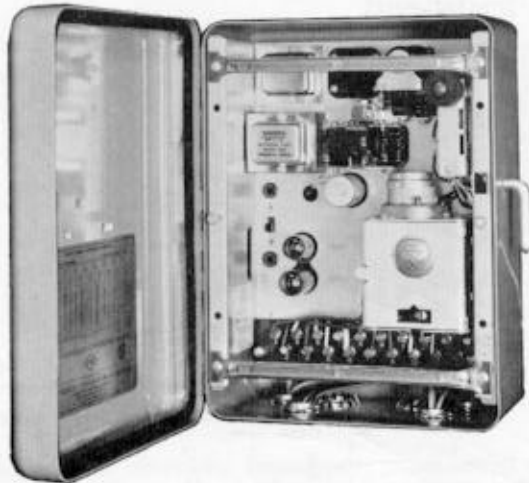




FLAME SAFEGUARD AND PROGRAMMING CONTROL

—for automatic burners—



26RJ8 Model 6060
26RJ8 Model 6160D



48PT1-1000



48PT1-9000



U.L. File # MP1537

C.S.A. File # 7989

FEATURES:

Fireeye FP-2 (Model 6160D) Flame Safeguard Control provides ignition and flame failure protection for automatically ignited industrial sizes of oil and gas burners. In conjunction with limit and operating controls, and interlock devices it automatically programs the operation of burner/blower motor, ignition, main fuel valves and modulator.

The control cycles automatically when the operating control circuit closes and following a power interruption, but must be manually reset following a safety shutdown.

Featured are — 60 second prepurge, pilot proving prior to energizing the main fuel valves, selectable 10 or 30 second trial for ignition of main flame and a post purge following fuel shutoff.

A safe start interlock is incorporated which is effective on every start. Any condition which causes the flame relay to be in its energized position during the checking period will cause safety lockout. The modulator switching circuit drives the air dampers closed during the off

period, open during the purge, to the starting position prior to lightoff and to automatic control after the main flame is established. An interlock circuit requires proof of Fuel Valve closure, another circuit proves that the burner equipment is at the starting position during lightoff. An interlock circuit is provided for air flow switches, fuel pressure switches, etc., which must be closed during the prepurge and firing cycle. A circuit is provided to de-energize the pilot spark ignitor at the time the pilot flame is proved to eliminate any spark ignition interference. The controls are designed to de-energize all fuel valves within 4 seconds following flame failure. An alarm circuit actuates audible or visual alarms following a safety lockout. The controls incorporate plug-in design for ease of installation.

Fireeye FP-2 system consists of Type 26RJ8 Model 6160D control and Type 48PT1 infra-red sensitive scanner for oil and gas flames.

SPECIFICATIONS:

FP-2 Type 26RJ8 Model 6160D with Type 48PT1 Flame Scanner

SUPPLY VOLTAGE:

26RJ8 Model 6160D—48PT1—120 volts (max. 132v, min. 102v) 60 Hz. May be used 50 Hz if timings multiplied by 1.2

VOLT-AMPERE RATINGS:

| | |
|-----------------------------|---------|
| Power Consumption Operating | 35 va |
| Power Consumption Standby | 10 va |
| Maximum Connected Load | 2000 va |

See adjacent chart for additional rating data

OPERATING TEMPERATURE LIMITS

| | | |
|-------------------------|-------|-------|
| | Max. | Min. |
| 26RJ8 Control (Ambient) | 125 F | -20 F |
| 48PT1 Flame Scanner | 125 F | -40 F |

Shipping weight per system — 22 lbs. approximate

Terminal Ratings (Maximum) for Type 26RJ8 Model 6160(D) Control

| Terminal | Typical Load | A | | B | |
|---------------------------|---|---|-----------------|--|--|
| | | Maximum Rating at 120v-60 Hz | | Alternate Rating at 120v-60Hz using Wire Rated at 75°C or Higher for Chassis Connections | |
| 1, 5, or 6 Combination | Ignition Transformer or Gas Pilot Valve | 500va (Transformer) 125va Pilot Duty or 300va (Transformer) 65va Pilot Duty 460va Opening 120va Holding 520va L.R. | Motorized Valve | 500va (Transformer) 50va Pilot Duty or 300va (Transformer) 125va Pilot Duty | |
| 7 | Main Fuel Valve | 130va Pilot Duty or 65va Pilot Duty 460va Opening 120va Holding 250va L.R. | Motorized Valve | 250va Pilot Duty or 65va Pilot Duty 125va Opening 500va Holding Valve | |
| 8 | Burner Motor Blower Motor Motor Starter | 5.8 amps — Full Load 34.8 amps — Locked Rotor or 250va Pilot Duty | | | |
| 9 | Alarm | 50va Pilot Duty | | | |
| 10, 11, 12, 13 | Modulator | 125va Pilot Duty @ 120 volts or 2 amps @ 30 volts AC maximum (N.E.C. Class 2) | | | |

Select ALL Terminal Ratings from ONE Column, either A or B. Total connected load not to exceed 2000va.

MOUNTING AND OUTLINE DIMENSIONS

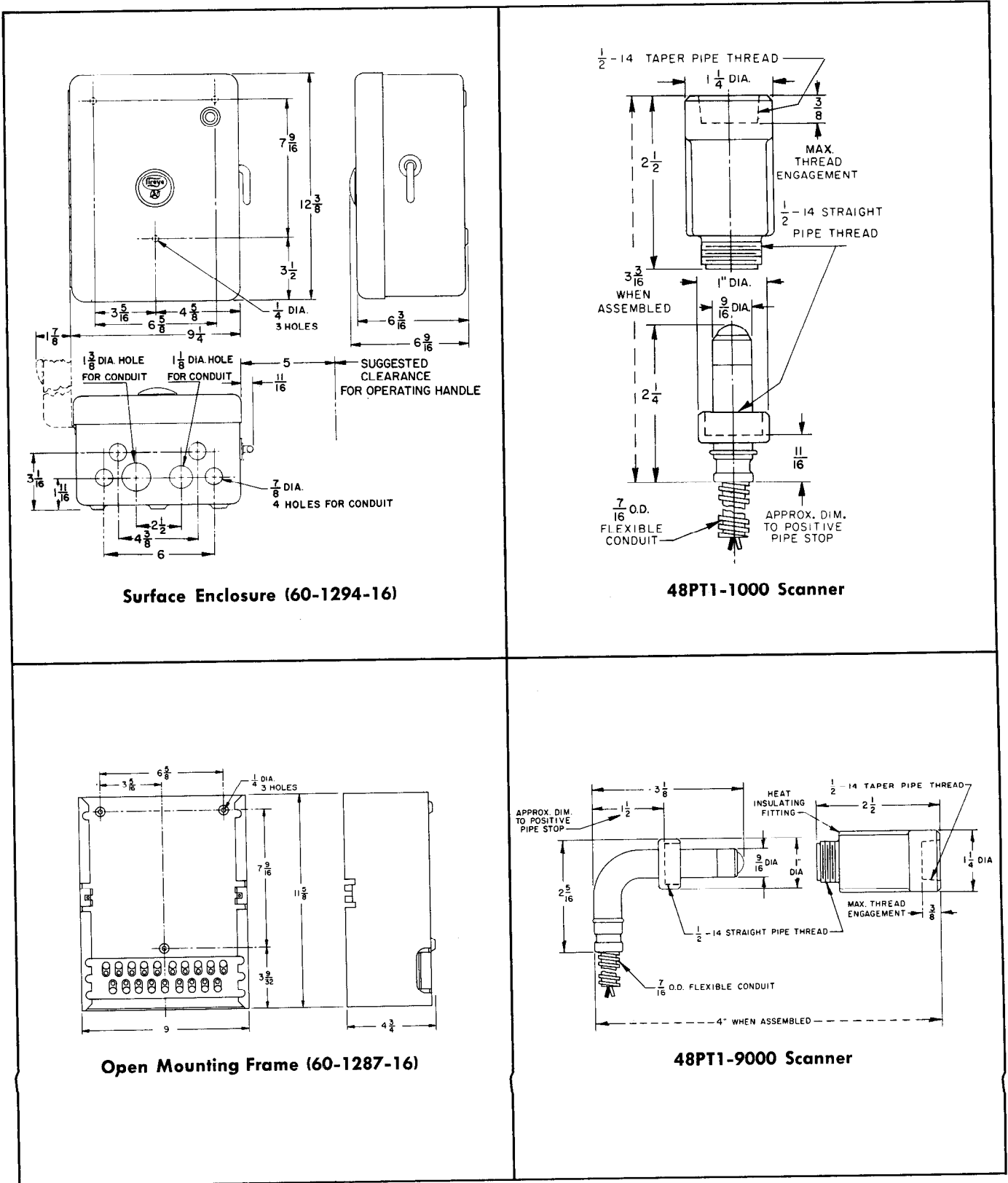


Figure 1

U.L. listed Primary Safety Control System consists of 28RJ8-6160D control in housing 60-1294-16 and 48PT1 scanner. (Above open mounting frame 60-1287-16 has U.L. Component Recognition only.)

