

## SECTION 33 00 00

### SITE PIPING

#### PART 1 - GENERAL

##### 1.01 RELATED DOCUMENTS

- A. The following shall apply to this Section:
  - 1. Drawings.
  - 2. General Conditions.
  - 3. Section 01 11 00 – Summary of Work.

##### 1.02 WORK INCLUDES

- A. The basic materials used in the various piping and fluid conveying systems 5'-0" outside the building to the serving utilities point of connection (POC). Unless stated otherwise the following is required:
  - 1. Water System
  - 2. Fire Hydrants and Valves (if used)
  - 3. Sanitary Sewer System
- B. Gas service, meter and regulator (if used) will be provided by the gas utility company.
- C. Unless noted on the drawings otherwise, work shall include:
  - 1. The procurement of and payment for all fees, permits and licenses required for the performance of the work.
  - 2. All fees and direct expenses involved in any inspections required for the project.
  - 3. All hoists, scaffolds, staging, runways, and equipment required for the performance of the work.
  - 4. All job measurements and shop layouts required for the proper installation of material and equipment included in the work.
  - 5. All lights, guards, and signs as required by safety regulations applicable to the work.
  - 6. The removal from the premises, as it accumulates, of all dirt and refuse resulting from the performance of the work.
- D. The work shall include revisions, modifications, and rework of existing work as required for installation of new work, and as required for connections of new work to existing systems, and of existing work to new systems.

##### 1.03 RELATED WORK

- A. Section 20 01 00 - "GENERAL PROVISIONS".
- D. Section 20 06 00 - "MECHANICAL IDENTIFICATION
- B. Section 20 03 00 - "MATERIALS AND METHODS".
- E. Section 21 13 13 - "WET-PIPE SPRINKLER SYSTEMS"
- C. Section 20 04 00 - "TESTING PIPING SYSTEMS"
- F. Section 22 00 00 - "PLUMBING"

##### 1.04 SUBMITTALS

- A. None required unless submitting for approved equals.

##### 1.05 QUALITY ASSURANCE

- A. Codes and Standards: Comply with current editions of following, as applicable:
  - 1. National Fuel Gas Code, NFPA 54.
  - 2. AWWA and ASTM standards.
  - 3. National Fire Protection Association NFPA 24.

## 1.06 PROTECTION OF EXISTING UTILITIES AND CONDITIONS

- A. The existing utilities and conditions as encountered or as shown on the drawings shall be protected from damage during all construction including the excavation and backfilling of trenches, and, if damaged, shall be repaired by the Contractor at his expense.

## 1.07 PRODUCT DELIVERY STORAGE AND HANDLING

- A. Follow manufacturer's directions in delivery, storage, protection and handling of all equipment and materials.
- B. Deliver and store equipment and materials to the site in original containers, suitably sheltered from the elements and mechanical injury, but readily accessible for inspection until installed.
- C. Plastic pipe and materials shall be stored under cover and protected from sunlight and heat.

## 1.08 INTERFERENCES

- A. The Contractor shall confer with other Contractors at the site to avoid interferences. In the event that interferences develop, the Engineer's decision will be final and no additional compensation will be allowed for the moving of misplaced piping, valves, etc.

## PART 2 - PRODUCTS

### 2.01 ACCEPTABLE MANUFACTURERS

- A. Valve and Valve Boxes
  - 1. Mueller.
- B. Hydrants and Valves
  - 1. Mueller.
  - 2. American Foundry.
  - 3. Clow.
  - 4. Waterous/Traverse City.

### 2.02 PIPING MATERIALS AND APPLICATIONS

- A. The following applications are for only from 5'-0" outside the building to the utility point of connection (POC).
- B. Underground domestic water service piping from the shut-off valve in the building to a point 5 feet outside the building.  
**(See drawings for which piping material (Copper or PVC) is required):**
  - 1.  $\frac{3}{4}$ " - 1  $\frac{1}{4}$ ", Schedule 40 PVC pipe with solvent-welded joints.
  - 2. 1  $\frac{1}{2}$ " - 3", SDR-21, PVC pipe (ASTM D2241) Class 200, Bell and Spigot with rubber gasketed joints and matching fittings. Provide concrete blocking at all tees and elbows.
  - 3.  $\frac{3}{4}$ " - 3", Type "K" hard drawn copper tubing (SIL-FOS 2, FOS-FLO 7 or other silver brazing material). All copper piping shall be installed with wrought copper fittings.
  - 4. 4" and larger, SDR-18 PVC pipe (AWWA C-900) Class 150 Bell and Spigot with rubber gasketed joints, and matching fittings. Provide concrete blocking at all tees and elbows.

