Note: The A/E must choose all design values in brackets below before using in project specifications

1 General
1.1 Provide all material, labor, engineering and operations necessary for the installation of a complete, operable fire detection and alarm system as shown on the drawings and as specified herein
1.2 The fire alarm system shall be initially configured by the manufacturer.

2 Related Requirements
2.1 Section 211000 Water-Based Fire Suppression Systems.

3 Reference
3.1 Abbreviations and Acronyms:
   - FACP - Fire Alarm Control Panel
   - FASP - Fire Alarm Sub-Control Panel
   - FAPS - Fire Alarm Power Supply
   - RAAP - Remote Alarm Annunciator Panel
   - FABC - Fire Alarm Battery Cabinet
   - ANAC - Addressable Notification Appliance Controller

4 Submittals
4.1 An action submittal for the fire alarm system shall be submitted to the owner for review and approval prior to system installation and shall include all of the following:
   - Voltage calculations and shop drawings with riser diagram and system layout showing the actual location of all components including initiating devices, notification appliances with candela ratings, control devices, monitoring devices, FACP, FASP, FAPS, RAAP, FABC, ANAC. Include the number of conductors, zones and conduit sizes.
   - Manufacturer’s product data sheets for all equipment and materials. Indicate which products will be used in the project.
4.2 A closeout submittal for the fire alarm system shall be submitted to the Owner after the system installation is complete and shall include all of the following:
   - Record documentation with all changes made since the approved action submittal.
   - A schedule of circuits and components by function, location and wire code.
   - A sequence of operation including a troubleshooting guide of the system.
   - Provide a “Fire Alarm System Record of Completion” in accordance with NFPA 72.
   - Provide a digital copy of the complete programming for the FACP.
   - All parts, maintenance manuals, keys, and a list of spare devices.
   - Furnish spare devices to the Owner as specified
     4.9.1 Furnish spare devices of each type installed on the project. The amount of spare devices shall be 6% of the total devices but not less than one device. This includes all notification appliances and initiating devices.
     4.9.2 Furnish one of each type of module installed on this project.

5 Quality Assurance
5.1 Contractor Qualifications
   5.1.1 The operation and configuration of the fire alarm system shall be certified by a Fire Protection Engineering Technician. The technician shall be a full-time employee of the system sub-contractor and be National Institute for Certification in Engineering Technologies (NICET) Level II certified, in the technical subfield of Fire Alarm Systems.
   5.1.2 Work shall be performed by a contractor regularly engaged in the design and installation of fire alarm systems.
5.2 Regulatory Requirements
   5.2.1 System design, installation and materials shall comply with the applicable regulating agencies and organizations, which include, but are not limited to the following:
      - Indiana Department of Homeland Security (IDHS) Division of Fire and Building Safety.
      - Underwriters Laboratories (UL).
      - Factory Mutual (FM).
      - Purdue University
5.3 System design, installation and materials shall comply with applicable codes, standards, and regulations, which include, but are not limited to the following:
- Indiana Building Code (IBC)
- Indiana Fire Code (IFC)
- Indiana Electrical Code (IEC)
- Indiana Mechanical Code (IMC)
- National Fire Protection Association (NFPA) Codes and Standards
- Americans with Disabilities Act (ADA)

5.4 It is the contractor’s responsibility to notify the engineer, architect and owner in writing prior to installation if there is a conflict or discrepancy between the applicable codes, standards or regulations and the drawings or specifications.

5.5 The contractor shall assume full financial responsibility for compliance with all applicable codes, standards and regulations. This includes compliance for modification or extension of existing systems. All deficiencies shall be corrected at no additional cost to the Owner.

6 Products

6.1 All products, equipment and materials shall be new, listed and installed in accordance with the manufacturer’s instructions and its listing.

6.2 Vendors shall be Simplex or Notifier.

6.3 [West Lafayette Campus] All locks on cabinets and manual pull stations shall be replaced with Fort #415 key lock.

7 Wiring

7.1 General

7.1.1 All fire alarm system wiring shall be sized and installed per fire alarm vendor and manufacturer’s recommendations. The contractor shall verify specific requirements with fire alarm vendor and make necessary changes both in sizes and quantities.

