PURPOSE OF THIS DOCUMENT

The intent of this document is to disseminate the San Francisco International Airport’s (SFO’s or Airport’s) expectations regarding the information presented to designers, engineers, general contractors and other industry specialists.

HOW TO USE THIS DOCUMENT

This document should be used as a resource for the development of project specific design documents including drawings, details and specifications. It is the responsibility of the design, engineering and construction professionals to adhere to all codes and regulations related to the content presented.

SCOPE

This section contains the Standards and Criteria for the Fire Alarm System installed at SFO. Any questions or concerns regarding the items or equals specified must be submitted to the Standards Committee in writing. All final decisions regarding products shall be made at the Airport’s discretion. If the Engineer of Record presents items that are not specified or named equals, they must be brought to the Standards Committee for evaluation of those products.

GENERAL INFORMATION

The currently adopted editions (at the time of submittal) of the California Fire Code (CFC), San Francisco Fire Code (SFFC) and SFFD Administrative Bulletins (AB), NFPA, 70, NFPA 72 and the California Building Code (CBC) are the underlying statutory codes and regulations guiding the Fire Alarm project standards, in no case shall the requirements of this standard be construed as taking precedence over more restrictive requirements of those codes.

The existing SFO Fire Alarm nodes and their device breakdown, as of December 2014, is available in Appendix A.

SFO Fiber Optic Cable Characteristics and Requirement are available in Appendix B.

The proposed SFO Campus Fire Alarm Network Segmentation diagram is available in Appendix C.

Whenever NFPA 70 or NFPA 72 is referenced in this document it shall mean the currently adopted edition of NFPA 70 or NFPA 72 as amended by the California Fire Code.

DRAWING REQUIREMENTS

A. All design disciplines including the architectural/engineering sub-consultants and the trade bid package subcontractors shall prepare documents using Revit in the current version utilized by the Airport in compliance with the Airport’s Building Information Modeling (BIM) Requirements as described in Document 00 73 87: BIM Requirements, unless waived by the Chief Development Officer.

B. When Revit models may not be applicable, (for example, tasks with underground infrastructure beyond a building footprint), Civil 3D may be used to model utilities and applicable infrastructure if approved by the Chief Development Officer.

C. Refer to technical specifications for As-Built requirements.
D. Documents and plans submitted to SFO shall be searchable using PDFs with live text. This includes, but is not limited to, text and symbols. The document shall also provide the capability to turn layers on and off. Any project using legacy documents which may be composed image files shall be converted to live text via Optical Character Recognition (OCR).

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SECTION 28 31 00 – FIRE DETECTION AND ALARM

PART 1 – GENERAL

1.1 DESCRIPTION

A. Provide fire alarm system plans and submittals in accordance with the Contract Documents and in compliance with the requirements of the most recently adopted editions of the California Building Code (CBC), California Fire Code (CFC), San Francisco Fire Code (SFFC), and SFFD Administrative Bulletin (AB) 2.01. Provide all equipment, engineering, drawings, labor, materials, accessories, and approvals from governing agencies required to furnish, install, start up, and commission a complete operating fire alarm system with said systems being made ready for operation in accordance with the requirements of SFO Building Inspection and Code Enforcement (BICE) department and SFO Fire Marshal (SFFD). Labor, materials, or accessories specifically called for in the Contract Documents to provide complete, operating, and approved systems, shall be provided without additional cost to the Owner.

B. The Fire Alarm System Contractor shall review the currently approved Fire Protection/Life Safety Report for the project’s scope of work and shall incorporate its requirements into the design of the Fire Alarm System.

C. Determine, coordinate, and incorporate the design and construction requirements of the Architect, Structural Engineer, Civil Engineer, Lighting Consultant, Foodservice Consultant, General Contractor, other Subcontractors, SFFD and other parties as required. An Engineer’s wet stamp and signature are required on all sheets of the plan submittal when plans are designed by one company/contractor and installed by another company/contractor. Engineer’s stamp and signature shall be provided by the installing contractor prior to submission to BICE.

D. The purpose of the performance-based specifications is to convey to the Contractor the scope of work required, all of which the Subcontractor is responsible to furnish, install, adjust, and make operable. Unless there is an increase in scope such as change in occupancy, change in use, or increased program area; the omission by the Subcontractor of any necessary system component, as required by BICE and SFO Fire Marshal (SFFD), shall not relieve the Subcontractor of the responsibility for providing such necessity and with no additional cost to the Owner.

E. No extra payments will be allowed to the Contractor because of extra work made necessary by their failure to include all necessary components of the system. Any case of error, omission, discrepancy or lack of clarity shall be promptly identified to the Owner and Design Team for clarification prior to the bid due date.

F. The Contractor shall provide all devices and equipment required by these specifications and drawings. Under no circumstances shall the Contractor delete any equipment or devices without the written directive of the Owner and Engineer and approval from the SFFD.

G. The fire alarm system shall be capable of stand-alone operation independent of other control systems if in the worst case event, the fire alarm system Class A network communication is severed.

H. Scope of the Fire Alarm System may include related work specified in other divisions:
   a. Addressable monitor module shall monitor each switch. Modules shall be located within five feet of unit.

2. Magnetic door holders and electric door locking hardware (electric door locking hardware requires separate SFFD approval).
   a. Addressable relay shall shunt door holder or door locking hardware circuit.

3. Damper end switches, differential air pressure switches, and air flow switches.
   a. Addressable monitor module shall monitor each device. Multiple outputs monitored by one single input module is not acceptable. Modules shall be located within five feet of unit.

4. Installation of duct type smoke detectors.
   a. Duct detection shall be installed by Mechanical Contractor and wired by Electrical Contractor in accordance with Mechanical Engineer of Record’s Sequence of Operations for Damper/Fan outputs.

5. Pre-action fire protection systems.
   a. Addressable monitor module shall be provided to monitor; Alarm, Trouble and Supervisory conditions. Modules shall be located within five feet of unit.

6. Clean agent fire protection systems.
   a. Addressable monitor module shall be provided to monitor; Alarm, Trouble, and Supervisory conditions. Modules shall be located within five feet of unit.

7. Wet Chemical Kitchen Hood System
   a. Addressable monitor module shall be provided to monitor; Alarm, Trouble, and Supervisory conditions. Modules shall be located within five feet of unit.

8. AED – Defibrillators
   a. Addressable monitor module shall be provided to monitor; Supervisory conditions. Modules shall be located within five feet of unit.

9. Baggage System
   a. Addressable relay module shall be provided to activate the shunt sequence of the baggage system and close necessary chop doors.

10. Fuel & Fuel Shutdown System (EFSO)
    a. Addressable monitor module shall be provided to monitor; Alarm condition of the EFSO system. Modules shall be located within the shutoff button on AOA. Activation of EFSO will transmit an alarm condition to the Communication Center, and shutdown the Fuel Farm.

11. Elevator Emergency Phones
    a. Addressable monitor module shall be provided to monitor; Emergency Phone located in Elevator Cab and transmit a Priority 2 (P2) Alarm condition as well as the Emergency Phone’s call number and location (Elevator Number). Modules shall be located within Elevator Machine Room.
12. Paging & Public Address System  
a. Addressable relay module shall be provided to notify the Public Address (PA) system when the fire alarm system is in alarm. PA system will switch to fire mode and receive a 5-watt fire alarm speaker circuit with live and pre-recorded evacuation tones and messages. PA system shall take this signal, amplify and broadcast through the PA system across the evacuation zone.

a. Additional language forthcoming in subsequent editions.

14. Smoke control/management systems.  
a. Additional language forthcoming in subsequent editions.

15. Battery Rooms and Cell Sites  
a. Additional language forthcoming in subsequent editions.

a. Additional language forthcoming in subsequent editions.

I. The Fire Alarm System contract is a performance-based contract. The Contractor will develop a complete set of code-compliant and fully coordinated construction documents to the satisfaction of the SFO Fire Marshal (SFFD) and Building Official (BICE). The fire alarm system contractor shall provide all required documentation and obtain all required permits and approvals. The Fire Alarm and Detection System contractor shall provide all devices and accessories in the quantities and locations necessary for a fully functional and code-compliant system.

J. The Contractor shall furnish and install additional devices for the fire alarm system to meet requirements of the SFO Fire Marshal's Office (SFFD) plan reviewers and field inspection team. The Contractor shall commence changes to the Scope of Work only upon written directive of the Owner and Engineer.

K. Network fire alarm control units shall include all features as described in this specification for stand-alone FACUs and shall have network communication capabilities as described herein

1. All points monitored and controlled by a single node shall be capable of being programmed as “Public.” Each point made public to the network may be programmed to be operated by any other node connected to the network.

2. Network communications shall be capable of supporting “point lists” that can be handled as though they were a single point.

3. The network shall provide a means to log into any node on the system via a laptop computer or Display/Keyboard and have complete network access (Set Host) for diagnostics, maintenance reporting, and information gathering of all nodes in the system. Systems not meeting this requirement must provide all diagnostic tools required to support this function from selected points on the network.

L. Power Requirements

1. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal AC power in a normal supervisory mode for 24 hours and 15 minutes of alarm operation. The system shall automatically transfer to battery standby upon power failure. All battery charging and recharging operations shall be automatic. Emergency generators, where present, shall provide emergency power as required by the CFC. Level, Class and Type of generator shall be clearly identified on the plan submittal.
2. All circuits requiring system-operating power shall be 24 VDC nominal voltage and shall be individually fused at the control unit.

3. The incoming power to the system shall be supervised so that any power failure will be indicated at the control unit. A green “power on” LED shall be displayed continuously at the user interface while incoming power is present.

4. The system batteries shall be supervised so that a low battery or a depleted battery condition, or disconnection of the battery shall be indicated at the control unit and displayed for the specific fault type.

5. The system shall support NAC Lockout feature to prevent subsequent activation of Notification Appliance Circuits after a Depleted Battery condition occurs in order to make use of battery reserve for front panel annunciation and control.

6. The system shall support 100% of addressable devices in alarm or operated at the same time, under both primary (AC) and secondary (battery) power conditions.

7. Loss of primary power shall sound a trouble signal at the FACU. FACU shall indicate when the system is operating on an alternate power supply.

M. Software: The fire alarm system shall allow for loading and editing instructions and operating sequences as necessary.

1. The system shall be capable of on-site programming to accommodate system expansion and facilitate changes in operation.

2. All software operations shall be stored in a non-volatile programmable memory within the fire alarm control unit. Loss of primary and secondary power shall not erase the instructions stored in memory.

3. Panels shall be capable of full system operation during new site specific configuration download, master exec downloads, and slave exec downloads.

4. Remote panel site-specific software and executive firmware downloads shall be capable of being performed over proprietary fire alarm network communications. Panels shall automatically store all program changes to the panel’s non-volatile memory each time a new program is downloaded. Panels shall be capable of storing the active site-specific configuration program and no less than 9 previous revisions in reserve. A compare utility program shall also be available to authorized users to compare any two of the saved programs. The compare utility shall provide a deviation report highlighting the changes between the two compared programs.

5. Panels shall provide electronic file storage with a means to retrieve a record copy of the site-specific software and up to 9 previous revisions. Sufficient file storage shall be provided for other related system documentation such as record drawings, record of completion, owner’s manuals, testing and maintenance records, etc.

6. The media used to store the record copy of site-specific software and other related system documentation shall be electrically supervised. If the media is removed a trouble shall be reported on the fire alarm control unit.

N. History Logs: The system shall provide a means to recall alarms and trouble conditions in chronological order for the purpose of recreating an event history. A separate alarm and trouble log shall be provided.

O. Recording of Events: The system shall be capable of recording all alarm, supervisory, and
trouble events by means of system printer. The printout shall include the type of signal (alarm, supervisory, or trouble) the device identification, date and time of the occurrence. The printout shall differentiate alarm signals from all other printed indications.

P. Required Functions: The following are required system functions and operating features:

1. Priority of Signals: Fire alarm events have highest priority, except when a risk analysis identifies other priorities. Subsequent alarm events are queued in the order received and do not affect existing alarm conditions. Supervisory and Trouble events have second priority. Signals of a higher-level priority take precedence over signals of lower priority even though the lower-priority condition occurred first. Annunciate all events regardless of priority or order received.

2. Noninterfering: An event on one zone does not prevent the receipt of signals from any other zone. All zones are manually resettable from the FACU after the initiating device or devices are restored to normal. The activation of an addressable device does not prevent the receipt of signals from subsequent addressable device activations.

3. Annunciation: Operation of alarm and supervisory initiating devices shall be annunciated at the FACU and the remote annunciator, indicating the type of device, the operational state of the device (i.e. alarm, trouble or supervisory) and shall display the custom label and address associated with the device.

4. Selective Alarm: A system alarm shall include:
   a. Indication of alarm condition at the FACU and the annunciator(s).
   b. Identification of the device /zone that is the source of the alarm at the FACU and the annunciator(s).
   c. Operation of audible and visible notification appliances until silenced at FACU.
   d. Selectively closing doors normally held open by magnetic door holders on the fire floor which is allowed only if individual smoke detectors are provided for each specific door.
   e. Unlocking designated doors.
   f. Shutting down supply and return fans serving zone where alarm is initiated unless supply and return fans are part of a mechanical smoke control system.
   g. Closing smoke dampers on system serving zone where alarm is initiated unless combination fire/smoke damper is part of a mechanical smoke control system.
   h. Initiation of smoke control sequence, where installed.
   i. Transmission of signal to the SFO Communications Center.
   j. Initiation of elevator Phase I functions (recall, shunt trip, illumination of indicator in cab, etc.) in accordance with ANSI/ASME A17.1 / CSA B44, Safety Code for Elevators and Escalators, when specified detectors or sensors are activated, as appropriate. When possible, compliance with the CBC Section, as found in Chapter 30, which allows for the elimination of automatic sprinklers and the requirement for shunt trip in specific elevator related spaces, is preferred.

