

Fire Protection & Life Safety

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7.1 General Approach

GSA's approach in the construction of new facilities and projects in existing facilities is to incorporate efficient, cost-effective fire protection and life safety systems that are effective in detecting, extinguishing or controlling a fire event that results in improving overall building safety. The primary goal is to protect human life from fire and products of combustion. The secondary goals are to reduce the potential loss from fire (i.e., Federal real and personal property, maintain client agency mission continuity, and control environmental impact) to the Federal Government and taxpayer.

Scope

This chapter provides the technical fire protection and life safety requirements and design criteria for GSA facilities to meet the goals identified above. The majority of the fire protection and life safety requirements are contained in numerous national codes and standards. Compliance with national codes and standards is explained, and areas where GSA's requirements differ from the referenced national codes and standards are delineated. The Authority Having Jurisdiction (AHJ), for all technical requirements in this chapter, for all fire protection and life safety code interpretations and code enforcement requirements is the GSA regional fire protection engineer.

Applicability

The technical fire protection and life safety requirements are primarily directed to the construction of new facilities and renovation projects. However, for renovation projects

where the work area consists of a portion or portions of a building, the requirements herein shall be limited to the work area(s) in which work is being performed, unless when specified by the GSA regional fire protection engineer that the requirements shall also apply throughout the floor on which the work area(s) are located or otherwise beyond the work area. Performance based designs are also encouraged.

A registered fire protection engineer is required to be a full participant of the architect/engineer (A/E) design team for each phase of the project from concepts through design, construction, final acceptance, and occupancy. The design team fire protection engineer must have at least 6 years experience from which at least 3 consecutive years are directly involved in the fire protection engineering field. This same or an equally competent professional must remain on the A/E's project staff for each phase of the project and shall perform the following:

- Analyses and provides criteria for the following:
 - Building Construction
 - Occupancy Classification
 - Means of Egress
 - Fire Alarm System
 - Water Based Fire Extinguishing System(s)
 - Non-Water Based Fire Extinguishing System(s)
 - Smoke Control System(s)
- Calculations for the following:
 - Egress
 - Water Supply
 - Smoke Control (Fire Dynamics)/Timed Egress
 - Audibility for Fire Alarm System

- Design of all fire protection and life safety systems including but not limited to:
 - Fire Alarm System
 - Water Based Fire Extinguishing System(s)
 - Smoke Control Systems/Stair Pressurization Systems

See Appendix A for specific submission requirements.

For all projects involving fire protection and life safety issues, a dialog must be established between the design team fire protection engineer and the GSA regional fire protection engineer. The GSA regional fire protection engineer shall have the right to revise the specific requirements within this chapter based on a technical evaluation/analysis and the project’s specific needs.

In addition, the Design Team’s registered fire protection engineer may propose alternative designs, systems, methods, or devices not specifically prescribed within this Chapter or in lieu of the specific prescribed requirements within this Chapter. The GSA regional fire protection engineer shall review the technical documentation submitted by the Design Team’s registered fire protection engineer to determine if the proposed alternative is deemed equivalent or superior to the intent of the prescribed requirements in this chapter. If the GSA regional fire protection engineer determines that the proposed alternative is deemed equivalent or superior to the intent of the prescribed requirements in this chapter, then the proposed alternative is considered approved by GSA for the purposes of this Chapter and for the application for which the proposed alternative will be used. Refer to Chapter 1 for additional information.

7.2 Certificate of Occupancy

No new construction or renovation project or portion thereof shall be occupied until the regional fire protection engineer has issued a certificate of occupancy to the GSA Project Manager. Issuance of a certificate of occupancy shall not be construed as an approval of any violation of a Code or GSA design standard or criteria.

Once the GSA regional fire protection engineer has ensured that to the best of their knowledge all fire protection and life safety systems have been completed, inspected, successfully tested and approved and all outstanding fire and life safety deficiencies have been corrected to afford a reasonable degree of safety to the building occupants from fire and similar emergencies, a certificate of occupancy will be issued to the GSA Project Manager.

The GSA regional fire protection engineer is authorized to issue a temporary certificate of occupancy. This certificate shall allow partial occupancy of specific areas, prior to completion of the project. All life safety and fire protection systems serving the areas proposed for occupancy and all floors below shall be completed, inspected, successfully tested and approved by the GSA regional fire protection engineer. The temporary certificate of occupancy shall identify the specific area(s) of the project where occupancy is permitted. Following the issuance of a temporary certificate of occupancy, the GSA regional fire protection engineer shall set a time frame for the completion, inspection, testing and approval of all life safety and fire protection systems, and the correction of any outstanding life safety and fire protection deficiencies. Upon completion, inspection, successful testing and approval of all fire protection and life safety systems and correction of all outstanding fire and life safety deficiencies, the GSA regional fire protection engineer will issue a certificate of occupancy to the GSA Project Manager.

7.3 Fire Safety During Construction and Renovation Projects

General. Fire safety during construction and renovation projects shall comply with the requirements in the International Building Code (IBC), International Fire Code (IFC), and National Fire Protection Association (NFPA) 241.

Fire Protection Systems. Disruptions to fire alarm and sprinkler systems shall be kept to a minimum or avoided. Delineate phasing of construction to ensure that installations of new systems are expedited, and existing systems are kept in service until the replacement system is operational. If fire protection systems are to be disrupted, procedures shall be incorporated into the design to maintain equivalent levels of fire protection and provide formal notification to the facility while systems are down. The GSA regional fire protection engineer shall make the final determination of the adequacy of proposed equivalent levels of fire protection prior to the disruption of any fire protection system. For example, the provision of a 24 hour fire watch by qualified individuals may provide an equivalent level of fire protection during system disruption in some circumstances.

7.4 Commissioning

The commissioning process will ensure that the fire protection and life safety systems and equipment installed in a building are in compliance with the building design requirements.

