

# NITROGEN-GENERATING SPRINKLER CORROSION INHIBITING SYSTEM

## PART 1 - GENERAL

### 1.1 SUMMARY

- A. This section outlines the requirements for the nitrogen-generating sprinkler corrosion inhibiting system. The work described in this section includes all engineering, labor, materials, equipment, and service required to design, supply, install, test, and commission the nitrogen generating corrosion inhibiting system.
- B. Section includes:
  - 1. Pipe, fittings, and specialties.
  - 2. Sprinkler corrosion inhibiting system.
  - 3. Related sections:
    - a. 01 43 00 Quality Control.
    - b. 21 05 00 Common Work Results for Fire Suppression.
    - c. 21 06 00 Schedules for Fire Suppression.
    - d. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specification Sections.

### 1.2 REFERENCES

- A. ASTM International (ASTM):
  - 1. A53 / A53M – Standard Specification for Pipe, Steel, Black, Welded and Seamless.
  - 2. A135 / A135M – Standard Specification for Electric-Resistance-Welded Steel Pipe.
  - 3. A234 / A234M – Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
  - 4. A733 – Standard Specification for Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples.
  - 5. A865 – Standard Specification for Threaded Couplings, Steel, Black, Welded or Seamless, for Use in Steel Pipe Joints.
- C. American National Standards Institute (ANSI):
  - 1. B2.1 – Basic Standards for Steel Pipe Threads.
  - 2. B16.1 – Cast Iron Pipe Flanges and Flanged Fittings.
  - 3. B16.3 – Malleable Iron Threaded Fittings.
  - 4. B16.4 – Cast Iron Threaded Fittings.
  - 5. B16.5 – Pipe Flanges and Flanged Fittings.
  - 6. B16.9 – Factory-Made Wrought Steel Butt-Welding Fittings.
  - 7. B16.39 – Malleable Iron Threaded Pipe Unions.
  - 8. B16.42 – Ductile Iron Pipe Flanges and Flanged Fittings, Classes 150 and 300.
  - 9. B1.20.1 – Pipe Threads, General Purpose (Inch).
- D. American Water Works Association (AWWA): C606 – Grooved and Shouldered Joints.

### 1.3 SYSTEM DESCRIPTION

- A. Furnish and install a sprinkler corrosion inhibiting system that fills the sprinkler piping with 98% nitrogen at required supervisory pressure. The system shall be NITROGEN-PAC™ M Series, manufactured by United Fire Systems (908-688-0300, x222) and shall consist of:
  - 1. Compressor / tank assembly.
  - 2. Nitrogen generator module.
  - 3. Refrigerated dryer.
  - 4. Nitrogen receiver assembly.
  - 5. Purge vent assemblies.
  - 6. Corrosion monitor assemblies.
  - 7. Nitrogen analyzer.
  - 8. Steel pipe or approved tubing to connect the various system components.
  - 9. Manual bypass valves.

#### 1.4 PERFORMANCE REQUIREMENTS

##### A. General.

1. Design and performance of systems, components, and methods specified herein shall comply with all applicable referenced codes and standards.
2. Contract drawings indicate the general arrangement of the system and are a guide for intent only. Contractor is responsible for providing and installing all equipment necessary to complete the installation in compliance with all applicable requirements.
3. Contractor shall design, furnish, and install the sprinkler corrosion inhibiting system(s) per this specification, and shall provide Professional Engineering services needed to assume Engineering responsibility.
4. Pipe sizing indicated on contract drawings is based on preliminary hydraulic estimates for routing indicated. Contractor is responsible for final hydraulic calculations and pipe sizing based on as-installed locations.
5. Contractor is responsible for all approved expansion devices where required.
6. All piping system components shall be approved for at least 175 PSIG (1200 kPa gage) working pressure.
7. All equipment and materials shall be new and unused.

#### 1.5 QUALITY ASSURANCE

- A. Perform a level of Quality Control in accordance with Section 01 43 00.
- B. Furnish a Quality Work Plan per Section 01 43 00 for this work.
- C. Pipe shall bear label, stamp, or other markings indicating material specification.
- D. Shop drawings and design calculations shall include a seal and signature by a qualified Licensed Professional Engineer, registered in the State where jobsite is located.

