AIRMAN

SG

INSTRUCTION MANUAL

ENGINE GENERATOR

SDG100S-7B1
SDG125S-7B1
SDG150S-7B1

[ENVIRONMENTAL CONTAINMENT
BASE TANK TYPE]

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

HOKUETSU INDUSTRIES CO., LTD.

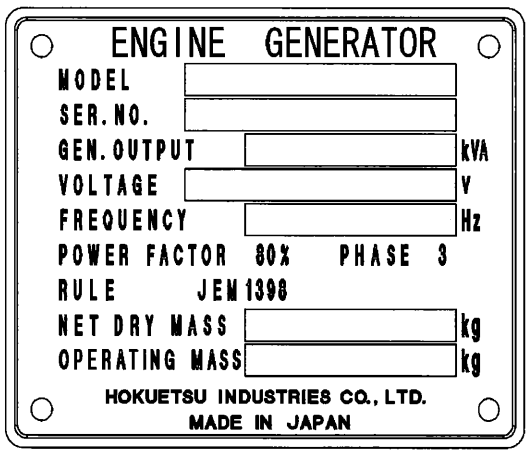
Preface

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.

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

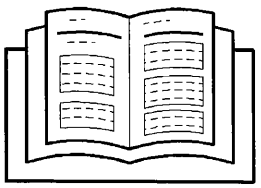
Follow warnings mentioned in this manual. This instruction manual does not describe all safety items. We, therefore, advise you to pay special attention to all items (even though they may not be described in the manual) for your safety.

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

Safety outfit

- 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.

TR0084

⚠ 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

Protection equipments

- 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.

TR0085

⚠ CAUTION

Safety fittings

- 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.

TR0096

⚠ CAUTION

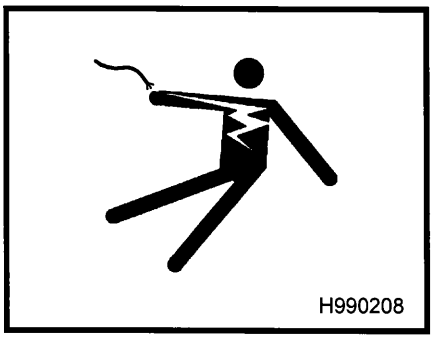
Safety around the machine

- 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.

1.2 Caution during Operation

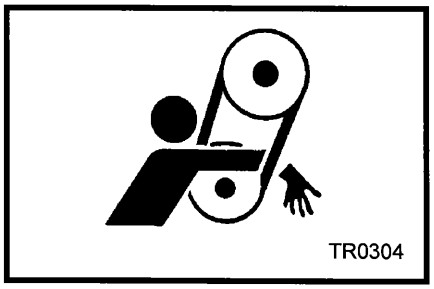
⚠ WARNING — ***Never touch the output terminals and interior of control board***

- Touching to the output terminals and the control board might cause electric shock so please don't open the cover of output terminal borad 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.


H990208

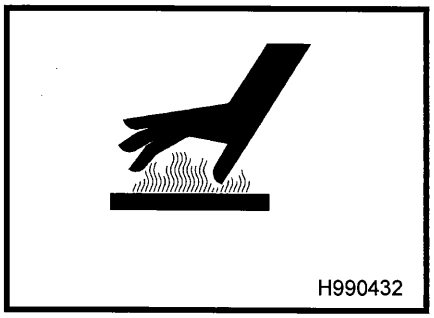
⚠ WARNING — ***Hands off from rotating parts and belts***

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


TR0304

⚠ 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.


H990432

1.Safety

⚠ CAUTION

Do not touch hot parts

- 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.

H990432

⚠ CAUTION

Fire prevention

- 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.

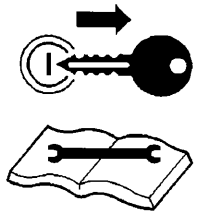
D004

H990433

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.



SY001

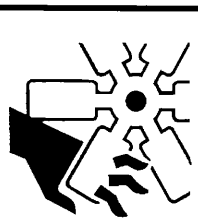
⚠ WARNING — ***Adjusting tension of belt***

- 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.

TR0304

⚠ 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.



W009

⚠ 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.

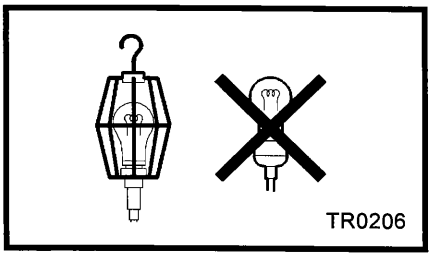
W003

1.Safety

⚠ CAUTION

Lighting apparatus

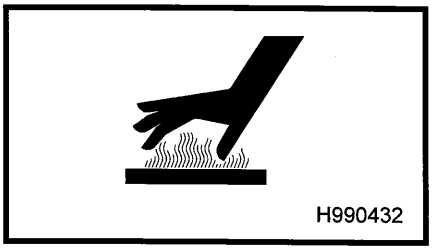
- It is recommended to use a lamp with safety guard fitted where the site is dark. Operating the machine gropingly or by relying on one's intuition could cause unexpected accidents. Any lamps without safety guard are not recommended since they can be broken and they could ignite flammables such as fuel,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


TR0206

⚠ CAUTION

Opening coolant water drain valve

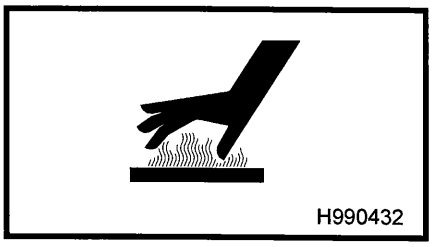
- Be sure to stop the engine, and let the coolant water sufficiently cool down before draining it.
- If the drain valve is opened before the coolant water is cooled enough, hot water could jet out, and it could cause scalding.


H990432

⚠ CAUTION

Refilling or draining of engine oil

- 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.


H990432

⚠ CAUTION

Caution of the cleaning

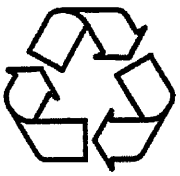
- When washing the machine, cover the control panel, generator and its electric parts to prevent them from being exposed to splashing water and avoid possible decrease in electrical insulation or other troubles to the machine.
- Dust, sand and dirt accumulated inside control panel could cause malfunction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

⚠ CAUTION — ***Handling of electrical equipment engine***

- The engine of this machine and electrical parts many electronic devices have been installed. If you do this please go airborne welding work, remove the connector of the electronic control equipment.
  Can cause equipment to malfunction due to electronic control of excessive current is applied.

⚠ CAUTION — ***Treatment of organic wastes***

- 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.

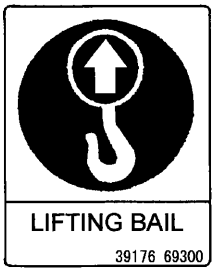


A100285

1.4 Safety Warning Labels

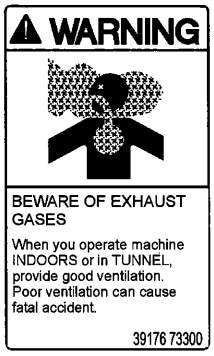
Following labels are attached to the machine.
Keep them clean at all times. If they are damaged or missing, immediately place an order with your nearest dealer for replacement. Part numbers are indicated on the lower right corner of the label.
Adhere a new one to the original location.

1



2

3



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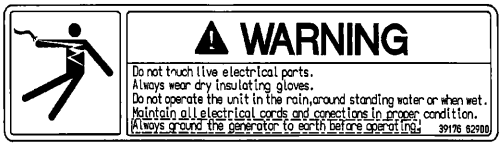

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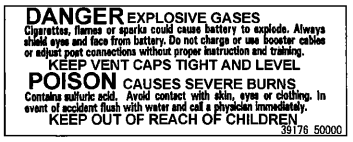

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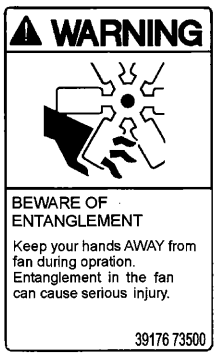

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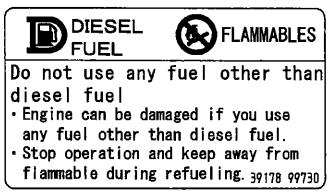
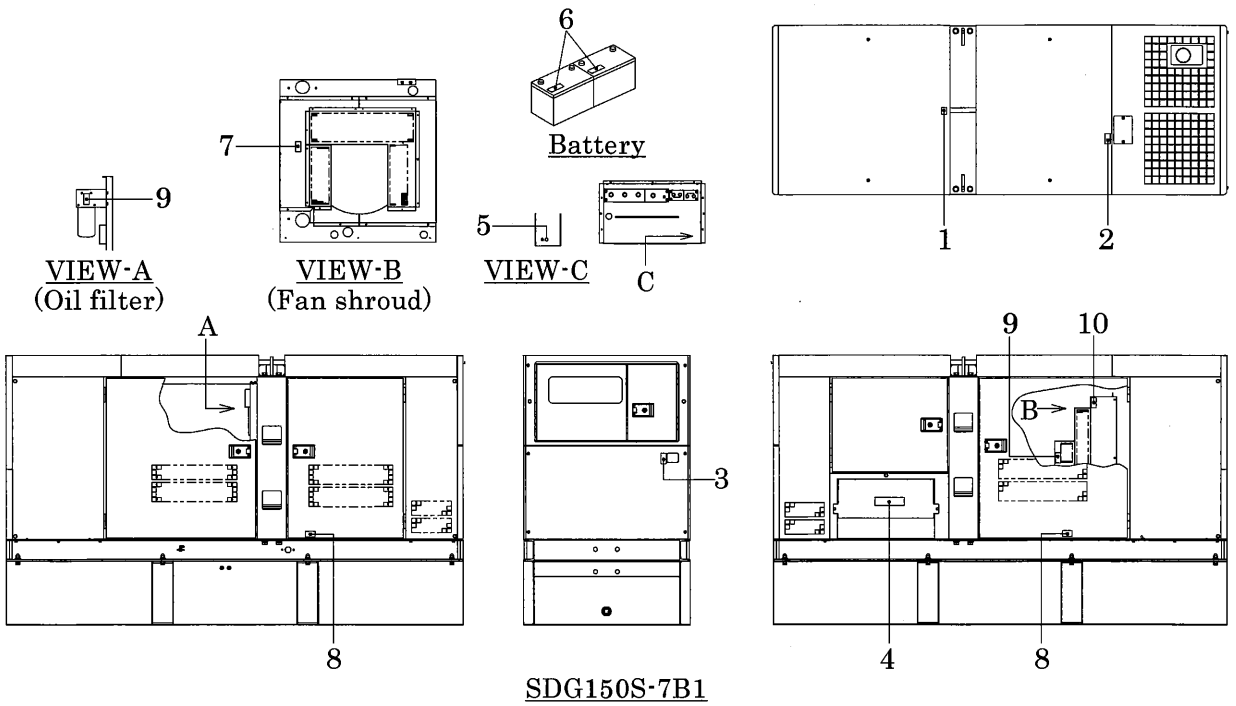


9

10

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



SDG150S-7B1

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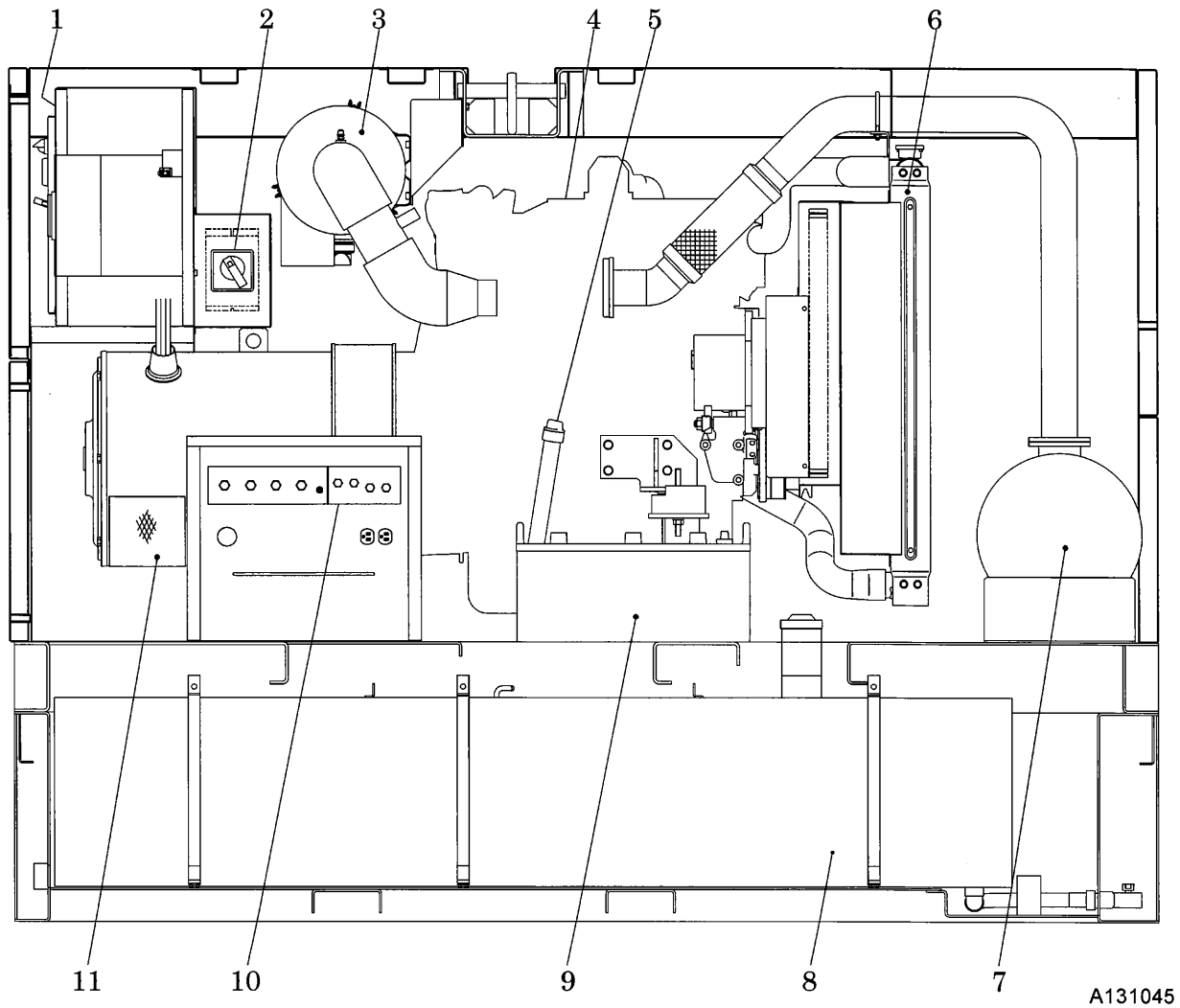
MEMO

2. Part Names

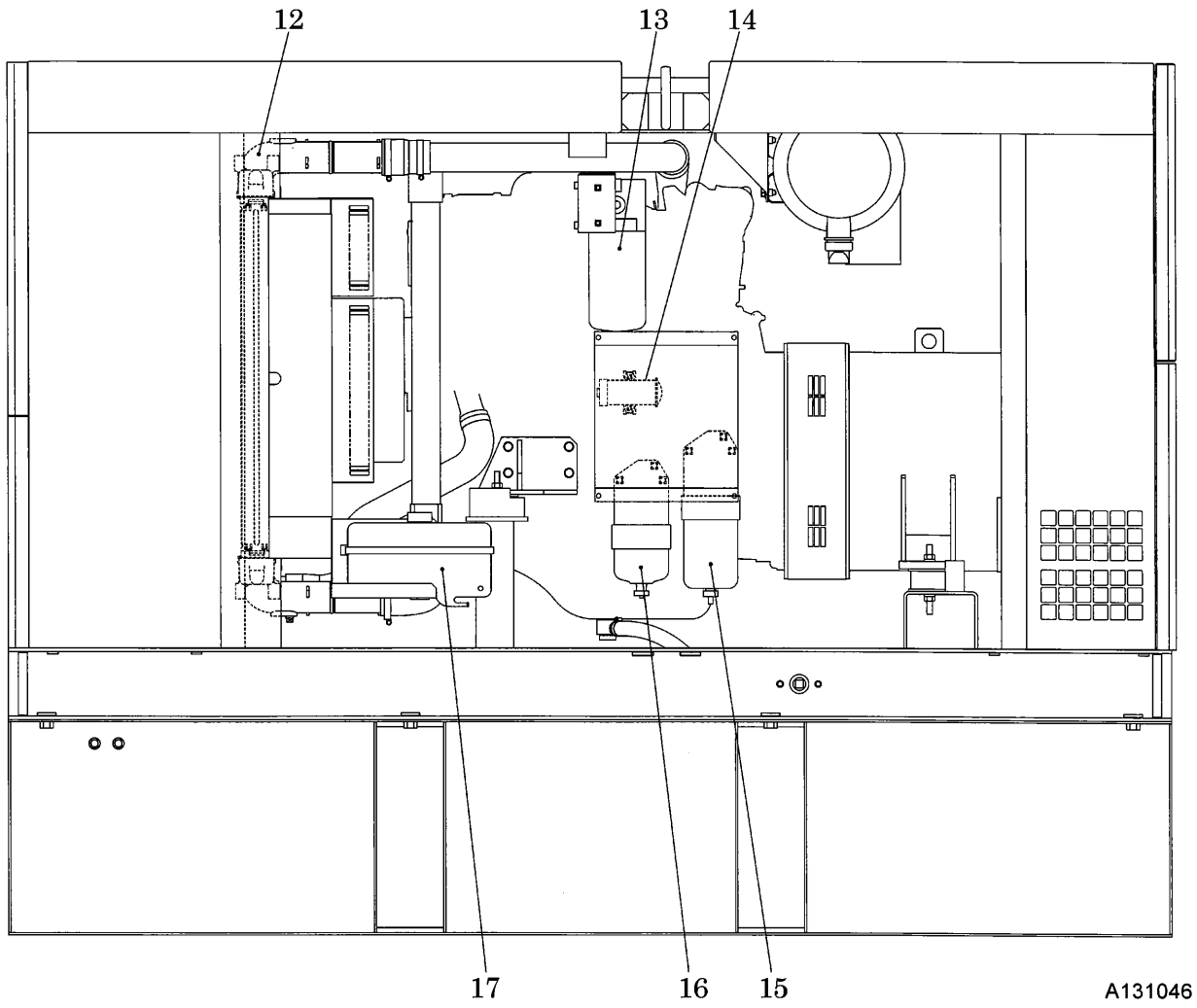
2.1 Internal Components



SDG100S-7B1

No.	Description	Function
1	Control panel	For intensively controlling device of various meters and controls.
2	Voltage selector switch	For switching output voltage.
3	Air filter	Filtering device for filtering dust floating in intake air.
4	Engine	For driving the generator.
5	Engine oil filler port (also used as oil level gauge)	For supplying and replenishing engine oil to engine. (also used for checking engine oil level)
6	Radiator	For cooling the coolant for engine in the system.
7	Exhaust muffler	For silencing the noise caused before discharging the air.
8	Fuel tank	For storing fuel.
9	Battery	For electrically starting engine.
10	Output terminals	Outlet port for AC power.
11	Generator	For generating AC power to be supplied.

2. Part Names



SDG100S-7B1

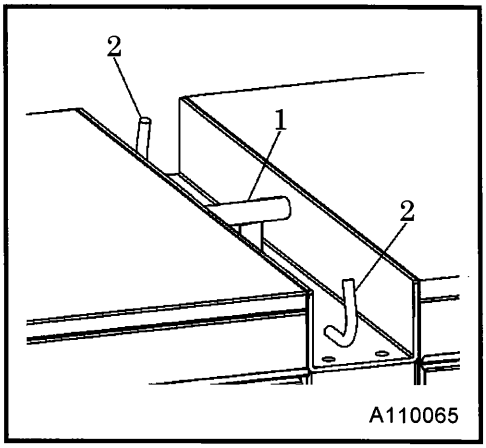
No.	Description	Function
12	Intercooler	For cooling the air compressed by engine supercharger.
13	Engine oil filter	For filtering engine oil in the system.
14	Fuel air-bleeding electromagnetic pump	For automatically bleeding air from fuel pipes.
15	Fuel pre-filter	For removing dust and water mixed in fuel.
16	Fuel filter	For filtering foreign matter and dust mixed in fuel.
17	Reserve tank	For checking coolant level and supplying it.

3. Installation

3.1 Transporting Machine

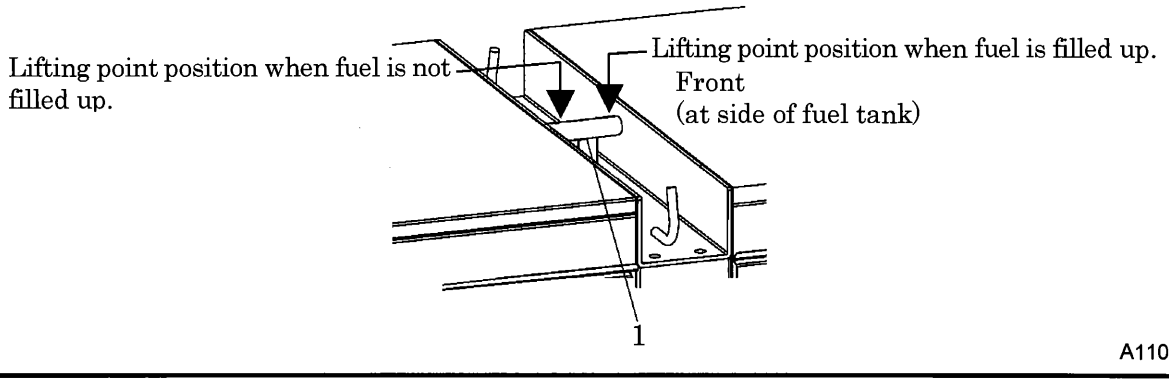
⚠ CAUTION — ***Transportation***

- 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.



