

# Project Manual

Addendum No. 01 to Construction  
Document  
Volume 02



COLLEGE OF  
Osteopathic Medicine  
AT THE CHEROKEE NATION

Tahlequah, Oklahoma

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## **SECTION 21 2200**

### **CLEAN-AGENT FIRE-EXTINGUISHING 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. Piping and piping specialties.
  - 2. Extinguishing-agent containers.
  - 3. Extinguishing agent.
  - 4. Detection and alarm devices.
  - 5. Control and alarm panels.
  - 6. Accessories.
  - 7. Connection devices for and wiring between system components.
  - 8. Connection devices for power and integration into building's fire-alarm system.

##### **1.3 DEFINITIONS**

- A. ATS: Acceptance Testing Specifications.
- B. EPO: Emergency Power Off.

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

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For clean-agent fire-extinguishing system signed and sealed by a qualified professional engineer.
  - 1. Include plans, elevations, sections, details, and attachments to other work.
  - 2. Include design calculations.
  - 3. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 4. Wiring Diagrams: For power, signal, and control wiring.
- C. Delegated-Design Submittal: For clean-agent fire-extinguishing system signed and sealed by the qualified professional engineer.
  - 1. Indicate compliance with performance requirements and design criteria, including

- analysis data.
2. Include design calculations for weight, volume, and concentration of extinguishing agent required for each hazard area.
  3. Indicate the Following on Reflected Ceiling Plans:
    - a. Ceiling penetrations and ceiling-mounted items.
    - b. Extinguishing-agent containers if mounted above floor, piping and discharge nozzles, detectors, and accessories.
    - c. Method of attaching hangers to building structure.
    - d. Other ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, and access panels.
  4. Indicate the Following on Occupied Work Area Plans:
    - a. Controls and alarms.
    - b. Extinguishing-agent containers, piping and discharge nozzles if mounted in space, detectors, and accessories.
    - c. Equipment and furnishings.
  5. Indicate the Following on Access Floor Space Plans:
    - a. Extinguishing-agent containers, piping and discharge nozzles, detectors, and accessories.
    - b. Method of supporting piping.
  6. Indicate the Following on Ceiling Plans:
    - a. Extinguishing-agent containers, piping and discharge nozzles, detectors, and accessories.
    - b. Method of supporting piping.
    - c. Other equipment located in the ceiling space that is being protected including sprinkler piping, HVAC equipment, raceways, or conduit.

## 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. Items Penetrating Finished Ceiling Include the Following:
    - a. Lighting fixtures.
    - b. Air outlets and inlets.
- B. Permit Approved Drawings: Working plans, prepared according to NFPA 2001, that have been approved by authorities having jurisdiction. Include design calculations.
- C. Seismic Qualification Certificates: For extinguishing-agent containers and control panels 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.

D. Field quality-control reports.

## **1.6 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For special agent system 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. Deliver extra materials to Owner.
  1. Detection Devices: Not less than 20 percent of amount of each type installed.
  2. Container Valves: Not less than 10 percent of amount of each size and type installed.
  3. Nozzles: Not less than 20 percent of amount of each type installed.
  4. Extinguishing Agent: Not less than 100 percent of amount installed in largest hazard area. Include pressure-rated containers with valves.

## **1.8 QUALITY ASSURANCE**

- A. 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. FM Global Compliance: Provide components that are FM Approved and that are listed in FM Global's "Approval Guide."
- C. UL Compliance: Provide equipment listed in UL's "Fire Protection Equipment Directory."
- D. Installation in compliance with NFPA 2001 "*Standard on Clean Agent Fire Extinguishing Systems.*"

## **PART 2 - PRODUCTS**

### **2.1 CLEAN-AGENT SYSTEMS**

- A. Fike, Ansul, or equivalent.
- B. Description: Clean-agent fire-extinguishing system shall be an engineered system for total flooding of the hazard area including the room cavity above the ceiling, below the ceiling, and below the raised floor. System includes separate zones above and below the ceiling and beneath the raised floor. If smoke is detected below the raised floor, extinguishing agent shall be discharged in the underfloor zone only. If smoke is detected below the ceiling, extinguishing agent shall be discharged in zones above and below the ceiling and below the floor. If smoke is detected above the ceiling, extinguishing agent shall be discharged in the zone above the

ceiling only.

