

Corrosion protection with polymer-enhanced pipe

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Why worry about corrosion?



So, what IS corrosion?

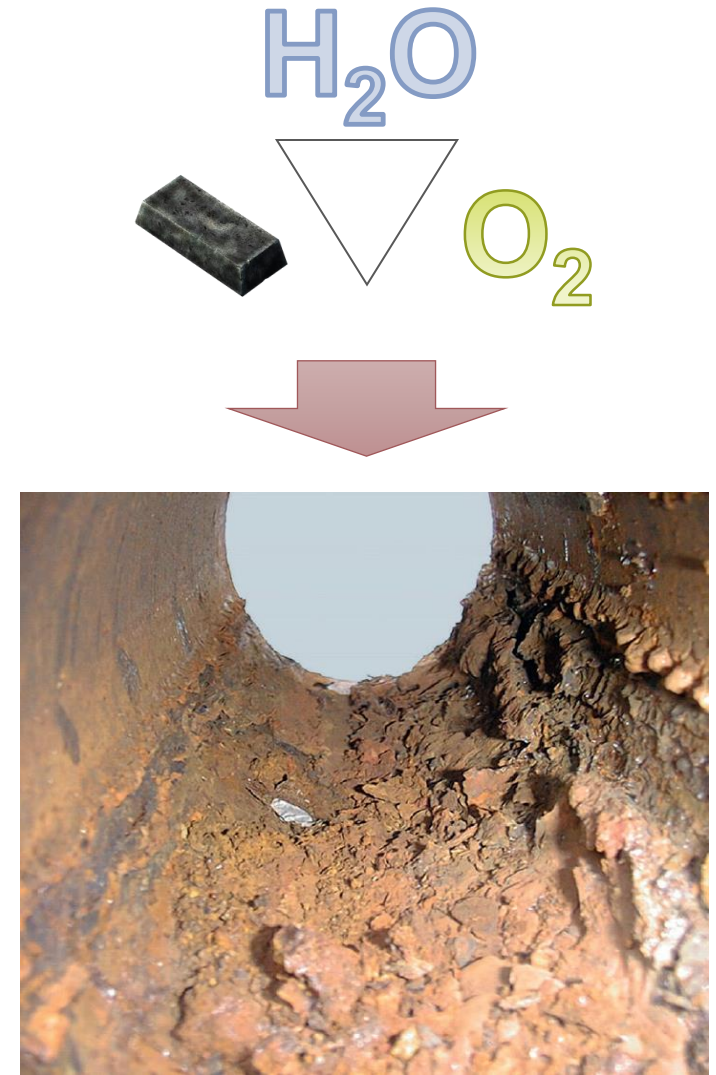
Corrosion is...the erosion or wearing away of material through chemical action

Steel pipes contain iron which will rust when in the presence of water and oxygen

First the metallic iron is partly dissolved in the water

The resulting iron ions then combine with the oxygen in the air and water to form iron oxide

So why is that an issue?



