Bandweaver

CASE STUDY

# PROTECTION OF FLOATING ROOF TANKS USING FIBER OPTIC LINEAR HEAT DETECTION (LHD) SYSTEM

## The Scenario

Floating roof tanks a storage tank commonly used to store large quantities of petroleum products such as crude oil or condensate. It consists of an open- topped cylindrical steel shell equipped with a roof that floats on the surface of the stored liquid.

One of the potential issues with the tanks relate to the seal between the roof and the tank inner wall, which is not a hermetic seal. This can lead to combustible gases collecting during normal operation on the roof of the tank (which results in a zone 0 rating for the tank roofs). The concentrations of the gases that accumulate on the tank roof are dependent on a number of factors including atmospheric conditions and level of the tank.

Historically greater than 90% of fires that have occurred in floating roof tanks have been fires caused by vapor leaking through the seals. The source of ignition is often atmospheric electricity and so occur spontaneously without human activity in the area and so introduces a number of challenges.

## Client Requirements

The operator is an international port operator with floating roof tanks for oil storage. The project involves nine 100,000 cubic meters and four 65,000 cubic meters external floating roof tanks, totalling 1.16 million cubic meters of oil depots.

There are several strategies the operators can deploy in order to contain these fires including foam systems, water cooling and bund protection. However, one of the key elements in the strategy is to detect fires as early as possible and fiber optic linear heat detection systems (based on Distributed Temperature Sensors DTS) provide an extremely effective early warning system.

This operator reviewed a number of different technologies that can operate effectively in a zone 0 environment and decided on the Bandweaver Fiber optic linear heat detection system based on the FireLaser DTS technology.

## What Did We Do?

Bandweaver provided 13 FireLaser DTS linear heat detection systems, which corresponded to one FireLaser per tank. Below is a summary of the system architecture.

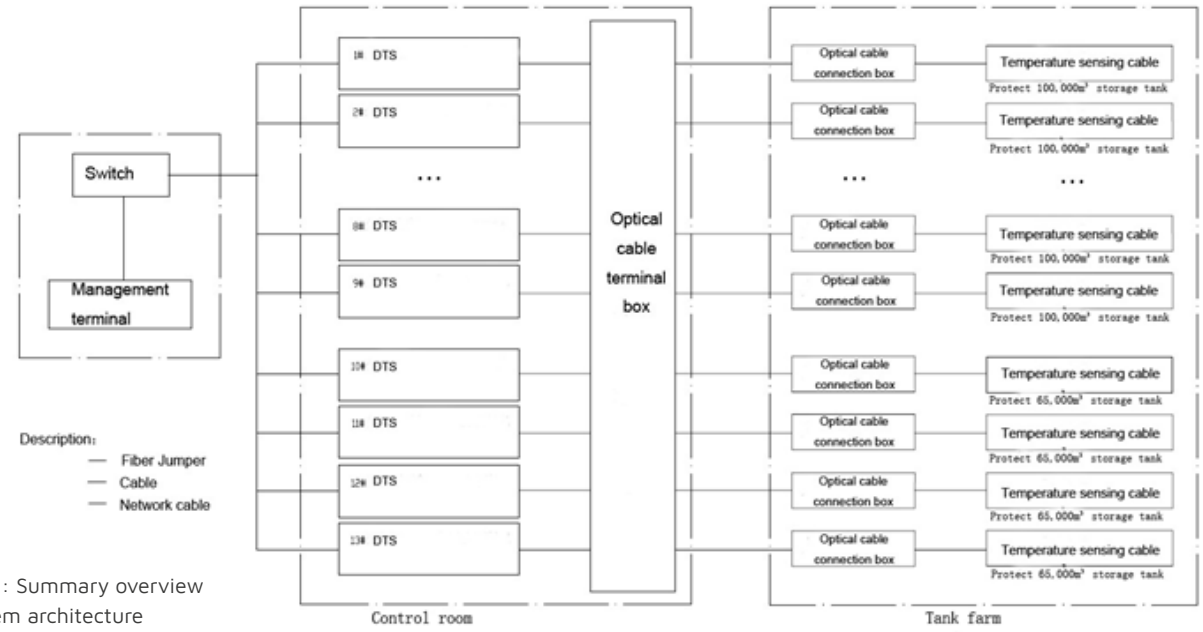
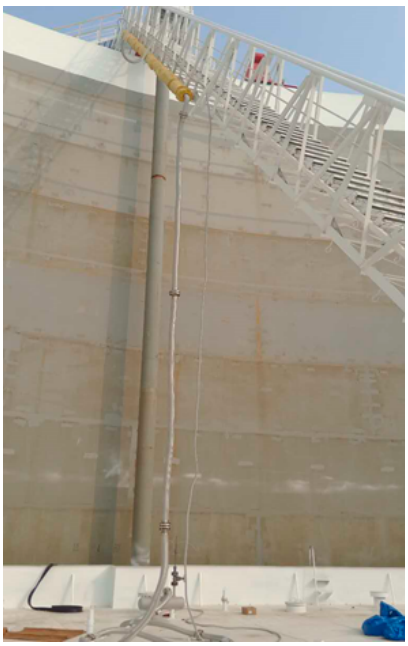



Figure 1: Summary overview of system architecture

The fiber optic cable was selected to provide the optimum balance between flexibility and ease of handling while providing a robust design which can withstand the rigours of a demanding operating environment. The fiber optic is completely passive, with no moving parts and is not effected by vibrations or EMI interference and is resistant to hydrocarbon chemicals, making it an ideal candidate for this environment.



