

## SECTION 02665 - WATER DISTRIBUTION SYSTEM

### 1.0 GENERAL

1.1 Work in this Section includes all exterior potable water distribution system piping and appurtenances.

1.2 Reference Specifications are referred to by abbreviation as follows:

- A. American National Standards Institute ..... ANSI
- B. American Society for Testing and Materials ..... ASTM
- C. American Water Works Association ..... AWWA
- D. Commercial Standard (National Bureau of Standards) ..... CS
- E. Federal Standards ..... FS
- F. Virginia Department of Transportation ..... VDOT

1.3 Separation of water lines and sanitary and/or combined sewers.

- A. Follow State Health Department "Waterworks Regulations" for separation of water mains and sewer lines.
- B. Parallel Installation
  - (1) Normal Conditions - Water lines shall be constructed at least 10' horizontally from a sewer or sewer manhole whenever possible. The distance shall be measured edge-to-edge.
  - (2) Unusual Conditions - When local conditions prevent a horizontal separation of at least 10', the water line may be laid closer to a sewer or sewer manhole provided that:
    - (a) The bottom of the water line is at least 18" above the top of the sewer.
    - (b) Where this vertical separation cannot be obtained, the sewer shall be constructed of ductile iron water pipe pressure-tested in place to 50 psi without leakage prior to backfilling. The sewer manhole shall be of watertight construction and tested in place.
- C. Crossing

- (1) Normal Conditions - Water lines crossing over sewers shall be laid to provide a separation of at least 18" between the bottom of the water line and the top of the sewer whenever possible.
  - (2) Unusual Conditions - When local conditions prevent a vertical separation described in crossing, normal conditions, paragraph above the following construction shall be used.
    - (a) Sewers passing over or under water lines shall be constructed of the materials described in parallel installation, unusual conditions - Paragraph (B) above.
    - (b) Water lines passing under sewers shall, in addition, be protected by providing:
      1. A vertical separation of at least 18" between the bottom of the sewer and the top of the water lines.
      2. Water lines passing under sewers shall, in addition, be constructed of ductile iron.
      3. That the length of the water line shall be centered at the point of the crossing so that joints shall be equidistant and as far as possible from the sewer.
- D. Sewers or sewer manholes - No water pipes shall pass through or come in contact with any part of sewer or sewer manhole.

## **2.0 PRODUCTS**

- A. Submit shop drawings on all products as required by New Kent County.
  - B. Provide certified test results of pipe testing.
- 2.1 Ductile iron pipe shall meet requirements of AWWA/ANSI C151/A21.51 Pressure Class 350, Special Class 51, unless otherwise indicated on the drawings.. All pipes shall have a cement mortar lining on the interior and a bituminous coating on the exterior.
  - 2.2 Flanged cast iron and ductile iron pipe shall meet the requirements of AWWA/ANSI C115/A.21.15 for Pressure Class 350, Special Class 53, unless otherwise shown on Contract Drawings. Thickness class shall meet requirements of AWWA/ANSI C150/A21.50. All pipes shall have a cement mortar lining on the interior and a bituminous seal coat on the exterior.
  - 2.3 Polyvinylchloride (PVC) pipe and fittings in sizes 4" through 12" shall meet the

requirements of AWWA C900, DR-18, CL 150 except that all connections shall be made using elastomeric gasket joints.

- 2.4 Polyvinylchloride (PVC) pipe for use in Directional Drilling shall be AWWA C900 CERTA-LOK as manufactured by Certain Teed Corporation.
- 2.5 Polyethylene pipe for use in Directional Drilling shall be Driscopipe HDPE, Series 4000, SDR 11 meeting the requirements of AWWA C906.
- 2.6 Copper tubing shall meet requirements of ASTM B88 for Type "L" copper, hard drawn, for above ground and Type "K" hard drawn for below ground.
- 2.7 Gray iron and ductile iron fittings shall meet requirements of AWWA/ANSI C110/A21.10. Pressure ratings shall be a minimum of 250 psi for fittings 12" and smaller and at least 150 psi for fittings 16" and larger, or pressure specified for adjacent piping, whichever is greater. All fittings shall be all bell, mechanical joint, or mechanical joint plain end unless otherwise approved by the Engineer. All fittings shall have a cement mortar lining on the interior and a bituminous coating on the exterior.
- 2.8 Compact ductile iron fittings shall meet requirements of AWWA/ANSI C153/A21.53 in sizes 4" through 12". 16" sizes shall conform to manufacturer's standard. All fittings shall be all bell, mechanical joint, or mechanical joint plain end unless otherwise approved by the Engineer. All fittings shall have a cement mortar lining on the interior and a bituminous coating on the exterior.
- 2.9 Mechanical joints and jointing materials shall meet requirements of AWWA/ANSI C111/A21.11.
  - A. Mechanical joint retainer glands shall meet requirements of AWWA/ANSI C111/A21.11. Glands for ductile iron pipe shall be Megalug Series 1100 as manufactured by EBAA Iron Sales Inc. or approved equal. Glands for PVC pipe shall be Megalug Series 2000 as manufactured by EBAA Iron Sales Inc. or approved equal.
  - B. Locked type mechanical joints may be used where restrained joints are required.
- 2.10 Push-on joint and rubber gasket shall meet requirements of AWWA/ANSI C111/A21.11.
  - A. Push-on joint retainer glands shall meet requirements of AWWA/ANSI C111/A21.11. Glands for ductile iron pipe shall be Megalug Series 1700 as manufactured by EBAA Iron Sales Inc. or approved equal. Glands for PVC pipe shall be Megalug Series 1600 or 6500 (IPS) as manufactured by EBAA Iron Sales Inc. or approved equal.
  - B. Locked type restrained push-on joints may be used where restrained joints are required.

