

SmartGen

MAKING CONTROL SMARTER

HFW50-12V/HFW50-24V HYDRONIC FUEL WATER HEATER USER MANUAL



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Table 1 Software Version

Date	Version	Content
2023-12-30	1.0	Original release.
2024-04-30	1.1	Add fuel consumption in Table 2 of performance parameter.
2024-08-23	1.2	Add the definitions for pins and wirings of power supply, introductions of auto/remote control logic.

1 OVERVIEW

HFW50 fuel auxiliary heating device is an intelligent fuel engine water heater. When the engine operation temperature is below 4°C, engine liquid coolant/lubricating oil may be coagulated to solid state in starting phase and lose lubrication or cooling effects, so that it may damage the engine. Therefore, heater shall be installed for engine to ensure normal starting and running. This device is able to heat the coolant, when the heated coolant flows through the heat exchanger of the vehicle and heats up the space inside the unit. At the same time, the coolant also flows to the engine and heats it up. The preheated engine is capable of reaching the working temperature faster, so that the engine can go to normal running.

The OLED of the heater displays various parameters. The heating temperature can be set by users, and drying burning prevention, overheating protection and fault alarm functions are fitted

This product is suitable for various engines with 30L displacement below.

2 PERFORMANCE AND CHARACTERISTICS

- Micro-processor design is applied, precise temperature sampling, the heating temperature can be set from control panel;
- OLED display screen is applied, which can display the current water temperature, user defined temperature, accumulated running time, accumulated fuel consumption, current voltage, operating mode, running phase, etc.;
- Circulation pump and heater are controlled separately; during heating, the water pump is firstly switched on, the heater starts after a delay for a period of time and enters the inertia phase when reaches to the setting temperature, the fuel pump is powered off first, then the water pump and fan will be powered off after a delay for a period of time, which prevents the heat concentration and extends usage life of the pump;
- Manual test function is fitted, which can force to work for 240s; check whether indicator, display screen and fuel pump are able to operate normally via panel button;
- Fine cast aluminum material is used for heater shell;
- Water drain valve is fitted at the bottom of the heater, which can be used on demand;
- This product can work normally at -40°C environment.

3 SPECIFICATION

Table 2 Performance Parameters

Model	HF50-12V	HF50-24V
Heat Flow	5500W	5500W
Rated Voltage	DC 12V	DC24V
Run-time Power Consumption	48W	48W
Start-up Power Consumption	180W	220W
Working Voltage Range	DC(10~16)V	DC(20~32)V
Fuel	Diesel Fuel	
Fuel Consumption	0.46L/h	0.55 L/h
Engine Displacement	≤30L	
Heating Medium	Purified Water, Coolant Liquid	
Thermostat Range	Off: (5~80)°C	On: (0~75)°C
Default Thermostat Range	Off: (40±5)°C	On: (25±5)°C
Drying Burning Protection Temp.	Temperature difference between water temperature sensor and drying burning sensor should be more than 100 °C or the temperature of dry burning sensor is more than 100 °C.	
Inlet/Outlet Size	Φ19.5mm	
Max. Water Pressure	0.5MPa	
Pump Flow Velocity	17L/min (1.5m of lift)	
Vibration Resistance	5Hz~8Hz: ±17mm 8Hz~100Hz: a=4g 100~500Hz: a=2g IEC 60068-2-6	
Shock Resistance	50g, 11ms, half-sine, complete shock test from three mutually perpendicular directions, totally 18 times IEC 60068-2-27	
Altitude	≤3000m; (≤5500m should be ordered)	
Working Temperature	-40°C~+70°C	
Storage Temperature	-40°C~+80°C	
Case Dimensions	315mm×192mm×230mm	
Weight (include accessories)	5.3kg	

4 INSTALLATION INSTRUCTIONS

Please install the heater vertically according to the Figure 1 before use. Pay attention to the direction of heater inlet and outlet, and ensure that the heater position is below the lowest water level of the engine and that all the air is exhausted out of the heater. Perfuse the heater with coolant.