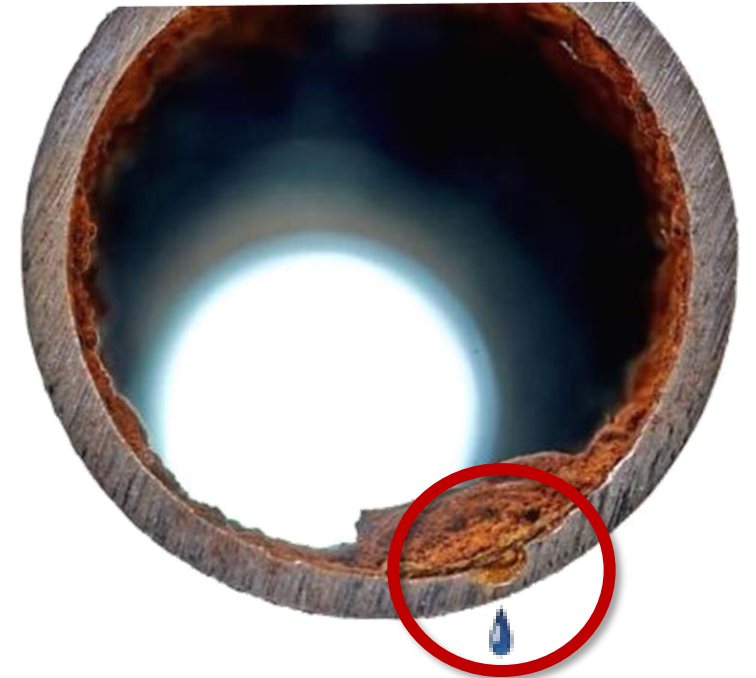
Surface corrosion

- Rough surfaces
- Encrustations
- Deposits



Pitting corrosion

- Perforation
- Rust-through



- Increased pipe friction
- Reduced clear cross-section of the pipes
- Clogging due to corrosion deposits
- Leakages

Corrosion is not rare and often remains undetected

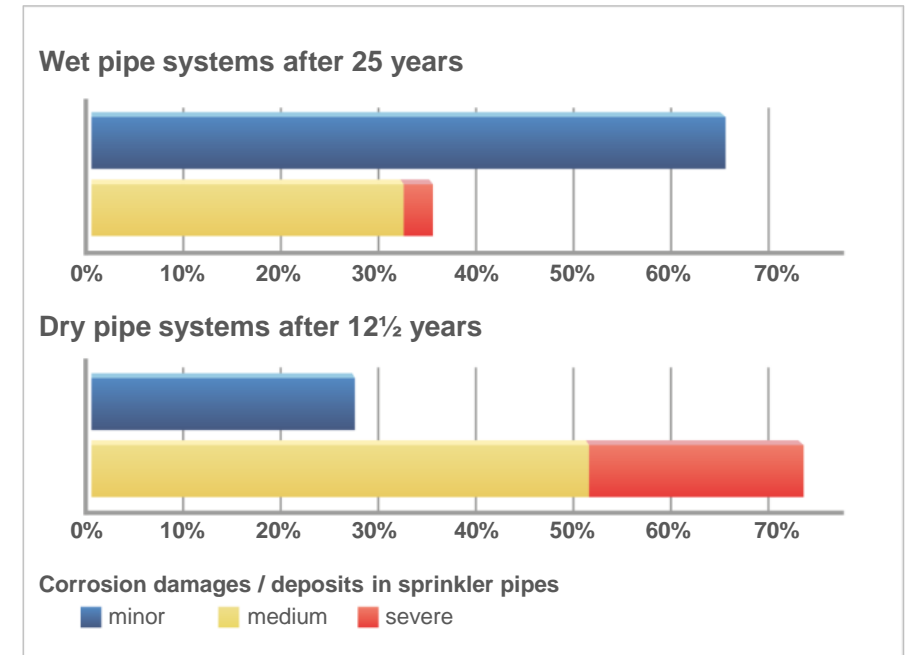
Wet pipe systems

- Up to now, pipes generally untreated inside (with powder coating outside)
- Medium to heavy signs of corrosion in a third of systems after 25 years

Dry pipe systems

- Particularly at risk due to moist compressed air and water that collects in the low points of the piping
- Medium to heavy signs of corrosion in two out of three dry pipe systems after 12,5 years

- **Problems remain undetected for long periods of time**
- **High repair costs in the long term**



Source: VdS Schadenverhütung (statistics of old system inspections)

So the problem remains hidden – how to we uncover it?



Inspections are required:

NFPA 25

- Internal inspection minimum every 5 years

FM DS 2-81


- Dry etc, internal or ultrasonic inspection of pipes every 3 years unless with N₂ (every 10 years) unless full flow can verify water delivery time to remote areas

EN12845

- Externally inspected each quarter
- Internally after 25 years

VdS CEA 4001

- Visual external inspection every month
- Entire pipework inspected after 25 years (wet) or 12.5 years (dry) and every 12.5 years after that regardless of type

A close-up photograph of a metal surface that has undergone severe corrosion. The surface is covered in a thick, brown, flaking layer of rust. The underlying metal is visible in some areas, appearing dark and pitted. A black rectangular text box is overlaid on the left side of the image. The background is a plain, light-colored wall.

