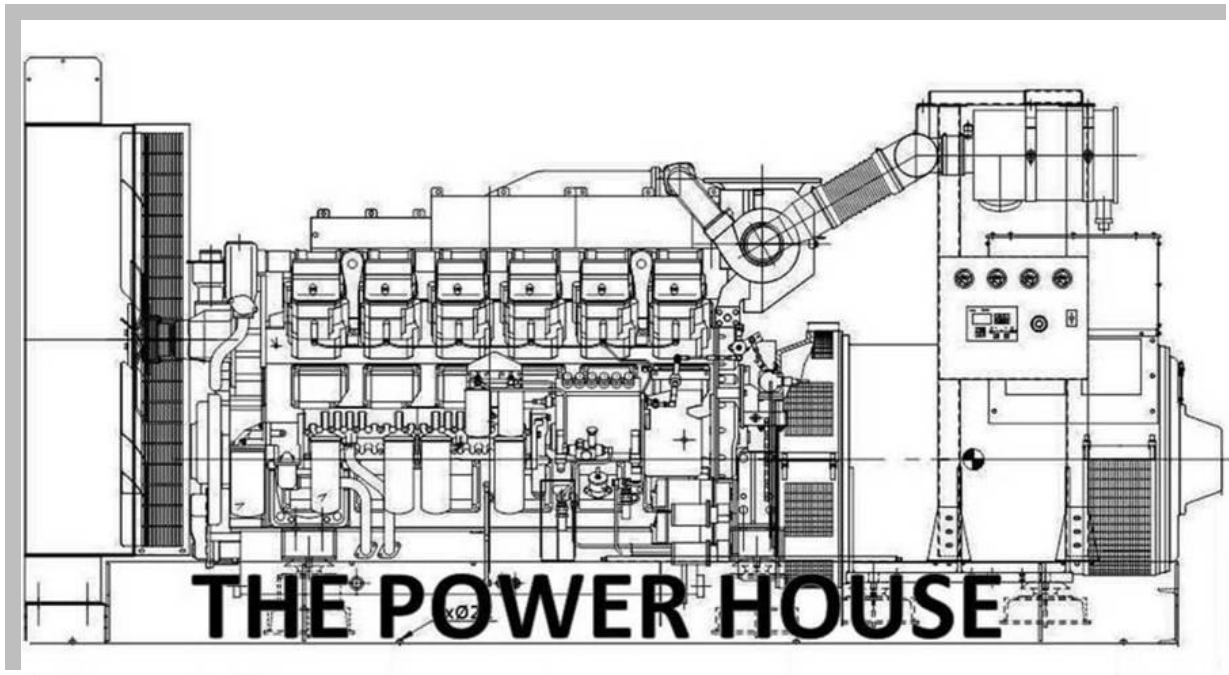


**OPERATION AND MAINTENANCE
MANUAL**



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➤ Prologue

1. Thank you for purchasing our generator set. Please do not operate until you have read and understand the manual. Prohibit running without reading the manual. We will not take the legal responsibility for those injured, dead or machine failures caused by improper operation.
2. Our generator set mainly is composed of three parts, that is, diesel engine as the driving force, generator as part of power source, control module for the control of the generating set. (Diesel engines, generators, control module, and other detailed information can be found in its respective manual for further instruction)
3. This manual mainly explains the operation processes and regulations. If the operator meets some problems which are not mentioned in the manual, or would like to know more, please contact your local dealers, or contact us directly.
4. Manual will be transferred, sold and used together with the generator set. The contents describe Company's latest information and are subject to changes without notice.

➤ Safety Instructions

1. Don't operate the unit in bad ventilation condition and constrained indoor space. Do not operate the unit in the ambient temperature higher than 40°C.
2. Don't operate the unit in humid environment.
3. Don't connect the unit to other power circuits while operating.
4. Keep inflammables at least 1 meter away from the unit.
5. Take care to avoid fuel spilling when filling, and smoking is prohibited while filling.
6. Make sure that the unit is at a cold-off state while filling.
7. Be aware of the dangerous by got an electric shock
 - a) Mechanism changeable switch should be used when the electricity produced by generator set enter into public electric circuits. Must be authorized by power supply bureau and should adopt special electrical equipment if indeed need to merge into the public circuits. Otherwise will cause serious problems both equipments shattered and body hurt.

b) Do comply with all provisions of the electrical equipment of some of the electrical installation and maintenance must have a qualified professional staff to conduct electrical.

8. Pay seriously attention to toxic emission

An appropriate drain system is needed for exhaust gas, and must check the drain system frequency to prevent be toxic by carbon monoxide or other toxic emission.

