SECTION 283111 - FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. This Section covers addressable fire alarm systems for wet and dry sprinkler systems, clean agent systems, and building fire alarms.

1.2 GENERAL REQUIREMENTS

A. The Fire Alarm System Installing Contractor shall furnish all labor, equipment, and materials, and perform all operations in connection with the installation of a new addressable, networked fire alarm system.

1.3 RELATED WORK

A. Submittal Procedures Section 013300
B. Operations and Maintenance Section 017823
C. Wet Sprinkler Systems Section 211313
D. Dry Sprinkler Systems Section 211316
E. Clean Agent Systems Section 211318 (future)
F. Electrical work All Div 16 Sections

1.4 REFERENCES

A. SRP Administrative Fire Code
B. NFPA 13, 2007 edition Standard for the Installation of Sprinkler Systems
C. NFPA 13e, 2005 edition Fire Dept Operations in Properties Protected by Sprinkler and Standpipe Systems
G. International Building Code – As adopted by the Municipality where the work occurs

1.5 QUALIFICATIONS

A. Designer Qualifications: Shop drawings and calculations must be prepared and submitted for approval, by a minimum NICET Level III certified technician.

B. Installer Qualifications: Project Manager or Office Superintendent must be a minimum NICET Level III certified technician.

1.6 SCOPE OF WORK

A. The project includes the design, fabrication and installation of a complete, code compliant, ready and operational closed circuit, addressable, automatic networked fire alarm system(s) as specified herein and indicated on the drawings.

B. When the work includes facilities that are presently controlled by various fire alarm control units (FACU) the Contractor shall install new FACUs in each of the buildings while the existing systems remain operating. Once the new fire alarm systems have been accepted by SRP, the existing fire alarm system, detection devices, notification appliances, conductor, and conduit shall be removed.

C. The alarm broadcast from each respective FACU shall be throughout each respective building for total evacuation of the occupants upon receipt of an alarm signal from any automatic or manual fire detection device.

D. The Contractor shall determine the means of routing the fire alarm conductors from each new FACU, detection devices, control wiring, and notification appliances. The Contractor shall obtain approval for the location of all equipment and associated wiring prior to installation from SRP. A smoke detector shall be furnished and installed by the Contractor in the immediate vicinity of all new fire alarm control equipment.

E. The scope of work includes the installation of all initiating devices, notification appliances and system control interfaces, etc. inside each building, as indicated on the drawings and identified in this specification.

F. The scope of work also includes training SRP personnel on the operation of the system, required maintenance tasks and frequencies, and the locations of all equipment necessary to maintain and operate the fire alarm system.

G. The Designer’s Scope of Work includes the writing of a Designer’s Narrative Report that includes the following minimum content. The Narrative Report is a project specific statement of how the designer has captured the Owner’s requirements for a fire alarm system Minimum content in the Narrative Report is:
   a. Basis of Design
   b. Sequence of Operations
c. Specialized Fire Protection Equipment (including sequence of operation)
d. System Testing Requirements

H. The Designer is responsible for producing a Fire Protection Impairment Plan in accordance with the referenced codes and standards if the designed scope of work will require the impairment or disabling of the existing fire alarm system. The Designer’s Impairment Plan must be submitted to the SRP Fire Protection Coordinator for approval prior to producing final Construction Documents. The minimum content of the Impairment Plan is:
   a. Scope of Impairment
   b. Methods to Provide Equivalent Protection
      a) Maintaining Security Department Notification
      b) Maintaining Occupant Notification
      c) Maintaining Fire Detection and Suppression
   c. Required Personnel and Materials
   d. Impairment Precautions

I. The scope of work also includes that the Contractor read, understand, and implement the requirements found in the Designer’s Narrative Report and Fire Protection Systems Impairment plan that may accompany these specifications.

J. The scope of work includes the removal of the existing fire alarm system, equipment, conduit, and conductors. SRP reserves the right to delete this work from the scope of work prior to the award of the contract.

K. As identified on the drawings, the scope of work may include furnishing and installing a NOTI-FIRE-NET web server. The location of the internet connection will be coordinated between the Contractor and SRP.

1.7 CONTRACTOR RESPONSIBILITIES

A. The Contractor is responsible to install:

1. A fire alarm control unit including supervised power supplies, and distributed power supplies (where applicable).

2. Addressable manual fire alarm boxes at all exits and in the common areas, as shown on the construction drawings.

3. A new fire detection devices (in those environments suitable for proper operation), as shown on the drawings.

4. Audible notification appliance circuits as shown on the drawings.

5. Addressable monitor modules and addressable control relay modules, as shown on the drawings, described in this specification, and as necessary for proper system performance.
6. Metal raceway, conductors, fittings, and all other accessories required to provide a complete and operable fire alarm and emergency voice communication system.

B. The installation and wiring of all devices in accordance with the latest published revision of the manufacturer’s installation instructions to achieve the system operation and function as specified herein.

a. The development of installation shop drawings for each fire alarm system installation in accordance with the applicable codes, cited in this specification. The Contractor shall submit the working drawings for review and approval by SRP.

C. Coordinating the installation of the fire alarm systems and testing of associated equipment and circuits with all related trades, Contractors, equipment maintenance and testing representatives, SRP and the authorities having jurisdiction. Where applicable, work and/or equipment provided in other sections and related to each fire alarm system shall include, but not be limited to:

a. Sprinkler waterflow and valve supervisory switches. The Contractor shall be responsible for all testing and wiring up to and including connection to all sprinkler waterflow switches and valve supervisory switches. All sprinkler waterflow and supervisory switches shall be monitored for integrity in accordance with NFPA 72. The Contractor shall verify the quantity and location of all sprinkler waterflow and supervisory switches.

b. HVAC Shutdown. The Contractor shall be responsible for all installation, programming, wiring, operation, and testing of all fire alarm system interfaces with HVAC units, duct detectors, fire or smoke dampers, and the BAS. All control and power wiring shall be inspected for compliance with NFPA 72. The Contractor shall verify the quantity and location of all HVAC units and duct detectors.

