

**DRY AND PREACTION FIRE SPRINKLER SYSTEMS**

**CORROSION MANAGEMENT DESIGN CRITERIA**

**PART 1 GENERAL**

1.01 DESCRIPTION OF WORK

1. Provide all required labor, materials, equipment and services necessary for a complete and operational Corrosion Management Program for the fire protection systems (FPS) as hereinafter described [and as indicated on the drawing(s)]. Specific manufacturer installation guidelines must be adhered to.
2. Basis of Design: Engineered Corrosion Solutions.
3. Corrosion Management Work may include the following listed products and services:
4. Corrosion Management Products must be as specified herein:
	1. Nitrogen Generator
		1. Wall Mount with Integral Air Compressor
		2. Stand Alone with Separate Air Compressor
	2. Air Maintenance Device
	3. Oxygen Removal Vent (standard)
	4. Oxygen Removal Vent (electric)
	5. Oxygen Removal Vent Controller with Oxygen Removal Vent
	6. In-Line Corrosion Detector
	7. Fixed On-line Gas Analyzer
	8. Remote Gas Sampling Port
	9. Handheld Gas Analyzer
5. Installation of air compressor and FPS air maintenance device
6. Installation of corrosion management products
7. Miscellaneous piping, fittings, couplings, valves, etc. as required
8. Coordination of work and schedules with other trades
9. System pressure testing
10. System commissioning

1.02 REFERENCES

1. All corrosion management work must be designed, installed, inspected, tested and maintained in accordance with all applicable codes, referenced standards, documents listed herein, the manufacturer’s instructions and the provisions of this specification:
2. NFPA 13, Standard for the Installation of Sprinkler Systems
3. NFPA 25, Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems
4. All corrosion Monitoring Devices must be provided to achieve compliance with Section 23.1.5.2 (4) of the 2010 Edition [24.1.5.2 (4) of the 2013 / 2016 Edition] [5.1.5.2 of the 2019 Edition / 5.1.4.2 of the 2022 Edition] of NFPA 13, Standard for the Installation of Sprinkler Systems and must be U.L. 2987 listed for monitoring corrosion in fire sprinkler systems.

1.03 QUALITY ASSURANCE

1. Equipment and components not specifically specified must be FM Approved or listed by Underwriter's Laboratories, Inc. for FPS installation.
2. All fire sprinkler system components must be installed free of rust/corrosion or visible damage. All items not complying with this requirement must be replaced at no cost to the Owner.

1.04 REGULATORY REQUIREMENTS

1. All work must meet the requirements of Section 1.02, References.
2. The fire sprinkler contractor must not pursue any interpretations of the Corrosion Management Program except through the Engineer.

