

CONTROL  
TYPE 26CF6 MODEL 1000



**FLAME SAFEGUARD  
AND PROGRAMMING  
CONTROL**

—for automatic burners

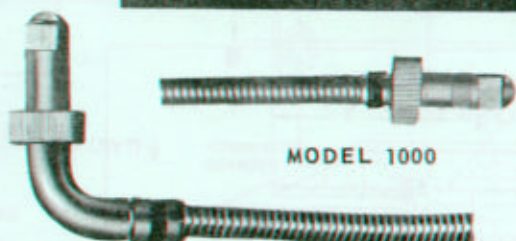


COVER

CHASSIS

BASE

**WITH  
FIRETRON® SCANNER  
TYPE 48PT2**



MODEL 1000

MODEL 9000



**FEATURES**

Fireeye System PBC-2 provides ignition and flame failure protection for commercial light oil, gas, or combination light oil/gas burners. In conjunction with operating, limit, and interlock devices it automatically programs each starting, operating, and shutdown period. The PBC-2 System consists of a type 26CF6 programming control and a Type 48PT2 scanner which uses a new type "Firetron" infrared sensitive cell to supervise visually both oil and gas flames.

The PBC-2 System monitors both main and pilot flames and does not permit the main fuel valve to be energized unless pilot flame has been established and proved. With an alternate connection for burners having direct spark ignition, the unsupervised trial-for-ignition period is precisely restricted to a safe short interval.

The 26CF6 control programs the operation of blower and/or burner motor, ignition system, and fuel valve, in a proper sequence which includes suitable purge periods before ignition and after burner shutdown. Additionally it is designed to de-energize all fuel valves within 1 to 4 seconds upon loss of flame signal. The control recycles automatically each time the operating or limit control closes, or after a power failure, but locks out and must be re-set manually following flame failure.

The PBC-2 System incorporates a safety checking circuit that is effective on every start. Any condition which will cause the flame relay to hold in during the checking period will stop the program before any ignition circuits are energized and, if sustained, will result in safety lockout.

**SPECIFICATIONS**

FIREEYE System PBC-2, consisting of Control Type 26CF6, Model 1000, and Scanner Type 48PT2

**SUPPLY VOLTAGE:**

120 volts (Min. 102v, Max. 132v)  
at 60 cycles, 1 phase  
(50 cycles, 1 phase optional)

**VOLT-AMPERE RATINGS:**

26CF6 consumption: 12 va  
Max. simultaneous connected load: 1800 va  
(See chart at right for additional rating information.)

**MAXIMUM OPERATING TEMPERATURE:**

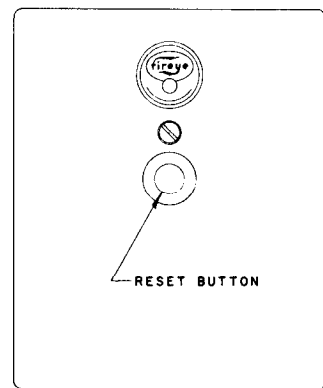
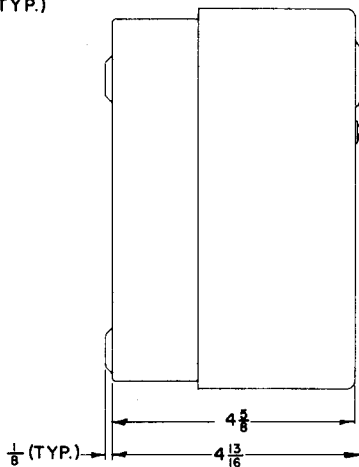
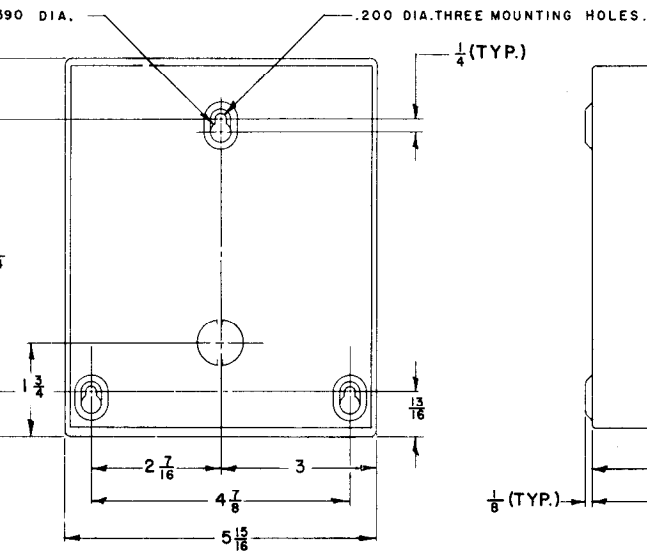
Scanner Type 48PT2 125F  
Control Type 26CF6 ambient, 125F

