

# Clearfuel Limited

## Operating Manual Of Various-Fuels Automatic Burner



- ★Read carefully the Manual before using and repairing.
- ★Only trained operators are allowed to run the burner.
- ★Cut off power before running and maintaining the burner.
- ★Accidents and risks may arise due to improper operation

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## **I. Main Features**

Our burner is designed to be very energy efficient and friendly-environment. Multiple fuels can be burned, especially the waste/used fuel oils (engine oil and vegetable oil), and realizes the fully-automatic control over the combustion process by adopting computerized control with the state patent (the state patent No. 200520000333.0) and the unique combustion technology. Widely used in the equipment integrated with the heat exchanger, such as large and small-sized industrial and utility boilers, coating machines and auto baking varnish workshops. Exhaust gas emission reaches the standards and the unit is approved by the environment protection authorities.

### **Good fuel atomization, less energy consumption and low noises**

The burner uses a special nozzle to burn and inject fuels evenly by using the compressed air as the primary air. The fuel oil obtains satisfactory atomization at the air pressure level starting as low as 0.05 MPa. Therefore the unit has less energy consumption and low noises, because it needs no atomization medium.

### **Good fuel-air mixing, stable flame, high combustion efficiency and friendly-environment**

The burner uses cyclone and straight-through flow simultaneously, and may obtain relatively satisfactory fuel concentration field by enabling the fuel and the combustion air to mix completely, while the cyclone may cause the reflow of the hot flue gas, improving greatly the stability of the flame. Therefore the unit may have an efficient and complete combustion and a thorough emission, and has less pollution to environment, complying with the most respective regulations.

### **Safe and reliable with fully-automatic control**

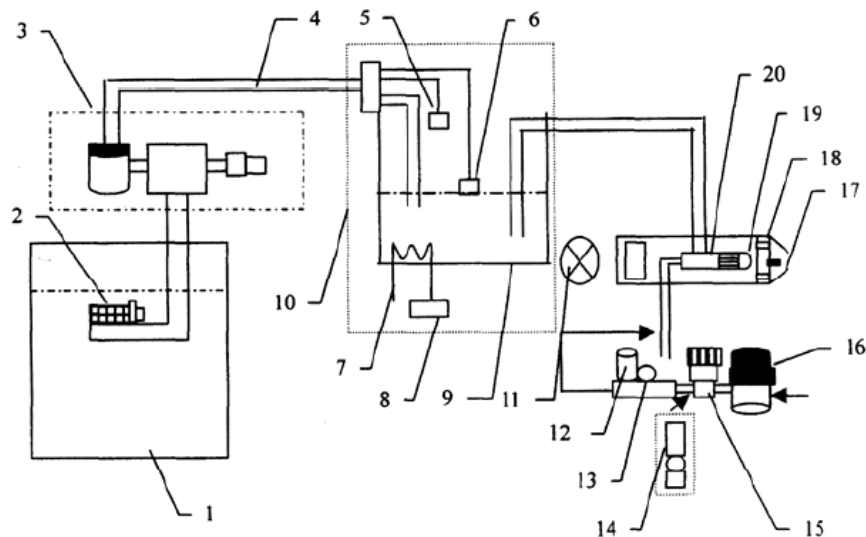
The burner uses the world-class flame supervision and combustion safety controllers, realizing the fully-automatic control including the air supply, firing, fuel injection, combustion, stopping and starting processes allows our burner to meet rigorous safety requirements. And it may stop automatically if any potential risks are indentified.

### **Easy installation**

The burner has flange which allows its easy installation and adjustment in place on the combustion chamber of a heater, boiler and the like. Blast pipe on the burner head can be adjusted by sliding it in or out of the flange to position it properly. Power supply cords have standard connectors hence connecting is self explanatory and does not require anything special to be done. Air supply line has quick-disconnect fittings. Placing of the fuel feeding hose to the barbed fitting on the bottom side of the tank cover is straight forward and does not require any special skills or tools.

