



# Chesterfield Fire and EMS

## Fire and Life Safety Division

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### FIRE SPRINKLER SYSTEM

NFPA –13, 2010 Edition; Virginia Construction Code (VCC) and Virginia Statewide Fire Prevention Code (VSFPC) 2012 Editions

Project Name : \_\_\_\_\_  
Project Address : \_\_\_\_\_  
File Number: \_\_\_\_\_ Date : \_\_\_\_\_  
Code Edition: \_\_\_\_\_

All supporting documentation-showing items listed below are required for review. The checklist is based on the **2010** Edition of NFPA 13, and the **2012** Edition of Virginia Construction Code.

#### **General (All submissions shall include the following):**

- Applications for permit shall be made to the Chesterfield Building Inspection Department prior to commencement of any installation or alteration involving fire protection systems regulated by the Virginia Construction Code. A minimum of three copies of shop drawings and manufacturer’s installation instructions shall be provided with the application prior to installation. The application shall clearly indicate the system is required or elective at the discretion of the owner. Virginia Construction Code, Section 108.1
  
- A signed copy of the completed owner’s certificate shall be attached to each set of plans in accordance with Section 22.1.4 and Figure A22.1 (b). This requirement is applicable for all buildings (new or existing) where there is a change of occupancy, change in commodity classification, increase or decrease in hydraulic density, or change in type of protection.
  
- Provide name, address, telephone numbers and e-mail address for designer.
  
- Submitted plans are to be uniform in size and drawn to a recognized scale.
  
- Submitted plans and calculations shall clearly indicate the design standard(s) and edition used to prepare the submission.
  
- Submitted plans shall include a schematic drawing of the fire protection underground showing point of entry into building, size and the length of pipe, fittings, point of connection to the county main and location of referenced water flow test point. The schematic drawing shall include location and the type of all valves, meters, and backflow prevention devices. Section 22.1.3

- Submitted plans shall clearly show a floor plan of each story, indicating location of all walls, partitions, and fire-rated assemblies. Intended use of each area, room, or void space shall be indicated on the plans. Section 22.1.3
- Submitted plans shall clearly indicate total area protected by each system riser on each floor. Section 22.1.3
- Submitted plans shall include a full height elevation cross-section with vertical and horizontal distances of sprinklers relative to the underside of roof or ceiling assembly and/or structural members to verify obstructed or unobstructed construction. Section 22.1.3
- Submitted plans shall clearly indicate the type and the location of all control valves, drain valves, test connections, hose outlets, related equipment and piping. Section 22.1.3
- Submitted plans shall clearly indicate an approved audible device connected to every automatic sprinkler system. Such sprinkler water-flow alarm device shall be activated by water flow equivalent to the flow of a single sprinkler of the smallest orifice size installed in the system. Alarm devices shall be provided on the exterior of the building in an approved location. Where a fire alarm system is installed, actuation of the automatic sprinkler system shall actuate the building fire alarm system.  
Section 22.1.3, VCC – 2012 Edition - Section 903.4.2
- Submitted plans shall clearly indicate make, type, model, temperature rating, thermal sensitivity, quantity of each type, and nominal K-factor of sprinklers including sprinkler identification number. Section 22.1.3
- A list of the sprinklers installed in the property shall be posted in the sprinkler cabinet. A copy of this list shall be available to this office for record retention in accordance with Section 6.2.9.7 and 6.2.9.7.1.
- Submitted plans shall clearly indicate the location of all special sprinklers, such as extended coverage, sidewall, intermediate or high temperature sprinklers. Section 22.1.3
- Submitted plans shall clearly indicate pipe types and wall thickness, type of fittings and joints, and type and locations of hangers, sleeves, braces, and methods to support sprinkler components. Section 22.1.3
- Submitted plans shall clearly indicate nominal pipe size and cutting lengths of pipe or center to center dimensions, including riser nipples, drop nipples, and armovers. Section 22.1.3
- All additional required items outlined in NFPA 13 – Section 22.1.3, as applicable, for the system design.

