

SECTION 28 31 00 – FIRE DETECTION AND ALARM**PART 1: GENERAL****1.01 Scope of Standard**

- A. This standard provides general guidance concerning the specific preferences of Texas State University for Fire Detection and Alarm.
- B. The design guidelines contained herein include the requirements for systems and materials for fire protection systems at Texas State University. It is the intention of this document to provide a minimum standard for fire protection systems at Texas State University so as to provide the highest level of fire safety possible; it is not intended to be a guide specification.
- C. **SPECIAL NOTE: Texas State University requires all buildings with monitored fire alarm systems to be programmed for General Alarms and full evacuation.**

1.02 Reference Standards

- A. This is to be used in the development of all fire alarm and signaling system designs for buildings and structures on Texas State University campuses.
- B. This standard is to apply to all fire alarm and signaling system components and equipment installed at Texas State University campuses during new construction, or as part of any improvement project.
- C. The work addressed in this section consists of a fire protection system, which may include, and at least will be coordinated with, all of the following building systems or components:
 - 1. Fire Suppression Systems.
 - 2. HVAC, fire, smoke, and combination fire/smoke dampers.
 - 3. Emergency power systems.
 - 4. Elevator installation. See the Texas State Elevator Code ASME/ANSI A17.1 and ASME/ANSI A17.3.

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- 5. Central Control and Monitoring System.
- 6. Gas Detection Systems (future) 7. Mass Notification Systems (future)
- 8. Smoke Control Systems.
- D. Referenced Publications: The documents or portions that are listed in this section shall be considered part of the requirements of this document. (Utilize most recent editions)
 - 1. NFPA 1, Uniform Fire Code
 - 2. NFPA 13, Standard for the Installation of Sprinkler Systems
 - 3. NFPA 14, Standard for the Installation of Standpipe and Hose Systems

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4. NFPA 17, Standard for Dry Chemical Extinguishing Systems
5. NFPA 17A, Standard for Wet Chemical Extinguishing Systems
6. NFPA 20, Standard for the Installation of Stationary Pumps for Fire Protection
7. NFPA 70, National Electrical Code
8. NFPA 72, National Fire Alarm and Signaling Code
9. NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems
10. NFPA 92, Standard for Smoke-Control Systems
11. NFPA 101, Life Safety Code
12. NFPA 2001, Standard on Clean Agent Fire Extinguishing Systems
13. NFPA 5000, Building Construction and Safety Code
14. IBC-International Building Code
15. IFC-International Fire Code
16. UL Standard 268, Smoke Detectors for Fire Protective Signaling Systems
17. UL Standard 268A, Smoke Detectors for Duct Application
18. UL Standard 346, Water flow Indicators for Fire Protective Signaling Systems
19. UL Standard 521, Heat Detectors for Fire Protective Signaling Systems
20. UL Standard 864, Control Units for Fire Protective Signaling Systems
21. UL Standard 1424, Cables for Power—Limited Fire Protective Signaling Systems
22. UL Standard 1480, Speakers for Fire Protective Signaling Systems
23. UL Standard 1481, Power Supplies for Fire Protective Signaling Systems
24. UL Standard 1711, Amplifiers for Fire Protective Signaling Systems
25. UL Standard 1971, Signaling Devices for the Hearing Impaired
26. UL Standard 2572, Control and Communication Units for Mass Notification Systems
27. ADA-Americans with Disabilities Act
28. TAS-Texas Accessibility Standards
29. American Society of Mechanical Engineers (ASME)/American National Standards Institute (ANSI)
30. ANSI A17.1, Elevator Code, latest edition
31. ANSI A17.3, Elevator Code for Existing Elevators, latest edition
32. ANSI A117.1, Accessibility Code, latest edition

1.03 General Conditions and Special Conditions:**A. The Contractor:**

1. The Contractor shall furnish all equipment, materials, tools, labor, engineering, drawings, etc. Necessary for a complete fire alarm system, with said system Being made ready for operation in accordance with the requirements of the authority having jurisdiction (AHJ), as follows.
2. The purpose of the contract documents is to convey to the Contractor the scope of work required, all of which the Contractor is responsible to furnish, install, adjust, and make operable.

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3. The omission by the contract documents of any necessary system component(s) as required by the Authority Having Jurisdiction (AHJ) or applicable codes shall not relieve the Contractor of the responsibility for providing such necessity, without additional cost to the Owner.
4. The Contractor shall visit the site before submitting his bid and shall examine all existing physical conditions, which may be material to the submission of the bid or performance of his work.
5. No extra payments will be allowed to the Contractor as a result of extra work made necessary by his failure to adequately assess the physical conditions of the job site.
6. Any case of error, omission, discrepancy or lack of clarity shall be promptly identified to the Owner and/or Engineer for clarification prior to the bid due date.

1.04 Performance Guidelines:

- A. Provide labor, materials, and equipment for a complete and functional fire alarm and supervisory signaling system as outlined. The Contractor shall be responsible for compliance with the entire project specifications as well as the following guidelines:
 1. Point addressable multiplex fire alarm control equipment, multiplex transponders, alarm signal initiating devices, notification appliances, annunciators, switches, relays, software and accessories.
 2. Monitoring of all fire alarm systems installed on Texas State University campuses shall be monitored by the EST FireWorks campus monitoring system for fire protection. This monitoring shall utilize the campus Ethernet IP configuration. All IP addresses needed for this installation will be issued by Technical Services to reside on their VLAN
 3. When remodeling an existing building or space, maintain the existing fire alarm systems in operational condition during the project.
 4. Core drilling and fire stopping.
 5. Cutting, patching and painting.
 6. Detailed shop drawings.
 7. Coordination of the work with other trades for this project and coordination with any other Owner projects ongoing at the time of Fire Alarm Contractor's work.
 8. On-site project supervision.

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9. Permits, fees, and other charges required for the work.
10. Record documents.
11. Operating and maintenance instructions.
12. Training of Owner’s personnel.
13. System testing, to include third party acceptance and 100% pre-testing prior to acceptance testing with the designated inspector from the office of Environmental Health, Safety, and Risk Management.
14. Warranty of equipment and labor.
15. Conducting weekly job progress meetings and issuing weekly written job progress reports to the Project Representative.
16. During the construction, it is the responsibility of the Contractor to assure that there is no disruption of the University’s normal functions, such as studying, testing, classes, research or administration.

1.05 System Abbreviations and Definitions:

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| A. | ADAAG: | Americans with Disabilities Act Accessibility Guidelines. |
| B. | AFF: | Above Finished Floor. |
| C. | AHU: | Air-handling unit. |
| D. | AHJ: | Authority Having Jurisdiction Texas State University
EHS/RM (512-245-3616) |
| E. | Approved: | Unless otherwise stated, materials, equipment or submittals approved by the Owner, Engineer, or AHJ. |
| F. | Circuit: | Wire path from a group of devices or appliances to a control panel or transponder. |
| G. | Concealed: | Where used in connection with installation of piping or conduit and accessories, shall mean “hidden from sight” as in shafts, furred spaces, in soffits, or above suspended ceilings. |
| H. | Contractor: | The company awarded the prime contract for this work and
any of its subcontractors, vendors, suppliers, or fabricators. |
| I. | CPU: | The central computer of a multiplex fire alarm control system. |
| J. | Engineer: | Professional Engineer or NICET III |
| K. | Exposed: | Where used in connection with installation of conduit and accessories, shall mean “visible” or “not concealed”. |
| L. | FACP: | Fire Alarm Control Panel. |
| M. | FM: | Factory Mutual. |
| N. | Furnish: | Supply materials. |
| O. | HVAC: | Heating Ventilating and Air Conditioning. |
| P. | IDC: | Initiating Device Circuit. |