SHIPPING WEIGHT: 11 lbs.

**TERMINAL RATINGS (MAX.) FOR TYPE 26CF6 MODEL 1000**

Term. #	Typical Load	Ratings at 120V 60 cy.	
		Standard	Alternate
5 or 5 & 6 Combined	Ignition Devices	300 va Transformer and 125 va Pilot Duty	Combined Load on Terminals 5, 6 & 7 300 VA transformer 130 VA Pilot Duty (terminals 5 and/or 6 portion not to exceed 125 VA; terminal 7 portion limited to 65 VA).
7	Main Fuel Valve(s)	125 va Pilot Duty	Motorized valve (1 or combined load of 2 on terminal 7): 120 va holding 460 va opening 520 va locked rotor
M	Burner or Blower Motor or Starter	Amperes at 120V 60c	
		Full Load	9.8 Locked Rotor 58.8
		Alternate 250 va Pilot Duty	
A	Alarm	50 va Pilot Duty	

# MOUNTING DIMENSIONS



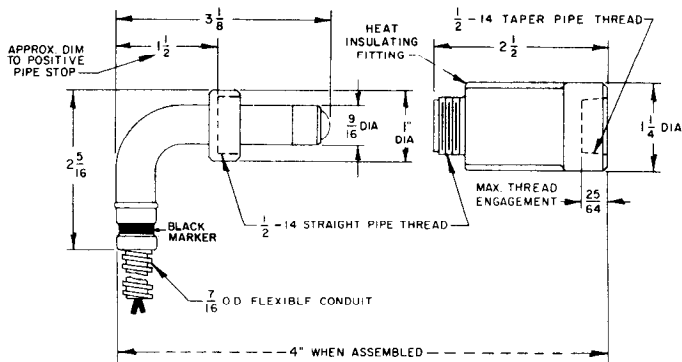
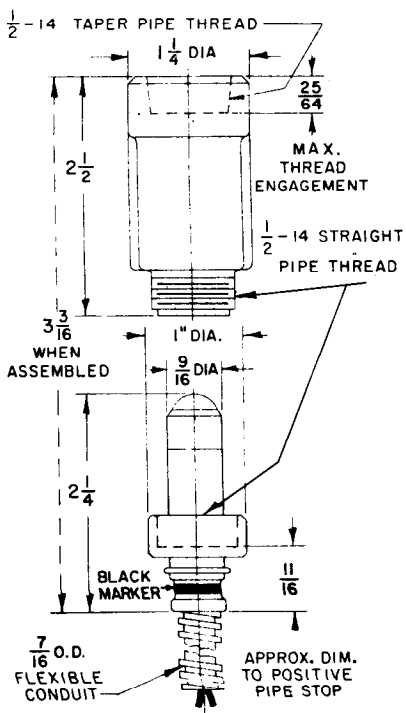
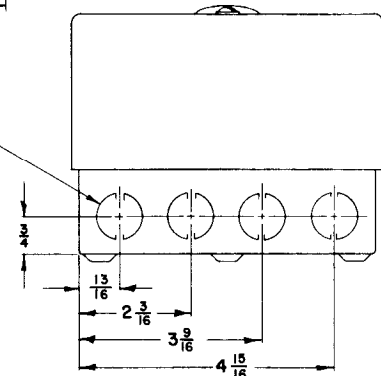
**NOTES:**

1. MATERIAL - COVER -  $\frac{3}{32}$  NOM. DIE CAST ALUMINUM.

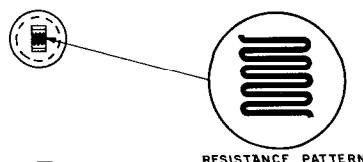
BASE - .047 C.R.S.

