



SANITARY SEWER, WATER LINE

AND

GAS FACILITIES

STANDARD SPECIFICATIONS AND DETAILS

2002

DEVELOPMENT STANDARDS

INDEX

DEVELOPMENT STANDARDS  
STANDARD SPECIFICATIONS FOR  
WATER AND SEWER SYSTEM CONSTRUCTION  
RICHMOND UTILITIES BOARD  
RICHMOND, KENTUCKY

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## DEVELOPMENT STANDARDS

### DIVISION 0

#### GENERAL CONDITIONS

##### 1. PURPOSE OF STANDARDS

These Specifications, and the Standard Construction Details accompanying them, are provided by the Richmond Utilities Board (RUB) to govern and control the materials and installation of sanitary sewer or water distribution facilities that are, or will become, the responsibility of the Richmond Utilities Board, Richmond, Kentucky, to operate and maintain as a portion of the system. These documents shall supersede all other construction details unless in violation of regulatory agency requirements. They are intended to secure facilities of such quality, and of the design incorporating criterion, such that will satisfy the requirements of the Richmond Utilities Board, the Madison County Health Department, the Kentucky State Health Department and the Kentucky Natural Resources and Environmental Protection cabinet, and any other agencies exercising control, such as the City of Richmond, the State Department of Transportation, or Railways. They are intended primarily for the use of land developers, subdivision developers, design engineers, and contractors who desire to construct the sewer an water facilities.

Prior to design the ENGINEER shall acquire an updated set of Richmond Utilities Infrastructure Development manuals, with a copy for CONTRACTOR. Copies of the manuals for the construction of sanitary sewers and force mains and water mains are available at the Richmond Utilities Board office, Richmond, Kentucky, and shall be made available to the CONTRACTOR, ENGINEER or other person for use on the job upon payment of \$25.00 each.

These Specifications may from time to time be changed by Addendum. Any items of construction not covered by these standards will be developed by the Richmond Utilities Board as needed.

##### 2. STANDARD PROCEDURES

Developer shall follow the standard operating procedures outlined in Richmond Utilities' *Construction and Acceptance of Utilities Policy*.

Subdividers and developers shall perform the construction of water and sanitary sewer facilities within and adjacent to his subdivision, as required to connect his system to the existing utility systems. The following shall be performed by the subdivider:

a. Employ a Registered Professional Engineer, experienced in water and sewer utility work to prepare plans for the proposed work, and submit the plans to the Richmond Utilities Board for their review and approval. These plans shall be developed in accordance to the latest revisions of the RUB Infrastructure Development manuals. The plans to be submitted shall consist of the following:

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(1) A Project Map, or plan of the subdivision, showing thereon all lots to be served; contours, on USGS Datum, at not greater than 2 foot intervals; location of all sanitary sewers and manholes (does not include service lateral to lots); location of all water mains, valves and fire hydrants (does not include service line to lots); and easements, if required, for those mains where off the street.

(2a) For sanitary sewers, there shall also be provided separate plan and profile sheets showing the sewers in plan and in profile, with flow line elevation of the sewers at manholes noted, and grades of sewer, with pipe material indicated. Manholes shall be stationed and lines keyed to reference the lines to those shown on the Project Map. Scale of the plan view shall be no smaller than 1" = 50', and vertical scale of profile shall be no smaller than 1" = 1', with 1" = 5' preferred.

(2b) For water lines there shall also be provided separate plan and profile sheets showing the water line elevations and other utility crossings with valves, air relief, fire hydrant, and other appurtenances with pipe material indicated. Scale of the plan view shall be no smaller than 1" = 50', and vertical scale of profile shall be no smaller than 1" = 5'.

(3) A vicinity map shall also be provided, showing the location of the subdivision in relation to other areas of the city.

(4) If a sewage pumping station is required, a location plot plan shall be provided, at scale no smaller than 1" = 10', with contours, showing facilities to be provided. Sewage force main from the sewage pumping station is to be shown in plan and profile as required for sanitary sewers.

(5) The Utilities Board's standard sheet size is 24" x 36", and plans submitted shall be on this size sheet.

(6) Initial submittal shall be 2 sets of prints of the above required plans. Richmond Utilities Board will review the plans for conformance with their standards and with their overall plans for their sewer system. If changes are required in the plans, the subdivider will cause the changes to be made and resubmit the plans for final Utilities Board approval. The developer shall secure the approval of the state control agencies. These drawings will be retained by the Richmond Utilities Board for their records. Electronic format will be required per Richmond Utilities.

(7) The subdivider's engineer shall prepare, and the subdivider secure, all necessary permits or easements required from the State Department of Transportation, railway companies and private properties, in the name of the City of Richmond for the benefit of the Richmond Utilities Board, Richmond, Kentucky, and deliver them to the Richmond Utilities Board.

b. Employ an experienced Utility Contractor to perform the necessary construction work. The Contractor shall keep on the work, during its progress, a competent superintendent and any necessary assistants, all satisfactory to the

## DEVELOPMENT STANDARDS

Richmond Utilities Board. Equipment and tools shall be of adequate size and in proper condition to perform the work.

c. Record drawings shall be provided showing actual construction, including sewer laterals and water service lines. Service shall not commence until acceptable record drawings are provided. The ENGINEER will also be required to submit electronic formatted "as-builts" in accordance to the RUB Infrastructure Procedures manual.

### 3. DEFINITIONS

Unless otherwise noted, the terms "OWNER," "CONTRACTOR," and "ENGINEER," as used in these Specifications, shall mean the following:

- a. "OWNER" shall mean the Richmond Utilities Board, Richmond, Kentucky.
- b. "CONTRACTOR" shall mean the subdivider or developer.
- c. "ENGINEER" shall mean the consulting engineer of the Richmond Utilities Board.

### 4. DESIGN CRITERIA

All water and sewer facilities shall be designed to conform with the Kentucky Department of Water Regulations, which includes conformance with "Ten States Standards." All materials used for construction of water and sewer facilities shall be new. Used materials are expressly prohibited.

All water mains and force mains shall be designed to include 12 gauge copper tracer wire. The following design criteria shall also be utilized.

- a. Water Mains and Appurtenances
  - (1) Minimum water main size shall be 8 inches in diameter.
  - (2) Minimum pressure class for PVC and PE pipe shall be 200 psi. Minimum pressure class for ductile iron pipe shall be 350 Class.
  - (3) Valves shall be resilient seat gate units and shall be located at all pipe junctions.
  - (4) Fire hydrants shall be located such that any residential lot is within 250 feet of a hydrant. Hydrant branches shall be 6 inches in diameter and equipped with a separate valve.
  - (5) Minimum depth of bury for water mains shall be 36 inches, unless otherwise approved in writing by the OWNER.

## DEVELOPMENT STANDARDS

(6) Water services shall be minimum 1 inch in diameter and utilize copper or SDR 9, PE with stainless steel stiffeners.

(7) Meter set details shall comply with Richmond Utilities standards.

(8) Fire protection systems shall provide isolation and backflow prevention as directed by Richmond Utilities.

### b. Sanitary Sewers

(1) Minimum 8 inch size for street sewers.

(2) Minimum 4 inch lateral service line from street sewer to lot line.

(3) Minimum velocity of 2 feet per second flow in sewer, based on sewer flowing full, with Kutter's roughness coefficient of  $n = 0.013$ .

(4) Design flow for sewer, not including infiltration and peaking factor, shall be 100 gpm per capita.

(5) Design flow for sewage pumping station, including infiltration and peaking factor, is 0.42 gpm per residential lot.

(6) Manholes to be placed at maximum spacing of 400 feet, and at all changes in grade or alignment.

(7) An extra fall through the manhole at 0.10 foot will be provided, in addition to the grade of the sewer.

(8) Where joining sewers of different size, the tops of the pipe will be matched.

(9) Two-way clean-out shall be provided at each lot line, installed either by the CONTRACTOR or plumber.

### 3. Sewage Pumping Stations and Force Mains

(1) Maximum motor rpm for sewage pump stations shall be 1800.

(2) Minimum size sewage force main is 4 inch, with minimum velocity of 2 fps in force main.

(3) Force mains will be designed without high points. If elimination of high points is not feasible, a manual air or automatic relief valve will be installed at each high point where air can be trapped.

(4) CONTRACTOR installed systems which do not comply with the above shall not be acceptable.

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- (5) Minimum depth of bury is 36 inches.

### 5. FINAL INSPECTION

Prior to acceptance by the Richmond Utilities Board, an inspection shall be made of all facilities included in the construction, in accordance with the RUB Infrastructure Procedures manual.

### 6. COST OF CONSTRUCTION

The subdivider/developer shall bear all costs incidental to installation of all facilities within and extending to the subdivision. However, the OWNER may participate in the cost of "oversizing" the facilities to serve additional areas, if the larger facilities are required by the OWNER'S master plan for the system. Each application for cost participation shall be considered on its own merits, and the OWNER reserves the right to approve or reject any application, as it may see fit.

**END OF SECTION**

SECTION 01500

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 GENERAL

1.01 SANITARY FACILITIES

- A. The CONTRACTOR shall construct and maintain, in a sanitary condition, sanitary facilities for the CONTRACTOR'S employees and also employees of the Subcontractors. The CONTRACTOR shall, at completion of the Contract Work, properly dispose of these sanitary facilities.

1.02 UTILITIES

- A. The obtaining of all utilities for construction, including power and water, shall be the responsibility of the CONTRACTOR.

1.03 MAINTENANCE OF SERVICE IN EXISTING UTILITIES

- A. Where the existing utilities must be disturbed during construction, their operation and function shall be maintained by the CONTRACTOR to such a degree that service to customers will be interrupted for minimum time periods only. **The OWNER shall be notified of interruptions in sufficient time to prepare for them and shall agree to the hour, date, and duration of them before they are undertaken.**
- B. Digging through services with trenching machines will not be permitted. Upon damage to utility services, such services shall be repaired immediately and tested to the satisfaction of the OWNER. The CONTRACTOR shall notify all utility users of impending interruption of service and shall be responsible for all damage resulting from same.
- C. The locations and sizes of existing mains cannot be guaranteed. It shall be the responsibility of the CONTRACTOR to locate and uncover existing lines, to which new mains are to be connected, and provide all connecting fittings of the correct size and type for each connection.

1.04 PROPERTY PROTECTION

- A. Care is to be exercised by the CONTRACTOR in all phases of construction, to prevent damage and/or injury to the OWNER's and/or other property.

1.05 CONSTRUCTION WARNING SIGNS

- A. The CONTRACTOR shall provide construction warning signs for each location where he is working in the State highway right-of-way or in City streets. He will further provide flagmen as required and shall abide by all Kentucky Transportation Cabinet, Department of Highways safety rules, including size, type and placement of construction signs. All signs shall be of professional quality.

1.06 RESPONSIBILITY FOR TRENCH SETTLEMENT

**SECTION 02235**

**CRUSHED STONE AND DENSE GRADED AGGREGATE (DGA)**

**PART 1 GENERAL**

1.01 SCOPE OF WORK

- A. Various sizes, types and quality of crushed stone aggregates are specified in this Section depending on applicability which may be specified in detail in other sections of these Specifications.
- B. The Utilities Board may require the use of crushed stone aggregates for purposes other than those specified in this or other Specification sections if such use is advisable.

**PART 2 PRODUCTS**

2.01 MATERIALS

- A. Crushed stone aggregate shall meet the applicable requirements for the intended use in accordance with Section 805 of the Kentucky Transportation Cabinet, Department of Highways, Standard Specifications for Road and Bridge Construction.

**PART 3 EXECUTION**

3.01 INSTALLATION

- A. Compacted Crushed Stone Aggregate
  - 1. Crushed stone shall be placed in uniform layers not greater than 6 inches deep and shaped by power equipment to required lines, grades, cross connections, and depths. No minimum compacted density, method of compaction, or compaction equipment is required since a nominal amount of compaction effort with vibration can establish the desired intergranular locking of the aggregate under controlled placement depth. Acceptable compaction can be achieved with pneumatic-tired and tracked equipment and rollers.
  - 2. All compaction operations shall be performed to the satisfaction of the Utilities Board
  - 3. Crushed stone shall be placed in those areas as directed by the Utilities Board.
- B. Compacted Dense Graded Aggregate (DGA)
  - 1. Dense graded aggregate shall be plant mixed with water, transported in such a manner as to deliver the mix to the project without loss or segregation, spread, and compacted to produce a density throughout not less than 84 percent of solid volume. Minimum dry density for compacted limestone DGA shall be 139 pounds per cubic foot when S.G. of limestone is 2.65. Construction requirements shall be in accordance with Section 303 of Kentucky Transportation Cabinet, Department of Highways, Standard Specifications for Road and Bridge Construction.

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2. Density tests shall be required in such number as determined by the Utilities Board.
3. Compacted material which does not meet density requirements shall be removed. The Utilities Board shall determine if removed material can be remixed and used again for fill.

**END OF SECTION**

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- A. The CONTRACTOR shall be responsible for any settlement caused by the construction, that occurs within 1 year after the final acceptance of this Contract by the OWNER. Repair of any damage caused by settlement shall meet the approval of the OWNER.

1.07 WASTE DISPOSAL

- A. The CONTRACTOR shall dispose of waste, including any hazardous waste, off-site in accordance with all applicable laws and regulations.

**END OF SECTION**

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SECTION 02326

STEEL COVER PIPE

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Steel cover pipe shall be furnished and installed per following Specifications.

1.02 RELATED WORK

- A. Sewer and Drain Pipe is specified in Section 02700.

PART 2 PRODUCTS

2.01 STEEL COVER PIPE

- A. Steel cover or jack pipe shall be plain end steel pipe with minimum yield strength of 35,000 psi and tensile strength of 60,000 psi per API-5L Grade B material. The steel pipe supplied shall be manufactured by the seamless, electric-weld, submerged-arc weld or gas metal-arc weld process as specified in API-5L. Certification of 35,000 psi minimum yield strength shall be furnished by the supplier through the CONTRACTOR to the Utilities Board in sufficient copies before pipe is shipped to job to permit the Utilities Board to retain 3 copies.
- B. Used pipe shall be acceptable if it meets the minimum requirements for size, thickness and strength for new pipe. Supplier shall furnish through the CONTRACTOR to the Utilities Board 3 copies of certification of test results of strength tests conducted on the used pipe prior to shipment to job site. Used pipe with excessive corrosion and pitting present shall not be supplied.
- C. The inside diameter of steel cover pipe shall be at least 2 inches greater than the largest outside diameter of the carrier pipe, joints or couplings, except for carrier pipe 6 inches or greater in diameter under railroads, the difference shall be 4 inches instead of 2 inches.
- D. Cover pipe shall have a **minimum** wall thickness as shown in the following table:

Nominal Diameter Inches	Nominal Thickness Inches	Nominal Diameter Inches	Nominal Thickness Inches
Under 10	0.188	24	0.438
10 & 12	0.250	26	0.438
14 & 16	0.281	28 & 30	0.500
18	0.312		
20	0.344		
22	0.375		

PART 3 EXECUTION

3.01 BORING OR JACKING

- A. Boring or jacking as specified herein will be allowed at locations other than those noted on the Drawings, where advantageous to lay pipe under streets, driveways, and sidewalks, without their monolithic structure being destroyed.
- B. Boring or jacking under highways, railroads, sidewalks, pipelines, etc., shall be done at the locations shown on the Drawings. It shall be performed by mechanical means and accurate vertical and horizontal alignment must be maintained. When shown on the Drawings, cover pipe shall be used and shall be installed inside bored holes concurrently with boring, or jacking.

3.02 STEEL COVER PIPE INSTALLATION

- A. Steel cover pipe shall be of the size and wall thickness as shown on the Drawings.
- B. When cover pipe is jacked, concurrent with boring, all joints shall be solidly welded. The weld shall be such that the joint shall be of such strength to withstand the forces exerted from the boring and jacking operation as well as the vertical loading imposed on the pipe after installation. The weld shall also be such that it provides a smooth, nonobstructing joint in the interior of the pipe which will allow easy installation of the carrier pipe without hanging or abrasion to the carrier pipe upon installation.
- C. When cover pipe is installed in open trench, it shall be bedded and backfilled per Specifications applying to sewer pipe in such locations.
- D. Cover pipe in open trench shall be joined in such manner that they will not be moved out of alignment or grade and that will prevent backfill material from entering joint. Where cover pipes are shown on the Drawings to be equipped with vent pipes, vents shall be installed as shown on the Drawings.

3.03 CARRIER PIPE IN COVER PIPE INSTALLATION

A. Pipeline Spacers

1. Pipes installed inside cover pipes shall be centered throughout the length of cover pipe. Centering shall be accomplished by the installation of bolt on style spacers with a 2 piece solid shell made from T-304 stainless steel of a minimum 14 gauge thickness. The shell shall be lined with a ribbed PVC sheet of a 0.090 inch thickness that overlaps the edges. Runners, made from UHMW polymer, shall be attached to the pipe in such a manner as to prevent the dislodgement of the spacers as the carrier pipe is pulled or pushed through the cover pipe. Risers shall be made from T-304 stainless steel of a minimum 14 gauge thickness and shall be attached to the shell by MIG welding. All welds shall be fully passivated. All fasteners shall be made from T-304 stainless steel.
2. Spacers shall be of such dimensions to provide 1) full supportive load capacity of the pipe and contents; 2) of such thickness to allow installation and/or removal of the pipe; and 3) to allow no greater than 1/2 inch movement of the carrier pipe within the cover pipe after the carrier pipe is installed.
3. Spacers shall be located immediately behind each bell and at a maximum spacing distance as shown below unless a lesser maximum spacing distance is recommended by the pipe manufacturer:

Pipeline Diameter (in.)

