

DIVISION 33 - UTILITIES

OSU OUTDOOR SPORTS COMPLEX RENOVATION

GBBN Architects
332 E. 8th St.
Cincinnati, OH 45202

Heapy Engineering
Mechanical Electrical Commissioning Technology
Dayton, Ohio Project No.2010-07123.CD

Section

INDEX

33 00 00 - COMMON WORK RESULTS FOR ELECTRICAL UTILITIES

- 33 05 01 - BASIC ELECTRICAL REQUIREMENTS
- 33 05 04 - BASIC ELECTRICAL MATERIALS AND METHODS
- 33 05 13 - MEDIUM VOLTAGE CABLE
- 33 05 26 - GROUNDING AND BONDING FOR ELECTRICAL UTILITIES SYSTEMS
- 33 05 53 - IDENTIFICATION FOR ELECTRICAL UTILITIES SYSTEMS
- 33 12 19 - PAD-MOUNT LIQUID FILLED MEDIUM VOLTAGE TRANSFORMER

MARCH, 2011

BLANK PAGE

(This page is left blank intentionally)

SECTION 33 05 01
MEDIUM VOLTAGE REQUIREMENTS

PART 1 – GENERAL

- 1.1 Refer to Section 26 05 01 Basic Electrical Requirements which are hereby made part of Division 33 Utilities, and shall be applicable to spec sections; 33 05 01, 33 05 04, 33 05 13, 33 05 26, 33 05 53, & 33 12 19.

PART 2 – PRODUCTS

NOT APPLICABLE

PART 3 – EXECUTION

NOT APPLICABLE

END OF SECTION

BLANK PAGE

(This page is left blank intentionally)

SECTION 33 05 04

BASIC ELECTRICAL UTILITIES MATERIALS AND METHODS

PART 1 – GENERAL

1.1 CONTINUITY OF SERVICE

- A. Procedures for making connections to existing utilities shall be planned at least two weeks in advance of the work and the work shall be executed in a manner to provide reasonably continuous service throughout the construction period. Connections shall be made only at times approved for the University. For interruption of service in major utility systems, the Contractor must submit to the Associate a step-by-step sequence of operations planned to accomplish the work. Outline must show tentative dates and times of day for shut-off and restoration of services.

The A/E will review the information given with the University Project Manager, who, upon approval of the planned operations, will make arrangements with appropriate University personnel for interruption of services.

Connection of the new feeders is by the Division 33 contractor with supervision by OSU UTHVS. When University assistance is anticipated for utility connections/disconnections consult with the OSU UTHVS Director, Department of Facility Operations and Development to obtain current construction outage charges. Only OSU UTHVS will perform switching. Charges for University assistance for building systems outages may be obtained by consulting with the Maintenance Division Director, Department of Facility Operations and Development.

Caution to Bidders: Bidders are cautioned that University will probably schedule interruption of services at times other than the contractors' normal working hours and that only designated University personnel are authorized to interrupt services.

PART 2 – PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

3.1 WORKMANSHIP

- A. Materials and equipment shall be installed and supported in a first-class and workmanlike manner by mechanics skilled in their particular trades. Workmanship shall be first-class in all respects, and the Associate Architect shall have the right to stop the work if highest quality workmanship is not maintained.

- B. Electrical work shall be performed by a licensed Electrical Contractor in accordance with requirements of the jurisdiction.

3.2 SAFETY

- A. Refer to Division 1 for additional information.
- B. Contractor shall comply with all requirements of Material Safety Data Sheets (MSDS's), lockout and tagout procedures, confined space entry requirements, hot work permits, construction site fire protection, for all contractor and subcontractor employees, hazardous materials abatement procedures, prohibition of mercury-containing material, etc.

3.3 PROTECTION

- A. Each Contractor shall be entirely responsible for all material and equipment furnished in connection with his work. Special care shall be taken to properly protect all parts thereof from theft, damage or deterioration during the entire construction period in such a manner as may be necessary, or as directed by the Associate Architect.
- B. The University's property and the property of other contractors shall be scrupulously respected at all times.

END OF SECTION

SECTION 33 05 13

MANHOLES AND STRUCTURES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Built-up and Precast concrete storm manhole, catch basin and inlet structures.
- B. Related Sections:
 - 1. SECTION 033000 – CONCRETE WORK
 - 2. SECTION 312333 – TRENCHING AND BACKFILLING:
 - a. Bedding and fill materials.
 - b. Protection of existing items.
 - c. Excavation, fill placement, compaction, backfilling and grading for installation of utility piping and conduit.
 - d. Measures to protect the Work of this Section.
 - 3. SECTION 333000 – SANITARY SEWERAGE UTILITIES: Installation of sanitary sewer access manholes.
 - 4. SECTION 334000 – STORM DRAINAGE UTILITIES: Installation of storm sewer access manholes, catch basins and inlets.

