

## SECTION 28 31 00 - FIRE DETECTION AND ALARM

### PART 1 - GENERAL

#### 1.1 DESIGN REQUIREMENTS

- A. Provide a microcomputer based system using multiplex techniques for alarm reporting, central monitoring, signaling, and selection of audible and visual signal circuits. The fire alarm system should be capable of making emergency announcements. The fire alarm subcontractor should work closely with the campus Information technology department working through the University Project Manager to make this work.
- B. Provide individually identified fire alarm sensors; pull stations, indicating devices, and compatible monitor and control devices. Provide a unique address for each device 8 digit only, with operator-assigned English language descriptor.
1. The system shall include the following major components
    - a. Fire Alarm Control Panel
      - 1) CU Anschutz buildings – Edwards EST3
      - 2) CU Denver buildings – Edwards EST3
      - 3) CU Denver buildings on Auraria Higher Education Campus – Verify with Project Manager.
    - b. Fire Alarm Annunciator Panel (FAAP) and LCD Display.
    - c. Fire Alarm Voice/Evacuation Panel (FVEP)
    - d. Fire Alarm Computer Terminal (FACT) – FACT refers to the individual building and University Police Building FACT.
      - 4) CU Anschutz buildings – FireWorks
      - 5) CU Denver buildings – FireWorks for Edwards fire alarm systems
      - 6) CU Denver buildings on Auraria Campus – Verify with Project Manager.
    - e. Fireman Two Way Telephone Panel (FTP) – If required by the building type.
    - f. Digital Alarm Communicator Transmitter (DACT) (3-Mod Comp)
    - g. Interface with campus overhead Emergency Paging system with Central Station monitoring computer controls.
  2. Conventional fire alarm initiating devices (smoke detectors, heat detectors, manual stations, water flow and tamper switches, pressure switches) shall each be individually addressable via, and shall report to the FACP.
  3. Control relays shall be individually commanded by the system to respond automatically in case of an alarm by related sensors or other devices. Manual control of fans, dampers and required relays shall be provided, as well as automatic control where required by code. Control sequences shall be as indicated on related mechanical systems control drawings.
- C. The system shall operate as a low voltage, zone-annunciated Fire Management System and shall include the following subsystems:
1. FACP to monitor addressable initiating and control devices, annunciate the alarm device exact location, initiate alarm and evacuation signals, and capture and recall elevators.
  2. FACP and Associated Auxiliary panels shall be provided with Class “A” wiring.
- D. Provide UL listed system. If required as a condition requisite to establishing UL listing of the entire installation as a system, the Contractor shall arrange for, and pay all costs associated with, any required off-site or on-site review, supervision, and/or inspection which may be required for gaining such UL listing.
- E. Conform to the following NFPA requirements:
1. Initiating Device Circuits (IDC) shall be Class B
  2. The Signaling Line Circuits (SLC) shall be configured as follows:
    - a. Class A for signaling line circuits connecting intelligent devices to the FACP.
    - b. Loss of connectivity between FACP and the facility's Central Control FACP shall not hamper functions of the fire alarm system within the building.

3. The Notification Appliance Circuit (NAC) shall be Class B

F. ANSCHUTZ MEDICAL CAMPUS SYSTEM LAYOUT

1. General:
  - a. All campus buildings will be equipped with a FACP. Locate near the main entry and a FVEP located near the FACP per the building design, for all non high-rise buildings.
  - b. Each FACP shall be networked into the campus network and accessible from the Campus FACT. Any FVEP shall be accessed from the Campus FCC FVEP microphone and/or the Campus Police Station FVEP microphone.
  - c. One FACP and FACT in one university high-rise building FCC and one university high-rise building FCC will be designated alternate locations for the Campus FCC FACP. All information residing in the FACP/FACT of the Campus will be duplicated at these two locations.
  - d. A FACT with FAP or a FAAP with LCD indicating building in alarm shall be located at the University Police Building. The Police Station shall be capable of accessing any FVEP via local microphone.
  - e. Every building will be equipped with a weatherproof speaker/strobe located at each exterior door.
  - f. Include the Following Front Panel Controls:
    - 1) Each floor shall have a disable button
    - 2) Elevator disable
    - 3) Fan/shut-down disable
    - 4) Pager disable
    - 5) Door disable
    - 6) Separate speaker and strobe disable
    - 7) Manual page by floor
    - 8) NETCOM DISABLE
    - 9) BAS DISABLE

- G. Provide interface with the Building Automation System to report all “alarm” and “supervisory” actions. Refer to Division 23.

