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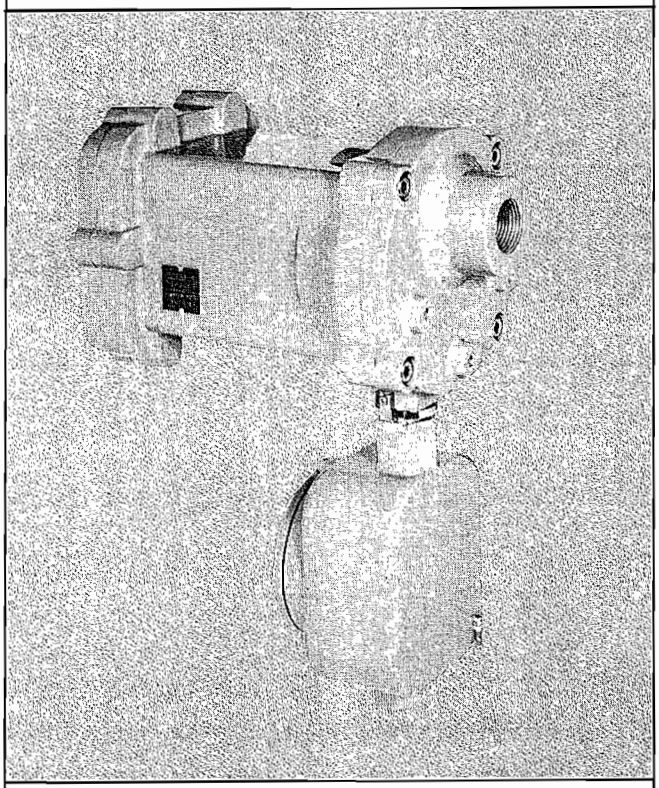
C7076D



ADJUSTABLE SENSITIVITY EXPLOSION-PROOF HOUSING ULTRAVIOLET FLAME DETECTOR

THE C7076D IS A SOLID-STATE, ADJUSTABLE SENSITIVITY, EXPLOSION-PROOF FLAME DETECTOR FOR SENSING THE ULTRAVIOLET RADIATION EMANATING FROM GAS, OIL, AND PULVERIZED COAL FLAMES. IT IS DESIGNED FOR BURNER MANAGEMENT AND FLAME SAFETY SYSTEMS WHICH REQUIRE OPTIMUM SENSITIVITY AND/OR FLAME DISCRIMINATION.

THE C7076D SATISFIES JIS C 0903, THE JAPANESE INDUSTRIAL STANDARDS FOR EXPLOSION PROOF HOUSINGS.

- The C7076D features two sensitivity adjustments—each with a 400:1 dynamic range.
- An integral flame signal meter jack facilitates precise sighting. (Remove the rear cover plate when measuring the signal current.)
- The high level output of the Ultraviolet Flame Detector permits long distance transmission without special wiring.
- Solid state circuitry assures long life and stable sensitivity over wide ranges of temperature and voltage.
- Dynamic Self-Checking System employs a closed-loop supervisory circuit to insure the integrity of both flame detector and amplifier 75 times per minute.
- Improper response to simulated flame loss results in a safety shutdown and/or alarm.
- The Explosion-Proof housing meets JIS C 0903, d2G4 standards (Explosion-Proof housing).
- Plug-in electronics chassis: Field replaceable, plugs into octal socket in housing. Contains ultraviolet sensing tube, shutter assembly, power supply, solid state circuitry, sensitivity adjustment controls, and flame current meter jack.

RESTRICTIONS ON USE

This product has been designed, developed and manufactured for general-purpose application in machinery and equipment.
Accordingly, when used in applications outlined below, special care should be taken to implement a fail-safe and/or redundant design concept as well as a periodic maintenance program.

- Safety devices for plant worker protection
- Start/stop control devices for transportation and material handling machines
- Aeronautical/aerospace machines
- Control devices for nuclear reactors

Never use this product in applications where human safety may be put at risk.

SPECIFICATIONS

IMPORTANT

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

MODEL:
C7076D Adjustable Sensitivity Explosion-Proof Ultraviolet Flame Detector, for use with R7476A Dynamic Self-Check Ultraviolet Amplifier.

ELECTRICAL RATINGS:
Voltage and Frequency–
100V ac 50Hz or 60Hz.
Satisfactory operation is provided between 85 and 110V ac.

Shutter Voltage– 100V ac
This is supplied by the appropriate flame safeguard control.

Power Consumption– 7 watts (14 VA) max.
This does not include shutter power (4.5 watts max.) which is supplied by the flame safeguard control.

SENSITIVITY SELECTION:
Remote sensitivity selection– external switch can be wired to select the setting of sensitivity control, either A or B. (Refer to Fig. 2)

External selector switch– must be rated for switching 20 milliamps at 48 volts dc.

SENSITIVITY ADJUSTMENT:
Range– 400 to 1
Sensitivity controls– two, labeled A and B, on plug-in electronics chassis. Each can be set independently and locked to prevent drift due to vibration.

FLAME SIGNAL:
Measured at the flame current meter jack;
C7076D Detector– 1.4 to 5.5 microamps (nominal).
R7476A Amplifier– 2.5 to 5.5 microamps (nominal).

SHUTTER FREQUENCY:
1.25Hz, nominal. Interrupts the line-of-sight of the detector about 75 times per minute to provide self-checking.

INTERCHANGEABILITY:
Not interchangeable with other flame detector models. Detector must be used with R7476A Dynamic Self-Check Ultraviolet Amplifier and R4332A/B Multiburner Modules

PRESSURE: Quartz viewing glass, 690 kPa max.

HOUSING: Explosion-Proof cast aluminum

AMBIENT OPERATING TEMPERATURE RATINGS:
Minus 29°C to Plus 70°C

STORAGE TEMPERATURE RATINGS:
Minus 51°C to Plus 85°C

MAXIMUM TEMPERATURE RATINGS AT THREADED SIGHTING HOLE: 71°C

WIRING CONNECTIONS:
Explosion-Proof terminal box–
PF1/2 Explosion-Proof metal conduit or Explosion-Proof Packing Type*

MOUNTING: C7076D is mounted with either 1 inch PT tapping or front flange.

Front flange– has three 8 milimeter tappings for mounting.

ALLOWABLE MOUNTING POSITIONS: See Figure 1

DIMENSIONS: See Figure 2

MASS: 8 kg (approx.)

ACCESSORIES:
188900A– Explosion-Proof Packing Adapter (Separate order)
Hexagon socket screw key for M3-1
Hook key for terminal box-1

REPLACEMENT PARTS:
190971F– Shutter Assembly (100V ac)
191053– Ultraviolet Sensing Tube
191050– Viewing lens (Quartz lens)
187092– Quartz glass (690 kPa)

APPROVALS: Approval No. T30089. JIS C 0903, d2G4, Flame proof construction for outdoors