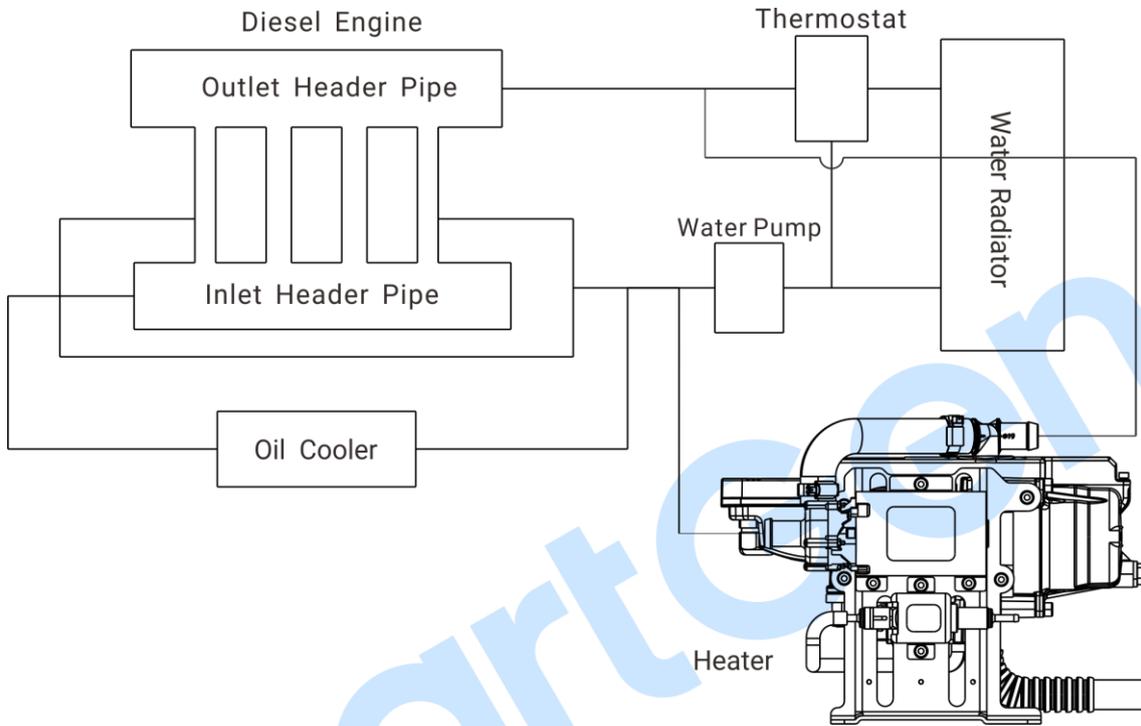


Fig.1 Installation Logic

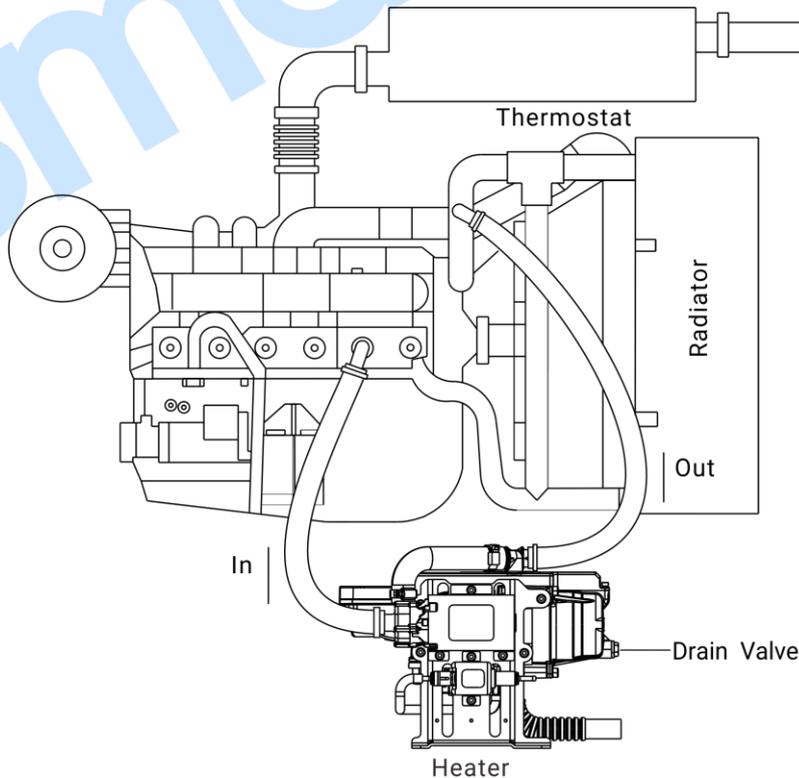


Fig.2 Installation Position



Fig.3 Incorrect Pipe Connection Methods

NOTE: If there is a W-shaped bend or reverse U-shaped bend during pipe connection, the air accumulated in the pipe cannot get out normally, resulting in the liquid cannot be circulated properly. The air dissolved in the liquid will be precipitated during heating and retained in the bend, so on the condition of unsmoothed pipeline, even if by the manual exhaust, it will repeat in the next heating process of air collection. To ensure that the smooth liquid circulation, the hosepipe with an inner diameter of more than 20mm and pipe joints with an inner diameter of more than 15mm should be selected.