1.2 PERFORMANCE REQUIREMENTS

A. General:

1. Normal operator interface, through the FACP located in each individual building where required, and at the designated FACT located in the Anschutz Medical Campus University Police Building in the Police Dispatch. All system early-warning pre-alarm, alarm, and trouble messages shall be annunciated on the FACT in a color-graphic format with English language descriptors.

B. High-Rise Buildings.

1. The fire alarm sequence of operation shall be in accordance with the requirements for high-rise buildings, including but not limited to the following:
  - a. The alarm and activate the strobes for the floor in alarm and the floors above and below.
  - b. Initiate stair pressurization and where used, initiate pressurization of the floors above and below the floor in alarm.
  - c. Release of stair, held-open doors, and re-entry doors.
  - d. Upon activation of the elevator, elevator shafts, or elevator lobby detectors, recall the elevators to the main exit level or alternate floor.
  - e. Activate refuge area communications link.
  - f. Annunciate the alarm to the building FACP, and FAAP, and to University Police FACT.
  - g. Annunciate the alarm condition and location to the building FAAP and local floor FAAP.
2. The Command Center of the High Rise Buildings shall also be equipped, under another contract, with the following remote status/control panels:
  - a. Buildings electrical distribution system.
  - b. Building fire pump.
  - c. Elevator status and control panel.

- d. Building voice paging system and/or voice evacuation system (i.e., Office Building) via zone interface panel and microphone.
      - e. CCTV system monitors and keyboard.
      - f. Smoke control panel.
      - g. Generator control panel.
    3. The FD will use these panels for viewing or controlling each of the above systems.
  - C. The FD will respond to the FACP of the building in alarm and to the Campus Police. The Campus Police FACT shall be automatically activated into the graphics mode to show the current status of all devices in alarm. The FD will take command of the Building's FACT to monitor the current response to the fire alarm condition. Using a "mouse driven" graphic menu, the FD shall be able to "zoom in" or "zoom out" of the graphic screens to view the current alarm condition.
    1. The FD will use the building's FCC PC graphic system to view and control the response of the fire alarm system by viewing special graphic screens such as:
      - a. A smoke control system status and control screen.
      - b. Any building within the complex connected to the fire alarm system.
      - c. Any preprogrammed screen existing within the fire alarm system.
      - d. Or other specialty screens that may be created at the request of the university Facilities Operations.
    2. Using the assigned FD Identification Code (ID password), the FD may use the FCC PC to alter the preprogrammed fire fighting response to the present alarm condition. A printer will provide hard copy documentation of all alarm conditions, ID password log on commands, and the system response to the specific fire alarm condition.
  - D. The Campus Control Center fire alarm computer will provide monitoring and secondary back up of the fire alarm computers located in the various fire command centers. If an equipment trouble alarm is initiated from a fire alarm device, it shall be reported at the FCC FACP of the building in alarm and the Campus Control Center PC.
  - E. If a fire alarm condition is received and the FD cannot initiate an appropriate response from the building's FCC PC (i.e., fire in the Buildings' FCC room, or a failure of the FCC PC), then an override ID password command can be used by the FD to make any system PC the primary PC for the manual fire fighting override response. The selected PC shall be able to alter a building's preprogrammed response to the alarm condition. The selected PC shall be able to access and control all PC graphic screens that reside within the system.
  - F. It shall be possible for all authorized personnel, using the proper ID password, to place the facility into smoke control operation through the graphic screens from the University Police (FACT), or the Building's FCC FACP.
  - G. Automatic Actions:
    1. Activation of an alarm-initiating device, as specified herein shall cause the following:
      - a. Annunciation of the alarm condition, type, and device address at the FACP, FACT and FAAP in a LCD format at the building FAAP. An audible signal shall sound and the alarm condition shall flash until acknowledged. The alarm condition and its location shall also be displayed at the University Police FACP, FACT, and FAAP per the building design.
      - b. The appropriate audio and visual alarms shall be transmitted throughout the building in alarm or to predetermined zones of the building in alarm.
      - c. Disable the elevator call system and recall the elevators to the level of discharge exit or to the alternate floor.
      - d. Initiate smoke control procedures and functions automatically (position dampers and control fans) from the building FACP.
      - e. Release self-closing fire and smoke doors in specified control zone when the system goes into alarm.
      - f. Provide control relay at each access control panel to unlock all secured doors in activated control zone.