D. The removal of any existing fire detection and alarm system control equipment, components and related equipment that are not specified as being part of the new system. Existing fire alarm system wire and cable shall be removed and disposed of off-site by the Contractor in accordance with the requirements of SRP. Removal of existing equipment shall include all cutting, patching and painting of existing walls, hard ceilings and/or replacement of suspended ceiling tiles.

E. Providing all required documentation, as specified in this specification.

F. It shall be the responsibility of the Contractor to visit the site, observe the existing conditions, and confirm the required quantities of devices and specific options for locations of the same.

G. Coordinating the Acceptance Test of the networked fire alarm systems with the building operators, SRP, and other parties identified by SRP. Prerequisites to the Acceptance Test are:
1. Provide documentation of all system startup, and pre-requisite tests, and record of completion.

2. Provide a test plan that outlines the sequence of testing, who will test, and how the Acceptance Test results will be documented at the time of the testing. Failure to provide this for review will result in postponement of the Acceptance Test.

H. The Systems shall be tested in accordance with the latest published edition of the equipment manufacturers’ testing procedures and guidelines.

1.8 SUBMITTALS

A. Prior to performing any work, the Contractor shall include the following documentation in addition to those documents required elsewhere in this specification:

1. A schedule indicating the delivery dates of the equipment to be supplied; installation sequence; time frame and the total amount of on-site technical assistance time (in man-hours per phase) that the supplier of the equipment has included in their bid to comply with the requirements of this specification and SRP’s requirements; and final acceptance test dates to meet SRP’s scheduled project completion dates.

2. A preliminary Equipment List identifying the type, quantity, make, and model number of each piece of equipment to be provided under this submittal. The Equipment List shall include the type, quantity, make and model of spare equipment, as specified in this specification. Types and quantities of equipment submitted shall coincide with the types and quantities of equipment used in the battery calculations and those shown on the shop drawings. A final Equipment List shall be submitted with the Operating and Maintenance (O&M) manual, as specified in this specification.

3. If the Contractor is also the designer of the fire alarm system, provide a sequence of operation that describes how the system responds during an alarm, supervisory and trouble condition. The description shall include fire alarm control unit LEDs, audible and visible indications; initiating devices, notification appliances, and auxiliary functions (such as elevator recall, HVAC fan unit shutdown, and smoke control system operation). The description shall provide sufficient information so that the exact function of each installed device and appliance is known.

4. Manufacturer’s original product datasheets, specifications, installation instruction sheets, and descriptive information for all major components of the system. Copies are not acceptable. All equipment and devices to be furnished under this contract shall be clearly marked (highlighted) on the product datasheets.
5. Submit manufacturer’s specification sheets for the type of conductor and or wir-
ing planned for use. Once a manufacturer is approved, the Contractor shall not
change without prior approval from SRP.

6. Detail sheets from the manufacturer of the U.L. Listed through-penetration fire
stop assembly.

7. Shop drawings (in accordance with SRP’ published CADD Standard) shall be
submitted including a riser diagram of each complete fire alarm system and a
complete set of point-to-point fire alarm control equipment installation dia-
grams; typical wiring diagrams are not acceptable.

8. A complete list of amperage requirements during normal, supervisory, trouble,
and alarm conditions for each component of the system.

9. Preliminary battery calculations showing total standby power and total alarm
power required meeting the specified system requirements. Final battery cal-
culations shall be submitted with the O&M manual, as specified in of this speci-
fication.

10. Preliminary system voltage drop calculations to assure that the system shall
operate per the prescribed backup time periods and under all voltage condi-
tions per UL and NFPA standards. Final voltage drop calculations shall be
submitted with the O&M manual and As-built drawings.

   a. Voltage drop calculations can be performed with negligible inductance.

   b. The voltage drop calculation shall take into consideration the cross sectional
area of each particular conductor for notification appliances (Circular Mils).

   c. The voltage drop calculations shall take into consideration the resistance in
ohms of one circular mil foot of conductor in the calculations. Information on
this can be found in Chapter 9, Table 8 of the *National Electrical Code*.

11. Test Plan must be submitted three weeks prior to the scheduled date of the
Acceptance Test for review and approval by SRP’s Fire Marshall.

1.9 SCHEDULING

A. Where the Fire Protection Contractor is not working for a General Contractor, the
Contractor shall provide a schedule to SRP indicating the installation sequence and
time frame prior to beginning work. The Contractor shall provide weekly updates to
SRP. It is the Contractor’s responsibility to have all wiring, circuit testing and device
installation completed in time for the equipment supplier to make all final connec-
tions and conduct all tests as outlined in these specifications.

B. The Contractor is responsible for coordinating the Acceptance Test for each fire
alarm system with SRP and other necessary parties identified by SRP.
1.10 SPARE PARTS

A. The manufacturer shall provide a suggested spare parts list with firm unit prices maintained for the duration of the manufacturer's warranty period as specified herein, for items such as power supplies, central processor units, fault isolator modules, monitor addressable modules, addressable control relay output modules and other modules that may be long lead replacement items. Costs for programming changes shall also be submitted with the bids. Guarantee firm costs for two years.

B. All spare parts shall be neatly and protectively packed in one or more cartons. The quantity, manufacturer, and model of each unit in the carton shall be identified on the outside of the carton. In addition, the name, address, and telephone number of the Contractor and of the manufacturer's local representative, plus the date of delivery, shall be neatly identified on the cover of each carton.

