



OWNER'S AND OPERATOR'S MANUAL

Diesel Engine Generator

DGK36FS

Vertical, Water-Cooled 4-Cycle Diesel Engine

California Proposition 65

 **WARNING**

Breathing diesel engine exhaust exposes you to chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

- Always start and operate the engine in a well ventilated area.
- If in an enclosed area, vent the exhaust to the outside.
- Do not modify or tamper with the exhaust system.
- Do not idle the engine except as necessary.

For more information go to www.P65warnings.ca.gov/diesel.

 **WARNING**

Cancer and reproductive Harm-
www.P65Warnings.ca.gov

 **WARNING**

Batteries, battery posts, terminals and related accessories contain lead and lead compounds, and other chemicals known to the State of California to cause cancer and birth defects or other reproductive harm. WASH HANDS AFTER HANDLING.

 **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.


DGK36FS
X753-008 49 1
X753801-560 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 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 Instructions

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 the breaker 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 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.
- 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 insert a pin, wire or other metal object into the electrical outlet.

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 open the spill containment drain valve and drain off the 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 operation.
- 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 splash 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. 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.
- 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 indicator 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 lift slowly and vertically.
- Personnel performing lifting work must wear protective gear 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 to avoid any unexpected move when transporting by truck or other vehicle.

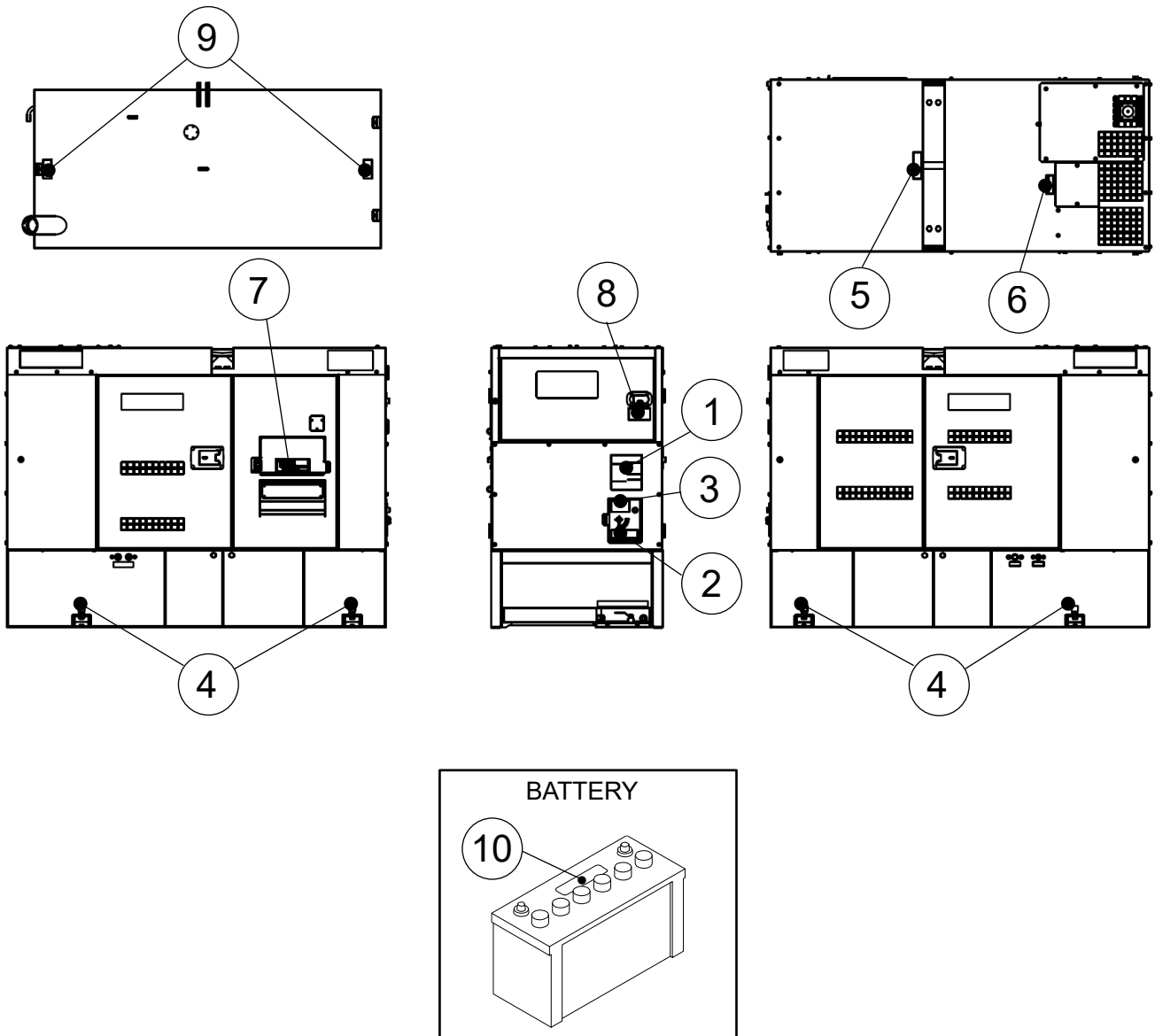
CAUTION : PROPERTY DAMAGE

- 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.

■ Danger/Warning/Caution Label Locations

If danger, 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 | Warnig/Caution | (Part no. :X505-007571) |
| ② | Warning: Fire | (Part no. :X505-007650) |
| ③ | EPA Regulation Complied Notice | (Part no. :X505-008400) |
| ④ | Spill containment bolts | (Part no. :M707-000380) |
| ⑤ | Warning: Injury | (Part no. :X505-007550) |
| ⑥ | Caution: GM SPEC LLC | (Part no. :X505-007840) |
| ⑦ | Warning: Electric shock | (Part no. :X564-000890) |
| ⑧ | Warning: Proposition 65 Generator | (Part no. :X505-010400) |
| ⑨ | Warning: Injury | (Part no. :X505-007820) |
| ⑩ | Warning: Proposition 65 Battery | (Part no. :X505-010410) |



2. Specifications

2-1. Specifications

Model		Unit		DGK36FS
Alternator	Generator Type	-		Revolving Field Brushless
	Rated Frequency	Hz		60
	Rated Output(Prime)	Single phase	kVA	36
			kW	36
	Standby Output	Single phase	kVA	40
			kW	40
	Rated Voltage	Single phase	V	120/240
	Rated Current	Single phase-120V	A	150 × 2
		Single phase-240V	A	150
	Power Factor	-		Single phase 1.0
	Insulation Class	-		F
Excitation	-		Self-Excitation (brushless)	
No. of Poles	-		4	
Engine	Type	-		Vertical Water-Cooled 4-Cycle Diesel
	Model(Manufacturer)	-		4LE2X(ISUZU)
	No. of Cylinders (Bore × Stroke)	(in./mm)		4(3.35x3.78/85x96)
	Continuous Rated Output	hp		59
	Rated Speed	rpm		1,800
	Displacement	cu.in./liters		133/2.179
	Combustion System	-		Direct Injection (Turbo-charged)
	Cooling Method	-		Water cooled
	Starting Method	-		Electric
	Fuel	-		No.2-D,S15 EPA regulation
	Lubricating Oil	-		API service-type CJ-4 class
	Fuel Tank Capacity	gal./liters		79/300
	Lubricant Volume	gal./liters		3.0/11.5(including filter 0.1/0.5)
	Cooling Water Volume	gal./liters		2.9/11(including sub-tank 0.4/1.5)
	Starting Motor Capacity	V-kW		12-2.0
	Charging Alternator Capacity	V-A		12-50
Battery Capacity	V-Ah		12-72	
Unit	Length	in./mm		83/2,100
	Width	in./mm		37/950
	Height	in./mm		61/1,550
	Dry Weight	lbs./kg		2,620/1,188
	Net Weight	lbs./kg		3,250/1,474

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: 5 to 104 °F (-15 to 40 °C)
- Relative humidity: 85% or less
- Altitude: 984 ft. (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

