

# **Project Manual**

Bid Package 02

Addendum No.01

Volume II

Divisions 21, & 28

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## **Cherokee Nation WILMA P. MANKILLER HEALTH CENTER EXPANSION**

Stilwell, Oklahoma

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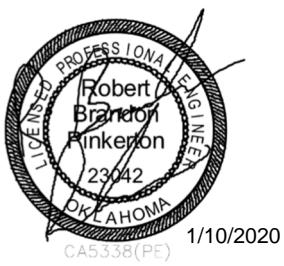
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## **SECTION 21 0513**

### **COMMON MOTOR REQUIREMENTS FOR FIRE SUPPRESSION EQUIPMENT**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

##### **1.3 COORDINATION**

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
  1. Motor controllers.
  2. Torque, speed, and horsepower requirements of the load.
  3. Ratings and characteristics of supply circuit and required control sequence.
  4. Ambient and environmental conditions of installation location.

#### **PART 2 - PRODUCTS**

##### **2.1 GENERAL MOTOR REQUIREMENTS**

- A. Comply with NEMA MG 1 unless otherwise indicated.
- B. Comply with IEEE 841 for severe-duty motors.

##### **2.2 MOTOR CHARACTERISTICS**

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

## **2.3 POLYPHASE MOTORS**

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
  - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
  - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Multispeed Motors: Separate winding for each speed.
- F. Rotor: Random-wound, squirrel cage.
- G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- H. Temperature Rise: Match insulation rating.
- I. Insulation: Class F.
- J. Code Letter Designation:
  - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
  - 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

## **2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS**

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers:
  - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
  - 2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
  - 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
  - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
- C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

## **2.5 SINGLE-PHASE MOTORS**

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
  - 1. Permanent-split capacitor.
  - 2. Split phase.
  - 3. Capacitor start, inductor run.
  - 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

## **PART 3 - EXECUTION (Not Applicable)**

**END OF SECTION**

## **SECTION 21 0517**

### **SLEEVES AND SLEEVE SEALS FOR FIRE-SUPPRESSION PIPING**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

- A. Section Includes:

1. Sleeves.
2. Stack-sleeve fittings.
3. Sleeve-seal systems.
4. Sleeve-seal fittings.
5. Grout.

##### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated.

#### **PART 2 - PRODUCTS**

##### **2.1 SLEEVES**

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- F. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
- G. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

## **2.2 STACK-SLEEVE FITTINGS**

- A. Manufacturers:
  - 1. Jay R. Smith Mfg. Co.
  - 2. Zurn Industries, LLC
  - 3. (Owner Selection)
- B. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.
  - 1. Underdeck Clamp: Clamping ring with setscrews.

## **2.3 SLEEVE-SEAL SYSTEMS**

- A. Manufacturers:
  - 1. Advanced Products and Systems, Inc.
  - 2. CALPICO, Inc.
  - 3. Metraflex Company
  - 4. (Owner Selection)
- B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
  - 1. Sealing Elements: NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  - 2. Pressure Plates: Carbon steel.
  - 3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating of length required to secure pressure plates to sealing elements.

## **2.4 SLEEVE-SEAL FITTINGS**

- A. Manufacturers:
  - 1. Advanced Products and Systems, Inc.
  - 2. CALPICO, Inc.
  - 3. Metraflex Company
  - 4. (Owner Selection)
- B. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

## **2.5 GROUT**

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## PART 3 - EXECUTION

### 3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
  - 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
  - 1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
  - 2. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
  - 3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
  - 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
  - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 07 9200 "Joint Sealants."
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 07 8413 "Penetration Firestopping."

### 3.2 STACK-SLEEVE-FITTING INSTALLATION

- A. Install stack-sleeve fittings in new slabs as slabs are constructed.
  - 1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
  - 2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 07 6200 "Sheet Metal Flashing and Trim."
  - 3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
  - 4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
  - 5. Using grout, seal the space around outside of stack-sleeve fittings.
- B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe

penetrations with firestop materials. Comply with requirements for firestopping specified in Section 07 8413 "Penetration Firestopping."

### **3.3 SLEEVE-SEAL-SYSTEM INSTALLATION**

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

### **3.4 SLEEVE-SEAL-FITTING INSTALLATION**

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

### **3.5 SLEEVE AND SLEEVE-SEAL SCHEDULE**

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
  1. Exterior Concrete Walls above Grade:
    - a. Piping Smaller Than NPS 6: Sleeve-seal fittings.
    - b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves with sleeve-seal system.
  2. Exterior Concrete Walls below Grade:
    - a. Piping Smaller Than NPS 6: Sleeve-seal fittings.
      - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
    - b. Piping NPS 6 Galvanized-steel-pipe sleeves with sleeve-seal system.
      - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
  3. Concrete Slabs-on-Grade:
    - a. Piping Smaller Than NPS 6: Sleeve-seal fittings.
      - 1) Select sleeve size to allow for 1-inch annular clear space between piping

- and sleeve for installing sleeve-seal system.
- b. Piping NPS 6 Galvanized-steel-pipe sleeves with sleeve-seal system.
- 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
4. Concrete Slabs above Grade:
- a. Piping Smaller Than NPS 6: PVC-pipe sleeves.
- b. Piping NPS 6 PVC-pipe sleeves.
5. Interior Partitions:
- a. Piping Smaller Than NPS 6 PVC-pipe sleeves.
- b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

**END OF SECTION**

## **SECTION 21 0518**

### **ESCUTCHEONS FOR FIRE-SUPPRESSION PIPING**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

- A. Section Includes:

1. Escutcheons.
2. Floor plates.

##### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated.

#### **PART 2 - PRODUCTS**

##### **2.1 ESCUTCHEONS**

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated and rough-brass finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
- C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.
- D. Split-Casting Brass Type: With polished, chrome-plated and rough-brass finish and with concealed hinge and setscrew.
- E. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed hinge, and spring-clip fasteners.

##### **2.2 FLOOR PLATES**

- A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.
- B. Split-Casting Floor Plates: Cast brass with concealed hinge.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
  - 1. Escutcheons for New Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    - b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
    - c. Insulated Piping: One-piece, stamped-steel type.
    - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
    - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
    - f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
    - g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type.
    - h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with finish.
    - i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type.
    - j. Bare Piping in Equipment Rooms: One-piece, cast-brass type with finish.
    - k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type.
  - 2. Escutcheons for Existing Piping:
    - a. Chrome-Plated Piping: Split-casting brass type with polished, chrome-plated finish.
    - b. Insulated Piping: Split-plate, stamped-steel type with concealed hinge.
    - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
    - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge.
    - e. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
    - f. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge.
    - g. Bare Piping in Unfinished Service Spaces: Split-casting brass type with rough-brass finish.
    - h. Bare Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with concealed hinge.
    - i. Bare Piping in Equipment Rooms: Split-casting brass type with rough-brass finish.
    - j. Bare Piping in Equipment Rooms: Split-plate, stamped-steel type with concealed hinge.
- C. Install floor plates for piping penetrations of equipment-room floors.
- D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
  - 1. New Piping: One-piece, floor-plate type.

2. Existing Piping: Split-casting, floor-plate type.

### **3.2 FIELD QUALITY CONTROL**

- A. Replace broken and damaged escutcheons and floor plates using new materials.

**END OF SECTION**

## **SECTION 21 0523**

### **GENERAL-DUTY VALVES FOR FIRE PROTECTION PIPING**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

1. Section Includes:
  1. Two-piece ball valves with indicators.
  2. Bronze butterfly valves with indicators.
  3. Iron butterfly valves with indicators.
  4. Check valves.
  5. Bronze OS&Y gate valves.
  6. Iron OS&Y gate valves.
  7. NRS gate valves.
  8. Indicator posts.
  9. Trim and drain valves.

##### **1.3 DEFINITIONS**

1. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
2. NRS: Nonrising stem.
3. OS&Y: Outside screw and yoke.
4. SBR: Styrene-butadiene rubber.

##### **1.4 ACTION SUBMITTALS**

1. Product Data: For each type of valve.

##### **1.5 DELIVERY, STORAGE, AND HANDLING**

1. Prepare valves for shipping as follows:
  1. Protect internal parts against rust and corrosion.
  2. Protect threads, flange faces, and weld ends.
  3. Set valves open to minimize exposure of functional surfaces.

2. Use the following precautions during storage:
  1. Maintain valve end protection.
  2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
  3. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.
  4. Protect flanges and specialties from moisture and dirt.

## PART 2 - PRODUCTS

### 2.1 GENERAL REQUIREMENTS FOR VALVES

1. UL Listed: Valves shall be listed in UL's "Online Certifications Directory" under the headings listed below and shall bear UL mark:
  1. Main Level: HAMV - Fire Main Equipment.
    - a. Level 1: HCBZ - Indicator Posts, Gate Valve.
    - b. Level 1: HLOT - Valves.
      - 1) Level 3: HLUG - Ball Valves, System Control.
      - 2) Level 3: HLXS - Butterfly Valves.
      - 3) Level 3: HMER - Check Valves.
      - 4) Level 3: HMRZ - Gate Valves.
  2. Main Level: VDGT - Sprinkler System & Water Spray System Devices.
    - a. Level 1: VQGU - Valves, Trim and Drain.
2. FM Global Approved: Valves shall be listed in its "Approval Guide," under the headings listed below:
  1. Automated Sprinkler Systems:
    - a. Indicator posts.
    - b. Valves.
      - 1) Gate valves.
      - 2) Check valves.
        - a) Single check valves.
    - 3) Miscellaneous valves.
  3. Source Limitations for Valves: Obtain valves for each valve type from single manufacturer.
  4. ASME Compliance:
    1. ASME B16.1 for flanges on iron valves.

2. ASME B1.20.1 for threads for threaded-end valves.
3. ASME B31.9 for building services piping valves.
5. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.
6. NFPA Compliance: Comply with NFPA 24 for valves.
7. Valve Pressure Ratings: Not less than the minimum pressure rating indicated or higher as required by system pressures.
8. Valve Sizes: Same as upstream piping unless otherwise indicated.
9. Valve Actuator Types:
  1. Worm-gear actuator with handwheel for quarter-turn valves, except for trim and drain valves.
  2. Handwheel: For other than quarter-turn trim and drain valves.
  3. Handlever: For quarter-turn trim and drain valves NPS 2 and smaller.

## **2.2 TWO-PIECE BALL VALVES WITH INDICATORS**

1. Manufacturers:
  1. Nibco Inc.
  2. Victaulic Company
  3. (Owner Selection)
2. Description:
  1. UL 1091, except with ball instead of disc and FM Global standard for indicating valves (butterfly or ball type), Class Number 1112.
  2. Minimum Pressure Rating: 175 psig.
  3. Body Design: Two piece.
  4. Body Material: Forged brass or bronze.
  5. Port Size: Full or standard.
  6. Seats: PTFE.
  7. Stem: Bronze or stainless steel.
  8. Ball: Chrome-plated brass.
  9. Actuator: Worm gear or traveling nut.
  10. Supervisory Switch: Internal or external.
  11. End Connections for Valves NPS 1 through NPS 2: Threaded ends.
  12. End Connections for Valves NPS 2-1/2: Grooved ends.

## **2.3 BRONZE BUTTERFLY VALVES WITH INDICATORS**

1. Manufacturers:
  1. Globe Fire Sprinkler Corp.
  2. Fivalco Inc.
  3. Milwaukee Valve Company
  4. (Owner Selection)
2. Description:

1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 1112.
2. Minimum Pressure rating: 175 psig.
3. Body Material: Bronze.
4. Seat Material: EPDM.
5. Stem Material: Bronze or stainless steel.
6. Disc: Stainless steel with EPDM coating.
7. Actuator: Worm gear or traveling nut.
8. Supervisory Switch: Internal or external.
9. Ends Connections for Valves NPS 1 through NPS 2: Threaded ends.
10. Ends Connections for Valves NPS 2-1/2: Grooved ends.

## **2.4 IRON BUTTERFLY VALVES WITH INDICATORS**

1. Manufacturers:
  1. Nibco Inc.
  2. Globe Fire Sprinkler Corp.
  3. Victaulic Company
  4. (Owner Selection)
2. Description:
  1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 112.
  2. Minimum Pressure Rating: 175 psig.
  3. Body Material: Cast or ductile iron with nylon.
  4. Seat Material: EPDM.
  5. Stem: Stainless steel.
  6. Disc: Ductile iron.
  7. Actuator: Worm gear or traveling nut.
  8. Supervisory Switch: Internal or external.
  9. Body Design: Lug or wafer.

## **2.5 CHECK VALVES**

1. Manufacturers:
  1. Victaulic Company
  2. Viking Corp.
  3. Nibco Inc.
  4. (Owner Selection)
2. Description:
  1. Standard: UL 312 and FM Global standard for swing check valves, Class Number 1210.
  2. Minimum Pressure Rating: 175 psig.
  3. Type: Single swing check.
  4. Body Material: Cast iron, ductile iron, or bronze.
  5. Clapper: Bronze, ductile iron, or stainless steel.
  6. Clapper Seat: Brass, bronze, or stainless steel.
  7. Hinge Shaft: Bronze or stainless steel.
  8. Hinge Spring: Stainless steel.
  9. End Connections: Flanged, grooved, or threaded.