#### 1.6 SUBMITTALS

- A. General Requirements. The Engineer shall review all submittals for conformance to the contract drawings and specifications. The contractor shall be required to resubmit any materials, with appropriate modifications, that are found to be in non-conformance with the requirements of the contract drawings and these specifications after review by the Engineer. Approval of the submittals by the Engineer shall not relieve the Contractor of their responsibility to meet the requirements of the drawings and specifications.
- B. Action Submittals.
  1. Product Data. For each type of product indicated, include, as applicable, product rated capacities, operational characteristics, electrical characteristics, materials of construction, standards of construction, and approvals.
    - a. Pipe.
    - b. Fittings.
    - c. Pipe hanging devices.
    - d. Pipe sleeves.
    - e. Nitrogen generating sprinkler corrosion inhibiting system.
  2. Shop Drawings. Include all pertinent information such as structural members, ceiling construction, partitions, lighting fixtures, air diffusers and registers, speakers, and piping runs.
    - a. Plan views of all rooms where nitrogen generating assemblies are located.
    - b. Plan views of all areas where intermediate pipe runs are located.
    - c. All details necessary for proper evaluation and installation of design, including:
      - i Provisions for commissioning, inspecting, and testing.
      - ii Pipe hanger locations and assembly.
- C. Delegated-Design Submittals. Include performance requirements and design criteria analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- D. Information Submittals.
  1. Qualification Data.
    - a. Installing Contractor.
    - b. Professional Engineer.
- E. Commissioning Submittal: Field Test Plan.

- F. Closeout Submittals. Provide six (6) sets of:
  - 1. As-Built Drawings.
  - 2. Field Test Data and Results.
- G. Operation and Maintenance Submittals. Provide six (6) sets of:
  - 1. Operation and Maintenance Instructions – Nitrogen Generating System, including:
    - a. Compressor / Tank Assembly.
    - b. Nitrogen Generator.
    - c. Refrigerated Dryer.
    - d. Nitrogen Receiver.
    - e. Purge Vent Assemblies.

## PART 2 - PRODUCTS

### 2.1 PIPE, FITTINGS, AND SPECIALTY

- A. General Requirements. Comply with requirements in “Piping Schedule” article and on contract drawings for applications of pipe and fitting materials and joining methods.
- B. Pipe.
  - 1. General Requirements. All pipe shall be black. Galvanized pipe shall not be permitted.
  - 2. Standards.
    - a. ASTM A53 / A53M – Standard Specification for Pipe, Steel, Black, Welded and Seamless.
    - b. ASTM A135 / A135M – Standard Specification for Electric-Resistance Welded Steel Pipe.
    - c. ASTM A733 – Standard Specification for Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples.
    - d. ANSI B2.1 – Basic Standards for Steel Pipe Threads.
    - e. ANSI B1.20.1 – Pipe Threads, General Purpose (Inch).
    - f. AWWA C606 – Grooved and Shouldered Joints.
    - g. UL 852 – *Metallic Sprinkler Pipe for Fire Protection Service*.
    - h. FM Class Number 1630 – *Steel Pipe for Automatic Fire Sprinkler Systems*.
  - 3. Schedule 40 Steel Pipe, ASTM A53 / A53M.
    - a. Threaded End. ANSI B2.1, ANSI B1.20.1. All threads shall be NPT.
    - b. Grooved End. AWWA C606. Grooves may be rolled or cut.
  - 4. Schedule 10 Pipe is not acceptable.
  - 5. Steel Pipe Nipples, Threaded End. ASTM A733.
- C. Fittings.
  - 1. General Requirements. All fittings shall be black or factory-painted. Galvanized fittings shall not be permitted.
  - 2. Standards.
    - a. ASTM A234/ A234M – Standard Specification for Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
    - b. ANSI B16.3 – Malleable Iron Threaded Fittings.
    - c. ANSI B16.4 – Cast Iron Threaded Fittings.
    - d. ANSI B16.9 – Factory-Made Wrought Steel Butt-Welding Fittings.
    - e. UL 213 Amendment 1 – *Rubber Gasketed Fittings for Fire Protection Service*.
    - f. UL 213C – *Grooved and Plain End Fittings*.
    - g. FM Class Number 1920 – *Pipe Couplings and Fittings for Aboveground Fire Protection Systems*.
  - 3. Threaded Fittings.
    - a. Malleable Iron, ASME B16.3.
    - b. Gray Iron, ASME B16.4.
  - 4. Grooved Joint Fittings. AWWA C606 and UL 213C ; provide products by one or more of the following manufacturers, subject to compliance with requirements:
    - a. Victaulic,
    - b. Anvil International, Inc. (Gruvlock),
    - c. Star Corporation,
    - d. Or approved equal.

