

**CITY OF LONGMONT**  
**SECTION 500 – WATER DISTRIBUTION**  
**TABLE OF CONTENTS**

<b>500.00</b>	<b>DESIGN CRITERIA .....</b>	<b>1</b>
500.01	GENERAL.....	1
500.02	HYDRAULIC GUIDELINES.....	1
500.03	LOOPING REQUIREMENTS.....	1
500.04	WATER MAIN SIZING.....	1
500.05	DEPTH.....	2
500.06	ALIGNMENT.....	2
500.07	GRADE .....	2
500.08	RESTRAINT.....	2
500.09	FUTURE CONNECTIONS.....	3
500.10	VALVE SPACING.....	3
500.11	FIRE HYDRANT LOCATION .....	3
500.12	FIRE SERVICE LINES AND FIRE HYDRANT MAINS.....	4
<b>501.00</b>	<b>GENERAL PROVISIONS.....</b>	<b>5</b>
501.01	OPERATION OF VALVES.....	5
501.02	CONNECTION TO EXISTING SYSTEM .....	5
501.03	INTERRUPTION OF WATER SERVICE.....	5
501.04	ABANDONMENT OF EXISTING WATER LINES OR "STUBS" .....	6
501.05	TAPPING AUTHORIZATION.....	6
501.06	CONSTRUCTION WATER.....	6
<b>502.00</b>	<b>WATER MAIN MATERIALS .....</b>	<b>7</b>
502.01	DUCTILE IRON PIPE.....	7
502.01.01	DESCRIPTION OF PIPE.....	7
502.01.02	PIPE COATING .....	7
502.01.03	CEMENT LINING.....	7
502.01.04	TAPPING.....	7
502.02	POLYVINYL CHLORIDE PIPE.....	8
502.02.01	DESCRIPTION OF PIPE.....	8
502.02.02	TAPPING.....	8
502.03	ASBESTOS CEMENT PIPE .....	8
502.04	FITTINGS, COUPLINGS, SLEEVES AND ACCESSORIES.....	9
502.04.01	DUCTILE IRON FITTINGS AND DUCTILE IRON COMPACT FITTINGS .....	9
502.04.02	BOLTED SLEEVE-TYPE COUPLINGS.....	10
502.04.03	FABRICATED STEEL AND STAINLESS-STEEL TAPPING SLEEVES .....	10
502.05	HYDRANTS.....	11
502.05.01	DRY BARREL FIRE HYDRANTS.....	11
502.05.02	FLUSH TYPE HYDRANTS (BLOW-OFF ASSEMBLIES) .....	12
502.06	VALVES .....	13
502.06.01	RESILIENT SEATED GATE VALVES.....	13
502.07	RESTRAINT, SUPPORT AND INSULATION .....	14
502.07.01	THRUST BLOCKS.....	14

502.07.02	JOINT RESTRAINTS.....	14
502.07.03	INSULATION.....	15
502.08	CORROSION PROTECTION.....	15
502.09	LOCATING SYSTEMS.....	15
502.09.01	TRACING WIRE.....	15
502.09.02	WARNING TAPE.....	16
502.09.03	ELECTRONIC MARKER SYSTEM.....	16
<b>503.00</b>	<b>INSTALLATION OF WATER MAINS AND APPURTENANCES.....</b>	<b>17</b>
503.01	RECEIVING, HANDLING AND STORAGE.....	17
503.02	ALIGNMENT AND GRADE.....	17
503.02.01	HORIZONTAL ALIGNMENT.....	17
503.02.02	VERTICAL ALIGNMENT.....	17
503.03	PIPE INSTALLATION.....	18
503.03.01	PIPE CLEANLINESS.....	18
503.03.02	FIELD CUTS.....	18
503.03.03	PIPE PLACEMENT IN TRENCH.....	18
503.03.04	LAYING OF PIPE.....	18
503.03.05	JOINT ASSEMBLY.....	19
503.03.06	PERMISSIBLE PIPE DEFLECTION.....	20
503.03.07	POLYETHYLENE ENCASEMENT.....	20
503.03.08	CORROSION PROTECTION.....	20
503.03.09	VALVES, FITTINGS, COUPLINGS, SLEEVES AND ACCESSORIES.....	21
503.04	FIRE HYDRANT INSTALLATION.....	21
503.04.01	LOCATION.....	21
503.04.02	POSITION.....	21
503.04.03	CONNECTION TO MAIN.....	21
503.04.04	HYDRANT DRAINAGE.....	22
503.04.05	THRUST BLOCK FOR HYDRANTS.....	22
503.04.06	USAGE AND OPERATION OF HYDRANTS.....	22
503.05	RESTRAINTS.....	22
503.05.01	THRUST BLOCKS.....	22
503.05.02	JOINT RESTRAINT.....	22
503.06	FILLING THE LINE.....	22
503.07	DISINFECTION AND FLUSHING.....	23
503.08	HYDROSTATIC TESTS.....	25
503.09	OPERATIONAL INSPECTION.....	26
<b>504.00</b>	<b>SERVICE LINES, VALVES, AND FITTINGS.....</b>	<b>27</b>
504.01	GENERAL.....	27
504.02	CURB STOP BOXES.....	28
504.03	OWNERSHIP.....	28
504.04	SERVICE LINE BOOSTER PUMPS.....	29
504.04.01	GENERAL.....	29
504.04.02	REQUIREMENTS.....	29
<b>505.00</b>	<b>WATER METERS, PITS AND VAULTS.....</b>	<b>31</b>
505.01	GENERAL.....	31

505.02	OWNERSHIP .....	31
505.03	MATERIALS .....	31
505.04	INSTALLATION .....	32
505.05	ACCESS.....	34
<b>506.00</b>	<b>BACKFLOW CONTROL.....</b>	<b>35</b>
506.01	DEFINITIONS.....	35
506.02	GENERAL.....	35
506.03	BACKFLOW PREVENTION ASSEMBLIES REQUIRED.....	36
506.03.01	SINGLE-FAMILY AND DUPLEX .....	36
506.03.02	MULTI-FAMILY .....	36
506.03.03	NON-RESIDENTIAL AND MIXED USE.....	36
506.03.04	IRRIGATION.....	37
506.03.05	FIRE SERVICE LINES.....	37
506.04	OWNERSHIP .....	37
506.05	DESIGN REQUIREMENTS .....	37
506.06	MATERIALS .....	39
506.07	ACCESS TO BACKFLOW PREVENTION.....	39
506.08	SPACE AND LOCATION REQUIREMENTS .....	39
506.09	INSTALLATION REQUIREMENTS .....	40
506.09.01	AIR GAPS.....	40
506.09.02	REDUCE PRESSURE ZONE OR REDUCED PRESSURE DETECTOR CHECK ASSEMBLIES ...	41
506.09.03	DOUBLE CHECK VALVE ASSEMBLIES.....	41
506.09.04	PRESSURE VACUUM BREAKER ASSEMBLIES.....	42
506.10	BACKFLOW PREVENTION ASSEMBLY SETS.....	42
506.11	TESTING AND CERTIFICATION OF BACKFLOW PREVENTION ASSEMBLIES.....	43
506.12	RECORDS AND REPORTS .....	43

**SECTION 500 - WATER DISTRIBUTION**  
**INDEX OF TABLES**

Table 5-1 MINIMUM RESTRAINT LENGTHS.....	3
Table 5-2 ALLOWABLE LEAKAGE .....	25

## **500.00 DESIGN CRITERIA**

### **500.01 GENERAL**

1. All additions or modifications to the City of Longmont water distribution system shall be designed in accordance with the criteria set forth in this Section and other Sections of the City Standards and may include criteria established by the City Engineer for the overall hydraulics of the water utility system. Additional criteria shall be outlined during public improvement plan review as determined necessary by the City Engineer.
2. These City Standards apply to pipe sizes up to and including 12 inches in diameter. Design requirements for pipe sizes larger than 12 inches shall be as determined by the City Engineer on a project by project basis. Additional details for larger diameter pipes are available from the Public Works and Natural Resources Department.
3. Redevelopment projects may be required to provide an analysis of the existing distribution system capacity and the condition of the water main and appurtenances in the vicinity of the project, as requested by the City. In areas where the water main does not conform to these City Standards or meet the needs of the proposed development, the City may require off-site improvements to existing City infrastructure to bring the water main and/or appurtenances into compliance with these City Standards.

### **500.02 HYDRAULIC GUIDELINES**

1. In accordance with the current Longmont Fire Department standards, the minimum fire flow shall be 2000 gpm for single family residences and 3500 gpm for multi-family residences and commercial or industrial buildings. The required fire flow for some structures may be greater. Refer to the City's adopted International Fire Code for specific requirements.
2. There are multiple pressure zones in the Water Distribution System. The Quality of Life Benchmark for the Water Distribution System is a minimum of 55 psi on the maximum day system demands and 40 psi on the peak hour system demands; however, this pressure is not available at all locations. Additional analysis may be required to determine if a booster pump is necessary on service lines.
3. The system shall be designed to supply the maximum day system demand plus fire flow demand with a residual pressure of no less than 20 psi at any point in the water distribution system.
4. The velocity of the water in water mains shall not exceed 5 feet per second during peak hour demands or 10 feet per second during maximum day demands plus fire flow. Fire lines shall be sized to meet the NFPA standard maximum flow velocity of 15 feet per second for systems requiring fire pumps and 20 feet per second for systems without fire pumps.

### **500.03 LOOPING REQUIREMENTS**

1. Water mains shall be designed to create a looped water system unless otherwise approved by the City Engineer.
2. When approved by the City Engineer, the maximum length of a dead-end water main shall not be greater than 500 feet.

### **500.04 WATER MAIN SIZING**

1. Minimum looped water main size shall be eight (8) inch.

2. Dead-end water mains with less than the equivalent of 10 three-quarter (3/4) inch domestic taps on the main line shall be six (6) inch diameter, unless approved by the City Engineer. In no case shall a dead-end water main serve less than the equivalent of four 3/4 inch domestic services.
3. The water turnover in dead-end water mains as calculated in the last 100 foot segment shall not exceed one day during low flow (winter) conditions as approved by the City Engineer.
4. Fire hydrant mains shall be six (6) inch.
5. Fire service lines shall be designed in accordance with the City's adopted fire and building codes.

**500.05 DEPTH**

1. Water mains shall be installed at a depth of 4-1/2 to 8 feet of cover measured from the top of the pipe to the finished ground surface.
2. If the grade of the surface is raised or lowered above an existing water main, the water main shall be relocated to maintain cover between 4-1/2 to 8 feet.

**500.06 ALIGNMENT**

1. All water mains shall be laid, when possible, generally 10 feet north or west of the center line of the street. If the curves exceed the City's maximum allowed joint deflections for the pipe material, then fittings shall be used.
2. All weather vehicular access shall be provided within 10 feet of manholes and valve boxes installed in areas outside of paved City ROW. Refer to Section 200 of these City Standards for access design standards.
3. Refer to Section 100 of these City Standards for horizontal and vertical separation from other utilities and structures.

**500.07 GRADE**

1. Air release and vacuum valves shall be required at high points on water mains or at valves where the water main slopes away from the valve as determined by the City Engineer.
2. Blow-off assemblies shall be required at low points on water mains or at valves where the water main slopes toward the valve as determined by the City Engineer.

**500.08 RESTRAINT**

1. Concrete thrust blocks shall be designed for the internal pipe pressure, surge pressure and the soil bearing capacity. The minimum design pressure shall be 150 psi with a safety factor of 1.5. The minimum soil bearing capacity shall be 1500 pounds per square foot (psf). The Design Engineer is responsible for verifying the actual site conditions with respect to the higher requirements.
2. Joint restraint shall be required in addition to concrete thrust blocks for vertical bends and when the water main must be placed into service before concrete thrust blocks have achieved a minimum compressive strength of 70% of the 28 day design strength.
3. Joint restraints shall be required for pressure testing of future connections and for temporary dead end water mains before connection to existing water mains. The following restraint lengths are required for dead end water mains:

Table 5-1 Minimum Restraint Lengths

Pipe Diameter (Inches)	Minimum Length of Pipe Restraint (Feet)
4	29
6	41
8	53
10	64
12	76

- a. These minimum restraint lengths are intended for typical conditions. The Design Engineer shall be responsible for determining the restraint length for the actual site conditions.

**500.09 FUTURE CONNECTIONS**

1. Where a connection is installed for a future water main extension, a valve shall be installed on the extension side of the connection to isolate the water main. The valve shall be adequately restrained to install the extension without isolating a water main other than the extension. Restraint may be made by a swivel tee, approved mechanical joint adapter, or the minimum lengths of pipe restraint, as shown in Table 5-1 of these City Standards, installed on the extension side of the valve.
2. These minimum lengths are intended for typical conditions. The Design Engineer shall be responsible for determining the restraint length for the actual site conditions.
3. A temporary blow off, flushing hydrant, or fire hydrant shall be installed on connections for future water main extensions.

**500.10 VALVE SPACING**

1. Valves shall be placed no more than 500 feet apart on water mains.
2. A valve shall be installed on all fire hydrant mains.
3. A valve is required on the water main between fire hydrants.
4. A minimum of two valves shall be installed at every tee and three valves installed at every cross. Valves at mechanical joint fittings shall be connected to the fitting with a 24 inch length of pipe between the fitting and the valve. Additional valves may be required on water mains as determined by the City Engineer.
5. Valves shall not be placed in a water main lowering.