- 2.11 Flanged joints for ductile iron pipe shall meet requirements of ANSI B16.1.
- 2.12 Flanged joint gaskets shall be full-face, made of rubber, and shall meet requirements of ANSI B16.21.
- 2.13 Cement mortar lining with bituminous seal coat for ductile iron pipe and fittings or for cast iron fittings shall meet requirements of AWWA C104.
  - A. Cement mortar lining shall be standard thickness.
- 2.14 Exterior, bituminous coating for ductile iron pipe and fittings and cast iron fittings shall meet requirements of AWWA C106 or AWWA C151 as applicable.
- 2.15 Metal harness shall be galvanized rods and clamps as detailed on Drawings.
- 2.16 Galvanized steel pipe is not acceptable for water systems.
- 2.17 Gate Valves
  - A. Non-rising stem valves, 3" thru 12", shall be resilient seated and shall meet requirements of AWWA C509. Valves shall have 250 psi working pressure. Valve ends shall be compatible with piping systems in which they are installed. Valve shall have ductile iron (ASTM A536) body, bronze mounted, bronze stem, ductile iron wedge coated with nitrile rubber. The interior and exterior of the body and bonnet shall have fusion bonded epoxy coating in accordance with ASNI/AWWA C550. Valve shall have o-ring seals and open counter-clockwise.
  - B. Operators
    - (1) Buried valves shall be equipped with 2" square operating nuts unless otherwise shown on the Drawings. Where nuts will be more than 48" below finished grade, extension stems shall be pin connected to valve stem. Extension stem shall raise operating nut to within 24" of finished grade.
    - (2) Interior valves shall be handwheel operated except where otherwise shown on the Drawings.
    - (3) Interior valves in inaccessible locations shall be provided with chain operators as shown on the Drawings.
  - C. Valves shall be American-Darling, Clow, Dresser (M&H), Kennedy, Mueller,, or approved equal meeting this Specification.

- D. Gate valves smaller than 3" shall be bronze, solid wedge, rising stem, at least 200 psig working pressure, Jenkins 49-U threaded ends or Jenkins 1242 solder ends.
- E. Tapping valves shall meet requirements of gate valves specified above except that seat opening shall be larger than nominal size and valve outlet end shall have mechanical joint. Inlet flange shall meet the requirements of ANSI B16.1, class 125 drilling and with MSS SP-60. Tapping valves shall be suitable for use with all approved tapping sleeves without modification

## 2.18 Butterfly Valves

- A. Butterfly valves 3" and larger shall be of the rubber seated, tight closing type meeting requirements of AWWA C504 and shall be Class 150B unless otherwise indicated. Wafer-type valves shall not be used.
- B. Valve ends shall be mechanical joint or bell joint in accordance with AWWA C111. Accessories (bolts, glands, and gaskets) shall be supplied by the valve manufacturer.
- C. Valve operator shall be of the traveling-nut type, sealed, gasketed and lubricated for underground service. Valve operator shall be capable of withstanding an input torque of 450' lb. at full open or closed position, without damage to the valve and valve operator. Valve operator shall be AWWA standard 2" square operating nut.
- D. Rubber seal may be applied to the body or to the disc.
- E. Valves shall open counter-clockwise.
- F. Valves shall be factory tested in accordance with Section 5.2 of AWWA Specification C504. Upon request the manufacturer shall furnish certified copies of test reports.
- G. Valves shall be American-Darling, Dresser "450", Pratt Groundhog or approved equal.

## 2.19 Check Valves

- A. Check valves 3" and larger shall be iron body, bronze mounted, swing check valves, meeting requirements of AWWA C508. Check valves 3 through 12" shall be for 175 psi non-shock cold water working pressure. Valves 14 through 24" shall be for 150 psi non-shock cold water. Valves shall have outside weight and lever.
- B. Manufacturer shall be American Darling Valve and Manufacturing Company, Eddy-Iowa Division of Clow Corporation, Kennedy Valve Manufacturing Company, M&H Division of Dresser Industries, or G-A Industries, Inc.

- C. Cushion Swing Check valves may be air cushioned, oil cushioned, or electronically operated and manufactured by APCO, G-A Industries, Inc, or Cla-Val. Cushion Check Valves shall be evaluated on a case-by-case situation.

## 2.20 Pressure Reducing Valve

### A. Piston Type

- (1) Valves shall be hydraulically operated and of the self-contained, differential piston type. The valves shall function to reduce high upstream pressure to a predetermined lower downstream pressure without shock or hammer.
- (2). The valve shall be air and water cushioned and when required, provide tight valve closure. When required, the valve shall open wide to permit full pipe line opening. An indicator shall be furnished as an integral part of the valve to show piston position within the body.
- (3) The valves shall be cast iron body. The piston shall be of cast bronze provided with renewable leather or composition cup and seat. The valve liner shall be of cast bronze provided with a leather or composition cup. The valve shall be provided with "V" shaped ports for flow passage downstream of the seat opening. The valve assembly shall be so constructed as to permit removal of the piston or liner from the valve body without removing the valve body from the line.
- (4) The pilot valve shall be of the single seated, globe body pattern, diaphragm operated and spring loaded with convenient discharge pressure setting over a range no less than 30 psi.
- (5) Valves in sizes 3-12" shall have a working pressure of 175 psi. Valves in sizes 16" and up shall have a working pressure of 150 psi. Valves shall be provided with 125 lb. ANSI flanges and shall be G-A Industries, Inc., Fig. No. 4500-D.