1.03 REFERENCES

A. ASTM International:

1. Standard Specification for Gray Iron Castings (ASTM A-48 / A-48M-00).
2. Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement (ASTM A-185-97).
3. Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement (ASTM A-615 / A-615M-01).
4. Standard Specification for Concrete Brick (ASTM C-55-01).
5. Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes (ASTM C-139-99).
6. Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets (ASTM C-443-98).
7. Standard Specification for Grout for Masonry (ASTM C-476-01).
8. Standard Specification for Precast Reinforced Concrete Manhole Sections (ASTM C-478-97).

B. City of Columbus 2002 edition of Construction and Material Specifications (CMSC).

1.04 QUALITY ASSURANCE

A. Regulatory Requirements (Tapping Mains):

1. Use materials as specified in this Section to tap to all existing mains.
2. Notify University at least 48 hours prior to tapping existing mains to request that an inspector witness all taps.
3. If required, submit portion of pipe removed by the boring machine to the inspector.

PART 2 – PRODUCTS

2.01 CONCRETE

- A. Provide concrete for work included in this Section as specified in SECTION 033000– CONCRETE WORK, but in no case provide concrete strength less than 4,000 PSI at 28 days.

2.02 REINFORCING

- A. Reinforcing Bars: Deformed type conforming to ASTM A-615 / A-615M, Grade 60; shop fabricated, of size, cross section and arrangement as indicated on the Drawings.
- B. Welded Wire Fabric: ASTM A-185, size as shown on the Drawings.

2.03 MASONRY

- A. Concrete Masonry Units: ASTM C-139.
- B. Concrete Brick: ASTM C-55, Grade A.
- C. Mortar: ASTM C-476, 1,800 PSI in 28 days consisting of one part Portland cement by volume, one quarter to one half part hydrated lime, and four parts of damp, loose sand plus water sufficient to provide a workable mixture.

2.04 PRECAST CONCRETE MANHOLES

- A. Precast Concrete Manholes: ASTM C-478, cones and sections free from fractures, large or deep cracks and surface roughness; slabs sound and free from gravel pockets. Include neoprene boots.
- B. Neoprene Boots: ASTM C-443 for sanitary sewers and ASTM C-478 for storm sewers.

2.05 CASTINGS

- A. Frame, Cover, Grating and Step Castings: ASTM A-48 / A-48M.

PART 3 – EXECUTION (See RELATED SECTIONS above)

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK.

SECTION 33 05 26**GROUNDING AND BONDING FOR ELECTRICAL UTILITIES SYSTEMS****PART 1 – GENERAL**

- 1.1 Work includes grounding and bonding of system neutral, equipment and conduit systems to conform to requirements of NESC and as detailed on the plans and in the specifications.

PART 2 - PRODUCTS

- 2.1 Grounding rods shall be copper clad, molten-welded copper to steel; unless otherwise designated, 0.625" diameter x 10 ft. long.
- 2.2 Clamps and continuity devices shall be non-ferrous material, UL approved. Connections to ground rods and all underground connections shall be "Thermoweld" or "Cadweld".
- 2.3 Ground conductors shall be insulated, identified by green insulation or by painting or taping green at all accessible locations and shall be connected with approved connectors and terminators to boxes, devices, equipment, etc. and to ground bars in panels.
- 2.4 Except where specifically allowed by OSU UTHVS, all electrical equipment grounding shall be via 4/0 copper conductors. Conductor and insulation when specified shall conform to the following requirements:
- A. 4/0 bare solid conductor shall be used in applications where the conductor is placed below grade or in a corrosive environment.
 - B. 4/0 bare medium stranded (7 strands) may be used in lieu of solid conductor in below grade applications and in mildly corrosive environments, and where conductor flexibility is a consideration.

PART 3 - EXECUTION

- 3.1 All connections in the primary grounding system shall be clamped, exothermic welded, Cadweld or equivalent. Individual grounding rods connected to the grounding system shall have a measured ground resistance of ten ohms (10 Ω) or less. This measurement may be made by any of the commonly accepted methods for measuring ground rod resistance to earth. Grounding for power equipment power circuit neutral grounding shall be no greater than one tenth ohm (0.1 Ω) measured from the neutral bus to the local ground bus or building structural steel. Primary circuit (13.2 kV system) grounding shall conform to the NESC for potential rise during ground fault. Ground resistance shall be no greater than three ohms (3 Ω) for cabinet and control circuit grounds. Only copper to copper ground connections may be clamped or bolted. With limited

exceptions, all other terminations shall be Cadweld. Provide additional length and/or additional rods until level is achieved. Tests shall be witnessed by OSU UTHVS representative.