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- Q. Install: Install materials, mount, and connect equipment or assemblies.
- R. LED: Light Emitting Diode.
- S. Listed: Materials or equipment included in a list published by a nationally recognized laboratory that maintains periodic inspection of production of listed equipment and materials, and whose listing states either that the equipment or material meets nationally recognized standards or has been tested and found suitable for use in a specified manner.
- T. LCD: Liquid Crystal Display.
- U. NFPA: National Fire Protection Association.
- V. NAC: Notification Appliance Circuit.
- W. NICET: National Institute for Certification in Engineering Technologies.
- X. Owner: Texas State University
601 University Drive San
Marcos, Texas 78666-4609
- Y. RPS: Remote Strobe Power Supply.
- Z. RTP: Remote Transponder Panel. AA.
SLC: Signaling Line Circuit.
- BB. Style 4: As defined by NFPA 72, 2010 edition. CC.
Style 7 As defined by NFPA 72, 2010 edition.
- DD. Supervisory: Signal indicating the need of action in connection with the supervision of fire suppression systems or equipment or with the maintenance of related systems.
- EE. Transponder: Single or multiple zone/point data collection panel used within a multiplex system.
- FF. Trouble: Signal initiated by the fire alarm system, indicative of a fault in a monitored circuit or component.
- GG. UL Listed: Materials or equipment listed by Underwriters Laboratories, Inc. (UL) and included in the most recent edition of the UL Fire Protection Equipment Directory.
- HH. Zone: Combination of one or more circuits or devices in a defined building area, i.e. 3 speaker circuits on a floor combined to form a single zone.

1.06 Objectives

- A. This standard is intended to achieve consistently high levels of fire detection/alarm system performance by:
1. Allowing designers to incorporate required or desired features as early in the design development process as possible.
 2. Assuring all systems are designed to meet all applicable codes, ordinances, laws, and sound engineering practices.
 3. Providing a basis for a general understanding among all parties involved in the design of systems.

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- A. All systems are to be compliant with applicable paragraphs of NFPA 101 "Life Safety Code".
- B. All systems are to be compliant with the requirements of NFPA 72 "National Fire Alarm and Signaling Code".
- C. All systems are to be compliant with approved types, styles, and equipment as approved by Facilities/Tech Services and Environment Health, Safety, and Risk Management.

1.08 System Features

- A. All system product lines shall be comprised of components capable of providing the following features when appropriate and specified by the project documents or the University:
 - 1. General alarm notification. .
 - 2. Positive alarm sequence.
 - 3. Voice alarm notification.
 - 4. Fireman's communications, with an Annunciator Panel, having remote microphone capability.
 - 5. Elevator capture/recall.
 - 6. Elevator power shunt trip.
 - 7. Smoke control/fan shutdown.
 - 8. Door release.
 - 9. Release locks on normally locked egress doors.
 - 10. Release and monitoring of clean agent and/or pre-action sprinkler systems.
 - 11. Alarm Verification.
 - 12. Monitor non-water based fire suppression systems.
 - 13. Multiple channel digital voice.
 - 14. Provisions for Mass Notification signals (future).
- B. Provide audible notification throughout the building in accordance with NFPA 72. Provide an individually silence-able 10 inch, 24 VDC general alarm bell on the building exterior. Provide remote microphone capability.
- C. Visual notification to ADA levels and TAS requirements shall be provided throughout the building.
- D. Smoke detectors shall be provided at all elevator lobbies, elevator equipment rooms and elevator hoist ways to perform capture/recall functions; excepting elevator pits, where heat detectors shall be utilized in place of smoke detectors.
- E. All systems shall be designed to provide manual means of alarm initiation at every exit from every level. Elevators are not to be considered an exit or means of egress.

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- F. Duct detectors for damper control shall be located within 5 feet of the damper. Install per IBC methods of coverage.

1.09 System Operation:

- A. The point addressable fire alarm and supervisory signaling system shall perform the following functions:
1. Continuous monitoring of the status of all fire alarm and supervisory signal initiating devices.
 2. Visible point annunciation of all fire alarm point trouble conditions at FACP.
 3. Continuous monitoring of all fire alarm transponders.
 4. Operation of indicated control functions.
 5. Notify the campus fire alarm monitoring system and be associated to the building graphics.
- B. Change in status of any initiating device on the system shall:
1. Activate audible and visible status change indicators and display the system point number, point description, status and message associated with the point.
 2. Permanently record the change in status, time, date, point description and message associated with the point in the historical event memory log.
 3. Notify the campus fire alarm monitoring system and be associated to the building graphics.
- C. Activation of any manual station, smoke detector, heat detector, or other initiating device shall cause the following functions to occur:
1. Manual station operation shall:
 - a. Activate audible and visible status change indicators, display the system point number, point description, and message associated with the point on the system's operator terminal.
 - b. Permanently record the change in status, time, date, point description and message associated with the point in the historical event memory log.
 - c. Activate the audible and visible notification appliances throughout the building.

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- d. Notify the campus fire alarm monitoring system and be associated to the building graphics.
2. Spot type heat detector or spot smoke detector operation shall:
 - a. Activate audible and visible status change indicators; display the system point number, point description, status and message associated with the point on the system's operator terminal.
 - b. Permanently record the change in status, time, date, point description and message associated with the point in the historical event memory log.
 - c. Activate the audible and visible notification appliances throughout the building.
 - d. Notify the campus fire alarm monitoring system and be associated to the building graphics.
 - e. Notify the campus fire alarm monitoring system and be associated to the building graphics.
 3. Duct smoke detector activation shall:
 - a. Activate audible and visible status change indicators and display the system point number, point description, status and message associated with the point on the system's operator terminal. Duct detector shall report a supervisory and shut down its associated unit.
 - b. Permanently record the change in status, time, date, point description and message associated with the point in the historical event memory log as a supervisory.
 - c. Shut down the fan unit associated with the duct detector or activate the appropriate smoke exhaust function.
 - d. Notify the campus fire alarm monitoring system and be associated to the building graphics.
 4. Elevator lobby or elevator machine room smoke or heat detector operation shall:
 - a. Activate audible and visual status change indicators and display the system point number, point description, and message associated with the point on the system's operator terminal.
 - b. Permanently record the change in status, time, date, point description and message associated with the point in the historical event memory log.

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- c. Immediately recall the affected elevators to the lobby level. If the alarm is on this level, recall the elevators to the alternate level. When appropriate with the sequence of operation, heat detectors in the elevator machine room and/or elevator hoist way shall shunt the elevator. All machine room detectors and hoist way detectors shall activate a flashing fire hat in the elevator cab.
 - d. Activate the audible and visible notification appliances throughout the building.
 - e. Activate the campus fire alarm monitoring system.
 - f. Upon alarm silence activation, audible and visible notification appliances in the affected area shall be silenced and shut off.
 - g. Notify the campus fire alarm monitoring system and be associated to the building graphics.
- D. Removal of any device, wiring disarrangement, or system component failure shall display on the fire alarm system operator's terminal, the change of status, time, date, point description and the message associated with the point.

1.10 Applicable Standards:

The following standards and guides (of the issue indicated) are hereby made a part of this work by reference thereto:

- A. National Fire Protection Association (NFPA):
 - 1. NFPA 1, Uniform Fire Code
 - 2. NFPA 13, Standard for Installation of Sprinkler Systems
 - 3. NFPA 14, Standard for Installation of Standpipe and Hose Systems
 - 4. NFPA 70 - National Electrical Code, latest edition.
 - 5. NFPA 72 - National Fire Alarm Code, latest edition.
 - 6. NFPA 90A - Air Conditioning and Ventilating Systems, latest edition.
 - 7. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations
 - 8. NFPA 101 – Life Safety Code, latest edition.
 - 9. NFPA 5000 , Building Construction and Safety Code
 - 10. IBC- International Building Code

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11. IFC- International Fire Code
- B. Underwriters Laboratories, Inc. (UL):
1. UL Fire Protection Equipment Directory, latest edition.
 2. UL Standard 268, Smoke Detectors for Fire Protective Signaling Systems, latest edition.
 3. UL Standard 268A, Smoke Detectors for Duct Application, latest edition.
 4. UL Standard 346, Water flow Indicators for Fire Protection Signaling Systems
 5. UL Standard 464, Audible Signal Appliances, latest edition.
 6. UL Standard 521, Heat Detectors for Fire Protective Signaling Systems, latest edition.
 7. UL Standard 864, Control Units for Fire Protective Signaling Systems, latest edition.
 8. UL Standard 1424, Cables for Power-Limited Fire Protective Signaling Systems, latest edition.
 9. UL Standards 1480, Speakers for Fire Protective Signaling Systems
 10. UL Standard 1481, Power Supplies for Fire Protective Signaling Systems, latest edition.
 11. UL 1711, Amplifiers for Fire Protective Signaling Systems
 12. UL Standard 1971, Signaling Devices for the Hearing Impaired, latest edition.
- C. Americans with Disabilities Act Accessibility Guidelines (ADAAG), latest edition.
- D. TAS- Texas Accessibility Standards
- E. American Society of Mechanical Engineers (ASME)/American National Standards Institute (ANSI):
1. ANSI A17.1, and Elevator Code, latest edition.
 2. ANSI A17.3, Elevator Code for Existing Elevators, latest edition.