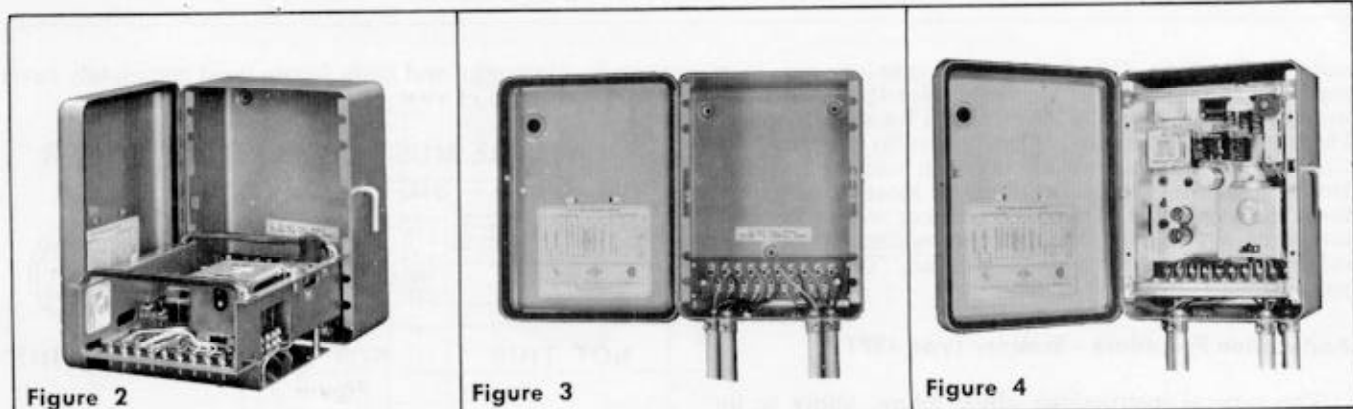


Figure 2

Figure 3

Figure 4

Installing the Type 26RJ8 Control

Select control mounting location on panel board or upright surface that is free from excessive vibration. Secure housing with screws or bolts using Figure 1 for drilling dimensions. After the housing is wired (Fig. 3), replace unused knockout plugs. Fasten pressure sensitive label in space provided in housing or frame. Plug chassis securely into housing (Fig. 4), and tighten captive thumb screws.

Electrical Rating Considerations

Electrical ratings of Fireeye controls, regardless of the terms in which they are stated, are based on normal circuit current in amperes multiplied by nominal circuit voltage, called volt-amperes and abbreviated as VA.

To convert from watts to volt-amperes or horsepower, etc., refer to the National Electric Code Handbook.

All published ratings apply to AC loads. For DC ratings, consult the factory.

Published load ratings assume that no contact be required to handle inrush current more often than once in 15 seconds. The use of control switches, solenoids, relays, etc. which chatter will lead to premature failure of switches in the Fireeye control. Similarly, the contacts cannot be expected to handle short circuit currents without damage. It is important to run through a test operation (with fuel shut off) following the tripping of a circuit breaker, a blown fuse or any known instance of chattering.

Running and Locked Rotor Amperes is a rating intended specifically for motors, but a non-pilot duty load (see below) may be applied if normal and inrush currents do not exceed running current rating. Also an indicator lamp may be combined with a motor load if the total of lamp inrush (figured at 10 times normal current) and motor locked rotor currents does not exceed the locked rotor rating.

VA Pilot Duty rating permits the connection of relays, solenoid valves, small motors, indicator lamps, and other electrical devices under the condition that normal operating VA may not exceed the rating. Inrush (or locked rotor) VA may not exceed ten times the rating.

VA rating not specified as pilot duty permits the connection of transformers and similar devices wherein the inrush current is not considered to exceed the normal current.

The maximum simultaneous running current load on the circuit supplying the Fireeye control may not exceed 2000 VA. Since the control itself is rated at up to 35 VA, the total load connected to the control (exclusive of flame failure alarm devices) may not exceed 1965 VA.

Because of special hazards that could accompany fusing of the fuel valve circuit contacts, they are constructed of a weld-resistant material.

INFRARED DETECTION

Scanner Type 48PT1

Install the Type 48PT1 Scanner as recommended by the burner manufacturer. If no instructions are provided, the scanner must be applied to facilitate monitoring of the pilot and main flames. The following description of operation of the Firetron cell will assist in making such an application.

Operation of Firetron® Cell

The active element of the Firetron cell is a lead sulfide (PbS) semiconductor whose electrical resistance instantaneously changes in accordance with the amount of infrared and visible radiation it receives from sources within its view. Such radiation originating in a combustion chamber may consist of a steady radiation from hot refractory or metal and an average value of flame radiation which continuously fluctuates in magnitude by an amount and at a rate which are functions of the type of fuel and combustion conditions.

When a DC voltage is impressed across the cell and a series resistor, the fluctuation of cell resistance corresponding to fluctuation of flame radiation produces a fluctuating voltage across the cell. This voltage is termed "flame signal" and is fed to an amplifier.

The amplifier responds to a fluctuating voltage but not a steady one. It therefore responds to a fluctuating flame signal but not to a steady refractory signal. Further, it is "tuned" for maximum response at a frequency of 10 cycles per second (a fluctuation rate found in all flames) and has relatively little response at power line (60 cycle) and very low (1 cycle) frequencies. When amplified flame signal exceeds a given magnitude, it causes energization of a flame relay.

Whereas the system does not "detect" hot refractory, excessive steady radiation reduces flame signal. The same effect results from excessive scanner temperature. To avoid nuisance shutdowns, it is important to avoid sighting hot refractory and to keep scanner temperature low (never over 125°F).

Control and Scanner Wiring

Make wiring connections at terminal panel at bottom of housing. Separate knockouts are provided for conduit connections for line voltage, and scanner circuits. Follow approved wiring diagrams. Connect bare wire directly to screw posts — without lugs.

Use suitable wire enclosed in rigid or flexible conduit for power connections. All wiring must comply with the National Electrical Code and local codes. Splices must be made only in troughs or junction boxes.

The control housing must be grounded either by the normal conduit ground or by an added grounding wire.

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 knockout directly under Terminal 15 of the Type 26RJ8 Control housing. Connect black wire to Terminal 14; white wire to Terminal 15. 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.

Application Procedure - Scanner Type 48PT1

The general instructions which follow, apply to installations of a single scanner which monitors both pilot and main flames. If separate scanners are used for pilot and main flames, consult the burner manufacturer for installation instructions.

1. Locate scanner sight tube point of entry below and close to the burner ignition assembly (Fig. 5) and drill a 7/8" hole through the boiler or furnace wall. The sight tube, a 4"-8" length of 1/2" black iron pipe, will be fixed to the hole when the proper position has been established.

