

MODULE

14

FIRE PROTECTION & LIFE SAFETY



DESIGN STANDARDS



English

June 2014

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Supersedes previous editions

Vertical line in page margin indicates revised text or change.

Module Organization

- This Module is a part of an integrated series of 17 Modules.
- Coordination with information from other Modules is required.
- The reference symbol <XX> is used to indicate a Module reference that includes related information.

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Fire Protection & Life Safety

14.1 General Requirements

A. Application:

1. Marriott International (MI) Fire Protection and Life Safety (FLS) Design Standards govern MI owned, managed and franchised Brand properties.
2. The FLS Design Standards include design standards, performance criteria, reference standards and life safety process verification that define a comprehensive fire protection program. Coordinate requirements with other Modules and in particular <10>, <12> and <15>.
3. Application of these Standards to a specific project requires a design analysis. For example, a project's qualification as either a low-rise or high-rise building will significantly affect the elements of a project's fire protection and life safety program.
4. When a MI property is integrated with or interconnected with another building, the building shall provide protection equal to the fire protection and life safety standards required for the MI property, as defined by FLS on a case-by-case evaluation.

B. Systems: Provide the following functional systems in compliance with the listed performance criteria:

- Automatic Sprinkler / Standpipe System
- Fire Alarm System
- Mechanical Smoke Control
- Type 1 - Grease Hood & Duct Fire Suppression
- Emergency Electric Systems
- Elevator Recall & Firefighters' Operation
- Central Control Station (Fire Command Room)
- Means of Egress & Facility Requirements

14.2 Definitions

- A. **Low-Rise Building:** A building that does not qualify as a High-Rise Building as defined below. (C)
- B. **High-Rise Building:** A building where the floor of an occupiable story is greater than 23 m (75 ft.) above the lowest level of fire department access.
- C. **Back-of-House (BOH):** Includes areas such as employee spaces, employee restrooms, laundry, offices, work areas, commercial kitchens, storage areas, shops, etc.
- D. **Guestroom:** The term “guestroom” includes suites, residences, serviced apartments, interval ownership, etc.

14.3 Codes, References & Standards

- A. **Application:** Current edition of associated references are the basis for FLS Design Standards and are applicable to all MI managed, owned and franchised properties.
- B. **National Fire Protection Association (NFPA) Standards:** The Life Safety Code - NFPA 101 is the basis for FLS Design Standards. Compliance with NFPA 101 is required in addition to the codes required by the governing authority. Comply with the following:

NFPA 101	Life Safety Code (except Chapter 43 and “horizontal exits” are not permitted)
NFPA 13	Standards for the Installation of Sprinkler Systems
NFPA 14	Standpipe Systems
NFPA 17A	Wet Chemical Extinguishing Systems
NFPA 20	Centrifugal Fire Pumps
NFPA 24	Private Fire Service Mains
NFPA 30	Flammable and Combustible Liquids Code
NFPA 70	National Electric Code
NFPA 72	National Fire Alarm Code
NFPA 80	Fire Doors and Fire Windows
NFPA 82	Incinerators, Waste and Linen Handling Systems and Equipment
NFPA 88A	Parking Structures
NFPA 90A	Installation of Air-Conditioning and Ventilation Systems
NFPA 92	Smoke Control Systems
NFPA 96	Ventilation and Fire Protection of Commercial Cooking Operations
NFPA 110	Emergency and Standby Power Systems
NFPA 750	Standard on Water Mist Fire Protection Systems
NFPA 1142	Water Supplies for Suburban and Rural Fire Fighting

- E. **Elevator & Escalator Safety Code:** Current ASME A17.1 edition and supplements.

- F. Underwriters Laboratories (UL) Listing:** Provide UL listed materials, appliances and equipment.
- G. Governing Regulations:** Comply with governing laws, codes, regulations and MI Design Standards, including MI requirements that exceed or are more stringent than governing laws, codes and regulations. If governing requirements conflict with MI's Design Standards, contact FLS for resolution.
- H. Tents & Temporary Structures:** Comply with MI's policy titled "Tents and Temporary Structures" as published on the Marriott Global Source.

14.4 Systems Testing

- A. Application:** Before a property is occupied, the fire protection and life safety systems shall be fully operational, contractor tested and acceptance obtained from FLS.
In order to obtain MI's acceptance, the fire protection and life safety systems shall be operated by the contractor under simulated emergency conditions in the presence of FLS personnel and the contractor shall demonstrate compliance with MI's Standards.
- B. Automatic Sprinkler, Water Mist & Standpipe System (Section 14.6):**
 - 1. Contractor shall flush and pressure test system.
 - 2. Contractor shall demonstrate compliance by testing water flow and tamper switches.
 - 3. Fire pump shall be tested and certified by the manufacturer.
 - 4. Underground mains flushed and tested.
- C. Fire Alarm (Section 14.7):**
 - 1. Contractor shall pretest and operate system without trouble lights exhibited.
 - 2. Contractor shall demonstrate compliance by testing all devices and appliances, auxiliary functions, initiating alarms, and verifying that proper point address and supervision appear on alarm panel.
- D. Mechanical Smoke Control (Section 14.8):**
 - 1. Balance Report: Prior to testing smoke control systems, HVAC systems shall be contractor tested and balanced. Test and balance report shall be available.
 - 2. Smoke Exhaust: Public area, atrium and guestroom corridor smoke exhaust systems shall be operational and tested to clear "cold smoke" so that exit signs are visible within 10 minutes of activation without smoke migration to other areas.

3. Stair Pressurization: Test and operate the system, concurrently with the smoke exhaust system, to confirm design pressures and door opening force.
- E. Type 1 - Grease Hood & Duct Fire Suppression (Section 14.9):**
1. Contractor shall pretest all coordinated components by activation of hood and duct suppression system control unit.
 2. Contractor shall demonstrate compliance by operating initiating devices, activating coordinated alarms, gas, electric and hood supply air fan shut off.
- F. Emergency Electrical Systems (Section 14.10):**
1. Generator shall be operational and tested to automatically activate upon loss of normal incoming power and to provide standby and emergency service to operate emergency lighting and specified systems.
 2. Battery standby power and UPS systems providing emergency power and lighting shall be fully operational.
- G. Elevator Recall & Firefighters' Operation (Section 14.11):** Elevator Phase 1 Designated Level and Alternate Level Recall and Phase 2 Firefighters' In-Car Operation Features shall be fully tested in compliance with ASME A17.1.
- H. Central Control Station (Fire Command Room) (Section 14.12):** Panels, indicators, controls and systems shall be operational, tested and accepted.
- I. Means of Egress (Section 14.13):** Facilities for means of egress shall be operational and unobstructed.