## Easy maintenance

Routine maintenance is taken into account in the design of the product. It is very convenient for the key elements to be dismantled, cleaned and changed if needed. And the unit adopts peculiar physical phenomenon, and there are no wear parts and consumables during the routine operation, which may keep maintenance and usage costs considerably low.



**Fig 1 Air and Fuel Oil Flow Chart**

1. Oil Storage Tank
2. Drift-Flux Oil Absorption
3. Oil Supply System
4. Oil Supply Pipe
5. Min. Oil-Level Control
6. Max. Oil-Level Control
7. Heating Pipe
8. Thermostat
9. Smaller Oil Tank
10. Fuel Pre-heater
11. Fan
12. Joint for Compressed Air
13. Air Pressure Gauge
14. Pressure-Regulating Valve
15. Solenoid Valve
16. Oil-Water Separator
17. Nozzle System for Combustion Unit
18. Flame Ring
19. Fuel Nozzle
20. Air/fuel mix chamber

## II. Range of Operation

As the heating object and its service situations of the burner differ, the pressure of the furnace hearth varies. When the backpressure (pressure of the furnace hearth) of the burner increases, the outlet airflow of the fan decreases, and then the injection pressure must be lowered or the injection volume must be decreased by changing a smaller nozzle so that the flow of the fuel oil can be matched with the airflow. The higher the backpressure is, the smaller the airflow of the fan is, the smaller the combustion capacity of the burner. Therefore the burner may function within certain range, when the backpressure is lifted to certain values, the airflow drops sharply, and firing and combustion situations deteriorate greatly even the burner gets quenched, no matter how we decrease the injection volume, we can't ensure the burner may have a normal combustion.

### Oil Supply System

Connections of the stainless steel braided oil-resistant hoses from the outlet of the fuel pump to the intake of the fuel filter and from the outlet of the fuel filter to the high temperature pre-heater system are tightly sealed and should be kept this way to prevent fuel leaks. The outlet of the fuel pump is a one-way valve.

To keep fuel supply system in good working condition, fuel filter should be protected from damages and it should be replaced periodically. The preinstalled fuel filter is a standard automotive oil filter (the supplied filter is usually Honda 15400-PR3)

The oil level of high-temperature fuel oil supply consists of a level control float ball and a computer-controlled switch. The oil level may be adjusted by adjusting the computer program.

### Photo Resistance

Photo resistance is a device that supervises the flame. Photo resistance may enable the controller to stop working within 10 seconds and whilst on the controller malfunction indicator light gets on, because photo resistance can't sense the luminosity of the flame if the flame can't be fired or flame is quenched during the operation when the burner initiates. On the contrary, under the circumstances that there is a strong ambient light illumination, photo resistance may sense the ambient lighting, and thinks the flame is burning, enabling the controller to have improper operation, that is, the controller will not inject oil when starting while it will not stop injecting when operating. Therefore we should dispel the interference of ambient lighting to the photo resistance.

### Malfunction Indicator Light

The controller will stop working within 10 seconds and the malfunction indicator light gets on when the burner can't start or operate normally due to some reasons. Facing this we should try to find the reasons possible to cause the troubles, and dispel the trouble, and then press the button of the reset button, the burner will function again.

According to the requirements users may install a fault warning device that will give a fault alarming when the burner is in trouble. Once the malfunction light gets on, the reset button can be pressed after **around 20 seconds**. And the burner should be started again with the manual reset.

Reset button may be disabled by control unit after several consecutive restart attempts. To enable it disconnect the burner from the power source.

### Computer Program Controller

A computer program controller is a device controlling the normal and safe operation of the burner. A series of program operating time has been preset to ensure the reliable and safe operation of the burner for the sake of safety except that burner is started and operated with the prescribed program.

## III. Installation

### Mounting burner to the combustion chamber

Fix the flange and seal ring of the burner on the support.