## **2.6 BRONZE OS&Y GATE VALVES**

1. Manufacturers:
  1. Nibco Inc.
  2. Zurn Industries, LLC
  3. United Brass Works
  4. (Owner Selection)
2. Description:
  1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
  2. Minimum Pressure Rating: 175 psig (1200 kPa).
  3. Body and Bonnet Material: Bronze or brass.
  4. Wedge: One-piece bronze or brass.
  5. Wedge Seat: Bronze.
  6. Stem: Bronze or brass.
  7. Packing: Non-asbestos PTFE.
  8. Supervisory Switch: External.
  9. End Connections: Threaded.

## **2.7 IRON OS&Y GATE VALVES**

1. Manufacturers:
  1. Zurn Industries
  2. Nibco Inc.
  3. Victaulic Company
  4. (Owner Selection)
2. Description:
  1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
  2. Minimum Pressure Rating: 175 psig (1200 kPa).
  3. Body and Bonnet Material: Cast or ductile iron.
  4. Wedge: Cast or ductile iron, or bronze with elastomeric coating.
  5. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
  6. Stem: Brass or bronze.
  7. Packing: Non-asbestos PTFE.
  8. Supervisory Switch: External.
  9. End Connections: Grooved or Threaded.

## **2.8 NRS GATE VALVES**

1. Manufacturers:
  1. Zurn Industries
  2. Nibco Inc.
  3. Victaulic Company
  4. (Owner Selection)
2. Description:
  1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).

- and NRS-type gate valves).
- 2. Minimum Pressure Rating: 175 psig (1200 kPa).
- 3. Body and Bonnet Material: Cast or ductile iron.
- 4. Wedge: Cast or ductile iron with elastomeric coating.
- 5. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
- 6. Stem: Brass or bronze.
- 7. Packing: Non-asbestos PTFE.
- 8. Supervisory Switch: External.
- 9. End Connections: Grooved or Threaded.

## **2.9 INDICATOR POSTS**

- 1. Manufacturers:
  - 1. Mueller Co.
  - 2. Nibco Inc.
  - 3. (Owner Selection)
- 2. Description:
  - 1. Standard: UL 789 and FM Global standard for indicator posts.
  - 2. Type: Wall.
  - 3. Base Barrel Material: Cast or ductile iron.
  - 4. Extension Barrel: Cast or ductile iron.
  - 5. Cap: Cast or ductile iron.
  - 6. Operation: Handwheel.

## **2.10 TRIM AND DRAIN VALVES**

- 1. Ball Valves:
  - 1. Manufacturers:
    - a. Victaulic Company
    - b. Nibco Inc.
    - c. Potter Roemer
    - d. (Owner Selection)
  - 2. Description:
    - a. Pressure Rating: 250 psig.
    - b. Body Design: Two piece.
    - c. Body Material: Forged brass or bronze.
    - d. Port size: Full or standard.
    - e. Seats: PTFE.
    - f. Stem: Bronze or stainless steel.
    - g. Ball: Chrome-plated brass.
    - h. Actuator: Handlever.
    - i. End Connections for Valves NPS 1 through NPS 2-1/2: Threaded ends.
    - j. End Connections for Valves NPS 1-1/4 and NPS 2-1/2: Grooved ends.
- 2. Angle Valves:
  - 1. Manufacturers:

- a. Nibco Inc.
  - b. United Brass Works, Inc.
  - c. (Owner Selection)
2. Description:
- a. Pressure Rating: 175 psig.
  - b. Body Material: Brass or bronze.
  - c. Ends: Threaded.
  - d. Stem: Bronze.
  - e. Disc: Bronze.
  - f. Packing: Asbestos free.
  - g. Handwheel: Malleable iron, bronze, or aluminum.
3. Globe Valves:
1. Manufacturers:
- a. Nibco Inc.
  - b. United Brass Works, Inc
  - c. (Owner Selection)
2. Description:
- a. Pressure Rating: 175 psig.
  - b. Body Material: Bronze with integral seat and screw-in bonnet.
  - c. Ends: Threaded.
  - d. Stem: Bronze.
  - e. Disc Holder and Nut: Bronze.
  - f. Disc Seat: Nitrile.
  - g. Packing: Asbestos free.
  - h. Handwheel: Malleable iron, bronze, or aluminum.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

1. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
2. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
3. Examine threads on valve and mating pipe for form and cleanliness.
4. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
5. Do not attempt to repair defective valves; replace with new valves.

### **3.2 GENERAL REQUIREMENTS FOR VALVE INSTALLATION**

1. Comply with requirements in the following Sections for specific valve installation requirements and applications:
  1. Section 21 1100 "Facility Fire-Suppression Water-Service Piping" for application of valves in fire-suppression water-service piping outside the building.
  2. Section 21 1200 "Fire-Suppression Standpipes" for application of valves in fire-suppression standpipes.
  3. Section 21 1313 "Wet-Pipe Sprinkler Systems" for application of valves in wet-pipe, fire-suppression sprinkler systems.
  4. Section 21 1316 "Dry-Pipe Sprinkler Systems" for application of valves in dry-pipe, fire-suppression sprinkler systems.
  5. Section 21 1339 "Foam-Water Systems" for application of valves in AFFF piping.
2. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
3. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
4. Install valves having threaded connections with unions at each piece of equipment arranged to allow easy access, service, maintenance, and equipment removal without system shutdown. Provide separate support where necessary.
5. Install valves in horizontal piping with stem at or above the pipe center.
6. Install valves in position to allow full stem movement.
7. Install valve tags. Comply with requirements in Section 21 0553 "Identification for Fire-Suppression Piping and Equipment" for valve tags and schedules and signs on surfaces concealing valves; and the NFPA standard applying to the piping system in which valves are installed. Install permanent identification signs indicating the portion of system controlled by each valve.
8. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections.
9. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

**END OF SECTION**

## **SECTION 21 0553**

### **IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

- A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Stencils.
5. Valve tags.
6. Warning tags.

##### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment-Label Schedule: Include a listing of all equipment to be labeled and the proposed content for each label.
- D. Valve Schedules: Valve numbering scheme.

#### **PART 2 - PRODUCTS**

##### **2.1 EQUIPMENT LABELS**

- A. Metal Labels for Equipment:

1. Manufacturers:
  - a. Brady Corp.
  - b. LEM Products Inc.
  - c. Craftmark Pipe Markers
  - d. (Owner Selection)
2. Material and Thickness: anodized aluminum, 0.032 inch thick, with predrilled holes for

- attachment hardware.
  - 3. Letter Color: White.
  - 4. Background Color: Red.
  - 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
  - 6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
  - 7. Fasteners: Stainless-steel rivets or self-tapping screws.
  - 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Plastic Labels for Equipment:
- 1. Manufacturers:
    - a. Brady Corp.
    - b. LEM Products Inc.
    - c. Craftmark Pipe Markers
    - d. (Owner Selection)
  - 2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, with predrilled holes for attachment hardware.
  - 3. Letter Color: White.
  - 4. Background Color: Red.
  - 5. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
  - 6. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
  - 7. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
  - 8. Fasteners: Stainless-steel rivets or self-tapping screws.
  - 9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.
- D. Equipment-Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

## 2.2 WARNING SIGNS AND LABELS

- A. Manufacturers:
- a. Brady Corp.
  - b. LEM Products Inc.
  - c. Craftmark Pipe Markers
  - d. (Owner Selection)
- B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, with predrilled holes for attachment hardware.

- C. Letter Color: White.
- D. Background Color: Red.
- E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- G. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- H. Fasteners: Stainless-steel rivets or self-tapping screws.
- I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- J. Label Content: Include caution and warning information, plus emergency notification instructions.

### **2.3 PIPE LABELS**

- A. Manufacturers:
  - a. Brady Corp.
  - b. LEM Products Inc.
  - c. Craftmark Pipe Markers
  - d. (Owner Selection)
- B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service and showing flow direction according to ASME A13.1.
- C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.
- D. Self-adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- E. Pipe-Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
  - 1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
  - 2. Lettering Size: At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.
- F. Pipe-Label Colors:
  - 1. Background Color: Safety Red.
  - 2. Letter Color: White.

### **2.4 STENCILS**

- A. Stencils for Piping:

1. **Manufacturers:**
  - a. Brimar Industries, Inc.
  - b. Craftmark Pipe Markers
  - c. Kolbi Pipe Marker Co.
  - d. (Owner Selection)
2. Lettering Size: At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.
3. Stencil Material: Fiberboard or metal.
4. Stencil Paint: Safety Red, exterior, gloss, acrylic enamel. Paint may be in pressurized spray-can form.
5. Identification Paint: White, exterior, acrylic enamel. Paint may be in pressurized spray-can form.

## 2.5 VALVE TAGS

- A. **Manufacturers:**
  - a. Brady Corp.
  - b. LEM Products Inc.
  - c. Craftmark Pipe Markers
  - d. (Owner Selection)
- B. Description: Stamped or engraved with 1/4-inch letters for piping-system abbreviation and 1/2-inch numbers.
  1. Tag Material: Stainless steel, 0.032 inch thick, with predrilled holes for attachment hardware.
  2. Fasteners: Brass beaded chain or S-hook.
  3. Valve-Tag Color: Safety Red.
  4. Letter Color: White.
- C. Valve Schedules: For each piping system, on 8-1/2-by-11-inchond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
  1. Valve-tag schedule shall be included in operation and maintenance data.

## 2.6 WARNING TAGS

- A. **Manufacturers:**
  - a. Brady Corp.
  - b. LEM Products Inc.
  - c. Craftmark Pipe Markers
  - d. (Owner Selection)
- B. Description: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
  1. Size: Approximately 4 by 7 inches.
  2. Fasteners: Brass grommet and wire.
  3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."

4. Color: Safety Yellow background with black lettering.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

### **3.2 GENERAL INSTALLATION REQUIREMENTS**

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be installed.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

### **3.3 EQUIPMENT LABEL INSTALLATION**

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

### **3.4 PIPE LABEL INSTALLATION**

- A. Piping: Painting of piping is specified in Section 09 "Interior Painting."
- B. Stenciled Pipe-Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, with painted, color-coded bands or rectangles on each piping system.
  1. Identification Paint: Use for contrasting background.
  2. Stencil Paint: Use for pipe marking.
- C. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
  1. Near each valve and control device.
  2. Near each branch connection excluding short takeoffs. Where flow pattern is not obvious, mark each pipe at branch.
  3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
  4. At access doors, manholes, and similar access points that permit a view of concealed piping.
  5. Near major equipment items and other points of origination and termination.
  6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in

- areas of congested piping and equipment.
- 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- D. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes including pipes where flow is allowed in both directions.

### **3.5 VALVE-TAG INSTALLATION**

- A. Install tags on valves and control devices in fire-suppression piping systems. List tagged valves in a valve-tag schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and with captions similar to those indicated in "Valve-Tag Size and Shape" Subparagraph below:
  - 1. Valve-Tag Size and Shape:
    - a. Fire-Suppression Standpipe: 2 inches, round.
    - b. Wet-Pipe Sprinkler System: 2 inches, round.
    - c. Dry-Pipe Sprinkler System: 2 inches, round.
    - d. Foam-Water System: 2 inches, round.
    - e. Clean-Agent Fire-Extinguishing System: 2 inches, round.

### **3.6 WARNING-TAG INSTALLATION**

- A. Write required message on, and attach warning tags to, equipment and other items where required.

**END OF SECTION**

**SECTION 21 1119**  
**FIRE-DEPARTMENT CONNECTIONS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  1. Flush-type fire-department connections.
  2. Yard-type fire-department connections.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each fire-department connection. Contractor to coordinate type of FDC, location and finish with local AHJ.

**PART 2 - PRODUCTS**

**2.1 FLUSH-TYPE FIRE-DEPARTMENT CONNECTION**

- A. Manufacturers:
  1. Elkhart Brass Mfg. Co.
  2. American Fire Hose and Cabinet
  3. Fire End & Croker Corp.
  4. (Owner Selection)
- B. Standard: UL 405.
- C. Type: Flush, for wall mounting.
- D. Pressure Rating: 175 psig minimum.
- E. Body Material: Corrosion-resistant metal.
- F. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
- G. Caps: Brass, lugged type, with gasket and chain.

- H. Escutcheon Plate: Rectangular, brass, wall type.
- I. Outlet: With pipe threads.
- J. Body Style: Horizontal.
- K. Number of Inlets: Two.
- L. Outlet Location: Back.
- M. Escutcheon Plate Marking: Similar to "AUTO SPKR"
- N. Finish: Polished chrome plated.
- O. Outlet Size: NPS 4 or NPS 5 or NPS 6 or NPS 8.

## **2.2 YARD-TYPE FIRE-DEPARTMENT CONNECTION**

- A. Manufacturers:
  1. Elkhart Brass Mfg. Co.
  2. American Fire Hose and Cabinet
  3. Fire End & Croker Corp.
  4. (Owner Selection)
- B. Standard: UL 405.
- C. Type: Exposed, freestanding.
- D. Pressure Rating: 175 psig.
- E. Body Material: Corrosion-resistant metal.
- F. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
- G. Caps: Brass, lugged type, with gasket and chain.
- H. Escutcheon Plate: Round, brass, floor type.
- I. Outlet: Bottom, with pipe threads.
- J. Number of Inlets: Two.
- K. Sleeve: Not required.
- L. Sleeve Height: 18 inches.
- M. Escutcheon Plate Marking: Similar to "AUTO SPKR & STANDPIPE"
- N. Finish: Polished chrome plated.
- O. Outlet Size: [NPS 4 ] [NPS 5 ] [NPS 6 ].

