USER MANUAL

DIESEL GENERATING SET

HDE20SS3, HDE40SS3,
HDE80SS3

Please read the manual carefully
before using the engine.
This guide contains important guidance
for safe operation.

CONTENT

Preface

Thank you for purchasing Diesel Generator Set Series.

This manual contains information for the correct operation and maintenance of your generator set. It also contains important safety and installation information, troubleshooting guidelines. Please always keep this manual with the equipment.

Please operate this equipment after thoroughly reviewing and understanding the contents of this manual.

The information contained in this manual was based on the genset in production at the time of publication. We reserve the right to make changes at any time without notice and without incurring any obligation.

1. IMPORTANT SAFETY INSTRUCTIONS

1.1 Overview

Thoroughly read this operation manual before operating the generator set. It contains important instructions that should be followed during operation and maintenance. Safe operation and top performance can only be achieved when equipment is properly operated and maintained. The owners and operators of the generator set are solely responsible for it's safe operation.

Generator set operation, maintenance, and installation must comply with all applicable local regulations. Electricity, fuel, exhaust, moving parts and batteries present hazards which can result in severe personal injury or death. Only trained and experienced personnel with knowledge of fuels, electricity, and machinery hazards should perform generator set installation or adjustment procedures; or remove, dismantle the generator set.

1.2 Safety symbols

The following symbols are applied in the manual indicate potentially hazardous conditions to the operators, service personnel, or the equipment.

DANGER
Indicates a hazardous situation that, if not avoided, will result in death or serious injury.

WARNING
Indicates a hazardous situation that, if not avoided, could result in death or serious injury.

CAUTION
Indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.

NOTE
Indicates information considered important, but not hazard-related(e.g., messages relating to property damage).

1.3 General Safety Precautions

1.3.1 To generator set operators

WARNING

- Do not operate the generator when fatigued, or after consuming any alcohol or drug.
- Wear suitable clothing when operating the generator. Loose clothing is easily caught in the moving parts and cause serious injury.
- Operators must be thoroughly trained before operating the unit.
- Only suitable trained and experienced service personnel can perform electrical and/or mechanical service.
- Do not allow any unauthorized personnel nearby the running generator set.
- Keep the generator set out of the reach of the children and pets.
- Pay attention to any abnormalities when the generator is running such as vibration, noise, exhaust smoke color and leaks. Shut down the generator immediately and troubleshoot before restarting the generator set.

1.3.2 Fuel and Fumes Are Flammable

WARNING

- Do not fill fuel tanks while the engine is running unless the tanks are outside the engine compartment. Fuel contact with hot engine or exhaust is a potential fire hazard.
- Do not permit any flame, cigarette, pilot light, spark, arcing equipment, or other ignition source near the generator set or fuel tank.
- Fuel pipes must be adequately secured and free of leaks. Fuel connection at the engine should be made with an approved flexible line. Do not use copper piping on flexible pipes.
- Flammable vapor can cause an engine to over speed and become difficult to stop, resulting in possible fire, explosion, severe personal injury or death. Do not operate the unit in flammable and explosive environments.
- Any spillage that occurs during fueling, oil top-off, or oil change must be cleaned up before starting the generator set.

1.3.3 Handling Waste

● Do not dispose the waste fuel/oil to the sewer or river to avoid environment pollution.

● The fuel/oil drained off the machine should be kept in the container.

● Dispose of all wastes properly in accordance with local environmental regulations. This includes fluids, filters, batteries, electrical components, etc.

1.3.4 Exhaust Gases Are Deadly

DANGER

● The generator emits carbon monoxide, a colorless, odorless gas which can kill you by asphyxiation.Do not breather in or come into contact with exhaust gases.

● The generator must be operated outdoors or in well ventilated areas.If the generator is operated indoors, it must be placed in a well-designed room with proper ventilation.

● Check the exhaust system for corrosion, obstruction, and leaks every time before starting the generator set and every eight hours when you run the unit continuously. Do not use exhaust gases to heat a compartment. Make sure that exhaust manifolds are secured and not warped.

1.3.5 Moving Parts Can Cause Severe Personal Injury or Death

DANGER

● Keep hands, clothing, and jewelry away from moving parts.

● Make sure the fasteners on the generator set are secure. Tighten supports and clamps. Generator guards doors must be completely closed and locked during running.

● Before starting work on the generator set, disconnect the battery charger from its AC source, then turn off the battery switch. This will prevent accidental starting.

● Do not wear loose clothing or jewelry in the vicinity of moving parts or while working on electrical equipment. Loose clothing and jewelry can become caught in the moving parts.

● If any adjustments must be made while the unit is running, use extreme caution around hot manifold, moving parts, etc.

● The electric cooling fan may run a few minutes more after the unit stopped. Do inspection or service only after the fan completely stopped.

1.3.6 Electric Shock and Arc Flashes Can Cause Severe Personal Injury or Death

DANGER

● Never operate the generator in wet conditions. Water will conduct electricity.

● An electric shock resulting in death can occur by touching the output terminals while generator set is running.

● When connecting the generator to the load, the circuit breaker must be placed in the OFF position and the generator stopped. (When in parallel operation, any other loads should be turned off besides this unit)

● The cover of the output terminals must be closed and the screws should be tightened before operating the generator

● The generator produces voltage even at low speeds. Ensure the generator stopped completely before inspection and service.

● Touching the circuit inside the control panel will lead to electric death. Please close the control box and tighten the screws before running the generator.

● Before opening the control box, close the circuit breaker and stop the generator. The control box contains live current.

● The circuit breaker prevents electric shock injuries. When replacing the circuit breaker, be sure to use the same specification one.

● The inspection of internal circuits of the control panel can only be performed after stopping the generator unit and removing the ignition

1.3.7 Generator Wiring

CAUTION

● Connections for standby power to a building's electrical system or to the mains must be made by a qualified electrician and must comply with all applicable laws and electrical codes.

● Improper connections can allow electrical current from the generator to back feed into the utility lines. Such back feed may electrocute utility company workers or others who contact the lines during a power outage, and when utility power is restored, the generator may explode, burn, or cause fires in the building's electrical system.

Earth Ground Connection

CAUTION

● The neutral of the generator set may be required to be bonded to earth ground at the generator set location, or at a remote location, depending on system design requirements. Consult the engineering drawings for the facility or a qualified electrical design engineer for proper installation.

NOTICE

● The end user is responsible to make sure the ground connection point surface area is clean and free of rust before making a connection.

● The end user is responsible for making sure that an earthing arrangement that is compliant with local conditions is established and tested before the equipment is used.

1.3.8 High Temperature

DANGER

● The generator set doors must be closed securely when the generator is operating. Do not get close to or touch the exhaust pipes and mufflers, radiator, cylinder cover, engine block and generator housing to prevent severe scald.

● The generator will remain hot for several minutes after shutting down. Inspection and maintenance of the generator set must be done only after the generator set is fully cooled down.

● If any check or service must be made while the unit is running, use extreme caution around hot manifold, moving parts, etc.

● Engine coolant is very hot and under high pressure. Don't open the radiator cap until the engine is completely cooled, other wise steam and hot water will be released and cause severe personal scald.

● Inspect the coolant level every time before operating generator set. Service cooling system before operating the unit or when the engine is completely stopped and the coolant temperature falls to 50^0C.

1.3.9 Battery

WARNING

● The battery can produce combustible gas leading to an explosion or serious injury.

● Charge the battery only in a well-ventilated area to prevent an explosion.

● When connecting the battery cables, connect the positive terminal first and then the negative terminal. Observe proper polarity to prevent a short circuit or sparks which could ignite the combustible gas produced by the battery.

● Turn off the battery switch or disconnect battery when performing maintenance on the generator.

● The electrolyte of the battery is diluted sulfuric acid which can cause severe burns. If electrolyte contacts the skin or clothing, immediately flush with large amounts of clean water. If electrolyte gets into the eyes, rinse the eyes with a large amount of water and seek immediate medical treatment.

● Inspect the storage battery after the engine is stopped.

1.3.10 High Noise Level

CAUTION

● The noise level of the generator is significantly increased with the doors open.

● If the unit has to operate with the door open, such as during an inspection, the operator shall wear protective ear plugs to prevent permanent hearing loss.

Noise instructions:

The noise level listed in this manual is not safety working level but emission level. There is a linkage between emission level and noise level. The emission level cannot be regarded as the standard to decide whether the noise protection measures need to be taken.

Factors affecting the actual noise level includes the operating ambient conditions and other noise sources (The quantity of the generators, working hours in the noisy environment, etc.) .

1.3.11 Stacking

CAUTION

● Improper stacking method will cause the generator sets fall down and cause serious accidents.

● The generator must be placed on solid level surface.

● Only one unit may be stacked on another one and the outline dimension and weight of the unit on the top must be smaller and lighter than the one on the bottom.

● Do not attempt to operate either generator while stacked. The vibration may cause one or both generators move and fall.

1.3.12 Transportation

WARNING

● Lift the generator set with the lifting eye in the middle of the top cover or four lifting eyes at the bottom. Otherwise the generator set may fall down due to insufficient strength. Or the generator set can be moved by forklift.

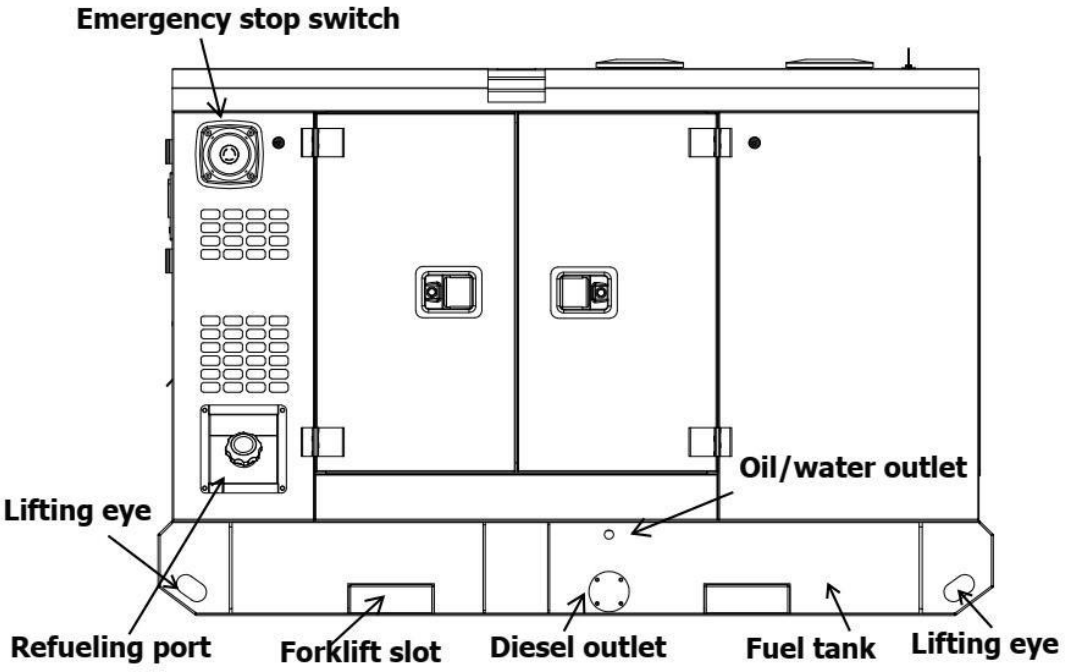
● Don't stand under the generator set while it is lifted up.

