**SECTION 28 46 21.1x FIRE ALARM SYSTEMS**

This document is provided as a reference for the design professionals working for American University (AU). This document should not be used directly as written project specifications. This document does not define products for maintenance replacement purposes, but rather should be used for renovation and new construction projects.

The American University Facilities Management Life Safety Manager/Master Electrician has established standards for fire alarm systems to protect the AU community and buildings. While the standards reflect best business practice and represent industry standards, they are applied based on assessments of plans for newly constructed buildings and major renovations and take into account-planned uses of each facility and its occupants. These assessments and the application of these standards are intended to foster a uniform level of protection and notification associated with university structures, both within and exterior to the buildings. The standards, or variations of the standards, are applied based on recommendations to Facilities Management developed through the Life Safety Master Plan and in consultation with University Safety and Security (USSS) and the university insurance provider.

The USSS Physical Security Unit also maintain lists of approved security hardware and will provide the information upon request. This hardware is standardized across campus and the physical security manager must approve variations from the list.

All security and emergency notification system designs for new buildings and major renovations are prepared in partnership with the Planning and Project Management department. Application of these standards to existing buildings/locations on campus as of May 2016 will be at the joint direction of Facilities Management and University Safety and Security Services based on objectives in the current departmental Master Plans and a detailed risk and threat analysis. The Designer shall consult with Facilities Management and Safety/Security requirements for commissioning in accordance with NFPA 3 Standard Commissioning of Fire Protection and Life Safety Systems and NFPA 4 Standard for Integrated Fire Protection and Life Safety System Testing.

American University fire alarm systems campus-wide are Siemens only, hard wired. Refer to MANUFACTURERS later in this document.

**PART 1 – GENERAL**

**RELATED DOCUMENTS**

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Provisions of Division 26 Electrical including labeling, wiring practices, fire stop, and general provisions, apply to this Section.
SUMMARY
A. The system shall include all wiring, raceways, terminal cabinets, pull boxes, outlet and mounting boxes, initiating devices, alarm indicating devices, annunciators, printers, control equipment, and all other accessories and miscellaneous items required for a complete operating system even though each item is not specifically mentioned or described.
B. Related Standards: The following standards contain requirements that relate to this Section: "Fire Protection" for water-flow, pressure, or tamper switches connected to fire alarm system.

DEFINITIONS
B. Alarm Signal: Signifies a state of emergency requiring immediate action. Pertains to signals such as the operation of a manual station and the operation of a sprinkler system flow switch.
C. Class A Wiring: Circuits arranged and electrically supervised so a single break or single ground fault condition will be indicated by a trouble signal at the fire alarm control panel (FACP) and the circuit will continue to be capable of operation for its intended service in the faulted condition no matter where the break or ground fault condition occurs.
D. Class B Wiring: Circuits electrically supervised such that a single break or a single ground fault condition will be indicated by a trouble signal at the FACP no matter where the break or ground fault condition occurs.
E. Hard-Wired System: Alarm, supervisory, and initiating devices directly connected, through individual dedicated conductors, to a central control panel without the use of multiplexing circuits or devices.
F. Multiplex System: One using a signaling method characterized by the simultaneous or sequential transmission, or both, and the reception of multiple signals in a communication channel, including means for positively identifying each signal.
G. Supervisory Signal: Indicates abnormal status or need for action regarding fire suppression or other protective system.
H. Trouble Signal: Indicates that a fault, such as an open circuit or ground, has occurred in the system.
I. Zone: A building area, which has all initiating devices located within it programmed to initiate an alarm and to give a common visual location indication on the system annunciator.

SYSTEM DESCRIPTION
A. General: This specification intends to describe an integrated fire detection and voice evacuation system to be intelligent device addressable, analog detecting, low-voltage and modular with multiplex communication techniques in full compliance with all applicable codes and standards. The features described in this
specification are a requirement for this project and shall be furnished by the successful contractor.