### B. Diaphragm Type

- (1) Valve will be designed to modulate reducing a higher inlet pressure to a constant downstream pressure regardless of the inlet pressure or flow fluctuations. The pressure reducing valve will be pilot operated and of globe designed.
- (2) Valve body will be ductile iron with 150 ANSI flanged ends rated to 250 psi working pressures. Main valve will be piston or diaphragm actuated. All ferrous metal surfaces will have an NSF approved fusion bonded

epoxy coating to decrease maintenance and protect the ductile iron surfaces. The main valve trim will be stainless steel. The pilot control will be bronze and have stainless trim. There shall be an X101 visual valve position indicator.

- (3) The valve will be a model 90G-01BYKC D.S. 150 ANSI as manufactured by CLA-VAL Co. Newport Beach, CA.

## 2.21 Altitude Valve

### A. Function

- (1) The altitude control valve shall be of the double acting type, functioning to close off at maximum pre-set level in tank or reservoir; and opening when the system pressure drops below the static head, for the purpose of returning the storage water back through the valve for distribution.
- (2) A hand operated valve in the power water line to the top of the piston shall permit adjustment of the speed of valve closing. The tank water level control shall be by means of a diaphragm operated, spring loaded, three way pilot which directs power water to or from the top of the main valve piston. The three way pilot shall be of bronze or stainless steel construction. The diaphragm surface exposed to the tank head shall be not less than 57 sq. inches. It shall be possible to adjust the spring above the diaphragm for water level control approximately 20% above or below the factory setting.
- (3) The valve shall be completely piped ready for installation.

### B. Piston Type Valve

- (1) 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.
- (2) 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.
- (3) 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.

- (4) 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.
- (5) The valve seals shall be easily renewable while no diaphragm shall be permitted within the main valve body.
- (6) All controls and piping shall be of non-corrosive construction.
- (7) A visual valve position indicator shall be provided for observing the valve piston position at any time.
- (8) The valve shall be GA Industries of Mars, Pennsylvania, Fig. 3300-DR.

C. Diaphragm Type Valve

- (1) The main valve shall operate on the differential pressure between the valve spring load and the desired water level condition.
- (2) Valve body will be ductile iron with 150 ANSI flanged ends rated to 250 psi working pressures. Main valve will be piston or diaphragm actuated. All ferrous metal surfaces will have an NSF approved fusion bonded epoxy coating to decrease maintenance and protect the ductile iron surfaces. The main valve trim will be stainless steel.
- (4) The valve shall be CLA-Valve Model 210-16BYKC.

2.22 Valve boxes shall be adjustable cast iron valve boxes of the two-piece type, consisting of lid and two-piece sliding extension. The word "water" shall be cast or embossed on the valve box lid in letters not less than 1" high. Valve box shall be manufactured by Mueller Company, Richard Foundry, Tyler, or approved equal.

2.23 Tapping Sleeves:

A. Stainless Steel:

- a. The body of tapping sleeve shall be of 18-8 type 304 stainless steel.
- b. Branch/flange to be ductile iron, carbon steel or 304 stainless steel, 150 lb. drilling.
- c. MJ Gland shall be permanently affixed to the outlet branch and be 304 stainless steel.
- d. Gaskets shall be Grade 60 compounded for use with water, alkalies, mild



acids and most hydro-carbon fluids, up to 212°F.

- e. Clamping hardware (nuts, bolts and washers) shall be 18-8 type 304 stainless steel, with plastic anti-gall washers. Drop-in bolts or welded-on studs are acceptable.

B. Cast Iron with Mechanical Joint Ends:

- a. The body and glands of the tapping sleeve shall be of ASTM-126, Class B cast or ductile iron. Sleeve shall be furnished complete with all mechanical joint accessories (bolts, nuts, gaskets and glands), and shall have a bituminous seal coating.
- b. Valve flange, body gaskets and clamping hardware (bolts, nuts and washers) shall be as specified for the fabricated steel tapping sleeve.

- C. Tapping sleeves shall meet requirements of AWWA C110 for pressure rating Suitable for 200 PSI test pressure or as shown on the Drawings. Sleeves shall be built in two sections and shall be mechanical joint type with flanged outlet. The tapping sleeve shall be for the size and type of pipe shown on the Drawings.

2.24 Flexible coupling shall be of gasketed, sleeve type. Each coupling shall consist of a steel middle ring, two steel followers, two rubber compounded wedge section gaskets and sufficient galvanized track, head steel bolts to properly compress the gaskets. Couplings shall be of the type to match piping in which installed. Couplings shall be long style Model 253 manufactured by Dresser Manufacturing Division of Dresser Industries, Model 441 manufactured by Smith-Blair, or Model 501 manufactured by Romac.

2.25 Flanged adapters for joining ductile iron plain-end pipe to flanged ductile iron items shall be Style 128 or 227 as manufactured by Dresser Manufacturing Division of Dresser Industries. Flanged adaptors for joining plain end PVC Pipe to flanged ductile iron items shall be Uni-Flange Series 900. Adapter shall be rated for a water working pressure of the pipe connected and shall have a 2:1 factor of safety.

2.26 Dismantling joint shall be a telescoping, flanged spool piece with tie rod restraints. A minimum of 1" of telescoping movement shall be provided by the dismantling joint.

- A. Flanges shall be AWWA Class D steel ring flange compatible with ANSI Class 125 and 150 bolt circles. In sizes 3"-12", pipe shall be standard weight class per ASTM A53 with end ring and body of ASTM A536 65-45-12 ductile iron. In sizes 14"-60", pipe shall be ASTM A36 plate 1% cold expanded to size with end ring and body of ASTM A36 steel.

