

## **SECTION 331100 – WATER MAINS AND ACCESSORIES**

### **Scope:**

This specification covers all aspects of requirements for new water mains, taps, and related accessories including submittals, products, and implementation. All new water infrastructure will be designed to meet required flows of the customer, the fire department responsible for the particular jurisdiction, and the Minimum Standards for Public Water Systems (May 2000) published by the Drinking Water Permitting and Engineering Program of the Georgia Environmental Protection Division. Design flows for new systems and taps will be determined by evaluating similar types of customers using actual metered data and contacting the appropriate fire department. Where data is not available, the Minimum Standards for Public Water Systems (May 2000) published by the Drinking Water Permitting and Engineering Program of the Georgia Environmental Protection Division will be used.

### **PART 1 - H.D.P.E. Pipe Specifications for Transmission of Potable Water**

#### **Scope:**

The Contractor will install water mains less than 8-inch in size using SDR 9 HDPE pipe for the transmission of potable water as shown on the Drawings and in accordance with these Specifications. Water mains larger than 8" shall be ductile iron pipe as presented in the applicable part of this Section and on the Drawings. HDPE pipe shall be installed in road right-of-ways or easements obtained by the Owner using trenching or horizontal boring in accordance with these specifications.

#### **Submittals:**

- A. The Contractor will submit complete product data from named vendor on all products proposed for use in the project.
- B. Results from recording of each fuse on HDPE pipe will be submitted to the Owner as part of the installation record.
- C. Contractor will submit a proposed method for pigging or cleaning lines for approval by the Owner after installation.
- D. Contractor shall provide proof of qualification for all labor involved in fusing of HDPE pipe. Proof of qualification shall be written confirmation of training by a manufacturer involved in the manufacture of HDPE pipe for more than two years. Only individuals with such qualifications will be allowed to perform fusing operations.
- E. Contractor shall submit proposed pressure testing methodology for review by the Owner prior to initiating any final pressure testing of pipe.

#### **Products:**

This section of the specifications covers the requirements for high density polyethylene pipe (HDPE) for transmission of potable water, fittings, accessories, and service lines. The minimum pipe size allowed is 2-inch for dead ends of less than 600 linear feet. The minimum pipe size for all other water mains is 6-inch.

- A. HDPE Pipe: Polyethylene pipe shall conform to ANSI/AWWA Standard C 906-90 (or most recent edition) and NSF 61. The pipe shall be PE 3408 with an SDR of 9 as directed by the owner and be rated for a pressure of 200 p.s.i., respectively. The carbon black content shall measure 2% to 3% by weight when tested according to ANSI/ASTM D 1603 or ASTM D 4211. The pipe shall be provided in ductile iron pipe sizes. The pipe shall be produced by Rinker, J-M PE Corporation Pipe, or equal. All polyethylene pipe shall be blue PRISMA coated or shall have co extruded blue striping for identification. The manufacturer shall have

an ISO 9001 listing covering the HDPE manufacturing facility as well as the corporate office. The Owner at no additional cost may require quality audits. All pipe will be provided in standard straight lengths. No coiled pipe will be accepted for installation on the project.

- (1) **Quality and Inspection:** All pipe shall be smooth on both the interior and exterior surfaces; be free of noticeable imperfections such as cracks, blisters, or kinks in the pipe. The Owner, if he so chooses, shall be able to inspect the pipe at the pipe plant, trench, and other various storage sites. Based on these observations the Owner will have the right to reject any and all piping not conforming to these stated requirements, independent of laboratory tests. Field repair of any damaged piping shall not be permitted. The Owner reserves the right to require the removal of fused connections for destructive testing to verify the integrity of fused joints, etc.
  - (2) **Experience of Manufacturer:** The pipe manufacturer shall provide evidence, if requested by the Owner, of having provided quality pipe and joints that have shown satisfactory results in service for a period of no less than two years. Evidence of completion of projects of similar size and timing for HDPE pipe will also be provided upon Owner request. All pipe within any given phase shall be from the same manufacturer.
  - (3) **Fittings:** The fittings shall meet all of the requirements of the pipe to which they are to be fused. They shall be homogeneous throughout and essentially uniform in color, opacity, density and other properties. Fittings should also be free of such defects as cuts, cracks, or holes. Fabricated fittings will not be allowed where molded or machined fittings are available. All fittings will be manufactured in accordance with AWWA C906 with a minimum pressure class of 200 psi.
  - (4) **Markings:** Markings shall be legible during usual handling of the pipe and be applied in a manner that will not damage the pipe. The following markings shall be provided as shown below:
    - a. Nominal size and OD base
    - b. Standard material code designation
    - c. Dimension ratio
    - d. Pressure class
    - e. AWWA designation for this standard (AWWA C 906-90)
    - f. Manufacturers production code
    - g. Material test category of pipe
    - h. NSF 61 approved
- B. **Locating Wire & Detector Tape:** The Contractor will supply all locating wire and detector tape. Locating wire shall be 8 gage, coated wire for the HDPE mainlines and 12 gage, coated wire for the HDPE service lines. Detection tape shall be composed of a solid aluminum foil encased in a protective plastic jacket. Tapes shall be color coded in accordance with AWWA color codes with the following legends: Water Systems, Safety Precaution Blue, "Caution Water Line Buried Below". Tape shall be permanently printed with no surface printing allowed. Tape width shall be a minimum of 2-inches when buried less than 10-inches below surface and 3-inches when buried greater than 10-inches. Tape shall be equal to Lineguard Type II Detectable, Allen Systems Detectatape, or equal
- C. **Electrofusion Couplings:** Electrofusion couplings and saddles will not be used on this Project without written approval of Owner.
- D. **Flange Assemblies:** Flange assemblies shall consist of a metal back-up flange or ring and a polyethylene flange adapter. The back-up flange shall be slipped over the pipe profile flange adapter and then be fused into the plain end pipe.

- E. The service lines shall be polyethylene tubing material with the standard PE code designation of PE 3408. Polyethylene tubing and piping shall SDR 9 as directed by the owner and be rated for a pressure of 200 psi p.s.i. respectively. Service tubing shall comply with all requirements of AWWA C901-02 for Polyethylene Pressure Pipe and Tubing, ½ inch through 3 inch for water service. Tubing dimensions shall be compatible with copper tubing outside dimensions. All tube and pipe shall be smooth on both the interior and exterior surfaces; be free of noticeable imperfections such as cracks, blisters, or kinks in the pipe. The Owner, if he so chooses, shall be able to inspect the tube or pipe at the pipe plant, trench, and other various storage sites. Based on these observations the Owner will have the right to reject any and all piping not conforming to these stated requirements, independent of laboratory tests. Field repair of any damaged tubing or piping shall not be permitted.

