



July 16, 2024

To: Plan Holders for SLN Terminal Expansion  
Salina Regional Airport  
Salina, KS  
AIP Project Number 2-20-0072-054/055-2024

Transmitted herewith Addendum No.2 to the Issued for Bid Contract Documents, Specifications and Plans dated July 2, 2024 for improvements to the Salina Regional Airport.

**Schedule I – Preliminary Measures**

**Schedule II – New Hold Room and TSA Screening Construction**

**Schedule III- New TSA Screening Set up; Remove Glass Partitions; Set up Temporary Bag Screening Area in Passenger Screening Area**

**Schedule IV- New Bag Screening/Makeup Area**

**Schedule V- Generator Installation**

**Schedule VI- Front Entry Canopy and Front Roadway Redevelopment**

Sincerely,

**Woolpert, Inc.**

Adam Acree  
Project Manager



**ADDENDUM NO. 2**  
**TO**  
**CONTRACT DOCUMENTS, TECHNICAL SPECIFICATIONS, AND**  
**PLANS**  
**FOR IMPROVEMENTS TO THE**  
**SALINA REGIONAL AIRPORT**  
**SALINA, KS**  
**AIP PROJECT NUMBER 2-20-0072-054/055-2024**

To All Bidders: You are requested to make all changes and/or additions contained in this addendum to the Bidding Documents. Failure to acknowledge this Addendum in Proposal shall result in rejection of bid. Bidders are informed that the above referenced Contract Documents, Technical Specifications, and Plans are modified as follows as of July 16, 2024:

**SPECIFICATIONS**

**ADDED :**The following Specification sections are being added per Addendum #2.

**Section: 26 32 00 Standby Generator**

**Justification:** For clarification

**Section: 26 36 23 Automatic Transfer Switch**

**Justification:** For clarification

**Section: 28 31 00 Fire Alarm Systems**

**Justification:** For clarification

Questions will be accepted via written email format to Woolpert Inc, ([Adam.Acree@woolpert.com](mailto:Adam.Acree@woolpert.com)) or on Quest CDN to until Friday, July 19, 2024.

## **SECTION 26 32 00- STANDBY GENERATOR**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This section includes furnishing and installing an engine-generator unit complete with engine and generator controls and all necessary accessories for an electric plant to provide standby electric power. Accessories required or recommended by unit manufacturer for satisfactory operation in this application, but not specifically described herein, shall be included as a part of the unit.
- B. Provide an automatic transfer switch as specified in SECTION “Automatic Transfer Switch”.

#### **1.2 SUBMITTALS**

- A. Shop Drawings: Provide the following information.
  - 1. Dimensioned outline plan and elevation drawings of engine-generator set and other components specified. Show required clearances. Indicate weights with and without fuel.
  - 2. Manufacturer’s name and catalog cuts listing type, model number, catalog number, performance data, efficiency, volts, amperes, kilowatts, and other pertinent data.
  - 3. Provide manufacturer’s installation instructions. Provide installation details including method of assembly, components, and locations and sizes of each field connection.
  - 4. One line diagrams and control schematics, which show equipment arrangement and functional operation.
  - 5. Data on features, components, accessories ratings, and performance.
  - 6. Thermal damage curve for generator.
  - 7. Time-current characteristic curves for generator protective device.
  - 8. Manufacturer’s installation instructions.
  - 9. Data and ratings of muffler.
  - 10. Fuel tank: construction, dimensions, UL ratings and accessories. Provide calculations indicating run time based on fuel tank size.
  - 11. Outdoor enclosure, including wind rating, and materials of construction.
  - 12. Sound attenuation enclosure data.
- B. Operation and Maintenance Manuals: In addition to items specified in Division 1 SECTION “Operation and Maintenance Data”, include the following:
  - 1. Provide manufacturers standard Operations and Maintenance manuals.
  - 2. List of tools and replacement items recommended being stored at the Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.
  - 3. Start up service report.

#### **1.3 QUALITY ASSURANCE**

- A. Service Center: Maintain, within 200 miles of Project site, a factory authorized service center capable of providing training, parts, and emergency maintenance repairs.
- B. Engine Exhaust Emissions: Comply with applicable state and local government requirements.
- C. Noise Emission: Comply with applicable state and local government requirements.

#### 1.4 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Fuses: One for every 10 of each type and rating, but not less than one of each.
  - 2. Indicator Lamps: Two for every six of each incandescent lamp type used, but not less than two of each.
  - 3. Filters: One set each of lubricating oil, fuel, and combustion-air filters.
  - 4. Fuel: Provide one full tank of fuel.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by one of the following (no substitutions):
  - 1. Cummins / Onan
  - 2. Kohler
  - 3. Generac
  - 4. Caterpillar

#### 2.2 RATINGS

- A. Generator set ratings shall be factory published ratings for at least one year previous to the date of bid. Ratings indicated are minimum ratings at the specified service conditions. The unit furnished shall be capable of starting all loads as indicated on the contract documents, plus any spare capacity indicated, plus equal or exceed ratings indicated. Provide the nominal ratings as indicated, with capacity as required to operate as a unit as evidenced by records of prototype testing.
  - 1. The unit shall have a continuous standby rating of not less than the size indicated on the drawings at 0.8 pf at the site elevation.
  - 2. Generator voltage shall be 120/208-volt, 3-phase, 4-wire, 60 Hz.

#### 2.3 SERVICE CONDITIONS

- A. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
  - 1. Ambient Temperature: Minus 16 to plus 110 deg F.
  - 2. Altitude: 1,200 feet.

#### 2.4 NAMEPLATES

- A. Each major system component shall be equipped with a nameplate to identify manufacturer's name and address, and model and serial number of component.

#### 2.5 MOUNTING FRAME

- A. Provide a mounting frame that has adequate strength and rigidity to maintain alignment of mounted components without depending on concrete foundation. Mounting frame shall be free from sharp edges and corners and shall have lifting attachments arranged for lifting with slings without damaging components.

## 2.6 GENERATOR-SET PERFORMANCE

- A. **Steady-State Voltage Stability:** Voltage regulation shall be within plus or minus 2 percent of rated voltage, from no load to full rated load. Stable or steady state operation is defined as operation with terminal voltage remaining constant within plus or minus 1 percent of rated voltage. Provide a minimum of plus or minus 5 percent voltage adjustment from rated value. Temperature rise shall be within NEMA MG1-22.40 definition.
- B. **Steady-State Frequency Stability:** Frequency regulation shall not exceed plus or minus 2 percent of rated frequency, from no load to rated load. When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
- C. **Output Waveform:** At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for any single harmonic.
- D. **Transient Performance:**
  - 1. **Voltage Dip:** The instantaneous voltage dip shall be less than 15 percent of rated voltage when all loads are applied as scheduled or shown. Recovery to stable operation shall occur within 2 seconds. Stable or steady state operation is defined as operation with terminal voltage remaining constant within plus or minus 1 percent of rated voltage.
  - 2. **Frequency Dip:** The instantaneous frequency dip shall be less than 5 percent of rated frequency when all loads are applied as scheduled or shown. Recovery to stable operation shall occur within 2 seconds.
- E. **Load Harmonics:** Generator supplied shall be suitable for and provide proper operation of the driven loads. Any harmonics generated by the load shall be accounted for in the generator selection and derating shall be applied as necessary.
- F. **Sustained Short-Circuit Current:** For a 3-phase, bolted short circuit at system output terminals for generators 100kw and larger, the system shall supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.