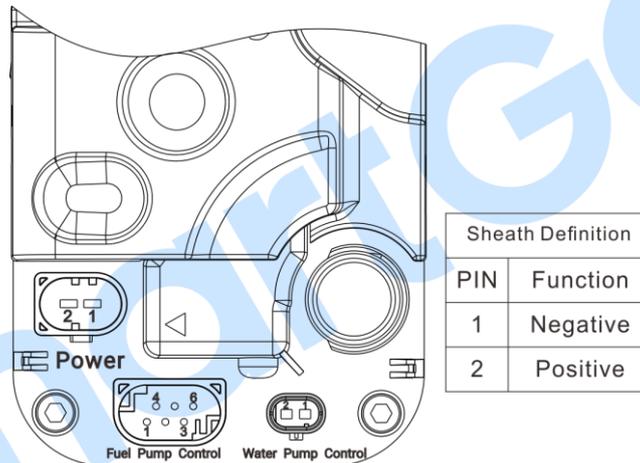


Fig.4 Pin Definition of Power Supply Port

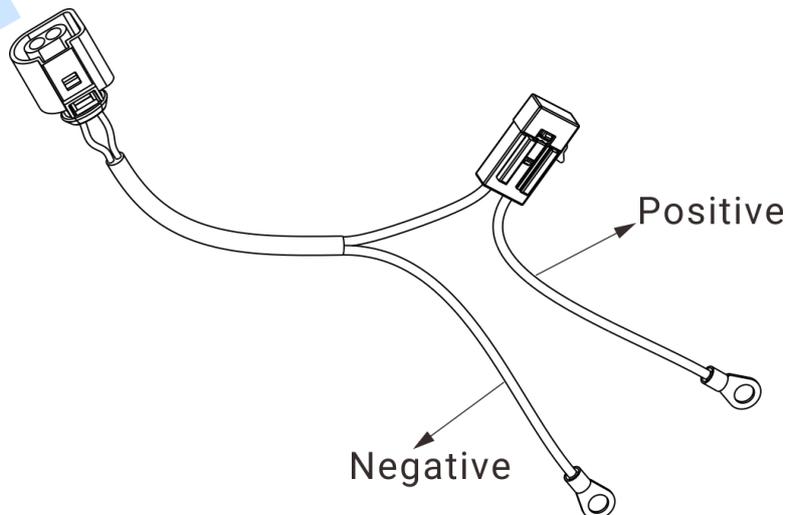


Fig.5 Wiring Definition of Power Supply Cable

NOTE: The red part of the cable is the positive side and it is connected to the fuse box; the black part of the cable is the negative side. When connecting the cables, please note that the polarity of the power supply. The wrong connection

between the positive and negative, may cause the damage or security problems.