**Implementation:**

- A. Unloading: Equipment and facilities for unloading, hauling, distributing and storing materials shall be furnished by the Contractor and shall at all times be available for use in unloading materials. Delays in unloading railroad cars, unloading trucks, or hauling from freight terminal that incur demurrage, truck waiting charges or terminal charges shall be at the expense of the Contractor.
- B. Handling: Pipe, fittings and other material shall be carefully handled so as to prevent breaking and/or damage. Pipe may be unloaded individually by hand but shall not be unloaded by rolling or dropping off of trucks or cars. Preferred unloading is in units using mechanical equipment, such as forklifts, cherry pickers or front end loaders with forks. If forklift equipment is not available units may be unloaded with use of spreader bar on top and nylon straps looped under the unit.
- C. Distributing: Materials shall be distributed and placed so as to least interfere with traffic. No street or roadway may be closed without first obtaining permission from the proper authorities. The Contractor shall furnish and maintain proper warning signs and obstruction lights for protection of traffic along highways, streets, and roadways upon which material is disturbed. No distributed material shall be placed in drainage ditches.
- D. Storage: All pipe, fittings and other materials which cannot be distributed along the route of the work shall be stored for subsequent use when needed. The Contractor shall make his own arrangements for the use of storage areas; except that, with permission, he may make reasonable use of the Owner's storage yards.
- E. Joining Methods for HDPE Pipe: The pipe and fittings shall be joined by butt or saddle fusion, mechanical joint adapters, or by flange connections in accordance with manufacturer's recommendations. All joints shall be fused, not including connections to existing utilities, unless otherwise shown on Drawings or requested by the Owner.
- (1) Fusion: The pipe shall be joined by heat fusion of the ends. Prior to fusion the pipe shall be clean and the ends shall be cut square. Fusion system operators shall be trained in the use of the equipment by the pipe supplier or manufacturer of the fusing machine and be experienced in the operation of the equipment. All fuses shall be recorded, the recording of the information must be provided to the Owner, and the recorded information must meet the standard requirements of the pipe manufacturer. All fusions failing to meet these requirements shall be removed and refused.
  - (2) Flange: A flange assembly consists of a metal back-up flange or ring and a polyethylene flange adapter. The back-up flange is slipped over the pipe profile and the stub-end, or flange adapter, is then fused into the plain end pipe.

- (3) Connection to Ductile Iron Pipe or Valves and Fire Hydrants: Connections to ductile iron pipe, valves, and fire hydrants shall be by mechanical joints or flanges. All connections to ductile iron pipe, valves or fire hydrants must be restrained.
- a. Restrained Mechanical Joints: Restrained mechanical joints shall be made using mechanical joint adapters and shall incorporate a factory installed stiffener manufactured by Rinker, J-M PE Corporation Pipe, or equal.
  - b. Flange: Flange connections shall be as described above in E (2).
- F. Installation of Locating Wire and Detector Tape: The Contractor shall be required to install locator wire along the entire section of pipeline and along all service connections. The locator wire shall be installed simultaneously with the polyethylene piping. Detector tape shall be installed by the Contractor once backfill has been placed and compacted to at least 12 inches above the top of the pipe and not more than 18 inches above the top of the pipe. Wire shall be properly spliced at each end connection and each service connection. Care should be taken to adequately wrap and protect wire at all splice locations. No bare wire shall be accepted. There will be no additional pay item for this work; it should be included in the Unit Price for installing polyethylene pipelines and services.
- G. Backfill and Bedding: Contractor will install pipe in accordance with ASTM D 2774 Standard Practice for Underground Installation of Thermoplastic Pipe, AWWA C906-90 (as amended), and the manufacturer's recommendations. Pipe shall not be installed in water or wet mucky soils, on rock or stony soil. When these conditions exist, Contractor shall remove the objectionable material to a depth of 6" below the pipes final grade and install crushed stone or other approved bedding materials.
- H. Cold (Field) Bending: Contractor shall not bend the pipe to fit a trench more than that allowed by the pipe manufacturer. For 6" and 8" SDR 9 pipe, the bending radius will not be less than 20 times the outer diameter of the pipe. For SDR 11 pipe, the bending radius will not be less than 25 times the outer diameter of the pipe.
- I. Installation by Pulling In: Contractor will submit to Owner maximum proposed pull in length for the pressure class and diameter pipe proposed to be pulled into an open trench. Pull in lengths will not exceed the maximum lengths recommended by the manufacturer for the class and diameter pipe. Final tie-ins should be made one day after pulling in to allow the pipe to recover from the stress of the pulling.
- J. Installation by Horizontal Boring or Directional Drilling: This work shall be done in accordance with Section 02229. Contractor shall install pipe under creeks and County Roads using horizontal boring or directional drilling when directed by Owner. Casing pipe will be installed for all creek and road crossings. The pipeline shall then be installed directly into the casing without centering spacers. At casing exit or entry points, pipe should be wrapped with an elastomeric sheet material.
- K. Protection of Pipe Openings: During installation, the Contractor will ensure that pipe ends that have not been fused will be protected against dirt, debris, animals, and other foreign materials. Plastic caps held in place with duct tape or other methods as approved by the Owner may be used.
- L. Connecting Service Lines to Main Lines: Connection to the main lines shall be made by using self-tapping saddles with integral cutters fused to the main line. Electro-fusion saddles are not allowed without prior approval of Owner. A curb cock shall be installed on the self-tapping saddle with a compression fitting. The meter connection shall be installed with a compression joint (Compression fittings shall have stiffener inserts listed with NSF for potable water service as made by Romac, Philmac or equal inserted in the tubing before

making the connection). The joints must withstand 200 psi test pressure. The curb stop and meter fitting shall be Mueller or equal.

