



Chesterfield Fire and EMS

Fire and Life Safety Division

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UNDERGROUND PIPING FOR FIRE SPRINKLER SYSTEM

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

Project Name: _____
Project Address: _____
Building Permit #: _____ 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, **2012** Edition of Virginia Construction Code and portions of Chesterfield County Water and Sewer Specifications applicable to fire line installations.

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**
- In order to resolve issues associated with fire protection underground permits, the following guidelines should be applied to contractors with respect to their contractor licensing requirements:
 - Contractors with a highway heavy classification (H/H) can install underground water lines for fire sprinkler or standpipe water services from the point of connection with the utility up to one foot above finished floor elevation including any detector check installations at the utility connection. This is limited only to fire protection water services and is not applicable to any other type of installation.
 - Contractors licensed as plumbing contractors (PLB) and fire sprinkler contractors (FSP) may also be issued permits for this type of work.
- 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 shall include a schematic drawing of the fire protection underground showing point of entry into building, size and the length of pipe, fittings and point of connection to the county main. The schematic drawing shall include location and type of all valves, meters, and backflow prevention devices. Section 22.1.3
- The type and class of pipe for a particular underground installation shall be determined through consideration of the following factors:
 - Fire resistance of the pipe
 - Maximum system working pressure
 - Depth at which the pipe is to be installed (minimum of 3' - 6" from top of pipe to finished grade)
 - Soil conditions
 - Corrosion
 - Susceptibility of pipe to other external loads, including earth loads, installation beneath buildings, and traffic or vehicle loads.
- Plans shall clearly indicate method of pipe restraint where change in run occurs, type of devices to be used and manufacturer's installation requirements.
- Plans shall include a backflow prevention device valve vault detail consistent with **Chesterfield Department of Utilities, Water and Sewer Specification and Procedures Part II, Standard Details**
 - **FIR-1 (1A) Detail** for 2" diameter pipe and smaller (<100 ft. pipe)
 - **FIR-2 Detail** for 2" or smaller Double Check Assembly and Vault (>100 ft. pipe)
 - **FIRE-3 Detail** for 3" or larger Double Check Assembly and Vault
- Double Check Assembly Vaults shall be installed so they are vertical, true and plumb.
- Double Check Assembly Vault top shall be a minimum of six inches above finished grade. Under no circumstances shall the vault top be at or below the finished grade per Chesterfield Department of Utilities Specification G (2) (B).
- Water discharging from the sump pump must be directed to "vegetation" in the vicinity of the vault.
- Plans shall indicate size and show routing of electrical conduit to valve vault where sump pump will be installed.
 - Where applicable, conduits for 110 vac sump pump circuit installation.
 - Note: A single outlet receptacle supplying a permanently installed sump pump shall not require GFI protection, and meets provisions for disconnect. Do not provide GFI protection on the sump pump.

- Plans shall show location of fire department connection (FDC), indicating the location of check valve and automatic ball drip drain; NFPA 13, Section 8.17.2.5
 - If the FDC is located at the vault, follow installation guide in the Department of Utilities vault detail.
 - If FDC is located on a building wall, delete the FDC at the vault.
 - When a fire pump is required, FDC supply piping shall be connected to the discharge side of fire pump. The required check valve shall be located immediately adjacent to the point of connection on the fire pump discharge piping. NFPA 13, Section 8.17.2.4.8.
 - The FDC shall be located not less than 18-inches and not more than 48-inches above the level of adjacent grade.
 - Where FDC's supply sprinkler systems in multiple buildings, the building address shall be included with the identification sign.
 - A metal sign with raised letters at least one-inch in size shall be mounted on all fire department connections serving automatic sprinklers, standpipes or fire pump connections. Such signs shall read: AUTOMATIC SPRINKLERS or STANDPIPES or TEST CONNECTION or a combination thereof as applicable.
 - Where the fire department connection does not serve the entire building, a sign shall be provided indicating the portions of the building served.
 - All signs must have white reflective letters on a red background.
 - Where the system demand pressure exceeds 150 psi, the fire department connection sign shall state the required design pressure. Section 8.17.2.4.7.3
 - A fire hydrant shall be provided within 50-foot accessible hose lay distance from the FDC.

- Plans showing the location of underground piping from valve vault to one-foot above finished floor shall indicate the transition of different pipe materials.

