

# RA890G Protectorelay™ Primary Control

*The RA890G Protectorelay™ control provides solid state electronic safeguard protection for industrial and commercial gas, oil, or combination gas-oil burners.*



- Designed for interrupted ignition with intermittent pilot for gas burners, and for interrupted or intermittent ignition on oil burners.
- Used only with a C7027, C7035, or C7044 Mini-peeper Ultraviolet Flame Detector.
- Either a line voltage or low voltage controller can be used.
- Solid state circuitry eliminates warmup and increases resistance to vibration.
- Push-to-reset safety switch button is in dust-resistant enclosure.
- Safe start check prevents start if flame or flame simulating failure is present.

- Automatic safety switch lockout if flame fails on start or if flame is not re-established after a flame failure.
- When limit control opens, control de-energizes ignition and fuel valves, but safety switch lockout will not occur.
- Test jack permits readings of flame signal.
- Easy mounting and removal through use of captive mounting screws. Durable thermosplastic mounting base.
- -40°F (-40°C) approved model available.

## CONTENTS

<i>Specifications</i> .....	2
<i>Ordering Information</i> .....	2
<i>Installation</i> .....	3
<i>Operation And Checkout</i> .....	5
<i>Service</i> .....	8
<i>Troubleshooting</i> .....	9



# Specifications

## TRADELINE® MODELS

TRADELINE® models are selected and packaged to provide ease of stocking, ease of handling, and maximum replacement value. TRADELINE® model specifications are the same for standard models except as noted below. TRADELINE® MODELS AVAILABLE: RA890G Protectorelay™ Primary Control—120 Vac, 50/60 Hz.

## STANDARD MODELS

**MODEL:** RA890G Protectorelay™ Primary Control.  
**VOLTAGE AND FREQUENCY:** 120V, 208V, 220V, 240V; 50/60 Hz models.  
**VOLT-AMPERE RATING:**  
 60 Hz: 14 VA maximum, 12 VA standby.  
 50 Hz: 18 VA maximum, 17 VA standby.  
**POWER CONSUMPTION:**  
 60 Hz: 9.5W maximum, 3W standby.  
 50 Hz: 10W maximum, 4W standby.  
**FLAME FAILURE RESPONSE TIME:** 0.8 or 3 seconds (nominal; separate models). 3 second response time recommended for nonrecycling cutoff system.  
**FLAME ESTABLISHING PERIOD:** Up to 15 seconds (nominal).  
**RECYCLE TIME:** Occurs immediately when flame loss is recognized. See Flame Failure Response Time.  
**SAFETY SWITCH TIMING (LOCKOUT TIMING):** 15 seconds. Timings are proportional with input voltages and temperatures. For RA890 classified in Underwriters Laboratories Inc gas groups 6 and 6a and oil group 8, the maximum safety switch timing with voltages ranging from 70 to 110 percent of rated voltage and with ambients ranging from 32°F (0°C) to 115°F (66°C) are allowed to be as high as 50 seconds.  
**DIMENSIONS (Including Subbase):** Approximately 5 x 5 x 5 (127 x 127 x 122 mm).  
**AMBIENT TEMPERATURE RATING:**  
**MINIMUM:** Models with 15 second safety switch: -20°F (-29°C).

**MAXIMUM:** Models without alarm contacts:

50 Hz: 115°F, 46°C.

60 Hz: 125°F, 52°C.

Models with alarm contacts:

50 Hz: 105°F, 41°C.

60 Hz: 115°F, 46°C.

**ALARM CONTACTS (Optional):** Isolated spdt contacts.

Alarm terminals are male quick-connects (female quick-connects included for field installation). See rating above.