- M. Installation of Fire Hydrants: Fire hydrants, in general, shall be installed and jointed as specified above for pipe and fittings. The installation of hydrants shall include the installation of extension sections, if required, and shall include the installation of crushed stone drain as shown on the Drawing Details and/or as specified herein. Class 1 or 2 soil materials will be installed under all fire hydrants to a depth of at least 6 inches as shown in the plans.
- N. Blocking and Restraining: Contractor shall fully restrain the pipe through the use of fully restrained joints by means of butt fusion, M-J adapters, or flange adapters. Do not use thrust blocks with HDPE pipe installations.
- O. Cleaning: Before acceptance of any line, the line must be clean. If the Contractor fails to close the pipe or debris is found to be in the line, the Contractor shall clean the line by pigging or other suitable means at the Contractor's expense. The Contractor shall be prepared to pig all lines installed within this project in order to remove the HDPE pipe shavings, etc. The successful bidder must propose a method of pigging the lines for approval by Dalton Utilities before proceeding with any pigging operations. This request must be submitted in writing and shall be approved in writing by the Owner prior to line purging.
- P. Testing: Testing of HDPE pipe installations will include destructive testing as well as final pressure testing to ensure no leaks are present in the line.
- (1) At the direction of the Owner, Contractor will perform destructive strap testing on selected fuses to determine if the fuses meet with manufacturer's requirements. Pipe used in this testing will not be installed in the Project.
  - (2) The testing of the HDPE pipe will be performed in accordance with AWWA C906-90 (as amended) and the manufacturer's recommendations. Contractor will submit a test protocol to the Owner for approval prior to implementing any testing.
- L. Sterilization of Pipe Lines: The AWWA Standard for Disinfecting Water Mains ANSI/AWWA C 651-92 (as amended to date) and these Specifications shall be the standard used to disinfect all new water lines and any existing lines contaminated during construction. The Contractor shall furnish all equipment and labor of every nature to disinfect new lines and any line contaminated during construction.
- (1) Clean Lines: Care shall be taken during construction to keep line free from debris, ground water and dirt.
  - (2) Cross Connections: Cross connections shall not be allowed during testing, flushing, chlorinating, or dechlorinating of the new lines.
  - (3) Flushing: All new lines shall be flushed before disinfecting. The recommended velocity by ANSI/AWWA C 651-92 for flushing is 2 ½ feet per second.
  - (4) Chlorination: All pipe and appurtenances, both existing and newly constructed which have been exposed to contamination by reason of the construction shall be sterilized after testing and flushing of the line has been completed. The line shall be filled, using the continuous feed method, with fresh water containing 50 parts per million of chlorine and allowed to stand for 24 hours. During the test, chlorine residuals shall be checked every 1200 feet on new lines, at the end of each new line, and at the end of all new service lines or connections.
  - (5) Dechlorination: After the new lines have been chlorinated for 24 hours, the chlorinated water shall be flushed from the lines. The discharge of the chlorinated

waste shall be chemically treated to remove the residual chlorine. (See appendix of ANSI/AWWA C 651-92 for chemicals and amounts to dissipate the chlorine.) The method for mixing and contact time shall be arranged by the Contractor.

- (6) Connections: After the pipe and appurtenances have been flushed, tested, chlorinated, and have passed the bacteriological test, they may be connected to the existing system.
- (1) Connections Equal to or Less than One Pipe Length (18 feet): The new pipe, fittings, and valves required for the connections shall be spray disinfected or swabbed with a minimum 1% solution of chlorine just prior to being installed, if the length of connection from the new main to the existing main is equal to or less than 18 feet.
- (2) Connections Greater Than One Pipe Length: The pipe required for the connection must be set up above ground, chlorinated and bacteriological samples taken as described above if the length of connection is greater than 18 feet. After the bacteriological tests have proven satisfactory, the new pipe can be used in connecting the new main to the existing system. After the samples have been taken, the ends of the new pipe must be closed with water-tight plugs or caps until the connections are made.

## **PART 2 - Ductile Iron Pipe Specifications for Transmission of Potable Water**

### **Scope:**

The Contractor shall provide all products and perform all labor associated with the installation of Ductile iron pipe in accordance with the Drawings. Ductile iron pipe meeting the requirements of this part of Section 02665 shall be used for all 12" through 30" pipe installed on the Project.

### **Submittals:**

Complete shop drawings and engineering data for all products shall be submitted to the Owner. In addition, the proposed route for laying of the 24" and 30" lines detailed in the Drawings shall be provided to the Owner for approval prior to beginning installation.

### **Products:**

- A. Ductile iron pipe shall be a minimum Special Thickness Class 51, unless otherwise specified or shown on the Drawings. All pipe shall be 6 inch through 30 inches in diameter and shall be installed in lengths of 18 to 20 feet. Minimum acceptable working pressure will be 350 psi for 6" through 12" pipe and 250 psi for 24" and 30" pipe. Ductile iron pipe shall be manufactured in accordance with AWWA C 151.
  - (1) Flanges: Flanged pipe shall have a minimum wall thickness equal to Special Class 53. All flanges shall be furnished by the pipe manufacturer.
  - (2) Lining and Coating: Pipe and fittings shall be cement lined in accordance with AWWA C 104. Pipe and fittings shall be installed with a bituminous outside coating and interior seal coating.
  - (3) Joints: Joints shall be push-on for pipe and standard mechanical for fittings, unless otherwise shown or specified. Push-on and mechanical joints shall conform to AWWA C 111.
  - (4) Flanged Joints: Flanged joints shall meet the requirements of ANSI B16.1, Class 125.

- (5) Ductile Iron Pipe Fittings: Fittings shall be ductile iron and shall conform to AWWA C 110 or AWWA C 153 with a minimum rated working pressure of 250 psi.
- (6) Gaskets: Appropriate gaskets for mechanical and flange joints shall be installed. Gaskets for flange joints shall be made of 1/8-inch thick, cloth reinforced rubber; gaskets may be ring type or full-face type.
- (7) Nuts and Bolts:
  - a. All bolts and nuts shall be threaded in accordance with ANSI B1.1, Coarse Thread Series, Class 2A external and 2B internal fit. All nuts and bolts shall be manufactured in the U.S.A.
  - b. Nuts and bolts for mechanical joints shall be Tee Head bolts and nuts of high strength low-alloy steel in accordance with ASTM A 242 to the dimensions shown in AWWA C111/ANSI A21.11.
  - c. Flanged joints shall be bolted with through stud or tap bolts of required size as directed. Bolt length and diameter shall conform to ANSI/AWWA C 115 for Class 125 flanges shown in ANSI/ASME B16.1.
- (8) Glands: Mechanical joint glands shall be ductile iron.
- (9) Polyethylene Film: Ductile iron pipe shall be encased with polyethylene film where shown on the Drawings or requested by the Owner. Polyethylene film shall have a minimum thickness of 8 mils, be tubular and meet the requirements of AWWA C105.
- (10) Thrust Collars: Thrust collars shall be welded-on ductile iron body type designed to withstand thrust due to 250 psi internal pressure on a dead end.
- (11) Welded-On Outlets: Welded-on-outlets shall be fabricated from centrifugally cast ductile iron pipe, manufactured and tested in accordance with ANSI/AWWA C151/A21.51. The outlet shall be furnished with a mechanical joint, restrained joint, flanged or plain end as required for the work. The outlets shall be rated for a minimum working pressure of 250 psi. All welding, fabrication and outlet hole drilling shall be performed by the manufacturer.
- (12) Inspection: Final acceptance will be on the basis of the Owner's inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards. Pipe damaged during unloading, transportation or storage shall not be installed.
- (13) Mechanical joint restraint devices: Mechanical joint restraint devices nominal pipe sizes 3 inch through 48 inch shall consist of multiple gripping wedges incorporated into a follower gland meeting the applicable requirements of ANSI/AWWA C110/A21.10. The devices shall have a working pressure rating of 350 psi for 3-16 inch and 250 psi for 18-48 inch. Ratings are for water pressure and must include a minimum safety factor of 2 to 1 in all sizes. Gland body, wedges and wedge actuating components shall be cast from grade 65-45-12 ductile iron material in accordance with ASTM A536. Ductile iron gripping wedges shall be heat treated within a range of 370 to 470 BHN. Three (3) test bars shall be incrementally poured per production shift as per Underwriter's Laboratory (U.L.) specifications and ASTM A536. Testing for tensile, yield and elongation shall be done in accordance with ASTM E8. Chemical and nodularity tests shall be performed as recommended by the Ductile Iron Society, on a per ladle basis. All components shall be manufactured and assembled in the United States. Restraint devices shall be Listed by Underwriters Laboratories (3" through 24" inch size) and Approved by Factory

