

Chesterfield Fire and EMS
Fire and Life Safety Division
FIRE PROTECTION UNDERGROUND
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Fire Protection Underground
NFPA 24 (2007 Edition)

Project Name : _____
Project Address : _____
Building Permit # : _____ Date : _____
Code Edition: _____

All supporting documentation, showing items listed below are required for review.
The checklist is based upon 2007 editions of NFPA 24 – Installation of Private Fire Service Mains and Their Appurtenances and NFPA 13 – Installation of Sprinkler Systems, as referred in the 2009 editions of the International Building and Fire Codes.

- Fire protection underground plans shall address the double check assembly device and vault, to 1 ft above finish floor.
- A minimum of four copies of shop drawings, and submittal data shall be provided with the permit application permitting evaluation of the system design prior to installation.
- Plans shall clearly indicate the project name and address including associated project building permit number.
- The submitted plans shall be drawn to an indicated scale on sheets of uniform size and shall include the following items that pertain to the design of the system. NFPA 24 – section 4.1.3.
 - Name of the owner.
 - Location of the project, including the street address.
 - Point of compass.
 - A graphic representation of the scale used on all plans.
 - Name, address and contact information of the installing contractor.
 - Size and location of all water supplies.
 - Size and location of standpipe risers, hose outlets, hand hose, monitor nozzles and other related equipment, where applicable.
 - Size of the private fire service main.
 - Length of main to be installed.
 - Location of the private fire service main to be installed in reference to the

- building and other landmarks.
 - Weight of the private fire main material to be installed.
 - Type/material of private fire service main to be installed.
 - Point of connection to the county water main or other source of water.
 - Size, type and location of valves, valve indicators, regulators, meters, backflow prevention device vault and backflow prevention device, including friction loss tables.
 - Depth of cover measured from the top of the pipe to finish grade. Minimum depth of cover is 3'6".
 - Method of restraint, type of devices to be used and the manufacturer's installation requirements.
- Plans shall clearly indicate the responsible designer's name, address, and contact information.
- Plans shall include a backflow prevention device valve vault detail consistent with **Chesterfield Department of Utilities, Water and Sewer Specification and Procedures**
http://www.co.chesterfield.va.us/communitydevelopment/utilities/specs/PART_2_02_Standard_Details.pdf
- 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)
 - FIR-3 Detail** for 3" or Larger Double Check Assembly and Vault
- Double Check Assembly Vaults shall be set so that they are vertical, true and plumb.
- The Double Check assembly Vault top shall be a minimum of six inches above the 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).
- Plans shall indicate the location and sizes of all piping and equipment used to maintain the backflow prevention device vault free from accumulation of water. NFPA 24 – 6.4.4.
- Drain line directly to acceptable discharge location.
 - Sump pump and drain line to acceptable discharge location.
 - Engineered drain field, requires professional engineer's sealed drawing(s) and calculations for drain field. **SPECIAL CONDITION:** requires third party inspection and certification prior to requesting a vault inspection.
- Plans shall indicate size and show routing of electrical conduits to valve vault.
- Conduit for fire alarm system circuit providing electronic monitoring of valves.
 - Where applicable, conduit for 110 vac sump pump circuit installation.
- NOTE:** Low voltage fire alarm circuits, 24 VDC, cannot be run in conduit common with vac circuits exceeding 50 volts; 2002 NEC 760-26(B).
- 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 the check valve and automatic ball drain; NFPA 24 – Section 5.9 and 5.9.4.
- FDC at valve vault, refer to the Department of Utilities vault detail.

- FDC on building, delete FDC from the Department of Utilities vault detail.
- When a fire pump is required for the building systems, separate FDC piping shall be connected to discharge side of fire pump. The required check valve shall be located immediately adjacent point of connection of the fire department connection to the fire pump discharge piping. The fire department connection piping shall be sloped to the automatic ball drip valve located in valve vault. Based upon pipe configuration, multiple low point drains may be required.

- The Fire Department Connection (FDC) shall be located not less than 18 inches and not more than 4 feet above the level of adjacent grade. NFPA 24 – A-5.9.
- A sign constructed of durable materials (preferably metal), permanently installed and readily visible shall be provided at the Fire Department Connection. The sign shall have letters six inches in height. The letters shall be of red reflective material on a white reflective background. The verbiage maybe "FDC" or "Fire Dept.Connection" in accordance with the International Fire Code (2009 edition) Section 912. When the FDC protects multiple addresses within a complex, but not all of the address, the specific addresses being protected shall be shown on the FDC sign. Minimum letter size shall be two inches.

