

AUTOMATIC FIREFIGHTING
SYSTEMS IN
ROAD TUNNELS





Hazard type

Fires such as the Mont-Blanc and St. Gotthard tunnels are unfortunately unforgettable. Therefore, we must ask: Is the estimated risk acceptable?

Year	Tunnel
1978	Velsen (Países Bajos)
1979	Nihonzaka (Japón)
1980	Sakai (Japón)
1982	Caldecott (USA)
1983	Pecorile (Italia)
1996	Aisló delle Femmine (Italia)
1999	El Mont Blanc (Francia - Italia)
1999	Tauern (Austria)
2001	Gleinalm (Austria)
2001	St Gotthard (Suiza)
2006	Túnel Viamala (Suiza)

Tunnel accidents have caused mass casualties and injuries, so fire protection in these environments is very important.

Tunnels and underground infrastructures are built with the purpose of overcoming physical obstacles for the benefit of transport and mobility.

The continual growth in the number of drivers each year as well as the various types of loads in the vehicles increase the risk of accident.

Therefore, the safety of tunnels should be considered as one of the top priorities in their design.

Road tunnels have traditionally been protected by a set of smoke control and ventilation systems to allow the evacuation of people. But the control, suppression or extinguishment of fire was never an issue. Cooling the tunnel structure and its possible collapse were not contemplated.

Since it is an open risk, where total flooding with extinguishing becomes inviable, water is deemed the most appropriate solution.

However, in a risk of these characteristics, the real challenges are visibility, the effect on assets involved, the size of pipes and, of course, the amount of water needed and its location.

Water mist does not affect visibility, does not damage existing equipment and uses less pipes, given its lower water requirements, with a consequent reduction in the number and size of tanks used. This is why it is the most effective solution.

DISTINGUISHING FEATURES

It must be borne in mind that there are countless types of tunnels, depending on:

- Number of bores
- Type of traffic: interurban, road, light vehicles etc.
- Pressure difference between the inlet and outlet ports
- Number of lanes
- Directions of travel: One-way or two-way
- Type of structure
- Etc.

Each tunnel therefore requires an accurate study according to each of its characteristics.

SIEX UNDERTAKES FULL-SCALE FIRE TESTS ON ALL THESE TYPES OF ENVIRONMENTS TO ENSURE EFFECTIVE PROTECTION.

WE ARE BACKED BY THE MOST IMPORTANT WATER MIST CERTIFICATION BODIES.



Sources of fire

The main cause for a fire in these facilities is traffic accidents.

Other factors to be considered include:

- Dirt or external elements that may produce flames due to overheating
- Ambient thermal, wind and pressure conditions
- Welding operations
- Internal combustion vehicles or machinery
- Fuel or oil spill
- Sparks caused by switches
- Short-circuits
- Overloading
- Static electricity



The protection must be looked at from three different perspectives:

Protection of the people inside the tunnel, avoiding the spread of fire.

Improved escape route visibility.

Protecting the structure by cooling it to prevent the collapse or deterioration of the tunnel structure.

Since the existing type of material may vary considerably depending on the type of cargo being transported, the estimated fire load that could occur in a fire will be taken into account.

Protection

Fast detection: heat-sensitive cables ... key factor in the comprehensive design for the protection of this hazard.

Smoke control and ventilation, calculated according to its environmental, structural and design features.

Control, suppression and/or extinguishing.

Cooling the structure.

REQUIRED PROPERTIES OF A PROTECTION AGENT:

NON-TOXIC AGENT

Since the tunnel will be occupied by people in transit, the extinguishing agent should be innocuous to humans and must also allow quick evacuation, ensuring people's physical health and visibility required for evacuation. Therefore, and given the general lack of evacuation infrastructure, visibility becomes a key pillar of fire protection.

FAST RESPONSE AGENT AND EQUIPMENT

Quick response time in the event of a fire translates into less damage and less chances of the fire spreading to more vehicles.

CLEAN AGENT

Residues left by the extinguishing agent must be avoided to facilitate subsequent cleaning and minimize the movement, inspection, dismantling and assembly of the equipment. Likewise, the idea is for the agent itself not to become a detrimental or harmful element.

HIGH COOLING CAPABILITY.

In order to protect the stability of the tunnel structure, the agent must have high cooling power to prevent the structure from collapsing.

ELECTRICALLY NON-CONDUCTIVE AGENT.

An extremely important factor which affects the protection of people. The risk of electrocution must be completely eliminated and it is likewise very important to use a non-conductor to prevent electrical fires within the tunnels of existing installations.

Solution



Water has been used as an extinguishing agent since man has been exposed to fire. Of the substances found in nature, water has the higher specific heat, after hydrogen and helium. The latent heat of vaporization is the highest of all liquids, making it an excellent firefighting agent.

Its effectiveness is proven, since the critical parameters have to be defined by full-scale tests, which test and analyze the adequacy of the design according to the type of hazard and its fire load.

There is no specific standard that applies, so we follow technical specifications and design, installation and testing protocols from internationally recognized bodies. SIEX tests and approves its nozzles in internationally approved labs for certain hazards, which can be treated as equivalent to other hazards.

SYSTEMS:

High-pressure pumpsets are used in these systems, because they are large-volume spaces.

Depending on the pipework used, it is possible to design:

- **Deluge systems**, with open nozzles non-pressurized network.
- **Pre-action systems**, with piping system pressurized up to the valve and from there on, dry pipe. This system allows double safety for the hazard: suppressing fire and also avoiding risks associated with water due to accidental releases, including drips.

