelry
- Such outfit could be caught in the machine or dragged in the rotating portion of the machine, and could cause a serious injury.

Safety outfit



CAUTION

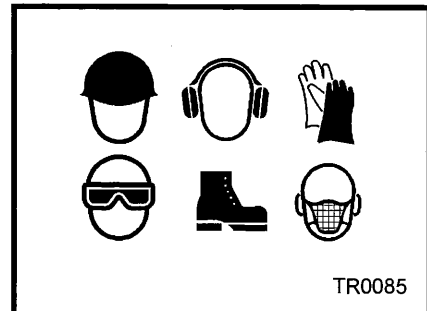
Maintain both physical and mental health

- Do not operate the machine when you are tired or drunk or under the influence of drugs. Otherwise, a hasty conclusion or careless handling may cause unexpected injury or accident. Manage your physical and mental health and be cautious in handling the machine.

CAUTION

- Please wear protection implements, such as a helmet, protection glasses, earplugs, safety shoes, a glove, and a protection-against-dust mask, according to the contents of work for safety.

Protection equipments



CAUTION

- Have first-aid boxes and fire-extinguishers near the machine ready for emergency situations such as injuries and a fire.
- It is advisable to have a list of phone numbers of doctors, ambulance and the fire department available in case of emergency.

Safety fittings



CAUTION

Safety around the machine

- Such things as unnecessary equipment and tools, cables, hoods, canvas sheets and pieces of wood which are a hindrance to the job, have to be cleared and removed. This is because operators and personnel nearby may stumble on them and may be injured.

1.Safety

1.2 Caution during Operation

WARNING

Never touch the output terminals and interior of control board

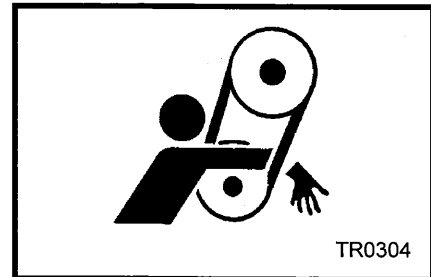
- Touching to the output terminals and the control board might cause electric shock so please don't open the cover of output terminal board during the operation of the machine. (There is hundreds volt at the output terminals.)
When it is unavoidable to open the door of machine, please don't touch the rotating parts and hot parts. Touching of those parts might cause scalding and serious injury.
- When removing or connecting a connecting cable for changing load, be sure to switch OFF the circuit breaker, remove the starter key from the starter switch, then carry out a work. The operator must keep the key during operation. Neglecting the cautions mentioned above, and a third party starting the machine during operation may cause serious accidents such as electric shock.



WARNING

Hands off from rotating parts and belts

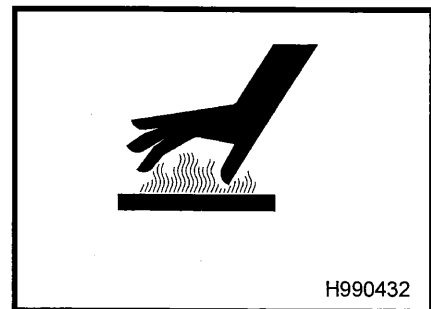
- Keep hands off from the rotating portion or belts while running. It could cause serious injuries if hands should be caught in.



CAUTION

Do not remove radiator cap during operation

- Do not, under any circumstance, open the radiator cap while running or immediately after stopping operation. Otherwise high temperature steam jets out and this could cause scalding.



1.Safety

CAUTION

- Never work nearby hot portions of the machine while it is running.
- Do not touch hot portions of the machine while inspecting the machine when running.
- Such parts as engine, exhaust manifold, exhaust pipe, muffler, and radiator are especially hot, so never touch those parts, because it could cause scalding.
- Coolant water and engine oil are also very hot and dangerous to touch. Avoid checking or refilling them while the machine is running.

Do not touch hot parts



H990432

CAUTION

- Do not, under any circumstance, bring lit cigarettes or matches near such oils as diesel fuel oil, and engine oil, etc. They are extremely flammable and dangerous, so be careful when handling.
- Refilling oils should be done in an outdoor well-ventilated place.
- Refuel after stopping the engine, and never leave the fuel nearby the machine. Do not spill. It may cause a fire. When it is spilt, wipe it up completely.
- **Do not fill fuel oil up to the cap level. When fuel tank is filled up to the cap level, fuel oil will be overfilled due to volume expansion caused by rise of ambient temperature. Further, fuel will be possibly spilled from fuel tank due to vibration caused during movement and/or transportation of machine.**
- Such parts as muffler and exhaust pipe can be extremely hot. Remove twigs, dried leaves, dried grass and waste paper, etc. from the exhaust outlet of the muffler.
- Keep a fire extinguisher available by the machine in case of unexpected fire.

Fire prevention



D004



H990433

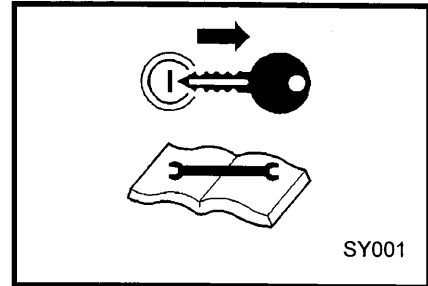
1.Safety

1.3 Caution during Inspection and Maintenance

WARNING

Hang a "Now Checking and under Maintenance" tag

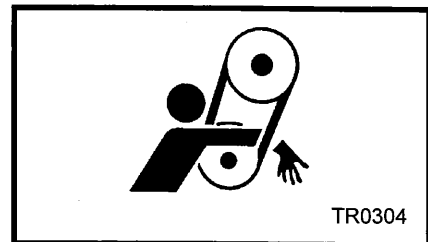
- Before starting inspection, switch off the circuit breaker of this machine, remove the starter key from the starter switch, and then hang a "Now Checking and under Maintenance" tag where it can be easily seen. The checker must keep the key during checking and maintenance.
- Remove the negative (-) side cable from the battery.
If the above procedure is neglected, and another person starts operating the machine during check or maintenance, it could cause serious injury.



WARNING

Adjusting tension of belt

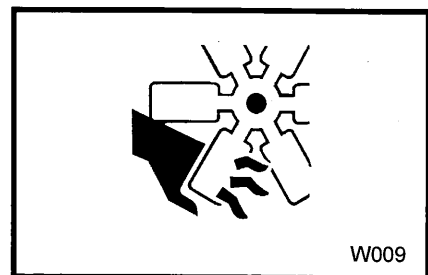
- Be sure to stop the engine and remove the starter key whenever the tension of the belt is to be adjusted.
- If the machine is running, it might catch the operator's hand into the belts, and this could cause a serious injury.



WARNING

Hands off from cooling fan

- Be sure to stop the engine and remove the starter key whenever the tension of the belt is to be adjusted.
- If the machine is running, it might catch the operator's hand into the belts, and this could cause a serious injury.



WARNING

Cleaning by air-blow

- When cleaning dust accumulated in such devices as the air-filter, etc., by blowing compressed air, wear safety glasses, etc. to protect your eyes.

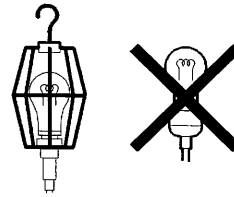


1.Safety

CAUTION

- It is recommended to use a lamp with safety guard fitted where the site is dark. Operating the machine gropingly or by relying on one's intuition could cause unexpected accidents. Any lamps without safety guard are not recommended since they can be broken and they could ignite flammables such as fuel, etc.

Lighting apparatus



TR0206

CAUTION

- Be sure to stop the engine, and let the coolant water sufficiently cool down before draining it.
- If the drain valve is opened before the coolant water is cooled enough, hot water could jet out, and it could cause scalding.

Opening coolant water drain valve



H990432

CAUTION

- After stopping the engine, wait 10 to 20 minutes until the engine oil cools off. Then check the level of the engine oil, or refill or drain the oil.
- The engine oil is very hot during operation and just after it stops. Be careful because the hot oil also pressurized blows off and it can cause burning.

Refilling or draining of engine oil



H990432

CAUTION

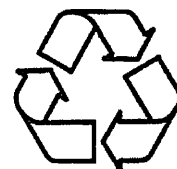
- When washing the machine, cover the control panel, generator and its electric parts to prevent them from being exposed to splashing water and avoid possible decrease in electrical insulation or other troubles to the machine.
- Dust, sand and dirt accumulated inside control panel could cause malfunction or trouble of the instruments. Clean them by blowing compressed air.

Caution of the cleaning

CAUTION

- Waste liquid from the machine contains harmful material. Do not discharge it onto the ground or into the river, lake or sea. Such material will pollute the environment.
- Be sure to use a container to hold the waste liquid from the machine.
- Be sure to follow the designated regulations when disposing of oil, fuel, coolant (antifreeze), filter, battery or other harmful materials.

Treatment of organic wastes



A100285

1.Safety

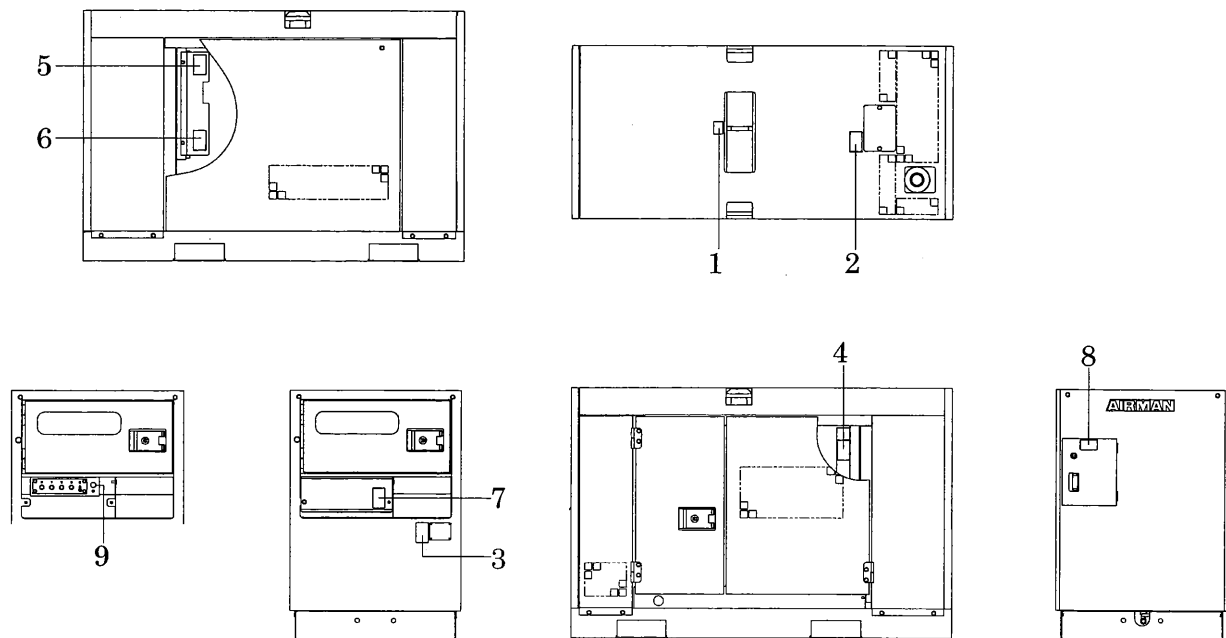
1.4 Safety Warning Labels

Following labels are attached to the machine.

Keep them clean at all times. If they are damaged or missing, immediately place an order with your nearest dealer for replacement. Part numbers are indicated on the lower right corner of the label. Adhere a new one to the original location.



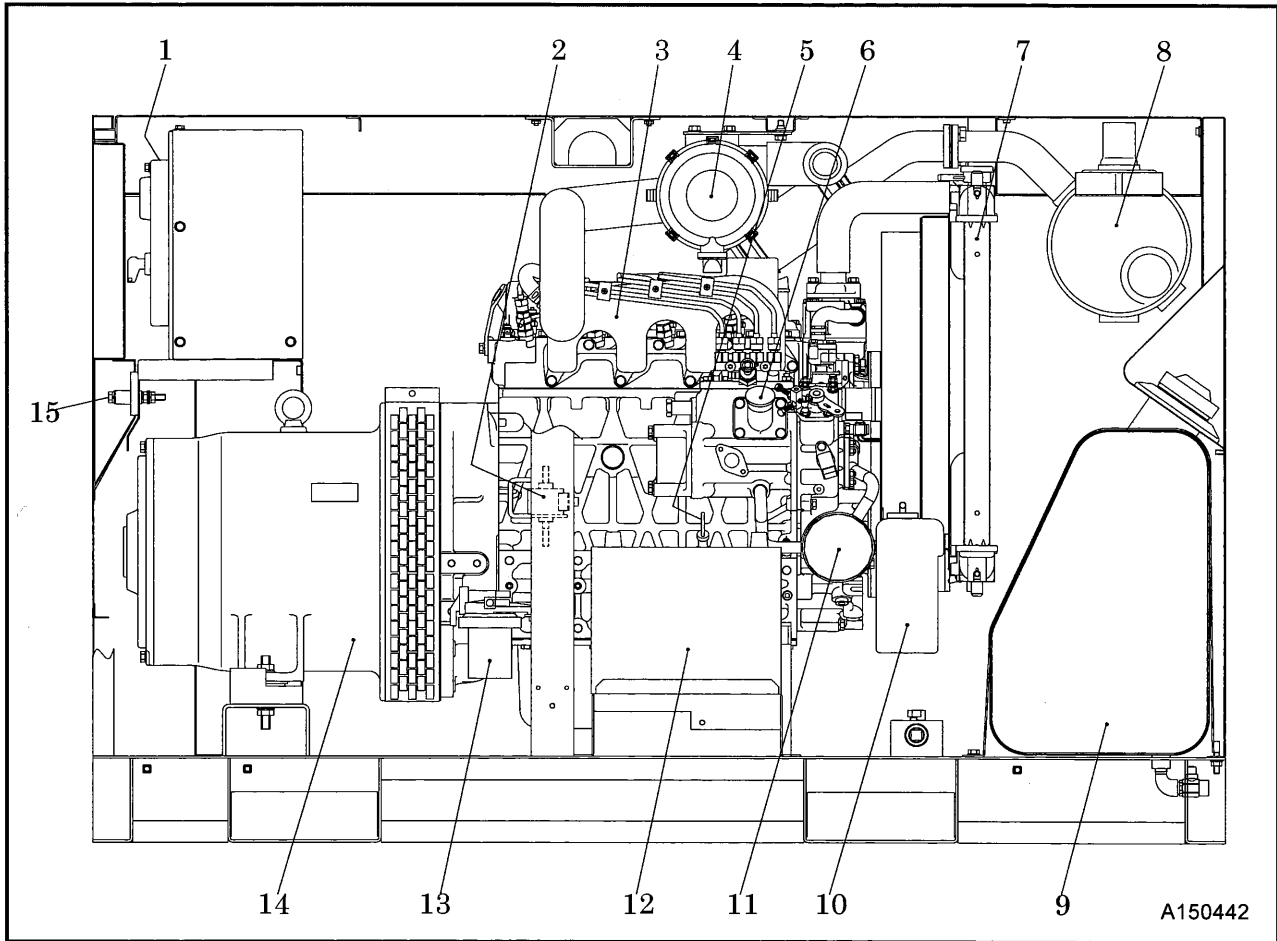
● The pasting position of safe warning label is as follows.



A150424E

2. Part Names

2.1 Internal Components



No.	Description	Function
1	Control panel	For intensively controlling device of various meters and controls.
2	Fuel air-bleeding electromagnetic pump	For automatically bleeding air from fuel pipes.
3	Engine	For driving the generator main unit.
4	Air filter	Filtering device for filtering dust floating in intake air.
5	Engine oil level gauge	For checking engine oil level.
6	Engine oil filler port	For supplying or adding engine oil.
7	Radiator	For cooling the coolant for engine in the system.
8	Exhaust muffler	For silencing the noise caused before discharging the air.
9	Fuel tank	For storing fuel.
10	Reserve tank	For checking coolant level and supplying it.
11	Engine oil filter	For filtering engine oil in the system.
12	Battery	For electrically starting engine.
13	Fuel filter (sedimentor)	For filtering dusts or foreign things in fuel in the system.
14	Generator main unit	For generating AC power to be supplied.
15	Output terminals	Equipped with three phase and single phase terminal and receptacle for single phase.

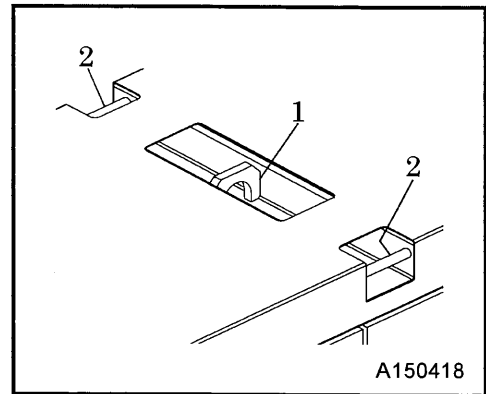
3. Installation

3.1 Transporting Unit

WARNING

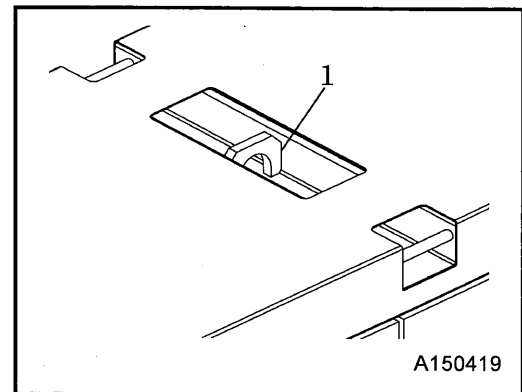
- Use the lifting bail “1” at the center of bonnet for hoisting up and down the machine. since the rope hook is not strong enough to be used for hoisting, never use it to prevent falling accident.
- When transporting the machine, be sure to put it on the truck bed and use the rope hooks “2” to secure it with rope.
- Do not hoist up the machine while it is running. Otherwise, a fatal trouble or serious accident may occur.