14.5 Submittals

- A. Submittal Requirements:** Prior to system installation or modification, submit one hard-copy of drawings, accompanying materials and documentation of the following for review and acceptance to:
1. Marriott Fire Protection & Life Safety:
 - a. Drawings Scale: Not less than the following:
 - International Projects: 1:100 scale.
 - Domestic (U.S. / Canada): 1/8 inch = 1 ft. scale.
 - b. Floor Plans: Show floor areas (m² or sq. ft.) and rooms exiting, exit capacity, occupant load diagrams, door hardware and fire resistance ratings.
 - c. Fire Alarm: System diagrams, shop drawings, equipment product sheets, voltage drop and battery calculations and sequence of operation matrix.
 - d. Automatic Sprinkler & Standpipe: System shop drawings, hydraulic calculations, and equipment product sheets, fire pump test curve, and controller and transfer switch equipment sheet.
 - e. Type 1 Grease Hood & Duct Fire Suppression: **<10>** Equipment product sheets and drawings (plan and side views) indicating cooking equipment, hood and suppression system.
 - f. Emergency Power: Plans for emergency lighting and exit signs, and information on the emergency power provided.
 - g. Smoke Control: System shop drawings, sequence of operations, riser diagrams and calculations (space volumes, air changes, make-up and exhaust air flow rates, fan and equipment flow capacities, name and locations).
 2. Zurich Services Corporation - MI Managed Properties Only:
 - a. Automatic Sprinkler & Standpipe: System shop drawings, hydraulic calculations and equipment product sheets.
 - b. Construction Drawings: Set of construction (contract) drawings.
- B. Mailing Addresses:**
1. Marriott International, Inc.; Marriott Fire Protection & Life Safety, Dept. 52/924.36; 10400 Fernwood Road; Bethesda, MD 20817
 2. Zurich Services Corporation, Mr. Dale Seemans, 611 Nemours Ln., Woods of Louviers, Newark, DE 19711.

14.6 Automatic Sprinkler, Water Mist & Standpipe System

- A. System Application:** Provide MI properties with a complete hydraulically designed combination, automatic sprinkler and Type 1 standpipe system or *HI-FOG* water mist system or *Minimax Minifog EconAqua* and Type 1 standpipe system, zoned by floor.
1. Building Footprint: Sprinkler building areas within building “footprint”, including canopies required by NFPA 13.
 2. Parking Structures: Provide sprinkler protection, unless greater than 50% of perimeter is open to exterior air and not under any portion of the building.
 3. Ballrooms & Exhibit Halls: Design the sprinkler system in compliance with Ordinary Hazard Group 1.
 4. Ancillary Buildings: Provide sprinkler protection for ancillary buildings that are occupied, have a significant content value or have a significant impact on business interruption if damaged as determined by FLS review. Examples include:
 - Golf Clubhouse
 - Golf Maintenance Building
 - Golf Car Storage Building
 - Occupied thatched roof buildings
 - Pool buildings with lockers or F&BSmall structures (less than 9.3 m² (100 sq. ft.)) located more than 9 m (30 ft.) from other buildings do not require sprinkler protection. Examples include:
 - Gazebos
 - Golf Comfort Stations
 - Golf Weather Protection Stations
 - Beach Shade Structures
 5. Utility Spaces: Provide complete sprinkler protection in electrical, mechanical, telephone and computer rooms.
 6. Loading Docks and Truck Bays: Provide sprinkler protection. If subject to freezing, provide dry pipe system.
 7. Freezer & Cooler Boxes: Protect with dry type sprinklers supplied from area wet pipe sprinkler system.
 8. Guestroom Closets & Pantries: Sprinklers are not required in clothes closets, linen closets and pantries within hotel guestrooms where the area does not exceed 2.2 m² (24 sq. ft.) and where the least dimension does not exceed 0.9 m (3 ft.) or within Residences where the area does not exceed 1.1 m² (12 sq. ft.). Closets and pantries with washer, dryer, water heater, mechanical or electrical equipment require sprinklers.

9. Guestroom & Residence Bathrooms: Sprinklers are not required if bathroom is less than 5.10 m² (55 sq. ft.). Regardless of bathroom area, sprinklers are required when combustible tubs, or shower and tub surrounds (plastic / fiberglass) enclosures are provided.
10. Coastal Areas: If the project is within 16 km (10 miles) of the coastline, provide exterior galvanized pipe and fittings with corrosion resistant sprinklers for wet pipe and dry pipe sprinkler systems in exterior unconditioned spaces.

B. Design Requirements:

1. Standards: NFPA 13 (not NFPA 13R), 14, 1142 and 20.
2. Water Source: Perform flow tests and document. Provide dependable source of water quantity and pressure from municipal water main or from on site cistern or tanks if municipal water is not available.
3. Safety Factor: Provide a 10% hydraulic safety factor up to a maximum of 0.7 bar (10 psi) for automatic sprinkler system and water mist system.
4. Pressure Reducing Valves:
 - a. In order to minimize adjustment and maintenance, design system within maximum pressure of 12 bar (175 psi) without use of pressure reducing valves. If pressure reducing valves are necessary, obtain acceptance and specific design requirements from FLS.
 - b. Pressure reducing valves shall be pressure reducing not flow restricting. Static and residual pressures shall not exceed 12 bar (175 psi).
5. Control Valves: Provide the following:
 - a. Supervisory Signal Initiating Device (tamper switch): Provide for each control valve.
 - b. Security: Secure valves in the open position with the applicable methods in the following areas:
 - Public Areas: Within public view or access, secure with chains or wire cables and provide keyed-alike locks.
 - Back of House: Behind locked doors or access panels, under control of the building engineer, secure with plastic or wire seals.
 - c. Access: Visible and readily accessible in back-of-house area or stairwell.
6. Check Valves: Provide check valves at floor control valves as required to eliminate false activation of sprinkler waterflow alarms on other floors.

7. Water Flow Switches: Provide retardant type. Initiate alarm signal between 30 and 60 seconds.
 8. CPVC Pipe & Fittings: If provided, install in compliance with manufacturer's specifications. Use chemically compatible materials that contact pipes and fittings.
 9. Water Reservoir:
 - a. Where fire protection and domestic water systems share a common water reservoir (tank, cistern, etc.), locate the domestic water connection at the reservoir above the water level reserved for the fire system to avoid depleting the fire system by domestic use.
 - b. Meet requirements for NFPA 22 Water Tank installation and monitoring by the fire alarm control panel (FACP).
 10. Fire Pumps: Locate fire pump drivers, fire pumps, fire pump controllers and fire pump power supplies (normal and standby) above the 100 year flood elevation and above the maximum anticipated hurricane storm surge elevations. Comply with NFPA 20 for design and installation.
 11. Zoning: Zone each floor / story separately at a minimum. See section 14.15 for example diagrams.
 - a. Low-Rise Buildings: Provide each zone with a control valve, flow switch and tamper switch monitored by the fire alarm system.
 - b. High-Rise Buildings: Connect guestroom and residential zone sprinkler piping to 2 risers at each floor interconnected with a control valve, check valve, flow switch and tamper switch at each riser.
 - c. Attic Spaces: Provide dedicated zone for attic spaces, separate from floor below.
 12. Microbiologically Influenced Corrosion (MIC): Refer to NFPA 13 for requirements.
- C. **Wet Pipe Sprinkler Systems:** Provide for habitable spaces such as guestrooms, guestroom corridors, restaurants, ballrooms, meeting rooms, public and back-of-house areas. Route wet pipes in heated spaces.
1. Heat tape and insulation is not considered "freeze protected" and is not acceptable.
 2. Antifreeze (liquid) systems are not permitted.
- D. **Dry Pipe Sprinkler Systems:** Provide in attic and unheated areas to avoid the possibility of freezing.
1. Dry type sprinklers supplied from the wet pipe sprinkler system may be provided in small unheated areas.
 2. Antifreeze (liquid) systems are not permitted.