FINISH - GRAY HAMMERTONE.

$\frac{7}{8}$  DIA. FIVE KNOCKOUTS.



**NOTE:** SCANNER TYPE 48PT-2 USES A NEW TYPE OF FIRETRON CELL NO. 4-263 (FIG. 1A). CHECK THE CELL PART NUMBER ON ALL NEW INSTALLATIONS AND WHEN REPLACEMENTS ARE MADE. (SCANNER TYPE 48PT-1 USES FIRETRON CELL #4-128, WHICH IS NOT COMPATIBLE WITH THE PBC-2 SYSTEM DESCRIBED IN THIS BULLETIN).



METHOD OF IDENTIFYING  
CORRECT CELL FOR SYSTEM PBC-2;  
PART NUMBER 4-263, FOR SCANNER  
TYPE 48PT2.

**Figure 1A**

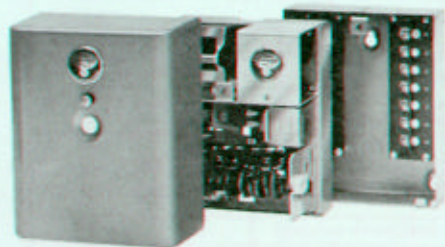


Figure 2

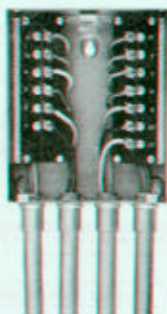


Figure 3

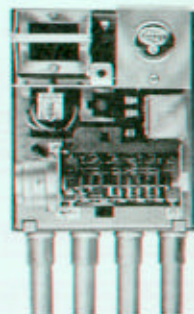


Figure 4

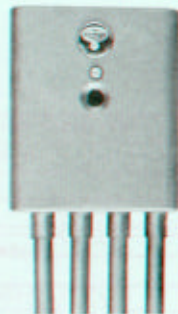


Figure 5

## INSTALLATION

### A. Control:

Follow the burner manufacturer's instructions, if supplied: Otherwise proceed as follows:

Locate sub-base on the burner, or on a panel free from excessive vibration and where ambient temperature is within the specified rating. The sub-base is generally mounted in the vertical position but may be mounted in any position if necessary. See Figures 2, 3, 4.

All wiring must comply with applicable electrical codes, regulations and ordinances and must be N.E.C. Class I wire. No. 14 TW (moisture-resistant) wire is recommended. Connections to terminals should be made either with looped bare wire ends or with UL approved wire lugs.

### B. Scanner:

Attach the cable supplied with the scanner to a junction box. Splice the cable wires to a pair of wires not smaller than #18. Install the complete run in a separate conduit to the control. Continuous conduit bonding between scanner and control is mandatory! Scanner may be located up to 100 feet from control. Do not pass scanner wiring through any junction box containing other wires. Do not run other wires through scanner conduit. This is a UL requirement.

## ELECTRICAL RATINGS

"VA" ratings (not specified as pilot duty) permit the connection of transformers and similar devices whose inrush current is approximately the same as their running current.

"VA pilot duty" ratings permit the connection of relays, solenoid valves, lamps, etc. whose total operating load does not exceed the published rating and whose total inrush current does not exceed 10 times the rating.

"Running and locked rotor" ratings are intended for motors. VA and VA (pilot duty) loads may be added to a motor load provided the total load does not exceed the published rating.