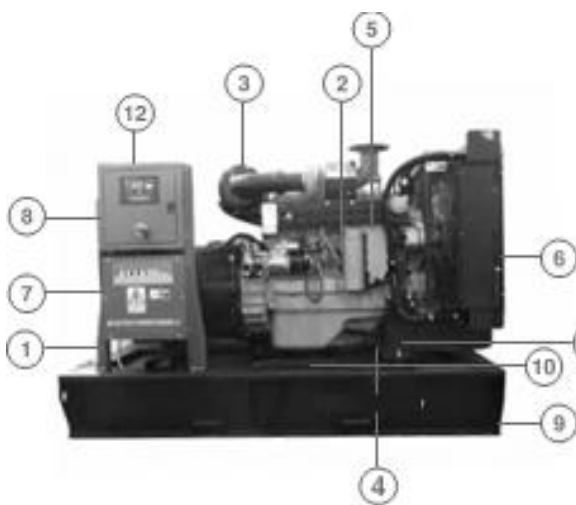
9. Operating safety

- a) Ensure that generator set does not run in a location where there are combustible and explosive substances.
- b) Do not permit loose clothing, long hair or falling tools near moving generator, or else will be very dangerous to human or equipment.
- c) Keep the fingers, tools or other things away from naked pipes and parts of the operating opening type generator set, in case of be burn by it.

10. Fire prevention

- a) Do not allow metal objects fall into generator set, which will lead to short circuit and cause fire.
- b) Keep the engine clean, because excessive amount of oil pollution may trigger the body damage caused by overheating and fire.

➤ Generating Sets Main Parts



No	Description
1	Generating Set Rating Label
2	Diesel Engine
3	Air Filter
4	Battery
5	Alternator
6	Terminal box
7	Base Frame
8	Fuel tank (inside the base frame)
9	Vibration isolators
10	Control Panel

➤ **Pre-operation Instruction**

1. Please select the proper light diesel which matches the operating environment, such as 0 # light diesel of national standards. Use 0 # light diesel in summer, use -10# or -20 # light diesel in southern region in winter and -30# or 35# light diesel in northern region in winter. Select CD.CF class light diesel oil in line with CYJ103A-711105-401 stated by Great Wall Company. Choose trademark according to the use of your generator's power units. Otherwise cause irreparable damage to your equipments.
(More Details on Our Diesel Engine Operation and Maintenance Manuals).
2. Fill adequate amount of proper lubricating oil, which matches the operation temperature, such as SAE15W-40 oil. (More Details on Our Diesel Engine Operation and Maintenance Manuals).
3. Choose suitable cooling water, such as the use of soft water, rain. (More Details on Our Diesel Engine Operation and Maintenance Manuals).
4. Remove air from fuel circuit, by using hand pressure pump to press the fuel, and discharging the air in the circuit between fuel tank and filter, until there's no bubble in the outflow of the fuel pipe line.
5. Generator set must be connected to ground protection, and whether its neutral line should connect to the ground should meet the standards of local electric power.
6. Check the battery, and its connection. Connect anode to the starter motor, and cathode to the ground.
7. For the sake of playing a normal battery performance, you should check the battery capacity and charge it at least three hours. When the storage batteries for more than 8 months or when need to used at low temperatures, you should recharging before using.
8. Do not permit allow generator's battery as other use, because the capacity of battery is only limited to the use of the generator itself.
9. Ensure that the electric floating charger under normal works at any time when the control system is equipment with electric floating charger.
10. Disconnect the battery terminals, check the battery capacity regularly.

➤ **Start the Generator Set**

(Note: Read the Operation Instruction of AMF Controller before starting the generator)

1. Before starting, make sure that all the pre-operation check has been done.

Note: The parameter of AMF Module has been set before delivery from the factory, therefore, amendment is prohibited, and could only be allowed after fully understanding the control panel operating manuals or contacting the suppliers or our Technology Dept.

2. Check the control panel and see whether it is in normal state or not.

- 1) If it shows "Stop....." press the Start button and then release it to get into starting state, and then it can be restarted.
- 2) If it shows "Emergency Shutdown" the unit can be restarted after reposition of the Emergency Stop Button.
- 3) If it shows "Lack of Oil Pressure Shutdown....." or other phenomena, the unit must be restarted after problems solved.
- 4) Make sure pressed the reset button when starting generator every time
3. If the control panel fails to start after three times, its control panel will show failed reasons. Please solve the problems before re-starting again, or discharge the air from fuel circuit again.
4. If it still fails to restart after problem-solving, please contact the supplier or our Technology Dept.
5. After starting the generator set successfully, check the oil pressure and other parameters and see whether they are in normal state or not.
6. Make sure whether your generator sets is auto starting function, if not, the auto starting button is useless, please starting the generator by manual process

