

**SECTION 33 30 00
SANITARY SEWERAGE UTILITIES**

PART 1 - GENERAL

1.1 DESCRIPTION:

Outside, underground sanitary sewer system, complete, ready for operation, including all gravity flow lines, pressure (force) lines, manholes, cleanouts, frames, covers, structures, appurtenances, and connections to new building and structure, service lines, existing sanitary sewer lines, and existing sanitary structures, and all other incidentals.

1.2 RELATED WORK:

- A. Maintenance of Existing Utilities: Section 01 00 00, GENERAL REQUIREMENTS.
- B. Excavation, Trench Widths, Pipe Bedding, Backfill, Shoring, Sheeting, Bracing: Section 31 20 00, EARTH MOVING.
- C. Concrete Work Reinforcing, Placement and Finishing; Section 03 30 00, CAST-IN-PLACE CONCRETE.
- D. Protection of Materials and Equipment: Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
- E. Sanitary Sewer Pumping Facilities, Division 22, PLUMBING.

1.3 QUALITY ASSURANCE:

- A. Products Criteria:
 - 1. Multiple Units: When two or more units of the same type or class of materials or equipment are required, these units shall be products of one manufacturer.
 - 2. Nameplates: Nameplate bearing manufacturer's name, or identifiable trademark, including model number, securely affixed in a conspicuous place on equipment, or name or trademark, including model number cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.
- B. Comply with the rules and regulations of the Public Utility having jurisdiction over the connection to Public Sanitary Sewer lines and the extension, and/or modifications to Public Utility Systems.

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1.4 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturers' Literature and Data: Submit the following as one package:
 - 1. Pipe, Fittings, and, Appurtenances.
 - 2. Jointing Material.
 - 3. Manhole and Structure Material.
 - 4. Frames and Covers.
 - 5. Steps and Ladders.
 - 6. Gate Valves.
 - 7. Valve Boxes.
 - 8. Air Release Valves.

1.5 APPLICABLE PUBLICATIONS:

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - A48/A48M-03.....Gray Iron Castings
 - A536-84(2004).....Ductile Iron Castings
 - A615/A615M-06.....Deformed and Plain Carbon-Steel Bars for
Concrete Reinforcement
 - A625/A625M-03.....Tin Mill Products, Black Plate, Single Reduced
 - A746-03.....Ductile Iron Gravity Sewer Pipe
 - C12-06.....Installing Vitrified Clay Pipe Lines
 - C76-05b/C76M-05b.....Reinforced Concrete Culvert, Storm Drain and
Sewer Pipe

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C139-05.....Concrete Masonry Units for Construction of Catch
Basins and Manholes

C150-05.....Portland Cement

C425-04.....Compression Joints for Vitrified Clay Pipe and
Fittings

C478-06a/C478M-06a.....Precast Reinforced Concrete Manhole Sections

C700-05.....Vitrified Clay Pipe, Extra Strength, Standard
Strength, and Perforated

C828-03.....Low-Pressure Air Test of Vitrified Clay Pipe
Lines

C857-95(2001).....Minimum Structural Design Loading for
Underground Precast Concrete Utility Structures

D698-00ael.....Laboratory Compaction Characteristics of Soil
Using Standard Effort (12,400 ft-lbf/ft³ (600
kN-m/m³))

D2321-05.....Underground Installation of Thermoplastic Pipes
for Sewers and Other Gravity-Flow Applications

D2412-02.....Determination of External Loading
Characteristics of Plastic Pipe by Parallel-
Plate Loading

D2992-01.....Practice for Obtaining Hydrostatic or Pressure
Design Basis for Fiberglass (Glass-Fiber-
Reinforced Thermosetting-Resin) Pipe and
Fittings

D3034-04a.....Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe
and Fittings

D3212-96a (2003) e1.....Joints for Drain and Sewer Plastic Pipes Using
Flexible Elastomeric Seals

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D3261-03.....Butt Heat Fusion Polyethylene (PE) Plastic
Fittings for Polyethylene (PE) Plastic Pipe and
Tubing

D3350-05.....Polyethylene Plastics Pipe and Fittings
Materials

D4101-05a.....Polypropylene Injection and Extrusion Materials

F477-02e1.....Elastomeric Seals (Gaskets) for Joining Plastic
Pipe

F679-06.....Poly (vinyl chloride) (PVC) Large-Diameter
Plastic Gravity Sewer Pipe and Fittings

