University Design Standard

Fire Alarm Systems

1.0 Overview

This document provides Virginia Tech’s standards for the design and installation of fire alarm systems and equipment in new construction, retrofit of new systems into existing buildings, and modifications to existing systems. These standards address issues beyond minimal code requirements, and reflect the university’s understanding of the importance of fire alarms in buildings, our commitment to providing safe facilities for the university community. All new University buildings shall be equipped with a fire alarm system with voice alarm capabilities meeting or exceeding these standards and applicable codes.

Over the years, Virginia Tech has developed a technologically advanced campus-wide fire alarm system through the standardization and integration of each new individual building system. These standards assure that each new system will have the proper technology to be fully compatible with the campus network, and to provide the level of fire protection the university desires.

In applying these standards to the design of a new system, designers are expected to follow everything listed without exception. Should a specific situation arise where the system designer believes that a variance from these standards is warranted, permission must be obtained from the university’s Chief Facilities Officer.

To determine the level of protection appropriate for a given type of building, several risk factors were considered. These were:

Building size - both the height and total area.

Building use – how the building is used and what hazards are present.

Occupant load – number of people occupying the building.

Type of construction – combustible, non-combustible, fire protected, etc.

Sprinkler protection – whether or not the building will be sprinklered.
Another factor considered was the need for a non-fire related emergency communication system in these buildings. A voice fire alarm system provides a public address function by use of the control panel microphone. This can effectively be used to communicate to all of the building’s occupants for any type of emergency, even when building evacuation is not needed.

Finally, there were many other issues that were addressed in developing these standards including; needs of the disabled, cost, aesthetics, fire department response, false alarms, testing, maintenance, State procurement regulations, and many others.

2.0 Design Phase Procedural Requirements

2.1 In designing Virginia Tech fire alarm systems, nothing in these standards shall be construed to allow anything less than full compliance with minimum legal requirements of the applicable codes and standards as established in the current edition of the Virginia Uniform Statewide Building Code (USBC). Any discrepancies found should be brought to the immediate attention of the university.

2.2 The latest published edition of NFPA 72 shall be used for all new fire alarm systems. A code modification may be required from the Bureau of Capital Outlay Management (BCOM) for required systems where the referenced edition in the USBC is not the most recent edition. The modification request is the responsibility of the university.

2.3 Capital Outlay Projects are subject to design requirements of the Construction and Professional Services Manual (CPSM). Presently there are no specific requirements for fire alarm systems in the CPSM, but since this could change, it is the responsibility of the A/E to review the CPSM to ensure that any requirements that may be added are met.

2.4 The communications protocol for the campus fire alarm network is proprietary to Simplex. No other manufacturer’s equipment can be properly integrated into the network, and provide the two-way communication needed for monitoring and control of the existing systems. Therefore, all fire alarm equipment shall be manufactured by Simplex.

2.5 As part of their service to the university, Simplex provides a high level of engineering support to A/E’s for the design of our new systems. A/E’s are required to contact the Roanoke branch office of SimplexGrinnell (800-274-2120) for their assistance for every project. We rely heavily on Simplex’s input to assure compliance with codes and university standards, and for proper integration of new systems into the campus network. The A/E shall send Simplex a copy of the set of preliminary design documents submitted to the university’s internal review team.

2.6 Simplex shall assist the A/E and the university by:

Providing Simplex specifications to the A/E for their use.

Meeting with A/E and university to go over basic system design issues.

Reviewing working drawing design documents to assure system equipment is properly specified, and located within the building in compliance with codes and university standards.

Analyzing existing equipment impacted by any new installation to ensure that it can work properly with the new equipment.

Inspecting and testing new systems to help assure that the complete system is installed properly and performs in a manner compliant with code.
Simplex will send the CAD drawing files they have prepared showing final device locations to Environmental Health and Safety Services.

2.7 Provisions need to be made to update the campus fire alarm network when new systems are added. The Graphics Command Center (GCC) in the Virginia Tech Police Department, as well as two other auxiliary GCC’s, must be reprogrammed to include information, site plans, floor plans, etc., as needed to add the new system to the network.

2.8 The university’s room numbering must be used to program the labels for the points in the control panel, and not the construction document numbers. The university’s room numbers are available on the university’s website -http://www.ccdc.vt.edu/Building.Info/Index.html -. The numbering typically will not be finalized until the latter part of the construction period. (This site is normally restricted to university IP addresses, but off individual off-campus users can be given special access by Planning Design and Construction.)