C. For Projects Less than 10,000 square feet:
   1. The Contractor shall furnish one additional smoke detectors and addressable bases as spares.
   2. The Contractor shall furnish one additional manual fire alarm boxes as spare.
   3. The Contractor shall furnish an additional one of each type of notification appliances (horns, horn/strobes, speakers, speaker/strobes and strobes of various candela ratings) installed in the building as spares.

D. For Projects over 10,000 square feet
   1. The Contractor shall furnish an additional 5% of the smoke detectors and addressable bases as spares.
   2. The Contractor shall furnish an additional 5% of the manual fire alarm boxes as spares.
   3. The Contractor shall furnish an additional 5% of each type of notification appliances (horns, horn/strobes, speakers, speaker/strobes and strobes of various candela ratings) installed in the building as spares.

1.11 AS-BUILT DRAWINGS

Any changes to the designed location of notification appliances and detection devices shall be approved prior to installation. Additionally, the as-builtts shall show how the cable and conduit has been routed and the location of all terminal and junction boxes. The as-builtts shall account for all field changes that were made during the installation.

A. Per SRP requirements, the Contractor shall develop a matrix of operations for each detection device (point), grouped for each building, which shows the device address, location, and function.
B. The Contractor shall show the equipment and addresses associated with each device, as listed in this specification, on a separate layer and provide copies of only this layer shown on the floor plans as part of the set of as-built drawings.

C. Upon completion of the installation of the system and a minimum of one (1) week prior to the Acceptance Test, the Contractor shall deliver two (2) complete sets of reproducible, full-size, appropriately scaled, as-built drawings to SRP.

1.12 TEST PLAN

A. Upon completion of the installation of each system and a minimum of two (2) weeks prior to the Acceptance Test, the Contractor shall deliver two (2) complete sets of the Test Plan, which shall describe how the system shall be tested. This shall include a step-by-step description of all tests and shall indicate type and location of test apparatus to be employed. All tests shall be conducted in the presence of SRP and other parties identified by SRP and shall not be conducted until the “Test Plan” is approved.

1.13 OPERATION AND MAINTENANCE MANUALS

A. In addition to items specified in Division 01 Section 017823 "Operation and Maintenance Data," include the following:

1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.

3. Record copy of site-specific software.
   a. Program Software Backup: On magnetic media or compact disk, complete with data files.
   b. Software operating and upgrade manuals.
   c. Device address list.
   d. Printout of software application and graphic screens.

4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:
   a. Frequency of testing of installed components.
   b. Frequency of inspection of installed components.
   c. Requirements and recommendations related to results of maintenance.
   d. Manufacturer’s user training manuals.

5. Manufacturer's required maintenance related to system warranty requirements.

6. Abbreviated operating instructions for mounting at fire alarm control unit.
PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. This specification identifies the essential functional requirements of the automatic networked fire alarm systems for installation. The manufacturer’s equipment (hardware and software) and system configuration shall comply with or exceed the functional intent of this specification.

B. Any case of error, omission, discrepancy, inconsistency or lack of clarity in the specifications or drawings shall be promptly identified to SRP

2.2 QUALIFICATION OF MANUFACTURERS

A. Acceptable manufacturers:
   1. Notifier Fire Systems (Northford, CT) or approved equal

2.3 QUALITY ASSURANCE

A. Each component of the networked fire alarm systems shall be Listed as a product of a single fire alarm system manufacturer under the appropriate category for the intended use by Underwriters Laboratories, Inc. (UL) and shall bear the “UL label”. All control equipment shall be listed under UL category UOJZ Control Units System as a single unit. Partial Listings, or multiple listings for various major sections of the control equipment, shall not be acceptable. Electrical components, devices, and accessories shall be Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

B. All control equipment shall have transient protection devices that comply with the requirements outlined in UL 864, *Standard for Control Units for Fire-Protective Signaling Systems*.

C. All materials and equipment supplied shall be new, first quality and the manufacturer’s best type and latest model capable of complying with all requirements of this specification and shall have been in continuous production and in continuous service in commercial applications for at least one year. Obsolete equipment shall not be used.

2.4 FIRE ALARM CONTROL UNIT NETWORK

A. The control units are scheduled for installation:

   (Designer to list panels to be installed and/or networked together.)
2.5 FUNCTIONAL DESCRIPTION OF THE SYSTEM

A. The following sections are a functional description of each fire alarm system in each building unless otherwise noted.

B. The new FACU shall include new control/communications equipment which is UL Listed or FM approved to operate with the submitted manual fire alarm boxes, sprinkler waterflow switches, valve supervisory switches, heat detectors and smoke detectors, alert SRP security, alert building occupants using audible and visible notification appliances, supervise each system for conditions which would impair proper system operation, annunciate such abnormal conditions, and where applicable, control related equipment as indicated on contract documents such as air handling units and smoke control.

C. Alarm Condition

1. The system operation shall be such that the alarm operation of any alarm-initiating device shall not prevent the subsequent alarm operation of any other initiating device due to wiring or power limitations.

2. The system alarm operation subsequent to the alarm activation of any manual fire alarm box, any system-type automatic detection device (smoke detector or heat detector), or sprinkler waterflow switch shall automatically perform the functions contained in this section and operate as follows:
   a. All audible notification appliances in the building, as designated on the drawings, shall initiate the alarm evacuation sequence.

3. Auxiliary Functions
   a. HVAC Fan Units

      The operation of duct smoke detectors shall cause the appropriate fan control relays to activate the shutdown of the associated fan(s).

      The Contractor shall deliver in a type written, tabular form, the fire detection device type, device number, location, and point identification of each fire detector installed. All duct smoke detectors shall be identified as to which air-handling units they are protecting.

D. Supervisory Condition

1. The FACU shall have a “SYSTEM SUPERVISORY” LED and a supervisory signal “ACKNOWLEDGE” switch.

E. Trouble Condition
1. The FACU shall have a “SYSTEM TROUBLE” LED and a trouble signal “ACKNOWLEDGE” switch.

2. Unacknowledged alarm messages shall have priority over trouble messages, and if such an Alarm occurs during a Trouble sequence, the Alarm condition shall have display priority.