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of fire-department connections.
- B. Examine roughing-in for fire-suppression standpipe system to verify actual locations of piping connections before fire-department connection installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. Install wall-type fire-department connections.
- B. Install yard-type fire-department connections in concrete slab support. Comply with requirements for concrete in Section 03 3000 "Cast-in-Place Concrete."
- C. Install two protective pipe bollards around each fire-department connection. Comply with requirements for bollards in Section 05 5000 "Metal Fabrications."
- D. Install automatic (ball-drip) drain valve at each check valve for fire-department connection.

**END OF SECTION**

**SECTION 21 1313**  
**WET-PIPE SPRINKLER SYSTEMS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:

1. Pipes, fittings, and specialties.
2. Cover system for sprinkler piping.
3. Specialty valves.
4. Sprinklers.
5. Alarm devices.
6. Manual control stations.
7. Control panels.
8. Pressure gages.

- B. Related Requirements:

1. Section 21 1119 "Fire Department Connections" for exposed-, flush-, and yard-type fire department connections.
2. Section 23 0523 "General-Duty Valves for Water-Based Fire-Suppression Piping" for ball, butterfly, check, gate, post-indicator, and trim and drain valves.

**1.3 DEFINITIONS**

- A. High-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure higher than standard 175 psig, but not higher than 250 psig.
- B. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175-psig maximum.

**1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Sustainable Design Submittals:
- C. Shop Drawings: For wet-pipe sprinkler systems.

1. Include plans, elevations, sections, and attachment details.
  2. Include diagrams for power, signal, and control wiring.
- D. Delegated-Design Submittal: For wet-pipe sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

## **1.5 INFORMATIONAL SUBMITTALS**

- A. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  1. Domestic water piping.
  2. Compressed air piping.
  3. HVAC hydronic piping.
  4. Items penetrating finished ceiling include the following:
    - a. Lighting fixtures.
    - b. Air outlets and inlets.
- B. Qualification Data: For qualified Installer and professional engineer.
- C. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.
- D. Welding certificates.
- E. Fire-hydrant flow test report.
- F. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
- G. Field quality-control reports.

## **1.6 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For wet-pipe sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.

## **1.7 MAINTENANCE MATERIAL SUBMITTALS**

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

## **1.8      QUALITY ASSURANCE**

- A.    Installer Qualifications:
  - 1.    Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
    - a.    Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.
- B.    Welding Qualifications: Qualify procedures and operators according to 2010 ASME Boiler and Pressure Vessel Code.

## **1.9      FIELD CONDITIONS**

- A.    Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:
  - 1.    Notify Construction Manager and Owner no fewer than two days in advance of proposed interruption of sprinkler service.
  - 2.    Do not proceed with interruption of sprinkler service without Construction Manager's and Owner's written permission.

# **PART 2 - PRODUCTS**

## **2.1      PERFORMANCE REQUIREMENTS**

- A.    Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:
  - 1.    NFPA 13.
  - B.    Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.
  - C.    High-Pressure Piping System Component: Listed for 250-psig minimum working pressure.
  - D.    Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design wet-pipe sprinkler systems.
    - 1.    Sprinkler system design shall be approved by authorities having jurisdiction.
      - a.    Margin of Safety for Available Water Flow and Pressure: 5 PSI percent, including losses through water-service piping, valves, and backflow preventers.
      - b.    Sprinkler Occupancy Hazard Classifications: According to NFPA 13 recommendations unless otherwise indicated or determined by authorities having jurisdiction.
    - 2.    Minimum Density for Automatic-Sprinkler Piping Design: According to NFPA 13 recommendations & UL listing unless otherwise indicated or determined by authorities having jurisdiction

- 3. Maximum Protection Area per Sprinkler: According to NFPA 13 recommendations & UL listing unless otherwise indicated or determined by authorities having jurisdiction.
- E. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.

## **2.2 STEEL PIPE AND FITTINGS**

- A. Standard-Weight, Galvanized and Black-Steel Pipe: ASTM A 53/A 53M, Pipe ends may be factory or field formed to match joining method.
- B. Schedule 10, Black-Steel Pipe: ASTM A 135/A 135M or ASTM A 795/A 795M, Schedule 10 in NPS 5 and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10, plain end.
- C. Galvanized and Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.
- D. Galvanized and Uncoated-Steel Couplings: ASTM A 865/A 865M, threaded.
- E. Galvanized and Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- F. Malleable- or Ductile-Iron Unions: UL 860.
- G. Cast-Iron Flanges: ASME 16.1, Class 125.
- H. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.
  - 1. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or EPDM rubber gasket.
    - a. Class 125 and Class 250, Cast-Iron, Flat-Face Flanges: Full-face gaskets.
    - b. Class 150 and Class 300, Ductile-Iron or -Steel, Raised-Face Flanges: Ring-type gaskets.
  - 2. Metal, Pipe-Flange Bolts and Nuts: Carbon steel unless otherwise indicated.
- I. Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.
  - 1. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- J. Grooved-Joint, Steel-Pipe Appurtenances:
  - 1. Manufacturers:
    - a. Anvil International
    - b. Tyco Fire Products
    - c. Victaulic Company
    - d. Approved Equal
  - 2. Pressure Rating: 250-psig minimum.
  - 3. Painted Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting, with dimensions matching steel pipe.

4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.
- K. Steel Pressure-Seal Fittings: UL 213, FM Global-approved, 175-psig pressure rating with steel housing, rubber O-rings, and pipe stop; for use with fitting manufacturers' pressure-seal tools.
1. Manufacturers:
    - a. Victaulic Company
    - b. Approved Equal
- L. Alarm Valves:
1. Manufacturers:
    - a. Reliable Automatic Sprinkler Co, Inc.
    - b. Victaulic Company
    - c. Viking Corp.
    - d. Approved Equal
  2. Standard: UL 193.
  3. Design: For horizontal or vertical installation.
  4. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, and fill-line attachment with strainer.
  5. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.
  6. Drip Cup Assembly: Pipe drain with check valve to main drain piping.
  7. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- M. Automatic (Ball Drip) Drain Valves:
1. Manufacturers:
    - a. Reliable Automatic Sprinkler Co, Inc.
    - b. Tyco Fire Products
    - c. (Owner Selection)
  2. Standard: UL 1726.
  3. Pressure Rating: 175-psig minimum.
  4. Type: Automatic draining, ball check.
  5. Size: NPS 3/4 .
  6. End Connections: Threaded.
- N. Flow Detection and Test Assemblies:
1. Manufacturers:
    - a. Reliable Automatic Sprinkler Co, Inc.
    - b. Tyco Fire Products
    - c. Victaulic Company
    - d. Approved Equal
  2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
  3. Pressure Rating: 175-psig minimum.
  4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
  5. Size: Same as connected piping.
  6. Inlet and Outlet: Threaded or grooved.

O. Sprinkler Inspector's Test Fittings:

1. Manufacturers:
  - a. Tyco Fire Products
  - b. Victaulic Company
  - c. Viking Corp.
2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
3. Pressure Rating: 175-psig minimum.
4. Body Material: Cast- or ductile-iron housing with sight glass.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

P. Flexible Sprinkler Hose Fittings:

1. Manufacturers:
  - a. Victaulic
  - b. Approved Equal
2. Standard: UL 1474.
3. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
4. Pressure Rating: 175-psig minimum.
5. Style 108 Coupling

## 2.3 SPRINKLERS

- A. Manufacturers:
  1. Victaulic Company
  2. Tyco Fire Products
  3. Viking Company
- B. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
- C. Pressure Rating for Residential Sprinklers: 175-psig maximum.
- D. Pressure Rating for Automatic Sprinklers: 175-psig minimum.
- E. Pressure Rating for High-Pressure Automatic Sprinklers: 250-psig minimum.
- F. Automatic Sprinklers with Heat-Responsive Element:
  1. Early-Suppression, Fast-Response Applications: UL 1767.
  2. Nonresidential Applications: UL 199.
  3. Residential Applications: UL 1626.
  4. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.
- G. Open Sprinklers with Heat-Responsive Element Removed: UL 199.
  1. Nominal Orifice: 1/2 inch, with discharge coefficient K between 5.3 and 5.8.
  2. Nominal Orifice: 17/32 inch with discharge coefficient K between 7.4 and 8.2.

- H. Sprinkler Finishes: Chrome plated.
- I. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
  - 1. Ceiling Mounting: Chrome-plated steel, one piece, flat .
  - 2. Sidewall Mounting: Chrome-plated steel, one piece, flat.
- J. Sprinkler Guards:
  - 1. Manufacturers:
    - a. Victaulic Company
    - b. Tyco Fire Products
    - c. Viking Company
  - 2. Standard: UL 199.
  - 3. Type: Wire cage with fastening device for attaching to sprinkler.

## **2.4 ALARM DEVICES**

- A. Alarm-device types shall match piping and equipment connections.
- B. Water-Motor-Operated Alarm:
  - 1. Manufacturers:
    - a. Victaulic Company
    - b. Tyco Fire Products
    - c. Viking Company
  - 2. Standard: UL 753.
  - 3. Type: Mechanically operated, with Pelton wheel.
  - 4. Alarm Gong: Cast aluminum with red-enamel factory finish.
  - 5. Size: 8-1/2-inches diameter.
  - 6. Components: Shaft length, bearings, and sleeve to suit wall construction.
  - 7. Inlet: NPS 3/4.
  - 8. Outlet: NPS 1 drain connection.
- C. Electrically Operated Alarm Bell:
  - 1. Manufacturers:
    - a. Fire-Lite Alarms, Inc.
    - b. Notifier
    - c. Potter Electric Signal Company
    - d. Approved Equal
  - 2. Standard: UL 464.
  - 3. Type: Vibrating, metal alarm bell.
  - 4. Size: 6" diameter.
  - 5. Finish: Red-enamel factory finish, suitable for outdoor use.
  - 6. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Water-Flow Indicators:

1. Manufacturers:
  - a. System Sensor
  - b. Viking Corp.
  - c. Potter Electric Signal Company
  - d. Approved Equal
2. Standard: UL 346.
3. Water-Flow Detector: Electrically supervised.
4. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
5. Type: Paddle operated.
6. Pressure Rating: 250 psig.
7. Design Installation: Horizontal or vertical.

E. Pressure Switches:

1. Manufacturers:
  - a. System Sensor
  - b. Viking Corp.
  - c. Potter Electric Signal Company
  - d. Approved Equal
2. Standard: UL 346.
3. Type: Electrically supervised water-flow switch with retard feature.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design Operation: Rising pressure signals water flow.

F. Valve Supervisory Switches:

1. Manufacturers:
  - a. Fire-Lite Alarms, Inc.
  - b. Potter Electric Signal Company
  - c. System Sensor
  - d. (Owner Selection)
2. Standard: UL 346.
3. Type: Electrically supervised.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design: Signals that controlled valve is in other than fully open position.
6. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

## 2.5 PRESSURE GAGES

A. Manufacturers:

1. Ashcroft, Inc.
2. AMETEK, Inc.
3. AGF Manufacturing Inc.
4. Approved Equal

- B. Standard: UL 393.
- C. Dial Size: 3-1/2- to 4-1/2-inch diameter.
- D. Pressure Gage Range: 0- to 250-psig minimum.
- E. Label: Include "WATER" label on dial face.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.
- B. Report test results promptly and in writing.

### **3.2 SERVICE-ENTRANCE PIPING**

- A. Connect sprinkler piping to water-service piping for service entrance to building. Comply with requirements for exterior piping in Section 21 1100 "Facility Fire-Suppression Water-Service Piping" for exterior piping.
- B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping. Comply with requirements for backflow preventers in Section 21 1100 "Facility Fire-Suppression Water-Service Piping."
- C. Install shutoff valve, check valve, pressure gage, and drain at connection to water service.

### **3.3 WATER-SUPPLY CONNECTIONS**

- A. Connect sprinkler piping to building's interior water-distribution piping. Comply with requirements for interior piping in Section 22 1116 "Domestic Water Piping."
- B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-distribution piping. Comply with requirements for backflow preventers in Section 22 1119 "Domestic Water Piping Specialties."
- C. Install shutoff valve, check valve, pressure gage, and drain at connection to water supply.

### **3.4 PIPING INSTALLATION**

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.
  - 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
  - 2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

- B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.
- C. Install seismic restraints on piping. Comply with NFPA 13 requirements for seismic-restraint device materials and installation.
- D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- E. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.
- H. Install sprinkler piping with drains for complete system drainage.
- I. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
- J. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.
- K. Install alarm devices in piping systems.
- L. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13. In seismic-rated areas, refer to Section 21 0548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."
- M. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they are not subject to freezing.
- N. Fill sprinkler system piping with water.
- O. Install electric heating cables and pipe insulation on sprinkler piping in areas subject to freezing. Comply with requirements for heating cables in Section 21 0533 "Heat Tracing for Fire-Suppression Piping" and for piping insulation in Section 21 0700 "Fire-Suppression Systems Insulation."
- P. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 21 0517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."
- Q. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 21 0517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."
- R. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 21 0518 "Escutcheons for Fire-Suppression Piping."

