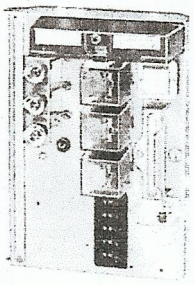
R4138 Industrial Flame Safeguard Primary Controls

Provide supervision of semi-automatic, industrial single or dual fuel burners.



- Directly replace all R4138A,B models.
- Delay admission of fuel to combustion chamber until pilot flame has been proven; then monitors flame through run period.
- Offer alarm terminal to operate an external, line voltage alarm when the system is shutdown.
- Use where long periods of burner operation without shutdown are normal, such as in heat-treating ovens and kilns.
- Plug-in S427D Purge Timer provides timed purge period prior to manual start.
- Incandescent indicator lamps (FLAME OFF, PURGE COMPLETE, FLAME ON) provide a visual check of the system condition.
- Clear plastic relay covers prevent contamination, damage and tampering.

APPROVALS:
Underwriters Laboratories Inc. Listed: File No. MP268, Guide No. MCCZ2.
Canadian Standards Association Certified: File No. LR1620, Guide Nos. 140-A-2, 300-1-0.2.
Factory Mutual Approved: Report No. 26037.
Industrial Risk Insurers Acceptable.

TEMPERATURE RATINGS: Ambient:

	Minimum[a]		Maximum	
	F	C	F	C
50 Hz	–20	–29	+120	+49
60 Hz	–20	–29	+130	+54

[a] 0 F (–18 C) if using S427D Purge Timer.

TIMING LOCKOUT SWITCH: 15 seconds, nominal.
FLAME FAILURE RESPONSE TIME: 2 to 4 seconds (see specific amplifier).
ELECTRICAL RATINGS:
Power Supply: 120V, 50/60 Hz
Power Consumption: Stand by — 13W (60 Hz); 14 W (50 Hz) max. Running — 19W (60 Hz); 21W (50 Hz) 1K pulled in max.

TERMINALS:

Terminal	Typical Load	Voltage	Pilot Duty Rating
16	Alarm	120 to 240V	125 VA
16	Alarm	up to 30V	50 VA
6	Ignition	120 to to 240V	250 VA
19	Pilot Valve, or 1st Stage Oil Valve	120 to 240V	125 VA
20	Main Fuel Valve(s)	120 to 240V	250 VA

REPLACEMENT PARTS:
118543A Incandescent Indicator Lamp, 120V or Sylvania type 120RB.
122514 Locking Cabinet Latch Assembly (with two keys).
122515 Nonlocking Cabinet Latch Assembly.

ACCESSORIES:
118811B Remote Reset Assembly. 120V, 60 Hz; provides capability of resetting lockout switch from remote location.
123514A Flame Simulator for rectification systems.
123514B Flame Simulator for ultraviolet systems.
Q477A1009 Panel—for mounting in customer's cabinet.
Q478A1015 Cabinet—for flush or surface mounting, without integral START-STOP switch.
Q478A1031 Cabinet—for flush or surface mounting, with integral START-STOP switch.

Available only through Honeywell Authorized Flame Safeguard Distributors.

Order Number	Mounting[a]	Use With[a]	Replaces
R4138C1018	Q477A Subbase for mounting in cabinet. Q478A Dust-resistant Cabinet, for flush or surface mounting, with locking cover (with or without START-STOP pushbutton station).	Plug-in flame signal amplifier and matching flame detector (order separately).	R4138A1004 R4138A1012
R4138D1016			R4138B1002

[a] Order separately.

INSTALLING THE R4138 (FIGS. 11, 12 AND 13)

1. If you are using the R4138 in a continuous (standing) pilot application, clip the pilot link jumper wire (Fig. 11). It must be clipped so that the system can start while the pilot flame is being detected.

2. If you are using the R4138 in a redundant parallel system, clip the pilot link jumper wire (Fig. 11). In a redundant parallel system, either of the R4138's may be removed while the system is running. If it is replaced while the burner is firing, the R4138 cannot start because the detector is sensing flame (safe start check). Clipping the pilot link jumper wire will allow the R4138 to start. If using a C7012E or F Purple Peeper Ultraviolet Flame Detector or a rectifying flame rod with an R7247 Dynamic Self Check Amplifier, all electronic components in the flame detection system will be tested in the first checking cycle.

