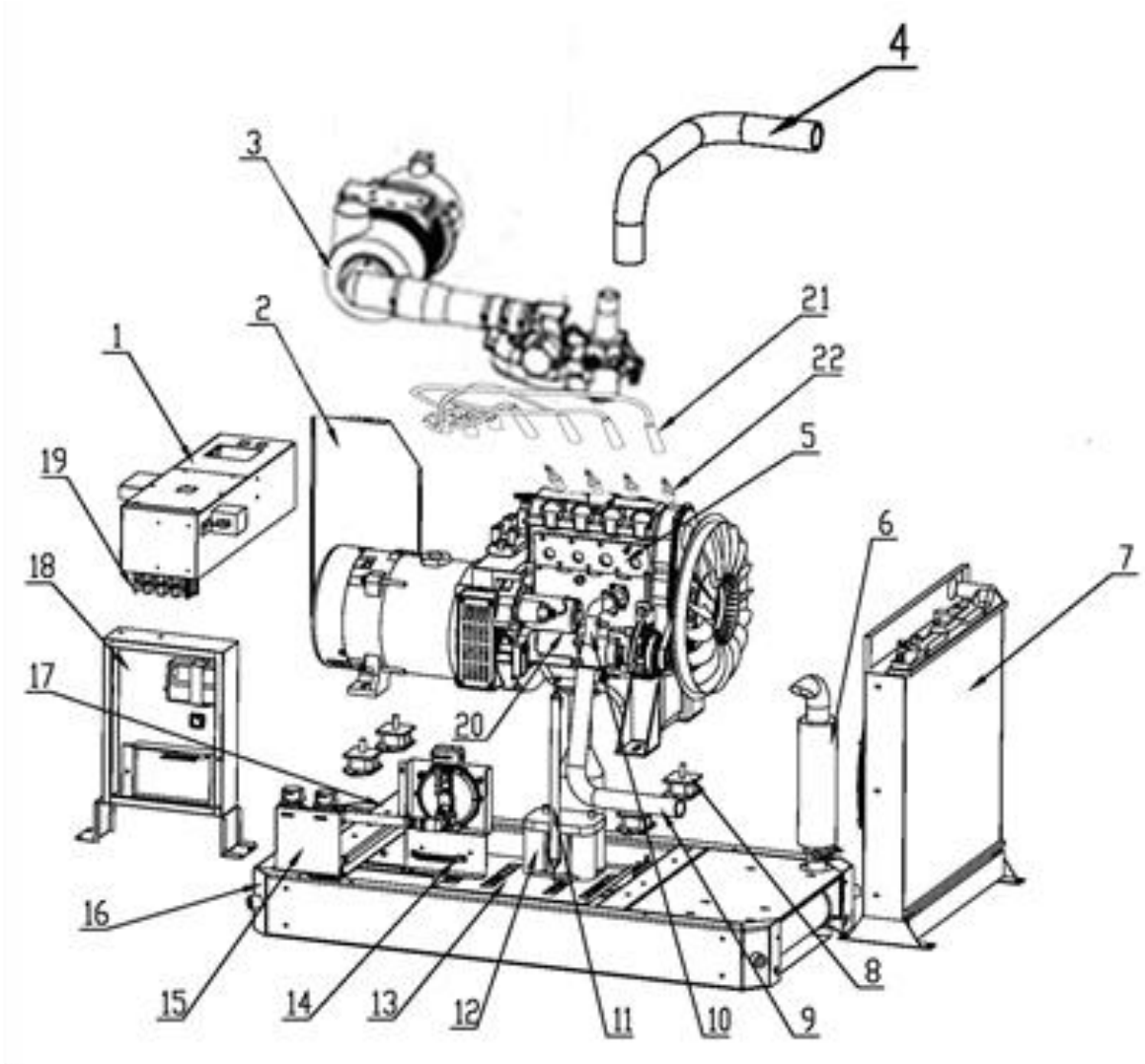
ALPINE POWER
SOLUTIONS INC.

# Installation, Maintenance, Repair Manual

## Only for authorized personnel




☐ PD20REG-DB

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# INTRODUCTION

Welcome to Alpine Power Solutions

Thank you for selecting an Alpine Power Solutions product. This manual is designed to provide crucial information on the operation and maintenance of your genset. Should you have any inquiries about our products, please don't hesitate to reach out to Alpine Power Solutions Inc.

Before initiating the use of this generator, we strongly recommend thoroughly reading this manual to ensure a comprehensive understanding of its contents.

Our generators are equipped with dedicated gas engines, ensuring optimal performance tailored for power output. With ongoing development, our units boast several advantages over similar products, including features like water-cooled exhaust systems, silent cooling mechanisms, electronic speed control, unattended power generation, multi-energy generation techniques, intelligent control systems, ultra-low temperature start technology, and more. These features are customizable to meet the diverse needs of users, providing advanced technology and high-quality products.

Given the continuous updates to our product line, there might be slight variations between this manual and the actual product. For any clarifications, please contact Alpine Power Solutions Inc.

At Alpine Power Solutions, "Customer satisfaction is our mission." Your feedback is invaluable to us. If you have suggestions or opinions while using our products, please reach out; we genuinely appreciate your input.

Should you encounter any challenges or difficulties, please contact us promptly. We are committed to serving you with utmost sincerity.

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# Chapter One Transportation of Genset

## Ⅰ. Transportation of Genset

The generator must be ensured to transport in the smooth transport channel. Ensure that the ground can withstand the weight of the unit.

The unit surface can not be placed with object of more than 200KG.

Do not tilt the machine more than 30 degrees. Try to avoid transporting on the uneven ground. The violent shaking during transportation unit may affect the unit.

When use forklift transportation, you have to ensure that the foot is wide enough to lift the unit from the bottom. Fully insert the fork leg is into the bottom of machine. Pay attention to the machine components of the damage, hold up and then sent to the flat ground.

## Ⅱ. Load and Unload of Genset

Install in accordance with the installation instructions. Avoid shipping damage or impact in transportation or installation of the unit. When the units shipped to the destination, please remove as the following manner:

● Use a forklift to lift up the unit with intact packing box and fork to the ground.
● Take down the packing box and bag and take out the accessory box and outriggers.
● Prepare 4 lifting ropes which are long enough to sling, and 4 screws which can pass through the screw hole (can be steel, etc.)
● Make the screw pass through the screw hole, and put the rope on the screw.
● Adjust the four lifting ropes on the lifting holes. The length of them should be as same as possible.
● Remove the 4 tripod mounting bolts from the unit.
● Lift the unit and take down the packing chassis, then put on the 4 outriggers .
● Put the unit on the ground and take off the screw and lifting rope.
● Adjust the height of the 4 outriggers to make the unit be set steady without any shaking.