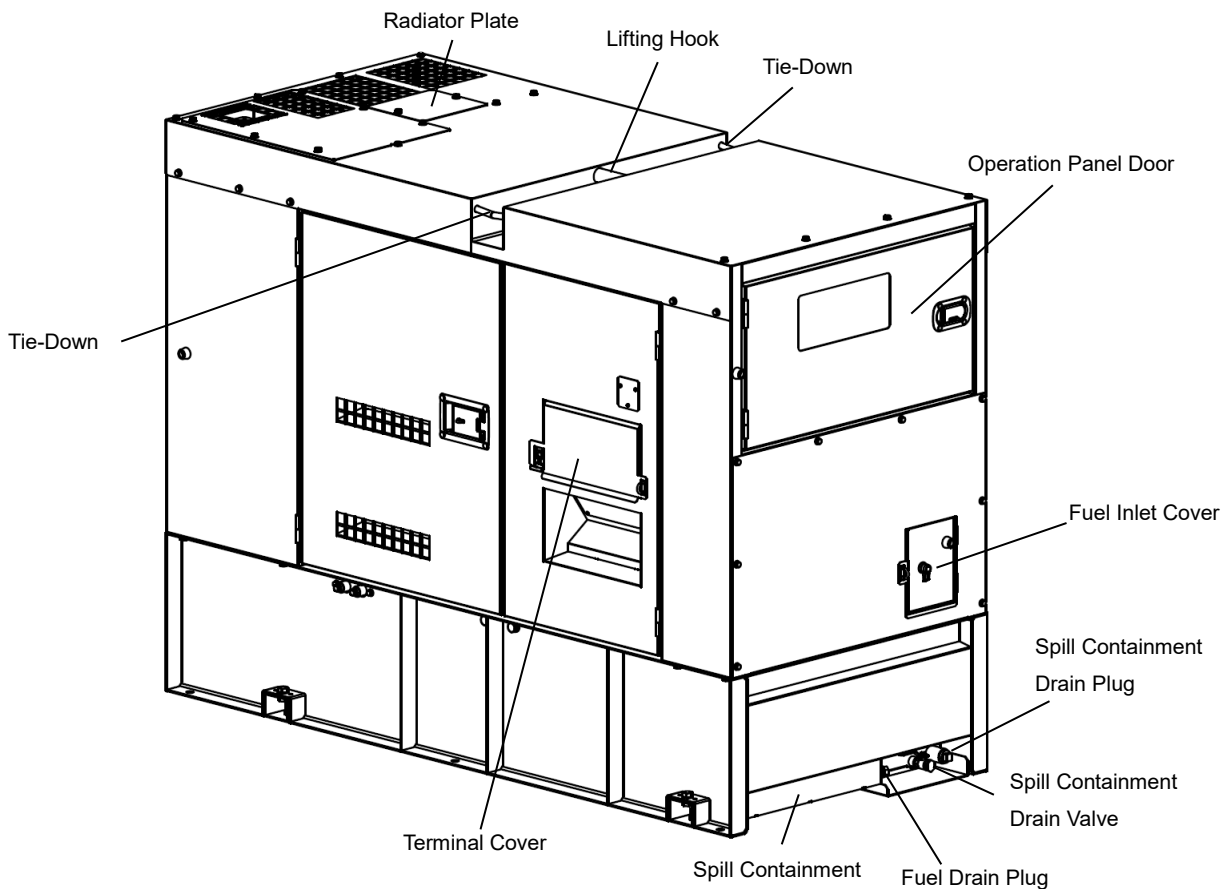


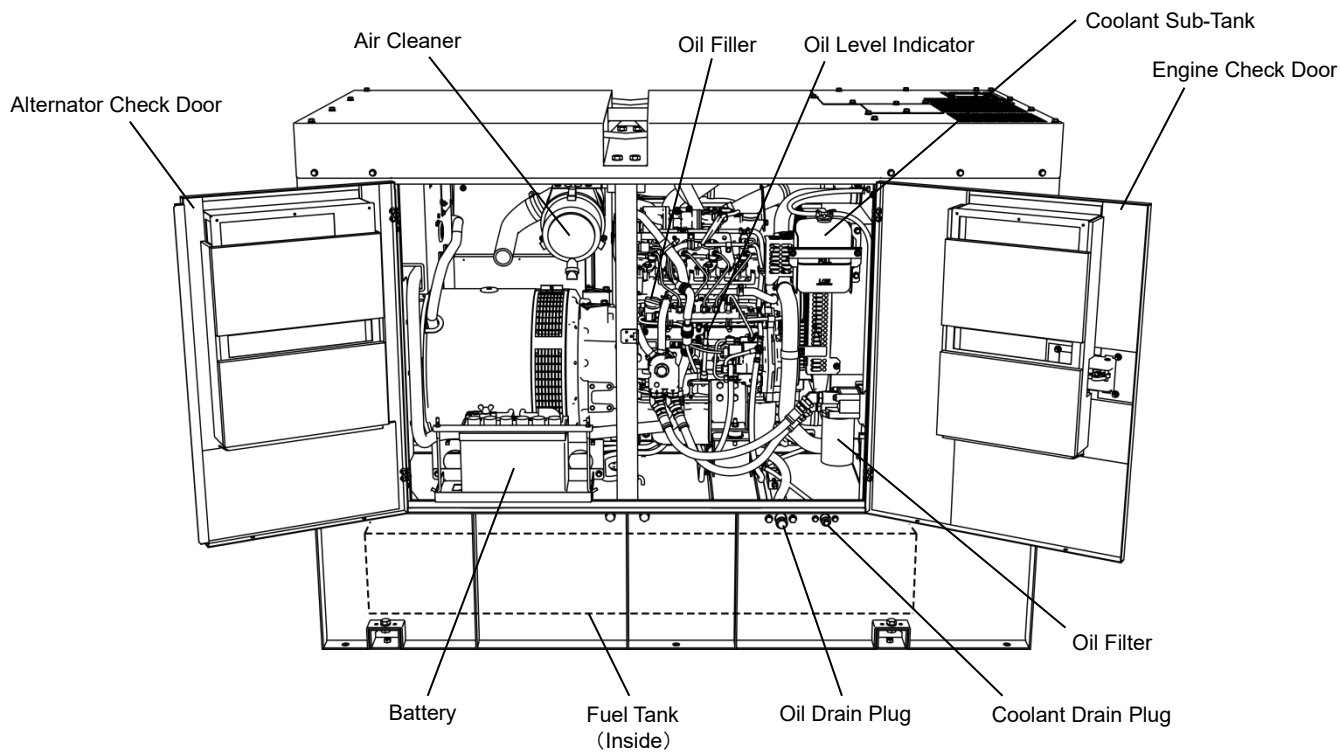
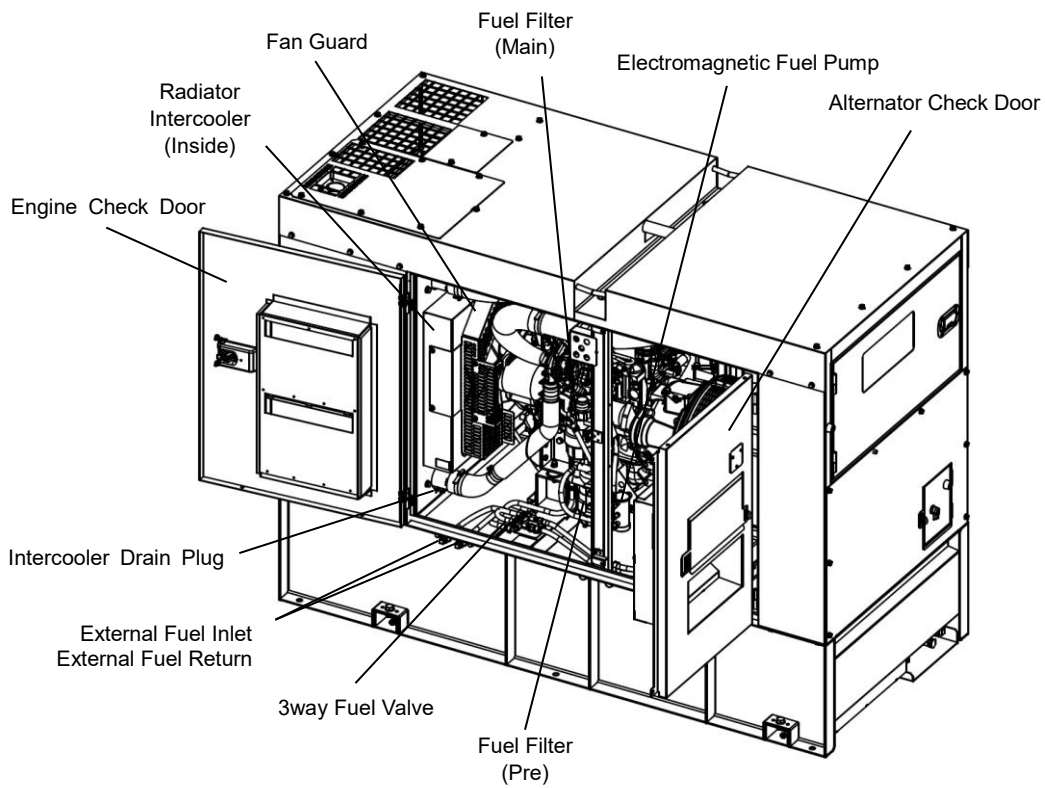
CAUTION : PROPERTY/SECONDARY DAMAGE

- 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

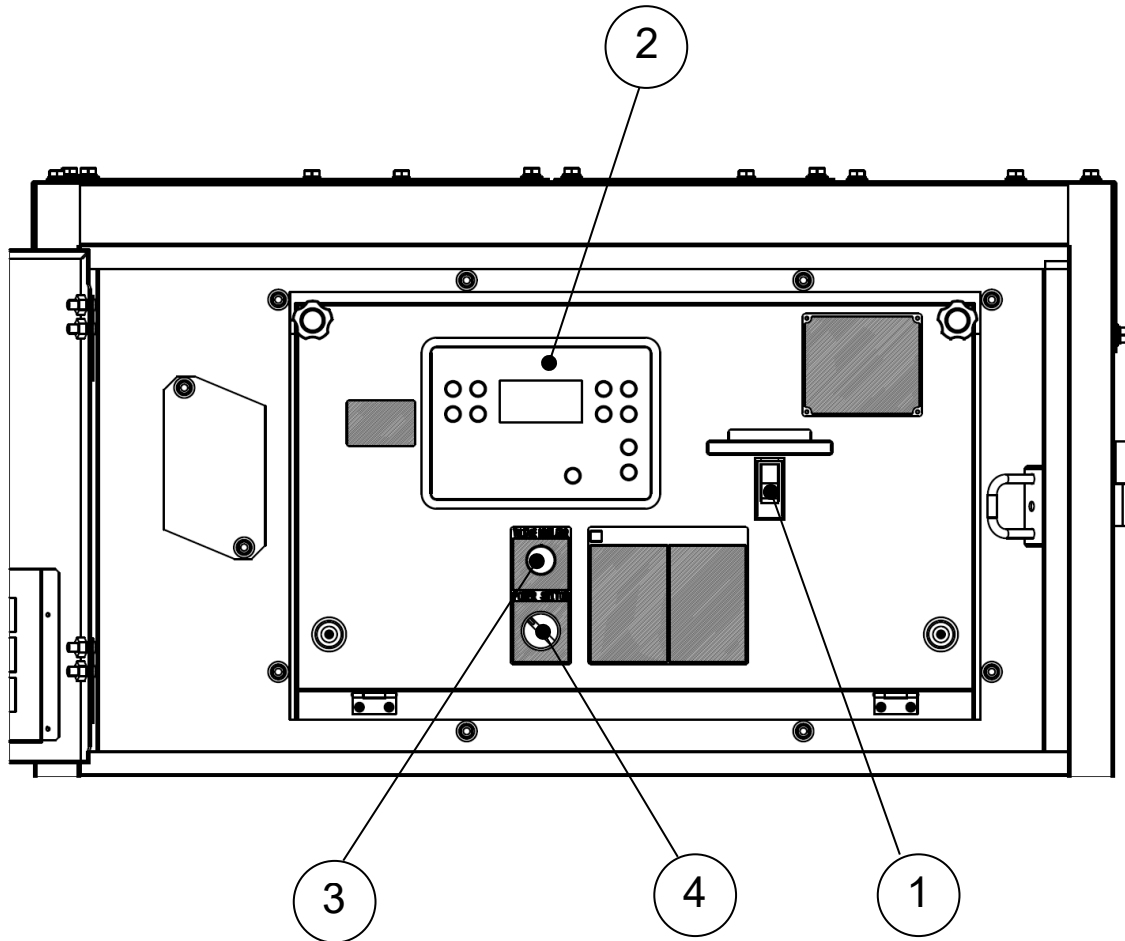




Accessories

Owner's and Operator's Manual	Product Warranty Manual	Engine Warranty Manual
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4-2. Operation Panel Configuration



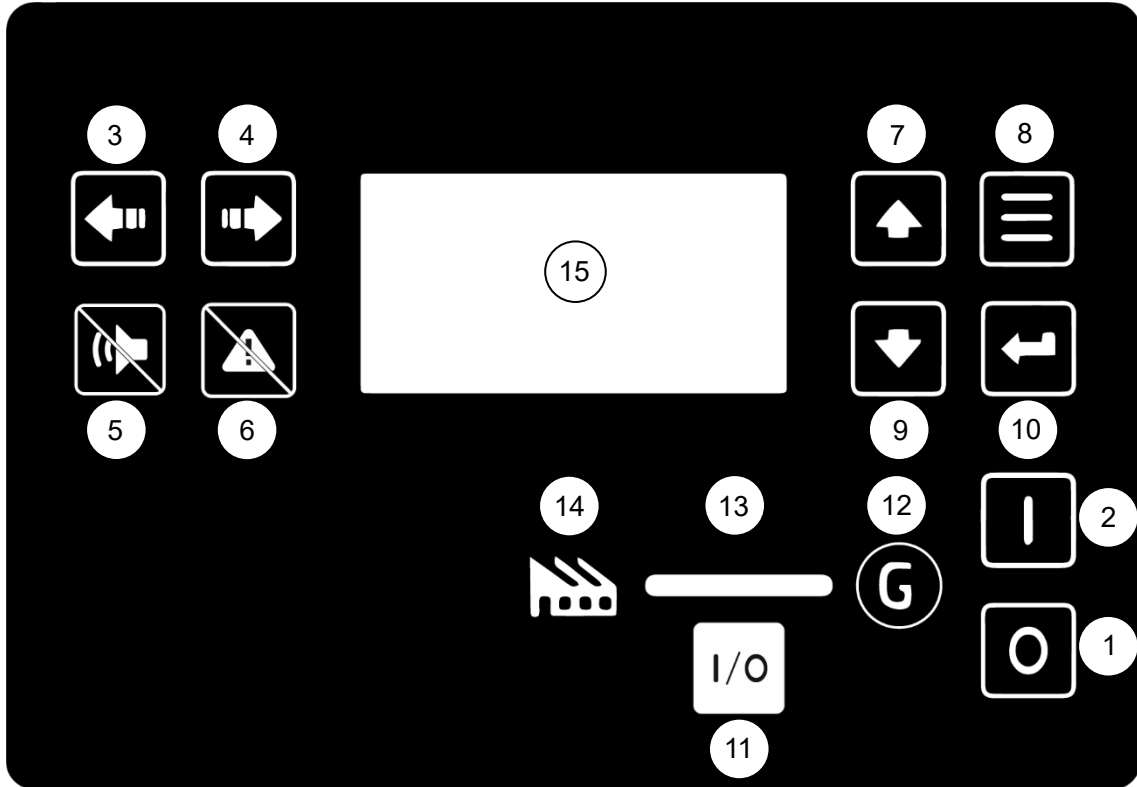
①	Circuit Breaker
②	Controller
③	Voltage Regulator
④	Power Switch

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 ON position, the status screen appears.(Refer to section “5-1.Controller (2)Operation Display”.)

(1) Front panel elements



① **STOP button**

Works in MAN mode only. Press this button to initiate the stop sequence of the gen-set.

② **START button**

Works in MAN mode only. 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 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 “screen”. Use PAGE button to switch over the pages.

(2) Operation Display

Use Up and Down button to move between measurement pages.

■ **Main Screen**

● **Operating Mode**

Selecting the operating mode is done through Left and Right buttons on the front panel.