7.1.2 Notification appliance circuits shall be loaded to not more than 75% of the circuit power rating.

7.1.3 Plenum-rated cables shall be approved by the Owner.

7.2 Wiring

7.2.1 12 AWG for AC, power supply connections

7.2.2 14 AWG for DC, power supply connections

7.2.3 12 AWG for DC, Audio/Visual Device Power (non-addressable)

7.2.4 2C/14 AWG UTP for DC, Audio/Visual Device Power (Simplex Addressable)

7.2.5 14 AWG for Discrete Control Circuits

7.2.6 IDNet/Mapnet/FlashScan/Data, and Network Communications (addressable systems) cable shall be 2/c, 18 AWG, solid copper and shielded. Manhattan Cable M39124, West Penn 975 or approved equal. If Simplex 4100ES is used then IDNet+ circuits do not require shielded cable. Unshielded twisted-pair wire shall be 2/c, 18 AWG, solid copper. West Penn 980 or approved equal.

7.2.7 All non-addressable signal and power cabling shall be type FPL, solid or stranded copper. Correct wire gauge indicated above. West Penn 994, 998, Manhattan Cable M39070, M39069, or approved equal.

7.2.8 Speaker cable shall be 2/c, 16 AWG, solid or stranded copper and shielded. Manhattan Cable M39126, West Penn 991 or approved equal.

7.3 Labels

7.3.1 All terminals shall be numbered and match the record documentation designations.

7.3.2 All switches shall be labeled as to function and/or position (“Normal”, “Test”)

7.4 Conductors

7.4.1 Black (Hot) and White (Neutral) for all 120V power wiring.

7.4.2 All fire alarm cable shall have red (positive) and black (negative) conductors with a red outer jacket.

7.4.3 Label each conductor at each termination.

7.4.4 Labels shall be 2, 3, or 4 characters per termination.

7.4.5 Labels shall be Brady adhesive type.

7.4.6 Labels shall be similar to the following or Owner approved designation:
- Network data/communications loop label: NWK:1
- Initiating device circuits(conventional) label: Z-1,
- Initiating device circuits(addressable) label: M plus (loop #) :1 (panel #) – 1 (device #) -1
- Notification appliance circuits label : A plus (panel #) : 1 (circuit #) -1
- Notification appliance circuits(voice) label: V plus (panel #) : 1 (circuit #) -1
8.1.6 Interior stairway means of egress doors provided with a lock from the side opposite the egress side shall be unlocked simultaneously without unlatching upon a signal from the FACP. The FACP or other means shall be located near the main entrance to the building to allow emergency personnel to unlock these doors.

8.1.7 Fire Alarm Test Switches

8.1.8 Provide fire alarm test switches in the FACP and FASP.

8.1.9 Provide one switch for each of the following (unless otherwise specified by Owner):

- All building audible/visible signals - defeat.
- Fire alarm receiving equipment circuit - defeated.
- Standby battery load - disconnected.
- All Fire Evacuation switch with indication of active alarm to fire alarm receiving equipment when activated (FACP). Red LED type only.
- Sprinkler alarm bell - silence.
- Preaction valve - defeat (one per circuit).
- Waterflow switch and pressure switch - defeat (one per zone).
- All magnetic door holders - defeat (one switch to control all magnets).
- All building fans shutdown - defeat (one switch to control all fans).
- All elevator home - defeat (one switch to control all elevator controllers located in the same elevator equipment room).
- Building smoke detectors - defeat (one per zone; zone defined as a single addressable device or a group of non-addressable devices connected to addressable monitor card). Verify with Architect/Owner the exact configuration or specific requirements for project.
- All duct smoke detectors - defeat (one switch to control all detectors).
- All smoke dampers - defeat (one switch to control all dampers).
- Immediate and time delay computer shutdown - defeat (one per circuit).
- Immediate and time delay computer air-conditioning shutdown - defeat (one per circuit).
- Alternative Automatic Fire-Extinguishing Systems – defeat (one per system).
- Communications/Data circuit - disconnect (one switch for each circuit).

8.1.10 If separate circuits are installed for audible and visual signals, then one defeat switch shall be provided for all of the audible and one for all of the visual signals.
8.1.11 Each fire alarm test switch shall have integral LED indicator and labeled as to function, normal and test.

8.1.12 Indicator lights shall be yellow LED type. NOTE: LEDs signify non-normal switch position, when LED is illuminated this will indicate a trouble condition.