**PART 2 PERFORMANCE CRITERIA**

2.01 EQUIPMENT REQUIREMENTS

1. Nitrogen Generator:
2. The nitrogen generator system must be FM 1035 Approved or U.L. Listed for use with a fire sprinkler system.
3. The nitrogen generator system provided must operate such that all the associated equipment is installed within the confines of the riser room. This includes the compressor, the nitrogen generator, the automatic gas analyzer and the venting devices (one (1) per dry pipe/preaction zone).
4. System must be capable of achieving 98% nitrogen gas composition throughout all of the dry pipe/preaction system piping within fourteen (14) days from the commencement of the inerting process.
5. System must employ membrane type nitrogen separators that provide “instant on-instant off” nitrogen gas production without the need for nitrogen storage tanks or refrigerated dryers.
6. The nitrogen generator must include an LCD display screen to operate and control the nitrogen generator and provide internet connectivity for remote monitoring and transmitting alerts via email.
7. Nitrogen separation membranes must provide a useful service life of at least ten (10) years of continuous operation in accordance with the membrane manufacturer’s specifications.
8. The nitrogen generator system must provide an automatic **“fill and purge” (variable pressure) breathing process**. This must be done while the fire sprinkler system is fully functional and must not alter or affect the design performance of the sprinkler system.
	1. A process that involves **fixed pressure** differential gas exchange is **not permitted**.
9. Nitrogen Generator Monitoring.
	1. At a minimum, the nitrogen generator should have the following features:
		1. LCD display to monitor and control locally and remotely via internet
		2. Data logging all operational functions and changes to the nitrogen generator
		3. Transmit alerts via email
		4. Hour meter
		5. Cycle counter
		6. Automatic air bypass with air bypass alarm
		7. Leak alarm
		8. Flow meter
		9. Filtration system with programmable automatic drain
	2. At a minimum, the nitrogen generation system should provide for the following monitoring output points:
		1. Nitrogen generator running mode
		2. Bypass mode
		3. Nitrogen generator on (presence of power)
		4. Leak monitor
10. Air Compressor:
11. Air compressor must comply with the NFPA 13 requirement to have a capacity capable of restoring normal gas pressure within the dry /preaction piping within thirty (30) minutes.
12. Air compressor must be capable of producing a continuous stream of compressed air at a minimum of 100+ psig (6.9+ bar) to meet the feed requirements of the nitrogen generator.
13. Air compressor must be rated for continuous duty service.
14. Air compressor must be capable of automatic cut in and cut out.
15. Air compressor must be equipped with vibration dampening system.
16. Air compressor must be equipped with an on-board after-cooler.
17. Air compressor equipped with an air storage tank must provide continuous delivery of compressed air to the nitrogen generator.
18. Air compressor equipped with an air storage tank must be equipped with an on-board automatic condensate water drain.
19. Compressors less than 3.0 hp must be an “oil less” design.
20. Oil less compressors must be of a design to provide 5000 hours of continuous duty service before requiring a gasket and seal rebuild.
21. Air Maintenance Device:
22. An approved air maintenance device must be installed on each dry pipe or preaction fire sprinkler system.
23. The air maintenance device must be equipped with a field adjustable pressure regulator for use in setting the maximum system pressure.
24. The air maintenance devices must be approved by the nitrogen generator equipment manufacturer.
25. The air maintenance device must be installed in accordance with the manufacturer’s instructions.
26. Dry Pipe/Preaction System Venting Device (standard): [**NOTE:** Select either standard oxygen removal vent, electric oxygen removal vent or vent controller with oxygen removal vent]
	1. Vent for removal of oxygen gas from the dry pipe/preaction fire sprinkler system piping must be installed on the riser above the control valve for each fire sprinkler zone that is being nitrogen inerted.
	2. Vent installed outside of the fire sprinkler valve room is not permitted.
	3. The venting device which allows for venting of gas and not water must include a float valve to prevent the discharge of water.
	4. Vent must include a device to prevent accidental depressurization of system if the supervisory gas source is lost.
	5. Vent must include a connection to sample the purity of nitrogen within the FPS. Purity sampling device can be portable or fixed.
	6. Vent must not require plumbing to drain.
	7. Vent must not require any power to properly function.
	8. Vent must include isolation ball valve for nitrogen inerting process and maintenance.
