

SECTION 12.0d

CONSTRUCTION SYSTEMS AND ASSEMBLIES STANDARDS AND GUIDELINES

ADDENDUM D: Alarm and Special Hazard Protection Specifications **Sections Included:**

SECTION 5.21.00 – FIRE SUPPRESSION
SECTION 5.21.10 – WATER-BASED FIRE-SUPPRESSION SYSTEMS
SECTION 5.28.30 – ELECTRONIC DETECTION AND ALARM
SECTION 5.28.30 – ELECTRONIC DETECTION AND ALARM

SECTION 5.21.00 – FIRE SUPPRESSION

PART 1 GENERAL

1.01 Scope of Standard

A. The design guidelines contained herein include the requirements for systems, materials, fittings, and valves utilized for fire protection systems at The University of Houston. It is the intention of this document to provide a minimum standard for fire protection materials, fittings, and valves at the University so as to provide the highest level of fire safety possible. This document is not intended to be a guide specification.

1.02 Scope of Work

A. Reference Standards (Utilize latest editions available):

1. NFPA 13-Standard for the Installation of Sprinkler Systems.
2. NFPA 13R-Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies
3. NFPA 14-Standard for the Installation of Standpipe and Hose Systems.
4. NFPA 24-Standard for the Installation of Private Fire Service Mains and their Appurtenances
5. NFPA 25-Standard for the Inspection, Testing, and Maintenance of Water Based Fire Protection Systems.

1.03 Related Work: References/Quality Assurance

A. The University of Houston, International Building Code, National Fire Codes as published by the National Fire Protection Association (NFPA), State Fire Marshal,

and the University of Houston Fire Marshal's requirements contain fire protection criteria and requirements for the installation of all fire suppression systems. The contractor shall conform to the following:

1. All materials and performance shall meet the appropriate ANSI, ASME, and ASTM Codes.
 2. Welding Materials and Procedures shall conform to the ASME Code.
 3. Only welders certified in accordance with ANSI/ASME Section 9 shall be employed.
- B. Each item of equipment shall be new and listed by Underwriters Laboratories (UL) or approved by FM Global. Each major item of equipment shall bear the manufacturer's name or trademark; serial number, and UL or FM label.
- C. Submittals:
1. The University of Houston Project Manager shall review and distribute all submittals including drawings, calculations, and material data for approval by the University of Houston, the U of H Fire Marshal, the Owner representative, and others as appropriate.
- D. Refer to provisions established in the Project Specifications and in related section of Division 01 – General Requirements. All product data shall be submitted under provisions of Division 01.
- E. Manufacturer's data sheets shall be provided for all materials and equipment for approval before purchase or installation. Data sheets shall describe the type of material, capacities, manufacturer, and part numbers of equipment and give information necessary for verifying equipment approval.

PART 2 PRODUCTS

2.01 Pipe

- A. Aboveground Pipe
1. All wet sprinkler system piping shall be a minimum of schedule 40 black steel with threaded fittings for sizes 2 inches and smaller, and black schedule 40 steel with grooved fittings for sizes larger than 2 inches. All dry and preaction system piping and fittings are required to be externally and internally galvanized.
 2. CPVC piping listed for use in fire sprinkler systems may be utilized where installed in accordance with UL listing. CPVC piping may only be installed in residential occupancies and structures up to and including four stories in height when the piping is installed and protected in accordance with the manufacturer's listed requirements. Provide CPVC fittings that listed with the CPVC piping being utilized.

3. Piping shall be concealed above suspended ceilings where installed, in a craftsman like manner, and shall not interfere in the complete function of other systems such as cable trays, access panels, or pedestrian passageways. Piping in all occupied areas and mechanical area passageways shall not be lower than 7'-6". Specific written approval may be granted for unavoidable projections, but under no circumstances shall overhead piping be installed lower than 6'-8" above the floor. Piping shall not reduce the required width of any means of egress, width of stairs, or clear width of corridor or passageway, to less than 44 inches in width. Installation of all piping shall be in coordination with piping ducts, light fixtures, and any other work that may obstruct sprinklers. The contractor shall coordinate with all trades having materials installed above the ceiling prior to commencement of any work.
4. Piping that is retrofit into an existing building with suspended ceilings shall be installed above the existing ceiling, unless exposed piping is approved by the University.
5. All exposed sprinkler and standpipe systems located in areas without suspended ceilings ~~is~~ are required to be painted. Prepare galvanized pipe as necessary, such as priming, prior to painting pipe. Coordinate color of pipe with the University. All pipe, whether concealed or exposed, is required to be marked "Fire Sprinkler System" with markers spaced at 10 foot intervals with red (or a contrasting color if pipe is painted red) letters at a minimum of 1 inch in height.

B. Underground Pipe:

1. Each underground pipe joint or connection shall include a compression-type joint restraint device (Mega Lug or equal). Any changes in direction of underground piping shall be provided with a thrust block or joint restraint as required per NFPA 13 and NFPA 24. Changes in direction where entering buildings shall be provided with both thrust blocks and joint restraints.
2. Underground pipe shall be installed by a fire sprinkler contractor licensed by the State of Texas or a Texas State licensed plumbing company holding a Registered Managing Employee - General (RME-G) certification from the Texas State Fire Marshal's Office to install underground fire service mains.
3. All underground pipe connection sprinkler and standpipe systems to the campus Fire Water Distribution System (FWDS) shall be rated for the maximum churn, or no flow pressure, of the largest fire pump in the FWDS zone plus the maximum static pressure at the suction side of the FWDS fire pump. Pipe shall be hydrostatically tested for two hours at the highest static pressure rating plus 50 psi, or 200 psi, whichever is greater per NFPA 24.

2.02 Mechanical Grooved Couplings

- A. When grooved couplings are used, rolled-grooved joints are required with fittings and couplings designed for a working pressure of 300 psi. Malleable iron housing clamps: ASTM A47; UL labeled; engage and lock, designed to permit some angular deflection, contraction, and expansion (Firelock fittings acceptable).
- B. Galvanized couplings are required for galvanized pipe.
- C. "C" shaped composition sealing gasket: ASTM D2000
- D. Steel bolts, nuts, and washers: ASTM A183 heat treated with minimum tensile strength of 110,000 psi.

2.03 Valves

- A. Unless specified otherwise, all valves shall be UL listed or FM approved and be suitable for the maximum anticipated system pressure or a minimum of 175 psi working pressure, whichever is greater.
- B. All valves in the sprinkler system shall be UL listed Outside Screw & Yoke (O.S.&Y.) type indicating valves. The use of any other type of indicating valve must first be approved by the U of H Fire Marshal.
- C. All O.S.&Y. valves shall have a built in tamper resistant switch for supervision of the open position. The switch shall be contained within a NEMA Type 1, general purpose indoor rated housing. Either unauthorized removal of the switch housing (when the valve is open) or closing the valve, shall cause the switch contacts to change position. The switch shall have four conductors to accommodate connections to Style 4 or Style 6 signaling line circuit devices.
- D. Where O.S.&Y indicating valves are installed, the following shall apply:
 - 1. Valves 2-1/2 inches and larger shall be iron body with brass seats, discs, and stems. Include tamper switches listed for use with OS&Y valves.
 - 2. Valves 2 inches and smaller shall be brass body, stem, and seat. Include tamper switches listed for use with OS&Y valves.
- E. Check valves shall comply with the following:
 - 1. Check valves 2-1/2 inches and larger shall be iron body swing check with cast brass hinge, rod and brass faced discs.
 - 2. Check valves 2 inches and smaller shall be UL listed brass body and all brass fitted.
- F. Ball valves shall be constructed of forged brass with Teflon seats and shall be provided with a vinyl-covered handle.
- G. Post Indicator Valve

1. Gate valve on incoming water service shall be operable by a UL listed post indicator valve with tamper switch monitored by the associated building fire alarm panel.
- H. All valves controlling water supply for sprinklers shall be readily accessible for use by emergency and maintenance personnel.
- I. Except for underground water supply valves located in roadway boxes, all valves controlling water supply to sprinklers shall be supervised by the fire alarm system.
- J. A control valve shall be installed at the base of each riser. Locate standpipe isolation control valves within the stair enclosure and exposed for maintenance purposes.
- K. Sprinkler systems shall have a minimum of one floor control valve installed on every floor.
- L. Pressure reducing valve:
 1. Sprinkler systems connected to the campus FWDS or new fire pump system are required to be provided with a pressure reducing valve. The pressure reducing valve shall be installed in a location that does not reduce pressures on the building standpipe system, if provided.

