

shindaiwa[®]

OWNER'S AND OPERATOR'S MANUAL

Diesel Engine Generator

DGA50CM

Vertical, Water-Cooled 4-Cycle Diesel Engine



CAUTION

Do not operate the Generator, or any other appliance, before you have read and understood the instructions for use and keep near for ready use.

DGA50CM
X750-031 07 0
X750802-140 1

Introduction

Thank you for purchasing this IPSTGenSet soundproof diesel engine generator.

- This manual has been created to ensure safe usage of this generator. Be sure to read this manual before operation. Improper operation/handling of this generator will result in an accident or malfunction.
 - Handling/Operation of this generator can only be performed by persons who understand the contents of this manual and can handle/operate the generator in a safe manner. Persons who suffer from an illness, are taking medicine or not feeling well such that safe operation would be negatively affected must not operate this generator.
 - Work performed using this generator and handling/operation of this generator must be in accordance with corresponding laws and regulations based on such laws. Consult with the authorized distributor where this generator was purchased if you have any inquiries regarding the corresponding laws.
 - Always be sure to include this manual when loaning out this generator and instruct operating personnel to read this manual before operation.
 - Store this manual in a specified location where it will be secure and available for consulting at any time. Order another copy from the authorized distributor where this generator was purchased if this manual becomes dusty, grimy or torn.
 - Consult with the authorized distributor where this generator was purchased if you have any inquiries regarding any points related to this generator and manual.
When inquiring about this generator, be sure to provide the model name and serial number.
 - If disposing of this generator, do so in a manner that is in compliance with laws related to industrial waste. Contact the authorized distributor where the generator was purchased if you have any inquiries regarding proper disposal.
- Caution notice ranks in this manual are classified as follows.

 **WARNING** : Indicates a potentially hazardous situation which, if not avoided, can result in death or serious injury

 **CAUTION** : Indicates a potentially hazardous situation which, if not avoided, can result in minor or moderate injury and property damage.

< **Note** > : Other types of cautions and indications.

- Note that  **CAUTION** items can also lead to major accidents under some circumstances if not correctly followed.
All caution notices are important. Be sure to follow all of them.

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1 Safety Guidelines

WARNING : EXHAUST GAS POISONING

- Do not operate the generator in poorly ventilated areas such as indoors or tunnels, as the exhaust gas of the engine contains substances that are harmful to human health.
- Do not direct exhaust fumes at bystanders or buildings.

WARNING : ELECTRIC SHOCK

- Do not operate the equipment with any doors or covers open.
- Always turn all the breakers OFF, place the Power Switch in the OFF position and stop the engine before connecting / disconnecting the load cable to the output terminal or receptacle.
- Close the output terminal cover before operating.
- Do not insert a pin, wire or other metal object into the electrical outlet.
- Do not touch the generator if the generator or casing or your body becomes wet during operation.
- Do not touch internal electric parts while the generator is operating.
- Always turn the Power Switch to the OFF position and stop the engine, then close and lock OPERATION PANEL DOOR before checking or maintaining the engine or any equipment.

WARNING : INJURY

- Close all doors and lock them during operation.
- Do not open the check door when the Power Switch is in the ON position. It will cause injury by rotating parts such as cooling fans and fan belt.
- Always turn the Power Switch to the OFF position and stop the engine, then close and lock OPERATION PANEL DOOR before checking or maintaining the engine or any equipment.
- Always be sure to use Lifting Hook when lifting up the generator. Using other parts when lifting up the generator could cause the result of falling.
- Do not attempt to lift the equipment with any additional weight such as optional fuel tanks or trailers.
- No persons should ever be under a lifted generator.
- Always be sure to check that the breakers on load side and switches for any equipment using the generator are at OFF before turning the breaker to ON. Also be sure to advise personnel on the load side that power will be turned on or off before operating the breaker.
- Do not modify the equipment and do not operate with parts removed.

CAUTION : EYE/SKIN INJURY

- Wear rubber gloves and other protective wear to protect eyes, skin and clothing from the battery fluid which contains diluted sulfuric acid. If the battery fluid contacts eyes or skin, wash out immediately with a sufficient amount of clean water. Be sure to receive medical treatment, especially if the fluid contacts the eyes.

CAUTION : EXPLOSION

- Never use or recharge the battery if the fluid level is below the minimum level.
- Do not create sparks or bring flame near the battery as it generates flammable gas.

⚠ CAUTION : FIRE 

- Do not carry flammable items (such as fuel, gas and paint) or items that are highly combustible near the generator as the muffler, exhaust gas and other parts become extremely hot.
- Position this generator 3 ft. (1 m) or more from walls or other hindrances, and on a level surface.
- Do not connect the generator output to indoor wiring.
- This generator uses diesel fuel. Always be sure to stop the engine and not bring flames close when inspecting fuel or refueling. Wait until the engine has cooled before performing such procedures.
- If fuel spills, always be sure to wipe and drain off spilled fuel.
- Do not operate the equipment with liquid accumulated in the spill containment.
- If fuel or oil is leaking, repair the leaking location before operating.
- Always be sure to wipe up any spilled fuel or oil.
- Allow the generator to cool before covering with the protective cover.
- Never allow flame to come close to the generator.
- Always make sure that the engine is stopped when working on piping.
- After working on the piping, check that there is no fuel leakage.
- Absolutely never inspect or perform maintenance to the equipment near fire or other open flame.

⚠ CAUTION : ELECTRIC SHOCK 

- Do not sprinkle water on equipment or used where exposed to rain.

⚠ CAUTION : BURNS 

- Do not touch the engine and surrounding components immediately after stopping the engine as they are still extremely hot.
- Do not open the radiator cap immediately after stopping the engine. Doing so will result in hot steam gushing out.
- Hot steam gushes out from the coolant sub-tank if the generator overheats. Do not touch the coolant sub-tank.
- Always be sure to stop the engine and allow the engine to cool when performing inspection or maintenance of engine oil. Opening the oil level gauge or oil filler cap during operation will result in hot oil gushing out.

⚠ CAUTION : INJURY 

- Always be sure to use Lifting Hook when lifting up the generator, and slowly lift it straight up.
- Personnel performing lifting work must wear protective gear such as helmets, safety shoes and gloves.
- Position the generator on a level stable surface so that it cannot slide or move in any manner.
- Before starting operation, always be sure to turn off all switches of equipment using the generator and all breakers to OFF.
- Do not move the generator during operation.
- Do not operate the generator if it has been modified or any parts have been removed.
- Securely fix the equipment with rope or similar item to avoid any unexpected move when transporting by truck or other vehicle.

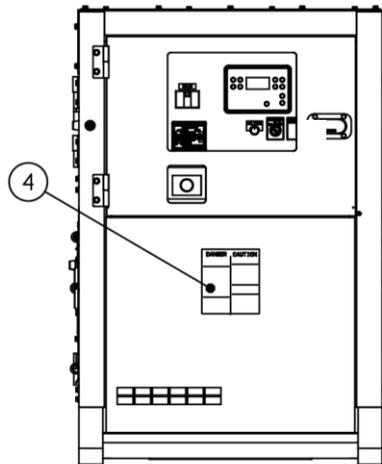
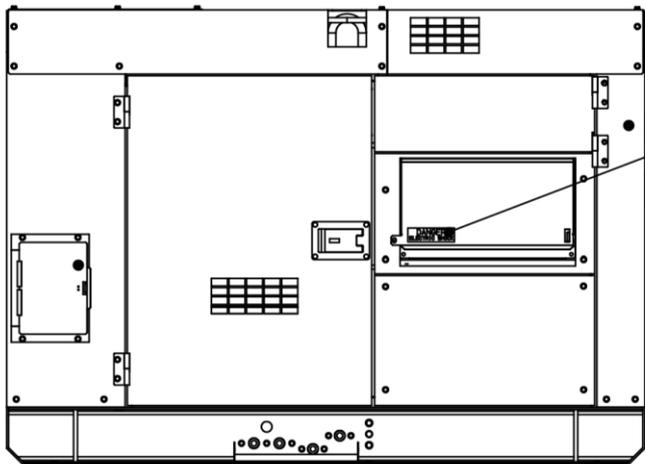
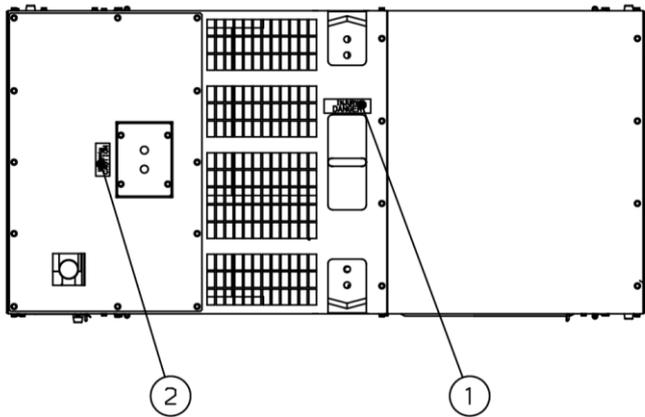
⚠ CAUTION : PROPERTY DAMAGE

- Do not use the equipment for any improper applications. Improper usage can result in an accident or malfunction.
- If using this generator for medical equipment, check before use with the medical equipment manufacturer, doctor, hospital or similar entity.
- Check that the generator output setting, output terminal connection and load power source are consistent.
- Cable burnout can occur due to generated heat if the load current exceeds the allowable current of the cable.
- The voltage drop between cables is large if the cable is excessively long or thin, resulting in decreased input voltage to equipment using the generator, thereby causing decreased performance, faulty operation and malfunction.

■ Warning / Caution Label Locations

When warning / caution labels become unreadable or damaged, place new labels at the appropriate locations as specified in the following figure. When ordering the labels, use the following part numbers.

1. Injuries(Part no.: X505-004630)
2. Caution (coolant).....(Part no.: X505-004650)
3. Caution (Electric Shock).....(Part no.: X505-004640)
4. Safety Precaution.....(Part no.: X505-004660)



2 Specifications

2-1. Data

		Unit	DGA50CM
Generator	Generating Method	-	Rotating Filed, Brushless 3-Phase Synchronous Generator
	Rated Output	kVA	50
		kW	40
	Rated Voltage	V	415
	Rated Current	A	69.6
	Rated Frequency	Hz	50
	Rated Speed	min ⁻¹	1500
	Phase & Wiring	-	3-Phase 3-Wire
	Power Factor	%	80
	Insulation Class	-	Alternator: F Exciter: B
	Exciting Method	-	Self Excitation(Brushless)
Poles	-	4	
Engine	Method	-	Vertical, Water-cooled 4-Cycle, Diesel Engine
	Model No.	-	Isuzu BB-4BG1T
	Cylinder-bore x stroke	mm	4-105 x 125
	Continuous Rated Output	kW{PS}	48.5{66.0}
	Speed	min ⁻¹	1500
	Displacement	L	4.329
	Combustion Method	-	Direct Injection(Turbo-charged)
	Cooling Method	-	Water-cooling radiator
	Lubricating	-	Trochoid pump, force-feed lubrication
	Starting	-	Starter Motor
	Fuel	-	Diesel
	Oil	-	SAE Class CD or higher
	Fuel Tank Capacity	L	160
	Lubricant Volume	L	13.2(including filter 1.1 L)
	Coolant Volume	L	17(including sub-tank 1.5 L)
	Starter Motor Cap.	V-kW	24 - 4.5
	Alternator Cap.	V-A	24 - 20
Battery	-	95D31R x 2	
Dimension	Length	mm	2000
	Width	mm	950
	Height	mm	1430
	Dry Weight	kg	1431
	Installed Weight	kg	1590

2-2. Ambient Condition

Be sure to use the equipment under the following ambient condition range. Otherwise the condition may cause damage, insufficient output or durability shortage to the equipment.