3. Use steel schedule 40 pipe. Include grooved fittings with cut grooves with sealing type gaskets. Install piping with a pitch, including heated areas.
 4. Design for dry valve trip test that provides water to the remote inspector test and drain assembly within 60 seconds after activation of inspector's test valve.
 5. Provide system with valve, trim, tank mounted compressor with a secured switch, control and test valves, gauges, pressure and high / low air pressure switches and appropriate drains.
- E. Inspector's Test & Drain Assembly:** See section 14.15 for example diagrams.
1. Drain Pipe: Provide continuous hard pipe (steel or CPVC) to exterior at ground level in a location where discharge will not damage exterior pavement or landscaping.
 2. Access: Visible and readily accessible in back-of-house area or stairwell.
 3. Location: Do not locate in finished areas (guestroom, guest corridor, etc.).
 4. Low Rise Buildings: Locate at farthest (remote) end of zone (not in guestrooms) with continuous hard pipe drain to exterior.
Sprinkler zones with dead end mains or more than one remote end, provide inspector's tests and drains at each dead end main and remote end.
 5. High Rise Buildings:
 - a. Guestroom & Residential Floors: Locate at each riser (interconnected system), continuous hard pipe drain to exterior.
 - b. Non-guestroom Floors: With one control valve, locate at remote end of zone, continuous hard pipe drain to exterior.
 - c. Sprinkler zones with dead end mains or more than one remote end, provide inspector's tests and drain assembly at each dead end main and remote end.

- F. Sprinklers:** Fast response / quick response 57° to 77° C (135° to 170° F) throughout guest and public areas. Concealed (cover plate) sprinklers are not permitted. Regardless of sprinkler type or listing, provide 0.10 gpm / sq. ft. minimum discharge density for light hazard areas. Exceptions where listed for a particular application are as follows:

Room / Space	Sprinkler Type	Temp. Rating
Attic Systems	Quick Response - ventilated	100° C (212° F)
	Quick Response - unventilated	141° C (286° F)
Dry Pipe Systems	Quick Response - ventilated (unoccupied spaces)	100° C (212° F)
	Quick Response - unventilated	141° C (286° F)
Mechanical / Electrical	Quick Response	68° to 77° C (155° to 170° F)
Balcony (combustible)	Quick Response - corrosion resistant, dry, side wall	100° C (212° F)
Porches	Quick Response - corrosion resistant, dry, side wall	100° C (212° F)
Parking Structures	Quick Response	68° to 77° C (155° to 170° F)
Elevator Machinery	Quick Response	100° C (212° F)
Swimming Pools (indoor)	Quick Response - corrosion resistant	68° to 77° C (155° to 170° F)
Sauna / Steam Rooms Laundry Dryer Plenum	Quick Response - corrosion resistant	141° C (286° F)
Walk-in Coolers / Freezers	Quick Response - dry pendant	74° C (165° F)
Commercial Kitchens	Quick Response	79° to 107° C (175° to 225° F)
Storage	Quick Response	68° to 77° C (155° to 170° F)

G. Sprinkler Coordination:

1. Install sprinklers with the manufacturer’s minimum allowable projection from the wall or ceiling.
2. Coordinate locations of sprinklers at guestrooms and public areas to avoid location conflicts (such as crown moldings, HVAC grilles, ceiling fans).
3. In corridor ceilings, generally, position sprinklers along centerline of corridor width.
4. In ceilings with acoustical tiles, position sprinklers in center of tiles.

14.7 Fire Alarm System

- A. Requirements:** Provide entire building with a central fire alarm system from MI's qualified equipment vendors. See section 14.16 for the Fire Alarm System Sequence Matrix. Coordinate with <15>.
1. Standard: NFPA 72.
 2. System: Provide a fully point addressable intelligent system (all alarm initiating and supervisory devices individually addressable) in all buildings.
 3. Supervising Station Service: Provide a remote supervising station service for Marriott properties that receives and records operation signals of the circuits and devices, and notifies the local fire department when a general alarm is activated.
 4. Campus Style Sites: Provide point addressable intelligent networking that reports to the continuously attended property location.
 5. Testing: Provide the following at the Fire Alarm Control Panel (FACP) for MI Managed Properties Only.
 - a. Individual disconnect buttons for testing purposes:
 - Audible appliances and visual strobes (sounder base and guestroom hearing impaired strobe shall function upon guestroom smoke sensor activation)
 - Door hold open mechanisms
 - Elevator recall
 - Air handlers
 - b. Alarm sensitivity testing capability at FACP.
 6. Exterior & Unconditioned Areas: Within 16 km (10 miles) of a coastline, provide NEMA weatherproof box, rated devices and appliances (weatherproof, corrosion resistant) listed for exterior exposure.
- B. System Smoke Sensors (Detectors):**
1. Guestrooms, Suite Rooms and other Sleeping Units: Provide 24 Volt system smoke sensors with sounder bases to meet the following:
 - a. Photoelectric type sensor.
 - b. Sounder Base: Provide minimum audible alarm of 85 dBA at 3 m (10 ft.); minimum of 75 dBA "at the pillow".
 - c. Activation of room system smoke sensor to immediately and automatically sound an alarm (three pulse temporal pattern) within the room of incident and annunciate as a supervisory signal.
 - d. System smoke sensor normal and emergency power is provided by the FACP.

- e. In suites and other mixed sleeping spaces, provide the following:
 - System smoke sensors in each separate sleeping room, living rooms convertible to sleeping and areas providing access to the corridor doorway.
 - Simultaneously activate multiple smoke sensor sounder bases located within the same suite or unit.
 - f. To minimize unwanted alarms, avoid locating smoke sensors near the kitchen or bathrooms.
 - g. Locate smoke sensors at the highest ceiling area in the room.
2. Public Areas, Corridor & BOH Areas: Provide system smoke sensors where:
 - a. Required by governing code.
 - b. Smoke exhaust is required in compliance with the other requirements of this Module.
 - c. In assembly areas in high rise buildings.
 3. Duct System Smoke Sensors:
 - a. Provide remote test switch and indicator light accessible from floor level.
 - b. Location: Provide downstream of air handling units over 945 l/s (2,000 cfm).
 - c. Operation: Smoke sensor shuts down AHU upon sensing smoke and annunciates at fire alarm panel, but does not activate smoke exhaust system.
- C. Carbon Monoxide (CO) Detectors:** Install CO detectors with sounders. Connect to the FACP and annunciate as a supervisory signal.
1. General: Provide in rooms and areas containing fuel burning appliances and equipment.
 2. Fireplaces: Provide detector in areas containing fuel burning (including wood) fireplaces.
- D. Manual Pull Stations:** At Reception Desk only, unless required in other locations by applicable codes.
- E. Firefighter Communication Systems:** Comply with governing code requirements.
- F. Alarm Notification Appliances:** Provide audible notification appliances (speakers, mini-horns, horns, or sounder bases of system smoke sensors listed for general and local evacuation) and visual notification strobe lights in locations according to the following:
1. Guestroom, Suite Rooms & other Sleeping Units: Provide audible appliances in each sleeping room. In properties with separate multiple sleeping spaces, such as suites and apartments, provide in each sleeping room.

