# CITY UTILITIES
# DESIGN STANDARDS MANUAL

**Book 5**
**Materials (MA)**
**MA7 Water Materials and Testing Requirements**

March 2018

## MA7.01 Purpose

This Chapter covers materials used for potable water distribution utility projects.

## MA7.02 Allowable Pipe Materials and Testing Requirements

Figure MA7.1 summarizes water main pipe materials used for potable water distribution system installations and is to be used as a reference for acceptable water pipe materials. The following Sections within this Chapter list more detailed requirements specific to each pipe material.

**Figure MA7.1 Allowable Public Water Main Pipe Materials**

| Pipe Material | Designation | [1]Min. Cover (ft) | Sizes (Diameter, in.) | | Bedding Req. | Master Spec Number |
|---|---|---|---|---|---|---|
| | | | Minimum | Maximum | | |
| Polyvinylchloride(PVC) Pressure | AWWA C900 | 5 | 6 | 12 | Flexible Detail - BS-5 | 33 05 37.16 |
| | AWWA C905 | | 16 | | | |
| High Density Polyethylene (HDPE) | AWWA C906 | | 6 | 36 | | 33 05 38.16 |
| Ductile Iron Pipe | AWWA C151 | | 24 | 54 | | 33 05 33 |
| Concrete Pressure | AWWA C300 | | 30 | 54 | Rigid Detail - BS-4 | - |
| | AWWA C301 | | 24 | 48 | | |
| | AWWA C303 | | 24 | 54 | | |

*Note: 1 - Minimum cover from finished grade to top of pipe (O.D), at completion of all project restoration.*

1. Pipe Testing Requirements

   The contractor shall be responsible for pipe testing. City Utilities will monitor testing. The following subsections include quality assurance and quality control requirements for the material listed in this Chapter.

2. Quality Assurance

   A. Manufacturers Qualifications

   - Pipe manufacturers shall have a minimum of 5 years of successful experience producing specified pipe and fittings, and document their success by showing evidence of at least 5 installations in satisfactory operation within the United States.

B. Supply and Compatibility

- Pipe, fittings and appurtenances shall be suitable for the specified service and integrated into the overall piping system by the pipe supplier.

3. Water Main Start-Up Sequencing – Gap Concept

When connecting new or replacement water main to City Utilities' water distribution system, use the following method:

- Only one point of connection between the new/replacement water main and the in-service water main system prior to pressure testing and disinfection.
- Contractor shall operate valves the connect to the existing service, under the observation of Water Maintenance and Service.
- The separation between the new/replacement water main is commonly called an air gap, and used to maintain the integrity of the in-service water main system.
- Successfully complete the pressure testing and disinfection of the new water main.
- Services shall be approved for potable use after successful pressure testing and disinfection of public water main.
- After successful pressure testing and disinfection on redevelopment mains, install all service connections. For new mains, services may be installed, but not activated, prior to successful pressure testing and disinfection.
- Continue this process until all water mains within the project are connected to City Utilities' water distribution system.
- The Contractor is responsible for turning all valves not accepted as part of the distribution system.
- After water main has successfully passed pressure testing and disinfection, contractor may make additional connections as necessary to finish installation.

4. Field Quality Control

This section covers pipe testing requirement after installation of the pipe. The following testing is required for water distribution projects:

- Hydrostatic Test
- Electrofusion Saddle Joint Test
- Disinfection Test
- Continuity Test

Prior to pressure testing and disinfection water mains complete the items listed in the data collection checklist. The checklist is provided in Exhibit MA7-1

A. Hydrostatic Testing for:

- DI Pipe (AWWA Manual M41)
- PVC Pressure Pipe (AWWA Standard C605)

- HDPE Pressure Pipe (ASTM F2164)
- Concrete Pressure Pipe (AWWA M9)