***NOTE:** For Explosion-Proof Packing Type connections, use Explosion-Proof Packing Adapter No. 188900A

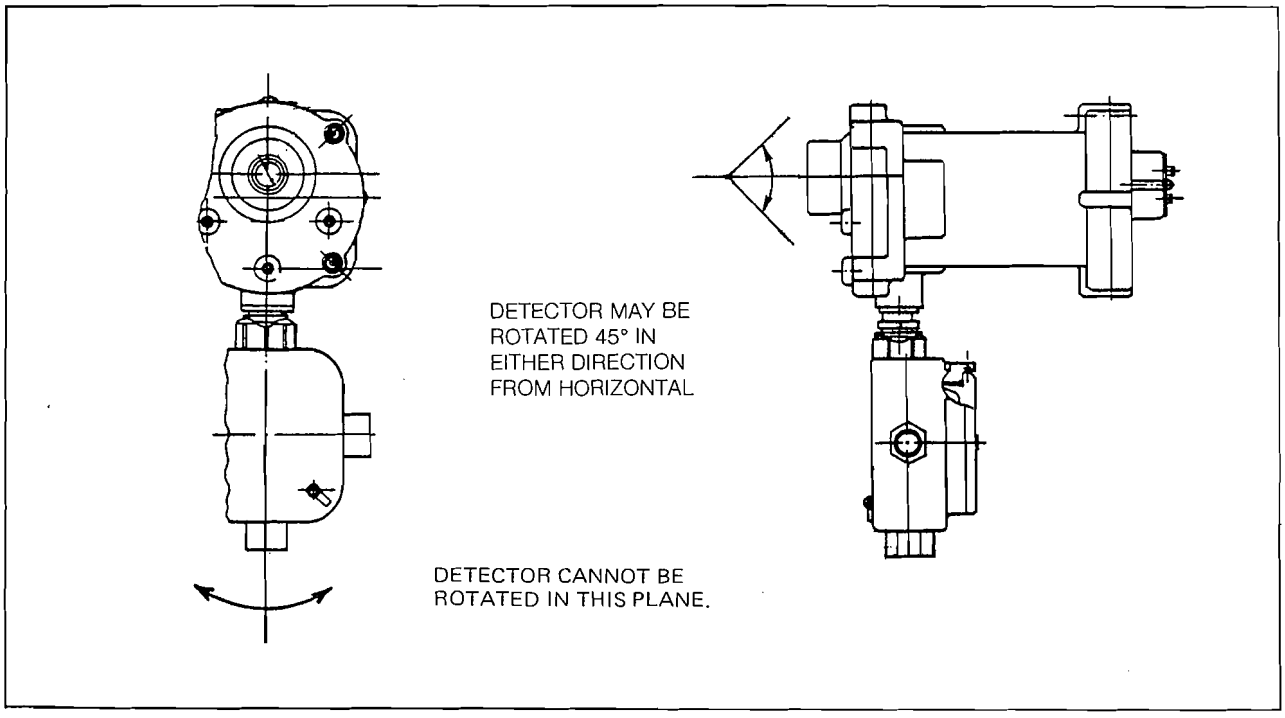


Fig. 1 Allowable Mounting Positions

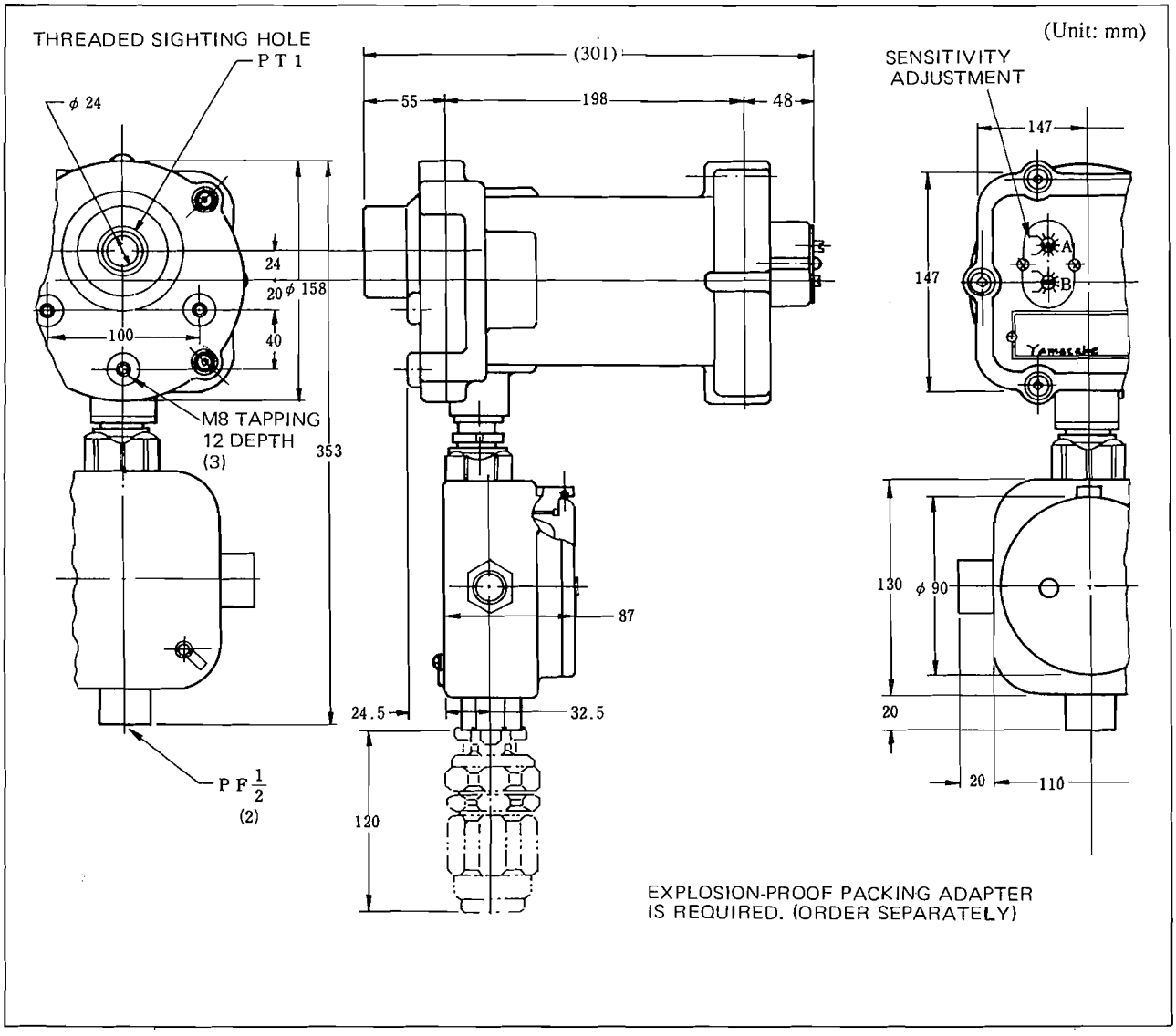


Fig. 2 Dimensions of C7076D

PLANNING THE INSTALLATION

Proper flame detector installation is the basis of a safe and reliable flame safeguard installation. Refer to the burner manufacturer's instructions as well as to those included here. Follow instructions carefully to make the best possible application of the flame detector.

DETERMINE THE LOCATION

Before beginning the actual installation, estimate the best location for mounting the detector based upon these factors:

TEMPERATURE

Install the C7076D where the surrounding temperature will remain within the specified ambient operating temperature ratings.

To keep the detector temperature within specifications, the temperature at threaded sighting hole must not exceed 71°C. If the temperature at threaded sighting hole will exceed temperature ratings, the introduction of cooling-purging air will be required.

VIBRATION

Do not install the C7076D where it could be subject to excessive vibration. It shortens the life of the electronic components. Vibration with a magnitude greater than 5 m/s² 60 Hz will require an antivibration mount to cushion the detector.

CLEARANCE

Make sure there will be enough room for servicing.

RADIATION SOURCES OTHER THAN FLAME

Radiation sources, other than flame, which could actuate the detection system are:

Ultraviolet sources
- Radiant Surface above 1200°C (2200°F)
- Spark from: ignition transformers
  welding arcs
  lightning
- Gas lasers
- Sun lamps
- Germicidal lamps
- Incandescent lamps held close to the sensing tube (filament above 1200°C/2200°F).

Gamma ray and X-ray sources
- Diffraction analyzers
- Electron microscopes
- Radiographic X-ray machines
- High voltage vacuum switches
- High voltage condensers
- Radioisotopes

Except under very unusual circumstances, none of these sources, except a radiant surface or ignition spark, would be present in or near the combustion chamber.

The detector may respond to a radiant surface at a temperature above 1200°C (2200°F) if both of these conditions are present:
- the detector sensitivity control is set at (or near) maximum, and
- the surface represents a significant percentage of the detector's field of view.

If the temperature of a radiant surface causes the flame relay (in the flame safeguard control) to pull in, re-aim the sight pipe so the detector views a cooler area, or decrease the sensitivity of the detector.

Ignition spark is a rich source of ultraviolet radiation. When installing the detector, make sure it does not respond to ignition spark.

SINGLE BURNER REQUIREMENTS

The detector must have an unobstructed view of the flame it is supervising under all firing conditions. This implies a proper sighting angle and the minimization of screening effects.

SIGHTING ANGLE

The first 30 percent of a flame (the root) radiates the most intense ultraviolet energy. Low angle sighting permits the detector to view a greater depth of the flame root, thus reducing the effects of irregularities in the flame pattern. The best sighting angle is nearly parallel to the axis of the flame, as shown in Figure 3.

IMPORTANT

When possible, it is desirable to tilt the detector and sight pipe downward to prevent the buildup of soot in the pipe or on the viewing glass and lens.

In most installations, the detector will need to respond to the pilot flame alone, then to the pilot and main burner flame together, and finally to the main burner flame alone. The detector must meet all sighting requirements which apply.

1. Pilot flame alone– the smallest pilot flame that can be detected must be capable of reliably igniting the main burner.
2. Pilot and main burner flame together– the detector must sight the junction of both flames.
3. Main burner flame alone– the detector must sight the most stable part of the flame for all firing rates.

SCREENING EFFECTS

Smoke, fuel mist, dirt, and dust are masking agents that absorb ultraviolet radiation from the flame. They create a screen that reduces the amount of ultraviolet radiation reaching the detector and may cause flame signal deterioration resulting in a shutdown. The adverse effects of screening may be minimized by proper burner adjustment, increasing the detector viewing area (shorten sight pipe and/or increase its diameter), and optimizing detector sensitivity.

MULTIBURNER-MULTIFUEL REQUIREMENTS

In addition to meeting the requirements for a single burner, a multiburner installation also requires flame discrimination. Flame discrimination may be defined as the location of all flame detectors such that each detector responds only to the flame(s) produced by the burner it is supervising.

MULTIBURNER REQUIREMENTS

In multiple burner systems, not every detector can be positioned so its line of sight does not intercept flames from other burners. This situation occurs in front-fired boiler furnaces having more than 1 row of burners, or in multilevel opposed-fired furnaces where the burners face each other.

When planning such an installation, locate each flame detector so that it has the best possible view of the root of the flame(s) it is supervising, and the worst possible view of all other flames. Figure 4 illustrates a critical detector application problem requiring flame discrimina-

tion. Flame discrimination is accomplished by Detector 1 by reducing its sensitivity until the flame relay (in the flame safeguard control) does not respond to Flame 2. Note that Detector 1 is aimed at the root of Flame 1 where UV (ultraviolet) energy is most intense.