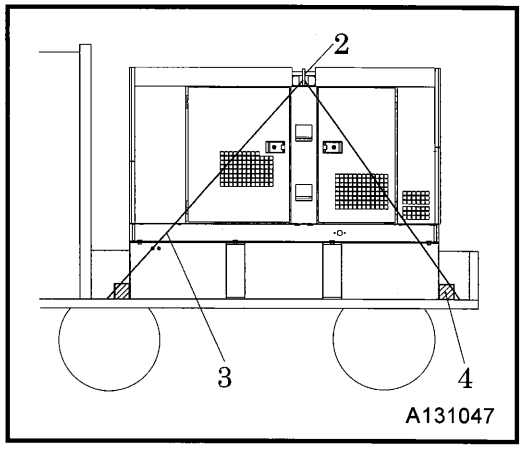
3.1.1 Lifting

- 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 transporting this machine on jobsite and from the job site to the other place, load it on truck and secure it to the truck bed with the rope "3", using the rope hooks "2" on both sides of the bonnet. Make sure to fix it with chokes "4".



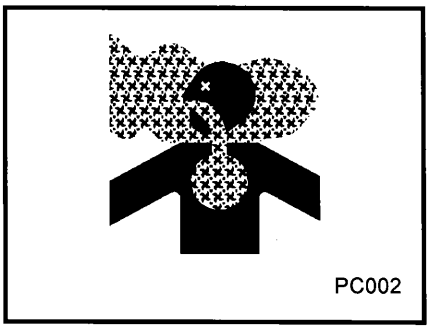
3. Installation

3.2 Conditions of Machine Installation

⚠ DANGER

Ventilation

- 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.

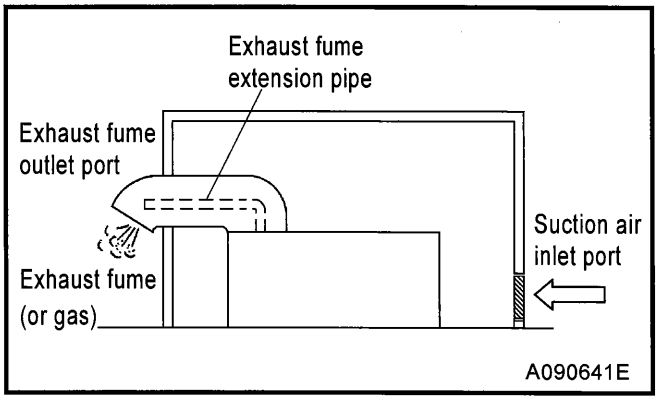


PC002

⚠ DANGER

In case that the machine is installed indoors

- In case that the machine 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.



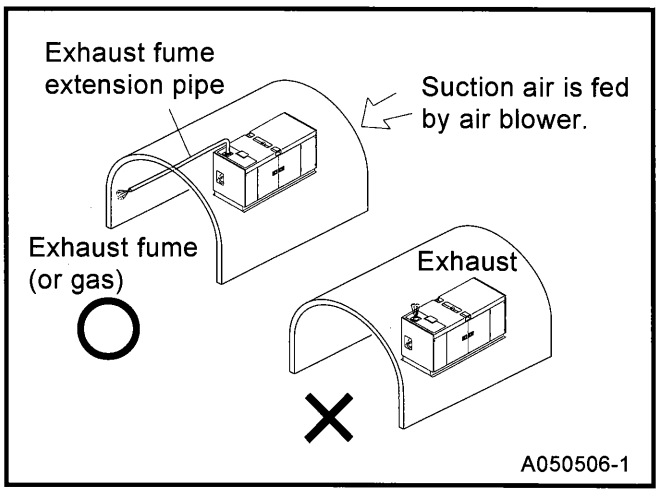
A090641E

- Also the cooling air outlet port of radiator should be provided outdoors through a duct or the like for air ventilation.
  (Engine blowby gas is exhausted together with cooling air through a duct.)

⚠ DANGER

Installing the machine st such poorly-ventilated place

- In case that the machine 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.



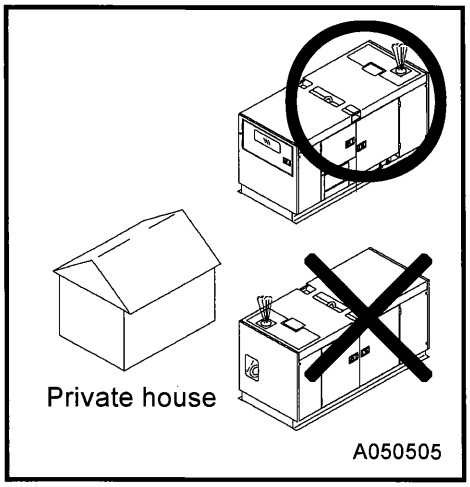
A050506-1

3. Installation

⚠ DANGER

How to locate the machine

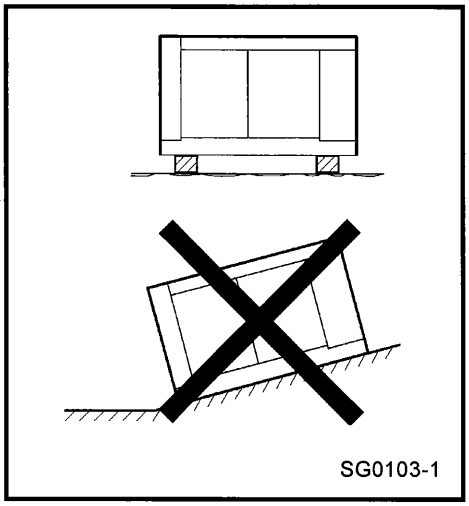
- Never locate the machine with the exhaust muffler facing any private house:
- As the exhaust fume (gas) from the engine is poisonous, never direct it to any other persons passing by.



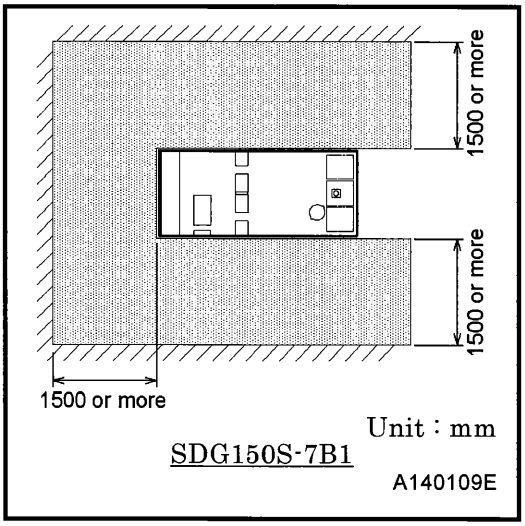
⚠ CAUTION

Installation

- 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 machine has to be installed inevitably on any rough and uneven ground; it is necessary to insert square wooden bars under the machine for levelling it.



- The machine should be operated in following conditions:
  - Ambient temperature ..... -15℃ to +40℃
  - 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.

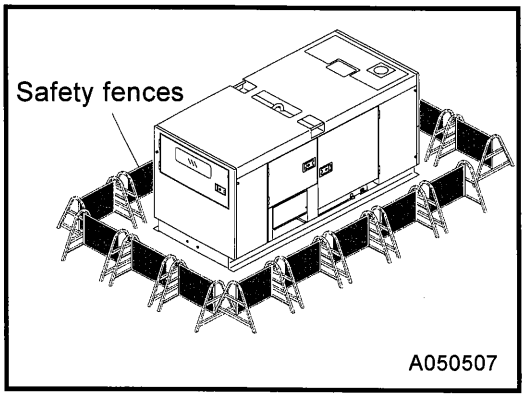


3. Installation

⚠ 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 machine:

Preparation of safety fences



3. Installation

3.3 Leakage Protection Device and Grounding Method

⚠ DANGER — ***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 interruptor 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.

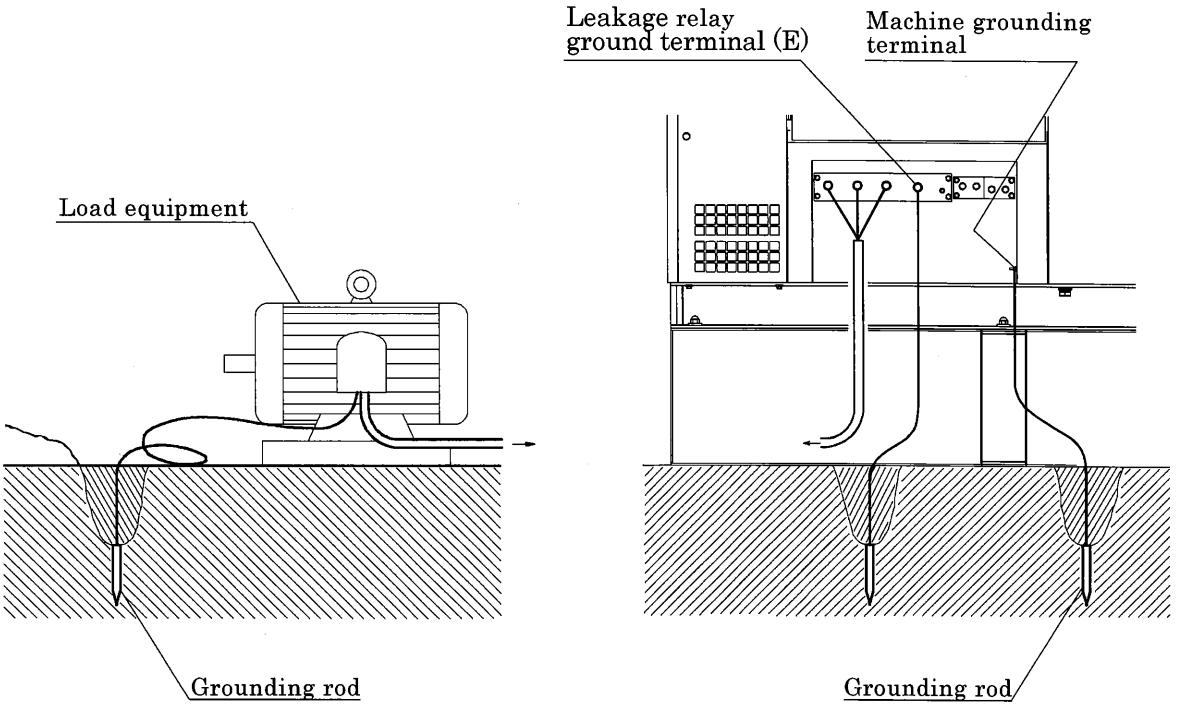
3.3.2 Grounding Method

<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.

Independent grounding method



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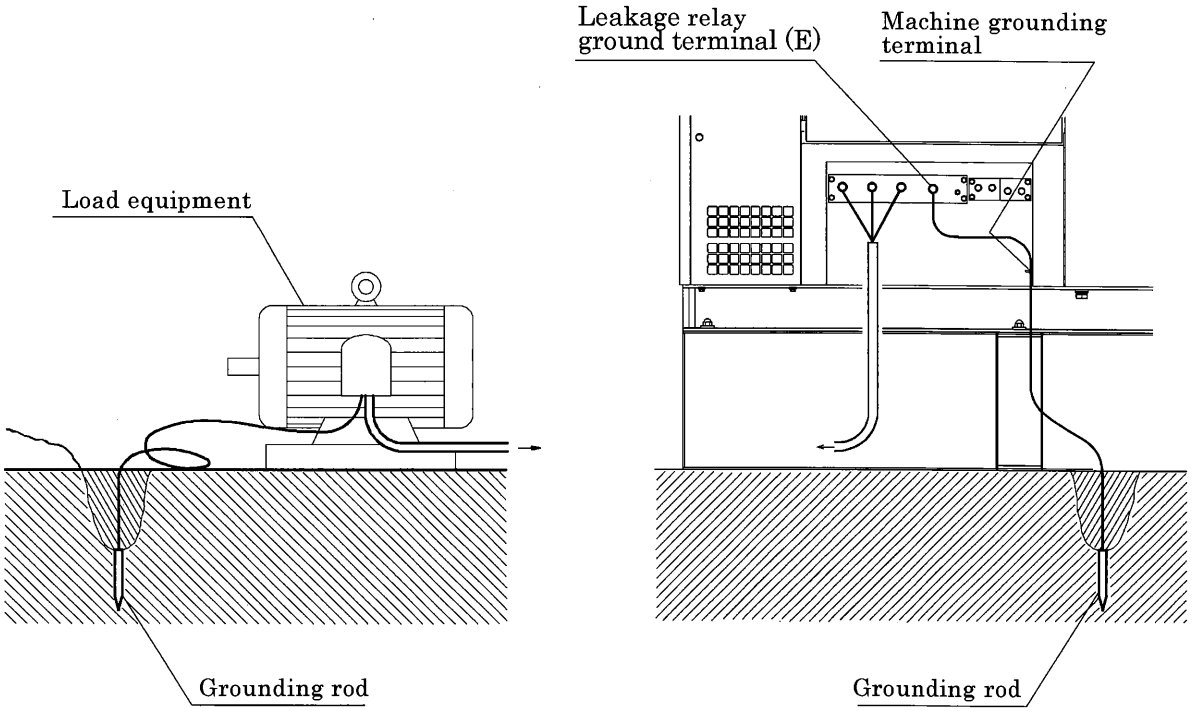
Common grounding method



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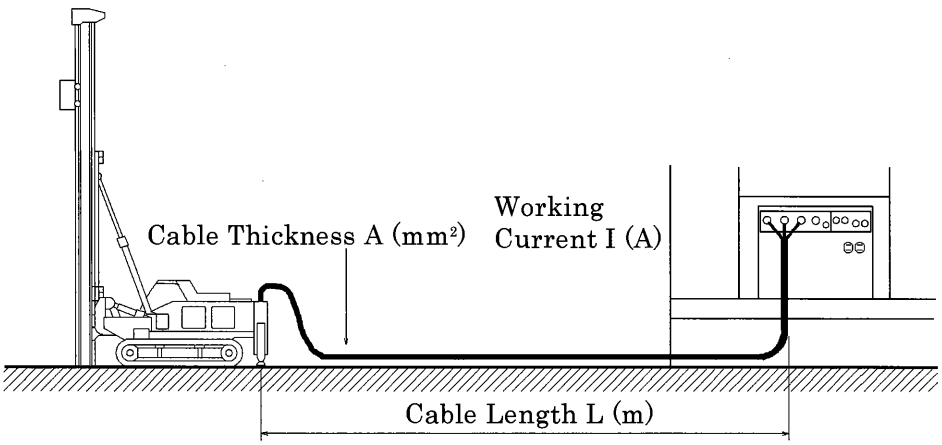
3. Installation

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
1-phase,2-wire type	$e=\frac{35.6\times L\times I}{1{,}000\times A}$	$A=\frac{35.6\times L\times I}{1{,}000\times e}$
3-phase,3-wire type	$e=\frac{30.8\times L\times I}{1{,}000\times A}$	$A=\frac{30.8\times L\times I}{1{,}000\times e}$
1-phase,3-wire type and 3-phase,4-wire type	$e'=\frac{17.8\times L\times I}{1{,}000\times A}$	$A=\frac{17.8\times L\times I}{1{,}000\times e'}$

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)

- 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 200V, with voltage drop of 10V.)

Single-Conductor Cabtyre Cable — Unit:mm²

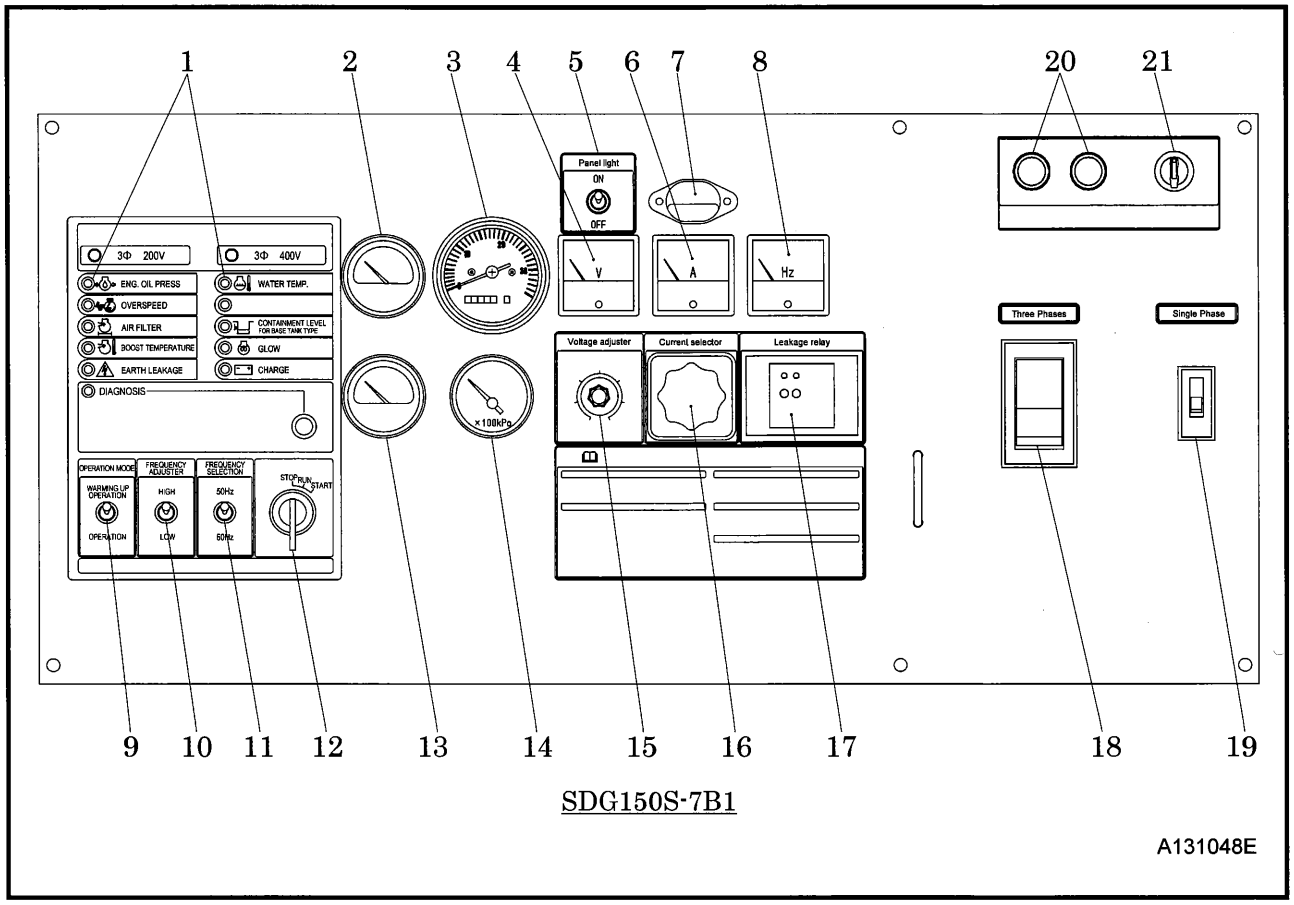
Current \ Length	50m	75m	100m	125m	150m	200m
150A	38	38	50	60	80	100
200A	60	60	60	80	100	125
300A	100	100	100	125	150	200
400A	125	125	150	200	200	250

Three-Conductor Cabtyre Cable — Unit:mm²

Current \ Length	50m	75m	100m	125m	150m	200m
150A	22×2	22×2	38×2	38×2	50×2	50×2
200A	38×2	38×2	38×2	50×2	50×2	60×2
300A	60×2	60×2	60×2	60×2	80×2	100×2
400A	60×2	60×2	60×2	80×2	100×2	125×2

4. Operation

4.1 Instrument panel



SDG150S-7B1

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1. Monitor lamp (for details, see 4.2.1)
2. Fuelmeter
3. Tachometer with hourmeter
4. Voltmeter
5. Panel light switch
6. Ammeter
7. Panel light
8. Frequency meter
9. Starter switch
10. Operation mode selection switch
11. Frequency adjustment switch
12. Frequency selection switch
13. Water temperature gauge
14. Engine oil pressure gauge
15. Voltage adjuster
16. Current selector
17. Leakage relay (for three-phase)
18. Circuit breaker
19. Circuit breaker (dedicated to single phase)
20. Synchronizing detection switch (SDG150S only)
21. Synchronizing switch (SDG150S only)

4. Operation

4.2 Protection device

⚠ CAUTION

- 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

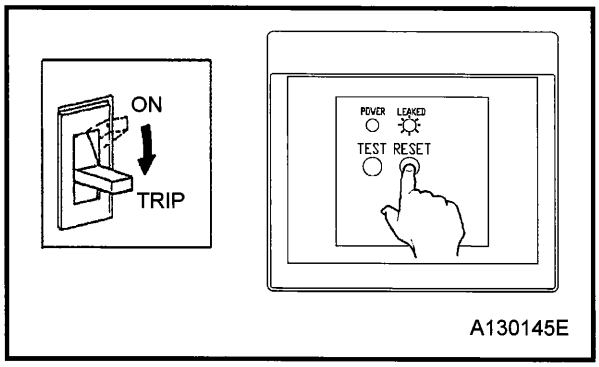
- This machine is equipped with the following devices in the table. Repair and make necessary treatment in accordance with the item ○.

Item	Engine stops	3 phase or single phase circuit breaker trips.	Lamp display	Monitor	Functions
Engine oil pressure drop	○	—	○		When engine oil pressure drops, it functions. Operating pressure: lower than 0.1MPa
Water temperature rises.	○	—	○		In case of abnormal rise of engine water temperature, it functions. temperature reaches 105℃
Excessive rotation	○	—	○		When engine rotates excessively, it begins to function. Function rotation: Under operation at 50Hz : 1,725min^{-1} (57.5Hz) Under operation at 60Hz : 2,070min^{-1} (69Hz)
Clogging of air filter	—	—	○		When air filter is clogged and it becomes necessary to clean it, it functions.
* Oil Fence	—	—	○		When more condensate (fuel, engine oil and coolant) than 1/3 of capacity in the oil fence is accumulated monitor lamp lights.
Boost temperature rises	—	—	○		When boost temperature rises higher than 85℃, monitor lamp goes on.
Leakage current	—	○	○		In case of current leakage it functions. Sensing current: 30 mA
Discharged battery	—	—	○		It functions in case of faulty battery.
Overcurrent or short circuit	—	○	—	—	In case of overload or short circuit accident, it functions.
Engine trouble	—	—	○	—	See 6.2.1 "Engine trouble"

* When the monitor lamp lights in the oil fence, immediately drain it. (For the capacity of the oil fence, refer to 8.1 Specifications). To protect environment, do not drain it directly into rivers. (For details, see 4.6)

4.2.2 Leakage relay

- When residual current flows to machine and load, the residual current indicator lamp goes on to trip the circuit breaker and circuit breaker (dedicated to single phase).
  <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 4.2.3)

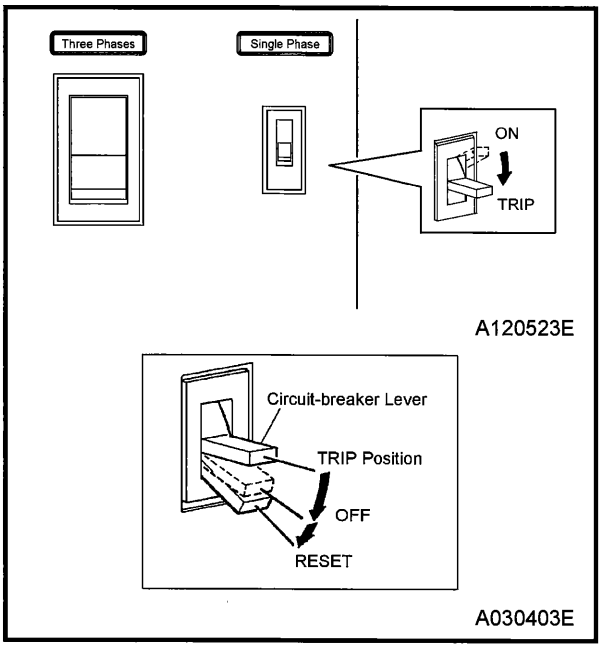


4.2.3 Circuit-breaker and circuit breaker (dedicated to single phase)

- In case overload and short-circuited wire connection should occur, the circuit-breaker trips.
- When this is tripped, stop the unit immediately and reset the circuit breaker after getting rid of the causes of trouble.