The Design Team's fire protection engineer shall prepare written commissioning plan documentation that outline the procedures, methods and documentation for each phase of the commissioning process for all types of active and passive fire protection and life safety systems from concept through construction, final acceptance, occupancy, and post occupancy. At a minimum, the commissioning plan documentation shall include a discussion on the building structure; applicable standards, federal laws and regulations; system and equipment performance assumptions, codes and standards strategies; testing and start-up requirements; inspection, testing and maintenance requirements; and safeguards to verify and confirm that systems, equipment and devices have undergone start-up testing prior to final acceptance testing, including the identification and notification of all parties needed to perform and witness all testing. The commissioning plan documentation shall also describe in detail the performance objectives of each fire protection and life safety system planned for the project. In addition, it shall also include all of the additions, deletions or modifications made to each of the fire protection and life safety systems during each phase of the project. All of this documentation will assist the Construction Manager, Project Manager, Commissioning Authority and the GSA regional fire protection engineer in the advocacy, review, inspection and final acceptance process.

In addition, the Design Team's fire protection engineer shall prepare construction contract specifications to align the actions of the construction contractor with the commissioning plan, addressing all involved tests, special inspections, and certifications.

Examples of fire protection and life safety commissioning activities include, but are not limited to the following items:

Preliminary planning: Assure proposed space is accommodated by each involved system as it applies to that space, in accordance with the requirements within PBS-P100 and all referenced codes & standards. Review associated project budgets to assure that an adequate amount of space is shown to not only address each system itself, but validate that architectural, structural, and mechanical system costs associated with pathway, firestopping, concealment, and placement are included in the project's budget. Integrate appropriate GSA guide specification requirements into systems planning in the review of the systems budgets to assure budget assumptions are in concert with the requirements for design.

Preliminary Concept Design: Review concept drawings to assure adequate egress from the conceptual facility, adequate utility connection/service for fire protection systems, adequate site access for fire department and other emergency responders, and assuring compliance with the requirements within PBS-P100 and all referenced codes and standards based on the limited information in this stage of design. Identify proposed hazard ratings and occupancy classifications of various building space types and confirm their impact to involved systems.

Final Concept Design: Confirm that proposed systems comply with the requirements within PBS-P100 and all referenced codes and standards. Assure that systems proposed for the facility will comply with the latest GSA guide specifications for each proposed system. Identify the designer's intent to use acceptable materials/equipment and that proposed capabilities (if any) are appropriate for the space occupancy classification and hazard ratings.

Design Development: Validate that concept approved fire protection and life safety systems are based on the requirements within PBS-P100, referenced codes and standards, and the latest edition of GSA guide specifications for the systems involved. Check fire protection & life safety engineering calculations to determine accuracy and proper application of design to the facility. Evaluate the project specifications and project drawings for correctness, coordination and agreement. Validate operational assumptions and level of details for each system to assure clarity and detail for project bids and construction direction. Coordinate work with the GSA review process so that the GSA regional fire protection engineer receives the project design package for review after completion of the aforementioned work.

Construction Documents: Review layouts for each fire protection and life safety system, validating that the construction documents are in compliance with the requirements within PBS-P100 and referenced codes and standards, that the construction documents conform to the design drawings, specifications, and supporting contract documents, and that equipment submittals are correctly annotated and the application of each piece of equipment is appropriate for the facility and this project. Review system/equipment locations to assure clearance when in proximity to ductwork and other building features. Validate appropriateness of control sequences, and their representation on drawings and/or specifications. Verify that specifications include appropriate spare parts.

Construction Inspection: During construction, inspect system installations to assure compliance with design intent, approved specifications & drawings, and approved submittals. Coordinate on site inspections with the GSA regional fire protection engineer for the project so that there is unified communication about each system and required changes or improvements. When all system components are in-place, coordinate preliminary and acceptance testing, checking functionality of all modes

of operation. Prepare test reports. Verify that training for building operating staff includes information on what to do for each mode of operation. Verify that an appropriate number of spare system parts are provided per terms of the construction contract. Assure that the GSA regional fire protection engineer is involved in the scheduling of all acceptance testing and has an opportunity to attend testing as required. Participate in the review of test results and needed corrections with the GSA regional fire protection engineer as a means to facilitate issuing a Certificate of Occupancy.

Post Construction Inspection/Operations: Coordinate with GSA project management staff to assure that appropriate service/maintenance agreements exist for the care/servicing of the commissioned systems.

These activities shall be done for the following systems:

- Fire Alarm Systems
 - Initiating Devices and Related Circuits
 - Notification Appliances and Related Circuits
 - Power Supplies and Protection of Same
 - Communication of Signals Exterior to the Building (Central Station & MegaCenter)
 - System Controls and Peripherals
 - Interface with Other Systems (e.g., HVAC, Security Systems, etc.)
- Water Based Fire Extinguishing Systems
 - Sprinkler Systems
 - Water Supply Information
- Fire Pumps
 - Fire Pump
 - Jockey Pump
 - Fire Pump Controller and Transfer Switch
 - Pressure Regulation at Fire Pump
 - Fire Pump Room
- Standpipe and Fire Department Hose Connection Systems
- Non-Water Based Fire Extinguishing Systems
 - Wet Chemical Systems
- Smoke Management Systems
 - Exit Stairway Pressurization
 - Atrium Smoke Removal
- Emergency Power Systems
- Fire Doors and Windows
- Emergency Lighting and Exit Lighting
- Exit signage
- Photoluminescent Material Stairway Marking.
- Egress Systems
 - Aisles
 - Exit Access
 - Exit Stairs
 - Exit Doors & Hardware
 - Exits
 - Exit Discharge
- Other Equipment and Systems
 - Spray Applied Fire Resistive Materials
 - Firestopping Materials
 - Interior Finish Materials
 - High Density Storage Systems
 - Essential Electronic Facility Protection
 - Lightning Protection
 - Portable Fire Extinguishers and Cabinets
 - Fire Command Center
 - Equivalent Technologies

7.5 Building Construction

Types of Construction. For each construction type, design fire resistive ratings of structural members in accordance with the requirements in the IBC.

Special Inspections. The GSA Project Manager shall ensure that special inspections for sprayed fire-resistant materials applied to structural elements and decks are in accordance with the requirements in the IBC. Special inspections shall be based on the fire-resistive design as designated in the approved construction documents.

