



OWNER'S AND OPERATOR'S MANUAL

Diesel Engine Generator

DG25MK

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.


DG25MK-400M/R
X753-007 95 1
X753801-350 1


Introduction

Thank you for purchasing this Shindaiwa 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 way 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 Instructions

WARNING : SUFFOCATION FROM EXHAUST FUME

- 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 pedestrians 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.
- 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.
- Close the output terminal cover before operating.
- Do not touch the generator if the generator or casing or your body becomes wet during operation.
- Do not touch output terminals or internal electric parts while the generator is operating.
- Ground the every earth grounding terminal to the earth as set out in the manual.
- If even one of all is unconnected by mistake or accident, it will be much more dangerous for human body than the NO-RELAY case, because leaking current inevitably goes through the body.
- Even though all the earth terminals of the loads have been grounded to the earth, the bonnet grounding terminal should be grounded to the earth.
- There is always a danger of being electrocuted by short-circuit. Be sure to test generator's insulation resistance periodically.
- Grounding should be made after the engine is stopped.
- Whenever the Earth leakage relay is activated, you should always repair the leaking place first of all.

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.
- Use the lifting hook to lift the machines, and do not lift up by using tie downs. Use of such could result in the generator falling.
- Do not lift any additional weight such as 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 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.
- Do not use this equipment when leak is found, and 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 Power Switch is OFF position 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 : 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, to avoid sustaining burns from hot vapor.
- 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 hooks when lifting up the generator, and slowly lift it straight up.
- Personnel performing lifting work must wear protective gears such as helmets, safety shoes and gloves.
- Remove the wood ties if using anchors to secure the generator.
- 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 so that it cannot move when transporting by truck or other vehicle.
- Check that the surrounding area is safe, before setting to Auto Mode.
- Be sure to communicate between operators mutually before attempting to set "Auto Mode" to avoid mechanical trouble and incidents.

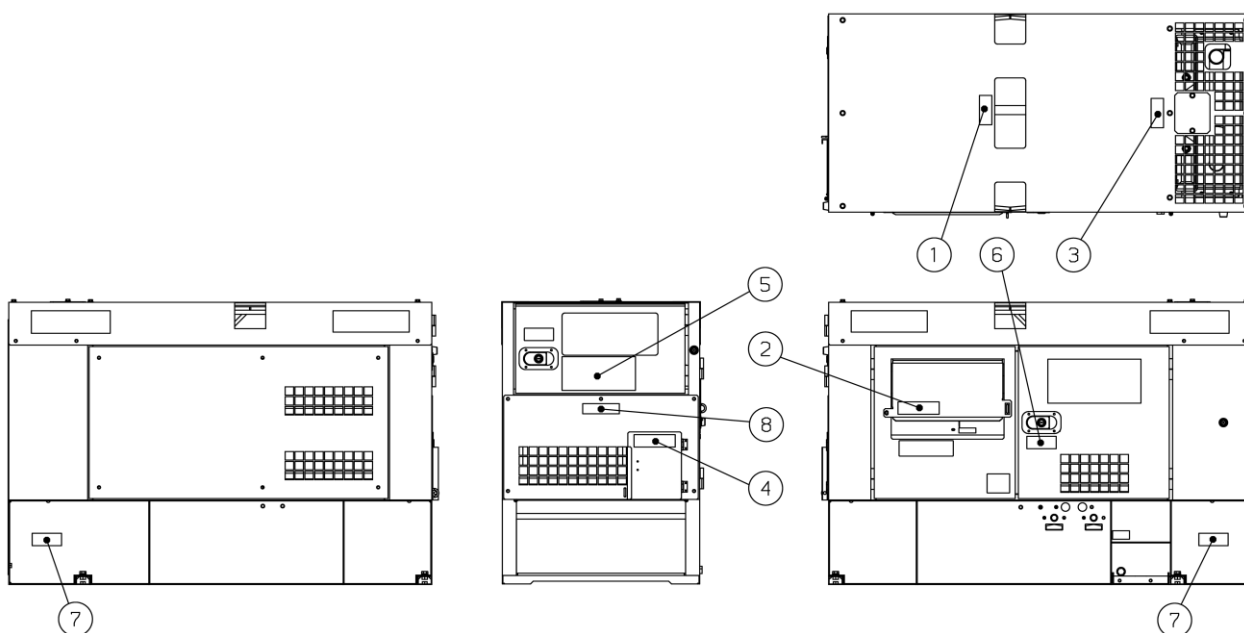
 CAUTION : PROPERTY DAMAGE

- 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.
- When changing the frequency, be sure to change both the Frequency Selector Switch and Controller settings.

■ Warning/Caution Label Locations

If warning or caution labels become damaged and difficult to read, replace with new labels in the indicated locations. Order labels using part number indicated in the parenthesis.

- | | |
|--------------------------|--------------------------|
| ① Injury | (Part no. : X505-007550) |
| ② Electric shock | (Part no. : X505-007560) |
| ③ Caution: gm spec LLC | (Part no. : X505-007840) |
| ④ Caution: fire | (Part no. : X505-007650) |
| ⑤ Warning/Caution | (Part no. : X505-008690) |
| ⑥ Injury | (Part no. : X505-010350) |
| ⑦ Burn | (Part no. : X505-007830) |
| ⑧ Caution: automatically | (Part no. : X564-000510) |



2. Specifications

2-1. Specifications

Model		Unit	DG25MK-400M	
Alternator	Generating Type	-	Rotating Filed, Brushless 3-Phase Synchronous Alternator	
	Rated Frequency	Hz	50	60
	Rated Output	kVA	20	25
		kW	16	20
	Rated Voltage	V	400 [200] *1	440 [220] *1
	Rated Current	A	28.9 [57.7] *1	32.8 [65.6] *1
	Winding	-	3-phase, 4-wire	
	Power factor	%	80	
	Insulation class	-	F	
	Excitation	-	Self-Excitation(Brushless)	
No. of poles	-	4		
Engine	Types	-	Vertical Water-cooled 4-cycle Diesel Engine	
	Model (Manufacturer)	-	V2403 (KUBOTA)	
	No. of Cylinders (bore x stroke)	mm	4 (87 X 102.4)	
	Continuous rated output	kW	19.1	23.7
		PS	26.0	32.2
	Rated speed	min ⁻¹	1500	1800
	Displacement	L	2.434	
	Combustion system	-	Direct Fuel Injection	
	Cooling method	-	Radiator	
	Lubricating method	-	Forced lubrication	
	Starting method	-	Electric start	
	Fuel	-	Diesel Fuel (ASTM No. 2-D)	
	Lubricant oil	-	CF class	
	Fuel tank capacity	L	65	
	Lubricant volume (Full)	L	9.7	
	Cooling water volume	L	9.7	
	Starting motor capacity	V-kW	12 - 1.4	
Charging dynamo capacity	V-A	12 - 30		
Battery	-	80D26R		
Unit	Length	mm	1500	
	Width	mm	700	
	Height	mm	1000	
	Dry Weight	kg	625	
	Installed Weight	kg	705	

*1:The values in brackets are optional data, when modified to 200/220V by the dealers only.
As default 3-phase output is set at 400/440V, contact your authorized distributor to adjust the terminal lug setting if necessary to obtain 200/220V for 3-phase output.

2-2. Ambient Conditions

Use this generator in ambient conditions as described below. Failure to provide these conditions can result in problems such as malfunction, insufficient output and reduced durability.

- Ambient temperature: -15 to 40 °C
- Relative humidity: 85% or less
- Elevation: 300 m or less

3. Applications

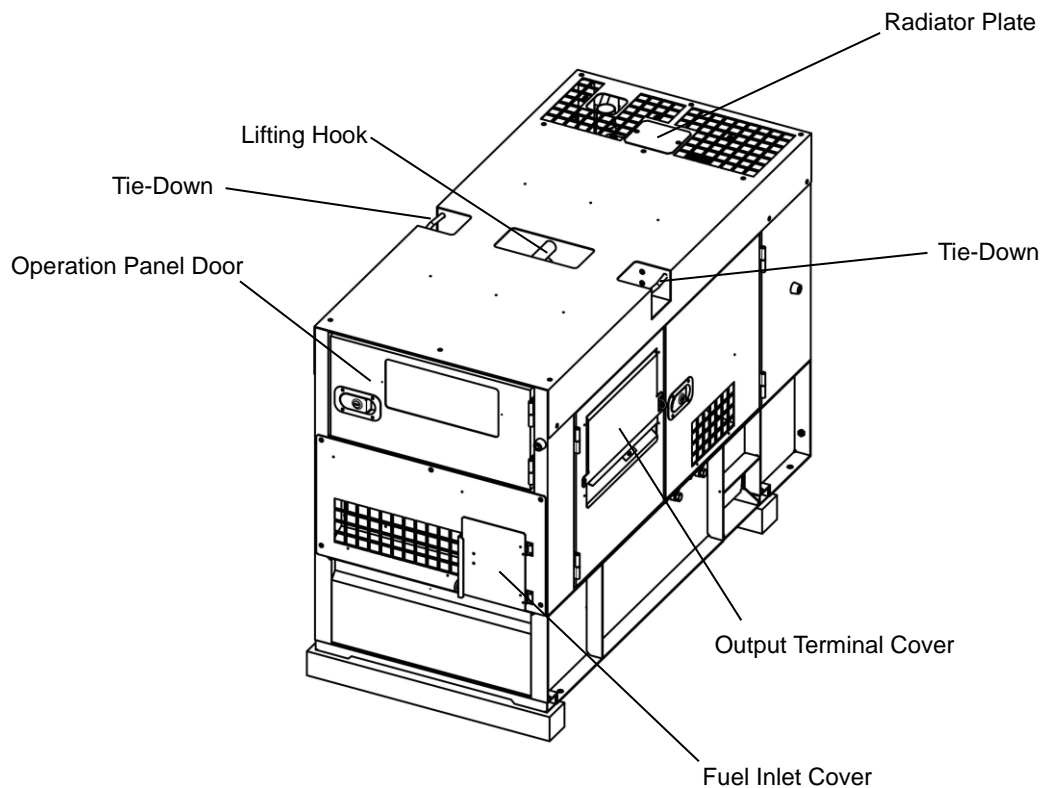
- Power source for submerged pumps and similar civil engineering equipment
- Power source for lighting and similar equipment
- Power source for electrical tools and household appliances

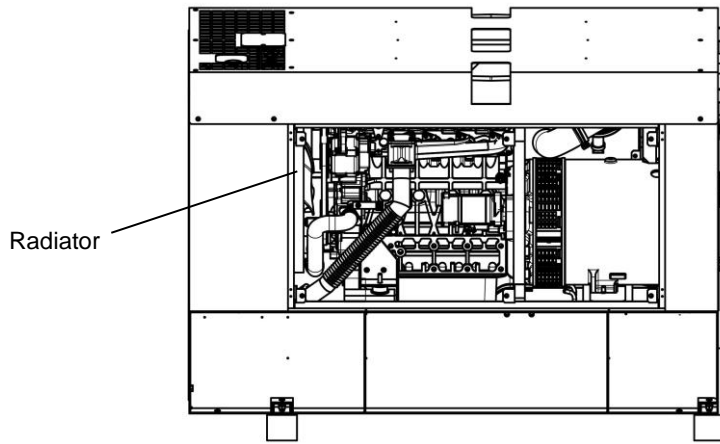
⚠ CAUTION : PROPERTY/SECONDARY DAMAGE

- Do not use for any application other than those listed above.
- If using this generator for medical equipment, check before use with the medical equipment manufacturer, doctor, hospital or similar entity.

