

CITY OF LONGMONT
SECTION 500 – WATER DISTRIBUTION
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500.00 DESIGN CRITERIA

500.01 GENERAL

- A. 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, other applicable Sections of the City Standards, applicable provisions of the City Code, and may also include criteria established by the City Engineer for the overall hydraulics of the water distribution system. Additional criteria may be outlined during plan review as determined by the City Engineer.
- B. 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 determined by the City Engineer on a project-by-project basis. Additional details for larger diameter pipe are available from the Water Department.
- C. The City may require Development projects 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. 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

- A. In accordance with the adopted 2021 International Fire Code (IFC), as amended, whereby the water supply is capable of supplying the required fire flow for fire protection of buildings within its jurisdiction, the minimum fire flow and flow duration requirements for the water distribution system shall be 2000 gallons per minute (gpm) for two (2) hours for one- and two-family dwellings and 3500 gpm for three (3) hours for all other buildings. The required fire flow and duration for some buildings may be greater in accordance with the City's adopted IFC, as amended. Refer to the City's adopted IFC, as amended, for specific requirements.
- B. 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 pounds per square inch (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 necessary by the property owner to determine if service lines require a booster pump to meet the needs of the property.
- C. 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.
- D. The velocity of the water in water mains shall not exceed five (5) feet per second during peak hour demands or 10 feet per second during maximum day demands plus fire flow.
- E. Fire service lines shall be sized to meet the National Fire Protection Association (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.
- F. Water flow design shall be calculated using the Average Daily Flow (see Table 5-1). Average Daily Flow is the the total volume of water received by a system over a 24-hour period, averaged over a 12-month period. Water mains exceeding eight (8) inches in diameter may need to be designed to the 90th percentile flow or demand, at the discretion of the City Engineer.

G. For Annexation Applications, Table 5-1 shall be used to estimate water demand for proposed land use.

Table 5-1 Water Demand per Envision Longmont Land Use Classifications*

Residential Land Uses	Dwelling Units per Acre / Land Categories	Average Daily Flow Over (2018-2022)	90 th Percentile (2005-2022)
Rural Neighborhood	1	640	753
Single-Family Neighborhood	1-8	1,359	1,716
Mixed Neighborhood	6-18	1,539	1,841
Multi-Family Neighborhood	18-35	2,496	2,841

Mixed Use	Dwelling Units per Acre / Land Categories	Average Daily Flow Over (2018-2022)	90 th Percentile (2005-2022)
Downtown Central Business District	N/A	1,343	1,518
Regional Center	N/A	1,135	1,506
Mixed Used Corridor	N/A	1,267	1,572
Neighborhood Center	N/A	1,486	1,733

Employment Land Uses	Dwelling Units per Acre / Land Categories	Average Daily Flow Over (2018-2022)	90 th Percentile (2005-2022)
Mixed-Use Employment	N/A	578	679
Primary Employment	N/A	936	1,068

Community	Dwelling Units per Acre / Land Categories	Average Daily Flow Over (2018-2022)	90 th Percentile (2005-2022)
Parks, Greenways, Open Space	N/A	217	330
Public/Quasi-Public	N/A	467	650

*Water Demand per Land Use in Gallons per day per platted lot acreage (gpd/ac)

500.03 LOOPING REQUIREMENTS

Water mains shall be designed to create a looped water system unless otherwise approved by the City Engineer. All dead-end water mains shall require approval from the City Engineer. Under no circumstance shall the length of a dead-end water main exceed 300 feet.

500.04 WATER MAIN SIZING

- A. Minimum looped water main size shall be an inside diameter of eight (8) inches.
- B. 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 (4), active three-quarter (¾) inch domestic services.
- C. The water turnover in dead-end water mains, as calculated in the last 100-foot segment, shall be less than one (1) day during low flow (winter) conditions as approved by the City Engineer.

D. Fire hydrant laterals shall be six (6) inches.

E. Fire service lines shall be designed in accordance with the City's adopted fire and building codes.

500.05 DEPTH

Water mains shall be installed at a depth of four-and-one-half (4-½) to eight (8) feet, from top of pipe to finished ground surface. If difficulties arise when crossing an interference, the cover over the pipe can be a minimum of three-and-one-half (3-½) feet and a maximum of 10 feet if approved in writing by the City Engineer. Pipeline insulation shall be required for any installations with a depth less than four (4) feet. If the grade of the surface is raised or lowered above an existing water main, the water main shall be relocated to maintain cover of four-and-one-half (4-½) to eight (8) feet; this depth may be allowed to be a minimum of three-and-one-half (3-½) feet and a maximum of 10 feet, if approved by the City Engineer.

500.06 ALIGNMENT

A. All water mains shall be laid ten 10 feet north or west of the center line of the street whenever possible. 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.

B. All-weather vehicular access shall be provided within ten 10 feet of vaults and valve boxes installed in areas outside of paved City ROW. Refer to Section 200 for access design standards.

C. Refer to Section 100 for horizontal and vertical separation from structures and other utilities.

500.07 GRADE

A. 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.

B. 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

A. THRUST RESTRAINT

- (1) Thrust restraint shall be provided for each fitting (e.g. valves, plugs, caps, tees, crosses, reducers, bends, hydrant tees to boots, etc.) as shown in the City of Longmont Standard Details, 500-11, 12, and 13.
- (2) Thrust restraint 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 one-point-five (1.5). The minimum soil bearing capacity shall be 1,000 pounds per square foot (psf). The Design Engineer shall be responsible for verifying project specific conditions and denoting thrust restraint requirements beyond these specifications, which will need approval from the City Engineer.
- (3) The thrust and blocking details, as shown in the City of Longmont Standard Details, are to be used as minimums only. The Design Engineer shall determine the required size of thrust blocks to be used, subject to approval of the City Engineer.

B. JOINT RESTRAINT

- (1) The joint restraint details, as shown in the City of Longmont Standard Details, are to be used as minimums only. The Design Engineer shall determine the required length of joint restraint to be used, subject to approval of the City Engineer.

- (2) All fittings shall be mechanically restrained to the adjacent pipe segment at minimum.
- (3) Concrete thrust blocks and blocking for valves, vertical bends, and reducers shall not be acceptable unless project-specific conditions will not allow for the required restrained joint pipe length on both sides of the valve. Design engineer shall provide means to restrain pipe to each side of valves, vertical bends, and reducers regardless of if concrete thrust blocks or restrained joint pipe length is utilized for thrust restraint.
- (4) If tie-ins or connections to existing waterlines do not allow for pipe joint restraint (i.e. due to existing pipeline material), Design Engineer shall provide for means to restrain pipe as necessary. Pipe joint restraint devices are not allowed for asbestos cement and cast-iron pipe.
- (5) Joint restraint shall be required whenever the water main must be placed into service before concrete thrust blocks have achieved a minimum compressive strength of 3,000 psi (regardless of overall mix design strength).
- (6) Restrained joint pipe at the required length shall be installed for pressure testing of pipe segments that will be utilized for future connections (i.e. temporary dead-end water mains).
- (7) Joint restraint shall be required for all pipe joints within a casing.
- (8) Joint restraint and concrete thrust blocks shall be used for fire hydrant laterals and assemblies.

500.09 FUTURE CONNECTIONS

- A. 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 in the future. Restraint shall be made by a swivel tee, or approved mechanical joint restraint adapter, and the minimum lengths of pipe restraint, as shown in the City of Longmont Standard Details.
- B. A temporary blow off, flushing hydrant, or fire hydrant shall be installed on connections for future water main extensions.

500.10 VALVE PLACEMENT

- A. Valves shall be placed no more than 500 feet apart on water mains.
- B. A valve shall be installed on all fire hydrant laterals.
- C. A valve is required on the water main between fire hydrants, and not to exceed 50 feet from the hydrant tee.
- D. A minimum of two (2) valves shall be installed at every main line tee and three (3) valves installed at every cross.
- E. Valves at mechanical joint fittings shall be connected to the fitting with a minimum 24-inch length of pipe between the fitting and the valve when not directly connected using a swivel tee adaptor or bolt-through mechanical joint adapter.
- F. A maximum of two valves may be connected to a tee or cross utilizing a swivel tee adapter and / or bolt-through mechanical joint adapter.
- G. Valves shall not be placed in a water main lowering or where the valve box would be within a gutter or drain pan.
- H. Valves shall be installed at each end of a lowering deeper than 10 feet. Valves shall be placed within 10

- I. Valves shall be installed at each end of the casing for any main that has a casing. Valves shall be placed within 10 feet of each end of the casing.
- J. Additional valves may be required on water mains as determined by the City Engineer.

500.11 FIRE HYDRANT PLACEMENT

- A. 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. The number of fire hydrants, their location, and spacing shall be as follows:
 - (1) Residential Areas – No more than 500 feet between hydrants starting at street intersections.
 - (2) Multiple Dwellings – No more than 500 feet between hydrants and not more than 200 feet from the end of a required emergency access.
 - (3) Commercial, Industrial, Storage Areas – No more than 500 feet between hydrants and not more than 200 feet from the end of a required emergency access.
 - (4) 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 as specifically approved by the City Engineer.
- B. Exceptions from the above requirements shall require approval from the City Fire Marshal in addition to the City Engineer, see section 100.08 of City Standards.

500.12 FIRE SERVICE LINES AND FIRE HYDRANT LATERALS

- A. All fire hydrant laterals shall extend from the hydrant tee and valve on the water main to the fire hydrant. Lowerings shall not be allowed on fire hydrant laterals.
- B. Fire service lines for internal fire suppression systems shall require a valve on the fire service line at the water main. The valve shall be restrained back to the water main by the Contractor. The valve shall 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, per Code.
- C. Plans for the installation of fire hydrant laterals or fire service lines shall be submitted to the City Engineer for approval and shall be stamped by a Design Engineer licensed in the state of Colorado. Plans shall be submitted, and approval by the City Engineer obtained, a minimum of two (2) weeks prior to beginning construction.
- D. 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 350 ductile iron. If the water main is PVC, Asbestos Cement Pipe (ACP), or steel pipe, the fire hydrant main shall be PVC pipe.
- E. All Combined fire/domestic service lines shall be PVC, DIP, stainless steel or copper pipe before the backflow.
- F. The use of any private fire service line to supply more than one (1) lot shall be prohibited.
- G. Fire service lines shall be electrically insulated from the water main if the water main is metallic pipe.