## 2.7 ENGINE

- A. Engine shall be four-cycle, multi-cylinder, liquid-cooled with mounted radiator, fan and water pump. It shall have an operating speed of 1,800 rpm to 3,000 rpm. Engine speed shall be governed by an electronic governor to maintain alternator frequency within 5 percent from no-load to full-load alternator output. Starting shall be by a 12-volt or 24-volt, solenoid shift, electric starter.
- B. **Lubrication System:** Full pressure lubrication shall be supplied by a positive displacement lube oil pump. The following items are mounted on engine or skid:
  - 1. **Filter and Strainer:** Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
  - 2. **Thermostatic Control Valve:** Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
  - 3. **Crankcase Drain:** Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

- C. Engine Fuel System:
  - 1. Engine shall be diesel fueled.
  - 2. Main Fuel Pump: Mounted on engine. Pump ensures adequate primary fuel flow under starting and load conditions.
  - 3. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.
  
- D. Engine Coolant Heater:
  - 1. Provide an electric coolant heater to maintain engine block temperature in cold weather.
  - 2. Heater power source shall be 120/208 VAC.
  - 3. Power source to the heater shall be controlled by a line voltage ambient temperature thermostat that provides power to the heater when the ambient temperature is below 40 to 60 degrees F, adjustable.
  - 4. The heater shall be provided with an internal liquid temperature thermostat to cycle the heater to maintain a setpoint liquid temperature when power is applied to the heater.

## 2.8 ENGINE COOLING SYSTEM

- A. Description: Closed loop, liquid cooled, with engine-driven coolant pump.
- B. Radiator: Rated for specified coolant.
  - 1. Radiator Core Tubes: Nonferrous-metal construction.
- C. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
- D. The radiator shall be equipped with a duct connection for ducting radiator discharge air to the outside of the building.

## 2.9 VARMIT PROOFING

- A. Provide metal barriers to prevent the entry of birds, snakes and rodents into the enclosure. Protect the conduit stub up area.

## 2.10 FUEL SUPPLY SYSTEM

- A. Comply with NFPA 30.
- B. Sub-Base mounted tank: Comply with UL 142. Provide a factory-fabricated fuel tank assembly with the following features:
  - 1. Containment: Integral rupture basin with a capacity of 150 percent of nominal capacity of sub-base tank.
    - a. Leak Detector: Locate in rupture basin and connect to provide audible and visual alarm in the event of a tank leak.
  - 2. Provide space for conduit stub ups to allow conduits to enter the unit inside the base.
  - 3. Tank Capacity: As recommended by engine manufacturer for an uninterrupted period of 24 hours operation at 100 percent of rated power output of engine generator system without being refilled.
  - 4. Low-Level Alarm Sensor: Liquid-level device operates alarm contacts at about 25 percent of normal fuel level.

5. Piping Connections: Factory-installed fuel supply and return lines from tank to engine; local fuel fill, vent line, and tank drain line with fitting and plug.
6. Provide mechanical level gauges.

#### 2.11 ENGINE EXHAUST SYSTEM

- A. Muffler: Critical type, sized as recommended by engine manufacturer; sound level measured at a distance of 10 feet (3 m) from exhaust discharge shall be 85 dBA or less.
- B. Condensate Drain for Muffler: Schedule 40, black steel pipe connected to muffler drain outlet through a petcock.
- C. Connection from Engine to Exhaust System: Flexible section of corrugated stainless-steel pipe.
- D. Connection from Exhaust Pipe to Muffler: Stainless-steel expansion joint with liner.
- E. Exhaust Piping External to Engine: ASTM A 53/A 53M, Schedule 40, welded, black steel, with welded joints and fittings.
- F. Provide rain cap for vertical discharge exhaust pipes.
- G. Insulation on indoor mounted piping. Provide insulation with physical protection for indoor exhaust piping.

#### 2.12 COMBUSTION-AIR INTAKE

- A. Description: Standard-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.

#### 2.13 STARTING SYSTEM

- A. Description: 12 or 24-V electric, with negative ground and including the following items:
  1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in "Environmental Conditions" Paragraph in "Service Conditions" Article.
  2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
  3. Cranking Cycle: As required by NFPA 110.
  4. Battery: Adequate capacity within ambient temperature range specified in "Environmental Conditions" Paragraph in "Service Conditions" Article to provide specified cranking cycle at least three times without recharging. Provide accessories required to support and fasten batteries in place.
  5. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.
  6. Battery Charger: Current-limiting, automatic-equalizing and float-charging type. Unit shall be designed for 120VAC source and be mounted on the engine generator skid. Unit shall comply with UL 1236 and include the following features:
    - a. Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.

- b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg F to plus 140 deg F to prevent overcharging at high temperatures and undercharging at low temperatures.
  - c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
  - d. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
  - e. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
7. Battery warming blanket, 120 volt. Thermostatically controlled heating blanket shall be arranged to maintain battery above plus 50 deg F regardless of external ambient temperature within range specified in "Environmental Conditions" Paragraph in "Service Conditions" Article.

## 2.14 CONTROL AND MONITORING

- A. Functional Description: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of the generator set. When mode-selector switch is switched to the on position, the generator set starts. The off position of the same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down the generator set and initiate alarms.
- B. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common control and monitoring panel mounted on the generator set. Mounting method shall isolate the control panel from generator-set vibration.
- C. Indicating and Protective Devices and Controls:
  1. AC voltmeter.
  2. AC ammeter.
  3. AC frequency meter.
  4. DC voltmeter (alternator battery charging).
  5. Engine-coolant temperature gage.
  6. Engine lubricating-oil pressure gage.
  7. Running-time meter.
  8. Ammeter-voltmeter, phase-selector switch(es).
  9. Generator-voltage adjusting rheostat.
  10. Start-stop switch.
  11. Overspeed shutdown device.
  12. Coolant high-temperature shutdown device.
  13. Coolant low-level shutdown device.
  14. Oil low-pressure shutdown device.
  15. Generator overload.
  16. Prime-mover shutdown button.
- D. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.



- E. Remote Alarm Annunciator: Comply with NFPA 99. Labeled LED shall identify each alarm event. Common audible signal shall sound for alarm conditions. Silencing switch in face of panel shall silence signal without altering visual indication. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate are surface (or flush) mounted type to suit mounting conditions indicated. Provide annunciation for the manufacturer's standard alarms as well as low fuel level and tank leak alarm indication.

#### 2.15 GENERATOR OVERCURRENT AND FAULT PROTECTION

- A. Generator Circuit Breaker: Provide line circuit breaker on the generator output.
- B. Ground-Fault Indication: Comply with NFPA 70, Article 700.7(D). Integrate ground-fault alarm indication with other generator-set alarm indications.

#### 2.16 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

- A. Comply with NEMA MG 1 and specified performance requirements.
- B. Drive: Exciter shall be rotated integrally with generator rotor.
- C. Electrical Insulation: Class H or Class F.
- D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.
- E. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.
- F. Excitation shall use no slip or collector rings, or brushes, and shall be arranged to sustain generator output under short-circuit conditions as specified.
- G. Enclosure: Dripproof.
- H. Instrument Transformers: Mounted within generator enclosure.
- I. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified.
  - 1. Adjusting rheostat on control and monitoring panel shall provide plus or minus 5 percent adjustment of output-voltage operating band.

#### 2.17 OUTDOOR GENERATOR-SET ENCLOSURE

- A. Description: Vandal-resistant, weatherproof steel housing, certified to withstand a wind load of at least 100 mph (160 km/h). Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Panels shall be removable by one person without tools. Instruments and control shall be mounted within enclosure. All openings shall have provisions for locking.

- B. Engine Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at rated load for 2 hours with ambient temperature at top of range specified in system service conditions.
  - 1. Louvers: Fixed-engine cooling-air inlet and discharge. Storm-proof and drainable louvers prevent entry of rain and snow.
- C. Provide sound attenuating enclosure. The average sound level shall not be more than 85dbA at full load at 23 feet in a parking lot at the manufacturers facility.
- D. Convenience GFI receptacle: Factory wired. Arrange for external electrical connection.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting standby engine-generator performance.
- B. Examine roughing-in of piping systems and electrical connections. Verify actual locations of connections before standby engine-generator installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 CONCRETE BASES

- A. Coordinate size and location of concrete bases. Verify structural requirements with structural engineer.
- B. Concrete base is specified in Division 26 SECTION "Basic Electrical Materials and Methods", and concrete materials and installation requirements are specified in Division 3.

#### 3.3 INSTALLATION

- A. Comply with engine-generator manufacturers' written installation and alignment instructions and with NFPA 110.
- B. Control and Alarm Wiring: Install control and signal wiring, from the generator set to the transfer switch and remote annunciator (if supplied), in separate raceways from the power conductors to minimize power circuit interference with the control circuits.
- C. Install engine generators level on concrete base.
- D. Install engine generator to provide access, without removing connections or accessories, for periodic maintenance.
- E. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted. Provide all required interconnecting wiring.
- F. Install exhaust-system piping. Extend to point of termination outside structure. Size piping according to manufacturer's written instructions.

1. Install condensate drain piping for engine exhaust system. Extend drain piping from low points of exhaust system and from muffler to condensate traps and to point of disposition.
2. Support exhaust piping and muffler with pipe hangers spaced a maximum of 20 feet (6 m) horizontally and at each floor vertically.
3. Restrain exhaust piping and mufflers with cable-type bracing assemblies meeting seismic criteria.

G. Install fuel tank vent and extend to point of termination outside structure. Size piping according to manufacturer's written instructions.

H. Install all required duct work for adequate cooling air flow.

### 3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections.

### 3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.

C. Complete installation and startup checks according to manufacturer's written instructions.

D. Simulate power failure. Demonstrate the ability to start all loads.

### 3.6 PERFORMANCE TESTING

A. The installed system shall be performance tested on-site operating the installed loads.

B. The load equipment shall perform in a comparable manner to when it is operated on utility power.

C. Lighting shall not blink or drop-out as other loads are started and stopped.

D. Motor starters, solid state soft starters, and VFD's shall operate properly without irregular speed changes or tripping while on generator power.

E. Measure the following parameters and submit a written report of the results:

1. Voltage dip during load starting
2. Frequency dip during load starting
3. Running load
4. Running frequency
5. Running power factor
6. Voltage dip during load stopping
7. Frequency dip during load stopping

### 3.7 TRAINING

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain standby engine generators. Provide one 4 hour training session, schedule in advance with the owner and the contractor.
  - 1. Coordinate this training with that for transfer switches.

END OF SECTION

## SECTION 26 36 23- AUTOMATIC TRANSFER SWITCH

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Provide transfer switch with current and voltage ratings shall be as indicated. The transfer switch shall be rated for continuous duty in an unventilated enclosure for all classes of load as indicated.

#### 1.2 SUBMITTALS

- A. Shop Drawings: Provide the following information.
  - 1. Indicate rated capacities, operating characteristics, furnished specialties, and accessories.
  - 2. Wiring Diagrams: Single-line diagram. Show all interconnecting power and control wiring requirements.
  - 3. Dimensioned outline plan and elevation drawings. Indicate weight, minimum clearances, conductor entry provisions, and gutter space.
  - 4. Manufacturer's name and catalog cuts listing type, model number, catalog number, ratings including voltage, ampacity, number of poles, neutral assemblies, UL Listing compliance, control features and accessories and other pertinent data.
  - 5. Where required by plans or installation, provide service entrance rated unit.
- B. Manufacturer Seismic Qualification Certification: Submit certification that transfer switches, accessories, and components will withstand seismic forces defined in Division 26 SECTION "Seismic Requirements for Electrical Work". Include the following:
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
- C. Operation and Maintenance Data. In addition to items specified in Division 1 SECTION "Operation and Maintenance Data", include the following:
  - 1. Provide manufacturers standard Operations and Maintenance manuals.
  - 2. Features and operating sequences.
  - 3. List of all settings and adjustments as installed.
  - 4. Procedures for regular operation such as emergency operation and regular testing recommendations and procedures.

#### 1.3 QUALITY ASSURANCE

- A. Service Center: Maintain, within 200 miles of Project site, a factory authorized service center capable of providing training, parts, and emergency maintenance repairs.
- B. The transfer switch shall be in accordance with the requirements of UL Standard 1008.

### PART 2 - PRODUCTS

#### 2.1 GENERAL REQUIREMENTS

- A. Indicated Current Ratings: Provide voltage and current ratings as indicated on plans.

- B. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty under the fault conditions indicated.
- C. Neutral Terminal: Solid and fully rated, unless otherwise indicated.
- D. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, either by color code or by numbered or lettered wire and cable tape markers at terminations.
  - 1. Designated Terminals: Pressure type suitable for types and sizes of field wiring indicated.
  - 2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
  - 3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.
- E. Enclosures: General-purpose NEMA Type 3R/ steel, complying with NEMA ICS 6, NEMA 250, and UL 508, unless otherwise indicated. The enclosure shall have hinged door with locking mechanism.
- F. Location: Transfer switch will be located in an outdoor, exposed location.
- G. Heater: Equip switches exposed to outdoor temperatures and humidity, and other units indicated, with an internal heater. Provide thermostat within enclosure to control heater. Heater shall be powered internally from the load side of the transfer switch.
- H. Controls and Displays (if applicable): Provide on enclosure door. Switches or adjustments that affect the transfer switch operating parameters shall be inside the lockable enclosure and/or shall be protected from change by a key or password. Switch is located in an publically accessible location. ALL controls, switches, and displays shall be located inside the switch enclosure behind the blank, lockable enclosure door – NO EXCEPTIONS.

## 2.2 SWITCHING DEVICE

- A. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions. Main and arcing contacts and control elements shall be renewable from the front of the switch without removing the switch from its enclosure and without removing the main power connections.
- B. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
  - 1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are not acceptable.
- C. Switching Arrangement: Provide one the following switching arrangements:
  - 1. Open Transition with In-Phase Monitor: Provide factory-wired, internal sensing which controls transfer in both directions so it occurs only when the two sources are synchronized. Sensor compares phase relationship and frequency difference between normal and emergency sources and initiates transfer when both sources are within 15 electrical degrees, and only if transfer can be completed within 60 electrical degrees. Transfer is initiated only if both sources are within 2 Hz of nominal frequency and 70 percent or more of nominal voltage. When both sources are energized, if one of the sources fails entirely, the transfer takes place following a time delay.

2. Open Transition with Programmed Neutral Switch Position: Switch operator has a programmed neutral position arranged to provide a midpoint between the two working switch positions, with an intentional, time-controlled pause at midpoint during transfer in both directions. Pause is adjustable from 0.5 to 10 seconds minimum unless otherwise indicated. When both sources are energized, if one of the sources fails entirely, the transfer takes place following a time delay.

D. Manual operation. Transfer switch shall have provisions for the manual operation of the switch if the controls or motor operator fail.

## 2.3 CONTROLS

A. Undervoltage Sensing for Each Phase of Normal Source: Senses low phase-to-ground voltage on each phase. Pickup voltage is adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.

B. Time Delay to Start Generator: Upon sensing undervoltage or loss of phase on the normal source, command the generator engine to start following an adjustable time delay of 0 to 60 seconds, set initially at 6 seconds. Transfer switch will operate as soon as the standby power source has stabilized.

C. Voltage/Frequency Lockout Relay: Prevents premature transfer to generator. Pickup voltage is adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency is adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.

D. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, and factory set for 10 minutes. Provides automatic defeat of delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.

E. Test Switch: Simulates normal-source failure.

F. Switch-Position Pilot Lights: Indicate source to which load is connected.

G. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.

1. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
2. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."

H. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240 VAC.

I. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.

J. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated for the requirements of the engine-generator, and 2 A at 30 VDC/240 VAC minimum.

- K. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.
- L. Accessories:
  - 1. Provide two sets N.O. and N.C contacts to indicate both when the unit is connected to the normal power source, and to the emergency power source.

#### 2.4 ENGINE-GENERATOR EXERCISER

- A. Provide a solid-state, programmable-time switch that starts and runs engine generator for a preset time then shuts down engine immediately or after a preset cool-down period if running under load. Control initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Set for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period unless otherwise indicated.
- B. Exerciser features include the following:
  - 1. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
  - 2. Push-button programming control with digital display of settings.
  - 3. Integral battery operation of time switch when normal control power is not available.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Floor-Mounted Switch (where applicable): Anchor to floor by bolting.
  - 1. Concrete Bases: 4 inches (100 mm) high, reinforced, with chamfered edges. Extend base no more than 2 inches (50 mm) in all directions beyond the maximum dimensions of switch, unless otherwise indicated. Cast anchor-bolt inserts into bases. Comply with Division 3 SECTION "Cast-in-Place Concrete".
- B. Identify components according to Division 26 SECTION "Electrical Identification".

#### 3.2 WIRING TO REMOTE COMPONENTS

- A. Provide control wiring between transfer switch and engine-generator for starting control, alarm, battery charging and engine temperature maintenance.

#### 3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect[, test, and adjust] field-assembled components and equipment installation, including connections[, and to assist in field testing]. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
  - 1. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
  - 2. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.



- a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
  - b. Simulate loss of phase-to-ground voltage for each phase of normal source.
  - c. Verify time-delay settings.
  - d. Verify pickup and dropout voltages by data readout or inspection of control settings.
  - e. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.
  - f. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.
3. Coordinate with settings of ground-fault protective devices for power delivery from both sources.
    - a. Verify grounding connections and locations and ratings of sensors.
- C. Coordinate tests with tests of generator and run them concurrently.
- D. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.
- E. Remove and replace malfunctioning units and retest as specified above.
- 3.4 DEMONSTRATION
- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment as specified below.
1. Coordinate this training with that for generator equipment.

END OF SECTION

## **SECTION 28 31 00- FIRE ALARM SYSTEM**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. The Contractor shall furnish and install all wiring, conduit, standard and special wall boxes and cabinets to make a complete and functioning system as hereinafter specified and shown on the plans. It shall be the responsibility of the Contractor to provide all installation equipment and material compatible to the system supplied. All equipment shall be located as shown on the drawings. Any equipment not specifically mentioned in this specification or not shown on the drawings, but required for the operation of a completely functional system shall be furnished and installed.
- B. The system shall consist of addressable initiating and non-addressable notification devices as shown on the plans and required for a complete and operable system.

#### **1.2 QUALITY ASSURANCE**

- A. Each and all items of the Fire Alarm System shall be listed as a product of a SINGLE fire alarm system manufacturer under the appropriate category by Underwriters' Laboratories, Inc. (UL), and shall bear the "U.L." label. All control equipment is to be listed under UL 864, "Control Units for Fire-Protective Signaling Systems" as a single control system. Partial listing shall NOT be acceptable.
- B. All equipment shall be U.L. approved and installed in accordance with the requirements of the NFPA 70 - National Electric Code, local codes and these specifications, with the stricter requirement governing in case of possible variance.
- C. The Fire Alarm System shall meet all applicable state and local codes and standards and conform to all requirements of the Americans with Disabilities Act (ADA).
- D. System shall fully comply with NFPA 72 - National Fire Alarm Code and NFPA 101 – Life Safety Code.
- E. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

#### **1.3 SUBMITTALS**

- A. Prior to submitting to the Engineer, the system supplier shall submit drawings to the Authority Having Jurisdiction (AHJ) for approval. Approval in writing by the AHJ must accompany the submittals to the Engineer.
- B. Submit the following in accordance with NFPA 72 Section 4.5.1 for approval:
  - 1. Product data for all fire alarm control panels and annunciator panels, alarm initiating devices, notification appliances, auxiliary devices, wires and cables and other necessary accessories.
  - 2. Complete sequence of operations of all functions of the system.
  - 3. A list of every system address provided for purposes of alarm initiation status monitoring, supervised signaling, and auxiliary controls.

4. Battery calculations to verify that the fire alarm system can provide a minimum of 5 minutes of alarm operation at the end of a 24-hour period of battery operation in a normal supervisory mode.
5. Copies of licenses and certificates as required by the city, county and state.
6. Control panel and annunciator panel inner wiring diagrams. Indicate equipment enclosure NEMA type, nameplate data, enclosure finish, and interior equipment layout dimensions.
7. Complete system-wiring diagram for all fire alarm system components. The system-wiring diagram shall include all interfaces to equipment supplied by others. The system-wiring diagram shall indicate wiring style, wiring and cable types and the wiring color code.
8. Floor plans indicating panel and device locations showing address of each addressable device. Show size and route of cable and conduits.

C. Operation and Maintenance Data, submit the following information:

1. Approved submittal information from 28 3100.1.3.B.
2. Completion documentation as required by NFPA 72 Section 4.5.2. Use the NFPA forms or equivalent.
3. Installation and maintenance sheets on all equipment.
4. Operations manual for the fire alarm control panel and fire alarm annunciator panel describing installation, operation, programming, control features, and system capabilities.
5. Documentation of panel programming and settings.
6. Copies of all letters of compliance, licenses, certifications and warranties.
7. Testing and inspection report for the fire alarm system.
8. As-built control panel and annunciator panel inner wiring diagrams. Indicate equipment enclosure NEMA type, nameplate data, enclosure finish, and interior equipment layout dimensions.
9. As-built system-wiring diagram for all fire alarm system components. The system-wiring diagram shall include all interfaces to equipment supplied by others. The system-wiring diagram shall indicate wiring style, wiring and cable types and the wiring color code.
10. As-built floor plans indicating panel and device locations showing address of each addressable device. Show size and route of cable and conduits.

#### 1.4 COORDINATION

- A. Coordinate the layout and installation of fire alarm system components with other construction. Coordinate the installation of fire alarm system materials and equipment for an efficient flow of the Work.
- B. Coordinate the layout and installation of wall and ceiling mounted devices with other equipment including light fixtures, HVAC diffusers, windows and other assemblies and furniture.
- C. Coordinate duct detectors and fire/smoke dampers with installation of duct work for proper access for maintenance and service.

#### 1.5 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  1. Smoke, Heat, and Flame Detectors: Quantity equal to 10 percent of amount of each type installed, but not less than 1 unit of each type.
  2. Detector Bases: Quantity equal to 2 percent of amount of each type installed, but not less than 1 unit of each type.

3. Keys and Tools: One extra set for access to locked and tamperproofed components.
4. Audible and Visual Notification Appliances: Quantity equal to 10 percent of each type installed, but not less than 1 unit of each type.
5. Fuses: Two of each type installed in the system.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. System wiring shall be a 2 wire CLASS B.
- B. Electrically supervise all field wiring for open circuits and ground faults.

### 2.2 WIRE

- A. All fire alarm system wiring shall be new unless otherwise indicated.
- B. Conform with NFPA 72 and Article 760 of the National Electric Code.
- C. Provide wire and cable listed and/or approved by a recognized testing agency for use with a protective signaling system.
- D. Provide conductors recommended by the manufacturer and listed for use with the fire alarm system hardware. Provide the number and size of conductors as selected by the fire alarm system supplier, but not smaller than #18 AWG for initiating device circuits or signaling line circuits and not smaller than #14 AWG for notification appliance circuits. Provide twisted, unshielded cable for signaling line circuits.
- E. Wiring shall be color-coded throughout the system.
- F. Ground all equipment with an approved earth ground wire being supplied at the control units.
- G. Verify ALL wiring requirements with manufacturer prior to installation.

### 2.3 EXISTING FIRE ALARM SYSTEM

- A. The existing fire alarm system shall remain in operation at ALL times when the building is occupied for normal operation. System outage(s) shall be coordinated with the Owner at least 3 weeks prior to the outage. The system shall be returned to full operation prior to return of normal occupancy. If the system has not been returned to service when normal occupancy resumes, a full time fire watch shall be provided at no extra cost to the Owner until the fire alarm system is returned to operational condition. Fire watch plan and details shall be approved by the Fire Marshall.

### 2.4 PROVISIONS FOR FUTURE EXPANSION

- A. The fire alarm system shall be designed to accommodate for future expansion and modifications.
- B. Provide the following:
  1. Signaling Line Circuit(s): 25 percent spare device addresses minimum
  2. Notification Appliance Circuits: 20 percent spare circuit ampacity minimum

3. Notification Appliance Circuits: Voltage drop not to exceed 80 percent of maximum allowed
4. Battery and Battery Charger: 20 percent spare capacity minimum

## 2.5 FIRE ALARM CONTROL PANEL

- A. The microprocessor controlled fire alarm control panel (FACP) shall monitor active addressable devices within the building. All initiating devices shall be addressable and shall connect to the FACP.
- B. The FACP shall be 24 VDC operation with 120 VAC supply power. Twenty-four (24) hours of standby power with 5-minutes of alarm operation at the end of this period shall be provided by internally mounted, properly sized, sealed gel type lead acid batteries. The system batteries shall be supervised so that a low battery condition or disconnection of the battery shall be audibly and visually indicated at the control panel and remote annunciator.
- C. An alarm shall be displayed on a multi-line display. The point label and device type identifier shall be displayed. The system alarm indicator shall flash on the control panel and the remote annunciator until the alarm has been acknowledged at the control panel or the remote annunciator. Once acknowledged, the indicator shall latch on. A subsequent alarm received from another zone after acknowledged shall flash the system alarm indicator on the control panel and remote annunciator. The display shall show the new alarm information.
- D. The incoming power to the system shall be supervised so that any power failure must be audibly and visually indicated at the control panel and the remote annunciator. A power on indicator light shall be displayed continuously while incoming power is present.
- E. The System Expansion Modules shall be electrically supervised for module placement. Should a module become disconnected, the system trouble indicator must illuminate and audible trouble signal must sound.
- F. The control panel shall have a dedicated Supervisory Service indicator and a dedicated Supervisory Service Acknowledge Switch.

## 2.6 SYSTEM OPERATION

- A. Programming:
  1. Provide all hardware, software, programming tools, and documentation necessary to modify the fire alarm system on site.
  2. The fire alarm control panel shall allow for loading or editing special instructions and operating sequences as required. The system shall be capable of on site programming to accommodate and facilitate expansion, building parameter changes or changes as required by local codes.
  3. All software operations shall be stored in a non-volatile programmable memory within the fire alarm control panel. Loss of primary and secondary power shall not erase the instructions stored in memory.
- B. Provide alarm initiation from addressable manual stations located at each exit, addressable automatic smoke/heat detectors located as shown, addressable duct smoke detectors in the air handling units, addressable sprinkler water flow and sprinkler tamper switches. All devices shall be located as shown on the drawings.

- C. Provide a general alarm indication throughout the building when any alarm initiating device described is activated. Provide audio/visual alarm notification appliances on the inside and outside of the building. All devices shall be located as shown on the drawings.
- D. Provide the closure of all smoke doors, smoke dampers, and shutdown of all air handling equipment controlled during a general alarm. This function shall remain in effect until the system has been completely returned to its normal state (silencing of signals alone shall not reset this control status).
- E. The entire system may be reset only following the resetting of individual alarm initiation devices.
- F. The ability for selective input/output control functions based on ANDing, ORing, timing and special coded operations shall also be incorporated in the resident software programming of the system.
- G. To accommodate and facilitate job site changes, initiation devices shall be individually configurable on site to provide either alarm/trouble operation, alarm only, trouble only, current limited alarm, no alarm, normally closed device monitoring, a non-latching circuit or an alarm verification circuit.
- H. Notification appliance circuits shall be individually configurable on site to provide upon activation a fast march-time, slow march time, temporal code, or master code until silenced or reset.
- I. The system shall have the capability to store a minimum of 300 alarms and 300 troubles in a historical data file.
- J. The activation of any system smoke detector shall initiate an Alarm Verification operation whereby the panel will reset the activated detector and wait for a second alarm activation. If, within one (1) minute after resetting, a second alarm is reported from the same or any other smoke detector, the system shall process the alarm as described previously. If no second alarm occurs within one minute the system shall resume normal operation. The Alarm Verification shall operate only on smoke detector alarms. Other activated initiating devices shall be processed immediately. The alarm verification operation shall be selectable by zone.
- K. The control panel shall have the capability to display the number of times a device has gone into a verification mode.
- L. Alarm verification zones shall have the capability of being divided into seven different groups where by only two verification zones from a group will confirm the first activation and cause the panel to follow programmed alarm sequence.
- M. A manual evacuation switch shall be provided to operate the systems alarm notification appliances. Other control circuits shall not be activated. However, a true alarm shall be processed as described previously.
- N. A manual door holder release switch shall be provided to release all door holders. Other control circuits shall not be activated. However, a true alarm shall be processed as described previously.

- O. Activation of an auxiliary bypass switch shall override the automatic functions either selectively or throughout the system.
- P. Alarm and trouble conditions shall be immediately displayed on the control panel from alphanumeric LCD display. If more alarms or troubles are in the system the operator may scroll to display new alarms.
- Q. The system shall have an alarm list key that will allow the operator to display all alarms, troubles, and supervisory service conditions with the time of occurrence.
- R. The actuation of the enable walk test program at the control panel shall activate the "Walk Test" mode of the system which shall cause the following to occur:
  - 1. The city connection circuit shall be disconnected.
  - 2. Control relay functions shall be bypassed.
  - 3. The control panel shall show a trouble condition.
  - 4. The alarm activation of any initiation device shall cause the audible signals to code a number of pulses to match the zone number.
  - 5. The panel shall automatically reset itself after signaling is complete.
  - 6. Any momentary opening of an initiating or notification appliance circuit wiring shall cause the audible signals to sound for 4 seconds to indicate the trouble condition.
  - 7. The control panel shall have the capacity of 8 distinctive walk test groups.
- S. All auxiliary manual controls shall be supervised so that all switches must be returned to the normal automatic position to clear system trouble.
- T. Each independently supervised circuit shall include a discrete read-out to indicate disarrangement conditions per circuit.
- U. The system shall have provisions for disabling and enabling all circuits individually for maintenance and testing purposes.

## 2.7 FIRE SPRINKLER OPERATIONS

- A. The activation of any standpipe or sprinkler valve tamper switch shall activate the system supervisory service audible signal and illuminate the indicator at the control panel and the remote annunciator. Differentiation between valve tamper activation and opens and/or grounds on fire alarm initiation circuit wiring shall be provided.
- B. Activating the Supervisory Service Acknowledge Switch shall silence the supervisory audible signal while maintaining the Supervisory Service indicator to show the tamper contact is still in the off-normal station.
- C. Restoring the valve to the normal position shall cause the Supervisory Service indicator to extinguish.
- D. Restoring the valve to the normal position shall cause the supervisory service audible signal to pulse thus indicating restoration to normal position. Activating the Supervisory Service Acknowledge Switch will silence the audible signal and restore the system to normal.

## 2.8 ELEVATOR OPERATIONS

- A. General: The fire alarm system shall be interfaced with the elevator control system to provide information and control signals required for proper operation.
- B. Smoke Detection: Provide at each elevator lobby and elevator machine room for elevator recall control.
- C. Sprinkler Operation: Provide heat detection at elevator shaft and elevator machine room to activate prior to sprinkler activation for elevator control and shutdown.
- D. Coordination: Fire alarm system supplier shall coordinate all features and functions required for elevator operation with the elevator supplier.

## 2.9 POSTED INSTRUCTION

- A. System instructions shall be posted at each fire alarm panel and fire alarm annunciator panel. Instructions shall briefly describe the functional operation of the system under normal, alarm, and trouble conditions. Instructions shall interpret the meaning of displays and signals. Instructions shall describe the appropriate response to each condition. Provide instructions on printed or typewritten sheet(s) or card(s) laminated for protection against moisture and dirt.

## 2.10 FIRE ALARM ANNUNCIATOR

- A. Where shown on the plans, provide and install an alpha/numeric Fire Alarm Annunciator(s), with a multi-line display. Annunciator shall display all alpha/numeric messages as displayed at the FACP. Annunciator shall also contain an alarm, trouble and supervisory service indicator and acknowledgment switches, system reset and alarm silence switch, (3) programmable indicators, alarmed silence indicator and a key switch to activate or deactivate all other switches.

## 2.11 NAC POWER EXTENDER PANEL

- A. Expansion (NAC) panels shall be utilized to provide notification appliance power as required in locations remote from the fire alarm control panel.
- B. The NAC Power Extender panel shall be a stand-alone panel capable of powering a minimum of 4 notification appliance circuits. Notification appliance circuits shall be rated at 2 amps each. Panel shall provide capability to be expanded to 8 notification appliance circuits.
- C. The internal power supply & battery charger shall be capable charging batteries internally mounted or mounted in an external cabinet.
- D. Alarms from the host fire alarm control panel shall signal the NAC power extender panel to activate. The panel shall monitor itself and each of its NACs for trouble conditions and shall report trouble conditions to the host panel.
- E. The NAC Power Extender panel shall be supervised by the FACP.
- F. NAC Power Extender panels shall be located in equipment rooms or spaces as approved by the Engineer. Panel shall be mounted at nominally 60 inches above the floor to the top of the panel. NAC power extender panels are NOT permitted to be mounted above ceilings or in any location difficult to access.



- G. Power for the NAC Power Extender panel shall be from a dedicated circuit. Provide a handle lock for the circuit breaker serving the panel.
- H. Provide automatic smoke detection at the location of each NAC power extender panel in accordance with NFPA 72, Article 4.4.5. Detectors shall be provided at each location even if not shown on the Drawings.

2.12 DIGITAL ALARM COMMUNICATOR TRANSMITTER (DACT):

- A. Provide communicator for connection from the Main FACP to the Local Fire Department or an approved central station (as required by Local Codes). Communicator type shall be as required by the local AHJ and shall be U.L. Listed to U.L. 864 conforming to the requirements of NFPA 72. Communicator shall transmit all alarms and be capable of supervising two telephone lines, if one line fails for more than 45 seconds a built in trouble alert shall be activated and a trouble signal automatically transmitted to the central station on the remaining line. The Communicator shall also send a test signal to the central station every 24 hours at a programmed time of day or night. Communicator shall be monitored by a U.L. Listed Monitoring Company.
- B. Provide communicator complete and ready for operation upon connection of communications lines by the Owner.

