DESIGN STANDARDS

APPENDIX

Section IV. Division 15
(Revised March 3, 2008)

Yale University
Facilities Planning & Construction
Division 15 Index

15300  FIRE PROTECTION DESIGN CRITERIA  [Revised 5/27/99]
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A. GENERAL

1. SUMMARY

   a. This section describes procedures and provisions that are applicable to all fire protection designs.

   b. Refer to other divisions of this Design Criteria manual for related requirements:

      1) General requirements, including cutting and patching, minor demolition, temporary utilities, etc.: Division 1.

      2) Sitework, including underground construction: Division 2.

      3) Equipment, including motors and controls, is described in divisions listed below. Extent of controls to be furnished with equipment shall be ascertained in advance, and related electrical equipment required to complete the installation (such as disconnect switches, starters, control transformers, and wiring) shall be included within the scope of Division 16.

         a) Special equipment, such as laboratory, medical, food service, etc.: Division 11.

         b) Conveying equipment, such as elevators, wheelchair lifts, hoists, etc.: Division 14.

         c) Mechanical equipment, such as HVAC equipment, compressors, and pumps: Division 15.

         d) Fire Alarm Division 16, All fire protection equipment to be connected to Fire Alarm System.

      4) Energy management and control system: Division 15.
2. REFERENCES

a. Designs shall conform to the following code's editions currently in effect in Connecticut:
   1) NFPA 13, 14, 20 and 24.
   2) National Electrical Code NFPA 70
   3) Elevator Code A17.1
   4) BOCA with Connecticut Supplement

3. SUBMITTALS

a. Information to be submitted by suppliers to Owner is described in section 15000.

b. Construction documents shall require submittal of product data and shop drawings for all equipment for which acceptable manufacturers are listed in this Design Criteria manual. The following information will be required to be submitted with product data and shop drawings:

   1) Cover sheet (in addition to letter of transmittal), 8-1/2 inches by 11 inches, attached to each copy of all submittals, indicating name of project, Yale project number, items included in submittal (with specification reference), names of contractor and fire protection subcontractor, and number and date of submission. Cover sheet shall include minimum 6 inch high by 8-1/2 inch wide space for review stamps and comments.

   2) Manufacturer's catalog cuts, specifications, and other data required to demonstrate compliance with specified requirements, with all options and accessories clearly indicated. Dimensional drawings, wiring diagrams, capacity calculations, etc., are to be included where applicable. All products should be made in the U.S.A. including pipes and fittings.

   3) Evidence of listing of Equipment by a nationally recognized testing laboratory.

   4) Manufacturer's installation instructions and operation and maintenance instructions.

   5) Warranty information for all products for which warranties in excess of one year are required.

4. SYSTEM DESCRIPTION/PERFORMANCE

a. Fire Protection designs shall take into account the needs of the end users and the actual conditions, which will be encountered in the field during construction. Coordinate locations of equipment with existing and new architectural, structural, and mechanical work.

b. Construction drawings shall reflect as closely as possible the actual locations of equipment and the actual routings of pipe.
c. Where possible, equipment such as panelboards, starters, contactors, and control panels for systems such as fire alarm shall be surface mounted in dedicated electrical rooms so that exposed conduits may be run to such equipment, facilitating future changes to the systems. Where dedicated electrical rooms are not available, such equipment shall be located in mechanical rooms or Electrical closets.

Provide fire alarm annunciator panel at the designed fire department access into the building.

d. Earthquake Protection: Seismic Bracing. Requirements to follow NFPA 13 and BOCA.

e. All fire sprinkler piping to be concealed where possible or directed.

5. HYDRAULICALLY CALCULATED FIRE PROTECTION SYSTEMS

a. Sprinkler systems shall be hydraulically designed for each hazard group density in a project based on NFPA requirements, the proposed campus wide high pressure fire main system, Yale Fire Marshal requirements and municipal requirements.

b. Obtain fire pump and hydrant flow test data from Yale Fire Marshal to determine the water supply available and its pressure at the project location.

c. Obtain data on the campus high-pressure fire mains and fire pumps from Yale Fire Marshal.

d. The fire main minimum piping size shall be 10" underground or 8" above ground. (If a building has a fire main loop and it is connected at both ends a 6" main may be used).