F. System Supervision

1. All wiring extending from the FACU and emergency voice evacuation system components shall be supervised for opens, shorts, and grounds. Systems containing unsupervised wiring of any type shall not be acceptable.

2. The occurrence of any fault shall activate the system trouble circuitry, but shall not interfere with the proper operation of any circuit that does not have a fault condition.

3. Incoming 120 VAC line power shall be supervised so that any power failure shall be audibly and visually indicated at the control unit.

4. Batteries shall be supervised so that a low battery condition or disconnection of the battery shall be audibly and visually indicated at the control unit and at the Police Command Center.

5. Interconnected Fire Safety Systems (releasing panels) shall be monitored for alarm and trouble conditions. The supervisory signal shall activate any time the monitored system indicates an off-normal condition.

G. System Reset

1. A “SYSTEM RESET” button shall be used to return the system to its normal state after an alarm condition has been remedied. Printed messages shall provide operator assurance of the sequential steps (i.e.: “IN PROGRESS”, “RESET COMPLETED”) as they occur, should all alarm conditions be cleared.

2. Should an alarm condition continue to exist, the system shall remain in an abnormal state. System control relays shall not reset. The control unit “ALARM” LED shall remain on. These points shall not require acknowledgment if they were previously acknowledged.

2.6 MINIMUM COMPONENTS

A. The automatic fire detection and alarm system shall consist of, but not be limited to:

1. In each building, a new FACU containing a Central Processing Unit (CPU) power supply, LED indicators, control switches and relays.

2. Input Devices (waterflow switches, tamper switches).
3. Addressable, analog photoelectric smoke detectors, with standard bases.


5. Addressable monitor modules and control relay output modules.

6. Fault Isolator Modules.

7. Annunciation at the FACU.

8. A permanent record of the alarm signal, time, and date.


10. Battery backup supervision.

11. Automatic supervision of alarm initiating circuits and notification appliance circuits.

2.7 FIRE ALARM CONTROL UNIT (FACU)

A. Acceptable Manufacturers and Models
   a. NFS 3030
   b. NFS 640
   c. NFS 320

B. The control unit shall be modular in construction and receive supervised plug-in component boards to provide system functions as hereinafter specified and/or to accommodate future system expansions.

C. A minimum of two (2) signaling line circuits shall be used, with devices equally distributed on each circuit. Each signaling line circuit shall be loaded to no more than 75% of its manufacturer specified capacity. Additional SLCs shall be furnished and installed as necessary to comply with this requirement.

D. A minimum of three fault isolator modules shall be used on each signaling line circuit. One fault isolator module shall be installed at the point the SLC leaves the FACU and at the point where new installed Class A (Style 6) SLCs return to the FACU. Fault isolator modules shall be placed in order to minimize loss of addressable devices. Fault isolator modules shall be placed at each floor, where the SLC spans multiple floors. In all cases, no more than 25 devices shall be installed on a circuit between fault isolators.

E. The control unit shall support a minimum of two (2) visible (strobe) and two (2) audible notification appliance circuits to provide an evenly distributed number of notification appliances per floor and circuit. All visible (strobe) notification appliance circuits shall be independent from the audible notification appliance circuits. Each circuit's power load shall not exceed 75% of the individual circuit power available from the
FACU and new installed circuits shall be Class A (Style Z) circuits. Additional NACs shall be furnished and installed as necessary to comply with this requirement.

F. Power for all notification appliances shall come from integral power supplies in the control unit. Remote power supplies, if needed, shall be of the same manufacturer as the FACU. The location of all remote control equipment, such as remote power supplies (extenders) shall be approved prior to installation by SRP. All locations containing remote control equipment (such as a power supply extender) shall be protected with a smoke detector, in accordance with NFPA 72.

G. The control unit and system wiring requirements shall be specified by the equipment supplier in their bid to the Contractor.

H. At a minimum, the FACU shall contain the following:

1. Annunciation. Annunciation shall be an integral part of the control system and shall indicate alarm, supervisory and trouble conditions and the corresponding address. The following initiating devices shall be annunciated individually:
   a. Smoke detectors;
   b. Sprinkler waterflow devices and tamper switches;
   c. Manual fire alarm boxes;
   d. Fire suppression releasing panel signals;

I. The functional operation of the control unit shall be established by programmable software.

1. The operating program shall be contained in nonvolatile EEPROM memory and shall be configurable in any of the following ways:
   a. At the factory;
   b. At the job site via modem; or
   c. At the job site via standard terminal or standard laptop computer.

J. Access and control of the operating program shall be restricted to proper personnel designated by SRP.

1. The control unit shall have a minimum of two (2) security levels. Each level shall have individual passwords. Illegal access attempts shall be rejected by the system and shall be displayed and recorded in the history file with time and date.

2. The “First” security level shall be the lowest security level and shall only allow access to the system status levels and lists and shall not impair system operation.
3. The “Second” security levels shall allow access to the operating system.

4. Accessing a programming function that disables normal system operation shall initiate a trouble sequence.

K. The system response to alarms shall be 2.5 seconds maximum for the first alarm.

L. The control unit shall contain an integral standby battery to provide continuous power in the event of AC power failure.
   1. The batteries shall be capable of providing [24] hours of backup power for the system and enough remaining power to operate all notification appliances for [15] minutes at the end of the [24] hour period.
   2. The calculations for battery standby shall include a “safety factor” (reserve power estimate) of a minimum 15%.
   3. Transfer from AC to battery power shall be instantaneous when AC voltage drops below 85 percent input. Transfer to battery standby shall be indicated by display and recorded in the history file with time and date. The indication shall be "AC OFF".
   4. Loss of building power for the system shall automatically and immediately cause transfer of the system to battery power and cause all audible trouble signals to sound. Upon return of building power, the system shall automatically retransfer thereto, and the batteries shall automatically recharge.
   5. During battery operation, the control unit shall process all inputs. However, the display shall provide five (5) seconds of indication for each new input condition, then turn off to conserve battery power.
   6. The control unit shall have a dual rate battery charger that shall maintain the batteries in a fully charged condition and shall provide recharge of the batteries to full capacity in forty-eight (48) hours.