- C. Delegated Design: Design clean-agent fire-extinguishing system and obtain approval from authorities having jurisdiction. Design system for Class A, B, and C fires as appropriate for areas being protected, and include safety factor. Use clean agent indicated and in concentration suitable for normally occupied areas.
- D. Performance Requirements: Discharge HFC 227ea within 10 seconds and maintain 7.1 percent concentration by volume at 70 deg F (21 deg C) for 10-minute holding time in hazard areas.
  - 1. HFC 227ea concentration in hazard areas greater than 9 percent immediately after discharge or less than 5.8 percent throughout holding time will not be accepted without written authorization from Owner and authorities having jurisdiction.
  - 2. System Capabilities: Minimum 620-psig (4278-kPa) calculated working pressure and 360-psig (2484-kPa) initial charging pressure.
- E. Performance Requirements: Discharge FK-5-1-12 within 10 seconds and maintain 6.6 percent concentration by volume at 70 deg F (21 deg C) for 10-minute holding time in hazard areas.
  - 1. FK-5-1-12 concentration in hazard areas greater than 10.0 percent immediately after discharge or less than 6.5 percent throughout holding time will not be accepted without written authorization from Owner and authorities having jurisdiction.
  - 2. System Capabilities: Minimum 620-psig (4278-kPa) calculated working pressure and 360-psig (2484-kPa) initial charging pressure.
- F. Performance Requirements: Discharge IG-541 within 60 seconds and maintain 38 percent concentration by volume at 70 deg F (21 deg C) for 10-minute holding time in hazard areas.
  - 1. IG-541 concentration in hazard areas greater than 40 percent immediately after discharge or less than 32 percent throughout holding time will not be accepted without written authorization from Owner and authorities having jurisdiction.
  - 2. System Capabilities: Minimum 2175-psig (15-MPa) calculated working pressure upstream from orifice union, minimum 1000-psig (6895-kPa) calculated working pressure downstream from orifice union, and 2175-psig (15-MPa) initial charging pressure.
- G. Verified Detection: Devices located in single zone. Sound alarm on activating single-detection device, and discharge extinguishing agent on actuating second-detection device.
- H. System Operating Sequence: System shall utilize air-sampling detectors reporting to a fully programmable microprocessor-based control panel programmed to operate as follows:
  - 1. Air-Sampling System:
    - a. First Detection Level (Alert): Mild audible and visual indication on annunciator panel. Strobe lights flash slowly in the protected area.
    - b. Second Detection Level (Action): Strong audible and visual indication on annunciator panel. Strobe lights flash rapidly in the protected area.
    - c. Third Detection Level (Fire 1): Strong audible and visual indication on annunciator panel. Energize horn(s), bell(s), and strobe light(s) in the protected area and outside entry doors. Shut down air-conditioning and ventilating systems serving the protected area, and close doors in the protected area. Send signal to fire-alarm system, initiate 30-second time delay for extinguishing-agent discharge, and discharge extinguishing agent. At agent discharge, terminate power to equipment in the protected area.
    - d. Fourth Detection Level (Fire 2): Release interlock to allow water in piping to the sprinkler system.

- I. Manual stations shall immediately discharge extinguishing agent when activated.
- J. Operating abort switches will delay extinguishing-agent discharge while being activated, and switches must be reset to prevent agent discharge. Release of hand pressure on the switch will cause agent discharge if the time delay has expired.
- K. EPO: Will terminate power to protected equipment immediately on actuation.
- L. Low-Agent Pressure Switch: Initiate trouble alarm if sensing less than set pressure.
- M. Power Transfer Switch: Transfer from normal to stand-by power source.
- N. Seismic Performance: Fire-suppression piping and containers 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]."

## 2.2 PIPING MATERIALS

- A. See ["HFC 227ea Agent Piping Applications"] ["IG-541 Agent Piping Applications"] ["FK-5-1-12 Agent Piping Applications"] Article for applications of pipe, tube, fitting, and joining materials.
- B. Piping, Valves, and Discharge Nozzles: Comply with types and standards listed in NFPA 2001, Section "Distribution," for charging pressure of system.

## 2.3 PIPE AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, Type S, Grade B or ASTM A 106/A 106M; Schedule 40, Schedule 80, and Schedule 160, seamless steel pipe.
  - 1. Threaded Fittings:
    - a. Malleable-Iron Fittings: ASME B16.3, Class 300.
    - b. Flanges and Flanged Fittings: ASME B16.5, Class 300 unless Class 600 is indicated.
    - c. Fittings Working Pressure: 620 psig (4278 kPa) minimum.
    - d. Flanged Joints: Class 300 minimum.
  - 2. Forged-Steel Welding Fittings: ASME B16.11, Class 3000, socket pattern.
  - 3. Steel, Grooved-End Fittings: FM Approved and NRTL listed, ASTM A 47/A 47M malleable iron or ASTM A 536 ductile iron, with dimensions matching steel pipe and ends factory grooved according to AWWA C606.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel.

- D. 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.
- E. Steel, Keyed Couplings: UL 213, AWWA C606, approved or listed for clean-agent service, and matching steel-pipe dimensions. Include ASTM A 536, ductile-iron housing, rubber gasket, and steel bolts and nuts.

## 2.4 VALVES

- A. General Valve Requirements:
  - 1. UL listed or FM Approved for use in fire-protection systems.
  - 2. Compatible with type of clean agent used.
- B. Container Valves: With rupture disc or solenoid and manual-release lever, capable of immediate and total agent discharge and suitable for intended flow capacity.
- C. Valves in Sections of Closed Piping and Manifolds: Fabricate to prevent entrapment of liquid or install valve and separate pressure relief device.
- D. Valves in Manifolds: Check valve; installed to prevent loss of extinguishing agent when container is removed from manifold.

