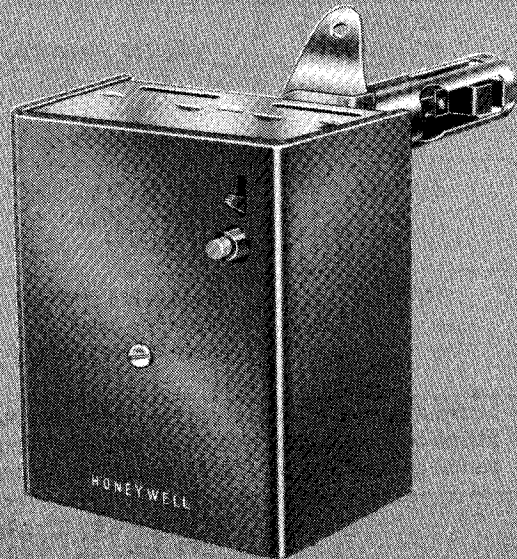


# Honeywell

## PROTECTORELAY OIL BURNER CONTROLS

THESE ONE-PIECE, STACK-MOUNTED OIL BURNER PRIMARY CONTROLS CYCLE THE BURNER ON THERMOSTAT DEMAND AND SHUT DOWN THE BURNER ON FLAME LOSS OR SYSTEM MALFUNCTION.

- Combine a Protectorelay unit for cycling the burner and a Pyrostat flame detector for sensing temperature changes of flue gases up to 1000° F [556° C].
- RA116A is used with intermittent ignition burners (formerly called constant ignition burners).
- RA117A and RA817A are used with interrupted ignition burners (formerly called intermittent ignition burners).
- Used with line voltage or 24V controllers.
- Safety switch may be manually tripped on all models.
- On RA116A, lockout occurs if flame is not re-established during safety switch timing.
- On RA117A and RA817A, flame or power failure is followed by a one minute (approximate) scavenging period and one attempt to re-establish flame. Lockout occurs if flame is not re-established.
- Manual reset of safety switch is required after ignition failure completely shuts off main burner.



**RA116A  
RA117A  
RA817A**

# SPECIFICATIONS

## — IMPORTANT —

THE SPECIFICATIONS GIVEN IN THIS PUBLICATION DO NOT INCLUDE NORMAL MANUFACTURING TOLERANCES. THEREFORE, UNITS MAY NOT MATCH THE LISTED SPECIFICATIONS EXACTLY. ALSO, PRODUCTS ARE TESTED AND CALIBRATED UNDER CLOSELY CONTROLLED CONDITIONS, AND SOME MINOR DIFFERENCES IN PERFORMANCE CAN BE EXPECTED IF THOSE CONDITIONS ARE CHANGED.

### SUPER TRADELINE MODELS

SUPER TRADELINE controls offer features not available on TRADELINE or standard models, and are designed to replace a wide range of Honeywell and competitive controls.

SUPER TRADELINE MODELS AVAILABLE:  
RA117A Stack Mounted Protectorelay  
Special SUPER TRADELINE packaging with cross reference label and SUPER TRADELINE instruction sheet.

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RA116A Stack Mounted Protectorelay  
Special TRADELINE packaging with cross reference label and TRADELINE instruction sheet.

### STANDARD MODELS

MODEL NUMBER	TYPE OF IGNITION	24V THERMOSTAT	IGNITION RATING	INPUT VOLTAGE
RA116A	Intermittent ignition <sup>a</sup> (formerly called constant ignition)	2-wire 3-wire series 10	360 VA	120V/60Hz
RA117A	Interrupted ignition <sup>b</sup> (formerly called intermittent ignition)	2-wire 3-wire series 10	550 VA	120V/60 Hz
RA817A	Interrupted ignition <sup>b</sup> (formerly called intermittent ignition)	2-wire	550 VA	110V/50 Hz 120V/60 Hz 220V/50 Hz 240V/60 Hz

<sup>a</sup> Lockout occurs if flame is not re-established during the safety switch timing.

<sup>b</sup> Flame or power failure is followed by a one minute (approximate) scavenging period and one attempt to re-establish the flame. Lockout occurs if flame is not re-established.

## ORDERING INFORMATION

FOR ORDERING INFORMATION WHEN PURCHASING REPLACEMENT AND MODERNIZATION PRODUCTS FROM YOUR TRADELINE WHOLESALER OR YOUR DISTRIBUTOR, REFER TO THE TRADELINE CATALOG OR PRICE SHEETS FOR COMPLETE ORDERING NUMBER, OR SPECIFY:

1. Order number. TRADELINE or SUPER TRADELINE.
2. Input voltage and frequency.

IF YOU HAVE ADDITIONAL QUESTIONS, NEED FURTHER INFORMATION, OR WANT TO COMMENT ON OUR PRODUCTS OR SERVICES, PLEASE WRITE OR PHONE:

1. YOUR LOCAL HONEYWELL RESIDENTIAL AND BUILDING CONTROLS DIVISION SALES OFFICE (CHECK WHITE PAGES OF PHONE DIRECTORY).
2. RESIDENTIAL AND BUILDING CONTROLS CUSTOMER SATISFACTION  
HONEYWELL INC., 1885 DOUGLAS DRIVE NORTH  
MINNEAPOLIS, MINNESOTA 55422-4386  
(612) 542-7500

IN CANADA: HONEYWELL CONTROLS LIMITED  
740 ELLESMERE ROAD  
SCARBOROUGH, ONTARIO M1P 2V9

INTERNATIONAL SALES AND SERVICE OFFICES IN ALL PRINCIPAL CITIES OF THE WORLD.