# Ⅲ. Installation of Genset

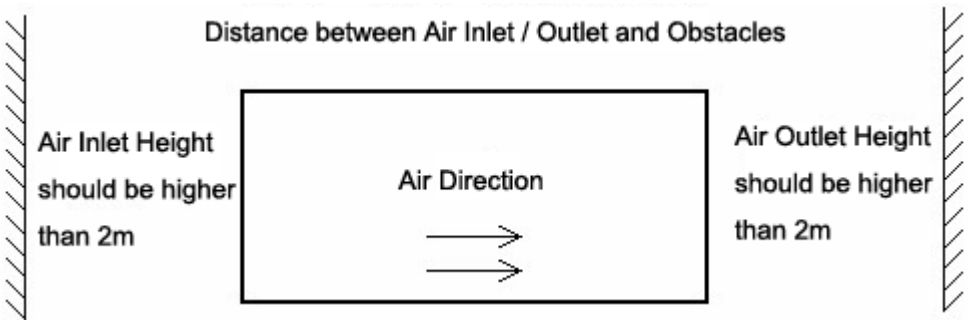
When install the units, make sure the installation ambient meets the following requirements:

### 1. Selection of installation place

● Make sure the unit is not installed in the place which the air can take the exhaust gas into the room.
● Make sure the exhaust gas can not be taken into the room. Or it will cause poison and suffocation.
● Make sure the unit is not installed in the place in which the combustible gas accumulated, inflow and leakage.
● Make sure that the installation site can withstand the weight of the unit, or it will cause crash of unit.
● Make sure that the installation of unit won't affect the living environment, or it will cause poisoning and suffocation.
● Make sure the installation of unit will not contact any animal and plant. Because the exhaust gas will do harm to them.
● If the unit will be installed in a high position, you must setup staircase or rail for installers to avoid falling.
● Make sure that the noise of the unit will not affect the surrounding（especially when installed in the living place）
● Avoid accumulating of rain in the installation place.
● Avoid the damage of strong wind if the unit is installed outside.
● The genset will interfere the electrical equipment. Please get it far away from them, such as TV, radio, computer, electric wire, etc.
● If there's snow in the installation place, you need to cover the unit with protection tent. And ensure the proper height of installation place to avoid the harm of snow.

### 2. Installation space

● Make sure the clearance between genset and combustible materials is not less than 3 meters.
●Make sure that there's enough space between genset and combustible materials for fire prevention.
● Make sure that there's enough space between refrigerant and gas pipe.
● The picture below shows the minimum space of installation. If there's not enough space, it will be difficult to perform maintenance on the genset.
● Keep proper distance from wall or other objects when install more than one genset in the same place. And keep proper distance between air inlet and outlet for better ventilation. Please contact the designated service provider to obtain the correct installation instructions.
● Choose the appropriate installation sites, installed on horizontal concrete surface.




### 3. Installation manner

After determined the installation location and space, you can install the genset. There are two main ways to install.

**Secure circuit connection:**

● Users must connect the GND wire to the grounding lug and tighten. The other side connects to the ground.
● The GND wire should be the same with, or not smaller than the load wire.
● Connecting according to the following connector bar from left side to right side.
● Connecting according to the following type due to different Models.

Used the insulated and certified wire/cable hose to connect the output hole. And the AC output wires/cable, and ATS control wires shall be separated by an insulation bushing (min 1.0mm).

Tighten all wires before operating generator set, or it will cause short circuit failure, do not connect generator sets together, damage may occur if wires are connected in reverse.

The AC output wires shall be at least 3AWG, and temperature rating shall not less than 75℃, and copper wires.

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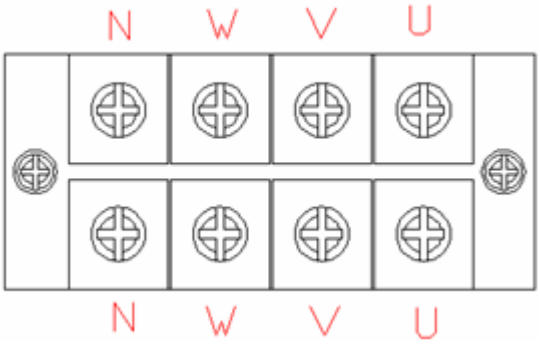
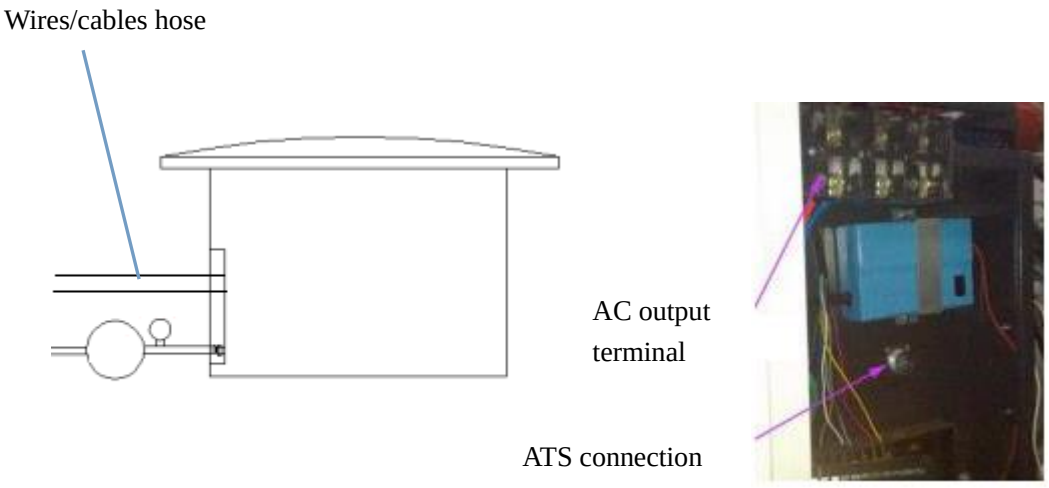


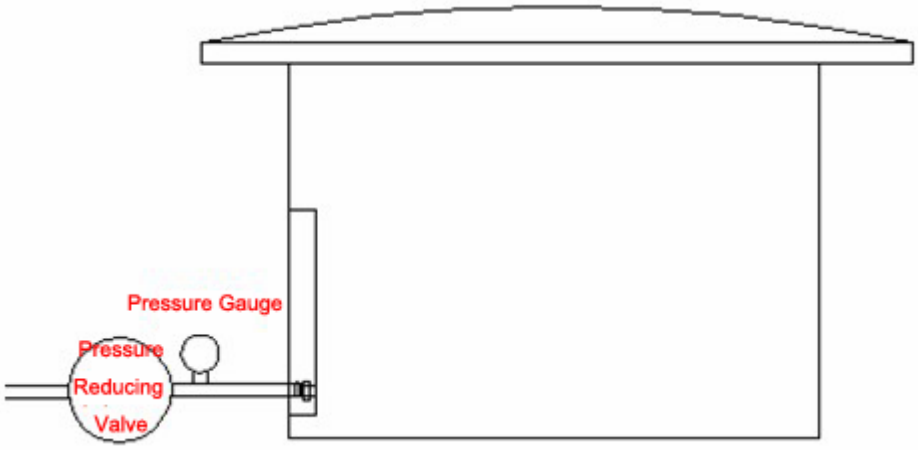

Customer outlet wire connect to N W V U below




● The connector bar is located inside the enclosure. Remove the left panel to view the connector bar and ATS connector. The wire will go out through the wire outlet on the enclosure.