- 3.2 Ground conductors shall be 600-volt insulated installed in rigid PVC or rigid galvanized conduit along with the circuit phase conductors. Main and Primary service transformers shall have a bonded secondary neutral that connects to an established ground grid, or grounding system. Cabinet grounds shall be 4/0 solid bare copper and run to an existing grounding system, an adjacent grounded cabinet or, in the absence of an established grounding system, to grounded building steel.

END OF SECTION

SECTION 33 05 53

IDENTIFICATION FOR ELECTRICAL UTILITIES SYSTEMS

PART 1 – GENERAL

1.1 Medium voltage cable identification:

- A) Identify each medium voltage cable passing through each electric vault with a stamped brass or stainless steel tag indicating phase and circuit number or load; secure to cable with permanent strap or band.

PART 2 – PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

- 3.1 Nameplates shall be secured to cable with permanent strap or band.

END OF SECTION

BLANK PAGE

(This page is left blank intentionally)

SECTION 33 11 01

WATER UTILITY DISTRIBUTION PIPING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes the following:
 - 1. Water main and water service installation from water main to 5 feet outside the building.
- B. Related Sections:
 - 1. SECTION 312333 – TRENCHING AND BACKFILLING:
 - a. Bedding and fill materials.
 - b. Protection for existing items.
 - c. Excavation, fill placement, compaction, backfilling and grading.
 - d. Measures to protect the Work of this Section.

1.03 REFERENCES

- A. American Water Works Association (AWWA) / American National Standards Institute (ANSI):
 - 1. Liquid Chlorine (AWWA B-301-99).
 - 2. Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water (AWWA C-104 / ANSI A-21.4-95).
 - 3. Ductile-Iron and Gray-Iron Fittings, 3 In. - 48 In. (76 mm - 1,219 mm), for Water (AWWA C-110 / A-21.10-98).

4. Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings (AWWA C-111 / ANSI A-21.11-00).
 5. Thickness Design of Ductile-Iron Pipe (AWWA C-150 / ANSI A-21.50-02).
 6. Ductile-Iron Pipe, Centrifugally Cast, for Water (AWWA C-151 / ANSI A-21.51-02).
 7. Metal-Seated Gate Valves for Water Supply Service (AWWA C-500-02).
 8. Dry-Barrel Fire Hydrants (AWWA C-502-94).
 9. Disinfecting Water Mains (AWWA C-651-05).
 10. Underground Service Line Valves and Fittings (AWWA C-800-01).
- B. City of Columbus 2002 edition of Construction and Material Specifications (CMSC).

1.04 SUBMITTALS

- A. Submit the following in accordance with the GENERAL REQUIREMENTS:
1. Product Data for pipes and fittings.
- B. Regulatory Requirements (Tapping Existing Mains):
1. When tapping existing mains, use the materials specified in this Section.
 2. Notify the University at least 48 hours prior to construction.
 3. Request an inspector to witness all taps.
 4. If required, submit the portion of pipe removed by the boring machine to the inspector.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Take care in loading, transporting and unloading to prevent damage to pipe, fittings and coatings.

- B. Do not drop pipe or fittings.
- C. Examine pipe and fittings before installing.
- D. Do not install defective pieces.
- E. Repair or replace pipe and fittings with damage to coatings as directed by the University.

PART 2 – PRODUCTS

2.01 PIPE MATERIALS

- A. Ductile Iron Pipe: Conform to AWWA C-151 / ANSI A-21.51. Supply thickness of pipe one class greater than that required under Table 50.12 of AWWA C-150 / ANSI A-21.50.
- B. Supply pipe in lengths not over 20 feet with rubber-ring type push-on, standard mechanical, bell, or flange joints.
- C. Provide pipe with a cement mortar lining and bituminous seal coat on the inside and a coal tar enamel coat on the outside per AWWA C-151 / ANSI A-21.51.
 - 1. Thickness of Cement Mortar Lining ("plus" tolerance of 1/8 inch):
 - a. Pipe between 2 and 12 inches in diameter: 1/8-inch thick.
 - b. Pipe between 14 and 24 inches in diameter: 3/16-inch thick.
 - c. Pipe between 30 and 48 inches in diameter: 1/4-inch thick.
- D. Copper Service Connection Pipe: Type "K" soft copper with flared fittings for underground pipe 2 inches and smaller.
 - 1. Compression fittings may be used on 1.5" to 2" copper pipe.
 - 2. Service Connection Pipes shall be installed with 4 feet 6 inches of cover.

2.02 PIPE FITTINGS

- A. Supply fittings of cast or ductile iron with a minimum pressure rating of 150 PSI and meeting the applicable requirements of ANSI and AWWA.
- B. Provide rubber gasket joints conforming to AWWA C-111 / ANSI A-21.11 for mechanical and push-on type joints.

- C. Provide bell joints conforming to AWWA C-151 / ANSI A-21.51 with a separately cast ductile iron bell and a cast steel retainer ring.
- D. Provide ductile or cast iron flanges, 250 PSI minimum pressure rating with same lining and coatings as pipe.