**AMBIENT TEMPERATURE:**

Operating: 0° F to 104° F [-18° C to 40° C].

Shipping: -40° F to 150° F [-40° C to 66° C].

**DIMENSIONS:** Refer to Fig. 1.

**ELECTRICAL RATINGS (amperes):**

	Motor Ratings	
	110V/50 Hz 120V/60 Hz	220V/50 Hz 240V/60 Hz
Full Load	7.4	3.7
Locked Rotor	44.4	22.2

**ELEMENT INSERTION LENGTH:**

Adjustable from 3-1/2 to 5-1/2 inches [89 to 140 millimeters].

**MOUNTING FLANGE:**

Available for 6 inch [152 millimeter] diameter pipe (refer to Fig. 2). Can also be flattened for flat-mounting applications.

24V THERMOSTAT HEAT ANTICIPATOR CURRENT: 0.4A.

LINE VOLTAGE THERMOSTAT OR CONTROLLER (RA116A, RA117A): 2 wire, 8A. Requires jumper across W and B terminals. Refer to Fig. 5 or 7.

SAFETY SWITCH TIMING: 75 Seconds (nominal).

**APPROVALS:**

UNDERWRITERS LABORATORIES INCORPORATED LISTED (RA116A, RA117A ONLY): File Number MP268, Guide Number MCCZ.

## COMPETITIVE CROSS-REFERENCE

The RA116A replaces the following competitive devices:

HONEYWELL	WHITE RODGERS	GENERAL ELECTRIC	GENERAL PERFEX
R116A,B	603	A101B2	5200
R124A,B	611-1	CR7865	5300
R134A	611-31		
R168A	611-33		
R494A	615		
RA116A,B	6L18		
RA416A			
RA816A,D <sup>b</sup>			

PENN	ITT GENERAL	MERCOID	DETROIT
664	5200	JM	CA701 <sup>a</sup>
670	R96A102A		CA702 <sup>a</sup>
680	R96G102DC		

<sup>a</sup> A Detroit 3-wire thermostat must be replaced by a 2-wire thermostat with a suitable heat anticipator.

<sup>b</sup> When replacing a model having an F or O terminal to power a clogged filter indicator light, provide a separate transformer for the light.

The RA117A replaces the following competitive devices:

HONEYWELL	WHITE RODGERS	GENERAL ELECTRIC	GENERAL PERFEX
R116A,B	602	A101A2	5200
R117A	603	A101B2	5230
R123A,B	610-2	CR7856	5520
R124A,B	610-32		5525 <sup>c</sup>
R134A	611-1		
R168A	611-31		
R494A	615		
RA116A,B	6L18		
RA117A			
RA416A			
RA816A			
RA817A,C			
RA817A,C <sup>b,c</sup>			

DELCO	PENN	ITT GENERAL	MERCOID	DETROIT
COA	664	5200	JM	CA701 <sup>a</sup>
COA-1	670	R96A102A	JM1	CA702 <sup>a</sup>
	672	R96G102DC		
	680			
	682			

<sup>a</sup> A Detroit 3-wire thermostat must be replaced by a 2-wire thermostat with a suitable heat anticipator.

<sup>b</sup> When replacing a model having an F or O terminal to power a clogged filter indicator light, provide a separate transformer for the light.

<sup>c</sup> Do not use RA117A to replace this control where timed ignition is required for a wall-flame burner.