Mutual (3" through 12" inch size). Mechanical joint restraint shall be Megalug Series 1100 produced by EBAA Iron Inc. or approved equal.

- B. **Copper Pipe Service Lines:** The service lines off of ductile iron pipe water mains shall be copper tubing material conforming to ASTM B 88, Type K. Fittings shall be brass with compression connection inlets and outlets, ANSI B16.26. Adapters shall be brass ANSI B16.18, where required. Unions shall be cast bronze and all joints shall be compression type.
- C. **Detection Tape:** Detection tape shall be composed of a solid aluminum foil encased in a protective plastic jacket. Tapes shall be color coded in accordance with AWWA color codes with the following legends: Water Systems, Safety Precaution Blue, "Caution Water Line Buried Below". Tape shall be permanently printed with no surface printing allowed. Tape width shall be a minimum of 2-inches when buried less than 10-inches below surface and 3-inches when buried greater than 10-inches. Tape shall be equal to Lineguard Type II Detectable, Allen Systems Detectatape, or equal.
- D. **Curb Stops and Meter Fittings:** The curb stop and meter fitting shall be Mueller or equal.

#### **Implementation:**

- A. **Unloading:** Equipment and facilities for unloading, hauling, distributing and storing materials shall be furnished by the Contractor and shall at all times be available for use in unloading materials. Delays in unloading railroad cars, unloading trucks, or hauling from freight terminal that incur demurrage, truck waiting charges or terminal charges shall be at the expense of the Contractor.
- B. **Handling:** Pipe, fittings and other material shall be carefully handled so as to prevent breaking and/or damage. Pipe may be unloaded individually by hand but shall not be unloaded by rolling or dropping off of trucks or cars. Preferred unloading is in units using mechanical equipment, such as fork lifts, cherry pickers or front end loaders with forks. If fork lift equipment is not available units may be unloaded with use of spreader bar on top and nylon strips or cables (cushioned with rubber hose sleeve) looped under the unit.
- C. **Distributing:** Materials shall be distributed and placed so as to least interfere with traffic. No street or roadway may be closed without first obtaining permission from the proper authorities. The Contractor shall furnish and maintain proper warning signs and obstruction lights for protection of traffic along highways, streets, and roadways upon which material is disturbed. No distributed material shall be placed in drainage ditches.
- D. **Storage:** All pipe, fittings and other materials which cannot be distributed along the route of the work shall be stored for subsequent use when needed. The Contractor shall make his own arrangements for the use of storage areas; except that, with permission, he may make reasonable use of the Owner's storage yards.
- E. **Installation of Pipe:** Contractor shall install ductile iron pipe in accordance with manufacturer's instructions and AWWA C600-99 as amended.
  - (1) Pipe, fittings, valves and hydrants shall be lowered into the trench in a careful manner using slings and ropes as necessary to avoid damage to the water main or the protective coatings of the water main. Pipe shall in no cases be dropped into the trench.
  - (2) All lumps, blisters, and excess coatings shall be removed from the socket and the plain ends of each pipe, and the outside of the plain end and the inside of the bell



shall be wiped clean and dry to ensure the removal of all dirt, sand, grit and other foreign materials prior to laying the pipe. No pipe containing dirt, debris or other foreign materials shall be laid.

- (3) As each pipe length is laid, the Contractor shall assemble the joint and bring the pipe to proper grade and alignment. Pipe shall be secured in place with the proper backfill.
- (4) Contractor shall not deflect any joint more than the maximum deflection recommended by the manufacturer. Contractor shall maintain a transit on site to check that deflections allowances are not exceeded.
- (5) Joints shall be push-on, mechanical or flange and shall be assembled in accordance with manufacturer's instructions.
- (6) Cutting of pipe: Cut ductile iron pipe using an abrasive wheel saw. Remove all burrs and smooth end before jointing. The Contractor shall cut the pipe and bevel the end, as necessary, to provide the correct length of pipe necessary for installing the fittings, valves, and accessories in the correct locations.
- (7) Quality and Inspection: All pipe shall be smooth on both the interior and exterior surfaces; be free of noticeable imperfections such as cracks, blisters, or kinks in the pipe. The Owner, if he so chooses, shall be able to inspect the pipe at the trench and other various storage sites. Based on these observations the Owner will have the right to reject any and all piping not conforming to these stated requirements, independent of laboratory tests. Field repair of any damaged piping shall not be permitted.

**M. Bedding of Ductile Iron Pipe:** All pipe shall be laid on foundations prepared in accordance with the following specifications. Pipe shall be laid as specified using the following classes of bedding required for the various type soils and conditions encountered. Bedding for all pipe shall be in accordance with ASTM D 2321, as amended to date, the manufacturer's recommendations and these Specifications.