Maximum Spacing (ft.)

- - - 1 1 .

2 - 2-1/2	4
3 - 8	7
10 - 26	10
28	9
30	8
32	7
34	6
36 - 38	5.5
40 - 44	5
46 - 48	4

The materials and spacing to be used shall be accepted by Richmond Utilities prior to installation. The polyethylene pipeline spacers shall be manufactured by Cascade Waterworks Manufacturing Co., of Yorkville, Illinois, Pipeline Seal and Insulator, Inc., of Houston, Texas, or equal. Installation shall be in accordance with manufacturer's recommendations.

**END OF SECTION**

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**SECTION 02500**

**BITUMINOUS PAVING**

**PART 1 GENERAL**

1.01 SCOPE OF WORK

- A. The CONTRACTOR shall be required to supply all materials and equipment and perform all work for the placement of the base and/or surface course for restoring to the preconstruction condition the surface of the existing streets, roads, drives and parking areas to the depths as shown in the detailed Drawings and as specified herein.

1.02 REFERENCES

- A. Unless noted, all Specifications designations denoted KTCSSRBC refer to the Kentucky Transportation Cabinet Department of Highways Standard Specification for Road and Bridge Construction. Appropriate technical portions of the referenced sections of the Specifications shall apply, but all work shall be as described herein unless otherwise specified or shown on the Drawings.

1.03 WORK DESCRIPTION

- A. Bituminous concrete shall be used for surfacing new roads and parking areas, for replacement of city streets, drives, parking areas and state highways of bituminous construction and for resurfacing existing roads and state highways at locations shown on the Drawings or specified.

1.04 QUALIFICATIONS

- A. The pavement design mixture shall be used as determined by local plant mix availability. The design mixture shall have been approved recently by the Kentucky Transportation Cabinet Department of Highways and used recently on a state paving project.

1.05 SUBMITTALS

- A. The design mix shall be submitted to the Utilities Board or its representative for review and acceptance. The submittal shall include the following:
  - 1. The last date the mixture was approved by the Kentucky Transportation Cabinet Department of Highways for use on a state road project.
  - 2. The location where the mixture was recently used, and the name and address of the paving contractor.

1.06 TRENCH WIDTH REPAVING - CITY AND COUNTY STREETS, ROADS AND PARKING AREAS

- A. The cut edges of the existing paving surface shall be trimmed a depth of at least 2 inches to straight lines for uniform appearance and clean surface at joints. The area between the cut edges of the paving shall be removed to a depth of 2 inches (minimum) or to the bottom of the existing paving. All unstable material in the trench shall be removed and replaced with compacted dense

graded aggregate and dense graded aggregate added as needed to bring the base surface to the bottom of existing paving or 2 inches below the existing surface, whichever is the lower. (Refer to surface replacement detail-drawing no. M 12)

- B. The paving subgrade shall be compacted under the wheel of a roller, until there is no observed settlement of the subgrade.
- C. The sides of existing pavement shall be covered with a tack coat and bituminous paving shall be hot applied as previously described. Final surface shall be finished to 1/4 inch above existing paving surface at edges and crowned to 1/2 inch above existing surface at the center.
- D. The CONTRACTOR shall maintain repaving up to grade of existing street surface until final completion and acceptance of work under his Contract. During the guarantee period of one year, the CONTRACTOR will be responsible for defective materials or workmanship, and natural settlement.
- E. In case additional bituminous paving is to be added due to settlement, surface to be built up shall have all dirt removed and such surface swept clean with a stiff wire brush or broom. A tack coat shall be applied to clean surface and additional paving placed in quantity required. Traffic shall be prevented from passing over the treated surface before the additional paving materials are placed.

**END OF SECTION**

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**SECTION 02610**

**PRESSURE PIPE  
WATER AND SANITARY SEWER FORCE MAINS**

**PART 1 GENERAL**

1.01 SUMMARY

- A. For Cover Pipe and Boring and/or Jacking see Section 02326.

1.02 SUBMITTALS

- A. The CONTRACTOR shall submit to the Utilities Board 3 copies of the bill of materials, manufacturer's test certifications, and manufacturer's descriptive literature for all piping.

**PART 2 PRODUCTS**

2.01 MATERIALS - PRESSURE PIPE

- A. Ductile Iron Pipe - Mechanical and Rubber Slip Joint Type

- 1. Pipe

- a. General

- (1) Ductile iron pipe shall be furnished for all piping 3 inches and over in size designated "D.I." on Drawings and shall be designed in accordance with ANSI/AWWA C150/A21.50-96 and ANSI/AWWA C151/A21.51-96 specifications and supplements thereto, and for pressures and conditions as stated in Article b.(1) below.

- b. Design Conditions

- (1) Pressure: Minimum 350 psi operating pressure plus 100 psi water hammer allowance.

- c. Lengths

- (1) Pipe may be furnished in 18 or 20 foot nominal laying lengths.

- d. Marking

- (1) The net weight, class or nominal thickness, and casting period shall be shown on each pipe. The manufacturer's mark, the year in which the pipe was produced, and the letters "DI" or "DUCTILE" shall be cast or stamped on the pipe.

- e. Spigot End of Pipe

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- (1) The spigot end of the pipe shall be free of blemishes and defects which might be responsible for a poor fit with the rubber ring gasket and result in leakage.

2. Fittings

a. General

- (1) Ductile iron compact fittings, meeting the requirements of ANSI/AWWA C153/A21.53-00, will be accepted through 16 inch diameter. Fittings larger than 16 inch diameter shall meet the requirements of ANSI/AWWA C110/A21.10-98.
- (2) Fittings shall be 350 psi pressure rating for all sizes through 30 inch.

b. Lining and Coating

- (1) All fittings shall be lined and coated the same as adjacent pipe.

3. Joints

a. General

- (1) Pipe joints shall be mechanical joint or rubber ring slip joint as shown on the Drawings.
- (2) All items used for jointing pipe shall be furnished with the pipe. The joints shall be made with tools and lubricant in strict conformity with the manufacturer's instructions. Copies of the instructions shall be delivered to the ENGINEER at start of construction in sufficient numbers that will permit the ENGINEER to retain 3 copies.

b. Mechanical Joints

- (1) Mechanical joints are to be furnished according to ANSI/AWWA C111/A21.11-00. All pipe joints must be furnished complete with all accessories. Mechanical joint bolts and nuts shall be of alloy cast iron or alloy steel (Corten type such as U.S. Alloy) or equal. Rubber gaskets shall be made of plain first grade rubber, free of imperfections and porosity. Hardness shall be  $75 \pm 5$  durometer.

c. Rubber Ring Slip Joint (Push On)

- (1) Rubber ring slip joint shall be equal to ANSI/AWWA C111/A21.11-00. The joints shall be of the following materials and assembled in the sequence outlined below:
  - (a) Rubber ring gasket compressed in groove in bell of pipe.
  - (b) Beveled spigot end of pipe for initial centering into rubber gasket in bell.

d. Special Gaskets

- (1) Where a water main is located within a 200-foot radius of an underground storage tank (UST), ductile iron pipe with special rubber gaskets shall be provided for the water main joints. Service lines within this 200-foot radius shall be copper with brass compression fittings.
- (2) These gaskets shall be manufactured of “nitrile rubber” material or other acceptable material possessing superior resistance to deterioration from petroleum based products.
- (3) This requirement will apply to the gaskets supplied for mechanical joints and push-on joints when located within the 200 foot radius of a UST.
- (4) The cost of the special gasket shall be incorporated into the cost of the installed pipe.

#### 4. Lining and Coating

- a. All ductile iron pipe for water service shall have manufacturer's standard outside bituminous or asphaltic base coating and a cement lining and bituminous seal coat on the inside. Cement mortar lining and bituminous seal coat inside shall conform to ANSI/AWWA C104/A21.4-95.

### B. Ductile Iron Pipe - Flanged

#### 1. Pipe

##### a. Flanged Pipe

- (1) Flanged pipe shall be made in accordance with ANSI/AWWA C115/A21.15-99 Specifications, and shall be thickness Class 53.

#### 2. Fittings

##### a. Flanged Pipe

- (1) Flanged joint fittings shall conform to ANSI/AWWA C110/A21.10-98 Standard for Gray Iron and Ductile Iron Fittings - 3 inch through 48 inch.
- (2) Fittings shall be 250 psi pressure rating for all sizes.
- (3) Fittings shall be ductile iron meeting the above requirements and shall be furnished complete with all joint accessories.

#### 3. Joints

##### a. General

- (1) All items used for jointing pipe shall be furnished with the pipe. The joints shall be made with tools and lubricant in strict conformity with the manufacturer's instructions. Copies of the instructions shall be delivered

to the Utilities Board at start of construction in sufficient numbers that will permit the Board to retain 3 copies.

b. Flanged Pipe

- (1) All ductile iron flanged pipe shall have flanges faced and drilled, 125 pound in accordance with ANSI/AWWA C110/A21.10-98 unless otherwise specified.
- (2) Flanges may be cast integrally with the pipe or they may be screwed on specially designed long hub flanges, refaced across both face of flange and end of pipe.
- (3) Flanged joints are to be furnished according to ANSI/AWWA C115/A21.15-99 and shall be ductile iron only. Flanged joints shall have 1/8 inch rubber full face gaskets made especially for water pipe use. Bolts for ductile iron flanged pipe must be of standard sizes for pipe to be fitted, and must be black steel, machine bolts with heavy hexagon heads and nuts meeting ANSI B18.2.1 and ANSI B18.2.2, respectively. In unheated vaults, submerged and/or damp locations, bolts and nuts for ductile iron flanged pipe shall be stainless steel.

4. Lining and Coating

a. Flanged Pipe

- (1) Flanged pipe for water and wastewater service shall be cement lined and bituminous coated the same as written herein for ductile iron pipe, mechanical and rubber slip joint type.

C. Polyethylene and Copper Pipe and Fittings

1. Outside, Underground Tubing with Compression Joints

- a. Small piping in the ground shall be of standard soft copper tubing for water service pipe, ASTM Specifications B 88-93, Type "K," or PE SDR-9, Class 200 psi, with bronze fittings, stops, and valves having compression connections for flared copper tubing.

D. Polyvinyl Chloride (PVC) Pipe (ASTM)

1. Pipe (2-Inch Through 8-Inch)

- a. PVC pipe shall be extruded from Class 12454-B polyvinyl chloride material with a hydrostatic design stress of 2000 psi for water at 73.4 degrees Fahrenheit, designated as PVC 1120, meeting ASTM Specifications D 1784-81 for material. Three-fourths inch through 1-1/2 inch water service piping shall be PVC Schedule 40 as specified in ASTM D 1785-93. Two inch through 12 inch pipe for water shall be SDR 21 for 200 psi allowable working pressure at 73.4 degrees Fahrenheit and a safety factor of 2.0, as specified in ASTM D 2241-93.

- b. The pipe shall be homogeneous throughout and free from cracks, holes, foreign inclusions or other defects. The pipe shall be as uniform as commercially practical in color.
- c. The workmanship, pipe dimensions and tolerances, outside diameters, wall thickness, eccentricity, sustained pressures, burst pressures, flattening, extrusion quality, marking and all other requirements of ASTM D 2241-93 shall be conformed with in all respects.
- d. Pipe shall be furnished in 20 foot lengths. The pipe may be double plain end or with bell on one end. Male ends of pipe must be beveled on the outside.
- e. Pipe shall have a ring painted around the male end or ends in such a manner as to allow field checking of setting depth of pipe in the socket. This requirement is made to assist construction superintendents and inspectors in visual inspection of pipe installation.
- f. Pipe must be delivered to job site by means which will adequately support it, and not subject it to undue stresses. In particular, the load shall be so supported that the bottom rows of pipe are not damaged by crushing. Pipe shall be unloaded carefully and strung or stored as close to the final point of placement as is practical.
- g. Pipe must not be exposed to the direct rays of the sun for an extended period of time. If pipe is not to be installed shortly after delivery to the job site, it must be stored in a shaded location.

2. Fittings

- a. Ductile iron compact fittings, meeting the requirements of ANSI/AWWA C153/A21.53-00, will be accepted through 16 inch diameter. Fittings larger than 16 inches in diameter shall meet the requirements of ANSI/AWWA C110/A21.10-98.
- b. Fittings shall be 350 psi pressure rating for all sizes through 30 inch.

2.02 SOURCE QUALITY CONTROL

A. Ductile Iron Pipe (Mechanical Joint and Rubber Slip Joint Type)

- 1. Hydrostatic and physical properties acceptance tests shall be in accordance with ANSI/AWWA Specification C151/A21.51-96 for ductile iron pipe centrifugally cast in metal molds or sand lined molds for water or other liquids.
- 2. The OWNER shall be provided with sufficient copies of each of the tests to permit the OWNER to retain 3 copies.
- 3. All items used for jointing pipe shall be tested before shipment.

B. Polyvinyl Chloride (PVC) Pipe (AWWA)

1. The manufacturer shall furnish an affidavit that all delivered materials comply with the requirements of this Specification.
2. Each length of pipe shall be proof tested at 4 times its rated class pressure.

C. Polyvinyl Chloride (PVC) Pipe (ASTM)

1. Samples of pipe and physical and chemical data sheets shall be submitted to the ENGINEER for review and acceptance before pipe is delivered to job.
2. Samples of solvents and the recommended instruction for their use must be submitted for the ENGINEER'S review and acceptance before delivery of solvent to the job.

D. Copper

1. Outside, Underground Tubing with Compression Joints
  - a. Catalog and test materials showing full compliance with these Specifications as required.

E. Polyethylene Pipe for Water Service Lines

1. Results of tests on the raw materials and the polyethylene pipe in accordance with ASTM standards and the Plastic Pipe Institute shall be furnished along with catalogs and other descriptive literature before the materials are sent to the job site (SDR 9, 200 psi).

### **PART 3 EXECUTION**

#### **3.01 TRENCH EXCAVATION - PRESSURE PIPE**

A. General

1. Trenching includes such items as railroad, street, road, sidewalk, pipe and small creek crossings; cutting, moving or repairing damage to fences, poles or gates and other surface structures, regardless of whether shown on the Drawings. The CONTRACTOR shall protect existing facilities against danger or damage while pipeline is being constructed and backfilled or from damage due to settlement of the backfill.
2. All excavation shall be open trenches, except where the Drawings call for tunneling, boring or jacking under structures, railroads, sidewalks, roads or highways.

B. Trees and Shrubs

1. Where pipelines run through wooded terrain, cutting of trees within limits of maximum permissible trench widths, as set forth in this article, will be permitted. However, cutting of additional trees on sides of trench to accommodate operating of trenching machine will not be permitted.

C. Highways, Streets and Railroads

1. Construction equipment injurious to paving encountered shall not be used. Curbs, sidewalks, and other structures shall be protected by the CONTRACTOR from damage by his construction equipment.
2. Where trenching is cut through paving which does not crumble on edges, trench edge shall be cut to at least 2 inches deep to straight and neat edges, before excavation is started, and care taken to preserve the edge to facilitate neat repaving.
3. The CONTRACTOR shall so coordinate his work as to produce a minimum of interference with normal traffic on highways and streets. He may, with the approval of the governing agency, close a street to traffic for such length of time considered necessary, provided persons occupying property abutting the street have an alternate route of access to the property which is suitable for their needs during the time of closure. It shall be the responsibility of the CONTRACTOR to give 24 hours advance notice to fire and police departments and to occupants of a street which will be closed, in a manner approved by the governing body.
4. The CONTRACTOR shall maintain road crossings in a passable condition for traffic until the final acceptance of the work.
5. Kentucky Transportation Cabinet permits shall be obtained by the CONTRACTOR prior to any work on state maintained roads and rights-of-way. Highway Department requirements in regard to trenching, tunneling, boring and jacking shall take precedence over the foregoing general specifications and the following tunneling and boring or jacking specifications, where they are involved.

#### D. Existing Utilities

1. The CONTRACTOR shall determine, as far as possible in advance, the location of all existing sewer, culvert, drain, water, electric, telephone conduits, and gas pipes, and other subsurface structures and avoid disturbing same in opening his trenches. In case of sewer, water and gas services and other facilities easily damaged by machine trenching, same shall be uncovered without damage ahead of trenching machine and left intact or removed without permanent damage ahead of trenching and restored immediately after trenching machine has passed. The CONTRACTOR shall protect such existing facilities, including power and telephone poles and guy wires, against danger or damage while pipeline is being constructed and backfilled, or from damage due to settlement of his backfill. It shall be the responsibility of the CONTRACTOR to inform the customers of utilities of disruption of any utility service as soon as it is known that it has been or will be cut off.
2. The CONTRACTOR shall, at all times during trenching operations, carry a stock of pipe and fittings likely to be needed for replacement of pipelines to facilitate immediate repair.

#### E. Pipelines in Same Trench

1. Pipelines (force mains and sewers) laid in same trench shall, be bedded on specified bedding materials, regardless of divergence in their elevations, unless otherwise specified. They shall never be laid in unsupported backfill or one above the other. Minimum horizontal separation between pipelines in the same ditch shall be 2 feet.