2.13 INITIATING DEVICES

- A. All initiating devices shall be addressable.
- B. Manual fire alarm pull stations: Manual fire alarm pull stations shall be double action plainly marked to "Push" and then "Pull Lever" located as shown on the plans.
  - 1. Indoor Protective Shield: At all pull stations unless otherwise indicated, provide a 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.
- C. Smoke Detectors and Bases: The smoke sensors shall be of the photoelectric type and shall communicate actual smoke chamber values to the system control unit. The sensors shall be listed to UL Standard 268 and shall be documented as compatible with the control equipment to which they are connected. The sensors shall be listed for both ceiling and wall mount applications. Each sensor and/or base shall contain an indicator that will flash each time it is scanned by the control unit (about once every 4 seconds).
- D. Heat Detectors and Bases: The heat sensors shall be self-restoring for both rate of rise and fixed temperature set points and rate of rise shall be selectable at 16 degrees or 20 degrees F per minute. Fixed temperature set point shall be 135 degrees F for alarm. Heat Sensors shall be capable of being programmed as a utility device to monitor for temperature extremes in the range from 32 degrees F to 158 degrees F (0 degrees C to 70 degrees C). Heat Sensors shall utilize the same Bases as other sensors.
- E. Duct Smoke Detectors: The duct smoke detectors shall operate as described under smoke detectors above. Detectors shall be equipped with a functional test device circuit capable of simulating a maximum acceptable amount of smoke for alarm. The test device circuit shall provide individual local tests of all components of the smoke detector and shall not require

generation of actual smoke within the A.H.U. Provide two (2) sampling tubes. Provide each duct sensor with a remote alarm indicator/test switch.

- F. Provide guards where indicated.
- G. Contractor shall provide all backboxes, standard and special as required for each location.

#### 2.14 NOTIFICATION APPLIANCES

- A. Notification Appliances shall contain the following features:
  - 1. Audible/Visual Appliances for Group, Zoned or General Alarm notification.
  - 2. Supervision of each individual appliance wiring and connections.
  - 3. All strobes on the same SLC circuit shall be synchronized.
  - 4. All strobes within a space or visible from a space shall be synchronized.
  - 5. Horn sounding pattern shall be selectable from the following:
    - a. Temporal Coded
    - b. March Time Coded
  - 6. Horns controlled separately from strobes on same circuit allowing on until silenced and on until reset operation.
- B. Interior Audible/Visual Notification Appliance (fire alarm audible/visual signal device): Provide a red, horizontal wall mount appliance with UL 1971/ADA strobe unit and horn, 24VDC. Provide 75 candela xenon flasher unless other candela brightness is indicated on the drawings.
- C. Interior Visual Notification Appliance (fire alarm visual only signal device): Provide a red, horizontal wall mount appliance with UL 1971/ADA strobe unit, 24VDC. Provide 75 candela xenon flasher unless other candela brightness is indicated on the drawings.
- D. Wire Guards: Provide wire guards for all audible/visual signals located in gymnasiums or multi-purpose rooms or where indicated on the drawings.
- E. Exterior Notification Appliance: Provide a weatherproof vibrating type horn or horn and strobe type as shown, with a weatherproof box.
- F. Contractor shall provide all backboxes, standard and special as required for each location.

#### 2.15 CONTROL RELAYS

- A. Provide control relays for air handling equipment shutdown, smoke damper control, fire shutter control, and similar functions. Relays shall be 24VDC operation, mounted in surface cabinet with indicator to show when relay is energized. These relays shall be controlled and powered from the FACP. Contacts shall be 2PDT rated at 10 amps resistive 28VDC/120VAC. Relays shall be located in equipment rooms or spaces as approved by the Engineer. Relays shall be mounted at nominally 60 to 96 inches above the floor to the top of the relay, except relays used to shut down air handling equipment may be mounted at the unit control panel. Relays are NOT permitted to be mounted above ceilings or in any location difficult to access. Power circuits switched by the relay shall be dedicated circuits with a handle lock for the circuit breaker. Provide a nameplate at the relay indicating the equipment identification name or power circuit being controlled.

## 2.16 MAGNETIC DOOR HOLDERS

- A. Provide 24 VDC magnetic door holders controlled by the fire alarm system. Unless otherwise shown, provide wall mounted semi-recessed type. Coordinate installation with door hardware. The FACP shall be equipped with auxiliary relays to release holders as required.

## 2.17 ISOLATORS

- A. Provide isolator module(s) to isolate wire-to-wire short circuits on Signaling Line Circuits (initiation circuits) while allowing the remainder of the circuit to continue to function. Isolator module shall be powered by the circuit – no external power source required. The module shall automatically disconnect the shorted portion of the circuit and when the circuit is repaired the module shall automatically reconnect the circuit. The module shall not require replacement or resetting after normal operation. The module shall have indicator light(s) to show unit status.

