SPECIFICATIONS ON HOW TO CHOOSE AND USE FLAME SENSORS

MODEL: 7515

Revision: 0

BULLETIN 7515

SUPERVISION FLAME DETECTION CIRCUIT

All flame detection systems utilize either an electrode or ultraviolet (UV) scanner as a flame sensor. The flame sensor circuit has a voltage of 300 VAC. This current is rectified to produce a DC current that can then be recognized by the ESTRO flame detection system. The input circuit adequately filters the continuous voltage and amplifies its signal in order to initiate either mechanical or optical couplers that interface the detection system with the control circuit. These circuits are always independent and provide operational safety and protection from electromagnetic fields.

The transformer-separator provides the electric power to the flame sensor. This allows the flame sensor to operate on either 115 V or 230 V. Additionally, it eliminates the problems associated with the phase-neutral and phase-to-phase systems.

FLAME SENSOR CABLE INSTALLATION TIPS

Due to the low voltage of flame sensors, precautionary measures should be taken to limit the possible interferences encountered by the flame detection system. The following are a few principles to be followed to obtain the best results:

- Cable lengths should be as short as possible. Standard cable lengths are between 30 and 60 feet. If longer cables are absolutely required follow this suggestion: Use Ultraviolet sensors as they are less sensitive to cable lengths. Cable lengths between 90 and 120 feet can be tolerated without causing problems. Cable lengths in excess of 300 feet are not common. Therefore, for runs in excess of 300 feet, on line and on temperature performance testing should be conducted as a part of the initial start-up to verify the functionality of the flame detection system.

- Cables should be inside conduits and as far as possible from other leads and power cables. Conduits should be metallic and grounded per the appropriate regulations. If there are numerous detection lines it is best not to group all the leads inside the same conduit. It is best to use more than one conduit.

- Single wire cable should be used as it has the higher insulating properties and lower capacitance. Any leakage path may affect the ionization current. Heat-resistant and insulating cable should be used. The cable size is not significant. However, single strand, 18 gauge and larger wire cable that complies with the regulations concerning the flame sensors should be used. Shielded cables are not recommended and multi-stranded wire cables must not be used.

- Ignition transformers may affect flame detection. Therefore, transformer high voltage cables to the spark plug or spark electrode should be as short as possible. Spark electrodes should be installed as far from the flame rods as possible. The two (2) circuits should be independent.

- Inverting the connections on the primary side of the ignition transformer may be helpful. This is particularly true when a decrease in the ionization current occurs during ignition. Systems using one electrode (uni-rod) for ignition and detection do not have this type of problem.

DETECTION USING A UV-TUBE

The micro-amp signal generated by a UV-tube is higher than those generated by a flame detection electrode. The UV-tube, within the detector, reacts only when it is exposed to UV radiation, generated by a flame, in the 190 to 270 nm spectrum band. Neither infra-red radiation (glowing fire brick), daylight nor artificial light produce signals within this wave length and therefore do not simulate a flame (exception: some discharge lamps i.e. mercury vapor, etc.).

When mounting a UV-sensor it should be directed at the flame. The field of vision should not be restricted or obstructed. To help prevent damage to and contaminates from harming the UV-detector tube, a quartz glass (window) may be installed within the detector housing.

The service life of the UV-tube is approximately 10,000 hours in a maximum temperature atmosphere of 125 F. Cooling air can be supplied if required.

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MAXIMUM RECOMMENDED LENGTHS FOR FLAME SENSOR CABLES AND INSULATING MATERIALS

Material	Max. Length (ft.)	Temperature (°F)	
		Min.	Max.
PVC (Polyvinyl Chloride) Vinoflex-Vestolit-Hostalit-Vinnol	< 150	-60	220
PE (Polyethylene) Lupolen-Hostalen-Vestolen	< 300	-95	175
PA (Polyamid) Nylon-Rilsan	*	-70	220
PP (Polypropylene) Hostalen PP-Novolen-Vestolen	< 300	15	195
PTFE (Polytetrafluorethylene) Teflon-Fuon-Hostaflon	< 300	-150	500
PVF 2 (Polyvinylfluorid) Kynar	*	-20	300
EFTE (Copolymer of PTFE) Tefzel	< 300	-150	300
PCTFE (ECTFE Polychlortrifluorethylene) Halon-Polifluoron	< 300	-40	300
PI (Polyamid) Kapton	< 240	-130	530
Pur (Polyurethan) Vulkollan-Caprolan-Desmopan	*	-75	195
PS (Polystyrene) Novodur-Luran-Hostyren-Vestyren	< 300	30	150
SiR (Silicone Rubber) Silopren-Silikon	< 300	-75	355
SBR (Styrene Butadiene Rubber) BUNA	< 60	-20	140
IIR (Butyl Rubber) Enjay-Butyl	< 120	-75	220
CR (Polichloroprene) Neoprene-Baypren	*	-40	140
CSM Hypalon	*	-20	220
Ethylene Polymer and Vinyl Acetate Levaprene	< 60	30	250

* Do not use.

NOTE: Pyronics “ECS” cable is available. This cable has been extensively tested with the ESTRO and ECS DRIVER SYSTEMS and found to be very compatible. Maximum run length is 1300 feet. Minimum and maximum temperatures are respectively - 4 °F and 158 °F.

DETECTION USING AN ELECTRODE (FLAME ROD)

By immersing an electrode into a flame it can be used as a flame sensor. The electrode, using the flame's ability to ionize gases, can detect the presence of a gas-fired flame. Electrodes are not recommended for oil-fired applications.

The intensity of the ionization current, 0 to 6 micro-amps, greatly increases as the caloric value of the gas and the flame temperature increase. Another important factor regarding the ionization current is the fuel/ air ratio. An excess gas (rich) flame will tend to generate low signals while a lean flame (excess air) will normally generate moderately high signals.

The electrode must not be in contact with the burner's metallic casing. During operation, the electrode must be immersed in the flame at all times.

For reliable detection the surface area of the burner's metallic casing touched by the flame should be four (4) to five (5) times the surface area of the electrode that is immersed in the flame. Should the area of the burner touched by the flame be insufficient additional surfaces may be added. The added area may be blades or small plates welded to the burner casing. If this option is not practical, the electrode may be shortened to increase the "touching" ratio. However, ensure that electrode remains in the flame pattern.

When one electrode is used for both ignition and flame detection, verify that it is adequately insulated. A faulty or inadequately insulated electrode may result in an operationally unsatisfactory flame detection system.

The flame signal strength (micro-amps) should remain fairly constant. A widely fluctuating signal is a tell-tail sign of a malfunctioning electrode or of the burner itself. Signal fluctuations may also be symptomatic of detector wiring interference or insulation defects.

Test the flame detection system over the burner's full range of the operation (high to low fire). Testing in this manner should provide a more reliable system as variations in operating temperatures and flame patterns may affect the flame detection performance.

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