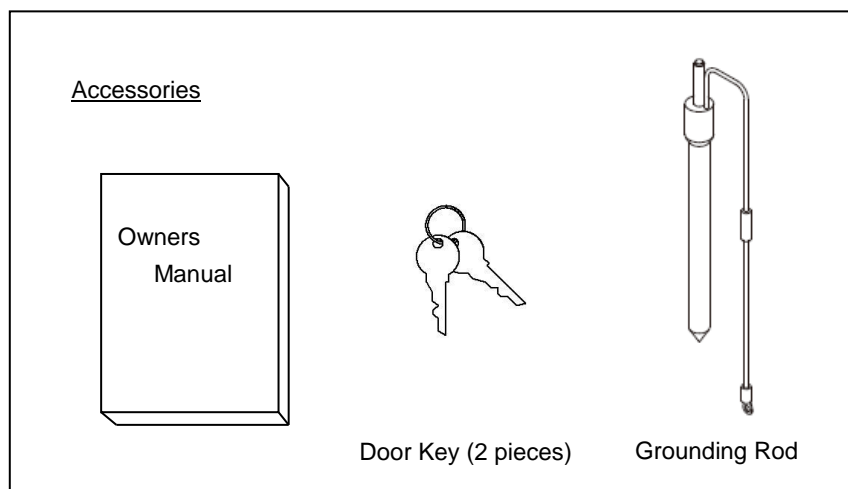
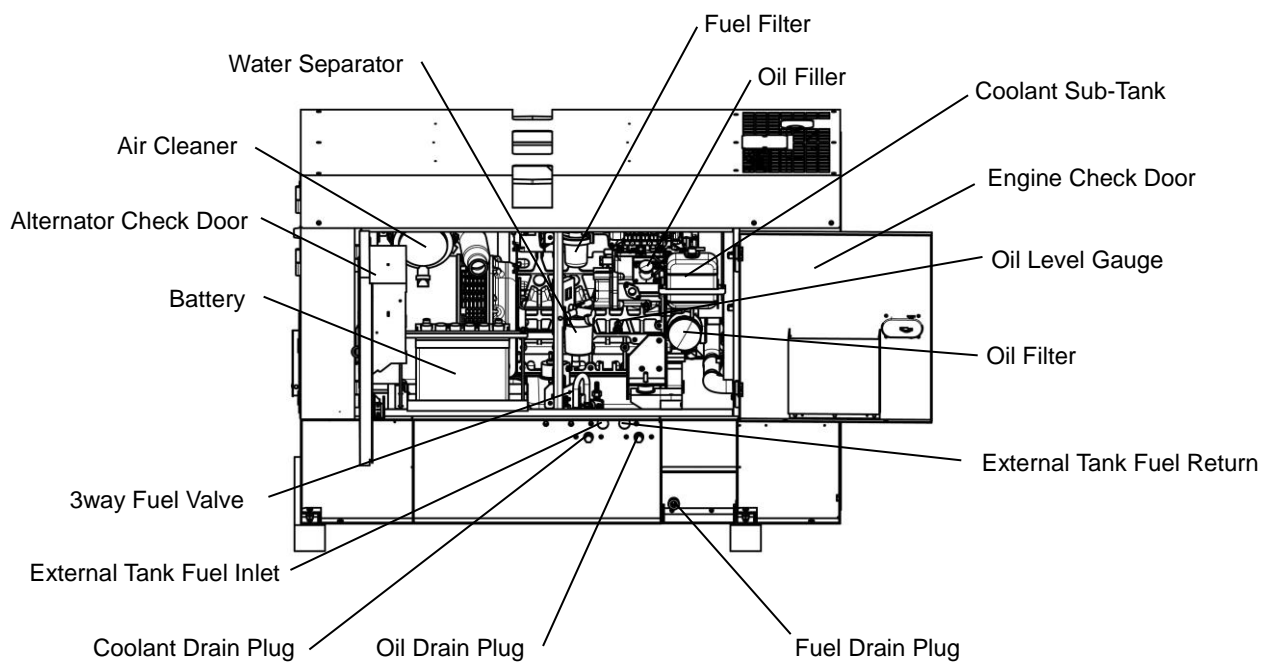
4. Part Names

4-1. External View/Part Names

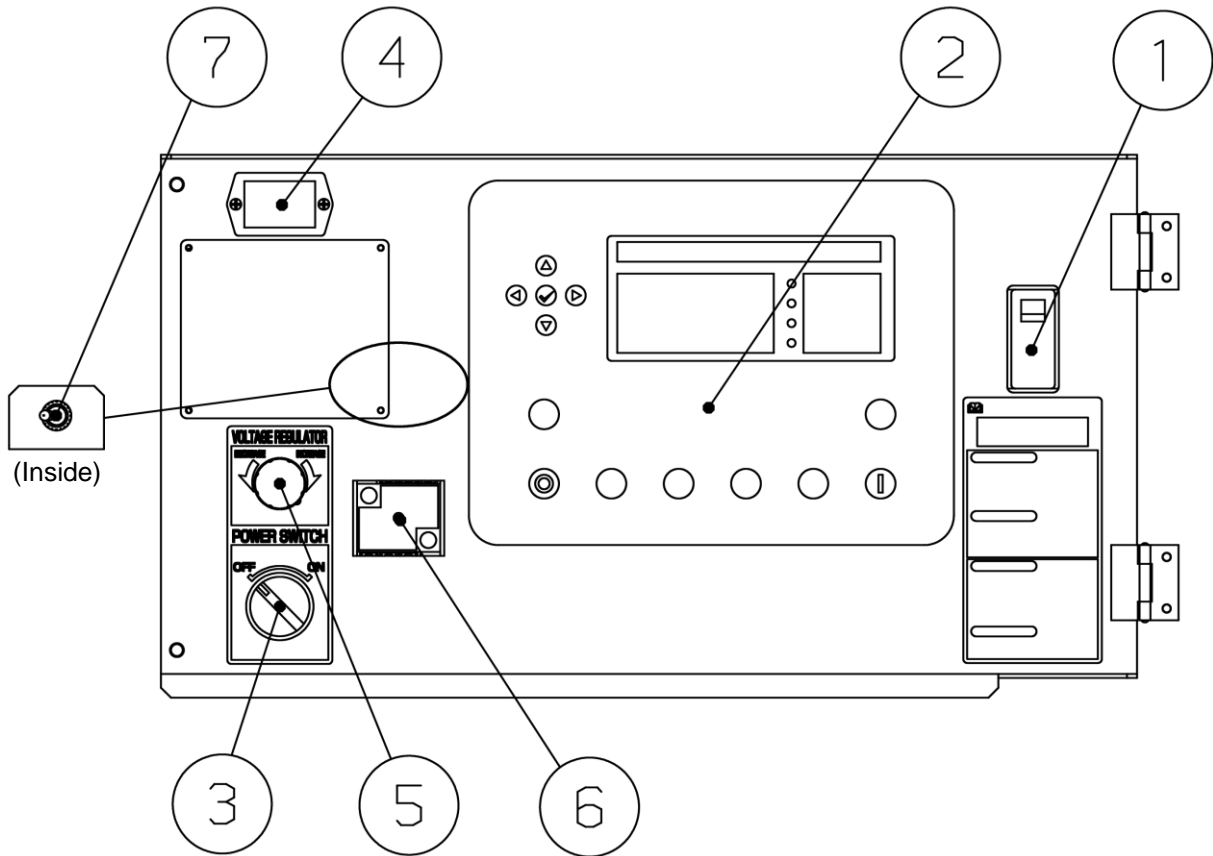




* Shown with side-plate removed.



4-2. Operation Panel Part Names



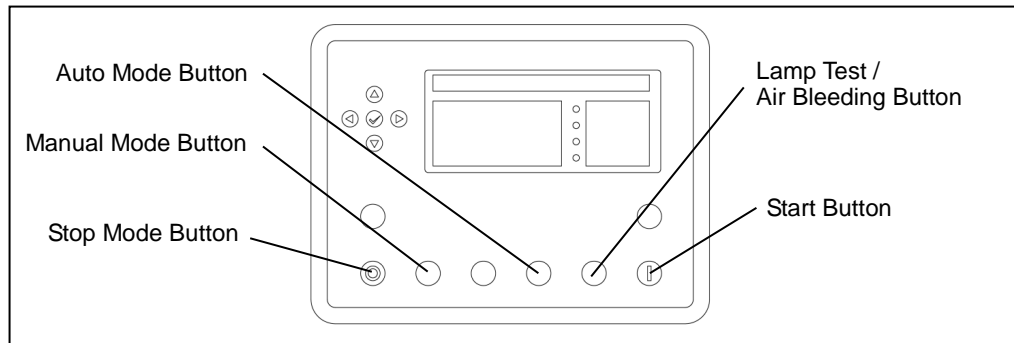
①	Circuit Breaker
②	Controller
③	Power Switch
④	Hour Meter
⑤	Voltage Regulator
⑥	Earth Leakage Relay
⑦	Frequency Selector Switch (inside)

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. (Refer to section "5-1. Controller (2) Operation Display".)

(1) Button



○ Stop Mode Button



This button places the controller into its Stop Mode. Pressing this button stops the engine and deletes any resolved alarms.

○ Manual Mode Button



This button places the controller into its Manual Mode. (Refer to section "9-1. Initial Startup/Pre-Check (1) Manual Start")

○ Auto Mode Button



This button places the controller into its Auto Mode. (Refer to section "9-1. Initial Startup/Pre-Check (2) Auto Start")

○ Lamp Test / Air Bleeding Button



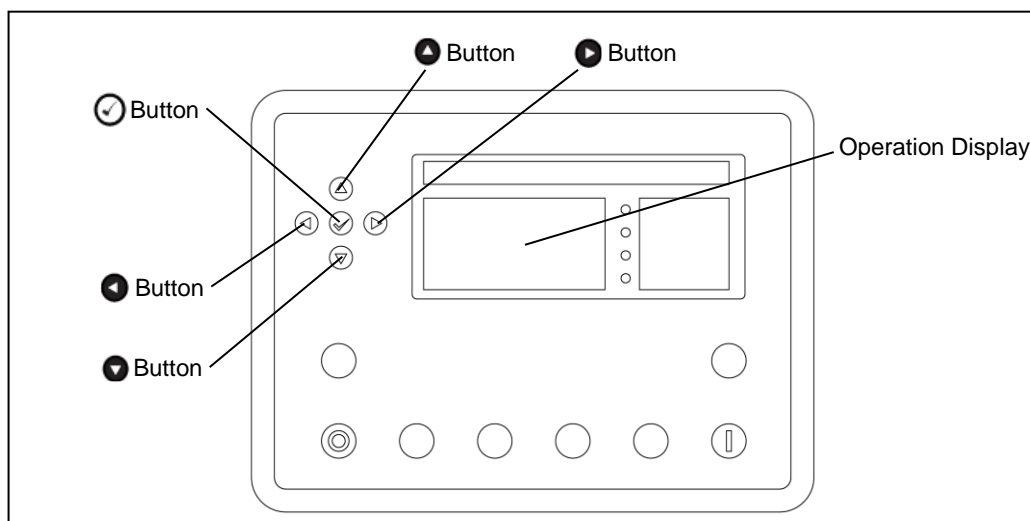
While this button is pressed, all LEDs on the controller are turned on as a lamp test function. Press and hold for approximately 2 seconds to automatically starts air-bleeding device. (Refer to section "9-2. Procedures during Operation (2) Adjustment during Operation")

○ Start Button



Pressing this button in Manual Mode starts the engine. (Refer to section "9-1. Initial Startup/Pre-Check (1) Manual Start")

(2) Operation Display



	Contents
⏪ Button, ⏩ Button	Switches the main screen displayed on the Operation Display.
⏴ Button, ⏵ Button	Displays the detailed status of the main screen.

< Note >

- If an error occurs during operation, the Operation Display automatically switches to the Alarm screen.
- If there is no operation for about 6 minutes while the engine is stopped, it will shift sleep mode to reduce battery consumption. Once it shift to sleep mode, the display of the Operation Display will disappear. To exit sleep mode, press any button on the controller.

■ Main screens

○ Status

Status Screen	Contents
Generator at Rest	Engine is stopped.
Generator Available	Engine is running.
Generator Locked Out	It is in a state where some abnormality has occurred and the engine cannot be started. Check the contents on the Alarm screen.
Waiting For Generator	Displayed when voltage and frequency are lower than the set value.

○ Engine

Status Screen	Contents
Engine Speed [rpm]	Engine speed
Engine Coolant Temp. [°C]	Coolant temperature meter
Engine Battery Voltage [V]	Battery voltage meter and battery charge meter
Engine Run Time	Hour meter
Engine Fuel Level [%][Litre]	The capacity of the fuel tank. When fuel is full, "++++" is displayed. When fuel is empty, "----" is displayed.

