

## N. Fire Protection Systems

### 1. Introduction

The following Fire Protection Systems Standards provide requirements and guidelines for use by the Consultant in the design and construction of fire alarm and suppression systems at the University of Chicago.

#### **General Design Requirements**

This standard applies to the design and installation of fire alarm and sprinkler systems, including equipment for new building construction, replacement of existing systems with new systems in existing buildings, and modifications to existing systems.

- It is expected that the project design follow all applicable FM Global Property Loss Prevention Data Sheets (Engineering Guidelines). The FS Project Manager will coordinate the review of system designs with FM Global.
- All new fire alarm systems shall be analog addressable systems with alarm verification features for all smoke detection. The system shall be a voice/speaker based system with Chicago Class 1 characteristics. All new fire sprinkler systems shall be installed and connected to the addressable fire alarm systems.
- It is not acceptable to provide a new panel and/or equipment to serve a portion of a building unless the new panel and/or equipment are fully 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 will not be permitted unless approved by the University.
- Where existing fire alarm or sprinkler systems are upgraded or replaced, the existing system shall remain in service until the new system is operational and final acceptance has been conducted by the University. Procedures for identifying existing devices and circuits to be connected to the new system, if required and the cut over of the existing fire alarm service to the new fire alarm system shall be included in the construction documents.
- If an existing fire alarm or sprinkler system is to be out of service for more than 4 hours during a normal work day, an approved fire watch will be required. If an existing fire alarm system is to be out of service during an after-hours period, an approved fire watch will be provided until service is restored.

#### **System Design Compliance and Certification**

Fire alarm designs shall be completed by an individual holding a NICET III (minimum) Fire Alarm Certification, and under the supervision of a licensed Professional Engineer. Fire

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sprinkler designs shall be completed under the supervision of a by a licensed Professional Engineer or qualified sprinkler contractor with a NICET certification, Fire Sprinkler Certification.

- The Consultant shall remain responsible for the final design of the fire alarm system. Nothing in this standard, including comments generated by the University staff and its agents, shall absolve the design consultant of this responsibility. Any conflicts between these standards and current codes in affect shall be brought to the University's attention.
- The Consultant shall adhere to this standard. 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.

The Chicago Building Code Occupancy classification shall be provided by the University. The classification shall be reviewed with the University if during the design process the design consultant believes it is incorrect.

## 2. Fire Protection Design Process

Process Phase	Fire Protection Objective
Programming	Determine scope of Fire Protection systems in response to Owner's Project Requirements.
Schematic Design	The design consultant shall complete a survey of the building to verify the existing system as installed. This survey shall include verification as to the type of the system or device installed and its location. The actual room usage shall be documented and compared to any room usage lists generated by the University. The actual documented room usage shall take precedent with regard to system design. Fire and smoke barriers shall be determined as well.
Schematic Design	<p>A meeting shall be scheduled with the FS Project Manager and the Building Users where the fire protection system is to be installed. The purpose of this meeting is to review and discuss the impact of the system design and installation on the physical building. The meeting shall document the following:</p> <ul style="list-style-type: none"> <li>• To establish the location of all major fire alarm equipment such as control panels and annunciators.</li> <li>• To establish the location of all major fire sprinkler equipment such as: <ul style="list-style-type: none"> <li>i. Fire pumps</li> <li>ii. Inspectors test stations</li> <li>iii. Fires stand pipes</li> </ul> </li> </ul>