- University Project Manager.
2. Provide smoke detector circuits with alarm verification with field-adjustable time from 0 to 60 seconds. Only verified alarms shall initiate the specified sequences.
  3. Activation of a sprinkler valve supervisory switch shall initiate supervisory alarm at the corresponding building FACP, FAAP, FACT, and FAP and initiate a supervisory alarm signal at the University Police FACT. Supervisory alarms shall be differentiated from a trouble condition on the circuit.
  4. A break in the initiating circuit or detector power wiring shall be annunciated as a trouble condition on the building FACP and the University Police FACT.
  5. A break in the audio/visual circuit wiring shall be annunciated as a trouble condition on the building FACP and the University Police FACT.
- H. Failsafe Operation: To increase the system's ability to survive damage from fire, malicious or accidental damage, premature component failure, etc., the fire alarm system shall provide the following functionality:
1. Each building FACP shall operate in a stand-alone manner, independent of any other FACP or FACT. The building FACP shall contain the complete data file for all connected devices, regardless of the building, and shall operate the same way whether connected to any other FACP or FACT. This includes:
    - a. Annunciation of device address and condition. One hundred percent of all connected devices shall be capable of operating for alarm simultaneously.
    - b. Logical Point Grouping annunciation and control. Each Logical Point Group shall contain up to 15 physical points and shall be capable of initiating a sequence of control actions.
    - c. Event-initiated control, signaling and/or annunciation sequences. One hundred percent of all connected devices shall be capable of being operated simultaneously.
    - d. Priority display of multiple alarms.
    - e. Complete supervision of all connected devices with no degraded operation.
    - f. Complete reset capabilities at FACP and FACT.
  2. Standby batteries capable of operating the FACP, FACT (except those supported by non-interruptible power supply systems), FAAP, FVEP, smoke detectors and alarm horns, strobes, secondary PC terminals, video display units and printers, shall be provided to automatically back up the emergency power source. The system shall have the capacity to operate FACP, as required per NFPA PCs for two hours, and then operate the fire alarm indicating devices for at least 15 minutes, per NFPA requirements. When commercial power is restored, the system shall transfer automatically to primary power. System power supply shall be equipped with battery charging circuits sufficient to recharge fully depleted batteries to within 70 percent of their maximum capacity within 12 hours.
  3. System operating software and data file shall be resident in nonvolatile memory. Loss of power, momentary or for a sustained period shall not require reloading of the software.
  4. All plug-in circuit boards shall be electrically supervised to assure that the proper board is in the proper position. Systems that use electrical continuity to supervise the presence of plug-in boards, but that do not assure that board positions have not been exchanged, shall provide additional means for the specified supervision, beyond that provided by locking covers.
  5. The FACT shall be provided with battery backup or individual dedicated UPS.
- I. Color code and minimum wire sizes for the fire alarm system as follows:
1. All wire is solid copper:
  2. All insulation colors shall be continuous for the full length of the wire.

3. Wire Jackets shall be stamped with the “Circuit Type” designation or shall have an affixed label designating the “Circuit Type” every twenty lineal feet at a minimum.

Circuit Type	Colors		Size
	Wire	# Of Conductors	
Initiating Circuits	(+) Red (-) Black	2	18 (THHN)
Signaling Circuits	(+) Red (-) Black	2	16 Twisted
Speaker Circuits	(+) Orange (-) Brown	2	14 Twisted
Strobe Circuits	(+) Yellow (-) Blue	2	14 Twisted
Fire Fighter Phone Circuit	(+) Red (-) White	2	14 Twisted/ Shielded
Fire Fighter Phone Riser Circuit	(+) Red (-) White	2	14 Twisted/ Shielded
RS-485 Circuit	(+) Blue (-) Gray	2	16 Twisted
Damper Control	(+) Red (-) Black	2	14 THHN
AHU Shutdown Circuit	(+) Red (-) Black	2	14 THHN
24VDC Power Circuit	(+) White (-) Black	2	14 THHN
Fire Alarm Remote Light Circuit	(+) Red (-) Black	2	18 THHN
Speaker Phone Cut Out Circuit	(+) Orange (-) Brown	2	14 Twisted
Low Level Audio Riser Circuit	(+) Red (-) Black	2	14 Twisted/ Shielded
High Level Audio Riser Circuit	(+) Red (-) Black	2	14 Twisted
Door Holder Circuit	(+) Red (-) Black	2	14 Twisted

J. Intelligent Features:

1. The following additional features shall be provided:
  - a. The fire alarm detector cleaning shall be annunciated at the FACP as a trouble condition by the device.
  - b. Dual Alarm threshold for day or night settings.

K. Interface With Other Systems:

1. Interface design of fire alarm system with closed circuit television (CCTV) system and FO signal transmission system.
2. The Electronic Security Department (ESD) will provide software to interface with the CCTV and fire alarm systems. CCTV and fire alarm manufacturers shall provide software protocol, for their systems, to ESD.
3. Consultant may purchase copy of specifications for interfacing systems from the university for the purpose of determining interfacing requirements.
4. Interface voice notification with the campus RAV system.