Transportation



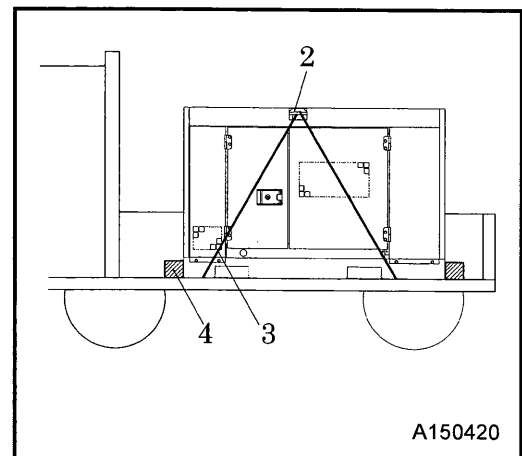
3.1.1 Lifting

- Use the lifting bail “1” fitted on center of bonnet.
- Select an appropriate crane or truck by referring to the mass and dimensions mentioned in “Specifications”.
- Only a qualified crane operator is allowed to operate a crane.



3.1.2 Securing a machine on truck bed when transporting

- When moving or transporting a machine from site, place it on truck bed and fasten it by ropes “3” at two hooks “2” on both right and left sides and 4 points on the common frame.



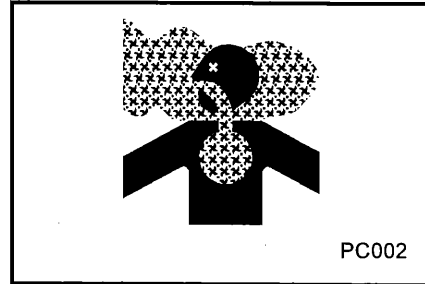
3. Installation

3.2 Conditions of Unit Installation

WARNING

- Exhaust gas from the engine is poisonous, and it could cause casualties when it is inhaled.
Avoid using the machine in an insufficiently ventilated building or a tunnel. When the machine is unavoidably used in such insufficiently ventilated place, ventilation devices and ventilation pipe should be provided for better ventilation.

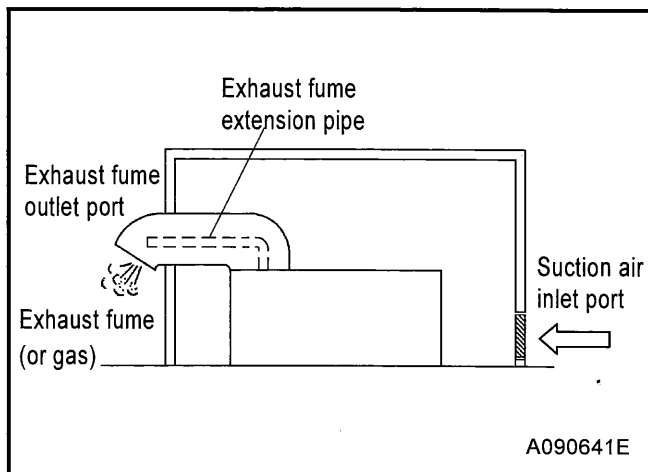
Ventilation



WARNING

In case that the unit is installed indoors

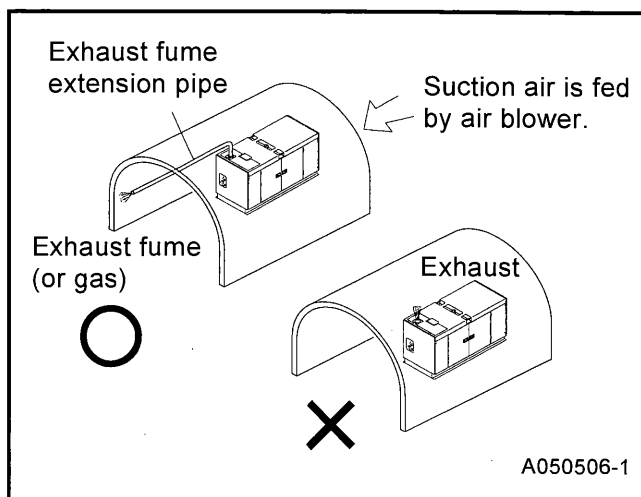
- In case that the unit is installed indoors for operation, suction air port and exhaust fume outlet port should be provided for better air ventilation.
- Make sure to secure enough space in front of air suction port and also to secure it after exhaust fume outlet port so that the engine may not get overheated.
- Exhaust pipe or the like should be provided at the exhaust outlet port so as to send out exhaust fume outdoors.
- Also the cooling air outlet port of radiator should be provided outdoors through a duct or the like for air ventilation.



WARNING

Installing the unit at such poorly-ventilated place

- In case that the unit is installed inside any tunnel, make sure to provide fresh air and ventilate it.
- In this case, make sure to extend the exhaust fume pipe outdoors, and also make sure to prevent any leak from any connection pipes.

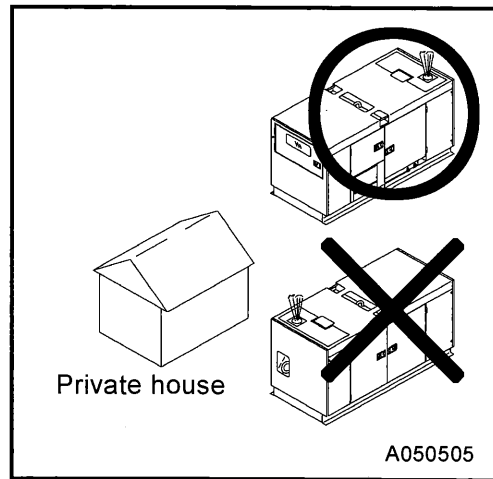


3. Installation

WARNING

- Never locate the unit with the exhaust muffler facing any private house:
- As the exhaust fume (gas) from the engine is poisonous, never direct it to any other persons passing by.

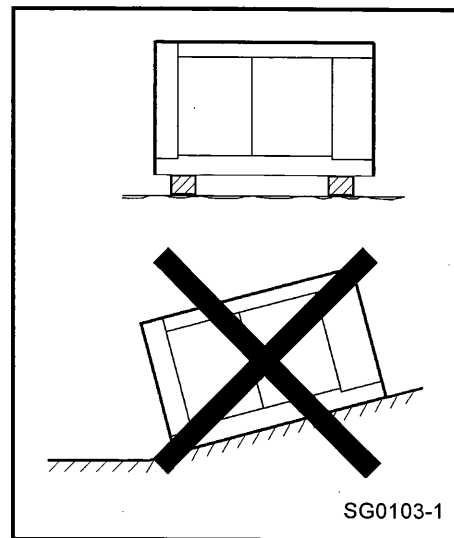
How to locate the unit



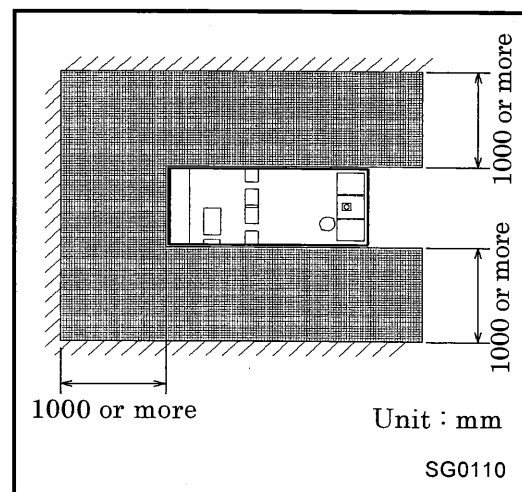
WARNING

- The machine has to be installed on dry, firm, and level area.
- The machine should be installed within 5° degree inclination.
- Avoid installing the machine in a place such as a damp place or a place where puddles are apt to be formed after rain. Such installation could cause electric shock.
- When installing the machine at the sea shore or on a ship, make sure that the machine should not be exposed directly to sea water.
- When installing the machine at a sandy place, make sure that exhaust from the generator or radiator does not blow the sand up in the air, or into the machine.
- In case that the unit has to be installed inevitably on any rough and uneven ground; it is necessary to insert square wooden bars under the unit for levelling it.

Installation



- The machine should be operated in following conditions:
- **Ambient temperature**.....-15°C to +40°C
- **Humidity** Less than 85%
- **Altitude**..... Lower than 1,000m above sea level
- If more than two machines are placed parallel in operation, keep enough distance so that exhaust air from one machine does not effect the other one.
- Keep enough space around the machine for inspection and maintenance access.

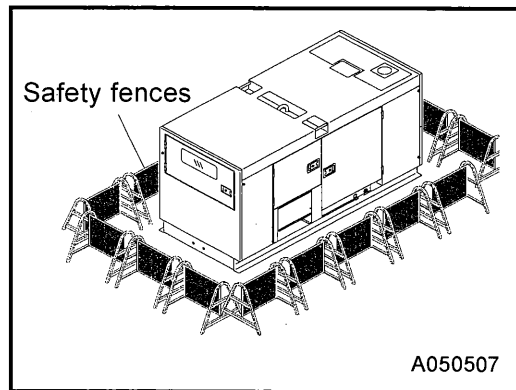


3. Installation

CAUTION

- In order to prevent from entering the jobsite or touching the equipment any other persons than the persons engaged in the job, please prepare for safety fences around the unit:

Preparation of safety fences



3. Installation

3.3 Leakage Protection Device and Grounding Method



Caution on Grounding

- Make sure to perform grounding connection of the external body of load. If such grounding connection is neglected or fails, it can cause electric shock to human body by leaked current, leading to serious accident as death.
- Grounding terminal for residual current relay and grounding terminal of the package of the machine can be connected to both independent grounding base and to common grounding base.
- This ground fault circuit interrupter does not function to protect such electric shock accident caused between these two wires (cables).

3.3.1 Leakage Protection Device

- This machine is equipped with a leakage relay which detects leakage caused by a defective insulation of working load to prevent an accident such as an electric shock by shutting down the circuit. However, for additional safety, install ground fault circuit interrupter (GFCI) for each load equipment close to the load equipment. The sensitivity current of the leakage relay is 30 mA.

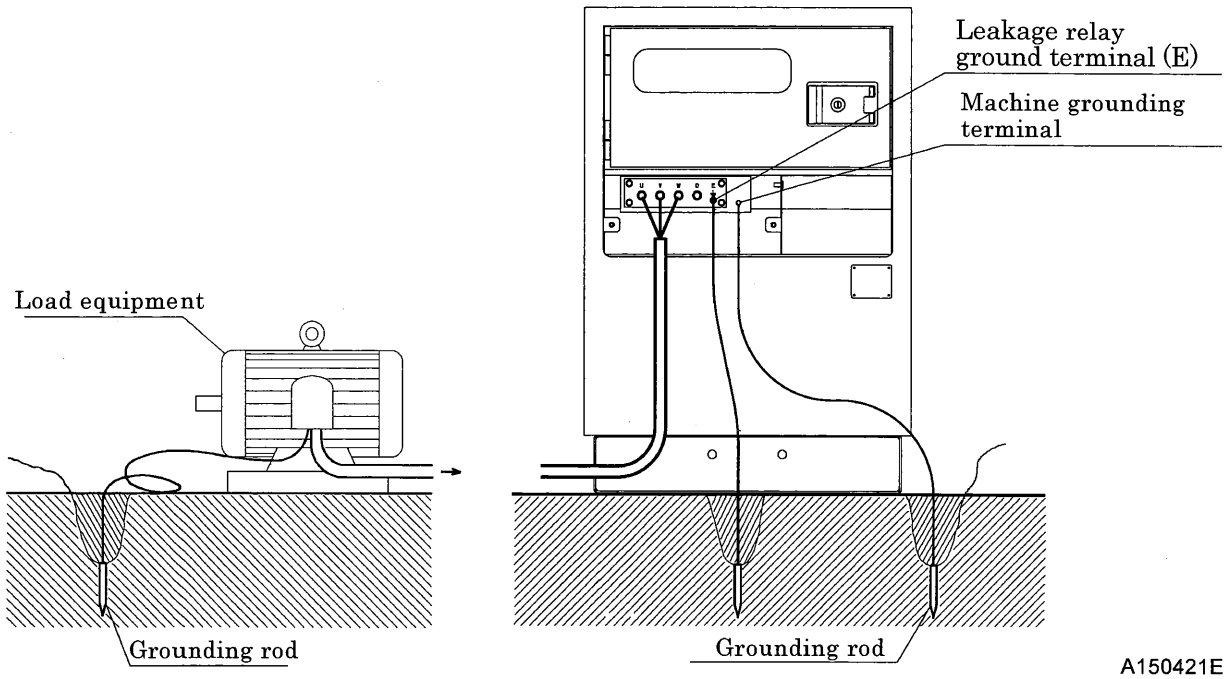
3.3.2 Grounding Method

<Procedure>

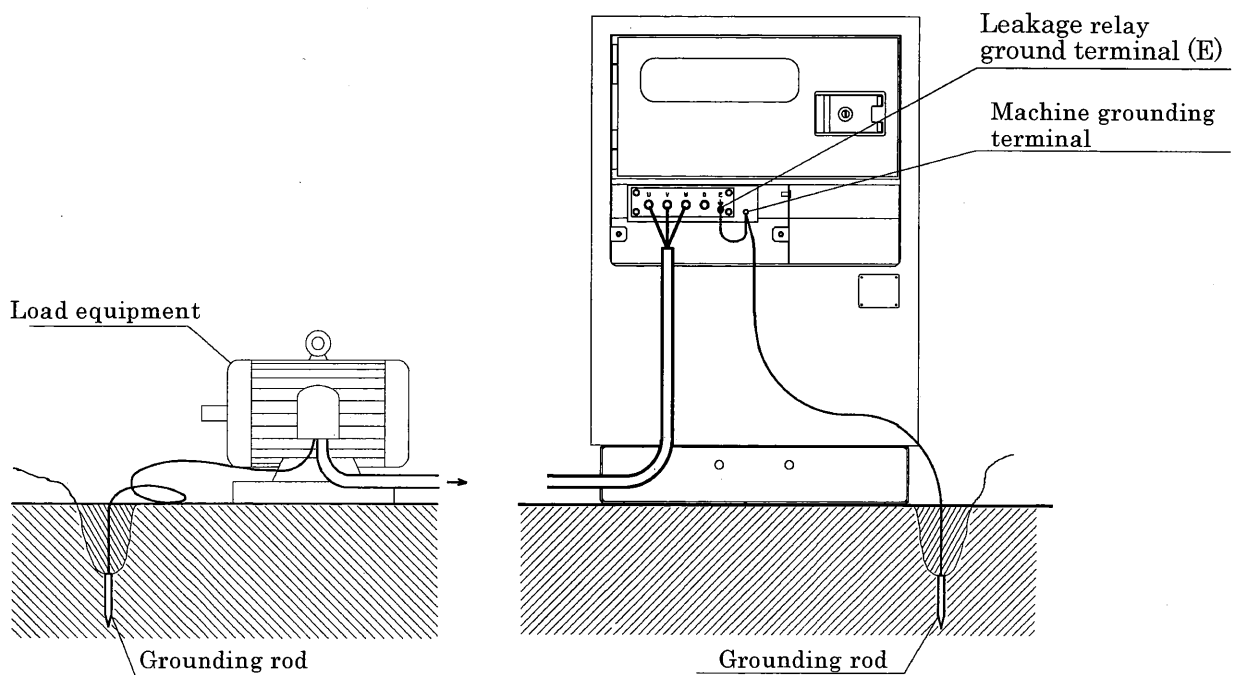
- Connect a lead wire fitted with a ground rod to the leakage relay grounding terminal (E) of the three-phase output terminal board.
 - ① Connect the generator machine ground terminal of the package to ground.
 - ② Be sure to ground the package of the load equipment as well.
 - ③ These grounding must be carried out in accordance with local regulations.

3. Installation

Independent grounding method



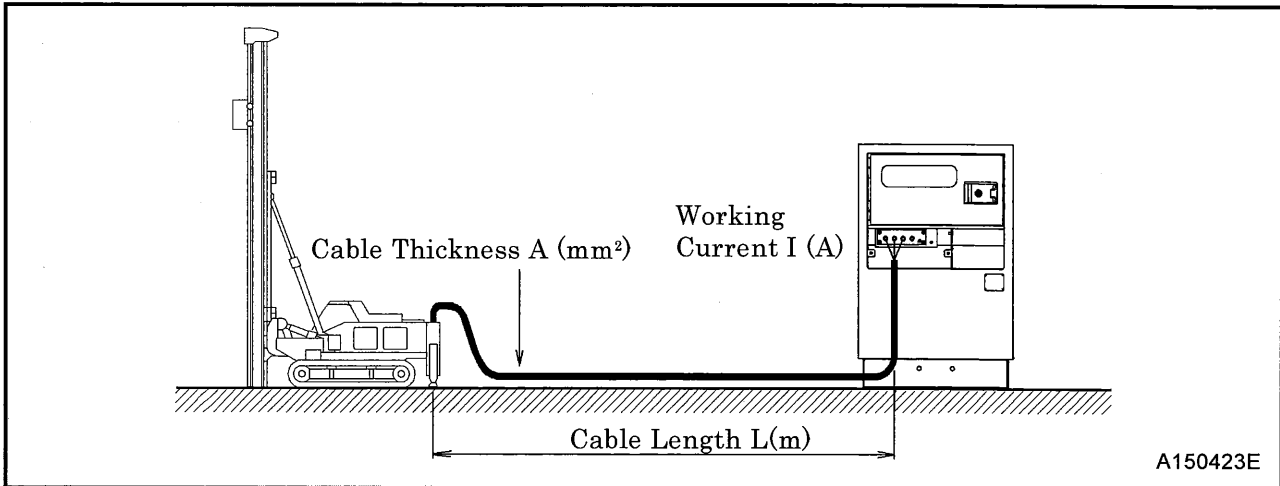
Common grounding method



3. Installation

3.4 Selecting Cable

- Select a cable with sufficient diameter by considering the permissible current on the cable and the distance from the machine to the load.
- If the current flowing to the load exceeds the permissible current of the cable, resultant overheating may burn the cable. Similarly, if the cable is too small in thickness to the length, the input voltage to the load will fall to cause the load input power to drop, as a result, the performance of the machine cannot be displayed.