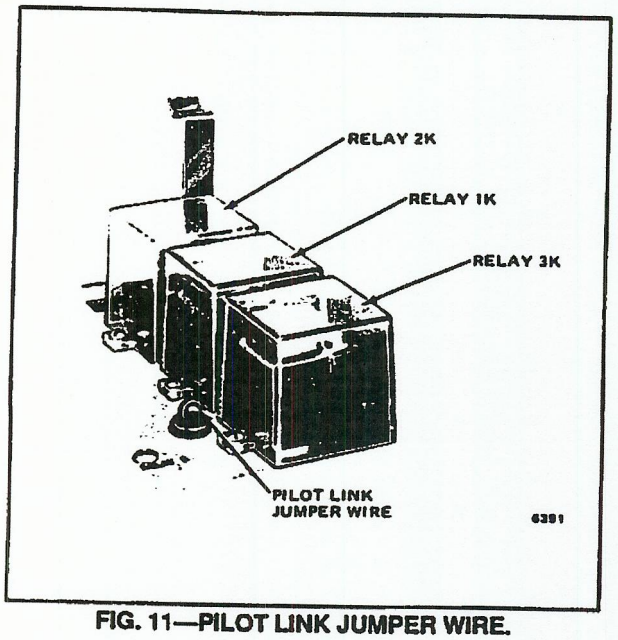


FIG. 11—PILOT LINK JUMPER WIRE.

3. Open the master switch.

4. Make sure no wiring is projecting outward from the terminal strip. Tuck wiring in against the back of the cabinet or subbase so it does not interfere with the contacts.

5. Grasp the handle of the R4138 chassis and insert the 2 ears (at the top and bottom along the left side) into the slots at the top and bottom of the terminal strip (Fig. 12).

6. Swing the chassis inward until the knife-blade contacts on the control engage the spring connectors alongside the terminal strip. Push in until the contacts are fully engaged.

7. Insert the chassis retaining screw (Fig. 13) into the threaded stud on the subbase or in the cabinet, and tighten it securely.

REMOVING THE R4138 (FIGS. 12 AND 13)

1. Open the master switch.

2. Disconnect the optional remote reset assembly (if used).

3. Loosen the chassis retaining screw completely from the threaded stud (Fig. 13).

4. Pull outward on the handle until the knife-blade contacts on the control disengage from the spring connectors alongside the terminal strip.

5. Disengage the 2 ears on the chassis from the slots at the top and bottom of the terminal strip (Fig. 12).

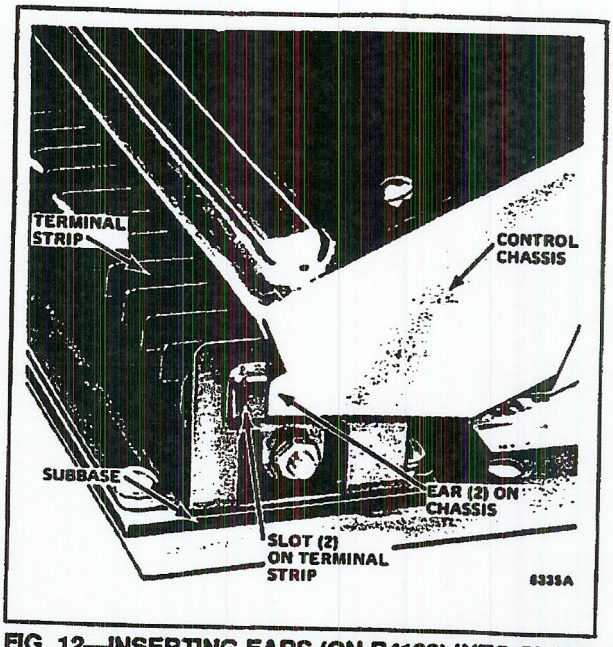


FIG. 12—INSERTING EARS (ON R4138) INTO SLOTS AT TOP AND BOTTOM OF TERMINAL STRIP.

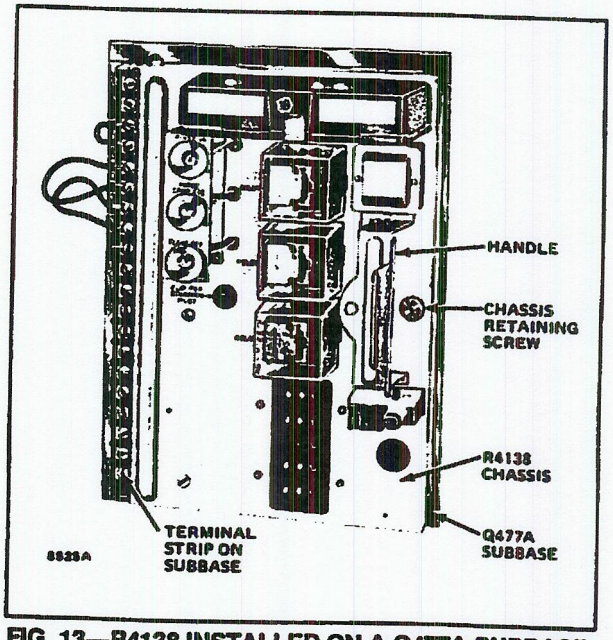


FIG. 13—R4138 INSTALLED ON A Q477A SUBBASE.