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	<ul style="list-style-type: none"> <li>iv. Auto sprinkler risers</li> <li>v. Siamese connections on the exterior of the building</li> <li>vi. Any other items that will impact the building's appearance</li> </ul> <ul style="list-style-type: none"> <li>• The extent of detector or sprinkler coverage beyond the Chicago Building Code minimum requirements shall be established. This determination shall be made based on the following considerations: <ul style="list-style-type: none"> <li>i. Building use and contents</li> <li>ii. Historical significance</li> <li>iii. Occupant load</li> <li>iv. Type of construction</li> <li>v. The installation of approved sprinkler systems</li> </ul> </li> <li>• The discussion shall include the type of initiating or sprinkler devices to be employed for the areas to be protected as the type of device will have an impact on maintenance and cost.</li> <li>• Issues and concerns the Users and/or University may have with the existing and proposed fire alarm or sprinkler system.</li> <li>• Proposed construction schedule and the impact on the building occupants.</li> <li>• Testing and acceptance of the system shall be discussed to establish what testing must be conducted outside of the normal work day. The costs for all premium time testing to include final acceptance testing shall be included in the construction documents.</li> </ul>
Schematic Design	Hydrant flow test shall be ordered.
Schematic Design	<p>Layout of major equipment and fire sprinkler /standpipe mains</p> <ul style="list-style-type: none"> <li>• Major Horizontal fire sprinkler/standpipe bulk mains</li> <li>• Auto Sprinkler Riser (ASR) <ul style="list-style-type: none"> <li>i. Auto sprinkler riser shall be located within the building, location to accommodate Fire Department</li> </ul> </li> <li>• Test and Drain Riser <ul style="list-style-type: none"> <li>i. Drain riser shall be located within the building, and shall be piped to the exterior of the building</li> </ul> </li> <li>• Fire Standpipe (FSP) <ul style="list-style-type: none"> <li>i. Based upon the buildings height, determine if fire standpipe system will be required</li> <li>ii. Determine number and locations of fire standpipe/s.</li> </ul> </li> <li>• Fire pump (FP) <ul style="list-style-type: none"> <li>i. Based upon any available information, determine the need for fire pump.</li> <li>ii. Determine preliminary location of proposed fire pump, if pump is to be placed within an existing building.</li> </ul> </li> <li>• Siamese Connections <ul style="list-style-type: none"> <li>i. Determine preliminary location of proposed fire</li> </ul> </li> </ul>

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	<p>department Siamese connections</p> <ul style="list-style-type: none"> <li>• Inspection and Test Valve (ITV) <ul style="list-style-type: none"> <li>i. Shall be included at farthest/highest point of the system.</li> </ul> </li> </ul>
Design Development	<p>Submission shall be made at the completion of the design development phase. This submission shall include:</p> <ul style="list-style-type: none"> <li>• A complete set of preliminary specifications for the fire alarm or sprinkler work to be accomplished. These specifications shall include all sections required to accomplish the work included in the project.</li> <li>• A complete set of floor plans identifying the location of all initiating and notification devices and other fire alarm or sprinkler equipment. A basic fire alarm and sprinkler riser diagram shall be included. Proposed vertical riser raceway locations shall be identified on the floor plans.</li> <li>• The fire alarm system design shall interface with existing building equipment related to or desired to be controlled by the fire alarm system. The sprinkler system design shall interface with other interlocked systems. The Consultant shall include in the design all work necessary to interface HVAC shut-down, sprinkler monitoring and control, building systems such as access control release, smoke management and other code specified supervisory functions. Any equipment, wiring, installation or other work necessary to finish all interface and output wiring or equipment shall be included in the design and subsequent bid packages.</li> </ul>
Design Development	<p>FM Global: Automatic Sprinkler Protection Submittals:</p> <p>Automatic sprinkler protection plan submittals should consist of the following items (confirm with FS Project Manager):</p> <ul style="list-style-type: none"> <li>• Fire Protection Drawings of the proposed system(s). At minimum, submitted fire protection drawings shall include: <ul style="list-style-type: none"> <li>i. Piping layout and sizes</li> <li>ii. Location and number of sprinklers (with fire sprinkler identification numbers (SIN) clearly indicated on the drawings).</li> <li>iii. Location of remote area used in hydraulic calculations</li> </ul> </li> <li>• Hydraulic Calculations</li> <li>• Specifications for materials being used, including but not limited to: <ul style="list-style-type: none"> <li>i. Sprinkler heads</li> <li>ii. Sprinkler pipe</li> <li>iii. Sprinkler control valves</li> <li>iv. Any peripheral equipment – including tamper alarms, water flow alarms, etc.</li> </ul> </li> <li>• Occupancy Details: in order to review submitted plans to ensure adequate protection, accurate occupancy detail must be provided.</li> </ul>