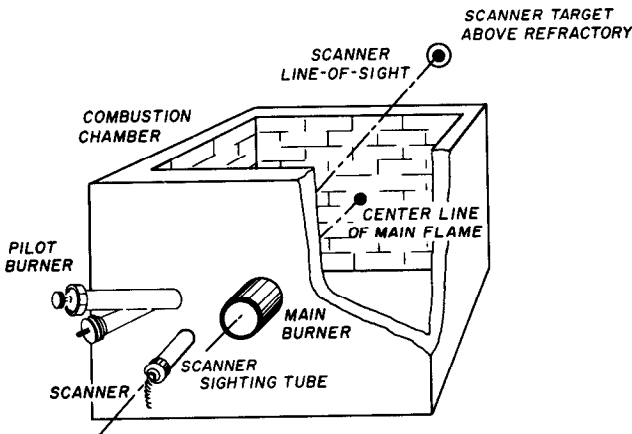


Figure 5

2. Position the scanner sight tube so that scanner line of sight will cross the intersection of pilot flame axis and main flame (Fig. 8). Tack weld the sight tube to the point of entry hole. Should it be necessary to remove refractory to obtain the proper line of sight, prepare a straight hole not less than 1/4" I.D. Flare this hole slightly as it enters the combustion chamber.

3. Scanner must have unobstructed view of both pilot and main flames (Fig. 6).

SCANNER MUST HAVE UNOBSTRUCTED VIEW OF FLAME

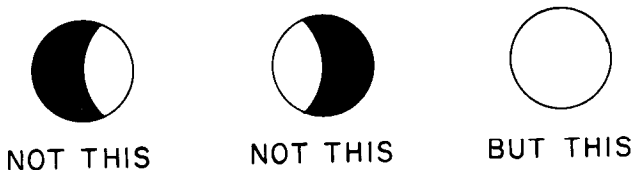


Figure 6

4. Both pilot and main flames must completely cover scanner field of view (Fig. 7).

FLAME MUST COMPLETELY COVER SIGHT OPENING

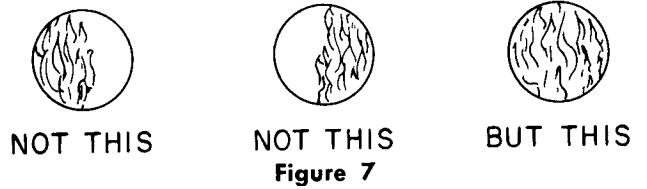


Figure 7

5. Scanner must not sight on refractory which will become incandescent during burner operation.

6. Scanner must not be allowed to exceed a temperature of 125°F.

For precise adjustment of the scanner viewing angle, Fireeye Swivel Mount (Part No. 60-302) is available. If it is necessary to restrict the area the scanner views (to reduce sensitivity, or because of unsatisfactory background), use Fireeye Orifice Set (Part No. 10-88).

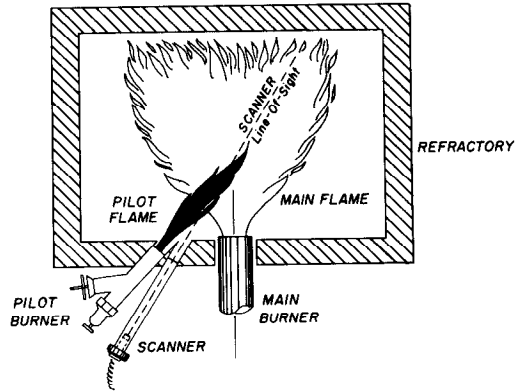
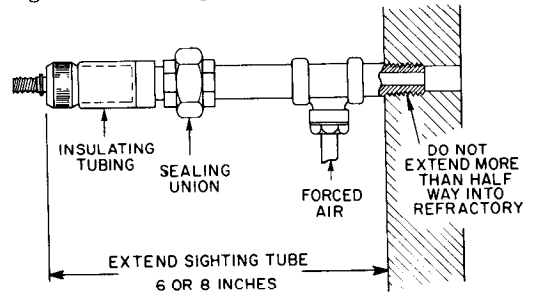


Figure 8

Reducing Scanner Temperature

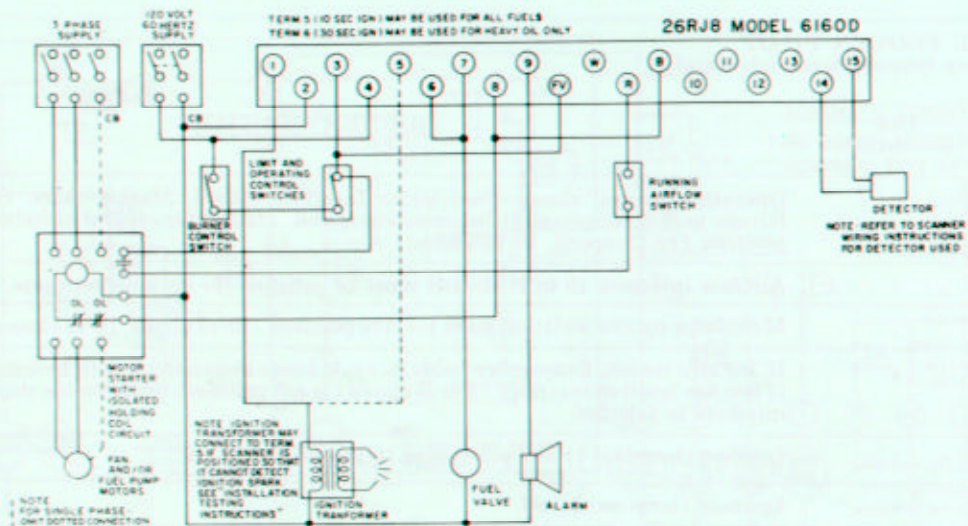
The Firetron Scanner (Temperature Limit 125°F.) should never get too hot to grasp comfortably in the hand. Keep the scanner cool by one or more of the following methods (Fig. 9).



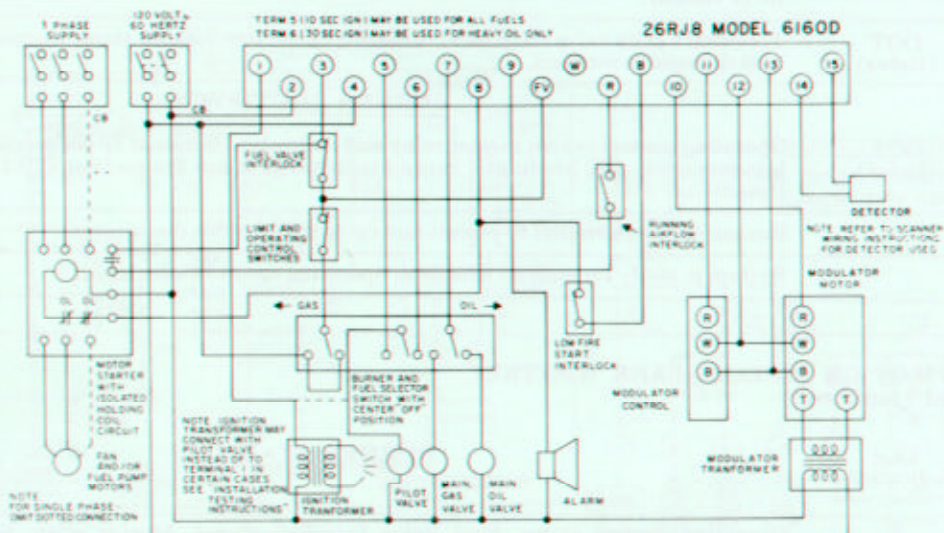
METHODS OF COOLING SCANNER

Figure 9

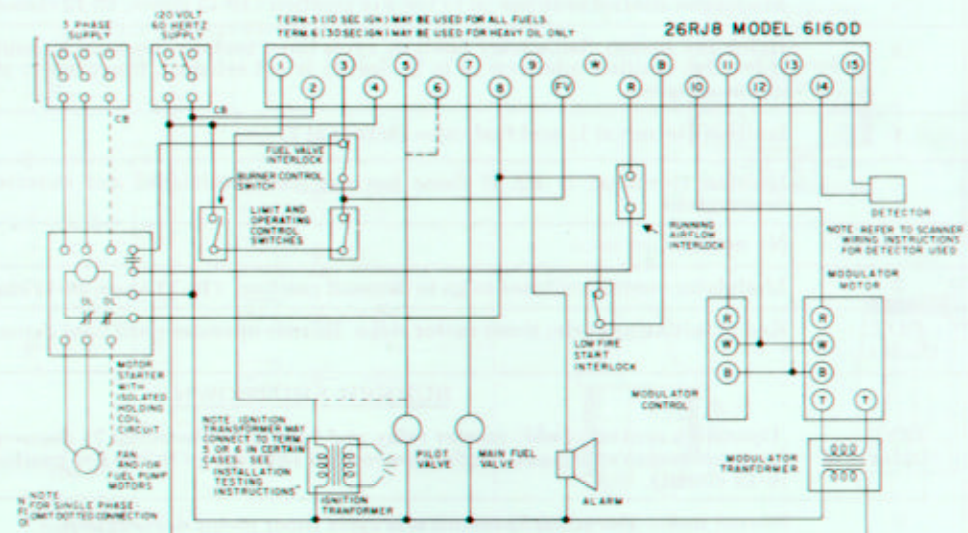
1. Use 6" to 8" length of pipe between scanner and hot furnace front plate.
2. Use insulating tube (Part No. 35-69) on the end of the iron pipe.
3. Force air into sighting tube.
4. Make sure sighting tube does not extend more than halfway into refractory wall.
5. Use Fireeye Sealing Union (Part No. 61-801) when using method 3 above.