**Secure gas pipe connection:**

● Connect pipe to the Pagoda-shaped connector at the end of the genset and tighten with clamps.




1. Pressure: 1.7 Kpa to 3.5 Kpa.
2. The pipe between pressure-reducing valve and genset should not be longer than 5 meters. The pipe diameter should not be smaller than 16mm.

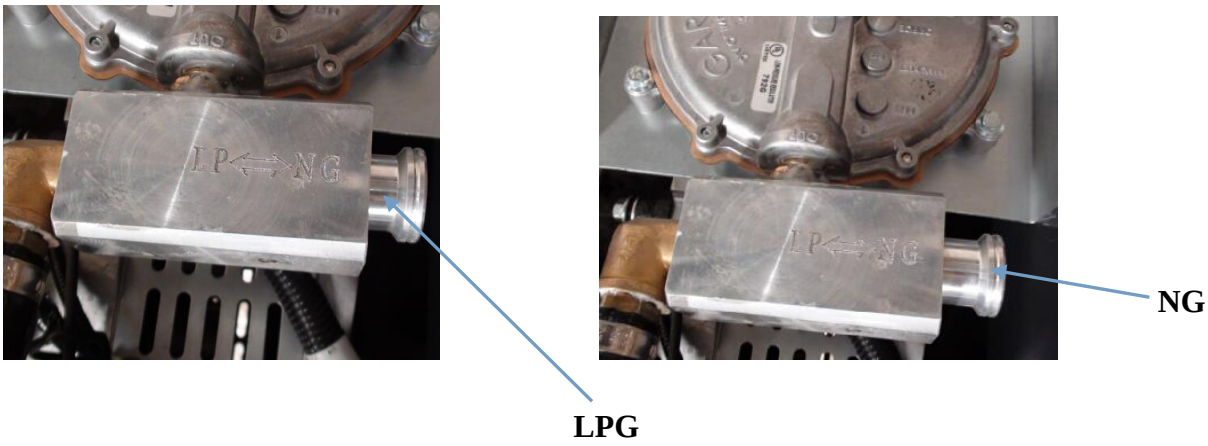
Two fuel connections on the fuel block allow field conversion between natural gas and LP vapor. The fuel metering valves are factory-set and sealed to provide the best possible hot and cold starting.

Use the following procedure to convert fuel

1. Natural Gas and Liquid Propane ( LP vapor)Conversion

● Use a pressure reducing valve to reduce LP vapor supply pressure.

● Moving the hose fitting to the natural gas or LP vapor port per the fuel which you want to use.




● Slide the hose onto the hose fitting and secure it with the clamp

● Check for leaks using a gas leak detector.
L：LPG
N：NG

# Chapter Two Maintenance of Genset

Regular maintenance is an important project for the rational use of the genset. To enable the genset to maintain in good technical condition, please be careful to maintain according to the specification.

The following genset maintenance specification is based on the genset works in a good environment and normal operating conditions. Please implement strictly according to the following requirements. If the working conditions and environment is terrible, (such as excessive dust, humidity, excess ambient temperature or the temperature is too low, etc.) the maintenance period should be shortened correspondingly.

## Ⅰ. Running-in of New Engine

The life of the engine has a great relation with the state of the first use. The new engine should be run as required. Or the abnormal engine will directly influent the life of genset.

## Ⅱ. Maintenance of the Fuel System

The genset is multi-fuel. In the genset maintenance, the way of maintenance will be different according to the fuel you should select for maintenance.

**Warning**

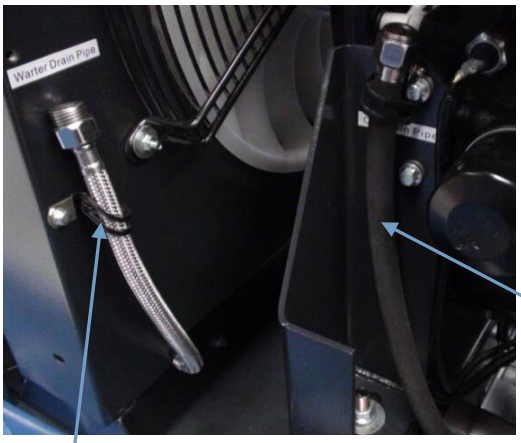
The fuel is flammable and explosive materials. It is prohibited to carry any fire in the operation!

**1. When using LPG as fuel：**

- Before each operation, you should check the solidity of the various components and timely handling the loose fasteners. Check if there's any leakage of the fuel tank, pipes and connections (soapy water can be used). Handle with it if there's any leakage.
- When replacing the fuel tank, you should close the valve and turn off the power.
- After fill with fuel gas, pay attention that whether there's any leakage of the gas supply system. You should make sure there's no leakage before using.
- Periodically check the pressure reducing valve, whether the solenoid valve sealing pad is deformed. Before inspect and dismantle, you should close the manual stop valve of the combination valve on the fuel tank. Then start the engine. Use up the gas in the pipeline before you can remove the solenoid valve and other parts, or it will have a greater risk of high-pressure work. It is not safe.
- Pressure reducer is an important component of the gas supply system. You should pay particular attention to its operation. If leakage occurs, the unit should be maintained. Periodically remove the pollution discharge plug on the pressure reducer. Drain off the oil and condensate. If the obstruction is not drained off, it will seriously affect its performance.

**2. When using NG as fuel：**

- Before each operation, you should check the solidity of the various components and timely handling the loose fasteners. Check if there's any leakage of the fuel tank, pipes and connections (soapy water can be used). Handle with it if there's any leakage.
- Periodically check the pressure reducer, whether the solenoid valve sealing pad is deformed.
- Periodically check the low-pressure pipe, whether there's wear down, aging and any leakage of the mixed gas(soapy water can be used).
- When maintenance of the gas pipeline, the valve should be closed before repair.
- When the engine working, especially high load, not allowed stopping immediately, it should work 1-3 min in no load state, then stop to let the engine cooling.
- When letting out the cooling water in cooling system, the water temperature must be low.