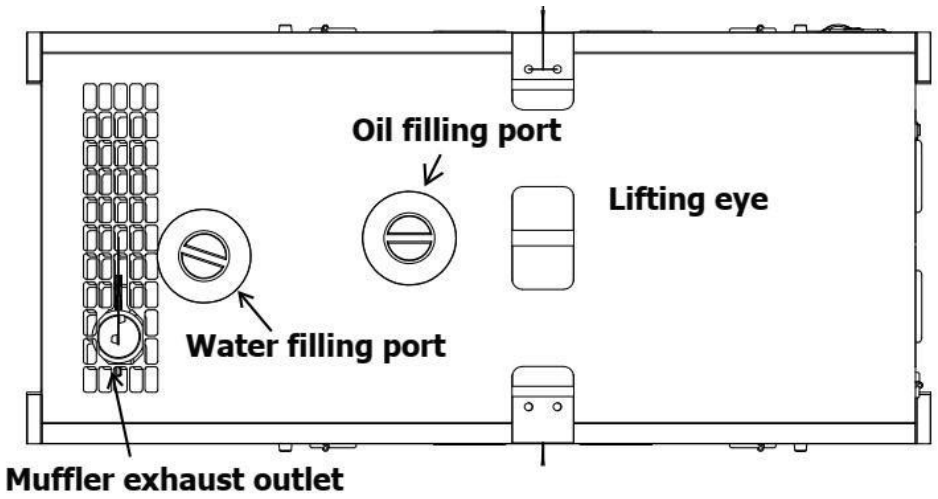
● Don't lift or move the generator set in operation.

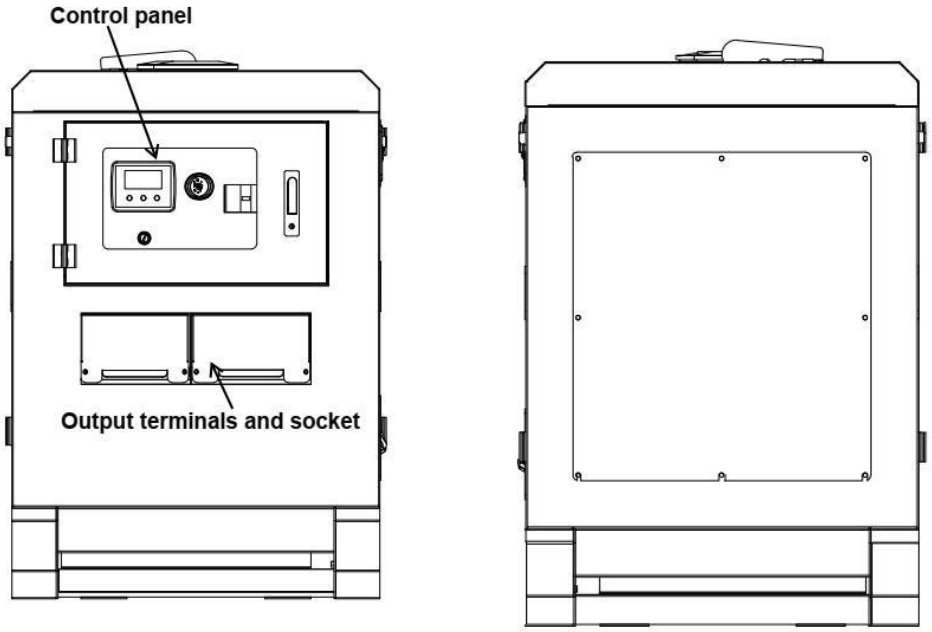
● Fix the unit properly when it’s transported by the truck.

2. PRODUCT INTRODUCTION

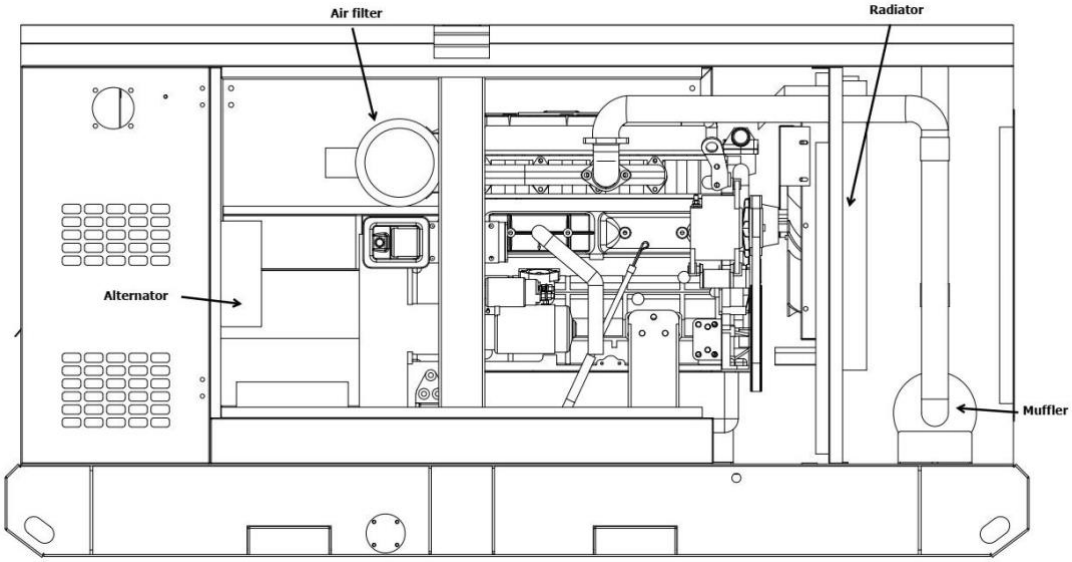
2.1 Main external parts identification



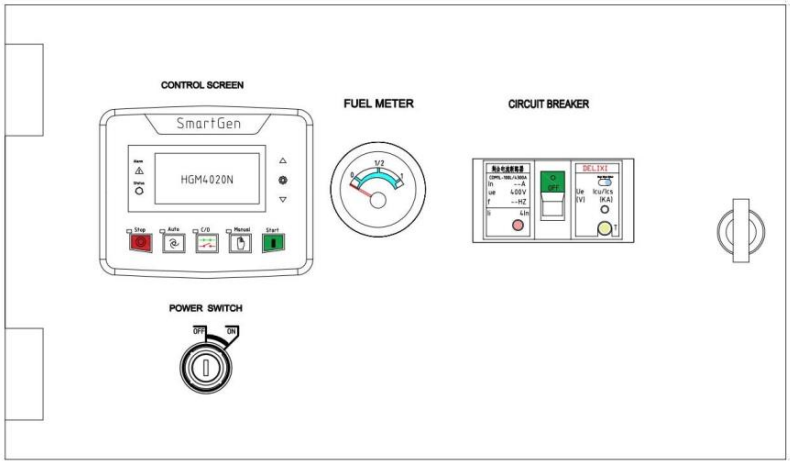


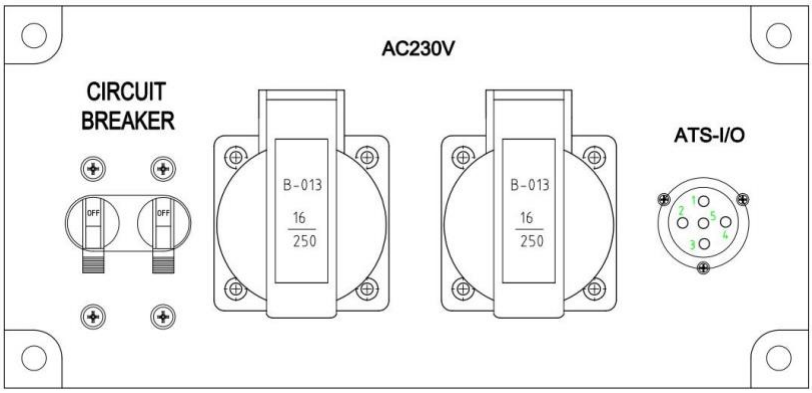


2.2 Main internal parts identification



2.3 Control panel





3. INSTALLATION

3.1 Installation of the generator

The following tips shall be observed during installation.

(1) Please install the unit on level ground firm enough to support the generator and contact the ground at all points. An uneven base will cause abnormal vibration.

Special foundation is unnecessary. A level and sufficiently strong concrete floor is adequate to prevent deflection and vibration and support the total weight of the generator set.

The width and depth of the foundation need to meet the requirement. Typically the foundation should be 150mm to 200mm (6 to 8 inches) deep and at least as wide and long as the generator set. The following formula may be used to calculate the minimum foundation depth:

T=K/(D×W×L)

T= thickness of foundation in m

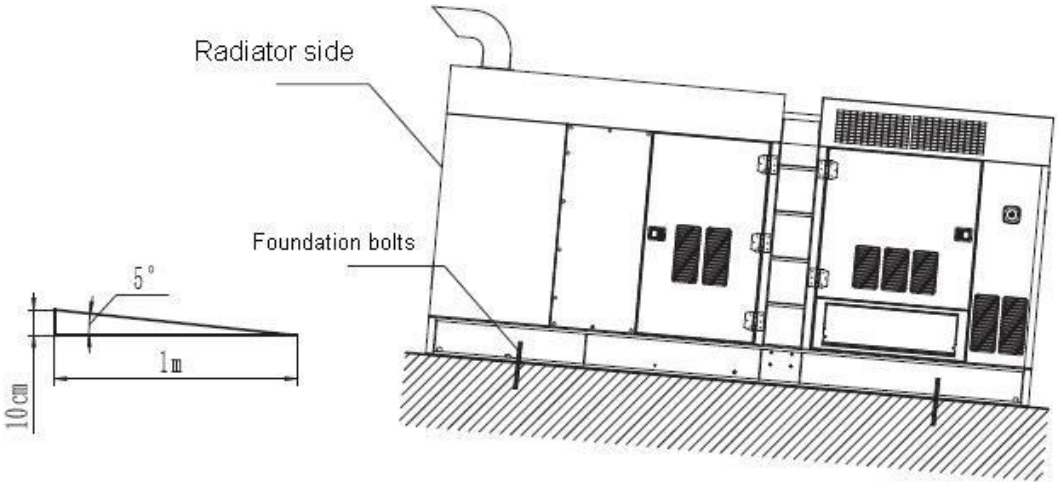
K= net weight of generator set in Kg

D= density of concrete (take 2403 Kg/m^3 as reference)

W= width of foundation in m

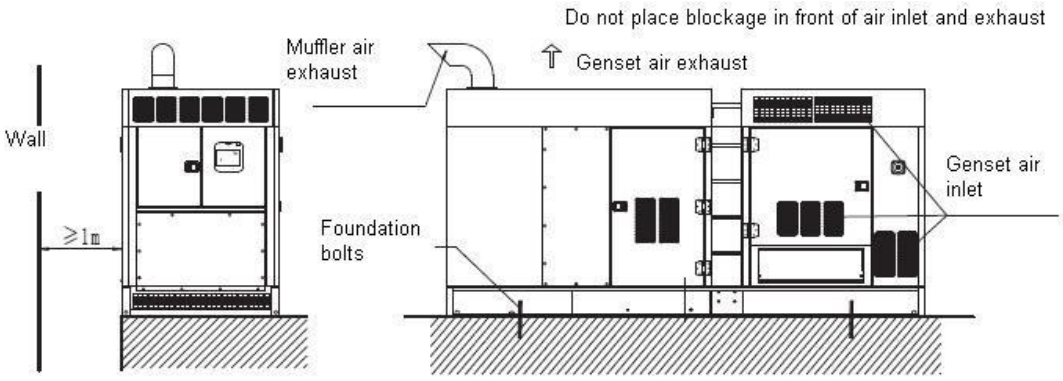
L= length of foundation in m

It is essential that the foundation should be leveled, preferably within ±0.5° of any horizontal plane.