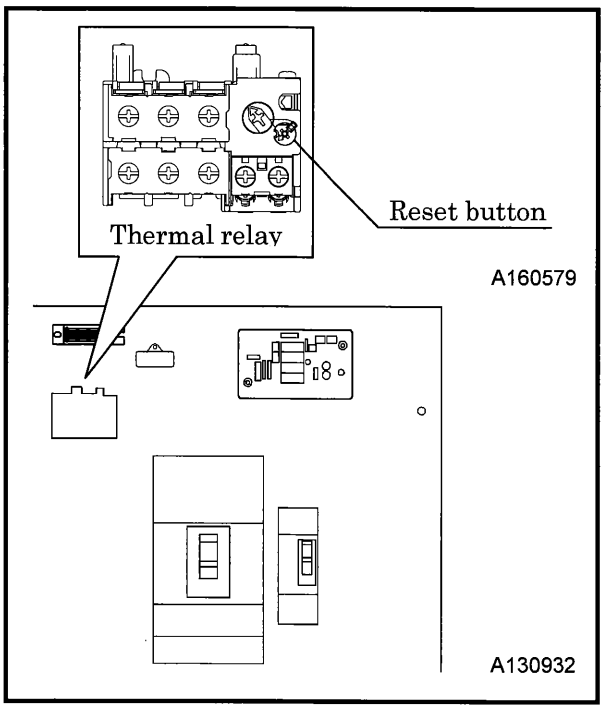
<How to reset>

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



4.2.4 Thermal relay

- In case overload or short-circuit should occur to load or load connection cable, this relay functions to trip the circuit breaker.
- It is not necessary to push the reset button even after the three phase main breaker is tripped since the thermal relay is set automatic return at factory.



4.2.5 Circuit protector (CP) for AVR protection

AVR is equipped with circuit-protector (CP) for protection against over current. 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.

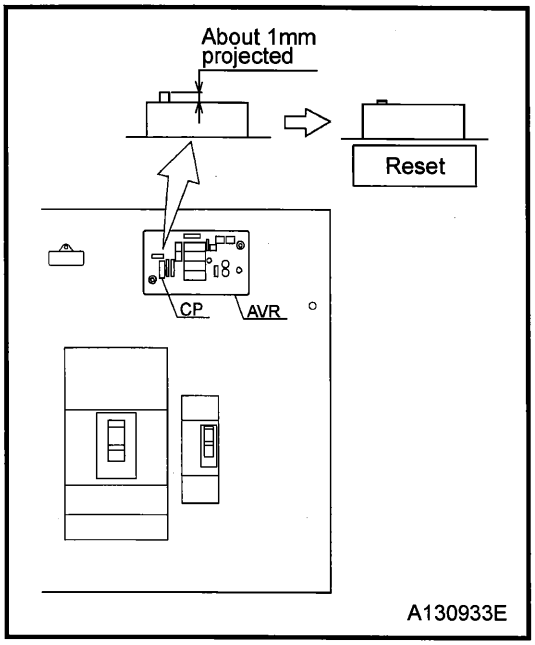
<Symptom>

- When circuit protector functions and load is applied to the machine, such trouble as larger variance of voltage and/or delayed voltage recovery follow.

<How to reset>

- Press the white colored AVR button inside the control panel for resetting the circuit breaker.

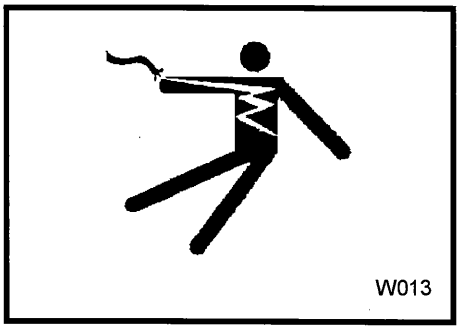
Note: Do not hold the button with such sharply pointed things as a screwdriver, ball point pens etc.



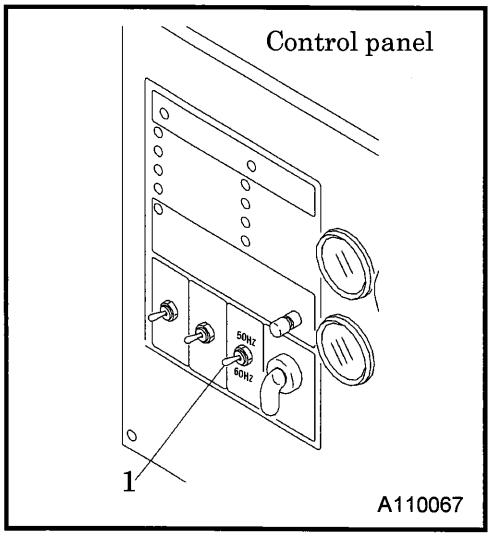
4.3 Check Frequency Selection Switch for AVR

⚠ DANGER — ***Do not leave control box open***

- Never touch the interior of control panel during operation.
- Notice that the voltage of several hundreds volts is applied in the control panel.
- When checking or operating the interior of the control panel for changing AVR frequency, be sure to stop the machine, remove the starter key from the starter switch, then carry out a work. The checker must keep the key during inspection.



- Stop engine once when changing frequency, and then select 50Hz or 60Hz to be used by using frequency selection switch provided on AVR of control plate.
- If the frequency selection switch "1" is not set to suite the frequency in use, the rated voltage cannot be obtained.



4. Operation

4.4 How To Switch Voltages

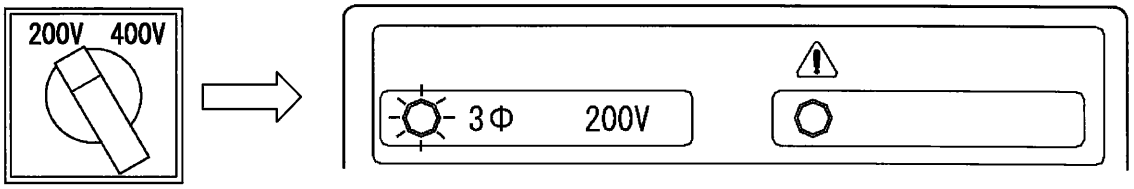
⚠ CAUTION

- It is possible to select 3 phase 4 wire 200 V or 3 phase 4 wire 400 V.
  But before starting operation, make sure to confirm the voltage set for the machine without fail. If any load is connected to the machine with the wrong voltage set, it can cause damage or burning accident to the load.
- When switching the voltages, make sure to stop the machine.

- Open the door on output terminal plate, and switch according to the voltage for voltage selector switch.
- Never switch during operation, because electric shock may occur or voltage change may be caused by voltage change due to action of AVR protection device.
- If the protection device works, push AVR white button to disengage the protection device.
- When this unit is operated, output display lamp on operation panel goes on according to selected output voltage. Check and confirm that the selected voltage is proper and correct.

「200V output」
The green lamp lights

Voltage selector switch



In case that 200V is selected

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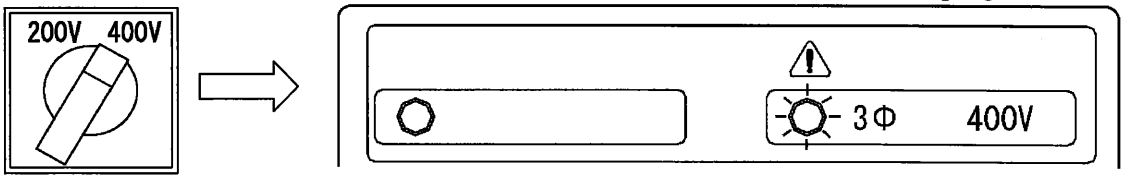
「400V output」
The red lamp lights



In case that 400V is selected

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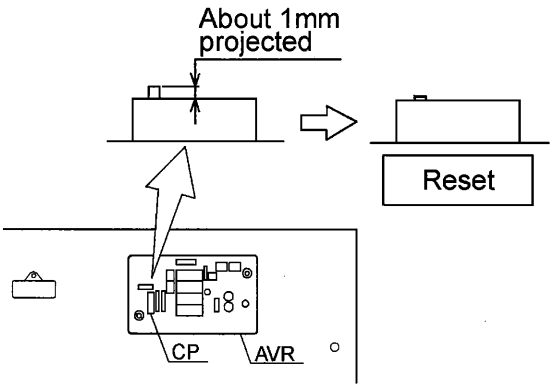
Relay panel in control panel



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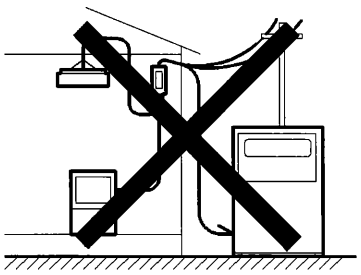
4.5 Connecting Load

⚠ DANGER — ***Electric shock and electric leak***

- 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 slackened during operation and may cause a fire or an electric shock accident.



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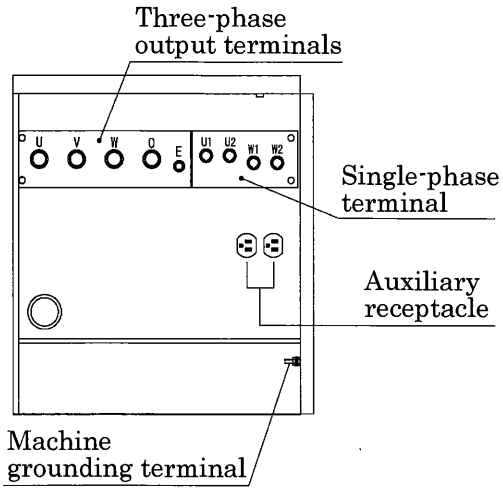
IMPORTANT

- 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.
- When using a single-phase load [200/220V or 115/127V], see to it that the loads on the different phases will be evenly balanced. Unbalanced loads may cause the generator main unit burning.

- 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 3.4)
- After checking phase number and voltage of the load, make sure to connect them correctly.

—Terminal size—

Three-phase output (U,V,W,O) : M12 (SDG100,125S)
: M14 (SDG150S)
Leakage relay ground terminal (E) : M6
Single phase output (U_1,U_2) : M10
Single phase output (W_1,W_2) : M10



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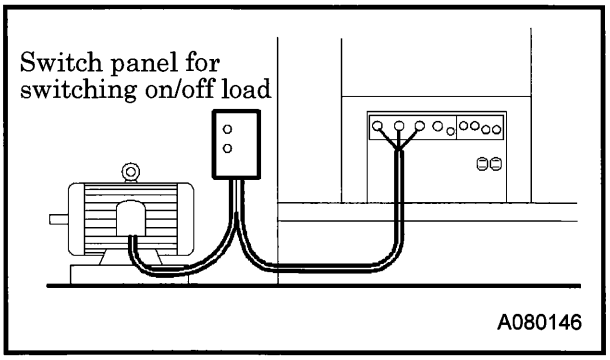
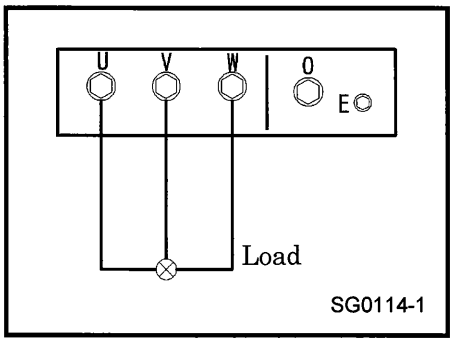
- Install a switch between the output terminal and the load to switch "ON/OFF" the load. Do not switch the load on/off directly by the circuit-breaker of the machine.
- It could cause damage to the connect the connecting cable to the load so that the output terminals should not touch each other circuit-breaker.



4.5.1 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. But please note that the data in the table is based on power factor of 80% (in case of electric motor operated). In case of different power factor, take care not to be overloaded, and reduce load.



Type	Permissible current value		
	SDG100S-7B1	SDG125S-7B1	SDG150S-7B1
50Hz/200V	231.0A	289.0A	361.0A
60Hz/220V	262.0A	328.0A	394.0A
50Hz/380V	121.5A	152.0A	190.0A
50Hz/400V	115.0A	144.0A	180.0A
60Hz/440V	131.0A	164.0A	197.0A

- In case inverter load:

  The inverter capacity (input kVA of inverter) should not exceed the following value (within rated output÷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 of SDG100S,at 50Hz, 80kVA÷3.0 = 27kVA.

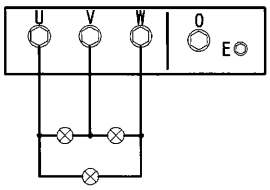
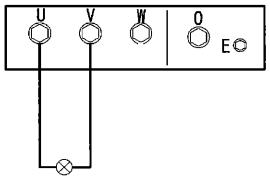
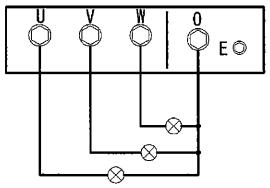
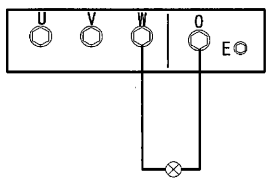
  50Hz: 27kVA (Input kVA of inverter) It is possible to use inverter capacity up to this value.

  60Hz: 33kVA (Input kVA of inverter) It is possible to use inverter capacity up to this value.

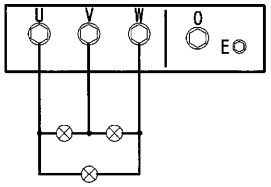
4.5.2 How to connect single phase load

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

[SDG100S-7B1]

<table>
<tr><th colspan="3">Conditions of Load</th><th>Allowable Current Limit</th><th>Conditions</th></tr>
<tr><td rowspan="4">3 phase 4 wire type</td><td rowspan="2">In case of using 2 phases</td><td>In case of using three phases
  </td><td><table><tr><th>Type</th><th>Permissible current value</th></tr><tr><td>50Hz/200V</td><td>231A</td></tr><tr><td>60Hz/220V</td><td>262A</td></tr><tr><td>50Hz/380V</td><td>121.5A</td></tr><tr><td>50Hz/400V</td><td>115A</td></tr><tr><td>60Hz/440V</td><td>131A</td></tr></table></td><td>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%.</td></tr>
<tr><td>In case of using single phase
  </td><td><table><tr><th>Type</th><th>Permissible current value</th></tr><tr><td>50Hz/200V</td><td>115A</td></tr><tr><td>60Hz/220V</td><td>131A</td></tr></table></td><td>50% or less of the rated current is allowable.</td></tr>
<tr><td rowspan="2">In case of using O phase</td><td>In case of using three phases
  </td><td><table><tr><th>Type</th><th>Permissible current value</th></tr><tr><td>50Hz/115V (200V)</td><td>231A</td></tr><tr><td>60Hz/127V (220V)</td><td>262A</td></tr><tr><td>50Hz/219V (380V)</td><td>121.5A</td></tr><tr><td>50Hz/231V (400V)</td><td>115A</td></tr><tr><td>60Hz/254V (440V)</td><td>131A</td></tr></table></td><td>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%.</td></tr>
<tr><td>In case of using single phase
  </td><td><table><tr><th>Type</th><th>Permissible current value</th></tr><tr><td>50Hz/115V (200V)</td><td>115A</td></tr><tr><td>60Hz/127V (220V)</td><td>131A</td></tr></table></td><td>50% or less of the rated current is allowable.</td></tr>
</table>

[SDG125S-7B1]

<table>
<tr><th colspan="3">Conditions of Load</th><th>Allowable Current Limit</th><th>Conditions</th></tr>
<tr><td rowspan="4">3 phase 4 wire type</td><td rowspan="2">In case of using 2 phases</td><td>In case of using three phases
 
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 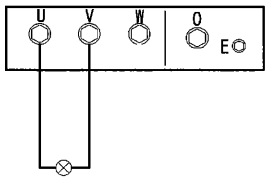
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 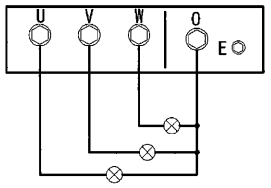
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 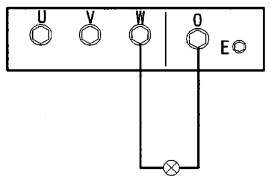
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 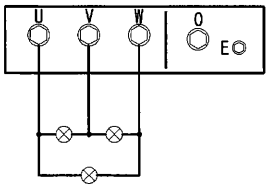
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 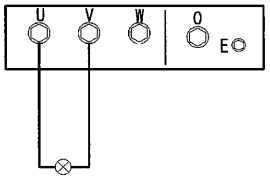
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 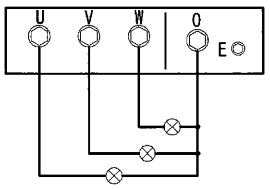
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 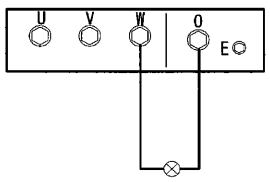
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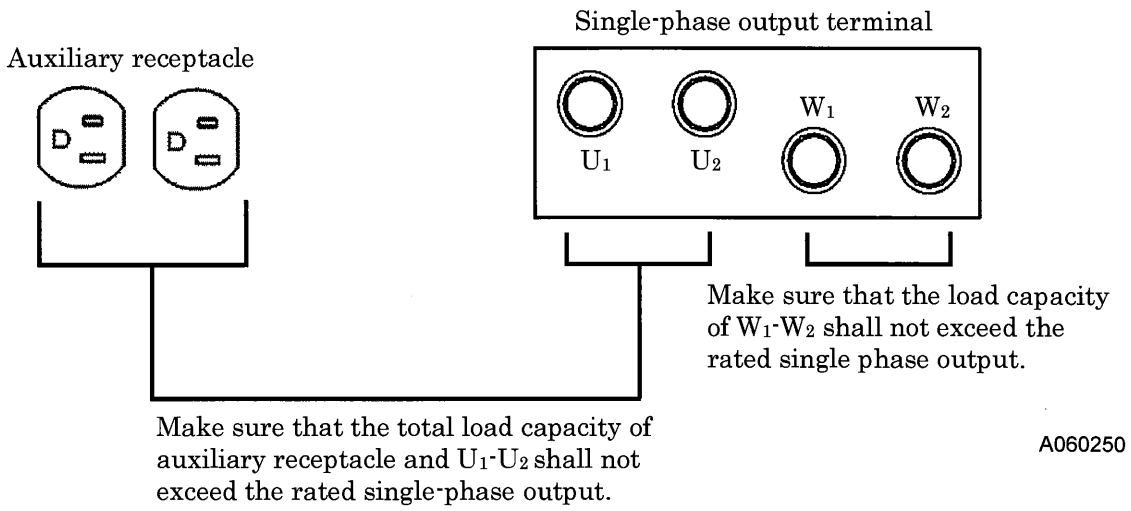
4.5.3 Single phase output (100/110V 50/60Hz)

- In the output terminal portion the single-phase output terminal (U_1-U_2) (W_1-W_2) 2 set and the auxiliary receptacle are provided.
- When the AC ammeter indicates 200/220V and 400/440V, the single-phase output voltage is 100/110V.
- The single-phase output can be used up to the rated outputs mentioned in the following table. When using the auxiliary receptacle, the total load capacity including U_1-U_2 terminal shall be used not to exceed the rated single phase output in the following table.
- In case that auxiliary receptacle is used, turn "ON" the circuit breaker (dedicated to single phase output) fitted on the control panel.



(50/60Hz)

Single phase output voltage	100/110V
Rated single phase output	10/11kVA×2
Rated current	100A×2

- When using both single output and three-phase output at the same time, the machine shall be used lower than the allowable current limit.
- Two auxiliary receptacles shall be used lower than total 15A.

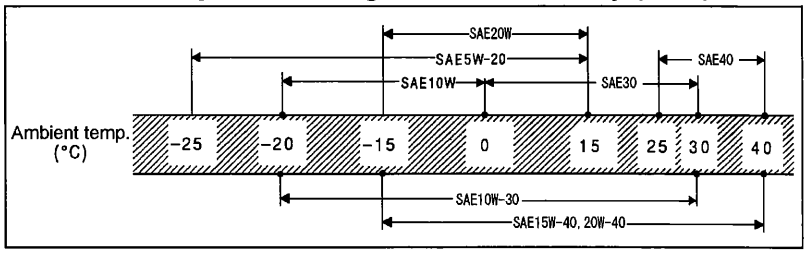
4.6 Engine Oil · Coolant · Fuel

4.6.1 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)



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***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.

4.6.2 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).

4.6.3 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

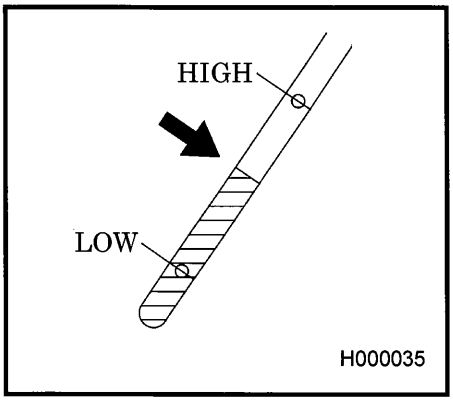
4.7 Check before Starting the Machine

⚠ CAUTION — ***Check before starting the machine***

- 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.