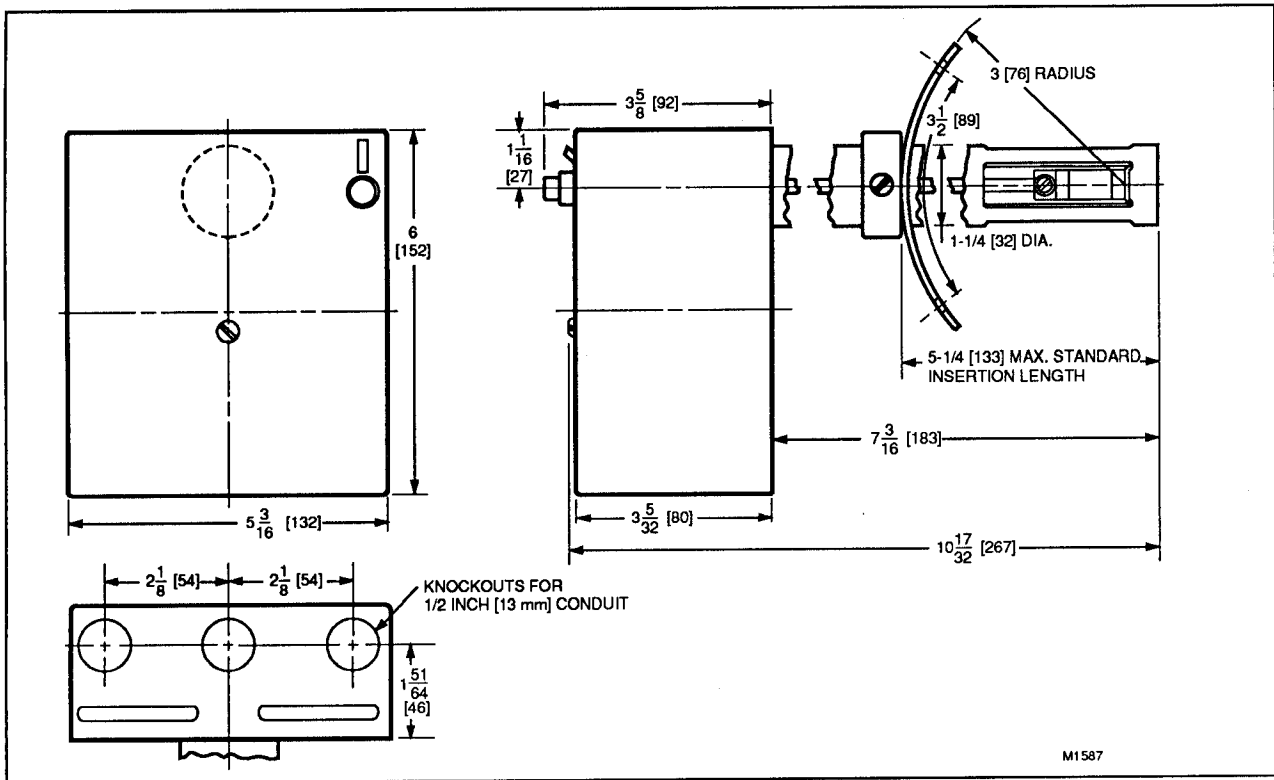


FIG. 1—INSTALLATION DIMENSIONS IN INCHES AND [MILLIMETERS].

## INSTALLATION

### WHEN INSTALLING THIS PRODUCT...

1. Read these instructions carefully. Failure to follow them could damage the product or cause hazardous condition.
2. Check the ratings given in these instructions and on the product to ensure the product is suitable for your application.
3. Ensure the installer is a trained, experienced service technician.
4. After completing installation, use these instructions to check product operation.

### CAUTION

1. Do not bend contact arms or stops on the Pyrostat detector mechanism or make any adjustments other than those given in the instructions.
2. Remove the cardboard packing behind the drive shaft lever by pushing the packing up and pulling it straight out over the top of the lever. Do not remove packing by pulling sideways.
3. Ensure all wiring complies with applicable codes and ordinances.

### MOUNTING (Refer to Fig. 2)

Follow the mounting instructions supplied by the furnace, boiler, or burner manufacturer, if available. Otherwise, use the instructions provided below.

When replacing one of the controls listed on page 3, identify each leadwire as it is removed from the old control by marking the wire with the number of the RA116A or RA117A terminal to which it will be connected. Refer to Table 1 and 2 to translate the old terminal identifications to the new RA116A or RA117A terminal identifications.

TABLE 1—IDENTIFYING TERMINALS FOR RA116A REPLACEMENT.

TERMINAL IDENTIFICATION ON OLD CONTROL	TERMINAL IDENTIFICATION ON NEW RA116A
1, LH, or HOT LINE	1
2, LG, or LINE	2
3, 4, M, or MOTOR	3

TABLE 2—IDENTIFYING TERMINALS FOR RA117A REPLACEMENT.

TERMINAL IDENTIFICATION ON OLD CONTROL	TERMINAL IDENTIFICATION ON NEW RA117A
1, LH, or HOT LINE	1
2, LG, or LINE	2
3, M, or MOTOR	3
4, I, or IGNITION	4

If the position of the old control was satisfactory, install the new RA116A or RA117A in the same location as the old one, making sure to insert the bimetal element the same distance into the stack as the old element. If the old element was inserted more than 5-1/2 inches [140 millimeters], insert the new control 5-1/2 inches [140 millimeters] into the stack.

If the position of the old control was not satisfactory, close the old holes tightly with a metal plate and follow these instructions.