INSTALLING A PLUG-IN FLAME SIGNAL AMPLIFIER (FIG. 14)

1. Make sure the amplifier nameplate is on the outside. Then align the circuit board with the keyed receptacle at the top of the R4138 chassis.

2. Push in the amplifier until the circuit board is fully inserted into the receptacle.

3. Make sure the spring clip on the R4138 chassis fits over the amplifier and that the amplifier is firmly in place.

NOTE: For further information about self-checking amplifiers, refer to the R7247B,C instruction sheet, form 60-2358, or to the R7248B instruction sheet, form 60-2357, packed with the amplifier.

OPERATION

The schematic below shows all relay contacts in the de-energized position. Refer to Sequence of Operation on next 4 pages.

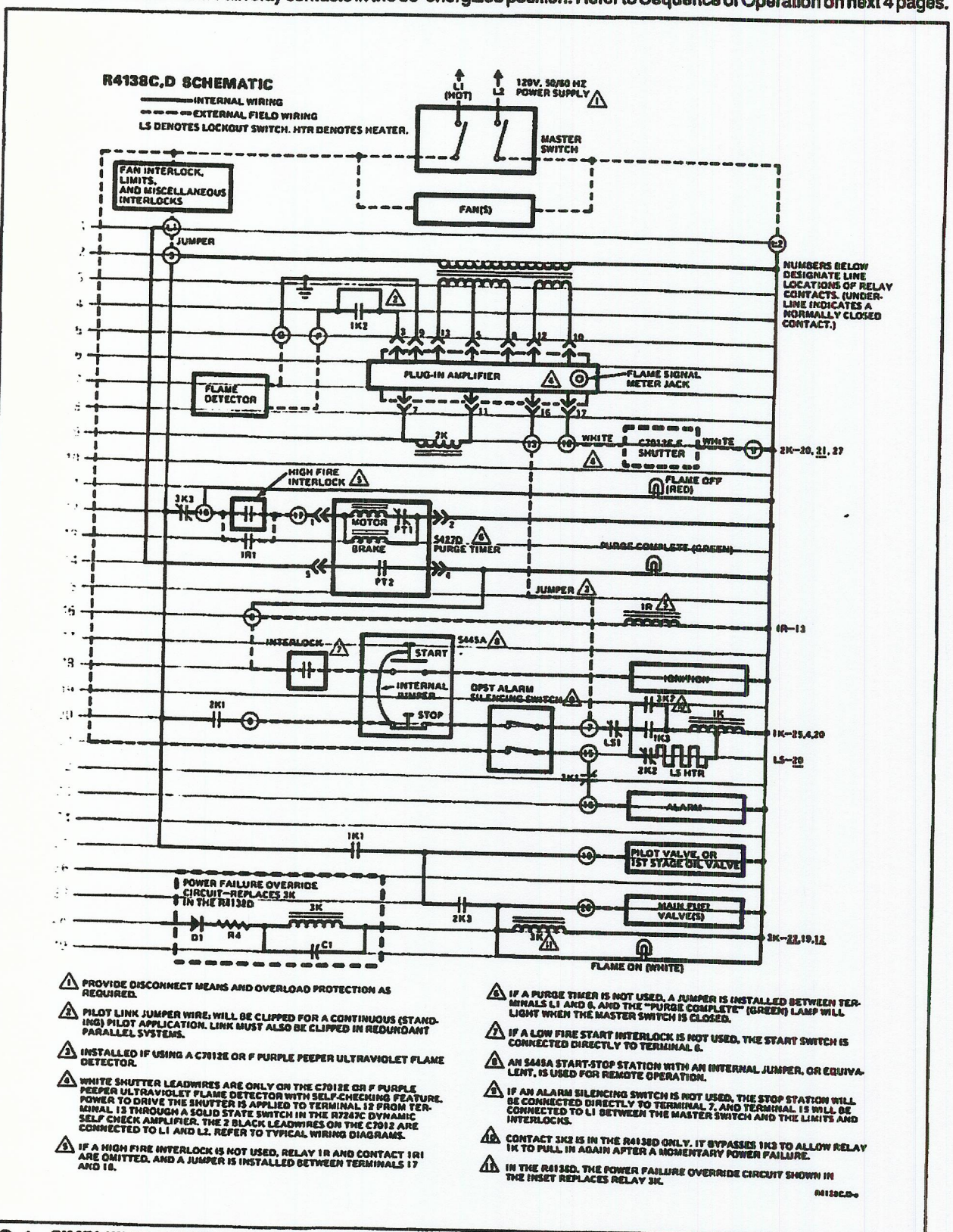


FIG. 1—SIMPLIFIED SCHEMATIC DIAGRAM OF THE R4138C AND D, SHOWING TYPICAL FIELD WIRING FOR A GAS OR OIL CUTOFF SYSTEM.

SEQUENCE OF OPERATION FOR THE R4138C,D

NOTE: Italics denote special applications.

NORMAL OPERATION

OPERATOR ACTION	R4138 OPERATION	SYSTEM OPERATION
TO START:		
1. Reset the lockout switch on the R4138. Reset all limits and interlocks. Close the master switch.	1. a. Power is applied to terminal L1 through the interlocks and limits, and to terminal 3 through the jumper from terminal L1; the plug-in amplifier is energized. b. Power is applied to terminal 15 (through the alarm silencing switch) and to terminal 16 (through 3K1). c. Power is applied to terminal 18 (through 3K3); the FLAME OFF (RED) lamp lights.	1. a. The fan(s) starts. b. The alarm is energized, but may be turned off by opening the alarm silencing switch (if used). c. None.
2. Open the damper to high fire position (if manually operated.)	2. a. None. b. Power is applied to terminal 17 (through the high fire interlock) and to the motor of the purge timer (through PT1), the purge timer starts. c. At the end of the preset time, PT1 opens and the purge timer stops. PT2 closes, applying power to terminal 6 (from terminal L1); the PURGE COMPLETE (GREEN) lamp lights	2. a. The high fire interlock closes when the damper is open. (The damper may open automatically.) b. The purge period begins, the fan(s) clears the combustion chamber of unburned fuel and fuel vapor. c. Relay 1R pulls in; 1R1 closes to bypass the high fire interlock and keep power applied to the purge timer. (If power is removed from the purge timer. It will reset, PT2 will open, and the system cannot be started.)
