PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Fire alarm control unit (FACU).
B. Manual fire alarm stations.
C. Automatic smoke detectors.
D. Automatic heat detectors.
E. Waterflow and valve position supervisory switches.
F. Fire alarm occupant notification appliances.
G. Auxiliary fire alarm equipment and initiating devices.
H. Fire alarm wiring and cables.
I. Enclosures for FACU panels.
J. Power supply 120V.
K. Fire alarm system installation.
L. Training sessions.
M. Training manuals and training aids.

1.02 RELATED SECTIONS

A. Section 02 41 19, Selective Structure Demolition
B. Section 07 84 00, Firestopping
C. Section 09 91 00, Painting
D. Section 20 50 13, Raceways for Facility Services
E. Section 20 70 26, Common Materials and Methods for Electrical Systems
F. Section 20 72 25, Factory and Field Testing
G. Section 26 05 24, Low Voltage Wires and Cables
H. Section 26 05 70, Electrical Cabinets and Enclosures
1.03 MEASUREMENT AND PAYMENT

A. Separate measurement or payment will not be made for the Work required under this Section. All costs in connection with the Work specified herein will be considered to be included with the related item of Work in the Bid Schedule of the Bid Form, or incidental to the Work of the Contract.

1.04 REFERENCES

A. National Fire Protection Association (NFPA):
   1. NFPA 70 National Electrical Code
   2. NFPA 72 National Fire Alarm and Signaling Code
   4. NFPA 130 Standard for Fixed Guideway Transit and Passenger Rail Systems

B. Americans with Disabilities Act (ADA)

C. Underwriters Laboratories, Inc. (UL):
   1. UL 268 Smoke Detectors for Fire Protective Signaling Systems

D. Factory Mutual System (FM)

E. National Electrical Manufacturers Association (NEMA)

1.05 REGULATORY REQUIREMENTS

A. California Code of Regulations (CCR):
   1. Title 8, Cal OSHA
   2. Title 19, Public Safety
   3. Title 24, Part 2, California Building Code
   4. Title 24, Part 3, California Electrical Code
   5. Title 24, Part 9, California Fire Code

1.06 SUBMITTALS

A. General: Refer to Section 01 33 00, Submittal Procedures; Section 01 33 23, Shop Drawings, Product Data and Samples; and Section 01 78 23, Operation and Maintenance Data Manual for submittal requirements and procedures.
B. Shop Drawings: Submit Shop Drawings including but not limited to the following:

1. Complete descriptive data indicating UL listing for system components.

2. Complete sequence of operation of the system (system logic).

3. Control unit general arrangement, and connection wiring with individual wire numbers, and color code. Module legends shall show the module type and the input and output connections.

4. Layout plan view showing location of initiating devices and notification appliances with zone and device numbers. Conduit size, and routing with wire fill must be shown on the same drawing.

5. Connection details typical for each device to be installed.

6. Nameplate schedules indicating text for annunciation and labeling.

7. Area coverage drawings with spacing requirements for the initiating and indicating/notification appliances in accordance with the requirements and criteria specified in the applicable Codes and Standards.

8. Standby Battery size calculations.


C. Product Data: Provide electrical characteristics and connection requirements.

D. Spare Parts List: The Supplier shall provide a recommended spare parts list for one-year operation, and pricing good for 90 Days from date of equipment delivery.

E. Reports: A certificate of compliance and other documentation, as required by latest NFPA 72, shall be provided at the times indicated therein. Complete and submit for acceptance the applicable and required information in the System Record of Completion as required by NFPA 72, Section 7.5.6.

F. FACU program and software for maintaining the fire alarm system and for making modifications to the system for the addition or removal of devices, control function changes, etc.

G. Testing Plan: Provide a testing plan for quarterly, semiannual, and annual maintenance with detailed instructions in accordance with NFPA 72, Chapter 14.

H. Record Documents: Submit Record Documents in accordance with Contract Specifications Section 01 78 39, Record Documents.

1.07 QUALITY ASSURANCE

A. General: Refer to Section 01 43 00 for Quality Assurance requirements and procedures.
B. Items of the fire alarm system shall be listed as a product of a single fire alarm system manufacturer under the appropriate category by the Underwriters Laboratories Inc. (UL), and shall bear the “UL” label. Control equipment shall be listed under UL category UOJZ as a single control unit. Partial listing will not be acceptable.

C. In addition to the UL-UOJZ requirement specified above, the system controls shall be UL listed for Power Limited Applications in accordance with California Electrical Code, Article 760. Circuits shall be marked in accordance with California Electrical Code, Article 760-22.

D. Components of the fire alarm system shall be listed by the California Department of Forestry and Fire Protection Office of the State Fire Marshal (CSFM).

E. When more restrictive requirements have been adopted by the local authority having jurisdiction (AHJ), the system shall comply with the local requirements.

1.08 INSTALLER AND MANUFACTURER QUALIFICATIONS

A. A company licensed by State of California as a fire alarm installer with a C-10 Contractor's license and specializing in installing the products specified in this Contract Specification with a minimum of five years documented experience.

B. Principal installation personnel shall have completed the system manufacturer's training courses on the equipment to be installed.

C. The fire alarm system supplier (FASS) shall be a specialty contractor or a manufacturer regularly engaged in the design and the installation of fire alarm systems and their related subsystems. For the purposes of this Section, a specialty contractor shall be interpreted to mean an organization that complies with the following criteria:

1. Employs personnel on this project who have successfully completed NFPA, National Institute for Certification in Engineering Technologies (NICET), or manufacturer’s training courses on general fire protection principles and practices.

2. Has performed work (including design, installation, startup, testing and maintenance) of similar or greater complexity on at least five previous projects.

3. Has been actively engaged in the type of work specified in this section for a minimum of five years.

D. For the purposes of this section, a manufacturer shall be interpreted to mean an organization that complies with the following criteria:

1. Manufactures at least 75 percent (as measured by equipment cost) of the hardware specified in this section and which is furnished for this project.

2. Complies with the preceding criteria established for a specialty contractor.
E. The FASS shall maintain a permanent, fully staffed and equipped service facility within 100 miles of the Jobsite. The service facility shall have full-time, NICET-certified employees qualified in the design, installation, testing, and servicing of the equipment and systems specified herein.

F. The FASS as a minimum shall be responsible for the technical supervision of the installation by providing on site supervision to the installers of the system.

1.09 MANUFACTURER’S FIELD SERVICES

A. Include services of factory or NICET (National Institute for Certification in Engineering Technologies) certified technician to supervise installation, adjustments, final connections, and system testing.