8.1.13 Switch in "center" position (Toggle Type), "out" position (Pushbutton Type) - normal operation. (Verify Type with Vendor).

8.1.14 Switch in "down" or "in" position (Toggle Type), "in" position (Pushbutton Type) - (test) - defeat. (Verify Type with Vendor).

- Particular function is inoperative.
- Integral indicator light "on".
- Trouble signal transmitted to fire alarm receiving equipment.
- All arranged in a horizontal or vertical row.

8.2 Disconnect Switch

8.2.1 Provide two-gang switch box in bottom left hand corner (1 ½" from side of panel) of FACP and FASP. Provide GRG conduit coupling on incoming conduit connector and chase nipple switch box to couplings as well as attaching box to panel back. Provide ½" chase nipple in top of box for power wiring to FACP and FASP. Switch box shall be Wiremold V5744-2.

8.2.2 Provide single pole red pilot handle switch for 120V internal panel disconnect and 120V 20A duplex receptacle in new switch box. Wire the receptacle ahead of the pilot switch. Single-pole red pilot handle switch shall be Hubbell 1221-PL or approved equal. Duplex receptacle shall be Hubbell 5362 or approved equal.

8.3 Telecommunications [Purdue West Lafayette Campus]

8.3.1 Provide single gang Wiremold j-box with duplex telephone outlet, Panduit #CJ5E8TIW Office White, Category 5E, T568B wiring standard, 8 conductor jack (2 required), Panduit #CBEIOW Office White, single opening wall plate, Panduit #CHF2IW-X, Office White snap-in module in top of opening (1 required) and Panduit #CHB2IW-X, Office White, blank fitting in bottom opening (1 required) mounted in FACP under or near pilot light switch and adjacent to 20A duplex receptacle. Locate phone outlet between receptacle and front edge of FACP cabinet. (2" maximum from j-box bottom to cabinet bottom).

8.3.2 Install 1" conduit with two (2) Commscope #5EN5 "gray", 24AWG, non-plenum category 5E or two (2) Commscope #5E55 "gray", 24AWG, plenum category 5E cables back to nearest telephone "IDF" or "BDF" location for connections to telephone system. Contact Owner for Purdue designated room number.

8.3.3 This contractor shall notify the Owners Representative as soon as cables have been installed, so arrangements for cable testing and acceptance can be made with the Owners Telecommunications personnel.

8.4 Remote Alarm Annunciator Panels (RAAP):

- RAAP shall be semi-flush or surface mounted with special steel back box. RAAP shall be Simplex 4603-9101 or Notifier LCD-160 and include special steel back box.

9 Power Sources

9.1 General

9.1.1 Power supply and automatic battery charger shall be mounted in the FACP and FASP.

9.1.2 "Back Wiring" of receptacles and switches is not approved. "Side Wiring" using formed eyes is the only approved method of connection.

9.2 Safety Switch

9.2.1 Provide a switch secured in either the on or off position labeled "Fire Alarm Power".

9.2.2 If the EM panel is a circuit breaker panel, a branch breaker may be used instead of the switch as long as a handle tie/lock and critical circuit tag are installed on the branch breaker.

9.3 Batteries

9.3.1 Self-protecting, lightning resistant, surge protection for input and output.

9.3.2 Battery cabinet shall be surface or semi-flush mounted adjacent to FACP and FASP of at least 12" H x 24" W x 6 ¾" D with battery shelf and solid door. Cabinet finish shall match the FACP and FASP. Include a battery load disconnect switch.

9.3.3 Batteries shall be compatible with the system with at least a 2 year warranty.

10 Initiating Devices

10.1 Manual Pull Stations — Manual pull stations shall be Simplex 4099-9004 or Notifier NBG-12LX.
10.2 Smoke Detectors

10.2.1 Smoke detectors shall have pulsating power on LED indicator that locks on to steady burn in an alarm situation.

10.2.2 Photoelectric smoke sensor shall be Simplex 4098-9714 or Notifier FSP-951.

10.2.3 Sensor base shall be Simplex 4098-9792 or Notifier B300-6. The tamper-resist feature shall not be activated.

10.3 Duct Smoke Detectors

10.3.1 Duct smoke sensor shall be Simplex 4098-9714 or Notifier FSP-951R.

10.3.2 Duct sensor housing shall be Simplex 4098-9756 or Notifier DNR.

10.3.3 Remote test station shall be Simplex 2098-9806 or Notifier RTS151KEY.

10.4 Heat Detectors

10.4.1 Heat detectors shall be combination rate of rise/fixd temp, rated at 135°F for areas where ambient temperatures do not exceed 120°F.