### 1.3 SUBMITTAL

- A. Provide shop drawings as follows:
  - 1. Floor plans with device layout, address and wiring.
  - 2. FACP layout.
  - 3. Riser diagrams.
  - 4. Battery calculation.
  - 5. Sequence of operation
  - 6. Equipment cut sheets
  - 7. FAAP layout.
- B. CADD generated layouts for FACT screen graphics.
- C. Operating and Maintenance Manuals.
- D. Project Record Documents:
  - 1. Prior to submittal of the as-built documents, submit a complete package of shop drawings to the university Facilities Operations Fire and Safety office for review. Drawings shall include floor plans and graphic maps for each building and/or floors.
  - 2. Submit record documents in accordance with the requirements of Section 01 78 39 and the following:
    - a. As-built point-to-point wiring diagrams depicting every device, including correct university room numbers.
    - b. Revised schematic, wiring, and interconnection diagrams of all circuits, internal and external, for all equipment installed and exact locations for all devices. These schematics shall include the conductor color-coding and terminal number identification system, location of all terminal boxes complete with numbering and each device address.
    - c. Complete, as-installed, riser diagrams indicating the wiring sequence of all alarm initiating devices, supervisory devices, and all signaling appliances on all signaling circuits.
    - d. A complete description of the system operation, including a schedule of relay abbreviations used on the drawings, list of relay functions, and the sequence of relay operation during supervisory trouble and alarm conditions.
    - e. Complete wiring and control diagrams for control and shutdown circuits for fan systems.

### 1.4 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in Intelligent Fire Management Systems.
- B. Installer: Company with certified personnel specializing in smoke detection and fire alarm systems with five years' documented experience as a fire alarm installing contractor.
- C. Fire Management system installer shall keep all smoke heads in the building covered until final building turn over. Failure to comply will mandate a complete cleaning of the individual heads on the system.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Edwards System Technology (Sole Sourced)

### 2.2 APPROVED INSTALLERS

- A. ADT, Rockies Life Safety Division, 6510 Franklin Street, Denver, CO 80229, (720) 826-5923
- B. Convergent – 7330 S. Alton Way, Suite 12K, Centennial, CO (303) 932-0757
- C. Fire Alarm Services, Inc – 4800 West 60<sup>th</sup> Avenue, Arvada, CO 80003 (303) 466-8800
- D. Meridian Fire and Security – 7173 S. Havana St Ste 400 Centennial CO, 80112 (303) 790-2520
- E. Other Edward System Technology installers will be considered if they have successfully completed 3 similar projects (in size and complexity) in the past 5 years in the Denver Metro area and NICET certified. Installer must demonstrate ability to provide ongoing service to any system it installs. Other installers must be approved in writing by the University Project Manager prior to bidding on the project. University approval takes 5 business days.

### 2.3 MATERIALS, GENERAL

- A. All equipment and materials used shall be standard components, regularly manufactured, and regularly utilized in the manufacturer's system.
- B. All systems and components shall have been thoroughly tested and proven in actual use.
- C. All equipment shall be listed and labeled by Underwriters Laboratories.
- D. All sensors shall be of the intelligent type and shall mount on a common base. This base shall be incompatible with conventional detectors.
- E. Where equipment of different manufacturers is used, such equipment shall be included under the required over-all UL system listing as a component of the integrated fire alarm system.
- F. The system shall be designed to operate with unshielded wire, to the maximum practicable extent. Shielded wire may be used. FO cable shall be utilized, as required or as indicated by the design documents.
- G. FACPs shall be provided with tamper switches on cabinet doors to protect against unauthorized access to internal devices. The panel shall provide commandable outputs, which can operate relays or logic level devices.
- H. Memory data shall be contained in EEPROM non-volatile memory. If non-volatile battery-backed RAM provides memory, removal of the board shall not cause loss of memory contents. I. The Fire Alarm annunciator panels shall be LCD types.
- J. Site Specific Customizing Software:
  - 1. General:
    - a. Provide software and Programs with technical support and training for the university's Facilities Operations staff during installation of system and completion.
    - b. Alarm display shall include, as a minimum:

- 1) Indication of alarm condition, i.e. ABNORMAL OFF, HI ALARM/ LO ALARM, analog value or status, and English group and point identification such as "SMOKE DETECTOR BUILDING "A" - 2ND FLOOR- ROOM 202".
  - 2) A discrete per point alarm action taking message, such as "CALL MAINTENANCE DEPT. EXT 5561", of up to 480 characters.
  - c. System shall automatically transmit alarm and troubles to selectable university pagers via a commercial carrier such as "AT&T Wireless".
  - d. The network routing properties for a panel's common controls determine which panels will respond when an operator presses the corresponding control command switch (Reset, Alarm Silence, Panel/Trouble Silence, Drill, Alternate Sensitivity) on the 3-LCD module.  
Only the panels defined in the selected network routing group will respond to the command. Any building connected by a bridge or other structure shall annunciate to its opposite number(s) alarm, supervisory, and trouble conditions via single LEDs on its front panel.
2. Point summary reports:
    - a. Point summary reports shall include the current value/status and condition.
    - b. Trend reports shall allow the operator to randomly select logical arrays of points.
    - c. Dynamic trends shall provide up to six points and show real time activity of the associated points.
    - d. Alarm reports shall be automatically issued.
    - e. A custom report capability shall be provided to allow the user to format reports of any mix of text, points with status/value and descriptors, and points with status/value only.
- K. Fire Alarm System Devices:
1. General:
    - a. Each device shall be assigned a unique address, 8 digit only Example (01020001). Address selection by jumpers is not acceptable. Devices which take their address from their position in the circuit are unacceptable. It is preferred that the address of the intelligent device be part of the device base rather than the device itself.
    - b. Devices shall receive power and communication from the same pair of wires. For fault-tolerant circuits, any separate power wiring shall also be made fault-tolerant.
  2. Analog Sensors (Photoelectric and Thermal):
    - a. Each sensor shall contain an LED, which blinks each time it is scanned by the FACP. The sensor LED is to remain illuminated to indicate alarm. All sensors not visible from the corridor shall have a remote light mounted in the corridor as shown on the drawings.
    - b. Each sensor shall be capable of being tested for alarm via command from the FACP or FACT. The values of the sensor shall be displayed at building FACP and FACT, and the University Police FACT.
  3. Monitor Modules:
    - a. The Monitor Module shall provide an addressable input for N.O. or N.C. contact devices such as manual stations, water-flow switches, sprinkler supervisory devices, door contacts, intrusion detectors, etc.
    - b. The Module shall mount in a standard electrical box.
  4. Control Modules:
    - a. The Control Module shall provide an addressable output for a separately powered alarm-indicating circuit or for a control relay.
    - b. The relay contacts shall be SPST (Form "C" rated at 2 amps at 28V DC).
    - c. The module shall mount in a standard electrical box.
    - d. Control voltage's connected to intelligent control relays shall not exceed 24VAC/24VDC. Isolation relays shall be used on control voltages on excess of 24VAC/24VDC.
  5. Fault Isolator Module (only if approved by the University Project Manager):
    - a. The Fault Isolator Module shall detect and isolate a short-circuited segment of a fire-alarm loop.
    - b. Modules shall be placed on every floor to limit the number lost addressable devices in case of a short-circuit on the intelligent circuit.



6. Intelligent manual pull stations shall be double action is typical on campus, mounted on standard electrical box. a. For public places, use single action pull stations with "Stopper II" cover.
  7. Magnetic door holders shall be wall- or floor-mount on a standard electrical box.
  8. Linear beam smoke detectors shall have cross-zone capabilities and be provided where shown on the drawings. Detectors shall consist of a transmitter and receiver unit utilizing infrared light to detect smoke between the units. These detectors shall have discriminating circuitry to differentiate between actual smoke, momentary blockage of the beam, and long-term blockage.
    - a. Contractor shall provide a weatherproof enclosure for each pair of devices, utilizing transparent panels to allow light transmission. Ensure range of detector is adequate to compensate for passage through this glass.
- L. Other Devices:
1. Speaker/Strobes:
    - a. Strobes shall be synchronized.
    - b. The speaker shall provide for minimum sound level of 95 dBA at 10 feet.
  2. Analog Air Duct Detectors:
    - a. Duct detectors shall be mounted exterior of duct with air sampling tube. Program duct detectors for supervisory indication only.
    - b. Provide fire alarm remote light red LED, mounted on a standard plate fitted to a standard electrical box. When device is not visible, labeled plate with the name of the device served.
    - c. Fire alarm remote light/test switch combination shall be utilized for each duct detector. The device shall have a red LED and two positions test switch mounted on a standard plate fitted to a standard electrical box. Plates shall be labeled with the name of the equipment served.
  3. Tamper Switches: Installed under Division 21.
  4. Flow Switches: Installed under Division 21.
  5. Sprinkler Pre-action Solenoid and Deluge Valves: Installed under Division 21
  6. Differential Pressure Switch: Installed under Division 23.
  7. Damper End Switches: for damper position indication. Installed, under Division 23.
  8. Relays provide addressable control and/or monitor module for each device indicated in paragraphs P. 3, 4, 5, 6 And 7 above. Include wiring to the device and to the fire alarm loop as required.
  9. Provide control relays as required to accomplish functions such as fan shutdown, damper positioning, door release, etc.
  10. Fire/Smoke dampers and smoke dampers will be provided under Division 23. The 24V wiring, including low voltage transformer P.E. switch, will be provided under Division 23. The 120V AC wiring will be provided under this section..
  11. Voice Evacuation Speaker/Strobe units shall be UL listed for use in voice evacuation systems. Audible and visual indications shall operate independently or in unison.
  12. Animal Care Facilities
    - a. Provide "Silentone" horns or approved equal throughout all animal care facilities. Provide red lensed strobe in animal holding rooms.
    - b. Provide speakers in the office areas of the animal facility.
- M. Voice Evacuation System:
1. The Contractor shall provide all work required for installation of a Voice Evacuation System for the buildings indicated by the drawings. Scope of this Contractor's work will be as described by this section of the specifications and as shown on the drawings.
  2. Buildings that are defined as high rise shall have the following: An Audible Alarm on the floor where that event is detected and a general message to all other floors stating, " A fire Alarm has been detected on (indicate floor number). Remain alert and evacuate if there are indications of fire.
- O. Voice Evacuation System:
1. The Contractor shall provide all work required for installation of a Voice Evacuation System for the buildings indicated by the drawings. Scope of this Contractor's work will be as described by