4.7.1 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.



<Procedures>

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.

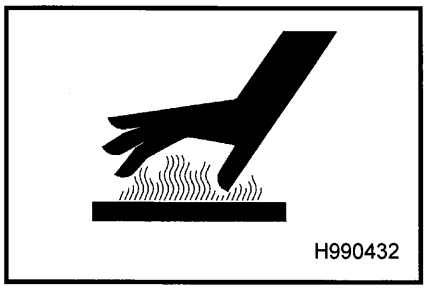
③ When the oil level is below its LOW, add engine oil. (See 5.5.1)

- 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.

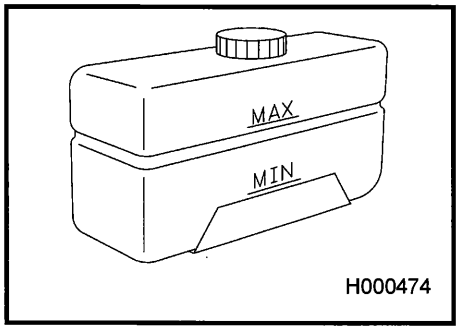
4.7.2 Check coolant level

⚠ CAUTION — ***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 5.5.21)



4.7.3 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 — ***Fire prevention***

- 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.
- Never use alcohol-base cleaning fluid. If it sticks to such parts made of plastic, it causes degradation of liquid surface visibility, and in worst case, it leads to crack and fuel leak due to crack caused.
- 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.**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4.7.4 Check fuel pre-filter for condensate

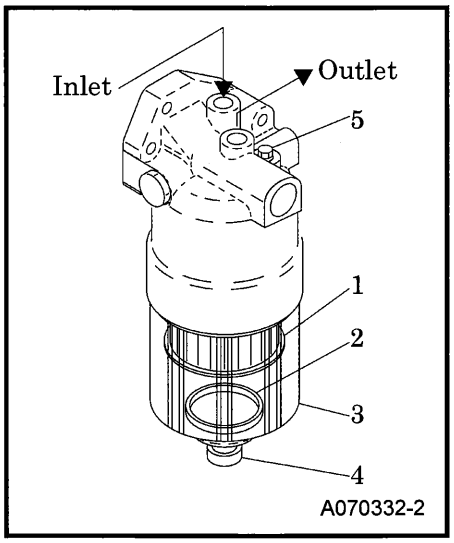
⚠ CAUTION

- At time of inspection, never use alcohol-base cleaner. If it sticks to such parts made of plastic, it causes degradation of liquid surface visibility, and in worst case, it leads to crack and fuel leak due to crack caused.

Check if the red float "2" in the pre filter rises up to the water drain level "1", then drain water if it is near the drain level.
<Procedures>

① Drain condensed water accumulated inside, after loosening drain plug "4" and air-bleeding plug "5".
② After draining the condensate, be sure to fasten the drain plug "4" and air-bleeding plug "5".

- Never remove case "3" of fuel pre-filter because if removed fuel comes out. In case that it is necessary to remove it, do it after having clogged the inlet hose using a clip or like.
- Drain the condensate in container, and then dispose of condensate according to the designated regulations.



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4.7.5 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)

4.7.6 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:

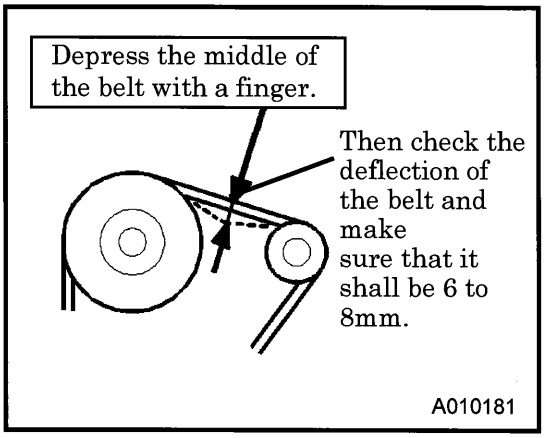
<Procedures>

① Unfasten the mounting bolts of the alternator to adjust the alternator.

② Visually check the belt for any crack, wear, and other defect.

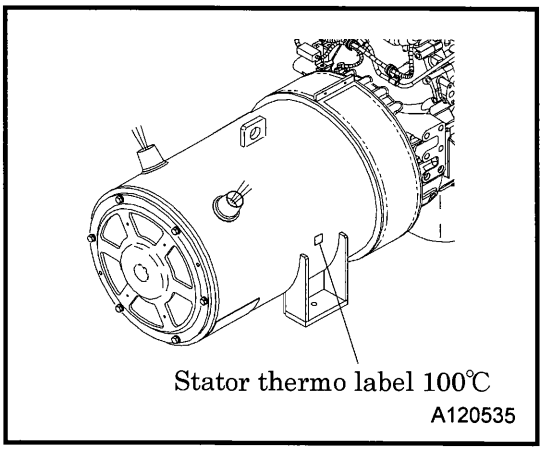
③ Loosen the mounting bolt of alternator once. Then adjust it so that the belt deflection will be 6-8mm (98.1N) when pressing with a finger.

④ Be careful not to leave any grease and LLC on the belt. If any of such material is left, wipe it off completely.



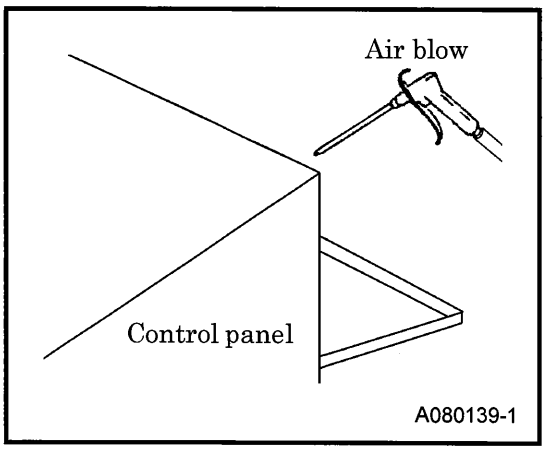
4.7.7 Check of thermo-label on the stator

- Thermo-label on the stator irreversibly changes its color from white to brown by reaching or exceeding 100°C, that signalize overload during operation. Do not overload the generator.
- Clean internal components of the alternator from dust and dirt with compressed air.
- Replace thermo-label, if it have changed the color once.
- When replace it, contact our office nearby or distributor.



4.7.8 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.



4.7.9 Check leakage relay operation

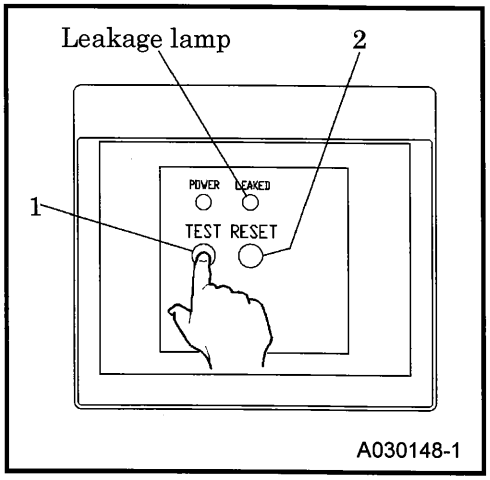
DANGER

- 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 4.8.1)
② Switch "ON" the circuit breaker.
③ Push the leakage relay TEST button "1".
The relay function is normal if the Leakage lamp"2"on the instrument panel is lighting up red and the circuit breaker is switched "OFF".
④ Push the RESET button "2" on leakage relay and set breaker lever downward to the "OFF" position.
⑤ Stop the machine. (See 4.8.4)



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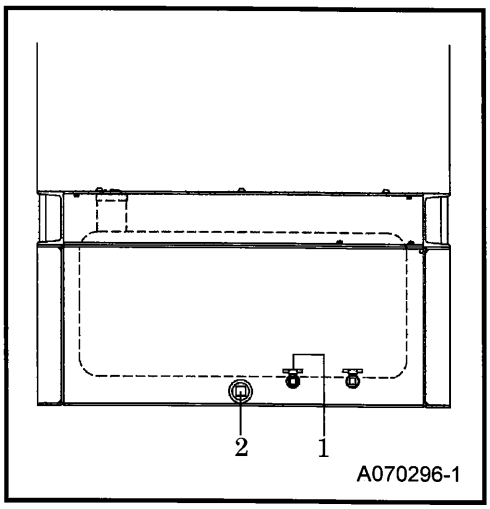
4.7.10 Check condensate in the oil fence

- Drain port in oil fence is provided on the side of oil fence. Open drain valve"1"and remove drain plug"2"to drain out the condensate in the oil fence.
- After making sure that all condensate is completely drained out, close drain valve"1"and install drain plug"2".
- Drain the condensate in container, and then dispose of condensate according to the designated regulations.



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4.7.11 Periodical Inspection of Machine Insides

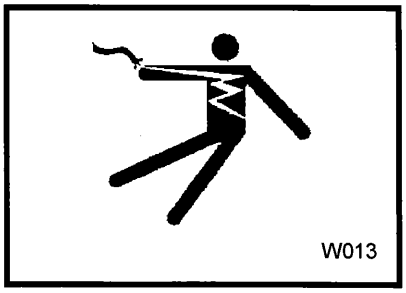
- Periodically check the inside of the generator for dusts (rubbishes) and flammables. When any flammables such as chips of wood, dead leaves (dry leaves) and waste paper are left near heated exhaust muffler and heated exhaust pipe, all of them should be eliminated.

4. Operation

4.8 Operation and Stopping

⚠ DANGER — ***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 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.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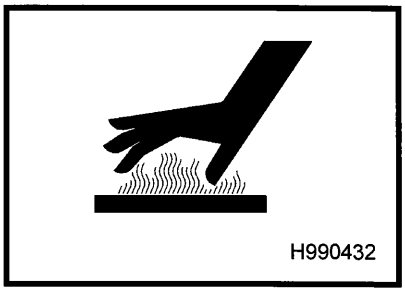
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⚠ CAUTION — ***Pay caution to overload and unbalanced load***

- 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 electing 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.

⚠ CAUTION — ***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


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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.

4.8.1 Procedure to start the machine

Follow the starting procedure below.

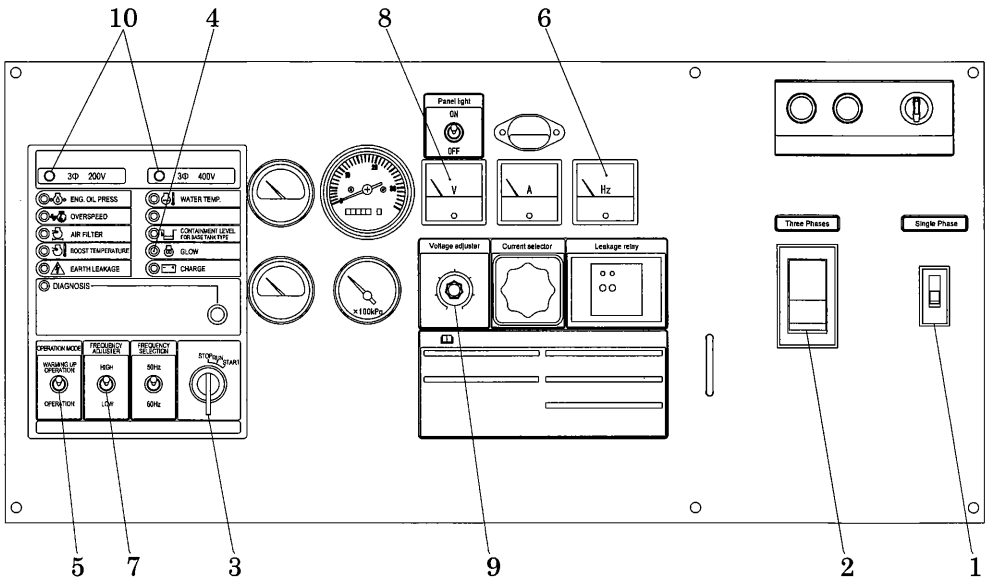
<When engine starts>

① Make sure that both circuit breaker (dedicated to single phase) "1" and circuit breaker "2" are "OFF". (In cold seasons, place operation mode selector switch "5" to "Warming up").

② When turning starter switch "3" to "RUN" position, preheating lamp "4" automatically goes on.

③ Immediately after the preheating lamp "4" distinguishes, turn starter switch "3" fully to the right to start engine.

④ Once the engine has started up, leave the engine running to warm up for approximately 5 minutes.



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<Confirmation of voltage and frequency>

① After warming up operation, switch operation mode selection switch "5" to "RUN" position.

② After finishing warming up operation, check and confirm frequency meter "6". If the frequency is wrong, turn frequency selector switch "7". If the frequency at load is adjusted higher than specified speed, turn selector switch to "LOW" and if lower, turn to "HIGH" and adjust it to rated speed (rated frequency). (See 4.8.2)

③ While watching the voltmeter "8", turn the voltage adjuster "9" knob to set the voltage to the rated. (See 4.8.2)

④ Output display lamp "10" is displayed in accordance with the selected output. 200V output lamp glows in green, and 400V lamp in red. (See 4.4)

<Loaded operation>

① Switch circuit breaker (dedicated to single phase) "1" or circuit breaker "2" "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.

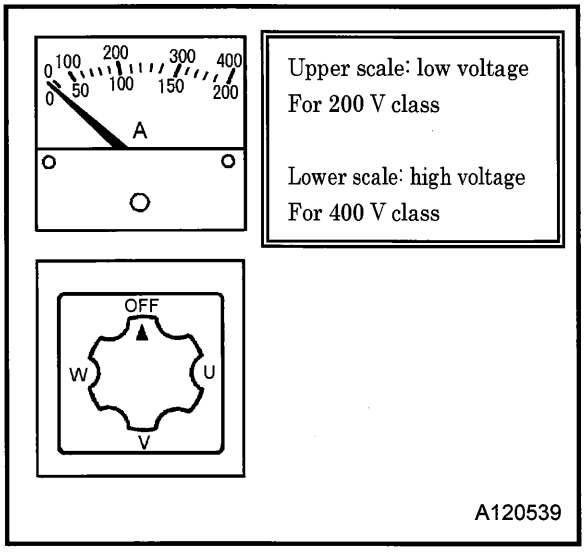
※ Before starting to supply power to the load, make sure that the voltage is in accordance with the load.

4.8.2 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)	Monitor lamp						Indicator lamp
					Engine oil pressure	Water temp.	Excessive rotation	Air filter	Oil fence	Charge	Leak
Before starting up	Starter switch (RUN)	0	0	0	● OFF	● OFF	● OFF	● OFF	● OFF	☼ ON	● OFF
SDG100S During operation (Full load)	50Hz	200/ 380/400	50	231/ 121.5/115							
	60Hz	220/440	60	262/131							
SDG125S During operation (Full load)	50Hz	200/ 380/400	50	289/ 152/144							
	60Hz	220/440	60	328/164				● OFF			
SDG150S During operation (Full load)	50Hz	200/ 380/400	50	361/ 190/180							
	60Hz	220/440	60	394/197							
During operation (Unload)	50Hz	200/ 380/400	50	0							
	60Hz	220/440	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.
- In single-phase load operation, check the current of U·V and W phase with the ammeter, by turning the current selection switch.
  When each current is unbalanced, change load connections so that the current of U·V and W, can be equally balanced. Also make sure that the current of each phase does not exceed the rated one.



4.8.3 Panel light

- The instruments are provided with transmission type illuminators. Switch "ON" the panel light so that they may light on.
- When illumination is not necessary, turn "OFF" the light. (If the machine is always operated with the lamp switched "ON", the lamp life can be shortened.)

4.8.4 Stopping Procedures

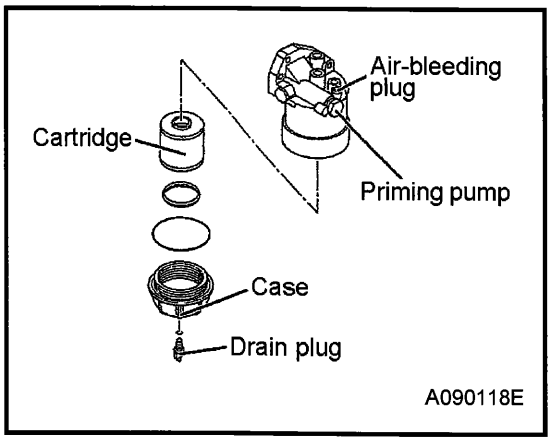
<Procedure>
① Set the circuit-breaker on the instrument panel of the machine to "OFF" position.
② After about 5 minutes cooling down operation, turn the starter switch to "STOP" position.

4.8.5 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
- Clogging of filter inside the fuel air-bleeding electromagnetic pump
- Discharge of battery (Low cranking speed)

4.8.6 Fuel line air bleeding device

If the unit runs out of fuel, bleed the air, according to the following procedures.
<Procedure>
① Place starter switch to "OPERATION" position to keep electromagnet pump functioning.
② Loosen "air bleeding plug" enough to move "Priming pump" (more often than 20 times) till fuel comes out.
③ Close "Air bleeding plug" and move "Priming pump" (more often than 10 times) till fuel is filled in fuel filter.
④ After waiting about 1 minute, loosen "Air bleeding plug" to bleed air from air filter.
⑤ Repeat the above procedures ②-④ till air does not come out from "Air bleeding plug".
(at least more often than three times).



⑥ Tighten "Air bleeding plug" for sure and wipe out fuel around.
⑦ Place operation mode selector switch to "Warming up" position to start engine.
If engine will not start at this time, repeat again the procedures from ③.
⑧ Perform warming up operation for 3 minutes after engine starts.
⑨ Place operation mode selector switch to "Operation position" to raise engine speed up to rated engine speed.
Thence repeat selection "Warming up" ⇔ "Operation" with operation mode selector switch.

4. Operation

4.9 Parallel Operation (SDG150S only)

⚠ CAUTION

- For load sharing, adjust the speed of each engine by turning frequency adjustment switch.
- Operate each generator at 70 ~ 80% of the rated capacity or less. A little difference of engine governor or cross current can cause overloading to one machine.
- When engine fuel shortage occurs or emergency stop device functions during parallel operation, generator becomes motor to forcefully drive engine. In this case, engine gets mal-lubricated and fails. Always watch the operation and should something abnormal occur, immediately shut down by using circuit breaker.
- During parallel operation cross current may cause malfunction to a ground fault circuit interrupter of the generator. Therefore, install a ground fault circuit interrupter to the load, and do not connect. the grounding terminal to the generator.

- As all these models are equipped with high precision parallel operation device (cross current prevention device), they can easily perform parallel operation. Such generators of same models and same capacity are better in efficiency for parallel operation.

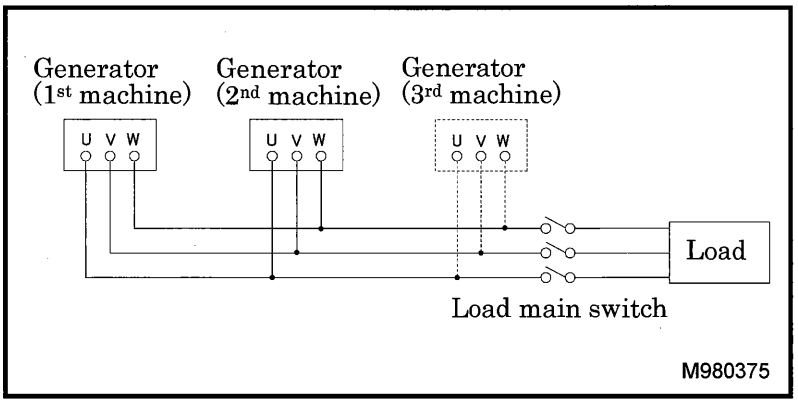
4.9.1 Preparations for operation

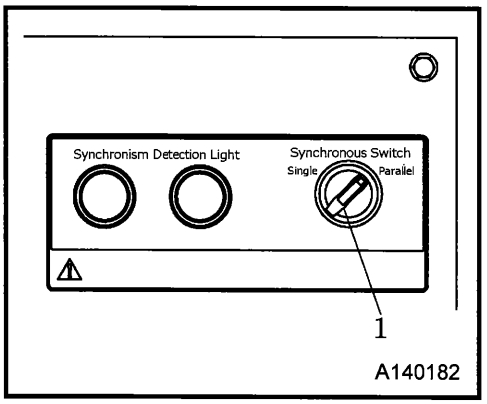
⚠ DANGER

- Make sure to stop engine before carrying out wiring connection.

- When making wiring connection between generators and connecting to load, connection of same phase (U·V·W) between each generator as shown in the following wiring diagram.
- When selecting voltage, use same voltage for all generators. (See 4.4)
- Place the synchronous switch "1" to the position of "Parallel" operation.
- Switch "OFF" all the three-phase circuit breaker for all the generator.

※ Make sure that load main switch is "OFF".





4.9.2 Procedure to start the machine

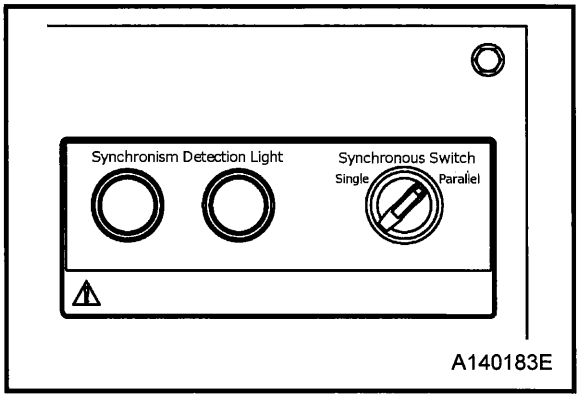
<Procedure>

① Operate each generator in accordance with the starting procedures in 4.8.1.

② Make sure that "Parallel" operation is switched on, and then adjust the voltage and frequency.

③ Open three-phase circuit breaker of second machine, and adjust the frequency adjusting switch of first machine so that synchronism detection light may slowly flash.

④ The instant that the synchronism detection light of first machines went out. The breaker of first machine should be opened. Thus synchronization process is completed.



⑤ In the same way as above, carry out synchronization for third machine and so on.

IMPORTANT

- In this case both machines are in no load and so the ammeters of both machines show 0 (zero). If ammeters show +plus, there is a cross current. Adjust all the voltage adjuster so that the ammeters show 0 (zero).

⑥ Switch "ON" load switches. In this time if each load of each generator is unbalanced, adjust engine speed of each generator for load sharing.

- At higher speed the load sharing of generator increases.
- At lower speed the load sharing of generator decreases.