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	This would include a general description of the area being protected and, in case of dedicated storage areas details of the materials being stored, storage height, storage arrangement, etc. should be provided.
Construction Documents	<p>A formal submission shall be made to the University's Risk Management, Audit and Safety Department for review by the University's insurance underwriter.</p> <ul style="list-style-type: none"> <li>• This submission will typically be 80% of the construction documents. This submission may be combined with the final construction document submission for small projects.</li> <li>• This submission will consist of a complete set of fire alarm drawings and specifications.</li> <li>• Formal review comments will be provided by the insurance company. The Consultant shall incorporate these comments into the drawings to the extent possible while keeping with sound engineering judgment and a detailed knowledge of the project as a whole. The Consultant will reconcile these comments with FS Project Manager in writing.</li> </ul>
Construction Documents	<p>Submission shall be at the completion of the construction document phase. This submission shall include:</p> <ul style="list-style-type: none"> <li>• A complete set of specifications to include all sections required to complete the required scope of work.</li> <li>• A complete set of drawings identifying the scope of work.</li> <li>• Fire alarm drawings shall include: <ul style="list-style-type: none"> <li>i. Floor plans identifying the placement of all initiating and notification devices as well as other required fire alarm equipment such as control and voice panels, annunciators remote power supplies and city tie boxes when required.</li> <li>ii. The location of all vertical fire alarm riser raceways.</li> <li>iii. Installation details.</li> <li>iv. The final sequence of operation. This sequence shall be identified using an Input/output matrix.</li> </ul> </li> <li>• Fire Sprinkler drawings shall include: <ul style="list-style-type: none"> <li>i. Floor plans identifying the placement of: <ul style="list-style-type: none"> <li>a. Location of fire protection equipment</li> <li>b. Location of all fire sprinkler standpipe systems</li> <li>c. Location of all bulk mains</li> <li>d. Location of auto sprinkler risers</li> <li>e. Location of test and drain risers.</li> </ul> </li> <li>ii. Installation details. <ul style="list-style-type: none"> <li>a. General project related details</li> <li>b. Specific project related details</li> </ul> </li> </ul> </li> </ul>

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	iii. Riser diagrams a. Fire protection stand pipe and Auto sprinkler risers
Construction	Shop drawings prepared by the fire alarm vendor shall be provided to the University FS group for review and comment. The shop drawings shall be prepared by a NICET III (minimum) Fire Alarm Certified individual. The shop drawings will include evidence of review by the Consultant prior to submitting to the University.
Construction/ Closeout	Prior to acceptance testing, the installing contractor will submit the following: <ul style="list-style-type: none"> <li>• The supervising installer will complete the “Fire Alarm record of Completion” form as described in NFPA-72 prior to scheduling the acceptance testing.</li> <li>• Equipment installation manual, operating, maintenance, programming, parts and repair manuals.</li> <li>• Spare equipment required by contract with inventory list.</li> <li>• Testing and maintenance schedule.</li> <li>• Completed as built drawings.</li> </ul>

### 3. System Guidelines

#### a) Fire Alarm System

1. All new fire alarm systems installed shall be an analog addressable system. The system and components shall be by a single manufacturer. The following system manufacturers are currently approved for use in new installation or complete replacement projects:
  - a. Notifier by Honeywell
  - b. EST by Edwards
  - c. Gamewell/FCI
  - d. Siemens

For projects that involve modifying or expanding an existing system, all new equipment shall be compatible with the existing manufacturer’s system. This requirement shall have precedence over using the preferred manufacturers listed above.

2. The installation of the fire alarm system shall be supervised by a NICET Level III (minimum) certified technician. The electrical contractor shall have this individual on staff or be

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- contractually supported by a company with such an individual. The contractors shall provide the qualification data for the supervising individual.
3. All concealed fire alarm raceways and exposed raceways in unfinished spaces shall be red. Back boxes shall have red cover plates permanently identified with FA on the plate. Exposed raceways in finished spaces shall be painted to match the surface to which it is mounted. All raceways shall be installed concealed unless approved by the University.
  4. Fire alarm systems manual pull stations shall be single action. Pull stations installed within occupancies where children are present shall be provided with a plastic protective shield with electronic sounder.
  5. The fire alarm control panel (FACP) shall be used to control pre-action systems. The FACP shall be UL listed to perform this function.
  6. All concealed duct mounted smoke detectors shall be provided with a remote indicator device. Remote test switches shall be provided.
  7. All initiating devices to be permanently labeled with the device address using an adhesive label.
  8. All notification circuits shall be Class A. Signaling circuits in non-city required buildings shall be installed as Class A.
  9. The FACP shall be provided with test/bypass switches to permit testing of the complete system with minimal disruption to the building occupants. Required test/bypass switches will include at a minimum the following:
    - a. Elevator recall
    - b. Notification device
    - c. AHU shutdown
    - d. Smoke damper closure
    - e. Electric lock release
    - f. Pre-action system release
    - g. Electric door hold open release
    - h. Sprinkler system bypass - flow switches, tamper switches, and fire pump run
  10. Systems installation shall include an exterior mounted red rotating beacon to be located at the building's main entrance. Location of the beacon shall be coordinated with the University.
  11. The building shall be interconnected to the University's Police Department fire alarm receiving station. The fire alarm design and installation shall include all digital alarm communicators and equipment to complete the remote station service. The design consultant shall coordinate phone line service with Capital Project Delivery Project Manager.
  12. All fire alarm systems shall be provided with a three year manufacturer's warranty (minimum).
  13. The construction documents shall include spare components to be turned over to the FS Project Manager upon completion of the project. The following shall be included at a minimum:
    - a. Two smoke detectors of each type used on the project.
    - b. One heat detector of each type used on the project.
    - c. One manual pull station.
    - d. Two audio devices of each type used on the project.
    - e. Two visual devices of each type used on the project.
    - f. One interface module of each type used on the project.