- H. Fire service lines shall be electronically locatable with a trace wire stubbed up inside a trace station outside of the fire riser room and valve box at the water main.

- I. On a case-by-case basis, as approved by the City Engineer, domestic taps may be allowed on private fire service lines provided that the service line meets all potable water service standards up to all backflow prevention devices and a valve is installed between the physical domestic tap on the fire service line and the water meter. This valve shall 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 B above and may close the valve and turn off the water when necessary. The property owner shall maintain the fire service line and domestic service line from the fire service line valve to the building or structure, per Code. Refer to the City Standard Details for the installation of the Combined Fire/Domestic Water Service.

- J. Domestic taps shall not be permitted on fire hydrant laterals.

501.00 GENERAL PROVISIONS

501.01 OPERATION OF VALVES

When connecting to the existing water system, mainline valves on the existing system and connecting valves shall be operated by City 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 of an emergency, the Contractor shall call the City at (303-651-8416) and notify the City Inspector.

501.02 CONNECTION TO EXISTING SYSTEM

- A. 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.
- B. 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, to keep the shutoff time to a minimum. The Contractor shall coordinate with the City Inspector and flush the connection to prevent contamination of the existing facilities as soon as possible after making the connections. The Contractor shall take every precaution necessary to prevent dirt or debris from entering the water main. Refer to AWWA 651 and Section 504 for disinfection and flushing requirements.
- C. Connections to the existing water system shall be completed in a proper, neat, and workmanlike manner. The City Inspector shall be notified at least 48 hours in advance of connection and shall 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. If a non-disinfected water main cannot be isolated, it shall not be connected to an existing, disinfected water main under any circumstance.
- D. 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 is responsible to use methods at their own disposal to dewater the trench and to complete any required testing or disinfection of the water line in compliance with all local, state, and federal regulations.
- E. All connections shall be valved to separate new construction from the existing system. Only one (1) connection to the existing system will be allowed until the new system has been completely tested.

501.03 INTERRUPTION OF WATER SERVICE

- A. For general noticing requirements for disruptions to City utility services, refer to Section 107. The Contractor shall not schedule disruptions of service on a Monday or Friday without approval by the City.
- B. The approval of the City Inspector shall be required for any water shut off. The Contractor shall notify the Public Safety Department at least eight (8) 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.
- C. 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, alternative means, as approved by the City, of providing water service to the affected customer during the installation of the connection.

- D. Planned disruptions may be cancelled if, in the opinion of the City Engineer, 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, does not have the required equipment, materials, and labor on hand to make the connection within the scheduled outage time, or if public safety concerns do not permit a water service disruption.

501.04 ABANDONMENT OF EXISTING WATER LINES OR “STUBS”

- A. All fire hydrant laterals, fire service lines, and water service lines (“water line”) 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. Any water mains that were installed and will not be used shall be disconnected from the water system. This shall include excavating the water main, removing any valves that are not needed, and installing an approved plug or repair clamp. 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. However, if the street was paved within the previous three (3) years and no street asphalt overlay is planned for the next five (5) years, then the developer shall place sufficient funds in cash escrow with the City for the City to abandon the service line in the future.
- B. A City Inspector shall be present at all water line abandonments. If a water main is to be taken out of service for an abandonment, approved flushing and disinfection procedures shall be completed by the Contractor in conjunction with the City Inspector.
- C. The Owner shall apply for a building permit and pay all fees prior to abandonment of all water services.
- D. The Contractor shall sufficiently expose the water main to accommodate the tapping abandonment equipment as determined by the City Inspector. The water main shall be exposed a minimum of 48 inches centered over the water line to be abandoned. Refer to Section 100 for trenching requirements.
- E. 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 or job site is determined by the City to be unsafe, the City personnel will not perform the abandonment. A new time shall be scheduled by the Owner through the City when the site is demonstrably safe.
- F. The Owner shall pay all costs and expenses incident to the abandonment of any water line. In the event of a rescheduled abandonment, all costs incurred by the City for time lost on the originally scheduled abandonment shall be billed to the Owner.
- G. No tap abandonment shall be scheduled less than 48 hours, or two (2) working days, from the time the City is contacted at (303-651-8416) by the Owner for the abandonment.
- H. For direct taps sized three-quarters ($\frac{3}{4}$) inch through two (2) inch, the City or City’s representative shall remove the corporation stop and install a plug.
- I. For saddle taps sized three-quarters ($\frac{3}{4}$) inch through two (2) inch, the Contractor shall provide an approved repair clamp and the City or City’s representative shall install the repair clamp.
- J. For Tee connections, the Contractor shall install a plug on the downstream side of the tee and install an approved thrust block or restraint to secure the plug. When a valve is present, the valve shall be removed.

- K. Water mains 12 inches in diameter or larger shall be abandoned in place using a flowable grout.

501.05 TAPPING AUTHORIZATION

- A. Taps up to and including two (2) inches shall be completed by the City or the City's representative. A City Inspector shall be present for all taps.
- B. Taps greater than two (2) inches shall be performed by a qualified Contractor in the presence of the City Inspector.
- C. All wet taps shall be at least one (1) nominal pipe size less than the water main that is being tapped. Size-on-size wet taps shall be prohibited.
- D. No taps shall be allowed on mains greater than 12 inches in diameter without the approval of the City Engineer.
- E. The Owner shall apply for a building permit and pay all fees prior to contacting the City at (303-651-8416) to schedule the tap.
- F. No tap shall be scheduled less than 48 hours, or two (2) working days, from the time the City is contacted by the Owner for the tap.
- G. The Contractor shall 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, Detail 500-17. Water taps shall be completed using equipment designed for tapping waterlines, including a shell cutter and a tapping machine specifically intended for this purpose.
- H. 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 or job site is determined by the City to be unsafe, City personnel will not perform the tap. A new time shall be scheduled by the Owner through the City at (303-651-8416) once the site is demonstrably safe.
- I. The Owner shall pay all costs and expenses incident to the installation and connection of water facilities and the building water system. In the event of a rescheduled tap, all costs incurred by the City for time lost on the originally scheduled tap will be billed to the Owner.

501.06 CONSTRUCTION WATER

Refer to Section 107.02.

502.00 WATER MAIN MATERIALS

502.01 GENERAL

- A. All materials shall comply with the requirements of the Safe Drinking Water Act and other applicable federal and state regulations for potable water systems, as amended.
- B. 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.
- C. Refer to the City's Approved Materials List, Appendix I-4 for a specific list of materials accepted by the City.

502.02 DUCTILE IRON PIPE

A. DESCRIPTION OF PIPE

- (1) DIP shall be designed and manufactured in accordance with AWWA C151. The pipe wall thickness for water mains and fire hydrant laterals 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 non-toxic, shall not support the growth of bacteria, and shall have no deteriorating effects on the gasket material. The 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.

B. PIPE COATING

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.

C. CEMENT LINING

Pipe shall be lined with cement mortar in accordance with AWWA C104. The thickness of linings for DIP shall not be less than one-sixteenth (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.

D. TAPPING

- (1) Service connections (taps) on DIP for domestic, irrigation, or fire service lines that are two (2) inches or smaller shall be tapped using a tapping saddle and 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) shall require approval 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 505.00 for service line requirements.

502.03 POLYVINYL CHLORIDE PIPE

A. DESCRIPTION OF PIPE

- (1) PVC pipe shall be designed and manufactured in accordance with AWWA C900. Dimension and Pressure Classes shall be as follows:
 - a. Fire lines and Water mains six (6) inches in diameter or smaller: Dimension Ratio 14 (DR 14), Pressure Class 305.
 - b. Water mains greater than six (6) inches in diameter: Dimension Ratio 18 (DR 18), Pressure Class 235 at a minimum.
- (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) PVC having any of the following visual defects shall not be accepted:
 - a. Straight pipe, measured from the concave side, deviating from straight greater than one-sixteenth (1/16) inch per foot of length.
 - b. Pipe which is sufficiently out-of-round to prohibit proper jointing.
 - c. Improperly formed bell and spigot ends.
 - d. Fractured, cracked, chipped, or otherwise damaged pipe.
 - e. Discolored pipe due to sun fading that is two (2) years or older.
 - f. Pipe that has been damaged during shipment or handling. Acceptance of the pipe at point of delivery will not relieve the Contractor of full responsibility for any defects in the material of the completed pipeline.
- (4) 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.
- (5) 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 in compliance with NSF/ANSI 61.

B. 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 shall not be allowed.
- (2) 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 a tapping sleeve as approved by the City Engineer.
- (3) Refer to Section 505.00 for service line requirements.

502.04 ASBESTOS CEMENT PIPE

The possible types of Asbestos-Containing Materials (ACM) that may be encountered include 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 shall be treated as ACM, unless testing shows otherwise.

A. The installation of ACM shall not be permitted.

B. 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. The pipe shall be wetted prior to cutting to prevent asbestos fibers from becoming airborne.

