

SECTION 281111 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEMS

PART 1 - GENERAL REQUIREMENTS

1.1 SECTION INCLUDES

- A. The work covered by this section of the specifications includes the furnishing of all labor, equipment, and material as herein specified.
- B. The University has entered into an agreement with SimplexGrinnell, Topeka, Kansas office to be the sole provider of all network-based fire alarm devices on campus. This agreement is in the form of a State of Kansas Division of Purchases Procurement Contract, No. 87082. SimplexGrinnell shall provide a turnkey fire alarm system including the installation electrical subcontractor work in their bid and is responsible for providing all proprietary fire alarm system components under the pricing terms referenced in that contract. The SimplexGrinnell electrical sub-contractor is responsible for providing non-proprietary components of the Fire Alarm System, such as conduit, cabling, raceways, and junction boxes in accordance with provisions of this specification section to SimplexGrinnell as the installing contractor. SimplexGrinnell shall include installation of this system in accordance with the provisions of this specification to the General Contractor, using a qualified electrical sub contractor competitively bid by SimplexGrinnell.
- C. This section requires SimplexGrinnell to furnish all materials required to provide a first class operating fire alarm system. The Contractor shall be responsible for installing, testing, and start-up of a complete functioning fire alarm system, and each element thereof, as specified or indicated on the Drawings or reasonably inferred, including every article, device or accessory (whether or not specifically called for by item) reasonably necessary to facilitate each system's function as indicated by the design and the equipment specified. Elements of the work include materials, labor, supervision, supplies, equipment, transportation and utilities. Installation of devices shall be performed or supervised by a National Institute for Certification of Engineering Technologies (NICET) Level 3 or higher Fire Alarm Technician. Submit copies of the certification for employees through shop drawing submittals.
- D. All fire alarm system components shall include addressable field devices, and multiplexed, programmable, operator interface panels.
- E. The scope of work in this section includes:
 - 1. Fire alarm control panels.
 - 2. Remote annunciator panels.
 - 3. Miniplex transponder panels.
 - 4. Manual fire alarm pull stations.
 - 5. Automatic smoke and heat detectors.
 - 6. Fire alarm notification appliances.
 - 7. Auxiliary fire alarm equipment.
 - 8. Activation and powering of combination fire and smoke dampers.
 - 9. Sprinkler system waterflow and valve tamper alarms.
 - 10. Air handling unit shutdown.
 - 11. Door holder release.
 - 12. Elevator recall.
 - 13. Battery stand-by power.
 - 14. Area of Refuge communications
 - 15. Knox Box key security system procurement and installation
 - 16. EPAS – Emergency Public Address System; local system integration, dedicated speakers, programming, fire alarm interface and off site connection to campus wide network.

17. Campus wide monitoring network; Local system integration, programming, updating graphics, and connection.
- F. Where coordination and interfacing with other systems or equipment is required, it shall be the responsibility of the fire alarm system installer (contractor) to either provide the relays, contacts, power supplies and other necessary hardware or see to it that such hardware is provided with the other systems or equipment.

1.2 RELATED WORK IN OTHER SECTIONS

- A. The contractor shall coordinate work in this section with all related trades. Work and/or equipment provided in other sections and related to the fire alarm system shall include, but not be limited to:
1. Sprinkler waterflow and valve tamper switches shall be provided by the fire sprinkler installer, but wired and connected by the fire alarm installer.
 2. Duct smoke detectors shall be furnished, wired and connected by the fire alarm system installer. The HVAC installer shall furnish necessary duct opening to install the duct smoke detector's housing.
 3. Air handling fan control circuits and contacts to be furnished by the HVAC control equipment.
 4. Conduit shall be by Division 26 "Common Work Results for Electrical".

1.3 APPLICABLE CODES AND STANDARDS

- A. The fire alarm shall meet the codes and standards cited below and applicable local building and fire codes. All fire alarm equipment shall be Underwriters Laboratory (UL) and Factory Mutual (FM) approved for the type and class of service performed.
1. NFPA 70 – National Electrical Code, 2002 Edition
 2. NFPA 72 – National Fire Alarm Code, 2002 Edition
 3. UL 864 – Control Units for Fire Protective Signaling Systems
 4. ULOJZ – Control Unit Systems
 5. UL 268 – Smoke Detectors for Fire Protective Signaling Systems
 6. UL 268A – Smoke Detectors for Duct Applications
 7. UL 521 – Heat Detectors for Fire Protective Signaling Systems
 8. UL 464 – Audible Signal Appliances
 9. UL 38 – Manual Signaling Boxes for Fire Alarm Systems
 10. UL 346 – Waterflow Indicators for Fire Protective Signaling Systems
 11. UL 1971 – Signaling Devices for the Hearing Impaired
 12. UL 1480 – Speakers for Fire Protection Signaling Systems
 13. UL 1481 – Power Supplies for Fire Protective Signaling Systems
 14. UL 1711 – Amplifiers for Fire Protective Signaling Systems
 15. NFPA 90A – Installation of Air Conditioning and Ventilating Systems, 1999 Edition
 16. IBC 2006 Edition with State of Kansas amendments.
 17. IFC 2006 Edition with State of Kansas amendments.
 18. 28 CFR Part 36 – Americans with Disabilities Act (ADA) 1998 Edition
 19. ASME A17.1 – Safety Code for Elevators and Escalators, 2000 Edition

1.4 SYSTEM DESCRIPTION

- A. This system shall be a continuation of the University of Kansas Life Safety Monitoring Network and Emergency Public Address System (EPAS). The contractor shall provide and install Corning wall mount cabinet WCH-02P within the telecommunications closet. The contractor shall provide

an install Corning module CCH-CP06-15T within the wall mount cabinet. The Contractor shall provide a 1" conduit from the telecommunications closet to the Fire Alarm Control Panel (FCP) location for network fiber and copper cabling. KU I.T. shall provide and install multi-mode fiber jumpers between the fiber feeder and the Corning CCH-CP06-15T module(s). Contractor shall provide and install Corning 6-strand, riser rated, multi-mode fiber cable item Corning MIC (6MM/riser 006K88-33150-29 between the CCH-CP06-15T module to the FCP. Contractor shall provide and install Copper UTP item: Berk-Tek 10032058 LANmark-350 Plenum UTP Cable with yellow jacket from telecommunications closet to FCP location for Emergency Public Address System (EPAS) network connections. Contractor shall leave enough cable slack to enter both the fiber and copper wall mounted junction boxes. Within the FCP, contractor shall provide and install an Ortronics brand double-gang surface box item OR-40300186 and for securing this box within the FCP, the contractor shall provide and install an adhesive 2-gang magnet item: (Anixter # 152915). KU I.T. will provide and install the Series II faceplate/fiber and copper connectivity jacks and related jumpers.