- Simplified three-phase three-wire formula to seek voltage drop or cross-sectional area of the cable from cable length and working current. Select such a cable length and thickness so that the voltage drop will remain less than 5%.

Output system	Voltage drop	Cross-sectional area of the cable	e : Voltage drop (V) e' : Voltage drop between an outside line or one line of each phase, and a neutral line (V) A : Cable thickness (mm²) L : Cable length (m) I : Working current (A)
Three-phase 3-wire Type	$e = \frac{30.8 \times L \times I}{1,000 \times A}$	$A = \frac{30.8 \times L \times I}{1,000 \times e}$	
Three-phase 4-wire Type	$e' = \frac{17.8 \times L \times I}{1,000 \times A}$	$A = \frac{17.8 \times L \times I}{1,000 \times e'}$	

- The following tables show the relations between the cabtyre cable length and the cable thickness (nominal cross-sectional area) suited to the working current. (Based on the condition that working voltage is 200 V, with voltage drop of 10 V.)

Single-Conductor Cabtyre Cable

Unit:mm²

Current \ Length	50m	75m	100m	125m	150m	200m
50A	8	14	22	22	30	38
100A	22	30	38	50	50	60

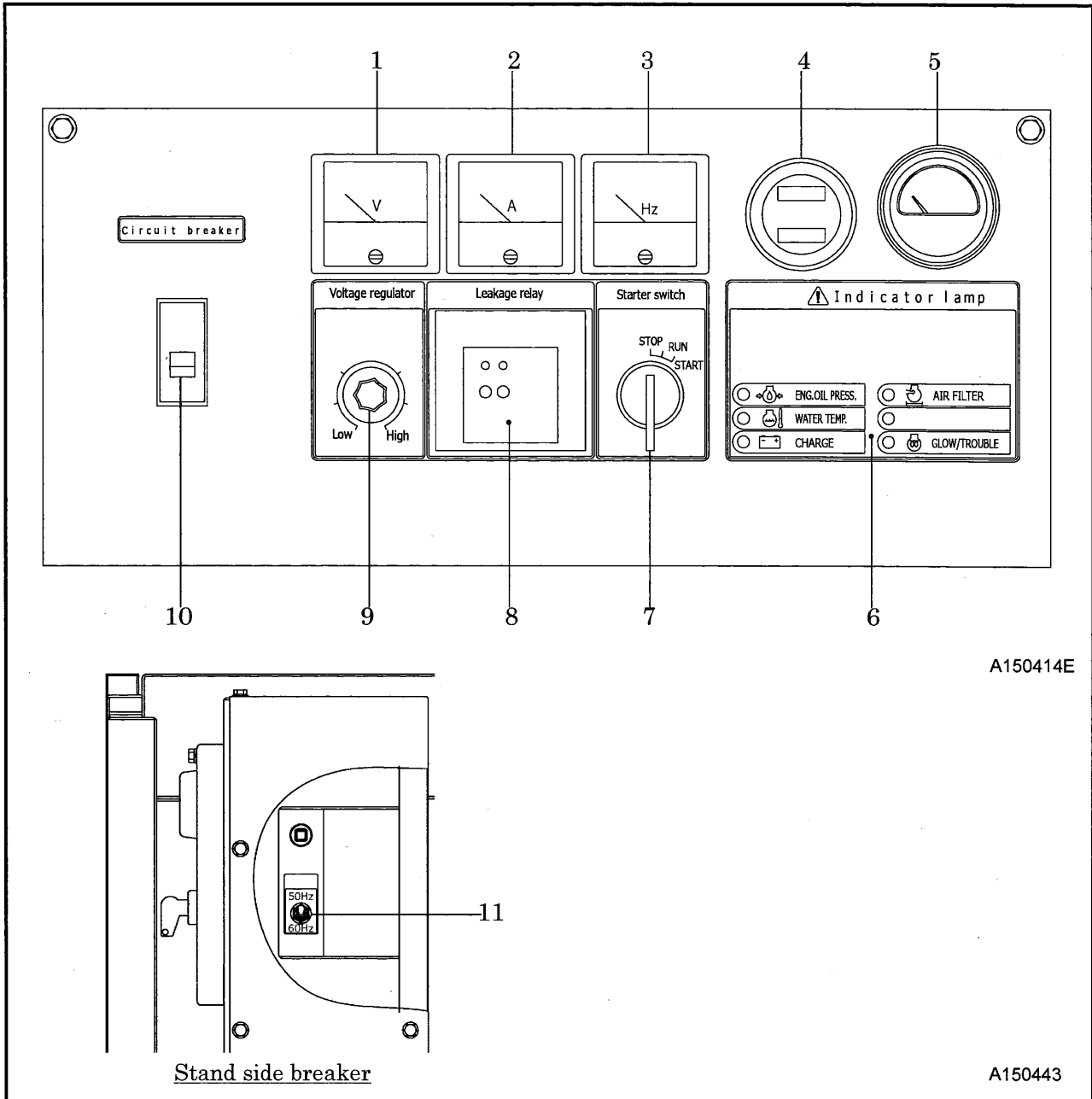
Three-Conductor Cabtyre Cable

Unit:mm²

Current \ Length	50m	75m	100m	125m	150m	200m
50A	14	14	22	22	30	38
100A	38	38	38	50	50	60

4. Operation

4.1 Instrument panel



- | | |
|------------------------------|--------------------------------|
| 1. Voltmeter | 7. Starter switch |
| 2. Ammeter | 8. Leakage relay |
| 3. Frequency meter | 9. Voltage regulator |
| 4. Fuel meter with hourmeter | 10. Circuit breaker |
| 5. Water temperature gauge | 11. Frequency selection switch |
| 6. Indicator lamp | |

4. Operation

4.2 Protection device



- For prevention of troubles during operation, this machine is provided with various protection devices. When the engine stops due to function of the protection devices and circuit breaker trips, get rid of the causes of trouble, referring to the trouble shooting clause and then restart operation.

4.2.1 List of protection devices

- This machine is equipped with the following devices in the table.
Repair and make necessary treatment in accordance with the item ○.

Item	Engine stops	Circuit breaker trips	Warning indicator ※1	Trouble indicator ※2	Indicator lamp	Functions
Engine oil pressure drop	○	—	○	○		When engine oil pressure drops, it functions. Operating pressure: lower than 0.05MPa
Engine water temperature rises	○	—	○	○		In case of abnormal rise of engine water temperature, it functions. Operating temperature: 115°C
Over current or short circuit	—	○	—	—	—	In case of overload or short circuit accident, it functions.
Leakage current ※3	—	○	○ Relay surface	—	—	In case of current leakage it functions. Sensing current: 30 mA
Battery charging	○	—	○	○		When battery charging is not performed well owing to a broken belt, it functions.
Clogging of air filter	—	—	○	—		When air filter is clogged and it becomes necessary to clean it, it functions.

※1 When any abnormality is detected, and the contact is “ON”, it causes warning light to go on.

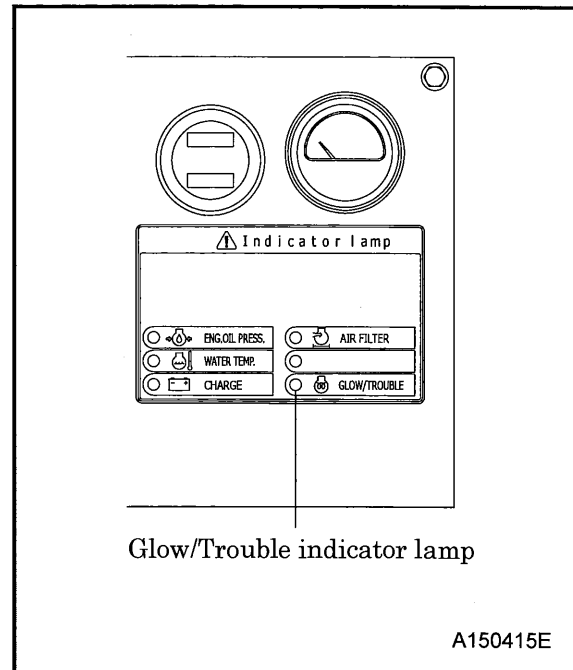
※2 When a trouble occurs, it causes abnormality indicator light to go on. Its flashing patterns show the conditions of the trouble.

※3 In order to ensure the function of ground fault circuit interrupter device, make sure to grounding connection. (See 3.3)

4. Operation

4.2.2 Emergency stop function

- This unit is equipped with the following protection devices. According to the kinds of trouble, the glow/trouble indicator lamp indicates each trouble by the pattern of flickering and also functions to stop engine in emergency.



Trouble	Flickering pattern of trouble indicator	Functions
Excessive RPM	L 1 and S 1	When engine speed rises abnormally, it functions. RPM speed: 2,070min ⁻¹
Drop of engine oil pressure	L 1 and S 2	When engine oil pressure drops, it functions. Function oil pressure: less than 0.05MPa
Battery charging faulty	L 1 and S 3	When battery charging is not performed well owing to a broken belt, it functions.
Rise of coolant temperature	L 1 and S 4	When engine coolant temperature rises abnormally, it functions. Function temperature: 115°C (Water temperature switch)
Malfunction of RPM sensor	L 2 and S 1	When RPM sensor is in disorder or cable connection is disconnected or short-circuited.
Trouble of solenoid sensor	L 2 and S 2	When cable of actuator is disconnected or short-circuited.
Disconnection of coolant temperature sensor	L 2 and S 4	When cable of coolant temperature sensor is disconnected.
Short-circuiting of coolant temp. sensor	L 2 and S 5	When cable of coolant temperature sensor is short-circuited.
Disconnection of alternator L terminal	L 2 and S 6	When cable of alternator L terminal is disconnected.
Excessive voltage	L 3 and S 1	When voltage of alternator rides abnormally. Function voltage: 18V.

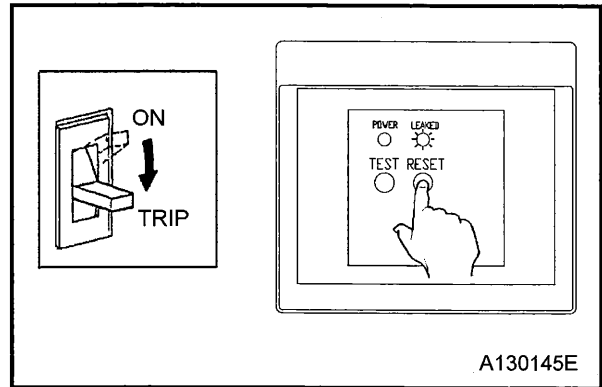
※When engine is brought to emergency stop, some of the above flashing patterns is indicated.

L and S mean Long time and short time alternatively. Also the numbers of each L and S mean repeated time of flickering lamp.

4. Operation

4.2.3 Leakage Relay

- When residual current flows to machine and load, the residual current indicator lamp goes on to trip the circuit-breaker.
<Set value at which it starts to function: 30mA>
- Pressing the reset button of leakage relay, and returning the lever of the circuit-breaker to "OFF" position once, then it is possible to switch "ON" the circuit-breaker again. (See 4.2.4)

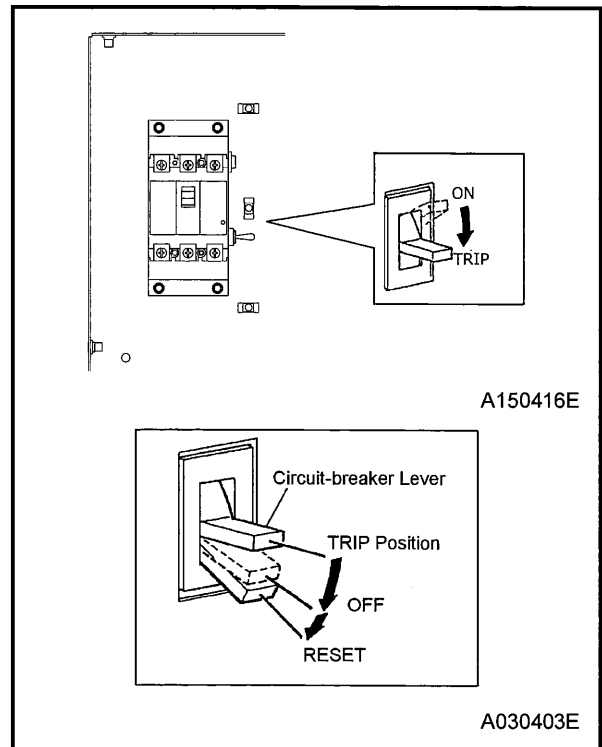


4.2.4 Circuit-breaker

- In case overload and short-circuited wire connection should occur, the circuit-breaker trips.
- It is impossible to switch "ON" the circuit-breaker tripped, and so stop the engine to reset the breaker.

<How to reset>

- In order to reset the lever of circuit-breaker, press hard the lever downward till the lever sounds "click".



4. Operation

4.2.5 Circuit protector (CP) for AVR protection

AVR is equipped with circuit-protector (CP) for protection against overcurrent. Under the following cases, it happens to function.

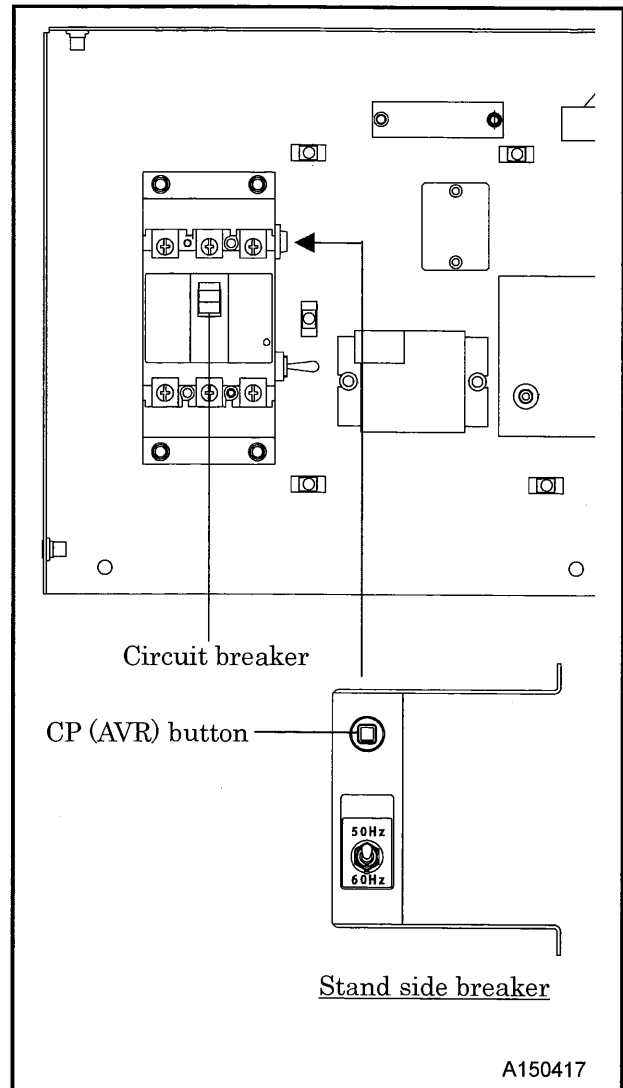
- In case the machine gets overloaded while engine speed is still lower.
- In case the output voltage of machine is increased higher than the specified voltage.

<Symptom>

- When CP functions, voltage drops.

<How to reset>

- Reset it by pressing CP (AVR) button which is provided at the side of the breaker plate in the control panel.



4. Operation

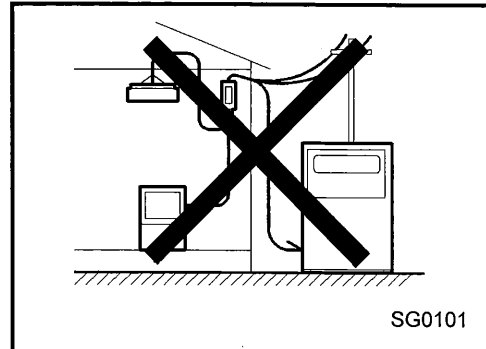
4.3 Connecting Load

⚠ DANGER

- Make sure not to connect the output terminal of the machine with the commercial power source from electric power company. This is not only prohibited by the regulations, but it may cause an electric shock, machine troubles and even a fire.
- Make sure to ground the machine and the load. It could cause an electric shock when the machine is installed at a damp place or on a steel frame or a steel plate.
- Never touch the output terminals during operation.
- Notice that the voltage of several hundreds volt is applied to the output terminal.
- When removing or connecting a connecting cable for changing load, be sure to switch OFF the circuit breaker, remove the starter key from the starter switch, then carry out a work. The operator must keep the key during operation.
- For a connecting cable to load, do not use a cable with damaged sheath nor an inappropriate insulation cable to the voltage.

Secure connections between each cable terminal and input/output terminal. Otherwise, it may be slacked during operation and may cause a fire or an electric shock accident.

