FIRE ALARM SYSTEM
The following is a standard specification for the fire alarm system. A copy of the specification for editing may be obtained by contacting the Architects & Engineers’ Contracts Office, aecontracts@ucdavis.edu.

FIRE ALARM--ALL TYPES OF OCCUPANCY
GUIDE SPECIFICATION 28 31 00

THE FOLLOWING GUIDE SPECIFICATION IS INTENDED TO BE EDITED ACCORDING TO THE SPECIFICS OF THE PROJECT.

WHERE [ ] OR { } APPEAR, THIS INDICATES REQUIREMENTS THAT ARE OPTIONAL DEPENDING UPON THE TYPE OF SYSTEM BEING PROVIDED OR PER INSTRUCTIONS ASSOCIATED WITH THE [ ] OR { }. THE HANDLING OF SUCH ITEMS WILL BE DECIDED BY CONSULTATION BETWEEN THE UNIVERSITY'S REPRESENTATIVE, ARCHITECTS AND ENGINEERS DEPARTMENT, OPERATIONS AND MAINTENANCE ALARMS DEPARTMENT, AND THE UNIVERSITY OF CALIFORNIA, DAVIS FIRE DEPARTMENT.

LAST UPDATE OF CONTENT—4/2/04
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SECTION 28 31 00
FIRE DETECTION AND ALARM

PART 1 – GENERAL

1.1 SUMMARY

A. Design/build and provide code compliant complete manual and automatic addressable fire
detection system and audible/visual alarm system, complete with connection to the Campus
Central Alarm Panel via connection point indicated on Drawings.

B. The Contractor is advised that the drawings are diagrammatic in nature and are not intended
to show all details. The Contractor is expected to provide final design, achieve the University
of California, Davis Fire Department (UCDFD) approval of the design, and to provide all
miscellaneous parts and labor required to install a complete workable system that is
approved by the UCDFD for building occupancy.

C. Related Sections include the following:
   1. Fire-Stopping: Section [13 XXX section number]
   2. Painting of Mechanical and Electrical Work: Section [15 & 16XXX section numbers]
   3. Conveying Systems/Elevators: Section [14XXX section number]
   4. Fire Protection/Automatic Sprinkler System: Section [13XXX section number]
   5. Conduit: Section [16XXX section number]
   6. Wire and Cable: Section [16XXX section number]
   7. Boxes: Section [16XXX section number]
   8. Cabinets and Enclosures: Section [16XXX section number]
   9. Electrical Identification: Section [16XXX section number]
   10. Building Automation and Control: Section [15XXX section number]
   11. Security Access Systems: Section [16XXX section number]
   12. Intrusion Detection Systems: Section [16XXX section number]
   13. Doors, Roll-Down Doors, Door Hardware: For door closers and holders with
       associated smoke detectors, electric door locks, and release devices that interface
       with the fire alarm system. Section [08XXX section number]
   14. Fire Smoke Dampers [15XXX section number]
   15. Telecommunications [16XXX section number]

1.2 DEFINITIONS

A. Wherever mentioned in this specification or on the drawings the equipment, devices, and
functions shall be as defined in Section 01424 Abbreviations, Symbols and Definitions
and supplemented as follows:
   1. UCDFD: University of California, Davis Fire Department.
   2. Emergency: An unsafe or intolerable condition requiring immediate correction.
   3. FACP: A Fire Alarm Control Panel, which processes alarm information and controls
      outputs.
   4. Alarm Signal: A signal that indicates a state of emergency requiring immediate
      notification of the fire department and of the building occupants. These are signals
      such as the operation of a manual pull station, the activation of a water flow switch in
      a sprinkler system, the receipt of an alarm signal from a smoke detector that has
gone through alarm verification, the receipt of an alarm signal from an elevator
      smoke detector or a computer room smoke detection panel, the operation of a duct
      smoke detector, the operation of a heat detector, or the operation of a pressure
      switch in a fire suppression system caused by the flow of fire extinguishing agent
      (e.g. kitchen fire extinguishing system, CO₂, etc.).
   5. Supervisory Signal: A signal that indicates the impairment of a fire protection
      system, which may prevent its normal use. These are signals from switches, such as
      a tamper switch; a low air pressure switch; a high air pressure switch; a generator
phase reversal switch; a generator power failure switch; a generator running switch; a fire pump phase reversal switch; a fire pump loss of power switch; or a fire pump running switch.

6. Trouble Signal: A signal that indicates that a fault, such as an open circuit or ground, has occurred in the fire alarm system or in a separate sub-system, whose control panel is monitored by the fire alarm system.

7. Multiplex System: A system in which multiple signals are transmitted via the same conduction path to a remote fire alarm control unit and fire alarm control panel, decoded and separated so that each signal will initiate the specified response.

8. Notification Appliance Circuit: A circuit to which notification appliances are connected to visually and audibly indicate an alarm signal.

9. Interface Device: An addressable device which interconnects hard wired systems or devices to a multiplex system.

10. Fire Alarm Power Boosters: Control panels that supply power to the notification appliances devices; and reports to and receives signals from the fire alarm control panel.

11. Master Fire Alarm Control Panel (MFACP): A master control panel having the features of a fire alarm control unit and to which all fire alarm control units are interconnected and report to. The panel has central processing, memory, input and output terminals, video display units (VDUs) and printers.

12. Class A Wiring: A circuit that is monitored for integrity such that a single break, a single wire-to-wire short, or a single loss of carrier condition will be indicated by a trouble signal on the FACP no matter where the break, short or loss of carrier condition occurs and will allow all functions of the affected circuit to remain operational. In accordance with NFPA 72, this would be Style 7 wiring for signaling line circuits.

13. Class B Wiring: A circuit that is monitored for integrity such that a single break, a single wire-to-wire short, or a single loss of carrier condition will be indicated by a trouble signal on the FACP no matter where the break, short or loss of carrier condition occurs, but which would prohibit devices beyond the fault, short or carrier loss from remaining operational. In accordance with NFPA 72, this would be Style 4 wiring for signaling line circuits, Style B for initiating device circuits, and Style Y for notification appliance circuits.

14. Signaling Line Circuit: A circuit to which any combination of circuit interfaces, control units, or transmitters are connected and over which multiple system input signals or output signals, or both, are carried.


16. Tamper Switch: A valve monitor switch as indicated in NFPA 72.

17. Initiating Device: A system component that originates transmission of a change of state condition, which initiates an appropriate response via the fire alarm system.

18. Terminal Cabinet: A steel cabinet with locking, hinge-mounted door in which terminal strips are securely mounted. Minimum size is 200 mm x 200 mm (8 inch x 8 inch).

19. VAC: Volts Alternating Current

1.3 SYSTEM DESCRIPTION

A. Noncoded, addressable system; multiplexed signal transmission dedicated to fire alarm service only, and interfaced with existing fire alarm system.

1.4 PERFORMANCE REQUIREMENTS

A. This specification establishes the requirements for the design and installation of a complete fire detection and alerting system for {Building/Location} as described in this section and the drawings.

B. Scope of Work
1. The scope of work includes, but is not limited to, provision of the following:
a. Detailed design and preparation of shop drawings, to meet the intent of the design as indicated in the drawings and these specifications, and to meet the requirements of applicable codes and the UCDFD. Drawings indicate preliminary design for the fire detection and alerting system, which must be followed as a guide, but responsibility for achieving a code-compliant and UCDFD-approved fire detection and alerting system, including additional items not shown on the drawings or listed in these specifications, rests entirely with the Contractor.

b. Installation of the complete fire detection and alerting system after final approval by UCDFD of the shop drawings and according to those shop drawings.

c. System software, database management utilities, firmware, and programming as required to provide a complete functioning interactive system

d. All necessary conduit and wiring associated with the fire detection and alerting system.

e. Smoke detectors, heat detectors, and manual pull stations.

f. Horns/speakers, strobes and remote lamps.

g. Connection to campus existing Gamewell master box.

h. Remote annunciator panel(s).

i. Provision of auxiliary controls and switches including interposing control, monitor relays, and interconnection coordination for the operation of the following systems:
   1) Fan control, smoke/fire damper interface {Mechanical – Air Distribution}
   2) Sprinkler systems {Mechanical – Fire Protection Systems}
   3) Elevator recall {Architectural – Conveying Systems}
   4) Commissioning {Electrical and Mechanical}
   5) Door control {Architectural – Access Control CAAMS}

j. Provision of a one-way supervised voice communication system as a part of the audio evacuation system.

k. Provision of a two-way supervised fireman's telephone system.

l. Fireman's fan control system.

m. Permanent signs, labels, and operational instructions.

n. Systems and Equipment Startup and Testing

o. Commissioning

p. Training.

q. Record drawings.

2. The furnishing and installation of the following is prescribed in another Section but connection is prescribed in this Section.

a. Fire sprinkler alarm system flow switches, valve monitors and post indicating valves (P.I.V.).

b. Elevator controller for recall.

c. Door hold-open/closure devices without integral smoke detectors (coordinate with section [08XXX], Hardware Specialties).

d. Electric door locks control panel for override control.

e. Fire barrier roll down doors and shutters.

f. Fire pump controller to monitor status.

g. Fan control system for smoke management.

3. The installation of the following is prescribed in another Section but the furnishing and connection in prescribed under this Section.

a. Duct mounted smoke detectors and test switches.

b. {Elevator cab mounted life safety speaker}.

c. {Elevator cab mounted fireman's phone jack}.

4. Work by University.

a. Final terminations to the campus McCulloh loop shall be performed by the University. As part of the Work, Contractor shall provide and install conduit and wires to the McCulloh loop as directed by the University. The University
shall only terminate the cables after the Contractor has completed the tasks identified on the drawings and in these specifications.

C. Codes and Standards
   1. Applicable Publications: Provide a system conforming to the requirements of the latest edition of the following publications including all amendments to these publications.
      a. American Society for Testing and Materials (ASTM)
      b. American Society of Mechanical Engineers (ANSI/ASME):
         1) A17.1 Safety Code for Elevators and Escalators
      d. National Fire Protection Association (NFPA):
         1) 70 National Electric Code (NEC)
         2) 72 National Fire Alarm Code
         3) 13 Standard for the Installation of Sprinkler Systems
         4) 20 Standard for the Installation of Centrifugal Fire Pumps
         5) 101 Life Safety Code
         6) 90A Standard for the Installation of Air Conditioning and Ventilating Systems
         7) 17 Dry Chemical Extinguishing System
   2. State and Local Codes: Perform all work in accordance with the requirements of the latest issue of the following codes and standards, unless specifically directed otherwise in this specification in order to allow designs in excess of the code requirements. Applicable portions of current editions as adopted by the California State Fire Marshal of the publications listed below form a part of this Specification:
      a. California Code of Regulations, Title 24, Parts 2,3,4,9, and 12 [1998 Edition]
      b. California Code of Regulations, Title 19
      d. Americans with Disabilities Act (ADA)
      e. California Building Code, Part 2
      f. California Electric Code, Part 3
      g. California Mechanical Code, Part 4
      i. Local rules and interpretations required by the DCFM, AHJ, including UC Davis Campus Standard.
   3. EIA, IEEE, NEMA and ANSI standards pertaining to fire detection, alarm and communication systems.
   4. UUKL listing: The fire alarm system shall be listed and meet the requirements for smoke control.