Although it sights Flame 2 it is not aimed at the root of Flame 2. The sensitivity of Detector 1 is reduced to a point that ensures maximum sensitivity to Flame 1 while rejecting Flame 2. Similarly, Detector 2 is adjusted to ensure maximum sensitivity to Flame 2 while rejecting Flame 1.

If the sensitivity control on a detector is set at its minimum position and flame discrimination can not be achieved, insert an orifice plate in the sight pipe. An orifice of the proper diameter will reduce the ultraviolet radiation reaching the detector so that the sensitivity can be adjusted to effect flame discrimination.

MULTIFUEL REQUIREMENTS

Detectors supervising burners that alternately fire more than one fuel may require a different sensitivity level for each fuel. For example, a higher sensitivity is required to reliably sense pulverized coal or No. 6* fuel oil in contrast to natural gas or to No. 2* fuel oil. Reliable flame sensing and flame discrimination may not be maintained simultaneously (without changing the sensitivity setting) when alternating between two fuels.

The C7076 has two integral sensitivity adjustments that can be remotely and automatically selected. The two sensitivity adjustments can be chosen by means of the fuel selector switch (refer to Remote Sensitivity Selection in the Installation Section).

The sensitivity adjustments should be made for both fuels as described in the section on multiburner requirements, using one adjustment pot for each fuel.

*NOTE: No. 2 and No. 6 Fuel Oils, see ASTM (American Society for Testing and Materials) D396 Fuel Oil

REDUNDANT FLAME DETECTION SYSTEM

Two C7076D detectors connected to two flame signal amplifiers wired in parallel comprise a redundant flame detection system. In addition to the features of parallel flame detectors, a redundant system increases reliability and is therefore recommended for critical burner applications. A flame failure, flame signal loss, or flame simultating failure occurring in either detector subsystem will cause an alarm (not a shutdown), allowing corrective action to avert shutdown.

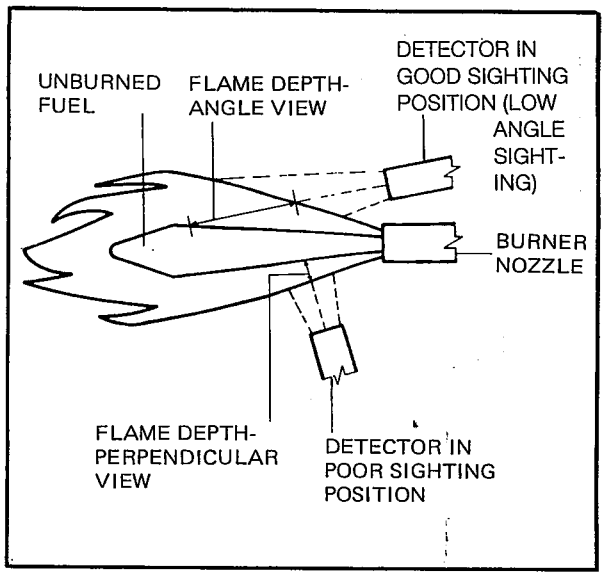


Fig. 3 Sighting Position

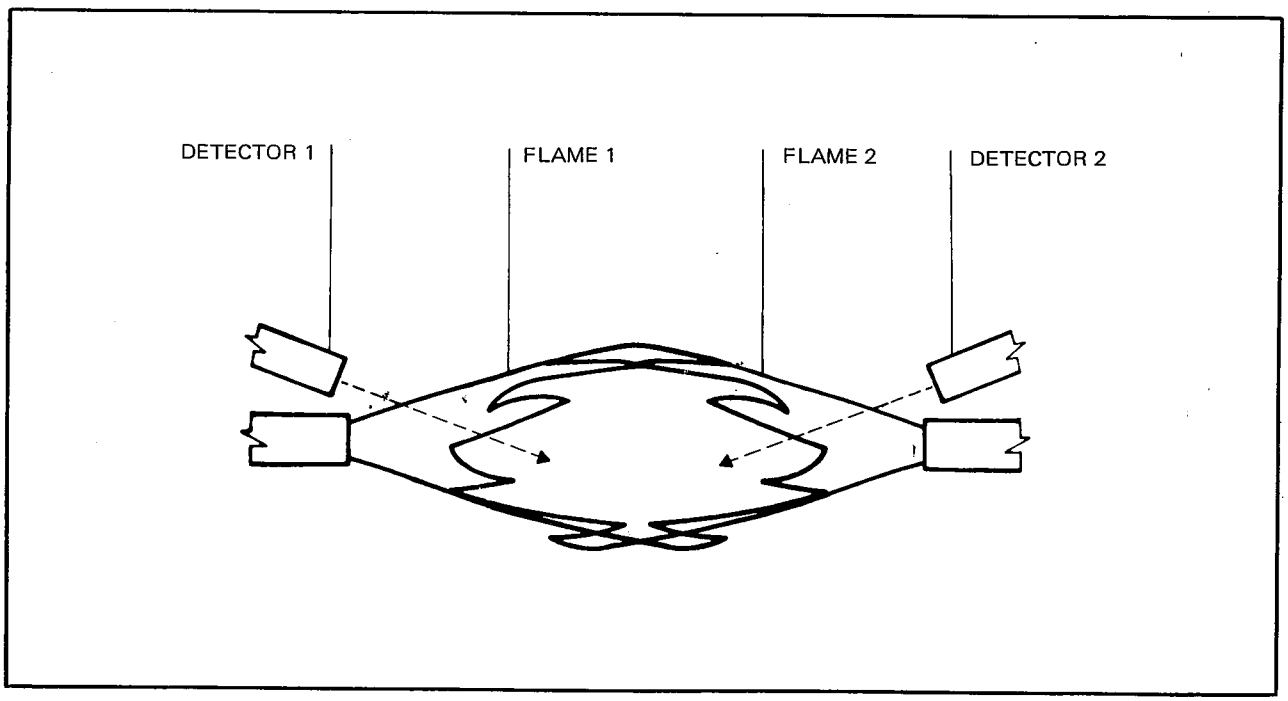


Fig. 4 Multiburner

INSTALLATION

CAUTION

1. Installer must be a trained, experienced flame safeguard control serviceman.
2. Disconnect power supply before beginning installation to prevent electrical shock and equipment damage.
3. All wiring must comply with applicable local electrical codes, ordinances, and regulations.
4. The metal conduit fitting or packing must be Explosion-Proof to meet JIS C 0903 standards.
5. Voltage and frequency of the power supply connected to this detector must agree with the values marked on the detector.
6. If an air supply is connected to the sighting pipe, its pressure must equal or exceed that required to seal off the detector from the combustion chamber.
7. On multiburner installations, each detector must respond only to the flame(s) produced by the burner it is supervising.
8. Do not connect more than 2 detectors in parallel to a single R7476A Dynamic Self Check Ultraviolet Amplifier.
9. Perform all required adjustments and checkout tests after installation is complete.

INSTALLING THE SIGHTING PIPE

1. Select The Pipe

After you have determined the approximate location and sighting angle, select the sighting pipe. A black iron pipe is recommended to provide reliable flame sensing. Stainless steel and galvanized pipes have bright surfaces that initially transmit ultraviolet radiation very well. However, their ability to transmit UV will decay when the bright surfaces become dull with age or contamination, and flame detection will become less reliable with time.

The detector is tapped for a 1 inch PT threaded pipe. A larger pipe may be necessary to obtain proper performance; any diameter other than 1 inch will require a reducer coupling (see Figure 6).

If a sighting pipe longer than 30 centimeters is required, use a 2 inches diameter pipe with the reducer as close to the detector as possible.

2. Prepare The Mounting Hole

Cut a hole of the proper diameter for the sighting pipe in the burner front or windbox at the selected location. The hole should be at least 2 inches in diameter to allow adjustment of the sighting angle. If register vanes interfere with the desired line of sight, trim the interfering vane(s) to assure an unobstructed view of the flame.

3. Mount The Sighting Pipe

Cut the pipe to the desired length. Thread one end of the pipe to fit the detector or required coupling (see Figure 6). Insert the other end of the pipe into the mounting hole, align the pipe to the desired sighting angle, and tack weld it in position.

IMPORTANT

When initially mounting the sighting pipe, tack weld it in place to allow further sighting adjustments. Make sure the tack weld will support the weight of the detector when it is installed.