5. Supervisory Operations: Upon activation of a supervisory device such as a fire pump power failure, low air pressure switch, and tamper switch, the system shall operate as follows:
a. Activate the system supervisory service audible signal and illuminate the LED at the control unit and the remote annunciator.

b. Pressing the Supervisory Acknowledge Key will silence the supervisory audible signal while maintaining the Supervisory LED “on” indicating off-normal condition.

c. Record the event in the FACU historical log.

d. Transmission of supervisory signal to the SFO Communications Center.

e. Restoring the condition shall cause the Supervisory LED to clear and restore the system to normal.

6. Alarm Silencing: If the “Alarm Silence” button is pressed, all audible and visible notification appliances shall cease operation.

7. Priority 2 Operations: Upon activation of a Priority 2 condition such as gas detection, chemical leak detection, and elevator emergency calls, the system shall operate as follows:

a. Activate the system Priority 2 audible signal at TSW in SFO Communication Center and illuminate the LED at the control unit and the remote annunciator.

b. Pressing the Priority 2 Acknowledge Key will silence the audible signal while maintaining the Priority 2 LED “on” indicating off-normal condition.

c. Record the event in the FACU historical log.

d. Transmission of Priority 2 signal to the SFO Communications Center.

e. Restoring the condition shall cause the Priority 2 LED to clear and restore the system to normal.

8. System Reset

a. The “System Reset” button shall be used to return the system to its normal state. Display messages shall provide operator assurance of the sequential steps (“IN PROGRESS”, “RESET COMPLETED”) as they occur. The system shall verify all circuits or devices are restored prior to resetting the system to avoid the potential for re-alarming the system. The display message shall indicate “ALARM PRESENT, SYSTEM RESET ABORTED.”

b. Should an alarm condition continue, the system will remain in an alarmed state.

9. A manual evacuation (drill) switch shall be provided to operate the notification appliances without causing other control circuits to be activated. The activation device can be a switch or button at the FACU and in addition to the manual station located in the FCC.

10. Walktest: The system shall have the capacity of 8 programmable passcode protected one person testing groups, such that only a portion of the system need be disabled during testing. The actuation of the “enable one-person test” program at the control unit shall activate the “One Person Testing” mode of the system as follows:

a. The city circuit connection and any suppression release circuits shall be bypassed for the testing group.

b. Control relay functions associated with one of the 8 testing groups shall be bypassed, all other zones shall remain active during bypass testing.

c. The control unit shall indicate a trouble condition.

d. The alarm activation of any initiating device in the testing group shall cause the audible
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notification appliances assigned only to that group to sound a code to identify the device or zone.

e. The unit shall automatically reset itself after signaling is complete.

f. Any opening of an initiating device or notification appliance circuit wiring shall cause the audible signals to sound for 4 seconds indicating the trouble condition.

g. All other zones shall remain active during any bypassed testing.

11. Install Mode: The system shall provide the capability to group all non-commissioned points and devices (devices that are installed but not programmed, commissioned or tested/accepted by the SFFD) into a single “Install Mode” trouble condition allowing an operator to clearly identify event activations from commissioned points and devices in occupied areas.

a. It shall be possible to individually remove points from Install Mode as required for phased system commissioning.

b. It shall be possible to retrieve an Install Mode report listing that includes a list of all points assigned to the Install Mode. Panels not having an install mode shall be reprogrammed to remove any non-commissioned points and devices.

12. Module Distribution:

a. The fire alarm control unit shall be capable of allowing remote location of the following modules; interface of such modules shall be through a Class B (Style 4) supervised serial communications channel (SLC):

1) Initiating Device Circuits
2) Notification Appliance Circuits
3) Auxiliary Control Circuits
4) Graphic Annunciator LED/Switch Control Modules

a) In systems with two or more Annunciators and/or Command Centers, each Annunciator/Command Center shall be programmable to allow multiple Annunciators/Command Centers to have equal operation priority or to allow hierarchal priority control to be assigned to individual Annunciator/Command Center locations.

13. In addition to the requirements of the currently adopted edition of the CFC, NFPA 70 and NFPA 72 as amended therein, the conditions listed above shall apply. In no case shall the requirements contained herein be less restrictive than the requirements of the adopted editions of the CFC, NFPA 70 and NFPA 72 that were in effect at the time of plan submittal.

1.2 DESCRIPTION

A. Fire alarm devices are indicated on plans for architectural coordination and general design intent only and do not necessarily represent the actual quantity of devices required. Provide all required conduit, wire, panels, controls, auxiliary devices, accessories, testing, etc. as required for a complete and operating code compliant system. The Contractor is responsible for providing the quantity of devices required for complete audible and visible notification coverage, and to meet the requirements of the currently adopted editions of the CBC, CFC, NFPA 70 and NFPA 72. Following the design phase, if additional devices are required to satisfy the local authority, they shall be provided as an additional cost to the Owner.
B. Obtain BICE & SFO Fire Marshal’s approval of fire alarm system and installation.

C. Equipment supplier shall have 24-hour parts and labor service available with a maximum 8-hour response time.

1.3 QUALITY ASSURANCE

A. Provide labor, materials, and equipment for a complete fire alarm and detection system outlined in these specifications. The Contractor shall be responsible for compliance with all required codes and the entire project specifications. In addition, the Contractor shall be a Sub-contractor to the General Contractor or Electrical Contractor and work with the General Contractor and Electrical Contractor to complete the project.

B. The Fire Alarm System shall be commissioned under the projects approved Master Test Plan (MTP).

1.4 REFERENCE CODES AND STANDARDS

A. The following codes, standards and guides (currently adopted editions at the time of permit application) are hereby made a part of this work by reference thereto:
   1. Americans with Disabilities Act (ADA)
   3. International Building Code with Local Amendments
   4. California Building Code (CBC)
   5. California Fire Code (CFC), as amended by the City and County of San Francisco
   6. San Francisco Fire Code (SFFC)
   7. SFFD Administrative Bulletin 2.01 for Fire Alarm Submittal Guidelines
   10. NFPA 13 – Standard for the Installation of Sprinkler Systems, as amended by CFC
   11. NFPA 20 – Standard for the Installation of Stationary Pumps for Fire Protection
   12. NFPA 70 – National Electrical Code, as amended by CFC
   13. NFPA 72 – National Fire Alarm and Signaling Code, as amended by CFC
   14. NFPA 90A – Air Conditioning and Ventilating Systems
   15. NFPA 92 – Standard for Smoke Control Systems
   17. NFPA 110 – Standard for Emergency and Standby Power Systems
   18. NFPA 2001 – Standard on Clean Agent Fire Extinguishing Systems
   19. Owner’s Insurance Underwriter
   20. California State Fire Marshal
   21. UL Standard 33 – Heat Responsive Links for Fire-Protection Service
   22. UL Standard 38 – Manually Actuated Signaling Boxes
   23. UL Standard 217 – Single and Multiple Station Smoke Alarms
   24. UL Standard 228 – Door Closers/ Holders, with or without Integral Smoke Detectors
   25. UL Standard 268 – Smoke Detectors for Fire Alarm Signaling Systems
   26. UL Standard 268A – Smoke Detectors for Duct Application
   27. UL Standards 464 – Audible Signal Appliances
   29. UL Standard 864 – Control Units and Accessories for Fire Protective Alarm Systems
   30. UL Standards 1480 – Speakers for Fire Alarm and Signaling Systems, Including Accessories
1.5 ABBREVIATIONS

A. The following abbreviations are used:

1. ADA – Americans with Disabilities Act
2. ADS – Acoustically Distinguishable Space
3. AED – Automatic External Defibrillator
4. AHJ – Authority Having Jurisdiction
5. BICE – Building Inspection & Code Enforcement
6. CFM – Cubic Feet per Minute
7. CO – Carbon Monoxide
8. CSFM – California State Fire Marshal
9. DWG – AutoCAD drawings format
10. ECC – Engineer’s Control Center
11. EFSO – Emergency Fuel Shut Off
12. EOL – End Of Line
13. EOLR – End Of Line Resistor
14. EVAC – Emergency Voice Alarm Communication System
15. DSD – Duct Smoke Detection
16. FACU – Fire Alarm Control Unit
17. FARA – Fire Alarm Remote Annunciator
18. FARU – Fire Alarm Remote Unit
19. FATC – Fire Alarm Terminal Cabinet
20. FCC – Fire Command Center
21. FSCP – Firefighter’s Smoke Control Panel
22. HVAC – Heating, Ventilation & Air Conditioning
23. Hz – Hertz
24. I/O – Input Output
25. ID – Identification
26. IEEE – Institute of Electrical & Electronic Engineers
27. IP – Internet Protocol
28. LAN – Local Area Network
29. LCD – Liquid Crystal Display
30. LED – Light Emitting Diode
31. MTP – Master Test Plan
32. NAC – Notification Appliance Circuits
33. NFPA – National Fire Protection Association
34. P1 – Priority One
35. P2 – Priority Two
36. SCC – Security Control Center
37. SLC – Signaling Line Circuits
38. SPDT – Single Pole, Double Throw Electrical Relay
39. TCP – Transmission Control Protocol
40. TSW – TrueSite Workstation
41. UL – Underwriters Laboratories
42. UTP – Untwisted Pair
43. WAN – Wide Area Network
1.6 SUBMITTALS

A. Comply with submittal requirements from BICE and SFO Fire Marshal (SFFD). Current submittal guidelines can be found in SFFD Administrative Bulletin (AB) 2.01.

B. Manufacturer’s product data sheets for equipment including California State Fire Marshal (CSFM) listing numbers.

C. Floor plans (minimum 1/8-inch scale) showing device locations and interconnecting conduit and wire. Floor plan (minimum 1/2-inch scale) of the FCC indicating fire alarm and detection system equipment, equipment furnished by others, tables, plan racks, and required clearances. Elevations (minimum 1/2-inch scale) of each wall of the FCC.

D. Riser diagram showing devices, equipment, and interconnecting conduit and wire. Indicate points of connection to other equipment such as motor control centers, damper actuators, fire pump controllers, kitchen hood fire protection systems, pre-action fire protection systems, clean agent fire protection systems, elevator machine rooms and shafts, electric door locking hardware, magnetic door holders, and other related devices and equipment.

E. See SFFD AB 2.01 for full list of submittals requirements. The following items are some of the important requirements:
   1. Detail drawings of FACU, FARA, FARUs, EVAC, and FSCP panel fronts.
   2. Wiring diagram for each device.
   3. Control and wiring diagrams for smoke control sequence.
   4. Voltage drop calculations.
   5. Battery sizing calculations.
   6. Fire alarm speaker amplifier sizing calculations.
   7. Visual alarm power supply sizing calculations.
   8. Equipment List (including CSFM listing)
   9. Event Matrix or Sequence of Operations
   10. Power supply calculations for magnetic door holders, and electric door locking hardware.
   11. Seismic restraint calculations.
   12. EVAC: Amplification sizing calculations
   13. Details for ancillary system interfaces with Fire Alarm System.
   14. Plans designed by one C-10 contractor may not be installed by another C-10 contractor, unless the plans are stamped and signed by the installing contractor’s electrical engineer.
   15. The design professional shall clearly identify all acoustically distinguishable spaces (ADS) that require voice intelligibility, including the test plan with testing instrument locations and heights as per NFPA 72.

1.7 FIELD TESTING

A. Wiring shall be inspected and tested for continuity and short circuits. Provide a Simplex TrueSTART Instrument to check out the installation wiring as well as device addressing. Testing for stray voltage, ground faults and short circuits must be done with a Fluke 179 Multimeter or equivalent. Megger connections should be avoided, especially at 500 volts. Most low voltage wiring is rated at 300 volts maximum for fire alarm addressable data, network communications,
and audio. Most wiring faults occur when field devices are terminated on circuits. Megger connections should not be done after field devices and/or control panels are terminated, as this may cause equipment damage.

B. Intelligibility testing shall be conducted for voice systems. Testing shall be in accordance with the currently adopted edition of NFPA 72, Annex D.

C. TrueSTART Instrument to test the following:
   1. Earth Fault Testing
   2. Duplicate Address Detection
   3. Device LED Activation
   4. Initiating Device Circuit Test
   5. Notification Appliance Circuit Test
   6. X-Talk Test (Cross-Talk)
   7. Memory Slots

D. Field Test Reports:
   1. The Fire Alarm System shall be commissioned under the project's Master Test Plan. Sample testing materials are available in Appendix D and E.
   2. Certification that equipment has been properly installed and is in satisfactory operating condition. Installation certification provided by installing contractor.
   3. Detailed operational test report in matrix form indicating each initiating device, each notification appliance, and each control and indicating light on each piece of equipment. Report shall certify the following:
      a. Successful operation of each alarm and supervisory initiating device
      b. Device unique label/description
      c. Successful operation of each notification appliance
      d. Successful operation of automatic smoke control sequences.
      e. Successful operation of FACU
      f. Successful operation of FARA
      g. Successful operation of FARU
      h. Successful operation of FSCP
      i. Successful operation of elevator recall sequence
      j. Successful operation of line supervision devices
      k. Successful operation of alarm monitoring to SFO Communication Center
   4. Testing and testing documentation in accordance with SFO testing procedures and the currently adopted edition of NFPA 72.