- (1) Bedding Material: Class I, and II, type materials can be used in all conditions for bedding. Type III materials can be used for bedding and haunching in dry ditches. Class IV and V materials will not be permitted for bedding and haunching under any condition.
- (2) Depth of Bedding: Trench shall be undercut to allow for a minimum of six inches (6") of bedding material. After joint assembly, Bedding material shall be placed under and up to the spring line of the pipe for the entire length of pipe and compacted. Compaction to the spring line of the pipe shall be of the same material used in the bedding. Selected backfill shall then be carried to a point twelve inches (12") above the top of pipe, using hand tools for tamping. Puddling will not be allowed as a method of compaction. The remaining backfill shall be as specified in "Selected Backfill" and "General Backfill" paragraphs of these specifications. Pipe shall have at least thirty-six inches (36") of cover before wheel loading and at least forty eight inches (48") of cover before using heavy duty tamping equipment such as a hydrohammer.
- (3) Definition of Bedding Material: Class I, II, III, IV, and V materials are defined as follows:

Class I	Angular ¼ to ¾ inches graded stone test revision of ASTM C 33 - Gradation # 67 (ASTM #67) or # 57 (ASTM #57) are acceptable.
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Class II	Coarse sands and gravel with maximum particle size of $\frac{3}{4}$ inches including variously graded sands and gravel containing small Percentages of fines, generally granular and non-cohesive, either wet or dry.
Class III	Fine sand and clayey (clay filled) gravel, including fine sands, sand-clay mixtures and gravel-clay mixtures.
Class IV	Silt, silty clays and clays, including inorganic clays and silts of medium to high plasticity and liquid limits.
Class V	This class includes organic soils as well as soils containing frozen earth, debris, rocks larger than 1-1/2 inches in diameter, and other foreign materials.

- (4) Trench Width: The maximum clear trench width at the top of the pipe shall not exceed a width equal to the nominal pipe diameter plus eighteen inches (18"). If this width is exceeded or the pipe is installed in a compacted embankment, pipe embedment shall be compacted to the trench walls.
- (5) Trench Depths: Maximum depth of backfill over ductile iron pipe shall be in accordance with manufacturer's recommendations and in any case shall not exceed 30 feet when Class I bedding and compaction to 95% of maximum dry density is achieved.

- F. **Connection of New Water Mains to Existing Water Mains:** The Contractor will be required to make connections to existing pipe lines as shown on the drawings. Before laying pipe, locate the points of connection and allow the Owner to confirm the nature of the connection. Contractor shall make connections to existing water mains only when system operations permit. Operation of existing valves shall be only under direct supervision of the Owner. Tapping saddles and tapping sleeves shall be installed as follows:
- (1) Holes in new pipe shall be machine cut, either in the field or at the factory. No torch cutting of holes shall be allowed.
  - (2) Prior to attaching saddles or sleeves, the existing pipe shall be thoroughly cleaned, utilizing a brush and rag to the satisfaction of the Owner.
  - (3) Before performing field machine cut, the watertightness of the saddle or sleeve assembly shall be pressure tested. The interior of the assembly shall be filled with water. An air compressor shall be attached which will induce a test pressure of 200 psi. No leakage shall be permitted for a period of 10 minutes.
- G. **Connections of Services to Main Lines:** Connection to the main lines shall be made by tapping into the main through a corporation stop. A corporation cock must be provided in the water main for each new service line. The joints shall withstand 200 psi test pressure. Bedding of service lines shall be equal to that used for ductile iron pipe.
- N. **Installation of Fire Hydrants:** Fire hydrants, in general, shall be installed and jointed as specified above for pipe and fittings. The installation of hydrants shall include the installation of extension sections, if required, and shall include the installation of crushed stone drain as shown on the Details in the Drawings. Fire hydrants shall be installed in accordance with AWWA C503-88 (as amended).
- O. **Blocking and Restraining:** Provide restraint at all points where hydraulic thrust may develop.

- (1) Retainer glands shall be used on fire hydrants, fittings and valves in addition to concrete blocking. Retainer glands shall be installed in accordance with the manufacturer's instructions, especially with respect to the torque of set screws. The Contractor shall provide a torque wrench to verify the torque on all set screws which do not have inherent torque indicators.
  - (2) Provide concrete blocking for all bends, tees, valves and other points where thrust may develop. All piping shall be properly blocked and restrained prior to pressure testing and placing the new line into service. All concrete blocking shall be allowed to achieve initial set prior to any loading of the pipeline. Blocking shall be as shown on the Drawings. Where rodding is required to restrain piping, all thread rods shall be coated as directed by the Owner prior to encasing with concrete and backfilling.
- P. **Cleaning**: Before acceptance of any water line, the line must be clean. If the Contractor fails to close the pipe or debris is found to be in the line, the Contractor shall clean the line by pigging or other suitable means at the Contractor's expense. The Contractor must propose a method of pigging the lines for approval by Owner before proceeding with any pigging operations. This request must be submitted in writing and shall be approved in writing by the Owner prior to line purging. No separate payment shall be made for the above work.
- Q. **Testing Pressure Lines**: Testing of ductile iron pressure pipe shall be in accordance with AWWA. The pipe line shall be filled with water, air completely exhausted and a leakage test made. The Contractor shall furnish a test pump, and means for accurate measurement of water introduced into a line during testing, and shall furnish and install corporation stops in the line as required for blowing lines free from air and at the test pump location.
- (1) Test pressures for the water line shall be 200 lbs per square inch pressure or as otherwise noted. The test pressure shall not be allowed to fall more than five (5) pounds per square inch below test pressure during the test. The water introduced into the line to maintain this pressure shall represent the leakage. Allowable leakage in gallons per hour per 1000 feet of pipeline shall not exceed  $0.1062 D$  ( $D$  is the nominal pipe diameter in inches). Minimum test period shall be twenty-four (24) hours. If in the opinion of the Owner additional testing is required, such additional testing shall be performed at no additional cost to the Owner.
  - (2) The Contractor shall furnish, install, and remove all temporary bulkheads, flanges, or plugs, to permit the required pressure tests, and shall furnish all equipment and labor to properly carry out such tests and to replace defective material.
  - (3) Any cracked or broken pipe shall be removed and replaced with sound pieces. Joints which leak shall be carefully remade. Remade joints and replaced material shall be re-tested under the same conditions of operation. If joints or materials are then found to be defective, they shall be remade and replaced until the line passes the required test.
- R. **Sterilization of Pipe Lines**: The AWWA Standard for Disinfecting Water Mains ANSI/AWWA C 651-92 (as amended to date) and these Specifications shall be the standard used to disinfect all new water lines and any existing lines contaminated during construction. The Contractor shall furnish all equipment and labor of every nature to disinfect new lines and any line contaminated during construction.
- (7) **Clean Lines**: Care shall be taken during construction to keep line free from debris, ground water and dirt.