3. When the PURGE COMPLETE (GREEN) lamp lights, close the damper to low fire position (if manually operated).	3. None.	3. The high fire interlock opens, and the low fire start interlock closes when the damper is closed. (The damper may close automatically.)
4. Close the alarm silencing switch (if it was opened in step 1).	4. None.	4. The alarm is energized.
5. Push in the START button and hold it in. NOTE: To avoid nuisance shutdowns when not using a purge timer, wait at least 10 seconds after the fan interlock closes before pushing in the START button	5. a. Power is applied to the ignition transformer from terminal 6 (through the low fire start interlock and the START station). b. Power is applied to terminal 7 from terminal 6 through the low fire start interlock, START station, internal jumper, STOP station, and alarm silencing switch). c. Relay 1K pulls in through LS1, 2K2, and the LS HTR (lockout switch heater), thus proving the continuity of the heater. (1) 1K1 closes, applying power to terminal 19 from terminal 3. (2) 1K2 closes. (3) 1K3 closes; the LS HTR (lockout switch heater) begins heating (by auto-transformer action of 1K through 1K3 and 2K2). d. *If an R7247C Dynamic Self Check Amplifier is used, power is applied from terminal 7 through the jumper to terminal 13, through the solid state switch in the amplifier (between amplifier terminals 16 and 17), to terminal 12.*	5. a. The ignition transformer is energized. b. None. c. (1) The pilot valve (or 1st stage oil valve) is energized. The valve opens and the pilot or 1st stage oil burner) is ignited. (2) *If the pilot link jumper wire has been clipped for a continuous (standing) pilot application, the flame detection circuit to the amplifier is complete.* (3) None. d. *If a C7012E or F Purple Peeper Ultraviolet flame Detector (with self-checking feature) is used, the shutter is energized.*

(continued on next page)