   6" Loop within a building
   8" feeder for a building from express main.
   10" express mains for more than one building

e. Multiple Water feeds to a Single Area.
   Fire mains on each floor to have only one control valve per section. If a floor needs to have more than one supply, the system shall be split with a separate supply for each section of the building. No area to have more than one supply to the same area. (i.e. no cross connection of mains)

f. Hydraulic Design vs. Pipe Schedule:
   All sprinkler systems to be designed based on the hydraulic design as stated above and NFPA 13. Design to include inside and outside hose streams as listed in NFPA 13. Pipe schedule to be used only when adding to an existing system that was installed based on a pipe schedule and the number of heads to be added is less than 10 sprinkler heads. If 10 or more sprinkler heads are to be added, then the entire system for the floor is to be based on hydraulic design. If additional sprinkler heads are to be installed on a hydraulically designed system, the addition must be hydraulically designed.

g. Hydraulic Design Plates:
Hydraulic Design Plates as per NFPA 13 are to be completed and mounted at the alarm check valve, dry pipe valve, pre-action valve for each area of the building. If different designs are used in the building then only the design for the most remote area is to be completed on the plate. Sign to be attached to valve with jack chain. One sign for each hazard area.

h. Hydraulic Calculations:

1. Hydraulic Calculations to be provided by the fire protection engineer/contractor for review to: Project Engineer, Project Management, Plant Engineering and the University Fire Marshal. These are to be submitted at the same time as the working drawings.
2. The engineer to do basic layout, scope of project and pipe mains and risers locations. The engineer shall also provide the contractor with Fire Protection hazard type and group, for each area. Show water density per square foot for each Fire Protection hazard type and group.
3. Contractor shall do hydraulic calculations and shop drawings. Contractor shall provide sealed shop drawings and hydraulic calculations by a Professional Engineer to Yale University Fire Marshal and Yale Project Manager.

6. SPRINKLER REQUIREMENTS

a. Sprinkler Protection: Areas to be included.

Sprinkler protection to be provided throughout the building or construction area and include all computer rooms, electrical rooms, electrical vaults, elevator rooms, elevator shafts, elevator pits, telephone rooms and closets, storage closets and janitor’s closets.

Stairwells to have a sprinkler head on each floor level and at the top and bottom of the stair landings.

Elevator shafts to have sprinkler protection at the top and bottom of the shaft (elevator pit). The installation shall be per NFPA 13; The National Electrical Code NFPA 70 and the Elevator code A17.1 Latest Edition. If required, On/Off sprinkler heads can be installed on the wet pipe system. The sprinkler head would be: Gem, On-Off Sprinkler, Flow Control Pendent. Model F927 Designer, ½”, 135°F or 175°F as needed with Wrench and escutcheon plate.

b. Sprinkler Protection: Areas that can be waived.

Sprinklers are not required in bathrooms that are located within DWELLING units, that do not exceed 55 Sq. Ft. in area, and that have walls and ceilings of noncombustible or limited combustible materials with a 15 Min. thermal barrier rating including the walls and ceilings behind fixtures. Sprinklers are required in bathrooms of nursing homes and in bathrooms opening directly onto public corridors or exit ways. Sprinkler protection is required in all closets were ever they are located and what ever the use.

c. Combined Standpipe and Sprinkler System:

Design to follow NFPA 13 and NFPA 14 for a combined system. Riser Control Valves to be provided at each riser with a proper drain. System design requires that the sprinkler system on a floor can be shut down and drained without having to shut down the standpipe system or sprinkler on other floors. Valves: Milwaukee,Sprink, and Victaulic.
d. **Separate Standpipe and Sprinkler System:**
   Design to follow NFPA 13 and NFPA 14 for separate systems. Riser Control Valves to be provided at each riser with a proper drain.

e. **Inspector’s Test/Drain Locations:**
   Each system to be provided with an inspector's test/drain for testing of each flow switch/pressure switch. The inspector's test location to be a max of 7' above finished floor. The inspector's test can be a combined Drain/Inspector's Test Station.