F714-05.....Polyethylene (PE) Plastic Pipe (SDR-PR) Based on
Outside Diameter

F794-03.....Poly (Vinyl Chloride)(PVC) Ribbed Gravity Sewer
Pipe and Fittings Based on Controlled Inside
Diameter

F894-05.....Polyethylene (PE) Large Diameter Profile Wall
Sewer and Drain Pipe

F949-03.....Poly (Vinyl Chloride) (PVC) Corrugated Sewer
Pipe with Smooth Interior and Fittings

C. American Water Works Association (AWWA):

C105/A21.5-05.....Polyethylene Encasement for Ductile Iron Pipe
Systems

C110/A21.10-03.....Ductile-Iron and Gray-Iron Fittings for Water

C111/A21.11-00.....Rubber Gasket Joints for Ductile Iron Pressure
Pipe and Fittings

C115-99.....Flanged Ductile-Iron Pipe with Threaded Flanges

C116-03.....Protective Fusion-Bonded Epoxy Coatings for the
Interior and Exterior Surfaces of Ductile Iron

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Pipe and Gray Iron Fittings for Water Supply Service

C151-/A21.51-02 Ductile-Iron Pipe, Centrifugally Cast for Water

C153-00 Ductile-Iron Compact Fittings for Water Services

C508-01.....Swing Check Valves for Waterworks, 2 inches (50 mm) Through 24 inches (600 mm) NPS

C509-01.....Resilient Seated Gate Valves for Water-Supply Service

C515-01.....Reduced-Wall, Resilient-Seated Gate Valves For Water Supply Service

C512-04.....Air Release, Air/Vacuum, and Combination Air Valves for Waterworks Service

C550-05.....Protective Epoxy Interior Coatings for Valves and Hydrants

C600-05.....Installation for Ductile-Iron Water Mains and Their Appurtenances

C605-94.....Underground Installation of Polyvinyl (PVC) Pressure Pipe and Fittings for Water

C900-97Polyvinyl Chloride (PVC) Pressure Pipe, 100 mm (4 inches) Through 300 mm (12 inches) for Water Distribution

C905-97.....Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 350 mm through 1,200 mm (14 Inches through 48 Inches), for Water Transmission and Distribution

C906-99.....Polyethylene (PE) Pressure Pipes and Fittings, 100 mm through 1575 mm (4 Inches through 63 Inches), for Water Distribution

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D. American Association of State Highway and Transportation Officials
(AASHTO):

M198-05.....Joints for Concrete Pipe, Manholes, and Precast
Box Sections using Preformed Flexible Joint
Sealants

E. Uni-Bell PVC Pipe Association:

Uni-B-6-98.....Recommended Practice Low Pressure Air Testing of
Installed Sewer Pipe

PART 2 - PRODUCTS

2.1 PIPING:

A. Pressure (Force) Lines (Pipe and Fittings):

1. All pipe and fittings used in the construction of force mains shall be rated for a minimum of 1035 kPa (150 psi).
2. Polyvinyl Chloride (PVC): PVC pipe 100 mm to 300 mm (4 to 12 inches) shall conform to AWWA C900, Class 150 (DR 18). Fittings for PVC pipe shall be ductile iron.

2.2 JOINTING MATERIAL:

A. Pressure (Force) Main:

1. All joints indicated on the drawings as being "restrained" shall be fully restrained and capable of restraining 50 percent above all loads acting on the joint, but not less than 1035 kPa (150 psi). Thrust blocks shall not be permitted.
2. Polyvinyl Chloride (PVC) Pipe (Pressure Use):
 - a. Push-on joints shall conform to AWWA C900, C905.
 - b. Push-on gaskets for pipe, ASTM F477.
 - c. Restrained joints shall comply with one of the following:
 - 1) Joints to mechanical ductile iron fittings shall comply with the requirements for ductile iron pipe, except the mechanical joint restraint gland shall be specifically designed for use with PVC pipe.

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- 2) Push-on bell and spigot joints shall be retained with retaining rings and thrust rods. The rings shall be ductile iron conforming to ASTM A536. The rings shall be split style with serrated inside face which grips the pipe when the halves of the ring is assembled together. The ring shall not bear directly on the back of the bell. The rods shall be of adequate size and number to resist all axial movement of the joint.