1.10 SPARE PARTS LIST

A. Provide the following spare parts list. Percentages will be taken from the total quantity installed for that device. The list will include but is not limited to the following:

<table>
<thead>
<tr>
<th>Part</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Automatic smoke detector</td>
<td>15 percent</td>
</tr>
<tr>
<td>2 Automatic heat detector</td>
<td>15 percent</td>
</tr>
<tr>
<td>3 Automatic smoke and heat detector base</td>
<td>15 percent</td>
</tr>
<tr>
<td>4 Automatic smoke detector tamper cover</td>
<td>10 units</td>
</tr>
<tr>
<td>5 Manual fire alarm pull station</td>
<td>15 percent</td>
</tr>
<tr>
<td>6 Manual pull station tamper resistant cover</td>
<td>10 units</td>
</tr>
<tr>
<td>7 Ceiling mounted speaker/strobe notification appliance</td>
<td>10 percent</td>
</tr>
<tr>
<td>8 Ceiling mounted speaker notification appliance</td>
<td>10 percent</td>
</tr>
<tr>
<td>9 Wall mounted speaker/strobe notification appliance</td>
<td>10 percent</td>
</tr>
<tr>
<td>10 Wall mounted strobe notification appliance</td>
<td>10 percent</td>
</tr>
<tr>
<td>11 Occupant notification tamper resistant cover</td>
<td>10 units</td>
</tr>
<tr>
<td>12 Monitor module</td>
<td>15 percent</td>
</tr>
<tr>
<td>13 Control module</td>
<td>15 percent</td>
</tr>
<tr>
<td>14 Six relay control module</td>
<td>3 units</td>
</tr>
<tr>
<td>15 Fire Alarm Control Unit with programming</td>
<td>1 unit</td>
</tr>
<tr>
<td>16 Keys of each type</td>
<td>12 units each</td>
</tr>
</tbody>
</table>
PART 2 – PRODUCTS

2.01 GENERAL REQUIREMENTS AND OPERATION

A. Provide an addressable, electrically supervised, manual and automatic, fire alarm and detection system, including proprietary and local alarm units, and occupant notification appliances.

B. Power supplies: Adequate to serve control unit modules, remote detectors, remote annunciators, smoke dampers, relays, alarm notification appliances, and other appurtenances as specified. Battery-operated emergency power supplies shall be furnished and sized with minimum 25 percent over the capacity required for the operating system in standby mode for minimum of 24 hours followed by alarm notification mode for 15 minutes per NFPA 72.

C. Performance and capacities of signaling line circuits shall be in accordance with NFPA 72, Class A; printer circuit in accordance with NFPA 72, Class E; initiating device circuits shall be in accordance with NFPA 72, Class A; and occupant notification circuits shall be in accordance with NFPA 72, Class A.

D. System Supervision: Alarm, trouble, and supervisory signals from intelligent reporting devices shall be encoded onto NFPA Class A Signaling Line Circuit (SLC). Alarm signals arriving at the fire alarm control unit shall not be lost following a power failure (or outage) until the alarm signal is processed and recorded.

E. Initiating Device Circuits (IDC): Supervised zone module with alarm and trouble indication; occurrence of an open condition shall place the circuit in trouble mode but shall not disable that circuit from initiating an alarm. Initiating device circuits shall be provided with Class A wiring.

F. Sprinkler system supervision circuits shall connect to the proprietary system transmitter via supervisory module for the tamper switches and valve position supervision switches with Class A wiring.

G. Occupant Notification Appliance Circuits: Supervised signal modules, sufficient for the indication/notification appliances connected to system; occurrence of an open or ground fault condition shall place the circuit in trouble mode but shall not disable any device on that circuit from signaling an alarm. Indicating appliance circuits shall be Class A wiring.

H. Auxiliary Relays: Provide sufficient double throw auxiliary relay contacts for each accessory function as indicated.

I. Trouble Sequence of Operation: System or circuit trouble shall place the system in the trouble mode, which shall cause the following system operations:

1. Visual and audible trouble alarm indicated by address at fire alarm control unit.

2. Manual acknowledge function at the fire alarm control unit shall silence the audible trouble alarm; visual alarm shall continue to be displayed and notification shall be maintained until initiating device failure or circuit trouble is cleared.
J. Alarm Sequence of Operation: Actuation of initiating device shall place the circuit in alarm mode, which shall cause the following system operations:

1. Sound and display local fire alarm notification appliances.
2. Transmit address alarm signal to control unit.
3. Indicate location of alarm address and type of device on fire alarm control unit.
4. Transmit signal by function to building mechanical systems as necessary and required for elevator control, escalator control, and other identified functions.
5. Alarm silence function at the fire alarm control unit shall silence audible alarm signaling devices; visual alarm shall continue to be displayed at the local fire alarm control unit, and notification via the network shall be maintained until alarm reset occurs. Actuation of a second initiating device shall cause the alarm to re-activate in accordance with this section.

K. Alarm Reset: System shall remain in the alarm mode until manually reset with key-accessible reset switch; system shall reset only if initiating circuits are out of alarm mode.

L. Lamp Test: Manual lamp test function shall cause alarm indication at each zone at fire alarm control unit.

M. Addressing: Actual room numbers and/or names will be assigned by the District and shall be shown on the Drawings. Control unit addressing shall include the address, room number or room/space name, type of address, and functions associated with the address.

N. Each fire alarm control unit shall have a minimum of 20 percent additional space for future expansion.

O. Each system shall be electrically supervised against open wire, shorts and ground faults in the initiating, and indication/notification circuits.

2.02 MANUFACTURERS

A. Acceptable Manufacturers:

1. Products described below and identified by product name, model number, or other manufacturer designation, are Basis of Design Products. Basis of Design Products establish the standards of type, function, dimension, in-service performance, physical properties, appearance, warranty, cost, and other characteristics required by the Contract.

2. Products of manufacturers not listed may be proposed for substitution, provided they are comparable to the products specified.

   a. If “No substitutions” is indicated next to the product name, provide only products of listed manufacturers.
b. The burden of proof of equality of proposed products is on the Contractor.

2.03 CONTROL UNITS

A. The main FACU and associated sub-assemblies shall be Notifier NFS2-3030 or equal, complete with power supply and the necessary components as shown below:

1. Central Processing Unit and Display.
2. Digital Voice Command.
3. Loop Control Module.
4. Loop Expander Module.
5. 75 Watt Amplifier.
6. Control Unit Power Supply.
10. Battery Box.

B. The sub-fire alarm control unit (sub-FACU) and associated sub-assemblies shall be Notifier NFS-320 or equal. The sub-FACU shall be capable of being networked to the main FACU. The sub-FACU shall be addressable, capable of Class A SLC and NAC configuration, and have an 80-character display. The sub-FACU shall be equipped with a power supply and the required components to perform the functions specified and shown in the design, including but not limited to:

1. Control unit complete with backbox and power supply
2. Batteries
3. Seismic Mounting Kit

C. The FACU shall communicate with and control the intelligent detectors, intelligent manual pull stations, addressable modules, and other system controlled devices. The FACU shall perform the following functions:

1. Supervise and monitor the appropriate intelligent addressable detectors and addressable modules connected to the system for normal, trouble and alarm conditions.
2. Supervise the appropriate signaling and notification circuits.
3. Detect the activation of any initiating device and the location of the alarm condition for devices on the circuit. Operate notification appliances and auxiliary devices as programmed.

4. Visually and audibly annunciate any trouble, supervisory, or alarm condition on the unit display. Communicate such alarms via the fire alarm communication network.

5. Cause the signals, annunciation, and control of HVAC fans, elevators, escalators, and other equipment, as indicated in the Drawings.

D. System Capacity and General Operation

1. The FACU shall provide or be capable of expansion to 3,180 intelligent addressable devices, with up to 318 intelligent/addressable devices per loop. Each addressable loop shall have a minimum of 15 percent spare capacity and the FACU shall have a total of 30 percent spare capacity.