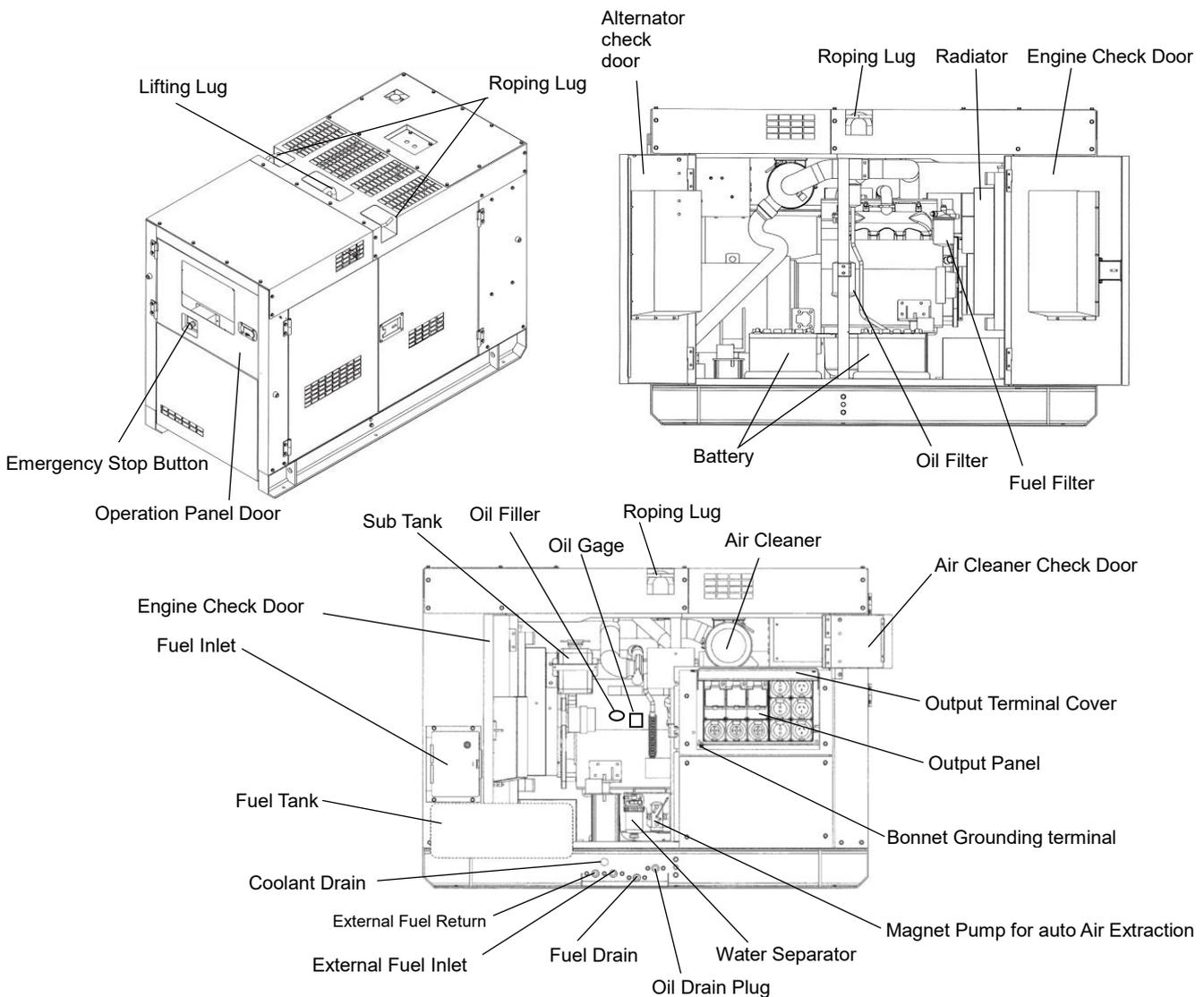
- Ambient: Temperature: from -15 to 40 degree Celsius
- Relative: Humidity: less than 80%
- Altitude: Less than 300m

3 Use

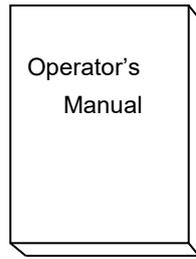
- Power Supply for submersible Pump, etc.
- Power Supply for lightings, etc.
- Power Supply for electric tools, home appliances

4 Parts (Components)

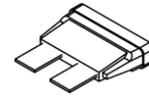
4-1. Outer and Main Components



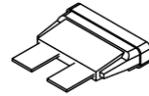
Accessories



Nipple (2 pieces)

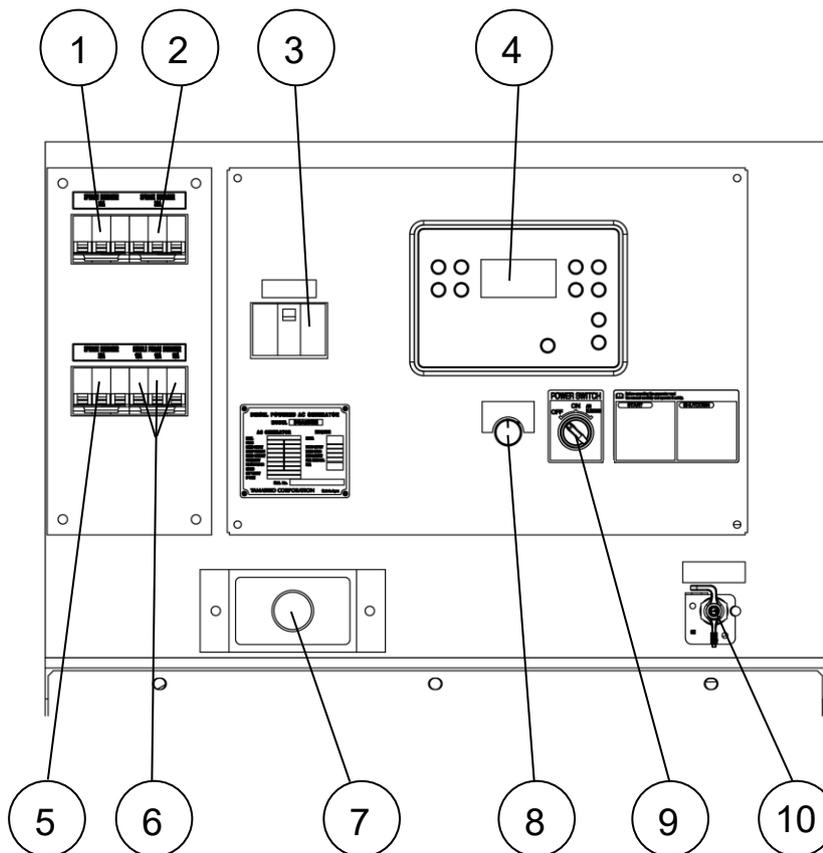


Fuse (3A)



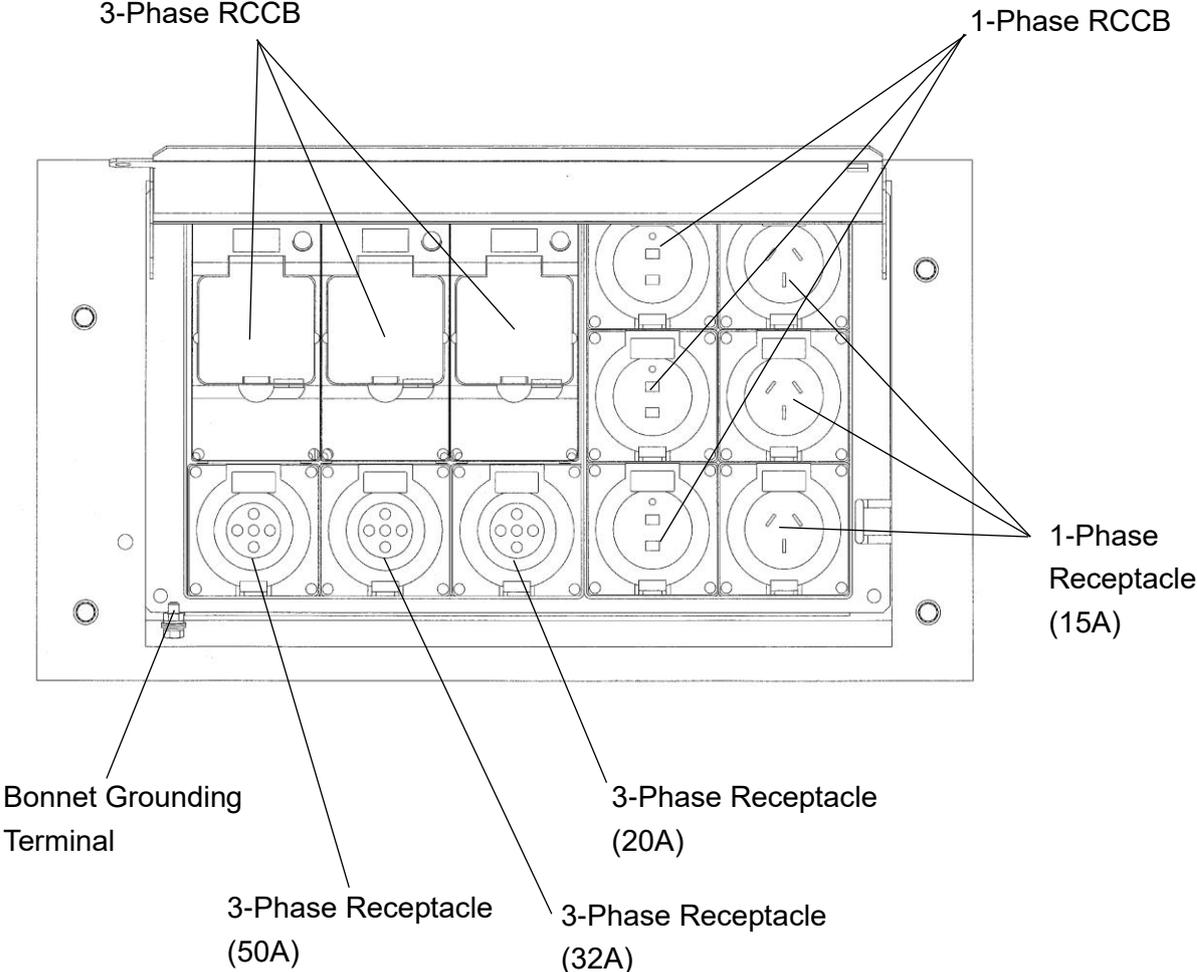
Fuse (10A)

4-2. Operation Panel



1	3-Phase Breaker(50A)
2	3-Phase Breaker(32A)
3	Main Circuit Breaker
4	Controller
5	3-Phase Breaker(20A)
6	1-Phase Breaker(15A)
7	Emergency Stop Button
8	Voltage Regulator
9	Power Switch / Air Bleeding
10	Battery Isolator

4-3. Output Panel

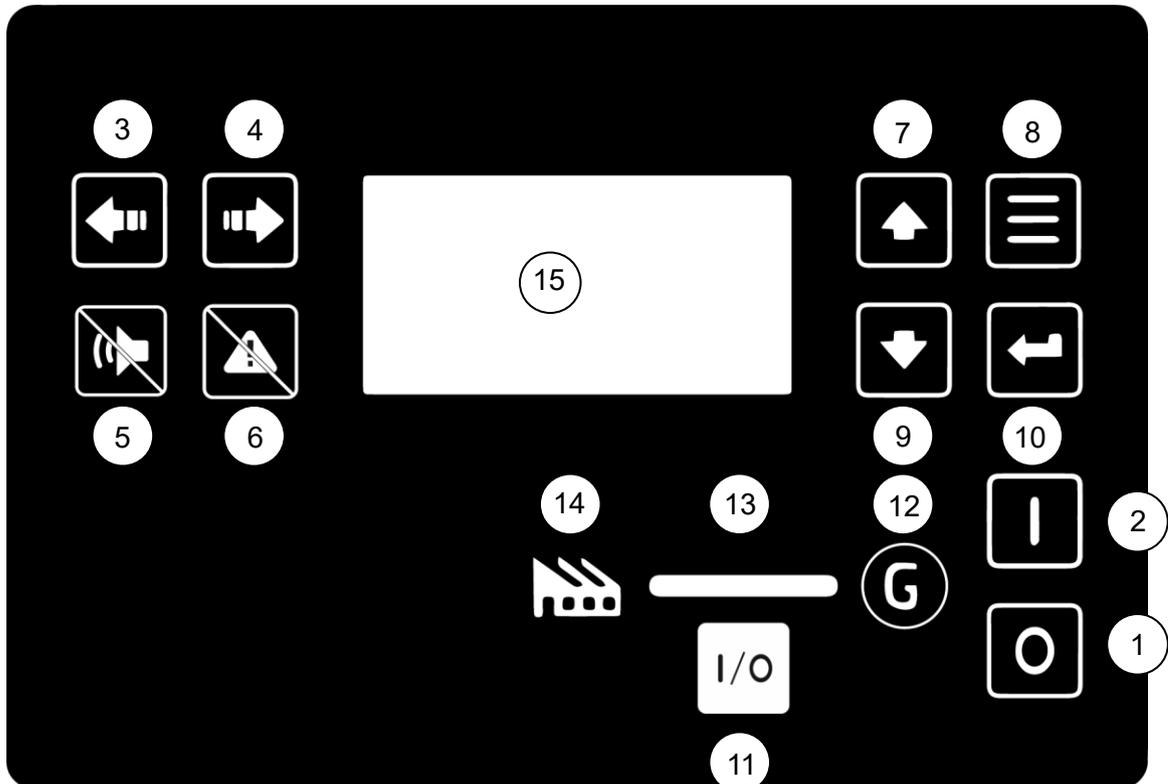


5 Equipment

5-1. Controller

This generator has a Controller which is used for starting or stopping the power generator or the engine, for monitoring. If you turn the Power Switch to ON position, the status Screen appears.