f. These proper drains would be from Alarm Check Valves, Dry Pipe Valves, Pre-Action Valves, Deluge Valves, Riser Valves and Sectional Drain Connections including drain lines at floor control valves. These should be piped outside the building or to a sump pit that can handle a flow of 250 GPM for at least 3 Minutes. The size of the main drain shall be as per NFPA 13.

g. **Victaulic grooved mechanical pipe couplings, fittings, valves and other grooved components** may be used as an option to welding, threading or flanged methods. All grooved components including groving tools and lubricant shall be of one manufacturer (Victaulic Company of America), and conform to local code approval and/or as listed by ANSI-B31.1, B-31.9, ASME, UL/FM, IAPMO or BOCA. Grooved end product manufacturer to be ISO-9001 certified. No other grooving tools will be allowed on the job site. Victaulic representative will review the tool operation and groove standards.

h. All grooved piping system shall be made in U.S.A.

7. **DRY PIPE SYSTEM**

a. **Dry Pipe Systems:** shall be installed in all areas subject to temperatures below 40°F such as, Attics and Unheated areas.

b. **Dry Pipe Valves:**
   Any reset tools needed to reset the valve to be provided at the valve. Valves to be Viking or Reliable. Viking requires additional tools that must be provided. Dry pipe sprinkler systems to include: Dry pipe valve, butterfly control valve with built in tamper switch, trim package with 0-300 PSI water gauge and 0-120 PSI air gauge, low air switch, pressure alarm switch, 2" drain line piped to proper drain, pipe separately drip cup or install drip cup in 2" drain with check valve. Compressor sized to sprinkler system size and a working pressure of 100 PSI. Compressor power switch to be provided at the compressor with a guard over the switch.

c. **Dry Pipe Piping:** *(change # 16, 9/1/2005)*
   Piping to follow NFPA 13. All grooved piping to be rolled grooved and not cut grooved. Both Schedule 10 and Schedule 40 can be used for sprinkler and standpipe systems. Fittings can be either cast iron or malleable iron. All equipment to be U.L./FM listed.
   Victaulic Type saddle fittings over 2 inches in diameter are not allowed in any Fire Protection piping. Provide full size Tees for 2 1/2 inch branch outlets or larger.
   All piping for dry pipe and pre-action sprinkler systems to be galvanized piping and fittings.
All dry and deluge sprinkler systems should be installed in mechanical areas in the lowest level of the building served. A floor drain must be located within four feet of the valve. If this is not possible, the floor covering must be water tight, and the area under the valve must be bermed and have a floor drain installed to keep water from escaping. In addition, the wall behind the valve must withstand water penetration.

The drain assembly serving the dry or deluge valve associated trim piping must be a dedicated non corrosive drain line that does not connect to any other drain line and does not contain any check valve assembly. The drain must be piped to atmosphere, either the floor drain in the area, or another appropriate location capable of accepting the full flow of the ball drip assembly for an indefinite amount of time.

d. **Dry Pendant Heads:**
Dry pendant heads or sidewall sprinklers to be installed in Cold/Environmental Rooms on wet pipe systems and from unheated attics on dry pipe systems. Piping layouts are to prevent any trapped sections of piping that will not drain and will trap water at the sprinkler heads. Sprinkler heads to have "Corrosion-Resistant Coatings" when installed to protect outside exposures or in hostile environments.

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**8. WET PIPE SYSTEMS**

a. All systems to be wet pipe except in areas subject to temperatures below 40°F, which will have a Dry Pipe System, installed. (Attic and Unheated Areas) Pre-Action System will be used only in areas where the concern for water damage by accidental activation or damage to a sprinkler head is of utmost concern.

b. **Piping:** (change # 17, 9/1/2005) Piping to follow NFPA 13. All grooved piping to be rolled grooved and not cut grooved. Both Schedule 10 and Schedule 40 can be used for sprinkler and standpipe systems. Fittings can be either cast iron or malleable iron. All equipment to be U.L./FM listed. Victaulic Type saddle fittings over 2 inches in diameter are not allowed in any Fire Protection piping. Provide full size Tees for 2 1/2 inch branch outlets or larger.

Yale prefers that branch connections be taken from the side or top of the main to prevent settlement of sediment in the heads possibly preventing actuation.