B. Gaskets shall be rubber in accordance with ASTM D2000 MBA810Z.

C. Nuts and bolts shall be ASTM 4588 HSLA.

- D. Tie rods shall be high tensile steel per ASTM A193 Grade B7.
  - E. Joints shall be coated with a NSF 61 certified, holiday tested, fusion bonded epoxy.
- 2.27 Fire hydrants shall conform to the requirements of AWWA Standard C502, latest revision for "Dry Barrel Fire Hydrants" and shall comply in full with the following requirements.
- A. Hydrants shall be of the three post type of dry top design rated 150 psi with compression main valve opening counterclockwise against pressure. Each hydrant shall have a 6" standardized, mechanical joint inlet connection with accessories. The internal valve shall provide a minimum of 4 1/2" unobstructed flow area. Each hydrant shall be designed to allow the removal of all operating parts through the standpipe without excavation. Each hydrant shall be constructed with an oil lubricated dry type bonnet with "O" ring seals above and below operating threads.
  - B. The standpipe sections shall be connected at the ground line by a two-part safety flange that prevents damage to the barrel sections when the hydrant is struck by a vehicle. The standpipe and safety flange design shall permit rotation of the hydrant nozzles to any desired position without excavation or disassembly of the operating components. Threaded joints, above or below ground, or breakable bolts will not be allowed for the barrel assembly.
  - C. The main valve operating rod shall be designed with a travel stop so that the rod cannot be placed in compression. Travel stops located at the bottom of the hydrant will not be acceptable. The operating rod threads top and bottom shall be isolated from contact with water in the bonnet or in the inlet shoe. A safety stem coupling on the operating rod shall be placed at the ground line.
  - D. The drain mechanism shall be co-related with the operation of the main valve to provide a momentary flushing of the drain ports each time the hydrant is opened. The drain ports shall be fully closed when the hydrant valve is more than 2 1/2 turns open. The drain ports shall be fully open when the hydrant is in the closed position.
  - E. The nozzle outlets shall consist of two (2) 2 1/2" hose nozzles 180° apart and one (1) 4 1/2" pumper connection. The nozzle threads shall conform to ANSI Standard B26. The nozzle caps shall be individually attached to the standpipe with heavy duty non-kinking chains that permit free turning of the cap. The operating nut and cap nuts shall be National Standard pentagon with 1 1/2" from point to flat.
  - F. The exterior of the hydrants above the ground line shall be shop painted Safety

Yellow. The bonnet shall be painted to reflect the projected fire flow, as determined by the engineer for each individual project. The color coding shall be as follows: (Paint codes by Rust-oleum)

Safety Yellow	V245479	
Safety Blue	V245474	1500 gpm or greater
Safety Green	V245476	1000-1499 gpm
Safety Orange	V245477	500-999 gpm
Safety Red	V245478	<499 gpm

- G. Fire hydrants shall be Mueller Model A-421 "Super Centurion", Kennedy K-81-A "Guardian", Clow Medallion or American Darling Mark 73.
  - H. Fire hydrant barrel diameter shall be 4 ½"
  - I. Fire hydrant date embossed on the barrel shall reflect the year of the installation.
  - J. Appurtenances with weepholes are subject to contamination when installed in areas subject to high groundwater, flooding, to contaminants or pollutant spills, or in areas where surface water ponds. Weepholes should be plugged when hydrants are installed under these conditions.
- 2.28 Pressure gauges shall be open front case type with bronze bourdon tube soldered to socket and tip, stainless steel movement, and a 4 1/2" white coated dial graduated from 0 to 160 psi. Gauges shall be similar to Ashcroft No. 1279.
- 2.29 Compound gauges shall be open front case type with bronze bourdon tube soldered to socket and tip, stainless steel movement, and a 4 1/2" white coated dial graduated from -15 to 100 psi. Gauges shall be equipped with a valve cock and diaphragm isolator.
- 2.30 Air release, Air/Vacuum, and Combination valves
- A. Low profile air release valves, combination valves, and air vacuum valves for water service located where indicated on Contract Drawings shall have a reinforced nylon body, noncorrosive internal parts including EDPM rolling seal, and solid polypropylene float. All valves shall have a polypropylene outlet flushing connection on the top that is easily accessible, using a ball valve as an isolation valve on the inlet side of the valve, and be rated at a working pressure of 250 psi (tested to 360 psi). Air release only valves for sizes smaller than 2" shall be Model S-050 as manufactured by A.R.I. Air/vacuum valves, combination valves, or 2" and larger air release only valves shall be Model D-040 2" or D-060-C HF as manufactured by A.R.I.
- 2.31 Water service connection accessories shall consist of corporation stop, meter box and meter yoke in accordance with Owner's Specifications.