M. Output Function Modules. The control unit shall utilize output function modules to control output functions. The modules shall plug into the control unit motherboard. The functions and presence of each module shall be supervised, and the “Second” and “Third” level passwords shall enable the user to request a list that locates the module by panel and slot within system. All modules shall be individually programmable by circuit as hereinafter specified.

1. Addressable control relays shall be provided for each of the following auxiliary functions:
   a. HVAC shutdown (where applicable);
   b. Damper control;
c. Fire suppression releasing panel signals;

d. Designer to add other locations such as doors.

2. The Contractor shall field verify the number and location of all auxiliary function control circuits. Additional addressable control relays shall be furnished and installed, as necessary, to comply with this requirement.

2.8 SYSTEM FIELD DEVICES - GENERAL

A. Connection of initiating devices and notification appliances to appropriate signaling line circuits and notification appliance circuits from each floor shall be as indicated on the installation drawing from the equipment supplier.

B. Addressable devices shall operate under the following ranges of environmental conditions:

1. Ambient Temperature: 32-100 degrees Fahrenheit.
2. Relative humidity: 0-93 percent, non-condensing.
3. Air velocity: 300 feet per minute.

C. Each addressable device shall include a means to assign a unique address code to the device in the field. This address code shall serve as the means by which the system program recognizes the device.

D. The address of each addressable device shall be clearly and permanently indicated in the base of each detector or on the face of monitor modules, control relay output modules, and manual fire alarm boxes.

E. Failure of any single device shall not hinder the operation of any other devices connected to the signaling line circuit.

F. Failure of the control unit to properly communicate with any addressable device shall initiate the proper trouble sequence. While in this trouble condition, the control unit shall cause actual alarm input from devices to override trouble alarm.

2.9 AUTOMATIC DETECTORS – GENERAL

A. All automatic smoke detectors shall be of the addressable, analog photoelectric type and shall be interchangeably mounted into a common twist-lock base.

B. The control unit shall recognize changes of detector type in each location and provide proper indication that reprogramming for the affected address is required.

C. Detector bases shall have Brady, or SRP approved equal, adhesive markers attached to them indicating the address of the detector. Markers shall be installed, by
the Contractor, on the inside of the base and lettering shall be a minimum of 12 point.

2.10 ADDRESSABLE PHOTOELECTRIC SMOKE DETECTORS

A. Photoelectric smoke detectors shall have a general alarm setting in all common spaces of 3.0% - 4.0% per foot obscuration.

B. The detectors shall provide a combination alarm/power LED. The LED shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control unit. The LED shall be placed into steady illumination under an alarm condition. An output connection shall also be provided in the base to connect an external remote alarm LED.

C. ACCLIMATE detectors or approved equal shall be installed in each employee break room where shown on the construction drawings.

2.11 DETECTOR BASES

A. Automatic detectors shall utilize a common, plug-in, twist-lock, tamper-resistant type base that accommodates photoelectric and thermal detectors. Detectors shall be interchangeable to simplify field conversion.

B. Removal of the detector from the base shall cause a trouble indication at the FACU. Removal of the detector shall not disrupt the alarm circuit wiring or prevent the receipt of alarms from other devices operating in the circuit.

C. Insertion of an incorrect detector type into the base shall cause a "Wrong Device" trouble condition at the FACU until the proper type of detector is installed, or the system is re-programmed. The system program shall recognize the insertion of a wrong device and shall automatically default to the setpoint values corresponding to the inserted device, and shall monitor alarm and trouble conditions according to the default parameters.

D. Provide bases constructed of white, high impact polycarbonate designed for mounting on a standard 3-1/2 inch or 4-inch octagonal or 4-inch square outlet box. Provide screw terminal connections for No. 12 AWG wire.

2.12 ADDRESSABLE MANUAL FIRE ALARM BOXES

A. Manual fire alarm boxes shall be of the non-coded, double-action type, surface or semi-flush mounted, as selected by SRP, with integral contact monitor module to provide addressable operation.

B. Faceplates shall be red with raised white identification lettering.

C. Stations shall mechanically latch after operation, with a key operated reset feature, keyed the same as FACU.
D. Every manual fire alarm box shall have an engraved nameplate permanently installed on its face or Brady, or SRP approved equal, adhesive markers attached to them indicating the address of the station. The Contractor shall install markers on the outside of the manual fire alarm box and lettering shall be a minimum of 12 point.

2.13 ADDRESSABLE MONITOR MODULES

A. Furnish and install addressable monitor modules to supervise and monitor the status of each non-addressable device, such as conventional spot-type heat detectors, sprinkler workflow alarm switch and valve supervisory switch contacts, special hazard fire suppression alarm contacts and fire pump supervision contacts.

B. Each addressable monitor module shall be able to support any number of normally open (N/O) devices. Wiring to the devices(s) being monitored shall be Class A supervised (Style D). Module status (normal, alarm, supervisory, trouble) shall be transmitted to the FACU.

C. The addressable monitor modules shall provide address-setting means.

D. Each addressable monitor module shall be provided with a switch to provide a means of disconnecting the initiating circuit to allow work to be performed on the initiating circuit without causing an alarm.

E. An LED shall be provided which shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control unit.

2.14 ADDRESSABLE CONTROL RELAY OUTPUT MODULES

A. Provide addressable control relay output modules to permit hardwired control capability from the signaling line circuit. Relay contacts shall be DPDT, rated 2 amperes at 24 VDC.