- A wet pipe system shall be provided with a listed relief valve not less than ½ inch in size and set to operate at 175 psi or 10 psi in excess of the maximum system pressure, whichever is greater. Section 7.1.2
- Protection of piping - Submitted plans shall clearly indicate method of maintaining a minimum temperature of 40° F for sprinkler system piping installed in unconditioned spaces. Section 8.16.4.1
- Where aboveground water-filled supply pipes, risers, system risers, or feed mains pass through open areas, cold rooms, passageways, or other areas exposed to temperatures below 40° F, the pipe shall be protected against freezing by insulating coverings, frost-proof casings, listed heat tracing systems, or other reliable means capable of maintaining a minimum temperature between 40° F and 120° F. Section 8.16.4.1.3
- Where listed heat tracing systems are used, they shall be supervised. Section 8.16.4.1.4
- Where listed heat tracing is utilized for branch lines, it shall be specifically listed for use on branch lines. Section 8.16.4.1.5
- Water delivery rate for dry pipe sprinkler systems to the inspector's test pipe shall be designed in accordance with Section 7.2.3.
- Hydraulically designed systems:
  1. For all systems the design area shall be the hydraulically most demanding based on the criteria of Chapter 11, Chapter 12, or the special design approaches in accordance with the requirements of Chapter 21.
  2. Hydraulic calculations shall be prepared on form sheets that include a summary sheet, detailed worksheets, and a graph sheet in accordance with Section 22.3.
  3. The hydraulic reference points shall be indicated on the plan corresponding with hydraulic calculation sheets. Section 22.1.3
  4. The protection areas covered per sprinkler head. Table 8.6.2.2.1 (a, b, c and d)
  5. Provide a copy of the Chesterfield County Department of Utilities water flow test results, dated within 12 months of plan submission date. Section 22.2.1.1

**Tenant Upfit:**

- Where existing systems are to be modified, sufficient details of the existing system shall be shown on the plans to determine the effect of proposed modification on total system. Section 22.1.3
- The submitted plans shall include a key plan or complete building floor plan indicating the location of the affected tenant space(s).
- The submitted plans shall clearly indicate the location and the floor level of the hydraulic remote area and its design criteria.

- Work being performed in the hydraulic remote area shall include hydraulic calculations and the Chesterfield County Department of Utilities water flow test results dated within 12 months of plan submission date.

**Limited Area Sprinkler System:**

- Submitted plans shall provide a key plan showing the room or space to be sprinklered. The plans shall indicate the location in the building, room number (s) or floor where the work is to be performed.
- Hydraulic calculations shall be provided in accordance with Sections 22.2, 22.3 and the Virginia Construction Code 2012 Edition, Section 903.3.5.1.1
  1. Where the sprinkler system is supplied through a domestic water meter, provide the Chesterfield County Department of Utilities Water Meter Sizing Form.
  2. Where the sprinkler system is supplied through a separate fire line connection 2” or smaller in diameter the Chesterfield County Department of Utilities Specification FIR-1 shall be used.
- When a control valve is provided downstream from the domestic water control valve the limited area sprinkler system shall be supervised in accordance with Virginia Construction Code 2012 Edition, Section 903.3.5.1.1 #1, Exception, and Section 903.4.

**Storage:**

**Miscellaneous Storage ≤ 12 feet in height Class I-IV Commodities, Group A Plastic, Rubber Tires and Rolled Paper:**

- The submitted plans shall clearly identify and indicate commodity classification, maximum storage height, proposed storage arrangement, widths and locations of all aisles. Chapter 13, Figure 13.2.1; Table 13.2.1
- Chapters 14 through 17 contain references that direct the user back to Chapter 13 for protection criteria for certain storage heights, including all 12-ft or less in height. The criteria outlined in Chapter 13 apply even though these storage arrangements do not meet the definition of miscellaneous. In these cases, neither the requirements in Chapter 12, nor those in the specific storage chapter the reference came from apply. Some exceptions do apply concerning specific hazards outlined in the commentary. See Chapter 13, Miscellaneous Storage Handbook.
- The submitted plans shall clearly indicate the roof or ceiling height within the storage area based on one of the table columns limiting heights from the storage level.

