SECTION 16725 – FIRE ALARM SYSTEM

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. All of the Contract Documents, as listed on the Table of Contents and including General and Supplementary Conditions and Division 1, General Requirements, shall be included in, and made part of, this Section.

1.2 DESCRIPTION OF WORK

A. Furnish and install a new, microprocessor based, fire alarm system according to the following specifications and as shown on the drawings.

B. The system shall utilize distributed processing techniques, be totally solid state, microprocessor based, and use digital transmission techniques, to ensure reliable operation, low maintenance costs and long life. The system shall be of the modular design to allow future expansion with a minimum of hardware additions. System operation shall not require personnel with special computer operation skills

C. The system shall include all necessary hardware, software and peripheral devices to perform the following functions:

1. Fire/smoke detection and alarm
2. One way voice evacuation signaling
3. System supervision
4. Trouble indications
5. Control functions, such as:

    a. Elevator recall
    b. Egress door release
    c. Magnetic hold open release

6. Status monitoring of non-system equipment, such as:

    a. Fire Pump
    b. Emergency Generator
    c. Sprinkler/standpipe system

7. Report alarm to the City of Portland via local energy master box.

1.3 RELATED WORK

A. For work to be included as part of this Section, to be furnished and installed by the Electrical Subcontractor, refer to the Related Work section of Specification Section 16010.

B. Carefully examine all of the Contract Documents, criteria sheets and all other Sections of the specifications for requirements which affect work under this Section, whether or not such work is specifically mentioned in this Section.

1.4 REFERENCES

A. The following list of Reference Standards shall be used in system design, installation, operation and maintenance. The Reference Standards used shall be the latest applicable edition of said Reference Standards unless otherwise approved (NFPA - National Fire Protection Association):

1. Maine Building Code/IBC
2. Maine State Fire Marshall
3. NFPA 70 – National Electrical Code
4. NFPA 72 - National Fire Alarm Code
5. NFPA 101 – Life Safety Code
6. Underwriters Laboratories (UL)
7. City of Portland Fire Department
8. International Municipal Signal Association Cable Specifications (IMSA)
9. Approved List of Materials and Methods of Construction for Municipal Fire Alarm
10. Americans with Disability Act

B. Each item of the fire alarm system shall be listed as a product of a single fire alarm manufacturer under the appropriate UL category and shall bear the UL label.

C. All control equipment shall be listed under UL UOJZ

1.5 QUALITY ASSURANCE

A. The manufacturers listed within this specification have been preselected for use on this project. No submittal will be accepted from a manufacturer other than specified.

B. To ensure system compatibility, all components of the fire alarm system including control panels, alarm initiating devices, alarm indicating devices, etc. shall be the products of one manufacturer.

1.6 WARRANTY

A. Attention is directed to provisions of the General Requirements, Supplementary General Requirements, Section 01784 - Warranties and Section 16010 – Electrical Special Conditions regarding guarantees and warranties for the work under this Contract.

1.7 ACCEPTABLE MANUFACTURERS

A. Simplex
B. Siemens Cerberus Division
C. Fire Control Instruments (FCI)
D. Edwards System Technology (EST)

1.8 MANUFACTURER'S REPRESENTATIVE

A. The Electrical Subcontractor shall provide, at the appropriate time or as directed by Architect, the on-site services of a competent factory trained Engineer of the manufacturer of the fire alarm equipment to inspect, test, adjust and place in proper operating condition any and all items of the same manufacturer. No additional compensation will be allowed for such services. A written report shall be issued by the particular manufacturer with his findings for the Architect's record.

B. All final connections, testing and adjusting of the system shall be done under the direct supervision of the system supplier. After completion of the installation, a trained technician employed by the system supplier shall demonstrate the system to the satisfaction of the Owner's representative and shall make all additional adjustment to the system operation as required by the Owner's representative as a result of this demonstration.

1.9 SUBMITTALS

A. Prepare and submit shop drawings in accordance with the requirements hereinbefore specified, and with the Shop Drawings, Product Data and Samples Section 01330 in the manner described therein, modified as noted hereinafter.

B. All shop drawings shall have clearly marked the appropriate specification number of drawing designation, for identification of the submittal.

C. Disposition of shop drawings shall not relieve the Electrical Subcontractor from the responsibility for deviations from drawing or specifications, unless he has submitted in writing a letter itemizing or calling attention to such deviations at time of submission and secured written approval from the Engineer, nor shall such disposition of shop drawings relieve the Electrical Subcontractor from responsibility for errors in shop drawings or schedules.

D. Fire alarm system shop drawings shall contain the following information. Shop drawings that are missing any information described below will not be reviewed:

1. A detailed list of each piece of equipment with model numbers and UL listings for each system component.
2. Manufacturer's specification sheets for each item listed above.
3. A description of how the specified system functions.
4. Confirmation that the manufacturer's representative will provide jobsite supervision during the installation of the system, perform the final testing of the system, and instruct the operating personnel on the operation of the system.
5. Stand-by battery calculations.
6. Amplifier calculations.
7. Power supply calculations.
8. Detailed 1-line schematic wiring diagrams of the specified system and the interconnection wiring, including:

    a. Conductor sizes and types with cut sheets and information indicating where each type and size is used.
    b. Conduit sizes and types.

9. Floor plans indicating location of all devices including location of all visual alarms.

1.10 CLOSEOUT SUBMITTALS AND O & M MANUALS

A. The following information shall be submitted for record purposes, in a binder, prior to final payment:

1. Final as-built drawings and information for items listed above.
2. Operation and maintenance manuals with the following information:

    a. Instruction books and/or instruction leaflets
    b. Recommended renewal parts
    c. A list of addresses of all peripheral devices connected to the system

3. Wiring diagrams.
4. Certified test reports.

1.11 CIRCUITING CRITERIA

A. Signaling Line Circuit

1. Initiating device wiring shall be configured as Class A, Style D.
2. A separate addressable initiating device circuit for each floor shall terminate on separate communication card in the fire alarm control panel. The system shall be designed with a maximum of 75% of the devices each communication card is capable of supporting.

B. Speakers Circuits

1. Speaker circuit wiring shall be configured as Class A, Style Z.
2. The system shall be provided with the minimum listed speaker circuits as follows:

    a. Two (2) speaker circuits for each floor level.
    b. One (1) speaker circuit for each stairwell.
    c. One (1) speaker circuit for each elevator group.
    d. Speaker circuits shall be selected via control zones.

3. Speaker circuits on floors shall be wired such that two adjacent speakers are on different speaker circuits.
4. Termination at shield on twisted shielded cable shall be verified per manufacturer's recommendation prior to energization of speaker circuits to ensure proper grounding and eliminate system-wide speaker noise.
5. Speaker circuits shall emanate from panel mounted speaker circuit modules, addressable modules shall not be used for speaker circuits.

C. Visual Strobes

1. Visual Strobe circuit wiring shall be configured as Class A, Style Z.
2. The system shall be provided with the minimum listed visual strobe circuits as follows:

    a. Two (2) visual strobe circuits for each floor level.
    b. One (1) visual strobe circuit for each stairwell.

3. Visual strobe circuits on floors shall be wired such that two adjacent strobes are on different circuits.

1.12 SYSTEM SUPERVISION

A. The following systems and equipment shall be electronically supervised:

1. All electronic circuit cards in the system
2. Audio amplifiers
3. Power supplies
4. Battery charger/batteries
5. Alarm initiating devices
6. Initiating device wiring
7. Audible device wiring
8. Visual appliance device wiring
9. System network wiring
10. System LED’s for burnout or disarrangement

B. Systems listed above shall be electronically supervised for:

1. Failed or missing electronic components/circuit cards

2. Failure of audio amplifiers
3. Failure of power supplies
4. Failure of battery charger and/or batteries
5. Loss of signal from alarm initiating device
6. Missing initiating device
7. Failed initiating device
8. Open circuit wiring
9. Short circuit wiring
10. Short to ground wiring

1.13 AUTOMATIC SYSTEM OPERATION

A. Normal Operation

1. Under normal operation the front panel of the fire alarm system, fire command center and remote annunciators shall display a "SYSTEM IS NORMAL" message and the current time and date.
2. The system shall continually monitor all components of the system, peripheral devices and system wiring for changes in status. The system shall alert any such changes following the sequences listed below.

B. Alarm Condition

1. Events to Activate Alarm Condition

a. Manual activation of a fire alarm pull station
b. Automatic activation of the following:

1) Heat detector
2) Duct mounted smoke detector
3) Sprinkler system water flow switch

c. Automatic activation of system smoke detectors initiated after an alarm verification feature as follows:

1) The panel will reset the activated smoke detector and wait for a second alarm activation. If, within one (1) minute after resetting, a second alarm is reported from the same or any other smoke detector, the system shall process the alarm. If no second alarm occurs within one minute the system shall resume normal operation. The alarm verification shall operate only on smoke detector alarms. Other activated initiating devices shall be processed immediately. The alarm verification operation shall be selectable by zone.
2) The control panel, fire command center and remote annunciators shall have the capability to display the number of times (tally) a zone has gone into a verification mode. Should this smoke verification tally reach a pre-programmed number, a trouble condition shall occur.