#### F. Trench Requirements

1. All trenches must be dug neatly to lines and grades.
2. The opening of more than 500 feet of trench ahead of pipe laying and more than 500 feet of open ditch left behind pipe laying, before backfilling, will not be permitted, except upon written consent of the OWNER. No trench shall be left open or work stopped on same for a considerable length of time. In case of objectionable delay trench shall be refilled according to backfill specifications.
3. Where subgrade of trench has insufficient stability to support the pipeline and hold it to its original grade, the Utilities Board may order stabilization by various means, exclusive of dewatering normally required for construction.
4. Excavation for pipe laying must be made of sufficient width to allow for proper jointing and alignment of the pipe, but not greater than the maximums permitted in the following table:

MAXIMUM TRENCH WIDTH AT TOP OF PIPE

<u>Nominal Pipe Size</u> (Ins.)	<u>Trench Width</u> (Ins.)	<u>Nominal Pipe Size</u> (Ins.)	<u>Trench Width</u> (Ins.)
4	28	20	44
6	30	24	48
8	32	30	54
10	34	36	60
12	36	42	66
14	38	48	72
16	40	54	78
18	42		

5. Trenches in earth or rock shall be dug as shown on the Drawings and be sufficiently deep to insure a 36 inch minimum cover over water lines and force mains. Depths of trenching shall also be adequate for at least 1 foot minimum cover over valve nuts. In order to eliminate the necessity for digging bell holes into the trench subgrade by hand and to insure a cushion under the pipe for uniform bearing, trench depth shall be the cover requirement plus outside diameter of barrel of pipe plus the required bedding cushion. The cushion construction requirement shall also apply to tunnels.
6. Trench line stations and locations of accessories will be set ahead of the trenching by the ENGINEER. These will be set at least each 100 feet of pipeline. Trenches must be dug true to alignment of stakes. Alignment of trenches or pipes in trench must not be changed to pass around obstacles such as poles, fences and other evident obstructions without the permission of the ENGINEER. Lines will be laid out to avoid obstacles as far as possible, contingent with maintenance of alignment necessary to finding pipeline in the future and avoiding obstruction to future utilities.

G. Damage to Existing Structures

1. Hand trenching is required where undue damage would be caused to existing structures and facilities by machine trenching.

2. In case of damage to any existing structures, repair and restoration shall be made at once and backfill shall not be replaced until this is done. In all cases, restoration and repair shall be such that the damaged structure will be in as good condition and serve its purpose as completely as before, and such restoration and repair shall be done without extra charge, except as set forth under the applicable provisions of the General and Special Conditions. Where there is the possibility of damage to existing utility lines by trenching machine, the CONTRACTOR shall make hand search excavation ahead of machine trenching, to uncover same. CONTRACTOR shall have pipe and fittings on hand to make repairs to existing water and sewer lines, if needed.

#### H. Dewatering of Trenches

1. Dewatering of trenches shall be considered a part of trenching. Dewatering of trenches shall include groundwater and storm or sanitary sewage. Suitable pumping and other dewatering equipment is to be provided by the CONTRACTOR, to insure the installation of the pipeline structure in a dewatered trench and under the proper conditions. Dewatering shall include all practical means available for prevention of surface runoff into trenches and scouring against newly laid pipe.
2. Piles of excavated materials shall be trenched or temporarily piped to prevent, as far as practical, blockage of drainage ditches and gutters, and water carriage of excavated materials over street and highway surfaces.

### 3.02 LAYING PRESSURE PIPE

#### A. General

1. Inspection of Materials
  - a. All pipe, fittings and accessories shall be subject to an inspection by the Utilities Board at the job site. Any damaged materials shall be repaired or replaced to the satisfaction of the Utilities Board. Should repairs to the piping materials be necessary, then same shall be made in the presence of the Utilities Board using proven methods prescribed by the pipe manufacturer.
  - b. The Utilities Board inspection of materials shall in no way relieve the CONTRACTOR of his responsibility.
2. Laying Requirements
  - a. Pressure pipe shall be laid to lines, cover or grades shown on the Drawings.
  - b. Pipes must be swabbed out before lowering into trench. In the case of pipelines 4 inch through 20 inch, a swab must also be dragged through the pipe after it is in place. Larger size pipe shall be visually inspected for cleanliness and proper jointing.
  - c. The points insisted upon in the laying of pipe will be: Proper alignment, evenness of width and depth of joints, perfection in jointing, and care of the pipe in handling.

- d. Precautions must be taken to prevent flotation of the pipe should water enter the trench prior to putting the pipeline into operation.
- e. In wet, yielding and mucky locations where pipe is in danger of sinking below grade or floating out of grade or alignment, or where the backfill materials are of such a fluid nature that such movements of the pipe might take place during the placing of the backfill, the pipe must be weighted or secured permanently in place by such means as will prove effective.
- f. Whenever pipe laying is stopped, the end of the pipe shall be securely plugged with the manufacturer's standard plug held in place by jute packing, caulked into place.
- g. Elbows, plugs, dead end valves, and tees shall be firmly blocked to prevent internal pressure from springing the pipe from the intended alignment, with permanent materials solidly placed without covering pipe joints. Restrained type pipe joints may be substituted for thrust blocks with the Utilities Board's permission. Pipe shall be free of all structures, other than entry to planned structures.
- h. No pipe shall be laid resting on solid rock, blocking or other unyielding objects. Jointing before placing in the trench and subsequent lowering of more than one section jointed together may be allowed, subject to the Utilities Board permission.

3. Installing Water Pipe in Cover Pipe

- a. Installation of water pipe in cover pipe is covered in Section 02326 of these specifications.

B. Laying Ductile Iron Pipe (Water Main)

1. Bedding and Backfilling

- a. The pipe shall be bedded in 6 inches minimum depth of crushed rock, size no. 57 or 78 through 16-inch diameter pipe, and no. 68 for pipe sizes 18 inches in diameter and larger.
- b. The crushed rock material shall then be hand placed to a point 12 inches above the barrel of the pipe. After the specified backfill is hand placed, rock, well mixed with earth, may be used in machine placed backfill in pieces no larger than 6 inches in any dimension and to an extent not greater than 1/4 the volume of the backfill materials used.
- c. The top 12 inches of backfill shall contain no rock over 1-1/2 inches in diameter nor pockets of crushed rock.
- d. If additional earth is required, it must be obtained and placed by the CONTRACTOR. Filling with rock and earth shall proceed simultaneously, in order that all voids be filled with earth.

- e. Sufficient space, limited to a maximum of 2 feet length, shall be left out of the specified earth or crushed stone bedding to facilitate proper jointing of the pipe.
- f. No pipe shall be laid resting on solid rock, blocking or other unyielding objects. Jointing before placing in the trench and subsequent lowering of more than one section may be allowed, subject to the Utilities Board's permission.

2. Installation of Pipe

- a. Ductile iron pipe shall first be thoroughly cleaned at joints, then joined according to instructions and with tools recommended by the pipe manufacturer. Sufficient copies of the manufacturer's installation instructions shall be furnished to permit the Utilities Board to retain 3 copies. One copy shall be available at all times at the site of the work.
- b. All pipes must be forced and held together or "homed" at the joints. Pipe must be aligned as each joint is placed, so as to present as nearly true, straight lines and grades as practical, and all curves and changes in grades must be laid in such manner that one-half of the maximum allowable deflection shown in the pipe manufacturer's catalog is not exceeded.
- c. Concrete blocking of fittings shall be as specified hereinafter in this Specification Section 02610.
- d. Cutting of pipe may be done by special pipe cutters as the CONTRACTOR may elect, but the CONTRACTOR will be held responsible for breakage or damage caused by careless cutting or handling. Cut edges of the pipe shall be made smooth and a bevel formed on the exterior of the pipe barrel when using rubber gasket type pipe.

C. Laying Copper Pipe and Fittings (Water Service)

1. Bedding and Backfilling

- a. The pipe shall be bedded in 6 inches minimum of loose soil and the hand placed backfill lightly consolidated to a depth of 12 inches above the top of the pipe. "Loose soil" or "select material" is defined as native soil excavated from the trench, free of rocks, foreign materials and frozen earth. The machine placed backfill may contain rock no larger than 6 inches in any dimension and to an extent no greater than 1/4 the volume of backfill materials used. The top 12 inches of backfill shall contain no rocks over 1-1/2 inches in diameter nor pockets of crushed rock.

2. Installing Copper Pipe and Fittings

- a. Exterior copper pipe shall be laid of type K pipe, with brass compression fittings. Joints shall be neatly reamed and flared and joints drawn up firmly. Pipe shall have at least 30 inch cover. Joints shall be tested and all leakage stopped before backfilling the pipe trench.
- b. All copper pipe shall be installed by experienced workmen.

D. Installation of Water Service Accessories

1. Water Service Meters

- a. Water service meters and accessories shall be installed as shown on the Drawings, with meter box centered over the meter.
- b. The location of water service connections shall be shown on the Drawings. Earth backfill shall be thoroughly tamped around meter boxes to prevent subsequent movement.

2. Air Valves and Corporation Stops

- a. The location of air valve assemblies, while being noted on the Drawings, could possibly be shifted in actual construction. For this reason, the same statements relative to the methods of installation of meters and water service connections apply to the installation of air valve assemblies. Air valve assembly boxes shall be installed in the same manner as water meter boxes except that the box will be located slightly off center of the air valve, in order to give better access to the stopcock between the valve and water main.
- b. Corporation stops, as shown on the Drawings, are required between the water main and the meter, and between the main and the air valve assembly.

E. Installation of Fire Hydrants

1. Fire hydrants shall be installed in the general location as shown on the Drawings. Hydrants shall be set such that the lowest nozzle shall be high enough above the ground to allow the uninhibited 360° swing of a 15 inch hydrant wrench.
2. Hydrant drainage pits shall be excavated below the hydrant to the depth shown on the Drawings. Crushed stone drainage media shall be of the size shown on the Drawings. Hydrant shall be set vertical and anchored as hereinafter specified.
3. Hydrants installed shall be anchored to prevent the hydrant from blowing off the feeder line when suddenly opened or closed. Likewise, the hydrant pilot valve shall be anchored to prevent blow-off when the hydrant is removed. The CONTRACTOR shall anchor the hydrant and pilot valve utilizing the following procedures:
  - a. Install restrained fittings from the main line branch tee to the isolation valve. Isolation valve shall be located within 2 feet of the main valve line.
  - b. Provide locked mechanical joint and/or restrained joint piping from the main line tee through isolation to the hydrant.
  - c. Provide a concrete thrust block on the hydrant.
4. Megalug restrained joint fittings and concrete thrust block at the hydrant shall be installed by the CONTRACTOR, per detail.
5. Tracer wire access shall be provided at each hydrant, per detail.

F. Blocking of Pipe at Bends and Ends (Water Mains, Sanitary Sewer Force Mains)

1. Horizontal Bends

- a. Concrete backing and/or blocking required at bends in the horizontal plane shall be accomplished per detail on the Drawings. The square footage of blocking area shall be obtained from Tables "A" and "B" through the following procedure:

Step No. 1 - From Table "A," select type soil and bearing area factor for particular fitting to be blocked.

Step No. 2 - From Table "B," select multiplier to be used for the size pipe being blocked and its test pressure.

Step No. 3 - Calculate actual bearing area required by multiplying bearing area factor from Table "A" by multiplier from Table "B" (e.g. - 16 inch tee with 250 psi test pressure in sandy clay -  $9.42 \times 1.78 = 16.7$  S.F. of bearing area required). Bearing area shall in no case be less than the minimum shown in Table "B."

**TABLE "A"**

Type Soil	Soil Bearing Pressure (PSF)	Bearing Area Factor for Degree of Bend (Square Feet)				
		90°	Plug/Tee	45°	22 1/2°	11 1/4°
Sandy Clay	3,000	13.33	9.42	7.21	3.68	1.85
Hard Clay	6,000	6.66	4.71	3.61	1.84	0.92
Shale	12,000	3.33	2.36	1.80	0.92	0.46
Solid Rock	16,000	2.50	1.77	1.35	0.69	0.35

**TABLE "B"**

Pipe Dia. (In.)	Min. Bearing Area (S.F.)	Multiplier for Pipe Test Pressure (TP)						
		(TP) 350 psi	(TP) 300 psi	(TP) 250 psi	(TP) 200 psi	(TP) 150 psi	(TP) 100 psi	(TP) 50 psi
4	1.0	0.16	0.13	0.11	0.09	0.07	0.04	0.02
6	1.0	0.35	0.30	0.25	0.20	0.15	0.10	0.05
8	1.0	0.62	0.53	0.44	0.36	0.27	0.18	0.09
10	1.0	0.97	0.83	0.69	0.56	0.42	0.28	0.14
12	1.3	1.40	1.20	1.00	0.80	0.60	0.40	0.20
14	1.5	1.91	1.63	1.36	1.09	0.82	0.54	0.27
16	1.8	2.49	2.13	1.78	1.42	1.07	0.71	0.36
18	2.3	3.15	2.70	2.25	1.80	1.35	0.90	0.45
20	2.5	3.89	3.33	2.78	2.22	1.67	1.11	0.56
24	3.6	5.60	4.80	4.00	3.20	2.40	1.60	0.80
30	5.2	8.75	7.50	6.25	5.00	3.75	2.50	1.25
36	7.0	12.60	10.80	9.00	7.20	5.40	3.60	1.80
42	9.1	17.15	14.70	12.25	9.80	7.35	4.90	2.45
48	11.4	22.40	19.20	16.00	12.80	9.60	6.40	3.20
54	13.5	28.35	24.30	20.25	16.20	12.15	8.10	4.05
60	16.0	35.00	30.00	25.00	20.00	15.00	10.00	5.00

- b. Consideration will be given to the use of restrained type mechanical joint pipe and fittings in lieu of concrete blocking. Use of the restrained joint pipe and fittings is subject to review and acceptance by the ENGINEER of the locking-method and adequacy of design for pressures involved.

2. Vertical Bends

- a. The use of vertical bends in lieu of extra depth trenching shall be subject to permission by the ENGINEER.
- b. Where the CONTRACTOR elects to use vertical bends, or where vertical bends are called for on the Drawings, the CONTRACTOR shall submit the blocking design, including calculations, to the Utilities Board for review and acceptance. Anchorages shall be designed to resist thrusts caused by the internal test pressure in the pipe. Protection against corrosion shall be inherent in the design.

G. Supplemental Backfilling Information (Water and Sewer Force Main Facilities)

1. General

- a. Excavated materials from trenches and tunnels, in excess of quantity required for trench backfill, shall be disposed of by the CONTRACTOR. It shall be the responsibility of the CONTRACTOR to obtain location or permits for its disposal.
- b. Where sod is destroyed in areas maintained equivalent to residence yards, it shall be replaced on slightly ridged backfill on trench, and where destroyed in areas adjacent to the trench, it shall be replaced by the CONTRACTOR with fresh sod.

- c. Where pastures, thin grass or cover crops are destroyed by trenching, laying, backfilling, or tunneling operations, surface shall be prepared by disking, fertilizing, seeding, and mulching, as specified in Section 02930. Requirements of the Department of Highways for reseeding shall take precedence over these Specifications where they are involved.
- d. Before completion of the project, all backfills shall be reshaped, holes filled, and surplus materials hauled away and all permanent walks, street, driveways, and highway paving and sod replacement.
- e. Backfill material must be uniformly ridged over trench, and excess hauled away. Ridged backfill shall be confined to the width of the trench and not allowed to overlap onto firm original earth, and its height shall not be in excess of needs for replacement of settlement of backfill.
- f. All rock, including crushed rock or gravel from construction, must be removed from yards and fields. Streets and walks shall be broomed to remove all earth and loose rock immediately following backfilling.

2. Special Requirements

- a. In case of bituminous or concrete paved street, highway, sidewalk and driveway crossings, or about manholes, valve and meter boxes located in such paving, the following backfill material and procedure is required:
  - (1) Place initial backfill over the pipe as previously specified.
  - (2) From the top of the initial backfill to the base of the bituminous or concrete pavement, fill the trench with flowable fill.
- b. In case of gravel surfaced street, highway, sidewalk and driveway crossings, or about manholes, valve and meter boxes located in such paving, fill trench to within 6 inches of the surface with one of the following materials of limited compressibility, uniformly distributed without mechanical compaction:
  - (1) Kentucky Department of Highways No. 78 crushed stone, or other gradation acceptable to the Utilities Board. In order to accommodate compacted temporary surfacing it may be necessary to bulkhead or otherwise confine the stone fill at the open end of the trench.
  - (2) Locally available granular material, such as bank sand or gravel, where acceptable to the Utilities Board. For acceptance, the material must have a limited compressibility, be free from detrimental quantities of silt and organic matter and must be durable.
- c. Temporary surfacing of gravel surface street, highway, railroad, sidewalk and driveway crossings, or within any roadway paving, or about manholes, valve and meter boxes located in such paving, shall consist of 6 inches compacted depth of crushed stone as specified under Section 02235 for temporary walkway or road surfacing, placed and compacted in the trench. Compaction shall be accomplished by methods which shall be sufficient to confine stone to the trench

under normal traffic. Backfills shall be maintained easily passable to traffic at original paving level until acceptance of project or replacement of paving or sidewalks.

- e. Railroad Company and Department of Highways requirements in regard to backfilling will take precedence over the above general specifications where they are involved.

#### H. Cut-Ins, Tie-Ins, and Cutting and Plugging

1. The Utilities Board shall not be responsible for cut-ins, tie-ins, cutting and plugging, due to water not being entirely cut off by the existing water main valves.
2. A cut-in is defined as the removal of one section of existing pipeline (2 cuts of pipe) and insertion of one or more new pipeline connections therein.
3. A tie-in is defined as the removal of an existing plug or cap and the connecting of the new pipeline into the existing pipeline or fitting or valve at the joint opened by such removal.
4. A cutting and plugging is defined as the cutting and installation of a plug in an existing line.