1.11 Submittals:

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A. Prior to installation, the following documents shall be provided to Texas State University for reference and/ or approval:

1. Shop Drawings: Shall be prepared using latest AutoCAD. Shop drawings shall be drawn to scale: $\frac{1}{8}''=1'-0''$ for floor plans and $\frac{1}{4}''=1'-0''$ for details. Drawings shall not be reproduced or copied in contractor's preparation of shop drawings. Include manufacture's name, model numbers, ratings, power requirements, equipment layout, conduits, device arrangement, and complete point to point wiring diagrams along with other required information including but not limited to:
 - a. General Drawing Notes.
 - b. Complete panel layout showing location of all modules, power supplies and batteries.
 - c. Complete panel layout showing all field terminations.
 - d. Main panel elevations.
 - e. Complete system riser diagrams.
 - f. Electrical back box requirements.
 - g. Control Equipment Schedules.
 - h. Panel Schematics showing all connections, between modules within the panels, to all modules from field wiring with zones identified.
 - i. Scale floor plans with layout of all devices with point numbers for initiating and notification devices, wiring connections, zones, wire size, and routing.
 - j. Detailed Legend
 - k. Fire Safety and related symbols shown on drawings and diagrams shall comply with NFPA70.
 - l. Detailed Input/ Output Matrix.
 - m. The contractor shall provide a signed "fire alarm and emergency communication system inspection and testing form for each system, consisting of completed copies of the appropriate pages from NFPA 72, at the final acceptance test. The fire alarm contractor shall attach the appropriate fire alarm tags to the panel as required by the State of Texas.

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- B. Product Data: Provide electrical characteristics, connections' requirements, and compatibility listings showing that components are compatible with each other, including but not limited to:
1. Manufacturer's data sheets with equipment to be used highlighted,
 - a. Fire Alarm Control Panel
 - b. Wiring
 - c. Batteries
 - d. Detectors
 - e. Manual Pull Stations
 - f. Audible Signaling Devices
 - g. Visual Signaling Devices
 - h. Control Devices
 - i. Annunciator Panel
 - j. Remote Microphone
 2. Wiring diagrams of all equipment,
 3. Installation instructions for all equipment,
 4. Equipment testing procedures,
 5. Equipment maintenance manuals
 6. Wire data sheets
- C. Software and Database Information:
1. Proposed point numbers,
 2. Labels of all addressable devices,
 3. Complete sequence of operation with input/output matrix for all points
 4. English action messages.
- D. System Calculations:
1. Complete calculations shall be provided which show the electrical load on the following system components:
 - a. Each system power supply, including standalone booster supplies.
 - b. Standby Battery Calculations plus a 20 percent de-rating factor.

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- c. Voltage drop calculations for each type of circuit (identify all mathematical formulas, variables, and constants).
 - d. dB loss calculations for speaker circuits.
 - e. Speaker circuit loading and amplifier loading.
 - f. Strobe circuit loading with 20% available capacity and the 4th circuit left for future use.
 - f. Provide 10amp power supplies.
 - g. Calculations for sounder base power shall include all base's being activated simultaneously on each auxiliary control circuit that draws power from any system power supply.
- E. Submittal packages shall be signed by NICET III or signed and sealed by a Professional Engineer (P.E.) registered in the State of Texas.
- F. Prior to start of construction, submit the information outlined in A, B, C, D, and E above to the following:
- 1. Three complete submittal packages to the Project Representative for review by the Owner and Engineer.
- G. Costs incurred by the Owner for the Engineer or the Project Representative to review additional submittals resulting from an initial rejection shall be the responsibility of the submitting contractor.
- H. PARTIAL SUBMITTALS ARE NOT ACCEPTABLE.

1.12 Unit Prices:

- A. The Contractor shall provide with his bid unit prices for the following list. The unit prices shall include the device, installation, conduit, wire, programming, testing and any other required installation for additions and or modifications (change orders).
- 1. Point Addressable smoke detector.
 - 2. Point Addressable duct smoke detector.
 - 3. Point Addressable heat detector.
 - 4. Point addressable manual station.

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5. Point addressable monitor module.
6. Point addressable control module.
7. Conventional heat detector.
8. Ceiling Multi-Cd Strobe
9. Ceiling Multi-Cd Speaker Strobe

1.13 Delivery, Storage and Handling of Materials:

- A. The Project Representative will designate an area for storage of all materials. At the end of each working day, all materials shall be returned to the designated area. Material, equipment, tools, etc. will not be left outside the storage area without the consent of the Project Representative.
- B. The cost of all material handling, delivery and freight is the Contractor's responsibility. The Owner or his representatives will not be responsible for materials delivered to the site.
- C. Maintain premises free from accumulation of waste materials or rubbish caused by this work. At the completion of the work, remove all surplus materials, tools, etc., and leave the premises clean to the Owner's satisfaction.

1.14 Quality Assurance:

- A. The company specializing in installing the products specified in this section must demonstrate a minimum of five years' experience. The company shall also employ NICET certified personnel in the Sub-field of Fire Alarm Systems, for the engineering and technical installation and supervision of the system. This certification shall be Level III for engineering and Level II for technical installation and supervision. Proof of certification shall be provided, along with a complete list of project personnel. All work shall be performed by skilled technicians, under the supervision and direction of the designated NICET Engineering Technician, all of whom shall be properly trained and qualified for this work.
- B. The installing Fire Alarm Contractor shall hold a current license, issued by the State of Texas Commission on Fire Safety, to design, install, and service fire detection and alarm equipment.
- C. The Fire Alarm Contractor shall maintain a fully staffed branch office including application engineers, drafters and technical service personnel.

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- D. All supplied equipment shall be standard products of the manufacturer and regularly stocked within the manufacturer's branch office.
- E. All technical service personnel shall be regularly employed by the fire alarm system contractor.
- F. All electrical installation of the fire alarm system, including wire installation and terminations, shall be performed by electricians in the employ of the Fire Alarm Contractor.
- G. Any subcontractors used to install portions of the system shall be approved by the Project Representative prior to commencement of the installation.

PART 2: PRODUCTS**2.01 Fire Alarm Control Panel (FACP):**

- A. Provide a UL listed point addressable fire alarm control system. Acceptable supplier EST or preapproved equivalent.
- B. Products shall be of the latest version. Models acceptable are EST-3 or preapproved equivalent.
Obsolete or discontinued models are not acceptable.
 - 1. Acceptable model for Round Rock Campus is EST-3 or preapproved equivalent
- C. All fire alarm control panels must be intelligent, addressable Central Processing Units (CPU) based and meets the latest edition of UL 864
- D. All FACPs must be capable of providing circuit integrity monitoring for all Signaling Line Circuits at a level of Class A, Style 6, as defined in NFPA 72
- E. All fire alarm initiating devices and notification appliances in finished areas shall be white.
- F. All FACPs must be capable of providing circuit integrity monitoring of Initiating Device Circuits (IDC's) at a level of Class B as defined in NFPA 72.
- G. Manufactured terminal boxes labeled "FIRE ALARM TERMINAL BOX" Space Age TC2 series or equal.
- H. With each installed field device affix a label to indicate the device's full address on its signaling line circuit.