What can we do about it?

Galvanized pipe is no longer the solution

Problems with galvanized pipes

- For many years, galvanized pipes were preferred for dry pipe and pre-action systems
- Disintegration of the zinc layer caused by residual moisture in combination with salts, oxygen and carbon dioxide
 - FM DS 2-1 “It should be noted that new dry or preaction systems can develop through-wall corrosion pinhole leakage from 2 to 3 years after initial installation due to residual water causing corrosion in galvanized steel pipe”
- Hydrogen formation may occur due to corrosion

Reactions in the world of standards

- Since 2013, NFPA shows no better C-value for galvanized pipe than for untreated steel pipe
- Since 2014, VdS no longer recommends galvanized pipe in dry pipe systems
- Since 2016, FM requires the integration of N₂ generators in galvanized dry pipe / preaction systems or other comprehensive measures to mitigate the risk of corrosion
- FM prohibits galvanized pipes in wet pipe systems since 2017 due to the hydrogen issue



Steel is still a very good choice for pipework



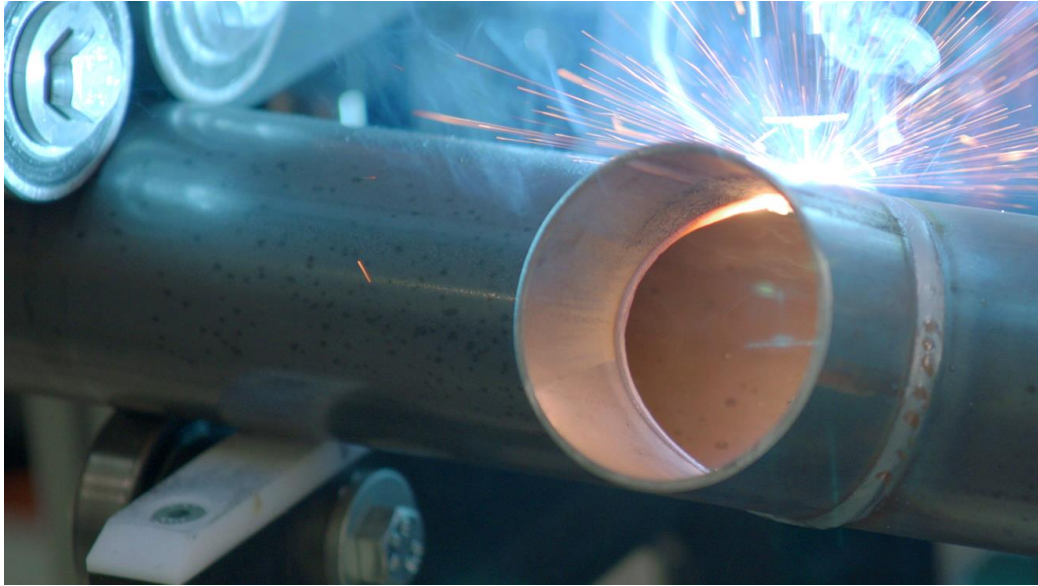
- Steel pipes have been used for decades in our industry
- The market is adapted to using them (on-site processes, tools, fittings etc)
- Steel pipes are easily sourced

HOWEVER

- We need to improve their corrosion performance
- We are not alone in tackling corrosion
- Looking at other industries we adapted well-established corrosion processes to pipework

Improving steel pipe





We start with steel pipe prefabrication

- Reading in the system drawing direct from CAD
- Direct connection of CAD system to the prefab production
- DN25 through to DN300
- 100mm up to 9m long
- All sizes and positions for outlets