C. 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.

D. Water main connections to ACP shall be made with an approved transition coupling.

502.05 FITTINGS, COUPLINGS, SLEEVES AND ACCESSORIES

A. DUCTILE IRON: FITTINGS AND 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 shall be permitted 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, C111, C116, C153, 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 meet NSF/ANSI 61. Lubricants 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 in accordance with AWWA C651.
- (6) Tee-head bolts and nuts shall be manufactured High Strength, Low-Alloy / Corrosion Resistant Steel that meets or exceeds ASTM A588, Grade A, AWWA C111 composition specifications. The material specifications of ASTM A588 meets or exceeds ASTM A307 Grade and shall be resin bonded with a PTFE-based coating. Bolt heads shall be at right angles to the bolt shank and the bolt shanks shall be straight within one-sixteenth (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 would weaken their structure or impair their service. Structural defects, including fractures, splits, and cracks are not acceptable. Repairing of structural defects shall not be allowed. Cosmetic defects that have no effect on the ability of the component to meet the structural design and test requirements may be allowed, as determined by the City Inspector. Excessive cosmetic defects, including pits and gouges, shall not be acceptable. Repairing of cosmetic defects, excluding any which are determined excessive, shall be 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 (2) face-to-face dimensions that are 180 degrees apart at the outside

edge shall not differ by more than one-eighth (1/8) inch. Misalignment of corresponding bolt holes shall not exceed one-eighth (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, Detail 500-16.

B. 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 (2) metallic pipe.
- (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 (2) pipe 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.
- (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 and nuts shall be manufactured from high-strength, low alloy stainless steel conforming to ASTM A307, Grade B in accordance with AWWA C111. Stainless steel bolt and nut workmanship shall be in accordance with this Section.
- (7) Ductile iron casting workmanship shall be in accordance with this Section. Mechanical joint alignment workmanship shall be in accordance with this Section.

C. FABRICATED STEEL AND STAINLESS-STEEL TAPPING SLEEVES

- (1) Tapping valves and sleeves shall be used concurrently to tap an existing water main that is in service and under pressure without interrupting service when approved by the City Engineer.
- (2) Stainless steel and epoxy-coated 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.
- (3) Uncoated fabricated carbon steel tapping sleeves shall not be allowed.
- (4) 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 a tapping valve in accordance with MSS SP-60. Hollow-back flanges and segmented flanges shall not be permitted.
- (5) 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.
- (6) Gaskets for the body of the tapping sleeve shall conform with ASTM D2000 and in accordance with AWWA C223.
- (7) Carbon steel bolts for connecting sections of the carbon steel tapping sleeve shall meet or exceed the requirements of ASTM A307, Grade B and be in accordance with AWWA C223. Nuts shall meet

or exceed the requirements of ASTM A563 heavy hex and be in accordance with AWWA C223. Carbon steel bolt and nut workmanship shall be in accordance with this Section.

- (8) 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, with 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.
- (9) Tapping sleeves shall be fusion bonded epoxy lined and coated per AWWA C213. Epoxy coating workmanship shall be in accordance with this Section.
- (10) Carbon steel connecting sections and flanges shall be clean and sound without defects that would weaken their structure or impair their service. Structural defects, including cracks and inclusions, shall not be acceptable. Repairing of structural defects shall not be allowed. Repairs within the bolt circle of any flange face shall not be allowed. Cosmetic defects that have no impact on the ability of the component to meet the structural design and test requirements may be allowed as determined by the City Inspector. Excessive cosmetic defects, including pits and gouges, shall not be acceptable. Repairing of cosmetic defects, excluding any that are determined excessive, are allowed in accordance with the manufacturer's recommendations.
- (11) Flanges for bolting shall be perpendicular to the pipe centerline and shall be parallel such that any two (2) face-to-face dimensions that are 180 degrees apart at the outside edge shall not differ by more than one-sixteenth (1/16) inch. Misalignment of corresponding bolt holes shall not exceed one-eighth (1/8) inch measured from like points on the bolt holes.
- (12) When tapping sleeves are used, a thrust block shall be placed behind the tapping sleeve.

502.06 HYDRANTS

A. 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 five-and-a-quarter (5-¼) inch main valve opening and be a three-way type with two, two-and-a-half (2-½) inch hose nozzles and one, four-and-a-half (4-½) 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. Food-grade anti-seize shall be applied to all nozzle threads and manufacturer approved oil or lubricant shall be applied to the upper stem.
- (3) The hydrant base shall be provided with a six (6) inch mechanical joint inlet that conforms to AWWA C111 and Section 502. The base shall have two (2) lugs for rodding of the pipe.
- (4) The hydrant shall have a compression-type main valve that closes with pressure to create a 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 four-and-a-half (4-½) feet and position the breakaway flange as shown in the City Standard Details for Fire Hydrants, Details 500-02 and 500-03.
- (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 one-and-one-eighth (1-1/8) inch National Standard pentagon, measured from point to opposite flat, with an integral weather seal. The hydrant shall open left (counterclockwise).
- (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. Ductile iron casting workmanship shall be in accordance with this Section. Flange joint alignment workmanship shall be in accordance with this Section.
- (11) Any damaged areas on fire hydrants shall be painted with an approved hydrant paint for Construction Acceptance and Final Acceptance.

B. 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, at the boundary of a subdivision filing for example, a temporary blow-off shall 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 (1), two-and-a-half (2-1/2) inch hose nozzle. The hose nozzle and operating nut shall be accessible and located in 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. The base shall have two (2) 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 that closes with pressure to create a 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 four and a half (4-1/2) feet and the hose nozzle shall be positioned four (4) to six (6) inches under the manhole cover.
- (7) The operating nut shall be a one-and-one-eighth (1-1/8) inch National Standard pentagon, measured from point to opposite flat, with an integral weather seal. The hydrant shall open left (counterclockwise).

- (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. Ductile iron casting workmanship shall be in accordance with this Section. Flange joint alignment workmanship shall be in accordance with this Section.

C. SAMPLING HYDRANTS

- (1) In the determination of the City Engineer, a water quality sampling station may be required if one does not currently exist within a one-half (½) mile radius of the proposed development or project area. The proposed location of the sampling station shall be reviewed and approved by the City Engineer to ensure it aligns with the intent of representative water quality monitoring.
- (2) When required, the water quality sampling station shall be a lead-free, freeze-resistant unit designed for convenient distribution system sampling. The station shall include a non-corroding, lockable, blue plastic enclosure with a durable internal anchor post for stability. The enclosure shall be fully removable to allow unobstructed access to both the valve handle and sampling tap. The enclosure shall not contain weep or drain holes.
- (3) The sampling station shall feature a three-quarter (¾) inch bronze ball valve with a chrome-plated ball, ensuring that only non-corrosive materials are exposed to water. The outlet nozzle shall be unthreaded and positioned at least 20 inches above finished grade to ensure ease of use and prevent contamination.
- (4) The station shall be compatible with a system to allow evacuation of water from the hydrant for freeze protection, shall not rely on weep holes for drainage, and shall be installed with grading that directs surface water away from the sampling station.
- (5) The sampling station shall be placed in a location that is fully accessible by maintenance vehicles, including large utility trucks. A minimum 5-foot radius around the station shall be kept clear of vegetation, fencing, structures, or other obstructions to ensure safe and unobstructed access for routine sampling, maintenance, and repairs.

502.07 RESILIENT SEATED GATE VALVES

- A. 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.
- B. 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 nuts. Gate valves shall be the same size as the water main and shall open left (counterclockwise). Valve nut extensions are prohibited.
- C. Except for tapping valves, gate valves shall be furnished with mechanical joints and accessories conforming to AWWA C111 and Section 502. 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.

- D. 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. Epoxy coating workmanship shall be in accordance with this Section.
- E. Ductile iron casting workmanship and mechanical joint alignment workmanship shall be in accordance with this Section. Flange joint alignment workmanship shall be in accordance with this Section.
- F. 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.

502.08 RESTRAINT, SUPPORT AND INSULATION

A. 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 4,500 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 one and a half (1 ½) 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.

B. JOINT RESTRAINTS

- (1) The materials of joint restraints shall meet the applicable AWWA standards and other requirements under 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 (2). 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. Wedges shall be contoured to provide exact fit of the pipe, and shall be manufactured of ductile iron, heat treated to a hardness of 370 BHN minimum. Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell and tee-head bolts conforming to AWWA C111 and C153 and also standard AWWA C151 ductile iron pipe and AWWA C900 PVC pipe.
- (3) The restraint device shall consist of numerous individually-activated gripping surfaces to maximize restraint capability. The gripping surfaces shall be wedges designed to spread the bearing surface around the full circumference of the pipe. Twist-off nuts, sized same as tee-head bolts, shall be used to ensure proper actuating of restraining devices. When the nut is sheared off, a standard hex nut shall remain. Alternatively, the restraint device for PVC pipe may consist of split restraint rings that incorporate a series of machined serrations (not “as-cast”) on the inside diameter to provide positive restraint, exact fit, and 360-degree contact and support of the pipe wall. Push-on joint restraint devices for C900 PVC pipe that utilize a bell ring that bears directly on the bell of the PVC pipe will not be allowed. Both restraint rings, behind the bell and on the spigot, shall utilize gripping wedges or machined serrations to restrain the push-on joint.
- (4) Joint restraints shall be coated with fusion-bonded, powder epoxy or polyolefin material in accordance with AWWA C116. Epoxy coating workmanship shall be in accordance with this Section.

- (5) Joint restraints shall be furnished with accessories, including gaskets, bolts and nuts, conforming to AWWA C111 and Section 502.
- (6) Ductile iron casting workmanship and mechanical joint alignment workmanship shall be in accordance with this Section.

C. 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.

502.09 CORROSION PROTECTION

- A. When the installation of a 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 for approval.
- B. 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.
- C. 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 National Association of Corrosion Engineers (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.
- D. 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.
- E. Pipe of dissimilar metallic materials shall be insulated from each other using insulated flanges or fittings with test stations as approved by the 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.

502.10 LOCATING SYSTEMS

All water mains shall be locatable. Refer to City Standards Section 100 for requirements of tracing wires, warning tape, and electronic marker systems.

