

# High-speed fire protection

*HI-FOG® for rolling stock*



# In the fight against fire on trains some seconds count more than others



The first minutes of a train fire are decisive: will it be suppressed and controlled, allowing the train to reach a safe place where passengers can be evacuated? Or will it grow and spread? Without an active protection solution, the risk of catastrophic fires on trains remains high.



The HI-FOG® Water Mist Fire Protection System is a modern and efficient fire protection solution for the millions of people using public transportation every day. HI-FOG® attacks fire with high-velocity plumes of water mist which penetrate to the seat of the fire.

The mist cools the surrounding air very effectively, suppressing the fire before it can spread. Using very little water, HI-FOG® minimizes damage and protects the integrity of carriages for all rolling stock types.

# Passive fire protection plays an important role

Modern trains are made of very safe and durable materials. Passive fire protection does an important job, but the threat of fire takes active forms: passengers bringing their luggage and belongings on board, vandalism, arson.

Fire on trains is best fought with an innovatively active fire suppression solution that minimizes all fire risks with a minimum of weight while taking up minimal space.



HI-FOG® is a true fire protection innovation which maximizes the fire fighting capability of water. It is ideally suited to trains.

## Drop vs. micro-droplet

HI-FOG® maximizes the fire fighting capability of water by generating a fine water mist composed of micro-droplets, representing a very large surface area of water within the volume of the carriage interior.

HI-FOG® water mist is unparalleled in its ability to attack two of the three prerequisites of fire – heat and oxygen (the combustible material being the third) – while being entirely harmless to people and the environment.

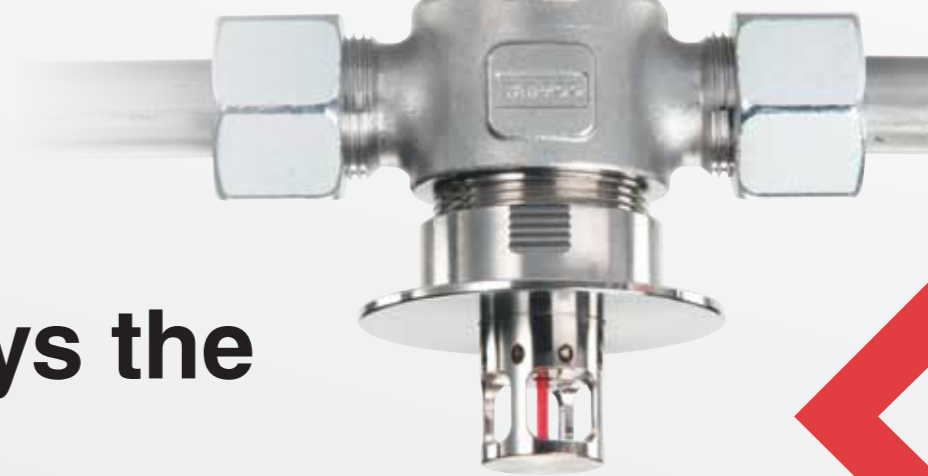


Typical size range of traditional sprinkler system drops 1 ... 5 mm.



Typical size range of HI-FOG® micro-droplets 0.025 ... 0.2 mm.

# HI-FOG® plays the leading role



## A HI-FOG® system for train fire protection comprises the following main parts:

- A HI-FOG® pump unit
- A water supply, cylinders or tank
- HI-FOG® train spray heads or sprinkler heads
- A fire detection system conforming to requirements
- Stainless steel tubing: 12 mm to 16 mm
- Section valves

Modern trains are highly engineered systems which achieve a balance of ideal space/weight ratios, passenger safety and comfort and energy efficiency. The engineering challenge is equally demanding when upgrading older trains with newer equipment. HI-FOG® does not introduce unwanted complexity into either equation.

## Many configurations

HI-FOG® is available in many configurations to accommodate the design constraints of specific train types. HI-FOG® requires less space than passive protection measures such as fire barriers and doors, and weighs less.

## High performance, low maintenance

HI-FOG® cools carriage interiors very effectively. With HI-FOG® on the job, carriage interiors can be made of materials that cost less, weigh less, and present fewer manufacturing constraints. The system's high-grade stainless steel components are very durable: the system has a low lifecycle cost.

## Little water = little weight

HI-FOG® is a high-pressure system that uses water in the most efficient way.

Water storage volume is low. The pump unit is very compact and the system tubing, made of high-quality stainless steel, is narrow in diameter.



# Suitable for every carriage type

Although fire risks are similar for every type of rolling stock, there are many different carriage configurations to account for: from open-ended metro cars with very few seats, to high-speed coaches with many seats in closed compartments, to sleeper cars with several small, closed compartments. HI-FOG® protects them all.



## HI-FOG® for open carriages

Carriages with open space designs connected by gangways have specific fire risks. HI-FOG® is a highly efficient replacement for the passive fire protection measures commonly used to protect such carriages.