1. Preparation for Testing:
   - Follow appropriate preparation for testing as specified in the manuals above for specified pipe material.
   - Prior to testing the contractor shall ensure that the line is clean and free of dirt and debris.
   - Prior to testing, ensure that adequate thrust protection is in place and joints are properly installed.
   - Prior to testing, install test riser and ensure equipment is properly calibrated.
2. Test Procedure for DIP, and PVC Pressure Pipe:
   - Fill pipeline slowly to minimize air entrapment and surge pressures. Fill rate shall not exceed one foot of pipe length per second in pipe being tested.
   - Expel air from pipe as required. Obtain approval of City Utilities Engineering prior to tapping pipe for expelling air.
   - Examine exposed joints and valves, and make repairs to eliminate visible leakage.
   - Add fluid as required to pressurize line to 150 psi or otherwise specified test pressure. Maintain test pressure for a stabilization period of ten minutes before beginning test.
   - Timed test period shall not begin until after pipe has been filled, air has been expelled, and pressure stabilized.
   - Timed Test Period: After stabilization period, maintain test pressure for at least two hours. During timed testing period, add fluid as required to maintain pressure within five psig of required test pressure.
   - Pump from test container to maintain test pressure. Measure volume of water pumped from test container and record on test report. Record pressure at test pump at 15 minute intervals for duration of test.
   - Results of the test shall be logged using the inspection form provided in Exhibit MA7-2.
3. Test Procedure for HDPE Pressure Pipe:
   - Fill pipeline slowly to minimize air entrapment and surge pressures. Fill rate shall not exceed one foot of pipe length per second in pipe being tested.

- Expel air from pipe as required. Obtain approval of City Utilities Engineering prior to tapping pipe for expelling air.
- Examine exposed joints and valves, and make repairs to eliminate visible leakage.
- The test section and the test liquid shall be allowed to equalize to a common temperature.
- After filling pipeline and purging air, gradually pressurize pipe to 150 psig or otherwise specified test pressure and maintain required test pressure for four hours for pipe to expand. During expansion, add fluid to maintain required test pressure. Begin timed test period after expansion period and other requirements are met.
- Timed test period shall not begin until after pipe has been filled, exposed to required wetting period, air has been expelled, and pressure stabilized.
- Timed Test Period: After four hour expansion phase, reduce test pressure by 10 psig and do not add liquid. Test pressure shall then remain steady for 1 hour, indicating no leakage.
- If no visible leakage is observed and pressure remains within 5% of the original test pressure for 1 hour, a passing test is indicated.
- Results of the test shall be logged using the inspection form provided in Exhibit MA7-3.

4. Test Procedure for Concrete Pressure Pipe

   - Fill pipeline slowly to minimize air entrapment and surge pressures. Fill rate shall not exceed one foot of pipe length per second in pipe being tested.
   - Expel air from pipe as required. Obtain approval of City Utilities Engineering prior to tapping pipe for expelling air.
   - After filling the pipe allow for a 48-hr wetting period to saturate the concrete lining.
   - Bring the pipeline to 120% of the working pressure, and maintain, within 5 psig, the pressure for the test duration of a minimum of 2hrs.

5. Makeup Water Allowances:

   - The allowable makeup water allowance is the maximum amount of water that is added into a pipeline undergoing hydrostatic pressure testing. The allowable leakage rates for the various pipe materials and joints are listed below.

- Pipes with flanged, welded, or fused joints
  - No addition of makeup water
- Allowance rates for Concrete Pressure Pipe conform to Figure MA7.3.
- Allowance rates for DIP and PVC pipes joined with rubber gaskets as sealing members include the following joint types; bell and spigot, push on, mechanical, bolted sleeve type couplings, grooved and shouldered couplings
  - Calculate makeup water rates using the following equation.

$$Q = \frac{LD\sqrt{P}}{148{,}000}$$

Where:

Q = quantity of makeup water (gph)
L = length of pipe section being tested (ft)
D = nominal diameter of the pipe (in)
P = average test pressure during the hydrostatic test ($psi_{gauge}$)

  - Figure MA7.2 represents the calculated values of rates 1,000 feet of pipe at the 150 psi test pressure.