2. The FACU shall communicate with, monitor, and control other modules within the FACU. Removal, disconnection, or failure of any control unit module shall be detected and reported to the system display.

3. The FACU shall contain and execute control-by-event programs for specific action to be taken if an alarm condition is detected by the system. Such control-by-event programs shall be held in non-volatile programmable memory and shall not be lost with system primary and secondary power failure.

4. Each peripheral device connected to the FACU shall be continuously scanned for proper operation. Data transmissions between the FACU and peripheral devices shall be reliable and error free. The transmission scheme used should employ dual transmission or other equivalent error checking techniques. Failure of any peripheral device to respond to an interrogation shall be annunciated as a trouble condition.

E. Display

1. The complete system display shall provide the controls and indicators used by the system operator and may also be used to program system operational parameters.

2. The display shall be minimum 16 line, 640 character LCD backlit with a minimum of 11 LED indicators for system status and alarm conditions.

3. The display assembly shall contain, and display as required, custom alphanumeric labels for intelligent detectors, and addressable modules.

F. Signaling Line Circuit (SLC) Interface

1. Notifier Loop Control and Expander Modules: LCM-320 and LEM-320, or equal. The FACU SLC interface shall monitor and control intelligent addressable devices, including intelligent detectors and monitor or control modules.
2. The SLC interface shall not require any jumper cuts or address switch settings to initialize operations.

3. The SLC interface shall provide power and communicate with intelligent addressable detectors and modules on a single pair of wires. This SLC Loop shall be Class A wiring.

4. The SLC interface shall receive information from intelligent detectors and shall process this information to determine whether normal, alarm, or trouble conditions exist for that particular detector. The FACU/SLC interface shall include software to automatically maintain the detector’s desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information may also be used for automatic detector testing and for the automatic determination of detector maintenance requirements.

5. The SLC interface board shall communicate with each intelligent addressable detector and addressable module on its SLC loop and verify proper device function and status. Communication with intelligent devices shall be performed at time intervals consistent with the FACU Listing/Approval.

G. FACU/AMP Enclosure:

1. Notifier CAB-4 or equal. The control unit shall be housed in a UL listed cabinet. Enclosure and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer’s standard finish.

2. The back box and door shall be constructed of steel with provisions for electrical conduit connections into the sides, top, and bottom.

3. The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators.

4. The control unit shall be modular in structure for ease of installation, maintenance, and future expansion.

5. The FACU and associated equipment shall be protected from the effects of voltage surges or line transients in accordance with UL 864 standards.

6. Each peripheral device connected to the FACU shall be continuously scanned for proper operation. Data transmissions between the FACU and peripheral devices shall be reliable and error free. The transmission scheme used shall employ dual transmission or other equivalent error checking techniques.

7. Provide seismic certification from manufacturers for equipment and enclosures. (Refer to ASCE7-10 section 13.2.2 2.)

8. Provide anchorage calculations and design details for enclosures and panels. (Refer to ASCE7-10 section 13)
H. FACU Power Supply

1. Notifier AMPS-24 or equal. The main power supply shall operate on 120 VAC, 60 Hz, and shall provide necessary power for the FACU.

2. It shall provide power necessary for proper operation of the occupant notification appliances. External power supplies shall be used to power the occupant notification appliances (strobos) as necessary.

3. It shall provide a battery charger and batteries for 24 hours of standby using dual-rate charging techniques for fast battery recharge.

4. It shall provide a very low frequency sweep earth detect circuit, capable of detecting earth faults on sensitive addressable modules.

5. It shall be power-limited per current UL 864 requirements.

6. It shall provide meters to indicate battery voltage and charging current.

7. A separate power supply shall be provided for externally controlled devices such as smoke dampers, remote relays, door holders, etc.

I. FACU Digital Voice Command

1. Notifier DVC-EM or equal. The digital voice command center located with the control unit, shall contain equipment required for audio control, emergency microphone system control, signaling, and supervisory functions. This shall include speaker zone indication and control, telephone circuit indication and control, digital voice units, microphone and main telephone handset.

2. The voice command center equipment shall perform the following functions:
   a. Operate as a supervised multi-channel emergency voice communication system. Audibly and visually annunciate the active or trouble condition of every speaker circuit.
   b. Audibly and visually annunciate any trouble condition for digital tone and voice units required for normal operation of the system.
   c. Provide all-call emergency paging activities through activation of a single control switch.
   d. Provide a factory recorded library of voice messages and tones in standard WAV. File format, which may be edited and saved on a PC running a current Windows® operating system.
   e. The digital voice command shall be modular in construction and shall be capable of being field programmable without requiring the return of any components to the manufacturer and without requiring use of any external computers or other programming equipment.
   f. The digital voice command and associated equipment shall be protected against unusually high voltage surges or line transients.
J. System Circuit Supervision

1. The FACU shall supervise circuits to intelligent devices, modules, horns, strobes, horn/strobes, speakers, speaker strobes, and any remote power supplies and shall annunciate loss of communications with these devices/appliances. The FACU shall continuously scan the devices for proper system operation. Upon loss of response from a device, an audible trouble shall sound.

2. Fire protection system valves shall be supervised for off-normal position.

K. Field Wiring Terminal Blocks

1. For ease of service, wiring terminal blocks shall be the plug-in type and have sufficient capacity for 16 to 12 AWG wire. Terminal blocks permanently fixed are not acceptable. The number of wires at each terminal shall not exceed two.

L. FACU Programming Features

1. The Contractor shall retain the services of factory certified technician for programming the FACU.

2. The system shall be programmable, configurable, and expandable in the field without the need for special tools or electronic equipment and shall not require field replacement of electronic integrated circuits.

3. Programming or editing of the program in the system shall be achieved without special equipment and without interrupting the alarm monitoring functions of the FACU.

4. Programming shall be accomplished through the standard FACU keyboard or through the video terminal.

5. Field defined programs shall be stored in non-volatile memory. The control unit shall maintain a history file of the last 4000 events, each with a time and date stamp. History events shall include all alarms, troubles, operator actions, and programming entries. The control panels shall maintain a 1000 event alarm history buffer, which consists of the 1000 most recent alarm events from the 4000-event history file.

6. The programming function shall be enabled with a password that may be defined specifically for the system when it is installed. Two levels of password protection shall be provided in addition to a key-lock cabinet. One level shall be used for status level changes such as zone disable or manual on/off commands. A second (higher-level) shall be used for actual change of program information.

7. System programming shall be capable of being backed-up on approved removable digital media (i.e. USB flash drive). This system back-up shall be capable of being downloaded to a replacement FACU system should the system be damaged due to fire or other event.
8. The Contractor shall turn over FACU passwords at the completion of programming or editing.

2.04 POWER SUPPLY FOR SPEAKERS

A. Notifier DAA2-7525 or equal. The digital amplifiers shall provide a minimum of 75 watts total output power at 25 VTMS and support two Class A high-level outputs.

B. Multiple audio amplifiers may be mounted in a single enclosure, either to supply incremental audio power, or to function as an automatically switched backup amplifier(s).