1. Follow these location considerations.

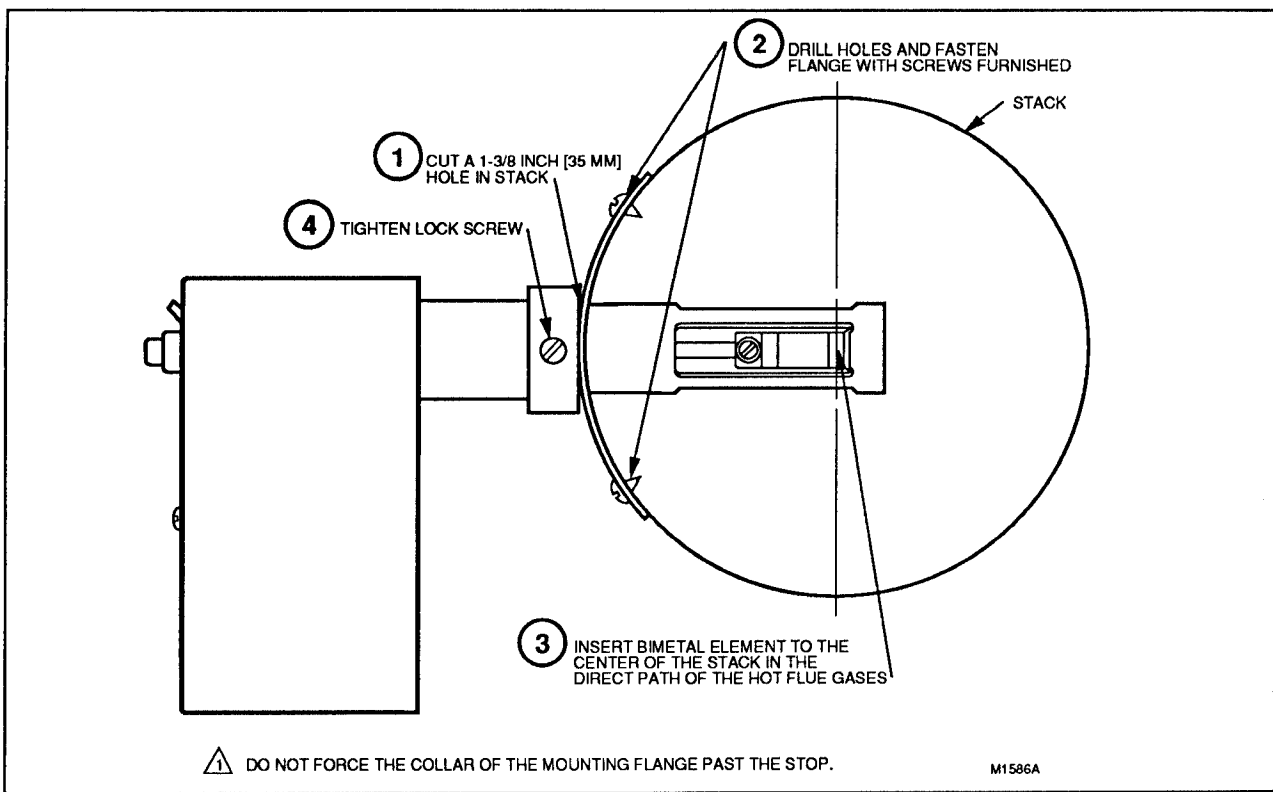


FIG. 2—MOUNTING AND LOCATION CONSIDERATIONS.

- Locate the control between the boiler or furnace and draft regulator.
- Locate the control as near as possible to the boiler or furnace.
- If mounting in an elbow, locate the element near the outer curve where the hottest gases flow.
- Do not locate the element where the temperature may exceed 1000° C [556° C].

2. Cut a 1-3/8 inch [35 millimeter] hole in the stack at the location desired.

3. Drill two holes and fasten the mounting flange using the screws provided. The flange should fit the mounting surface snugly, but it may be bent to fit a different radius stack or flattened to fit a flat surface. Do not force the collar or mounting flange past the stop.

4. Insert the bimetal element at the center of the stack in direct path of the hottest flue gases.

5. Tighten the lockscrew.

#### WIRING

Follow the appliance manufacturer's instructions, if available. Otherwise, follow the wiring diagrams shown in Fig. 3 through 7.

#### WIRING DIAGRAMS

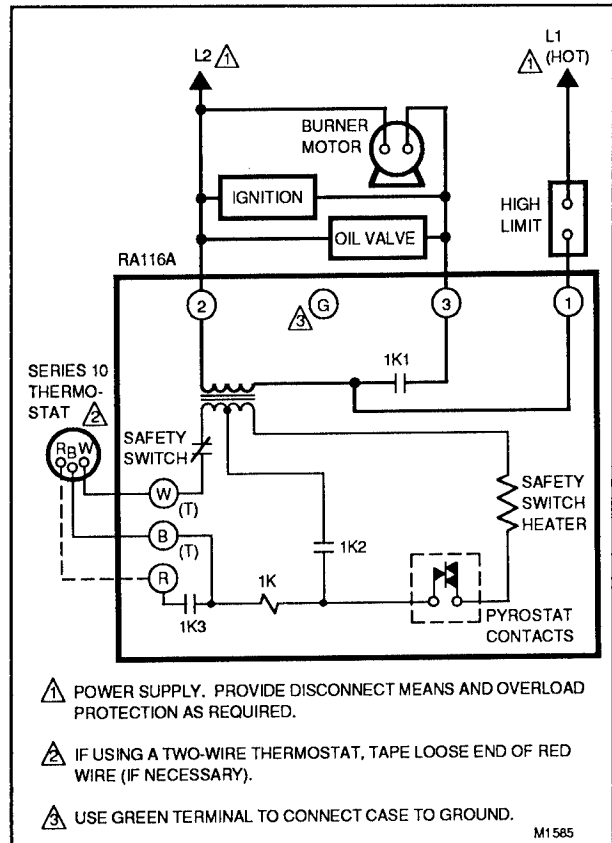


FIG. 3—RA116A WIRING DIAGRAM WITH A 24V, 3-WIRE THERMOSTAT.