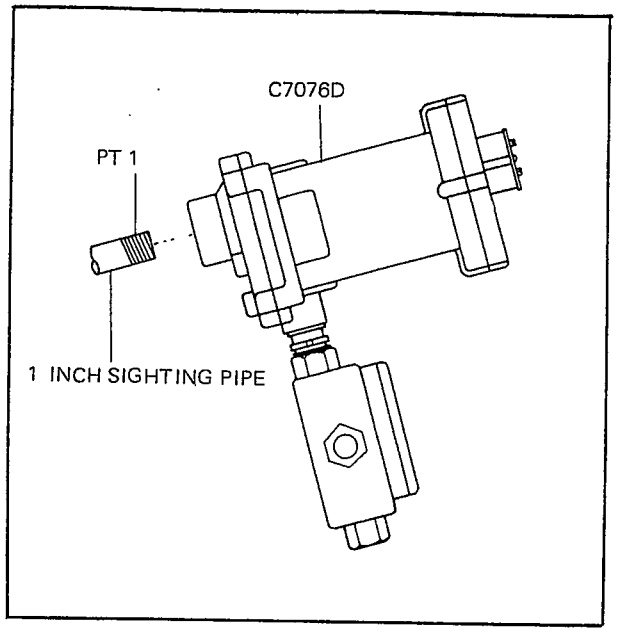


Fig. 5 C7076D Direct Mounting

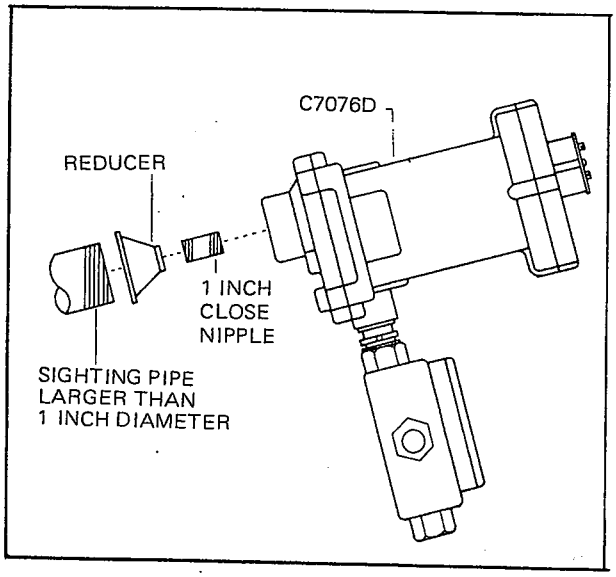


Fig. 6 C7076D Using a Reducer for Larger Pipes

4. Changing The Sighting Pipe Geometry

The geometry of the sighting pipe affects the performance of the detector. If the flame signal is too small, reduce the length or increase the field of view of the detector.

MOUNT THE DETECTOR

Mount the detector directly onto a 1 inch PT threaded pipe (Fugure 5). Use a crescent wrench to tighten the detector onto the sighting pipe.

REDUCER

For sighting pipes of larger diameter than the mounting flange connector or union, install a reducer as shown in Figure 6. The reducer will require a close nipple with external threads.

SIGHTING PIPE VENTILATION

It may be necessary to ventilate the sighting pipe in order to cool the detector or to clear a viewing path through screening material.

For a negative pressure combustion chamber, drilling a few holes in the section of the sighting pipe outside of the combustion chamber will allow air at atmospheric pressure to blow through the sighting pipe into the chamber. A perforated pipe nipple between the sighting pipe and the detector can also be used.

For a positive pressure combustion chamber, connect a supply of pressurized air from the burner blower to blow through the sighting pipe into the chamber.

A flexible air supply line must be used to allow repositioning of the sighting pipe until the permanent detector position has been verified. The air pressure must be greater than the chamber pressure.

WIRING

CAUTION

Disconnect power supply before connecting wiring to prevent electrical shock or equipment damage.

All wiring must comply with applicable codes, ordinances and regulations. A 1.25 or 1.00mm (No. 16 or No. 18 AWG) flexible fixture wire is recommended for wiring to the detector.

Follow manufacturer's wiring information if provided. Figure 7 shows typical wiring connections of C7076D and R4332, R4334.

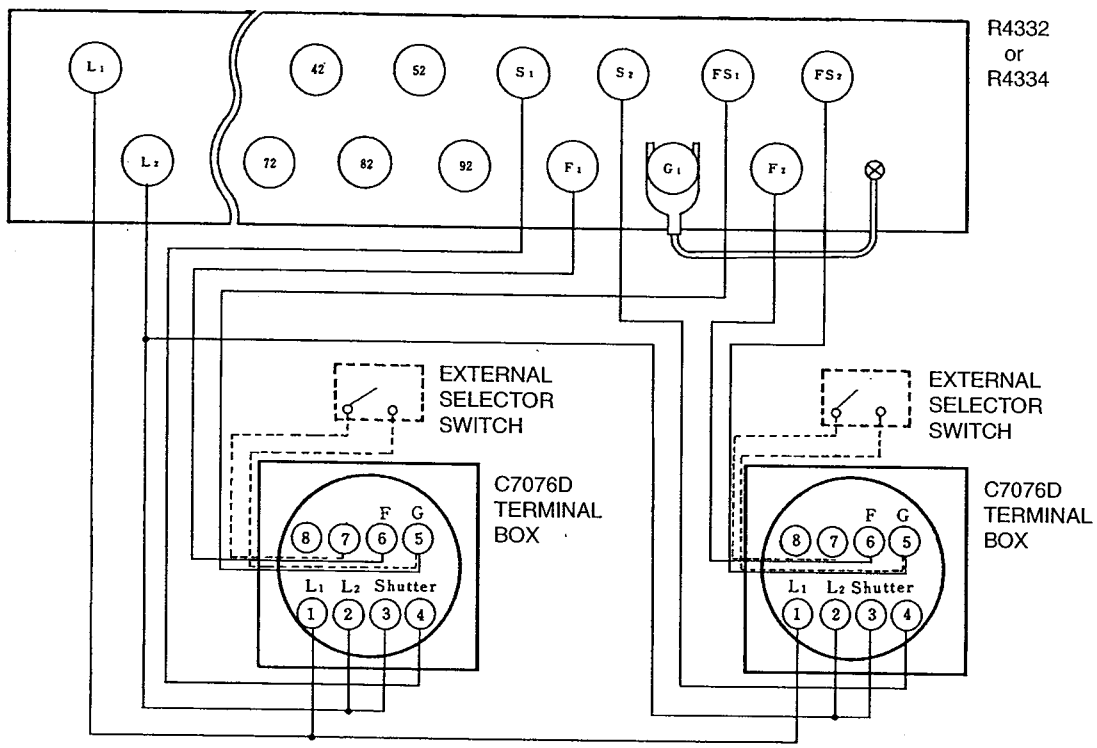
When wiring a C7076D, you need not consider lead-wire length, shielding, separate conduits, or other special requirements.

REMOTE SENSITIVITY SELECTION

For systems with burner firing more than one fuel, each with a different level of UV emission, or whose flame patterns change with firing rate, two sensitivity adjustments are provided.

An external selector switch (SPST) is required to choose between the two sensitivity settings. (Refer to Sensitivity Adjustments in the Adjustments and Check-out section.) With the external selector switch open, the "A" sensitivity control setting will determine the sensitivity of the detector; with the switch closed, the "B" setting will determine sensitivity.

For automatic sensitivity selection, the switch may be incorporated into the fuel selector switch or the firing rate switch.



MAKING THE CONNECTIONS TO C7076D

1. Loosen the lock screw for explosion-proof terminal box cover.
2. Remove the Explosion-Proof Terminal Box cover by turning it counterclockwise (↶) with the attached wrench.
3. Put lead wires into the terminal box in accordance with Explosion-Proof Codes or associated ordinances. e.g., JIS C 0903 Explosion-Proof metal conduit or Explosion-Proof Packing Type.
4. Connect lead wires to appropriate terminals.
5. Conduct a complete checkout when connection is complete.
6. Replace the cover and tighten the lock screw securely.

Caution: Ensure the supply voltage (①−②) and the shutter voltage (④−③) are equal when C 7076D is used in conjunction with an R 4332 or R4334.

Fig. 7 Connections of C7076D

ADJUSTMENTS AND CHECKOUT

CAUTION

Before initial burner lightoff, consult the burner/boiler manufacturer's instructions and the sequence of operation for the burner management system.

FLAME SIGNAL READINGS

The final sighting position of the C7076D may be most readily determined by using a FSP136A Analog flame meter or equivalent.

CAUTION

The Flame Signal Readings of C7076D in the Explosion-Proof Area must be done under the specified condition and must also comply with the related regulations and/or limitations.

To read the flame signal, connect the FSP136A Analog flame meter or equivalent to the FLAME CURRENT meter jack on the plug-in electronics chassis. This output is the unprocessed flame signal from the detector, and is intended as a diagnostic aid. Readings taken at the detector will facilitate installing the detector in the best sighting position by pinpointing the region of greatest UV intensity for a given flame.

CAUTION

When the Flame Signal Readings is completed, put the cover back in accordance with THE MAINTENANCE PROCEDURE page 13.

Figure 8 illustrates the relationship between detector and amplifier readings. Detector saturation (the point at which an increase in ultraviolet intensity does not produce a noticeable increase in flame signal strength) occurs at "A". "B" represents the point at which the amplifier is saturated while the minimum ultraviolet intensity required for system operation is at "C".

The linearity of the detector output curve shows that a unit increase in ultraviolet intensity is accompanied by a corresponding increase in flame signal strength. This condition facilitates pinpointing the location of the most intense ultraviolet radiating from a flame. Thus, by locating the optimum flame signal with the detector, the peak ultraviolet signal, and therefore the most reliable reading, is obtained.

The minimum acceptable stable flame signal readings are;

C7076D Flame Detector: 1.4 microamps.
R7476A Flame Signal Amplifier: 2.5 microamps.

SENSITIVITY ADJUSTMENTS

IMPORTANT

The sensitivity adjustment should not be performed in an explosive atmosphere until the area has been made safe.