Status Screen	Contents
OFF	No start the gen-set is possible
MAN	The engine can be started and stopped manually using the Start and Stop buttons
AUTO	Engine start/stop request is given by Remote start terminal

● **Engine state machine**

Status Screen	Contents
Init	Autotest during controller power on
Not ready	Gen-set is not ready to start
Prestart	Prestart sequence is in process
Cranking	Engine is cranking
Pause	Pause between start attempts
Running	Gen set is running
Stop	Stop
Shutdown	Shut-down is ready to run

- Breaker status
Not used.
- RH
Running hours.
- RPM
Engine speed.
- Current process timer
Process content and remaining execution time.

■ Measurement Screens

○ Generator

Status Screen	Contents
L1N (V)	U-N voltage
L2N (V)	W-N voltage
L1L2 (V)	U-W voltage
Generator Freq (Hz)	Frequency

○ Generator Current

Status Screen	Contents
L1 (A)	U phase current
L2 (A)	W phase current

○ Analog Inputs

Status Screen	Contents
Fuel Level (gal)	Fuel amount
BatteryVoltage (V)	Battery voltage

○ Binary Inputs

Status Screen	Contents
1 Remote Start/Stop	Remote start terminal is closed and the value is "1"
2 Terminal Cover Open	The value is "1" while the terminal cover is open
3 Spill Containment Fluid Level Check	If the spill containment is filled with liquid, the value is "1"
4 Air Filter Clogging Up	If the Air Filter is clogged, the value is "1"

○ Binary Outputs

Status Screen	Contents
1 BREAKER SHT	During BREAKER shunt, the value is "1"
2 ACC	During ACC output, the value is "1"
3 Starter	During cranking, the value is "1"
4 ECM Power	During ECM Power output, the value is "1"
7 OverSpeed	During OverSpeed, the value is "1"

○ Generator Power

Status Screen	Contents
L1 (kW), (PF), (kVA)	U-phase active power, power factor, apparent power
L2 (kW), (PF), (kVA)	U-phase active power, power factor, apparent power
Σ (kW), (PF), (kVA)	Total active power, power factor, apparent power

○ ECU Values

Status Screen	Contents
Load (%)	Load factor
EngineSpeed (rpm)	Engine speed
DPFReagen	During DPF regeneration, the value is “1”
T-coolant (°F)	Coolant temperature
P-Oil (psi)	Oil Pressure
FuelRate (g/h)	Fuel economy
T-IntManifold (°F)	Intake temperature in the manifold
T-Intake (°F)	Intake temperature
DEFLevelLamp	Not used
DEFLevel (%)	Not used

○ ECU Values

Status Screen	Contents
Genset kWh	Counter of active power
Genset kVArh	Counter of reactive power
Running Hours	Engine operation hours counter
Num Starts	Engine start commands counter
Num E-Stops	Emergency stop alarms counter
Shutdowns	Shutdown alarms counter

○ Aftertreatment

Not used.

○ Plug-in Modules

It is used when installing an additional module.

○ Alarm List

It is an alarm list. If an error occurs during operation, the operation display will automatically switch to the alarm screen. Resolve the reason and press the FAULT RESET button to clear the alarm.

5-2. Spill Containment

⚠ 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.

⚠ CAUTION : FIRE 

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

The bed of this generator is equipped with the spill containment (structure for preventing leakage of liquid) so that any spilled liquid will not leak to outside of the generator when oil or fuel is spilled or leak. Before starting operation, check if there is accumulated liquid in the spill containment. Flush out any liquid that has accumulated.

(Refer to section “8-5. Checking the Spill Containment” for inspection procedures.)

(Refer to section “10. Inspection/Maintenance (9) Flushing Liquid in Spill Containment” for flushing procedures.)

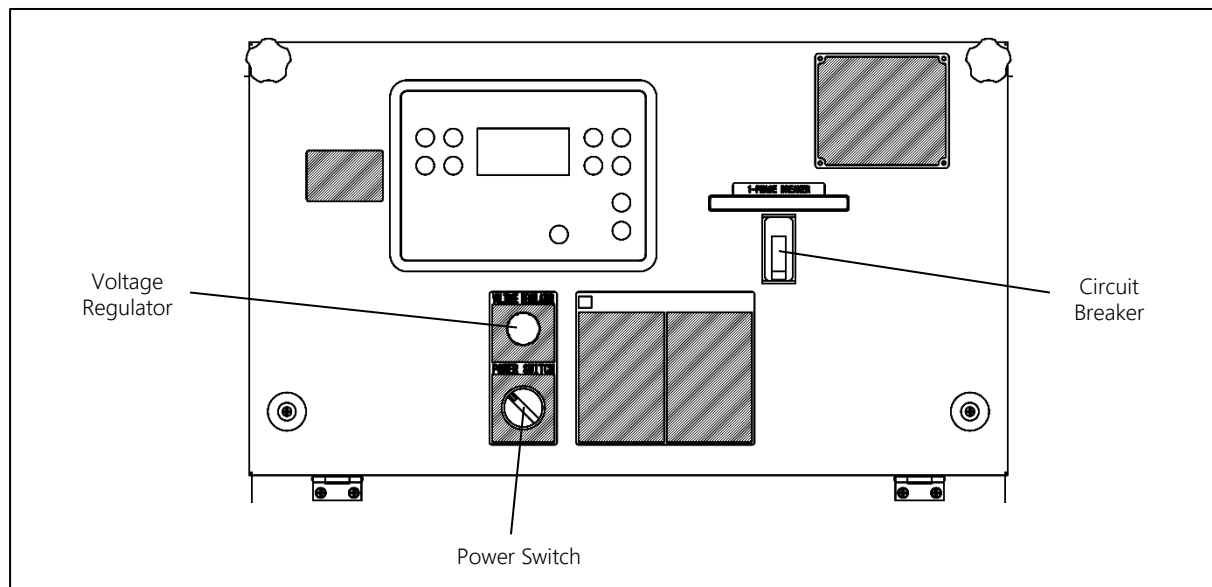
The generator is equipped with the following in order to prevent liquid from spilling in case you forget to flush the liquid: The operation panel is equipped with the SPILL CONTAINMENT CHECKING indicator that illuminates when its sensor is triggered as the spill containment capacity accumulated enough liquid to reach to about 8 gal (30.3 liters).

(Refer to section “10. Inspection/Maintenance (9) Flushing Liquid in Spill Containment”.)

< Note >

- Water can also accumulate in the spill containment due to rain entering into the generator. Accordingly, you should periodically flush liquid accumulated within the generator. However, you should flush water according to the frequency/amount of rainfall.
- The types of liquids that can accumulate in the spill containment include oil, fuel, coolant, battery fluid and DEF such that are mixed with rain water and other spills. Dispose of flushed liquids according to the applicable laws and regulations.

5-3. Switches



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 >

- Do not leave the generator in this ON position with the engine stopped. Doing so will cause the battery to drain.

(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.

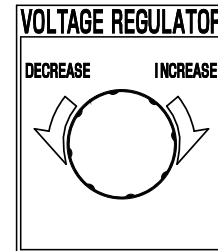
< Note >

- Do not turn ON/OFF the breaker manually to operate or stop a load.

Voltage Regulator

(3) Voltage Regulator

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



5-4. Fuel Piping Switch (3Way Fuel Valve)

⚠ CAUTION : FIRE

- Always make sure that the engine is stopped when working on piping for Fuel System.
- Always be sure to wipe up any spilled fuel.
- After working on the piping, check that there is no fuel leakage.

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

(1) If using the internal fuel tank

Change the lever of the three-way fuel valve turned to the “B” side to supply fuel from the internal tank. It is turned to the “B” side when the generator is shipped from the factory.

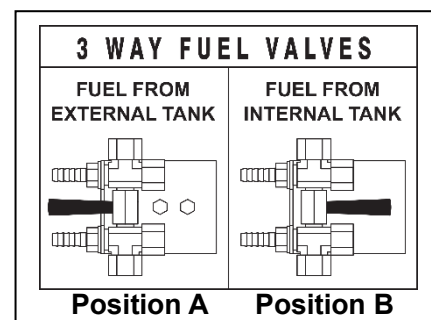
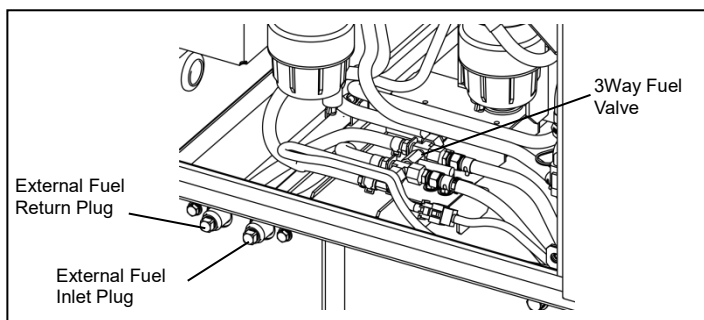
< Note >

- When disconnecting piping from the external tank, turn the lever to the “B” side, and attach the bundled plug (R1/2”) 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 “A” side to supply fuel from the external tank.

Refer to “9-5. Connecting with External Fuel Tank” for corresponding procedures.



6. Transport/Installation

6-1. Transport Procedures

⚠ WARNING : INJURY



- 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.
- No persons should ever be under a lifted generator.

⚠ CAUTION : INJURY



- Always be sure to use “Lifting Hook” when lifting up the generator, and lift slowly and vertically.
- Personnel performing lifting work must wear protective gear such as helmets, safety shoes and gloves.
- Do not move the generator during operation.

(1) Lifting Procedures

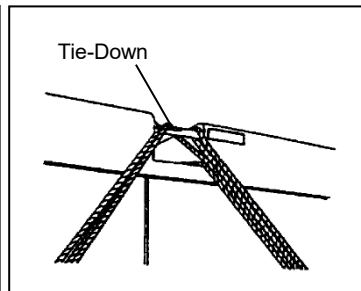
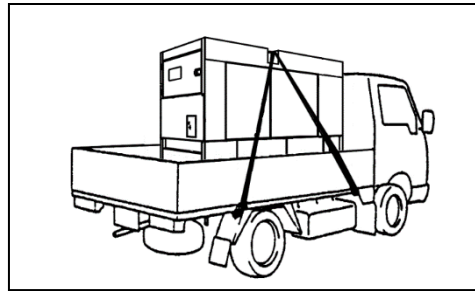
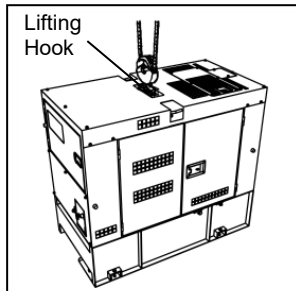
Always be sure to use lifting hooks when lifting up the generator, and raise it slowly at a completely vertical angle.

(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 : 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.



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.
- 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 3 ft. (1 m) or more from walls or other hindrances so that the operation panel door and Left/Right 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 could 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 for use, and 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 120 V and voltage drops by 6 V.

Single-phase Cabtyre cables

(Unit: AWG)

Current \ Length	200 ft. (61 m) or less	300 ft. (91 m)	400 ft. (122 m)
10 A	10	8	8
20 A	8	6	4
30 A	6	4	2
50 A	4	2	1/0
100 A	1	2/0	3/0
130 A	1/0	3/0	4/0
150 A	2/0	4/0	—

7-2. Connecting Load Cables

⚠ WARNING : ELECTRIC SHOCK 

- Always turn the breaker 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 insert a pin, needle or other metal object into the receptacle.
- Do not touch the generator if the generator or casing becomes wet during operation.

⚠ CAUTION : FIRE 

- Do not connect the generator output to indoor wiring.

< Note >

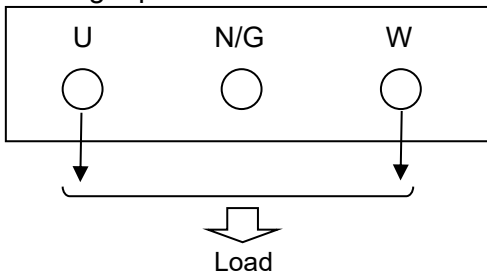
- When connecting a load, check that the generator output setting, output terminal connection position, and load power source are all matching.
- If using the N/G terminal, be careful that the currents of each phase are uniform.
- Use proper tools when connecting a load to sufficiently tighten the connection. Failure to sufficiently tightened will result in cable burnout.
- Terminal cover must remain closed during operation or breaker will trip.