**Miscellaneous Storage ≥ 12 feet in height Class I-IV Commodities, Group A plastic, Rubber Tires and Rolled Paper:**

- The submitted plans shall clearly indicate which of the following sprinkler system designs is used in accordance with Chapters 14, 15, 16, 17, 18, 19, 20, 21, NFPA 30, NFPA 30B, and NFPA 33:
  1. Control Mode Density/Area Sprinkler Protection Criteria
  2. Control Mode Specific Application (CMSA)
  3. Early Suppression Fast-Response (ESFR)
  4. Protection Criteria for Rack Storage
  5. High-Expansion Foam
  
- The submitted plans shall clearly indicate the commodity classification, the maximum storage height, the proposed storage arrangement, the widths and locations of all aisles. Section 22.1.3.
  
- For Group A plastic storage, the highest stock storage level and the lowest expected stock storage level, based on normal product inventory levels, shall be indicated for rack storage, palletized, solid piled, bin box or shelf storage arrangements. Chapters 15 and 17
  
- The submitted plans shall clearly indicate the minimum and the maximum distance between the sprinkler deflector and the top of the storage.
  
- The submitted plans shall clearly indicate the rack configuration, the width and height of the racks and the location and size of the rack flue spaces for the following arrangements:
  1. Single Row Racks, as defined by Section 3.9.3.7.5.
  2. Double Row Racks, as defined by Section 3.9.3.7.1.
  3. Multiple Rows Racks, as defined Section 3.9.3.7.3.
  4. Portable Racks, as defined by Section 3.9.3.7.4.
  5. Movable Racks, as defined by Section 3.9.3.7.2.
  6. Shelf Storage Units, as defined by Section 3.9.2.6
  
- The submitted plans shall clearly indicate the method of storage to be used:
  1. Wood pallets on racks
  2. Expanded plastic pallets on racks
  3. Solid shelving
  4. Open shelving
  5. Encapsulated wrapping materials.

**Special Notes**

- Pump and riser room size.** Fire pump and automatic sprinkler system riser rooms shall be designed with adequate space for all equipment necessary for the installation, as defined by the manufacturer, with sufficient working room around the stationary equipment. Clearances around equipment to elements of permanent construction, including other *installed equipment and appliances*, shall be sufficient to allow inspection, service, repair or replacement without removing *such elements of permanent construction or disabling the function of a required fire-resistance-rated assembly*. Fire pump and automatic sprinkler system riser rooms shall be provided with a door(s) and

unobstructed passageway large enough to allow removal of the largest piece of equipment. 2012 Edition of VCC, Section 901.8

- All fire pump and booster fire pump installations shall comply with NFPA 20.
- The submitted plans shall clearly indicate the location of the device used for forward flow tests at system demand, downstream of all backflow prevention valves. Section 8.17.4.6.1
- Fire sprinkler systems shall be monitored off-site to an approved supervising station in accordance with NFPA 72. Exceptions: One and Two-Family Dwellings and Limited Area Sprinkler Systems serving fewer than 20 sprinklers. 2012 Edition of VCC Section 901.6.1
- Piping between the sprinkler system and a pressure actuated alarm-initiating *should* be galvanized or of nonferrous metal or other approved corrosion-resistant material of not less than 3/8-inch nominal pipe size. 2010 Edition NFPA-72 Section A17.12.1
- Dry Sprinklers** – Where dry sprinklers are connected to wet pipe sprinkler systems protecting areas subject to freezing temperatures, the minimum length between the sprinkler and fitting shall be in accordance with the manufacturer’s instructions. The dry sprinklers must be of sufficient length to avoid freezing of the water-filled pipes due to conduction. Dry sprinkler manufacturers have minimum required lengths to ensure that the dry sprinkler is properly installed and that the point of attachment to the wet pipe sprinkler system will be properly protected against condensation, freezing, and ice plugs. While dry sprinklers are available in many different lengths for various applications, where utilized in conjunction with a wet pipe sprinkler system, care should be taken to ensure that the minimum required lengths are met based on the manufacturer’s recommendations and the expected exposed temperature. Ambient temperature is a term which refers to the temperature in a room, or the temperature which surrounds an object under discussion. The current record low temperature for Richmond, VA is (negative) -12 degrees Fahrenheit as recorded by The Southeast Regional Climate Center for Selected Cities in the Southeast. This will be the minimum temperature used for design purpose with a minimum interior room temperature of 40 degrees Fahrenheit to base the length of dry sprinklers (sidewalls, pendants, etc.). Section 8.4.9
- Antifreeze systems shall be the least desirable choice of system design. If all other alternative type systems are unworkable, the design, installation and charging of antifreeze systems shall comply with Section 7.6 and 22.4.4.5.