10.4.2 Heat sensor shall be Simplex 4098-9733 or Notifier FST-951R.

10.4.3 Sensor base shall be Simplex 4098-9792 or Notifier B300-6. The tamper-resist feature shall not be activated.

11 Notification Appliances

11.1 General

11.1.1 Wall mounted notification appliances shall be [red].

11.1.2 Ceiling mounted notification appliances shall be approved by the Owner and shall be [white].

11.2 Audible appliances shall be Simplex 4901-9820, Simplex 49AO-WRF, Wheelock MT-12/24-R, Gentex GEH3-WR or Notifier equal.

11.3 Visible appliances shall be Simplex 4906-9101, Simplex 49VO-WRF, Wheelock STR, Gentex GES3-WR or Notifier equal.

11.4 Combination Audible/Visible appliances shall be Simplex 4906-9127, Simplex 49AV-WRF, Wheelock HSR, Gentex GEC3-WR or Notifier equal.

11.5 Emergency Voice/Alarm Communication

11.5.1 Speakers shall be dual voltage evacuation, multi-tap type, set according to vendor’s drawings. Speakers shall operate on a 70.7 VRMS notification circuit.

11.5.2 Voice only appliances shall be Simplex 4902-9716 wall red, 4902-9721 ceiling white, 49HF-APPLW wall addressable, 49HF-APPLC ceiling addressable, Wheelock ET, or Gentex SSPK-CLPW or Notifier equal. Combination voice/visible appliances shall be Simplex 4906-9151 wall red, 4906-9154 ceiling white, 49HFV-APPLW wall addressable, 49HFV-APPLC ceiling addressable, Wheelock ET, Gentex SSPK-WLPR or Notifier equal.

12 Auxiliary Input/Output Devices

12.1 General — Auxiliary hardwired control relays shall be Simplex or Notifier as required by the system. Unit shall be fast acting heavy-duty power relay with full floating movable contact carrier to assure ample wipe, high contact pressure and accurate alignment. Contacts shall be rated as required. Relay shall include deformed cold rolled 16 gauge steel enclosure with screw-type cover, if not mounted in FACP.

12.2 Monitor Module:

12.2.1 Addressable zone monitor—module shall be Simplex 2190-9155, Simplex 4090-9001, Notifier FMM-1 or Notifier FZM-1.

12.2.2 Signal Module—Addressable zone signal module shall be Simplex 2190-9161, Notifier FCM-1.

12.2.3 Relay Module—Addressable relay module shall be Simplex 2190-9163, Simplex 4090-9002, Notifier FRM-1.

13 Knox-Box [New Construction]

13.1 Knox-box shall be [surface] [recessed] mount without a tamper switch.

14 Execution

14.1 Panels shall have transient surge protection built-in or additionally provided. Provide transient surge protection for wiring runs between buildings and any devices mounted on the exterior of the building.

15 System Description

15.1 The fire alarm system shall be modular with the latest compatible version of software from the manufacturer. The system shall be capable of on-site programming to accommodate system expansion and facilitate changes in operation.

15.2 All active points, spare points and hardware
related points shall include numerical identification as well as a text description.

15.3 Network communication between the FACP and FASP shall be accomplished using a class “A” communications loop. A single open, ground or short on the network loop shall not degrade network communications. Communications on the loop shall be passed in the opposite direction to maintain communications throughout all FASP. The status of the communications link shall be reported at the FACP. The network communications wiring shall be installed in separate conduits to provide maximum survivability of the system.