### 3.03 FIELD QUALITY CONTROL

#### A. Testing Water Pipe for Leakage

1. The CONTRACTOR will be required to test all water mains and appurtenances with water. The maximum test pressure, measured at the lowest elevation of the pipeline being tested, shall be the pressure class of the pipe unless a specific test pressure is requested by the OWNER.
2. When the line or section being tested is pumped up to the required pressure, it shall be valved off from the pump and a pressure gauge placed in the line. The pressure drop in the line, if any, shall be noted. If no pressure drop is noted in 4 hours, the OWNER, at his discretion, may accept the line or section as being tested, or he may require the test run the full 24 hours.
3. At the end of the 24 hour test period, the pressure shall be recorded. If there is a drop in pressure, the CONTRACTOR will be required to pump the section being tested up to initial test pressure and maintain that pressure for an additional 24 hours, measuring the amount of water required to accomplish this.
4. Should there be leakage, the CONTRACTOR will be required to locate and repair the leaks and retest the section.
5. During the pressure test all fire hydrant isolation valves must be open in order to test all piping and connections.
6. The CONTRACTOR shall furnish meter or suction tank, pipe test plugs, and bypass piping, and make all connections for conducting the above tests. The pumping equipment used shall be centrifugal pump, or other pumping equipment which will not place shock

pressures on the pipeline. Power plunger or positive displacement pumps will not be permitted for use on closed pipe system for any purpose.

7. Inspection of pipe laying shall in no way relieve the CONTRACTOR of the responsibility for passing tests or correcting poor workmanship.

#### B. Disinfection of Water Mains

1. Upon completion of the work and cleaning up, and prior to final acceptance, the CONTRACTOR shall disinfect all water lines constructed which are to carry treated water.
2. Prior to starting disinfection, all water mains must be thoroughly flushed to remove mud, rocks, etc. Disinfection will then be accomplished by the adding of a chlorine solution while filling the main to obtain the initial 50 ppm of chlorine. The CONTRACTOR shall supply all equipment, labor, etc., necessary for flushing and disinfecting the mains. The CONTRACTOR shall submit, in writing, to the Utilities Board, the method he proposes to use for adding the chlorine.
3. The calcium hypochlorite granule or tablet method shall not be used.
4. Disinfection shall be accomplished by filling the new and/or repaired portions of the system with water having a chlorine content of at least 50 parts per million and at the end of a 24 hour contact time a residual of at least 25 parts per million shall remain. At the end of the 24 hour contact period, all the sterilized surfaces and areas shall be thoroughly flushed from the water system. Chlorinated water shall be disposed of in accordance with 401 KAR 5:031 and 8:020, which state that the allowable in stream concentration of chlorine is 10 ug/l, which is equal to 0.01 mg/l. The CONTRACTOR shall submit, in writing to the Utilities Board, the method he proposes for dechlorinating. Recommended chemicals, as given in AWWA C651-99, are sulfur dioxide, sodium bisulfate, sodium sulfite, and sodium thiosulfate.
5. For tie-ins to an existing system such as tapping valves where keeping the main out of service would restrict service to existing customers, disinfection shall, at the Utilities Board's discretion, consist of thoroughly cleaning the new part with a solution containing not less than 200 mg/l (ppm) chlorine.
6. After initial disinfection and flushing, the OWNER will collect water samples for bacteriological testing. A core zone, which includes up to the first 1/2 mile, shall be established. Two samples shall be taken from the core zone. Additionally, 1 sample taken from each mile of new distribution main shall be submitted to the cabinet. A new or routine replacement main shall not be placed in service until negative laboratory results are obtained on the bacteriological analyses. Sample bottles shall be clearly identified as "special" construction tests. If any of the samples are found to be positive or contain confluent growth, the CONTRACTOR shall repeat the disinfection procedure until the required numbers of negative samples are obtained.

#### C. Testing Sanitary Sewer Force Main Pipe for Leakage

1. The CONTRACTOR will be required to test all force mains and appurtenances with water. The maximum test pressure, measured at the lowest elevation of the pipeline being

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tested, shall be the pressure class of the pipe unless a specific test pressure is requested by the OWNER.

2. When the line or section being tested is pumped up to the required pressure, it shall be valved off from the pump and a pressure gauge placed in the line. The pressure drop in the line, if any, shall be noted. If no pressure drop is noted in 4 hours, the OWNER, at his discretion, may accept the line or section as being tested, or he may require the test run the full 24 hours.
3. At the end of the 24 hour test period, the pressure shall be recorded. If there is a drop in pressure, the CONTRACTOR will be required to pump the section being tested up to initial test pressure and maintain that pressure for an additional 24 hours, measuring the amount of water required to accomplish this.
4. Should there be leakage, the CONTRACTOR will be required to locate and repair the leaks and retest the section.
5. The CONTRACTOR shall furnish meter or suction tank, pipe test plugs, and bypass piping, and make all connections for conducting the above tests. The pumping equipment used shall be centrifugal pump, or other pumping equipment which will not place shock pressures on the pipeline. Power plunger or positive displacement pumps will not be permitted for use on closed pipe system for any purpose.
6. Inspection of pipe laying shall in no way relieve the CONTRACTOR of the responsibility for passing tests or correcting poor workmanship.

**END OF SECTION**

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**SECTION 02700**

**SEWER AND DRAIN PIPE**

**PART 1 GENERAL**

1.01 SUMMARY

- A. All pipe and accessories supplied shall be as specified herein.
- B. Where a specific type of pipe or pipe material is called for on the Drawings, substitute materials may not be furnished and installed without specific acceptance of the Utilities Board.

1.02 RELATED WORK

- A. For cover pipe and boring and/or jacking see Section 02326.

1.03 REFERENCES

- A. Where referenced specifications (ASTM, AWWA, etc.), are mentioned, these standards are deemed to be the minimum standard of quality of materials or methods to apply to this project.

1.04 SUBMITTALS

- A. Copies of the manufacturer's directions for handling and installing the particular pipe supplied and accepted shall be furnished to the Utilities Board at the first delivery of pipe to the project in numbers that will permit the Utilities Board to retain 3 copies.
- B. The manufacturer's instructions shall be strictly followed unless a conflict exists between the manufacturer's instructions and those contained herein. In such cases, the Utilities Board shall determine which methods are to be followed and no pipe shall be installed until the CONTRACTOR has received written instruction from the Utilities Board as to which procedure to follow.

1.05 QUALITY ASSURANCE

- A. Where pipe enters manholes, the pipe manufacturer shall certify that their pipe is compatible with the watertight, flexible seal to be used at manhole openings as specified in Section 03480 of these Specifications, and that their combined use will produce a flexible watertight installation.

**PART 2 PRODUCTS**

2.01 MANUFACTURERS

- A. All pipe, fittings and jointing materials shall be of one manufacturer unless different types are otherwise accepted by the Utilities Board.

2.02 MATERIALS - SEWER AND DRAIN PIPE

- A. Sewer Transition Joints

1. Where sewer pipes of different materials are to be joined, i.e., VC pipe to DI pipe, VC pipe to PVC pipe, or some other combination, an adapter made for this purpose shall be used. The adapter shall be made of polyurethane or polyvinyl chloride with stainless steel clamps and shall be equal to the Fernco Adapter by Fernco Joint Sealer Company, Ferndale, Michigan.

## B. PVC (Polyvinyl-Chloride) Sewer Pipe

1. Pipe
  - a. PVC pipe 4 inch through 15 inch diameter supplied for use on this project shall be Type PSM Polyvinyl Chloride (PVC) Sewer Pipe as specified per ASTM D 3034-00. PVC pipe 18 inch through 27 inch diameter shall be as specified in ASTM F 679-01.
  - b. The pipe shall be made of PVC plastic having a cell classification of 12454-B or 12454-C as defined in ASTM D 1784-99a. Compounds having different cell classifications due to one or more properties being superior to those of the specified compound are acceptable. Clean rework material, generated from the pipe manufacturer's pipe or fittings production may be used by the same manufacturer provided the reworked products meets the requirements stated herein.
  - c. The pipe shall be homogeneous throughout, free of cracks, holes, foreign inclusions or other injurious defects. The pipe shall be uniform in color, wall thickness, density and other physical properties. The maximum laying length for all PVC pipe supplied shall be 13.0± feet. Wall thickness shall be SDR-35 per ASTM D 3034-00 or wall thickness T-1 per ASTM F 679-01. Marking and identification of pipe shall be per ASTM D 3034-00 or ASTM F 679-01 as applicable.
  - d. The maximum laying length for all PVC pipe supplied shall be 13.0± feet.
2. Fittings
  - a. PVC fittings supplied for use on this project shall meet all the physical and quality requirements as hereinbefore specified for PVC pipe.
  - b. PVC fittings for 4 inch through 15 inch diameter pipe shall meet the dimensional requirements of the tables as shown in ASTM D 3034-00 except that saddle type wyes or tee branches shall not be allowed for use on new sewer mains. Where 90° bends are used, they shall be the long radius type. PVC fittings for 18 inch through 27 inch diameter pipe shall conform to the requirements of ASTM F 679-01.
3. Joints - Exterior Piping
  - a. Joints for PVC pipe and fittings for sewer mains and exterior plant gravity sewers shall be of the "Push-On Type" composed of an elastomeric ring gasket compressed in the annular space between a bell end or socket and spigot end of the pipe.

- b. All surfaces of the bell, socket or spigot end of the pipe against which the ring gasket may bear shall be smooth, free of cracks or other imperfections that could adversely affect the sealing capacity of the joint.
- c. Lubricant for use in assembling joints shall be supplied with the pipe or be of the specific manufacturer as recommended by the pipe manufacturer for use with the specific pipe supplied. The lubricant shall not cause deterioration of either the elastomeric ring gasket or pipe material.
- d. Where PVC pipe and fittings are connected to piping of other materials, the manufacturer's standard adapters or transition pieces shall be used. Should manufacturer not produce an adapter for a specific pipe of other material, the adapters or transition fittings as specified in this section of these Specifications shall be used.

C. Ductile Iron Sewer Pipe

1. Pipe

- a. This specification covers 4 to 54 inch ductile iron gravity sewer pipe designated "DI" on the Drawings. Pipe furnished under this Specification shall comply with all provisions of ANSI/ASTM A 746-99. Maximum design thickness shall be based on depth of cover, trench loadings and other conditions per ANSI/AWWA C150/A21.50-96.
- b. Metal Design Strength psi (Minimum)
 

Tensile Strength	60,000
Yield Strength	42,000
Percent Elongation	10
- c. The net weight, class or nominal thickness, and casting period shall be shown on each pipe. The manufacturer's mark, the year in which the pipe was produced, and the letters "DI" or "DUCTILE" shall be cast or stamped on the pipe.

2. Fittings

- a. Fittings for ductile iron sewer pipe shall be mechanical joint or rubber ring slip joint fittings.
- b. Ductile iron mechanical and rubber ring slip fittings shall conform to ANSI/AWWA C110/A21.10-98 for gray iron and ductile iron fittings. Mechanical joints and rubber slip ring joints shall also conform in all respects to ANSI/AWWA C111/A21.11-00.
- c. All fittings shall be manufactured for the size and pressure class of the pipeline in which they are to be used. All fittings shall be furnished complete with all joint accessories.

3. Joints

- a. Pipe joints shall be mechanical joint or rubber ring slip joint.

- b. Mechanical joints are to be furnished according to ANSI/AWWA C111/A21.11-00. All pipe joints must be furnished complete with all accessories. Mechanical joint bolts and nuts shall be of alloy steel cast iron or alloy steel (Corten type such as U.S. Alloy) or equal. Rubber gaskets shall be made of plain first grade rubber, free of imperfections and porosity. Hardness shall be 70 to 75 durometer.
- c. Rubber ring slip joints shall be equal to ANSI/AWWA C111/A21.11-00. The joints shall be of the following materials and assembled in the sequence outlined below:
  - (1) Rubber ring gasket compressed in groove in bell of pipe.
  - (2) Beveled spigot end of pipe for initial centering into rubber gasket in bell.
- d. All items used for jointing pipe shall be furnished with the pipe and tested before shipment. The joints shall be made with tools and lubricant in strict conformity with the manufacturer's instructions. Manufacturer's instructions shall be delivered to the ENGINEER through the CONTRACTOR at start of construction in numbers that will allow 3 copies to be retained in the ENGINEER'S file.
- e. The type of joint for ductile iron sewer pipe shall be as shown on the Drawings. Where no specific type joint is shown, the joint shall be the slip joint type with rubber ring gasket.

4. Coating and Linings

- a. All ductile iron pipe and fittings for gravity sewer service shall be bituminous coated outside in accordance with ANSI/AWWA C151/A21.51-96 for pipe and ANSI/AWWA C110/A21.10-98 for fittings.
- b. All ductile iron pipe and fittings for gravity sewer service shall be cement-mortar lined with seal coat in accordance with ANSI/AWWA C104/A21.4-95.

2.03 SOURCE QUALITY CONTROL

A. PVC Polyvinyl-Chloride Sewer Pipe

- 1. Pipe shall be tested and inspected at the factory and inspected at the job site. Testing shall be accomplished in conformance with the following ASTM specifications utilizing the test methods specified therein:

Dimensions	ASTM D 3034-00 or ASTM F 679-01 and D 2122-98
Extrusion Quality	ASTM D 2152-95
Pipe Stiffness (5%)	ASTM D 2412-96a
Impact Resistance	ASTM D 2444-99
Chemical Resistance	ASTM D 1784-99

In addition, a typical joint assembly, both gasket type joint and solvent weld joint, shall be tested by a qualified independent laboratory per test requirements of ASTM D 3212-96a. The manufacturer shall submit through the CONTRACTOR sufficient copies of

certification and test results for each lot of material represented by shipment to the job site that will permit the ENGINEER to retain 3 copies.

### **PART 3 EXECUTION**

#### **3.01 Trench Excavation - Sewer Pipe**

##### **A. General**

1. All excavation shall be open trenches, except where the Drawings call for tunneling, boring or jacking under structures, railroads, sidewalks, roads or highways.

##### **B. Trees and Shrubs**

1. Where pipelines run through wooded terrain, cutting of trees within limits of maximum permissible trench widths, as set forth in this article, will be permitted. However, cutting of additional trees on sides of trench to accommodate operating of trenching machine will not be permitted.

##### **C. Highways, Streets and Railroads**

1. Trenching also includes such items as railroad, street, road, sidewalk, pipe, small creek crossings, cutting, moving or repairing damage to fences, poles or gates and other surface structures, regardless of whether shown on the Drawings.
2. The CONTRACTOR shall so coordinate his work as to produce a minimum of interference with normal traffic on highways and streets. He may, with the approval of the governing agency, close a street to traffic for such length of time considered necessary, provided persons occupying property abutting the street have an alternate route of access to the property which is suitable for their needs during the time of closure. It shall be the responsibility of the CONTRACTOR to give 24 hours advance notice to fire and police departments and to occupants of a street which will be closed, in a manner approved by the governing body.
3. The opening of more than 500 feet of trench ahead of pipe laying and more than 500 feet of open ditch left behind pipe laying, before backfilling, will not be permitted, except upon written consent of the OWNER. No trench shall be left open or work stopped on same for a considerable length of time. In case of objectionable delay trench shall be refilled according to backfill specifications.
4. Construction equipment will not be approved for use where treads are injurious to paving encountered. Curbs, sidewalks, and other structures shall be protected by the CONTRACTOR from damage by his construction equipment.
5. In case of damage to any existing structures, repair and restoration shall be made at once and backfill shall not be replaced until this is done. In all cases, restoration and repair shall be such that the damaged structure will be in as good condition and serve its purpose as completely as before, and such restoration and repair shall be done without extra charge, except as set forth under the applicable provisions of the General and Special Conditions.

6. Where trenching is cut through paving which does not crumble on edges, trench edge shall be cut to at least 2 inches deep to straight and neat edges, before excavation is started, and care taken to preserve the edge to facilitate neat repaving.
7. The CONTRACTOR shall maintain road crossings in a passable condition for traffic until the final acceptance of the work.
8. Railroad company and Department of Highways requirements in regard to trenching, tunneling, boring and jacking shall take precedence over the foregoing general specifications and the following tunneling and boring or jacking specifications, where they are involved. Where work is within railroad right-of-way, Railroad Protective Insurance shall be carried by the CONTRACTOR in the amounts required by the Railroad Company.
9. The insurance policy shall name the railroad as the insured and the original policy shall be delivered to the railroad after submitting same to the OWNER for review.

#### D. Existing Utilities

1. The CONTRACTOR shall determine, as far as possible in advance, the location of all existing sewer, culvert, drain, water, electric, telephone conduits, gas pipes, and other subsurface structures and avoid disturbing same in opening his trenches. In case of sewer, water and gas services and other facilities easily damaged by machine trenching, same shall be uncovered without damage ahead of trenching machine and left intact or removed without permanent damage ahead of trenching and restored immediately after machine has passed. The CONTRACTOR shall protect such existing facilities, including power and telephone poles and guy wires, against danger or damage while pipeline is being constructed and backfilled, or from damage due to settlement of his backfill. It shall be the responsibility of the CONTRACTOR to inform the customers of utilities of disruption of any utility service as soon as it is known that it has been or will be cut off.
2. Where there is the possibility of damage to existing utility lines by trenching machine, the CONTRACTOR shall make hand search excavation ahead of machine trenching, to uncover same. Hand trenching is required where undue damage would be caused to existing structures and utilities by machine trenching.

#### E. Location of Proposed Pipelines

1. The location of pipelines and their appurtenances, as shown on the Drawings, are those intended for the final construction. However, conditions may present themselves before construction on any line is started that would indicate desirable changes in location. Also, development of property traversed may require location changes. In such cases, the OWNER reserves the right to make reasonable changes in line and structure locations. The OWNER is under no obligation to locate pipelines so they can be excavated by machine.

#### F. Construction Stake-out

1. Offset line and grade stakes shall be set and cut sheets prepared before trenching work is started. All stake-out work and cut sheet preparation shall be accomplished by the CONTRACTOR. The CONTRACTOR shall provide all material and labor for the stake-out work.