3) Alarm verification zones shall be able to be divided into multiple separate groups whereby only verification zones from the same group will confirm the first activation and cause the alarm sequence to occur.

2. Alarm Condition Operation

a. Any event activating an alarm condition shall immediately result in the following:

1) Sound the alarm signal at the control panel, fire command center and remote annunciators and the system alarm LED shall flash.
2) Display the assigned English language message and activated event, with time, date and code, for the point in alarm on the alpha-numeric display at the control panel, fire command center and remote annunciators. The top line of alpha-numeric display shall be the point label including device type and the second line shall indicate the device location (floor and room number).

Note: The room number used for identification shall be the room number as assigned by the Owner and not, necessarily, the number indicated on the drawings.

3) The appropriate alarm LED shall flash on the LED annunciator at the fire command center.
4) Local energy master box shall contact the City of Portland Fire Department.
5) Voice activated alarm signal

a) Sound an alert signal to all locations within the building. The alert signal tone shall be constant 900 Hz pulsed to produce three (3) rounds of the code four-four-four (4-4-4), duration of each round shall be approximately (15) seconds with an interruption between rounds of approximately (3) seconds.
b) Activate a pre-recorded digital voice message (female voice) to all locations within the building which shall contain the following information:

(1) "ATTENTION PLEASE" "ATTENTION PLEASE" The signal tone you have just heard indicates a report of an emergency in this building. If your floor evacuation signal sounds after this message, walk to the nearest stairway exit and leave the floor. All handicapped occupants shall follow the building evacuation plan. While the report is being verified, occupants on other floors should await further instructions."
(2) This message shall be transmitted three (3) times.

c) Upon completion of the voice message, sound the evacuation signal throughout the building. The evacuation signal shall be as follows:

(1) In all areas of the building, the evacuation signal shall be a temporal code 3.
(2) The evacuation signal shall sound until signal silence is activated at the control panel.

d) The final alarm sequence shall be customized for the facility and local Fire Department requirements.

6) All visible alarm indicating appliances in the building shall flash continuously.
7) All doors in the building normally held open by door control devices shall release.
8) The exterior beacon shall operate.
9) Activate all motor operated fire and smoke shutters.
10) Automatically unlock, but not unlatch, all locked stairwell doors via the security system.

3. Elevator Recall Function Initiation

a. In addition to the alarm condition operation described above, the activation of smoke detectors within elevator lobbies, elevator machine rooms or elevator shaft shall initiate the elevator recall function.
b. Each elevator car shall be captured, separately, and recalled to the main floor. If the alarm originated on the main floor, the elevator shall be recalled to the designated alternate floor.
c. In addition, the activation of any smoke detector within an elevator machine room shall actuate machine room ventilation duct damper via a control module.

4. Air Handling System Interface

a. In addition to the alarm condition operation described above:

1) The activation of any duct smoke detector shall initiate fan shutdown of the respective air handling unit.
2) The activation of any device within the zone served by air handling equipment shall initiate smoke control mode for respective air handling unit.

b. Shutdown shall be activated directly by an integral, supervised relay.
c. H-O-A switches shall be provided for manual override control of all required HVAC system fans. H-O-A switches shall include a status monitor indicating the actual status of each fan.

5. Fail Safe Security System Initiation

a. In addition to the alarm condition operation described above, the system shall send a signal, via auxiliary dry contact closure, to the building security system, indicating the floor in alarm to initiate “fail safe” security features.

6. Audio/Visual and/or Dimming System Interface

a. In addition to the alarm condition operation described above, the system shall send a signal, via auxiliary dry contact closure, to audio/visual systems and/or dimming systems in auditoria, lecture halls, classrooms, etc. indicating general alarm condition to disable audio/visual equipment and bring lighting up to full illumination.

C. Trouble Condition

1. Events to Activate Trouble Condition

a. Failed or missing electronic components/circuit cards
b. Failed or missing audio amplifiers
c. Failed or missing power supplies
d. Failed or missing battery charger
e. Failed or missing batteries
f. Low battery condition
g. Loss of signal from alarm initiating device
h. Missing initiating device
i. Failed initiating device
j. Open circuit system interconnection wiring
k. Short circuit system interconnection wiring
l. Short to ground system interconnection wiring
m. Auxiliary manual controls switches in “off Normal” position

2. Trouble Condition Operation

a. Each component of the system as identified above shall be supervised and uniquely identified on the alpha-numeric display at the control panel, fire command center and remote annunciator. In addition a corresponding yellow LED shall flash.
b. The system trouble audible signal shall be activated at the control panel, fire command center and remote annunciator.
c. Device identification shall be transmitted to the control panel for processing according to the program instructions.
d. Should a component become non-operational, tampered with, or removed, a discrete trouble signal, unique to the device, shall be transmitted to, and annunciated at, the control panel, fire command center and remote annunciator. The system control panel will be capable of displaying the type of trouble condition (open, short, ground, device missing/failed).
e. Should a device fail it shall not hinder the operation of other system devices.

f. There shall be no limit to the number of components indicating a supervisory condition, simultaneously.

D. Supervisory Condition

1. Events to Activate a Supervisory Condition

a. Activation of any standpipe valve supervisory (tamper) switch
b. Activation of any sprinkler valve supervisory (tamper) switch

2. Supervisory Condition Operation

a. The supervisory condition shall send a signal to the approved central station via the digital dialer.
b. The supervisory condition shall be uniquely identified on the alpha-numeric display at the control panel, fire command center and remote annunciator. In addition a corresponding yellow LED shall flash.
c. The system supervisory audible signal shall be activated at the control panel, fire command center and remote annunciator
d. Differentiation between a supervisory condition and a trouble condition shall be provided.
e. Restoring s standpipe or sprinkler valve to its normal position shall cause the supervisory condition LED to extinguish and the audible signal to pulse indicating the restoration to normal condition.

E. Abnormal Condition Acknowledging

1. Pressing the acknowledge button shall display the first unacknowledged abnormal condition, and require another acknowledge action to acknowledge the next point displayed. As each unacknowledged abnormal condition is acknowledged a message will be displayed informing the user that the abnormal condition has been acknowledged. After all points have been acknowledged, the LED's shall glow steady and the audible alarm will be silenced. The total number of alarms, supervisory and trouble conditions shall be displayed along with a prompt to review each list chronologically. The end of the list shall be indicated by an end of list message "END of LIST".
2. These acknowledge functions may be passcode protected if the user has insufficient privilege to acknowledge such conditions. A message shall indicate insufficient privilege but allow the user to view the points without acknowledging them.
3. Any subsequent abnormal conditions, after all other abnormal conditions have been acknowledged, shall reactivate the alarm signal at the panel.

F. Alarm Silencing

1. When the "ALARM SILENCE" button is activated all audible alarm signals shall cease operation, visual signals will continue to flash until the visual signal stop switch is activated, or system is reset.
2. Any subsequent alarm, after the alarm silence button is activated, shall reactivate all audible alarms and visual signals.

3. Should a supervisory trouble condition be present within the system and the audible trouble signal silenced, the trouble signal shall resound at preprogrammed time intervals to act as reminder that the fire alarm system is not 100% operational. Both the time interval and the trouble reminder signal shall be programmable to suit the Owner's application.

G. System Reset

1. The SYSTEM RESET button shall be used to return the system to its normal state after an alarm condition has been remedied. The LCD display shall step the user through the reset process with simple English Language messages. Messages, "SYSTEM RESET IN PROGRESS", will first be displayed followed by the message, "SYSTEM RESET COMPLETED", and finally, "SYSTEM IS NORMAL", if all alarm conditions have been cleared.
2. Should an alarm condition continue to exist the message, "SYSTEM RESET IN PROGRESS", will be followed by the message, "SYSTEM RESET ABORTED", and the system will remain in an abnormal state. System control relays shall not reset. The audible alarm at the panel and the alarm LED will be on.
3. Any subsequent alarm, after system reset, shall reactivate the entire system.

H. Priorities

1. The system shall provide for priorities of different types of alarms and supervisory or trouble indications. Fire alarm points shall have the highest priority level. Other alarms and supervisory or trouble indications shall have the second level of priority and conditions that do not require operator involvement will be the third level of priority. All control points shall be assigned to the appropriate priority to assure proper operation during an emergency condition.