D. Approval Authorities
   1. The Approval Authority for this section of the project shall be the UCDFD.

E. Nameplates and Labeling
   1. All fire alarm components shall be labeled. Identification tags shall be red, laminated plastic with engraved white lettering. Labels shall be mounted on panels with screws.
   2. Each FACP shall have a label placed on the front of the control panel indicating with 1/4 inch lettering stating: “FIRE ALARM ACCOUNT. ###”. The numbers shall indicate the account number. The sign shall also include the words, “CALL
EMERGENCY DISPATCH CENTER BEFORE ANY ACTIVITY WITH THIS SYSTEM” in ½ inch letters.

3. Each remote annunciation panel shall have a red laminated plastic identification label with ¼ inch lettering stating “FIRE ALARM ACCOUNT. ###”. The numbers shall indicate the account number.

4. Each fire alarm terminal box installed in or on a wall shall have a red laminated plastic identification label with ¼ inch lettering stating “FIRE ALARM TERMINAL” on the front cover.

5. Where terminal boxes are concealed in the ceiling, the box shall have a red laminated plastic identification label with ¼ inch lettering stating “FIRE ALARM TERMINAL” attached to the front face of the box. A red laminated plastic identification label with ¼ inch lettering stating “FIRE ALARM TERMINAL” shall be permanently attached to the ceiling T-bar grid at the access point or next to the access door nearest the terminal box.

6. Fire/smoke dampers concealed in the ceiling area shall be identified with a red laminated plastic identification label with ¼ inch lettering stating “FIRE/SMOKE DAMPER ###_###” with the numbers indicating the point/zone and account number. The label shall be permanently attached to the ceiling T-bar grid at the access point or next to the access door nearest the fire/smoke damper.

7. Duct detectors concealed in the ceiling shall be identified with a red laminated plastic identification label with ¼ inch lettering stating “DUCT DETECTOR ###_###” with the numbers indicating the device and account number. The label shall be permanently attached to the ceiling T-bar grid at the access point or next to the access door nearest the duct detector. Attach a similar label next to each remote test switch.

8. Heat, smoke, products of combustion and addressable modules shall have red laminated plastic identification label with ¼ inch lettering stating “[module, point, zone] ###_###” with the numbers indicating the device and account number. Label device and/or module in an unobtrusive location where not visible when the device/module is installed.

1.5 SYSTEM OPERATION – GENERAL REQUIREMENT

A. Fire alarm functions: Activation of a pull station, sprinkler water flow or activation of an automatic sensing device for fire, temperature, flame, or smoke shall result in the following:
   1. The appropriate zone will operate and transmit to the UC Davis Dispatch Center or other designated and UCDFD approved central station.
   2. An audible evacuation alarm signal will continuously sound a temporal 3-pulse signal until the system is reset or voice override is utilized.
   3. The visual notification appliance will flash until the system is reset.
   4. The master fire alarm box will trip.

B. Auxiliary control functions: The fire alarm system shall, during certain alarm conditions, control the following types of equipment: Doors, fans, dampers, elevators, etc. Direct control from detector output contacts is not permissible unless the contacts are fully programmable from the FACP. As a minimum, the controls shall accomplish the following:
   1. Automatically restore the signal to the controlled systems to normal operation after FACP is reset from alarm posture.
   2. If there are two or more fans of 20 HP or greater controlled directly from the FACP, then the fans shall stagger start with an appropriate delay between each start. The time delay and sequencing shall be incorporated into the ventilation controls or fan motor controllers by way of time-delay relays, etc. A 10-second delay between fan restart is recommended.
   3. Phase I operation of elevator
4. Fan control  
   a. Environmental fans: General building fans shall shut down upon activation of any fire alarm device via direct control from the FACP. FACP control shall have priority over all other interlocks and controls.
   b. Dedicated fire safety fans: Shaft pressurization and other dedicated fire safety fans shall start and be controlled directly from the FACP.
   c. Manual override: Provide on-off-auto manual override switches with priority over local Hand-Off-Automatic (HOA), and other automatic control for all dedicated fire safety fans as identified above.
   d. Fan status:  
      1) Provide contact point for positive feedback fan status at the FACP using a current sensor relay (provided in section 15 [XXX] located at the load side of the disconnect switch for all dedicated fire safety fans.
      2) Provide a red LED for run and a green LED for stop indication at FAP.
      3) Provide specific wiring diagrams for (a) through (d) above.

5. Drop all magnetically held doors following a 15-second time delay.

C. Supervisory functions
   1. Supervise the 120 VAC circuits supplying the FACP.
   2. Supervise the master box trip circuit, alarm initiating circuits, building signaling circuits, and auxiliary control circuits, except the door circuits, against grounds, opens, and shorts.
   3. Any equipment trouble or malfunction or activation of a sprinkler system supervisory switch shall transmit a trouble signal.
   4. Upon application or reapplication of 120 VAC power, the fire alarm system shall automatically, without any operator intervention, initialize all circuitry and shall be in a normal operating condition. Systems which require operator intervention to reset manual controls following a 120 VAC restoration are not acceptable.

1.6 SYSTEM SEQUENCE OF OPERATION -- DETAILED DESCRIPTION

A. Alarm Signal Activation Sequence
   1. Pull station and sprinkler water flow activation shall result in the following:
      a. The FACP will go into alarm mode; local sounder will beep and the zone/address in alarm will be annunciated at LCD display.
      b. The appropriate zone will operate and transmit the alarm signal via two dedicated telephone lines to the UC Davis Dispatch Center or other designated and UCDFD approved central station.
      c. The Gamewell Master fire alarm box will be tripped by the FACP.
      d. An audible evacuation alarm signal throughout the building will continuously sound a temporal 3-pulse signal until the system is reset or voice override is utilized.
      e. The visual evacuation alarm devices throughout the building will flash in synchronized patterns until the system is reset.
      f. The appropriate zone/address will be annunciated at the Remote Annunciator Panels.
      g. Activate the fire alarm horns and/or sounder bells of smoke detectors in the living room of all residential units.
      h. Activate all the strobes in the living room of all residential handicap units.
      i. Activate the following control functions further described in Section 1.6B
         1) Door holder/releases shall deactivate on floor of alarm.
         2) [For high-rise facilities, initiate the smoke control sequence delineated in smoke report]

   2. Duct Smoke Detectors for fan shut down or fire/smoke damper control
      a. Residential Occupancy. The activation of any duct smoke detector shall cause the following to immediately happen:
         1) All actions in 1.6.A.1.a through i except 1.6.A.1.i.2) above, and:
         2) Shut down associated HVAC fan
3) Close associated fire/smoke damper.
4) Activate the remote indicator associated with the duct smoke detector.

b. Non-residential Occupancy. The activation of any duct smoke detector shall cause the following to immediately happen:
1) Fire alarm control panel to go into alarm mode.
2) Annunciate alarm signal at the Fire Alarm control panel and at the Fire Department remote annunciators.
3) Transmit a distinctive alarm signal to the UC Davis Dispatch Center via telephone lines to the Fire Alarm receivers.
4) Activate the remote indicator associated with the duct smoke detector.
5) Shut down associated HVAC fan or close associated fire/smoke damper

3. Area Smoke Detectors for Elevators, Residential & Non-residential Facilities

a. Elevator lobby or elevator machine room smoke detector activation shall cause the following to immediately happen:
1) All actions in 1.6.A.1.a through i except 1.6.A.1.i.2) above, and:
2) The activation of a non-egress floor elevator lobby smoke detector or the elevator machine room smoke detector shall operate a supervised relay contact located in the elevator room for connection to the elevator controller. This dry contact signal shall initiate the elevator to be brought to the primary recall floor, or:
3) The activation of the egress elevator lobby smoke detector in the primary-recall-floor, shall operate a supervised relay contact located in the elevator room for connection to the elevator controller. This dry contact signal shall initiate the elevator to be brought to the alternate elevator recall floor.
4) Elevator capture operational control sequence shall conform to CCR Title 8 regulations. If applicable, the existing elevators are to be equipped with recall functions at a later date. All necessary fire alarm components, wiring and programming required to initiate elevator recall are to be provided under this contract. All functions of the fire alarm system affecting elevator recall will be tested during acceptance of the system.
5) Shutdown of the elevator air-handler
6) Activation of the elevator shutdown functions if applicable
7) For high-rise facilities, initiate the smoke control sequence delineated in smoke report

b. Residential
1) Common Area Smoke Detectors: Activation of smoke detectors in the corridors, lobbies, storage rooms, electrical rooms and common spaces shall result in all actions in 1.6.A.2.a.1) through 4).
2) Dwelling Unit Area Smoke Detectors: The detection of smoke by any addressable smoke detector within a dwelling unit shall not cause the fire alarm control panel to go into alarm mode, but shall cause the following to immediately happen:
   a) Standard dwelling unit (non-handicap)
      i. Actuate the horn of all addressable smoke detectors within the dwelling.
      ii. Annunciate a distinct supervisory signal at the Fire Alarm control panel and at the remote annunciator(s).
      iii. Transmit the distinct supervisory signal to the UC Davis Dispatch Center.
   b) Accessible (handicap) dwelling unit
      i. Actuate the horn of all addressable smoke detectors within the dwelling unit.
ii. Activate the strobe in the unit. The strobe(s) in the unit shall be powered and supervised by the building’s power booster and controlled through an addressable control module.

iii. Annunciate a distinct supervisory signal at the Fire Alarm control panel and at the remote annunciator(s).

iv. Transmit the distinct supervisory signal to UC Davis Dispatch Center via telephone lines to the Fire Alarm receivers.

c. Non-Residential: Area smoke detector, heat detector, or flame detector activation anywhere in the facility shall cause the following to happen:
   1) Fire alarm control panel to go into alarm mode.
   2) Annunciate alarm signal at the Fire Alarm Control Panel and at all annunciators.
   3) Transmit a distinctive alarm signal to the UC Davis Dispatch Center.
   4) [For high-rise facilities, initiate the smoke control sequence delineated in smoke report]

4. Smoke Detector for the Release of Automatic Closing Fire Doors
   a. Fire door release not initiated by a fire alarm system that includes smoke detectors protecting the areas on both sides of the affected door shall have one or more smoke detectors located within five feet of the door opening and shall be in accordance with NFPA 72 section 5-10.7.
      1) Swing-type fire doors shall release upon the activation of any area or ceiling smoke detector on the floor where the door is located. Doors to remain released until FACP is manually reset.
      2) Roll down or horizontally sliding fire doors shall only release upon the activation of the smoke detectors located on one or both sides of the opening in accordance with NFPA 72 section 5-10.7.4. All other initiating devices will not cause the roll down or horizontally sliding fire doors to close.

5. Fire suppression systems
   a. The activation of any detection device associated with a fixed fire suppression system in the building shall cause the following to immediately happen:
      1) All actions 1.6.A.1.a through i above.

B. Supervisory Signal Activation Sequence
   1. Sprinkler system control valve supervisory switch: The activation of any sprinkler system control valve supervisory switch shall not sound the alarm signals but shall, when activated, cause the following to occur:
      a. Annunciate a distinct supervisory signal at the Fire Alarm control panel and at the remote annunciator(s).
      b. Transmit the distinct supervisory signal to UCD Emergency Dispatch Center via telephone lines to the Fire Alarm receivers.

