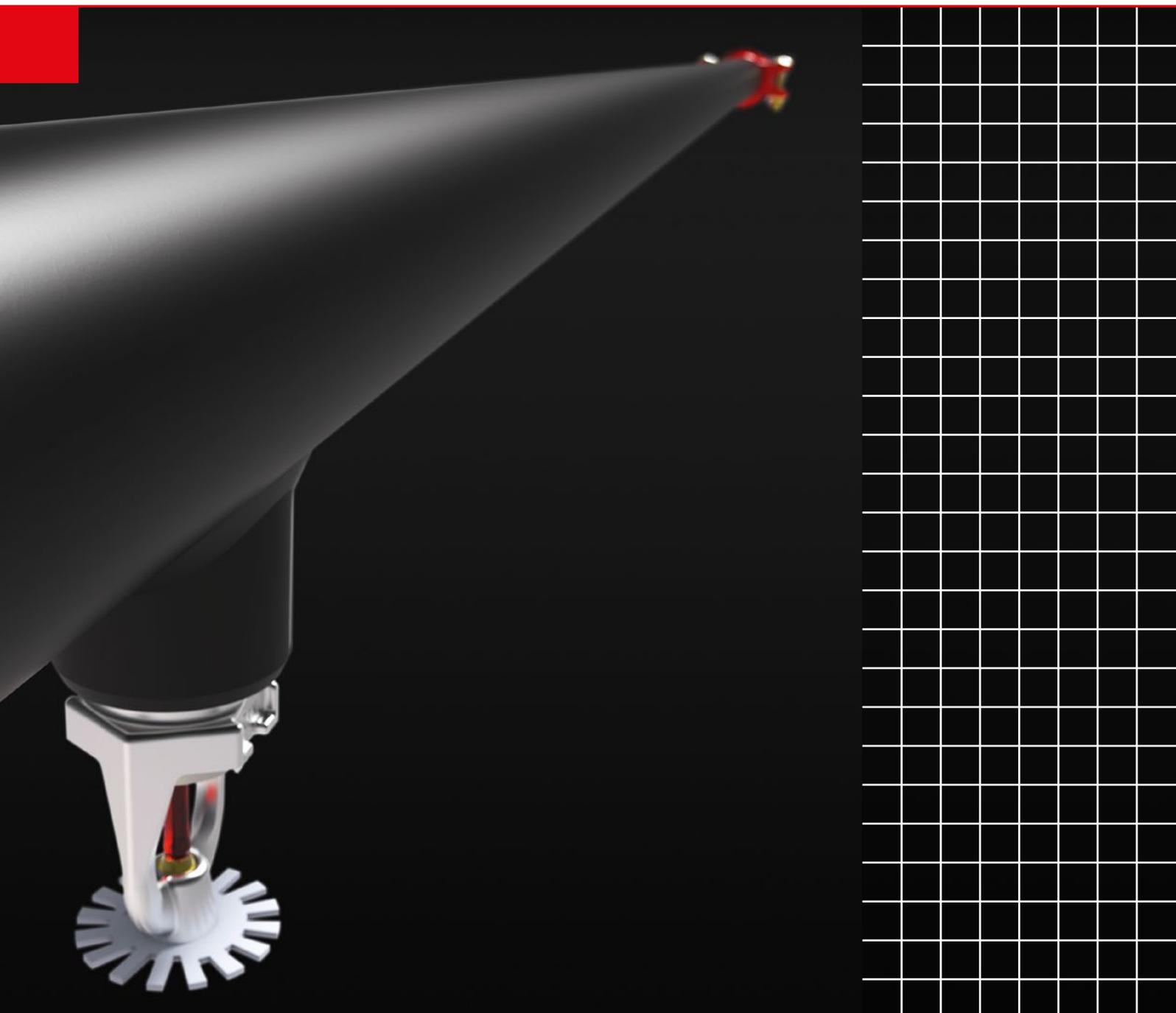


Experts in fire protection

**MINIMAX**

## Fendium Pipe – Polymer-Enhanced, Corrosion-Protected



TECHNOLOGY

WATER-BASED  
EXTINGUISHING SYSTEMS

## Fendum – a quantum leap in sustainable fire protection

Fire suppression systems typically remain unused for many years, and fortunately in most cases, they are never needed at all. Nevertheless they must be ready for operation at any time. Corrosive conditions are often present in the piping of water-based suppression systems, which may not only cause perforation of the pipes, but also deposits that can reduce internal diameters. That's why Fendum pipe is enhanced with a special polymer that provides lasting protection against corrosion.

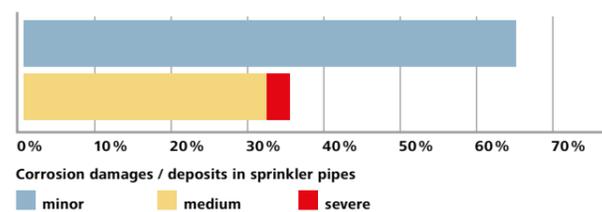
Corrosion in steel pipes used traditionally for water-based suppression systems comes in many forms: Pitting corrosion causes perforation and rust-through. Surface corrosion leads to rough surfaces, encrustations and deposits that increase pipe friction and reduce the clear cross-section of the pipes. Corrosion deposits may come loose and cause clogging.



Corrosion on the inside of an untreated pipe

Rough and constricted pipes, as well as clogged sprinklers or nozzles, impair the system's extinguishing effectiveness in the event of a fire, thus eventually putting people and assets at risk and jeopardizing the continued operation of the business. But even when the suppression system is just in its standby condition, corrosion may cause problems: leakages may occur not only as a result of rust-through, but also due to roughened surfaces below the gaskets of pipe couplings. This means costly water damage and business interruptions.

Wet pipe systems after 25 years

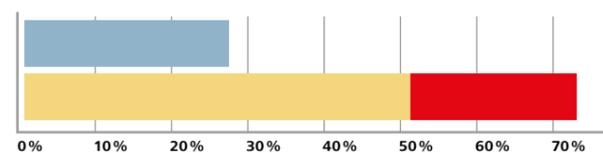


Corrosion occurs not only in wet pipe systems, which are permanently filled with water, but also in dry pipe and preaction systems, which are particularly at risk due to moist compressed air and water that collects in the low points of the piping. As the problems start on the inside of the pipes, they often remain undetected for long periods of time.