- A. Corporation Stops - Plug Type only for 3/4" and 1"; Plug Type or Ball Valves for 1 1/2" and 2" (3/4" thru 2" with "cc" thread inlet)
- (1) Mueller
    - (a) H-15000
    - (b) H-15008 (3/4" and 1" corp stop with compression outlet for copper) or H-15071 (3/4" and 1" connector only to convert a normal H-15000 corp stop to compression, to avoid using special tapping machine adapters)
  - (2) Ford
    - (a) F-600 (Plug type with flare outlet only for 3/4" and 1")
    - (b) F-1000-3G (3/4" corp stop with compression connection for copper) or C04-33G (3/4" connector only to convert a normal F-600-3 corp stop to compression, to avoid using special tapping machine adapters)
    - (c) F-1000-4G (1" corp stop with compression connection for copper) or C04-44G (1" connector only to convert a normal F-600-4 corp stop to compression, to avoid using special tapping machine)
  - (3) McDonald
    - (a) 4701
    - (b) 4701-T (3/4" and 1" corp stop with compression outlet for copper) or 4700-T (3/4" and 1" connector only to convert a normal #4701 corp stop to compression, to avoid using special tapping machine adapters)
  - (4) JJC #J-1500
  - (5) Ford FB-600 (Ball valve with flare outlet only for 1 1/2" & 2")
  - (6) Ford FB-100OG (Ball valve with compression outlet only for 1 1/2" & 2")
  - (7) Cambridge Brass
    - (a) 302-A Plug type with flare or compression outlet – 3/4", 1", 1 1/2", 2"

(b) 301-A Ball valve with flare or compression outlet – 1 1/2", 2"

B. Meter Yokes - 5/8" x 3/4"

(1) Ford Y502

(2) Cambridge Brass 460-2

### 2.32 Manholes

A. Manholes shall be constructed of pre-cast reinforced concrete manhole sections in accordance with the requirements of ASTM C478 and detailed in Section 00870 - Standard Details.

B. A maximum of two lift holes per manhole section may be provided.

C. Provide tongue and groove type joints in manhole sections with a pre-formed groove in the tongue for placement of sealing gaskets.

(1) Bituminous mastic or butyl rubber gaskets shall comply with requirements of ASTM C990 or C443, respectively.

(2) Gaskets shall provide the sole element in sealing the joint from either internal or external hydrostatic pressure.

D. Provide flexible pipe connections to manholes, other than acid-resistant manholes, for pipes 15 in. and smaller in size.

(1) Materials shall be resistant to water, sewage, acids, ozone, weathering and aging. Use neoprene conforming to ASTM C923 and stainless steel, Series 300.

(2) Cast or core drill openings in manholes to receive connectors. Connectors shall be suitable for field repair or replacement. Connectors not suitable for field replacement are unacceptable.

(3) The assembled connectors shall allow at least an 11° angular deflection of the pipe and at least one inch of lateral misalignment in any direction and be suitable for a normal variation in diameter or roundness for the pipe material used.

(4) Connectors shall be similar to Kor-n-Seal as manufactured by National Pollution Control Systems, Inc.

E. Liners for acid-resistant manholes shall be of fiberglass reinforced polyester or polyvinylchloride construction and shall be installed to protect the pre-cast

manhole sections from the inside base of the manhole to the base of the manhole frame.

- (1) FRP liners shall consist of a 3/16 in. thick fiberglass reinforced polyester with a 15 mil gel coat interior surface. The polyester resin shall be similar to Dion No. 6694. Joints between sections of the liner shall be sealed in accordance with the manufacturer's instructions.
  - (2) PVC liners shall consist of polyvinylchloride plates, not less than 0.060 in. thick, with integral bonding ribs and shall be similar to Amercoat "T-Lock Amer-Plate". Joints between sections of liner shall be welded in accordance with the manufacturer's instructions.
- F. Sealant for manhole frames shall be a one-component polyurethane sealant similar to Sika "Sikaflex" Type 1a.
- G. Sealant for flexible pipe connections shall be a two-component polyurethane sealant similar to Sika "Sikaflex" Type 2c with primer Type 429.
- H. Manhole steps shall be corrosion-resistant and shall be one inch square cast iron, rubber-covered steel or aluminum. The steps shall conform to the dimensions shown in Section 00870 - Standard Details.
- I. Manhole frames and covers shall be molded of gray cast iron conforming to ASTM A48, Class 30. Castings shall be coated with a coal tar pitch varnish, to which sufficient oil has been added to make a smooth coating, tough and tenacious when cold, but not tacky or brittle. Seating surfaces between frame and cover shall be machined. The dimensions and weights shall conform to the requirements shown in Section 00870 -Standard Details.
- (1) Standard Manhole Frame and Cover shall be similar to East Jordan Iron Works Catalog No. 1045Z frame and Catalog No. 1040C cover
  - (2) Vandal-proof Manhole Frame and Cover shall be similar to East Jordan Iron Works, Inc. Catalog No. 1045Z frame and Catalog No. 1040AGS cover.
  - (3) Watertight Manhole Frame and Cover shall be similar to East Jordan Iron Works, Inc. Catalog No. 1045ZPT frame and Catalog No. 1040APT cover.

### 2.33 Polymer Concrete Manholes

- A. Polymer concrete manholes may be provided where manholes and/or pump station wet wells with acid resistant liners are noted on the Contract Drawings.

B. References

- (1) ASTM D 6783 Standard specification for polymer concrete pipe.
- (2) ASTM F 477 Specification for elastometric seals (gaskets) for joining plastic pipe.
- (3) ASTM C 579 Standard test method for compressive strength of chemical resistant mortars, grouts, monolithic surfacing and polymeric concretes.
- (4) ASTM C 33 Standard specification for concrete aggregates.

C. Quality Assurance and Manufacturer Testing

- (1) Pipes: Pipe shall be manufactured in accordance with ASTM D 6783.
- (2) Joints: Joints shall meet the requirements of ASTM D 4161.
- (3) Three edge bearing strength:
  - (a) Pipe shall be designed to meet D load requirements of external soil and hydrostatic loads. Design strength shall be tested in accordance with the three-edge bearing test method of ASTM D 6783.
- (4) Compressive strength: Pipe shall have a minimum unconfined compressive strength of 13,000 psi when measured in accordance with ASTM C 579.