   2. Area Smoke Detector and Duct Smoke Detector in Non-Residential occupancy: The activation of any area smoke or duct smoke detector in a non-residential occupancy shall not sound the alarm signals but shall, when activated, cause the following to occur:
      a. Annunciate a distinct supervisory signal at the Fire Alarm control panel and at the remote annunciator(s).
      b. Transmit the distinct supervisory signal to UCD Emergency Dispatch Center via telephone lines to the Fire Alarm receivers.

   3. Dwelling Unit Area Smoke Detector and Duct Smoke Detector in Residential occupancy: The activation of any area smoke or duct smoke detector in a residential occupancy shall not sound the alarm signals but shall, when activated, cause the following to occur:
a. Annunciate a distinct supervisory signal at the Fire Alarm control panel and at
the remote annunciator(s).

b. Transmit the distinct supervisory signal to UCD Emergency Dispatch Center
via telephone lines to the Fire Alarm receivers.

C. Trouble Signals
1. The panel shall be placed in trouble mode upon detection of any fire alarm system
impairment, including a single break/open, ground fault, loss of primary (AC) power
supply, absence of a battery supply, low battery voltage or the removal of any
system detector or alarm panel module. A trouble condition shall cause the following
to occur:
   a. Fire alarm control panel to go into trouble mode.
   b. Transmit the trouble signal to UCD Emergency Dispatch Center via telephone
      lines to the Fire Alarm receivers and (if applicable) via the existing Gamewell
trouble loop.

1.7 SUBMITTALS

A. Conform to Section 01334 Shop Drawings, Product Data, and Samples and to the
requirements of Section 01789 Project Record Documents

B. Procedure
1. The University's Representative shall forward a copy of the Architectural
   backgrounds to the Contractor.
2. Prepare and submit copies of shop drawings, catalog cut sheets, CSFM listing
   sheets, and additional information required in this section, to the University's
   Representative for approval.
3. If the submittals are not approved in the second submittal, the contractor will be
   required to attend a meeting at the UCDFD's office to discuss comments prior to
   the next submittal.
4. The contractor shall not start any construction on the fire alarm system prior to
   approval of related submittals by the UCDFD. If any such construction precedes
   submittal approval, all inspection by the UCDFD will cease, and resulting project
delays will be solely the responsibility of the Contractor.
5. Conform to other submittal information listed at the UCDFD web page:
   UCDFDfirenetHome (http://fire.ucdavis.edu/ucdfire/UCDFDfirenetHome.htm).
6. While the system installation is in progress, one set of shop drawings that have
   been stamped “approved” by the UCDFD shall be kept at the job site and will be
   updated regularly to reflect current as-built information. See paragraph 1.7.H for
   as-built requirements.
7. Submit Testing & Commissioning Procedures prior to pre-test. See Section 01660
   Systems and Equipment Start-up and “Testing”, and Section 01662
   Commissioning.
8. Submit Field quality-control test reports.
9. Prepare and submit record documents in accordance with Section 01789 Project
   Record Documents.

C. Manufacturer's Product Data—Submit the following:
1. Equipment schedule showing exact types, current CSFM listing, and quantity of all
   fire alarm devices.
2. Technical data showing exact types of all fire alarm devices. Specific components
   on catalog cut sheets must be highlighted or otherwise identified. All equipment
   drawing alarm or supervisory current shall have documentation of the current draw
   clearly marked and highlighted in the submittal information.
3. Technical information showing physical dimensions, weight, finish and mounting
   requirements.

D. Shop Drawings
1. Submit shop drawings as follows:
Drawn with AUTOCAD (latest version) to the same scale as the architectural drawings, showing device layout, raceway routing, conduit and wire size, wire identification numbers, room and floor identification numbers, and utilizing NFPA 170 symbols for all devices. These drawings shall be prepared by persons meeting the requirement of paragraph 1.8. The drawings shall be stamped and signed by the contractor’s engineer who shall be a licensed fire protection engineer or a licensed professional engineer in the state of California. Include the following:
   a. Title Page
      1) Provide the following checklist from the California State Fire Marshal, and certify that all have been provided in the shop drawings:

   **CALIFORNIA STATE FIRE MARSHAL
FIRE ALARM SYSTEM SUBMITTAL CHECKLIST**

**I. ADMINISTRATIVE**

A. Installing contractors name, address, phone number. UFC 1001.3
B. Basis for system installation / Building code occupancy classification. UFC 1001.3
C. Building owner and/or tenant. UFC 1001.3

**II. FIRE ALARM EQUIPMENT**

A. Manufacturer's specification sheet. UFC 1001.3, 1007.3.4.3
B. Equipment application per listing/approvals. UFC 1001.3, 1007.3.2
C. CSFM building materials listing sheet/numbers. UFC 1001.3 & T19

**III. GENERAL INFORMATION**

A. Appropriate codes & standards, including edition. UFC 1001.3, CBC
   Section 3505.1.3
B. Type of system or service involved. NFPA 72, 1993
C. Voice evacuation message/language(s), if involved. NFPA 72, 3-2.4.1
D. Written sequence of operation or matrix table. U FC 1007.3.4.3
E. Combination systems specific additional uses. U FC 1007.3.3.4, NFPA 72, 3-8.14
F. HVAC locations > 2000 cfm. CMC, Section 608
G. Special system features/operations. UFC 1007.3.4.3
H. Required placarding. UFC 1007.3.4.2 & NFPA 72, 1993

**IV. PLANS & DRAWINGS**

A. Scaled floor plans, including north reference. UFC 1001.3
B. Completed title block with site address and issuing contractor's business address. UFC 1001.3
C. Identification of each room's use. UFC 1001.3
D. Location of all components, including, end-of-line devices, if involved. UFC 1001.3
E. Symbol legend, including quantities, mfg name, model, etc. UFC 1001.3
F. Identification of circuit styles, designations and methods. UFC 1001.3
G. Description of zone assignments/device addresses. UFC 1001.3, 1007.3.3.7
H. Complete building cross-section, include attic, soffit, or ceiling details. UFC 1001.3
I. Location of sprinkler system test valve. UFC 1001.3
J. Specifications and details of through-penetration fire stopping, U.L. Fire Resistance if required. Directories
K. Device Mounting heights for manual boxes and visible notification appliances. NFPA 72, 3-8.1.1, 5-9.1.1 & 6-4.1.1
L. Primary power supply details. NFPA 72, 1-5.2.4, 2.8
M. Secondary power supply calculations. NFPA 72, 1-5.2.5
N. Voltage drop calculations. UFC 1001.3

**V. SINGLE LINE (RISER) DIAGRAM**

A. Conductor information, including size, stranding, insulation type, etc. CEC, Article 760
B. Conduit fill calculations or NEC reference. CEC, Table #4
C. Location of end-of-line devices. UFC 1001.3 "

2) Title block showing the Installer’s name, address, telephone number and license number.

3) Title block indicating project site address and University CAAN number, which shall be provided by the University’s Representative.

4) Include an accurate legend of symbols for all fire alarm devices being installed. The legend must include the quantity and model number for each device.

5) Wire/circuit legend with circuit identification, color, gauge, wire type, number of conductors, etc.

6) A Materials Submittal cover sheet identifying all FACP equipment, model numbers, and quantities including the California State Fire Marshall listing numbers and expiration date for each component. The listing sheet shall be cross-referenced with and shall match the manufacturer’s catalog data sheet.

7) Compliance Statements included on the Title Page:
   a) “The fire alarm system shall conform to Article 760 of the California Electrical Code. Installation of the fire alarm system shall not be started until detailed drawings and specifications, including current California State Fire Marshal listing sheets for each component of the fire alarm system, have been approved by the California State Fire Marshal and the University Fire Department.
   b) A set of fire alarm shop drawings that are stamped approved by the UCDFD shall be on the job site and used for installation. Any deviation from approved shop drawings, including substitution of devices, shall be approved in writing by the University Fire Department prior to installation.
   c) Any discrepancies between the drawings and the code or recognized standards shall be brought to the attention of the University’s Representative and the UCDFD.
   d) Upon completion of the installation of the fire alarm system, the contractor shall coordinate with other trades to test interconnections of the fire alarm system with other building systems and equipment. Once all functions indicated in the fire alarm system sequence of operations have been verified through testing by the installing contractor, an acceptance test must be performed in the presence of the University Fire Department. The acceptance test must successfully demonstrate all functions required in the contract.”

b. Floor Plans
   1) The entire project area, room numbers and use for all rooms or spaces.
   2) All fire rated walls, clearly identified within the project area.
   3) Indicate all (new and existing) final fire alarm device outlet locations.
   4) Show size and route of cable and conduits.
   5) Wire identification: Information showing conductor types, sizes and quantities for each conduit run.
   6) Device address for all addressable devices.
   7) Duct air velocity where each duct smoke detectors employing the use of sampling tubes is installed.
   8) Air handling systems supplying more than 2,000 cubic feet per minute.

c. Schematic and Wiring Sheets
   1) Riser diagrams with FACP, terminal cabinets, raceway layout, circuit style and identification labels (format and designations in accordance with paragraph 1.4E of this section), riser conduit size, and all devices; horizontal and vertical lines shall be provided to illustrate floors and zones.
2) Complete interior wiring diagrams for the fire alarm control panel and interior modules, cards and power supplies.

3) Point-to-point wiring diagrams showing interconnections between fire alarm control panels, terminal cabinets, annunciator panels, and fire alarm devices. All installed wiring (not factory wiring harnesses) shall be indicated. All variances from typical shall be illustrated in separate diagrams.

4) Point-to-point wiring indicating interface connections to equipment supplied by other sections including but not limited to all HVAC control panels, fire/smoke dampers, field devices, relays, elevators, and other auxiliary control(s).

d. Calculation Sheets

1) Alarm power requirements for all equipment in accordance with the voltage level conditions of notification devices described in Part 2 of this section.

2) Supervisory power requirements for all equipment.

3) Battery capacity calculations for all fire alarm control panels and auxiliary power supplies. Battery calculations shall include all electrical requirements of the entire fire alarm system, including the power consumption Calculation requirements in accordance with Part 2 of this section.

4) Power supply rating justification showing power requirements for each of the system power supplies. Calculation requirements in accordance with Part 2 of this section.

5) Voltage drop calculations for wiring runs indicating cumulative current draw and voltage drop from the panel to the last device in the loop. Calculation requirements as indicated in Part 2 of this section.

6) Raceway size calculations showing percentage fill in accordance with this specification.

e. Installation Detail Sheets

1) Detailed mounting installation diagrams of the control panel(s), remote annunciator(s), and audible silencing switch.

2) Elevation drawing showing all fire alarm equipment enclosures and raceways on the walls where they will be installed. Panels must not be higher than 6 feet and system status displays should be at eye level (+60 inches above finished floor). No equipment or raceways may be located under a cabinet containing batteries.

3) Front view of the control panel(s) and all annunciator panels.

4) FACP, labels and labeling schemes for circuits, and field devices; nameplates and messages on the control panel(s) and annunciators shall be provided in actual size (see nameplate and labeling requirements in this section)

5) Elevation details for manual pull stations and visual alarm signaling devices.

6) Duct Smoke Detectors: Performance parameters and installation details for each detector, verifying that each detector is listed for the complete range of air velocity, temperature, and humidity possible when air-handling system is operating.

7) Ductwork Coordination Drawings: Plans, sections, and elevations of ducts, drawn to scale and coordinating the installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, the detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.