4.9.3 Stopping Procedures

<Procedure>

① Switch "OFF" load switches.

② Stop each generator in accordance with the "Stopping Procedures in 4.8.4".

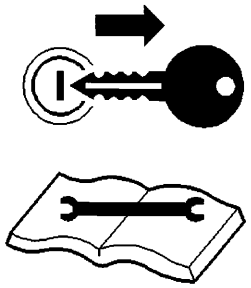
5. Periodic Inspection/Maintenance

5.1 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.

⚠ DANGER — ***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.



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IMPORTANT — ***Precaution for check and maintenance***

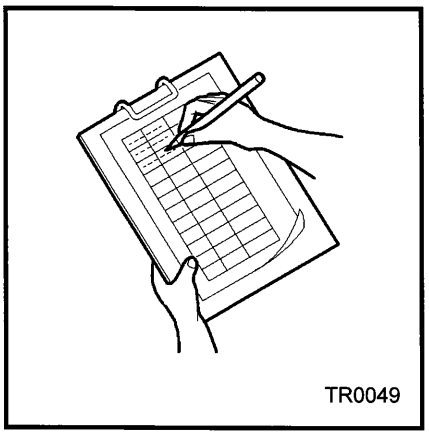
- Be sure to use recommended fuel, oil, grease, or antifreeze.
- Do not disassemble or adjust engine, compressor or part(s) for which inspection or maintenance is not referred to in this manual.
- Use genuine parts for replacement.
- Any breakdown, caused by using unapproved parts or by wrong handling, 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 receiver waste liquid so that such liquid cannot be spilt 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.

5. Periodic Inspection/Maintenance

5.2 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.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- 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.

5.3 Periodic Replacement of Parts

IMPORTANT

- 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
	SDG100, 125S-7B1	SDG150S-7B1	
Air filter element	32143 16200	32143 12500	1
Engine oil filter element	41291 00500	←	1
Fuel filter element	43543 01000	←	1
Fuel pre filter element	43543 00900	←	1
Belt	ISUZU 898062-7130	ISUZU 898046-1660	1
Gasket for filter inside fuel air-bleeding electric pump	ISUZU 898071-4040	←	1
Breather separator (element kit)	-	ISUZU 898030-5320	1
Gasket for engine supply pump strainer "3"	ISUZU 109630-0830	←	3
Gasket for engine supply pump strainer "4"	ISUZU 109630-0850	←	3
Copper packing for air bleeding plug of the EGR cooler.	ISUZU 909571-4100	←	1

5. Periodic Inspection/Maintenance

5.4 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	50	250	500	1,000	Page	Remarks
Generator	Check ground of machine package and leakage relay.	○					4-14	
	Check of thermo-label on the stator	○					4-15	
	Cleaning the instruments inside control panel	○					4-15	Cleaning should be done when needed.
	Check leakage relay operation.	○					4-16	
	Check each instrument and monitor lamp.	○					4-19	
	Check insulation resistance.			○			5-5	Every 2 months
	Check of thermo-label on the rotor bearing			○			5-6	Every 2 months
	How to check thermal relay.			○			5-6	Every 2 months
Engine	Check engine oil level.	○					4-13	
	Check coolant level.	○					4-13	
	Check fuel	○					4-14	
	Check fuel pre-filter for condensate.	○					4-14	
	Check belt tension.	○					4-15	In the case of NG, it exchanges.
	Change engine oil.		○ (First time)		○		5-4	
	Change engine oil filter.		○ (First time)		○		5-5	
	Check and clean clogging of air filter element.			○			5-6	Perform cleaning when the monitor lamp glows.
	Drain fuel tank.			○			5-7	
	Check battery electrolyte.			○			5-7	
	Check specific gravity of battery electrolyte				○		5-7	
	Change fuel filter and fuel pre-filter element.				○		5-7	
	Clean outside of radiator and intercooler.				○		5-8	Dirt condition cleans.
	Change breather separator.				○		5-8	SDG150S only
	Drain intercooler.				○		5-8	
	Check for crack and leak on the exhaust flexible pipe.				○		5-9	Every 4 months
	Clean the strainer provided inside the engine feed pump				○		5-9	
	Clean filter inside the fuel air-bleeding electromagnetic pump				○		5-10	
	Change air filter element.					○	5-11	
	Change coolant. (LLC)					○	5-13	Replaced every 2 years
	Check engine valve clearance.					●		
	Clean inside the fuel tank.					●		
Others	Check condensate in the oil fence.	○					4-16	
	Check the terminal portion of electrical circuits and cable connections.				○		5-10	Every 4 months
	Check vibration isolator rubbers					○	5-11	Yearly
	Check each rubber hose.					○	5-11	Yearly
	Clean inside of the oil fence and check it for any rust.					●	5-12	Check it every other 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.

5. Periodic Inspection/Maintenance

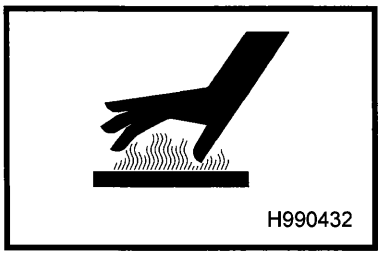
5.5 Maintenance

5.5.1 Change engine oil

[At 50 hours for the first change and every 500 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.



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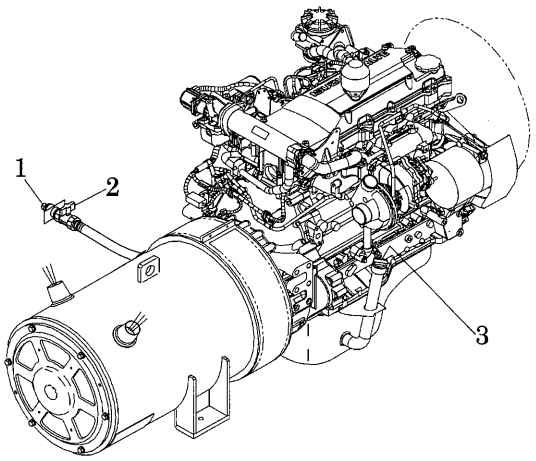
<Procedure>

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.

③ After finishing the oil supply, tighten the cap of oil filter port "3" firmly.

④ Please be sure to check whether engine oil is normal oil supply with an oil level gauge before operating this machine.



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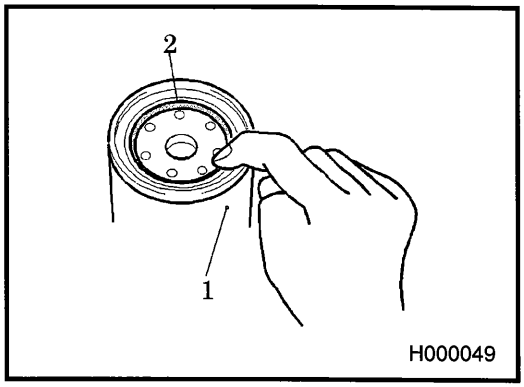
5.5.2 Change engine oil filter

[At 50 hours for the first change and every 500 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.
(For part number, See 5.3)



5.5.3 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 1MΩ, 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 and dry them.
  Even if it carries out the above disposal, when you do not recover, contact us directly or our distributors.

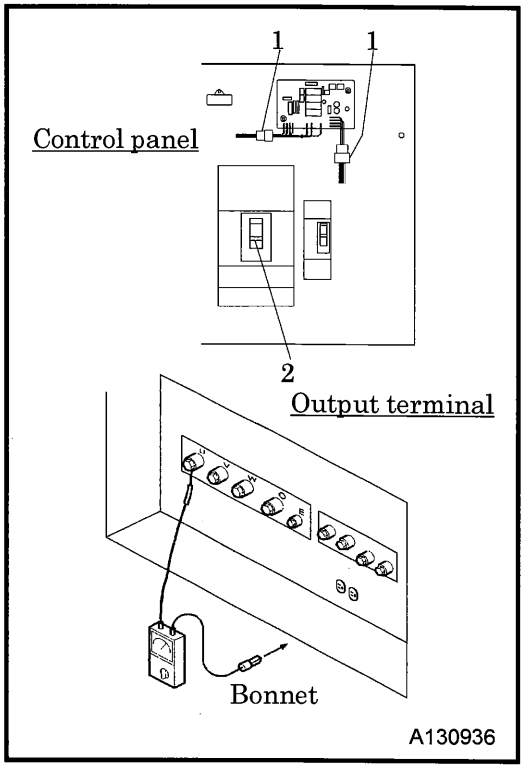
<Procedure>

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.

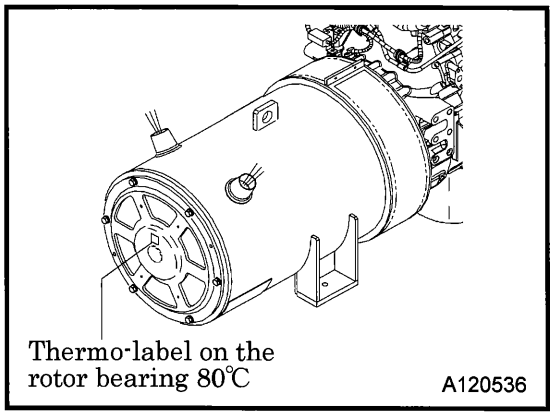
④ If insulation resistance value measured is found more than 1MΩ, it is good.



5.5.4 Check of thermo-label on the rotor bearing

[Every 2 months or every 250 hours]

- Thermo-label on the rotor bearing irreversibly changes its color from white to blue by reaching or exceeding 80°C. Be sure to check the bearing for backlash and noise.
- Replace thermo-label, if it have changed the color once.
- When replace it, contact our office nearby or distributor.

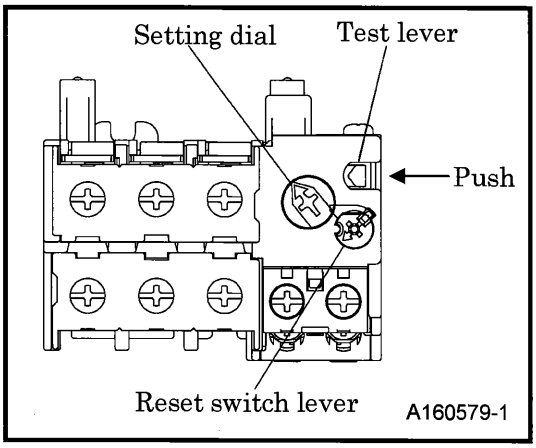


5.5.5 How to check thermal relay

[Every 2 months or every 250 hours]

<Procedure>

① Turn the starter switch to "ON".
② Turn the circuit breaker (dedicated to single phase) and the other breaker to "ON".
③ Push the test lever of the thermal relay in the "arrow" direction, and then both circuit breakers can "TRIP".
④ It is possible to return the circuit breakers to "ON" position again by placing the lever of the breakers to "OFF" position again.



5.5.6 Check and clean clogging of air filter element

[Every 250 hours]

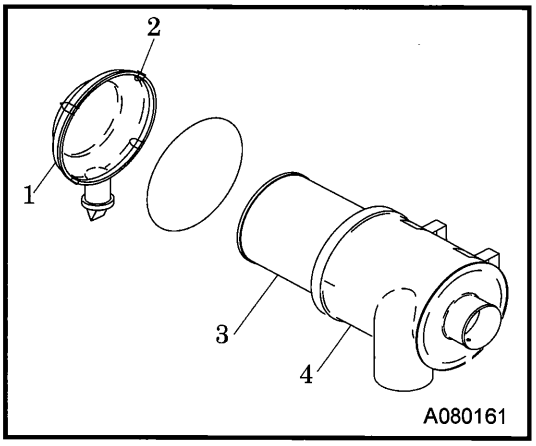
IMPORTANT — ***Be sure to properly clean air filter element***

- 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>

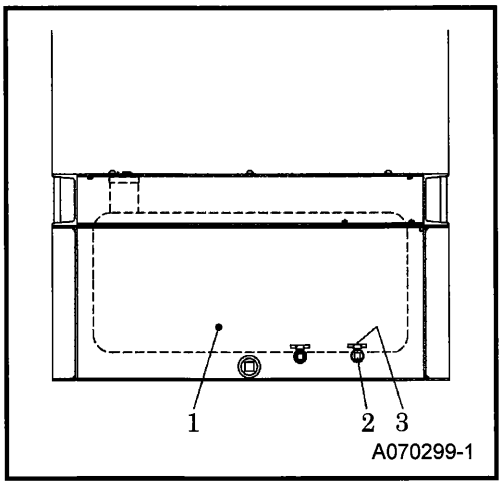
① After removing the cap "1" by loosening its latch "2" , clean its interior properly.
② Remove the element "3" , and clean it.
③ When installing the cap"1"after finishing the cleaning job, push the element into the case "4" surely by hand, and then make sure that the latch "2" fixing the cap surely hooks the case "4" . Finally tighten it.
④ If the element is found heavily dusty, replace it with a new one. (For part number, See 5.3)



5.5.7 Drain fuel tank

[Every 250 hours]

- To drain fuel tank "1" , remove drain plug "2" , and open drain valve "3" to drain the condensate accumulated in fuel tank "1" .
- After making sure that all condensate is completely drained out, close drain valve "3" firmly and install drain plug "2" .
- Dispose of condensate according to the designated regulations.



5.5.8 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 6.1)

(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.

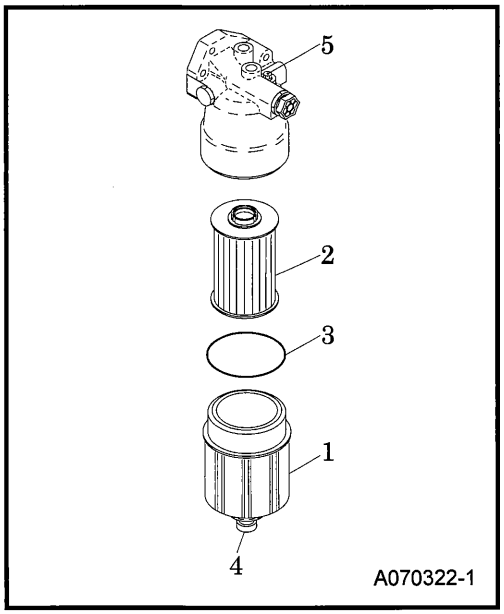
5.5.9 Change fuel filter and fuel pre-filter element

[Every 500 hours]

<Procedure>

① Loosen the drain plug "4" and the air bleeding plug "5" to drain out the fuel inside the fuel filter; After the drainage has been finished, retighten the drain plug "4" and the air bleeding plug "5" surely.
② Remove the filter case "1", using a filter wrench.
③ Screw in the new element "2" with the packing "3" coated slightly with oil. (For part number, See 5.3)
④ After the packing "3" touches the sealing face, further tighten it by turning it with the filter wrench.
⑤ Bleed air from fuel. (See 4.8.6)
⑥ After installing the element, check it for any leak during operation.

- How to change is mentioned in engine manual.
Please refer to engine manual.

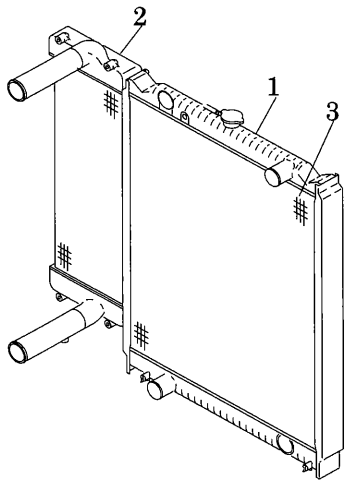


5. Periodic Inspection/Maintenance

5.5.10 Clean outside of radiator and intercooler

[Every 500 hours]

- When the fin tubes "3" of radiator "1" and inter cooler "2" 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 "3" 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.



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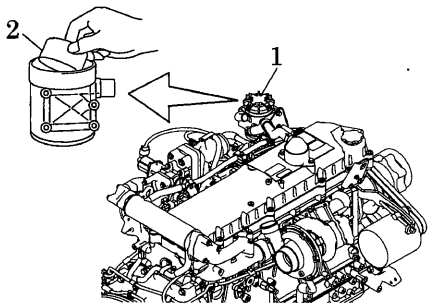
5.5.11 Change breather separator (SDG150S only)

[Every 500 hours]

<Procedure>

① Remove cap "1" of breather separator, and take out element kid "2" from inside.

② Install a new element kid "2" and also cap "1" for sure. (For part number, See 5.3)



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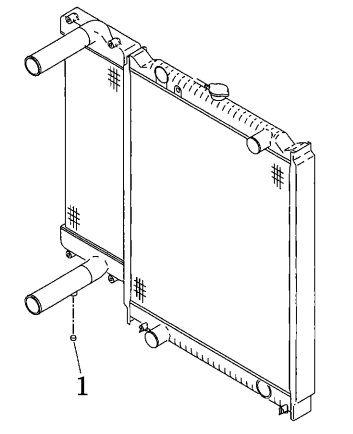
5.5.12 Drain intercooler

[Every 500 hours]

- Remove drain plug "1" below intercooler to drain condensate.
- After finishing drainage, install drain plug "1".



SDG150S-7B1

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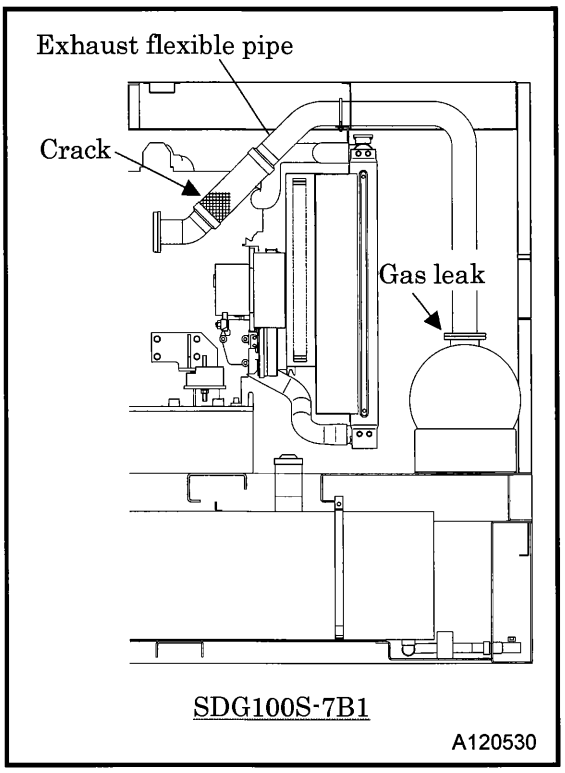
5.5.13 Check for crack and leak on the exhaust flexible pipe

[Every 4 months or every 500 hours]

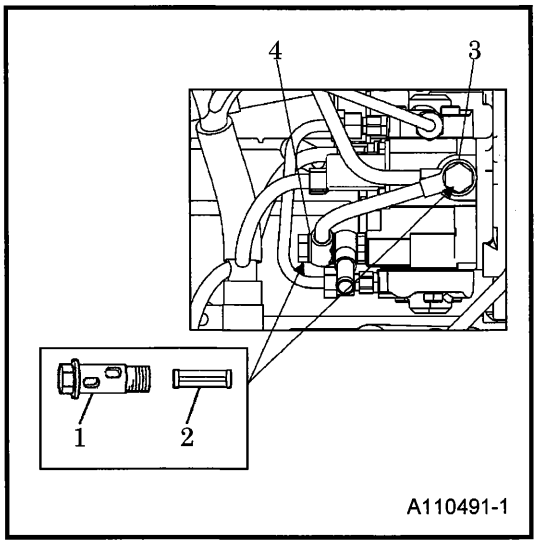
- Check for any crack and gas leak on the flexible pipe and exhaust between flexible pipe between engine exhaust outlet and the flexible pipe.
- If any leak is found, avoid getting burned by the exhaust gas.



5.5.14 Clean the strainer provided inside the engine feed pump

[Every 500 hours]

- Regularly remove and clean the strainer "2" in the joint bolt "1" at the side of feed pump inlet port.
- Remove the strainer "2" by loosening the joint bolt "1" and clean it with diesel fuel oil, and also using high air pressure blow. At this time be sure to replace gasket "3" and "4".
  (For replacement parts, refer to 5.3)
  Then after finishing all cleaning jobs, install it again in reverse steps.



5.5.15 Check the terminal portion of electrical circuits and cable connections

[Every 4 months or every 500 hours]

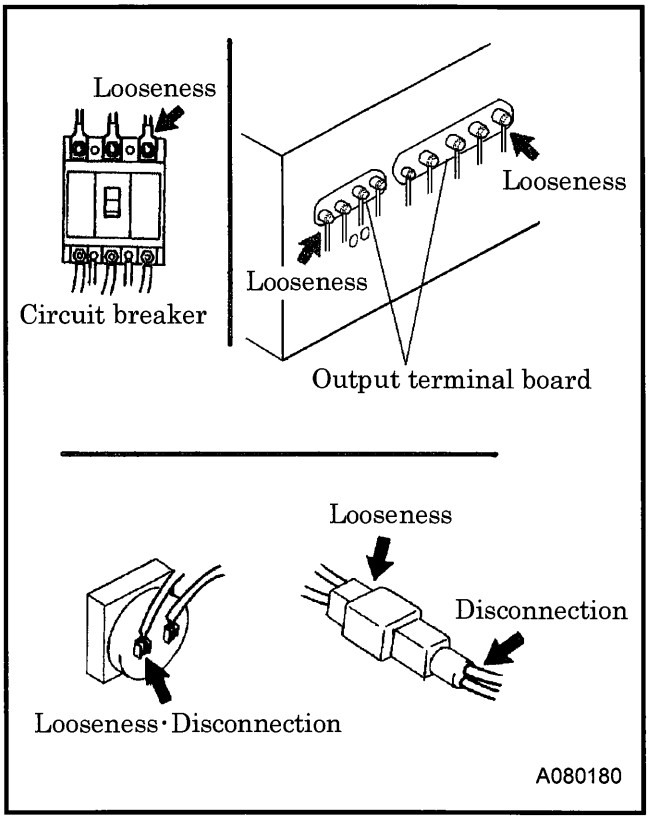
Check for any looseness on the cables and any damages on insulated covers and disconnection, disconnected cables, or short-circuit etc.