## 2.5 EXTINGUISHING-AGENT CONTAINERS

- A. Description: Steel tanks complying with ASME Boiler and Pressure Vessel Code: Section VIII, for unfired pressure vessels. Include minimum working-pressure rating that matches system charging pressure, valve, pressure switch, and pressure gage.
  - 1. Finish: **Manufacturer's standard color**, enamel or epoxy paint.
  - 2. Manifold: Fabricate with valves, pressure switches, and connections for multiple storage containers, as indicated.
  - 3. Manifold: Fabricate with valves, pressure switches, selector switch, and connections for main- and reserve-supply banks of multiple storage containers.
  - 4. Storage-Tank Brackets: Factory- or field-fabricated retaining brackets consisting of steel straps and channels; suitable for container support, maintenance, and tank refilling or replacement.

## 2.6 FIRE-EXTINGUISHING CLEAN AGENT

- A. HFC 227ea Clean Agent: Heptafluoropropane.
- B. FK-5-1-12 Clean Agent: Dodecafluoro-2-methylpentan-3-one.
- C. IG-541 Clean Agent: Mixture of nitrogen, argon, and carbon dioxide inert gases.

## 2.7 DISCHARGE NOZZLES

- A. Equipment manufacturer's standard one-piece brass or aluminum alloy of type, size, discharge pattern, and capacity required for application.



## 2.8 MANIFOLD AND ORIFICE UNIONS

- A. Description: NRTL-listed device with minimum **2175-psig (15-MPa)** pressure rating, to control flow and reduce pressure of IG-541 gas in piping.
  - 1. **NPS 2 (DN 50)** and Smaller: Piping assembly with orifice, sized for system design requirements.
  - 2. **NPS 2-1/2 (DN 65)** and Larger: Piping assembly with nipple, sized for system design requirements.

## 2.9 CONTROL PANELS

- A. Description: FM Approved or NRTL listed, including equipment and features required for testing, supervising, and operating fire-extinguishing system. Controls panels will be listed with all clean agent suppression gases and solenoids.
- B. Power Requirements: 120/240-V ac; with electrical contacts for connection to system components and fire-alarm system, and transformer or rectifier as needed to produce power at voltage required for accessories and alarm devices.
- C. Enclosure: NEMA ICS 6, Type 1, enameled-steel cabinet.
  - 1. Mounting: **Surface.**
- D. Supervised Circuits: Separate circuits for each independent hazard area.
  - 1. Detection circuits equal to the required number of zones, or addressable devices assigned to the required number of zones.
  - 2. Manual pull-station circuit.
  - 3. Alarm circuit.
  - 4. Release circuit.
  - 5. Abort circuit.
  - 6. EPO circuit.
- E. Control-Panel Features:
  - 1. Electrical contacts for shutting down fans, activating dampers, and operating system electrical devices.
  - 2. Automatic switchover to standby power at loss of primary power.
  - 3. Storage container, low-pressure indicator.
  - 4. Service disconnect to interrupt system operation for maintenance with visual status indication on the annunciator panel.
- F. Annunciator Panel: Graphic type showing protected, hazard-area plans, as well as locations of detectors and abort, EPO, and manual stations. Include lamps to indicate device-initiating alarm, electrical contacts for connection to control panel, and stainless-steel or aluminum enclosure.
- G. Standby Power: Sealed lead calcium batteries with capacity to operate system for 24 hours and alarm for minimum of 15 minutes. Include automatic battery charger that has a varying charging rate between trickle and high depending on battery voltage, and that is capable of maintaining batteries fully charged. Include manual voltage control, dc voltmeter, dc ammeter, electrical contacts for connection to control panel, automatic transfer switch, and suitable enclosure.

## **2.10 DETECTION DEVICES**

- A. General Requirements for Detection Devices:
  - 1. Comply with NFPA 2001, NFPA 72, and UL 268.
  - 2. 24-V dc, nominal.
- B. Ionization Detectors: Dual-chamber type, having sampling and referencing chambers, with smoke-sensing element.
- C. Photoelectric Detectors: LED light source and silicon photodiode receiving element.
- D. Remote Air-Sampling Detector System: Includes air-sampling pipe network, a laser-based photoelectric detector, a sample transport fan, and a control unit.
  - 1. Pipe Network: CPVC tubing connects control unit with calibrated sampling holes.
  - 2. Smoke Detector: Particle-counting type with continuous laser beam. Sensitivity adjustable to a minimum of four preset values.
  - 3. Sample Transport Fan: Centrifugal type, creating a minimum static pressure of 0.05-inch wg (12.5 Pa) at all sampling ports.
  - 4. Control Unit: Multizone unit as indicated on Drawings. Provides same system power supply, supervision, and alarm features as specified for the control panel plus separate trouble indication for airflow and detector problems.
- E. Signals to the Central Fire Alarm Control Panel: Any type of local system trouble is reported to the central fire alarm control panel as a composite "trouble" signal. Alarms on each system zone are individually reported to the central fire alarm control panel as separately identified zones.

## **2.11 MANUAL STATIONS**

- A. General Description: Surface FM Approved or NRTL listed, with clear plastic hinged cover, 120-V ac or low voltage compatible with controls. Include contacts for connection to control panel.
- B. Manual Release: "MANUAL RELEASE" caption, and red finish. Unit can manually discharge extinguishing agent with operating device that remains engaged until unlocked.
- C. Abort Switch: "ABORT" caption, momentary contact, with green finish.
- D. EPO Switch: "EPO" caption, with yellow finish.