GENERAL CONSIDERATIONS

1. If a single detector is required to supervise both the pilot and main burner flames, verify the flame signal for each flame individually.
2. Make sure the minimum acceptable stable flame signal (1.4 microamps at the detector, or 2.5 microamps at the amplifier) is obtained throughout the entire turndown range of the burner.

SINGLE BURNER SYSTEMS

1. Adjust Sensitivity Control "A" for maximum sensitivity.
   a. If the remote sensitivity selection feature is used, make sure the external selector switch is open for Control "A" adjustment.
   b. Loosen the set point locking screw by Sensitivity Control "A".
   c. Turn the control clockwise (↻) to MAX position.
   d. Tighten the set point locking screw 1/4 past (do not over-tighten).
2. Adjust by reading the C7076D Flame Current.

IMPORTANT

In case of removing the C7076D rear cover plate and read the C7076D Flame Current, proceed the adjustments as follows.

a. Loosen the 6 screws in the rear cover plate of the C7076D and remove the plate.
b. Connect a FSP136A Analog flame meter to the FLAME CURRENT meter jack on the plug-in electronics chassis. The FSP136A selector switch must be at the "SPL" position. (If a FSP136A is not available, a microammeter with a 0 to 25 micro-amp dc range, shunted with 50 microfarad capacitor, may be used.)
c. Insert the plug into the FLAME CURRENT meter jack, and allow a few seconds for the meter reading to stabilize.
d. Read the average stable current, disregarding the peaks due to shutter operation.
e. Observe the flame signal while varying the line of sight of the detector. (Adjust the angle and/or position of the sighting pipe which was only tack welded as previously instructed.)
f. Try several sighting angles until you obtain the highest and most stable meter reading possible. (If it is less than 1.4 microamps, refer to the Troubleshooting section.)
g. Repeat step "f" for both the pilot and the main burner flame. Do not sacrifice the main flame signal to obtain an unnecessary high pilot flame signal.
h. Repeat steps "a" to "d" for Sensitivity Control "B", only if it is used. Make sure the extenal selector switch is closed while adjusting Control "B".
i. Secure the tack weld the sighting pipe. Do not weld the sighting pipe permanently into the place until you have completed the spark hold-in and pilot turndown tests.
j. Remove the plug from the FLAME CURRENT meter jack.
k. Replace the rear cover plate and tighten the screws securely as in THE MAINTENANCE PROCEDURE (Replace the plug-in electronics chassis.) steps 7 to 12 page 13.

Adjust by reading the R7476A amplifier flame current.

IMPORTANT

If the rear coverplate cannot be opened or removed, the Sensitivity Adjustments should be done by reading the R7476A amplifier flame current as follows.

a. Connect a FSP136A to the FLAME CURRENT meter jack on the R7476A amplifier. The W136A selector switch must be at the "SPL" position. (See above adjustment "b" to "j".)
b. Insert the plug into the R7476A FLAME CURRENT meter jack, and allow a few seconds for the meter reading to stabilize.
c. Read the average stable current, disregarding the peaks due to shutter operation.
d. Observe the flame signal while varying the line of sight of the detector.
e. Try several sighting angles until you obtain the highest and most stable meter reading possible.
f. Repeat "e" for both the pilot and the main burner flame. Do not sacrifice the main flame signal to obtain an unnecessary high pilot flame signal.
g. Repeat steps "a" to "c" for Sensitivity Control "B" if used. Make sure the external selector switch is closed while adjusting Control "B".
h. Secure the tack weld the sighting pipe. Do not weld the sighting pipe permanently into the place until you have completed the spark hold-in and pilot turndown tests.
i. Remove the plug from the FLAME CURRENT meter jack.

MULTIBURNER SYSTEMS (Flame discrimination)

1. Complete steps 1 through 3 under "single burner systems" above for each burner.
2. With all "A" sensitivity controls set to MAX position and all burners firing at full load, select one burner and proceed as follows:
   a. Shut down the chosen burner, then note the flame signal reading.
   b. Loosen the locking nut on Sensitivity Control "A".
   c. Gradually reduce the sensitivity by turning Control "A" counterclockwise until the flame relay (in the flame safeguard control) drops out.
   d. Relight the burner and note the flame signal reading. The difference between the new reading and the initial reading in step "a" represents the degree of flame discrimination.

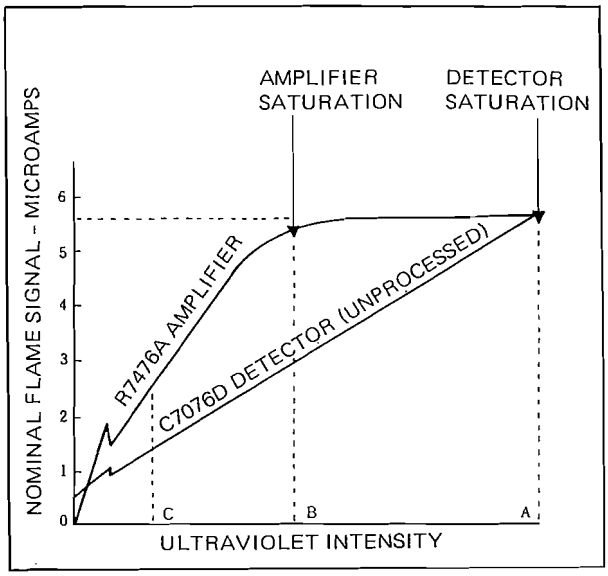


Fig. 8 The Flame Currents at C7076D Detector and R7476A Amplifier

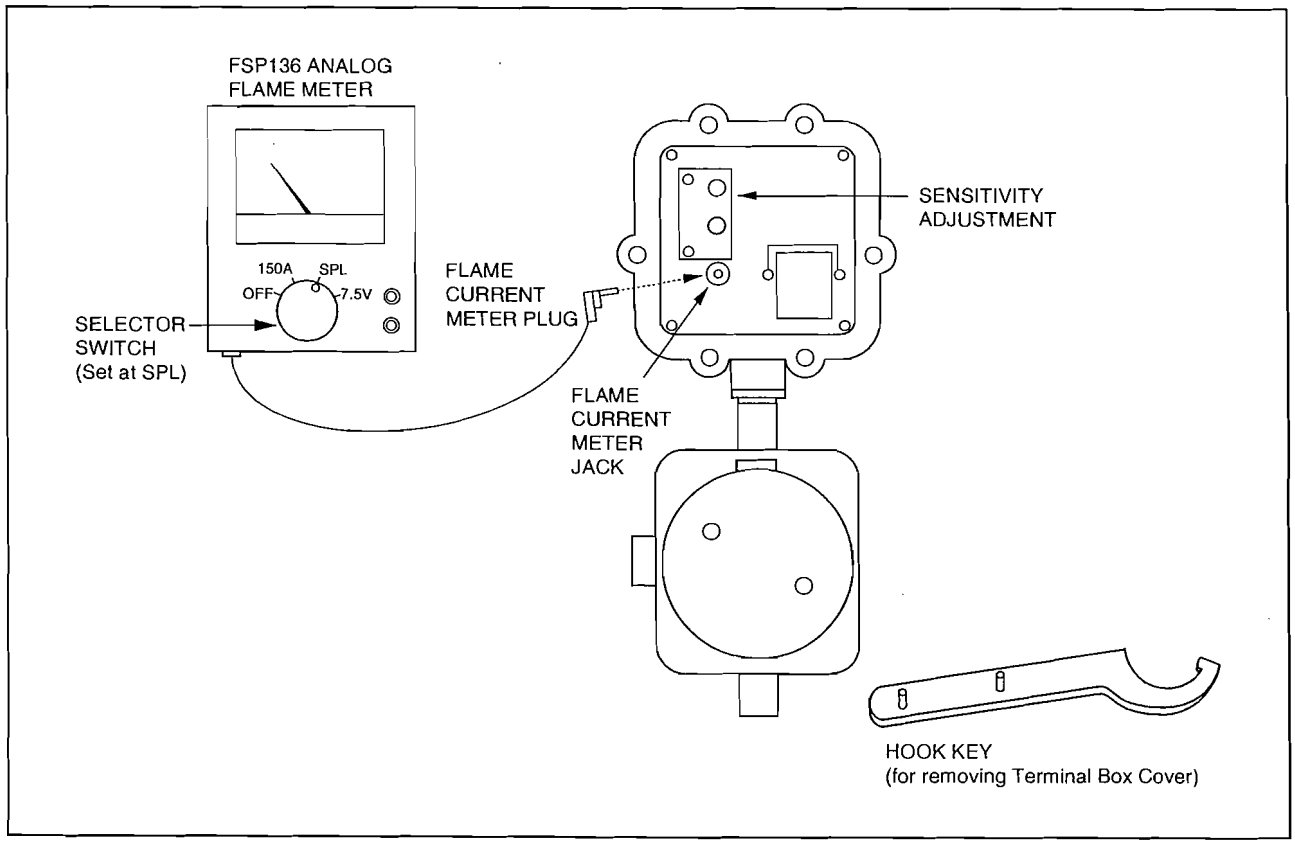


Fig. 9 Sensor Flame Current Reading

3. Repeat step 2 for Sensitiivity Control "A" on each burner.
4. Repeat step 2 for Sensitivity Control "B" (if used) on each burner. Verify that Sensitivity Controls "A" and "B" on each detector are properly indexed by the system fuel selector, firing rate switch, etc.