## PART 3 - EXECUTION

### 3.1 FIRE ALARM INSTALLATION AND WIRING

- A. This Contractor shall furnish and install all wiring, conduit, junction boxes, and outlet boxes required for the installation of a complete system. All wiring shall be installed in metallic raceway.
- B. Detectors at Control Equipment: Provide automatic smoke detection at the location of each fire alarm control unit, fire alarm annunciator, auxiliary control panel, NAC power extender panel, and remote panel in accordance with NFPA 72, Article 4.4.5. Detectors shall be provided at each location even if not shown on the Drawings.
- C. Isolators:
  - 1. Multi-building Campus: Provide an isolator module on each circuit serving a separate structure at the facility. Install the module in the structure where the fire alarm control panel is located prior to the circuit exiting to serve the adjacent building.
  - 2. Multi-story Construction: Provide an isolator module on each circuit serving more than one floor level or provide a separate Signaling Line Circuit for each floor. Install the module on the primary floor served by the circuit prior to going to each other floor level(s).
  - 3. Provide isolator(s) at any location shown on the drawings.
  - 4. Install isolator modules at accessible locations nominally 60 inches above the floor. Location of each isolator shall be listed at the Fire Alarm Control Panel.
- D. Device installation:
  - 1. Devices shall be installed in accordance with details and notes on the drawings and in compliance with NFPA 72.
  - 2. Smoke Detectors: Install ceiling-mounted detectors not less than 4 inches from a side wall to the near edge. Install detectors located on the wall at least 4 inches but not more than 12 inches below the ceiling. For exposed solid joist construction, mount detectors on the bottoms of the joists. On smooth ceilings, install detectors not over 30 feet apart in any direction. Install detectors no closer than 5 feet from air registers.
  - 3. Audible Notification Appliances: Install not less than 80 inches above the finished floor nor 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 or as indicated. Combine audible and visual notification appliances at the same location into a single unit.
4. Visual Notification Appliances: Install not less than 80 inches above the finished floor and at least 6 inches below the ceiling.
  5. Fire Alarm Control Panel (FACP): Mount with tops of cabinets not more than 6 feet above the finished floor.
  6. Annunciator: Arrange as indicated, with the top of the unit no more than 6 feet above the finished floor.
- E. Installation of equipment and devices that pertain to other work in the contract shall be closely coordinated with the appropriate subcontractors.
- F. Contractor shall not remove protective covers from smoke or heat sensors until all construction work and cleanup has been performed. If this is not adhered to, all cleaning costs to clean dirty smoke detectors shall be paid for by the Contractor.
- G. Contractor wiring installation:
1. Wiring Method:
    - a. Install all wiring in metal raceway according to Division 26/28.
    - b. Type MC Cable or flexible metal conduit may be “fished” in inaccessible spaces.
    - c. Cable in exposed, existing finished locations shall be installed in surface metal raceway.
    - d. Cable in exposed, unfinished locations shall be installed in exposed conduit.
    - e. All splices shall be made in junction boxes.
    - f. All raceways shall be routed parallel or perpendicular with building walls and structure.
    - g. Wiring Within Equipment Enclosures: Install conductors parallel with or at right angles to the sides and back of the enclosure. Bundle, lace, and train the conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the wiring diagrams of the system. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
    - h. System Wiring: Wire and cable shall be a type listed for its intended use by an approval agency acceptable to the Authority Having Jurisdiction (AHJ) and shall be installed in accordance with the appropriate articles from the current approved edition of the National Electric Code (NEC), (NFPA 70). It is the Contractor’s responsibility to obtain from the Fire Alarm System Manufacturer written instruction regarding the appropriate wire/cable to be used for this installation. No deviation from the written instruction shall be made by the Contractor without the prior written approval of the Fire Alarm System Manufacturer.
    - i. Color Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm initiating device circuits wiring and a different color code for supervisory circuits. Color-code notification appliance circuits differently from alarm-initiating circuits. Paint fire alarm system junction boxes and covers red.
- H. 120-Volt Power Circuits: Power for the Fire Alarm Control Panel, Smoke Dampers, NAC Power Extender panel(s), and other system equipment shall each be connected to a separate dedicated circuit. Provide a handle lock for each circuit breaker serving fire alarm system equipment. Clearly identify the equipment on the panelboard directory. Provide a nameplate at each fire

alarm system equipment identifying the panelboard and circuit number providing power to that device.

- I. Grounding: Ground equipment and conductor and cable shields as specified by the equipment manufacturer. For audio circuits, minimize to the greatest extent possible ground loops, common mode returns, noise pickup, cross talk, and other impairments.
- J. Field quality control: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components, and adjustment of the system.
- K. Programming: Provide services of a factory-authorized service representative to program the system and enter all required data into the equipment.
- L. Cleaning and adjusting:
  - 1. Cleaning: Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean unit internally using methods and materials recommended by manufacturer.
  - 2. Adjustments: When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels and adjusting controls and sensitivities to suit actual occupied conditions. Provide at least one visit to the site for this purpose.

### 3.2 TESTING

- A. The manufacturer or manufacturer's representative shall coordinate and provide testing of the system in the presence of the Fire Marshall, Fire Department, or applicable AHJ in accordance with their testing requirements.
- B. Tests:
  - 1. Provide services of a factory-authorized service representative to supervise the pre-testing and final testing of the system.
  - 2. Pre-testing: Upon completing installation of the system, align, adjust, and balance the system and perform complete pre-testing. Determine, through pre-testing, the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed in pre-testing. Replace malfunctioning or damaged items with new and retest until satisfactory performance and conditions are achieved. Prepare forms for systematic recording of acceptance test results.
  - 3. Report of Pre-testing: After pre-testing is complete, provide a letter certifying the installation is complete and fully operable, including the names and titles of the witnesses to the preliminary tests.
  - 4. System Final Test Notice: Provide a 10-day minimum notice in writing when the system is ready for final acceptance testing.
  - 5. System Final Tests: Test the system according to the procedures outlined in NFPA 72. Minimum required tests are as follows:
    - a. Contractor shall verify the absence of unwanted voltages between circuit conductors and ground.
    - b. Contractor shall Megger test all conductors other than those intentionally and permanently grounded with electronic components disconnected (prior to connecting equipment). Test for resistance to ground. Report readings less than 1 megohm for evaluation.
    - c. Contractor shall test all conductors for short circuits utilizing an insulation-testing device.

- d. With each circuit pair, short circuit at the far end of the circuit and measure the circuit resistance with an ohmmeter. Record the circuit resistance of each circuit on the record drawings.
  - e. Verify the control unit is in the normal condition as detailed in the manufacturer's operating and maintenance manual.
  - f. Test initiating, notification, and signaling circuits for proper signal transmission under open circuit conditions. One connection each should be opened at not less than 10 percent of the initiating and notification devices. Observe proper signal transmission according to class of wiring used.
  - g. Test each initiating device and notification appliance for alarm operation and proper response at the control unit. Test smoke detectors with actual products of combustion.
  - h. Close each sprinkler valve and verify proper supervisory alarm.
  - i. Activate each sprinkler flow alarm and verify proper system alarm.
  - j. Measure and record the actual current draw of each Notification Appliance Circuit.
  - k. Test the system for all specified functions according to the manufacturer's operating and maintenance manual. Systematically initiate specified functional performance items at each station including making all possible alarm and monitoring initiations and using all communications options. For each item, observe related performance at all devices required to be affected by the item under all system sequences. Observe indicating lights, displays, signal tones, and annunciator indications.
  - l. Test both primary power and secondary power. Verify, by test, the secondary power system is capable of operating the system for the period and in the manner specified.
  - m. Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets the Specifications and complies with applicable standards.
  - n. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log. Submit log upon the satisfactory completion of tests.
  - o. Tag all equipment, stations, and other components at which tests have been satisfactorily completed.
  - p. In order to obtain a certificate of occupancy, demonstrate that the system meets the Specifications and complies with applicable standards. This final test shall be witnessed by a representative of the Authority Having Jurisdiction and a factory-authorized service representative.
  - q. Fill out completion document as required by NFPA 72 section 4.5.2. Use NFPA forms or equivalent.
- C. Demonstrate system operation in the presence of the Architect, Engineer, and Owner.

### 3.3 TRAINING

- A. Provide the services of a factory-authorized service representative at the project location to demonstrate the system and train Owner's maintenance personnel. Train Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventive maintaining of the system. Provide a minimum of 8 hours training. Schedule training with the Owner at least seven days in advance.

3.4 SERVICE

- A. After the guarantee period, the manufacturer shall provide an annual preventative maintenance service contract upon request. The preventative maintenance service contract shall provide the service necessary for the future proper performance of this system. Service shall be available with a maximum 24-hour response time. The prime function of this organization shall be prompt, efficient service. Upon project completion, the equipment supplier shall present a full coverage preventative maintenance agreement to the Owner for his purchase approval covering all service and instructions to the customer, within a minimum of two (2) inspections per year with no additional charge for emergency calls between inspections during normal working hours.

3.5 GUARANTEE

- A. See general conditions.
- B. Provide any service incidental for the proper performance of the system during the guarantee period.

END OF SECTION