○ Generator

Status Screen	Contents
Generator Voltage (ph-N)	Phase-Neutral voltage meter.
Generator Voltage (ph-ph)	Phase-Phase voltage meter.
Generator Frequency	Frequency meter.
Generator Current (A)	Current meter.
Generator Earth Current (A)	No use.
Generator Load Ph-N (kW)(%)	Real power and load factor.
Generator Total Load (kW)(%)	Total of real power and load factor.
Generator Load Ph-N (kVA)	Apparent power and load factor.
Generator Total Load (kVA)(%)	Total Apparent power and load factor.
Generator Power Factor	Power factor and average of power factor.
Generator Load ph-N (kvar)	Reactive power.
Generator Total Load (kvar)	Total of reactive power.
Generator Load (kWh, kVAh, kvarh)	Accumulation of real power/apparent power/reactive power.
Gen Phase Sequence	No use.
Active Config	Ph-N voltage, frequency, voltage set in the Alt Config is displayed.

○ Mains

Status Screen	Contents
Mains Voltage	No use.
Mains Frequency	No use.
Mains Phase Sequence	No use.
Active Config	No use.

○ Alarms

If an error occurs during operation, the Operation Display automatically switches to the Alarm screen, and displays error details. Refer to "**9-4. Protective Functions**" for details of main errors.

When the Stop Mode Button is pressed after the error is cleared, the alarm display disappears.

< Note >

- Even if the earth leakage relay operates and the breaker is turned off, nothing is displayed on the Alarm screen.

○ Event Log

Displays the operation history of this generator. This Event Log records up to 250 items. When EventLog exceeds 250 items, the oldest history is overwritten.

○ Communications

Display the Serial Port.

○ PLC Instrument

Display the time of air-bleeding.

○ About

Display the version information.

(3) Editor

This generator has with the Controller Editor function, which allows you to change frequency, date and contrast of the controller.

- 1 Press the Stop Mode Button.
- 2 Press the Stop Mode Button and "☑" button together to enter the editor display.
- 3 Press the "⬅" button or the "➡" button to select the main screen.

■ Main screens

○ Alt Config

Status Screen	Contents
Config to Edit	No use.
Default Config	Change frequency. (Refer to section "5-4. Frequency change")

○ Display

Status Screen	Contents
Contrast	Set the Contrast. The default contrast is 55%.
Date and Time	Set the Date and Time.

- 4 Press the "⬅" or "➡" button to select the item you want to change.
- 5 Press the "☑" button.
- 6 Press the "⬅" or "➡" button to change the item.
- 7 Press the "☑" button to confirm the changes.
- 8 To save the changes, press and hold the "☑" button.
Not to save the change, press and hold the Stop Mode Button.

5-2. Warning Indicators



WARNING : INJURY



- 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.



CAUTION: BURNS



- Do not touch the engine and surrounding components immediately after stopping the engine as they are still extremely hot.

This generator is equipped with the following warning indicators: Low Oil Pressure, High Coolant Temperature, Air Filter Clogging, Overload Pre-Caution, Fail to Start, Water In Fuel, Charge Alt Failure, Fuel Level Low. Turn the Power Switch to ON position causes "Low Oil Pressure" and "High Coolant Temperature" warning indicator to illuminate, and all indicator lights will go off as engine starts. An indicator illuminates if malfunction/fault occurs during operation and the engine automatically stops depending on the fault type. If the generator automatically stopped, check each illuminated warning indicator at the time of engine stop, and inspect the failed component.

(1) Low Oil Pressure



CAUTION: BURNS



- Always be sure to stop the engine and allow the engine to cool when performing inspection or maintenance of engine oil. Opening the oil gauge or oil filler cap during operation will result in hot oil gushing out.

If the engine oil pressure drops below 0.49 x 100 kPa during operation, the Low Oil Pressure indicator illuminates on the controller, and "Oil Pressure Low Switch" appear on the Operation Display, and the engine will be automatically stopped. If this occurs, check the engine oil level and add engine oil until it reaches the maximum level.

< Note >

- This Low Oil Pressure indicator cannot detect oil deterioration. Change the engine oil periodically. (Refer to section "8-1. Checking Engine Oil".)

(2) High Coolant Temperature



CAUTION: BURNS



- Do not open the radiator cap immediately after stopping the engine. Do 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.

If the coolant temperature rises above 115 °C during operation, the High Coolant Temperature indicators illuminate on the controller, and "Coolant Temp High Switch" appear on the Operation Display, and the engine will be automatically stopped. If this occurs, hot steam will gush out of the coolant sub-tank. Check the coolant sub-tank coolant level after the generator cools and add coolant to the coolant sub-tank if it is insufficient. (Refer to section "8-2. Checking Coolant".) If the coolant is at the specified amount, it is probable that the fan belt is loose or there is a coolant leak. Wait for the engine to cool and inspect for these problems.

< Note >

- The coolant temperature cannot be detected if the coolant level is excessively low. Always be sure to check the coolant level in the radiator coolant sub-tank before starting work.

(3) Air Filter Clogging

If the air cleaner element becomes clogged during operation, the Air Filter Clogging indicators illuminate on the controller, and "Air Filter Clogging" appear on the Operation Display. If it is appeared, immediately stop the engine and clean or replace the air cleaner element. (Refer to section "10. Inspection/Maintenance (3) Air Filter Element Cleaning/Replacement".)

(4) Overload Pre-Caution

If the output current exceeds around 80% of the rated current, the Overload indicators illuminate on the controller, and "Over Load Pre-Caution" appear on the Operation Display. Use this generator in a range that does not exceed the rated current while the Overload indicators is illuminating. The Overload indicators turns off when the output current drops below 80% of the rated current.

< Note >

- When the output current reaches the rated current, "Over Current Immediate Warning" is displayed on the Operation Display and output to the load side is cut.

(5) Fail to Start

If the engine fails to start for three times in succession, "Fail to Start" is displayed on Operation Display. If that happens, turn the Power Switch to the OFF position, and inspect the generator. (Refer to section "12. Troubleshooting")

(6) Water in Fuel

If the liquid stored in the water separator exceeds approximately 110 ml during operation, "Water in Fuel" appear on the Operation Display. If it illuminates, immediately stop the engine and drain the liquid stored in the water separator. (Refer to section "10. Inspection/Maintenance (4) Draining Liquid in Water Separator".)

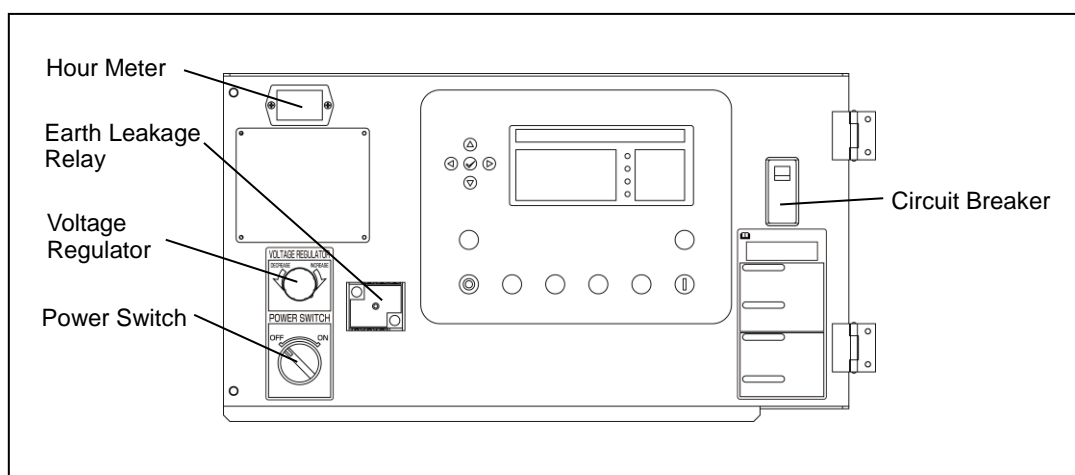
(7) Charge Alt Failure

"Charge Alt Failure" appear on the Operation Display when charging is not possible during operation. If charging is not possible and the battery voltage drops below 8 V, the ENGINE warning indicator also lights up and the engine automatically stops. If this occurs, contact the authorized distributor where the generator was purchased.

(8) Fuel Level Low

If the amount of fuel is small, "Fuel Level Low" appear on the Operation Display, and the engine will be automatically stopped. Check if there is a sufficient amount of fuel and add fuel insufficient.

5-3. Meters and Switches



Meters

(1) Hour Meter

Displays the operating time. Use this as a reference for managing periodic inspection interval.

< Note >

- EngineRunTime of controller and HourMeter value may not be matched. In that case, you check the HourMeter time.

Switches

(1) Power Switch

This is the main Power Switch of the generator.

When the Power Switch turned to OFF position, the engine is stopped.

< Note >

- If there is no operation for about 6 minutes while the engine is stopped, it will shift sleep mode to reduce battery consumption. Once it shift to sleep mode, the display of the Operation Display will disappear. To exit sleep mode, press any button on the controller.
- If the engine is not started for a long time when the Power Switch is ON position, the battery will deteriorate.

(2) Circuit Breaker

This switch is for transmitting electrical power to the load side. Turn to ON position to output voltage to the output terminals. Output to the load side is cut off when there is a short circuit or overload on the load side.

(3) 3-Phase Earth Leakage Relay

When current leak occurs, it trips to stop power transmission to load.

< Note >

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

Voltage Regulator

(1) Voltage Regulator

This dial is for regulating voltage output by the generator. Turn the dial clockwise to increase the voltage and counterclockwise to decrease it.

5-4. Frequency change



WARNING : ELECTRIC SHOCK



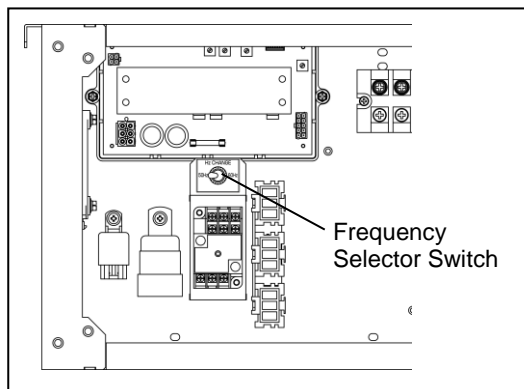
- Always turn all the breakers OFF, place the Power Switch in the OFF position and stop the engine.



CAUTION : PROPERTY DAMAGE

- When changing the frequency, be sure to change both the Frequency Selector Switch and Controller settings.

- 1 Loosen the two screws to open the operation panel.
- 2 Change the Frequency Selector Switch if the frequency in the area where using this generator changes.
- 3 Close the operation panel to tighten two screws.
- 4 Turn the Power Switch to ON position.
- 5 Press the Stop Mode Button and "✓" button together to enter the editor display.
- 6 Press the "⬅" button or the "➡" button to select the Alt Config.
- 7 Press the "⬆" button or the "⬇" button to select the Default Config and press the "✓" button.
- 8 Press the "⬆" button or the "⬇" button, select the same frequency as in step 2 and press the "✓" button.
- 9 Press and hold the "✓" button to save settings.



< Note >

- Check that no loads are connected before using the frequency selector switch.
- Be sure to select "50Hz 400V" or "60Hz 440V". Contact distributor if you want to use "50Hz 200V" or "60Hz 220V".
- This switch is set to 50Hz when shipped from the factory.

5-5. Fuel Piping Switch (3Way Fuel Valve)

⚠ CAUTION : FIRE

- Always make sure that the Power Switch is OFF position when working on piping.
- Always be sure to wipe up any spilled fuel.
- After working on the piping, check that there is no fuel leakage.

Change the 3-way fuel valve to switch to supply fuel from the external tank. In that case, the internal fuel tank is not used.

(1) If using the internal fuel tank

The 3-way fuel valve turned to the “A” side when the generator is shipped from the factory.