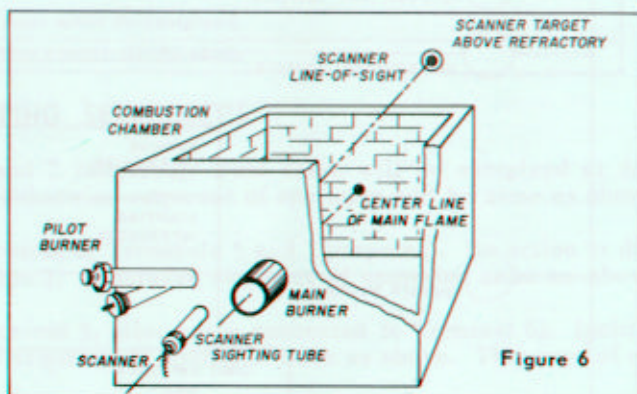


Figure 6

## APPLICATION PROCEDURE

### A. Scanner Type 48PT2

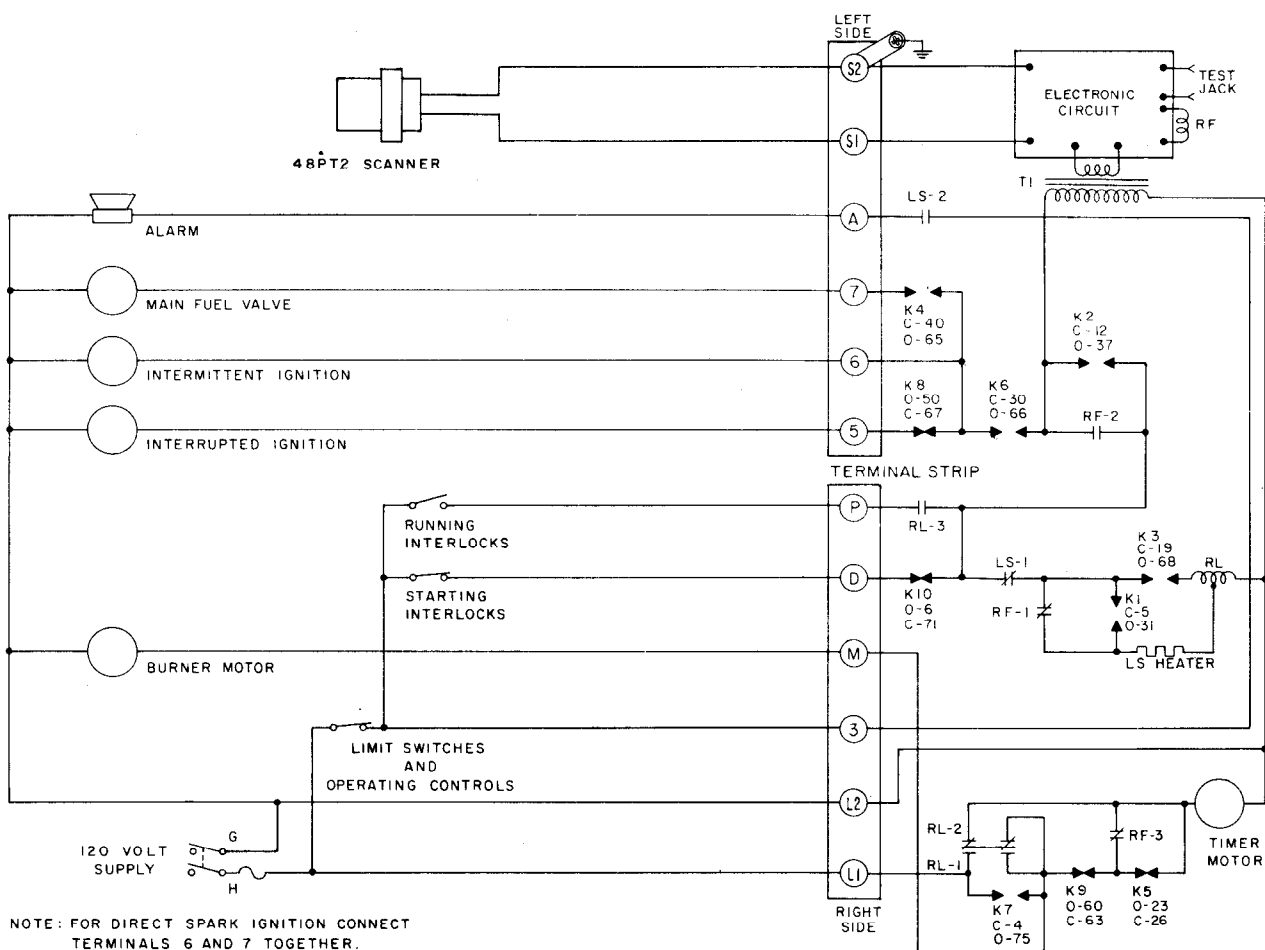
When a single scanner is used to detect both pilot and main flames, the sight pipe on which the scanner mounts must be aimed so that the scanner sights a point at the intersection of main and pilot flames. See Figure 6.