- Where the system demand pressure exceeds 150 psi, the fire department connection sign shall state the required design pressure. NFPA 24 – Section 5.9.5.4.

- Plans shall show the location of all municipal fire hydrants indicating the location of control valves permitting hydrant service; (Municipal) Chesterfield Department of Utilities.
- A hydrant shall be provided within 50 feet accessible hose lay distance from the Fire Department Connection.

- The plans showing the location of the underground piping from the valve vault to 1 ft. above finished floor shall indicate the transition of different pipe materials.
- Specific detail(s) shall be provided for pipe material transitions, changes in pipe connections (slip joint, fixed flange, mechanical joints, mega-lug joints); NFPA 24 – Section 4.1.3.

- Plans shall clearly indicate the method of providing corrosion protection for bolted/threaded assemblies, retaining rods, clamps, and other restraining devices; NFPA 24 – Section 10.3.5.2

- Plans shall indicate the location of all thrust blocks, rodding, and restraint devices.
- For calculated bearing and gravity thrust blocks refer to NFPA -24 Section 10.8.2, Tables A10.8.2 (a, b and c) and Figures A10.8.2 (a, b and c).
- Refer to the attached bearing thrust block tables.
- When thrust blocking does not bear against undisturbed soil an engineer's report confirming that soil suitability shall be submitted..
- Threaded rod shall not be formed or bent. NFPA 24 – Section 10.8.3.1.2.4.
- Listed joint restraint systems such as bolted flange, heat fused, welded joints shall comply with NFPA 24 – Section 10.8.3.
- Rodding and clamps shall be provided with corrosion protection. NFPA 24 – Section

10.8.3.1.1, 10.8.3.1.2 and Table 10.8.3.1.2.2.

- Plans shall provide calculated vertical and horizontal thrust forces for pipe elevation changes indicating appropriate restraint method; NFPA 13: 6-3.2, Figure A-6-3.2(d).

Vertical Thrust Force = $T_y = PA \sin \theta$... **Horizontal Thrust Force** = $T_x = PA (1 - \cos \theta)$

P = Water Pressure, **A**= Pipe Area (πr^2): 4"= 12.5 in², 6"= 28 in², 8"= 50 in², 10"= 78.5 in²

Sin θ : 22.5° =.38, 45° =.70, 90° =1.0 ... **(1 - cos θ)**: 22.5° =.076, 45° =.29, 90° = 1.0

- Gravity thrust block size = $Vg = \frac{S_f PA \sin \theta}{W_m} = \frac{(1.5)(T_y)}{W_m}$

S_f= Safety Factor (1.5)

W_m

= Mass of blocking material (concrete: 145 lbs/ft³)

- Restraint device(s), rodding, mechanical joint system.

- Plans shall include a stub-up riser detail for piping from 5' feet outside of the building to 1 ft. above finished floor. The detail shall include, but not be limited to the following:

- Depth of bury
- 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.

- Provide the following manufacturer's product data sheets with the submittal:

- Backflow prevention devices including friction loss chart.
- OS&Y and PIV valves.
- Tamper switches.
- Fire department connection with a minimum of (2) - 2 ½ " NST hose connections
- Automatic ball drain for the fire department connection piping.
- Check valve for the fire department connection piping.
- Sump pump.
- Vault doors
- Pipe penetration seals at vault (flexible)
- Pre-fabricated vault construction details.
- Pipe, fittings, and restraint devices.
- Other _____

NOTE: Backflow devices must be approved by Chesterfield Department of Utilities.

http://www.co.chesterfield.va.us/CommunityDevelopment/Utilities/specs/PART_5_01_Table_of_Contents.htm

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

http://www.co.chesterfield.va.us/CommunityDevelopment/Utilities/specs/PART_5_01_Table_of_Contents.htm

Areas in table have been derived using a water pressure of 225 psi (15.5 bars) and a soil resistance of 2000 pounds per square foot (1.0 bars). The values include a 1.5 safety factor. NFPA 24

| 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 |
| 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. 2007 NFPA 24 Table 10.8.3.1.2.2