1.14 STATUS MONITORING OF NON-SYSTEM EQUIPMENT

A. Separate, life safety, supervised indication shall be provided to annunciate status, at the control panel, fire command center and remote annunciators, via necessary auxiliary relays with dry contacts at the equipment, and monitor modules for the following status points:

1. Valve tamper at fire pump
2. Fire pump "running"
3. Fire pump "power loss"
4. Fire pump "phase reversal" each pump
5. Emergency generator "ON"
6. Sprinkler valve tampers by device
7. Standpipe valve tampers by device
8. Each stairwell pressurization fan that is running
9. Each smoke removal fan that is running

1.15 SYSTEM OPERATION DURING LOSS OF NORMAL POWER

A. The fire alarm system shall operate as indicated above, utilizing battery back-up. The "SYSTEM IS NORMAL" message at all alpha-numeric displays shall change to "SYSTEM ON BATTERY POWER", the green "Power On" LED shall extinguish, the yellow trouble LED shall flash and the audible device shall sound.

B. Acknowledging the condition, as described above, shall silence the audible device and the LED shall glow steady. The system shall remain in this state until normal power is restored.

C. All doors normally held open by door hold-open devices shall release.

D. Automatic doors shall be made inoperable.

1.16 MANUAL SYSTEM OPERATION

A. A manual evacuation (drill) switch shall be provided at the control panel and fire command center to operate the alarm indicating appliances, without causing other control circuits to be activated. However, should a true alarm occur, all alarm functions shall occur as described previously.

B. Auxiliary bypass switches shall be provided for the following:

1. Door hold open release
2. Audio/Visual device disable
3. Elevator recall bypass
4. Fan control bypass (i.e. H-O-A switches)

C. Activation of auxiliary by-pass switches shall override the selected automatic functions, and indicate a trouble condition at the control panel, fire command center and remote annunciator.

1.17 SYSTEM PROGRAMMING

A. The fire alarm system shall allow for loading and editing of special instructions and operating sequences as required. The system shall be capable of on site programming to accommodate system expansion and facilitate changes in operation. All software operations shall be stored in a non-volatile, programmable memory within the fire alarm control panel. Loss of primary and secondary power shall not erase the instructions stored in memory.

B. Full flexibility for selective input/output control functions shall also be incorporated in the resident software programming of the system.

C. Resident software shall allow for full configuration of initiating circuits so that additional hardware shall not be necessary to accommodate changes.

D. The fire alarm manufacturer shall include in his bid a minimum of two (2) additional system reprogram procedures to allow last minute additions to the system based on the Fire Department review of operation.

1.18 SYSTEM TESTING

A. Enable Walk Test

1. The actuation of the "enable walk test" program at the control panel shall activate the "Walk Test" mode of the system which shall cause the following to occur:

a. The city circuit connection shall be by-passed.
b. Control relay functions shall be by-passed.
c. The control panel shall show a trouble condition.
d. The activation of any alarm initiation device shall cause the audible signals to code a number of pulses to match the zone number.
e. The panel shall automatically reset itself after signaling is complete.
f. Any momentary opening of an initiating or indicating appliance circuit wiring shall cause the audible signals to sound for 4 seconds indicating a trouble condition.
g. The system shall have the capacity for multiple distinctive walk test groups. Such that only a portion of the system need be disabled during testing.

2. Walk Test Voice Message

a. The fire command center shall include a passcode protected voice message panel switch for broadcasting a system testing message manually prior to system testing.
b. After gaining access to the feature, the system shall allow activation of a panel switch that will broadcast two (2) rounds of the test message, then stop. The panel shall include an LED that will illuminate when this feature has been activated.
c. The test message shall be:

"Attention building occupants; a test of the building fire alarm system is being conducted. Unless instructed otherwise, please disregard all fire alarm alert tones, voice messages and flashing lights. At the conclusion of the testing, an announcement will be made to indicate that all fire alarm testing has been completed."

d. The fire command center shall also include a passcode protected voice message panel switch for broadcasting a system test completed message manually following the completion of the test.
e. After gaining access to the feature, the system shall allow activation of a panel switch that will broadcast two (2) rounds of the test complete message, then stop. The panel shall include an LED that will illuminate when this feature has been activated.

f. The test complete message shall be:

"Attention building occupants; all testing of the building fire alarm system has been completed. Any fire alarm alert tones, voice messages and flashing lights, from this point forward, indicate an actual fire alarm event. Please respond to the fire alarm message and, if the alert tone on this floor sounds, evacuate the building."

B. Silent Walk Test with History Logging

1. The system shall be capable of being tested by one (1) person. The control panel shall be capable of supporting multiple, separate testing groups whereby one group of points may be in a testing mode and the other (non-testing) groups may be active and operate as programmed per normal system operation.
2. While in testing mode, the alarm activation of an initiating device circuit shall be silently logged as an alarm condition in the historical data file. The panel shall automatically reset itself after logging of the alarm.
3. The momentary disconnection of an initiating or indicating device circuit shall be silently logged as a trouble condition in the historical data file. The panel shall automatically reset itself after logging of the trouble condition.
4. Should the walk test feature be on for an inappropriate amount of time, it shall revert to the normal mode automatically.
5. After testing is considered complete, testing data may be retrieved from the system in chronological order to ensure device/circuit activation.
6. Should an alarm condition occur from an active point, not in walk test mode, it shall perform operations described under operation.

C. The system shall be capable of disabling or enabling circuits individually for maintenance and testing purposes.

1.19 HISTORY LOGGING

A. The control panel shall have the ability to store a minimum of three hundred (300) events in an alarm log plus an additional three hundred (300) events in a separate trouble log. These events shall be stored in non-volatile, battery protected memory Real time and date shall accompany all history event recording.

B. The following historical alarm log events shall be stored:

1. Alarms
2. Alarm Acknowledgement
3. Alarm Silence
4. System Reset
5. Alarm Historical Log Cleared

C. The following Historical Trouble log events shall be stored:

1. Trouble Conditions
2. Supervisory Alarms
3. Trouble Acknowledgement
4. Supervisory Acknowledgement
5. Alarm Verification Tallies
6. Walk Test Results
7. Trouble Historical Log Cleared

1.20 ACCESS LEVELS

A. The system shall accommodate multiple access levels for the purposes of security. Basic system actions shall not require a passcode.

B. Passcodes shall consist of up to (10) digits. Changes to passcodes shall only be made by authorized personnel.

C. In order to maintain security when entering a passcode the digits entered will not be displayed, but a cursor will move along filling the position with an “X” to indicate that the digit has been accepted. All key presses will be acknowledged by a local audible sound.

D. When a correct passcode is entered, the message "ACCESS GRANTED" shall be displayed. The new access level shall be in effect until the operator manually logs out or the keypad has been inactive for 10 minutes.

E. Should an invalid code be imputed, the operator shall be notified with the message, "ERROR...INCORRECT PASSCODE", and shall be allowed up to (3) chances to enter a valid code. After (3) unsuccessful tries, the message, "ACCESS DENIED", shall be displayed. The level shall not be altered, and the operator shall no longer be in the menu option.

F. Access to a level will only allow the operator to perform all actions within that level plus all actions of lower levels, not higher levels.

G. The following keys/switches shall have access levels associated with them:

1. Alarm Silence
2. System Reset
3. Set Time/Date
4. Manual Control
5. On/Off/Auto Control
6. Disable/Enable
7. Clear Historical Alarm Log
8. Clear Historical Trouble Log
9. Walk Test
10. Change Alarm Verification

H. Acknowledge keys shall also require privileged access to acknowledge points. If the operator presses an (ACK) key with insufficient access, an error message will be displayed.

PART 2 - PRODUCTS

2.1 FIRE ALARM CONTROL PANELS

A. Furnish and install solid state, microprocessor based, fire alarm control panels in locations as shown on the drawings. The system construction shall be modular to allow future additions without the need to replace the entire control. It shall display only those primary controls and displays essential to operation during a fire alarm condition. Keyboards or keypads shall not be required to operate the system during fire alarm conditions.

B. Systems with multiple control panels shall be designed, such that each control panel has “stand-alone” capabilities. Each fire alarm control panel shall contain independent power supplies, amplifiers and batteries. In the event that a control panel looses connection with the system, a trouble signal shall sound and the disconnected panel shall continue to function based on the last set of instructions received.

C. A local audible device shall sound during "Alarm", "Trouble" or "Supervisory" conditions. This audible device shall sound differently during each condition to distinguish one condition from another without having to view the panel. This audible feedback shall also sound during each key press to ensure that the key has been pressed properly.