2. Hearing Accessible Designated Guestrooms, Suites, or Residential Units: Provide audible alarm appliances and visual alarm strobes.
 - a. Arrange strobes to flash in each room or area, within direct line of sight from bed pillows, and bathroom when the following occurs:
 - System smoke sensors and (CO) detectors in rooms or units activate.
 - Building fire alarm notification alarms activate.
 - b. Strobe Light Rating:
 - 177 candela - within 61 cm (24 inch) from the ceiling.
 - 110 candela - more than 61 cm (24 inch) from the ceiling.
 3. Public Areas, Corridors & BOH: Provide audible and visual notification appliances.
- G. Emergency Occupant Notification:**
1. Low-Rise Buildings: Automatic alert tone (three pulse temporal pattern).
 2. Assembly Spaces Over 300 Occupants: Continuous cycle alert tone and automatic prerecorded voice message with manual voice communication override.
 3. High-Rise Buildings: Continuous cycle alert tone and automatic prerecorded voice message with manual voice communication override.
- H. Annunciator:** Provide point address to indicate floor, specific location, device and type of alarm. Provide annunciators in areas monitored 24 hours by property employees (Security, AYS, PABX room, Reception Desk) in locations acceptable to Marriott and governing authority.
- I. Door Hold Open Mechanism:** Automatically release doors in affected zone when an alarm is activated. See “Means of Egress” section in this Module.

14.8 Mechanical Smoke Control Systems

- A. Application:** Provide an engineered mechanical smoke control system including public area smoke exhaust and stair pressurization for egress stairs. Coordinate smoke control system requirements with Module <15>.
- B. Systems & Locations:** Design for the following mechanical smoke control systems:
- Smoke exhaust - public areas exit access
 - Smoke exhaust - guestroom corridors
 - Pressurization - egress stairs (including transfer enclosures)
- C. Standards:** NFPA 92
- D. Building Configuration:**
1. High-Rise Buildings: Mechanical smoke control is required.
 2. Atrium: Consult FLS for atrium smoke control requirements.
- E. Acceptance:** Obtain FLS acceptance for entire smoke control systems design, sequences of operation and air quantities.
- F. Smoke Exhaust System Configurations:**
1. Zones: Each space is treated as an individual fire / smoke zone.
 2. Capacity: In spaces requiring smoke exhaust, provide a minimum of 10 to 12 air changes per hour.
 - a. In larger spaces such as atriums and exhibit halls, increase the air change rates.
 - b. Consult with FLS on project specific criteria.
 - c. Calculate zone volumes using slab to slab heights.
 3. Makeup Air: Provide makeup air for each smoke exhaust zone. Provide mechanical supply air no less than 70% of exhaust rate.
 4. Ducted System: Provide hard ducted smoke exhaust from each smoke zone. Return air plenums and slot diffusers are not permitted for smoke exhaust systems.
 5. Dampers: Provide motor operated, low leakage, automatic reset, dampers for smoke exhaust systems. Manual reset dampers are not allowed.
 6. Configuration: Separate supply grill from exhaust grill to promote sweeping of the smoke. Locate supply adjacent to exits so smoke is moving against the direction of egress. Provide adequate make-up air and exhaust points to eliminate dead spots and prevent excessive air velocities.

- G. Public Areas Exit Access:** Provide hard ducted, mechanical smoke exhaust from each smoke zone in lobby, atriums, pre-function areas, corridors and other exit access in the front-of-house.
1. Sequence of Operation - Public Areas:
 - a. Signal: The smoke exhaust system is initiated automatically by a signal from the fire alarm panel when an area smoke sensor is activated.
 - b. Smoke Exhaust Fan: Discharge damper fully opens. The fan starts and provides 100% exhaust to exterior.
 - c. HVAC System - Confined Areas: In zones where makeup air is not readily available (ballroom, meeting room, etc.), the return damper of the HVAC system serving the smoke zone closes and the supply fan reduces to 50% outside air.
 - d. Other Zones: Supply, return and exhaust fans for HVAC systems in other zones remain in normal operating mode.
- H. Guestroom Corridors:** Centrally locate on each floor a dedicated mechanical smoke exhaust riser with normally closed smoke dampers on each floor.
1. Capacity: Size each roof mounted smoke exhaust fan to serve corridors of one floor.
 2. Distance: 30 m (100 ft.) maximum horizontal distance between supply grilles and exhaust grilles.
 3. Zones: If smoke doors divide corridor into two or more sections, provide independent exhaust inlet in each section.
 4. Sequence of Operation - Guestroom Corridors:
 - a. Activate automatically by area smoke sensors and by floor water flow switches (independent of each other).
 - b. Upon activation, normally closed smoke exhaust damper on floor of incidence opens and dampers are closed on remaining non-incidence floors.
 - c. Discharge damper fully opens and the smoke exhaust fan starts.
 - d. Guest corridor and guestroom DOAS (Dedicated Outside Air System) continues to operate in normal mode.
 - e. If applicable, secondary guest corridor pressurization fans start (sized for a minimum capacity of 6 air changes per hour supply air to each floor) and guest corridor and guestroom DOAS is turned off.
 - f. Guest Room Floors: Exhaust fans, including those serving vending rooms and electrical rooms and guestroom bathrooms, continue to operate in normal mode.

- I. **Stair Pressurization / Smoke-proof Enclosure:** Maintain a smoke free stair through one of the following in compliance with NFPA 101.
 1. Natural Ventilation:
 - a. Open stairwells
 - b. Open balcony or vestibule
 2. Mechanical Vestibule Ventilation: Ventilate vestibule with not less than one air change per minute and provide exhaust at 150% of the supply.
 3. Mechanical Pressurization:
 - a. System Configurations: The following are approximate stair enclosure heights and typical design arrangements for fans and ducts:
 - 10 Stories: Single induction point
 - 10 to 20 Stories: One fan at top and one at bottom
 - 20 or More Stories: One or more supply fans ducted through stair with supply registers located every third floor.
 - b. Fan:
 - Type: Provide fan with variable frequency drive. Determine a single set point during commissioning with all doors closed.
 - Capacity: Size fans to provide a balanced 1,700 m³ / hour (1,000 cfm) per door.
 - Supply Damper: Motor operated, low leakage
 - c. Design Pressure: Provide pressure differential across doors of not less than 2.5 N m² (0.05 inch w.c.).
 4. Other Criteria:
 - a. Doors: 13.50 kg (30 lbs.) maximum opening force across doors into egress stairs.
 - b. Sequence of Operation:
 - Initiation: System is automatically initiated by a signal from the fire alarm panel due to activation of either a public space (excluding guestrooms) smoke sensor or sprinkler flow switch.
 - Dedicated Smoke Sensor: In areas without full area smoke detection, provide smoke sensor within 3 m (10 ft.) of stair enclosure exit doors to activate system.
 - Supply Damper: Upon activation, supply damper fully opens and stairwell pressurization fans start.
- J. **Back-of-House Areas:** Provide smoke control only where required by governing authorities having jurisdiction.

