

Return On Investment (ROI)

Engineered Corrosion Solution, LLC

ROI for ECS Dry Pipe Nitrogen Inerting (DPNI) System on
Double Interlock Preaction Systems in Mission Critical Setting



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Corrosion
Solutions™

Complete Corrosion Control.



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Engineered Corrosion Solutions (ECS) invented and developed Dry Pipe Nitrogen Inerting (DPNI) technology to protect black steel and galvanized steel fire sprinkler piping from oxygen corrosion. We have placed particular emphasis on reducing the risk associated with fire sprinkler piping leaks in the mission critical data center setting. ECS was the first in the industry to point out the acute vulnerability of galvanized steel piping to highly localized attack by oxygen corrosion under the conditions that typically exist within the double interlock preaction fire sprinkler system piping network. ECS does not recommend the use of galvanized steel piping in any water based fire sprinkler applications. DPNI can protect both black steel and galvanized steel piping from oxygen corrosion.

Corrosion in double interlock preaction fire sprinkler systems creates three different kinds of risk for the data center owner:

1. Fire sprinkler system **repair and replacement** cost risk caused by leaks
 - Reduced service life for the initial fire sprinkler system investment
 - Property maintenance personnel costs
2. Will corrosion that has occurred within the fire sprinkler system prevent the fire sprinkler system from **functioning** as designed?
 - Life safety risk to occupants
 - Property and structure risk
3. Will corrosion that has occurred within the fire sprinkler system result in **water leakage**?
 - Water damage to structure
 - Water damage to the data hall equipment
 - Business continuity risk – shut down for leaks and associated repairs

Any ROI evaluation of the DPNI technology must integrate consideration of these risk items to fully gauge the value of the investment as part of an overall risk management assessment. In the mission critical setting, the risk that a corrosion related leak in the fire sprinkler piping will adversely impact the equipment in the data hall is an extremely high impact risk.

Insofar as repair and replacement ROI for the nitrogen inerted dry pipe system we can state the following:

Galvanized Dry Pipe Systems (no corrosion protection) – schedule 10 > 2.5 inch, schedule 40 < 2.0 inch

- Average cost of installation – \$3-5 per square foot (varies based on location)
- Exterior protection – not necessary with galvanized piping



- Average time to first corrosion related leak – 3-5 years (Note that average leak repair cost is \$1500-\$2500 per leak)
- Average time to replacement of mains – 10-15 years

Black Steel Dry Pipe Systems (no corrosion protection) – schedule 10 > 2.5 inch, schedule 40 < 2.0 inch

- Average cost of installation – \$2-4 per square foot (varies based on location)
- Exterior protection of the fire sprinkler piping - \$1 per square foot for painting, slightly higher for powder coating
- Average time to first corrosion related leak – 10-15 years (Note that average leak repair cost is \$1500-\$2500 per leak)
- Average time to replacement of mains – 15-20 years

With ECS Dry Pipe Nitrogen Inerting (DPNI) protection in the data center

In general, the cost per square foot for the DPNI technology decreases as the size of the data hall being protected increases.

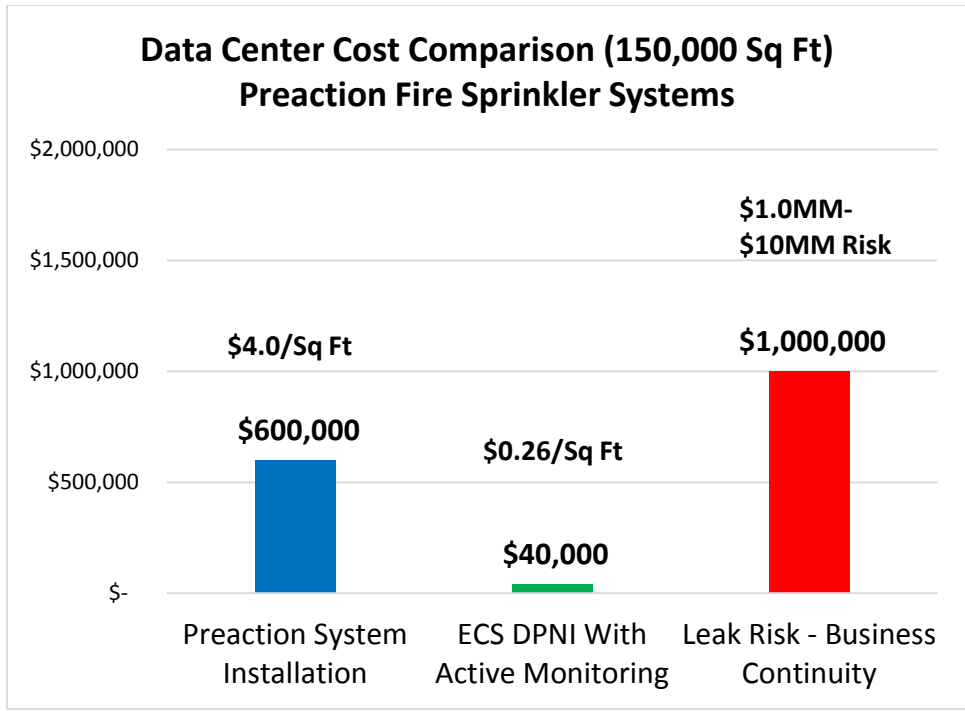
Example One: Data center occupying 25,000 square feet with one (1) preaction zone