B. Signal Transmission: Multiplex signal transmission dedicated to fire alarm service only.

C. Audible Alarm Indication: By sounding of voice evacuation via speakers.

D. System connections for alarm-initiation and alarm-indicating circuits: Class B wiring.

E. Functional Description: The following are required system functions and operating features:
   i. Priority of Signals: Accomplish automatic response functions by the first zone initiated. Alarm functions resulting from initiation by the first zone are not altered by subsequent alarms. The highest priority is an alarm signal. Supervisory and trouble signals have second- and third-level priority. Signals of a higher-level priority take precedence over signals of lower priority even though the lower-priority condition occurred first. Annuncate all alarm signals regardless of priority or order received.
   ii. Non-interfering: Zone, power, wire, and supervise the system so a signal on one zone does not prevent the receipt of signals from any other zone. All zones are manually re-settable from the FACP after the initiating device or devices are restored to normal. Systems that require the use of batteries or battery backup for the programming function are not acceptable.
   iii. The system shall monitor all alarm initiating and supervisory devices, initiate audible and visual alarm, supervisory and trouble signals, initiate automatic elevator recall, de-energize magnetic door holders, initiate shutdown of air handling units whether in automatic or hand operation, close respective fire/smoke dampers, operate smoke control systems, operate smoke relief hatches, provide alpha/numeric display of alarm, supervisory and trouble conditions at the fire alarm control panel, provide a hard copy record of system events, provide LED annunciation at all remote annunciators, and transmit required signals to a remote central station.
   iv. Silencing at FACP: Switches provide capability for acknowledgment of alarm, supervisory, trouble, and other specified signals at the FACP; and capability to silence the local audible signal and light a light-emitting diode (LED). Subsequent zone alarms because the audible signal to sound again until silenced in turn by switch operation. Restoration to normal of alarm, supervisory, and trouble conditions extinguish the associated LED and cause the audible signal to sound again until the restoration is acknowledged by switch operation.
   v. Loss of primary power at the FACP sounds trouble signal at the FACP and indicates at the FACP when the system is operating on an alternate power supply.
   vi. Annunciation: Manual and automatic operation of alarm-and supervisory-initiating devices is annunciated both on the FACP and on the annunciator, indicating the location and type device.
vii. FACP Alphanumeric Display: Displays plain-language description of alarms, trouble signals, supervisory signals, monitoring actions, system and component status, and system commands.

viii. Remote Detector Sensitivity Adjustment: Manipulation of controls at the FACP causes the selection of specific addressable smoke detectors for adjustment, display of their status and sensitivity settings, and control of changes in those settings. The same controls can be used to program repetitive, scheduled, automated changes in sensitivity of specific detectors. The system printer records sensitivity adjustments and sensitivity adjustment schedule changes.

F. Recording of Events: Record all alarm, supervisory, and trouble events by means of the NCC-WAN printer. Printouts are by zone, device, and function. When the FACP receives a signal, the alarm, supervisory, and trouble conditions are printed. The printout includes the type of signal (alarm, supervisory, or trouble) the zone identification, date, and the time of the occurrence. The printout differentiates alarm signals from all other printed indications. When the system is reset, this event is also printed, including the same information concerning device, location, date, and time. A command initiates the printout of a list of existing alarm, supervisory, and trouble conditions in the system.

i. Permissible Signal Time Elapse: The maximum permissible elapsed time between the actuation of any fire alarm or fire-detection system alarm-initiating device and its indication at the FACP is ten seconds.

ii. Circuit Supervision: Indicate circuit faults by means of both a zone and a trouble signal at the FACP. Provide a distinctive indicating audible tone and (LED) indicating light. The maximum elapsed time between the occurrence of the trouble condition and its indication at the FACP is 200 seconds.

SYSTEM OPERATION:
A. Activation of any system fire, security, supervisory, trouble, or status-initiating device shall cause the following actions and indications in the Fire Command Center at University Safety and Security Services in the NCC Network Command Center. The USSS command center is located on East Campus, lower level of the Don Meyers Technology and Innovation Building.

