

SECTION 600 WATER SUPPLY FACILITIES

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SECTION 600 WATER SUPPLY FACILITIES

610.00 DESIGN CRITERIA

610.01 General

All water distribution systems shall comply with the requirements of the STANDARDS AND SPECIFICATIONS for water main and service line construction and may include special criteria established by the Town for the overall hydraulics of the water utility system. Special criteria shall be outlined at pre-design meetings scheduled, as determined necessary, by the Town Engineer. The requirements set forth in the latest edition of the Denver Water Board Engineering Standards shall apply for information not set forth in these STANDARDS AND SPECIFICATIONS.

611.00 Design Flow Requirements

The design of the water distribution system shall be based on the following:

UNIT WATER DEMANDS FOR FUTURE LAND USE

Land Type	Avg. Demand	Max. Day Demand	Peak Hour: Max. Day Flow Ratio
Residential	140 GPCD*	1,000 gpd/SFE	2.0
Commercial	N/A	3,000 gpd/acre	2.0
Industrial	N/A	1,630 gpd/SFE	2.0

*Gallons Per Capita/Day

611.01 Fire Flows

Fire flows may be calculated from more than one hydrant, providing the hydrants used are directly accessible to all possible fire locations in the area served. Fire flows, per Mountain View Fire Protection District, shall be:

- A. Available fire flow shall be based on a 20 psi residual minimum.
- B. Minimum fire flow for any newly developed areas:
 - 1. 1 and 2 family units..... 1,000 gpm, 2 hour duration
 - 2. Multi-family units 1,500 gpm, 2 hour duration
 - 3. Institutional development 2,000 gpm, 2 hour duration
 - 4. Commercial development..... 2,500 gpm, 2 hour duration
 - 5. Industrial development..... 3,500 gpm, 3 hour duration

Note: above fire flow requirements may be increased due to type of construction and size of building, per direction of the Fire Marshall.

612.00 Operating Pressure Requirements

All areas shall be designed to provide a maximum static head of two hundred ninety (290) feet (one hundred twenty-five [125] psi) and a minimum static head of one hundred (100) feet (forty-three [43] psi). Distribution systems shall also be designed to maintain a twenty (20) psi residual pressure during required fire flow and a forty- (40) psi residential residual during peak residential flows. The maximum pressure drop from static head to either fire flow or peak residential flow shall not exceed thirty- (30) psi.

613.00 Fire Hydrant Spacing

In single-family residential areas, fire hydrants shall be spaced a maximum of five hundred (500) feet apart as measured along street curb line and at an overall spacing that will average not less than one hydrant to two hundred thousand (200,000) square feet accessible to the fire hydrant throughout an individual subdivision. A hydrant shall be placed in the end of each cul-de-sac.

In business, industrial, and high-density residential areas, hydrants shall be spaced not greater than three hundred feet (300) apart or as approved by Mountain View Fire Protection District.

614.00 Fire Lines

All Buildings except single-family residential: Valves on newly constructed fire lines shall be located on the tee at the main line. The owner shall maintain all private fire lines beginning at and including this valve. All fire sprinkler taps shall be installed with an approved backflow prevention device, and a flow switch which will indicate when water has flowed through the line. A property requiring a domestic service line and a fire protection service line will have separate taps for each. Irrigation taps shall not be allowed on the fire protection service line. Fire protection service lines shall be constructed of PVC from the fire line valve to the 90 degree bend for the building standpipe. The 90 degree bend and standpipe shall be in conformance with the International Fire Code as adopted by the Building Division. Fire line valves shall have a flange connection and shall bolt directly to a mechanical joint anchoring tee (swivel tee) at the main. Fire lines valve boxes will have "FIRE" printed on the valve lid.

Single family residential (including townhomes): Fire protection systems are required for all residential spaces. Fire protection systems that are not passive purge are required to have a backflow preventer installed. Fire protection service lines shall be made a minimum 5 feet after the meter. Meter sizing shall be determined by the Engineer of Record for the project. When a 1" meter is required due to fire service requirements, please refer to Title 8 of the Code of Ordinances Town of Erie.

615.00 Distribution System Layout

Distribution mains and lateral lines shall be located as indicated on the accepted plans and shall be a minimum of eight-inch (8) diameter pipe. Where approved by the Town's engineer, 6-inch main for short dead-end or cul-de-sac type streets shall be allowed; these lines shall be no longer than 300 lineal feet and serve no more than 12 residences.

Dead ends shall be minimized by looping whenever possible. Mains at ends of long cul-de-sacs shall be looped along lot lines to adjacent streets and a utility easement shall be provided with a minimum of 30-foot width, centered on the water main. Dead ends shall be provided with a fire hydrant. Blow off hydrant assemblies may be allowed on a case by case basis, upon approval by the Town's engineer.

Mains and laterals shall be extended to the boundaries of Filings and completely across the frontage of individual lots.

616.00 Valve Spacing and Marking

Valves shall be placed with a maximum spacing of six hundred (600) feet in all distribution mains and lateral lines. Valves shall also be placed to ensure that only one hydrant will be out of service in the event of a main break.

Tees shall require three (3) valves. Crosses shall require four (4) valves. Valves shall be restrained to the tee or cross. For a succession of short blocks perpendicular to the direction of the distribution main and without residential or commercial services between, one or more intersection(s) may have the valve in that direction omitted, but must maintain the six hundred (600) foot maximum spacing requirement.

Valves shall also be placed at each end of a main running through an easement on private property, on each side of a major creek or channel crossing, and on each side (at property lines extended) of a distribution main that provides service to a hospital, school or large industrial user.

617.00 Air Relief Valves

Air relief valves shall be installed at each high point in all transmission mains and those distribution mains and as may be required by the Town Engineer.

Air relief valves shall be installed in precast manholes or vaults fitted with air vents open to the atmosphere and in accordance with the Standard Drawings. (Also see Section 632.10 Air Relief Valves).

618.00 Temporary Blow-off Valves

Provisions shall be included in the design to allow for the flushing of distribution mains and lateral lines at any low point in the system, or at any point noted on the accepted plans. Fire hydrants shall

be used for all permanent blow-offs, however for temporary dead-end watermains, a temporary blow off valve may be permitted. The blow-off assembly shall be installed perpendicular to and on the downhill side of the main and shall drain to the nearest gutter line or drainage channel. The blow-off assembly standpipe must have a threaded end to accept a fire hose coupling. The top of the standpipe shall be between four to six inches (4" - 6") below grade in accordance with the Standard Drawings.

619.00 Pipe

All pipe used for distribution mains having a diameter of twelve inches (12") or less shall be PVC pipe unless otherwise approved in writing by the Town Engineer. Distribution mains in excess of twelve inches (12") in diameter shall be subject to approval and as directed by the Town Engineer. The design engineer will specify the pipe class as required for specific project conditions (see Section 632.00).

619.01 Hydraulic Design

All pipes shall be designed to provide a maximum velocity of ten feet (10') per second. Distribution mains shall be designed using a Hazen-Williams friction coefficient of 120. Maximum allowable head losses (peak hour) noted below:

Pipe Size	Max. Head Loss
8" - 12"	2' per 1,000'
14" - 16"	2' per 1,000'
20"	1.5' per 1,000'
Over 20"	1' per 1000'

619.02 Location (Typical)

Water mains will typically be located ten feet (10') north or west of the centerline of the street unless otherwise approved by the Town Engineer.

At street intersections, valves shall be restrained to tees or cross. Fire hydrant gate valves shall be restrained to the swivel tee. All fire hydrants shall have a restrained connection directly to the tee off the main (see the Standard Drawings).