7.6 Interior Finishes

General. The interior finish requirements for walls, ceilings, floors, draperies, curtains, and movable partitions shall meet the requirements in the IBC.

Special Requirements. The following requirements take precedence over the requirements in the IBC:

Adhesives and other materials used for the installation of carpets shall be limited to those having a flash point of 60 degrees C (140 degrees F) or higher.

All other materials composed of combustible substances, such as wood (e.g., plywood, 610 mm by 1219 mm (2 feet by 4 feet) wood boards, etc.) shall be treated with fire-retardant chemicals by a pressure impregnation process or other methods that treats the materials throughout (as opposed to surface treatment).

7.7 Occupancy Classifications

General. Occupancy classifications shall meet the requirements in the IBC.



Charles Evans Whittaker U.S. Courthouse, Kansas City, MO

7.8 Means of Egress

General. The means of egress design requirements for the building shall meet the requirements in NFPA 101. The technical egress design requirements in NFPA 101 shall be used in lieu of the technical egress design requirements in the IBC.

Special Requirements. The following requirements take precedence over the requirements in NFPA 101:

- In buildings that are protected throughout by an automatic sprinkler system, 1-hour fire rated corridors shall not be required.
- Interlocking (scissor) stairs shall count as only one exit stair. A minimum of two exit stairs are required for any multi-story building.
- For common paths of travel and dead end corridors, GSA permits the NFPA 101 exceptions for sprinkler protection to apply to fully sprinklered individual floors, even if the other floors of the building are not sprinklered.
- Fire escapes, as defined in the NFPA 101, shall not be considered approved exits.

Stairway Pressurization. In new construction projects having occupied floors located more than 22860 mm (75 feet) above the level of exit discharge or more than 9144 mm (30 feet) below the level of exit discharge, exit stairways shall be pressurized in accordance with the requirements in the IBC.

Photoluminescent Materials

Exit Stair Identification Signs. The following requirements take precedence over the requirements in NFPA 101:

- Stair identification signs shall have a photoluminescent background complying with Standard Specification for Photoluminescent (Phosphorescent) Safety Markings ASTM E2072-04 as a minimum standard.
- The signs shall be a minimum size of 457 mm (18 inches) by 305 (12 inches).
- The letters designating the identification of the stair enclosure shall be a minimum of 38 mm (1 1/2 inches) in height.
- The number designating the floor level shall be a minimum of 127 mm (5 inches) in height and located in the center of the sign.
- All other lettering and numbers shall be a minimum of 25 mm (1 inch) in height.
- The directional arrow shall be a minimum of 76 mm (3 inches) in length.

For projects in historic structures, the Design Team fire protection engineer shall consult with the GSA Regional Historic Preservation Officer and the GSA regional fire protection engineer regarding these requirements.

Exit Stair Treads. The following requirements take precedence over the requirements in the NFPA 101:

- Stair treads shall incorporate a photoluminescent stripe that is either an applied coating, or a material integral with, the full width of the horizontal leading edge of each stair tread, including the horizontal leading edge of each landing nosing.

- The width of the photoluminescent stripe shall be between 25 mm (1 inch) and 51 mm (2 inches).
- The width of the photoluminescent stripe, measured horizontally from the leading edge of the nosing shall be consistent at all nosings.
- The photoluminescent materials used shall comply with ASTM E2072-04 as a minimum standard.

For projects in historic structures, the Design Team fire protection engineer shall consult with the GSA Regional Historic Preservation Officer and the GSA regional fire protection engineer regarding these requirements.

Exit Stair Handrails. The following requirements take precedence over the requirements in the NFPA 101:

- Stair handrails shall incorporate a photoluminescent marking that is either an applied coating, or a material integral with, the entire length of each handrail.
- The photoluminescent handrail marking, at a minimum, shall be located at the top surface of each handrail, having a minimum width of 13 mm (1/2 inch).
- The photoluminescent handrail marking shall stop at the end of each handrail. If the handrail turns a corner, the marking shall continue around the corner.
- The photoluminescent materials used shall comply with ASTM E2072-04 as a minimum standard.

For projects in historic structures, the Design Team fire protection engineer shall consult with the GSA Regional Historic Preservation Officer and the GSA regional fire protection engineer regarding these requirements.

7.9 Fire Alarm Systems

General. Fire alarm systems shall be installed in accordance with the requirements in NFPA 72, the IFC, and the applicable GSA fire alarm system specification.

Special Requirements. The following requirements take precedence over the requirements in NFPA 72 and the IFC:

- All fire alarm systems shall be addressable systems.
- All fire alarm systems installed in buildings shall be an emergency voice/alarm communication system when any one of the following conditions exist:
 - The building is 2 or more stories in height above the level of exit discharge.
 - The total calculated occupant load of the building is 300 or more occupants.
 - The building is subject to 100 or more occupants above or below the level of exit discharge.

The emergency voice/alarm communication system shall provide an automatic response to the receipt of a signal indicative of a fire emergency. Manual control with the capability of making live voice announcements shall also be furnished to provide occupants notification either on a selective or all-call basis

- With the exception of mass notification, fire alarm systems shall not be integrated with other building systems such as building automation, energy management, security, etc. Fire alarm systems shall be self-contained, stand alone systems able to function independently of other building systems.
- All emergency voice/alarm communication systems shall be installed within a room separated from the remainder of the building by not less than a 1-hour fire resistance rated fire barrier.

- Each fire alarm system shall be provided with a power conditioner to protect the fire alarm system from electrical surges, spikes, sags, over-voltages, brownouts, and electrical noise. The power conditioner shall be U.L. listed and shall have built in overload protection.
- Wiring supervision for fire alarm systems shall be provided as defined in NFPA 72 as follows:
 - Interconnected riser loop or network (Style 7 – Class A)
 - Initiating device circuits (Style B – Class B)
 - Signaling line circuit for each floor (Style 4 – Class B)
 - Signaling line circuit for network (Style 7 – Class A)
 - Notification appliance circuits (Style Y – Class B)
- All fire alarm signals (i.e., alarm, supervisory, and trouble signals) shall be automatically transmitted via a digital alarm communicator over leased phone lines to a U.L. listed Central Station Service and the GSA Regional Emergency Management Control Center.
- All fire alarm system wiring shall be solid copper and installed in conduit. Stranded wiring shall not be used.
- Conduit shall be rigid metal or electrical metallic tubing, with a minimum inside diameter of 19 mm (3/4 inch) that utilizes compression type fittings and couplings.