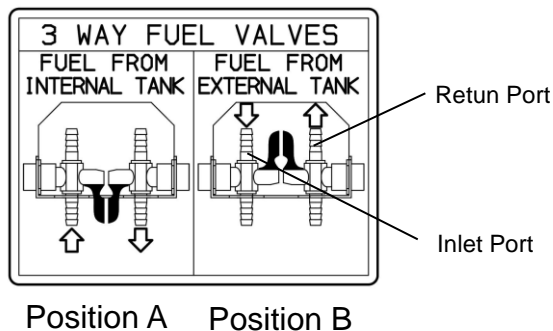
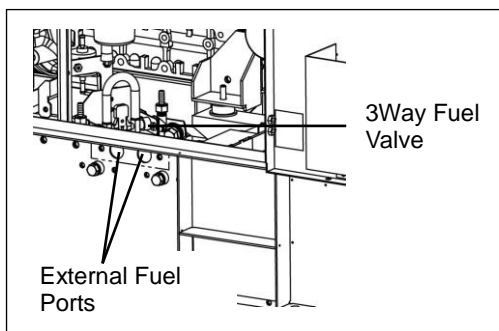
< Note >

- When disconnecting piping from the external tank, turn the lever to the “A” side, and attach the connecting hose to the external tank fuel inlet/return.

(2) If using an external fuel tank

Connect hoses from the external fuel tank to the external fuel inlet and the external fuel return. Change the lever of the 3way fuel valve to the “B” side to supply fuel from the external tank.

(Refer to “9-5. Connecting an External Fuel Tank” for corresponding procedures.)



6. Transporting/Installing

6-1. Transport Procedures

⚠ WARNING : INJURY

- Do not lift up the unit using tie down. Use of such could result in the generator falling.
- No persons should ever be under a lifted generator.

⚠ CAUTION : INJURY

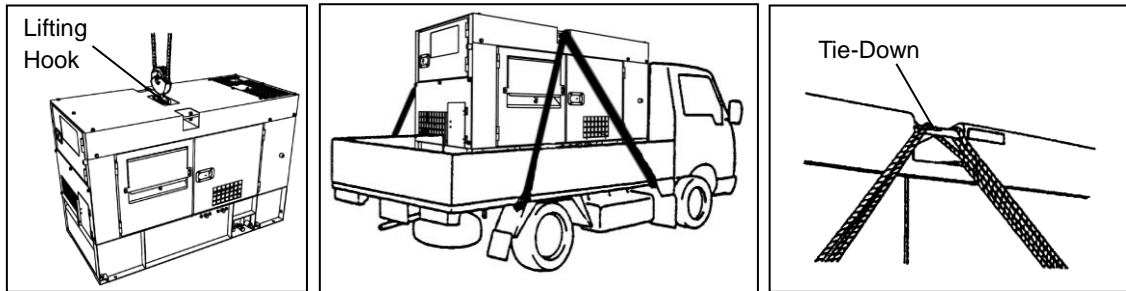
- Always be sure to use lifting hooks when lifting up the generator, and slowly lift it straight up.
- Personnel performing lifting work must wear protective gears such as helmets, safety shoes and gloves.
- Do not move the generator during operation.

(1) Lifting Procedures

Always be sure to use lifting hooks when lifting up the generator, and slowly lift it straight up.

(2) Transport

When transporting this generator, tie rope to the left and right tie downs, and securely fix the generator.



< Note >

- Handle this generator with great care when raising, lowering and transporting. Rough handling of generator can result in damage or malfunction.

6-2. Installation Procedures

⚠ WARNING : SUFFOCATION FROM EXHAUST FUME

- 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 pedestrians or buildings.

⚠ 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 1 m or more from walls or other hindrances, and on a level surface.
- Remove the wood ties if using anchors to secure the generator.
- Do not connect the generator output to indoor wiring.

- If installing this generator, set up barriers or fencing completely around the boundary line of the construction area and take measures to prevent persons not involved in the construction from entering the area.
- Position this generator on a hard, flat and leveled surface.
- Position this generator 1 m or more from walls or other hindrances so that the operation panel door and side-plate and check doors are accessible for internal inspection/maintenance.

< Note >

- This generator is manufactured presupposing that it will be installed on a flat, hard and leveled surface. Accordingly, care must be taken as using under any other installation conditions can result in a fault or malfunction.
- Do not place any objects where they will interfere with the radiator or muffler exhaust ports. Objects interfering with these ports will result in reduced engine output, overheating, and electrical component fault/malfunction.
- Operating the equipment in dusty or excessively salty location can result in a clogged radiator or overheating resulting in malfunction/fault or reduced insulation of electrical components. Be sure to thoroughly inspect and perform maintenance if using in such locations.

7. Load Connections

7-1. Load Cable Selection

CAUTION : PROPERTY DAMAGE

- 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.

Select cable for use that has sufficient thickness and an allowable current possible for use, giving consideration to the distance from the generator to the equipment using the generator.

< Note >

- Select cable with a thickness that ensures that the voltage drop across the cable will be within 5% of the rated voltage.

■ Load Cable Selection Tables

(Ex.) If used voltage is 440V and voltage drops by 22 V.

3-phase: Cabtyre cables

(Unit: AWG)

Length Current	30 m or less	61 m	91 m	122 m	152 m	183 m
20 A	12	12	12	12	12	12
25 A	12	12	12	12	12	10
30 A	12	12	12	12	10	10
35 A	12	12	12	10	10	8
40 A	12	12	12	10	10	8

(Unit: mm²)

Length Current	50 m or less	75 m	100 m	125 m	150 m	200 m
20 A	3.5	3.5	3.5	3.5	3.5	3.5
25 A	3.5	3.5	3.5	3.5	3.5	5.5
30 A	3.5	3.5	3.5	3.5	5.5	5.5
35 A	3.5	3.5	3.5	5.5	5.5	8
40 A	3.5	3.5	3.5	5.5	5.5	8

7-2. Connecting Load Cables

WARNING : ELECTRIC SHOCK

- 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.
- Close the output terminal cover before operating.
- Do not touch the generator if the generator or casing or your body becomes wet during operation.

CAUTION : FIRE

- Do not connect the generator output to indoor wiring.

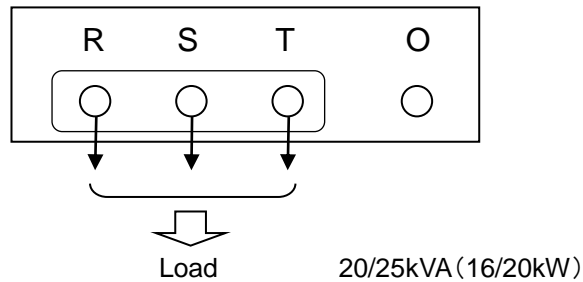
< Note >

- When connecting a load, check that the generator output setting, output terminal connection position, and load power source are all matching.
- If using the O terminal, be careful that the currents of each phase are uniform.
- Use proper tools when connecting a load to sufficiently tighten the connection. Failure to sufficiently tighten the connection will result in cable burnout.

(1) 3-Phase Output Terminal

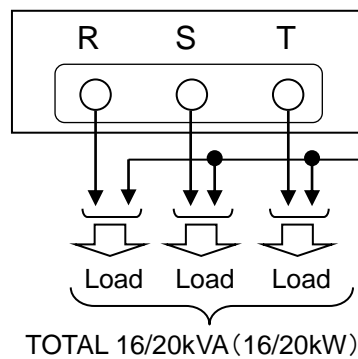
■ For 3-phase load:

- Terminal voltage is 400/440 V [200/220 V] (50/60Hz).
- * The values in brackets are for when set to 200/220V.



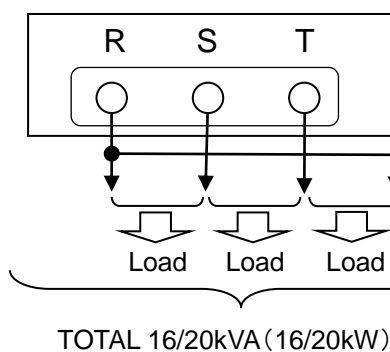
■ For 1-phase load:

- Terminal voltage is 230/254 V [115/127 V] (50/60Hz).
- * The values in brackets are for when set to 200/220V.



■ For 1-phase load:

- Terminal voltage is 400/440 V [200/220 V] (50/60Hz).
- * The values in brackets are for when set to 200/220V.



Total output capacity

Unit	3-phase load	1-phase load		Total
	R-S-T	R-O,S-O,T-O	R-S,S-T,T-R	
kVA	20/25	6.7/8.3	11.5/14.4	20/25
kW	16/20	6.7/8.3	11.5/14.4	16/20

7-3. Earth Leakage Relay 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 bonnet grounding terminal should be grounded to the earth.
- Grounding should be made after the engine is stopped.
- Whenever the Earth leakage relay is activated, you should always repair the leaking place first of all.

The generator is provided with the earth leakage breaker relay 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 the earth leakage relay ;

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

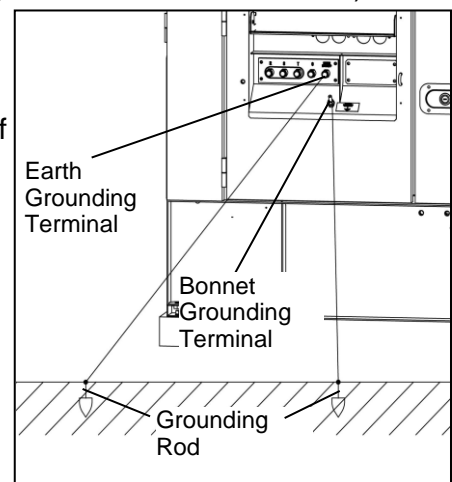
(1) Grounding Work

The qualified electrician should perform the grounding of the following 3 points(500Ω or below).

- The Bonnet grounding terminal of the generator.
- The Earth leakage 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 gineeringsection.



(2) Operation Check

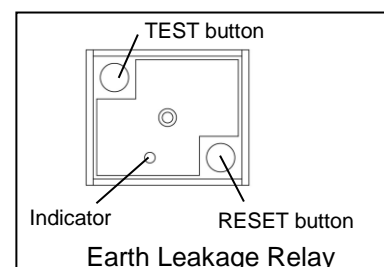
⚠ WARNING : ELECTRIC SHOCK

- Before turning the circuit breaker to ON position, ensure that the breaker or the switch of loads are positioned to OFF. Operate the circuit breaker, well-communicating with the electrician by the load side.

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

● Actuation test of the Earth Leakage Relay and Breaker

1. Ensure that the breaker and the switches of loads are positioned to OFF.
2. Ensure that the circuit breaker positioned to OFF. (Refer to "4-2.Operation Panel")
3. Following the procedure in 9-1, Initial Startup / Pre-Check, start an engine.
4. Turn breaker to ON.
5. Push the TEST button on Earth Leakage Relay. When the button is pushed, the earth leakage indicator turns ON and circuit breakers are positioned in the middle between ON and OFF positions simultaneously, the device works normally.



- 6 Push the reset button. The earth leakage indicator turns OFF subsequently.
- 7 Turn (Push-down) the circuit breaker (lever) to OFF position.

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) Earth leakage Relay has activated

If the earth leakage breaker relay has been activated, the earth leakage indicator turns ON, and the breaker (lever) is tripped and positioned in the middle between ON and OFF.

When this occurs, stop the engine and repair the location of earth leakage before restarting operation. (In the case the earth leakage indicating lamp does not turn to ON simultaneously, the cause is Over-Loaded.)

8. Pre-Operation Inspection

⚠ WARNING : ELECTRIC SHOCK/INJURY

- 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 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.

⚠ CAUTION : BURNS

- Do not touch the engine and surrounding components immediately after stopping the engine as they are still extremely hot.

⚠ CAUTION : FIRE

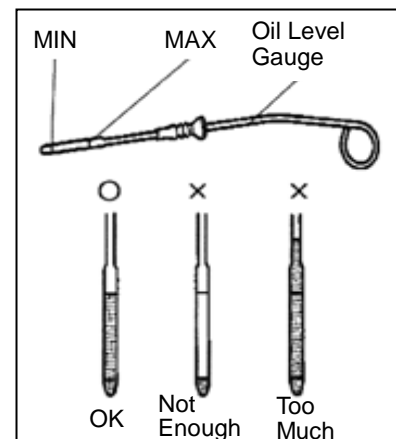
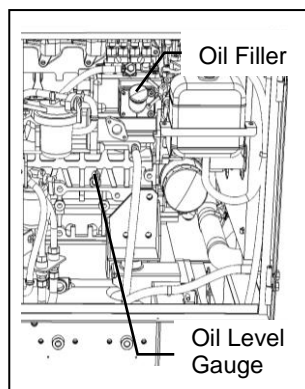
- Always be sure to wipe up any spilled fuel or oil.