2.3 NOT USED**2.4 NOT USED****2.5 NOT USED****2.6 NOT USED****2.7 SEWAGE WET WELL (LARGER THAN 300 GALLONS WORKING VOLUME):**

- A. Wet well shall be a rectangular precast vault conforming to ASTM C857.

The vault shall have a precast bottom, walls, and top structure. The vault shall be constructed of 35 MPa (5000 psi) concrete at 28 days and ASTM A625, Grade 60 reinforcement. The vault shall be rated for HS20-44 loading and 30 percent impact loads.

- B. All joints in the precast structure shall be tongue and groove. Flexible sealing compound, conforming to AASHTO M198, shall be placed in all joints to form a watertight structure.

2.8 CONCRETE PROTECTIVE COATING:

Concrete coating for the interior of wet wells shall consist of an epoxy blended filler sealer, and a cross linked epoxy phenolic cured, resistant protective coating.

2.9 ACID NEUTRALIZATION TANKS:

Acid neutralization tanks shall be constructed of 6 mm (1/4 inch) plate non code mild carbon steel suitable for rubber type lining with all welds double butt, continuous full welded, non porous and ground smooth and having no crevices, offsets or sharpened edges. The bottom and side walls shall be lined with 6 mm (1/4 inch) thermoplastic sheet lining fused directly to white ceramic lining 50 mm (2 inches) thick laid in Permamate acid and alkali proof mortar. The tank shall include 1050 mm (42 inch) ID manway riser constructed of steel shell with an interior corrosion resistant coating and complete cast iron frame and lid at the finish grade. Neutralizing charge shall be limestone, 75 mm (3 inches) in size.

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2.10 GATE VALVES:

A. AWWA C509, resilient seated gate valves rated for 1360 kPa (200 psi) WSP, reduced-wall resilient seated gates valves may be supplied in accordance with AWWA C515. Asbestos packing is prohibited. The interior and exterior of the valve shall be epoxy coated for AWWA C550.

B. Operation:

1. Shall turn counterclockwise to open.
2. Underground: 50 mm (2 inch) nut for socket wrench operation.
3. Above Ground and In Pits: Handwheels.

C. Joints: End of valve shall accommodate, or be adapted to, pipe furnished.

2.11 VALVE BOXES:

A. Cast iron extension box with screw or slide-type adjustment and flared base. Minimum thickness of metal shall be 5 mm (3/16 inch). Box shall be of such length as will be adapted, without full extension, to depth of cover required over pipe at valve location.

B. Cast the word "SEWER" on the cover.

C. Provide a "T" handle socket wrench, of 16 mm (5/8 inch) round stock long enough to extend 600 mm (2 feet) above top of deepest valve box.

2.12 CHECK VALVES

Check valves shall be swing-check valves conforming to AWWA C508. The interior and exterior of the valve shall be epoxy coated per AWWA C550. The check valve shall be rated for minimum of 850 kPa (125 psi) working pressure.

2.13 OIL AND GREASE INTERCEPTOR AND GREASE REMOVAL PIT:

2.14 AIR RELEASE VALVE:

Valves shall be combination air release and vacuum valve with a single body. The valves shall be rated for 1025 kPa (150 Psi) working pressure, and conform to AWWA C512. Valve shall be provided with threaded connections, and be mounted on a full opening ball valve which shall isolate the valve from the system.

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2.15 CLEANOUT FRAMES AND COVERS:

Frames and covers shall be gray iron casting conforming to ASTM C48. The frame and cover shall be rated for HS20-44 wheel loading, have a studded pattern on its cover, vent holes, and lifting slots. The cover shall fit firmly on the frame without movement when subject to vehicular traffic. The word "SEWER" shall be cast on the cover.

2.16 WARNING TAPE:

Standard, .1mm (4Mil) polyethylene 76 mm (3 inch) wide tape detectable type, green with black letters and imprinted with "CAUTION BURIED SEWER LINE BELOW".

PART 3 - EXECUTION

3.1 BUILDING SERVICE LINES:

- A. Install sanitary sewer service lines to point of connection within approximately 1500 mm (5 feet) outside of buildings where service is required and make connections. Coordinate the invert and location of the service line with the Contractor installing the building lines.
- B. Connections of service line to building piping shall be made after the new sanitary sewer system has been constructed, tested, and accepted for operation by the Contracting Officer's Technical Representative (COTR). The Contractor shall install all temporary caps or plugs required for testing.
- C. When building services have not been installed at the time when the sanitary sewer system is complete, provide temporary plugs or caps at the ends of all service lines. Mark the location and depth of the service lines with continuous warning tape placed 300 mm (12 inches) above service lines.