15.4 FACP and FASP shall provide inputs and outputs as follows:

15.5 Initiating Device Circuits (Alarm & Trouble):
- Manual Stations
- Smoke Detectors
- Heat Detectors
- Waterflow Switches
- Supervisory Switches (Trouble Only)
- Pressure Switches (Trouble Only)
- Preaction Solenoid Valves (Trouble Only)
- Alternative Automatic Fire-Extinguishing Systems

15.6 Notification Appliance Circuits (Alarm & Trouble):
- Audible/Visible Signals
- Audible Only Signals
- Visible Only Signals
- Sprinkler Bell

15.7 Control Circuits (Alarm & Trouble):
- Door Holder Control
- Smoke Damper Control
- Air Distribution System Fan Shutdown
- Elevator Recall

15.8 Fire Pump Monitoring (Alarm & Trouble):
- Fire Pump Running
- Fire Pump Controller Loss of Normal Power (Trouble Only)
- Fire Pump Controller Loss of Emergency Power (Trouble Only)
- Fire Pump Controller on Emergency Power (Trouble Only)
- Fire Pump Controller Phase Reversal (Trouble Only)

15.9 [Emergency Voice/Alarm Communication]
An emergency voice/alarm communication system, integral within the FACP, shall include central voice alarm system components complete with microphone, digital voice controller, custom voice message library, pre-amplifier, amplifiers and tone generators. Features to be included:

15.9.1 70.7 volt output amplifiers with battery backup. Amplifiers shall be UL listed. Provide power to drive all speakers plus 50%. Equally balance all amplifiers. Provide one backup amplifier for every three amplifiers provided. This amplifier shall automatically take over in the event any of the three primary amplifiers fail.

15.9.2 The message shall be custom as designated by the Owner. The words of the message shall be professionally recorded and digitized.

15.9.3 There shall be a designated message for the following: FIRE ALARM EVACUATION

15.9.4 The fire alarm evacuation message shall be initiated automatically.

15.9.5 Voice communications circuits shall be supervised.

16 Installation

16.1 Initiating Devices — General

16.1.1 All initiating devices shall have individual zone addresses.

16.1.2 Final connections of equipment, devices and wiring shall be made under the direct supervision of the manufacturer’s representative.

16.2 Manual Pull Stations

16.2.1 Manual pull stations shall be mounted at 4’ above finished floor.

16.2.2 Manual pull stations shall be surface mounted using Simplex 2975-9178, Notifier SB-10 or semi-flush mounted using Simplex 2099-9813 trim plate, Notifier BG-TR trim ring. Simplex 2099-9814 back ring may be used to surface mount Simplex manual stations to a Wiremold box.

16.3 Smoke Detectors

16.3.1 Smoke detectors should not be located in direct airflow or closer than 36” from an air supply diffuser or return air opening.

16.3.2 Each elevator recall smoke detector, upon activation of alarm, shall home per the Indiana Elevator Safety Code.

16.3.3 Provide wiring where smoke detectors are required to activate elevator hoistway smoke relief equipment. These smoke
detector(s) shall be on a separate zone with a defeat switch in the FACP.

16.4 Duct Smoke Detectors

16.4.1 Provide duct smoke detectors in accordance with the IMC.

16.4.2 Each duct smoke detector, upon activation of alarm, shall shut down all operational capabilities of the respective air distribution system in accordance with the listing and labeling of appliances used in the system.

16.4.3 The sampling tube shall match duct size.

16.4.4 Provide a remote control station mounted at most 6' above finished floor with indicator lights and key test switch in the immediate area near detector.

16.4.5 Duct detectors, remote test stations and indicator lights shall have legend tags denoting which fan unit they serve and the type (conventional or addressable) of the detector.

16.5 Notification Appliances

16.5.1 Provide appropriate back-boxes, adapter plate, and skirts for mounting, supplied by the manufacturer.

16.5.2 Notification appliances, at all outdoor, freezer, or wet locations, shall be installed in weatherproof back-boxes.

16.5.3 All visible notification appliance circuits shall be synchronized to comply with ADA recommendations regarding photo-sensitive epilepsy.

16.6 Auxiliary Input/Output Devices

16.6.1 All signal, monitor, control and relay modules shall be mounted in appropriately sized lift-off-cover JIC type boxes in an accessible location at a maximum of 6' above finished floor. Where modules are installed above ceiling grids, the location shall be marked on the grid.

16.6.2 All remotely mounted discrete input/output cards shall be installed in J-boxes such that all switches, fuses, LEDs shall be visible and readily accessible.