**Figure MA7.2 Allowable Testing Allowance for DIP and PVC Pipe (per 1,000' of pipeline at 150 psi)**

| Nominal Pipe Diameter (in) | Testing Allowance (gph) |
|---|---|
| 4 | 0.33 |
| 6 | 0.50 |
| 8 | 0.66 |
| 10 | 0.83 |
| 12 | 0.99 |
| 16 | 1.32 |
| 20 | 1.66 |
| 24 | 1.99 |
| 30 | 2.48 |
| 36 | 2.98 |
| 42 | 3.48 |
| 48 | 3.97 |
| 54 | 4.47 |
| 60 | 4.97 |

*Note: Table is an excerpt from AWWA M41 and AWWA C605.*

**Figure MA7.3 Allowable Testing Allowance Concrete Pressure Pipe**

| Type of Pipe | Makeup Allowance (gal/in dia/mi pipe/24hr) |
|---|---|
| AWWA C300, 301 and C303 | 10 |

*Note: Table is an excerpt from AWWA M9.*

B. Electrofusion Saddle Joint Test for:

- HDPE Pipe with electrofusion saddle connection for water services.

The contractor shall be responsible for testing the electrofusion saddle joint for leakage prior to tapping into the water main. Testing procedures are as follows:

1. Install electrofusion saddle based on the manufacturers recommended procedures and allow the joint to cool.
2. Visually inspect for defects, and repair, prior to conducting joint pressure test.
3. Install an appropriate joint testing device into the corporation stop. Device shall have a plain end HDPE pipe that directly connects to the service corporation stop and include a pressure gauge, and appropriate testing fitting appurtenance.
4. Gradually fill the saddle with air to 100 psig. The joint is acceptable if the 100psig is maintained for at least 5 min.
5. After successful testing of the saddle joint, complete tapping procedures.
6. If electrofusion saddle joint fails, completely remove the saddle and reinstall according to the listed installation requirements.

C. Cleaning and Disinfection

The contractor shall be responsible for cleaning and disinfecting the pipe. City Utilities is only responsible for monitoring, collecting, and testing samples during the cleaning and disinfection process.

1. Cleaning

- Thoroughly clean all piping, including flushing with water, in manner approved by City Utilities, prior to placing in service. Chlorine solution and sodium hypochlorite solution shall be flushed with water.

2. Disinfection:

- City Utilities requires disinfection of all potable and finished water piping.
- Prior to disinfection, clean piping as specified and flush thoroughly.

- Conform to procedures described in AWWA C651. Use the continuous feed or slug method of disinfecting.
- Utilize calcium hypochlorite in granular form containing 65 percent available chlorine by weight for disinfection.
- Bacteriologic samples and tests will be performed by a Water Maintenance and Service Technician. This includes procuring the sample, transporting sample to the Filtration Plant, and receiving and communicating the results of the test. Certified test laboratory report will be provided as needed. Notify Water Maintenance and Service a minimum 24 hours prior to testing.
- Chlorine concentration in water flowing through the new water main shall be between 50 and 100 mg/L free chlorine. The chlorine shall be applied continuously and for a sufficient period to expose all piping interior to a concentration of approximately 100 mg/L for at least 3 hours but not more than 24 hours. Disinfect piping and all related components. Repeat as necessary to provide complete disinfection.
- After required retention period,
    - Flush dechlorinated water to the Sanitary Sewer, unless otherwise acceptable to City Utilities.
    - If water has been properly dechlorinated, flushing to the Storm Sewer is acceptable. Properly dispose of chlorinated water in accordance with Laws and Regulations.
    - Do not discharge chlorinated water to storm sewers, ditches, or overland.
    - No flushing during a rain event.
- If first sample fails, one more is allowed. If the second sample fails, another flush must take place. If the sample failures continue, the disinfection process must be repeated. Contractor must remain on site for the entire disinfection process until the pipe passes.

D. Continuity Testing

Continuity testing of the tracing wire shall be performed by the contractor in the presence of the engineer. Continuity testing shall be performed using a direct-connect signal generating device and Schonstedt or equivalent underground pipe locating equipment along mains and services. Breaks in conductivity shall be repaired and the wire re-tested until tracing wire passes test.

## MA7.03 Polyvinylchloride (PVC) Pipe - Pressure

This section covers pressurized PVC pipe and the various joint types. Figure MA7.4 list typical pressure PVC pipe used for buried applications.