**500.11 FIRE HYDRANT LOCATION**

1. The Developer shall provide fire hydrants which conform to the requirements of these Specifications. Fire hydrant location and spacing shall be determined by the Fire Department in accordance with the City’s adopted International Fire Code. Generally, the number of fire hydrants, their location and spacing shall be as follows:
  - a. Residential Areas – 500 feet between hydrants starting at street intersections.
  - b. Multiple Dwellings – 500 feet between hydrants and not more than 200 feet from the end of a required emergency access.

- c. Commercial, Industrial, Storage – 500 feet between hydrants and not more than 200 feet from the end of a required emergency access.
  - d. No fire hydrant line shall be connected to less than an eight (8) inch water main or to a "dead end" water main unless the hydrant can deliver 1500 gpm with minimum of a 20 psi residual, or specifically approved by the City Engineer.
2. Exceptions from the above requirements shall be approved by the City Engineer and the City Fire Marshall.

**500.12 FIRE SERVICE LINES AND FIRE HYDRANT MAINS**

- 1. All fire hydrant mains shall extend from the hydrant tee and valve on the water main to the fire hydrant.
- 2. Fire service lines for internal fire suppression systems shall require a valve on the fire service line at the water main. The valve will be owned and maintained by the City. The valve shall open left. The property owner shall own and maintain the fire service line from the valve to the building or structure.
- 3. Plans for the installation of fire hydrant mains or fire service lines must be submitted to the City Engineer for approval and must be stamped by a Design Engineer. Plans must be submitted and approved by the City Engineer one week prior to construction.
- 4. Fire hydrant mains shall be Ductile Iron Pipe (DIP) or Polyvinyl Chloride Pipe (PVC) pipe, with swivel tees. Any fittings used shall be a minimum Class 250 ductile iron. If the water main is PVC, Asbestos Cement (AC) or steel pipe, the fire hydrant main shall be PVC pipe. If the water main is DIP, the fire hydrant run shall be DIP.
- 5. The use of any private fire service line to supply more than one lot is prohibited.
- 6. Fire service lines shall be electrically insulated from the water main if the water main is metallic pipe.
- 7. On a case by case basis, as approved by the City Engineer, domestic taps may be allowed on private fire service lines provided that a valve is installed between the physical domestic tap on the fire service line and the water meter. This valve must remain accessible to the City so that water may be turned off. The City shall own and maintain the fire service line valve at the water main as specified in Paragraph 2 above. The property owner shall maintain the fire service line from the fire service line valve to the building or structure including the domestic service line from the fire service line to the building or structure. Refer to the City Standard Details for the installation of the Combined Fire/Domestic Water Service.



## **501.00 GENERAL PROVISIONS**

### **501.01 OPERATION OF VALVES**

1. When connecting to the existing water system, mainline valves on the existing system and connecting valves shall be operated by PWNR personnel ONLY. The Contractor shall notify the City Engineer and City Inspector at least 48 hours prior to needing any valve operated. In the case on an emergency call the City's Water Utilities Division at (303-651-8416) and notify the City Inspector.

### **501.02 CONNECTION TO EXISTING SYSTEM**

1. At locations where connections to existing water mains are to be installed, the Contractor shall locate the existing mains both vertically and horizontally and verify their exact size and material in advance of the time scheduled for making the connections.
2. Prior to connecting to existing water mains, the Contractor shall have all personnel, materials, and equipment ready to connect the fitting to the existing main, so as to keep the shutoff time to a minimum. As soon as possible after making the connections, the Contractor shall flush the connection so as to prevent contamination of the existing facilities. The Contractor shall take every precaution necessary to prevent dirt or debris from entering the water main. Refer to Section 503.07 of these City Standards for disinfection and flushing requirements.
3. Connections to the existing water system shall be completed in a neat and workmanlike manner. The City Inspector shall be notified at least 48 hours in advance and be present at all times during the construction of the connection. The connection is subject to approval by the City Engineer and the City Inspector. Under NO circumstances shall a non-disinfected water main, which cannot be isolated, be connected to an existing disinfected water main.
4. The City does not guarantee the water tightness of existing valves on existing facilities. If existing valves leak, the City shall assist in reducing the influx of water, but the Contractor must use methods at their own disposal to dewater the trench and complete any required testing or disinfection of the water line.
5. All connections shall be valved to separate new construction from the existing system. Only one connection to the existing system will be allowed until the new system has been completely tested. Valves shall be kept closed until Construction Acceptance of the new system.

### **501.03 INTERRUPTION OF WATER SERVICE**

1. For general noticing requirements for disruptions to City utility services refer to Section 107 of these City Standards for the Interruption of Water, Wastewater and Storm Sewer. The Contractor shall not schedule disruptions of service on a Monday or Friday without approval by the City.
2. With the approval of the City Inspector, the Contractor shall notify the Public Safety Department at least 48 hours in advance of any water shut off. A description of the boundaries of the affected area and the location of all fire hydrants in the area shall be provided to the Public Safety Department.
3. If the City determines that a customer cannot be out of water service during normal business hours, the Contractor shall schedule outages at times approved by the City or shall provide an appropriate means as approved by the City of providing water service to the affected customer during the installation of the connection.
4. Planned disruptions may be cancelled at the discretion of the City, if in the opinion of the City, the Contractor has not completed work necessary for the proposed connection by the beginning of the

day of the connection, is not ready to begin the connection at the start of scheduled outage or does not have the required equipment, materials and labor on hand to make the connection within the scheduled outage time.

**501.04 ABANDONMENT OF EXISTING WATER LINES OR "STUBS"**

1. All water mains, fire service lines and water service lines that were installed and will not be used (such as a replat or a change in building configurations) shall be abandoned at the water main. This shall include excavating the water main and removing any valves on the line to be abandoned and replacing them with a plug. However, if the street was paved within the previous three years and no street asphalt overlay is planned for the next five years, then the developer shall place in cash escrow with the City, sufficient funds for the City to abandon the service line in the future. The type of remediation of the asphalt street cut shall be determined during the review of the Site Plan, Public Improvement Plan, Building Permit, or Work in the Right of Way Permit.

**501.05 TAPPING AUTHORIZATION**

1. Taps up to and including two (2) inches shall be completed by certified City PWNR Operations Division personnel only.
2. Taps greater than two (2) inches shall be performed by a qualified Contractor.
3. All wet taps shall be at least one nominal pipe size less than the water main that is being tapped. Size on size wet taps are prohibited.
4. The Owner shall apply for the tap and pay all associated tapping fees prior to contacting the City PWNR Operations Division to schedule the tap.
5. No tap shall be scheduled less than 48 hours, or two working days, from the time the City PWNR Operations Division is contacted by the Owner for the tap.
6. The Contractor must sufficiently expose the water main to accommodate the tapping equipment as determined by the City. The water main shall be exposed a minimum of 48 inches centered over the connection. Refer to the City's Standard Details for Service Connection Trenches.
7. The Contractor shall be responsible for compliance with all OSHA trench and job site safety requirements. No City personnel will enter an unsafe job site. If the trench and or job site is determined by the City to be unsafe, the City personnel will not perform the tap. A new time shall be scheduled by the Owner through the City PWNR Operations Division.
8. The Owner shall pay all costs and expenses incident to the installation and connection of water facilities and the building water system. All costs incurred by the City for time lost on the originally scheduled tap may be billed to the Owner.

**501.06 CONSTRUCTION WATER**

1. Refer to Section 107.02 of these City Standards.

## **502.00 WATER MAIN MATERIALS**

1. All materials shall comply with the requirements of the Safe Drinking Water Act and other applicable federal and state regulations for potable water systems.
2. Products intended for contact with potable water shall be certified to the requirements of NSF/ANSI 61. Certification shall be accomplished by a certification organization accredited by ANSI.
3. Refer to the City's Approved Materials List for a specific list of materials accepted by the City. A copy of the Approved Materials List can be obtained from the PWR Department.

### **502.01 DUCTILE IRON PIPE**

#### **502.01.01 DESCRIPTION OF PIPE**

1. Ductile Iron Pipe (DIP) shall be designed and manufactured in accordance with AWWA C151. The pipe wall thickness for water mains and fire hydrant mains shall be Pressure Class 350 or Special Thickness Class 50.
2. All joints for DIP shall be push-on single rubber gasket joints manufactured in accordance with AWWA C111. The pipe manufacturer shall furnish all joint materials including rubber gasket and joint lubricant.
3. Gaskets shall be manufactured from Styrene Butadiene Rubber (SBR) in accordance with AWWA C111. Gaskets shall be free from porous areas, foreign materials or other defects that make them unfit for the use intended. The lubricant shall be nontoxic, shall not support the growth of bacteria and shall have no deteriorating effects on the gasket material. Lubricant shall not impart taste or odor to water in the pipe when used in accordance with AWWA C600 and when the pipe has been flushed according to AWWA C651.

#### **502.01.02 PIPE COATING**

1. Pipe shall be coated on the outside with a bituminous coating approximately one (1) mil thick in accordance with AWWA C151. The finished coating shall be continuous and smooth, neither brittle when cold nor sticky when exposed to the sun, and shall be strongly adhered to the pipe.

#### **502.01.03 CEMENT LINING**

1. Pipe shall be lined with cement mortar in accordance with AWWA C104. The thickness of linings for DIP shall not be less than 1/16 inch. The lining surface shall be free from ridges, corrugations or defects that reduce the thickness of the lining to less than the specified thickness. Longitudinal cracks with lengths equal to or less than the pipe circumference are acceptable.

#### **502.01.04 TAPPING**

1. Service connections (taps) on DIP for domestic, irrigation or fire service lines that are two (2) inches or smaller shall be direct tapped using a corporation stop of the same size as the service line through a corporation stop supplied by the Contractor.
2. Service connections on DIP for domestic, irrigation or fire service lines that are larger than two (2) inches shall be made by a tee connection or an approved tapping sleeve as approved by the City Engineer.

3. Service connections made on existing DIP or Cast Iron Pipe (CIP) must be approved by the City Engineer and may require a tee connection.
4. Service lines shall be electrically insulated from DIP and CIP water mains by means of an approved insulating fitting or gasket.
5. Refer to Section 501.05 of these City Standards for tapping authorization.
6. Refer to Section 504.00 of these City Standards for service line requirements.

## **502.02 POLYVINYL CHLORIDE PIPE**

### **502.02.01 DESCRIPTION OF PIPE**

1. Polyvinyl Chloride (PVC) pipe shall be designed and manufactured in accordance with AWWA C900. The minimum pipe wall thickness for water mains and fire hydrant mains shall be Dimension Ratio 18 (DR 18), Pressure Class 235.
2. Pipe shall be homogeneous throughout; free from voids, cracks and inclusions; and uniform in color and density. Pipe surfaces shall be free from nicks and scratches deeper than 10% of the wall thickness. The joining surfaces of pipe spigots and integral-bells shall be free from imperfections that might cause leakage.
3. All joints shall be made using an integral bell with an elastomeric gasket push-on type joint or using machined couplings of a sleeve type with rubber ring gaskets and machined pipe ends to form a push-on type joint. Solvent cement joints are strictly prohibited. The pipe manufacturer shall furnish all joint materials including rubber gasket and joint lubricant.
4. Gaskets and lubricant intended for use with PVC pipe shall be manufactured in accordance with ASTM F477 and AWWA C900. Gaskets and lubricants shall be non-toxic, water soluble and certified for compliance with NSF/ANSI 61.

### **502.02.02 TAPPING**

1. Service connections (taps) on PVC pipe for domestic, irrigation or fire line services that are two (2) inches or smaller shall be made using a corporation stop of the same size as the service line through an approved tapping saddle for PVC pipe and corporation stop supplied by the Contractor. Direct taps are not allowed.
2. Service connections that are two (2) inches and smaller are not allowed on PVC pipe containing water under pressure.
3. Service connections on PVC pipe for water mains or domestic, irrigation or fire line services that are larger than two (2) inches shall be made by a tee connection or an approved tapping sleeve as approved by the City Engineer.
4. Refer to Section 501.05 of these City Standards for tapping authorization.
5. Refer to Section 504.00 of these City Standards for service line requirements.

## **502.03 ASBESTOS CEMENT PIPE**

1. The possible types of Asbestos-Containing Materials (ACM) that may be encountered include Asbestos Cement Pipe (ACP) and coal-tar enamel coating on older steel pipe that was reinforced with fibrous

material, such as asbestos felt. All coal-tar coatings on steel water mains must be treated as ACM unless testing shows otherwise.

2. The installation of ACM is not permitted.
3. Service connections (taps) on ACP for domestic, irrigation or fire line services that are two (2) inches or smaller shall be made using a corporation stop of the same size as the service line through an approved tapping saddle for ACP and corporation stop supplied by the Contractor. To reduce the incidence of airborne asbestos fibers, an approved pipe may be used in place of ACP wherever tapping is necessary.
4. For service connections on ACP larger than two (2) inches, a full section of ACP shall be removed and replaced with an approved pipe material.
5. Water main connections to ACP shall be made with an approved transition coupling.