C. The audio amplifier shall include an integral power supply and shall provide built-in LED indicators to signal all required status, faults, operation, and alarm conditions.

2.05 POWER SUPPLY FOR STROBES

A. Notifier ACPS-610 or equal. The notification appliance power supply shall operate on 120 VAC, 60 Hz, and shall provide necessary power for the power supply.

B. It shall provide power necessary for proper operation of the occupant notification appliances (strobes). The power supply shall have a minimum of four (4) Class A, individually addressable outputs, each with a minimum output of 1.5 amps per circuit/output.

C. It shall provide a battery charger and batteries for 24 hours of standby using dual-rate charging techniques for fast battery recharge.

D. It shall provide supervision of the power supply and the associated circuits and communicate with the FACU via monitoring modules or similar devices.

E. It shall be power-limited per current UL 864 requirements.

2.06 ANNUNCIATOR

A. Notifier LCD-160 or equal. The annunciator shall be equipped with one (1) Notifier Annunciator Control Module ACM-24AT and with one (1) Notifier Annunciator Expander Module AEM-24AT, or equal.

B. The annunciator (including ACM and AEM modules) shall be housed in a secure, lockable enclosure with the screen and indicators visible without opening the door, Notifier ABS-4D(C), or equal.

C. The annunciator shall have a 640-character liquid crystal display with backlit control; be capable of remote control of the FACU; be capable of providing events and preprogrammed custom messages as displayed on the FACU; and a full screen with soft key functions.

2.07 SYSTEM COMPONENTS
A. Addressable Devices (General)

1. Addressable devices shall provide an address-setting means.

2. Alarm initiating devices shall be intelligent and addressable, shall be compatible with the FACU, and shall connect to the FACU signaling line circuits.

3. Addressable devices shall provide an address setting means.

4. Detectors shall be intelligent and addressable, shall be compatible with the FACU, and shall connect to the FACU signaling line circuits.

5. Smoke detector sensitivity shall be set through the FACU and shall be adjustable in the field through the field programming of the system.

6. Detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA 72.

7. The detectors shall be ceiling-mounted and shall include a separate twist-lock base that includes a tamper proof feature.

8. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the FACU. Such a test may be initiated at the detector itself or initiated remotely on command from the control unit.

9. Detectors shall store an internal identifying type code that the control unit shall use to identify the type of device.

B. Addressable Manual Pull Station

1. Manual pull stations shall be Notifier NB-12LX, Notifier N-MPS, or equal, compatible with the FACU. Manual pull stations shall, on command from the FACU, send data to the control unit representing the state of the manual switch and the addressable communication status. They shall use a manually operated test-reset keylock and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a hex key wrench or similar tool. Manual pull stations shall be provided with a non-alarming anti-tampering assembly, Safety Technology International (STI) Stopper II, or equal.

2. Manual stations shall be constructed of cast metal or plastic with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters.

3. Stations shall be suitable for flush or semi-flush mounting as shown on the plans and shall be installed such that the operable part is 42 inches to 48 inches on center above the finished floor.

4. A permanent label identifying the pull station address shall be provided on each pull station.
C. Addressable Photoelectric Smoke Detector

1. Photoelectric detectors shall be Notifier FSP-851 or equal, compatible with the FACU. The detectors shall use the photoelectric principal to measure smoke density and shall, on command from the control unit, send data to the control unit representing the analog level of smoke density. Smoke detectors installed in public restrooms shall be provided with an anti-tampering and protective assembly, Safety Technology International (STI) Smoke Detector Damage Stopper-Steel, Steel Web Stopper for Smoke Detectors, or equal.

2. The smoke detectors shall be profiled for office or duct (as necessary and appropriate).

3. A permanent label, legible from the floor level, identifying the detector address shall be provided on each detector base.

D. Addressable Heat Detector

1. Heat detectors shall be Notifier FST-851 or equal, compatible with the FACU. The detectors shall use the rate-of-rise and fixed temperature principals to measure heat.

   EXCEPTION: Heat detectors installed in escalator machinery spaces accessed from the exterior of the Station shall be Notifier 302-AW-135 Rate Anticipation, all weather vertical mounting 135 degrees Fahrenheit, or equal, mounted in a NEMA 4 box. The device shall be capable of immediate response; self-restoring; hermetically sealed, shock resistant, corrosion resistant, and tamper-proof.

2. The heat detectors shall be fixed temperature of 135 degrees Fahrenheit and 15 degrees Fahrenheit per minute rate-of-rise.

   EXCEPTION: Heat detectors installed in escalator machinery spaces accessed from the exterior of the station.

3. A permanent label, legible from the floor level, identifying the detector address shall be provided on each detector base.

E. SUB-FACU Photoelectric Smoke Detectors

1. Photoelectric detectors shall be System Sensor i3 2W-B, or equal, compatible with the FACU. The detectors shall use the photoelectric principal to measure smoke density.

2. A permanent label, legible from the floor level, identifying the detector zone and device number shall be provided on each detector base.

3. Photoelectric smoke detectors shall be arranged in a cross-zone fashion using two alarm initiating device circuits.
F. Sprinkler Waterflow and Valve Position Supervisory Switches

1. Existing waterflow and valve position supervisory switches for the sprinkler system shall be connected to the FACU using compatible monitor modules.

2. When operated, an alarm signal shall be initiated at the FACU.

3. A permanent label, legible from the floor level, identifying the address shall be provided on each device as shown on the Drawings.

G. Monitor Modules

1. Monitor modules shall be Notifier FMM-1, FDM-1, or equal, compatible with the FACU. Modules shall, on command, from the FACU, send data to the control unit representing the state of the module and the addressable communication status.

2. Monitor modules shall be mounted on the wall, adjacent to the monitored device.

3. A permanent label, legible from the floor level, identifying the address shall be provided on each device as shown on the Drawings.

H. Control Modules

1. Control Modules shall be Notifier FRM-1, FCM-1, FDRM-1, XP6-R, or equal, compatible with the FACU. Modules shall, on command, from the FACU, send data to the control unit representing the state of the module and the addressable communication status and perform the intended function.

2. Control modules shall be located no greater than 3 feet from the component controlling the device.

3. A permanent label, legible from the floor level, identifying the address shall be provided on each device.

I. Occupant Notification Appliances

1. Occupant notification appliances shall be System Sensor, L-Series, or equal, compatible with the FACU. Strobes shall have a plug-in design; protective cover to reduce ground faults; mounting plate with onboard shorting spring for testing wiring continuity; and field selectable candela settings of 15, 30, 75, 95, 110, 135, and 185 candelas. Speakers shall have a plug-in design; protective cover to reduce ground faults; mounting plate with onboard shorting spring for testing wiring continuity; and a rotary switch to control speaker power with settings of 1/4, 1/2, 1, and 2 watts.

2. Strobes: ADA and NFPA 72, compatible with the FACU, field selectable candela values, strobe light with red lettered “FIRE” on white cover plate, System Sensor L-Series, SCWL, SWL, or equal.
3. Combination horn/strobes: ADA and NFPA 72, compatible with the FACU, field selectable candela values, strobe light with red lettered "FIRE" on white cover plate, System Sensor L-Series, P2WL, PC2WL, or equal.