AUTOMATIC LIGHT OIL BURNER - DIRECT SPARK IGNITION - NO MODULATION



AUTOMATIC GAS/OIL COMBINATION BURNER - GAS ELECTRIC PILOT - WITH BURNER MODULATION

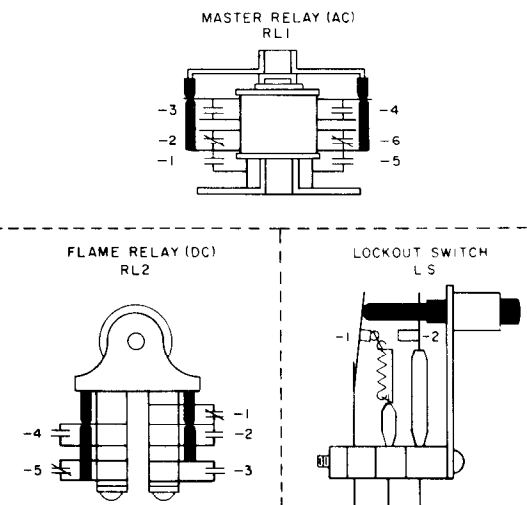
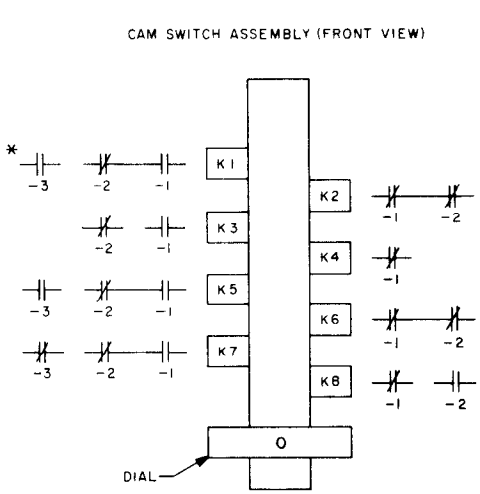
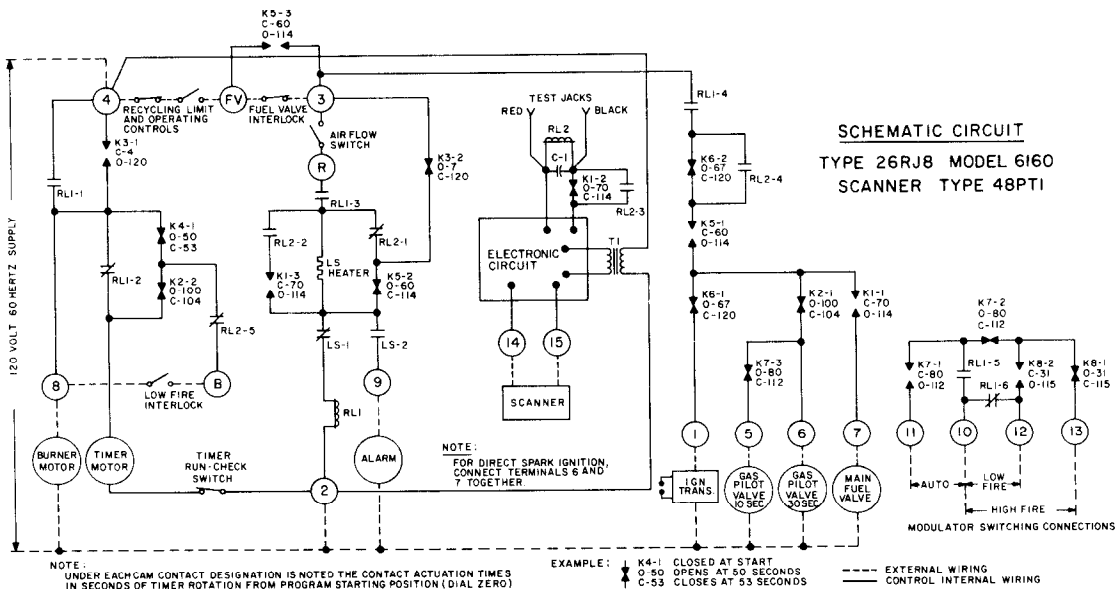
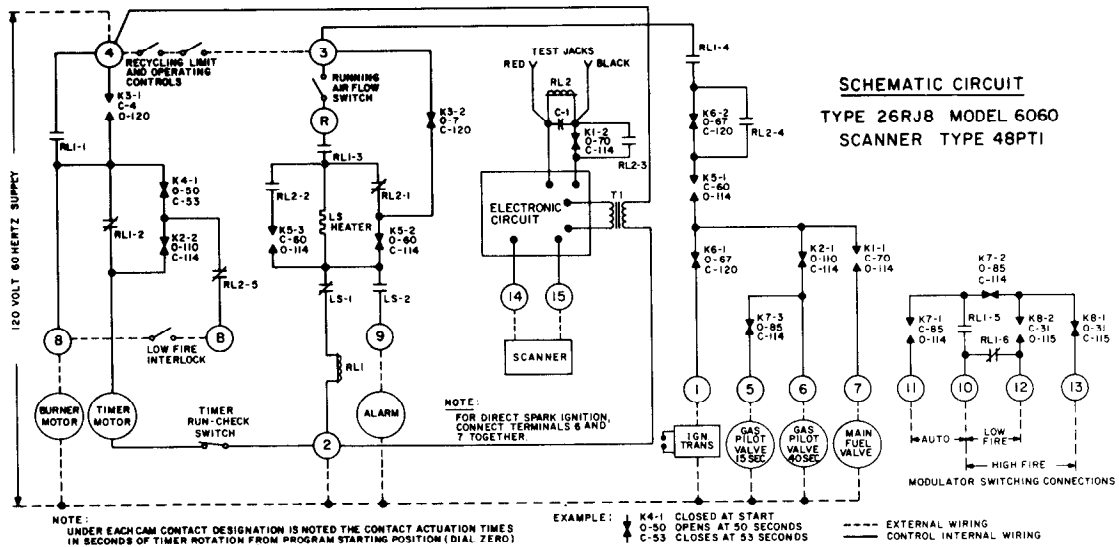