- K. Smoke Control Panel:** Provide a smoke control panel for manual control of equipment that is part of the smoke control system with Hand-Off-Automatic (HOA) and pilot lights (one switch and lights for each zone).
 - 1. Location: Position the smoke control panel at the location of the main fire alarm panel.
 - 2. Power: Provide internal power source for manual operation of all equipment. Provide voltage same as fire alarm system.
 - 3. 'Hand' Position: Manually activates all equipment into smoke control mode.
 - 4. 'Off' Position: Shuts down the equipment and returns all dampers to their normal mode.
 - 5. 'Automatic' Position: Allows system to operate in normal building mode, or in smoke control mode upon receipt of a signal from the fire alarm panel.
- L. Fire Alarm Matrix:** See "Fire Alarm System Sequence Matrix" at end of this Module for sequence of operation.

14.9 Type 1 - Grease Hood & Duct Fire Suppression

- A. Application:** Provide fire suppression system for hoods and ducts at food production cooking locations that produce grease laden vapors. Coordinate fire suppression system function and design with Modules <10>, <15B> and <15C>.
 - 1. Suppression System: Provide Ansul "Piranha" or "CaptiveAire Core" dual agent suppression system.
- B. Sequence of Operation:** The hood and duct fire suppression system control units initiate the following:
 - 1. Alarm Signal: Send fire alarm signal to FACP.
 - 2. Gas: Automatically activate solenoid to turn off gas to affected cooking lines.
 - 3. Power: Automatically turn off power to cooking appliances, lighting and hood makeup air handler, except exhaust fan continues to operate.

14.10 Emergency Electrical Systems <15>

- A. Standards:** NFPA 110, NFPA 70 (NEC), NFPA 101
- B. System Requirements:** Provide standby power for emergency power and lighting in the event of loss of normal incoming electrical service.
- Transfer from one power source to another must take no longer than 10 seconds.
 - See Module <15> for backup operational power loads to maintain property operations.
- C. Emergency Lighting:** Provide emergency lighting for code required egress, property operations and safety, as follows:
- Exit signs
 - Egress paths and stairs
 - Exterior exit door discharge
 - Meeting Rooms, Ballrooms, Exhibit Halls
 - Restaurants, Lounges
 - Public stairs and steps
 - Telephone Equipment Room
 - Mechanical, electrical and elevator rooms
 - Public toilets
 - Fire Pump / Sprinkler Riser Room
 - Kitchens (commercial F&B preparation areas)
 - Laundry
 - Reception Desk
 - Employee Cafeteria / Breakroom
 - Employees lockers and toilets
 - Fitness Center
 - Engineering / Maintenance Office
 - Administrative Office area
 - PABX & AYS Room
 - Security Office
 - Parking Structure
 - Indoor Pool room
 - Spa Treatment Rooms
 - Fire Command Room (high-rise building)

14.11 Elevator Recall & Firefighters' Operation <12>

- A. ASME A17.1:** Provide Elevator Phase 1 Designated Level and Alternate Level Recall, Shunt Trip and Phase 2 Firefighters' In-Car Operations in compliance with ASME A17.1; see Module <12>.

14.12 Central Control Station (Fire Command Room)

- A. High-Rise Buildings:** Provide at a location acceptable to the governing authority. <15>

14.13 Means of Egress

- A. Standards:** Comply with NFPA 101, The Life Safety Code, except “horizontal exits” are not permitted.
- B. Guestroom Areas Corridors:** <7> Comply with the following:
1. Exits: 2 or more remote exits
 2. Dead-End Corridor Limit: 15.24 m (50 ft.)
 3. Common Path Limit: 15.24 m (50 ft.)
- C. Assembly Spaces:** <3> <6>
1. Occupant Load Factors:
 - a. Ballrooms, Meeting Rooms & Exhibit Halls: 0.65 m² (7 sq. ft.) per occupant
 - b. Restaurant, Lounges & Boardrooms: 1.4 m² (15 sq. ft.) per occupant
 2. Design Requirements:
 - a. Dead-End Corridor Limit: 6.10 m (20 ft.)
 - b. Common Path Limit: 6.10 m (20 ft.)
 - c. Panic & Fire Exit Hardware: Provide hardware on assembly occupancy doors where occupant loads are greater than 99 persons and on doors in the paths of travel to the exterior exit discharge.
 - d. Remote Exits: Occupant loads greater than 49 persons, using the above occupant load factors, requires two or more remote exits. Distance between the nearest edges of remote exits is a minimum of one third the greatest diagonal dimension of the space.
 - e. Door Hold Open Mechanism: Required on entry doors from public areas to assembly rooms <6> greater than 65 m² (700 sq. ft.). Provide electromagnetic door hold open mechanism connected to the fire alarm system and electrical service <15> to hold doors open and to automatically release doors when an alarm is activated.
 - f. Operable Partitions: Doors in operable partitions do not qualify as exits, unless a door opens directly into an exit access corridor.
 - g. Commercial Kitchen Areas: Egress paths through Kitchens do not qualify as exits.

- h. Banquet Chairs: Provide a fastening device on banquet chairs to connect chairs to each other in rows to prevent individual chair displacement from blocking rows and aisles during emergency egress from assembly occupancies with more than 200 persons.

D. Egress Capacity:

1. Stairways:

- a. 7.6 mm (0.3 inch) width per person
- b. For stairways wider than 1120 mm (44 inch), the capacity may be increased using the following equation:

$$C = 146.7 + \left(\frac{W_n - 44}{0.218} \right)$$

C = capacity, in persons

W_n = nominal width of the stair

- 2. Doors, Level Components & Ramps: 5 mm (0.2 inch) width per person

- E. **Multi-Use Exits:** Avoid sharing stairs and exit corridors with other properties (office, retail, residence, etc.). If unavoidable, submit and obtain acceptance from FLS of alternate facilities that safeguard the property operational and security integrity. <1>

- F. **Exterior Exit Path:** Provide the required width for the exit capacity but not less than 90 cm (3 ft.), hard surfaced walkway leading to a public way.

- G. **Evacuation Signage:** <GR> Provide in guestrooms <7> and other rooms and spaces as directed by FLS.

- H. **Stair Signage:** In stairs at each landing, include stair designation, floor level, if roof access is available and direction to exit discharge.