In all instances, the water mains shall extend to the boundary line of the property or subdivision served. A main serving one lot shall extend the entire way across the frontage for that lot. Mains serving a subdivision shall extend to the center of boundary streets, to boundary lines or to the outside of paved areas as may be noted on the accepted plans.

619.03 Pipe Deflection

Changes in direction of waterline pipe greater than one degree for PVC pipe shall require fittings. Axial deflection at the joints shall not be in excess of manufacturer's recommendation.

619.04 Minimum Depth

All pipe shall be installed with a minimum of four feet six inches (4'-6") of cover from finished grade of street to the top of the pipe barrel. Where necessary, and approved by the Town Engineer, a minimum of 3 feet and maximum of 10 feet may be considered. Appropriate insulation and load protection may be required. Trenching, backfilling and compacting shall be completed in accordance with Section 350.00, Trenching, Backfilling and Compacting, of these STANDARDS AND SPECIFICATIONS.

619.05 Service Connections

See Section 640.00 of these STANDARDS AND SPECIFICATIONS for details on Town standards for service stub-ins and house service connections.

620.00 GENERAL PROVISIONS**621.00 General**

All water main construction within the Town and all water service line construction connecting to the Town's water mains shall be done in accordance with these STANDARDS AND SPECIFICATIONS and the accepted plans and shall apply to new water system construction as well as repairs to existing facilities.

When special conditions are encountered or deviations from these STANDARDS AND SPECIFICATIONS are required by the Town Engineer, and such changes are in the best interests of the Town, the decision of the Town Engineer shall be final.

All existing water main stubs and water service line stubs that are intended to remain unused or to be abandoned shall be removed back to the water main per the direction of the Town Engineer at the stakeholder's expense.

622.00 Permits Required

A public improvement permit shall not be issued until the Town Engineer has accepted the water main plans. A pre-construction meeting with the Town Inspector and Town Engineer, the Developer and the Contractor shall be scheduled and completed prior to the commencement of any construction. The Town Engineer shall be notified two (2) workdays (forty-eight [48] hours) before construction is to begin.

623.00 Maintenance of Traffic

When street cuts are required for water facilities construction, the following conditions shall be met to avoid interference with traffic:

- A. Street service cuts shall be open only between 9:00 a.m. and 4:00 p.m.
- B. Two-way traffic shall be maintained at all times around the construction area. A Traffic Control Plan (TCP) must be prepared in accordance with Section 141.08, Traffic Control, Barricades and Warning Signs, of these STANDARDS AND SPECIFICATIONS and submitted to the Town Engineer for his approval prior to the commencement of construction.

630.00 WATER MAIN CONSTRUCTION**631.00 Site Work and Earthwork**

Earthwork shall be performed in accordance with Section 340.00, Earthwork, of these STANDARDS AND SPECIFICATIONS.

631.01 Trenching, Backfill and Compaction

Trenching, backfilling and compacting shall be performed in accordance with Section 350.00, Trenching, Backfilling and Compaction, of these STANDARDS AND SPECIFICATIONS.

631.02 Preservation of Monuments

Refer to Section 141.00, Protection of Public and Utility Interests, of these STANDARDS AND SPECIFICATIONS.

632.00 Materials**632.01 General**

All references cited in these STANDARDS AND SPECIFICATIONS as the Denver Water Board Specifications shall mean the latest edition of the Engineering Standards of the Board of Water Commissioners of Denver, Colorado.

632.02 Pipe

All pipe for waterline construction shall be as described in Section 619.00 of these STANDARDS AND SPECIFICATIONS.

PVC Pipe: All PVC pressure pipe in sizes through twelve inches (12") in diameter shall be in conformance with AWWA C-900 or AWWA C-909 Class 150 and have a minimum working pressure of 150 psi (DR-18).

PVC pressure pipe in sizes fourteen inches (14") through forty-eight inches (48") in diameter shall be in accordance with AWWA C905-97 and have a minimum working pressure of 165 psi (DR-25). PVC pressure pipe fourteen inches (14") through forty-eight inches (48") in diameter and having an operating pressure in excess of 125 psi, or when required by the Town Engineer, shall have a minimum working pressure of 235 psi (DR-18).

All pipe shall be marked with the weight, class designation and size.

Installation of PVC pipe shall be in accordance with the manufacturer's recommendations and these STANDARDS AND SPECIFICATIONS.

Ductile Iron Pipe - All ductile iron pipe shall be in compliance with AWWA C151. Class designation shall be as shown on the accepted plans or as designated by the Town Engineer for each individual project. Joints shall be mechanical or push-on, in conformance with AWWA C111. Ductile iron pipe shall have a standard cement mortar lining in conformance with AWWA C104, and a bituminous outside coating approximately one (1) mil thick. Each pipe shall be marked with the weight, class designation and size.

632.03 Polyethylene Wrap for Ductile Iron Pipe

The Polyethylene encasement material shall be in accordance with Section 632.17 of these STANDARDS AND SPECIFICATIONS.

632.04 Fittings

Ductile iron fittings shall be in conformance with AWWA C110 and/or C153. Class designation shall be compatible with the pipe class designated for the project. Joints shall be either mechanical, push-on type or integral restrained joints conforming to the requirements of AWWA. Rubber gasketed joints shall be in conformance with AWWA C111. A standard thickness cement mortar lining shall be applied in conformance with AWWA C104. All fittings shall receive a bituminous outside coating approximately one (1) mil thick or lined and coated with fusion banded epoxy coating in accordance with AWWA C116.

632.05 Gate Valves

Gate valves in sizes four inches (4") to twelve inches (12") shall be of the ductile iron body, non-rising bronze stem, resilient-seated type manufactured in accordance with AWWA standard C515 with the specific requirements outlined.

General: Valves shall provide zero leakage at working pressures up through one hundred and fifty (150) psi in either direction. They shall open left and be furnished with a two-inch (2") square operating nut or hand wheel as indicated. End connections shall be furnished with all necessary joint materials and shall have a full opening flow way of equal diameter to the nominal size of the connecting pipe.

Design: The disc casting shall be open on one side so as to form no cavities for the accumulation of solids and permit the application of the protective coating. The sealing mechanism shall consist of a replaceable, contoured natural rubber disc seat ring internally reinforced by a steel ring and molded separately from the disc. The seat ring shall be secured to the disc with self-locking stainless-steel screws and shaped so that it cannot be installed improperly. The seat ring shall seal against an accurately formed machined surface in the valve body.

Valves shall be provided with three (3) O-ring stem seals with two (2) placed above and one (1) below the thrust collar. The two (2) upper O-rings shall be replaceable with the valve fully open and under pressure. The area between the O-rings shall be filled with a lubricant to reduce friction and to lubricate the O-ring each time the valve is operated. An anti-friction washer shall be placed above the thrust collar to further minimize operating torque. Structural design of the valve shall be such that if excessive torque is applied to the stem, failure of the pressure retaining parts will not occur. Stem failure under such conditions shall occur externally at such a point as to enable the stem to be safely turned by use of a pipe wrench or other such readily available tool after exposure of the valve. The stem shall then be replaceable through removal of the two-bolt stuffing box.

The valves shall have Type 304 stainless steel bolts and nuts for the stuffing box and bonnet.

Coating: Coatings shall be equal to or exceed AWWA C550-81 and the specific requirements outlined. All internal ferrous metal surfaces shall be fully coated, holiday free, to a minimum thickness of four (4) mils. The coating shall be a two-part thermosetting epoxy suitable for field over-coating and for touchup with the same coating material without special surface preparation or extreme heat. The supplier shall furnish detailed performance tests of adhesion, hardness and abrasion resistance of the furnished coatings. Coatings shall have a successful record of performance in valves, pipe or other allied equipment, for a minimum of ten (10) years.