3.0 General Design Standards

3.1 General: The following requirements are applicable to all fire alarm systems regardless of the type of building in which the system is installed.

3.2 Simplex – All equipment shall be manufactured by Simplex.

3.3 Control & annunciator panels

3.3.1 All displays and annunciators shall be the Info Alarm display.

3.3.2 Location of control panel – The fire alarm control panel shall be located at the primary entry point to be used by the Blacksburg Volunteer Fire Department. The university will provide this information to the A/E after consultation with the BVFD.

3.3.3 Remote annunciator panels shall only be used where two or more fire department response points are clearly identified. Otherwise, the main control panel is all that is needed.

3.3.4 The FACP shall be used to control preaction sprinkler systems. The panel must be UL listed or FM approved for this function.

3.3.5 Mounting height of FACP – 75 inches above finished floor to the top of the 4100 panel.

3.3.6 Max limitation on power supplies – The design load placed on the power supply shall not exceed sixty percent of the power supply capacity.

3.3.7 Individual signal circuits shall not exceed sixty percent of the card capacity. For voice systems this assumes that all speakers are tapped at their maximum wattage, which is currently 2 watts.

3.3.8 Location of secondary panels – All secondary panels for the fire alarm system shall be located either in electrical closets or in public spaces where they are readily accessible.

3.3.9 All batteries associated with the fire alarm system shall be no more than three months old (based on the date code on the battery) at the time of system acceptance.
3.3.10 Batteries serving the FACP but installed in separate cabinets shall be located adjacent to the FACP and no higher than three feet above the floor.

3.3.11 Emergency power – Where a generator is present, the FACP and all secondary panels shall be tied to the emergency circuit, and batteries shall also be provided, sized per NFPA 72 requirements. Where there is no generator, batteries shall be provided and sized per NFPA 72 requirements as the secondary power source.

3.3.12 If smoke control or stairwell pressurization systems are being installed, the FACP shall provide a manual means of activating and disabling these systems. Switches shall be clearly labeled as to the specific system they control.

3.3.13 Degree of point reporting – All initiating devices shall be reported individually to the GCC.

3.3.14 Level of graphics at GCC – Point by point graphic identification and annunciation of all initiating devices shown on floor plans shall be provided.

3.3.15 Network node – The panel shall be configured as a node on the campus Simplex 4190 fire alarm network.

3.4 Initiating Devices

3.4.1 Location of pull stations – Per code, unless existing conditions create installation problems where a reasonably safe alternative needs to be considered. All pull stations must be listed for the environmental conditions for the area of installation.

3.4.2 All pull stations shall be single action.

3.4.3 Addressable initiating devices – All devices shall be addressable type devices. All initiating devices must be listed for the environmental conditions for the area of installation.

3.4.4 Duct detectors – Unless required by code are not to be installed on any air handling equipment. When duct detectors are installed the detector must be accessible for maintenance and a remote LED shall be placed on a wall or ceiling in public area where it will be readily visible and will not be obstructed by furniture, and shall be located as close as possible to the AHU. Signage shall be provided indicating the AHU served. Do not provide test switches.

3.4.5 Any locations that detectors are to be installed that may be problematic for maintenance access or because of adverse environmental conditions aspirating early warning smoke detectors shall be used as an alternative to spot detectors.

3.5 Notification Devices

3.5.1 Strobes shall be installed in conformance with NFPA 72. Compliance with the 1996 or later edition has been accepted by BCOM as meeting all requirements of the CPSM and referenced accessibility standards. Strobes must be listed for the environmental conditions for the area of installation.

3.5.2 Ceiling mounted strobes are acceptable.

3.5.3 Location of strobes – All public spaces listed above for detection; and also, classrooms, bathrooms, laboratories, assembly spaces, conference rooms, shops with high ambient noise
levels, mechanical rooms and other areas as required by the USBC. Placement shall be made with consideration of ambient light levels.

3.5.4 Synchronization of strobes – Strobes shall be synchronized and all strobes shall be the addressable type.

3.5.5 The university prefers to use the same candela rated strobe throughout a given building when it can be achieved without adding significant cost to a project. If the cost impact becomes significant, the A/E must discuss this with the university to determine the level to which the standard will be followed.

3.5.6 Mounting height of strobes – Wall mounted strobes must be installed so that the bottom of the device is a minimum of 80” and a maximum of 96” above finish floor. Some strobe models will place the strobe itself below the bottom of the box. To avoid errors, the specified mounting height should be 88” to the top or bottom of the box.