Branch connections shall be taken from the side or top of the main to prevent settlement of sediment in the heads possible preventing actuation.

c. **Hangers:** Per NFPA-13, UL/FM Listed.

d. **Alarm Check Valves. Wet Pipe Systems:**
An alarm check valve or equivalent to be installed at the main feed riser for each system. The trim on the valve to include, supply and system gauges, 0-300 PSI with shut off valves, main drain, sized as per NFPA 13, main flow switch. Flow switch to have 0-90 Sec. retard on the switch, set for 30 sec. and two sets of contacts. Alarm check valve to include trim package with bypass check valve and alarm line.
The installation of an outside Water Motor Gong will be decided on a project to project basis.

Retard chamber drain to be separate from 2” drain line.
Alarm Check Valve: Reliable or Viking.
Flow Switch: Potter or System Sensor.
Water Motor Gong: Reliable, Viking.

9. **HIGH PRESSURE WET PIPE SYSTEMS. OVER 100 PSI SYSTEMS**

a. All systems to be wet pipe except in areas subject to temperatures below 40°F, which will have a Dry System, installed. (Attic and Unheated Areas) Pre-Action System will be used only in areas where the concern for water damage by accidental activation or damage to a sprinkler head is of utmost concern.

b. **Piping:** Piping to follow NFPA 13. All grooved piping to be rolled grooved and not cut grooved. Only Schedule 40 can be used for sprinkler and standpipe high-pressure systems. Only class 250 psi fittings can be used. Fittings can be either cast iron or malleable iron. All equipment to be U.L./FM listed. Victaulic Type saddle fittings are not allowed in any high pressure Fire Protection piping. Provide full size Tees for all branch outlets.

c. **Hangers:** Per NFPA-13, UL/FM Listed. Note Exception No. 1 and Exception No. 2 in NFPA 4-14.2.3.3 copied below in Italics. Also note Exception No. 1 in NFPA 4-14.2.3.4 copied below in Italics.

*Exception No. 1:* When the maximum pressure at the sprinkler exceeds 100 psi (6.9 bars), and a branch line above a ceiling supplies sprinklers in a pendent position below the ceiling, the hanger assembly supporting the pipe supplying an end sprinkler in a pendent position shall be of a type that prevents upward movement of the pipe.

*Exception No. 2:* When the maximum pressure at the sprinkler exceeds 100 psi (6.9 bars), the unsupported length between the end sprinkler in a pendent position or drop nipple and the last hanger on the branch line shall not be greater than 12 in. (305 mm) for steel pipe or 6 in. (152 mm) for copper pipe. When this limit is exceeded, the pipe shall be extended beyond the end sprinkler and supported by an additional hanger. The hanger closest to the sprinkler shall be of a type that prevents upward movement of the piping.

*4-14.2.3.4* The length of an unsupported arm over to a sprinkler shall not exceed 24 in. (610 mm) for steel pipe or 12 in. (305 mm) for copper tube.

*Exception:* Where the maximum pressure at the sprinkler exceeds 100 psi (6.9 bars) and a branch line above a ceiling supplies sprinklers in a pendent position below the ceiling, the length of an unsupported arm over to a sprinkler and drop nipple shall not exceed 12 in. (305 mm) for steel pipe and 6 in. (152 mm) for copper tube. Where the limits of the unsupported arm over lengths of 4-14.2.3.4 or this Exception are exceeded, the hanger closest to the sprinkler shall be of a type that prevents upward movement of the piping.
d. **Alarm Check Valves. Wet Pipe Systems:**

An alarm check valve or equivalent to be installed at the main feed riser for each system. The trim on the valve to include, supply and system gauges, 0-300 PSI with shut off valves, main drain, sized as per NFPA 13, main pressure switch or main flow switch. Flow switch to have 0-90 Sec. retard on the switch, set for 30 sec. and two sets of contacts. Alarm check valve to include trim package with bypass check valve and alarm line.

The installation of an outside Water Motor Gong will be decided on a project to project basis.

Retard chamber drain to be separate from 2" drain line.