5 OPERATING INSTRUCTIONS

5.1 OPERATION PANEL

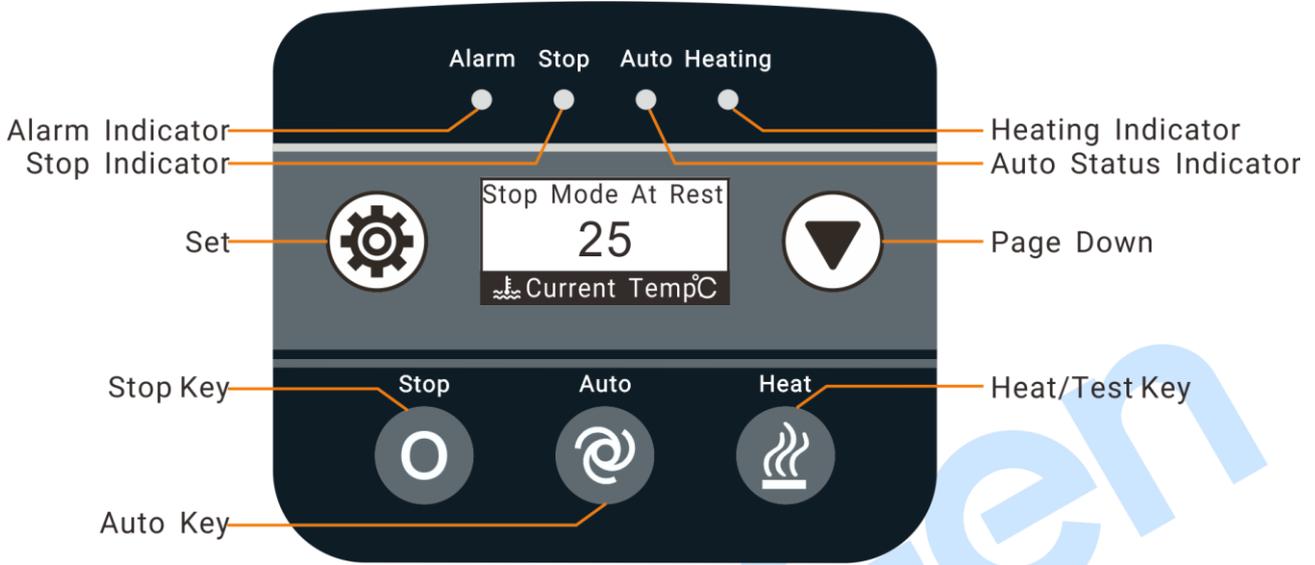


Fig.6 Operation Panel Drawing

5.2 OPERATION DESCRIPTION

5.2.1 PARAMETER CHECK

Press  to switch screen display and do value adjustment.

5.2.2 TEST RUNNING

Press , the heater enters the forced heating status, and then enters the automatic status after 240s.

5.2.3 ALARM REMOVE

Press stop key to remove the alarm.

5.3 KEYS DESCRIPTION

Table 3 Keys Description

Sign	Keys Definition	Description
	Heat	Press this key to force the heater to run for 240s and then enters the automatic status after running test.
	Stop	Press this key to stop the heater running.

	Auto	Press this key to make heater enter the automatic running status.
	Set	Press this key to set the parameters; hold and press it to return to the main screen.
	Down	This key is used to display the contents of next screen and data adjustment; hold and press it to do lamp test.
/	Pump Oil	Press the Auto key and Down key simultaneously can force the pump; press the Stop key to stop the pump.

5.4 INDICATOR DESCRIPTION

Table 4 Indicator Description

Sign	Definition	Description
Alarm	Alarm Indicator	When it is on, the heater fails to run and stops. The heater will judge the fault type according to the alarm information of display screen.
Auto	Auto Indicator	When it is on, the heater is in Auto status.
Stop	Stop Indicator	When it is on, the heater is in Stop status.
Heating	Heating Indicator	When it is on, the heater is heating.

5.5 DISPLAY DESCRIPTION

Table 5 Display Description

Content	Description
Current Temp.	The current temperature of antifreeze liquid.
Battery Voltage	The current voltage supplied.
Off Temp.	The setting value of target temperature in cycle/constant temperature mode.
Reset Temp.	The setting value of reset temperature in cycle/constant mode.
Accumulated Running Time	The total heating time, unit is hour.
Accumulated Fuel Consumption	The accumulated fuel consumption, unit is L.
Menu Setting	1. Parameter Setting 2. Language 3. Local/Remote 4. About
Language Menu	1) Simplified Chinese 1. English
Local/Remote	0: Local 1: Remote
About Menu	1. Digital input/output screen; 2. PD number, model and internal temperature interface of display board MCU.
Alarm Interface	Display the current fault alarm information.

5.6 PARAMETER SETTING INSTRUCTION

Press  to enter the setting in main menu, input the password (0318) to enter the parameter setting and adjust the value via , press  to shift/confirm, select confirm to return to the previous menu and return to the home page without any operation in 5 minutes, the screen will go off automatically after 5s.

Table 6 Parameter Setting Description

Category	Item	Range	Default	Description
Cycle/Constant Temp. Mode Set	Off Temp.	(5~80)°C	40	Off temperature setting in cycle/constant temperature mode.
	Reset Temp.	(0~75)°C	25	Reset temperature setting in cycle/constant temperature mode.
Preheat Mode Set	Working Temp.	(0~85)°C	40	Working temperature setting in preheat mode.
	Working Time	(0~120)min	90	Working time setting in preheat mode.
Module Set	Language Selection	(0~1)	0	0: Simplified Chinese 1: English
	Password Set	(0-9999)	0318	Password of parameter setting.
	Module Address	(1-254)	1	Module address setting.
	Working Mode	(0~2)	0	0: Preheat Mode 1: Cycle Mode 2: Constant Temperature Mode
	Power-on Mode	(0~1)	0	0: Stop Mode 1: Auto Mode
Input Port Set	Input Type	(0~5)	0	0: Not Used 1: Remote Start Input 2: Reserved 3: Reserved 4: Reserved 5: Reserved
	Active Type	(0~1)	0	0: Active for on 1: Active for off
Output Port Set	Output Type	(0~19)	0	0: Not Used 1: Ignition failure output 2: Overheat sensor open output 3: Overheat sensor short-circuit output 4: High voltage output 5: Low voltage output 6: Dry burning protection out 7: Exhaust sensor open output 8: Exhaust sensor short-circuit output 9: Water temperature sensor open output