Traditionally, water-based suppression systems are installed using steel pipes with paint or powder coating on the outside. On the inside, however, these pipes are untreated and therefore not protected against corrosion. For many years, galvanized pipes were considered an alternative, especially for dry pipe systems. However, even the small quantities of water contained in dry pipe and preaction systems – in conjunction with salts, oxygen and carbon dioxide – can lead to a disintegration of the zinc coating.

One in three wet pipe systems shows medium to severe corrosion issues within 25 years, which often requires replacement of the affected pipes. In two out of three dry pipe systems, replacement is required after only 12½ years (Source: VdS Schadenverhütung – an independent German approval body for fire protection). This means that corrosion impairs not only the functional safety of the suppression system, but also leads to substantial repair costs for system owners and operators in the long term.

Dry pipe systems after 12½ years



VdS statistics on inspections of old systems



Corrosion could largely be avoided by using stainless steel pipes in water-based suppression systems, but for cost reasons they are rarely used for this purpose.

Fendum Polymer-Enhanced Steel Pipes are the solution. They feature a special polymer protecting them against corrosion both on the outside and the inside. Independent tests confirm that the polymer provides an extremely high level of resistance against corrosive influences.

When used as intended, Fendum pipe has a significantly longer lifespan than pipe that is untreated on the inside. Minimax offers a 10-year guarantee against rust-through on Fendum pipe – a guarantee that far exceeds the statutory warranty obligations and industry standards.

Fendum is approved by both VdS Schadenverhütung and FM Global.