### Oil Pipe

If you are planning using only big oil Tank supplied with the burner, the installation procedures are quite simple and straight forward. All you need to do is to attach the stainless steel braided fuel supply line attached to the outlet of the fuel filter to the fitting on the small high temperature fuel pre-heater tank and to attach floating fuel supply intake line to the barbed fitting on the bottom side of the tank cover.

Bigger auxiliary fuel storage tank may be preferred to be used with the burner instead of the big oil tank. Fuel supply system parts can be used in such case: floating fuel supply intake line, fuel pump, fuel filter.

If you store fuel in an auxiliary tank outdoors, please remember to take measures to prevent the water in the fuel from freezing and the fuel from thickening.

### Connection of Power Supply

Put the plug on the burner into the socket on the fuel pump.

Contact the power supply of the burner (110V / 220V)

Please connect the power cord of the big oil tank to the power source when the weather is very cold or the oil can not pumped from the big oil tank.

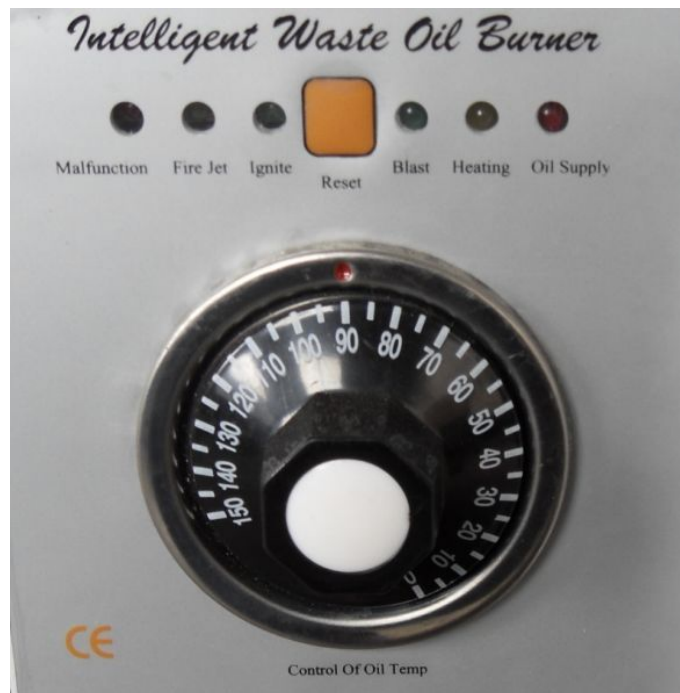
### Connection of Compressed Air Supply

Connect the air pump to the coupler of the air piping. We have installed an oil-water separator between the compressor and the air piping to avoid the shut-off trouble caused by the water in the air piping.

## Special Parts

1. Oil Tank
2. Oils in the oil pre-heater/heating oil-storage tank. The power line in the plastic box mounted at the bottom of the oil tank should be connected to the power supply directly.
3. Oil-pumping device should be mounted on the oil storage tank or the auxiliary oil storage container connecting to the oil piping, which transmits automatically the fuel oil with a preheating temperature of 40°C into the smaller oil tank.
4. A floating sucker should be connected to the bottom of the oil piping and inserted into the oil storage tank or the auxiliary oil storage container.

## IV. Operation



Indicate Lights are as followed:

- Oil supply working light
- Heating working light
- Blast working light
- Reset button
- Ignite working light
- Fire Jet working light
- Malfunction indicator light

"Reset" button: after resolving all the problems, press it to restart the burner.

"Oil supply" light on when oil pump is operating to maintain operational oil level in the small tank.

"Heating" light on when the oil in small tank is heating.

"Blast" light on when cage fan is working.

"Ignite" light on when burner is igniting.

"Fire Jet" light on when burner is burning.

"Malfunction" light on when there is something wrong.