Category	Item	Range	Default	Description
				10: Water temperature sensor short-circuit output 11: Water pump open output 12: Glow plug open output 13: Motor open output 14: Common alarm output 15: Reserved 16: Reserved 17: Reserved 18: Reserved 19: Reserved
	Active Type	(0~1)	0	0: Normally open output 1: Normally closed output

NOTE: remote start input function: the active type can be configured by keys or PC. The input port is inactive when local is configured, heating or not can be controlled by keys or PC; after remote control is configured and enabled, in Auto Mode and when it meets the working requirements, heating will be activated when input port is active and deactivated when input port is inactive.

Output port function: the output type and active type can be configured by keys or PC, the relay will activate when a corresponding status is initiated.

5.7 WORKING MODE DESCRIPTION

Table 7 Working Mode Description

Mode/Phase	Definition	Description
Power-on Mode	Power-on Stop Mode	In this mode, the heater enters Stop Mode when it is powered on.
	Power-on Auto Mode	In this mode, the heater enters Auto Mode when it is powered on.
Working Mode	Preheat Mode	In this mode, press the auto key to start the heater, when the water temperature reaches the working temperature of preheat mode, or the running time reaches the working time of the preheat mode, the heater will stop running.
	Cycle Mode	In this mode, press the auto key to start the heater, when the water temperature is higher than the off temperature, the heater will stop running; when the water temperature is lower than the reset temperature, the heater will start to start automatically.
	Constant Temp. Mode	In this mode, press the auto key to start the heater and heat up to 10°C below, the fuel pump will run in frequency converting status. When the water temperature is higher than the off temperature, the heater will stop working, while the water temperature is lower than the reset temperature, the heater will start to work automatically.
Working Phase	At Rest	Standby status.
	Starting Phase	The starting phase of heater.
	Heating Phase	The heater enters the heating phase after successful ignition.
	Inertia Phase	After heating to the set temperature, the oil pump will power off first, then the water pump and fan will stop working after a period time of

Mode/Phase	Definition	Description
		delay, which will prevent the heat concentration, and the ignition plug will restart to ignite the remaining fuel in the combustor.

5.8 CONTROL LOGIC ILLUSTRATION

5.8.1 REMOTE CONTROL LOGIC

1. Select "Remote" in "Local/Remote" setting of menu;
2. Configure the input port as "Remote Start Input";
3. In auto mode, the engine starts to run when input port is active and the set temperature is reached, while the engine stops when input port is inactive.

5.8.2 AUTOMATIC CONTROL LOGIC

Set power-on mode as "Auto Mode", the engine starts to operate automatically when the set temperature is reached;

Set power-on mode as "Stop Mode", when pressing the "Heat" key, the heater will be forced to run for 240s and enter to auto status after testing.

NOTE: Set the heater as preheating mode before testing, in this mode, the engine will enter into the standby status in auto mode and will not restart (Press the auto key again if the engine needs to start again); if the cycle or constant temperature mode is set, the engine will circularly start if reset conditions are met.

5.9 FAULT DESCRIPTION

Table 8 Fault Description

Displayed Content	Description
Ignition Failure	During starting process, the temperature of exhaust sensor is too low in a certain time.
Flame Off	During normal running, the low exhaust temperature or the variable temperature of the exhaust gas falls too fast, it is considered as flame off.
Overheating Sensor Open	The dry burning temperature sensor is open.
Overheating Sensor Short Circuit	The dry burning temperature sensor is short-circuited.
High Voltage	When the input voltage of power supply is higher than the default value, the heater will alarm and stop working; then enters the standby status.
Low Voltage	When the input voltage of power supply is lower than the default value, the heater will alarm and stop working; then enters the standby status.
Dry Burning Protection	The temperature difference of dry burning temperature sensor and water temperature sensor is large or the dry burning temperature sensor is high.
Exhaust Temperature Sensor Open	The exhaust temperature sensor is open.
Exhaust Temperature Sensor Short Circuit	The exhaust temperature sensor is short circuited.
Water Temperature Sensor Open	The water temperature sensor is open.