PART 3 – EXECUTION

3.01 HANDLING OF PIPE AND FITTINGS

- A. Carefully inspect pipe and fittings just prior to being laid or installed. Thoroughly clean pipe and fittings before installing. Keep clean until used and when installed or laid.
- B. Remove pipe discovered to be defective after it has been laid, and replace with sound pipe.

3.02 INSTALLATION

- A. Install ductile iron pipe and fittings per the requirements of AWWA Specifications for Installation of Ductile-Iron Water Mains and Appurtenances.
 - 1. Exception: Where otherwise specified.
- B. Construct a firm, even bearing throughout the length of the pipe by tamping selected material at the sides of the pipe up to the mid-section. Blocking will be grounds for rejection of the installation.
- C. Preserve alignment in laying. Do not exceed the Pipe Manufacturer's recommendations for deflection at joints. Provide fittings in addition to those shown on the Drawings if required for crossing utilities encountered upon opening the trench. Use solid sleeves only where approved by the University.
- D. When pipe cutting is required, machine cut without damage to the pipe or cement lining. Cut ends smooth and at right angles to the axis of the pipe. Bevel pipe ends to be used with a rubber joint and file or grind smooth to conform to the manufactured spigot end. Do not damage cement lining.
- E. Close the open ends of pipe by watertight plugs or other approved means when not laying pipe or when trench is unattended.

F. Jointing ductile iron pipe:

1. Push-on Bell Joints: Construct per the Pipe Manufacturer's printed instructions.
 - a. Lay pipe with bell ends forward.
 - b. Insert a rubber gasket in the groove of the bell end of the pipe.
 - c. Clean and lubricate joint surfaces.
 - d. Insert plain end of pipe in alignment with bell end of pipe to which it is to be joined and push "home" with jack or by other approved means.
 - e. After joining the pipe, use metal feeler to assure rubber gasket is correctly located.
2. Flanged Joints:
 - a. Construct with rubber ring gaskets with cloth insertion.
 - 1) For pipe 12 inches in diameter and under – Provide 1/16-inch thick gaskets.
 - 2) For pipe over 12 inches in diameter – Provide 3/32-inch thick gaskets.
 - b. Construct flanged joints with bolts or bolt studs, with a nut on each end, or studs with nuts where then flange is tapped.
 - c. For number and size of bolts, conform to the same American Standard as the flanges.
 - d. Provide bolts and nuts conforming to ASTM A-307, Grade B. Provide bolt studs of the same quality as machine bolts.
3. Mechanical Joints: Construct per "Notes on Method of Installation" under AWWA C-111 / ANSI A-21.11 and the Pipe Manufacturer's printed instructions.
 - a. Thoroughly clean joint surfaces and rubber gasket with soapy water before tightening bolts to specified torques.

- b. Do not use extension wrenches or pipe over handle or ordinary ratchet wrench to secure greater leverage.
4. Tighten bolts in flanged or mechanical joints alternately and evenly. Apply a heavy bituminous mastic coating to bolts and nuts after installation.
 5. Sleeve-Type Couplings:
 - a. Thoroughly clean pipe ends for a distance of 8 inches prior to installing sleeve-type couplings. Soapy water may be used as a gasket lubricant.
 - b. Slip a follower and gasket, in that order, over each pipe to a distance of about 6 inches from the end.
 - c. Place the middle ring on the already laid pipe end until it is properly centered over the joint.
 - d. Insert the other pipe end into the middle ring and bring to proper position in relation to the already laid pipe.
 - e. Press the gaskets and followers evenly and firmly into the middle ring flares. Insert bolts and finger tighten nuts.
 - f. Then progressively and uniformly tighten diametrically opposite nuts all around the joint with a torque wrench of the appropriate size and torque for the bolts.
 - 1) For 5/8-inch bolts, do not exceed torque of 75 foot-pounds.
 - 2) For 3/4-inch bolts, do not exceed torque of 90 foot-pounds.
 - g. Before backfilling, thoroughly coat exterior surfaces of buried sleeve-type couplings, including the middle and follower rings, bolts, and nuts with an approved heavy bodied bituminous mastic. Take care to ensure that the underside - as well as the more readily accessible parts - are well coated.
 - h. Do not make up the pipe sleeve-coupling bolts where flanged pipe joints are on either side of a sleeve-type coupling until after the flanged joints are made first.