2.04 Piping Accessories

- A. All hanger components other than all thread shall be UL listed or FM approved. No sprinkler piping is to be supported from any mechanical or electrical devices and/or equipment (ducts, lights, etc.). Hanger assemblies installed outside, or otherwise exposed to weather, shall be externally galvanized.
- B. Provide sleeves where pipes penetrate beams, floors, or walls and install prior to construction of walls or pouring of concrete. Install sleeves flush with all surfaces.
- C. Sleeves for underground pipe shall have mechanical rubber seals and be watertight.
- D. Floor, wall, and ceiling plates shall be pressed steel or cast iron split plates, chromium plated.
- E. Pressure gauges shall be UL listed or FM approved for fire service.

2.05 Identification Tags

- A. Identification signs shall be porcelain enameled 18 gauge and shall be affixed securely by brass chain to all valves. The signs shall be red in color.

- B. Provide an approved laminated valve chart in frame and Plexiglas cover showing location and use of each valve. The chart shall be secured in a visible location acceptable to the University near the system riser.
- C. The main drain sign shall be labeled “MAIN DRAIN”. Riser drains shall be labeled “RISER DRAIN” or “DRAIN”.
- D. Auxiliary drain signs shall be labeled “AUXILIARY DRAIN”.
- E. Inspector’s test connection signs shall be labeled “INSPECTOR’S TEST”.
- F. All water supply control valves shall have a standard sign identifying the portion of the system controlled, noting that the valve shall be kept open, and leaving a blank space for notification information.
- G. All isolation valves shall be marked on identification tag whether valve is to be “normally open” (NO) or “normally closed” (NC).

2.06 Drains and Test Piping

- A. All portions of the system shall be equipped with drains of the size specified in NFPA 13. Design sprinkler system that will drain to the riser. All drains, including auxiliary drains, shall be piped to the sanitary sewer system or other approved location.
- B. Every water flow switch shall have an inspector’s test connection located downstream and piped to the sanitary sewer system.

2.07 Backflow Preventer

- A. A double check backflow prevention assembly shall be installed prior to any sprinkler or standpipe system connected to the City of Houston water distribution system, including connection of pressure maintenance pumps to the building’s domestic water line utilized to fill sprinkler system piping. Backflow preventers are not required for fire sprinkler and standpipe piping connected directly to the campus FWDS.

2.08 Fire Sprinkler Standard:

- A. A remote express drain line is required for all building with floor control assemblies in addition to the main / inspectors test drain. This drain line shall be installed in the remote stairwell from the supply standpipe. The drain line shall be piped to a sanitary sewer or other approved location.

PART 3 EXECUTION

3.01 Guarantee

- A. The Contractor shall guarantee and service all workmanship and materials to be as represented by him, and shall repair or replace, at no additional cost to the Owner, any part thereof, which may become defective within the period of one (1) year after the date of final acceptance by the Engineer, ordinary wear and tear expected. Contractor shall be responsible for, and pay for, any damages caused by, or resulting from defects in his work.

3.02 Qualifications

- A. System design and installation shall be supervised by a licensed NICET Level III sprinkler system technician or fire protection engineer with not less than five (5) years of experience with sprinkler systems. Accurate As-Built drawings shall be required in the form of three hard copies and two copies on CD in the specified format. The signature of the RME or engineer constitutes an affidavit that the statements, representations, and information presented in the submittal constitute a complete operational system conforming to applicable state laws and recognized good engineering practices. All field installation work shall be continuously supervised by a NICET Level II or III sprinkler system technician.

3.03 System Acceptance Testing and Commissioning

- A. Perform acceptance tests according to NFPA 13, NFPA 13R, NFPA 14, and NFPA 24. Acceptance tests shall be witnessed by UH Fire Marshal. Provide copies of State test reports to the U of H Fire Marshal, FP&C Services, and other interested parties as tests are completed. Provide a complete set including all tests results to the Owner at the completion of the project and a copy in each O&M Manual.

END OF SECTION 5.21.00 – FIRE SUPPRESSION

SECTION 5.21.10 – WATER-BASED FIRE-SUPPRESSION SYSTEMS

PART 1 GENERAL

1.01 Scope of Standard

- A. This standard provides general requirements of the University of Houston for combination automatic sprinkler/standpipe, automatic fire sprinkler, and standpipe systems. This document is not intended to serve as a guide specification.
- B. The design guidelines contained herein include the requirements for fire protection systems at the University of Houston. It is the intention of this document to provide a minimum standard for fire protection systems at the University so as to provide the highest level of fire safety possible.

1.02 Scope of Work

- A. Provide all design and material required to provide a complete fire protection system to protect the specified building in accordance with design requirements. Antifreeze loops are not permitted. The preference of the University is to connect to the campus Fire Water Distribution System (FWDS) provide code compliant combination wet automatic fire sprinkler and where possible, automatic standpipe systems that do not contain alarm valves or local alarm devices, and a minimum 10-psi or 10% safety factor, whichever is greater, without requiring a building fire pump.
- B. Provide a complete automatic sprinkler system as defined by the latest edition of NFPA 13. All fire sprinkler systems installed on campus are required to be wet pipe systems unless the area being protected cannot be maintained above 40 degrees F, as required per NFPA 13. These areas will require a dry pipe system to be installed. Antifreeze systems of any size are not permitted on campus. Rooms or areas where it is not desirable to have water filled piping within the room, such as special collections, computer rooms, etc. may utilize double interlock preaction systems. Use of preaction systems must be approved by the University prior to system design.
- C. Standpipe systems must be installed where required by NFPA 101 or the latest edition of the International Building Code. All standpipe systems shall be Class I in all cases, regardless of minimum code requirements, and designed per the latest edition of NFPA 14. 2-1/2" hose valves are required at the intermediate stair landing of all stairs and a separate fire sprinkler riser located in one main stair landing. Provide standpipe isolation control valves with tamper switches for each standpipe as required per NFPA 14. Locate isolation control valves within the stair enclosure and exposed for maintenance purposes.
- D. The work addressed in this section consists of a fire protection system, which may include coordination with one or more of the following:

1. Fire Alarm Systems
2. HVAC and smoke control systems and fire smoke, and combination fire/smoke dampers.
3. Emergency power systems.
4. Elevator installation. See the Texas State Elevator Code ASME/ANSI A17. 1 and ASME/ANSI A17.3.
5. Central control and monitoring system.

E. Reference Standards (Utilize latest editions available):

1. NFPA 13- Standard for the Installation of Sprinkler Systems.
2. NFPA 13R-Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies
3. NFPA 14- Standard for the Installation of Standpipe and Hose Systems.
4. NFPA 24- Standard for the Installation of Private Fire Service Mains and their Appurtenances.
5. NFPA 25-Standard for the Inspection, Testing, and Maintenance of Water Based Fire Protection Systems.
6. NFPA 101-Life Safety Code.
7. IBC-International Building Code.

1.03 Related Work: References/Quality Assurance

- A. The University, the International Building Code, National Fire Codes as published by the National Fire Protection Association (NFPA), State Fire Marshal, and the University of Houston Fire Marshal's requirements contain fire protection criteria and requirements for the design of all fire suppression systems. The project shall conform to the following:
- B. Conform to a minimum of the latest edition of NFPA 13 for sprinkler systems. Insurer may require design in excess of NFPA 13.
- C. Conform to a minimum of the latest edition of NFPA 14 for standpipe systems. Insurer may require design in excess of NFPA 14.

1.04 Submittals

- A. The University of Houston Project Manager shall review and distribute all submittals for approval by the University insurer, the U of H Fire Marshal, the Owner's representative, and others as appropriate.
- B. Refer to provisions established in the Project Specifications and in related section of Division 01 – General Requirements. All product data shall be submitted under provisions of Division 01.
- C. Manufacturer's data sheets shall be provided for all materials and equipment for approval before purchase or installation. Data sheets shall describe the type of material, capacities, manufacturer, part numbers of equipment, and give information necessary for verifying equipment approval.
- D. The Contractor shall submit detailed and accurate shop drawings prepared in accordance with NFPA 13, NFPA 14 (if applicable), and NFPA 24 for approval of all equipment to be constructed and installed. Shop drawings shall identify all materials and list all equipment to be used. Shop drawings shall include ceiling grid or reflected ceiling layout and shall be coordinated with other trades prior to submittal.
- E. Hydraulic calculations for sprinkler systems shall comply with NFPA 13 and shall include comprehensive hydraulic data sheets. Provide a 10 psi or 10% safety factor, whichever is greater, for all sprinkler system hydraulic calculations.
- F. Provide hydraulic calculations for automatic standpipes, where required per NFPA 14, to provide 100 psi when flowing 500 gpm at the most remote standpipe outlet and 250 gpm at each additional standpipe. Provide hydraulic calculations for manual standpipes to demonstrate the pressure available at the top of each standpipe while flowing, the demand required per NFPA 14 utilizing both the available water supply and the nominal City of Houston fire truck pumper through the fire department connection.
- G. Prior to preparing shop drawings and hydraulic calculations, the design engineer is required to verify the adequacy of the water pressure and other pertinent water supply data from either the campus Fire Water Distribution System (FWDS) or the City of Houston water distribution system, depending on which system will be utilized to supply the new sprinkler and/or standpipe system. Hydrant flow tests performed on the University distribution system shall incorporate erosion control requirements in this standard. See 2.10L Field Acceptance. The design engineer shall immediately notify the U of H Fire Marshal and Project Manager of the need for testing the appropriate water supply or fire pump, or the need for any special considerations required. The U of H Fire Marshal shall witness all flow tests. The engineer shall provide the record data at the point of the new utility connection as follows:
 - 1. Building Name and flange elevation (ft)
 - 2. Test Hydrants (hydrant numbers and location) and hydrant elevations (ft)
 - 3. Flow rate (gpm), static pressure (psi), and residual pressure (psi)

- H. No work shall be performed until the University has approved the shop drawings, calculations, and data sheets. The Contractor is solely liable for any work performed prior to this approval.

