

DIVISION 21 - FIRE SUPPRESSION

21 00 00 Fire Suppression General Requirements

1. At a minimum, follow the requirements set forth in the governing plumbing codes and their referenced standards and regulations.
 - 2009 Virginia Uniform Statewide Building Code (IBC),
 - ASME A17.1, Safety Code for Elevators and Escalators,
 - 2008 International Electrical Code,
 - 2009 Virginia Fire Prevention Code (IFC),
 - National Fire Protection Association (NFPA),
 - NFPA 13, Standard for the Installation of Sprinkler Systems,
 - NFPA 13R, Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies,
 - NFPA 14, Standard for the Installation of Standpipe and Hose Systems
 - NFPA 20, Standard for the Installation of Stationary Pumps for Fire Protection,
 - NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems,
 - NFPA 45, Standard for Fire Protection for Laboratories Using Chemicals,
 - NFPA 2001, Standard on Clean Agent Fire Extinguishing Systems,
 - Factory Mutual Global
 - Property Loss Prevention Data Sheet 3-26 “Fire Protection Water Demand for Nonstorage Sprinklered Properties,”
 - Bureau of Capital Outlay Management (BCOM) Construction and Professional Services Manual.
2. Design fire protection systems in accordance with governing codes and approved by the authority having jurisdiction. Factory Mutual Global Standards specified herein shall be met beyond the applicable code. These requirements will be reviewed case by case for each project and the Consultant will be instructed as required by GMU Facilities.
3. All fire protection system components shall be FM Approved, including but not limited to sprinkler heads, valves, pipe, fittings, hangers, pumps, controllers, tamper switches and related specialties.
4. Any requirements specified in this design manual that may exceed the minimum requirements of the governing code shall be adhered to unless prior approval is granted by GMU.
5. Coordinate fire sprinkler/standpipe service entrance with the corresponding site utility plans. Verify all sizes and depths are coordinated.
6. Coordinate fire department connection (FDC), fire pump test header and fire hydrant locations with the corresponding site plans. Ensure any FDC is within 50 feet of a fire hydrant.
7. This Section must be coordinated with the General Conditions. Do not address items such as handling of shop drawings, maintenance manuals and other information contained in the General Conditions or written in Division 1.
8. All equipment shall be installed with sufficient walk-around room to insure proper maintenance of equipment.
9. Products and materials manufactured in the United States are preferred.

10. The A/E may specify a single manufacturer and model number to establish a basis of design, however, all specifications shall be open to equal manufacturers or vendors. Where a basis of design specification is indicated, provide at least three other qualified manufacturers or vendors.
11. Refer to Section 10 44 00 "Fire Protection Specialties" for information on fire extinguishers and fire extinguisher cabinets.
12. For all new construction, renovations and alterations, the Contractor shall mark-up the contract documents to indicate any changes in construction and installation due to field conditions or other deviations from the plans and specifications. The A/E shall take the record drawings and produce the As-Builts with a CAD file.

22 05 29 Hangers and Supports for Fire Protection Piping and Equipment

1. Provide calculations for pipeline flexibility. Anchor as needed. Conform to ASME Code for allowable stresses.
2. Hanger installation shall be in accordance with FM LPDS 2-8N and NFPA 13 requirements.
3. Seismic requirements must be considered as required.

21 05 23 General Fire Suppression Valves

1. Control Valves:
 - In all buildings with fire alarm systems, all control valves, including post indicator and wall indicator valves, shall be electrically supervised by the fire alarm panel.
 - At all locations that control valves are concealed above ceilings or behind access doors, a sign shall be provided on the ceiling below the valve or the access door indicating the location of the control valve.
 - In residential buildings, all control valves that are located in spaces accessible by the occupants of the building shall be provided with lockable tamper prevention devices and locks (that shall be specified by the University).
 - Control valves shall only be installed in corridors, stairwells, mechanical rooms, fire pump rooms and sprinkler valve rooms and shall be easily accessible. The control valves shall be accessible with the use of no more than a six foot stepladder. Provide 24" x 24" access door for valves located above inaccessible ceiling types.
 - Control valves shall not be installed, above or below ceilings in classrooms, offices, conference rooms or any dormitory living quarters.
 - Each control valve shall be supplied with a sign indicating the area of the building that is served by the valve.
2. Inspector Test Valves:
 - At all locations that inspector test valves (ITV) are concealed above ceilings or behind access doors, a sign shall be provided on the ceiling below the valve or on the access door indicating the location of the ITV.
 - Inspector test valves shall only be installed in mechanical rooms, corridors, stairwells, fire pump rooms, sprinkler valve rooms and custodial closets and shall be easily accessible. The ITV's shall be accessible with the use of no more than a six foot stepladder.
 - Inspector test valves shall not be installed, above or below ceilings, in classrooms, offices, conference rooms or in dormitory living quarters or in any area requiring entry through a classroom, office, conference room or any dormitory living quarters.