Even after long-term use, the surfaces of Fendum pipe are similarly smooth as those of plastic pipe and widely free of deposits that reduce the inside diameters. For this reason, both VdS Schadenverhütung and FM Global have confirmed the favorable Hazen-Williams coefficient (C-value) of 140 with Fendum pipe for the purpose of hydraulic calculations. In contrast, the C-value of galvanized or internally untreated steel pipes is 120 or even only 100 for internally untreated steel pipes in dry pipe systems according to FM. The higher the C-value, the lower the pressure loss. This means that with Fendum, in many cases the suppression system can be designed with smaller pipes or smaller pumps requiring less space. In addition, smaller pipes weigh less making installation easier.

Fendum makes extinguishing systems more durable, safer and more efficient.



\*Subject to agreement

## Polymer and steel become one

Fendium pipe is steel pipe with a special polymer protecting it against corrosion on both the outside and the inside. In contrast to paint and powder coating, the polymer protection is formed in a chemical process unifying polymer and steel.

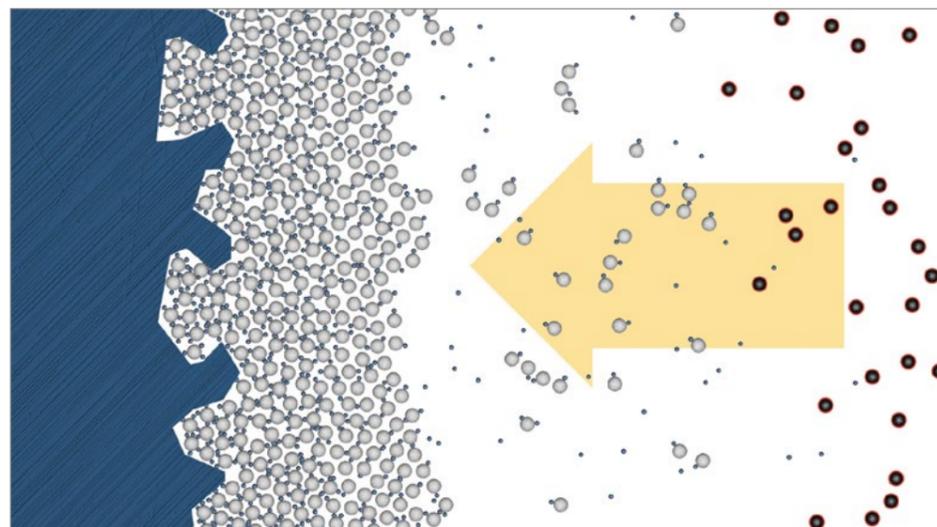
The special Fendium polymer protection is produced in several process steps.

After thorough cleaning and pretreatment, the steel pipe to be enhanced is dipped in a tank filled with Fendium polymer emulsion. Iron fluorides contained in the emulsion are continuously supplied to the pipe and provide a release of iron ions on the surface of the steel pipe.

As soon as the positively charged iron ions collide with the polymer particles also contained in the emulsion, they adhere to them and partly neutralize their negative charge. The polymer particles are now able to combine with each other and are attracted to the positively polarized steel pipe surface.

In this way, the polymer protection develops and the pipe's roughness is smoothed out. Once the desired polymer protection is achieved, this process step is terminated by removing the pipe from the dip tank.

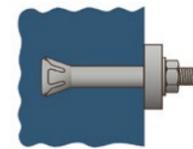
To continue the process, gelling takes place in the pre-dryer. The pipe is warmed up, causing the polymer particles to run into each other and the pipe to be smoothed further. Finally, the polymer is baked and cured in the hot-air oven.