### **3.5 JOINT CONSTRUCTION**

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
- B. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
- G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- H. Steel-Piping, Pressure-Sealed Joints: Join lightwall steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.
- I. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
  - 1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.
- J. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.
- K. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

### **3.6 VALVE AND SPECIALTIES INSTALLATION**

- A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
- B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

- C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
- D. Specialty Valves:
  - 1. Install valves in vertical position for proper direction of flow, in main supply to system.
  - 2. Install alarm valves with bypass check valve and retarding chamber drain-line connection.
  - 3. Install deluge valves in vertical position, in proper direction of flow, and in main supply to deluge system. Install trim sets for drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.

### **3.7 SPRINKLER INSTALLATION**

- A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels.
- B. Install heat trace on sprinkler piping subject to freezing. Upon approval from AHJ and Engineer, contractor may elect to provide dry-type sprinklers with water supply from heated space if the contractor coordinates and accepts all additional cost associated with this change from all affected disciplines. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.
- C. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid.

### **3.8 IDENTIFICATION**

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.
- B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."

### **3.9 FIELD QUALITY CONTROL**

- A. Perform the following tests and inspections:
  - 1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
  - 3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
  - 4. Energize circuits to electrical equipment and devices.
  - 5. Coordinate with fire-alarm tests. Operate as required under the direction of low voltage technician.
  - 6. Coordinate with fire-pump tests. Operate as required under the direction of low voltage technician.
  - 7. Verify that equipment hose threads are same as local fire department equipment.
- B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

- C. Prepare test and inspection reports.

### **3.10 CLEANING**

- A. Clean dirt and debris from sprinklers.
- B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

### **3.11 DEMONSTRATION**

- A. Train Owner's maintenance personnel to adjust, operate, and maintain specialty valves and pressure-maintenance pumps.

### **3.12 PIPING SCHEDULE**

- A. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with joints.
- B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.
- C. Copper-tube, extruded-tee connections may be used for tee branches in copper tubing instead of specified copper fittings. Branch-connection joints must be brazed.
- D. CPVC pipe, Schedule 40 CPVC fittings, and solvent-cemented joints may be used for light-hazard and residential occupancies.
- E. Standard-pressure, wet-pipe sprinkler system, NPS 2 and smaller, shall be one of the following:
  1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
  2. Standard-weight, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
  3. Standard-weight, black-steel pipe with plain ends; uncoated, plain-end-pipe fittings; and twist-locked joints.
  4. Standard-weight, galvanized-steel pipe with plain ends; galvanized, plain-end-pipe fittings; and twist-locked joints.
  5. Standard-weight, black-steel pipe with [cut-] [or] [roll-]grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
  6. Standard-weight, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
  7. Standard-weight, black-steel pipe with plain ends; steel welding fittings; and welded joints.
- F. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 to NPS 4, shall be one of the following:
  1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.

2. Standard-weight, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
  3. Standard-weight, black-steel pipe with [cut-] [or] [roll-]grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
  4. Standard-weight, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
  5. Standard-weight, black-steel pipe with plain ends; steel welding fittings; and welded joints.
- G. Standard-pressure, wet-pipe sprinkler system, NPS 5 and larger, shall be one of the following:
1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
  2. Standard-weight, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
  3. Standard-weight, black-steel pipe with cut or roll grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
  4. Standard-weight, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
  5. Standard-weight, black-steel pipe with plain ends; steel welding fittings; and welded joints.

### **3.13 SPRINKLER SCHEDULE**

- A. Use sprinkler types in subparagraphs below for the following applications:
1. Rooms without Ceilings: Upright sprinklers.
  2. Rooms with Suspended Ceilings: Recessed sprinklers unless indicated otherwise.
  3. Wall Mounting: Sidewall sprinklers.
  4. Spaces Subject to Freezing: Sidewall, dry sprinklers unless indicated otherwise.
- B. Provide sprinkler types in subparagraphs below with finishes indicated.
1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
  2. Flush Sprinklers: Bright chrome, with painted white escutcheon.
  3. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
  4. Residential Sprinklers: Dull chrome.
  5. Upright, Pendent and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

**END OF SECTION**

**SECTION 21 1316**  
**DRY-PIPE SPRINKLER SYSTEMS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:

1. Pipes, fittings, and specialties.
2. Specialty valves.
3. Sprinkler specialty pipe fittings.
4. Sprinklers.
5. Alarm devices.
6. Manual control stations.
7. Control panels.
8. Pressure gages.

- B. Related Requirements:

1. Section 21 1119 "Fire Department Connections" for exposed-, flush-, and yard-type fire department connections.
2. Section 23 0523 "General-Duty Valves for Water-Based Fire-Suppression Piping" for ball, butterfly, check, gate, post-indicator, and trim and drain valves.

**1.3 DEFINITIONS**

- A. Standard-Pressure Sprinkler Piping: Dry-pipe sprinkler system piping designed to operate at working pressure of 175-psig maximum.

**1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

- B. Shop Drawings: For dry-pipe sprinkler systems.

1. Include plans, elevations, sections, and attachment details.
2. Include diagrams for power, signal, and control wiring.

- C. Delegated-Design Submittal: For dry-pipe sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

## **1.5 INFORMATIONAL SUBMITTALS**

- A. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Domestic water piping.
  2. Compressed air piping.
  3. HVAC hydronic piping.
  4. Items penetrating finished ceiling including the following:
    - a. Lighting fixtures.
    - b. Air outlets and inlets.
- B. Qualification Data: For qualified Installer and professional engineer.
- C. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.
- D. Fire-hydrant flow test report.
- E. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
- F. Field quality-control reports.

## **1.6 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For dry-pipe sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.

## **1.7 MAINTENANCE MATERIAL SUBMITTALS**

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

## **1.8 QUALITY ASSURANCE**

- A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
  - a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

## **1.9 FIELD CONDITIONS**

- A. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:
  1. Notify Architect Construction Manager Owner no fewer than two days in advance of proposed interruption of sprinkler service.
  2. Do not proceed with interruption of sprinkler service without Architect's Construction Manager's Owner's written permission.

## **PART 2 - PRODUCTS**

### **2.1 SYSTEM DESCRIPTIONS**

- A. Dry-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing compressed air. Opening of sprinklers releases compressed air and permits water pressure to open dry-pipe valve. Water then flows into piping and discharges from opened sprinklers.
- B. Combined Dry-Pipe and Preactivation Sprinkler System: Automatic sprinklers are attached to piping containing compressed air. Fire-detection system, located in same area as sprinklers, actuates tripping devices that open dry-pipe valve without loss of air pressure and actuates fire alarm. Water discharges from opened sprinklers.
- C. Single-Interlock Preactivation Sprinkler System: Automatic sprinklers are attached to piping containing low-pressure air. Actuation of fire-detection system, located in same area as sprinklers, opens deluge valve, permitting water to flow into sprinkler piping and to discharge from opened sprinklers.
- D. Double-Interlock Preactivation Sprinkler System: Automatic sprinklers are attached to piping containing low-pressure air. Actuation of a fire-detection system, located in same area as sprinklers, opens deluge valve, permitting water to flow into sprinkler piping. A closed solenoid valve in the sprinkler piping is opened by another fire-detection device; water will then discharge from opened sprinklers.

### **2.2 PERFORMANCE REQUIREMENTS**

- A. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:
  1. NFPA 13.
  2. NFPA 13R.
- B. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.

- C. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design wet-pipe sprinkler systems.
- D. Sprinkler system design shall be approved by authorities having jurisdiction.
  - 1. Margin of Safety for Available Water Flow and Pressure: 20 percent, including losses through water-service piping, valves, and backflow preventers.
  - 2. Sprinkler Occupancy Hazard Classifications: According to NPFA 13 recommendations & As determined by authorities having jurisdiction
  - 3. Minimum Density for Automatic-Sprinkler Piping Design: According to NPFA 13 recommendations & As determined by authorities having jurisdiction
  - 4. Maximum Protection Area per Sprinkler: According to UL listing.
  - 5. Total Combined Hose-Stream Demand Requirement: According to NPFA 13 recommendations & As determined by authorities having jurisdiction
- E. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.

### **2.3 STEEL PIPE AND FITTINGS**

- A. Standard-Weight, Galvanized-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.
- B. Schedule 30, Galvanized-Steel Pipe: ASTM A 135/A 135M; ASTM A 795/A 795M, Type E; or ASME B36.10M wrought steel, with wall thickness not less than Schedule 30 and not more than Schedule 40. Pipe ends may be factory or field formed to match joining method.
- C. Thinwall Galvanized-Steel Pipe: ASTM A 135/A 135M or ASTM A 795/A 795M, threadable, with wall thickness less than Schedule 30 and equal to or greater than Schedule 10. Pipe ends may be factory or field formed to match joining method.
- D. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.
- E. Galvanized-Steel Couplings: ASTM A 865/A 865M, threaded.
- F. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- G. Malleable- or Ductile-Iron Unions: UL 860.
- H. Cast-Iron Flanges: ASME B16.1, Class 125.
- I. Plain-End-Pipe Fittings: UL 213, ductile-iron body with retainer lugs that require one-quarter turn or screwed retainer pin to secure pipe in fitting.
- J. Grooved-Joint, Steel-Pipe Appurtenances:
  - 1. Pressure Rating: **[300-psig]** minimum.
  - 2. Galvanized, Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting, with dimensions matching steel pipe.

3. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

## 2.4 SPECIALTY VALVES

- A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
- B. Pressure Rating:
  1. Standard-Pressure Piping Specialty Valves: 175-psig minimum.
- C. Body Material: Cast or ductile iron.
- D. Size: Same as connected piping.
- E. End Connections: Flanged or grooved.
- F. Dry-Pipe Valves:
  1. Standard: UL 260.
  2. Design: Differential-pressure type.
  3. Include UL 1486, quick-opening devices, trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
  4. Air-Pressure Maintenance Device:
    5. Standard: UL 260.
    6. Type: Automatic device to maintain minimum air pressure in piping.
    7. Include shutoff valves to permit servicing without shutting down sprinkler piping, bypass valve for quick filling, pressure regulator or switch to maintain pressure, strainer, pressure ratings with 14- to 60-psig adjustable range, and [175-psig] [300-psig] outlet pressure.
    8. Air Compressor:
      - a. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
      - b. Motor Horsepower: Fractional.
      - c. Power: 120-V ac, 60 Hz, single phase.
- G. Deluge Valves:
  1. Standard: UL 260.
  2. Design: Hydraulically operated, differential-pressure type.
  3. Include trim sets for alarm-test bypass, drain, electrical water-flow alarm switch, pressure gages, drip cup assembly piped without valves and separate from main drain line, and fill-line attachment with strainer.
  4. Dry, Pilot-Line Trim Set: Include dry, pilot-line actuator; air- and water-pressure gages; low-air-pressure warning switch; air relief valve; and actuation device. Dry, pilot-line actuator includes cast-iron, operated, diaphragm-type valve with resilient facing plate, resilient diaphragm, and replaceable bronze seat. Valve includes threaded water and air inlets and water outlet. Loss of air pressure on dry, pilot-line side allows pilot-line actuator to open and causes deluge valve to open immediately.
  5. Air-Pressure Maintenance Device:
    - a. Standard: UL 260.
    - b. Type: Automatic device to maintain minimum air pressure in piping.
    - c. Include shutoff valves to permit servicing without shutting down sprinkler piping, bypass valve for quick filling, pressure regulator or switch to maintain pressure,

strainer, pressure ratings with 14- to 60-psig adjustable range, and [175-psig] [300-psig] outlet pressure.

6. Air Compressor:
  7. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
  8. Motor Horsepower: Fractional.
  9. Power: 120-V ac, 60 Hz, single phase.
  10. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application
- H. Automatic (Ball Drip) Drain Valves:
  1. Standard: UL 1726.
  2. Pressure Rating: 175-psig minimum.
  3. Type: Automatic draining, ball check.
  4. Size: NPS 3/4.
  5. End Connections: Threaded.

## 2.5 SPRINKLER PIPING SPECIALTIES

- A. General Requirements for Dry-Pipe System Fittings: UL listed for dry-pipe service.
- B. Branch Outlet Fittings:
  1. Standard: UL 213.
  2. Pressure Rating: 300 psig.
  3. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
  4. Type: Mechanical-tee and -cross fittings.
  5. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
  6. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
  7. Branch Outlets: Grooved, plain-end pipe, or threaded.
- C. Flow Detection and Test Assemblies:
  1. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
  2. Pressure Rating: 300 psig.
  3. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
  4. Size: Same as connected piping.
  5. Inlet and Outlet: Threaded.
- D. Branch Line Testers:
  1. Standard: UL 199.
  2. Pressure Rating: 175-psig minimum.
  3. Body Material: Brass.
  4. Size: Same as connected piping.
  5. Inlet: Threaded.
  6. Drain Outlet: Threaded and capped.
  7. Branch Outlet: Threaded, for sprinkler.
- E. Sprinkler Inspector's Test Fittings:
  1. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
  2. Pressure Rating: 300 psig.
  3. Body Material: Cast- or ductile-iron housing with sight glass.
  4. Size: Same as connected piping.