(1) Single-Phase Three-Wire Output Terminal and Receptacle

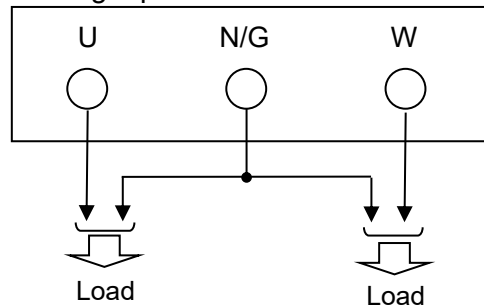
■ For single-phase three-wire type load:

- U-W terminal voltage is 240 V.
- U-N/G terminal voltage is 120 V.
- W-N/G terminal voltage is 120 V.

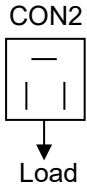
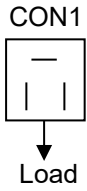
■ For single-phase 240 V load:



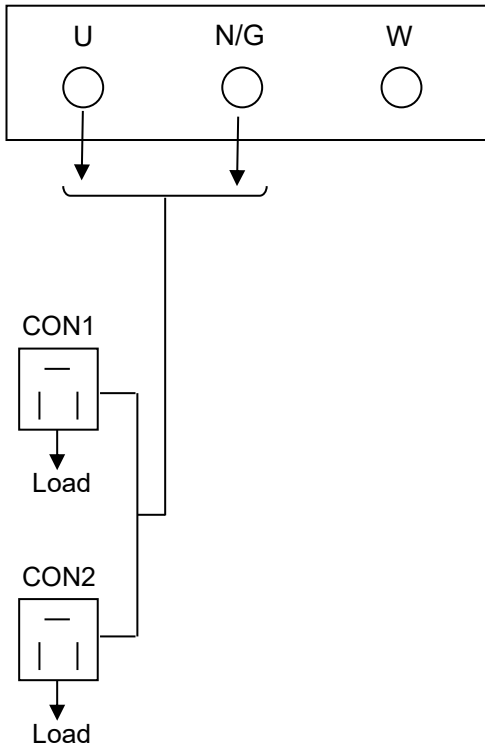
■ For single-phase 120 V load:



■ Single-phase 120V receptacle



■ Power available for use by each output terminal and receptacle are as show below.



■ Maximum individual allowable kVA as shown below.

(Unit: kVA)

1-phase, 3-wireoutput terminal		1-phase 120 V receptacle		Total
		CON1	CON2	
U-W	36	-	-	36
U-N/G	18	Total 2.4		18
W-N/G	18	-	-	18

※Maximum total allowable capacity is less than 36kVA.

< Note >

- If using a single-phase 120 V (between output terminals U-N/G and W-N/G), connect an equivalent load between U-N/G and W-N/G.
- If using a single-phase three-wire output terminal simultaneously with a receptacle output, make sure that currents passing through each phase are less than the rated current of this generator.

8. Pre-Operation Inspection

⚠ WARNING : 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 belts.

⚠ CAUTION : BURNS 

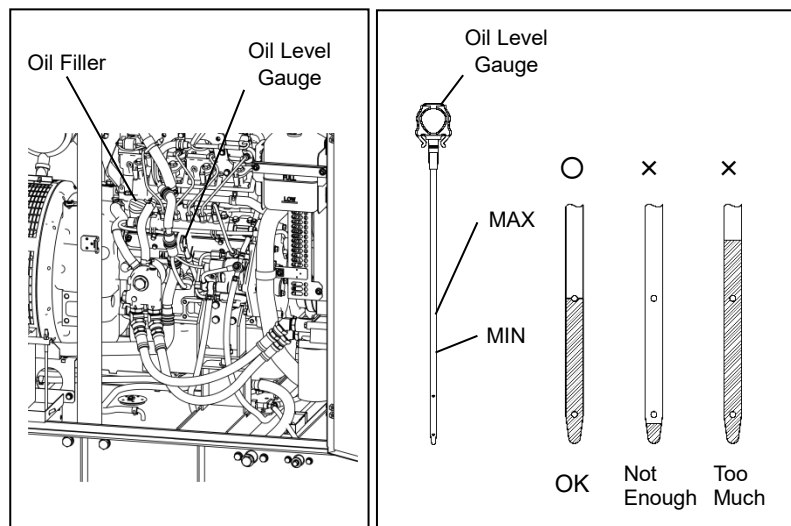
- Do not touch the engine and surrounding components immediately after stopping the engine as they are still extremely hot.

⚠ 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 to add 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 oil to avoid engine damage.

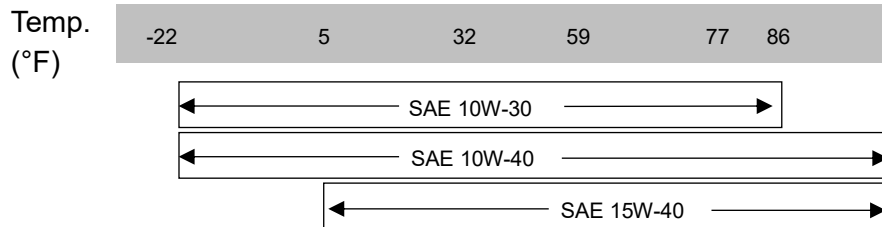
(1) Types of Engine Oil

Use only API service-type CJ-4 class.

(2) Engine Oil Viscosity Grades

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

Total Lubrication Oil Amount
3.0(0.1) gal.

Value in parenthesis is the filter capacity

8-2. Checking Coolant

CAUTION: BURNS

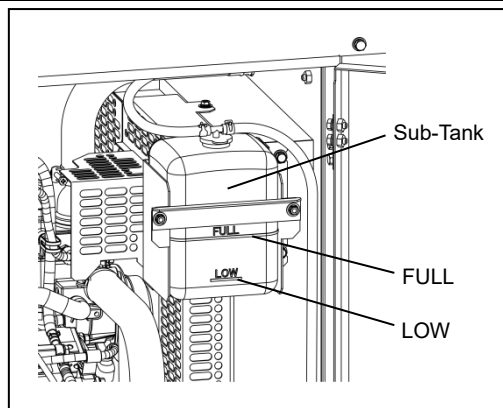


- Do not open the radiator cap immediately after stopping the engine. Do so will result in hot steam gushing out.
- Hot steam gushes out from the coolant sub-tank if the generator overheats. Do not touch the coolant sub-tank.

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.

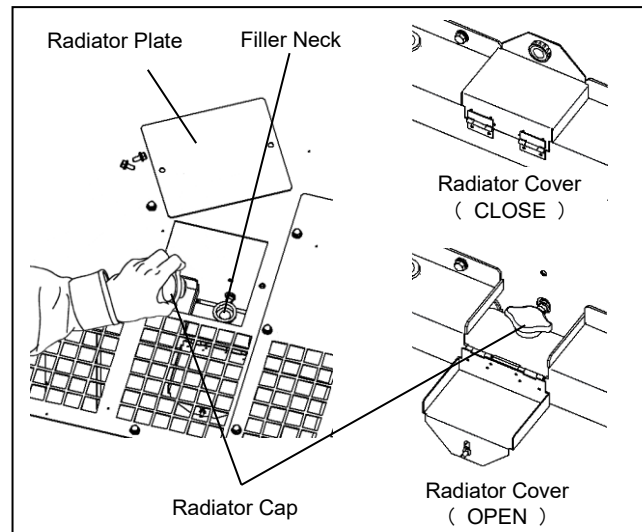
(1) Filling the Sub-Tank

- 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 >

- Use GM SPEC 6277M or equivalent.
- Use a 50:50 mix of Long Life Coolant (LLC).
- Always use potable water when mixing the coolant.
- Use LLC with the same mixture ratio in the coolant sub-tank.
- Do not increase the LLC mixture ratio unless necessary. Doing so could result in overheating or another fault/malfunction.
- If adding LLC, be sure to use the same brand/type that is still in the generator.
- Do not mix different brands/types. Doing so could result in a chemical reaction and the creation of toxic substances.
- Change the LLC every 1,000 hours or every 1 year.
- 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 Capacity

Total Coolant Capacity
2.9(0.4) gal.

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.
- If fuel spills, always be sure to open the spill containment drain valve and drain off the spilled fuel.
(Refer to section “**10. Inspection/Maintenance (9) Flushing Liquid in Spill Containment**”.)

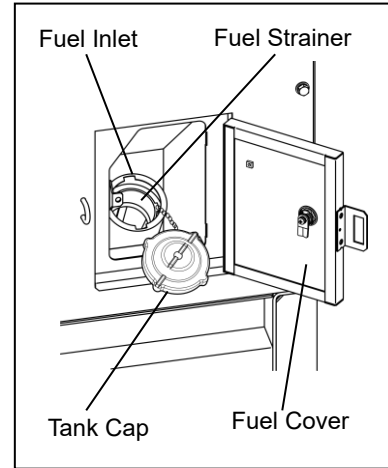
Check if sufficient amount of fuel before use and add fuel if insufficient.

The fuel level on the control panel 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, S15. Engine is designed to operate on Ultra Low Sulfur Diesel Fuel only. Use of any other fuel may result in engine no longer operating in compliance with emissions requirements.
- The fuel supply pump, injectors and other parts of the fuel system and engine can be damaged if any fuel or fuel additives used other than those specifically recommended by the engine manufacturer.
- Always be sure to use the fuel filter attached to the fuel inlet.
- Carefully add fuel until the tank is filled with specified amount.
- Always be sure to wipe up any spilled fuel.

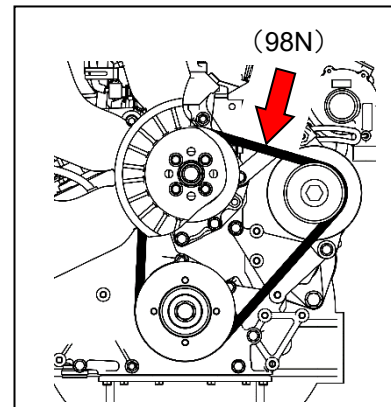


8-4. Checking the Fan Belt

(1) Fan Belt Tension

Press your finger against the middle of the fan belt.

(approx. 98N) If the slack is 0.22 to 0.26 inch, the tension is normal.

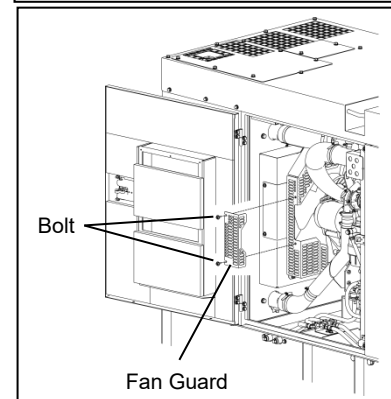


(2) Fan Belt Condition

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

(3) Fan Belt Adjustment

- 1 Remove the fan guard.
- 2 Loosen the bolts of the alternator.
- 3 Pull the alternator out and adjust the fan belt tension.
- 4 Securely tighten the bolts of the alternator.
- 5 Check that the fan belt tension is correct.
- 6 Attach the fan guard.

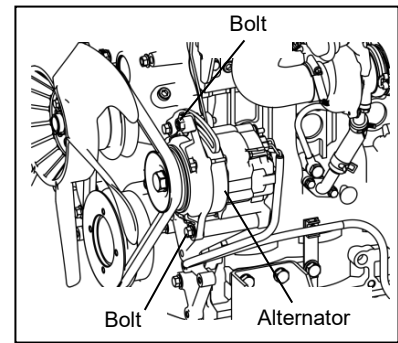


(4) Replacing the Fan Belt

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.



8-5. Checking the Spill Containment

CAUTION : FIRE

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

Open the check door and check the inside of the spill containment. Flush out any accumulated liquid. Refer to section “10. Inspection/Maintenance (9) Flushing Liquid in Spill Containment” for flushing procedures.

< Note >

- The types of liquids that can accumulate in the spill containment include oil, fuel, coolant and battery fluid such that it is not possible to distinguish between rain water and other liquids. Dispose of flushed liquids according to the related laws and regulations.

8-6. Checking for Fuel, Oil and Coolant Leak

CAUTION : FIRE

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

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

8-7. Checking the Battery

California Proposition 65

WARNING

Batteries, battery posts, terminals and related accessories contain lead and lead compounds, and other chemicals known to the State of California to cause cancer and birth defects or other reproductive harm. WASH HANDS AFTER HANDLING.