6. Set and joint required valves, hydrants, fittings and other appurtenances as required or indicated on the Drawings.

3.03 FIELD QUALITY CONTROL

A. Tests (Pressure and Leakage of Underground Pressure Piping):

1. Furnish necessary equipment and labor for carrying out a pressure test and leakage test of the pipe lines. Obtain prior approval from the University for the procedures and methods of carrying out the pressure and leakage tests.
2. Make taps and furnish necessary caps, plugs, and the like, as required, in conjunction with testing a portion of the pipe between valves. Furnish a test pump, gauges and other equipment required in conjunction with carrying out the hydrostatic tests.
3. The test pressures for the various pipe lines are:
 - a. Water Mains: 100 PSI.
4. Allowable leakage at the test pressure shall be 30 gallons per day per mile of pipe for each inch nominal diameter. Hydrant branch gate valves are to remain open during this test. Continue the test for not less than one hour and not more than four hours, if satisfactory results are obtained. Supply labor, equipment, gauges, pumps, and the like, required to conduct the test. Perform the test per AWWA Standards.
 - a. If allowable leakage is exceeded, take corrective measures and retest.

3.04 DISINFECTING POTABLE WATER PIPE LINES

- A. Before placing in service, chlorinate potable water pipe lines per AWWA B-301, and as approved by the University. The location of the chlorination and sampling points will be determined by the University. Uncover and backfill for chlorination taps as required.
- B. Chlorination Procedure:
 1. Flush all dirty or discolored water from the lines. Introduce chlorine-approved doses through a tap at one end, while water is being withdrawn at the other end of the line. The chlorination solution is to remain in the line for 24 hours.

2. Following the chlorination period, flush treated water from the lines at their extremities and replace with water from the distribution system. Bacteriological sampling and analysis shall then be made by the Contractor per AWWA C-651.
 3. Re-chlorination may be required if necessary. Do not place the line in service until the requirements of the local or State Health Department are satisfied.
- C. Special disinfecting procedures may be required in connections to mains.

END OF SECTION

SECTION 33 30 00

SANITARY SEWERAGE UTILITIES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes sanitary sewer installation from building to existing sanitary sewer line.
- B. Related Requirements:
 - 1. SECTION 31 23 33 – TRENCHING AND BACKFILLING:
 - a. Bedding and fill materials.
 - b. Protection for existing items.
 - c. Excavation, fill placement, compaction, backfilling and grading.
 - d. Measures to protect the Work of this Section.
 - 2. SECTION 33 05 13 – MANHOLES AND STRUCTURES: Sanitary manholes, catch basins and inlets.
 - 3. SECTION 33 40 00 – STORM DRAINAGE UTILITIES: Installation of storm water sewer piping.

1.03 REFERENCES

- A. ASTM International:
 - 1. Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe (ASTM C-14-99).
 - 2. Standard Specification for Concrete Aggregates (ASTM C-33-02).

3. Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (ASTM C-76-00).
 4. Standard Specification for Portland Cement (ASTM C-150-02).
 5. Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets (ASTM C-443-98).
 6. Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings (ASTM D-3034-00).
 7. Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals (ASTM D-3212-96a).
 8. Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe (ASTM F-477-99).
 9. Standard Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings (ASTM F-679-01).
- B. City of Columbus 2002 edition of Construction and Material Specifications (CMSC).
- C. City of Columbus and Franklin County: Applicable specifications and standards.

1.04 SUBMITTALS

- A. Submit the following in accordance with the GENERAL REQUIREMENTS:
1. Product Data for pipes and fittings.

1.05 PROJECT CONDITIONS

- A. Environmental Requirements (Pipe Laying in Cold Weather):
1. Do not lay pipe on frozen ground or frozen bedding material.
 2. Heat pipe as recommended by the Pipe Manufacturer.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Polyvinyl Chloride (PVC) Pipe and Fittings:
 - 1. 4- through 15-inch diameter: ASTM D-3034, SDR 35.
 - 2. 18- through 27-inch diameter: ASTM F-679.
 - 3. Joints in Plastic Pipe: Elastomeric gasket seal per ASTM D-3212 and ASTM F-477.

PART 3 – EXECUTION

3.01 PIPE LAYING IN COLD WEATHER

- A. Do not lay pipe on frozen ground or frozen bedding material. Heat pipe as recommended by the Pipe Manufacturer.

3.02 PIPE PREPARATION AND HANDLING

- A. Inspect pipe and fittings prior to lowering into trench to ensure no cracked, broken, or otherwise defective materials are being used. Clean ends of pipe thoroughly. Remove foreign matter and dirt from inside of pipe and keep clean during and after laying.
- B. Use proper implements, tools, and facilities for the safe and proper protection of the Work. Lower pipe into the trench in such a manner as to avoid physical damage to the pipe. Remove damaged pipe from the Site. Do not drop or dump pipe into trenches under any circumstances.
- C. Excavate bell holes at each joint to permit proper assembly and inspection of entire joint.

3.03 LAYING AND JOINTING PIPE AND FITTINGS

- A. Start pipe laying proceeding upgrade with spigot ends pointing in direction of flow. After a section of pipe has been lowered into the prepared trench, clean the end of the pipe to be joined, the inside of the joint, and if applicable, the rubber ring, immediately before joining the pipe. Assemble the joint following manufacturer's recommendations for type of joint used. Provide special tools and appliances required for the jointing assembly.