The sensing cable was installed around the rim of the seal with cable fixtures supporting every 1m along the rim's edge.

Typically for floating roof tank installations, the fiber optic cable is routed outside the tank to the top of the staircase and then is incorporated into the rolling ladder structure. For the cable management this can either be managed using specific cable retraction/management systems or can be incorporated by attaching to the hinge system of the rolling ladder which takes into account the elevation level of the roof.

The 13 fiber optic FireLaser DTS systems were integrated with the fire panel and each tank was allocated 8 zones. The FireLaser DTS has the capability to configure both maximum temperature alarm limits and rate of rise. The intelligent alarming capability allows fires to be detected much earlier than with conventional linear heat detection systems. Also due to the distributed nature of the measurement the precise location of the fire can be located to within 1m.

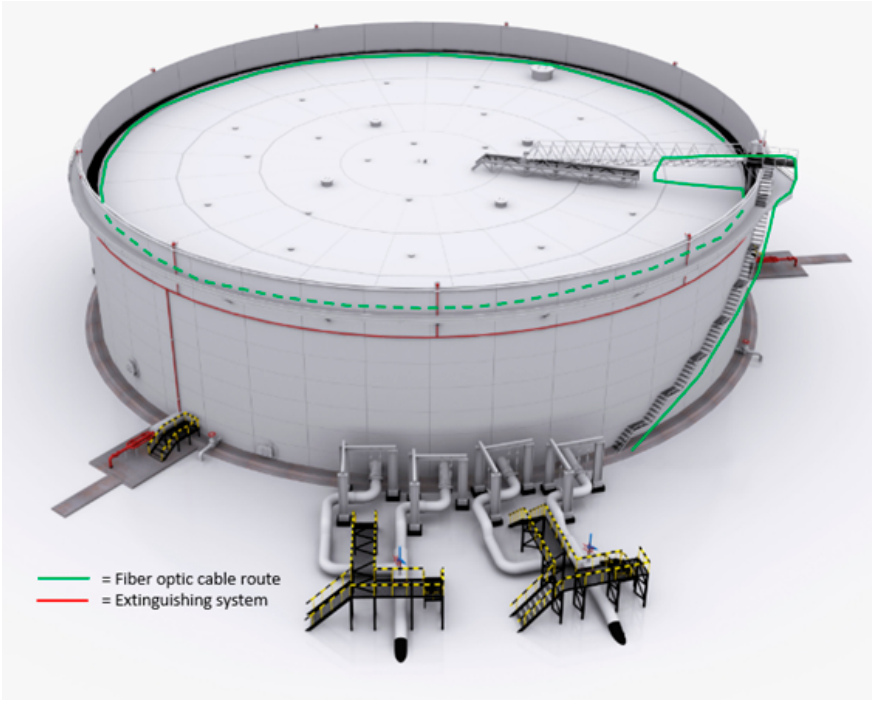



Figure 3: Cable route around tank

Figure 4: The 13 FireLaser DTS systems in the cabinet

For this project, the customer was particularly concerned about compliance with standards and reliability. The relevant accreditations that helped convince the customer to proceed with the FireLaser solution are as follows:

- EX approval for use in hazardous zones
- EN54 part 22 Linear Heat Detection system
- SIL 2 rated certification
- MTBF > 29 years (Telcordia standard)

## Benefits to the Client

When evaluating the system, the client used a number of factors to make the choice across the lifetime of the project. Below are the following benefits which helped persuade the client the fiber optic LHD systems were a superior choice to other technologies:

**High Reliability:** Fiber optic sensors are completely passive and are immune to EMC interference, not affected by dust or other environmental factors and are completely non-corrosive. Therefore, the lifetime of a fiber optic cable can be greater than 30 years, without any maintenance required.

**Ease of Installation:** The fiber optic cable is extremely lightweight, flexible yet rugged and so is very simple to install. Given the distributed nature of the cable the cable is one continuous sensor and so the design and manufacture process is much simpler and more reliable than having to plan and manufacture individual sensing components.

**Low Cost of Ownership:** Compared with alternative sensing technologies (e.g. flame detectors) the linear heat detection system requires very low maintenance and so is a lower cost of ownership and higher reliability over the lifetime of the project.

**Early Detection:** Because the sensing cable was installed along all points along the rim, it means that any fire will be detected to within 1m. Additionally with the intelligent alarming, incorporating rate of rise fires will be detected at much lower temperatures resulting in earlier detection and a much lower risk profile to the asset.

**Intrinsically Safe:** The amount of optical power in the sensing cable is very small and is not capable of causing ignition, making these sensors ideal for use in hazardous zones where EX rated equipment is required.