- this section of the specifications and as shown on the drawings.
2. Buildings that are defined as high rise shall have the following: An Audible Alarm on the floor where that event is detected and a general message to all other floors stating, “ A fire Alarm has been detected on (indicate floor number). Remain alert and evacuate if there are indications of fire. If no danger is noted, you may await further instruction. Elevators have been recalled to level 1 (or alternate floor if the fire alarm is on level 1) until the fire alarm is over.”
  3. Fire Alarm Voice Evacuation Panel (FVEP):
    - a. The FVEP shall be located in conjunction with the FACP and shall provide evacuation signals, pre-recorded fire alarm messages, and one-way communication (paging) on a selective.
    - b. FVEP equipment shall include the following:
      - 1) Voice paging, hand-held, push-to-talk microphone with dynamic noise canceling.  
Frequency response shall be flat within + 3 dB from 200 to 5,000 Hz.
      - 2) Zone paging selector switches and LED's, with one selector switch and two LED's provided for each speaker zone.
      - 3) "Manual Fire Evacuation Tone" switch and LED.
      - 4) "Silencing" fire evacuation tones (self-restoring switch) and LED.
      - 5) "Pre-recorded Message" switch and LED.
      - 6) "All Call", switch and LED, with the switch enabling the operator to simultaneously page all speaker zones on both risers.
      - 7) Reset switch.
      - 8) Lamp test switch.
      - 9) "Page" LED, which will light when the paging microphone is used.
      - 10) The FVEP shall also be equipped with LED's to indicate trouble conditions for the following:
        - a) Each individual speaker zone.
        - b) Amplifier, preamplifier, fire tone, pre-recorded messages, and voices paging.
      - 11) All switches and LED's shall be clearly identified with engraved labels.
      - 12) Each group of LED's shall have distinctive colors, such as:
        - a) Fire Tone - Red
        - b) Silence - Yellow
        - c) Page - Green
        - d) Trouble - Yellow
        - e) Pre-recorded Message - Red
    - c. The fire evacuation signal shall be applied to any specific zone automatically from the FACP or FACT, or shall be selected manually by the speaker zone switch.
  4. FVEP Audio Cabinet:
    - a. 100% redundant tone generators, preamplifiers, and amplifiers shall be provided.
    - b. The audio trunk shall be electronically supervised and shall be automatic switchover from one audio signal path to the other.
    - c. Each amplifier module shall be provided with two 40-watt amplifiers, and shall power a minimum of 8 speaker zones.
    - d. Pre-recorded message shall be programmed and recorded in a memory chip. Tape cassette players are not acceptable.
    - e. The FVEP audio cabinet shall be capable of remote "All Page" activation via local microphone from the University Police Station. The system shall allow the selection of individual building or "All" buildings for "Disaster Messages".
    - f. Provide capability of testing and adjusting audio amplifier outputs. Provide test switch at the FACP.

P. Spare Parts: Refer to Section 01 78 46 – Extra Stock Materials.

## PART 3 - EXECUTION

### 3.1 INSTALLATION – FIRE ALARM

#### A. Fire Alarm layouts:

##### 1. General:

- a. Provide a fire alarm system for each building.
  - 1) Actual detection required per building shall be determined by National codes, Local codes and the university CBO, whichever is more stringent.
- b. Provide shunt trip circuit breaker for connection to elevators with sprinkle red shafts.