4. Speakers: ADA and NFPA 72, compatible with the FACU, field selectable candela values, strobe light with red lettered "FIRE" on white cover plate, System Sensor L-Series, SPCW8, SPWL, or equal.

5. Combination speaker/strobes: ADA and NFPA 72, compatible with the FACU, field selectable candela values, strobe light with red lettered "FIRE" on white cover plate, System Sensor L-Series, SPSCWL, SPSWL, or equal.

6. A permanent label, legible from the floor level, identifying the address shall be provided on each appliance.

7. Notification appliances installed in public restrooms shall be provided with an anti-tampering and protective assembly, Safety Technology International (STI) Smoke Horn/Strobe/Speaker Damage Stopper, Stopper Dome, or equal.

**2.08 BATTERIES AND POWER SUPPLY**

**A. Battery**

1. Notifier BAT-12550 or equal. Batteries shall be 12V.

2. Battery shall have sufficient capacity to power the fire alarm system for not less than twenty-four hours plus 15 minutes of alarm upon a normal AC power failure.

**B. Power Supply**

1. Provide Power Supplies as specified in Articles, 2.02H, 2.03, and 2.04.

2. Shall be completely automatic, with constant potential charger maintaining the battery fully charged under all service conditions. Charger shall operate from a 120V 60Hz source.

3. Shall be rated for fully charging a completely discharged battery within 48 hours while simultaneously supplying any loads connected to the battery.

4. Shall have protection to prevent discharge through the charger.

5. Shall have protection for overloads and short circuits on both AC and DC.

**2.09 FIRE ALARM WIRE AND CABLE**

**A.** Wiring shall be installed in a continuous galvanized rigid steel (GRS) conduit system. Conduits shall be concealed, to the extent practical and feasible. Conduit and wire shall be in accordance with the California Electrical Code (CEC), NFPA 72, and NFPA 130, Chapter 12.
1. Cable and wiring meeting the requirements of NFPA 72, Chapter 12 of NFPA 130, and the California Electrical Code may be installed in concealed spaces (e.g. above ceilings). Cable and wire shall not be installed in ventilation ducts. Fire alarm cabling and wiring shall be in GRS conduit.

2. Conductors shall be fire/smoke rated in accordance with the requirements of Chapter 12 of NFPA 130.

3. Conductors shall be labeled at each end.

B. Conduit/Raceway:

1. Wiring shall be installed in conduit or raceway. Raceway fill shall not exceed 40 percent of interior cross-sectional area where three or more cables are contained within a single conduit.

2. A fire alarm riser diagram indicating type and quantity of devices and size and quantity of conductors and conduits, shall be submitted for approval.

3. Cable must be separated from any open conductors of Power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, as per NEC Article 760-29.

4. Wiring for 24V control, alarm notification, emergency communication, and similar power limited auxiliary functions may be run in the same conduit as initiating and signaling line circuits. Circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of circuits without interference or loss of signals.

5. Conduit shall not enter the fire alarm control unit, or any other remotely mounted control unit equipment or back boxes, except where conduit entry is specified by the manufacturer.


7. No conductor or cable splices shall be permitted.

8. Provide type and spacing of the fasteners specified/designed for installation of fire alarm devices and conduit installation so that it is within the exception limit of seismic requirements. (Refer to ASCE7-10 section 13.4.5.)

C. Wire

1. Fire alarm system wiring shall be new.

2. Wiring shall be in accordance with the California Electrical Code, Article 760, NFPA 72, Chapter 12 of NFPA 130, and as recommended by the manufacturer. Number and size of conductors shall be as recommended by the fire alarm system manufacturer.
3. Wire and cable shall be CSFM listed for use with a protective signaling system. Wire and cable not installed in conduit shall have the fire resistance rating suitable for the installation as indicated in the California Electrical Code and shall be supported and protected in accordance with the California Electrical Code and the manufacturer’s requirements.

4. Field wiring shall be supervised. In the event of a primary power failure, disconnected standby battery, removal of any internal modules, or any open circuits in the field wiring; a trouble signal will be activated until the system and its associated field wiring are restored to normal condition.

D. Terminal Boxes, Junction Boxes, and Cabinets

1. Boxes and cabinets shall be UL listed for their use and purpose.

2. Fire alarm boxes, conduit body covers, and cabinets shall be painted red.

E. The FACU shall be connected to a separate dedicated branch circuit with a maximum 20 amperes. This circuit shall be labeled at the main power distribution panel as FIRE ALARM. Fire alarm control unit primary power wiring shall be 12 AWG.

2.10 SCADA INTERFACE, DRY CONTACTS, AND REMOTE MONITORING

A. SCADA Points to Operation Control Center (OCC). Provide an interposing relay cabinet (IRC) with 3 six-relay modules XP6-C next to CAB44. The relays shall be programmed to send the following signals to OCC:

1. Fire Alarm Summary

2. Fire Alarm System Malfunction

3. Manual Pull Station

4. Waterflow

5. Water Valve Closed

6. 480V Switchgear Room

7. Train Control Room

8. Concourse Level

9. Upper Platform Level or Platform if only one level

10. Lower Platform Level (If applicable)

11. Substation (If applicable)
12. Public Address (PA) Preemption

The public address preemption relay shall suppress all automatic messages, but continue to allow manually operated messages through the PA system.

B. Dry Contact to Station Agent Booth (SAB). Provide 1-relay module next to the Supervisory Cabinet in the SAB. The relay shall be programmed to activate on a fire alarm for fare gate and emergency barrier release.

C. Remote Monitoring System (RMS). Provide all infrastructure for remote monitoring of the fire alarm system between the FACU and the train control room. Provide an ethernet connection when the distance is less than 250 feet or else provide 6 strands multimode fiber connected to the fiber entry cabinet. Coordinate with the District for connection to CAB100.

2.11 ENCLOSURES FOR FACU/AMP PANELS

Additional enclosures for main fire alarm panels and control equipment are required due to the dusty environment conditions within the control rooms.

A. Additional Enclosures for FA Control Units and Relay boxes:

1. Standard wall-mounted electrical enclosures from sheet metal shall be provided for additional protection.

2. For locations with size restrictions the internal battery enclosures can be mounted outside next to the main enclosure for the FA control units and the main enclosure can be reduced in size to utilize the space only needed for the main FA control units.

3. NEMA Rating shall be at minimum NEMA 4. (Due to the very dusty environment enclosures with gasket sealing and tight doors are required.)

4. Viewing Windows: Each door of the main control unit enclosures shall be equipped with a window big enough to view the main control panels annunciations and status monitors and to show the general content of the enclosures. (Relay boxes and Interposing Relay Cabinet (IRC) enclosures do not require additional windows)

5. Color: FA enclosures shall be painted red.

6. Provide seismic certification from manufacturers for equipment and enclosures. (Refer to ASCE7-10 section 13.2.2 2.)

7. Provide anchorage calculations and design details for enclosures and panels. (Refer to ASCE7-10 section 13)
2.12 POWER SOURCE

A. Distribution Panel Boards:
   1. Power supply shall be 120V single phase out of existing nearby panel boards.
   2. Connect to 3-phase 208/120V or 1-phase 240/120V power source.