### 1. Oil filling

When the burner is used for first time or after emptying the smaller high temperature pre-heater tank for maintenance or other purposes, please fill the oil into small tank manually approximately in half. *Please note: if the oil is very dirty, please do not fill this oil to small tank directly, the nozzle may be blocked, so please pay attention to waste oil.*

#### *Warning:*

*If the oil level in small tank is too high, the float switch will turn off automatically, while the oil level in small tank is too low, the heating element is easy to be damaged.*

### 2. Air adjustment

Adjust the air gauge to set the consumption of oil, at the same time, the flame is adjusted accordingly.

Adjust the secondary air (wind knob) to control the exhaust of waste air, but it is better to keep the initial setting.

### 3. Control of Oil Temp

Set the preheating temperature according to the oil.

Vegetable Oil	120°C-140°C
Waste Oil	90°C-100°C
Diesel Oil	0°C

### 4. Power connection

Connect 220V /110V power, then burner will start to work.

### 5. Oil Supplying

After connecting with the power, the burner will pump oil from big tank to small tank, there is a float switch in small tank to monitor the oil level, when the oil level is up to high position, the pump will stop pumping oil. When the float switch did not work, time delay control will work, if oil pumping exceeds 80 seconds limit, the malfunction light will twinkle and the burner will stop, the pump will stop pumping oil too.

### 6. Oil heating

After supplying oil, the heating element in small tank will heat the oil according to the setting of temperature controller.

### 7. Ignite and fire jet

When the oil in small tank reaches the set temperature, the burner will ignite and fire jet.

#### Notice:

- a. The burner has to be placed not lower than the big oil tank. Otherwise a magnetic valve needed to cut off oil flowing from the big tank to the burner when all machines not work.
- b. The burner will function automatically when the fuel oil is heated to the prescribed temperature.

## V. Maintenance

Periodically check the oil-water separator and empty and clean it if needed. If burner was not used for three days or more drain water and sludge from the small high temperature fuel pre-heater tank using the drain valve on its bottom.

### Monthly Work

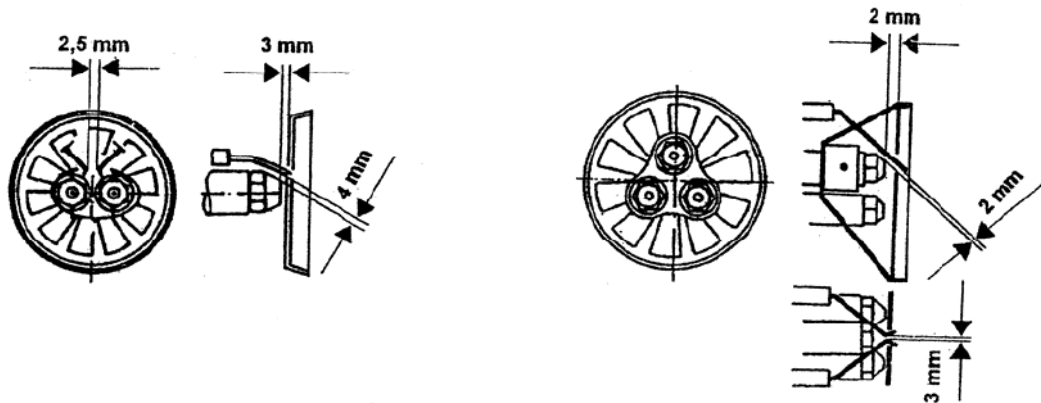
Clean the fuel oil filter of the big oil tank and the strainer mounted on floating fuel supply intake line.

Discharge the water deposited in the oil storage tank ( big tank and smaller tank)

Clean the photo cell.

Clean the igniter electrodes and the flame ring. Use compressed air to clean the nozzles and check the igniter electrodes distance.

Fig 3



### Annual Maintenance (before and after using the burner)

Do the same as the monthly maintenance described above.

Clean the pipe of the heating element and smaller tank.