1.5 SUBMITTALS

- A. **Reference specification section 260010, GENERAL ELECTRICAL REQUIREMENTS for general shop drawing submittal requirements. Also comply with the submittal requirements stated in this specification section. Submittals not complying fully with the submittal requirements of section 260010 and this section will be rejected.**
- B. Submit a Description of Operation that explains in detail the specific methods the submitted fire alarm system functions. Pre-printed, generic material will not be accepted and will be rejected.
- C. Shop Drawings:
 - 1. The fire alarm system equipment vendor, SimplexGrinnell, shall provide shop drawings showing fire alarm floor plans and a riser diagram showing all new and existing fire alarm devices. Fire alarm floor plans and riser diagram shall show fire alarm control panel, annunciator, all fire alarm initiating devices and notification appliances. Show typical wiring diagrams of control panel/s, annunciator and each device and wiring connections required. Show all interfaces to other systems, such as temperature control systems, and security systems.
 - 2. The fire alarm floor plans shall be drawn at the same scale as the contract drawings or 1/8" = 1'-0", whichever is larger and shall have room numbers and names indicated.
 - 3. The fire alarm floor plans and riser diagram shall show wiring to all fire alarm devices/appliances, indicating wire sizes and quantities as well as conduit/raceway sizes and locations of end-of-line (EOL) resistors. The fire alarm floor plans and riser diagram shall clearly show the routing of all fire alarm system wiring, including all horizontal routing and vertical routing (in chases). Routing of all fire alarm wiring shall comply with the "Survivability" requirements of NFPA 72.
 - 4. The fire alarm floor plans shall also contain a Bill of Materials and a Sequence of Operations Matrix that explains how the submitted fire alarm system functions.
- D. Product Data: Provide product cutsheets showing material specifications, electrical characteristics and connection requirements.
- E. Record Drawings
 - 1. The fire shop drawings and all information contained therein shall be utilized as the basis for the "As Built" Record Drawings.
 - 2. **The Contractor shall be responsible for providing detailed as-built field changes recorded on a set of drawings to the Architect / Engineer AND the fire alarm equipment vendor for inclusion in each of their respective "AS BUILT" Record Drawings.**
 - 3. The "**AS BUILT**" Record Drawings shall show actual locations of initiating devices,

notification appliances, and end-of-line devices. Show the approximate location, size and type of all wiring and routing of wiring. Drawings shall include one-line riser diagrams, typical wiring diagrams, internal panel wiring diagrams and sequence of operations. Labeling convention shall match field labeling. Drawings shall include sound level test results in dB in each room and or areas. Sound readings can be used from fire testing modified to include any final speaker changes made during acceptance testing.

4. Record shop drawings shall be CADD produced in AutoCAD 2000 or greater and provided to the owner (Design and Construction Management- Attention Bob Rombach) in dwg and PDF electronic form along with paper copies (2)11X17 and (2) full size.
5. Electronic data files shall be retrievable in AutoCad via "DWG" and "DXF" format as furnished by the contractor and proven retrievable.

F. Operation and Maintenance (O&M) Manuals (Preliminary and Final)

1. The O&M Manuals shall be provided in labeled 3-ring binder with cover, binding label, tabbed fly sheets and plastic insert folders for the Record A/E Drawings and system program disks. Omit plastic insert folders for preliminary submittal. Include the following sections with the appropriate information for each section:
 - a. Typewritten Index.
 - b. Qualifications. Provide Manufacturer, Installer and Fire Alarm Technician qualification.
 - c. Bill of Materials. Provide complete nomenclature, part number and vendor information for all parts, including all modular components.
 - d. Basic Operations Cheat Sheet. To be duplicated and posted under laminate glass adjacent to Fire Alarm Control Panel.
 - e. Operating Instructions. Complete instructions detailing operation and maintenance of all equipment involved including installation, operating, maintenance and programming.
 - f. Product Data: Provide product cutsheets showing material specifications, electrical characteristics and connection requirements. Indicate within the submittal all applicable UL listings and all applicable approvals or certifications. Delete or otherwise clearly designate all manufacturers' data with which the installation is not concerned.
 - g. Guarantee. Copy of all guarantees and warranties issued.
 - h. Battery and Voltage Drop Calculations: Provide calculations for battery capacity for both alarm/supervisory modes and current drain/load consumption of all circuits while in alarm condition. Provide complete calculations for voltage drop on all notification appliance circuits and verify the system will provide the proper voltage to supply the notification appliances.
 - i. Testing Report/Address Description List: Provide in hardcopy and Excel Version 2000 format a complete spreadsheet indicating the proposed address labels and address descriptions for all proposed system addresses as they will be shown on the fire alarm control panel and the network annunciator(s). This shall include all addresses and device labels. The spreadsheet shall also include a pass/fail notation column and a notes column for each item to be tested as required by NFPA 72 and these specifications.
 - j. Testing Forms. Completed forms, including NFPA 72 "Record of Completion" form. Submit sample forms with preliminary submittal.
 - k. Program Hardcopy. Final System Programming Printout.
 - l. Contact list with minimum three service representative phone and pager numbers.