B. Power Supply Circuit and Breaker:
   1. Each FACU and AMP panel must be labeled with the dedicated electrical panel board and circuit breaker.
   2. A dedicated circuit branch shall be only used for the fire alarm system.
   3. Breaker shall be new even if the existing breaker space for the FA system is utilized.
   4. Breaker shall be 120V single phase, 20A, and must match the panel manufacturer’s specification.
   5. Each breaker for the FA system shall be equipped with a breaker locking device (according NFPA 72, Section 10.6.5.4).
   6. Contractor shall verify exact breaker space depending on panel condition and spare availability.
   7. Each circuit must be labeled with red placard “FIRE ALARM SYSTEM” (according NFPA 72, Section 10.6.5.2.2).
   8. Conduit shall be minimum 3/4 inch.
   9. Provide type and spacing of the fasteners specified/designed for installation of fire alarm devices and conduit installation so that it is within the exception limit of seismic requirements (Refer to ASCE7-10 section 13.4.5.).

2.13 FACTORY TEST

A. Perform final checkouts and test. Ship panels only after required factory tests are performed and required modifications or corrections are made. A factory certificate of inspection is required before shipment and shall accompany the shipping documents.
PART 3 – EXECUTION

3.01 INSTALLATION

A. Install initiating devices, control units, audible signals, connections to equipment provided under other sections and related work following equipment manufacturers’ requirements for a complete and properly functioning system that will perform specified functions.

B. Interface and Coordination: Indicated diagrams and details show the general location and arrangement of equipment, conduit, wiring, and devices. Provide outlets, control and detection devices, and equipment properly located and readily accessible. Control and detection devices, equipment, and outlets shall be located to avoid interference with mechanical, architectural, and structural features.

C. Control and other panels shall be mounted with sufficient clearance for observation and testing. Fire alarm junction boxes shall be clearly marked for distinct identification.

D. Wiring Methods:

1. Wiring shall be installed in a continuous GRS conduit system. Conduits shall be concealed.

2. Prepare and submit a fire alarm riser diagram indicating type and quantity of devices and size and quantity of conductors and conduits.

3. No wiring other than that directly associated with fire alarm detection, alarm, or auxiliary functions shall be permitted in fire alarm conduits. Wiring splices shall be avoided to the extent possible and if needed, they shall be made only in junction boxes and shall be connected with crimp-type connectors. Wire nut type connections are not acceptable.

4. Transposing or changing color-coding of wires will not be permitted. Conductors in conduit containing more than one wire shall be labeled on each end with wire markers conforming to the requirements of Specifications Section 26 05 24, Low Voltage Wires and Cables. Conductors in cabinets shall be carefully formed and harnessed so that each drops off directly opposite to its terminal. Cabinet terminals shall be numbered and coded. Controls and function switches shall be clearly labeled on equipment panels.

5. Wiring shall be checked and tested to ensure that there are no grounds, opens, or shorts. The minimum allowable resistance between any two conductors or between conductors and ground is 10 Megaohm as checked by a Megger after conduit, conductors, and detector bases have been installed, but before the detector devices are plugged into the bases or end-of-line devices installed.

6. Conduits entering or leaving the terminal cabinets and junction boxes shall be numbered in a logical and consecutive manner. A number shall be used only once.
7. Conductors shall be tagged, labeled, and color-coded. Color-coding shall be by wire insulation, not taping or banding. The numbering and color-coding shall be continuous for each circuit wire.

8. Wire shall be numbered at each connection, termination, and junction point. Wire numbering tags shall be professionally manufactured wire-markers. Each group of wires shall be tagged with its destination at each panel, terminal box, or junction box.

E. Fire alarm circuits in conduit shall be installed in dedicated raceways and shall not be mixed with any other raceway systems of any Class wiring.

F. Provide conduit and properly looped wiring necessary for the total operational system. Conduit size and wire quantity, size, and type shall be suitable for the equipment supplied and conform to equipment Suppliers’ requirements. No wiring other than fire alarm circuits shall be permitted in the fire alarm system conduits; 120V circuits shall be in separate fire alarm conduits.

G. End-of-line devices, for either initiating or indicating/notification appliance circuits, shall be mounted in accordance with the manufacturer’s requirements.

H. Automatic detector and occupant notification appliance installations shall conform to NFPA 72.

I. Make conduit and wiring connections to initiating devices, indicating/notification appliances, door release devices, sprinkler flow switches, sprinkler valve tamper switches, and duct smoke detectors.

J. Solid conductors terminated at screwed connections of any type shall be formed about the screw shank in a clockwise direction. Stranded conductors shall be terminated with a pressure-applied lug connector, applied with a tool approved for the use by the lug connector manufacturer and the Engineer.

K. Wiring shall be checked and tested to ensure that there are no grounds, opens, or shorts.

L. Install wiring in accordance with the California Electrical Code, NFPA 72, and Chapter 12 of NFPA 130. Pull conductors to necessary and appropriate devices and appliances.

M. Provide necessary connections and terminations. Field and FACU wiring shall be terminated in terminal cabinets or on field devices/appliances. Connections shall be made on terminals.

N. Provide initial system addressing. Use the District’s room numbers or names for annunciation.

O. The FACU shall be programmed to identify the specific initiating device address or number; location or room number; brief description of room or area; device type; floor level; and status for initiating devices and must match the label on the device.
P. Notify the Engineer at least 30 Days prior to the cutover period when the existing fire alarm system is taken offline, and the new fire alarm system is made operational.

Q. The existing fire alarm system shall remain in operation for the duration of the Work. If any portion of the existing fire alarm system is taken offline, then the Contractor must notify the District and fire watch must be provided until full operation of the fire alarm system is restored.

R. During the cutover period, if the District is unable to provide fire watch, the Contractor shall ensure that public safety is maintained by providing one or more fire watch personnel, as required and approved by the Engineer. Fire watches shall be provided with not less than one approved means for notification of the fire department and their only duty shall be to perform constant patrols of the protected premises and keep watch for fires. Fire watch personnel shall comply with the following:

1. Fire watch personnel shall remain on duty while places requiring a fire watch are open to the public, or when an activity requiring a fire watch is being conducted.

2. On-duty fire watch personnel shall have the following responsibilities:
   a. Identifying and controlling fire hazards, detecting early signs of unwanted fire, raising an alarm of fire and notifying the fire department.
   b. Keep diligent watch for fires, obstructions to means of egress and other hazards.
   c. Take prompt measures for remediation of hazards and extinguishment of fires that occur.
   d. Take prompt measures to assist in the evacuation of the public from the structures.

3.02 FIELD QUALITY CONTROL

A. Provide the testing program, qualified technical personnel, tools, test equipment, and other items required to perform the tests.

B. Furnish written notice as to when installed equipment will be tested so that the Engineer and AHJ can be present to witness the tests. A minimum of 30 Days prior notice of a proposed test shall be provided.

C. At the Contractor’s option, a representative of the equipment manufacturer may be present to witness the tests and verify the results.

D. Tests shall not alter the Contractor’s guaranty of the equipment. Replace and retest work and materials found to be not in compliance with Specification requirements.