## **2.12 SWITCHES**

- A. Description: FM Approved or NRTL listed, where available, 120-Vac or low voltage compatible with controls. Include contacts for connection to control panel.
  - 1. Low-Agent Pressure Switches: Pneumatic operation.
  - 2. Power Transfer Switches: Key-operation selector, for transfer of release circuit signal from main supply to reserve supply.
  - 3. Door Closers: Magnetic retaining and release device or electrical interlock to cause the door operator to drive the door closed.

## **2.13 ALARM DEVICES**

- A. Description: Listed and labeled by an NRTL or FM Approved, low voltage, and surface mounting. Comply with requirements in Section 28 3111 "Digital, Addressable Fire-Alarm System" or Section 28 3112 "Zoned (DC Loop) Fire-Alarm System" for alarm and monitoring devices.
- B. Bells: Minimum 6-inch (150-mm) diameter.
- C. Horns: 90 to 94 dBA.
- D. Strobe Lights: Translucent lens, with "FIRE" or similar caption.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine areas and conditions, with Installer present, for compliance with hazard-area leakage requirements, installation tolerances, and other conditions affecting work performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 HFC 227ea AGENT PIPING APPLICATIONS**

- A. Flanged pipe and fittings and flanged joints may be used to connect to specialties and accessories and where required for maintenance.
- B. NPS 2 (DN 50) and Smaller: Schedule 40, steel pipe; malleable-iron threaded fittings; and threaded joints.
- C. NPS 2-1/2 (DN 65) and Larger: Schedule 40, steel pipe; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.

### **3.3 IG-541 AGENT PIPING APPLICATIONS**

- A. Piping between Storage Containers and Orifice Union: Schedule 80, steel pipe; forged-steel welding fittings; and welded joints, malleable-iron fittings with threaded or flanged joints.
- B. Piping Downstream from Orifice Union: Schedule 40, steel pipe; forged-steel welding fittings; and welded joints, malleable-iron fittings with threaded or flanged joints.

### **3.4 FK-5-1-12 AGENT PIPING APPLICATIONS**

- A. Flanged pipe and fittings and flanged joints may be used to connect to specialties and accessories and where required for maintenance.
- B. NPS 2 (DN 50) and Smaller: Schedule 40, steel pipe; malleable-iron threaded fittings; and threaded joints.

- C. NPS 2-1/2 (DN 65) and Larger: Schedule 40, steel pipe; forged-steel welding fittings; and welded joint steel, grooved-end fittings; steel, keyed couplings; and grooved joints.

### **3.5 CLEAN-AGENT PIPING INSTALLATION**

- A. Install clean-agent extinguishing piping and other components level and plumb, according to manufacturers' written instructions.
- B. Grooved Piping Joints: Groove pipe ends according to AWWA C606 dimensions. Assemble grooved-end steel pipe and steel, grooved-end fittings with steel, keyed couplings and lubricant according to manufacturer's written instructions.
- C. Install extinguishing-agent containers anchored to substrate.
- D. Install pipe and fittings, valves, and discharge nozzles according to requirements listed in NFPA 2001, Section "Distribution."
  - 1. Install valves designed to prevent entrapment of liquid or install pressure relief devices in valved sections of piping systems.
  - 2. Support piping using supports and methods according to NFPA 13.
  - 3. Install seismic restraints for extinguishing-agent containers and piping systems.
  - 4. Install control panels, detection system components, alarms, and accessories, complying with requirements of NFPA 2001, Section "Detection, Actuation, and Control Systems," as required for supervised system application.

### **3.6 CONNECTIONS**

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to equipment, allow space for service and maintenance.
- C. Connect electrical devices to control panel and to building's fire-alarm system. Electrical power, wiring, and devices are specified in Section 28 3111 "Digital, Addressable Fire-Alarm System" or Section 28 3112 "Zoned (DC Loop) Fire-Alarm System."

### **3.7 IDENTIFICATION**

- A. Identify system components and equipment. Comply with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."
- B. Identify piping, extinguishing-agent containers, other equipment, and panels according to NFPA 2001.
- C. Install signs at entry doors for protected areas to warn occupants that they are entering a room protected with a clean-agent fire-extinguishing system.
- D. Install signs at entry doors to advise persons outside the room the meaning of the horn(s), bell(s), and strobe light(s) outside the protected space.

### **3.8 FIELD QUALITY CONTROL**

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- 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 tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Tests and Inspections:
  - 1. After installing clean-agent extinguishing piping system and after electrical circuitry has been energized, test for compliance with requirements.
  - 2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Sections "Inspection and Test Procedures" and "System Function Tests." Certify compliance with test parameters.
  - 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. Remove malfunctioning units, replace with new units, and retest.
  - 5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Units will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports.

### **3.9 CLEANING**

- A. Each pipe section shall be cleaned internally after preparation and before assembly by means of swabbing, using a suitable nonflammable cleaner. Pipe network shall be free of particulate matter and oil residue before installing nozzles or discharge devices.

### **3.10 SYSTEM FILLING**

- A. Preparation:
  - 1. Verify that piping system installation is completed and cleaned.
  - 2. Check for complete enclosure integrity.
  - 3. Check operation of ventilation and exhaust systems.
- B. Filling Procedures:
  - 1. Fill extinguishing-agent containers with extinguishing agent and pressurize to indicated charging pressure.
  - 2. Install filled extinguishing-agent containers.
  - 3. Energize circuits.