- Equipment required:
 - ECS Pre-engineered, skid mounted nitrogen generator (1)
 - ECS SMART Vent (1)
 - ECS Gas Analyzer (1)
 - ECS In-line Corrosion Detector (1)
- Approximate cost: \$25,000 or **\$1.00/square foot** (includes installation and commissioning)

Example Two: Data center occupying 150,000 square feet with six (6) preaction zones

- Equipment required:
 - ECS Stand-alone nitrogen generator (1)
 - Stand-alone redundant duplex compressor (1)
 - ECS SMART Vent (6) – one per zone
 - ECS Gas Analyzer (1)
 - ECS In-Line Corrosion Detector (2)
- Approximate cost: \$40,000 or **\$0.266/square foot** (includes installation and commissioning)





Oxygen corrosion will absolutely occur under the trapped pools of water that inevitably develop in the main lines of double interlock preaction fire sprinkler systems. Leaks always occur under the trapped pools of water in the main line piping. This means that when the pin-hole leak develops pressurized water is always discharged. When compared to the risk that a corrosion related leak will occur in a data hall over the servers, the cost of installation of the ECS DPNI technology is very minor.

ECS has been installing the DPNI systems on preaction systems in data centers since February of 2009 on both galvanized steel and black steel piping. Over 100 large data centers have employed the ECS DPNI technology. On systems where DPNI was installed as part of the original construction, there has not been one recorded corrosion related leak in the fire sprinkler system piping. On system where DPNI was used as part of the remediation process which typically involved some surgical pipe replacement, there has not been one recorded corrosion related leak in the fire sprinkler system piping.



DPNI Case History – Mission Critical Data Center in Missouri

Background – 100,000 square foot data center originally built and opened in 2002 with double interlock preaction fire sprinkler systems to protect the data halls. Galvanized steel piping was used for all of the preaction fire sprinkler systems. After 8 years of service leaks began to develop in the 3” galvanized schedule 10 main piping within the facility. All of the leaks occurred within the main line piping under accumulations of trapped water. The metal loss was characterized by highly localized attack with many deep singular round bottomed pits beneath the trapped pools of water.