8) Voice/Alarm Signaling Service: Equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
9) Details and listing numbers of through penetration fire stop systems.
10) Details on support and anchorage of any fire alarm equipment weighing over 20 pounds.
11) Dimensioned drawings of all raceways routing and crossover details showing accurately scaled layouts and spatial relationship to associated equipment and connections. These drawings shall be fully coordinated with other trades prior to submittal. Show relationship to adjacent surrounding structure. At the completion of the work, revise all shop drawings and other documentation to reflect any revisions.

f. Schedule Sheets
1) Schedule of addressable circuits and corresponding circuit lengths
2) Circuit schedules for horns, speakers, strobes, auxiliary controls.
3) Functional response matrix identifying all system responses upon activation of each type of device.
4) Annunciator text messages and device address for each addressable device as delineated in the Annunciation Section.
5) Annunciation requirements: In an addressable system, each initiating device shall annunciate at the FACP (and remote annunciator) as a discrete point on an alphanumeric display. Provide descriptive alphanumeric program labels for each system-initiating device in accordance with the following format: Zone/Module/Point/Device Type/Specific Information and/or Location (and special access notes)

Examples:
PART 2 - Zone 107, Module 33, Point 24, MPS, 4th Fl, C-Wing, corridor by Room 432
PART 3 - Zone 66, Module 1, Point 76, Duct Detector, 7th Fl, SF-2, in Mech Room 711
PART 4 - Zone 10, Module 33, Point 10, Water flow, 3rd Fl, Tower, in Stair No. 2

E. Qualification Data: For Installer. Refer to paragraph 1.8 of this Section.

F. Testing & Commissioning Procedures:
1. Comply with the submittal requirements of Section 01660 Systems and Equipment Start-up and “Testing.
2. Comply with the submittal requirements of Section 01662 Commissioning.
3. In addition, prior to pre-test, submit the following for review and approval via the University's Representative to the O & M Alarm Shop for University's Representative approval:
   a. A written acceptance test procedure (ATP), which shall include customized check-off sheets.
   b. An electronic copy of the UC Davis Zone Sheet listing all circuits to identify the following:
      1) Device address (initiating only)
      2) Manufacturer fixed labels (device type)
      3) Custom labels (conforming to UC Davis standard format)
      4) A complete copy of panel programming.

G. Field quality-control test reports. See Quality Assurance, Paragraph 1.8 of this Section.

H. As-built Drawings
1. While the system installation is in progress, one additional set of shop drawings will be kept at the job site. This set will be designated as the As-Built Drawings and will
be updated regularly to reflect current as-built information. These drawings shall reflect the following:

a. Changes as a result of final installation, testing, or a change to the system design.

b. An accurate depiction of risers, raceway, conduit, all wire runs, cable identification, conduit size, location of junction boxes, terminal boxes, sources of power, devices, sensors, equipment, controlled equipment (motor starters, fans, pumps, valves, dampers, etc.)

2. One set of as-built drawings can be replaced with a fresh updated set of drawings, but there shall never be more than one active set of as-built drawings.

3. The University’s Representative and UCDFD shall be given access to this set of as-built drawings at all times so that progress may be reviewed and copies can be made.

I. Record Documents

1. Comply with the requirements of Section 01789 Project Record Documents.

J. Operation and Maintenance Manuals

1. Comply with the requirements of Section 01830 Operation and Maintenance.

2. Comply with NFPA 72, Appendix A, recommendations for University Representative’s manual. Include abbreviated operating instructions for mounting at the FACP.

3. Submit operation and maintenance manuals including a brief description of the functions of and theory of operation of each system. Provide clear, concise and detailed operating instructions for all control functions giving the information required to properly operate the equipment and systems.

4. Include technical data sheets, floor plans showing locations of all devices and any other pertinent information such as schematics, parts lists, adjustments and troubleshooting procedures.

5. Include all working programs on 3-1/2-inch floppy disks and 5-inch compact disks, as well as a printed program listing with a license issued to the University’s Representative (for on-site-system use) to modify and reproduce software documentation.

H. Final Completion Documentation

1. Approval and Acceptance: Provide the Record of Completion form according to NFPA 72 to University’s Representative.

2. Record of Completion Documents: Provide the Permanent Records according to NFPA 72 to University’s Representative.

3. Submit the following documents to the University’s Representative:
   a. Letter to the University’s Representative certifying that the fire alarm system is completely functional and conforms to all applicable codes, ordinances, and requirements of the contract.
   b. Installation permit from the DCFM or AHJ to the University’s Representative.

1.8 QUALITY ASSURANCE

A. The Contractor shall design, supervise, program, test, and commission the installed system and provide warranty service in accordance with NFPA 72. The Contractor’s design shall complement the design provided by the qualified designer. A qualified designer as defined by NFPA 72, 1999 1-5.1.3, A-1-5.1.3 shall have the proper training, education and experience.

B. Manufacturer Qualifications: Equipment shall only be provided from firms regularly engaged in design and manufacture of fire detection, alarm and communications systems, components and accessories, of types, sizes, capacities and characteristics required, whose products have been in satisfactory use in similar service for not less than 5 years.
C. Approved Equipment: Provide fire alarm materials, equipment and devices that have been constructed in accordance with the latest edition of the following publications from Underwriters Laboratories Inc. (UL), or Factory Mutual Engineering Corporation (FM). Materials shall be tested and listed and approved for fire protection service when so required by NFPA 72 or this specification.
1. UL 228 - Door Holding Devices
2. UL 464 - Audible Signal Appliances, Fifth Edition
3. UL 864 - Control Units for Fire Protective Signaling Systems, Sixth Edition
4. UL 1638 - Visual Signaling Appliances Standard
5. UL 1971 - Signaling Devices for the Hearing Impaired
6. UL Fire Protection Equipment Directory
7. UL Electrical Construction Materials Directory
8. FM P7825 Approval Guide

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Qualifications—Contractor shall meet the following qualifications, and shall submit proof within 10 days of the Notice to Proceed as described below:
1. Qualified personnel shall include, but shall not be limited to, individuals with the following qualifications:
   a. Factory trained and certified.
   b. National Institute for Certification in Engineering Technologies (NICET) fire alarm certified (Level III minimum or Level IV)
   c. International Municipal Signal Association (IMSA) fire alarm certified.
   d. Trained and qualified personnel employed by an organization listed by a national testing laboratory for the servicing of fire alarm systems.
   e. A professional engineer, registered in the State of the installation.
2. Contractor must possess a C-10 Electrical State of California Contractor’s License and have a minimum of 5 years experience in the business of installing fire alarm systems.
3. Contractor shall have successfully completed similar local (Northern California) jobs in scope and nature, using the proposed product line, fire alarm panel, and equipment, in other buildings over the past three years. For new product lines, one system shall have been completed and in service for at least 1 year.
4. Provide a list of at least 3 similar fire alarm projects valued at least at $50,000.00 performed by Contractor with its own forces within the last 3 years including for each project the following information:
   a. Name, address and phone number of project representative for person or entity for which project was performed.
   b. Date project was started.
   c. Date project was completed.
   d. The dollar amount for the project contract.
   e. Description of work performed.
5. Contractor shall be the manufacturer or a local authorized representative of the manufacturer with a proven track record of being responsive, providing accurate and complete submittals, meeting project schedules, and being prepared for system testing and acceptance.
6. Contractor shall be able to provide a fully equipped and qualified factory-trained repair technician at the job site for any request for emergency services within the time stipulated under the paragraph 1.10 Guarantee. This service shall be available 24 hours a day during the term of warranty.
7. Contractor shall furnish evidence that the fire alarm equipment supplier has an experienced and effective service organization, which carries a stock of repair parts for the system to be furnished. The Contractor must be able to provide any replacement part on site within 48 hours during the warranty period. Should the
Contractor fail to comply with the service requirements of this section, the University's Representative will then have the option to make the necessary repairs and back charge the Contractor without any loss of warranty or guarantee as provided by the contract documents.

8. Contractor shall employ the services of a factory-authorized service representative who is factory-trained and certified to supervise the field assembly and connection of components, program, pre-test, test, adjust, and commission the system.

F. Shop Testing: Shop test all fire detection, alarm and communications systems assemblies prior to delivery to the job site to ensure that all components perform to Specifications.

1.9 SEQUENCING AND SCHEDULING

A. Existing Fire Alarm Equipment: Maintain fully operational until the new equipment has been tested and accepted by the University's Representative. As new equipment is installed, it shall be labeled “NOT IN SERVICE” until the new equipment is accepted. Once the new system is completed, tested, and accepted by the University's Representative it shall be placed in service and connected to the existing UL listed central station service. All new equipment shall have tags removed and the existing equipment shall be tagged “NOT IN SERVICE” until removed from the building.

G. Equipment Removal: All existing equipment, wiring, junction boxes and conduit for the existing fire alarm system shall be removed after the installation of the new system has been accepted by the University Fire Marshal. All existing panels, other panels, manual pull stations, detectors or bells shall be turned over to the University's Representative.
   1. All other materials shall be removed from the site and disposed of by the Contractor.
   2. All areas where existing devices were removed and not replaced shall be restored to match adjacent surfaces or repaired as indicated on the Drawings.

H. Interruption of Existing Fire Alarm Service: Do not interrupt fire alarm service to facilities occupied by University or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:
   1. Notify the University’s Representative in writing no fewer than 14 days in advance of proposed interruption of fire alarm service.
   2. Do not proceed with interruption of fire alarm service without the University Representative's written permission.

I. Fire Watch: Where it is necessary to shut down existing fire alarm systems for switch-over purposes or any other reason that leaves the building unprotected, the Contractor shall provide a continuous UCDFD approved fire watch during the shutdown.
   1. Fire watch personnel shall be trained in the use and operation of portable fire extinguishers, and instructed in how to contact the UC Davis Dispatch Center by either radio or telephone.
   2. Continuous rounds to cover all areas of the building are required every 30 minutes.
   3. An evacuation plan which includes a method to notify all occupants is required in occupied buildings.
   4. Maintain a log of the rounds and comprehensive notes.
   5. Provide a 30-day notice to the University's Representative and attend coordination meetings for fire watch approval.

J. Existing Electrical Systems: Provide 48 hours notice to the University’s Representative before working on any existing equipment or circuits.

1.10 GUARANTEE

A. Refer to Section 01780 Guarantees, Warranties, Bonds, Service and Maintenance Contracts and Exhibit 19 Guarantee/Warranty form.
B. In addition to the above, the Contractor shall guarantee labor, materials, and equipment provided under this contract against defects for a period of 2 years from the date of final acceptance of this work by the University's Representative and the receipt of as-built drawings and schematics of all equipment. Where the original manufacturer's warranty covers a longer time period than that required by these specifications, the manufacturer's warranty shall govern.

Submit a written guarantee agreeing to repair or replace defective materials and workmanship within the required response time described below during the warranty period, at no cost to the University, which shall start on the date of system acceptance. Defective materials and workmanship are defined to include operational failures, performance below required minimums, evidence that the system will not be reasonably maintainable, errors in documentation, abnormal operations, unsafe conditions, and similar unsatisfactory performance when operated within the conditions specified in these documents and manufacturer's recommendations.

1. Response time for emergency service shall be no longer than 2 hours from the time of notification. Response time for non-emergency service shall be no longer than 24 hours from the time of notification. These services shall be available 24 hours a day.

2. Repairs or replacements shall be completed within 16 hours of notification. For all repairs that cannot be completed after the initial response, a written plan of correction shall be submitted to the University prior to leaving the premises.