- Inspector test valves discharge shall be piped to a drain capable of handling the discharge at full flow or to the exterior of the building.
3. Drain Valves:
 - Drain valves shall only be installed in corridors, stairwells, mechanical rooms, fire pump rooms and sprinkler valve rooms and shall be easily accessible. The drain valves shall be accessible with the use of no more than a six foot stepladder.
 - Drain valves shall not be installed, above or below ceilings, in classrooms, offices, conference rooms or in dormitory living quarters, or in any area requiring entry through a classroom, office, conference room or any dormitory living.
 4. Main drains discharge shall be piped to the exterior of the building.
 5. Auxiliary drain valves discharge shall be piped to a drain capable of handling the discharge at full flow or to the exterior of the building.

21 05 53 Identification for Fire Suppression Piping and Equipment

1. Utilize standard tag or placard to mark all major equipment. Tag all valves and provide valve chart for each floor.
2. Utilize standard Commonwealth of Virginia color coding for various building service piping and equipment. Mark each with name of service, direction of flow, and associated unit served where appropriate.
3. Equipment requiring electrical power shall be provided with a label indicating the electrical panel and/or motor controller feeding the equipment.
4. Plastic labels for equipment shall be multi-layer, multi-color phenolic with contact-type permanent adhesive compatible with attached substrate. Labels shall be 1/16" thick with black lettering over red background.
5. Equipment labels shall include the equipment's name and unique drawing designation or schedule tag number.
6. Provide pre-coiled, semi-rigid labels to cover full circumference of pipe. Pressure-sensitive type markers are not acceptable.
7. Valves shall be tagged with stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers. 1 1/2" diameter disk with smooth edges.
8. Valve tag material shall be brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware. Brass wire-link or beaded chain or S-hook.
9. Unless specified otherwise, comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

21 11 00 Facility Fire Suppression Water Service Piping

1. A separate water service shall be provided to buildings with fire protection standpipes and sprinkler systems. Fire suppression water shall not be supplied to a building through a combined domestic water service.
2. Unless specified otherwise, fire protection water services shall not be metered.
3. Fire department connections to sprinkler and or standpipe systems shall not be flush mounted or wall mounted. Fire department connections shall be located a minimum of 25 feet from the building. This requirement is often cited by BCOM under the rationale that fire response personnel are at risk of a wall collapsing if they approach a burning building.

4. Fire department connections shall be labeled with a permanently fixed, weather resistant information placard describing the type of system served and the area of coverage.
5. Fire protection water service, below grade, 4 inch and larger:
 - Cement lined ductile iron, Class 52, AWWA C 151.
 - Mechanical joint, ductile iron fittings, AWWA C 110, ductile or gray iron standard pattern or AWWA C 153 ductile iron compact pattern.
 - AWWA C 111 rubber gaskets. ANSI Class 150 flanges.
6. Water service flexible joints: Compound, ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include two gasketed ball-joint sections and one or more gasketed sleeve sections. Assemble components for offset and expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts. 250 psig pressure rating. Pressure containing parts shall be lined with a minimum of 15 mils of fusion bonded epoxy conforming to the applicable requirements of ANSI/AWWA C213 and shall be factory holiday tested with a 1500 volt spark test. Flexible expansion joint shall have flanged connections conforming to ANSI/AWWA A21.11/C110. Bolts and nuts shall be 316 stainless steel and gaskets shall be neoprene. Equal to EBAA Iron, Inc
7. Flanges shall be ANSI Class 150 flange adapter equal to Victaulic Style 641 for connections to flanged equipment. ANSI B16.1 dimensions.
8. Provide di-electric couplings or unions between dissimilar pipe materials.
9. Provide unions at connections to equipment.
10. Any improperly installed piping, joints or fittings or any piping that does not pass pressure testing requirements shall be removed and replaced.