#### **502.04 FITTINGS, COUPLINGS, SLEEVES AND ACCESSORIES**

##### **502.04.01 DUCTILE IRON FITTINGS AND DUCTILE IRON COMPACT FITTINGS**

1. Ductile Iron Fittings and Ductile Iron Compact Fittings (DI fittings) shall be designed and manufactured in accordance with AWWA C110 or C153, respectively. DI fittings shall be manufactured from ductile iron conforming to ASTM A536, Grade 65-45-12. Fittings shall have a pressure rating of 350 psi.
2. Swivel tees and mechanical joint adapters are not included in AWWA C110 or C153; but are allowed for hydrant and fire line connections and connections to existing water mains. Use for other connections shall be approved on a case by case basis by the City Engineer. The grade of ductile iron, lining, coating, gasket and accessories for swivel tees and mechanical joint adapters shall be manufactured in accordance with AWWA C110 and the standards in this Section. Mechanical joint adapters may be used when the same size of swivel tee is not manufactured.
3. DI fittings shall be lined and coated with fusion-bonded epoxy material in accordance with AWWA C116. Visual examination shall not disclose disbondment, blisters, cracks, or lack of coating coverage. Damaged lining and coating shall be cleaned, prepared and recoated in accordance with the manufacturer's recommended procedures.
4. DI fittings shall be furnished with mechanical joints and accessories designed and manufactured in accordance with AWWA C111. Accessories for the mechanical joint shall consist of the gasket, gland, and fasteners and shall be furnished and packaged separately.
5. Gaskets shall be manufactured from SBR in accordance with AWWA C111. Gaskets shall be free from porous areas, foreign materials or other defects that make them unfit for the use intended. The lubricant shall be nontoxic, shall not support the growth of bacteria and shall have no deteriorating effects on the gasket material. It shall not impart taste or odor to water in the pipe when used in accordance with AWWA C600 and when the pipe has been flushed according to AWWA C651.
6. Tee-head bolts shall be manufactured from high-strength, low alloy carbon steel conforming to ASTM A307, Grade B and in accordance with AWWA C111. Nuts shall be manufactured from carbon steel conforming to ASTM A563 for heavy hex nuts and in accordance with AWWA C111. Bolt heads shall be at right angles to the bolt shank and the bolt shanks shall be straight within 1/16 inch. Bolts and nuts shall be sound, clean and coated with a rust-resistant lubricant. Their surfaces shall be free of objectionable protrusions that would interfere with their fit in the made-up mechanical joint.

7. Castings shall be clean and sound without defects that will weaken their structure or impair their service. Structural defects, including fractures, splits and cracks, are not acceptable. Repairing of structural defects is not allowed. Cosmetic defects that have no effect on the ability of the component to meet the structural design and test requirements are allowed as determined by the City Inspector. Excessive cosmetic defects, including pits and gouges, are not acceptable. Repairing of cosmetic defects are allowed in accordance with the manufacturer's recommendations.
8. Joint ends, glands and rings for bolting shall be perpendicular to the pipe centerline and shall be parallel such that any two face to face dimensions 180 degrees part at the outside edge shall not differ by more than 1/8 inch. Misalignment of corresponding bolt holes shall not exceed 1/8 inch measured from like points on the bolt holes.
9. All fittings shall be wrapped in polyethylene encasement. Refer to the City Standard Details for Polyethylene Encasement.

#### 502.04.02 BOLTED SLEEVE-TYPE COUPLINGS

1. Straight, transition, reducing and insulating couplings shall be designed and manufactured in accordance with AWWA C219 with a minimum pressure rating of 150 psi. Straight couplings may be used only when the same size of mechanical joint solid sleeve is not manufactured. Reducing couplings may be used only when the same size of mechanical joint reducer is not manufactured. Insulating couplings shall be used when joining two metallic pipes.
2. "Wide range" and "extended range" transition couplings that meet the AWWA C219 requirements in this Section; but, do not meet AWWA C219 in its entirety, are allowed to join two pipes of the same nominal size but with different outside diameters.
3. The center sleeve and end rings shall be manufactured from ductile iron meeting or exceeding the requirements of ASTM A536, Grade 65-45-12. The center sleeve and end rings shall be round and free of irregularities, flat spots, or surface defects that would impair the performance of the coupling.
4. Ductile iron couplings shall be lined and coated with fusion-bonded epoxy material in accordance with AWWA C116. See Section 502.04.01 paragraph 3 of these City Standards for epoxy coating workmanship.
5. Gaskets shall be manufactured from SBR in accordance with AWWA C219. Reclaimed rubber shall not be used. The gaskets shall be free from porous areas, foreign materials and visible defects.
6. Bolts shall be manufactured from high-strength, low alloy steel conforming to ASTM A307, Grade B in accordance with AWWA C219. Nuts shall be manufactured from carbon steel conforming to ASTM A563 for heavy hex nuts in accordance with AWWA C219. See Section 502.04.01 paragraph 6 of these City Standards for carbon steel bolt and nut workmanship.
7. See Section 502.04.01 paragraph 7 of these City Standards for ductile iron casting workmanship. See Section 502.04.01 paragraph 8 of these City Standards for mechanical joint alignment workmanship.

#### 502.04.03 FABRICATED STEEL AND STAINLESS-STEEL TAPPING SLEEVES

1. Tapping valves and sleeves shall be used concurrently to tap an existing CIP, CIP, ACP and PVC water main that is in service and under pressure without interrupting service when approved by the City Engineer.

2. Fabricated carbon steel tapping sleeves shall be designed and manufactured in accordance with AWWA C223 with a minimum pressure rating of 150 psi. Carbon steel tapping sleeves shall be manufactured from carbon steel, ASTM A36 or equal. Stainless steel tapping sleeves are not allowed.
3. Carbon steel flanges shall be fabricated from steel plate with AWWA C207 Class "D" dimensions and ANSI B16.5 Class 150 drilling. Flange faces shall be machined to a flat surface with a serrated finish and recessed for tapping valve in accordance with MSS SP-60. Hollow-back flanges and segmented flanges are not acceptable.
4. Flange gaskets shall be manufactured from SBR compounded for water service conforming to ASTM D2000 and in accordance with AWWA C207. For connections between dissimilar metals, gaskets shall electrically isolate the joint. The gasket shall be pressure rated by the gasket manufacturer to no less than 150 psi and shall meet the required seating stress to which it will be seated. Gaskets shall be shop glued to the groove provided in the body section.
5. Gaskets for the body of the tapping sleeve shall conform with ASTM D2000 and in accordance with of AWWA C223.
6. Carbon steel bolts for connecting sections of the carbon steel tapping sleeve shall meet or exceed the requirements of ASTM A307, Grade B and in accordance with AWWA C223. Nuts shall meet or exceed the requirements of ASTM A563 heavy hex and in accordance with AWWA C223. See Section 502.04.01 paragraph 6 of these City Standards for carbon steel bolt and nut workmanship.
7. Bolts for flange connections may be track head, carriage head or hexagonal head with dimensions conforming to ASME B18.10, ASME B18.5 and ASME B18.2.1, respectively, and nuts conforming to ASME B18.2 in accordance with AWWA C223. Bolts for flange connections shall be ASTM A193 Grade B7 with ASTM A563 heavy hex nuts in accordance with AWWA C207. For connections between dissimilar metals, bolt sleeves and washers shall electrically isolate the joint.
8. Tapping sleeve shall be fusion bonded epoxy lined and coated per AWWA C213. See Section 502.04.01 paragraph 3 these City Standards for epoxy coating workmanship.
9. Carbon steel connecting sections and flanges shall be clean and sound without defects that will weaken their structure or impair their service. Structural defects, including cracks and inclusions, are not acceptable. Repairing of structural defects is not allowed. Repairs within the bolt circle of any flange face are not allowed. Cosmetic defects that have no effect on the ability of the component to meet the structural design and test requirements are allowed as determined by the City Inspector. Excessive cosmetic defects, including pits and gouges, are not acceptable. Repairing of cosmetic defects are allowed in accordance with the manufacture's recommendations.
10. Flanges for bolting shall be perpendicular to the pipe centerline and shall be parallel such that any two face to face dimensions 180 degrees part at the outside edge shall not differ by more than 1/16 inch. Misalignment of corresponding bolt holes shall not exceed 1/8 inch measured from like points on the bolt holes.
11. When tapping sleeves are used, a thrust block shall be placed behind the tapping sleeve.

## **502.05           HYDRANTS**

### **502.05.01        DRY BARREL FIRE HYDRANTS**

1. Dry-barrel fire hydrants shall be designed and manufactured in accordance with AWWA C502 and certified to NSF/ANSI Standard 61 and NSF/ANSI 372. The bonnet, upper and lower barrel sections

shall be manufactured from gray iron conforming to ASTM A126, class B or ductile iron conforming to ASTM A536. Fire hydrants shall have a 250 psi rated working pressure.

2. Hydrants shall have a 5-1/4 inch main valve opening and be a three-way type with two 2-1/2 inch hose nozzles and one 4-1/2 inch pumper nozzle. The hose and pumper nozzles shall be located in the same horizontal plane at least 18 inches above ground line. The nozzles shall meet National Standard hose coupling thread (NST) specifications and be furnished with nozzle caps and security chains.
3. The hydrant base shall be provided with a six (6) inch mechanical joint inlet that conforms to AWWA C111 and Section 502.04.01 of these City Standards. The base shall have two lugs for rodding of the pipe.
4. The hydrant shall have a compression-type main valve closes with pressure for positive seal. The valve assembly shall include one or more drain valves that work automatically with the main valve to drain the barrel when the main valve is in the closed position.
5. The depth of bury varies and shall be furnished to maintain a minimum cover over the hydrant main of 4-1/2 feet and position the breakaway flange as shown in the City Standard Details for Fire Hydrants.
6. Hydrants shall be equipped with traffic features that include a breakaway safety flange, bolts and nuts, and stem coupling.
7. The operating nut shall be a 1-1/2 inch National Standard pentagon, measured from point to opposite flat, with an integral weather seal. The hydrant shall open left (counter-clockwise).
8. Ferrous metal parts of the hydrant, inside and outside, shall be thoroughly cleaned before coating. The exterior surfaces of the hydrant top section shall be painted with a primer coat and a second coat of an inert, corrosion-resistant coating. The paint color shall be red with white caps, bonnet and operating nut. All fire hydrants shall be painted at the factory. The exterior surfaces below the ground line shall be painted with an asphaltic coating in accordance with AWWA C110. The hydrant shoe and connecting gland shall be lined and coated with fusion-bonded epoxy in accordance with AWWA C116. The interior of the hydrant, except machined surfaces, shall be coated with an epoxy coating in accordance with AWWA C116.
9. Bolts and nuts shall be manufactured from high-strength, low alloy carbon steel conforming to ASTM A307 Grades A or B or SAE J429 Grade 2 and in accordance with AWWA C502.
10. When assembled, hydrants shall be well fitted and shall operate smoothly. The body and shaft seal shall be watertight. See Section 502.04.01 paragraph 7 of these City Standards for ductile iron casting workmanship. See Section 502.04.03 paragraph 10 of these City Standards for flange joint alignment workmanship.
11. Any damages to fire hydrants shall be painted with an approved hydrant paint for Construction Acceptance and Final Acceptance.

#### 502.05.02 FLUSH TYPE HYDRANTS (BLOW-OFF ASSEMBLIES)

1. In installations where the main will be permanently dead-ended, such as a cul-de-sac, a flush type hydrant (permanent blow-off assembly) or fire hydrant shall be installed. The flush type hydrant shall be installed at a right angle to the main and on the side that allows the water to drain away from the main to the nearest gutter. Where the main will be temporarily dead-ended, for example the boundary of a subdivision filing, a temporary blow-off may be installed, unless a fire hydrant, which can serve additionally as a blow-off, is located at the main's temporary end.



2. Flush type hydrants are not included in AWWA C502; but, shall be designed and manufactured in accordance with the AWWA C502 requirements in this Section and certified to NSF/ANSI Standard 61 and NSF/ANSI 372. The barrel section shall be manufactured from gray iron conforming to ASTM A126, class B or ductile iron conforming to ASTM A536. Flush type hydrants shall have a minimum rated working pressure of 150 psi.
3. Hydrants shall have a minimum two (2) inch main valve opening with one 2-1/2 inch hose nozzle. The hose nozzle and operating nut shall be located in a cast iron box with lid centered below a traffic rated manhole ring and cover. The nozzle shall meet National Standard hose coupling thread specifications and be furnished with a nozzle cap and security chain.
4. The hydrant base shall be provided with a minimum three (3) inch mechanical joint inlet that conforms to AWWA C111 and Section 502.04.01 of these City Standards. The base shall have two lugs for rodding of the pipe. Bolts and nuts shall be manufactured from high-strength, low alloy carbon steel conforming to ASTM A242 in accordance with AWWA C502.
5. The hydrant shall have a compression-type main valve closes with pressure for positive seal. The valve assembly shall include one or more drain valves that work automatically with the main valve to drain the barrel when the main valve is in the closed position.
6. The depth of bury varies and shall be furnished to maintain a minimum cover over the hydrant main of 4-1/2 feet and position the cast iron box lid with 4 to 6 inch clearance under manhole cover.
7. The operating nut shall be a 1-1/2 inch National Standard pentagon, measured from point to opposite flat, with an integral weather seal. The hydrant shall open left (counter-clockwise).
8. Ferrous metal parts of the hydrant, inside and outside, shall be thoroughly cleaned before coating. The exterior surfaces below the ground line shall be painted with an asphaltic coating in accordance with AWWA C110. The hydrant shoe and connecting gland shall be lined and coated with fusion-bonded epoxy in accordance with AWWA C116. The interior of the hydrant, except machined surfaces, shall be coated with an epoxy coating in accordance with AWWA C116.
9. When assembled, hydrants shall be well fitted and shall operate smoothly. The body and shaft seal shall be watertight. See Section 502.04.01 paragraph 7 of these City Standards for ductile iron casting workmanship. See Section 502.04.03 paragraph 10 of these City Standards for flange joint alignment workmanship.