(1) Front panel elements



① **STOP button**

Press this button to initiate the stop sequence of the gen-set.

② **START button**

Press this button to initiate the start sequence of the engine.

③ **LEFT button**

Use this button to move left or to change the mode. The button can change the mode only if the main screen with the indicator of currently selected mode is displayed.

④ **RIGHT button**

Use this button to move right or to change the mode. The button can change the mode only if the main screen with the indicator of currently selected mode is displayed.

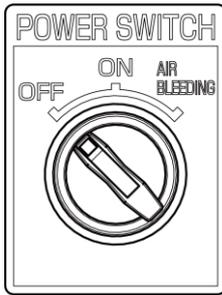
- ⑤ **HORN RESET button**
Use this button deactivate the horn output without acknowledging the alarms.
- ⑥ **FAULT RESET button**
Use this button to acknowledge alarms and deactivate the horn output. Inactive alarm will disappear immediately and status of active alarms will be changed to “confirmed” so they will disappear as soon as their reasons dismiss.
- ⑦ **UP button**
Use this button to move up or increase value.
- ⑧ **PAGE button**
Use this button to switch over display pages.
- ⑨ **DOWN button**
Use this button to move down or decrease value.
- ⑩ **ENTER button**
Use this button to finish editing a setpoint or moving right in the history page.
- ⑪ **GCB button**
No use.
- ⑫ **GENERATOR status indicator**
There are two states – Gen-set OK (indicator is green) and Gen-set failure (indicator is red). Green LED is on if the generator voltage is present and within limits. Red LED starts flashing when gen-set failure occurs. After FAULT RESET button is pressed, goes to steady light (if an alarm is still active) or is off (if no alarm is active).
- ⑬ **GCB on**
No use.
- ⑭ **Load**
No use.
- ⑮ **Operation Display**

< Note >

- The displayed information is structured into “pages” and “screens”. USE PAGE button to switch over the pages.

5-2. Switches

(1) Power Switch / Air Bleeding

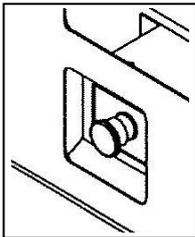


This is the main Power Switch of the generator.

When the Power Switch turned to OFF position, the Controller is OFF.

When the Power Switch turned to AIR BLEEDING position, automatically starts air-bleeding device.

(2) Emergency Stop Button

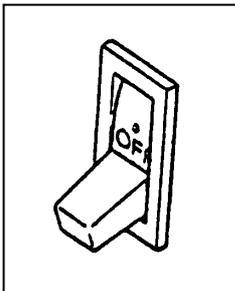


This button is used to stop the engine in emergency.

By inserting the button, the engine stops.

Be sure to restore the Power Switch to OFF and re-set the button, turning clockwise after using the emergency stop button.

(3) Main Circuit Breaker



By turning this circuit breaker on the control panel to ON, Power will be transferred to the output receptacles and to the load side.

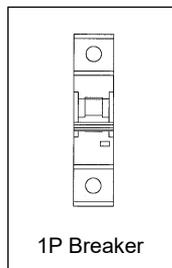
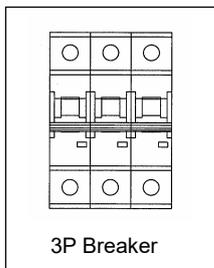
The breaker trips to OFF, either overload or short-circuit.

< Note >

- Do not use RCCB as the ON/OFF switch to the load.

(4) 3-Phase Circuit Breaker

1-Phase Circuit Breaker



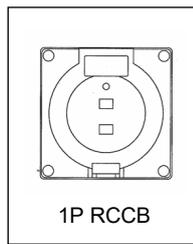
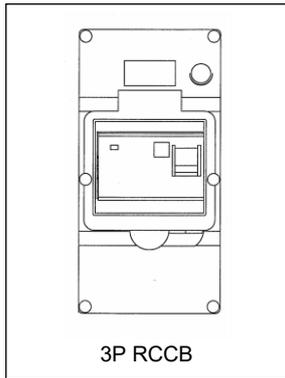
Each receptacle, 3-Phase and 1-Phase is incorporated with circuit breaker respectively. The breaker trips on overload or short-circuit on to stop power transmission to load.

< Note >

- Do not use this breaker as the ON/OFF switch to the load.

(5) 3-Phase Residual Current Circuit Breaker (3P RCCB)

1-Phase Residual Current Circuit Breaker (1P RCCB)

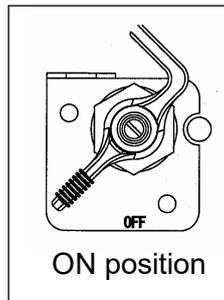
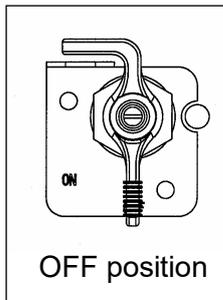


Each receptacle, 3-Phase and 1-Phase is incorporated with RCCB respectively. When current leak occurs, it trips to stop power transmission to load.

< Note >

- Do not use this breaker as the ON/OFF switch to the load

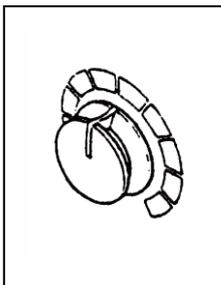
(6) Battery Isolator



When turning the switch to OFF, the engine electric circuit does not activate due to no battery power.

5-3. Voltage Regulator

(1) Voltage Regulator



The dial adjusts generator output voltage.
By turning the dial clockwise, you can increase the voltage.
By turning the dial counter-clockwise, you can decrease the voltage.

5-4. Fuel Line Changeover Valve (3-way valve)



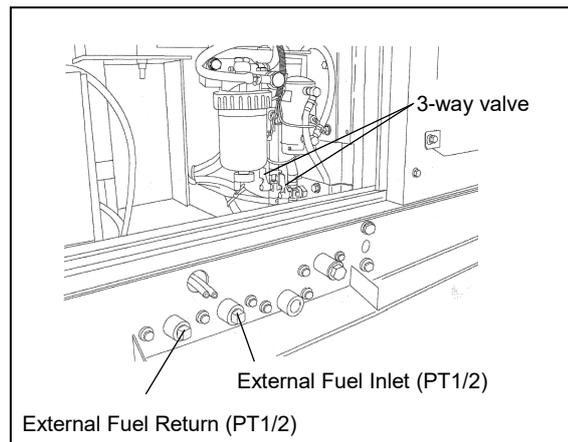
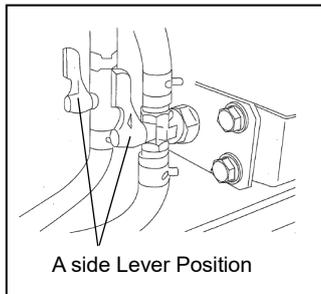
CAUTION : Fire

- Always stop the engine when performing any work on the fuel line.
- Always wipe any drip of Diesel fuel or engine oil. Do not use this equipment, when a leak is found. Repair the equipment before use.
- Be sure to confirm that there is no leakage in the piping.

By switching the 3-way valve, you can use fuel from external fuel tank.
In this case, the built-in tank fuel cannot be used.

(1) Using fuel from built-in fuel tank

The lever for 3-way valve is set to **A** when the equipment is shipped.
Outer fuel inlet and return are closed with plugs (PT1/2).
Use fuel as they are.



< Note >

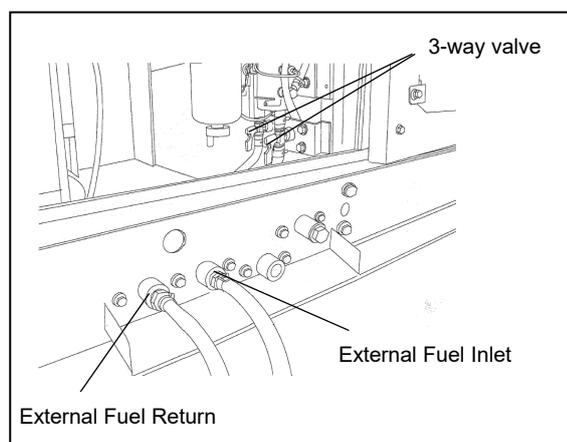
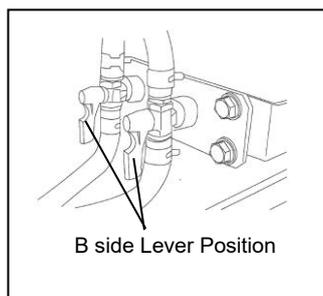
- After having used the outer fuel and removed piping, be sure to set the lever to A position and fix the plugs.

(2) Using fuel from external fuel tank

Connect hoses from the external fuel tank to the external fuel intake and the external fuel return ports, and set the lever for 3-way valve to **B** position.

You can now supply the fuel from the external gas tank.

For detailed instructions, refer to 『9-5.Connecting to External Fuel Tank』



6 Transportation and installation

6-1. How to transport



WARNING : Injuries

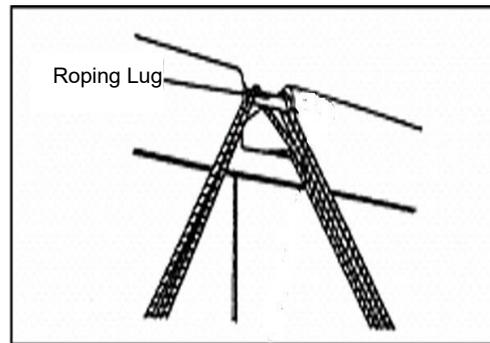
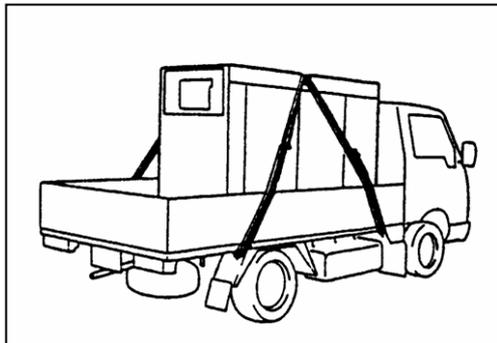
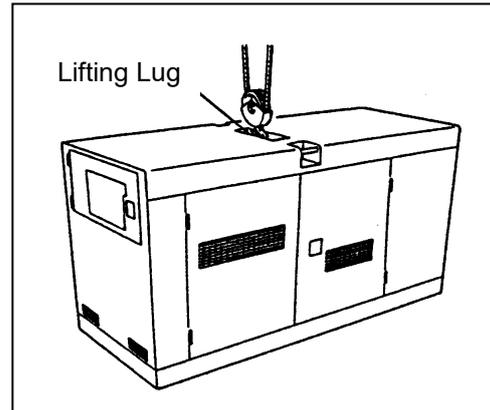
- When lifting the equipment, always use a lift hook.
- Never use roping lug for lifting the unit, for it may cause equipment to drop.

(1) Lifting the equipment

Always use a Lift lug, when lifting the equipment for transportation.

(2) Transporting the equipment

When transporting the equipment, make sure that the equipment is secured properly with ropes tied to the roping lugs through.



< Note >

- Always use extreme care when loading, unloading, and transporting the equipment, otherwise damages and malfunction of the equipment may bring.

6-2. Installation



WARNING : Suffocation from exhaust gas

- Exhaust fumes from the engine contains many elements harmful to humans. Do not operate this equipment in poorly ventilated area, such as inside a room or in a tunnel



CAUTION : Suffocation from exhaust gas

- Do not point the exhaust fume toward pedestrians or buildings.



CAUTION : Fire

- Always operate this equipment on flat surface and, at least 1 meter away from any objects (wall, box, etc.).
- Temperature around muffler and exhaust can get extremely high. Keep any inflammable items (such as fuel, gas, paint, etc.) away from the equipment.

- Always set the equipment on hard, flat surface.
- Keep the equipment at least 1m from a wall or any obstacles, to allow workable space to access the control panel and opening of the panel door.

< Note >

- This equipment must be operated on hard and flat surface. Operating under any other conditions may result in malfunctions.
- Do not block the airflow from radiator vent or muffler exhaust. It may result in reduced engine performance, overheating, or damage to the electrical parts.
- Operating in dusty area or salty air (by the ocean), or any other particulate environment may result in clogged radiator, which may cause overheating, other malfunctions and insulation deterioration. Use extreme care, frequent checks and maintenance.