4. Adjust operating controls.

### **3.11 DEMONSTRATION**

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

**END OF SECTION**

**SECTION 27 9000**  
**DISTRIBUTION ANTENNA SYSTEM**

**PART 1 – GENERAL**

**1.1 SECTION INCLUDES:**

- A. Drawings and general provisions of the contract, including general and supplemental conditions apply to this section.
- B. All materials, equipment, transportation, and labor necessary to achieve a complete and functional system.
- C. The work of this section also includes:
  - 1. Required licenses, insurance, and permits including payment of charges and fees.
  - 2. Verification of dimensions and conditions at the job site.
  - 3. Preparation of submittal information.
  - 4. Pick-up of owner furnished equipment and incorporation into project.
  - 5. Development and implementation of DAS equipment and rack layouts, which will become the property of the owner.
  - 6. Installation in accordance with the contract document, manufacturer's recommendation, and in conformity with applicable codes and authority having jurisdiction.
  - 7. Extension of electrical service, including ground, to equipment locations, if required.
  - 8. Initial tests and adjustments, written report and documentation.
  - 9. Instruction of operating personnel.
  - 10. Provision of manuals.
  - 11. Maintenance services and warranty.

**1.2 RESPONSIBILITY**

- A. Supply accessories and minor equipment items needed for a complete system, even if not specifically mentioned in the specifications or on the associated drawings, without claims for additional payments.
- B. Notwithstanding any detailed information in the Contract Documents, it is the responsibility of the Contractor to supply the DAS system in full working order. Notify the

architect of any discrepancies in part numbers or quantities before bid. Failing to provide such notification, supply items, and quantities according to the intent of the specifications and drawings, without claim for additional payment.

- C. Execute all work in accordance with the National Electrical Code, the National Electrical Safety Code, the Occupational Safety and Health Act and all applicable State and Local Codes, ordinances, and regulations. If a conflict develops between the contract document and the appropriate codes and is reported to the Architect prior to bid opening, the Architect will prepare the necessary clarification. Where a conflict is reported after contract award, propose a resolution of the conflict and, upon approval, perform work.

### **1.3 RELATED WORK SPECIFIED ELSEWHERE**

- A. Access Points
- B. Voice/data locations
- C. Card Readers
- D. Electrical Work, conduit, floor boxes, wall boxes, pull boxes, junction boxes, AC power circuits, and grounding wiring
- E. Digital Signage

### **1.4 REFERENCES**

- A. Published specification standards, tests or recommended methods of trade, industry or government organizations apply to work in this section where cited below:
  - 1. American National Safety Institute (ANSI)
  - 2. American Society of Testing and Materials (ASTM)
  - 3. Electronics Industries Association (EIA)
  - 4. Federal Communications Commission (FCC)
  - 5. National Electrical Manufacturer's Association (NEMA)
  - 6. National Electric Code (NEC)
  - 7. Underwriters Laboratories (UL)
  - 8. Occupational Safety and Health Administration (OSHA)
  - 9. Building Industry Consulting Service International (BICSI)
  - 10. Tribal Employment Rights Ordinance (TERO) does not apply to this project

### **1.5 DESCRIPTIONS AND REQUIREMENTS**



- a. The DAS system shall provide total coverage for the Cherokee Health Facility including administrative offices and loading dock.
- b. The DAS system shall be carrier format neutral and support every cellular carrier, independent of wireless frequencies and format used.
- c. The DAS system and all its subsystems shall be designed to operate twentyfour (24) hours a day 365 days a year
- d. Must be compatible with current (EVDO/EVDV/LTE/4G and UMTS) and new technologies, (for example 5G) as well as current re-banding efforts
- e. Must not interfere with the CHEROKEE NATION 's local life safety (Police and Fire) frequencies - (800M Hz and 700MHz).
- f. Must be maintained as technologies evolve and be able to expand the DAS system to accommodate additional interested carriers at later intervals.
- g. Design must use (host-based) or (distributed) modular architecture
- h. Prior to any installation, all antenna mounting locations are to be approved

#### **1.5a Signal Coverage and Reliability**

- a. Active Signal Handling: The DAS system will have active (powered) elements that filter and amplify signals to consistently deliver wireless services at the appropriate power levels. The solution will support all requested services to ensure that each service (or carrier) has the ability to adjust and control power levels without disturbing other services.
- b. RF Signal Coverage: At a minimum, for cellular and PCS coverage, the system must deliver signal strength of -85 dBm to -89 dBm (3 Bars) to 95% of the facility.
- c. Fiber Optic Transport: The DAS system may utilize fiber optics to distribute signals within the vertical risers.
- d. Broadband Distribution: The DAS will use Cat6 or coax cable in the horizontal runs to remote antenna units or directly to passive broadband antennas in the distribution area
- e. Coverage Selectability: The DAS system will use a point-to-multipoint distribution architecture to provide different services and power levels across the facility.
- f. Centralized Power: The DAS architecture will support either remote, centralized power or uninterrupted power supplies (UPS).

SNMP Integration: The DAS shall be SNMP compliant.