5. Inlet and Outlet: Threaded.
- F. Adjustable Drop Nipples:
1. Standard: UL 1474.
  2. Pressure Rating: 300 psig.
  3. Body Material: Steel pipe with EPDM O-ring seals.
  4. Size: Same as connected piping.
  5. Length: Adjustable.
  6. Inlet and Outlet: Threaded.
- G. Flexible Sprinkler Hose Fittings:
1. Standard: UL 1474.
  2. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
  3. Pressure Rating: 300 psig.
  4. Size: Same as connected piping, for sprinkler.

## **2.6 SPRINKLERS**

- A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
- B. Pressure Rating for Residential Sprinklers: 175-psig maximum.
- C. Pressure Rating for Automatic Sprinklers: 175-psig minimum.
- D. Pressure Rating for High-Pressure Automatic Sprinklers: 300 psig.
- E. Automatic Sprinklers with Heat-Responsive Element:
  1. Nonresidential Applications: UL 199.
  2. Residential Applications: UL 1626.
  3. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.
- F. Sprinkler Finishes: Chrome plated.
- G. Special Coatings: corrosion-resistant paint.
- H. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
  1. Ceiling Mounting: Chrome-plated steel, , with 1-inch vertical adjustment.
  2. Sidewall Mounting: Chrome-plated steel, one piece, flat.
- I. Sprinkler Guards:
  1. Standard: UL 199.
  2. Type: Wire cage with fastening device for attaching to sprinkler.

## **2.7 ALARM DEVICES**

- A. Alarm-device types shall match piping and equipment connections.

- B. Water-Motor-Operated Alarm:
  - 1. Standard: UL 753.
  - 2. Type: Mechanically operated, with Pelton wheel.
  - 3. Alarm Gong: Cast aluminum with red-enamel factory finish.
  - 4. Size: 10-inch diameter.
  - 5. Components: Shaft length, bearings, and sleeve to suit wall construction.
  - 6. Inlet: NPS 3/4.
  - 7. Outlet: NPS 1 drain connection.
  
- C. Electrically Operated Alarm Bell:
  - 1. Standard: UL 464.
  - 2. Type: Vibrating, metal alarm bell.
  - 3. Finish: Red-enamel factory finish, suitable for outdoor use.
  - 4. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  
- D. Pressure Switches:
  - 1. Standard: UL 346.
  - 2. Type: Electrically supervised water-flow switch with retard feature.
  - 3. Components: Single-pole, double-throw switch with normally closed contacts.
  - 4. Design Operation: Rising pressure signals water flow.
  
- E. Valve Supervisory Switches:
  - 1. Standard: UL 346.
  - 2. Type: Electrically supervised.
  - 3. Components: Single-pole, double-throw switch with normally closed contacts.
  - 4. Design: Signals that controlled valve is in other than fully open position.
  - 5. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application

## **2.8 MANUAL CONTROL STATIONS**

- A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide" for hydraulic operation, with union, NPS 1/2 pipe nipple, and bronze ball valve.
  
- B. Include metal enclosure labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.

## **2.9 CONTROL PANELS**

- A. Description: Single-area, two-area, or single-area cross-zoned type control panel as indicated, including NEMA ICS 6, Type 1 enclosure, detector, alarm, and solenoid-valve circuitry for operation of deluge valves.
  - 1. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide" when used with thermal detectors and Class A detector circuit wiring.
  - 2. Electrical characteristics are 120-V ac, 60 Hz, with 24-V dc rechargeable batteries.
  - 3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application

- B. Manual Control Stations: Electric operation, metal enclosure, labeled "MANUAL CONTROL STATION," with operating instructions and cover held closed by breakable strut to prevent accidental opening.
- C. Manual Control Stations: Hydraulic operation, with union, NPS 1/2 pipe nipple, and bronze ball valve. Include metal enclosure labeled "MANUAL CONTROL STATION," with operating instructions and cover held closed by breakable strut to prevent accidental opening.
- D. Panels Components:
  - 1. Power supply.
  - 2. Battery charger.
  - 3. Standby batteries.
  - 4. Field-wiring terminal strip.
  - 5. Electrically supervised solenoid valves and polarized fire-alarm bell.
  - 6. Lamp test facility.
  - 7. Single-pole, double-throw auxiliary alarm contacts.
  - 8. Rectifier.

## **2.10 PRESSURE GAGES**

- A. Standard: UL 393.
- B. Dial Size: 3-1/2- to 4-1/2-inch diameter.
- C. Pressure Gage Range: 0 to 300 psig.
- D. Label: Include "WATER" or "AIR/WATER" label on dial face.
- E. Air System Piping Gage: Include retard feature and "AIR" or "AIR/WATER" label on dial face.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.
- B. Report test results promptly and in writing.

### **3.2 SERVICE-ENTRANCE PIPING**

- A. Connect sprinkler piping to water-service piping for service entrance to building. Comply with requirements in Section 21 1100 "Facility Fire-Suppression Water-Service Piping" for exterior piping.
- B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping. Comply with requirements for backflow preventers in Section 21 1100 "Facility Fire-Suppression Water-Service Piping."
- C. Install shutoff valve, check valve, pressure gage, and drain at connection to water service.

### **3.3 WATER-SUPPLY CONNECTIONS**

- A. Connect sprinkler piping to building's interior water-distribution piping. Comply with requirements for interior piping in Section 22 1116 "Domestic Water Piping."
- B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-distribution piping. Comply with requirements in Section 22 1119 "Domestic Water Piping Specialties" for backflow preventers.
- C. Install shutoff valve, check valve, pressure gage, and drain at connection to water supply.

### **3.4 PIPING INSTALLATION**

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.
  - 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
  - 2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.
- B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.
- C. Install seismic restraints on piping. Comply with NFPA 13 requirements for seismic-restraint device materials and installation.
- D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- E. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.
- H. Install sprinkler piping with drains for complete system drainage.
- I. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
- J. Install automatic (ball drip) drain valves to drain piping between fire department connections and check valves. Drain to floor drain or to outside building.
- K. Connect compressed-air supply to dry-pipe sprinkler piping.
- L. Connect air compressor to the following piping and wiring:
  - 1. Pressure gages and controls.
  - 2. Electrical power system.
  - 3. Fire-alarm devices, including low-pressure alarm.

- M. Install alarm devices in piping systems.
- N. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements in NFPA 13. In seismic-rated areas, refer to Section 21 0548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."
- O. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they are not subject to freezing.
- P. Drain dry-pipe sprinkler piping.
- Q. Pressurize and check dry-pipe sprinkler system piping and air-pressure maintenance devices air compressors.
- R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 21 0517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."
- S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 21 0517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."
- T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 21 0518 "Escutcheons for Fire-Suppression Piping."

### **3.5 JOINT CONSTRUCTION**

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
- B. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
- G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

- H. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.
- I. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.
- J. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.
- K. Copper-Tubing Grooved Joints: Roll rounded-edge groove in end of tube according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join copper tube and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
- L. Copper-Tubing, Pressure-Sealed Joints: Join copper tube and copper pressure-seal fittings with tools recommended by fitting manufacturer.
- M. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.
- N. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

### **3.6 VALVE AND SPECIALTIES INSTALLATION**

- A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
- B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
- D. Specialty Valves:
  - 1. Install valves in vertical position for proper direction of flow, in main supply to system.
  - 2. Install dry-pipe and deluge valves with trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
    - a. Install air compressor and compressed-air-supply piping.
    - b. Install air-pressure maintenance device with shutoff valves to permit servicing without shutting down sprinkler system; bypass valve for quick system filling; pressure regulator or switch to maintain system pressure; strainer; pressure ratings with 14- to 60-psig adjustable range; and 175-psig maximum inlet pressure.
    - c. Install compressed-air-supply piping from building's compressed-air piping system.

### **3.7 SPRINKLER INSTALLATION**

- A. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical ceiling panels.
- B. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.
- C. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid.

### **3.8 IDENTIFICATION**

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.
- B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."

### **3.9 FIELD QUALITY CONTROL**

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
  2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
  3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
  4. Energize circuits to electrical equipment and devices.
  5. Start and run air compressors.
  6. Coordinate with fire-alarm tests. Operate as required.
  7. Coordinate with fire-pump tests. Operate as required.
  8. Verify that equipment hose threads are same as local fire department equipment.
- B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

### **3.10 CLEANING**

- A. Clean dirt and debris from sprinklers.
- B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

### **3.11 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.

### **3.12 PIPING SCHEDULE**

- A. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with threaded ends, cast-iron threaded fittings, and threaded grooved ends, grooved-end fittings, grooved-end-pipe couplings, and grooved joints.
- B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.
- C. Copper-tube, extruded-tee connections may be used for tee branches in copper tubing instead of specified copper fittings. Branch-connection joints must be brazed.
- D. Standard-pressure, dry-pipe sprinkler system, NPS 2 and smaller, shall be one of the following:
  1. Standard-weight, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
  2. Standard-weight, galvanized-steel pipe with plain ends; plain-end-pipe fittings; and twist-locked joints.
  3. Standard-weight, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
- E. Standard-pressure, dry-pipe sprinkler system, NPS 2-1/2 to NPS 4, shall be one of the following:
  1. Standard-weight, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
  2. Standard-weight, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
- F. Standard-pressure, dry-pipe sprinkler system, NPS 5 and NPS 6, shall be one of the following:
  1. Standard-weight, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
  2. Standard-weight, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

### **3.13 SPRINKLER SCHEDULE**

- A. Use sprinkler types in subparagraphs below for the following applications:
  1. Rooms without Ceilings: Upright sprinklers.
  2. Rooms with Suspended Ceilings: Dry concealed sprinklers.
  3. Wall Mounting: Dry sidewall sprinklers.
  4. Spaces Subject to Freezing: Dry sidewall sprinklers.
  5. Special Applications: Extended-coverage and quick-response sprinklers where indicated.
- B. Provide sprinkler types in subparagraphs below with finishes indicated.
  1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
  2. Flush Sprinklers: Bright chrome, with painted white escutcheon.
  3. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
  4. Upright Pendant and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

**END OF SECTION**

**SECTION 21 3113**  
**ELECTRIC-DRIVE, CENTRIFUGAL FIRE PUMPS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:

1. End-suction fire pumps.
2. In-line fire pumps.
3. Horizontally mounted, single-stage, split-case fire pumps.
4. Horizontally mounted, multistage, split-case fire pumps.
5. Vertically mounted, single-stage, split-case fire pumps.
6. Fire-pump accessories and specialties.
7. Flowmeter systems.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product. Include rated capacities, operating characteristics, performance curves, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For fire pumps, motor drivers, and fire-pump accessories and specialties.
1. Include plans, elevations, sections, and mounting and attachment details.
  2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  3. Include diagrams for power, signal, and control wiring.

**1.4 INFORMATIONAL SUBMITTALS**

- A. Seismic Qualification Certificates: For fire pumps, accessories, and components, from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

- B. Product Certificates: For each type of fire pump, from manufacturer.
- C. Source quality-control reports.
- D. Field quality-control reports.

## **1.5 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For fire pumps to include in operation and maintenance manuals.

# **PART 2 - PRODUCTS**

## **2.1 PERFORMANCE REQUIREMENTS**

- A. NFPA Compliance: Comply with NFPA 20.
- B. Seismic Performance: Fire pumps shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
  - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event.
  - 2. Component Importance Factor: 1.5.
- C. Pump Equipment, Accessory, and Specialty Pressure Rating: 175 psig minimum unless higher pressure rating is indicated.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

## **2.2 GENERAL REQUIREMENTS FOR CENTRIFUGAL FIRE PUMPS**

- A. Description: Factory-assembled and -tested fire-pump and driver unit.
- B. Base: Fabricated and attached to fire-pump and driver unit, with reinforcement to resist movement of pump during seismic events when base is anchored to building substrate.
- C. Finish: Red paint applied to factory-assembled and -tested unit before shipping.

## **2.3 END-SUCTION FIRE PUMPS**

- A. **Manufacturers:**
  - 1. Peerless Pump Company
  - 2. Patterson Pump Company
  - 3. S.A. Armstrong Limited
  - 4. (Owner Selection)
- B. Pump:

1. Standard: UL 448, for end-suction pumps for fire service.
  2. Casing: Radially split case, top centerline discharge, self-venting, cast iron, with ASME B16.1 pipe-flange connections.
  3. Impeller: Cast bronze, statically and dynamically balanced, and keyed to shaft.
  4. Wear Rings: Replaceable bronze.
  5. Shaft and Sleeve: Steel shaft with stainless-steel sleeves.
    - a. Shaft Bearings: Grease-lubricated, back-to-back thrust ball bearings and one radial roller bearing.
    - b. Seals: Stuffing box with minimum of four rings of graphite-impregnated braided yarn and bronze packing gland.
  6. Mounting: Back pullout design, allowing complete rotating assembly removal without disturbing the casing piping connections. Pump and driver shafts are horizontal, with pump and driver on same base.
- C. Coupling: Flexible and capable of absorbing torsional vibration and shaft misalignment. Include metal coupling guard.
- D. Driver:
1. Standard: UL 1004A.
  2. Type: Electric motor; NEMA MG 1, polyphase Design B.
- E. Capacities and Characteristics:
1. Per design build fire protection contractor.