7 Connecting Load

7-1. Select Load Cable

Select the cable with proper gauge, based on its allowable amperage and the distance between the generator and the machinery to be connected.



CAUTION : Damage to properties

- If the load exceeds the allowable amperage, the damage to the cable may be damaged in overheating.
- If the cable is either too long or too small gauge, there will be greater voltage drop between cables which brings voltage drop to loads. It may result in reduced performance in the connected loads, malfunction, or damages.

< Note >

- It is recommended to select the proper gauge and length of cable, in consideration of the maximum 5% marginal drop only for the rated voltage, between the terminals of loads and generator via the cables.

■ Expedient Formula: the voltage drop of cables

● 3-Phase 3-Wire

$$\text{Voltage Drop (V)} = \frac{1}{58} \times \frac{\text{Length (m)}}{\text{Dia (mm}^2\text{)}} \times \text{Current (A)} \times \sqrt{3}$$

● 1-Phase 2-Wire

$$\text{Voltage Drop (V)} = \frac{1}{58} \times \frac{\text{Length (m)}}{\text{Dia (mm}^2\text{)}} \times \text{Current (A)} \times 2$$

7-2. Connecting Load Cable



WARNING : Electric Shock

- Before connecting or disconnecting a load cable from output receptacles, always turn a circuit breaker to OFF position, stop the engine, and turn the Power Switch to the OFF position.



CAUTION : Fire

- Do not connect AC output to any indoor wiring.

< Note >

- Divide loads into 3 circuits proportionally as possible, when using the maximum output power especially, and connect them to each phase (R,S,T) respectively.
- Be careful to limit the current under the rated current per the phase.
- Note that the 1-phase output power decreases when 3-phase output power is used simultaneously.
- Be careful to limit the total current under the rated output current when using 1-Phase and 3-Phase output simultaneously.

7-3. Residual Current Circuit Breaker (RCCB) and Grounding



WARNING : Electric Shock

- Ground the every grounding terminal to the earth as set in the manual. If even one of all is unconnected by mistake or accident, it will be much more dangerous for human than the NO-RELAY case, because leaking current inevitably goes through the body.
- Even though all the bonnets of the loads have been grounded to the earth, the earth grounding terminal and the outer bonnet (canopy) grounding terminal should be grounded to the earth.
- Grounding should be made after the engine is stopped.
 - Whenever the Residual Current Circuit Breaker is activated, you should always repair the leaking place first of all.

The generator is provided with the Residual Current Circuit Breaker (RCCB) to detect any Leakage produced due to such the trouble as insulation failure of the load while the generator is running and to cut off the circuit for protection against any accident such as electrical shock resulting from the trouble.

The specification of RCCB;

- Rated Sensitive Current: 30mA (or below) (Grounding resistance: 500 Ω or below)
- Sensitive time: Within 0.1second

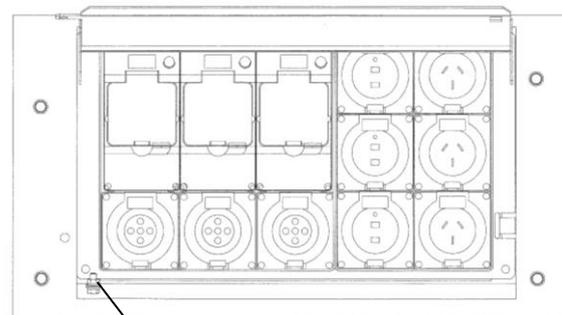
(1) Grounding Work

The qualified electrician should perform the grounding of the following 2 points (500 Ω or below).

- The Bonnet (Canopy) grounding terminal of the generator.
- The Bonnet of the load.

< Note >

- In the event you cannot ground the generator to the earth, consult with the authorized distributor or our engineering section.



Bonnet Grounding Terminal

(2) Operation Check

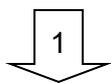


WARNING : Electric Shock / Injuries

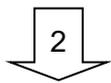
- Before turning RCCB to ON position, ensure that the breakers or the switches of loads are positioned to OFF. You should communicate well with the electrician by the load side when operating RCCB.

Before operating the generator, check always if the device can work.

● Actuation test of the Residual Current Circuit Breaker



Ensure that the breakers and the switches of loads are positioned to OFF.



Ensure every breaker to set OFF. Refer to 『4-2.Operation Panel』 and 『4-3.Output Panel』



Following the procedure in 9-1, Initializing / Preparation, start an engine.



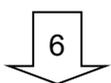
Turn every breaker and RCCB to ON. Push the RESET (Green) button on the 1-Phase RCCB.

Confirm the red lamp on the 1-Phase RCCB turned ON and the indicator on the 3-Phase RCCB turns RED display.

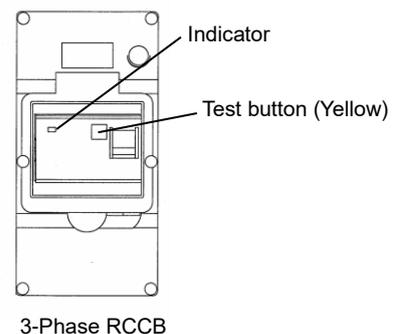
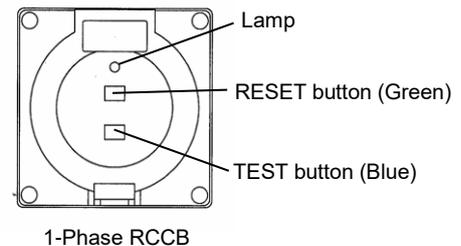


Push the TEST button (Yellow) on 3-Phase RCCB.

Indicator changes to Green from RED and RCCB trips to OFF, Which shows NORMAL.



Push the TEST button (Blue) on 1-Phase RCCB. Red lamp turns to OFF and RCCB trips to OFF, Which shows NORMAL.

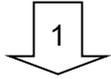


In the event you cannot complete every step of the above procedure to the end, the device is out of order. Consult with our authorized distributor or our engineering section and ask to repair.

(3) RCCB has activated.

When the RCCB has activated, repair the leakage point and restore it by the following procedure.

(Overload happens when the breaker activates but the Residual Current Circuit Breaker does not activate.)



Turn the 3-Phase RCCB to ON to restore.
Turn the 1-Phase RCCB to RESET to restore.

By the above procedure, you can reset the RCCB to ON positions.

8 Initialization and Pre-check



WARNING : Electric Shock / Injuries

- Before performing any equipment check or maintenance, stop the engine, and turn the Power Switch to the OFF position.



CAUTION : Fire / Burns

- When checking engine, always stop the engine, and keep away from fire. Wait until the engine cools down, before performing any checks.



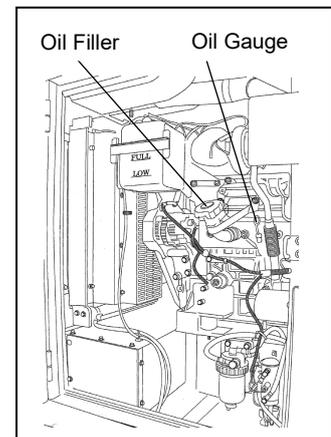
CAUTION : Fire

- Always wipe any drip of fuel or oil. Do not use this equipment when a leak is found. Repair the equipment before use.

8-1. Checking Engine Oil

When checking for engine oil, be sure to keep the equipment leveled, and insert (not screw in forcibly) the oil gauge all the way in.

Prior to starting the equipment, make sure to fill the engine oil to the UPPER LIMIT line through the oil filler.



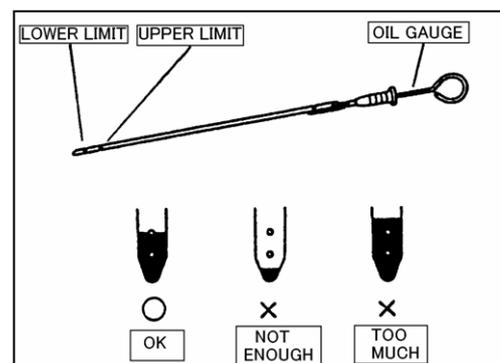
< Note >

- Check engine oil volume IN 10-20 MINUTES LATER, always after stopping engine or replenishing fuel.
- If the equipment is not leveled, you cannot obtain accurate oil level.
- Do not overfill the engine oil. The excessive amount of engine oil may damage the engine.

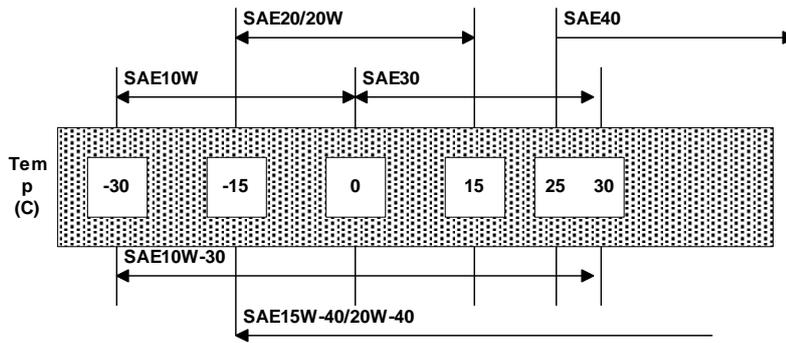
(1) Selecting proper engine oil

Use the API class CD grade or higher.

(2) Use the engine oil for Diesel engine with proper viscosity, based on the temperature (refer to the chart below).



- Viscosity and temperature



(3) Replacing Engine Oil Volume (Unit: Liter)

Lubrication Oil (including the oil in filter)
13.2 (1.1)

Value in () shows the oil in filter

8-2. Checking Coolant / Water

⚠ WARNING : Injuries

- Before performing any equipment check or maintenance, stop the engine, and turn the Power Switch to the OFF position.

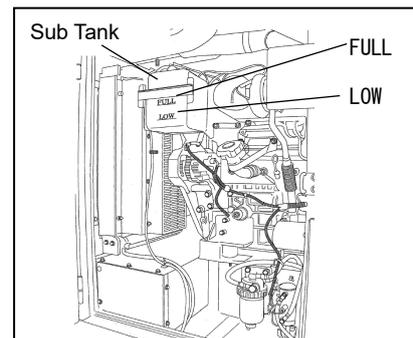
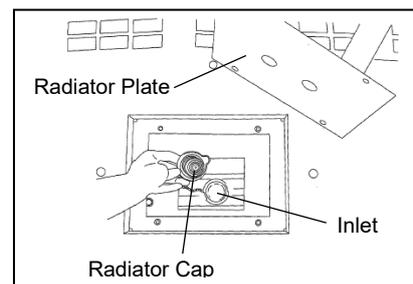
⚠ CAUTION : Burns

- Do not open the radiator cap while operating this equipment or immediately after stopping the equipment, to avoid sustaining burns from hot vapor or water.
- Do not touch the engine and muffler during operation and immediately after stopping the equipment, for the temperature can reach extremely high levels.

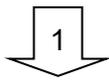
Check the radiator and coolant reservoir tank for water and add water in case of shortage.

(1) Checking Radiator / Adding water

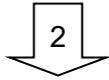
- 1 Remove the Radiator Plate .
- 2 Remove the Radiator Cap.
- 3 Fill up water to the radiator water inlet top.
- 4 Reinstall the Cap and tighten it.
- 5 Reinstall the Radiator Plate.



(2) Checking coolant in Sub Tank / Adding coolant



Check to see if the water/coolant level is between FULL and LOW line in the Sub Tank.



Fill up to the FULL line, if the water/coolant level is low.

< Note >

- Use soft water, such as tap water.
- If the outside temperature is near freezing, use Long Life Coolant (LLC)(30% mixture LLC is used, when shipped from factory).
- Use same type of coolant with identical mixture ratio for the Sub Tank.
- Mixture ratio of the coolant should be between 30 to 50%, depending on the ambient temperature.
- When replenishing LLC, be sure to use the same brand as the LLC left in the Radiator and Sub Tank.
- Never use the mixed LLC by different brands or specifications.
- Replace LLC every 2 years or 1000 hours.

Mixture ratio (for reference only) :

Ambient temperature	-15°C	-23°C	-35°C
Mixture ratio	30%	40%	50%

(3) Coolant Volume

Unit: L

Total Coolant Volume (including Sub Tank)
17 (1.5)

The value of () shows the Sub Tank volume.

8-3. Checking Fan Belt



WARNING : Injuries

- Before performing any equipment check or maintenance, stop the engine, and turn the Power Switch to the OFF position.
- Close and lock all doors during operating this equipment, to avoid injuries by unintentionally touching cooling fan and fan belt.