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 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.

- 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.

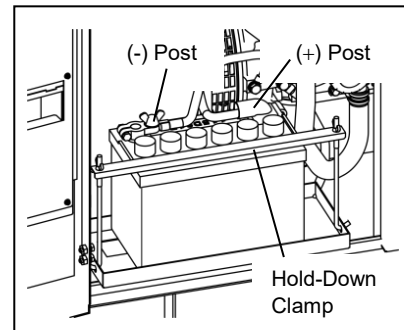
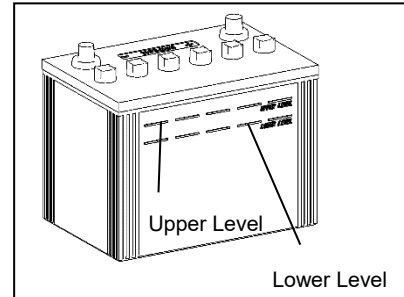
<Note >

- 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.

*Reverse the procedure above for installing the battery.
(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 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 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 

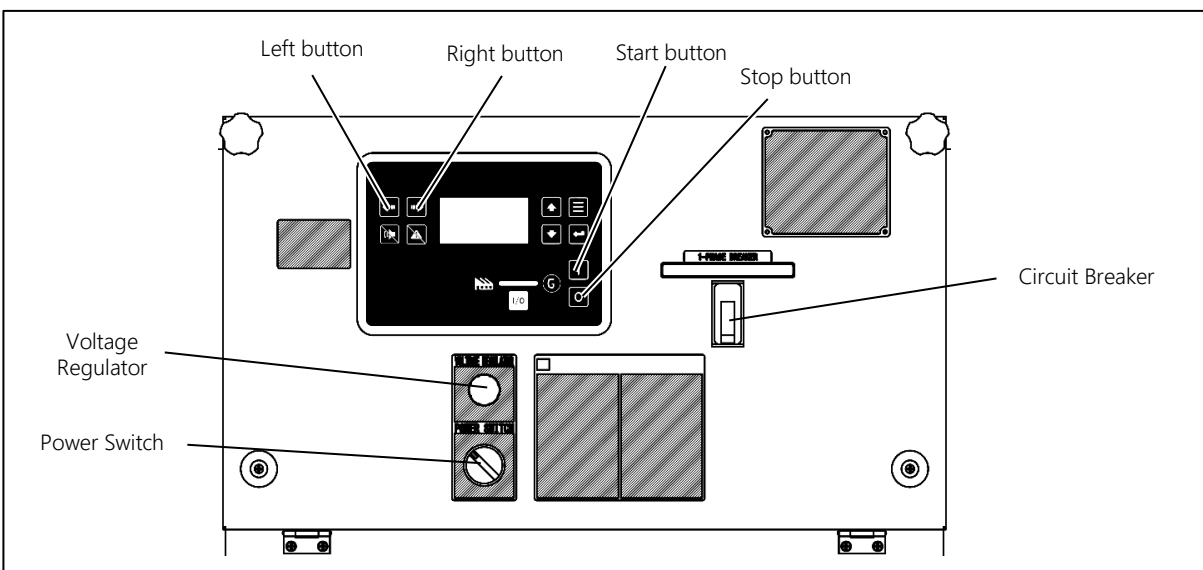
- Do not carry flammable items (such as fuel, gas and paint) or items that are highly combustible near the generator as the muffler, exhaust gas and other parts become extremely hot.
- Position this generator 3 ft. (1 m) or more from walls or other hindrances, and on a level surface.

⚠ 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.

< Note >

- Check that the surrounding area is safe before starting the engine.
- When there are multiple workers who are working together, they must mutually communicate 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 deteriorate 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 in the opening and closing of the door. The door is opened and closed suddenly especially in strong winds and the sloped place, and your finger might be pinched in a door.



(1) Manual Start

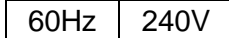
- 1 Turn off the Circuit Breaker on the operation panel of this machine.
- 2 Turn the Power Switch to ON position.
- 3 Press the Left button or Right button to select MAN mode.
- 4 Press the Start button to start the engine.
- 5 Warm up the engine for approximately 5 minutes.



< Note >

- Please keep in mind that the muffler may emit some smoke when engine is started.

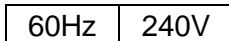
- 6 Use the VOLTAGE REGULATOR dial to adjust the voltage to the specified value.



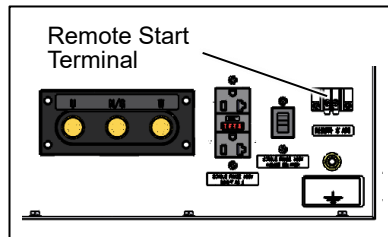
- 7 Turn the Circuite Breaker to ON to start AC power delivery.

(2) Auto Start

- 1 Turn off the Circuit Breaker on the operation panel of this machine.
- 2 Turn the Power Switch to ON position.
- 3 Press the Left button or Right button to select MAN mode.
- 4 Press the Start button to start the engine.
- 5 Use the VOLTAGE REGULATOR dial to adjust the voltage to the specified value.



- 6 Press the Stop button to shut off the engine.
- 7 Press the Left button or Right button to select AUTO mode.
- 8 Turn the Circuit Breaker to ON position.
- 9 The engine starts when the "REMOTE START" terminal closes.



< 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 3 days to charge the battery.

9-2. Procedures during Operation

(1) Checks after Startup

- Make sure that all meters and indicators 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 symptoms occurs, stop using this generator and request authorized distributor where the generator was purchased to repair the generator.

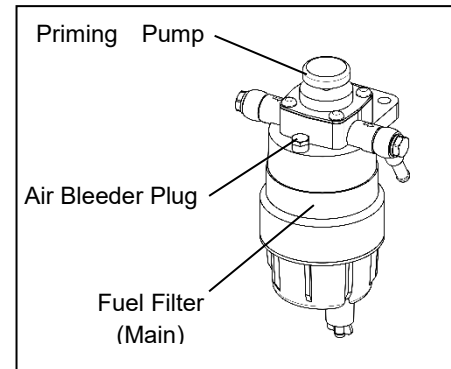
(2) Adjustment during Operation

During load operation, check the voltmeter 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 easily according to the following procedures even if the engine has stopped due to running out of fuel.

- 1 Turn the Circuit Breaker in the operation panel to OFF position.
- 2 Turn the Power Switch to OFF.
- 3 Add fuel to the fuel tank.
- 4 Turn the Power Switch to ON.
- 5 Press the Left button or Right button to select MAN mode, active the electromagnetic pump. Please do not start engine.
- 6 Loosen the air bleeder plug of the fuel filter sufficiently, and operate the priming pump until the fuel comes out.
- 7 Tighten the air bleeder plug and operate the priming pump 10 times or more until the fuel filter is filled with fuel.
- 8 Wait for approx. 1 minute, and loosen the air bleeder plug to remove the air from the fuel filter.
Repeat Steps 3 through 5 at least 3 times until air does not come out from the air bleeder plug.
Repeat Steps 3 through 5 at least 3 times until air does not come out from the air bleeder plug.
- 9 does not come out from the air bleeder plug.
- 10 Securely tighten the air bleeder plug, and wipe off the fuel spread around.
■ Air bleeder plug tightening torque : 8 to 12 N·m (0.8 to 1.2 kgf·m)
- 11 Start the engine. If the engine does not start at this time, repeat the procedure from Step 7.



< Note >

- Do not apply any loads until air-bleeding has been completed (until the engine speed becomes stable). Doing so can cause a malfunction.
- Be careful not to over-tighten the air bleeder plug.
- If the engine stops immediately after starting, the machine tries to restart it automatically.

9-3. Stopping Operation



- 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.
- 2 Turn the Circuit Breaker on the operation panel to OFF.
- 3 Cool down the engine for approximately 3 minutes.

- 4 Press the Stop 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 to ON position, the standby current may drain the battery.


(2) Auto Start

- 1 The engine stops when the REMOTE START terminal opens.
- 2 Turn the Circuit Breaker on the operation panel to OFF position.
- 3 Press the Stop 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 to ON 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 extremely hot.
- Hot steam gushes out from the coolant sub-tank if the generator overheats. Do not touch the coolant sub-tank.


This generator is equipped with functions to automatically stop operation when there is a fault/malfunction during operation, and one to warn the operator of the fault location by use of indicator lamps. Check the fault location when the engine is automatically stopped or an indicator lamp illuminates to stop the engine.

Protection Feature List

No.	Abnormality	Action	Breaker Trip	Engine Automatic Shutdown	Controller Display	Cause
1	High Water Temperature		-	○	○	Activates due to high water temperature in the engine Default : 212°F (100°C)
2	Low Oil Pressure		-	○	○	Activate due to low oil pressure in the engine Default 14 psi (0.98 x 100 kPa)
3	Insufficient Battery Charge		-	-	○	Activates in battery charge Impossible

No.	Abnormality / Action	Breaker Trip	Engine Automatic Shutdown	Controller Display	Cause
4	Engine Overspeed		○	○	Engine speed is too fast (2,070 rpm or more)
5	Spill Containment Fluid Level Check	–	–	○	Spill containment accumulated fluid has exceeded the specified level making it necessary to flush the fluid
6	Air Filter Clogging Up	–	–	○	The element is clogged making it necessary to clean or replace the element
7	Fuel Level Low	–	–	○	The amount of fuel is small
8	Overcurrent	○	○	○	Activates in overcurrent
9	Terminal Cover Open	○	–	○	Activates when terminal cover is opened.
10	Over Crank	–	○	○	Engine startup failure

* ○ indicates the automatic activation.


⚠ 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.

< Note >

- If an error occurs during operation, the operation display automatically switch to the alarm screen. Resolve the reason and press the FAULT RESET button to clear the alarm.

(1) High Water Temperature

⚠ CAUTION: BURNS 

- 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.

If the coolant temperature rises above 212 °F(100°C) during operation, the alarm message "Sd T-Coolant" will appear, 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 loosen or there is a coolant leak. Wait for the engine to cool down 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 operation.

(2) 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 14 psi (0.98 x 100 kPa) during operation, the alarm message "ECU P-Oil" will appear, 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 oil pressure warning indicator cannot detect oil deterioration. Change the engine oil periodically. (Refer to section "8-1. Checking Engine Oil".)

(3) Insufficient Battery Charge

If charging is not possible during operation, the alarm message "*Wrn Charging Alternator Fail" will appear. If this occurs, contact authorized distributor where the generator was purchased.

< Note >

- This battery charging warning indicator cannot detect battery deterioration or insufficient battery fluid. (Refer to section "8-7. Checking the Battery".)

(4) Engine Overspeed

This generator is equipped with a function such that the engine is automatically stopped if an engine fault occurs causing the engine speed to increase excessively. If the engine speed exceed above 2,070rpm during operation, the alarm message "ECU EngineSpeed" will appear, and the engine will be automatically stopped. If this occurs, it is probable that some malfunction has occurred in the engine. Contact authorized distributor where the generator was purchased.

(5) Spill Containment Fluid Level Check

The alarm message "*Wrn Spill Containment Fluid Level Check" will appear if the liquid stored in the spill containment exceeds approximately about 12gal (45.4 liters) during operation. If it occurs, immediately stop the engine and flush the liquid stored in the spill containment.

(Refer to section "10. Inspection/Maintenance (9) Flushing Liquid in Spill Containment".)

< Note >

- Although the fluids that can leak internally consist of oil, fuel and coolant, the spill containment does not have a function that can separate rainwater that has leaked into the equipment from these internally leaked fluids. Properly dispose of liquid drained from the spill containment in a manner according to the applicable laws and regulations.

(6) Air Filter Clogging Up

The alarm message “*Wrn Air Filter Clogging Up” will appear if the air cleaner element becomes clogged during operation. If it illuminates, immediately stop the engine and clean or replace the air cleaner element.

(Refer to section “10. Inspection/Maintenance (3) Air Filter Element Cleaning/Replacement”.)

(7) Fuel Level Low

The alarm message “*Wrn Fuel Level” will appear if the amount of fuel is small. Check if there is a sufficient amount of fuel and add fuel insufficient.

(8) Overcurrent

If an overcurrent or short circuit is detected during operation, the breaker will be shut off and automatically stopped. Use so as not to exceed the rated current.