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- I. Mark each cable or wire to designated terminal with labeling tool in all junction boxes, terminal cans, riser cans, ins and outs of devices in the field, and at the FACP.
- J. All FACPs must provide twenty percent (20%) excess power supply, input circuit, and output circuit capacity at final acceptance to allow for future expansion by the owner on the Signal Line Circuit (slc).
- K. Zone labeling must be textual by alpha-numeric display at the FACP and remote annunciator to allow “first response” by persons not trained in fire alarm technology.
- L. Textual (alpha-numeric) language must be conventional, concise, clear and accurate to facilitate rapid response.
- M. All FACPs must provide a control to silence the Public Alarm to allow for maintenance and testing, and to reduce disruption to include sounder bases, visual notification, and audible notification.
- N. All FACPs must provide a control to override for door holder release, smoke control/fan shutdown feature, sounder base, water flow, strobes, speakers and damper activation to allow for maintenance and testing. Program panel to allow functions to be disabled by floor or by group as required by Texas State University.
- O. All FACPs must be connected to a Primary and Secondary Power source. The secondary power supply must be sized to provide 15 minutes of operation in alarm conditions after 24 hours of system operation in standby power. Where voice evacuation systems are utilized, 15 minutes of alarm shall be provided.
- P. All FACPs must provide a separate digital address for each initiating device to facilitate rapid response and maintenance and testing.
- Q. All FACPs must provide a separate digital address for each individual flow switch and tamper switch .
- R. All programming must be permanent and non-volatile to reduce outage time due to failure.
- S. All FACPs must be listed and approved and the smoke detector sensitivity test level set to reduce maintenance costs.
- T. All FACPs must be capable of providing drift compensation. Drift compensation is considered equal to adjustability at the detector.

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- U. All FACP's must be field programmable, using internal or connected components, for all changes, alterations, modifications, additions, deletions and hardware and software upgrades.
- V. All voice evacuation messages shall be in a female voice.
- W. All FACP's shall be capable, using internal or connected components, of generating comprehensive reports for sensitivity, verification counts, address registers.
- X. A fault isolation device shall be provided electrically between each building level and building wing. This device shall be capable of automatically isolating wire-to-wire faults on each SLC to the building level or wing involved. The device shall be powered by the SLC loop. The device shall provide visual indication at the device of a short circuit (isolate) condition. The device shall reset to the normal mode upon elimination of the wire-to-wire short. All fault isolation devices shall be physically located within the terminal box for that floor.
- Y. All nodes to have 120VAC surge protection and dedicated 120vac.
Acceptable models: Eaton model AGPH12005 or preapproved equivalent provided by the fire alarm contractor and installed by the electrical contractor.

2.02 Point Addressable Multiplex Equipment:

- A. The FACP shall be wall mounted and installed where shown on the drawings. The FACP shall be equipped with locked enclosures having removable access panels for servicing of electronic components. All controls and displays shall be mounted at heights allowing easy access by operating personnel. The FACP shall include, but not be limited to, the following major components, some of which may be physically separate from the main cabinet:
 - 1. Central processing equipment.
 - 2. Normal AC power supplies.
 - 3. Data transmission equipment.
 - 4. Mass data storage (if required).
 - 5. Emergency power supplies.
- B. The central processing unit (CPU) shall be a "mini" or "micro" computer, listed in accordance with UL 864. The main memory system shall be adequately sized to provide display, print out and control of 150 percent of the actual alarm and command points as described herein and indicated on the drawings. All basic alarm and control software shall be included and be at the latest edition of SDU. The CPU shall be completely field programmable and all data entered shall reside in the system memory.

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- C. The CPU shall be equipped with a nonvolatile main memory system of EPROM, battery protected RAM, or EEPROM memory system. The mass storage system shall be equipped with all necessary control hardware and software.
- D. Normal operating power for the FACP shall be 120 volt AC supplied from dedicated circuits (of the emergency power panel, if provided). All circuits shall be protected by circuit breakers of proper size. In addition, the CPU shall be provided with an emergency battery standby power system, which shall operate the system for 24 hours in the standby mode and 15 minutes in full alarm condition. Remotely powered Audio/visual alarms must also function in a power outage.
- E. The system operating terminal shall be the liquid crystal display type (LCD). The LCD shall include, at a minimum, control function keys, digital display window, programming keys and key-operated lock-out capability. Programmable bypass switch Control Display Module of 12 LEDs and switches. Programmed per owner's instructions.
- F. The time shall be permanently displayed on the LCD and shall be visible at all times. The LCD shall allow the operator to perform the following minimum tasks:
 - 1. Inquire point status.
 - 2. Start or stop equipment manually.
 - 3. Test and reset equipment manually.
 - 4. Initiate control by event sequences.
 - 5. Bypass control zones and points during manual system tests.
 - 6. Push button bypasses shall be installed to bypass all outputs.
 - 7. Manually request "logs" of system status.
 - 8. Acknowledge status changes.
 - 9. Silence local alarm sounder.
 - 10. Monitor and control smoke detector sensitivity.

2.03 Expansion / Transponder Panels:

- A. Remote multiplex input/output (RTP) panels shall be provided as required. The cabinets shall be surface mounted with a locking door or cover.

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- B. The RTP panels shall accommodate all specified alarm input points, supervisory input points, command points and shall allow a 20 percent expansion of connected points. All assemblies within the RTP panels shall be modular to allow for expansion and servicing of equipment. All power supplies, standby power, motherboards and terminal strips shall be included to accommodate specified future expansion so that expansion can be accomplished by simple installation of circuit boards and wiring to remote devices.
- C. Normal system power shall be provided by the dedicated circuits. A standby power supply shall be provided at each RTP cabinet location, which shall operate the system for 24 hours upon loss of normal AC power and 15 minutes in full alarm mode. Emergency power circuit shall recharge the unit to normal capacity within 48 hours of restoration of normal power. One emergency power supply unit may power more than one RTP cabinet if all such cabinets are at one location. The loss of AC or DC power at any RTP shall cause a distinct power failure signal.
- D. Batteries for emergency standby power shall be sealed lead-acid or gel cell of sufficient quantity to provide 24-hour standby with 15 minutes in full alarm. Batteries shall be mounted in a separate vented enclosure.
- E. The RTP cabinets shall accept input/output (alarm and/or command) modules for the specified points and/or zones plus spares. The type of input/output modules shall include, but not be limited to the following:
 - 1. Equipment command control modules shall provide the functions of start/stop, on/off, bypass/normal and test/reset as required for the equipment to be controlled.
 - 2. Addressable device data transmission, supervision, control, and power.
- F. The RTP panels shall accommodate all specified speaker circuits and strobe notification circuits and shall allow a 25 percent expansion of connected points. All assemblies within the RTP panels shall be modular to allow for expansion and servicing of equipment. All power supplies, standby power, motherboards, amplifiers and terminal strips shall be included to accommodate specified future expansion so that expansion can be accomplished by simple installation of circuit boards and wiring to remote devices.
- G. Each remote transponder panel shall be capable of degraded mode operation. In this mode, the system shall receive an alarm from any analog or conventional initiating device and activate all indicating appliances served from the panel.
- H. One backup amplifier shall be installed per panel. Backup amplifier shall be sized based on the largest amplifier in the associated cabinet.
- I. Remote Strobe Power Supplies shall include:

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1. A minimum of four notification appliance circuit monitoring and control modules. The modules shall be designed to meet Style Y NAC wiring.
2. Power supply with battery charger and standby batteries. Batteries shall be sized for 24 hours in standby condition and 15 minutes in full alarm condition.
3. Provision to be supervised and activated by the main fire alarm system.
4. All remote strobe power supplies shall allow for 25% expansion and use.
5. All remote power supplies (NAC panels) shall leave the 4th circuit available for future expansion.
6. All remote strobe power supplies shall be independently activated by an addressable control module and use that control module for monitoring the power supply.
7. ALL Remote Booster Power Supplies shall be EST BPS10A or preapproved equivalent.