8-1. Checking Engine Oil

To check the engine oil, keep the equipment in leveled position, remove the oil level gauge and wipe so that no oil remains, and then re-insert the dipstick fully. Prior to starting the engine, make sure to fill the engine oil through the oil filler until it reaches the MAX line.

< Note >

- Wait approximately five minutes or more after stopping the engine or adding oil before checking the oil level again.
- An accurate oil level reading cannot be obtained if the generator is not placed in leveled position.
- Do not overfill with oil to avoid engine damage.



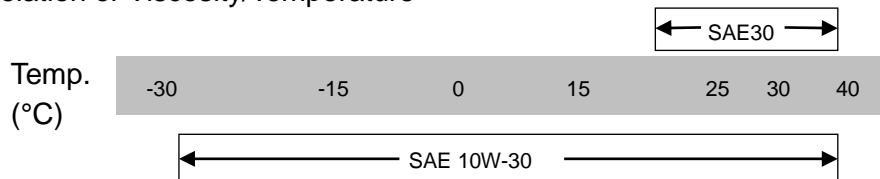
(1) Types of Engine Oil

Use only API service-type CF class.

(2) Engine Oil Viscosity

Use a diesel engine oil with an appropriate viscosity corresponding to the ambient temperature (refer to the table).

○ Relation of Viscosity/Temperature



(3) Engine Oil Replacement Amount

(Unit: L)

Total Lubrication Oil Amount
9.7 (0.3)

Value in parenthesis is the filter capacity.

8-2. Checking Coolant

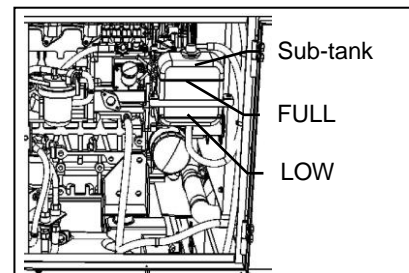
⚠ CAUTION : BURNS

- Do not open the radiator cap immediately after stopping the engine. Do so will result in steam gushing out.
- Hot steam gushes out from the coolant sub-tank if the generator overheats. Do not touch the coolant sub-tank.

Check that the sub-tank coolant level is in between FULL and LOW. If the sub-tank coolant is lower than the LOW level, add coolant to the sub-tank and radiator.

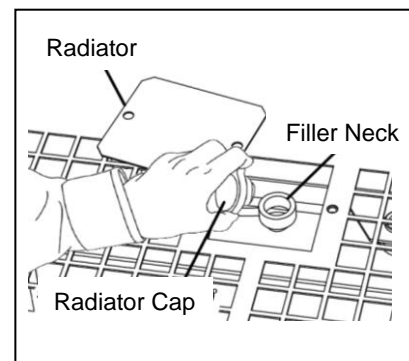
(1) Filling the Sub-Tank

- 1 Remove the sub-tank cap.
- 2 Fill the sub-tank with coolant until it reaches the FULL line.
- 3 Re-attach the cap.



(2) Filling the Radiator

- 1 Remove the radiator plate.
- 2 Remove the radiator cap.
- 3 Fill with coolant through the filler neck until the radiator is full.
- 4 Re-attach and tighten the radiator cap.
- 5 Attach the radiator plate.



< Note >

- Be sure to only use long life coolant (LLC) for the aluminum radiator. The coolant should be mixed with good quality softened tap water, and contain anti-freezing and anti-rust components.
- The LLC mix ratio is 30% liquid and 70% water when shipped from the factory. (Isuzu Genuine LLC: Besco LLC Super-Type E)
- Be sure to use the same LLC in the sub-tank.
- The mix ratio should be changed according to the ambient temperature but should remain between 30 and 50%.
- Do not increase the LLC mixture ratio unless necessary. Doing so could result in overheating or another fault/malfunction.

- When replenishing LLC, be sure to use the same brand as the LLC remaining in the radiator and sub-tank.
- Never use an LLC mixture of two different brands.
- Be sure to completely change every 2 years or 2,000 hours or less.
- LLC is a toxic substance. Wear rubber gloves and other protective wear when handling.
- If someone mistakenly ingests LLC, induce vomiting immediately and seek medical care.
- If LLC gets on skin or clothing, wash with water immediately.
- LLC is flammable. Store in a location where flame is prohibited and it cannot be accessed by children.
- Engine coolant could leak if the radiator is not completely tightened or there is a gap in the seating face. Always be sure to securely tighten the radiator cap.
- Do not add engine coolant past the FULL level line of the coolant sub-tank.

(3) Coolant Amount

(Unit: L)

Total Coolant Amount
9.7(1.1)

Value in parenthesis is the sub-tank capacity.

8-3. Checking the Fuel

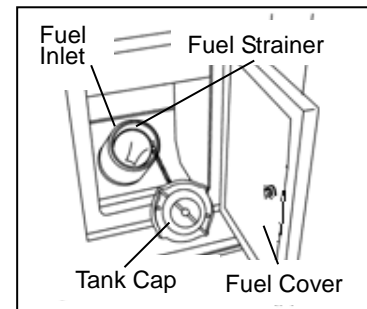
⚠ CAUTION : FIRE

- 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.

Check if there is a sufficient amount of fuel and add fuel if insufficient. The engine fuel level on the controller will only display the fuel level for the internal fuel tank. Be sure to close the cap tightly after refueling.

< Note >

- Use Diesel fuel, ASTM D975 No.2-D in the event ambient temperature reaches down to -5°C .
- The fuel supply pump, injectors and other parts of the fuel system and engine can be damaged if any fuel or fuel additives are used other than those specifically recommended by the engine manufacturer.
- Always be sure to use the fuel strainer attached to the fuel inlet.
- Carefully add fuel until the tank is full.
- Always be sure to wipe up any spilled fuel.



8-4. Checking for Fuel, Oil and Coolant Leaks

⚠ CAUTION : FIRE

- If fuel or oil is leaking, repair the leaking location before operating.

Open the check door and check for fuel, oil and coolant leakage from fuel piping connections and similar locations.

8-5. Checking the Battery

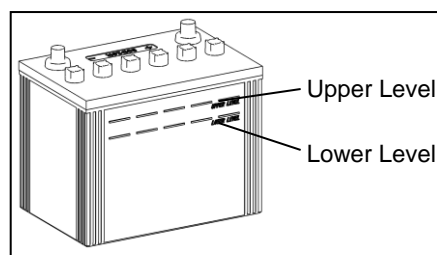
⚠ CAUTION : EYE/SKIN INJURY

- 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 large amount of 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.

- 1 Check the fluid level, and add distilled water until it reaches the upper level when the fluid level is near the lower level.
- 2 Check the terminals for looseness and tighten properly.



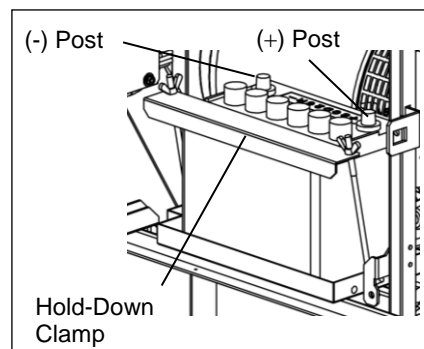
< Note >

- It is necessary to recharge the battery when the specific gravity of the battery fluid is 1.23 or less. Request the authorized distributor where the generator was purchased to recharge the battery.

■ Replacing the Battery

- 1 Remove the battery negative (-) cable.
(Always be sure to remove the negative (-) side first.)
- 2 Remove the battery hold-down clamp.
- 3 Remove the battery positive (+) cable.
- 4 Remove the battery.

- * Install the battery by performing the above procedures in the reverse order.
(First connect the positive (+) cable of the replaced battery.)



9. Operating Procedures

9-1. Initial Startup/Pre-Check

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 : INJURY

- Always be sure to check that the breaker 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 before operating the breaker.
- 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.

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 1 m or more from walls or other hindrances, and on a level surface.

CAUTION : INJURY

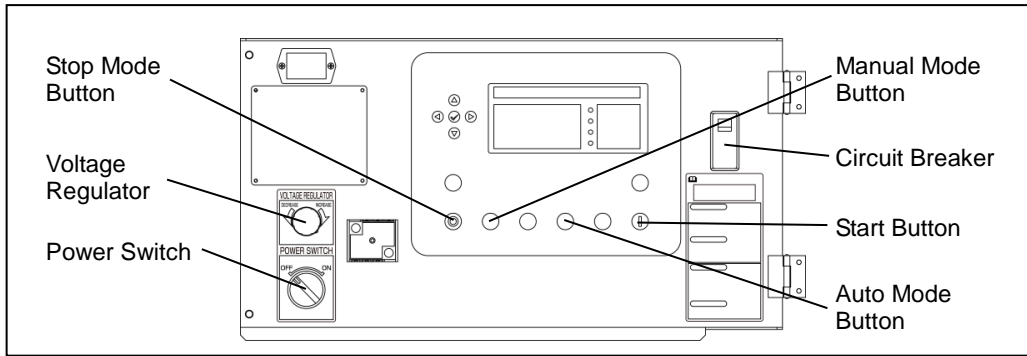
- Do not operate the generator if it has been modified or any parts have been removed.
- Position the generator on a level stable surface so that it cannot slide or move in any manner.
- Before starting operation, always be sure to turn off all switches of equipment being used and breaker to OFF.
- Check that the surrounding area is safe, before setting to Auto Mode.
- Be sure to communicate between operators mutually before attempting to set "Auto Mode" to avoid mechanical trouble and incidents.

CAUTION : PROPERTY DAMAGE

- When changing the frequency, be sure to change both the Frequency Selector Switch and Controller settings.

< Note >

- Check that the surrounding area is safe before starting the engine.
- When there are multiple workers who are working together, they must mutually signal each other before starting the engine.
- Do not use in an area with high temperature or humidity, or an area with a large amount of dust.
- Do not open any doors during operation. Operating with door open can negatively affect cooling effect, resulting in an equipment malfunction.
- Use ear protection if the level of noise is high. Failure to do so could result in hearing damage.
- Please be careful about a strong wind and the opening and shutting of the door. If a door is opened suddenly and is closed, and a finger might be sandwiched.



(1) Manual Start

1. Set frequency. (Refer to section "5-4. Frequency change")
2. Turn the Circuit Breaker to OFF position.
3. Turn the Power Switch to ON position.

< Note >

- When turn the Power Switch to the ON position, the "Low Oil Pressure" and "High Coolant Temperature" warning indicators will illuminate, but all indicator lights will turn off when the engine is started.

4. Press the Manual Mode Button.
5. Press the Start Button to start the engine.

< Note >

- When the Start Button is pressed, preheating is automatically performed, but preheating is skipped when the coolant temperature not less than 30 degrees.
- Pre-heating time depends on the coolant temperature.
- Automatically repeats "Crank Attempt" and "Crank Rest" up to 3 times.
- Please keep in mind that the muffler may emit some smoke when engine is started.

6. Let engine idles for approximately for five minutes.
7. Adjust the voltage regulator dial to the specified voltage.

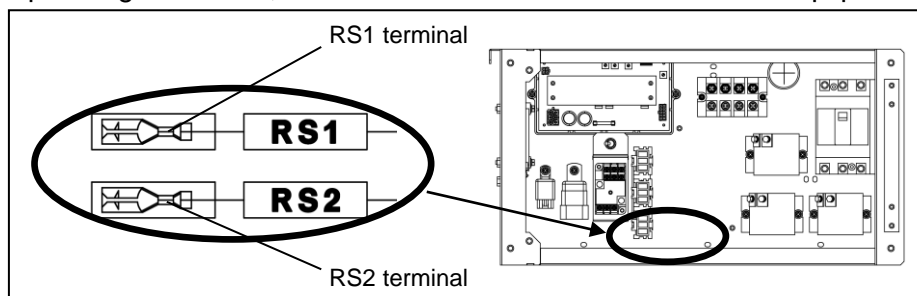
50Hz Operation	400V [200V]
60Hz Operation	440V [220V]

* The values in brackets are for when set to 200/220V.