**FLAME DETECTOR:** C7027, C7035 or C7044 Ultraviolet Flame Detector.

**MOUNTING:** Q270A Universal Mounting Base (ordered separately).

**ELECTRICAL RATINGS:**

Terminal	Electrical Load		120 Vac	240 Vac
			3	Burner Motor
	Locked Rotor	31.2A	15.6A	
	Ignition <sup>a</sup>	3.0A	1.5A	
	Pilot Fuel Valve	25VA	25VA	
4	Ignition <sup>a</sup>		3.0A	1.5A
5	Main Valve (Pilot Duty)		125VA	125VA
	Alternate Rating: 25 VA pilot duty plus one or more motorized valves with total rating of 400 VA opening, 200 VA holding.			

<sup>a</sup> If ignition and motor are connected to terminal 3, terminal 4 cannot be used. This prevents overloading relay 1K.

Alarm Contacts: 3.0 A at 24 Vac, or 75 VA pilot duty at 120 Vac in suitable wiring enclosure.

Low Voltage Control Circuit (T-T): 0.17A.

**NOTE:** Allowable inrush can be up to ten times the pilot duty rating.

## Ordering Information

When purchasing replacement and modernization products from your TRADELINE® wholesaler or distributor, refer to the Tradeline Catalog or price sheets for complete ordering number, or specify—

1. Order number specify TRADELINE®, if desired.
2. Voltage and frequency.
3. Flame response time.
4. Alarm contacts, if desired.
5. Accessories, if desired.

If you have additional questions, need further information, or would like to comment on our products or services, please write or phone:

1. Your local Home and Building Control Sales Office (please check the white pages of your phone directory).
2. Home and Building Control Customer Logistics  
Honeywell Inc., 1885 Douglas Drive North  
Minneapolis, Minnesota 55422-4386

In Canada—Honeywell Limited/Honeywell Limitée, 35 Dynamic Drive, Scarborough, Ontario M1V 4Z9. International Sales and Service Offices in all principal cities of the world. Manufacturing in Australia, Canada, Finland, France, Germany, Japan, Mexico, Netherlands, Spain, Taiwan, United Kingdom, U.S.A.

EXAMPLE: Pilot duty rating = 25 VA.  
 At 120V, running current is  $25 \div 20 = 0.21A$ .  
 Maximum allowable inrush is 10 times 0.21 = 2.1A.

UNDERWRITERS LABORATORIES INCLISTED: 120V models only: File no. MP268, Guide no. MCCZ.

NOTE: All devices meeting UL component recognition bear the following symbol: 

Canadian Standards Associated Certified: 120 V models only: File no. LR9S329  
 Factory Mutual Approved: Report no. 22013.

American Gas Association Design Certified For -20°F (-29°C). Certificate no. 20-6b.

**ACCESSORIES:**

- Models with 15 second safety switch: -20F (-29°C).
- W136A Microammeter.
- 123514B Flame Simulator.
- 196146 Meter Connector Plug.
- FSP1535 Test Panel: For operational check of the RA890E,F,G,H,J or the R4795.
- 118702E Remote Reset Cover Assembly.
- 202471A Cover Assembly with reset button.

# Installation



## CAUTION

Ultraviolet sensing tubes have a life expectancy of 40,000 hours of continuous use within the ambient temperature and voltage ratings. Worn out ultraviolet sensing tubes result in failure of the sensing tube to properly discriminate between flame conditions.

Systems using the RA890G with the C7027, C7035 and C7044 Flame Detectors should only be used on burners that cycle On and Off at least once every 24 hours. Appliances with burners that remain on for 24 hours continuously or longer should use the C7012E Flame Detector with the R7247C Amplifier or the C7076A Flame Detector with the R7476A Amplifier as the ultraviolet flame detection system.

### WHEN INSTALLING THIS PRODUCT...

1. Read these instructions carefully. Failure to follow them could damage the product or cause a hazardous condition.
2. Check the ratings given in the instructions and on the product to make sure the product is suitable for your application.
3. Installer must be a trained, experienced flame safeguard control technician.
4. After installation is complete, check out product operation as provided in these instructions.



