City of Richmond

Bureau of Permits and Inspections
Department of Planning and Development Review

Commercial & Residential Sprinkler Systems, Private Fire Service Mains

All supporting documentation-showing items listed below are required for review. The checklist is based on the applicable current NFPA standards, 2021 editions of the Virginia Construction Code (VCC), International Fire Code and Virginia Statewide Fire Prevention Code (VSFPC), and Virginia Residential Code.

General (All submissions shall include the following):

☐ Applications for permit shall be made to the Richmond Building Inspection Department prior to commencement of any installation or alteration involving fire protection systems regulated by the Virginia Construction Code, except that applications for emergency alterations, repairs, or equipment replacement shall be submitted by the end of the first working day that follows the day such work commences. Shop drawings, data sheets, specification sheets, and manufacturer's installation instructions shall be provided with the application prior to installation electronically. The application shall clearly indicate if the system is required or elective at the discretion of the owner. VCC 2021 Section 108.1

☐ A signed copy of the completed owner's certificate shall be attached to each set of plans in accordance with NFPA 13 Section 23.1.4 and NFPA 13, Figure A23.1 (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 email address for the designer on the plans. Proper seal and signature shall be placed on the plans. VCC 2021 Section 109.3

☐ Submitted plans are to be uniform in size and drawn to a recognized scale. The minimum scale used on plans shall be 1/8" = 1'-0". Civil and site plans can be plotted at a smaller scale, such as 1" = 30'-0". VCC 2021 Section 109.3

☐ Submitted plans and calculations shall clearly indicate the design standard(s) and edition used to prepare the submission. VCC 2021 Section 109.3

☐ Submitted plans shall include a schematic drawing of the fire protection underground showing the point of entry into building, size and length of pipe, fittings, point of connection to the main and location of referenced water flow test point, and termination height above finished floor. The schematic drawing shall include location and the type of all valves, meters, and backflow prevention devices. NFPA 24 & NFPA 13, Section 23.1.3. Reference Private Fire Service Main section below for further details. – Note: This is required on all sprinkler drawings as a reference.

☐ 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, or void space shall be indicated on the plans. NFPA 13, Section 23.1.3

☐ Submitted plans shall clearly indicate total area protected by each system riser on each floor. NFPA 13, Section 23.1.3

☐ Submitted plans shall include a full height 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. NFPA 13, Section 23.1.3

☐ Submitted plans shall clearly indicate the type and the location of all control valves, drain valves, test connections, hose outlets, related equipment and piping. If the control valves are to be monitored by the FACP, either a detail or indication shall be placed on the plans to show the FACP tie-in. NFPA 13, Section 23.1.3

☐ 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. NFPA 13, Section 23.1.3, VCC 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. NFPA 13, Section 23.1.3

☐ 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 NFPA 13, Sections 6.2.9.7 and 6.2.9.7.1

☐ Submitted plans shall clearly indicate pipe types and wall thickness, type of fittings and joints, and type of locations of hangers, sleeves, braces and methods to support sprinkler components. Section NFPA 13 2019 Ed, 27.1.3

☐ Submitted plans shall clearly indicate nominal pipe size and cutting lengths of pipe or

center to center dimensions, including riser nipples, drop nipples, and arm-overs. NFPA 13 2019 Ed, 27.1.3

☐ All additional required items outlined in NFPA 13 Section 27.1.3, as applicable, for the system design.

☐ A wet pipe system shall be provided with a listed relief valve not less than ½" in size and set to operate at 175 psi or 10 psi in excess of the maximum system pressure, whichever is greater, unless meeting the exception described in NFPA 13 2019 Ed 8.1.2.2. Reference NFPA 13 2019 Ed Section 8.1.2.1

☐ Protection of piping – Submitted plans shall clearly indicate method of maintaining a minimum temperature of 40 degrees F for sprinkler system piping installed in unconditioned spaces. NFPA 13 2019 Ed 8.3.1.8.2.1

☐ 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 degrees 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 degrees F and 120 degrees F. NFPA 2019 Ed 16.4.1.3

☐ Where listed heat tracing systems are used, they shall be supervised/monitored. NFPA 2019 Ed 16.4.1.4.2