OPERATOR ACTION	R4138 OPERATION	SYSTEM OPERATION
	e. None.	e. The flame detector detects the pilot flame for 1st stage oil flame).
	f. When the flame is detected, relay 2K pulls in. (1) 2K1 closes, bypassing the purge timer contact PT2, low fire start interlock, START station, and internal jumper. Power will be applied to terminal 7 (from terminal 3, through 2K1 to terminal 8, and through the STOP station and alarm silencing switch) to hold in relay 1K (unless the limits open, the STOP button is pressed, or safety shutdown occurs). (2) 2K2 opens; the LS HTR stops heating. (3) 2K3 closes, applying power to terminal 20 (from terminal 3 through 1K1). Relay 3K pulls in and the FLAME ON (WHITE) lamp lights.	f. (1) None. (2) None. (3) The automatic main fuel valve(s) is energized. The valve(s) opens and the main burner is ignited. The system is in the run condition. *(If a manually opened valve is used, the main burner will not be ignited until step 7 is completed.)*
	g. When relay 3K pulls in— (1) 3K1 opens, removing power from terminal 16. (2) <u>R4138D only</u>: 3K2 closes, bypassing 1K3. Relay 1K can pull back in after a momentary power failure if 3K is still pulled in. (3) 3K3 opens, removing power from terminal 18. The FLAME OFF (RED) lamp goes out. The purge timer resets and PT2 opens, removing power from terminal 6. The PURGE COMPLETE (GREEN) lamp goes out.	g. (1) The alarm is de-energized (2) None. (3) Relay 1R drops out and 1R1 opens.
6. When the FLAME ON (WHITE) lamp lights, release the START button.	6. Normal operation, including self-checking of the flame detection system (if a self-checking system is used).	6. The ignition transformer is de-energized.
7. *Open manual main fuel valve(s) (if used).*	7. Normal operation.	7. *The main burner is ignited. The system is in the run condition.*
<u>TO STOP</u>:		
8. Push in the STOP button and hold it in until the FLAME OFF (RED) lamp lights or until all relays drop out.	8. a. Power is removed from terminal 7. b. Relay 1K drops out. 1K1 opens, removing power from terminals 19 and 20. Relay 3K drops out and the FLAME ON (WHITE) lamp goes out. c. When relay 3K drops out— (1) 3K1 closes. (2) 3K3 closes; the FLAME OFF (RED) lamp lights. d. When the flames go out, relay 2K drops out. e. All relay contacts are reset for the next startup.	8. a. *C7012E,F shutter is de-energized.* b. The pilot valve (or 1st stage oil valve) and the main fuel valve(s) are de-energized. The valves close and all flames go out. c. (1) The alarm is energized. (2) None. d. None. e. None.
9. Opens the alarm silencing switch (if used).	9. Power is removed from terminals 15 and 16.	9. The alarm is de-energized.
10. Open the master switch.	10. Power is removed from terminals L1 and 3. The plug-in amplifier is de-energized, and the FLAME OFF (RED) lamp goes out.	

(continued on next page)