In installations using individual 48PT2 scanners to monitor main and pilot flames, the main flame scanner should be sighted to avoid detecting the pilot flame.

Proper scanner positioning must assure the following:

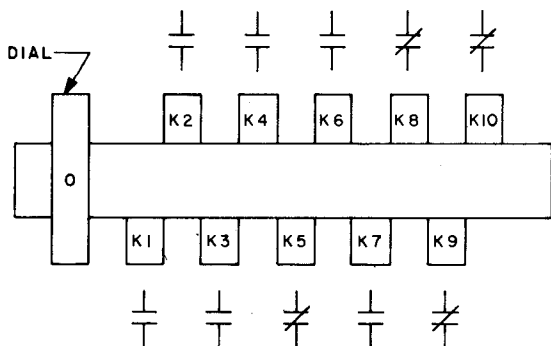
- a. Reliable pilot flame signal.
- b. Reliable main flame signal.
- c. A pilot flame too short or in the wrong position to ignite the main flame reliably must not be detected.
- d. Scanner must have unobstructed view of flame being monitored.
- e. Flame being monitored must completely cover scanner field of view.
- f. To avoid nuisance shutdowns, it is important to avoid sighting hot refractory and to keep scanner temperature low (never over 125°F).
- g. When the proper position has been established drill a 1 1/4 in. dia. hole through the furnace wall and install a 4 in. to 8 in. length of threaded black iron pipe on which to mount the 48PT2 scanner.
- h. When a satisfactory sighting position has been confirmed by operating tests, the sight tube should be firmly welded in place.

# INSTALLATION WIRING

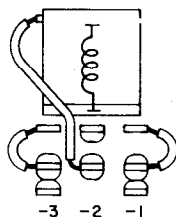


## CAM and RELAY CONTACT IDENTIFICATION

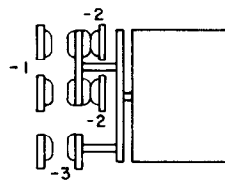
CAM SWITCH ASSEMBLY (FRONT VIEW)



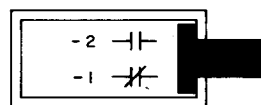
FLAME RELAY (DC)  
RF



MASTER RELAY (AC)  
RL



LOCKOUT SWITCH  
LS



TYPE 26CF6 MODEL 1000  
CAM AND RELAY CONTACT IDENTIFICATION

# TIMING SEQUENCE: PBC-2 SYSTEM WITH TYPE 26CF6 MODEL 1000

PBC-2 System: Gas or oil proven pilot. (No connection between terminals 6 and 7)		
Timer Rotation (Seconds)	Dial Indications	<u>BURNER START-UP</u> Action
0	0	Operating control closes. Master relay, timer motor and burner motor (terminal M) become energized.
23	X	If, for any reason, flame relay holds in, cycle timer motor stops until lockout switch trips.
30	1	Ignition (terminal 5) on.
37	A	Flame supervision starts.
40	2	Main fuel valve (terminal 7) on (assuming pilot flame is proven).
50	3	Ignition (terminal 5) off.
60	DOT (Index)	End of initiating cycle; timer motor stops. Burner operates until heat demand is satisfied.
<u>BURNER SHUTDOWN</u>		
60	DOT (Index)	Operating control opens; master relay and fuel valve (terminal 7) de-energized; timer motor becomes energized.
75	0	Burner motor (terminal M) circuit and cycle timer motor de-energized.
<u>System is ready for start-up whenever operating control closes again.</u>		

## ALTERNATE OPERATING SEQUENCES

- Unproven pilot or direct spark ignition (Terminals 6 and 7 jumpered). Fuel valve will be energized at dial position 1. There will be no action at dial position 2. Otherwise sequence of operation will be same as above.
- Intermittent spark ignition (transformer connected to Terminal 6, Terminals 5 and 7 jumpered). No action at dial positions 2 and 3. Fuel valve energized at dial position 1. Otherwise sequence of operation same as above.
- Intermittent pilot ignition (transformer connected to Terminal 5, pilot valve connected to Terminal 6). Ignition transformer de-energized at dial position 3. Otherwise sequence of operation same as above. This type of operation is not suitable for oil burners.