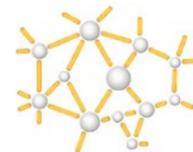
Development of the polymer protection on the steel pipe surface

-  **Iron ions**  
(positively charged)
-  **Polymer particles**  
stable in emulsion  
(negatively charged)
-  **Polymer particles**  
precipitated from emulsion  
(negative charge partly neutralized)

The result of the polymer enhancement is a gradual transition from the steel core to pure polymer. Polymer and steel are unified by the following effects:



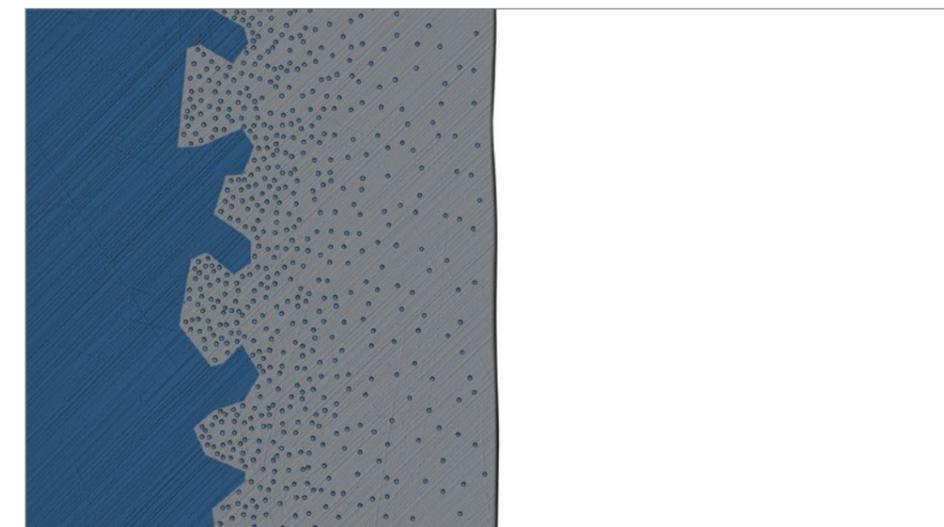
Microstructural interlocking of the polymer with the steel core



Three-dimensional cross-linking of the polymer molecules to one large macromolecule



Forces of attraction between the positively polarized steel core surface and the negative charge carriers contained in the polymer



Gradual transition from the steel core to pure polymer

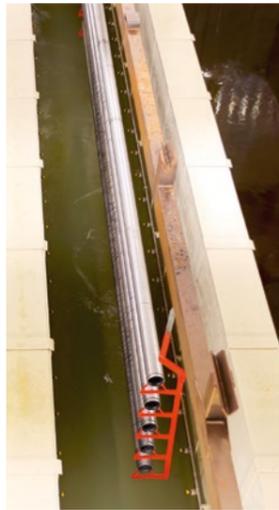
-  **Steel**
-  **Polymer**  
with embedded iron ions

These effects minimize the risk of the polymer delaminating, which sets Fendium polymer enhancement apart from paint and powder coating, for example.

During the manufacturing process, the polymer is formed not only on the outside, but also on the inside of the pipe. Fendium pipe therefore provides smooth surfaces and lasting corrosion protection all around.

## Quality from the world's largest pipe prefabrication plant

Innovative Fendium pipe is produced at MV Pipe Technologies, a Minimax affiliated company, in the world's largest pipe prefabrication plant in the fire protection industry. This factory is unique due to its size and the cutting-edge technologies and procedures employed.



In a highly integrated and automated process, simple steel pipes are turned into custom-made distribution and branch pipes – according to the system plans provided by the Minimax design engineer and with the desired surface treatment and color. Using pre-fabricated pipes, the entire piping for water-based suppression systems can be installed quickly and efficiently on the construction site.

To ensure that cut edges and weld seams are protected with the polymer as well, each pipe receives its individual shape with suitable connections and welded outlets first. To this end, MV Pipe Technologies uses state-of-the-art welding and plasma cutting technologies and sets new standards for welding seam precision.