☐ Where listed heat tracing is utilized for branch lines it shall be specifically listed for use on branch lines. NFPA 2019 Ed 16.4.1.4.1

☐ Water delivery rate for dry pipe sprinkler systems to the inspector's test pipe shall be designed in accordance with NFPA 2019 Ed 8.2.3.2

☐ Hydraulically designed systems:

1) For all systems the design area shall be the hydraulically most demanding based on the criteria of NFPA 13 Chapter 11, Chapter 12, or the special design approaches in accordance with the requirements of NFPA 13 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 NFPA 13 2019 Ed, Section 27.4.1
3) The hydraulic reference points shall be indicated on the plan corresponding with hydraulic calculation sheets. NFPA 13 2019 Ed, Section 27.4.5.6
4) The protection areas covered per sprinkler head. NFPA 13 2019 Ed, Tables 10.2.4.2.1 (a, b, c, and d)

Provide a copy of the Richmond City Department of Public Utilities water flow test results, dated within 12 months of plan submission date. NFPA 13 2019 Ed, Section 4.6.1.1

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. NFPA 13 2019 Ed, Section 27.1.3

☐ The submitted plans shall include a key plan or complete building floor plan indicating the location of the affected tenant space(s). NFPA 13 2019 Ed, Section 27.1.3

☐ The submitted plans shall clearly indicate the location and the floor level of the hydraulic remote area and its design criteria. NFPA 13 2019 Ed, Section 27.1.3

☐ Work being performed in the hydraulic remote area shall include hydraulic calculations and the Richmond City Department of Public Utilities water flow test results dated within 12 months of plan submission date. NFPA 13 2019 Ed, Section 4.6.1.1

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. NFPA 13 2019 Ed, Section 27.1.3

☐ When a control valve is provided downstream from the domestic water control valve, the limited area sprinkler system shall be supervised in accordance with VCC 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. NFPA 13 2019 Ed Chapter 4, Table 4.3.1.7.1

☐ 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 greater than or equal to 12’ 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 NFPA 13, NFPA 30, NFPA 30B, 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. NFPA 13 2019 Ed, Section 27.4.2

☐ 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.

☐ 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 NFPA 13 2019 Ed, Section 3.3.157
2) Double Row Racks, as defined by NFPA 13 2019 Ed, Section 3.3.56
3) Multiple Rows Racks, as defined by NFPA 13 2019 Ed, Section 3.3.127
4) Portable Racks, as defined by NFPA 13 2019 Ed, Section 3.3.140
5) Movable Racks, as defined by NFPA 13 2019 Ed, Section 3.3.125
6) Shelf Storage Units, as defined by NFPA 13 2019 Ed, Section 3.3.188

☐ 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. VCC 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. NFPA 13 2019 Ed, Section 16.14.5.1

☐ 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. VCC 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" nominal pipe size. NFPA 72 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.) NFPA 13 2019 Ed, Section 15.3

☐ 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 NFPA 13 2019 Ed, Section 8.6 and 27.2.4.7.2

NFPA 13 Anti-Freeze 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 Antifreeze 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 a different type of sprinkler system shall be used in lieu of an antifreeze system (i.e. 0 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 submittal 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 Dacry-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. NFPA 13 2019 Ed, Section 27.2.4.7.2

☐ 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. NFPA 13 2019 Ed, Section 8.6.3.2; Figure 8.6.3.3 or 8.6.3.4

☐ An approved, listed expansion chamber shall be provided on all antifreeze systems. NFPA 13 2019 Ed, Section 8.6.3.3

NFPA 13D One and Two Family Dwellings, Manufactured Homes, & Accessory Dwelling Unit Sprinkler Systems

☐ Applications for permit shall be made to the Richmond Building Inspection
☐ Department prior to commencement of any installation or alteration involving fire
☐ protection systems regulated by the Virginia Construction Code, Existing Building Code, or International Residential Code (IRC). Shop drawings, data sheets, specification sheets, and manufacturer's installation instructions shall be provided with the application prior to installation electronically. The application shall clearly indicate the system is required or elective at the discretion of the owner. VCC Section 108.1

☐ Provide name, address, telephone numbers, and email address for the designer.