1.8 IDENTIFICATION

A. Provide an identification nameplate for each equipment cabinet.

B. Fire alarm conduits shall be identified by self-adhering, non-conductive markers with orange background and black lettering. Markers shall be placed on all exposed or accessible raceways within 18 inches of raceway terminations, wherever raceway enters or leaves concealed space, and every 10 feet along raceway. Markers shall be a minimum of 2” by 8” with 1-1/8” minimum lettering. Fire alarm raceways shall be identified “FIRE ALARM.” Handwritten labels are not acceptable. Refer
to Electrical Specification Section 25 05 53: Identification for Electrical Systems for additional requirements.

C. All fire alarm peripheral devices shall be labeled with a Construction Grade P-Touch label in accordance with the following numbering scheme:
   1. Initiating Devices – Node#: SLC#-Device# Example: N1:M1-111
   2. Speaker Devices – Node#: SIG#-Device# Example: N1:S1-11

D. Prior to adhering labels to any equipment, the installing contractor is responsible to properly clean device surface in accordance with device manufacturer recommendations, prior to applying labels.

1.9 SEQUENCE OF OPERATION

A. The system shall operate automatically in accordance with the sequence of operations matrix. A sample matrix is available in Appendix F.

B. Elevators shall be recalled to the Arrivals level or an alternate level such as the Departures level if the Arrivals level is the level of device activation (elevator lobby smoke detector). Alternate level assignment shall be determined by the SFFD.

C. Air Handling Systems:
   1. Activation of a supply or return air duct detector shall shut down the associated fan or air handling system and shall comply with the requirements of the Section addressing Automatic Shutoffs in the currently adopted edition of the CMC. Note, multiple units, with a combined total of more than 2,000 CFM serving the same enclosed space, will be required to shut down simultaneously upon detection of smoke.

D. Combination Fire/Smoke Dampers:
   1. Activation of a duct or smoke detector at a combination fire/smoke damper shall close the associated fire/smoke damper unless combination fire/smoke damper is part of a mechanical smoke control system. Smoke Control Sequence of Operation provided by Mechanical Engineer of Record shall be used for the basis of the fire alarm sequencing matrix.

E. Elevator Machine Rooms:
   1. Activation of installed heat detectors, where required by code, in elevator machine room or hoistway shall automatically operate the shunt-trip operated overcurrent protection devices supplying power to the elevators, resulting in the disconnection of power to the associated elevators. SFFD prefers to eliminate sprinklers in elevator hoistway, elevator machine room, elevator machinery space, elevator control space or elevator control room, in compliance with the CBC Section, as found in Chapter 30, which allows for the elimination of automatic sprinklers and the requirement for shunt trip.

   2. Elevator Cab Emergency Phone shall be monitored by the fire alarm system as a P2 Alarm condition and provide the following information:
      a. Elevator location or elevator number
      b. Phone number of emergency phone
      c. Phone shall connect to SFO Communication Center
F. Smoke Control Sequence (when required by code):

1. Provide controls, relays, control panels, and interfaces for automatic override control of each air handling system used for smoke control.

2. Fire detection and control systems for mechanical smoke control systems shall be supervised in accordance with the Fire Code. Supervision shall provide positive confirmation of actuation, testing of devices, manual override mechanisms, and the presence of power downstream of power disconnect switches. Damper status supervision shall be accomplished by activation of damper limit switches. Air flow status shall be by differential pressure switches. Fire-fighter’s smoke control panel shall be approved prior to fabrication by Mechanical Engineer of Record, BICE and SFFD.

3. Installation inspection and testing of smoke control systems shall be in compliance with SFBC AB-047 and the currently adopted editions of the CBC and CFC.

4. Smoke Control Sequence of Operation shall be in accordance with Mechanical Engineer of Record Smoke Control Report and Drawings.

G. The EVAC shall automatically activate the audible and visual notification appliances in accordance with the approved Fire Protection and Life Safety Report and/or the approved Fire Alarm Plans.

H. Defibrillators AED shall be monitored by the fire alarm system as a Supervisory condition and provide the following information:

1. Defibrillators location

I. Baggage system shall be monitored by the fire alarm system as an Alarm condition and provide the following information:

1. Send signal to Baggage System for shut down (General Alarm)

2. Close chop doors (General Alarm)
   a. Interface shall be provided via Baggage System or at local chop door.

J. Fuel System shall be monitored by the fire alarm system as an Alarm condition and provide the following information:

1. Initiate alarm condition at the fire alarm system (Notification devices shall not activate)

2. Identify location of Emergency Fuel Shut Off (EFSO) station. Location to be reviewed and approved by SFFD and SFO Fuels.

3. Close valves locally if required

4. Send signal to shut down Fuel Farm

K. Paging System shall interface with the fire alarm system and provide the following signals to the paging system:

1. Addressable fire alarm relay for shunt and/or activation of paging system fire mode.

2. One fire alarm speaker circuit dedicated for the paging system for live (selective evacuation) and pre-recorded messages to be broadcast through the paging system.

L. Wet Chemical Kitchen Hood Systems in addition to compliance with the requirements of the currently adopted edition of the CFC for Commercial Kitchen Hoods and the Section and subsections

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pertaining to commercial cooking systems as found in Chapter 9 for Alternative Automatic Fire-Extinguishing Systems the following shall be provided:

1. Kitchen Hood System location

1.10 ADDRESSABLE DEVICE & SYSTEM ZONING

A. Alarm Initiating Devices:
   1. Provide a separate, individual addressable device for each manual pull station, area smoke detector, duct smoke detector, area heat detector, and sprinkler water flow switch.

B. Supervisory Initiating Devices:
   1. Provide a separate, individual addressable device for each sprinkler tamper switch.

C. Pre-Action Fire Protection Systems:
   1. System alarm (separate, individual addressable device per system).
   2. System trouble (separate, individual addressable device per system).
   3. System supervisory (separate, individual addressable device per system).

D. Clean Agent Fire Protection Systems:
   1. System alarm (separate, individual addressable device per system).
   2. System trouble (separate, individual addressable device per system). System supervisory (separate, individual addressable device per system).

E. Audible and Visual Notification Appliances:
   1. Alarm notification zoning shall be as approved by SFFD.

PART 2 – PRODUCTS & EQUIPMENT

2.1 ACCEPTABLE MANUFACTURERS

A. Fire alarm system components shall be of the same manufacturer, unless otherwise noted and shall be compatible with existing fire alarm network, UL and CSFM listed.

B. Acceptable manufacturers:
   1. Simplex
   2. Or approved equal.

C. Products for this project shall be of the latest design. Obsolete or discontinued models are not acceptable.

2.2 SYSTEM TYPE

A. The fire alarm system shall be the fully addressable type. Each fire alarm initiating device shall have a unique addressable device address, identifying the device type and location. Provide interface modules to connect non-addressable devices to addressable wiring channels.

B. All zoning/device location information shall be field-programmable to meet the exact job requirements as approved by the Architect/Engineer and as required by the SFO Fire Marshal’s Office.
C. Notification devices shall be addressable. Each fire alarm notification device shall have a unique addressable device address, identifying the device type and location. Provide interface modules to connect non-addressable devices to addressable wiring channels.

2.3 LINE SUPERVISION

A. All system equipment and wiring shall be supervised in compliance with the requirements of NFPA 72.

B. All styles of Class A circuits shall be installed such that the outgoing and return conductors, exiting from and returning to the control unit, respectively, are routed separately. The outgoing and return (redundant) circuit conductors shall not be run in the same cable assembly (multi-conductor cable), enclosure, or raceway. Class A circuits shall be provided for all Fire Alarm Network Communication (Simplex 4120 Fire Alarm Network) and when required by the currently adopted editions of the CFC and NFPA 72.

C. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded NFPA Class B, SLC.

D. Exception: Class A shall be provided for high-rise buildings (CFC Section 907.6.1.1) or to match existing.

E. When required notification appliance circuits and any other circuits necessary for the operation of the notification appliance circuits shall be protected from the point at which they exit the control unit until the point that they enter the notification zone that they serve using a 2-hour rated cable assembly and meet the requirements of the currently adopted edition of NFPA 72 sections regarding Pathway Survivability.

2.4 STANDBY BATTERIES

A. Provide sufficient battery capacity to operate the entire system upon loss of power as required by NFPA 72.

B. Emergency generators, where present, shall provide emergency power as required by the CFC and NFPA 72.

C. The system shall automatically transfer to the standby batteries upon power failure. Battery charging and recharging shall be automatic.

2.5 FIRE ALARM CONTROL UNIT (FACU)

A. General: Comply with UL 864, “Control Units and Accessories for Fire Alarm Systems.”

B. The following FACU hardware shall be provided:

1. Power Limited base panel with red cabinet and door, 120 VAC input power.
2. 2,500-point capacity where (1) point equals (1) monitor (input) or (1) control (output).
3. 2000 points of annunciation where one (1) point of annunciation equals:
   a. 1 LED driver output on a graphic driver or 1 switch input on a graphic switch input module.
   b. 1 LED on panel or 1 switch on panel.
4. From all battery charging circuits in the system provide battery voltage and ammeter readouts on the FACU LCD Display.

5. One Auxiliary electronically resettable fused 2A @24VDC Output, with programmable disconnect operation for 4-wire detector reset.

6. One Auxiliary Relay, SPDT 2A @32VDC, programmable as a trouble relay, either as normally energized or de-energized, or as an auxiliary control.

7. Three (3) Class B Addressable Notification Appliance Signaling Line Circuits (SLCs).
   a. Each Addressable Notification Appliance SLC shall be rated at 3A and capable of supporting up to 63 Notification Appliances per channel.
   b. Wiring shall be 16 AWG to 12 AWG unshielded twisted pair wire. Systems that require shielded wire for Notification Appliances will not be accepted.
   c. A constant voltage under both primary and secondary power conditions shall be maintained at the notification appliance field wiring terminal connections in the FACU to ensure the voltage drop on the circuit is consistent under both primary and secondary power conditions.
   d. For systems that do not provide a constant voltage source at the FACU notification appliance field wiring terminal connections, the fire alarm contractor shall:
      1) Provide separate point-to-point voltage drop calculations for all notification appliances under worst case secondary power specifications, and
      2) Perform a complete functional test of all notification appliances under worst case secondary power conditions.
   e. Where required provide Intelligent Remote Battery Charger for charging up to 110Ah batteries.
   f. Power Supplies with three (3) Class B integral Intelligent Addressable Notification Appliance Signaling Line Circuits (SLCs) for system expansion.
      1) Each Addressable Notification Appliance SLC shall be rated at 3A and capable of supporting up to 63 Notification Appliances per channel.
      2) Wiring shall be 16 AWG to 12 AWG unshielded twisted pair wire. Systems that require shielded wire for Notification Appliances will not be accepted.
      3) A constant voltage under both primary and secondary power conditions shall be maintained at the notification appliance field wiring terminal connections in the FACU to ensure the voltage drop on the circuit is consistent under both primary and secondary power conditions.
      4) For systems that do not provide a constant voltage source at the FACU notification appliance field wiring terminal connections, the fire alarm contractor shall:
         a) Provide separate point-to-point voltage drop calculations for all notification appliances under worst case secondary power specifications, and
         b) Perform a complete functional test of all notification appliances under worst case secondary power conditions.
   g. The FACU shall support up to (5) RS-232-C ports and one service port. All (5) RS-232 Ports shall be capable of two-way communications.
h. Remote Unit Interface: supervised serial communication channel for control and monitoring of remotely located annunciators and I/O panels.

i. Modular Network Communications Card.

8. Cabinet: Lockable steel enclosure. Arrange unit so all operations required for testing or for normal care and maintenance of the system are performed from the front of the enclosure. If more than a single unit is required to form a complete control unit, provide exactly matching modular unit enclosures.

9. Alphanumeric Display and System Controls: Panel shall include an LCD display to indicate alarm, supervisory, trouble, and component status messages and shall include a keypad for use in entering and executing control commands.

10. Distributed Module Operation: FACU shall be capable of allowing remote location of the following modules; interface of such modules shall be through a Class B (Style 4) supervised serial communications channel (SLC):
   a. Addressable Signaling Line Circuits
   b. Initiating Device Circuits
   c. Notification Appliance Circuits
   d. Auxiliary Control Circuits
   e. Graphic Annunciator LED/Switch Control Modules
      1) In systems with two or more Annunciators and/or Command Centers, each Annunciator/Command Center shall be programmable to allow multiple Annunciators/Command Centers to have equal operation priority or to allow hierarchal priority control to be assigned to individual Annunciator/Command Center locations.
   f. Amplifiers, voice and telephone control circuits

11. Voice Alarm: Provide an emergency communication system, integral with the FACU, including voice alarm system components, microphones, amplifiers, and tone generators. Features include:
   a. Amplifiers comply with UL 1711, “Amplifiers for Fire Protective Signaling Systems.” Amplifiers shall provide an onboard local mode temporal coded horn tone as a default backup tone. Test switches on the amplifier shall be provided to test and observe amplifier backup switchover. Each amplifier shall communicate to the host panel amplifier and NAC circuit voltage and current levels for display on the user interface. Each amplifier shall be capable of performing constant supervision for non-alarm audio functions such as background music and general paging.
   b. All announcements are made over dedicated, supervised communication lines.
   c. Emergency voice communication audio controller module shall provide up to 32 minutes of message memory for digitally stored messages. Provide supervised connections for master microphone and up to 5 remote microphones.
   d. When required, Redundant Voice Command Centers shall be capable of generating voice paging from more than one node in a network audio system.