- I. **Exit Discharge:** Discharge one half of all exits directly to the building exterior.

- J. **Means of Egress Signage:** Provide egress and exit sign quantities and locations as follows:

- 1. Provide a minimum of two remote exit signs or directional exit signs, visible from locations in a corridor and in spaces with more than 49 occupants.
- 2. Position exit signs to indicate available exits and exit directions, regardless of the exit distance from the sign to the exit.
- 3. Place exit signs perpendicular to the occupant's line of sight.

- K. Doors:** Do not lock stair doors and exit doors from either side. Doors to the exterior must allow for exit discharge but may be designed to prevent entry from the exterior.
- L. Stair Handrails:** At a minimum, provide handrails on both sides of stairways. See Module <16>.

14.14 Facility Requirements

- A. Fire Resistance Ratings:** Fire resistance ratings of walls, doors, shafts, stair enclosures, floor / ceiling assemblies and flammability ratings of furnishing, carpeting, curtains and wall finishes shall comply with NFPA 101.
- B. Fireplaces:** Obtain FLS acceptance of custom fireplaces.
- C. Linen & Trash Chutes:** <7> Comply with NFPA 82, NFPA 101 and NFPA 13.
 - 1. Chute Vent:** Extend (full size) a minimum of 90 cm (3 ft.) above the roof line.
 - 2. Construction:** Provide metal, prefabricated, manufactured chute within a fire rated shaft.
 - 3. Loading Door:** Protect chute openings with a fire rated loading door, located within a service opening room (vestibule).
 - 4. Room Enclosure:** Construct the service opening room (vestibule) with fire rated enclosure and door.
 - 5. Sprinkler:** Install a sprinkler above the top service opening of the chute, above the lowest service opening, and above service openings at alternate levels in buildings over two stories in height.

14.15 Example Diagrams

- A. General:** The following schematic diagrams are provided to illustrate the systems described in this Module.
- *Figure 1:* Isometric of Typical Zoned Low-Rise Sprinkler System
 - *Figure 2:* Detail: Inspector's Test & Drain Assembly
 - *Figure 3:* Isometric of Typical Interconnected High-Rise Sprinkler System
 - *Figure 4:* Floor Control Valve, Inspector's Test Assembly & Fire Hose Station
 - *Figure 5:* Typical Interconnected High-Rise Sprinkler Riser Diagram

Figure 1 - Isometric of Typical Zoned Low-Rise Sprinkler System

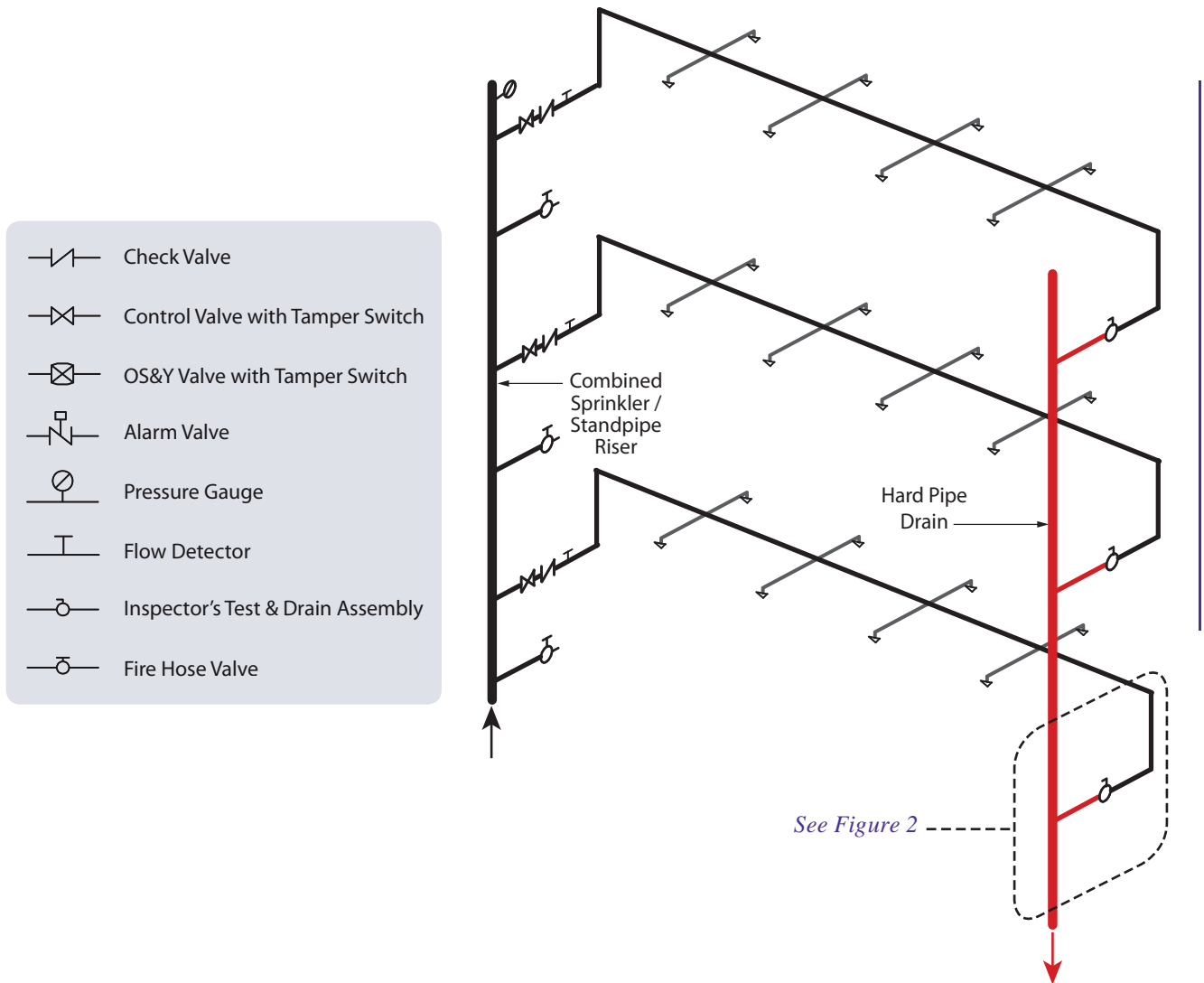
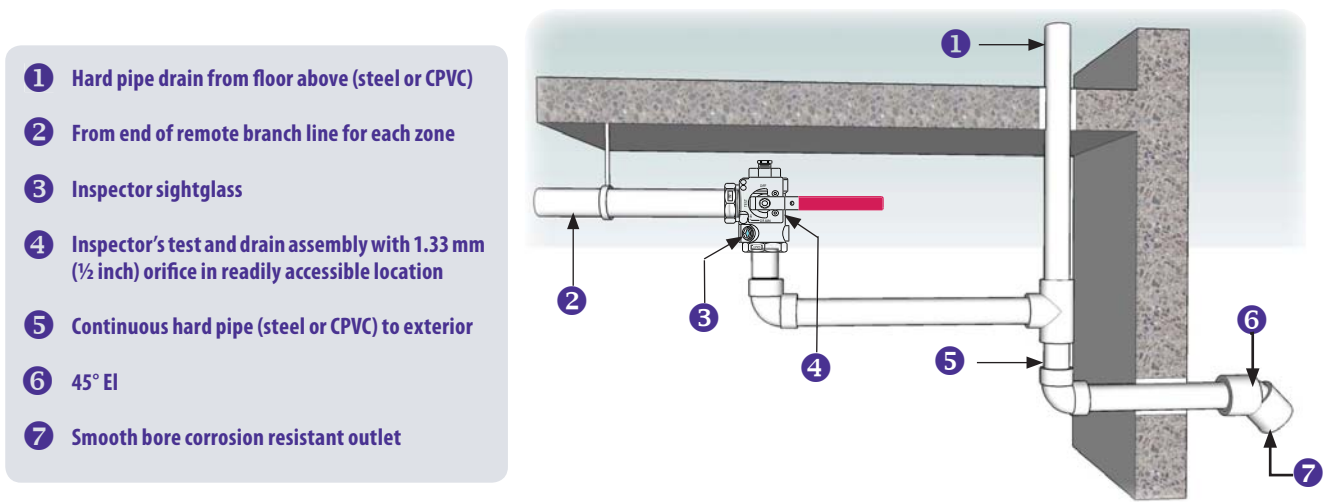


