

MIFCO COMBUSTION SAFEGUARD SYSTEM No. 4

**SAFE STARTING:**

1. Open the lid and swing away from the burner. (WARNING - DO NOT SWING THE HOT LID OVER BURNER EQUIPMENT.)
2. Open main gas line shut off cock leading to the furnace. This does not include the gas adjusting valve at the mixer.
3. Be sure both mixer gas and air adjusting valves are closed.

**IGNITION:**

4. Press the start button. This energizes the flame protection circuit.
5. There will be a 2 second self diagnostic period when the unit receives power. During this time, the unit checks all circuits for continuity before powering the blower.
6. After the blower starts, there is a 30 second purge cycle prior to the spark transformer and main gas coming on.
7. When the purge cycle is finished, the spark transformer and main gas solenoid will receive power. This will be indicated by the PILOT and MAIN indicator lights on the flame supervision chassis. At that time, you have 10 seconds to achieve ignition before the unit shuts down for flame failure. Open the gas adjusting valve slowly (smaller adjusting valve which enters the side of the mixer) until main burner ignites. When the flame is established and is being seen by the flame scanner, the FLAME indicator light on the chassis will be lit. The ignition trial period only lasts for 10 seconds, so burner flame must be established within this time.
8. Adjust the mixer to about 1/3 firing rate. Adjusting any two valve burner system is identical to adjusting an oxy-acetylene torch. Increase the gas slightly until the flame shows a slight excess of gas, then open the air valve to form the flame cone at burner tunnel. IMPORTANT THE MAIN BURNER FLAME MUST BE HELD NEAR THE BURNER TUNNEL OPENING SO THE ULTRAVIOLET SCANNER CAN SEE THE FLAME.

**ADJUSTING:**

9. Close the furnace lid and continue opening the gas and air valves per step 8 until the air valve is wide open. There should NEVER BE MORE THAN 5 inches of flame coming out of the exhaust port at any time during adjustment of burner. See the Operating Manual for adjusting the atmosphere for melting.
10. To decrease heat, close the air valve until the exhaust flame at the exhaust port is about 5 inches long. Next, close the gas valve until the flame disappears into the furnace. Repeat the turn down sequence to the desired firing rate. Idle is about one fourth open.

**SHUT DOWN FOR POURING OR TEMPERATURE CHECK:**

11. IDLE FURNACE PER STEP 10, then press the stop button. This closes the gas solenoid shut off valve and stops the blower. DO NOT CHANGE IDLE ADJUSTMENT OF VALVES. To restart the furnace, press the start button and the furnace will re-ignite at the idle position.

**SHUT DOWN TO SECURE FURNACE AT END OF MELTING PERIOD:**

12. Press the stop button. Close both of the mixer adjusting valves. Close the gas line shut off cock. Close the furnace cover.

## RE-IGNITION AFTER FLAME FAILURE:

- a. Turn off all burner adjusting valves.
- b. Press the stop button on the start-stop station.
- c. Wait 50 to 60 seconds for safety timers to cool off.
- d. Depress the RESET button on the flame supervision chassis.
- e. Open the furnace cover. Repeat ignition steps 4 through 8.

## TROUBLE SHOOTING FOR INITIAL START-UP:

A. FURNACE WILL NOT RESTART AFTER MELTING CYCLE AND SHUTDOWN: The gas valve was closed, extinguishing the flame before the stop button was pressed. This simulates a flame failure and initiates the flame failure shutdown cycle. Follow the steps in RE-IGNITION AFTER FLAME FAILURE, to restart the furnace.

B. FURNACE IGNITES SATISFACTORILY, BUT SHUTS DOWN WHEN HEATING RATE IS INCREASED: Too much gas in the mixture. The flame blows away from the burner tunnel, simulating a flame failure. Refer to the information in STEP 8 of IGNITION.

C. FURNACE SHUTS DOWN WHEN FURNACE IS ADJUSTED TO MAXIMUM FIRING: Insufficient gas supply. The excess air extinguished the flame. Have a gas utility company check the gas regulator and size of installation against the BTU rating of furnace.

D. SLOW MELTING: Insufficient gas supply. The operator should be able to open the air valve all the way and still have excess gas available. See the Operating Manual on: OPERATION.