Electric shock and electric leak



IMPORTANT

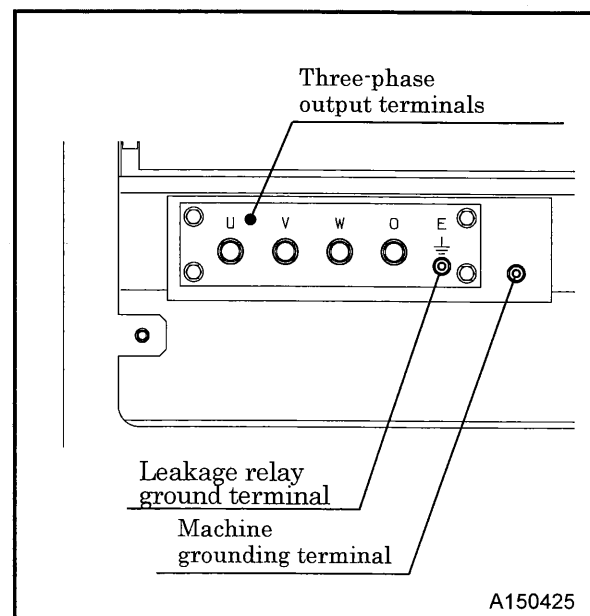
- Notice that the terminal O is not a grounding terminal of the generator. Never connect a grounding wire to it. Such connection may cause the generator main unit or the load troubles.

- Select a cable with sufficient diameter by considering the load capacity and the distance from the generator to the load. Use terminals for connection and securely fasten them. (See 3.3)
- After checking phase number and voltage of the load, make sure to connect them correctly.

—Terminal size—

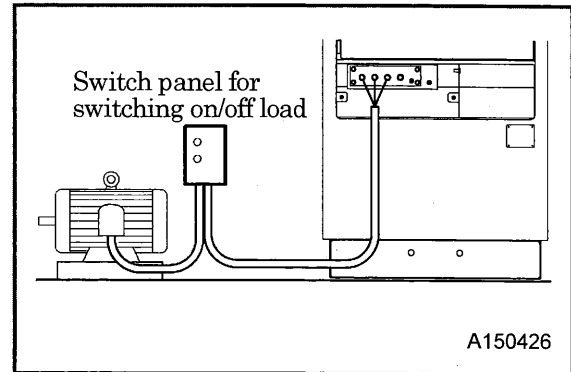
Three-phase output(U · V · W · O) : M8

Leakage relay ground terminal(E) : M6



4. Operation

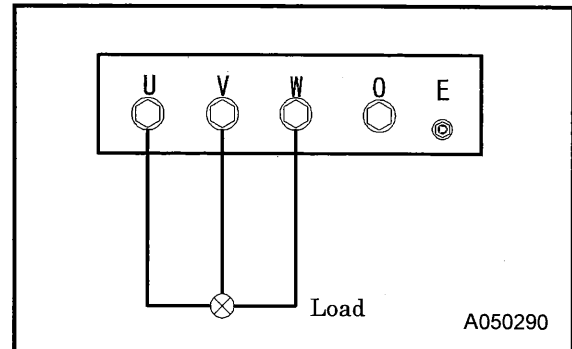
- Install a switch between the output terminal and the load to switch "ON-OFF" the load. Do not switch the load on/off directly by the circuit-breaker of the machine.
- It could cause damage to the Connect the connecting cable to the load so that the output terminals should not touch each other. circuit-breaker.



4.3.1 How to connect three phase load

- In case of three-phase load:
Each electric current value of each phase (U.V.W) should not exceed the values in the following table.

Type	Permissible current value
50Hz/400V	28.9A
60Hz/440V	32.8A



- In case inverter load:
The inverter capacity (input kVA of inverter) should not exceed the following value (within rated output \div 3.0). Also select generator so that the rated output (kVA) of generator so that the rated output (kVA) of generator may be three times of the inverter capacity.

Example: In case at 50Hz, $20\text{kVA} \div 3.0 = 6.7\text{kVA}$.

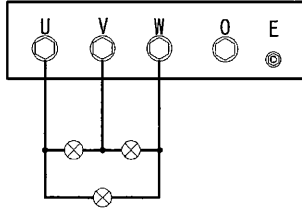
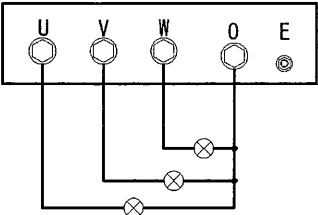
50Hz: 6.7kVA (Input kVA of inverter). It is possible to use inverter capacity up to this value.

60Hz: 8.3kVA (Input kVA of inverter) It is possible to use inverter capacity up to this value.

4. Operation

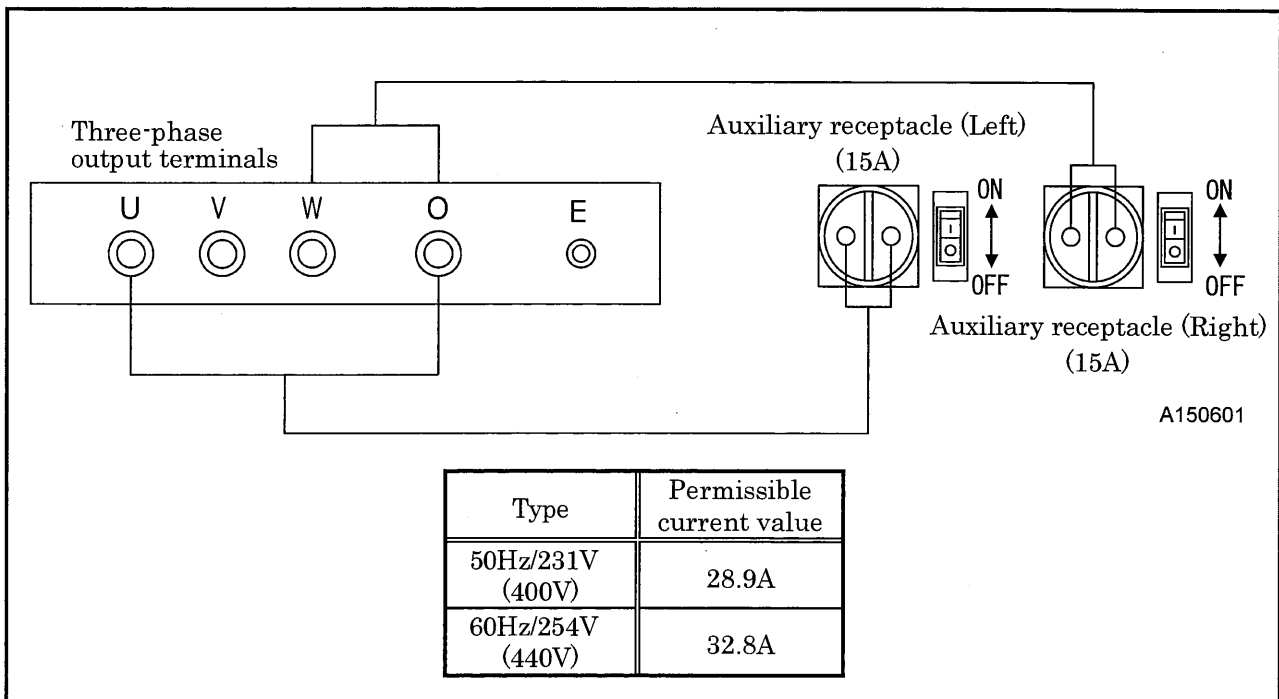
4.3.2 How to connect single phase load

- The method of connection of 3 phase 4 wire single phase load is as follows.
The allowable current limit shall not exceed the values in the following table.

Conditions of load		Allowable current limit	Conditions						
3 phase 4 wire type	In case of using 2 phases	 <table border="1"> <thead> <tr> <th>Type</th> <th>Permissible current value</th> </tr> </thead> <tbody> <tr> <td>50Hz/400V</td> <td>28.9A</td> </tr> <tr> <td>60Hz/440V</td> <td>32.8A</td> </tr> </tbody> </table>	Type	Permissible current value	50Hz/400V	28.9A	60Hz/440V	32.8A	Allowable current limit up to the rated current. Adjust the load capacity so that each current value of each phase (U·V·W) may not be more unbalanced than 50%.
	Type	Permissible current value							
50Hz/400V	28.9A								
60Hz/440V	32.8A								
In case of using O phase	 <table border="1"> <thead> <tr> <th>Type</th> <th>Permissible current value</th> </tr> </thead> <tbody> <tr> <td>50Hz/231V (400V)</td> <td>28.9A</td> </tr> <tr> <td>60Hz/254V (440V)</td> <td>32.8A</td> </tr> </tbody> </table>	Type	Permissible current value	50Hz/231V (400V)	28.9A	60Hz/254V (440V)	32.8A	Allowable current limit up to the rated current. Adjust the load capacity, so that each current value of each phase (U·V·W) may not be more unbalanced than 50%.	
Type	Permissible current value								
50Hz/231V (400V)	28.9A								
60Hz/254V (440V)	32.8A								

4.3.3 Auxiliary receptacle output (Factory option)

- When using the auxiliary receptacle, the total load capacity with three -phase out put terminals shall be used never exceed the maximum combined simultaneous power consumption.
Adjust the load capacity so that each current value of each phase (U · V · W) may not be more unbalanced than 50%.
- When using receptacle outlet please turn 「ON」 a nearby breaker.



4. Operation

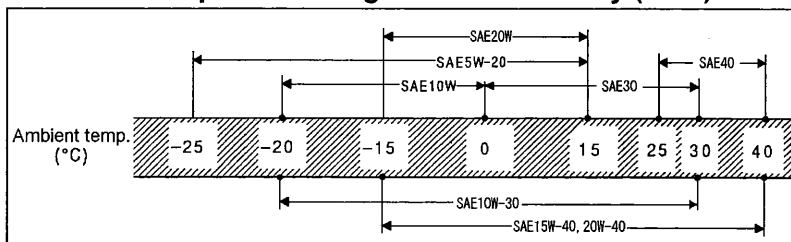
4.4 Engine Oil · Coolant · Fuel

4.4.1 Engine Oil

IMPORTANT

- Viscosity of engine oil greatly affects startability, performance, oil consumption of the engine, as well as wear of the moving parts.
- Choose appropriate oil based upon the table below according to the outside air temperature.

Ambient temperature range and oil viscosity (SAE)



A100293E

*** When the unit is delivered from factory, it is filled with the engine oil having the following specifications:**

Classification	API service classification CF class or higher
Viscosity	SAE10W-30

- When two or more different brands of oil are mixed, its performance can be deteriorated. Do not mix oils.
- When it is expected to be used for a long period at light load (less than 20% load), it is better to replace the oil with suitable oil.
- Follow the designated regulations to dispose of engine oil.

4.4.2 Coolant

IMPORTANT

Quality of coolant and antifreeze

- Use soft water of good quality such as tap water for coolant.
- When water with dirt, sand, and/or dust contained, or hard water such as well water (ground water) is used, this will cause deposits inside radiator or on cylinder head, and will cause engine overheat due to poor flow of coolant.
- When the unit is used in a cold region and possible freezing is expected, it is recommended to use LLC (Antifreeze) for the coolant.
- Adjust mixing ratio of LLC with water according to the temperature. **(When the unit is delivered from factory, it is filled with the oil of density 35%.) Use LLC within the range of its mixing ratio between 30 and 60%. (If LLC in the water exceeds more than 60%, it may decrease its antifreezing effect.)**
- Follow the designated regulations to dispose of LLC (Antifreeze).

4.4.3 Fuel

IMPORTANT

Choose appropriate fuel

- Be sure to use diesel fuel oil.
(Using other oil will cause low power output or damage the engine.)
- As for fuel, use diesel fuel oil (having higher than 45 cetane number).
- Use of diesel fuel oil having lower than 45 cetane number will cause inferior function to engine and, what is worse, it will cause serious accident to the engine.

4. Operation

4.5 Check before Starting the Machine



Check before starting the unit

- Be sure to check the machine before operation.
When any abnormality is found, be sure to repair it before starting the unit.
- Be sure to make daily check before operation. If the unit is operated without prior check and without noticing its abnormality, such operation could cause seizure of components or may even cause fire.

4.5.1 Check Engine Oil Level

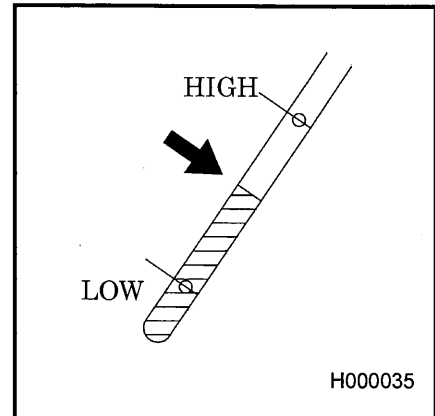
- The machine should be on level before checking oil level.
- When you check oil level after you have once started operation, wait 10 to 20 minutes after stopping engine, before checking the oil level.

<Procedure>

- ① Pull out the engine oil level dipstick, and wipe it with a clean cloth.
- ② Then, re-insert the dipstick fully and pull it out again.
If the gauge shows the oil level between LOW and HIGH limits, it is normal.
- ③ When the oil level is below its LOW, add engine oil.

(See 6.5.1.)

- While checking oil level, check also for contamination. If the oil is found dirty, contaminated, or should be changed according to the periodic inspection list, change the oil.

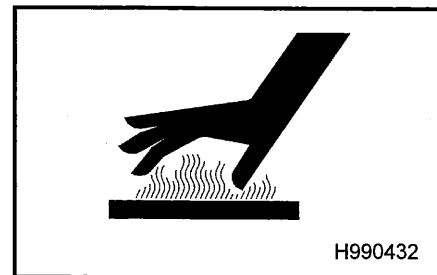


4.5.2 Check Coolant Level



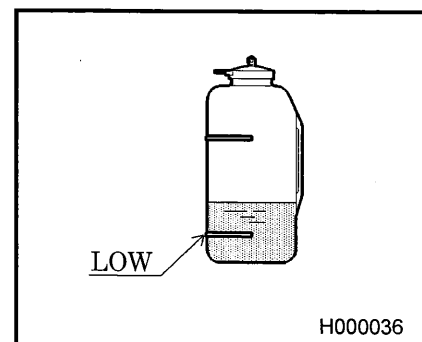
Taking off the radiator cap

- Be sure to stop the machine first and then loosen the radiator cap slowly, after the coolant water is sufficiently cooled and the inner pressure is released.
If this procedure is neglected, its inner pressure can blow off the cap, and steam jetting out of the radiator could cause scalding.



- Check the coolant level in the reserve tank. If it is lower than the limit, open the cap and replenish the coolant.
(Level must be kept above LOW mark)
- If little coolant is left in the reserve tank, replenish the tank and radiator also.

(See 6.5.13)



4. Operation

4.5.3 Check Fuel

- Before starting operation, make sure to check the level of residual fuel so that fuel shortage during operation can be avoided.
- If necessary, drain condensate accumulated at the bottom of the fuel tank.

CAUTION

- Do not, under any circumstance, bring lit cigarettes and/or matches to the fuel.
- The fuel is extremely flammable and dangerous. Be careful of fire because it is very likely to catch fire.
- Refuel only after stopping the engine, and never leave open fuel can near the machine. Do not spill. It could cause a fire. When it is spilt, wipe it up completely.
- Refilling fuel tank should be done in an outdoor well-ventilated place.
- **Do not fill fuel oil up to the cap level. When fuel tank is filled up to the cap level, fuel oil will be overfilled due to volume expansion caused by rise of ambient temperature. Further, fuel will be possibly spilled from fuel tank due to vibration caused during movement and/or transportation of machine.**

Fire prevention

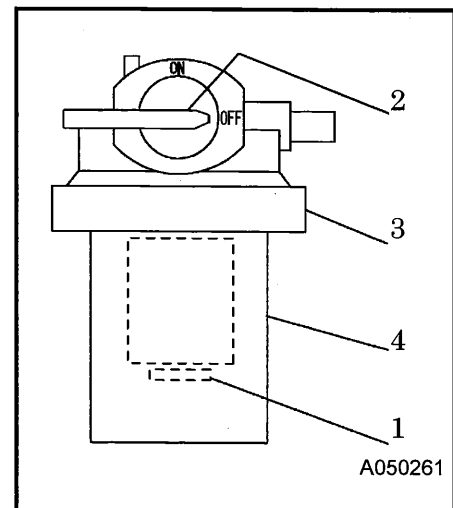


4.5.4 Check for condensate of fuel filter

When the red float "1" of fuel filter is lowered at the bottom, drain condensate from it.

<Procedure>

- ① Place the lever "2" of fuel filter to "OFF" position.
 - ② Loosen the ring nut "3" and remove the cup "4". Carefully handle the cup because it is filled with fuel, and never spill the fuel inside the machine.
 - ③ After draining the water collected inside, clean the cup "4" and then install it.
 - ④ Turn the lever "2" to "ON" position and fill the cup "4" with fuel. Then bleed air. (See 4.6.5)
- Drain the condensate in container, and then dispose of condensate according to the designated regulations.



4.5.5 Check belt Tension

IMPORTANT

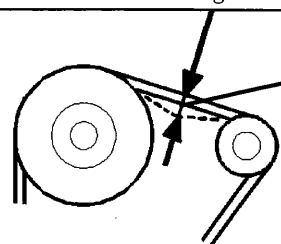
- If belt tension too tight, it can cause shaft breakage or shorten the life of a bearing. If too loose, the belt may slip and will cause early breakage or damage to the belt.

