FIRE DETECTION IN TUNNELS AND METROS USING "TATUS"

Fire detection in tunnels and metros is a critical aspect of ensuring the safety of passengers and infrastructure. Distributed Temperature Sensing (DTS) is one technology that can be employed for fire detection in these environments. DTS systems use fibre optic cables to measure temperature variations along the entire length of the cable, allowing for continuous monitoring of the tunnel or metro area. The system can be configured with multiple channels so that the same system can monitor e.g., the main tunnel, access and maintenance tunnels, stations and other related areas.

Here's how DTS can be utilized for fire detection in Tunnels and Metros:

Installation of Fiber Optic Cable: Fiber optic cables are installed along the length of the tunnel or metro area. These cables can be attached to the tunnel walls, ceiling, or even buried underground, depending on the specific requirements.

Temperature Monitoring: The DTS system uses the fibre optic cable as a sensor. Laser pulses are sent through the cable, and the backscattered light is analysed to determine temperature changes along its length. By measuring the temperature at various points, the system can create a real-time temperature profile of the entire tunnel.

Alarm Thresholds: The DTS system is configured with predefined temperature thresholds that indicate the presence of a fire. If the temperature exceeds these thresholds, an alarm is triggered, indicating a potential fire event.

Early Warning and Visualization: When a fire is detected, the DTS system can immediately provide early warning to the tunnel or metro operators. The system can also visualize the location of the fire, showing the affected area on a control panel or graphical interface. This allows for a quick response and targeted firefighting efforts.

Integration with Fire Suppression Systems: DTS systems can be integrated with fire suppression systems, such as water sprinklers or foam generators. Once a fire is detected, the DTS system can automatically activate the appropriate fire suppression measures in the affected area, helping to control and extinguish the fire more effectively.

Data Logging and Analysis: DTS systems can record and store temperature data over time, enabling post-incident analysis and investigation. This data can provide valuable insights into the behaviour and development of fires in tunnels and metros, helping to improve safety measures and response strategies in the future.

There are several advantages to using Distributed Temperature Sensing (DTS) for fire detection in tunnels and metros:

Continuous Monitoring: DTS provides continuous temperature monitoring along the entire length of the fiber optic cable. This allows for real-time detection of temperature changes and the early identification of potential fire incidents. Unlike spot detectors, which cover limited areas, DTS provides comprehensive coverage and reduces the risk of missed detections.

Precise Localization: DTS can accurately pinpoint the location of a fire within the tunnel or metro area. By analysing temperature changes along the fibre optic cable, the system can provide precise information about the fire's location. This enables responders to quickly locate and address the fire, reducing response time and potential damage.

Early Warning System: DTS can provide early warnings of fire events. By continuously monitoring temperature variations, the system can detect the initial stages of a fire before it fully develops. This early warning capability allows for timely evacuation of passengers and prompt deployment of firefighting resources.

Immune to Environmental Factors: DTS is less susceptible to environmental factors that can affect the performance of traditional fire detection systems. It is not affected by airflows, drafts, or the presence of dust, smoke, or gases. This makes DTS highly reliable in tunnel and metro environments where these factors can be common, ensuring accurate and consistent fire detection.

Scalability and Flexibility: DTS can be easily scaled to cover large tunnel and metro networks. The fibre optic cables can be installed along the desired areas, and the system can adapt to different tunnel layouts and configurations. This scalability and flexibility make DTS suitable for both new installations and retrofitting existing tunnels and metros.

Integration with Control Systems: DTS can be integrated with control systems and fire alarm systems, providing seamless integration with existing safety infrastructure. This allows for automated responses, such as activating fire suppression systems or triggering alarms, improving the effectiveness of emergency response procedures.

Data Logging and Analysis: DTS systems can record and store temperature data over time. This data can be analysed to gain insights into fire behaviour, identify patterns, and improve fire safety protocols. The historical data can also be useful for post-incident investigations and learning lessons for future prevention.

In case of fire, intense heat, and dense smoke, the fire must be kept subdued until the fire brigade arrives. 'TATUS' can be coupled to operate with modern fire suppression systems based on e.g., water mist that dissipates the heat energy from the fire. 'TATUS' pinpoints the fire location and ensures that these fire suppression systems are selectively actuated at the fire location and in the direction of the propagation to allow the fire fighting forces maximum accessibility and to minimize the heat impact on the structure.