### Keeping the Scanner Cool

The Firetron Scanner (Temperature Limit 125°F.) should never get too hot to grasp comfortably in the hand. Keep the scanner cool by one or more of the following methods (Fig. 10).

- Use 6" to 8" length of pipe between scanner and hot furnace front plate.
- Use insulating tube (Part No. 35-69) on the end of the iron pipe.
- Force air into sighting tube.
- Make sure sighting tube does not extend more than halfway into refractory wall.

- Use Fireeye Sealing Union (Part No. 60-801) when using method 3 above.

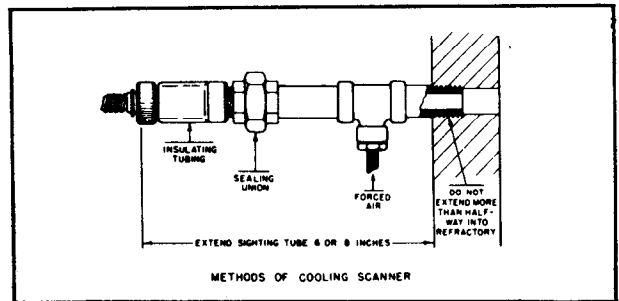


Figure 7

## INSTALLATION TESTING

### TESTING:

With a 20,000 ohms/volt test meter set on the 10 v DC scale and plugged into the test jacks on the control (top jack +, bottom jack -), the flame relay will pull in at approximately 2 v DC.

To assure sufficient margin of signal to hold in during random momentary downward fluctuations of signal, it is desirable to obtain (if possible) an average of 5 to 7 v DC or more.

Maximum or saturation signal occurs at about 7 v DC.

### A. Normal Pilot Test

- Before making pilot flame checks, manually shut off fuel supply to main burner.
- Make temporary connection of pilot valve circuit to terminal 6.
- Allow control to program normally and observe pilot signal on voltmeter. If average voltage reading is below 5 volts, attempt to increase by readjusting pilot flame or re-aligning scanner.
- Check pilot failure protection by manually shutting off pilot fuel and then proceeding with a normal attempt to start. With no pilot fuel, the control should go off on safety.

**B. Main Flame Test**

1. Reconnect pilot valve to terminal 5.
2. Proceed through a normal startup. After the pilot flame is shut off, observe the reading on the test voltmeter. If the voltmeter reading is below 5 volts, attempt to increase by readjusting main flame or realigning scanner.
3. Check main flame failure protection by manually shutting off the main fuel supply. Within 4 seconds after main flame goes out, the flame relay (RF) will drop out. The alarm circuit will be energized following safety lockout.

**C. Minimum Pilot Test**

This test insures that the 48PT2 scanner will not detect a pilot flame too small to light off the main flame. It must be made on every new installation and following any repositioning of the scanner.

1. Follow steps 1 and 2 of A above.
2. Allow control to program normally to "dot" position. Reduce fuel supply to the pilot until the flame relay remains de-energized, then

slowly increase pilot fuel just to the point where the flame relay becomes steadily energized. This is called the minimum pilot adjustment.

3. Turn on main fuel with hand valve. The main fuel must light immediately from the reduced pilot flame. CAUTION: If main flame does not ignite in approximately the same time as with normal full pilot flame, immediately turn the burner switch off. Then repeat the minimum pilot test until main flame light reliably on several trials.
4. When minimum pilot test is completed, increase the pilot flame to normal size.

**Checking Detection with Hot Combustion Chamber**

With all the foregoing tests and final burner adjustments completed, operate the burner (observing manufacturer's warm-up instructions) until combustion chamber is at maximum expected temperature. Recheck for adequate signal with main flame only and with pilot only. If steady output voltage of 5 to 7 volts DC is not measured at the test jacks, realign scanner sighting to obtain suitable output voltage and then repeat all steps through 15.

**MAINTENANCE****Humidity Effects:**

It is good practice to minimize any possible adverse effects of high humidity by keeping control equipment continuously powered, even during periods when it is not in use.

**Scanner:**

The scanner lens must be kept clean. Even a small amount of contamination will reduce the flame signal reaching the cell. A routine schedule should

be set up. Wipe the lens with a clean soft cloth. If necessary, dampen the cloth with concentrated detergent.