IMPORTANT

If the sensitivity control on a detector is reduced to MIN position and flame discrimination cannot be achieved, insert an orifice plate in the sight pipe. An orifice of the proper diameter will reduce the ultraviolet radiation reaching the detector so that the sensitivity can be adjusted to effect flame discrimination.

IMPORTANT

Complete pre-testing of the flame discrimination is required if burner flames are too close to each other or burner flames make one flame ball (junction of both flames).

MULTIFUEL SYSTEMS

For multifuel systems use one sensitivity control for each fuel. Follow step 2 and 3 above for each fuel.

IGNITION SPARK RESPONSE TEST

An ignition spark response test must be done for all detectors to ensure that ignition spark will not actuate the flame relay in the flame safeguard control. The test is done by manually closing all fuel valves, starting the system, and observing the flame relay when ignition comes on. If the flame relay pulls in, the C7076 must be repositioned to eliminate the response to ignition spark.

PILOT (IGNITOR) TURNDOWN TEST

A pilot (ignitor) turndown test must be done for all applications in which the detector must prove the pilot before the main fuel valve can open. This test proves that the smallest pilot flame which can hold in the flame relay (in the flame safeguard control) is also capable of safely igniting the main burner. The test consists of closing the main fuel valve, reducing the pilot flame until it is just able to hold in the flame relay, and then opening the main fuel valve to verify a safe main burner lightoff.

SECURE THE SIGHTING PIPE

When the flame signal is acceptable and all adjustments have been made, remove the detector and secure the sighting pipe. Weld the sighting pipe in its final position, then reinstall the detector.

FINAL CHECKOUT

Before putting the burner(s) into service, check out the installation using procedures in the Checkout section of the instruction sheet for the appropriate flame safeguard control. After completing the checkout, run the burner(s) through at least one complete cycle to verify proper operation.

TROUBLESHOOTING

CAUTION

1. Use utmost care while troubleshooting the detector; line voltage is present on some of the terminals when power is on.
2. Open the master switch before removing or installing the plug-in electronics chassis or the detector.
3. Before making a replacement, make sure you have the correct part (check its part number and voltage rating).
4. Upon completion of troubleshooting, be sure to perform the adjustments and checkout beginning on page 8.

If you can't obtain a satisfactory flame signal while adjusting the sensitivity, follow these procedures. If you encounter other problems in the system, refer to the Troubleshooting section in the instruction sheet for the appropriate flame safeguard control.

CAUTION

The following procedures should not be performed in an explosive atmosphere until the area has been made safe.

IMPORTANT

Instructions for replacing the quartz glass, viewing lens, sensing tube, coil and shutter assembly, and plug-in electronics chassis are given in the Service section (page 12).

EQUIPMENT REQUIRED

1. Voltmeter with 0 to 300 volt ac scale.
2. Analog flame meter (FSP136A or equivalent) with 0 to 25 microamp range "SPL" damping.
3. Meter connector plug.
4. Replacement parts– see Specifications section.

PRELIMINARY PROCEDURES

1. If you are using remote sensitivity selection, make sure that the external selector switch is open if adjusting Sensitivity Control "A" or closed if adjusting Sensitivity Control "B".
2. If the combustion chamber has a positive pressure, make sure the sighting pipe inlet pressure of airflow equals or exceeds that required for sighting pipe seal off.
3. Remove the Explosion-Proof Terminal Box cover to expose the terminal block by turning it counterclockwise (↺) with the wrench.
4. After each step in the following procedures, loosen the six screws in the rear cover plate and check for a meter reading at the FLAME CURRENT METER jack on the detector (Fig. 9)
   a. If you get a reading above 1.4 microamps and the flame relay (in the flame safeguard control) pulls in, return to Sensitivity Adjustments page 8.
   b. If you do not get a reading, proceed with Procedure A.
   c. If you get a reading but the flame relay (in the flame safeguard control) does not pull in, proceed with Procedure B.

TROUBLESHOOTING PROCEDURES

If the detector develops a signal at the FLAME CURRENT METER jack, skip Procedure A for a zero flame signal reading. Refer to the Figure 7 for terminal locations.

A. ZERO FLAME SIGNAL READING AT DETECTOR (Flame relay does not pull in)

1. Complete the Preliminary Procedures described above.
2. Check for proper line voltage. Connect an ac voltmeter across terminals 1 and 2 on the terminal block. Make sure the ac voltage measured is within the following voltage range:
   Nominal voltage rating: 100V ac
   Acceptable line voltage
   Minimum: 85V ac
   Maximum: 110V ac
   a. If there is no voltage, make sure line voltage power is connected to the master switch, the master switch is closed, and overload protection (circuit breaker, fuse, or similar device) has not opened the power circuit.
   b. If the measured voltage is not within the proper voltage range, make sure the main power supply is of the correct voltage and frequency. Then trace the wiring between the detector and the main power supply to determine the problem.
3. Determine if the self-checking shutter is open by looking into the front of the detector through the pipe.
   a. If the shutter is not open, connect an ac voltmeter across terminals 3 and 4 on the terminal block. Make sure the ac voltage measured is within the voltage range mentioned below for the particular detector model used. (The nominal voltage rating is printed on the transformer cover next to the sensitivity controls on the rear of the plug-in electronics chassis.)
      Nominal detector voltage rating: 100V ac
      Acceptable shutter voltage
      Minimum: 85V ac
      Maximum: 110V ac
      (1) If the proper voltage is present, replace the coil and shutter assembly or the entire plug-in electronics chassis (see Service section).
      (2) If the measured voltage is not within the proper voltage range, connect a dc voltmeter (capable of measuring 50 volts) across terminals 6(F) and 5(G) on the terminal block (F is +, G is -).
      – If the voltage is 2 volts or more, replace the plug-in electronics chassis (see Service Section).
      – If the voltage is less than 2 volts, trace the shutter wiring between the detector and flame safeguard control (refer to Figure 7). If the wiring is correct but the proper voltage is still not present, replace the plug-in R7476A Dynamic Self-Check Ultraviolet Amplifier.
   b. If the shutter is open, make sure the sensitivity control on the plug-in electronics chassis is not set too low for the flame conditions encountered. (Refer to Adjustments and Checkout section.)
4. Make sure the viewing path is clear.
   a. Clean the sighting pipe. Make sure there are no obstructions in it.
   b. Make sure the proper viewing lens and quartz glass are used.

IMPORTANT

Window glass does not transmit ultraviolet radiation. You can check for an improper lens by testing the detector with the lens removed (front cover plate off).

   c. Clean the viewing lens and glass with a soft, clean cloth.
5. If the previous actions have not corrected the problem, replace the Ultraviolet Sensing Tube No. 191053 (see Service section).
6. If you still do not get a meter reading, replace the plug-in electronics chassis.

B. FLAME SIGNAL READING PRESENT AT DETECTOR (Flame relay does not pull in)

1. Complete the Preliminary Procedures described above.
2. Determine if the self-checking shutter is closed by looking into the front of the detector through the pipe in the wiring compartment. If the shutter is closed and the signal at the FLAME CURRENT jack on the detector is 1 microamp or more, remove the ultraviolet sensing tube (see Service section) and operate the detector.
   a. If the shutter opens, replace the Ultraviolet Sensing Tube No. 191053.
   b. If the shutter stays closed, replace the plug-in electronics chassis (see Service section).
3. If the flame signal measured at the FLAME CURRENT METER jack on the detector is weak (less than 1.4 microamps), proceed as follows:
   a. Clean the sighting pipe. Make sure there are no obstructions in it.
   b. Clean the viewing lens and glass with a soft, clean cloth.
   c. Make sure the sensitivity control on the plug-in electronics chassis is not set too low for the flame conditions encountered. (Refer to Adjustments and Checkout section.)
   d. Resight the detector. See Planning the Installation and Installation sections.
4. If the flame signal measured at the FLAME CURRENT METER jack on the detector is strong (greater than 1.4 microamps), but the flame relay does not pull in, connect a dc voltmeter (capable of measuring 50 volts) across terminals 6(F) and 5(G) on the terminal block (F is +, G is –).
   a. If the voltage is less than 5 volts and the shutter is not oscillating, disconnect the "F" leadwire from terminal 6 for a moment.
      (1) If the voltage (5 to 6) rises, trace the wiring between the detector and the flame safeguard control (refer to Figure 7). If the wiring is correct (no "shorts"), replace the plug-in R7476A Dynamic Self-Check Ultraviolet Amplifier.
      (2) If the voltage (F to G) does not rise, replace the plug-in electronics chassis (see Service section).
   b. If the voltage is 5 volts or more, check the F and G leadwires between the detector and the flame safeguard control. If they are wired properly (no "opens"), replace the plug-in R7476A Dynamic Self-Check Ultraviolet Amplifier.
5. If the previous actions have not corrected the problem, replace the plug-in electronics chassis.

SERVICE AND MAINTENANCE

CAUTION

1. Only qualified servicemen should attempt to service or repair flame safeguard controls and burner management systems.
2. If the combusion chamber has a positive pressure, make sure the airflow through the sighting pipe equals or exceeds the value required for seal-off before removing the detector.
3. Open the master switch before removing or installing the plug-in electronics chassis or the detector.
4. Before making a replacement, make sure you have the correct part (check its part number and voltage rating).