12. Evacuation System - Non-Alarm Audio
   a. The fire alarm control unit shall be capable of non-alarm audio from an owner supplied paging and/or music source over the fire alarm evacuation speakers. This feature shall be an integral part of the fire alarm system, and shall use some or all of the audio
components from the fire alarm evacuation system.

b. The fire alarm system and the non-alarm audio operation shall comply with NFPA 72 requirements for non-emergency purposes at a fire command center that is not constantly attended by a trained operator.

c. All fire alarm system hardware and software shall be UL listed for non-alarm audio use. The fire alarm system shall supervise for system hardware and field wiring faults while playing non-alarm audio over the evacuation speakers. Any hardware failure or speaker circuit fault detected when the system is playing non-alarm audio shall report a trouble on the fire alarm control unit. All audio components used for both the non-alarm audio and the fire alarm evacuation system shall be manufactured by the same supplier.

d. The non-alarm audio shall have two dedicated audio inputs to the fire alarm control unit. Terminal strip connections and an industry standard RCA receptacle shall be provided at the fire alarm control unit for terminating the owner’s audio source. The fire alarm input shall be 600-Ohm impedance. The inputs on the fire alarm control unit shall be electrically isolated via an isolation transformer.

e. The fire alarm control unit shall accept industry standard “line level audio input” from the owner’s non-alarm audio source. The fire alarm system hardware and software shall distribute the audio over the fire alarm evacuation speakers. The selection of which speaker zones to distribute the non-alarm audio to the building occupants shall be coordinated with the owner’s representative.

f. The fire alarm control unit shall be able to make audio input level adjustments from the owner’s non-alarm audio source. This adjustment will match the non-alarm audio source to the fire alarm input. After the audio levels are adjusted, the owner shall control the volume level from the non-alarm audio source. If provided, this shall be included in the testing matrix to verify that low settings do not adversely affect the alarm audibility requirements.

g. The fire alarm system will provide operator “buttons” that have the capability to adjust the volume level of pre-assigned non-alarm audio zones. The volume level of non-alarm audio that is being broadcast to any audio zone will also be individually adjustable by time of day via a pre-specified schedule. If provided, this shall be included in the testing matrix to verify that low settings do not adversely affect the alarm audibility requirements.

h. The non-alarm audio shall be the lowest priority audio on the fire alarm system. The non-alarm audio shall not interfere with any of the fire alarm emergency signals that may include live voice, pre-recorded emergency voice messages, or any alert tones. Switches shall be located on the fire alarm control unit to turn on or off the non-alarm audio system feature. The fire alarm control unit shall have LED lamps to indicate the ON vs. OFF status of the non-alarm audio feature. Speaker circuits that are actively broadcasting non-alarm audio will also be indicated by LEDs.

i. The non-alarm audio shall be synchronized throughout the fire alarm life safety system amplifiers and speaker circuits. Any remote amplifier panels located on the fire alarm system network shall also be synchronized. The system shall be capable of accepting a system-wide non-alarm audio input at the main fire alarm control or another local non-alarm audio input at a remote amplifier panel to serve only the areas served by that remote panel.

j. Multiple non-alarm audio sources must be accessible by the fire alarm non-alarm audio system. Each separate non-alarm audio source will have the ability to be broadcast into a distinct fire zone, depending on occupant preference. Any system restricted to a
limited number of non-audio sources will not be accepted. The system must have the capability of broadcasting an unlimited number of non-alarm sources, except as determined by the number of individual fire zones served by the fire alarm system.

k. Non-alarm audio shall be automatically turned off in the event of primary power failure to the fire alarm control unit or any of the remote amplifier panels controlled by the main fire alarm control unit.

C. Provide power on LED, power failure LED, system trouble LED, system reset switch, alarm silence switch, trouble silence switch, manual audible and visible signal switch, alarm acknowledge switch, trouble acknowledge switch, supervisory service acknowledge switch, lamp test button, tone alert, battery supervision LED, auxiliary relays, and other system indicators and controls necessary for processing alarm and signaling functions. Indicating lamps shall be LED type.

D. Provide appropriate permanent identification of control and indicating functions.

E. Provide a dot-matrix printer type, listed and labeled as an integral part of the fire alarm system.

F. Annunciation:
   1. Serial annunciator with back lit, alphanumeric, 80-character liquid crystal display indicating clear language information as to the type of alarm (device type), point status (alarm or trouble), number of alarms on the system, and a custom location label. Ability to scroll back through prior system actions.

   2. Provide a permanent binder with typewritten, laminated inserts cross-referencing location labels to description and location of system address. Floor plans identifying device locations shall be included. This documentation shall be provided as supplemental documentation in the FCC.

2.6 FIRE ALARM REMOTE UNITS (FARU)

A. FARU’s shall be independent fire alarm systems for distributed processing and special purpose applications. Provide FARU’s for distributed processing of fire management system functions.

B. Solid state, microprocessor based, modular design, fully supervised. Steel enclosure in standard finish, with hinged, locking door. Integral power supply, standby batteries, and battery charger.

C. Provide power on LED, power failure LED, system trouble LED, system reset switch, alarm silence switch, trouble silence switch, alarm acknowledge switch, trouble acknowledge switch, supervisory service acknowledge switch, lamp test button, tone alert, battery supervision LED, auxiliary relays, and other system indicators and controls necessary for processing alarm and signaling functions. Indicating lamps shall be LED type.

D. Provide appropriate permanent identification labeling of control and indicating functions.

E. LED annunciation of alarm and supervisory zones. Provide a red (alarm) and yellow (zone trouble or supervision) light for each annunciation zone.

2.7 FIRE ALARM TERMINAL CABINETS (FATC)

A. Steel enclosure in standard finish, hinged locking door, fire-retardant plywood backboard, and coded terminal blocks.
B. Provide appropriate permanent identification labeling of control and indicating functions.

2.8 FIRE ALARM REMOTE ANNUNCIATOR (FARA)

A. Provide a remote LCD display terminal with keypad where required by BICE and SFO Fire Marshal (SFFD).

2.9 FIRE ALARM INITIATING DEVICES

A. General:
1. Addressable type.
2. Provide auxiliary relays where required to satisfy system operational requirements.
3. Smoke detectors shall be analog type.

B. Manual Pull Stations:
1. One Manual Pull Station shall be provided at each FACU / Network Node
2. High impact Lexan or die cast metal.
3. Double action, mechanically latched upon operation until key-operated manual reset. Pull station front shall be hinged to back plate assembly, requiring keyed opening to reset.
4. In accordance with the currently adopted editions of the California Building Code and Title 24, where required, pull station shall be operable with one hand and shall not require tight grasping, pinching or twisting of the wrist. Provide a more easily operated pull station lever compared to standard stations.

C. Area Smoke, Carbon Monoxide and Heat Detectors:
1. General:
   a. All devices installed during construction shall be protected as required by the currently adopted edition of NFPA 72.
   b. In areas susceptible to false alarms, CO detection accompanied with area smoke detection may/will be used to eliminate false alarms and in accordance with the currently adopted editions of the CBC and NFPA 72.
   c. Common base for detachable, low profile, photoelectric type smoke, and heat detector heads.
   d. Monitoring: FACU shall individually monitor sensors for calibration, sensitivity, and alarm condition, and shall individually adjust for sensitivity. The control unit shall determine the condition of each sensor by comparing the sensor value to the stored values.
   e. Each sensor base shall contain an LED that will flash each time it is scanned by the Control Unit (once every 4 seconds). In alarm condition, the sensor base LED shall be on steady.
   f. Each sensor base shall contain a magnetically actuated test switch to provide for easy alarm testing at the sensor location. Magnetically actuating smoke detectors for testing is not allowed. This feature is primarily utilized for maintenance staff and repairs.
   g. Each sensor shall be scanned by the Control Unit for its type identification to prevent inadvertent substitution of another sensor type. Upon detection of a “wrong device”, the control unit shall operate with the installed device at the default alarm settings for that
sensor; 2.5% obscuration for photoelectric sensor, 135 °F and 15 °F rate-of-rise for the heat sensor, but shall indicate a “Wrong Device” trouble condition.

h. Environmental Compensation: The FACU shall maintain a moving average of the sensor's smoke chamber value to automatically compensate for dust, dirt, and other conditions that could affect detection operations.

i. Programmable Sensitivity: Photoelectric Smoke Sensors shall have 7 selectable sensitivity levels ranging from 0.2% to 3.7%, programmed and monitored from the FACU.

j. Sensitivity Testing Reports: The FACU shall provide sensor reports that meet NFPA 72 calibrated test method requirements.

1) Reports shall be capable of being printed for annual recording and logging of the calibration maintenance schedule.

2) Where required, reports shall be accessible remotely through:
   a) A Fire Panel Internet Interface using Ethernet and TCP/IP communications protocol compatible with IEEE Standard 802.3. The Fire Panel Internet Interface shall be capable of automatically scheduling email reports to individual user accounts on a weekly, bi-weekly, or monthly schedule
   b) A PC Annunciator using an RS232-C connection to the FACU or a PC Annunciator Client using a TCP/IP communications protocol connection to the PC Annunciator server compatible with IEEE Standard 802.3.

k. The system shall provide a means to automatically indicate when a sensor requires cleaning. The FACU shall continuously perform an automatic self-test on each sensor that will check sensor electronics and ensure the accuracy of the values being transmitted. Any sensor that fails this test shall indicate a “SELF TEST ABNORMAL” trouble condition.

l. Multi-Sensors shall combine photoelectric smoke sensing and heat sensing technologies. An alarm shall be determined by either smoke detection, with selectable sensitivity from 0.2 to 3.7% obscuration; or heat detection, selectable as fixed temperature or fixed with selectable rate-of-rise; or based on an analysis of the combination of smoke and heat activity. Use of CO sensor can also be used in a multi-sensor application if applicable and in accordance with section 2.9 C.1.4 of this specification.

m. Programmable bases. It shall be possible to program relay and sounder bases to operate independently of their associated sensor.

n. Magnet test activation of smoke sensors shall be distinguished by its label and history log entry as being activated by a magnet.

2. Photoelectric type area smoke detector:
   a. LED light source, silicon photodiode receiving element. Line filter and time delay circuitry (positive alarm sequence) to prevent transient false alarms.
   b. 360° smoke entry, locking tamper screw, pulsating on power LED indicator, UL 268.

3. Area heat detector:
   a. 135° fixed temperature self-restoring type.
   b. Locking tamper screw, UL 521.
c. Thermal sensor shall be of the epoxy encapsulated electronic design. It shall be thermostat-based, rate-compensated, self-restoring and shall not be affected by thermal lag.

d. Sensor fixed temperature sensing shall be independent of rate-of-rise sensing and programmable to operate at 135 °F or 155 °F. Sensor rate-of-rise temperature detection shall be selectable at the FACU for either 15 °F or 20 °F per minute.

e. Sensor shall have the capability to be programmed as a utility monitoring device to monitor for temperature extremes in the range from 32 °F to 155 °F

4. Addressable CO Sensor:

a. The CO Sensor shall be an addressable carbon monoxide (CO) sensing module providing both CO toxic gas detection and enhanced fire detection, and shall be listed to UL 268, Smoke Detectors for Fire Alarm Signaling Systems and UL 2075, Gas and Vapor Detectors and Sensors; allowing systems to be listed to Standard 2034, Single and Multiple Station Carbon Monoxide Alarms. In areas susceptible to false alarms and in sleeping areas (Airport Hotel Project), CO detection accompanied with area smoke detection may/will be used to eliminate false alarms and in accordance with the currently adopted editions of the CBC, CFC and NFPA 72.

1) The CO Sensor shall include CO sensor element mounted in the sensor base which can be easily replaced without replacing the complete sensor base assembly.

2) The CO Sensor base shall provide address selection in the base allowing the address to remain with its location when the sensor is removed for service or type change.

3) The CO Sensor base shall include an integral red LED to indicate the power-on, trouble, test mode or alarm status.

4) CO sensor shall provide enhanced fire detection with the addition of two selectable modes of operation: Nuisance Alarm Reduction Mode and Faster Fire Detection.

5) The CO Sensor base shall report the following CO Sensor troubles:
   a) Communication loss
   b) Disabled
   c) Almost Expired (12 Months)
   d) Almost Expired (6 Months)
   e) Expired (End of Life)
   f) Sensor Missing/Failed.

D. Beam Detectors:

1. Separate transmitter and receiver units, UL 268.

2. Microprocessor based, temperature compensated, automatic gain control, field-adjustable beam obscuration sensitivity, adjustable optics, auxiliary contacts, tamper switch, red LED alarm indicator, and yellow LED trouble indicator.

3. Provide a remote indicator/test unit.

E. Duct Type Smoke Detectors:

1. General:
   a. Common base for detachable ionization or photoelectric type smoke detector head.
b. Duct housing with hinged door and full length sampling tube. Visible alarm LED, remote LED output, UL 268A.

c. Provide auxiliary contacts.

d. The Duct Housing shall provide a supervised relay driver circuit for driving up to 15 relays with a single “Form C” contact rated at 7A@ 28VDC or 10A@ 120VAC. This auxiliary relay output shall be fully programmable. Relay shall be mounted within 3 feet of HVAC control circuit.

e. Duct Housing shall provide a relay control trouble indicator Yellow LED.

f. Duct Housing shall have a transparent cover to monitor for the presence of smoke. Cover shall secure to housing by means of four (4) captive fastening screws.

g. Duct Housing shall provide 2 Test Ports for measuring airflow and for testing.