Figure 2 - Detail: Inspector's Test & Drain Assembly



- 1 Hard pipe drain from floor above (steel or CPVC)
- 2 From end of remote branch line for each zone
- 3 Inspector sightglass
- 4 Inspector's test and drain assembly with 1.33 mm (1/2 inch) orifice in readily accessible location
- 5 Continuous hard pipe (steel or CPVC) to exterior
- 6 45° El
- 7 Smooth bore corrosion resistant outlet

Figure 3 - Isometric of Typical Interconnected High-Rise Sprinkler System

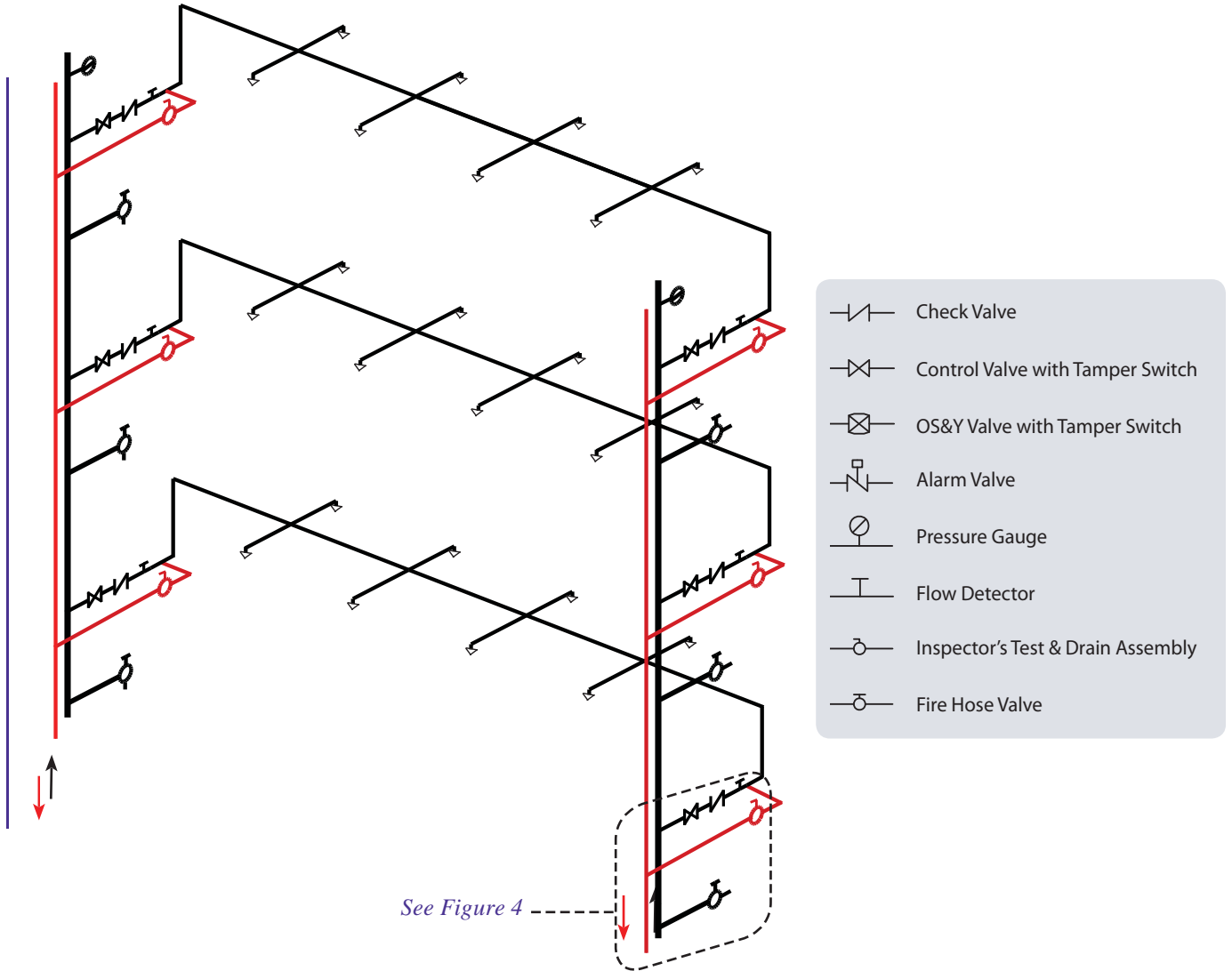


Figure 4 - Floor Control Valve, Inspector's Test Assembly & Fire Hose Station

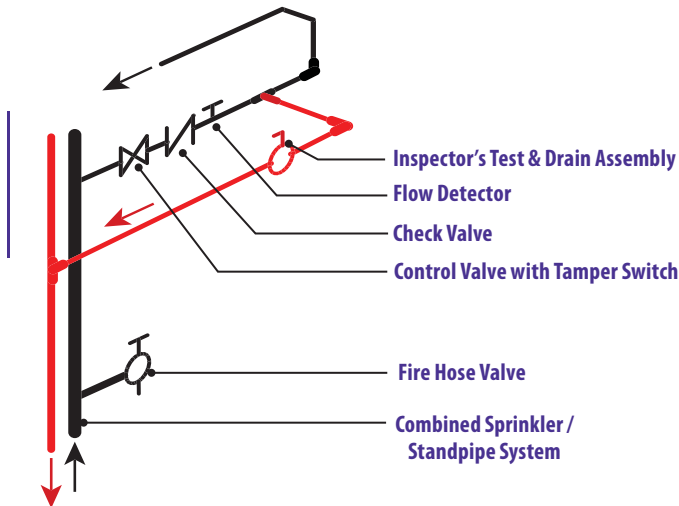
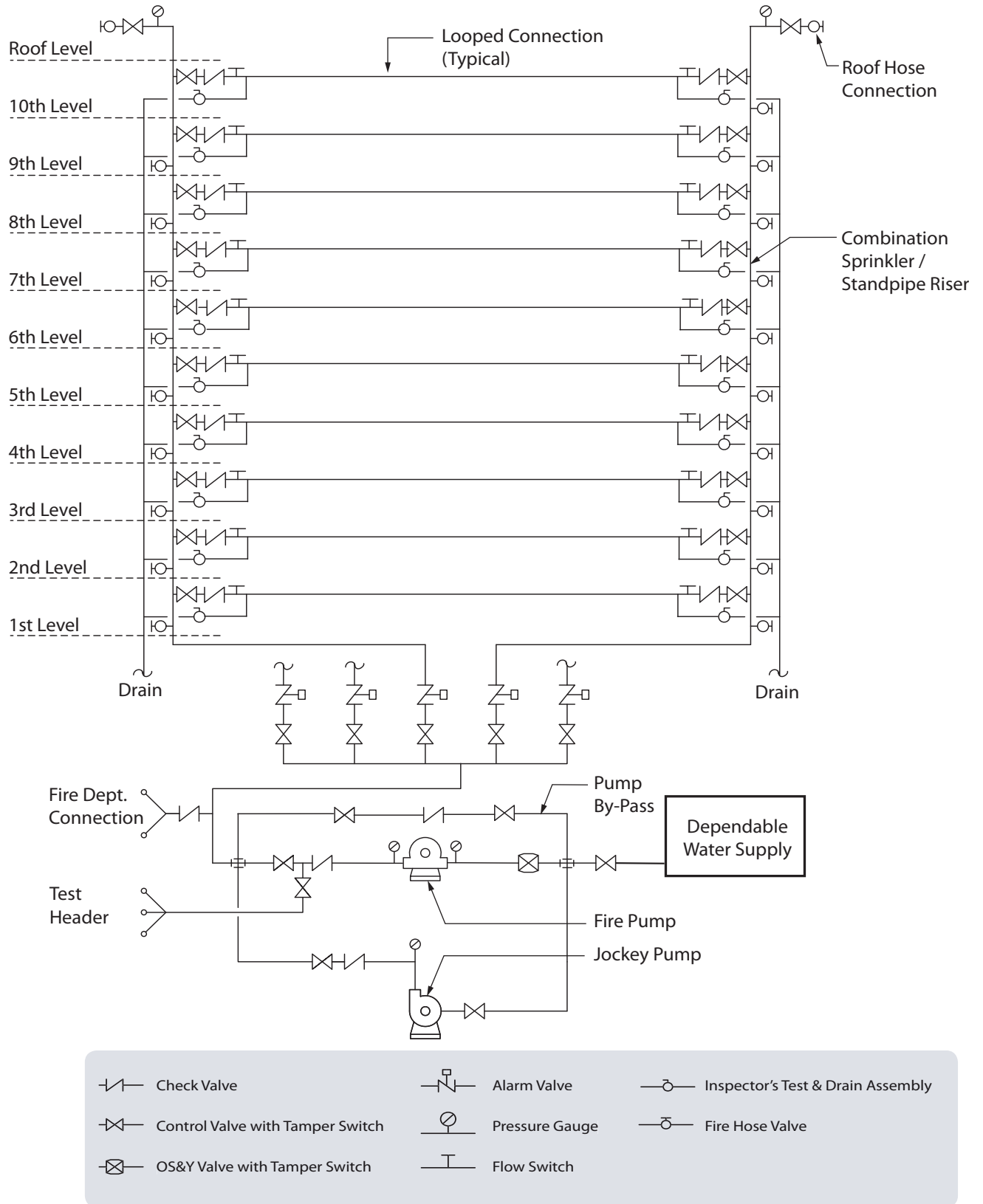


Figure 5 - Typical Interconnected High-Rise Sprinkler Riser Diagram



14.16 Fire Alarm System Sequence Matrix

General Notes:	System Smoke Sensors (1)	System Heat Detectors (7)	Elevator Lobby smoke detectors (2)	Guestroom System Smoke Sensors (3)	Manual Pull Stations	Waterflow Switches	Dry Sprinkler Pressure Switches	Type 1 - Grease Hood & Duct Fire Suppression	Low / High Air Supply Switches	Duct Smoke Sensors	Sprinkler Valve Tamper Switches	Fire Pump Signals (8)	Emergency Generator Signals (9)	Carbon Monoxide Signals
FACP: Display an audible / visual alarm.	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Remote Annunciator: Display an audible / visual alarm.	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Audible / Visual Alarms: Activate audible / visual strobe appliances on affected floor. (5)	X	X			X	X	X	X						
Assembly Doors and Fire Doors: Release magnetic door holders on affected floor.	X	X				X	X							
Stairwell Pressurization: Automatically activate pressurization.	X	X			X	X	X							
Smoke Exhaust: Automatically activate exhaust system in affected zones.	X	X				X (4)	X (4)							
Guestroom Audible Alarms: Activate alarms in rooms on affected floor. (5)	X	X			X	X	X	X						