- C. Underground fire protection water piping:
  - 1. 3" and smaller polyvinyl chloride (PVC) pipe, class 200 bell and spigot with rubber sealing ring, (SDR-21, with matching fittings). Provide concrete blocking at all tees and elbows.
  - 2. 4" and larger polyvinyl chloride (PVC) pipe, class 150 bell and spigot with rubber sealing ring conforming to AWWA C900. Fittings shall be ductile-iron conforming to AWWA C111/A21.11 with non-toxic rubber gaskets. Provide concrete blocking at all tees and elbows.
  - 3. Ductile iron pipe, 150 psi working pressure, conforming to ANSI/AWWA C-151/A21.51 with mechanical joint fittings conforming to AWWA C-111/A21.11 with gasket material that is non-toxic, durable and impervious. Provide concrete blocking at all tees and elbows.
- D. Sanitary Sewer Piping:
  - 1. Polyvinyl chloride (PVC) sewer pipe shall conform to ASTM D3034 (SDR-35). Fittings shall also conform to ASTM D3034 (SDR-35). Connections shall be molded tees and wyes. Joints shall be rubber gasketed.
  - 2. Cast iron or ductile iron pipe and fittings shall conform to USASI #A-21 class 50 with mechanical or push-on joints.

## 2.03 VALVES AND VALVE BOXES

- A. Valves shall be AWWA iron body, bronze mounted, double disc, parallel seat, non-rising stem gate valves with a working pressure of 200 psi. Valves shall be furnished with end connections as required.
- B. Valve boxes shall be cast iron, two-piece, slip or screw type.
- C. Valve and boxes shall be as approved by the water department.

## 2.04 FIRE HYDRANTS

- A. Fire hydrants shall be of the compression type with break flange and shall comply to AWWA Standard C-502. Hydrants shall be tested to 300 psi with a working pressure of 150 psi.
- B. Hydrants nozzle arrangement shall be one 4" pumper nozzle and two, 2-1/2" hose nozzles equipped with caps and chains. Nozzle threads shall comply with the fire department standard.
- C. Hydrant inlet shall be 6" with mechanical joint or flanged connection as required. Main valve shall be 5-1/4". Hydrants shall have conventional packing.
- D. Install shutoff valve ahead of each hydrant with cast iron valve box. Valves shall be UL listed, 175 psi working pressure, iron body. Bronze mounted, non-rising stem.
- E. Hydrants and valves are subject to approval by the local fire department.

## PART 3 - EXECUTION

### 3.01 EXCAVATION AND BACKFILLING

- A. General
  - 1. The underground pipe lines shall be constructed of the materials specified and as shown on the drawings or as directed by the Engineer. The pipe shall be laid true to lines and grades shown on the drawings using batten boards. All pipe which has its grade or joint disturbed or is found to be defective or damaged after laying shall be taken up and re-laid or replaced as directed by the Engineer without additional charge. Trenches shall be kept free from water until pipe jointing material has set and pipe shall not be laid when the trench conditions or the weather is unsuitable for such work. At all times when work is not in progress, all open ends of pipe and fitting shall be securely closed to the satisfaction of the Engineer so that no trench water, earth or foreign substances will enter the pipe or fittings.