Manual Fire Alarm Boxes

General. Manual fire alarm boxes shall be installed in accordance with the requirements in NFPA 72, the IFC, and manufacturer's instructions.

Special Requirements. The following requirements take precedence over the requirements in NFPA 72 and the IFC:

- Manual fire alarm boxes shall be installed in every new construction project in accordance with the spacing and location requirements in NFPA 72.
- Manual fire alarm boxes shall be double-action stations.
- Manual fire alarm boxes shall be of contrasting color to the background on which they are mounted.

Waterflow Switches

General. Waterflow switch(es) shall be installed in accordance with the requirements in NFPA 13, NFPA 72 and the IFC.

Special Requirements. The following requirements take precedence over the requirements in NFPA 13, NFPA 72 and the IFC:

- A waterflow switch(es) shall be provided for each floor or fire area protected by sprinkler systems.
- Each waterflow switch shall be separately annunciated at the main fire alarm control unit and all required annunciators.

Smoke Detectors

General. Smoke detectors shall be installed in accordance with the requirements in NFPA 72, the IFC, and the International Mechanical Code (IMC).

Special Requirements. The following requirements take precedence over the requirements in NFPA 72, the IFC and the IMC:

- Area smoke detectors shall not be installed in each of the following rooms: mechanical equipment, electrical closet, telephone closet, emergency generator room, uninterruptible power service and battery rooms, and other similar rooms.
- Smoke detection appropriate for the application shall be installed in each of the following rooms: electrical switch gear, transformer vaults and telephone exchanges (PABX).
- Duct smoke detectors shall meet the requirements in the IFC and IMC.

Audible Notification Appliances

General. Performance, location, and mounting of audible notification appliances shall be in accordance with the requirements in NFPA 72.

Special Requirements. The following requirements take precedence over the requirements in NFPA 72:

- To ensure audible signals are clearly heard, the sound level shall be at least 70 dBA throughout the office space, general building areas and corridors measured 1524 mm (5 feet) above the floor. The sound level in other areas shall be at least 15 dBA above the average sound level or 5 dBA above any noise source lasting 60 seconds or longer.
- The design for achieving the required minimum dBA levels shall take into consideration all building construction materials such as carpeting, hard surfaces, walls, doors, etc., and any other materials that can cause sound level attenuation and/or clarity problems in the placement and location of all audible notification appliances. The *SFPE Handbook of Fire Protection Engineering*, Chapter on *Design of Detection Systems* or other audio design guides should be used to provide guidance and methodology to achieve the required dBA levels.
- Where emergency voice/alarm communication systems are provided, fire alarm speakers shall be installed in elevator cars and exit stairways; however they shall only be activated to broadcast live voice messages (e.g., manual announcements only). The automatic voice messages shall be broadcast through the fire alarm speakers on the appropriate floors, but not in stairs or elevator cars.

Visible Notification Appliances

General. Placement and spacing of visible notification appliances shall be in accordance with the requirements in NFPA 72.

Special Requirements. The following requirements take precedence over the requirements in NFPA 72:

- Visible notification appliances shall only be installed in projects that involve the installation of new fire alarm systems.
- Visible notification appliances shall only be required to be installed in public and common areas. For the purposes of this requirement, visible notification appliances shall not be required to be installed in individual offices. Public and common areas include public rest rooms, reception areas, building core areas, conference rooms, open office areas, etc.
- Visual notification appliance circuits shall have a minimum of 25 percent spare capacity.
- Visible notification appliances shall not be installed in exit enclosures (i.e., exit stairs, etc.).

Fire Alarm Messages for High Rise Occupancies

Upon receipt of any fire alarm signal, the fire alarm system shall automatically activate a distinctive three-pulse temporal whoop pattern for three (3) cycles followed by the specified automatic voice messages which shall be repeated until the control panel is reset (i.e., three-pulse temporal whoop pattern - three-pulse temporal whoop pattern - three-pulse temporal whoop pattern - voice message; three-pulse temporal whoop pattern - three-pulse temporal whoop pattern - three-pulse temporal whoop pattern - voice message; etc.), or until overridden by manually activated live voice messages.

The automatic voice messages shall be broadcast through the fire alarm speakers on the specified floors, but not in exit stairs or elevator cars. However, the capability to transmit voice messages to elevator cars and exit stairs shall be included, but be manual only.

The “**Fire Zone**” message shall be broadcast through speakers on the floor of alarm origin, the floor immediately above the floor of origin, and the floor immediately below the floor of origin. In addition, the visible alarm notification appliance circuit(s) shall be activated on the floor of alarm origin, the floor immediately above the floor of origin, and one floor immediately below the floor of origin. A first floor alarm shall transmit a “Fire Zone” message to all below grade levels.

The “**Safe Area Zone**” message shall simultaneously be broadcast to all other building floors. However, the visible alarm notification appliance circuit(s) shall not be activated on these floors. The “Safe Area Zone” message shall activate for two complete rounds and silence automatically. After five minutes, if the system is still in an alarm condition, the “Safe Area Zone” message shall automatically start and activate for two complete rounds and silence again. This sequence shall be repeated until the fire alarm system is reset. In the event a subsequent fire alarm is received at the fire alarm control panel by a floor that was previously receiving a “Safe Area Zone” message, this floor shall automatically revert to perform the actions for a “Fire Zone” message.

A live voice message shall override the automatic output through use of a microphone input at the main fire command center. When using the microphone, live messages shall be broadcast through speakers in stairwells, in elevator cars, and throughout the selected floor or floors. Each stairwell shall have its own dedicated speaker zone and speaker zone activation switch. Each elevator bank shall have its own dedicated speaker zone and speaker zone activation switch. An “All Call” switch shall be provided which activates all speakers in the building simultaneously.