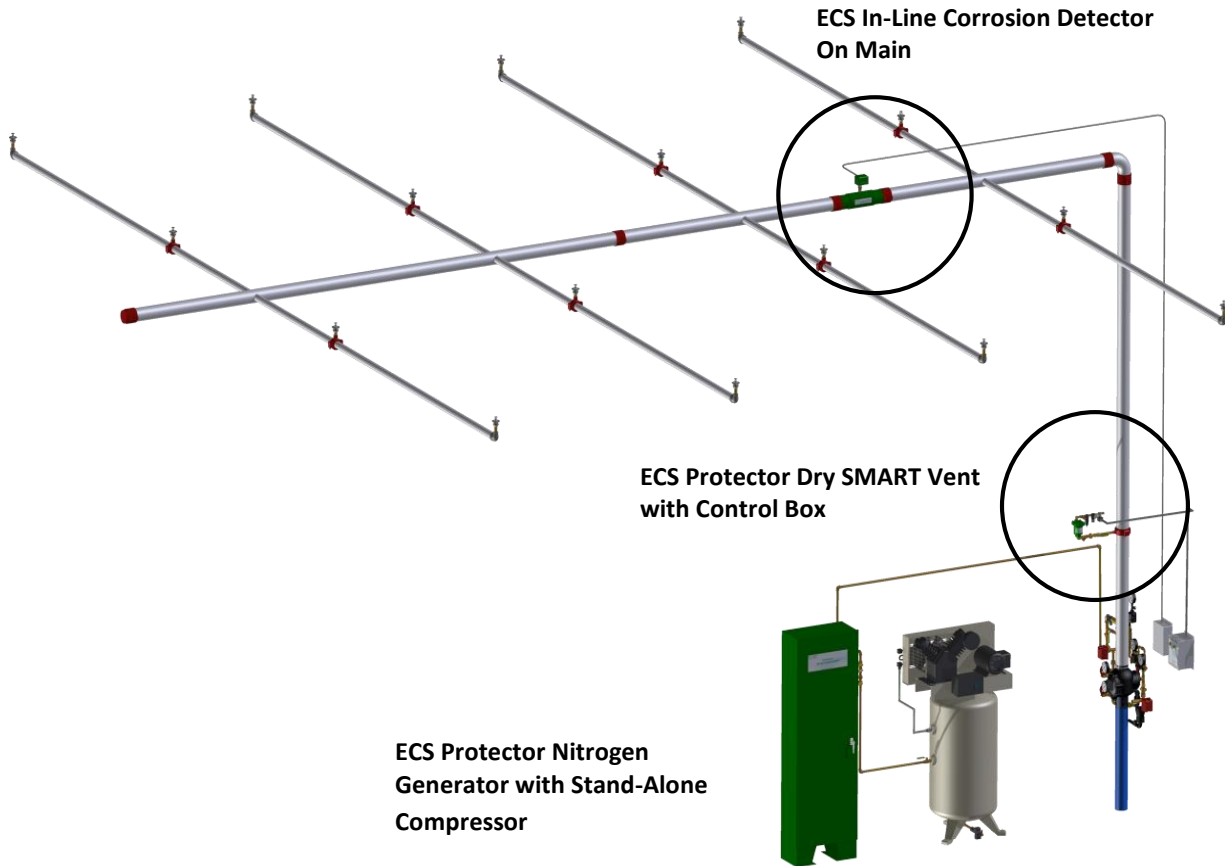
A corrosion assessment survey was performed in July 2010 to determine the extent of damage within the fire sprinkler piping. The video scoping results indicated that there was extensive damage due to oxygen corrosion within the mains at the trapped water locations throughout the facility. The schedule 40 galvanized branch lines exhibited minor corrosion and did not contain much trapped water. The average corrosion pit depth from the pipe samples that were extracted from the facility was 45% wall penetration.

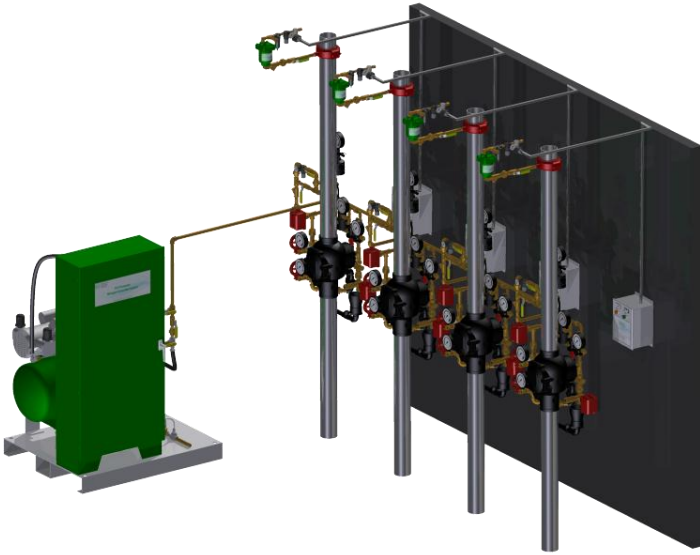
Dry Pipe Nitrogen Inerting (DPNI) – In early 2011 the client elected to install the ECS nitrogen generator and employ the patented “fill and purge” breathing technology to remove oxygen from the fire sprinkler piping and provide nitrogen gas for pressure maintenance. The fill and purge breathing process is the only approach that can effectively remove oxygen from the system piping before it can react with the pipe metal. A single **ECS PGEN-20 Nitrogen Generator** was installed and commissioned to handle the five (5) preaction sprinkler systems within the facility.