3.2 NOT USED

3.3 REGRADING:

- A. Raise or lower existing manholes and structures frames and covers, cleanout frames and covers and valve boxes in regraded areas to finish grade. Carefully remove, clean and salvage cast iron frames and covers. Adjust the elevation of the top of the manhole or structure as detailed on the drawings. Adjust the elevation of the cleanout pipe riser, and reinstall the cap or plug. Reset cast iron frame and cover, grouting

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below and around the frame. Install concrete collar around reset frame and cover as specified for new construction.

- B. During periods when work is progressing on adjusting manholes or structures cover elevations, the Contractor shall install a temporary cover above the bench of the structure or manhole. The temporary cover shall be installed above the high flow elevation within the structure, and shall prevent debris from entering the wastewater stream.
- C. The Contractor shall comply with all OSHA confined space requirements when working within existing structures.

3.4 CONNECTIONS TO EXISTING VA OWNED MANHOLES:

- A. During construction of new connections to existing manholes, it shall be the sole responsibility of the Contractor to maintain continued sanitary sewer service to all buildings and users upstream. The contractor shall provide, install, and maintain all pumping, conveyance system, dams, weirs, etc. required to maintain the continuous flow of sewage. All temporary measures required to meet this requirement shall be subject to the review of the COTR.
- B. Core existing structure, install pipe at the design invert. Install an elastomeric gasket around the pipe, and grout the interstitial space between the pipe and the core.
- C. The bench of the manhole shall be cleaned and reshaped to provide a smooth flowline for all pipes connected to the manhole.
- D. Connections and alterations to existing manholes shall be constructed so that finished work conforms as nearly as practicable to the applicable requirements specified for new manholes, including concrete and masonry work, cutting and shaping.

3.5 NOT USED

3.6 PIPE SEPARATION:

- A. Horizontal Separation - Water Mains and Sewers:
 - 1. Existing and proposed water mains shall be at least 3 meters (10 feet) horizontally from any proposed gravity flow and pressure (force main) sanitary sewer or sewer service connection.

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2. Gravity flow mains and pressure (force) mains may be located closer than 3 meters (10 feet) but not closer than 1.8 m (6 feet) to a water main when:
 - a. Local conditions prevent a lateral separation of ten feet; and
 - b. The water main invert is at least 450 mm (18 inches) above the crown of the gravity sewer or 600 mm (24 inches) above the crown of the pressure (force) main; and
 - c. The water main is in a separate trench separated by undisturbed earth.
3. When it is impossible to meet (1) or (2) above, both the water main and sanitary sewer main shall be constructed of push-on or mechanical joint ductile iron pipe. The pipe for the sanitary sewer main shall comply with the specifications for pressure (force) mains, and the water main material shall comply with Section 33 10 00, WATER UTILITIES. The sewer shall be pressure tested as specified for pressure (force) mains before backfilling.

B. Vertical Separation - Water Mains and Sewers at Crossings:

1. Water mains shall be separated from sewer mains so that the invert of the water main is a minimum of 600 mm (24 inches) above the crown of gravity flow sewer or 1200 mm (48 inches) above the crown of pressure (force) mains. The vertical separation shall be maintained within 3 meters (10 feet) horizontally of the sewer and water crossing. When these vertical separations are met, no additional protection is required.
2. In no case shall pressure (force) sanitary main cross above, or within 600 mm (24 inches) of water lines.
3. When it is impossible to meet (1) above, the gravity flow sewer may be installed 450 mm (18 inches) above or 300 mm (12 inches) below the water main, provided that both the water main and sewer shall be constructed of push-on or mechanical ductile pipe. Pressure (Force) sewers may be installed 600 mm (24 inches) below the water line provided both the water line and sewer line are constructed of

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ductile iron pipe. The pipe for the sewer shall conform to the requirements for pressure sewers specified herein. Piping for the water main shall conform to Section 33 10 00, WATER UTILITIES.

4. The required vertical separation between the sewer and the water main shall extend on each side of the crossing until the perpendicular distance from the water main to the sewer line is at least 3 meters (10 feet).