If the ground or floor may be wet from time to time, the foundation should be raised above the floor. This will provide a dry footing for generator set and its operator. It will also minimize corrosive action on the base frame.

(2) The unit must be installed at least 500 mm away from any wall. The exhaust outlet of the radiator, the air inlet and exhaust outlet cannot be blocked. Increased back pressure and decreased cooling air will cause the engine overheat and low speed.



(3) Operate the generator set in an area free of moisture, dust and other debris and with an adequate supply of fresh air. Moisture can cause a short circuit and debris will block the radiator intake.

(4) Position the load with consideration of the connecting cables are as short as possible. If the cables are too long, resistance increases and voltage drops thus lowering generator efficiency.

3.2 Key points about generator set location

The location of the generator set is influenced by factors such as ventilation, exhaust piping, electrical service, fuel supply and accessibility for maintenance and service. Following key factors must be considered before locating the generator set.

WARNING

Ventilation

- Insufficient ventilation will cause carbon monoxide poisoning and death.
- Don't use the generator indoors or in any location with poor ventilation.
- If the generator has to be placed in an area with ventilation, suitable air intakes should be provided along with an adequate method to exhaust waste gas.
- The exhaust outlet of the generator should not be directed to offices, residences or pedestrians.

Vibration

● Excessive vibration can shorten the life of the generator

● The machine must be placed on the firm and level ground.

● Excessive vibration can affect the local environment severely.

Noise

● Always operate the generator with all doors securely closed.

● Excessive noise can be controlled by using an insulated machine room with sound deadening

Safety distance

● Always leave at least one meter space around all filling ports to facilitate service

● Leave enough space above the enclosure for exhaust and radiator filling.

● To prevent the intrusion of debris into the generator, provide screens at all intakes in some tough working conditions.

Others

● The main diesel fuel supply should be as close as possible to the unit. If the main fuel tank is installed underground, an auxiliary pump and day tank are necessary to transfer fuel from the main tank to the day tank.

● Applicable fire rating codes and standards must be met.

3.3 Indoor installation

The base frame request of indoor installation is same as above 3.1 and 3.2. The key point about indoor installation is to ensure the air inlet and exhaust free. The engine exhaust must be exhausted to outdoor. The exhaust port cannot directly face to air inlet/outlet of building. The air inlet and exhaust port of genset must be at least 1.5meters away from any block.

WARNING

The exhaust layout and installation must be performed by professionals. If the exhaust pipe is soft type, the pipe must be placed in straight line. The sharp bending is forbidden, otherwise the exhaust back pressure will be too large to impact genset running.

Drill the hole in the wall based on exhaust pipe diameter and then heighten the pipe end with bolts. It's suggested to install a shelter for the pipe to prevent sand and water from entering into pipe. Do install a rainproof cap at the end of exhaust pipe. The cap will close while genset is not running and it will open with engine exhaust while genset is running.

WARNING

Do clean all accumulated sand on the rainproof cap before starting genset. Otherwise, the sand may block the pipe.

4. LOAD CONNECTION

WARNING

To avoid personal injury:

Before the generator connected to a building's electrical system, a licensed electrician must install an isolation(transfer) switch in the building's main fuse box. The switch is the connection point for generator power and allows selection of generator or main line power to the building. This will prevent the generator from charging the main power line (backfeeding) when the main power supply has failed or has been turned off for the line repair. Backfeeding can electrocute or injure line maintenance personnel. Meanwhile, generator and building electrical system damage will occur when normal operating power returns if unit is used without an isolation switch.

WARNING

To avoid personal injury:

Connect or disconnect the load to the AC receptacles or terminals only when the engine is stopped.

For your safety, close the terminal cover after connecting the load and secure the cover with lock bolts.

4.1 Input power of the load

NOTICE

Motor driven loads demand large starting current. If the starting current of the load does not match the output of the generator, the load will not start. Consider the following when connecting the load to the generator:

● As to motor type load, the starting current of the motor is 5-8 times bigger than normal operating current, thus the instantaneous overload of the generator can occur and prevent the load from starting. Consult the load manufacturer to determine the starting power required.

● The following formulas of power calculations.

(1) Input power of squirrel cage asynchronous motor (kVA)

$$\text{Input power (kVA)} = \frac{\text{Rated power of motor (KW)}}{\text{Motor efficiency} * \text{power factor of motor}}$$

Power factor of motor: 0.8 Motor efficiency: 0.8

Genset power kVA= 1.56 times rated power of motor (kW)

(2) Directly start the squirrel cage asynchronous motor (using a knife switch)

Generator power =2 time rated power of motor

(3) Use a contactor to directly start the squirrel cage motor.

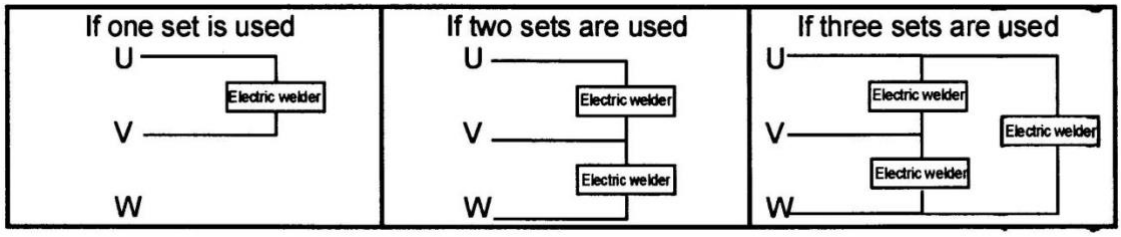
Generator power = 3 times rated power of motor

(4) Apply a star-triangle mode to start the squirrel cage motor.

Generator power = 1.2-1.5 times rated power of the motor

When using several AC welding machines at the same time, it is necessary to balance the load.

Therefore, the connection is allocated evenly to each phase according to the following drawing.



NOTICE

● The input power of each welding machine shall be regulated below 1/3 of the output power of the generator. If there is an overload, the alternator winding may be burned.

● Turn off the circuit breaker on the control panel and then connect the load to the AC output terminals. If there are several motor loads in the circuit, the motor with the high power consumption should be started first then the others in turn.

4.2 Grounding

DANGER

●Touching the output terminals while genset is running may cause electric shock and death.

● The circuit breaker shall be switched off while connecting the load to the genset.

● The output terminal cover must be closed and screwed before the generator set is operated.

● Worn or defective cables shall not be used to prevent electric shock. Bolts used to secure cables must be tightened to protect from overheating.

4.2.1 Grounding the load

CAUTION

● The grounding at the load side must be connected even it is connected to the generator equipped with leakage protection device.

● Sections of the ground cable shall be selected based on load capacities and technical standards of electrical devices.

4.2.2 Common grounding

The genset enclosure and the load must be grounded separately and independently. However when it is difficult to achieve independent grounding, a common grounding method may be used.

● For the cable thickness for common grounding, the largest value shall be selected according to individual grounding requirements.

● For the ground resistance of common grounding, the smallest value shall be selected according to individual grounding requirements.

● Tighten and connect all terminals securely.

NOTICE

● If the grounding rod is pushed into shady soil with high humidity, the upper end shall be buried below ground level.

● Avoid placing the grounding rod in an area with pedestrian traffic so as not to disturb the connections

● When leads are extended, they shall be connected as follows:

Connection leads shall be connected firmly by welding or using sleeves with joints covered with insulating tape. In addition, joints should be revealed positioned for convenient regular inspection.

● Do not bury grounding rods in places within 2 meters of lightning rods

● Do not use a common ground such as telephone system grounds

CAUTION

Bolts shall be securely tightened to connect to the load to prevent overheating and fires.

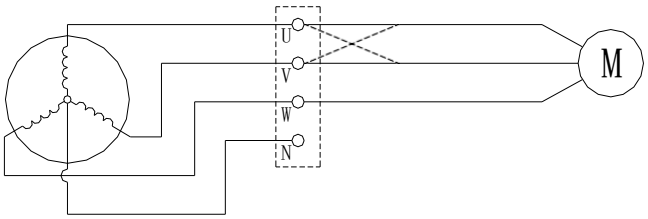
4.3 Load connection

(1) Connection method of 3-phase 4-wire terminals

Cables shall be connected to the 3-phase connector on the output terminal

CAUTION

Verify phase and voltage of the load prior to connection. Besides, check3-phase 4-wire terminals in the output junction box of the unit.



CAUTION

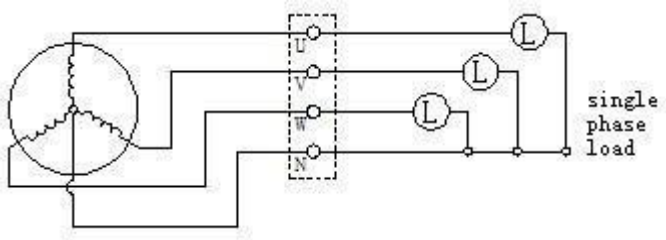
When a 3-phase electromotor is used, please exchange any two of three terminals if the electromotor reverses.

(3) Use modes of the combination of 3-phase connectors:

NOTICE

Please confirm that the readings of the AC current in the control panel can exceed the rated current.

The permissible current (output) of the generator is the sum of the single phase and the three phases. When the AC voltmeter displays 400/416V(50/60Hz), the single phase output voltage shall be 230/240V.