Messages shall be digitized voice and utilize a professional quality male voice and shall be as follows:

- **“Fire Zone” Message:** “May I have your attention, please. May I have your attention, please. A fire has been reported which may affect your floor. Please walk to the nearest exit and leave the building. Please do not use the elevators,” or
- **“Fire Zone” Message:** “May I have your attention, please. May I have your attention, please. A fire has been reported which may affect your floor. Please walk to the nearest exit, walk down ___ floors, re-enter the building, walk onto the floor, and await further instructions. Please do not use the elevators.”
- **“Safe Area Zone” Message:** “May I have your attention, please. May I have your attention, please. A fire has been reported in another area of the building. You are in a safe area. Please stay in your work area and await further instructions. Please do not use the elevators.”

Annunciator. All fire alarm systems shall have at least one annunciator located within 7620 mm (25 feet) from the primary fire department entrance to the building. For projects in historic structures, the Design Team fire protection engineer shall consult with the GSA Regional Historic Preservation Officer and GSA regional fire protection engineer regarding this requirement.

Survivability

General. The fire alarm system shall meet the survivability requirements in NFPA 72.

Special Requirements. The following requirements take precedence over the requirements in NFPA 72:

- Two vertical risers (i.e., supply and return interconnected network circuits Style 7 - Class A) shall be installed as remote as practicable from each other so that a single fire will not involve both risers.
- The two vertical risers shall be protected by a minimum 2-hour rated enclosure or an approved 2-hour rated cable or system, not common to both vertical risers.
- The horizontal interconnection between the two vertical risers at the top and bottom shall be protected by a minimum 2-hour rated enclosure, or an approved 2-hour cable or system, or an approved construction material having a 2-hour fire resistance rating.
- A minimum of two (2) distinct fire alarm audible notification appliance circuits and a minimum of two (2) distinct visible notification appliance circuits shall be provided on each floor.
- Adjacent fire alarm audible and visible notification appliances shall be on separate circuits.

Fire Command Center

General. The fire command center shall meet the requirements in the IFC.

Special Requirements. The following requirements take precedence over the requirements in the IFC:

- A fire command center shall be constructed in all new construction projects and meet the construction requirements in the IFC.
- Each fire command center shall be provided in a location approved by the GSA regional fire protection engineer after consultation with the local fire department.
- Each fire command center shall be provided with appropriate lighting, ventilation, and emergency lighting.

7.10 Water Supply for Fire Protection

Adequacy of Water Supply. The designer shall assess adequacy of the existing water supply. The designer shall perform water supply flow testing of fire hydrants and/or fire pumps. If data less than one year old is available from the local jurisdiction, the designer shall verify the locations involved as well as the quality and accuracy of the data.

Capacity and Duration. The required fire flows and pressures for buildings shall comply with the requirements in NFPA 13 and the IBC.

Fire Pump Design. When a fire pump is necessary to supplement fire flow and pressure, size it to comply with the requirements in NFPA 13, 14, and 20. For emergency power requirements see PBS-P100, Chapter 6.

Special Requirements. The following requirements take precedence over the requirements in NFPA 13, 14, and 20:

- The fire pump shall be sized only for the sprinkler system requirements only if the local responding fire department can provide the necessary flow and pressure for manual fire fighting operations (i.e., hose stations), through fire department siamese connections.

- The fire pump shall be electric motor driven, horizontal split case centrifugal type, unless this is not feasible.

Fire Pump Installation. The fire pump shall be installed in accordance with the requirements in NFPA 20.

Fire Pump Operations. A fire pump shall start automatically at 69 kPa (10 psi) below pressure maintenance pump (jockey pump) start pressure.

Fire Pump Controller. The power transfer switch and the fire pump controller shall be factory assembled and packaged as a single unit. Separate transfer switches are not permitted. The fire pump controller shall be monitored by the fire alarm system.

Pressure Maintenance Pump (Jockey Pump). A pressure maintenance pump shall be utilized where it is desirable to maintain a uniform or relatively high pressure on the fire protection system. A jockey pump shall be sized to make up the allowable leakage rate within 10 minutes or 3.8 lpm (1 gpm), whichever is larger.

7.11 Water Based Fire Extinguishing Systems

General. Automatic sprinklers systems shall be installed in accordance with the requirements in NFPA 13, the IBC, and the appropriate GSA sprinkler system specification.

Special Requirements. The following requirements take precedence over the requirements in NFPA 13 and the IBC:

- Automatic sprinklers shall be installed throughout all new construction projects where the building has a sufficient municipal water supply system for the design and installation of a sprinkler system at the site.
- Automatic sprinklers shall be installed throughout the designated work area for all major renovation projects where the building has a sufficient municipal water supply system for the design and installation of a sprinkler system at the site.
- Where project sites are located in remote/isolated areas having insufficient or nonexistent water supplies in close proximity, designing the fire sprinkler system in accordance with NFPA 13 can be both impractical and economically very onerous. See Section “Automatic Sprinkler Systems for Remote/Isolated Facilities” for additional information regarding automatic sprinkler system requirements.
- All sprinkler systems shall be wet-pipe sprinkler systems, unless installed in areas subject to freezing.
- In areas subject to freezing, install dry-pipe sprinkler systems, dry pendent sprinklers, or provide heat in the space, and/or reroute the sprinkler piping. Heat tape shall not be used on sprinkler piping.

- Antifreeze sprinkler systems shall not be installed in any new construction or renovation projects.
- Pre-action type sprinkler systems shall not be installed in any new construction or renovation projects.

Sprinkler System Design

General. Sprinkler systems shall be hydraulically calculated in accordance with the requirements in NFPA 13.

Special Requirements. The following requirements take precedence over the requirements in NFPA 13:

- Sprinkler systems shall be designed using a minimum system design area of 1,500 sq. ft. and shall not be decreased below this value.
- Where floor openings are not classified as atriums, the sprinklers at the ceiling shall be zoned with the lower level if it is enclosed on the upper level (the enclosure is effectively creating a high ceiling). Otherwise, sprinklers shall be zoned with the upper level.
- Sprinkler system control valves shall be located in accessible spaces. Sprinkler system control valves shall not be located in above ceiling spaces.