## CAUTION

1. Disconnect power supply before beginning installation to prevent electrical shock and equipment damage. All wiring must comply with applicable local electrical codes, ordinances, and regulations.
2. Limits must be rated to carry and break current to the ignition transformer, pilot valve (or first stage oil valve), and main fuel valve(s) simultaneously.
3. All external timers must be Listed or Component Recognized by authorities that have jurisdiction for the specific purposes for which they are used.

Follow the burner manufacturer instructions when supplied; otherwise, proceed as follows.

### LOCATION

#### Temperature

Install the RA890G where the surrounding temperatures remain within the ambient Operating Temperature Ratings listed in the SPECIFICATIONS section.

#### Humidity

Install the RA890G where the relative humidity never reaches the saturation point. Condensation of moisture on the RA890G may cause enough leakage to short the flame signal to ground and prevent the burner from starting.

#### Vibration

Do not install the RA890G where it could be subject to excessive vibration. Vibration shortens the life of the electronic components.

#### Weather

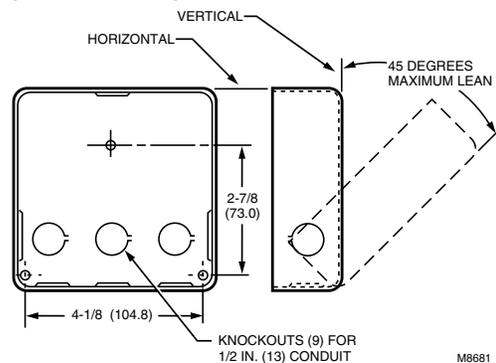
The RA890G is not designed to be weathertight. If it is installed outdoors, use a suitable weathertight enclosure.

### MOUNT SUBBASE

Locate subbase where ambient temperature is within the specified rating.

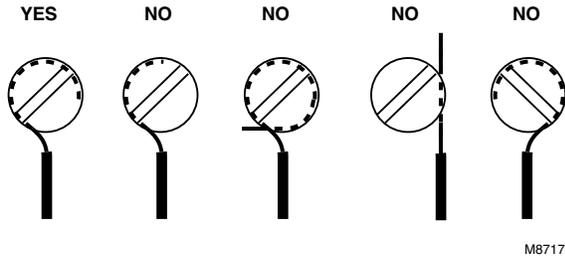
Mount the subbase so that the top and bottom are horizontal and the back is vertical. The subbase may lean backward as much as 45 degrees if necessary. See Fig. 1.

Fig. 1—Mounting Subbase. in in. (mm)



### WIRING THE SUBBASE

**IMPORTANT:** When connecting wire to screw terminal of terminal strip, wrap wire at least 3/4 of distance around screw without overlapping. With appropriately sized screwdriver, tighten screw until wire is snugly in contact with underside of screw and contact plate. Tighten screw additional one-half turn. Do not use push-type ratchet screwdriver.



1. All wiring must comply with applicable electrical codes, ordinances, and regulations. Use NEC Class 1 wiring.
2. For *normal installations*, use moisture-resistant No. 14 wire (rated for 167°F (75°C) or higher required by Underwriters Laboratories Inc).
3. For *high temperature installations*, use moisture-resistant No. 14 wire selected for a temperature rating above the maximum operating temperature for all but the ignition and flame detector F leadwires.