- a. Centralized Management System: In the absence of an SNMP-based NMS system, the DAS must provide a centralized management system that provides a system-wide view of the in-building deployment.
- b. End-to-End Visibility: The DAS management system will provide end-to-end status information from the BDA/BTS to the remote-end including the antennas.

## 1.6 SUBMITTALS

- A. Provide submittals in the quantities specified in the General requirements
- B. Provide the following in one submission for approval within 30 days of issuance of Notice to Proceed and prior to commencement of work:
- C. Provide an equipment list and manufacturers data sheet on products to be incorporated within the work specifications order. Submit bound originals of:
  - 1. Manufacturers product technical data for each product in sufficient detail to facilitate proper evaluation of the suitability of the products for incorporation within the work
  - 2. Each submittal shall include a unique number and be numbered in consecutive order
  - 3. Provide a complete table of contents with the project title and number, submittal number, date of submission, referenced addendum or change order number as applicable.
  - 4. Where a data-sheet shows more than one product, indicate the model being proposed with an arrow or another appropriate symbol.
  - 5. Bind the submittal in titled three-ring D binders sized for 150 percent of the material. Maximize size, three-inch spine. Use multiple volumes as required. Separate major groupings with label binder tabs.
- D. Shop Drawings
  - 1. Schematic: Detailed wiring diagrams showing the interconnection of components and products, wiring and cabling diagrams depicting cable types and designators and device designators. Provide connector designations and terminal strip identification along with color codes for cables connecting to these devices. Give each component a unique designator and use this designator consistently throughout the project.
  - 2. Equipment: Location of equipment in racks, in ceilings or on walls, with dimensions, wire routing, and cabling within housings, AC power outlets (if applicable) and terminal strip locations.

3. Full fabrication details of any custom enclosures and millwork indicating size, material, finish and openings for equipment.
4. Antenna mounting details, include hardware types and load capacity.
5. Fabricated mounting plates to include dimensioned locations of components, component types, plate material and color and bill of material.
6. Drawings executed at an appropriate scale, but not smaller than 1/8 inch = 1' foot.
7. Label equipment and use cabling labeling scheme. Include font sizes and styles, explanation of scheme and designator schedule.
8. Consultant's project documents in electronic format cannot be supplied to the contractor for their use as part of the submittals. Discuss with owner.
9. Contractor to provide wiring schedule showing source and destination of wiring and indicating which wiring is in conduit.
10. Contractor is to provide any other pertinent data which is necessary for a complete system.

**E. Contract Close-Out Submittals**

1. Submit four bound originals of the following Project Record Manual information after substantial completion but prior to final inspection.
2. This will include manufacturer's data sheets for each type of product by manufacturer and model or part number unless specified otherwise herein.
3. Supply manufacturer's serial numbers for each product
4. For custom modifications, a description of the purpose, capabilities, and operation on each item.
5. Manufacturer's maintenance and care instructions.
6. Separately bind list by manufacturer and model number of part number of products incorporated with the work, arranged in alphanumeric order. When applicable, bind manufacturer's warranty statements separately.
7. Record Drawings: Final rendition of shop drawings depicting what is incorporated within the work. Drawings are to be executed at an appropriate scale, but not smaller than 1/8 inch = 1'.
8. Test Reports: Recorded findings of Commissioning
9. System Operations and Instructions: Prepare a complete and typical procedure for the operation of the equipment as a system, organized by subsystem or activity, describe the operation of system capabilities, assume the intended reader of the manual to be technically inexperienced and unfamiliar with this facility/operation.

10. Maintenance Instructions: Include maintenance phone number(s) and hours, maintenance schedule, description of products recommended or provided for maintenance purposes, and instructions for the proper use of these products.
11. Contractor is to provide any other pertinent data which is necessary for a complete system.
12. Segregate documents into separate binders
13. Bind project record manual is titled three-ring D style binders.
14. Regarding re-submission requirements, make any requested corrections or changes in submittals required. Resubmit for review until no exceptions are taken. Indicate any changes that have been made other than those requested.

## **1.7 QUALITY ASSURANCE**

- A. Qualifications: Firm experienced in the provision of systems similar in complexity to those required for this specific project must meet the following: No less than three years' experience in equipment and systems of the specified types, experience with at least three comparable scale projects within the last two years, be a fully franchised dealer and service facility for the manufacturer's products furnished, maintain a fully staffed and equipped service facility with full-time field technicians, have at least one supervisory employee having completed and certified (where applicable) and proof is to be supplied as a submittal item. At the request of the owner, demonstrate that adequate plant and equipment are available to complete the work and adequate staff with commensurate experience and technical expertise is available.
- B. Work: Perform work in compliance with the applicable standards listed herein and governing codes and regulations of the authorities having jurisdiction and the Contract documents. Drawings and specification requirements govern where they exceed Code and Regulation requirements. Where requirements between governing Codes and Regulations vary, the more restrictive provision applies. Nothing in the Contract documents grants authority or permission to disregard or violate any legal requirements.
- C. Coordinate exact location and installation of equipment, power, grounding and raceway requirements with the Architect.

## **1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Ship products in its original container to prevent damaging or entrance of foreign matter.
- B. Handling and shipping in accordance with manufacturer's recommendation.
- C. Provide protective covering during construction to prevent damaging or entrance of foreign matter
- D. Replace at no expense to owner, products damaged during storage, handling or the course of construction.