27. Dry Pipe/Preaction System Venting Device (electric): [**NOTE:** Select either standard oxygen removal vent, electric oxygen removal vent or vent controller with oxygen removal vent]
28. Vent for removal of oxygen gas from the dry pipe/preaction fire sprinkler system piping must be installed on the riser above the control valve for each fire sprinkler zone that is being nitrogen inerted.
29. Vent installed outside of the fire sprinkler valve room is not permitted.
30. The venting device which allows for venting of gas and not water must include a float valve to prevent the discharge of water.
31. Vent must include a device to prevent accidental depressurization of system if the supervisory gas source is lost.
32. Vent must close automatically at the completion of the nitrogen inerting process without manual intervention.
33. Vents must include a connection to sample the purity of nitrogen within the FPS. Purity sampling device can be portable or fixed.
34. Vent must not require plumbing to drain.
35. Vent must include isolation ball valve for maintenance.
36. Dry Pipe/Preaction System Venting Device (vent controller with oxygen removal vent): [**NOTE:** Select either standard oxygen removal vent, electric oxygen removal vent or vent controller with oxygen removal vent].
	1. Vents for removal of oxygen gas from the dry pipe/preaction fire sprinkler system piping must be installed on the riser above the control valve for each fire sprinkler zone that is being nitrogen inerted.
	2. At a minimum, the vent controller should have the following features:
		1. Monitor and control the oxygen venting in multiple FPS individually.
		2. Monitor sprinkler system pressure and nitrogen purity as well as perform leak rate, pressure and purity checks.
		3. Automatically control the oxygen venting process.
		4. Store all information in removeable data storage.
		5. Internet connectivity for remote monitoring and transmitting alerts via email.
		6. LCD display to access all functions of the vent controller including the data on an individual system basis.
		7. Common supervisory output signal.
	3. Vent installed outside of the fire sprinkler valve room is not permitted.
	4. The venting device which allows for venting of gas and not water must include a float valve to prevent the discharge of water.
	5. Vent must include a device to prevent accidental depressurization of system if the supervisory gas source is lost.
	6. Vent must include a connection to sample the purity of nitrogen within the FPS.
	7. Vent must not require plumbing to drain.
	8. Vent must include isolation ball valve for nitrogen inerting process and maintenance.
37. Corrosion Monitoring Detector: [**Note:** Include this section if corrosion monitoring detector is included in this project]
	* + 1. Corrosion monitoring detector must be integral to the dry pipe/preaction piping system and installed in the piping network where trapped water is most likely to exist.
			2. Corrosion monitoring detector must be U.L. 2987 listed for use in a fire sprinkler system.
			3. Corrosion monitoring detector must not create any obstruction within the dry pipe/preaction piping system.
			4. Corrosion monitoring detector must provide early warning corrosion monitoring system that provides a signal alert to indicated that the corrosion activity within the dry pipe/preaction fire sprinkler system piping has exceeded the acceptable limits.
			5. Corrosion monitoring detector must match the dry pipe/preaction system piping for composition and schedule and does not impact sprinkler system hydraulic performance.
			6. Early warning signal must be capable of communicating in one of the following ways:
				1. Signal to the building monitoring system
				2. Local signal (LED or audible) alarm
38. Fixed Online Gas Analyzer: [**Note:** Include this section if fixed online gas analyzer is included in this project]
	* + 1. Fixed online gas analyzer must be installed in the fire sprinkler valve room and be configured to sample gas the largest fire sprinkler system supplied by the nitrogen generator.
			2. Fixed gas analyzer must be equipped with a digital display to display either oxygen or nitrogen gas purity levels.
			3. Fixed gas analyzer must include analog (0-5VDC, 0-10VDC and 4-20mA) and digital monitoring outputs to monitor the nitrogen purity in the fire sprinkler system.
			4. The oxygen sensing element in the fixed gas analyzer must have a minimum useful life of ten (10) years.
39. Gas Sampling Port: [**NOTE:** Include if remote gas sampling ports required and is specified.]
40. The fire sprinkler contractor must provide gas sampling ports as directed by the design engineer.
41. Install in accordance with the manufacturer’s instructions.
42. Handheld Gas Analyzer:
	* + 1. Handheld gas analyzer must be equipped with a quick connect fitting compatible with gas sampling ports on nitrogen generation equipment.
			2. Sensing element in the handheld gas analyzer must have a minimum useful life of two (2) years.