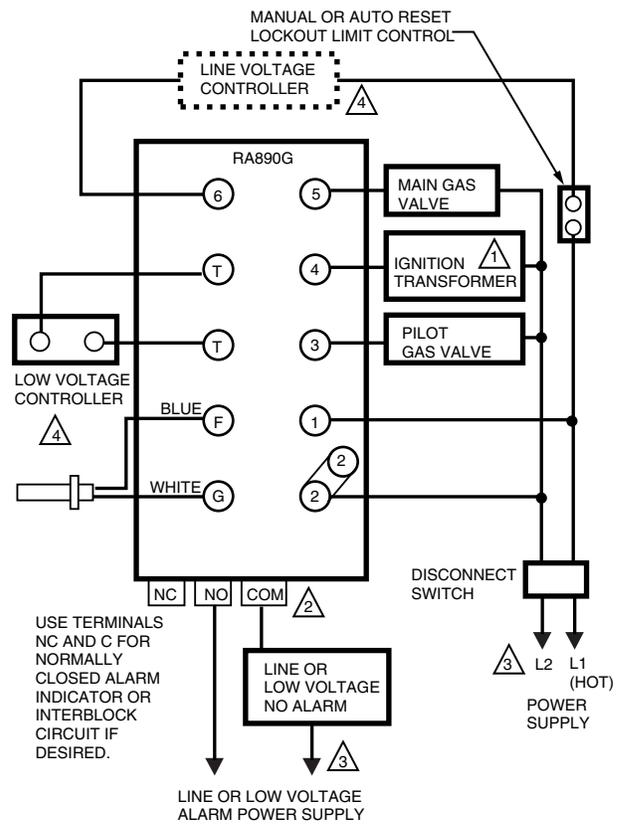
- a. For *the ignition*, use Honeywell Specification no. R1061012 Ignition Cable or equivalent. (This wire is rated at 350°F (175°C) for continuous duty, and up to 500°F (260°C) for intermittent use. It was tested to 25,000 volts.)
- b. For *the flame detector F leadwire*, use Honeywell Specification no. R1298020 or equivalent. (This wire is rated up to 400°F (205°C) for continuous duty. It is tested for operation up to 600 volts and breakdown up to 7500 volts.)

4. For *ignition installations in a contaminating environment*, use Honeywell Specification no. R1239001 High Tension Ignition Cable or equivalent. This wire is very resistant to severe conditions of oil, heat, and corona, and is tested to withstand high voltages up to 25,000V rms in a salt bath for one minute without breakdown. It is rated at 200°F (93°C) for continuous duty, and up to 350°F (175°C) for intermittent use.

**IMPORTANT:** Do not run high voltage ignition transformer wires in the same conduit with the flame detector wiring.

5. Refer to Fig. 2 and 3 for typical field wiring connections. Follow the burner manufacturer's wiring diagram if provided.

**Fig. 2—Gas system with interrupted ignition.**



- ⚠ 1 FOR INTERMITTENT IGNITION, CONNECT TO TERMINAL 3.
- ⚠ 2 ALARM TERMINALS OPTIONAL. IF LINE VOLTAGE ALARM IS USED, RA890G MUST BE MOUNTED IN SUITABLE ENCLOSURE. ALARM TERMINALS ARE ENERGIZED THROUGH THE RA890 SAFETY SWITCH. ALARM IS NOT SOUNDED UNTIL THE SAFETY SWITCH TRIPS OUT.
- ⚠ 3 PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.
- ⚠ 4 MAY USE LINE OR LOW VOLTAGE CONTROLLER. IF LINE VOLTAGE CONTROLLER IS USED, CONNECT IT BETWEEN THE LIMIT CONTROL AND TERMINAL 6. JUMPER T-T.