503.00 INSTALLATION OF WATER MAINS AND APPURTENANCES

503.01 GENERAL

- A. All water mains and appurtenances shall be installed per AWWA C600-17 for DIP pipe and AWWA C605-13 for PVC pipe.
- B. 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.
- C. Refer to City Standards Section 100 for additional requirements.

503.02 RECEIVING, HANDLING AND STORAGE

- A. It is the responsibility of the Contractor to ensure that all materials 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.
- B. 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.
- C. 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.
- D. 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.
- E. 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.

503.03 ALIGNMENT AND GRADE

A. 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 no more than 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. Spacing from other utilities shall be in conformance with City Standards Section 100.
- (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.

B. 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 no more than three (3) inches is permissible. However, in no situation shall the water main be installed with a cover of less than four-and-one-half (4.5) 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. Spacing from other utilities shall be in conformance with Section 100 of these Standards.

- (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.

503.04 PIPE INSTALLATION

A. PIPE CLEANLINESS

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.

B. 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 exposed pipe past the fittings to remain after cutting is 24 inches.
- (3) Flame cutting of ductile pipe is prohibited.
- (4) Asbestos cement pipe shall not be sawcut, but an entire section of pipe shall be removed to the nearest joint and replaced with a non-asbestos pipe material. Refer to Section 502 for additional information.

C. 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 City Standards Section 504.05 for installation of chlorine tablets for disinfection.

D. 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 shall 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) 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 coiled and taped around the barrel of each fire 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. Refer to 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) All water mains shall have a utility warning tape installed in the trench 18 to 24 inches above the crown of the pipe.
- (6) Where water mains are located outside of public ROW, marker posts shall be installed at all bends, valves, and at least every 250 feet to identify the water main. Refer to City Standards Section 100 for additional information.

E. JOINT ASSEMBLY

- (1) Refer to Section 503.05 for Permissible Pipe Deflection.
- (2) Push on joints shall be installed in accordance with AWWA C600, AWWA C605, 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 manufacturers' recommendations. Sharp edges shall be filed or grinded. The plain end of the pipe shall be pushed into the bell of the pipe. The joint must be kept straight while pushing and the deflection made 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 pipe together, a timber header shall be used between the pipe and the equipment to avoid damage.
 - e. Pipe shall be inserted to insertion point in accordance with manufacturer's specifications.
- (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 lubricant 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 manufacturer's 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 manufacturer. Final tightening shall be done to the manufacturer'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 shall bear uniformly on the gasket and the bolts tightened in a progressive crisscross order.
 - c. Users of flanged fittings shall be careful to prevent bending or torsional strains from being applied to the flanges, flange fittings, or flanged appurtenances. Piping systems shall 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 shall be accomplished with an approved sleeve or transition piece.

503.05 PERMISSIBLE PIPE DEFLECTION

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.

503.06 POLYETHYLENE ENCASEMENT

- A. All metallic water mains, fire hydrant mains, and appurtenances shall require a polyethylene encasement to protect against corrosion. Polyethylene encasements shall be installed per Detail 500-12 "Polyethylene Encasement AWWA C105 Method 'A.'"
- B. 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.
- C. 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 (2) or three (3) 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 shall be inspected for any damage after the tap is complete and repaired as necessary.

503.07 CORROSION PROTECTION

- A. Cathodic protection shall be installed and tested as required per Section 502.09.
- B. 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.

503.08 VALVES, FITTINGS, COUPLINGS, SLEEVES AND ACCESSORIES

- A. Valves, fittings, couplings, sleeves, and accessories shall be set and joined to the pipe in the manner specified in Section 503.04.
- B. Valves, fittings, couplings, 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.
- C. Valves and valve boxes shall be installed per AWWA C509-15. A valve box shall be provided for every valve installed. Refer to Detail 500-07 "Valve Box."
- D. All valves shall be supplied with mechanical joint restraints.

- E. 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.
- F. The valve box shall be designed and installed so as not to transmit loads or stress to the valve, valve stem, or piping system.
- G. The valve box shall be centered and plumb over the wrench nut of the valve, with the box cover one-quarter (¼) inch below the surface of the surrounding pavement or such level as may be directed by the City Engineer.
- H. The valve box covers shall be traffic rated and shall have the word “WATER” cast into the top of the cover.
- I. Valve nut extensions shall be prohibited.

503.09 FIRE HYDRANT INSTALLATION

A. LOCATION

Hydrants shall be located as shown in the Fire Hydrant Easement Detail, Detail 500-04, and shall conform to the following conditions:

- (1) When placed behind the curb, the hydrant barrel shall be set so that neither 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.
- (2) When set in the lawn space between the curb and the sidewalk, no portion of the nozzle cap shall be within 24 inches of an adjacent sidewalk.
- (3) When set between the sidewalk and the property line, no portion of the hydrant nozzle cap shall be less than 24 inches nor more than 30 inches from the sidewalk.

B. POSITION

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 appropriate access. Hydrants shall be set to the established grade, with the safety flange approximately four (4) to six (6) inches vertically above the final grade, or as per the manufacturer’s recommendations.

C. CONNECTION TO MAIN

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

D. 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 one-and-a-half (1-½) 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, which shall be filled with one-and-a-half (1-½) inch washed rock under and around the elbow of the hydrant and to a level of six (6) inches above the weep holes. The drainage pit shall be covered with polywrap or filter fabric prior to backfill.

E. RESTRAINTS FOR HYDRANTS

Joint restraint for hydrants shall be provided per Section 503.10. The hydrant mains shall have mechanical joint restraint from the tee to the bowl of the hydrant. The bowl of each hydrant shall be well braced against unexcavated earth at the end of the trench with a concrete thrust block.

F. HYDRANT USAGE AND OPERATION

Water usage from a fire hydrant is strictly prohibited unless a special use permit is issued by the City of Longmont per City Standards Section 107.02.

503.10 RESTRAINTS

A. THRUST BLOCKS

- (1) Concrete thrust blocks shall be designed per Section 502.08A. 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 in accordance with the thrust block details. 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, Details 500-10 through 500-13, for typical thrust block installations and sizing. Forms for thrust blocks may be required by the City Engineer or City Inspector.
- (2) If the thrust block's soil bearing surface is disturbed, making a concrete thrust block or thrust anchor unusable, mechanical joint restraint and the required length of restrained joint pipe shall be installed.
- (3) Prior to placing concrete, the City Inspector will inspect and approve the trench wall and any forms.
- (4) Concrete shall be placed in the presence of the City Inspector unless inspection is waived prior to the placement by the City Inspector due to the circumstances of the site.
- (5) Concrete shall not be placed on frozen subgrade.
- (6) When concrete is placed against the ground without the use of forms, the ground shall be thoroughly moistened, or other provisions shall be made, to prevent the ground from drawing water in from the concrete.
- (7) Newly-placed concrete shall set undisturbed for a minimum of 24 hours. Backfill may be placed over the concrete thrust blocks after the surface has set sufficiently for the thrust blocks to be able to resist the weight of the backfill. The backfill above the thrust block shall not be tamped or compacted for a minimum of 24 hours after placement.

B. JOINT RESTRAINT

- (1) Joint restraints shall be installed in accordance with Section 503.04. Joint restraint devices shall be installed in accordance with the manufacturer's written instructions.
- (2) Restraint devices with 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, per the manufacturer's recommendation. Use a torque-limiting wrench to confirm that the wedge nuts are tightened to the manufacturer's specifications.

503.11 FILLING THE LINE

- A. 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 shall not operate or interfere with City water main valves.

- B. All water mains shall be filled no faster than one (1) foot per second but shall be filled slowly enough that no surges are caused, the rate that air can be released is not exceeded, and the chlorine tablets do not come loose from the pipe. All air in the line shall be purged through blow-offs or hydrants.
- C. 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 determination of the City Engineer. All costs related to performing the tap shall be the responsibility of the Contractor or developer. Tapping fees shall not apply.

503.12 OPERATIONAL INSPECTION

- A. 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, which shall include but shall not be limited to the following: All valve boxes are centered over the operating nut and valves are opened.
- B. All nozzle caps have been treated with manufacturer-approved anti-seize. The upper stem and operating nut have been lubricated according to the manufacturer's specifications.
- C. Hydrants shall meet the following conditions:
 - (1) Each hydrant operates and drains properly, and
 - (2) All hydrant bonnets shall have received lubrication.
- D. All curb stop boxes are plumb.
- E. All curb stops are operable, and water is available at each curb stop.
- F. All tracing wires and locating devices shall be tested for continuity and detectability.

504.00 DISINFECTION, FLUSHING, AND HYDROSTATIC TESTING

504.01 GENERAL

- A. The Contractor is responsible for the disinfection of all applicable water mains. Such water mains shall be disinfected and shall demonstrate satisfactory bacteriological results prior to being accepted by the City of Longmont and brought into service.
- B. The Contractor shall employ the Tablet Method, as described in AWWA C651, as amended and reproduced herein, to disinfect water mains, unless explicitly authorized to do otherwise in writing by the City Engineer or as allowed in this section. The Granular Method shall not be used.
- C. The City Inspector shall be present during disinfection. The Contractor shall provide at least 48 hours advance notice of the proposed disinfection date.
- D. All work performed and materials furnished shall be in accordance with the following standards, as applicable:
 - (1) AWWA C651 Disinfecting Water Mains
 - (2) AWWA B300 Hypochlorites
- E. The Contractor shall be responsible for submitting manufacturer's certifications to the City Engineer prior to construction, that the materials to be incorporated into the project meet the specified requirements. All pipe materials and appurtenances shall be examined and their quality and cleanliness verified by the City Inspector prior to their incorporation into the project.
- F. The chlorination of potable water mains shall be done prior to hydrostatic testing.
- G. The tablet method of chlorination gives an initial chlorine dose of 25 mg/L. The Contractor and all relevant personnel shall exercise extreme care according to industry standard when handling hypochlorite and when conducting all pressure testing and flushing.
- H. Potable water shall be used for disinfection, hydrostatic pressure testing, and flushing. Before filling with potable water, the water main shall be clean and free from debris to the satisfaction of the City Engineer and City Inspector.
- I. Adequate drainage shall be provided during flushing. Drainage should take place away from the construction or work area. Valve(s) isolating the main from the existing system shall be marked to prevent unintentional release of the elevated chlorine residual water used for disinfection.