Alarm Check Valve: Reliable or Viking.
Flow Switch: Potter or System Sensor.
Water Motor Gong: Reliable, Viking.

e. **Pressure Restricting Valves**

Provide a pressure-restricting valve at each fire hose location over 100 psi as required by NFPA. 14 Pressure Restricting Valve: Croker fig-5066 or Potter-Roemer fig 4085 2 1/2 with 2 1/2 x 1 1/2 reducer, cap and chain. Pin type is the only approved valve.

f. **Pressure Reducing Valves**

Pressure reducing valves shall be installed on each zone of a High Pressure Wet pipe System to maintain a maximum zone pressure of 175 psi as required by NFPA. A high pressure supervised, with a tamper switch, butterfly/gate valve shall be installed before the pressure reducing valve for maintenance.

Pressure Reducing Valve: Watts.

10. **PRE-ACTION SYSTEM**

a. Pre-Action System will be used only in areas where the concern for water damage by accidental activation or damage to a sprinkler head is of utmost concern.

b. Pre-Action systems when used should be of the double interlock design with a check valve above the pre-action valve. If a single interlock is desired, then the fire alarm system must be programmed to activate by any two detectors on the floor in the area protected by the pre-action system. An air compressor set at 50 PSI is to be installed to keep the pre-action valve from opening until the sprinkler head is activated. If a single interlock is used, the compressor must be set at 25 PSI to provide trace air for the system and enough pressure to release the sprinkler head plug if the element is damaged. The fire alarm system smoke detection must be in alarm for that area before the pre-action valve can activate. The smoke detectors are to be connected to the building fire alarm system. A separate pre-action control panel is to be installed for each pre-action valve which will monitor the valve for Valve Tamper, Low Air, Pressure Alarm and will control the activation of the pre-action valve from the main fire alarm control panel. 60 Hours Battery Backup to be provided. Viking pre-action system.
**Piping:** Piping to follow NFPA 13. All grooved piping to be rolled grooved and not cut grooved. Both Schedule 10 and Schedule 40 can be used for sprinkler and standpipe systems. Fittings can be either cast iron or malleable iron. All equipment to be U.L./FM listed. Victaulic Type saddle fittings over 2 inches in diameter are not allowed in any Fire Protection piping. Provide full size Tees for 2 1/2 inch branch outlets or larger.

Piping - galvanized piping and fittings.

11. **IDENTIFICATION SYSTEMS**

   a. **Piping**
      To be painted red or as directed by architect.
      Label piping - SETON pipe marking system as per NFPA 13.

   b. **Valve Tags and Charts:**
      Valve Tags on fire protection valves and valve charts to be provided. Valve tags to be brass and list the building and valve number. The chart to be wall mounted and its location to be coordinated with the University Fire Marshal.

   c. **Signs:**
      Signs to be provided on all valves as per NFPA 13 including Control Valves, Aux. Drains, Inspector's Test, Test Valves, Air Line, Main Drains etc. If a valve is above a ceiling the sign shall be on the wall near the valve in the ceiling. If behind a ceiling hatch, the sign shall be on or near the hatch. If behind a wall hatch, the sign shall be mounted on or near the wall hatch. Control Valves and Inspector's Test in closets or rooms to have a sign on or near the door to indicate the device is in the closet or room. Signs mounted on walls/ceilings/hatches to be permanently attached to the surface with fasteners or adhesive (Liquid Nails). Signs hung from a pipe or valve to be attached with jack chain. Wire not allowed, Sign to list area of coverage/control. Size 2” X 6”.

12. **OCCUPANCY CLASSIFICATIONS:**

    Dwelling Units
    Light Hazard
    Ordinary Hazard I
    Ordinary Hazard II.

    Ordinary Hazard II shall include all laboratory units and library stack areas wherever they are located.
    Attics and basements used for storage to be classified as Ordinary Hazard I
    Dining Hall kitchens to be Ordinary Hazard I.
B. MATERIALS

1. Under Ground Fire mains:
   All piping to be class 52, Ductile Iron, Cement Lined, and coated for direct burial. All under ground fire mains to be at least 8”. If the underground fire main is an express main for more than one building then the size is to be 10”. Installation of all piping shall to follow NFPA 24.