Displayed Content	Description
Water Temperature Sensor Short Circuit	The water temperature sensor is short-circuited
Motor Open	The motor is open.
Glow Plug Open	The glow plug is open.

6 EXTERNAL WIRING AND COMMUNICATION

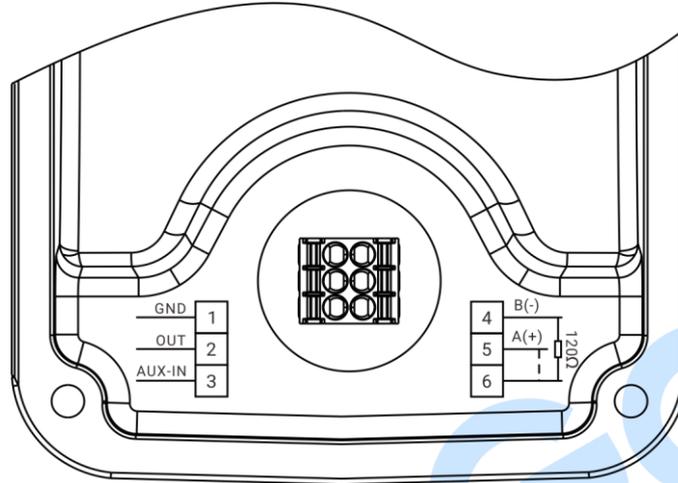


Fig.7 Communication Wiring
Table 9 Terminal Description

No.	Function	Cable Size	Remark
1	GND	1.5mm ²	The grounded terminal of switching quantity.
2	Flex. Relay Output Port	1.5mm ²	Active relay (COM B-), normally open output, rated 10A.
3	Aux. Input Port	1.0mm ²	Active for GND.
4	RS485 B(-)	1.5mm ²	Impedance-120Ω shielding wire is recommended and its single end grounded.
5	RS485 A(+)	1.5mm ²	
6	Terminal Matching Resistance (120Ω)	1.0mm ²	Short connected Terminal 5 and Terminal 6 if 120Ω matching resistance is needed.

7 USE AND MAINTENANCE

- 1) When the heater needs to be repaired or replaced fittings, press stop key to make the heater enter the stop status;
- 2) Ensure that the heater is full of coolant liquid before starting, using the exhaust valve to get the air out of pipe;
- 3) It is highly recommended to use antifreeze with corresponding label;
- 4) If purified water is used for coolant liquid, after shutdown, discharge the water when the ambient temperature is lower than 0 °C, which will prevent the heater from freezing and breaking;
- 5) Water drain valve: using internal hex wrench, adjustable wrench or cross screwdriver to open or close.
- 6) 4mm² copper wire is used for power line connection.

7) This product needs to use low-temperature diesel fuel that matched with ambient temperature, otherwise the diesel will be coagulated in the pipeline when the temperature is too low and causing the heater to fail to work.