**Oil Drain Pipe**

**Water drain Pipe**

## Ⅲ. Maintenance of the Lubricating System

### 1. Engine oil

Oil viscosity: Select the viscosity brand according to the ambient temperature.

Oil quality level (according to standards set by the American Petroleum Institute): API SE SP SG or higher-level oil.

After 30 hours running of new engine, the oil must be replaced. Only maintain and replace of the oil according to the requirement, can ensure the long engine life.

**Note**

Different grades of oil can not be mixed to use.

### 2. Replacement of the new engine oil

**The steps to replace engine oil:**

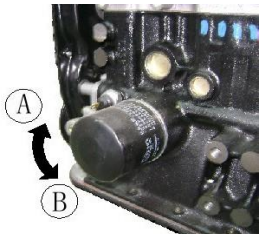
- Start the engine for several minutes to increase the temperature of the engine oil and then stop the engine.
- Put a disk under the oil drain plug. Take off the oil drain bolt to drain off all the engine oil.
- Check whether the oil drain screw and gasket are not damaged. Please replace them if necessary.
- Put on the oil drain screw and gasket again. Pay attention that there shouldn't be any oil leakage!
- Fill with the new engine oil and test whether the oil level meet the requirement standard (Oil level should between level A and B).


### 3. Replacement of the oil filter

The oil filter must be replaced when the engine is cooled. The replacement cycle should be according to the maintenance cycle.

**Steps for replacement：**

- Use the oil filter spanner to take of the oil filter
- Coat the gasket surface with a thin layer of oil to adapt the new oil filter.
- Fix the new oil filter
- Run the genset for a few minutes. Check if there's any oil leakage. Then check the oil level of the oil pan and fill oil to the specified oil level.
- Use oil filter spanner to fix the oil filter, the torque is between 15N.M-20N.M. When you remove the filter cartridge, the oil level will drop. Be sure to check the oil spills.




Direction A：Screw up  Direction B：Unscrew

### Ⅳ. Maintenance of the cooling system

When the engine is in operation, there must be enough cooling liquid in the cooling system to make sure the engine can work normally. So, we must check it before we use it, if the coolant (clean, soft water) is not enough we have to add it as soon as possible. Its forbid to use soda or mineral hard water or poor quality of coolant.

1、Replace the cooling liquid: we suggest using high quality glycol and cooling fluid and mix it under the factory's standard.

**Caution**

**Do not replace cooling liquid when the engine is hot.**

After long terms of usage, the coolant gets bad or any reasons of repair which leads to replace the cooling water, we should do as follows：

● Get a container ready and put it under the waterspout.
● Take down the cover of radiator.
● Open the let out pipe valve or row cock.
● Eliminate the coolant totally and then use the clean water to wash.
● Close the let out valve of water pipes or install row cock.
● Refill the suggested cooling liquid to the radiator and cooling tank till they are full.
● Start the genset with no-load for a minute. Refill coolant to the radiator till the level keeps steady and no falling, then stop the genset.
● Add cooling liquid to the radiator to the full level.
● Fill the expansion tank with coolant to the “FULL” level.
● Install the radiator and cover of expansion tank. Check carefully: no leaks allowed in the cooling system！


**Hard water, saline water or mineral water is harmful to the engine, please use cold boiling water distilled water if soft water cannot get.**

1. Maintenance of the radiator：

● Check the radiator hose, if the clips can not fix the hose or there is leaks, please refix the clips.
● If the radiator hose inflate, harden or cracking, please replace the hose and fix it well.
● Clean the cooling fin of the radiator, use the compressed air to blow off the dust and dirt

2. Adjust and replace the water pump belt

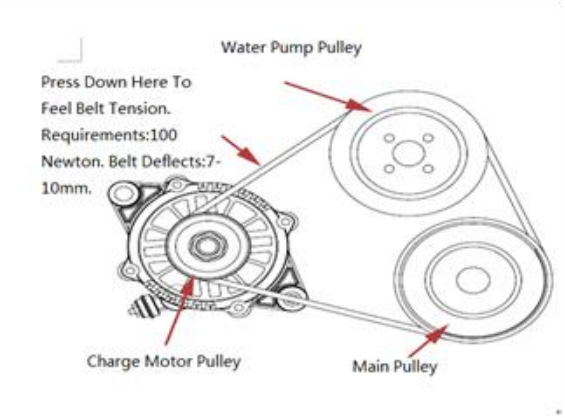
Pump belt is used to drive the water pump. If the tension is not enough or too tight, it will caused the engine with too hot. When the belt can not work, you should do as follows to check，adjust or replace.

Deflect check of the belt：

7～10mm（0.28-0.35in）/100N｛10.01kgf（22.1 lbs）｝

Adjust the deflected belt：

● Stop the engine.
● Use the thumb to press on the belt of the pulley wheel.
● If the tightness is not correct, adjust it by relaxing the regulating wheel, until to the acceptable degree.
● Replace the water pump belt when its broken.




## Ⅴ. Maintenance of the air filter

Take down the filter cartridge and clean it according to the maintenance table. The steps are as follows:


- Remove the filter cap then take out of the filter element.
- Blow off the dust on the filter element with compressed air.
- Clean the filter element with gasoline, then drying it with compressed air. You are not allowed to clean it with water.
- Replace the broken filter element.
- Install the filter cartridge and air filter head and the original sample.

## Ⅵ. Maintenance in winter

When the temperature is under 5℃, please maintain the engine specially.

1. Please use the especial winter used engine oil

2. Add antifreeze to the coolant system, or drain the coolant when the temperature is drop to 40℃～50℃, or it will damage the pipes after frozen.

## Ⅶ. Maintains of ignition system

This engine adopts electronic ignition, the order is 1-3-4-2. Suggested sparkplug: F7RTC or the similar type, or the wrong types of the spark plug will damage the engine.