M8718

### APPLICATIONS

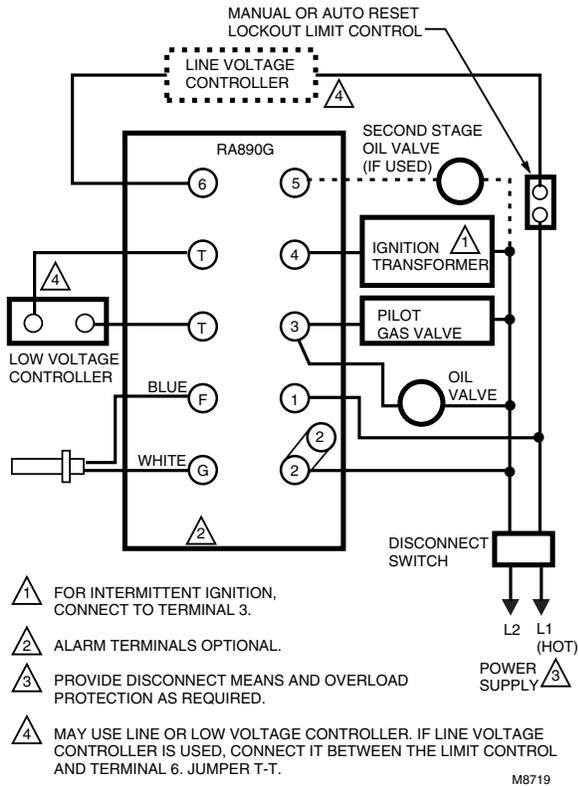
Either a line or low voltage controller can be used. If a line voltage controller is used, connect it between the limit control and terminal 6, and jumper T-T.

Refer to the appropriate flame detector instructions when paralleling two flame detectors.

**IMPORTANT:** The C7027, C7035 and C7044 Flame Detector leads are color coded blue and white. The blue lead must be connected to the F terminal and the white lead to the G terminal. The circuit is dc and the UV tube is polarity sensitive. Reversing the leads, even momentarily, can damage or destroy the UV tube.

All wiring must be NEC Class 1 and conform to local electrical codes, ordinances, and regulations. If the leadwires are not long enough to reach the flame safeguard control, splices must be made in a junction box.

**Fig. 3—Oil-Fired system with interrupted ignition.**

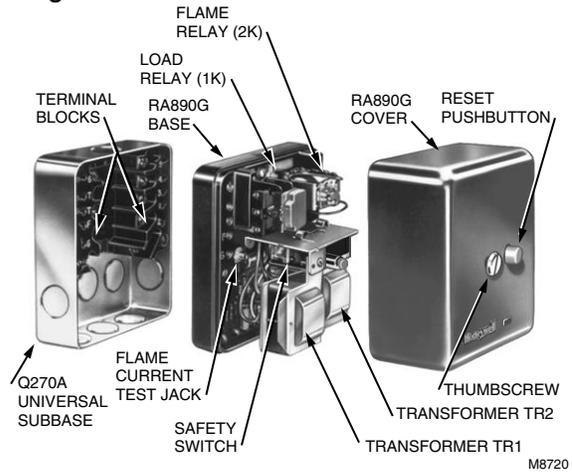


The use of manual reset limits is desirable with the RA890G to prevent the system from cycling off the high limit and to assure that the condition that causes the limitation is detected as soon as possible.

**MOUNT RA890G**

Check that the power is Off.  
 Remove relay cover and position the RA890G over the Q270A Universal Mounting Base. See Fig. 4. Start all ten mounting screws and tighten uniformly. These screws complete electrical circuits and hold the RA890G to the subbase.  
 As shipped from the factory, the RA890G is suitable for use with interrupted or intermittent systems.

**Fig. 4—RA890G and Q270A Subbase.**



# Operation And Checkout

## CAUTION

1. Use extreme care while testing the RA890G; line voltage is present on some terminals and contacts when power is On.
2. Disconnect power supply before removing cover, removing RA890G from subbase, or reinstalling RA890G onto subbase.

**PRELIMINARY CHECKS**

Before placing the system in operation, complete the following preliminary checks:

1. Check wiring. Use a meter to check the continuity of all circuits.
2. Check flame detector installation.
3. Check burner adjustments.
4. Thoroughly purge gas piping.
5. Reset the safety switch by pushing in and then releasing the purple safety switch button.