[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]

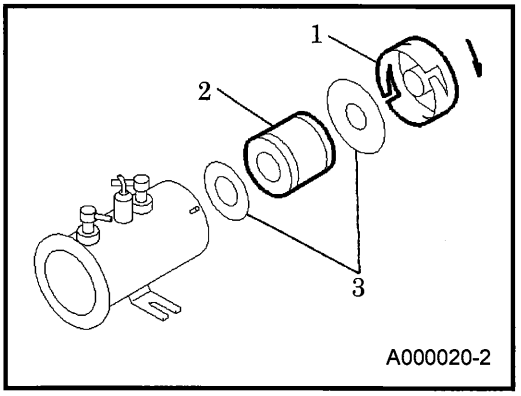
- Portion of connectors to the engine.
- Check for looseness of terminal connections.



5.5.16 Clean filter inside the fuel air-bleeding electromagnetic pump

[Every 500 hours]

- Turning the cap "1" counterclockwise to remove it, the filter "2" (steel mesh type) inside will come off. So, clean it. (For replacement parts, refer to 5.3)
- Whenever the filter "2" is removed, the gaskets "3" should be replaced without fail.
- As the fuel inside spills out when it is removed, prepare a fuel receiver.



5.5.17 Change air filter element

[Every 1,000 hours]

IMPORTANT ***Be sure to properly clean air filter element***

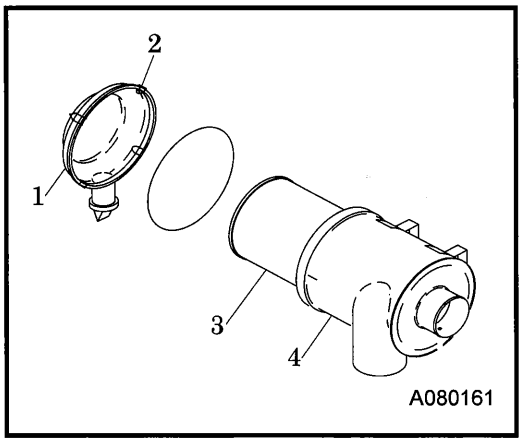
- When an element that is clogged or has holes or cracks is used, dust or foreign material will get in the engine. This causes accelerated wear in each sliding part of the engine. Be sure to make daily check and cleaning so that the life of the engine will not be shortened.

<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. (For replacement parts, refer to 5.3)

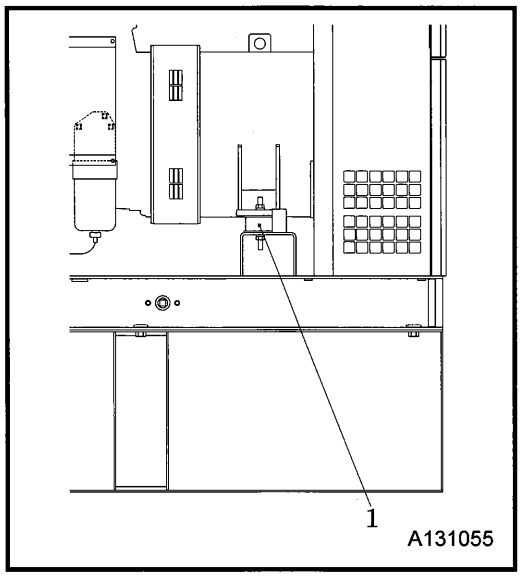
③ When installing the cap "1" after replacing it, properly push the element into the case "4" by hand and then make sure that the hooks for fixing the cap are surely set. Finally tighten it.



5.5.18 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.



5.5.19 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.
- 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.

5.5.20 Clean inside of the oil fence and check it for any rust

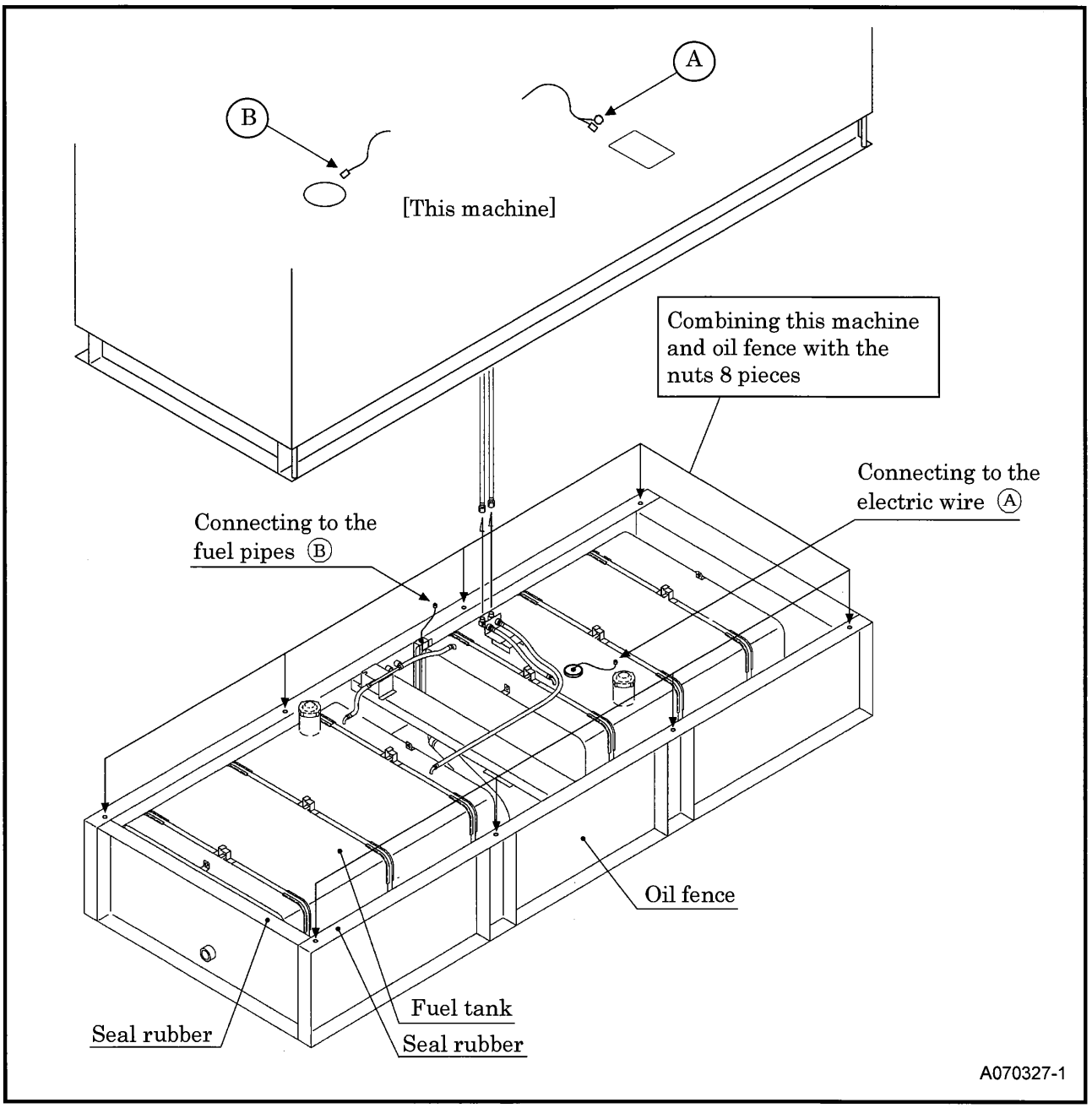
[Every 1 years]

<Procedure>

① Remove the oil filler cap cover, fuel pipes and electric wire connected to the fuel tank.
② Remove 8 pieces of the bolts connecting oil fence and the machine with the lifting eye hooked with the crane.
③ Lift up the machine to separate the oil fence from the machine.
④ Check and clean the inside of the oil fence.

- Check the inside of the oil fence for dust, fur and other foreign matter and check it for any rust.
- When the oil fence is found rusted, remove the rust outside and inside and paint it again.
- Should any leakage be found, contact your dealer or us directly.
- Check whether the seal rubber attached on the top of oil fence is slanted or curved.

⑤ Combining this machine and the oil fence, tighten the nuts 8 pieces.
⑥ Install oil filler cap cover, fuel pipes and also electric wires.



5. Periodic Inspection/Maintenance

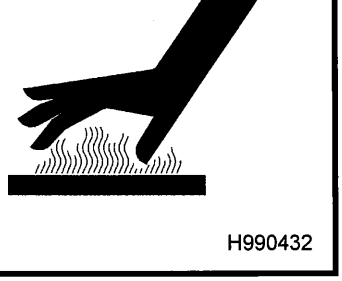
5.5.21 Change coolant

[Every 2 years]

⚠ CAUTION

Upon changing coolant

- 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.



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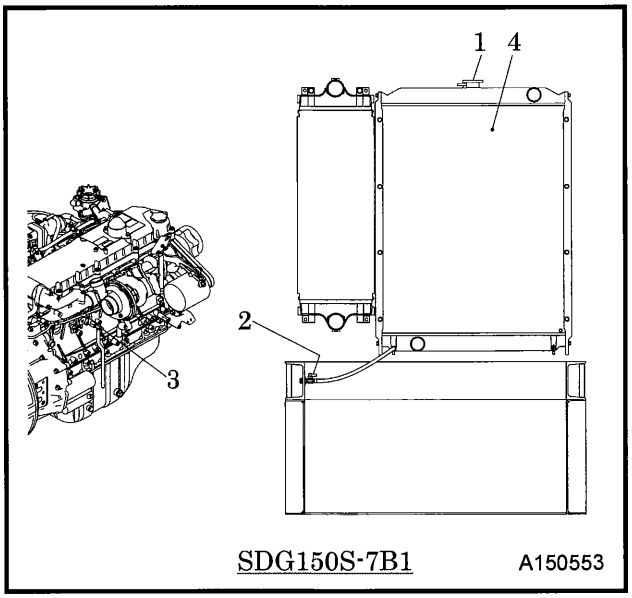
<Procedure>

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" .



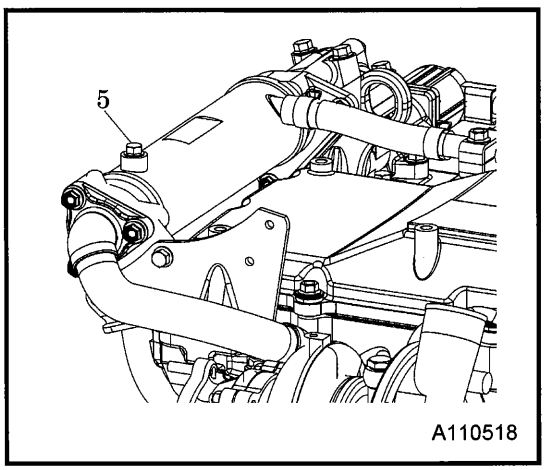
SDG150S-7B1 A150553

④ Loosen air bleeding plug "5" of EGR cooler and bleed air of EGR cooler.

⑤ When coolant flows over from air bleeding plug "5", retighten the plug and replace the copper packing with new one to avoid leak.
(For replacement parts, refer to 5.3)

⑥ 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.

- For the details of replacement procedures, please refer to engine operation manual.



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5. Periodic Inspection/Maintenance

5.6 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.)

⚠ CAUTION

- 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.

Type		SDG100S-7B1				SDG125S-7B1				SDG150S-7B1			
Frequency	Hz	50		60		50		60		50		60	
Rated voltage	V	200	380/400	220	440	200	380/400	220	440	200	380/400	220	440
Load current	A	190	100/95	210	105	240	125/120	270	135	290	155/145	320	160

6. Maintenance/Adjustment

6.1 Maintenance of Battery

⚠ DANGER

Handling battery

- 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.

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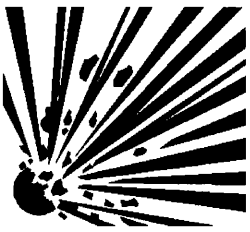

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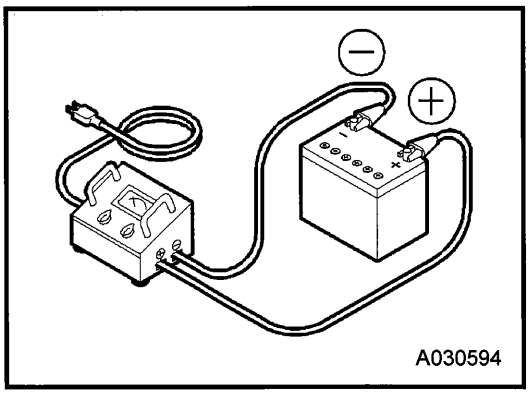
6. Maintenance/Adjustment

6.1.1 Charge battery

- Disconnect the cable between battery and the unit, and charge the battery with a 12 V battery charger.
  Do not charge two batteries at the same time.
- Be sure not to connect (+) and (–) terminals backwards.
- Be sure to read the operation manual of the battery charger to know if it is applicable, before using it.



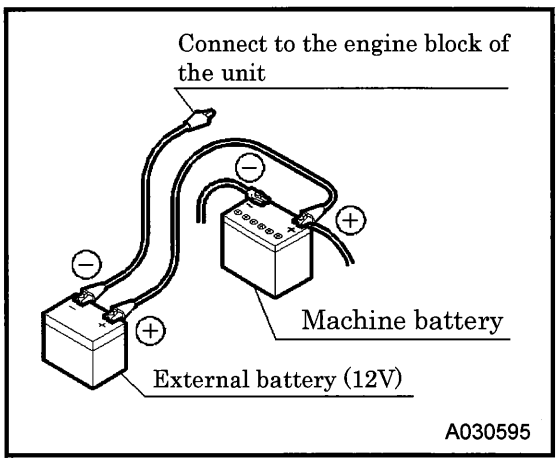
6.1.2 How to use booster cable

⚠ CAUTION — ***Do not reverse the cable connection***

- When a booster cable has to be used or when cables are connected again after an battery is replaced, be careful not to connect (+) and (–) terminals backwards. Such wrong-connection will cause spark and damage to each component.

<Procedure for using a booster cable>

① Stop the engine.
② Connect one end of the (+) cable to the (+) terminal of the machine battery.
③ Connect the other end of the (+) cable to the (+) terminal of the external battery.
④ Connect the (–) cable with the terminal (–) of the external battery.
⑤ Connect the other end of the (–) cable to the engine block of the machine.
⑥ Start up the engine.
⑦ Disconnect the booster cable by following the procedure back in the reverse order.



6.2 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) Fuel pre filter clogging (3) Filter of fuel air-bleeding electric pump clogging (4) No diesel fuel oil (5) Air mixing in fuel piping	Disassemble, clean, and change Disassemble, clean, and change Change filter Replenish fuel Bleed air
Engine oil pressure drop monitor 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 monitor 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
Excessive rotation monitor lamp glows.	(1) Trouble of engine governor	Repair
Leakage monitor lamp glows.	(1) Leakage on generator side (2) Leakage on load side (3) Leakage on connecting cable (4) Defective leakage relay	Repair Repair Repair Repair
Recharging monitor lamp glows.	(1) Alternator problem (2) Looseness, disconnection of wiring or connector	Check/change Check/repair
Air filter clogging monitor lamp glows.	(1) Air filter clogging	Clean

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.
Oil fence monitor lamp glows.	(1) The condensate (fuel, engine oil and coolant) is accumulated in the oil fence. (2) The liquid surface level detecting switch does not function good.	Drain the condensate. Check/change
Monitor lamp for elevation of intake air temperature from turbo-charge lights up.	(1) Internal temperature of turbo-charge is high. (Over 85℃)	Refer to the engine instruction manual.
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) AVR frequency selection switch is not set to meet the frequency to be operated. (9) Function circuit protector (CP) for AVR protection	Change Check/repair Repair Change Change Repair Repair Check/select 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 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 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. Maintenance/Adjustment

6.2.1 Engine trouble

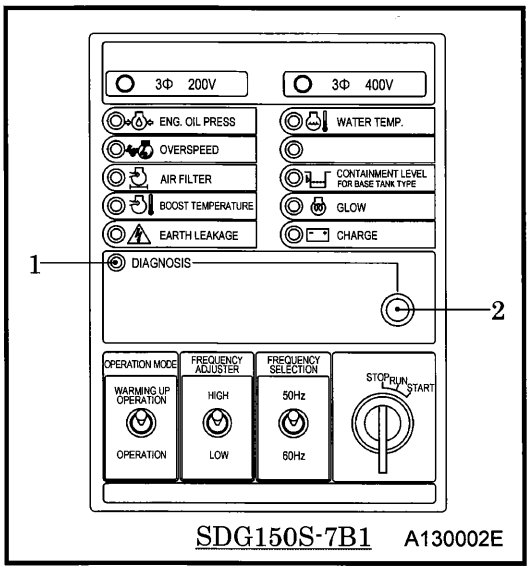
- This is equipped with controller which memorizes engine troubles. When engine fails, trouble diagnosis lamp "1" lights. For the details of the troubles, press trouble diagnosis switch "2" and then the trouble conditions are displayed.

<Procedure>

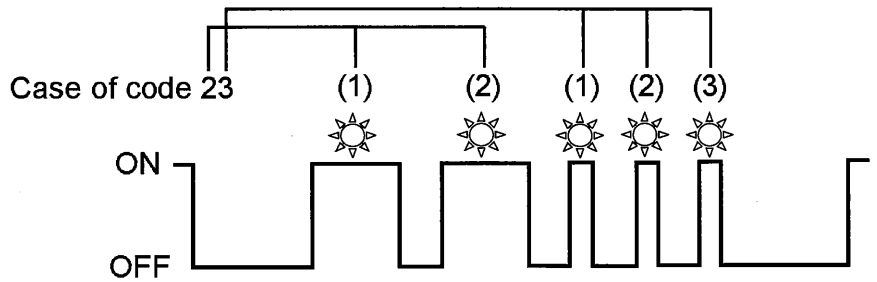
① Turn starter switch to "Operation" position and continue pressing trouble diagnosis switch "2" .

② If there are any troubles while pressing the switch, blinking pattern of trouble diagnosis lamp "1" shows details of the troubles.

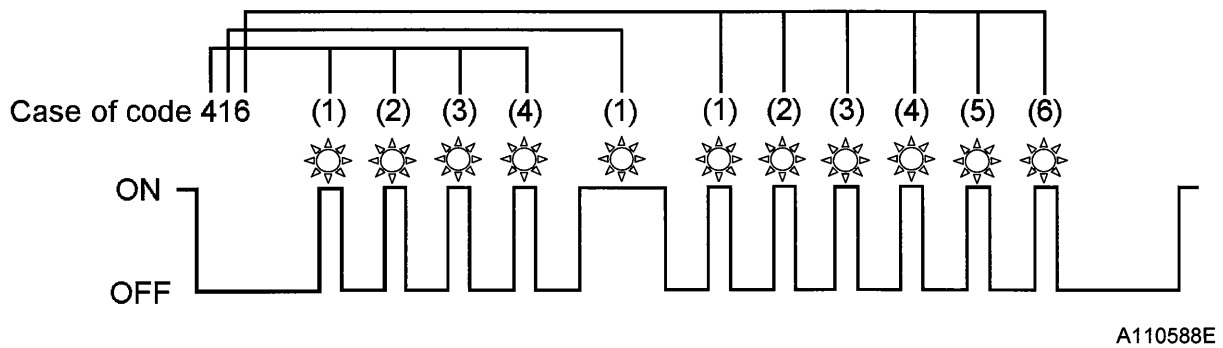
- Special knowledge on trouble conditions is required. So please contact your distributor or directly us.



[Example of blinking pattern]



Long interval blinking 2 times and short interval blinking 3 times mean code 23.



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Short interval blinking 4 times and long interval blinking 1 time and short interval blinking 6 times are code 416.

Long interval blinking : approx. 1.2 seconds
Short interval blinking : approx. 0.3 seconds

[List of diagnostic codes]

Some examples of diagnostic codes are mentioned in the following table.
Concerning the codes of trouble conditions, they are grouped into decades of the trouble kinds.
For the details and countermeasures, contact our office nearby or distributor because technical knowledge is required.

Code	Items to be detected	Details
14	Cam sensor is faulty	Disconnection of sensor cable
15	Crank sensor is faulty	Disconnection of sensor cable
22	Suction air temperature sensor is faulty	Disconnection of suction air temperature sensor harness, short-circuited and degraded
23	Coolant temperature sensor is faulty	Disconnection of coolant temperature sensor harness, short-circuited and degraded
24	Accelerator sensor is faulty	Accelerator sensor opening is more than 45%
32	Boost pressure sensor is faulty	Disconnection of boost pressure sensor harness, short-circuited and degraded
34	Charge circuit is faulty	ECU charge circuit is faulty
44	EGR (exhaust·gas·recirculation) position is faulty	Disconnection of sensor harness, short-circuited and degraded
45	EGR (exhaust·gas·recirculation) valve control is faulty	Failure of drive motor, disconnection and valve is pinched and sticking
51	CPU is faulty	CPU is faulty
55	5V power supply voltage is faulty	Power supply to sensor is short-circuited, power supply circuit in ECM (engine control module) is damaged.
71	Atmospheric sensor is faulty	Disconnection of atmospheric sensor harness, short-circuited and degraded
118	Common rail pressure faulty	Common rail pressure abnormally rises.
211	Fuel temperature sensor is faulty	Disconnection of fuel temperature sensor harness, short-circuited and degraded
227	Pump no-pressure feed (fuel leak)	Common rail pressure will not rise up to required range.
245	Common rail pressure sensor is faulty	Short circuit of sensor harness
247	SCV (suction control valve) driving system is disconnection and short circuit.	Disconnection of SCV (suction control valve) harness, short-circuited and degraded
271 ~274	Injection nozzle function is disconnection	Electric wiring disconnection of No.1-4 cylinder injector and short circuit
294	Engine oil pressure sensor is faulty	Disconnection of engine oil pressure sensor harness, short-circuited and degraded
416	Main relay system is faulty	Disconnection of harness and GND short-circuited and relay OFF
542	Overheating	Overheating, and sticking
543	Overrun (excessive RPM)	Engine abnormally high speed

7. Storage of the Machine

7.1 Preparation for Long-term Storage

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

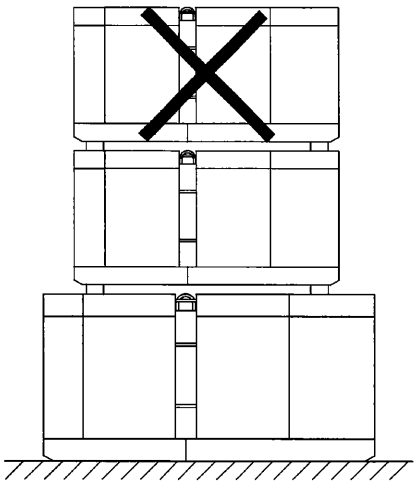
<Procedure>

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 machine, if possible, and store it in a dry place. (Charge the battery at least once every month.)
④ Discharge coolant and fuel from the machine.
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 machine.
⑥ Measure the insulation resistance of the generator, and make sure that it is more than 1MΩ. (See 5.5.3)
⑦ Be sure to repair any trouble and maintain the machine so that it will be ready for the next operation.