F. These ports will allow aerosol injection in order to test the activation of the duct smoke sensor.

a. Duct Housing shall provide a magnetic test area and Red sensor status LED.

b. For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housing front cover

2. Photoelectric type area smoke detector:

a. LED light source, silicon photodiode receiving element. Line filter to prevent transient false supervisory signals and shutdown of HVAC equipment.

3. Remote alarm indicator:

a. The remote indicators with red LED and stainless steel faceplate, where required by the AHJ, shall be installed at an approved location. Provide where initiating devices are installed in remote locations that are not visible to responding personnel.

G. Waterflow Switches:

1. Addressable transmitters/monitor modules shall be provided to interface with provided水流 switch alarm contacts.

H. Tamper Switches:

1. Addressable transmitters/monitor modules shall be provided where required to interface with contact alarm devices.

I. Addressable Transmitters/Monitor Modules:

1. Addressable transmitters/monitor modules shall be provided where required to interface with contact alarm devices.

J. Addressable Relay Modules:

1. Addressable relay modules shall be provided where required to provide audible alarm interface and/or relay control interface.

K. Addressable Transmitters/Monitor/Control Modules:

1. Addressable Dual Point Multi-state input and relay output modules shall be provided where required to interface with tri-state alarm devices.
L. Magnetic Door Holders

1. Description: Units shall be listed to UL 228. Units are equipped for wall or floor mounting as indicated and are complete with matching door plate. Unit shall operate from a 120VAC, a 24VAC or a 24VDC source, and develop a minimum of 25 lbs. holding force.


3. Shall release upon activation of local or area detection or loss of power.

2.10 EMERGENCY VOICE ALARM COMMUNICATION SYSTEM (EVAC)

A. One-way voice paging and fire alarm evacuation signal between the FCC and alarm notification appliances. Provide a distributed amplification system integrated into the FACP and FARP’s. Dual channel type to permit simultaneous paging to selected speaker zones while fire alarm evacuation signal is being transmitted to other speaker zones. The use of this feature shall be clearly identified in the sequence of operations and the integrated test plan for the fire alarm. Amplifiers and visual alarm power supplies shall be sized to support full coverage of all areas of the building plus 50% spare. Provide additional space for a minimum of 20% modular expansion of amplification capacity.

B. Selective zone paging to all or any combination of speaker zones. Automatic or manual selection of speaker zones shall activate a red LED for the activated speaker zones.

C. EVAC LED shall indicate fire alarm evacuation signal is being transmitted.

D. EVAC switch shall initiate the fire alarm evacuation signal.

E. Silence LED shall indicate alarm evacuation signal has been silenced.

F. Silence switch shall silence the fire alarm audile and visual notification signals. Time delay which allows the system to self-restore to current system condition.

G. Each speaker zone shall have a manual selection switch, red LED to indicate active zone, and yellow LED to indicate speaker zone trouble.

H. ALL-CALL switch shall activate all speaker zones.

I. Acknowledge switch, system trouble, reset, and lamp test switch.

J. Hand held microphone with push to talk switch for voice paging. The microphone shall have priority over pre-recorded messages and the fire alarm evacuation signal. The microphone shall be noise canceling type with frequency response of 200 to 4000Hz.

K. The fire alarm evacuation signal shall be an alarm tone followed by a pre-recorded message as required by the SFFD. Failure of the primary tone generator shall result in a trouble signal and automatic switchover to a backup tone generator.

L. Pre-amplifiers shall be solid state type, arranged in modular units so that failure of a primary pre-amplifier unit shall result in a trouble signal and automatic switchover to a backup preamplifier unit.

M. Amplifier modules shall be supervised such that a loss or reduction of signal shall result in a trouble condition. Amplifiers shall be rated for continuous maximum power output for 24 hours minimum. System frequency response shall be plus or minus 3db from 100Hz to 6KHz.
N. Amplifiers shall be solid state type, arranged in modular units so that failure of a primary amplifier shall result in a trouble signal and automatic switchover to a backup amplifier unit.

2.11 NOTIFICATION DEVICES

A. General:

1. Addressable type.

2. Visible notification appliances shall be White with Red Lettering.

3. Visible notification appliances shall be synchronized throughout the building. The candela rating and placement of visible notification appliances shall be in accordance with the currently adopted edition of the CFC and NFPA 72 requirements, as amended by the CFC.

4. Shall have the ability to confirm function and operation of each device from the FACP utilizing a self-test function.

5. Monitoring: The FACU shall monitor individual addressable notification appliances for status, condition, type of appliance, and configured appliance settings. A fault in any individual appliance shall automatically report a trouble condition on the FACU.

6. Individual Appliance Custom Label: Each addressable appliance shall have its own 40-character custom label to identify the location of the appliance and to aid in troubleshooting fault conditions.

7. Individual Appliance Information Display:

   a. The FACU shall be capable of calling up detailed information for each addressable appliance including the appliance location, status, condition, type of appliance, and configured appliance settings.

8. Programmable Appliance Settings:

   a. The selectable operation of each addressable notification appliance shall be capable of being configured by the FACU without having to replace or remove the appliance from the wall or ceiling.

      1) Programmable appliance settings for applicable addressable notification appliances shall include:

         a) Candela Selections:

            (1) Indoor: 15, 30, 75, 110, 135, or 185 cd (per UL1971)

            (2) UL Weatherproof: 15 or 75 cd (per UL1971), and 75 or 185 cd.

   b. Other Emergency and Non-Emergency Notification:

      1) Where required, notification appliances for purposes not related to fire alarm shall be capable of:

         a) Being connected to the same circuit as the fire alarm appliances, and

         b) Being individually configured for their intended use without requiring additional circuits or wiring.

   c. Addressable Notification Appliance Automated Self-Test:

      1) The fire alarm control unit shall be capable of performing an automated functional self-
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test of all self-test notification appliances and meet the requirements of the currently adopted edition of NFPA 72, Section for Automated Testing and the Testing Table requirements. A plan for the use of the fire alarm self-test function shall be submitted to the SFFD for review and approval prior to implementation. This test does not alleviate visual inspection requirements.

2) Test results for each self-test notification appliance shall be stored in non-volatile memory at the fire alarm control unit.

3) The fire alarm control unit shall be capable of running a functional automated test for all self-test notification appliances in a general alarm group or for all self-test appliances within a specific notification zone.

4) The duration required to complete the automated functional test for all self-test notification appliances shall be accomplished as identified in the manufacturers published instructions.

5) The automated test results for all self-test notification appliances shall be available from the fire alarm control unit as identified in the manufacturers published instructions.

6) If any notification appliance fails its automated functional self-test, an audible and visual trouble signal shall be annunciated at the fire alarm control unit.

   a) The self-test trouble signal shall be a latching trouble signal which requires manual restoration to normal.

d. Addressable Notification Appliance Reports:

1) The fire alarm control unit shall maintain configuration and test data for each self-test addressable notification appliance.

2) The fire alarm control unit shall be capable of generating configuration, self-test, and deficiency reports, that can be viewed through the fire alarm control unit user interface or printed via the fire alarm control panel service port.

   a) At minimum, the configuration report shall include the following information applicable for each addressable notification appliance:

      (1) Point ID
      (2) Custom Label
      (3) Device Type
      (4) Candela Setting

   b) At minimum, the self-test report shall include the following information applicable for each self-test notification appliance:

      (1) Point ID
      (2) Custom Label
      (3) Time and Date of last test
      (4) Pass / Fail results of last visual test
      (5) Pass / Fail results of last audible test

   c) The fire alarm control unit shall also be capable of providing a deficiency report that includes a list of all self-test notification appliances that have failed self-test.

B. Addressable Speakers:

1. Flush ceiling or wall mounted as shown on Drawings, 4” cone, perforated faceplate in baked
white enamel finish, fire retardant, moisture resistant, frequency response 400 Hz to 4000 Hz, taps at 0.25, 0.5, 1 and 2 watts, UL 1480.

2. Addressable speaker: Speaker notification appliances shall be listed to UL 1480.

3. The speaker shall operate on a standard 25VRMS or 70.7VRMS NAC using twisted/shielded wire.

4. The following taps are available: 0.25W, 0.50W, 1.0W and 2.0W. At the 1.0W tap, the speaker has minimum UL rated sound pressure level of 84dBA at 10'.

5. The speaker shall have a frequency response of 400 to 4000 Hz for Fire Alarm and 125 to 12 kHz for general signaling.

6. Intelligibility shall be verified using listed testing instruments and in accordance with the currently adopted edition of NFPA 72 Annex D.

C. Addressable Visual Alarm:

1. Flush wall mounted, high intensity strobe, vertical orientation with red vertical lettering FIRE, white faceplate, ADA, UL 464.

2. Visible/Only: Addressable strobe shall be listed to UL 1971. The V/O device shall consist of a xenon flash tube and associated lens/reflector system, cover and mounting plate. For ease of installation the mounting plate shall mount directly to standard single gang, double gang or 4’ square electrical box, without the use of special adapters or trim rings. When the appliance is connected to an active circuit, the front cover of the appliance shall be removable without causing a trouble indication on the fire alarm control unit. Appliances shall be wired with UTP conductors, having a minimum of 3 twists per foot. The V/O appliance shall be provided with multiple minimum flash intensities of 15cd, 75cd, 110cd, 135cd and 185cd. The Candela levels shall be settable from the fire alarm control unit or by using a hardware selector on the appliance.

D. Combination Addressable Speaker/Visual Alarm:

1. Flush wall mounted or Ceiling mounted type.

2. 4” cone speaker, perforated faceplate in baked white enamel finish, fire retardant, moisture resistant, frequency response 400Hz to 4000Hz, taps at ¼, ½, 1, and 2 watts, UL 1480.

3. High intensity strobe, vertical orientation with red vertical lettering FIRE, ADA, UL 464.

E. Provide interconnection to the public address system to enhance the required intelligibility throughout. Provide all required override connections to override the public address system upon fire alarm activation, together with all required emergency power connections for new and existing equipment.

F. Emergency responder radio coverage shall be tested in accordance with the currently adopted edition of the CFC Section that addresses Emergency Responder Radio Coverage. (New buildings)

G. Network Synchronization of Notification Appliances

1. The fire alarm and emergency communications network shall be capable of providing UL Listed synchronization across all the notification appliance circuits for all panels on a network loop in accordance with the requirements of UL 1971.

2. Systems that require all notification appliances to be connected to a single panel for
synchronization thus creating a potential single point of failure are not acceptable.

3. Up to 99 panels on a network loop shall be capable of UL Listed synchronization of all notification appliance circuits across the network loop in accordance with the requirements of UL 1971.

4. Should network communications be disrupted, re-synchronization shall occur across all nodes that continue to communicate together after network re-initialization is completed and restored to affected nodes.

H. Network Communication:

1. Network node communication shall be through a token ring topology configuration, or combination thereof.

2. A single open, ground or short on the network communication loop shall not degrade network communications. Token shall be passed in opposite direction to maintain communications throughout all network nodes. At the same time the status of the communication link shall be reported.

3. If a group of nodes becomes isolated from the rest of the network due to multiple fault conditions, that group shall automatically form a sub-network with all common interaction of monitoring and control remaining intact. The network shall be notified with the exact details of the lost communications.

4. Fiber optics communication shall be provided as an option via a fiber optics modem. Modem shall multiplex audio signals and digital communication via full duplex transmission over a single fiber optic cable, either single mode or multi-mode.

5. The communication method shall be NFPA 72 Class X.

2.12 TRUESITE GRAPHICAL WORKSTATION (TSW)

A. The Graphical Workstations are existing and shall be updated to incorporate any and all changes to the existing fire alarm system:

1. Programming and point lists with descriptions shall be updated to reflect or incorporate new work.

2. As-built condition of graphics shall be provided to update existing TSW and SFO Tech Shop record drawings.
   a. AutoCAD File Import shall support importing of DWG files up to compatible AutoCAD Versions.
   b. AutoCAD File Export shall support DWG/DXF file export in Airport compatible AutoCAD format.

3. Graphic files shall be capable of being modified in the graphical workstation editor or exported back to AutoCAD file formats where files can be edited in AutoCAD and re-imported for system changes and upgrades.

4. Remote Ethernet Client Support: The Graphical Workstation server shall be capable of supporting up to 20 Simultaneous Remote Client Connections over Ethernet. When the maximum simultaneous client connections have been reached a notice shall be communicated to any additional client connection attempts indicating the connection capacity limit has been reached.
a. Remote Clients shall be configurable for “Restricted Feature” view only or for “Protected Feature” full control operation.

b. Each Remote Client shall be configurable for Supervised or Unsupervised operation. Loss of communication with a supervised client shall be indicated at both the server and the remote supervised client. Loss of communication to an unsupervised client shall be indicated at the remote client only.

c. Remote Client operation shall be independent of the server whereas an operator at the remote client location shall be able to view graphics and text and control the system, independent of the server.

d. It shall be possible to vector information to Remote Supervised Clients by selecting which points and/or event categories (Alarm, Priority 2, Supervisory, Trouble) are to be displayed at each Remote Supervised Client.

e. A minimum 3 Mb/s connection speed shall be provided to Remote Clients

f. Logins/Logouts at Remote Clients shall be logged in the Historical Log. Supervised Clients shall be specified by client name.

g. The Graphical Workstation server shall be capable of supporting both Agency Listed Fire Alarm Ethernet LAN Applications and Supplemental Annunciation over the Customer’s Ethernet LAN/WAN. Where a Fire Alarm Ethernet LAN is specified only Agency Listed Ethernet hardware shall be installed.