AUTOMATIC GAS OR OIL BURNER - GAS ELECTRIC PILOT - WITH BURNER MODULATION

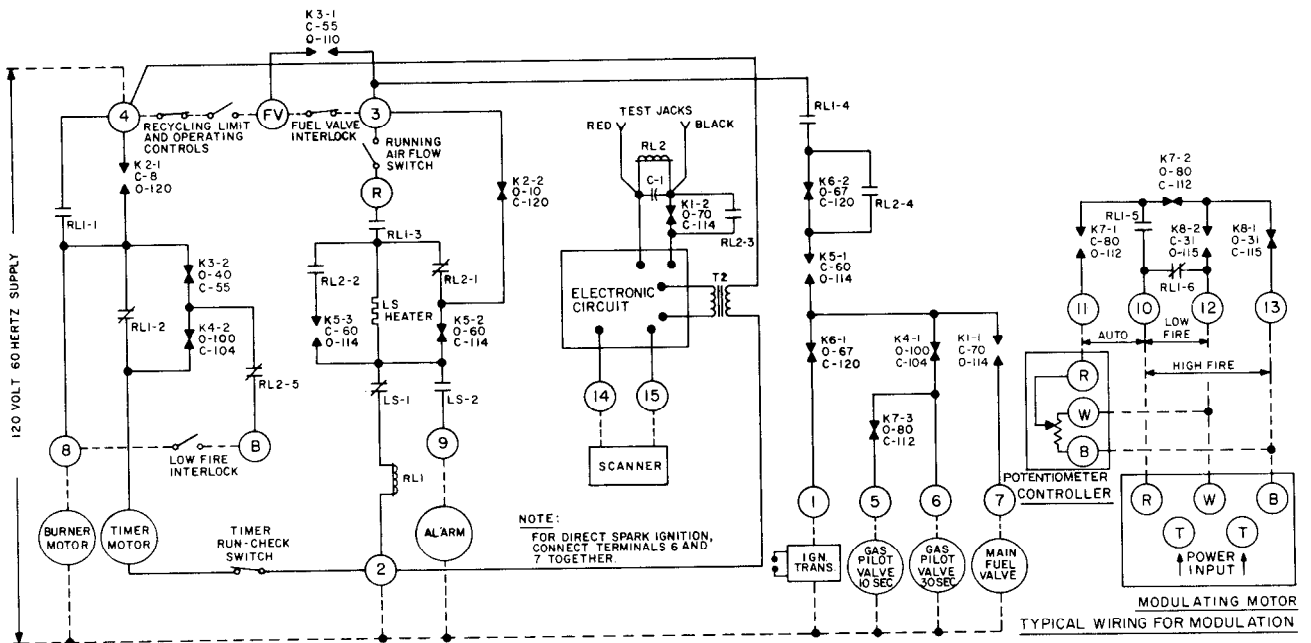
TIMING SEQUENCE: FP-2 SYSTEM WITH TYPE 26RJ8 MODEL 6160D

| GAS OR OIL PROVEN PILOT (No connection between terminals 6 and 7) | | |
|---|-----------------------------|--|
| Timer Rotation (Seconds) | Dial Indications | <u>BURNER STARTUP</u> |
| 0 | 0 | Operating control closes. Fuel Valve Interlock closed. Master relay, timer motor and burner motor (terminal 8) becomes energized. Modulator control switches go to high fire position (10-12 opens, 10-13 closes). |
| 7 | - | Air flow interlock (3 to R closed) must be satisfied for cycle to continue. |
| 31 | - | Modulator control switches go to low fire position (10-13 opens, 10-12 closes). |
| 50 | x | If, for any reason, flame relay holds in, cycle timer motor stops until lockout switch trips. If low fire ignition interlock (8 to B closed) is not satisfied, timer motor stops until interlock is satisfied. |
| 60 | 1 | Ignition (terminal 1) and pilot valve (terminal 5 or 6) on. |
| 67 | - | Ignition (terminal 1) off. |
| 70 | 2 | Fuel valve (Terminal 7) on (provided pilot is proven). |
| 80 | 3 | Terminal 5 pilot valve off. Modulator control switches go to demand position. (10-12 open, 10-11 closed). |
| 100 | DOT (Index) | Terminal 6 pilot valve off. End of initiating cycle; timer motor stops. Burner operates until heat demand is satisfied. |
| <u>BURNER SHUTDOWN</u> | | |
| 100 | DOT (Index) | Operating control opens; master relay and fuel valve (terminal 7) deenergized; timer motor becomes energized. Modulator control switches go to low fire position (10-11 open, 10-12 closed). |
| 120 | 0 | Burner motor (terminal 8) circuit and cycle timer motor deenergized. |
| | | System is ready for startup whenever operating control closes again. |

| UNPROVEN PILOT OR DIRECT SPARK IGNITION (Terminals 6 and 7 jumpered) | | |
|--|-----------------------------|--|
| Timer Rotation (Seconds) | Dial Indications | <u>BURNER STARTUP</u> |
| 0 | 0 | Operating control closes. Fuel Valve Interlock closed. Master relay, timer motor and burner motor (terminal 8) becomes energized. Modulator control switches go to high fire position (10-12 opens, 10-13 closes). |
| 7 | - | Purge air flow interlock (3 to R closed) must be satisfied for cycle to continue. |
| 31 | - | Modulator control switches go to low fire position (10-13 opens, 10-12 closes). |
| 50 | x | If, for any reason, flame relay holds in, cycle timer motor stops until lockout switch trips. If low fire ignition interlock (8 to B closed) is not satisfied, timer motor stops until interlock is satisfied. |
| 60 | 1 | Ignition (terminal 1) and fuel valve (terminal 7) on. |
| 67 | - | Ignition (terminal 1) off. If flame has not been established and detected, fuel valve is deenergized. |
| 70 | 2 | No action. |
| 80 | 3 | Modulator control switches to go to demand position. (10-12 open, 10-11 closed.) |
| 100 | DOT (Index) | End of initiating cycle; timer motor stops. Burner operates until heat demand is satisfied. |
| <u>BURNER SHUTDOWN</u> | | |
| 100 | DOT (Index) | Operating control opens; master relay and fuel valve (terminal 7) deenergized; timer motor becomes energized. Modulator control switches go to low fire position (10-11 open, 10-12 closed). |
| 120 | 0 | Burner motor (terminal 8) circuit and cycle timer motor deenergized. |
| | | System is ready for startup whenever operating control closes again. |



TYPE 26RJ8 MODEL 6060 & 6160
CAM AND RELAY CONTACT IDENTIFICATION

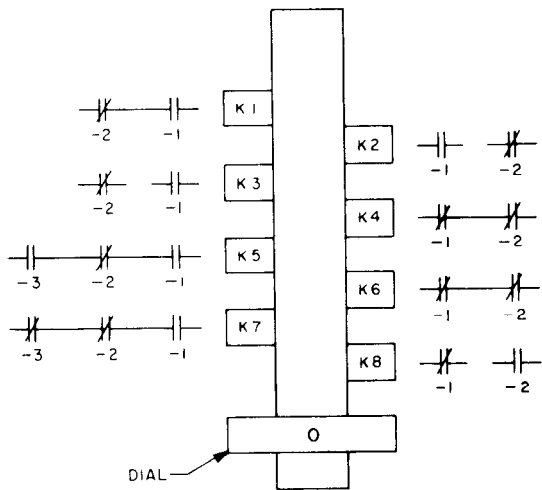


NOTE: UNDER EACH CAM CONTACT DESIGNATION IS NOTED THE CONTACT ACTUATION TIMES IN SECONDS OF TIMER ROTATION FROM PROGRAM STARTING POSITION (DIAL ZERO)

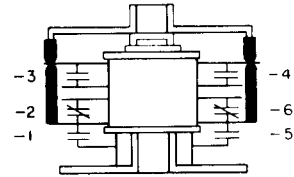
EXAMPLE:
 K3-2 CLOSED AT START
 O-40 OPENS AT 40 SECONDS
 C-55 CLOSES AT 55 SECONDS

--- EXTERNAL WIRING
 ——— CONTROL INTERNAL WIRING

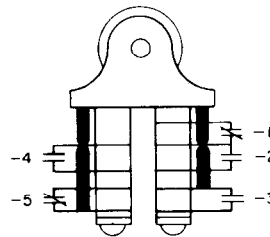
CAM SWITCH ASSEMBLY (FRONT VIEW)



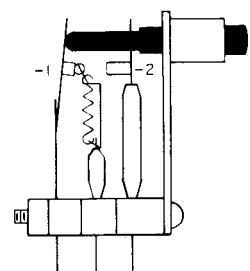
MASTER RELAY (AC) RLI



FLAME RELAY (DC) RL2



LOCKOUT SWITCH LS



TYPE 26RJ8 MODEL 6160D
 CAM AND RELAY CONTACT IDENTIFICATION

RELAY, LOCKOUT SWITCH AND TIMER OPERATION

- A. Master Relay (RL1) is located slightly above center of chassis. When all starting circuits are closed RL1 pulls in. Only with RL1 energized is power made available to the ignition and fuel valve switching circuits. RL1 remains energized from the start of a program until a limit or operating control opens or the lockout switch trips.
- B. Flame Relay (RL2) is located at top right of chassis. It is energized in response to flame signal. As long as there is a flame present it remains energized.
- C. The lockout switch (LS) is located to the right of RL2 on the chassis. It trips if RL2 holds in during "safety check" at start, or if RL2 drops out due to ignition failure, or flame failure. It is a thermally actuated device which trips after its heater is continuously energized for about one minute. Its contacts will not automatically reset and must be manually reset after a cooling period of about two minutes.
- D. The timer (K) is located at the lower right hand side of the chassis. It consists of multiple-leaf switches actuated by cams driven by a synchronous motor. Timer shaft position is indicated by a drum-type dial.

