Installing Flame Monitoring Equipment on Eclipse Burners

NOTICE

- **The contents of this Information Guide are not intended to supersede any information or installation recommendations provided by manufacturers of flame monitoring equipment. If they appear to conflict, contact the Eclipse factory and/or the flame monitor manufacturer for clarification.**

General

Flame monitoring equipment is widely accepted as a way to enhance the operating safety of combustion equipment. To maintain that degree of safety and to avoid lost production due to nuisance shutdowns, use care and common sense in installing and maintaining that equipment. This Information Guide contains recommendations and tips on the proper use of flame monitoring equipment.

Detector Types

Five types of flame detectors are used to monitor burner flames:

Thermocouples (Heat-Actuated Detectors)

When heated, thermocouples generate a millivolt signal which can be used to actuate fuel shutoff valves. They are not allowed on industrial combustion equipment covered by NFPA Standard 86 and have limited acceptance under European standard EN 746-2. Thermocouple flame detectors are typically used on small listed combustion appliances. **Eclipse does not recommend the use of heat actuated detectors on its burners.**

Photocells

These detectors employ a light-sensitive cell that sends a signal when it sees a flame. Photocells must be used in dark chambers with bright flames and may not see the translucent blue flame of some gas burners. **Eclipse does not recommend the use of photocells for flame detection on its burners.**

Lead Sulfide (P_bS)

Lead sulfide cells are sensitive to infrared radiation. When present in sufficient strength, this radiation will cause the cell to close the circuit to the automatic fuel shutoff valve. There have been instances where lead sulfide cells have been "fooled" by infrared radiation from hot refractory surfaces, even when no flame is present. Certain controllers use circuitry to detect only the flickering infrared radiation from the flame and ignore the steady state radiation from the refractory. However, vibration and swirling contaminants in the sighting path may still send a signal when there is no flame. **Eclipse does not recommend the use of Lead Sulfide for flame detection on its burners.**

Flame Rods

Flame rods operate on the rectification principle. Flames contain ions capable of conducting electrical current. An AC voltage on the flame rod will conduct current through the flame to a grounding surface, usually the metal parts of the burner. The signal will be rectified to DC with a 4 to 1 ratio of surface areas of the burner ground and flame rod that are in contact with the flame. On receipt of the DC signal, the controller will send power to keep the automatic fuel shutoff valves open. If the flame rod shorts to ground, then the DC signal is lost and the resulting AC signal is rejected by the controller and the shutoff valves are closed. Because of this action, flame rods with appropriate flame safeguard controllers are considered fail safe.

Unless the burner manufacturer's literature states otherwise, use flame rods only on gas burners, not oil burners. The rods may accumulate soot, or oil film, causing nuisance shutdowns.

Flame rods will work properly only if you maintain a predetermined ratio of rod surface area to burner grounding area in contact with the flame. Consequently, observe the flame rod length recommendations published for various burners.

Ultraviolet (UV) Scanners

UV scanners pass electrical current pulses where they see ultraviolet radiation, which is present in gas and oil flames. They are much less susceptible than photocells or lead sulfide cells to being "fooled" by stray radiation from hot refractories or other sources.

The UV scanner uses a tube made of quartz or other special glass that is transparent to UV radiation and may be damaged with rough handling. Any type of lens or window used with UV scanners cannot be made of standard glass. Soot, steam and unburned hydrocarbons can also absorb UV radiation and weaken the flame signal. Most tubes are designed to respond only to certain UV wavelengths from the flame and not from sunlight. Eclipse recommends use of UV tubes that are solar blind.

UV scanner brands must not be mixed between manufacturers of the flame safeguards. A scanner and its particular tube are matched to the controller and approved by agencies for use together. Only use scanners that are specifically recommended for use with the controller.

Installation of Flame Detectors on Burners

General

Install the flame detector in the burner connections specified by the burner documentation. These connections provide the proper location for sighting both the pilot and main flames.

Flame Rod Installation

1. Check the flame rod electrode to make sure it is the length recommended for the burner and is not bent, kinked, or twisted.
2. Inspect the rod insulator. It should not be cracked or chipped.
3. Screw the flame rod directly into the burner's threaded connection. If the thread sizes differ, use a reducing bushing to make them match. Avoid adaptors made of pipe couplings and nipples - they may change the insertion length of the flame rod below that required for a strong flame signal. Do not overtighten the rod in the burner connection, or you may crack its insulator. Also make sure that the flame electrode doesn't touch any of the burner parts.

UV Scanner Installation

1. Mount the scanner to the burner connection using an Eclipse Scanner Adapter (Bulletin 836), Heat Block Seal (Bulletin 834) or pipe fittings. Do not use pipe or fittings of any size smaller than the smaller of the two thread connections, or weak flame signals will result. Install the scanner as close to the burner as temperature conditions permit. This ensures the best possible field of view for the scanner.
2. Make sure the scanner mounting nut is screwed snugly onto the adapter thread and that the scanner nut gasket (if furnished) is in place. Loose-fitting scanners may tilt on their adaptors, causing them to sight at the wrong angle.
3. Do not allow the scanner to operate at temperatures above the manufacturer's published limit. Scanners can be overheated by high ambient temperatures, heat conducted and radiated from burner and furnace surfaces, or a combination of the two. On most installations, scanners can be kept cool by purge air blown into the scanner adaptor as shown in Figure 1.