(9) Terminal Cover Open

If the terminal cover is opened during operation, the breaker will shut off. If you use a generator, close it, turn off the breaker, and then turn it on again.

(10) Over Crank

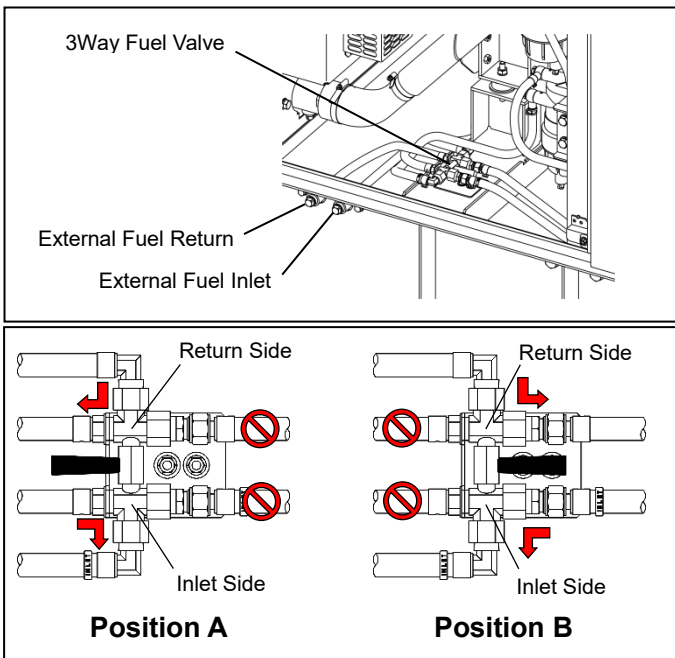
If the engine fails to start, the alarm message “*Sd Start Fail” will appear, and the engine will be automatically stopped. If that happens, set the Power Switch to Stop, and inspect the machine. (Refer to section “12. Troubleshooting.”)

9-5. Connecting with External Fuel Tank

⚠ CAUTION : FIRE 

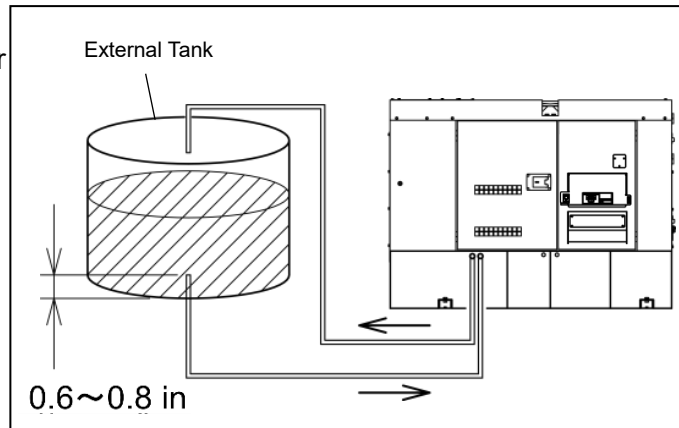
- Always make sure that the engine is stopped when working on piping.
- Always be sure to wipe up any spilled fuel.
- After working on the piping, check that there is no fuel leakage.

- 1 Turn the 3way fuel valve lever to the “B” side.(Position for using the internal tank.)
- 2 Remove the plugs(R1/2”) from both the external fuel inlet and the external fuel return.
- 3 Connect the hoses from an external fuel tank, as shown below.
- 4 Turn the 3way fuel valve lever to the “A” side.(Position for using the external tank.)
- 5 Bleed air from the external tank connecting hose. Fuel can be supplied from the external tank after completing the above procedures.



< Note >

- If using a hose for the piping, use oil-resistant hose with an internal diameter of 0.31 to 0.35 in (8 to 9 mm).
- Set the fuel level of the external fuel tank from 0 to 10 ft. (3 m) above from the bottom of this generator. The fuel level of the external fuel tank being lower than this generator will result in poor engine operation or shut off.
- Turn the 3way fuel valve lever to the “B” side in order to prevent fuel from flowing out from the external tank fuel inlet/return.
- Turn the lever completely. 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 0.6 to 0.8 in. (15 to 20 mm) above the bottom 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.
- Air may remain in hoses or pipes immediately after connecting the external fuel tank resulting in unstable engine speed and engine shut off.
- Do not leave the generator unattended for unmanned operation until you have confirmed that the engine speed is stable.



10. Inspection/Maintenance



California Proposition 65

⚠ WARNING

Batteries, battery posts, terminals and related accessories contain lead and lead compounds, and other chemicals known to the State of California to cause cancer and birth defects or other reproductive harm. WASH HANDS AFTER HANDLING.

⚠ 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.
- 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.
- No persons should be under a suspended generator at all time.

- ⚠ 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 sub-tank if the generator overheats. Do not touch the coolant sub-tank.
- ⚠ CAUTION : INJURY**
 - Personnel performing lifting work must wear protective gear such as helmets, safety shoes and gloves.
 - Always be sure to use “Lifting Hook” when lifting up the generator, and lift slowly and vertically.

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. When door is opened or closed suddenly, a finger might be pinched.

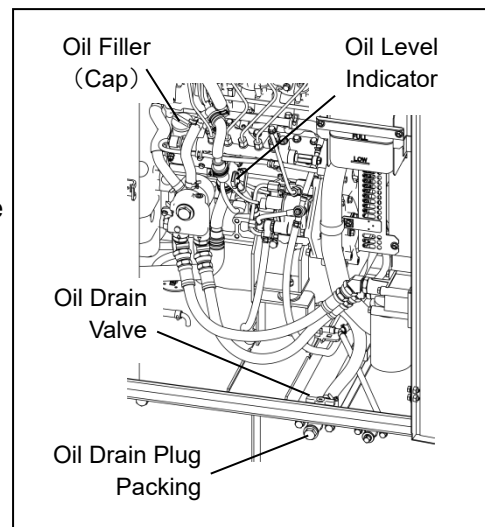
Description		Daily	Every 250 hrs	Every 500 hrs	Every 750 hrs	Every 1,000 hrs	Every 1,500 hrs	Every 3,000 hrs	Remarks
Engine	Each parts (Clean/Tightening)	○							
	Exhaust color (Check)	○							
	Engine oil (Check/Add)	○							
	Engine oil (Replace)		○						
	Oil filter (Replace)			○					
	Coolant (Check/Add)	○							
	Coolant (Replace/ Radiator Flush)					○ Every 1 year			
	Fuel filter (Check/Drain excess water and sediments)	○							

Description		Daily	Every 250 hrs	Every 500 hrs	Every 750 hrs	Every 1,000 hrs	Every 1,500 hrs	Every 3,000 hrs	Remarks
Engine	Fuel filter (Replace)			○					
	Fuel tank (Drain water/Clean)		○ (Drain)		● (Clean)				
	Electromagnetic pump filter (Clean/Replace)			○					
	Air cleaner element (Clean/Replace)		○ (Clean)	○ (Replace)					
	Battery fluid level (Check/Add)	○							
	Battery gravity (Check)	○							
	Check for leaks (Fuel/Oil/Coolant)	○							
	Fan belt tension (Check)	○							
	Fan belt (Replace)			●					
	Intercooler (Drain)			○					
	Fuel/Cooling Water/Oil Hoses and Anti-Vibration Rubber (Replace)								● Every 2 years
	Radiator and Intercooler (Clean)			●					
	Valve clearance (Check/Adjust)					●			
	Supply pump filter (Check/Clean)			●					
	Fuel injector (Check)							●	
Elimination of carbon in the exhaust system		○							
Generator	Indicators, Gauges Alarms (Check)	○							
	Insulation test		●						
Others	Spill containment fluid (Check/Drain)	○							
	Spill containment (Check/Clean)	○		● (Clean)					

(1) Engine Oil Replacement

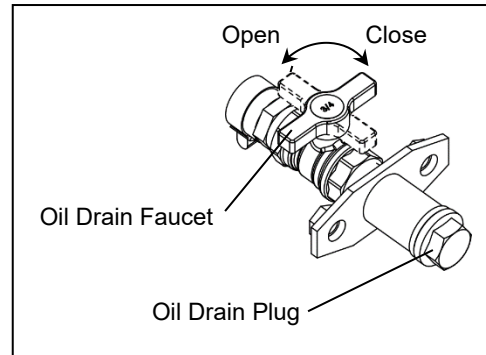
Replace	Every 250 hours
---------	-----------------

- 1 Set a container to catch spilled engine oil.
- 2 Remove the oil filler cap.
- 3 After removing the oil drain plug and o-ring, open the oil drain faucet and drain the engine oil.
- 4 After the oil has been drained, close the oil drain faucet and reinsert the oil drain plug with o-ring.
- 5 Add oil through the oil filler until it is at the maximum level while checking the oil level using the oil level indicator.
- 6 Attach the oil filler cap.



< Note >

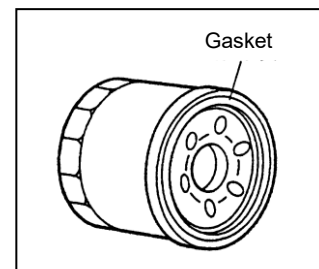
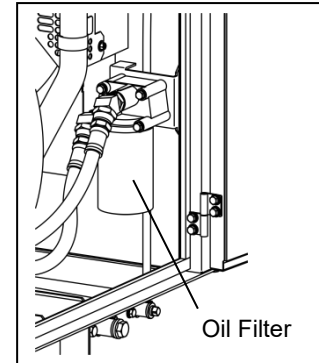
- Refer to section “8-1. Checking Engine Oil” for engine oil replacement amounts and types.
- After reinserting the oil drain plug and shortly after starting the engine, be sure to always check that there is no oil leakage.
- Always be sure to wipe up any spilled engine oil.



(2) Replacing the Oil Filter

Replace	Every 500 hours
---------	-----------------

- 1 Drain the engine oil. (Refer to section “(1) Engine Oil Replacement”.)
- 2 Remove the oil filter using a filter wrench.
- 3 Apply thin layer of oil on a new oil filter gasket.
- 4 Thread the oil filter by hand(do not use a filter wrench), and it in until the gasket contacts the seal surface, and then tighten it with one turn using filter wrench.
- 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.: 8944567412 (Isuzu part no.)
- Always be sure to wipe up any spilled engine oil.

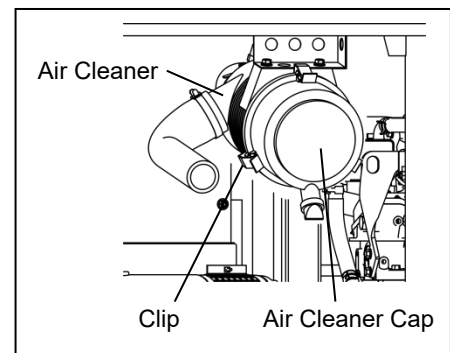
(3) Air Filter Element Cleaning/Replacement

Clean	Every 250 hours
Replace	Every 500 hours

- 1 Remove the air cleaner clips and cleaner cap.
- 2 Remove the element.
- 3 Clean or replace the element. Attach 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 evacuator valve once a week in normal operating conditions or daily if operating in a



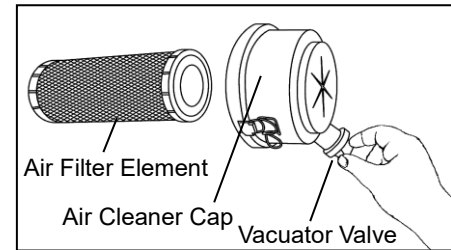
location that is excessively dirty or dusty. Wipe away any dirt or moisture that has adhered to the parts.

- Never touch the elements for any reason except cleaning.
- Element part no.: P822768 (Isuzu 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 Fuel Filter (Main and Pre-Filters)

Check/Drain	Daily
-------------	-------

Drain water when the float (red) inside the cup floats to the water draining position.

- 1 Set a container to catch spilled water.
- 2 Loosen the air bleeder plug of the fuel filter sufficiently.
- 3 Loosen the drain plug on the bottom to drain the water.
- 4 When water draining is completed, tighten the drain plug on the bottom.