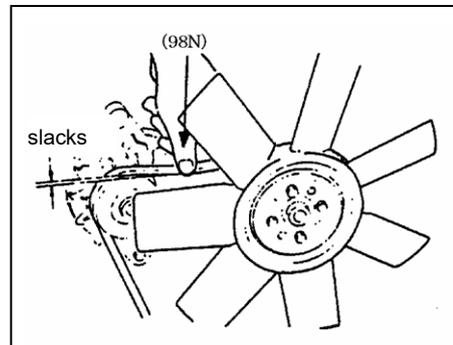


CAUTION : Burns

- Do not touch the engine and muffler during operation and immediately after stopping the equipment, for the temperature can reach extremely high level.

(1) Fan Belt Tension

The tension is proper when the fan belt has 8 to 12mm slacks, when applying a finger pressure (about 98N {approximately 10kgf}) at midpoint between fan pulley and Alternator Pulley.



(2) Condition

Check for any damage on the Fan Belt.
Replace if necessary.

8-4. Checking Fuel



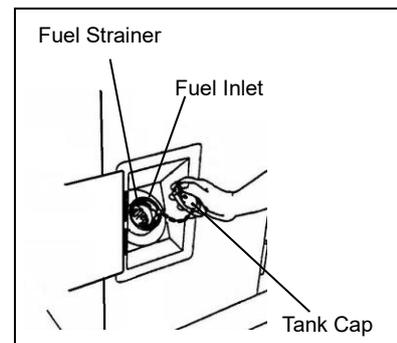
CAUTION : Fire

- Always wipe any drip of Diesel fuel or oil.
- Do not use this equipment when a leak is found.
Repair the equipment before use.

Check for the fuel level in the tank. Add if necessary.

< Note >

- Use Diesel fuel, ASTM D975 No.2-D in the event ambient temperature reaches down to -5°C .
- Always use the Diesel Fuel Strainer
- Fill the fuel tank slightly less than the FULL tank level.
- The engine is designed to use either No.1-D or No.2-D Diesel fuel. However, for economical purpose, use No.2-D Diesel fuel whenever possible at the temperature less than -7°C , No.2-D fuel may pose operating problems. At the much colder temperature, use No.1-D fuel (if available) or use winterized No.2-D (blend of 1-D and 2-D).



This blended fuel is usually called also No.2-D. It can be used in colder temperature than N0.2-D fuel, which has not been winterized. Check with service station operator to be sure you can get the proper blend fuel.

● Fuel requirements:

NOTICE: The fuel injection pump, injector or other parts of the fuel system and engine can be damaged if you use any fuel or fuel additive other than those specifically recommended by Isuzu.

Such damage is not our responsibility, and is not covered by the Warranty.

To help avoid fuel system or engine damage, please heed the following:

- Some service stations mix used engine oil with diesel fuel. Some manufacturers of large diesel engines allow this; however, for your diesel engine, do not use the diesel fuel which has been contaminated with engine oil. Besides causing engine damage, such fuel can also affect emission control. Before using any diesel fuel, check with the service station operator to see if the fuel has been mixed with engine oil.
- Do not use any fuel additive. At the time this manual was printed, no other fuel additive was recommended. (See your authorized dealer to find out if this has changed.)

8-5. Checking Fuel, Engine Oil, and Coolant Leakage



CAUTION : Fire

- Never use this equipment when a leak is found. Repair the equipment first of all.

Be sure to check for any fuel leak at the fuel hose connections, and oil and coolant leak by opening Side Doors.

8-6. Checking Battery



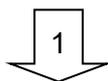
CAUTION : Injuries to eyes and skin

- Battery fluid contains diluted sulfuric acid. Avoid contact with eyes, skin or on clothing. If the acid comes in contact, especially with eyes, flush with a lot of water, and contact physician or doctor immediately.



CAUTION : Explosion

- When the liquid level is below the LOWER level, never use the equipment nor recharge battery.
- Battery may emit some combustible gas, so keep it away from fire and sparks.



Check the fluid level. If the level is near or lower than the LOWER LEVEL, add distilled water until the fluid level reaches the UPPER LEVEL limit.



Make sure that the battery cables are firmly secured to the posts. Tighten the clamps more if necessary.

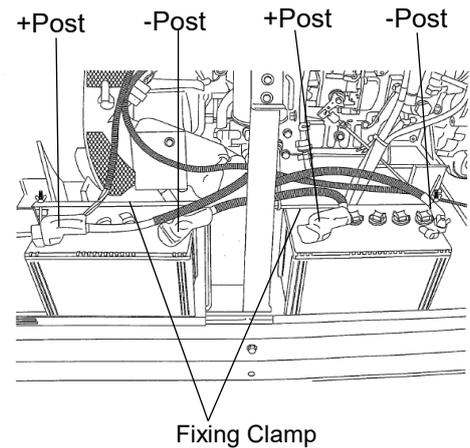
< Note >

- Check the hydrometer of the battery fluid. If it falls below 1.23, the battery requires recharging. Please call our authorized distributor or our engineering section.

■ Replacing the Battery

< Note >

- Dual batteries has been connected in a series.
Always follow the below instruction when replacing the Battery or Remove the Battery cables to avoid Battery short circuit.



(1) Replacing the Right (R) side Battery

- 1 Disconnect the negative (-) terminal from the Right Battery always.
- 2 Disconnect the positive (+) terminal from the R Battery.
- 3 Disconnect the negative (-) terminal from the Left side L Battery.
- 4 Disassemble the fixing clamp of the R Battery.
- 5 Remove the R Battery.

※Reinstall a new Battery in the reverse order (always install the cable to the **positive (+)** post of the new Battery first).

(2) Replacing the Left (L) Battery

- 1 Disconnect the positive (+) terminal from the L Battery.
- 2 Disassemble the fixing clamp of the L Battery.
- 3 Remove the L Battery.

※Reinstall a new Battery in the reverse order (always install the cable to the **positive (+)** post of the new Battery first).

< Note >

- Make sure that the Battery cables are firmly secured to the posts.
Tighten the clamps more if necessary.
Be careful to secure the removed cable are insulated and does not contact with terminal post to avoid electrical shock.

9 Operation

9-1. Initialization and Preparation



WARNING : Suffocation from exhaust gas

- Exhaust fumes from the engine contains many elements harmful To humans. Do not operate this equipment in poorly ventilated area, such as inside a room or in a tunnel



CAUTION : Suffocation from exhaust gas

- Do not point the exhaust fume toward pedestrians or buildings.



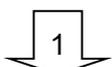
CAUTION : Fire

- Temperature around muffler and exhaust can get extremely high levels. Keep any inflammable items (such as fuel, gas, paint, etc.) away from the equipment.
- Always operate this equipment on flat surface and, at least 1 meter away from any objects (wall, box, etc.).

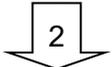


CAUTION : Injuries

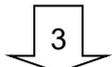
- Always place the equipment on a flat and stable surface, to keep the equipment from sliding.
- When starting the engine, turn off the connected equipment and set the circuit breaker to OFF position.



Turn every circuit breakers to OFF position.



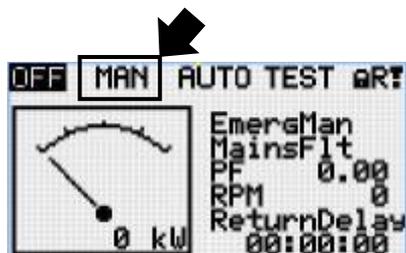
Turn the Battery Isolator to ON position.



Turn the Power Switch to ON position.



Check MAN mode.



Press the Start button to start the engine.

< Note >

- If you need to restart, wait at least 30seconds before the retry.

6 Let engine idles for approximately 5 minutes.

7 Ensure that the tachometer shows the following frequency at no load.

	No Load Frequency (Revolving Speed)
50Hz RUN	52.5Hz (about) (1575min ⁻¹)

< Note >

- By setting frequency to the above frequency under no load, 50Hz(almost) will be obtained at the rated output load.

8 Adjusting the Voltage Regulate Dial, set it to the required voltage.

50Hz RUN	415V
----------	------

9 Turn the circuit breakers to ON to send power to the load side.



WARNING : Electric Shock / Injuries

- Before turning RCCB to ON to send power to the load side, always ensure that any circuit breaker and switch of loads are positioned to OFF.
In the case the generator and the load are away from each other, proceed with the above steps, communicating well with the other person by the load in order to prevent from accident.

9-2. Procedures during Operation

(1) Checks after Startup

- Make sure that the controller is in normal status.
- Check that there is no abnormal vibration or noise.
- Check that the exhaust gas color is normal. When operation is normal, the exhaust gas should be colorless or slightly bluish.

< Note >

- If abnormal, stop using this generator and request authorized distributor where the generator was purchased to repair the generator.

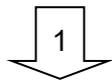
(2) Adjustment during operation

During load operation, check the voltage on the Operation Display and finely adjust voltage using the voltage regulator dial.

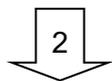
- Extracting the air out of the fuelling system for engine stop due to no fuel.

This generator is equipped with automatic extracting feature.

Thus, if the engine stops due to running out of fuel, follow the next steps to extract the air out.



Add fuel to the fuel tank.



Turn the Power Switch to AIR BLEEDING position. It will take approximately 30 seconds to extract the air out.

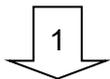


Press the Start Button, and confirm the engine has started properly.

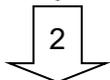
< Note >

- In the case air is in the fuel line, the engine speeds is unstable. In the case, perform the vacuum again.

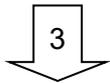
9-3. Stopping



Turn the switch on the equipment and the circuit breaker on the load to OFF.



Turn every circuit breaker to OFF position.



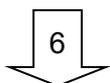
Let engine idles for approximately 3 minutes. (for cool down)



Press the Stop button to shut off the engine.



Turn the Power Switch to OFF position.



Turn the Battery Isolator to OFF position.

9-4. Protection Functions



- Do not open the check door when the Power Switch is in the ON position. It will cause injury by rotating parts such as cooling fans and fan belt.
- Always turn the Power Switch to the OFF position and stop the engine, then close and lock OPERATION PANEL DOOR before checking or maintaining the engine or any equipment.



- Do not touch the engine and surrounding components immediately after stopping the engine as they are still hot.
- Hot steam gushes out from the coolant subtank if the generator overheats. Do not touch the coolant subtank.

This generator is equipped with functions to automatically stop operation when there is a fault/malfunction during operation, and this is to warn the operator of the fault location by use of the Operation Display. Check the fault location when the engine is automatically stopped or appear warning on the Operation Display.

Protection Feature List

No.	Action Abnormality	RCCB Trip	Breaker Trip	Engine Automatic Shutdown	Controller display	Cause
1	Low Oil Pressure	-	-	○	○	Activate due to low oil pressure in the engine Default : 0.98 × 100 kPa
2	High Coolant Temperature	-	-	○	○	Activates due to high water temperature in the engine. Default : 105°C
3	Overload	-	○	-	○	Activates in overload
4	Fail to Start	-	-	-	○	The engine fails to start three times
5	Charge Alt Failure	-	-	○	○	Activates in battery charge Impossible
6	Fuel Level Low	-	-	-	○	The amount of fuel is small
7	Current Leakage	○	-	-	-	Activates in current leakage

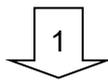
※ ○ indicates the automatic activation.

9-5. Connecting to External Fuel Tank

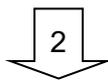


CAUTION

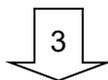
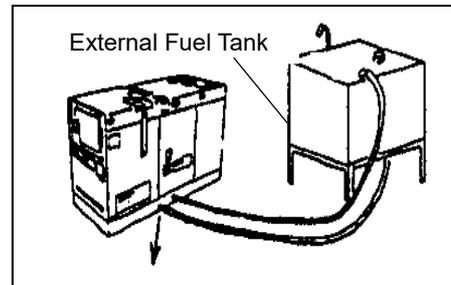
- Always stop the engine, when working on the fuel line.
- Always wipe any drip of Diesel fuel or oil. Do not use this equipment when a leak is found. Repair the equipment before use.
- Ensure that there is no fuel leakage on the fuel line after the fuel line working finished.



Turn the 3-way valve lever to A position.
(Installed tank use position)



Disconnect the P/T 1/2 plugs from the External Fuel Intake and the External Fuel Return, and then connect the hoses from the External Fuel Tank, as shown below.