632.06 Butterfly Valves

All valves having a nominal diameter greater than twelve (12) inches shall be geared butterfly valves designed for direct burial and shall conform to AWWA specification C504, Class 250B. Valves shall be of the tight closing rubber seat type with rubber seats which are bonded to the valve body. No metal-to-metal sealing surfaces will be permitted. Valves shall be bubble tight at one hundred fifty (150) psi rated pressure with flow in either direction. Valve discs shall rotate 90 degrees from the full open position to the tight shut position. Butterfly valves used with Class 200 PVC shall include a standard pipe spacer to allow for unobstructed movement of the valve disc. Coatings shall conform to standards specified in Section 632.04. Valve bearings shall be sleeve-type corrosion-resistant, and self-lubricating with the load not to exceed twenty-five hundred (2500) psi.

Valve operators shall be the traveling nut type designed to withstand three hundred (300) foot pounds of input torque at full open or closed positions without damage to the valve or operator; shall be fully gasketed, grease packed, and designed to withstand submersion in water to ten (10) psi; and shall close with a clockwise rotation of a two inch (2") square AWWA nut, seventeen (17) to thirty (30)

turns depending upon size. Hydrostatic and leakage tests shall be conducted in accordance with AWWA C504, Section A.6. All bolts and nuts shall be Type 304 stainless steel.

632.07 Pressure Reducing Valves

Pressure reducing valves (PRVs) shall be installed at the location(s) noted on the accepted plans. PRVs shall be capable of maintaining a constant downstream pressure regardless of varying inlet pressure. PRVs shall be a hydraulically operated, diaphragm-actuated, globe or angle pattern valve. They shall contain a resilient, synthetic rubber disc, having a rectangular cross-section, contained on three and one-half (3-1/2) sides by a disc retainer and forming a tight seal against a single removable seat insert. The diaphragm assembly containing a valve stem shall be fully guided at both ends by a bearing in the valve cover and an integral bearing in the valve seat. This diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure. The diaphragm shall consist of nylon fabric with synthetic rubber and shall not be used as a seating surface. Packing glands and/or stuffing boxes are not permitted and there shall be no pistons operating the valve or pilot controls. All necessary repairs shall be made possible without removing the valve from the line. The valve shall be furnished with indicator rod to show valve position. All bolts and nuts shall be Type 304 stainless steel.

The pilot control shall be a direct-acting, adjustable, spring-loaded, normally open, diaphragm valve, designed to permit flow when controlled pressure is less than the spring setting. The control system shall include a fixed orifice. Pilot control piping shall be all stainless steel.

The valves shall be Clayton 90-01BYKC and/or a Clayton 90-01ASKC Pressure Reducing Valve manufactured by Cla-Val Co., or an approved equal. The bypass valve shall be 2-inch for main line sizes up to 12-inch. Main sizes larger than 12-inch will require an engineered design submitted for review and approval.

All pressure reducing valves shall be 150 class. Distribution main and lateral line pressure reducing valves shall be installed in a vault and contain parallel valves for high and low flow ranges. Piping must be ductile iron through the vault walls extending three (3) feet past the vault walls and shall be as shown on the Standard Drawings. Oil filled differential gauges shall be installed.

The calibration of the pressure reducing valves shall be the responsibility of the Developer or Contractor installing the valves and completed by a factory trained representative. The Town shall be notified prior to scheduling the calibration. The calibration shall be to the satisfaction of the Town.

632.08 Fire Hydrants

Fire hydrants shall conform to the requirements of AWWA standard for dry-barrel fire hydrants (ANSI\AWWA C-502-85), and in addition, shall be listed by Underwriters Laboratories and Factory Mutual Research Corporation. Casting marks or other permanent means shall be used to identify the fire hydrant as conforming to these standards. All bolts and nuts shall be Type 304 stainless steel.

Fire hydrants shall also conform to the following supplementary specifications:

- A. Hydrants shall be rated at 1.5 times the operating line pressure and tested at 500 PSI per Section 5.1 of AWWA C502. Production testing of each hydrant shall be performed at 500 psi to assure proper assembly and operation and detection of any imperfections. All iron parts as designated in Section 3.1.2 of AWWA C502-85 shall be ductile iron – Class 52.
- B. The bury depth (distance from ground line to insert of the hydrant inlet) shall be specified here in after or as shown on drawing.
- C. There shall be two 2-1/2" nozzles 180 degrees apart and one 4-1/2" pumper. All nozzles shall be at the same elevation. Nozzle threads shall be National Standard Fire Hose coupling screw thread as described in Appendix A of AWWA C502, unless otherwise specified. Nozzles caps shall be provided with chains and gaskets. Nozzles caps shall have nut configuration the same as the hydrant-operating nut. Nozzles shall be reverse threaded into the upper barrel and mechanically locked in place.
- D. Hydrant main valve shall be 5-1/4" (or 4-1/2" specified one or the other) minimum and shall be of the full compression design, opening against and closing with the pressure. The main valve seat ring shall thread into a bronze sub-seat and all gaskets sealing the seat ring shall be on a bronze-to-bronze seating surface. The seat ring threads shall not serve as pressure seal. The entire valve and rod assembly shall be removable by use of a small lightweight seat removal wrench.
- E. The drain valves shall allow complete drainage of all residual water in the hydrant. The circumferential drain passage inside the hydrant shall be bronze on all surfaces. The draining system of the hydrant will be bronze, with a sliding bronze drain valve. Sliding drain valves made of rubber, plastic, or leather will not be allowed.
- F. All exterior bolting and fasteners below the ground line shall be plated steel.
- G. Hydrants shall have a breakaway flange and rod coupling designed to break upon traffic impact to prevent further damage to the hydrant and connecting pipe. The frangible coupling shall allow the upper section to be rotated to any desired position. Couplings, which employ lug devices or a breakaway barrel, are not acceptable. Frangible bolts are not acceptable due to the possibility for the use of non-frangible bolts.
- H. Hydrant operating nut shall be ductile iron and shall be pentagonal in shape, 1-1/2" point to flat (AWWA Standard). The operating nut shall also function as a weather shield. Hydrant shall open left (counterclockwise).
- I. The operating machine shall utilize two (2) O-ring seals between the revolving nut and bronze-sheathed upper section of the valve rod. The top of the rod shall also be fitted with a travel stop nut to limit downward travel on the rod. All-weather grease shall be used to provide permanent lubrication. A thermoplastic trust washer shall be used to reduce friction in the trust collar while opening the hydrant.
- J. The hydrant inlet shall be either mechanical joint or tyton joint restraint, if specified shall be accomplished for mechanical joint by use of mechanical joint gripper glands and for tyton joints with field-lock gaskets.

- K. Hydrants shall be painted red with white caps and shall be repainted at time of final acceptance. Hydrants for non-potable use shall be painted purple.
- L. Manufacturer shall certify that the hydrants furnished meet this specification.
- M. Fire hydrants shall be Waterous Pacer WB-67-250 or Mueller Super Centurion 250, A423.

632.09 Valve Boxes

All buried valves shall be provided with a valve box. Valve boxes shall be gray cast iron, ASTM A48 Class 20A, two (2) piece adjustable screw boxes with a round base and a five and one-fourth (5-1/4) inch screw-type shaft suitable for depth of cover as required. Valve box lids for water mains shall be marked with the word "WATER," valve box lids for fire lines shall be marked "FIRE," and valve box lids for Non-Potable water mains shall be marked "NON-POTABLE WATER." Refer to Parks and Recreation Section 1000 regarding valve box lids for irrigation lines.