**NFPA 13 Sprinkler Systems:**

1. A placard shall be placed on the antifreeze system main valve that indicates the manufacturer type and brand of antifreeze solution, the concentration by volume used, and the volume of the antifreeze solution used in the system.
2. Antifreeze solutions shall be limited to the minimum concentration necessary for the temperature conditions but shall not exceed the premixed antifreeze solution for

glycerin (chemically pure or United States Pharmacopoeia 96.5%) at a maximum concentration of 48% by volume or propylene glycol at a maximum concentration of 38% by volume.

3. Premixed antifreeze solutions of propylene glycol exceeding 40% concentration by volume shall be permitted for use with ESFR sprinklers where the ESFR sprinklers are listed for such use in a specific application.
4. Premixed antifreeze solutions other than those described above that are listed by an independent nationally recognized testing laboratory for use in sprinkler systems shall be permitted. Documentation of the listing and use limitation shall be submitted with the plans.
5. All premixed antifreeze solutions shall be provided with a certificate from the manufacturer indicating the type of antifreeze, concentration by volume, and freeze point. A copy of the manufacturer's certification shall be submitted with the plans.
6. A premix antifreeze solution with a freeze point below the expected minimum, not exceeding the above maximums, shall be provided.
7. If an antifreeze solution is to be used with listed CPVC sprinkler piping and fittings, only glycerin shall be used. The use of diethylene, ethylene, or propylene glycols are prohibited.
8. The use of antifreeze solutions shall be permitted within the dwelling unit portions of sprinkler systems, designed in accordance with NFPA 13, only when the maximum antifreeze solution outlined in Item 2 is not exceeded.  
If the temperature condition to prevent freezing cannot be met at the maximum solution concentration specified in Item 2 a different type of sprinkler system shall be used in lieu of an antifreeze system (i.e. – running all pipe in the heated area, insulation, dry pipe system or pre-action system where permitted by the applicable building and fire codes).
9. The submitted plan shall indicate the provision of an antifreeze test port at the lowest and highest elevations of the antifreeze system. Antifreeze systems with a capacity of 150 gallons or greater shall have additional test ports provided at 100-gallon capacity points in the system piping.

### **NFPA 13R Sprinklers Systems:**

1. Antifreeze sprinkler systems designed in accordance with NFPA 13R shall comply with Items 1-9 above (NFPA 13).
2. The use of antifreeze solutions shall be permitted within the dwelling unit portions of sprinkler systems, designed in accordance with NFPA 13R, only when the maximum antifreeze solution outlined in Item 2 (NFPA 13), listed above, is not exceeded. If the temperature condition to prevent freezing cannot be met at the maximum solution concentration specified in Item 2 a different type of sprinkler system shall be used in lieu of an antifreeze system (i.e. – running all pipe when the heated area, insulation, dry pipe system or pre-action system where permitted by the applicable building and fire codes).
3. The submitted plan shall indicate the provision of an antifreeze test port at the lowest and highest elevations of the antifreeze system. Antifreeze systems with a capacity of 150 gallons or greater shall have additional test ports provided at 100 gallon capacity points in the system piping.

- In addition to standard hydraulic calculations, antifreeze systems with a capacity greater than 40 gallons shall also be calculated using the Darcy-Weisbach formula. A copy of the annotated Moody diagram shall be included for all NFPA 13 and 13R antifreeze sprinkler systems with a capacity of 40 gallons or more. Section 22.4.2.1.3
- An approved reduced pressure principle backflow prevention device, RPZ-listed assembly, including approved indicating control valves shall be provided at the point of connection of the wet pipe sprinkler system supplying the anti-freeze sprinkler system. An approved, listed reduced pressure backflow prevention device is required on all antifreeze systems. Section 7.6.3.2; Figure 7.6.3.3 or 7.6.3.4.
- An approved, listed expansion chamber shall be provided on all antifreeze systems. Section 7.6.3.3