➤ **Operating the Generator Set**

1. After starting the new generator sets, it shouldn't get into full-load operation immediately. Instead, heat it up by letting it run without load first until the cooling water temperature reaches 50°C, and then it can be running in full load.
2. While operating, pay attention to its oil pressure, oil temperature and cooling water temperature, so as to make sure it is in normal state.
3. While operating, pay attention to oil circuit, waterways and connecting spots. If it leaks, the problem should be eliminated immediately to prevent from wasting and pollution of the environment.
4. New or overhauled diesel generator set should be set in operation for 60 hours before full load operation.
5. It is not allowed to operate generator set with problems unsolved, so as to avoid damage to parts, unit accident, and personal injury.
6. Don't run the generator while the differences among phases is over 25%, otherwise, some accident will happen.
7. For keeping your generator at good working state and generating electricity normally, you have to run it at least once per month, and the continuous time must not less than 20 minutes.
8. In order to ensure the accuracy of generating units to the normal operation of power generation, you should start generating units once a month at least, and run 20 minutes.
9. Must always pay attention to the parameters of the display screen whether it's normal or not, and also we need to pay attention to the color of exhaust smoke and the sound of operating. Stop the generator set immediately and check it when find out abnormal. When running normally, increase capacity orderly until reach the rated load.

➤ **Stopping the Generator Set**

1. If the unit is automatic generator set, when it is in auto state, and when power supply gets back to normal, the unit will switch automatically and stop after 120 seconds.
2. Before stopping the generator set, please unload it first, and press the stop button on the control panel, then the unit will be stopped after delay.
3. Prohibit stopping the unit when its water temperature is too high, except in emergent cases.
4. When the temperature is below 5°C, after stopping the unit, if without using anti-freeze liquid, the cooling water should be discharged totally so as to prevent the unit body and pump from being frost damaged.
5. After it runs, trouble-shoot problems occurred during each operation.
6. Press emergent stop button, if you encounter some emergencies while operating.
7. Had best adjust the load from small to large, and then turn the generator off.

➤ **Safety Operation Rules**

1. Never allowed the person who doesn't know how to operate and who doesn't have basic electrical knowledge to operate the unit.
2. Make sure that all the pre-operation works have been done before starting except for automatic diesel generator set,
3. Precautions against fire. Keep fire far away from the running unit. When the diesel generator set runs near the inflammable goods, adding fire extinguisher set on the exhaust pipe.
4. Prohibit to disassemble and to adjust generator set while operating.
5. Stop the unit when there is abnormal noise, and restart it after the problem been obviated.
6. Always e careful during repairing or disassembly to avoid being injured by the running parts or other accidents.
7. Keep generator set under integrity circumstances, clean and wipe the generator set entirely both pre-teardown and pre-assembly in order to ensure the perfect quality of assembly. Complicated adjustment and maintenance should be carried out indoors to prevent environmental pollution of the generator inner units.
8. Our company is not responsible for all the negative consequences caused by self-alteration of the structure of generator set.
9. Must choose genuine spare parts as replacement parts.

➤ **Control System with automatic Mains Failure**

AMF 4.0 module controls generating set system. Module has been designed to monitor the mains supply automatic engine starting stopping metering and generating protection and transfer switch operations. It can be operated in automatic test manual modes

The control unit has 5 digital display which allows all the measured engine and alternator values to be monitored simultaneously. The following digital data can be monitoring from the front panel of the unit:

There phase mains and generator voltage current
Mains and generator frequency
DC battery voltage
Oil pressure
Engine temp.
Engine working hour time

The engine oil pressure and coolant temp. values are also displayed in analogue bar graph displays as well as digital displays.

➤ **Diesel Generator Set Maintenance**

Do regular technical maintenance, and operate the generator set properly. Keep the generator set in good technical equipment and proper maintenance, so as to extend the service life.