All valves set at greater than normal depth shall have an extension stem provided and installed with the valve box so that the valve may be operated with a standard seven (7) foot valve key. A valve operating nut at six (6) foot or greater below final grade shall have an extension stem provided to bring the operating nut to a depth of four (4) feet below final grade. Provide an extension key pinned to the valve nut with a 1/4-inch stainless steel bolt and include a centering guide ring. Coatings shall conform to standards specified in Section 632.05. The Town Engineer shall accept valve boxes and final grade only when the final grade is completed.

Boxes shall be Tyler Pipe screw-type cast iron valve box assembly Series 6850, or an approved equal.

632.10 Air Relief Valves

Air relief valves shall be designed to allow large quantities of air to escape out of the orifice when the pipeline is being filled and shall close watertight when water enters the valve. To break a vacuum, the valve shall also allow large quantities of air to enter the pipeline when the pipeline is being drained, or a break has occurred.

The valve shall consist of a body, cover, baffle, float and seat. The float shall be stainless steel designed to withstand a maximum pressure of 1,000 psi. All material shall conform to ASTM A126 GR. B and ASTM A240.

Air relief valves shall be installed in a vault in accordance with the Standard Drawings. Galvanized piping or fittings shall not be allowed, see Section 617.00 Air Relief Valves. Air relief valves shall be as manufactured by APCO Model No. 50, Vent-O-MAT, or approved equal.

632.11 Blow-off Assembly

The blow-off shall be through a two-inch (2) ball valve with a two-inch (2) gate valve operating nut, box, piping and cover. Unless otherwise approved in writing by the Town Engineer, all piping shall be threaded copper and valves shall be brass. Galvanized piping or fittings are prohibited. Refer to the Standard Drawings.

632.12 Vaults

Vaults may be precast or cast-in-place and shall be constructed in accordance with these STANDARDS AND SPECIFICATIONS. Precast vaults shall be so designed that all joints and corners are waterproof. Precast and cast-in-place vaults shall be made waterproof after construction by use of sealants, epoxies, (e.g. Ram-Nek) or other approved methods.

The vault roof shall be designed to support the overhead fill, any surcharge and an H-20 traffic loading. Particular care shall be taken in selecting precast vaults that the application not be one of either shallow or deep cover over the roof.

Cast-in-place meter vaults shall conform to the Standard Drawings.

632.13 Manholes

Manholes may be constructed of cast-in-place concrete or precast concrete. Concrete precast reinforced risers and tops must conform to ASTM Designation C-478 except that wall thickness may be either wall "A" or wall "B" as described in ASTM Designation C-76. Manholes shall conform to details shown on the Standard Drawings unless otherwise approved by the Town Engineer. Cones shall be eccentric.

The top of the manhole vault shall be a minimum of twelve (12) inches below the finished street or ground surface elevation. The first step shall be a maximum of eighteen (18)-inches below the finished grade. Concrete extension risers or grade rings shall be used to bring the manhole ring and cover up to finished street or ground surface elevation.

Manhole rings and covers (all traffic covers shall be designed for H-20 traffic loading):

- A. Twenty-four (24) inch manhole rings and covers; cover weight = approximately one hundred sixty-five (165) pounds, ring weight = approximately two hundred forty (240) pounds.
- B. Twenty-four (24) inch by thirty-six (36) inch double ring and cover (36" cover with auxiliary 24" opening and cover);
 36" cover weight = approximately two hundred fifty (250) pounds.
 24" cover weight = approximately one hundred sixty-five (165) pounds.
 36" ring weight = approximately two hundred eighty (280) pounds.
- C. Manholes located in drainage ways, floodplains, near roadway sump conditions, or as otherwise directed shall be fitted with watertight lids with hinges and locking devices. Bolted manhole lids are not acceptable. A submittal detailing the watertight lid to be used must be accepted by the Town.

Steps shall have a minimum tensile strength of 38,000 psi, minimum yield strength of 35,000 psi, and have an elongation of not less than ten percent (10%) in two (2) inches without permanent deformation, steps must carry a load of one thousand (1,000) pounds when projected six (6) inches from the wall and fifteen hundred (1,500) pounds when projected four (4) inches from the wall. Steps shall be one-half (1/2) inch diameter steel-reinforcing rods completely encapsulated in Copolymer Polypropylene as manufactured by M.A. Industries, Inc. or an approved equal. Steps shall be spaced as shown on the Standard Drawings. All manhole steps shall be cast into the manhole barrel when the manhole is poured. The maximum distance from the finished ground (street) surface to the first step shall be twenty-four (24) inches.

Mortar for manholes shall be mixed in the following proportions by volume: One (1) part Portland cement; one-half (1/2) part hydrated lime; and three (3) parts sand or masonry cement. The cement, lime, and sand will be thoroughly mixed dry and only enough water added to form a mortar of proper consistency. Mortar shall be used within one (1) hour after mixing with no retempering permitted. Mortar that has taken a partial set is prohibited from use.

632.14 Manhole Base Slabs and Base Beams

Manhole base slabs may be poured in place or precast. Where possible, inverts will be the PVC pipe with the top half cut out. The slab shall be designed to uniformly support the earth load and any other reasonable loads that may occur. The minimum slab thickness shall be six (6) inches. The minimum reinforcement will be #4 Rebar grid on one (1) foot centers.

If required, manhole base beams shall be precast, reinforced concrete. The beams shall be twelve (12) inches wide by nine (9) inches deep by eight (8) feet long.

The reinforcement shall consist of three (3) No. 5 bars longitudinally and No. 4 bars at twelve (12) inch centers transversely.

632.15 Sump Pits for Vaults and Manholes

Sumps with a gravity drain line or sump pump are required for vaults or manholes in areas where there is a history of seepage into existing vaults and in all telemetry equipment and pressure regulating valve manholes and vault installations, as determined by the Town Engineer.

Normal practice in constructing a sump is to excavate a thirty- (30) inch diameter hole about three (3) feet deep. A six-inch (6) floor is poured and allowed to set. Then a twenty-four-inch (24) diameter cardboard tubing (i.e. Sonotube or approved equal) is used for an inside form, and concrete is poured behind it approximately three inches (3) thick. An approved waterstop shall be installed between the wall and floor and wall and vault or manhole base.

632.16 Vent Pipes

Unless otherwise approved by the Town Engineer, vent pipes shall be used in vaults and pits to allow gases to escape. Installations that contain electrical equipment shall have a blower attached to the vent system. Vent pipes shall be field located at the nearest intersection of the street property line and the side lot line. Refer to the Standard Drawings.

Above ground vent pipe shall be six (6) inch nominal diameter galvanized steel pipe, Grade 40, conforming to ASTM Standard Designation A 53. The vent screen shall be a three (3/4) fourths inch No. 9-11 flattened expanded galvanized metal screen. Below ground vent pipe shall be six (6) inch, AWWA C900, DR-18 PVC. All pipe penetrations through the vault wall or ceiling shall be made watertight using Link-Seal modular seals. A PVC joint by standard pipe thread female adapter shall be used to connect the steel pipe to the PVC pipe at ground level.

632.17 Corrosion Protection Systems

When soil resistivity is less than two thousand five hundred (2,500) ohm-centimeters (OHM-CM), but greater than one thousand (1,000) OHM-CM, ductile iron pipe may be used if approved by the Town Engineer but must be protected against corrosion with design provided by a qualified professional.

632.17.01 Polyethylene Encasement Material

Polyethylene wrap shall be used on all cast iron or ductile iron pipe, fittings, rods, and appurtenances. Refer to the Standard Drawings. Polyethylene wrap for non-potable use shall be purple.