## **502.06 VALVES**

### **502.06.01 RESILIENT SEATED GATE VALVES**

1. Resilient seated gate valves, including tapping valves, shall be designed and manufactured in accordance with AWWA C509 or AWWA C515. Valves shall have a minimum pressure rating of 200 psi.
2. Gate valves shall be resilient seated gate valves with ductile iron body, non-rising stem, compression seating, double "O" ring stem seals, with two (2) inch square wrench nut. Gate valves shall be the same size as the water main and shall open left (counterclockwise). Valve nut extensions are prohibited.
3. Except for tapping valves, gate valves shall be furnished with mechanical joints and accessories conforming to AWWA C111 and Section 502.04.01 of this Section. Tapping valves shall have a flange end on the tapping sleeve side and a mechanical joint end on the water main side conforming to AWWA C509 and C515 requirements. The flange end of a tapping valve that forms a joint with the

tapping sleeve shall conform to the dimensions of MSS SP-60. The connecting flange of the tapping valve that mates with the tapping machine shall conform to the dimensions of MSS SP-113.

4. Gate valves shall be lined and coated with fusion-bonded powder epoxy material in accordance with AWWA C116 meeting or exceeding applicable requirements in AWWA C509 or AWWA C515. See Section 502.04.01 paragraph 3 for epoxy coating workmanship.
5. See Section 502.04.01 paragraph 7 of these City Standards for ductile iron casting workmanship. See Section 502.04.01 paragraph 8 of these City Standards for mechanical joint alignment workmanship. See Section 502.04.03 paragraph 10 of these City Standards for flange joint alignment workmanship.
6. Valve box sections shall be cast iron, screw type with a lid. Bases shall be suitable for the valves furnished and for the depth of cover specified. The box shall have a circular base for support around the valve.

## **502.07 RESTRAINT, SUPPORT AND INSULATION**

### **502.07.01 THRUST BLOCKS**

1. Thrust blocks shall be constructed of Class B concrete in accordance with Section 601 of the CDOT Standard Specifications. The concrete mix design shall be approved for sacked mixes and batch plant mixes.
2. Class B concrete has a minimum 28 day compressive strength of 4500 psi with five to eight percent (5-8%) air content and a maximum water/cementitious material ratio of 0.45. The coarse aggregate shall have a nominal maximum size of 1-1/2 inches. Fly ash may be used as a cement substitute in concrete mixes in accordance with Section 601 of the CDOT Standard Specifications. The amount of fly ash shall not exceed 15% by weight of the total cementitious materials. The Design Engineer shall perform soil tests to determine if a sulfate resistant design mix is required.

### **502.07.02 JOINT RESTRAINTS**

1. AWWA has not approved a standard for mechanical joint and bell joint restraints. The materials of joint restraints shall meet the applicable AWWA standards and other requirements these City Standards. The pressure rating of joint restraints shall meet or exceed the pressure rating of the pipe being restrained with a safety factor no less than two. Joint restraints for PVC pipe shall also conform to ASTM F1674.
2. Glands and rings shall be manufactured from ductile iron meeting or exceeding the requirements of ASTM A536, Grade 65-45-12 and in accordance with the applicable AWWA C111 requirements.
3. Joint restraints shall be lined and coated with fusion-bonded powder epoxy or polyolefin material in accordance with AWWA C116. See Section 502.04.01 paragraph 3 of these City Standards for epoxy coating workmanship.
4. Joint restraints shall be furnished with accessories, including gaskets, bolts and nuts, conforming to AWWA C111 and Section 502.04.01 of these City Standards.
5. See Section 502.04.01 paragraph 7 of these City Standards for ductile iron casting workmanship. See Section 502.04.01 paragraph 8 of these City Standards for mechanical joint alignment workmanship.

### 502.07.03 INSULATION

1. Pipe and fitting covering insulation shall be closed-cell, impermeable, high compressive strength glass or rigid foam material. Half shells shall be prefabricated for straight pipe and shall be furnished with manufacturer recommended adhesive and jacketing suitable for direct bury.
2. Board insulation shall be two (2) inch thick closed cell, impermeable, high compressive strength glass or rigid foam insulation board suitable for direct bury.

### 502.08 CORROSION PROTECTION

1. When the installation of metallic water main is proposed, a soil corrosion potential survey of the construction area at pipe depth shall be performed. At a minimum, the survey shall include the procedures and tests in Appendix A of AWWA C105. Resistivity surveys shall utilize the saturated sample (water saturated soil box) method. The survey data, observations and evaluation shall be submitted to the City Engineer.
2. When water mains are to be constructed in “corrosive soils” that have a resistivity of less than 1,500 ohm-centimeters; an AWWA evaluation of 10 points or greater (Table A.1 in Appendix A of AWWA C105); or where stray current corrosion is expected to be severe, then an approved PVC pipe shall be selected unless otherwise allowed in these City Standards. When water mains are to be constructed in soils that are not corrosive as defined in this Section, metallic or nonmetallic pipe material may be selected.
3. When a metallic pipe must be used in “corrosive soils”, additional cathodic protection shall be required. The cathodic protection system shall be designed by a qualified corrosion engineer and tested by a NACE certified tester or technician. The test station details shall be approved by the City Engineer to maintain consistency with existing cathodic protection systems. Additional pipe coating requirements may be required by the City Engineer for “uniquely severe environments” as defined by AWWA C105.
4. All metallic pipe, fittings, valves and appurtenances shall be protected against corrosion by polyethylene encasement in accordance with AWWA C105. The polyethylene shall have a minimum wall thickness of eight (8) mils. The encasement shall be secured with a pipe wrapping tape that adheres to metal and plastic and is approved for below ground use.
5. Pipes of dissimilar metallic materials shall be insulated from each other using insulated flanges or fittings with test stations as approved by City Engineer. Insulated joints shall be tested prior to backfill and again after backfill by a NACE certified tester or technician to confirm the insulating kit is functioning properly.

### 502.09 LOCATING SYSTEMS

#### 502.09.01 TRACING WIRE

1. All water mains without joint bonding and non-metallic service lines shall be installed with tracing wire taped securely to the top of the pipe. The tracing wire shall be a 12 AWG solid copper wire with a High Density Polyethylene (HDPE) or High Molecular Weight Polyethylene (HMWPE) coating designated for direct burial. The tracing wire shall be secured with a pipe wrapping tape that adheres to metal and plastic and is approved for below ground use.
2. Wire splices shall be connected in a UL Standard 486D approved splice kit for use in wet, damp, direct bury locations.

3. Tracing wire shall be brought to grade at all fire hydrants and designated locations in an approved test box. Test boxes shall have a lid with a terminal for direct connection to the tracer wire, locking cover and cast iron collar.

#### 502.09.02 WARNING TAPE

1. All water mains shall have a utility warning tape installed in the trench 12 to 18 inches above the crown of the pipe. The warning tape shall be a six (6) inch wide detectable aluminum foil plastic backed tape. The tape shall be APWA color coded blue with a repeating warning message indicating that a potable water main is located below the tape.

#### 502.09.03 ELECTRONIC MARKER SYSTEM

1. A buried electronic marker shall be installed at all horizontal and vertical bends. The electronic marker shall be capable of receiving a signal from the manufacturer's locator and returning a signal with a unique serial number and accurately indicating the marker's horizontal position.

## **503.00           INSTALLATION OF WATER MAINS AND APPURTENANCES**

1. All water mains and appurtenances shall be installed per AWWA C600-17 for DIP pipe and AWWA C605-13 for PVC pipe.
2. Products intended for contact with potable water shall be certified to the requirements of NSF/ANSI 61. Certification shall be accomplished by a certification organization accredited by ANSI.

### **503.01           RECEIVING, HANDLING AND STORAGE**

1. It is the responsibility of the Contractor to ensure that all material delivered to the site are free of defects. Any materials that are found to be defective shall be clearly marked by the Contractor and removed from the site.
2. Pipe material shall be moved, loaded, transported, and placed by lifting to avoid shock or damage to the materials. Under no circumstance shall any pipe or appurtenance be dropped. If any pipe or material is dropped, it shall be clearly marked by the Contractor and removed from the site, even when no defects are visually seen.
3. If there are any visual defects in the lining or coating of pipe material or appurtenances, the material shall be replaced with a defect free pipe material or appurtenance.
4. Pipe material and appurtenances shall be stored in a manner that keeps the materials free from dirt and foreign matter. The pipe shall be kept off the ground at all times with the use of sandbags, timbers, or other approved material.
5. All water main materials and appurtenances shall be inspected by the City Inspector for damage or defects prior to installation. Defective or damaged material shall be marked and removed from the job site.

### **503.02           ALIGNMENT AND GRADE**

#### **503.02.01       HORIZONTAL ALIGNMENT**

1. All water main pipe shall be laid to the line and grade shown on the approved plans.
2. A construction tolerance of plus or minus three (3) inches is permissible. Any deviation of greater than three (3) inches requires the water main to be removed and placed at the approved alignment. At the request of the City Inspector or City Engineer, the Contractor shall provide a survey of the pipe alignment as proof of the horizontal alignment.
3. Any deviation from the horizontal alignment shown on the approved plans shall be submitted to the Design Engineer and an updated plan sheet shall be approved by the City Engineer prior to installation of the water main.

#### **503.02.02       VERTICAL ALIGNMENT**

1. All water main pipe shall be laid to the line and grade shown on the approved plans.
2. A construction tolerance of three (3) inches is permissible. However, in no situation shall the water main be installed with a cover of less than 4-1/2 feet or less than 18 inches of vertical separation between other utilities without written approval from the City Engineer. Any deviation of greater than three (3) inches requires the water main to be removed and placed at the approved grade. At the request of the City Inspector or City Engineer, the Contractor or Developer shall provide a survey of the pipe alignment as proof of the grade of the water main.

3. Any deviation from the vertical alignment shown on the approved plans shall be submitted to the Design Engineer and approved by the City Engineer prior to installation of the water main.

### **503.03 PIPE INSTALLATION**

#### **503.03.01 PIPE CLEANLINESS**

1. All foreign matter or dirt shall be removed from the interior and machined ends of pipe and accessories before being lowered into position in the trench. Pipe shall be kept clean by means approved by the City Engineer during and after laying of the pipe or appurtenance.

#### **503.03.02 FIELD CUTS**

1. The cutting of pipe for inserting valves or fittings shall be done in a neat and workmanlike manner without damage to the pipe or lining and so as to leave a smooth end at right angles to the longitudinal axis of the pipe.
2. The minimum length of pipe to remain after cutting is 24 inches.
3. Flame cutting of ductile pipe is prohibited.
4. Asbestos cement pipe shall not be saw cut, but an entire section of pipe shall be removed to the nearest joint and replaced with a non-asbestos type pipe. Refer to Section 502.03 of these City Standards for additional information.

#### **503.03.03 PIPE PLACEMENT IN TRENCH**

1. Implements, tools and facilities satisfactory to the City Engineer shall be provided and used by the Contractor for the safe and efficient execution of the work. All pipe, fittings, valves, hydrants and accessories shall be carefully lowered into the trench with suitable equipment in a manner that will prevent damage to pipe and appurtenances. Under no circumstances shall pipe or accessories be dropped or dumped into the trench.
2. Pipe and accessories shall be inspected for defects prior to being lowered into the trench. Any defective, damaged or unsound material shall be repaired or replaced as directed by the City Inspector.
3. Refer to Section 503.07 of these City Standards for installation of chlorine tablets for disinfection.

#### **503.03.04 LAYING OF PIPE**

1. Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in line. If that is not possible, the City Engineer or the City Inspector may require that before lowering the pipe into the trench, a heavy, tightly woven canvas bag be placed over each end and left there until the connection is to be made. The end of the pipe will be plugged or capped with approved materials when work stops.
2. Pipe shall be laid with bell ends facing in the direction of laying, unless directed otherwise by the City Engineer. Where pipe is laid on a grade of 10% or greater, the laying shall start at the bottom and shall proceed upward with the bell ends of the pipe up-grade.
3. No pipe shall be laid when, in the opinion of the City Engineer or the City inspector, trench conditions are unsuitable.
4. A minimum 12 AWG, direct bury, solid copper tracing wire shall be buried directly above all water main pipe and non-metallic service lines. The copper wire shall be attached to the top of the pipe with

polyethelene tape and brought to the surface at each fire hydrant. The wire shall be coiled and taped around the barrel of the hydrant just below the top flange. The wire shall be brought up to grade in a tracer station box located behind the hydrant with a minimum excess length of 24 inches. See the City's Standard Fire Hydrant Details for additional information. If there is no fire hydrant where the tracing wire can be brought up to grade, the wire may be brought up in a valve box as directed in the field by the City Engineer or City Inspector.

5. For water mains installed outside of City Right of Way, tracing wire shall be installed as detailed above and there shall also be warning tape installed 12 to 18 inches directly above the water main. In addition to warning tape, marker posts (see Section 100 City's Standard Marker Post Detail for additional information) shall be installed at all bends, valve, and at least every 250 feet to identify the water main.