3.5.7 Speakers that are installed separately from strobes must be mounted at least 90 inches AFF. All speakers must be listed for the environmental conditions for the area of installation.

3.5.8 A/V unit mounting heights are dictated by the requirements for the strobe, not the speaker.

3.5.9 All speakers shall be tapped at their maximum capacity, which is currently 2 watts.

3.5.10 Ceiling mounted speakers are acceptable.

3.6 Circuits and wiring

3.6.1 To ensure that communications to the campus fire alarm network is within distance limitations, and will function properly the contractor shall provide and install two (2) single mode 9/125 micron fiber optic cables consisting of no fewer than eight (8) fibers each. These cables will be routed one each to two (2) existing University buildings of the University’s choice and routed and connected to the fire alarm panel in each of these buildings. This will include providing and installing the appropriate fiber modems necessary in the fire alarm panels at the remote buildings.

3.6.2 Class B circuits shall be used unless prior approval to use Class A circuits has been given by the university.

3.6.3 Conduit vs. cable – For new construction, wire in conduit or EMT that is dedicated to the fire alarm system shall be used, unless there are conditions where the use of cable is preferable. Cable that is not in conduit or EMT can be used only with prior approval of the university. For retrofit installations, the use of cable will generally be more acceptable, but it must be installed in locations where it will be protected by building construction (i.e. above ceilings, in cable trays, chases, within walls, etc. as long as the installation complies with the NEC.).

3.6.4 No conduit or EMT shall be run below slabs.

3.6.5 Wiremold may be used in retrofit installations, but only with the university’s permission.

3.7 Interface with other fire protection systems and VT Alerts

3.7.1 Mass Notification To ensure the emergency notification to all members of the University community, the equipment necessary to connect to the University’s Emergency Communication

Revised 06/20/2013
Page 5 of 9
System (VTAlerts) shall be provided and installed to the building fire alarm panel. This will include two (2) ethernet ports installed in the building fire alarm panel.

3.7.2 Where the building contains other fire related systems, such as sprinklers, hood suppression, fire door hold-open devices, etc., these systems shall be connected to the new FACP and monitored for alarms, trouble, or supervisory conditions.

3.7.3 The A/E shall coordinate the sprinkler and fire alarm design to help assure that the number of flow; tamper and pressure switches are identified as accurately as possible in the working drawing design.

3.7.4 Where a fire pump is present, a “pump running” condition shall be treated as a supervisory condition, and not an alarm.

3.7.5 Where dry-pipe valves are installed in buildings not normally occupied, where loss of heat in the room could go undetected, a means for monitoring the temperature of the sprinkler riser room shall be installed and programmed to provide a supervisory signal to the fire alarm panel.

3.7.6 A supervised tamper switch is required on all exterior post indicator valves on fire protection water supply lines. These valves are typically installed 40 feet from the building, which will require underground circuit be provided to the switch.

3.7.7 Every tamper and flow switch shall be individually addressed, regardless of their proximity to other devices.

3.8 Miscellaneous

3.8.1 Color of devices – Panels – beige; pull stations – red; A/V devices – color at the university’s discretion. All ceiling mounted devices shall be white.

3.8.2 Consideration shall be given to any room within the building that may be subject to washdown cleaning.

4.0 Building Specific Design Standards

4.1 Categories of University Buildings

4.1.1 Class 1 - Large academic, administrative, assembly and research buildings (multi-story with elevator), or otherwise classified as such as needed to address specific safety concerns.

4.1.2 Class 2 - Large residential: all dormitories.

4.1.3 Class 3 - Small residential: Special Purpose Housing

4.1.4 Class 4 - Small administrative, research

4.2 Class 1 Buildings

4.2.1 Panel model – 4100ES or the latest version of this level of panel.

4.2.2 Type of audible devices – All notification audible devices shall be speakers.

4.2.3 Addressable audible devices – When addressable speakers become available from Simplex, they are to be used.
4.2.4 Addressable strobes – Strobes shall be the addressable type.

4.2.5 Level of automatic detection – For non-sprinklered buildings, public area smoke detection shall be provided. This will include areas such as lobbies, hallways, reception areas, above every floor landing in all stairwells, elevator hobbies, and similar spaces. Auditoriums shall be addressed on a case-by-case basis, with university consultation.

4.2.6 Specific areas that require heat detection in non-sprinklered buildings – mechanical equipment rooms; attics and crawl spaces built with combustible construction; chemical storage rooms; shop areas used for welding, woodworking, painting, etc.; or any other area with a hazard that warrants heat detection as determined by the university.