PERIODIC MAINTENANCE

1. Keep the flame detection system adjusted for safe and reliable operation.
2. Clean the viewing lens and glass regularly.
   a. Remove the C7076D from the sighting pipe.
   b. Clean the quartz lens and glass with a soft, clean cloth.
   c. If the lens or the glass is damaged or it is coated with a substance which cannot be cleaned off, replace it.

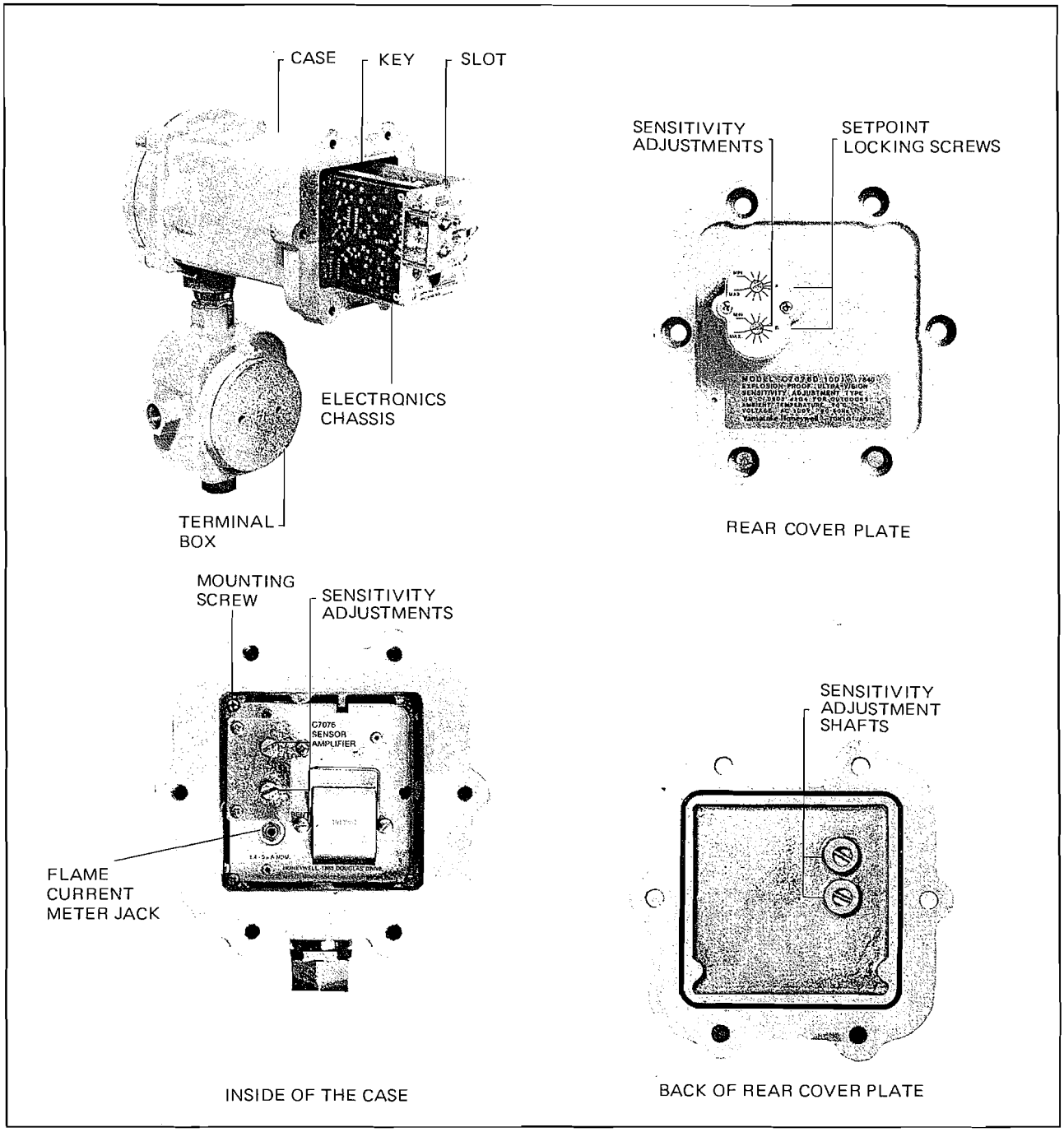


Photo. 1 Replacing the Plug-in Electronics Chassis

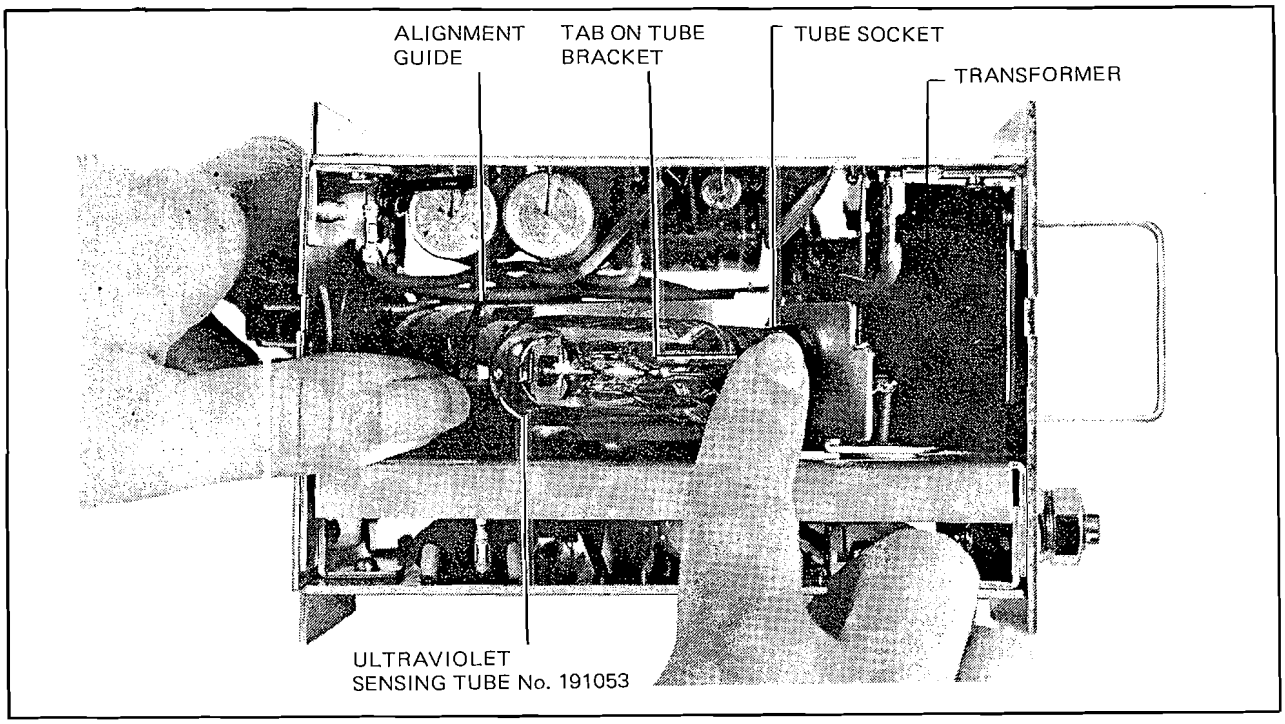


Photo. 2 Replacing the Ultraviolet Sensing Tube

3. Replace the Ultraviolet Sensing Tube No. 191053 if it is damaged.
4. Check inside of the electronics chassis. If the shutter doesn't work smoothly, fix it or replace the shutter with new one.
5. Read the flame current as required and adjust in accordance with the ADJUSTMENTS procedure page 8.

MAINTENANCE PROCEDURES

REPLACING THE PLUG-IN ELECTRONICS CHASSIS

1. Open the master switch to interrupt all power to the detector.
2. Loosen the 6 screws in the rear cover plate and remove the plate.
3. Remove the 4 screws that hold the plug-in electronics chassis and pull the chassis out of the housing.
4. Align the slot in the top of the new chassis with the key in the housing. (Make sure the part number and voltage rating of the new chassis are correct.)
5. Insert the new chassis in the housing and push it firmly all the way in (Photo. 1). Make sure the octal plug on the chassis is securely seated in the socket in the housing.
6. Insert the 4 screws that hold the chassis and tighten them securely.

IMPORTANT

The following steps 7 to 12 should not be performed in an explosive atmosphere until the area has been made safe.

7. Connect the FSP136A Analog flame meter to the FLAME CURRENT METER jack.
8. Close the master switch and adjust the Sensitivity Control(s) in accordance with the ADJUSTMENT procedure page 8.
9. Read and make a memo of the positions of the sensitivity control(s). Then, turn the both sensitivity controls to either direction, NAX or MIN.
10. Loosen lock screws by the sensitivity control drive shafts on the rear cover and turn the shafts to MAX or MIN, the same directions as the sensitivity control of the electronic chassis.
11. Replace the cover carefully, so that the ends of shafts in the rear cover just meet the sensitivity controls, and tighten the 6 screws securely.
12. Turn the shafts (sensitivity controls) to the positions you have written on the memo.