**NORMAL OPERATION SUMMARY**

- Refer to Fig. 5 for the internal schematic of the control.
1. *Call for heat*—Load relay pulls in after a slight delay (flame relay must be out), ignition starts, pilot valve or burner motor is powered. Safety switch heats. A safety shutdown occurs if a flame or flame simulating condition is detected at startup.
  2. *Flame proved*—Flame relay pulls in, safety switch heater is de-energized, main valve is powered, ignition is cut off (if used for interrupted ignition).
  3. *Call for heat satisfied*—Load relay drops out, fuel valves close, burner motor stops, and flame relay drops out.

NOTE: The pull-in of the load relay is delayed by a thermistor with a nominal delay time of 3 to 5 seconds. The thermistor is affected by ambient temperature. The delay time may be as little as two seconds when the ambient temperature is high, or as long as 30 seconds when the ambient temperature is low. As the thermistor warms up, the 1K relay may hum slightly before it pulls in. This is normal.

**IMPORTANT:** *If limit control opens, ignition and fuel valves are de-energized, but safety switch lockout will not occur. When normal conditions are restored and the limit closes, the RA890G recycles.*

**CHECKOUT REQUIRED**

Before the installation is complete, satisfactorily complete all checkout tests indicated below. Repeat these tests after any adjustments are made to the system.

Flame Current Check (all installations).

Pilot Turndown Test (all installations that required proof of pilot before main fuel valve is opened).

Ignition Spark Response Test (all installations).

Safe Shutdown Checks—Flame failure, power failure, limit action (all installations).

**FLAME CURRENT CHECK**

The Flame Current Check is the best indicator of proper flame detector application. Perform the check at the time of installation, at any time service is done on the system, and at

least once a month (or more often) while the system is in operation. This prevents shutdowns due to poor flame signal.

Use a W136A Microammeter, or equivalent, and read the flame signal while the burner is running. Insert a 196146 Test Cable, wired color-to-color to the W136A leadwires, into the test jack on the RA890G. See Fig. 6.

When reading the flame current, assure that the following criteria are met:

1. The flame current is steady; meter does not vary more than a needle width.
2. The flame current is at least 1.5 microamperes for an ultraviolet type detector such as used with the RA890G.

If a satisfactory reading is not obtained, check the power source for the proper line voltage, and the flame size and the detector for proper sensing.

Directions for obtaining a steady current reading are included in the instructions packed with the C7027, C7035 or C7044 Ultraviolet Flame Detector.

NOTE: Flame current cannot be measured by putting a microammeter in the F lead.

