Technical Publication

Offshore Platform Fire Safety Sprinkler System Depends on Liquid Flow Assurance Switch

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Offshore platforms around the globe are essential to the production of oil/gas and the global energy supply chain, but they represent a daily hazardous operating environment to the employees that work there 24-x-7. The potential dangers range from a mix of toxic and combustible gases, including, but not limited to, deadly hydrogen sulfide (H2S) to explosive methane (CH4), and other mixed hydrocarbon gases that are easily flammable.

For these reasons, offshore platform work environments are governed by a web of complex international health and safety standards that always include requirements for gas and flame detectors, as well as automated fire sprinkler systems that rely on seawater to douse flames before they are out of control. Serious accidents due to fire have occurred far from shore on oil/gas platforms with disastrous results that include the tragic loss of life, catastrophic damage to equipment and severe pollution of the fragile marine environment.

In response to global health and safety standards, the designers, operators and owners of offshore platforms *(Figure 1)* are constantly seeking innovative solutions to improve the reliability of their automated fire sprinkler systems in order to assure effectiveness and reduce false alarms or their downtime. Operators aboard a platform need to be informed immediately both when gas or flames are detected, and also, importantly, when the automated fire sprinkling system initiates operation to ensure control of the event has started and staff are evacuated to safe areas while minimizing the impact of any fire.

The Problem

Under normal conditions in a fire sprinkler system for an offshore platform the pipe remains filled with seawater. In the event of a fire, the sprinklers are opened and the water is discharged to extinguish the fire immediately. A typical offshore platform sprinkler installation is built with a 3 or 4 inch (76.2 or 101.6 mm) main line with branching of multiple, smaller diameter pipes that feed the individual sprinkler nodes.

Each individual sprinkler is fed by a much smaller line size of 0.25 inch or 0.5 inch [6.35 mm or 12.7 mm], which makes it difficult for flow sensors to detect and measure a very low flow of seawater in the main line if, for example, only one or two sprinklers are activated. It's very important for the operational integrity of the system to detect even these very low flow rate changes so an alarm is generated even when a single sprinkler has been activated to initiate a fire alarm.

Figure 1: Offshore platform

In addition to low flow rates, the flow instrument chosen must also be capable of withstanding a high flow rate in the event that all connected sprinklers are activated simultaneously should an explosion and large fire occur. The fire sprinkler system is tested once a year, and during the test it be ensured that the flow sensors are operational and flow alarms are generated correctly.

The Solution

The system design engineers at a large engineering consulting firm contacted Fluid Components International (FCI) regarding their need to assure sprinkler system water flow for offshore platforms. The firm designs fire safety sprinkler systems for operators around the globe including Europe, the Middle East and Asia.

The design engineers told the FCI application team that their fire suppression system requires the platform's operators to be alerted if the seawater's flow rate on the main lines is interrupted or changes. The challenge was to find a highly sensitive flow sensing switch capable of detecting very low flows with a continuously reliable and rugged design to withstand harsh, corrosive seawater and with agency HazardEx approvals for installation in a potentially explosive gas environment.

The design firm team provided the applications team at FCI with the following specification requirements:

- **Pipe diameter:** 3-inch or 4-inch [76-mm or 102-mm] Schedule 40 pipe
- **Media:** seawater
- **Flow alarm level/trip point 1:** low flow detection of 1 ft/sec [0,3 m/sec]
- **Relay status:** Energized when flow above trip point
- **Flow alarm level/trip point 2:** Empty pipe detection (wet/dry)

After reviewing these requirements, the FCI application team recommended the company's rugged thermal FLT93S switch *(Figure 2)*. It is designed with a fail-safe, dual alarm (SPDT) control circuit and provides multiple field-selectable parameters such as the monitoring and alarm of low flow liquid or air while also supplying a non-linear process temperature measurement. The switch has many factory or in-field set point variations including; high flow alarm, low flow alarm, point level detection wet/dry with temperature output, three-phase (water/oil/air) level interface, or fail-safe flow, level, or temperature.

The FLT93S switch met all the engineering firm's requirements with its superior low-flow detection. It easily recognizes very low liquid flow rates from 1 ft/sec [0,3 m/sec] when installed on either the 3-inch or 4-inch (Schedule 40) piping. For example, the primary flow alarm level trip point was set at 1 ft/sec [0,3 m/sec] to signal low flow conditions that would indicate either an actual fire or a leak in the main line piping. The second alarm was set in this application for dry running conditions indicating an empty pipe due to a major break in the line or other interruption to the seawater supply.

Two standard flow sensing element configurations are available to meet the most demanding oil/gas industry application requirements. The FLT93S switch is designed for use in standard heavy industrial applications and in applications with high velocity liquid setpoint requirements such as the fire sprinkler system. The FLT9F configuration is designed for fast response in air and gas applications and is commonly used in variety of other flow sensing applications on offshore platforms.

The precision FLT93S switch is accurate in liquids to ±0.5% reading or ±0.04 fps [±0.012 mps]. This application also was well within the rugged FLT93S's pressure operating limit of up to 3500 psig [240 bar(g)]. An optional FLT93L in-line flow switch, for small line sizes, is capable of operating pressure of 10,000 psig [690 bar (g)].

Figure 2: FCI's FLT93 flow switch

The chosen flow switch features field configurable dual SPDT or single DPDT relays rated to 6 amps at 115 Vac, 240 Vac or 24 Vdc. For this marine environment, the FLT93 was supplied with its optional, corrosion resistant 316L stainless steel enclosure. The sensor element itself is also all-welded, 316L stainless steel.

The sensor can be supplied optionally in other materials of construction such as Hastelloy C, titanium or Monel. The highly reliable FLT93S switch has a 180-year mean time between failure (MBTF) rating. The FLT93 Series is rated as a SIL 2 device for safety instrumented systems (SIS). The instrument has been independently evaluated by industry expert exida for compliance. FCI is committed to safety in the hazardous industries and complying with IEC 61508 and 61511.

The FLT93's hazardous area approval ratings on the full instrument also helped the manufacturer save on wire and installation costs. With its robust no-moving parts flow circuit design and the ultra-rugged enclosure, the switch offers long, worry-free service. Its no-moving parts design also eliminates the expense of routine maintenance checks.

Conclusions

After final engineering firm design approval and installation of the first units on offshore platforms, the FLT93S switches have been in operation for over ten years and there have been no problems reported. The engineering design firm continues to use this switch in its fire sprinkler systems and in other applications aboard offshore platforms. ■