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- g. One duct detector housing and remote indicator and test switch.
- h. Metal wall cabinet to store the devices in each facility.

**b) Fire Sprinkler System**

1. The following system or component manufacturers are approved for use in new installation or replacement projects:
  - a. Grooved fittings, UL listed, FM approved
    - i. Gruvlock
    - ii. Vitaulic
  - b. Schedule 40 pipe, ASTM A53, ASTM A135
  - c. Schedule 10 pipe, ASTM A135
  - d. Backflow preventers
    - i. Watts
    - ii. Wilkins
    - iii. Febco
  - e. Fire sprinkler components
    - i. Reliable Sprinkler
    - ii. Viking Sprinkler
    - iii. Tyco
  - f. Clean agent gas systems FE25, FM200, FE227
    - i. Du Pont
    - ii. Fike
    - iii. Great lakes
  - g. Nitrogen generation system
    - i. Corrosion Solutions
  - h. Corrosion monitoring station
    - i. Corrosion Solutions
  - i. Fire pumps
    - i. Patterson Pump Company
    - ii. Peerless Pump
    - iii. Aura Fairbanks
  - j. Fire pump controllers
    - i. Firetrol
    - ii. Cutler-Hammer
    - iii. Master
2. The following piping requirements are to be provided upstream of backflow preventers:
  - a. Pipe
    - i. Schedule 40 galvanized steel
    - ii. Ductile iron pipe

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- b. Fittings
    - i. Roll grooved
    - ii. Cut grooved
    - iii. Mechanical joint
    - iv. Welded and threaded
  - c. Valves
    - i. Minimum pressure rating: 175 psig
3. The following piping requirements apply downstream of backflow preventers:
- a. Pipe
    - i. Schedule 10 black steel pipe
    - ii. Schedule 40 black steel pipe
  - b. Fittings
    - i. Roll grooved
    - ii. Cut grooved
    - iii. Threaded
    - iv. Welded and threaded cast iron
  - c. Valves
    - i. Minimum pressure rating: 175 psig
4. The following piping requirements apply for interior installations:
- a. Pipe
    - i. Schedule 10 black steel pipe
    - ii. Schedule 40 black steel pipe
  - b. Fittings
    - i. Roll grooved for Schedule 10 or 40. Coordinate pressure ratings with fire pump discharge pressure.
    - ii. Cut grooved for Schedule 40. Coordinate pressure ratings with fire pump discharge pressure.
    - iii. Copper
    - iv. Threaded
    - v. Welded and threaded cast iron
  - c. Valves
    - i. Minimum pressure rating: 175 psig. Coordinate pressure ratings with fire pump discharge pressure.
    - ii. Minimum pressure rating: 250 psig. Coordinate pressure ratings with fire pump discharge pressure.
5. The following piping requirements apply for exterior installations:
- a. Pipe
    - i. Schedule 40 black steel pipe
  - b. Fittings
    - i. Roll grooved
    - ii. Cut grooved