8. Turn on the Circuit Breaker to activate power supply.

(2) Auto Start

This generator has an Auto Start function that automatically start the engine by closing the RS1/RS2 terminals. The engine stops automatically when the RS1/RS2 terminals open. Before operating Auto Start, connect the RS1/RS2 terminals to the equipment.



< Note >

- When the RS1/RS2 terminals to close and press the Auto Mode Button, the engine will start up immediately.

1. Set frequency. (Refer to section "5-4. Frequency change")
2. Turn the Circuit Breaker to OFF position.
3. Turn the Power Switch to ON position.

< Note >

- When turn the Power Switch to the ON position, the “Low Oil Pressure” and “High Coolant Temperature” warning indicators will illuminate, but all indicator lights will turn off when the engine is started.

4. Press the Manual Mode Button.
5. Press the Start Button to start the engine.
6. Adjust voltage using the voltage regulator dial.

50Hz Operation	400V [200V]
60Hz Operation	440V [220V]

* The values in brackets are for when set to 200/220V.

7. Press the Stop Mode Button to shut off the engine.
8. Press the Auto Mode Button.
9. Turn the Circuit Breaker to ON position.
10. The engine starts when the RS1/RS2 terminals close.

< Note >

- Please keep in mind that the muffler may emit some smoke when engine is started.
- The battery is always drained while Auto Mode is selected. Start the engine at least once a week to charge the battery.

9-2. Procedures during Operation

(1) Checks after Startup

- Make sure that the controller and hour meter are in normal status. (Refer to section “5. Equipment”.)
- 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.

■ Restarting after stopping due to running out of fuel.

The fuel filter includes an automatic air-bleeding device. Restart the engine according to the following procedures even if the engine has stopped due to running out of fuel.

1. Add fuel to the generator.
2. Press and hold the Lamp Test / Air Bleeding Button for approximately 2 seconds to automatically starts air-bleeding device. Air-bleeding device runs for up to 4 minutes.
3. Press the Manual Mode Button.
4. Press the Start Button, and confirm the engine has started properly.

< Note >

- Start the engine and check that the air is completely bled from the system. If air bleeding is not complete, engine rotation will not be stable. In that case, repeat the air bleeding operation.

9-3. Stopping Operation



CAUTION : BURNS



- Do not touch the engine and surrounding components immediately after stopping the engine as they are still extremely hot.

(1) Manual Start

- 1 Turn the switches and breakers on the load side to OFF position.
- 2 Turn the breaker on the operation panel to OFF position.
- 3 The engine cools down for approximately 3 minutes.
- 4 Press the Stop Mode Button to shut off the engine.
- 5 Turn the Power Switch to OFF position.

< Note >

- Set the Power Switch to OFF position if the generator will not be used for a prolonged period. If you leave the Power Switch in the OFF position, the standby current may drain the battery.

(2) Auto Start

- 1 The engine stops when the RS1/RS2 terminals open.
- 2 Turn the breaker on the operation panel to OFF position.
- 3 Press the Stop Mode Button to shut off the engine.
- 4 Turn the Power Switch to OFF position.

< Note >

- Set the Power Switch to OFF position if the generator will not be used for a prolonged period. If you leave the Power Switch in the OFF position, the standby current may drain the battery.

9-4. Protective Functions



WARNING : INJURY



- 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.



CAUTION : BURNS



- 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 indicator lamps or the Operation Display. Check the fault location when the engine is automatically stopped or an indicator lamp illuminates to stop the engine or appear warning on the Operation Display.

Protection Feature List

No.	Action Abnormality	Earth Leakage Relay Active	Breaker Trip	Engine Automatic Shutdown	Warning Indicator Flash	Controller display	Cause
1	Low Oil Pressure	-	-	○	○	○	Activate due to low oil pressure in the engine Default : 0.49 × 100 kPa
2	High Coolant Temperature	-	-	○	○	○	Activates due to high water temperature in the engine. Default : 115°C
3	Air Filter Clogging	-	-	-	○	○	The element is clogged making it necessary to clean or replace the element.
4	Overload	-	○	-	○	○	Activates in overload Flashes when at approx. 80% of rated output. Load rejection when the rated output is exceeded.
5	Fail to Start	-	-	-	-	○	The engine fails to start three times
6	Water In Fuel	-	-	-	-	○	When the water separator is full of water.
7	Charge Alt Failure	-	-	○	-	○	Activates in battery charge Impossible
8	Fuel Level Low	-	-	○	-	○	The amount of fuel is small
9	Current Leakage	○	○	-	-	-	Activates in current leakage

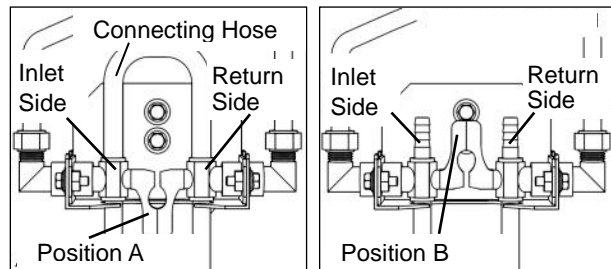
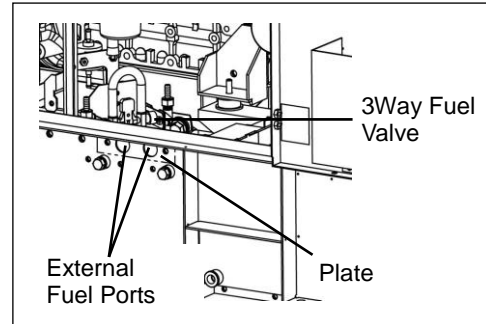
* ○ indicates the automatic activation.

9-5. Connecting with External Fuel Tank

⚠ CAUTION : FIRE

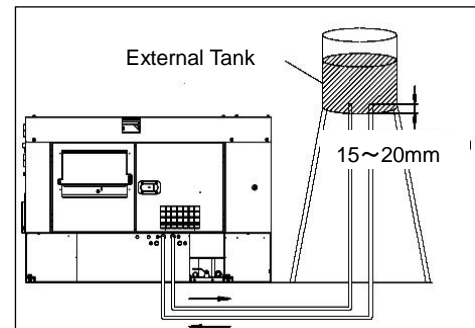
- Always make sure that the Power Switch is OFF position when working on piping.
- Always be sure to wipe up any spilled fuel.
- After working on the piping, check that there is no fuel leakage.

- 1 Turn the 3way fuel valve lever to the “A” side.(Position for using the internal tank.)
- 2 Remove the connecting hose from the 3way fuel valve.
- 3 Remove the plate.
- 4 Pass the fuel hose from the external tank through the external fuel ports and connect to the external tank fuel inlet/return of the 3way fuel valve.
- 5 Turn the 3way fuel valve lever to the “B” side.(Position for using the external tank.)
- 6 Bleed air from the external tank connecting hose. Fuel can be supplied from the external tank after completing the above procedures.



< Note >

- Protect the piping connecting the external fuel tank and this generator with corrugate tubing or similar in order to prevent interference between the generator internal parts and the external fuel ports.
- If using a hose for the piping, use oil-resistant hose with an internal diameter of 8 to 9 mm.
- Set the fuel level of the external fuel tank from 0 to 3 m from the underside of this generator. The fuel level of the external fuel tank being lower than this generator will result in poor engine operation or stoppage.
- Turn the 3way fuel valve lever to the “A” side in order to prevent fuel from flowing out from the external tank fuel inlet/return.
- Turn the lever completely as far as possible. If the lever is not completely pressed to either side, it might not be possible to supply fuel causing the engine to stop.
- Set the supply side so that it is 15 to 20 mm above the underside of the tank in order to prevent foreign material or water from being suctioned from inside the external fuel tank.
- Set the external fuel tank return side at the same height as the supply side in order to prevent poor engine operation due to air mixed in with the fuel.
- Refer to section “9-2 Procedures during Operation” for air bleeding.
- Some air may remain in hoses or pipes immediately after connecting the external fuel tank resulting in unstable engine speed and engine stoppage.
- Do not leave the generator unattended for unmanned operation until you have confirmed that the engine speed is stable.



10. Inspection/Maintenance



WARNING : ELECTRIC SHOCK/INJURY



- Do not touch output terminals or internal electric parts while the generator is operating.
- 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 lift up using tie downs. Use of such could result in the generator falling.
- No persons should ever be under a lifted generator.



CAUTION : FIRE



- Always be sure to wipe up any spilled fuel or oil.



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. Do so will result in steam gushing out.
- Hot steam gushes out from the coolant subtank if the generator overheats. Do not touch the coolant subtank.



CAUTION : INJURY

- Personnel performing lifting work must wear protective gears such as helmets, safety shoes and gloves.
- Always be sure to use lifting hooks when lifting up the generator, and slowly lift it straight up.

Perform periodic inspection and maintenance according to the following table in order to constantly maintain this generator in good working condition. Use the hour meter as a reference for the operating time.

< Note >

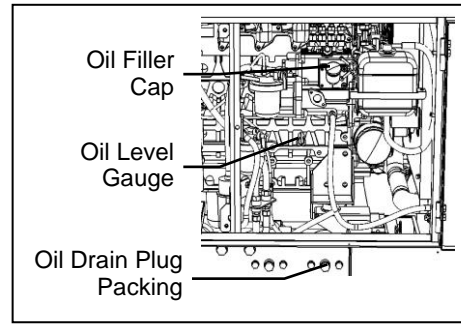
- All procedures except for pre-operation inspection should be performed by specialized technicians.
- Request authorized distributor where the generator was purchased to perform the procedures in the table with a “●”.
- Always be sure to use genuine parts or those indicated specifically for replacement parts.
- Use a container to catch fluid bled from this generator that is large enough to prevent the fluid from spilling on the ground.
Dispose of oil, fuel, coolant (LLC), filter, battery and other hazardous materials according to laws and regulations concerning industrial waste.
Contact authorized distributor where the generator was purchased if you have any inquiries regarding proper disposal.
- When check doors are open during maintenance, take measures so that unrelated personnel cannot accidentally come close to the generator. Close all doors and covers if you are going to be away from this generator.
- Please be careful about a strong wind and the opening and shutting of the door at the sloping place enough. When door is opened or closed suddenly, a finger might be sandwiched.

	Description	Daily	Every 100 hrs	Every 200 hrs	Every 450 hrs	Every 500 hrs	Every 800 hrs	Every 1500 hrs	Every 2000 hrs	Remarks	
Engine	Each parts (Clean/Tightening)	○									
	Engine oil (Check/Add)	○									
	Engine oil (Replace)			○ 1 st time at 50hrs							
	Oil filter (Replace)			○ 1 st time at 50hrs							
	Coolant (Check/Add)	○									
	Coolant (Replace/Radiator Flush)								○ or 2years		
	Exhaust color (Check)	○									
	Water separator (Check/Drain excess water and sediments)	○ (Check)	○ (Drain)								
	Fuel filter/element (Replace)				○ (Replace)						
	Fuel tank (Drain water)			○							
	Water separator and Gauze filter (Clean)				○						
	Fuel tank (Clean)				●						
	Check for leaks (Fuel/Oil/Coolant)	○									
	Fuel/Cooling Water/Oil Hoses and Anti-Vibration Rubber (Replace)									● Every 2 years	
	Air cleaner element (Clean)		○ 1 st time at 50hrs								
	Air cleaner element (Replace)	once in 6times cleaning or 1year									
	Battery fluid level (Check/Add)	○									
Battery gravity (Check)		○ or 1years									
Fan belt tension (Check)		○ 1 st time at 50hrs									
Fan belt (Replace)						● or 2years					
Engine	Radiator and fins (Clean)				●						
	Valve clearance (Check/Adjust)						●				
	Fuel injector (Check)							●			
	Elimination of excessive carbon in the exhaust system by extensive light load			○							
Generator	Indicators, Gauges Alarms (Check)	○									
	Operation check of Earth Leakage Relay	○									
	Grounding resistance check	○									
	Insulation test			○							

(1) Engine Oil Replacement

First Time	50 hours
Thereafter	Every 200 hours

- 1 Remove the oil filler cap.
- 2 After removing the oil drain plug and packing (a rubber seal is attached), drain the engine oil.
- 3 After the oil has been drained, reinsert the oil drain plug with new packing (a rubber seal is attached).
- 4 Add oil through the oil filler until it is at the maximum level while checking the oil level using the oil level gauge.
- 5 Attach the oil filler cap.