## VI. Troubles Shooting

Troubles	Reasons Possible	Solutions
The limited time of oil pumping is exceeded.	<ol style="list-style-type: none"> <li>1. Float switch in the small tank did not work.</li> <li>2. The wire of float switch is disconnected</li> <li>3. There is no oil in big tank</li> <li>4. The oil pump is damaged.</li> <li>5. The wire connection of oil pump is disconnected.</li> <li>6. Suction pipe is not inserted into big tank</li> </ol>	<ol style="list-style-type: none"> <li>1. Change a new float switch</li> <li>2. Connect it</li> <li>3. Fill the oil into big tank</li> <li>4. Change a new oil pump</li> <li>5. Check it and connect it.</li> <li>6. Insert it.</li> </ol>

Troubles	Reasons Possible	Solutions
Burner can't be started	<ol style="list-style-type: none"> <li>1. There is no voltage or low voltage on the power line.</li> <li>2. The heater of the smaller oil tank has an open circuit.</li> <li>3. The power fuse is broken off.</li> <li>4. There is no compressed air or the pressure is over-low.</li> <li>5. There is something wrong with the solenoid valve.</li> <li>6. The oil temperature is so low that the fuel oil is too thick to be injected into the smaller oil tank.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the reasons and dispel the trouble.</li> <li>2. Check the heating circuit.</li> <li>3. Change it.</li> <li>4. Connect to the compressed air supply and adjust the pressure.</li> <li>5. Check the solenoid valve and change it if necessary.</li> <li>6. Have heat preservation on the oil piping.</li> </ol>
Burner injects oil but often stops (malfunction light is on) because it can't fire. If the fuel oil has a good state (which is not contaminated by water and the like) and it has a good atomization, the trouble will lie in the firing device.	<ol style="list-style-type: none"> <li>1. Firing circuit is damaged.</li> <li>2. The conductor of the transformer igniter is ageing and loses its unction.</li> <li>3. The conductor of the transformer igniter is not stranded well.</li> <li>4. The transformer igniter is damaged.</li> <li>5. The distance between the igniter electrode ends is incorrect.</li> <li>6. The electrode discharges electricity toward the ground (housing) because the electrode is dirty or the insulation is damaged. Whilst check the insulated porcelain.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the whole circuit and repair it.</li> <li>2. Change it.</li> <li>3. Strand it tightly.</li> <li>4. Change it.</li> <li>5. Adjust it to the correct position as shown in the figure.</li> <li>6. Clean and change them if necessary.</li> </ol>
Burner injects oil but often stops (malfunction light is on) because it can't fire.	<ol style="list-style-type: none"> <li>1. There is some water in the fuel oil.</li> <li>2. The combustion airflow is too strong.</li> <li>3. The vent between swirler and burner head is too wide.</li> <li>4. Fuel nozzle is worn or dirty.</li> <li>5. The blast motor or the starting capacitance is damaged.</li> </ol>	<ol style="list-style-type: none"> <li>1. Clean the bigger oil tank, and drain the water at the tank bottom.</li> <li>2. Decrease the combustion airflow.</li> <li>3. Adjust the burner head to the correct position.</li> <li>4. Clean or change it.</li> <li>5. Repair or change it.</li> </ol>