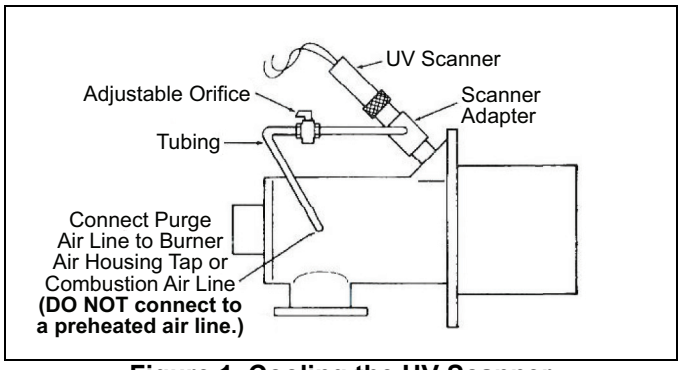

Figure 1. Cooling the UV Scanner

Eclipse UV scanner adaptors and Heat Block Seals include tapped connections for purge lines. The adjustable orifice cock in Figure 1 permits setting the purge air at the optimum flow rate.

On some burners, the scanner connection sights through the length of the combustion air housing. The cold combustion air should suffice to keep the scanner cool, so no additional purge air is required.

Preheated air burners pose a special problem, because the larger amount of heat conducted and radiated from the burner can easily overheat the scanner. Always use a Heat Block Seal such as Eclipe's HBS (Bulletin 834) on preheated air burners. These adaptors include a quartz lense and a non-metallic insulating nipple to reduce the heat conducted back to the scanner. Cool purge air will probably also be required.

In extreme cases, even these measures may not be sufficient, and it may be necessary to use a radiation shield or to blow cooling air over the scanner.

Wiring

Follow Manufacturer's Recommendations

Follow the flame detector manufacturer's recommendations regarding wire gauges, insulation grades and line lengths. Wire type and length may weaken signal strength due to capacitive coupling to ground.

On some installations, the wiring and its conduit may be exposed to higher-than-normal temperatures. In these cases, use wiring with high temperature insulation.

Wiring Splices

Make as few wiring splices as possible between the detector and its relay, as each splice is a potential source of current leakage or grounding.

Make sure the bare wire ends at each splice are clean and not oxidized. Secure splices with twist or crimp connectors, and tape, if necessary, to ensure that no bare metal is exposed. Make sure the connectors and tape are rated for the temperature at the splice location.

Use Caution Regarding Wires Through Boxes

Take care not to cut or nick the wires when pulling them through conduit or junction boxes.

Wires from Several Flame Detectors

Wires from several flame detectors may be run together in a common conduit, but do not place them in the same conduit with high voltage ignition wires. Some manufacturers permit detector lead wires in the same conduit as 120 VAC control wiring, but may limit the length of run in a shared conduit. For longer runs, separate conduits are required.

Also, long runs may require shielding to prevent cross interference and inducing a false signal onto a wire of a detector with no flame from a detector wire that is sensing a flame.

Make sure that you connect the flame sensor of a burner to the electrical circuit of that burner.

Grounding

Make sure the flame relay is properly grounded. UV scanners generally require grounding as well - this can be done through the burner. However, if the scanner is mounted on a Heat Block Seal using a non-metallic nipple, there will not be a ground connection to the burner. Likewise, do not use non-conducting pipe dope on scanner or adaptor threads.

Spark Interference

Electric spark ignition produces strong ultraviolet radiation. A UV scanner can detect this radiation on some burners, either by direct line of sight or by reflections from burner parts. Test the effect of the ignition system on the flame signal and control sequence both without and with flow of fuel to the burner. Flame rod signals can also be affected due to electrical interference and sharing of the ground connections. The signal may be increased, decreased or very erratic while the ignition is on. The following steps may help reduce spark interference:

1. Separate or shield the detector wiring from the ignition wiring.
2. Ensure proper grounding of the ignition transformer to burner housing.
3. Reverse the wires feeding the primary to the ignition transformer.
4. Check for proper spark gap.
5. Clean, repair or replace faulty wiring and connectors.
6. Move the location of the ignition transformer.
7. Block UV scanner sighting with an orifice adapter.
8. Use a half-wave ignition transformer if allowed for the type of igniter and burner.

General Electrical Information

CAUTION

- **Installation and trouble-shooting of flame supervisory circuits should be done by qualified electricians, technicians or engineers experienced in all facets of this type of control equipment.**

Electrical Wiring Compliances

All the electrical wiring must comply with all applicable local codes and/or standards such as NFPA Standard 70, IEC60364, CSA C22, BS7671 and be acceptable to the local authority having jurisdiction.

Handling Flame Supervisory Components

Exercise extreme caution in handling all flame supervisory components. Many parts of the system operate at high voltage and pose an electrocution hazard.

Troubleshooting

Refer to the product literature for the specific type of flame supervising equipment in use. In addition, check that the installation was made according to the recommendations in this Information Guide.

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