1. Pressure PVC Pipe

   Minimum wall thickness for potable water distribution is DR 18, sizes are based on DIP size.

2. Gaskets

   When pipe is installed in oil contaminated soils use Nitrile Gaskets.

3. Pipe Material Designation

   Pipe and couplings are made from PVC compounds having a minimum cell classification of 12454, as defined in ASTM D 1784.

**Figure MA7.4 Polyvinylchloride (PVC) Pipe- Pressure**

| Material | Pipe Designation | DR Minimum | Joints | Gaskets | Fittings | Sizes (in) | |
|---|---|---|---|---|---|---|---|
| | | | | | | Min | Max |
| Polyvinyl Chloride Pipe (PVC) | AWWA C900 | 18 | Bell and Spigot | ASTM F477 ASTM D3139 | Refer to Section MA7.12 | 6 | 16 |

## MA7.04 High Density Polyethylene (HDPE) Pipe - Pressure

This section covers pressurized HDPE pipe, FigureMA7.5 list typical HDPE pipe used for buried applications.

1. Pressure HDPE Pipe

   Minimum wall thickness for Potable Water Distribution is DR11, sizes are based on DIP size.

2. Pipe Material Designation

   Pipe material used for the manufacture of HDPE shall be extra high molecular weight, high density ethylene/hexane copolymer PE 4710 polyethylene resin meeting the requirements of ASTM D3350 with a cell classification of PE 445574C-CC3.

3. Adaptors

   Fused mechanical joint adaptors shall be used to connect to fittings and valves. Pipe stiffeners and wedge-style restraint are not permitted.

4. Joints

   All joints must utilize butt-fusion or electrofusion couplings.

**Figure MA7.5 High Density Polyethylene (HDPE) Pipe - Pressure**

| Material | Pipe Designation | DR Minimum | Joints | Gaskets | Fittings | Sizes (in) | |
|---|---|---|---|---|---|---|---|
| | | | | | | Min | Max |
| High Density Polyethylene (HDPE) Pipe | AWWA C906 | 11 | Butt Heat Fusion ASTM D3262 | - | Refer to Section MA7.12 | [1]6 | 36 |

*Note 1: Minimum of 2-inch HDPE pipe is acceptable in dead end applications, but required approval by City Utilities Engineering.*

## MA7.05 Ductile Iron Pipe (DIP)

This section covers ductile iron pipe (DIP) for buried applications. Figure MA7.6 lists acceptable ductile iron pipe for potable water distribution systems.

- Standard ductile iron pipe is cement mortar lined with a bituminous seal-coat.
- Consider alternative linings for services involving abrasives, pH levels below 4 and above 12 (6 and 12 without seal coat), acids, industrial wastes, chemicals and scum and grease lines.

**Figure MA7.6 –Ductile Iron Pipe**

| Material | Designation | Pressure Class | | Joints | Gaskets | Water Projects Lining | Coating | Sizes (in) | |
|---|---|---|---|---|---|---|---|---|---|
| | | Class | Designation | | | | | Min | Max |
| Ductile Iron | AWWA C151 | 250-350 | AWWA C150 | Push-on (AWWA C111 and C151) | Vulcanized SBR | Cement Mortar-AWWA C140 | Asphaltic - AWWA C151 | 24 | 54 |

1. Exterior Coating

   Minimum thickness of the asphaltic coating is 1 mil.

2. Exterior Wrap

   Encase DIP and appurtenances in a polyethylene wrap in accordance with AWWA C105. Polyethylene wrap supplied in sheets or tubes is acceptable. Minimum thickness of linear low-density polyethylene film is 8 mil. Circumferential wraps of adhesive tape should be placed at 2-ft intervals along the barrel of the pipe.

## MA7.06 Concrete Pressure Pipe

This section covers concrete pressure pipe, Figure MA7.7 list typical concrete pressure pipe.

1. Concrete Pressure Pipe

   - Pressure class is to be selected based on the project specific external and internal live and dead loads.