Guestrooms Audible / Visual Signals: Activate both signals in hearing impaired guestrooms on affected floor. (5)	X	X			X	X	X	X						
Local Audible Alarms: Activate audible alarms only in rooms containing alarm.				X										X (6)
Guestroom Local Audible / Visual Signals: Activate both signals only in hearing impaired guestroom containing alarm.				X										X (6)
Air Handlers: Automatically shut off associated air handlers.										X				
Cooking Area Gas / Electric: Automatically shut off associated cooking line gas & electric and makeup air handler.								X						
Elevator Phase 1 Designated Level and Alternate Level Recall, Phase 2 Firefighters' In-Car Operation.			X											
Notes / Notations:														
(1) System smoke sensors not located in guestrooms.														
(2) Provide Elevator Phase 1 Designated Level and Alternate Level Recall, Shunt Trip Function and Phase 2 Firefighters' In-Car Operation in compliance with ASME A17.1, Elevator Code.														
(3) Guestroom Smoke Sensors: Provide photoelectric type, with sounder base (minimum ratings of 85 dBA, with 75 dBA "at the pillow"). In suites, multiple sensors shall activate simultaneously.														
(4) Except on guestroom floors, water flow alarms shall not activate smoke control exhaust fans where smoke control zones and fire sprinkler zones do not correspond.														
(5) Fire alarms shall activate only on floor of alarm. Governing authority may require additional zoning.														
(6) Carbon monoxide detectors in guestrooms, public and BOH areas shall activate an alarm in the guestroom and rooms of incident and at the fire alarm control panel.														
(7) Heat detectors are not recommended since fire sprinklers serve the same function.														
(8) Provide "fire pump run" and "fire pump fault" supervisory signals from controller to the FACP, as a minimum.														
(9) Provide "generator run" and "generator fault" supervisory signals to the FACP.														

