



CHECKLIST: FIRE PROTECTION UNDERGROUND

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OFFICE USE ONLY

APPLICATION #:

PERMIT #:

The checklist is based upon 2016 editions of NFPA 24 – Installation of Private Fire Service Mains and Their Appurtenances and NFPA 13 – Installation of Sprinkler Systems, as referenced in the 2018 editions of the International Building and Fire Codes.

PROJECT NAME:

PARCEL ID NUMBER:

PROJECT ADDRESS:

DATE:

Plans/Specifications submitted for review must include:

- Fire protection underground plans shall address the double check assembly device and vault, to one foot above finished floor.
- A minimum of four copies of shop drawings, calculations and submittal data shall be provided with the permit application permitting evaluation of the system PRIOR TO installation.
- Plans shall clearly indicate the project name, the project address, the responsible designer's name, address, and contact information.
- 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.

- U Plans shall include a backflow prevention device valve vault detail consistent with Prince George County Utilities Department, Water & Sewer Standard Specifications (<http://www.princegeorgeva.org/Index.aspx?page=86>).
 - 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.
- U Plans shall indicate the location and sizes of all piping and equipment maintaining the valve vault free from accumulation of water. (5-14.1.4.2.).
 - Drain line directly to storm sewer or acceptable discharge location.
 - Sump pump and drain line to storm sewer or 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.
- U 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; 2017 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 GFI PUMP.
- U Plans shall show location of Fire Department Connection (FDC), indicating the location of the check valve and automatic ball drain. (5-15.2.2, 5-15.2.3, 5-15.2.4, 5-15.2.5).
 - FDC at valve vault.
 - FDC away from building (minimum 40 feet).
 - 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.
- U The Fire Department Connection (FDC) shall be located not less than 18 inches and not more than four feet above the level of adjacent grade. (5-15.2)
 - 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 (2018 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.
- U 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.

- U Plans shall show the location of all fire hydrants.
 - The indicating control valves permitting hydrant service for private fire hydrants shall be shown.
 - A hydrant shall be provided within 50 ft. accessible hose lay distance from the Fire Department Connection.
- U 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.
 -
- U Submitted plans shall indicate a minimum 3'-6" depth of burial measured from the top of the pipe to finished grade for all underground piping. (5-14.4.1.1, 5-14.4.1.2, Figure A 5-14.4.1.1).
- U Plans shall clearly indicate the method of providing corrosion protection for rods, nuts, bolts, washers, clamps, and other restraining devices. (5-14.3.2).
- U Plans shall indicate the location of ALL thrust blocks, rodding, and restraint devices.
- U Calculated bearing and gravity thrust blocks. (Tables A-6-3.2 (a), (b), Figures A-6-3.2 (a), (b), (d). NFPA 24: Table A-10.8.2 (a), (b), Figure A.10.8.2(d))
 - Attached bearing thrust block tables.
 - Thrust blocking not bearing against undisturbed soil requires an engineer's report.
 - Threaded rod shall not be formed or bent. (6-3.3.1.2, 20:10.8.3.1.2.4)
 - Listed joint restraint systems; bolted flange, heat fused, welded. (6-3.3)
 - Rodding and clamps with corrosion protection. (6-3.3.1.2, 5-14.3)
- U Plans shall provide calculated vertical and horizontal thrust forces for pipe elevation changes indicating appropriate restraint method. (NFPA 24: 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

W_m = Mass of blocking material (concrete: 145 lbs/ft³ Restraint device(s), rodding, mechanical joint system.

 - Restraint device(s), rodding, mechanical joint system.
- U Plans shall include a stub-up riser detail for piping from 5 ft. 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 1/2 " 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)
 - Prefabricated vault construction details.
 - Pipe, fittings, and restraint devices.
 - Other

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

Note: Areas in the following tables 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				
	in.	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"	³ / ₄
10"-12"	1 ¹ / ₂

THRUST @ 225 PSI WATER PRESSURE FOR FITTINGS			
Pipe	90° Bend	45° Bend	Dead End
4	2559	1385	1810
6	5288	2862	3739
8	9097	4923	6433
10	13685	7406	9677
12	19353	10474	13685

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. 1999 NFPA 13:Table 6-3.3.1.2.