

Basis of Design

The purpose of this section is to provide the guidelines for the development of the design of fire alarm systems.

Background

New facilities and facilities to be substantially renovated must include a fire alarm system. Exceptions include small buildings and temporary facilities where little value is added by provision of an alarm system. Discuss exceptions with Environmental Health and Safety (EH&S).

Fire alarm systems at the Seattle campus are maintained by Campus Engineering and Operations. As a result the University has found it cost effective to develop specific standards for design, installation and acceptance of fire alarm systems. The standards include a sole-source justification for Simplex fire alarm systems. Please use the UW Fire Alarm Guide Specification and discuss deviations with Environmental Health and Safety. The guide specification requires customization to suit a specific project.

University buildings not located on the main campus are maintained through service contract. The sole source with Simplex as referenced above does not apply. Projects should list at least three locally represented fire alarm manufactures. The vendors must meet our pre-determined standardized qualifications as outlined in the guide specification. The UW Fire Protection Engineer should be consulted for assistance in this selection process.

Buildings on the Seattle campus are monitored by the University's McCulloh system. Connection to the McCulloh system is typically achieved through the utility tunnel. Connection to this system requires unique equipment that allows for the transmission of alarm-specific information to the University Police Department.

The UW Fire Protection Engineer within EH&S is responsible to review and approve fire alarm design for UW facilities. Renovated facilities requiring modification of existing systems will require discussions with the UW Signal Shop and the University's Fire Protection Engineer.

Design Criteria

Fire Alarm System / Fire Alarm Control Panel (FACP)

- The fire alarm control panel shall be addressable with analog sensor and PNIS proprietary station monitoring capability. For larger buildings the fire alarm system should include voice system regardless of Code. This significantly improves maintenance as it allows University Operations personnel to announce tests. Guidelines are as follows:
 - 1) Simplex 4100U/4120: A Voice system is the standard for large buildings.
 - 2) Simplex updated and replaced their previous smaller addressable panels with the 4100U series. The basic 4100U panel without voice capabilities shall be specified for small buildings.
 - 3) The 4120 provides network ability within a multi-building complex.
- The FACP shall be located in a mechanical space unless a fire command center is required by Code. A small annunciator must be provided at the main entrance.
- University Operations personnel must be able to perform comprehensive tests on the system with minimum disruption to occupants. Fire alarm system control must originate from the control panel and/or programmable field devices. Individual bypass switches located at the

main control panel must provide system wide bypass for each type of output to accommodate testing with minimal disruption.

- Renovation: It is not acceptable to provide a new panel that serves a portion of a building unless the new panel is compatible with the existing system and listed to function as a single networked system. When older systems cannot be expanded to serve a renovated space, a new fire alarm panel should be provided for the entire building. Hybrid systems supporting new and old technology are acceptable in some instances. Consult with the Department of Environmental Health & Safety.
- Temporary Facilities and Control: Where existing fire alarm systems are upgraded or replaced, the existing system shall remain in service until the new system is operational and satisfactorily tested by the University. Include procedures for identifying all devices, wires, and connection of old devices to new (as appropriate) and transfer of service between old and new. If service is anticipated to be out beyond a single 7am – 5pm workday, an approved fire watch will be necessary. Consult with UW Fire Protection Engineer for specifics regarding fire watch requirements.

Circuit And Raceway

- Fire alarm system wire and cable shall be located in metal conduit or wire mold regardless of Code exceptions. Location and routing shall take advantage of areas easily accessed by University Operations personnel (hallways/corridors) and shall consider future modification and/or extension wherever practical.
- Raceway layout shall consist of a vertical riser of terminal cabinets located on each floor. Larger buildings and buildings with two or more wings may require multiple risers and terminal cabinets per floor. Consultants are encouraged to show at least two lateral branch lines per floor originating from each terminal cabinet
- Raceway fill shall be less than 40%. Calculations proving this will need to be submitted for review at some phase of the design. Raceway capacity between control panels and terminal cabinets shall be sufficiently sized to accept additional circuits in the future. Consultants are encouraged to show a minimum size that would accommodate future work.
- Circuits shall be laid out to serve a specific geographical area (zone) per floor.
- Field located transponders and power supply panels maybe used. Good access must be provided for testing and maintenance requirements.

Device Layout

- The design shall include complete smoke detection throughout public corridors. Corridor detection shall be spaced 35 – 40 feet on center. Coordinate detector locations with ceiling diffusers; none may be closer than 3 feet.
- Smoke detectors shall be provided throughout library stack areas.
- Smoke detectors shall be provided at all elevator lobbies.
- A smoke detector shall be provided above the fire alarm panel.
- Smoke detectors shall not be provided in exit stairs, laboratories, or dirty environments that would be prone to false alarm.
- For buildings not equipped with fire sprinklers, provide heat detectors in kitchens, storerooms, mechanical rooms, janitor closets, etc, as required by the Seattle Fire Code and NFPA 72.

