ILD-X

In-Line Corrosion Detector

Project Case Study - ECS In-Line Corrosion Detector

ECS In-Line Corrosion Detector

Project Type: Field Case Study at Mission Critical Data Center

Nitrogen Introduced: March, 2011

Background

Subject Building

- New construction mission critical colocation data center
- 450,000 sq. ft. fully sprinklered building
- 39 preaction systems, 7 wet pipe sprinkler systems

Fire Sprinkler Systems

- Use of schedule 10 and schedule 40 black steel pipe in all sprinkler systems
- All system risers located inside building in either main sprinkler riser room or remotely in building corridors
- ECS Corrosion Management System installed with sprinkler systems during construction:
    1. ECS Protector Nitrogen Generator (supplies all dry/preaction systems)
    2. ECS Protector Manual Dry Vents (all dry/preaction systems)
    3. ECS Ejector Automatic Air Vents (all wet systems)
    4. ECS In-Line Corrosion Detector (all sprinkler systems)
- No system failure or corrosion history due to new construction

Subject Data Center

ECS In-Line Corrosion Detector

- Provides real-time in-situ corrosion monitoring of fire sprinkler systems
- Installed in-line with system piping where corrosion is most likely to occur
- Manufactured with 18" spool piece milled from the outside to a thickness of 25 mils (0.025 inches) to provide early warning failure point
- Sleeve welded over thin-wall section to create pressure chamber and eliminate water discharge risk
- Pressure chamber monitored by listed pressure switch

4 in. In-Line Detector installed in building

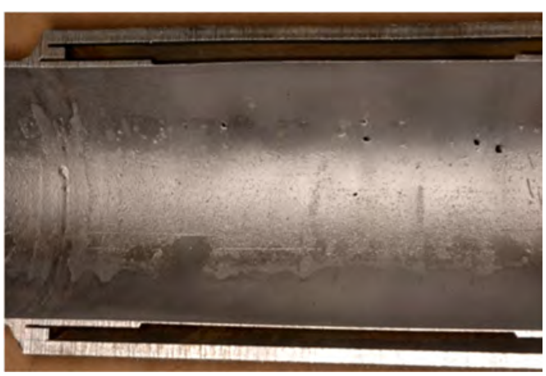
ECS In-Line Corrosion Detector Activation

All ECS corrosion management equipment was installed on the fire sprinkler system during construction per manufacturer's recommendations and the design of the specifying engineer. An ECS In-Line Corrosion Detector was installed on each fire sprinkler system. The device was installed on the supply main adjacent to the riser in preaction systems and on high branch lines in wet pipe systems. Prior to the commissioning of the nitrogen generation system all fire sprinkler systems were hydrostatically tested per NFPA requirements and maintained with supervisory gas from the air compressor only.

Approximately 8 weeks after hydrostatic testing and prior to commissioning of the nitrogen generation system the facility received a supervisory signal indicating activation of a 4" ECS In-Line Corrosion Detector installed on a preaction system.

Due to the rapid activation of the ECS In-Line Corrosion Detector the installing contractor performed troubleshooting procedures to eliminate all possible sources of false alarm or product defect. Within two weeks the facility reported activation of a second ECS In-Line Corrosion Detector. The second activation also involved a 4" unit installed on a preaction system. Both activated ECS In-Line Corrosion Detectors were returned to ECS for testing and analysis. Replacement ECS In-Line Corrosion Detectors were provided to the facility to ensure the sprinkler systems would continue to be monitored for corrosion activity.

4 inch ECS In-Line Detector after 8 weeks exposure to compressed air (As Received)



ECS In-Line Detector after 8 weeks exposure to compressed air (After Media Blasting)

Results and Conclusions

Approximately two weeks after activation of the second ECS In-Line Corrosion Detector the ECS Protector Nitrogen Generation System was commissioned and placed in service. The Dry Pipe Nitrogen Inerting (DPNI) process commenced and within 14 days all preaction fire sprinkler systems were protected by a minimum 98% nitrogen atmosphere.

Once the preaction fire sprinkler systems were exposed to a high nitrogen atmosphere the facility reported no additional activation of ECS In-Line Corrosion Detectors. To date there has been no additional corrosion activity within the fire sprinkler systems at the facility.

Testing and analysis performed by an independent third party laboratory validated that both ECS In-Line Corrosion Detectors were activated due to through-the-wall oxygen corrosion failures at the thin wall section of the device. There was clear evidence that hydrostatic testing of the sprinkler systems resulted in trapped water at the devices. The air/water interface is the most common location for corrosion activity inside fire sprinkler systems. The small pools of trapped water inside the ECS In-Line Corrosion Detectors caused a rapid oxidation reaction and sufficient metal loss to breach the 25 mil thin wall section.

Ultimately the ECS In-Line Corrosion Detector performed exactly as designed as an early warning corrosion detector. Hydrostatic testing of the system initiated the oxygen corrosion reaction. The thin wall section was breached before any other system piping and activated the pressure switch monitoring the chamber outside the thin wall section. The welded sleeve over the thin wall section prevented water leakage from the device located over mechanical equipment.

Recommendations

1. Install an ECS In-Line Corrosion Detector on fire sprinkler systems as early as possible in the system life cycle. All system activity (draining, filling, testing, etc.) results in cumulative corrosion damage.
2. Choose an installation location where corrosion is most likely to occur.
   a. In dry and preaction systems install on a supply main downstream of the sprinkler riser where water will collect as it drains back to the riser
   b. In wet systems install on a high branch line where trapped air is present to form an air/ water interface
3. Connect the pressure switch to a building monitoring system to provide continuous real-time corrosion monitoring of the fire sprinkler system piping network.
4. Minimize the amount of water permitted to enter dry or preaction sprinkler systems.
   a. When permitted by the authority having jurisdiction, install a secondary riser control valve above dry/preaction valves to prevent full water discharge in the system during trip testing
   b. When permitted by the authority having jurisdiction, substitute hydrostatic testing with air pressure testing
5. Establish a corrosion control program immediately following hydrostatic testing of all fire sprinkler systems. Dry Pipe Nitrogen Inerting (DPNI) and Wet Pipe Nitrogen Inerting (WPNI) will prevent oxygen inside the sprinkler system from causing corrosion and premature failures in system piping.
6. Develop a protocol to minimize oxygen ingress in the fire sprinkler systems when they are taken out of service for maintenance or modification.

Thin wall cross section

ECS In-Line Detector installed at air/water interface