##### 2. Regardless of building occupancy rating, the following areas shall be provided with detection:

- a. Laboratories
- b. Electrical Rooms
- c. Mechanical Rooms
- d. Telecommunications Rooms
- e. Data Centers
- f. Dedicated Storage Rooms
- g. Kitchens

##### 3. In general, the following type of detection shall be provided in each type of room:

- a. Photoelectric Smoke Detection:
  - 1) Electrical/Telecommunication Rooms
  - 2) Office Corridors (except where sprinkled)
  - 3) Offices (except where sprinkled)
  - 4) Laboratories
  - 5) Mechanical Ducts
  - 6) Elevator Shafts/Machine Rooms
  - 7) Dedicated Storage Rooms
  - 8) Linear Equipment Rooms
- b. Thermal Detection:
  - 1) Restrooms
  - 2) Mechanical Rooms
  - 3) Kitchens/Break rooms
  - 4) Environmental Services (Janitor) Rooms
  - 5) Elevator Shafts/Machine Rooms
  - 6) Generator Rooms
  - 7) Autoclaves
- c. Flame Detection:
  - 1) Generator Rooms

##### 4. Provide control module at each access control panel for interface with access control system.

#### B. Installation shall be supervised and tested by the manufacturer of the system equipment.

#### C. Low Voltage/Wire and Cable: All LV/W&C shall be run in conduit in floors, walls and non accessible spaces. In hallways, LVW/C can be run in bridge rings attached to the common telecom and other low voltage system cable tray. LV/W&C must be run in a conduit sleeve, minimum 2" dia. with plastic bushings, from the point it leaves the bridge ring on the cable tray to the interior side of a room. Once the LV/W&C enters the room it can be supported from bridge rings or j-hooks. Wiring shall comply with Division 27 and approved NEC.

#### D. Low Voltage/Wire and Cable and Hallway Devices: LV/W&C running from the cable tray to devices in the hallway shall be protected by plenum rated flexible sleeving or flexible metal conduit. LV/W&C in

sleeving or flexible metal conduit shall be supported per NEC and installed with UL approved connectors and plastic bushings on both ends.

- E. Outlet pull and junction boxes shall be painted red on the exterior. F. Devices: Locate devices per ADA standards.
- G. In construction areas where there is existing equipment, the equipment must be protected during construction and the devices taken off line to eliminate false alarms. All devices associated with modifications to an existing.
- H. Contractor is liable for damage. The university must be notified at the completion of each project to ensure that the system is returned to normal.
- I. If room numbers are changed or new room numbers established, the University Project Manager must be notified before implementation so that the system can be re-programmed and is accurate in the event of an alarm.
- J. All devices mounted in ceiling tile to be supported by T-bar hanger bracket and appropriate box. Plaster ring is not acceptable.
- K. Labeling:
  - 1. Observe the university fire alarm color code guide.
  - 2. Label each splice with correct information.
  - 3. Label each initiating device with correct device address. Use Kroy labeler or equal.
  - 4. Final, correct university room numbers (not design/construction room numbers) must be provided for correct programming.
  - 5. All detectors to have factory dust covers installed until after the final inspection and clean up is complete.
  - 6. All duct detectors to have individual remote LED/test stations installed. Mount at 6'-0" AFF in main corridor adjacent to area served. Label as directed by the University Project Manager.
  - 7. All shielded wiring to be bonded together at each device and insulated from contact with the conduit or box.
  - 8. All equipment and associated wiring removed from service will be returned to the University Project Manager for proper disposal.
  - 9. Avoid locating detectors above countertops and/or shelving.
  - 10. Locate detectors at least eight feet from supply or return air diffusers.
  - 11. Use fixed heat detectors near autoclaves and steam sterilizers.
  - 12. Mount remote lights for room detectors above door to corridor, centered.
- L. Construction Requirements:
  - 1. Integrity of Structure: Do not drill or pierce structural members without prior approval from the University Project Manager and Structural Engineer.
  - 2. Penetration of Walls, Etc.: Fire caulks or seal all penetrations made through walls, floors, and ceilings around the conduit. Maintain the integrity of fire ratings within the structure. Where visible, paint to match surface.
  - 3. Wherever possible, install conduits and raceways in a concealed manner, except at surface-mounted cabinets.
  - 4. Access to Existing Facilities: Install all conduit and pull boxes to maintain or provide access to existing valves; covers to existing pull boxes; wire ways or access doors; electrical outlets; switches; motors, etc.
  - 5. Support bridle rings/"J" Hooks independently from structure, may have separate point of attachment to cable tray.
  - 6. No other wiring or systems to be installed with fire alarm.
  - 7. The addition or removal of any walls, doors, or other floor plan modifications will require the contractor to update the FACT graphics and graphic map at the FACP.