D. Materials

- (1) Resin: The manufacturer shall use only polyester resin systems designed for use with this particular application.
- (2) Filler: All aggregate, sand and quartz powder shall meet the requirements of ASTM C 33, where applicable.
- (3) Additives: Resin Additives, such as curing agents, pigments, dyes, fillers and thixotropic agents, when used, shall not be detrimental to the manhole.
- (4) Elastometric Gaskets: Gaskets shall be suitable for the service intended. All gaskets shall meet the requirement of ASTM F 477.

E. Manufacturing and Product Construction

- (1) Manholes: Manhole components shall be manufactured by the vibratory

vertical casting process resulting in a dense, non-porous, corrosion-resistant, homogenous, composite surface.

- (2) Joints: The manhole components shall be connected with a compatible epoxy bonding agent or an elastometric sealing gasket as the sole means to maintain joint water-tightness. Joints at pipe tie-ins may use flexible elastometric couplings, fiberglass overlay or a compatible epoxy material for binding manhole components directly to the adjoining pipe. Epoxy bonding shall require a flexible pipe joint within one pipe diameter from the manhole's external wall. Epoxy bonding material shall be approved by the manhole manufacturer.
- (3) Fittings: Cones, reducer slabs, base slabs and adjusting rings shall be of the same material as adjoining riser sections. Fittings shall be manufactured elastometric gaskets, epoxy bonding or fiberglass overlay.
- (4) Acceptable manufacturer: Manufacturer of pipe and fittings shall employ manufacturing methods and material formulations in use for a minimum of ten years. Manufacturer shall be Amitech America, Ltd., Meyer Rohr + Schacht GmbH or equal.

#### F. Design

- (1) Manholes shall be designed to withstand all live loads and dead loads as described shown on the Contract Drawings, and as required by the Virginia Department of Transportation for structures constructed in or adjacent to road right-of-ways. Dead loads shall include overburden load, soil side pressure and hydrostatic loading conditions.
- (2) Manholes shall be designed to resist buoyancy for the project conditions.

2.34 Globe valves smaller than 3" shall be of bronze construction with bronze plug type discs and solder joint ends.

2.35 Thrust blocking shall be as shown in Contract Documents or as directed by Project Representative based upon field conditions. Concrete shall have 3000 psi strength at 28 days in accordance with Section 03300 - Cast-in-Place Concrete and shall meet requirements of ASTM C94.

2.36 Detectable Marking Tape & Tracing Wire

- A. Plastic marking tape consisting of one layer of aluminum foil laminated between two layers of inert plastic film. Tape shall be resistant to alkalis, acids and other destructive agents commonly found in the soil. The laminate shall be strong enough that the layers cannot be separated by hand.



- B. Tape shall be a minimum of 4 1/2 mils thick with a minimum tensile strength of 60 lbs. in the machine direction and 58 lbs. in the transverse direction per 3" wide strip. Tape color shall be APWA Color Coded for marking the particular utility line and shall be imprinted with a continuous warning message to indicate the type of utility being marked, the message normally being repeated every 16 to 36". Tape shall be inductively locatable and conductively traceable using a standard pipe and cable locating device. Tape shall be 3" wide Terra Tape "Sentry Line Detectable 620".
  - C. In addition to the marking tape, a tracing wire of 12 gauge copper shall be installed and taped directly on the pipe in a manner that a continuous trace results. Turn up into meter boxes every 2,500 LF if no other appurtenances (valves, hydrants, etc.) are available within that distance.
- 2.37 Double Detector Check Valves (DDC's) shall be of ductile iron body, epoxy coated, UL and FM approved. The check valves shall be accessible for maintenance without removing the device from the line. DDC's shall be Zurn Wilkins Model 350 DA for 2" and 350 ADA for 2-1/2" or greater or approved equal.

### **3.0 EXECUTION**

#### **3.1 Pipe Laying, General**

- A. Take all precautions necessary to insure that pipe, valves, fittings, and other accessories are not damaged in unloading, handling, and placing in trench. Examine each piece of material just prior to installation to determine that no damage has occurred. Remove any damaged material from the site and replace with undamaged material.
- B. Exercise care to keep foreign material and dirt from entering pipe during storage, handling, and placing in trench. Close ends of in-place pipe at the end of any work period to preclude the entry of animals and foreign material.
- C. Bedding of pipe shall be as specified in Section 02225 - Trenching & Backfilling.
- D. Do not lay pipe when trench bottom is muddy or frozen, or has standing water.
- E. Use only those tools specifically intended for cutting the size and material and type pipe involved. Make cut to prevent damage to pipe or lining and to leave a smooth end at right angles to the axis of the pipe.
- F. Lay pipe with bell ends facing the direction of laying. Where grade is 10% or greater, lay pipe uphill with bell ends upgrade.
- G. All ductile iron pipe 8" in diameter and smaller and all PVC pipe 12" in diameter and smaller shall be driven home by hand.

H. Generally, water lines shall be located a minimum of 5 feet off the back of the curb, and 1 foot off the edge of pavement if a ditch is present.

3.2 Install pressure line with a minimum depth of cover of 42" over the top of the pipe, where no grades are shown on the Contract Drawings.

A. Where grades on the pressure line conflict with existing pipes or structures, lay pressure line to additional depth with a uniform vertical curve to provide proper clearance without the use of fittings. No additional payment will be allowed for additional excavation. Provide allowance for expansion as directed by Engineer.

B. Lay pressure line pipe with bell ends facing the direction of laying. Where grade is 10% or greater, pipe shall be laid uphill with bell ends upgrade.