Steps when replace the spark plug：

● Pull out the cylinder lines of the spark plug.
● Take down the spark plug with spark plug socket
● Check the spark plug, replace them when pole broken, or insulator burst
● Measure the gap of spark plug, if it's not correct, adjust outsider pole of spark plug heads lightly

| Items | Remarks | 1st Use Check | First 50 Hour | Every 100 Hour | Every 200 Hour | Every 400 Hour | Every 1000 Hour |
|---|---|---|---|---|---|---|---|
| Oil | Check Oil Level | ● | | | | | |
| | Replace | | ● | ● | | | |
| Oil Filter | Replace | | ● | | ● | | |
| Air Filter | Clean | | | ● | | | |
| | Replace Filter Element | | | | | ● | |
| Spark Plug | Check | | | ● | | | |
| | Replace | | | | | ● | |
| Cooling System | Check Coolant Level and Leakage Occurs | ● | ● | ● | | | |
| | Clean radiator | | | | ● | | |
| | Check the fan running condition | | | | ● | | |
| | Check radiator hose connection | | ● | | ● | | |
| | Change the coolant | | | | | ● | |
| Gas Valve | Check/adjust | ● | | | ● | | |
| Gas Pipe | Check the gas pipe is damage or not | | ● | | | ● | |
| Exhaust System | Check to see if there is leakage, tighten or replace if needed | | ● | | | | ● |
| Screw and Nut | Check all screws, nuts whether become loosen and then screw down. | | ● | | ● | | |
| Water Pump Belt | Adjust tension | | ● | ● | | | |
| | Replace | | | | | | ● |
| Aging Wires | Check all wires for aging situation and if the connectors are loose or not | | ● | | ● | | |
| Timing Belt | Depends on the wear pattern | Change Every 800 Hours | | | | | |

**Note**

**The right gap of spark plug is 0.9-1.1mm**

●Screwing in the spark plug with hands, then tightening with spark plug socket。
● Reinstall the cylinder line.

## Ⅷ. Maintenance of Other Systems

● Keep the generator clean.
●Add lubrication oil and antirust at the frictional position
●Check all the screws loosen or not, and tighten them

## Ⅸ. Engine Maintenance

Operate as the following table to maintain the engine, so that to obtain longer lifetime.
The signal “●” means maintaining must do as the left hand required.

# Chapter Three: Engine Fault and Troubleshooting

## Ⅰ. Common Faults and Repair Methods of Engine

| # | Fault | Fault and eliminate |
|---|---|---|
| 1 | Hard to start | **Ⅰ. Electrical system fault**<br>1. Storage battery with not enough power；<br>2. Bonding of storage battery cannot connect well；<br>3. Starting dynamo fault；<br>4. Ignition system fault；<br>5. Spark plug carbon deposition and tarnish；<br>6. Improper clearance of spark plug；<br>7.Spark plug insulation burning out or electrode short circuit；<br>8. Ignition coil was burnout；<br>9. Solenoid valve damage.<br>Handling method：<br>1. Check the starting dynamo to see whether it is blocked or not；<br>2. Check ignition, you can pull out the high-tension cable and put on a spark plug, put them on the engine, to see whether it sparks or not；<br>3. Check the voltage of storage battery to see the whether it is under 12.4v；<br>4. Replace or maintain spark plug；<br>5.Replace ignition coil, high pressure wire, solenoid valve； |
| | | **Ⅱ、Gas supply system fault：**<br>1. Keep the hand valve of gas bomb at off mode；(open the valve)<br>2. Pressure reducer or solenoid valve damaged；(replace)<br>3. Supply voltage is too low, cannot open the pipe solenoid and solenoid of the pressure reducer；<br>Dealing methods for Item 3: replace the battery or charge for the battery promptly；<br>4. Solenoid valve cannot connect well；(Seat properly)<br>5. Fuel switch damaged or was not pulled to “on” position；<br>6. Blocking in the high pressure pipe；<br>Handling method: Use the spanner to open the joint softly, |

| | | |
|---|---|---|
| | | if it leaks that proof the parts of before are ok, use the same way to check one by one；<br>7. Low pressure pipe buckling；(Support)<br>8. Oil filter is too dirty；(clean)<br>9. Check LPG、NG pressure to see whether it is normal or not； |
| 2 | Idling unstable | 1. Pressure reducer seals cannot fix well；(reseal)<br>2. Check the tightening screw of the mixer to see whether it is loosen or not, check all of the connection of the gas inlet pipe and mixer to see whether it is leaking or not<br>3. Check the fixed bolt of speed motor to see whether it is loosen or not；<br>4. Check the LPG、NG pressure to see whether it is normal or not；<br>5. Check the screw of pressure regulating valve to see whether it is loosen or not；<br>6. Check the LPG tank surface to see whether it is frosted or not； |
| 3 | Engine running erratic | 1. The top dead center signal of cylinder one is not correct.<br>2. Speed signal is not correct.<br>Elimination method: check or replace the sensor.<br>3. Temperature of pressure reducing is too low.<br>4. Pressure reducer cannot work normally, repair or replace.<br>5. Cylinder blow by.<br>Elimination method: check the cylinder cap of the screw, when necessity replace the cylinder cap seal and check cylinder jacket ledge of the altitude difference compared with the surface of the unit. |

| | | |
|---|---|---|
| 4 | Engine with not enough power, power, tumbling, consumption of the NG increases | 1. Low pressure pipe buckled or too long；（settle）<br>2. Ignition system with not enough ignition power.<br>3. High tension line and FBT is not connected well.<br>4. High tension and spark plug are not connected well.<br>5. Some of the cylinders miss the ignition；<br>Handling method of 3, 4, 5<br>1）Pull out the spark plug, observe pole top to see whether it has burned trace, if there is, then replace the spark plug<br>2）Use the multi meter test the resistance of the high tension line, if it disconnection, then change the high tension line<br>6. Under pressure of the cylinder；(check the adjust valve and check or replace the packing ring )<br>7. High pressure pipe blocked or out of shape； (sweep or clear up)<br>8. Dirtiness or leakage that changes the vacuum level；(overhauling or clean the air filter)<br>9. Mixer is not sealed well；(replace)<br>10. The joint part of mixer and throttle leaking；(settle)<br>11. Check gas pressure, flow to see whether it is under the right condition；<br>12. Check whether gas is up to standard；<br>13. Check the gas to see whether it is up to standard；<br>14. Pressure reducer cannot offer enough heat, check the inlet/outlet pipe connection, use the hands to touch the reducer shell, if the water cycle cannot work smoothly, it will be warm, or check the waterway to see whether it is blocked or not；<br>15. Air filter, exhaust system jam, (clean air filter and exhaust pipe).<br>16. Voltage output instability； (adjust or change) |