2. The cut sheets shall contain the following minimum information:
  - (a) Manhole stations
  - (b) Grade between manholes
  - (c) Centerline and offset stations
  - (d) Amount and direction of offset
  - (e) Centerline elevation
  - (f) Centerline cut
  - (g) Offset elevation
  - (h) Offset cut
  - (i) Average trench depth
  - (j) Utilities information and depths and/or any other pertinent information.
3. Grades shown on the Drawings or as revised in the field are invert of pipe and NOT trench subgrade. The centerline cuts on the cut sheets shall have this calculation made, original ground surface to invert of sewer pipe, which is the depth which shall be used for calculation of the average depth of trench and backfill.

#### G. Trench Requirements

1. All trenches must be dug neatly to lines and grades as shown on the Drawings, as established in the field and/or as established on the cut sheets. Trenches shall be of sufficient width to properly assemble or bolt joints.
2. For maximum permissible trench depth per width of trench at top of pipe, for various pipe sizes, side support, classes of pipe, their reinforcing and bedding refer to tables for the several pipe materials under this Section 02700 of these Specifications.
3. Trenching shall be completed between one grade control point and the next in advance of the laying of pipe, where pipes, culverts, or other structures may be encountered whose grade cannot reasonably be determined ahead of trenching.
4. Where grade (batter) boards are used to establish finish grade, they shall be set by the CONTRACTOR, with at least 3 boards set at all times where installation is in progress. These will be set each 25 feet or less and will be set perpendicular to and spanning the centerline of the trench, such that the grade string is in the vertical plane of the pipe flow line. Grade boards shall be supported by stakes driven firmly on each side of the trench, unless otherwise acceptable to the ENGINEER. Where laser beam equipment is used, the set-up shall be per the laser manufacturer's instructions and/or the permission of the ENGINEER.
5. Grades shown on the Drawings and/or profiles, cut sheets and offset stakes are the elevations of the invert of the pipe in all cases and excavation in open trench or tunnel must be made of sufficient depth to take care of required bedding of pipe and bells below these lines.
6. For 6 inch through 16 inch size pipe in earth or on solid rock or where concrete cradle or arch is to be used, trenches shall be dug to a depth of at least 6 inches below bottom of barrel of pipe.

7. When trench or tunnel is dug below required grade, the pipe must be brought to grade by filling with crushed rock for pipe bedding as specified in Section 02235 of these Specifications. Fill for pipe support shall not be made with material excavated from trench or bell holes.

#### H. Dewatering of Trenches

1. Dewatering of trenches shall be considered a part of trenching. Dewatering of trenches shall include groundwater and storm or sanitary sewage. Suitable pumping and other dewatering equipment is to be provided by the CONTRACTOR, to insure the installation of the pipeline structure in a dewatered trench and under the proper conditions. Dewatering shall include all practical means available for prevention of surface runoff into trenches and scouring against newly laid pipe.
2. Piles of excavated materials shall be trenched or temporarily piped to prevent, as far as practical, blockage of drainage ditches and gutters, and water carriage of excavated materials over street and highway surfaces.
3. Where subgrade of trench has insufficient stability to support the pipeline and hold it to its original grade, the Utilities Board may order stabilization by various means.

### 3.02 LAYING SEWER PIPE

#### A. General

1. Checking of Pipe
  - a. The selection of pipe strength class shall be based on earth weight of 130 pounds per cubic foot and a safety factor of 1.50.
  - b. All pipe and fittings must be tested for uniform diameter, straightness and defects by the CONTRACTOR before being lowered into trench, and rejected pipe marked in a way not to impair its value. Rejected pipe must be separated from accepted pipe and removed from the project. The Utilities Board will make periodic observations of pipe in storage and/or incorporated into the work. Pipe found defective, not meeting Specifications, or improperly installed shall be rejected and replaced.
2. Alignment and Grade
  - a. All pipe, after being inspected and accepted, shall be laid to correspond with lines and grades staked out by the CONTRACTOR. All sewer lines shall be laid to constant grades between invert elevations shown on the Drawings. Grades shown on the Drawings are invert of pipe and NOT trench subgrade. The pipe lengths shall be fitted together and matched, so that they will form a sewer with a smooth and uniform invert, visible as a full circle from manhole to manhole, except in special cases where curved sewer lines are planned.
3. Unstable Subgrade
  - a. In wet, yielding, and mucky locations where pipe is in danger of sinking below grade or floating out of grade or line, or where backfill materials are of such a fluid nature that such movements of pipe might take place during the placing of

the backfill, the pipe must be weighted or secured permanently in place by such means as will prove effective.

#### 4. Control of Quantities Laid

- a. Laying of pipe may be held up by the Utilities Board until trench has progressed far enough ahead to remove the possibility of having to change grade or alignment on account of other structures, pipelines or conduits.
- b. Unless permitted or directed, not less than 100 feet of pipe shall be laid at one operation except for the following reasons:
  - (1) Street and railroad crossings.
  - (2) Wet caving trenches.
  - (3) Business houses or institutions damaged by prolonged disconnection from street.
  - (4) Less than 100 feet distance between manholes or pipe control sections.

#### 5. Bedding of Pipe

- a. Six inch through 16 inch pipe shall be laid with bottom quadrant of pipe bedded in at least 6 inch depth of stone. Stone for bedding of 6 inch through 16 inch pipe shall be Kentucky Department of Highways Size 78 crushed rock as specified in Section 02235 of these Specifications, spaded into place.
- b. No filling of trench with earth to bring pipe to grade will be permitted. If trenches are dug too deep, they must be brought to grade and supported by crushed rock for pipe bedding as specified in Section 02235 of these Specifications. No pipe shall be laid in the trench until the subgrade is inspected and found correct.

#### 6. Laying of Pipe

- a. Laying crew foreman shall direct subgrade preparation and plumbing and leveling invert of pipe to grade and line, the pipe layer following his directions in placing the pipe. The pipe layer will be responsible for pipe bedding, cleaning joint, proper placement of joint annular ring or gasket, tight jointing and homing pipe, securing pipe against settlement or other movement, and inspecting and swabbing out any jointing material from inside of pipe.
- b. No joints will be accepted that show leakage and, after backfilling and inspection, any joints are found that are allowing groundwater to enter the sewer must be excavated and corrected.
- c. Plugs in branch fittings to future building sewers shall be protected from excavators by the method as shown on the Drawings for protecting the ends of laterals and shall be so constructed and joined in bell of pipe that they will be watertight, yet removable without breaking the bell or coupling when removed.

#### 7. Laying of Branch Pipes and Laterals

- a. Branch pipes shall be laid to serve the abutting property at points to be designated by the Utilities Board. Such pipes shall be connected to sewer main through tees or Y-branches of size of running sewer barrel and 6 inch side opening, with 6 inch 30 degree or 45 degree bends. Branch fittings in sewer and the connected bend, shall be supported from bottom of trench per standard details shown on Drawings.
- b. House lateral pipes shall be laid to edge of street paving adjacent to property to be served, in the case of vacant lots, and to its property line, in the case of built-up property. The end openings shall be plugged with appropriate watertight plugs of permanent materials in the bell of the sewer pipe, removable without breakage of pipe bell. Dead ends of sewers shall be plugged similarly.
- c. Under normal conditions, where elevations are not critical, branch service sewers to customers shall be laid on not less than .01 foot per foot of length grade. Where elevations are critical, minimum grade shall be .005 foot per foot laid with batter boards and grade line string, same as specified for street sewers.
- d. In the case of deep sewers, branch pipes may be brought up to a depth of approximately 5 feet below ground level with suitable bends and sewer pipe. These pipes shall be laid on a slant outside sewer trench, so they will be supported on original earth and not dragged down and cracked by backfill settlement.
- e. In case of deep sewers in rock or narrow places, branch pipes shall be of cast iron soil pipe installed vertically per standard details of Drawings, with branch fittings in sewer main encased in Class 2,500 concrete.
- f. All lateral sewers and branch pipes installed shall have a detectable mylar tape placed in the backfill over and running with the lateral sewer. The tape shall be readily detectable employing the same type metal locators as used for the location of metal pipelines. The tape shall be bright orange in color and have the words, "Caution, Sewer Line Below" printed on it. The tape shall be installed as shown on the standard details of the Drawings.
- g. The tape shall be Type II, Detectable Mylar Marking Tape as manufactured by Line Guard, Inc. or equal.

## 8. Piping Connections at Structures

- a. Lines
  - (1) Pipes shall be laid free from all structures other than manholes. Any pipe entering structures underground unsupported by original earth shall be supported by Class 2,000 concrete, brick and mortar masonry, or Class 4,000 concrete beams and columns as shown on detailed Drawings.
  - (2) Pipe shall be connected to manholes by fabricated manhole entry seals, specified in Section 03480 of these Specifications.
  - (3) Pipe stubbed out of manholes for future connections shall be plugged and tightly sealed with same jointing material used to plug laterals.

9. Protection of Pipe in Trench

- a. No walking upon the completed pipelines will be permitted until trench has been backfilled to a depth of at least 6 inches over the top of the pipe. The interior of the pipe shall, as the work progresses, be cleaned of all dirt, jointing materials, and superfluous materials of every description. When laying of pipe is stopped for any reason, the exposed end of such pipe shall be closed with a suitable plug fitted into the pipe bell, so as to exclude earth and other material, precautions being taken to prevent flotation of pipe by runoff into trench.

10. Observation of Pipeline

- a. No backfilling (except for securing pipe in place) over pipe will be allowed until the Utilities Board has had an opportunity to observe the joints, alignment and grade, in the section laid, but such observation shall not relieve the CONTRACTOR of further liability in case of defects occurring during or after placement of backfill.

B. Laying Sewer Pipe

1. PVC Pipe

- a. PVC sewer pipe laying shall comply with the requirements of ASTM D 2321-00 and the additional requirements of these Specifications and standard details.
- b. Article 3.02.A of this Section 02700 shall apply to the installation of PVC sewer pipe. The pipe shall be bedded true to line and grade with uniform and continuous support from a firm base. The bedding material shall conform to that specified in Article 3.02.A of this Section 02700.
- c. All PVC sewer pipe shall be installed in a manner to limit deflection of the pipe to 5 percent. The maximum initial (60 days) deflection of the installed pipe shall not exceed the 5 percent limit when installed per ASTM D 2321-74 (1980).
- d. Deflection tests will be performed in the field and shall be measured and recorded by the CONTRACTOR in the presence of the Utilities Board using appropriate methods approved by the pipe manufacturer and acceptable to the Utilities Board. All manhole to manhole sections shall be tested.
- e. When laser equipment is being used for laying PVC sewer pipe, the CONTRACTOR shall provide adequate ventilation through the pipe to prevent distortion of the beams.

2. Ductile Iron Sewer Pipe

- a. Ductile iron sewers shall be laid in compliance with the requirements of these Specifications and standard details. Restrictions on depth of cover shall follow ANSI/AWWA C150/A21.50-96 requirements in Section 02610 for various classes of cast iron pipe. Joints shall be made with mechanical or rubber ring slip joint, according to the manufacturer's specifications and with tools recommended by them. A copy of the manufacturer's instructions shall be available at the site

of work at all times when pipe is being laid. Joints shall be thoroughly cleaned and dry before pipes are laid in place.

- b. Cutting of pipe may be done by wheeled pipe cutters or by hammer and chisel, as the CONTRACTOR may elect, but the CONTRACTOR will be held responsible for breakage or damage caused by careless cutting or handling.
- c. Sufficient excavation for bell holes will be required as necessary for proper jointing or tightening of bolts. No pipe shall be laid resting on rock, blocking or other unyielding objects, except where laid above ground on piers or in permanent tunnels. Exact lines and grades will be required on exposed pipelines placed on piers. Attachment of pipe to piers shall be as shown on the Standard Detail Drawings.
- d. In permanent tunnels pipe shall be laid with bells resting on tunnel liner or on blocks just behind bells. After pipe has been adjusted to proper line and grade, a bedding of Class 2,000 concrete shall be poured under pipe to support the entire bottom quadrant.

### 3.03 TRENCH BACKFILL - SEWER PIPE

#### A. General

1. Excavated materials from trenches and tunnels, in excess of quantity required for trench backfill, shall be disposed of by the CONTRACTOR. It shall be the responsibility of the CONTRACTOR to obtain location or permits for its disposal.
2. Railroad company and Department of Highways requirements in regard to backfilling will take precedence over the above general Specifications where they are involved.
3. Mechanical tamping, may be required by the Utilities Board in locations other than those specifically designated herein.
4. Before completion, all backfills shall be reshaped, holes filled, surplus materials hauled away, all permanent walks, street, driveways, highway paving replaced, and all sodding, seeding, and planting work performed.

#### B. Haunching

1. Upon completion of bedding and laying the sewer or drain pipe, the CONTRACTOR shall place crushed rock, Kentucky Department of Highways Size 68 or 78 dependent on size of pipe, or the same material used for pipe bedding on both sides simultaneously to the top of the pipe. This material shall be hand placed using shovel or other satisfactory tool to work the haunching material completely under the bottom quadrant and around the sides of the pipe to assure the maintenance of alignment of the pipe. No compaction of this material is required other than that obtained by the workmen walking on the material during placement.
2. The haunching material is required for all sewer or drain pipe installed in open trenches except where concrete pipe arch is required, in which case the haunching material is required to the bottom of the arch. Where concrete cradle is required, the haunching material shall be placed from top of cradle to top of pipe.

C. Initial Backfill

1. Upon completion of the haunching material to the top of the pipe, initial backfill shall be placed as hereby specified. This material shall serve as protection for the top of pipe reducing the possibility of damage to the pipe during the placement of backfill for the remainder of the trench depth.
2. The initial backfill shall be crushed rock, or the material used for bedding and haunching the pipe, of the same gradation of the pipe bedding material. Other alternate materials may be used only with the specific written permission of the Utilities Board when the work is located inside traffic areas.
3. In the case of ductile iron or concrete pipe the initial backfill shall be hand placed to a point 6 inches above the barrel of the pipe. In case of plastic pipe, the initial backfill shall be hand placed and evenly spread to a point 12 inches above the pipe barrel for up to 4 feet cover, to a point 18 inches above the barrel for 4 feet to 10 feet cover, and ductile iron pipe shall be used when trench depths exceed 10 feet.
4. The initial backfill material is required over sewer and drain pipe in all open trenches.

D. Final Backfill

1. Outside Traffic Areas
  - a. After the above specified initial backfill is hand placed, rock may be used in machine placed backfill in pieces no larger than 8 inches in any dimension and to an extent not greater than one-half the volume of the backfill materials required to backfill trench. Larger rock fill will be allowed in wide trenches where side slopes are low enough to prevent rock from dropping over pipeline. If additional earth is required, it must be obtained and placed by the CONTRACTOR. Filling with rock and earth shall proceed simultaneously, in order that all voids or pockets, created by rock backfill, may be filled with earth. Machine backfilling may be employed with tamping, except as hereinafter restricted, provided caution is used in quantity per dump and in uniformity of level of backfilling. Backfill material must be uniformly ridged over trench, and excess hauled away, with no excavated rock over 1/2 inch diameter or pockets of crushed rock or gravel in top 12 inches of backfill, the top 12 inches reserved for topsoil or material more suited to sustain surface growth. Ridged backfill shall be confined to the width of the trench and not allowed to overlap onto firm original earth, and its height shall not be in excess of that required to provide for settlement of backfill.
2. Inside Traffic Areas
  - a. Where sewer and drain pipe is located in street, highway, railroad, sidewalk and driveway crossings or within any roadway paving, or about manholes, valve and meter boxes located in such paving, the following backfill material and procedure is required:
    - (1) Fill trench to within 10 inches of the surface with one of the following materials of limited compressibility, uniformly distributed without mechanical compaction.

- (a) Dense graded aggregate (Kentucky Department of Highways Class A, Grading D).
- (b) Kentucky Department of Highways No. 78 crushed stone, or other gradation acceptable to the Utilities Board In order to accommodate compacted temporary surfacing it may be necessary to bulkhead or otherwise confine the stone fill at the open end of the trench.

### 3.04 FIELD QUALITY CONTROL - TESTING SEWERS FOR LEAKS, INFILTRATION, AND DEFLECTION

#### A. Sewers

##### 1. General

- a. All sewers constructed shall be tested for leaks infiltration, and deflection using methods as hereinafter specified. The sequence and methods of test shall be as follows:
- b. The CONTRACTOR shall furnish all materials, equipment and labor required for all types of tests, the CONTRACTOR also being responsible recording data and calculating air losses and/or infiltration rates.

##### 2. Sequence

###### a. Initial Testing

- (1) From the first manhole to manhole section of sewer laid for each size of pipe and type of joint, shall be given a smoke test prior to the sewer being backfilled and while the sewer trench is dewatered to bottom of the pipe being tested.
- (2) Should, based on the results of the test of the first section of pipe laid, the materials being used and the CONTRACTOR'S installation procedures prove to be satisfactory, subsequent smoke testing may, at the discretion of the Utilities Board, be waived. Should, however, based on the results of the test of the first section of pipe laid, the material being used and/or the CONTRACTOR'S installation procedures prove to be unsatisfactory, subsequent smoke testing shall, at the discretion of the Utilities Board, be continued until such time that, in the opinion of the Utilities Board, problems with materials and/or installation procedures have been corrected.
- (3) Such subsequent testing shall likewise be done while trenches are dewatered to bottom of pipe to be tested and immediately after completion of either the public sewer lines or laterals, in not more than 2 sections between manholes at a time. All defective work, as so proven by the smoke test, shall be immediately repaired and retested until proven to be satisfactory.