PART 2 PRODUCTS

2.01 Piping and Fittings

- A. Refer to Section 5.21.00

2.02 Valves

- A. Refer to Section 5.21.00

2.03 Sprinklers

- A. Sprinklers shall be listed or FM approved and shall not include O-rings seals. Any sprinkler that incurs damage, is painted, or is sprayed with any obstructive material during construction shall be replaced at no cost to the University. Installation of sprinklers shall be coordinated with other work, including duct and electric fixture installation, to prevent sprinkler obstructions.
- B. Sprinklers located less than eight feet above finished floor or that may be subject to mechanical damage shall be provided with guards listed for use with the model of sprinkler installed.
- C. Quick-response sprinklers are required throughout all light-hazard occupancies, and laboratory units and may also be installed in ordinary-hazard occupancies for the quick-response hydraulic design area reduction per NFPA 13 for utilizing quick-response sprinklers. Extended coverage sprinklers may be utilized if proven in the hydraulic calculations.
- D. Unless specific aesthetic appearance is required for the project, white or chrome recessed pendent sprinklers with matching escutcheons shall be provided in areas with suspended ceilings, and brass upright sprinklers shall be provided in areas without suspended ceilings. Verify with the U of H Project Manager prior to specifying sprinkler type and finish.
- E. Where required by the project, sprinklers shall be centered in two directions in ceiling tiles. Pendent sprinklers required to be placed in the center of ceiling tiles, shall be supplied from a return bend that connects to an outlet at the top of the fire sprinkler branch line piping.
- F. Main electrical equipment rooms may have alternate protection such as a pre-action, dry sprinkler systems or chemical suppression system. Approval must be sought by appropriate department in cooperation with the UH Fire Marshal's Office.

2.04 Drains and Test Piping

- A. All trapped portions of the system shall be equipped with drains of the size specified in NFPA 13. Where possible, design a system that will completely drain to the system riser. Where any trapped water exists, provide an auxiliary drain per NFPA 13 and pipe to the sanitary sewer system or other acceptable location.
- B. Every water flow switch shall have an inspector's test connection located downstream of the water flow switch and piped to the sanitary sewer system or other acceptable location.

2.05 Dry Pipe System

- A. Dry pipe systems shall only be installed where the area being protected cannot be maintained above 40 degrees F, as required per NFPA 13.
- B. In areas subject to freezing that cannot be protected by dry type sprinklers on a wet sprinkler system, a dry pipe system shall be installed. Antifreeze loops are not permitted.
- C. Pitch dry pipe system piping a minimum of 1/4-inch per 10 feet for dry system mains and minimum of 1/2-inch per 10 feet for dry system branch lines.
- D. Provide full length dry pendent sprinklers that connect directly to the dry system branch line tee fittings in areas with suspended ceilings. Do not install dry pendent sprinklers on drops.
- E. Provide a tank or riser-mounted air compressor listed for fire protection use and sized to refill the entire dry pipe system within 30 minutes as required per NFPA 13.
- F. Utilize an air maintenance device and supervisory air pressure switch to maintain and monitor the dry pipe system air pressure.

2.06 Pre-action Sprinkler System

- A. Provide a double interlock pre-action system where the University prefers to eliminate water filled piping within the room, such as special collections, etc.
- B. Pitch pre-action system piping a minimum of 1/4-inch per 10 feet for pre-action system mains and minimum of 1/2-inch per 10 feet for pre-action system branch lines.
- C. Provide full length dry pendent sprinklers than connect directly to the pre-action system branch line tee fittings in areas with suspended ceilings. Do not install dry pendent sprinklers on drops.

- D. Provide a tank or riser-mounted air compressor listed for fire protection use and sized to refill the entire pre-action system within 30 minutes as required per NFPA 13.
- E. Utilize an air maintenance device and supervisory air pressure switch to maintain and monitor pre-action system air pressure.
- F. Requirements for detection, pre-action system releasing, pre-action system monitoring, and the pre-action release control panel are noted in Section 28.30.00.

2.07 Standpipe Systems

- A. Where a standpipe system is required to be installed, the standpipe shall be designed as Class I, manual-wet or automatic-wet standpipe as required by NFPA 14 and the IBC.
- B. Where a standpipe system is required in a building or area where the temperature cannot be maintained above 40 degrees F at all times, a dry standpipe is required to be installed. Dry standpipe systems installed on campus shall be Class I, manual-dry standpipes as defined by NFPA 14. Provide galvanized pipe, fittings, and hangers for all dry standpipe systems.
- C. Each standpipe shall be installed with a UL listed 2-1/2 inch NST fire department hose connection with caps and located in the intermediate stairwell landing with caps hose valves on each floor. Where the distance between the stairwells exceeds the criteria indicated in NFPA 14, provide additional hose valves locations. Locate the additional hose valves in UL listed recessed valve cabinets utilizing only 2-1/2" hose valves without the hose.
- D. Provide standpipe isolation control valves supervised by the fire alarm system as required per NFPA 14. Locate standpipe isolation valves within stairwells and exposed, unless an alternate location has been approved by the University.
- E. Each standpipe shall have a drain sized and located in accordance with NFPA 14. Each drain shall be discharged to sanitary sewer or other acceptable location.
- F. All dry standpipe system piping shall be installed so that the entire system may be drained back to the system riser. Where building conditions do not allow complete system drainage, provide auxiliary drains for all trapped sections of pipe in accordance with NFPA 13. The number of auxiliary drains shall be kept to a minimum.
- G. Each dry standpipe shall be provided with an air and vacuum valve installed at the top of each riser. The air and vacuum valve shall be 1 inch APCO Series 140 air and vacuum valve, manufactured by Valve and Primer Corporation or approved equal.

- H. Where required, a conveniently accessible two-way hose connection shall be provided at the roof level. If the building layout and construction permits, penetrations for the roof level hose connection shall be through an exterior wall and not through the roof.
- I. Manual-wet standpipe systems calculated utilizing the responding fire department pumper truck for the required pressure and flow per NFPA 14 shall be tested utilizing the pumper truck to prove the hydraulic calculations submitted during design.
- J. Where a combination sprinkler/standpipe is provided, the floor control assembly supplying the sprinkler system is required to have a check valve per NFPA 14.

2.08 Fire Department Connections

- A. Each fire department connection shall be flush wall-mounted type. Freestanding type fire department connections shall only be installed when approved by the University. Each fire department connection shall consist of a minimum of two 2-1/2 inch inlets compatible with equipment utilized by the City of Houston Fire Department and equipped with UL listed caps approved for use by the City of Houston Fire Department. The fire department connection shall be labeled to indicate the type of system served with raised letters at least one inch in size and cast on the escutcheon plate provided. The fire department connection shall not be less than two feet and not more than 3 feet 6 inches in elevation, measured from the ground level to the centerline of the inlets.

PART 3 EXECUTION

3.01 Guarantee

- A. The Contractor shall guarantee and service all workmanship and materials to be as represented by him, and shall repair or replace, at no additional cost to the Owner, any part thereof, which may become defective within the period of one (1) year after the date of final acceptance by the Engineer and U of H Contractor shall be responsible for, and pay for, any damages caused by, or resulting from defects in his work.

3.02 Qualifications

- A. System design and installation shall be supervised by a licensed NICET Level III sprinkler system technician or fire protection engineer with not less than five (5) years' experience with sprinkler systems. Accurate As-Built drawings shall be required in the form of three hard copies and two copies of CD in the specified format. The signature of the RME or engineer constitutes an affidavit that the statements, representations, and information presented in the submittal constitute a complete operational system conforming to applicable state laws and recognized

good engineering practices. All field installation work shall be continuously supervised by a NICET Level II or III sprinkler system technician.

3.03 Microbiological Influenced Corrosion (MIC)

- A. Provide testing on the City of Houston water supply or the campus FWDS, whichever will be supplying the new sprinkler and/or standpipe system, in accordance with the University for MIC testing procedures.
- B. Utilize methods and procedures for flushing sprinkler and standpipe piping as required by U of H for MIC testing.