8 WATER DRAIN VALVE

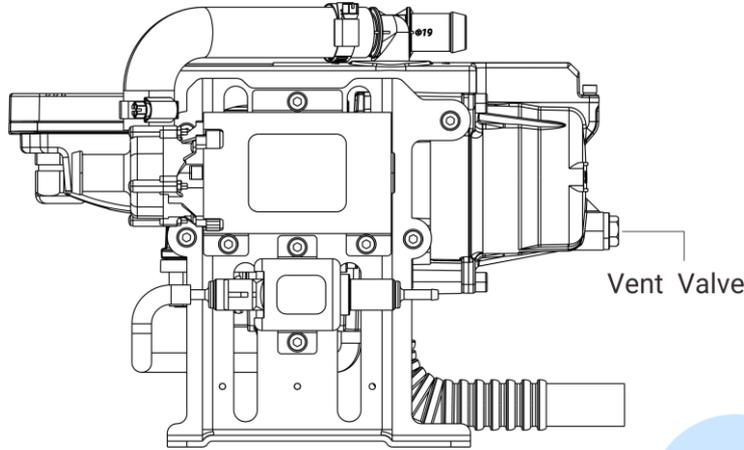


Fig.8 Vent Valve

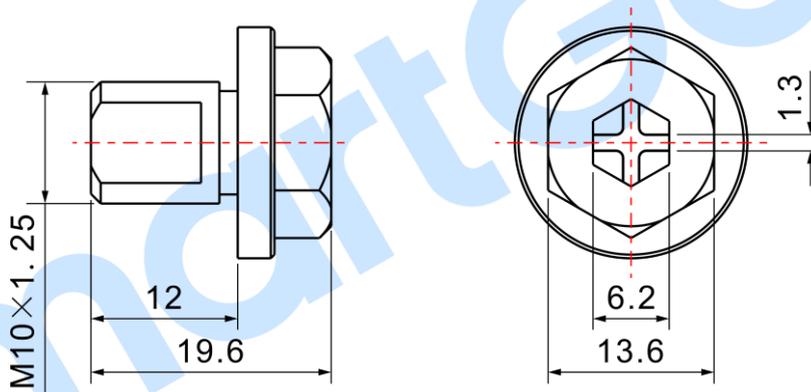


Fig.9 Bolt of Vent Valve

9 DIESEL LABEL AND USING TEMPERATURE

Table 10 Diesel Label and Using Temperature Table

Above 5°C	Above -5°C	-15°C Above	-30°C Above	-41°C Above
0#Diesel	-10# Diesel	-20# Diesel	-35# Diesel	-50# Diesel

Table 11 Faults and Solutions

Faults	Inspection Measures	Possible Solutions
Dry Burning Protection	1. Check the valve to assure whether it is opened and whether the heater is full of water; 2. Check whether the hosepipe has an obvious W-shaped or reverse U-shaped trend, and whether there is an obvious hot and cold alternating area.	Exhaust the air in the heater and pipe, optimize the hosepipe trend
High Outlet Temperature	It occurs when the hosepipe is too long, both the inner diameter of the hosepipe and the fitting joints are too small, as well as the water flow is not smooth so that the heat cannot be transferred properly.	Shorten the hosepipe length, using the hosepipe with an inner diameter of more than 20mm, and the connectors with an inner diameter of more than 15mm.
Ignition Failure	Ignition plug is abnormal.	Change the ignition plug.
	Insufficient fuel in fuel tank.	Replenish the fuel oil.
	The oil pump is abnormal.	Check the operations of the oil pump.
	Excessive carbon deposits in combustor.	Change and clean the combustor.
	The fuel pipe is blocked or broken.	Check whether the fuel pipe is blocked by impurities, all connections are in good condition, if so, please repair or replace it.
	The fuel coagulation will block the fuel pipe.	Check whether the fuel is coagulated, if so, please replace the low-temperature fuel that is suitable for the environment.
	The smoke exhaust pipe is not smooth or blocked.	Check whether the smoke exhaust pipe is blocked, if so, please clean it.
	Inlet is not smooth or blocked.	Check whether the inlet pipe is blocked, if so, please clean it.
Controller failure.	Replace the controller.	