   A. Reinforced Concrete Cylinder Pipe is comprised of the following:

   - welded steel cylinder with steel joint rings welded to its ends
   - reinforcing cage or cages of steel bars
   - wire, or welded wire fabric surrounding the steel cylinder
   - wall of dense concrete covering the steel cylinder and reinforcing cage or cages inside and out
   - joints with a preformed watertight gasket.
   - fittings are fabricated from welded steel sheet or plate, and lined and coated with cement mortar

   B. Prestressed Concrete Cylinder Pipe is comprised of the following:

   - welded steel cylinder with steel joint rings welded to its ends
   - steel cylinder encased in concrete
   - reinforcement consisting of high-tensile wire wound around outside of the core in one or more layers at a predetermined stress and securely fastened at its ends
   - coating of dense mortar or concrete covering the core and wire, except surfaces of joint rings; self-centering joint with watertight preformed rubber gasket
   - For embedded cylinder pipe at least one-third of total core thickness shall be outside of cylinder.
   - Fittings are fabricated from welded steel sheet or plate, and lined and coated with cement mortar.

   C. Concrete Bar-Wrapped Cylinder Pipe is comprised of the following:

   - welded steel cylinder with sized steel joint rings welded to its ends
   - lining of concrete or cement mortar centrifugally applied within steel cylinder and spigot ring
   - reinforcement consisting of continuous steel rod wound helically around outside of cylinder at predetermined stress and securely fastened by welding to steel joint ring at each end of cylinder
   - a coating of dense mortar covering cylinder and rods, except for necessary exposed surfaces of spigot joint rings and a self-centering watertight preformed rubber gasket.
   - Fittings are fabricated from welded steel sheet or plate, and lined and coated with cement mortar.

2. Restrained Joints

   Refer to manufactures restrained joint recommendations for concrete pressure pipe.

**Figure MA7.7 Concrete Pressure Pipe**

| Material | Designation | Pressure Class | Joints | Gaskets | Fittings | Sizes (in) | |
|---|---|---|---|---|---|---|---|
| | | | | | | Min | Max |
| Reinforced Concrete Cylinder Pipe | AWWA C300 | 150-260 PSI | Bell and Spigot – Mortar Encased | Rubber O-Ring | AWWA C300 | 30 | 54 |
| Prestressed Concrete Cylinder Pipe - Lined | AWWA C301 | 250-350 PSI | | | AWWA C301 | 24 | 48 |
| Prestressed Concrete Cylinder Pipe - Embedded | | | | | | 54 | |
| Concrete Bar-Wrapped Cylinder Pipe | AWWA C303 | 400+ PSI | | | AWWA 303 | 24 | 54 |

## MA7.07 Service Connections

This section covers small and large service connections used for potable water distribution systems, refer to Figure MA7.8 for acceptable pipe material. For typical layouts of service connections refer to Standard Detail W-40.

1. Buried Service Identification

   - Refer to section MA7.12.11 for tracing wire material requirements.
   - Refer to Standard Details W-52 and W-53 for installation of tracing wire.

**Figure MA7.8 Service Connections**

| Service Size | Material | Pipe Designation | Sizes (in) | |
|---|---|---|---|---|
| | | | Min | Max |
| Small Services | High Density Polyethylene (HDPE) Tubing (DR9) | AWWA C901 | 1 | 2 |
| Large Services | PVC and HDPE | | 3 | - |

*Note: DI permitted at building in conjunction with backflow prevention or fire suppression.*

2. Corporation Stops

   Figure MA7.9 lists corporation stop requirements for various service diameters.

   - The corporation stops shall be ball type valves of extra heavy, all brass construction.
   - The corporation stops shall have a flat, thick, operating head with a 360 degree rotation.
   - The corporation stop inlet threads shall be machined with standard AWWA tapered threads.

**Figure MA7.9 – Corporation Stops**

| Manufacturer | Material | Product Number | Pressure Rating | Valve | Inlet | Outlet |
|---|---|---|---|---|---|---|
| Mueller | No Lead Brass | B-25000N | 300 PSI | Ball | AWWA Thread | Flare |
| | | B-25008N | | | | CTS Compression |
| Ford Meter Box Company | No Lead Brass | FB600-NL | 300 PSI | Ball | AWWA Thread | Flare |
| | | FB1000-NL | | | | CTS Compression |
| A.Y. McDonald | No Lead Brass | 74701B | 300 PSI | Ball | AWWA Thread | Flare |
| | | 74701B-22 | | | | CTS Compression |

3. Curb Stops

   Figure MA7.10 lists curb stop requirements for various service diameters. To maintain consistency install curb stops, in the open position, perpendicular to the street.