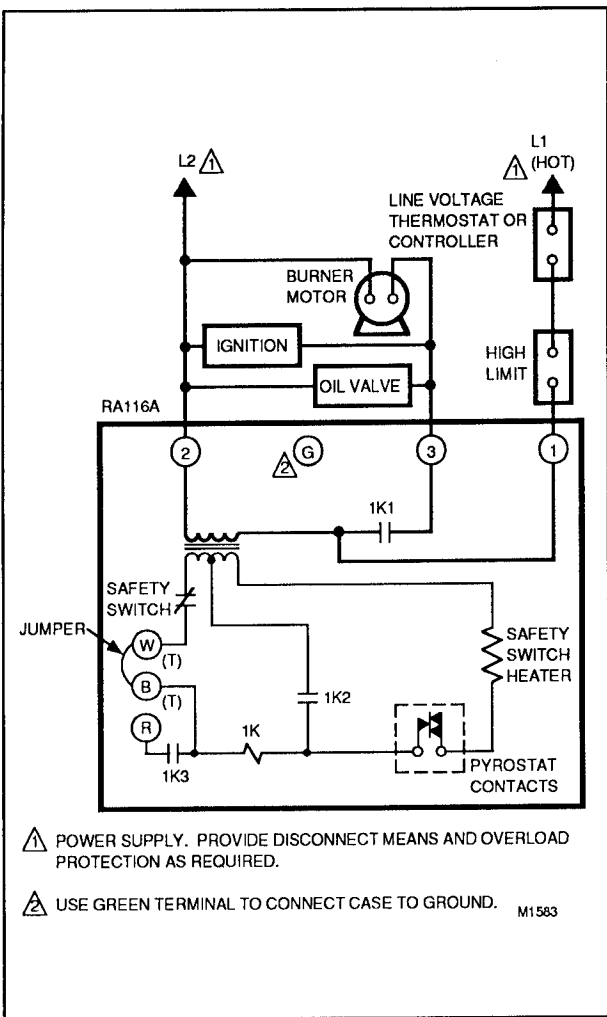


FIG. 4—RA116A WIRING DIAGRAM WITH A LINE VOLTAGE THERMOSTAT OR CONTROLLER.

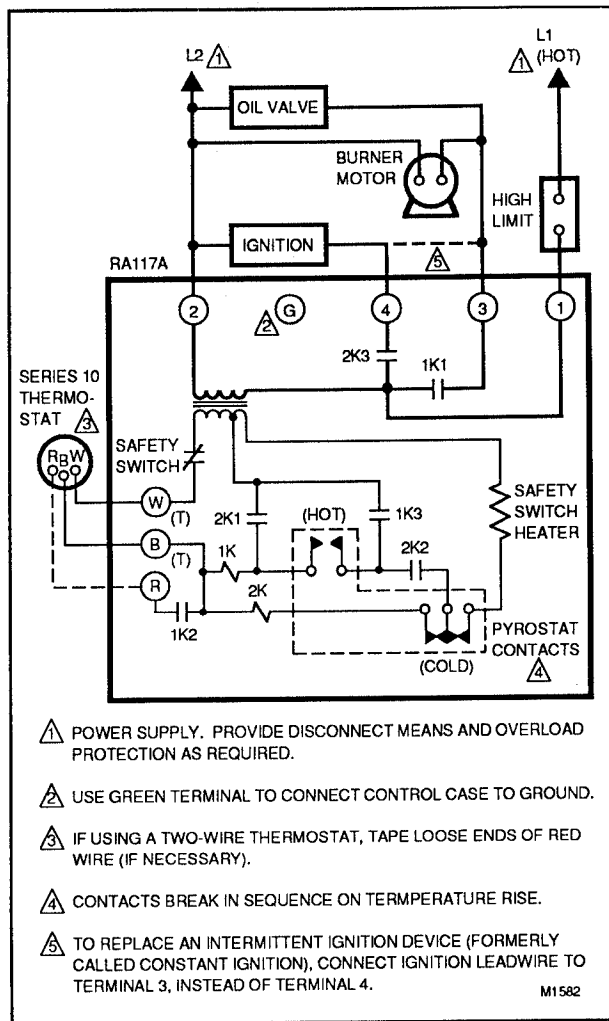


FIG. 5—RA117A WIRING DIAGRAM WITH A 24V, 3-WIRE THERMOSTAT.