HI-FOG® imposes fewer structural constraints on open carriage designs than passive fire protection measures, allowing train manufacturers to increase the space available for passengers while improving comfort. Savings can be achieved during construction: train designers have a wider range of interior materials at their disposal and can select according to cost-effectiveness.



## HI-FOG® and the Madrid Metro

Marioff began to supply HI-FOG® to the Madrid Metro in 1994. Today, HI-FOG® protects about 1,300 carriages of trains operated by the Madrid Metro. The carriages, featuring open designs, are supplied by three different manufacturers – Marioff protects the different types with one flexible HI-FOG® system. One pump unit protects four carriages simultaneously and the system comprises a fire detection system of the aspiration type. Many Madrid Metro stations are also protected by HI-FOG®.



## HI-FOG® for closed carriages

HI-FOG® is a highly flexible system for closed and compartmentalized carriages — for high-speed trains, commuter trains and sleeper cars. HI-FOG® adapts to the most structurally challenging compartments.

Marioff has a long history of retrofitting HI-FOG® in cramped and complex spaces, and will put this vast experience to work for you in finding the best solution for closed carriages.



# HI-FOG® for locomotives

Fire is an ever-present risk in locomotives of all types – diesel, electric or hybrid. Every locomotive fire has the potential to take the train out of operation, causing network delays, and the risk of a complete write-off is high.

Marioff has gained an enormous body of experience in the protection of power generation spaces such as marine vessel engine rooms, gas turbine spaces (on e.g. offshore platforms) and wind turbines. This experience is at your disposal for the fire protection of locomotives. We can offer a solution combining water mist and gas technology as needed.



# Ensuring transportation continuity

HI-FOG® is a safe, field-proven fire protection solution for a very wide range of spaces both large and small. It is ideally suited for the closed spaces of carriages and locomotives, as well as the open spaces of tunnels and stations. It will protect your rolling stock, keep traffic flowing safely through your tunnels, and allow passengers to use your stations with peace of mind.



## HI-FOG® for stations

HI-FOG® can completely protect passenger stations: platforms, escalators, machinery rooms and high-voltage areas. HI-FOG® does not impose specific structural demands on the building. It is an environmentally responsible addition thanks to its small tubing, low water consumption and minimal power consumption.



## HI-FOG® for tunnels

Fire is particularly dangerous in the tunnel environment, a fact that has prompted a number of forward-looking tunnel operators to adopt HI-FOG®.

HI-FOG® proves its value in the first seconds and minutes of a tunnel fire, engaging the fire instantly and reducing the ambient temperature. It prevents the fire from spreading, facilitating the

evacuation of motorists to emergency exits and moderating conditions for the emergency services arriving on the scene.

# Customized turnkey solutions

The HI-FOG® water mist fire protection system will help you keep railway traffic flowing safely through your network by minimizing the threat posed by fire. This is a long-term proposition, and Marioff can provide a complete turnkey solution.

## Design and project management

Marioff will design the right HI-FOG® system for your rolling stock based on the fire risk assessment, water supply and any special protection requirements. The system is dimensioned based on the fire risk assessment results. Zone size is calculated according to a number of parameters including carriage design, the expected fire load, the accuracy of the fire detection system and the ventilation technique. A Marioff project manager will ensure smooth system delivery and commissioning.

## Installation

Marioff is expert at installation in various environments. The full range of our experience will be placed at your disposal in the project planning stages. Through its numerous subsidiaries and installation partners, Marioff will always be at your side.

## Training

As part of your overall safety regimen, Marioff will train your staff to operate and maintain the HI-FOG® system to make sure it performs at its best when it really matters – all the time.

## Service and maintenance

Marioff's service and maintenance team provides a full palette of services to ensure that your HI-FOG® system stays in peak condition throughout its life.



# The world's pre-eminent water mist company

Founded in 1985, Marioff is the world's leading provider of water mist systems on land and at sea. Almost 1,000 passenger cruise ships and ferries are protected by HI-FOG® at sea.

About 1,500 installations are protected by HI-FOG® on land: historic buildings, art galleries, churches, libraries and archives, museums, hotels, hospitals, data centers, energy facilities, road tunnels, metro trains and stations, factories – the list is long and growing fast.

## Relentless fire testing

With countless full-scale fire tests behind it, the HI-FOG® water mist protection system is the world's most tested water mist system. HI-FOG® has been tested thoroughly for rolling stock fire protection and its performance in this environment is known and impressive.

## World's most approved water mist system

HI-FOG® has received more type approvals, across more application areas, than any other water mist system.



Full-scale fire test carried out for a tunnel project.



Pop-out nozzle on stand-by position.



Pop-out spray head on pre-activation position.



Pop-out sprinkler on pre-activation position.



12 mm HI-FOG® tube, actual size.



16 mm HI-FOG® tube, actual size.



Gas-driven (GPU) pump unit for trains, undercarriage installation.



MAU 100 cylinder unit for trains.



Gas-driven (GPU) pump unit for interior installation.



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