Twenty-four (24) inch flat width tubing shall be used with four-inch (4), six (6) inch and eight (8) inch diameter pipe. Thirty-inch (30) flat width tubing shall be used with all twelve (12) inch diameter pipes. Thirty-six (36) inch flat width tubing shall be used for sixteen (16) inch diameter pipe. Fifty-two (52) inch flat width tubing shall be used with twenty (20) inch and twenty-four (24) inch diameter pipe.

Harness rods shall be covered by a four (4) inch wide flat polyethylene tubing. The entire joint shall be covered by a cigarette-wrap of forty-eight (48) inch wide polyethylene sheet material over each set of lugs. Irregular shaped valves and fittings shall be covered with a forty-eight (48) inch wide flat polyethylene sheet material.

632.17.02 Insulators

Insulators shall be installed at the outlet end of the corporation stop. Insulators shall be Ford Service Insulators or an approved equal for service lines. Refer to the Standard Drawings.

632.17.03 Tape

The polyethylene seams and overlaps shall be wrapped and held in place by means of two-inch wide plastic-backed adhesive tape. The tape shall be Polyken #900 (polyethylene), Scotchrap #50 (polyvinyl) or equal. The tape shall be such that the adhesive will bond securely to both metal surfaces and polyethylene film.

632.18 Tracer Wire and Warning Tape

A No. 12 AWG insulated, single strand copper wire shall be attached to all pipes, for the purpose of future locating, as detailed in the Standard Drawings. A three (3) inch wide, detectable warning tape shall be installed above all pipe, for the purpose of warning of location of buried pipeline as detailed in the Standard Drawings. Certification of continuity testing required at time of Initial Acceptance.

632.19 Bedding Materials

Bedding materials shall be in accordance with Section 352.00, Bedding for Pipelines and Service Lines, of these STANDARDS AND SPECIFICATIONS.

632.20 Concrete

All concrete shall conform to Town Standards for Portland Cement Concrete Work as specified in Section 400 of these STANDARDS AND SPECIFICATIONS and applicable referenced portions of the Denver Water Board Specifications.

632.21 Plastic Liner Pipe (slip lining)

Water main slip lining materials shall comply with all applicable requirements of Section 732.09, Plastic Liner Pipe (slip lining), of these STANDARDS AND SPECIFICATIONS and as herein noted.

632.22 Steel Casings for Bores

Steel casing pipe shall comply with all applicable requirements of Section 732.10, Steel Casings for Bores, of these STANDARDS AND SPECIFICATIONS.

633.00 Installation**633.01 General**

All work shall conform to applicable portions of AWWA C600, "Installation of Ductile Iron Water Mains", and to the pipe manufacturer's installation instructions except as modified by these specifications.

633.02 Alignment and Grade

Field parties, under the supervision of a licensed surveyor or a professional engineer, will determine alignment and grade of the pipe and the location of fittings, valves, and hydrants. The required minimum depth of cover between the top of the pipe barrel and the finished street grade is four (4) feet six (6) inches. The water main shall be laid to the required lines and grades with fittings, valves, and hydrants at the required locations. As-built drawings of pipe alignment, verified by a licensed surveyor or a professional engineer, shall be furnished to the Town Engineer.

633.03 Protection of Existing Underground Utilities

The Contractor shall be held responsible for the protection of public improvements as stated in Section 141.00, Protection of Public and Utility Interests, of these STANDARDS AND SPECIFICATIONS. It shall be the Contractor's responsibility to replace all damaged public improvements at his own expense.

633.04 Interruption of Services

Interruption of services shall be accomplished in accordance with Section 312.00, Protection of Public Improvements, of these STANDARDS AND SPECIFICATIONS.

633.05 Pipe Installation

Proper equipment, tools, and facilities shall be provided and used by the Contractor for safe and convenient performance of the work. All pipe, fittings, valves, and hydrants shall be carefully lowered into the trench piece-by-piece in such a manner as to prevent damage to pipe materials and to protect coatings and linings. Under no circumstances shall pipe or fittings be dropped or dumped into the trench; any pipe or fittings that are dumped shall be removed from the work site and shall not be used.

All pipe and fittings shall be carefully examined for cracks and other defects, while suspended above the trench, immediately before installation in final position. The groove in the bells of ductile iron pipe shall be full and continuous or the pipe will be rejected. Defective pipe or fittings shall be removed from the job site within twenty-four (24) hours. All foreign matter or soil shall be removed from the interior and ends of pipe and accessories before they are lowered into position in the trench. Every precaution shall be taken to prevent foreign material, including trench water from entering the pipe. If the pipe laying crew cannot lower the pipe into the trench and into place without getting soil into it, the representative of the Town Engineer shall require that before lowering the pipe, a heavy, tightly woven canvas bag of suitable size be placed over each end of the pipe and left there until the connection is made to the adjacent pipe. During construction, no debris, tools, clothing, gravel or other foreign materials shall be placed in the pipe. During construction the Contractor shall provide and maintain adequate equipment to properly remove and dispose of all water entering the trench or any other part of the work.

When buried, all ductile iron pipe fittings and appurtenances shall be protected with thick polyethylene film wrap. Miscellaneous steel or other ferrous pipe for blow-offs, etc., shall be similarly protected.

Methods for applying the wrap will conform to the following procedure:

- A. Take up pipe by a crane at the side of the trench using either a sling or pipe tongs and raise the pipe about three (3) feet off the ground. Slip a section of polyethylene tube over the spigot end of the pipe and bunch-up, accordion fashion, between the ends of the pipe and the sling. The tube shall be cut to a length approximately two (2) feet longer than the length of the pipe.
- B. Lower the pipe into the trench. Seat spigot end in bell of adjacent pipe and lower pipe to the trench bottom. A shallow bell-hole shall be provided in the trench bottom to facilitate wrapping of the joint.
- C. Make up the pipe joints in the normal fashion.
- D. Remove sling from center of pipe and hook into bell cavity; raise bell end three (3) or four (4) inches to permit tube of polyethylene film to be slipped along the full length of the barrel. Enough film shall remain bunched-up, accordion fashion, at each end of the pipe to overlap adjoining pipe about one (1) foot.
- E. To make an overlap joint; (1) pull film over bell of pipe; (2) fold film around adjacent spigot and wrap with about three (3) circumferential turns of the two (2) inch wide plastic adhesive tape to seal the tube of film to the pipe. The tube of the adjacent pipe shall be pulled over the above wrap on the pipe bell and sealed in place behind the bell using about three (3) circumferential turns of the two (2) inch plastic adhesive tape.
- F. The resulting wrap on the bell of the pipe shall be loose and will be pulled firmly around the barrel of the pipe; excess material shall be folded over at the top and the
- G. fold held in place by means of six (6) inch strips of two (2) inch wide plastic adhesive tape at intervals of about three (3) feet along the pipe barrel.
- H. Fittings, valves, hydrants, etc., shall be hand-wrapped using sheet polyethylene film held in place with plastic adhesive tape. Bends, reducers, and offsets shall be wrapped with polyethylene tube in the same manner as pipe. Valves shall be wrapped by bringing tube wrap on adjacent pipe over bells or flanges of the valve and sealing with adhesive tape. The valve bodies must then be wrapped with a flat sheet of film, passed under valve bottom and brought up around body of stem, and fastened in place with adhesive tape. Hydrants shall be wrapped with polyethylene tube slipped over hydrant to encase it from the lead-in valve to the ground level of the hydrant. All fittings requiring concrete backing shall be completely wrapped prior to placement of concrete thrust block.

According to the manufacturer's recommendation, as each length of pipe is placed in the trench, the circular rubber gasket must be lubricated and installed. The plain end shall be centered in the socket with care to keep the joint from contacting the ground. The pipe shall then be properly seated to the reference mark and brought to correct line and grade. Do not insert beyond the reference mark. After installation of the polyethylene protective wrap as described above, pipe shall be secured in place by installation of backfill or bedding material, tamped under and along it up to the spring line of the pipe.

Whenever pipe laying is not in progress, the open ends of pipe shall be closed by means of a watertight plug. Cutting of pipe for inserting valves, fittings, or closures pieces shall be done in a neat and professional manner without damage to the pipe or lining, so as to assure a smooth end at right angles to the axis of the pipe. Pipe ends shall be smooth and beveled with a file or other tools according to the pipe manufacturer's recommendations.

The Town Engineer shall be notified at least one working day (twenty-four [24] hours) in advance of when pipe is to be laid in any trench. No pipes shall be covered until a representative of the Town has inspected them.

633.06 Thrust Blocking, Restrained Joints and Fittings

Thrust blocks and mechanical restraints shall be used at all valves, bends, fittings with mechanical or push-on type connections and dead ends length shall be as required by the design engineer.

Thrust blocking shall be in accordance with the Standard Drawings. Care shall be taken not to block outlets or to cover bolts, nuts, clamps or other fittings or to make them inaccessible. A bond breaker shall be placed between the pipe and the thrust block to aid in ease of future removal. The thrust block shall bear against undisturbed earth.

All forming for thrust blocks and anchors shall be done by bulk heading around the shape of the thrust block or anchor with wood, burlap, or reinforced paper sacks filled with sand or earth. Wood forms shall be removed before backfilling. Newly placed thrust blocks shall be allowed to set, undisturbed, for a minimum of twenty-four (24) hours prior to any backfilling, tamping or compaction.

Sakrete Concrete is an acceptable method for placing thrust blocks, but the material shall be rated for a minimum compressive strength of 5,000 psi. Prior to placement, the Town's Construction Inspector must accept and verify the material meets the stated strength requirements.

Mechanical restraints shall be used at all valves, bends, fittings with mechanical or push-on type connections and dead ends. Restraints shall be protected in accordance with Section 632.17 of these STANDARDS AND SPECIFICATIONS. Mechanical restraints shall be MegaLug by EBBA Iron, "Star Products", "All Grip" Series 3600, Ford Uni-Flange Series 1400 and 1500 or approved equal.

633.07 Setting Valves and Hydrants

Immediately prior to installation of a valve or hydrant, the following operations shall be performed. The valve or hydrant shall be carefully inspected. The interior shall be thoroughly cleaned; the valve or hydrant shall be operated as many times as necessary to determine that all parts are in proper working order with the valve seating properly and the hydrant drain valve operating properly. Valves and hydrants shall be set plumb, in a vertical position and securely braced in place.

Each hydrant shall have a six (6) inch gate valve on the inlet line and shall be connected to the main by a six (6) inch ductile iron, polyethylene wrapped pipe. The gate valve shall be restrained to a swivel tee or mechanical joint tee with anchor coupling.

Hydrants shall be set with the bury line at the established finished grade and with hose nozzles parallel to the curb with the pumper nozzle facing the curb and at least six inches (6") behind curbs or sidewalks.

Hydrants shall be provided with a drainage pit with nine (9) square feet of surface area and two (2) feet of depth below the barrel of the inlet. Pits shall be backfilled with one and one-half (1-1/2) inch, washed, crushed rock to a level six (6) inches above the barrel drain hole. A concrete thrust block will be provided at the bowl of each hydrant as shown on the Standard Drawings and shall be placed to prevent obstruction of the barrel drain hole. Hydrants and valves shall be backfilled to the ground surface as specified in Section 350.00 of these STANDARDS AND SPECIFICATIONS.

633.08 Plastic Liner Pipe (Slip lining)

Plastic liner pipe shall be installed in accordance with all applicable portions of Section 733.09, Plastic Liner Pipe, of these STANDARDS AND SPECIFICATIONS.

633.09 Steel Casing and Carrier Pipe Installation

Steel casing and carrier pipe shall be installed in accordance with Section 733.10, Steel Casing and Carrier Pipe Installation, of these STANDARDS AND SPECIFICATIONS.

633.10 Test Stations

Underground pipeline test stations shall be installed at the locations shown on the accepted plans and in accordance with the details shown on the Standard Drawings.

633.11 Plugging of Dead Ends

Standard plugs or caps shall be installed at temporary dead ends of all fittings and pipes, and an adequate thrust block provided. Mechanical restrained joints shall be provided as required by the Town Engineer. Dead ends on any line shall be provided with a fire hydrant and proper valve.

633.12 Filling and Venting the Line

The Town's Public Works Department shall operate all valves. The line shall be slowly filled with water and all air expelled from the pipe. Care shall be taken that all available hydrants (including hydrant gate valves), air relief valves, and other vents are open during the filling of the line. Where hydrants or other vents are not available in the line, the Contractor shall make whatever taps are required for venting purposes. The rate of filling the line shall not exceed the venting capacity.

633.13 Disinfection and Flushing of Mains and Fire Lines

All mains and fire lines shall be disinfected in accordance with the requirements of the Colorado Department of Health and the procedure set forth in AWWA C651, "Standard for Disinfecting Water Mains".

The chlorine solution shall be retained in the line for at least twenty-four (24) hours. The chlorine residual at the pipe extremities and other representative points shall be at least twenty-five (25) parts per million at the end of the twenty-four (24) hour period. If the test is unsatisfactory, the disinfection shall be repeated until a twenty-five (25) parts per million chlorine residual is obtained.

Following chlorination, the main shall be thoroughly flushed through all extremities until the water runs clear with no chlorine residual in excess of that carried in the existing system. As a minimum, the total capacity of that portion of the line(s) being tested must be flushed. The Contractor shall provide a Certified Water Tester to conduct a low chlorine test which shall be passed prior to performing a pressure test of the system. A low chlorine test shall be found to be passing with a result at or below 2.0 mg/L.

The line shall be tested for turbidity at the discretion of the Town Engineer. If the test is above one (1) NTU, the line shall be flushed again. If the turbidity test fails a second time the line shall be re-chlorinated as noted above and then re-flushed.

Two twenty-four (24) hour Bacteriological tests, from multiple points to be determined by the Town Engineer, for total coli-form bacteria shall be performed a minimum of 24 hours apart. If either of these tests fail, the line shall be re-chlorinated, re-flushed and then retested. A Certified Water Tester from a third-party testing agency shall be required to perform the Bacteriological test. The Contractor will not be permitted to perform the Bacteriological test and deliver the samples to the laboratory themselves.

The Contractor shall take all necessary precautions to prevent the flow of strong chlorine solution into existing water facilities and shall assume all responsibility for damages done by heavily chlorinated water. No water mains shall be placed in service or tapped until a written release is obtained from the public health authority having jurisdiction and a copy of that release furnished to the Town Engineer.

633.14 Leakage

Pressure and leakage tests shall be conducted according to the applicable sections of AWWA C600/605 to a pressure of one hundred and fifty (150) pounds per square (psi) inch at the low point of the section being tested for the duration of two (2) hours. The maximum length of line to be tested shall be one thousand (1,000) feet. All joints are to be watertight within tolerances allowed by the specifications in AWWA C600/605. Any leakage that is discovered by observation or tests shall be located and made watertight by the Contractor. Pressure and leakage tests shall be conducted before the line has passed all required disinfection tests. All bacteriological testing will follow pressure testing and leak repairs.