   - The curb stops shall be minimum ball type valves of extra heavy, all brass construction
   - The curb stops shall have a heavy or thick tee-head operator and a 90 degree rotation of the ball.
   - Each stop shall be equipped with a curb box.
   - Ball valves shall have Teflon coated balls and hard or synthetic rubber seat-rings.

4. Curb Boxes

   - Curb boxes shall be cast iron, Buffalo screw type boxes, and have a shaft size of 3” with a base sized appropriately to fit over the service line.
   - The word “water” shall be cast on the valve and curb box lid.
   - Refer to Standard Detail STR-44, for curb box layout.
   - Use Vadle or equivalent centering piece on ¾-inch and 1-inch curb stops.

**Figure MA7.10 – Curb Stops**

| Manufacturer | Material | Product Number | Pressure Rating | Valve | Inlets/Outlets |
|---|---|---|---|---|---|
| Mueller | No Lead Brass | B-25204N | 300 PSI | Ball | Flare |
| | | B-2520938N | | | CTS Compression |
| Ford Meter Box Company | No Lead Brass | B22-NL | 300 PSI | Ball | Flare |
| | | B44-NL | | | CTS Compression |
| A.Y. McDonald | No Lead Brass | 76100 | 300 PSI | Ball | Flare |
| | | 76100-22 | | | CTS Compression |

5. Service Tapping Saddles

   - Tapping saddles for PVC:
     The tapping saddles and hardware shall be ductile iron with epoxy coating, stainless steel or bronze material with AWWA tapered threads, and shall be hinged or bolted, both with a minimum strap width of 2”. A 3 piece tapping saddle design is not allowed.
   - Tapping Saddles for HDPE:
     Electrofusion saddles shall be used for service connections, and are manufactured in accordance with ASTM F-1055. Conform with the following material requirements:

     a) Pre-Blended resin PE2406/2708 which complies with ASTM D3350.

     b) Resin must be acceptable for use with potable water and comply with NSF Standard 61.

6. Pipe Stiffener for Services

   - Use full length stainless steel pipe inserts intended for use with compression style fittings.
   - Segmented and none-segmented styles are acceptable.
   - Stiffener must match the service line inner diameter and extend fully into the fitting.

## MA7.08 Fire Hydrants and Mainline Valves

This section covers fire hydrants, mainline valves and valves boxes for potable water mains.

1. Fire Hydrants

   Refer to Figure MA7.11 for acceptable fire hydrant types and manufactures, or approved equal. Fire hydrants are manufactured in accordance with AWWA C502

   Each hydrant shall be equipped with the following:

   - 1- 4½" pump connection with NSFH threads of 4 threads per inch
   - 2 - 2½" hose connections with NSFH 7½ threads per inch
   - The hydrant shall open left (counterclockwise) and be of sufficient length for 5' burial
   - Paint applied prior to shipment and after installation in accordance with AWWA C502. Federal yellow shall be the color used to paint all hydrants.
   - An auxiliary valve as detailed on fire hydrant assembly standards, refer to Chapter W7 - Appurtenances.
     Design such that the valve will remain closed if the upper portion of the fire hydrant is removed or broken off. The operating nut shall be pentagonal and shall turn counterclockwise to open.
   - The following fire hydrants, or approved equal, are acceptable for potable water mains, listed by manufacturer and model number:

**Figure MA7.11 – Fire Hydrants**

| Manufacturer | Model | Designation | Working Pressure (psig) | Hydrant Color | Standard Detail |
|---|---|---|---|---|---|
| American | American Flow Control B62B | AWWA C502 | 200 | Federal Yellow | W-17 |
| Clow | Medallion | | 250 | | |
| Kennedy | Guardian | | 250 | | |
| Muller | A-423 | | 250 | | |

2. Mainline Valves

   Refer to Figure MA7.12 for acceptable resilient wedge gate and butterfly valves, or approved equals. Use butterfly valves for valves 24-inches in diameter or greater; use resilient wedge gate valves for valves smaller than 24-inches in diameter.