5. Email Support. The graphical workstation shall have the ability to transmit email notifications when events occur on the graphical workstation.

a. Up to 50 user email accounts shall be supported.

b. Each email user account shall be configurable to receive one or more types of events (Fire, Priority 2, Supervisory, and/or Trouble).

c. The email content shall be selectable to include or exclude pre-defined message content allowing the size and content of the email message to be managed.

PART 3 – EXECUTION

3.1 GENERAL

A. All equipment shall be installed and connected in accordance with the manufacturer’s recommendations.

B. Wiring shall be color coded, and in accordance with the manufacturer’s recommendations, NEC, and SFO Tech Shop requirements. Install wiring in an independent, dedicated metallic raceway system.

C. All fire alarm system raceways that are 0.75” or 1” in size shall be solid metallic red conduit. Conduits larger than 1” in size can be solid red conduit or be labeled in accordance with 1.8B.

D. Separate circuits shall be provided for Class B; Initiating Circuits, Notification Circuits and Suppression/Releasing Circuits. Pursuant to NFPA 72, these fire alarm circuits shall be permitted within the same fire alarm raceway.

E. Fire alarm junction boxes or terminal cans to be painted red or be labeled “FIRE ALARM.”

F. Connections to devices attached to accessible ceiling tiles and grids may be flexible metal
conduit where permitted by SFO.

G. Provide appropriately sized back boxes for surface-mounted fire alarm notification appliances, paint to match device faceplate color. Stacked or punch pressed steel type back boxes are not permitted.

H. Exterior conduits and boxes shall be water-tight.

I. Provide water-tight type back boxes where installed recessed flush in perimeter walls below grade.

J. Provide wire ways above and/or below equipment cabinets to accommodate large concentrations of wiring. Conductors within equipment cabinets shall be carefully formed and harnessed.

K. Connect equipment to emergency power system.

L. Provide power supply wiring to electric damper actuators used for smoke control that are not controlled by the temperature control system.

M. FSCP and smoke control sequence wiring shall be dedicated and independent from other systems.

N. Area- and duct-type smoke detectors shall be photoelectric type, unless otherwise noted.

O. Provide a 1" empty conduit from the FACU to the nearest telecom terminal backboard.

3.2 DEVICE WIRING

A. All conductors shall be 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. Color coding shall be as follows:

B. Fire Alarm Notification conductor colors shall be provided as follows:
   1. Non-Addressable Strobes: #12 Stranded, Blue (+) and White (-)
   2. Non-Addressable Speaker: #16 Solid, Red (+) and Black (-)
   3. Addressable Strobes: #12 Stranded, Orange (+) and Yellow (-)
   4. Addressable Speaker: #16 Solid, Red (+) and Black (-)

C. Fire Alarm Initiating conductor colors shall be provided as follows:
   1. Non-Addressable: #12 Stranded, Red (+) and Black (-)
   2. Addressable: #16 Solid TSP, Red (+) and Black (-)
   3. Fire Alarm 24VDC: #14 Stranded, Red (+) and Black (-)
   4. Releasing: #14 Stranded, Pink (+) and Purple (-)

D. Conductors shall be rated for installation condition or environment. Exterior or underground conductors shall be rated for exterior or burial installation.

E. Conductor sizes shown are SFO minimum requirements.

3.3 DEVICE MOUNTING

A. Unless otherwise noted on the Drawings, plans, specifications, manufacturer’s recommendations, by BICE or SFO Fire Marshal (SFFD), the recommended mounting heights and requirements are as follows:
1. **Control Panel:**
   a. Fire Alarm control unit and remote units and their components shall be mounted so that no part of the enclosing cabinet is less than 12 inches or more than 78 inches above the finished floor. All manually operable controls shall be at least three feet and less than five feet above the finished floor. Panel shall be installed to comply with the requirements of UL 864. The LCD display for the control panel shall be mounted at centerline 5’6” above the finished floor.

2. **Detectors:**
   a. All devices installed during construction shall be protected as required by the currently adopted edition of NFPA 72 as amended by the CFC.
   b. Detectors shall be installed and spaced in accordance with the currently adopted edition of NFPA 72 as amended by the CFC.

3. **Visual Notification Appliances:**
   a. Visual notification appliances shall be installed and spaced in accordance with the currently adopted edition of NFPA 72 as amended by the CFC.

4. **Audible Signal Appliances:**
   a. Audible notification appliances shall be installed and spaced in accordance with the currently adopted edition of NFPA 72 as amended by the CFC.

5. **Combination Audible and Visual Appliances:**
   a. The location of audible/visual signal appliances shall comply with visual signal appliance mounting requirements.
   b. Ceiling-mounted appliances shall be in accordance with the requirements of the currently adopted edition of NFPA 72 as amended by the CFC.

6. **End of Line (EOL) Resistors** shall be mounted in accessible areas. Mounting of EOL resistors in tenant spaces not accessible to the landlord will not be allowed.

7. **Duct-mounted smoke detectors** shall be provided where indicated on the supply and return side of all air-handling systems with CFM rating greater than 2000 CFM and will provide automatic shut off of air-handling units in accordance with the currently adopted edition of the CMC. Simultaneous shut down of multiple small units serving the same enclosed space within the building whose cumulative CFM exceeds 2,000 CFM will be required.

8. Only designated speakers, strobes, and telephones shall be surface mounted. All surface-mounted devices shall be smooth sided, without knockouts and painted red. Use of standard electrical boxes for surface-mounted equipment is prohibited.

9. **Point-addressable monitor modules and control modules** shall be securely mounted in back boxes or mounted on rails within a larger enclosure. The use of wire nuts to make connections to these modules is strictly prohibited.

10. All panels visible to the public or noted on the Drawings shall be finished as directed by the Architect.

**B. Device Spacing:**

1. Speakers shall meet BICE and SFFD intelligibility requirements and testing in accordance with the currently adopted edition of NFPA 72 Annex D.

2. Acoustically Distinguishable Spaces (ADS) shall be clearly identified on the plans including...
testing parameters.

3. Corridor strobes shall be spaced not greater than 100 feet on center and no more than 15 feet from each end of the corridor in accordance with the currently adopted edition of NFPA 72 as amended by the CFC.

4. Spot type smoke detectors installed in rooms shall be spaced not greater than 15’ from a wall and not greater than 30’ on center. Corridor smoke detectors spacing shall be no greater than that shown in the currently adopted edition of NFPA 72 as amended by the CFC.

5. Beam detectors shall be spaced in accordance with manufacturer’s installation instructions.

3.4 TEST/FIELD QUALITY CONTROL

A. Quality control shall be in concurrence with commissioning under the Airport’s Master Test Plan (MTP). See Appendix C and D for more information.

B. A complete pre-test shall be performed by the installing contractors before the final test. This test will take place in the presence of the Owner’s Representative to ensure the fire alarm system is operating properly. An NFPA 72, Fire Alarm System Record of Completion indicating the fire alarm system and all functions related to the fire alarm system have been tested and work properly shall be issued to the Owner and the Owner’s Representative before scheduling a final test with BICE and SFO Fire Marshal.

C. Installer Qualifications: A factory authorized installer is to perform the work of this section.

D. Each and every item of the Fire Alarm System shall be listed under the appropriate category by Underwriters Laboratories, Inc. (UL), and shall bear the “UL” label as well as California State Fire Marshal Listing (CSFM).

E. The final alarm acceptance test shall be coordinated with the Owner’s Representative, BICE Inspectors and the SFO Fire Marshal. The entire fire alarm system shall be pretested and all deficiencies corrected and retested prior to scheduling the final test with BICE Inspectors and the SFFD. A letter certifying that the installation is complete and fully operational shall be forwarded to the Owner’s Representative.

F. During execution of the MTP, the Contractor shall submit the completed NFPA 72 Fire Alarm System Record of Completion, conditional to the final acceptance of the project. The Fire Alarm System Record of Completion shall be signed by a factory-certified technician, certifying that the fire alarm system has been installed, tested and will function in accordance with the manufacturer’s specifications and the currently adopted edition of NFPA 72 requirements. The installing contractor shall also issue a letter to the Owner’s Representative indicating the fire alarm system has been installed, tested and is operating in accordance with the design drawings and specifications.

3.5 EXTRA MATERIALS

A. General: Furnish extra materials, packaged with protective covering for storage, and identified with labels clearly describing contents as follows:

1. Manual Stations: Furnish quantity equal to 5% of the number of manual stations installed; not less than one of each type.

2. Notification Appliances: Furnish quantity equal to 10% of each type and number of units installed, but not less than one of each type.
3. Smoke Detectors or Sensors, Fire Detectors, and Flame Detectors: Furnish quantity equal to 10 percent of each type and number of units installed but not less than one of each type.

4. Detectors or Sensor Bases: Furnish quantity equal to 5 percent of each type and number of units installed but not less than one of each type.

5. Addressable Relays and Monitor Modules: Furnish quantity equal to 10 percent of each type and number of units installed but not less than one of each type.

6. SDI Solo Smoke Detector Test Kit shall be provided to SFO Tech Shop for ongoing Airport performed testing.

3.6 PROJECT TESTING & INSPECTION AGREEMENT

A. General Description:

1. Periodic Inspections and testing are conducted to assure that obvious damages or changes that might affect the system’s operability will be visually identified and to statistically assure operational reliability of all fire protection and life safety systems are maintained in accordance to all Local, State, and National Standards/Requirements.

2. Three (3) year testing contract shall be included. (New Systems ONLY)

   a. Fire alarm testing shall commence one year after final acceptance test by BICE and SFO Fire Marshal (SFFD).

   b. Electronic semi-annual testing of water flow alarm devises and valve supervisory alarm devices shall commence 6 months after final acceptance test by BICE and SFO Fire Marshal (SFFD).

   c. Quarterly sprinkler system inspections shall begin 3 months after final acceptance test by BICE and SFO Fire Marshal (SFFD).

3. All testing shall be conducted by appropriately licensed Contractors.

B. Fire Alarm

1. Testing shall be in accordance with the currently adopted edition of NFPA 72 and per equipment manufacturers published instructions.

   a. Control Panel: Annually

      1) Control equipment shall be tested to verify correct receipt of alarm, supervisory, and trouble signals (inputs), operation of evacuation signals and auxiliary functions (outputs), circuit supervision including detection of open circuits and ground faults, and power supply supervision for detection of loss of AC power and disconnection of back up batteries.

   b. Annunciator: Annually

      1) The correct operation and identification of information relayed from fire alarm control panel to annunciators shall be verified. If provided the correct operation shall be verified.

   c. Batteries: Annually and Semi-Annually

      1) Semi-Annually - Batteries shall be tested to verify the battery performs under load, in accordance with the battery manufacturer’s specifications. Verify the voltage does not fall below the levels specified.
2) Annually – in accordance with NFPA 72 Table 14.4.3.2 section 9(c)(1,2,3); Battery Replacement: Conduct charger test, and discharge test

d. Smoke Detector: Annually / Biennially / Semiannually

1) The detectors shall be tested in place to ensure smoke entry into the sensing chamber and an alarm response. The test will be performed with a listed aerosol approved fake smoke and once it is tested, the detector will report back to the panel initiating an alarm.

2) The smoke detector also needs to have sensitivity testing performed on a biennial frequency.

e. Duct Detector: Annually

1) Tested and inspected to ensure that the device will sample the airstream. The detector alarm response shall be verified through the end sampling port on each pipe run and; air flow through other pipes, where provided, shall be verified as well.

f. Smoke Beam Detector: Annually

1) The detector shall be tested as identified in the manufacturers published instructions. These instructions should provide a procedure that simulates the presence of smoke.

g. Heat Detector: Annually

1) Remote heat test shall be performed with a heat source listed, labeled and tested in accordance with the manufacturers published instructions.

h. Flame Detectors

1) The test plan for the testing of flame detectors shall be submitted to the AHJ for review and approval.

i. Manual fire alarm boxes: Annually

1) To be tested and inspected to make sure that they are communicating with the fire alarm panel. They will be physically pulled and tested during a test.

j. Audible & Visual Notification: Annually

1) Sound pressure level shall be measured as well as making sure that each audible and visual device is initiating a flash or sound.

k. Fire Sprinkler Water Flow Switch: Semi-Annually

1) Switch shall be operated. The inspectors test valve will be opened, which will allow water to flow through the sprinkler system. The flow of water will activate the flow switch within 30 to 90 seconds, activating the alarm.

l. Fire Sprinkler Control Valve Tamper Switch: Semi-Annually

1) Operate sprinkler control valve so that the supervisory switch shall create a distinctive signal indicating movement from the valves normal position during either the first two revolutions of the hand wheel or when the stem of the valve has moved one fifth of the distance from its normal position.