3.7 GENERAL PIPING INSTALLATION:

- A. Lay pipes true to line and grade. Gravity flow sewer shall be laid with bells facing upgrade. Pressure (force) mains shall have the bells facing the direction of flow.
- B. Do not lay pipe on unstable material, in wet trench or when trench and weather conditions are unsuitable for the work.
- C. Support pipe on compacted bedding material. Excavate bell holes only large enough to properly make the joint.
- D. Inspect pipes and fittings, for defects before installation. Defective materials shall be plainly marked and removed from the site. Cut pipe shall have smooth regular ends at right angles to axis of pipe.
- E. Clean interior of all pipe thoroughly before installation. When work is not in progress, open ends of pipe shall be closed securely to prevent entrance of storm water, dirt or other substances.
- F. Lower pipe into trench carefully and bring to proper line, grade, and joint. After jointing, interior of each pipe shall be thoroughly wiped or swabbed to remove any dirt, trash or excess jointing materials.
- G. Do not lay sewer pipe in same trench with another pipe or other utility. Sanitary sewers shall cross at least 600 mm (2 feet) below water lines.
- H. Do not walk on pipe in trenches until covered by layers of bedding or backfill material to a depth of 300 mm (12 inches) over the crown of the pipe.
- I. Warning tape shall be continuously placed 300 mm (12 inches) above sewer pipe

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J. Install gravity sewer line in accordance with the provisions of these specifications and the following standards:

1. Ductile Iron Piping: AWWA C111 and C600.
2. Vitrified Clay Piping: ASTM C12.
3. Polyvinyl Chloride (PVC) Piping: ASTM D2321.
4. High Density Polyethylene (HDPE) Piping: Comply with manufacturer's recommendations with gaskets with fused joints.

K. Gravity Flow Lines with Secondary Containment:

1. Install per manufacturer's recommendations. Install all pipe centering devices to maintain an interstitial space below the invert of the carrier pipe. Both the carrier and containment pipe shall be tested for leaks.

L. Installation of Pressure (Force) Mains:

1. Sections of piping listed on the drawings shall be fully restrained using approved joint restraint devices. Joint restraint devices shall be installed in accordance with the manufacturer's recommendations. For devices with twist of nuts, the twist of nuts shall be placed on top of the fitting for the Engineer's inspection. The Contractor shall torque test all bolts, set screws, identified by the COTR.
2. Thrust blocks shall not be permitted.
3. Install pressure (force) mains in accordance with the provisions of these specifications and the following standards:
 - a. Ductile Iron Piping: AWWA C111 and C600.
 - b. Polyvinyl Chloride (PVC) Piping: AWWA C605.
 - c. High Density Polyethylene (HDPE) Piping: Per manufacturer's recommendations.

3.8 MANHOLES AND VAULTS:

A. General:

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1. Circular Structures:

- a. Precast concrete segmental blocks shall lay true and plumb. All horizontal and vertical joints shall be completely filled with mortar. Parge interior and exterior of structure with 15 mm (1/2 inch) or cement mortar applied with a trowel and finished to an even glazed surface.
- b. Precast reinforced concrete rings shall be installed true and plumb. The joints between rings and between rings and the base and top, shall be sealed with a preform flexible gasket material specifically manufactured for this type of application. Adjust the length of the rings so that the eccentric conical top section will be at the required elevation. Cutting the conical top section is not acceptable.
- c. Precast reinforced concrete manhole risers and tops. Install as specified for precast reinforced concrete rings.

2. Rectangular Structures:

- a. Reinforced concrete structures shall be installed in accordance with Division 03, CONCRETE.
 - b. Precast concrete structures shall be placed on a 200 mm (8 inch) reinforced concrete pad, or be provided with a precast concrete base section. Structures provided with a base section shall be set on 200 mm (8 inches) thick aggregate base course compacted to a minimum of 95 percent of the maximum density as determined by ASTM D698. Set precast section true and plumb. Seal all joints with preform flexible gasket material.
3. Do not build structures when air temperature is 0 degrees C (32 degrees F), or below.
4. Invert channels shall be smooth and semicircular in shape conforming to inside of adjacent sewer section. Make changes in direction of flow with a smooth curve of as large a radius as size of structure will permit. Make changes in size and grade of channels gradually and evenly. Construct invert channels by one of the listed methods:

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- a. Forming directly in concrete base of structure.
 - b. Building up with brick and mortar.
- 5. Floor of structure outside the channels shall be smooth and slope toward channels not less than 1:12 (1-inch per foot) nor more than 1:6 (2 inches per foot). Bottom slab and benches shall be concrete.
 - 6. The wall that support access rungs or ladder shall be 90 degrees vertical from the floor of structure to manhole cover.
 - 7. Install steps and ladders per the manufacturer's recommendations. Steps and ladders shall not move or flex when used. All loose steps and ladders shall be replaced by the Contractor.
 - 8. Install manhole frames and covers on a mortar bed, and flush with the finish pavement. Frames and covers shall not move when subject to vehicular traffic. Install a concrete collar around the frame to protect the frame from moving until the adjacent pavement is placed. In unpaved areas, the rim elevation shall be 50 mm (2 inches) above the adjacent finish grade. Install a 200 mm (8 inches) thick, by 300 mm (12 inches) concrete collar around the perimeter of the frame. Slope the top of the collar away from the frame.

3.9 NOT USED

3.10 NOT USED

3.11 WET WELLS (PRECAST CONCRETE):

- A. Install the wet well on a 200 mm (8 inches) compacted aggregate base course.
- B. Set precast units level and plumb. Install sealant between all precast.
- C. Core openings for pipe penetrations and seal with a modular seal. Seal shall be "link-seal" or approved equal.
- D. Grout all joints and depressions in the vault. Install concrete protective coating per the manufacturer's recommendations. The final coating shall be applied in two coats, providing a minimum thickness .15 - .20 mm (6-8 mils) dry film thickness per coat.
- E. Set top of wet well 300 mm (12 inches) above finish grade.

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F. Pipe and fittings entering and within the wet well shall be poly lined ductile iron pipe.

G. All pipe penetrations through the walls of the wet well shall be sealed water tight.

3.12 NOT USED

3.13 NOT USED

3.14 NOT USED

3.15 CLEANOUTS:

A. 150 millimeters (6 inches) in diameter and consisting of a ductile iron 45 degree fitting on end of run, or combination Y fitting and 1/8 bend in the run with ductile iron pipe extension, water tight plug or cap and cast frame and cover flush with finished grade. Center-set cleanouts, located in unpaved areas, in a 300 by 300 by 150 mm (12 by 12 by 6 inches) thick concrete slab set flush with adjacent finished grade. Where cleanout is in force main, provide a blind flange top connection. The center of the flange shall be equipped with a 50 mm (2 inches) base valve to allow the pressure in the line to be relieved prior to removal of the blind flange. Frames and covers for pressure (force) mains shall be 600 mm (24 inches) in diameter.

B. The top of the cleanout assembly shall be 50 mm (2 inches) below the bottom of the cover to prevent loads being transferred from the frame and cover to the piping.

3.16 SETTING OF GATE VALVES:

A. Avoid setting valves under pavement except where shown on the drawings.

B. Clean valve interior before installation.

C. Set valve plumb, restrain ends of valves when indicated on the drawing.

D. Set valve box cover flush with the finished grade. Valve box shall be centered over the operating nut.

3.17 NOT USED

3.18 SETTING OF AIR RELEASE VALVES:

A. Set valves in vault with adequate space for maintenance of the valve.

The vault shall have a solid floor to prevent all sanitary blowoff from being absorbed into the soils.

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- B. Valves shall be set plumb and supported to the vault. Maintain accessibility to the isolation valve on the air valve line.
- C. Install the valve after the completion of testing of the pressure (force) main.

3.19 INSPECTION OF SEWERS:

Inspect and obtain the COTR's approval. Thoroughly flush out before inspection. Lamp test between structures and show full bore indicating sewer is true to line and grade. Lip at joints on the inside of gravity sewer lines are not acceptable.

3.20 TESTING OF SANITARY SEWERS:

- A. Pressure (Force) Mains: Test at 690 kPa (100 psi) for two hours. Leakage shall be per the following:

$$L=J*D*\sqrt{P}/4500$$

Where:

L = Maximum Allowable Leakage in Gallons per Hour

J = Number of Joints in Test Area

D = Diameter of Pipe in Inches

P = Average Test Pressure (Psi)

- B. Testing of Concrete Wet Well: No leakage with the wet well completely filled with water for a duration of 4 hours.

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