- (8) Cross Connections: Cross connections shall not be allowed during testing, flushing, chlorinating, or dechlorinating of the new lines.
- (9) Flushing: All new lines shall be flushed before disinfecting. The recommended velocity by ANSI/AWWA C 651-92 for flushing is 2 ½ feet per second.
- (10) Chlorination: All pipe and appurtenances, both existing and newly constructed which have been exposed to contamination by reason of the construction shall be sterilized after testing and flushing of the line has been completed. The line shall be filled, using the continuous feed method, with fresh water containing 50 parts per million of chlorine and allowed to stand for 24 hours. During the test, chlorine residuals shall be checked every 1200 feet on new lines, at the end of each new line, and at the end of all new service lines or connections.
- (11) Dechlorination: After the new lines have been chlorinated for 24 hours, the chlorinated water shall be flushed from the lines. The discharge of the chlorinated waste shall be chemically treated to remove the residual chlorine. (See appendix of ANSI/AWWA C 651-92 for chemicals and amounts to dissipate the chlorine.) The method for mixing and contact time shall be arranged by the Contractor.
- (12) Bacteriological Tests: After final flushing and before connection of new mains to existing mains, two consecutive sets of acceptable samples, taken at least 24 hours apart, shall be collected from the new main. At least one set of samples shall be collected from each 1200 feet of the new line, plus one set at the end of the line and one set of samples at the end of each branch line. All samples shall be tested for bacteriological quality in accordance with Standard Methods for the Examination of Water and Wastewater (Latest edition), and shall show the absence of coliform organisms. If the bacteriological tests do not pass, the procedure shall be repeated until they are successful. All samples shall be obtained and tested by the Owner.
- (13) Connections: After the pipe and appurtenances have been flushed, tested, chlorinated, and have passed the bacteriological test, they may be connected to the existing system.
- (3) Connections Equal to or Less than One Pipe Length (18 feet): The new pipe, fittings, and valves required for the connections shall be spray disinfected or swabbed with a minimum 1% solution of chlorine just prior to being installed, if the length of connection from the new main to the existing main is equal to or less than 18 feet.
- (4) Connections Greater Than One Pipe Length: The pipe required for the connection must be set up above ground, chlorinated and bacteriological samples taken as described above if the length of connection is greater than 18 feet. After the bacteriological tests have proven satisfactory, the new pipe can be used in connecting the new main to the existing system. After the samples have been taken, the ends of the new pipe must be closed with water-tight plugs or caps until the connections are made.

### **PART 3 - Water Valves and Accessories**

#### **Scope:**

Contractor shall provide and install all valves as shown on the Drawings or specified herein. Valves shall be of same manufacturer throughout where possible. Manufacturer's name and pressure rating of the valve shall be clearly marked on the valve body. Valves shall comply with ANSI/NSF 61 as related to the Safe Drinking Water Additives Program.

**Submittals:**

- A. Submit complete shop drawings of all valves and appurtenances to the Owner for approval. Clearly indicate make, model, location, type, size and pressure ratings. Include operating and maintenance data for all valves.
- B. The valve manufacturer shall include as a part of the submittal package, a written affidavit of compliance with ANSI/NSF 61 and also include specific reference to the authorized certifying agency along with the approval identification detail.

**Products and Implementation:**

- A. **Resilient Seated Gate Valves:** The Contractor shall install resilient seated gate valves as indicated on the Drawings, or specified by the Owner. Resilient seated gate valves size 4-inch through 24-inch shall conform, in general, with AWWA C 509 as amended to date, shall be equipped with O-ring packing and shall be as follows:
  - (1) **General Construction:** Resilient seated gate valves shall be of the highest quality and finish, and shall open and close freely and easily. With the valve open, an unobstructed waterway shall be afforded, the diameter which shall not be less than the full nominal diameter of the valve. If guides or guide lugs are used, the design shall be such that corrosion in the guide area does not affect sealing. Resilient seats may be applied to the body or gate and shall seat against a corrosion-resistant surface. The surface may be either metallic or non-metallic. Resilient seats shall be bonded or mechanically attached to either the gate or valve body. The mating surface of the resilient seat shall be machined to a smooth, even finish. All stems shall be forged bronze stems.
  - (2) **Working Pressure:** Water working pressure for valves shall be 250 psi.
  - (3) **Operation:** All valves shall open left. Valves shall be operated by nut. Operating nuts shall conform to the present standard of the Owner, and shall have an arrow cast on them, indicating the direction for opening the valve.
  - (4) **Marking:** Each valve shall be plainly marked with the manufacturer's name or particular mark, the year of manufacture, the size of the valve, and designation indicating working pressure, all cast on the bonnet or body.
  - (5) **Spacing:** In-line valve spacing will not exceed 2,400 linear feet for water mains being used for distribution that are less than or equal to 24-inch in size. For transmission mains, valve spacing will be determined in the design of the project.
  - (6) **Vertical Installation:** Valves shall be for vertical installation only, with operating nut and N.R.S.
  - (7) **Testing:** All gate valves shall be tested in accordance with AWWA standards.
  - (8) **Jointing:** All gate valves shall be furnished with mechanical joints, and necessary bolts, glands, and gaskets except valves in hydrant runs and these shall be flange and mechanical joint.
  - (9) **Manufacture:** Valves shall be furnished as manufactured by Mueller, Clow, or equal.

**B. Butterfly Valves:** The Contractor shall install the butterfly valves complete with valve operators and accessories as shown on the Drawings or specified on water transmission mains larger than 24-inch in size. Valves and accessories shall be in accordance with the applicable ASTM and/or ANSI/AWWA Specifications, as amended to date, and shall be manufactured by Henry Pratt or equal.