**PART 3 EXECUTION**

3.01 COORDINATION WITH OTHER TRADES

1. Coordinate closely with the General Contractor, other trades and the Owner to expedite construction, commissioning and avoid interference.

3.02 SUPERVISION AND TRAINING

1. [**Note:** Include this section if on-site commissioning is included in this project]Provide on-site Commissioning Services Package from the equipment manufacturer. Commissioning Services Package must include a manufacturer’s certified representative on-site for a minimum of one (1) day to verify the installation of the equipment and provide training to the Owner and Owner’s Representative.
2. Provide one (1) printed copy and an electronic file of the Owner’s Installation and Operations Manual for all corrosion control equipment. Owner’s Manual must include protocols for operation and maintenance of all equipment installed as part of this scope of work.

3.03 CORROSION PRODUCTS/SYSTEM COMMISSIONING PROTOCOL

1. Dry Pipe and Preaction Fire Sprinkler System: [**Note:** Select applicable statements based on scope of work]
2. Confirm the operation of system air compressor and connect air compressor and nitrogen generator to the fire sprinkler system.
3. Determine the operating pressure range for the dry pipe/preaction fire sprinkler system and set the system air maintenance device for each fire sprinkler system.
4. Document the twenty-four (24) hour leak rate, in psig/hour (bar/hour), of each fire sprinkler system and provide documentation as part of the As-Built document submittal.
5. Install all of the nitrogen inerting equipment.
6. Close the isolation ball valve of the oxygen removal vent during hydrostatic and/or air pressure testing of the fire sprinkler system and then open the isolation ball valve for the commissioning and operation of the system.
7. Confirm the condensate water discharge from the air compressor drain and the nitrogen generator drain are piped to a floor drain or building exterior.
8. [**NOTE**: include if remote monitoring of nitrogen generator is included in the project]
	1. The fire sprinkler contractor must provide an ethernet connection to the nitrogen generator from the local area network (LAN) for connection of the nitrogen generator to the internet.
	2. All connections have been made as specified and as indicated in the manufacturer’s installation instructions.
	3. The fire sprinkler contractor must coordinate and verify proper operation of the LAN connection with local internet provider or building IT Services Manager.
9. [**NOTE**: include if Vent Controller with oxygen removal Vent is included in the project]The fire sprinkler contractor must install the vent controller(s) and oxygen removal vents(s) at the locations as shown on the approved shop drawings.
	1. [**NOTE**: include if Vent Controller is monitored by building monitoring system in the project] Confirm that the vent controller(s) has been connected to the monitoring system, as shown on the approved shop drawings.
	2. All connections have been made as specified and as indicated in the manufacturer’s installation instructions.
	3. [**NOTE**: include if Vent Controller is monitored remote through internet in the project]Provide an ethernet connection to the nitrogen generator from the local area network (LAN) for connection of the nitrogen generator to the internet.
		1. Coordinate and verify proper operation of the LAN connection with local internet provider or building IT Services Manager.
10. [**Note:** Include if corrosion monitoring detectors are included in this project]Confirm the corrosion monitoring detector is installed in the locations shown on the approved shop drawings.
	1. [**NOTE**: include if In-Line Corrosion Detector is monitored by building monitoring system in the project]Confirm that the in-line corrosion detector has been connected to the building monitoring system as shown on the approved shop drawings.
	2. All connections have been made as specified and as indicated in the manufacturer’s installation instructions.
11. [**Note:** Include if fixed gas analyzer is included in this project]The fire sprinkler contractor must install the fixed gas analyzer(s) at the locations as shown on the approved shop drawings.
	1. [**NOTE**: include if fixed gas analyzer is monitored by building monitoring system in the project]Confirm that the fixed gas analyzer(s) has been connected to the building monitoring system as shown on the approved shop drawings.
	2. All connections have been made as specified and as indicated in the manufacturer’s installation instructions.
12. [**Note:** Include if on-site commissioning is included in this project]The fire sprinkler contractor must coordinate with the nitrogen generator manufacturer to schedule the on-site commissioning package at a time that has been coordinated with the General Contractor, Owner and Owner’s Representative.
13. [**Note:** Include if standard (manual) oxygen removal vents are included in this project]The fire sprinkler contractor must close all oxygen removal vents that are not equipped with electronic activation once the fire sprinkler system nitrogen concentration has reached 98% or greater within fourteen (14) days.
	1. Continuous venting is not permitted.

**END CORROSION MANAGEMENT SPECIFICATION**