

Fire Protection of Metro systems

Scope

The fire risks in urban underground transport systems or metros are amplified by the problems associated with mass evacuation of people in case of emergency. The primary danger is that posed by smoke, as this is difficult to vent in a controlled way from an underground space.

Although most metro systems now operate no-smoking policies, a small minority of people disregard the rules and a casually dropped cigarette butt is the biggest fire danger. There is a particular danger if this occurs on an escalator where there is also the risk of fire from major mechanical failure. Fires can also occur due to overheating of electric cables or equipment in transformer & switchgear rooms, control rooms, garbage rooms, store rooms and retail shops. Fires can also result from accidents involving refurbishment work. They may also be deliberately started by an arsonist.

Because of the dangers of smoke underground, the primary objective of fixed fire protection systems must be to rapidly extinguish or suppress a fire so that smoke is minimised and surrounding areas are cooled so that re-ignition cannot occur. Systems must be extremely reliable and ideally capable of frequent testing to ensure operational readiness. They should also not be people harmful or a danger to, equipment or the environment, whether set off in a fire or accidentally discharged.

Current state of the art

Many urban underground transport systems have limited fixed fire protection systems, relying on smoke detection and manual intervention of security staff with back-up from fire services. Escalators however have normally been protected by Halon or water spray systems. Storage and retail areas may be protected by sprinkler or water spray systems. Gaseous extinguishing systems have also been used to protect store rooms, control rooms, transformer and switchgear rooms.

There are specific disadvantages to the use of conventional water-based systems in underground applications. Installation of large bore piping and equipment may be virtually impossible, particularly in areas some distance underground. Systems are inefficient so large volumes of smoke may be produced before the fire is extinguished. Also, removing large volumes of discharged water can provide a real difficulty. For environmental reasons most Halon systems have now been replaced, but gaseous systems are generally unsuitable for most metro risks because of the difficulty of guaranteeing enclosure integrity.

Water mist is therefore increasingly recognised as the most suitable fixed fire protection technology for protecting metro systems. Water mist is safe for people and the environment. High radiant heat blocking means that equipment near the fire is not damaged. Because of small piping sizes, water mist systems can be easily installed in existing stations and equipment such as escalators. Systems use water efficiently so smoke output is minimised, and discharge rates are low so water removal is not an issue. Total flooding water mist systems are ideal for smaller spaces because a gas-tight enclosure is not necessary.

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. For metro complexes systems have been designed for the specific risks and operating conditions. Escalators and other risk spaces in a single station are normally connected to a single central pump and water storage unit that can operate for a short time in an emergency without electric power. Small individual rooms can be economically protected by pre-engineered 'total flooding' HI-FOG sprinkler systems requiring no external detection, water or electric supply.

Fast suppression or extinguishing is achieved with a water discharge rate 70-90% less than conventional water-based systems. Small bore 16 and 30mm tubes are prepared on site so no pre-planning is required. Tubes can be clamped directly to walls, so retrofitting existing stations is easy and design and civil engineering costs are minimised. A complete HI-FOG system can be installed on an escalator in only one day. All HI-FOG metro systems are designed to be frequently tested to ensure operational readiness.

HI-FOG details

A HI-FOG system for protecting metro complexes will consist of the escalator sub-systems and other designated risk spaces connected by small bore stainless steel tubing via selector valves to the centralised pump and water storage unit. The escalator sub-systems utilise a fast-acting detection system to activate a number of open spray heads simultaneously. Local manual over-ride activation is also provided in case of failure of the detection system. Other risk spaces such as transformer rooms and retail shops are normally protected by HI-FOG automatic sprinklers, again connected via selector valves to the centralised unit.

The centralised HI-FOG (SPU) pump and water storage unit is electrically-driven and dimensioned for simultaneous operation at two escalators. It incorporates a water supply tank and an emergency nitrogen powered GPU (Gas-driven Pump Unit) in case of complete electric power failure.

Remote spaces can be protected by Marioff's SCAU (Self Contained Accumulator Unit). The Unit uses stored nitrogen cylinders and non-pressurised water cylinders. A signal from the detection system opens a valve to release the nitrogen, which drives the water from the water cylinders in a controlled sequence to the HI-FOG nozzles or sprinklers.

References

Marioff has supplied a number of HI-FOG systems to protect underground metro systems around the world. In London over 300 HI-FOG self-contained systems are protecting store rooms in stations around the city. HI-FOG centralised systems have been installed in over 75 stations of the Madrid Metro after extensive fire tests were carried out, including some in an operational station. 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 fire protection solution for urban underground transport systems. The technology combines optimum suppression performance whilst remaining 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.