⚠ CAUTION

- When stacking up the machines for storage, only two machines 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



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8. Specifications

8.1 Specifications

Model			SDG100S-7B1			
Specifications			Dual Voltage Type (With oil fence)			
Generator	Exciting system		Brushless			
	Phase number		Three-phase, four-wire system			
	Power factor	%	80			
	Frequency	Hz	50		60	
	Rated output	kVA	80		100	
	Rated output	kW	64		80	
	Voltage	V	200	380/400	220	440
	Current	A	231	121.5/115	262	131
	Single phase output: Voltage	V	100		110	
	Single phase output: Exclusive terminal	kVA	10×2 sets		11×2 sets	
	Single phase output: Receptacle	kVA	1.5×1 sets (Total 2outlets)		1.65×1 sets (Total 2outlets)	
Engine	Model		ISUZU BI-4HK1X			
	Type		4-cycle, water-cooled, direct injection, turbo charged, intercooled			
	Number of cylinders		4			
	Total displacement	L	5.193			
	Rated output	kW	96.3		113.6	
	Revolution per minute	min^{-1}	1,500		1,800	
	Lubricating oil capacity	L	20.5			
	Coolant capacity (including radiator)	L	21.5			
	Battery		170F51(12V)			
	Fuel tank capacity	L	740			
Weight・Mass	Overall length	mm	2,450			
	Overall width	mm	1,180			
	Overall height	mm	1,830			
	Net dry mass (weight)	kg	2,095			
	Operating mass (weight)	kg	2,750			
Others	The capacity of oil fence	L	170			

8. Specifications

Model			SDG125S-7B1			
Specifications			Dual Voltage Type (With oil fence)			
Generator	Exciting system		Brushless			
	Phase number		Three-phase, four-wire system			
	Power factor	%	80			
	Frequency	Hz	50		60	
	Rated output	kVA	100		125	
	Rated output	kW	80		100	
	Voltage	V	200	380/400	220	440
	Current	A	289	152/144	328	164
	Single phase output: Voltage	V	100		110	
	Single phase output: Exclusive terminal	kVA	10×2 sets		11×2 sets	
	Single phase output: Receptacle	kVA	1.5×1 sets (Total 2outlets)		1.65×1 sets (Total 2outlets)	
Engine	Model		ISUZU BI-4HK1X			
	Type		4-cycle, water-cooled, direct injection, turbo charged, intercooled			
	Number of cylinders		4			
	Total displacement	L	5.193			
	Rated output	kW	96.3		113.6	
	Revolution per minute	min^{-1}	1,500		1,800	
	Lubricating oil capacity	L	20.5			
	Coolant capacity (including radiator)	L	21.5			
	Battery		170F51(12V)			
	Fuel tank capacity	L	740			
Weight・Mass	Overall length	mm	2,450			
	Overall width	mm	1,180			
	Overall height	mm	1,830			
	Net dry mass (weight)	kg	2,145			
	Operating mass (weight)	kg	2,800			
Others	The capacity of oil fence	L	170			

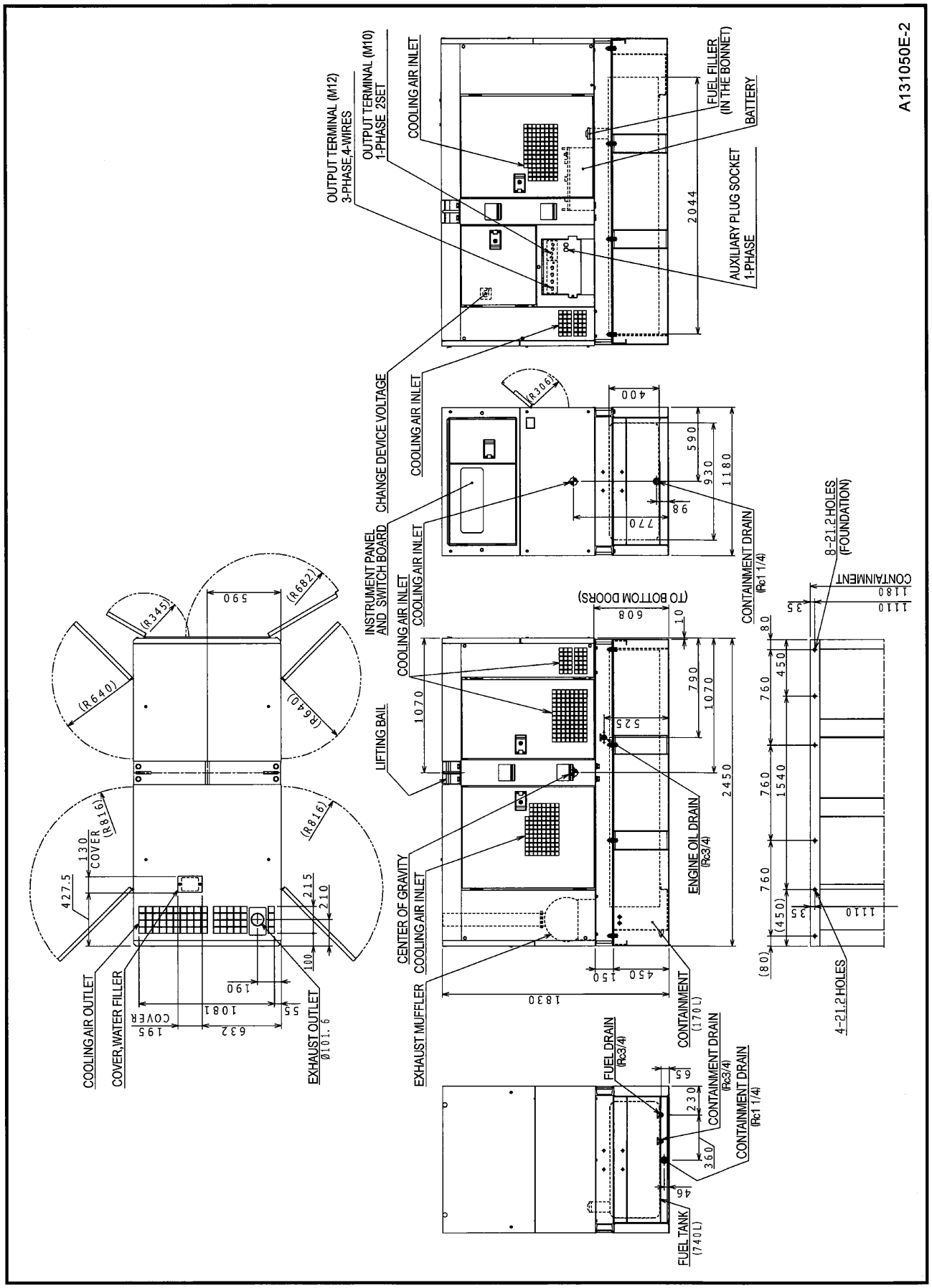
8. Specifications

Model				SDG150S-7B1			
Specifications				Dual Voltage Type (With oil fence)			
Generator	Exciting system			Brushless			
	Phase number			Three-phase, four-wire system			
	Power factor		%	80			
	Frequency		Hz	50		60	
	Rated output		kVA	125		150	
	Rated output		kW	100		120	
	Voltage		V	200	380/400	220	440
	Current		A	361	190/180	394	197
	Single phase output	Voltage	V	100		110	
		Exclusive terminal	kVA	10×2 sets		11×2 sets	
		Receptacle	kVA	1.5×1 sets (Total 2outlets)		1.65×1 sets (Total 2outlets)	
Engine	Model			ISUZU BH-6HK1X			
	Type			4-cycle, water-cooled, direct injection, turbo charged, intercooled			
	Number of cylinders			6			
	Total displacement		L	7.790			
	Rated output		kW	119		142	
	Revolution per minute		min^{-1}	1,500		1,800	
	Lubricating oil capacity		L	38.0			
	Coolant capacity (including radiator)		L	28.3			
	Battery			95D31R×2(24V)			
	Fuel tank capacity		L	815			
Weight・Mass	Overall length		mm	3,190			
	Overall width		mm	1,180			
	Overall height		mm	1,880			
	Net dry mass (weight)		kg	2,725			
	Operating mass (weight)		kg	3,460			
Others	The capacity of oil fence		L	423			

8. Specifications

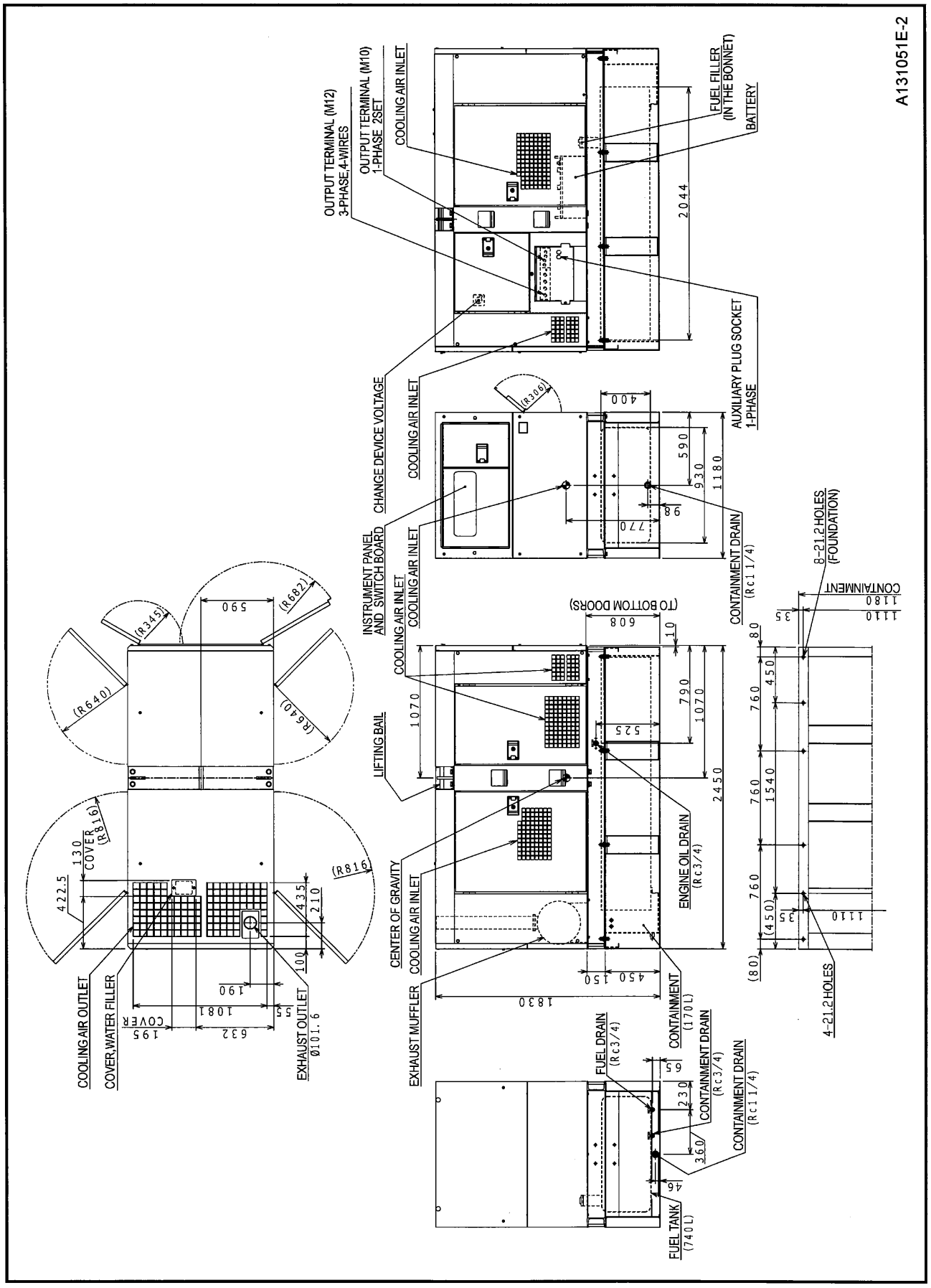
8.2 Outline drawing

SDG100S-7B1



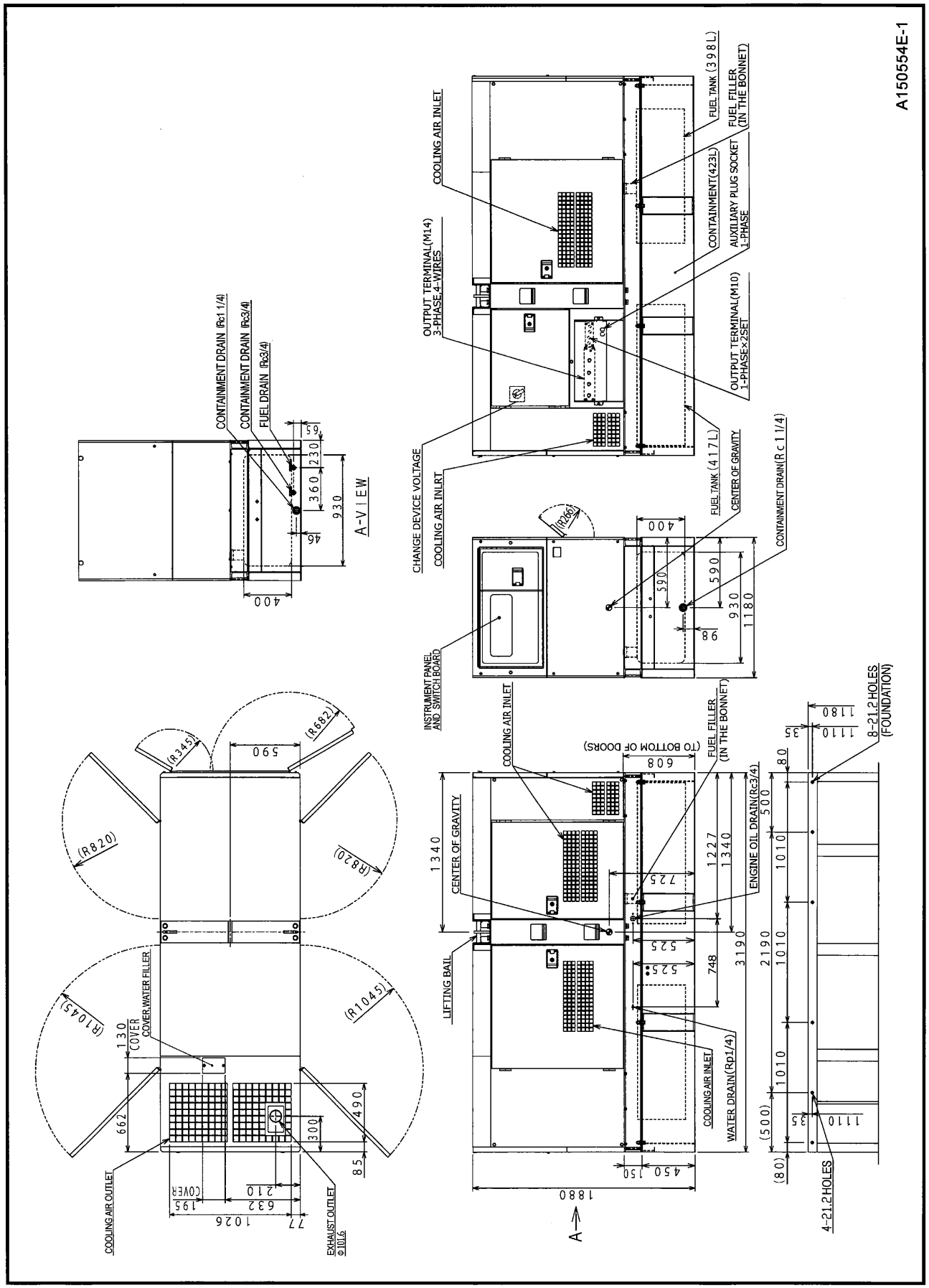
8. Specifications

SDG125S-7B1



8. Specifications

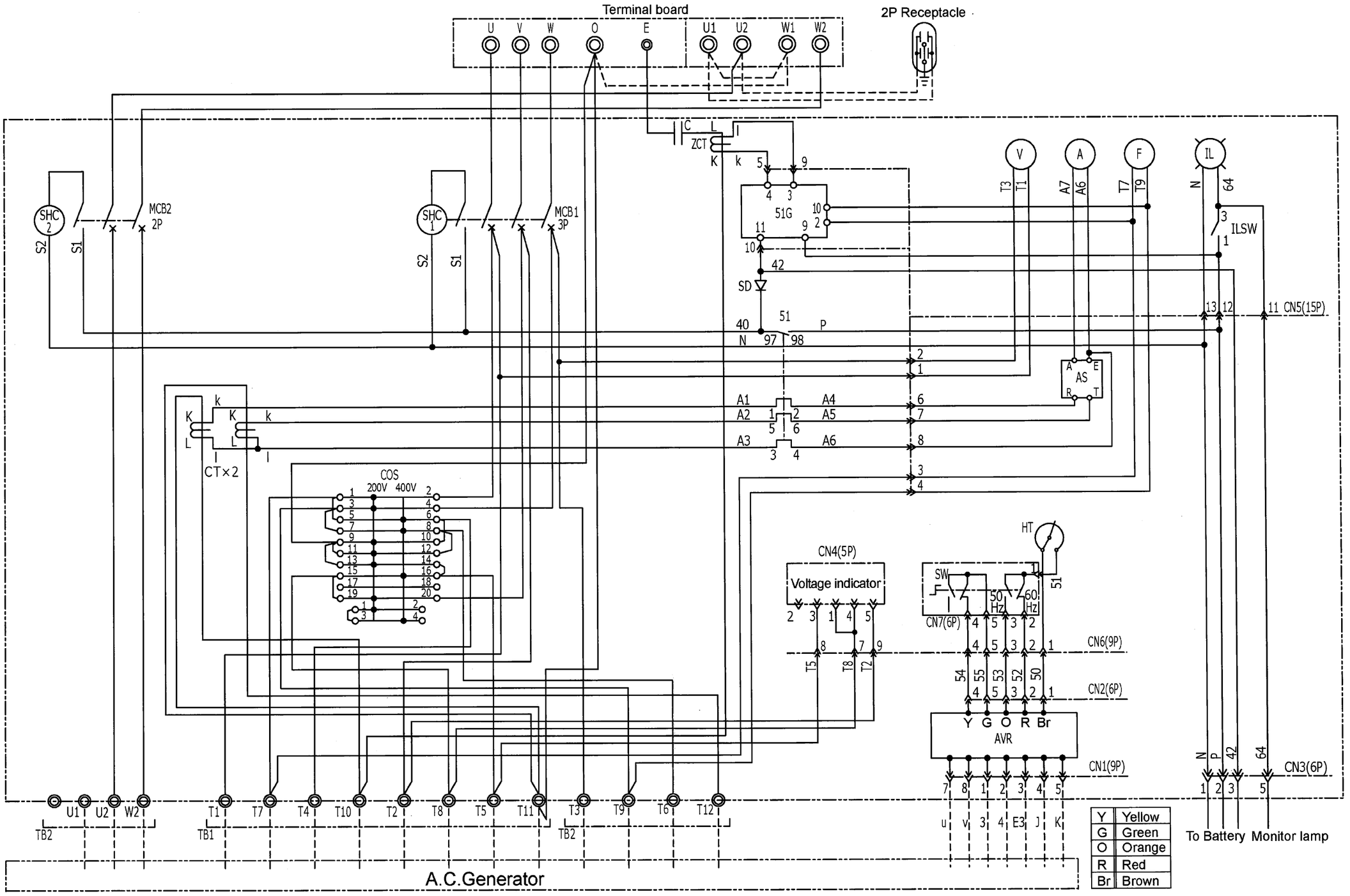
SDG150-7B1



9. Wiring Diagram

9.1 Generator Wiring Diagram

SDG100,125S-7B1



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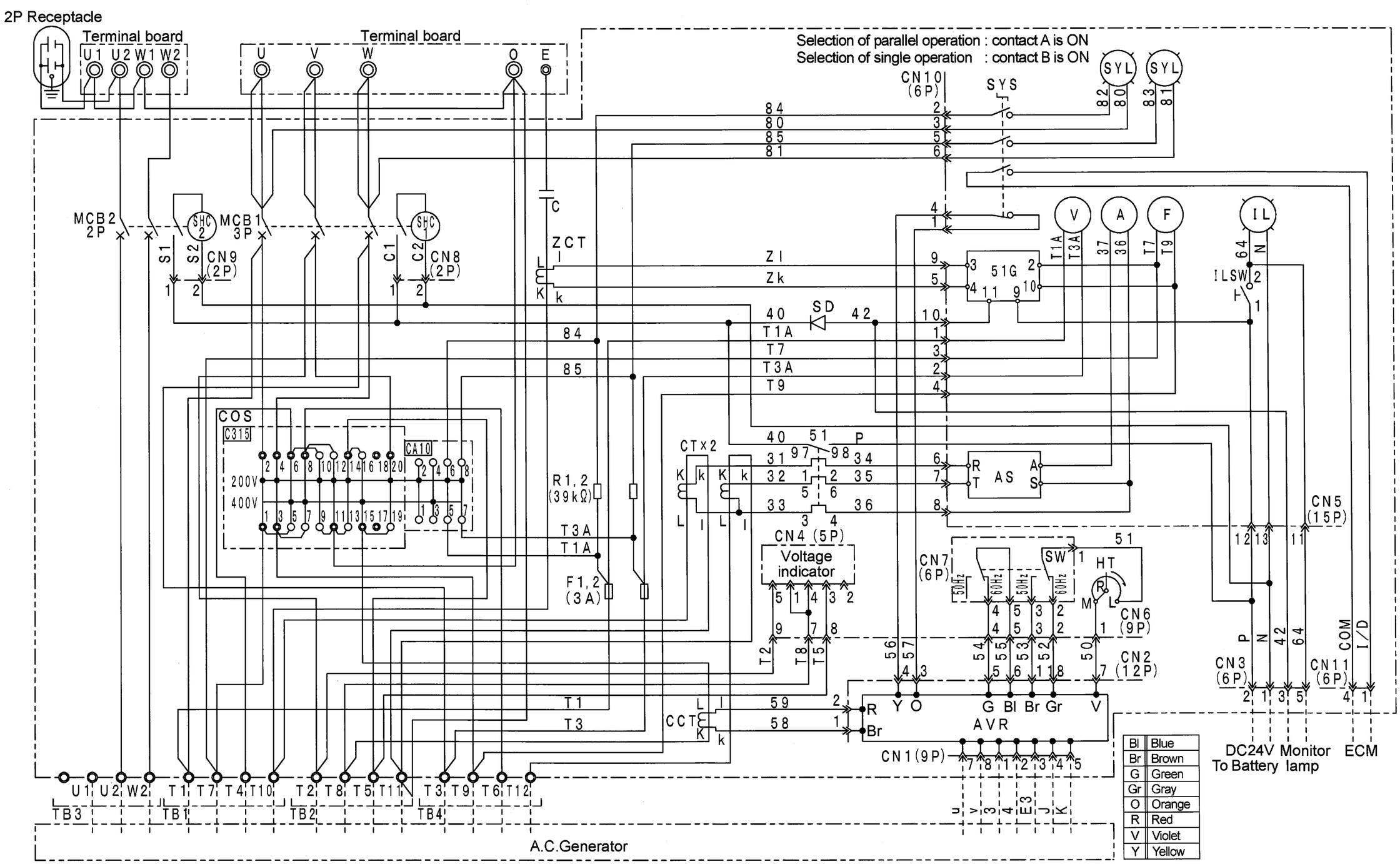
9. Wiring Diagram