2.04 Point Addressable System Software:

- A. As part of the initial system installation, provide all executive system software including, but not limited to, the following:
 1. Basic alarm processing programs.
 2. Control by event programs.
 3. System point scanning routines.
 4. Password control routines.
 5. Emergency file display routines.
 6. Smoke detector sensitivity routines.
 7. Provide all hardware, software, programming tools, access codes, access keys, documentation, and training necessary to modify the fire alarm system on site. Modification includes addition and deletion of devices, circuits, zones, and changes to system operation and custom label changes for devices or zones. The system structure and software shall place no limit on the type or extent of software modifications on-site. Modification of software shall not require power-down of the system or loss of system fire protection while modifications are being made.

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8. If the system access code is either a hardware key or software key, the Contractor/ Vendor shall provide the proper key to meet the above requirements.
- B. Provide as part of the system all preparation and installation of data files including, but not limited to, the following:
1. Point descriptions.
 2. Control by event sequences.
 3. Emergency file statements.
 4. Print statements.
 5. Password installation.
- C. Systems which rely on EPROM shall be factory reprogrammed at no additional cost to the Owner as many times as required until the system is accepted by the Owner.
- D. Point/zone descriptions shall consist of English language statements which adequately define the point or zone. The use of abbreviations shall be limited to commonly used fire alarm system abbreviations.
- E. System emergency file statements shall be assigned to individual points/zones to assist operator response to an emergency condition. The emergency file shall consist of English language statements which adequately define the desired action. The use of look-up tables is expressly forbidden.

2.05 Alarm Initiating Devices:

- A. Manual Pull Stations
1. Provide point addressable manual stations where indicated. The manual stations shall be double-action key reset type, red with white lettering, and shall be mounted in the existing locations unless otherwise noted:
 2. Surface mounted stations shall mount on a UL listed, red, smooth sided back box provided by the manufacturer. Semi-flush mounted stations shall mount on a standard electrical box.
 3. Operation of a manual station shall cause its contacts to manually lock-in until manually reset and visibly indicate that the station was activated.
 4. Manual stations mounted exposed to the environment shall be in weather resistant enclosures.
 5. Manual pull stations shall be EST model SIGA-278 or preapproved equivalent
- B. Photoelectric Smoke Detectors

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1. Point addressable analog photoelectric type smoke detectors shall be provided where indicated. The smoke detectors shall be provided with integral LEDs to indicate detectors in alarm. The detectors shall operate from the two-wire alarm initiating circuit (SLC) and be listed under UL Standard 268, latest edition.
2. Sounder base installation in ALL residence rooms. These circuits shall have power failure monitoring at the end of the circuit.
3. All residence rooms shall comply with the 520 Hz rule in NFPA 72.
4. Photoelectric smoke detectors shall be EST model SIGA2-PS with SIGA-SB4 bases in standard locations and SIGA-AB4G-LF in all sleeping rooms or preapproved equivalent

C. Duct Mounted Smoke Detectors

1. Point addressable analog photoelectric type duct mounted smoke detectors shall be provided where indicated. The duct detectors shall be provided with integral LEDs to indicate detectors in alarm. The detectors shall operate from the two-wire alarm initiating circuit (SLC). The smoke detectors listed under UL Standard 268A, latest edition, shall be provided with approved duct housings mounted on the exterior of the duct, and shall have perforated sampling tubes extending across the width of the duct. Provide an auxiliary DPDT load relay for fan shutdown control where required by the points list.
2. Each duct detector above ceiling or ceiling height 7ft shall have installed a remote test switch. Test switches shall be EST model SD-TRK or preapproved equivalent.
3. Duct detectors above ceiling grid shall have a 1” label installed on the grid or at the access to the duct detector White background red letters.
4. Duct detectors shall be EST model SIGA-SD with a sampling tube to extend the full length of the duct.
5. PRESSURE DIFFERENTIAL READINGS FOR DUCT DETECTOR SAMPLE AIR FLOW WILL BE LABELED ON THE FRONT OF THE DETECTOR.

D. Heat Detectors

1. Point addressable heat detectors listed under UL Standard 521, latest edition, shall be provided where indicated. The heat detectors shall be rate compensated type or analog type. Intelligent heat detectors shall be EST model SIGA2-HRS with SIGA-SB4 bases or preapproved equivalent
2. Conventional rate of rise heat detectors listed under UL Standard 521, latest edition, EST model 302-ET or preapproved equivalent, shall be provided where indicated. Temperature ratings of the heat detectors shall be appropriate for the area protected.

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3. Addressable point monitoring interface modules shall be used to monitor the conventional heat detectors. The interface modules shall provide Style B electrical supervision of monitored devices.
4. Conventional heat detectors listed under UL Standard 521, latest edition, EST model 302-ET or preapproved equivalent shall be installed in all outside elevator lobbies, or specified areas by Tech Services.
5. Addressable point monitoring interface modules shall be used to monitor the conventional heat detector and be installed in weatherproof enclosures. The interface module shall provide Style B electrical supervision of the monitored device.

E. Project-Beam Detector

1. All projected-beam detectors must operate on the infrared principle.
2. All projected-beam detectors must have automatic gain control circuits to compensate for deterioration of signal strength due to environmental factor such as dirt accumulation, component aging and temperature fluctuations.
3. Transmitting and receiving units of projected-beam detectors must be protected from physical damage.
4. All projected-beam detectors must have circuits to prevent “false” alarms due to sudden and complete obscuration.
5. All projected-beam detectors shall be installed in a safe and accessible manner.

F. Air Sampling Smoke Detection

1. Provide air sampling smoke detection if required by the project.
2. Locate air sampling smoke detection ports in accordance with NFPA 72 and manufacture’s requirements.
3. Maintain a maximum transport time of 120 seconds, or the transport time specified by the manufacturer, from the farthest sampling point, whichever is less.
4. Utilize CPVC piping that is listed for use in air sampling systems. Label piping as required per NFPA 72.
5. Air sampling system shall be VESDA or preapproved equivalent

G. Water Flow Switches

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1. Fire detection / alarm systems must be interconnected to the fire alarm sprinkler systems by water flow switches and must be set for a 60 second delay prior to “ALARM”.
2. Each water flow switch shall be monitored by an addressable module on the SLC.
3. It is the responsibility of the Sprinkler Contractor to locate the water flow switches to assure indication of water flow within the building and at each level of the building.
4. Water flow switches shall be monitored by a SIGA-CT1, SIGA-CT1HT, SIGA-CT2, or SIGA-MCT2 or preapproved equivalent. Contractor shall not use the SIGA-WTM module.

H. Supervisory (Tamper) Switches

1. Connect tamper switches installed on all sprinkler, PIV, or standpipe valves to the fire alarm system to indicate closing or opening of the valves.
2. Each tamper switch shall be monitored by an addressable module on the SLC.
3. It is the responsibility of the Sprinkler Contractor to locate the tamper switches to assure indication of the valve position within the building and at each level.
4. Tamper switches shall be monitored by a SIGA-CT1, SIGA-CT1HT, SIGA-CT2, or SIGA-MCT2 or preapproved equivalent. Contractor shall not use the SIGA-WTM module.

2.06 Alarm Notification Appliances:

- A. Fire alarm system audible notification is required to be provided by speakers in all buildings. The fire alarm signal generated must be the distinctive three-pulse temporal pattern described by NFPA and ANSI codes.
- B. Provide audible systems with voice intelligibility measured in accordance with the guidelines in Annex A of IEC 60849, Sound Systems for Emergency Purposes. When tested in accordance with Annex B, Clause B1, of IEC 60849, the system shall exceed the equivalent of the common intelligible scale (CIS) score of 0.70.
 1. Voice Alarm Notification
 - a. Provide speakers for annunciation of voice messages. Signals generated shall be Distinctive Evacuation Signal (three pulse temporal pattern) alternated with the custom message.