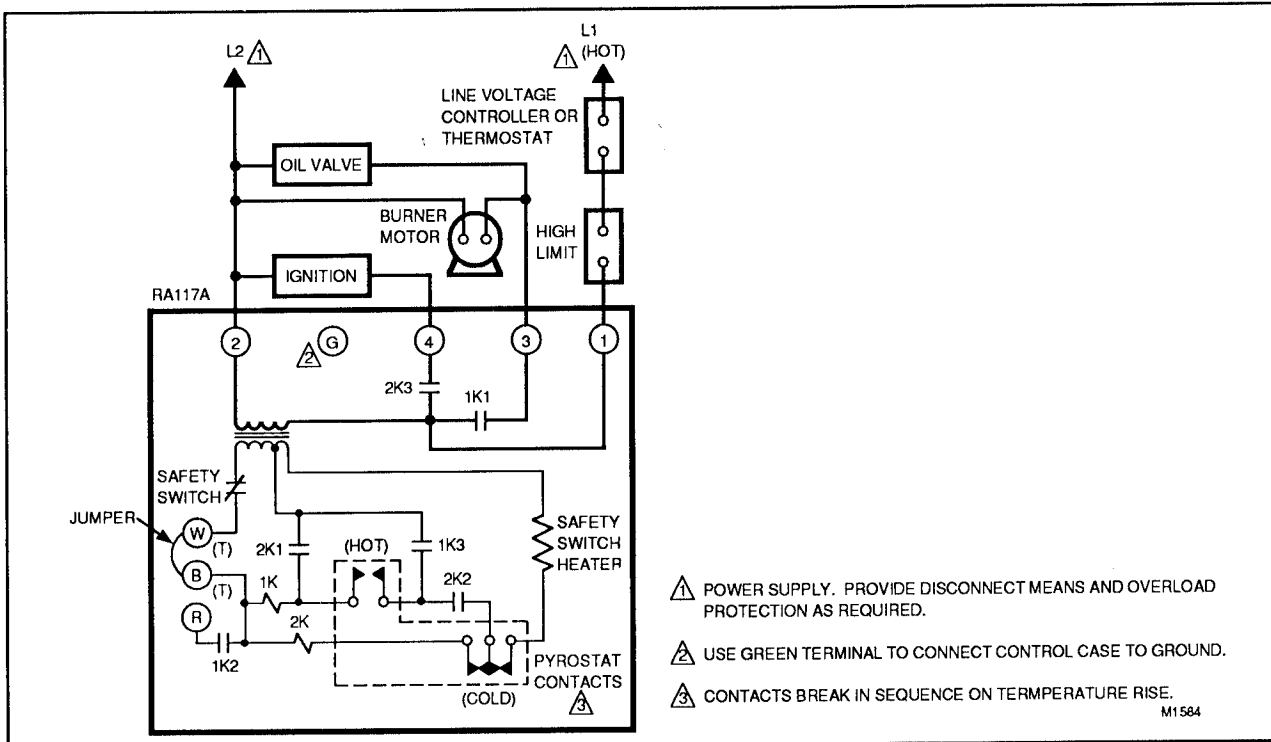
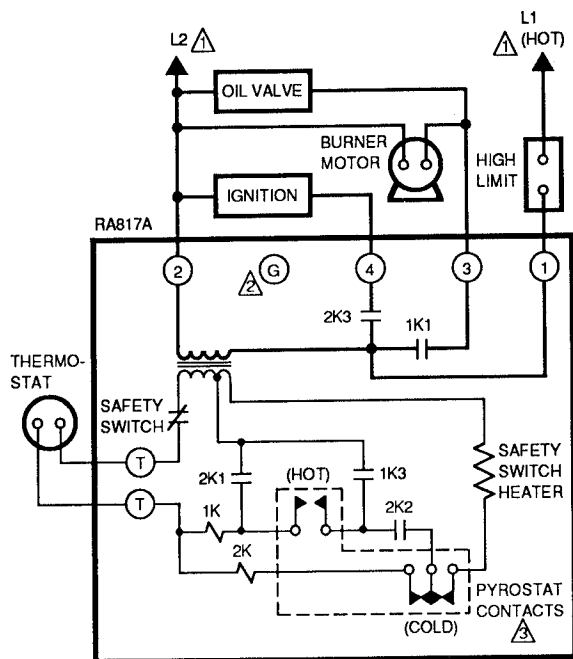


FIG. 6—RA117A WIRING DIAGRAM WITH A LINE VOLTAGE THERMOSTAT OR CONTROLLER.



△ POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.

△ USE GREEN TERMINAL TO CONNECT CASE TO GROUND.

△ CONTACTS BREAK IN SEQUENCE ON TEMPERATURE RISE.

M1581

FIG. 7—RA817A WIRING DIAGRAM.

## OPERATION

The schematic diagrams show all systems in the idle condition:

- Burner off, no call for heat.
- Pyrostat contacts closed (RA116A).
- "Cold" contacts closed, "hot" contacts open (RA117A, RA817A).
- Safety switches closed.
- All relays de-energized.

### NORMAL OPERATING SEQUENCE

On a thermostat (or line voltage controller) call for heat, the ignition, oil valve, and burner motor start. The safety switch begins heating. After the burner flame is established, the stack temperature rises and expands the bimetal detector element. The Pyrostat contacts open (RA116A) or the "hot" contacts close and the "cold" contacts open (RA117A, RA817A), de-energizing the safety switch heater. The ignition circuit de-energizes (RA117A, RA817A only).

When the call for heat is satisfied, the system returns to the idle condition.

### IGNITION FAILURE

If the burner flame is not established within approximately 75 seconds (nominal) of a thermostat (or line voltage controller) call for heat, the Pyrostat contacts (RA116A) or "cold" contacts (RA117A, RA817A) remain closed. During that time, the safety switch is heated. If the burner flame is not established after 75 seconds (nominal), the system locks out and cannot be started again until the safety switch is manually reset.

