SECTION 7 – WATER DESIGN

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7 WATER DESIGN

7.1 GENERAL
7.1.1 SPECIFICATION AND DESIGN MANUAL

7.2 WATER SYSTEM DESIGN STANDARDS
7.2.1 GENERAL
7.2.2 TAPS

7.3 POLICY AND EXECUTION
7.3.1 PREREQUISITE CONDITIONS FOR TESTING AND DISINFECTION
7.3.2 PRESSURE TESTS & LEAKAGE
7.3.3 FINAL ACCEPTANCE

7.4 REFERENCES

7.1 GENERAL

7.1.1 SPECIFICATION AND DESIGN MANUAL

A. All projects within the jurisdiction of the City of Fairfax shall be designed and constructed in accordance with the City's *Public Facilities Manual*, latest revision.

B. Public water distribution systems shall conform to the design and construction requirements of Fairfax Water, which are not outlined in this document.

C. Fairfax Water is the approving authority for all water design and specifications and must provide final approval for design.

D. The purpose of this module is to establish standard design procedures and criteria for the design of water service connections to buildings in the City of Fairfax.

7.2 WATER SYSTEM DESIGN STANDARDS

7.2.1 GENERAL

A. This section applies to the design of water service connections to buildings and related appurtenances in the City of Fairfax. Water mains, fire hydrants, manholes, and related appurtenances fall under the authority of Fairfax Water.

B. Distribution system service connections shall meet the minimum requirements of the Virginia Department of Health *Waterworks Regulations***,** latest revision.

7.2.2 TAPS

A. **Tapping Outlet:** A tapping outlet shall be provided for each existing commercial and/or residential building and elsewhere at locations and of such sizes as shown on the plans.

The outlet shall be construed in accordance with the detail shown on the plans and installed in accordance with the pipe manufacturer's specifications.

B. **Materials:** Taps shall be made in accordance with the following table:

Service Size	Type Tap Allowed
¾-inch and 1-inch	Direct tap
1 1/2 & 2-inch	Double strap bronze saddle
3-inch thru 12-inch	Tapping sleeve & valve

7.3 POLICY AND EXECUTION

7.3.2 PREREQUISITE CONDITIONS FOR TESTING AND DISINFECTION

Pipelines shall be tested, in sections between valves, as soon as the installation is completed. Using this method, errors in workmanship can be identified immediately and leaks can be fixed quickly and with minimum expense. Prerequisite Conditions for Testing and Disinfection shall be as follows:

A. Pipelines and appurtenances have been laid and the trench backfilled.

B. Hydrants shall be properly located, operable and plumb and at correct elevation.

C. Valves shall be properly located, operable and at correct elevation. Valve boxes or manholes shall be centered over operating nuts and the top of the box or manhole shall be at proper elevation.

D. All services shall be installed.

E. All reaction anchors have had sufficient set of 7 days or high early strength concrete, 3000 psi or greater, may be used to reduce the number of days required.

F. Lines shall be properly vented where entrapped air is a consideration.

G. All visible leaks, broken or cracked pipe, valves, hydrants, etc. shall be repaired in a manner approved by the Department of Public Works. Defective material shall be removed completely and replaced with new materials.

H. Air release valves shall be installed complete and in place.

I. All construction activities on the project, that requires trenching or excavation within the limits of the water location shall be completed.

7.3.3 PRESSURE TESTS & LEAKAGE

The Contractor shall test completed sections of water line, including service lines, fire hydrants, and fittings with water. This testing, however, does not relieve the Contractor of his responsibility to repair or replace any cracked or defective pipe. All work necessary to secure a tight line shall be done at the Contractor's expense. Testing shall be performed in the presence of the Public Works Engineer or his/her representative.

A. **Pressure Test**: Subject the pipe system to a hydrostatic pressure test. Raise the pressure by pump to 150 psi, 150% of design working pressure, the maximum operating pressure for the locality as determined by the Department, or test pressure as shown on the drawings, whichever is greater. Measure pressure at the low point on the system compensating for gauge elevation. Maintain this pressure (+ or – 5psi) for 2 hours. If pressure cannot be maintained using reasonable pumping rate, determine cause, repair, and repeat the test until successful. Extreme care shall be used to prevent backflow into the potable water supply. The lines should be allowed to stand under pressure for a period of 24 hours prior to the test. Air should be vented from all high points just prior to the test. Only clean water, free of dirt and other debris, from a clean container shall be used for testing. The Contractor shall notify the Public Works Engineer at least 24 hours in advance of any expected test. The contractor shall pretest all mains for a period of 2 hours before notifying the City for a final pressure test. No final pressure test will begin after 2:00 PM. Contactor shall be responsible for all labor, materials, and equipment to perform the testing. Cost shall be included in other items bid.

   Tapping sleeve and valve shall be hydrostatically tested in place prior to tapping of the existing line in accordance with the manufacturer's recommendations.

   The City's inspector will verify 1 pressure test – the final observation of the test section.

