

A28.1 Standard of Practice - Fire Alarm Systems

NOTE: Significant revisions or additions to the previous standards are highlighted in italics.

OBJECTIVE OF STANDARD

- ❑ To provide compliant “*smart*” addressable voice fire alarm systems, integrated into the campus wide monitoring network maintaining consistent design features to insure continuity between buildings and components.
- ❑ To provide a complete Campus EPAS (Emergency Public Address System) utilizing the fire alarm system network and components, integrated into all facilities and exterior public areas.
- ❑ Utilize detection features of these systems to provide the earliest warning of an emergency event.

BACKGROUND

The University of Kansas has invested in providing over 60 new addressable voice fire alarm systems over the past 15 years connected to a campus monitoring and emergency dispatch center. Connected to this system is a central Emergency Public Address System (EPAS) connecting an additional 15 buildings that have older fire alarm systems. The complete system is capable of providing early warning in specific areas, precise graphic reporting of the location of events and providing live voice or recorded messages throughout 75 buildings and surrounding exterior areas for emergency messages including weather alerts and threats.

A contract for procurement of these systems is in place with SimplexGrinnell who provide a turnkey installation for major projects. Continuity of design and installation is insured using a pre-approved qualified contractor list and a clearly defined review processes through the University Fire Marshal Authority at DCM. All installed systems are maintained and tested by in house facilities personnel.

BASIS FOR DESIGN

Any new fire alarm system should be designed as a “protected premises fire alarm system” in accordance with NFPA 72 (National Fire Alarm Code), providing the following functions.

- ❑ Voice alarm utilizing NFPA international tones and voice messages.
- ❑ Campus fiber network connection to the campus monitoring and dispatch center.
- ❑ EPAS features for live voice throughout campus from the KU Public Safety Facility.
- ❑ Egress corridor and critical area detection to provide early warning of a fire event.
- ❑ Security points connected to Public Safety to monitor key campus resources.
- ❑ Single provider and qualified installers to maintain system integrity.

DESIGN IMPLEMENTATION

The fire alarm Designer shall be familiar with the Code Footprint for the building, specific occupancy characteristics and work closely with the Architect to apply all applicable code requirements to the design. The Designer shall discuss these standards and how they apply to the project with the Architect and University Fire Marshal. They shall utilize the KU standard fire alarm specification for all designs. Additional requirements may result from one or more of the following considerations:

- Requirements of the AHJ – the designer should determine if the project area is subject to existing fire code violations that may be require to be addressed as part of each project.
- Code equivalencies:
 - The University prefers NOT to use code equivalencies in new buildings.
 - If an equivalency is proposed for a project to addressed fire citations or special conditions, it must be approved in writing by DCM, OFPM and the KSFMO and documented on the Code Footprint.
- Special detection requirements - such as devices or configurations that are resistant to false alarms in areas like performance theaters and concession stands.
- Special signaling appliances - such as signs, strobes and speakers appropriately placed for protection of disabled individuals in practice rooms or listening labs.

DESIGN CRITERIA

The Designer shall review the KU standard specification, utilize the devices and connectivity required per those specification and consider the following specific items in completing a fire alarm system installation or upgrade design:

General

- Design shall be strictly per applicable codes, including but not limited to, NFPA 72, the Kansas Fire Prevention Code and ADAAG.
- Design shall use addressable voice speaker based systems. Horn-type zone systems can be used in very small buildings if approved by KU Fire Marshal. System Designer must be experienced in designing voice systems and dependent on the type of project, may be required to be a Fire Protection Engineer specialized in voice fire alarm systems.
- Provide raceways for fire alarm wiring; utilize red conduit if concealed, painted conduit to match wall if exposed in finished service areas and wire-mold if exposed in public areas. Junction box covers shall be painted red for identification.
- An electrical outlet shall be provided within 10 feet of the fire alarm control panel.
- Signaling line circuits shall NOT be loaded greater than 75 percent of capacity. The panel shall have one spare signaling line circuit or capacity for 50 additional initiating devices.
- Provide an 18"x12" red remote annunciator panel at building entrance with microphone. Refer to specification for details; mount centerline at 60" AFF. A remote annunciator is not needed if the main fire control panel is located at the primary fire department access entrance (preferred in small buildings).

- Use door hold-open circuits from fire alarm panel in lieu of auxiliary contacts in the detector base or a local device.
- System shall be connected to an emergency backup power source if available and have a red lockout type breaker in electrical service panel per applicable code requirements.
- Provide recessed KNOX Box at 5' above floor line at the exterior of the main entrance. Verify location with KU Fire Marshal and city fire department, via the UFMA.