3.03 System Acceptance Testing and Commissioning

- A. Perform acceptance tests according to NFPA 13 and U of H Guidelines that apply to fire sprinkler system testing with a representative of U of H Fire Marshal's Office present. Provide copies of State test reports to the U of H Fire Marshal as tests are completed. Provide a complete set of all test results to the University at the completion of the project and a copy in each O&M Manual.

END OF SECTION 5.21.10 – WATER-BASED FIRE-SUPPRESSION SYSTEMS

SECTION 5.21.20 – Special Hazard Fire Extinguishing Systems

PART 1 GENERAL

1.01 Scope of Standard

- A This standard provides general requirements of the University of Houston for fire extinguishing systems other than water based fire suppression systems. This document is not intended to serve as a guide specification.
- B The design guidelines contained herein include the requirements for fire extinguishing systems at the University of Houston. It is the intention of this document to provide a minimum standard for the installation of fire extinguishing systems at the University so as to provide the highest level of fire safety possible.

1.02 Scope of Work

- A Provide clean agent suppression systems when the project contains an area or room with sensitive equipment or contents, and the University requires a clean agent system to activate prior to the required water based sprinkler system.
- B Provide wet or dry chemical suppression systems where required by the International Building Code, FM Global (FM), NFPA 101 or University requirements. Extinguishing systems protecting cooking appliances, hoods, and branch exhaust ducts are required to be wet chemical extinguishing systems as required by the University.
- C The work addressed in this section consists of non water based fire extinguishing systems which will be coordinated with all of the following:
 - (1) Fire Alarm Systems
 - (2) Emergency Power Systems
 - (3) Central Control and Monitoring System
- D Reference Standards (Utilize latest editions available):
 - (1) NFPA 17 Standard on Dry Chemical Extinguishing Systems
 - (2) NFPA 17A Standard for Wet Chemical Extinguishing Systems
 - (3) NFPA 2001 Standard on Clean Agent Extinguishing Systems
 - (4) UL 300 Fire Testing of Fire Extinguishing Systems for Protection of Restaurant Cooking Areas

1.03 Related Work: References/Quality Assurance

A FM Global (FM), International Building Code, National Fire Codes as published by the National Fire Protection Association (NFPA) and the University of Houston Fire Marshal's requirements contain fire protection criteria and requirements for the design of all fire suppression systems. The project shall conform to following:

(1) Conform to a minimum of the latest edition of NFPA 2001 for clean agent systems, NFPA 17A for wet chemical suppression systems, and NFPA 17 for dry chemical suppression systems. U of H Fire Marshal may require design in excess of NFPA requirements.

(2) All design shall conform to requirements of FM.

1.04 Submittals

A The University of Houston Project Manager shall review and distribute all submittals for approval by FM, the U of H Fire Marshal, the Owner representative, and others as appropriate.

B Refer to provisions established in the Project Specifications and in related section of Division 01 – General Requirements. All product data shall be submitted under provisions of Division 01.

C Manufacturer's data sheets shall be provided for all materials and equipment for approval before purchase or installation. Data sheets shall describe the type of material, capacities, manufacturer, and part numbers of equipment and give information necessary for verifying equipment approval.

D The Contractor shall submit detailed and accurate shop drawings prepared in accordance with NFPA 17 and NFPA 17A for wet and dry chemical systems for approval of all equipment to be constructed and installed. Shop drawings shall identify all materials and list all equipment to be used. Shop drawings shall be coordinated with other trades prior to submittal.

E The Contractor shall submit detailed and accurate shop drawings and calculations prepared in accordance with NFPA 2001 for clean agent systems for approval of all equipment to be constructed and installed as follows:

(1) Submit shop drawings and flow calculations from a UL listed computer program to the U of H Fire Marshal for approval. Total agent discharge time must be shown and detailed by zone.

(2) Include data for each piece of equipment comprising the system including cylinders, manifolds, control panel, and nozzles. Include product data and design calculations bearing stamp of approval of the University. Include calculations

that verify system pressures, nozzle flow rate, orifice size, node numbers, piping pressure losses, component flow data and pipe sizes.

- (3) Include manufacturer's certificate that system meets or exceeds specified requirements and NFPA 2001.
 - (4) Include welder's certificate of compliance with ASME SEC 9.
 - (5) Include manufacturer's installation instructions.
 - (6) Indicate detailed pipe layout, hangars and supports, components and accessories.
 - (7) Project Record Documents: Accurately record exact location of equipment, equipment identification markings, conduit and piping routing details and agent storage positions.
- F No work shall be performed until the University of Houston Fire Marshal's Office has approved the shop drawings, calculations, and data sheets for the new system. The contractor is solely liable for any work performed prior to this approval.

PART 2 PRODUCTS

2.01 Clean Agent Systems

- A Pipe: Black Steel Pipe: ASTM A53 seamless or electric resistance welded. Grades A or B, with internal working pressure equal to the maximum pressure of the clean agent being utilized. ASTM A 120 or ASTM A 53 Class "F" shall not be used.
- B Pipe joints and Fittings: In accordance with NFPA 2001 for clean agent system being utilized and compatible with piping. Roll groove fittings must be approved by the manufacturer for use with the clean agent system.
- C Pipe Hangers: ASME B31.1, UL or FM approved for sprinkler systems, split clamp up to 2-1/2 inch size, riser clamps over 2-1/2 inch size, adequate for offset or discharge thrust.
- D Escutcheons: Chrome plated pressed or stamped brass, one piece or split pattern, minimum 2-inches larger than opening.
- E Gauges: ASME B40.1, UL 393, and UL 404, 3-1/2 inch diameter cast aluminum case, phosphor bronze bourdon tube, rotary brass movement, brass socket, front recalibration adjustment, black figures on white background, one percent midscale accuracy, scale calibrate in pounds per square inch.

2.02 Wet and Dry Chemical Extinguishing Systems

- A Provide wet chemical extinguishing systems in accordance with NFPA 17A. Where the wet chemical extinguishing system is protecting cooking appliances, hoods, and branch exhaust ducts, the system shall comply with UL 300, *Fire Testing of Fire Extinguishing Systems for Protection of Restaurant Cooking Areas*.
- B Provide dry chemical extinguishing systems in accordance with NFPA 17. Utilize discharge nozzles, manual actuators, shutoff devices, pipe, and fittings in accordance with NFPA 17 and manufacturer's requirements.
- C Shut down all sources of fuel and electrical power to all cooking equipment producing heat upon system activation as required per NFPA 17 and NFPA 17A.
- D Monitor wet and dry chemical extinguishing systems with building fire alarm system.

PART 3 EXECUTION

3.01 Guarantee

- A The Contractor shall guarantee and service all workmanship and materials to be as represented by him, and shall repair or replace, at no additional cost to the Owner, any part thereof, which may become defective within the period of one (1) year after the date of final acceptance by the Engineer, ordinary wear and tear excepted. Contractor shall be responsible for, and pay for, any damages caused by, or resulting from defects in his work.

3.02 Qualifications

- A System design and installation shall be supervised by licensed NICET Level III sprinkler system technician or fire protection engineer with not less than five (5) years experience with sprinkler systems. Shop drawings shall be prepared and engineered. Accurate As-Built drawings shall be required in the form of three hard copies and two copies on CD in the specified format. The signature of the RME or engineer constitutes an affidavit that the statements, representations, and information presented in the submittal constitute a complete operational system conforming to applicable state laws and recognized good engineering practices. All field installation work shall be continuously supervised by a NICET Level II or III sprinkler technician.

3.03 Clean Agent Systems Testing

- A Pressure test the entire enclosure with test fan procedures per NFPA 2001, pressurizing protected area both under positive and negative conditions. Confirm that leakage is within system design allowance with a temperature of 70 degrees F. Provide any required follow up tests at no cost to the Owner.
- B Test distribution piping and valves, prior to nozzle installation, to 40 pounds per square inch air pressure test, shut valves and compressor. Inspect joints using soap

water solution or halide torch or lamp. Maintain minimum test pressure for at least 10 minutes. If pressure drops more than 20 percent during test, repair leaks and retest.

- C Upon completion of installation provide final checkout inspection by factory-trained representative of manufacturer to ascertain proper system operation. Leave system in a fully commissioned and automatic readiness state with circuitry energized and supervised.
- D Conduct a room pressurization test in each protected space to determine the presence of openings that could affect the agent concentration level. Testing must be in accordance with NFPA 2001. If room pressurization testing indicates openings exist that would result in leaks or loss of extinguishing agent, coordinate the proper sealing of the protected space as necessary until a successful room pressurization test is achieved. Submit copies of successful test results to Owner. Upon acceptance, the complete system may be placed into service.
- E Submit original copies of tests, indicating that factory trained technical representatives of the manufacturer have inspected and tested systems and are satisfied with methods of installation, connections and operation.