11 OVERALL AND INSTALLATION DIMENSIONS

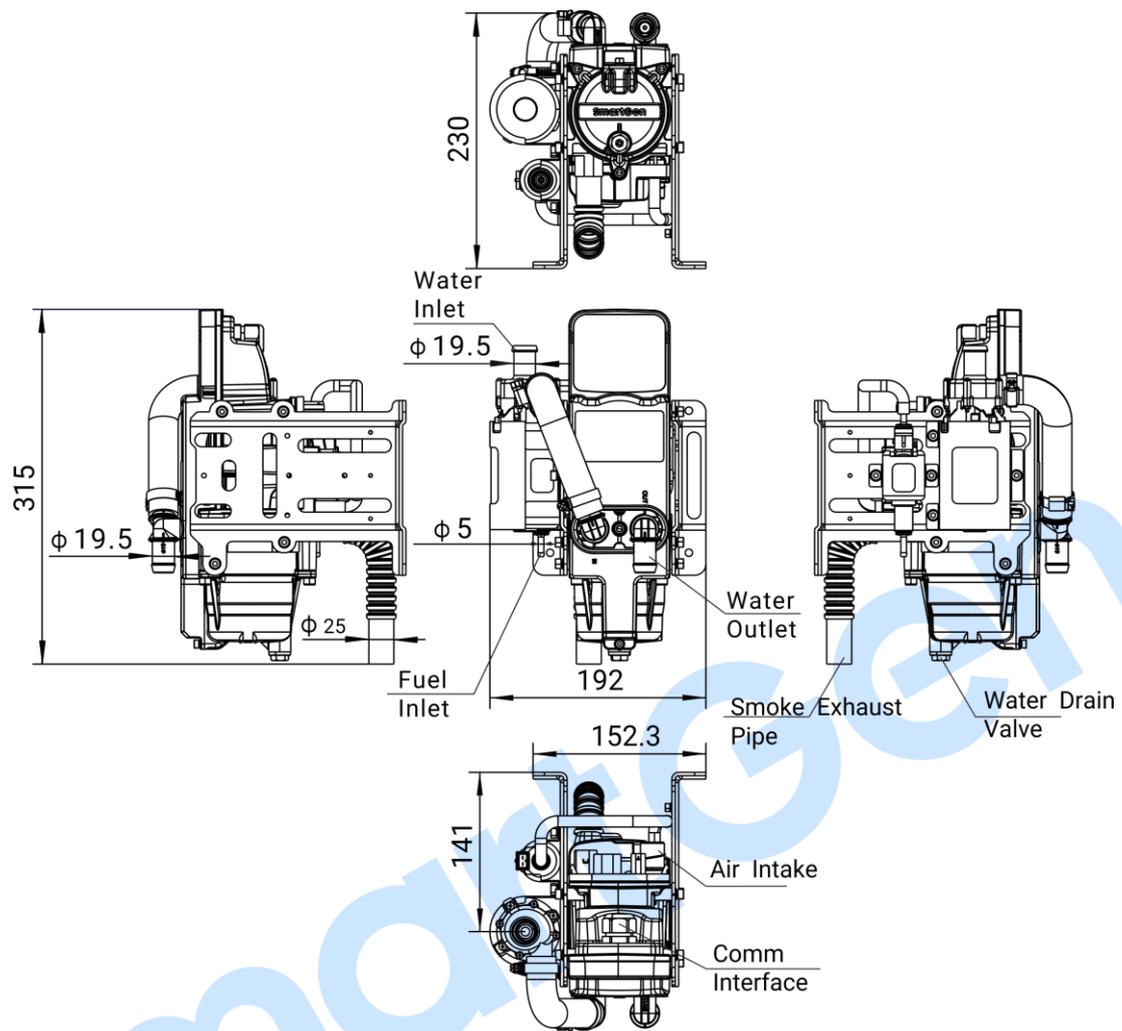


Fig.10 Overall Dimensions (Unit: mm)

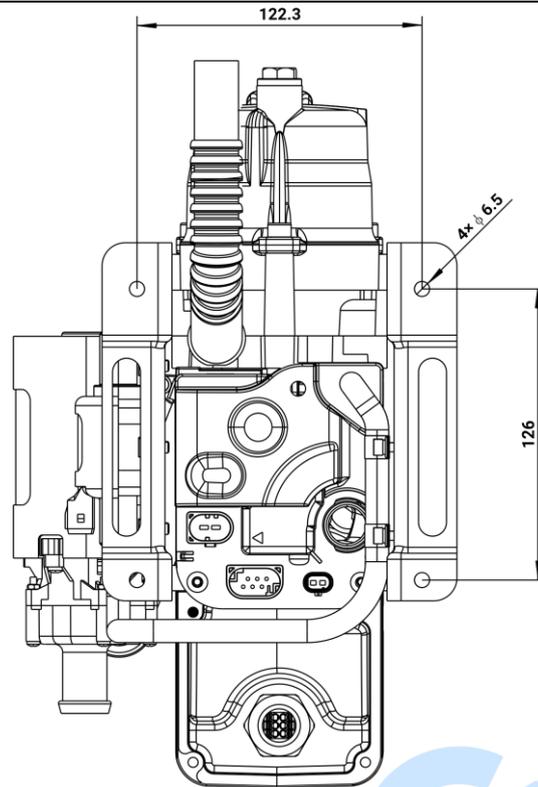


Fig.11 Installation Dimensions (Unit: mm)

12 PACKING LIST

Table 12 Packing List

No.	Item	Model	Numbers/Unit
1	Heater	HFW50-12V/HFW50-24V	1
2	Wiring Harnesses		1
3	Hexagon Head Bolt (Stainless Steel)	GB/T 5783 M6x40	4
4	Spring Washer (Stainless Steel)	GB/T 93 6	4
5	Flat Washer (Stainless Steel)	GB/T 95 6	4
6	Hexagon Nut (Stainless Steel)	GB/T 6170 M6	4
7	Smoke Exhaust Pipe	PYG-HFW50-01	1
8	Hose Clamp (19-29)	19-29	7
9	Hose Clamp(10-12)	10-12	5
10	Nylon Fuel Pipe (External Diameter 5∅)	External Diameter ∅5	4m
11	Oil-resistant Pipe (Inner Diameter 3.5∅)	Inner Diameter 3.5∅*50mm	2
12	Installation Instructions		1