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- b. Audible Message--- “Attention, please! Attention, please! An emergency situation has been detected in the building. Please evacuate immediately in accordance with safety and security regulations. Use stairwells; do NOT use the elevators. Repeat: use stairwell; do NOT use elevators. Go to your assigned area outside the building or follow the instructions of the staff or emergency personnel. Do not re-enter the building until instructed to do so by emergency personnel. Please evacuate the building immediately.”
 - c. Digitized audible evacuation messages shall sound once and shall be preceded by a minimum of two cycles of the three pulse temporal pattern emergency evacuation signal.
 - d. Provide Annunciator Panel with Remote Microphone capability.
- C. Strobe units, listed to UL Standard 1971, shall be provided where indicated. Whenever possible, units shall be ceiling mounted. Wall mounted units, if necessary due to installation environment shall be semi-flush type. The units shall operate on 24 volt DC polarized power to allow for supervision. The strobe minimum effective intensity shall be 15 candelas and have a flash rate of 1 to 3 Hertz as defined by UL 1971. All strobes shall be ceiling mounted.
- D. All notification devices shall be white in color and without the word “FIRE” on the device. Switch to blank for Mass Notification.
- E. Strobes may be combined with speakers where shown on the drawing.
- F. All visual notification appliances must be xenon strobe, compliant with the current requirements of ADA and TAS.
- G. All visual notification devices within a room or adjacent space within field of view must be synchronized as required per NFPA 72.
- H. Ceiling mounted strobes and speaker/strobes shall be used where installation location meet manufactures and NFPA 72 guidelines.
- I. Speakers shall be provided where indicated. Sound pressure level shall be 15 dB above ambient or 5dB over maximum having of over 60 seconds whichever is greater per the latest edition of NFPA 72 throughout the building. 520Hz speakers to be installed in all sleeping rooms.
- 1. Average Ambient Sound Level According to Location. The following sound levels shall be used for design purposes.
 - a. Business occupancies 55 dB
 - b. Educational occupancies 45 dB
 - c. Industrial occupancies 80 dB
 - d. Institutional occupancies 50 dB
 - e. Mercantile occupancies 40 dB

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f. Mechanical rooms	85 dB
g. Places of assembly	55 dB
h. Residential occupancies	35 dB
i. Storage occupancies	30 dB

- J. Sounder Base notification shall be used in all dormitory residence rooms.

2.07 Monitoring:

- A. Monitoring of all fire alarm systems installed on Texas State University campuses shall be monitored by the EST FireWorks campus monitoring system for fire protection. This monitoring shall utilize the campus Ethernet IP configuration. All IP addresses needed for this installation will be issued by Technical Services to reside on their VLAN.
- B. Monitoring shall consist of graphics for all-addressable points in the fire alarm system. Point associations shall be completed between the point and the graphics.

2.08 Control Devices:

- A. Provide addressable control module and isolation relays (MR101 style) for all interconnections to other systems for controls. (control module shall be a sigma cc1s or mcc1s) or preapproved equivalent 24VDC control voltage for the isolation relays shall come from the fire system 24VDC power and will be monitored for integrity. Control devices as such but not limited to:
1. HVAC Control - Provide relays/contacts for fan shutdown and smoke control sequence where indicated. The control relays/contacts shall be 24 volts DC low voltage type, each with number of contacts as required and housed in metal enclosure. The contacts shall be rated as required for continuous duty. (MR101 style) or preapproved equivalent
 2. Elevator Controls Provide control relays/contacts for elevator recall where indicated. The control relays/contacts shall be MR101 style or preapproved equivalent, 24volt DC low voltage type, each with number of contacts as required and housed in metal enclosure. The contacts shall be rated as required for continuous duty. (MR101 style) or preapproved equivalent
 3. Security Controls Provide control relays/contacts for security tie in where indicated. The control relays/contacts shall be MR101 style or preapproved equivalent, 24volt DC low voltage type, each with number of contacts as required and housed in metal enclosure. The contacts shall be rated as required for continuous duty.
 4. Fire Damper Control Provide control relays/contacts for fire dampers where indicated. The control relays/contacts shall be MR101 style or preapproved equivalent, 24volt DC low voltage type, each with number of contacts as required

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and housed in metal enclosure. The contacts shall be rated as required for continuous duty.

a. Duct detectors for damper control shall be located within 5 feet of the damper. Install per IBC methods of coverage.

5. Stairwell Fan Control Provide control relays/contacts for stair well pressurization fans where indicated. The control relays/contacts shall be MR101 style or preapproved equivalent, 24volt DC low voltage type, each with number of contacts as required and housed in metal enclosure. The contacts shall be rated as required for continuous duty.
6. Smoke Evac Control Provide control relays/contacts for smoke evacuation control where indicated. The control relays/contacts shall be MR101 style, 24volt DC low voltage type, each with number of contacts as required and housed in metal enclosure. The contacts shall be rated as required for continuous duty.
7. Control devices shall be MR 101 style and labeled at the location of what it controls.
8. Automatic Door Control Provide control relays to release Smoke control doors that are normally open electrically. These doors shall close on any “ALARM” condition. All door control will be 24 vdc provided by fire alarm power supply. Releasing will be by a MR101 style relay or preapproved equivalent.
9. Access Control Doors Provide control relays to release normally electrically locked security access doors. These doors shall unlock on any “ALARM”. Releasing will be provided by a MR101 style relay or preapproved equivalent.
10. All control devices are to be installed within 3 feet of the controlled power origination or controlled device.

2.09 Bypass Functions

A. Bypass switches shall be installed at the FACP to bypass the following controlled outputs that pertain to the project:

1. NACs by Floor
2. AHU Shut-down
3. Elevator Recall
4. Door Release / Fire Curtains
5. Security Override / Access Control
6. Fire smoke Dampers
7. Stairwell Pressurization Fans
8. Smoke Evacuation Control
9. Water flow Switches

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10. Sounder Bases

- B. A minimum of 10 extra bypass buttons shall be installed for future use.

2.10 Documentation:

- A. Storage shall be provided adjacent to (within five feet of) the FACP. This storage shall be capable of storing and securing all documents required for the fire alarm system maintenance and response. Storage shall be for fire alarm documents only. Storage shall include but not limited to:

1. 18” x 24” set of laminated fire alarm drawings
2. Installation Certificate.
3. Panel points list
4. Copy of the most recent program shall be installed into the storage container USB drive
5. STORAGE CONTAINER PREFERRED IS AS FOLLOWS: Manufacturer: Space Age Electronics Manufacturer Part#:SSU00685 or preapproved equivalent

PART 3: EXECUTION OF INSTALLATION**3.01 Installation Contractor:**

- A. The Fire Alarm System Supplier shall furnish on-the-job supervision for the proper installation of his devices in cooperation with, or as may be required by, other trades. This supervision shall include, but not be limited to, the following:
1. Provide specific on-site instructions to others on mounting and installation of each type of device by physically observing the mounting of one or more of each type of device, as required, to assure that the installer is properly instructed in the work.
 2. Provide other supervision as required by the trades to properly perform alarm installation work.
 3. Perform a complete test of the system, certifying that all devices have been activated and that the devices and systems perform in accordance with the requirements of these specifications.
 4. Install, test, trouble-shoot and correct all system software provided under these specifications. This includes, but is not limited to, actual keyboard entry,

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reprogramming required to meet these specifications and any other task associated with the system software. Contractor shall provide 10% testing after every program change.

5. Provide layout drawings and detailed wiring diagrams to the Authority Having Jurisdiction as required by the Submittal section of these specifications and current NFPA 101 requirements.
- B. The Fire Alarm Contractor shall furnish all material and labor to provide a complete and functional system, which operates in accordance with the requirements of these specifications, Texas State University Construction Standards and Texas State University Technical Standard on the Construction Documents CD or on the Facilities Planning Design and Construction website.