504.02 MATERIALS

- A. Calcium Hypochlorite, in the form of five-gram (5g) tablets conforming to the requirements of AWWA B300, shall be used to disinfect water mains.
 - (1) Granular calcium hypochlorite shall not be used for water main disinfection purposes in the City of Longmont.
 - (2) Calcium Hypochlorite intended for swimming pool disinfection is difficult to eliminate from water mains and so shall not be used for water main disinfection.
 - (3) Calcium Hypochlorite tablets shall not be used in High Density Polyethylene pipe systems.
- B. Tablet Adhesive shall meet the requirements of NSF/ANSI/CAN 61.

- C. Any sealing gasket lubricant, if required, shall meet the requirements of NSF/ANSI/CAN 61 and shall be free of odors.

504.03 PREVENTATIVE AND CORRECTIVE MEASURES

- A. Heavy particulates generally contain bacteria and prevent even very high chlorine concentrations from contacting and killing these organisms. Therefore, the procedures of this section shall be observed to ensure that a water main and its appurtenances have been thoroughly cleaned for the disinfection by chlorination. The new main shall be isolated from the active distribution system until bacteriological tests, as described in this section, are satisfactorily completed.
- B. Water mains and appurtenances shall be completely installed, flushed, disinfected, and satisfactory bacteriological sample results received before making permanent connections to the active distribution system. Sanitary construction practices, in accordance with Water Resource Foundations Field Pocket Guide “Good Practices for Preventing Microbial Contamination of Water Mains” and AWWA C-651, shall be followed during installation of the final connection so that there is no contamination of the new or existing water main with foreign material or groundwater.
- C. The interiors of pipe, fittings, and valves shall be kept clean and dry to protect from contamination.
- D. No contaminated material, or any material capable of supporting the growth of microorganisms, shall be used for sealing joints. Sealing materials or gaskets shall be handled in a manner that avoids contamination. If needed, sealing gasket lubricant shall be delivered to the job site in closed containers, shall be kept clean, and shall be applied with dedicated clean applicators.
- E. Openings in the main shall be closed with watertight endcaps, plugs, or other protective devices when pipe laying is stopped at the close of the day’s work or for other reasons, such as rest breaks or meal periods, to prevent soil, animals, or other material from entering. Joints of pipe in the trench shall be completed before work is stopped. If water accumulates in the trench, plugs shall remain in place until the trench is free of standing water and mud that may enter the pipe.
- F. Pipe delivered for construction shall be stored, strung, and handled in such a manner as to minimize the entrance of foreign material as much as possible.
- G. Delay in placement of delivered pipe invites contamination. The more closely the rate of delivery is correlated to the rate of pipe laying, the lower the risk of contamination. Pipe delivery and laying shall be coordinated such that pipes are installed as promptly as possible.
- H. 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 determination of the City Engineer or City Inspector, the dirt remaining in the pipe will not be removed during 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.
- I. If it is not possible to keep the pipe and fittings dry during installation, they 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; filled with chlorinated potable water that has a chlorine residual not less than 25 mg/l at the end of a 24-hour holding period; and the chlorinated water flushed from the main. After construction is completed, the main shall

be disinfected using the continuous feed or slug methods in conformance with AWWA C651, or as directed by the City Engineer.

- J. 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.

504.04 CONNECTIONS TO EXISTING MAINS

- A. Water mains and appurtenances shall be completely installed, flushed, and disinfected, and satisfactory bacteriological samples results received, before making permanent connections to the active distribution system. Sanitary construction practices shall be followed during installation of the final connection so that there is no contamination of the new or existing water main with foreign material or ground water.

Connection disinfection procedures shall vary as follows:

- (1) For connections that have a total length from the end of the new main to the existing main equal to or less than 20 feet:
 - The new pipe, fittings, and valve(s) required for the connection may be spray-disinfected or swabbed with a minimum one-percent (1%) hypochlorite disinfection solution just before being installed.
- (2) For connections that have a total length from the end of the new main to the existing main greater than 20 feet:
 - The pipe shall be set up aboveground and disinfected with bacteriological samples taken as described in Section 504.07. After satisfactory bacteriological sample results have been received for pre-disinfected pipe, the pipe can be used in connecting the new main to the active distribution system. Between the time the satisfactory bacteriological sample results are received and the time that the connection piping is installed, the ends of the piping shall be sealed with plastic wraps, watertight plugs, or caps.

- B. Basic disinfection and contamination prevention procedures when cutting into existing pipe shall include the following:

- (1) Prevent contaminants from entering the existing pipe by fully exposing the existing pipe, clearing trench soil away, maintaining a dewatered trench, and keeping all pipe materials being used in the connection in a clean and sanitary condition.
- (2) Clean and disinfect by spraying or swabbing with a one percent (1%) hypochlorite disinfection:
 - a. Exposed portions of existing pipe interior surfaces,
 - b. Pipe materials used in the connection, and
 - c. 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 volumes of water turnover, making sure that the flushed water is visually clear. Chlorine residual is required to be acceptable to the City Inspector, and if not, continue to flush the main until acceptable level is achieved. The City may take bacteriological samples to verify the connection was completed in a sanitary manner. If any samples return positive, the redisinfection process described in AWWA C651 shall be followed.

504.05 METHOD OF CHLORINATION

- A. The tablet method consists of placing 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 pipe and appurtenances are kept clean and dry during construction.

- B. Five-gram (5g) calcium hypochlorite tablets in the amount indicated below shall be placed in the upstream end of each section of pipe to be disinfected, including branch lines, with at least one tablet placed in each hydrant, hydrant main, or other appurtenances. The number of five-gram (5g) tablets required for each pipe section shall be $0.0012d^2L$ rounded to the next higher integer, where d is the inside pipe diameter in inches, L is the length of the pipe section in feet. The following table shows the tablets required for typical pipe sizes.

Table 5-2 Number of 5-g Hypochlorite Tablets Required for Dose of 25 mg/l*

Pipe Diameter (inches)	Length of Pipe Section (feet)	Length of Pipe Section (feet)	Length of Pipe Section (feet)	Length of Pipe Section (feet)	Length of Pipe Section (feet)
/	13 or less	18	20	30	40
4	1	1	1	1	1
6	1	1	1	2	2
8	1	2	2	3	4
10	2	3	3	4	5
12	3	4	4	6	7

* Based on 3.25 g available chlorine per tablet

- C. Calcium hypochlorite tablets shall be attached inside and at the top of the main by an approved adhesive (see 504.02B) used in accordance with the manufacturer's instructions. There shall be adhesive only on the broadside of the tablet attached to the surface of the pipe. 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.
- D. When installation has been completed, the main shall be slowly filled with water by the City Inspector at a rate to ensure that the full-pipe velocity is no greater than one (1) foot per second and that the tablet(s) do not come loose from the pipe. Precautions shall be taken to ensure air pockets are eliminated. Valves shall be positioned so that the strong chlorine solution in the main being treated will not flow into any water main in active service. The chlorinated water shall remain in the pipe for at least 48 hours, unless otherwise permitted by the City Engineer. After the applicable retention period, the water in the main shall be tested by the Inspector to ensure a detectable free chlorine residual of not less than 10 mg/L shall be found at each sampling point.
- E. The chlorine concentration shall be monitored during the bacteriological tests to ensure that all the tablets have been dissolved and the chlorine concentration does not rise. If there are indications that there are undissolved tablets in the line, whatever methods are required to evacuate all tablets from the line shall be taken. The Contractor shall monitor the line at 24-hour intervals until line is stabilized.

504.06 FLUSHING FOR WATER MAINS

- A. Heavily chlorinated water should not remain in prolonged contact with the pipe after the applicable retention period. In order to prevent damage to the pipe lining or corrosion damage to the pipe itself, the heavily chlorinated water shall be flushed from the main, fittings, valves, and branches until chlorine measurements show that the concentration in the water leaving the main is no higher than that generally prevailing in the distribution system or that is acceptable for domestic use, per AWWA C-651 as amended.
- B. Industry-standard care shall be taken in flushing the main to prevent damage or danger to the public and the environment. The discharge location for the chlorinated water shall be inspected. A neutralizing

chemical shall be applied to the water to be discharged to thoroughly neutralize the residual chlorine (see ANSI/AWWA C655 for neutralizing chemicals). Where necessary, federal, state, or local regulatory agencies should be contacted to determine special provisions for the disposal of heavily chlorinated water.

504.07 BACTERIOLOGICAL TESTS

The City's Construction Inspector shall collect water samples to test for bacteriological quality to show the absence of coliform and heterotrophic organisms in the pipeline. Testing shall be done after final flushing and disinfection procedures. Under no circumstances shall the main be put in service prior to bacteriological testing.