- B. Lay pipes uniformly to line and grade so that finished sewer will present a uniform bore. Variations from line and grade in excess of the specified tolerances will be considered sufficient cause for rejection of the Work.
- C. When pipes are to be jointed with rubber gaskets, warm the gasket or joint material sufficiently to facilitate making a proper joint.
- D. Prevent excavated or other foreign material from getting into the pipe during the laying operation. Close and block the open end of the last laid section of pipe to prevent entry of foreign material or creep of the gasketed joints:
 - 1. When laying operations are not in progress.
 - 2. At the close of the day's work.
 - 3. Whenever the workers are absent.
- E. Plug or close off pipes that are stubbed off for manhole construction or for connection by others with temporary plugs.
- F. Take necessary precautions to prevent the "uplift" or floating of the line prior to the completion of the backfilling operation.
- G. Make connections of non-reinforced pipe to manholes or concrete structures, so that a standard pipe joint is located not more than one foot from the outside edge of the structure.
- H. When field cutting or machining the pipe is necessary, use only tools and methods recommended by the Pipe Manufacturer [and approved by the [Architect/Engineer] [Contracting Officer]].
- I. Check pipe for alignment and grade after joint has been made. Ensure pipe bedding forms a continuous and uniform bearing and support for the pipe barrel between joints. Apply sufficient pressure in making the joint to assure the joint is "home" as defined in Pipe Manufacturer's standard installation instructions. Place sufficient pipe cover material to secure pipe from movement before next joint is installed to assure proper pipe alignment and joint makeup.

3.04 LINE AND GRADE

- A. Do not deviate from line and grade, as established by the Drawings, more than 1/2 inch for line and 1/4 inch for grade, provided that such variation does not result in a level or reverse sloping invert. Measure for grade at the pipe invert, not at the top of the pipe, because of the permissible variation in pipe wall thickness. Furnish and set the line and grade boards at maximum intervals of 25 feet. If grade boards prove impractical because of trench or other conditions, other methods of controlling line and grade may be submitted to the Architect/Engineer] [Contracting Officer] for approval.

3.05 DEWATERING

- A. Employ such means as well pointing, ditching, pumping or bailing to prevent water from entering the trench during the laying operation and allow for proper construction of the backfill in the pipe zone. Do not lay pipe in water.

3.06 ABANDONED SEWERS, DRAINS AND DRAINAGE STRUCTURES

- A. Fill sewers and drainage structures that are to be abandoned in place with sand or cellular concrete and bulkhead with an 8-inch brick or concrete block wall. Maintain service in such sewers and drains until otherwise directed. Bulkhead and abandon existing sewers, manholes, catch basins and catch leads that are no longer in use.
- B. Remove manholes and catch basins to be abandoned to a depth of three feet below the proposed grade and backfill the remaining portion of the structure. Remove castings and deliver to the University. Reuse, if possible in new work.

3.07 FIELD QUALITY CONTROL

- A. Notify the University or local utility owner at least 24 hours prior to tapping existing main to enable inspector to witness all taps. If required, submit portion of pipe removed by boring machine to inspector.
- B. Perform cleaning and testing of sewers following the current and applicable standards of the Authority having Jurisdiction.

- C. Test sewers for leakage by infiltration or exfiltration. Backfill the trench up to at least the lower half of the pipe prior to testing for leakage. If required, place sufficient additional backfill to prevent pipe movement during testing. Leave joints uncovered to permit inspection. Correct visible leaks encountered regardless of leak test results.
- D. Measure the infiltration using a suitable weir or other acceptable device when the water table is two feet or more above of the top of the pipe line section to be tested.
- E. When infiltration cannot be properly tested, test exfiltration by filling the line to be tested with water so that a head of at least two feet is provided above the water table and the top of the pipe at the upper end of the pipe line. Allow to stand until the pipe has reached its maximum absorption, but not less than four hours. After absorption, re-establish the head. Measure the amount of water required to maintain this water level during a two hour test period.
- F. If leakage exceeds 100 gallons per day per mile of pipe for each inch nominal diameter as measured by either the infiltration or exfiltration test, take corrective measures and retest.

3.08 CLEANING

- A. Perform cleaning of sewers following the current and applicable standards of the authorities having jurisdiction.
- B. Prior to final acceptance and final manhole-to-manhole inspection of the sewer system by the authorities having jurisdiction, flush and clean all parts of the system. Remove accumulated construction debris, rocks, gravel, sand, silt, and other foreign material from the sewer system at or near the closest downstream manhole. If necessary, use mechanical rodding or bucketing equipment.
- C. Upon the authorities having jurisdiction's final manhole-to-manhole inspection of the sewer system, if foreign matter is still present in the system, re-flush and clean the sections and portions of the lines as required.