| | | |
|---|---|---|
| 5 | Sudden Stop | 1. Safety slice was burnt out；(replace)<br>2. GND not connect well； (reconnect)<br>3. Pressure reducer water cycle emerges ice block.<br>(Handling method: Clear the water cycle)<br>4. Pressure reducer low-pressure chamber leaks or diaphragm broken, repair or replace(settle or replace)<br>5. Air filter is too dirty or leak ； (check or clean)<br>6. Solenoid valve fault closed.<br>7. Fault of emergency stop switch. |
| 6 | Abnormal sound when the engine is operating | 1. Ignition time is too early which causes detonation.<br>2. Ignition time is too late which causes exhaust pipe blasting or mixer tempering.<br>Dealing methods for Item 1 and 2: adjust the ignition time of the distributor.<br>3. Gap between the piston and cylinder is too much, it knocks when start the engine, and lighten as heat of the engine.<br>4. The gap between piston pin and pin hole is too big, sound is light but tine, especially clearer when idling.<br>5. The gap between main bearing and connecting rod bearing is too big, can hear the spare parts knocks when the engine speed lower down, it sounds heavy and strong<br>6. The crankshaft end play is too big, can hear the crashes when idling<br>7. Valve spring break off, valve clearance excessive gap, that can hear the litter sound or rhythm knocking around the cylinder cap<br>Dealing methods for Item 3, 4, 5, 6 and 7: replace the parts, insure the regulation gap.<br>8. When the piston hits the cylinder, that can hear the knocks of metal crashes around the cylinder cap<br>Eliminate method: check the piston and valve to see whether they are hits or not, then check distribution gear mark.<br>9. When the speed lower down because of too large of abrade gear gap, that can hear the knocks in the gear room<br>Dealing methods for Item 8 and 9: replace the gear |

| | | |
|---|---|---|
| 7 | Temperature of the engine oil is too high | 1. Check around to see whether it is ventilated or not<br>2. Too much of the engine load<br>3. Engine oil is not enough or too much<br>4. Down exhaust is too much<br>Dealing methods for Item 4: replace the packing ring or the cylinder liner.<br>5. Blocking in the oil cooler, oil temperature controller valve opened, the temperature is not right, Shell is blocked by the dirt<br>6. Oil mark is not correct (oil viscosity is too high) |
| 8 | Pressure of engine oil is not enough | 1. Not enough oil in the oil pan<br>Dealing method: add oil to the selected level.<br>2. Damage of oil pump gear<br>Dealing method: replace the oil pump.<br>3. Blocking in the oil strainer or the oil filter<br>4. Damage or blocking in the relief valve or the pressure stabilizer spring<br>5. Blocking or leakage in the oil pipe<br>Dealing methods for Item 3, 4 and 5: replace the spare parts. |
| 9 | The temperature of cooling water is too high | 1. Water thermometer or sensor plug not work<br>Remove method: check and replace.<br>2. Water/coolant level low (add water/coolant )<br>3. Engine load if too much<br>4. Check around to see whether it is ventilated or not |
| 10 | Starter fault | 1. Starter do not run<br>2. The starter idling starting weak<br>3. It's hard for the gear to return<br>Prevention method：Check the lines of the battery voltage and make sure whether it been changed |

| | | |
|---|---|---|
| 11 | Muffler with black smoke | 1、Check the air filter to see whether it blocked or unobstructed<br>2、Pressure regulating valve cannot work normally<br>Prevention method：Adjust the screw of the valve.<br>3、Ignition time too early, adjust ignition timing<br>4、The spark plug cannot work normally<br>5、High-tension line cannot work normally<br>6、High pressure cannot work normally<br>Project4、5、6 handling method: replace the related accessories. |
| 12 | Muffler with blue smoke | 1、Check the engine oil, whether it too much, pour out excess oil<br>2、Replace or clean the packing ring<br>3、Overhaul or replace piston and cylinder block |
| 13 | Muffler with white smoke | 1、Engine preheating is not enough<br>2、Water in the cylinder, overhaul the engine cylinder |
| 14 | Muffler with flare up and explosive sound | 1、Carburetor floater oil level is too high, adjust the floater<br>2、Exhaust valve is not totally sealing, polish the valve<br>3、Ignite too late, adjust the ignition timing |
| 15 | Load speed drops too much | 1、Gas pipe jammed；（check and clean the pipe）<br>2、Dirty air filter；（clean the air filter core）<br>3、Improper valve clearance；（repair and adjust） |

## Ⅱ. Common Faults and Repair Methods of Generator

| # | Fault Symptoms | Reason & Troubleshooting |
|---|---|---|
| 1 | Generator without power indication | 1. Check whether the battery is damaged.<br>2. Fuse broken.<br>(Check, replace) |
| 2 | Generator has power indication but no power output | 1. Breaker not open.<br>2. AC output is poorly connected; （Check, fix up）<br>3. Check AVR and its fuse.<br>4. Check carbon brush; |

| | | |
|---|---|---|
| 3 | Generator overheating | 1. Lack of coolant or pipe blocked;（Add coolant or clean up pipe）<br>2. Thermostat closed or damaged;<br>3. Water pump worn out or damaged; （Clean or replace pump）<br>4. Too much engine oil; （Remove the unnecessary engine oil）<br>5. Damage of rotor bearing; （Replace bearing）<br>6. Radiator blocked or damaged; （Clean or replace radiator）<br>7. Short circuit of stator winding; （Check wiring）<br>8. Rubbing of stator and rotor （Check, adjust gap） |
| 4 | Insufficient power output | 1. Abnormal gas pressure;（adjust pressure）<br>2. Engine throttle worn out;<br>3. Air filter blocked;<br>4. Some spark or cylinder wire is damaged;<br>5. Too much oil;<br>6. Piston ring worn out; |

## IV. Troubleshooting

1. Simple check

- Battery voltage, working voltage.
- Sufficient gas storage, solenoid valve of gas bottle open or not.
- Entrance and pressure reducer gas solenoid valve properly open or not.
- High voltage normal or not（spark plug）.
- Speed sensor signal normal or not.
- Observe exhaust gas (smell, color, sound, feel).
- A comprehensive check and the focus on one part or one target.

2. Parts replacing inspect

- Replace the suspected parts with a new and same one, then observe operation.
- If the fault disappeared, place back the suspected parts, then start the engine and observe it.
- If the fault appears again, verify the damaged parts , use the new and same part to replace it.
- If faced with a comprehensive fault, pleas shrink the sinking scope, and then use the replacement method to check.

## Ⅲ. Main Common Faults and Removal Methods of Genset

### Can not start the genset:

When the generator sets cannot start, the engine is not working normally. Please check one by one as the following methods:

1. Basic checking:

- Check whether the unit filled with engine oil or not.
- Check whether the unit filled with enough coolant or not.
- Check whether the gas valve open or not, whether with the suitable gas input.
- Check whether the battery is sufficiently charged or not.

- Check the mains input when starting the unit automatically.
- Check the power indicator lights up or not.