- A. The Contractor shall schedule sampling and bacteriological testing with the City Inspector a minimum of 48 hours in advance.
- B. All test results shall be sent to the City for review and approval.
- C. Water mains shall not be placed in service until written release is obtained from the City.
- D. Sets of samples shall be collected from every 1,200 feet of the new water main and all fire hydrants, with one additional set from the end of the line and at least one set from each branch greater than one pipe length long.
- E. If trench water has entered the new main during construction, or if the City Engineer determines that excessive quantities of dirt or debris have entered the new main, bacteriological samples shall be taken at intervals of approximately 200 feet and shall be identified by location. Samples shall be taken of water that has been standing in the new main for at least 16 hours after the final flushing is completed.
- F. The first two sets of samples shall be collected per one of the following two options:
 - (1) Option A: take an initial set of samples and then resample again after a minimum of 16 hours using the sampling site procedures outlined in AWWA C651. Both sets of samples must pass for the main to be approved for release, per the procedure outlined below.
 - (2) Option B: let the main sit for a minimum of 16 hours without any water use. Then, using the sampling site procedures outlined in AWWA C651 and without flushing the main, collect two (2) sets of samples a minimum of 15 minutes apart while the sampling taps are left running. Both sets of samples must pass for the main to be approved for release, per the procedure outlined below.
- D. The third set of samples shall be taken after the completion of the hydrostatic testing at the location(s) used for hydrostatic testing.
- E. Samples for bacteriological analysis shall be collected in sterile bottles treated with sodium thiosulfate in accordance with Section 9060, "Samples from Standard Methods for the Examination of Water and Wastewater", latest edition. No hose shall be used in the collection of samples. If no other sampling port is available, well-flushed fire hydrants may be used with the understanding that they do not represent optimum sampling conditions. A combination blowoff and sampling tap used for mains up to and including eight-inch (8 inch) diameter is preferred for the collection of samples. There should be no water in the trench up to the connection for sampling. The sampling pipe shall be dedicated, cleaned, disinfected, and flushed prior to sampling.

- F. For mains that were depressurized and/or wholly or partially dewatered, one set of samples is required. Samples shall be collected downstream of the connection or repair site and at intervals of approximately 200 feet within the length of pipe that was shut down. If direction of flow is not known, samples shall be collected on either side of the connection or repair site.
 - (1) For mains that were always maintained under pressurized conditions, disinfection and/or testing is not required, in the determination of the City Engineer, depending on the circumstances.
 - (2) However, under either main connection or repair scenario, a scour flush to clear may be required before the release of the connected or repaired section, in the determination of the City Engineer, depending on the circumstances.

- G. Samples shall be tested for bacteriological quality in accordance with “Standard Methods for the Examination of Water and Wastewater” and shall show the absence of total coliform bacteria and Escherichia Coli. In addition, samples shall be tested for acceptable aesthetic quality (e.g. chlorine residual [free and/or total], pH, temperature, alkalinity, specific conductance, turbidity). Levels shall be required to be as expected or typical for the water system as determined by City Inspector.

- H. The record of compliance shall be the bacteriological test results certifying that the water sampled is free of coliform bacteria contamination.

- I. If a pipeline is not promptly returned to service, the situation should be evaluated by the City Engineer to determine if the water quality may have been impacted in the interim and if additional testing and further action, such as but not limited to flushing and re-disinfection, is warranted. Test results shall confirm that the water quality is appropriate for distribution as determined the City Inspector. Although this assessment is unique for each system, parameters considered for testing include disinfectant residual, total coliform bacteria, E. coli, heterotrophic plate count, turbidity, pH, alkalinity, total chlorine, odor, and specific conductance.

504.08 REDISINFECTION

If the initial disinfection fails to produce satisfactory bacteriological results or if tests indicate that other water quality parameters do not meet AWWA C651 standards, the new main may be reflashed and shall be resampled. If check samples also fail to produce acceptable results, the main shall be rechlorinated by the continuous-feed or slug method in accordance with AWWA C651 until satisfactory results are obtained.

504.09 pH CONTROL

After completion of disinfection, new water mains with cement mortar linings shall be tested for pH. Mains with a pH greater than eight-point-five (8.5) shall be thoroughly flushed until the pH is less than eight-point-five (8.5). pH testing shall be done by City personnel.

504.10 HYDROSTATIC TESTING

- A. All water mains and appurtenances shall be tested in accordance with AWWA C600 and C605.

- B. 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 3,000 psi (regardless of overall mix design strength) and the water main has been disinfected, flushed, and has passed all other required testing.
 - (1) If any other method of disinfection is used outside of the tablet method, then hydrostatic testing shall occur prior to disinfection, flushing, and any other required testing.

- C. Sufficient backfill shall be placed between joints and fittings to stabilize the constructed water main; however, subject to the determination of the City Inspector, joints, fittings, valves, and/or other appurtenances may be required to remain uncovered so that visual inspection may be made at the time of testing. Tests shall include testing of service lines and curb stops on new water main installation.
- D. 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.
- E. The City Inspector shall be notified at least 24 hours in advance of any testing required by this Section. All testing shall be done in the presence of the City Inspector.
- F. 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.
- G. While the test pressure is maintained for two (2) continuous hours, the allowable leakage from the pipe shall not exceed the allowable leakage listed in Table 5-3, below. An examination shall be made of the water main during testing and any leaks shall be repaired. Any pipe or fitting found to be cracked shall be removed, replaced, and disinfected per Section 504 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.
- H. No leakage shall be allowed through the bonnet of any valve. Any valve that leaks through the bonnet shall be removed and replaced.
- I. The hydrostatic pressure test shall be performed against each valve, as directed by the City Engineer, within the new piping system. 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 5-3 Allowable Leakage In Gallons

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

505.00 SERVICE LINES, VALVES, AND FITTINGS

505.01 GENERAL

- A. Service lines shall be of a size that is adequate to supply the requirements of the property being served in accordance with the Building Code per the approved plans. The minimum size allowable for a service line shall be three-quarter ($\frac{3}{4}$) inch.
- (1) All single-family residential water meters shall be five-eighths by three-quarters ($\frac{5}{8}$ " x $\frac{3}{4}$ "") unless otherwise approved by the City Engineer or required for fire suppression.
 - (2) With each request for a new water service for all non-single-family residential taps and service line requests, the Design Engineer shall provide a fixture count by an accredited Fixture Unit Count methodology . 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.
 - (3) Where a residential fire suppression system is required, the water service line shall be increased in size according to fire suppression calculations. The sizing of the water service line for the property being served shall be based on peak demand, as calculated in the International Plumbing Code (IPC) or International Residential Code (IRC), latest edition.
 - (4) The installation or maintenance of any water service line requires a building permit be issued for the work. The permit shall specify the required inspections and special requirements.
- B. All service lines supplying water from the City's Distribution System shall conform to one of the following types of pipe:
- (1) Seamless copper tube, "Type K, soft," for service lines from three-quarter ($\frac{3}{4}$) inch to two (2) inches in diameter.
 - (2) Ductile Iron Pipe conforming to these City Standards for service lines three (3) inches in diameter and larger.
 - (3) PVC pipe conforming to these City Standards for service lines four (4) inches in diameter and larger.
 - (4) Stainless steel pipe conforming to AWWA C220 as amended for service lines one-half ($\frac{1}{2}$) inch in diameter and larger.
 - (5) Galvanized or cast-iron piping is not allowed in service lines for potable water.
- C. No solder containing lead shall be used. All soldering fluxes, plumbing pastes, pipe dopes, sealants, coatings, gaskets, and similar material that may come into contact with potable water shall be non-toxic and certified per NSF/ANSI 61.
- D. 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, Details 500-17 through 500-23, for typical service line installation and additional information.
- E. 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.
- (1) Service lines three-quarters ($\frac{3}{4}$) to two (2) inches in diameter shall have a curb stop and box installed within a tree lawn in the ROW that is at least five (5) feet in width or in a utility easement as shown in the City's Standard Details.
 - (2) Service lines three (3) inches and larger shall have a gate valve installed within the ROW or in a utility easement.

- F. 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.
- G. All corporation stops shall have Corporation Cock (CC) threads.
- H. 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.
- I. 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 that contain a potential health hazard, as determined by the City Engineer, by a minimum of 10 feet. 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 with less separation with the approval of the City Engineer and under the following conditions:
 - (1) The water service shall be installed a minimum of 18 inches above the sewer service in a separately excavated trench.
 - (2) If the services must be installed in the same trench, the water service shall be installed a minimum of 18 inches above the sewer service on a separately excavated shelf of undisturbed soil.
 - (3) Four-and-a-half (4-½) feet of cover shall be maintained as a minimum over the water service.
- J. 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.
- K. All taps shall be at least 24 inches from any joint, fitting, valve, or other tap unless approved otherwise by the City Engineer. Taps on the same plane shall be at least 36 inches apart and shall be at least 18 inches apart on the alternating plane.
- L. 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.

505.02 CURB STOP BOXES

- A. The approved list of curb stop boxes is located in the City's Approved Materials List.
- B. Curb stops installed shall 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.

505.03 OWNERSHIP

- A. The City shall own and maintain the water service line from the water main to the curb stop, excluding the curb stop valve, box, and stem where a curb stop exists, per City Code. In instances where no curb stop or outside meter exists, the City will own and maintain the service line from the water main to the ROW 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

water meter. If the domestic service line is tapped onto a private fire service line, as provided for in Section 500.13H, 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.

- B. The owner of the premises shall maintain the curb stop box and meter pit so that it will always be conveniently accessible to City personnel and in good working order, properly capped and clean of debris and other foreign matter. See the City's Standard Details, 500-20 through 500-25, for a typical meter pit installation.

505.04 SERVICE LINE BOOSTER PUMPS

A. 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 booster pumps and the Design Engineer shall consider the feasibility of other options, such as increasing the service line size, prior to submitting a request to the City 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 current 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.

B. REQUIREMENTS

An analysis of the booster pump's 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:

- (1) Justification outlining the reason that a booster pump is necessary.
- (2) The existing flow and pressure of the distribution system at the proposed service line connection to the distribution system.
- (3) The proposed or necessary flow and pressure requirements for the service line.
- (4) Proposed pump characteristics including hydraulic calculations, system demand curve, and the supply curve.
- (5) City-maintained concrete trail layout, landscape, and irrigation construction performed in areas maintained and/or owned by the City.
- (6) Physical diagram(s) showing the general layout of the pump and all appurtenances. The diagram(s) shall clearly indicate the installation of an RPZ backflow prevention assembly.
- (7) Analysis of the pump's impact 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 D & E for velocity requirements.
- (8) Analysis of the pump's effect on the distribution system's 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.
- (9) 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:

- a. A Variable Frequency Driven (VFD) Pump that is programmed to start and shutdown between eight (8) and 20 seconds as the pump starts up and shuts down.
- b. A soft start/shutdown control that is programmed to increase and decrease voltage between eight (8) and 20 seconds as the pump starts up and shuts down.