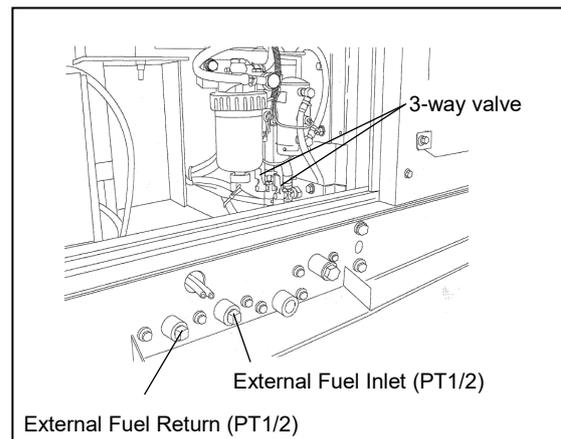


Turn the 3-way Valve Lever to B position.
(External tank use position)



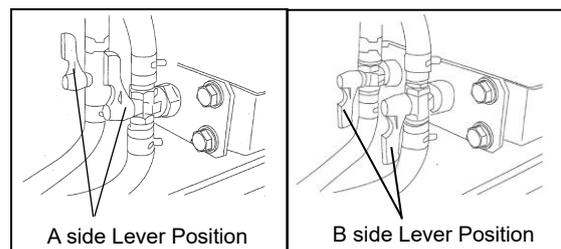
Extract the air out from the connected hoses.

By the above procedure, it makes possible to use an External Fuel Tank.



< Note >

- Use always oil-proof hose in 8-10mm inner diameter as connecting hose.
- The fuel level in the external fuel tank should be 0 to 3m higher than the bottom of the equipment. Otherwise, it may cause engine malfunction or stoppage.
- To avoid any leak from the external fuel intake and return ports, always turn the lever for 3-way Valve to A position whenever piping work is performed.
- Use extreme caution when connecting the hoses. If the lever position is set improper, the fuel may leak from either the Built-in Fuel Tank or the External Fuel Tank.
- Set the fuel intake position 15-20mm above from the External Fuel Intake bottom line, otherwise water or garbage in the tank may come into the fuel line.
- In order to avoid engine malfunction due to air suction, set the fuel return at the same level as the fuel intake level in the External Tank.
- Refer air extraction to 『9-2. Procedures during Operation』



- Just after having connected to External Fuel Tank, there may be a case that engine speed is unstable and engine stops due to insufficient air extraction. Therefore, be sure to confirm that the air is extracted completely and the engine speeds keeps stable before leaving the equipment under people-less operation.

10 Check / Maintenance



WARNING : Electric Shock/Injuries

- Before performing any equipment check or maintenance, stop the engine, and turn the Power Switch to the OFF position.



CAUTION : Fire/Burns

- When checking engine, always stop the engine, and keep away from fire. Wait until the engine cools down, before performing any checks.



CAUTION : Fire

- Always wipe any drip of fuel or oil. Do not use this equipment when a Leak is found. Repair the equipment before use.

To optimize the use of this generator, we recommend the periodical equipment checks and maintenance, based on following maintenance matrix.

< Note >

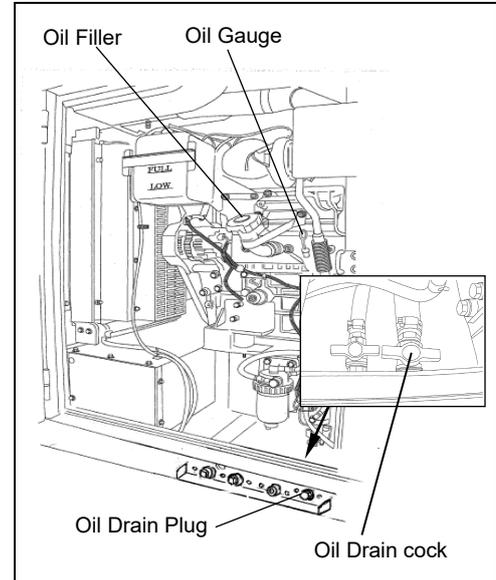
- The authorized technicians only should perform all maintenance work, except for the pre-startup checks.
- Request for the maintenance items with ●mark to our authorized dealer or our engineering section.
- This chart only covers the simple checks and maintenance as for the engine. For more detailed guide.
- Always use our genuine parts only for replacement.

Description	Startup check	Every 200hrs	Every 400hrs	Every 500hrs	Every 1000hrs
Engine Side					
Clean each parts / tightening	○				
Engine oil checks / add oil	○				
Engine oil change (<i>1st time at 50 hr mark</i>)		○			
Oil Filter change (<i>1st time at 50 hr mark</i>)			○		
Coolant level check / add coolant	○				
Exhaust color check	○				
Coolant change					○ or 2 yr.
Drain excess water and sediments in the water separator	○	○ Clean			
Drain water from Fuel Filter or replace		○ Clean		○ Replace	
Drain water from Fuel Tank		○			
Clean water separator and clean Gauze Filter in Engine Feed Pump				○ Clean	
Change filter in the Magnet Pump for air extraction in fuel line					○ Replace
Clean inside Fuel Tank					●
Leak check (fuel, oil, and coolant)	○				
Replacing fuel hose					● or 1 yr.
Clean or replace Air Cleaner Element		○ Clean		○ Replace	
Battery fluid level check	○				
Battery hydrometer check				○	
Fan Belt check	○				
Radiator Flush Cleaning				●	
Check and adjust Engine Valve clearance					●
Compression check					●
Fuel injection nozzle check			●		
Fuel injection timing check					●
Generator side					
Indicators, Gauge Alarms check	○				
Operation check of RCCB	○				
Grounding resistance check	○				
Insulation test		○			

(1) Change engine oil

Initial	50 hours
2 nd and after	Every 200 hours

- 1 Remove the Oil Filler Cap.
- 2 Remove the Oil Drain Plug and then turn The Oil Drain Lever to OPEN and drain engine oil.
- 3 Turn the Oil Drain Lever to CLOSE and tighten the Oil Drain Plug.
- 4 Add oil through oil filler to fill it up to the MAX level while checking the oil level on the oil level gauge.
- 5 Tighten the Oil Filler Cap.



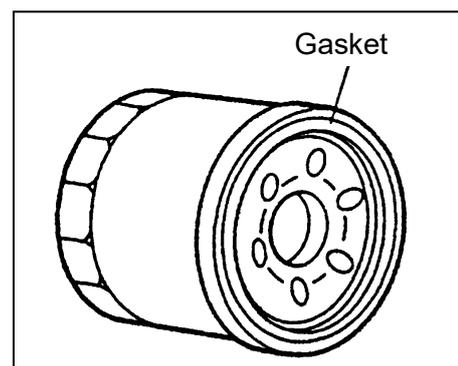
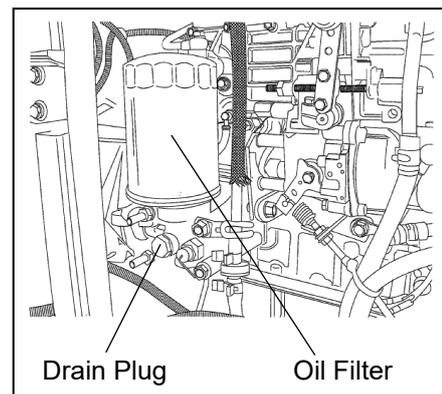
< Note >

- For the volume and the type of engine oil to use and to replace, refer to 『8-1. Checking Engine Oil』 .

(2) Oil Filter Change

Initial	50 hours
2 nd and after	Every 400 hours

- 1 Drain the engine oil fully, as described in (1) CHANGE ENGINE OIL.
- 2 Loosen and remove the oil filter, using an oil filter wrench.
- 3 Smear a little engine oil on the rubber gasket of the new oil filter.
- 4 Screw a new filter into place and tighten it by hand until the gasket contacts the seat. Then, give it additional 2/3 turns, using an oil filter wrench after the gasket touch the seal surface.
- 5 Supply engine oil.



< Note >

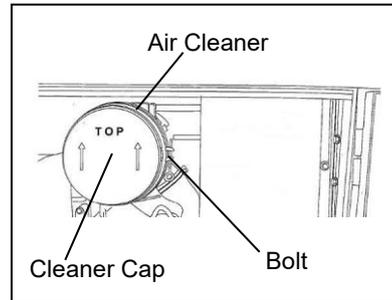
- If an oil filter wrench is not at hand, contact our authorized distributor or our engineering section to replace.
- Oil Filter Part No.

Isuzu Part No.	8943212190
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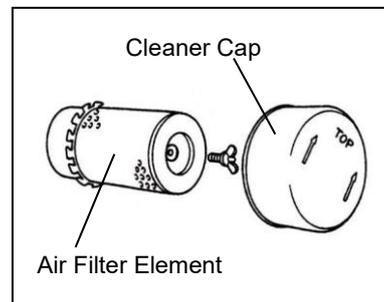
(3) Cleaning / Changing Air Filter Element

Clean	Every 200 hours
Change	Every 500 hours

1 Loosen the Air Cleaner Fixing Bolt and remove the Cleaner Cap.



2 Loosen the Wing Bolt and remove the Air Filter Element.



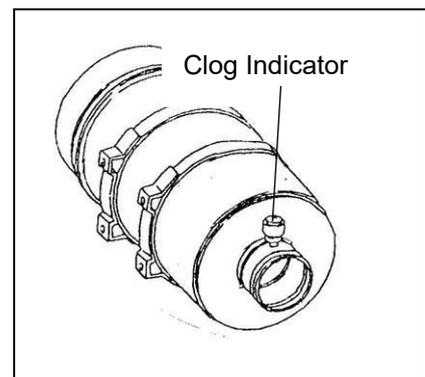
3 Clean or change an Air Filter Element and reinstall it in the reverse order.

< Note >

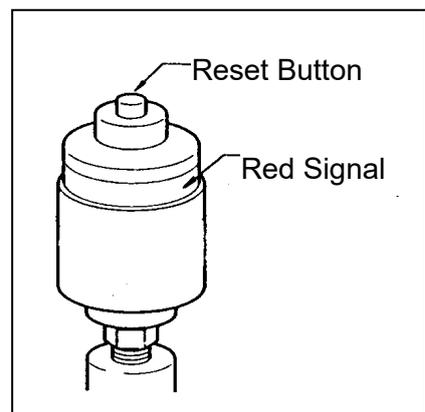
- Always make sure that the arrow mark on the Cleaner Cap is pointing upward.
- Clean more frequently, if the equipment used in dusty environment
- Element Part No.

Isuzu Part No.	9142151351
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- Clean Air Filter Element
<Dried contaminants adhered>
Blast the compressed air to Element from inside.
- <Carbon and oil adhered>
Change to a new Filter.



- Clog Indicator
The clog indicator to display clog in the Air Filter Element is incorporated to air filter unit.
- Whenever RED SIGNAL appears in the indicator window, clean or change Element regardless of operation hour.
- After cleaning or changing finishes, push the reset button to release the RED SIGNAL.

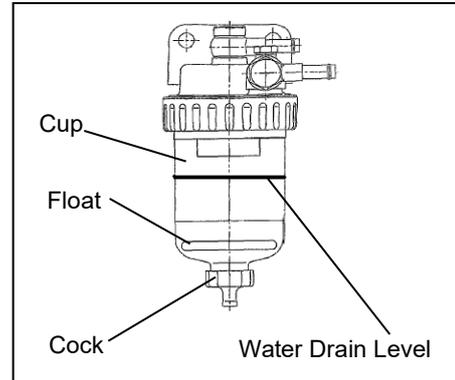


(4) Drain water in the Water Sedimentor

Check	Startup
Clean	Every 200 hours

When a float (red) in the cup is floating at drain level, drain water.

- 1 Loosen the Cock.
- 2 After draining finishes, tighten the Cock.



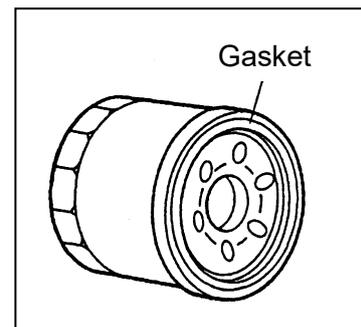
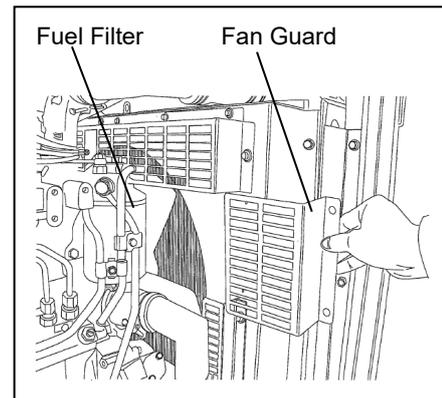
< Note >

- After draining finishes, extract the air in fuel line. (Refer to 『9-2. Procedures during Operation』 .)