3.02 Installation, Interconnection and Operation

- A. Conduit, raceway and wiring systems as indicated herein.
1. Exposed areas shall have wiring installed in steel conduit with steel connectors conduit or approved raceway, parallel to existing building structure.
 2. Exposed conduit or wire mold will require painting to blend with architecture.
 3. All riser-wiring and wiring between floors shall be installed in conduit.
 4. In any areas where hard ceilings are use, a conduit raceway shall be provide from hallway to device/s in room. (i.e. Initiating and notification devices)
 5. FMC runs shall not exceed six feet.
 6. Concealed wiring may be plenum cable (see NFPA 70, NEC per application) and bundled and secured in a proper manner.
 7. All wire installed for this project shall be new and be UL listed for use in fire alarm systems.
 8. Strap or bundle all cables and wires inside equipment enclosures and terminal cabinets, parallel to the enclosure sides.
 9. All plenum wiring will be supported by J-hooks or D-rings. One hole cable straps are not acceptable.
 10. IF DUCT DETECTOR IS INSTALLED IN COLD DECK, INSTALL WITH SEALTIGHT FLEX CONDUIT or preapproved equivalent

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11. THE INSULATION SHALL BE SIZED SO THAT THERE IS A 3 INCH GAP around detector.

B. Wiring Requirements

1. Wire: Basic wiring materials and installation must comply with NFPA 70, conductor sizes must be sized in accordance with NFPA 72 and NFPA 70 to provide the minimum required voltage drop
2. Wire used for 120 VAC power circuits shall be a minimum of 12 AWG standard copper conductors, with THHN insulation.
 - a. Surge protection shall be installed in accordance with NFPA 70 and 72. 120VAC Power Filters shall be installed on all fire alarm panels. (Eaton power line filter ADPV12005) or preapproved equivalent
3. Wire used for 24 VDC power circuits shall be a minimum of 14 AWG solid copper conductors with outer jacket “Black”.
 - a. Surge protection shall be installed in accordance with NFPA 70 and 72. (Ditek DTK-2MH-LP36B) or preapproved equivalent
4. Wire used for strobe circuits shall be a minimum of 14 AWG solid copper conductors with outer jacket “Yellow”.
 - a. Surge protection shall be installed in accordance with NFPA 70 and 72.
5. Wire used for point addressable, signaling circuits, network transmission systems shall be a minimum of 18 AWG solid copper conductor with outer jacket “Red”.
 - a. Surge protection shall be installed in accordance with NFPA 70 and 72.
6. Wire shall be UL listed for use in fire alarm speaker systems or as required by NFPA 70, article 760. All wire shall be solid conductors of copper, minimum 16 AWG with outer jackets “Blue”.
 - a. Surge protection shall be installed in accordance with NFPA 70 and 72.
 - b. All networking cabling shall be at a level of class A between all CPU’s.
7. All SLC riser-wiring shall be monitored at a level of Class A.
 - a. Isolation Modules shall be installed per floor and per wing with floors with more than one wing.

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- b. Surge protection shall be installed in accordance with NFPA 70 and 72.
- 8. All Field Initiating Device Circuits (SLC) shall be monitored at a level of Class B.
- 9. All Notification Appliance Circuits shall be monitored at a level of Class B
 - a. Surge protection shall be installed in accordance with NFPA 70 and 72.
- 10. Elevator interface wiring must meet NEC 620. Colors for control wiring :
 - a. Main Floor Recall---Red
 - b. Alternate Floor Recall---Blue
 - c. Fire Hat Signal---Yellow
 - d. Supply Power---Black
- 11. 120 VAC dedicated circuit primary power from the nearest emergency lighting panel shall be connected to each fire alarm control panel, remote transponder panel and strobe power supply panel.
- 12. Dedicated lockable breakers for the fire alarm system circuits shall be provided for the fire alarm system.
- 13. No dedicated fire alarm system 120 VAC primary power circuit shall be loaded beyond 80 percent of the circuit's rated capacity.
- 14. Conduit:
 - a. Conduit shall be EMT type except where otherwise required by local code or these specifications.
 - b. Conduit fills per NFPA 70, NEC with 3/4- inch minimum conduit size.
 - c. Exterior fittings shall be steel compression type, interior steel screw type.
 - d. All conduit fittings and connections shall be painted red.
 - e. Crimp fittings are prohibited.
 - f. All box fittings shall have installed plastic inserts.
- 15.

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16. Junction Boxes: Sectional boxes shall not be used.
 - a. Each box shall be large enough to accommodate required splices and conduit in accordance with the NFPA 70.
 - b. All box covers shall be painted red and labeled Fire Alarm.
17. Field Terminal Cabinets (FTC):
 - a. FTC shall be UL listed for use in electrical wiring systems.
 - b. SPACE AGE ELECTRONICS FIRE ALARM TERMINAL CABINETS WITH A MINIMUM OF 10% SPARE TERMINALS AVAILABLE FOR FUTURE USE. or preapproved equivalent
 - c. FTC shall be painted red with label “Fire Alarm Equipment” stenciled on cover.
 - d. UL listed terminal strips shall be provided for all wiring splices in terminal boxes. All terminals shall be permanently labeled. **Wire nuts are not acceptable.**
17. Patch all walls, floors and ceilings which are penetrated or damaged during construction; match existing adjacent surfaces.
18. All slab penetrations shall be completely sealed and made watertight.
19. Restore all firewalls to rated conditions.
20. Repair and patch surfaces to match existing finish.
21. X-ray floor areas prior to core drilling.

B. Mounting:

1. Manual stations in finished areas shall be mounted flush boxes unless otherwise noted. Stations located in unfinished areas shall be surface mounted on back-boxes provided by the station manufacturer. All stations shall be mounted at 48 inches AFF as measured from the pull lever.
2. Strobes and speaker/strobes shall be ceiling mounted unless approved by Technical Service, where wall mounted devices are acceptable, devices shall be mounted such that the entire lens is not less than 80 in and not greater than 96 in. al the finished floor or 6 inches below the ceiling, whichever is lower in cases where ceiling mounted is not an option.

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3. Speaker only devices shall be ceiling mounted where applicable, wall mounted at 80 inches AFF or 6 inches below the ceiling, whichever is lower in cases where ceiling mounted is not an option.
 4. All alarm devices, speakers, and strobes shall be mounted in accordance with the manufacturer's installation instructions and utilize the manufacturer's suggested mounting box.
 5. All surface mounted speaker and strobes boxes shall be smooth sided, without knock-outs. Use of standard electrical boxes for surface mounted equipment is prohibited.
 6. Point addressable monitor modules and control modules shall be securely mounted in back-boxes or mounted on rails within a larger enclosure.
 7. All flush and semi-flush devices or panels shall be installed with trim rings or cover plates.
 8. All panels visible to the public or noted on the drawings shall be finished as directed by the Owner.
- C. Repairing and patching surfaces to match existing finish.
- D. X-raying of floor areas prior to core drilling.
- E. All coring and sleeve required.
- F. All fire alarm system data transmission shall be enclosed in 2-hour fire rated construction or other method acceptable to the Authority Having Jurisdiction.
- G. Connecting to Existing Systems
1. Operations of and connections to existing fire alarm systems must be supervised and/or coordinated by Texas State University's Technical Services Shop.
 2. Existing systems must remain operational during modifications or additions to the existing system throughout the duration of the project unless approved by the AHJ.
 3. Where part or all the fire alarm system is required to be demolished, remove the existing fire alarm components only after the new system installation is completed and accepted by the Third Party Inspection.
 4. Existing equipment that is required to be salvaged shall be stored in a secure area designated by Texas State University.

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5. All modifications need to be reflected on the graphics.