- D. Couplings.
  - 1. Standards.
    - a. ASTM A865 – Standard Specification for Threaded Couplings, Steel, Black, Welded or Seamless, for Use in Steel Pipe Joints.
    - b. FM Class Number 1920 – *Pipe Couplings and Fittings for Aboveground Fire Protection Systems*.
    - c. Grooved-End Pipe Couplings. AWWA C606, UL 213, and UL 213C, rigid pattern, unless otherwise indicated. Include steel housing sections, EDPM rubber gasket, B18.2.1 carbon steel bolts, and nuts.
- E. Unions.
  - 1. General Requirements.
    - a. Unions shall be malleable or ductile iron.
    - b. Unions shall be used only as necessary where joining pipe is impossible or impractical without them.
  - 2. Standards.
    - a. ANSI B16.39 – Malleable Iron Threaded Pipe Unions.
    - b. UL 860 – *Pipe Unions for Fire Protection Service*.
- F. Hangers.
  - 1. General Requirements.
    - a. Design, provide, fabricate, and install all hangers and supports adequate to support pipe, allow for imposed forces, satisfy structural requirements, and maintain proper clearances to adjacent piping, equipment, and structural elements.
    - b. Hangers and supports shall keep piping in alignment without sagging or interference.
    - c. Hangers and supports shall permit installation of pipe with proper pitch to allow complete draining.
    - d. Hangers and supports shall be capable of screw adjustment after pipe is erected and shall be provided with locking method, such as double nutting, to prevent loss of adjustment.
  - 2. Standards.
    - a. UL 203 – *Pipe Hanger Equipment for Fire Protection Service*.
    - b. FM Class Numbers 1951 / 1952 / 1953 – *Pipe Hanger Components for Automatic Sprinkler Systems*.
    - c. NFPA 13 – *Installation of Sprinkler Systems*.

2.2 SPRINKLER CORROSION INHIBITING SYSTEM. Furnish and install a nitrogen generating sprinkler corrosion inhibiting system. This system shall provide nitrogen for supervisory pressure of the preaction sprinkler system pipe instead of air. The system shall be NITROGEN-PAC™ M Series, manufactured by United Fire Systems (908-688-0300, x222).

- A. General Requirements.
  - 1. The nitrogen generating system shall provide a minimum of 98% purity nitrogen within the sprinkler pipe after a reasonable time allowed for purging.
  - 2. The nitrogen generating system shall seamlessly integrate with the Preaction-Pac sprinkler assembly.
  - 3. Separate AC circuits, of the proper phase and current and voltage rating, shall be provided by the Electrical Contractor for the compressor / tank assembly and the refrigerated dryer.
- B. Specific Product Requirements.
  - 1. Compressor / tank assembly, consisting of a DOT or ASME air storage tank, an air compressor mounted on top of the air storage tank, and an outlet regulator with ball valve.
  - 2. Nitrogen generator module, consisting of:
    - a. 14 gage steel enclosure, powder coated red inside and out, with door attached by heavy gage continuous hinge.
    - b. Nitrogen separator using membrane technology.
    - c. Air stream membrane dryer.
    - d. High-capacity particulate and coalescing filters.
    - e. Stainless steel automatic drains.
    - f. Nitrogen separator inlet pressure gage.

3. Refrigerated dryer.
4. Nitrogen receiver assembly, consisting of a DOT or ASME nitrogen storage tank rated for 200 PSIG, a 150 PSIG safety relief valve, a 0-160 PSIG pressure gage, and 1/2" NPT female inlets and outlets.
5. Purge vent assemblies, consisting of a fixed orifice for purging that also permits connection of a portable nitrogen analyzer, strainer, float valve that closes when sprinkler water reaches the device, and a ball valve.
6. Corrosion monitor assemblies, consisting of a precision-manufactured corrosion coupon, a pressure switch that will sense supervisory pressure when the corrosion coupon is perforated by corrosion, a shutoff ball valve, and a bleed valve.
7. Nitrogen analyzer, consisting of a hand-held, battery-operated device equipped with a quick-connect fitting for connection to the nitrogen generator test port or to the outlet of a purge vent assembly to measure the percentage of nitrogen inside the pipe. The measurement range shall be 0 – 99.9% with a 0.1% resolution.
8. Steel pipe or approved tubing rated for a minimum of 175 PSI shall be used to connect the various system components.
9. Manual bypass valves shall permit the filling of the system with supervisory air pressure in a maximum of 30 minutes, per NFPA 13.