- B. Excavation
1. Perform all excavation of every description and of whatever substances encountered, to the depths indicated on the drawings. Unless otherwise indicated on the drawings, the minimum cover over the top of the water lines shall be 3'-0". All excavation materials not required for fill or backfill shall be removed from the site, or utilized as directed by the Engineer. All excavation shall be made by open cut. The banks of trenches shall be kept as nearly vertical as practicable and where required, shall be properly sheeted and braced. Trenches shall be excavated true to line and shall not be less than 12" wider nor more than 16" wider than the outside diameter of the pipe to be laid therein. The maximum width of trench specified applies to the width at or below the level of the top of the pipe. The width of the trench above that level maybe made as wide as necessary for sheeting and bracing and the proper installation of the work. The bottom of trenches shall be accurately graded and shaped so that each section of pipe for at least one-third (1/3) of its exterior circumference and for its entire length shall rest firmly on undisturbed soil, except for portions of the pipe sections where it is necessary to excavate for bell holes and for the proper sealing of pipe joints. Provide a 4" sand or crushed rock base under all underground piping. Piping shall have 12" of sand or crushed rock cover properly compacted.
  2. Where rock, clay, hardpan, or similar formation is encountered, it shall be removed and replaced with suitably selected sand or crushed rock.
  3. See the applicable section of these specifications for contract payment provisions for removal of rock.
- C. Drainage and Removal of Water
1. The Contractor shall control the grades around all excavations so as to prevent water from running into the excavated areas or tunnels. Any water which accumulates in excavations or tunnels shall be removed promptly. Grading shall be brought to meet existing adjacent grade.
- D. Bracing and Shoring
1. This Contractor shall do all shoring and bracing necessary to retain earth banks and prevent caving in and displacement of adjacent soil, furnishing all necessary timbers, cribbing, planking or sheet piling for that purpose. Proper shoring for safety of working is the exclusive responsibility of the contractor.
- E. Protection of Existing Utilities
1. All existing utilities shall be protected from damage during the entire construction, including the excavation and backfilling of trenches and, if damaged, shall be repaired by the Contractor at his expense.
- F. Installation of Pipe
1. Pipe lines shall be laid to the grades and alignment indicated on the drawings or as directed by the Engineer. All pipe lines shall be laid at a constant grade as required by code.
  2. Install piping in accordance with the following standards:
    - a. Ductile - iron pipe - AWWA C600.
    - b. Polyvinyl chloride - per manufacturers instructions
  3. Provide anchorage for tees, bends, valves, hydrants, etc. Thrust blocks shall be concrete, 2500 psi.
- G. Backfilling
1. The trenches shall not be backfilled until all required tests are performed and until the systems, as installed, conform to the requirements of the Specifications. After the trench bottom or bedding has been prepared and the pipe installed, sand or gravel at a moisture content which will facilitate compaction, shall be carefully placed alongside the pipe in layers not exceeding 6" in depth. Care shall be taken to insure thorough compaction of the fill. Each layer shall be thoroughly compacted to 95% proctor density by tamping.
  2. The remainder of the backfill under pavements, curbs, gutters, sidewalks, and driveways shall consist of sand, gravel, or crushed rock as approved by the Engineer. Rock, broken concrete or pavement, large boulders, and frozen earth

- shall not be used as backfill material.
3. The Contractor shall be responsible for backfilling all ditches, trenches or excavation covered by this contract.
- H. Replacement of Pavements, Walks, Curbs, and Lawn Areas.
1. Pavements, walks, streets, curbs, and lawn areas which are cut or damaged during construction of the sewers, gas lines, water lines, etc. shall be replaced and restored to the original conditions by this Contractor.

### 3.02 LINES, GRADES, AND ELEVATIONS

- A. Sewer lines, grades and elevations shall be laid out with a surveyor's transit and level to offset stakes set to one side of the trench. After the trench is excavated, these lines and grades shall be transferred to a string stretched between batter boards set at 50 ft. intervals across the trench. During the pipe laying, the line shall be determined by hanging a plumb bob from the grade string. The invert of each length of pipe shall be set to the proper elevation by measuring down from the string with a grade rod.
- B. No blocking of any kind shall be used to adjust the pipe to grade except when used with embedment concrete. Bedding shall be required for all sewer construction, except ductile iron pipe, and shall be of a minimum thickness equal to 1/4 of the outside diameter of the sewer pipe but shall not be less than four inches (4").
- C. Each section shall be unobstructed, smooth, straight, true, and with uniform slope. Compliance with this requirement shall be demonstrated to Engineer by arranging for visual inspection by him and by shining a light from one end of the section to the other end.

### 3.03 SEWER INSTALLATION

- A. Take great care in working on existing sewers so as not to interrupt service to any existing building without permission.
- B. Where sewer pipes do not rest on natural ground but cross building excavation, the pipes in this area shall be supported on 8" concrete block or 6" poured concrete walls which are built up from undisturbed ground.
- C. Where branch sewers connect to main sewer, they shall drop at 22-1/2° or 45° and connect at 22-1/2° or 45°. 90° connections will not be permitted. Flow line of two sewers shall be continuous or shall drop in direction of flow.