G. NICET certification information referred to in Section 1.1.C of this section.

H. Indicate within the submittal all applicable UL listings and all applicable approvals or certifications.

I. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of products.

1.6 QUALIFICATIONS

- A. Manufacturer: SimplexGrinnell, Atlas/Soundolier, Wheelock
- B. Installer: Company specializing in installing the products specified in this section with minimum three years documented experience with voice addressable fire alarm systems. Shall be bondable and licensed Contractor and employ full-time factory-trained and certified installers and technicians. Installers shall provide with the fire alarm submittal proof of factory training or experience for each installer. Contractor shall list their assigned Project Foreman with their bid.
Pre-Approved Contractors:
 - 1. Torgeson Electric
 - 2. Davin Electric
 - 3. Current Electric
 - 4. DL Smith Electric
 - 5. McElroy Electric
 - 6. Oliver Electric
 - 7. Lynn Electric
 - 8. Wyre, Inc. Electric
 - 9. Huxtable Electric
 - 10. Ace Electric
 - 11. Heartland Electric
 - 12. Schmidlein Electric
 - 13. Shelley Electric
 - 14. SKC Electric
 - 15. Capital Electric
 - 16. Bart's Electric
 - 17. Wachter Electric
 - 18. Contractors not listed that meet the above listed qualifications may provide qualifications for approval to the General Contractor. Approval must be processed and documented before final addenda is issued before project is bid.
- C. Final checkout and verification: Shall be conducted by a technician certified by the National Institute for Certification in Engineering Technologies (NICET) registered as level 3 or higher in the fire protection technology certification program. Provide certification information with fire alarm submittal.
- D. The equipment manufacturer's service department shall be fully stocked in standard parts and components and engaged in the maintenance of fire alarm systems. On-the-premises service shall be available within 4 hours of notification, 7 days a week, 24 hours a day.

1.7 SERVICE AND GUARANTEE

- A. Furnish service and maintenance of fire alarm system including wiring and raceways for one year from date of substantial completion.
- B. All components, system software, parts and assemblies shall be guaranteed against defects in materials and workmanship for the one-year period stated above.
- C. Labor (including travel expenses) to trouble-shoot, repair, reprogram, or replace components shall be furnished by this contractor at no charge during the warranty period.
- D. All corrective software modifications made during warranty periods shall be updated on all user documentation and on user and manufacturer archived software disks.

1.8 EXTRA MATERIALS

- A. Provide 10% of the total or a minimum of three (3) manual pull stations.
- B. Provide 10% of the total or a minimum of two (2) of each type of automatic smoke detector.
- C. Provide 5% of the total or a minimum of one (1) of each type of automatic heat detector.
- D. Provide 5% of the total or a minimum of two (2) of each strobe type and candela rating.
- E. Provide 5% of the total or a minimum of two (2) of each speaker type. Combination speaker/strobe units matching the units installed are acceptable.

PART 2 - PRODUCTS AND MATERIALS

2.1 GENERAL:

- A. All equipment shall be Underwriters Laboratory (UL) Listed for the type and class of service performed.
- B. Accessory and ancillary components, as required, shall be certified or cataloged by the manufacturer and listed to operate with the system.
- C. All similar equipment shall be of a single manufacturer. Products furnished shall be new. The manufacturer shall be able to refer to similar installations rendering satisfactory service.
- D. All equipment and components shall be installed in strict compliance with manufacturer's recommendations.

2.2 MANUFACTURERS

- A. Subject to compliance with requirements, provide products manufactured by SimplexGrinnell, Atlas/Soundolier and Wheelock as indicated on the Drawings.

2.3 FIRE ALARM SYSTEM CONTROL PANEL

- A. FACP - The Fire Alarm System Control panel shall be a SimplexGrinnell model 4100U.
- B. FAAP - Remote Annunciator: Provide supervised remote annunciator(s) where shown on the plans, including audible and visible indication of fire alarm by address, audible and visible indication of system trouble and supervisory. Install in flush mounted enclosure (6 gang rough in @ 60" centerline AFF).
- C. FAAPM – Remote Enunciator with Microphone: provide supervised remote annunciator (FAAP) and remote microphone, hand held push to talk, noise cancelling mounted to right of FAAP with 5 feet coiled cable and L.E.D. to indicate the push to talk has been activated. Program 1st soft key on FAAP for all speaker activation and label as such. Provide all mounted in spaceage XL8 enclosure, 18x24, clear front panel, flush mounted or semi flush mounted with trim kit. Paint inside of cabinet red to match exterior. Provide Simplex "B" key to lock cabinet. Customize front clear panel with access hole to reach 1st 3 fire alarm acknowledge keys. Height of cabinet shall be 60" to the center line of cabinet above finished floor (AFF).