☐ Submitted plans are to be uniform in size and drawn to a recognized scale.

☐ A review of these plans will be conducted by the following city departments, as applicable:

- Planning and Development Review (PDR), Permits & Inspections Division
- Planning and Development Review (PDR) Historical Review
- Planning and Development Review (PDR) Chesapeake Bay Area Review
- Fire Department
- Department of Public Utilities (DPU)
- Department of Public Works

☐ Submitted plans shall clearly indicate the design standard(s) and edition used to prepare the submission.

☐ Each room on the plan shall be clearly labeled for use identification.

☐ Each plan shall include an overhead view; include piping configuration, ceiling fixtures (fans, lights, etc.) to verify obstruction distance requirements are met. Provide the distance on the plans from any obstruction to the sprinkler head.

☐ Provide a water flow test result from DPU and all water supply information. This will determine if the hydraulic calculations provided by the domestic water feed will be adequate to supply the sprinkler system. If the domestic water supply is not adequate, please indicate how the water supply will be met. If a tank and pump are to be installed, all details of the tank, pump, and connections will need to be included.

☐ For water supply tanks, indicate the size of the tank. Tank storage capacity should be sufficient for sprinkler demand (2 heads for 10 minutes).

☐ If a fire pump is installed, ensure that the pump is shown on the electrical drawings.

Electrical inspectors will ensure that the pump is installed per applicable electrical codes.

☐ If a backflow prevention device is required, show the location of that device on the plans, and any valves relating to its control.

☐ Show the connection point of the sprinkler system to the water supply.

☐ Show the water supply pipe (service line) size and all sprinkler pipe sizes.

☐ Provide a riser diagram at service area/point of entry provided.

☐ Include the riser location and detail, including pressure gauge above and below check valves, if applicable. If a riser is provided and is located in a closet, indicate that a sign is to be placed on the door to the room containing the riser which states “Sprinkler Riser Room”. If there are any control valves on the riser, a sign will be required to be placed on the control valves indicating their function.

☐ Provide a cut sheet for each type of sprinkler head used (submittal data sheets).

☐ Show make, model, size, K-factor, temperature, style, quantity, and flow demand for all sprinkler heads.

☐ If the home or ADU is not equipped with smoke alarms or smoke detectors installed in accordance with NFPA 72, a local water flow alarm shall be installed on the sprinkler system. Show all details of the water flow alarm on the sprinkler plans, if applicable.

☐ Provide freeze protection and/or insulation detail on the sprinkler plans.

☐ Show detail of all pipe hangers to be used.

☐ Show maximum sprinkler head spacing.

☐ Provide detail submittal cut sheet) for each pipe material used.

☐ Identify on the sprinkler plans the remote/design area for a 2-head flow test.

☐ Provide remote/design area hydraulic data.

☐ If any pipe protection plates are installed, include their data sheet and show locations on the sprinkler plans.

☐ Ensure nodes correspond to the fire safety plan

☐ Summary sheet and detailed worksheet are provided.

☐ Supply and demand curve are provided.

☐ Graph sheet (including pump sheet if applicable) are provided.

☐ Test and drain connections are provided in the sprinkler system and shown on the sprinkler plans.

☐ Control valves for shutoff provided in accordance with NFPA 13D chapter 7.

NFPA 24 Private Fire Service Main (Fire Line) Installations

☐ A Sprinkler permit application for the fire line shall be made separately from the sprinkler permit for the interior sprinkler system installation. The scope of work for the fire line shall be clearly denoted in the permit description. VCC 2021 Section 108.1

- Exception: If the sprinkler contractor who is doing the interior sprinkler work is also the same contractor that will install the fire line, the fire line plan may be submitted and reviewed along with the interior sprinkler plan under one single sprinkler permit application. Be sure to include the fire line scope of work in the permit description.

☐ Applications for permit shall be made to the City of Richmond Planning and Development Review, Bureau of Permits and Inspections Office prior to commencement of any installation or alteration involving fire protection systems regulated by the Virginia Construction Code. The application shall clearly indicate the system is required or elective at the discretion of the owner. VCC Section 108.1.