16.6.3 Provide fire alarm modules necessary for the FACP to unlock interior stairway means of egress doors.

16.7 Fire Suppression Systems

16.7.1 Coordinate with the fire suppression contractor to provide all necessary wiring for fire suppression systems.

16.7.2 Provide all wiring for waterflow switches. Main waterflow switches shall be hardwired back to the FACP. Provide separate zone circuit wiring to each switch to actuate fire alarm system.

16.7.3 Provide all wiring for supervisory switches. Each supervisory switch shall have a separate zone circuit. Each supervisory switch shall cause a "trouble signal only" if the valve is turned, the unit is removed from its mounting, or housing cover is removed. The FACP shall have indications that distinguish between valve closed and circuit trouble.

16.7.4 Provide all wiring for fire suppression system releasing panels.

16.7.5 Provide a weatherproof alarm bell bell mounted 10 to 15 feet above grade on the exterior of the building. The alarm bell shall be supervised and actuated by any flow switch through the FACP. Alarm bell shall be 10" 24VDC vibrating type equipped with any options required for the particular location and system. Alarm bell shall be Wheelock MB-G10-24-R.

16.8 Door Release Devices

16.8.1 Magnetic door holders shall be UL 228 listed. Units shall be either wall or floor mounting as indicated on the drawings and be complete with matching door plate (finish to match door hardware). Units shall operate at 24VDC and develop a minimum of 25 lbs. holding power.

16.9 Smoke Dampers

16.9.1 Smoke dampers shall be close upon actuation of a smoke detector or detectors installed in accordance with one of the design methods in the IMC.

16.10 Alternative Automatic Fire-Extinguishing Systems

16.10.1 Wet-chemical systems, dry-chemical systems, foam systems, carbon dioxide systems, halon systems, clean-agent systems shall be connected to the fire alarm system in accordance with the owner’s instructions, the drawings and specifications.

16.10.2 Provide all wiring to alternative automatic fire-extinguishing system’s devices and panels.

16.11 Connection to Fire Alarm Receiving Equipment [Purdue West Lafayette]:

16.11.1 The fire alarm system shall be capable of transmitting all alarm, trouble and supervisory signals to the Owner’s existing Digitize 3505 Prism LX directly without damage.

16.12 Connection to Fire Alarm Receiving Equipment [Off Site]:

Page 7 of 8
16.12.1 Provide form “C” dry relay contacts for interface to off-site alarm monitoring equipment. Provide for separate alarm, trouble, and supervisory output.

16.12.2 Provide an integral serial digital alarm communicator transmitter (DACT) for connection to central station monitoring.

16.13 Knox-Box

16.13.1 Provide a Knox-Box on the exterior of the building. The installation location shall be approved by the Owner.

17 Supervision

17.1 All initiating devices and notification appliances shall cause a trouble signal if the device circuitry is broken or the device is removed.

17.2 Power supplies shall cause a trouble signal if the main or any auxiliary power supply fails.

17.3 All modules shall cause a trouble signal if the device is removed from the circuit.

17.4 The connecting circuit from the FACP to the fire alarm receiving equipment shall cause a trouble signal if the connecting circuit is open or wire to wire short.

17.5 Upon activation of a supervisory device or any of the above listed conditions, the respective trouble LED shall be lit on the FACP and indicated on the display in the FACP, FASP and RAAP.

18 Closeout Activities

18.1 Acceptance Test Preparation

18.1.1 Verify that the fire alarm system is installed in accordance with the drawings, specifications and the code.

18.1.2 Test the function of the fire alarm system with the manufacturer’s representative.

18.2 Acceptance Test

18.2.1 Schedule an acceptance test with the Owner at least seven days in advance.

18.2.2 The fire alarm system acceptance test will fail if the contractor has not completed the acceptance test preparation.

18.2.3 Demonstrate the operation of the complete fire alarm system including but not limited to annunciators, initiating devices, notification appliances, emergency control function interfaces, fire suppression system components and connection to fire alarm receiving equipment.

18.2.4 Acceptance test failures will be rescheduled.

18.3 System Acceptance

18.3.1 The fire alarm system acceptance shall be coordinated with fire suppression system acceptance.

18.3.2 The Owner’s Fire Equipment Services personnel shall be given instruction for operating and testing the fire alarm system immediately upon system acceptance.

18.3.3 Provide the closeout submittal to the Owner upon completion of the fire alarm.