- Provide fire alarm manual pull stations at all building exits in the direct path of egress. Pull stations shall be provided on individual floors within 5 feet of all exit stair doors. Additional devices in corridors and in stairs are not required or desired, as they become a maintenance burden.
- Fire alarm audibility and visual notification is required throughout the building with speaker strobe devices positioned in corridors. Typically fire alarm speaker audibility can only be achieved through a single door. Therefore an office inside a suite would require an audible device within the suite to ensure sufficient audibility in the office.
- Avoid speaker placement in individual offices and restrooms where possible.
- Visual notification must be in compliance with NFPA 72, including minimum candela intensity throughout all public spaces including but not limited to corridors, classrooms, conference rooms and restrooms. Strobe design must include candela rating on the individual device and a template should be used to ensure sufficient intensity to provide coverage to all required areas. Synchronize visual notification devices when more than two devices are in the line of sight. The preferred method is to synchronize the circuit at the individual floor terminal cabinet. All new systems to be synchronized.
- Devices shall be combination speaker/strobe, with speakers provided wherever a strobe is required. Individual strobes are also acceptable where appropriate (i.e. small restrooms and conference rooms that receive adequate audibility from corridor speakers). Speaker/strobes are also required in acoustic (sound) rooms, coolers, environmental rooms and other areas resistant to sound transmission that are regularly occupied.
- Do not provide speaker/strobes in exit stairs or elevators, unless mandated by high-rise requirements (in such cases the speakers shall be voice only). Provide two-way firefighter phones jacks only when high-rise Code requirements apply.

Spare Capacity

- Provide 20% spare capacity on all circuits, considering both circuit and panel limitations. This includes device count, circuit length, voltage drop, and panel capacity. Other spare capacity should be specified.

Auxiliary Controls

- Coordinate auxiliary controls for fans, smoke dampers, fire suppression systems, elevator and door control. Include all necessary components and relays to make an operational system.
- For campus consistency the preferred method of fan control is from the FACP via relay at the fan's MCC. This method offers proven reliability, simplicity and is best suited for minimizing maintenance complications with University personnel. Additional design direction on fan control follows under a separate heading dedicated to this topic.
- Control fire smoke dampers from the FACP via a supervised relay or electro-pneumatic switch serving a number of dampers. Depending on damper quantities a number of relays maybe required for a floor. Relays must be labeled and shall be accessible for maintenance. Either 110 VAC or pneumatic actuated dampers must be specified. The FACP must not provide power for dampers.
- To minimize duct over pressurization, damper interface from the FACP shall include a 30 second delay programmed into the FACP to ensure fan blades have stopped rotating.
- Provide smoke detectors for fire/smoke and smoke dampers.

- Include interface with all necessary fire sprinkler components, water flow devices and valve supervision. Include connection to exterior control valve and exterior bell if provided. Locate the bell near the fire department connection.
- Provide fire alarm circuits to elevator controller. Provide three supervised relays in the elevator machine room. Additional requirements apply to high-rise buildings.
- Coordinate door hold open requirements with the Architect. Complete smoke detection throughout the corridor should provide the smoke activation element for most door holder applications.

Fan Control

- Consider methods of fan control other than via the FACP, such as DDC (listed for the purpose of smoke control), engineered smoke control system, or fail safe control per NFPA 72 on a case-by-case basis. University experience with smoke control systems is not favorable. Identify such systems early in the design process and include coordinated efforts between the architectural, mechanical and electrical elements. The complicated maintenance aspects and the University maintenance system need to be included in the design.
- Consider operable sash and breakable windows in lieu of engineered smoke controlled systems.
- Dedicated rather than environmental fans are preferred for smoke control, particularly for elevator and stair shaft pressurization and atrium smoke control. These fans must be controlled by the fire alarm panel.
- If environmental fans are used for smoke control, the DDC must be listed for that purpose. The A/E should meet with EH&S and Engineering Services representative early in the design to discuss design options.
- The designer shall establish a schedule of fans controlled by the fire alarm system. The schedule shall differentiate between dedicated life safety fans and environmental fans.
- Environmental fans requiring automatic shutdown (excess of 2000 CFM) shall include a fire relay within 3 feet of the MCC. Include specific wiring diagrams for fire alarm control, especially for existing fan controllers. The fire alarm control shall have priority control over fan's MCC HOA position.
- A duct type smoke detector is required for environmental fans requiring automatic shutdown. Show duct detectors on drawings and include fan designation for each detector (for example, list fan being controlled adjacent to duct detector symbol). Consider practicality of installation, Code-required laminar flow and maintenance access. Provide multiple detectors if necessary.

Testing

- Tailor testing and commissioning with the scope of the project. Some projects may only use specifications with testing and commissioning combined. Other large projects may have separate specifications for testing and commissioning. The two guide specifications are written to accommodate either method.

Design Evaluation Submittals

The following information is required to evaluate the design:

- Programming Phase: Design narrative/concept detailing the provision of a fire alarm system. Include any unique design aspects of system.
- Schematic Design Phase: System definition, design scope and any unique challenges or aspects of project. Provide a field audibility study (for retrofit projects), FACP and annunciator locations, terminal cabinet and main conduit routing locations, and point of connection to McCullah loop.
- Design Development Phase: Provide raceway design layout, for FACP connection to terminal cabinets, main lateral runs per floor, riser diagram, and strobe design calculations. All device locations. Auxiliary interface – Fans, dampers, fire sprinklers, elevator, door holders, etc.
- Construction Document Phase: Provide final wiring interface details, including interface with auxiliary equipment (fans/MCC, dampers, fire sprinklers, elevator and door holders), and a FACP detail showing elevation, location and raceway to terminal cabinets. Resolve of all previous University design comments. Provide the Fire Alarm Specification Section 283111 (Fire Alarm Systems, Volume 3) tailored for the project.

Construction Submittals

- Fire Alarm System Contractor Shop Drawings and Calculations and Product Submittals: As noted in Fire Alarm Systems, subsection 1.09; submit for review and approval by the Owner. The Owner's representative for this section is Environmental Health and Safety.

Products, Materials and Equipment

- See background above and the guide specification for approved products. Contact EH&S for alternates.

Installation, Fabrication and Construction

- See attached Fire Alarm Systems guide specification for details.

END OF DESIGN GUIDE