- Plans shall clearly indicate the method of providing corrosion protection for bolted/threaded assemblies, retaining rods, clamps, and other restraining devices. NFPA 13, Section 10.3.5.2

- Plans shall indicate the location of all thrust blocks, rodding, and restraint devices. NFPA 13, Section 10.8.1
 - For calculated bearing and gravity thrust blocks refer to Section 10.8.2, Tables A.10.8.2(a, b, & c) and Figures A. 10.8.2(a, b & c).
 - Refer to attached bearing thrust block tables.
 - When thrust blocking does not bear against undisturbed soil and engineer's report confirming soil suitability shall be submitted.
 - Threaded rod shall not be formed or bent. Section 10.8.3.1.2.4
 - Listed joint restraint systems such as bolted flange, heat fused, welded joints shall comply with Section 10.8.3.
 - Rodding and clamps shall be provided with corrosion protection Section 10.8.3.5.

- Plans shall include a stub-up riser detail for piping from five-feet outside of the building to one-foot above finished floor. The detail shall include, but not be limited to the following:
 - Depth of bury from finished grade to top of pipe.
 - Pipe size and material type.
 - Restraint device(s), thrust blocks, rodding, joint system.
 - Transition details for connection of dissimilar piping materials.
 - Mechanical fittings and flanges for connecting sprinkler system components.

- Include the following manufacturer's product data sheets with the submittal:
 - Backflow prevention devices including friction loss chart.
 - Any valves.
 - Fire department connection with a minimum of (Two) – 2 ½ inch National Standard Thread (NST) hose connections.
 - Automatic ball drip for the fire department connection piping.
 - Check valve for the fire department connection piping.
 - Sump pump.
 - Vault doors.
 - Pipe penetration seals at vault. Include FDC protection, water line protection and sump discharge pipe protection.
 - Pre-fabricated vault construction details.
 - Pipe, fittings, and restraint devices.
 - NOTE: Backflow devices must be approved by Chesterfield Utilities Department and this office.

- NOTE: Pre-cast Double Check Assembly Vaults shall be limited to those approved by the Chesterfield Utilities Department. Poured in-place vaults shall conform to the construction specification as approved by the Utilities Department.

- NOTE: NFPA 13, 2010 and 2013 Editions, Section 8.17.4.6.1 requires a “means” downstream of all backflow prevention devices to verify the sprinkler system flow demand. This “means” location is up to the designer. For instance, (1) a test header or other connection on the interior sprinkler system riser would be acceptable or (2) a bypass line around the check valve in the fire department connection supply line with a control valve in the normally closed position would be acceptable. A method not acceptable would be disconnecting and reversing the FDC check valve and using this set-up to conduct flow testing. It is unlikely that property owners will undertake such effort and expense to conduct this important test. Plans submitted for the fire protection underground or the sprinkler system must clearly show the test port location.

Inspection and Testing

Four-inch and larger fire protection underground piping

- Installation and testing of fire protection underground mains are permitted to be performed in phases on large complex projects at the discretion of the Assistant Fire Marshal – Plans Review for that district. When the Assistant Fire Marshal enters into an agreement to permit phased installation that includes covering the various phases prior to a complete hydrostatic pressure test of the installation, the following procedure shall be followed:
 - Each phase of the underground piping shall be hydrostatically pressure tested prior to concealment. The thrust blocking/restraint devices shall be inspected.
 - The on-site approved plans for the underground piping shall be marked to indicate the phase or section tested. The plans shall be marked, dated and signed by the inspector.
 - Upon completion of the installation, the entire installed fire protection underground shall be hydrostatically pressure tested.
 - The final hydrostatic pressure test and thrust blocking / restraint device inspection results will be entered into POSSE.

- Flushing of the fire protection underground piping will only be performed after the county utilities department has released their portion of the new water main supplying the underground piping. This is to ensure flushing routine does not impair or negate bacteria testing required by the utilities department. Flushing rates for fire protection underground shall be in accordance with NFPA 13. Before performing flush tests, inquire about the status of the underground to verify “jumpers” have been removed.

- The backflow preventer is required to be tested by providing a forward flow test to document opening of check valves to allow the minimum required water supply for the interior fire sprinkler system design. This test “may” be completed during flushing operations of the underground piping.

- Inspection of the vault and its components shall be performed when the installing contractor indicates all work in the vault is complete. Also, the Contractor Materials and Test Certification shall be completed and provided.

- A “final fire protection underground inspection” will be requested by the installing contractor to complete the permit process.