(5) Maintenance of the Fuel Filter

Drain	Every 200 hours
Change	Every 500 hours

- 1 Loosen the fixing screw of the Fan Guard located on the side of the Fuel Filter. Remove the Fan Guard.
- 2 Disassemble Fuel Filter using filter wrench.
- 3 Drain the remaining water from the Filter.
- 4 Apply little amount of the diesel fuel onto new Fuel Filter Gasket.
- 5 Tighten the Fuel Filter using finger until the filter gently seated to the bracket, Then tighten the Filter 2/3 rotation using fuel filter wrench.
- 6 Reassemble the Fan Guard to the original position with fixing screw.



< Note >

- Do not operate the generator without reassembling the Fan Guard to avoid injury.
- After draining finishes, extract the air in fuel line. (Refer to 『9-2. Procedures during Operation』 .)
- Fuel Filter Part No.

Isuzu Part No.	1132400791
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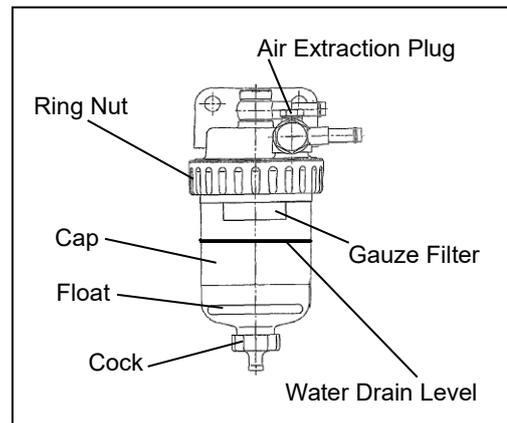
(7) Clean Gauze Filter in Water Separator

Clean	Every 500 hours
-------	-----------------

1 Loosen the Cock and then loosen the air extraction plug.

2 Turn the ring nut counter-clockwise to remove the cup and the Gauze Filter after the fuel inside does not come out from the lever.

3 Wash the Gauze Filter in Diesel fuel and reinstall the unit in the reverse order.



Tightening Torque	
Ring Nut	15Nm{1.5kgfm}
Air Extraction Plug	10Nm{1.0kgfm}

< Note >

- Clean the Filter more frequently as Gauze Filter is clogged in shorter period when using the fuel from the oil drum than other fuel source.
- Put a tray under the lever in order to catch spilled fuel when loosening the lever.
- Extract the air in fuel line after Gauze Filter washing finishes.
(Refer to 『9-2. Procedures during Operation』 .)
- Ensure that there is no fuel leakage after reinstallation.

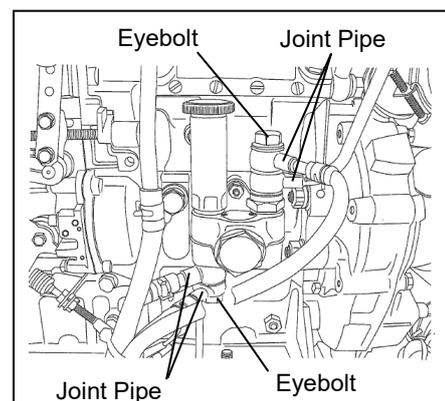
(8) Clean Gauze Filter in Engine Feed Pump

Clean	Every 500 hours
-------	-----------------

1 Remove Eyebolts.

2 Remove Gauze Filter in Eyebolts.

3 Wash Gauze Filters in Diesel fuel and Reinstall in the reverse order.

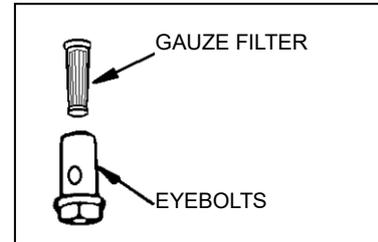


Eyebolt tightening torque	24.5Nm {2.5kgfm}
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< Note >

- Put a tray under the lever in order to catch spilled fuel when loosening the lever.
- Gaskets are attached to both ends of joint pipe. Be careful not to lose and install them in the unit without fail.

- Change both Gauze Filter and eyebolt when Gauze Filter is damaged.
- Extract the air in fuel line after Gauze Filter washing finishes.
(Refer to 『9-2. Procedures during Operation』 .)
- Ensure that there is no fuel leakage after reinstallation.
- Eyebolt Part No. (Gauze Filter included)



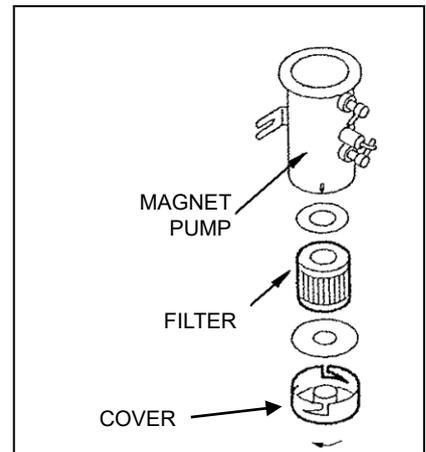
Isuzu Part No.	8970631550
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(9) Change Filter in the Magnet Pump for automatic fuel extraction

Change	Every 1000 hours
--------	------------------

1 Turn the Cover, located at the bottom of pump, counter-clockwise and remove Filter.

2 Reinstall a replacing Filter in the reverse order.



< Note >

- Put a tray under the lever in order to catch spilled fuel when changing Filter.
- Extract the air in fuel line after filter changing finishes.
(Refer to 『9-2. Procedures during Operation』 .)
- Ensure that there is no fuel leakage after reinstallation.
- Filter Part No.

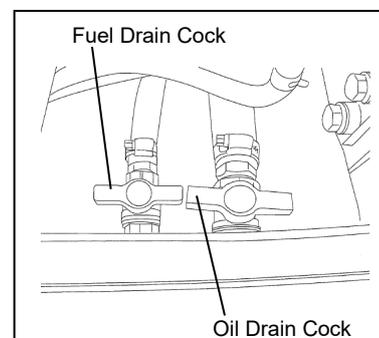
Isuzu Part No.	8943370220
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(10) Drain water in fuel tank

Drain	Every 200 hours
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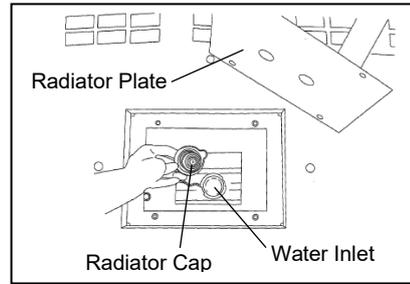
1 Turn the Fuel Drain Lever to OPEN.

2 After draining water, turn the Fuel Drain Lever CLOSE.



(11) Change Coolant

Change	2 years or 1000 hours
--------	-----------------------

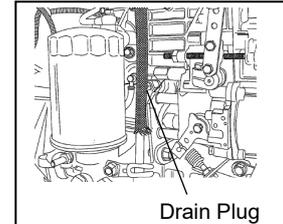
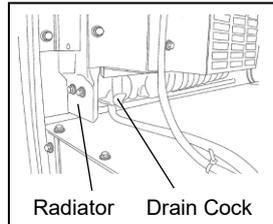


1 Remove the Radiator Plate.

2 Remove the Radiator Cap.

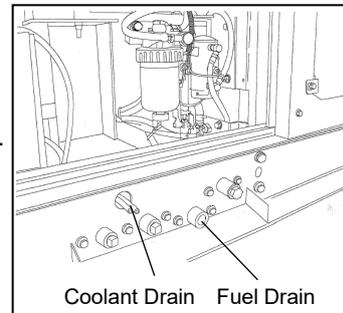
3 Loosen the Radiator Drain Cock and the Drain Plug on the engine side.

4 After draining finishes, tighten the Radiator Drain Cock and the Drain Plug on the engine side.



5 Remove the Sub Tank Stay and drain coolant in the Sub Tank.

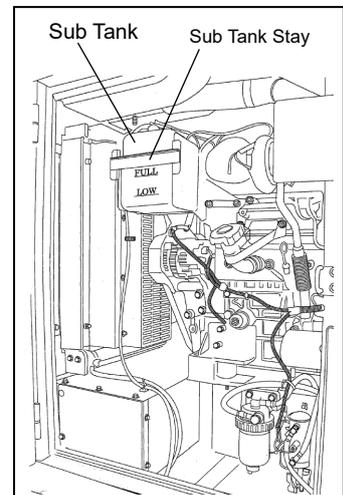
6 Reinstall the Sub Tank and fill coolant up to FULL level.



7 Fill coolant into Radiator up as far as the water inlet level.

8 Tighten the Radiator Cap.

9 Reinstall the Radiator Plate.



< Note >

- Refer Coolant to 『8-2. Checking Coolant/Water』 .

11 Long-term storage



WARNING : Electric Shock/Injuries

- Before performing any equipment check or maintenance, stop the engine, and turn the Power Switch to the OFF position.



CAUTION : Fire/Injuries

- Temperature around muffler and exhaust can get extremely high levels. Keep any inflammable items (such as fuel, gas, paint, etc.) away from the equipment.
- When checking engine, always stop the engine, and keep away from fire. Wait until the engine cools down, before performing any checks.

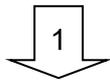


CAUTION : Fire

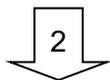
- Always wipe any drip of Diesel fuel or oil. Do not use this equipment when a leak is found. Repair the equipment before use.

(1) Storage Procedures

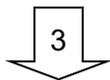
If the generator will not be used for more than two months, perform the following maintenance and storage procedures.



Remove Battery.



Change engine oil.



Drain fuel in the Fuel Tank and Fuel Filter.



Clean all parts, cover the equipment, and store it in the place where dust and humidity are less as possible.

< Note >

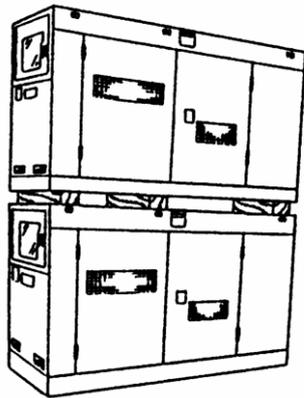
- Charge the removed Battery once a month.

(2) Stacking

WARNING : Injuries

If you have to stack two generators at warehouse, always proceed with the following steps.

- Ensure that there is no dent on bonnet, loose bolt or no bolt in the equipment.
- Always place the equipment horizontal on a flat and stable surface to be endurable for the total weight, and to keep the equipment from sliding.
- When lifting the equipment, always use a lift hook.
- Always place ties (sleepers) on the lower equipment firstly and then stack the upper equipment on it. All the ties should be the same size (dimension) and longer than the width of the lower generator.
- Do not stack more than 2 units. The lower generator should be bigger than the upper generator in size and weight.
- Do not operate the stacking/stacked equipment.



12 Troubleshooting

WARNING : Electric Shock

- Do not operate the equipment, if the equipment or you are wet.
- Before performing any equipment check or maintenance, stop the engine.

CAUTION : Injuries

- When performing equipment check and maintenance, always stop the engine.

CAUTION : Fire/Burns

- Never get fire near to the equipment.
- When checking engine oil or changing oil, always stop the engine, and wait until the engine cools down.
If you open either the oil gauge or the oil filler cap during operation, hot oil may cause some injury.