B. **Leakage Test**: During the pressure test, subject the system to a leakage test. Leakage shall be defined as the quantity of water that must be supplied into the pipe to maintain the test pressure, after all air in the pipeline has been expelled and the pipe has been tested for a duration of 2 hours. The maximum allowable leakage shall be no greater than allowances shown in the table below (in accordance with Section 5.2, Table 6A - Hydrostatic Testing of AWWA C 600-93, *AWWA Standard for Installation of Ductile Iron Water Mains and Their Appurtenances*).

   No leakage shall be allowed for services.

   No leakage will be allowed for all welded steel pipe. If leaks are revealed by test, repair by rewelding. Peening of leaks will not be allowed. A certified welder must perform all welding.

If leakage exceeds allowances, the Contractor shall be responsible for locating, repairing leaks, and retesting of line until successful, at the Contractor's expense.

7.3.4 FINAL ACCEPTANCE

Upon completion of water main installations and prior to acceptance, the Contractor shall provide adequate and competent personnel to conduct, in conjunction with the City of Fairfax and Fairfax Water, an inspection of each valve and hydrant on the newly completed main. The purpose of this inspection shall be to insure the operability and location of each valve and to further insure that all valves are left in the open position.

AWWA C600 TABLE 6A
ALLOWABLE PRESSURE TEST LEAKAGE
(Allowable Leakage per 1000 ft. of Pipeline * in gph)
(This table is excerpted from AWWA C600, Section 5.2, Table 6A)

AVG. TEST PRESSURE, PSI	NOMINAL PIPE DIAMETER-IN.																
	2	3	4	6	8	10	12	14	16	18	20	24	30	36	42	48	54
450	0.32	0.48	0.64	0.95	1.27	1.59	1.91	2.23	2.55	2.87	3.18	3.82	4.78	5.73	6.69	7.64	8.60
400	0.30	0.45	0.60	0.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00	3.60	4.50	5.41	6.31	7.21	8.11
350	0.28	0.42	0.56	0.84	1.12	1.40	1.69	1.97	2.25	2.53	2.81	3.37	4.21	5.06	5.90	6.74	7.58
300	0.26	0.39	0.52	0.78	1.04	1.30	1.56	1.82	2.08	2.34	2.60	3.12	3.90	4.68	5.46	6.24	7.02
275	0.25	0.37	0.50	0.75	1.00	1.24	1.49	1.74	1.99	2.24	2.49	2.99	3.73	4.48	5.23	5.98	6.72
250	0.24	0.36	0.47	0.71	0.95	1.19	1.42	1.66	1.90	2.14	2.37	2.85	3.56	4.27	4.99	5.70	6.41
225	0.23	0.34	0.45	0.68	0.90	1.13	1.35	1.58	1.80	2.03	2.25	2.70	3.38	4.05	4.73	5.41	6.03
200	0.21	0.32	0.43	0.64	0.85	1.06	1.28	1.48	1.70	1.91	2.12	2.55	3.19	3.82	4.46	5.09	5.73
175	0.20	0.30	0.40	0.59	0.80	0.99	1.19	1.39	1.59	1.79	1.98	2.38	2.98	3.58	4.17	4.77	5.36
150	0.19	0.28	0.37	0.55	0.74	0.92	1.10	1.29	1.47	1.66	1.84	2.21	2.76	3.31	3.86	4.41	4.97
125	0.17	0.25	0.34	0.50	0.67	0.84	1.01	1.18	1.34	1.51	1.68	2.01	2.52	3.02	3.53	4.03	4.53
100	0.15	0.23	0.30	0.45	0.60	0.75	0.90	1.05	1.20	1.35	1.50	1.80	2.25	2.70	3.15	3.60	4.05

*** For pipe with 18 ft. nominal lengths. To obtain the recommended allowable leakage for pipe with 20 ft. nominal lengths, multiply the leakage calculated from the table by 0.9. If the pipeline under test contains sections of various diameter, the allowable leakage will be the sum of the computed leakage for each size.**

**** This table is excerpted from AWWA C-600, Section 5.2 Table 6A**

7.4 REFERENCES

1. ASTM B-88, *Standard Specification for Seamless Copper Water Tube*, FS WW-T-799.

2. AWWA C600-93, *AWWA Standard for Installation of Ductile Iron Water Mains and Their Appurtenances.*

3. AWWA C651, *AWWA Standard for Disinfecting Water Mains.*

4. AWWA C700, *AWWA Standard for Cold-Water Meters-Displacement Type, Bronze Main Case*.

5. AWWA C701, *AWWA Standard of Cold-Water Meters-Turbine Type for Customer service.*

6. AWWA C702, *AWWA Standard for Cold-Water Meters-Compound Type.*

7. AWWA C800, *AWWA Standard for Underground Service Line Valves and Fittings.*

8. Virginia Department of Health *Waterworks Regulations*, latest revision.

END OF SECTION 7

Back to Top