- (4) Observation of pipe laying and smoke testing shall in no way relieve the CONTRACTOR of the responsibility of conducting the required low pressure air test, infiltration tests, or correcting poor workmanship.

b. Subsequent Testing

- (1) As soon as it is practicable after installing and backfilling sewers, and before putting new sewers into service, low pressure air tests shall be made from manhole to manhole, or up to a maximum of 500 feet of sewer main and 500 feet of sewer laterals at a time, as directed by the ENGINEER. The maximum allowance for air loss during testing shall be determined by tables of minimum holding time for a pressure drop of 1.0 psi and are based on an average loss of 0.003 cubic feet of air per minute per square foot of internal pipe surface, when tested at an average pressure of 3.0 psi greater than the average back pressure of any groundwater present. These tables may be obtained from the National Clay Pipe Institute (NCPI), and must be furnished in at least 2 copies to the Utilities Board.
- (2) Upon completion of installation and backfilling of all sewers constructed, the low pressure air test is required for all sewers so constructed.

c. Additional Testing

- (1) Upon completion of the required initial (smoke) testing and required subsequent (low pressure air) testing, and prior to placing the sewer into operation, if ground and/or surface water flow is observed in the completed sewer, the Utilities Board may order infiltration tests be accomplished to determine whether the flow is within acceptable and allowable limits. This additional testing may be required even though the results of the initial smoke testing and subsequent low pressure air testing indicate the sewers are substantially watertight. The infiltration tests shall be conducted, on order of the Utilities Board, as hereinafter specified.

3. Equipment

a. Smoke Testing

- (1) The smoke testing blower shall have a capacity of at least 1,200 cfm.
- (2) The smoke bombs shall produce a chemical reaction generated, white to gray smoke, leaving no residue, and be nontoxic and nonexplosive. Each bomb shall be capable of producing 25,000 cubic feet of smoke per 3 minutes and shall be equal to that manufactured by Superior Signal Company, 6 Colfax Street, South River, New Jersey.

b. Low Pressure Air Testing

- (1) Air test equipment shall be equal to Cherne Air-Loc Equipment, as manufactured by Cherne Industrial, Inc., Hopkins, Minnesota.

- (2) Equipment used shall meet the following minimum requirements:
  - (a) Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be inspected.
  - (b) Pneumatic plugs shall resist internal test pressures without requiring internal bracing or blocking.
  - (c) All air used shall pass through a single control panel.
  - (d) Three individual hoses shall be used for the following connections:
    - (I) From control panel to pneumatic plugs for inflation.
    - (ii) From control panel to sealed line for introducing the low pressure air.
    - (iii) From sealed line to control panel for continually monitoring the air pressure rise in the sealed line.

#### 4. Procedures

##### a. Safety Precautions

- (1) The air test may be dangerous if a line is improperly prepared. It is extremely important that the various plugs be installed and braced in such a way as to prevent blowouts. Inasmuch as a force of 25 lbs. is exerted on an 8 inch plug by expulsion of a poorly installed plug or of a plug that is partially deflated before the pipe pressure is released can be dangerous.
- (2) As a safety precaution, pressurizing equipment shall include a regulator set at 10 psi to avoid over-pressurizing and damaging an otherwise acceptable line. No one shall be allowed in the manholes during testing.

##### b. Low Pressure Air Test

- (1) All pneumatic plugs shall be seal tested before being used in the actual test installation. One length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be checked. Air shall be introduced into the plugs to 25 psig. The sealed pipe shall be pressurized to 5 psig. The plugs shall hold against this pressure without bracing and without movement of the plugs out of the pipe.
- (2) Clean pipe to be tested by propelling snug fitting inflated rubber ball through the pipe with water.
- (3) Plug all pipe outlets with suitable test plugs. Brace each plug securely.
- (4) If the pipe to be tested is submerged in groundwater, insert a pipe probe by boring or jetting into the backfill material adjacent to the center of the

pipe, and determine the pressure in the probe when the air passes slowly through it. This is the backpressure due to groundwater submergence over the end of the probe. All gauge pressures in the test shall be increased by this amount.

- (5) Add air slowly to the portion of the pipe installation under test until the internal air pressure is raised to 4.0 psig.
- (6) After an internal pressure of 4.0 psig is obtained, allow at least 2 minutes for air temperature to stabilize, adding only the amount of air required to maintain pressure.
- (7) When pressure decreases to 3.5 psig, start stopwatch. Determine the time in seconds that is required for the internal air pressure to reach 2.5 psig. Minimum permissible pressure holding times for runs of single pipe diameter and for systems of 4 inch, 6 inch, or 8 inch laterals in combination with trunklines are indicated in the NCPI tables **in seconds**.

c. Infiltration Test

- (1) Before putting new sewer lines into service, weir test shall be made of flow of water in the sewers from manhole to manhole or up to a maximum of 3,000 foot sections at a time, as directed by the Utilities Board. These tests shall be made when, in the Utilities Board's judgement, groundwater level is equal to the highest groundwater condition in a normal year.
- (2) The maximum allowance for all sewer pipe materials shall be 100 gallons per 24 hours per inch diameter per mile of sewer pipe and manholes.

d. Deflection Test

- (1) Deflection tests shall be performed on all PVC or flexible sewers. If the deflection test is to be run using a rigid ball or mandrel, it shall have a diameter equal to 95 percent of the inside diameter of the pipe. The test shall be performed without mechanical pulling devices. Pipe deflection shall be measured and recorded by the CONTRACTOR in the presence of the Utilities Board using appropriate methods approved by the pipe manufacturer and acceptable to the Utilities Board.

e. Vacuum Testing

- (1) General
  - (a) All new manholes installed on this project shall be subjected to a vacuum test to determine the seal of all joints within the manhole. The vacuum test will not be required for existing manholes that are adjusted or partially reconstructed. The following test procedure is required for all new manholes:

- (I) Lift holes shall be plugged with an approved nonshrinkable grout prior to testing.
- (ii) Drop connections shall be installed prior to testing.
- (iii) The manhole shall be finished and backfilled to design elevation prior to testing.
- (iv) The vacuum test shall include testing of the seal between the cast iron frame and top slab or cone section, slab, barrel sections, and/or grade rings.

(2) Testing Procedure

- (a) Temporarily plug (and brace) all pipes entering the manhole at least 8 inches into the sewer pipe. The plug shall be inflated at a location beyond the manhole/pipe gasket.
- (b) The pressure gauge for the test hood shall be liquid filled, having a 3-1/2 inch face with scale reading from 0 to 30 inches of mercury.
- (c) The test head shall be placed inside the manhole frame and inflated according to the testing equipment manufacturer's recommendations.
- (d) A vacuum of 10 inches of mercury shall be drawn on the manhole. Upon reaching 10 inches of vacuum, close the valve on the vacuum line to the manhole and disconnect the vacuum line.
- (e) For the manhole to be considered as having passed the vacuum test, the time for the vacuum reading to drop from 10 inches of mercury to 9 inches of mercury must be equal to or greater than the following values:

**Time (Minutes)**

<b>Manhole Depth</b>	<b>4' Dia.</b>	<b>5' Dia.</b>	<b>6' Dia.</b>
20 feet or less	1	2	3
20.1 feet to 30.0 feet	2	3	4

- (f) Manholes failing the vacuum test shall be repaired with nonshrink grout or other suitable material and retested per the procedure shown previously.
- (g) All temporary plugs and braces shall be removed after each test.
- (h) The CONTRACTOR shall provide all equipment and labor required for vacuum testing of new manholes. The cost for this procedure shall be incorporated into the price bid for the manhole.

5. Repairs and Acceptance

- a. If the sewer fails to meet the requirements of the above tests, the CONTRACTOR shall, at his own expense, determine the source of leakage and make the necessary repairs or replacements.
- b. On completion of sewer lines, all sewers and manholes will be inspected for foreign matter, including sand brought in by infiltration, and any such matter shall be removed before final acceptance of the lines. Any visible leakage at manholes or into lines shall be corrected regardless of the results of the required tests.

**END OF SECTION**

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## SECTION 03300

### CAST-IN-PLACE CONCRETE

#### PART 1 GENERAL

##### 1.01 SCOPE OF WORK

###### A. Work Included:

1. All concrete work shown on Drawings.
2. Reinforcing steel.
3. Concrete accessories.
4. Built-in work furnished under other Sections, including setting and placing unless otherwise specified.
5. Construction, contraction (control) and expansion joints.
6. Forming, finishing, curing and patching.
7. Moisture barrier under interior slabs-on-grade as specified.

##### 1.02 RELATED WORK

- A. Precast structural concrete - Section 03400.

##### 1.03 CODES AND STANDARDS

###### A. Conform to the following:

1. ACI 318-89, "Building Code Requirements for Reinforced Concrete."
2. Governing Building Code. Comply with all requirements of the governing building code that are more stringent than the above-referenced codes, standards and Specifications.
3. ACI SP-15 (89), Field Reference Manual. A copy of this publication must be kept in the field office at all times during concrete construction.
4. ACI 304, Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.
5. ACI 311, Recommended Practice for Concrete Inspection.
6. ACI 211.1, Recommended Practice for Selecting Proportions for Normal and Heavyweight Concrete.
7. ACI 214, Recommended Practice for Evaluation of Compression Test Results of Field Concrete.
8. ACI 305, Recommended Practice for Hot Weather Concreting.
9. ACI 306, Recommended Practice for Cold Weather Concreting.
10. ACI 308, Recommended Practice for Curing Concrete.
11. ACI 309, Recommended Practice for Consolidation of Concrete.
12. AASHTO M 182, Burlap Cloth Made from Jute or Kenaf.

- B. All work shall be performed to secure for the entire job homogeneous concrete having required strength, durability and weathering resistance, without planes of weakness and other structural defects and free of pronounced honeycombs, air pockets, voids, projections, offsets of plane, and other defacements on exposed surfaces.

###### C. Standard Specifications

The "Specifications for Structural Concrete for Buildings" ACI 301-89 are hereby incorporated as a part of these Specifications and are as much a part of the contract documents as if reproduced herein. Modifications shall take precedence over items specified in ACI 301 and as incorporated in Part III are preceded by the relative ACI 301 designation. All ACI 301 items unless so modified below are incorporated as written. When any part of any item is modified or voided by these modifications, the unaltered provisions of that part shall apply as written. Copy of ACI 301 shall be kept in the project field office at all times. No work shall proceed until persons directly responsible for the project representing the contractors, subcontractors, suppliers and testing agencies have a copy of this Specification and an understanding of the provisions therein.

## **PART 2 PRODUCTS**

Not used.

## **PART 3 EXECUTION**

Not used.

**END OF SECTION**

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## SECTION 03480

### PRECAST CONCRETE SPECIALTIES

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. All items supplied for use shall be as specified herein.

##### 1.02 RELATED WORK

- A. Concrete specifications are included in Section 03300.
- B. Castings are specified in Section 05540.
- C. Connecting piping is specified in Section 02700.

##### 1.03 REFERENCES

- A. Where referenced specifications (ASTM, ACI, PCI, etc.), are mentioned, these standards are deemed to be the minimum standard of quality of materials or methods.

##### 1.04 SUBMITTALS

- A. Shop drawings shall be submitted in accordance with Section 01300.

##### 1.05 QUALITY ASSURANCE

- A. The precast fabricator shall be qualified in accordance with PCI MNL-116 - Manual for Quality Control for plants and production of precast concrete products.

##### 1.06 DELIVERY, STORAGE AND HANDLING

- A. Handle precast members in position consistent with their shape and design. Lift and support members only at such designated points.
- B. Provide temporary lateral support during storage as necessary to prevent bowing and warping. Temporary lateral devices shall be clean, non-staining and shall not inhibit uniform curing of exposed surfaces.
- C. Protect edges of members from chipping or spalling.
- D. Mark units with date of production and final position in structure.

#### PART 2 PRODUCTS

##### 2.01 MATERIALS

- A. Concrete materials including cement, water, sand and coarse aggregate shall conform to ACI 301-84 (Revised 1988).

- B. Reinforcing steel and prestressing wire and strand shall conform to ACI 301-84 (Revised 1988).
- C. Initial Drawings shall be sent through the general CONTRACTOR to the Utilities Board in 3 copies for checking and return to the general CONTRACTOR in 2 copies.
- D. Final Drawings shall be sent to the Utilities Board through the general CONTRACTOR in 5 copies for conformance and return in 3 copies.

## 2.02 PRECAST MANHOLES AND ACCESSORIES

### A. Precast Reinforced Concrete Manhole Walls and Slabs

- 1. Precast reinforced concrete manhole walls and cone tops shall be of tongue-and-groove type conforming to ASTM C 478-80. Cone tops may be of concentric or eccentric configuration. Top slabs for manholes shall conform to details on the Drawings and to ASTM Designation C 478-80. All precast slabs shall be clearly marked "TRAFFIC" or "NONTRAFFIC" and "TOP" or "BOTTOM." Prior to use of precast reinforced concrete wall sections and top and bottom slabs, shop drawings covering details of construction including accessories shall be submitted to the ENGINEER for review.
- 2. Precast manholes with "knock-out panels" for pipe entry are not acceptable.

### B. Manhole Adjustment Rings

- 1. Manhole frame adjustment rings shall be precast concrete rings for use between the top slab or top of cone and the manhole frame. Maximum allowable adjustment shall be 6 inches.

### C. Mortar Materials

- 1. Portland Cement
  - a. Any standard brand, conforming to ASTM Specification C 150-81, Type 1, same as specified for concrete.
- 2. Sand
  - a. First quality, clean, natural Kentucky River or Ohio River sand. When dry, 100 percent shall pass a No. 8 sieve and not more than 35 percent shall pass a No. 50 sieve, and conforming to ASTM Standard Specification C 144-81.

### D. Preformed Elastic Rope Joint Fillers

- 1. Gasket-type sealant to fill tongue-and-groove joints at top of precast manhole bases and between barrel sections shall be preformed, flexible, watertight, designed for specific joint requirements and meet Federal Specification SS-S-00210 and AASHTO M-198. Sealant shall be Con-Seal manufactured by Concrete Sealants, Inc., New Carlisle, Ohio or Ram-Nek manufactured by K.T. Snyder Co., Inc., Houston, Texas, or equal. Primers, if required by manufacturer, shall be supplied by the sealant manufacturer.

### E. Pipe Entry Seal

1. Pipes entering manholes shall be attached by a rubberized entry seal. The seal shall encircle the pipe snugly for the prevention of groundwater leakage into or sewage leakage out of the manhole. The seal may be of the cast-in-place type or the boot type with stainless steel clamps. The manufacturer of the seal shall certify that the seal material is compatible with the pipe material used on the project.
2. Cast-in-place seal shall be flexible, multi-finned, push-in type of premolded neoprene meeting ASTM C 443-79, Dura-Seal as manufactured by Dura-Tech Inc., Dayton, Ohio or equal.
3. Boot seal shall be flexible of premolded neoprene (ASTM C 923-79) with stainless steel expanding snap-ring inserted into cored hole of manhole barrel and exterior stainless steel ring (minimum 2) to clamp boot around pipe, Kor-N-Seal as manufactured by Reliance Universal, Inc., Knoxville, Tennessee, or equal.

F. Steps

1. Manhole steps shall be cast into the manhole wall at intervals of not more than 12 inches where depths of manholes are greater than 4 feet.

### **PART 3 EXECUTION**

#### **3.01 PRECAST MANHOLE CONSTRUCTION**

A. General

1. Manhole construction will not be permitted under conditions where there is danger of freezing or when materials are frozen. Manholes shall be protected from freezing weather for a period of at least 48 hours after construction.

B. Excavation

1. Excavation for manholes, control chambers and interceptor structures shall be made of sufficient width to adequately accommodate all work and proper centering. Depth of excavation shall extend sufficiently to accommodate the type of manhole provided. Where a poured concrete base is used, the excavation must be of sufficient depth to allow for a minimum of 3 inches between the bottom of the lower pipe opening and bottom of manhole barrel and an 8 inch thickness for the poured concrete base. Where a precast concrete base is used, whether as a separate unit or integral with the bottom barrel section, the excavation shall be such to allow for a 12 inch depth crushed stone sub-base when in earth or a 9 inch depth crushed stone sub-base when in rock, below the bottom of the precast concrete base.
2. Where the manhole subgrade is located in unstable material, the Utilities Board may order various methods of stabilization such as extra depths of crushed stone, concrete or other means as will prove effective.

C. Manhole Installation

1. Manhole Base

- a. Poured floor slabs of manholes shall be of Class 3,500 concrete according to Section 03300, and shall be placed ahead of sewer laying to avoid displacement of sewer ends while placing concrete. The part of the concrete slab under the manhole walls shall have a smooth trowel finish. Top of slab shall be 3 inches (or as shown on manhole details) below the lowest sewer invert grade. In sandy soils, a 6 mil polyethylene film shall be used under manhole slabs to prevent loss of moisture in concrete during placement.
- b. Precast concrete base slabs will be allowed based upon the Utilities Board acceptance of the particular base slab provided. The general requirements for poured slabs shall also apply to precast slabs. Precast base slabs shall be placed on a crushed stone subgrade which has been leveled and compacted to the proper elevation. Crushed stone shall be DGA or Kentucky Department of Highways size 57 and shall be 12 inches in depth when on earth and 9 inches in depth when on solid rock.
- c. Precast concrete manhole bottoms with accurately formed channels will be allowed as alternate to standard design, provided smooth surfaces and accurate levels, widths and slopes are obtained. The forms shall be constructed according to the angles and invert elevations obtained from the "stakeout" operation, and variation of forms more than  $\pm 2^{\circ}00'$  horizontally shall be cause for rejection. Changes in angles or elevations of manhole inverts, caused by relocation of a manhole after the original stakeout, shall be the responsibility of the CONTRACTOR if such relocation is necessitated by conflict with water, gas, drain or other utility lines or obstructions. Placement shall be as detailed for precast slabs above.