E. FURNACE WILL NOT START AFTER FLAME FAILURE SHUTDOWN: The flame relay has not been reset. See STEP "d" in RE-IGNITION. Insufficient waiting period for cool down of timers. See STEP "c" RE-IGNITION.

## SERVICING - TROUBLE SHOOTING:

Problems with MIFCO furnaces with Fireye Controls can be easily isolated by following the approved procedure in the sequence given below. Before starting any trouble shooting, however, make sure of the following:

1. Installation and wiring has been made in accordance with the manufacturer's instructions.
2. The Fireye Chassis is securely plugged in and the top and bottom retaining screws are tightened. The Lockout Switch (red pushbutton) is reset.

In the following list, problems are listed first, and the possible causes are listed below in numerical order. Refer to the manufacturer's instruction manual included in this operating manual for proper component and contact identification. It is necessary to have a 20,000 ohm, DC volt meter to perform signal testing. This meter, set on 150 volt AC scale, may be used to check line and load voltages at the identified terminal studs on the components.

### A. FURNACE WILL NOT START:

1. No voltage at start button or at UV terminals S1 and S2:
  - a. Power cord not plugged into outlet.
  - b. No power at outlet, (check with meter).
  - c. Disconnect switch is off that feeds outlet.

## **A. FURNACE WILL NOT START: - (cont.)**

- d. Broken wire between outlet and control box.
  - e. Blown fuse that feeds circuit breaker.
  - f. Check the 2 amp control fuse.
2. Insufficient voltage at UV terminals S1 and S2:
    - a. Minimum voltage is 102 volt - 50/60 cycle.
    - b. Maximum voltage is 132 volt - 50/60 cycle.
  3. No voltage to coil of motor starting relay R-1:
    - a. With volt-meter, check wires to relay coil from start / stop buttons.
  4. Unit not properly grounded.

## **B. MOTOR STARTING AND HOLDING RELAY WILL NOT OPERATE:**

1. No action when start button is activated:
  - a. Check for voltage on either side of start button. If there is no voltage, replace the bad switch.
  - b. Check relay coil, gray wire, for voltage.

## **C. HOLDING RELAY WORKS BUT MOTOR DOES NOT RUN:**

1. Check motor overload:
  - a. Check with voltmeter to see if power is passing through to motor. Check from ground to overload.
  - b. Push the reset button on the motor overload.
  - c. Check the heater element on the top of the motor overload to see if it is burnt in half.
  - d. Examine relay contacts.

## **D. THE MOTOR RUNS, BUT THE SPARK DOES NOT COME ON:**

1. Check the spark plug for power:
  - a. Remove the spark plug cap. Hold this cap by the outside corner and hold the cap up to a metal part of the furnace and push the start button to see if there is a spark at the cap.
2. Check the air pressure switch:
  - a. Replace the air switch. If you get a spark when you press the start button, you know the old switch is bad.
  - b. With the air switch replaced and the motor running, check UV terminals 2 & 4 for line voltage, 120V. If no voltage is present, replace UV chassis.
3. Check the spark plug:
  - a. Pull off the spark wire and hold by the outside corner of the connector cap. Hold the metal part of the cap close to the burner and press the start button. If it sparks, the transformer is OK. If not, check the spark wire connections on both ends and try again. If there is still no spark and there is 120 volts-on terminals 2 & 4, then you should replace the spark transformer.
4. The spark plug does not fire:
  - a. Remove the plug and look for cracks in the porcelain insulator. If it is cracked, replace with the same electrode.

4. (cont.)

b. If the plug is not cracked, install it back in the furnace. The gap between the wire tip of the plug and the end of the burner nozzle should be 1/16" to 1/8". This can be adjusted by bending the electrode wire, swiveling the electrode, and then tightening the clamping nut to hold it in place. Observation can be made with a mirror inside the furnace or through the UV Scanner observation port. In either case, **BE SURE THE GAS IS OFF.**

#### **E. THE MOTOR RUNS, THERE IS A SPARK, BUT NO GAS:**

1. Scanner does not see spark:

Remove the scanner to see if the sight tube is blocked.  
Wipe off scanner bulb with soft cloth or tissue and replace.