NORMAL CIRCUIT CONDITIONS RELATED TO SECONDS OF TIMER ROTATION

SHADED BAR INDICATES TERMINAL ENERGIZED OR CIRCUIT CLOSED BETWEEN DESIGNATED TERMINALS

| | | | | | | | | | | | | | |
|--------------|---------------------------|----|----|----|----|----|-------|----|----|-----|-----|-----|-----|
| SECONDS = 0 | 10 | 20 | 30 | 40 | 50 | 60 | 67 70 | 80 | 90 | 100 | 100 | 110 | 120 |
| 1 | [Shaded bar from 0 to 60] | | | | | | | | | | | | |
| 5 | [Shaded bar from 0 to 60] | | | | | | | | | | | | |
| 6 | [Shaded bar from 0 to 60] | | | | | | | | | | | | |
| 7 | [Shaded bar from 0 to 60] | | | | | | | | | | | | |
| 8 | [Shaded bar from 0 to 60] | | | | | | | | | | | | |
| 10-11 (AUTO) | [Shaded bar from 0 to 60] | | | | | | | | | | | | |
| 10-12 (LOW) | [Shaded bar from 0 to 60] | | | | | | | | | | | | |
| 10-13 (HIGH) | [Shaded bar from 0 to 60] | | | | | | | | | | | | |

DIAL POSITION=0 x 1 2 3 HEAT CYCLE 0

FLAME FAILURE RESPONSE TIME—NOT MORE THAN 4 SECONDS

TYPE 26RJ8

FIREYE PROGRAMMING CONTROL

| | | | | | | | | | |
|---|---|---|---|----|---|----|----|----|----|
| 1 | 3 | 5 | 7 | 9 | W | B | 11 | 13 | 15 |
| 2 | 4 | 6 | 8 | FV | R | 10 | 12 | 14 | |

MODEL 6160D

U.S. PATENT NO.
2,643,311 — 2,811,711
ALSO FOREIGN PATENTS
ISSUED AND PENDING

| | | | | | |
|---|----------------------------------|----|----|--------------------------------|----|
| 4 | ← HOT 120V SUPPLY COMMON → | 2 | 14 | ← BLACK SCANNER WHITE-GROUND → | 15 |
| 4 | ← LIMIT AND OPERATING SWITCHES → | FV | | ← FUEL VALVE INTERLOCK → | 3 |
| 8 | ← LOW FIRE IGNITION INTERLOCK → | B | R | ← RUNNING AIR FLOW SWITCH → | 3 |

| | | | | | | |
|---|----------------------|---|--|-----------------------------------|---|--|
| IGNITION CONNECTIONS (COMBINED RATING: IGN. TRANSFORMER - 500 VA. VALVE - 125 VA PILOT DUTY) | | | 8 | 10 | MODULATOR SWITCHING CONNECTIONS 125 VA PILOT DUTY OR IF 30V. MAX. 2A. MAX. | |
| 1 | IGNITION TRANSFORMER | | BURNER MOTOR 5.8 AMPS FULL LOAD 34.8 AMPS LOCKED ROTOR OR 250 VA PILOT DUTY | 11 | | |
| | FUEL | TRIAL-FOR-IGN. PERIOD | | 12 | | |
| 5 | GAS OR OIL | 10 SEC.-SUPERVISED | | 13 | | |
| 6 | OIL ONLY | 30 SEC.-SUPERVISED | | 9 | ALARM (50 VA PILOT DUTY) | |
| | OIL ONLY | 7 SEC.-UNSUPERVISED (JUMPER TERMINALS 6 AND 7) | 7 | FUEL VALVE (130 VA PILOT DUTY) | | |
| | | PILOT OR SPARK | | | | |

ALL RATINGS ARE AT 120V, 60HZ EXCEPT AS NOTED-ALL WIRING MUST BE SUITABLE FOR LINE VOLTAGE

MFD. BY
ELECTRONICS CORPORATION OF AMERICA
COMBUSTION CONTROL DIVISION
CAMBRIDGE, MASSACHUSETTS
E.C.A. (CANADA) LTD. TORONTO, ONTARIO

Installation Testing

1. FLAME SIGNAL MEASUREMENT

Flame signal voltage may be measured with a suitable DC voltmeter having a resistance of at least 1000 ohms per volt connected at the test jacks.

| | Minimum | Average | Maximum |
|-------|---------|-----------|---------|
| 26RJ8 | 80VDC | 90-115VDC | 115 |

2. Test Switch (Figure 12) when in "check" position, electrically disconnects the timer motor, stopping the automatic program.



Figure 12

3. 26RJ8 Control Flame Signal Attenuator. Directly above the vacuum tubes on the chassis is a recessed pin, which when grounded to the chassis by a clip cord (Fig. 13), will reduce the sensitivity of the flame signal amplifier 40% for test purposes.

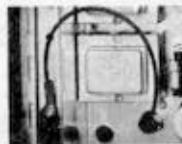


Figure 13

For Burner with Pilot Ignition Checking Scanner Viewing of Pilot Flame

1. Make sure that control and scanner have been properly installed and wired.

26RJ8 Control

2. (Optional) Ground the attenuator pin to the chassis.

3. Plug DC Voltmeter leads in to test jacks on control chassis (Red-plus; Black-minus).

4. Turn burner switch on. Let timer progress normally from dial "0" past dial "X". When timer has slightly passed Dial "1" and ignition is energized, place the test switch in the "check" position.

5. If pilot flame is not established within 15 seconds turn burner switch off, place the test switch in the "run" position, turn burner switch back on and repeat from step 4. Repeat as necessary until pilot flame is established.

6. Observe reading on voltmeter. Reading should be steady; see chart. If the reading fluctuates, it will be necessary to adjust the pilot flame. Continue adjustment until steady, correct reading is obtained.

NOTE: If pilot is not detected within about 60 seconds, control will lock out, making it inoperative. It will be necessary to allow two or three minutes for the thermal element to cool and to reset the control manually. Then repeat from step 4.

Checking Scanner Viewing of Main Flame

7. Turn burner switch to "off", place test switch in "run" position, return burner switch to "on" and let control cycle normally.

8. As dial reaches position "2" watch for establishment of main flame. If flame is not established within about 5 seconds, turn burner switch "off", then return to "on" and allow control to recycle normally for a new lighting trial.

NOTE: On an initial starting attempt, portions of fuel lines may be empty and require "bleeding" time. It is better to accomplish this with repeated short lighting-trial periods with intervening purge periods than to risk prolonged fuel introduction at a time when burner adjustments have not been completed and the minimum pilot test has not been conducted. Do not repeat unsuccessful lighting attempts without rechecking burner and pilot adjustments if lighting does not occur within 5 seconds after fuel introduction is verified or can be reasonably assumed.

9. When main flame is established, leave burner on and let timer progress until ignition shuts off (dial position 3 or "dot"). If scanner main flame sighting is reasonably good, the flame relay will stay energized, main flame will stay lit, and the timer will progress to dial "dot" position and stop. If flame goes out due to instability without ignition, readjust burner and repeat light-off procedure.

10. With step 9 completed and burner remaining lit with timer at "dot" position, readjust burner as necessary for correct flame size and optimum combustion, then recheck for proper lighting. If scanner is properly sighted, the DC voltmeter will now register a steady signal voltage with pilot flame only and with main flame only. Repeat burner adjustments as necessary to obtain this condition if it does not exist initially.