### BURNER FLAME FAILURE DURING THE RUNNING CYCLE

#### RA116A

The loss of burner flame reduces the stack temperature, closes the Pyrostat contacts, and energizes the safety switch. If the burner flame is not re-established within the 75 second (nominal) safety switch timing, the system locks out and cannot be started again until the safety switch is manually reset.

#### RA117A, RA817A

The loss of burner flame reduces the stack temperature, opens the "hot" contacts, and shuts the system down by de-energizing the 2K burner motor relay. After a one minute (approximate) scavenging period, the "cold" contacts close and energize the safety switch heater. If the thermostat (or line voltage controller) is still calling for heat, the Protectorelay control makes one attempt to restart the system. If the burner flame is not re-established in 75 seconds (nominal), the system locks out and cannot be started again until the safety switch is manually reset.

### POWER FAILURE DURING THE RUNNING CYCLE

A power failure shuts off the ignition and burner motor. If the thermostat is still calling for heat when power is restored, the stack temperature must cool and return the system to the idle position. Once the system returns to the idle condition, it begins the normal operating sequence.

# STARTUP AND CHECKOUT

## WARNING

### FIRE HAZARD CAN CAUSE SEVERE BURNS

Ensure the combustion chamber is free of oil or oil vapor before starting system.

### STEP THE PYROSTAT DETECTOR CONTACTS

The detector contacts are actuated by a friction clutch that is mounted on a rod connected directly to the heat-actuated element. Occasionally, this clutch gets "out of step" after a long period of idleness. To place the clutch and the contacts "in step,"

1. Remove the cover.
2. Pull the lever forward 1/4 inch (Fig. 8).
3. Slowly release the lever.
4. Replace the cover.

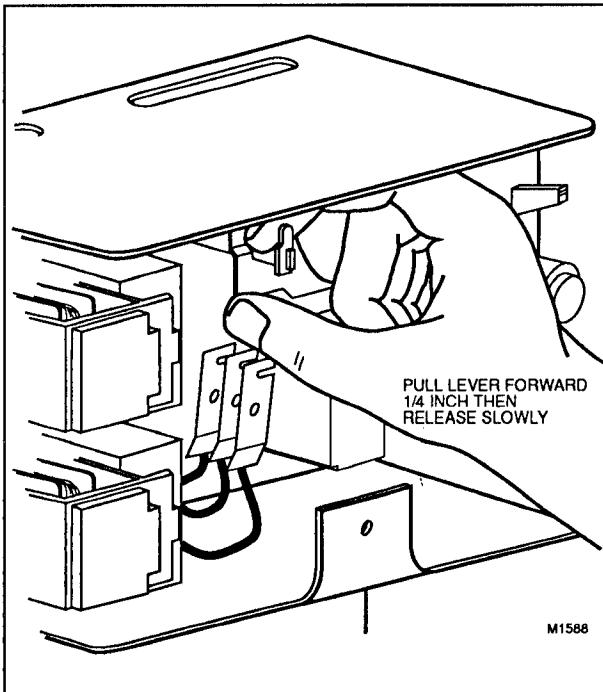


FIG. 8—STEPPING THE PYROSTAT DETECTOR CONTACTS.

### START THE SYSTEM

1. Ensure the Pyrostat detectors are in step.
2. Push in and release the safety switch reset button.
3. Open the hand valve in the oil supply line.
4. Set the limit control and thermostat to call for heat.
5. Close the line switch. The burner should start.

### CHECK THE SAFETY FEATURES

#### Simulate Flame Failure:

1. Follow the starting procedure to turn on the burner.
2. Close the hand valve in the oil supply line.
3. The RA116A locks out after 75 second (nominal) safety switch timing. The RA117A and RA817A lock out after one minute (approximate) scavenging period and 75 second (nominal) safety switch timing.
4. Reset the safety switch and open the hand valve in the oil supply line.

#### Simulate Ignition Failure:

1. Follow the starting procedure to turn on the burner, except do not open the oil supply hand valve.
2. Safety switch locks out after 75 second (nominal) safety switch timing. Ignition and burner motor stops and oil valve closes.
3. Reset the safety switch and open the hand valve in the oil supply line.

#### Simulate Power Failure:

1. Follow the starting procedure to turn on the burner.
2. With the burner running, trip the circuit breaker or remove the fuse to turn off power to the system. The burner should stop.
3. Restore power. The burner should restart.

#### Check the Scavenger Timing:

1. Follow the starting procedure to turn on the burner.
  2. With the burner operating normally, open and immediately close the line switch. The burner should stop immediately.
  3. After recycle timing (one minute approximately), the burner should restart automatically.
- If the system does not operate as described, proceed to Troubleshooting.



# TROUBLESHOOTING AND MAINTENANCE

To completely troubleshoot an oil burner installation, check the burner, ignition transformer, and oil primary control for proper operation and condition.

## TRIP SAFETY SWITCH BEFORE OPERATING BURNER MAINTENANCE

### CAUTION

Tripping the safety switch shuts down the burner but does not disconnect the power supply. Turn off the power at the system switch or the circuit breaker before servicing the control system, burner motor, oil valve, or ignition to avoid electrical shock.