1.11 MAINTENANCE CONTRACT

A. The equipment manufacturer shall provide to the University a maintenance contract proposal to provide a minimum of 2 inspections and tests per year in compliance with NFPA-72H guidelines.

1. After system acceptance, the Contractor shall provide the required yearly inspections described above as part of the contract warranty. The inspection services under this contract shall be performed at no additional cost during the warranty period.

2. The University shall have the option of renewing the maintenance contract for single or multiple years up to five years at the contract sum quoted upon completion of the warranty period.

3. The Contractor performing the contract services shall be qualified and listed to maintain ongoing certification of the completed system to the UL for specific installed system listing.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. The fire alarm control equipment shall consist of a system assembled as an approved unit of regularly manufactured components, by a single manufacturer for the purposes described elsewhere in this specification. The fire alarm control equipment must have a proven track record of service and reliability in projects of similar scope to this project. Interconnecting equipment that has not been listed for interconnection, or the creation of components or system into a nonstandard unit that is not normally available from the manufacturer, is not acceptable.

B. Provide products by the following:

1. Silent Knight – Campus Standard, no exceptions, no substitutions.

2.2 EXISTING FIRE ALARM SYSTEM

A. Compatibility with Existing Equipment: Fire alarm system and components shall operate as an extension of an existing system.
2.3 SYSTEM SOFTWARE
A. The CPU and Life Safety Software shall be the latest version listed by the CSFM. Time
and date information will be included in all output messages.
B. The fire alarm system shall allow for loading and editing instructions and operating
sequences as necessary. The system shall be capable of on-site programming to
accommodate system expansion and facilitate changes in operation. All software
operations shall be stored in a non-volatile programmable memory within the fire alarm
control unit. Loss of primary and secondary power shall not erase the instructions stored in
memory.

2.4 FIRE ALARM CONTROL PANELS (FACP)
A. General Description
1. Modular, power-limited design with electronic modules, UL 864 listed.
2. Equipped with a nonvolatile memory that requires no battery backup.
3. Addressable initiation devices that communicate device identity and status.
   a. Smoke sensors shall additionally communicate sensitivity setting and allow for
      adjustment of sensitivity at the FACP.
   b. Temperature sensors shall additionally test for and communicate the
      sensitivity range of the device.
3. Addressable control circuits for operation of mechanical equipment.
C. Circuits
   a. System Layout: Install no more than 80 percent of maximum addressable
device capacity on each signaling line circuit.
2. Notification-Appliance Circuits: NFPA 72, Class B, Style Y.
3. Actuation of alarm notification appliances, [emergency voice communications,]
   annunciation, [smoke control,] [elevator recall,] [and actuation of suppression
   systems] shall occur within 10 seconds after the activation of an initiating device.
4. Electrical monitoring for the integrity of wiring external to the FACP for mechanical
equipment shutdown and magnetic door-holding circuits is not required, provided a
break in the circuit will cause doors to close and mechanical equipment to shut
down. Locate addressable control module within 5 feet of control panel being
controlled.
D. Smoke-Alarm Verification
1. An activated smoke detector shall automatically reset and then recheck the
   atmosphere following a 60-second waiting period.
2. The fire alarm system will not activate until detection is confirmed following the
   waiting period.
3. Activation of a second detector during the waiting period shall activate the alarm
   system immediately.
4. All area and duct smoke detectors shall be enabled with this feature.
5. Provide a disabling feature at the system keypad for system commissioning and
   University confidence testing.
6. Disabling this feature shall be accomplished via the keypad on a zone, or group of
   zones, basis.
7. Enable the feature following University and DCFM approval of the system.
E. Notification-Appliance Circuit: Operation shall sound in a [temporal pattern, complying with
   ANSI S3.41] [60 beats per minute, march-time pattern] [120 beats per minute, march-time
   pattern].
1. The FACP shall support independent {speaker} horn and visual alarm circuits
   originating from FACP mounted hardware for each floor and zone of the building.
   a. Provide a schedule by performing circuit load calculations considering wire
      length, gauge, number of devices, and FACP specifications.
   b. Do not use a single circuit for multiple floors or zones; however, a number of
      circuits may be required for a single zone.
2. Visual notification circuits shall be synchronized per circuit at each floor's terminal cabinet.

3. No horn [speaker] or strobe circuit shall exceed 10 percent voltage loss measured at the end-of-line device. No strobe circuit shall exceed a 2.1-volt line loss measured at the end-of-line device with a 21-volt DC input at the fire alarm panel end of the circuit.

4. Calculate visual alarm (strobe) circuit capacity and line loss using the strobe's 20-volt DC ratings.

5. The FACP shall support independent door and [corridor damper] control circuits originating from FACP mounted hardware for each floor and zone of the building.

F. Elevator Controls

1. Heat detector operation shuts down elevator power by operating a shunt trip in a circuit breaker feeding the elevator through an addressable control module.

2. Water-flow alarm connected to sprinkler in an elevator shaft and elevator machine room shuts down elevators associated with the location without time delay through an addressable control module.

3. Activation of the heat detector or water flow will operate the building notification appliances and annunciator.

G. Power Supply

1. General requirements: The FACP and Power Boosters shall have the following requirements:
   a. All 24 VDC power supply shall be powered by 120-volt AC power, with a battery backup system regardless of the building's primary or alternate source of power.
   b. Power supply shall have a dedicated fused safety switch for this connection at the service entrance equipment. Paint the switch box red and identify it with FIRE ALARM SYSTEM POWER.
   c. Surge Suppression: Install surge protection on normal ac power for the FACP and its accessories. Comply with Division 16 Section Transient Voltage Suppression for auxiliary panel suppressors.
   d. Install surge protectors recommended by FACP manufacturer. Install on all system wiring external to the building housing the FACP.
   e. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module.
   f. Secondary Power: 24-V dc supply system with batteries and automatic battery charger and an automatic transfer switch.
   g. Batteries: [Sealed lead calcium] [Sealed, valve-regulated, recombinant lead acid] [Vented, wet-cell pocket, plate nickel cadmium]. Sized with 25 percent reserve capacity for future expansion.
   h. 24-hour system backup capability plus 5 minutes of full alarm operation at the end of a 24-hour period.
   i. Charger shall be able to restore batteries to full charge within 48 hours after a complete discharge.
   j. No power supply shall be loaded to greater than 80 percent of its rated capacity. Rated capacity shall be calculated as the total load plus 25 percent future expansion.

2. Additional Requirements - FACP and Power Boosters
   a. Fire Alarm Panel Supply
      1) The FACP shall supervise battery and charging system.
      2) The FACP shall include trouble annunciation of high/low voltage, shorted cell and open circuits.
      3) A means of disconnecting the 120 VAC feed to the FACP for maintenance shall be provided within the FACP or in a locked enclosure within 10 feet of the FACP.
   b. Power Boosters
1) Power supply shall have normally open trouble output contacts for monitoring by an external fire alarm system interface module.

2) Power supply shall have supervised input circuit for external activation of alarm notification appliance circuits from fire alarm system interface module.

3) Choose this option for critical facilities only. {Cabinet shall be provided with tamper switch on the door. Tamper switch shall be supervised by an external fire alarm system interface module. Opening of the door shall result in a trouble condition at the FACP.}

3. Door Holder Auxiliary Power Supplies
   a. All 24 VDC power supply shall be powered by 120-volt AC power, with battery backup system to supply all loads plus 25 percentage future capacity.
   b. Power supply shall only be loaded at 80 percentage of its rated capacity. Apply this factor after adding the future capacity to the total load calculated in 3.a above.
   c. Emergency power is not required for the door holders. Doors may close upon loss of building power.
   d. Door Holder Power Supply may be configured to be de-energized upon loss of 120 VAC power to minimize 24 VDC battery supply requirements. Clearly indicate this function on the shop drawing battery calculations.

H. Alarm Silencing, Trouble, and Supervisory Alarm Reset: Manual reset at the FACP [and remote annunciators,] after initiating devices are restored to normal.
   1. Silencing-switch operation halts alarm operation of notification appliances and activates an alarm silence light. Display of identity of the alarm zone or device is retained.
   2. Subsequent alarm signals from other devices or zones reactivate notification appliances until silencing switch is operated again.
   3. When alarm-initiating devices return to normal and system reset switch is operated, notification appliances operate again until alarm silence switch is reset.

I. Walk Test: A test mode to allow one person to test alarm and supervisory features of initiating devices.
   1. Enabling of this mode shall require the entry of a password.
   2. The FACP and annunciators shall display a test indication while the test is underway.
   3. Test mode causes the system’s signal to sound, and a report to be printed, when a device is activated, or a trouble or supervisory condition identified, followed by a prompt automatic reset of the FACP.
   4. The signal sounding shall be capable of being turned off independent of the printing function.
   5. If testing ceases while in walk-test mode, after a preset delay, the system shall automatically return to normal.
   6. This feature shall be available for system acceptance testing/commissioning.

J. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and control of changes in those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and make a printout of the final adjusted values on the system printer.

K. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, trouble, and supervisory signals to a remote alarm station through a digital alarm communicator transmitter and telephone lines.
L. Service Modem: Ports shall be RS-232 for system printer and for connection to a dial-in terminal unit.

1. The dial-in port shall allow remote access to the FACP for programming changes and system diagnostic routines. Access by a remote terminal shall be by encrypted password algorithm.

M. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble), and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also print system reset event, including the same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.

N. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

O. History log: Log a history of alarm and trouble events for the system.

O. Alphanumeric Display and System Controls: Arranged for interface between human operator at the FACP and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, three lines of 80 characters, minimum.

2. Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.

2.5 VOICE COMMUNICATION SYSTEM

A. Voice/Alarm Signaling Service: A central emergency communication system with redundant microphones, preamplifiers, amplifiers, and tone generators provided [in a separate cabinet located in the Fire Command Center] [as a special module that is part of the FACP].

3. Indicated number of alarm channels for automatic, simultaneous transmission of different announcements to different zones, or for manual transmission of announcements by use of the central-control microphone. Amplifiers shall be UL 1711 listed.

a. Allow the application of and evacuation signal to indicated number of zones and, at the same time, allow voice paging to the other zones selectively or in any combination.

b. Programmable tone and message sequence selection.

c. Standard digitally recorded messages for Evacuation and All Clear.

d. Generate tones to be sequenced with audio messages of the type recommended by NFPA 72 and that are compatible with tone patterns of the notification-appliance circuits of the FACP.

4. Notification-Appliance Circuits: NFPA 72, Class B.

5. Status Annunciator: Indicate the status of various voice/alarm speaker zones and the status of firefighters' two-way telephone communication zones.

6. Preamplifiers, amplifiers, and tone generators requirements:

a. Audio amplifiers shall be sized to provide ½ Watt minimum speaker taps and as indicated on the drawings.

b. Each audio amplifier shall have 50 percent minimum spare capacity when attached to the speakers necessary to meet audio requirements.

c. Automatically transfer to backup units, on primary equipment failure. FACP shall incorporate a spare automatic backup audio amplifier equal in size to the largest individual amplifier.
7. Locate all amplifiers at the head-end (FACP) of the system.
8. Mount all components within a steel enclosure with locked door(s).