- D. 4100U MINIPLEX Transponder. The System shall be shall be UL listed under Standards 864 (Control Units for Fire-Protective Signaling Systems). Modular construction with a surface mounted enclosure
- E. Power supply: Provide two separate and reliable power supplies. The control panel shall receive 120 VAC power via a dedicated fused disconnect circuit of the building's electrical system. Each shall have adequate capacity for the system. The fire alarm contractor shall submit battery calculations for review and approval. The calculations shall indicate each device and the load required in stand-by and alarm mode. The secondary power system shall be a battery-operated emergency power supply and charger with capacity for operating system in standby mode for 24 hours followed by alarm mode for 15 minutes.
- F. System Supervision: Automatically detects and reports open circuits, shorts, and grounds of wiring for initiating device, signaling line, and notification appliance circuits. Alarm, supervisory and trouble signals shall via an existing fiber network to the Campus 911 Center.
- G. Initiating Device Circuits: Provide circuitry, which meets the performance requirements during abnormal conditions, based upon the style and class of the circuitry selected. Initiating device circuits shall be the same class and style as the existing fire alarm system.
- H. Notification Appliance Circuits: Provide circuitry, which meets the performance requirements during abnormal conditions, based upon the style and class of the circuitry selected. Notification appliance circuits shall be the same class and style as the existing fire alarm system.
- I. Signaling Line Circuits: Provide circuitry, which meets the performance requirements during abnormal conditions, based upon the style and class of the circuitry selected. Signaling line circuits shall be the same class and style as the existing fire alarm system.
- J. Auxiliary Relays: Provide sufficient SPDT auxiliary relay contacts to provide accessory functions specified.
- K. Provide TROUBLE ACKNOWLEDGE, DRILL, and ALARM SILENCE switch.
- L. Control Panel: The control panel and remote annunciator panel shall have dedicated alarm, supervisory and trouble LED's and dedicated alarm, supervisory and trouble acknowledge switches.
- M. Lamp Test: Manual lamp test function causes each LED to function at fire alarm control panel.
- N. Drill Sequence of Operation: Manual drill function causes alarm mode operation as described above.
- O. Addressable systems shall have Silent Walk Test, History logging for a minimum of 400 events, 80 character LCD display.
- P. *Smoke Control System: (Remove this section if not applicable to this project. Customize operating perimeters if needed).The smoke control system shall be by mechanical means. Coordinate with the Mechanical Contractor and provide the necessary conduit and wiring. Automatic start shall occur upon alarm condition at fire alarm control panel.*
- Q. Voice Communication: The system shall incorporate one-way voice communication via specified speakers. Separate home run and circuit required for speakers dedicated for EPAS operation only. A central audible module shall provide for the necessary alarm message/tone generation,

main and remote microphone connections and mixers/pre-amplifier circuits. Continuous supervision shall be provided along with specific information as to the type of failure (main microphone trouble, tone trouble, etc.) The following functions shall be provided at the fire alarm control panel.

1. Hand held push to talk, noise canceling microphone in recessed protective panel mounted enclosure; 5 feet coiled cable; and LED to indicate the microphone push to talk has been pressed.
2. Audible control switch module: Switches shall include "all circuits", "aux tone 1", "aux tone 2", "tone stop switch", "audible trouble reset"; and these switches shall be supervised.
3. Audible power amplifiers shall be self filtered; contain 24 volt power supply, transformer and amplifier monitor circuits; provide 25 volt RMS output with frequency response of 120 HZ to 12,000 HZ. **Amplifier shall operate all system speakers plus thirty-five (35) percent spare capacity.** Additional amplifiers shall be added to existing notification lines to reach the required thirty-five (35) percent spare capacity.
4. Audible supervision for open, short, or ground fault shall be provided with a distinct and individual trouble indication for each fault.
5. Digitized voice messages are required to notify building occupants during alarm conditions. Message player shall not rely on tape or mechanical means of transmitting the voice message. A KU standard evacuation message shall be provided; however, the system shall be capable of transmitting a custom message of up to five (5) minutes long.
6. Alarm sequence shall consist of a temporal (3) alarm tone for a maximum of 15 seconds followed by an automatic pre-selected message. At the end of the message the tone shall resume. This sequence shall continue until the fire alarm control panel has been silenced. Manual voice paging shall be available via panel switches to page individual floors or groups of floors. Each floor shall be an individual audible zone and have a corresponding audible switch. EPAS speakers on exterior shall be on a dedicated zone for programming purposes. Exterior EPAS speakers shall not be on during a normal fire alarm.

2.4 SEQUENCE OF OPERATIONS

- A. Trouble Sequence of Operation: System or circuit trouble places system in trouble mode, which causes the following system operations:
 1. Visible and audible trouble alarm indicated at fire alarm control panel.
 2. Visible and audible trouble alarm indicated at new and existing remote annunciator panels.
 3. Trouble signal transmitted via an existing fiber network to the Campus 911 Center.
 4. Manual acknowledge function at fire alarm control panel silences audible trouble alarm; visible alarm is displayed until initiating failure or circuit trouble is cleared.
- B. Supervisory Sequence of Operation: The activation of any sprinkler valve tamper switch or duct-mounted smoke detector places system in supervisory mode, which causes the following system operations:
 1. Visible and audible supervisory alarm indicated by address at fire alarm control panel.
 2. Visible and audible supervisory alarm indicated by address at new and existing remote annunciator panels.
 3. Supervisory signal transmitted via an existing fiber network to the Campus 911 Center.
 4. Duct-mounted smoke detectors shall shutdown their respective unit upon detection of smoke and remain down until manually reset. They do not set off general alarm.
 5. Manual acknowledge function at fire alarm control panel and remote annunciator panel silences audible supervisory alarm; visible alarm is displayed until device is returned to its normal position/supervisory condition is cleared.
- C. Alarm Sequence of Operation: Actuation of an alarm initiating device places circuit in alarm mode, which causes the following system operations.
 1. Audible notification appliances shall sound until silenced by the alarm silence switch at the control panel.

2. All visible alarm notification appliances shall display a continuous synchronized pattern until reset by the Alarm Reset Switch.
 3. Alarm signal transmitted via an existing fiber network to the Campus 911 Center.
 4. All air-handling systems that are monitored shall shutdown and remain down until the fire alarm control panel is reset.
 5. The alarm LED shall flash on the control panel and remote annunciator panel until the alarm has been acknowledged at the control panel/remote annunciator panel. Once acknowledged, this same LED shall latch on and the custom label for the address in alarm shall be displayed on the alphanumeric LCD readout. A subsequent alarm received from another address after acknowledged shall flash the alarm LED on the control panel showing the new alarm information.
 6. A pulsing alarm tone shall occur within the control panel until acknowledged.
- D. Activation of an Elevator Lobby or Elevator Machine Room smoke or heat detector shall place the system in alarm mode and shall initiate Phase I elevator recall per ASME A17.1. Provide output signals and logic as required by code and by the elevator system supplier and installer.