#### 503.03.05 JOINT ASSEMBLY

1. Refer to Section 503.03.06 of these City Standards for Permissible Pipe Deflection.
2. Push on joints shall be installed in accordance with AWWA C600-17, AWWA C605-13, and AWWA M23 including the following steps:
  - a. Thoroughly clean the groove and bell socket of the pipe or fitting and install the appropriate gasket. In cold weather, it is preferable to warm the gasket to facilitate assembly of the joint.
  - b. Apply lubricant to the exposed surface of the gasket and plain end of the pipe. Every effort should be made to protect the lubricant from contamination.
  - c. The plain end of the pipe shall be beveled per the manufactures recommendations. Sharp edges shall be filed or grinded. Push the plain end into the bell of the pipe. Keep the joint straight while pushing and make deflection only after the joint is assembled.
  - d. Small pipe can generally be pushed into the bell socket with a long bar. If equipment is being used to push the pipes together, a timber header shall be used between the pipe and the equipment to avoid damage.
3. Mechanical joints shall be installed in accordance with AWWA C-600-17 including the following steps:
  - a. Thoroughly clean the socket and plain end with an approved lubricate or soapy water meeting AWWA C111 just prior to slipping the gasket onto the plain end with the lip extension toward the plain end, followed by the gasket with the narrow edge of the gasket toward the plain end. In cold weather it is preferable to warm the gasket to facilitate the assembly of the joint.
  - b. Insert the pipe into the socket and press the gasket firmly and evenly into the gasket recess. Keep the joint straight during assembly.
  - c. Push the gland toward the socket and center it around the pipe with the gland lip against the gasket. Insert bolts and hand tighten nuts. Make deflection after joint assembly but before tightening bolts.
  - d. Tighten the bolts to the normal range of bolt torque (refer to AWWA C600-17 and manufacturers recommendations for torque specifications) while maintaining approximately the same distance between the gland and the face of the flange at all points around the socket. Diametrically opposite nuts shall be tightened progressively and evenly in accordance with tightening sequence recommended by the manufacture. Final tightening shall be done to the manufacture's specifications with a torque-limiting wrench.

4. Flanged or swivel joints shall be installed in accordance with AWWA C-115-11 and AWWA C-110-12 including the following steps:
  - a. The underground use of flanged joints is generally not desirable because of the rigidity of the joint.
  - b. Flange faces should bear uniformly on the gasket and the bolts tightened in a progressive crisscross order.
  - c. Users of flanged fittings should be careful to prevent bending or torsional strains from being applied to the flanges, flange fittings, or flanged appurtenances. Piping systems must be designed so that piping connected to flanges or flanged fittings is properly anchored, supported, or restrained to prevent breakage.
5. The joining of different types of pipe with an inside diameter greater than eight (8) inches shall be accomplished with an approved sleeve or transition piece.

#### 503.03.06 PERMISSIBLE PIPE DEFLECTION

1. The pipe barrel shall not be deflected either vertically or horizontally. All deflection shall be made through a fitting at no more than one-half (1/2) of the manufacturer's allowable joint deflection.

#### 503.03.07 POLYETHYLENE ENCASEMENT

1. All metallic water mains, fire hydrant mains, and appurtenances shall require a polyethylene encasement to protect against corrosion. Polyethylene encasements shall be installed per the City's Standard Detail for Polyethylene Encasement AWWA C105 Method "A".
2. Necessary precautions shall be taken to prevent damage to the polyethylene encasement film. Any damage to the encasement shall be repaired as directed by the City Inspector.
3. Service taps on DIP water mains encased in polyethylene may be accomplished using an X-shaped cut in the polyethylene and temporarily folding back the film. After the tap has been completed, cuts in the polyethylene and any other areas of damage to the film shall be repaired with tape as described in AWWA C105. The preferred method of making direct service taps consists of applying two or three wraps of polyethylene adhesive tape completely around the pipe to cover the area where the tapping machine and chain will be mounted. After the tapping machine is mounted, the corporation stop is installed directly through the tape and polyethylene. The area should be inspected for any damage after the tap is complete and repaired as necessary.

#### 503.03.08 CORROSION PROTECTION

1. Cathodic protection shall be installed and tested as required per section 502.08 of these City Standards.
2. Particular care shall be taken to insulate between dissimilar metallic materials. Whenever it is necessary to join pipe of dissimilar metal, an approved insulated coupling shall be installed. The Contractor shall conduct a resistivity test across the joint as required by the qualified corrosion engineer. If the resistivity test fails, the insulated joint shall be removed and repaired. The joint shall then be reinstalled and retested. This procedure shall continue until a successful test result is obtained. A test station shall then be installed near the joint for future testing of continuity.



### 503.03.09 VALVES, FITTINGS, COUPLINGS, SLEEVES AND ACCESSORIES

1. Valves, fittings, coupling, sleeves, and accessories shall be set and joined to the pipe in the manner specified above in Pipe Installation.
2. Valves, fittings, coupling, sleeves, and accessories shall be installed at the location shown on the approved plans. Any deviation from the approved plans shall be approved by the Design Engineer and the City Engineer prior to installation.
3. Valves and valve boxes shall be installed per AWWA C509-15. A valve box shall be provided for every valve installed. Refer to City Standard Details for Valve Box installation.
4. To help prevent foreign materials from inadvertently entering the valve, the valve shall be in the closed position prior to being lowered into the trench. The valve shall be placed on a firm footing in the trench to prevent settling and excess strain on the connection to the pipe.
5. The valve box shall be designed and installed so as to not transmit loads or stress to the valve, valve stem, or piping system.
6. The valve box shall be centered and plumb over the wrench nut of the valve, with the box cover 1/4 inch below the surface of the surrounding pavement or such other level as may be directed by the City Engineer.
7. The valve box covers shall be traffic rated and shall have the word "WATER" cast into the top of the cover.
8. Valve nut extensions are prohibited.

### 503.04 FIRE HYDRANT INSTALLATION

#### 503.04.01 LOCATION

1. Hydrants shall be located at least one (1) foot inside the right-of-way or five (5) feet inside of a water utility easement and five feet (5) from the side lot line and shall conform to the following conditions:
  - a. When placed behind the curb, the hydrant barrel shall be set so that no portion of the pumper or hose nozzle cap will be less than 24 inches nor more than 30 inches horizontal distance from the face of the curb.
  - b. When set in the lawn space between the curb and the sidewalk, no portion of the hydrant or nozzle cap shall be within 24 inches of an adjacent sidewalk.
  - c. When set between the sidewalk and the property line, no portion of the hydrant or nozzle cap shall be within 18 inches of the sidewalk, or no greater than 24 inches from the sidewalk.

#### 503.04.02 POSITION

1. All hydrants shall stand plumb and shall have their nozzles parallel with, or at right angles to, the appropriate curb, with the pumper nozzle facing the fire access. Hydrants shall be set to the established grade, with the safety flange approximately 4 to 6 inches, or as per the manufacturer's recommendations, vertically above the final grade.

#### 503.04.03 CONNECTION TO MAIN

1. Each hydrant shall be connected to the water main with a six (6) inch MJ by swivel tee and a six (6) inch MJ gate valve or a six (6) inch tapping sleeve and tapping valve.

#### 503.04.04 HYDRANT DRAINAGE

1. Wherever a hydrant is set in soil that is pervious, drainage shall be provided at the base of the hydrant by placing 1-1/2 inch washed rock, from the bottom of the trench to at least six (6) inches above the waste opening in the hydrant and to a distance of one (1) foot around the elbow.
2. Wherever a hydrant is set in clay or other impervious soil, a drainage pit shall be excavated below each hydrant and filled with 1-1/2 inch washed rock and under and around the elbow of the hydrant and to a level of six (6) inches above the waste opening. The drainage pit shall be covered with polywrap or filter fabric prior to backfill.

#### 503.04.05 THRUST BLOCK FOR HYDRANTS

1. The bowl of each hydrant shall be well braced against unexcavated earth at the end of the trench with a concrete thrust block.

#### 503.04.06 USAGE AND OPERATION OF HYDRANTS

1. Water usage from a fire hydrant is strictly prohibited unless a special use permit is issued by the City of Longmont Public Works and Natural Resources Department per Section 107.02 of these City Standards.

### 503.05 RESTRAINTS

#### 503.05.01 THRUST BLOCKS

1. Concrete thrust blocks shall be designed per Section 502.07.01 of these City Standards. Thrust blocks shall be placed between undisturbed soil or fill that has been compacted to a minimum of 95% standard proctor density and the fitting to be anchored; the area of bearing on the pipe and on the ground in each instance shall be approved by the City Engineer. The thrust blocks shall be placed so that the pipe and fitting joints will be accessible for repair. All fittings and piping shall be protected with a polyethylene encasement as a suitable bond breaker prior to pouring a concrete thrust block. Refer to the City Standard Details for typical thrust block installations and sizing. Forms for thrust blocks may be required by the City Engineer or City Inspector.

#### 503.05.02 JOINT RESTRAINT

1. Joint restraints shall be incorporated in a follower gland that is installed in accordance with Section 503.03.05 of the City Standards. Twist-off nuts shall be tightened until all wedges are in firm contact with the pipe surface and with approximately the same distance between the gland and the pipe surface. Tighten in an alternating manner until all of the nuts have been twisted off. Use a torque-limiting wrench to confirm that the wedge nuts are tightened to the manufacturer's specifications.

### 503.06 FILLING THE LINE

1. The water main shall be filled by the City Inspector after the water main has been backfilled and compacted in accordance with these City Standards. The Contractor is prohibited from operating City water main valves.
2. All water mains shall be filled slowly, filling at a rate which will not cause surges or exceed the rate at which air can be released. All air in the line shall be purged through blow-offs or hydrants. Care shall be taken to fill the line at a rate of no greater than one (1) foot per second to ensure that the chlorine tablets do not come loose from the pipe.

3. Where blow-offs or hydrants are not available or effective in purging air from the line, the City Engineer shall require a tap to purge the line. The location and the size of the tap shall be at the City Engineer's discretion. All costs related to performing the tap shall be the responsibility of the Contractor or developer. Tapping fees shall not apply.

#### **503.07 DISINFECTION AND FLUSHING**

1. All water mains and appurtenances shall be disinfected prior to being brought into service. Water mains shall be disinfected in accordance with AWWA B300 and AWWA C651.
2. The City Inspector shall be notified 48 hours in advance of testing and be present during disinfection and flushing.
3. The chlorination of finished water mains shall be done prior to the hydrostatic testing. Before filling the main with potable water, the main shall be clean and free from debris to the satisfaction of the City Engineer and City Inspector.
4. Disinfection by chlorination of the main shall be performed prior to Construction Acceptance by the City. The chlorinating agent and method of application shall be approved by the City Engineer in accordance with AWWA C-651.
5. The Tablet/Granular Method defined in AWWA C-651 shall be used to disinfect the water main. Chlorine tablets shall be used for disinfection and comply with AWWA B300, the tablets shall be attached to the top of the pipe with an approved adhesive specific for this purpose just prior to the installation of the pipe in the trench. The granular form is not allowed for disinfection purposes in a water main. (Refer to the City's Approved Materials List)
  - a. The tablet method consists of adhering calcium hypochlorite tablets in the water main during installation and then filling the main with potable water to create a chlorine solution. This method may be used only if the pipes and appurtenances are kept clean and dry during construction.
  - b. Calcium hypochlorite tablets (5 grams) shall be placed in the upstream end of each section of pipe to be disinfected, including branch lines. Also, at least one tablet shall be placed in each hydrant, hydrant main and other appurtenances.
  - c. Calcium hypochlorite tablets shall be attached by an approved adhesive. Adhesive shall only be placed on the broadside of the tablet attached to the surface of the pipe. Attach tablets inside and at the top of the main. If the tablets are attached before the pipe section is placed in the trench, their positions shall be marked on the pipe exterior to indicate that the pipe has been installed with the tablets at the top of the water main pipe.
6. The water main is to be filled slowly by the City Inspector at a rate to ensure that water within the water main will flow at a velocity no greater than one (1) foot per second. After the water main is filled with potable water and chlorine, the chlorinated water shall be held in contact with the main for 40 hours. If the water temperature is less than 41°F (5°C), the water shall remain in the pipe for at least 48 hours. After the applicable retention period, the water in the main shall be tested by the City Inspector to ensure a residual chlorine content of not less than 25 mg/l and not more than 100 mg/l.
7. After the residual chlorine content in the water main has been tested, the water main shall then be thoroughly flushed to remove the heavily chlorinated water within 48 hours of the completion of the residual chlorine content test. Care shall be taken in flushing the main to prevent damage or danger to the public and the environment. The City Engineer may require Contractor to dechlorinate the flushed water.