B. Furnish and install addressable control relay output modules for the functions as specified in this specification.

C. Each relay shall operate according to the control program resident in the FACU. Relays shall be supervised for trouble conditions (open, short, device missing/failed) at the FACU.

D. Relay output modules shall include a mounting plate for installation in a junction box.

E. The relay output module shall provide address-setting means and shall also store an internal identifying code that the control unit shall use to identify the type of device.

F. An LED shall be provided which shall flash under normal conditions, indicating that the Relay Output Module is operational and is in regular communication with the control unit.

G. Provide transient suppressors for inductive loads.
2.15 FAULT ISOLATOR MODULES

A. Fault isolator modules shall provide short circuit isolation for signaling line circuit wiring. Fault isolator modules shall be listed to UL 864, *Standard for Control Units for Fire-Protective Signaling Systems*.

B. The isolator module shall mount directly to a minimum 2 1/8 inch deep, standard 4-inch square electrical box, without the use of special adapters or trim rings.

C. Power and communications shall be supplied by the signaling line circuit.

D. Fault isolator modules shall report faults to the host FACU.

E. After the wiring fault is repaired, the fault isolator modules shall test the lines and automatically restore the connection.

2.16 AUDIBLE AND VISIBLE NOTIFICATION APPLIANCES

A. General
   1. All notification appliances shall be rated at 24 VDC and shall be powered by supervised notification appliance circuits originating from the FACU or remote power extenders listed for this purpose.
   2. Notification appliances installed in the men and women rooms shall be weather proof.

B. Visible (strobe) notification appliances
   1. All strobes shall conform to the requirements of NFPA 72, UFAS and the ADA and shall be listed to UL 1971, *Standard for Signaling Devices for the Hearing Impaired*.
   2. All visible notification appliance circuits shall be synchronized and have a rated light output as indicated on design drawings.
   3. A strobe notification appliance shall be installed on the outside of every entry door to a space that is protected by a HALON suppression system. The body of the notification appliance shall have the words HALON on it.

2.17 LOUD HORN

A. To be added by Designer where required

2.18 BEACONS

2.19 FIRE ALARM SYSTEM PRINTER
A. When shown on the drawings, provide a fire alarm system printer Listed and labeled as an integral part of the fire alarm system. The system printer shall be UL listed to Standard 864 under UL category UOXX System Control Unit Accessories and supervised by the FACU.

B. The system printer shall record all alarm, supervisory, and trouble events. The printout shall include the type of signal (alarm, supervisory, or trouble) the device identification, date and time of the occurrence. The printout differentiates alarm signals from all other printed indications.

C. The system printer shall be arranged to have the ability to provide hard copy records of system events, addressable analog sensor reports (sensitivity reports, etc.), Walk-test system testing reports and History files.

D. Printer Ribbons: The Contractor shall furnish 2 spare printer ribbons.

E. The fire alarm system printer shall be installed in the vicinity of the FACU. If adequate table space is not provided by SRP for the printer, the Contractor shall furnish and install an adequately sized table.

2.20 WIRE GAUGE

A. Unless otherwise indicated on the design drawings or manufacturer’s specifications, the following minimum sizes of conductors shall be used for all new wiring:

1. Power Supply Conductors (Primary and Secondary) No. 12 AWG

2. Signaling Line Circuit Conductors

3. LCD Remote Alarm Annunciators No. 14 AWG

4. Notification Appliance Circuits No. 14 AWG

5. Speaker Circuits No. 14 AWG

B. All Conductors shall be plenum rated as described in the National Electrical Code

PART 3 - EXECUTION

3.0 INSTALLATION

A. The Contractor shall plan and use caution while removing existing ceiling tiles for the installation of the fire alarm system and voice evacuation components. All ceiling tiles shall be re-installed by the Contractor. Broken ceiling tiles and their location shall be reported to SRP.
B. The supervisory work of the qualified manufacturer’s technical representative shall include, but not necessarily be limited to, checking all the system wiring connections; advising the Contractor regarding technical details of the installation; and the adjustment and testing of all components of the system in order to ensure a complete and satisfactorily operable system. The manufacturer’s technical representative shall be on site, as required by SRP, during the entire installation and connection of the new control equipment. The technical representative shall monitor all wiring changes and assist the Contractor to ensure a smooth transition to the new control equipment. The cost of the technical representative shall be paid by the Contractor and shall be included in the bid price. The minimum amount of man-hours for this technical representative to be carried is 40 hours. The Contractor shall identify the amount of manufacturer’s technical representative’s man-hours that shall be provided and the per-hour cost (including the cost for possible overtime [premium] hours) for the technical representative’s time.

C. The manufacturer’s technical representative shall also be required to instruct designated building and management personnel in the general operation of the system and to give the designated personnel an overview of the system functions when the system is in normal, supervisory mode, alarm mode, and trouble mode, as specified in this specification.

D. Automatic Detectors

1. In general, automatic detectors shall be mounted on the structural ceiling or finished ceiling and not on the bottom or side of any type of construction or structure, which extends down from the ceiling.

2. Automatic detectors shall be located near points where air currents normally intersect. Detectors shall not be located in the direct path of the draft from an HVAC air supply grille, a door, window, or hallway. Detectors shall be installed a minimum of three (3) feet from an HVAC air supply diffuser, in accordance with NFPA 72.

3. All automatic detectors shall be installed as indicated on the plans, within five (5) feet of the location shown on the drawings to accommodate construction, and readily visible from the floor. The mounting location of every device shall be approved by SRP.

E. Addressable Photoelectric Smoke Detectors

1. Addressable analog photoelectric smoke detectors shall be installed as shown on the drawings. These common area detectors shall be spaced at thirty (30) foot centers, and in accordance with NFPA 72 and the manufacturer’s installation instructions. Smoke detectors shall only be installed in those environments suitable for proper smoke detector operation.