- Adjust the belt and alternator belt by the following procedure:

<Procedure>

- ① Unfasten the mounting bolts of the alternator to adjust the alternator.
- ② Visually check the belt for any crack, wear, and other defect.
- ③ Loosen the mounting bolt of alternator once. Then adjust it so that the belt deflection will be 8-12 mm (98.1N) when pressing with a finger.
- ④ Be careful not to leave any grease and LLC on the belt. If any of such material is left, wipe it off completely.

Depress the middle of the belt with a finger.



Then check the deflection of the belt and make sure that it shall be 8 to 12mm.

A010181

4. Operation

4.5.6 Check Ground of Machine Package and Leakage Relay

Make sure that the machine grounding terminal of the machine package, leakage relay grounding terminal, and the package of the load are securely grounded. (See 3.3)

4.5.7 Check Leakage Relay Operation

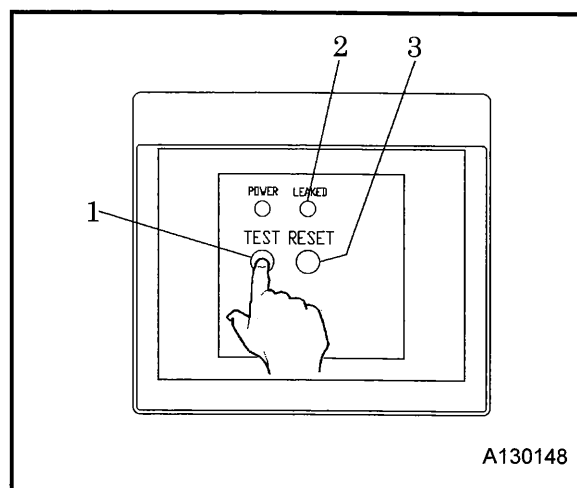


- Never attempt to test the leakage relay by way of human body.
- In case the leakage relay has tripped due to leakage, always investigate the cause to remove it.

Regularly check the relay operation for safety.

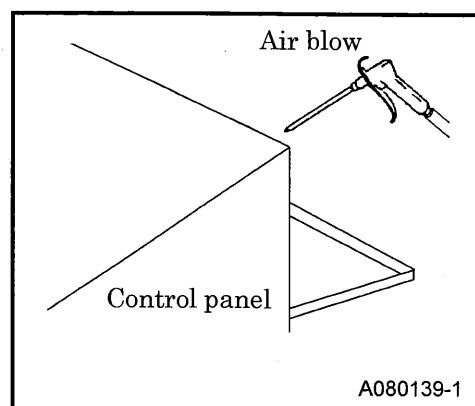
<Procedure>

- ① Start up the machine. (See 4.6.1)
- ② Switch "ON" the circuit breaker.
- ③ Push the leakage relay test button "1". When the red lamp on the leakage relay and the "LEAKED" lamp "2" on the instrument panel glow, the relay function is normal if the circuit breaker is switched "OFF".
- ④ To set the breaker "ON" once again, push the leakage relay reset button "3" and set the breaker lever back to the "OFF" position



4.5.8 Cleaning the instruments inside control panel

- Before starting operation, open control panel and check each breaker, terminal plate and each controller for any dust, sand and dirt accumulated.
- If the machine is operated with such dust, sand and dirt sticking, it could cause malfunction and trouble of instrumentation. If any, stop the machine, and clean them by blowing compressed air. when doing cleaning job, wear protection glasses.



4.5.9 Periodical Inspection of Machine Insides

- Periodically check the inside of the generator for dusts (rubbishes) and flammables. When any flammables such as chips of wood, dead leaves (dry leaves) and waste paper are left near heated exhaust muffler and heated exhaust pipe, all of them should be eliminated.

4. Operation

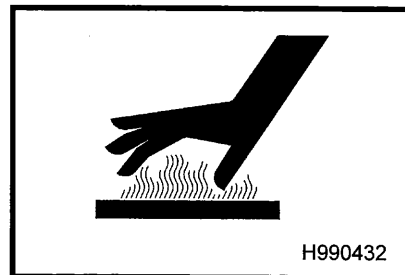
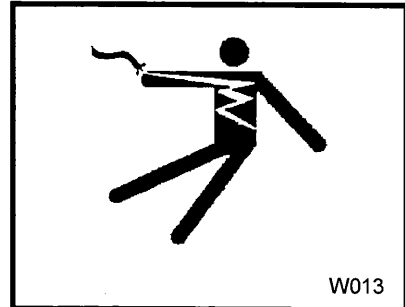
4.6 Operation and Stopping



Never touch the interior of output terminals ,control board

- Keep the output terminal cover shut and locked whenever the machine is running.
- Notice that the voltage of several hundreds volt is applied to the output terminal and control board.
- When opening the door unavoidably, be careful not to touch the rotating parts and hot parts. It could cause scalding and serious injury.
- When removing or connecting a connecting cable for changing load, be sure to switch OFF the circuit breaker, remove the starter key from the starter switch, then carry out a work. The operator must keep the starter key during operation.

Neglecting the cautions mentioned above, and a third party starting the machine during operation may cause serious accidents such as electric shock.



Pay caution to overload and unbalanced load

- When the breaker functions so often during operation, reduce the load.
- When using single- phase load, check the current of each phase and try to keep the load of each phase constantly average.
- If you continue to operate the generator main unit, ignoring and neglecting these cautions, it could cause burning to the unit and resulting in fire. Furthermore, should continue operation at the lower level than the standard rated frequency, it could cause burns to the generator main unit and also the motor of the load.



Draining during operation prohibited

- Do not, under any circumstance, open the portions below during operation.
- Coolant drain valve and plug
- Engine oil drain valve and plug



4. Operation

IMPORTANT

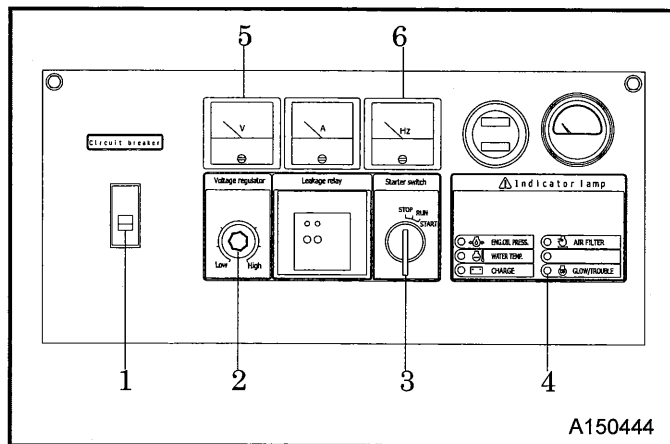
- After the engine starts up, warm up it under unload for approx. five minutes.
 - Warming up after starting up is necessary for smooth operation of the engine. Do not operate the engine at full load immediately after it starts up. This will shorten the equipment life.
 - During the warm-up operation, examine the different parts of the equipment for any looseness, leakage of water, oil, fuel, and other irregularities.
 - Also, make sure that the alarm lamps are off.
 - Be sure to operate the generator at a rated frequency, irrespective of the load capacity.
- If the machine is operated with a frequency lower than the rated frequency, it could cause the generator main unit or to be burned.

4.6.1 Procedure to Start the Unit

Follow the starting procedure below.

<Start engine>

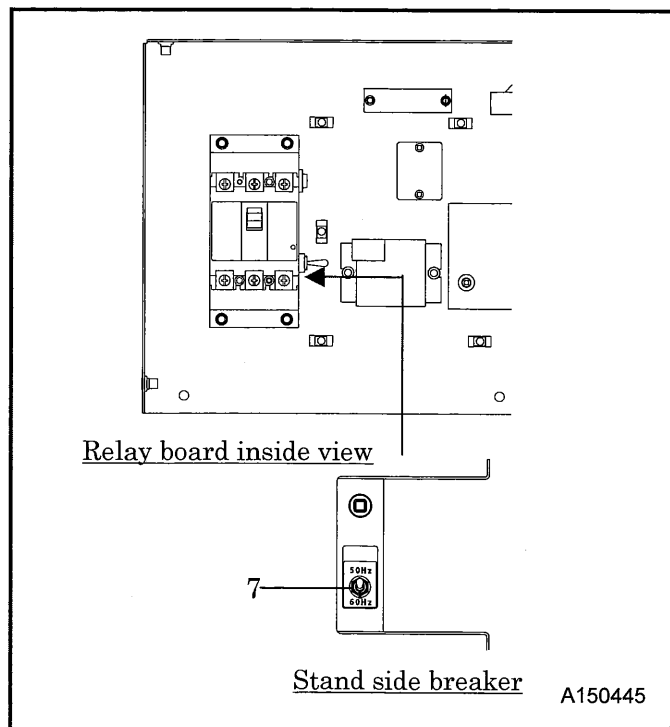
- ① Make sure that circuit breaker "1" are "OFF".
- ② Turn the starter switch "3" to "RUN". Then preheating lamp "4" glows.
- ③ Immediately when the preheat lampswitches off, fully turn the starter switch clockwise to start engine.
- ④ Once the engine has started up, leave the engine running to warm up for approximately 5 minutes.



A150444

<Check and confirm voltage and frequency>

- ① Check the frequency meter "6". When the meter indicates wrong Hz, correct it and set it to your desired frequency, using the frequency selector switch "7".
- ② While watching the voltmeter "5", turn the voltage regulator controlling "2" knob to set the voltage to the rated.



Relay board inside view

Stand side breaker

A150445

<Loaded operation>

- ① Switch circuit breaker "1" "ON", then supply power to the load.
 - ② During operation, check and confirm whether the generator functions properly, according to the table on next page.
- ※ Before starting to supply power to the load, make sure that the voltage is in accordance with the load.

4. Operation

4.6.2 Gauge Indication while Operating

- During normal operation, each indication of instruments is shown in the table below. Refer to the table for daily checks.

		Voltmeter (V)	Frequency meter (Hz)	Ammeter (A)	Indicator lamp									
					Engine oil pressure	Water temp.	Charge	Engine air filter	Leak					
Before Starting up	Starter switch (RUN)	0	0	0	☀ ON	● OFF	☀ ON	● OFF	● OFF					
							● OFF							
During Operation (Full load)	50Hz	400	50	28.9										
	60Hz	440	60	32.8										
During Operation (Unload)	50Hz	400	50	0										
	60Hz	440	60											

- Be sure to check at times to see if gauges or each component of the unit are properly working, or if there is any air-leak, oil-leak, water-leak or fuel-leak etc.
- The table above gives standard values. They may vary slightly depending on the operating conditions and other factors.

4.6.3 Stopping Procedures

<Procedure>

- ① Set the circuit-breaker on the instrument panel of the machine to "OFF" position.
- ② After about five minutes' cooling down operation, turn the starter switch to "STOP" position.

4.6.4 Operating Procedures when Engine Fails to Start up on First Attempt

- When the engine fails to start up even following the start-up procedures, do not keep the starter running, but set the starter switch back to "STOP" and wait about 30 seconds. Then, repeat the start-up procedure once again.
- If the repeated procedure does not allow the engine to run, the following causes are suspected. Therefore, check the following:
 - No fuel
 - Clogging of fuel filter
 - Discharge of battery (Low cranking speed)

4.6.5 Fuel Line Air Bleeding Device

If the unit runs out of fuel, bleed the air, according to the following procedures.

<Procedure>

- ① Replenish fuel.
- ② Turn the starter switch to "RUN" position.
Then the electric pump starts to automatically bleed air caught in fuel pipes.
- ③ Air bleeding will be completed within 20 to 30 seconds.

5. Failure and Troubleshooting

5.1 Troubleshooting

- Should any trouble occur during operation, do not leave it. Investigate the cause and take appropriate measures.
- Read the manual carefully and fully understand what to do in case of trouble.
- The better you understand the construction and function of the unit, the faster you can find a problem and solution.
- This chapter describes the state, cause and countermeasures of important troubles in detail:

Symptom	Cause	Counter measures
Starter does not rotate. Low starter revolution speed even when starting.	(1) Battery malfunction	Check Battery → Charge/Change
Starter rotates but engine does not start up.	(1) Fuel filter clogging (2) Malfunction of controller (3) No diesel fuel oil (4) Air mixing in fuel pipings	Disassemble, clean, and change Check fuse Check connector Check controller Replenish fuel Bleed air
Engine oil pressure drop indicator lamp glows.	(1) Engine oil shortage (2) Engine oil filter clogging (3) Oil pressure switch malfunction (4) Loosened or disconnected wiring, or connector	Replenish fuel Change Change Check/repair
Coolant temperature rise indicator lamp glows.	(1) Radiator clogging (2) Faulty thermostat (3) Faulty coolant temperature switch (4) Shortage of coolant (5) Slip of belt (6) Looseness, disconnection of wiring or connectors	Clean Change Change Replenish Adjust tension Check/repair
Leakage indicator lamp glows.	(1) Leakage on generator side (2) Leakage on load side (3) Leakage on connecting cable (4) Defective leakage relay	Check/repair Check/repair Check/repair Check/repair
Recharging indicator lamp glows.	(1) Alternator problem (2) Looseness, disconnection of wiring or connector	Check/change Check/repair
Air filter clogging indicator lamp glows.	(1) Air filter clogging	Clean

5. Failure and Troubleshooting

Symptom	Cause	Counter measures
Circuit breaker trips.	(1) Overloaded (2) Short-circuit occurred at the load side.	Reduce the load Get rid of cause of short-circuiting.
Even when operated at a rated speed, no voltage or too low voltage generated.	(1) Faulty voltmeter (2) Poor tightening of terminals (3) Broken or short-circuited winding of generator main unit (4) Faulty AVR (5) Faulty silicon rectifier (mounted on generator main unit rotor) (6) Faulty exciter (7) Broken or short-circuited circuit to exciter field winding (8) Function circuit protector (CP) for AVR protection	Check/change Check/repair Check/repair Check/change Check/change Check/repair Check/repair Reset
Too high voltage generated when set at the rated frequency (50Hz/60Hz), Voltage will not drop even when the voltage regulator controlling knob is turned.	(1) Loosened or disconnected wiring, or connector to AVR (2) Faulty AVR (3) Broken wire or poor contact of AVR variable resistor	Check/repair Check/change Repair or change
Unstable voltage generation	(1) Poor tightening of each terminal (2) Faulty AVR (3) Function circuit protector (CP) for AVR protection	Check/repair Check/change Reset

- Please contact your nearest dealer if you find it difficult to repair by yourselves.
- Please refer to the engine operation manual for troubles concerning the engine.

6. Periodic Inspection/Maintenance

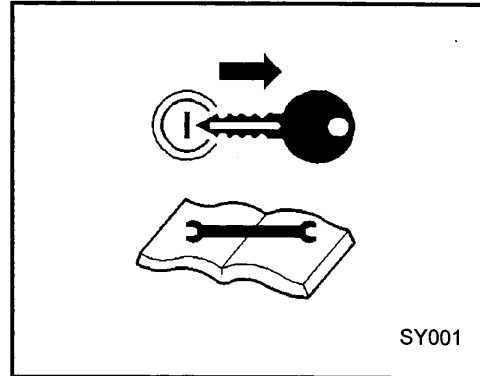
6.1 Important Items at Periodic Inspection and Maintenance or after Maintenance

The following table shows the inspection and maintenance intervals under normal operation conditions. When used or operated under hard environmental conditions, it is impossible to warrant the unit even if the above conditions are performed according to the intervals listed in the above table.

WARNING

Hang a "Now Checking and under Maintenance" tag

- Remove the starter key from the starter switch before starting inspection, and hang up a "Now Checking and under Maintenance" tag where it can be easily seen. The checker must keep the key during checking and maintenance.
- Remove the negative (-) side cable from the battery. If the above procedure is neglected, and should another person start operating the machine during check or maintenance, it could cause serious injury.
- Be sure to use appropriate tools for inspection and maintenance work. Inappropriate tools could cause unexpected injury.



IMPORTANT

Precaution for check and maintenance

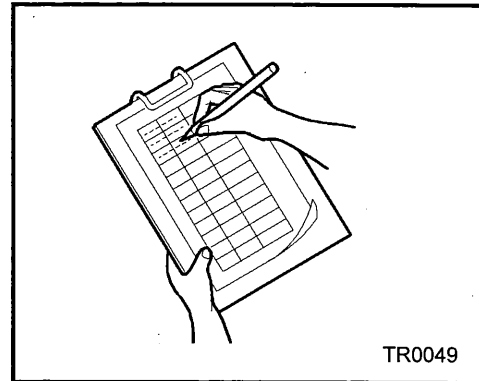
- Be sure to use recommended fuel, oil, grease, or antifreeze.
- Do not disassemble or adjust engine, compressor or part(s) for which inspection or maintenance is not referred to in this manual.
- Use genuine parts for replacement.
- Any breakdown, caused by using unapproved parts or by wrong handling, will be out of the scope of "WARRANTY".
- Check rotor and stator of generator body for any seizure of foreign matter, dust or dirt, and cable disconnection.
- Do not pour water or steam on electrical components.
- Place a container or a pan underneath the oil port to receive waste liquid so that such liquid cannot be spilled out on the floor or inside the machine.
- Be sure that no waste liquid is disposed of on the ground. Such waste on the ground, river or lake will cause serious environmental contamination. Be sure to follow the local regulations. If harmful material such as oil, antifreeze solution or filters are disposed of incorrectly, the responsible person should be punished by the authority.
- Observe local regulations when disposing of such toxic materials as oil, fuel, coolant (anti-freeze), filters, and battery etc.

6. Periodic Inspection/Maintenance

6.2 Daily Inspection and Keeping Operation Log

- Be sure to carry out daily inspection every morning before operation. See Chapter 4 “OPERATION” of the manual for the details of inspection.
- Pay attention to and carefully observe the following points during daily operation or inspection and maintenance work. If any trouble or abnormality is found, immediately investigate its cause and make repairs. If the cause is unknown or not traceable, or if the trouble involves a part or component not described in the manual, ask your nearest dealer for information.