1. Diesel engine maintenance technique, such as: Replacing the oil and oil filter of the new generator after running 100 hours (see the manual of diesel engine maintenance)
2. Alternator maintenance technique (, see the manual of alternator maintenance)

➤ **Judging and dealing with general malfunctions**

1 Can't be started

Reason:

- ① wrong position of stop Electromagnet
- ② No working of stop Electromagnet
- ③ There is air in the fuel circuit
- ④ Leaking in the intake fuel circuit
- ⑤ No working of starting engine

Method:

- ① Adjusting the position of stop Electromagnet
- ② Checking out the voltage and condition of Electromagnet
- ③ Releasing the air from the fuel circuit
- ④ Getting rid of Leaking in the intake fuel circuit
- ⑤ No signal or broken down of relay, if starting engine is broken down, replacing it

2 Shutting down suddenly

Reason:

- ① Low pressure of lubricating oil
- ② over loaded of generator
- ③ High temperature of water or oil
- ④ Leaking in the fuel circuit
- ⑤ No power supply of control panel

Method:

- ① adjusting the pressure of lubricating oil, or replacing the sensor
- ② Discharging some loads
- ③ Checking out the water of radiator and whether it is full or not. And cleaning the radiator.
- ④ Solving leaking in the fuel circuit
- ⑤ Checking out the line and the condition of the control panel

3 Can't be shut down

Reason:

- ① Halt of extinguishing device
- ② disconnection of extinguishing spring

Method:

- ① Repairing or replacing it
- ② Replacing it

4 No voltage output

Reason:

- ① No switching on or broken down of the Air switch
- ② Losing magnetism of generator

Method:

- ① Switching on or replacing it
- ② Replacing it

5 low voltage output

Reason:

- ① Low speed
- ② Voltage of AVR voltage adjustment getting low

Method:

- ① Turning up the speed
- ② Turning up the voltage or replacing it

6 instability of output voltage

Reason:

- ① Instability of speed of revolution
- ② Broken down of AVR voltage adjustment

Method:

- ① Keeping the speed of revolution stably
- ② Replacing the AVR voltage adjustment

7 instability of frequency

Reason:

- ① Instability of speed of revolution
- ② Broken down of AVR voltage adjustment

Method:

- ① Keeping the speed of revolution stably
- ② Replacing the AVR voltage adjustment

8 Low frequency

Reason:

- ① Low speed
- ② Frequency of AVR getting low or high

Method:

- ① Turning up the speed
- ② Turning up the frequency value or replacing it

X. Maintenance notice

1. It is very important to us the right lubrication oil, which will make the engine work normally and extend the service time.

The choice of lubrication oil depends on quality grade and Viscosity rank made by API and SAE respectively. Viscosity rank of lubrication oil adopts the international SAE standard.

For example, lubrication oil of SAE15W/40 is multistage machine oils, whose working environment is under $-10^{\circ}\text{C}\sim+45^{\circ}\text{C}$. Using multistage machine oils will extend the oil change period. If environment temperature is lower than permitted temperature, it will influence the

engine cold starting. Environment temperature higher than the permitted temperature for a long time will cause the initial engine damage.

2 Use of the coolant

The non-air cooled generating set use water as the cooling medium; it should use the water which has been processed, and add some definite proportions antiseptic into it. Antifreeze should be used under low temperature (below $^{\circ}\text{C}$)

For preventing water incrustation forming in the cooling system, and influence the cooling effect of the engine. Usually we can use she water which has been boiled & deposited and filtrated. (PH class 6-8)

It also has she same function as she antiseptic. The antifreeze could be confected by she processed soft water and add 40% ethanol antifreeze. The freezing point of this kind of proportional antifreeze is -25°C , the freezing point will be -40°C if still add additive and make the concentration high than 50%. Then the drop of the freezing point will indistinct and the cooling effect will also be influenced if remain to increase the proportion.

In the areas where has no for preventing frostbite, anticorrosion additive should be added into...

the coolant. The cubage proportion should be 30(water):1(anticorrosion additive).It could reduce the aperture cauterization of the cylinder liner. But don't add any antiseptic into the coolant which has been filled with antifreeze, to avoid producing a lot of bubble and depress the effect of the coolant. Please pay more regards to safety because of this two kind of additive do harm to people.

3 Select of fuel

The major target which influences the quality of the diesel is the sulfur content. If the sulfur content is higher than 0.5%,it will have strong impact on the service life of the engine, and shorten replace cycle of the replacing the lube.

Then Gen set should use the best quality solar oil which accord with the regulations of nation. The main way to choose the diesel oil is according the ambient temperature.

The fuel will be congealed and the engine will be difficult to star and run if choose the wrong type in the clod district.

Please see the following form for the coincidence relation of the type of solar oil and ambient temperature:

Ambient℃	>12	>4~12	>-5~4	>-14~-5	>-29~-14	>-44~-29
Fuel type	10	0	-10	-20	-35	-50

4 Check-up & maintenance works

The daily check-up & maintenance works of the Generator mainly carried out according to the manual of the manufacturer.

4.1 Lubricating system

1. The oil change cycle should according to the condition of service and oil quality.

The oil change cycle is according to 250~400hours worked for the ordinary circs.