E. Maintain test data sheets showing the results of tests performed. Provide data sheets listing the acceptable or specified test limits and the values actually measured. Furnish one set to the Engineer. Retain one set.
F. Provide data sheets showing the test set-up, the equipment used, the names of persons performing the test, the names of witnesses, the date, the location, and the serial number of the equipment under test. The test data sheets will be reviewed by the Engineer and accepted as submitted, or additional tests may be required. If additional tests are required because initial test results do not comply with these Specifications, the retesting shall be documented and submitted as before.

G. Perform inspection of control panel as follows:

1. The inspection shall first cover a physical check of panels in reference to the following items:
   a. Proper model numbers.
   b. Arrangement of instruments per Shop Drawings on panel front.
   c. Arrangement of back-mounted accessories for proper clearance, operation, and maintenance.
   d. Finish of panel.
   e. Tagging of wiring.

2. A test as per Article 3.09 and checkout report shall be prepared by the technician and submitted in triplicate, one copy of that shall be registered with the equipment manufacturer. Report shall include, but not be limited to:
   a. A complete list of equipment installed and wired.
   b. Indication that equipment is properly installed and functions and conforms with this Contract Specification.
   c. Tests of individual zones as applicable.
   d. Serial numbers, locations by zone, and model number for each installed detector.
   e. Voltage (sensitivity) settings for each detector as measured in place with air conditioning system operating.
   f. Response time on thermostats, flow switches, and flame detectors (if used).
   g. Technician’s name, certificate number, and date.
   h. Perform sequence of operations tests as shown in Attachment A.

3. After completion of the physical inspection, perform circuit checkouts as required to verify the correct operation of the system.

H. Field Tests

1. The Contractor shall perform electrical and mechanical tests required by NFPA 72, and the equipment manufacturer’s installation procedures. A sample functional test procedure is shown in Attachment B.
2. Pre-testing: The system shall be pre-tested prior to final Acceptance testing. All points shall be tested from point of initiation to the final point or points of annunciation. Circuits shall be tested for continuity and ability to transmit the required signal correctly to the FACP. Problems due to wrong wire type, wire twist, impedance, mismatches, noise filtering, or shielding shall be corrected during pre-testing and prior to any final Acceptance tests. Pre-testing shall include every device in the system. Coordinate with other trades as necessary for testing. Provide the following tests and procedures:

   a. Sprinkler Flow Switches: Record time delay from water flow to alarm and adjust as necessary for 30 to 50 seconds delay.
   b. Valve Tamper Switches: Verify “trouble” signal is received on closing of each valve.
   c. Smoke Detectors: Test with actual or approved artificial smoke. Verify that reset does not occur when devices are cleared of smoke. Verify supervisory circuit function.
   d. Elevator Recall: Verify that elevators recall to designated floor.
   e. Escalator: Verify that power to the driving machine motor is interrupted and brakes apply upon station fire alarm signal.
   f. Central Notification: Verify that one set of conductors in the terminal cabinet becomes a short circuit on any “trouble” condition and that the other set becomes a short circuit on any alarm condition. Verify that the conductor groups are labeled properly.

3. The Contractor shall measure and adjust each of the detectors to the maximum stable sensitivity setting. This shall be performed at the operational location of the unit and under normal operational environmental conditions in the area. Bench settings are not acceptable.

4. Test splice points back to previous splice or terminal points before encapsulant is placed around the splice point.

5. Check electrical instruments and each electrical circuit for continuity either by checking entire “loops” if within panel or by simulating field conditions or operations. This test shall include instruments, alarms, relays, and pressure switches that are part of the panel circuits. When full simulation is not possible or practicable, wires shall be given a point-to-point continuity check.

3.03 FIRE ALARM NAMEPLATES

A. Identify fire alarm equipment devices so that the address may be visible from the floor.

3.04 PROGRAMMING

A. The Contractor shall use a factory certified technician for all programming.
B. The District’s room numbers or names provided by the Engineer for annunciation shall be used. The Contractor shall update the Construction Drawings to reflect the addresses used.

3.05 JOB CONDITIONS

A. Coordinate Work schedule and material deliveries with the Engineer.

B. Minimize impairments of existing fire protection system and coordinate any proposed shutdown with the Engineer. Restore existing fire protection systems removed from service as part of this Work at the end of each working day.

C. The Work performed occurs within existing buildings. Equipment and material furnished and installed from the Work shall be coordinated with existing space constraints. Fabricate equipment and material such that complete systems may be broken down into sections suitable for passage through existing passageways without modification to the building unless other arrangements are made with the Engineer to provide access.

3.06 PENETRATIONS

A. The Contractor shall be responsible for openings and penetrations required.

B. Provide penetrations of rated assemblies with through penetration fire stop systems with T ratings equal to those of the assembly penetrated.

3.07 PAINTING

A. Exposed conduit shall be painted to match the surrounding wall or ceiling surface. Clean exposed surfaces of oil, dirt, and other debris to the satisfaction of the Engineer prior to painting. Paint samples shall be approved by the Engineer prior to application.

3.08 DEMONSTRATION AND TRAINING

A. General:

1. Prior to Final Inspection and Acceptance, instruct and train the District’s designated operating and maintenance (O&M) personnel in the operation, start-up and shut-down, adjustment, troubleshooting, servicing, and preventive maintenance of equipment and systems.

2. Explain to the District's O&M personnel, in full and to their complete understanding, procedures necessary to operate and maintain equipment and systems on a continuing basis.

3. Provide training manuals and other instructional materials and teaching aids as required to properly perform the required instruction and training.
4. Review the contents of O&M manuals specified in Section 01 78 23, Operation and Maintenance Data, with the District's O&M personnel in full detail to explain all aspects of the manuals and the operation and maintenance of equipment and systems.

5. Provide classroom and on-site instruction as most appropriate for the equipment or system.

6. Training programs shall be provided by manufacturer certified personnel.

7. Operation and maintenance manuals are specified in Section 01 78 23, Operation and Maintenance Data, and may be used for student training manuals upon approval.

8. Various specific and detailed requirements for instruction and training of the District personnel are specified in this Section, and in Sections 01 35 14, Operating System Interface and 01 35 24, Construction Safety.

B. Target Audience:

1. Station Agents: Must be able to reset alarms. Training to be conducted via train-the-trainer sessions.

2. Electricians: Training shall include basic familiarization and preventive maintenance procedures: removing, cleaning, replacing and testing components, disabling and enabling components through programming and interpreting the signaling output.

3. Fire Alarm Technicians/Engineers: Must be factory certified. Training shall include how to install, operate, start-up and shut-down, adjust, maintain, inspect, troubleshoot, test and modify equipment and systems. Training must include procedures necessary for preventive maintenance on the equipment and systems on a continuing basis. Must be able to program the Fire Alarm Control Unit (FACU). Programming tasks include, but are not limited to, deleting a device or zone, recognizing a substitute or replacement device.

4. Number of participants to train are as follows:
   a. Station Agent Trainers: 2
   b. Electricians: 20
   c. Fire Alarm Technicians/Engineers: 6

C. Classroom Sessions:

1. The Contractor shall provide instruction and training sessions in the operation and maintenance of equipment and systems for the District O&M personnel prior to Acceptance by the Engineer of the affected work.
2. Minimum class lengths are as follows:
   a. Station Agent Train the Trainer: 4 hours
   b. Electricians: 4 hours
   c. Fire Alarm Technicians/Engineers: 40 hours

3. Contractor shall provide a detailed instructor guide for the Station Agent and Electrician courses. The instructor guide is a written record of the facts and details taught in the training course. Instructor guide shall include a course outline broken down by topics with a description of key points covered in each topic, the method of delivery, details for conducting hands-on activities and any actions required to configure and prepare training equipment/training aids.

