GROUNDING METHODS FOR FIREYE® FLAME-MONITOR™ APPLICATIONS

SERVICE NOTE #100

Definition

The primary function of electrical grounding required by the National Electrical Code (NEC) is to provide safety for equipment and personnel from abnormal electrical conditions. The grounding also provides a path for dissipation of the high-energy electrical discharges caused by lightning, as well as prevents build-up of static charges on equipment and materials. In addition, the ground establishes an equipotential or zero-voltage (reference) for the electrical system.

A good ground system should be provided to minimize the effects of AC quality problems. A properly designed ground system meeting all the safety requirements will ensure that any AC voltage quality problems, such as spikes, surges and impulses have a low impedance path to ground. A low impedance path to ground is required to ensure that large currents involved with any surge voltages will follow the desired path in preference to alternative paths, where extensive damage may occur to equipment.

General Rules

The Flame-Monitor system, being microprocessor based, requires a ground system that provides a zero-voltage reference. Fireye bulletin E1101 specifies, with the Flame-Monitor removed, the voltage measured from L2 to all other terminals except L1 should be 0 volts.

1. The most effective ground is to run the ground wire in the same raceway as the hot and neutral from the main distribution service panel (not intermediate subpanels) to the burner control panel and insure that this ground wire is well bonded to the control panel.
2. The wiring base of the Flame-Monitor must have earth ground providing a connection between the subbase and the control panel or the burner.
3. The earth ground wire must be capable of conducting the current to blow the 20A fuse in event of an internal short circuit. A number 14 copper conductor is adequate, wide straps or brackets are preferred rather than lead wires.
4. The ground path needs to be low impedance (less than 1 ohm) to the equipment frame which in turn needs a low impedance to earth ground. For a ground path to be low impedance at RF frequencies, the connection must be made with minimum length conductors having maximum surface areas.
5. All connections should be free of non-conducting coatings and protected against rust.
6. Utilizing conduit as a means of providing a ground must be avoided.
7. Installing ground rods at the burner control panel defeats the purpose of a single point ground as described above and could also present a safety hazard.

Upgrade or Retro-fit

It is recommended to change the existing P-Series chassis to a new Flame-Monitor subbase (60-1386-2 or 60-1466-2),

If the installation is an upgrade, particularly using a P-FM adapter, this means the wiring has been in place for a number of years and probably, over time, has had other wires added to the system. All wiring and terminal connections should be inspected for tightness. Long wires should be shortened and routed directly point to point instead of lengthened using wire nuts. If the existing frame is used, the frame of the P-Series chassis should be well bonded to the panel and the adapter securely screwed into the chassis.

Often, C-Series and/or D-Series subbases are not properly grounded so the same rules for the P-Series should apply. The subbases for the C and D Series were factory painted and not plated. Good bonding screws with star washers should be utilized. Refer to General Rules above.

Installation

Do not run high voltage ignition transformer wires in the same conduit with flame detection wiring.

Do not run scanner wires in a conduit with line voltage circuits.

Ensure the frame of the ignition transformer is securely connected to control panel frame or the burner frame.

The Flame-Monitor chassis (E100/E110) contains a transient suppressing device connected internally across hot and neutral and then to the internal bracket. For this to be effective the chassis must be screwed securely into the wiring subbase so that the spot face on the bracket located in the E100/E110 chassis comes in contact with the locking nut located in the subbase.

Remote Display

When the ED510 is to be remotely mounted on the front of the control panel, the ED580 cable must contain a ferrite core, currently supplied by Fireye with the ED580 cable. High frequency currents flow more to the surface of the conductor. The 60 Hz ground system, properly designed, has sufficient low-impedance at 60 Hz to maintain all metal surfaces at the same ground reference. But, this same system is unable to provide this at higher frequencies because of the increased impedance caused by the 'skin effect'. The purpose of the ferrite core is to provide a low-impedance at these higher frequencies and absorb this unwanted energy.

Care must be taken not to route the ED580 cable in close proximity to any starter motor contactors located in the control panel or across any high voltage ignition wires. Refer to Fireye bulletin E-8002 for proper installation.

Communications

When interfacing Fireye controls to a communication system, be it an E500, PLC or other microprocessor based device, ferrite cores should also be utilized. Fireye supplied ED512 cables provide the ferrite cores attached to the cables. For longer runs beyond the lengths of ED512, proper twisted shielded pair cable must be utilized. In a multi-drop system, the shields should be tied together within a cabinet and not to any ground point. The shield at the source end of the cable of the multi-drop connection can then be terminated to ground. Source end is defined as the originating end of the communication system

Care must be taken not to route communication cables in close proximity to any starter motor contactors located in the control panel or across any high voltage ignition wires. Refer to Fireye bulletin E-8002 for proper installation.

Expansion Module

For connection to an E300 expansion module, the Fireye E350 cable must be utilized with the green grounding wire being connected to the green screw at the Flame-Monitor end. Care must be taken not to route the expansion module cable in close proximity to any starter motor contactors located in the control panel or across any high voltage ignition wires. It is not good practice to route the E350 cable in the same race way as the high voltage control wires.

Scanners

The armored cable supplied with the Ultra-Violet and Infrared scanners should be connected to equipment by means of a good mechanical connection such as a conduit fitting. It may be necessary to utilize heat insulator (35-69) to isolate the sensing end of the scanner from boiler ground. Care must be taken not to route the scanner cable across the high voltage ignition cable. The high energy ignition cable should be checked periodically for cracking, connections and aging.

In applications using flame rod units and the ERT1 amplifier, it may be beneficial to route a separate return wire for the S2 terminal to the flame rod assembly. This will minimize the effects of transient currents flowing into the Flame-Monitor.

In all cases, scanner wires should be routed in separate conduit and not joined with any high voltage AC or ignition cables.

Maintenance

Periodically, the spark electrode should be inspected for proper gapping and cracked ceramics. At ignition time, the high energy from the ignition transformer will attempt to conduct to the point of least resistance and with an improper spark gap, where the conduction takes place will no longer be controlled.

The VA rating of the control transformer must be sized to handle the inrush currents of the pilot solenoid and ignition transformer at PTFI and the then the inrush currents of the main fuel valve assembly at MTFI time.

Inspect neatness of wiring in junction boxes and cabinets. It is best to have connections short and direct and also not having wires bunched up and tied off. Also connections should be periodically inspected for tightness and corrosion.