## **1.9 PROJECT CONDITIONS**

- A. Verify conditions on the job site applicable to this work. Notify Architect in writing of discrepancies, conflicts or omissions promptly upon discovery.
- B. The drawings diagrammatically show cabling and arrangements of equipment fitting the space available without interference. If conditions exist which make it impossible to install work as shown, recommend solutions and/or submit drawings to the Architect for approval, showing how the work should be installed.

## **1.10 WARRANTY**

- A. Warrant labor and products for one year following the date of substantial completion to be free of defects and deficiencies and to conform to the drawings and specifications as to kind, quality, function and characteristics. Repair or replace defects occurring in labor or products within the warranty period without charge.
- B. This warranty is in addition to any specific warranties issued by the manufacturers for greater periods of time.
- C. Within the warranty period, answer service calls within eight (8) hours and correct the deficiency within forty-eight (48) hours.
- D. Provide owner with the name and telephone number of the person to call for service. This information is to be a part of the project record drawings.
- E. Thirty days prior to the end of the warranty period, provide a complete checkout of all system components. Repair or replace any defective equipment discovered during the testing. Correct any defects in writing or other functional problems reported to the owner. Warranty replacement and service of equipment shall not apply to owner furnished equipment (OFE). Coordinate inspection visits with the owner.

## **PART 2 – PRODUCTS**

### **2.1 ACCEPTABLE MANUFACTURERS**

- A. Model numbers and manufacturers included in this specification are listed as a standard of function, performance, and quality.
- B. Refer to General and Supplementary Conditions and Division I Specifications Section for equipment substitution procedure.

### **2.2 GENERAL**

- A. Products quantity is as required. If a quantity is given, provide at least the given amount.
- B. Products shall be new, free from defects and listed by UL when applicable UL standards exist. Provide products of a given type from one manufacturer.

- C. Regardless of the length or completeness of the descriptive paragraph herein, provide products complying with the specified manufacturer's published specifications.
- D. Take care during installation to prevent scratches, dents, chips, etc.

### **2.3 MANUFACTURER AND PRODUCTS**

- A. If a specified product has been discontinued by a manufacturer, provide the replacement model (as certified by the manufacturer) at no additional charge to the owner.
- B. Provide manufacturer's latest offerings assuming the products are not in alpha or beta testing and fully available to the general marketplace.

### **2.4 Constructions Standards**

All construction Standards shall be followed. An extensive approval process is required prior to any installations. The selected contractor is responsible for all permits, licenses, certificates, TERO (if applicable) and authorizations for construction activities. Construction activity may be dictated by other trades completing the facility.

### **2.5 Codes**

#### **2.2.1 Mandatory Code Compliance:**

National Electric Safety Code (National Bureau of Standards)  
National Electrical Code (National Bureau of Fire Underwriters)  
Applicable FCC and other applicable federal, state and local regulations and ordinances.

The installation, operation or maintenance of the system shall not endanger or interfere with the safety of persons or property located at the facility.

### **2.6 Macro/Micro Sites/Pico**

2.3.1 A good design will minimize the equipment that would be placed or mounted internally on building structures and in any publicly visible location.

#### **2.6.1 Demarcation**

**2.6.2** The contractor will establish a clearly labeled point of demarcation at each site.

**2.6.3** The contractor's technicians will provide fiber optic cable to extend from the host DEMARC to head-end or distributed equipment.

### **2.7 Fixtures**

2.7.1 Fixtures will not be placed in locations that will interfere with gas, electric, steam, fixtures, water other fixtures the owner deems as having priority.

2.7.2 Aesthetics - use of stealth antennas and antennas that blend into the building architecture is highly recommended.

2.7.3 Indoor antennas shall be low profile, flush-mount types suitable for suspended ceilings or walls and shall be of a multi-band configuration. It is acceptable to surface mount antennas in an open ceiling environment and to install surface mount antennas to walls, near ceiling height.

2.7.4 Prior to any installation, all antenna mounting locations are to be approved by the owner.

## **2.8 Access**

2.8.1 The selected contractor will be dependent on the owner for facility access. The owner maintains will coordinate as required.

## **2.9 Renovations**

2.9.1 When the owner undertakes building improvements which affect the DAS, the owner may direct the contractor to remove or relocate its wires, conduits, cables and other property located in the facility.

## **2.10 IMPLEMENTATION & PROJECT PLAN**

2.11 The Contractor will coordinate all activity and hardware installation that affects the use of fiber, conduit, and cable tray with the owner.

2.12 Implementation & Project plans must include:

Timeline to include:

Planning, installation, testing and other major milestones associated with the project

Milestones at which the owner must be engaged to provide support, the type of support required, the length of time estimated will be required of the owner resources.

Project plan to include:

- i) Design drawings
- ii) Additional surveys to develop the design must be obtained at Contractors expense.
- iii) Contractor will provide layout of the network design

Should such final design, in the owner's judgment, deviate from the bid in a manner that constitutes any hardship for the owner, the owner reserves the right to terminate without cost or cause any contract resulting from this procurement.