Seismic Protection. Seismic protection shall be installed where required in the IBC.

Types of Sprinklers

General. Quick response sprinklers (QRS) shall be installed in all new construction and renovation projects in accordance with the requirements in NFPA 13.

Special Requirements. The following requirements take precedence over the requirements in NFPA 13:

- Sprinklers equipped with “O-ring” water seals shall not be utilized in any new construction or renovation projects.

- QRS sprinklers shall not be installed in high temperature areas (e.g., high temperature areas defined in NFPA 13 or elevator machine rooms, etc.) in a building. Standard response sprinklers shall be installed of the appropriate temperature rating.
- All automatic sprinklers installed less than 2134 mm (7 feet) above the floor shall be equipped with sprinkler guards to provide protection against accidental damage.

Sprinkler Piping System

General. Sprinkler piping, fittings, control valves, check valves, and drain assemblies shall meet the requirements in NFPA 13.

Special Requirements. The following requirements take precedence over the requirements in NFPA 13:

- Black steel piping and/or copper tubing shall be used for all wet-pipe sprinkler piping. Chlorinated polyvinyl chloride (CPVC) sprinkler piping shall not be installed in any new construction or renovation project, unless specifically approved for installation by the GSA regional fire protection engineer.
- Galvanized (internal and external) sprinkler piping shall be used for all dry-pipe sprinkler systems.
- Steel pipe sizes 51 mm (2 inches) and smaller shall be Schedule 40 and shall be threaded.
- Steel pipe sizes larger than 51 mm (2 inches) shall be minimum Schedule 10. Piping less than Schedule 40 shall be roll grooved.
- Threadable lightwall pipe shall not be used.
- Steel piping having a corrosion resistant ratio less than 1 shall not be used.
- Plain-end fittings shall not be used.

Fire Department Connections. Underwriters Laboratories Inc (UL) listed locking fire department connection caps shall be installed on all fire department

connections where the local fire department has a program and the hardware to accommodate locking fire department caps.

Automatic Sprinkler Systems for Remote/Isolated Facilities

General. The requirements below apply to facilities located in remote/isolated areas having insufficient or nonexistent water supply sources for the design and installation of a fire sprinkler system in accordance with the requirements in the NFPA 13. These facilities must also meet the criteria set forth below to determine when it is not economically feasible to install automatic fire sprinkler protection in accordance with NFPA 13.

1. The cost associated with the installation of the interior NFPA 13 fire sprinkler system (includes all costs such as labor, materials, the adequate water supply source, pumps, etc.) has a cost exceeding \$10.00 per square foot; and
2. The costs associated with connecting the interior NFPA 13 fire sprinkler system to the adequate water supply source (includes all costs such as labor, materials, the adequate water supply source, pumps, etc.) is greater than 50 percent of the cost for the installation of the interior NFPA 13 fire sprinkler system.

If the preceding conditions exist, the sprinkler system shall be designed in accordance with the requirements in NFPA 13D.

Special Requirements. The following requirements take precedence over the requirements in NFPA 13D:

- The water supply source for the sprinkler system shall be a minimum of 1,000 gallons and shall be capable of meeting system demands for at least 30 minutes.
- Antifreeze sprinkler systems shall not be permitted.

7.12 Non-Water Based Fire Extinguishing Systems

Wet Chemical Extinguishing Systems. Wet chemical extinguishing systems shall be installed to protect commercial food heat-processing appliances required to have a Type 1 hood in accordance with the requirements in NFPA 17A and the manufacturers recommendations.

Dry Chemical Extinguishing Systems. Dry chemical extinguishing systems shall not be installed to protect any commercial cooking equipment installations.

Clean Agent Extinguishing Systems. Clean agent extinguishing systems shall not be installed in any new construction or renovation project, unless specifically approved for installation by the GSA regional fire protection engineer. However, an approved clean agent extinguishing system shall not be installed in lieu of a wet-pipe sprinkler system.

7.13 Standpipes and Fire Department Hose Outlets

Standpipes

General. Standpipes shall be installed in buildings where required in the IFC.

Special Requirements. The following requirements take precedence over the requirements in the IFC:

- All standpipes shall be connected to the fire protection water supply, be permanently pressurized, and be installed in accordance with the requirements in NFPA 14.
- Dry standpipes shall only be permitted in spaces subject to freezing.
- Where standpipe and sprinkler systems are required, a combination sprinkler/standpipe system design shall be provided.

Fire Department Hose Outlets. Each fire main riser shall be provided with 63 mm (2 1/2 inch) fire department hose outlets. Each outlet shall be located in the stair shaft and have a removable 38 mm (1 1/2 inch) adapter and cap. Threads and valves shall be compatible with the local fire department requirements.

7.14 Portable Fire Extinguishers and Cabinets

General. Portable fire extinguishers and cabinets shall be installed in accordance with the requirements in the IFC.

Special Requirements. The following requirements take precedence over the requirements in the IFC:

- Portable fire extinguishers and cabinets shall not be installed in common areas, general office or court space when the building is protected throughout with quick response sprinklers.
- In office buildings protected throughout with quick response sprinklers, fire extinguishers shall only be installed in areas such as mechanical and elevator equipment areas, computer rooms, UPS rooms, generators rooms, kitchen areas, special hazard areas, etc.

7.15 Fire Protection for Storage Facilities

General Storage. The storage arrangements and protection of a general storage facility shall meet the requirements in NFPA 13 and NFPA 231.

Rack Storage. The storage arrangements and protection of a rack storage facility shall meet the requirements in NFPA 13 and, NFPA 230.

Record Storage. The storage arrangements and protection of a record storage facility shall meet the requirements in NFPA 13 and NFPA 232.

Archive and Record Center

General. The storage arrangements and protection of an archive and record center shall meet the requirements in NFPA 13, NFPA 232 and the information provided in NFPA 232A and the National Archives and Records Administration guidelines as published in the Federal Register, GSA sponsored large scale fire testing.