8. If dirt enters the pipe, it shall be removed and the interior of the pipe shall be swabbed with a one percent (1%) hypochlorite disinfection solution. If in the opinion of the City Engineer or City Inspector, the dirt remaining in the pipe will not be removed using the flushing operation, the interior of the pipe shall be cleaned by mechanical means acceptable to the City Engineer or City Inspector and swabbed with a one percent (1%) hypochlorite disinfection solution.
9. If it is not possible to keep the pipe and fittings dry during installation, it shall be flushed with potable water at a velocity of three (3) feet per second or greater for a minimum of three (3) pipe volumes and filled with chlorinated potable water that has a chlorine residual of not less than 25 mg/l at the end of a 24 hour holding period. The chlorinated water shall be flushed from the water main after the 24 hour holding period. At the completion of construction, the water main shall be disinfected using the continuous feed or slug method in conformance with AWWA C651.
10. If chemical contamination occurs, such as a hydraulic oil leak or petroleum project spill, the exposed pipe sections shall be replaced and not reused for potable water applications.
11. At connections to an existing water main, the new pipe, fittings, and valve(s) required for the connection shall be cleaned and swabbed with a minimum one percent (1%) solution of chlorine just before being installed. Basic disinfection and contamination procedures shall be followed when cutting into existing pipe and shall include:
  - a. Prevent contaminants from entering the existing pipe by fully exposing the existing pipe and securing from trench soil contamination, maintaining a dewatered trench, and keeping all pipe materials being used in the connection in a clean and sanitary condition.
  - b. Clean and disinfect the following items by spraying or swabbing with a minimum one percent (1%) chlorine solution:
    - (i) Exposed portions of existing pipe interior surfaces,
    - (ii) Pipe materials used in the connection, and
    - (iii) Handheld materials and tools used to make the repair.
  - c. The existing water main shall be returned to service with flushing to scour the pipe and obtain three (3) volumes of water turnover, making sure that the flushed water is visually clear. It is advisable to check for a typical system chlorine residual, and if not found, to continue flushing until residuals are restored to levels maintained in the distribution system.
12. After final flushing and before the new water main is opened to the distribution system, two consecutive sets of acceptable samples, taken at least 24 hours apart, shall be collected from the new main. The first set of samples shall be collected from every 1200 feet of the new water main and all fire hydrants, flush type hydrants, blow offs, plus one set from the end of the line and at least one set from each branch more than 100 feet long. The first set of samples shall be taken of water that has stood in the new main for at least 24 hours after final flushing. The second set of samples shall be taken after completion of the hydrostatic testing at the locations(s) used for hydrostatic testing. All samples shall be collected and tested in accordance with Standard Methods for the Examination of Water and Wastewater, and shall show the absence of coliform organisms, and, if required, the presence of a chlorine residual. Sampling and testing of residual chlorine and coliform organisms will be performed by the City Inspector.
13. If the initial disinfection fails to produce satisfactory bacteriological results or if tests indicate that other water quality parameters do not meet City potable water standards, the new main may be reflashed and shall be resampled. If the samples fail to produce acceptable results, the main shall be

rechlorinated by the continuous feed or slug method of chlorination in accordance with AWWA C-651 until satisfactory results are obtained.

14. After completion of disinfection, new water mains with cement mortar linings shall be tested for pH. Water mains with a pH greater than 8.5 shall be thoroughly flushed until the pH is less than 8.5. pH testing will be performed by the City Inspector.

**503.08 HYDROSTATIC TESTS**

1. All water mains and appurtenances shall be testing in accordance with AWWA C600 and C605.
2. No hydrostatic tests shall be performed on any portion of the water main until all field placed concrete has achieved a minimum compressive strength of 70% of the 28 day design strength and the water main has been disinfected, flushed, and passed all required testing. Sufficient backfill shall be placed between joints and fittings to stabilize the constructed water main, however joints, fittings, valves, etc., may be required by the City Inspector to remain uncovered so that visual inspection may be made at the time of testing. Tests shall include testing of service lines to and including the curb stop on new water main installation.
3. All water main pipe shall be field tested to a minimum of 150 psi at all points in the line and 200 psi for private fire service lines.
4. The City Inspector shall be notified at least 24 hours in advance of any testing. All testing shall be done in the presence of the City Inspector.
5. The Contractor shall furnish the necessary equipment to do the pressure test including a calibrated meter. The pipeline shall be in a state of readiness for testing, having been filled, flushed of high chlorine, and purged of air.
6. While the test pressure is maintained for two continuous hours, the allowable leakage from the pipe shall not exceed allowable leakage in Table 5-2. An examination may be made of the water main in general during testing, and any leaks shall be repaired. Any pipe or fitting found to be cracked shall be removed, replaced, and disinfected per Section 503.07 of these City Standards. Cutting and replacing of pavement, excavating and backfilling are a necessary part of locating and repairing leaks discovered by pressure testing of pipe and the costs of these activities shall be borne by the Contractor.
7. No leakage is allowed through the bonnet of any valve. Any valve that leaks through the bonnet shall be removed and replaced.
8. Allowable leakage for each section between water main valves shall not exceed the following leakage rate (gallons per hour per 1000 feet of pipe):

Table 5-2 Allowable Leakage

Pipe Size (inches)	Water Main at 150 psi	Fire Line at 200 psi
4	0.33	0.38
6	0.50	0.57
8	0.66	0.76
12	0.99	1.15

**503.09 OPERATIONAL INSPECTION**

1. Prior to Construction Acceptance of the project and in the presence of the City Inspector, the Contractor or City Inspector shall operate all valves, hydrants, and water services to ascertain that the entire facility is in good working order including but not limited to the following:
  - a. All valve boxes are to be centered over the operating nut and valves are opened;
  - b. All hydrants operate and drain properly;
  - c. All curb boxes are plumb and centered;
  - d. Water is available at all curb stops and;
  - e. All tracing wire and locating devices shall be tested for contiguity.

**504.01 GENERAL**

1. Service lines shall be of a size which is adequate to supply the requirements of the property being served while not being so large as to cause inaccuracies in metering low flows. The minimum size allowable for a service line shall be 3/4 inch.
  - a. With each request for a new water service, the Design Engineer shall provide a fixture count by an accredited Fixture Unit Count methodology for all non-single-family residential taps and service line requests. Taps and service lines shall be sized to produce a water velocity in the service line that is no greater than 10 feet per second at peak demand as estimated by an accredited Fixture Unit Count methodology.
  - b. A one (1) inch domestic tap may be installed in areas where a residential fire sprinkler system is to be installed, refer to Chapter 14.04 of the City Code. The requirements of the property being served shall be defined as peak demand, as calculated in the IPC or IRC, latest edition.
2. All service lines supplying water from the City's Distribution System shall conform to one of the following types of pipe:
  - a. Seamless copper tube, "Type K, soft", for service lines 3/4 inch through and including 2 (two) inches in diameter.
  - b. Ductile Iron Pipe conforming to these City Standards for service lines three (3) inches in diameter and larger.
  - c. PVC pipe conforming to these City Standards for service lines four (4) inches in diameter and larger.
  - d. Galvanized piping is not allowed.
3. No solder containing lead shall be used. All soldering fluxes, plumbing pastes, pipe dopes, sealants, coatings, gaskets, and similar material which may come into contact with potable water must be non-toxic and certified per NSF/ANSI 61.
4. Each subdivided lot shall be served by a separate service line and meter except as provided for in the City Code. Refer to the City's Standard Details for typical service line installation and additional information.
5. All service lines shall have a curb stop or gate valve installed outside of the structure and an isolation valve installed inside of the structure. The curb stop or gate valve shall be located in a utility easement or in ROW depending on the type of installation. Refer to the City's Standard Details for typical service line installations.
  - a. Service lines 3/4 to 2 inch in diameter shall have a curb stop and box installed within a five (5) foot or larger tree lawn in the ROW or in a utility easement as shown in the City's Standard Details.
  - b. Service lines three (3) inches and larger shall have a gate valve installed within the ROW or in a utility easement.
6. A meter pit shall be located six (6) feet behind the back of an attached or detached sidewalk. All water meter pits shall be located in a water easement. The location of the meter pit shall be subject to the approval of the City Engineer.
7. All corporation stops shall have Corporation Cock (CC) threads.

8. The tap, corporation stop, meter, and that portion of the service line between the corporation stop and five (5) feet past the meter shall be the same size and material. The service line may be increased in size to the next approved larger diameter beginning five (5) feet downstream of the meter. This is permitted to satisfy maximum pressure loss criteria, it is not for achieving greater flow using a smaller tap.
9. Service lines shall not be installed in trenches containing conduits which carry any substances other than potable water without written permission of the City Engineer. Service lines shall be separated laterally from conduits which contain a potential health hazard, as determined by the City Engineer, by a minimum of 10 feet.
  - a. Exception: If it is not possible to achieve a 10 foot separation of the water and sewer services due to the size, location or other physical restraints of the lot, the lines may be installed in the same trench with the approval of the City Engineer and under the following conditions:
    - (i) The water service must be installed 18 inches above the sewer service on a separately excavated shelf of undisturbed soil in the common trench.
    - (ii) 4-1/2 feet of cover must be maintained as a minimum over the water service.
10. All service lines shall be inspected by the City Inspector. It is the responsibility of the Contractor or developer to submit as-built drawings indicating the actual locations of all service stub-outs, prior to issuance of Final Acceptance.
11. All taps shall be at least 18 inches from any joint, fitting, valve or other tap unless approved otherwise by City Engineer.
12. Location of all service lines shall be marked with a "w" chiseled or saw cut in the sidewalk or curb closest to the property line.

#### **504.02 CURB STOP BOXES**

1. The approved list of curb stop boxes is located in the City's Approved Materials List.
2. Curb stops installed must conform to AWWA C800 for service lines up to and including two (2) inches in diameter. For all service lines greater than two (2) inches in diameter, a gate valve shall be installed.

#### **504.03 OWNERSHIP**

1. The City shall maintain the water service line from the mainline to the curb stop, excluding the curb stop valve, box and stem, where a curb stop exists. In instances where no curb stop or outside meter exists, the City will maintain the service line from the main to the right-of-way or water easement line. In instances where an outside meter exists without a separate curb stop, the City will maintain the service line from the main to the meter, provided the meter is within fifteen feet of the ROW line. All remaining portions of the service line are to be maintained by the property owner, excluding the meter and backflow prevention assembly. If the domestic service line is tapped onto a private fire service line, as provided for in Section 500.11 of these City Standards, the property owner shall maintain the fire service line from the fire service valve to the building or structure including the domestic service line downstream of the fire service line.
2. The owner of the premises shall maintain the curb stop box and meter pit so that it will always be conveniently accessible and in good working order, properly capped and clean of debris and other foreign matter, see the City's Standard Details for a typical meter pit installation.



## **504.04 SERVICE LINE BOOSTER PUMPS**

### **504.04.01 GENERAL**

1. This Section only applies to booster pumps connected directly to the City's Distribution System to provide a boost in the service line pressure for fire service lines, water service lines, and irrigation service lines.
2. The City strongly discourages the installation of pumps and the Design Engineer shall consider the feasibility of other options, such as increasing the service line size, prior to submitting a request for the installation of a booster pump.
3. All service lines that require a booster pump shall be submitted to the City for approval prior to installation of the booster pump.
4. At the City's sole discretion, the City may prohibit the installation of a pumping facility where such installation may be injurious to the operation or future operation of the City's Distribution System.
5. A booster pump shall not be used to provide additional flow through a water meter, the booster pump shall only be used to provide an increase in the pressure of the service line.

### **504.04.02 REQUIREMENTS**

1. An analysis of the booster pumps impacts on the distribution system shall be submitted to the City for review and approval prior to the installation of a booster pump. The following criteria shall be addressed in the analysis:
  - a. Justification outlining the reason that a booster pump is necessary.
  - b. The existing flow and pressure of the distribution system at the proposed service line connection to the distribution system.
  - c. The proposed or necessary flow and pressure requirements for the service line.
  - d. Proposed pump characteristics including hydraulic calculations, system demand curve, and the supply curve.
  - e. Physical diagram showing the general layout of the pump and all appurtenances. The diagram shall clearly indicate the installation of the necessary back flow prevention assembly.
  - f. Analysis of the pumps effect on the distribution system at 100% and 150% of the design pump flow at max day conditions. Evaluate the velocity in the water main at 150% and the velocity of the service line at 100%. Refer to Section 500.02 of these City Standards for the velocity requirements.
  - g. Analysis of the pumps effect on the distribution systems residual pressure in the water main. The pump shall be equipped with controls that include a pressure sensor upstream of the booster pump, with the ability to shut down if the supply pressure drops below 20 psi.
  - h. The booster pump system shall be designed to protect the distribution system from water hammer. The Design Engineer shall submit supporting documentation stating how water hammer is being addressed. Two potentially acceptable options are as follows:
    - (i) A Variable Frequency Driven (VFD) Pump that is programmed to start and shutdown between 8 and 20 seconds as the pump starts up and shuts down.

- (ii) A soft start/shutdown control that is programmed to increase and decrease voltage between 8 and 20 seconds as the pump starts up and shuts down.

## **505.00 WATER METERS, PITS AND VAULTS**

### **505.01 GENERAL**

1. All work and materials must be acceptable to the City Engineer.
2. All work and materials are subject to inspection by the City of Longmont at all times.
3. There shall be only one City water meter per service tap purchased. Specifically, the City will not provide individual water meters nor metered billing services in multi-unit structures with only one service tap.
4. The tap, water service line between the main and the meter, and water meter shall all be the same nominal size. Variation between service line and meter size must be approved by the City Engineer. Where the meter size is smaller or larger than the service line size, the water service size shall be considered equal to the water meter size. There shall be installed upstream and downstream of the water meter a pipe of the same diameter and 20 times that diameter in length in accordance with AWWA requirements.
5. The City reserves unto itself sole responsibility for testing and certifying the accuracy of City water meters. No one shall in any way attempt to test, certify, or calibrate a City owned water meter without City approval.
6. Modification, alteration or relocation in metering equipment must be approved by the City.
7. Water meter and offsite reading equipment costs, fees, and repair costs shall be determined by the City of Longmont.
8. The City shall have the sole right to determine the rated size, kind, type, make, and component configuration of water meters and offsite reading equipment.

### **505.02 OWNERSHIP**

1. Water meters and reading equipment shall be obtained from the City of Longmont, upon payment of fees, and shall remain in the City's ownership.
2. City ownership of water meters extends only to the body and register of the meter.
3. Water meters installed at a premise shall remain with that premise and are not transferable.