D. The panel shall have an alpha-numeric display to indicate status of the system.

E. The following primary controls shall be visible through a front access panel:

1. Alpha-numeric display
2. Individual red system alarm LED
3. Individual yellow supervisory service LED
4. Individual yellow trouble LED
5. Green "POWER ON" LED
6. Non-system equipment monitoring LED’s
7. Alarm acknowledge key
8. Supervisory acknowledge key
9. Trouble acknowledge key
10. Alarm silence key
11. System reset key

F. The following secondary control switches and LED's shall be available behind a locked access door:

1. Local city loop disconnect/switch
2. Local manual evacuation (drill)
3. Local door holder release by-pass

4. Local audible signal silence

G. The control panel shall provide the following:

1. Setting of time and date
2. LED test switch
3. Alarm, trouble, and abnormal condition listing
4. Enabling and disabling of each monitor point individually
5. Activation and deactivation of each control point separately
6. Changing operator access levels
7. Walk Test enable
8. Running diagnostic functions
9. Displaying software revision level
10. Displaying historical logs
11. Displaying PC card status
12. Point listing

H. For maintenance purposes, the following lists shall be available from the point lists menu:

1. All points list by address
2. Monitor point list
3. Signal list
4. Speaker list
5. Auxiliary control list
6. Feedback point list
7. Pseudo point list
8. LED/switch status list

I. Scrolling through menu options or lists shall be accomplished in a self-directing manner in which prompting messages shall direct the user. These controls shall be located behind an access door.

J. RS-232-C Output

1. Fire alarm control panel shall be capable of operating remote CRT's and/or printers. Output shall be ASCII from an EIA RS-232-C connection with an adjustable baud rate.
2. Each RS-232-C port shall be capable of supporting and supervising a remote CRT or printer supporting multiple remote CRT displays or printers. Data amplifiers shall be used to increase CRT or printer line distance. The fire alarm control panel shall support multiple RS-232-C ports.

K. Equipment Enclosures

1. Provide cabinets of sufficient size to accommodate all equipment. Cabinets shall be constructed of code gauge steel and shall be equipped with locks and a transparent door panel providing freedom from tampering yet allowing full view of the various lights and controls. Color of cabinets shall be red.

2.2 FIRE ALARM TERMINAL CABINETS

A. Fire alarm terminal cabinets shall be provided in locations as shown on the drawings and other locations as required for proper system wiring.

B. Fire Alarm terminal cabinets shall be painted red and shall contain the number and type of terminals and jumpers as required to support the system wiring in areas where the control panels are remote from the devices or for floors that do not include control panels.

2.3 MUNICIPAL MASTER BOX

A. Furnish and install a local energy type municipal master box, Gamewell M34-72. Coordinate location with Fire Department. Provide with grounding assembly, ground ___, lightning _____.

2.4 ONE WAY VOICE COMMUNICATION

A. One-way voice communication to all areas of the building shall be accomplished through a push-to-talk microphone at the fire command center. The one-way voice communication shall override the alarm signal tone. Each area of the building shall have a circuit selector switch at the fire command center to activate or bypass the voice or tone communications to a particular area on a selected or general basis.

B. The microphone shall be a dynamic communication type with a frequency range of 200 Hz to 4,000 Hz and shall be equipped with 5’-0” retractable coiled cord. An LED indicator shall be provided to indicate microphone “push-to-talk” button has been pressed and speaker circuits are ready for transmission.

C. Manual Voice Paging Sequence

1. The voice paging system shall be configured to allow selective voice paging per speaker zone. Upon activation of any speaker manual control switch, two (2) seconds of tone (different from the Alert Tone or Evacuation tone) shall sound over the speakers indicating an impending voice message will occur.
2. If any speaker manual control switches are activated, the control panel operator shall be able to make announcements via the push-to-talk paging microphone over the preselected speakers.
3. Facility for total building evacuation and paging shall be provided to allow for activation of all speakers. This shall be accomplished by the means of an "All Call" switch.

D. Provide area paging selector switches with LED indicators at the fire command center for each area as follows:

1. Ground

2. First Floor
3. Second Floor
4. Third Floor
5. Fourth Floor
6. Penthouse
7. Stairwell #1
8. Stairwell #2
9. All Call

E. Speaker circuits shall be supplied which are capable of supplying audio signals from the system amplifiers.

2.5 FIRE COMMAND CENTER

A. The fire command center shall be comprised of the following components:

1. Alpha-numeric LCD display.
2. LED Display.

    a. In addition to the alpha-numeric display, an LED display shall be incorporated into the fire command center. This display shall indicate the device type and the area location for allow a quick analysis of the alarm condition.
    b. The LED display shall consist of individual annunciation, per floor, per device type (i.e., manual station, automatic device, sprinkler flow, duct smoke detector, etc.)
    c. The LED display shall also consist of individual status monitoring of non-system equipment such as the fire pump, emergency generator, sprinkler and standpipe valve tampers.

3. One way voice communication equipment.

4. Graphic H-O-A switch panel:

    a. Provide H-O-A switches for control and status monitoring of various HVAC equipment. The H-O-A switches shall contain a 3-position switch for manual on/off and automatic controls. Each H-O-A switch shall have a green "On" LED and a red "Off" LED with separate supervised remote inputs for monitoring and displaying the status of the equipment.
    b. All LED’s for the status monitoring of the equipment shall be wired to show the actual status, "On" or "Off", of the controlled items via signals from a dry set of contacts generated from the building automation automatic temperature control (ATC) system. H-O-A switches shall be provided for control of fans at the main fire command center as indicated below:

        1) All supply and return air handling units that may cause recirculation of smoke.
        2) Supply and exhaust fans.

c. The following units shall be controlled with H-O-A switches:

1) All supply air handling units
2) All exhaust air handling units

d. This H-O-A switch panel shall be designed as a graphic representation of the building, indicating each floor and relative locations of the equipment controlled by each switch.

5. Local audible device.
6. All primary fire alarm system controls.
7. All secondary fire alarm system controls switches and LED's behind an access door, including:

a. Reporting loop disconnect
b. Manual evacuation (drill)
c. Door release bypass controls
d. Audible signal silence
e. Elevator recall by-pass

8. All system programming controls.

B. Equipment Enclosures

1. Provide cabinets of sufficient size to accommodate all equipment. Cabinets shall be constructed of code gauge steel and shall be equipped with locks and a transparent door panel providing freedom from tampering yet allowing full view of the various lights and controls. Color of cabinets shall be red.

2.6 REMOTE FIRE ALARM ANNUNCIATOR

A. Furnish and install a remote annunciator panel consisting of an alpha-numeric display unit tandem wired with the alpha-numeric display in the fire command center.

B. There shall also be indication for each alarm indicating sprinkler manual or automatic device via an LED.

C. In addition, there shall be the following:

1. Individual red system alarm LED
2. Individual yellow supervising service LED
3. Individual yellow trouble LED
4. Green "Power On" LED

D. There shall be a graphic panel adjacent the remote annunciator to indicate the location of the fire command center in relation to the remote annunciator.

2.7 PATIENT ROOM SMOKE DETECTOR ANNUNCIATOR

A. Furnish and install a patient room smoke detector annunciator at each main nurses' station indicated on the drawings for individual annunciation of patient bedroom smoke detectors.

B. The patient room smoke detector annunciator shall consist of an 80 character alpha-numeric display connected to the fire alarm system and programmed for individual alarm status of each patient room smoke detector in each nursing unit. Provide supervised power from the fire alarm control panel.

C. The patient room smoke detector annunciator shall have the following features:

1. LCD readout of alarm status of each patient room smoke detector with patient room number identified. Room number shall be assigned by the Owner and is not, necessarily, the room number indicated on the drawings.
2. Audible alarm device
3. Audible device silence switch
4. Resetting of the smoke detector shall be accomplished at the control panel or fire command center.

2.8 ATC INTERFACE PANEL

A. Furnish and install red terminal cabinets with separate terminations for all fire alarm control and monitor points jumpered to separate terminations for all ATC monitor and control points. The ATC interface panel shall be labeled as such with 2" high white lettering on a red background.

B. Each conductor entering the ATC interface panel from the fire alarm system shall be appropriately and clearly identified and coordinated with the ATC Subcontractor to ensure proper interface.

C. Control Signals

1. Wiring from the fire alarm system to the ATC interface panel shall be provided for the following alarm and trouble signals generated by the fire alarm system:

   a. General alarm
   b. General trouble
   c. Each duct smoke detector in alarm

2. Wiring from the H-O-A switch panel in the fire command center to the ATC interface panel shall be provided to allow for the following operation:

   a. When the H-O-A is in the automatic position, the controlled equipment shall operate as directed by the ATC system.

b. When the H-O-A switch is in the "ON" position, a signal shall be sent to the ATC system to bypass all other control of the selected equipment and turn the controlled equipment on. The controlled equipment shall continue to operate until the H-O-A switch is restored to the "AUTOMATIC" or "OFF" position.

c. When the H-O-A switch is in the "OFF" position, a signal shall be sent to the ATC system to bypass all other control of the selected equipment and turn the controlled equipment off. The controlled equipment shall remain in the off condition until the H-O-A switch is restored to the "AUTOMATIC" or "ON" position.