### 3.04 FIELD QUALITY CONTROL

- A. Water Line Testing: Before joints are painted or covered, test underground water lines to hydrostatic pressure of at least 150 lbs. psi. Leakage shall not exceed 200 gal. per inch of pipe diameter per mile per 24 hours. Contractor shall be responsible for discovering leaks and making necessary repairs.
- B. Underground sewers shall be tested in one or more sections by closing outlets; extending connections to 4'-0" above grade; filling system to top of lowest extensions. Inward (from wet trench) or outward (to dry trench), infiltration shall not exceed 200 gallons per 24 hours per mile per inch diameter of pipe.
- C. Leaks shall be repaired and tests repeated until leakage or infiltration is within above limits.
- D. Substitution of air testing is not permitted.

### 3.05 CONTINUITY OF SERVICES (UTILITY OUTAGES)

- A. All existing services must be kept in continuous operation with no interruption of services (sewer, water, gas, etc.). Contractor shall install temporary services as required to maintain this continuous operation and shall remove all temporary services when work is completed. Where interruptions are absolutely mandatory, they shall be

kept to an absolute minimum and coordinated with Engineer.

3.06 EQUIPMENT INSTALLATION

- A. All fire hydrants, valves, valve boxes, etc. shall be installed as detailed and per manufacturer's instructions and recommendations.

END OF SECTION

## SECTION 33 40 00

### STORM DRAINAGE SYSTEMS

#### PART 1 – GENERAL

##### 1.01 SUMMARY

- A. Provide storm drainage systems where indicated.

##### 1.02 SUBMITTALS

- A. Comply with Section 01 33 00.
- B. Upon request, submit for approval shop drawings, product data, test reports for the following items where indicated:
  - 1. Manholes and Catch Basins
  - 2. Steps
  - 3. Frames and Covers

##### 1.03 QUALITY ASSURANCE

- A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
- B. Standards: Comply with the provisions of the following specifications and standards, except as otherwise noted or specified.
  - 1. ASTM A760-10 Standard Specification for Corrugated Steel Pipe, Metallic Coated for Sewers and Drains.
  - 2. ASTM C76-13a, Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
  - 3. ASTM C478-13 Standard Specification for Precast Reinforced Concrete Manhole Sections.
  - 4. ASTM C507-13a Standard Specification for Reinforced Concrete Elliptical Culver, Storm Drain, and Sewer Pipe.
  - 5. ASTM C858-10e1 Standard Specification for Underground Precast Concrete Utility Structures.
  - 6. ASTM D2751-05 Standard Specification for Acrylonitrile Butadiene Styrene (ABS) Sewer Pipe and Fittings.
  - 7. ASTM D3034-08, Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
  - 8. ASTM D3350-12e1 Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
  - 9. AASHTO M-294, 12 to 36 inch pipe, Specification for Corrugated Polyethylene Pipe.

#### PART 2 – PRODUCTS

##### 2.01 MATERIALS

- A. Pipe and Fittings:
  - 1. Corrugated Metal Pipe (CMP):
    - a. Meet requirements of ASTM A760-10.
    - b. 16 gauge, standard round, galvanized with 2 ounces zinc per square foot sheet metal.

- c. Corrugations:
  - 1). 6" to 10" pipe: 1-1/2" x 1/4" depth helical corrugations.
  - 2). 12" to 60" pipe: 2-2/3" x 1/2" depth helical corrugations.
- d. Banded joints.
- 2. Polyvinyl Chloride (PVC) Pipe & Fittings:
  - a. Meet requirements of ASTM D3034-08, SDR 35.
  - b. Fittings: Slip joint with elastomeric seals.
- 3. Acrylonitrile-Butadiene-Styrene (ABS) Pipe and Fittings:
  - a. Meet requirements of ASTM D2751-05.
  - b. Solvent-cemented or gasketed joints.
- 4. Reinforced Concrete Pipe (RCP) and Fittings:
  - a. Meet requirements of ASTM C76-13a, Class III.
  - b. Tongue and groove mastic joints.
- 5. Elliptical reinforced concrete pipe:
  - a. Meet requirements of ASTM C507-13a.
  - b. Tongue and groove mastic joint.
- 6. High density Polyethylene (HDPE) pipe & fittings:
  - a. Meet requirements of ASTM D3350-12e1, AASHTO M 294.
  - b. Silt tight joints ASTM D3350-12e1.
- 7. Gaskets: Compatible with pipe materials joined.
- B. Manholes and Catch Basins:
  - 1. Precast Concrete Manholes and Catch Basins: ASTM C478-13 or ASTM C858-10e1.
    - a. Materials shall be in conformance with Section 03 30 00.
    - b. Cones and sections shall be substantially free of gravel pockets.
    - c. Joints between precast sections shall be designed for rubber gaskets, or bituminous material.
    - d. Base sections shall be placed on a well graded 6" granular bedding course firmly tamped and level extending to the limits of the excavation assuring uniform contact and support of precast element.
    - e. After placement and before damp proofing, the lift holes shall be completely filled with a non-shrink grout to provide a smooth exterior surface.
  - 2. Cast-In-Place Concrete Manholes and Catch Basins: 4000 psi.
    - a. Materials shall be in conformance with Section 03 30 00.
    - b. Monolithic concrete structures shall conform to detailed shop drawings submitted to the Civil Engineer for approval prior to beginning work and shall conform to the dimensional requirements shown on the plans.
    - c. Unless otherwise specified, cast-in-place bases shall be at least 12" in thickness and shall extend at least 12" radially outside of the outside dimension of the manhole or catch basin section.
  - 3. Protective Coatings: All concrete manholes and catch basins, precast or cast-in-place, shall be coated as follows:
    - a. Internally: Two (2) coats Koppers Bituastic 300-M, Porter's No. 7080 Maxi-Build II, or approved, coal tar epoxy. Each coat shall provide not less than 10 mils dry thickness, to result in a total dry mil thickness of 20. Follow manufacturer's recommendations.
    - b. Externally: Two (2) coats Tnemec 47-461 Asphalt Base Foundation Coating, or approved equal. Application shall produce as 8 mil dry film first coat and a 5.5 mil dry film second coat. Follow manufacturer's recommendations.
    - c. Test may be requested by Engineer to demonstrate mil thickness and Holiday Detector Test compliance.
  - 4. Steps: Type and model as shown on plans.
    - a. Steel reinforcing rods with load and pullout ratings meeting OSHA Standards, and conforming to ASTM C478-13 or equivalent.
    - b. Polypropylene coating shall conform to ASTM D4101-11 under Type II, Grade 16906.



- c. Steel reinforcing rods shall be ½" deformed reinforcing rod, Grade 60, conforming to ASTM A615-12.
- 5. Frames and Covers: Type and model as shown on plans with machined horizontal bearing surfaces.
  - a. Gray iron conforming to requirements of ASTM A48-03 (2012).
  - b. Ductile iron conforming to requirements of ASTM A536-84 (2009), Grade 60-40-18, heavy-duty ductile iron with lettering.
  - c. Set unit in full mortar beds or bituminous mastic beds. Mortar shall be mixed in portion of one part cement to three parts sand, by volume, based on dry materials.
  - d. Castings shall be set accurately to the finished elevation so that no subsequent adjustment will be necessary.
- 6. Poured Inverts: Poured inverts shall be made to conform accurately to the flow grade and shall be brought together smoothly with well rounded junctions, satisfactory to the Civil Engineer, and in conformance with details shown on plans.
- C. Outfalls for Storm Sewerage System: Cast-in-place reinforced concrete pipe, head wall apron, tapered sides, and rip rap systems as indicated on plans.
- D. Trench Drains for Storm Sewerage System: Interlocking precast polymer concrete modular units with grates, channel caps, and related accessories.
- E. Identification: Metallic-core plastic underground warning tapes.

## PART 3 – EXECUTION

### 3.01 INSTALLATION

- A. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction. Coordinate with work of other sections.
- B. Earthwork shall comply with requirements of section 31 00 00.
- C. All pipe and appurtenances shall be constructed at the location and elevations indicated on the plans or as established by the Civil Engineer.
- D. Prior to the construction of any storm drainage systems, the Contractor shall place adequate line and grade stakes and shall also set stakes and furnish grades so that all structure tops can be set to finish grade as indicated.
- E. Pipe connections: Special care shall be taken to see that the openings through which pipes enter the manhole structure are completely watertight. Those materials designed on plans as RCP type piping shall be required to be installed with closure pieces, four feet in length, at every manhole or catch basin, for all pipe entering or exiting.
- F. Where connections are made to existing systems, rout out old drainage lines.
- G. All newly constructed systems shall be cleaned of any accumulation of silt, debris, or foreign matter of any kind, and shall be free from such accumulations at time of final inspection.
- H. Test for proper operation. Protect work from damage.

END OF SECTION

## SECTION 33 50 00

### GAS DISTRIBUTION SYSTEM

#### PART 1 - GENERAL

##### 1.01 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.
1. AMERICAN GAS ASSOCIATION (AGA)
    - a. AGA-01 - (1989) A.G.A. Plastic Pipe Manual for Gas Service
  2. AMERICAN PETROLEUM INSTITUTE (API)
    - a. API Spec 5L - (1992) Line Pipe
  3. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
    - a. ASTM D 2513 - (1991a) Thermoplastic Gas Pressure Pipe, Tubing, and Fittings
    - b. ASTM D 2683 - (1990) Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Poly-ethylene Pipe and Tubing
    - c. ASTM D 3261 - (1990) Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
    - d. ASTM D 3350 - (1984) Polyethylene Plastics Pipe and Fittings Materials
  4. AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)
    - a. ASME-17 - (1992; Addenda Dec 1992) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications
    - b. ASME B16.21 - (1992) Nonmetallic Flat Gaskets for Pipe Flanges
    - c. ASME B16.40 - (1985) Manually Operated Thermoplastic Gas Shutoffs and Valves in Gas Distribution Systems
    - d. ASME B31.1 - (1992) Power Piping
    - e. ASME B31.8 - (1989; B31.8a, B31.8b, B31.8c, Errata Jul 6, 1990 & Feb 28, 1991) Gas Transmission and Distribution Piping Systems
  5. FEDERAL SPECIFICATIONS (FS)
    - a. FS L-C-530 - (Rev C) Coating, Pipe, Thermoplastic Resin
  6. MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)
    - a. MSS SP-25 - (1978; R 1988) Standard Marking System for Valves, Fittings, Flanges and Unions
    - b. MSS SP-84 - (1990) Valves - Socket Welding and Threaded Ends
  7. MILITARY SPECIFICATIONS (MS)
    - a. MS MIL-T-27730 - (Rev A) Tape, Antiseize, Polytetrafluoroethylene, with Dispenser
  8. NATIONAL ASSOCIATION OF CORROSION ENGINEERS (NACE)
    - a. NACE RP0274 - (1974) High Voltage Electrical Inspection of Pipeline Coatings Prior to Installation
  9. STEEL STRUCTURES PAINTING COUNCIL (SSPC)
    - a. SSPC SP 6 - (1991) Commercial Blast Cleaning
  10. UNDERWRITERS LABORATORIES (UL)
    - a. UL-06 - (1992) Gas and Oil Equipment Directory

##### 1.02 GENERAL REQUIREMENTS

- A. Piping: Piping shall be joined by performance qualified joiners using qualified procedures in accordance with AGA-01. Manufacturer's prequalified joining procedures shall be used. All joints shall be inspected by a qualified inspector in the joining procedures being used in accordance with AGA-01. Joiners and inspectors shall be qualified at the job site by a person who has been trained and certified by the

manufacturer of the pipe to train and qualify joiners and inspectors in each joining procedure to be used on the job. Training will include use of equipment, explanation of the procedure, and successfully making joints which pass tests specified in AGA-01. The Contractor shall submit a copy of the training procedure and qualification of the trainer for approval of the Engineer. The Engineer shall be notified at least 24 hours in advance of the date to qualify joiners and inspectors. The Contractor shall provide the Engineer a copy report of each inspector's and joiner's training and test results.

- B. Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Asbestos or products containing asbestos shall not be used. Equipment shall be supported by a service organization that is, in the opinion of the Engineer, reasonably convenient to the site. Valves, flanges, and fittings shall be marked in accordance with MSS SP-25.
- C. The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Engineer of any discrepancy before performing the work.
- D. When shipping, delivering, and installing, pipe and components shall be handled carefully to ensure a sound, undamaged condition. Particular care shall be taken not to damage pipe coating. No pipe or material of any kind shall be placed inside another pipe or fitting after the coating has been applied, except as specified in paragraph INSTALLATION. Plastic pipe shall be handled in conformance with AGA-01.
- E. Hot tapping of existing mains shall be performed by a contracting firm or utility company experienced and qualified to do such work and with at least 5 years experience in the successful performance of such work. The Contractor(s) or utility company performing hot taps and squeeze-off of existing utility lines shall accomplish the taps, plugging, and squeeze-off operations using equipment specifically designed for such purposes and approved by the Engineer prior to the performance of any such work.

### 1.03 SUBMITTALS

- A. Follow the procedures specified in Division 01, Section 01 33 00

## PART 2 – PRODUCTS

### 2.01 PIPE, FITTINGS, AND ASSOCIATED MATERIALS

- A. Polyethylene Pipe, Tubing, Fittings and Joints
  1. Polyethylene pipe, tubing, fittings and joints shall conform to ASTM D 3350 and ASTM D 2513, pipe designations PE 2406 and PE 3408, rated SDR 26 or less, as specified in ASME B31.8. Pipe sections shall be marked as required by ASTM D 2513. Butt fittings shall conform to ASTM D 3261 and socket fittings shall conform to ASTM D 2683. Fittings shall match the service rating of the pipe.
- B. Identification: Provide pipe flow markings and metal tags for each valve, meter, and regulator shall be provided as required by the Engineer.
- C. Insulating Joint Materials: Insulating joint materials shall be provided between flanged or threaded metallic pipe systems where shown to control galvanic or electrolytic action. Joints for threaded pipe shall be steel body nut type dielectric type unions with insulating gaskets. Joints for flanged pipe shall consist of full face sandwich-type flange insulating gasket of the dielectric type, insulating sleeves for flange bolts and insulating washers for flange nuts.
- D. Gas transition fittings shall be manufactured steel fittings approved for jointing steel and polyethylene pipe. Approved transition fittings are those that conform to AGA-01 requirements for transition fittings.

- E. Valves shall be suitable for shutoff or isolation service and shall conform to the following:
  - 1. Steel Valves (For above Grade Only on Meter Riser): Steel valves 1-1/2 inches and smaller installed aboveground shall conform to MSS SP-84, carbon steel, socket weld or threaded ends with handwheel or wrench operator.
  - 2. Polyethylene valves for underground installation only, shall conform to ASME B16.40. Polyethylene valves in sizes 1/2-inch to 6 inches shall be used with polyethylene distribution and service lines.
- F. Protective Covering Materials: Continuously extruded polyethylene and adhesive materials shall conform to FS L-C-530, Part (3).

### PART 3 - EXECUTION

#### 3.01 EXCAVATION AND BACKFILLING

- A. Earthwork shall be as specified in Section 31 00 00

#### 3.02 PIPE FOR GAS MAINS

- A. All pipe for gas mains shall be orange or yellow colored polyethylene. Steel fittings at hot taps shall be coated with protective covering as specified. Plastic mains shall not be installed aboveground.

#### 3.03 SERVICE LINES

- A. Service lines shall be constructed of materials specified for gas mains and shall extend from a gas main to and including the point of delivery within 5 feet of the building. The point of delivery is the meter set assembly. The service lines shall be connected to the gas mains as indicated. Service line shall be provided with an isolation valve of the same size as the service line. The service lines shall be as short and as straight as practicable between the point of delivery and the gas main and shall not be bent or curved laterally unless necessary to avoid obstructions or otherwise permitted. Service lines shall be laid with as few joints as practicable using standard lengths of pipe. Shorter lengths shall be used only for closures. Plastic service lines shall not be installed aboveground.

#### 3.04 PIPE, TUBING, AND FITTINGS

- A. Pipe, tubing and fittings shall be clear and free of cutting burrs and defects in structure or threading and shall be thoroughly brushed and chip-and scale-blown. Defects in pipe or tubing or fittings shall not be repaired. When defective pipe, tubing, or fittings are located in a system, the defective material shall be replaced.