**Fig. 5—Internal Schematic of RA890G (Typical External Connections Included).**

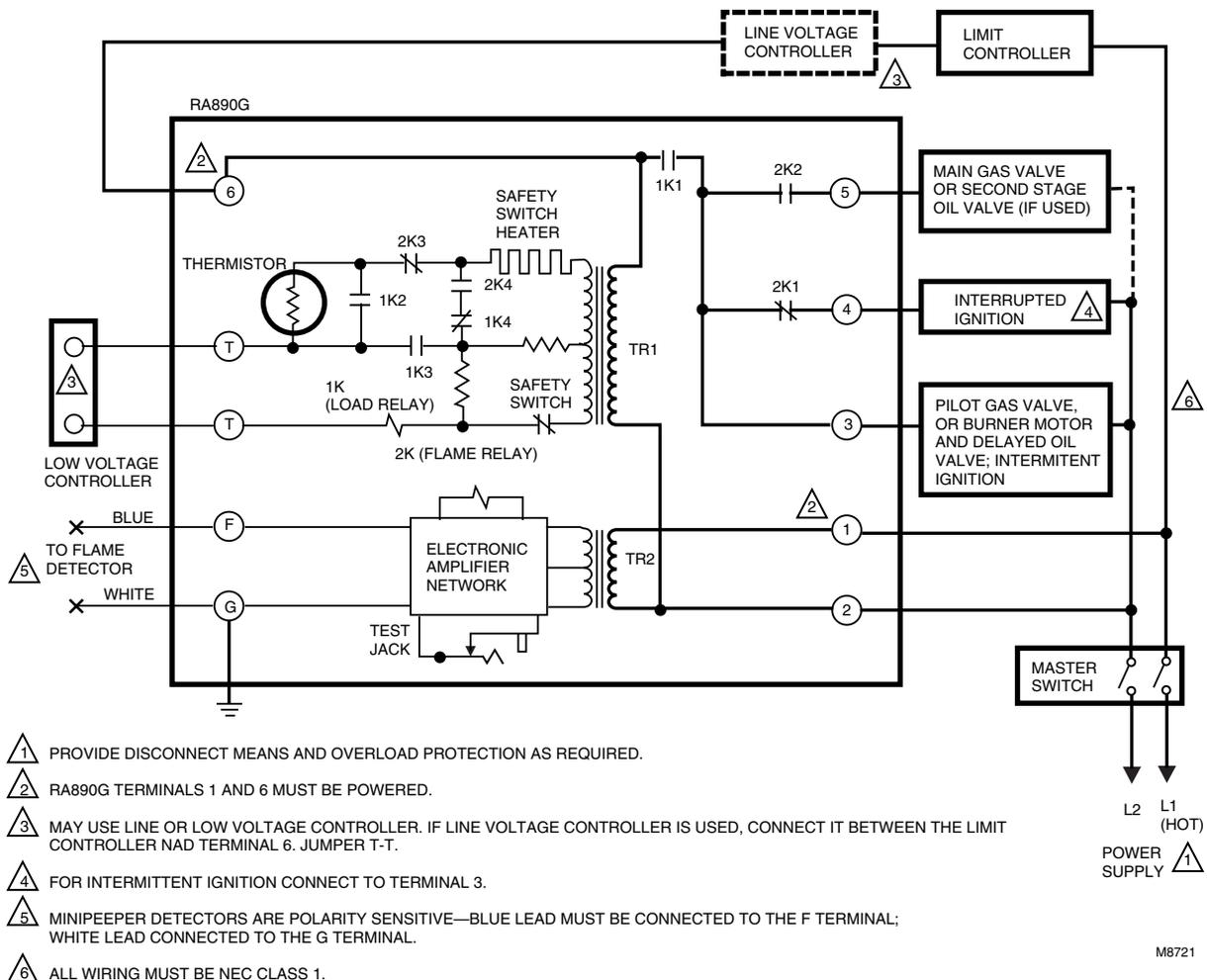
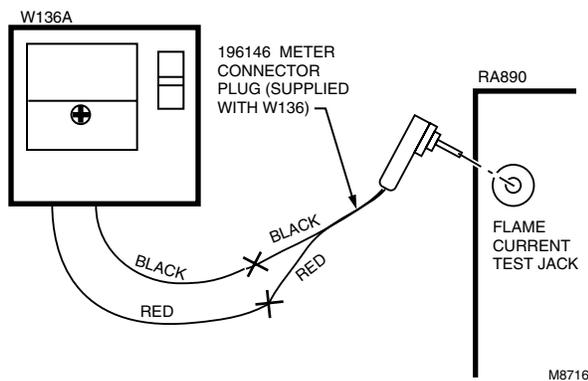


Fig. 6—Flame current check.



### PILOT TURNDOWN TEST



## CAUTION

The pilot turndown test should be performed only by qualified personnel, and the instructions should be followed carefully.

On systems that prove a pilot before the main fuel valve can be opened, perform a pilot turndown test to prove that the main burner can be lighted by the smallest pilot that will hold in the flame relay. Perform a flame current check before and after the pilot turndown test.