- Exceptions: Work may begin on a fire line emergency repair or replacement prior to the issuance of an approved sprinkler permit, so long as the permit is applied for on the first day that the emergency repair or replacement begins. No work may be concealed prior to an inspection.

☐ A proper fire line permit applications shall include all of the following:

- A cover page, including:
  - Name of Owner
  - Building Address and Project Name (if applicable)
  - Point of Compass
  - A graphic representation of the scale used on all plans
  - Name and Address of the contractor
  - Professional Engineer's seal and signature
  - Applicable Virginia Construction code year, as well as any applicable NFPA Standards and their year versions.

    Reference NFPA 24 2019 Ed Section 4.1

- A civil site plan that includes:
  - Size and location of all water supplies.
  - Size and location of standpipe risers, hose outlets, fire department connections, or any other system that will be fed by the fire line.
  - DO NOT include items on the civil site plan that are not pertinent to the installation of the fire line, such as landscape, lighting, bikes, etc. We do not need to see the entire civil site plan for this review, only the applicable sheets.

- A fire line plan that includes the following:
  Note: The fire line sheet(s) from the civil site plans are acceptable for the review, so long as the below information is included on the plan.
  - Size of the pipe to be used
  - Length of pipe runs
  - Location of the pipe runs
  - Pipe material
  - Point of connection to the city main
  - Sizes, types, and locations of valves, valve indicators, regulators, meters, heated above ground enclosures, valve pits. Identification signs shall be provided at each valve to indicate the valve's function and the part of the system the valve controls.
    - Exception: Identification signs shall not be required for underground gate valves with roadway boxes.
  - Depth at which the top of the pipe is laid below finished grade. (Minimum 3.5ft or 42 inches required per code)
  - Method of piping restraint
  - Backfill material
  - Entrance into the building, including any foundation sleeves that may be necessary and the detail of how the pipe will lay in the sleeve, and the riser turn-up into the building. This will include the termination height of the riser above the finished floor.
  - If above ground heated enclosures are to be used, details will need to show the method of heating to be utilized to maintain the required minimum 40 degrees F.
  - Fire Alarm Control Panel (FACP) tie-ins for valve monitoring are required to be shown for valves that control the flow of water to the sprinkler system.
    - Exceptions: Valves located underground in a road style valve box are not required to be monitored.
  - If the fire line installation contractor is installing the fire department connection, such as a remote FDC, all piping details shall be shown on the fire line plan for the FDC using the above criteria.
    - The FDC line shall show which hose threads are to be used and what size. (Richmond Standard required)
    - The FDC line shall have an approved automatic drain valve installed, and the details of such device shall be shown on the plan. If the automatic drain valve is to be buried, the outlet shall discharge into a bed of crushed stone or pea gravel and shall be accessible. A detail must be shown on the plan how the drain valve shall be made accessible.
    - A sign shall be installed on the remote FDC. The sign shall indicate the type of system being supplied, the building address, and if the system demand pressure exceeds 150psi, the sign shall indicate the required inlet PSI. Where a remote FDC services multiple buildings, structures, or locations, the sign shall indicate the building, structures,

or locations that FDC serves.

- If multiple buildings share a single address and are denoted by either numbers or letters (ex: 123 Main Street, building 1 or building B), then the FDC sign shall indicate the address and building number or letter assignment.
- If multiple buildings are built in close proximity to one another, and are served by remote fire department connections, in addition to the building displaying the address, the FDC sign shall include the address to the building it serves.
- The following criteria shall be followed when designing an FDC sign:
    - The fire department connection sign shall read "FIRE DEPARTMENT CONNECTION or FDC". The building owner, representative, sprinkler contractor, or general contractor may choose which wording they prefer to utilize. The minimum size of the sign shall be 5-inch high by 7-inch wide, WHITE letters with RED background. Letters shall be 2 inches in height with 3/8 stroke width and be all capital letters. The sign shall be permanently attached to the FDC piping, under the FDC hose threads. The sign shall be constructed of reflective aluminum for outdoor applications.

- Hydraulic calculations that indicate that the proposed fire line size will provide the required flow to the sprinkler system.

- All manufacturer's installation instructions for all materials used to form the fire line. This includes piping, valves, connections, fittings, and appurtenances.