## PART 3 – EXECUTION

### 3.1 PIPING INSTALLATION

- A. Location and Arrangement. Contract drawings, plans, schematics, and diagrams indicate general location and arrangement of piping. Working drawings shall indicate actual piping installation layout. Install piping per working drawings.
- B. Deviations. Installation deviations from approved working drawings require written approval from the Engineer. During installation, do not deviate from approved working drawings without written approval from the Engineer.
- C. Fittings. Use listed fittings to make changes in direction and pipe size reductions.
- D. Pipe Ends. Ream ends of pipe to remove burrs. Bevel plain ends of pipe.
- E. Examination. Examine all pipe and fittings thoroughly before installation. Do not install damaged or defective pipe or fittings.
- F. Cleaning. Remove scale, slag, dirt, oil, cutting and threading shavings, and debris from inside and outside of pipe after fabrication and before assembly. Use a non-toxic solvent to ensure pipe is clean. Pipe shall be free of solvent and water when installed.
- G. Sleeves.  
Install sleeves where piping penetrates walls, ceilings, and floors.
  1. Install sleeve seals for piping penetrations of concrete walls and slabs.
  2. Install escutcheons at all penetrations.
  3. Comply with requirements for sleeves, sleeve seals, and escutcheons in Division 21 section "Sleeves, Sleeve Seals, and Escutcheons for Fire Suppression Piping."

### 3.2 ELECTRICAL INSTALLATION

- A. Location and Arrangement. Contract drawings, plans, schematics, and diagrams indicate general location and arrangement of electrical devices. Working drawings shall indicate actual device installation layout. Install devices per working drawings.
- B. Deviations. Installation deviations from approved working drawings require written approval from the Engineer. During installation, do not deviate from approved working drawings without written approval from the Engineer.
- C. Wiring.
  1. All wiring shall be of the proper size to conduct the circuit current, but shall not be smaller than #18 AWG unless permitted by the local electrical code.
  2. Wire that has scrapes, nicks, gouges, or crushed insulation shall not be used.
  3. The manufacturer's minimum wire-bending radii shall be observed in all enclosures, raceways, and conduits.
  4. Aluminum wire shall not be used.

5. Splicing of circuits shall be kept to a minimum, and is only permitted in an electrical box suitable for the purpose. Appropriate hardware shall be used to make the wire splices. Wires that are spliced together shall have the same color insulation.
  6. Wire with white insulation shall be used exclusively for the identification of the neutral conductor of AC circuits. Wire with green insulation shall be used exclusively for the identification of the earth-ground conductor of AC or DC circuits. Appropriate color-coding shall be utilized for all other field wiring.
  7. All electrical circuits shall be numerically tagged with suitable markings at each terminal point. All circuits shall correspond with the installation drawings.
- D. Raceways.
1. Wiring to be installed in a minimum  $\frac{3}{4}$  inch EMT using steel compression fittings.
  2. All electrical enclosures, raceways, and conduits shall be provided and installed in accordance with applicable codes and intended use, and shall contain only those electrical circuits associated with the fire detection and control system. No circuit or circuits that are unrelated to the fire detection system shall be routed through the enclosures, raceways, and conduits dedicated to the fire detection system.

### 3.3 MECHANICAL TESTING

- A. Testing to be performed by the installing licensed sprinkler contractor in accordance with manufacturer's commissioning instructions.
- B. Test Plan.
  1. The Contractor shall submit a test plan that describes how the system shall be tested. This shall include a step-by-step description of all tests and shall indicate type and location of test apparatus to be used. At a minimum, the tests to be conducted shall be per the relevant referenced codes and any additional supplemental tests required by the authority having jurisdiction.
  2. Tests shall not be scheduled or conducted until the Engineer approves the test plan.
- C. Execution. All tests shall be performed in the presence of the Engineer and the authority having jurisdiction. The Contractor shall record all equipment, tests and system configurations in a format approved by the Engineer and the authority having jurisdiction. A copy of the commissioning tests and results shall be provided to the Engineer, the authority having jurisdiction, and the end user.

### 3.4 ELECTRICAL CHECKOUT AND TESTING

- A. Electrical checkout and testing shall be performed by the Contractor. Contractor personnel shall be competent fire alarm technicians with a current training certificate from United Fire Systems or approved equal.
- B. Test Plan.
  1. The Contractor shall submit a test plan that describes how the system shall be tested. This shall include a step-by-step description of all tests and shall indicate type and location of test apparatus to be used. At a minimum, the tests to be conducted shall be per the relevant referenced codes and any additional supplemental tests required by the authority having jurisdiction.
  2. Tests shall not be scheduled or conducted until the Engineer approves the test plan.
- C. Execution. All tests shall be performed in the presence of the Engineer and the authority having jurisdiction. The Contractor shall record all equipment, tests and system configurations in a format approved by the Engineer and the authority having jurisdiction. A copy of the commissioning tests and results shall be provided to the Engineer, the authority having jurisdiction, and the end user.

### 3.5 WARRANTY

- A. All equipment and installation to be warranted against defects for 12 months starting upon the date of system acceptance by all authorities having jurisdiction.