Depending on the size of hazards protected, selector valves may or may not be used with the same water supply. The type of application will be local.

ACTIVATION METHOD

SMOTHERING:

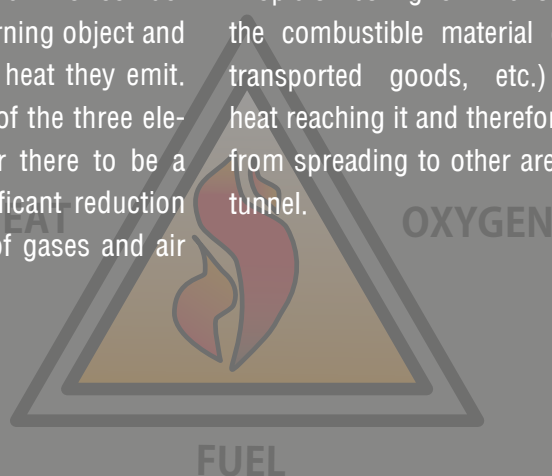
Liquid water increases its volume by a factor of about 1,600 as it vaporizes. This change of state can be produced locally by the direct effect of the flame and throughout the environment if the temperature is high. Thus, the oxygen concentration around the fire is reduced, controlling the tunnel fire.

COOLING:

Water droplets come into contact with the flame or burning object and absorb much of the heat they emit. This eliminates one of the three elements necessary for there to be a fire, causing a significant reduction in the temperature of gases and air surrounding the fire.

FUEL SEPARATION:

Droplets resting on the surface of the combustible material (vehicles, transported goods, etc.) prevent heat reaching it and therefore the fire from spreading to other areas of the tunnel.





OBJECTIVES

CONTROL

Limits growth and spread, thanks to the fact that water mist cools surrounding objects, combustible material and gas. The discharge is designed to maintain the fire under control until the arrival of fire fighting equipment.

SUPPRESSION

By sharply reducing heat release, the fire resurgence is prevented.

EXTINGUISHING

Water mist prevents the fire reaction using intense discharges.

FIRE BARRIER

Prevents the spread of flames to other sectors while scrubbing smoke and improving visibility.

BENEFITS

OF THE EXTINGUISHING AGENT:

DAMAGE REDUCTION:

CAUSED BY WATER:

Unlike traditional sprinkler systems, the small droplet size and the low flow of water mist systems minimize damage. Sometimes the damage caused by massive flooding is greater than the fire damage.

PRODUCED BY PARTICLES AND SMOKE:

The discharge of water mist has the effect of scrubbing smoke and particles produced by the fire, which facilitates evacuation and the arrival of fire fighters responsible for extinguishing the fire.

HIGH SUPPRESSION AND CONTROL CAPABILITY

RAPID TEMPERATURE DROP IN THE HAZARD

MAY BE USED IN LOCAL APPLICATION

ENVIRONMENTALLY FRIENDLY.

INSTALLATION BENEFITS:

MINIMAL SPACE REQUIREMENT:

The size of the pumping units and water tanks installed in the tunnels is lower than with traditional systems, thanks to significant savings in the water used. This means less space is required in the pump room.

LONG PIPE RUNS:

The high pressure at which the water is pumped allows piping networks with longer pipe runs to be used, such that a single pump room can supply water to the entire tunnel.

EASY INSTALLATION AND LOW MAINTENANCE COSTS:

The small pipe sizes and type of accessories used lead to very simple installation of the piping network. The installed system is light. Loads due to the weight of the piping and the liquid itself are reduced, thus reducing the installation cost. The handling of installation elements translates into shorter assembly times and working times, compared to other systems.

Our commitment

CHOICE OF SYSTEMS

SIEX has the widest range of products and systems to suit different needs, both as regards pressures and extinguishing agents.

COMPETITIVE PRICE

Optimizing all of our processes make us more and more competitive worldwide.

SPECIALIZED ENGINEERING

Our highly qualified staff ensure the best service for customers both as regards technical advice on the choice of system, and solving any problems that might arise after installation. Backed up by our extensive experience and a track record of successful projects.

INNOVATION

At the forefront of innovation in every product we develop, ensuring the technical features offered.

QUALITY GUARANTEE

All products meet the highest quality requirements and internationally recognised official approvals.

OTHER SPECIAL HAZARDS PROTECTING BY SIEX:

SERVICE STATIONS

ARCHIVES AND LIBRARIES

DPCs

PAINT SPRAY BOOTHS

ELECTRICAL PANELS

INDUSTRIAL KITCHEN

TURBINES AND GENERATORS

ROAD TUNNELS

NATURAL GAS PLANTS

CLEAN ROOMS

CABLE TUNNELS

TELECOMMUNICATION CENTRES

HOTELS

HOSPITALS

EDUCATIONAL ESTABLISHMENTS

TRAIN AND UNDERGROUND STATIONS

TRAINS

TRANSFORMERS

OFFSHORE PLATFORMS

SOLAR THERMAL PLANTS

MACHINE TOOLS

PRINTING INDUSTRY

HISTORIC BUILDINGS

ROBOTIC PARKINGS

WIND TURBINES

STEEL INDUSTRY

BANKS

OFFICES

LARGE VEHICLES

CONVEYOR BELTS

GAS PUMPS

OIL & GAS

TIMBER INDUSTRY



C/ Merindad de Montija, 6
P.I. Villalonqu jar
09001 Burgos (SPAIN)

tlfno: +34 947 28 11 08

fax: +34 947 28 11 12

siex@siex2001.com

www.siex2001.com



SIEX®