SDG150S-7B1



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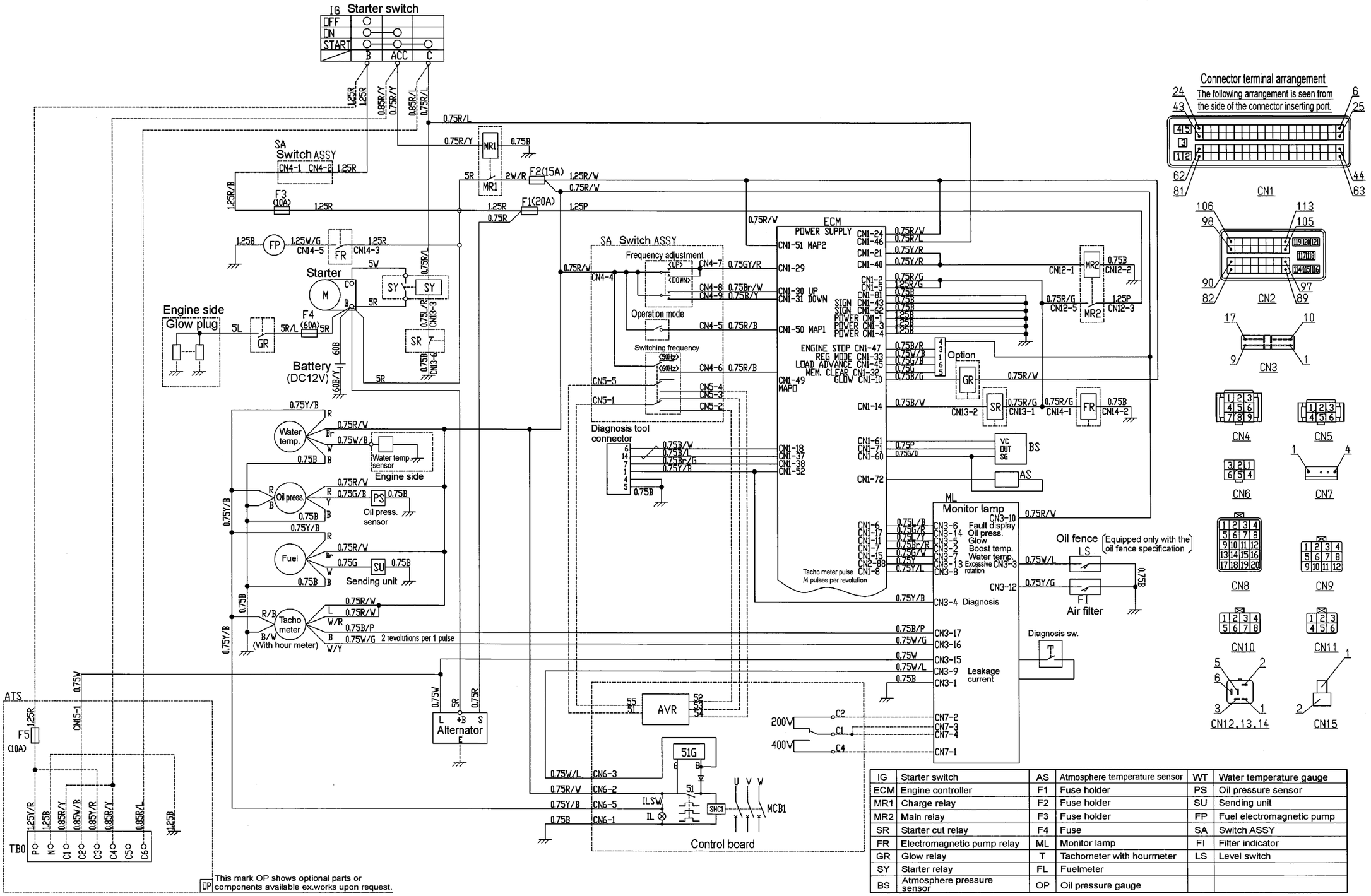
9. Wiring Diagram

9.2 Engine Wiring Diagram

SDG100,125S-7B1



IG	Starter switch	AS	Atmosphere temperature sensor	WT	Water temperature gauge
ECM	Engine controller	F1	Fuse holder	PS	Oil pressure sensor
MR1	Charge relay	F2	Fuse holder	SU	Sending unit
MR2	Main relay	F3	Fuse holder	FP	Fuel electromagnetic pump
SR	Starter cut relay	F4	Fuse	SA	Switch ASSY
FR	Electromagnetic pump relay	ML	Monitor lamp	FI	Filter indicator
GR	Glow relay	T	Tachometer with hourmeter	LS	Level switch
SY	Starter relay	FL	Fuelmeter		
BS	Atmosphere pressure sensor	OP	Oil pressure gauge		

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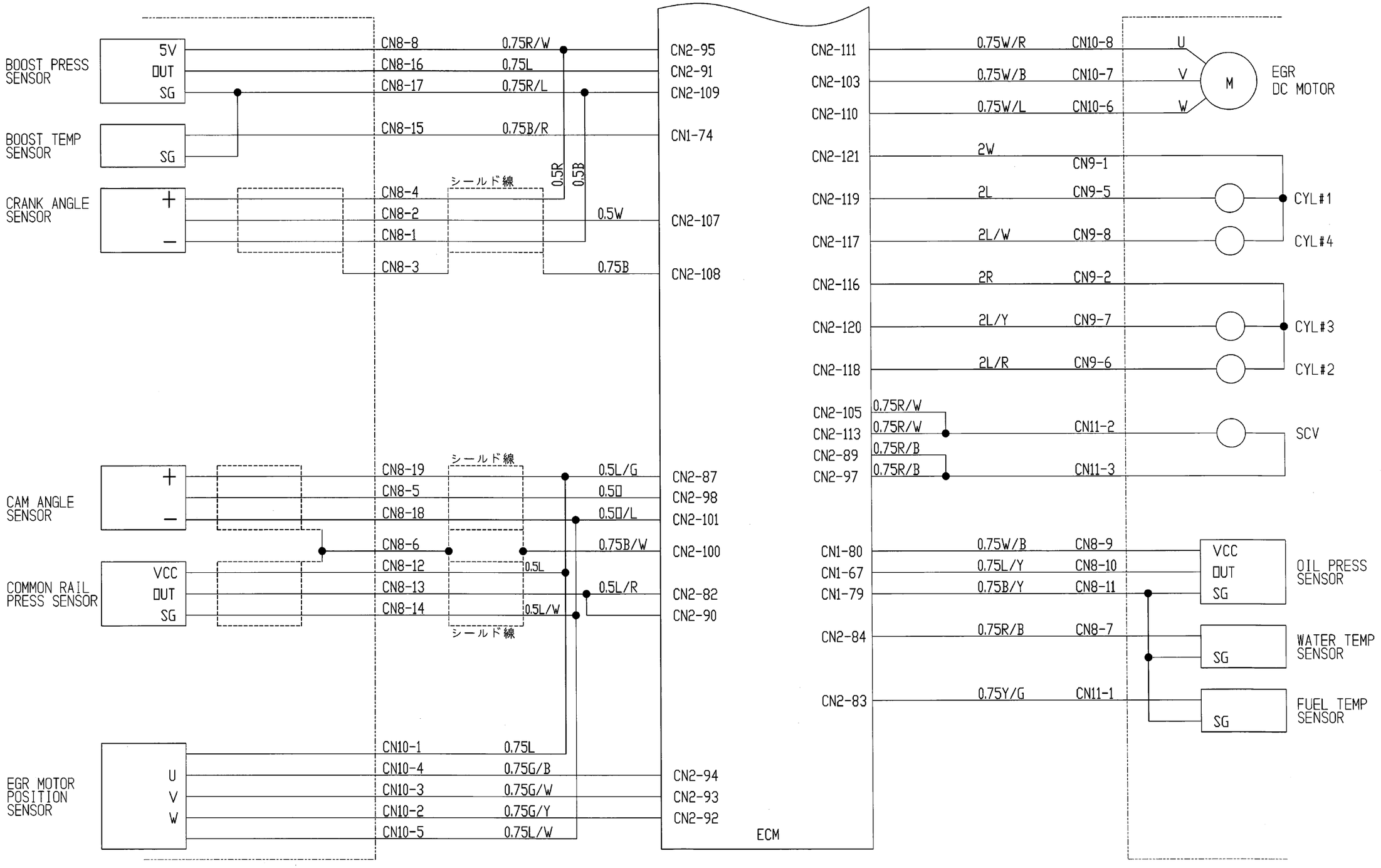
9. Wiring Diagram

SDG100,125S-7B1



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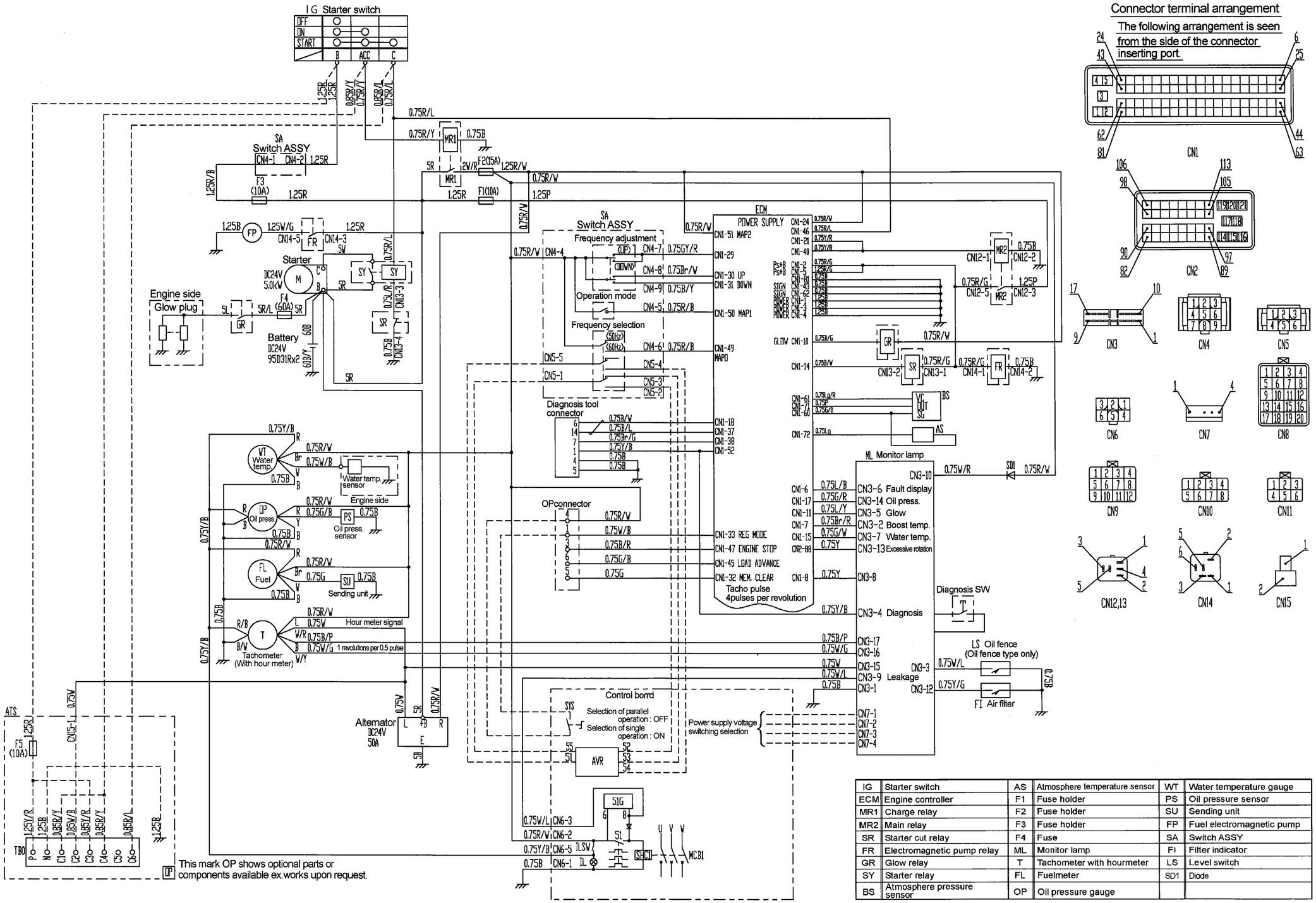
9. Wiring Diagram

SDG150S-7B1



IG	Starter switch	AS	Atmosphere temperature sensor	WT	Water temperature gauge
ECM	Engine controller	F1	Fuse holder	PS	Oil pressure sensor
MR1	Charge relay	F2	Fuse holder	SU	Sending unit
MR2	Main relay	F3	Fuse holder	FP	Fuel electromagnetic pump
SR	Starter cut relay	F4	Fuse	SA	Switch ASSY
FR	Electromagnetic pump relay	ML	Monitor lamp	FI	Filter indicator
GR	Glow relay	T	Tachometer with hourmeter	LS	Level switch
SY	Starter relay	FL	Fuelmeter	SD1	Diode
BS	Atmosphere pressure sensor	OP	Oil pressure gauge		

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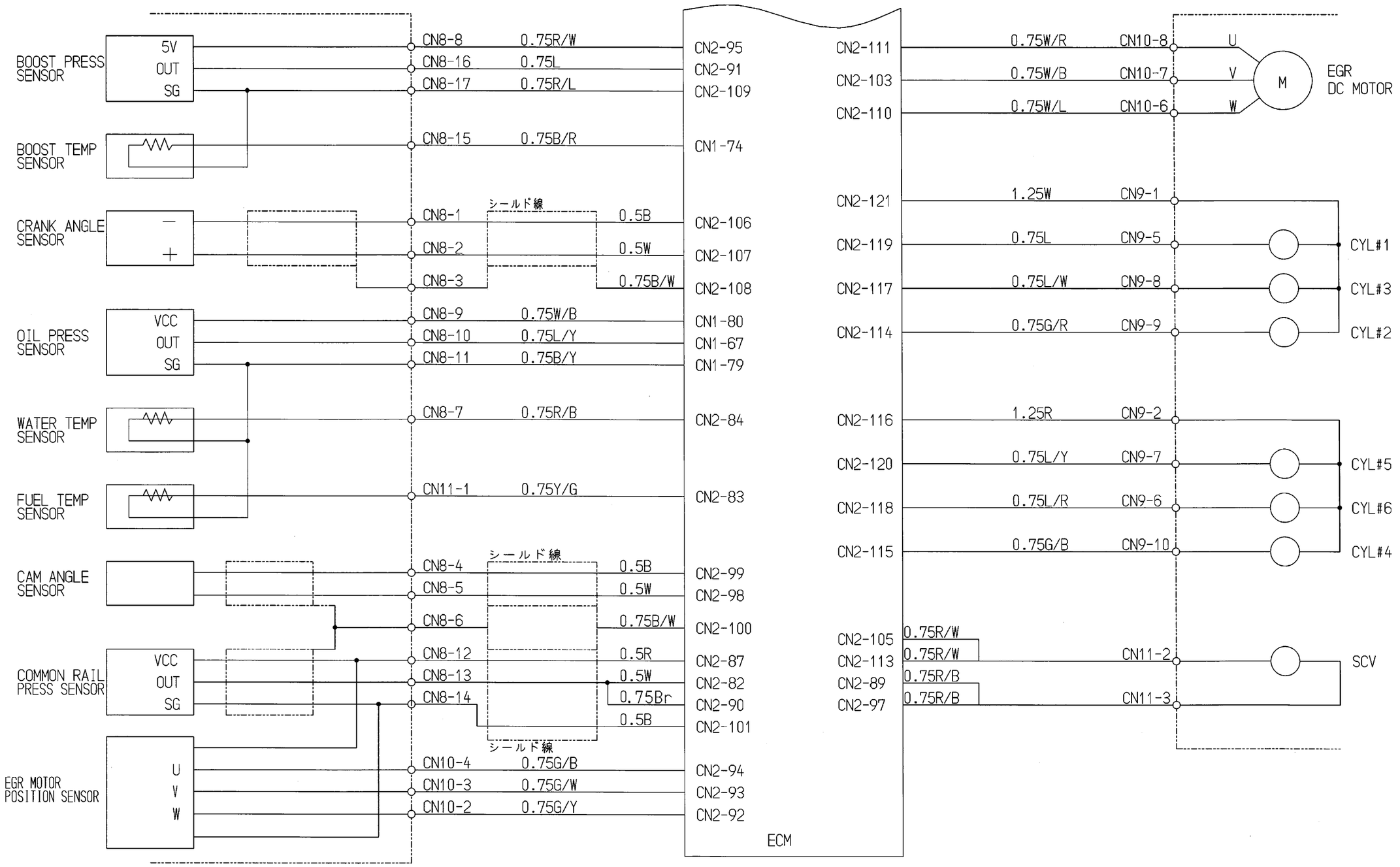
9. Wiring Diagram

SDG150S-7B1



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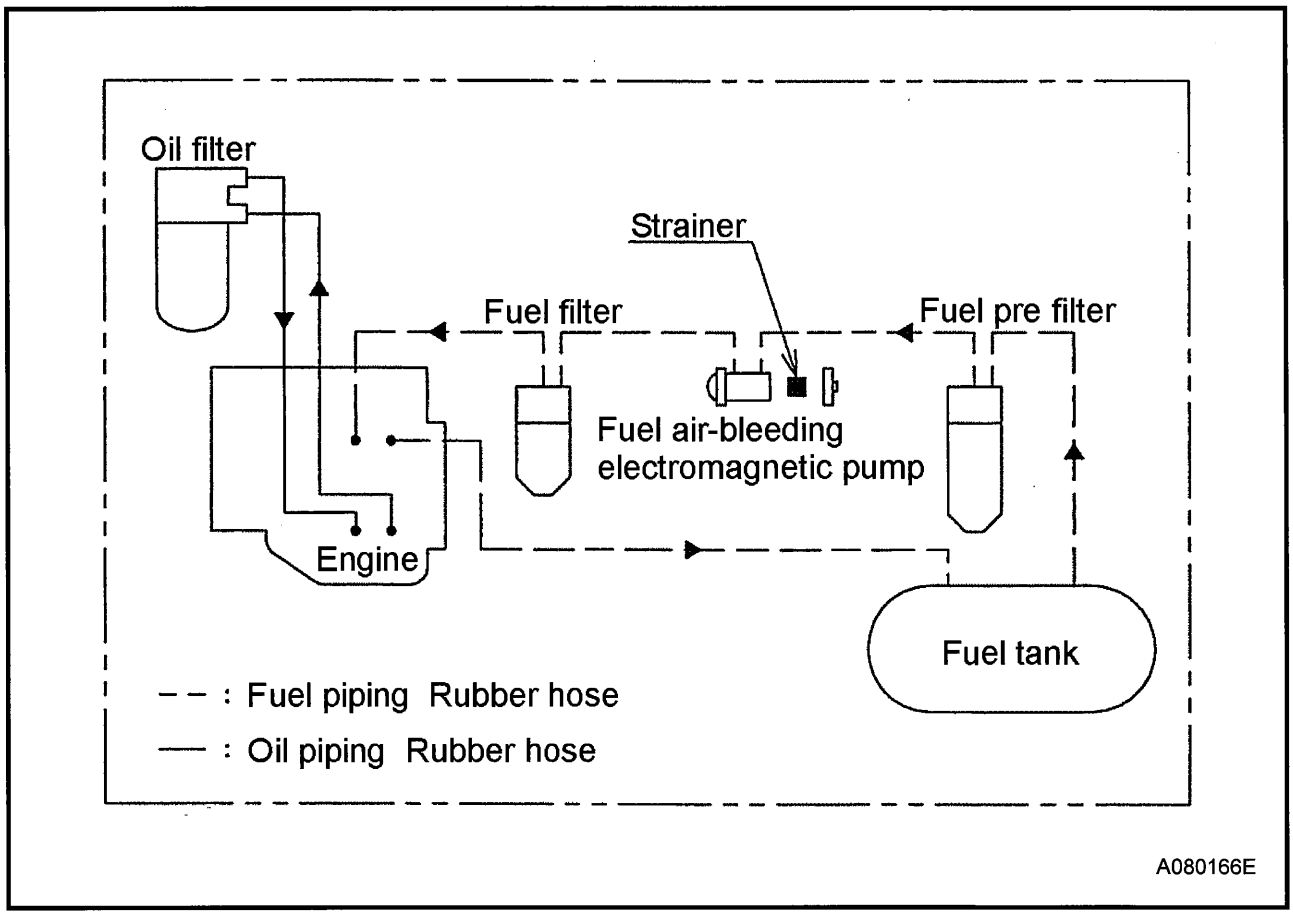
10. Piping Diagram

10.1 Fuel piping



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OPERATION LOG

OPERATION DATE	OPERATION TIME		TOTAL OPERATION HOURS (h)	FREQUENCY (Hz)	OUTPUT VOLTAGE(V)	OUTPUT CURRENT(A)			AMBIENT TEMP.(°C)	COOLANT TEMP.(°C)	ENG. OIL PRESS.(kPa)	ENG.OIL REPLACEMENT HOUR (h)	REMARKS (INSPECTION/PART CHANGE HISTORY ETC.)
	START TIME	STOP TIME				U	V	W					
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