B. Fire Alarm Condition:
   i. Sound an audible alarm and display a custom screen/message defining the building in alarm and the specific alarm point initiating the alarm.
   ii. Log to the system history archives all activity pertaining to the alarm condition.
   iii. A simultaneous message shall be delivered via all alarm speakers including those installed in stairways and elevators informing occupants of the imminent shutdown of elevator circuits and the expected high traffic load in the stairwells.
iv. An automatic announcement or tone evacuation signal shall be capable of interruption by the operation of the system microphone to give voice evacuation instructions overriding the pre-programmed sequences.

v. Status lights next to speaker selection switches on the control panel shall indicate speaker circuit selection.

vi. Audible signals shall be silenced from the fire alarm control panel by an alarm silence switch. Visual signals shall be programmed to flash until system reset or alarm silencing, as required by the local District of Columbia Fire Marshal or designated authority having jurisdiction (AHJ).

vii. A signal dedicated to sprinkler system water flow alarm shall not be silenced while the sprinkler system is flowing at a rate of flow equal to a single head.

viii. Activation of any smoke detector in a single elevator lobby or an elevator equipment room shall cause the recall of that bank of elevators to the 1st floor and the lockout of controls. In the event of recall initiation by a detector in the first floor lobby, the recall shall be to the alternate floor as determined by the AHJ. Furthermore, any single device activation in a Residence Hall will trigger this same "lobby" recall response.

ix. Where indicated on drawings heat detectors in elevator shaft and machine rooms shall activate an elevator power shunt trip breaker. The heat detectors shall be rated at a temperature below the ratings of the sprinkler heads in respective locations to insure that the power shall be shut off before activation of sprinkler system.

x. Remote LCD annunciators shall display the alarm condition via unique messages as required by the system owner. LED type annunciator displays, conventional and graphic style shall indicate alarm zoning as specified.

xi. System operated duct detectors as per local requirements shall accomplish HVAC shut down.

xii. Door closure devices shall operate by floor or by local requirements.

xiii. Activation of Stairwell pressurization, Smoke purge, and damper control shall be as required and operated as per local requirements.

xiv. Print alarm conditions on NCC-WAN printer located at the USSS office at East Campus.

C. Supervisory Condition:

i. Display the origin of the supervisory condition.

ii. Activate supervisory audible and dedicated visual signal.

iii. Audible signals shall be silenced from the control panel by the supervisory acknowledge switch.

iv. Record within system history the initiating device and time of occurrence of the event.

v. Print supervisory condition to system printer.

vi. Remote LCD annunciators shall display the supervisory condition via unique messages as required by the system owner. LED type annunciator displays, conventional and graphic style shall indicate alarm zoning as specified.

D. Trouble Condition:
i. Display the origin of the trouble condition.
ii. Activate trouble audible and visual signals at the control panel and as indicated on the drawings.
iii. Audible signal shall be silenced from the fire alarm control panel by a trouble acknowledge switch.
iv. Trouble reports for primary system power failure to the master control shall be automatically delayed for a period equal to 25% of the system standby battery capacity to eliminate spurious reports because of power fluctuations.
v. Record within system history, the occurrence of the event, the time of occurrence and the device initiating the event.
vi. Print trouble condition to system printer.

SUBMITTALS
A. No substitutions of equipment or materials shall be allowed.
B. Submittals must be signed by NICET Level IV Senior Engineering Technologist employed by Siemens Industry, Inc., 6435 Virginia Manor Road, Beltsville, MD 20705.
C. Provide six (6) sets of complete submittals which shall include drawings of all annunciator panel graphics, schematic wiring drawings of the control panel showing internal and external control panel wiring and all devices. Sequence of operation, annunciator wiring and faceplate drawings, specification sheets for all equipment, all devices, and battery calculations shall be provided. Drawings of the control panel and graphic annunciator panel(s) shall be done on 30" x 42" sheet size. Partial submittals will not be accepted.
D. Submittals shall be provided in accordance with project submittal schedule as outlined in the Division 1 General Requirements of the contract or the contract project manual.
E. If re-submittals are required, they shall be provided within two (2) weeks after the date of notification. If re-submittals are not received by the Engineer in two (2) weeks, the supplier will be considered non-responsive and subsequent submittals from the supplier will not be reviewed. The Contractor shall then provide submittals from another equipment supplier within two (2) weeks as directed by the Owner at no change in contract price.
F. The cost of review of any submittals after two (2) submittals have been disapproved shall be paid by the Contractor to the Engineer. The Contractor shall then deliver a purchase order to the Engineer before any submittals will be reviewed.

RECORD DOCUMENTS
A. The As-Built drawings shall include one (1) complete set of 30" x 42" contract base sheet drawings with any and all changes included and noted. The approved contract panel drawings and graphic annunciator panel drawings shall also be
provided in PDF format. The Conduit Plan shall show the device address for all intelligent/analog initiating devices. The electrician in charge of the system installation shall keep the As-built drawings up to date continuously. These drawings shall be reviewed on a weekly basis for accuracy and completeness.