4.2.7 Specific areas that require smoke detection in non-sprinklered buildings – CNS communication closets; large electrical rooms containing either distribution transformers or switchgear; transformer vaults; at the FACP; storage rooms which are greater than 100 square feet, open into a space without smoke detection, and are neither sprinklered or enclosed by fire rated construction.

4.2.8 Laboratories involving hazardous operations must be evaluated for the need for automatic detection (either heat or smoke) on a case-by-case basis.

4.2.9 Specific areas that require smoke detection in sprinklered buildings – elevator lobbies, transformer vaults, CNS communication closets, at the FACP.

4.2.10 Elevator machine rooms – In general, smoke detectors shall be installed in these rooms, however, if the ambient conditions in the room are such that a smoke detector would result in nuisance alarms, another appropriate detector may be used with the university’s concurrence.

4.3 Class 2 Buildings

4.3.1 All provisions for Class 1 systems shall apply, unless otherwise modified here.

4.3.2 All sleeping rooms shall be equipped with system smoke detectors with sounder bases programmed to function as a single station detector. This will satisfy the code requirement for single station detectors. If the detector is still in an alarm condition at the end of 60 seconds, the system shall sound a general alarm.

4.3.3 All detectors within a suite shall be programmed to operate the sounder bases simultaneously.

4.3.4 In addition to the public spaces listed for Class I buildings, strobes shall be installed in all suite living rooms, and in all bedrooms designed specifically to accommodate the disabled. Strobes shall be 110 candela in these bedrooms.

4.3.5 All pull stations shall be equipped with alarmed, lexan “Stopper II” covers to prevent vandalism.

4.4 Class 3 Buildings

4.4.1 All requirements for Class 2 buildings shall apply.

4.5 Class 4 Buildings

4.5.1 Panel model – 4100ES or the latest version of this level of panel.
4.5.2 Type of audible devices – All notification audible devices shall be speakers.

4.5.3 Addressable audible devices – When addressable speakers become available from Simplex, they are to be used.

4.5.4 Addressable strobes – Strobes shall be the addressable type.

4.5.5 Level of automatic detection – For non-sprinklered buildings, public area smoke detection shall be provided. This will include areas such as lobbies, hallways, reception areas, above every floor landing in all stairwells, elevator hobbies, and similar spaces. Auditoriums shall be addressed on a case-by-case basis, with university consultation.

4.5.6 Specific areas that require heat detection in non-sprinklered buildings – mechanical equipment rooms; attics and crawl spaces built with combustible construction; chemical storage rooms; shop areas used for welding, woodworking, painting, etc.; or any other area with a hazard that warrants heat detection as determined by the university.

4.5.7 Specific areas that require smoke detection in non-sprinklered buildings – CNS communication closets; large electrical rooms containing either distribution transformers or switchgear; transformer vaults; at the FACP; storage rooms which are greater than 100 square feet, open into a space without smoke detection, and are neither sprinklered or enclosed by fire rated construction.

4.5.8 Laboratories involving hazardous operations must be evaluated for the need for automatic detection (either heat or smoke) on a case-by-case basis.

4.5.9 Specific areas that require smoke detection in sprinklered buildings – elevator lobbies, transformer vaults, CNS communication closets, at the FACP.

4.5.10 Elevator machine rooms – In general, smoke detectors shall be installed in these rooms, however, if the ambient conditions in the room are such that a smoke detector would result in nuisance alarms, another appropriate detector may be used with the university’s concurrence.

5.0 Acceptance Testing and Warranty Period

5.1 As part of the final inspection and systems test, Simplex will verify the candela rating of every strobe in its installed location, to ensure that the installing contractor has installed these devices per contract documents, and per code. A copy of this report shall be provided to the University’s Fire Protection Specialist.

5.2 Simplex will measure the loudness of the alarm signal, in all areas of the building, to assure that the installed system produces the signal volume as required by code. All intervening room doors shall be shut during the test. A copy of this report shall be provided to the University’s Fire Protection Specialist.

5.3 Simplex will provide the university with a written statement verifying the successful completion of all required tests. This document will be required at the time of substantial completion, before a Certificate of Occupancy can be obtained for the building. A copy must also be provided to the State Fire Marshal’s Office.
5.4 Warranty period testing – During the one-year warranty period, two complete system tests shall be provided and included as part of the initial purchase of the system. The first test shall be done after six months from substantial completion, and the second during the eleventh month. These must be scheduled through the university’s Fire Protection Specialist.