11. With all steps through 10 satisfactorily completed, remove attenuator connection (if used) and proceed with minimum pilot test.

Minimum Pilot Test

This test assures that the scanner will not detect flame too small to light off the main flame. It must be made (a) on every new installation (b) following any change of scanner location or viewing angle, and (c) following replacement of the scanner cell. Note: 26RJ8 Control — Do not conduct this test with the attenuator pin grounded!

12. Repeat step 4. When the timer has slightly passed dial "1" and the pilot is ignited, place the test switch in the "check" position.

13. Reduce the size of the pilot until the flame relay is observed to drop out, then slowly increase the size of pilot flame just to the point where the flame relay pulls in. This is called minimum pilot. (Note Figs. 14, 15, 16.)

14. When timer reaches dial position "2", watch for main flame to light. CAUTION: If main flame does not ignite in approximately the same time as it did with normal full pilot flame, immediately turn the burner switch off. Realign the scanner sighting tube so that detection requires a larger pilot flame and repeat minimum pilot test. Repeat this process until main flame lights reliably on several trials.

15. After minimum pilot test is completed, increase pilot flame to normal size, and place the test switch in the "run" position.

26RJ8 Control

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 90 or more volts DC is not measured at the test jacks, realign scanner sighting to obtain suitable output voltage and then repeat all steps through 15.

For Burner with Spark Ignition (No Pilot)

Checking Scanner Viewing of Main Flame

1. Proceed according to steps 1, 2, and 3 as outlined previously.

2. Turn burner switch on. Master relay will pull in and timer will start.

3. As timer reaches dial position 1, watch for main flame to be established. If flame is not established by the time dial position "2" is reached, turn burner switch off and then on again and allow control to recycle normally.

CAUTION: If fuel is observed to enter combustion chamber and ignition does not occur at once, shut burner switch off and check electrode settings. Do not repeat ignition attempts unless a good spark can be observed in a position where the fuel will be readily ignited.

4. If burner ignites and burns properly, DC voltmeter will register a steady signal voltage. If voltmeter registers satisfactorily until ignition shuts off at dial position 3 and then becomes unsteady, readjust burner to obtain stable flame both with and without ignition on.

5. Remove attenuator connection (if used).

Checking Pilot Flame Failure Protection

1. Shut off the fuel to the pilot burner.

2. Start the control cycle.

3. After 60 seconds' purge period, the pilot assembly will be energized.

4. Because no pilot flame is detected, the pilot assembly will shut off after 7 seconds. The main fuel valve will not be energized.

5. The programming timer will complete its cycle during which time the lockout switch will trip, effecting a safety lockout and actuating the alarm (if used).

Checking Main Flame Failure Protection

1. Start the burner in the normal manner.

2. After the startup programming has been completed, shut off the main fuel supply.

3. Within 4 seconds after the flame fails, the main fuel valve will close and after approximately 60 seconds, the lockout switch will trip.

4. Following a 20-second post purge or spin-down period, the blower motor will stop, and the alarm circuit will be energized.

5. The lockout switch may be reset after allowing the thermal element to cool (approximately 2 minutes).

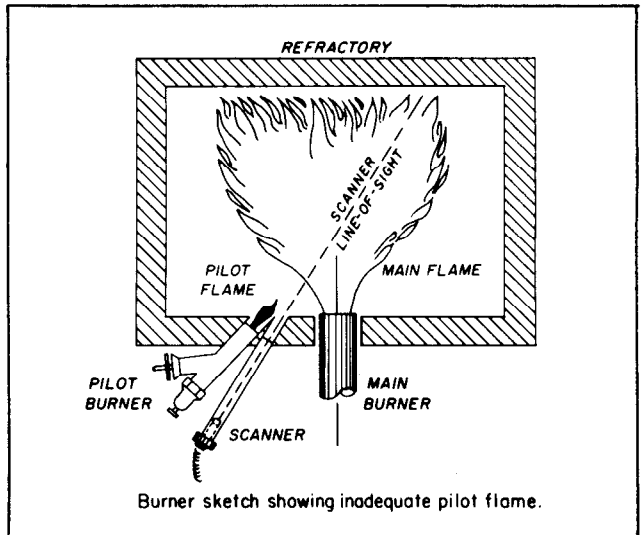


Figure 14

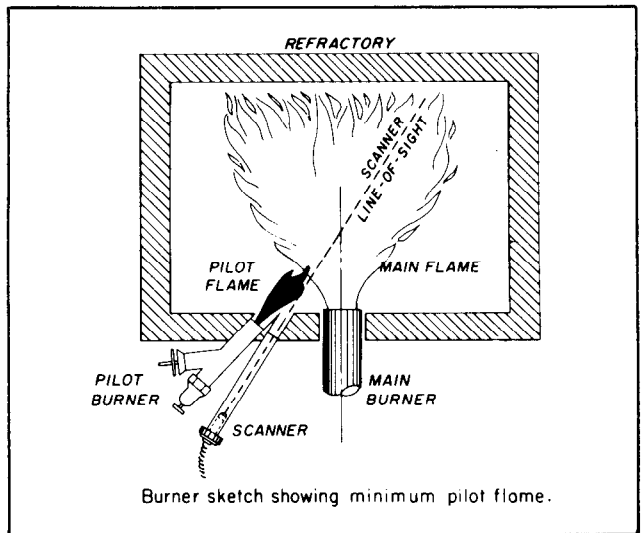


Figure 15

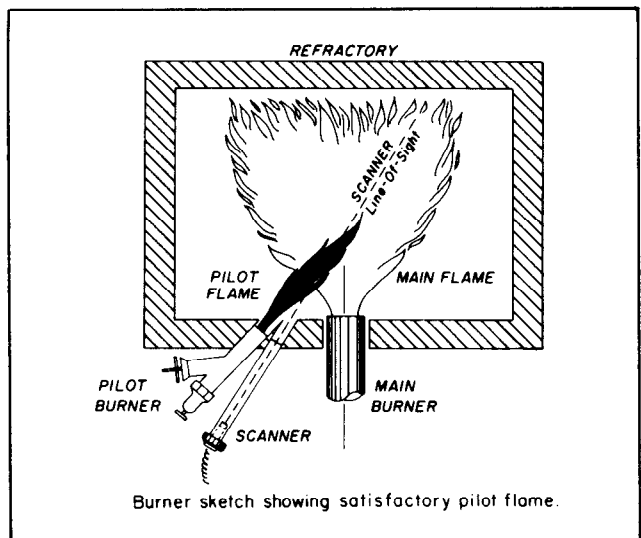


Figure 16

SERVICING

Troubles in FP-2 System installations can be readily isolated by following the approved procedure in the sequence given below. Before beginning any troubleshooting, however, make sure that:

1. Installation and wiring have been made in accordance with instructions.
2. Chassis is securely plugged in and thumbscrews tightened; AC line plug is in socket or slide switch is in "run" position; lockout switch is reset.
3. Make sure that voltage source to the control (whether supplied directly from the line or from a control circuit transformer) complies with the voltage and frequency ratings shown on page 1. NOTE: 60 cycle programming controls can be operated from 50 cycle supply if the voltage is within the range specified for 60 cycles, but all program timings will be increased by 20 percent.

In the following tabulation, troubles appear within boxes and possible causes are listed below the boxes.

CONDITION: Zero voltage between terminals 2 and 4.

1. Disconnect Switch off.
2. Blown fuse.
3. Broken wire.
4. Incorrect wiring.

CONDITION: Zero voltage between terminals FV and 2.

1. Open limit switch circuit (Pressure, LWCO etc.)
2. Broken wire.
3. Incorrect wiring.

CONDITION: Zero voltage between terminals 3 and 2.

1. Fuel Valve Interlock open.

CONDITION: Master relay (RL1) does not pull in.

1. Contacts K2-2, K5-2, LS-1 dirty or open.
2. Timer not at dial zero position.
3. Lockout switch tripped.
4. RL1 armature may be mechanically stuck open.
5. Supply voltage is too low (see page 1 for rated minimum).
6. Defective programming control; replace.