SAFETY OPERATION

ABNORMAL CONDITION	R4138 OPERATION	SYSTEM OPERATION
Safe Start Check—A flame, or a condition simulating a flame, is present before the START button is pressed. *NOTE: This check does not apply if using a continuous (standing) pilot, or if using a C7012E or F Flame Detector with the jumper connected between terminals 13 and 7.*	Relay 2K pulls in when the flame (or flame-simulating condition) is detected. Contact 2K2 opens, preventing relay 1K from pulling in when the START button is pressed. • 1K1 stays open; no power can be applied to terminals 19 and 20. • Relay 3K cannot pull in; 3K1 and 3K3 remain closed. The FLAME OFF (RED) lamp remains on. The PURGE COMPLETE (GREEN) lamp may also come on.	The system cannot be started until the condition is corrected and 2K drops out. • The pilot valve (or 1st stage oil valve) and the automatic main fuel valve(s) cannot be energized. • The alarm remains energized.
The pilot (or 1st stage oil burner, is not ignited.	No flame is detected, so relay 2K does not pull in. 1. 2K2 stays closed; the LS HTR (lockout switch heater) heats until the lockout switch trips (if the START button is held in longer than the lockout switch timing). a. LS1 opens and relay 1K drops out, 1K1 opens, removing power from terminal 19. b. 2K3 stays open; power cannot be applied to terminal 20. c. Relay 3K cannot pull in; 3K1 and 3K3 remain closed. The FLAME OFF (RED) lamp remains on. 2. If the START button is released before the lockout switch trips— a. 2K1 stays open; the START station is not bypassed. When the START button is released, power is removed from terminal 7. b. Relay 1K drops out and 1K1 opens, removing power from terminal 19. c. 2K3 stays open; power cannot be applied to terminal 20. d. Relay 3K cannot pull in; 3K1 and 3K3 remain closed. The FLAME OFF (RED) lamp remains on.	The system cannot be started. The ignition transformer is de-energized when the START button is released. 1. Safety shutdown with lockout occurs. The lockout switch must be *manually* reset to try to restart the system. a. The pilot valve (or 1st stage oil valve) is de-energized, and the valve closes. b. The automatic main fuel valve(s) cannot be energized. c. The alarm remains energized. 2. Safety shutdown occurs. The START button must be *manually* pressed to try to restart the system. a. When the START button is released, the ignition transformer is de-energized. b. The pilot valve (or 1st stage oil valve) is de-energized, and the valve closes. c. The automatic main fuel valve(s) cannot be energized. d. The alarm remains energized.
The flame goes out during the run period. NOTE: Safety operation is the same if the main burner is not ignited in a system with an interrupted pilot (obtained only by the addition of external circuitry).	Relay 2K drops out. • 2K1 open, removing power from terminals 8 and 7. Relay 1K drops out and 1K1 opens, removing power from terminals 19 and 20. The FLAME ON (WHITE) lamp goes out. • Relay 3K drops out; 3K1 and 3K3 close. The FLAME OFF (RED) lamp lights.	Safety shutdown occurs. • The pilot valve (or 1st stage oil valve) and the automatic main fuel valve(s) are de-energized, and the valves close. • The alarm is energized.
A limit or interlock opens.	Power is removed from all terminals except 15. All indicator lamps go out and all relays drop out. 3K1 closes, applying power to terminal 16.	The system shuts down. All valves are de-energized, and the valves close. The alarm is energized.
Momentary power failure.	R4138C: Power is removed from all terminals, all indicator lamps go out, and all relays drop out.	The system shuts down. The alarm is energized when power is restored.

(continued on next page)

ABNORMAL CONDITION	R4138 OPERATION	SYSTEM OPERATION
Momentary power failure.	R4138D: Power is removed from all terminals, all indicator lamps go out, and all relays except 3K drop out. The charge on capacitor C1 will hold in 3K for about 1 second. • If power is restored before 3K drops out and before the pilot flame (or 1st stage oil flame) goes out— — 3K2 will stay closed, bypassing 1K3; 3K1 and 3K3 will stay open. — relay 2K will pull back in; 2K1 and 2K3 will close, and 2K2 will open. — the START station will be bypassed through 2K1, the STOP station, and the alarm silencing switch. — power will be reapplied to terminal 7. — relay 1K will pull back in through LS1 and 3K2. — operation will return to normal. • If 3K drops out before power is restored— — 3K2 will open, so 1K3 will not be bypassed; 3K1 and 3K3 will close. — relay 1K cannot pull back in since both 1K3 and 3K2 are open. — 1K1 stays open, so 3K cannot pull back in. — the FLAME OFF (RED) lamp will light when power is restored. • If the pilot flame (or 1st stage oil flame) goes out before power is restored, — relay 2K cannot pull back in, so 2K1 stays open. — the START station cannot be bypassed. — power will *not* be reapplied to terminal 7. — relay 1K cannot pull back in. — relay 3K will drop out; 3K1 and 3K3 will close. — the FLAME OFF (RED) lamp will light when power is restored.	• If power is restored within 1 second and the pilot flame (or 1st stage oil flame) is still burning (the valve must be slow closing), normal operation will be resumed. The alarm will not be energized. If the main burner flame has gone out, it will be reignited by the pilot flame. (Power failure override circuits may have to be added to the pilot valve and main valve(s) to ensure that they do not close on a momentary power interruption.) • The system shuts down. All valves are de-energized, and the valves close. The alarm is energized when power is restored. • The system shuts down. All valves are de-energized, and the valves close. The alarm is energized when power is restored.
IF USING A SELF-CHECKING FLAME DETECTION SYSTEM: The flame detection system fails while the system is turned off or during the purge period.	Relay 2K cannot pull in when the system is started-same operation as if the pilot (or 1st stage oil burner) is not ignited.	Safety shutdown occurs. Lockout will occur if the START button is held in longer than the lockout switch timing.
The flame detection system fails during the run period with the burner firing.	Relay 2K drops out—same operation as if the flame goes out.	Safety shutdown occurs.