Fire Protection of Train systems

Scope

Passenger and freight trains provide a variety of fire risks, dependent on the type of train, and operating conditions. However it is now recognised that the consequences of a fire in an underground passenger or freight train is much more serious.

Train engine compartments have traditionally been fitted with fixed fire protection systems but passenger compartments and driver's cabins have relied on manual intervention with portable fire extinguishers. Freight wagons have not been protected.

In diesel-engine trains the fire risk in the engine compartment normally involves the accidental release of diesel or lubrication oil onto nearby hot surfaces such as a hot exhaust manifold. On electric trains the risk is from overheating of electric motors or ancillary equipment. In passenger compartments the risk is accidental fires from smoking, as well as arson. In freight wagons a variety of fires risks occur.

The objective of a fixed fire protection system in a train is therefore to extinguish engine fires, and suppress any fire in the passenger compartment and driver's cabin without comprising safety of staff or passengers. Systems must be robust enough to withstand constant movement, vibration and possible vandalism. They should not harm the environment, nor damage sensitive electronics and electrical equipment.

Current state of the art

Engine compartments in trains have traditionally been protected with Halon or foam systems. Some of the Halon systems still exist, but many have been replaced with other gaseous agents. Fixed fire protection systems are not common in passenger compartments but conventional low-flow sprinklers have been fitted in rare instances. Freight wagons have not traditionally been protected.

As Halon has continued to be phased out for environmental reasons alternative gaseous agents have been used, although systems do not provide cooling to prevent re-ignition and may be ineffective if enclosure integrity is not maintained. Foam systems can damage surrounding equipment and special clean-up procedures are needed. In passenger compartments conventional sprinklers have not proved popular as the amount of water needed to be effective has meant severe weight penalties.

Recent advances in water mist fire protection technology now allow the introduction of fixed systems to protect all parts of trains – engine spaces, passenger compartments and freight wagons. In engine compartments water mist can provide fast extinguishing and cooling without clean-up or environmental problems. In passenger compartments and freight wagons water mist systems can provide fast and efficient suppression without undue weight penalties.

HI-FOG solution – features and benefits

Marioff has developed a range of HI-FOG water mist fire protection solutions for a wide variety of applications. This includes a complete train protection system using a lightweight self-contained air-driven pump unit fitted underneath one of the carriages. Discrete HI-FOG 'vandal-proof' spray heads are fitted in the passenger compartment and driver's cabin in each carriage. As an option the system can also protect the engine compartment. The pump unit is designed to operate even under high vibration conditions and incorporates a water tank and easily replenished air cylinders so maintenance and recharging are easy. Because of the small amount of water discharged the system does not harm sensitive electronics or electrical equipment.

If only engine compartment protection is required Marioff will provide a pre-engineered self-contained pressure cylinder system which is simple and needs no electric power. This operates for a short duration, typically ten minutes, and provide cooling to prevent re-ignition and radiation blocking to protect other equipment in the compartment.

Specialised high-performance HI-FOG systems have also been designed to protect railway freight wagons that provide a high fire risk.

HI-FOG details

A HI-FOG system for protecting passenger trains will consist of a self-contained GPU (Gas-driven Pump Unit) fitted underneath one of the carriages, spray heads, interconnecting tubing and necessary selector valves. Small bore stainless steel tubes are used in the carriages to connect to the ceiling mounted spray heads. The system is interconnected between carriages by armoured hoses. Water and compressed air volumes are determined after discussions with the client as to the 'worst-case' event and required discharge time.

The HI-FOG passenger train system uses a separate fast-acting detection system to give a signal which locates the fire location. The system is normally activated by the driver, but is set to operate automatically when the train is not in operation.

A HI-FOG system for protecting only the engine compartment will consist of a MAU (Machinery Accumulator Unit) mounted in the locomotive, spray heads and interconnecting tubing. This is activated automatically with manual over-ride from the driver as an option.

References

Marioff has supplied a number of HI-FOG systems to protect three and five car trains operated by Madrid Metro. Extensive full-scale fire tests were carried out to ensure an efficient system with minimal water usage. In addition equipment was tested to ensure capability of withstanding the rigorous operating conditions. The final system design was developed in partnership with Madrid Metro who insisted on reliability and stand-alone capability as being key elements.

Conclusion

Water mist is the ideal solution for fixed fire protection of all areas on trains. The technology combines optimum suppression performance with lightweight. Water mist is safe for people, equipment and the environment. HI-FOG is the leading water mist technology with more approved systems and a larger reference list than any other water mist manufacturer today.