- (1) **General:** The butterfly valves shall be rubber seated and shall fully comply with AWWA Specifications C 504. The seat shall be natural rubber or synthetic rubber compound which shall be mechanically retained or bonded to the valve body or mechanically retained or bonded to the valve body or mechanically retained on the valve disc. All butterfly valves and operators shall be designed for 250 psig operating pressure. Valves shall be bubble tight at rated pressures and shall be satisfactory for applications involving valve operation after long periods of inactivity. Valve discs shall rotate 90<sup>0</sup> from full open position to the tight shut position. A certification attesting to operation and leak test shall be furnished with the valves upon shipment. Wafer type valves are not acceptable.
- (2) **Valve Body:** The valve body shall be of cast iron conforming to ASTM A 126, Class B, with flanged ends and drilling in accordance with ANSI B 17.1, Class 125 or with manufacturer's standard mechanical joints conforming to ANSI 21.11, with necessary nuts, bolts, glands, and gaskets. Drilled and tapped holes are permitted where required at the body bearing trunnions. The body shall be designed to withstand the internal forces acting directly and the forces resulting from the thrust of the operating mechanism. Trunnion bosses shall be located at diametrically opposite points in the valve body which shall be accurately bored to accept permanently self-lubricated shaft bearing bushings. The trunnion box at the outer trunnion shall include a factory set two-way bronze thrust bearing and a cast iron thrust bearing cover.
- (3) **Valve Shafts:** Valve shafts may consist of a one-piece unit or may be the "stub-shaft" type. Valve shafts shall be turned, ground, and polished. Valve shafts shall be constructed of 18-8 Type 304 Stainless Steel (AWWA A 296). Shaft diameters shall meet requirements established by AWWA C 504, or service required. Valve shafts shall be securely attached to the valve disc by means of taper pins. Taper pins shall be mechanically secured.
- (4) **Valve Disc:** Valve discs 20-inches and smaller shall be constructed of alloy cast iron ASTM A 436, Type 1 (Ni-Resist), ductile iron ASTM A 536, Class 65-45-12 or cast iron ASTM A 41. Valve discs 24-inches and larger shall be constructed of ductile iron ASTM A 536, Class 65-45-12 or cast iron ASTM A 48 with 18-8, Type 304 stainless steel seating edges. The valve discs shall be designed to withstand bending and bearing loads resulting from the pressure load and operating forces. The faces to the discs shall be smooth and free of external projections. All retaining or pinning hardware in contact with liquids shall be monel or 316 stainless steel.
- (5) **Valve Seats:** Valve seats shall be natural rubber or Buna "N" rubber. Rubber seats in the valve body shall be retained by 18-8 stainless steel mechanical means, or bonded, without retaining hardware in the flow stream. Rubber seats attached to the disc shall be retained with an 18-8 stainless steel clamp ring and stainless steel bolting. Retaining ring cap screws shall pass through the rubber seat and be self-locking. Mating seat surfaces for resilient seats shall be 18-8 stainless steel. Seats should be a full 360<sup>0</sup> without interruption. Valve seats shall be designed to permit removal and replacement in the field for valves 30-inches in diameter and larger.
- (6) **Valve Bearings:** The valve shall be fitted with sleeve type bearings. Bearings shall be corrosion resistant and self-lubricating. Bearing load shall not exceed 1/5 of the

compressive strength of the bearing or shaft material. Bearing material must have coefficient of friction no greater than 0.10 which must be maintained regardless of wear.

- (7) Testing: Hydrostatic and leakage tests shall be conducted in strict accordance with AWWA C 504, Section 5, except that the leakage test will be performed after the operator has been mounted on the valve.
  - (8) Affidavit of Compliance: The manufacturer shall provide an "Affidavit of Compliance" that the valve furnished complies with the applicable provisions of AWWA C 504.
  - (9) Painting: All surfaces of the valve shall be clean, dry and free from grease before painting. The interior and exterior valve surfaces except for disc, seating and finished portions shall receive two coats of asphalt varnish in accordance with Federal Specification TT-V-51C.
  - (10) Manufacture: Valves shall be furnished as manufactured by Henry Pratt, or equal.
  - (11) Spacing: In-line valve spacing for transmission water mains will be determined for as part of the design for each new transmission main.
  - (12) Valve Operators: Valve operators shall conform to AWWA Specification C 504, as amended to date, and shall be equipped with mechanical stop-limiting devices to prevent over travel of the disc in the open and closed positions.
    - a. Manual operators, valve sizes 16" and larger, shall be of the totally enclosed oil bath lubricating gear reducing type. Primary gearing shall consist of a self-locking worm gear constructed of high tensile bronze and a worm constructed of hardened alloy steel with the thread ground and polished. Valve sizes smaller than 16" may have the slotted lever or link-lever design.
    - b. The operators shall be designed to hold the valve in any intermediate position between fully opened and fully closed without creeping or fluttering.
    - c. Extension stems: Valves shall have extension stems, chain wheels, or floor stands or extension bonnets with handwheels as shown. Extension stems shall extend from the valves to the connections with the operators.
    - d. Hand wheels for operators shall be mounted in a vertical plane with horizontal shafts and equipped with locking devices and position indicators.
    - e. Operators: Operators for buried valves shall have extension stems, 2 inch square operating nuts and valve boxes.
- C. **Valve Boxes:** Valve boxes shall be two-piece, with covers. The covers shall have the word "WATER" inscribed on the top. The bottom part of the valve box may be 6-inch cast iron pipe. The top part shall be of the sliding type sized to fit over the 6-inch pipe and be 36 inches in length. Valve boxes and covers shall be constructed of cast iron. The 6-inch pipe shall extend not less than 18 inches into the sliding top.
- (1) Extension stems shall be furnished for all valves so as to bring the 2 inch square AWWA operating nut of such valve within six inches of the top of the valve box. Operating nuts shall have an arrow cast on the top indicating the direction for opening the valve. Provide ground level position indicator. The Contractor shall also provide concrete valve box markers which shall extend a minimum of 12 inches above finished grade.

- (2) Tools: One socket wrench of proper length for valve operation shall be provided by the Contractor.

D. **Tapping Sleeve and Tapping Valve** : Tapping sleeves for all taps on Ductile Iron or Cast Iron Mains shall meet AWWA C223-02 and be split sleeve, mechanical joint type with flanged valve connections furnished by Mueller or equal. Tapping sleeves for taps on existing HDPE Mains shall be as manufactured by JCM Model Number 452 or equal. Tapping gate valves with tapping sleeves shall be furnished in accordance with the specifications for gate valves. Hub connection of valve furnished with tapping sleeve shall be mechanical joint. Tapping Machine: The Contractor shall furnish the valve tapping machine and all other equipment required for installation of the tapping sleeve and valve. Tapping sleeves and valves shall be installed under the supervision of skilled mechanics.

E. **Hydrants**: The Contractor shall install fire hydrants as indicated on the Drawings, and as specified herein. Hydrants will be installed at minimum distances required by the fire department with jurisdiction over the particular area where the new water infrastructure is being installed. Where possible, hydrants will be used for flushing on 6-inch lines for all dead ends. All fire hydrants shall meet the requirements of AWWA C 502, and the standards of the Owner. Fire hydrants furnished shall be Mueller "Centurion Improved", or approved equal. Any variances from the Mueller "Centurion Improved" shall be approved in writing by the Owner prior to bidding. All fire hydrants shall be installed with Tamper Proof kits.