Special Requirements. The following requirements take precedence over the requirements in NFPA 232:

- Smoke detectors shall be installed throughout archival storage areas in accordance with the requirements in NFPA 72.

Flammable and Combustible Liquid Storage. The storage arrangements and protection of a flammable and combustible liquid storage area shall meet the requirements in NFPA 30 and the applicable Factory Mutual Data Sheets.

7.16 Special Fire Protection Requirements

Elevator Systems

General. Elevator systems shall be designed and installed in accordance with the requirements in ANSI/ASME Standard A17.1 and the IBC.

Special Requirements. The following requirements take precedence over the requirements in ANSI/ASME Standard A17.1 and the IBC:

- Venting of hoistways shall meet the requirements in the IBC.
- Each elevator machine room shall be provided with a wet-pipe sprinkler system using standard response sprinklers. The sprinkler system for the elevator machine room shall be provided with separate manual isolation valves and a separate water flow switch located outside the room in an accessible location. Tamper switches shall be provided on all such valves.
- Sprinkler protected elevator machine rooms containing elevator control equipment shall be provided with a means to disconnect automatically the main line power supply to the affected elevator prior to the application of water in accordance with the requirements in NFPA 72.
- Enclosed elevator lobbies are not required to be installed in buildings protected throughout by an automatic sprinkler system.

Electrical Equipment Rooms and Electrical Closets

General. All electrical equipment rooms (e.g., switch gear rooms, transformer vaults, etc.) and electrical closets shall be protected by an automatic sprinkler system in accordance with the requirements in NFPA 13.

Special Requirements. The following requirements take precedence over the requirements in NFPA 13:

- All electrical switchgear rooms and transformer vaults shall be provided with separate manual isolation valves and a separate water flow switch located outside the room in an accessible location. Tamper switches shall be provided on all such valves.
- Sprinklers installed in electrical equipment rooms and electrical closets shall be equipped with sprinkler guards to provide protection against accidental damage.

Essential Electronic Facilities

General. Essential electronic facilities consist of spaces that have high value or mission essential electrical equipment such as mainframe computers or telephone switches with the potential for high dollar loss and/or business interruption. Essential electronic facilities shall be designed in accordance with the requirements in NFPA 75 and the appropriate GSA computer room fire alarm system specification.

Special Requirements. The following requirements take precedence over the requirements in NFPA 75:

- A wet pipe sprinkler system shall be provided throughout the facility including data storage areas.
- Quick response sprinklers shall be used throughout the facility including data storage areas.
- The sprinkler system shall have a separate isolation valve and a separate water flow switch located outside of each protected area in an accessible location. Each valve shall be provided with a tamper switch that is connected to the building's fire alarm system.
- Activation of the sprinkler water flow switch shall disconnect power to the computers and to the HVAC systems with no time delay.
- The activation of two cross-zoned conventional photoelectric smoke detectors or the activation of one

intelligent analog/addressable photoelectric smoke detector utilizing early warning smoke detection technology (e.g., smoke detectors having enhanced algorithms, fire alarm control panel having capability to program individual smoke detector response parameters, or smoke detectors using air sampling technology for use in essential electronic facilities, etc.) within a single protected area shall disconnect power to the computer equipment and to the HVAC system after a pre-set time delay.

- Water based and/or non-water based fire extinguishing systems shall not be installed below raised floors that are less than or equal to 457 mm (18 inches) in height.

Places of Confinement

General. Places of confinement are considered places where persons are held under lock during daytime hours, but not overnight.

Special Requirements. Places of confinement shall meet the following requirements:

- Places of confinement shall be separated from other parts of the building by fire partitions having a minimum 1-hour fire resistance rating. The fire-resistive enclosure shall also include all areas within the secure prisoner movement system.
- Sprinklers shall be installed within all places of confinement, including, but not limited to, prisoner holding cells, the main prisoner detention cell block, prisoner attorney interview rooms, etc.
- The sprinklers installed shall be institutional quick response flush pendent sprinklers designed for standard and extended coverage applications.
- The institutional sprinklers shall have a solder-link type fusible element, a tamper-resistant escutcheon, and a retaining flange that prevents sprinkler movement away from walls and ceilings.

Atriums

General. Atriums shall be designed in accordance with the requirements in the IBC.

Special Requirements. The following requirements take precedence over the requirements in the IBC:

- The atrium sprinkler system shall be designed as a separate sprinkler zone. In addition, a separate manual isolation valve and a separate water flow switch shall be located in an accessible location. A tamper switch shall be provided on all such valves.
- Atrium smoke removal systems shall be designed and installed in accordance with the requirements in the IBC.

Track Files

General. A track file uses a single aisle to give access to an otherwise solid group of open-shelf files. Access is gained by moving shelf units on rollers along a track until the proper unit is exposed.

Special Requirements. Track files shall meet the following requirements:

- The track file system shall be constructed entirely of steel. At least 1.4 mm (18-gauge) sheet metal shall be used for all parts of the shelving unit.
- The system shall be no more than 2438 mm (8 feet) high, and a minimum clearance of 457 mm (18 inches) shall be maintained between the top of the shelving and the ceiling.
- The sprinkler density shall be 12.2 (L/min)/m² (0.3 gpm/sq. ft.) over 139 m² (1500 sq. ft.). Sprinkler spacing shall be 9.3 m² (100 sq. ft.) maximum.
- The back cover of stationary end files shall be solid sheet metal.
- For floor loading requirements see PBS-P100, Chapter 4.

Cooling Towers

General. Cooling towers shall meet the requirements in NFPA 214.

Special Requirements. The following requirements take precedence over the requirements in NFPA 214:

- Cooling towers over 57 cubic meters (2000 cubic feet) in size, having combustible fill shall be provided with an automatic deluge sprinkler system.
- Automatic sprinkler protection shall not be required in cooling towers over 57 cubic meters (2000 cubic feet) in size, constructed of non-combustible materials, having non-combustible components (including piping) and non-combustible decks.
- Automatic sprinkler protection is required for cooling towers which are constructed of combustible materials, have combustible components (such as PVC fill, louvers, drift eliminators, etc.), or a combustible deck.