2. It is necessary step to keep the super performance of the lube oil to replace the oil filter and filter element.

4.2 Fuel system

For avoiding the high precision & high pressure oil pump would be damaged, any diesel should be filtrated before enter into the oil transfer pump. The strainer of the fuel filter should be replaced or cleaned after working for 250~400hours. (Would be brought forward based on the oiliness.)

4.3 Cooling system

1. The cleaning interval of intercooler and radiator should be confirmed accord to the working environment of Gen set. Commonly the internal system should be cleaned with neuter cleaning agent and pure water per 1500~2000hour. And should often to check and clean begrime on the heat sink.
2. The coolant should be replaced entirely after the cooling system has been cleaned.

4.4 Inlet system

The maintenance of the inlet system mostly is to check, clean and replace element of air cleaner.

1. The non-throwaway air filter could discharge the dust from the dust outlet, open the covering and take out he filter element with the pressed air(the supreme air pressure should no more than 500Kpa).And blow it from outside or clap it lightly. As the same time, check whether the filter element by photic method is out of repair or not, and please pay attention not to let the seal ring been damaged. And the filter element should be replaced at least once per year.
2. The air resistance indicator of throwaway air filter should be checked after the engine has stopped. Please replace the air filter if there appears red mark. Press the barrage indicator for restoration. The air filter which has been replaced could be recycled again.

➤ Maintenance schedule

XII Notes to Generator Set Movement

1. Generator base beam is designed for forklift or crane. When moving the unit, make sure the forklift passes through the slot; otherwise it may touch the fuel tank and cause fuel leakage.
2. When putting the unit down from hanging ropes, pay attention to whether there's anything under it in order to prevent from breaking the fuel tank,.
3. Moving the unit in stability and balance. Pay attention to the safety for both people and the generator set.

The generating sets must undergo maintenance periodically to improve their durability and performance, decrease their repair time and to prevent break-downs before they occur.

While daily and weekly maintenance can be performed by the user, monthly maintenance must be performed by an educated team of expert technicians. These maintenances should be performed by the Authorized Service Centers during the warranty period. When the warranty expires, it is possible to recieve a 24/7 regular maintenance service upon the signing of a periodical control and maintenance agreement withTPH Authorized Service Centers. You will not be charged for labor for breakdowns and maintenance services covered by this agreement.

Maintenance Calendar

Generator Maintenance Chart		20~40 hours	Per day or per 8 hours	Per 6 months or 300 hours	Per 12 months or 400 hours	Per 800 hours	Per 1200 hours	Per 2000 hours
Check	check the volume of cooling liquid	•	•	•	•	•	•	•
	check the triangle belt and tightening degree	•		•	•	•	•	•
	clean the filter of fuel pump				•	•	•	•
	Check the liquid in the fuel filter	•	•	•	•	•	•	•
Replace	Replace the diesel filter element	•			•	•	•	•
	Oil change	•			•	•	•	•
	Replace oil filter element or oil filter	•			•	•	•	•
	replace the filter of cooling liquid				•	•	•	•
	replace the air filter element				•	•	•	•
Engine	Check the injector						•	•
	check and adjust the speed without load	•			•	•		
	check the oil level		•	•				
	check the oil pressure	•	•	•	•	•	•	•
	check and adjust valve clearance					•	•	•
Air intake system	Clean exhaust system					•	•	•
	Clean air filter or spill dust							
	Dirtiest working environment	•	•	•	•	•	•	•
	general working environment			•	•	•	•	•
	clean the shell of turbocharger					•	•	•
Electric system	Check charging alternator, starter and so on						•	•
	Check electric control box line and tighten clamp				•	•	•	•

➤ Recommended cable cross sections (50 Hz. Gen Set)

stand-by power kVA	full load current at U=400 VAC (Amper)	current capacity of cable at air for single core cable (40 C ambient temperature) (Amper)	cable section (YVV) single core for each phase (mm ²)
20	28	33	4
25	36	42	6
30	43	57	10
33	47	57	10
40	58	76	16
43	62	76	16
50	72	101	25
55	79	101	25
66	95	123	35
70	101	123	35
93	134	155	50
110	159	191	70
125	180	228	95
145	209	267	120
150	216	267	120
175	252	305	150
200	288	382	2x70
250	360	456	2x95
275	397	456	2.95
350	505	610	2x150
400	577	684	3x95
500	721	915	3x150
550	793	915	3x150
700	1011	1220	4x150
825	1190	1335	5x120
880	1270	1525	5x150
1030	1486	1830	6x150
1100	1587	1830	6x150
1410	2037	2440	8x150
1675	2417	2745	9x150
2250	3251	3600	12x150