REPLACING THE ULTRAVIOLET SENSING TUBE

1. Open the master switch and remove the plug-in electronics chassis. (Complete steps 1 through 3 of "Replacing the Plug-in Electronics Chassis" above.)
2. Locate the sensing tube near the top of the chassis (Photo. 2).
3. Gently bend the alignment guide, just enough to free the tip of the tube.
4. Grasp the tab on the tube bracket and swing the tube out from the chassis.
5. Pull the tube out of its socket.
6. Align the 3 pins on the new tube with the holes in the socket.
7. Push the new tube firmly into the socket. Make sure it is seated securely.
8. Swing the tube back into place in the chassis. The alignment guide will snap into place around the tip of the tube.
9. Reinstall the plug-in electronics chassis. (Refer to steps 4 through 12 of "Replacing the plug-in electronics chassis" above.)
10. Close the master switch and perform the adjustments and checkout.

IMPORTANT

Be very careful not to kink or otherwise damage the shutter (Photo. 3).

REPLACING THE COIL AND SHUTTER ASSEMBLY

1. Open the master switch and remove the plug-in electronics chassis. (Complete steps 1 through 3 of "Replacing the plug-in electronics chassis".)

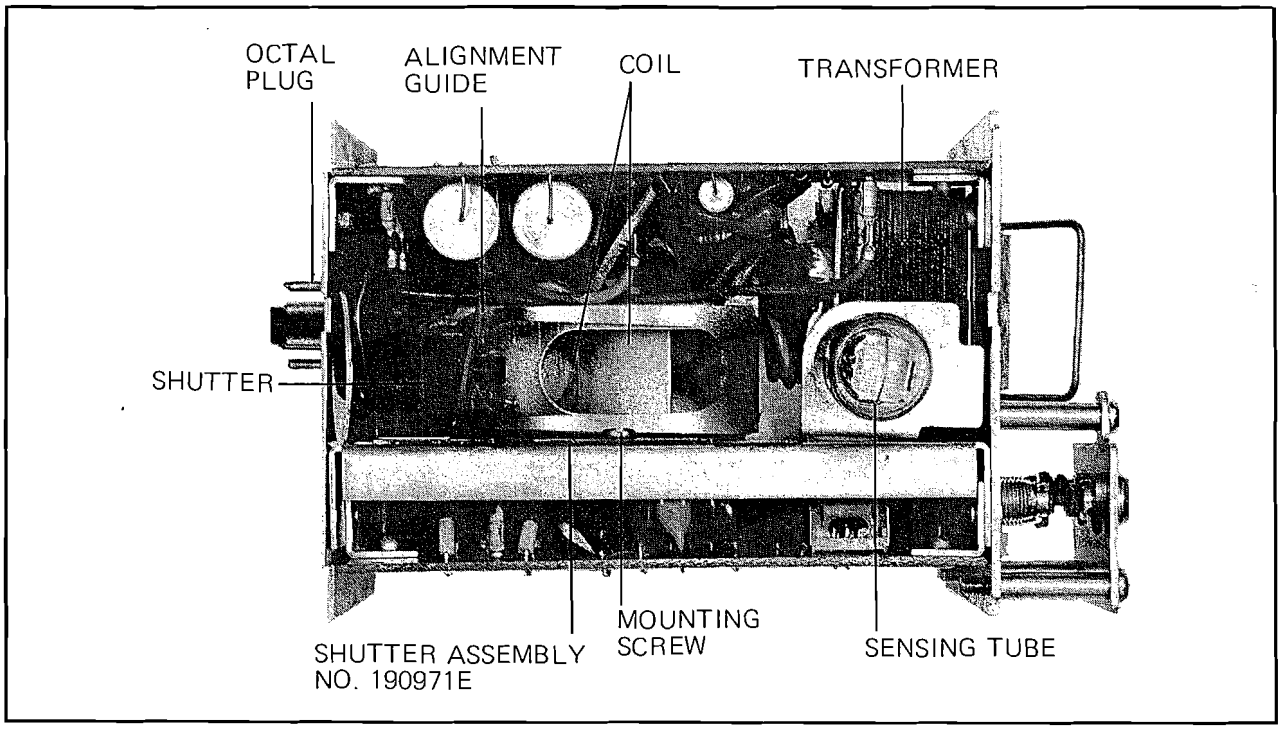


Photo. 3 Coil and Shutter Assembly

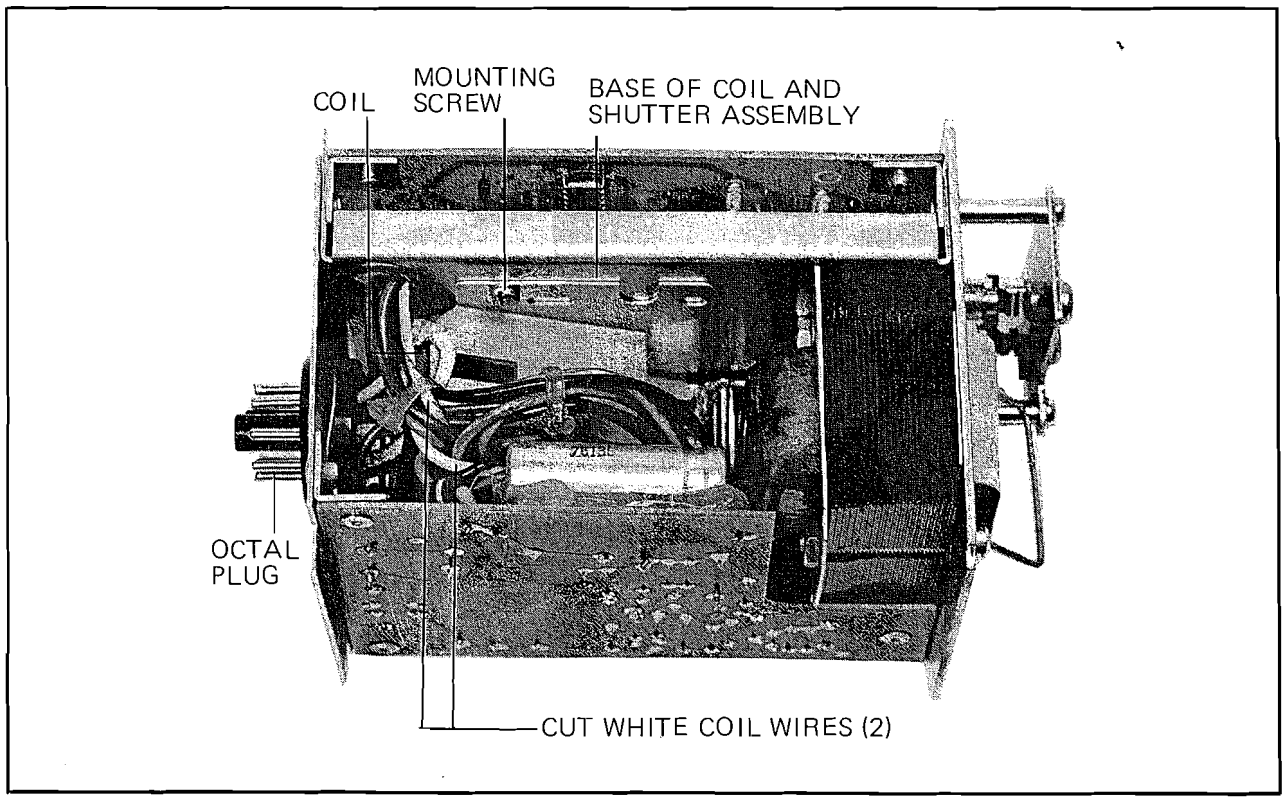


Photo. 4 Replacing the Coil and Shutter Assembly

2. Locate the coil near the bottom of the chassis (Photo. 4).
3. Cut the 2 white coil wires as close to the coil as possible.
4. Remove the mounting screw from the base of the coil and shutter assembly.
5. Turn the chassis over and locate the sensing tube.
6. Gently push the alignment guide away from the tube (just enough toe free the tip of the sensing tube) and swing the tube out from the chassis as far as it will go (Photo. 2).
7. Remove the other mounting screw from the base of the coil and shutter assembly (Photo. 3).
8. Carefully slide the coil and shutter assembly out of the chassis.

NOTE: It may be necessary to move some of the transformer leadwires out of the way in order to slide the coil and shutter assembly past them.

9. Slide the new coil and shutter assembly into place. (Make sure its part number and voltage rating are correct.)
10. Remove about 6mm (1/4 inch) of insulation from each of the 2 short, white leadwires still connected to the octal plug.
11. Using wire nuts, connect one of the coil wires to one of the short, white leadwires on the plug and connect the other coil wire to the other short, white leadwire.
12. Insert the 2 mounting screws in the base of the coil and shutter assembly and tighten them securely.
13. Swing the sensing tube back into place in the chassis. The alignment guide will snap into place around the tip of the tube.
14. Reinstall the plug-in electronics chassis. (Refer to steps 4 through 12 of "Replacing the Plug-in Electronics Chassis".)
15. Close the master switch.

IMPORTANT

Be very careful not to kink or otherwise damage the shutter.

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FIGURES

PHOTOGRAPHS

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Specifications are subject to change without notice.

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