C. All lines shall be laid based on cut sheets.

3.3 Joining Mechanical Joint Pipe

A. Thoroughly clean inside of the bell and 8" of the outside of the spigot end of the joining pipe to remove oil, grit, excess coating and other foreign matter. Paint the bell and the spigot with soap solution (half cup granulated soap dissolved in 1 gallon water). Slip cast-iron gland on spigot end with lip extension of gland toward end of pipe. Paint rubber gasket with or dip into the soap solution and place on the spigot end with thick edge toward the gland. Apply a thin film of gasket lubricant supplied by pipe manufacturer that meets the requirements of AWWA C111/C600, to either the gasket or the spigot end of the joining pipe.

B. Push the spigot end forward to seat in the bell. Then, press the gasket into the bell so that it is located evenly around the joint. Move the gland into position, insert bolts and screw nuts up finger tight. Then tighten all nuts to torque listed below:

<u>Bolt Size - Inches</u>	<u>Torque Ft. - Lbs.</u>
5/8	40 - 60
3/4	60 - 90
1	70 - 100
1¼	90 - 120

Tighten nuts on alternate side of the gland until pressure on the gland is equally distributed.

C. Join lock-type mechanical joint pipe according to manufacturer's recommendations.

D. Permissible deflection in mechanical joint pipe shall not be greater than 2/3 of

that listed in AWWA C600.

- E. Permissible deflection in lock-type mechanical joint pipe shall be as recommended by manufacturer.

### 3.4 Joining Push-On Joint Pipe

- A. Thoroughly clean inside of the bell and 8" of the outside of spigot end of the joining pipe to remove oil, grit, excess coating, and other foreign matter. Flex rubber gasket and insert in the gasket recess of the bell socket. Apply a thin film of gasket lubricant supplied by pipe manufacturer, to either the gasket or the spigot end of the joining pipe. Start the spigot end of the pipe into the socket with care. Then complete the joint by forcing the plain end of the bottom of the socket with a forked tool or jack-type device. File the end of field cut pipe to match the manufactured spigot end.
- B. Join restrained push-on joints according to manufacturer's recommendations.
- C. Permissible deflection in push-on joint pipe shall not be greater than 2/3 of that listed in AWWA C600.
- D. Permissible deflection in restrained push-on joint pipe shall be as recommended by manufacturer.

### 3.5 Joining Fabricated Steel Pipe

- A. Join steel pipe by field welding in accordance with AWWA C206.
- B. Repair cement lining in welded steel water pipe in accordance with AWWA C205.
- C. Join steel pipe by use of flexible coupling. Install flexible couplings as recommended by the manufacturer.
- D. Coat flexible coupling installed on steel pipe in accordance with AWWA C203.

3.6 Join reinforced concrete water pipe with rubber gaskets installed as recommended by manufacturer.

3.7 Join PVC pipe and fittings in accordance with manufacturers' instructions and install in accordance with ASTM D2321.

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### 3.8 Setting Valves and Valve Boxes

- A. Install valves with operator stems in the vertical plane through the pipe axis and perpendicular to the pipe axis. Locate valves where shown on Contract Drawings. Thoroughly clean before installation. Check valves for satisfactory operation.
  - B. Equip all underground valves with valve boxes where shown on the Contract Drawings. Set valve boxes in accordance with Section 00870 - Standard Details. Set box in alignment with valve stem centered on valve nut. Set the valve box to prevent transmitting shock or stress to the valve. Set the box cover flush with the finished ground surface or pavement.
  - C. Construct manholes for all underground valves where shown on the Contract Drawings. Construct manholes so as to prevent transmitting any load or shock to the valve or pipe. Locate manholes and valve relative to each other in order that packing, operator and other parts of the valve are readily accessible for minor repairs.
  - D. Valves shall be marked in non-residential easements by markers approved by the County.
- 3.9 Manhole shall be constructed to the elevations shown on the Contract Drawings in accordance with the provisions of Section 00870 - Standard Details.
- A. Set manhole base section on bed of VDOT #57 stone to a minimum depth of 6". Stone shall be thoroughly compacted and carefully leveled.
  - B. Join all manhole riser and cone or flat slab top sections by the use of rubber gaskets.
  - C. Plug lift holes and repair any defects in manhole.
  - D. Sealant for adjusting rings shall be a one-component polyurethane sealant similar to Sika "Sikaflex" Type 1a.
    - (1) Rings will not be required outside of paved roadways or walkways unless called for on the Drawings.
    - (2) Rings in paved roadways or walkways shall permit upward or downward adjustment of manhole frame by 6".
  - E. Set manhole frame in bed of sealant. Bed shall consist of one, 3/8" bead laid flush with the inside edge of the frame base and another 3/8" bead laid flush with the outside edge of the frame base.
  - F. Bolt watertight manhole frames to manhole cone or flat slab top section as shown on the Standard Details.