2.5 REMOTE POWER SUPPLY.

- A. RPS shall be a 24 VDC power supply used to power Notification Appliances and field devices that require regulated 24VDC power. The power supply shall also include and charge backup batteries.
- B. Each addressable RPS shall provide up to a minimum of 6.0 amps of 24 volt DC regulated power for Notification Appliance Circuit (NAC) power or 5 amps of 24 volt DC general power. The power supply shall have an additional .5 amp of 24 VDC auxiliary power for use within the same cabinet as the power supply. It shall include an integral charger designed to charge 7.0 - 25.0 amp hour batteries.
- C. The addressable power supply shall provide four individually addressable Notification Appliance Circuits that may be configured as two Class "A" and two Class "B" or four Class "B" only circuits. All circuits shall be power-limited per UL 864 requirements.
- D. The addressable power supply shall provide built-in synchronization for certain Notification Appliances on each circuit without the need for additional synchronization modules. The power supply's output circuits shall be individually selected for synchronization. A single addressable power supply shall be capable of supporting both synchronized and non-synchronized Notification Appliances at the same time.
- E. The RPS shall supervise for battery charging failure, AC power loss, power brownout, battery failure, NAC loss, and optional ground fault detection. In the event of a trouble condition, the addressable power supply shall report the incident and the applicable address to the FACP via the SLC.
- F. RPS's shall mount in a dedicated backbox.
- G. Protected Equipment Smoke Detection: A system smoke detector shall be located in the area of the RPS. These smoke detectors are not shown on the plans and are a responsibility of the contractor.
- H. The addressable power supply shall interface and synchronize with other power supplies of the same type. The required wiring to interface multiple addressable power supplies shall be a single unshielded, twisted pair wire.

2.6 INITIATING DEVICES

- A. Manual Pull Station: UL 38 listed double-action, fully addressable manual pull station. Finished in red with molded, raised letter operating instructions in contrasting color. Station shall show visible indication of operation. Break glass panel and concealed glass rod style shall not be provided. Reset shall be by key. Semi-flush mount on recessed outlet box. Device shall be labeled in ¼" letters with their address on the outside of the base of the device. Device shall be provided regardless if building is fully sprinklered.
- B. Smoke Detector: UL 268 listed operating at 24 V dc nominal. Device shall of the plug-in type and shall be provided with an integral LED to indicate power-on status and if detector has activated. Detectors shall be self-restoring and shall not require resetting or readjustment after actuation to restore them to normal operation. Detectors shall be labeled in ¼" letters with their address on the outside of the base of the device.
 - 1. Photoelectric detectors shall utilize LED or infrared light source with matching silicon-cell receiver. Detector shall have sensitivity between 2.5 and 3.5 percent/foot smoke obscuration when tested according to UL 268A.
- C. Duct-Mounted Smoke Detector: UL 268A listed operating at 24 V dc nominal. Device shall of the plug-in type and shall be provided with an integral LED to indicate power-on status and if detector has activated. Detectors shall be self-restoring and shall not require resetting or readjustment after actuation to restore them to normal operation. Detectors shall be provided with the manufacturer's standard duct-mounted housing to protect the measuring chamber from damage, dust and insects. Label address of device on the outside of the housing.
 - 1. Photoelectric detectors shall utilize LED or infrared light source with matching silicon-cell receiver. Detector shall have sensitivity between 2.5 and 3.5 percent/foot smoke obscuration when tested according to UL 268A.
 - 2. Detectors shall be listed for use for variations in air duct velocity between 300 and 4000 feet per second.
 - 3. Sampling Tubes: Design and dimensions as recommended by manufacturer for the specific duct size, air velocity, and installation conditions where applicable.
 - 4. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.
 - 5. Weatherproof Duct Housing Enclosure: UL listed for use with the supplied detector. The enclosure shall comply with NEMA 250 requirements for Type 4X.
- D. Heat Detector: UL 521 listed operating at 24 V dc nominal. Device shall be of the plug-in type and shall be provided with an integral LED to indicate power-on status if detector has activated and labeled on base.
 - 1. Combination Type: Actuated by either a fixed temperature of 135 deg F or rate-of-rise of temperature that exceeds 15 deg F per minute, unless otherwise indicated.
- E. Waterflow Alarm Switches: Shall be provided by the Fire Sprinkler Installer and shall be wired complete and ready for use by the Fire Alarm System Installer. Switch shall have an adjustable delay to minimize false alarms due to fluctuations in water pressure. Switches shall be accessible and labeled to be seen from an occupied space.
- F. Sprinkler Valve Tamper Switches: Shall be provided by the Fire Sprinkler Installer and shall be wired complete and ready for use by the Fire Alarm System Installer. Both valves and fire alarm components shall be accessible and labeled to be seen in a normally occupied location.

2.7 NOTIFICATION APPLIANCES

- A. Alarm Speakers- wall application: Speaker shall be UL 1480 listed; high quality tone and voice reproduction; capacitor connected for connection to supervised notification appliance circuit;

semi-flush mounting; four inch cone; high impact, flame retardant PC/ABS thermoplastic; 25 or 70 VRMS; multi-tapped output power rated ¼ to 2 watts and produce 79 to 88 dB at 10 feet. Speakers shall be set at 2 watts unless otherwise noted on plans.