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6. The following piping requirements apply for dry sprinkler systems:
  - a. Pipe
    - i. Schedule 40 galvanized pipe
  - b. Fittings
    - i. Roll grooved
    - ii. Cut grooved
    - iii. Welded joints are **not** acceptable
7. The following piping requirements apply for clean agent systems:
  - a. Pipe (Per manufacturer's requirements for applicable pressures)
    - i. Schedule 40
    - ii. Schedule 80
    - iii. Schedule 160
  - b. Fittings (Per manufacturer's requirements for applicable pressures)
    - i. Threaded Class 300
    - ii. Threaded Class 600
    - iii. Forged steel welded fittings Class 3000
8. Backflow preventers:
  - a. Reduced Pressure Principle
    - i. Configuration – Horizontal
    - ii. Bypass with displacement-type water meter, shut off valves and reduced pressure principle backflow preventer
    - iii. Pressure loss to be no greater than 15 psig throughout its operating range.
  - b. Double-Check
    - i. Configuration – Horizontal
    - ii. Bypass with displacement-type water meter, shut off valves and double-check backflow preventer.
    - iii. Pressure loss to be no greater than 7 psig throughout its operating range.
9. Wet pipe sprinkler systems:
  - a. Pipe shall be coated on the interior by the manufacturer to provide resistance to microbiologically influenced corrosion (MIC).
  - b. Provide automatic air vents to vent trapped air in a wet pipe sprinkler system.
  - c. Provide Corrosion Monitoring Station, designed to monitor internal corrosion activity in a water based fire protection system.
10. Dry pipe sprinkler systems:
  - a. Pre-packaged, cabinet mounted dry pipe valve/system, including fractional hp air compressor.
  - b. Nitrogen generation system, connected to the air supply serving the dry pipe system. System shall vent oxygen rich air out of the system in order to achieve a 95% or greater concentration of nitrogen into the system.
11. General sprinkler installation requirements:
  - a. Rooms without ceilings: upright heads

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- b. Suspended Ceilings: recessed pendent sprinklers, including escutcheons (phantom)
  - c. Main electrical rooms shall **not** be sprinkled by either a wet or a dry system. Main electrical rooms will have heat and smoke detection only.
  - d. Provide extra stock of sprinklers and wrench for each type of sprinkler. Quantity per code for each type.
12. Exposed pipe installations:
- a. All exposed pipe shall be painted.
13. Fire pump:
- a. Electric Drive, Centrifugal
    - i. Ensure 100 PSI at the most remote and tallest building fire standpipe termination.
    - ii. Inlet/outlet flange rated to meet the inlet and outlet pressures anticipated.
    - iii. Voltage shall be determined by Electrical Engineer.
    - iv. Controller solid state soft start with transfer switch to emergency power.
    - v. Ensure proper ventilation.
    - vi. Pump shall be located in dedicated fire pump room.

### c) Testing and Acceptance

1. Final acceptance testing shall be performed by the installing contractor at the direction of the University FS Project Manager. The system shall be completely operational, finished and ready for acceptance testing in accordance with the anticipated project schedule. The FS Project Manager and EHS representative will be notified 10 working days in advance of the proposed date for acceptance testing
2. Acceptance test procedure:
  - a. Final acceptance testing shall consist of testing 100% of the installed devices. This shall include initiating, notification, interface and control devices.
  - b. Initiating device testing shall not be performed using a magnet. Demonstration of the functionality of smoke detectors shall be performed using an UL listed aerosol product. Heat type spot detectors shall be tested using a UL listed heat source. Non-restorable heat detection devices shall not be tested.
  - c. Any failure of a device to function as required due to programming errors shall result in the test being immediately stopped. Testing will resume from the beginning after the programming error is resolved. Failure of a device to function due to a hardware failure will not require the test to restart from the beginning. The device shall be replaced and testing will resume where the test was temporarily halted.
  - d. Completed as-built drawings will be on site and verified during the acceptance test to include device addresses.
  - e. The Engineer of Record shall be present for the final acceptance testing.
  - f. After 100% of all notification devices are tested, one detection device in each zone shall be tested with the notification devices activated. Upon successful completion of that test, the remainder of the detection devices may be tested in a bypass mode.

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#### 4. References

Buildings requiring fire alarm systems as identified in the Chicago Building Code shall follow the established City permit process. Buildings which will have a fire alarm system installed even though it is a non-city required system, shall comply with the Chicago Building Code with regard to design and installation requirements.

The system and all components shall be listed by Underwriters Laboratory (UL) for fire protective signaling service under the latest edition of UL 864.

The system design and related components shall comply with the latest FM Global Property Loss Prevention Data Sheets and approved products as applicable.

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