21 12 00 Fire Suppression Standpipes

1. Where required by the IBC, standpipe systems shall be of the automatic wet type, Class III with 2 1/2" x 1 1/2" removable cap connection.
2. Hose cabinets may be used only for required supplemental hose valves outside of the main egress stairwells.
3. Fire department hose valves shall not be provided with hoses.

21 13 13 Wet Pipe Sprinkler Systems

1. Automatic sprinkler system calculations shall include a 10 psi safety factor to accommodate for any future deterioration or fluctuations in the water supply system.
2. A two-color plastic engraved identification card shall be provided for each sprinkler system zone indicating the hydraulic design information and secured to the respective floor control valve, zone valve or sprinkler riser.
3. All sprinkler heads should be installed using the appropriate wrench as specified by the sprinkler manufacturer. This will help to insure that the heads are installed properly without damage.
4. All steel piping shall be not less than Schedule 40 wall thickness for any pipe size.
5. The use of CPVC sprinkler pipe and fittings (e.g Blazemaster®) for any application is not acceptable and shall not be specified.
6. All sprinkler piping should be hydrostatically tested at 200 psi and should maintain that pressure without loss for 2 hours. Pressure loss should be determined by drop in gauge pressure or visual leakage.
7. Sprinkler system Hazard Category criteria shall be determined by Table 1 in [FM Global Property Loss Prevention Data Sheet, 3-26](#).

8. For any occupancy that does not exactly match that in Table 1 or for guidance on determining what design to use from the tables, contact the FM Global Plan Review Department or GMU's FM Global servicing engineer. The densities in the table are presented only as guidelines; other factors may affect the recommended design criteria.
9. The design criteria for water density and area of coverage shall be determined by Table 2 of the FM LPDS 3-26.
10. The interior and exterior hose demand allowance and duration shall be determined by Table 3 of the FM LPDS 3-26. Interior hose stream demand shall be not less than 150 gpm and shall be taken from the hose valve nearest to the sprinkler riser supplying the system feeding the area covered. In buildings without an interior standpipe system, the interior hose stream demand may be eliminated, but included in the total hose stream demand as exterior.
11. The minimum sprinkler K-factors shall be determined by Table 4 of the FM LPDS 3-36 for the Hazard Classification.
12. The minimum end head pressure for sprinklers shall be determined by Table 5 of the FM LPDS 3-36.
13. The maximum flow velocity in any part of an automatic sprinkler system shall be 20 feet per second.
14. Test Connections - Each water flow indicator shall be provided with an Inspector's Test Connection, consisting of a test pipe of not less than 1" diameter terminating in a smooth bore corrosion resistant orifice giving a flow equivalent to one sprinkler head of the type installed on the system. Test connection shall discharge to the building exterior. The 1" control valve for the Inspector's Test Connection shall be located not more than 7' above finished floor. An alternative arrangement for the Inspector's Test Connection is the "Testmaster", manufactured by the Victaulic Corporation.
15. Final acceptance will be upon completion of the Contractor's Material and Test Certificate (Form 85A) and field examination by an FM Global representative.
16. The A/E shall provide a full head layout on the plans as required by BCOM. Also, the A/E shall include the sprinkler main and branch piping layout for the most hydraulically remote/demanding area. Pipe sizes shall be shown. Provide hydraulic summary indicating design criteria, area covered, required flow rate, end head pressure, required pressure at the riser and pressure available at the riser for each area calculated.
17. Hydraulic calculations shall be based on approved flow tests which will be performed by GMU. All hydraulic calculations shall be reviewed by Owner and Factory Mutual.
18. Hydraulic Design Submittal: In addition to the distribution of drawings specified in General Conditions, the University shall be provided with one set of shop drawings depicting the complete automatic sprinkler system. Shop drawings shall clearly identify the hydraulically remote area, and all reference nodes shall be included from the supply to and including the remote area. In addition, one complete set of hydraulic calculations, including detail and summary sheets, shall also be submitted for retention by the University.
19. Automatic Sprinkler System Submittals shall include:
 - o Piping layout and sizes,
 - o Location and number of sprinklers (with sprinkler identification numbers (SIN) clearly indicated on the drawing),
 - o Fire department inlet connection location and configuration,
 - o Location of remote area used in hydraulic calculations,
 - o Hydraulic Calculations,
 - o Sprinkler head types,
 - o Sprinkler pipe and fittings,
 - o Sprinkler control valves,
 - o Any peripheral equipment - including tamper alarms, waterflow alarms, etc.
 - o Occupancy Details - In order to review submitted plans to ensure adequate protection, accurate occupancy details must be provided. This would include a general description of the