   All pipe connections to be by Mechanical Joint SSB-Ductile Iron Class 350 Fittings. Mechanical Joint Restraint shall be with retainer glands.
   All pipe to have full rodding for its entire length and not just at connections. Supports, Anchors, Tie Rods and Thrust Blocks to be installed as per NFPA 24 (Latest Edition). Piping Marking shall include buried warning tape.

2. Standpipes:
   All standpipes to be 6” ID except in the residential colleges where by hydraulic calculation they can be 4” in size. The standpipe system and the sprinkler risers can be combined when the system is hydraulically calculated. All fire hose valves shall be 2 1/2” pressure restricting angle valves with quick release pin and male hose threaded outlets and reducing to 1 1/2”. Class 1 standpipe as per NFPA 14. No hose to be provided. Include 2 1/2” and 1 1/2” Caps and Chains. Finish of Fire Hose Valve (FHV) to be determined at the time of design with the architect. Install as per NFPA 14. Fire hose valve to be Crocker fig-5066 or Potter Roemer fig 4085. Spanner Wrench all caps. Pin type is the only approved valve. 0-300 PSI gauge plus valve to be installed at top of each stand pipe. Set pressure of fire hose valve based on location in building.

3. Back Flow Preventer:
   Reduced pressure back-flow preventer to be installed on all fire sprinkler/standpipe systems as required by the Regional Water Authority, but not on the Yale high pressure fire main since it already has a RPBFP. Any pressure reduction to be included in the Hydraulic Calculations for the system. The Back Flow Preventer to be installed inside the building with control valves before and after the unit. Drain to be piped to a proper drain location such as outside, sump pit or floor drain that is in good condition. The condition of all drains to be verified before any piping is done. The back flow preventer to be installed after the fire pump as per NFPA 20. FEBCO or Watts.

4. Main Drains:
   All main drains from the sprinkler system and standpipe system are to be piped to a proper drain location that can handle both water supply testing and draining of the systems. These proper drains would be from Alarm Check Valves, Dry Pipe Valves, Pre-Action Valves, Deluge Valves, Riser Valves and Sectional Drain Connections including drain lines at floor control valves. These should be piped outside the building or to a sump pit that can handle a flow of 250 G.P.M. for at least 3 minutes. The size of the main drain to be as per NFPA 13. All Drains are to be galvanized pipe and fittings.

5. Auxiliary Drains:
   Including Low Point Drains
   All low point drains to be provided as per NFPA 13 and to have a valve, hose Connection and cap provided with sign and chain. All plugs to be replaced with a hose connection and cap. All drains at floor control valves to be piped as per main drains except in the residential colleges where the drain can be a valve, hose connection and cap because of the small size of each floor system.
   Dry systems to be provided with drum drips at low points with valves, hose connection and cap. All drains are to be galvanized pipe and fittings.
**Piping:** Piping to follow NFPA 13. All grooved piping to be rolled grooved and not cut grooved. Both Schedule 10 and Schedule 40 can be used for sprinkler and standpipe systems. Fittings can be either cast iron or malleable iron. All equipment to be U.L./FM listed.

Victaulic Type saddle fittings over 2 inches in diameter are not allowed in any Fire Protection piping. Provide full size Tees for 2 1/2 inch branch outlets or larger.

6. **Sprinkler Heads:**
All sprinkler heads to be UL listed Quick Response Commercial sprinkler heads designed for Ordinary Hazard Application. They must also be listed for installation in Light Hazard areas. All sprinkler heads to have a least a 1/2" orifice with a temperature rating to match location installed. High temperature heads to be installed in any location subject to high heat potential including mechanical areas, attic areas and unvented skylight areas where 200/212° F sprinkler heads are to be installed. Quick response and standard heads are not to be used in the same area.

All concealed sprinkler heads to have white cover plates. Concealed sprinkler heads to be Reliable Model G4QR, 165 F. Cover Plate White. K=5.62 or current model. Sprinkler heads with Corrosion-Resistant Coatings to be used in hostile environments.