3. HVAC air handling units, consisting of supply and return fans, shall have separate H-O-A switches for each fan.

4. HVAC air handling units (such as supply air handling units or exhaust air handling units) consisting of multiple fans, in parallel, in a common unit, shall have one H-O-A switch for the unit to control both fan simultaneously.

D. Monitor Signals

1. Wiring from the ATC interface panel (originating at the ATC system) shall be provided for the following monitor signals:

a. For each piece of equipment controlled by a H-O-A switch, the ATC system shall determine the actual status, ON or OFF, of the equipment. These status signals shall be used to illuminate the proper LED at each H-O-A switch.

E. It shall be the Electrical Subcontractor's responsibility to coordinate with the ATC Subcontractor and fire alarm manufacturer the proper rating (amperage and voltage) and contact types between the fire alarm system and the ATC system to accomplish the above.

F. All wiring between the fire alarm system and the ATC interface panel shall be by the Electrical Subcontractor. All wiring between the ATC system and the ATC interface panel shall be by the ATC Subcontractor.

2.9 TONE GENERATORS/AUDIO AMPLIFIERS

A. Tones generators shall be provided to generate the following tones:

1. The pre-signal alert tone shall be a Coded horn 4-4-4 code operating at 900 Hz.
2. The evacuation tone shall be a temporal code.
3. The pre-signal alert tone and evacuation tone in the animal facility shall be provided from a separate tone generator and shall be between 430 and 470 Hz with a sound output of 97 dB at 12".

B. Audio power amplifiers shall be furnished with a self-contained, filtered power supply, transformer and amplifier monitor circuits. Amplifiers modules shall provide a 25 VRMS output with a frequency response of 120 to 12,000 Hz. Provide a sufficient quantity of amplifiers to operate all system speakers, simultaneously plus a total of 25% spare capacity. Calculation shall assume each speaker is connected at the one (1) watt tap and each trumpet

speaker is connected at the 15 watt tap. The system shall be provided with either redundant amplifiers, or floating back-up amplifiers to switch over circuits from any amplifier that has failed.

C. The audio system shall also include music inputs and mixer pre-amp circuits. Audio outputs shall have individual gain control.

2.10 POWER SUPPLIES

A. Fire Alarm System Power Supplies

1. Power supplies for the fire alarm system shall consist of full wave, rectified 24 volts DC. Multiple power supplies shall be provided as required to provide 24 volt DC power to all fire alarm system equipment and peripheral equipment connected to the system.
2. The power supply shall receive 120 volt AC power from the building emergency power system and the secondary output of the power supply shall be fused.
3. Power supplies shall be of the dead front construction and housed in a steel enclosure integral to the fire alarm system control panels. Externally mounted power supplies shall not be acceptable.

B. Visual Device Power Supplies

1. Power supplies for visual notification devices (ADA strobes) shall provide regulated power for multiple uses.
2. The power supply shall be arranged to allow visual device synchronization throughout the facility.
3. Provide sufficient size and quantity of power supplies to operate all system visual strobes simultaneously, plus 25% spare capacity.

2.11 BATTERIES/BATTERY CHARGER

A. Batteries

1. Rechargeable, sealed lead-acid batteries shall be provided with reliable and repeatable discharge and recharge characteristics for use in fire alarm systems.
2. Batteries shall be of identical voltage, model number, appearance and approximately the same date of manufacture to allow connections in series to produce a system voltage of 24 volts DC.

B. Battery Charger

1. The battery charger shall automatically charge and monitor the condition of the batteries. The charger shall be dual-rate type with a combination high rate/float maintenance rate which is capable of recharging fully discharged batteries to 70% charge within 12 hours.
2. The control panel shall include a voltmeter and ammeter to indicate battery voltage and charging current.

3. The charger shall include a green “Charger On” LED, a yellow Charger Trouble” LED and a red “High Rate” LED. The charger shall also include battery voltage test points and a fuse for overcurrent protection.

C. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal 120 VAC power in a normal supervisory mode for a period of sixty (60) hours with fifteen (15) minutes of alarm operation at the end of this period. The system shall automatically transfer to the standby batteries upon normal power failure. All battery charging and recharging operations shall be automatic.

D. Power cable size from the batteries to the control panel and/or fire command center shall be determined by the manufacturer based on power demand and acceptable voltage drop calculations.

E. All external circuits requiring system operating power shall be individually fused at the control panel.

2.12 SYSTEM INTERFACE MODULES

A. General

1. System interface modules shall communicate over the same lines as the other addressable devices and shall receive their operating power from a separate source within the fire alarm control panel.

B. Communicating Device Module

1. All alarm initiating devices indicated on the electrical drawings shall be addressable. These devices shall report to a communicating device module in the control panel. Each module will communicate with the microprocessor to continually poll the remote devices for normal, abnormal, shorted, and open line conditions.
2. The communicating device module shall continuously interrogate each of the addressable devices on its communications channel for status changes and/or trouble conditions.
3. The system shall communicate with each initiation device individually and each device shall be individually annunciated at the control panel, fire command center and remote annunciator.
4. Each device shall have the capability of being disabled or enabled, individually.
5. As a minimum, a separate, isolated circuit shall be provided for each floor.
6. The number of addressable devices connected to the communicating device module shall not exceed 75% of its capacity, to allow for future expansion.
7. Each addressable device must be uniquely identified by an address code at time of installation. Verbiage at each alpha-numeric display shall, as a minimum, indicate device type, floor and room number. Room number shall be as designated by the Owner and not necessarily the room number indicated on the drawings.
8. Sensing circuits from the communicating device module shall be "Class A" McCulloh, supervised to provide an indication of sensing circuit faults. Supervision points shall not reduce available system alarm points. Control points shall be capable of initiating remote

alarm signals or systems, and providing a momentary pulse to allow reset of remotely located fire or other types of local controls, by using the manual control feature of the system keyboard.

C. Monitor Module

1. Monitor modules shall supervise and monitor the status of non-addressable, normally open, direct contact devices such as sprinkler water flow switches and valve tamper (supervisory) switches. These monitor modules shall communicate the equipment status (normal, alarm, trouble) to the control panel.
2. Monitor modules shall also be used to indicate status of equipment such as, emergency generator, fire pump controllers, and other systems as indicated on the drawings.

D. Control Module

1. Control modules shall supervise and control the operation of auxiliary devices. Control modules shall also operate functions such as building fans and dampers, elevator recall, release door hold back devices, as well as any other system control functions indicated on the drawings or mentioned in these specifications.
2. Control modules shall provide 2-pole, 2-throw, supervised relay switching that may be used to connect through easily replaceable 2A fuses.
3. Control modules shall communicate the supervised wiring status (normal, trouble) to the fire alarm control panel and will receive a command to transfer the relay from the fire alarm control panel.

2.13 SMOKE DETECTORS

A. Photoelectric Smoke Detector

1. Photoelectric smoke detectors shall be analog addressable and shall utilize a light emitting device and a light sensing device mounted within a smoke chamber. The smoke chamber shall be designed to effectively manage light dissipation and extraneous reflections from dust particles, insects or other airborne contaminants is such a way as to maintain stable, consistent detector operation.
2. The control panel shall be capable of continually analyzing the analog signal from each smoke detector for calibration, sensitivity and address identification. The values from each detector shall be displayed at the control panel upon command.
3. Each smoke detector shall have a unique address. Systems that utilize detector bases, separate from the detectors, shall ensure the bases are interchangeable with other addressable devices.
4. Each smoke detector shall include an LED that shall flash once every 30 – 60 seconds to indicate that it is operating properly. If the detector goes into alarm, and the alarm is confirmed by the control panel, the LED shall flash continuously until the system is reset at the control panel.
5. Each detectors sensitivity shall be individually adjustable from the control panel. Should a detectors signal reach a predetermined level, and remain there for a predetermined

duration, a discrete detector trouble signal shall be annunciated at the control panel, fire command center and remote annunciator.

6. Should a detectors signal reach a an alarm level, the alarm sequence of events shall be initiated.
7. Smoke detectors shall be capable of operating one remote alarm indicator, an auxiliary relay or an audible base. These devices shall be capable of being activated by the associated detector or any other detector as programmed at the control panel.
8. Where shown on the drawings, smoke detectors shall include a 135 degree Fahrenheit, fixed temperature, self restoring heat sensor.
9. Detectors shall operate properly from +32 to 100 degrees Fahrenheit and from 0 to 93% relative humidity, non-condensing.

