

FIRE PROTECTION OF COAL SILOS IN CEMENT PLANT: FIBER OPTIC LINEAR HEAT DETECTION BASED ON ACCESS DTS



The Scenario

Bandweaver has been awarded the contract to supply 20 Access Distributed Temperature Sensing (DTS) systems for the protection of coal storage silos within cement plants.

Fire and explosion hazards arise due to the nature of several processes occurring during cement manufacturing and the raw materials being used. Beside property damage resulting from fires and explosions, these accidents can cause injuries and fatalities to workers. Therefore, understanding hazard prevention is important in these industries.

The cement manufacturing process typically involves quarrying, drying & grinding, kiln burning and cooling, finish grinding, and packaging. During the kiln burning process, raw mix is transported to the kiln where it is heated to temperatures of up to 1450°C. The heating fuel for this kiln is typically coal, which is stored in steel silos.

Client Requirements

The client required a system for the early detection of the oxidation process so that action can be taken before extensive damage occurs.

On average 0.2 – 0.3 tonnes of coal are consumed in the kiln per kilogram of clinker cement production. As such, coal storage during cement manufacturing is an important component to consider in hazard analysis.

Among the various causes of coal fires, spontaneous combustion during storage results in a large number of losses. Spontaneous combustion is caused by absorption of oxygen at the outer and inner surface of coal which results in oxidation. Oxidation is an exothermic reaction that causes the temperature of the coal stack to rise gradually. As the pile exceeds approximately 800°C, ignition can occur. Spontaneous combustion of the coal depends on many factors and critical among these is the type, age and composition of coal.

The system was required to provide early detection on the silo and full coverage so that any hot spots within the silo will be detected very early on so that damage can be prevented. As a lot of the raw materials and fuels are highly combustible, the system must be certified for use in explosive atmospheres.



Figure 1 - Example of failed coil silo

What Did We Do?

The end user evaluated a number of possible solutions and developed the Fiber Optic Linear Heat Detection (LHD) system based on Bandweaver's fiber optic based Access DTS. A specific algorithm was developed based on the Access rate of rise temperature smart alarming system. Redundancy was also designed into the system so that it offered full coverage as well as providing 100% redundancy in the event of system maintenance and/or repair.

Below shows the overall system architecture and pattern of the cable layout on the silos.

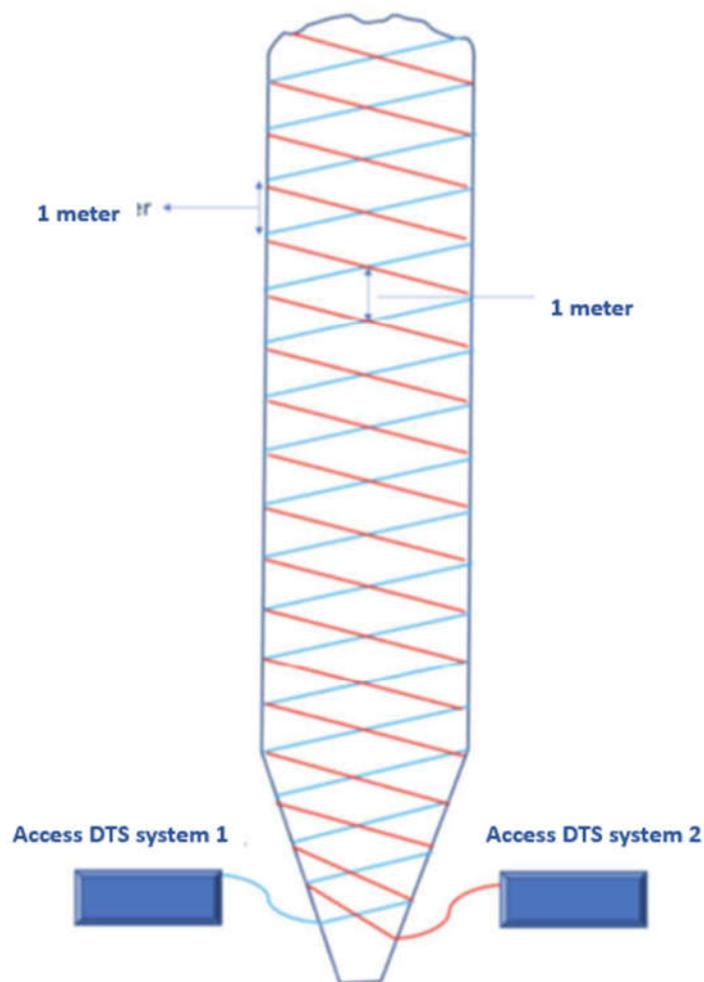


Figure 2 - LHD system architecture

As can be seen from the diagram above, the fiber optic sensing cable was installed in a diamond grid pattern on the silo based on 2 reverse spiral configurations (one spiral is red and the other coloured blue in the diagram). Each of the respective sensing cables is connected to an Access DTS system. In the event of damage to either of the cables or removal of either of the Access DTS systems, the overall system continues to provide complete coverage.



Benefits To The Client

The Access fiber optic Linear Heat Detection (LHD) system based on Access DTS technology exceeded the expectations of the customer. Some of the key following benefits and advantages to the end user include:

- **Early detection of exothermic reaction:** With the rate of rise smart alarms build into the Access DTS it is possible to detect any exothermic reactions long before there is any potential damage caused to the asset.
- **Low Cost of Ownership:** Fiber optic cables are completely passive and have no moving parts, they are non-corrosive and immune to electromagnetic interference and typically have lifetimes in excess of 30 years and so carry a very low cost of ownership and no maintenance.
- **Complete Coverage:** The distributed nature of the Access Distributed Temperature Sensing (DTS) solution means that the sensing points are effectively 1m apart, which gives a much denser coverage of detection points than conventional technology and all areas of the vessel are monitored with no gaps in coverage.
- **Intrinsically safe:** The optical power within the sensing cable is too low to be able to cause ignition and so is fully certified and suitable for use in hazardous areas where explosion or combustion of combustible materials is a real risk.

About Bandweaver Technologies

With an installed base of over 40,000km and 5,000 systems installed worldwide, Bandweaver's vision is to be the first choice for integrated distributed fiber optic sensing solutions across the globe. Since 2002, Bandweaver has been committed to delivering reliable, innovative, client-centric and value-added products and services, via a dedicated and talented team of people.

Bandweaver manufactures and distributes advanced fiber optic monitoring sensors and integrated technologies, enabling customers to monitor, secure and keep personnel and critical assets safe.

With quality and excellence as fundamental elements of Bandweaver's portfolio, the business is continuously developing its range of technologies, including Distributed Temperature Sensors (DTS), Distributed Acoustic Sensors (DAS) and integrated smart intelligent software solutions.

Utilising the latest technologies, Bandweaver provides solutions for Security, Fire, Power and Pipelines. For further information please contact our global team at info@bandweaver.com