## 2. Manhole Barrel

- a. Manhole structure walls shall be constructed of precast concrete as shown on standard detail Drawings and as specified in this Section 03480. Barrels shall be accurately centered on the base slab as staked in the field.
- b. When poured or precast concrete base slabs are used, the first barrel section shall be seated in and sealed with cement mortar. Intermediate barrel sections may be seated in and sealed with cement mortar or rope joint filler both as specified in this Section. Where rope joint filler is used, it shall be placed on the outside lip of the tongue and groove barrel section. Where a primer or adhesive is to be used with the rope joint filler, it shall be that specified by the joint filler manufacturer. Precast concrete frame adjustment rings and cast iron frame shall set in a full bed of cement mortar.
- c. Precast barrel sections shall have steps cast in place or slots for steps left in place with steps to be located over the manhole outlet sewer pipe. Pipe openings shall be positioned to this arrangement. Likewise, eccentric corbel sections and precast top slabs with offset entrance shall be positioned on center with the manhole steps over the outlet sewer pipe.

## 3. Manhole Inverts

- a. Channels through manholes shall be formed of either split tiles, prefabricated forms, or hand finished of the same size as the sewer pipes connected.

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- b. After the first barrel section has been set, the floor shall be brought up within 1 inch of the top of the sewer channels with crushed stone or broken brick ballast which shall be shaped to provide a slope of at least 3 inches from manhole sides to main sewer channels. One and one-half inches thickness of mortar proportioned by volume, 1 part Portland cement and 2 parts concrete sand in a damp, loose condition (80 pounds per cubic foot dry basis), shall be placed over the ballast. This shall be wood float finished to provide a smooth and well drained floor to the manhole channels.
- c. The completed channels shall provide a smooth, steady transition between manhole inlet and outlet pipes. Any roughness or ragged edges within the completed channel shall be corrected prior to acceptance of the manhole.

4. Manhole Drops

- a. For joining sewer lines at different levels, drop manholes shall be provided. The drop inlets shall be as shown on the standard details.

D. Backfill

- 1. Backfill shall be accomplished per the requirements for sewer backfill as specified in Section 02700.

**END OF SECTION**

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## SECTION 05540

### CASTINGS

#### PART 1 GENERAL

##### 1.02 SCOPE OF WORK

- A. Included in this section are manhole covers, steps, valve boxes, and hatch covers.

##### 1.02 RELATED WORK NOT INCLUDED

- A. Concrete work is included in Division 3.
- B. Surface preparation and finishing of castings is included in Division 9, Section 09900.

##### 1.03 SUBMITTALS

- A. The CONTRACTOR shall submit to the Utilities Board, in accordance with Division 1, Section 01300, copies of construction details of castings proposed for use.

#### PART 2 MATERIALS

##### 2.01 GENERAL

- A. All castings shall be gray iron, conforming to the requirements of the ASTM Standards, Designation A 48-83, Class 35-B for manhole casting and class 20 for valve boxes.

##### 2.02 MANHOLE CASTINGS

###### A. Frames and Covers

1. Manhole castings shall consist of cast iron frames and 22-3/4 inch diameter covers, having a combined weight of not less than 325 pounds for out of traffic locations and 425 pounds for traffic locations. The frame shall be at least 7 inches high overall. Manhole covers must set neatly in the frame, with contact surfaces machined smooth for even bearing. The top of the cover shall be flush with the frame edge. The top of the cover shall have sufficient corrugations to prevent slipperiness and be marked in large letters "SANITARY SEWER" or "STORM SEWER" as applies. Covers shall have one pick hole only, about 1-1/2 inches wide and 1/2 inch deep with 3/8 inch square undercut at rear and 3/4 inch square undercut on sides. Covers on sanitary sewer manholes must not be perforated.

###### B. Steps

1. Cast iron or polypropylene plastic encapsulated steel manhole steps shall be of patterns shown on the detail Drawings, and have corrugated treads. In case of need for nonprotruding steps, shop drawings of special inset cast iron steps shall be reviewed by and be acceptable to the Utilities Board prior to use.

2. It is intended that the cast iron step be Neenah Foundry Company's R-1980-E, or equal, and the polypropylene plastic encapsulated steel step be M.A. Industries PS-1, PS-1PF or equal.

## 2.03 VALVE BOXES

### A. Slide Type for Iron Body Gate Valves

1. Valve boxes for 2 inch through 10 inch valves shall be the cast iron slide type, without screw, of sufficient length to allow for 20 to 30 inches of cover over the top of the pipe, Opelika Foundry Company No. 4908 or equal. The inner section shall have a minimum inside diameter of 5-1/4 inches with a hood type base that will cover the packing gland on a 2 inch through 10 inch valve (minimum of 8 inches inside diameter). The base of the top section shall be flanged at least 1-1/4 inches. The caps shall be circular with a corrugated surface and have pick holes in the periphery and be marked "Water," or "Sewer," according to use. For 12 inch through 16 inch valves, the valve boxes shall be cast iron, Opelika Foundry Company No. 4907 or equal.
2. Valve boxes for valves in the horizontal position shall be cast iron Opelika Foundry Co. No. 4907 or equal, with a base that is sized to allow covering of the bevel gear case and centering of the operating nut in the valve box.

## PART 3 EXECUTION

Not used.

**END OF SECTION**

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SECTION 11312

SUBMERSIBLE SEWAGE PUMPS AND ACCESSORIES

**PART 1 GENERAL**

1.01 SUMMARY

- A. Provide all equipment and services required to furnish and install the submersible sewage pumps as shown on the Drawings and specified herein.

1.02 RELATED WORK

- A. Special requirements for materials and equipment are given in Section 01600.
- B. Painting is shown on the Drawings.
- C. Motors and electrical work are specified in Division 16.

1.03 REFERENCES

- A. Where referenced specifications (ASTM, ACI, PCI, etc.), are mentioned, these standards are deemed to be the minimum standard of quality of materials or methods to apply to this project.

1.04 SUBMITTALS

- A. Shop drawings, control drawings, and operation and maintenance instructions shall be submitted in accordance with Section 01300. Refer to Section 01600 for additional requirements.

1.05 QUALITY ASSURANCE

- A. The pump manufacturer shall have a minimum number of not less than 50 units of the type specified and required installed and in operation handling sewage for no less than 2 years in North America.

**PART 2 PRODUCTS**

2.01 PUMPS AND MOTORS

- A. The pumps shall be capable of handling raw, unscreened sewage. The design of the connection between the pumps and the discharge piping shall be such that the pumps will be automatically connected to the discharge piping when lowered into place. The pumps shall be easily removable for servicing or inspection, requiring no bolts, nuts or other fasteners to be removed for this purpose, or need for personnel to enter the wet well. The pumps shall be fitted with a stainless steel chain for each pump, of adequate strength and length to permit raising the pump for inspection and removal.

## B. Casing and Impeller

1. The stator casing, oil casing and impeller shall be of grey iron construction, with all parts coming in contact with sewage being protected by a coat of rubber-asphalt paint. All external bolts and nuts shall be of stainless steel. The wear ring between impeller and pump housing shall be of stainless steel or bronze with vitrile rubber O-ring or neoprene O-ring at the inlet of the pump. The impeller shall be of nonclog design, capable of passing solids, fibrous material, and heavy sludge, and constructed with long throughway with no acute turns.

## C. Shaft Seal

1. Each pump shall be provided with a tandem double mechanical seal running in an oil reservoir, composed of two separate lapped face seals, each consisting of one stationary and one rotating ring with each pair held in contact by a separate spring. The lower seal shall be tungsten-carbide on tungsten-carbide or silicon carbide on silicon carbide. The upper seal shall be either tungsten carbide, silicon carbide or tool steel on carbon. The compression spring shall be protected against exposure to the pumped liquid.
2. The pumped liquid shall be sealed from the oil reservoir by one face seal and the oil reservoir from the motor chamber by the other. The seals shall require neither maintenance nor adjustment, and shall be easily replaced.
3. Seal failure detection shall be provided and wired to an indicator light in the control panel.

## D. Pump Mounting and Removal Facilities

1. A sliding guide bracket shall be an integral part of the pumping unit. The pump casing shall have a machined connection with yoke to connect with the cast iron discharge connection, which shall be bolted to the floor of the sump and so designed as to receive the pump connection without the need of any bolts or nuts.
2. Sealing of the pumping unit to the discharge connection shall be accomplished by a simple linear downward motion of the pump with the entire weight of the pumping unit guided to and wedging tightly against the discharge connection.
3. Guide rails and all accessories shall be non-sparking stainless steel.

## E. Motors

1. Pump motor shall be housed in an oil or air-filled watertight casing and shall have Class F insulated windings which shall be moisture resistant. All 3 phase motors shall be dual voltage. Pump motors shall have cooling characteristics suitable to permit continuous operation in a totally, partially or nonsubmerged condition.
2. Motors shall not be overloaded under any condition of operation. Motor service factor shall not be used to prevent overloading. See Division 16 - Electrical for detailed motor specifications.

3. Motors shall be furnished with extra hard usage flexible power cables, length as required. The cable entry into the motor housing shall be equipped with integral strain relief or an external strain relief device installed to prevent cable pullout.
4. Each submersible pump shall be equipped with a power cable of sufficient length to reach to the disconnect switch or control panel without splicing.
5. The pump/motor assembly shall be suitable for use in hazardous locations. The assembly shall be rated or certified for use in NEC Class 1, Group D, Division 1 hazardous locations.

F. Pump Warranty

1. The pump manufacturer shall warrant the pumps being supplied to the OWNER against defects in workmanship and materials for a period of 5 years under normal use, operation and service. In addition, the manufacturer shall replace certain parts which become defective through normal use and wear on a progressive schedule of cost for a period of 5 years. Parts included are the mechanical seal, impeller, pump housing, wear ring, and ball bearings. The warranty shall be in published form and apply to all similar units.

2.02 PUMP AND MOTOR CHARACTERISTICS

- A. The service conditions, size and characteristics of the pumps and motors shall be as shown in Table 1.

1. Table 1 - Example - Pumping Station

| Item                                                   | Unit    | Quantity |
|--------------------------------------------------------|---------|----------|
| Number of Units Required                               | --      | _____    |
| Minimum Static Head                                    | Feet    | _____    |
| Average Static Head                                    | Feet    | _____    |
| Maximum Static Head                                    | Feet    | _____    |
| Capacity Requirement                                   | gpm     | _____    |
| Total Head @ Capacity Required and Maximum Static Head | Feet    | _____    |
| Pump Efficiency @ Capacity Required                    | Percent | _____    |
| Minimum Shutoff Head                                   | Feet    | _____    |
| Minimum Discharge Size, Diameter                       | Inches  | _____    |
| Diameter of Solids Passed                              | Inches  | _____    |
| Maximum Motor Size                                     | Hp      | _____    |
| Maximum Allowable Pump and Motor Speed                 | rpm     | 1800     |
| Motor Phase                                            | --      | _____    |
| Motor Voltage                                          | V, ___  | _____    |

2.03 ACCESS FRAME AND GUIDES

- A. A complete access frame and guides for each pump shall be furnished complete with hinged and hasp-equipped cover(s), stainless steel upper guide holder and level sensor cable holder. Frame shall be securely mounted above the pumps. Each door shall have safety locking handle in open position. Doors shall be of checkered aluminum plate, aluminum frame and all stainless steel hardware.
- B. Lower guide holders shall be an integral part of the discharge connection. Guide bars shall be of stainless steel pipe of the size indicated on Drawings or required by the pump manufacturer.

2.04 CONTROLS

- A. The pumps shall be furnished with a control panel as specified in Division 16. The pumps shall operate by wet well level control system or by liquid level sensors. The lead pump will operate via variable frequency drives under normal conditions. Three sensors are required, three

normally open for stop, start lead, and start lag. See the control circuit on the drawings and sequence of operation in Division 16 of these specifications for complete control requirements. The controls for the pumps shall be provided by the pump manufacturer.

- B. Each submersible pump shall be furnished with seal leak detection. Extra hard usage power cable shall also be furnished with each pump, and a power cable support/mounting bracket. All cables shall be of adequate length to remove pumps and set wet well pump control elevations as necessary.

### **PART 3 EXECUTION**

#### **3.01 DELIVERY, STORAGE AND HANDLING**

- A. Store indoors.
- B. Pumps and motors shall not be stored on vibrating bases or floors. Any motor so stored should be disassembled and inspected for bearing damage, prior to service. If bearing damage is evident, replace bearing.
- C. Check the rust preventative coating on external machined surfaces (including shaft extension) for damage. If necessary, recoat the surfaces with Rust Veto No. 342 (Manufactured by E.F. Houghton Co.) or equivalent. The condition of the rust preventative coating shall be checked periodically and surfaces should be recoated as recommended by the coating manufacturer.
- D. Oil lubricated bearings - drain oil from bearing housing and refill, to maximum level, with a circulating type oil. Oil should be changed every 12 months while motor is in storage.
- E. Grease lubricated bearings - once a month, inject a small quantity of grease into the grease fill such that grease is purged from the drain. Inspect purged greases for water condensation or oxidation. If water condensation or oxidation is evident, the motor shall be disassembled and contaminated grease removed, and replaced with new grease.
- F. Take precautions as necessary to prevent rodents, snakes or other small animals from nesting inside pump.
- G. Prevent moisture or condensation from accumulating by energizing motor space heaters if provided, or applying reduced voltage to one phase of motor windings (trickle-voltage-heating). Request percent of rated voltage and transformer capacity to be used from manufacturer. The winding should be maintained 5°C minimum above ambient temperature (some locations require a higher temperature above ambient) to prevent condensation.
- H. If pump and motor are covered by plastic or similar material, additional precautions such as heated or circulating air and silica gel may be necessary, to protect against moisture or condensation.
- I. Rotate pump and motor shaft several revolutions by hand once every two weeks while in storage to insure a protective oil film on bearing surfaces.
- J. Start-up preparation after storage:
  - 1. Thoroughly clean and inspect motor.
  - 2. Change oil or grease in bearing housing.

3. Secure all plugs, fittings, etc., to prevent leakage.
4. Check insulation resistance.

### 3.02 INSTALLATION

- A. Submersible pumps shall be shipped to the job completely assembled with the power cable attached. The unit must be properly stored and special care given to the protection of the power cable to protect it from mechanical damage and protect the cut end of the cable from the intrusion of moisture. The cable will act like a wick if the cut is allowed to lay in a pool of water. Should this condition be allowed to occur, the unit shall be shipped back to the manufacturer for complete drying out and testing. A test report from the manufacturer shall be required before any payment for unit is made.
- B. It is important that the discharge connection is attached to the bottom slab level and at the exact location required relative to the access cover. Suggested procedure:
  1. Install access cover.
  2. Attach upper guide bracket(s).
  3. Put discharge connection(s) on bottom slab.
  4. Cut to length and install guide bars between upper guide bracket(s) and discharge connection(s).
  5. Check with level (shim, if necessary) and anchor discharge connection(s) exactly where position will result in guide bars being parallel and vertical.
- C. Use proper gaskets, tighten SS bolts gradually and evenly. In deep stations install discharge pipe brackets to relieve discharge connections from overload and intermediate guide bar brackets to prevent guide bars from bending when pumps are pulled.
- D. Lower pump units into place along guide bars. Check visually metal-to-metal contact between volute flange and discharge connection. If necessary, re-check and re-align discharge connection(s) and guide bars with pumps in place.
- E. After proper alignment of all components, including metal-to-metal connection of pump flange is established, grout access cover, discharge connection(s) and pipe thrulets. Build up and shape slopes at pump bottom in accordance with Drawings.
- F. As a part of the final inspection each pump shall be pulled to verify trueness of alignment of guide rails, in the presence of the OWNER and the ENGINEER.
- G. All motors and controls shall be connected and the motor operated while disconnected from the pump to determine proper rotation and to observe for vibration or motor defects. Disconnecting of the pump and motor on certain factory assembled units may be waived by the ENGINEER.

### 3.03 TESTING OF PUMPS

- A. All pumps shall be tested to verify performance data submitted. When possible, pumps shall be tested by pumping down a basin or by filling a basin. All pumps shall be tested for capacity at a minimum of 3 points on the pump curve. The motor full load amperage and voltage shall be checked and must fall within the rated values of the motor tested. Failure to perform can result in having the unit removed and replaced.

- B. All tests shall be performed by the CONTRACTOR in the presence of Richmond Utilities. All equipment needed for the pump tests, rulers, stopwatch, gauges, volt meter and ammeter shall be provided by the CONTRACTOR.
- C. All motors shall be megged with the winding resistance recorded. Motor voltage and amperage shall also be measured and recorded.
- D. All test data shall be reported to Richmond Utilities in writing.

### 3.04 SPARE PARTS

- A. Spare parts shall be furnished for all pumping equipment. All spare parts shall be boxed and tagged with positive identification, including part number, description and the particular pump to which it applies.
- B. The required spare parts shall include the following items as a minimum for each different size or model pumping unit:

One complete set of mechanical seals

One set of impeller adjustment washers

One set of O-rings

Wear ring

Impeller screw

**END OF SECTION**

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**SECTION 15100**

**SMALL PLUMBING VALVES, PLUMBING SPECIALTIES  
AND SERVICE ACCESSORIES**

**PART 1 GENERAL**

1.01 INCLUDED

- A. Furnish all valves and appurtenances as shown on the Drawings and as specified herein.

1.02 SYSTEM DESCRIPTION

- A. All of the equipment and materials specified herein is intended to be standard for use in controlling the flow of wastewater, sludge, water, air or chemicals, depending on the applications.