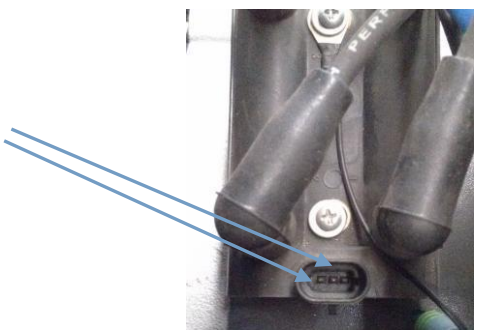
2. Checking method:

- Gas flow checking: when the gas flow is too much, bend the gas pipe, so that the gas flow is reduced. Or turn the transition nut to adjust the pipe area.
- Battery voltage test: use a multi meter to test the battery voltage, the voltage is 12.6 V, which means the battery with has power; if the voltage is below 12.6V, the battery cannot drive the starting motor.
- Cylinder wire checking: check it as the picture below, the gap between the conductor and engine is 3-5mm, start the start motor, then there will be spark if ignited.

- Spark plug checking: Connect the spark plug with land, start the start motor, observe whether the spark plug discharging to the ground or not, if there is spark, then the spark plug damaged.

- Igniter checking: use a multimeter to test the socket voltage, which should be 12V

Test the first two corresponding positions



- Checking the speed motor: when the generator starts working, the main shaft of the speed motor should rotate substantially to open the throttle.

3. Solving method:

According to the checking method above, repair or replace the suspected item. If the problem is still unsolved, please contact our local agency.

## IV. Generator hunting elimination

After starting the generator, there is too much regular pattern vibration, main shaft of speed motor rotating obviously, which means generator hunting (frequency fluctuation>2Hz). The power output produced while hunting will not influence the use of electricity (except the high precision equipment which needs high quality of electricity frequency). Still, it should be adjusted and repaired promptly.

### 1. General checking:

- Check whether the gas pressure normal or not.
- Check whether the fuel pipe extruded or blocked.
- Check whether the speed sensor loosened or damaged.
- Check whether the speed motor blocked or not.

### 2. Measuring method:

- Connect a pressure meter in the inlet pipe, open the gas valve, observe the data on pressure gage.
- Observe whether the gas valve extruded or not.
- Open the fuel switch, see if there's a voice "da" from the solenoid valve.
- Use the multi meter Ohm level, measure the two joints of the speed sensor, there should be resistance.
- Check whether the electrical speed regulation has 12v DC power input.

## V. Trouble shooting of no power output.

After starting the generator, there is no power output under the right speed and frequency, please.

do as following steps to check and solve problems:

### 1. Basic checking:

- Check whether the battery has enough voltage（Voltage>12V）.
- Check whether the voltage input and output wire faced with short circuit.
- Connect the voltage regulator and battery, check whether the regulator and the battery has the same voltage input.
- When the generator operates normally, the carbon brush should have about 70V voltage.

2. Measuring method

- Use the multi meter 20V DC to measure the voltage of battery, voltage regulator input, and carbon brush.
- Use the multi meter 200V DC to measure the voltage of the carbon brush.

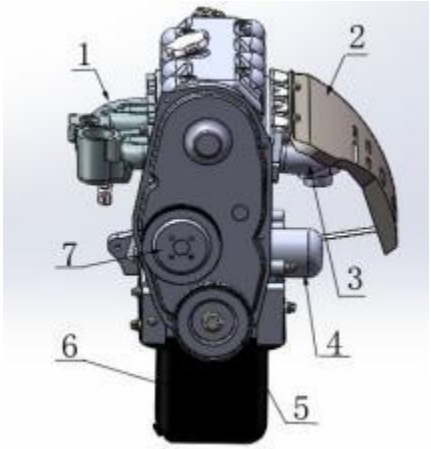
3. Solving method：

- when the voltage regulator has input but no output, there may be three possible protections (output short circuit protection, sampling losing protection, secondary winding protection). We should cut the positive power, connect the regulator again when the regulator discharges. The common protection time is 90 seconds, but under abnormal conditions it will take about 1 hour.

## Chapter Four: Primary Parts Structure of Engine

The generator unit is assembled from a large number of integrated components, including the primary silent cooling system, electronic speed control system, automatic power generating system, multi-energy power generation technologies, intelligent control systems, and ultra-low temperature starting technology.

### Ⅰ. Engine

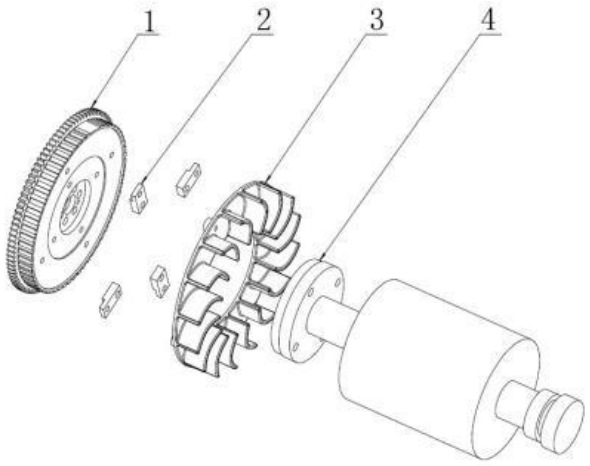



1.gas inlet manifold
2.exhaust manifold shield
3.exhaust pipe
4.oil filter
5.spindle pulley
6.oil pan
7.water pump pulley

## ENGINE SPECIFICATION

| MODEL# | PD20REG-DB/PD20REG-DB-3 |
|---|---|
| WARRANTY（YEARS） | 2 |
| ENGINE PART # | 465QR |
| VOLUME (cc) | 998 |
| COMPRESSION RATIO | 9.5:1 |
| IGNITION SYSTEM | ECM |
| ELECTRIC START | YES |
| ENGINE ALTEERNATOR | QDY112 12V 0.8KW |
| FUEL TYPE | NG/LPG |
| CYLINDER BORE&STROKE（mm×mm） | L4-65.5×74 |
| ASPIRATION TYPE | NATURAL ASPIRATION |
| OIL CAPACITY | 4.0 L |
| SPIN ON OIL FILTER | YES |
| CYLINDER BLOCK | CAST IRON |
| SLEEVE | CAST IRON |
| CHARGING | 14V/70A Charging motor |
| Starting current（CCA） | 525 |
| Cooling system | LIQUID COOLED |
| Overheat stop | YES |
| Low oil pressure stop | YES |

### Ⅱ. Generator




1.Fly wheel
2.Fan connection block
3.Alternator fan
4.Alternator rotor

This generator is directly coupled and attached to the engine.