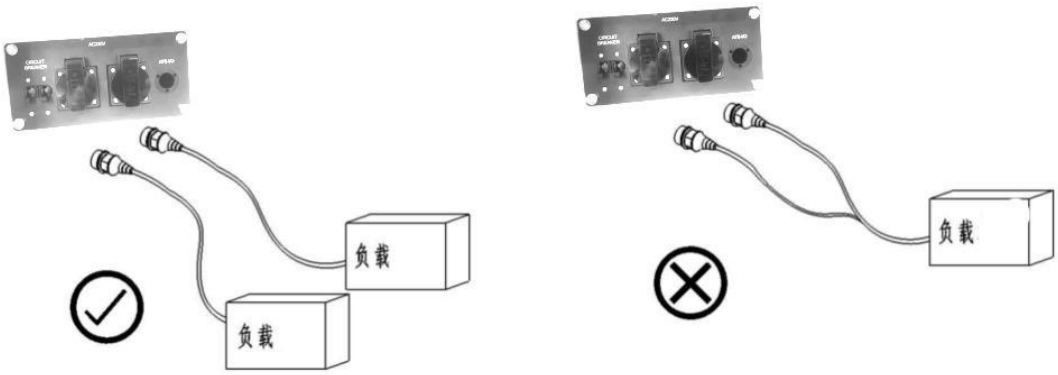


（4） Single output from three phase genset

NOTICE

- Apply single phase receptacle:
  Turn single phase breaker to “ON” position, then the receptacle is ready for output.
- There’re two single receptacles in the panel, both of their circuits are independent.

- Overload is forbidden in case of single phase receptacle output.



WARNING

It's top important to keep three phases loading in balance.

The loading capacity of each phase is 1/3 of genset rated power. F.g. the rated power of genset is 9kW, then each phase can output 3kW. When only one phase output, N wire current is three times than rated current of three phase(there's no current pass though N wire during three phase ouput.). N wire maybe burned, so it's not recommende to apply single phase for long time. Besides, do choose the proper N wire with cross sectional area ≤UVW to prevent N wire.

In case only apply output from either U-N or U-N or V-N phase:

The single phase output must be ≤25% of rated power. If single phase ouput from the receptacle, the single phase current must be less than the receptacle current capacity.

Two conditions must be meet simutaneously while both single phase and three phase output at same time:

① Total current output both of single phase and three phase must be less than rated current of genset.

②The unbalance ratio of UVW phase current must be ≤20% of rated current of genset.

If single phase output from the receptacle, then single phase current must be less than the receptacle current capacity.

WARNING

If long time running or overload single phase output in three phase genset, the alternator will run with serious phase unbalance, resulted the alternator will overheat and burned.

(5) Notes for load connection:

- A switch for switching on or off the load must be installed between terminals of the generator and the load.
- If the breaker of the generator is directly applied as the load switch of the load, the breaker may fail prematurely due to frequent start and shutdown.
- The generator breaker shall be put in the OFF position while cable connecting. Connections should only be conducted while the engine is stopped
- Do not connect cables with other output wires.
- Close the output terminal cover board and tighten securely after cable connections are completed.

4.4 Selection of three phase cables

NOTICE

The permissible current of the cable and the distance between the generator and the load must be considered prior to selection of the the cable diameter.

If the load current passing through the cable exceeds the capacity of the cable, the cable will overheat and fail. If the cable is too long, the diameter is too small and the voltage drop in the cable wire is too big, the input voltage to the load will reduce and may not start the load.

● The length and the cross-sectional area of the cable should be within 5% of the rated voltage as following reference.

● The value of voltage drop is calculated based on length, cross-sectional area and service current of the cable in 3-phase 3-wire types.

$$\text{Potential e (V)} = \frac{1}{58} \text{ X } \frac{\text{Length}}{\text{Section area}} \text{ X Current (A) X } \sqrt{3}$$

The relationship of permissible current, voltage drop, cross-sectional area and service current of insulating wire and cables (single-core and multi-core) is shown in the table below (only for service voltage of 220V and voltage drop less than 10V):

Item number	Cross sectional area of copper wire	Single core current carrying capacity (25)(A)		Voltage drop mv/M	Three core current carrying capacity (25)(A)		Voltage drop mv/M	Four core current carrying capacity (25 (A)		Voltage drop mv/M
		VV22	YJV22		VV22	YJV22		VV22	YJV22	
1	1.5mm^2	20	25	30.86	13	18	30.86	13	13	30.86
2	2.5mm^2	28	35	18.9	18	22	18.9	18	30	18.9
3	4mm^2	38	50	11.76	24	32	11.76	25	32	11.76
4	6mm^2	48	60	7.86	32	41	7.86	33	42	7.86
5	10mm^2	65	85	4.67	45	55	4.67	47	56	4.67
6	16mm^2	88	110	2.95	61	75	2.6	65	80	2.6
7	25mm^2	113	157	1.87	85	105	1.6	86	108	1.6
8	35mm^2	142	192	1.35	105	130	1.2	108	130	1.2
9	50mm^2	171	232	1.01	124	155	0.87	137	165	0.87
10	70mm^2	218	294	0.71	160	205	0.61	176	220	0.61
11	95mm^2	265	355	0.52	201	248	0.45	217	265	0.45
12	120mm^2	305	410	0.43	235	292	0.36	253	310	0.36
13	150mm^2	355	478	0.36	275	343	0.3	290	360	0.3
14	185mm^2	410	550	0.3	323	400	0.25	333	415	0.25
15	240mm^2	490	660	0.25	381	480	0.21	400	495	0.21

NOTICE

The above table is based on an ambient temperature of 25ºC. Changes of ambient temperature and the method of laying wires and cables can influence the current carrying capacity. The above table is only for reference.

5. OPERATION

NOTICE

This section describes the operation of the generator set. The text should be read in conjunction with the control panel operation manual and engine operation manual.

CAUTION

- Read “Safety Precautions” in the front of this manual.
- Read all danger,warning and caution labels located on the generator set.
- To avoid the danger of exhaust fume poisoning, do not operate the engine in a closed building without proper ventilation.
- Always turn off the circuit breaker while connecting load to the genset.

5.1 Engine preparation

- Check fuel, lubricant, and coolant levels.
- Check the battery charge level and the battery cable connections.
- Switch on the power key, the controller will enter self-checking mode for checking low oil pressure, high water temperature and emergency shut down etc fault warning. Do all troubleshooting before further operation.
- Check the shut down solenoid can move free or not, the transmission mechanic is blocked or not and all roting parts normal.

5.1.1 Adding diesel fuel

WARNING

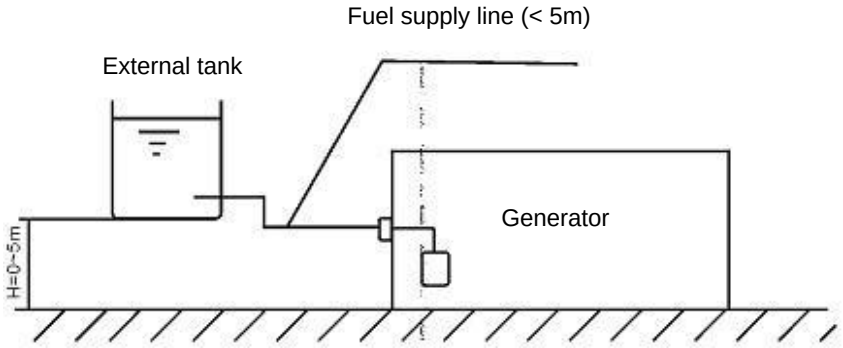
Refer to Engine User Manual about fuel grade.

- Do not use the wrong type of diesel fuel to prevent damage to the injection pump and injectors. Using fuel with the wrong flash point can increase the possibility of an explosion.
- Clean up all spilled fuel before starting the generator
- Fill the fuel tank to 90% capacity to allow for expansion in warm weather.

5.1.2 Adding fuel to the external tank(Optional)

- Check all fuel lines for wear and the tightness of all connections and joints.
- Do not place the external tank more than 5 meters away from the generator and the base

of the tank should be no more than 5 meters above the generator.



NOTICE

Check the external fuel tank regularly. The fuel can overheat due to long time idle running if there is no fuel in the external fuel tank. Do apply different grade diesel based on the real time ambient temperature. If the summer suitable diesel is applied in winter, the engine will freeze and hard start.

5.1.3 Adding oil

CAUTION

● Check the oil level on the dipstick. First pull out the dipstick and wipe it clean and then reinsert it into the tube and check the level again. Add lubricant up to the area between the two scale marks on the dipstick. Be careful not to overfill the oil level.

● Check the oil and make sure it does not appear dirty or mixed with coolant.

● Start the engine and let it run for 3-5 minutes. Shut it off and recheck the oil level after waiting another 3-5 minutes for the oil to return to the oil pan.

WARNING

● Oil is very important for engine starting and service life. Do apply the specified oil. If the oil grade is not correct, it will cause engine internal parts damage or wear too earlier, thus the engine service life will shorten.

● Do apply SAE10W-30, SAE15W-40 grade oil which is suitable for common condition.

● Do clean the surrounding area of oil filler.

● Do not mix the different type oil, otherwise the lubricating performance will be reduced.

WARNING

5.1.4 Adding coolant

(1) Filling the radiator

Make sure the engine is cooled completely before removing the radiator cap. Coolant is hot and under pressure and can easily cause burns.

● Open the radiator cap and visually check the coolant level. Add the proper mixture of water and antifreeze(the ratio is based on ambient temperature).

● Add coolant slowly until it is at an overflow point. Clean up all spills.

● Make sure the radiator cap is reinstalled securely. A loose cap will reduce the pressure in the system and cause the coolant overheat.

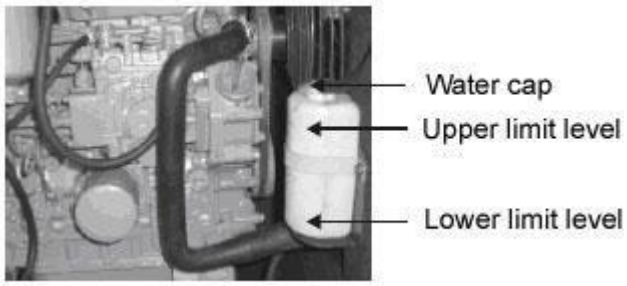
● Only apply the coolant with antirust. The pure water will freeze and expend in winter, that will cause the coolant system parts damaged. Meanwhile the pure water will cause rust inside pipes to reduce the cooling efficiency.

● Only add the same brand and same ratio anti-freeze liquid.

(2). Filling the expansion tank(Optional)

● Remove the cover of the expansion tank. Add coolant to the upper scale mark. Reinstall the cover.

● Check the condition of the rubber hoses and clamps connecting the expansion tank and radiator. Replace the hose there are cracks.



5.1.5 Trial running

When the generator is used for the first time or immediately after long term storage, a short trial run at zero load should be conducted, which is helpful for adequate lubrication of moving parts and increase the service life of engine.

CAUTION

Check the lubricant and coolant levels after the five minute trail run. The levels in the oil pan and radiator will drop when oil and coolant are full of systems.. Add fluids to the proper level.

5.2 Start genset

1. Make sure the main circuit breaker is in “OFF” position.
2. Turn the Power Switch to “ ON” position to make the controller enter into self-checking mode.
3. Press”MANUAL” key on the controller, the manual mode indicating light will be on, and then press “ START” to start genset.