F. Addressable Manual Fire Alarm Boxes
1. Unless otherwise directed, manual fire alarm boxes shall be installed at every exit. Install in accordance with NFPA 72 and as shown on the drawings.

2. Manual fire alarm boxes shall be installed within five feet (5') of each exit that they serve and mounted no higher than forty eight inches (48") above the finished floor. All boxes shall have a protective cover installed over them in the vehicle repair bays, shops, and warehouse areas.

G. Addressable Monitor Modules

1. Addressable monitor modules shall include a mounting plate for installation in a junction box or shall be mounted in a locked cabinet or approved box, as shown on the manufacturers recommended specifications.

H. Audible and Visible Notification Appliances

1. The notification appliances shall be installed in accordance with the recommended audibility levels and the required illumination levels as described in NFPA 72. The minimum acceptable decibel level is 15 dBA over background noise. The maximum acceptable decibel level is 110 dBA.

2. All notification appliances shall be installed in environmental conditions in accordance with their Listing and manufacturer's specifications and installation instructions.

I. Notification Appliance Circuits

1. Notification appliance circuits shall not be installed in the same raceway with signaling line circuits unless approved in writing by the networked fire alarm systems supplier.

2. Notification appliance circuits and control equipment shall be arranged and installed so that loss of any one (1) notification appliance circuit shall not cause the loss of any other notification appliance circuit in the systems.

J. Labeling and Marking

All of the hardware covered in Part 2 and Part 3.1 of this Specification shall have Brady adhesive markers, or SRP approved equal, attached to them indicating the address of the hardware. Markers shall be installed, by the Contractor, on the inside of the base and lettering shall be a minimum of 12 point

3.2 WIRING

A. All wiring shall comply with this section.

B. The entire wiring and raceway system for the networked fire alarm systems shall be in full accordance with NFPA 70, National Electrical Code.

C. The Contractor shall furnish and install low voltage surge arrestors on all SLCs, NACs, transmitter, and auxiliary control circuits for all circuits that leave the building shell. Units shall be UL 497B compliant with a 30 volt clamping level and have a re-

D. The Contractor shall furnish all metal raceway, wiring, outlet boxes, junction boxes, cabinets, labels and similar devices necessary for the complete installation of the fire alarm systems. All wiring shall be of the type as specified herein and recommended by the manufacturer and shall be installed in metal raceway throughout.

E. Terminal cabinets with side hinged, lockable red covers, supplied by Space Age Electronics, Marlboro, MA, or approved equal shall be provided at all junction points. All conductor splices shall be made on screw-type terminal blocks – wire nuts, butt, crimp or screw type connectors shall not be used. All terminals within a terminal cabinet shall be properly and permanently labeled. All junction box covers shall be painted red.

F. Raceways containing conductors identified as "Fire Alarm System" conductors shall not contain any other conductors, and no AC carrying conductors shall be allowed in the same raceway with the DC fire alarm detection and signaling conductors.

G. The conductors for the notification appliance circuits shall not be installed in the same raceway as the conductors for signaling line circuits unless written certification from the manufacturer is supplied to SRP indicating that the inclusion of these circuits in the same raceway is acceptable and that no additional consideration is needed for these circuits.

H. All existing wiring shall be tested for abnormal conditions (grounds, shorts, opens, etc.) prior to reuse. In general, existing initiating device circuits shall be reused as signaling line circuits, if the circuit is not loaded to more than 75% of the available circuit loading and the distance limitations as set forth by the manufacturers recommended specifications are not exceeded; existing notification appliance circuits shall be reused, only if the existing circuit is not loaded to more than 75% of the available power for the circuit from the FACU. In the event that a signaling line circuit or a notification appliance circuit load exceeds 75% of the available circuit loading new circuits shall be installed.

I. All wiring shall test free from grounds and short circuit faults. The testing results shall be recorded, signed by the Contractor and forwarded to the supplier and SRP. No connections to the FACU shall be made until the system wiring has been accepted by the equipment supplier.

J. All conductors installed in ducts, plenum, air handling spaces and the under floor of computer rooms shall comply with the applicable sections of NEC Section 300.22.

K. Color coding of conductors shall be approved by SRP. Unless otherwise indicated, the color code for all fire alarm and emergency voice evacuation system conductors shall be as follows:
1. Signaling line circuits and initiating device circuits shall be red and black. Red shall be positive and black shall be negative.

2. Audible notification appliance circuits shall be blue and white. Blue shall be positive and white shall be negative (NAC).

3. Flashing strobe circuits shall be orange and yellow. Orange shall be positive and yellow shall be negative (NAC).

4. Two wire notification appliance circuits shall be blue and white. Blue shall be positive and white shall be negative.

5. Sprinkler/standpipe circuits shall be red and black. Red shall be positive and black shall be negative.

6. Smoke detector power circuits shall be brown and violet. Violet shall be positive and brown shall be negative.

7. Auxiliary remote power supply circuits shall be brown and violet. Violet shall be positive and brown shall be negative.

8. Electro-magnetic door hold-open circuits shall be gray and gray.

9. HVAC shut-down and damper circuits shall be orange and yellow.

10. Bond wires from the control unit to the ground rod, and all required bonding conductors shall be green.

11. AC supply circuit to the main FACU shall be white, black and red. The black shall be one phase, and the red shall be the opposite phase, if required. The white shall be the neutral. If a separate feed is required for the battery charger, it shall be black and white unless the main FACU requires only one AC feed. In that case, the conductors to the battery charger shall be red and white.

L. All fire alarm conductors shall be installed in EMT as a minimum. Minimum conduit size is ¾-inches. All conduits in occupied areas shall be concealed.

M. All junction and pull box covers shall be red. Label all conduits every 10’ “Fire Alarm” or approved equal, in red letters.