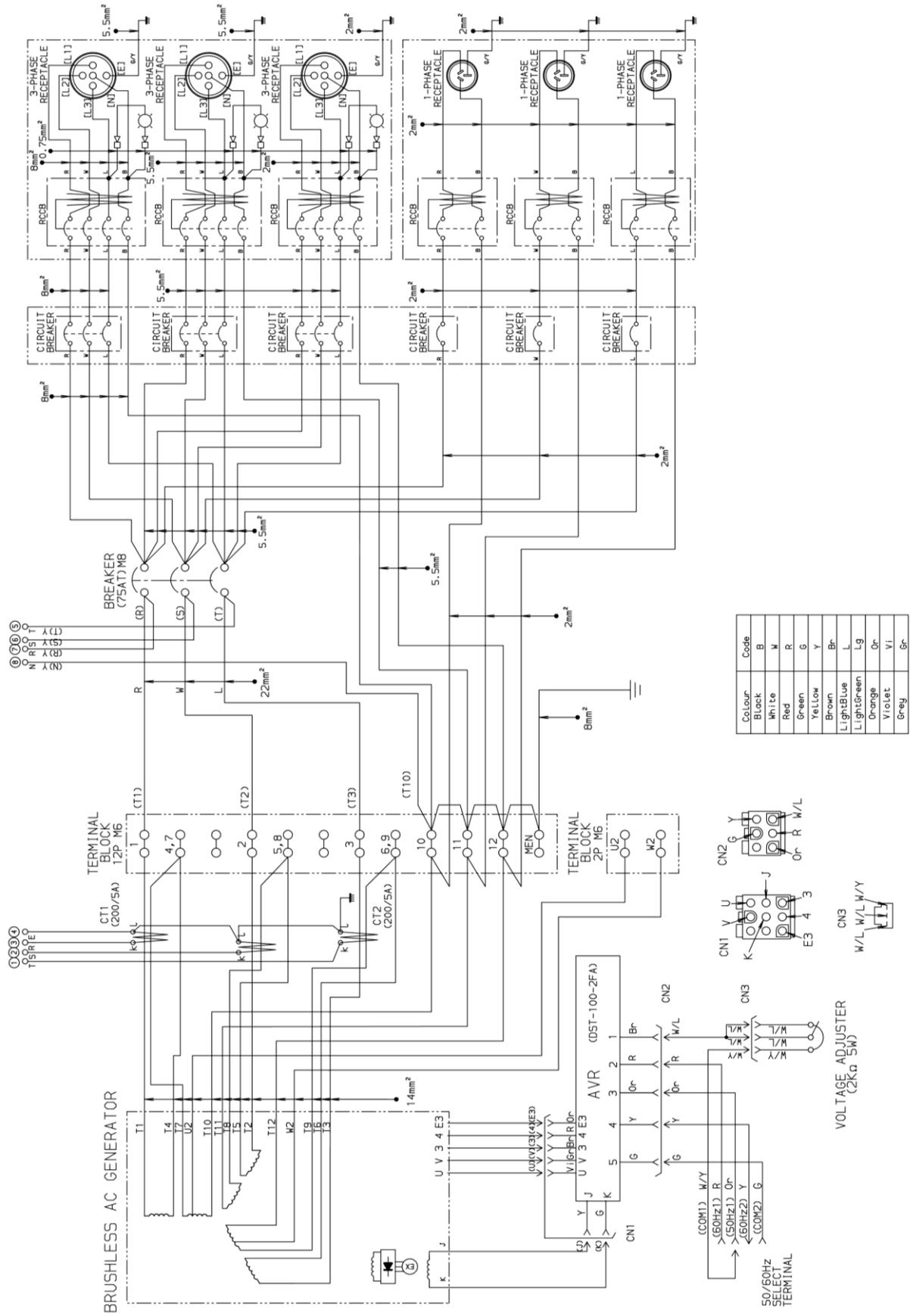
Follow the guideline below, when performing any troubleshooting. If you cannot resolve the problems by this troubleshooting guide, contact our authorized distributor or our engineering section to request the repair.

Symptom		Presumable Cause	Action
Engine does not start	Starter motor does not drive or speed is low.	<ol style="list-style-type: none"> 1. Battery Isolator is OFF 2. Battery output is weak 3. Battery is deteriorated 4. Battery terminal is OFF or loose 5. Battery terminal is corroded 6. Power Switch or relay is defective 7. Starter motor is defective 	<ol style="list-style-type: none"> 1. Turn Battery Isolator to ON 2. Check / battery liquid/ or Charge 3. Change battery 4. Fix / Tighten terminal 5. Clean terminal 6. Ask our distributor to repair 7. Ask our distributor to repair
	Starter motor drives but engine does not start	<ol style="list-style-type: none"> 1. Fuel is insufficient 2. Fuel filter is clogged 3. Gauze Filter is clogged 4. Water is interfused in fuel line 5. Air is interfused in fuel line 6. Poor piping connection to external fuel tank 7. Fuel Tank Selector Lever (3-way valve) position is wrong 8. Fuel cut solenoid (motor) does not work 	<ol style="list-style-type: none"> 1. Add fuel 2. Clean / Change fuel filter 3. Clean / Change Gauze Filter 4. Drain water in water separator, fuel filter or fuel tank 5. Extract the air 6. Check piping connection 7. check lever (3-way valve) 8-1. Check / Change fuse 8-2. Check / Change fuel cut solenoid
	<Ambient temperature falls down below zero>	<ol style="list-style-type: none"> 1. Fuel is frozen 2. Water in fuel line is frozen 3. Pre-heater is defective 	<ol style="list-style-type: none"> 1. Use winterized fuel 2. Drain water in fuel line 3. Ask our distributor to repair
Engine starts but stalls immediately	<ol style="list-style-type: none"> 1. Fuel filter is clogged 2. Gauze Filter is clogged 3. Water is interfused in fuel line 4. Air is interfused in fuel line 5. Poor piping connection to external fuel tank 6. Air filter element is clogged 7. Lubricant oil is insufficient 	<ol style="list-style-type: none"> 1. Clean / Change fuel filter 2. Clean / Change Gauze Filter 3. Drain water in water separator, fuel filter or fuel tank 4. Extract the air 5. Check piping connection 6. Check / Change air filter element 7. Supply lubricant oil 	
Engine oil pressure is low	<ol style="list-style-type: none"> 1. Lubricant oil is insufficient 2. Oil filter is clogged 3. Oil Pressure switch is defective 4. Wrong oil is used 	<ol style="list-style-type: none"> 1. Supply lubricant oil 2. Change oil filter 3. Ask our distributor to repair 4. Change to proper kind and viscosity oil 	

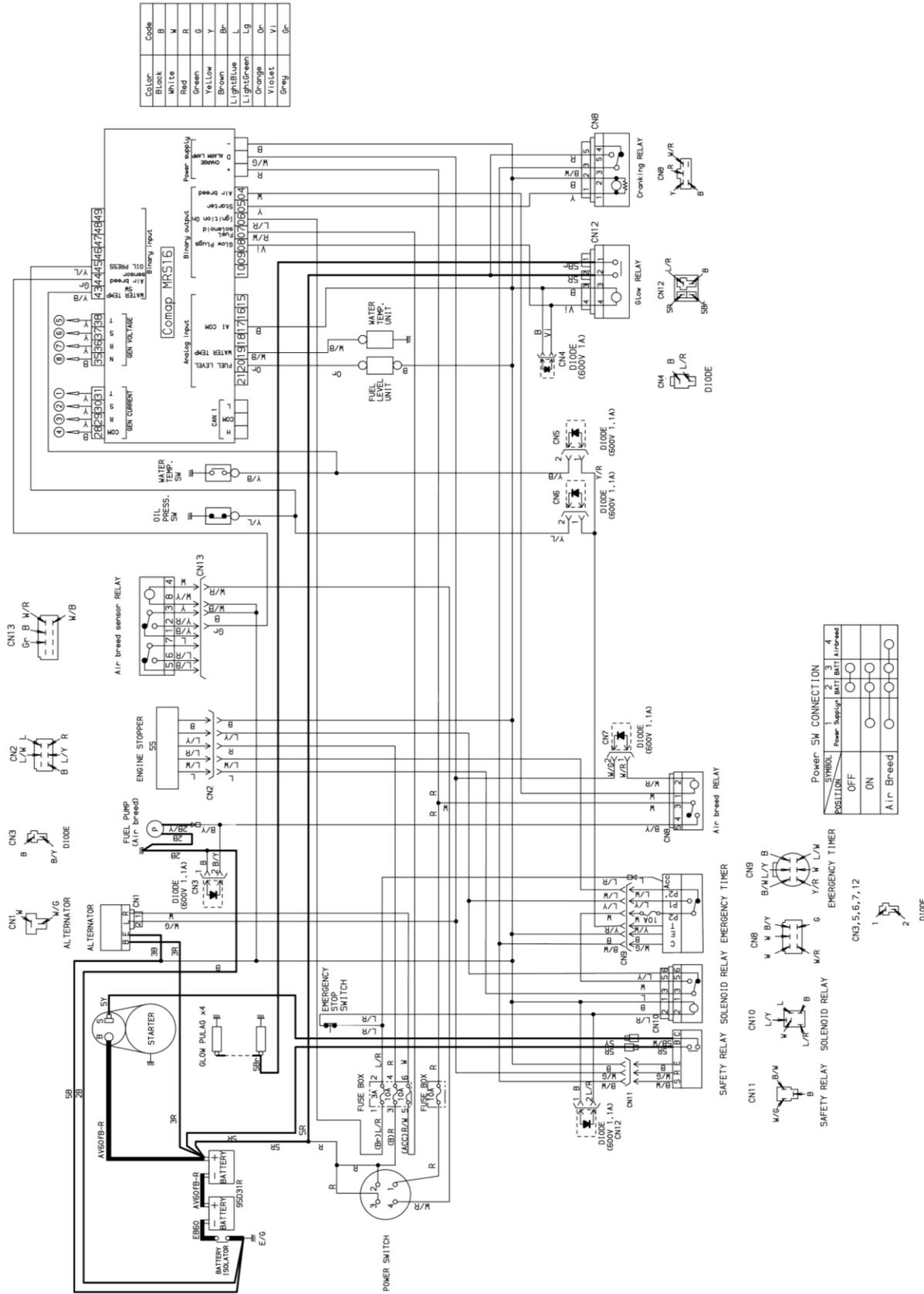
Overheated	<ol style="list-style-type: none"> 1. Engine thermostat is defective 2. Water temp sensor is defective 3. Controller is defective 4. Fan belt tension is weak 5. Coolant is insufficient 6. Radiator core is clogged 	<ol style="list-style-type: none"> 1. Ask our distributor to repair 2. Ask our distributor to repair 3. Ask our distributor to repair 4. Check / Adjust fan belt 5. Check / Supply coolant 6. Clean radiator core
Black smoke comes out from Muffler	<ol style="list-style-type: none"> 1. Air filter element is clogged 2. Fuel injection nozzle is defective 3. Improper fuel is used 	<ol style="list-style-type: none"> 1. Check / Change air filter element 2. Ask our distributor to repair 3. Change to clean fuel
White smoke comes out from Muffler	<ol style="list-style-type: none"> 1. Too much or too little oil to cylinder 2. Water is interfused in fuel line 3. Fuel injection nozzle is defective 4. Coolant temperature is too low 5. Engine thermostat is defective 	<ol style="list-style-type: none"> 1. Ask our distributor to repair 2. Drain water in water separator, fuel filter or fuel tank 3. Ask our distributor to repair 4. Warm-up driving is needed 5. Ask our distributor to repair
Voltage value does not change	<ol style="list-style-type: none"> 1. Controller is defective 2. AVR is defective 3. Disconnected circuit, loose terminal or departed 4. Initial exciter is defective 5. Alternator is defective 6. AVR protective device has activated 	<ol style="list-style-type: none"> 1. Ask our distributor to repair 2. Ask our distributor to repair 3. Ask our distributor to repair 4. Ask our distributor to repair 5. Ask our distributor to repair 6. Press the AVR reset button to release the protective device
The voltage does not rise to the rated voltage	<ol style="list-style-type: none"> 1. Controller is defective 2. AVR is defective 3. Voltage regulator dial is defective 4. Frequency is low 	<ol style="list-style-type: none"> 1. Ask our distributor to repair 2. Ask our distributor to repair 3. Ask our distributor to repair 4. Ask our distributor to repair
The voltage value exceed the rated voltage	<ol style="list-style-type: none"> 1. Controller is defective 2. AVR is defective 3. Improper load cable connection 	<ol style="list-style-type: none"> 1. Ask our distributor to repair 2. Ask our distributor to repair 3. Correctly set the connection location to the output terminal

<p>The voltage drops drastically when connecting to load</p>	<ol style="list-style-type: none"> 1. AVR is defective 2. Unbalanced loads sharing to each terminal 3. Wrong frequency is used 4. Loads total exceeds the rated current 5. AVR protective device has activated 	<ol style="list-style-type: none"> 1. Ask our distributor to repair 2. Balance the loads sharing to each terminal 3. Set the switch to the load frequency 4. Decrease the loads to meet the rated output 5. Press the AVR reset button to release the protective device
<p>Cannot turn the breaker to ON</p>	<ol style="list-style-type: none"> 1. The Main breaker positions at between ON and OFF 2. Short circuit on the load 	<ol style="list-style-type: none"> 1. Once turning the lever to OFF, turn it to ON 2. Check the load circuit
<p>Controller does not turn on</p>	<ol style="list-style-type: none"> 1. Battery output is weak 2. Battery is deteriorated 3. Battery terminal is OFF or loose 4. Battery terminal is corroded 5. Fuse is blown 6. Disconnected circuit, loose terminal or departed 7. Controller or Power Switch is defective 	<ol style="list-style-type: none"> 1. Check/ battery liquid/ or Change 2. Change battery 3. Fix/Tighten terminal 4. Clean terminal 5. Check/Change fuse 6. Ask our distributor to repair 7. Ask our distributor to repair

13 Generator Circuit Diagram



14 Engine Circuit Diagram



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