END OF SECTION

SECTION 33 40 00

STORM DRAINAGE UTILITIES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes underground storm sewer and trench drain installation.
- B. Related Sections:
 - 1. SECTION 330513 – MANHOLES AND STRUCTURES: Storm water manholes, catch basins and inlets.
 - 2. SECTION 312333 – TRENCHING AND BACKFILLING:
 - a. Bedding and fill materials.
 - b. Protection for existing items.
 - c. Excavation, fill placement, compaction, backfilling and grading.
 - d. Measures to protect the Work of this Section.

1.03 REFERENCES

- A. ASTM International:
 - 1. Standard Specification for Clay Drain Tile and Perforated Clay Drain Tile (ASTM C-4-00).
 - 2. Standard Practice for Installing Vitrified Clay Pipe Lines (ASTM C-12-00).
 - 3. Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe (ASTM C-14-99).
 - 4. Standard Specification for Concrete Aggregates (ASTM C-33-01).

5. Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (ASTM C-76-00).
 6. Standard Specification for Portland Cement (ASTM C-150-00).
 7. Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets (ASTM C-443-98).
 8. Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings (ASTM D-3034-00).
 9. Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals (ASTM D-3212-96a).
 10. Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe (ASTM F-477-99).
 11. Standard Specification for Type PS-46 and Type PS-115 Poly(Vinyl Chloride) (PVC) Plastic Gravity Flow Sewer Pipe and Fittings (ASTM F-789-95a).
 12. Standard Specification for Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter (ASTM F-794-99).
 13. Standard Specification for Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe (ASTM F-894-07).
- B. American Association of State Highway and Transportation Officials (AASHTO):
1. Standard Specification for Corrugated Polyethylene Pipe (AASHTO M-294).
- C. City of Columbus 2002 edition of Construction and Material Specifications (CMSC).

1.04 SUBMITTALS

- A. Submit the following in accordance with the GENERAL REQUIREMENTS:
1. Product Data for pipes and fittings.

1.05 PROJECT CONDITIONS

- A. Environmental Requirements (Pipe Laying in Cold Weather):
1. Do not lay pipe on frozen ground or frozen bedding material.
 2. Heat pipe as recommended by the Pipe Manufacturer.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Polyvinyl Chloride (PVC) Pipe and Fittings:
1. 4- through 15-inch diameter: Solid wall plastic pipe and fittings per ASTM F-789 or ASTM D-3034, SDR 35.
 2. 18- through 48-inch diameter: Profile wall plastic pipe and fittings with concentric ribs per ASTM F-794.
 3. Joints in Plastic Pipe: Elastomeric gasket seal per ASTM D-3212 and ASTM F-477.
- B. High Density Polyethylene (HDPE) Pipe and Fittings:
1. 8 inch through 36 inch diameter: AASHTO M294 Type S, Type III, Class C, Category 5, Grade P34:
 - a. Perforated, corrugated pipe under Synthetic and Natural Turf Playing Systems and swales.
 - b. Solid corrugated pipe with smooth interior under pavement and lawn areas.
 2. Over 36 inches in diameter: ASTM F894, PS46, RSC 160 Profile Wall Pipe.
- C. Precast Concrete Pipe:
1. 10 inches and under: Non-Reinforced Concrete Sewer Pipe per ASTM C-14, Class 3.
 2. 12 inches and over: Reinforced Concrete Sewer Pipe per ASTM C-76, Class IV.

3. Joints in Concrete Pipe: Modified grooved tongue with rubber gaskets per ASTM C-443.

D. Trench Drains and Trench Drain Basins:

1. Approved Product: ACO Flowdrain FG-100 (nominal 4" wide channel) Trench Drain System. Channel bottoms pre-sloped at standard 1.0% percent grade with all trench drain pieces to be made of orthophthalic polyester resin FRP. Trench drain grating frames to be enamel coated mild steel, using a "Z-profile" design. Trench drain grating to be light duty slotted gray colored plastic, ACO Model #495Q, complete with Quicklock fasteners.

2. Approved Trench Drain Manufacturer:

ACO Polymer Products, Incorporated
12080 Ravenna Road
PO Box 245
Chardon, OH 44024-0245
Contact: Fred Clements – fclements@aco-online.com
(704) 535-0792

E. Concrete Encasement of Trench Drain System:

1. Provide concrete for work included in this Section as specified in SECTION 033000– CONCRETE WORK, but in no case provide concrete strength less than 4,000 PSI at 28 days.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Pipe Preparation and Handling:

1. Inspect pipe and fittings prior to lowering into trench to ensure no cracked, broken, or otherwise defective materials are being used. Clean ends of pipe thoroughly. Remove foreign matter and dirt from inside of pipe and keep clean during and after laying.
2. Use proper implements, tools, and facilities for the safe and proper protection of the work. Lower pipe into the trench in such a manner as to avoid physical damage to the pipe. Remove damaged pipe from the Site. Do not drop or dump pipe into trenches under any circumstances.