- (1) Cover: Hydrants shall be four feet depth of cover over the leader pipe.
- (2) Extension Stems: However, if the hydrant is located so as to require additional cover the Contractor shall install the required extension sections.
- (3) Valve Opening: Valve opening shall be not less than four and one-half inches (4-1/2"). Hydrants shall open left.
- (4) Hose and Pumper Connection: Hose nozzles shall be two (2) in number and two and one-half inches (2-1/2") in size. One (1) Pumper connection shall be provided.
- (5) Threads: Threads for hose nozzles shall be "National Standard".
- (6) Operating Nut: Operating nut shall be square, flat surfaces and be approximately one inch (1") across.
- (7) Shoe Connection: Shoe connection shall be six inches (6"), furnished with mechanical joint for connection to spigot of mechanical joint hydrant lead.
- (8) General Construction: Hydrants shall be compressive type, self-coiling, non-freezing, and provided with a safety flange and coupling.
- (9) The operating unit shall be totally sealed away from the hydrant barrel and all working parts shall be continuously and automatically lubricated from a large oil reservoir and packing gland. Drain mechanism shall be simple, positive, and automatic in operation.
- (10) The safety flange on barrel and safety coupling on valve stem shall operate to prevent damage to barrel and stem in case of a traffic accident. The force of the impact shall break the flange and spread the coupling. The construction of the flange and coupling shall be such as to permit rapid and inexpensive replacement. They shall be located above the ground line. Hydrant shall be so constructed as to permit facing nozzles in any direction at any time without digging up the hydrant or cutting



off the water. This shall be accomplished by removing safety flange bolts and revolving the head.

- (11) All working parts of the hydrant, including the seat ring shall be removable through the top without digging. Seat rings shall be so shaped and arranged as to be readily removable. Seat rings shall be bronze and shall screw into a bronze bushing in the shoe. An O-ring seal between the shoe and seat ring shall provide a watertight non-wearing, permanent seat between shoe and seat ring. This seal shall always come out with main valve removal. Hose connections shall be either threaded and locked in place or breech-locked into the hydrant.

**O. Pressure Reducing & Sustaining Valve:** The Contractor shall install these where shown on the plans or as directed by the Owner. These valves will be installed where high-pressure systems connect to the lower pressure systems, in particular where the additional pressure would cause line pressure to exceed the rated working pressure of the pipeline material.

- (1) The valves shall be installed in 4' -0" or 5' -0" diameter reinforced concrete manholes as directed by the Owner. The Unit Price bid for this work should include the manhole housing structure, etc.
- (2) The pressure reducing and sustaining valve shall maintain any desired downstream-delivery pressure for which Reducing Pilot Valve is adjusted provided the upstream head does not drop below a determined head. In event upstream head drops to a minimum pressure for which Sustaining Pilot Valve is adjusted, it will cause the main valve to close to sustain the minimum pressure in the higher pressure system, and not serve the lower pressure system, until the head in the higher pressure system comes back to or more than normal.
- (3) The main valve shall operate on the differential piston principle such that the area on the underside of the piston is no less than the pipe area, and the area on the upper surface of the piston is of a greater area than the underside of the piston.
- (4) The valve piston shall be guided on its outside diameter by long stroke stationary Vee ports which shall be downstream of the seating surface to minimize the consequences of throttling. Throttling shall be done by the valve Vee ports and not the valve seating surfaces.
- (5) The valve shall be capable of operating in any position and shall incorporate only one flanged cover at the valve top from which all internal parts shall be accessible. There shall be no stems, stem guides, or spokes within the waterway. There shall be no springs to assist the valve operation.
- (6) The valve body shall be of cast iron ASTM A-126 with flanges conforming to the latest ANSI Standards. The valve shall be extra heavy construction throughout. The valve interior trim shall be bronze B-62 as well as the main valve operation.
- (7) The valve seals shall be easily renewable while no diaphragm shall be permitted within the main valve body.
- (8) All controls and piping shall be of non-corrosive construction.
- (9) A visual valve position indicator shall be provided for observing the valve piston position at any time.

(10) The valve shall be completely piped ready for installation. The valve shall be as manufactured by GA Industries, Cla-Val or equal and shall be provided in the diameters as shown on the plans or as requested by the Owner.

G. **Air release & Vacuum Break Valve** : Air release and vacuum break valves shall be installed where shown on the Drawings and as specified herein. Air release and vacuum break combination valves shall meet the requirements of AWWA C512-99 as amended.

- (1) The air release and vacuum break valve shall be of the compact single chamber design with solid cylindrical H.D.P.E. control floats housed in a tubular stainless steel body with epoxy powder coated cast iron or steel ends secured by means of stainless steel tie rods.
- (2) The unit price for air release and vacuum break combination valves shall include concrete vaults as shown in the Drawings and specified herein.
- (3) The valve shall have an integral 'Anti – Shock' Orifice mechanism which shall operate automatically to limit transient pressure rise or shock induced by closure to twice the working pressure. The intake orifice area shall be equal to the nominal size of the valve i.e., a 6" valve shall have a 6" intake orifice.
- (4) Large orifice sealing shall be effected by the flat face of the control float seating against a nitrile rubber 'O' ring housed in a dovetail groove circumferentially surrounding the orifice.
- (5) Discharge of pressurized air shall be controlled by the seating and unseating of a small orifice nozzle on a natural rubber seal affixed into the control float. The nozzle shall have a flat seating land surrounding the orifice so that the damage to the rubber seal is prevented.
- (6) The valve construction shall be proportioned with regard to material strength characteristics, so that deformation, leaking or damage of any kind does not occur by submission to twice the designed working pressure.
- (7) The valve design shall incorporate an over pressure safety feature that will fail without an explosive effect, such as is normally the case when highly compressed air is released suddenly. The feature shall consist of easily replaceable components such as gaskets, seals or the like.
- (8) Connection to the valve inlet shall be facilitated by a screwed NPT male end (1" & 2" only) or a flanged end conforming to ANSI B16.1 Class 125 and Class 250 or ANSI B16.5 Class 300 Standards.
- (9) Flanged ends shall be supplied with the requisite number of stainless steel or mild steel screwed studs inserted for alignment to the specified standard.
- (10) The valve shall be as manufactured by Vent-O-Mat, or equal.
- (11) Valve size shall be 2" for all 6", 8" and 12" water mains and 6" for all 24" and 30" water mains to be installed in this project.

H. **Blow Offs**: Blow offs for flushing dead ends will be minimum 4-inch on mains 6-inch and larger and set inside meter box at grade. Blow offs to be used only when hydrants infeasible.

**END OF SECTION**