2. Broken Scanner wire:

a. Check for cuts or mashed conduit.

3. Ignition signal testing using a 20,000 ohm per volt DC volt meter:

Connect the meter to terminals S1 & S2.

Set the volt meter on the 10 volt DC scale and initiate a normal start up, but with the gas valve CLOSED. The meter should read between 4 1/2 and 5 volts. If the-meter goes backwards, reverse the leads. If the reading is less than 4 1/2 volts, the scanner needs to be replaced.

#### **F. GAS SOLENOID WILL NOT OPEN:**

1. After checking all of the above, check terminals 2 & 3 on UV Chassis for line voltage:

a. Put the volt meter back on the AC-250 volt scale and put the leads on terminals 2 & 3. Start the furnace, and when the unit goes to Main Flame, terminal 3 should be energized, reading 120 volts. If it is not, and every thing else proves out, the chances are that the UV Chassis is bad and needs replacing.

2. Terminal 3 is powered but the solenoid still will not open:

a. Check for broken wires or loose connections.

b. The solenoid wires can be taken loose by a qualified electrician and powered with 120 volts to see if it will open. If it does not open, it will have to be replaced.

c. Check to see that the gas pressure is not higher than the rating on the valve nameplate.

#### **G. MAIN FLAME SIGNAL TESTING:**

1. Same procedure as STEP E - 3

#### **H. MAIN FLAME DOES NOT LIGHT:**

1. Gas valve shutoff someplace in building.

#### **I. MAIN FLAME LIGHTS AND GOES OUT AFTER 10 SECONDS:**

1. Flame not adjusted properly:

a. It is best to get the furnace flame at least half way open before the spark goes off, especially on a cold start up.

## **J. FURNACE SHUTS DOWN WHEN IT IS ADJUSTED TO MAXIMUM FIRE:**

1. Insufficient gas supply:
  - a. Excess of air extinguishes the flame. Have the gas utility company check the gas pressure with the furnace running. If the pressure drops to 10", the gas supply is inadequate.
  - b. Not enough gas in adjustment, the flame should come out of the exhaust port about 3 inches.
2. Too much gas:
  - a. The flame is burning away from the burner port. The UV Scanner cannot see flame and turns off gas.

## **K. SLOW MELTING:**

1. Insufficient gas supply:
  - a. The operator should be able to open the air valve all the way and still have an excess of gas after the flame has been balanced.
2. Low service line voltage:
  - a. The voltage on the service line should be 115 volts. Low voltage causes the rpm of the motor to drop, which results in a reduced volume of air.
  - b. Bad bearings will also slow down a motor.

## **L. FURNACE WILL NOT RESTART AFTER STOPPING:**

1. Gas valve was shut off before stop button was pressed:
  - a. The reset has kicked out. Push the Reset Button on the UV Chassis and then restart.
2. UV Chassis may be going out.
3. Gas supply marginal and / or fluctuates:
  - a. When starting with the valves in a set position and the gas supply or pressure changes, like when a boiler comes on, the valve setting would not be right and the unit would not start.

## **M. FURNACE WILL NOT START AFTER FLAME FAILURE:**

1. Not enough time has elapsed for blower to stop spinning and allow the air switch to reset:
  - a. Allow blower to stop spinning then press reset button on UV Chassis.
2. Bad UV Chassis.
3. Bad UV Scanner.
  - a. Check and replace if necessary.

## **N. ELECTRICAL SEQUENCE:**

1. Press the start button and the system performs- self check.
2. Holding coil pulls in and motor starts.
3. Air switch closes powering terminal 6 in UV Chassis.
4. Terminals 4 and 3 powered. Ignition transformer powered and ignition timing starts. Main gas solenoid powered.

## N. ELECTRICAL SEQUENCE - (cont.):

5. Gas in scanner ionized, allowing power to flow between electrodes.
6. Main flame is proven and stays on.
7. Flame failure for any reason cuts off power to terminal 4 and 3 in 3 seconds.
8. Alarm light comes on.
9. Push reset button.
10. Blower failure, air switch opens - cutting power to gas solenoid. Blower runs another 10 seconds and turns off.