3. Excavate bell holes at each joint to permit proper assembly and inspection of entire joint.

B. Laying and Jointing Pipe and Fittings:

1. Start pipe laying proceeding upgrade with spigot ends pointing in direction of flow. After a section of pipe has been lowered into the prepared trench; clean the end of the pipe to be joined, the inside of the joint, and if applicable, the rubber ring, immediately before joining the pipe. Assemble the joint following manufacturer's recommendations for type of joint used. Provide special tools and appliances required for the jointing assembly.
2. Lay pipes uniformly to line and grade so that finished sewer will present a uniform bore. Variations from line and grade in excess of the specified tolerances will be considered sufficient cause for rejection of the Work.
3. When pipes are to be jointed with rubber gaskets, warm the gasket or joint material sufficiently to facilitate making a proper joint.
4. Prevent excavated or other foreign material from getting into the pipe during the laying operation. Close and block the open end of the last laid section of pipe to prevent entry of foreign material or creep of the gasketed joints:
 - a. When laying operations are not in progress.
 - b. At the close of the day's work.
 - c. Whenever the workers are absent.
5. Plug or close off pipes which are stubbed off for manhole construction or for connection by others with temporary plugs.
6. Take necessary precautions to prevent the "uplift" or floating of the line prior to the completion of the backfilling operation.
7. Make connections of non-reinforced pipe to manholes or concrete structures, so that a standard pipe joint is located not more than one foot from the outside edge of the structure.
8. When field cutting or machining the pipe is necessary, use only tools and methods recommended by the Pipe Manufacturer and approved by the University.

9. Check pipe for alignment and grade after joint has been made. Ensure pipe bedding forms a continuous and uniform bearing and support for the pipe barrel between joints. Apply sufficient pressure in making the joint to assure the joint is "home" as defined in Pipe Manufacturer's standard installation instructions. Place sufficient pipe cover material to secure pipe from movement before next joint is installed to assure proper pipe alignment and joint makeup.
- C. Line and Grade: Do not deviate from line and grade, as established by the drawings, more than 1/2 inch for line and 1/4 inch for grade, provided that such variation does not result in a level or reverse sloping invert. Measure for grade at the pipe invert, not at the top of the pipe, because of the permissible variation in pipe wall thickness. Furnish and set the line and grade boards at maximum intervals of 25 feet. If grade boards prove impractical because of trench or other conditions, other methods of controlling line and grade may be submitted to the University for approval.
- D. Dewatering: Employ such means as well pointing, ditching, pumping or bailing to prevent water from entering the trench during the laying operation and allow for proper construction of the backfill in the pipe zone. Do not lay pipe in water.
- E. Abandoned Sewers, Drains and Drainage Structures:
1. Fill sewers, storm drains and drainage structures which are to be abandoned in place with sand or cellular concrete and bulkhead with an 8-inch brick or concrete block wall. Maintain service in such sewers and drains until otherwise directed. Bulkhead and abandon existing storm sewer, manholes, catch basins and catch leads that are no longer in use.
 2. Remove manholes and catch basins to be abandoned to a depth of three feet below the proposed grade and backfill the remaining portion of the structure. Remove castings and deliver to the University. Reuse, if possible in new work.

3.02 FIELD QUALITY CONTROL

- A. Notify the University or local utility owner at least 24 hours prior to tapping existing main to enable inspector to witness all taps. If required, submit portion of pipe removed by boring machine to inspector.
- B. Perform cleaning and testing of sewers following the current and applicable standards of the Authority having Jurisdiction.

- C. Measure the infiltration using a suitable weir or other acceptable device when the water table is two feet or more above of the top of the pipe line section to be tested.
- D. When infiltration cannot be properly tested, test exfiltration by filling the line to be tested with water so that a head of at least two feet is provided above the water table and the top of the pipe at the upper end of the pipe line. Allow to stand until the pipe has reached its maximum absorption, but not less than four hours. After absorption, re-establish the head. Measure the amount of water required to maintain this water level during a two hour test period.
- E. When leakage exceeds 250 gallons per inch of diameter per mile of pipeline per day as measured by either the infiltration or exfiltration test, take corrective measures and retest.

3.03 CLEANING

- A. Prior to final acceptance and final manhole to manhole inspection of the sewer system by the University, flush and clean all parts of the system. Remove accumulated construction debris, rocks, gravel, sand, silt, and other foreign material from the sewer system at or near the closest downstream manhole. If necessary, use mechanical rodding or bucketing equipment.
- B. Upon the University's final manhole to manhole inspection of the sewer system, if foreign matter is still present in the system, re-flush and clean the sections and portions of the lines as required.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK.