SECTION 28 46 21 - FIRE ALARM AND DETECTION SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. It is the intent of these specifications, drawings, schedules and riser diagrams to describe the minimum requirements to furnish and install an extension to the existing fire alarm system main panel. **All new initiation and annunciation, in addition to wiring throughout the building shall be provided as part of this project. The existing head-end shall remain and be expanded/upgraded as required to meet the bidding documents.** The system shall include the following:

1. Addressable Monitoring and Control.
2. Manual Operator Switches and Annunciation.
3. Manual Stations.
4. Addressable Smoke Detectors with Application Specific Detection.
5. Addressable Duct Smoke Detectors with Application Specific Detection.
6. Addressable Heat Detection.
7. Addressable Continuous Linear Heat-Detector Systems and Air-Sampling Smoke Detector Systems.

    a. For use in elevator pits and shafts.

8. Addressable Monitoring and Control Modes for:

    a. Elevator Recall Control.
    b. Air Handling Unit Control.
    c. Smoke Damper Control.
    d. Kitchen Hood Suppression Monitoring.

        1) Additional relays shall be provided as required to interface with shunt trip devices, gas valve(s), utility distribution system(s), kitchen hood suppression system(s) and other kitchen devices.

    e. Fire Pump Control and Supervision.

        1) Fire Pump Supervision shall include remote annunciation per NFPA 20 including, but not limited to the following:

            a) Run.
            b) Controller Main Switch Set to Off or Manual.
            c) Trouble on the Controller or Engine.

    f. Sprinkler System Flow and Tamper Valves.

        1) Electronic flow valves: provide power to valve from battery panel, contact to receive signal of flow and relay to provide test and reset functions. Coordinate all wiring, etc. with valve to ensure proper connections and programming is provided.

    g. Knox Box.

h. Magnetic Door Holders.

1) Additional low voltage button, with label, shall be provided at the building administration area to release all mag locks in the building, in the event that there is an emergency.

i. Spark Detection for Duct Collection System.

1) Where spark detection is indicated on the drawings, provide the required fire alarm connection at this location. Review with the local fire marshal exact sequence of operations.
2) Coordinate connection requirements with the spark detection installing contractor.

9. Remote Annunciation and Control.
10. Firefighter's microphone shall be located near administration area, where directed by the owner in the field. Provide all accessories, wiring, programming, etc. as required.
11. Remote Network panels.
12. Visual Indicating Appliances.
13. Audible Indicating Appliances. (Speakers)
14. Central Station Reporting of Alarm, Trouble and Supervisory Conditions.
15. Standby Batteries.
16. Record documents in Document Storage Box.
17. Conduit, Wire, Outlet Boxes, Miscellaneous Parts.
18. Other items required for a complete and operational system.

B. **This is a phase project. All additional accessories, wiring, time, programming, etc. shall be provided as required so that there is a complete and functioning fire alarm and detection system at the end of each individual phase. All features of the system shall be available throughout the construction. Refer to the Phasing drawings for a complete understanding of the scope of the phases for the project.**

C. The Contractor shall be responsible for submitting all drawings, riser diagrams, calculations etc. to local authority for their approval. All components require U.L. and FM compliance. The Contractor shall be required to provide UL and FM certification documentation to township officials to meet all township requirements before the township will accept the system. The Contractor shall be responsible to review all annunciator, Knox Box and sprinkler gong locations with local officials prior to beginning work. The Contractor shall be responsible for any and all permits required by the township.

D. The Contractor shall verify that all peripheral devices (initiation and annunciation) is compatible with the system. If an alternate manufacturer of peripheral device is required for compatibility with the system, the contractor shall supply the alternate manufacture at no additional cost to the Owner. The alternate manufactured device shall be equivalent in performance and appearance to the specified.

E. Provide interconnections as listed in part 2.

F. Provide training as listed in part 3.

1.2 CODES AND STANDARDS

A. NEC Compliance: Comply with the National Electric Code (NEC), latest version in effect as of the bid due date of this project, as applicable to construction and installation of fire alarm and detection system components and accessories.

B. The Fire Alarm System Supplier shall contract with an independent Electrical Inspection Agency to inspect the fire alarm system installation for compliance with Article 760 of the NEC and other applicable articles of the NEC. The Inspection Agency shall be a different company than the Electrical Inspection Agency used by the Electrical Contractor. An approval certificate from the Electrical Inspection Agency shall be submitted to the Architect and Engineer before final approval of the system is granted.

C. The name of the Electrical Inspection Agency is to be submitted with the shop drawings for approval by the Architect and Engineer of record for this project.

D. NFPA Compliance: Comply with latest edition of NFPA 72 National Fire Alarm Code, as applied to construction and installation of fire alarm and detection system components and accessories. The Contractor shall be responsible to have the Fire Alarm manufacturer review the drawings prior to installation of any device. Any device(s) required to be added or relocated to meet NFPA requirements shall be submitted prior to installation.

E. ADA Compliance: Provide fire alarm system signaling components which meet the Americans with Disabilities Act (ADA) and any subsequent modifications and clarifications to this law.

F. U.L Compliance and Labeling: Provide fire alarm and detection system components which are U.L. listed and labeled for their intended use and service. In addition to the fire alarm equipment listing requirements, if the local municipality requires, the Fire Alarm System Equipment Supplier shall be U.L. listed as an Alarm Service Company for Local, Remote, Auxiliary and Proprietary Protective Signaling Systems. The U.L. Listing Certification number for the Alarm Service Company shall be included in the submittal information.

G. Commonwealth of Pennsylvania: The complete installation shall be installed in a manner to provide a system that meets the requirements of the Pennsylvania Construction Code Act (Title 34) as adopted on April 11, 2003 and the Uniform Construction Code.

H. Local Code Requirements: Comply with the latest codes as adopted by the local code authority having jurisdiction (AHJ) and implemented by its building code services bureau. The Contractor and equipment supplier shall assist the building code services bureau inspectors in the final test of equipment and operation of the system.

I. NICET Certification: The Equipment Supplier shall employ at least one individual full time in the office supporting this project that has attained NICET Level III Certification in Fire Alarm Systems. All submittals and drawings shall be approved, initialed and show the NICET Certification Number of the individual maintaining the certification and taking responsibility for the documentation. As an alternate to the NICET Level III requirement, all submittals, drawings, and testing shall be reviewed, witnessed, and stamped sealed by a Professional Engineer (PE), licensed in the State of Pennsylvania, and the PE shall present a final letter of certification of the system at the completion of the project.

1. While the system has been designed as part of the bidding documents, it is the Vendor's responsibility to review all equipment locations to ensure compliance with the supplied products. The Vendor shall also provide all required battery calculations, wiring requirements, etc. for a complete and functioning code compliant system. Should a deficiency be found during the review process, the Vendor shall submit, in writing, all deficiencies for Engineer review.

1.3 DESCRIPTION OF WORK

A. It is the intent of these Specifications and Drawings to describe the minimum requirements to furnish and install a complete fire alarm system. The system shall be addressable type to include manual stations, automatic detectors, visual indicating appliances, audible indicating appliances, equipment and connections for remote Central Station monitoring, sprinkler flow and tamper switch monitoring, duct detectors, air handling unit control, standby batteries, conduit, wire, outlet boxes, elevator recall, door hold

open devices, kitchen hood systems and any other items required to provide a complete and operational system.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A factory authorized installer is to perform the work of this section. The authorized installer shall include a service department and employ factory trained and NICET certified technicians, and shall be located within 100 miles of this project location. The installer shall have a minimum of 5 years' experience installing fire protective signaling systems.

B. 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 "UL" label.

C. The Manufacturer shall be a nationally recognized company specializing in fire alarm and detection systems.

1.5 SUBMITTALS

A. Submit under provisions of Division 26 "Basic Electrical Requirements."

B. The installing contractor and/or equipment manufacturer shall provide complete and detailed shop drawings and include:

1. Detailed written system description describing system functions and operation. All specification deviations shall be clearly noted and marked.
2. Control panel wiring schematic and interconnections.
3. Complete point to point wiring diagram showing terminal connections to all system devices.
4. Riser wiring diagram and associated zones.
5. Complete floor plan drawings locating all devices associated with the fire alarm system.
6. Factory data sheets on which piece of equipment to be used and so marked as to model, dimensions, size, voltage, and configuration.
7. Complete Bill of Material for reference.
8. Programming matrix defining all input/output functions and zoning.
9. Provide complete battery calculations for both alarm and supervisory mode.
10. Provide audibility calculations shop drawings per IFC 907.

C. The equipment supplier must have a minimum NICET Level 3 Certification, or Submittals and Drawings must be stamped by a Registered Fire Protection Engineer.

D. Submit a copy of NICET Level III Certificate and technician's factory certification cards.

E. All submittal data will be in bound form with contractor's name, supplier's name, project name, and State Fire Alarm License number adequately identified.

F. When preparing submittals and any required final programming, use a room number schedule generated by the architect and/or the owner, which indicates the actual room numbers that will be used when the building is occupied. If the schedule is not available, revise the initial submittal, when a schedule is available, to reflect the proper room numbers.

G. **Project Completion Documentation:**

1. At the completion of the project, the following documentation shall be provided in compliance to Division 26 “Basic Electrical Requirements” and Division 01 sections, as well as included in the Document Storage Box:

   a. Complete set of Operation and Maintenance manuals.
   b. Program documentation as specified in this section.
   c. Complete set of As-Built fire alarm drawings, indicating all device programming and identification, and battery calculations. Drawings must include all newly installed equipment, as well as any exiting equipment scheduled to remain.
   d. All other NFPA and UCC required documentation.

1.6 WARRANTY AND MAINTENANCE SERVICE

A. The Contractor shall warrant the fire alarm equipment and wiring to be free from inherent mechanical and electrical defects for a period of two (2) years from the date of the final acceptance of the system of the last phase of the project. The Fire Alarm System equipment shall have a warranty of two (2) years from date of the last phase of the project. Defective equipment shall be replaced at no cost to the Owner during this two-year warranty period.

B. Maintenance Service Contract: Provide warranty maintenance of fire alarm systems and equipment for a period of two (2) years, using factory-authorized service representatives.

C. Basic Services: Systematic, routine maintenance visits on at times scheduled with the Owner. In addition, respond to service calls within 24 hours of notification of system trouble. Adjust and replace defective parts and components with original manufacturer's replacement parts, components, and supplies.

D. Additional Services: Perform services within the above period not classified as routine maintenance or as warranty work when authorized in writing. Compensation for additional services must be agreed upon in writing prior to performing services.

E. Testing & Inspections: Perform NFPA 72 and the Pennsylvania Department of Labor & Industry, Uniform Construction Code required testing and inspections during the two (2) year period at no additional cost to the owner.

F. Renewal of Maintenance Service Contract: No later than 60 days prior to the expiration of the maintenance services contract, deliver to the Owner a proposal to provide contract maintenance and repair services for an additional one-year term. Owner will be under no obligation to accept maintenance service contract renewal proposal.

1.7 ADDITIONAL DOCUMENTAITON AND PROGRAMMING REQUIREMENTS

A. The vendor shall provide drawings showing all fire alarm devices and their device identification in the software. These drawings must include all devices, whether shown on the project drawings, or not, and shall include any existing devices that are remaining to be reused.

B. At the end of the project, the vendor shall program all device point identification to match existing room numbering at the completion of the project.

C. At project completion, all of the above documentation shall be provided as part of the operation and maintenance manuals and as-built documentation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Siemens XLS.

2.2 FIRE ALARM AND DETECTION SYSTEMS

A. General: Provide fire alarm and detection system products of types, sizes and capacities indicated that comply with manufacturer's standard design, materials, and components; construct in accordance with published product information, and as required for complete installation. Provide fire alarm and detection systems for applications indicated, and with the following sequence of operations, components and function features.

B. The system shall be addressable type, to include manual stations, automatic detectors, visual indicating appliances, audible indicating appliances, remote annunciators, equipment and connections for remote monitoring, sprinkler flow switch, sprinkler tamper switch, duct detector, standby batteries, conduit, wire, outlet boxes and any other items required to provide a complete and operational system.

C. Provide fire alarm and detection systems for applications indicated, and with the following sequence of operations, components, and function features.

D. Operation: The system specified is an addressable type system that provides the capability of monitoring individual devices such as smoke detectors, heat detectors, manual pull stations, sprinkler activating devices and other auxiliary functions for alarm and trouble indications. All items monitored for alarm and/or trouble conditions shall be capable of custom programming a minimum of 232 alpha/numeric character identification that is displayed on the control unit. In addition to the text message the user can view a graphic map with an icon indicating the location of the event in the building. Custom programming of automatic operation for individual devices for alarm signaling, fire department reporting, remote annunciation and other auxiliary control functions shall be provided. The system shall have a minimum capacity of 2500 input and 2500 output devices within the Main Processor. If the system needs grow beyond of 2500 points, the system shall be able to be networked to identical panels. In addition, the system shall have the following functions:

1. Initiating Device Calibration Check: It shall be possible to check the calibration at each initiating device at the control unit to verify correct operation.
2. Detector Sensitivity Check/Adjustment: Provide the capability of checking and adjusting individual detectors for alarm condition sensitivity from the control unit. The detector sensitivity monitoring shall meet and be listed by Underwriters' Laboratory for this function.
3. Coded Signaling: Operate audible notification appliance signals on a Coded manor in accordance with the National Standard. The system shall have the ability to code each device with a distinctive code. This code shall be software selectable.
4. Compare Function: Software to allow for a printout of a comparison of the original or previous program and any software modifications that are made to indicate any deficiencies caused by reprogramming. Systems not providing a compare printout function shall require 100% re-testing after every software modification and furnish a print out with each device being re-tested to the institution.
5. Detector Maintenance Monitoring: Provide monitoring of smoke detector chambers for gradual build-up of foreign materials in the sensing chamber. When the control senses a high level of contamination, the control panel shall cause a trouble condition and indicate the specific detector that needs maintenance.

6. Automatic Drift Compensation: All smoke detectors shall be monitored for changes in sensitivity ranges and automatically adjust the detection window, up or down, to compensate for environmental changes or degradation of detector components.
7. Visual Indicating Appliances Control: All visual indicating appliances shall be synchronized throughout the facility.
8. Application Specific Detection: Smoke detectors shall be individually programmed to provide the maximum sensitivity allowed by UL standards to actual fire phenomena and be discriminatory to deceptive phenomena that cause unwanted alarms. The program shall allow for a selection of 11 application specific environments to choose from as listed below. These selections shall be submitted for application to the Engineer before final acceptance of the system. Systems not including this feature shall provide both ionization and photoelectric detection at each location, programmed with algorithms to provide the earliest possible detection and minimize unwanted alarms.

Application Specific	Normal Environment
Office	Reasonably clean, climate-controlled atmosphere
Warehouse	Airborne dust, equipment, fork truck, light-to-medium dock area exhaust fumes
Lobby	Relatively clean area, temperature changes, cellular telephones, cigarette/cigar smoking fumes
Computer Room	Very controlled environment: clean, temperature closely regulated, high-cost clean machinery operating, no smoking, high air velocity
Healthcare	Higher-level; risk, relatively clean, electronic equipment
Dormitory	Airborne dust, temperature changes, living quarters, cooking fumes, smoking
Parking Garage	Airborne dust, car and diesel fumes, temperature swings
Utility Room	Normal to somewhat dirty environment, heat from running equipment
Hostile Environment	Dirty, dusty, humid, operating equipment, RF present, wide temperature swings
Precious Storage	Sensitive materials or equipment storage, clean dust-free environment, earliest warning desired
Duct	Installation in air handling systems

9. Alarm Verification: Provide field programmable alarm verification for all smoke detectors that allows a time delay of up to 50 seconds before a smoke detector signals the alarm. This feature shall not be utilized or required with application specific detectors where no delays of reporting of fire phenomena are necessary and ‘deceptive phenomena’ is ignored.
10. Detector Maintenance Monitoring: Provide monitoring of smoke detector chambers for gradual build-up of foreign materials in the sensing chamber. When the control senses a high level of contamination, the control panel shall cause a trouble condition and indicate the specific detector that needs maintenance.

11. Automatic Drift Compensation: All smoke detectors shall be monitored for changes in sensitivity ranges and automatically adjust the detection window up or down to compensate for environmental changes or degradation of detector components.
12. Battery Standby: Provide in the control unit cabinet, batteries that will operate all system initiating devices for a minimum of 24 hours during power outage and operate the entire system for a minimum of 2 hours of emergency operation or 15 minutes of evacuation alarm at maximum connected load. The batteries shall be sealed type and automatically recharge after normal power is restored.
13. Device Bypassing: Provide the capability through the control panel keypad to individually disarm an initiating device or output circuit. If an initiating device such as a smoke detector malfunctions, disarming and bypassing the unit shall be possible without affecting other devices within the system. Output control functions such as notification appliance circuits or fun shut down shall be capable of being individually bypassed during tests or abnormal conditions. A trouble condition shall be created when any initiating or output device is disarmed or bypassed.
14. Event History Storage: All events of the system shall be logged in non-volatile history buffer with a minimum capacity of 1000 events. The events may be recalled by category.
15. Walk Test: A walk test feature shall be provided that allows testing individual zones, loops or the entire system in either a silent or audible basis. In either test, programmed functions shall be bypassed.
16. Fully Field Programmable: The complete system operation shall be programmed via a standard laptop computer. The program shall be capable of being stored in the computer hard disk, storage media and printed on standard continuous form paper. The complete program shall be turned over to the Owner upon acceptance of the system. The program shall be in digital format on storage media as well as a printed hard copy.
17. Compare Program: The system program shall allow for a printout of any and only changes that have been made to the program since the last program event or session. This printout shall indicate the time and date of the previous and current program sessions. Once the system is accepted by the authority having jurisdiction (AHJ), a copy of the current program must be signed by the AHJ on the first page and last page of the continuous form printout. Any changes to the program after this time and date, must be submitted for approval by the AHJ in printed form or the entire system must be re-tested and approved at the discretion of the Department of General Services Engineer and the AHJ. With the compare program printout, all the devices and their operation shall be tested in accordance with NFPA 72 which requires an additional 10% of the unchanged portion of the system, up to a total of 50 devices, to be tested. Documentation shall be provided that these tests were made after each programming change or session that is downloaded to the system.

2.3 MATERIALS AND EQUIPMENT

A. Fire Alarm Control Panel. Existing panel shall be expanded and upgraded to meet the following:

1. Provide a fire alarm control panel cabinet as shown on the drawings that includes the required power supply, human interface display unit with keyboard, card rack assemblies with spare space capacity to expand the system a minimum of 50%, central processing unit, programmable memory board, addressable input modules, signal circuit modules, auxiliary relay function modules, battery charger, battery shelf, and required sealed batteries. The Contractor shall provide 120V power supply as required.

    a. Provide in a surface mounted enclosure when installed in mechanical or electrical space. When located in a finished location, provide recessed enclosure.

2. All devices must be individually mapped and inputted in the system so that they may be presented with individual identification on the display unit during alarm, trouble and supervisory conditions.
3. The fire alarm control panel shall be microprocessor based using multiple microprocessors throughout the system providing rapid processing of smoke detector and other initiation device

information to control system output functions. There shall be a watchdog circuit, which shall verify the system processors and the software program. Problems with either the processors or the system program the panel shall activate a trouble signal, and reset the panel. The system modules shall communicate with an RS 485 network communications protocol. All module wiring shall be to terminal blocks, which will plug into the system card cage. The blocks shall be color coded to prevent accidental crossing of wiring.

4. Provide all required Device Loop Cards, Signal Circuits, Zone Indicating Cards, and other cards as required for a fully functioning system.
5. The system card cage shall provide the mounting of all system cards, field wiring, and panel's inter-card wiring. The terminal strips for the cards shall be color-coded to eliminate the possibility of making the wrong connection. The terminal blocks maybe disconnected and reconnected while the system is powered up without causing any difficulties. All power limited field wiring shall connect to the top of the card cage. All non-power limited internal wiring shall be connected to the bottom of the card cage. The card cage shall hold the systems cards and have capability of connecting multiple card cages to meet system demands.
6. Provide Audio Input Card to allow up to two external audio sources such as Background music or PBX conventional paging or any source such as CD and tape player.
7. Provide Tape Recorder Card as required to allow one analog output (voice/telephone) to be recorded and distributed throughout the building using the fire alarm speakers.
8. The system shall be capable of providing both horns and speakers.
9. When connected with an existing system, provide all required interface cards/modules to communicate with existing devices.

B. Power Supply:

1. The system Power Supply/Charger shall be a 12-amp supply with battery charger. The power supply shall be filtered and regulated. The system power supply shall have 4 relays, 1 for common alarm, one for common trouble and two programmable relays. The power supply shall be rated for 120/240 VAC 50/60 Hz.
2. The battery charger shall be able to charge the system batteries per battery specifications. Battery charging shall be microprocessor controlled and programmed with a special software package to select charging rates and battery sizes.
3. The battery charger shall be able to accept, and be provided with Thermistor for monitoring battery temperature to control charging rate.

C. System Enclosures:

1. Provide the enclosure needed to hold all the cards and modules as specified with at least spare capacity for two cards. The enclosure outer door shall be either black or red. Provide the color as to the local AHJ requirements. The outer doors shall be capable of being a left-hand open or a right-hand open. The inner door shall have a left-hand opening. System enclosure doors shall provide where required ventilation for the modules or cards in the enclosure.
2. Provide system enclosure for all amplifiers. Where required by the manufacturer, provide means for venting heat from the enclosure either by having enclosure sides and top vented or the doors vented.

D. Off-Site Communications:

1. Provide network communications with cellular backup. Coordinate exact requirements with Owner's monitoring agency to ensure complete compatibility. The contractor shall provide all power and interconnecting wiring as required.

E. Initiation Devices:

1. All initiation devices shall be insensitive to initiating loop polarity. Specifically, the devices shall be insensitive to plus/minus voltage connections on either Style 4 or Style 6 circuits.
2. Smoke Detectors:

   a. Smoke detectors shall be ceiling mounted digital addressable photoelectric type smoke detectors with integrated heat sensors. The combination detector head and twist lock base shall be U.L. listed compatible with the fire alarm control panel.
   b. The base shall permit direct interchange with the heat detector. The base shall be the appropriate twist lock base.
   c. The smoke detector shall have a flashing status LED for visual supervision. When the detector is actuated, the flashing LED will latch on steady at full brilliance. The detector may be reset by actuating the control panel's reset switch. The sensitivity of the detector shall be capable of being selected and measured by the control panel without the need for external test equipment.
   d. The vandal security-locking feature shall be used in those areas as indicated on the drawing. The locking feature shall be field selectable when required. It shall be possible to perform a sensitivity test of the detector without the need of generating smoke. The test method shall simulate the effects of products of combustion in the chamber to ensure testing of the detector circuits.
   e. Detectors shall have completely closed back to restrict entry of dust and air turbulence and have a 30-mesh insect screen. Electronics of the unit shall be shielded to protect against false alarms from E.M.I. and R.F.I.

3. Heat Detectors:

   a. Furnish and install digital addressable heat detectors. The combination heat detector and twist lock base shall be U.L. listed compatible with the fire alarm control panel.
   b. The base shall permit direct interchange with the photoelectric smoke detector. The base shall be appropriate twist lock base.
   c. The heat detector shall have a flashing status LED for visual supervision. When the detector is actuated, the flashing LED will latch on steady at full brilliance. The detector may be reset by actuating the control panel's reset switch.
   d. The vandal security-locking feature shall be used in those areas as indicated on the drawings. Electronics of the unit shall be shielded to protect against false alarms from E.M.I. and R.F.I.

4. Combination Fire and Carbon Monoxide Detectors:

   a. Combination fire and carbon monoxide detectors shall be ceiling mounted digital addressable detectors with integrated sensing elements, including smoke, CO, light/flame and heat. The detector head and twist lock base shall be U.L. listed compatible with the fire alarm control panel.
   b. The smoke detector shall have a flashing status LED for visual supervision. The detector may be reset by actuating the control panel's reset switch. The sensitivity of the detector shall be capable of being selected and measured by the control panel without the need for external test equipment.
   c. The vandal security-locking feature shall be used in those areas as indicated on the drawing. The locking feature shall be field selectable when required. It shall be possible to perform a sensitivity test of the detector without the need of generating smoke. The test method shall simulate the effects of products of combustion in the chamber to ensure testing of the detector circuits.

5. Duct Detectors:

   a. Duct Detector shall include an enclosure with a photoelectric smoke head as previously specified and auxiliary output. Duct Detectors shall be provided with remote indicator lights and appropriate sampling tube for duct size.
   b. Duct Detectors shall be provided with NEMA 4X enclosure and strip heat as required for exterior applications, powered from the fire alarm system. Provide sufficient power and wire as required to operate detector.
   c. Program duct detectors as directed by owner/fire marshal.

6. Beam Smoke Detectors:

   a. Projected Beam Light Source and Receiver: Designed to accommodate small angular movements and continue to operate and not cause nuisance alarms.
   b. Detector Address: Accessible from FACP and able to identify detector's location within system and its sensitivity setting.
   c. Operator at FACP, having designated access level, must be able to manually access the following for each detector:

      1) Primary status.
      2) Device type.
      3) Present average value.
      4) Present sensitivity selected.
      5) Sensor range (normal, dirty, etc.)

   d. For detectors that require additional power, provide power as required for full functionality.

7. Continuous Linear Heat-Detector System

   a. Provide continuous linear heat-detector systems in the elevator pit and shaft, in lieu of spot type detectors. Control unit shall be placed outside elevator in coordinated location. Locate detector cable within 2’-0” of sprinkler heads.
   b. Detector Cable: Rated detection temperature as identified in the locally adopted version of IFC and NFPA 72. Listed for "regular" service and the environment for which it is installed. Cable includes two steel actuator wires twisted together with spring pressure, wrapped with protective tape, and finished with PVC outer sheath. Each actuator wire is insulated with heat-sensitive material that reacts with heat to allow cable twist pressure to short circuit wires at location of elevated temperature.
   c. Control Unit: Two-zone or multizone unit as required. Provide same system power supply, supervision, and alarm features as specified for FACU.
   d. Signals to FACU: Local system trouble must be reported to FACU as composite "trouble" signal. Alarms on each detection zone must be individually reported to central FACU as separately identified zones.
   e. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to FACU.
   f. Provide power as required for the installation.

8. Air-Sampling Smoke Detectors

   a. Provide air-sampling smoke detectors the elevator shaft, in lieu of spot type detectors. Detector unit shall be placed outside elevator in coordinated location with tube extended into shaft to appropriate location.
   b. General: Air-sampling smoke detector must be laser based using piping system and fan to transport particles of combustion to detector. Provide two levels of alarm from each zone covered by detector and two supervisory levels of alarm from each detector. Air being

sampled must pass through filters to remove dust particulates greater than 20 microns before entering detection chamber. Detectors must communicate with FACU via addressable module.

c. Detector, Filter, Aspirator, and Relays: Housed in mounting box and arranged such that air is drawn from detection area and sample passes through dual-stage filter and detector by aspirator.
d. Four independent, field-programmable, smoke-alarm thresholds per sensor pipe and programmable scan time delay. Threshold set points must be programmable.
e. Power Supply: Regulated 24 V(dc), monitored by FACU, with battery backup.
f. Provide four in-line sample pipe inlets that must contain flow sensor for each pipe inlet. Detector must be capable of identifying pipe from which smoke was detected.
g. Aspirator: Air pump capable of allowing for multiple sampling pipe runs up to 650 ft. (200 m) in total, (four pipe runs per detector) with transport time of less than 120 seconds from farthest sample port.
h. Sampling Tubes: Provide sampling tube appropriate for the application, meeting locally adopted IFC and NFPA 72 requirements.
i. Locate detector
j. Provide power as required for the installation.

9. Manual Pull Stations:

a. Manual Fire Alarm Stations shall be double action type, with a key operated test-reset lock in order that they may be tested, and so designed that after actual emergency operation, they cannot be restored to normal except by use of a key. The reset key shall be so designed that it will reset manual station and open FACP without use of another key. An operated station shall automatically condition itself so as to be visually detected, as operated, at a minimum distance of fifty feet, front or side. Manual stations shall be constructed with clearly visible operating instructions on the front of the stations in raised letters. Stations shall be suitable for surface mounting on matching back box, or semi-flush mounting on a standard single-gang box, and shall be installed within the limits defined by the Americans with Disabilities Act (ADA) dependent on manual station accessibility or per local requirements.
b. Manual Fire Alarm Stations shall utilize push in/pull down operation.
c. Housing material shall be metal or LEXAN polycarbonate resin.

10. Addressable Interface Devices:

a. Addressable Interface devices compatible with the system shall be provided to monitor contacts for such items as water-flow, tamper, pressure, and PIV switches, Knox Box, Air Handling Unit Fans that are required by codes to be controlled, Kitchen Hood Suppression System, and Elevator Recall Modes connected to the fire alarm system. These interface devices shall be able to monitor a single or dual contacts. An address will be provided for each contact. Where remote supervised relay is required, the interface shall be equipped with a SPDT relay rated for 4 amps resistive and 3.5 amps inductive.

F. Notification Appliances:

1. Finishes:

a. All celling devices shall be white with red lettering, unless noted otherwise.
b. All wall mounted devices shall be white with red lettering, unless noted otherwise.

2. The speaker/strobe or speaker appliance as indicated on the drawings shall be a multiple tap speaker having taps for ¼, ½, 1 and 2 watts. The speaker/strobes shall have a synchronized strobe light with multiple candela taps to meet the intended application. The strobe light taps shall be adjustable for 15, 30, 75, and 110 candela. Do not load any circuit beyond 75 % of its capacity.

3. The strobe only appliance as indicated on the drawings shall be a synchronized strobe light with multiple candela taps to meet the intended application. The strobe light taps shall be adjustable for 15, 30, 75, and 110 candela. Do not load any circuit beyond 75 % of its capacity.
4. Where shown on the drawings, provide strobe units in combination with the audible indicating appliances. Strobes shall be supervised and synchronized within each circuit. Provide protective guards for all strobes located in Locker Rooms, Gymnasium and Aux. Gymnasium.
5. An alarm extender panel shall be provided where needed. The power supply shall be a minimum of 8 amps. The power supply shall contain four supervised notification circuits strobes and audibles. There shall be a 1 amp filtered auxiliary power limited output.
6. Provide Weatherproof Strobe, Speaker and Speaker/Strobe Units with NEMA 4X enclosures when located exterior of the building and where indicated on the drawings. These units shall have the same feature as speaker/strobe unit mentioned above and shall be weatherproof and rated for outdoor use. Furnish with surface weatherproof backbox.
7. Where notification appliances are indicated, provide manufacturer approved weather proof enclosures, etc.
8. Where devices are indicated to be installed in the ceiling, provide comparable devices designed to be installed in the ceiling.
9. Where devices are indicated to be installed on walls requiring surface installation in lieu of recessed, devices shall be mounted using a manufacturer's prescribed matching enamel outlet box. Finish of box shall match device.