1. Open the main power switch.
2. Shut off the fuel supply to the main burner *only* by closing the manual main burner shutoff cock. *Do not shut off the fuel supply to the pilot valve.*
3. Restore power to the relay.
4. Start the system by raising the setpoint of the controller (or pressing the START button). The pilot will light and pull in the flame relay.
5. Reduce the size of the pilot flame to the turndown condition by slowly closing the manual valve on the pilot gas line. At the turndown condition, the pilot will be small enough to just barely hold in the flame relay (2K).
  - a. Turn down the pilot until relay 2K drops out.
  - b. Turn the pilot back up slowly just until relay 2K pulls back in.
  - c. Again turn the pilot down slightly, but not enough so the relay drops out.

If the relay drops out again, simply turn up the pilot and try again. The closer the pilot is to the dropout condition, the more conclusive the test will be.

6. Check that the pilot is lit and relay 2K is pulled in.
7. Open the manual main burner shutoff cock. Main flame should light smoothly within one second. *If the burner does not light within one second, close the shutoff cock and shut off power to the relay. Proceed to step 9.*
8. If the burner lights, repeat step 7 two or three times to verify smooth lightoff.
9. If the lightoff is unsatisfactory, readjust the flame detector to require a larger pilot flame to hold in the flame

relay. This usually requires resighting the detector farther out on the axis of the pilot flame.



## CAUTION

If the pilot needs to be adjusted and rechecked, allow five minutes for the purge of unburned gases in the firebox before proceeding to the next step.

10. Repeat the entire turndown test until the flame is established promptly in step 7.

11. Turn up the pilot to full flame at the completion of the test. Perform a flame current check before leaving the job.

### IGNITION SPARK RESPONSE TEST

The flame detection system should not respond to the ignition spark (no meter movement). To determine flame detector sensitivity to ignition spark, perform the following steps:

1. Shut off pilot and main fuel manual valves.
2. Connect a W136 Microammeter and 196146 Test Cable into the test jack on the RA890G. (See Flame Current check procedure section.)
3. Raise the controller setpoint. This should energize the ignition transformer and produce an ignition spark.
4. The W136 Meter should not indicate a signal present.
5. If the meter indicates UV is being detected, resight the flame detector until the UV signal is eliminated. It may be necessary to construct a barrier to block the ignition spark from the detector view. Continue adjusting until the ignition spark flame signal is less than one-fourth microampere.

NOTE: The Honeywell Q624A Solid State Spark Generator prevents detection of ignition spark when properly applied with flame detection systems using C7027, C7035, or C7044 Minipeeper Ultraviolet Flame Detectors. The Q624A is for use only with gas pilots.

### SAFE SHUTDOWN CHECKS LIMIT ACTION

With the burner operating, lower the high limit setting to simulate an overheated boiler or furnace. Normal shutdown should occur. Restore the normal limit setting; the burner should restart.

### FLAME FAILURE RESPONSE TEST

With the burner operating for a period of five minutes, close the manual fuel valves to simulate a flame failure. The W136 Meter reading should drop to zero within the flame response timing of the flame safeguard relay (0.8 to 3 seconds nominal). This action should be followed by safety switch lockout (15 seconds nominal). After the safety switch cools, open the manual valves. The burner should restart when the safety switch is reset.

If the meter reading does not drop to zero within the allowed time, replace the UV detector and repeat the test.

**IMPORTANT:** Repeat ALL required checkout tests after all adjustments are complete. ALL tests must be satisfied with the flame detector in its FINAL position.

**POWER FAILURE**

With the burner operating, open and then immediately close the line switch to simulate a power failure. Burner should shut down. After a short delay for component check, burner should restart and operate normally.

**FLAME DURING START**

The RA90G should shut down on safety during start-up if a flame or flame simulating condition is detected. Insert 123514B flame simulator into the test jack. Start the system by raising the controller setpoint or pressing the start button.

Hold the simulator on terminal F; the flame relay should pull in and system should lock out within the safety switch timing. Remove the simulator and reset the safety switch after it cools.

**NOTE:** At the completion of all Checkout tests, make sure that the RA890 is not on safety lockout, the pilot is turned up to its normal level, and all limit settings are correct. Operate the system through one normal cycle before leaving the installation.