3.04 Wet and Dry Chemical Extinguishing Testing

- A Wet chemical systems shall be tested in accordance with NFPA 17A, and dry chemical systems shall be tested in accordance with NFPA 17.
- B Submit original copies of tests, indicating that factory trained technical representatives of the manufacturer have inspected and tested systems and are satisfied with methods of installation, connections, and operations.
- C. Perform acceptance test of the system with the University of Houston Fire Marshal's Office. Schedule the test at least 48 hours with the U of H Fire Marshal.

END OF SECTION 5.21.20 – SPECIAL HAZARD FIRE EXTINGUISHING SYSTEMS

SECTION 5.28.30 – ELECTRONIC DETECTION AND ALARM

PART 1 GENERAL

1.01 Scope of Standard

- A. This standard is intended to assure that detection/alarm systems at the University of Houston provide the highest level of fire safety possible. This document is not intended to be a guide specification.

1.02 Scope of Work

- A. This standard is to be used in the development of all fire detection/alarm system designs for buildings and structures at the University of Houston.
- B. This standard is to apply to all fire detection/alarm system components and equipment installed at any University of Houston campus during new construction or as part of any improvement project.
- C. The work addressed in this section consists of a fire protection system, which may include, and at least will be coordinated with all of the following building systems or components:
 - 1. Fire Suppression Systems.
 - 2. HVAC and smoke control systems: fire, smoke, and combination fire/smoke dampers.
 - 3. Emergency Power Systems.
 - 4. Elevator installation. See the Texas State Elevator Code ASME/ANSI A17.1 and ASME/ANSI A17.3.
 - 5. Central control and monitoring system.
 - 6. Security Systems.

D. Referenced Publications

The documents or portions thereof listed in this section shall be considered part of the requirements of this document (utilize latest editions).

- 1. NFPA 1, Uniform Fire Code
- 2. NFPA 13, Standard for the Installation of Sprinkler Systems

3. NFPA 14, Standard for the Installation of Standpipe and Hose Systems
4. NFPA 70, National Electrical Code
5. NFPA 72, National Fire Alarm and Signaling Code
6. NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems
7. NFPA 101, Life Safety Code
8. NFPA 5000, Building Construction and Safety Code
9. IBC-International Building Code
- ~~10. IFC-International Fire Code [deleted]~~
11. UL Standard 268, Smoke Detectors for Fire Protective Signaling Systems
12. UL Standard 268A, Smoke Detectors for Duct Application
13. UL Standard 346, Water-flow Indicators for Fire Protective Signaling Systems
14. UL Standard 521, Heat Detectors for Fire Protective Signaling Systems
15. UL Standard 864, Control Units for Fire Protective Signaling Systems
16. UL Standard 1424, Cables for Power—Limited Fire Protective Signaling Systems
17. UL Standard 1480, Speakers for Fire Protective Signaling Systems
18. UL Standard 1481, Power Supplies for Fire Protective Signaling Systems
19. UL Standard 1711, Amplifiers for Fire Protective Signaling Systems
20. UL Standard 1971, Signaling Devices for the Hearing Impaired
21. ADA-Americans with Disabilities Act
22. TAS-Texas Accessibility Standards
23. American Society of Mechanical Engineers (ASME)/American National Standards Institute (ANSI):
 - a. ANSI A17.1, Elevator Code, latest edition
 - b. ANSI A17.3, Elevator Code for Existing Elevators, latest edition.

c. ANSI A117.1, Accessibility Code, latest edition.

1.03 Objectives

- A. This standard is intended it achieve consistently high levels of fire detection/alarm system performance by:
 - 1. Allowing designers to incorporate required or desired features as early in the design development process as possible.
 - 2. Assuring all systems is designed to meet all applicable codes, ordinances, laws, and sound engineering judgment.
 - 3. Providing a basis for a general understanding among all parties involved in the design of systems.

1.04 Concepts

- A. All systems are to be compliant with applicable paragraphs of National Fire Protection Association (NFPA) Code 101 “Life Safety Code”.
- B. All systems are to be compliant with the requirements of NFPA 72 “National Fire Alarm and Signaling Code”.
- C. All systems are to be compliant with the requirements of NFPA 70 “National Electrical Code”

1.05 System Features

- A. All system product lines must be comprised of components capable of providing the following features when appropriate and specified by the project documents or the University:
 - 1. Floor above/floor below notification.
 - 2. Private alarm notification.
 - 3. Positive alarm sequence.
 - 4. Voice alarm notification.
 - 5. Fireman’s communications.
 - 6. Elevator capture/recall.
 - 7. Elevator power shunt trip.
 - 8. Smoke control/fan shutdown.

9. Door release.
10. Release locks on normally locked egress doors.
11. Release and monitoring of clean agent and/or pre-action sprinkler systems.
12. Monitor non-water based fire suppression systems.
13. Multiple channel voice.

B. Provide audible alarming throughout the building in accordance with NFPA 72.

C. Visual alarming to ADA levels and TAS requirements must be provided throughout the building.

D. Smoke detectors must be provided at all elevator lobbies, elevator equipment rooms and elevator hoist-ways to perform capture/recall functions.

E. All systems must be designed to provide manual means of alarm initiation at every exit from every level. Elevators are not to be considered an exit or route of egress.

F. Smoke detector is required in every corridor and path of egress.

1.06 Description of Work

A. All designs must provide for each building a complete and working digital, addressable, closed circuit, automatic and manual fire detection/alarm system for each floor of the building to perform detection, monitoring, and alarm functions for the building.

1.07 Quality Assurance

A. Installer Qualifications:

1. Authorized and designated representative of fire alarm manufacturer to sell, install, and service proposed manufacturer's equipment. Verify equipment supplier has technical factory training specifically for the system proposed.
2. Licensed by State Fire Marshal to sell, install, and service fire alarm systems.
3. Actively engaged in business of selling, installing, and servicing fire alarm systems for at least five years with minimum of ten such installations completed and operating properly.
4. Equipment furnished shall be of current manufacture.

- B. The equipment furnished shall be listed and approved by a testing laboratory. This listing shall be for all functions required by this specification.
- C. The Contractor shall provide a signed “Fire Alarm Certification and Description” for each system, consisting of completed copies of the appropriate pages from NFPA 72, at the final Acceptance Test.
- D. Provide staff installation superintendents who are licensed by the State Fire Marshal’s Office for such purpose and under whose supervision installation, final connections, and testing will be performed.
- E. All systems must comply with applicable paragraphs of the National Electric Code.

1.08 Submittals

Prior to installation, the following documents shall be provided to the University of Houston Fire Marshal’s Office for reference and/or approval:

- A. Shop drawings: Include manufacturer’s name, model numbers, ratings, power requirements, equipment layout, conduit, device arrangement, and complete point to point wiring diagrams along with other required information including but not limited to:
 - 1. General Drawing Notes
 - 2. Electrical back box requirements
 - 3. Control Equipment Schedules
 - 4. Panel Schematics showing all connections, between modules within panels, to all modules from field wiring with zones identified.
 - 5. Riser Diagrams indicating circuits, type of devices, number of devices, number of conductors, conduit size, junction boxes, and zones.
 - 6. Scaled floor plans with layout of all devices with point numbers for initiating and notification devices, wiring connections, zoning, wire sizes and routing.
 - a. Wattage setting for each speaker labeled adjacent to the speaker
 - b. Candela rating for each strobe labeled adjacent to the strobe
 - 7. Detailed Legend
 - 8. Fire safety and related symbols shown on drawing and diagrams shall comply with NFPA 170.
 - 9. Detailed input/output matrix

- B. Product Data: Provide electrical characteristics, connection requirements and compatibility listing showing that components are compatible with each other including but not limited to:
1. Full equipment list including model numbers and quantities
 2. Complete system operation
 3. Highlighted Data Sheets on Devices and Products
 - a. Fire Alarm Control Panel
 - b. Wiring
 - c. Batteries
 - d. Detectors
 - e. Manual Stations
 - f. Audible Signaling Devices
 - g. Visual Signaling Devices
 - h. Control Devices
 4. Wiring diagrams of all equipment
 5. Installation instructions for all equipment
 6. Equipment testing procedures
 7. Equipment maintenance manuals
 8. Wire data sheets
- C. System Calculations – Complete calculations shall be provided which show the electrical load on the following system components:
1. Each system power supply, including stand-alone booster supplies
 2. Standby Battery Calculations plus a 20 percent de-rating factor
 3. Voltage drop calculations for each type of circuit (identify all mathematical formulas, variables, and constants)
 4. dB loss calculations for speaker circuits
 5. Speaker circuit loading and amplifier loading
 6. Strobe circuit loading
 7. Each auxiliary control circuit that draws power from any system power supply
- D. Software and Database Information:

1. Proposed point numbers
 2. Labels of all addressable devices
 3. English action messages
 4. Add programming rules, Equations, with comments listed
- E. The submittal package shall be signed by State of Texas Alarm Planning Superintendent (NICET III) or signed and sealed by a Professional Engineer (P.E.) registered in the State of Texas.