506.00 WATER METERS, PITS AND VAULTS

506.01 GENERAL

- A. All work and materials must be approved by the City Engineer.
- B. All work and materials shall be subject to inspection by the City of Longmont at all reasonable times.
- C. There shall be only one City water meter per service tap purchased. Specifically, the City will neither provide individual water meters nor metered billing services in multi-unit structures with only one service tap.
- D. The tap, water service line between the main and the meter, and water meter shall all be the same nominal size. 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, both 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.
- E. The City is responsible for testing and certifying the accuracy of City water meters. No one other than City personnel shall attempt to test, certify, or calibrate a City-owned water meter in any way without City approval.
- F. Any proposed modification, alteration, or relocation of metering equipment shall require City approval.
- G. The costs, fees, and repair costs for water meters and offsite reading equipment shall be determined by the City of Longmont and paid for by the property owner.
- H. 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.

506.02 OWNERSHIP

- A. 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 and maintenance.
- B. The City owns the water meter in its entirety. The meter setter (yoke) and appurtenances are privately owned and maintained.
- C. Water meters installed at a premise shall remain with that premise and are not transferable.

506.03 MATERIALS

- A. Materials shall be in accordance with the Approved Materials List, Appendix I-4.
- B. 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.
- C. No solder containing lead shall be used. All soldering fluxes, plumbing pastes, pipe dopes, sealants, coatings, gaskets, and similar material that may come into contact with potable water shall be non-toxic and certified per NSF/ANSI 61.

506.04 INSTALLATION

- A. The Contractor is responsible for installing all necessary appurtenances for a water service. The City will install the water meter once the meter setter or approved plumbing has been installed.
- B. The installation of water meter pits or meter vaults in streets, roadways, sidewalks, driveways, alleys, in concrete, or parking lots shall be prohibited.
- C. Meters for residential and irrigation services that are one (1) inch or less 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.
 - (1) Meters currently located inside of single-family or duplex residential premises shall be moved to the outside in a meter pit when there is any further development on the property. All costs shall be the responsibility of the customer.
- D. When a domestic service requires an RPZ backflow assembly (Refer to Section 507), 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. Single-family and duplex developments shall place the water meter in meter pits outside of the dwelling units per the approved details.
- E. Meters for irrigation services larger than one (1) inch are required to be placed in a five (5) foot diameter (or larger) vault.
- F. The vault for services that are larger than two (2) inch shall be designed by a Design Engineer and approved by the City.
- G. The water meter shall be situated such that it is protected from freezing and frost damage. In the event that a water meter is damaged from negligence by the property owner, the property owner will be responsible for all costs associated with fixing or replacing the water meter, including City staff's time.
- H. Water meter pit locations shall be installed per City Standard Details for water services, see Details 500-20 through 500-25. 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.
- I. For installation outside the City limits, the meter pit shall be installed immediately adjacent to the ROW.
- J. The placement of the meter vault or pit shall be inspected by the City Inspector before backfilling.
- K. 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 raised or lowered when the final grade is established. The top of the meter pit or vault lid shall be a minimum of two (2) inches above final 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 surface with the completion of the landscaping.
- L. The service line through and on both sides of the meter pit or vault shall be of the same material.

- M. No branch connections shall be made in the meter pit. Connections shall be made more than five (5) feet from the meter pit on the downstream side.
- N. Service line valves four (4) inches in diameter and larger shall be supported by adjustable steel supports in all meter vaults.
- O. One-and-a-half (1-½) inch diameter and larger meters shall be supported by adjustable steel supports.
- P. Manhole frames and covers shall be an eight (8) inch frame, 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 Irrigation Manhole Covers, see Detail 500-26.
- Q. Refer to the City's Approved Materials List for acceptable meter pits, covers, meter setters, and additional appurtenances.
- R. Meters installed other than shown and detailed herein shall be considered as non-standard and shall require an exception from the City for approval of proposed piping layout, meter setting, and structural design of vaults for each separate installation.
- S. Backflow prevention assemblies shall be required in accordance with Section 14.06, City Code, and Section 507 below.
- T. The following shall apply to two (2) feet in diameter water meter pit installations (for one (1) inch or smaller water services).
 - (1) The pit shall rest upon brick supports or concrete blocks.
 - (2) The installed pit shall have its top locking lid at the same elevations as the grade of the adjacent landscaping.
 - (3) Care shall be taken that drainage of surface waters be directed away from the pit lid and do not puddle over the pit.
 - (4) Both the inner frost lid and the top locking lid shall be installed on the pit. The locking mechanism shall be fully functional.
 - (5) 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.
 - (6) 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.
 - (7) The meter shall be within 16 to 20 inches below the top lid.
- U. The following apply to five (5) feet and larger water meter vault installations (for one-and-a-half (1.5) inch and larger water services).
 - (1) 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.
 - (2) Vaults must be of watertight construction.
 - (3) 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.
 - (4) Water meter setters for one-and-a-half (1-½) 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 shall have an inlet valve,

an outlet valve, and a bypass valve. The bypass valve shall be lockable in the off position and shall only be operated by City personnel. 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, Appendix I-4, for water meter setters.

(5) Water meter setters for dedicated irrigation systems shall not have a bypass.

V. The following shall apply to meters installed internal to a structure.

- (1) Bypasses for one and a half (1 ½) inch 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 lockable in the off position and shall only be operated by City personnel.
- (2) When installing one and a half (1-½) inch and larger water meters and backflow prevention assemblies inside commercial buildings and inside of a locked room, the City must be provided access via a lockbox, locked with an approved lock with a key to the room and installed just outside of the locked door.

W. The property owner is required to bear the costs of relocating a meter and/or remote when the owner's actions limit existing access for the meter readers or introduce a safety hazard. This would include remodeling, additions, fences, new landscaping, meter signal blocking, etc.

506.05 ACCESS

- A. Free, easy, and ready access to the meter from public ROW shall be provided to City personnel or Contractors for the purposes of testing, certification, repair, maintenance, or replacement of water meters at any reasonable hour.
- B. All water meters shall be periodically tested and certified by City personnel or Contractors. The customer or user shall take whatever measures are necessary for providing access to the water meter.
- C. There shall be a clear line of access to the water meter for City personnel or Contractors. This access line shall be free of any impediment, including safety hazards, to the movement of personnel and necessary tools, equipment, or material.
- D. 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 impediments, belongings, material, or property to ensure reasonable conditions of access.
- E. There shall be no obstruction of any sort that would hamper access to perform the usual and necessary work related to meters. Nor shall there be any obstruction that would impair a clear view of the water meter. The area around the water meter shall allow room for personnel to stand directly in front of and in close proximity to the water meter, have a clear view of the meter, and have room to operate customary tools without hindrance.
- F. 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.

507.00 BACKFLOW CONTROL

507.01 DEFINITIONS

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 Section 14.06.010, City Code.

BACKPRESSURE: Refer to Section 14.06.010, City Code.

BACK SIPHONAGE: Refer to Section 14.06.010, City Code.

CONTAINMENT: Refer to Section 14.06.010, City Code.

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

CROSS-CONNECTION: Refer to Section 14.06.010, City Code.

WATER SERVICE CONNECTION: Refer to Section 14.06.010, City Code.

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).

507.02 GENERAL

- A. All backflow prevention and cross-connection controls shall meet the requirements of Chapter 14.06, City Code, and the State of Colorado Department of Public Health and Environment (CDPHE) Regulation 11.39.
 - (1) An approved backflow prevention assembly (assembly) used for protection by containment shall be required on any water service connection whenever there is an actual or potential risk for cross-contamination or backflow due to backpressure and/or back-siphonage.
- B. When connecting to the City's Distribution System, the applicant shall be responsible for complying with these City Standards.
- C. The City's approved backflow prevention method to control cross connections standard is "Containment."
- D. 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. RPZ backflow assemblies installed as containment on domestic potable plumbing systems shall be lead-free.
- E. Double Check Valve Assemblies (DCVA) used for backflow prevention shall meet the requirements of AWWA C510-17.
 - (1) DCVA assemblies shall require approval from the City Engineer.

- F. RPZ backflow prevention assemblies shall meet the requirements of AWWA C511-17.
- G. All work and materials shall be subject to inspection by the City at all reasonable times.
- H. The modification, alteration, or relocation of backflow assembly equipment shall require City approval and a building permit.
- I. All work necessary to achieve installation of a backflow prevention assembly shall be inspected. Inspections will be required as follows:
 - (1) Backflow prevention assembly sets, assembly installation, and discharge piping where appropriate, shall be approved by City Engineer prior to assembly installation.
 - (2) Where backflow prevention assemblies are required, no Certificate of Occupancy shall be issued without an approved inspection and assembly test result submitted to the City Engineer.
- J. To be approved, the specific make, model, and manufacturer of the backflow prevention assembly must 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).
- K. Backflow prevention assemblies shall be in the most recent listing approved 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."