633.15 Manholes

Refer to Section 733.08, Construction of Manholes and Cleanouts, of these STANDARDS AND SPECIFICATIONS.

633.16 Inspections

Refer to Section 154.00, Inspections, of these STANDARDS AND SPECIFICATIONS.

634.00 NON-POTABLE WATER SYSTEM**634.01** General

The minimum standards for the Non-Potable Water System shall be similar to those given in Section 630.00 for Water Distribution Systems with the exceptions as listed hereinafter.

634.02 Design/Sizing

Non-Potable Water Main sizing shall be to deliver not less than twenty (20) psi dynamic pressure at the Non-Potable Water Main during peak flow rate (demand) conditions. The Non-Potable Water System will not be designed to provide any fire protection flows.

634.03 Non-Potable Water Main Materials

Non-Potable Water Mains shall be purple and shall conform to AWWA C900 PVC, Purple Pressure Pipe for Non-Potable water, minimum Pressure Class 235. DR 18.

634.04 Valve Boxes:

Valve boxes shall be in accordance with Drawing No. W38. The triangular valve box covers shall be Model # 4TCI16S by Castings, Inc. or approved equal and shall have "Non-Potable Water" cast on the cover.

634.05 Warning Notification on Lines and Tape

All Non-Potable Water Mains shall be installed with warning tapes and with the warning printed directly onto the Non-Potable Water Main. The warning tape, and printing directly on the Non-Potable Water Main, shall state: "NON-POTABLE LINE – DO NOT DRINK".

634.06 Non-Potable Water Main Installation

All mains shall be flushed in accordance with Section 633.13. Disinfection of Non-Potable Water Mains is not required.

The Non-Potable Water Main should not be installed closer than ten feet (10') horizontally to the Potable Water Main or Sanitary Sewer.

640.00 WATER SERVICE LINE CONSTRUCTION**641.00 General**

All water service line locations shall be marked on the curb with a "W" or "V" symbol where services cross under the curb. Water service shall be in a separate trench and shall be a minimum of ten (10) feet from the sewer service line. The water service line shall be a minimum of eighteen (18) inches above any sanitary sewer crossing. All service lines shall be stubbed into the lot either ten (10) feet beyond the back of the walk or five (5) feet past any utility easement, whichever is greater, and shall be marked at the end of the water service with a 2x4 painted blue.

The water service line at the curb stop shall be no deeper than five (5) feet - six (6) inches. The water service line shall be a minimum of two (2) feet from the property line and shall not be located under a driveway unless approved by the Town Engineer.

The tap, corporation stop, meter, and the portion of the service line between the corporation stop and 5-feet past the meter shall be the same size. The service line may only be increased one standard size to the next approved larger diameter beginning 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.

641.01 Excavation

All excavation shall be performed in accordance with Section 341.00 of these STANDARDS AND SPECIFICATIONS.

642.00 Equipment and Materials**642.01 General**

All references cited in these STANDARDS AND SPECIFICATIONS as the Denver Water Board Specifications shall mean the latest edition of the Engineering Standards of the Board of Water Commissioners of Denver, Colorado.

642.02 Service Lines

Service lines shall be of the size that is adequate to supply the requirements of the property being served. The minimum size line shall be three (3/4) fourths inch. All service pipes shall conform to one of the following specifications:

- A. Seamless copper tube of the type designated as "Type K" (soft) in the industry may be used for service lines three fourths (3/4) inch through two (2) inches.

- B. Crosslinked polyethylene (Pex-a) may be used for service lines one (1) inch and smaller.
 - a. Pex-a municipal water service pipe shall be manufactured using the high-pressure peroxide method of crosslinking.
 - b. Pipe shall be certified to AWWA C904 Crosslinked Polyethylene Pressure Pipe by an approved testing agency.

- C. Ductile Iron Pipe or PVC pressure pipe conforming to the Denver Water Board Specifications may be used for three-inch (3") service lines and shall be used for all service lines larger than three inches (3").

Service lines shall be of the same type material from beginning to end, unless the appropriate insulator is installed at the junctions of dissimilar metals and unless approved by the Town Engineer. Service lines shall be consistent throughout a Development and shall be clearly labeled on the Accepted Plans unless otherwise approved by the Town Engineer. Tracer wire to be secured to service line from water main to curb stop with 1 ½ inch polyethylene tape wrapped around twice with a maximum distance of 10 feet between tapped locations. Minimum of two (2) locations is required on all service lines. Tracer wire to be installed through curb stop service box and to extend a distance of 3 feet beyond curb stop box top. The extra tracer wire shall be coiled and stored inside curb stop service box.

642.03 Service Saddles

Service saddles shall be used for wet tapping of all PVC mains for service taps. Service saddles shall be ROMAC 202 B or approved equal. The service saddle shall be protected from corrosion in accordance with the Standard Drawings.

642.04 Meters

642.05 (Left Blank Intentionally)

642.06 (Left Blank Intentionally)

642.07 Outside Meter Settings

All meters shall be shipped and installed by the Town.

The meter shall be furnished and installed by the Town, in a pit, manhole, or vault which shall allow for free and easy access with adequate room for installation, inspection and maintenance and shall provide protection from freezing in accordance with the Standard Drawings.

642.08 Inside Meter Setting and Remote Readers

All inside meters shall only be used with special approval of the Town Engineer. All inside meter settings shall be installed in a manner which will allow free access and adequate room for inspection and maintenance and will protect the meter from freezing in accordance with the Standard Drawings.

642.09 Meter Bypass Line

A locking bypass line shall be required for all meters one and one half (1-1/2) inches and larger, unless otherwise approved by the Town Engineer, whether installed in an inside or outside setting. Bypass lines shall contain an independent control valve and shall contain no tees, plugs, or other outlets through which water could be withdrawn, as indicated on the Standard Drawings.

642.10 Meter Check Valves

Swing check valves shall be required for all meters one and one-half (1-1/2) inch and larger unless otherwise approved by the Town Engineer, whether installed in an inside or outside setting. Check valves may be required on meters smaller than one and one-half (1-1/2) inch where any condition might exist that could cause a flow of water from the property to the main.

Valves for Use with Meters-

Gate valves three (3) inch and smaller to be used with copper service pipe shall be brass, with non-rising stems and solid wedge disc, manufactured in accordance with ASTM Specification B 62-76 and Federal Specification WW-V-54 Class A 125 PSI WSP, 150 PSI, WOG. Gate valves shall meet the requirements of AWWA Standard C800. Also refer to the Standard Drawings of these STANDARDS AND SPECIFICATIONS.

Valves larger than three (3) inches for use with ductile iron service pipe shall be gate valves with cast iron bodies. All gate valves larger than three (3) inches shall be supported by adjustable steel valve supports.

642.11 (Left Blank Intentionally)**642.12 Meter Yokes (Copper Setters)**

Meter Yokes (Copper Setters) shall be a Ford Series 80, McDonald Series 31, Cambridge Series 6040, Mueller Series P-2474, or James Jones Company Series J04 with an angle ball valve and a padlock wing on the inlet side of meter. Yoke shall have a dual check valve on the outlet side. Service connections shall be compression fittings, with a "110", "Cam Pack", or "Mac Pack" type fitting and shall be vertical.

642.13 Residential Meters

The standard residential meters shall be 3/4 x 5/8 or 3/4 x 3/4 and shall be approved by the Town Engineer.