## **2.4 IN-LINE FIRE PUMPS**

- A. Manufacturers:
1. Peerless Pump Company
  2. Patterson Pump Company
  3. S.A. Armstrong Limited
  4. (Owner Selection)
- B. Pump:
1. Standard: UL 448, for in-line pumps for fire service.
  2. Casing: Radially split case, cast iron, with ASME B16.1 pipe-flange connections.
  3. Impeller: Cast bronze, statically and dynamically balanced, and keyed to shaft.
  4. Wear Rings: Replaceable bronze.
  5. Shaft and Sleeve: Steel shaft with bronze sleeve.
    - a. Shaft Bearings: Grease-lubricated ball bearings in cast-iron housing.
    - b. Seals: Stuffing box with minimum of four rings of graphite-impregnated braided yarn and bronze packing gland.
  6. Mounting: Pump and driver shaft is vertical, with motor above pump and pump on base. Motor and pump rotating assembly shall be removable from top without removing the pump casing from the piping.
- C. Coupling: None or rigid.

- D. Driver:
1. Standard: UL 1004A.
  2. Type: Electric motor; NEMA MG 1, polyphase Design B.

- E. Capacities and Characteristics:
1. Per design build fire protection contractor.

## 2.5 HORIZONTALLY MOUNTED, SINGLE-STAGE, SPLIT-CASE FIRE PUMPS

- A. Manufacturers:
1. Peerless Pump Company
  2. Patterson Pump Company
  3. S.A. Armstrong Limited
  4. (Owner Selection)
- B. Pump:
1. Standard: UL 448, for split-case pumps for fire service.
  2. Casing: Axially split case, cast iron, with ASME B16.1 pipe-flange connections.
  3. Impeller: Double suction, cast bronze, statically and dynamically balanced, and keyed to shaft.
  4. Wear Rings: Replaceable bronze.
  5. Shaft and Sleeve: Alloy steel shaft with bronze sleeve.
    - a. Shaft Bearings: Grease-lubricated ball bearings in cast-iron housing.
    - b. Seals: Stuffing box with minimum of four rings of graphite-impregnated braided yarn and bronze packing gland.
  6. Mounting: Pump and driver shafts are horizontal, with pump and driver on same base.
- C. Coupling: Flexible and capable of absorbing torsional vibration and shaft misalignment. Include metal coupling guard.
- D. Driver:
1. Standard: UL 1004A.
  2. Type: Electric motor; NEMA MG 1, polyphase Design B.
- E. Capacities and Characteristics:
1. Per design build fire protection contractor.

## 2.6 HORIZONTALLY MOUNTED, MULTISTAGE, SPLIT-CASE FIRE PUMPS

- A. Manufacturers:
1. Peerless Pump Company
  2. Patterson Pump Company
  3. S.A. Armstrong Limited
  4. (Owner Selection)
- B. Pump:

1. Standard: UL 448, for split-case pumps for fire service.
  2. Number of Stages: Two.
  3. Casing: Axially split case, cast iron with ASME B16.1 pipe-flange connections.
  4. Impeller: Single suction, cast bronze, statically and dynamically balanced, and keyed to shaft.
  5. Wear Rings: Replaceable bronze.
  6. Shaft and Sleeve: Alloy steel shaft with bronze sleeve.
    - a. Shaft Bearings: Grease-lubricated ball bearings in cast-iron housing.
    - b. Seals: Stuffing box with minimum of four rings of graphite-impregnated braided yarn and bronze packing gland.
  7. Mounting: Pump and driver shafts are horizontal, with pump and driver on same base.
- C. Coupling: Flexible and capable of absorbing torsional vibration and shaft misalignment. Include metal coupling guard.
- D. Driver:
1. Standard: UL 1004A.
  2. Type: Electric motor; NEMA MG 1, polyphase Design B.
- E. Capacities and Characteristics:
1. Per design build fire protection contractor.

## **2.7 VERTICALLY MOUNTED, SINGLE-STAGE, SPLIT-CASE FIRE PUMPS**

- A. Manufacturers:
1. Peerless Pump Company
  2. Patterson Pump Company
  3. S.A. Armstrong Limited
  4. (Owner Selection)
- B. Pump:
1. Standard: UL 448, for split-case pumps for fire service.
  2. Casing: Axially split case, cast iron, with ASME B16.1 pipe-flange connections.
  3. Impeller: Double suction, cast bronze, statically and dynamically balanced, and keyed to shaft.
  4. Wear Rings: Replaceable bronze.
  5. Shaft and Sleeve: Alloy steel shaft with bronze sleeve.
    - a. Shaft Bearings: Grease-lubricated ball bearings in cast-iron housing.
    - b. Seals: Stuffing box with minimum of four rings of graphite-impregnated braided yarn and bronze packing gland.
  6. Mounting: Pump and driver shafts are vertical, with motor above pump and pump on base.
- C. Coupling: Flexible and capable of absorbing torsional vibration and shaft misalignment. Include metal coupling guard.
- D. Driver:

1. Standard: UL 1004A.
  2. Type: Electric motor; NEMA MG 1, polyphase Design B.
- E. Capacities and Characteristics:
1. Per design build fire protection contractor.

## 2.8 FIRE-PUMP ACCESSORIES AND SPECIALTIES

- A. Automatic Air-Release Valves: Comply with NFPA 20 for installation in fire-pump casing.
- B. Circulation Relief Valves: UL 1478, brass, spring loaded; for installation in pump discharge piping.
- C. Relief Valves:
  1. Manufacturers:
    - a. Zurn Industries
    - b. Cla-Val Automatic Control Valves
    - c. BERMAD Control Valves
  2. Description: UL 1478, bronze or cast iron, spring loaded; for installation in fire-suppression water-supply piping.
- D. Inlet Fitting: Eccentric tapered reducer at pump suction inlet.
- E. Outlet Fitting: Concentric tapered reducer at pump discharge outlet.
- F. Discharge Cone: Closed or open type.
- G. Hose Valve Manifold Assembly:
  1. Standard: Comply with requirements in NFPA 20.
  2. Header Pipe: ASTM A 53/A 53M, Schedule 40, galvanized steel, with ends threaded according to ASME B1.20.1.
  3. Header Pipe Fittings: ASME B16.4, galvanized cast-iron threaded fittings.
  4. Automatic Drain Valve: UL 1726.
  5. Manifold:
    - a. Test Connections: Comply with UL 405; however, provide outlets without clappers instead of inlets.
    - b. Body: Flush type, brass or ductile iron, with number of outlets required by NFPA 20.
    - c. Nipples: ASTM A 53/A 53M, Schedule 40, galvanized-steel pipe, with ends threaded according to ASME B1.20.1.
    - d. Adapters and Caps with Chain: Brass or bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads.
    - e. Escutcheon Plate: Brass or bronze; rectangular.
    - f. Hose Valves: UL 668, bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads.
    - g. Exposed Parts Finish: chrome plated.
    - h. Escutcheon Plate Marking: Equivalent to "FIRE PUMP TEST."
  6. Manifold:

- a. Test Connections: Comply with UL 405; however, provide outlets without clappers instead of inlets.
- b. Body: Exposed type, brass, with number of outlets required by NFPA 20.
- c. Escutcheon Plate: Brass or bronze; round.
- d. Hose Valves: UL 668, bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads. Include caps and chains.
- e. Exposed Parts Finish: chrome plated.
- f. Escutcheon Plate Marking: Equivalent to "FIRE PUMP TEST."

## **2.9 FLOWMETER SYSTEMS**

- A. Manufacturers:
  1. Victaulic Company
  2. Hydro Flow Products, Inc.
  3. Emerson Process Management
- B. Description: UL-listed or FM-Approved, fire-pump flowmeter system able to indicate flow to not less than 175 percent of fire-pump rated capacity.
- C. Pressure Rating: 175 psig minimum.
- D. Sensor: Annubar probe, orifice plate, or venturi unless otherwise indicated. Sensor size shall match pipe, tubing, flowmeter, and fittings.
- E. Permanently Mounted Flowmeter: Compatible with flow sensor; with dial not less than 4-1/2 inches in diameter. Include bracket or device for wall mounting.
  - 1. Tubing Package: NPS 1/8 or NPS 1/4 plastic tubing with copper or brass fittings and valves.
- F. Portable Flowmeter: Compatible with flow sensor; with dial not less than 4-1/2 inches in diameter and with two 12-foot-long hoses in carrying case.

## **2.10 GROUT**

- A. Standard: ASTM C 1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink and recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## **2.11 SOURCE QUALITY CONTROL**

- A. Testing: Test and inspect fire pumps according to UL 448 requirements for "Operation Test" and "Manufacturing and Production Tests."
  - 1. Verification of Performance: Rate fire pumps according to UL 448.

- B. Fire pumps will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine equipment bases and anchorage provisions, with Installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance of fire pumps.
- B. Examine roughing-in for fire-suppression piping systems to verify actual locations of piping connections before fire-pump installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. Fire-Pump Installation Standard: Comply with NFPA 20 for installation of fire pumps, relief valves, and related components.
- B. Equipment Mounting:
  - 1. Install fire pumps on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 03 "Cast-in-Place Concrete." and "Miscellaneous Cast-in-Place Concrete."
  - 2. Comply with requirements for vibration isolation and seismic-control devices specified in Section 21 0548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."
  - 3. Comply with requirements for vibration isolation devices specified in Section 21 0548.13 "Vibration Controls for Fire-Suppression Piping and Equipment."
- C. Install fire-pump suction and discharge piping equal to or larger than sizes required by NFPA 20.
- D. Support piping and pumps separately, so weight of piping does not rest on pumps.
- E. Install valves that are same size as connecting piping. Comply with requirements for fire-protection valves specified in Section 21 "Fire-Suppression Standpipes." and "Wet-Pipe Sprinkler Systems."
- F. Install pressure gages on fire-pump suction and discharge flange pressure-gage tappings. Comply with requirements for pressure gages specified in Section 21 "Fire-Suppression Standpipes." and "Wet-Pipe Sprinkler Systems."
- G. Install piping hangers and supports, anchors, valves, gages, and equipment supports according to NFPA 20.
- H. Install flowmeters and sensors. Install flowmeter-system components and make connections according to NFPA 20 and manufacturer's written instructions.

- I. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not factory mounted. Furnish copies of manufacturers' wiring diagram submittals to electrical Installer.
- J. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

### **3.3 ALIGNMENT**

- A. Align end-suction and split-case pump and driver shafts after complete unit has been leveled on concrete base, grout has set, and anchor bolts have been tightened.
- B. After alignment is correct, tighten anchor bolts evenly. Fill baseplate completely with grout, with metal blocks and shims or wedges in place. Tighten anchor bolts after grout has hardened. Check alignment and make required corrections.
- C. Align piping connections.
- D. Align pump and driver shafts for angular and parallel alignment according to HI 1.4 and to tolerances specified by manufacturer.

### **3.4 CONNECTIONS**

- A. Comply with requirements for piping and valves specified in Section 21 "Fire-Suppression Standpipes." and "Wet-Pipe Sprinkler Systems." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to pumps and equipment to allow service and maintenance.
- C. Connect relief-valve discharge to drainage piping or point of discharge.
- D. Connect flowmeter-system meters, sensors, and valves to tubing.
- E. Connect fire pumps to their controllers.

### **3.5 IDENTIFICATION**

- A. Identify system components. Comply with requirements for fire-pump marking according to NFPA 20.

### **3.6 FIELD QUALITY CONTROL**

- A. Test each fire pump with its controller as a unit. Comply with requirements for electric-motor-driver fire-pump controllers specified in Section 26 2933 "Controllers for Fire-Pump Drivers."
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Perform the following tests and inspections with the assistance of a factory-authorized service representative.

1. After installing components, assemblies, and equipment, including controller, test for compliance with requirements.
  2. Test according to NFPA 20 for acceptance and performance testing.
  3. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  4. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Components, assemblies, and equipment will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.
- F. Furnish fire hoses in number, size, and length required to reach storm drain or other acceptable location to dispose of fire-pump test water. Hoses are for tests only and do not convey to Owner.

### **3.7      STARTUP SERVICE**

- A. Engage a factory-authorized service representative to perform startup service.
1. Complete installation and startup checks according to manufacturer's written instructions.

### **3.8      DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire pumps.

**END OF SECTION**

## **SECTION 28 3111**

### **DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

- A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Non-system smoke detectors.
5. Heat detectors.
6. Notification appliances.
7. Remote annunciation.
8. Addressable interface device.
9. Network communications.

- B. Related Requirements:

1. Section 28 0513 "Conductors and Cables for Electronic Safety and Security" for cables and conductors for fire-alarm systems.

##### **1.3 DEFINITIONS**

- A. EMT: Electrical Metallic Tubing.
- B. FACP: Fire Alarm Control Panel.
- C. HLI: High Level Interface.
- D. NICET: National Institute for Certification in Engineering Technologies.
- E. PC: Personal computer.
- F. VESDA: Very Early Smoke-Detection Apparatus.

##### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product, including furnished options and accessories.
  - 1. Include construction details, material descriptions, dimensions, profiles, and finishes.