Spare sprinkler heads, storage box, wrench, cover plates and escutcheons to be provided as per NFPA 13 on each sprinkler project for each type of sprinkler head installed. At least six (6) sprinkler heads of each type shall be provided at each location as spare sprinkler heads. At least one sprinkler head wrench of each type shall be provided at each location as a spare sprinkler head wrench. If sprinkler caps are provided, then at least six sprinkler caps are to be provided as spares. An example, if five different sprinkler heads are installed in a project with sprinkler caps, then the contractor must provide at least six (6) sprinkler heads of each type installed, total 30 sprinkler heads with five proper sprinkler wrenches and 6 sprinkler caps in a storage box. Sprinkler guards to be installed in any location where sprinkler heads are subject to mechanical damage or are located below 7' 6" above finished floor. Extended coverage sprinkler heads on light hazard or as listed. Reliable, Central or Viking.

7. **Floor Control Equipment:**
Floor control valves shall be butterfly valves (Milwaukee, Victaulic), with a built in tamper switch and two sets of contacts (part of Tamper Switch). Each floor to have a Flow Switch with two sets of contacts and a retard switch (part of Flow Switch) from 0-90 Seconds. Set at 30 Seconds. In the residential colleges the flow switch would be on the riser only for each entry way and not on every floor. A pressure gauge (Ashcroft) 0-300 PSI with shut off valve at each floor except in the residential colleges where the gauge would be at the riser control valve. The drain valve /inspector's test to be piped outside or to a drain that can handle a flow of 50 G.P.M. for 3 minutes such as a janitor's sink. They are not to be piped to a floor drain. In the residential colleges the drain valve after the floor control valve can be a hose connection and cap. The drain/inspector's test after the riser control valve in the residential colleges to be piped as per the main drains.

8. **Valves: Above ground and within buildings.**
All control valves to be butterfly valves with a built in tamper switch and two sets of contacts. Tamper switch to be connected to the building fire alarm system as a separate point or zone as a supervisory alarm (trouble) and not on the same point or zone of any alarm causing device. All valves to be Left Hand to Open (counter clock wise). Milwaukee, VICTAULIC

9. **Valves: Underground**
All curb boxes, PIV's and other control valves to be Left Hand to Open. (counter clock wise). All PIV's to have a tamper switch with two sets of contacts included.
10. **Check Valves:** VIKING, VICTAULIC, RELIABLE,

11. **Fire Pump:**

Fire pumps to be installed as needed to increase the flow and pressure needed to meet the requirements of NFPA 13 and NFPA 14 in each building. The design to follow NFPA 20 and to include the following:
- The fire pump shall be located in a separate secured space. The space shall be key locked using the Yale Fire Marshal master key.
- Flushing of piping: All piping to be flushed through the fire pump by-pass with the valves to the fire pump closed. The flushing rate as per NFPA 20. This is to be done before the fire pump test is started.

Testing Requirements: The fire pump is to be tested following the guide lines of NFPA 20 and NFPA 25 with a complete report from the contractor with Mfg. test curves and actual test curves from on site testing. The test is to include RPM reading of the pump and ampere/voltage readings on all electric leads from the controller for each flow rate.
- The test is to be witnessed by the City and University Fire Marshal and to include, at least churn, rated and 150% flow rates and emergency power tests.
- A fire pump test header is to be provided on the outside of each building where a fire pump has been installed and its location to be coordinated with the University Fire Marshal. Size of piping and number of outlets as per NFPA 20 including control valves and drain. All fire pumps to be provided with a bypass around the pump as outlined in NFPA 20. Controller is to be connected to fire alarm control panel for supervision of power supplies and fire pump status, such as pump running, no power, phase reversal, transfer of power etc.
- Control Valves (Stockham) before and after the fire pump to be full flow type so as to not restrict the flow for the pump. OS&Y type, with tamper switches.
- All control valves to have a tamper switch installed with two sets of contacts and set for proper operation and connected to the fire alarm control panel. Potter or System Sensor.
- All fire pump controllers to be combined Normal and Emergency Power type with automatic transfer between power supplies.
- Jockey Pump to be installed to maintain pressure on the system and to be set to start at 10 PSI below churn pressure of the fire pump and stop at 10 PSI above churn pressure of fire pump.
- Fire Pump to be set to start at 25 PSI below churn pressure and stop at churn pressure. Run Timer to be set for 10 Minutes, with automatic shutdown after automatic start.
- Casing relief drain to be a separate drain line from drip cup drains.
- Fire Pump: ITT-AC, Peerless
- Fire Pump Controller: Metron, Inc.
- Jockey Pump: Grundfos
- Jockey Pump Controller: Metron, Inc.