B. Ionization Smoke Detectors

1. Ionization smoke detectors shall be addressable and shall contain two ionization chambers. The reference chamber and the system software shall compensate against sensitivity changes caused by environmental factors such as temperature, humidity and barometric pressure.
2. The control panel shall be capable of continually analyzing the analog signal from each smoke detector for calibration, sensitivity and address identification. The values from each detector shall be displayed at the control panel upon command.
3. Each smoke detector shall have a unique address. Systems that utilize detector bases, separate from the detectors, shall ensure the bases are interchangeable with other addressable devices.
4. Each smoke detector shall include an LED that shall flash once every 30 – 60 seconds to indicate that it is operating properly. If the detector goes into alarm, and the alarm is confirmed by the control panel, the LED shall flash continuously until the system is reset at the control panel.
5. Each detectors sensitivity shall be individually adjustable from the control panel. Should a detectors signal reach a predetermined level, and remain there for a predetermined duration, a discrete detector trouble signal shall be annunciated at the control panel, fire command center and remote annunciator.
6. Should a detectors signal reach a an alarm level, the alarm sequence of events shall be initiated.
7. Smoke detectors shall be capable of operating one remote alarm indicator, an auxiliary relay or an audible base. These devices shall be capable of being activated by the associated detector or any other detector as programmed at the control panel.
8. Detectors shall operate properly from +32 to 100 degrees Fahrenheit and from 0 to 93% relative humidity, non-condensing.

C. Duct Smoke Detectors

1. Duct mounted smoke detectors shall be addressable and shall be comprised of a photoelectric smoke detector as specified above mounted within an air duct housing designed for detection of smoke in heating, air conditioning and ventilation (HVAC) ducts in accordance with NFPA 90A.
2. The duct smoke detector housing shall include sampling tubes that extend into and across the duct of the HVAC system. When fans are operating, a continuous cross sectional

sampling of air from the duct shall flow through the smoke detector in the housing, after which, the air shall be returned to the duct.

3. Upon alarm actuation of the smoke detector a supervised relay, incorporated into the duct smoke detector shall directly shut down the respective fan.
4. The duct smoke detector shall obtain its operating power from the fire alarm control panel. If the duct smoke detector requires power from an external source, the manufacturer shall inform the Electrical Subcontractor of this requirement and the Electrical Subcontractor shall provide this power from the emergency distribution system at no additional cost to the Owner.
5. Each duct smoke detector shall be furnished with a supervised auxiliary relay for use by the ATC system manufacturer for fan shut-down.
6. Each duct smoke detector shall include a remote alarm indicator (LED) with a key switch. This device shall be mounted within proximity of the duct detector and labeled to clearly show which detector it is associated with. The device shall be a key activated device that, when manually operated, will functionally test the detector and force the associated detector into alarm. The system will then activate all functions programmed to follow the detector. The LED shall illuminates when the detector is in alarm.

D. Beam Type Smoke Detectors

1. Beam type smoke detectors shall be addressable and shall consist of transmitter, reflector and receiver to sense smoke obscuration across large distances. The beam shall traverse the protected area and re reflected to the receiver. The resultant signal shall be evaluated by the system and result in alarm.
2. The detector shall cover distances from 20 feet to 250 feet and shall be unaffected by extraneous light in the space

2.14 FIRE DETECTORS

A. Fire detectors shall be addressable and shall contain a smoke chamber designed to effectively manage light dissipation and extraneous reflections from dust particles, insects or other airborne contaminants is such a way as to maintain stable, consistent detector operation.

B. The detector and control panel shall incorporate the appropriate technology to allow the detector to be programmed to match the environment in which it is installed. The system technology shall allow for multiple environmental choices. The system shall automatically set detector alarm and pre-alarm points, as well as calculation factors for weighing input from the detector sensors. The detector shall have a default mode if the operator fails to set the mode.

C. The control panel shall be capable of continually analyzing the analog signal from each smoke detector for calibration, sensitivity and address identification. The values from each detector shall be displayed at the control panel upon command.

D. Each smoke detector shall have a unique address. Systems that utilize detector bases, separate from the detectors, shall ensure the bases are interchangeable with other addressable devices.

E. Each smoke detector shall include an LED that shall flash once every 30 – 60 seconds to indicate that it is operating properly. If the detector goes into alarm, and the alarm is confirmed by the control panel, the LED shall flash continuously until the system is reset at the control panel.

F. Each detectors sensitivity shall be individually adjustable from the control panel. Should a detectors signal reach a predetermined level, and remain there for a predetermined duration, a discrete detector trouble signal shall be annunciated at the control panel, fire command center and remote annunciator.

G. Should a detectors signal reach a an alarm level, the alarm sequence of events shall be initiated.

H. Smoke detectors shall be capable of operating one remote alarm indicator, an auxiliary relay or an audible base. These devices shall be capable of being activated by the associated detector or any other detector as programmed at the control panel.

I. Detectors shall operate properly from +32 to 100 degrees Fahrenheit and from 0 to 93% relative humidity, non-condensing.

2.15 HEAT/RATE-OF-RISE DETECTORS

A. Heat/rate-of-rise detectors shall be addressable and shall be the fixed temperature/rate-of-rise type. The fixed temperature shall be 135 degrees Fahrenheit unless indicated otherwise on the drawings. Detectors shall be automatically restorable.

B. Heat/rate-or-rise detectors shall be capable of operating one remote alarm indicator, an auxiliary relay or an audible base. These devices shall be capable of being activated by the associated detector or any other detector as programmed at the control panel.

2.16 MANUAL PULL STATIONS

A. Manual pull stations shall be addressable and shall be of the double action, break rod type. The device shall be red with the words “FIRE ALARM” in white, raised letters. The station shall mechanically latch upon operation and remain so until manually reset. Only authorized individuals will have the tools/keys to reset the device.

2.17 DOOR HOLD OPEN DEVICES

A. Door hold open devices shall be furnished and installed by the Construction Manager. The Electrical Subcontractor shall coordinate the proper voltage of these devices with the door hardware supplier and provide all required wiring and additional hardware to properly control doors.

2.18 WATER FLOW SWITCHES

A. Water flow switches shall be provided by the Fire Protection Subcontractor. Furnish an addressable monitor module for each water flow switch shown on the drawings.

2.19 TAMPER (SUPERVISORY) SWITCHES

A. Tamper (supervisory) switches shall be provided by the Fire Protection Subcontractor. Furnish an addressable monitor module for each tamper (supervisory) switch shown on the drawings.

2.20 ALARM INDICATING DEVICES

A. Combination Speaker and Strobe

1. Furnish and install combination audio/ADA visual alarm assemblies, mounted with red impact resistant and flame retardant thermoplastic injection molded frame and ADA compliant strobe lamp.
2. Speakers

   a. Provide a 4" speaker with a matching transformer with variable taps at 0.25, 0.5, 1.0 and 2.0 watts. The speaker shall utilize a high quality cone, and be moisture repellant and fire retardant with smooth frequency response 400 Hz to 4,000 Hz for minimal distortion.
   b. Speakers tap settings shall be as follows:

1)	Corridors	1.0 watt
2)	Rooms smaller than 100 sq. ft.	0.5 watt
3)	Rooms from 100 to 400 sq. ft.	1.0 watt
4)	Rooms larger than 400 sq. ft.	2.0 watt

3. Visual strobes

   a. Visual strobes shall have an intensity of 15, 75, or 110 candela and comply with ADA Standards. All visual strobes throughout the facility shall be synchronized.
   b. Visual strobe intensities shall be as follows:

1)	Corridors	75
2)	Bathrooms	15
3)	Rooms smaller than 100 sq. ft.	15
4)	Rooms from 100 to 400 sq. ft.	75
5)	Rooms larger than 400 sq. ft.	110

4. The entire assembly shall meet UL 1480 testing procedures.

B. Trumpet Audio/Visual Alarm Unit

1. Furnish and install surface mounted fire alarm trumpet speaker assemblies, where shown on the plans.
2. Provide speaker with a matching transformer with variable taps up to 15 watts.
3. Each trumpet speaker shall be complete with a 110 candela ADA compliant visual strobes. All visual strobes throughout the facility shall be synchronized.

C. Rotating Beacons

1. Furnish and install UL listed rotating beacons on the exterior of the building as indicated on the drawings. The unit shall have a red lens and 50 watt lamp. Mounting shall be via 1" cast pipe mount on a weatherproof base. The entire unit shall be weatherproof.

2.21 REMOTE ALARM INDICATORS

A. Provide remote alarm indicators with an LED as shown on the drawings for selected smoke detectors. Device shall be labeled to clearly show which detector it is associated with. LED shall illuminate when the detector is in alarm.

2.22 ELEVATOR INTERFACE

A. Each bank of elevators shall be provided with control modules located in the Elevator Machine Room for elevator recall signal for designated floors and alternate floors. Contacts shall be dry for termination to the elevator controllers by the Elevator Contractor.