2.6 FIREFIGHTERS' TWO-WAY TELEPHONE COMMUNICATION SERVICE

A. Dedicated, two-way, supervised, telephone voice communication links between the FACP, [the Fire Command Center,] and remote firefighters' telephone stations. Supervised telephone lines shall be connected to talk circuits by controls in a control module. Provide the following:
   1. Selective-talk type for use by firefighters and fire wardens.
   2. Controls to disconnect phones from talk circuits if too many phones are in use simultaneously.
   3. Audible Pulse and Tone Generator, and High-Intensity Lamp: When a remote telephone is activated, it causes audible signal to sound and high-intensity lamp to flash.
   4. Selector panel controls simultaneous operation of telephones in selected zones and permits up to six phones to be operated simultaneously. Indicate ground faults and open or shorted telephone lines on the panel front by individual LEDs.
   5. Provide [graphic] [liquid-crystal digital] display to indicate location of caller.
   6. Remote Telephone Cabinet: Flush or surface-mounted cabinet, as indicated, factory-standard red finish, with handset.
      a. Install one-piece handset to cabinet with vandal-resistant armored cord. Silk-screened or engraved label on cabinet door, designating ["Fire Warden Phone" or] Fire Emergency Phone.
      b. With break-glass type door access lock.
   8. Handsets: Provide [push-to-talk] type sets [with noise-canceling microphone]. Provide <Insert number> handsets stored in a cabinet [adjacent to the FACP] [in the Fire Command Center]. MASTER FIRE ALARM BOX.

2.7 SILENCING SWITCH

A. Individual, fully supervised, test and maintenance switches shall be mounted in a box located next to the FACP and shall prevent operation of the master box; shall bypass the alarm signaling devices (e.g., speakers, horns, strobes); and shall intercept or block fan controls, door controls, elevator controls, dampers and other circuits as specified.

B. Keyed box shall be painted red. Keyed box shall match the Fire Alarm Control Panel key.

2.8 MANUAL STATIONS

A. Description: UL 38 listed; finished in red with molded, raised-letter operating instructions in contrasting color. Station shall show visible indication of operation. Mounted on recessed outlet box; if indicated as surface mounted, provide manufacturer's surface back box.
   1. Single action mechanism, pull lever type. With integral addressable module arranged to communicate status (normal, alarm, or trouble) to the FACP.
   2. Reset shall be accomplished with a lock and key.
   3. The station housing shall be fire red factory finish.
   4. Exposed back boxes shall be manufactured and designed specifically for the application.
   5. Indoor Protective Shield: Factory-fabricated clear plastic enclosure, hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.
   6. Weatherproof Protective Shield: Factory-fabricated clear plastic enclosure, hinged at the top to permit lifting for access to initiate an alarm.

2.9 SMOKE DETECTORS/SENSORS

A. General Description
1. UL 268 listed, operating at 24-V dc, nominal.

2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.

[Retain subparagraph above or first subparagraph and associated subparagraphs below, or both. If retaining both, indicate detector types on Drawings.]

3. Multipurpose type, containing the following:
   a. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
   b. Piezoelectric sounder rated at 88 dBA at 10 feet (3 m) according to UL 464.
   c. Heat sensor, combination rate-of-rise and fixed temperature.

4. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. Provide terminals in the fixed base for connection of building wiring.

5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.

6. Integral Visual-Indicating Light: LED type. Indicating [detector has operated] [and power-on] status.

[Retain subparagraph and associated subparagraphs below for analog-addressable system where remotely adjustable detectors are to be used. If both standard-addressable and analog-addressable devices are required, indicate device types on Drawings.]

7. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at the FACP for calibration, sensitivity, and alarm condition, and individually adjustable for sensitivity from the FACP.
   a. Rate-of-rise temperature characteristic shall be selectable at the FACP for 15 or 20 deg F (8 or 11 deg C) per minute.
   b. Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at the FACP to operate at 135 or 155 deg F (57 or 68 deg C).

[Indicate the specific number of levels on Drawings or in the Remarks column of a detector schedule]
   c. Provide multiple levels of detection sensitivity for each sensor.

B. Ceiling or area-type smoke detectors

1. Detectors shall be photoelectric
   a. Sensor: LED or infrared light source with matching silicon-cell receiver.

[Verify detector sensitivity below with manufacturers selected.]
   b. Detector Sensitivity: Between 2.5 and 3.5 percent/foot (0.008 and 0.011 percent/mm) smoke obscuration when tested according to UL 268A.

2. Separate base. [Addressable analog or two-wire type utilizing addressable component by other manufactures must be approved by the University’s Representative, O & M Alarms and UCDFD].

3. The detectors, complete with terminating equipment, shall be fully supervised, and shall not activate alarm due to rapid changes in humidity, or a fan maintenance shutdown, etc.

4. The detector shall be equipped with LED alarm condition indicator light.

5. When exposed back boxes are needed for interior work use round wire mold boxes of the appropriate size.

C. Beam-Type Smoke Detector: Each detector shall consist of a separate transmitter and receiver, and shall have the following features.

1. UL 268 listed, operating at 24-V dc, nominal.
2. **Adjustable Sensitivity:** At least six sensitivity levels, settable at the receiver, measured as percent of obscuration.

3. **Two selectable alarm delay settings,** allowing each to be associated with a corresponding sensitivity.

4. **Trouble signal delay,** fixed at 20 seconds.

5. **Separate Color-Coded LEDs:** Indicate normal, alarm, and trouble status [with remote indicator panels].

[Edit first paragraph and subparagraphs below to suit Project. Coordinate with Drawings.]

D. **Remote Air-Sampling Detector System:** Includes air-sampling pipe network, a laser-based photoelectric detector, a sample transport fan, and a control unit.

1. UL 268 listed, operating at 24-V dc, nominal.

[Other pipe materials may be specified in first subparagraph below depending on codes and Project.]

2. **Pipe Network:** Electrical metallic tubing connects control unit with designated sampling holes.

3. **Smoke Detector:** Particle-counting type with continuous laser beam. Sensitivity adjustable to a minimum of three preset values.

4. **Sample Transport Fan:** Centrifugal type, creating a minimum static pressure of 0.05-inch wg (12.5 Pa) at all sampling ports.

[Coordinate two subparagraphs below with FACP Article.]

5. **Control Unit:** Single or multizone unit as indicated on the drawings. Provides same system power supply, supervision, and alarm features as specified for the central FACP plus separate trouble indication for airflow and detector problems.

6. **Signals to the Central FACP:** Any type of local system trouble is reported to the central FACP as a composite trouble signal. Alarms on each system zone are individually reported to the central FACP as separately identified zones.

E. **Duct Smoke Detectors**

1. **Photoelectric Smoke Detectors**

   a. **Sensor:** LED or infrared light source with matching silicon-cell receiver.

   [Verify detector sensitivity below with manufacturers selected. Increased and decreased sensitivities are available to meet special environmental requirements.]

   b. **Detector Sensitivity:** Between 2.5 and 3.5 percent/foot (0.008 and 0.011 percent/mm) smoke obscuration when tested according to UL 268A.

   2. UL 268A listed, operating at 24-V dc, nominal.

   3. **Integral Addressable Module:** Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.

   4. **Plug-in Arrangement:** Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. The fixed base shall be designed for mounting directly to the air duct. Provide terminals in the fixed base for connection to building wiring.

   a. **Weatherproof Duct Housing Enclosure:** UL listed for use with the supplied detector. The enclosure shall comply with NEMA 250 requirements for Type 4X.

   5. **Self-Restoring:** Detectors shall not require resetting or readjustment after actuation to restore them to normal operation.

   6. **Integral Visual-Indicating Light:** LED type. Indicating [detector has operated] [and power-on] status. [Provide remote status and alarm indicator and test station where indicated.]
[Retain subparagraph below for analog-addressable system where remotely adjustable detectors are to be used. If both standard-addressable and analog-addressable devices are required, indicate device types on Drawings]

7. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at the FACP for calibration, sensitivity, and alarm condition, and individually adjustable for sensitivity from the FACP.

[The number of FACP settable levels varies among manufacturers and between detector types. Indicate the specific number of levels on Drawings or in the Remarks column of a detector schedule].

8. Each sensor shall have multiple levels of detection sensitivity.
9. Sampling Tubes: Design and dimensions as recommended by manufacturer for the specific duct size, air velocity, and installation conditions where applied.
11. Addressable analog or two-wire type utilizing addressable component by other manufactures must be approved by the University’s “Representative, O & M Alarms and UCDFD”.
12. The devices shall include necessary sampling tube extensions.
13. The device shall function uniformly in air velocities of 500 FPM through 4000 FPM.
14. Heat sensor feature is not required.
15. Install remote indicating light where indicated on the drawings and where detector indicating lights are not readily visible.
16. Mount remote indicator lights adjacent to the unit, 4 to 6 feet above finished floor. The location must not obstruct area served.
17. Device shall be flush or semi-flush mounted with identifying nameplate.
18. Integral Visual-Indicating Light: LED type. Indicating [detector has operated] [and power-on] status.

2.10 HEAT DETECTORS

A. General: UL 521 listed.

[Preferably heat detectors shall be a rate of rise and fixed temperature low profile (addressable) type and shall be ordinary temperature range in all areas except where located in a high ambient temperature area].

B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F (57 deg C) or rate-of-rise of temperature that exceeds 15 deg F (8 deg C) per minute, unless otherwise indicated.

1. Mounting: [Adapter plate for outlet box mounting] [Plug-in base, interchangeable with smoke-detector bases].
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.

C. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190 deg F (88 deg C).

1. Mounting: [Adapter plate for outlet box mounting] [Plug-in base, interchangeable with smoke-detector bases].
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.

D. An indicator on the exposed surface of the detector shall display the actuated condition of the detector.

E. Analog detectors may be used as part of an addressable system.
2.11 NOTIFICATION APPLIANCES

A. Description: Equipped for mounting as indicated on the drawings and with screw terminals for system connections.

B. Bells: Electric vibrating, 24-V dc, under-dome type with provision for housing the operating mechanism behind the bell. Bells shall produce a sound-pressure level of 94 dBA, measured 10 feet from the bell. 10-inch size, unless otherwise indicated. Bells are weatherproof where indicated.

C. Chimes, Low-Level Output: Vibrating type, 75-dBA minimum rated output.

D. Chimes, High-Level Output: Vibrating type, 81-dBA minimum rated output.

E. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn.

F. Visible Alarm Devices: Xenon strobe lights listed under UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word FIRE is engraved in minimum 1-inch-high letters on the lens.
   1. Rated Light Output
      a. 15 candelas from end of corridor.
      b. 110 candelas at the pillow in sleeping areas of accessible living units.
      c. 75 or 110 candela as indicated on the drawings.
   2. Strobe Leads: Factory connected to screw terminals.

G. Voice/Tone Speakers
   1. UL 1480 listed.
   2. High-Range Units (in noisy environments): Rated 2 to 15 W.
   3. Low-Range Units (in quiet environments): Rated 1 to 2 W.
   4. Mounting: Flush, semi recessed, or surface mounted; bi-directional as indicated.
   5. Matching Transformers: Tap range matched to the acoustical environment of the speaker location.
   6. Speakers located in rest rooms and similar enclosed areas where alarm threshold may be high should be tapped at ¼ watt.
   7. All settings other than ½ watt are identified on the drawings.

H. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly.
   1. Speaker/strobes color shall be as approved by UC Davis Representative and have sealed back, metal grill, with multiple wattage taps including ¼, ½, 1 watt, and 2 watts, and multiple candela taps 15, 30, 75 or 110.
   2. Install all speakers at the ½ watt setting unless indicated otherwise on the drawings and with the candela setting as indicated on the drawings.