1.03 QUALITY ASSURANCE

- A. All of the types of valves and appurtenances shall be products of well established firms who are fully experienced, reputable and qualified in the manufacture of the particular equipment to be furnished. All materials of construction shall be of an acceptable type and shall be designated for the pressure and temperatures at which they are to be operated, for the materials they are to handle and for the use for which they are intended. The materials shall meet established technical standards of quality and strength necessary to assure safe installations and conform to applicable standards. The equipment shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these Specifications as applicable.

1.04 REFERENCES

- A. Kentucky Building Code.

1.05 SUBMITTALS

- A. Copies of all materials required to establish compliance with these Specifications shall be submitted in accordance with the provisions of the General Conditions. Submittals shall include at least the following:
  - 1. Certified drawings showing all important details of construction and dimensions.
  - 2. Descriptive literature, bulletins, and/or catalogs of the equipment.
  - 3. The total weight of each item.
  - 4. A complete total bill of materials.
  - 5. A list of the manufacturer's recommended spare parts.

1.06 OPERATING INSTRUCTIONS

- A. Operating and maintenance instructions shall be furnished to the ENGINEER as required in the General Conditions. The instructions shall be prepared specifically for this installation and shall

include all required cuts, drawings, equipment lists, descriptions, etc., that are required to instruct operating and maintenance personnel unfamiliar with such equipment.

## **PART 2 PRODUCTS**

### **2.01 GENERAL**

- A. All valves and appurtenances shall be of the size shown on the Drawings and as far as possible all equipment of the same type shall be from one manufacturer.
- B. All valves and appurtenances shall have the name of the maker, flow directional arrows, and the working pressure for which they are designed cast in raised letters upon some appropriate part of the body.

### **2.02 GATE VALVES**

- A. Gate valves shall be used in shut-off applications and where the valves are scheduled for infrequent use.
  - 1. Gate Valves for Sewage
    - a. Gate valves for sewage service 3 inches and smaller shall be rated for safe operation at 125 psi saturated steam and 200 psi non-shock cold water, oil or gas (WOG).
    - b. The valves shall be of the rising stem, inside screw, screw-in bonnet, solid wedge disc type.
    - c. The body, bonnet, disc, packing nut and stem shall be bronze construction. Packing shall be the TFE non-asbestos suitable for a maximum temperature of 200 degrees Fahrenheit.
    - d. Gate valves with threaded end connections shall be Milwaukee 148, Hammond IB640 or equal.

### **2.03 MISCELLANEOUS COCKS**

- A. Gauge Cocks
  - 1. Gauge cocks for sewage service shall be 316 stainless steel construction rated for safe operation at 10,000 psi at 100 degrees Fahrenheit. The valve shall be nitrogen tested for seat leakage, maximum allowable leak rate 0.1 scc./min.
  - 2. Gauge cocks shall be Whitey Co. "BV" series bleed valves or equal.

### **2.04 MISCELLANEOUS STOPS**

- A. Corporation Stops
  - 1. Corporation stops to be used with threaded pipe where connected into cast iron pipe, shall be brass ground joint type with AWWA CC or CS taper thread inlets. Stops shall be Mueller H-10045, Ford, or equal.

2. Corporation stops to be used with copper pipe with compression type connections, where connected into cast iron or asbestos-cement pipe, shall be the same, except with compression type outlet connections. Stops shall be Mueller H-15000, H-15010, H-15020, Ford, or equal.
3. Corporation stops shall be factory tested to 250 psi to be compatible with the pipes in which they are installed.

### **PART 3 EXECUTION**

#### **3.01 INSTALLATION**

- A. All valves and appurtenances shall be installed in the locations shown, true to alignment and rigidly supported. Any damage to the above items shall be repaired to the satisfaction of Richmond Utilities before they are installed.
- B. Control valves in all locations shall be so grouped and located that they may be easily operated, through access panels, doors, or adjacent to equipment.
- C. After installation, all valves and appurtenances shall be tested at least one hour at the working pressure corresponding to the class of pipe, unless a different test pressure is specified. If any joint proves to be defective, it shall be repaired to the satisfaction of Richmond Utilities.
- D. All materials shall be carefully inspected for defects in workmanship and materials; all debris and foreign material cleaned out of valve openings, etc.; all operating mechanisms operated to check their proper functioning, and all nuts and bolts checked for tightness. Valves and other equipment which do not operate easily, or are otherwise defective, shall be repaired or replaced at no additional cost to the OWNER.

**END OF SECTION**

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## SECTION 15102

### VALVES

#### PART 1 GENERAL

##### 1.01 SCOPE

- A. Furnish all labor, materials, equipment, and incidentals required and install complete and ready for operation all valves and appurtenances.
- B. The equipment shall include but not be limited to, the following:
  - 1. Butterfly valves
  - 2. Gate valves
  - 3. Tapping valves, sleeves and crosses

##### 1.02 RELATED WORK

- A. Excavation, backfill and grading is included in Division 2.
- B. Piping is included in the respective sections of Division 2.
- C. Valves and service accessories on all plumbing systems are included in Division 15.
- D. Special sequence or schedule requirements (if any) are specified in Section 01010 - Summary of Work.

##### 1.03 DESCRIPTIONS OF SYSTEMS

- A. All of the equipment and materials specified herein is intended to be standard for use in controlling the flow of water or sewer.

##### 1.04 QUALIFICATIONS

- A. All of the types of valves and appurtenances shall be products of well established firms who are fully experienced, reputable and qualified in the manufacture of the particular equipment to be furnished. The equipment shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these specifications as applicable.
- B. Acceptable Manufacturers
  - 1. Butterfly Valves - Pratt, Mueller or equal.
  - 2. Gate Valves - Kennedy, Clow, Mueller or equal.
  - 3. Tapping Valves - Clow, Mueller or equal.

##### 1.05 SUBMITTALS

- A. Complete shop drawings of all valves and appurtenances shall be submitted to the Utilities Board in accordance with the requirements of Sections 00820 and 01300.

B. The Utilities Board shall be furnished 2 certified copies of reports covering the required leakages, hydrostatic and proof-of-design tests on the valves.

C. Gate Valves

1. The Utilities Board shall be furnished 2 copies of affidavit of compliance stating that the valves and materials used in their construction conform to the applicable requirements of ANSI/AWWA C500-93, and that all tests specified therein have been made and that the test requirements have been met.

1.06 OPERATING INSTRUCTIONS

A. Manufacturer's operating and maintenance instructions shall be furnished to the Utilities Board as set forth in Section 01600.

**PART 2 PRODUCTS**

2.01 MATERIALS AND EQUIPMENT

A. General

1. All valves and appurtenances shall be of the size shown on the Drawings and as far as possible all equipment of the same type shall be from one manufacturer.
2. All valves and appurtenances shall have the name of the maker, flow-directional arrows, and the working pressure for which they are designed cast in raised letters on some appropriate part of the body.
3. All valves shall open left (counter clockwise).
4. All bolts and studs shall be in accordance with ASTM A-307-00 Grade B and nuts shall be in accordance with ASTM A-563-00. Bolts, studs and nuts shall be electrogalvanized according to ASTM B-633-98.
5. All bolts, studs and nuts in contact with water, in any moist atmosphere or damp area such as occurs above water, or exposed to weather shall be stainless steel.
6. All bolts delivered to the job shall be free of rust and dirt and shall be stored in a manner to protect them from rust and dirt. All bolts shall be tightened to the proper torque. They shall be of the size recommended for the pipe and fittings they are to be used on and shall be in the recommended quantity. Tightening of bolts shall be alternated, so as to not produce undue stress on the valves and fittings.

2.02 BUTTERFLY VALVES

A. Rubber Seated Butterfly Valves

1. General

a. Unless otherwise noted in these Specifications or on the Drawings, all butterfly valves shall meet the requirements of ANSI/AWWA Specification C504-00. All

future reference to section and paragraph numbers will be those of ANSI/AWWA C504-00.

- b. Unless otherwise shown on the Drawings, the maximum nonshock shutoff pressure will not exceed those specified for the various valve classes.
- c. Unless otherwise noted on the Drawings or called for in these Specifications, flow through the valves will be:

|               |                                     |
|---------------|-------------------------------------|
| Normal:       | Not more than 6 feet/second maximum |
| When Opening: | 10 feet/second                      |
| When Closing: | 16 feet/second                      |

## 2. General Design

### a. Valve Bodies

- (1) Valve bodies shall be of ductile iron. They shall be short body mechanical joint ends. Wafer type valves are not acceptable.

### b. Valve Shafts

- (1) Valve shafts shall be in accordance with the requirements of Section 3, paragraph 3.3, and subparagraphs 3.3.1 thru 3.3.4, except that carbon steel shafts are not acceptable.

### c. Valve Discs

- (1) Valve disc shall be in accordance with Section 3, paragraph 3.4, and subparagraphs 3.4.1 thru 3.4.4, except that cast steel and fabricated steel disc are not acceptable.
- (2) The manufacturer shall furnish the Utilities Board dimensions of the clearance required for the valve disc.

### d. Valve Seals

- (1) Valve shaft seals shall be standard split V type packing, standard O-ring seals or for a pull down packing.

### e. Valve Actuators

#### (1) General

- (a) Valve actuators shall be of type as shown on the Drawings. They shall be equipped with adjustable mechanical stop-limiting devices to prevent over-travel of the valve disc in the open and closed positions. Actuator housings, supports, and connections to the valve shall be designed with a minimum safety factor of 5, based on the ultimate strength, or 3, based on the yield strength of the materials used.

- (b) Valve actuators shall be in accordance with Section 3, paragraph 3.8, subparagraphs 3.8.1 thru 3.8.4, and subparagraphs 3.8.7.9 thru 3.8.7.11.
- ©) Certification for the proof of design test of the valve actuator shall be submitted in accordance with Sections 00820 and 01300.

(2) Buried Actuators

- (a) Buried valve actuators shall be lubricated for life of the valve and be designed for satisfactory operation in groundwater conditions. They shall be designed for operation of Class 150 B butterfly valves. They shall also be nut and key type of 30 inch bury over top of pipe. All valves with nuts over 30 inches below top of valve box shall have extension stems to within 12 inches of top of boxes. Extension stems shall be manufactured from solid 3/4-inch steel with nut adapters welded to the shaft. Bottom nut adapter shall be firmly attached to the manufacturer's valve nut. Welds should be mechanically cleaned. Stem shall have an epoxy coating.

f. Workmanship and Painting

- (1) Workmanship and painting shall be in accordance with Section 4, paragraphs 4.1 and 4.2, and subparagraphs 4.2.1 thru 4.2.3, except that non-buried or submerged valves inside plants shall be prepared for and given a prime coat only.

## 2.03 GATE VALVES

### A. Resilient-Seated Gate Valve (AWWA Type)

#### 1. General

- a. Resilient-seated gate valves shall conform in all respects to ANSI/AWWA C509-01 with non-rising or rising stems, in sizes 3, 4, 6, 8, 10, and 12 inch NPS except as otherwise noted below. They shall be designed for a working water pressure of 200 psi.
- b. Valves shall have a clear unobstructed water way, without pockets or ridges in the seating area of the valve body. When fully open the water way shall be at least as large as the pipe diameter to which it is connected.
- c. All future references to section and paragraph numbers shall be those of ANSI/AWWA C509-01.

#### 2. Materials

##### a. Physical and Chemical Properties

- (1) Physical and chemical characteristics of the valve components shall be in accordance with Section 2.2, except that carbon steel castings for valves

are not acceptable. Paint shall be as hereinafter specified under "Valve Protection."

3. Detailed Design

a. Valve Ends

(1) General

(a) Valve ends shall be mechanical joint, as shown on the Drawings and/or as listed in the resilient seat valve schedule.

b. Stem Seal

(1) Stem seals shall be O-rings in accordance with Section 4.8, paragraph 4.8.2 and subparagraph 4.8.2.1, and materials shall be in accordance with paragraph 4.8.3.

c. Wrench Nuts and Handwheels

(1) Wrench nuts and handwheels shall be in accordance with Section 4.10 and subparagraphs 4.10.1 through 4.10.5, except that all valves whether NRS or O S & Y shall open by turning counterclockwise.

d. Gaskets

(1) Gaskets where used shall be in accordance with Section 4.15. O-rings of Buna-N or equal material.

e. Valve Seats

(1) Valve seats shall be in accordance with Section 4.12, except that seats applied to the valve body are not acceptable.

f. Seat Reinforcement

(1) Seat reinforcement where used shall be in accordance with Section 4.13, except that exposed mechanical devices and hardware used shall be bronze and/or stainless steel.

4. Fabrication

a. Valve Protection (Painting and Coating)

(1) Exterior

(a) Exterior painting of the valve may be in accordance with section 2.2.7.1, or it may be the same as that specified for interior painting of the valves.

(2) Interior

- (a) The interior of the valve shall be prepared for and painted in accordance with AWWA C550-01. The coating may be a fusion bonded epoxy, in 8 to 10 mil thickness or it may be a two-part thermosetting epoxy having the same mil thickness. After application the interior coating shall be visually examined and holiday tested in accordance with AWWA C550-01.

## 2.04 TAPPING VALVES AND TAPPING SLEEVES AND CROSSES

### A. Tapping Valves

1. Tapping valves for use with tapping sleeve and crosses shall be in accordance with the specifications for gate valves, except that one end shall have a flanged connection and the other end either a hub or mechanical joint connection.
2. They shall be for 250 psi in sizes 2 inch thru 24-inch.
3. Valves shall open by turning counterclockwise.
4. Inlet flanges of valves shall meet ANSI B16.1, Class 125 standard.

### B. Tapping Sleeves and Tapping Crosses

1. Tapping sleeves and tapping crosses shall have heavy cross sections to strengthen the existing water main at the point of installation.
2. Mainline end connections to existing pipeline shall be mechanical joint with large and small gaskets.
3. Mechanical joint tapping sleeves and crosses shall have a maximum working pressure of 250 psi.
4. Outlet end of tapping sleeves and crosses shall have ANSI B16.1, Class 125 flanges.

### C. Quality Standard

1. For full body tapping valves, tapping sleeves and tapping crosses shall be in features and quality equal to those of American Valve and Hydrant Company, Mueller Company or Dresser Manufacturing Company.
2. For stainless steel tapping sleeves use JCM style 452 with 1/4-inch neck and 5/16-inch body, or equal.

### D. Test and Certification

1. Tests on tapping valves shall be in accordance with these Specifications for gate valves.

### E. Protection

1. Tapping Valves

- a. Protection of tapping sleeves and valves shall be in accordance with these Specifications for gate valves.

2. Tapping Sleeves and Crosses

- a. Protection for tapping sleeves and crosses shall be in accordance with these Specifications for ductile iron pipe fittings.

## 2.05 DRY-BARREL FIRE HYDRANTS

- A. All post-type dry barrel fire hydrants will have compression type vales, operating against pressure. They shall meet all requirements of ANSI/AWWA Specification C502-94.
- B. They shall have two 2-1/2 inch hose connection nozzles and one 4-1/2 inch steamer connection nozzle, all with caps and drains, and have national support threads.
- C. Main valve opening size shall be 5-1/4 inch, which must remain closed when the above ground breakable safety section of the hydrant barrel is broken off.
- D. All hydrants shall have 6 inch mechanical joint bell connection designed for 200 pounds working water pressure, in accordance with ANSI/AWWA C110/A21.10-98. Joint accessories are to be furnished with the hydrant.
- E. Finish paint color of the hydrant barrel above ground line shall be red.
- F. All hydrants shall have an automatic drain feature providing positive barrel drainage after hydrant use.
- G. The lowest outlet level of the hydrant shall be located sufficiently above the indicated ground level to permit a 360° swing of a 15 inch hydrant wrench. One standard hydrant wrench is to be provided. All hydrants shall open by turning counterclockwise. All hydrants shall be installed plumb and at proper bury depth. OWNER may require concrete stabilizing collar (2.5' x 2.5' x 0.5') with rebar around hydrants.
- H. Quality Standard
  1. All post type fire hydrants shall have the features, and be equal to those of Mueller-Centurion, Kennedy #6335T or #615102, or M & H #5129363.12-7.

## PART 3 EXECUTION

### 3.01 INSTALLATION (In Structures, Vaults and Basins)

#### A. Exterior

1. Valves in ground shall be installed with operating stems vertical, unless other wise shown on the Drawings or called for in these Specifications. Tops of operating nuts shall be not more than 30 inches below ground surface. Where valve operating nuts are more than 30 inches below tops of valve boxes, stems shall be provided to bring the operating nut to within 12 to 24 inches of box tops.

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2. Valve boxes shall be accurately centered over valve operating nuts and the backfill shall be mechanically tamped about them, to prevent subsequent movement. Tops of boxes shall be flush with ground surface, paving, walk, or road surface.
  3. All valves shall be installed as shown on the Drawings. Any valve or stand found to be binding unduly shall be made to operate freely.
- C. For butterfly valves, installation shall be in accordance with Appendix B., Sections B.1 through B.5 of ANSI/AWWA C504-00.
- D. For gate valves, installation shall be in accordance with Appendix A, Sections A.5.1 through A.5.7 of ANSI/AWWA C509-01.

### 3.02 SHOP PAINTING

- A. Interior surfaces of all valves, the exterior surfaces of buried valves and miscellaneous piping appurtenances shall be given a shop finish of an asphalt varnish conforming to Federal Specification TT-V51e for Varnish Asphalt.

### 3.03 INSPECTION AND TESTING

- A. The various pipelines in which the valves and appurtenances are to be installed are specified to be field tested. During these tests any defective valve or appurtenance shall be adjusted, removed and replaced, or otherwise made acceptable to the Utilities Board.
- B. Testing shall be done in accordance with Section 02610 "TESTING" with no visible leaks allowed on valves.

**END OF SECTION**