- B. Alarm Audible/Visible Combination wall (speaker/Strobes): Combination units shall provide a common enclosure for the fire alarm, audible and visible alarm appliances and be UL listed for its purpose. Capacitor connected for connection to supervised notification appliance circuit; semi-flush mounting; four inch cone; high impact, flame retardant PC/ABS thermoplastic; 25 or 70 VRMS; multi-tapped output power rated ¼ to 2 watts and produce 79 to 88 dB at 10 feet. TrueAlert model 4906 – 9151 Red set at 2 watts unless otherwise noted for color and wattage.
- C. Atlas/Soundolier Speakers- exterior/interior (Wall Mount): Provide voice control loudspeaker, model number **VT-157UCR** (Red for Fire Alarm function set at 2 watts) **VT-157UCN** (Gray for EPAS (*Emergency Public Address System*) function set at 8 watts unless otherwise indicated). Model shall be a double re-entrant type with 15 watts RMS audible power rating compression driver producing a UL-rated sound pressure level of 102 dB measured at 15 watts at 10 feet, within a frequency range of 400 Hz to 4 kHz. Unit shall be finished in red baked epoxy for fire alarm function and Gray epoxy for EPAS function. When noted, mounting can be in TWIN configuration with TVTA-R (RED) or TVTA-N (GRAY) housing two speakers 180 degrees apart.
- D. Atlas/Soundolier Speakers (Ceiling Mounted)- public areas and corridors in finished ceilings: Atlas/Soundolier #UHT, UL listed to Standard 1480, 8-inch cone, multi-tapped design with output power of 1/2, 1, 2, 5 watt and 10 watt power rating with either 25 or 70.7 VRMS input. Semi-flush ceiling mounted; #U51-8 standard round grille with #U95-8 enclosure (required for UL listing). Speaker output shall exceed 80 dBA at 10 feet and not exceed 120 dBA at the minimum hearing distance from the device. The speakers shall have multiple taps and shall utilize the 2-watt tap unless otherwise indicated on plans. Loudspeaker assembly shall be provided with white cover and shall be labeled by the installer with Owner provided “FIRE” labels permanently applied to the speaker cover.
- E. Visible Alarm Notification Appliances (Strobes): Strobes shall be xenon or equivalent, unfiltered or clear filtered white light, a minimum intensity of 15/75 candela and as indicated on drawings, flash rate range from 1 to 3 Hz, a maximum pulse duration of 0.2 sec with a maximum duty cycle of 40%. Strobe shall meet all requirements of the Americans with Disabilities Act (minimum 75 cd as tested per UL 1971). *Ceiling strobes must be mounted 6” below ceiling per current state of Kansas Code interpretation.*
- F. Simplex Audible/Visible Alarm Notification Appliances (Speaker/Strobes): CEILING MOUNTED COMBINATION UNITS are NOT ALLOWED.
- G. Audible/Visible Combination wall (speaker/Strobes): Combination units shall provide a common enclosure for the fire alarm, audible and visible alarm appliances and be UL listed for its purpose. Capacitor connected for connection to supervised notification appliance circuit; semi-flush mounting; four inch cone; high impact, flame retardant PC/ABS thermoplastic; 25 or 70 VRMS; multi-tapped output power rated ¼ to 2 watts and produce 79 to 88 dB at 10 feet. TrueAlert model 4906 – 9151 Red set at 2 watts unless otherwise noted for color and wattage.
- H. Weatherproof Exterior Strobes - above FDC (Fire Department Connection) application: Cooper Wheelock RSSWP-2475 W-FR Red, 24 VDC to be used with WPSBB-R back Box.
- I. Weatherproof Horn Loudspeaker: Cooper Wheelock STH-15S- Gray for EPAS application (exterior) – set at 8 watts. STH-15SR- Red for Fire Alarm application set at 2 to 4 watts.
- J. Weatherproof Strobe Speaker Assembly - Wall mount: Cooper Wheelock ET-70WP-24185W-FR. Not to be installed in same visible areas as SimplexGrinnell strobes due to inability to

synchronize. Application- wet areas, pools, shower rooms.

2.8 AUXILIARY DEVICES

- A. Door Release: Magnetic door holders shall be suitable for wall or floor mounting. The electromagnet shall require no more than 3 watts to produce 25-lbf of holding force. The coil voltage shall be 120 VAC.
- B. Remote Indicators: LED indicating lights. Light activates when the associated device is in an alarm or trouble mode. Lamp is flush mounted in a single-gang wall plate.
- C. Addressable Interface Device: Microelectronic monitor module listed for use in providing a system address for listed alarm-initiating devices for wired applications with normally open contacts.
- D. Provide with integral relay capable of providing a direct signal to the elevator controller to initiate elevator recall or to a circuit-breaker shunt trip for power shutdown.
- E. Control Relay Module: Provide intelligent control relay modules. The Control Relay Module shall provide one form "C" dry relay contact rated at 2 amps @ 24 VDC to control external appliances or equipment shutdown. The control relay shall be rated for pilot duty and releasing systems. The position of the relay contact shall be confirmed by the system firmware.
- F. Knox Box: Provide and install monitored Knox Box, 3200 Series, KD Bronze flush mount, hinged door with submaster cylinder and back box. Request order forms through DCM, attention Bob Rombach @ brombach@ku.edu.

2.9 FIRE ALARM 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. 16 AWG or size as recommended by system manufacturer.
- C. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, colored insulation matching University approved color-code.
 - 1. Low-Voltage Circuits: No. 16 AWG, minimum.
- D. Line-Voltage Circuits: No. 12 AWG, minimum.
- E. Fire Alarm Power Branch Circuits: Building wire as specified in Division 26.
- F. Signaling Line, Initiating Device and Notification Appliance Circuits: Power limited fire-protective signaling cable, solid copper conductor, 300 volts insulation, suitable for temperature, conditions and location installed. Minimum wire size for initiating device circuits, control circuits and notification appliance circuits shall be determined by calculations and manufacturer's requirements or recommendations. Wire and cable shall be twisted and shielded if recommended by the system manufacturer. Initiating, notification, and control circuits shall be sized based on 20% additional power consuming devices. The conductors shall meet the requirements of NEC article 760.
- G. The type of cable chosen should be based on fire alarm system requirements, specification requirements and applicable code requirements. Consideration should also be given to the

length of cable runs and potential interference.

- H. All wiring provided on this project shall be UL listed for the intended use. All wiring including wiring to existing modified devices and appliances shall be new.