B. The Electrical Subcontractor shall fully coordinate all requirements with the Elevator Contractor.

C. Furnish to the Elevator Contractor, fire alarm audible/visual units and firefighters emergency telephones ([1] for each elevator). These components shall be installed by the Elevator Contractor. All wiring for systems shall be done by the Electrical Subcontractor and brought to a designated point as directed by the Elevator Contractor. The Elevator Contractor shall install all wiring required within the elevators shafts, etc.

2.23 ELEVATOR FIRE ALARM SYSTEM

A. Furnish and install an independent, two zone fire alarm control panel for each elevator machine room, for receiving signals from heat detectors mounted in elevator machine rooms and elevator shafts. The elevator fire alarm system shall be a completely independent system from the main building fire alarm system and shall tie into and annunciate as a separate zone of the main fire alarm system.

B. Provide heat detectors within 24” of each sprinkler head in elevator machine rooms and elevator shafts.

C. Upon receipt of an alarm condition signal from a heat detector, a signal shall be sent to all respective elevator machine shunt trip circuit breakers to disconnect power to all elevator machines in the elevator machine room associated with the heat detector in alarm.

D. The elevator shunt-trip fire alarm system shall be manufactured by the same manufacturer as the main fire alarm system.

2.24 WIRING AND RACEWAYS

A. Wiring

1. All wiring shall be installed in conduit. Size and type of all system wiring shall be as recommended by the system manufacturer.
2. Survivability

a. Two (2) hour fire rated conductors, such as Pyrotenax type Pyro CIC shall be used as indicated below, size to be determined by fire alarm manufacturer:

1) All network wiring between fire alarm transponder panels and terminal cabinets.
2) Wiring from fire alarm transponder panel to the fire command center.

B. Raceways

1. Raceways for all fire alarm wiring and peripheral equipment shall be Rigid Galvanized Steel, Intermediate Metal Conduit or Electrical Metallic Tubing (EMT), subject to the restrictions of the National Electrical Code. Refer to Specification Section 16100 for additional information.

2.25 KEY REPOSITORY

A. Provide a metal key repository at the fire command center location. Keys to the command center, elevators, electric and mechanical rooms and such other keys as required by the City of Portland Fire Department shall be provided within the repository. The repository shall have flush hinged door with lock. Lock and key for this repository shall be a City of Portland Fire Department type. Each key type shall have its own hook inside the repository and shall have a nameplate above the hook indicating the room or function which the key serves.

2.26 SPARE PARTS

A. The fire alarm system shall be furnished with spare parts stored in an area approved by the Fire Department.

B. The following list of spare parts shall be supplied:

1. Two (2) spare control modules.
2. Two (2) spare monitor modules.
3. Six (6) addressable bases.
4. Six (6) area smoke detectors.
5. Six (6) speaker/light units.

PART 3 - EXECUTION

3.1 COOPERATION AND WORK PROGRESS

A. The Electrical work shall be carried on under the usual construction conditions, in conjunction with all other work at the site. The Electrical Subcontractor shall cooperate with the Architect, Construction Manager, all other Subcontractors and equipment suppliers working at the site. The Electrical Subcontractor shall coordinate the work and proceed in a manner so as not to delay the progress of the project.

B. The Electrical Subcontractor shall coordinate his work with the progress of the building and other Trades so that he will complete his work as soon as conditions permit and such that interruptions of the building functions will be at a minimum. Any overtime hours worked or additional costs incurred due to lack of or improper coordination with other Trades or the Owner by the Electrical Subcontractor, shall be assumed by him without any additional cost to the Owner.

C. The Electrical Subcontractor shall furnish information on all equipment that is furnished under this Section but installed under another Section to the installing Subcontractor as specified herein.

D. The Electrical Subcontractor shall provide all materials, equipment and workmanship to provide for adequate protection of all electrical equipment during the course of construction of the project. This shall also include protection from moisture and all foreign matter. The Electrical Subcontractor shall also be responsible for damage which he causes to the work of other Trades, and he shall remedy such injury at his own expense.

E. Waste materials shall be removed promptly from the premises. All material and equipment stored on the premises shall be kept in a neat and orderly fashion. Material or equipment shall not be stored where exposed to the weather. The Electrical Subcontractor shall be responsible for the security, safekeeping and damages, including acts of vandalism, of all material and equipment stored at the job site.

F. The Electrical Subcontractor shall be responsible for unloading all electrical equipment and materials delivered to the site. This shall also include all large and heavy items or equipment which require hoisting. Consult with the Construction Manager for hoisting/crane requirements. During construction of the building, the Electrical Subcontractor shall provide additional protection against moisture, dust accumulation and physical damage of the main service and

distribution equipment. This shall include furnishing and installing temporary heaters within these units, as approved, to evaporate excessive moisture and ventilate it from the room, as may be required.

G. It shall be the responsibility of the Electrical Subcontractor to coordinate the delivery of the electrical equipment to the project prior to the time installation of equipment will be required; but he shall also make sure such equipment is not delivered too far in advance of such required installation, to ensure that possible damage and deterioration of such equipment will not occur. Such equipment stored for an excessively long period of time (as determined in the opinion of the Architect) on the project site prior to installation may be subject to rejection by the Architect.

H. The Electrical Subcontractor shall erect and maintain, at all times, necessary safeguards for the protection of life and property of the Owner, Workmen, Staff and the Public.

I. Prior to installation, the Electrical Subcontractor has the responsibility to coordinate the exact mounting arrangement and location of electrical equipment to allow proper space requirements as indicated in the NEC. Particular attention shall be given in the field to group installations. If it is questionable that sufficient space, conflict with the work of other Subcontractors, architectural or structural obstructions will result in an arrangement which will prevent proper access, operation or maintenance of the indicated equipment, the Electrical Subcontractor shall immediately notify the Construction Manager and not proceed with this part of the Contract work until definite instructions have been given to him by the Architect.

3.2 INSTALLATION

A. General

1. Furnish and install the complete fire alarm system in accordance to the drawings, these specifications and all applicable Codes and Ordinances and in accordance with the manufacturer’s recommendations.
2. The Electrical Subcontractor shall furnish and install, in accordance with manufacturer's instructions, all wiring, conduit and outlet boxes required for the erection of a complete system as described herein and as indicated on the drawings.
3. Final connections between the control equipment and wiring system shall be made under direct supervision of a representative of the manufacturer.
4. The Electrical Subcontractor shall be responsible for the proper placement of all heat and smoke detectors to ensure proper spacing. Smoke detectors shall be spaces a maximum of 30’-0” on center and no greater than 15’-0” from end walls, doors, etc.
5. Installation of equipment and devices that pertain to other work in the Contract shall be closely coordinated with the appropriate Contractors. The Electrical Subcontractor shall clean all dirt and debris from the inside and the outside of the fire alarm equipment after completion of the installation.
6. Cover all smoke detection devices with plastic bags immediately after installation to maintain cleanliness. If detectors are contaminated with dirt or dust during the construction period, it shall be the responsibility of the Electrical Subcontractor, at his

cost, to clean or replace each device as directed by the Owners representative or the Authority having jurisdiction.

7. All miscellaneous hardware and support accessories, including support rods, nuts, bolts, screws and other such items, shall be furnished as required for proper installation of the system and shall be of a galvanized or cadmium plated finish, or of other approved rust-inhibiting coating.
8. The Electrical Subcontractor shall ensure that all concealed equipment that may require maintenance or access for any reason are made easily accessible.

B. Environmental limitations for the system shall be as follows:

1. Temperature:

   a. CPU: 32°F to 120°F;
   b. Transponders: 32°F to 120°F

2. Humidity:

   a. CPU: 90% non-condensing;
   b. Transponders: 95% non-condensing

C. Raceways

1. All fire alarm system wiring shall be run in conduit as specified in section 16100 and shall meet the requirements of NEC Article 760 and all National, State and Local Electrical Codes. Conduit sizes shall be determined by the fire alarm equipment manufacturer to support the quantities and types of wiring to be installed. Minimum ½" conduit.
2. All pull and junction boxes shall be sprayed red and labeled "Fire Alarm". A red stripe, 4" wide, shall be painted on all conduit for fire alarm system wiring and/or all junction boxes and conduit fittings shall be painted red. Wiring color code shall be maintained throughout the installation. Fire alarm cable in raceways shall be tagged every 20'-0" and shall have the legend "Municipal Fire Alarm Cable".

D. Wiring

1. Wiring types and sizes shall be as recommended by the equipment manufacturer. Minimum #16 AWG.
2. All wiring shall be UL listed for fire protective signaling systems and meet the requirements of NEC Article 760.
3. Color code shall be used throughout. All wires shall be tagged at all junction points and shall test free from grounds or crosses between the conductors.
4. Wiring shall be routed to maintain sufficient distance between the feed and return loop as required by the Authority Having Jurisdiction.
5. Maximum wiring distances shall be within manufacturer's specifications.
6. T-tapping of signal device conductors to signal circuit conductors shall NOT be accepted.