- (a) Controls and instruments function properly.
- (b) Quantity and any leak of water, fuel, and oil or any contamination should be checked.
- (c) Appearance, abnormal noise or excessive heat should be checked.
- (d) Loose bolt or nut should be checked.
- (e) Any damage, wear or shortage of machine components and parts should be checked.
- (f) Performance of each part or component should be proper.



- Keep the operation log to record constant inspection of each component, so that trouble of the machine can be easily discovered and preventive measures can be taken.
It is very useful to record information such as frequency, temperature, current, maintenance items and replenishment of lubricant on a daily maintenance log.

6.3 Periodic Replacement of Parts

IMPORTANT

Use our genuine elements

- Air filter is a crucial component for the performance and the life of a unit.
Use genuine part for replacement.
- Part number changes upon modification. For replacement of parts, make sure whether the part number is correct or applicable.

Part Name	Part Number	Quantity
Engine oil filter	37438 07800	1
Air filter element	32143 11500	1
Fuel filter element “4”	43541 01300	1
O-ring “5”	KUBOTA 04811-50650	1
O-ring “6”	KUBOTA 04816-00160	1
Belt	KUBOTA 17112-9701-0	1
Engine fuel hose	KUBOTA 17331-4250-0	1

6. Periodic Inspection/Maintenance

6.4 Periodic Inspection List

Such items marked ○ shall be carried out by customers.

For the following items or clauses marked ●, contact us directly or our distributors because they require expert technical knowledge on them.

The following table shows the intervals of inspection and maintenance under normal operation conditions. Inspection and maintenance should be done at either of the hour or the period mentioned in the remarks column, whichever comes earlier.

* Refer to engine operation manual for inspection and maintenance of an engine.

(Unit : Hour)

Maintenance		Daily	Every 50 hours	Every 250 hours	Every 500 hours	Every 1,000 hours	Page	Remarks
Generator	Check ground of machine package and leakage relay.	○					4-12	
	Check leakage relay operation.	○					4-12	
	Cleaning the instruments inside control panel.	○					4-12	Cleaning should be done when needed.
	Check each instrument and indicator lamp.	○					4-15	
	Check insulation resistance.			○			6-5	Every 2 months
Engine	Check engine oil level.	○					4-10	
	Check coolant level.	○					4-10	
	Check fuel.	○					4-11	
	Check for condensate of fuel filter	○					4-11	
	Check belt tension.	○					4-11	In the case of NG, it exchanges.
	Change engine oil.		○ (First time)	○			6-4	
	Change engine oil filter.		○ (First time)	○			6-5	
	Check and clean clogging of air filter element.			○			6-6	Perform cleaning when the monitor lamp glows.
	Drain fuel tank.			○			6-6	
	Check battery electrolyte.			○			6-6	
	Check specific gravity of battery electrolyte				○		6-7	
	Change fuel filter element.				○		6-8	
	Clean outside of radiator.				○		6-8	Dirt condition cleans.
	Check for crack and leak on the exhaust flexible pipe.				○		6-8	Every 4 months
	Change air filter element					○	6-9	
	Check engine valve clearance.					●		
	Adjust fuel injection nozzle.					●		
	Check fuel injection timing.					●		
	Clean inside the fuel tank.					●		
	Change coolant. (LLC)						6-10	Every 2 years
Check engine fuel hose			○ (Check)			6-11	Every 2 years	
Others	Check the terminal portion of electrical circuits and cable connections.				○		6-9	Every 4 months
	Check vibration isolator rubbers					○	6-10	Every 1 year
	Check each rubber hose.					○	6-11	Every 1 year

Note : The above intervals of inspection and maintenance are respectively based on the operation time of 125 hours of used per month and of 1,500 hours of use per year.

6. Periodic Inspection/Maintenance

6.5 Maintenance

6.5.1 Change Engine Oil

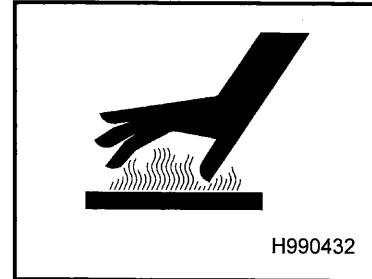
[At 50 hours for the first change and every 250 hours thereafter]



CAUTION

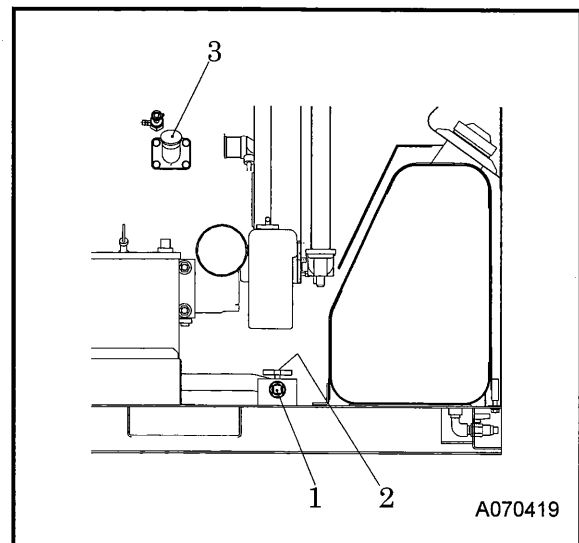
Caution in filling or draining engine oil

- When checking, replenishing, and draining the engine oil, be sure to wait 10 to 20 minutes after engine stops until it cools down.
- Engine oil is very hot and highly pressurized during or just after the operation. Hot oil could blow out and can cause injury.
- Never supply more engine oil than the proper level. Too much oil could cause white smoke out of the exhaust, and it can cause damage and accident to engine.



<Procedure>

- ① Remove the drain plug "1" attached outside the plane, open a drain valve "2" inside the plane, and discharge engine oil drain.
- ② When the oil is completely drained, close a drain valve "2" after attaching a drain plug "1", remove the cap of an engine oil filler port "3", refill new engine oil. **[Oil supply: about 9.5 L]**
- ③ After completing oil supply, insert the oil filler cap "3" firmly.
- ④ Please be sure to check whether engine oil is normal oil supply with an oil level gauge before operating this machine.



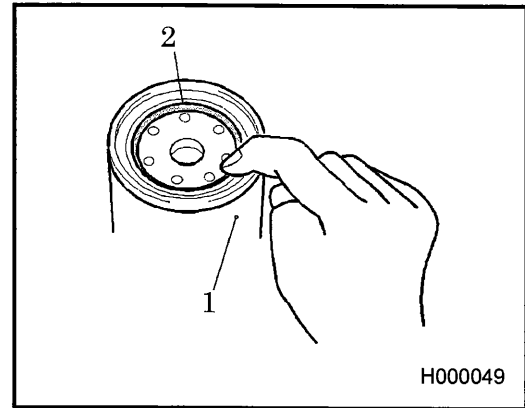
6. Periodic Inspection/Maintenance

6.5.2 Change Engine Oil Filter

[At 50 hours for the first change and every 250 hours thereafter]

<Procedure>

- ① When installing a new oil filter "1", spread oil over the packing "2", and then screw it in. After the packing "2" touches the sealing face, tighten another 2/3 turn with a filter wrench.
- ② After the oil filter "1" is assembled, check if there are any oil leaks during operation. (See 6.3)



6.5.3 Check Insulation Resistance

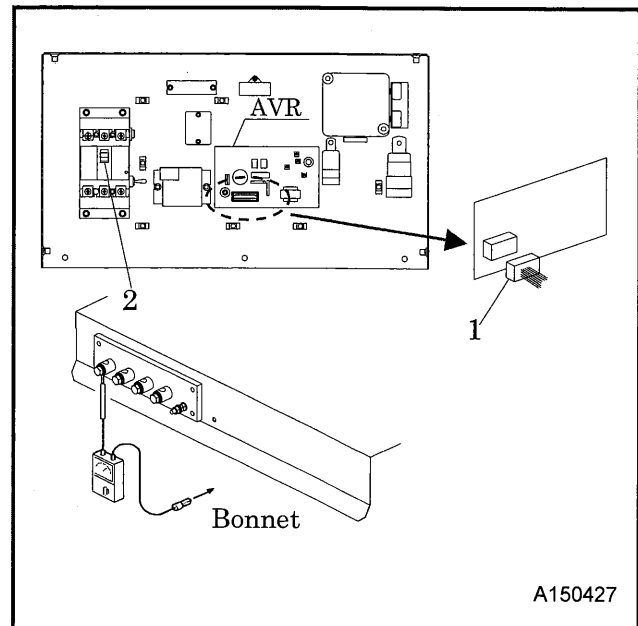
[Every 2 months or every 250 hours]

IMPORTANT

- Insulation resistance should be regularly checked or measured with a 500V insulation resistance meter. If it is reduced to lower than $1M\Omega$, it could cause an electrical leakage or a fire.
- For recovery or improvement of insulation resistance, wipe and clean dust and dirt around output terminals, circuit breaker, generator body outlet port and receptacle(factory option) and dry them. Even if it carries out the above disposal, when you do not recover, contact us directly or our distributors.

<Procedure>

- ① Remove the load side cable from the output terminal board.
- ② Remove the AVR connector "1" inside the machine control panel.
- ③ Switch "ON" the circuit breaker "2", measure each insulation resistance between the terminals U. V. W terminal and bonnet.
- ④ If insulation resistance value measured is found more than $1M\Omega$, it is good.



6. Periodic Inspection/Maintenance

6.5.4 Check and Clean Clogging of Air Filter Element

[Every 250 hours]

IMPORTANT

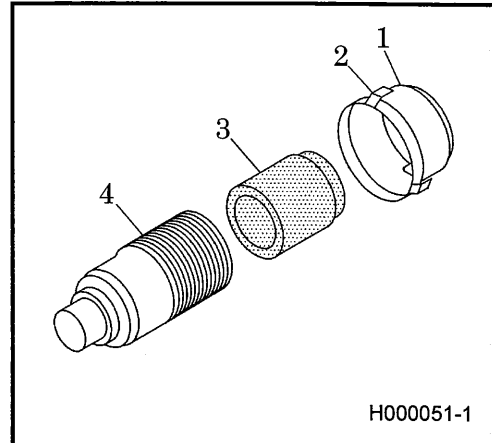
Be sure to properly clean air filter element

- When an element that is clogged or has holes or cracks is used, dust or foreign material will get in the engine. This causes accelerated wear in each sliding part of the engine. Be sure to make daily check and cleaning so that the life of the engine will not be shortened.

- When the air filter monitor lamp glows, clean the air filter.

<Procedure>

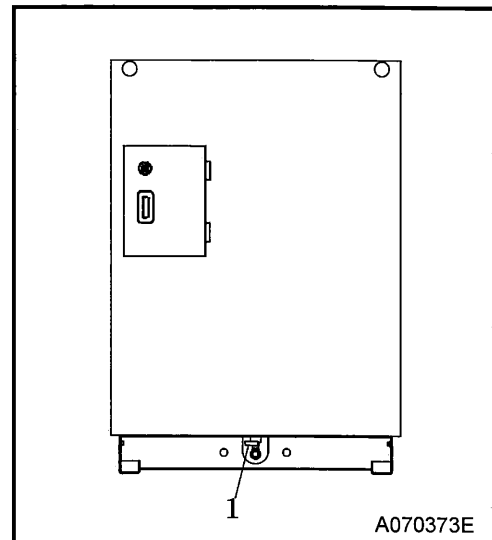
- ① After removing the cap "1" by loosening its latch "2", clean its interior properly.
- ② Remove the element "3", and clean it.
- ③ When installing the cap "1" after finishing the cleaning job, push the element into the case "4" surely by hand, and then make sure that the latch "2" fixing the cap surely hooks the case "4". Finally tighten it.
- ④ If the element is found heavily dusty, replace it with a new one. **(See 6.3)**



6.5.5 Drain Fuel Tank

[Every 250 hours]

- Fuel tank drain is loosen the drain valve "1" located outside the frame to discharge condensate left in the tank.
- When completely drained, firmly close the drain valve "1".
- Dispose of condensate according to the designated regulations.



6.5.6 Check Battery electrolyte and specific gravity of battery electrolyte

[Battery electrolyte : every 250 hours]

[Specific gravity of battery electrolyte : every 500 hours]

If there to be a problem in starting an engine due to a flat battery, carry out the checks by following the procedures below:

(1) Ordinary type battery:

Measure specific gravity of battery electrolyte, and if it shows below 1.24, recharge the battery immediately. **(See 6.5.7)**

(2) Enclosed type battery:

Check the indicator on top surface of the battery.

If the indicator shows that charge is needed, recharge the battery immediately.

6. Periodic Inspection/Maintenance

6.5.7 Maintenance of Battery

WARNING

- Keep flames away from battery.
 - Battery may generate hydrogen gas and may explode.
 - Therefore, recharging should be done at a well-ventilated place.
 - Do not spark near the battery nor light a match, nor bring lit cigarette and match close to the battery.
- Do not check the battery by short-circuiting the positive and negative terminals with a metallic piece.

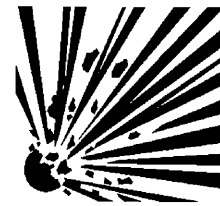
Never operate the machine nor charge the batteries with the battery liquid level being kept lower than the "LOWER" level. Continuing operation at this lower level will cause deterioration of such parts as pole plates etc., and also it may cause explosion as well as reduction of battery life.
- Add distilled water so that the liquid level may reach the middle level between the "UPPER" and "LOWER" level without any delay.
- Do not charge the frozen battery. Otherwise it may explode. If the battery is frozen, warm it up until the battery temperature becomes 16°C to 30°C.
- Battery electrolyte is dilute sulfuric acid.

In case of mishandling, it could cause skin burning.
- Wear protective gloves and safety glasses when handling a battery.
 - When such battery electrolyte contacts your clothes or skin, wash it away with large amount of water immediately.
 - If the battery electrolyte gets into your eyes, wash it away immediately with plenty of water and see a doctor at once, because it is feared that eyesight might be lost.
- Dispose of battery, observing local regulations.

Handling battery



D004



W010



TR0093

CAUTION

Reverse connection prohibited

- Never reverse the cable connections. — When a booster-cable is unavoidably used or when a set of cables is connected after a battery change, be sure to correctly connect the electric terminals (+) and (-). Reversely-connected cables will cause sparks or damage to components.

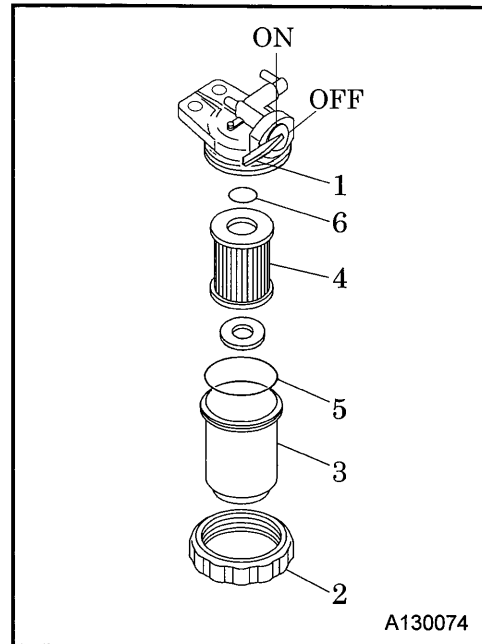
6. Periodic Inspection/Maintenance

6.5.8 Change fuel filter element

[Every 500 hours]

<Procedure>

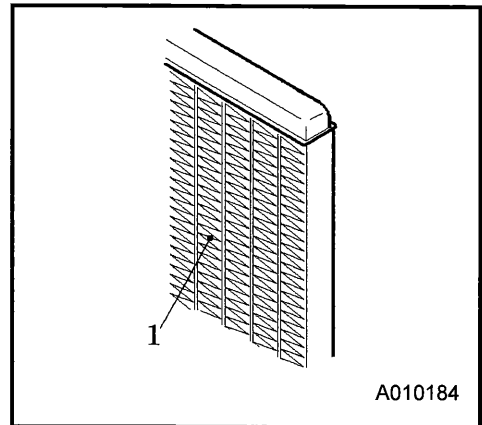
- ① Turn the lever "1" of fuel filter to "OFF" and cut off fuel supply.
- ② Loosen the ring nut "2" to remove cup "3", take out the element "4".
- ③ Clean the cup "3", fit a new element "4" in, and install a new O-ring "5", "6". (See.6.3)
- ④ After installing the cup "3" with the element "4" built in to the body, securely fasten it by the ring nut "2".
- ⑤ Turning lever of fuel filter "1" to "ON" position, supply fuel in the cup. Then bleed air completely from fuel system. (See 4.6.5)



6.5.9 Clean outside of Radiator

[Every 500 hours]

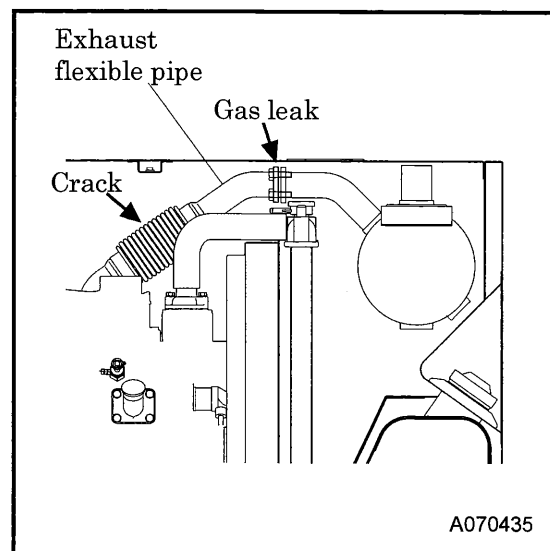
- When the fin tubes "1" of radiator are clogged by dust or other foreign materials, the heat exchange efficiency drops and this will raise coolant temperature. These tubes and fins should be cleaned depending on the state of dirt inside the tubes even before maintenance schedule.
- Do not use high pressure washer for washing to prevent fin tubes "1" from being damaged.
- When the unit is used, installed near seaside and on boat board, clean the radiator using fresh water more times than once a month.