Residential Housing Units

General. Residential housing units shall meet the requirements in the International Residential Code (IRC).

Special Requirements. The following requirements take precedence over the requirements in the IRC:

- Stairways in residential housing units shall have a maximum riser height of 178 mm (7 inches) and a minimum tread depth of 279 mm (11 inches).
- Residential housing units are required to be protected by an automatic fire sprinkler system. The design of the automatic fire sprinkler system for the residential housing shall be based on the design and installation requirements in NFPA 13D. Each residential housing unit shall be provided with a local waterflow switch that will initiate

a local alarm. The sprinkler waterflow alarm shall be arranged so that the operation of the waterflow switch shall produce an alarm signal that is audible throughout all inhabited areas of the individual housing unit. The sprinkler system waterflow switch and control valve shall be monitored for alarm, supervisory, and trouble conditions.

- Residential housing units shall be provided with approved multiple-station smoke alarms in the following locations: (a) in all sleeping rooms, (b) outside of each separate sleeping area, in the immediate vicinity of the sleeping rooms, and (c) on each level of the dwelling unit, including basements. All smoke alarms shall be designed and installed in accordance with the requirements in the NFPA 72. All smoke alarms within the residential housing unit shall be interconnected in such a manner that the activation of any single smoke alarm will activate all the smoke alarms within the individual residential housing unit, and produce an alarm signal that is audible throughout all inhabited areas of the individual residential housing unit. Manual fire alarm stations shall not be installed in the residential housing unit.

Chemical Laboratories

General. Laboratories shall meet the design requirements in NFPA 45 and the IBC.

Special Requirements. The following requirements take precedence over the requirements in NFPA 45:

- Laboratories handling or storing hazardous chemicals, flammable gases, flammable liquids, explosives, and biological laboratories shall not be expanded in existing office buildings.
- All chemical laboratories shall be sprinklered, regardless of size. Sprinkler protection shall be calculated to provide a density of 0.15 gpm per sq. ft. over a 3,000 sq. ft. area.

U.S. Court Facilities

For special fire protection and life safety requirements for U.S. Courts facilities, refer to PBS-P100 Chapter 9 and the *U.S. Courts Design Guide*.

U.S. Marshal Service

For special fire protection and life safety requirements for U.S. Marshal Service space, refer to the *USMS Requirements and Specifications for Special Purpose and Support Space; Volumes I, II, and III*.

Land Port of Entry Facilities

For special fire protection and life safety requirements for Land Port of Entry Facilities, refer to the *Land Port of Entry Design Guide*.

Child Care Centers

For special fire protection and life safety requirements for Child Care Centers, refer to the GSA *Child Care Center Design Guide* (PBS-P140).



Child Care Center

7.17 Emergency Power, Lighting and Exit Signage

Emergency and Standby Power Systems. Emergency and standby power shall meet the performance requirements in NFPA 70, NFPA 110, and NFPA 111.

Emergency Lighting. Emergency lighting shall meet the performance requirements in NFPA 101.

Exit Signage. Exit signage shall be installed and meet the performance requirements in NFPA 101.

7.18 Historic Structures

For an overall fire protection plan and to emphasize the Design Team's responsibility to address fire protection and to preserve the historic integrity of historic structures, the Design Team shall explore alternative approaches outlined in state rehabilitation codes, International Existing Building Code (IEBC), and performance based codes to resolve conflicts between prescriptive code requirements and preservation goals. In addition, the requirements and recommendations of NFPA 914 shall be considered for rehabilitation projects in historic structures. The Design Team shall also evaluate the HUD Guideline Fire Ratings of Archaic Materials and Assemblies that provides test data on the fire resistance of a variety of historic materials and GSA publication titled *Fire Safety Retrofitting in Historic Buildings*.

GSA's regional fire protection engineer serves as the AHJ, who must exercise professional judgment to assess the acceptability of alternative compliance solutions. Early and frequent coordination between the architects, State Historic Preservation Officer, Regional Historic Preservation Officer, preservation specialists, external review groups, and the Design Team's fire protection engineer is imperative to timely resolution of conflicts between fire safety and preservation goals.

Fire Protection Alternatives for Consideration. Listed below are fire protection alternatives for the Design Team's fire protection engineer to consider when designing a project:

- New stair enclosures in historic buildings should be designed to minimize visual impact on significant spaces, including historic lobbies and corridors. Cross corridor doors should be designed to provide maximum height and width clearance and avoid visually truncating the corridor. Oversized hold-open doors will achieve this end in most circumstances. For more ornamental spaces, accordion rated doors may be used. Transparent treatments, such

as rated glass assemblies or historic doors modified to incorporate rated glass should be considered when barriers must be kept closed to maintain a rated enclosure. Non-prescriptive compliance solutions, such as modification of historic door assemblies, must be approved by GSA's regional fire protection engineer.

- New fire-rated doors in preservation zones should be designed to resemble historic doors in panel detailing and finish. True-paneled fire doors are preferred for replacement of original paneled stair or corridor doors.
- In historically significant spaces, sprinklers should be carefully placed to minimize damage to ornamental materials. Develop detailed drawings for architecturally sensitive areas, showing precise sprinkler locations and finishing notes as necessary to ensure proper installation. Sprinklers should be centered and placed symmetrically in relation to ornamental patterns and architectural features defining the space, such as arched openings.
- Sprinklers and escutcheons should match original architectural surfaces or hardware. Oxidized brass or bronze heads are recommended for use in deeply colored (unpainted) woodwork. In elaborately decorated ceilings, heads should be camouflaged by custom coating and omitting escutcheon plates. In such cases, low profile, quick response sprinklers are preferred.
- In historically significant spaces, smoke detectors should be placed to minimize destruction of ornamental surfaces. Where ceilings are elaborately embellished, explore alternative detection products and approaches such as air sampling detection, projected beam, low profile spot detectors, recessed installation, or custom-coating detector housings to blend with ornamental finishes. Application of special finish treatments outside of the standard factory process must be coordinated with, and approved in writing by, the manufacturer to ensure that UL labels and detector performance are not compromised. Smoke detector housings must be removed prior to application of special finishes.