Development of proven technology to fire protection needs



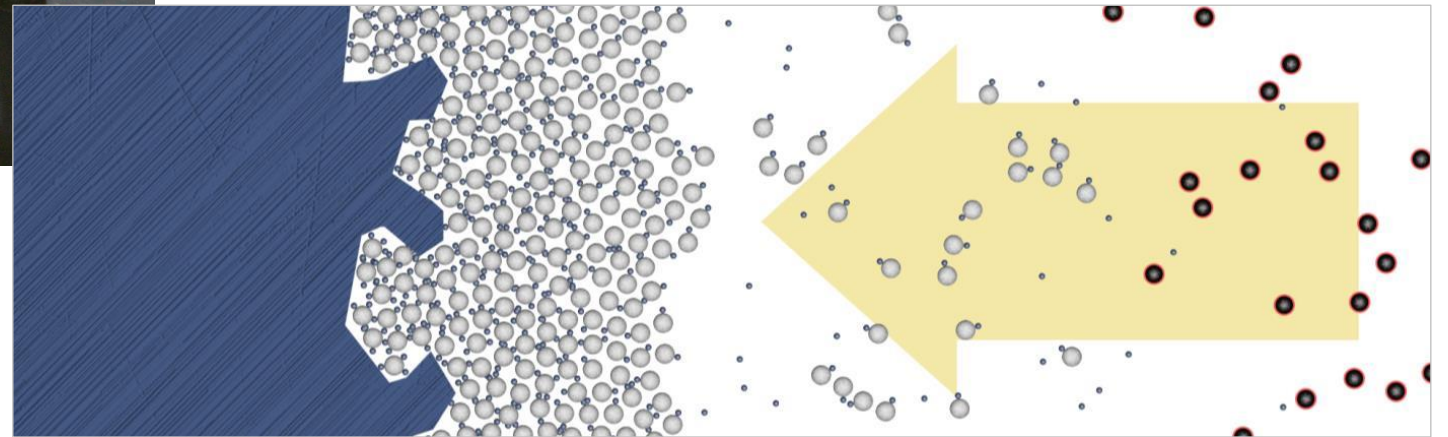
Next we clean and prepare the pipes

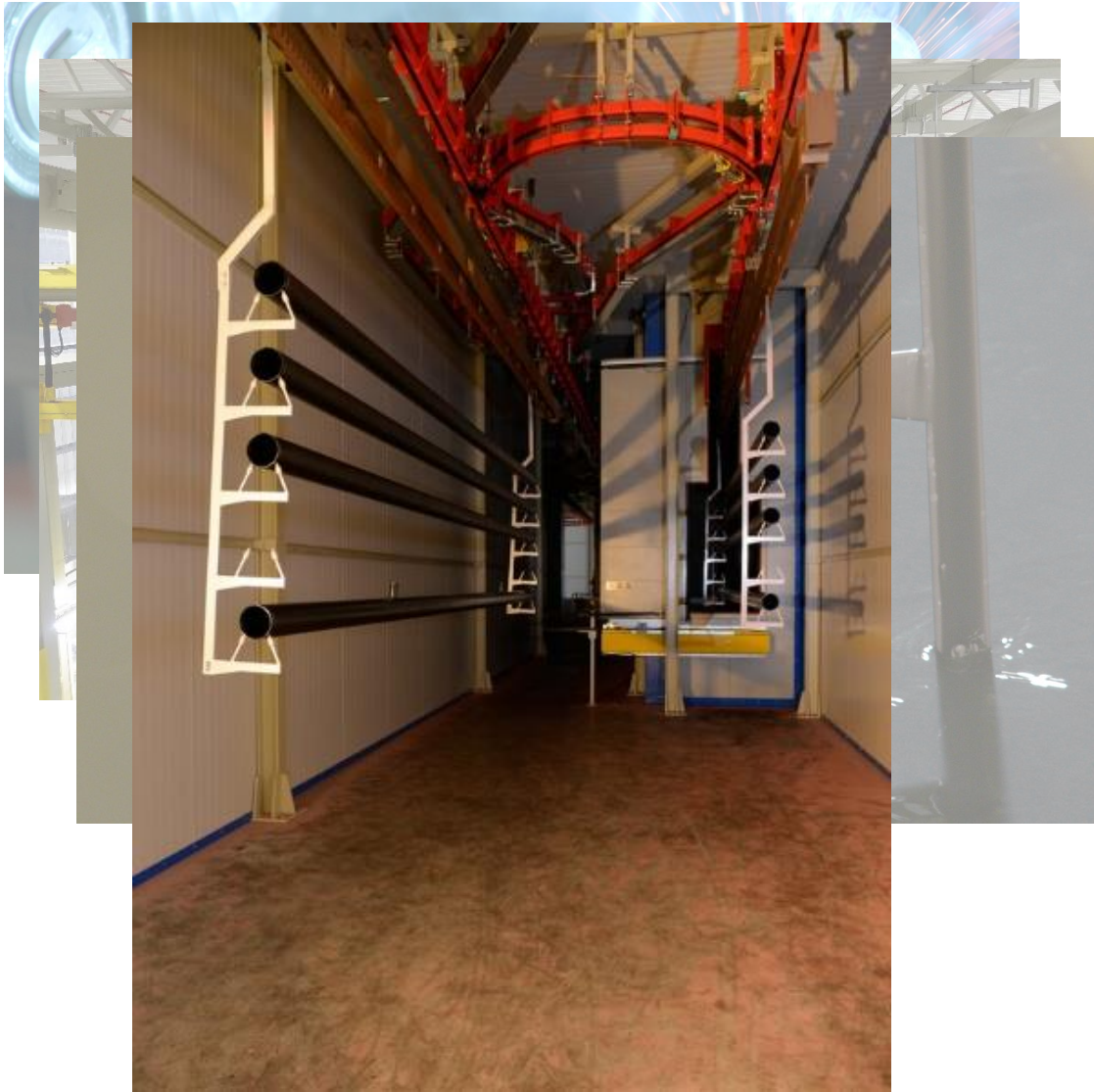
- Pipes pass through many baths to clean them
- Critical to get to the bare steel with no oxidation
- Cleaning outside AND inside (not easy!!)