● If the engine cannot start, restart it after 30seconds. In case of three times failure starting, the genset will enter into alram mode. Do check fuel supply system and battery voltage. Don’t start engine many times by force to avoid start motor damage.

● As to the genset with preheat system, the genset will automatically switch on the preheater after starting signal(the presetted time is 10s.). And then the genset will start after preheating.

4. When genset is running, turn the main circuit breaker to “ON” position.

NOTICE

● Long time running start motor will greatly consume battery and even burn the battery.

● Engine preheating also greatly consume battery power. Do adjust preheating time according to ambient temperature.

5.3 Stop genset

1. Unload the generator.
2. Turn the main circuit breaker to “OFF” position.
3. Press red “STOP” knob on the controller to shut down the generator.
4. When the engine is completely stopped, turn the Power Switch to “ OFF” position to cut down the controller power.

WARNING

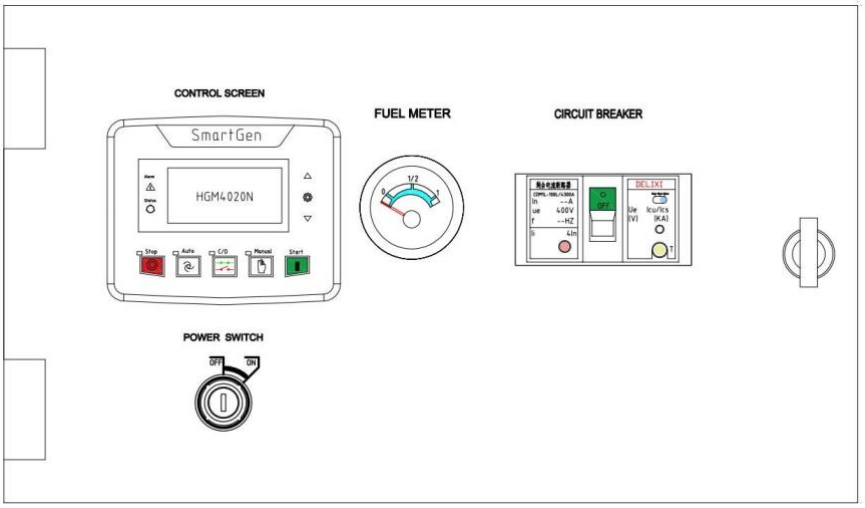
As to some models(refer to engine manual), the throttle is in open status when the genset is running and it will be in close status after the genset is stopped.

1, DO NOT press “STOP” knob when the genset is not started yet, but the start key is already in “ ON” position. Otherwise, the throttle will be hot and the using life will be impacted.

2, DO press” STOP” knob to stop genset.(In case ATS connected, the genset will be stopped automatically.)

3, If the controller screen indicating the defect, do press “↑”knob to defects interface and then press“STOP” knob to clean defects.

4,Do not shut down the generator with a load applied.



5.4 Control panel

5.4.1 controller

We apply HGM4020 controller as our standard configuration. But other brand or models are also available. To make users fully understand the main features or function of each kind of controller, we attached the controller operation manual to each genset. Please read controller manuals carefully before operation and keep manuals always with the genset.

5.4.2 Fuel gauge

It's easy to check fuel tank level from control panel with fuel gauge.

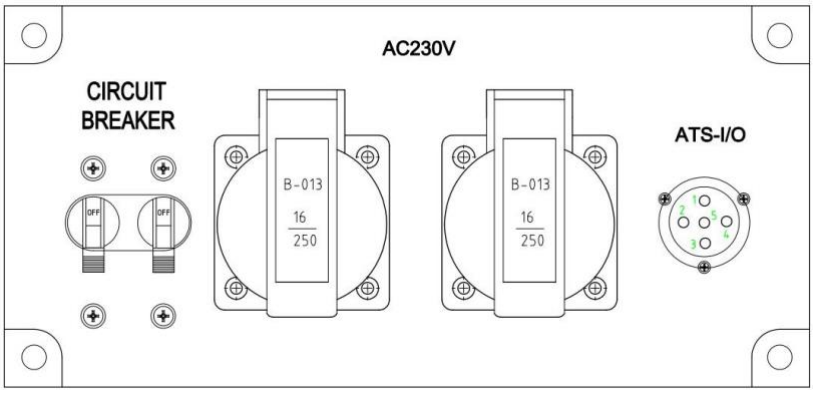
5.4.3 Main circuit breaker

MCCB, MCCB with RCD, MCB three kinds of breakers are optional.

5.4.4 Power Switch

5.5 Receptacle panel

For the convenience of connecting loads by users, the genset is equipped with receptacles and circuit breakers. (The receptacle type is vary with local application.) The receptacles and output terminals are located in different cells with locable cover.



5.5.1 ATS connector

Optional part.

5.5.2 Single phase receptacle

5.5.3 Breaker

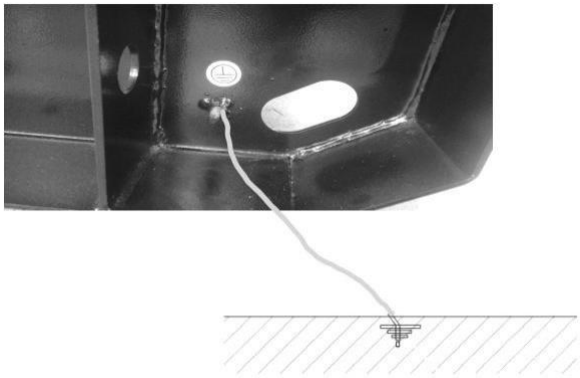
Special for single phase receptacle

5.6 Output terminal

Connect the cable to above three phase and four wires terminals.

5.7 Grounding

The grounding of genset canopy.

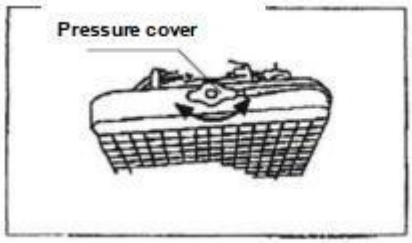


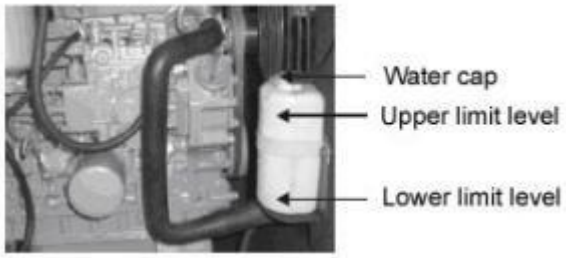
Check the grounding of the generator

The generator should be grounded to its own ground. Do not connect the phase (N) exclusively used for the three-phase connector directly to the ground wire, It should be connected to the neutral point (N) output of the generator.

WARNING

When the generator is running or when it has just stopped running, the coolant will be extremely hot and under high pressure. Do not open the radiator cap or the expansion tank cap until the engine has cooed sufficiently to prevent burns.





5.8 Low load operation

Please avoid an extended no load or low load operation

Run time below ¼ load should be limited to 5 hours. Otherwise, carbon deposit will be caused both in the engine and exhaust, accordingly the service life of engine will beshorten. Low load on a new engine will not generate enough heat to seat the piston rings and cause oil consumption issues.

A ¼ load or more is suitable for long time operation.

5.9 After startup

a. Make sure all parameters on the display panel are within limits.

b. Check the engine for leaks.

c. Check the color of the exhaust smoke. The exhaust should be colorless or light gray under normal load and slightly darker under heavy load.

d. Listen for abnormal sounds and check for excessive vibration.

e. Put the circuit breaker in the “ON” position.

5.10 Load input

NOTICE

During the first 50 hours avoid rapid acceleration or deceleration of the engine and avoid heavy load.

When the unit starts successfully and runs smoothly and electrical parameters are normal, the generator breaker can be switched on to ON position.

a. With a load is applied, readjust the rated RPM, frequency, and voltage.

b. Check the parameters on the control display. The parameters must stay within normal limit and no warning lights blink.

c. Shut down the engine if any abnormalities are noted and troubleshoot and repair any faults.

d. If the generator shuts off by running out of fuel, refuel the tank and bleed the air from the high pressure fuel lines to prevent hard starting.

5.11 Emergency Stop

If you notice dangerous symptoms such as overspeed, short circuit, engine noise, fluid leak, etc., shut down the generator by pressing the “Emergency Stop” Button.

After the generator has been repaired, reset the “Emergency Stop” button.

CAUTION

The main breaker will trip immediately after pressing the “Emergency Stop” button. The load is powered off and the generator shuts down. The control panel will display an alarm indication.

To recover the operation of the generator, reset the “Emergency Stop” and then press the “Stop” button on the controller until the alarm is off. Restart the genset normally.

Close the main breaker when the genset is in normal operation to power the load.

WARNING

An emergency shutdown is harmful to the generator. Only apply it during in an extreme situation.

6. PERIODIC MAINTENANCE AND SERVICE

6.1 Inspection cycle

6.1.1 After the first 50 hours of operation

- Replace engine oil and filter.
- Check the tension of the fan belt.

6.1.2 250 hour inspection

- Replace engine oil and filter
- Clean or replace the air filter element.
- Measure the generator insulation resistance. (Also inspect monthly)
- Check the specific gravity of the storage battery.

6.1.3 500 hour inspection

- Replace the fuel filter element
- Clean the radiator
- Check the terminals and the wire connectors of the electrical circuit.
- Perform the 250 hour items.

6.1.4 1000 hour inspection

- Clean the inside of the fuel filter
- Replace the air filter element
- Check and adjust the fuel injection timing
- Check the vibration isolators for wear
- Check all rubber and nylon hoses for wear.
- Check the sound damping material
- Perform the 250 and 500 hour inspection items.

6.1.5 Maintenance operations

(1) Oil change

- Run the engine for 3-5 minutes so the oil will flow freely. Remove the oil drain plug from the engine and drain the oil into a suitable container.
- Replace the oil drain plug

- Fill the engine with fresh oil to the H level on the dipstick.
- Run the engine for five minutes then recheck the oil level after allowing time for the oil to drain completely back to the oil pan.

(2) Oil filter replacement.
- Use a filter wrench and remove the oil filter.
- Apply a thin film of clean engine oil to the sealing gasket of the new filter element.
- When installing the new filter, hand tighten then use the filter wrench for ¾ revolution.

(3) Check belt tension
- Press the middle of the belt tightly with the thumb and check the degree of deflection.
- Belt tension is specified in engine manual.
- Loosen the bolt that secures the alternator.
- Move the alternator until the belt deflection is between 10 and 15 mm. Tighten up the alternator mounting bolt.
- Check the belt for oil and dirt that can cause the belt to slip.

(4) Clean the air filter
- Remove the filter element from the air filter housing
- Use compressed air to blow dirt and contaminants from the cartridge and the housing.
- Check the element for torn paper or deformation. If found, replace the element.