- 3.10 Locate fire hydrants as shown on Contract Drawings and in accordance with Section 00870 - Standard Details.
- 3.11 Provide air and vacuum valve at locations shown on Contract Drawings. Install gate valve between water main and relief valves. Construct manholes for air and vacuum relief valve as shown on Drawings.
- 3.12 Provide reaction anchors of concrete blocking and pipe restraints at all changes in direction of pressure pipelines and as shown on Contract Drawings.
- A. Concrete reaction anchors shall bear against undisturbed earth and shall be of the size and shape shown on the Contract Drawings.
  - B. Use restraints as shown on Drawings and in Details. Restraints shall either be Meg-a-Lug or approved equal OR the pipe provided shall have integral restrained joints..
  - C. Where retainer glands are used, extreme care shall be taken so that each set screw is tightened as recommended by the manufacturer before the pipe is backfilled and tested.
- 3.13 Installation of Tapping Sleeves and Tapping Valves
- A. All tapping sleeves must be crated for shipment with a signed manufacturer's tag certifying that the sleeve meets New Kent County specifications. The County inspector shall turn this tag in to the contract file with the location of installation note on the tag.
  - B. Rigorous testing and conditions relating to tapping sleeves, applied to all manufacturers, is standard operating procedure. These conditions are as follows:
    - 1. The tapping sleeve shall be tested in place to a minimum of 200 psi. It is the contractor's responsibility to order the correct pressure rated tapping sleeve.
    - 2. If the sleeve fails the 200 psi pressure test, the original failed sleeve shall be replaced with an entirely new sleeve.
    - 3. The concrete thrust block shall be poured to also support the tapping sleeve from beneath. The tapping sleeve, valve and tapping machine assembly is to be adequately supported during the tapping operation to prevent movement or rotation of the tapping sleeve.
    - 4. Installation instructions must be followed in strict accordance with the latest County's procedures.

- C. The actual tap shall be made in presence of a representative of the Department. The Department shall be notified 48 hours in advance of making the tap.

### 3.14 Detectable Tape

- A. Install marking tape in all trenches containing buried, non-metallic, pressure pipe lines. Tape shall be installed in all trenches a minimum of 18" over the pipe. Place tape on edge of trench toward the center of the pavement in roadways. In other locations, place tape to the north or east of the utility line. Wrap tape around all valves, corporation stops and meter setters. Wrap tape three turns around base of fire hydrants and extend tape up above ground against fire hydrants. Tape shall be made electrically conductive throughout the entire system through the use of splices of a type recommended by the manufacturer

In addition to the marking tape, a tracing wire of 12 gauge copper shall be installed and taped directly on the pipe in a manner that a continuous tract results. Turn up into meter boxes every 2,500 LF if no other appurtenances (valves, hydrants, etc.) are available within that distance.

### 3.15 Disinfection of Water Lines

- A. Disinfect and test water mains and accessories in accordance with AWWA Standard C 651 and the following:
- B. All water lines shall be disinfected prior to being placed in operation.
- C. Prior to disinfection all water lines shall be flushed. All valves and hydrants shall be operated during this operation. Flushing velocities should not be less than 3.0 ft./sec.
- D. Methods of Chlorine Application
  - (1) Continuous feed method – Potable water shall be introduced into the pipe line at a constant flow rate. Chlorine shall be added to a constant rate to this flow so that the chlorine concentration in the water in the pipe is at least 50 mg/L. The chlorinated water shall remain in the pipe line at least 24 hours, after which, the chlorine concentration in the water shall be at least 10 mg/L. All valves and appurtenances shall be operated while the chlorinated water remains in the pipe line.
  - (2) Slug Method – Potable water shall be introduced into the pipe line at a constant flow rate. This water shall receive a chlorine dosage which will result in a chlorine concentration of 100 mg/L in a "slug" of the water. The chlorine shall be added long enough to insure that all portions of the pipe are exposed to the 100 mg/L chlorine solution for at least 3 hours.

The chlorine residual shall be checked at regular intervals not to exceed 2000' to insure that adequate disinfection is occurring. As the chlorinated water passes valves and appurtenances, they shall be operated to insure disinfection of these appurtenances.

- (3) The filling velocity of the potable water in the pipe line shall be less than 1 ft/sec. The water chlorine solution shall remain in contact with the pipe for 24 hours. All valves and appurtenances shall be operated while the chlorinated water is in the pipe line.
  - (4) Under no circumstances are tablets or powders to be used to disinfect water lines.
- E. Final Flushing - After the required retention period, the heavily chlorinated water shall be flushed from the pipe line using potable water.
- F. Testing - After the lines have been flushed, the water lines shall be tested. Samples shall be collected at regular intervals, not exceeding 1200' throughout the length of pipe line.
- (1) All chlorine residual determinations shall be made using only those methods approved by the Health Department.
  - (2) Two water samples for bacteriological analysis must be collected at least 16 hours apart and analyzed by a certified laboratory. The results of these samples must indicate no coliform contamination before the pipe, tanks, or equipment can be utilized as part of the waterworks. If contamination is indicated, then the disinfection procedures must be repeated.
- G. Maintain a copy of AWWA Standard C651 on Project site during all disinfecting operations.

### 3.16 Acceptance Tests

- A. Supply the pumps, calibrated gages and meters, and all the necessary apparatus. Notify the New Kent County at least 48 hours in advance of the test date and perform tests in presence of New Kent County's representative.
- B. The Department will supply water at no cost for one test of potable water lines only; all other water will be supplied by the Contractor at his own cost.
- C. After the line has been backfilled and at least seven days after the last concrete reaction anchor has been poured, subject the line or any valved section of the line to a hydrostatic pressure test in accordance with AWWA C600, except as modified herein. Fill the system with water at a velocity of approximately 1' per sec. while necessary measures are taken to eliminate all air. After the system has

been filled, raise the pressure by pump to 1.5 x the working pressure or 150 psi, whichever is greater. Test pressures shall: (1) Not be less than 1.25 x the working pressure at the highest point along the test section, (2) not exceed thrust restraint pressure, (3) not vary by more than + or -5 psi, (4) not exceed twice the rated pressure of the valves or hydrants when test includes closed gate valves, (5) not exceed rated pressure of valves if resilient-seated butterfly valves are used, (6) shall be at least 150 psig. Measure pressure at the low point on the system compensating for gage elevation. Maintain this pressure for two hours. If pressure cannot be maintained, determine cause, repair and repeat the test until successful.

END OF SECTION