The Fendium process

- The pipe is dipped in a tank filled with Fendium polymer emulsion
- Iron fluorides in the emulsion cause the pipe surface to release iron ions
- These iron ions partly neutralize the negative charge of polymer particles
- Polymer particles combine with each other and are attracted to the positively polarized steel pipe surface
- The polymer protection is bonded at a molecular level to the pipe – **outside and inside**





Finals steps

- The pipe is heated to further smoothen the surface of the pipe
- If required, a powder coat is added at this stage
- The pipe is heated to harden and finalise the surface

Development of proven technology to fire protection needs

Read to ship

- Pipes are bundled for shipping
- Either in standard 6m lengths
- or as prefab according to the system drawings



Testing & evaluation



Testing by FM & VdS validates our claims

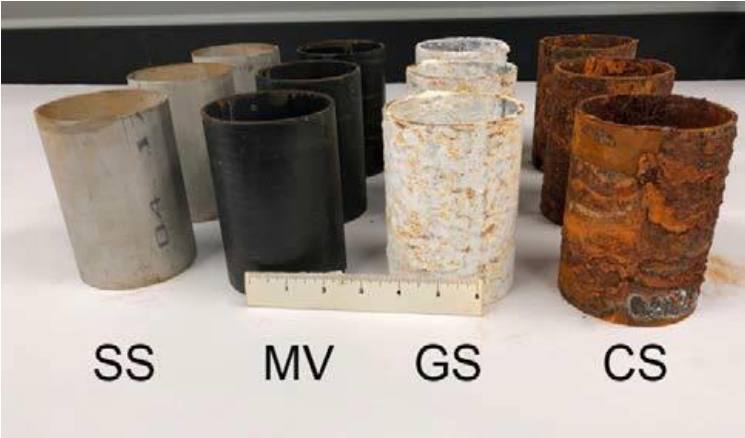


- Friction loss
 - Before and after corrosion
- Impact and abrasive
- Grooved compatibility
- Adhesion/Delamination
- Chemical compatibility
- Salt spray