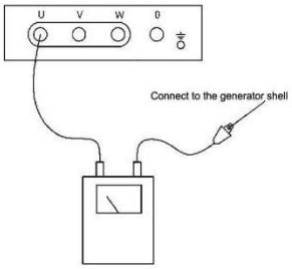
(5) Measure the insulating resistance

DANGER

● Measure the insulating resistance only after the generator has stopped.
● First remove the wires connecting the AVR and the controller to prevent permanent damage.
● Measure once each month with a 500V insulating-resistance meter (mega ohmmeter or megger)

Test Procedure

-Remove the three phase cable from the three phase terminal on the power output terminal. Switch the breaker to the ON position and measure the insulating resistance between the output terminal and the alternator cover. The test voltage should be applied for 60 seconds.
-When the insulating resistance is below 1M, leakage has occurred. Clean any dirt, oil and rust from each output terminal, breaker and the cables and retest.



(6) Check the battery.

Check the electrolyte specific gravity.

If the starter rotation speed is slower than the rated value, it will lead to start failure so keep the battery charged. If the genset cannot start after charging, replace the battery.

Measure the specific gravity of the electrolyte level with a hydrometer if the battery lacks an adequate charge. If the residual voltage is below 75%, charge the battery.

Check the battery voltage first before starting the genset if it hasn't been used for more than 3 months. Charge the battery if the voltage is lower than 12V. Starting a genset with low voltage may damage the starting motor.

Calculate the charging ratio on the basis of measured specific gravity according to the table below:

Temperature (ºC) / Charging ratio %	20	-10	0
100	1.28	1.30	1.29
90	1.26	1.28	1.27
80	1.24	1.26	1.25
75	1.23	1.25	1.24

Note: A tolerance of ± 0.01 is permissible.

Charge the battery immediately when the charging ratio is lower than 75%.

NOTICE

Remove the battery wires before charging.

Charge the battery in a well-ventilated area.

Disconnect the negative cable first when disconnecting cables. (If you disconnect the positive cable first, it may cause an electrical spark the cable is touches the genset housing). When reconnecting the cables, connect the positive cable first and then connect negative wire.

Keep fire, sparks or any other source of combustion away from the highly inflammable gas.

CAUTION

Never produce spark or get close to the fire to avoid explosion by the inflammable gas produced during the charging.

If the battery is extremely hot, i.e. electrolyte temperature is above 45°C, stop charging until it cools down.

Stop charging when the battery is completely charged. Otherwise, over charging charging will cause below problems:

1） Battery overheating

2） Loss of electrolyte

3） Battery failure

When reconnecting the battery, connect the positive (+) lead of the battery first and then negative (-) lead.

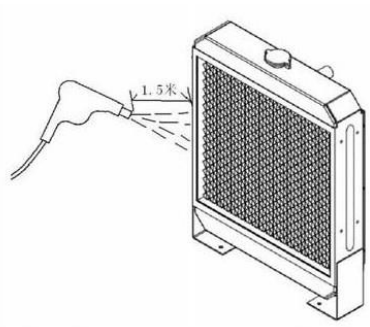
Do not reversely connect the battery terminal or the AC alternator will be burnt.

(6) Fuel filter replacement

- Remove the fuel filter with a filter wrench.
- Apply a thin film of engine oil on the new filter sealing ring.
- Hand tighten the new filter then use the filter wrench and tighten an additional 2/3 revolution.
- Bleed air from the fuel lines after replacing the filter and before starting the engine.

(7) Cleaning the radiator

When cleaning the radiator, use steam or low pressure compressed air to clean the radiator cooling fins.



CAUTION

Do not use high pressure air or the radiator may be damaged. Remove the fan if access to the radiator is blocked.

(8) Check the electrical terminals.

Check all terminals for rust, corrosion, burns on all circuits.

(9) Clean the internal fuel tank

Empty the fuel tank and remove all water and sediment.

(10) Replacement of air filter components

Do apply genuine parts for replacement.

(11) Check the isolators

The rubber vibration isolators that support the engine and generator can deform due to heavy wear or oil and water contamination. Contact the customer service department for the proper replacement parts.

(12) Check all rubber and nylon hoses.
Look for cracks, bulges, splits, and other signs of wear. Replace as necessary.

(13) Check the sound damping materials. Contact the customer service department for replacement sections if they become detached or damaged.

6.2 Maintenance schedule

Carry out maintenance of your diesel engine according to engine manuals. In case of touh working temperatures dusty or frequent-stop conditions, the maintenance interval should be shortened.

7. TROUBLESHOOTING

7.1 Engine faults and troubleshooting

This section lists common faults and corrective action. The user should shut down the engine immediately to minimize damage caused by the fault to prevent a more catastrophic failure. As to engine troubleshooting, please refer to engine manual for more information.

7.1.1 Engine won't start

Possible Cause	Corrective Action
1.Fuel supply or delivery fault	
a. air in the fuel system	Discharge air in system
b. blockage in the fuel system	Dismantle and clean
c. malfunction of the injection pump	Check and repair
d. fuel injection fault	Check fuel injector for spraying conditions; wear condition of plunger and oil outlet valve as well as oil outlet valve spring for cracks
e. wrong injection advanced angle	Check and adjust
f. fuel shutoff handle is in the shutoff position	Put the fuel-cut handle at fuel supply position
2. low engine compression	Replace worn rings (replace all rings on the piston)
a. piston ring wear	Clean ring grooves
b. piston rings stuck	Broken or weak valve springs: improper valve clearance or leaking valve guides- repair
c. valve leakage	Warm engine with auxiliary devices as necessary
d. low ambient temperature	
3. Electrical system faults	
a. insufficient battery voltage	Charge the battery to full cranking capacity
b. bad continuity of electric circuit	Check wires for continuity and secure connections
c. bad contact of brushes and commutator of starting motor	Repair or replace electric brushes and use fine sand paper to clean the commutator surface followed by blowing off dust
d. insufficient torsional moment of starter clutch disc; slippage	Add shims and adjust
e. Starter gear disengaged from flywheel ring gear	Check starter operation and ring gear teeth

7.1.2 Unsteady engine running of (surging)

Possible Cause	Corrective Action
1. air in fuel system	Bleed air
2. water in fuel	Check water content in fuel
3. leakage in fuel lines and connections	Check and repair
4. abnormal operation of speed regulator	Check and calibrate speed regulator
5. gas blowby in cylinder	Check cylinder head gasket and replace as necessary; check the height of cylinder liner projection- reseat as necessary
6. uneven fuel delivery to cylinders	
a. uneven fuel supply of injection pumps	Check and adjust
b. bad injector nozzle or stuck plunger	Check fuel injector condition. Replace or repair as necessary
c. broken injection pump spring plunger	Replace spring

7.1.3 Insufficient engine power or sudden drop of power

Possible Cause	Corrective Action
1. air filter blockage	Clean or replace filter element
2. fuel shutoff lever not in fuel supply position;	Put lever in proper position
3. damage of valve spring or valve push rod;	Replace
4. valve clearance out of adjustment	Adjust
5. low compression	Refer to section 7.2
5. wrong fuel supply advance angle	Check and adjust
6. air mixing in fuel supply system or blockage in the system	Refer to section 7-1, items a and b
7. insufficient fuel supply;	Check fuel injection plunger and outlet valve
8. bad quality of atomization	Check, clean and adjust pressure
9. bad sealing of injector taper washer;	Check, repair or replace injector
10.malfunction of speed regulator;	Replace washer
11.engine overheat;	Check speed regulator and adjust
12. Carbon buildup in cylinder head	Check and repair cooling system as necessary
13.blockage of exhaust	Remove carbon deposits
	Remove blockage

7.1.4 Abnormal noise during running

Possible Cause	Corrective Action
1. early injection timing causes rhythmic and ringing metal knock in cylinder;	Adjust fuel supply advance angle
2. late injection causes noise in cylinder	Adjust fuel supply advanced angle;
3. Excessive clearance between piston and cylinder, impact sound from cylinder after starting and becomes lower as engine warms up.	Replace piston Replace parts to achieve specified clearance
4. Excessive clearance between piston and cylinder, sharp and low sound, particularly at idle	Replace parts to achieve specified clearance
5. Excessive clearance between main shaft and connecting rod; impact sound at sudden RPM drop and becomes louder at low speeds	Replace thrust plate to ensure specified clearance
6. Excessive axial clearance of crankshaft, impact sound of moving of crankshaft under idle speed;	Replace parts and check and adjust valve clearance;
7.broken valve spring, bent push rod or overlarge valve clearance, noise or rhythmic knock sound from cylinder head cover	Check piston and valves for impact. Rebuild or replace cylinder head Replace gears as necessary
8. Valves contacting is piston crown, metal knock sound from cylinder head	
9. Excessive gear clearance due to wear-knocking sound during sudden RPM drop	

7.1.5 Abnormal exhaust color

Engine exhaust smoke under normal loading should be in light grey and dark grey under short term heavy load. Blue, white or black smoke indicates fault. Blue smoke indicates engine oil in the combustion chamber. White smoke means incomplete combustion of fuel in the cylinder or water in fuel. Black smoke is an indication of excessive fuel and incomplete combustion.

Possible Cause	Corrective Action
1.blue smoke	
a. reverse installation of piston ring, stuck or worn rings	Inspect and reinstall or replace rings
b. worn valve guides	Renew valve guides
2. white smoke	
a .bad atomization of injector, leakage;	Adjust injection pressure, check sealing condition of even components;

b. water in cylinder; 3. black smoke	Check and remove fault
a. overload of engine;	Adjust to regulated load
b. over fueling	Adjust fuel supply volume;
c. late fuel supply and late combustion;	Adjust fuel supply advance angle;
d. misadjusted valve clearance, bad valve guides, air leakage;	Check valve clearance, valve spring, taper sealing and remove any faults.
e. air filter blockage	Check and remove fault.
f. low turbocharger boots pressure	Check turbocharger operation

7.1.6 High engine oil temperature

Possible Causes	Corrective Action
1. excessive load on engine	Reduce load
2. too low or too high oil level	Add or remove engine oil to meet specification
3. low piston cooling	Check piston cooling, liner sealing
4. defective oil cooler, by-pass valve or engine block cooling	Check, clean and adjust.

7.1.7 Insufficient engine oil pressure

Possible Cause	Corrective Action
1. defective pressure gauge, sensor or broken lines	Replace pressure gauge or sensor or check lines
2.insufficient engine oil	Add engine oil to regulated level;
3.diluted engine oil	Check engine oil for proper viscosity or dilution
	Adjust clearance or replace gears;
4. wear or improper assembly of engine oil pump gears	Replace or remove pump gears
5. blockage of engine oil screen or filter;	Clean screen, replace filter
6. defective spring in pressure limiting valve or pressure stabilization valve	Check valves for proper operation
7. blockage or leakage of engine oil lines	Check lines for obstruction

7.1.8 High coolant temperature

Possible Cause	Corrective Action
1. defective water temperature gauge or sensor	Inspect and replace; Add coolant

2. insufficient coolant	Check pump and belt for proper operation
3. water pump defective or belt loose	Remove scale and deposits. Check radiator core
3. heavy deposits and scale inside engine	and clean as necessary
block, coolant lines or radiator	Reduce loads
4. engine overloaded.	