CONDITION: Master relay pulls in but timer does not start.

1. Contacts RL1-1, K3-2 or K4-2 are dirty or open.
2. Timer motor is mechanically bound; check by rotating timer dial.
3. Defective programming control; replace.

CONDITION: Programming timer starts. Blower Motor does not start.

1. Insufficient voltage between Terminals 2 and 8.
2. Blown motor fuse.
3. Motor Starter overloads tripped.
4. Burner motor incorrectly wired.
5. Defective motor or starter.

CONDITION: Modulator motor does not drive toward open-damper position.

1. Modulator motor not powered.
2. Linkage jammed.
3. Incorrect wiring.
4. Contacts RL1-5, K7-2, K8-1 dirty or open.
5. Contact RL1-6 does not open.
6. Defective modulator equipment.

CONDITION: RL1 drops out after 7 seconds.

1. Running air flow interlock circuit (3-R) open.
2. Contact RL1-3 dirty or open.
3. Open lockout switch heater.

CONDITION: Timer stops when "X" appears in window.

1. Low fire interlock (8-B) open.
2. Flame relay (RL-2) holds in due to residual flame in combustion chamber.
3. Defective programming control.
4. Defective scanner.

CONDITION: Modulator motor does not drive toward closed-damper position at about 31 seconds.

1. Modulator motor not powered.
2. Linkage jammed.
3. Incorrect or faulty wiring.
4. Contacts RL1-5, K7-2, K8-2 dirty or open.
5. Defective modulator equipment.

CONDITION: Timer dial reaches position "1". Pilot flame is not established.

1. Insufficient voltage between Terminals 2 and 1, 5 or 6:
2. Contacts RL1-4, K6-2, K5-1, K6-1, K4-1 or K7-3 dirty or open.
3. Defective pilot gas valve.
4. Defective ignition transformer or electrode.
5. Improper electrode setting.
6. Plugged pilot burner.
7. Insufficient gas pressure.
8. Improper pilot burner adjustment.
9. Ignition assembly incorrectly wired.

CONDITION: Flame relay (RL2) does not pull in when pilot flame lights.

1. Pilot flame too small. Make sure gas pressure is not less than specified for the pilot burner.
2. Scanner sight tube obstructed or scanner lens dirty.
3. Scanner sighting is incorrect.
4. Scanner is incorrectly wired — black wire is to terminal 14 and white wire to 15.
5. Flame relay is mechanically bound.
6. Defective Scanner or cell (48PT1).
7. Defective control.
8. Scanner is too hot or sees hot refractory. Tubes reversed or inoperative.
9. Contact K1-2 dirty or open.

CONDITION: Timer dial reaches position "2". Main fuel valve stays shut.

1. Insufficient voltage between Terminals 2 and 7.
2. Contacts RL2-4, RL2-3 or K1-1 dirty or open.
3. Defective valve.
4. Incorrect wiring.
5. Pilot flame not detected.

CONDITION: Fuel valve is energized. Main flame does not light.

1. Inadequate pilot.
2. Incorrect burner adjustment.
3. No main fuel.

CONDITION: Fuel Valve is energized momentarily.

1. Contacts RL2-3 dirty or open.

CONDITION: Main flame lights and then goes out.

1. Lockout switch has tripped. Allow to cool for two minutes and reset.
2. Limit and operating control circuit or running interlock circuit open.
3. Contacts RL2-2 or K5-3 dirty or open.

CONDITION: Timer dial reaches position "3" or "dot". Pilot flame does not go out.

1. Gas pilot valve is stuck open.
2. Contacts K7-3 or K4-1 do not open.
3. Valve incorrectly wired.

CONDITION: Timer dial reaches position "3". Modulator motor does not respond to modulation controller.

1. Modulator motor not powered.
2. Setting of modulation controller incorrect.
3. Linkage jammed.
4. Incorrect wiring.
5. Contacts K7-1, RL1-5 dirty or open.
6. Defective modulator equipment.

CONDITION: Main flame goes out when pilot shuts off.

1. Scanner does not "see" main flame.
2. Incorrect burner adjustment.
3. Incorrect wiring to main fuel valve.

CONDITION: Timer does not stop at "dot".

1. Contacts K4-2 or RL1-2 stuck closed.

CONDITION: Timer does not rotate to "O" when operating or limit control opens.

1. Contacts RL1-2 or K2-1 dirty or open.
2. Limit switches incorrectly wired.

CONDITION: During post purge period modulator motor does not drive toward damper-closed position.

1. Modulator motor not powered.
2. Linkage jammed.
3. Incorrect wiring.
4. Contacts RL1-6 dirty or open.
5. Defective modulator equipment.

CONDITION: Timer does not stop at "O".

1. Contacts RL1-1 or K2-1 stuck closed.
2. Limit and operating switch circuit closed.

CONDITION: Burner motor does not stop when timer dial reaches "O".

1. Contacts RL1-1 or K2-1 stuck closed.
2. Limit and operating switch circuit close.
3. Motor starter is mechanically stuck.
4. Motor starter is incorrectly wired.

CONDITION: Alarm is not energized following flame failure shutdown.

1. Contacts K3-1, K2-2, K5-2 or LS-2 open or dirty.
2. Limit circuit open.
3. Defective alarm.

CONDITION: Nuisance lockouts

1. Contacts RL2-2 or K5-3 dirty or open.

48PT1 Scanner

FIRETRON Cell: Estimated life 20,000 hours, when operated within ambient temperature limits. The scanner lens should be cleaned as often as operating conditions demand.

Tubes: Types 12AX7; 12BH7A; have an estimated life of 10,000 hours. Annual replacement recommended. Replacement tubes are available from local radio tube supply sources.

FP-2

Humidity Effects: To protect against high resistance leakage in the electronic circuit resulting from high

humidity it is recommended that the 26RJ8 Control be left powered continually even when not in operation. If it is necessary to shut down completely for an extended period, power should be turned on for 48 hours before putting the control back in operation.

Rotation: It is recommended that units purchased as spares be rotated periodically, so that each unit will be placed in operation at least every 90 days.

Contacts: All relay contacts are designed with adequate wiping action for self cleaning under normal conditions. In atmospheres carrying excessive dust or oily vapors, contacts may require occasional cleaning. Use a burnishing tool or fine grade of crocus cloth for cleaning.

Never file, sandpaper or apply liquid or aerosol spray cleaners.

NOTE*Periodic Safety Check*

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.

WARRANTY

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 a UL listed Electronic Flame Safeguard and Programming Control having the following functions:
 - 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 to purge the combustion chamber and heat exchanger at maximum airflow to accomplish 4 air transfers of the entire volume shall be provided. The control system shall be interlocked to prevent the burner from firing until the desired purge is accomplished.
 - c. A pilot proving period of not more than 7 sec. prior to energizing the main fuel valve shall be provided.
 - d. Limited trial-for-ignition of main flame, 10 sec. maximum for gas or light oil, 30 sec. maximum for heavy oil shall be provided.
 - e. Safety shutdown shall be accomplished within 4 sec. following a flame failure.
 - f. A post-purge period of not less than 20 sec. shall be accomplished following each normal shutdown and not less than 60 sec. following a safety shutdown.
 - g. The control system shall recycle automatically under control of the operating control, running air flow interlock, and when power is restored following power failure. Manual resets shall be required following any safety lockout.

MECHANICAL and ELECTRICAL

3. 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 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° and through a supply voltage range of plus 10% or minus 15% of normal 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. Test jacks shall be provided for direct connection of a DC voltmeter to measure flame signal voltage.
 - e. The control chassis shall be of plug in design to facilitate replacement without disconnecting any external wiring.

FLAME DETECTION

4. Infrared (Pbs)
 - a. The pilot and main flame shall be monitored by an infrared-sensitive flame scanner sensitive to flame radiation. The scanner shall not be actuated by hot refractory or any other source of infrared radiation.
 - b. The scanner shall mount and sight through a ½ inch standard pipe.
 - c. The scanner shall be suitable for operation over a temperature range of -40°F to 125°F.
 - d. The flame safeguard control system shall be FIREYE FP-2 with Control type 26RJ8, model 6160D.