Installation acceptance:

The DAS system will be approved and accepted by the owner within one week of Contractor's notification for completion.

Final 'as-built' drawings are to be submitted to the owner within one (1) week of completion and acceptance.

## **2.13 CABLING**

See cable types on drawings

## **2.14 EQUIPMENT RACK**

- A. Equipment Housing
  - 1. Fully welded construction, open sides
  - 2. 14-gauge steel tops and bottoms
  - 3. EIA/TIA frame
  - 4. Drilled and tapped mounting rails
  - 5. Black powder coat finish
  - 6. Acceptable Product
    - a. Middle Atlantic or equivalent

## **2.15 OTHER ITEMS**

Color coordinate Antennas—If visible, paint according to architect interior designs scheme and ensure warranty is not impacted.

# **PART 3 - EXECUTION**

## **3.1 GENERAL**

- A. Coordinate incorporation of the work specified herein with another project work so as to facilitate a cohesive final product.
- B. The installation recommendations contained within ASDI and Telecommunications Distribution Methods Manual are mandatory minimum standards and requirements.
- C. Mount equipment and enclosures plumb and level.



- D. Permanently installed equipment to be firmly and safely held in place. Design equipment supports to support loads imposed with a safety factor of at least five. Seismic bracing shall be installed on appropriate equipment where local codes require such installation.
- E. Verify all locations of equipment in all rooms with owner's representative, the owner, and consultant.

### **3.2 INSTALLATION**

- A. Install all equipment and systems according to manufacturer's specifications
- B. Ensure contractor complies with all state and local building codes and ordinances

### **3.3 LABELING OF EQUIPMENT**

- A. Provide each terminal strip with a unique descriptor and a numerical designator for each terminal. Show terminal strip descriptor and designator on system schematic drawings.
- B. Provide logical and legible cable and wiring label permanently affixed for easy identification

### **3.4 ENGRAVING**

- A. Text font: 1/8-inch block sans serif characters unless noted otherwise
- B. On dark material, provide white characters, on stainless steel or brushed natural aluminum plates, or light-colored materials, provide black characters.
- C. Provide at least two lines of text with first-line listing the general device name, e.g. amplifier. The second line is to include schematic reference of the device, e.g. AMP-1.
- D. Equipment label: black and white characters except where indicated.

### **3.5 COMMISSIONING**

- A. Ensure the following prior to energizing or testing the system:
- B. All products are installed in proper and safe manner according to manufacturer's instructions.
- C. Shrink tubing are present where required.
- D. Dust, debris, solder splatter, etc. is removed.
- E. Cable is dressed, routed, and labeled; connections are consistent with regard to polarity.
- F. Labeling has been provided.
- G. Temporary facilities and utilities have been properly disconnected, removed and disposed of off-site.

- H. Products are neat, clean and unmarred and parts securely attached.
- I. Broken work, including glass, raised flooring and supports, ceiling tiles and supports walls, doors, etc. have been placed or properly repaired, and debris cleaned up and discarded.
- J. Electronic devices are properly grounded.
- K. Test each AC power receptacle with a circuit checker for proper hot, neutral and ground connections.
- L. Measure and record the DC resistance between the technical ground in any equipment rack or console and the main building ground. Resistance should be 0.15 ohms or less.

### **3.6 FINAL INSPECTION AND TESTING**

- A. Upon completion of installation, final inspection and test will be observed by the owner no earlier than two weeks after receipt of the written results.
- B. Provide a minimum of (1) person for inspection and (1) person for testing familiar with aspects of the system to assist the owner.
- C. The process of testing the system may necessitate moving and adjusting certain components.
- D. Testing includes operation of each major system and any other components deemed necessary. Perform tests and provide required test equipment, tools, and material required to make any necessary repairs, corrections and/or adjustments.

### **3.7 TESTING**

- A. Thirty days prior to start of testing, provide a list to the owner of test equipment make, model, numbers and calibration dates that will be used.
- B. The following equipment and systems shall be available on-site for the entire test period through final system testing:
  - 1. Power
  - 2. Spectrum
  - 3. Thermal Imaging
  - 4. RF
  - 5. Terminations
  - 6. Interference
  - 7. Optimal antenna placement verification
  - 8. Mobile Apps
  - 9. OTDR

10. Cell/Advisor Base Station Analyzer
11. T-BERD MTS-2000 or equal
12. Smart Class Fiber with P-5000 Microscope
13. Certifier 40G or equal

### **3.8 INSTRUCTION OF OWNER PERSONNEL**

- A. Provide 2 hours instruction to owner designated personnel focusing on the use, operation and maintenance of the systems, scheduled as a minimum of two separate sessions, by an instructor fully knowledgeable and qualified in system operation. The system Reference Manuals should be complete and on-site at the time of this instruction. Coordinate schedule of demonstration with owner's representative.

### **3.8 CLEANUP AND REPAIR**

- A. Upon completion of the work, remove refuse and rubbish from and about the premises. Leave areas and equipment clean and in an operational state. Repair any damage caused to the premises by the installation of systems at no cost to the owner.

**END OF DOCUMENT**

17-13 OSU, College of Osteopathic Medicine at  
Cherokee Nation  
Childers Architect  
08-23-19

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DISTRIBUTION ANTENNA  
SYSTEM