C. Wet Pipe Sprinkler System

1. Inspections and Testing shall be in accordance with current California Amended Edition of NFPA 25
a. Summary of Requirements and Frequencies as follows: Reference Table 5.1.1.2 NFPA 25 CA Edition

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Table 5.1.1.2
Summary of Sprinkler System Inspection, Testing, and Maintenance
Sprinklers
At 75 years and every 5 years thereafter
5.3.1.1.1.5

Sprinklers – dry
At 10 years and every 10 years thereafter
5.3.1.1.1.6

Maintenance

Valves (all types)
Varies on Type
Table 13.1.1.2

Low-point drains (dry-pipe system)

Sprinklers and automatic spray nozzles protecting commercial cooking equipment and ventilation systems
5.4.1.9

Investigation

Obstruction
14.3

### Additional Requirements:

1. All systems shall be properly tagged, at the conclusion of each inspection, with approved tags noting the date and technician performing the inspection.
2. Inspection reports shall be filled out and shall indicate the condition of the system, at the time of the inspection and shall include all pertinent test data.
3. All inspections and tests shall be performed by properly trained and experienced fire protection technicians.

### D. Standpipe System & Fire Hose Equipment:

1. Inspections and Testing shall be in accordance with current California Amended Edition of NFPA 25 2011.
   
   a. Summary of Requirements and frequencies as follows: Reference Table 6.1.1.2 NFPA 25 CA Edition

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<td>6.2.2</td>
</tr>
<tr>
<td>Hose</td>
<td>Annually</td>
<td>NFPA 1962</td>
</tr>
<tr>
<td>Hose storage device</td>
<td>5 years</td>
<td>NFPA 1962</td>
</tr>
<tr>
<td>Hose Nozzle</td>
<td>Annually after each use</td>
<td>NFPA 1962</td>
</tr>
<tr>
<td>Hydraulic design information sign</td>
<td>Annually</td>
<td>6.2.3</td>
</tr>
<tr>
<td>Test</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table 13.1.1.2

<table>
<thead>
<tr>
<th>Supervisory Signal Devices (except valve supervisory switches)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Valve supervisory devices</td>
<td>Table 13.1.1.2</td>
</tr>
<tr>
<td>Supervisory signal devices</td>
<td>Table 13.1.1.2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Frequency</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hose storage device</td>
<td>5 years</td>
<td>NFPA 1962</td>
</tr>
<tr>
<td>Hose</td>
<td>5 years/3 years</td>
<td>NFPA 1962</td>
</tr>
<tr>
<td>Pressure control valve</td>
<td></td>
<td>Table 13.1.1.2</td>
</tr>
<tr>
<td>Pressure Reducing valve</td>
<td></td>
<td>Table 13.1.1.2</td>
</tr>
<tr>
<td>Hydrostatic test</td>
<td>5 years</td>
<td>6.3.2</td>
</tr>
<tr>
<td>Flow test</td>
<td>5 years</td>
<td>6.3.1</td>
</tr>
<tr>
<td>Main Drains</td>
<td>Annually</td>
<td>13.1.1.2</td>
</tr>
<tr>
<td>Maintenance</td>
<td></td>
<td>Table 6.1.2</td>
</tr>
<tr>
<td>Valve (all types)</td>
<td>Annually/ as needed</td>
<td>Table 13.1.1.2</td>
</tr>
</tbody>
</table>

b. Additional Requirements:

1. All systems shall be properly tagged, at the conclusion of each inspection, with approved tags noting the date and technician performing the inspection.

2. Inspection reports shall be filled out and shall indicate the condition of the system, at the time of the inspection and shall include all pertinent test data.

3. All inspections and tests shall be performed by properly trained and experienced fire protection technicians

### E. Fire Pump Systems

1. Inspections and Testing shall be in accordance with current California Amended Edition of NFPA 25

a. Summary of Requirements and frequencies as follows: Reference Table 8.1.1.2 NFPA 25 2016 California Edition.

<table>
<thead>
<tr>
<th>Item</th>
<th>Frequency</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pump Operation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>With No Flow Condition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diesel engine driven fire pumps</td>
<td>Weekly</td>
<td>8.3.1</td>
</tr>
<tr>
<td>Electric motor driven fire pumps</td>
<td>Monthly</td>
<td></td>
</tr>
<tr>
<td>With Flow Condition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diesel engine driven fire pumps</td>
<td>Annual</td>
<td>8.3.3</td>
</tr>
<tr>
<td>Electric motor driven fire pumps</td>
<td>Annual</td>
<td></td>
</tr>
</tbody>
</table>
### Fire Pump alarm signals

<table>
<thead>
<tr>
<th>Maintenance</th>
<th>Annual</th>
<th>8.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydraulic</td>
<td>Annually</td>
<td></td>
</tr>
<tr>
<td>Mechanical transmission</td>
<td>Annually</td>
<td></td>
</tr>
<tr>
<td>Electrical system</td>
<td>Varies</td>
<td>8.5</td>
</tr>
<tr>
<td>Controller, various components</td>
<td>Varies</td>
<td>8.5</td>
</tr>
<tr>
<td>Motor</td>
<td>Annually</td>
<td></td>
</tr>
<tr>
<td>Diesel engine system, various components</td>
<td>Varies</td>
<td>8.5</td>
</tr>
</tbody>
</table>

b. Additional requirements: to be performed Annually

1) Perform a thorough visual inspection of all fire pump components and piping. Check all water control valves to see that they are in the proper open or closed position.

2) Check the fire and jockey pump controllers to see that operating power is available. Check and record the existing static water supply pressures.

3) Check the fire and jockey pump for automatic start by dropping the sensing line pressure at controller test cock. Record the start pressures of both pumps and start test again by dropping the fire pump controller for proper timer operation.

4) The relief valves, packing, bearing, and shaft rotation shall be checked during the operational testing and sequencing of the pumps.

5) Test all associated alarms for proper operation, including pump operating alarms and power loss alarms. Tamper switches shall be tested for proper supervisory signal. The test header ball drip shall be cleaned as needed, and checked for proper operation.

6) In addition to the above, the fire pump shall be flow tested to determine its ability to attain satisfactory performance at peak loads, as per its rated specifications, and in accordance with California Title #19.

7) All pump control valves shall be cleaned, lubricated and fully operated. All pressure gauges will be checked for accuracy.

c. Additional requirements: to be performed at three year intervals:

1) Fire pump flow test shall be performed with water discharging to atmosphere. A fire pump capacity test report shall be completed with a graph outlining fire pump performance.

d. Additional Requirements:

1) All systems shall be properly tagged, at the conclusion of each inspection, with approved tags noting the date and technician performing the inspection.

### F. Fire Extinguisher Inspection:

1. Testing shall be in accordance with the currently adopted editions of the CFC Section 906 & CCR Title 19

a. Accessible Extinguishers: Annually

1) A trained technician shall perform inspections and diagnostic tests for all portable fire
extinguishers.

2) A trained and certified person who has undergone the instructions necessary to reliably perform maintenance and has manufacturer's service manual shall service fire extinguishers not more than 1 year apart adhering to standards set in CFC Section 906 & CCR Title 19

b. Additional Specifications

1) Any discrepancies found are to be noted.

2) Certain additional services may be required by the SFO Fire Marshal (SFFD). The SFO Fire Marshal or internal organizational requirements may be more restrictive than state/provincial requirements. Building owners and managers should make themselves aware of applicable codes and references in order to ensure that contracted Services fulfill requirements.

G. Clean Agent Systems (Special Hazard Systems):

1. Testing shall be in accordance with current CCR Title 19 & NFPA 2001 and shall be performed by appropriately licensed Contractors. **Discharge tests shall not be required.**

a. FM200: Semi-Annual

1) Make a thorough visual inspection of the piping system and discharge nozzle connections to insure they are secured to all brackets, hangers and discharge manifold connections. Inspect nozzles to ensure that the orifices are clear and unobstructed.

2) Check for proper position and alignment with hazard area. Inspect hazard area and system for operation instructions and warning signs.

3) All control panels shall be functionally tested for proper operation, including circuitry trouble signaling, alarm signaling and remote signaling.

4) Inspect cylinders, cylinder straps and outlet fittings connected to the discharge manifold for tightness and secure bracing.

5) Agent cylinders shall be checked for proper quantity of agent as well as storage pressure. The date of the last hydrostatic test of agent cylinders shall be recorded.

6) System shall be placed back into service upon completion of testing and verification of conditions ready to reset system.

b. FM200: Annual

1) All auxiliary contact operated devices, such as door holders, equipment shut down, and smoke exhaust systems shall be tested and operation verified. EPO shutdown shall be bypassed. Ventilation shut down shall be tested, and then bypassed upon verification of operation for duration of remaining testing.

2) Test control panel for ground fault detection. Test control panel to ensure alarm initiation overrides trouble conditions. The backup power supply to the panel shall be tested and the panel tested for automatic switch over and trouble signaling.

3) Test electrically, and mechanically operated releases, both local and remote, shall be functionally tested for proper operation.

4) Manual releases shall be checked to insure they are visible and properly identified. Test all heat/smoke detection devices for proper operation.
5) Test pre-discharge alarms, discharge alarms, timers, and releasing circuits for proper operation.

6) Test all audible and visual alarm indicators for proper operation. Remote annunciators (if applicable) shall be tested for proper signaling and zone identification.

7) Enclosure protected by the clean agent system shall be thoroughly inspected to determine if penetrations have occurred that could lead to agent leakage. Any conditions that are found which could result in the inability of the enclosure to maintain the clean agent concentration shall be corrected, up to and including retest of the enclosure.

H. Kitchen Hood System Inspection:

1. Testing shall be in accordance with the currently adopted editions of NFPA, CCR Title 19 and CFC Section 904.11.6.

   a. Semi-Annually (at least):

      1) Trained technicians will perform inspections and diagnostic tests for the kitchen fire suppression devices currently connected to kitchen fire suppression system and replace fusible links.

      2) Components and devices logged for:

          a) Location of each device tested, including system address or zone location

          b) Test results and applicable voltage readings

          c) Required device tags

          d) Any discrepancies found noted

          e) Inspection documentation to be provided

3.7 TRAINING

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

B. Train Owner’s maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventive maintenance of the system. Provide a minimum of 8 hours’ training for a total of two sessions.

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

D. Training shall also be provided for SFO emergency responders (SFFD) on basic operation and function of the Fire Alarm System and New FACU. A minimum of 2 hours for a total of 3 sessions.

END OF SECTION 28 31 00
## APPENDIX A – SFO FIRE ALARM NODE BREAKDOWN

### SFO FIRE ALARM NODE BREAKDOWN

As of December 2014

<table>
<thead>
<tr>
<th>BAA</th>
<th>N55-N56-N57</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAG</td>
<td>N64-N68-N69</td>
</tr>
<tr>
<td>T1</td>
<td>N5 &amp; N8 &amp; N14-N15 &amp; N18 &amp; N20-N21</td>
</tr>
<tr>
<td>T2</td>
<td>N60-N61-N62 &amp; N66</td>
</tr>
<tr>
<td>T3</td>
<td>N64 &amp; N65</td>
</tr>
<tr>
<td>BARB</td>
<td>N60-N61-N62-N63 &amp; N64</td>
</tr>
<tr>
<td>BAC</td>
<td>N7 &amp; N9 &amp; N13</td>
</tr>
<tr>
<td>BAD</td>
<td>N36</td>
</tr>
<tr>
<td>BAE</td>
<td>N23 &amp; N37</td>
</tr>
<tr>
<td>BAF</td>
<td>N26 &amp; N27 &amp; N38</td>
</tr>
</tbody>
</table>

| PARKING GARAGE | N22 |
| GARE 'A' | N54 |
| GARE 'G' | N50 |
| RENTAL CAR | N52 |
| BART STN / CONCOURSE | N53 |
| PERIMETER BLDGS | N3 |
| ELEVATORS | N4 |
| T5W | N1 & N33 & N39 & N51 |
APPENDIX B – SFO FIBER-OPTIC CABLE CHARACTERISTICS AND REQUIREMENTS

FIBER OPTIC CABLE CHARACTERISTICS

1.1 This section refers only to the fiber limitations of the fiber media modules that attach to a network interface card.

A. All fiber cables shall be multimode, graded index. ST style connectors must be used.

B. No physical strain shall be put on the cables.

C. There must be no cable bends of less than a 2” radius.

D. The fiber backbone must comply with, at a minimum, ANSI/TIA/EIA 568-B-3 industry standards.

E. Two methods are available for joining fiber cable. Both methods are allowed on a fiber 4120 Network:
   1. Splices provide a permanent, very low loss, fiber-to-fiber connection and should only be performed by experienced personnel.
   2. Couplers provide temporary connection between two ST style connectors with a loss of 1.2 dB.

F. The characteristics of the 4100-0143 or 4100-6057 fiber optic media card are as follows.
   1. Maximum attenuation (inclusive of all cabling losses, connector losses, splice losses, and safety margin):
      a. 50/125 cable is 17 dB
      b. 62.5/125 cable is 20.4 dB

1.2 Maximum line lengths for 50/125 and 62.5/125 cable with 2 different specified losses per kilometer are shown in the table below.

<table>
<thead>
<tr>
<th>Fiber Cable</th>
<th>Loss Per Kilometer</th>
<th>Power Margin</th>
<th>Maximum distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>50/125 Fiber</td>
<td>4 db</td>
<td>4 db</td>
<td>10,000 feet</td>
</tr>
<tr>
<td>50/125 Fiber</td>
<td>3 db</td>
<td>3 db</td>
<td>15,000 feet</td>
</tr>
<tr>
<td>62.5/125 Fiber</td>
<td>4 db</td>
<td>4 db</td>
<td>13,000 feet</td>
</tr>
<tr>
<td>62.5/125 Fiber</td>
<td>3.75 db</td>
<td>3 db</td>
<td>15,000 feet</td>
</tr>
</tbody>
</table>

All the information above is based on the minimum launch power of the transmitter into the specified cable and the maximum value of the minimum input sensitivity of the receiver. For a complete list of fiber cables and their transmission distances, refer to the “Fiber Optic System Tutorial and Installation Recommendations” document.