Detection:

- Provide corridor smoke detection throughout. Provide spot detection for top of stairwells, storage rooms, communications closets, computer centers, air handler rooms and electrical closets.
- Provide heat detection in housekeeping dens (due to sink); top of elevator shafts (OFPM requirement) and mechanical areas with steam or boilers (avoids false alarms).
- Provide beam detection for atriums, large areas if point detect can be reduce more than 6 point devices to 1 beam detector which makes it more economical.
- Detection devices can not be located in inaccessible or extremely high locations. They need to be serviced so the designer must coordinate location with Architect and KU.
- Concealed initiating devices (duct smoke detectors, plenum or under-floor detectors, etc.) shall have remote alarm indicators identifying the location of the device. Locate remote indicators adjacent to the device (at a finished ceiling or wall 60" AFF). Duct smoke detectors shall have remote indicators with test stations. They may be grouped only if they are within reasonable proximity to each other.
- Indicate on drawings all network connections and monitoring points for other systems.
- All addressable devices shall receive visible address labels with large lettering on base.

Visual Alarms

- Wall strobe devices need to be specified at 82" above finished floor. Ceiling strobes are NOT approved for use by the State at this time. **Expected change - July 1, 2010.**
- AV devices (Audible/visual) should NOT be located in the middle of feature walls due to conflicts with marker boards, furniture, equipment, displays and artwork. If possible, considering required strobe coverage, locate devices just above light switch adjacent to the primary access door.
- Provide a weatherproof exterior strobe with NO speaker mounted above the sprinkler system fire department's Siamese connection 8' to 10' above grade.
- Signaling line circuits shall NOT be loaded greater than 75 percent of capacity. The panel shall have one spare signaling line circuit or capacity for 50 additional initiating devices.
- Strobes shall be located and spaced in large public areas independently when ceiling speakers are utilized.

Audible Alarms

- Systems shall include exterior fire alarm speakers (red) at key entrances set at 2 watts and exterior EPAS speakers (gray) at 8 to 15 watts. EPAS speakers are connected independently, programmed to activate only when emergency enouncements are initiated from the main panel or PSO. Fire alarm messages do not use these speakers.

- Speakers located in corridors, usually suspended ceilings, shall be ceiling mounted “Atlas Soundolier” speakers with labels stating “FIRE” on the face of the speaker. Labels will be provided by KU. Design for 2 watts for most spaces, 5 watts for large lobbies.
- High noise mechanical rooms shall have Cooper Wheelock horn speakers set at 4 watts.
- Service areas, rest rooms, medium size rooms, conference rooms, classrooms and Labs shall have standard 4” wall mounted speaker/strobe units locate if possible above wall switch adjacent to entrance door. Provide second wall AV if coverage is required. Verify with Architectural layout of lab equipment and hoods to maintain strobe visibility.
- Note that speakers shall be tapped at 2 watts unless otherwise noted; indicate ½ or 1 watt at locations that do not require as much sound.
- Speakers shall be located and spaced in large public areas independently of strobes.
- In voice systems provide a microphone at fire alarm main panel and at the remote enunciator if utilized.
- DO NOT LOCATE SPEAKERS NEAR PANELS WITH MICROPHONES- (feed-back)

All fire alarm systems are monitored using (5) “IMS” graphic based computers located on West Campus at Public Safety, Housing and Facilities Operations. It is critical that the Designer include current and correct building names and numbers, floor designations, and room, corridor, stairway and elevator numbering on all documents that illustrate the fire alarm system design so that the programming can be accurate.

SimplexGrinnell shall submit graphic plans to PSO for approval of the graphics before installation of the system on the network.

CONSTRUCTION DOCUMENTS

The Designer shall include the following minimum information in construction documents for each project:

- Indicate fire alarm control panel and annunciator locations on code footprint and plans
- Utilize and adapt the KU standard specifications for fire alarm systems, as indicated in [Appendix A28.2](#).
- Only utilize types of device listed in the KU standard specifications. Additional devices can be used only upon permission of the University Fire Marshal. Submit requests at DD
- Utilize standard SimplexGrinnell graphic symbols throughout plans, as indicated in [Appendix A28.3](#).
- Locate all door holds, duct detectors, elevator interface points, hood suppression points, dry chemical interface, Sapphire Suppression and sprinkler monitoring devices

DESIGN AND PLAN REVIEWS

The Designer should submit preliminary and final plans for review as follows:

- Submit preliminary layout to KU Fire Marshal through the DCM Project Manager at the completion of DD. Layout can be of the complete system or partial system to verify that the design methods follow the design standards herein.