PART 2 PRODUCTS

2.01 Fire Alarm Control Panel (FACP)

- A. Acceptable Manufacturers model Simplex 4100U.
- B. All fire alarm control panels must be intelligent, addressable Central Processing Units (CPU) based and meets the latest edition of UL 864.
- C. All FACPs must be capable of providing circuit integrity monitoring for all Signaling Line Circuits at a level of Class A, Style 6, as defined in NFPA 72.
- D. All FACPs must be capable of providing circuit integrity monitoring of Initiating Device Circuits (IDC's) at level of Class B as defined in NFPA 72.
- E. All FACPs must be capable of providing circuit integrity monitoring of Notification Appliance Circuits (NAC's) at a level of Class B as defined in NFPA 72.
- F. Panels shall have provisions for smoke detector "Alarm Verification" for Signaling Line Circuits must be provided.
- G. Manufactured terminal boxes labeled "FIRE ALARM TERMINAL BOX" Space Age TC series or equal.
- H. With each installed field device affix a label to indicate the devices full address on its signaling line circuit.
- I. Mark each cable or wire to designated terminal with labeling tool.
- J. All FACPs must provide twenty percent (20%) excess power supply, input circuit, and output circuit capacity at final acceptance to allow for future expansion by the owner.
- K. Zone labeling must be textual by alpha-numeric display at the FACP and remote annunciator to allow "first response" by persons not trained in fire alarm technology.

- L. Textual (alpha-numeric) language must be conventional, concise, clear and accurate to facilitate rapid response.
- M. All FACP's must provide a control to silence the Public Alarm to allow for maintenance and testing, and to reduce disruption.
- N. All FACP's must provide a control to override the smoke control/fan shutdown feature to allow for maintenance and testing. Program panel shall allow functions to be disabled by floor or group as required by U of H.
- O. All FACP's must be connected to a Primary and Secondary Power source. The secondary power supply must be sized to provide 5 minutes of operation in alarm conditions after 24 hours of system operation in standby power. Where voice evacuation systems are utilized, 15 minutes of alarm shall be provided.
- P. All FACP's must provide a separate digital address for initiating device to facilitate rapid response and maintenance and testing.
- Q. All FACP's must provide a separate digital address for each individual flow switch.
- R. All programming must be permanent and non-volatile to reduce outage time due to failure.
- S. All FACP's must provide a panel mounted printer to print a log of all status change activity.
- T. All FACP's must be listed and approved as the smoke detector sensitivity test set to reduce maintenance costs.
- U. All FACP's must be capable of providing drift compensation. Drift compensation is considered equal to adjustability at the detector.
- V. All FACP's must be field programmable, using internal or connected components, for all changes, alterations, modifications, additions, deletions, and hardware and software upgrades.
- W. All messages shall be recorded in a male voice.
- X. All FACP's must be capable, using internal or connected components, of generating comprehensive reports for sensitivity, verification counts, address registers.
- Y. Where a clean agent fire suppression system and/or pre-action sprinkler system is specified for the project, the FACP must be UL listed for releasing service the pre-action and/or clean agent system specified in Section 21.20.00. Initiating devices shall be connected to a UL listed releasing panel. All initiating, output and releasing circuits shall reside in one fire alarm control panel.

Z. A fault isolation device shall be provided electrically between each building level. This device shall be capable of automatically isolating wire-to-wire faults on each SLC to the building level involved. The device shall be powered by the SLC loop. The device shall provide visual indication at the device of a short circuit (isolate) condition. The device shall reset to the normal mode upon elimination of the wire-to-wire short. All fault isolation devices shall be physically located within the marshaling box for that floor.

AA. All wiring within the FACP shall be labeled.

2.02 Remote Monitor

A. All systems must be capable of interconnection to the Campus-Wide Proprietary Supervisory Signaling System utilizing one set of Form C contacts (one normally open, one normally closed) for transmission of each of the following signals separately:

1. ALARM
2. WATER-FLOW
3. SUPERVISORY
4. TROUBLE

B. All systems must provide a Wiring Interface Panel (junction box) to accommodate the connection between the new fire alarm system and the existing Proprietary Protective Signaling System. The WIP must be accessible and located within a room that is nearest to the campus utilities tunnel system. Conduit and 18/10 conductor cabling must be provided between this panel and the FACP to perform the functions listed above.

2.03 Distributed Power Supplies

A. Distributed power supplies for powering Notification Appliance Circuits, beam smoke detectors, and control relays may be used.

B. All distributed power supply inputs must be controlled by addressable interface devices located on the same floor as the power supply and controlled by the SLC serving the area to facilitate maintenance.

C. The distributed power supplies must be sized to provide 15 minutes of operation in alarm after 24 hours of system operation in standby power. Where voice evacuation systems are utilized, 15 minutes of alarm must be provided after operation in standby power.

2.04 Manual Pull Stations

- A. All manual pull stations must be of the “double-action” type to reduce unintentional or vandal alarms. Pull stations required to break glass to activate are not acceptable. Provide pull stations that utilize the same key as FACP for resetting.
- B. Each manual pull station must have a unique digital address on the SLC.
- C. Where separate addressable monitor modules are used for monitoring conventional type manual pull stations, the modules are required to be installed within the manual pull station back box.
- D. Every pull station in the public areas must have a tamper proof cover (Stopper II).

2.05 Heat Detectors

- A. All heat detectors shall be fixed temperature, rate-of-rise, or combination fixed temperature and rate-of-rise, spot type.
- B. Each addressable heat detector must have a unique address on the SLC
- C. Non resetting detectors must give visual indication of “ALARM” condition to facilitate rapid response.
- D. Where separate addressable monitor modules are used for monitoring conventional type heat detectors, the modules are required to be installed within the heat detector junction box.

2.06 Smoke Detectors

- A. All spot type smoke detectors shall be photoelectric or combination photoelectric and ionization type.
- B. Each smoke detector, whether spot-type, or projected-beam type, must have a unique digital address on the SLC.
- C. All smoke detectors must be field measurable and adjustable for sensitivity.
- D. All smoke detectors, except projected beam type, must be powered from the SLC.
- E. The FACP must function as the smoke detector sensitivity test set and must be approved and listed for that service.
- F. All smoke detectors must meet or exceed the requirements of Underwriter’s Laboratory Standard 268, as amended, and must be listed and approved for use with the FACP provided.

2.07 Duct-Mounted Smoke Detectors

- A. It is the joint responsibility of the Fire Alarm and the Mechanical Contractors to assure that all supply and return air is sampled as required per NFPA 90A. Label duct work and direction of air flow and identify the proper locations for duct detectors. Provide only addressable system duct detectors, factory installed duct detectors within air handling unit are not acceptable.

2.08 Projected-Beam Smoke Detectors

- A. All projected-beam detectors must operate on the infrared principle.
- B. All projected-beam detectors must have automatic gain control circuits to compensate for deterioration of signal strength due to environmental factors such as dirt and dust accumulation, component aging and temperature fluctuations.
- C. Transmitting and receiving units of projected-beam detectors must be protected from physical damage.
- D. All projected-beam smoke detectors must have circuits to prevent “false” alarms due to sudden and complete obscuration.

2.09 Air Sampling Smoke Detection

- A. Provide air sampling smoke detection system if required by the project.
- B. Locate air sampling ports in accordance with NFPA 72 and manufacturer’s requirements.
- C. Maintain a maximum transport time of 120 seconds, or the transport time specified by the manufacturer, from the farthest sampling point, whichever is less.
- D. Utilize CPVC piping that is listed for use in air sampling systems. Label piping as required per NFPA 72.

2.010 Water-flow Switches

- A. Fire detection/alarm systems must be interconnected to the fire sprinkler systems by water-flow switches must be set for a 60 second delay (retard) prior to the “ALARM”.
- B. Each water-flow switch must be monitored for a unique digital address on the SLC.
- C. It is the responsibility of the Sprinkler Contractor to locate the water-flow switches to assure indication of water-flow within the building and at each level of the building to reduce water damage.

2.011 Supervisory (Tamper) Switches

- A. Connect tamper switches installed on all sprinkler or standpipe system valves to the fire alarm system to indicate closing or opening of the valves.