FIBER OPTIC CABLE REQUIREMENTS

The fiber optic cabling must be compliant with TIA-EIA-568-B. Note that this standard defines “outside plant” as “Telecommunications infrastructure designed for installation exterior to buildings.”

The outside plant fiber must comply with ANSI/ICEA S-87-640, and inside plant fiber must comply with ANSI/ICEA S-83-596. Additionally, it must meet the specifications in the following table for attenuation and bandwidth for the
given fiber type and wavelength.

<table>
<thead>
<tr>
<th>Optical Fiber Cable Type</th>
<th>Wavelength (nm)</th>
<th>Maximum Attenuation (dB/km)</th>
<th>Minimum Bandwidth Capacity for Overfilled Launch</th>
</tr>
</thead>
<tbody>
<tr>
<td>50/125 µm Multimode</td>
<td>850</td>
<td>3.5</td>
<td>500</td>
</tr>
<tr>
<td>62.5/125 µm Multimode</td>
<td>850</td>
<td>3.5</td>
<td>160</td>
</tr>
</tbody>
</table>

The fiber must be either 50/125 µm or 62.5/125 µm graded-index multimode fiber. Individual fibers and groups of fibers must be identifiable in accordance with ANSI/TIA/EIA-598-A. The cable must be listed and marked as required under the applicable electrical code and local building code requirements.
APPENDIX D – SAMPLE FIRE ALARM DEVICE TYPE TESTING

Below are procedures and descriptions on how each device type shall be tested during the system test. Devices to be tested are listed in the Project Master Testing Plan Form/Checklist. All testing shall comply with the requirements of the currently adopted edition of the CFC and all applicable NFPA Standards.

SMOKE DETECTOR:
The detectors shall be tested in place to ensure smoke entry into the sensing chamber and an alarm response, or in accordance with the manufacturer’s published instructions. The test will be performed with a listed aerosol approved “fake” smoke and once it is tested, the detector will report back to the TSW and Graphic representation shall be confirmed.

HEAT DETECTORS:
Heat test shall be performed with a listed and labeled heat source. The heat source is placed up to the heat detector and the heat detector will then activate. The heat detector will report back to the TSW and Graphic representation shall be confirmed.

PULL STATIONS:
Device shall be pulled and pull station shall report back to the TSW and Graphic representation shall be confirmed.

AUDIBLE/VISUALS:
Device shall be manually activated and confirmation that each device is initiating a flash and/or sound.

WATER FLOW SWITCH:
Switch shall be manually operated. Water Flow shall report back to the TSW and Graphic representation shall be confirmed.

TAMPER SWITCH:
The valve tamper shall be tested by turning the valve handle as identified in Section 3.5, B, 1 l above. Tamper Switch shall report back to the TSW and Graphic representation shall be confirmed.

DUCT DETECTOR:
The detectors shall be tested in place; “fake” smoke is placed in the chamber and tested utilizing the duct detectors test port. When the smoke enters the chamber, the duct detector shall send a signal to the TSW and Graphic representation shall be confirmed. Pressure differential testing of the sampling tubes shall be conducted in accordance with the currently adopted edition of NFPA 72.
# APPENDIX E – SAMPLE FIRE ALARM TESTING CHECKLIST

## Fire Alarm Testing Sequence / Overview

<table>
<thead>
<tr>
<th>Date Scheduled</th>
<th>ATCT - System &amp; Devices by Area</th>
<th>Testing/Inspection Requirements</th>
<th>Testing &amp; Inspection details/Status</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>x-Required</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Fire Command Center - Inspections

<table>
<thead>
<tr>
<th>Date</th>
<th>Task Description</th>
<th>Pass Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>5/4/2015</td>
<td>Visually inspect Fire Alarm Panel, validate panel for functionality and battery dates</td>
<td>N/A</td>
</tr>
<tr>
<td>5/4/2015</td>
<td>Test ground fault condition, demonstrate ground fault condition and validate trouble</td>
<td>N/A</td>
</tr>
<tr>
<td>5/4/2015</td>
<td>Two way radio communication, verify communication functions</td>
<td>N/A</td>
</tr>
<tr>
<td>5/4/2015</td>
<td>Paging system/ Shunt SFO/ Paging, verify proper shunt and override of system as noted below with specific devices</td>
<td>N/A</td>
</tr>
<tr>
<td>5/4/2015</td>
<td>Verify the paging system in rooms and spaces will amplify and distribute the fire alarm signal</td>
<td></td>
</tr>
</tbody>
</table>

### General - Inspections

<table>
<thead>
<tr>
<th>Date</th>
<th>Task Description</th>
<th>Pass Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>5/4/2015</td>
<td>Firefighters phone jacks, demonstrate functionality and communication, inspect all phone jacks</td>
<td>N/A</td>
</tr>
<tr>
<td>5/4/2015</td>
<td>Visual appliances, inspection of current signals, verify proper coverage against ceiling drawings</td>
<td></td>
</tr>
<tr>
<td>5/4/2015</td>
<td>Speakers / horns, demonstrate functionality and verify speaker settings</td>
<td>N/A</td>
</tr>
<tr>
<td>5/4/2015</td>
<td>Door magnetic hold open, verify functionality of smoke, heat, visual pull</td>
<td>N/A</td>
</tr>
<tr>
<td>5/4/2015</td>
<td>Automated External Defibrillators, verify supervisory at command center</td>
<td></td>
</tr>
</tbody>
</table>

### Device - Tests

<table>
<thead>
<tr>
<th>Date</th>
<th>Task Description</th>
<th>Pass Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>5/4/2015</td>
<td>Stair control damper, verify supervisory address</td>
<td></td>
</tr>
<tr>
<td>5/4/2015</td>
<td>Stair control damper, verify supervisory address</td>
<td></td>
</tr>
<tr>
<td>5/4/2015</td>
<td>Core lobby area smoke detector, validate three pull stations with three pull stations</td>
<td></td>
</tr>
<tr>
<td>5/4/2015</td>
<td>Core lobby area smoke detector, validate three pull stations with three pull stations</td>
<td></td>
</tr>
<tr>
<td>5/4/2015</td>
<td>Stair area smoke detector, validate three pull stations with three pull stations</td>
<td></td>
</tr>
<tr>
<td>5/4/2015</td>
<td>Stair area smoke detector, validate three pull stations with three pull stations</td>
<td></td>
</tr>
<tr>
<td>5/4/2015</td>
<td>Mechanical room pull station, validate three pull stations with three pull stations</td>
<td></td>
</tr>
<tr>
<td>5/4/2015</td>
<td>Mechanical room pull station, validate three pull stations with three pull stations</td>
<td></td>
</tr>
<tr>
<td>5/4/2015</td>
<td>Mechanical room smoke detector, validate three pull stations with three pull stations</td>
<td></td>
</tr>
<tr>
<td>5/4/2015</td>
<td>Mechanical room smoke detector, validate three pull stations with three pull stations</td>
<td></td>
</tr>
<tr>
<td>5/4/2015</td>
<td>Mechanical room smoke detector, validate three pull stations with three pull stations</td>
<td></td>
</tr>
<tr>
<td>5/4/2015</td>
<td>Mechanical room smoke detector, validate three pull stations with three pull stations</td>
<td></td>
</tr>
<tr>
<td>5/4/2015</td>
<td>Core lobby area smoke detector, validate three pull stations with three pull stations</td>
<td></td>
</tr>
<tr>
<td>5/4/2015</td>
<td>Core lobby area smoke detector, validate three pull stations with three pull stations</td>
<td></td>
</tr>
<tr>
<td>5/4/2015</td>
<td>Electrical equipment CRAC Unit 1, validate three pull stations with three pull stations</td>
<td></td>
</tr>
<tr>
<td>5/4/2015</td>
<td>Electrical equipment CRAC Unit 2, validate three pull stations with three pull stations</td>
<td></td>
</tr>
<tr>
<td>5/4/2015</td>
<td>Electrical equipment CRAC Unit 3, validate three pull stations with three pull stations</td>
<td></td>
</tr>
<tr>
<td>5/4/2015</td>
<td>Mechanical equipment AHU #1, validate three pull stations with three pull stations</td>
<td></td>
</tr>
<tr>
<td>5/4/2015</td>
<td>Mechanical equipment AHU #2, validate three pull stations with three pull stations</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX F – SAMPLE SEQUENCE OF OPERATIONS MATRIX

Fire alarm sequence of operation matrix shall be formatted as represented on page 57 and in annex A of the current edition of NFPA 72. The system of operation shall be incorporated within the fire alarm plan submittal. Within NFPA 72 Annex A, figure A.14.6.2.4 (of the current 2016 edition), a typical input/output matrix sequence of operation is shown. The system inputs are represented on the left side of the matrix table, and the system outputs are represented on the top of the matrix table, with the actual input/output operation represented within the matrix table as a black dot. Additional inputs/outputs as required by SFIA shall be incorporated within the matrix table.
NOTE 1 NOT USED.
NOTE 2: AFTER POSITIVE ALARM SEQUENCE PER 2016 NFPA 72, SECTION 23.8.1.3

AUDIO MESSAGE: “ATTENTION. ATTENTION. ATTENTION. AN EMERGENCY HAS BEEN REPORTED. ALL OCCUPANTS WALK TO THE NEAREST EXIT AND LEAVE THE BUILDING. DO NOT USE THE ELEVATOR. WALK TO THE NEAREST EXIT. WALK TO THE NEAREST EXIT.” FOLLOWED BY THE TEMPORAL CODE SIGNAL CONTINUOUSLY UNTIL SILENCED. MANUAL PAGING CONTROL SHALL BE PROVIDED AT THE FIRE ALARM CONTROL PANEL.

AUTOMATIC VOICE COMMUNICATION OPERATION SHALL BE SIMILAR TO THE EXISTING AUDIO SYSTEM OPERATION IN THE INTERNATIONAL TERMINAL BUILDING AND SHALL CONSIST OF THE TEMPORAL CODE PATTERN REPEATED TWICE, THE AUDIO MESSAGE REPEATED TWICE, FOLLOWED BY THE TEMPORAL CODE SIGNAL CONTINUOUSLY UNTIL SILENCED. MANUAL PAGING CONTROL SHALL BE PROVIDED AT THE FIRE ALARM CONTROL PANEL.

AUDIO MESSAGE: “ATTENTION. ATTENTION. ATTENTION. AN EMERGENCY HAS BEEN REPORTED. ALL OCCUPANTS WALK TO THE NEAREST EXIT AND LEAVE THE BUILDING. DO NOT USE THE ELEVATOR. WALK TO THE NEAREST EXIT.” WALK TO THE NEAREST EXIT.”
APPENDIX G – TYPICAL FIRE ALARM DETAILS

Fire alarm details shall include the items outlined within SFFD Administrative Bulletin 2.01
IL USIED 9NGLE
GANG ELECTICAL BOX (2 1/8" MIN. DEPIH)
(SUPPLIED BY CONTRACTOR)

BACK BOX COVER OPTIONS:
SEMI-FLUSH TURN PLATE 4090-9006 (SHOWN)
WITH LIGHT PIPE FOR LED VIEWING
SINGLE GANG COVER W/ 2 1/8/32
FLATHEAD SCREWS
(SUPPLIED BY CONTRACTOR)

4" SQUARE BOX WITH COVER (WEATHER PROOF) MONITOR
MODULES FOR SUPERVISION OF EMERGENCY FUEL SHUTOFF
LOCATED WITHIN
4" SQUARE BOX.

EMERGENCY FUEL SHUTOFF BUTTON
4090-9001 – ELEVATOR CAB CALL BUTTON

UL LISTED SINGLE
GANG ELECTRICAL BOX (2 1/8" MIN. DEPTH)
(SUPPLIED BY CONTRACTOR)

4090-8510 BRACKET
REQUIRED WHEN USING
THE SIMPLEX TRIM PLATES
OPTIONAL WHEN USING
A CONTRACTOR SUPPLIED
SINGLE GANG COVER

BACK BOX COVER OPTIONS:
SEM-FUSH TRIM PLATE 4090-9606 (SHOWN)
WITH LIGHT PIPE FOR LED HEADING
SURFACE TRIM PLATE 4090-8807
WITH LIGHT PIPE FOR LED HEADING
SINGLE GANG COVER W/ 3/6/32
FLATHEAD SCREWS
(SUPPLIED BY CONTRACTOR)

ADDRESS DIALING INFORMATION
SEE INSTALLATION INSTRUCTIONS
(574-331) FOR SETTINGS

FROM EACH OR
PREVIOUS
SLC DEVICE

IDNET/WAFNET + - R
IDNET/WAFNET -- B

IDNET/WAFNET SLC LINES

ELEVATOR ALARM BUTTON

733-898
(4.7K 1/2W)

ELEVATOR CAB CALL BUTTON

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Standards Adoption

The "Life Safety– Fire Alarm System" Version 3.1, March 2018 standards were adopted by the Standards Committee on April 5th, 2018, and are effective immediately.

Confirmed:

[Signature]

Geoffrey M. Neumayr, Standards Committee Chair