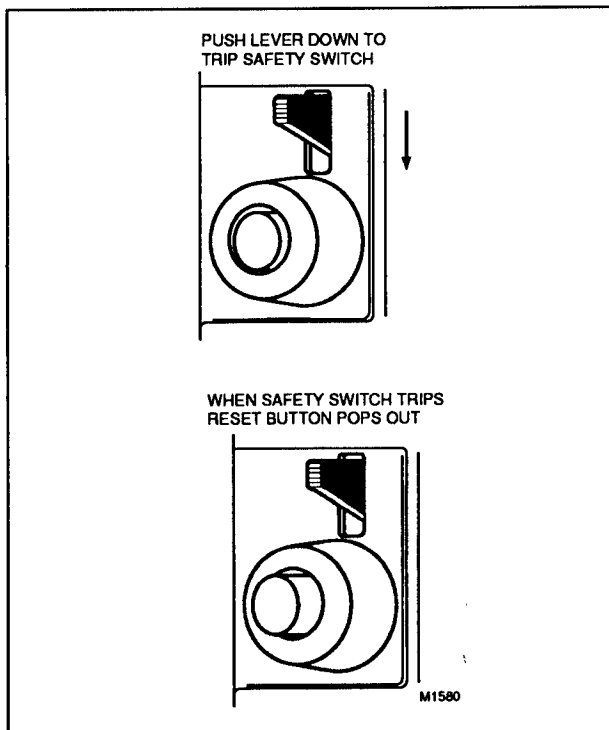


FIG. 9—TRIPPING AND RESETTING THE SAFETY SWITCH.

To trip the safety switch, move the safety switch lever down until the red reset button pops out. Refer to Fig. 9. The burner will not operate until the safety switch is reset by pushing the red reset button.

### PRELIMINARY STEPS

Before checking the oil primary and cad cell, check out the following parts of the burner and ignition systems. Repair or replace controls as indicated.

1. Wiring connections, power supply, and burner motor fuse. Ensure power is on to the controls, burner motor, and ignition transformer.
2. Limit switch.
3. Ignition transformer.
4. Electrode gap and position.
5. Contacts between ignition transformer and electrode.
6. Oil pump pressure.
7. Oil tubing to tank.
8. Oil nozzle.
9. Oil supply.
10. Oil filter.

If the system is still not operating properly, check the oil primary control as instructed below.

### CHECK THE OIL PRIMARY CONTROL

### CAUTION

Since troubleshooting is done with the system powered, observe all necessary precautions to prevent electrical shock or equipment damage.

### Equipment Required:

1. Screwdriver
2. 0 to 300 Vac Voltmeter
3. Insulated Jumper Wires
4. Hard Surface Card (such as a business card) for cleaning contacts

**Burner Does Not Start When Thermostat Calls For Heat**

**PRELIMINARY CHECKS**

1. Ensure all limit switches are closed.
2. Ensure safety switch is reset.
3. Check for the proper line voltage at the oil primary.

Proceed as follows after completing the preliminary checks.

PROCEDURE	CORRECTIVE ACTION	
	BURNER STARTS	BURNER DOES NOT START
1. Jumper the thermostat terminals: <ul style="list-style-type: none"> <li>• Low voltage thermostat at oil primary</li> <li>• Line voltage thermostat at thermostat</li> </ul>	Trouble in the thermostat circuit. Check the thermostat and wiring connections.	Trouble is in the bimetal detector or the oil primary. Put contacts in step by pulling drive shaft lever out 1/4 inch and releasing. Refer to Fig. 8.
2. Jumper thermostat terminals to start burner.	Bimetal detector and oil primary are OK.	Clean the bimetal detector contacts and timer contacts (if provided). Go to step 3.
3. Jumper thermostat terminals to start burner.	Bimetal detector and oil primary are OK.	Go to step 4.
4. Jumper the thermostat terminals and jumper the normally closed contacts.	Reclean the bimetal detector contacts again and recheck by jumpering the thermostat terminals. If the burner starts, bimetal detector and oil primary are OK.	Go to step 5.
5. Jumper the thermostat terminals and jumper the R and B terminals on the oil primary.	Check for broken wires, loose connections between the bimetal detector and the control. Repair and recheck by jumpering the thermostat terminals. Replace the bimetal detector if necessary.	Replace the oil primary and perform Startup and Checkout procedures.

**Burner Starts, Flame is Established. Then Safety Switch Locks Out on Safety.**

**PRELIMINARY STEPS:**

1. Reset the safety switch.
2. Clean bimetal detector contacts.

Proceed as follows after completing the preliminary checks.

PROCEDURE	CORRECTIVE ACTION	
	BURNER KEEPS RUNNING	BURNER LOCKS OUT
1. Jumper thermostat terminals to start burner. <ul style="list-style-type: none"> <li>• Low voltage thermostat at oil primary</li> <li>• Line voltage thermostat at thermostat</li> </ul>	Bimetal detector and oil primary are OK.	<ul style="list-style-type: none"> <li>• Clean the drive shaft, remove the detector and clean bimetal element. Replace the detector.</li> <li>• Check the detector location. If the stack temperature is below 300° F [149° C], replace the bimetal detector.</li> </ul>
2. Reset the safety switch and jumper the thermostat terminals to start the burner.	Bimetal detector and oil primary are OK.	Replace the oil primary and perform Startup and Checkout procedures.

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