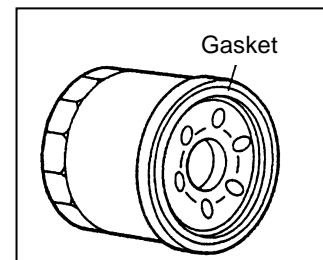
< Note >

- Refer to section “8-1. Checking Engine Oil” for engine oil replacement amounts and types.
- Replace the packing of the oil drain plug with new packing each time the oil is replaced.
- Packing part no.: 6C090-58961 (Kubota part no.)
- After reinserting the oil drain plug and shortly after starting the engine, be sure to always check that there is no oil leakage.

(2) Replacing the Oil Filter

First Time	50 hours
Thereafter	Every 200 hours

- 1 Drain the engine oil. (Refer to section “(1) Engine Oil Replacement”.)
- 2 Remove the oil filter using a filter wrench.
- 3 Spread a thin layer of oil on a new oil filter gasket.
- 4 Thread the oil filter by hand, and turn by hand (do not use a filter wrench) from when the gasket contacts the seal surface until it is securely tightened.
- 5 Add engine oil to the generator.
- 6 Shortly after starting the engine, always be sure to check that there is no oil leaking from the seal surface.



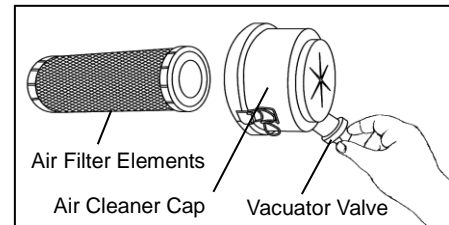
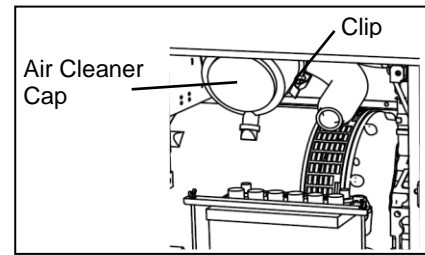
< Note >

- Request the authorized distributor where the generator was purchased to perform this procedure if you do not have a filter wrench.
- Oil filter part no.: 16414-32432 (Kubota part no.)

(3) Air Filter Element Cleaning/Replacement

First Time (clean)	50 hours
Thereafter (clean)	100 hours
Replace	once in 6 times cleaning or Every 1 year

1. Remove the air cleaner clips and cleaner cap.
2. Remove the element.
3. Clean or replace the element. Replace by performing the above procedures in reverse order.



< Note >

- Always be sure to turn the cleaner cap in the direction indicated by the arrow.
- Replace the elements earlier if using in an excessively dusty location.
- Do not add oil as this generator uses a dry element.
- Clear foreign material by pinching the vacuator valve once a week in normal operating conditions or daily if operating in a location that is excessively dirty or dusty. Wipe away any dirt or moisture that has adhered to the parts.
- Never touch the elements for any reason except cleaning.
- Element part no.: R1401-42271 (Kubota part no.)

■ Cleaning the air filter element

If dry dust is adhering : Blow compressed air from inside the element.

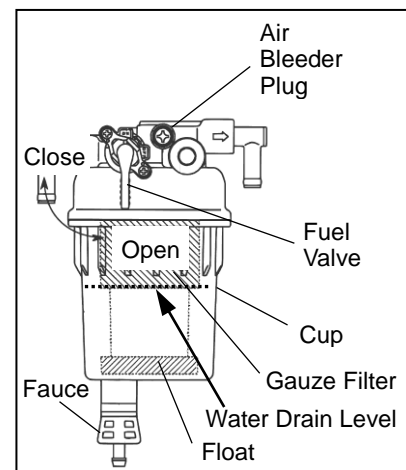
If carbon or oil is adhering : Replace with new parts.

(4) Draining Water from the Water Separator

Check	Daily
Clean	Every 100 hours

Drain water when the float (red) inside the cup is at the water draining position.

1. Close the fuel valve.
2. Loosen the faucet and then loosen the air bleeder plug.
3. After water has been drained, tighten the faucet and air bleeder plug.
4. If foreign material is adhering to the gauze filter in the cup, remove the cup, float and gauze filter, and clean by blowing compressed air from the inside of the gauze filter.
5. Reassemble the gauze filter, cup and float to their original locations.



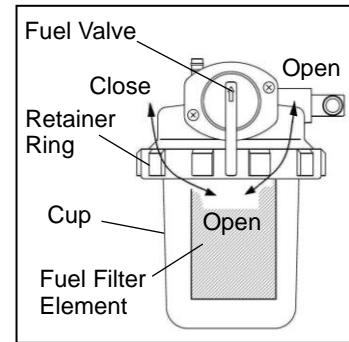
< Note >

- When attaching the cup, check that there is no foreign material adhering to the O-ring.
- After attaching, open the fuel valve, and be sure to always start the engine and check that there is no fuel leakage.
- If water is accumulate in the cup, draining water from the fuel tank. (Refer to section “(6) Draining Water from the Fuel Tank”.)

(5) Fuel Filter Cleaning/Replacement

Replace	Every 450 hours
---------	-----------------

- 1 Close the fuel valve.
- 2 Turn the retainer ring to the left and remove the cup and element.
- 3 Remove any water or foreign material from the cup and clean the element using compressed air. (Or replace the element.)
- 4 Install in the reverse order of removal.



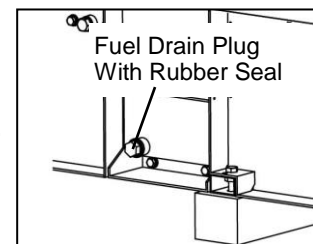
< Note >

- When attaching the cup, check that there is no foreign material adhering to the O-ring.
- After attaching, open the fuel valve, and be sure to always start the engine and check that there is no fuel leakage.
- Be sure to wipe away any fuel that has spilled out of the piping when removing the filter.
- Fuel filter element part no.:15521-43161 (Kubota part no.)
- You can install a large fuel filter to this generator. To install, first remove the standard fuel filter from the stay and install the large fuel filter.
- Large fuel filter part no.:1K947-43012 (Kubota part no.)
- Large fuel filter element part no.:1K947-43171 (Kubota part no.)

(6) Draining Water from the Fuel Tank

Drain Water	Every 200 hours
-------------	-----------------

- 1 Remove the fuel drain plug and packing (with rubber seal).
- 2 After the water has been drained, reinsert the fuel drain plug with new packing (with rubber seal).



< Note >

- Replace the packing of the fuel drain plug with new packing each time the water is drained.
- Packing part no.: V106-000110
- After reinserting the fuel drain plug, be sure to always check that there is no fuel leakage.

(7) Checking the Fan Belt

First Time	50 hours
Thereafter	Every 100 hours
Replace	Every 2year or Every 500 hours

① Fan Belt Tension

Press your finger against the middle of the fan belt.
(approx. 98N) If the slack is 7 to 9 mm, the tension is normal.

② Fan Belt Condition

Check the fan belt for damage and replace if any damage or other fault is found.

③ Fan Belt Adjustment

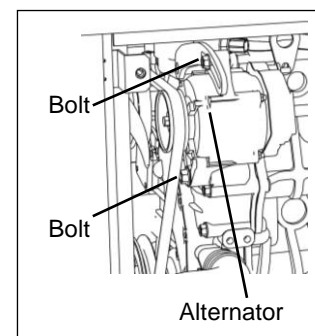
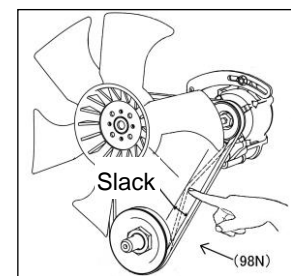
- 1 Loosen the alternator installation bolts, pull the alternator out and adjust the fan belt tension.
- 2 Securely tighten the alternator installation bolts.
- 3 Check that the fan belt tension is correct.

④ Replacing the Fan Belt

Request the authorized distributor where the generator was purchased to replace the fan belt.

< Note >

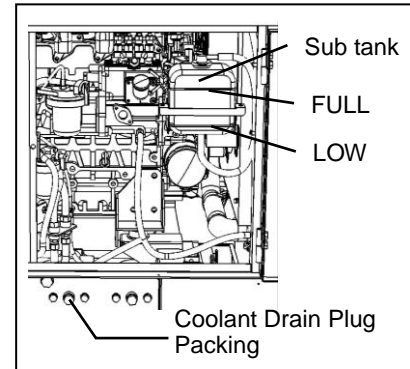
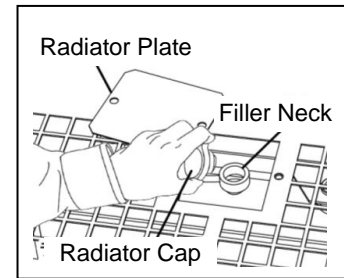
- Use of a loose or damaged fan belt could result in overheating or insufficient charging.
- Do not operate the generator if fan guard has been removed.



(8) Coolant Replacement

Replace	Every 2 years or Every 2000 hours
---------	-----------------------------------

- 1 Remove the radiator plate.
- 2 Remove the radiator cap.
- 3 Remove the coolant drain plug and packing.
- 4 After the coolant has been drained, reinsert the coolant drain plug with new packing.
- 5 Remove the subtank and flush the coolant from the subtank.
- 6 Reattach the subtank to its original position and fill with coolant until it reaches the FULL level.
- 7 Fill the radiator with coolant until it reaches the filler neck.
- 8 Re-attach and tighten the radiator cap.
- 9 Attach the radiator plate.



< Note >

- Refer to section “8-2. Checking Coolant” for coolant information.
- Replace the packing of the coolant drain plug with new packing each time the coolant is changed.
- Packing part no.: 6C090-58961 (Kubota part no.)
- After reinserting the coolant drain plug and shortly after starting the engine, be sure to always check that there is no coolant leakage.

(9) Elimination of excessive carbon in the exhaust system by extensive light load

⚠ 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 : INJURY

- 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.
- Close all doors and lock them during operation.

⚠ 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 1 m or more from walls or other hindrances, and on a level surface .

⚠ CAUTION : INJURY

- Do not operate the generator if it has been modified or any parts have been removed.
- 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 being used and all breakers to OFF.

Clean	Every 200 hours
-------	-----------------

Accumulation of carbon (soot, unburned fuel) in the exhaust system could cause engine output loss and/or engine fault. To eliminate soot and unburned fuel, run the unit at more than 70% of the rated output for about half an hour, until the exhaust gas become mostly colorless. The carbon will accumulate when the unit runs at less than 30% of rated output.

< Note >

- When the unit operates at rated power, accumulation of carbon in the exhaust pipe line and muffler might be lead to back fire incident. Do not bring flammable items that are highly combustible near the generator.

11. Long-Term Storage

⚠ WARNING : INJURY 

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

⚠ CAUTION : FIRE 

- Always be sure to wipe up any spilled fuel or oil.
- Allow the generator to cool before covering with the protective cover.

⚠ CAUTION : BURNS 

- Do not touch the engine and surrounding components immediately after stopping the engine as they are still extremely hot.

(1) Storage Procedures

Perform the following maintenance procedures before storing this generator if it is not going to be used for two months or more.