507.03 BACKFLOW PREVENTION ASSEMBLIES REQUIRED

A. SINGLE-FAMILY AND DUPLEX

- (1) Single-Family and Duplex Residential units shall comply with requirements of the City's adopted IRC or IPC.
- (2) Higher hazard connections, as determined by the City, shall require backflow prevention assemblies, including but not limited to:
 - a. Auxiliary water sources (e.g. wells, ponds, lagoons, irrigation ditches), fountains, hot tubs or swimming pools piped with permanent plumbing, reclaimed water systems, greywater systems, or onsite water storage tanks with permanent plumbing.
 - b. Home business and hobbies including, but not limited to, agricultural commerce and hydroponic systems, doctor's offices, photo laboratories, hide tanning operations, and metal plating operations.
 - c. Hydronic heating/cooling systems or boilers chillers.
 - d. Other activities of similar nature, as determined by the City on a case-by-case basis.
- (3) Residential fire suppression system (RFSS) (sprinklers) are permitted but shall meet the requirements of NFPA 13D and shall be a multipurpose configuration with a looped or gridded system or be passive purge. Standalone systems shall not be permitted in single-family or duplex dwellings.

B. MULTI-FAMILY

- (1) In multi-Family Developments, any connection that includes more than two dwelling units without an individual service line shall be required to install an RPZ backflow assembly at each service connection, except as follows: in townhomes, condos, and other multi-family installations where one water meter is being installed per dwelling unit, backflow prevention shall be installed per "Single-Family and Duplex" requirements per the 2021 IFC as adopted and amended.

- (2) 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 and a floor drain.
- (3) The RPZ backflow assembly shall be installed per City Standard Details, see Details 500-27 and 500-28A.

C. 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) 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, a floor drain, and meet the requirements of Section 506.
- (3) The RPZ backflow assembly shall be installed per City Standard Details, see Details 500-27 and 500-28A.

D. IRRIGATION

- (1) For all Multi-Family, Mixed Use, Non-Residential irrigation services, and dedicated 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.

E. 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: RPZ backflow prevention assemblies shall be installed whenever any chemical additive, pump, injection, or other means of producing backpressure, except for a Fire Department Connection (FDC), 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) 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. If a RPZ backflow assembly is installed the room shall have a floor drain.

507.04 OWNERSHIP

- A. Backflow prevention assemblies shall be privately owned and maintained by the property owner.

- B. Backflow prevention assemblies shall not be transferable to another premise, property, area, or street address.
- C. Only properly-trained and certified cross-connection control personnel are permitted to install, repair, replace, relocate, maintain, test, certify, modify, or otherwise access the internal workings of a backflow prevention assembly. Any repair or modification to a backflow prevention assembly will require a building permit, backflow survey or inspection, and a backflow test.

507.05 DESIGN REQUIREMENTS

A. LOCATION REQUIREMENTS

- (1) Backflow prevention assemblies used for protection by containment shall be located downstream of the water meter.
- (2) Backflow prevention assemblies used for protection by containment shall be located such that all water entering the premises 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:
 - a. There may be closed-loop bypass around the backflow prevention assembly provided the bypass itself has in it a similar type of approved backflow prevention assembly. The purpose shall only be to ensure continuous water delivery while one assembly is undergoing testing, maintenance, repair, or replacement. The bypass shall have a valve upstream of the backflow prevention assembly that is lockable in the off position and shall only be operated by City personnel.
The City may authorize more than one (1) approved backflow prevention assembly when physical conditions in a retrofit situation pose unusual problems to the installation of a single assembly.

B. PRESSURE INCREASES

- (1) Most backflow prevention assemblies, by the very nature of their design, do not allow any release of pressure that 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. The customer or user shall ensure that there is adequate protection from increases in water pressure on the downstream, customer, or user's side of a backflow prevention assembly.
- (2) THE CITY NEITHER ACCEPTS NOR TAKES ANY RESPONSIBILITY OR LIABILITY FOR DAMAGES OF WHATEVER KIND THAT 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.
- (3) 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 required for the protection of the system.

C. ISOLATION VALVES

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

D. DRAINAGE

- (1) 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 proper drainage to direct the discharge from such assemblies to prevent creating a hazard such as freezing or debris accumulation.
- (2) The City accepts no responsibility nor liability for damages to property or injury caused or related to venting of water or water mixed with other materials.
- (3) 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 connect any dumped or vented water or water mixed with other substances into the sanitary sewer system, in compliance with International Plumbing Code as adopted and amended.

E. STOP AND WASTE VALVES

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.

507.06 MATERIALS

- A. Materials shall be in accordance with the most recent listing approved 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."
- B. No solder containing lead shall be used. All soldering fluxes, plumbing pastes, pipe dopes, sealants, coatings, gaskets, and similar materials that may come into contact with potable water shall be non-toxic and certified per NSF/ANSI 61.

507.07 ACCESS TO BACKFLOW PREVENTION

- A. Customer or user shall ensure that City personnel or Contractors have free, easy, and ready access at any reasonable hour to the backflow assembly used for protection by containment in the public rights-of-way for the purposes of testing, certification, repair, maintenance, or replacement.
- B. All backflow prevention assemblies shall be required to be tested and certified annually. The customer or user shall take whatever measures are necessary for providing periodic access to the assembly for the purposes of testing and certification.
- C. There shall be a clear line of access to the backflow prevention assembly for City personnel or Contractors. This access line shall be free of any impediment, including safety hazards, to the movement of personnel and necessary tools, equipment, or material.
- D. 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 impediments, belongings, material, or property to ensure reasonable conditions of access.
- E. There shall be no obstruction of any sort that would hamper access to perform usual and necessary work related to assemblies. Nor shall there be any obstruction which would impair the clear view of the

assembly set. The area around the assembly set shall allow room for personnel to stand directly in front of and in close proximity to the assembly set, have a clear view of the set, and have room to operate customary tools without hindrance.

- F. 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 City personnel the procedures to be followed for ready access through such locks, alarms, or other security arrangements.

507.08 SPACE AND LOCATION REQUIREMENTS

The following requirements shall apply to backflow prevention assembly sets in all newly-constructed structures or facilities and, where reasonable, in all retrofit 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 that is subjected to freezing temperatures on its other side. Assemblies larger than two (2) inches in diameter that 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 accommodate the use of 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. Assemblies shall be accessible without the use of ladders.
- H. No assembly set shall be installed in or above a ceiling.
- I. No assembly shall be located such that any vented or dumped water cannot be safely carried away without damaging property.
- J. 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 that may be present.
- K. 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.
- L. All assemblies shall be located such that they are protected against vandalism, mischief, and deterioration due to atmospheric conditions.

507.09 INSTALLATION REQUIREMENTS

A. AIR GAPS

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 that provide water for pumping. Air gaps shall conform to the following:

- (1) They shall be located downstream of the City water meter.
- (2) 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.
- (3) They shall be constructed such that the potable water supply line is at a vertical distance of not less than two (2) 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.
- (4) 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.
- (5) There shall be adequate drainage arrangements to handle full volume overflows of the receiving vessel.
- (6) The water supply or service line shall be protected from freezing.
- (7) Air gaps used for protection by containment shall be considered an approved backflow prevention method and shall be inspected during site survey intervals.

B. REDUCE PRESSURE ZONE OR REDUCED PRESSURE DETECTOR CHECK ASSEMBLIES

An RPZ or Reduced Pressure Detector Check (RPDC) backflow prevention assembly shall be installed for protection by containment and shall meet the following conditions:

- (1) RPZ and RPDC assemblies shall be installed per the manufacturer's recommendations and in the approved orientation as listed by FCCC&HR.
- (2) RPZ assemblies two (2) inches and smaller shall be equipped with full port/quarter turn ball isolating valves.
- (3) RPZ and RPDC assemblies sized two and a half (2 ½) inches 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.
- (4) RPZ and RPDC assemblies shall be protected against frost and freeze damage.
- (5) RPZ and RPDC assemblies installed inside structures may have a drainage line through an exterior wall to daylight, provided that 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.
- (6) RPZ and RPDC assemblies may have drain lines connected to a sewer system, provided that a building permit is obtained and a City Inspector approves the sewer system connection. The drain valve shall have an air gap installed between the assembly and the drain line.

C. DOUBLE CHECK VALVE ASSEMBLIES

A double check valve (DCV) assembly for fire service lines shall conform to the following:

- (1) When installed horizontally, DCV assemblies shall be in an upright position and essentially plumb.

- (2) DCV assemblies may be installed vertically provided the water flow is in an upward direction through the assembly and is an approved orientation by FCCC&HR.
- (3) DCV assemblies two (2) inches and smaller shall be equipped with full port/quarter turn ball isolating valves.
- (4) DCV assemblies sized two and a half (2 ½) 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.
- (5) DCV assemblies shall be protected against frost and freeze damage.
- (6) DCV assemblies shall not be installed in underground vaults, either alone or in conjunction with water meters.
- (7) 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.

D. PRESSURE VACUUM BREAKER ASSEMBLIES

Pressure Vacuum Breaker (PVB) assemblies shall only be used for protection by containment for water service lines supplying single-family landscaping irrigation systems. PVB assemblies are not permitted for dedicated irrigation tap control and cannot be used in lieu of RPZ or DCV assemblies. PVB assemblies shall conform to the following:

- (1) PVB assemblies shall be installed in an upright position and essentially plumb.
- (2) 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.
- (3) 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.
- (4) PVB assemblies used for protection by containment of a landscaping irrigation system shall be equipped with full port/quarter turn isolating ball valves.
- (5) PVB assemblies can have valves, including "stop and waste" type, on their downstream side.
- (6) 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, and is not likely to be, submerged.
- (7) 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.

507.10 BACKFLOW PREVENTION ASSEMBLY SETS

- A. 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 systems.
- B. 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.
- C. 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.

- D. 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.
- E. 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.

507.11 TESTING AND CERTIFICATION OF BACKFLOW PREVENTION ASSEMBLIES

- A. Refer to Chapter 14.06, City Code, for additional requirements.
- B. Repair Parts.
 - (1) 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.
 - (2) The reuse of parts from check valves by reversing the part shall not be allowed.
- C. 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.

507.12 RECORDS AND REPORTS

Refer to Chapter 14.06, City Code.