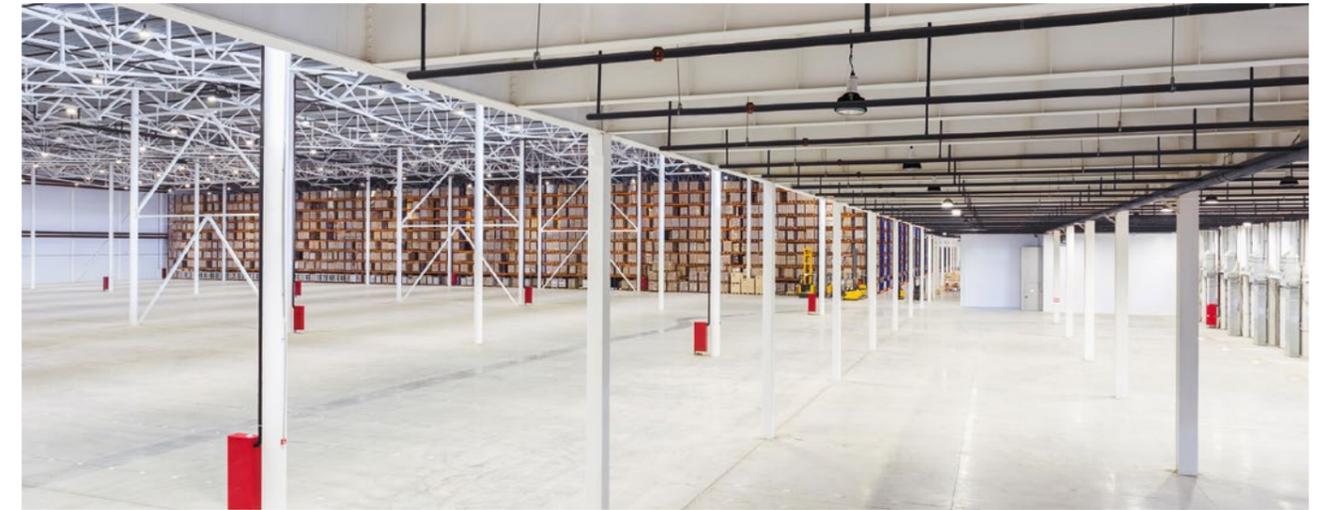
After mechanical processing, the corrosion-protective polymer is formed on the outside as well as on the inside of each steel pipe in a patented procedure. After the polymer enhancement the pipe is black – however, by adding an outer powder coating, Fendium pipe can be delivered in other colors as well.

The entire production process is environmentally friendly. All liquids used for surface treatment are water-based and are continuously recycled. Heat and electricity are generated efficiently and sustainably in the internal co-generation unit. The extended lifespan of Fendium pipe also contributes to a reduced environmental footprint.

The capacities available at MV Pipe Technologies, the automated processes in the plant and the high quality of the prefabricated pipe enable Minimax to install even large fire suppression systems smoothly and swiftly.

## Fendium – Series and application range

Fendium pipe can be used for almost all types of water-based suppression systems. It is available with different levels of polymer protection suitable for the respective corrosive conditions.



The Basic Series of Fendium pipe are intended exclusively for use in wet pipe sprinkler systems.

The Plus Series provide even stronger polymer protection and are therefore also well-suited for areas with greater risk of corrosion, including

- dry pipe and preaction sprinkler systems,
- deluge systems,
- low-pressure water mist systems,
- hydrant systems and dry risers,
- spark extinguishing systems.

Fendium pipes with an increased level of polymer protection are marked with an engraved plus sign.

## Fendium – a quantum leap in sustainable fire protection

- The polymer provides lasting protection to the steel pipe against corrosion both outside and inside.
- Long lifespan, 10-year guarantee against rust-through\*
- Low pipe friction allows the use of smaller pipes or smaller pumps in many cases.
- Less space is required due to smaller pipes or smaller pumps
- Polymer and steel are unified – unlike paint and powder coating
- Quality from the world's largest pipe prefabrication plant in the fire protection industry
- Available with different levels of polymer protection suitable for different corrosive conditions



\* Subject to agreement



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