2. Include rated capacities, operating characteristics, and electrical characteristics.
- B. Shop Drawings: For fire-alarm system.
1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
  2. Include plans, elevations, sections, details, and attachments to other work.
  3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
  4. Detail assembly and support requirements.
  5. Include voltage drop calculations for notification-appliance circuits.
  6. Include battery-size calculations.
  7. Include input/output matrix.
  8. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
  9. Include performance parameters and installation details for each detector.
  10. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
  11. Provide program report showing that air-sampling detector pipe layout balances pneumatically within the airflow range of the air-sampling detector.
  12. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale; coordinate location of duct smoke detectors and access to them.
    - a. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators.
    - b. Show field wiring required for HVAC unit shutdown on alarm.
    - c. Show field wiring and equipment required for HVAC unit shutdown on alarm and override by firefighters' control system.
    - d. Show field wiring and equipment required for HVAC unit shutdown on alarm and override by firefighters' smoke-evacuation system.
    - e. Locate detectors according to manufacturer's written recommendations.
    - f. Show air-sampling detector pipe routing.
  13. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
  14. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.
- C. General Submittal Requirements:
1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
  2. Shop Drawings shall be prepared by persons with the following qualifications:
    - a. Trained and certified by manufacturer in fire-alarm system design.
    - b. NICET-certified, fire-alarm technician; Level IV minimum.
    - c. Licensed or certified by authorities having jurisdiction.
- D. Delegated-Design Submittal: For notification appliances and smoke and heat detectors, in addition to submittals listed above, indicate compliance with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Drawings showing the location of each notification appliance and smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the device.
2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72. Calculate spacing and intensities for strobe signals and sound-pressure levels for audible appliances.
3. Indicate audible appliances required to produce square wave signal per NFPA 72.

## **1.5 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For Installer.
- B. Seismic Qualification Certificates: For fire-alarm control unit, accessories, and components, from manufacturer.
  1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Field quality-control reports.

## **1.6 Sample Warranty: For special warranty.**

## **1.7 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.
  1. In addition to items specified in Section 01 7823 "Operation and Maintenance Data," include the following:
    - a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
    - b. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
    - c. Complete wiring diagrams showing connections between all devices and equipment. Each conductor shall be numbered at every junction point with indication of origination and termination points.
    - d. Riser diagram.
    - e. Device addresses.
    - f. Air-sampling system sample port locations and modeling program report showing layout meets performance criteria.
    - g. Record copy of site-specific software.
    - h. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:
      - 1) Equipment tested.
      - 2) Frequency of testing of installed components.

- 3) Frequency of inspection of installed components.
    - 4) Requirements and recommendations related to results of maintenance.
    - 5) Manufacturer's user training manuals.
  - i. Manufacturer's required maintenance related to system warranty requirements.
  - j. Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciation unit.
- B. Software and Firmware Operational Documentation:
1. Software operating and upgrade manuals.
  2. Program Software Backup: On magnetic media or compact disk, complete with data files.
  3. Device address list.
  4. Printout of software application and graphic screens.

## **1.8 MAINTENANCE MATERIAL SUBMITTALS**

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
  2. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
  3. Smoke Detectors, Fire Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than one unit of each type.
  4. Detector Bases: Quantity equal to two percent of amount of each type installed, but no fewer than one unit of each type.
  5. Keys and Tools: One extra set for access to locked or tamperproofed components.
  6. Audible and Visual Notification Appliances: One of each type installed.
  7. Fuses: Two of each type installed in the system. Provide in a box or cabinet with compartments marked with fuse types and sizes.
  8. Filters for Air-Sampling Detectors: Quantity equal to two percent of amount of each type installed, but no fewer than one unit of each type.
  9. Air-Sampling Fan: Quantity equal to one for every five detectors, but no fewer than one unit of each type.

## **1.9 QUALITY ASSURANCE**

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level IV technician.
- C. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL (nationally recognized testing laboratory).
- D. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.
- E. NFPA Certification: Obtain certification according to NFPA 72 in the form of a placard by an FM Global-approved alarm company.

- F. NFPA Certification: Obtain certification according to NFPA 72 by.

## **1.10 PROJECT CONDITIONS**

- A. Perform a full test of the existing system prior to starting work. Document any equipment or components not functioning as designed.
- B. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:
  1. Notify Construction Manager no fewer than seven days in advance of proposed interruption of fire-alarm service.
  2. Do not proceed with interruption of fire-alarm service without Construction Manager's written permission.
- C. Use of Devices during Construction: Protect devices during construction unless devices are placed in service to protect the facility during construction.

## **1.11 SEQUENCING AND SCHEDULING**

- A. Existing Fire-Alarm Equipment: Maintain existing equipment fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service, and label existing fire-alarm equipment "NOT IN SERVICE" until removed from the building.
- B. Equipment Removal: After acceptance of new fire-alarm system, remove existing disconnected fire-alarm equipment and wiring.

## **1.12 WARRANTY**

- A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail in materials or workmanship within specified warranty period.
  1. Warranty Extent: All equipment and components not covered in the Maintenance Service Agreement.
  2. Warranty Period: Five years from date of Substantial Completion.

# **PART 2 - PRODUCTS**

## **2.1 SYSTEM DESCRIPTION**

- A. Source Limitations for Fire-Alarm System and Components: Components shall be compatible with, and operate as an extension of, existing system. Provide system manufacturer's certification that all components provided have been tested as, and will operate as, a system.
- B. Noncoded, **UL-certified** addressable system, with multiplexed signal transmission and **horn/strobe** evacuation.
- C. Automatic sensitivity control of certain smoke detectors.

- D. All components provided shall be listed for use with the selected system.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

## **2.2 SYSTEMS OPERATIONAL DESCRIPTION**

- A. Fire-alarm signal initiation shall be by one or more of the following devices:
  - 1. Manual stations.
  - 2. Heat detectors.
  - 3. Flame detectors.
  - 4. Smoke detectors.
  - 5. Duct smoke detectors.
  - 6. Air-sampling smoke-detection system (VESDA).
  - 7. Carbon monoxide detectors.
  - 8. Combustible gas detectors.
  - 9. Automatic sprinkler system water flow.
  - 10. Preaction system.
  - 11. Fire-extinguishing system operation.
  - 12. Fire standpipe system.
  - 13. Dry system pressure flow switch.
  - 14. Fire pump running.
- B. Fire-alarm signal shall initiate the following actions:
  - 1. Continuously operate alarm notification appliances.
  - 2. Identify alarm and specific initiating device at fire-alarm control unit.
  - 3. Transmit an alarm signal to the remote alarm receiving station.
  - 4. Unlock electric door locks in designated egress paths.
  - 5. Release fire and smoke doors held open by magnetic door holders.
  - 6. Activate voice/alarm communication system.
  - 7. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
  - 8. Activate smoke-control system (smoke management) at firefighters' smoke-control system panel.
  - 9. Activate stairwell and elevator-shaft pressurization systems.
  - 10. Close smoke dampers in air ducts of designated air-conditioning duct systems.
  - 11. Activate preaction system.
  - 12. Recall elevators to primary or alternate recall floors.
  - 13. Activate elevator power shunt trip.
  - 14. Activate emergency lighting control.
  - 15. Activate emergency shutoffs for gas and fuel supplies.
  - 16. Record events in the system memory.
  - 17. Record events by the system printer.
  - 18. Indicate device in alarm on the graphic annunciator.
- C. Supervisory signal initiation shall be by one or more of the following devices and actions:
  - 1. Valve supervisory switch.
  - 2. High- or low-air-pressure switch of a dry-pipe or preaction sprinkler system.
  - 3. Alert and Action signals of air-sampling detector system.
  - 4. Elevator shunt-trip supervision.
  - 5. Fire pump running.
  - 6. Fire-pump loss of power.

7. Fire-pump power phase reversal.
  8. Independent fire-detection and -suppression systems.
  9. User disabling of zones or individual devices.
  10. Loss of communication with any panel on the network.
- D. System trouble signal initiation shall be by one or more of the following devices and actions:
1. Open circuits, shorts, and grounds in designated circuits.
  2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
  3. Loss of communication with any addressable sensor, input module, relay, control module, remote annunciator, printer interface, or Ethernet module.
  4. Loss of primary power at fire-alarm control unit.
  5. Ground or a single break in internal circuits of fire-alarm control unit.
  6. Abnormal ac voltage at fire-alarm control unit.
  7. Break in standby battery circuitry.
  8. Failure of battery charging.
  9. Abnormal position of any switch at fire-alarm control unit or annunciator.
  10. Voice signal amplifier failure.
  11. Hose cabinet door open.
- E. System Supervisory Signal Actions:
1. Initiate notification appliances.
  2. Identify specific device initiating the event at fire-alarm control unit.
  3. Record the event on system printer.
  4. After a time delay of 200 seconds, transmit a trouble or supervisory signal to the remote alarm receiving station.
  5. Transmit system status to building management system.
  6. Display system status on graphic annunciator.

### **2.3 FIRE-ALARM CONTROL UNIT**

- A. Manufacturers:
1. FCI
  2. SimplexGrinnell LP.
  3. Notifier
  4. (Owner Selection)
- B. General Requirements for Fire-Alarm Control Unit:
1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864.
    - a. System software and programs shall be held in nonvolatile flash, electrically erasable, programmable, read-only memory, retaining the information through failure of primary and secondary power supplies.
    - b. Include a real-time clock for time annotation of events on the event recorder and printer.
    - c. Provide communication between the FACP and remote circuit interface panels, annunciators, and displays.
    - d. The FACP shall be listed for connection to a central-station signaling system service.

- e. Provide nonvolatile memory for system database, logic, and operating system and event history. The system shall require no manual input to initialize in the event of a complete power down condition. The FACP shall provide a minimum 500-event history log.
  - 2. Addressable Initiation Device Circuits: The FACP shall indicate which communication zones have been silenced and shall provide selective silencing of alarm notification appliance by building communication zone.
  - 3. Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment: The FACP shall be listed for releasing service.
- C. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
- 1. Announcer and Display: Liquid-crystal type, 80 characters, minimum.
  - 2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.
- D. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
- 1. Announcer and Display: Liquid-crystal type, two or three] line(s) of 40 or 80 characters, minimum.
  - 2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.
- E. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:
- 1. Pathway Class Designations: NFPA 72, **Class A or Class B**.
  - 2. Pathway Survivability:**[Level 0 or Level 1]**.
  - 3. Install no more than 256 addressable devices on each signaling-line circuit.
  - 4. Serial Interfaces:
    - a. One dedicated RS 485 port for **central-station or remote station** operation using point ID DACT.
    - b. One RS 485 port for remote annunciators, Ethernet module, or multi-interface module (printer port).
    - c. One **USB** port for PC configuration.
    - d. One RS 232 port for VESDA HLI connection.
    - e. One RS 232 port for voice evacuation interface.
- F. Smoke-Alarm Verification:
- 1. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.
  - 2. Activate an approved "alarm-verification" sequence at fire-alarm control unit and detector.
  - 3. Record events by the system printer.
  - 4. Sound general alarm if the alarm is verified.
  - 5. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.
- G. Notification-Appliance Circuit:

1. Audible appliances shall sound in a three-pulse temporal pattern, as defined in NFPA 72.
2. Where notification appliances provide signals to sleeping areas, the alarm signal shall be a 520-Hz square wave with an intensity 15 dB above the average ambient sound level or 5 dB above the maximum sound level, or at least 75 dBA, whichever is greater, measured at the pillow.
3. Visual alarm appliances shall flash in synchronization where multiple appliances are in the same field of view, as defined in NFPA 72.

**H. Elevator Recall:**

1. Elevator recall shall be initiated only by one of the following alarm-initiating devices:
  - a. Elevator lobby detectors except the lobby detector on the designated floor.
  - b. Smoke detector in elevator machine room.
  - c. Smoke detectors in elevator hoistway.
2. Elevator controller shall be programmed to move the cars to the alternate recall floor if lobby detectors located on the designated recall floors are activated.
3. Water-flow alarm connected to sprinkler in an elevator shaft and elevator machine room shall shut down elevators associated with the location without time delay.
  - a. Water-flow switch associated with the sprinkler in the elevator pit may have a delay to allow elevators to move to the designated floor.

**I. Door Controls:** Door hold-open devices that are controlled by smoke detectors at doors in smoke-barrier walls shall [be] [not be] connected to fire-alarm system.

**J. Remote Smoke-Detector Sensitivity Adjustment:** Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and print out the final adjusted values on system printer.

**K. Transmission to Remote Alarm Receiving Station:** Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

**L. Voice/Alarm Signaling Service:** Central emergency communication system with redundant microphones, preamplifiers, amplifiers, and tone generators provided.

1. Indicate number of alarm channels for automatic, simultaneous transmission of different announcements to different zones or for manual transmission of announcements by use of the central-control microphone. Amplifiers shall comply with UL 1711.
  - a. Allow the application of, and evacuation signal to, indicated number of zones and, at the same time, allow voice paging to the other zones selectively or in any combination.
  - b. Programmable tone and message sequence selection.
  - c. Standard digitally recorded messages for "Evacuation" and "All Clear."
  - d. Generate tones to be sequenced with audio messages of type recommended by NFPA 72 and that are compatible with tone patterns of notification-appliance circuits of fire-alarm control unit.
2. Status Announcer: Indicate the status of various voice/alarm speaker zones and the status of firefighters' two-way telephone communication zones.

3. Preamplifiers, amplifiers, and tone generators shall automatically transfer to backup units, on primary equipment failure.
- M. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also print system reset event, including same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.
- N. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, shall be powered by 24-V dc source.
  1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.
- O. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
  1. Batteries: Sealed lead calcium.
- P. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

## 2.4 MANUAL FIRE-ALARM BOXES

- A. Manufacturers:
  1. SimplexGrinnell LP.
  2. Notifier
  3. Bosch Security Systems
  4. (Owner Selection)
- B. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
  1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral or attached addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
  2. Station Reset: Key- or wrench-operated switch.
  3. Indoor Protective Shield: Factory-fabricated, clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.
  4. Weatherproof Protective Shield: Factory-fabricated, clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

## 2.5 SYSTEM SMOKE DETECTORS

- A. Manufacturers:
  1. SimplexGrinnell LP.