4. Training sessions shall be conducted by representatives of the various equipment and product manufacturers and the Subcontractors who are involved in the installation and acceptance testing of the affected equipment and systems. Training sessions shall enable a qualified service technician to troubleshoot and sustain the equipment and systems.

5. The Engineer will provide a classroom facility for such instruction and training sessions as required for Station Agent Train the Trainer and Electricians.

6. For the electrician course, a demonstration class shall be conducted to demonstrate compliance with this technical specification section and for approval of the Engineer.
   a. The approved instructor guides, training materials and training aids shall be used in the demonstration class.
   b. The demonstration shall be presented to an evaluation team composed for the District personnel from the group to be trained, including Employee Development Specialists, Supervisors, and Foreworkers.
   c. The evaluation team shall prepare a list of nonconformances, and recommend either acceptance, acceptance with changes, or rejection of the training demonstration.
   d. The evaluation team may recommend that all (when rejected) or a portion (when accepted with changes) of the training demonstration be repeated.

7. The Contractor shall schedule the training sessions through the Engineer at a time convenient to the District.
   a. Training classes for Electricians required on shifts as follows:
      1) 2 classes on day shift
      2) 2 classes on swing shift
      3) 1 class on graveyard shift
   b. The Contractor shall notify the Engineer of the proposed Station Agent and Electrician training sessions at least 30 Days before the dates the training will be held.
c. The Contractor shall notify the Engineer of the proposed training session dates for the Fire Alarm Technician/Engineer course at least six weeks prior to those dates.

D. On-Site and Hands-on Sessions:

1. Provide on-site, hands-on training sessions as required to demonstrate actual operating and maintenance procedures on the equipment. Hands-on training shall provide District personnel with actual operating and maintenance experience. Hands on sessions will enable each student to practice on the equipment. Demonstration by the instructor is not adequate.

2. Provide equipment and training aids to enable hands-on training in a location other than where the equipment is installed.

3. Installed equipment must be sufficiently tested to confirm it operates as expected before training is conducted and to enable completion of all hands-on activities and maintenance procedures.

4. Maximum class size for hands-on training is four (4).

E. Train the Trainer

1. Contractor shall deliver two (2) classes as designed for the EDS (trainers) responsible for training Station Agents.

2. Contractor shall review the instructor guide with the EDS after delivery of the course.

3. Contractor shall walk through how to configure training equipment/training aids in accordance with the instructor guide.

4. Contractor shall observe a minimum of one delivery per EDS trained via Train the Trainer session to confirm course is delivered as designed and accurate information provided.

5. Contractor shall be available to answer questions until all staff are trained. Questions shall be answered within 48 hours (two calendar days) of submission.

F. Videotaping Rights: The Engineer shall have the right to videotape of all training sessions presented by the Contractor. The Engineer shall also have the right to use these videotapes for future District conducted training courses

3.09 TRAINING MANUALS AND TRAINING AIDS

A. The Contractor shall provide instructor guides, student training manuals and any other materials or training aids to supplement the O&M Manuals specified in Section 01 78 23, Operation and Maintenance Data, and submit them to the Engineer for review and approval at least 60 Days before the scheduled start of training sessions. Student training manuals shall be prepared specifically for use as
training aids. All materials must be approved before the start of training, including applicable demonstration class.

B. Operation and Maintenance Manuals are specified in Section 01 78 23, Operation and Maintenance Data. O&M manuals may be used for student training manuals with approval.

C. Provide each training-session participant with one copy of pertinent training manuals at the start of training sessions. Provide the Engineer with electronic copies of all instructor guides, student training manuals, and any other materials.

D. Upon completion of each training session or course of instruction, instructor’s manuals, O&M manuals, training manuals, training aids and special tools shall become the property of the District. Provide the Engineer with all revisions to the training manuals throughout the Contract and Guaranty periods.

E. The District reserves the right to copy all training manuals and training aids for use in District-conducted training courses.

F. The Contractor shall be responsible in providing all tools, equipment, training aids, and other materials required for the training of District personnel. The number of special tools and other training equipment shall be adequate for the number of participants attending the training sessions.

G. The Contractor shall provide copies of the program user software and licenses for each individual participating in the Fire Alarm Technicians/Engineers training.

3.10 SYSTEM ACCEPTANCE

A. Procedure for the Acceptance tests shall be submitted for the Engineer’s approval. Tests shall be performed in the presence of the Engineer.

B. The completed system shall be tested to ensure that it is operating properly. The testing shall consist of exposing the installed detection units to the standard test per requirements of NFPA 72.

C. Acceptance of the system shall require a demonstration of the operation and stability performance of the system. This shall be adequately demonstrated if the system operates for a ninety (90) day period without any unwarranted alarms. Should an unwarranted alarm(s) occur, the Contractor shall readjust or replace the detector(s) and begin another ninety (90) day test period.

D. As required by the Engineer, the Contractor shall recheck the detectors using the installation standard test after each readjustment or replacement of detectors. This test shall not start until the Engineer has obtained beneficial use of the building under test.

E. If the requirements of the above paragraphs are not completed within one (1) year after commencing the tests described therein, the Contractor shall replace the system, and the process shall be repeated until acceptance of the equipment.
F. Perform Sequence of Operation test procedures as shown in Attachment A.

END OF SECTION 28 31 00
**SEQUENCE OF OPERATION**

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### FUNCTIONAL TEST

#### 1.01 TEST OBJECTIVES

A. To verify that the fire alarm/SCADA interface performs correctly in response to various fire alarm conditions

B. Repeat the tests for each station and record the results in the test report.

#### 1.02 TEST PROCEDURE

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<tr>
<th>Step #</th>
<th>Description</th>
</tr>
</thead>
</table>
| 1.     | Activate a “manual pull station”.  
      | Verify that the alarm is reported on the SAB control panel and at OCC but do not acknowledge the alarm.  
      | Verify that the fare gates open.  
      | Verify that 15 seconds later that the message “Escalator about to be stopped” is announced over the speaker system.  
      | Verify that the alarm is broadcast.  
      | After one minute, acknowledge the alarm and verify that the notification appliances stop.  
      | Repeat step 1 and acknowledge the alarm immediately.  
<pre><code>  | Verify that the message is not broadcast over the speaker system and that the alarm is not initiated. |
</code></pre>
<table>
<thead>
<tr>
<th>Test #</th>
<th>Station 1</th>
<th>Station 2</th>
<th>Station 3</th>
<th>…</th>
<th>Comments</th>
</tr>
</thead>
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</tbody>
</table>

Enter a check mark if acceptable; enter N if unacceptable.

*Contractor shall provide the list of tests that need to be performed.

Tested by: __________________________ Date: ________________
Witness initials: ______; ______; ______

END OF ATTACHMENTS TO SECTION 28 31 00