Optical Flame Detection for Oil & Gas Production, Refining and Distribution

Optical Flame detectors are well suited for use in Oil & Gas production, refining and distribution applications. When properly located and aimed, they can quickly detect a fire and signal the control system which will initiate the configured response. These detectors are highly reliable and false alarm resistant.

Challenges Related to Optical Flame Detection:

Environment – The natural environment including salt spray, heavy windblown rain and extreme temperatures need to be considered when specifying a flame detector. Many Oil and Gas applications also have process flare stacks which can be a source of unwanted alarms for UV and IR technologies. A flame detectors view of process flares and the reflected energy associated with them needs to be minimized. Field of View (FOV sight restrictors and aiming tools are required for this purpose. Hot processes can be a false alarm risk for IR detectors, but Multi-Spectrum Infrared (MIR) detectors are less affected by them. Detector configuration, aiming and sight restrictors can be employed to mitigate this risk.

Oil mist and smoke – Oil production or leaking lube oil lines can result in oil mist that coats the surface of any optical flame detectors in the area. Oil coated optics, oil mists, and smoky atmospheres can desensitize UV and UVIR detectors. IR detectors are less affected by these conditions.

Restricted view – Optical flame detectors must have a direct line of sight to reliably detect a fire. Consider obstructions when selecting detector mounting locations. UV optical flame detection technology may be less effective than IR technology at detecting a fire that is partially obstructed by objects within the detector's field of view.

Recommended Flame Detection Technologies:

Most modern flame detectors are designed to detect the typical fires associated with Oil and Gas applications including crude oil, methane, and lubrication oil. Just as important as selecting a detector that has the ability to detect a fire, the decision as to what technology to utilize must also consider the false alarm rejection performance and the required maintenance intervals of the technology.

To that end Factory Mutual (FM) Global Loss Prevention Data Sheet 5-48 indicates that the user should consider the fuel, location of expected fire, distance, detector characteristics, and potential nuisance sources.

The HSE for the EU describes the design requirements for Fire and Gas systems as the following:

Fire & gas systems should have performance standards that link the size and nature of the hazards to the characteristics of the system. Included among these performance standards are adequate availability and survivability. It is equally important for a fire & gas system to be operated, maintained, and modified in such a way as to continue to meet the design safety intent whilst in service.

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The requirement for the proper detection technology selection is like the requirements set forth by FM. Hydrocarbons are a very efficient absorber of UV energy, so UV flame detectors are prone to blinding by the hydrocarbon content of any smoke between the detector and the source, or by hydrocarbon contamination of the optical system (though this problem should be detected by the optical integrity check). Welding is an efficient generator of UV energy, so UV detectors must be inhibited if there is any welding in the vicinity; this reduces their availability and the level of protection they provide.

The design of the Det-Tronics X3301 Multispectrum Infrared Flame Detector provides increased flame detection availability in all environments. The patented flame recognition algorithms and detection wavelengths were selected for optimal fire detection in a variety of applications. The X3301 Multispectrum IR technology provides an improved level of performance when compared to ultraviolet and single frequency infrared technologies. Based on our experience, as well as FM, HSE, and NFPA performance-based code guidance, Det-Tronics recommends using multispectrum infrared flame detection for most applications in the oil & gas industry.

The following is a guideline of technology preferences Oil & Gas applications.

X3301 Multispectrum IR Flame Detector – Det-Tronics recommends the X3301 for use in most Oil & Gas applications. It is available with five different sensitivity settings and multiple configuration options to suit the varying needs of challenging environments. This detector is designed to reliably detect hydrocarbon-based fires that are typically associated with the processes with these facilities. The X3301 is engineered to offer customers the highest level of detection capability and false alarm rejection, while being highly resistant to fire detection range loss caused by oil mist contamination of optics. The technology detects flame through smoke and requires less frequent cleaning maintenance than UV or UV/IR technology-based flame detectors. The X3301's detection capabilities and electronic circuitry are continuously monitored for faults and failures. All optics and sensors are monitored by the Det-Tronics Automatic Optical Integrity (Oi) system.

X3302 Multispectrum IR Flame Detector – Det-Tronics recommends the X3302 for Oil & Gas applications in which hydrogen and substances that produce hydrogen (because of thermal decomposition) are the primary fire hazard. This detector is designed to specifically detect the inherent characteristics of hydrogen fires. The X3302 shares many attributes with the X3301; it has been engineered to offer the highest level of false alarm rejection while being resistant to fire detection range loss by oil mist contamination of the optics. The X3302 detects H2 flames through smoke and requires less frequent cleaning maintenance when compared to UV flame detectors, which have traditionally been used for H2 fire detection. The X3302 detection capabilities, sensors, and optics are also continuously monitored, similar to the X3301.

X5200 UVIR Flame Detector – This detector can detect the typical hydrocarbon-based fires associated with Oil & Gas applications, although this technology may be slower to detect some types of fires when compared to Multispectrum IR or IR technology. Short duration fires (commonly referred to as flash fires), or partially obstructed fires may be more difficult to detect with UV/IR technology. The X5200 has a good level of false alarm rejection but may be susceptible to reduced fire detection range due to oil mist, or the smoke that may precede a fire. In both situations, the fire size may need to be larger, and a fire may take longer to be detected. More frequent maintenance may also be required to keep the optical surfaces clean. The X5200's detection capabilities, sensors, and optics are also continuously monitored, similar to the X3301.

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