   A. Resilient Wedge Gate Valves

      Resilient seated gate valves are to be manufactured in accordance with AWWA C515, and be equipped with the following:

      - Valves shall be ductile iron bronze mounted
      - Resilient seats applied in accordance with AWWA C515
      - Potable water mains use resilient seat gate valves unless the valves are not available in a required size.
      - Valves shall have mechanical joints, unless HDPE fusible end valve is used.

- Valves shall open right (clockwise) and shall be equipped with O-ring packing and a 2" operating nut and non-rising stem.
- Valves shall have stainless steel bolting.
- Valve body bonnet bolts shall be stainless steel

B. Butterfly Valves

Butterfly valves are to be manufactured in accordance with AWWA C504 and be equipped with the following:

- Stainless steel shafts, bolts, screws, and nuts.
- The shaft seats, bearings, operators, body and discs shall be designed based on Class 150B.
- The seating ring shall be made of rubber and located in the body or on the disc and shall be adjustable and field replaceable. The shaft shall be of the through type or stub type and shall be marked on the end to indicate the position of the valve disc with respect to the shaft.
- Discs shall be of corrosion-resistant alloy cast iron. The valves shall be equipped with a stainless steel stop in the body to prevent the disc from rotating through the closed position. The shaft seals shall be of the "split-V" or Chevron type. The operator shall be permanently lubricated and sealed for buried service and shall be equipped with a 2" square opening nut.
- The operator shall be constructed such that the valve will open right (clockwise).

3. Valve Boxes

- Valve boxes shall be cast iron, two piece, screw type, and have a shaft size of 5¼", with a round base.
- The word "water" shall be cast on the valve box lid.
- Refer to Standard Detail STR-43, for layout of valve boxes.
- Use Posicap valve box aligner or equivalent.

4. Mechanical Joint Bolts

- All bolts shall be Cor Blue, Blue Fluoro, or approved equal.

**Figure MA7.12 – Mainline Valves**

| Mainline Valve Type | Manufacturer | Model | Designation | Working Pressure (psig) | Sizes (in) | |
|---|---|---|---|---|---|---|
| | | | | | Min | Max |
| Resilient Wedge Gate Valves | American Flow Control | 2500 Series | AWWA C515 | 250 | 4 | 24 |
| | Clow | 2638 | | | 4 | 16 |
| | Kennedy | KS-RW | | | 4 | 16 |
| | Mueller | 2361 | | | 14 | 48 |
| | AVK (for HDPE) | Series 66 | | | 6 | 12 |
| Butterfly Valves | Clow/Kennedy | 4500 Series | AWWA C504 | 250 | 24 | 24 |
| | | 1450 Series | | | 30 | 48 |
| | Mueller | Lineseal XPII | | 250 | 24 | 48 |
| | DeZurik | BAW | | 250 | 24 | 48 |

## MA7.09 Air Release Structures

This section covers air release structures for water mains. In typical urban applications, water services and fire hydrants act as air release structures. Based on project specific requirements air release structures may be necessary and include the following:

- Doghouse style manhole
- Saddle or tee connection to the mainline
- Valmatic Model #25 VC Air Release Valve, or equal

Refer to Standard Details STR 40-1, STR 40-2, and STR 40-3 for layout of acceptable air release structures.

## MA7.10 Backflow Prevention

This section covers backflow prevention devices for use with potable water distribution systems. All backflow prevention devices must be approved and listed by the Foundation for Cross Connection Control and Hydraulic Research as published by the University of Southern California. Current listings are available from the following locations:

- University of Southern California

  http://www.usc.edu/dept/fccchr/list.html

- IDEM – Title 327 IAC 8- 10
  http://www.in.gov/legislative/iac/T03270/A00080.PDF

Refer to Standard details W-30, W-31, W-32, W-33, and W-34 for the layouts of acceptable backflow prevention devices.

## MA7.11 Water Meters

This section covers water meters and water meter boxes for potable water distribution systems.