**Periodic Safety Checks:**

It is recommended that a procedure be established to test, at least once a month, the complete flame safeguard system. This test should verify flame failure safety shutdown and fuel valve tightness.

**SERVICING**

Trouble in Pbc-2 system installations can be readily isolated by following the approved procedure in the sequence given below. Before beginning any trouble-shooting, however, make sure that:

1. Installation and wiring have been made in accordance with the installation instructions.
2. Chassis is properly positioned on base and the retaining screw is tightened.
3. The lockout switch is reset.

In the following tabulation, trouble appears within the boxes and possible causes are listed below the boxes.

- |           |  |
|-----------|--|
| <b>A.</b> | Zero voltage at terminals L1-L2  |
|           | 1. Disconnect switch off.<br>2. Blown fuse.<br>3. Broken wire.<br>4. Incorrect wiring. |
| <b>B.</b> | Low voltage at terminals L1-L2   |
|           | 1. Minimum operating voltage is 102 volts.   |
| <b>C.</b> | Zero voltage at terminals 3-L2   |
|           | 1. Open limit switch or operating control.<br>2. Broken wire or loose connection.      |
| <b>D.</b> | Zero voltage at terminals D-L2   |
|           | 1. Open starting interlock switch, 3-D.<br>2. Broken wire or loose connection.         |

- |           |   |
|-----------|---|
| <b>E.</b> | RL relay is not energized   |
|           | 1. Lockout switch is tripped.<br>2. Relay is mechanically blocked open.<br>3. Contacts K10, LS-1, RF-1 open or dirty.<br>4. Replace the chassis.  |
| <b>F.</b> | Timer motor does not start  |
|           | 1. Contacts RL1, K9, K5 open or dirty.<br>2. Defective timer motor.   |
| <b>G.</b> | Burner motor does not start   |
|           | 1. Blown motor fuse or tripped overload.<br>2. Motor defective.<br>3. Incorrect wiring.<br>4. Contacts RL-1 open or dirty.  |
| <b>H.</b> | RL relay drops out at 6 second point  |
|           | 1. Running interlock circuit open 3-P.<br>2. Broken wire or loose connection.<br>3. Contacts RL-3 open or dirty.  |
| <b>I.</b> | Timer stops at 26 second point  |
|           | 1. Flame relay, RF, is in energized position because scanner is sighting flame.<br>2. Scanner wires run with power wiring.<br>3. Relay RF mechanically blocked in.<br>4. Contacts RF-3 open or dirty. |

J. Pilot flame is not established at 30 second point.  
(Pilot ignited burner)

1. Defective or improperly adjusted ignition electrodes.
2. Defective ignition transformer.
3. Defective pilot fuel valve.
4. Plugged or misadjusted pilot burner.
5. No pilot fuel.
6. Incorrect wiring or loose connection.
7. Contacts RL-3, K2, K6, K8 open or dirty.

K. Main flame is not established at 30 second point.  
(Spark ignited burner)

1. No fuel or plugged burner.
2. Burner not properly adjusted.
3. Defective main fuel solenoid valve (thermister delay valves not suitable)
4. Jumper between 6-7 or 5-7 not installed.
5. Spark ignition not adequate.
6. Contacts RL3, K2, K6, K8 open or dirty.

L. Flame relay RF does not pull in when flame is established

1. Scanner does not see fire.
2. Flame relay blocked open mechanically.
3. Broken scanner wire, or loose connection.
4. Defective scanner or programmer.

M. Main flame does not light (Pilot ignited burner)

1. Defective main fuel solenoid valve.

2. No main fuel or burner out of adjustment.
3. Inadequate pilot flame.
4. Incorrect wiring, broken wire or loose connection.
5. Contacts K4 open or dirty.