2.012 Audible Appliances

- A. Fire alarm system audible notification appliances are required to be provided by speakers in all buildings. The fire alarm speakers will also be utilized by the mass notification system for audible notification. The fire alarm signal generated must be the distinctive three-pulse temporal pattern described by NFPA and ANSI codes.
- B. The Evacuation Signal produced by the speakers must be altered with a custom textual message as indicated in Section 3.08 below.
- C. Provide audible systems with voice intelligibility measured in accordance with the guidelines in Annex A of IEC 60849, Sound Systems for Emergency Purposes. When tested in accordance with Annex B, Clause B1, of IEC 60849, the system shall exceed the equivalent of a common intelligible scale (CIS) score of 0.70.

2.013 Visual Appliances

- A. All visual notification appliances must be xenon strobe, compliant with current requirements of ADA and TAS.
- B. All visual notification devices within a room or adjacent space within the field of view must be synchronized as required per NFPA 72.
- C. Strobes used in combination systems where the same strobe is used for both mass notification and fire notification shall be clear or nominal white meeting the listing requirements of UL 1971 and either have no marking or be marked with the word "ALERT" stamped or imprinted on the appliance and be visible to the public.

2.014 Remote Annunciator

- A. When required by the project, an LCD remote annunciator shall be located in an open accessible area acceptable to the AHJ.
- B. Remote annunciator must display the same addressable and common signal information as the main FACP.

2.015 Monitoring Devices

- A. Addressable monitoring devices used to monitor contact-closure initiating devices such as water-flow switches, and tamper switches must derive power from the SLC to which they are connected.

- B. Each monitoring device must have a unique digital address on the SLC.
- C. Monitoring devices used to interface smoke detectors to the SLC shall be limited to existing spot type smoke detectors or duct-mounted smoke detectors.

2.016 Control Devices

- A. Addressable control devices must not control more than one type of appliance/device.

2.017 Documentation storage shall be provided at or adjacent to (within five feet of) the FACP. This storage shall be capable of storing and securing all documents required for system maintenance and response. Storage shall be separated from all active electrical, electronic, or electromechanical parts and components. If adequate, storage may contain unconnected spare/repair parts.

PART 3 INTERCONNECTION AND OPERATION

3.01 Signaling Line Circuits (SLC)

- A. All FACPs must provide circuit integrity monitoring for all Signaling Line Circuits at a level of Class A, Style 6.

- B. All the following devices/appliances must be individually addressed on the SLC:

1. Smoke detectors
2. Heat detectors.
3. Manual stations.
4. Monitor devices.
5. Control devices.
6. IDCs.
7. Audio NACs.
8. Visual NACs

- C. No splicing of the wiring is acceptable. No wire nuts may be used only terminal strips contained within a terminal box.

3.02 Initiating Device Circuits (IDC)

- A. Initiating Device Circuits (IDCs) must be monitored at a level of Class B.

- B. No splicing of the wiring is acceptable. No wire nuts may be used only terminal strips contained within a terminal box.

3.03 Notification Appliance Circuits (NAC)

- A. All Notification Appliance Circuits (NAC) must be monitored at a level of Class B.
- B. Direct current notification appliance power provided from a distributed power supply must be controlled by a digital addressable control device on the SLC.
- C. Audible notification appliances and visual notification appliances must always be connected to separate NACs to facilitate maintenance.
- D. No splicing of the wiring is acceptable. No wire nuts may be used only terminal strips contained within a terminal box.

3.04 Auxiliary Functions

- A. Locate control devices utilized for operating auxiliary functions mounted within 3 feet of the system being controlled as required per NFPA 72.

3.05 Floor Above/Floor Below Notification

- A. Selective evacuation shall be permitted if approved by the U. of H. Fire Marshal.
- B. In high rise structures, each level must constitute a minimum of one audio Notification Appliance Circuit and one visual Notification Appliance Circuit. NACs must be capable of initiating a general alarm or allow selectable notification.
- C. The FACP must also provide a control to the panel to allow sounding the Public Alarm throughout the structure (All-call) and activate both audio and visual notification for building evacuation at the FACP.

3.06 Positive Alarm Sequence

- A. Positive alarm sequencing shall be permitted.

3.07 Voice Alarm Notification

- A. When required by code, the audible portion of the Public Alarm for all systems must be a Voice Alarm. Provide speakers for annunciation of voice messages. Signal generated must be the Distinctive Evacuation Signal (three-pulse temporal pattern) alternated with a digitized custom textual message.

- B. Audible message required for voice evacuation shall be as follows:

The standard campus evacuation message shall play.

- C. The digitized audible message shall sound twice, and then the three-pulse temporal pattern shall resume.
- D. The FACP shall provide a microphone and associated controls to allow voice paging to selected areas.

3.08 Fire Department Communication System

- A. Where required by code, provide a complete and separate two-way fire department communication system.
- B. Electrically supervised two-way fireman's phone jacks must be provided at the entrance to all elevators, enclosed stairwells, elevator lobbies, and emergency standby power rooms. Phone jacks are also required in fire pump rooms and fire command centers, where provided.
- C. Wiring for the Fireman's Communication System may be installed in common raceway or conduit utilized by the fire alarm system.

3.09 Elevator Recall

- A. Provide elevator recall in accordance with ASME A17.1, ASME A17.3, and NFPA 72.

3.010 Fan Shutdown

- A. Initiation by duct-mounted smoke detectors must cause shutdown of associated air handling units and alarm signal at the fire alarm control panel. Motor control circuits must not be routed through the housing.
- B. The SLC must connect to a control device within three feet of the motor starter or other approved location to interrupt the motor control circuits.
- C. The control device must be assigned a unique digital address on the SLC.
- D. A "BYPASS" control must be provided at the FACP.
- E. Where a smoke control system is provided, connect FACP to smoke control panel for initiation of smoke control system and associated dampers in accordance with NFPA 92A and NFPA 92B. The smoke control panel, provided by others, is required to comply with UL 864 and listed as smoke control equipment.

3.011 Automatic Door Control

- A. Automatic Release-to-Close

1. Smoke control doors normally held open electrically must be allowed to close upon any “ALARM” condition.

B. Automatic Unlock

1. Access control door normally electrically locked for security must unlock on any “ALARM” condition.

3.012 Wiring

- A. Basic wiring materials and installation must comply with NFPA 70.

- B. Conductor sizes must be sized in accordance with NFPA 72 and NFPA 70 to provide the minimum required voltage drop.

- C. Install wiring in conduit or raceway where required per NFPA 70.

- D. All system wiring shall be color coded in accordance with the following:

1. Power circuits-Black
2. Strobe circuits-Yellow or White
3. One way voice speakers-Blue
4. Signaling line circuits, initiating device circuits, network communications cable-Red
5. Ground conductor-Green
6. Elevator interface wiring must meet NEC 620.
 - a. Main Floor Recall-Red
 - b. Alternate Floor Recall-Blue
 - c. Fire Hat Signal-Yellow
 - d. Supply power-Black

- E. Circuits extending beyond buildings

1. Where circuits are required to extend outside of the building, wiring must be provided with primary protectors in accordance with NFPA 70 Article 760 and Article 800.

PART 4 SPECIAL CONDITIONS

4.01 General

- A. It is the responsibility of the Contractor to assure that there is no disruption of the University’s normal functions during construction such as studying, testing, class, research, or administration.

4.02 Connecting to Existing Systems

- A. Operations of and connections to existing fire alarm systems must be supervised and/or coordinated by the University of Houston Fire Alarm Shop (FAS) Shop staff and the Fire Marshal's Office. A permit is required.
- B. Existing systems must remain operational during modifications or additions to the existing system throughout the duration of the project.
- C. Where part or all of the existing fire alarm system is required to be demolished, remove the existing fire alarm components only after the new system installation is complete and accepted by the Fire Alarm Systems Shop (FAS) and the U. of H. Fire Marshal.
- D. Existing equipment that is required to be salvaged by the University shall be stored in a secure area designated by the University.

4.03 Pre-action and Clean Agent Releasing Systems

- A. Where the project requires releasing of a pre-action and/or clean agent system, the room or area in which the suppression system is located shall utilize two separate smoke detectors or activation of a manual release station to activate the suppression system.
- B. Reduce smoke detector spacing for rooms or areas utilizing high airflow as required per NFPA 72.

4.04 Smoke Control System

- A. Where a smoke control system is required for the project, connect FACP to smoke control panel for initiation of smoke control system and associated dampers upon activation of sprinkler system water flow switch and/or total coverage smoke detection system located within the area requiring smoke control. The smoke control panel, provided by others, is required to comply with UL 864 and listed as smoke control equipment. Where a smoke control system is required, the FACP shall provide the relay interface to a separate smoke control panel compatible with the Building BAS system.
- B. In the event a fire alarm control panel is to be utilized for smoke control functions, it must be listed in accordance with UL 864 as smoke control equipment.