PART 3 - EXECUTION

3.1 GENERAL

- A. The Contractor shall install, program and test all new equipment identified in this contract and/or revise existing equipment as noted.
- B. The installation supervisor shall be on the job site during the entire installation. The installation supervisor shall maintain marked up copies of the drawings at the job site showing as-built conditions. These drawings shall be updated daily and available for Owner review.
- C. The Contractor shall provide all required conduit and all associated hardware, and shall install (pull), connect, and test all cable for a complete fire alarm system. All wiring shall be installed in accordance with the guidelines of these specifications and documents as well as the NFPA codes and standards listed in these specifications.

3.2 EQUIPMENT INSTALLATION (*CONSULTANT TO CUSTOMIZE PER PROJECT*)

- A. The MINIPLEX transponder remote unit interface circuit (RUI), is required to be tied into any existing RUI circuit (consultant to customize per project).
- B. The MINIPLEX transponder will require a direct connection to the fire alarm control panel for an audio riser. This circuit carries the pre-recorded voice evacuation message and live announcements being made at the fire alarm control panel.
- C. Install manual station with operating handle 48 inches above floor unless noted otherwise on drawings.
- D. Install ceiling mounted initiating devices in areas with exposed structure tight to underside of floor/roof deck.
- E. Install ceiling mounted visible and audible/visible notification appliances in areas with exposed structure to bottom of floor/roof structure or at 30 ft AFF, whichever is lower. Visual devices shall be not be closer than 6" to finished ceiling.
- F. Install ceiling mounted visible and audible notification appliances in areas with finished ceilings flush with bottom of ceiling or at 30 ft AFF, whichever is lower.
- G. Install wall mounted visible and audible/visible notification appliances with visible element (strobe) at 82" above finished floor unless noted otherwise on drawings. Wall mounted visible devices shall not be any higher than 90" AFF or 6 inches below the ceiling whichever applies.
- H. Install wall mounted audible devices with the top of the device no more than 90 inches above finished floor or 6 inches below the ceiling, whichever is lower, unless noted otherwise on Drawings. If combination devices are installed, they shall be installed per the visible signal device requirements.
- I. Mount outlet box for electric door holder to withstand 80 pounds (36.4 kg) pulling force. Mount

such that magnetic pad extensions are not required. If pad extension need to be used because of unusual conditions they must be fused so they do not go out of adjustment.

- J. Locate smoke detectors not closer than 3 feet from air-supply diffuser or return-air opening and not directly in the air stream. Duct Smoke Detectors: Comply with NFPA 72. Install sampling tubes so they extend the full width of the duct and are supported per manufacturer's instructions. Insure the sampling segment is correctly sized for the application per manufacturer's instructions. Verify the sample tubes are correctly oriented in the air stream before final inspection. Leading tube with sample holes is first, exhaust tube (short tube) is last. Indicate with an arrow on duct direction of air flow.
- K. Heat Detectors in Elevator Mechanical Rooms: Coordinate temperature rating and location with sprinkler rating and location.
- L. Remote Status and Alarm Indicators: Install near each smoke and/or smoke duct detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from a normal viewing position. Locate in a public space adjacent to the device they monitor on the ceiling if the device is within the ceiling or a wall accessible from the ground without a ladder.
- M. FACP: Surface mount with tops of cabinets not more than 72 inches above the finished floor unless noted otherwise.
- N. Remote Annunciator: Flush mount with center of display at 60 inches above the finished floor.
- O. Make conduit and wiring connections to equipment provided by others.
- P. Provide strobe synchronization as required per NFPA 72.
- Q. Knox Box: Mount flush to exterior building wall at 60 inches AFF

3.3 WIRING INSTALLATION

- A. Install wiring according to the following:
 - 1. NECA 1.
 - 2. TIA/EIA 568-A.
- B. Routing of all fire alarm wiring shall comply with the "Survivability" requirements of NFPA 72.
- C. Wiring Method: Install wiring in metal raceway according to Division 26 Section "Wiring Devices."
 - 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.
- E. Minimum allowable conduit size shall be ½ inch for drops to individual devices and ¾ inch otherwise. Conduit shall be sized so that conduit fill does not exceed 75% of NFPA 70 maximum fill requirements. Cables in vertical risers shall not exceed 50% of NFPA 70 maximum fill requirements. Conduit installation shall be as required by the Contractor's layout and as described in these specifications. All conduit field routing shall be acceptable to the Owner. Routing not acceptable shall be rerouted and replaced without expense to the Owner.
- F. 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, and properly installed twisted wire in wire nuts or plug connectors.

- G. All wire, cable, conduit and raceways shall be concealed in walls, ceiling spaces, electrical shafts or closets in finished areas except as specifically noted otherwise. Conduit and raceways may be exposed in unfinished areas or where specifically approved by the DFM or DCM. Exposed conduit required in finished non public areas shall be painted to match walls and finish. Exposed conduit in non-finished, non public areas shall be unfinished. Exposed raceways in public areas shall be in prefinished wire mold.
- H. Except as otherwise specified or indicated on the drawings, all conduit shall be installed parallel or perpendicular to dominant surfaces with right angle turns made of symmetrical bends or fittings. Except where prevented by the location of other work, a single conduit or a conduit group shall be centered on structural members.
- I. Conduit shall be located at least six inches from hot water or steam pipes, and from other hot surfaces. Conduit shall not block access to any existing equipment or fixtures.
- J. All fire alarm conduits shall be prefinished red. Junction boxes covers shall be labeled and painted red as specified in Division 26. 1. Exposed conduit required in finished non public areas shall be painted to match walls and finish. 2. Exposed conduit in non-finished, non public areas shall be unfinished. 3. Exposed raceways in public areas shall be in prefinished wire mold.
- K. All wiring shall be terminated at devices or panels using terminal connectors for screw type terminals. All terminal connectors for conductors shall be pre-insulated ring type or pre-insulated spade type. Pre-insulated terminal connectors shall include a vinyl sleeve, color coded to indicate conductor size. Pre-insulated terminal connectors shall include a metallic support sleeve bonded to the vinyl-insulating sleeve and designed to grip the conductor insulation. Fire alarm cabling shall be the type and color as listed below by circuit identification:
 - 1. A- Zone Circuit; Anixter SG1402N10 / Red
 - 2. B- Visual/Signal Circuit; Anixter SG1202N10 / Red
 - 3. C- Auxiliary Power Circuit; Anixter SG1402N10 / Green
 - 4. D- Door Holder Circuit; Anixter SG1402N10 / Yellow
 - 5. E- MAPNet / IDNet Power Circuit; Anixter SG1402N10 / Green
 - 6. K- Remote Test/LED Circuit; Anixter SG1402N10 / Green
 - 7. M- MAPNet / IDNet Circuit; Anixter SG1802S19 / Red
 - 8. N- RUI/N2 Communication; Anixter SG1802S19 /Red
 - 9. R- Relay Circuit; Anixter SG1402N10 / Yellow
 - 10. S- Speaker Circuit; Anixter SG1802S19 / Blue
 - 11. Au- Audio Riser Circuit; Anixter SG1802S19 / Red
 - 12. MC- Microphone Control Circuit; Anixter SG1802S19 / Green
- L. Do not load signaling line circuits greater than seventy five (75) percent capacity.
- M. Mount end-of-line device in box with last device or separate box adjacent to last device in circuit for conventional hardwired class B initiating and notification appliance circuits.
- N. Conduit shall be securely fastened to all boxes and cabinets. Threads on metallic conduit shall project through the wall of the box to allow the bushing to butt against the end of the conduit. The locknuts both inside and outside shall then be tightened sufficiently to bond the conduit securely to the box. Conduit shall enter cabinets from the bottom and sides only. .
- O. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.