N Ignition does not shut off at 50 seconds

1. Pilot valve stuck open.
2. Incorrect wiring.
3. Contacts K8 remain closed.

O. Timer does not stop at Dot

1. Contacts K9, RL-2 remain closed.

P. Lockout switch trips erratically with burner operating normally.

1. Contacts RF-1 or K1 remain closed.
2. Insufficient cooling time allotted following a lockout 2 minutes recommended.

Q. Main fuel does not shut off when limit switch opens

1. Fuel solenoid valve stuck open.
2. Incorrect wiring.

R. Timer does not rotate to zero when limit switch opens

1. Contacts RL-2 open or dirty.

S. Burner motor and timer motor do not stop at zero

1. Operating control has reclosed.
2. Contacts RL-1 or K7 remain closed.

## WARRANTIES AND PURCHASER'S EXCLUSIVE REMEDIES

We guarantee for one year from date of shipment to replace or, at our option, to repair any products or parts thereof (except lamps, electronic tubes and photocells) which are found defective in material or workmanship or which otherwise fail to conform to the contract description or to any warranty, express or implied.

We make no warranties which extend beyond the description of our product on the face of our sales orders.

The Purchaser's remedies with respect to any product or part sold by us shall be limited exclusively to the right to replacement or repair f.o.b. Cambridge, as above provided. In no event shall we be liable for consequential or special damages of any nature which may arise in connection with such product or part.

# SUGGESTED SPECIFICATIONS FOR FLAME SAFEGUARD CONTROL FOR AUTOMATIC COMMERCIAL-INDUSTRIAL BURNERS

## General

1. Each automatically fired burner shall be equipped with an Electronic Combustion Safety and Programming Control which is UL listed and FM approved. This control shall provide the following:
  - a. The control shall accomplish a safe start component check during each start, which will prevent the burner from firing under any condition which causes the flame relay to assume and hold its energized position due to the presence of an actual flame, a flame simulating component failure or mechanical failure.
  - b. A purge period of not less than 30 seconds with an interlock circuit provided to prove air flow during the purge period and all during the firing cycle. In addition, a starting interlock circuit is required to prove that the burner equipment is in the low fire position at the start of the cycle.
  - c. A pilot establishing period of not more than 7 seconds.
  - d. Limited trial-for-ignition of main flame, restricted to 10 seconds for pilot ignited oil or gas burners, 7 seconds for spark ignited oil burners.
  - e. Safety shutdown following flame failure, with fuel and ignition circuits de-energized in not more than 4 seconds.
  - f. A post purge period of 15 seconds following a normal shutdown and 60 seconds or more following safety shutdown.
  - g. The control system shall recycle automatically under control of the operating control, and when power is restored following power failure. Manual reset shall be required following any safety lockout.
2. The control shall permit direct connection of safety limit switches, operating controls, starting interlocks, air flow switches, fuel temperature and pressure switches, running interlocks and lockout alarms.
3. The pilot and main flames shall be monitored by an infrared sensitive flame scanner which shall not be actuated by hot refractory.

## Mechanical and Electrical

4. The control system shall be designed for 120 volt operation with one side grounded. All switching shall be accomplished in the hot circuit. The control and/or scanner shall have the following features:
  - a. The program timing shall be accomplished by cam driven heavy duty switch assembly readily accessible for inspection. The timing periods must not vary more than 5% through an ambient temperature range of 0°F to 125°F and through a supply voltage range of plus 10% or minus 15% of nominal line voltage.
  - b. The contacts in the fuel valve circuit shall be of a weld-resistant tungsten alloy material.
  - c. The safety lockout switch shall be temperature compensated and contain alarm contacts rated at not less than 50 va at 120 volts ac.
  - d. The flame relay circuit of the flame safeguard control must incorporate a latch circuit which prevents the flame relay from becoming re-energized following a safety shutdown, until a lockout has occurred and manual reset has initiated a complete restart.
  - e. Test jacks shall be provided for direct connection of a DC voltmeter to measure flame signal voltage.
  - f. The control chassis shall be of plug in design to facilitate replacement without disconnecting any external wiring.
  - g. The scanner shall mount on and sight through a 1/2 inch standard pipe.
  - h. The control shall be suitable for operation over an ambient temperature range of 0°F - 125°F.
  - i. The scanner shall be suitable for operation over a temperature range of 0°F - 125°F, as measured on the mounting hub.
5. The flame safeguard control system shall be FIREYE PBC-2 with Control type 26CF6, model 1000 and scanner type 48PT2.



**COMBUSTION CONTROL DIVISION**  
**ELECTRONICS CORPORATION OF AMERICA**  
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