- 1 Remove the battery.
(Refer to section “**8-7. Checking the Battery Replacing the Battery**”.)
- 2 Replace the engine oil.
(Refer to section “**10. Inspection/Maintenance (1) Engine Oil Replacement**”.)
- 3 Drain the fuel from the fuel tank and filter.
(Refer to section “**10. Inspection/Maintenance (5) Fuel Filter Cleaning/Replacement**”.)
(Refer to section “**10. Inspection/Maintenance (6) Draining Water from the Fuel Tank**”.)
- 4 Turn the Power Switch to OFF position and store in a secure location.
- 5 Clean up all generator components, and store in a dry and dust-free location. Also cover when storing so that rain cannot enter through the suction or exhaust ports.

< Note >

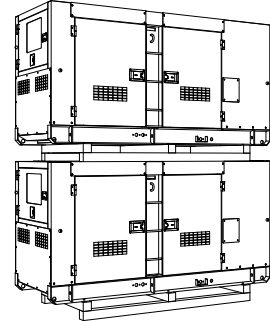
- Adjust the fluid of the removed battery to the appropriate level and recharge approximately every month.

(2) Double-Stacking Storage Procedures

WARNING : INJURY

Always be sure to observe the following items when double stacking this generator in a warehouse or similar location.

- Check that the Top cover of this generator is not dented, and that bolts are not loosen or missing.
- Set in a location with a flat hard floor capable of withstanding the double-stacking weight.
- Always be sure to use lifting hooks when lifting this generator.
- Insert wood ties of the same size and that are wider than this generator between each generator, and set another generator on top of the ties.
- Never stack more than two levels, and do not set a generator on top that is larger in weight/size than that on the bottom.
- Do not operate the generator when it is double stacked.



12. Troubleshooting

WARNING : ELECTRIC SHOCK/INJURY

- Do not touch output terminals or internal electric parts while the generator is operating.
- 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.

CAUTION : FIRE

- Never allow flame to come close to the generator.

CAUTION : BURNS

- Do not touch the engine and surrounding components immediately after stopping the engine as they are still extremely hot.

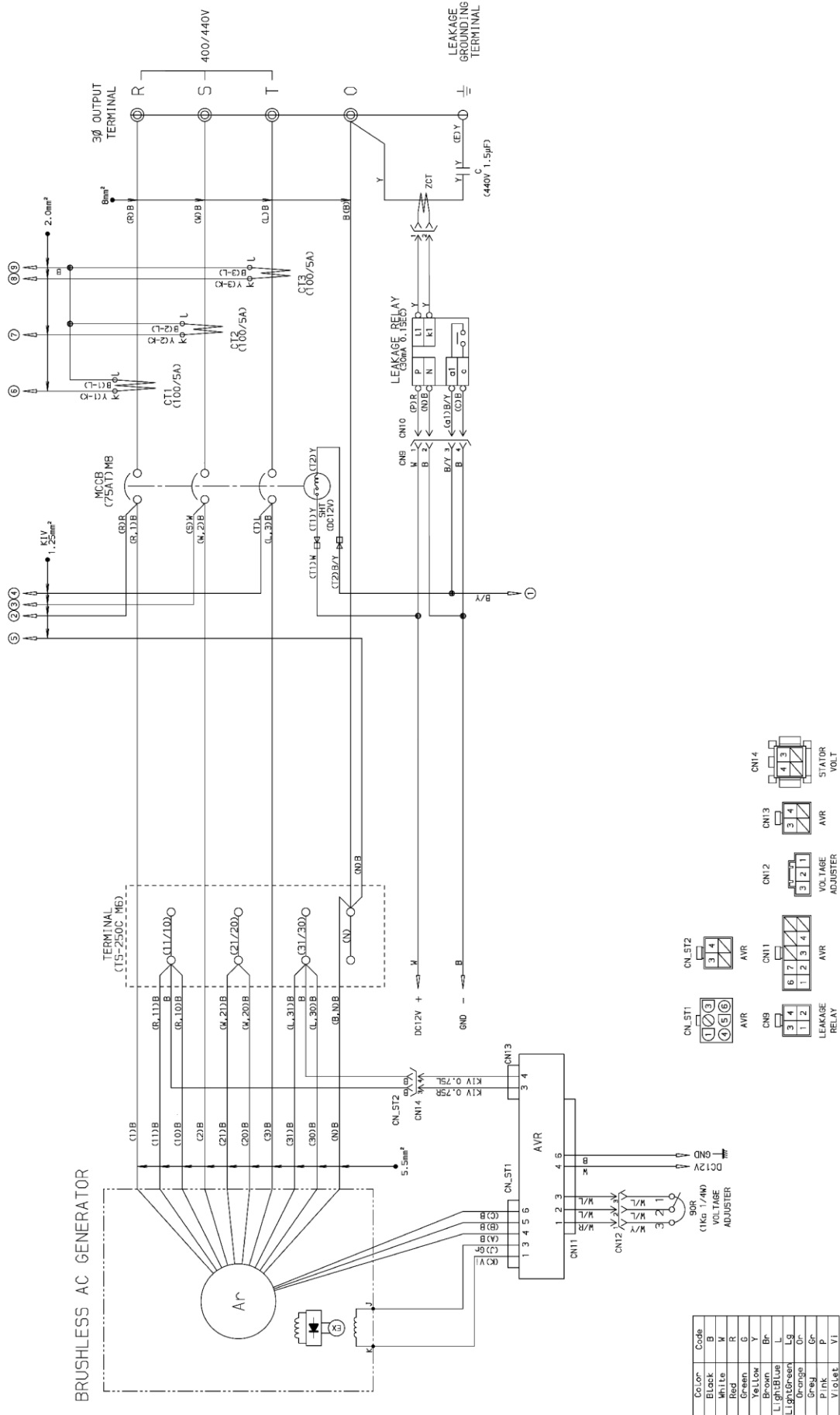
Inspect this generator when operation is poor to determine the fault/malfunction. Request the authorized distributor where the generator was purchased to perform maintenance if you cannot find any faults/malfunctions during inspection.

Problem	Suspected cause	Action
Engine does not start	<ul 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. Relay is defective. 6. Starter motor is defective. 7. ECU(Engine Controller) or controller is defective. 8. Battery Isolator is OFF. 	<ul style="list-style-type: none"> 1. Check / battery liquid/ or Charge. 2. Change battery. 3. Fix / Tighten terminal. 4. Clean terminal. 5. Ask our distributor to repair. 6. Ask our distributor to repair. 7. Ask our distributor to repair. 8. Ask our distributor to repair.
	<ul 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. 9. Fuel pump defective. 	<ul 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. 9-1. Check/Change fuse. 9-2. Check/Change fuel pump.
	<ul style="list-style-type: none"> 1. Fuel is frozen. 2. Water in fuel line is frozen. 3. Pre-heater is defective. 	<ul 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	<ul 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. 8. Emergency operation/Fault detection. 	<ul 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. 8. Ask our distributor to repair.
Engine oil pressure is low	<ul 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. 	<ul 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	<ul 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. 	<ul 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	<ul style="list-style-type: none"> 1. Air filter element is clogged. 2. Fuel injection nozzle is defective. 3. Improper fuel is used. 	<ul style="list-style-type: none"> 1. Check/Change air filter element. 2. Ask our distributor to repair. 3. Change to clean fuel.

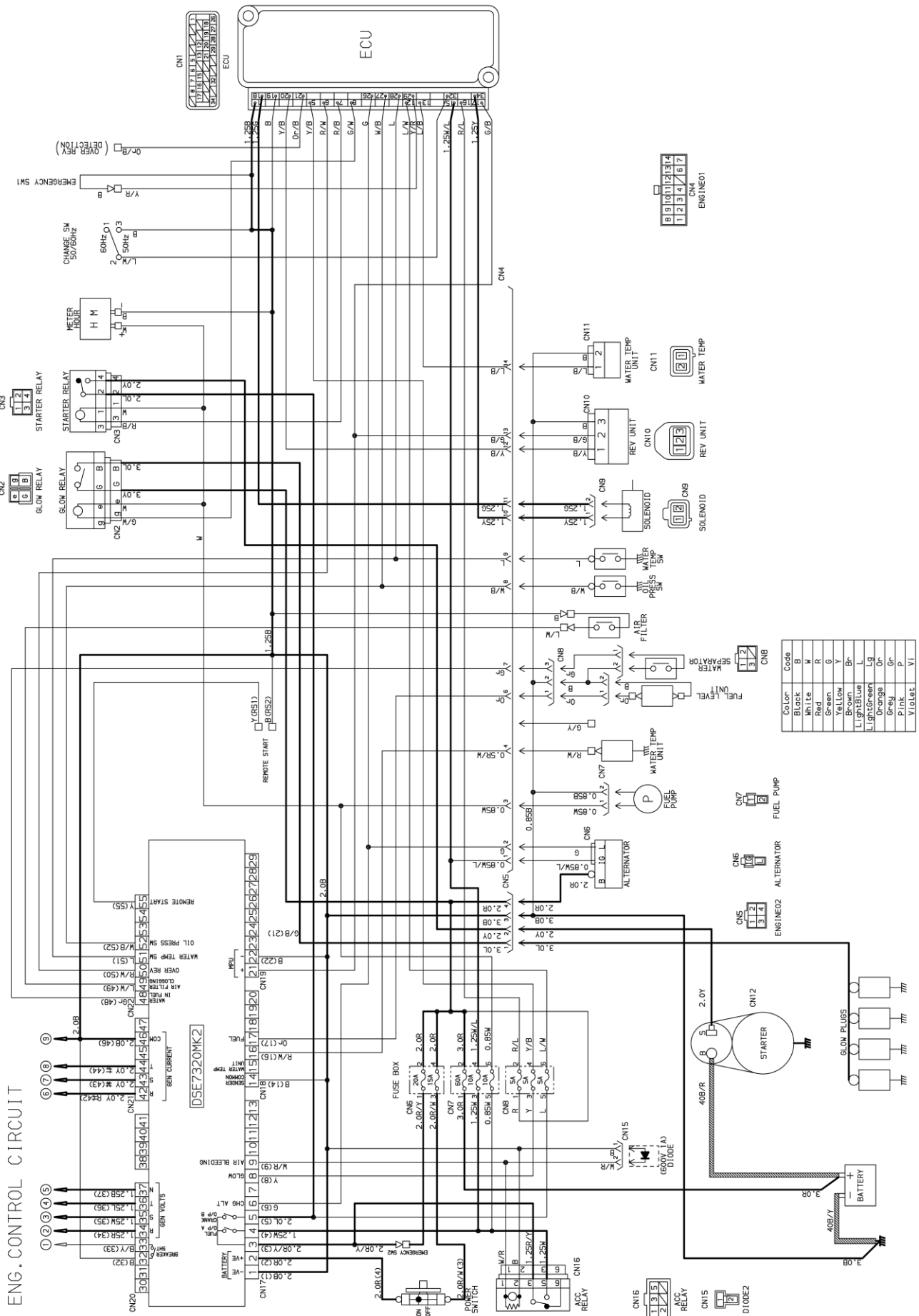
Problem	Suspected cause	Action
White smoke comes out from muffler	<ol style="list-style-type: none"> 1. Too much or too little oil to cylinder. 2. Water is interfused in fuel line. 3. Fuel injection nozzle is defective. 4. Coolant temperature is too low. 5. Engine thermostat is defective. 	<ol style="list-style-type: 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 operation. 	<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. Replace AVR fuse.
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 exceeded 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.
The voltage drops drastically when connecting to load	<ol style="list-style-type: none"> 1. AVR is defective. 2. Unbalanced loads sharing to each terminal. 3. The current of the used equipment exceeds the rated current. Loads total exceeds the rated current. 4. Over load. 5. AVR protective device operation. 6. Frequency selector is wrong setting. 	<ol style="list-style-type: none"> 1. Ask our distributor to repair. 2. Balance the loads sharing to each terminal. 3. Change to a device with an available capacity. 4. Decrease the loads to meet the rated output. 5. Replace AVR fuse. 6. Set to proper frequency.
Cannot turn the breaker to ON	<ol style="list-style-type: none"> 1. The breaker positions at between ON and OFF. 2. Short circuit on the load. 3. Earth Leakage Relay operates. 	<ol style="list-style-type: none"> 1. Once turning the lever to OFF, turn it to ON. 2. Check the load circuit. 3. Repair the earth leakage location.
Controller does not turn on	<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 Charge. 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

(1) 400/440V



14. Engine Electrical Circuit Diagram



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