2.12 SPRINKLER SYSTEM REMOTE INDICATORS

A. Remote status and alarm indicator and test stations, with LED indicating lights. Light is connected to flash when the associated device is in an alarm or trouble mode. Lamp is flush mounted in a single-gang wall plate. A red, laminated, phenolic-resin identification plate at the indicating light identifies, in engraved white letters, device initiating the signal and room where the smoke detector or valve is located. For water-flow switches, the identification plate also designates protected spaces downstream from the water-flow switch.
B. Tamper supervisory valve and water flow switches shall be provided by Division 15 Section [XXXXX]. Wiring and raceway from the switches to the fire alarm addressable interface modules and the final connection to the fire alarm system shall be provided and installed by this section.

C. The sprinkler electric bell shall be provided under this section and shall be Wheelock model MB-20, 24 VDC.

2.13 MAGNETIC DOOR HOLDERS

A. Description: Units are equipped for wall or floor mounting as indicated on the drawings and are complete with matching door plate.

1. Electromagnet: Requires no more than 3 W to develop 25-lbf (111-N) holding force.
2. Wall-Mounted Units: Flush mounted, unless otherwise indicated.

B. Material and Finish: Match door hardware.

2.14 REMOTE ANNUNCIATOR

A. Description: Duplicate annunciator functions of the FACP for alarm, supervisory, and trouble indications. Also duplicate manual switching functions of the FACP, including acknowledging, silencing, resetting, and testing.

1. Mounting: [Flush] [Surface] cabinet, NEMA 250, Class 1.

B. Display Type and Functional Performance: Alphanumeric display same as the FACP. Controls with associated LEDs permit acknowledging, silencing, resetting, and testing functions for alarm, supervisory, and trouble signals identical to those in the FACP.

C. Provide alphanumeric type remote annunciator with 80 character LCD display. Mount annunciator(s) at locations determined by UCDFD. Coordination site walk or plan review is recommended to determine the minimum of two quantities and locations.

2.15 MASTER FIRE ALARM BOX—Existing system at University:

A. Gamewell M34-53 (Shunt Type).

2.16 ADDRESSABLE INTERFACE MODULE

A. Description: Microelectronic monitor module listed for use in providing a system address for listed alarm-initiating devices for wired applications with normally open contacts.

B. Integral Relay: Capable of providing a direct signal [to the elevator controller to initiate elevator recall] [to a circuit-breaker shunt trip for power shutdown] [Insert other functions].

C. Provide addressable interface modules to interface with non-addressable initiating devices, installed in junction box adjacent to water flow, and tamper switches.

2.17 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Listed and labeled according to UL 632.

B. Functional Performance: Unit receives an alarm, supervisory, or trouble signal from the FACP, and automatically captures one or two telephone lines and dials a preset number for a remote central station. When contact is made with the central station(s), the signal is transmitted. The unit supervises up to two telephone lines. Where supervising 2 lines, if service on either line is interrupted for longer than 45 seconds, the unit initiates a local trouble signal and transmits a signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. When telephone service is restored, unit
automatically reports that event to the central station. If service is lost on both telephone lines, the local trouble signal is initiated.

C. Secondary Power: Integral rechargeable battery and automatic charger. Battery capacity is adequate to comply with NFPA 72 requirements.
D. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.18 FIRE ALARM TERMINAL CABINETS AND AUXILIARY CABINETS
A. Enclosures shall be NEMA Type 1 or Type 12. All panels shall be {surface or flush} mounted with hinged door and latch with lock. All locks shall match FACP key. Box and front shall be steel, painted to match wall in finished areas.
B. Fire alarm terminal cabinet shall be labeled with a riveted or screwed laminated plastic nameplate indicating “FIRE ALARM TERMINAL CABINET” in ¼ inch white letters on a red background.
C. Provide a wire schematic similar to that specified inside the cabinet door. Also, provide a schedule identifying all end of line resistors for the zone and their respective locations.
D. All end-of-line devices shall be located in the terminal cabinet or the end of the corridor for the area served.
E. Provide identified terminal blocks in all terminal cabinets and auxiliary control cabinets. These blocks shall be sized to accommodate wire from 19 gauge to 10 gauge.
F. Backboards in the terminal cabinets shall be constructed of fire retardant treated ¾ inch exterior grade plywood, painted white.

2.19 SPARES
A. Provide FACP spare equipment for 5 percent (at least two each) spare fully operational {speaker}, horn/strobe, smoke detectors, heat detectors, addressable input modules, addressable relay modules, manual pull stations, beam detectors, matching bases for each of the initiating devices, duct detector housing with function cards, and auxiliary control circuits.
B. Provide one spare expansion or isolation module.
C. Provide 25 percent spare capacity for FACP I/O points.

2.20 SMOKE/FIRE DAMPERS
A. Dampers shall be as described in Division 15.
B. Interface relays shall be provided to operate 120VAC AC smoke dampers from the 24VDC fire alarm system.
C. Fire alarm relay contacts shall be rated at 10 amps.
1. Interface relay is to be provided to operate a 120 VAC smoke damper from 24 VDC fire alarm system. Fire alarm contacts shall be rated at 10amps. Mount in NEMA 1 enclosure in the proximity of the fire alarm terminal cabinet.
2. The interposing relay is to be normally closed and the damper(s) powered open.
3. Upon alarm, or AC power failure, the dampers shall close.
4. Interposing relays shall be UL cross-listed with the FACP.
5. Multiple fire/smoke dampers in a common area per floor shall be controlled with a single interposing relay.
2.21 WIRE AND CABLE

A. Wire and cable for fire alarm systems shall be UL listed and labeled as complying with NFPA 70, Article 760.

B. Signaling Line Circuits: Twisted, shielded pair, not less than [No. 18 AWG] size as recommended by system manufacturer.

   1. Low-Voltage Circuits: No. 16 AWG, minimum.
   2. Line-Voltage Circuits: No. 12 AWG, minimum.
   3. Multiconductor Armored Cable: NFPA 70 Type MC, copper conductors, TFN/THHN conductor insulation, copper drain wire, copper armor [with outer jacket] with red identifier stripe, UL listed for fire alarm and cable tray installation, plenum rated, and complying with requirements in UL 2196 for a 2-hour rating.

D. Refer to Table below for type and minimum wire sizes. Single conductor wires shall be solid.

The following wire will be used unless an alternate is approved by the University. Single conductor wires shall be solid.

<table>
<thead>
<tr>
<th>Circuit Type ID</th>
<th>Quantity/Color</th>
<th>Size</th>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Addressable Circuit</td>
<td>Note 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24 VDC sq.in.</td>
<td>1 pink (pos) THHN 1 grey (neg) THHN</td>
<td>#14</td>
<td>0.0174 sq. in.</td>
</tr>
<tr>
<td>Remote Indicator Light</td>
<td>1 pair TFN (2 pink)</td>
<td>#16</td>
<td>0.0158 sq. in.</td>
</tr>
<tr>
<td>Monitor Switch (tamper, flow &amp; pressure)</td>
<td>2 pair TFN (2 yellow, 2 brown)</td>
<td>#16</td>
<td>0.0158 sq. in.</td>
</tr>
<tr>
<td>(Note 1,2) Visual Alarm (Strobes) (Note 3)</td>
<td>1 pair THHN 1 brown (negative) 1 blue (positive)</td>
<td>#12</td>
<td>0.0234 sq. in.</td>
</tr>
<tr>
<td>Door Holder &amp; Door Lock</td>
<td>1 black, 1 red THNN</td>
<td>#14</td>
<td>0.0174 sq. in.</td>
</tr>
<tr>
<td>Smoke Control Damper</td>
<td>1 pair THHN (Light blue)</td>
<td>#14</td>
<td>0.0174 sq. in.</td>
</tr>
<tr>
<td>Fan Control (Simple shutdown)</td>
<td>2 orange THHN</td>
<td>#14</td>
<td>0.0174 sq. in.</td>
</tr>
<tr>
<td>Fan Control (Shutdown, override, and status)</td>
<td>5 orange THHN (3 orange, control) (2 orange, status)</td>
<td>#14</td>
<td>0.0435 sq. in.</td>
</tr>
<tr>
<td>Elevator Recall</td>
<td>4 yellow THHN</td>
<td>#14</td>
<td>0.0348 sq. in.</td>
</tr>
<tr>
<td>FACP to Master Box</td>
<td>See Figure B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------------</td>
<td>-------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Panel Ground</td>
<td>1 green THHN</td>
<td>#10</td>
<td>0.0184 sq. in.</td>
</tr>
<tr>
<td>Panel Power</td>
<td>See Specification</td>
<td>#12</td>
<td>0.0234 sq. in.</td>
</tr>
</tbody>
</table>

**NOTE 1:** Cable must conform to FACP system manufacturer’s requirements.

**NOTE 2:** Contractor's option, 14 or 16 gauge (see 2.04.) This is a two conductor shielded cable. The same size cable shall be used for the entire system.

**NOTE 3:** See 2.05. All circuits shall be 14 gauge; twelve-gauge wire is prohibited. Provide multiple circuits for a single zone as required.

**PART 3 – INSTALLATION**

**3.1 EQUIPMENT INSTALLATION**

A. Connecting to Existing Equipment: Verify that existing fire alarm system is operational before making changes or connections.

1. Connect new equipment to the existing control panel in existing parts of the building.
2. Connect new equipment to existing monitoring equipment at the Supervising Station.
3. Expand, modify, and supplement the existing [control] [monitoring] equipment as necessary to extend the existing [control] [monitoring] functions to the new points. New components shall be capable of merging with the existing configuration without degrading the performance of either system.

B. Smoke or Heat Detector Spacing

1. Smooth ceiling spacing shall not exceed 30 feet.
2. Spacing of heat detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas, shall be determined according to Appendix A in NFPA 72.
3. Spacing of heat detectors shall be determined based on guidelines and recommendations in NFPA 72.

C. HVAC: Locate detectors not closer than 3 feet from air-supply diffuser or return-air opening.

D. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of the duct.

E. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.

F. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.

G. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.

H. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling.

I. Device Location-Indicating Lights: Locate in public space near the device they monitor.

J. FACP: Surface mount with tops of cabinets not more than 72 inches above the finished floor.
K. Annunciator: Install with top of panel not more than 72 inches above the finished floor.

3.2 MOUNTING POSITION

A. FACP: Locate as indicated on the drawings.

B. Evacuation horn/speaker/strobe shall be mounted on the walls, 80 to 96 inches above finish floor, in accordance with all applicable codes, standards and regulations.

C. Pull stations: in accordance with all applicable codes, standards and regulations.

D. Battery cabinet: Shall be located under FACP. If indicated, locate as illustrated on the drawings. If required due to physical constraints and not indicated, consult O & M Alarm Shop.

E. Duct detectors: Placement must conform to NFPA standards. Coordinate location with mechanical. For assistance consult with the University's Representative.

F. Remote annunciator panel: Location shall be as indicated on the drawings.

G. Firefighter’s telephone jacks: 4 feet from floor to center of device

3.3 WIRING INSTALLATION

B. Install wiring according to the following:

1. NECA 1.
2. TIA/EIA 568-A.

C. Wiring Method: Install wiring in metal raceway according to Division 16 Section Raceways and Boxes.

1. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated raceway system. This system shall not be used for any other wire or cable.