### **505.03 MATERIALS**

1. Materials shall be in accordance with the Approved Materials List.
2. Water meter couplers and companion flanges shall be obtained from the Public Works and Natural Resources Department. Water meters four (4) inches and larger shall be obtained by special arrangement.
3. The user or customer has the sole responsibility to determine the potential loads a meter pit and meter vault will require and shall provide the structural strength required. The City may require AASHTO HS-20 loading.
4. No solder containing lead shall be used. All soldering fluxes, plumbing pastes, pipe dopes, sealants, coatings, gaskets, and similar material which may come into contact with potable water must be non-toxic and certified per NSF/ANSI 61.

#### **505.04           INSTALLATION**

1. The installation of water meter pits or meter vaults in streets, roadways, driveways, alleys, or parking lots is not allowed.
2. Meters for residential and irrigation services that are 3/4 or 1 inch shall be placed in a meter pit outside of the structure as indicated in the City's Standard Details for residential or irrigation services. All meter pits shall be placed on the lot that is being served, except for irrigation services.
3. When a domestic service requires an RPZ backflow assembly (Refer to section 506 of these City Standards) the water meter shall be placed inside the building in a utility room that is accessible from the exterior of the building along with the RPZ backflow assembly.
4. Meters for irrigation services larger than one (1) inch are required to be placed in a five (5) foot diameter (or larger) vault. Meters for all irrigation taps receiving a tap fee waiver (City parks, arterial streets and primary greenways) must be installed in a vault. The vault for services that are larger than two (2) inch shall be designed by a Design Engineer.
5. The water meter shall be situated such that it is protected from freezing and frost damage.
6. Water meter pit locations shall be installed per City Standard Details for water services. Water meter pits shall not be installed with the construction of the water service line until such time as the electric service lines, or other adjacent utilities, have been installed unless otherwise approved by the City Engineer.
7. For installation outside the City limit, the meter pit shall be installed immediately adjacent to the ROW.
8. The placement of the meter must be inspected by the City Inspector before backfilling.
9. If the street or ground is not to final grade at the time of installation of the meter, the meter pit or vault shall be raise or lower when the final grade is established. The top of the meter pit or vault lid must be a minimum of two (2) inches above finish grade if no sod or other landscape covering is in place at the time of final inspection. The meter pit or vault lid shall be flush with the sod or finished ground service with the completion of the landscaping.
10. The service line through and on both sides of the meter pit or vault must be of the same material.
11. No branch connections shall be made in the meter pit. Connections must be made more than five (5) feet from the meter pit on the downstream side.
12. Service line valves four (4) inches in diameter and larger shall be supported by adjustable steel supports in all meter vaults.
13. 1-1/2 inch diameter and larger meters shall be supported by adjustable steel supports.
14. Manhole frames and covers shall be an eight (8) inch frame, be 24 inches in diameter and aluminum in material. A two (2) inch hole shall be drilled through the lid and have a recessed (counter sunk) area for the antenna. Refer to City Standard Details for Standard Manhole Covers.
15. Refer to the City's Approved Materials List for acceptable meter pits and covers.
16. Meters installed other than shown and detailed herein shall be considered as non-standard and shall require an exception for approval of proposed piping layout, meter setting, and structural design of vault for each separate installation.
17. Backflow prevention assemblies will be required in accordance with the City Code 14.06 and Section 506 of these City Standards.

18. The following apply to two (2) feet in diameter water meter pit installations (3/4 inch and 1 inch residential and irrigation services).
  - a. The pit shall rest upon brick supports or concrete blocks.
  - b. The installed pit shall have its top locking lid at the same elevations as the grade of the adjacent landscaping.
  - c. Care shall be taken that drainage of surface waters be directed away from the pit lid and do not puddle over the pit.
  - d. Both the inner frost lid and the top locking lid shall be installed on the pit. The locking mechanism shall be fully functional.
  - e. When installed, the water meter shall not be touching or resting against the pit barrel or pit cone assembly. The water meter shall lie horizontal and be level.
  - f. Water meter pits shall not contain any plumbing fixture, fitting, valve, or pipe not directly a part of the pit assembly, the water meter set, or the water meter itself. Lawn irrigation tees, valves, and winterizing fittings shall not be allowed inside a water meter pit.
  - g. The meter must be within 16 to 20 inches below the top lid.
19. The following apply to five (5) feet and larger water meter vault installations (1-1/2 inch and larger irrigation services).
  - a. Water meter vaults proposed for water meters larger than two (2) inches, manifold water meter sets, fire line rated water meters, or specifically constructed water meter sets shall be approved by the City Engineer prior to the start of construction.
  - b. Vaults are to be of water tight construction.
  - c. To the extent possible, the top of the water meter register head shall be visible from the opened access lid. The water meter shall be equipped with off-site reading equipment as specified by the City Public Works and Natural Resources Department.
  - d. Water meter setters for 1-1/2 inch and two (2) inch services shall have a horizontal inlet and outlet. Water meter setters shall be a minimum of 12 inches in height and will have an inlet valve, outlet valve and a bypass with valve. Water meter setters shall be plumbed with compression fittings. Water meter setters shall be installed perpendicular to the vault floor with one (1) inch diameter support rods or pipe with a minimum length of 18 inches installed for support. Refer to the City's Approved Materials List for water meter setters.
  - e. Water meter setters for dedicated irrigation systems shall not have a bypass.
20. The following apply to meters installed internal to a structure.
  - a. Bypasses for 1-1/2 inches and larger meters are required for commercial, industrial and multi-family users. The size of the bypass shall be the same size as the water meter. The bypass valve shall be stainless steel and lockable.
  - b. When installing 1-1/2 inches and larger water meters and backflow prevention assemblies inside commercial buildings and inside of a locked room, a lock box, locked with an approved lock with a key to the room, must be provided for access by the City and installed just outside of the locked door. The lock box must be purchased from the City of Longmont Public Works and Natural Resources Department.

21. The property owner is required to bear the costs of relocating a meter and/or remote when their actions limit existing free and easy access for the meter readers or introduces a safety hazard. This would include remodeling, additions, fences, new landscaping, etc.

**505.05 ACCESS**

1. Free, easy, and ready access for the purposes of testing, certification, repair, maintenance, or replacement shall be provided to water meters at any reasonable hour.
2. All water meters have to be periodically tested and certified. The customer or user shall take whatever measures are necessary for providing access to the water meter.
3. There shall be a clear line of access to the water meter. This access line shall be free of any impediment, including safety hazards, to the movement of personnel and necessary tools, equipment, or material.
4. Lines of access and openings governing access to the water meter set shall be large enough to accommodate the passage of the water meter without the water meter having to be dismantled in any way. It is the responsibility of the customer or user to move belongings, material, or property to insure reasonable conditions of access.
5. There shall be no obstruction of any sort which would necessitate the reaching around, through, behind, under, or over in order to perform usual and necessary work. Nor shall there be any obstruction which would impair the clear vision of the water meter. The area around the water meter shall be fully sufficient for a person to place his body squarely before and in close proximity to the water meter, have a clear view of the meter, and have room to operate customary tools without hindrance.
6. Whenever security considerations necessitate that access to a water meter be controlled through the use of a lock, alarm, or other such device, the customer or user shall make known to the City the procedures to be followed for ready access through such locks, alarms, or other security arrangements.

**506.01 DEFINITIONS**

1. Whenever the following terms or words are used in this chapter, they shall have the following meanings ascribed to them. For definitions not defined below reference the Definition Section 101 of these City Standards:

**AIR GAP:** The unobstructed vertical distance through the free atmosphere between the lowest opening from any pipe or faucet supplying water to a tank, plumbing fixture, pool, or other device and the flood level rim of said vessel or container. An approved air-gap shall be at least double the diameter of the supply pipe, measured vertically, above the flood level rim of the vessel or container; and, in no case less than one (1) inch.

**BACKFLOW:** Refer to City Code Section 14.06.010 Definitions.

**BACKPRESSURE:** Refer to City Code Section 14.06.010 Definitions.

**BACK SIPHONAGE:** Refer to City Code Section 14.06.010 Definitions.

**CONTAINMENT:** Refer to City Code Section 14.06.010 Definitions.

**CERTIFIED CROSS-CONNECTION CONTROL TECHNICIAN:** Refer to City Code Section 14.06.010 Definitions.

**APPROVED TESTING LABORATORY:** The Foundation for Cross-Connection Control and Hydraulic Research of the University of Southern California (FCCC&HR) and the American Society of Sanitary Engineers (ASSE).

**506.02 GENERAL**

1. All backflow prevention and cross-connection controls shall meet the requirements of City Code Chapter 14.06 and the State of Colorado Regulations 11.39.
  - a. An approved backflow prevention assembly (assembly) used for protection by containment is required on any water service line whenever there is an actual or potential situation when backflow due to backpressure and/or backsiphonage can occur.
2. When connecting into the City of Longmont Distribution system the applicant shall be responsible for complying with these City Standards.
3. Reduced Pressure Zone (RPZ) backflow prevention assemblies shall be installed above ground. Under no circumstance shall an RPZ backflow assembly be installed below ground in a vault or meter pit.
4. Double Check Valve Backflow Prevention assemblies shall meet the requirements of AWWA C510-17.
5. RPZ backflow prevention assemblies shall meet the requirements of AWWA C511-17
6. All work and materials are subject to inspection by the City of Longmont at all times.
7. Modification, alteration or relocation in backflow assembly equipment must be approved by the City.
8. All work necessary to achieve installation of a backflow prevention assembly shall be inspected. Inspections will be required as follows:

- a. Backflow prevention assembly sets, assembly installation, and discharge piping where appropriate, shall be approved by City PWR Operations personnel prior to assembly installation.
  - b. Where backflow prevention assemblies are required, no Certificate of Occupancy shall be issued without an approved inspection and assembly test result submitted to the PWR Operations Division.
9. The specific make, model, and manufacturer shall be found in the most recent listing published by The Foundation for Cross-Connection Control and Hydraulic Research of the University of Southern California's (FCCC&HR) "List of Approved Backflow Prevention Assemblies." In the cases of single family residences, the assemblies shall bear the approval of the American Society of Sanitary Engineers (ASSE).
  10. Backflow prevention assemblies that are to be owned by the City shall be of a make and model as shown on the Approved Materials List.

### **506.03 BACKFLOW PREVENTION ASSEMBLIES REQUIRED**

#### **506.03.01 SINGLE-FAMILY AND DUPLEX**

1. Single-Family and Duplex Residential units shall comply with requirements of the City's adopted IRC or IPC.
2. Certain higher hazard connection, as determined by the City, will be evaluated for installation, inspection, and reporting requirements.

#### **506.03.02 MULTI-FAMILY**

1. Multi-Family Developments shall be required to install an RPZ backflow assembly at each service connection, except as follows:
  - a. In townhome, condos, and other multi-family installations where one water meter is being installed per dwelling unit, install backflow prevention per Section 506.03.1 of these City Standards.
2. Installation of an RPZ backflow assembly shall be installed in a dedicated utility room. The utility room shall be temperature controlled to prevent freezing. The utility room shall have an external building access door.
3. The RPZ backflow assembly shall be installed per City Standard Details.

#### **506.03.03 NON-RESIDENTIAL AND MIXED USE**

1. Non-Residential and Mixed Use Developments shall be required to install an RPZ backflow assembly at each service connection.
2. Installation of an RPZ backflow assembly shall be installed in a dedicated utility room. The utility room shall be temperature controlled to prevent freezing. If access to the building utility room is limited, the utility room shall have an external building access door and meet the requirements of Section 505 of these City Standards.
3. The RPZ backflow assembly shall be installed per City Standard Details.



#### 506.03.04 IRRIGATION

1. For all Multi-Family, Mixed Use, and Non-Residential irrigation services, an RPZ backflow assembly shall be installed at each service connection.
2. The RPZ backflow assembly shall be installed per City Standard Details.
3. Installation of an RPZ backflow assembly above ground in a small enclosure is acceptable provided that the enclosure has non-corrodible screened opening(s) which will provide the necessary drainage without the air gap funnel being submerged in the vented or dumped water.

#### 506.03.05 FIRE SERVICE LINES

1. Unless otherwise required by City ordinance, all newly constructed or modified fire suppression systems using potable water from the City's water distribution system shall be required to have an approved backflow prevention assembly installed. Such fire suppression systems shall conform to the following:
  - a. All fire suppression lines shall be protected with a double check backflow prevention assembly except as follows:
    - (i) RPZ backflow prevention assemblies shall be installed whenever any chemical additive, pump, injection, or other means of producing backpressure, except for a "siamese" type connection, is present. RPZ backflow prevention assemblies shall also be installed in any situation where a second source of water is utilized, or may be utilized.
  - b. All backflow prevention assemblies shall conform to their appropriate installation requirements.
  - c. Where a single water service line is used for supplying domestic water and fire suppression water, both the portion of the piping system supplying the domestic water and the portion supplying fire suppression water shall have installed the appropriate backflow prevention assemblies.
2. Installation of a DCVA or RPZ backflow assembly shall be installed in a dedicated utility room. The utility room shall be temperature controlled. If access to the building utility room is limited, the utility room shall have an external building access door.

#### 506.04 OWNERSHIP

1. Backflow prevention assemblies shall be privately owned and maintained by the property owner.
2. Backflow prevention assemblies are not transferable to another premise, property, area, or street address.
3. Only properly trained and certified cross-connection control personnel are permitted to install, repair, replace, relocate, maintain, test, certify, modify, or otherwise affect the internal workings of a backflow prevention assembly.