N. Exposed raceways shall be run parallel and perpendicular to the walls and ceilings. Wherever practical, exposed raceways shall be run on the ceiling as close as possible to a wall or as high as possible on a wall. Where exposed raceways shall cross under a structural beam or rib, they shall be run down on one side of the beam or rib, across its bottom, and up to the ceiling on the other side of the beam or rib. No spanning from beam to beam or rib to rib shall be permitted. The use of a raceway body on one side of a beam or rib shall be permitted provided it shall be readily accessible. Where metal raceway is installed exposed, it shall be painted to match the walls and/or ceilings on which it is installed, as instructed by SRP. The method and
location of all exposed raceways shall be approved by SRP prior to start of any in-
stallation work.

O. Fault isolator modules shall be furnished as required and shall be mounted as di-
rected by the manufacturer. The field location of the fault circuit isolators shall be
labeled so that the devices may be easily located, and that location shall be noted
on the point-to-point and as-built drawings.

P. The power employed to operate the fire alarm systems shall have a high degree of
reliability and capacity for the intended service. Connections to this power service
shall be made on a dedicated branch circuit(s). The circuit shall be mechanically pro-
tected.

Q. Circuit disconnecting means shall have a red marking, shall be accessible to autho-
rized personnel, and shall be identified as “FIRE ALARM CIRCUIT CONTROL.” The
location of the circuit disconnecting means shall be permanently identified on a na-
meplate installed on the inside of the FACU.

R. All wiring within the control unit shall be neatly served in the panel gutters and be
secured by means of Thomas & Betts "Ty-Raps" or by other approved means.

S. All conductors and EMT shall be installed in a neat and workmanlike manner. Verti-
cally and horizontally positioned EMT and or conductors shall be supported in ac-
cordance with good tradesman practices and including but not limited to the NEC
Sections 376 and 378.

T. Where penetrations of floor slabs, fire-resistance rated walls and/or smoke barrier
walls are made, the wiring shall be sleeved in metal raceway and the penetrations
shall be fire-stopped with approved or UL Listed through-penetration firestop as-
sembly material acceptable to SRP.

3.3 ACCEPTANCE TEST WITNESSED BY SRP

A. Prerequisites to the Acceptance Test
   1. Submittal of a Test Plan for approval (three weeks prior to proposed test date).
   2. Completion of tests on all components in accordance with the Test Plan by
      Contractor and manufacturers’ reps.
   3. Submittal of as-built drawings.

B. Before the installation will be considered complete and acceptable by SRP, the en-
tire system must pass an Acceptance Test. This test shall be coordinated and per-
formed by the Contractor, in the presence of a representative of the manufacturer,
SRP, and other interested parties identified by SRP. The test shall not be conducted
until all parties agree on the scheduled test date.

C. The Contractor shall provide all the necessary personnel and equipment to conduct
the tests.
D. At a minimum, the Contractor shall perform the following:

1. Operate every building fire alarm device to ensure proper operation, correct annunciation at each remote annunciator (as shown on the drawings) and at the control unit, and proper operation of all alarm detection and control devices, horns, speakers, and auxiliary functions. Where applying heat would destroy any detector, they may be manually operated.

2. The signaling line circuits and the notification appliance circuits shall be opened in at least two locations per floor to check for the presence of correct supervisory circuitry.

3. One-half of all tests shall be performed on battery standby power.

E. If the Final Acceptance Test fails, the Contractor shall pay all costs incurred to SRP for any and all reacceptance testing.

F. Upon satisfactory completion of the tests, the Contractor shall leave the fire alarm and fiber network systems (if installed) in proper working order and without additional expense to SRP, shall replace any defective materials or equipment provided by the Contractor under this Contract within two years from the date of final acceptance by the awarding authority.

3.4 TRAINING REQUIREMENTS

A. Security Personnel: Prior to final acceptance of the fire alarm and emergency voice evacuation system, the Contractor and supplier shall provide operation training to each shift of the building’s designated Security personnel. Each training session shall be a minimum of 1 hour and shall be conducted on shift or at a time acceptable to the building’s operators. Each session shall include an overview of the system and the devices connected to it, emergency procedures (including alarm, trouble and supervisory condition procedures), control unit operation, and safety requirements. Each session shall include a complete demonstration of the system. Dates and times of each training period shall be coordinated through SRP, not less than two weeks prior to the training session.

B. SRP Maintenance Technicians: The Contractor shall arrange for manufacturer training representatives to provide the necessary factory training for operation and troubleshooting of the installed equipment to the buildings property management and maintenance technicians. This training shall include providing the Manager with all access codes and written certification that he is authorized to operate and troubleshoot the equipment supplied by the manufacturer. If this training shall be conducted off-site, all additional costs (transportation, lodging, meals, etc.) associated with the off-site training shall be included in the bid for four (4) maintenance personnel to travel to the off-site training location.

1. Training shall specifically include the procedure for printing the FACU’s history log to the printer on a weekly basis.
3.5 CLEANING AND ADJUSTING

A. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and marred finish to match original finish. Clean unit(s) internally using methods and materials recommended by manufacturer.

3.6 EQUIPMENT REMOVAL

A. Once the new fire alarm and voice evacuation system has been accepted by SRP, the Contractor shall completely remove the existing fire detection, notification appliances, conductors, and EMT. The equipment removed shall be boxed, labeled, and delivered for inspection to SRP. All removed and or unused, fire alarm components shall be removed and disposed of properly off-site by the Contractor.

B. Remove all conductors connected from the removed devices and appliances.

C. The Contractor shall perform all removal work efforts in accordance with the best and most modern practices.

D. The preparation, installation, and clean up of all UL Listed through-penetration fire-stop assemblies needed as a result of this work shall be the responsibility of the Contractor and shall be coordinated with SRP.