B. The Operation and Maintenance Manual shall include a complete set of equipment, component and device specification and data sheets as well as a reduced size paper copy (11" x 17") of the complete set of system drawings described in the specification section. A copy of the NFPA 72 Test Report/Certificate, the printer record of all test activity including the sensitivity readings for all intelligent/analog smoke detectors, the required system and component warrantee papers, and the name and address of the installer shall be included. The manual shall be bound in a black three-ring loose-leaf binder with dividers and a table of contents. Four (4) duplicate sets are required or as otherwise required in the contract documents.

C. Six (6) sets of keys to all locks shall be provided at occupancy with each set of keys properly and legibly marked and tagged. Loose keys will not be accepted. Transmit to Facilities Management Material Supply Manager and Life Safety Manager jointly for acceptance at occupancy.

D. All documents and items described above shall be submitted for approval and turnover prior to the final testing and system certification with the exception of the NFPA 72 Test Report/Certificate that shall be delivered by hand to the Owner within two (2) days of the actual test and acceptance.

QUALITY ASSURANCE

A. Qualifications of the Installer: an electrical contractor experienced in the installation of fire alarm systems shall install the system. A minimum of five years verifiable installation of fire alarm systems is required for both the firm and the site supervisor.

B. The name of the electrician who will be responsible for the fire alarm system installation shall be submitted for the Owner's approval before any work is started on the system. The qualifications and experience of the proposed individual shall also be included. The Owner-approved fire alarm installation electrician shall remain on this project until the fire alarm system is accepted by the Owner.

C. The services of a technician who has been trained and certified by the manufacturer of the equipment being supplied shall be provided to supervise the installation, adjustments, tests and final connections and certification of the system.

D. The system control panel, annunciators, devices specified, and their installation and operation shall conform to the most stringent applicable requirements of the following publications and this specification unless otherwise noted:
   i. NFPA 70 The National Electric Code
   ii. NFPA 72 The National Fire Alarm Code
   iii. NFPA 90A
   iv. BOCA

E. The control panel, annunciators, all initiating and indicating devices and all other devices connected to the system shall be UL Listed as provided and shall bear UL
labels for the applicable NFPA fire alarm standards for which the equipment is to be used.

F. Specifications govern over drawings. Any conflict between the specifications and the drawings shall be brought to the attention of the Engineer at least 48 hours before the bid date and time or the decisions of the Engineer shall be final.

OPERATING INSTRUCTIONS
A. Upon the completion of all work and of all tests, the Contractor shall furnish the necessary skilled labor for providing operating instructions of all systems and equipment for a period of one (1) day of eight (8) hours for each building or as otherwise directed by the project documents. During this period, instruction will be given to the owner or his representative in the full operation, adjustment and maintenance of all equipment furnished or provided.

B. See the requirements for owner training in Division 1. Training may be videotaped at the discretion of the owner.

ACCEPTANCE OF SYSTEM
A. Total acceptance of the system will only be made after the required tests, commissioning, complete record document package and the instruction period have been provided.

GUARANTEE
A. The Contractor shall guarantee labor, materials and equipment provided under this contract against system defects for a period of one (1) year after the date of final acceptance of this work by the Owner.

B. Service shall be provided by the equipment supplier during the guarantee period seven (7) days a week including holidays and shall be provided within four (4) hours after notification. All repairs shall be effected within twenty-four (24) hours after notification.

C. Should the Contractor fail to comply with the above requirements, the Owner will then have the option to make the necessary repairs and back charge the Contractor without any loss of warranty or guarantee as provided by the contract.

D. Any guarantee that is in conflict with the above will not be acceptable.

MANUFACTURERS
A. Manufacturers: The only acceptable supplier for the fire alarm equipment to be used on this project is Siemens Building Technologies, Incorporated.

B. The equipment shall be Siemens type XLS for all new work and major renovations. FM is migrating to this system campus wide. An updated specification will be published as part of the Life Safety Master Plan. The equipment for minor changes and repairs on the existing fire alarm equipment shall be Siemens type MXLV only. Refer to the 2015 American University Design
and Construction Standards (archived) for applicable specification requirements. The equipment shall be Siemens type MXLV.