Troubles	Reasons Possible	Solutions
Burner injects oil but often stops after the flame has burned for a few seconds (malfunction light is on). There may be something wrong with the flame controller.	<ol style="list-style-type: none"> <li>1. Photo cell is damaged or blocked by the oil smoke or it is not plugged well.</li> <li>2. The ventilation is inefficient.</li> <li>3. The loop of the photo resistance is damaged.</li> <li>4. The swirler and the burner head are dirty.</li> </ol>	<ol style="list-style-type: none"> <li>1. Change or clean it and plug it well.</li> <li>2. Check the boiler and vent of the smoke pipe, and clean them.</li> <li>3. Change it.</li> <li>4. Clean them.</li> </ol>
Burner starts very late.	<ol style="list-style-type: none"> <li>1. The heating pipe and the thermostat in the smaller oil tank of the burner are very dirty or there are troubles on them.</li> </ol>	<ol style="list-style-type: none"> <li>1. Clean the heating pipe and the thermostat, and change them if necessary.</li> </ol>
Oil pump can't pump the oil.	<ol style="list-style-type: none"> <li>1. The oil pump is very dirty.</li> <li>2. The strainer mounted before the floating sucker is very dirty.</li> <li>3. There is something wrong with the oil-pumping motor or the starting capacitance.</li> <li>4. The fuel oil filter is blocked.</li> </ol>	<ol style="list-style-type: none"> <li>1. Clean the oil pump.</li> <li>2. Clean the strainer.</li> <li>3. Repair or change them.</li> <li>4. Change it.</li> </ol>
There are too many carbon deposits on the fuel nozzle and the flame ring.	<ol style="list-style-type: none"> <li>1. The installation position of the flame ring is incorrect.</li> <li>2. The compressed air is too much or less.</li> <li>3. The ventilation in the heating chamber is inefficient.</li> </ol>	<ol style="list-style-type: none"> <li>1. Adjust the position of the flame ring.</li> <li>2. Adjust the primary airflow.</li> <li>3. Provide efficient ventilation.</li> </ol>
The flame is not good with some sparks.	<ol style="list-style-type: none"> <li>1. The atomization pressure of the compressed air is too low.</li> <li>2. There is too much combustion air.</li> <li>3. The fuel nozzle is dirty or loses its function.</li> <li>4. There is some water in the fuel oil.</li> </ol>	<ol style="list-style-type: none"> <li>1. Increase the primary compressed airflow.</li> <li>2. Decrease the combustion airflow.</li> <li>3. Clean or change it.</li> <li>4. Pump the water from the oil tank with a proper pump.</li> </ol>

Troubles	Reasons Possible	Solutions
<p>The flame has its bad pattern with smoke and soot.</p>	<ol style="list-style-type: none"> <li>1. The combustion airflow is inefficient.</li> <li>2. The fuel nozzle is dirty or loses its function.</li> <li>3. The design of the combustion chamber is not reasonable or the chamber is too small.</li> <li>4. The injection volume of the nozzle is inefficient, compared with the size of the combustion chamber.</li> <li>5. Flameproof asbestos seal ring is unfit or it is too big.</li> <li>6. The boiler or the smoke pipe is blocked.</li> <li>7. The atomization pressure of the compressed air is too low.</li> </ol>	<ol style="list-style-type: none"> <li>1. Increase combustion airflow.</li> <li>2. Clean or change it.</li> <li>3. Decrease the injection volume to satisfy the combustion chamber, or change the burner.</li> <li>4. Change the nozzle to increase the injection volume.</li> <li>5. Change the size of the seal ring up to the standards.</li> <li>6. Clear the carbon deposits.</li> <li>7. Increase the primary compressed airflow.</li> </ol>
<p>The flame has a bad quality with pulsation combustion or blow-off combustion.</p>	<ol style="list-style-type: none"> <li>1. The ventilation has a strong draft (only when there is an IDF to the smoke pipe).</li> <li>2. Fuel nozzle loses its function (worn or blocked).</li> <li>3. There is some water in the fuel oil.</li> <li>4. There is greasy dirt on the swirler.</li> <li>5. The combustion airflow is too strong.</li> <li>6. The vent between swirler and burner head is too wide.</li> </ol>	<ol style="list-style-type: none"> <li>1. Adjust the IDF speed by changing the diameter of the pulley.</li> <li>2. Clean or change it.</li> <li>3. Pump the water from the oil tank with a proper pump.</li> <li>4. Clean it.</li> <li>5. Decrease the combustion airflow.</li> <li>6. Adjust the position of the burner head, and decrease the area of the vent.</li> </ol>
<p>There is soot at the outlet of the smoke pipe.</p>	<ol style="list-style-type: none"> <li>1. The temperature of the smoke exhaust is very low, and the smoke pipe has bad heat insulation, or the cold airflow enters the smoke pipe.</li> </ol>	<ol style="list-style-type: none"> <li>1. Improve the heat insulation, and seal all the gaps through which the cold airflow may enter.</li> </ol>

## Wiring Diagram