Salt spray testing demonstrates performance

1 Month



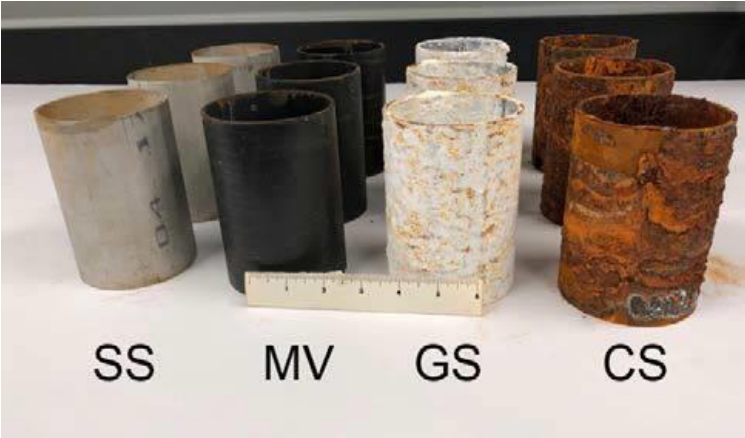
3 Months



6 Months

Salt spray testing demonstrates performance

1 Month



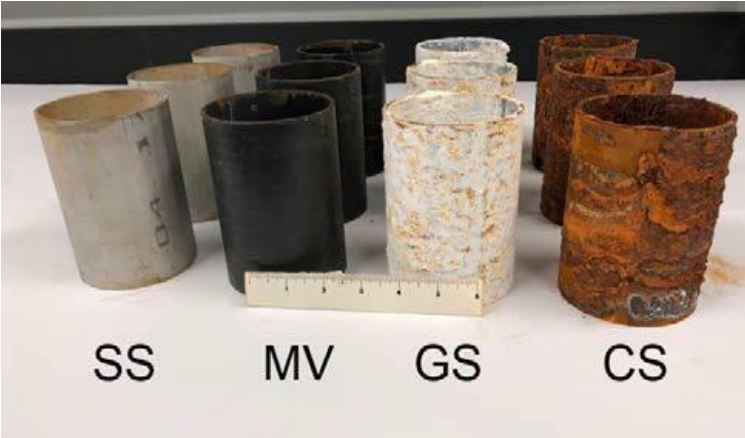
3 Months



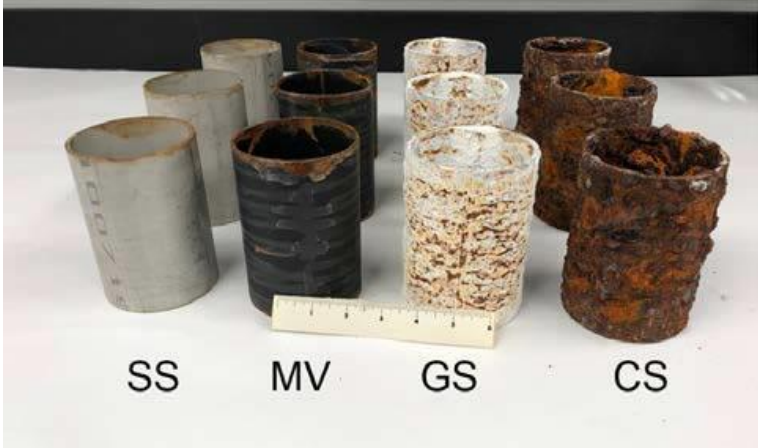
6 Months

Salt spray testing demonstrates performance

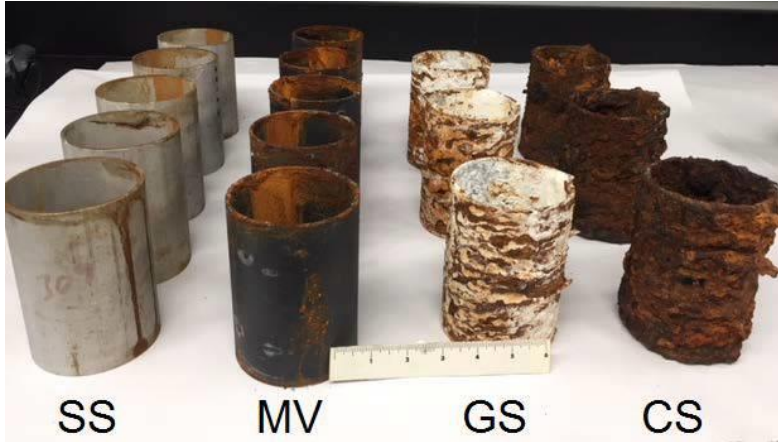
1 Month



3 Months



6 Months



Product range





The pipes are now FM and VdS approved:

- C140 confirmed
- Two pipe specs for grooving & threading
- Wet, dry, preaction & deluge
- DN25 to DN300
- Standard black or painted options

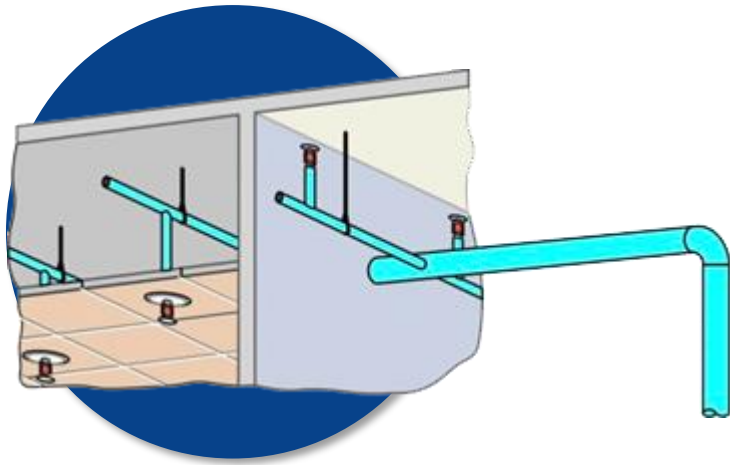
However, prefab is not a single product, the production is just as important:

- The dedicated factory is also approved to produce prefabricated pipes



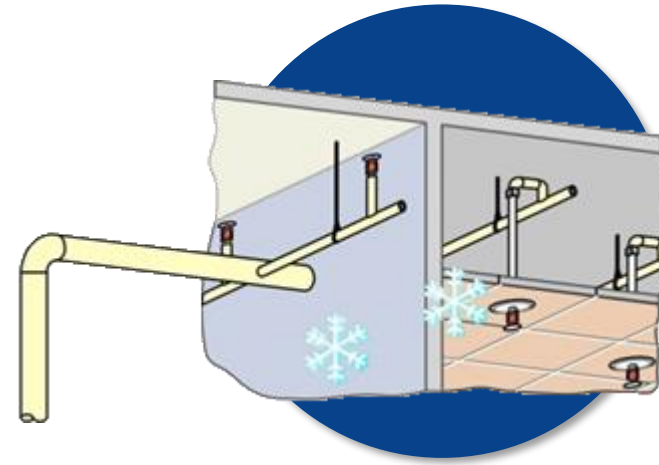
Fendium is available in two qualities – Basic and Plus

The right pipe for every application:



Fendium Basic

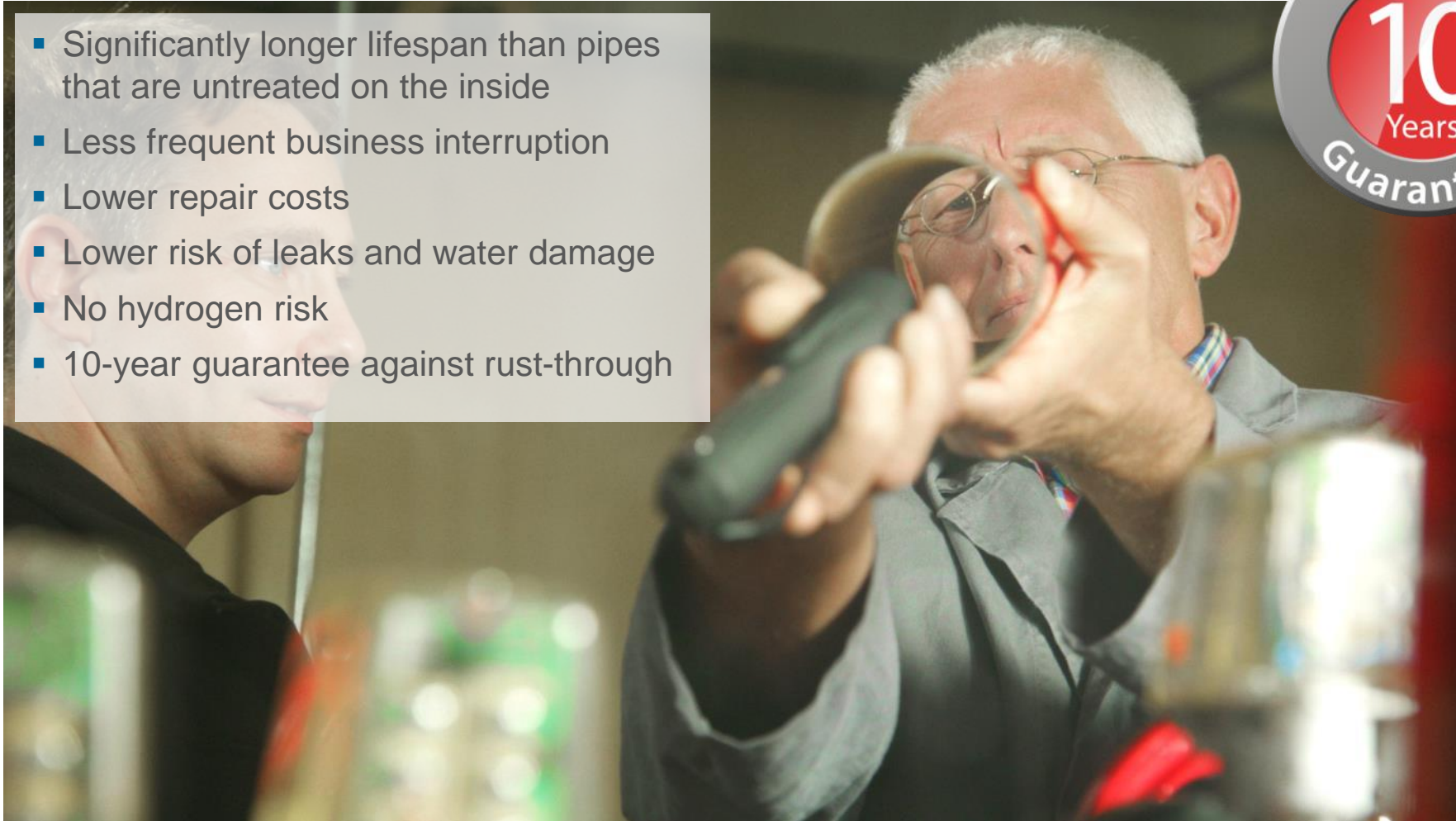
- Regular polymer protection
- Replaces internally untreated steel pipe
- Only for wet pipe systems of sprinkler systems



Fendium Plus

- Fortified polymer protection
- Replaces galvanized steel pipe
- For nearly all water-based suppression systems:
 - Sprinkler systems including dry pipe systems
 - Deluge systems
 - Low-pressure water mist systems
 - Hydrant systems and dry risers
 - (Spark extinguishing systems)

- Significantly longer lifespan than pipes that are untreated on the inside
- Less frequent business interruption
- Lower repair costs
- Lower risk of leaks and water damage
- No hydrogen risk
- 10-year guarantee against rust-through



Fendum: Hydraulic performance bring benefits

- Smooth surfaces even after long use
- Less pipe friction – hydraulic calcs with $C = 140$
- Smaller pumps in many cases
 - Less diesel consumption
 - Smaller power consumption, cabling...
- Less space is required due to smaller pipes or smaller pumps (more space above ceiling, fewer problems with other trades...)
- Smaller pipes:
 - Weigh less
 - Easier and faster to install
 - Reduced ceiling load
 - Smaller grooved and hanging materials
- No requirement for galvanized grooved fittings





Fendium

Thank you for listening