6.5.10 Check for crack and leak on the exhaust flexible pipe

[Every 4 months or every 500 hours]

- Check for any crack and gas leak on the flexible pipe and exhaust between flexible pipe between engine exhaust outlet and the flexible pipe.
- If any leak is found, avoid getting burned by the exhaust gas.



6. Periodic Inspection/Maintenance

6.5.11 Check the terminal portion of electrical circuits and cable connections

[Every 4 months or every 500 hours]

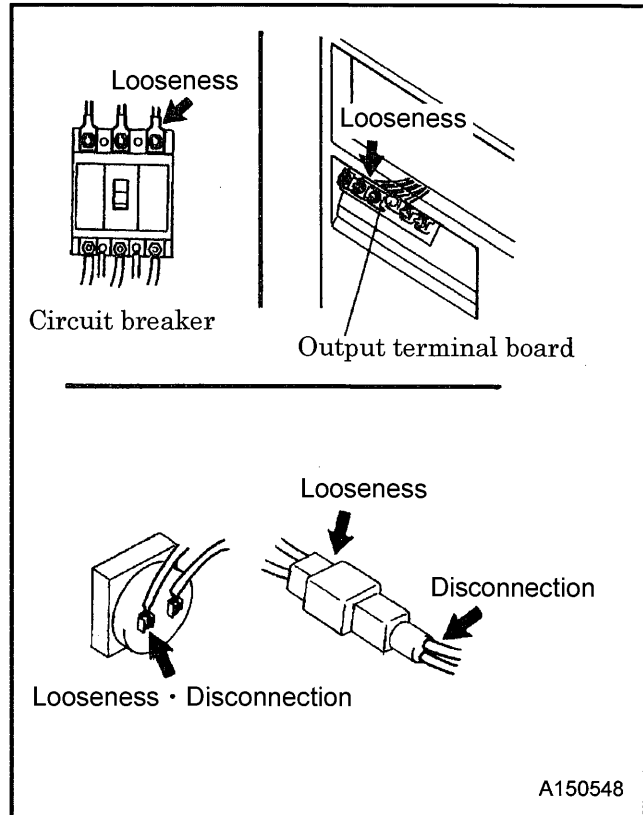
Check for any looseness on the cables and any damages on insulated covers and disconnection, disconnected cables, or short-circuit etc.

[Checking points of electrical circuits on the generator side]

- Terminal connection of three-phase output terminal plate.
- Main circuit of circuit breaker.
- Terminal connection on control box.
- Each terminal connection of each instrument.

[Checking points of electrical circuits on the engine side]

- Portion of connectors to the engine.
- Check for looseness of terminal connections.



6.5.12 Change Air Filter Element

[Every 1,000 hours]

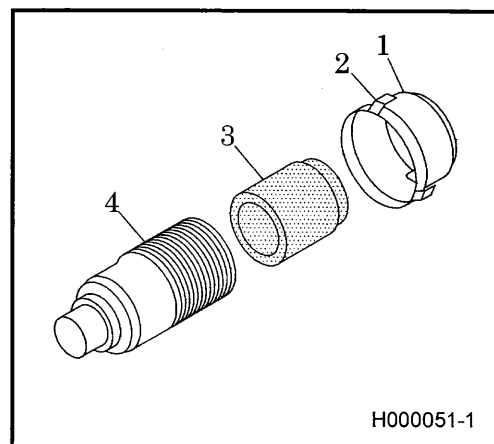
IMPORTANT

Be sure to properly clean air filter element

- When an element that is clogged or has holes or cracks is used, dust or foreign material will get in the engine. This causes accelerated wear in each sliding part of the engine. Be sure to make daily check and cleaning so that the life of the engine will not be shortened.

<Procedure>

- ① After removing the cap "1" by loosening its latch "2", clean its interior properly.
- ② Remove the element "3" and then replace it with a new one. **(See 6.3)**
- ③ When installing the cap "1" after replacing it, properly push the element into the case "4" by hand and then make sure that the hooks for fixing the cap are surely set. Finally tighten it.



6. Periodic Inspection/Maintenance

6.5.13 Change Coolant

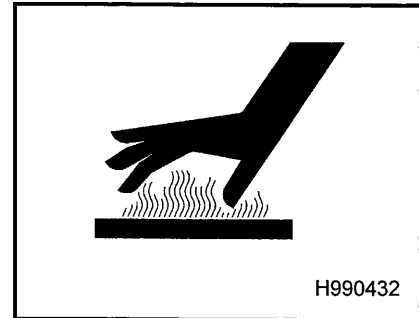
[Every 2 years]



CAUTION

Caution in filling or draining engine oil

- Be sure to stop the machine and loosen the radiator cap slowly, after the coolant water is sufficiently cooled and the inner pressure is released, then take the cap off.
If the following procedures are neglected, the radiator cap could be blown by the internal pressure or hot moisture air be blown out to cause burning. Therefore, make sure to carry out them without fail.
- LLC (Antifreeze) is a toxic material.
- If it should be swallowed by mistake, it is necessary to see a doctor immediately instead of being sent out enforcedly.
- When a person gets LLC (Antifreeze) in his eyes, wash the eyes with clean running water and make him see a doctor immediately.
- When LLC (Antifreeze) is stored, put it in a container with an indication saying "LLC (Antifreeze) inside" and seal it up, then Keep it in a place away from children.
- Beware of flames.

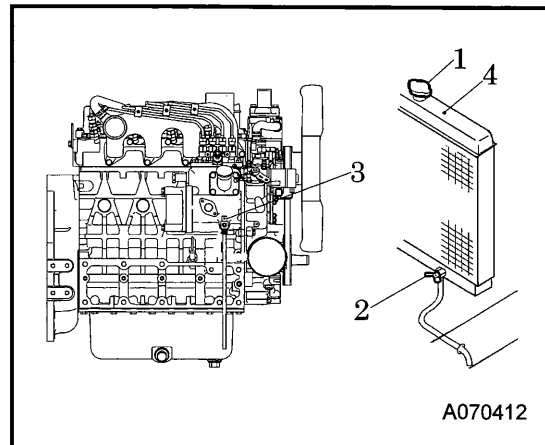


<Procedure>

- ① To drain coolant, remove the radiator cap "1", then loosen the drain valve "2".
- ② Be sure to also unfasten the drain plug "3" on the engine cylinder block for drainage.
- ③ When the coolant is completely drained out, close each drain valve "2" and drain plug "3", and supply new coolant from the filler port of radiator "4".

[Water supply: about 7.0 L]

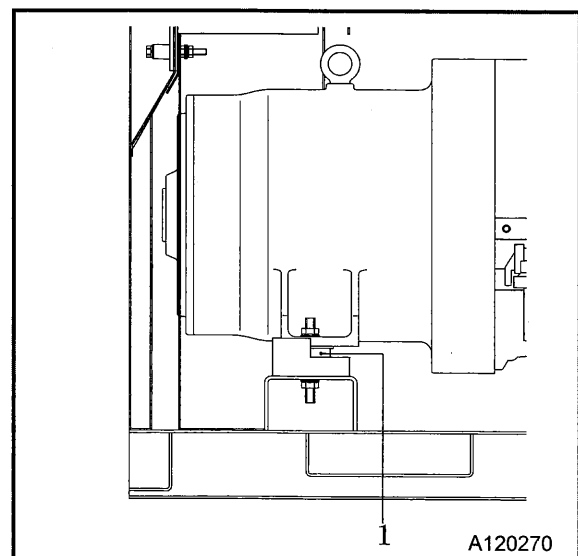
- ④ After changing the coolant, run the engine under unload operation for 2 to 3 minutes, then stop it. Check the coolant level again and replenish it if necessary.



6.5.14 Check vibration isolator rubbers

[Every 1 year or every 1,000 hours]

- The vibration isolation rubber "1" is used for the support of generator and engine. Check the rubber for any damage or deterioration due to oil sticking.



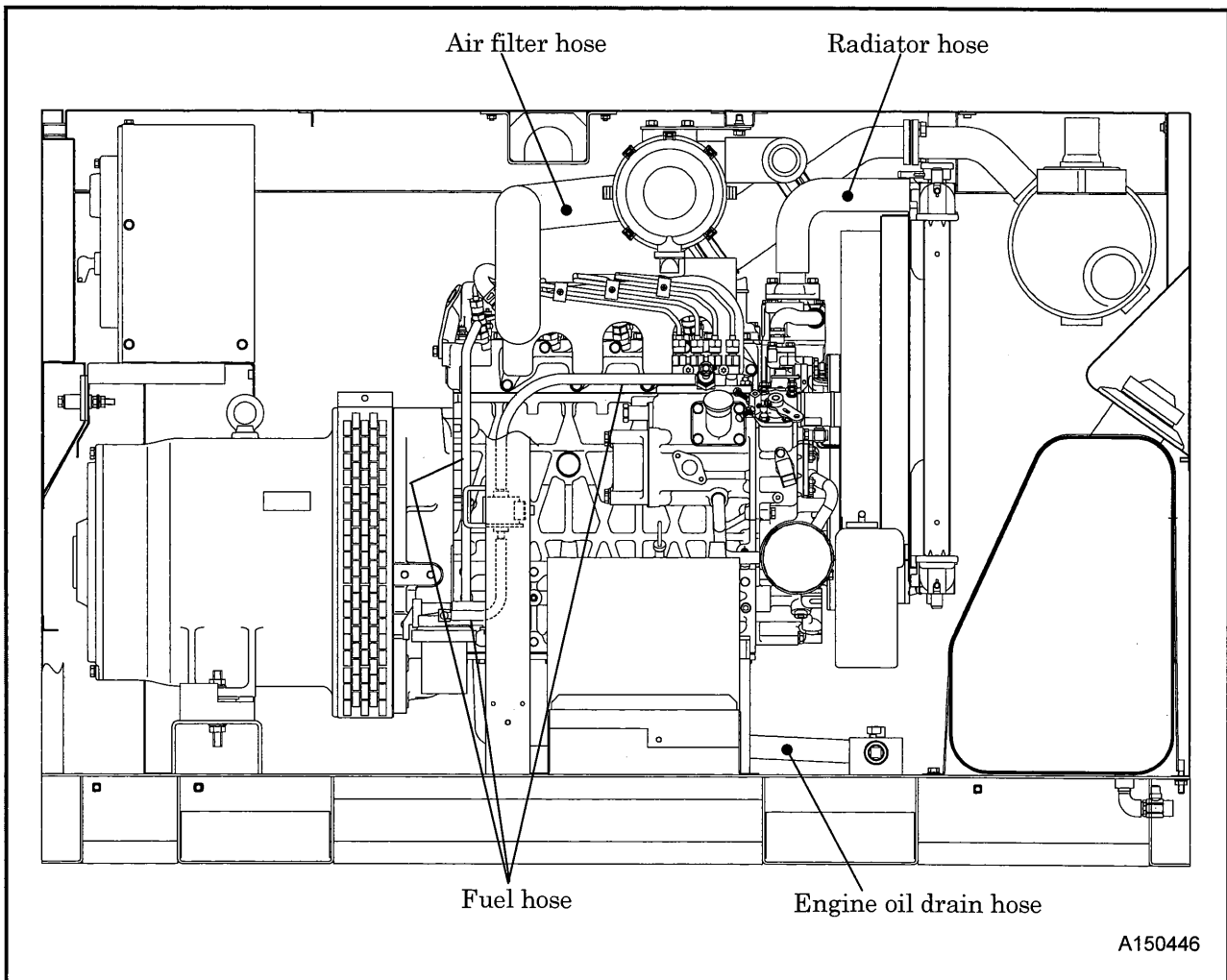
6. Periodic Inspection/Maintenance

6.5.15 Check each rubber hose

[Every 1 year or every 1,000 hours]

Check all the rubber hoses for being hardened, crack and fissure.

- If any hardening, crack or fissures are found on each hose (air filter, radiator, fuel and drain) replace it by a new one.
 - Check each clip fixing the hoses and if any loosened hose is found, retighten it.
 - Even before the periodical internal comes, replace it if any hardening, any cracks are found.
- When replacing it, please contact our branch office or your distributor.



6.5.16 Check and change engine fuel hose

[Check every 50 hours / Change every 2 years]

- Rubber hoses become hardened or deteriorated, replace them even before the specified hours or periodical intervals.
- Ask your nearest dealer for its replacement.

6. Periodic Inspection/Maintenance

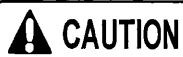
6.6 Periodical Load Operation to be Performed

[Check and inspection upon each occurrence of the following phenomena]

When a diesel engine driven generator is continuously operated with less than 30% load or no load for a long time, carbon will be stuck inside exhaust pipe, exhaust muffler and engine body and also unburned fuel will come out from connected portion of exhaust pipe and outlet port of exhaust muffler. If it is continuously operated under the conditions, the fuel which comes out can ignite and it could cause a fire.

Further, carbon sticking and carbon accumulated could cause power drop of the engine and also it could cause overheating to the engine, resulting a serious damage to the engine. In case that this phenomena occurs, eliminate the carbon accumulated by burning it during the operation with a load burdened until the exhaust gas becomes almost clear.

(For load current, refer to the following table as a standard value.)



- In case of load operation, increase load factor, checking the conditions of exhaust.
Carefully perform load operation, watching the surroundings because it could sometimes cause sparks.

Frequency	Hz	50	60
Rated voltage	V	400	440
Load current	A	23	26

7. Disposal of products and storage of the machine

7.1 Preparation for Long-term Storage

When the unit is left unused or not operated longer than half a year (6 months), store it at the dry place where no dust exists after the following treatments have been done to it.

- Put the unit in a temporary cabin if it is stored outside. Avoid leaving the unit outside with a sheet cover directly on the paint for a long time, or this will cause rust to the unit.
- Perform the following treatments at least once every three months.

<Procedure>

- ① Discharge existing lubricant from the engine oil pan. Pour new lubricant in the engine to clean its inside. After running it for a while, drain it again.
- ② Spread lubricant on each moving part.
- ③ Completely charge the battery and disconnect grounding wires. Remove the battery from the unit, if possible, and store it in a dry place. (Charge the battery at least once every month.)
- ④ Discharge coolant and fuel from the unit.
- ⑤ Seal air-intake port of engine and other openings like the muffler with a vinyl sheet, packing tape, etc., to prevent moisture and dust from getting in the unit.
- ⑥ Measure the insulation resistance of the generator, and make sure that it is more than $1M\Omega$.

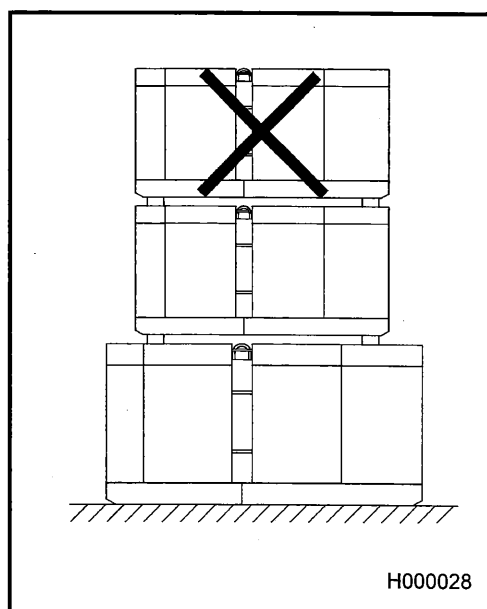
(See 6.5.3)

- ⑦ Be sure to repair any trouble and maintain the unit so that it will be ready for the next operation.

WARNING

- When stacking up the machines for storage, only two units stacking is acceptable. The mass of the lower machine should be larger than that of the upper one.
- Select a leveled floor with sufficient strength.
- Before stacking the machines up, check the machine for deformation of bonnet, looseness or missing of bolts, and other parts.
- When stacking them, be sure to securely fix them as shown in the figure so that the balanced weight is applied to each squared lumber for preventing a sideslip or a collapse.
- Never operate the machines with stacking conditions. It is very dangerous.
- Machines stacked could fall down due to sideslip or collapse when an earthquake occurs. Therefore, safety should be sufficiently considered for surroundings of storage places.

Stacking up box type machines



7.2 Disposal of products

- When disposing of this product, be sure to remove the coolant and oil from it.
When you have anything unclear or you want to advise us, contact our office nearby or distributor.