- M. Prior to start of construction, disable existing fire alarm devices, as necessary. A minimum of two working days notice, prior to construction, shall be coordinated through the University Project Manager.

### 3.2 TESTING, CLEANING AND CERTIFICATION

- A. When installation is complete, system shall be tested in accordance with NFPA72 requirements. A representative of the system manufacturer shall submit a written report of the findings to the A/E with copy of to the FD. System testing shall include, at the least, verifying the following:
  - 1. The functional operation of each re-settable initiating device (manual stations, detectors, etc.) and circuit.
  - 2. All notification appliances shall be tested for a minimum of ten minutes under normal alarm conditions.
- H. Contractor is liable for damage. The university must be notified at the completion of each project to ensure that the system is returned to normal.
- I. If room numbers are changed or new room numbers established, the University Project Manager must be notified before implementation so that the system can be re-programmed and is accurate in the event of an alarm.
- J. All devices mounted in ceiling tile to be supported by T-bar hanger bracket and appropriate box. Plaster ring is not acceptable.
- K. Labeling:
  - 1. Observe the university fire alarm color code guide.
  - 2. Label each splice with correct information.
  - 3. Label each initiating device with correct device address. Use Kroy labeler or equal.
  - 4. Final, correct university room numbers (not design/construction room numbers) must be provided for correct programming.
  - 5. All detectors to have factory dust covers installed until after the final inspection and clean up is complete.
  - 6. All duct detectors to have individual remote LED/test stations installed. Mount at 6'-0" AFF in main corridor adjacent to area served. Label as directed by the University Project Manager.
  - 7. All shielded wiring to be bonded together at each device and insulated from contact with the conduit or box.
  - 8. All equipment and associated wiring removed from service will be returned to the University Project Manager for proper disposal.
  - 9. Avoid locating detectors above countertops and/or shelving.
  - 10. Locate detectors at least eight feet from supply or return air diffusers.
  - 11. Use fixed heat detectors near autoclaves and steam sterilizers.
  - 12. Mount remote lights for room detectors above door to corridor, centered.
- L. Construction Requirements:
  - 1. Integrity of Structure: Do not drill or pierce structural members without prior approval from the University Project Manager and Structural Engineer.
  - 2. Penetration of Walls, Etc.: Fire caulks or seal all penetrations made through walls, floors, and ceilings around the conduit. Maintain the integrity of fire ratings within the structure. Where visible, paint to match surface.
  - 3. Wherever possible, install conduits and raceways in a concealed manner, except at surface-mounted cabinets.
  - 4. Access to Existing Facilities: Install all conduit and pull boxes to maintain or provide access to existing valves; covers to existing pull boxes; wire ways or access doors; electrical outlets; switches; motors, etc.

5. Support bridle rings/"J" Hooks independently from structure, may have separate point of attachment to cable tray.
  6. No other wiring or systems to be installed with fire alarm.
- M. Prior to start of construction, disable existing fire alarm devices, as necessary. A minimum of two working days notice, prior to construction, shall be coordinated through the University Project Manager.

### 3.3 TESTING, CLEANING AND CERTIFICATION

- A. When installation is complete, system shall be tested in accordance with NFPA72 requirements. A representative of the system manufacturer shall submit a written report of the findings to the A/E with copy of to the FD. System testing shall include, at the least, verifying the following:
1. The functional operation of each re-settable initiating device (manual stations, detectors, etc.) and circuit.
  2. All notification appliances shall be tested for a minimum of ten minutes under normal alarm conditions.
  3. The functional operation of each and every alarm device and circuit.
  4. The functional operation of each monitored device circuit.
  5. The functional operation of each control circuit, including fan controls.
  6. The supervision functions of each initiating, indicating, monitoring, control and supply circuit.
  7. Control station automatic signaling.
  8. That all software protocol, access codes and operation instructions have been supplied.
  9. All installed or modified fire alarm systems for remodels or new projects shall be tested and certified by a Factory Representative. Upon a system test completion a "Letter of Certification" shall be issued to the university.
- B. All testing and verifications shall be conducted in the presence of the university Facilities Operations Fire and Safety personnel.
- C. There shall be an operational test by the FD.

### 3.4 COMMISSIONING (DEMONSTRATION)

- A. The equipment supplier shall provide a minimum of 8 hours of system training for the university Facilities Operations personnel training for each new system.

## PART 4 – CHANGE LOG

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|------------|---|
| 3/8/2021   | 1. Updated pre-approved distributor/installer list, added FAS.<br>2. Added 3.1 L 7 – FACT and graphic map update requirements.<br>3. Corrected various section numbering. |
| 12/29/2020 | 1. Updated approved installer Systems Group and added ADT.  |

**END OF SECTION 28 31 00**