7.1.9 Insufficient fuel volume in injection pump

Possible Cause	Corrective Action
1. broken check valve or wear of valve seat;	Replace spring and repair check valve
2. plunger worn	Replace plunger
3. air leakage of oil intake bolt	Replace washer and tighten bolt

7.1.10 Injection pump malfunction

Possible Cause	Corrective Action
1. no fuel supply	
a. defective fuel transfer pump	Check and replace if defective
b .blockage in fuel filter or supply line	Clean or replace;
c. air in fuel system	Bleed air
d. broken outlet valve spring;	Replace spring.
2. uneven supply	
a. air in fuel system	Bleed air
b .broken outlet valve spring	Replace spring
c. fuel outlet valve seating surface worn	Replace or repair
d. plunger broken or spring worn	Replace parts
e. debris in plunger path	Clean
f. low inlet pressure	Check fuel transfer pump and filter
3. insufficient fuel supply volume	
a. outlet valve leaking fuel	Repair or replace parts
b. fuel leaking at connection joints	Check and repair
c. plunger worn.	Replace plunger

7.1.11 Injector faults

Possible Cause	Corrective Action
1. low or no fuel delivery	
a. air in fuel lines	Bleed air
b. needle valve seized in valve body;	Repair or replace
c. excessive clearance between needle	Replace

valve and valve body	
d. fuel leakage;	Tighten joint or replace part
e. low or high fuel supply	Re-flow injector on test bench or replace
2. low injection pressure;	
a. pressure regulating bolt loose	Adjust to regulated pressure
b. spring tension low	Replace spring
3. high injection pressure;	
a. stuck needle valve	Repair
b. blockage in spray hole	Clean injector tip
c. pressure regulating spring not set	Adjust
4. leaking fuel	
a. pressure regulating spring broken	Replace spring
b. contact surface of needle valve and valve body	Repair or replace; Clean or replace;
damaged	Replace
c. needle valve stuck	Replace
d. tightening nut deformed	Grind or replace
e. uneven contact surface of injector seat	
5. bad atomization;	Replace part;
a. needle valve deformation or damage	Clean
b. needle valve and valve surface dirty	Clean or replace
c. blockage in injector nozzle;	Clean or replace
d. stuck needle valve.	

7.1.12 Fault of speed regulator

Possible Cause	Corrective Action
1.unsteady speed regulation	
a. uneven fuel supply	Adjust oil supply volume;
b. blockage or fuel leakage from injector;	Check or replace injection components or assembly
c. broken fuel pump plunger or fuel outlet valve spring	
2.idle speed cannot be attained	Replace plunger or spring
a. operating arm does not bottom out	Check and adjust
b. stuck gear ring and adjusting gear rod	Check and remove fault;
3.travelling block	Check and adjust
a. deformation of adjusting spring;	
b. inconformity between opening and closing distance of fly ball;	Replace spring
c. oversized clearance due to wear of floating lever rod;	Check and calibrate;
4.Uncontrolled spray (wide open fueling	Replace rod
a. high rotary speed	

b. malfunction of speed regulator c. Stuck adjusting gear rod and gear ring.	Check and adjust Check and repair Inspect and repair

7.1.13 Sudden engine shutdown

Possible Cause	Corrective Action
1.crankshaft won't rotate after stop; a. crankshaft locked b. piston won't travel in cylinder liner; 2.crankshaft freewheeling after stop a. air in fuel system; b. fuel system blockage c. air filter block or fuel cutoff handle is in the fuel cutoff position.	 Inspect crankshaft and bushing, replace the bushing; Replace piston and cylinder liner Bleed air Find cause of blockage and repair Replace air filter and put the fuel supply cutoff to the correct position.

7.2 Alternator faults

7.2.1 Mechanical faults

Faults	Possible cause & corrective action
1. bearing overheating (>80℃) or abnormal noise	- Bearing installed incorrectly or has failed - Check the color. Replace the bearing if it has turned blue or the grease has turned black.
2. overheating- generator frame over 40℃ above ambient temperature	- Air intake is blocked. -Poor ventilation - Over voltage. - Overload
3. Vibration	- Poor alignment -Rotor is not balanced
4. Abnormal noise or vibration.	- Short circuit - Parallel fault. - Coupling is broken or damaged. - Shaft is broken or damaged. - Main stator damage or short circuit. - Fan fault.

7.2.2 Electrical faults

Fault and possible cause	Corrective action
Voltage does not build up	
(1) Regulator fuse blown	Check all wiring, if there is no problem replace the fuse
(2) Voltmeter damaged	Verify the panel meter with multi-meter or other meter that is known to be accurate.
(3) Defective voltmeter	Check the meter and replace as necessary
(4) Loose connecting plug of the AVR.	Check the connecting plug; make sure all joints are tight and making good contact
(5) Surge suppressor short circuit	Check the surge suppressor and eliminate the short circuit
(6) Defective diodes	Remove the diodes and test them with a multi-meter. Replace the bad diode.
(7) Lost residual magnetism	Connect a 12V battery to the exciter field, the + of battery to the F+ (red lead) and the - to the F- (black lead) for 15 to 20 seconds. Caution: The generator should be stayed still during flashing.
(8) Incorrect connection	Check carefully, and correct the wiring refer to the wiring diagram.
(9) Exciter field break	Clean, twist and weld the broken wire. Wrap the joint with insulating material.
(10) Loose joints or poor contact	Clean and tight the joints again.
(11) Armature winding broken	Repair the break or rewind the armature
(12) Armature winding of generator short circuit	Short circuit will cause the winding to fail and they should be replaced.
(13) Armature winding of exciter break or short circuit	Locate the failure and replace the winding.
(14) Incorrect speed	Verify speed with tachometer or frequency meter.
(15) AVR protective shutdown circuits	Correct the problem and adjust AVR. Refer to the AVR manual.
(16) AVR inoperative	Adjust or replace the AVR. Refer to AVR manual.

Low voltage at no load (1) Voltmeter fault. (2) Engine speed is too low. (3) Wires are connected improperly (4) Residual voltage is too low. (5) Winding or rectifier fault. (6) AVR fault.	 Check the voltage with another voltmeter. Check the engine speed with tachometer and repair as necessary Refer to the wiring diagram. See (7) above. Check the wiring & resistance and replace as necessary Adjust or replace AVR
Low voltage at load (1) Overload (2) Motor load or inductive load (3) Low engine speed (4) Wires are not connected properly (5) Voltage drop in the circuit	 Reduce the load to the rated value. Check that the starting motor load is within the capacity of the generator Check the engine speed with tachometer. Please refer to the wiring diagram. Choose power cables with larger cross section.
Output voltage fluctuation (1) Incorrect speed (2) Unstable speed (3) AVR stability (4) Defective/loose connections (5) Defective diodes, surge suppressor or generator windings. (6) Remote voltage adjust rheostat (if used). (7) Defective AVR (8) Defective bearing of worn bearing carrier causing an uneven air gap.	 Verify speed with tachometer Check governor stability. Adjust AVR stability. Refer to AVR manual. Inspect all wiring for loose or dirty connections. Test generator with constant excitation (12V battery test). Check operation of rheostat. Refer to AVR manual. Replace the AVR. Refer to AVR manual. Replace worn bearing. Check bearing carrier for wear. Replace as necessary.
High voltage (1) Voltmeter fault (2) Incorrect wiring (3) AVR setting (4) AVR fault (5) Advance power factor	 Check the voltage with another voltmeter. Please refer to the wiring diagram. Setting the AVR in accordance with the manual Replace AVR Check the power factor and set AVR according to load
Voltage builds up then drops Wrong AVR setting	 Set the AVR

8. STORAGE

●If the generator is to be put into storage for over 90 days, store the generator in a clean well-ventilated area free from moisture.

1) Run the engine for three minutes then completely drain the oil from the engine. Replace the engine oil filter then fill the engine with fresh engine oil.

2) If the generator is to be stored without antifreeze, drain all coolant from the engine.

- Open the side door of the enclosure and remove the radiator cap
- Open the coolant drain at the bottom of the radiator and drain the coolant from the radiator
- Open the drainage plug on the side of the engine block and drain the coolant from the engine
- Drain the coolant recovery tank if so equipped.
- Replace all caps and plugs and close the enclosure

3) Drain all fuel from the fuel tank.

4) Lubricate the speed governing system linkage.

5) Clean all dirt and dust from the generator and the enclosure

6) Remove the cable from the (-) terminal of storage battery. Charge the battery once a month to maintain a proper charge level

7) Cover the controller and cover the unit with plastic or heavy canvas.

8) After removing the unit from storage and before the initial startup, prepare the unit in accordance with the instructions in chapter 5;

Please refer to the engine operation manual for further engine-related preparations

9. TECHNICAL SPECIFICATIONS

9.1 Technical standards refered

GB/T 2820.1-2009 Reciprocating internal combustion engine-driven alternator units-Part 1: Use, quota, and performance
GB/T 2820.2-2009 Reciprocating internal combustion engine-driven alternator sets-Part 2: Engine
GB/T 2820.3-2009 Reciprocating internal combustion engine-driven alternator sets-Part 3: alternators for generator sets
GB/T 2820.4-2009 Reciprocating internal combustion engine-driven alternator sets-Part 4: Controls and switchgear
GB/T 2820.5-2009 Reciprocating internal combustion engine-driven alternator sets-Part 5: Generator sets
GB/T 2820.6-2009 Reciprocating combustion-driven alternator units — Part 6: Test methods
GB/T 2820.7-2002 Reciprocating internal combustion engine-driven alternator sets — Part 7: Technical instructions for technical conditions and design
GB/T 2820.9-2002 Reciprocating internal combustion engine-driven alternator sets-Part 9: Measurement and evaluation of mechanical vibration
GB/T 2820.10-2002 Reciprocating internal combustion engine-driven alternator sets-Part 10: Measurement of noise (package method)
GB/T 4712-2008 Automatic diesel generator set grouping requirements
GB/T 6071-2008 Reciprocating internal combustion engine Performance — Part 1: Calibration and testing method of power, fuel consumption, and oil consumption, additional requirements for general engines
GB/T 12786-2006 General technical conditions for automatic internal combustion engine power station
GB/T 20136-2006 General test method for internal combustion engine power station
JB/T 7606-1994 Technical requirements for final assembly of internal combustion engine power station
JB/T 10303-2001 Technical conditions of power-frequency diesel generator set

9.2 Modified ambient power coefficient

Modified ambient power coefficient conditions

The conditions of generator rated output:

Altitude: 0 m Ambient temperature: 25ºC Relative humidity: 30%

Ambient modified coefficient: C (Relative humidity 30%)

Altitude (m)	Ambient temperature (ºC)				
	25	30	35	40	45
0	1	0.98	0.96	0.93	0.90
500	0.93	0.91	0.89	0.87	0.84
1000	0.87	0.85	0.82	0.80	0.78
2000	0.75	0.73	0.71	0.69	0.66
3000	0.64	0.62	0.6	0.58	0.56
4000	0.54	0.52	0.5	0.48	0.46