G. Other Conditions:

1. After installation of smoke detectors, in potentially dusty areas, the Contractor shall provide an airtight plastic cover over the units to keep contaminants from entering the unit in all areas, until time of acceptance. It is the responsibility of the Contractor to either clean or replace any devices that have become soiled or contaminated by construction dirt.
2. The fire alarm equipment distributor shall stock the recommended spare parts listed for the UL certification.

H. Knox Box: Existing to remain. Provide connection to fire alarm system.

I. Annunciator: Provide a flush mounted annunciator. Electrical Contractor shall verify exact location of annunciators with local authority having jurisdiction prior to installing. Annunciator shall provide full device information during alarm, trouble and supervisory conditions. Affected device shall be identified with location in the building.

J. Door Holders: Provide 24 VDC to GC provided door holders, and interconnect with the fire alarm system. The door holders shall be controlled for fail safe operation and shall not hold open during normal power failure.

K. Document Storage Box:

1. Description: Enclosure to accommodate standard 8-1/2-by-11-inch manuals and loose document records. Legend sheet will be permanently attached to door for system required documentation, key contacts, and system information. Provide two key ring holders with location to mount standard business cards for key contact personnel.
2. Material and Finish: 18-gauge cold-rolled steel; four mounting holes.
3. Color: Red powder-coat epoxy finish.
4. Labeling: Permanently screened with 1-inch-high lettering "SYSTEM RECORD DOCUMENTS" with white indelible ink.
5. Security: Locked with 3/4-inch barrel lock. Provide solid 12-inch stainless steel piano hinge.

2.4 INTERCONNECTIONS

A. Provide connections to the remote sound systems and intercom system so that all remote systems will mute during an alarm.

PART 3 - INSTALLATION

3.1 GENERAL

A. Examine areas and conditions under which fire alarm system is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

B. Install system and materials in accordance with manufacturer's instructions and rough-in drawings, and details on the drawings. Install electrical work and use electrical products of these specifications.

C. The Contractor shall install backboxes flush in wall with conduit to above accessible ceilings for fire alarm system. The contractor shall coordinate locations and backbox sizes.

D. This contractor is responsible for furnishing and installing all devices in ceiling tiles, including but not limited to backboxes, and supports.

E. In addition to providing smoke detectors at the locations indicated on the drawings, and within these specifications, smoke detectors shall be provided at all fire alarm control units and transponders, notification appliance circuit power extenders, supervising station transmitting equipment and other NFPA and IFC required areas.

F. Install Document Storage Box near main FACP. Field verify with Owner exact location.

3.2 LABELING

A. All devices shall be labeled with their device point identification, matching the program ID. Provide loop identification for devices without specific point identification.

B. For devices located above the ceiling, provide identification of the device, as well as on the T-bar directly below the device. Identification information shall also be provided on remote indicators installed for duct detectors.

C. Devices requiring power (FACP, remote battery cabinets, etc.) shall be provided with label of circuit feeding device.

3.3 EQUIPMENT INSTALLATION

A. Notification Appliances: Mount semi-flush in recessed backboxes. Where surface mounting is approved, use manufacturer's standard surface backbox with finish matching device (provide red for red devices and white for white devices).

1. The use of pre-punched, or standard galvanized 4” square boxes shall not be acceptable under any circumstances.

B. Manual Pull Stations: Mount semi-flush in recessed back boxes. Where surface mounting is approved, use manufacturers standard surface Red backbox.

1. The use of pre-punched, or standard galvanized 4” square boxes shall not be acceptable under any circumstances.

C. Ceiling Mounted Smoke Detectors: Not less than 4” from a side wall to the near edge. For exposed solid-joist construction, mount detectors on the bottom of joists. On smooth ceilings, install not more than 30 ft. apart in any direction.

D. Notification Appliances: Mount semi-flush in recessed backboxes. Where surface mounting is approved, use manufacturer's standard surface backbox with finish matching device (provide red for red devices and white for white devices).

1. The use of pre-punched, or standard galvanized 4” square boxes shall not be acceptable under any circumstances.

E. Audible Alarm Indicated Devices: Install not less than 6” below the ceiling. Install Speakers on flush mounted back boxes with the device operating mechanism concealed behind a grille. Combine audible and visible alarms at the same location into a single unit.

F. Visible Alarm Indicated Devices: Install at least 6” below the ceiling and at a Maximum height of 96 inches.

G. FACP or Remote Network Panel: Install with tops of cabinets not more than 72” above the finished floor. Verify exact height with local authority having jurisdiction.

H. Annunciator: Install with the top of the panel not more than 72” above the finished floor. Verify exact height with local authority having jurisdiction.

I. Notification Appliances: Mount semi-flush in recessed backboxes. Where surface mounting is approved, use manufacturer's standard surface backbox with finish matching device (provide red for red devices and white for white devices).

J. Remote Battery Panels: Install in mechanical or electrical spaces when available. Janitor closets may be used, if installed high on wall, away from water. Only use storage closets when necessary, and install high and out of the way of Owner storage space.