4.05 Mass Notification System

- A. Include the additional equipment required to connect to the future campus wide mass notification system. Fire alarm speakers and speaker/strobes will be utilized for the audible portion of the mass notification system. Coordinate with U of H for

additional requirements involving equipment and connection to mass notification system.

PART 5 TESTING

5.01 General

- A. Upon completion of the system, the Contractor must perform a complete and comprehensive test of the entire system in accordance with the provisions of NFPA 72. Contractor shall document their testing electronically using logging software commonly available.
- B. It is responsibility of the Contractor to demonstrate to the University that the system is installed and functions in accordance with the project documents and applicable codes.

5.02 Specific Tests

- A. An acceptance test will be conducted at the completion of each project. The test will be the responsibility of the contractor and must be performed in strict compliance with the provisions of NFPA 72.
- B. In addition to the provisions of NFPA 72 and/or the above paragraph, it is the responsibility of the Contractor to provide all of the following:
 - 1. Smoke detector sensitivity report.
 - 2. Pressure differential reading for duct detector sample air flow.
 - 3. Closed loop resistance and EOL resistance readings for all field wiring.
 - 4. Programming volatility test.
- C. Third Party Testing

- 1. Third party testing shall be conducted by an independent third party reporting to and approved by the U. of H. Fire Marshal's Office. Third Party testing shall include repeating all of the tests described in "Contractor's Test" above. A detailed listing of any deficiencies found during these tests shall be forwarded to the Contractor and shall serve as a punch—list for the system.
- 2. The U. of H. Fire Marshal's Office may, at its sole option, witness and/or participate in any and all tests.

3. If, at any point during their tests, the Third Party finds significant deficiencies they are to report those to the U. of H. Fire Marshal's Office who will then determine the appropriate course of action. If the Owner determines that the number and/or severity of the deficiencies so justify, they may stop the Third Party testing and instruct the Contractor to correct the deficiencies and recertify the system. Such retesting shall include Supervision testing of 100% of the Initiating Device Circuits, Notification Appliance Circuits, and Signaling Line Circuits.
4. If retesting by the Third Party is required due to significant deficiencies in the work of the Contractor, the Contractor shall reimburse the Owner for the cost of the Third Party tests conducted to that point.

D. Fix Deficiencies:

1. A copy of the formatted check list shall be transmitted to the contractor to serve as a punch list for the correction of the noted deficiencies. The Contractor shall notify the verifying party in writing that the deficiencies have been corrected along with a copy of the punch list with the corrected deficiencies initiated by the Contractor to indicate the corrections.
2. The Contractor shall provide updated certification forms as set forth in Section II Certification of this document.

E. Third Party Retest:

1. Each deficient item shall be retested. Retesting of the system shall be conducted in accordance with NFPA 72, Table 14.4.2.2, Test Methods. If any software changes are made to the system updated site-specific software print out with all changes highlighted will be submitted to the verifying party prior to the start of retesting.

F. Third Party Certification:

1. The Third Party shall then retest each portion of the system affected by the corrections. If no additional deficiencies are found, the Third Party shall issue a "Third Party Certification" stating that they have tested the system and certify that it complies with the appropriate sections of NFPA 72. Such certification shall not contain any disclaimers or similar comments.

G. Campus Test and Acceptance:

1. Upon receipt of all documents from the final "Contractor's Certification" and the "Third Party Certification," the (FAS) and /or U. of H. Fire Marshal will conduct any tests it determines to be necessary, consistent with the specified survivability style and performance requirements for the system. If

no additional deficiencies are found, they will accept the system. If additional deficiencies are found, the Contractor will be required to correct the deficiencies, re-test and re-certify the system. Such re-testing shall include Supervision testing of 100% of the Initiating Device Circuits, Notification Appliance Circuits and Signaling Line Circuits. The Third Party shall then re-test each portion of the system affected by the corrections. If no additional deficiencies are found the Third Party shall re-issue a “Third Party Certification” as set forth in Section VI Third Party Certification of this document.

H. Fire Alarm Testing Overview:

1. Note: The Campus Fire Marshal may, at its sole option, require assistance and/or participation of the Contractor in this testing.

Fire Alarm System Testing Overview				
	Contractor	General Contractor	U. of H. Fire Marshal’s Office	3 RD Party
I. Contractor’s Test	X	X		
II. Contractor’s Certification	X	X		
III. 3 rd Party Test	X	X	X	X
IV. Fix Deficiencies	X	X		
V. 3 rd Party Retest	X	X	X	X
VI. 3 rd Party Certification				X
VII. Campus Test and Acceptance	X*	X*	X	

2. References:

- a. Texas Administrative Code, Title 28. Insurance, Part 1. Texas Department of Insurance, Chapter 34. State Fire Marshal, Subchapter F. Fire Alarm Rules.
- b. National Fire Alarm Code (NFPA 72), 2016 edition

PART 6 DOCUMENTATION

6.01 General

A. A documentation package must be provided by the Contractor before final testing with FAS and U. of H. Fire Marshal that shall include all information needed to allow the University to perform additions, modifications, maintenance, and repair of the system.

B. This must include:

1. Equipment schematic diagram for all components and modules.

2. Equipment technical data.
3. Field Device address register
4. Equipment repair parts lists.
5. Programming disk with all system software required for a restart after traumatic failure. Software must be of appropriate and compatible update version for the firmware installed including hardware key, if required.

C. “As-Built” wiring, conduit diagrams to include:

1. Floor plan layout drawings showing all significant conduit routes and sizes, wire amounts, sizes and color code and marshaling box locations.
2. Riser diagram showing all significant conduit routes and sizes, wire amounts, sizes and color code and marshaling box locations.

D. Floor plan device layout drawing to include:

1. All initiating device locations and digital addresses.
2. All notification appliance locations and NAC digital addresses or device number.
3. All control device locations and digital addresses.
4. All monitor device locations for supervisory switch groups.
5. All distributed power supply locations and digital addresses.
6. Schematic representation of all SLCs, NACs, control circuits, audio circuits, and power circuits.

E. Riser Diagram to include:

1. All initiating devices with their electrical location and digital address on the SLC.
2. All notification appliances with their electrical location and device number or digital address on the SLC.
3. All control devices with their electrical location and digital address on the SLC.
4. All supervisory switch locations and their interconnection to the monitor device (IDCs).
5. All monitor devices with their electrical location and digital address on the SLC.
6. All distributed power supplies with their associated wiring and digital addresses on the SLC.
7. Schematic representation of all SLCs, NACs, audio circuits and power circuits.

F. Interconnection diagram(s) for all internal components of the Fire Alarm Control Panel, including switch settings, jumpers, module addresses, and Terminations on drawings.

G. State of Texas (FML009) or NFPA certification form.

- H. Programming guide for the functional programming to provide for field changes to the zone schedule or other operational features.
- I. Backup copy of the operating system and/or all resident programming, software or firmware, which would be required to restore the system for full operation after a complete failure or equipment replacement.
- J. A system hardware component capable of storing and transporting the above listed programming and operating systems and reports.
- K. Provide factory logging software for periodic testing.

6.02 Warranty

6.03 Warranty Maintenance

- A. The Contractor shall warranty all materials, installation and workmanship for one (1) years from date of acceptance by the University of Houston, unless otherwise specified. A copy of the manufacturer's warranty shall be provided with closeout documentation and included with the operation and installation manuals.
- B. Materials, installation or workmanship found to be defective during that period shall be replaced without cost to the University of Houston. This Contractor shall initiate repair of any warranty defects within 8 hours of notification of such defects and shall be repaired within 24 hours.
- C. The warranty or any part of the warranty shall not be made void by any required operation or inspection of the system after acceptance during the warranty period. The University of Houston will use University of Houston personnel to provide required tests and inspections.
- D. If the Owner experiences more than two Nuisance alarms or unexplained false alarms or troubles in any 24-hour period while the system is under warranty, the Contractor shall provide the necessary labor, materials, and technical expertise to promptly correct the problem(s) at no cost to the University of Houston.
- E. The fire alarm contractor shall maintain a service organization with adequate spare parts stock within 75 miles of the installation.
- F. Spare Parts – The Contractor shall supply the following spare parts:
 - 1. Automatic detection devices – Two (2) percent of the installed quantity of each type.
 - 2. Manual fire alarm stations – Two (2) percent of the installed quantity of each type.

3. Modules – Two (2) percent of the installed quantity of each type.
4. Audible and visible devices – One (1) percent of the installed quantity of each type and color, but no less than two (2) devices.
5. Keys – A minimum of three (3) sets of keys shall be provided and appropriately identified.

6.04 Training

- A. Provide services of manufacturer's representative to instruct Owner's personnel in operation and maintenance of system for a minimum of two 4 hour sessions.
- B. Factory training at the expense of the Fire Alarm Contractor for two U of H FAS personnel is required for the installed system.

END OF SECTION 5.28.30 – ELECTRONIC DETECTION AND ALARM