#### 506.05 DESIGN REQUIREMENTS

1. Location requirements
  - a. Backflow prevention assemblies used for protection by containment shall be located downstream of the water meter.
  - b. Backflow prevention assemblies used for protection by containment shall be located such that all water entering the premise or property through the water service line shall pass through the

assembly prior to any use by the customer or user. There shall be no fitting, fixture, or other means capable of diverting water from the service line before the backflow prevention assembly. The exceptions are as follows:

- (i) There may be closed loop bypass around the backflow prevention assembly, provided the bypass itself has in it a similar type approved backflow prevention assembly. The purpose shall only be to insure continuous water delivery while one assembly is undergoing testing, maintenance, repair, or replacement.
- (ii) Landscape irrigation systems may be teed before the backflow prevention assembly used for containment, provided such systems are themselves properly equipped with an approved backflow prevention assembly.
- (iii) The City may authorize more than one approved backflow prevention assembly when physical conditions in a retro-fit situation pose unusual problems to the installation of a single assembly.

## 2. Pressure Increases

- a. Most backflow prevention assemblies, by the very nature of their design, do not allow any release of pressure which may build up on the customer or user's side of the piping or plumbing system to escape back to the City's water distribution system. Customer or users must ensure that there is adequate protection from increases in water pressure on the downstream or user's side of a backflow prevention assembly.

THE CITY DOES NOT ACCEPT NOR TAKE ANY RESPONSIBILITY NOR LIABILITY FOR DAMAGES OF WHATEVER KIND WHICH MAY BE OCCASIONED BY OR RELATED TO AN INCREASE OR DECREASE IN PRESSURE IN THE PIPING OR PLUMBING SYSTEM DUE TO THE INSTALLATION OR OPERATION OF AN APPROVED BACKFLOW PREVENTION ASSEMBLY.

- b. The customer or user shall maintain in good working order pressure relief valves on their hot water tanks, boilers, and hot water heating systems. Further, the customer or user shall install and maintain whatever additional pressure relief valves, water hammer arrests, pressure expansion tanks, or other means deemed prudent and wise.

## 3. Isolation Valves

- a. All assembly installations require isolations valves, before and after the assembly, for testing, repair and maintenance.

## 4. Drainage

- a. Certain types of approved backflow prevention assemblies are specifically designed to dump or vent water to the atmosphere as an expected part of their operation. The customer or user shall be responsible for providing whatever drainage work may be needed to control and carry away water which may be dumped or vented by such assemblies.
- b. The City accepts no responsibility nor liability for damages or injury caused or related to the dumping or venting of water, or water mixed with other materials.
- c. RPZ backflow prevention assemblies may dump or vent large quantities of water under pressure. These assemblies are equipped with an air gap funnel to catch the dumped or vented water. The customer or user shall provide whatever piping is necessary from the outlet side of the air gap funnel to effectively and safely carry away and dispose of any dumped or vented water or water mixed with other substances, in compliance with applicable regulations and requirements.

5. Stop and Waste Valves

- a. Stop and waste valves on the upstream side of a backflow prevention assembly will be allowed only if the valves can vent to daylight. No upstream stop and waste valve may be buried nor be situated such that it is, or potentially can be, submerged by the water it vents or dumps, any other water, or any other liquids.

**506.06 MATERIALS**

1. Materials shall be in accordance with the City's Approved Materials List.
2. No solder containing lead shall be used. All soldering fluxes, plumbing pastes, pipe dopes, sealants, coatings, gaskets, and similar materials which may come into contact with potable water must be non-toxic and approved for general plumbing use.

**506.07 ACCESS TO BACKFLOW PREVENTION**

1. Free, easy, and ready access for the purposes of testing, certification, repair, maintenance, or replacement shall be provided to backflow prevention assemblies used for protection by containment at any reasonable hour.
2. All backflow prevention assemblies have to be periodically tested and certified, most of them annually. The customer or user shall take whatever measures are necessary for providing this periodic access to the assembly for the purposes of testing and certification.
3. There shall be a clear line of access to the backflow prevention assembly. This access line shall be free of any impediment, including safety hazards, to the movement of personnel and necessary tools, equipment, or material.
4. Lines of access and openings governing access to the assembly set shall be large enough to accommodate the passage of the backflow prevention assembly without the assembly having to be dismantled in any way. It is the responsibility of the customer or user to move belongings, material, or property to insure reasonable conditions of access.
5. There shall be no obstruction of any sort which would necessitate the reaching around, through, behind, under, or over in order to perform usual and necessary work. Nor shall there be any obstruction which would impair the clear vision of the assembly set. The area around the assembly set shall be fully sufficient for a person to place his body squarely before and in close proximity to the assembly set, have a clear view of the set, and have room to operate customary tools without hindrance.
6. Whenever security considerations necessitate that access to a backflow prevention assembly be controlled through the use of a lock, alarm, or other such device, the customer or user shall make known to the superintendent the procedures to be followed for ready access through such locks, alarms, or other security arrangements.

**506.08 SPACE AND LOCATION REQUIREMENTS**

1. The following requirements shall apply to backflow prevention assembly sets in all newly constructed structures or facilities and, where reasonable, in all retro-fit situations:
  - a. A minimum vertical distance of 12 inches shall exist between the ground or floor and the lowest point on the assembly, including the air gap funnel on RPZ backflow prevention assemblies.

- b. The lowest point on the assembly shall not exceed 30 inches above the floor, ground, or a firm, permanent footing surface.
- c. For assemblies two (2) inches and smaller, the closest side of the assembly shall not be less than two (2) inches from any wall or obstruction and shall be at least four (4) inches from any surface which is subjected to freezing temperatures on its other side. Assemblies larger than two (2) inches in diameter which require companion flanges for installation shall have a minimum clearance of 12 inches from the closest wall or obstruction.
- d. At least one side of the assembly shall be open to ready and easy access.
- e. The piping side of all unions and companion flanges shall allow sufficient room to introduce bolts, nuts, and use usual tools. In no case shall the piping side of a union or companion flange be closer than four (4) inches to a wall, floor, or other obstruction.
- f. There shall be at least 12 inches of clearance between the test cocks and any adjacent wall, fixture, or ceiling.
- g. No assembly set shall be installed in or above a ceiling.
- h. No assembly shall be located such that any vented or dumped water cannot be safely carried away without damaging property.
- i. No assembly, including any air gap funnel, shall be located such that it is likely to be submerged in the water it vents or dumps, in ground water, or in other water or liquids which may be present.
- j. No assembly shall be located either above or below a hazardous location, such as a chemical mixing tank, electrical apparatus, electronic equipment, or a storage site for chemicals or other hazardous materials.
- k. All assemblies shall be located such that they are protected against vandalism, mischief, and deterioration due to atmospheric conditions.

## **506.09           INSTALLATION REQUIREMENTS**

### **506.09.01       AIR GAPS**

- 1. Properly constructed and located air gaps are approved for protection by containment for all degrees of hazard. Air gaps used for protection by containment are most commonly used for applications on tank loading stations, pools used for swimming, wading, or therapy, chemical processing tanks, and sumps or tanks which provide water for pumping. Air gaps shall conform to the following:
  - a. They shall be located downstream of the City water meter.
  - b. They shall be constructed such that no hose, piping arrangement, or other fixture may be attached to defeat the air gap separation. This includes any solid funnel arrangement installed to prevent splashing.
  - c. They shall be constructed such that the potable water supply line is at a vertical distance of not less than two inside pipe diameters (of the potable supply line) above the flood level of the receiving vessel, and in no case shall the air gap between the potable line and the receiving vessel be less than one (1) inch.
  - d. When the potable supply line discharge is within two (2) inside pipe diameters of any wall or protrusion, the required vertical air gap between the potable supply discharge and receiving

vessel shall be extended to a minimum of three (3) inside pipe diameters of the potable supply line, or two (2) inches, whichever is greater.

- e. There shall be adequate drainage arrangements to handle full volume overflows of the receiving vessel.
- f. The water supply or service line shall be protected from freezing.
- g. Air gaps used for protection by containment shall be considered approved backflow prevention method and shall be inspected at least annually.

#### 506.09.02 REDUCE PRESSURE ZONE OR REDUCED PRESSURE DETECTOR CHECK ASSEMBLIES

1. An RPZ or Reduced Pressure Detector Check (RPDC) backflow prevention assembly shall be installed for protection by containment and shall meet the following:
  - a. When installed horizontally, they shall be in an upright position, essentially plumb, and with the relief valve pointed down. RPZ and RPDC assemblies larger than two (2) inches in size must be installed horizontally. RPZ devices two (2) inches and smaller may be installed in a vertical position provided the water flow will be in an upward direction through the assembly. Such installations require the addition of a vent elbow such that the outlet of the air gap funnel will be pointing down. RPZ and RPDC assemblies shall be installed per the manufactures recommendations.
  - b. RPZ assemblies two (2) inches and smaller shall be equipped with full port/quarter turn ball isolating valves.
  - c. RPZ and RPDC assemblies sized 2-1/2 inch and larger are normally provided with resilient seat butterfly type isolating valves. OS and Y type gate valves can be substituted for the butterfly valves when the assembly is to be used in a fire suppression water line.
  - d. RPZ and RPDC assemblies shall be protected against frost and freeze damage.
  - e. RPZ and RPDC assemblies installed inside structures may have a drainage line through an exterior wall to daylight provided any dumped or vented water exiting the drain line will not pose a hazard to the public. Such drain line shall be equipped with a non-corrodible screen at the discharge opening.
  - f. RPZ and RPDC assemblies may have drain lines connected to a sewer system, provided a building permit is obtained and a City Inspector approves the sewer system connection.
  - g. The City may elect to remove the operators or handles from the isolating valves or to chain them together to prevent unauthorized operation of the isolating valves.

#### 506.09.03 DOUBLE CHECK VALVE ASSEMBLIES

1. A double check valve (DCV) assembly for fire service lines shall conform to the following:
  - a. When installed horizontally, DCV assemblies shall be in an upright position and essentially plumb.
  - b. DCV assemblies may be installed vertically, provided, the water flow is in an upward direction through the assembly.
  - c. DCV assemblies two (2) inches and smaller shall be equipped with full port/quarter turn ball isolating valves.

- d. DCV assemblies sized 2-1/2 inches and larger are normally provided with resilient seat butterfly type isolating valves. OS & Y type gate valves can be substituted for the butterfly valves when the assembly is to be used in a fire suppression water line.
- e. DCV assemblies shall be protected against frost and freeze damage.
- f. DCV assemblies shall not be installed in underground vaults, either alone or in conjunction with water meters.
- g. Installation of a DCV assembly above ground in a small enclosure is acceptable, provided that the enclosure provides the necessary frost protection and conditions of access.
- h. The City may elect to remove the operators or handles from the isolating valves or to chain them together to prevent unauthorized operation of the isolating valves.

#### 506.09.04 PRESSURE VACUUM BREAKER ASSEMBLIES

1. Pressure Vacuum Breaker (PVB) assemblies shall only be used for protection by containment for water service lines supplying landscaping irrigation systems. PVB assemblies cannot be used in lieu of an RPZ or DCV assemblies. PVB assemblies shall conform to the following:
  - a. PVB assemblies shall be installed in an upright position and essentially plumb.
  - b. PVB assemblies shall be installed with the critical level mark, or bottom of the assembly if it has no critical level mark, a minimum of 12 inches above the highest point of downstream usage.
  - c. PVB assemblies shall not be installed where they are, or where they will be subjected to backpressure. However, they can be subjected to continuous line pressure, provided it is not greater than the water pressure on the supply side of the assembly.
  - d. PVB assemblies used for protection by containment of a landscaping irrigation system shall be equipped with full port/quarter turn isolating ball valves.
  - e. PVB assemblies can have valves, including "stop and waste" type, on their downstream side.
  - f. PVB assemblies shall be protected against frost and freeze damage. Air ports for winterizing the assembly by means of blowing out water are acceptable upstream of the PVB assembly provided the air port is not, nor is likely to be, submerged.
  - g. Installation of a PVB assembly above ground in a small enclosure is acceptable provided that the enclosure provides the necessary conditions of access and adequate drainage.

#### 506.10 BACKFLOW PREVENTION ASSEMBLY SETS

1. The backflow prevention assembly set and connected piping or plumbing shall be firmly supported so that there is no centerline misalignment in the assembly set when the assembly is not in place. The backflow prevention assembly is not to be used to support nor bear the weight of other components in plumbing or piping system.
2. No part or component of the assembly set is to be used for any purpose other than holding and securing the backflow prevention assembly in place.
3. In no case shall the backflow prevention assembly set allow the assembly to rest directly upon a lower weight bearing surface. Removable blocking or approved jacks shall be used between the assembly and the bearing surface to provide adequate support to the assembly or the assembly set. Such blocking shall be of cement block, brick, or similar non-biodegradable materials.

4. Only bottom support as provided by movable blocking or approved jacks shall be in contact with the backflow prevention assembly. No strapping, pipe hangers, or similar supporting devices shall be attached or connected to the assembly itself.
5. All backflow prevention assembly sets shall be thoroughly flushed to remove all construction debris and foreign matter from them and the service line or plumbing system piping prior to assembly installation.

**506.11 TESTING AND CERTIFICATION OF BACKFLOW PREVENTION ASSEMBLIES**

1. Refer to City Code Chapter 14.06 for additional requirements.
2. Repair Parts
  - a. Only replacement parts produced by or specifically recommended by the backflow prevention assembly manufacturer shall be used in the repair of the backflow prevention assembly.
  - b. The reuse of parts from check valves by reversing the part will not be allowed.
3. All testing gauges used by Certified Cross-Connection Control Technicians shall be checked for accuracy at least yearly and proof of testing shall be provided to the City upon request.

**506.12 RECORDS AND REPORTS**

1. Refer to City Code Chapter 14.06.