1. Water Meters

   Meters are supplied, installed, and maintained by Water Maintenance and Service.

2. Water Meter Boxes

   - Water Meter Boxes shall be manufactured by Ford Meter Box Company Wabash, or Engineer approved equal, and equipped with a double lid cover and a yoke bar.
   - Use a plastic pit setter; refer to W-61 for the size and spacing requirements and W-56 & W-57 for the meter pipe cover requirements.

## MA7.12 Water Appurtenances

This section covers water appurtenances, for potable water distribution systems, including:

- Buried Piping Identification
- Polyethylene Wrap
- Restraint Devices
- Fittings

1. Buried Piping Identification

   The following materials are used for identifying buried water infrastructure. Tracing wire is used on all water mains, regardless of material, including service lines.

   A. Tracing Wire

      - Open Cut Installation: Use # 12 or stronger High Strength, Copper Clad Steel Reinforced, HDPE insulated tracing wire with 21% conductivity for locating purposes and a minimum break load of 300lbs.
      - Trenchless Installation: Use # 12 or stronger Extra High Strength, Copper Clad Steel Reinforced, HDPE insulated tracing wire with 21% conductivity for locating purposes and a minimum break load of 1,100lbs.

   B. Waterproof Connection Device

      Use a DRYCONN direct bury lug to connect mainline tracing wire to service line tracing wire and splice tracing wire.

C. Tracing Wire Corrosion Protection

Use a magnesium alloy sacrificial anode, manufactured in accordance with ASTM B843, to protect tracing wire from corrosion. The following packaged anode, or approved equal, are acceptable:

- Packaged Magnesium Anode 17D4 as manufactured by Corrpro Companies Inc.

Tracing Wire Corrosion Protection Installation:

1. Install magnesium anodes onto the tracing wire. Place at approximately 3,000 feet spacing intervals along the entire length of the proposed pipeline.
2. Connect the lead wire from the anode to the tracing wire using approved direct bury lug connectors.
3. Insulate the splice with two half-lapped layers of 3/4 inch wide self-sealing rubber tape followed by two half-lapped layers of 3/4 inch wide electrical tape.
4. Do not dangle the anodes by the lead wire.

2. Polyethylene Wrap

Refer to Section MA7.05 for polyethylene wrap requirements.

3. Restraint Devices for PVC

For restraining water main joints use wedge action retainer glands that are manufactured in accordance with AWWA C110 or AWWA C153. The following types or approved equal are acceptable:

- EBBA Iron– MegaLug
- Romac – RomaGrip
- Sigma – One-Lok
- Stargrip – Series 3000

When water main diameter exceeds 12-inches, consult with City Utilities for appropriate restraint devices.

4. Restraint Devices for HDPE

Fused mechanical joint adaptors shall be used.

Thrust anchors or approved equal shall be used where the Poisson effect is anticipated.

5. Fittings for PVC Pipe

Fittings for PVC water mains shall be ductile iron and conform to the requirements listed in Figure MA7.13. Appropriate pressure rating, gaskets, bolts, and nuts shall be used for joints. All restraint bolts are to be Co Blue Fluoro or approved equal.

**Figure MA7.13 – Ductile Iron Water Main Fittings for PVC**

| Fittings | Designation | Gaskets | Coating | Lining |
|---|---|---|---|---|
| Compact | AWWA C153 | AWWA C111 | Asphaltic | Cement Mortar AWWA C104 |

6. Fittings for HDPE Pipe

   Fittings for HDPE water mains shall be HDPE and conform to the requirements listed in Figure MA7.14. Fittings shall have a pressure rating equal to or greater than the pipe mainline material and conform to NSF Standard 61 and AWWA C906. Join fittings with butt fusion welds or electrofusion couplings.

**Figure MA7.14 – HDPE Water Main Fittings for HDPE Pipe**

| Fittings | Designation | Pressure Rating | Sizes | |
|---|---|---|---|---|
| Molded | ASTM D3261 | ≥ pressure rating of mainline pipe | 6 | 12 |
| Fabricated | ASTM F2206 | Min. DR9 | 12 | 24 |