SECTION 283111 - FIRE ALARM AND SMOKE DETECTION SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Base Bid:
1. Contractor shall provide:
a. The Contractor shall provide all required components, devices, conduit, cable, and labor necessary for the complete and successful installation of a fire alarm system including but not limited to the following:
1) Manual pullstations.
2) Detection Devices (including Smoke, Heat and Duct Detectors).
3) Notification Appliances (Visual and Audible/Visual signals).
4) Addressable Interface Units (Monitoring / Control / Relay modules).
5) Fire Alarm Annunciator Panel(s).
6) Remote Power Supplies (RPS units).
7) Remote Communicator (Network) Module
8) Fire alarm wire and cable.
9) Interface to controlled equipment (electromagnetic door holders, air-handling units, access control system) including addressable interface units, wiring (and needed raceway) and programming.
10) Multi-criteria (combined smoke and thermal) detectors.
11) Necessary software and programming.
12) Nameplates for all addressable devices and control units (remote power supplies, etc.
2. Owner shall furnish:
a. The Owner will furnish the Johnson Control IFC-320 fire alarm control panel, the control panel and all associated programming will be by the contractor.

1.2 REFERENCES

A. NFPA 70 – National Electrical Code (NEC), 2008.

B. NFPA 72 – National Fire Alarm Code, 2007.

C. NFPA 101 – Life Safety Code (latest version).

D. International Building Code (IBC), 2006.

E. Americans With Disabilities Act (ADAAG) and Illinois Accessibility Code.

1.3 REGULATORY REQUIREMENTS

A. System: UL listed. Components for interaction and/or control with Fire Protection Preaction system shall be FM-listed for releasing.

1.4 SYSTEM DESCRIPTION

A. Fire Alarm system:
1. Fire Alarm System: Control Panel shall include Automatic and Manual Initiation, and Visual and Audible signaling. System shall also include monitoring modules to monitor tamper switches and flow switches, and control / relay modules to control indicated equipment (electromagnetic door holders, air-handling unit shutdown, etc.).
2. Signal Transmission: Multiplex signal transmission. Initiation device circuits shall be wired Class B, Style 4. Notification Appliance Circuits shall be wired Class B, Style Y.
3. Battery Backup (Reserve): Contractor shall provide backup batteries for control panel, remote power supplies and other control units and active electronics using **60h** of standby time and **15min** of alarm.

B. Definitions:
1. GENERAL ALARM:
a. Audible, Visual and combined Notification Appliances and auxiliary devices are activated. By convention, we define “auxiliary devices” as equipment that: transmit signal(s) to building mechanical systems to initiate shutdown of fans, and transmit signal(s) to access control system to deactivate electric / electronic doors.
b. Fire Alarm Visual and Audible signals shall be transmitted to the Fire Alarm Annunciator Panels and the existing Control Panel and indicate the location of individual alarm initiating device on 80-character display on Fire Alarm Control Panel.
2. ALARM: Fire alarm Notification appliances are not activated and auxiliary devices are not shut down. Visual and audible signals will be transmitted to the Fire Alarm Annunciator Panels and indicate the location of individual alarm initiating device on 80-character display on Fire Alarm Control Panel.
3. NOTIFICATION: General notification appliances are activated.

C. SEQUENCE OF OPERATION:
1. Elevator Operation:
a. Actuation of a single smoke detector located in the elevator lobbies or smoke or a heat detector in the elevator equipment rooms or elevator hoistways shall transmit signals to the respective elevator control panel to initiate Phase I Emergency Recall sequence:
1) First signal shall be initiated by a lobby smoke detector on an alternate exit floor to return the elevator to the primary exit floor.
2) Second signal shall be initiated by the smoke detector located on the primary exit floor to send the elevator to the alternate exit floor.
3) Third signal shall be initiated by a smoke detector located in the elevator hoistway or machine room to signal elevator “fire hat” to indicate to emergency response personnel that the elevator may not be safe to use.
4) Alarms initiated by other devices in the system shall not cause the elevators to enter the recall sequence.
2. Actuation of a manual fire alarm pull station, heat detector, smoke detector, or flow switch shall cause the fire alarm system to enter GENERAL ALARM.
3. Actuation of a smoke detector located in the air handling ductwork shall send the system into ALARM and transmit signal to shut down the associated air handling unit. Detectors shall only shut down the fans associated with it.
4. Activation of any other system smoke detector will cause system to enter ALARM.
5. Actuation of a monitoring module connected to a sprinkler tamper switch shall cause

system to enter TROUBLE – tamper switches shall not send system into alarm.

6. System ground fault, open circuit, AC power failure or system failure shall cause system to enter TROUBLE mode.
7. GENERAL ALARM Sequence of Operation (see Definitions / this section for additional information):
   a. Indicate location of individual alarm initiating device in English on 80-character displays on Fire Alarm Control (both existing and new) and Annunciator Panels.
   b. Activate Building Fire Alarm notification appliances.
   c. Transmit signal to release door hold open devices (electromagnetic door holders).
   d. Transmit signal to shutdown the associated air handling unit (as indicated above).
   e. Transmit signal to monitoring facility via Remote Communicator (Network) Module.
8. TROUBLE Sequence of Operation:
   a. Indicate location of individual trouble alarm device in English on 80-character display and provide visual and audible trouble signal at the Fire Alarm Control (both existing and new) and Annunciator Panel(s).
   b. Manual ACKNOWLEDGE function at either type of panel silences audible trouble alarm; visual alarm is displayed until initiating trouble is cleared.
   c. Transmit signal to monitoring facility via Remote Communicator (Network) Module.
9. DRILL Sequence of Operation: Manual DRILL function causes ALARM mode operation to:
   a. Sound and display local fire alarm notification devices.
   b. Transmit signal to release door hold open devices.
   c. Transmit signal to Fire Alarm system Annunciator Panels.
10. Alarm Reset and Silence: Key-accessible RESET function at the control panels acknowledges alarm or trouble and resets system out of ALARM if alarm signaling circuits have cleared. If signaling circuits have not cleared, the local panel audible signal silences, the notification devices will be turned off, and an LED is lit. Subsequent alarms or troubles shall cause the panels' audible signal and the notification devices to operate until silenced in turn. Restoration to normal of the signaling circuit shall extinguish the associated LED and cause the panel audible signal to sound until the restoration is acknowledged by switch operation.
11. SUPERVISORY Sequence of Operation:
   a. Indicate location of individual supervisory initiating device in English on 80-character displays on local fire alarm control panel and local fire alarm annunciator(s).
   b. Transmit signal to monitoring facility via Remote Communicator (Network) Module.

1.5 SUBMITTALS

A. Submit shop drawings and product data under provisions of Specification 013323 "Shop Drawings, Product Data and Samples".

B. Provide project specific wiring diagrams, data sheets, and equipment ratings, layout, dimensions, and finishes, and battery calculation chart. Include a complete sequence of operation for the system.

C. Submit manufacturer's installation instructions.

D. Submit manufacturer's certificate that system meets or exceeds specified requirements.

E. Electrical Contractor shall include device listings on both the detector and intelligent module

loops with their shop drawings to confirm adherence to requirements outlined by paragraph 1.5A, 3.

1.6 PROJECT RECORD DOCUMENTS

A. Submit documents under provisions of Specification 017839 "Project Record Documents".

B. Include plans, diagrams and details including location of end of line devices on notification circuits.

C. Record Documents shall be furnished to A/E for delivery to Owner in both print and electronic format. Electronic format includes CAD drawings (AutoCAD version 2002 or later) on compact disc. A/E will furnish Contractor and/or their supplier with all electronic files for preparation.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit data under provisions of Section 07823 - Operating and Maintenance Data.

B. Include operating instructions, and maintenance and repair procedures and Project Record Drawings with manual.

C. Include manufacturer representative's letter stating that system is fully operational.

D. Per NFPA 72 standards, provide Testing Report (by programming and testing firm) and Certification of Completion and Compliance (by installing contractor) stating that system is fully operational and building is ready to occupy without the need for Fire Watch or other exceptions.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site.

B. Store and protect products.

1.9 WARRANTY

A. The fire alarm system modifications and new components shall be fully guaranteed for a period of one year beginning on the date of substantial completion. Substantial completion will be granted after the system is fully operational and all testing documentation has been completed.

B. The guarantee shall include the entire scope of work including all equipment, devices, materials, cable/wire, software and installation.

C. The guarantee shall exclude acts of God, vandalism, physical abuse or operator misuse.

PART 2 - PRODUCTS

2.1 FIRE ALARM AND SMOKE DETECTION SYSTEM

A. Manufacturers
1. Johnson Control – IFC-320 (furnished by owner)

2.2 INITIATING DEVICES

A. Manual Station: Double-action type, fabricated of metal or high-impact plastic, and finished in red with molded raised letter operating instructions of contrasting color. Stations requiring the breaking of a glass rod shall not be provided. Provide with keyed reset.

B. Smoke Detector: Comply with UL 268; the Photoelectric-Type Smoke Detectors shall be Intelligent and Addressable, and shall connect with two wires to one of the Fire Alarm Control Panel Signaling Line Circuits. The detectors shall use either a light obscuration or light scattering principal to measure products of combustion and shall, on command from the control panel, send data to the panel representing the analog level of products of combustion.

C. Heat Detector: The Intelligent Heat Detectors shall be Intelligent and Addressable, and shall connect with two wires to one of the Fire Alarm Control Panel Signaling Line Circuits. The detectors shall use an electronic sensor to measure thermal conditions caused by a fire and shall, on command from the control panel, send data to the panel representing the analog level of such thermal measurements.

D. Duct Mounted Smoke Detector: Duct Smoke Detectors shall be addressable and analog devices similar to the area smoke detectors except enclosed in an enclosure / housing rated for duct application and supplied with sampling tubes sized for the duct.

E. Monitor modules shall be provided to connect any N.O. or N.C. dry contact device as shown. The Monitor Module shall provide address setting and store an internal identifying code that the Fire Alarm Control Panel shall use to identify the type of device.

F. Control Modules shall be provided to supervise and control the operation of one signal circuit or as an addressable dry contact (form C) relay. The Control Module shall provide address-setting means and store an internal identifying code that the Control Panel shall use to identify the type of device.

2.3 SIGNALING DEVICES

A. Audible/Visual Signal: certifications shall include NFPA 72, UL 1971, and Americans with Disabilities Act. Device shall be semi-flush type horn/strobe with red lettered FIRE on white device body. Sound Rating 89 dB at 10 feet (minimum). Provide with integral strobe assembly and flasher with candela rating as indicated on the drawings. Device shall be clearly marked with strobe device intensity rating visible without unit disassembly or device removal. Devices shall be capable of silencing the audible component while the visual component is still active, on the same pair of NAC circuit wires.

B. Visual Fire Alarm System Signal: certifications include NFPA 72, UL 1971, and Americans with Disabilities Act. Device shall be semi-flush strobe assembly and flasher with candela rating as indicated on the drawings, with red lettered FIRE on white device body. Device shall be clearly

marked with strobe device intensity rating visible without unit disassembly or device removal.

C. Electrical Contractor shall provide water-resistant notification appliances or clear/transparent appliance cover at all exterior appliances

2.4 LOCAL FIRE ALARM ANNUNCIATOR PANEL

A. The annunciator shall be semi-flush or flush mounted and capable of displaying in English on an 80-haracter LCD display. The annunciator shall include a Piezo sounder, time and date display, system acknowledge switch, signal silence switch and system reset switch.

B. The annunciator shall include LEDs to indicate: Power, Alarm and Trouble.

C. Provide a key-switch that will enable / disable the function of the control switches of the annunciator.

2.5 REMOTE POWER SUPPLIES

A. Remote power supply shall be rated for 120-volt input with regulated, filtered and power limited, individually protected 24-volt outputs. The unit shall be self-contained in a lockable cabinet and have integral batteries and battery charger.

B. The power supply shall have four outputs with a full load output of 10.0 amps and continuous load output of 8.0 amps. The power supply shall also have fully supervised power supply, battery and notification appliance circuits.

C. Provide battery calculations and provide required battery capacity to meet Code required emergency power source duration (24-hour in standby mode, 15m in alarm).

2.6 FIRE ALARM WIRE AND CABLE

A. Provide all fire alarm cabling as power-limited fire-protective signaling cable, plenum rated (FPLP).

B. Initiating and Signaling Circuits:
1. Meets requirements of Article 760 of the NEC for power limited cable, including required jacket marking.
2. Minimum wire gauge: #16 AWG solid copper.
3. Number of pairs: 1 Pair, shielded.
4. Voltage rating: 300 volts.
5. Jacket material: Plenum rated (FPLP).
6. Temperature rating: 105 deg. C in plenum.
7. Shielding: Overall foil shield with 22-gauge drain wire.

C. Notification Appliance Circuits (NAC) and Control Circuits:
1. Meets requirements of Article 760 of the NEC for power limited cables, including required jacket marking.
2. Minimum wire gauge: #14 AWG solid copper.

3. Number of pairs: 1 Pair, unshielded.
4. Voltage rating: 300 volts.
5. Jacket material: Riser rated (FPLP).
6. Temperature rating: 105 deg. C in plenum.

2.7 NAMEPLATES AND LABELS.

A. Nameplates and labels shall be provided for all addressable devices. Nameplates and labels shall be in accordance with Specification Section 260553 and mounted within the protective cover for the device were applicable. Labels for ceiling mounted smoke or heat detectors shall have 1/4" lettering and be mounted on the inside of the protective cover at the base of the unit. The contractor shall take care to orient all nameplates so that they can be read from the floor. Labels for pull stations and other wall devices shall have 1/8" lettering. These shall be secured to the wall using tamper proof screws.

B. In addition to the devices indicated on the electrical drawings, Electrical Contractor shall provide (10) additional single-input intelligent monitoring modules and (5) additional control modules, plus all installation and programming labor, as well as all final connections. E.C. shall also include an allotment (both material and labor costs) of 200'-0" of SLC (Fire Alarm signaling line circuit) cabling, 100'-0" of 3/4" EMT conduit, and 50'-0" of 3/4" liquid-tight flexible conduit, as well as all fittings, connectors, etc. Also provide (1) duct detector with 72" sampling tubes and (3) control modules per installation and programming labor, as well as all final connections and intermediate wiring between control module and control circuit associated with monitored/controlled HVAC unit/device.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install system in accordance with NFPA Standards referenced in Parts 1 and 2 of this Section.
1. Fire alarm wiring shall be installed in conduit per specification section 26 05 19.

B. Connect fire alarm system initiating circuits to devices to be controlled by fire alarm. Coordinate with equipment supplier.

3.2 EQUIPMENT INSTALLATION

A. Smoke Detectors: Install detectors indicated to be ceiling mounted not less than four inches (4") from a sidewall to the near edge. Install detectors located on the wall at least four inches (4") but not more than twelve inches (12") below the ceiling. For exposed solid joist construction, mount detectors on the bottoms of the joists. Install detectors no closer than three feet (3') from air registers. Duct Mounted Smoke Detector (if any): Securely mount detector housing to duct and install sampling tube. Seal all duct penetrations to provide an airtight installation. Modify associated equipment's starting mechanism to incorporate fan shutdown. Equipment starting mechanism shall be modified such that the fire alarm system will shutdown fan regardless of hand-off-auto switch position.

B. Manual Pull Stations: Unless otherwise indicated mount semi-flush in recessed back boxes with operating handles 48" above finished floor. For surface mounted devices, mount device in surface box appropriately sized for device. Dimensions of device shall not exceed dimensions of surface mounted box by more than 1/8 in.

C. Addressable Interface Units: devices shall be mounted in an electrical junction box (confirm size with supplier / manufacturer) and shall be in close proximity to equipment (e.g. flow and/or tamper switch) – NFPA 72 notes that supervisory modules shall be no greater than 3'-0" from device it's monitoring or controlling. All units shall have unique identifier / address and supervise only one device; "ganging" of equipment and connecting it to one addressable interface unit is prohibited.

D. Notification Appliances: Install eighty inches (80") above floor or six inches (6") below the ceiling, whichever is lower. If architectural appurtenances (i.e. mirrors or furniture) interfere with device mounting at this height, devices may be installed up to ninety-six inches (96") above floor. As noted on the drawings, if location or area still prohibits the installation of wall-mounted appliances, Electrical Contractor may install ceiling-mounted detectors, albeit at no additional cost and in compliance of NPFA 72 paragraph 7.5.4 ("Appliance Location").

E. Fire Alarm Control Panel: Surface-mounted as indicated on the drawings with tops of cabinets not more than six feet (6') above the finished floor. Fire Alarm Annunciator Panel: Flush mount with top of device not more than sixty-six inches (5'-6") above the finished floor.

3.3 WIRING INSTALLATION

A. Wiring Method: Install wiring in accordance with Section 260519 - "Building Wire & Cable". Contractor shall protect all edges of surface raceway to ensure that cable is not damaged during installation.

B. Wiring 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 in accordance with the wiring diagrams of the system. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

C. Cable Taps: Use numbered terminal strips in junction, pull or outlet boxes, cabinets, or equipment enclosures where any circuit tap is made.

D. Alarm Wiring: For the low-voltage portion of the fire alarm system, install 75-deg C insulation in wet, damp, or dry locations. Provide wiring operating at line voltage having similar insulation.

E. Color Coding: Color code all fire alarm conductors differently from the normal building power wiring. Provide one color code for alarm circuits wiring and a different color code for supervisory circuits. Provide a color code for audible alarm indicating circuits different from alarm initiating circuits. Use different colors for visual alarm indicating devices.

F. Install fire alarm cabling in conduit in mechanical and storage rooms. Raceway and/or conduit shall be painted to match adjacent surfaces.

G. Install fire alarm cabling to structure (decking) above accessible ceiling space.

3.4 GROUNDING

A. Ground equipment and conductor and cable shields. Provide 5-ohm ground at main equipment location. Measure, record, and report ground resistance.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Provide services of a factory-authorized service representative for the pretesting, testing, and adjustment of the system.

B. Pretesting: Upon completing installation of the system, align, adjust, and balance the system and perform complete pretesting. Determine, through pretesting, the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed in pretesting. 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. Each device shall be tested during the pretest. Verify the absence of unwanted voltages between circuit conductors and ground. Megger test all conductors other than those intentionally and permanently grounded with electronic components disconnected. Test for resistance to ground. Report readings less than 1-megohm for evaluation. Test all conductors for short circuits utilizing an insulation testing device. With each circuit pair, short circuit at the far end of the circuit and measure the circuit resistance with an ohmmeter.

C. Report of Pretesting: After pretesting is complete, provide a letter certifying the installation is complete and fully operable. The letter shall include the names and titles of the witnesses to the preliminary tests.

D. Final Test Notice: Provide 10 days minimum notice in writing when the system is ready for final acceptance testing.

E. Final Test: This test must be complete for the fire alarm system to be considered 'Fully Operational'.
1. Have the fire alarm acceptance test performed by the Alarm Company Representative and installing Contractor in the presence of Engineer and St. Clair Co Public Building Commission personnel.
2. Acceptable Test Procedures: Test the system in accordance with the procedures outlined in NFPA 72. Minimum required tests are as follows:

-Normal Power to Panel	(Secure/Normal)
-Disconnect Power to Panel	(Trouble)
-Activated Detection Device	(Alarm)
-Silence Alarm Signaling Devices	(Trouble)
-Return Normal Power to Panel & Reset Panel	(Secure/Normal)
-Place Each Function Switch in an Abnormal Positions	(Trouble)
-Remove supervised Devices from System (During this portion of testing, ensure proper wire has been used and devices are properly installed).	(Trouble)
-Return Supervised Device to System	(Secure/Normal)

-Disconnect Normal Power to Panel	(Trouble)
-Activate Detector(s) (Alarm) Inspect all Horns/Bells, Zone Indication, and Auxiliary Devices	(Working List)
-Silence Horns/Bells	(Alarm/Trouble)
-Reset System	(Trouble)
-Return Normal Power to System	(Secure/Normal)

Place Panel in Alarm Condition. Disconnect Primary Power Source for a Minimum of 15 Seconds and Return to Normal Power. (The above transfer procedure shall not cause a loss of an alarm condition at Receiving Station.)

a. Test the system for all specified functions in accordance with 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. Record the functionality of each and every device in the system.

b. 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.

3. Submit system test certification / record of completion information.
4. This test must be complete for the fire alarm system to be considered 'Fully Operational'.

3.6 CORRECTION OF DEFECTS

A. When the tests disclose any unsatisfactory workmanship or equipment furnished under this Contract, correct defects and retest. Repeat tests until satisfactory results are obtained.

B. When any wiring or equipment is damaged by tests, repair or replace such wiring or equipment. Test repaired items to ensure satisfactory operation.

3.7 COMMISSIONING

A. Provide the services of a factory-authorized service representative to demonstrate and train the University's personnel as specified below.
1. Train maintenance personnel in the procedures and schedules involved in installing, operating, troubleshooting, servicing, and preventive maintaining of the system. Allot (8) hours for this training.
2. Provide (4) hours of additional training for the University's appointed responding personnel regarding the operation of the specific systems installed on this project. This phase of training shall not include installing, troubleshooting, servicing or preventive maintenance.
3. Operation and Maintenance Manuals shall be submitted to the Engineer and approved prior to Training. Utilize the O&M manual as reference material during all training sessions.
4. Schedule training at least two weeks in advance. Notify both A/E and Owner of training

dates.

B. All commissioning work performed by Electrical Contractor shall be in coordination with project Commissioning Agent – see section 28 08 00 Commissioning of Life Safety and Security Systems.

C. SOFTWARE
1. Contractor and Fire Alarm system manufacturer / supplier shall furnish complete programming of system on compact or digital disc (CD, DVD, etc.) at commencement of project. Provide this information with O&M Manuals.

3.8 WARRANTY

A. General. The contractor warrants that all work provided under the contract will be in conformance with the contract and free from defects in workmanship, materials and equipment for a period of one (1) year or such longer periods may be specified in the contract documents, except as provided below. Warranty time periods shall commence from the date of Owner acceptance of the whole, or any part of the project.

B. Latent Defects. On demand by the Owner, at any time within the one (1) year period following substantial completion or final acceptance, if applicable, the Contractor shall promptly repair or replace all defective or non-conforming work resulting from, or constituting, latent defects, fraud, fraudulent concealment or gross negligence. The Owner and/or A/E will give timely notice of such defects.

C. Prompt Repair. Upon notice from Owner of such defects or non-conforming work, the Contractor shall promptly visit the site within 48 hours in the company of a building representative, and shall provide all labor, material and equipment to promptly repair or replace the defective or non-conforming work. The repair shall include all adjacent work not necessarily provided by the Contractor but damaged as a result of such defects or non-conforming work, Owner may repair or replace such work and charge the cost thereof to the Contractor. Work which is repaired or replaced by the Contractor shall be inspected and shall be warranted by the Contractor in accordance with this Article. The warranties set forth herein are in addition to all warranties or guarantees expressed or implied by operation of law, statute or ordinance.

D. Commercial Warranties. The Contractor shall deliver all commercial warranties received from manufacturers to the A/E prior to final completion but this shall not reduce Contractor's obligations under this article.

END OF SECTION 283111