■ Drain plug tightening torque :

1.5 to 2.5N·m(0.15 to 0.25kgf·m)

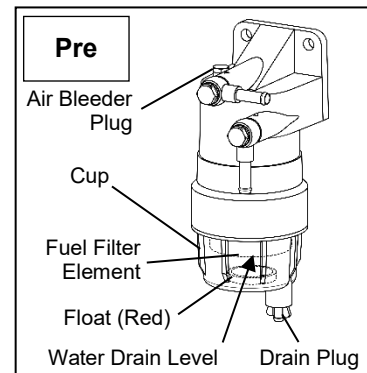
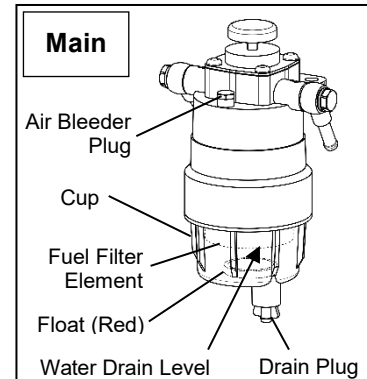
- 5 Tighten the air-bleeding plug.

■ Air-bleeding plug tightening torque :

8 to 12N·m(0.8 to 1.2kgf·m)

< **Note** >

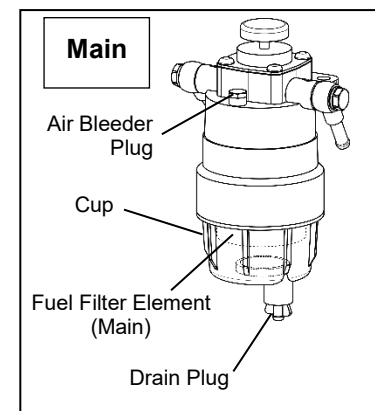
- After reinserting, be sure to always start the engine and check that there is no fuel leakage.
- If water is accumulate in the cup, draining water from the fuel tank.
- Be careful not to over-tighten the drain plug and air bleeder plug.
- Always be sure to wipe up any spilled fuel.



(5) Fuel Filter Replacement (Main and Pre-Filters)

Replace	Every 500 hours
---------	-----------------

- 1 Set a container to catch spilled fuel.
- 2 Loosen the air bleeder plug of the fuel filter sufficiently.
- 3 Loosen the drain plug on the bottom to drain the fuel.
- 4 Remove the outer case of the filter using the specified filter wrench.
- 5 Remove the fuel filter element.
- 6 Install a new fuel filter element.
- 7 Replace the O-ring of the outer case.
- 8 Spread a thin layer of fuel on a new O-ring.
- 9 Thread the outer case by hand (do not use a filter wrench), and it in until the O-ring contacts the seal surface, and then tighten it using the special filter wrench.

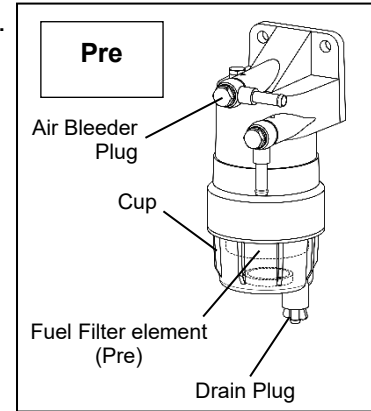


10 Tighten the drain plug on the bottom and the air-bleeding plug.

- Drain plug tightening torque :
1.5 to 2.5N·m(0.15 to 0.25kgf·m)
- Air-bleeding plug tightening torque :
8 to 12N·m(0.8 to 1.2kgf·m)
- Outer case tightening torque :
18 to 22N·m(1.8 to 2.2kgf·m)

< Note >

- When attaching the cup, check that there is no foreign material adhering to the O-ring.
- Be careful not to over-tighten the drain plug and air bleeder plug.
- After attaching, be sure to always start the engine and check that there is no fuel leakage.
- Always be sure to wipe up any spilled fuel.
- If water is accumulate in the cup, draining water from the fuel tank and the water separator.
- Main filter element (Including O-ring) part no.: 8982402800 (Isuzu part no.)
- Pre filter element (Including O-ring) part no.: 8982402790 (Isuzu part no.)
- After replacing the filter, always air out the fuel system.
(Refer to section "9-3. Procedures during Operation".)



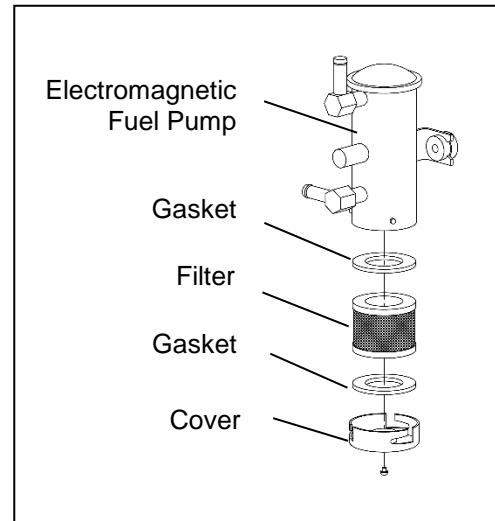
(6) Electromagnetic Fuel Pump Filter Cleaning/Replacement

Clean/Replace	Every500 hours
---------------	----------------

- 1 Set a container to catch spilled fuel.
- 2 Turn the cover, located at the bottom of pump, counter-clockwise and remove cover.
- 3 Remove the filter and gasket.
- 4 Clean the filter with the compressed air and rinse it in the fuel before installing the filter and gasket.
- 5 Reinstall in the reverse order.

< Note >

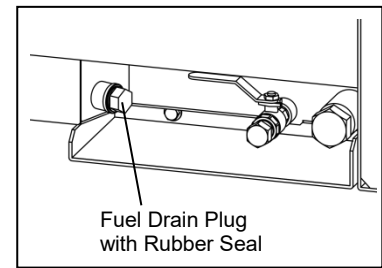
- After attaching, be sure to always start the engine and check that there is no fuel leakage.
- Always be sure to wipe up any spilled fuel.
- After replacing the filter, always air out the fuel system.
(Refer to section "9-3. Procedures during Operation".)
- When a damage is found on the filter and gasket, replace with new parts.
- Filter kit (Including Gasket kit) part no. : 8980714010 (Isuzu part no.)
- Gasket kit (Without Filter) part no. : 8980714040 (Isuzu part no.)



(7) Draining Water from the Fuel Tank

Drain Water	Every 250 hours
-------------	-----------------

- 1 Set a container to catch spilled water.
- 2 Remove the fuel drain plug and packing (with rubber seal).
- 3 After the water has been drained, reinsert the fuel drain plug with new packing (with rubber seal).



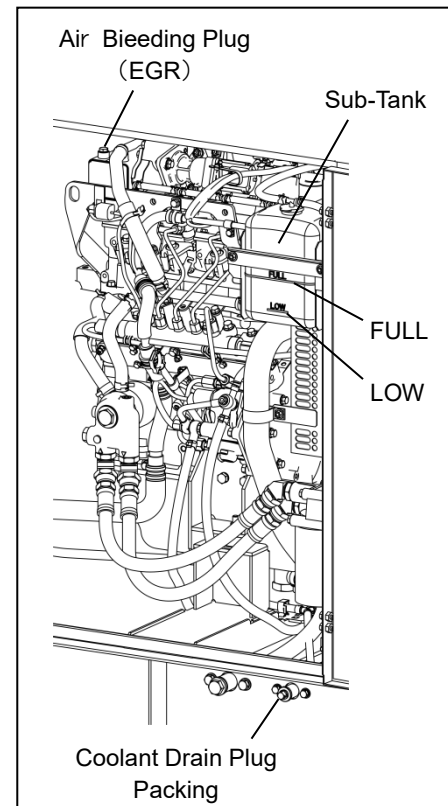
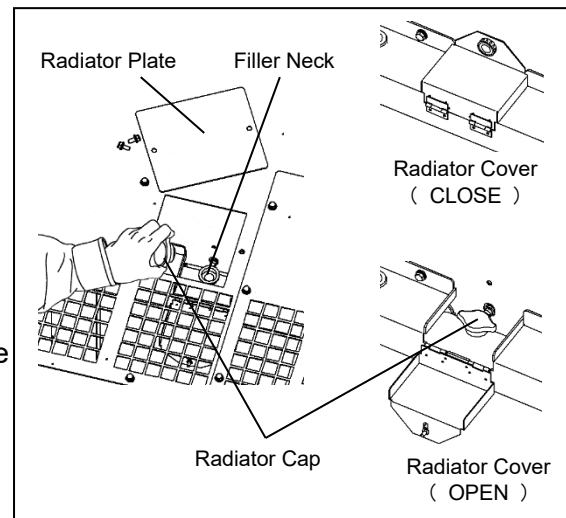
< Note >

- 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.

(8) Coolant Replacement

Replace	Every 1,000 hours
---------	-------------------

- 1 Set a container to catch spilled engine oil.
- 2 Remove the radiator plate.
- 3 Remove the radiator cap.
- 4 Remove the coolant drain plug.
- 5 Apply sealant coating to the plug or wrap it in seal tape.
- 6 After the coolant has been drained, tighten the coolant drain plug.
- 7 Remove the subtank and flush the coolant from the subtank.
- 8 Reattach the subtank to its original position and fill with coolant until it reaches the FULL level.
- 9 Fill the radiator with coolant until it reaches the filler neck.
- 10 Loosen the air release plug of the EGR cooler in order to bleed air from within the EGR.
- 11 When coolant flows out from the air-bleeding plug, tighten the air-bleeding plug with new gasket.
 - Air-bleeding plug tightening torque :
19 to 25N·m (1.9 to 2.5kgf·m)
- 12 Add the radiator with coolant until it reaches the filler neck.
- 13 Re-attach and tighten the radiator cap.
- 14 Attach the radiator plate.



< Note >

- After reinserting the coolant drain plug and shortly after starting the engine, be sure to always check that there is no coolant leakage.
- Be careful not to over-tighten the air-bleeding plug.

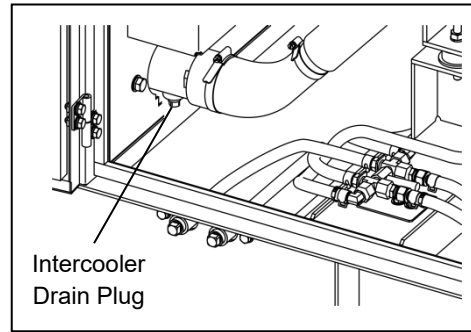
(9) Draining Water and Oil from the Intercooler

Drain Water and Oil	Every 500 hours
---------------------	-----------------

- 1 Remove the drain plug.
- 2 After the water and oil have been drained, re-install and tighten the drain plug.

< Note >

- After reinstalling the drain plug, be sure to always check to avoid any leakage.



(10) Flushing Liquid in Spill Containment

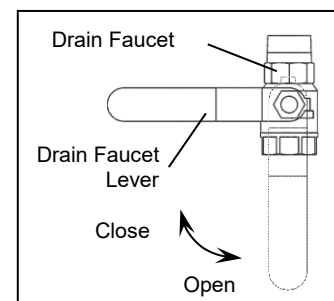
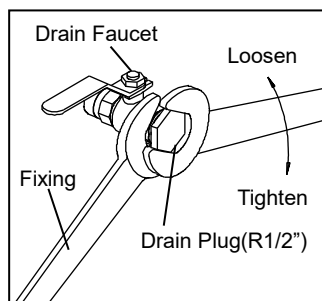
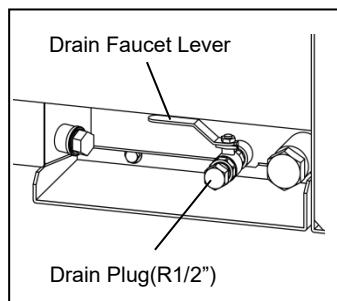
Check	Daily
-------	-------

- 1 Set a container to catch spilled liquid from the flushing port of the drain faucet on the front of this generator.
- 2 Remove the drain plug (R1/2") and open the drain faucet lever.

< Note >

- When removing or attaching the plug, hold the drain faucet fixed using an open end wrench or similar tool and turn the plug.
- If oil or other liquid mixed in with the flushed liquid, this could be oil leakage etc. In such case, check for the leaked location.
- The types of liquids that can accumulate in the spill containment include oil, fuel, coolant water and battery fluid such that it is not possible to distinguish between rain water and other liquids. Dispose of flushed liquids according to the related laws and regulations.