## Alternator specifications

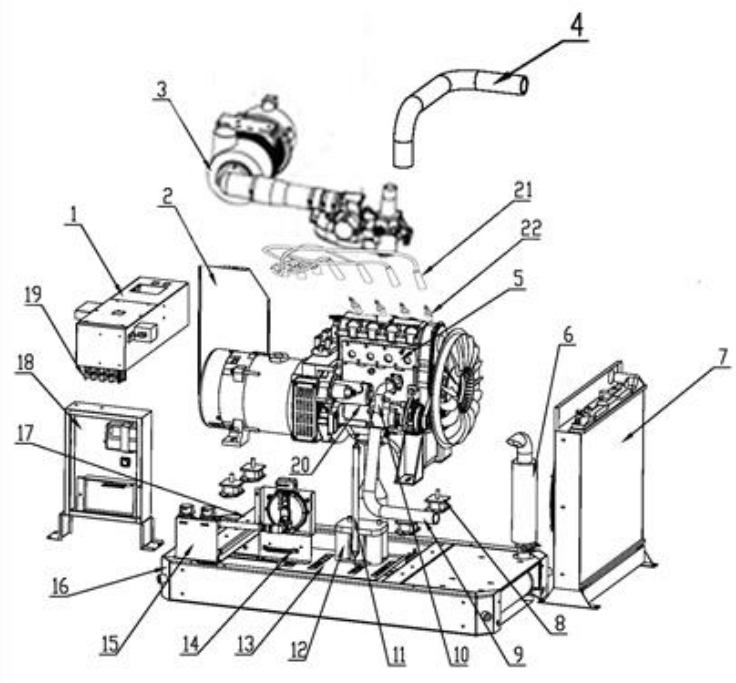
| MODEL | PD20REG-DB/PD20REG-DB-3 |
|---|---|
| ALTERNATOR TYPE | synchronous, rotating magnetic field |
| VOLT. REG. SYSTEM | AVR |
| EXCITATION TYPE | BRUSH |
| POLES | 2 |
| THD @ FULL LOAD | ≤5% |
| INSULATION CLASS | F |
| STATOR WINDING MATERIAL | COPPER |
| ROTOR WINDING MATERIAL | COPPER |
| ROTOR OD(mm) | 164 |
| STATOR OUTSIDE DIAMETER (mm) | 270 |
| STACK LENGTH (mm) | Single 160（three 140） |
| LAMINATION MATERIAL | cold rolling |
| CONNECTION METHOD | DIRECT COUPLED |
| Motor bearings | 6306RS |

## Ⅲ. Generator Enclosure

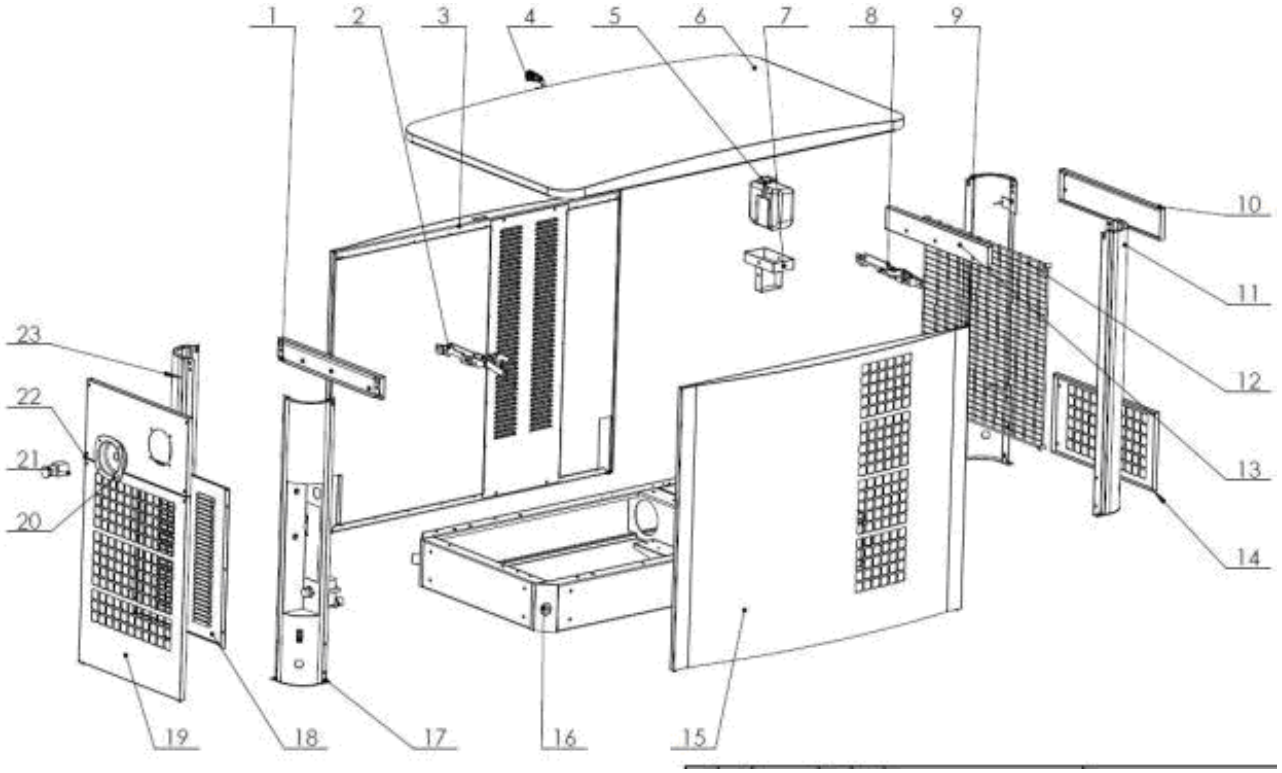
The main frame and chassis are the primary structures to which all other component pieces are attached. The structure makes up the main noise protection and reduction features of the generator set. Other component parts include the chassis, Radiator compartments, electronic control box compartment, and electronic screen board compartments.

## 1. Inner spare parts:

① PD20REG-DB/PD20REG-DB-3




**2.** PD20REG-DB/PD20REG-DB-3



Attachment:

| Item | Unit | Conversion |
|---|---|---|
| Power | kW | 1kW=1.36Ps(1kw=3.6HP) |
| Torsion | N·m | 1kgf·m=9.81N·m |
| Speed | r/min | |
| Engine oil, fuel oil consumption | g/kW·h | 1g/Ps·h)=1.36g/kW·h |
| Capacity(L) | L | 1L=1000ml |
| Proportion | cm2 | $1m^2=10000cm^2$ |
| Pressure | kPa<br>MPa | 1kgf/cm2=98.1kPa=0.0981Mpa |
| Power | N | 1kgf=9.8N |
| Length | m | 1m=1000mm |
| Time | min(s) | 1min=60s |
| Temperature | K（℃） | 273K=0℃ |
| Voltage | V | |
| Current | A | |
| Crankshaft corner | °CA | Degrees crankshaft corner |
| Quality | g | 1kgf.m=9.81N.m |