- ❑ Submit a complete and final layout at the 50% CD submittal for detailed review to the KU Fire Marshal through the DCM Project Manager as above. It is important to pick up all comments accurately. Devices missing or wrong will result in costly changes later.
- ❑ Submit FINAL check set electronically one week before final submittal to the Architect for the final bid set. An electronic review will be processed to verify items were picked up.
- ❑ A final complete contract document review is required to be sent to OFPM at time of printing and bidding. Their review of the fire alarm system is general at this stage.
- ❑ **SHOP DRAWINGS: VERY IMPORTANT-** Submittal from the Contractor during construction shall be reviewed by the Engineer of Record and if possible “approved as noted” to save a re-submittal delay. One shop drawing with the Engineer’s review stamp shall be sent to the University Fire Marshal for quick review and forwarding to OFPM for the formal AHJ review and approval.
 - ❑ Work can not be done on the system until the OFPM review is completed and approval is received so it is critical to complete the process in a timely manner.
 - ❑ Submittal must include a REQUEST FOR REVIEW form available at the OFPM website. OFPM will respond with comments or approval only to the Engineer of Record and to the Agency Contact (University Fire Marshal / Bob Rombach). The Engineer must monitor this process and respond to comments quickly. If comments are not received in 2 weeks the Engineer must request from both OFPM and KU a status update to verify if they submittal is hung up. Copy [the](#) University Fire Marshal and the DCM PM on all communications.

PRE-TESTING PROTOCOL

- ❑ Pre-testing: Upon completing installation pre-test all devices, device address, device labels and functional programming before acceptance tests are scheduled.
- ❑ Contractor shall NOT install smoke detector heads in spaces that are not clean. If they get dirty they will be replaced at the contractor expense.
- ❑ Wiring runs shall be tested for continuity, short circuits and grounds.
- ❑ Voice system audibility and dB level shall be tested and documented. Provide results on 11x17 floor plan sheets for final acceptance test.

Final Test Notice: Provide an 8 day minimum notice to DCM, OFPM and FS in writing when the system is ready for final acceptance testing.

FORMAL ACCEPTANCE TESTING

- ❑ Fire alarm system shall be ready for use, completely operational, and accepted by the KU Fire Marshal and OFPM Inspector at least 10 days before the date of Substantial Completion of each part of the work, and before a certificate of occupancy can be issued by the AHJ.
- ❑ Final test and inspection shall be held in the presence of:
 - ❑ Manufacturer's authorized technical representative.
 - ❑ AHJ inspector (OFPM, or City inspector for projects on non-state property)

- University Representative (usually KU Fire Marshal)
- Contractor and/or Fire Alarm Subcontractor
- Design Engineer
- Facilities Services representative(s) (usually FS Instrumentation)

Formal system acceptance shall be in accordance with the procedures outlined in NFPA 72, the manufacturer's recommendations, and the University's direction. Refer to Fire Alarm testing form available at http://www.ufma.ku.edu/files/UFMA_FireAlarm_test.pdf for an outline of testing procedure. The formal system acceptance test shall include the following and shall be conducted in the order listed below:

- Step 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.
- Step 2. **Battery verification test** - Before returning to normal power verify battery power.
- Step 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.
- Step 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.
- Step 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.
- Step 6. **Duct detection operational test** - Verify each duct detector operation; mechanical unit shutdown; sensing tube orientation; labeling and remote test switch installation.
- Step 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.
- Step 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.
- Step 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.
- Step 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.

Step 11. **Network test** - SimplexGrinnell shall verify and certify that all devices are graphically monitored at PSO through the IMS stations.

- In the event the system fails to perform as specified the AHJ Inspector, University Representative or the Design Engineer, can and should terminate the test. The Contractor shall correct all deficiencies and request a re-test.
- All approved project submittals, drawings, specifications, certifications, test results, and current as-built/record drawings shall be available at test location.

WRITTEN CERTIFICATIONS AND TEST REPORTS

The following written certifications and/or test reports shall be submitted by the installation contractor before final and formal acceptance:

- Written certification and test results confirming the system is free of ground faults, short circuits, and the absence of unwanted voltages between circuit conductors and ground as per manufacturer's recommendations and NFPA 72.
- Written certification and test results of the complete system checkout procedure as per manufacturer's published installation recommendations and NFPA 72. This shall include:
 - A complete list of equipment installation and wiring.
 - Indication that all equipment is properly installed and functioning, and conforms with the Specifications.
 - Technician's name, certification number, and data.

As-Built Submittals: After completion of all the tests and adjustments listed above, the following submittals shall be processed:

Electrical Sub-contractor - shall submit to the Contractor, SimplexGrinnell and the Engineer.

- "As-built" record drawings showing all changes of system devices, end of line devices and conduit / wiring layouts on both the Contract documents and Shop Drawings.
- Sound reading in dB for every room updated from pre-test information.
- Detailed catalog data on all installed system components- Operating & Maintenance manual.
- Copy of the test report.

The Design Engineer - shall submit an As-Built of the Contract Documents to DCM-PM & OFPM

SimplexGrinnell - shall submit to KU Fire Marshal "As-Built" record documents of the SHOP Drawings as follows:

- Paper copies- 2 sets of full size plans, 2 project manuals, 2 half size plans.
- Electronic plans in AutoCAD and PDF formats sent to the DCM FTP site.