Note: When the relative humidity is 60%, the modified coefficient is C-0.01

When the relative humidity is 80%, the modified coefficient is C-0.02

When the relative humidity is 90%, the modified coefficient is C-0.03

When the relative humidity is 100%, the modified coefficient is C-0.04

Example:

When the rated power of generator is PN =5KW, altitude is 1000m, ambient temperature is 35ºC, relative humidity is 80%, the rated power of generator is:

P=Pn×(C-0.02) = 5 × (0.82-0.02) = 4KW

CAUTION

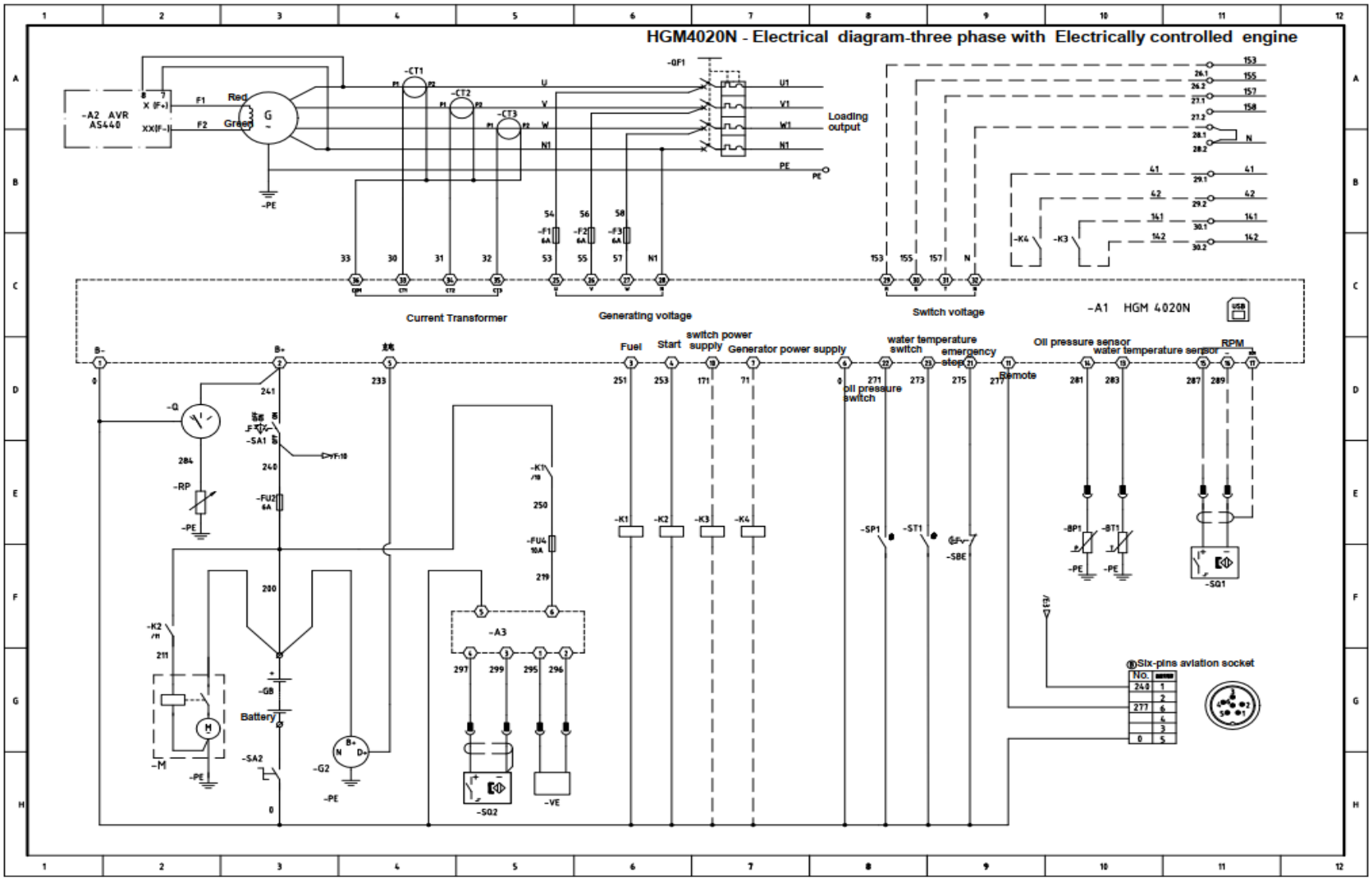
Ambient conditions:

1000 mbar, 25ºC, relative humidity 30％; the rated value observes the standard of ISO 3046.

1-P.R.P. Prime Power —ISO8528： Prime power means the maximum power of continuous running at the maintenance interval under varying load conditions. The mean power should not exceed 80% of prime power if 24 hours continuous running is required.

2-Standby power (ISO3046 Fuel Stop power): Standby power means the maximum running power of the generator. The run time limit will be 500 hours under varying load conditions or emergency. The run time limit each year should not be more than 25 hours under a 100% load while or 200 hours under a 90% load. Overload is not allowed.

9.3 Wiring diagram



9.4 Technical specification

Genset		HDE20SS3	HDE40SS3	HDE80SS3
Main Configuration				
Model (Super silent type)		HDE20SS3	HDE40SS3	HDE80SS3
Engine model		PD490C1	PD4105C1	PD4110ZIC1
Alternator model		PPA183-18C	PPA183-30C	PPA223-68C
Controller brand		SMARTGEN	SMARTGEN	SMARTGEN
Controller model		HGM 4020	HGM 4020	HGM 4020
Electrical Performance				
Frequency	Hz	50	50	50
Prime power	kVA	20	37	80
	kW	16	30	64
Standby power	kVA	22	41	89
	kW	18	33	71
Rated voltage	V	230/400	230/400	230/400
Rated current	A	28.9	53.4	115.5
Power factor	cosφ	0.8	0.8	0.8
Frequency droop δf_{st}	%	≤5	≤5	≤5
Steady-state frequency band β_f	%	≤1.5	≤1.5	≤1.5
Steady-state voltage regulation δUst	%	≤ ±2.5	≤ ±2.5	≤ ±2.5
Transient frequency deviation(Sudden increase) δf^{+}_{dyn}	%	≤-10	≤-10	≤-10
Transient frequency deviation(Sudden decrease) δf^{-}_{dyn}	%	≤+12	≤+12	≤+12
Frequency recovery time t_f	S	≤5	≤5	≤5
Transient voltage deviation(Sudden increase) δU^{+}_{dyn}	%	≤-20	≤-20	≤-20
Transient voltage deviation(Sudden decrease) δU^{-}_{dyn}	%	≤+25	≤+25	≤+25
Voltage recovery time t_U	S	≤6	≤6	≤6
Main genset data				
Dimension (Super silent type)（L×W×H)	mm	1720*820*1150	2000*850*1150	2350*970*1350
Net weight (Super silent type)	kg	815	1060	1440
Fuel tank capacity (Super silent type))	L	92	120	164
Continuous running time@100%load	Hr	17	14	8
Noise level@7m (Ultra silent type)	dBa	51	51	53
Alternator				
Model		PPA183-18C	PPA183-30C	PPA223-68C
Wiring type		Star-series	Star-series	Star-series
Rated Power@1500rpm	kW	16	30	68
Efficiency	%	84.9	86.6	90.2
Excitation type		Self-excitation	Self-excitation	Self-excitation
Telephone interference factor (TIF)		＜50	＜50	＜50
Telephone harmonic factor (THF)		＜2%	＜2%	＜2%
Protection		H	H	H
Insulation		IP23	IP23	IP23
Engine				
Model		PD490C1	PD4105C1	PD4110ZIC1
Speed	rpm	1500	1500	1500
Rated power	kW	21	38	80
No. of cylinders		4	4	4
Cylinder arrangement		Vertical	Vertical	Vertical
Cooling system		Water cooled	Water cooled	Water cooled
Bore	mm	90	105	110

Stroke	mm	100	118	118
Displacement	L	2.54	4.087	4.3
Compression ratio		18	18	18
Governor type		Electronic	Electronic	Electronic
Air Inlet System				
Aspiration type		Natural	Natural	Turbocharged
Max inlet resistance	kPa	3.5	4	4.9
Air flow	m³/min	1.42	2.28	5.31
Exhaust System				
Exhaust gas temp(after Turbo)	℃	500	500	550
Exhaust flow	m³/min	3.68	5.91	13.53
Max exhaust back pressure	kPa	6	6	6
Lubricating System				
Oil capacity	L	8	13	17
Oil grade		CD 15W-40	CD 15W-40	CF 15W-40
Oil consumption (as % of fuel consumption)		0.75%	0.77%	0.82%
Low Oil Pressure Warning	kPa	100	100	100
Cooling System				
Coolant Capacity for Engine	L	5	7.2	7.2
Coolant capacity (w/radiator)	L	9	11.2	18.7
Max. Coolant Warning Temperature	℃	95	95	95
Max temp of radiator	℃	50	50	50
Fuel System				
Injection method		Direct	Direct	Direct
Fuel consumption（50%）	L/h	2.98	5.58	12.59
Fuel consumption（75%）	L/h	4.05	6.75	16.27
Fuel consumption （100%）	L/h	5.45	8.8	20.94
Starting System				
Starter capacity	KW	3.5	4.5/5	4.5/5
Starting voltage	V	12	12/24	12/24
Battery capacity	Ah	60	80	2x80

** The specification data is subject to change without notice.*

Generator set controller			
Controller brand	SmartGen		
Controller model	HGM 4020		
Data display		Function	
Mains Line Voltage (Uab Ubc Uca)	●	RS485 communication interface enable “Three remote functions” according to MODBUS protocol	●
Mains Phase Voltage (Uab Ubc Uca)	●		
Generator Line Voltage (Uab Ubc Uca)	●		
Generator Phase Voltage (Uab Ubc Uca)	●	CAN BUS Port	●
Mains Frequency	●	ETS (energize to stop)	●
Mains Phase Sequence	●	Idle Control	●
Generator Frequency	●	Preheat Control	●
Generator Phase Sequence	●	Rise/Drop Speed Control	●
Load Current (A)	●	Emergency Start	●
Each Phase and Total Active Power (kW)	●	Flywheel Tooth Number Automatic Recognition	●
Reactive Power (kavr)	●		
Apparent Power (kVA)	●	Event log, real-time clock scheduled start & stop generator	●
Power Factor	●		
Accumulate Total Generator Power	●	AMF	●
Output Percentage with Load (%)	●	Protection	
Coolant Temperature (℃)	●	High Coolant Temperature	●
Oil Pressure (kPa)	●	High/Low Oil Pressure	●
Fuel Level (%) Fuel Quantity Left (L)	●	Over/Under Voltage	●
Engine Speed (rpm)	●	Over/Under Frequency	●
Battery Voltage (V)	●	Low Fuel Level	●
Charger Voltage (V)	●	Generator Set Overload	●
Hour Meter	●		
Start Times Accumulation	●		