Three-inch and smaller fire protection underground piping NFPA 13R, NFPA 13D and limited area sprinkler systems

- Thrust blocks are not required unless a fire department connection (FDC) supplies the underground piping on the supply side of the floor flange. (Possible FIR-2 arrangement) or if the pipe joining method is approved for use without thrust blocks (i.e. – glued joints), solid run of copper pipe with no joints or crimped copper joints from an approved

crimping system (i.e. – Ridgid ProPress System or other UL listed copper crimping system approved for fire protection systems). Standard bell and spigot joints may require thrust blocking in unusual circumstances. The use of mega lug fittings also qualifies as a non-thrust block joining method.

- Hydrostatic pressure tests will be conducted at one of the following pressures depending on the type of arrangement to be installed:
 - FIR-1 150 psi or 1 ½ times the working static pressure, whichever is greater.
 - FIR-1A 150 psi or 1 ½ times the working static pressure, whichever is greater.
 - FIR-1B 100 psi or 1 ½ times the working static pressure, whichever is greater. (One & Two-Family Dwelling Units Only)
 - FIR-2 150 psi unless system is equipped with a fire department connection at the underground vault. If a fire department connection is provided, the minimum test pressure is 200 psi.

- Flushing of the fire protection underground piping will only be performed after the county utilities department has released their portion of the new water main supplying the underground piping. This is to ensure flushing routine does not impair or negate bacteria testing required by the utilities department. Flushing rates for fire protection underground shall be in accordance with NFPA 13R and/or 13D depending on the system design standard. Before performing flush tests inquire about the status of the underground to verify “jumpers” have been removed.

- The backflow preventer is required to be tested by providing a forward flow test to document opening of check valves to allow the minimum required water supply for the interior fire sprinkler system design. This test “may” be completed during flushing operations of the underground piping.

- Depth of bury for all underground fire line piping is 42-inches from finish grade to top of piping.

- Backflow prevention device shall be as specified in the Chesterfield County Utilities Department – Water and Sewer Specifications and Procedures – Part V.

- Backflow prevention devices shall be located as specified in the Chesterfield County Utilities Department – Water and Sewer Specifications and Procedures. Refer to Chesterfield County Utilities Department – Water and Sewer Specifications and Procedures – Specification Drawing FIR-1, FIR-1A, FIR1-B and FIR-2.

- When backflow prevention devices are located within the building, the Fire and Life Safety Division will review and inspect all underground piping from the street control valve located at the tap on the county main to one-foot above finished floor. Refer to Chesterfield County Utilities Department – Water and Sewer Specifications and Procedures – Part II – Specification Drawing FIR-1, FIRE-1A and FIR-1b.

- ❑ Vaults for backflow prevention devices shall be in accordance with the Chesterfield County Utilities Department – Water and Sewer Specifications and Procedures.

CONCRETE THRUST BLOCKS, MINIMUM AREA OF BEARING						
Pipe Size	90° Bend		45° Bend		Tees, Plugs, Caps, & Hydrants	
	ft ²	m ²	ft ²	m ²	ft ²	m ²
in.						
4	2	0.19	2	0.19	2	0.19
6	5	0.46	3	0.28	4	0.37
8	8	0.74	5	0.46	6	0.56
10	13	1.21	7	0.65	9	0.84
12	18	1.67	10	0.93	13	1.21

CONCRETE THRUST BLOCKS, MINIMUM AMOUNT OF CONCRETE	
Size of Fitting	Cubic Yards
3"-8"	¾
10"-12"	1 ½

THRUST @ 225 PSI WATER PRESSURE FOR FITTINGS			
Pipe	90° Bend	45° Bend	Dead End
4	2,559	1,385	1,810
6	5,288	2,862	3,739
8	9,097	4,923	6,433
10	13,685	7,406	9,677
12	19,353	10,474	13,685

Water Pressure > 100 psi MULTIPLY Table by Ratio of Pressure ... 150 psi/100 psi = 1.5 Factor
2007 NFPA 24

Minimum Thrust Block Size

$$A_b = (h)(b) = T (S_f) / S_b$$

(h) = block height, (b) = block width

T = thrust force table,

S_f = safety factor (1.5)

S_b = soil bearing from table

SOIL	BEARING lb./ft ²
SOFT CLAY	1,000
SAND	4,000
SAND CLAY	6,000
HARD CLAY	9,000

ROD NUMBER – DIAMETER COMBINATIONS				
Pipe Size	5/8 in.	3/4 in.	7/8 in.	1 in.
4	2	_____	_____	_____
6	2	_____	_____	_____
8	3	2	_____	_____
10	4	3	2	_____
12	6	4	3	2

Table derived using pressure of 225 psi (15.5 bars) and design stress of 25,000. 2010 NFPA 24 Table 10.8.3.1.2.2