642.14 Residential Meter Pits and Covers

Meter pits shall be PVC or HDPE, four (4) foot tall, twenty-four (24) inch diameter body, twenty (20) inch diameter top opening in accordance with ASTM/D1505 and ASTM/D746. Meter pit covers shall be tight-fitting with a double cover and shall be Rotec DFW 12" AMR, Nicor Read Rite AMR or approved equal. The meter pit cover shall be installed at two (2) inches above final grade. The frost proof lid shall be per meter pit standard detail.

642.15 Corporation Stops

Corporation stops shall provide the connection for the service line to the main. Corporation stops shall be Ford model F1000, McDonald model 4701, Cambridge model 301, Mueller model 300, James Jones Company series J1949, with compression fittings with a "110", "Cam Pack", or "Mac Pack" type fitting. See the Standard Drawings.

642.16 Curb Stops

Curb stops for service lines shall be installed on the inlet side of the meter pit to provide a means for shut off. Placement of the curb stop and stop box shall be one (1) foot from the meter pit. Curb stops shall be Ford model B44-333, McDonald model 6100, Cambridge model 301, Mueller model 300, James Jones Company model J3401, with compression fittings with a "110", "Cam Pack", or "Mac Pack" type fitting. See the Standard Drawings.

642.17 Curb Stop Service Boxes

Curb stop service boxes shall be cast iron, screw adjustable, two and three quarters (2-3/4) inch ODW Pentagon nut lid. The bottom part shaped like an inverted U straddling the service line shall have a flanged bottom so as to support itself. Curb stop service boxes shall be Tyler Pipe screw type series 6500 and shall be set two (2) inches above grade.

643.00 Tapping the Main

All taps shall be wet taps. Shut down of any portion of the water system shall only be allowed when uncontrolled circumstances do not permit a wet tap. Any shut down of the water system must be approved in writing by the Town Engineer and coordinated with the Town's utility.

The contractor shall do tapping of all mains. Notification must be given to the Construction Inspector two working days (forty-eight [48] hours) in advance of the tap in order to provide ample time to schedule inspection of the work.

644.00 Inspection

All taps, meter sets, and inspections must be scheduled during regular working hours a minimum of two working days (forty-eight [48] hours) in advance. All taps, inspections and meter sets shall be scheduled by calling 303-926-2870. All installations by Contractors must meet these STANDARDS AND SPECIFICATIONS. Unnecessary recall inspections or meter installations are subject to an assessment that will equal the expenses accrued to complete the inspection. This amount will be one and one-half (1½) times that of the inspector's wages.

645.00 NON-POTABLE WATER SERVICES.

645.01 General

The Non-Potable Water Service Lines shall be installed similarly to the standards designated in Section 640.00 for Water Service Lines; with the exceptions in materials and installation as itemized below. Non-Potable Water Service Lines shall be marked on the curb with an "R" where the service line cross under the curb.

645.02 Non-Potable Water Service Line Materials

All Non-Potable Water Service Lines outside the meter pit shall be of plastic materials, as follows:

Three-quarter inch (3/4") through three-inch (3") size Non-Potable Water Service Lines shall be polyethylene, non-jointed, conforming to AWWA C901, minimum Class 160 psi, using HDPE 3408 material. All PE service lines shall conform to Iron Pipe Size (IPS) sharing the same O.D. as Schedule 40 and 80 PVC. The pipe shall have purple color coding, permanently co-extruded stripes on the pipe.

Non-Potable Water Service Lines four-inch (4") diameter and larger shall be AWWA C900 Purple Pressure Pipe for reclaimed water, minimum Pressure Class 235, DR 18.

645.03 Warning Notification on Non-Potable Water Service Line and with Tape

All Non-Potable Water Service Lines shall be installed with warning tapes and with the warning printed directly onto the pipe. Warning tapes shall be installed directly on top of the Non-Potable Water Service Line longitudinally and shall be centered. Acceptable tape or printing directly on the Non-Potable Water Service Line shall state: "NON-POTABLE LINE – DO NOT DRINK".

645.04 Meters and Meter Pits

Three-quarter inch (3/4") and one-inch (1") meters shall be installed per Drawing W12A; one and one-half (1-1/2") and two-inch (2") meters shall be installed per Drawing W13. The requirements of Potable Water meters shall apply except; polyethylene by copper compression couplings shall be provided at the meter pit inlet and outlet, the meter color shall be purple, the pre-cast

polyethylene meter pit interior color shall be purple, and by-pass piping is not needed. The ball valves shall have an enlarged tee-head embossed with "Non-Potable Water". The meter and meter pit cover shall be marked for identification purposes with a color designated by the Town.

645.05 **Non-Potable Water Service Line Installation**

The Non-Potable Water Service Line shall not be installed closer than ten feet (10') horizontally to the Water Service Line or Sewer Service Line. No Non-Potable Water Service Lines shall be installed inside a building or within five feet (5') of a building foundation. A warning tape shall be installed per 645.03. If the meter is not installed at the time of Non-Potable Water Service Line installation, in the right-of-way, a one and one-half inch (1-1/2") black PVC or Acrylonitrile-Butadiene-Styrene marker pipe six feet (6') long, shall be installed vertically at the end of the Non-Potable Water Service Line as a marker.

650.00 **PUMPING FACILITIES**

651.00 **General**

In those locations where the Town's water distribution system may not be capable of providing adequate water pressure, the Town may require the construction of a pumping facility in order to provide proper service. The Town may not approve the installation of a pumping facility where, in the opinion of the Town Engineer, such installation would be injurious to the operation, or future operation, of the Town's water system.

The Town shall design any permanent regional (or wholesale) facilities, with reimbursement by the developer(s) served.

Where temporary pumping facilities are allowed, the Developer must provide the Town Engineer with a set of design calculations and drawings for review and acceptance by the Town Engineer as required under Section 160.00, Plans and Specifications, of these STANDARDS AND SPECIFICATIONS. The Developer shall also prepare written plan for the ultimate dismantling of the temporary pumping facility and the assimilation of the development into the Town's potable water system. The pumping facility must satisfy all requirements of the Colorado Department of Health and of these STANDARDS AND SPECIFICATIONS. The Town shall require that the Developer prepare a set of digital "as built" drawings and an AutoCAD file of the pumping facility in accordance with Section 222.00, Initial Acceptance Procedures, of these STANDARDS AND SPECIFICATIONS. Upon completion of the pumping facility, the Contractor shall also provide the Town with two (2) copies of an "Operation & Maintenance Manual" for the facility. Approved temporary pumping facilities shall be owned and maintained by the developer or neighborhood association.

652.00 **Design Criteria**

652.01 **Pumps and Pump Station**

All pertinent portions of the Denver Water Board Specifications Section 5.08, Pumping Facilities, shall apply. Applicable portions of the Denver Water Board Specifications Section 6.46, Electric Pump Motors, shall also be followed.

A standby generator, capable of operating the entire station, shall be provided. The generator may be housed inside of a separate all weather enclosure.

652.02 Controls and Supervisory Control and Data Acquisition (SCADA)

All new controls and telemetry equipment must be compatible with and easily integrated into the Town's system. Controls and SCADA systems are subject to review and acceptance by the Town Engineer prior to installation.

652.03 Site Improvements

Refer to Section 762.04, Site Improvements, of these STANDARDS AND SPECIFICATIONS.

660.00 TRENCHING, BACKFILLING AND COMPACTING

Trenching, backfilling and compacting shall be performed in accordance with all applicable portions of Section 350.00, Trenching, Backfilling and Compacting, of these STANDARDS AND SPECIFICATIONS.

670.00 RESTORATION AND CLEANUP

Restoration and cleanup shall be completed in accordance with Section 360.00, Restoration and Cleanup, of these STANDARDS AND SPECIFICATIONS.