area being protected and, in the case of dedicated storage areas details of the materials being stored, storage height, storage arrangement, etc. should be provided.

21 13 16 Dry Pipe Sprinkler Systems

1. Specify only galvanized pipe and fittings for dry pipe and preaction sprinkler systems.
2. Coordinate the requirements for preaction or preaction type interlocks for sprinklers in elevator machine rooms and at the tops of elevator hoist ways with GMU Fire Marshall, FM and BCOM.
 - A “preaction” sprinkler system or equivalent solenoid valve assembly is required to supply sprinklers located in the elevator machine room and at the top of hoist ways.
 - The sprinkler(s) located in the hoist way pit may be wet pipe.
 - All sprinklers must have a minimum operating temperature of 250°F.
 - All control valves shall be located outside the protected area and each machine room, top of hoist way and bottom of hoist way (pit) shall have its own control valve.
 - The elevator machine room preaction valve or solenoid valve shall be activated by a fixed temperature or rate compensated heat detector with a temperature rating of 200°F.
 - These same detectors shall also initiate the automatic recall and then shutdown of main power to all elevators served by the machine room.
 - Each separate elevator hoist way shall have “preaction” valve activated by a 200°F heat detector that also initiates the shutdown of main power to all elevators in the hoist way.
 - Sprinklers located in the elevator pit shall have a separate control valve and water flow alarm switch. This flow switch, in addition to providing an alarm signal, causes shutdown of elevator power to all elevators in the hoist way.
 - In lieu of a solenoid valve, a packaged, modular preaction pre-action valve package provided by major sprinkler manufacturers may be used.

21 22 00 Clean Agent Fire Extinguishing Systems

1. Design and install clean agent fire extinguishing systems in accordance with NFPA 2001.
2. Coordinate fire alarm, HVAC controls and dampers, and interface with preaction systems (if used in conjunction) with the clean agent system monitoring and activation sequences.
3. Clean agent systems shall be used only as a first response extinguishing system to preserve vital or costly equipment in the hazard zone. They shall not be used as a substitution to a required automatic wet sprinkler system (or pre-action system) designed and installed in accordance with NFPA 13.

21 13 13 Electric Drive Centrifugal Fire Pumps

1. Buildings less than three stories (i.e. low rise) should not require fire pumps.
2. The installation of a fire pump is prohibited to reduce interior sprinkler piping sizing is prohibited when street pressure alone with appropriately sized mains and branches will provide specified water density over the coverage area.
3. Fire pumps shall be installed on the discharge side of water service entry backflow preventor(s).

21 34 00 Pressure Maintenance Pumps

1. Fire pumps shall be provided with a properly sized pressure maintenance (jockey) pump. The jockey pump stop setpoint shall be equal to the fire pump churn pressure plus the minimum static supply pressure.
2. The jockey pump start set point shall be at least 10 psi less than the jockey pump stop setpoint.
3. The fire pump start setpoint shall be 5 psi less than the jockey pump start point.

21 39 00 Controllers for Fire Pump Drivers

1. The power supply for electric fire pumps shall be connected before the building's main electrical disconnect. Power supply protection devices (fuses or circuit breakers) shall not be installed in the power supply circuits ahead of the fire pump feeder circuits. The power supply to the controller shall be run in such a way as to ensure that it would not be exposed to fire in the building.
2. Electric fire pumps shall be fed from emergency power through an automatic transfer switch.