3.4 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals according to Division 26 Section "Identification for Electrical Systems."
- B. Lettering and Graphics: Coordinate names, abbreviations, colors, and other designations used in electrical identification work with corresponding designations specified or indicated on the approved drawings.
- C. Install identification products in accordance with the manufacturer's written instructions.
- D. Install instructions frame in a location visible from the FACP.
- E. Power-supply disconnect switch shall be red, labeled "FIRE ALARM" and locking type.

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. Systems shall be checked and tested in accordance with the instructions provided by the manufacturer to insure that the system functions as required and is free of grounds, opens, and shorts. Each device shall be tested. Smoke detectors shall be tested with UL listed canned smoke aerosol. Smoke detectors shall not be installed in bases until areas are cleaned, and major construction is completed and free of dust. Orange shipping covers are NOT dust covers and will not protect smoke detectors from construction dust. Smoke detectors will need to be removed, sealed and protected or replaced if dirty.
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. Before requesting final approval of the installation, submit a written statement using the form for Record of Completion shown in NFPA 72.
 - 2. 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 the Fire Alarm Technician.
 - 3. Visual Inspection: Conduct visual inspection before testing. Use Record Drawings and system documentation for the inspection. Identify improperly located, damaged, or nonfunctional equipment, and correct before beginning tests.
 - 4. Testing: Follow procedure and record results complying with requirements in NFPA 72.
 - 5. 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.

3.7 MANUFACTURER'S FIELD SERVICES

- A. Include services of factory trained and certified technician to supervise installation, adjustments, final connections, and system testing as performed by the fire alarm contractor's factory-trained technicians.

3.8 DEMONSTRATION

- A. The equipment supplier's factory trained technician shall train the Owner's personnel in the proper use and maintenance of the system. Training sessions shall be conducted as needed,

not to exceed a total of 2 sessions, with each session lasting a maximum of 4 hours each.

- B. Demonstrate normal and abnormal modes of operation, and required responses to each.

3.9 ACCEPTANCE TESTING

- A. Upon completion of the system installation, a factory-trained technician shall perform all necessary tests and adjustments in the presence of the Owner's designated personnel, the contractor and the AHJ(Authority Having Jurisdiction) inspector. Test shall include the following and be conducted in the listed order.
 1. **24 hour backup power test-** System primary power shall be disconnected for a period of 24 hours. At the end of that period, an alarm condition shall be created and the system shall perform as specified for 15 minutes (5 minutes for Horn systems). During the 15 minutes all sound and visual devices are checked for proper operation.
 2. **Battery verification test-** Before returning to normal power verify battery power.
 3. **Sound and visual device test-** Return to normal power and continue device verification throughout project; Verify strobe operation and synchronization; Verify sound level pre-testing and speaker operation; Verify that EPAS speakers are NOT operating under fire alarm conditions; Verify that labels are in place; Verify conduit is correct and document needed changes if any. Sound in all areas shall be 15 dB over ambient with ambient being approximately 50 db in normal office or classroom environments.
 4. **Sprinkler device test-** Check all device locations, proper access, visible labeling and proper operation. Verify activation of each tamper switch and test flow switch timing which should be between 25 and 45 seconds.
 5. **Elevator recall and shaft devices test-** With elevator service tech, test top of shaft heat detector, pit devices, each floor recall detection and primary and secondary floor operation.
 6. **Duct detection operational test-** Verify each duct detector operation; mechanical unit shutdown; sensing tube orientation; labeling and remote test switch installation.
 7. **Device walk test-** With system reset and in audible walk test, verify individual device operation, label and digital address. Utilize smoke for smoke detector test, magnets will not be allowed. If testing is done during building operational hours provide voice activated communication device at the main panel to here call outs.
 8. **Ground fault, short and open circuit test-** For each circuit or zone create a ground fault, short and open circuit by opening up a device and creating each condition. System should report problem in walk test.
 9. **EPAS (Emergency Public Address System) test-** Verify operation of all exterior EPAS speakers from main panel or remote enunciator. Call Public Safety dispatch and request message be sent from dispatch to verify network connectivity.
 10. **Knox Box alarm test-** Open and or close Knox box to verify supervisory alarm function. Do not do this test in walk test. Verify reset function.
 11. **Network test-** SimplexGrinnell shall verify and certify that all devices are graphically monitored at PSO through the IMS stations.

END OF SECTION 281111