- 3 Close the drain faucet lever after the liquid has been flushed, and apply sealant coating to the plug or wrap it in thread seal tape.



(11) Spill Containment Cleaning/Inspection



WARNING : INJURY



- 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 at all time.



CAUTION : INJURY



- Always be sure to use lifting hooks when lifting up the generator, and raise it slowly at a completely vertical angle.
- Personnel performing lifting work must wear protective gear such as helmets, safety shoes and gloves.
- Do not move the generator during operation.

Clean

Every 500 hours

Separate the spill containment from this generator to clean and inspect the spill containment.

■ Spill Containment Separate/Reassemble

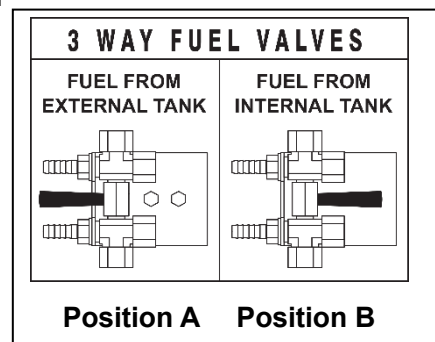
- 1 Turn the 3way fuel valve lever to the “A” side.
- 2 Remove the wiring connector.
- 3 Remove the fuel hoses (supply and return sides).
- 4 Remove the four spill containment fixing bolts (M12, 4 pieces).

< Note >

- When removing the fuel hoses, hold the union joint fixed using a spanner or similar tool.
 - Prepare a container to receive the fuel remaining in the fuel piping that will flow out of the removed fuel piping.
- 5 Lift the generator, separate the spill containment and set the generator on a flat surface.
 - 6 After cleaning and inspecting the inside of the spill containment, reassemble the spill container with this generator by performing the above procedures in the reverse order.
 - 7 Reassemble the fuel piping and wiring connector to their original positions.
 - 8 Turn the 3way fuel valve lever to the “B” side.

< Note >

- After reassembling, bleed air from the fuel system.
(Refer to section “9-3. Procedures during Operation”.)
- After reassembling, check that there is no fuel leakage.



■ Spill Containment Cleaning/Inspection

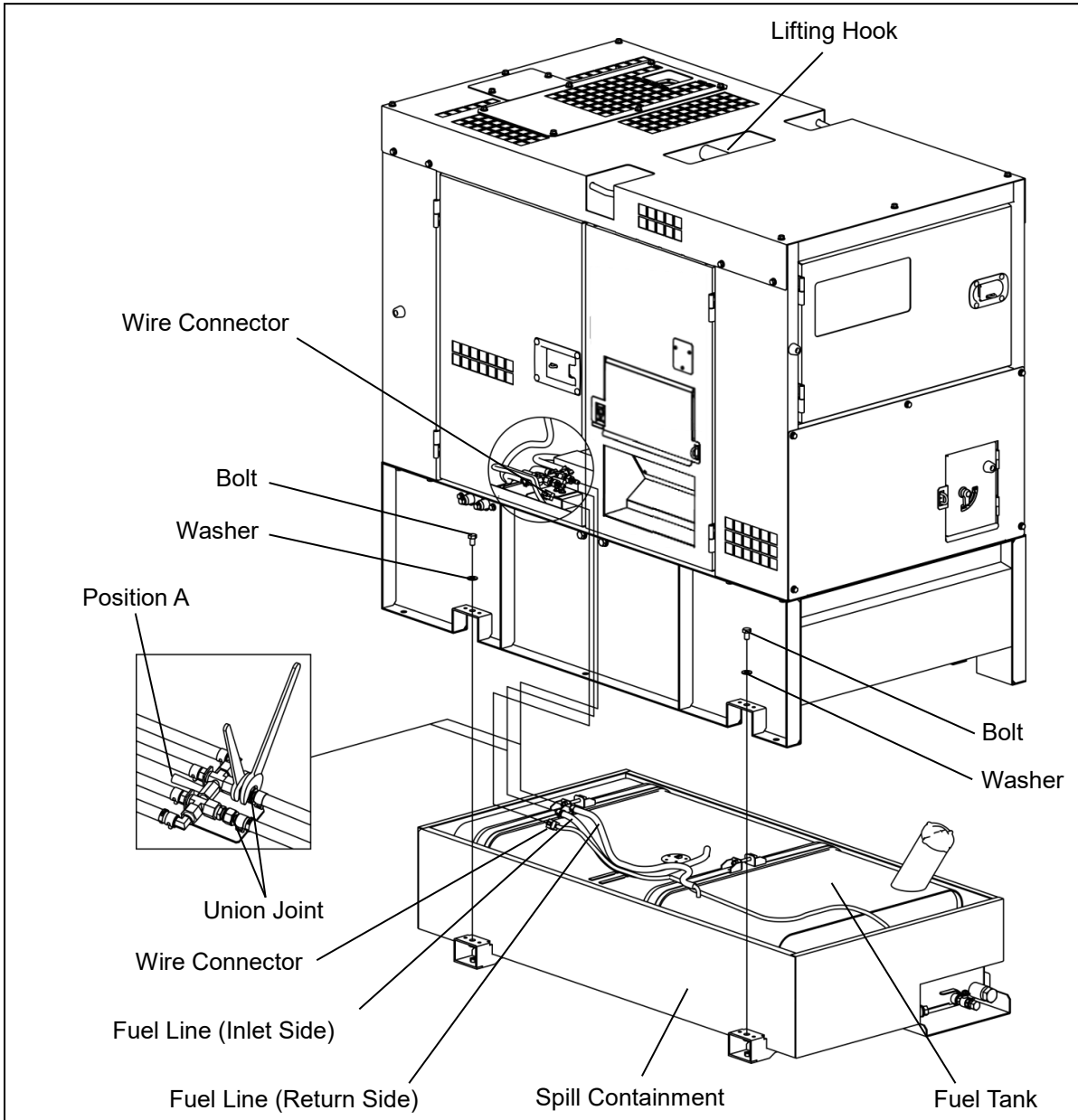
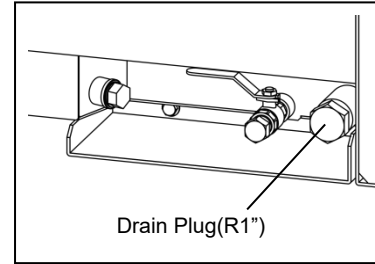
- 1 Use a high-pressure cleaner or similar equipment to clean the inside of the spill containment.
- 2 Remove the drain plug (R1”) to drain the cleaning water.
- 3 Check that there no rust has developed inside of the spill containment. If rust has developed, remove the rust and clean again.
- 4 Tentatively, apply sealant coating to the plug (R1”) or wrap it in seal tape and reinsert it.
- 5 Allow water to accumulate and check that the spill containment has no internal leakage.

6 Remove the drain plug (R1") to drain the water.

7 After the procedures have been completed, apply sealant coating to the plug (R1") or wrap it in seal tape and reinsert it.

< Note >

- If the fluid drained when cleaning the spill containment contains oil or grease, dispose of it according to the related laws and regulations.
- If the spill containment has a leak, contact the authorized distributor where the generator was purchased.



(12) Elimination of excessive carbon in the exhaust system by extended 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 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 3 ft. (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 250 hours
-------	-----------------

Accumulation of carbon (soot, unburned fuel) in the exhaust system could cause system deteriorates or an engine fault occurs. 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 be easier to be accumulated when the unit runs at less than 30% of rated output.

< Note >

- When the unit runs at rated power suddenly, accumulation of carbon in the exhaust system might cause back fire symptoms. Operate the generator starting from 50% of the rated output and then increase load gradually after confirming exhaust gas become colorless. Do not carry flammable items that are highly combustible near the generator.

11. Long-Term Storage

WARNING : 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.

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”.)
- 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 (4) Draining Water from the Fuel Filter (Main and Pre-Filters).”)
(Refer to section “10. Inspection/Maintenance (7) Draining Water from the Fuel Tank”.)
- 4 Clean up and inspect inside of the spill containment.
(Refer to section “10. Inspection/Maintenance (9) Flushing Liquid in Spill Containment”.)
- 5 Store in a secured location.
- 6 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 >

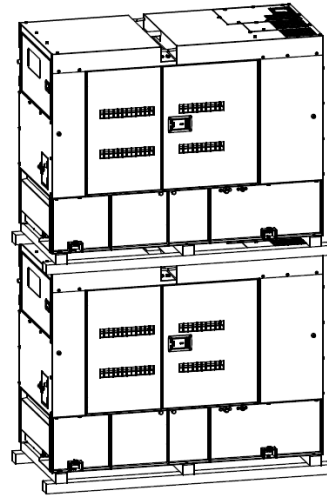
- Maintain fluid of the removed battery to the appropriate level and recharge every month.

(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 hood of this generator is not dented, and that bolts are not loose or missing.
- Set in a location with a flat hard floor capable of withstanding the double-stacking weight.
- 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.
- 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 closer to the generator.

CAUTION : BURNS

- Do not touch the engine and muffler 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	Starter motor does not drive or speed is low	<ol style="list-style-type: none"> 1. Battery output is weak 2. Battery is deteriorated 3. Battery terminal is OFF or loosen 4. Battery terminal is corroded 5. Power switch or relay is defective 6. Starter motor is defective 7. ECU (Engine Controller) or controller is defective 	<ol style="list-style-type: none"> 1. Check battery fluid or charge 2. Replace Battery 3. Fix/Tighten terminal 4. Clean terminal 5. Contact distributor or dealer for repair 6. Contact distributor or dealer for repair 7. Contact distributor or dealer for 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. Water is interfused in fuel line 4. Air is interfused in fuel line 5. Mistake of connecting with external tank 6. Mistake of turning 3way fuel valve lever 7. Fuel pump defective 8. Solenoid fault 	<ol style="list-style-type: none"> 1. Add fuel 2. Clean/Replace fuel filter 3. Drain water in water separator, fuel filter or fuel tank 4. Extract the air 5. Check fuel piping 6. Check 3way fuel valve 7-1. Check/Replace fuse 7-2. Check/Replace fuel pump 8-1. Check/Replace fuse 8-2. Ask our distributor to repair
	<Ambient temperature falls down below 32°F (0°C) >	<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. Contact distributor or dealer for repair
Engine starts but stalls immediately	<ol style="list-style-type: none"> 1. Fuel filter is clogged 2. Water is interfused in fuel line 3. Air is interfused in fuel line 4. Mistake of connecting with external tank 5. Air filter element is clogged 6. Lubricant oil level is insufficient 7. Emergency operation/Fault detection 	<ol style="list-style-type: none"> 1. Clean/Replace fuel filter 2. Drain water in water separator, fuel filter or fuel tank 3. Extract the air 4. Check fuel piping 5. Check/Replace air filter element 6. Add lubricant oil 7. Ask our distributor to repair 	
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. Add lubricant oil 2. Replace oil filter ask our distributor to repair 3. Contact 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. Water temp meter is defective 4. Fan belt tension is loosen or insufficient. 5. Coolant level is insufficient 6. Radiator core is clogged 	<ol style="list-style-type: none"> 1. Contact our distributor to repair 2. Contact our distributor to repair 3. Contact our distributor to repair 4. Check/Adjust fan belt 5. Check/Add 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 	<ol style="list-style-type: none"> 1. Check/Change air filter element 2. Contact distributor or dealer for repair 	

Problem	Suspected cause	Action
White smoke comes out from Muffler	<ol style="list-style-type: none"> 3. Improper fuel is used 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"> 3. Change to clean fuel 1. Contact distributor or dealer for repair 2. Drain water in fuel filter or fuel tank 3. Contact distributor or dealer for repair 4. Warm-up driving is needed 5. Contact distributor or dealer for 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 	<ol style="list-style-type: none"> 1. Contact distributor or dealer for repair 2. Contact distributor or dealer for repair 3. Contact distributor or dealer for repair 4. Contact distributor or dealer for repair 5. Contact distributor or dealer for repair
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. Contact distributor or dealer for repair 2. Contact distributor or dealer for repair 3. Contact distributor or dealer for repair 4. Contact distributor or dealer for 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. Contact distributor or dealer for repair 2. Contact distributor or dealer for repair 3. Correctly set the connection location to the receptacle
Cannot turn the breaker to ON	<ol style="list-style-type: none"> 1. The Main breaker positions were set in 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
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 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

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