3.03 Record Drawings Shall Include The Following:

- A. Two (2) sets of prints and a set of CDs of “as-built” drawings and wiring diagrams in AutoCAD.
- B. Two (2) sets of customized “as-built” operating manuals.
- C. Two (2) complete sets of “as-built” data sheets for all system-connected equipment.
- D. Two (2) sets of the complete “as-built” software listing of all data files, event programs, print statements, and passwords, etc.
- E. The USB drive of the final panel program in .sdu format.
- F. The spreadsheet file of devices and locations in .xls format.
- G. The completed test form which complies with NFPA 72, signed and dated by the fire alarm system manufacturer or his agent.
- H. The NFPA 72 completion certificate, signed by the Authority having Jurisdiction.

All items of this section shall be provided to the owner prior to final payment request.

3.04 Spare Parts:

- A. All spare parts shall be directly interchangeable with the corresponding components of the installed systems.
- B. The Fire Alarm Contractor shall furnish a listing, in duplicate, of all spare parts and accessories which the manufacturer recommends to be stocked for proper maintenance of system.
- C. The Fire Alarm Contractor shall furnish 10 of each new field device installed or 3% of the total type of devices installed, whichever is greater on the fire system as spare parts for TSU. Devices: any detector, pull stations, any module used, isolation and monitoring relays, door holders, and audio and visual devices.
- D. Contractor shall provide a Signature Map Fault Tool (SIGA-MFT) or preapproved equivalent

Part 4: Tests/Field Quality Control and Commissioning:**4.01 General**

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- A. Upon completion of the system, perform a complete and comprehensive test of the entire system in accordance with the provisions of NFPA 72. Contractor shall document testing electronically using logging software commonly available.
- B. AHJ shall witness 100% pretest prior to third party commissioning.

4.02 Specific Tests/ Inspections

- A. An acceptance will be conducted at the completion of each project. The test will be the responsibility of the Fire Alarm Contractor and shall be performed in strict compliance with the provisions of NFPA 72.
- B. In addition to the provisions of NFPA 72 and/or the paragraph above, it is the responsibility of the Contractor to provide all of the following on a set of clean red line prints prior to the acceptance testing:
 - 1. Smoke detector sensitivity report. Smoke detector percent dirty shall not exceed 10% at the time of acceptance.
 - 2. Contractor shall provide a Signature Map Fault Tool report or preapproved equivalent .
 - 3. Pressure differential readings for duct detector sample airflow.
 - 4. Closed loop resistance and EOL resistance readings for all field wiring.
 - 5. Audible decibel readings for the entire building documented on a clean set of fire alarm prints for the building.
 - 6. The fire alarm contractor shall provide the Texas Insurance Code Fire Alarm System Installation Inspection Form to Texas State University Technical Services Department at the following intervals for installation approval:
 - a. At the completion of the device back-box installation but prior to the start of the cable installation;
 - b. At the completion of cable installation but prior to the start of device installation;
 - c. At the completion of device installation but prior to activating the fire alarm system.
- C. Third Party Testing:
 - 1. Third Party testing shall be conducted by an independent third party, who shall be independent of the Professional Service Provider or design team companies,

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reporting to and approved by the Owner. Third Party testing shall include repeating all the tests described in “Fire Alarm Contractors Test” above.

2. Detailed listing of any deficiencies found during these tests shall be forwarded to the Fire Alarm Contractor and Texas State University’s office of Environmental Health, Safety and Risk Management and shall serve as a punch list for the system.
3. All witness testing shall be performed by the State of Texas Fire Alarm Planning Superintendent (NICET Level III in Fire Alarm Systems) or by a Professional Engineer (P.E.) registered in Fire Protection in the State of Texas.
4. The Campus may at its sole option witness and /or participate in any and all tests.
5. If, at any point during their tests, the Third Party finds significant deficiencies they are to report those to the Owner who will then determine an appropriate course of action. If the Owner determines that the number of and/or severity of the deficiencies so justify , they may stop the Third Party Testing and instruct the Fire Alarm Contractor to correct the deficiencies and re- certify the system. Such retesting shall include Supervision testing of 100% of the Initiating Device Circuits, Notification Appliance Circuits, and Signaling Circuits.
6. If retesting by the Third Party is required due to significant deficiencies in the work of the Contractor, the Contractor shall reimburse the Owner for the cost of the Third Party Tests conducted to that point.

D. Deficiencies Repairs:

1. A copy of the formatted check list shall be transmitted to the contractor to serve as punch list for the correction of the noted deficiencies. The Contractor shall notify the verifying party, in writing, that the deficiencies have been corrected along with a copy of the punch out list with the corrected deficiencies initialed by the Contractor to indicate the corrections.
2. The Fire Alarm Contractor shall provide updated certification forms as set forth in Section

E. Third Party Retest:

1. Each deficient item shall be retested. Retesting of the system shall be conducted in accordance with NFPA 72, Table 14.4.2.2, test Methods. If any software changes are made to the system, updated site-specific software and print out with changes highlighted will be submitted to the verifying party prior to the start of the retest.

F. Third Party Certification:

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1. The Third Party shall then retest each portion of the system affected by the corrections. If no additional deficiencies are found, the Third Party shall issue a “Third Party Certification” stating that they have tested the system and certify that it complies with the appropriate sections of NFPA72. Such certification shall not contain any disclaimers or similar comments.
- G. Campus Test and Acceptance:
1. Upon receipt of all documents from the final “Fire Alarm Contractor’s Certification” and the “Third Party Certification”, the Campus will conduct any tests it determines to be necessary, consistent with the specified survivability style and performance requirements for the system. If no additional deficiencies are found, they will accept the system. If additional deficiencies are found, the Contractor will be required to correct the deficiencies, re-test and re-certify the system. Such re-testing shall include Supervision testing 100% of the Initiating Device Circuits, Notification Appliance Circuits, and Signal Line circuits. The Third Party shall then re-test each portion of the system affected by the corrections; if no additional deficiencies are found, the Third Party shall re-issue a “Third Party Certification” as set forth in Section “F” Third Party Certification of this document.

Part 5 Warranty and Training**5.01 Warranty:**

- A. The contractor shall provide a two-year written warranty against defects in material and workmanship furnished under this Contract. The costs of such warranty shall be part of the purchase price. The warranty commences when the system and installation are accepted by the Owner.
- B. The warranty or any part of the warranty shall not be made void by any required operation or annual inspections of the system after acceptance during the warranty period.
- C. The warranty shall include all necessary material, travel, labor, and parts to replace defective components or materials at the job site. This Contractor shall commence repair of any “in warranty” defects within 8 hours of notification of such defects.
- D. The warranty shall include all necessary factory and field software required to perform the specified tasks. This item does include software installed prior to system acceptance. Software updates, equipment revisions, releases updated by the manufacture are to be included in this warranty.
- E. The Contractor shall include, as part of the two-year warranty, a test and inspection of the entire fire alarm system one year after the date of completion. The

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Contractor shall provide a written report of any deficiencies and repair any of the deficiencies. The test and report shall conform to the certification as described in NFPA 72 and as required by the Owner.

5.02 Training:**A. Operator Training**

1. Provide training of operating personnel in proper system operation and required user maintenance procedures.
2. Three operating manuals containing illustrations, description of each detection device, operation of control panels, switches, pilot lights, etc.
3. One 4-hour training sessions for operating personnel. These sessions are to cover proper operating and response procedures. These instructions shall be sufficient to enable a previously or untrained person to properly operate the system
4. Provide three software manuals containing a listing of all points, event programs, basic programming and instructions, and software trouble-shooting information.

B. Technical Training

1. The Technical Service Staff shall be fully trained and be given the capability by the product Vendor and Installation Contractor to modify, to program, to fully repair, to service, and to maintain the system after the warranty period.
 - a. Such training shall consist of one Technical Services Staff to be factory trained and certified to perform any programming and maintenance.
 - b. Factory training shall include travel, per diem, housing, etc.
2. The above training shall include, but not limited to providing and reviewing all programming software, access codes, and licenses that allow the Owner to add or to delete any points, the mapping of devices, and to change a heat detector to a smoke detector. To meet this requirement, provide the necessary configuration and/or access code (hardware and/or hasp software key). If the Vendor and Installation Contractor cannot meet this requirement, the product is not acceptable.

END OF SECTION 28 31 00