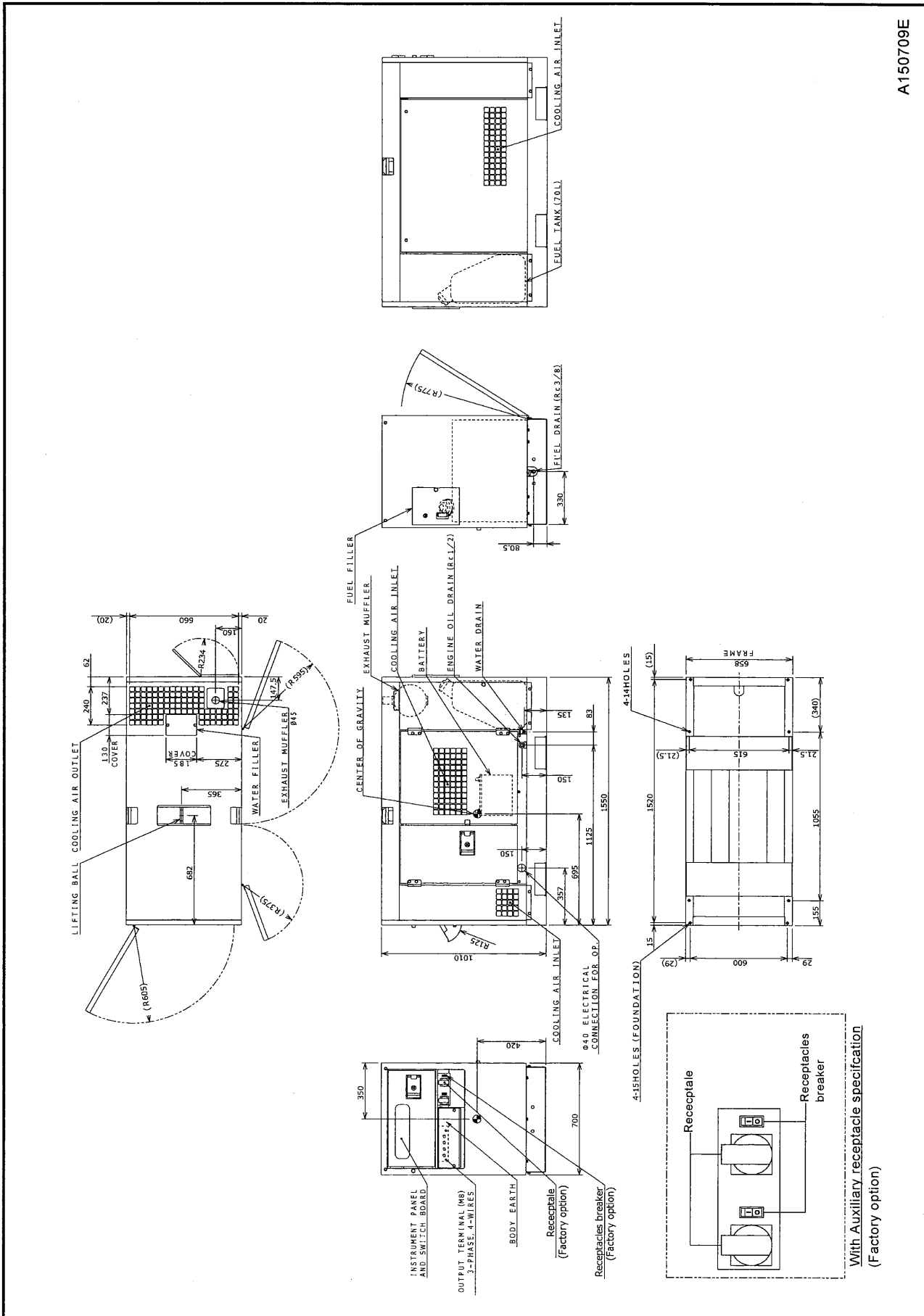
8. Specifications

8.1 Specifications

Model		SDG25S-3A8		
Specifications		400V Type		
Generator	Exciting system		Brushless	
	Power factor	%	80	
	Frequency	Hz	50	60
	Rated output	kVA	20	25
	Rated output	kW	16	20
	Voltage	V	400	440
	Current	A	28.9	32.8
	Receptacle output Voltage (Factory option)	V	231	254
	Receptacle output current (Factory option)	A	15×2	
Engine	Model	KUBOTA V2403-E2B		
	Type	4-cycle, water-cooled, swirl chamber type		
	Number of cylinders	4		
	Total displacement	L	2.434	
	Rated output	kW	19.1	23.7
	Revolution per minute	min ⁻¹	1,500	1,800
	Lubricating oil capacity	L	9.5	
	Coolant capacity (including radiator)	L	7.0	
	Battery	80D26R(12V) equivalent		
	Fuel tank capacity	L	70	
Weight · Mass	Overall length	mm	1,550	
	Overall width	mm	700	
	Overall height	mm	1,010	
	Net dry mass (weight)	kg	625	
	Operating mass (weight)	kg	695	

8. Specifications

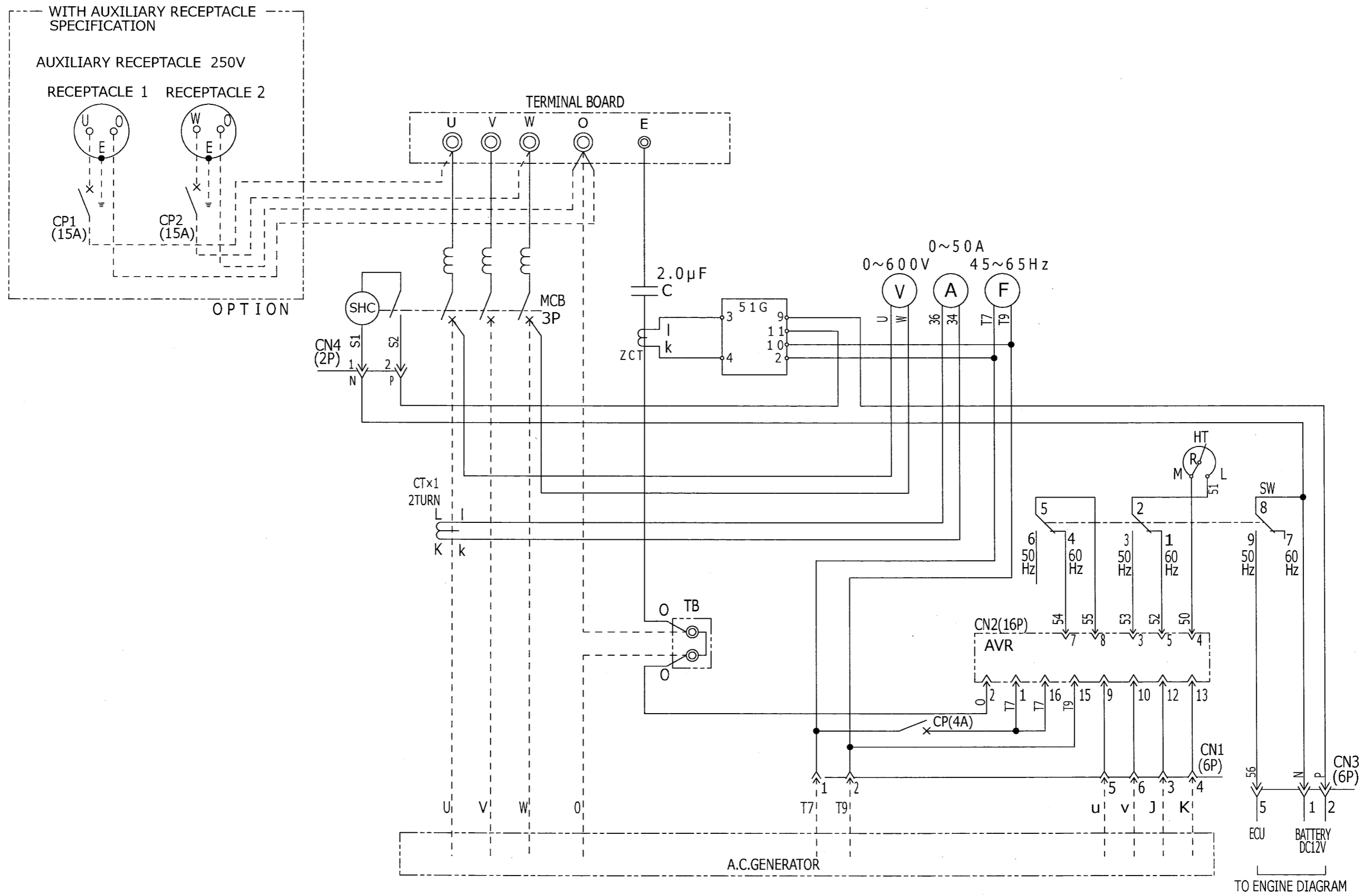
8.2 Outline drawing



A150709E

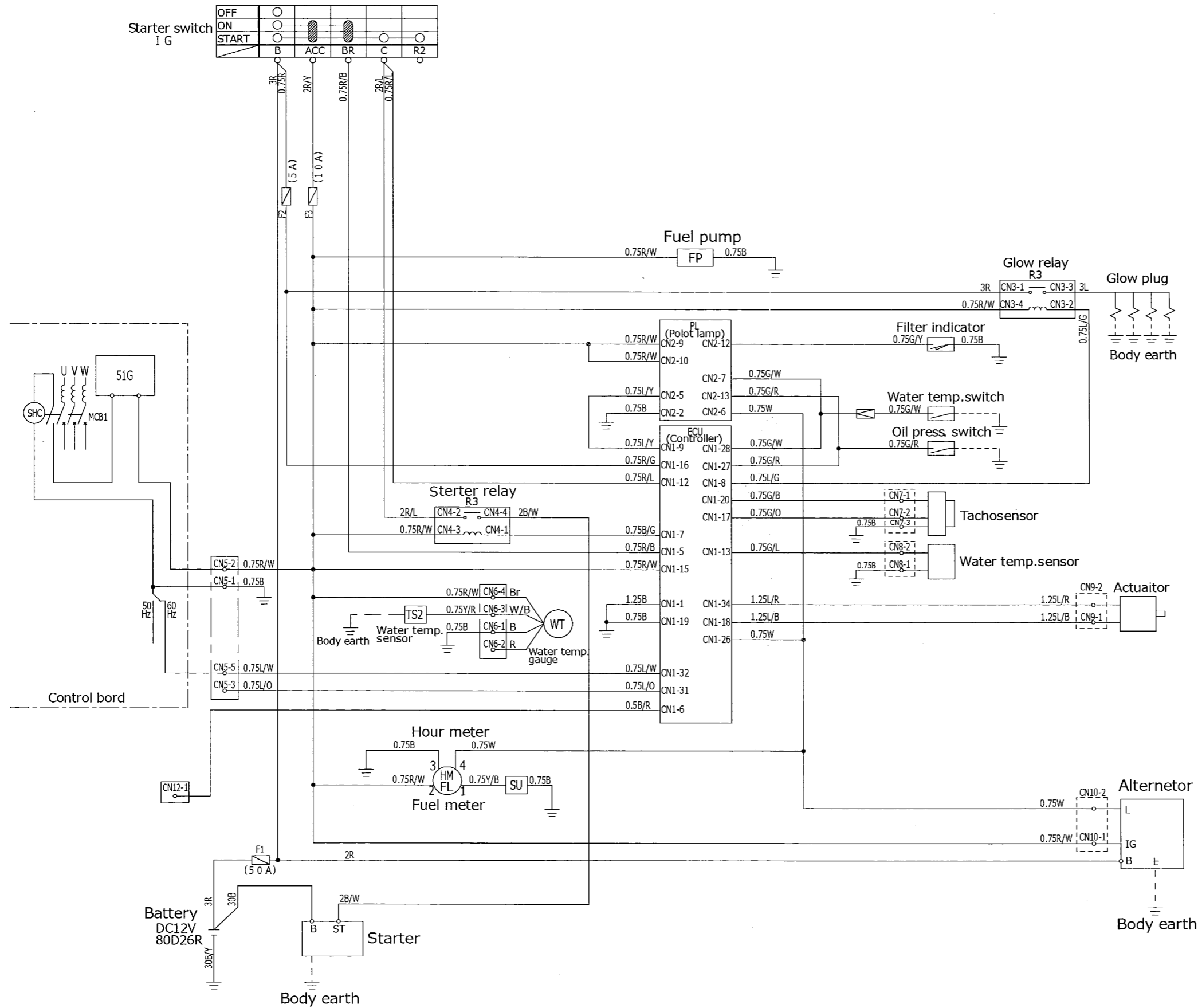
9. Wiring Diagram

9.1 Generator Wiring Diagram



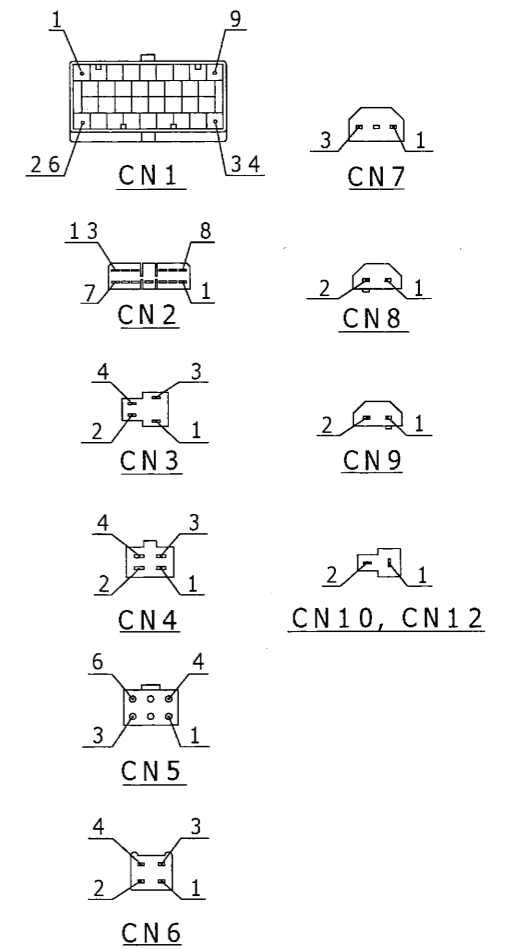
9. Wiring Diagram

9.2 Engine Wiring Diagram



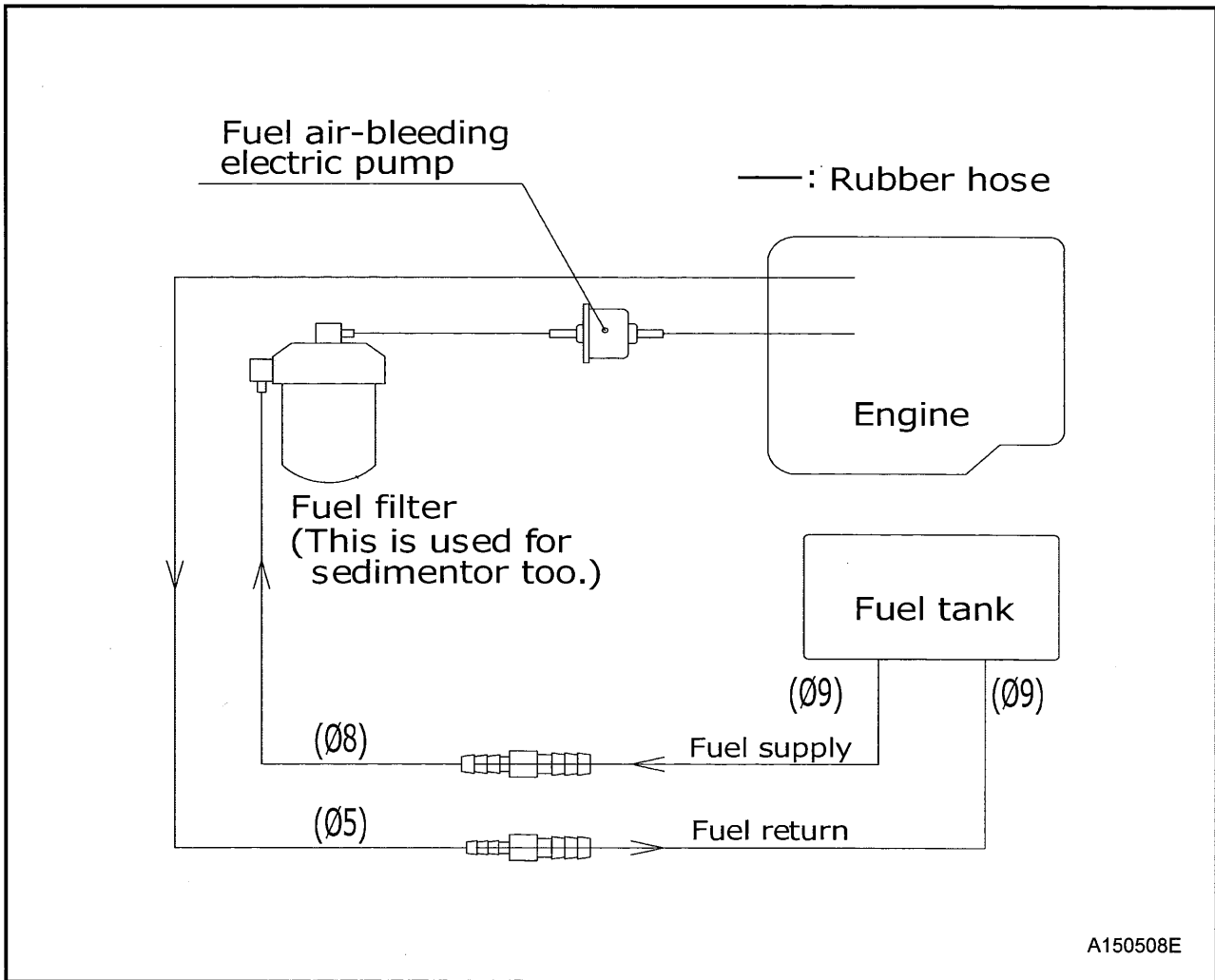
Connector terminal arrangement

The following arrangement is seen from the side of the connector inserting port.



10. Piping Diagram

10.1 Fuel piping



HOKUETSU INDUSTRIES CO., LTD.

8TH FLOOR SHINJUKU SAN-EI BLDG,
22-2 NISHI-SHINJUKU 1-CHOME, SHINJUKU-KU
TOKYO 160-0023 JAPAN
TEL:81-3-3348-7281
FAX:81-3-3348-7289
URL:<http://www.airman.co.jp>

Copyright(C)2015 HOKUETSU INDUSTRIES CO., LTD. All Rights Reserved.

39600 72930

Printed MAR. 2016

AIRMAN
HOKUETSU INDUSTRIES CO., LTD.