2. System Sensor
3. Bosch Security Systems
4. (Owner Selection)

B. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors shall be four or two wire type.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type, indicating detector has operated.
7. Remote Control: Unless otherwise indicated, detectors shall be digital-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition.
  - a. Rate-of-rise temperature characteristic of combination smoke- and heat-detection units shall be selectable at fire-alarm control unit for 15 or 20 deg per minute.
  - b. Fixed-temperature sensing characteristic of combination smoke- and heat-detection units shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F
  - c. Multiple levels of detection sensitivity for each sensor.
  - d. Sensitivity levels based on time of day.

C. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
  - a. Primary status.
  - b. Device type.
  - c. Present average value.
  - d. Present sensitivity selected.
  - e. Sensor range (normal, dirty, etc.).

D. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
  - a. Primary status.
  - b. Device type.
  - c. Present average value.
  - d. Present sensitivity selected.
  - e. Sensor range (normal, dirty, etc.).

3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector for smoke detection in HVAC system ducts.
4. Each sensor shall have multiple levels of detection sensitivity.
5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
6. Relay Fan Shutdown: Fully programmable relay rated to interrupt fan motor-control circuit.

## **2.6 CARBON MONOXIDE DETECTORS**

- A. General: Carbon monoxide detector listed for connection to fire-alarm system.

1. Mounting: Adapter plate for outlet box mounting.
2. Testable by introducing test carbon monoxide into the sensing cell.
3. Detector shall provide alarm contacts and trouble contacts.
4. Detector shall send trouble alarm when nearing end-of-life, power supply problems, or internal faults.
5. Comply with UL 2075.
6. Locate, mount, and wire according to manufacturer's written instructions.
7. Provide means for addressable connection to fire-alarm system.
8. Test button simulates an alarm condition.

## **2.7 HEAT DETECTORS**

- A. Manufacturers:

1. SimplexGrinnell LP.
2. System Sensor
3. Bosch Security Systems
4. (Owner Selection)

- B. General Requirements for Heat Detectors: Comply with UL 521.

1. Temperature sensors shall test for and communicate the sensitivity range of the device.

- C. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F or a rate of rise that exceeds 15 deg F per minute unless otherwise indicated.

1. Mounting: [Adapter plate for outlet box mounting] [Twist-lock base interchangeable with smoke-detector bases].
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

- D. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190 deg F.

1. Mounting: [Adapter plate for outlet box mounting] [Twist-lock base interchangeable with smoke-detector bases].
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

- E. Continuous Linear Heat-Detector System:

1. Detector Cable: Rated detection temperature 155 deg F. Listed for "regular" service and a standard environment. Cable includes two steel actuator wires twisted together with spring pressure, wrapped with protective tape, and finished with PVC outer sheath. Each actuator wire is insulated with heat-sensitive material that reacts with heat to allow the cable twist pressure to short circuit wires at the location of elevated temperature.
2. Control Unit: Two-zone or multizone unit as indicated. Provide same system power supply, supervision, and alarm features as specified for fire-alarm control unit.
3. Signals to Fire-Alarm Control Unit: Any type of local system trouble shall be reported to fire-alarm control unit as a composite "trouble" signal. Alarms on each detection zone shall be individually reported to central fire-alarm control unit as separately identified zones.
4. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

## **2.8 NOTIFICATION APPLIANCES**

- A. Manufacturers:
  1. SimplexGrinnell LP.
  2. Gentex Corp.
  3. Siemens Industry, Inc.
  4. (Owner Selection)
- B. General Requirements for Notification Appliances: Individually addressed, connected to a signaling-line circuit, equipped for mounting as indicated, and with screw terminals for system connections.
- C. General Requirements for Notification Appliances: Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.
  1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.
- D. Chimes, Low-Level Output: Vibrating type, 75-dBA minimum rated output.
- E. Chimes, High-Level Output: Vibrating type, 81-dBA minimum rated output.
- F. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn, using the coded signal prescribed in UL 464 test protocol.
- G. Visible Notification Appliances: Xenon strobe lights complying with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- high letters on the lens.
  1. Rated Light Output:
    - a. [15] [30] [75] [110] [175] cd.
    - b. 15/30/75/110 cd, selectable in the field.
  2. Mounting: Wall mounted unless otherwise indicated.

3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
4. Flashing shall be in a temporal pattern, synchronized with other units.
5. Strobe Leads: Factory connected to screw terminals.
6. Mounting Faceplate: Factory finished, [red] [white].

H. Voice/Tone Notification Appliances:

1. Comply with UL 1480.
2. Speakers for Voice Notification: Locate speakers for voice notification to provide the intelligibility requirements of the "Notification Appliances" and "Emergency Communications Systems" chapters in NFPA 72.
3. High-Range Units: Rated 2 to 15 W.
4. Low-Range Units: Rated 1 to 2 W.
5. Mounting: Flush.
6. Matching Transformers: Tap range matched to acoustical environment of speaker location.

I. Exit Marking Audible Notification Appliance:

1. Exit marking audible notification appliances shall meet the audibility requirements in NFPA 72.
2. Provide exit marking audible notification appliances at the entrance to all building exits.
3. Provide exit marking audible notification appliances at the entrance to areas of refuge with audible signals distinct from those used for building exit marking.

## **2.9 GRAPHIC ANNUNCIATOR**

- A. Manufacturers:
1. SimplexGrinnell LP
  2. Siemens Industry, Inc.
  3. GE UTC Fire & Security
  4. (Owner Selection)
- B. Graphic Annunciator Panel: Mounted in an aluminum frame with nonglare, minimum 3/16-inch-thick, clear acrylic cover over graphic representation of the facility. Detector locations shall be represented by red LED lamps. Normal system operation shall be indicated by a lighted, green LED. Trouble and supervisory alarms shall be represented by an amber LED.
1. Comply with UL 864.
  2. Operating voltage shall be 24-V dc provided by a local 24-V power supply provided with the annunciator.
  3. Include built-in voltage regulation, reverse polarity protection, RS 232/422 serial communications, and a lamp test switch.
  4. Surface mounted in a NEMA 250, Type 1 cabinet, with key lock and no exposed screws or hinges.
  5. Graphic representation of the facility shall be a CAD drawing and each detector shall be represented by an LED in its actual location. CAD drawing shall be at 1/8-inch per foot scale or larger.
  6. The LED representing a detector shall flash two times per second while detector is an alarm.
- C. Graphic Annunciator Workstation: PC-based, with fire-alarm annunciator software with historical logging, report generation, and a graphic interface showing all alarm points in the system. PC

with operating system software, minimum hard drive, <Insert inches digital display monitor, with wireless keyboard and mouse.

## **2.10 REMOTE ANNUNCIATOR**

- A. Description: Announcer functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.
  - 1. Mounting: [Flush] [Surface] cabinet, NEMA 250, Type 1.
- B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

## **2.11 ADDRESSABLE INTERFACE DEVICE**

- A. General:
  - 1. Include address-setting means on the module.
  - 2. Store an internal identifying code for control panel use to identify the module type.
  - 3. Listed for controlling HVAC fan motor controllers.
- B. Monitor Module: Microelectronic module providing a system address for alarm-initiating devices for wired applications with normally open contacts.
- C. Integral Relay: Capable of providing a direct signal.
  - 1. Allow the control panel to switch the relay contacts on command.
  - 2. Have a minimum of two normally open and two normally closed contacts available for field wiring.
- D. Control Module:
  - 1. Operate notification devices.
  - 2. Operate solenoids for use in sprinkler service.

## **2.12 NETWORK COMMUNICATIONS**

- A. Provide network communications for fire-alarm system according to fire-alarm manufacturer's written requirements.
- B. Provide network communications pathway per manufacturer's written requirements and requirements in NFPA 72 and NFPA 70.
- C. Provide integration gateway using [BACnet] [Modbus] <Insert protocol> for connection to building automation system.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.
  - 1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.
- B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 EQUIPMENT INSTALLATION**

- A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."
  - 1. Devices placed in service before all other trades have completed cleanup shall be replaced.
  - 2. Devices installed but not yet placed in service shall be protected from construction dust, debris, dirt, moisture, and damage according to manufacturer's written storage instructions.
- B. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.
  - 1. Connect new equipment to existing control panel in existing part of the building.
  - 2. Connect new equipment to existing monitoring equipment at the supervising station.
  - 3. Expand, modify, and supplement existing **monitoring** equipment as necessary to extend existing **monitoring** functions to the new points. New components shall be capable of merging with existing configuration without degrading the performance of either system.
- C. Equipment Mounting: Install fire-alarm control unit on finished floor.
  - 1. Comply with requirements for seismic-restraint devices specified in Section 26 0548.16 "Seismic Controls for Electrical Systems."
- D. Install wall-mounted equipment, with tops of cabinets not more than 78 inches above the finished floor.
  - 1. Comply with requirements for seismic-restraint devices specified in Section 26 0548.16 "Seismic Controls for Electrical Systems."
- E. Manual Fire-Alarm Boxes:
  - 1. Install manual fire-alarm box in the normal path of egress within 60 inches of the exit doorway.
  - 2. Mount manual fire-alarm box on a background of a contrasting color.

3. The operable part of manual fire-alarm box shall be between 42 inches and 48 inches above floor level. All devices shall be mounted at the same height unless otherwise indicated.

F. Smoke- or Heat-Detector Spacing:

1. Comply with the "Smoke-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
2. Comply with the "Heat-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for heat-detector spacing.
3. Smooth ceiling spacing shall not exceed 30 feet.
4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Annex A in NFPA 72.
5. HVAC: Locate detectors not closer than 36 inches from air-supply diffuser or return-air opening.
6. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture and not directly above pendant mounted or indirect lighting.

G. Install a cover on each smoke detector that is not placed in service during construction. Cover shall remain in place except during system testing. Remove cover prior to system turnover.

H. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct. Tubes more than 36 inches long shall be supported at both ends.

1. Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to system turnover.

I. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.

J. Remote Status and Alarm Indicators: Install in a visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.

K. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.

L. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling. Install all devices at the same height unless otherwise indicated.

M. Device Location-Indicating Lights: Locate in public space near the device they monitor.

N. Antenna for Radio Alarm Transmitter: Mount to building structure where indicated. Use mounting arrangement and substrate connection that resists 100-mph wind load with a gust factor of 1.3 without damage.

### 3.3 PATHWAYS

- A. Pathways above recessed ceilings and in no accessible locations may be routed exposed.
  1. Exposed pathways located less than 96 inches above the floor shall be installed in EMT.

- B. Pathways shall be installed in EMT.
- C. Exposed EMT shall be painted red enamel.

### **3.4 CONNECTIONS**

- A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section 08 7100 "Door Hardware." Connect hardware and devices to fire-alarm system.
  - 1. Verify that hardware and devices are listed for use with installed fire-alarm system before making connections.
- B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
  - 1. Alarm-initiating connection to smoke-control system (smoke management) at firefighters' smoke-control system panel.
  - 2. Alarm-initiating connection to stairwell and elevator-shaft pressurization systems.
  - 3. Smoke dampers in air ducts of designated HVAC duct systems.
  - 4. Magnetically held-open doors.
  - 5. Electronically locked doors and access gates.
  - 6. Alarm-initiating connection to elevator recall system and components.
  - 7. Alarm-initiating connection to activate emergency lighting control.
  - 8. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
  - 9. Supervisory connections at valve supervisory switches.
  - 10. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
  - 11. Supervisory connections at elevator shunt-trip breaker.
  - 12. Data communication circuits for connection to building management system.
  - 13. Data communication circuits for connection to mass notification system.
  - 14. Supervisory connections at fire-extinguisher locations.
  - 15. Supervisory connections at fire-pump power failure including a dead-phase or phase-reversal condition.
  - 16. Supervisory connections at fire-pump engine control panel.

### **3.5 IDENTIFICATION**

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."
- B. Install framed instructions in a location visible from fire-alarm control unit.

### **3.6 GROUNDING**

- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.
- B. Ground shielded cables at the control panel location only. Insulate shield at device location.

### **3.7 FIELD QUALITY CONTROL**

- A. Field tests shall be witnessed by authorities having jurisdiction and engineer.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
- D. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  1. Visual Inspection: Conduct visual inspection prior to testing.
    - a. Inspection shall be based on completed record Drawings and system documentation that is required by the "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
    - b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
  2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
  3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
  4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
  5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
  6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
- E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
- F. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- G. Prepare test and inspection reports.
- H. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
- I. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

### **3.8 MAINTENANCE SERVICE**

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include preventive maintenance, repair or replacement of worn or defective

components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Include visual inspections according to the "Visual Inspection Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
2. Perform tests in the "Test Methods" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
3. Perform tests per the "Testing Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

### **3.9 SOFTWARE SERVICE AGREEMENT**

- A. Comply with UL 864.
- B. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.
- C. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
  1. Upgrade Notice: At least 30 days to allow Owner to schedule access to system and to upgrade computer equipment if necessary.

### **3.10 DEMONSTRATION**

- A. Train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

**END OF SECTION**