Results – No fire sprinkler system piping was replaced within the facility prior to the installation of the ECS nitrogen generation system. ECS recommended that under a nitrogen atmosphere the corrosion in the fire sprinkler system piping would be stopped, even in locations with trapped pools of water. Since the ECS PGEN-20 nitrogen generator was installed and commissioned, there have been no recorded leaks within the preaction fire sprinkler systems in the facility.

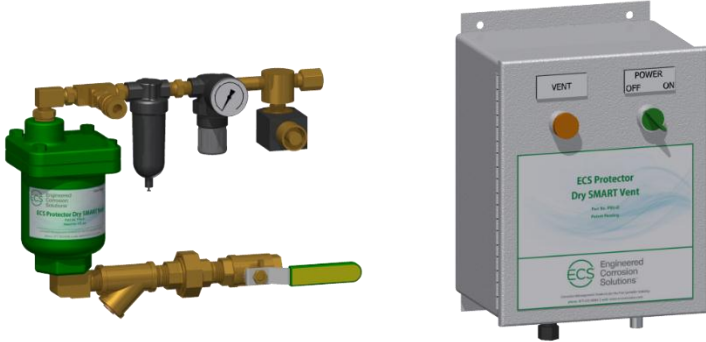


Typical Dry Pipe (Preaction) Fire Sprinkler System Corrosion Management Equipment Installation

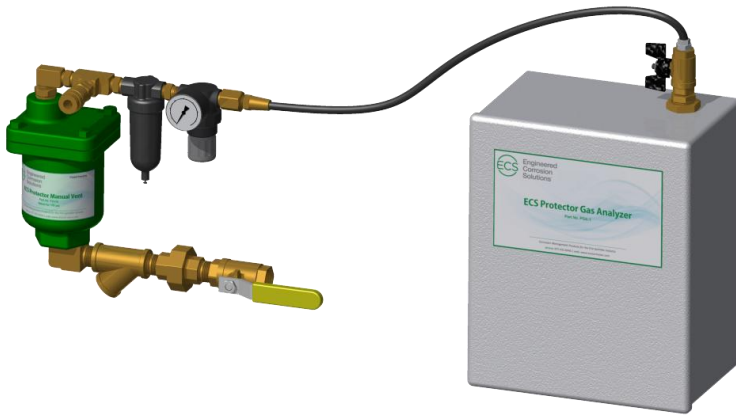




ECS Protector Pre-Engineered Nitrogen Generator



ECS Protector Dry SMART Vent



ECS Protector Gas Analyzer with ECS Protector Manual Vent



ECS In-Line Corrosion Detector

Engineered Corrosion Solutions, LLC is a corrosion management consulting firm that offers fire sprinkler system assessment and analysis coupled with design services and a full suite of corrosion management strategies that include equipment and integrated devices for controlling corrosion in water-based wet, dry, and preaction fire sprinkler systems. We understand the science of corrosion in fire sprinkler systems in a complete variety of different settings from parking structures to warehouses to clean rooms to data centers.

Engineered Corrosion Solutions, LLC offers proprietary dry pipe nitrogen inerting technology (DPNI) and wet pipe nitrogen inerting technology (WPNI), which includes the ECS Protector Nitrogen Generator, Pre-Engineered Skid Mounted Nitrogen Generator, Gas Analyzers, SMART Dry Vent, Two (2) Wet Pipe Nitrogen Inerting Vents and the industry's first real time in-situ corrosion monitoring device the ECS In-Line Corrosion Detector. Finally, we offer the first comprehensive remote corrosion monitoring system that provides live validation of the corrosion control strategy that is in place within your facility.

For complete information about the entire line of corrosion management products and services please visit the Engineered Corrosion Solutions website at www.ecscorrosion.com for a the complete list of downloads of White Papers, FAQs, installation schematics and product spec sheets or contact us (314) 432-1377 and one of our engineers will assist in personally answering any of your questions.