12. **Fire Department Connections.**

Provide a sign at connection. “Stand Pipe” or “Combined Standpipe and Sprinklers”
Fire department connection to be provided to each sprinkler/standpipe system with 2-2 1/2" connections by a 6" feed to the system. Check valve and auto ball drip to be provided on each connection. Connection to be a brass flush unit when ever possible. Location to be coordinated with the City and University Fire Marshal on the exterior of the building. Spanner Wrench all caps.

The installation of an outside Water Motor Gong will be decided on a project to project basis. Reliable, Viking.
13. **Roof Manifolds:**

   Are to be provided as required to test the standpipe system for proper flow and pressure at the top of the most remote riser. All manifolds subject to freezing to be provided with a butterfly valve with a tamper switch and an Aux. Drain with valve, hose connection and cap above the control valve. Crocker, Potter Roemer

14. **Corridor Fire Mains.**

   Mains to be sized with a uniform size for the entire length of the corridor as per the hydraulic calculations so that the system can be expanded as needed. Such as Medical Laboratory Areas, 3" or 4" for the entire length of the corridor. Corridor fire mains that are installed before the rooms/labs have sprinkler protection to be provided with 2" taps on the main every 15 ft. for future connections. Aux. Drains with valve, hose connection and cap to be provided on the main as per NFPA 13 to drain any trapped sections of piping. Signs to be provided as per NFPA 13 for these aux. drains. Provide signs above and below ceiling.

15. **Extinguishers.**

   Type ABC: UL rated 4A-60B:C, 10 lb. capacity, stored-pressure multi-purpose dry chemical. Amerex 441
   Type ABC: UL rated 3A-40B:C, 6 lb. capacity, stored-pressure multi-purpose dry chemical. Amerex 461
   Type BC UL rated 10 B:C 10 lb capacity, etc. Amerex 330
   Type BC UL rated 5 B:C SLB capacity Amerex 322

   Installation: provide wall brackets for surface-mounted extinguishers. Secure mounting to surface.

   Mounting heights: top maximum 60 inch above floor.

16. **Fire Extinguisher Cabinet**

   Potter-Roemer 1700 Series; recessed; Cabinet to be constructed of #22 gage steel box; one piece #20 gage steel frame with a continuous steel hinge (brass pin); pull handle with friction catch; painted inside with baked-on enamel, outside with prime coat or as directed by Architect.

   Install cabinets in coordination with masonry coursing, and so that top of extinguisher is not more than five feet above floor. Set cabinets plumb, square, and level, with frame tight to wall surface securely anchored.

C. **EXECUTION**

1. All piping shall be installed by a licensed F-2 or F-1 mechanics. Contractor shall provide names and license numbers of all persons working on fire protection. The contractor shall provide this information to the Yale Project Manager in charge of the work.

2. **CLOSE OUT REQUIREMENTS:**
a. **As Built Drawings:**

As Built Drawings from the fire protection contractor are to be provided for review and final printing to both the Project Engineer for the Project and the University Fire Marshal. When approved and sealed the final sets are to be printed and provided to the plan room, engineer and University Fire Marshal. Reproducible drawings are also to be provided to the plan room. A set of as built drawings shall to be located at the alarm check valve in a protective tube.

b. **Flushing of Systems:**

All sprinkler systems, standpipe systems, fire pumps, jockey pumps, and fire mains are to be flushed clean as outlined in NFPA 13, 14, 20 and NFPA 24. These standards outline the flow rates required to have the systems cleaned of any debris. This is to be included in the test reports and is to be signed and witnessed.

c. **System Testing:**

All piping, fittings and system components are to be tested as per NFPA 13, 14 and 24 with water which is 50 PSI above the highest static pressure for the system or 200 PSI for 2 Hours, which ever is greater. Both above ground and underground piping to be included. High pressure fire mains and systems shall be tested to 225 PSI. Certificates to be completed and signed for each part of the system with copies provided to the University Fire Marshal, Project Engineer, and Project Manager.