D. Wiring Method

1. Cables and raceways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable.
2. Fire-Rated Cables: Use of 2-hour fire-rated fire alarm cables, NFPA 70 Types MI and CI, is not permitted.
3. Signaling Line Circuits: Power-limited fire alarm cables shall not be installed in the same cable or raceway as signaling line circuits.
4. All wire shall be new, UL approved, marked, and brought to the job site in original packages.
5. Wire insulation shall be one of the types required by NEC. All wires shall be sized per NEC for the load serviced. Field wiring for initiation, supervision, and signal circuits shall be solid conductor. All wire shall be approved for fire alarm installations.
6. Pig tailing and Tee tapping is prohibited for all system circuits, except door circuits and addressable signaling line circuits or as recommended by manufacturer.
7. Addressable signaling line circuits may be Tee tapped only in the terminal can for the floor, which that circuit serves.
8. Fire alarm system shall be wired Class B, device to device, with no splicing unless approved by the University's Representative.
9. End of line resistors shall be located in the terminal cabinet or the end of the corridor or other unassigned (public) space for the zone served.
10. Splicing when approved shall be made with Minnesota Mining & Mfg. Co. Scotchloc spring connectors with steel cap and PVC insulation, Thomas & Betts or approved equal.

11. Colors shall match when possible and the conductors shall be mechanically secured to each other so that no stress is applied to the splice.

12. Aluminum wire and solid wire are not permitted unless recommended by the manufacturer. All wire and cable type to be used must be approved.

13. Wire pulls by powered mechanical means will not be permitted.

14. Conduit shall be thoroughly cleaned of all foreign material just prior to pulling the wire or cable.

15. Lubricants shall be compounds specifically prepared for cable pulling and shall not contain petroleum or other products, which will affect cable insulation.

16. Wire that has scrapes, nicks, gouges, or crushed insulation shall not be used and must be removed.

17. Do not run low voltage energy limited wiring in the same wire-ways with, or closely parallel to, high voltage and/or switched power wiring.

18. Interposing relays shall be used for all switched power loads and shall be located such that the switched power conductors do not run in the same raceway as the interposing relay coil power or any other energy-limited low voltage conductors.

19. All wiring shall be contained in metal conduit or raceways dedicated to fire alarm service.

20. Conduit size shall be ¾ inch minimum, except conduit up to 30 feet in length, from junction box to an individual device may be ½ inch. Surface mounted raceways shall be Wire mold #700 minimum, T&B, or equal (also see Division 16000, Basic Electrical Requirements).

21. No raceway shall be filled in excess of 40 percent. The Contractor shall demonstrate by performing fill calculations showing that the designs comply with these criteria. Exceptions are only allowed when use of existing wire ways is approved.

22. Provide 6 inch by 6 inch or larger junction boxes at all junctions where four or more conduits are combined. Use of extension rings to achieve adequate space for a device or junction is not allowed.

23. The raceway system shall resemble a branch and tree configuration where the main run has limited offsets, and branch lines run perpendicular to the main run.
   a. Each device shall be connected from a junction box on the main FA raceway so that the main raceway does not pass through a device back box.
   b. Branches shall be provided with sufficient junction boxes so that not more than three unassociated circuits pass through a device back box.

24. All raceways shall run parallel or perpendicular to walls, floors, and ceilings.

25. Raceways between FACP and terminal cabinets shall not be larger than 2-½ inches in diameter. Where additional capacity is needed, provided a second, third, or more raceways.

26. As a minimum, provide a single 1-½ inch diameter raceway between the FACP and terminal cabinets, regardless of the wire fill.

27. For surface-mounted raceway, runs shall be routed on walls out of visual sight, with vertical drops to wall-mounted devices. Submit routing proposal to University's Representative for approval prior to installation.

28. Do not encase raceway in concrete unless specifically called for.

29. No wire run or circuit shall be longer than 80 percent of the maximum allowable length and power consumption for the wire size and application. No output circuit shall exceed 80 percent of the maximum load capacity specified by the manufacturer.

30. Terminate all wiring for each zone or floor in a terminal cabinet as indicated on the contract drawings prior to running the wires to the fire alarm panel. Provide at least one terminal cabinet for each floor.
31. All solid wire terminations shall be made bare to screw terminals specifically designed for bare wire connection. Make cable shield terminations with T&B Sta-Kon, Scotchloc, or equal self-insulated spade lugs where connected to screw type terminals.

32. Wiring in all cabinets and terminal boxes shall be neatly arranged and bundled with tie wraps or equivalent.

33. Paint all junction box covers for the fire alarm system red. Paint J-Box covers in finished areas to match the wall or ceiling and put a ½ inch minimum red dot on the cover.

34. All conduit and raceways shall be color-coded by a ¾ inch red tape band at 10 foot intervals. Use Scotch Brand #35 tape, 3M or equal.

35. The Utility McCulloh Loop cable is Non-Power Limited, and its raceway must connect into the Non-Power Limited section on the FACP.

36. All inductive loads (door holders, interface relays) without integral reverse EMF suppression must have suppression on those circuits.

E. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system’s wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

F. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.

G. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and a different color-code for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.

H. Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum 1-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signals from other floors or zones.

I. Wiring to Remote Alarm Transmitting Device: 1 inch conduit between the FACP and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals according to Section (16XXX) nameplate and Labeling, and Section (16XXX) Basic Electrical Materials and Methods.

B. Install instructions frame in a location visible from the FACP.

C. Paint power supply disconnect switch red and label FIRE ALARM.

3.5 GROUNDING

A. Ground the FACP and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to the FACP.

3.6 FIELD QUALITY CONTROL

A. General: Comply with the following requirements:
1. Engage a factory authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

2. Comply with the requirements of Section 01660 Systems and Equipment Start-up and Testing.

3. Comply with the requirements of Section 01662 Commissioning.

4. Perform the following field tests and inspections and prepare test reports:
   a. Before requesting final approval of the installation, submit a written statement using the form for Record of Completion shown in NFPA 72.
   b. Perform each electrical test and visual and mechanical inspection listed in NFPA 72. Certify compliance with test parameters. All tests shall be conducted under the direct supervision of a NICET technician certified under the Fire Alarm Systems program at Level III.
      1) Include the existing system in tests and inspections.
   c. Visual Inspection: Conduct a visual inspection before any testing. Use as-built drawings and system documentation for the inspection. Identify improperly located, damaged, or nonfunctional equipment, and correct before beginning tests.
   d. Testing: Follow procedure and record results complying with requirements in NFPA 72. In addition, perform procedures described in paragraphs 3.6B through AA below.
      1) Detectors that are outside their marked sensitivity range shall be replaced.
   e. Test and Inspection Records: Prepare according to NFPA 72, including demonstration of sequences of operation by using the matrix-style form in Appendix A in NFPA 70.

B. Perform a preliminary test, which will be conducted by the Contractor and witnessed by the University's Representative.
   1. This test shall be completed after the system is complete and clear of troubles.
   2. Should the results not be satisfactory to the University's Representative, then corrections will be made and a re-test will be required at the Contractor's expense. The Installer and a factory trained technician for the FACP shall be present for all testing.
   3. The preliminary test shall be in accordance with a written Acceptance Test Procedure (ATP) to demonstrate and certify proper system operation. See paragraph 1.7F Testing and Commissioning Procedures of this Section.

C. All detectors shall be removed from their base and checked for trouble.

D. Remove one device per signaling circuit from its box and lift a wire to test for supervision and ground. Failure due to improper system wiring will require a comprehensive test of the circuit.

E. All bypass and control switches shall be operated to indicate proper supervision of the switch.

F. All valve and sprinkler supervision switches shall be operated to verify proper response.

G. All valve and sprinkler supervision switches shall have one wire removed to verify proper supervision.

H. Each alarm output, detection, or supervision zone may be tested for proper response to ground conditions.
I. Test the Gamewell Master Box for proper operation.

J. All local remote annunciators shall be tested for proper operation. AC power shall be interrupted for 24 hours and followed by a 5 minute alarm test.

K. Remove all critical fuses to check for proper supervision (if applicable).

L. Test the firefighter's telephone system for supervision of the wiring and for quality of voice transmission.

M. Test all detectors for alarm operation.

N. Test all signaling devices for proper operation. Devices that fail and are replaced will require a retest.

O. Test all alarm sounding devices for proper operation.

P. Audibility tests will be conducted by the Contractor to determine compliance with the dB requirements. For replacement systems in occupied buildings, the audibility test shall be conducted after normal working hours. Ambient readings conducted during working hours.

Q. All elevator, fan, door holder, damper and other control functions and circuits shall be tested for proper operation. Test for proper operation of the Public Address portion of the FACP.

R. Test fan and damper control, including manual override and priorities. Coordinate with other trades.

S. Test magnetic door closers, holders, locking mechanisms. Verify appropriate priority with security and access control systems.

T. Test elevator recall, Phase I and II as required.

U. Test transfer to emergency power, where provided.

V. Test alarm verification function. Confirm no delay occurs if two detectors are activated.

W. Confirm analog sensor adjustable sensitivity function is operable and properly set. i.e.: day/night sensitivity.

X. Demonstrate history log functions.

Y. Confirm signal reports to UC Davis Dispatch Center.

Z. Smoke sensor sensitivity report: Following completion of the preliminary test, the Contractor shall place the FACP on line with outputs bypassed for a period of 10 days.
   1. A report of all system smoke sensors with sensor high and low readings and recommendations for alarm threshold settings, and device relocation if necessary, shall then be submitted to the University.
   2. The Contractor shall then adjust detector sensitivity as approved by the University.

AA. After satisfactory completion of the preliminary testing, the University's Representative will arrange for the UCDFD to witness a final Contractor-executed acceptance test of the system.
   1. Final acceptance will be granted by the UCDFD.
2. Approval of the UCDFD shall be evidenced in writing and a copy forwarded to the University's Representative. 
3. The requirements for final testing shall be the same as listed under preliminary test above. 

3.7 ADJUSTING 

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project outside normal occupancy hours for this purpose. 

B. Follow-Up Tests and Inspections: After date of Substantial Completion, test the fire alarm system complying with testing and visual inspection requirements in NFPA 72. Perform tests and inspections listed for three monthly, and one quarterly, periods. 

C. Semiannual Test and Inspection: Six months after date of Substantial Completion, test the fire alarm system complying with the testing and visual inspection requirements in NFPA 72. Perform tests and inspections listed for monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections. 

D. Annual Test and Inspection: One year after date of Substantial Completion, test the fire alarm system complying with the testing and visual inspection requirements in NFPA 72. Perform tests and inspections listed for monthly, quarterly, semiannual, and annual periods. Use forms developed for initial tests and inspections. 

3.8 DEMONSTRATION AND TRAINING 

A. General: Engage a factory-authorized service representative to train University Representative's maintenance personnel to adjust, operate, and maintain the fire alarm system, appliances, and devices. 

B. Comply with the requirements of Section 01664 Training. 

C. The Contractor shall, after two weeks (minimum) written notification to the University's Representative, conduct a training session during which all maintenance and operational aspects of the system will be described and demonstrated to personnel selected by the University. This will include O & M Alarm personnel, and separate training for three firefighter shifts. The sessions shall be conducted by a manufacturer's representative thoroughly familiar with the characteristics of the installed system. Each individual session will be a minimum of 4 hours of instruction: 2 hrs. Classroom and 2 hrs. hands-on training at project site prior to occupancy. 

END OF GUIDE SPECIFICATION SECTION