3.4 WIRING

A. Wiring connections shall be made by the Contractor as shown on drawings furnished by the representative of the equipment manufacturer. Power shall not be applied to the system until the representative of the manufacturer has approved the connections to the control equipment.

B. The system shall be installed in a manner approved by the State Inspections Department and the National Electric Code utilizing approved raceways or approved fire alarm cable.

C. Power for all fire alarm devices, including, but not limited to control panel, remote battery panels, initiation devices and annunciation devices, 120V and less shall be provided. Any power at 120V shall be connected to the nearest available panelboard on a 20A, 1P breaker. Provide a handle locking devices. The breaker or breakers for the fire alarm system shall be clearly marked.

D. All fire alarm cabling shall be plenum rated. Contractor shall install in a code compliant method. Fire alarm cable shall **not** be installed in the cable tray or with data cabling within J-hooks.

E. Fire alarm circuit identification shall meet N.E.C. Article 760.

3.5 FIELD QUALITY CONTROL

A. The manufacturer shall provide local representative to review the system installation with installers to assure proper wiring and installation methods are used. Job visits shall be made by representatives of the equipment manufacturer as necessary through construction.

B. Demonstration of System Operation: After adjustments to the system have been completed, arrange for a demonstration of the system operation for personnel designated by the Owner.

C. Notify in writing through the prime Contractor, the Architect, Consulting Engineer and the Owner of the time and date the demonstration will take place. Provide a technician representing the equipment manufacturer to conduct the system demonstration.

D. Pre-Testing: After installation, align, adjust, and balance the system and perform complete pre-testing. Determine, through pre-testing, the compliance of the system with requirements of drawings and specifications. Correct deficiencies observed in pre-testing. Replace malfunctioning or damaged items with new ones, and retest until satisfactory performance and conditions are achieved. Prepare forms for systematic recording of acceptance test results.

E. 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 witnesses to preliminary tests.

F. Final Test Notice: Provide a minimum of five (5) days' notice in writing when the system is ready for final acceptance testing.

G. Minimum System Tests: Test the system according to procedures outlined in NFPA 72. Minimum required tests are as follows:

1. Verify the absence of unwanted voltages between circuit conductors and ground.
2. Test all conductors for short circuits using an insulation testing device.
3. 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 record drawing.
4. Verify that the control unit is in the normal condition as detailed in the manufacturer's operation and maintenance manual.
5. Test initiating and indicating circuits for proper signal transmission under open circuit conditions. One connection each should be opened at not less than 10% of initiating and indicating devices. Observe proper signal transmission according to class of wiring used.
6. Test each initiating and indicating device for alarm operation and proper response at the control unit. Test smoke detectors with actual products of combustion.
7. Test the system for all specified functions according to the approved operation 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 sequence. Observe indicating lights, displays, signal tones, and Annunciator indications. Observe all voice audio for routing, clarity, quality, freedom from noise and distortion, and proper volume level.
8. Test Both Primary and Secondary Power: Verify by test that the secondary power system is capable of operating the system for the period and in the manner specified.

H. Re-Testing: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets specifications and complies with applicable standards.

I. 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 on the satisfactory completion of tests.

J. Tag all equipment, stations, and other components at which tests have been satisfactorily completed.

3.6 TRAINING

A. Provide the services of a factory-authorized service representative to demonstrate the system and train Owner's maintenance personnel as specified below.

1. 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.
2. Schedule training with the Owner at least seven days in advance.

3.7 SEQUENCE OF OPERATIONS

A. In additions to the operations and functions listed, the following shall also occur:

1. Elevator Recall shall be programmed to meet the requirements of the local fire marshal or local authority having jurisdiction.
2. Where duct mounted smoke detectors are indicated specifically for air handling unit control, the associated air handling unit shall be connected to the fire alarm system via interface module. An auxiliary relay base shall not be used, unless noted otherwise.

    a. Upon a duct mounted smoke detector alarm condition, the connection to the mechanical equipment’s starter via interface module shall shut down its respective unit. A supervisory signal shall be sent to the fire alarm control panel which in turn will send a signal to the automatic temperature control (ATC) system. The ATC system, depending on its programming, may shut down all or some of the other mechanical equipment in the building.

3. Where smoke detectors are indicated for smoke dampers, individual interface modules shall be wired to each damper, and an additional interface module shall be wired to the ductwork’s associated air handler.

    a. Upon activation of a smoke detector associated with a specific damper, or at the unit feeding the ductwork with the damper, the interface module at the air handler starter shall shut down the unit and follow duct mounted smoke detector procedures. In addition, all smoke dampers associated with that particular air handler in addition to transfer ducts shall also close. Notification shall be sent to the fire alarm system and the ATC system.
    b. The smoke dampers will be provided at 24V. Coordinate power connection to smoke dampers with installing contractor, and provide appropriate power to dampers for control meeting all NFPA requirements.

3.8 TOWNSHIP/FIRE MARSHAL DRAWINGS

A. The Contractor shall provide CADD Drawings on 8 ½” x 11” (or as otherwise required by the local Fire Marshall or authority) sheets showing all As-Built device locations with identification numbers attached. These Drawings shall show all devices within the building. These Drawings shall be turned over to the township representative/Fire Marshal for their approval.

END OF SECTION 28 46 21