3.3 ADDITIONAL DEVICE INSTALLATION REQUIREMENTS

A. The Electrical Subcontractor shall carry within his bid the cost of materials and labor required for installing additional devices which may be required by the Fire Department during final inspection. This shall be carried as a separate line item and unit cost associated for each item as indicated in Equipment Allowances section of this specification.

B. The cost shall include the following additional devices:

1. 5 pull stations
2. 10 smoke detectors
3. 5 heat detectors
4. 4 duct smoke detectors/remote alarm indicators, test switch
5. 10 A/V devices
6. 5 monitor modules
7. 5 control modules

C. As part of the allowance, carry 25’-0” of cabling/conduit for each device listed above.

3.4 MATERIALS AND WORKMANSHIP

A. All materials and equipment shall be new and unused and shall meet requirements of the latest Standards of NFPA, UL, NEMA, IPCEA, ANSI and IEEE. Equipment shall have components required or recommended by OSHA, applicable NFPA documents and shall be UL listed and labeled.

B. Despite references in the specifications or on the drawings to materials or pieces of equipment by name, make or catalog number, such references shall be interpreted as establishing standards of quality for materials and performance.

C. Finish of materials, components and equipment shall not be less than Industry good practice. When material or equipment is visible or subject to corrosive or atmospheric conditions, the finish shall be as approved by the Architect.

D. Provide proper access to material or equipment that requires inspection, replacement, repair or service. If proper access cannot be provided, confer with the Architect as to the best method of approach to minimize effects of reduced access.

E. All work shall be installed in a neat and workmanlike manner and shall be done in accordance with all Local and State Codes.

F. The Owner will not be responsible for material, equipment or the installation of same before testing and acceptance.

3.5 COORDINATION OF MAINTENANCE AND MONITORING

A. It shall be the responsibility of the representative of the equipment manufacturer to arrange for meetings between the Owner's representatives and the representatives of qualified companies who specialize in the maintenance, testing and central station monitoring of fire alarm systems.

B. Require the manufacturer of the equipment to include the furnishing of complete installation drawings of catalog cuts of all components. The foregoing materials shall be submitted to the Engineer for approval with shop drawings, prior to the ordering of equipment or starting the installation.

C. Provide the services of an authorized technical representative of the manufacturer of the equipment to supervise the installation, adjustment and all testing of the system required to assure a complete and fully operative facility in accordance with this specification and all Fire Department Regulations. A signed test report substantiating this shall be submitted by the manufacturer.

D. It shall be the responsibility of the Electrical Subcontractor, where equipment or systems added under this Contract are found to be defective or not in accordance with the manufacturer's published data, the specification and/or Contract Drawings, to correct all discrepancies. It shall further be the responsibility of the Electrical Subcontractor to perform all retests and indicate to the Owner, the Fire Department and the Engineer that all systems perform as required by the Contract Drawings and specifications. Retests shall be performed in accordance with the Owner's requirements and at a time which is acceptable to the Owner, and all costs for retesting and operational retesting shall be borne by the Electrical Subcontractor. The Electrical Subcontractor shall notify the Owner and Engineer (7) days in advance of the date when the system will be ready for retesting.

3.6 MANUFACTURER'S CERTIFICATION

A. The qualified, factory trained authorized representative of the manufacturer shall provide on-site supervision of the fire alarm system installation. The representative shall certify, in writing, that the system and equipment has been installed, adjusted, and tested in accordance with the manufacturer's recommendations.

B. The Electrical Subcontractor shall provide three (3) copies of the manufacturer's representative's certification before final payment is made.

3.7 FIELD ACCEPTANCE TESTS

A. The Owner shall not be responsible for fire alarm system material or equipment prior to testing and acceptance.

B. Before final approval and acceptance by Building Owner, fire protection and life safety systems shall be subjected to tests specified in any applicable NFPA Codes and Standards. Tests shall be witnessed by the representative of the Fire Department and by the representatives of the Owner's Building Construction Department, Risk Management Division and Security Department. Piping, wiring and accessory devices in any portion of new system shall not be covered up or concealed permanently until they have been tested and approved. At least 48 hours notice shall be given to aforementioned representatives before test.

C. Test shall comprise activating and verifying the operations of each and every device (input and output) and auxiliary functions. No exceptions to this requirement will be accepted. A written test log of this complete test shall be submitted prior to acceptance of the system by the Owner.

D. Manual and Automatic Fire Alarm Systems

1. Upon completion of system or part as determined by the Owner, satisfactory acceptance test of entire installation shall be made. Test shall include central control station, (i.e. the proprietary protective signaling system), and manual and automatic fire alarm systems. Test(s) shall include but shall not be limited to the following: Manual pull stations, evacuation signals/lights, thermal and/or smoke detectors, automatic door release devices, waterflow and supervisory alarm devices, and elevator capture and recall.

E. Test shall meet requirements of the following:

1. NFPA 72: Local Protective Signaling Systems
2. NFPA 72: Auxiliary Protective Signaling Systems
3. NFPA 72: Central Station Systems
4. NFPA 72: Proprietary Protective Signaling Systems
5. NFPA 72: Automatic Fire Detectors
6. NFPA 13A: Care and Maintenance of Sprinkler Systems

F. To assure that wire size, power supply, number of devices on a circuit, etc., are suitable to support 100 percent of devices being in alarm or operated simultaneously, this test shall include the following:

1. Place all sensors and monitor modules in alarm. Each shall display its address and alarm condition. At least the first ten (10) devices on each circuit shall also have their alarm LED's lighted.
2. Operate all control modules for the alarm or operated condition. Each module shall display its address and condition.
3. Reset all alarmed and operated devices. The panel shall display the address of any off-normal devices.

G. Test each sensor for alarm verification by momentarily testing for alarm. The sensor shall not initiate an alarm. Then, test by placing the sensor in alarm such that it remains in alarm for the selected verification time. The sensor shall initiate an alarm.

H. Test each sensor for trouble by removing the sensor from its base. The address and trouble condition for each shall be displayed. Insert a different type of sensor into the base. The address

and trouble condition shall be displayed. The sensor will return to normal only when the proper sensor type is reinserted in the base.

I. Print out the English language descriptor and status of each module in the system. The printout shall also include the date and time.

J. Audible sound level measurements shall be conducted throughout the entire building, and all spaces with the evacuation system sounding. Measurements shall be recorded in the following format for each space:

"Room/Area"	"Ambient Sound Level db"	"Ambient And Evacuation Sound Level dB"

These measurements shall be done to certify that all areas conform to the Fire Department sound level requirements for evacuation alarm signals.

K. The equipment manufacturer shall have a local branch office staffed with trained, full-time employees who are capable of performing testing, inspection, repair, and maintenance services for the life of the system.

3.8 TRAINING

A. A training session shall be presented by a fully qualified, trained representative of the equipment manufacturer who is thoroughly knowledgeable of the specific installation. It should be given to personnel responsible for operating the system and representatives of the Boston Fire Department.

3.9 FIRE ALARM INSPECTION AND TESTING CONTRACT (BY OWNER)

A. Before making final connections to master boxes, a 24 hour on call, 4 hour response time, City of Boston approved Service and Testing Inspection Contract shall be in evidence between the person holding title to interior fire alarm system and holder of certificate of competency.

B. Transmitters shall be tested at least twice monthly. During bi-annual test of each system, at least one alarm initiating circuit shall be tested in each alarm circuit. Submit report of each month's test.

C. Detectors associated with interior fire alarm system shall be tested once every 12 months, with 1/12 (one-twelfth) number being tested in each monthly test.

D. Self-restoring detectors shall be exposed either to heat or smoke to test ability to initiate alarm.

E. Fusible link detectors shall be unscrewed from holders to test ability to initiate alarm. Every six months, one fusible link shall be exposed to heat to test ability of fusible link to respond to heat.

F. Quarterly test reports shall include the following information:

1. Date of test.
2. Name and location being tested.
3. Number of interior alarm circuits.
4. Number of devices tested and type.
5. Condition of emergency stand-by power supply.
6. Name of company conducting test.
7. Name and signature of person conducting test.

G. Testing agreement shall not cover:

1. Damage resulting from accidents, fire, storm, water, negligence, misuse, vandalism, nor defective or improper wiring.
2. Testing of waterflow switches on sprinkler system (waterflow switches to be tested by sprinkler company personnel).
3. Testing or repairs of door release mechanisms covered in another section of hardware contract.
4. Testing or repairs of dampers, smoke hatches, elevator controls, and other peripheral equipment not supplied by fire alarm manufacturer.

H. The tester shall be responsible for coordination between the sprinkler and smoke control testers so that water flow, valve tamper, door, damper and fan controls are all tested in a comprehensive manner at the same time.

END OF SECTION