#### 3.05 PROTECTIVE COVERING FOR UNDERGROUND STEEL FITTINGS

- A. Except as otherwise specified, protective coverings shall be applied mechanically in a factory or field plant especially equipped for the purpose. Fittings that cannot be coated and wrapped mechanically shall have the protective covering applied by hand, preferably at the plant that applies the covering to the pipe. Joints shall be coated and wrapped by hand. Hand coating and wrapping shall be done in a manner and with materials that will produce a covering equal in thickness to that of the covering applied mechanically. The coatings shall consist of one of the following:
  - 1. Thermoplastic Resin Coating System: The coating system shall conform to FS L-C-530, Part (3). The exterior of the pipe shall be cleaned to a commercial grade blast cleaning finish in accordance with SSPC SP 6. Adhesive compound shall be applied to the pipe. Immediately after the adhesive is applied, a seamless tube of

polyethylene shall be extruded over the adhesive to produce a bonded seamless coating. The nominal thickness of the pipe coating system shall be 10 mils (plus or minus 10 percent) of adhesive and 40 mils (plus or minus 10 percent) of polyethylene for pipes 2 through 16 inches in diameter. Joint coating field repair material shall be applied as recommended by the manufacturer and shall be one of the following:

- a. Heat shrinkable polyethylene sleeves.
  - b. Polyvinyl chloride pressure-sensitive adhesive tape.
  - c. High density polyethylene/bituminous rubber compound tape.
2. The coating system shall be inspected for holes, voids, cracks, and other damage during installation.

### 3.06 INSTALLATION

- A. Installation of the gas distribution system, including all equipment, shall be in conformance with the manufacturer's recommendations and applicable sections of ASME B31.8 and with AGA-01. Abandoning existing gas piping shall be done in accordance with ASME B31.8. Pipe cutting shall be done without damage to the pipe. Unless otherwise authorized, cutting shall be done by an approved type of mechanical cutter. Wheel cutters shall be used where practicable. Cutting of plastic pipe shall be in accordance with AGA-01. Valve installation in plastic pipe shall be designed to protect the plastic pipe against excessive torsional or shearing loads when the valve is operated and from any other stresses which may be exerted through the valve or valve box.
- B. Installing Pipe Underground: Gas mains and service lines shall be graded as indicated. Mains shall have 24-inch minimum cover, service lines shall have 18-inch minimum cover, and both mains and service lines shall be placed on firmly compacted select material for the full length. Trench shall be excavated below pipe grade, bedded with bank sand, and compacted to provide full-length bearing. Laying the pipe on blocks to produce uniform grade will not be permitted. The pipe shall be clean inside before it is lowered into the trench and shall be kept free of water, soil, and all other foreign matter that might damage or obstruct the operation of the valves, regulators, meters, or other equipment. When work is not in progress, open ends of pipe or fittings shall be securely closed by expandable plugs or other suitable means. Minor changes in line or gradient of pipe that can be accomplished through the natural flexibility of the pipe material without producing permanent deformation and without overstressing joints may be made when approved. Changes in line or gradient that exceed the limitations specified shall be made with fittings specified. When polyethylene piping is installed underground, foil backed magnetic tape shall be placed above the pipe to permit locating with a magnetic detector. After laying of pipe and testing, trench shall be backfilled to 12 inches over pipe with compacted bank sand. Remaining backfill is to be select soil compacted in 8-inch layers to finish grade.
- C. Where "squeeze-off" of existing polyethylene piping is permitted for temporary shut off during connection of mains or branches, a "squeeze-off" tool specifically designed for the pipe size and material encountered shall be used. After squeeze-off operation is complete, a rerounding support clamp shall be applied to reduce pipe stress. Rerounding support clamp shall be constructed of 2306 polyethylene material.

### 3.07 PIPE JOINTS

- A. Pipe joints shall be designed and installed to effectively sustain the longitudinal pullout forces caused by the contraction of piping or superimposed loads.
- B. Polyethylene Pipe Jointing Procedures: Jointing procedures shall conform to AGA-01. Indiscriminate heat fusion joining of plastic pipe or fittings made from different polyethylene resins by classification or by manufacturer shall be avoided if other alternative joining procedures are available. If heat fusion joining of dissimilar

polyethylenes is required, special procedures are required. The method of heat fusion joining dissimilar polyethylenes resins shall be tested in accordance with paragraph TESTING, subparagraph Destructive Tests of Plastic Pipe Joints.

1. Personnel which perform joining procedures for polyethylene pipe shall meet the following qualifications prior to commencing work:
    - a. Performed joining of piping on at least one project using piping of the same type and size as to be installed under this contract.
    - b. Attend a qualification training course, after contract award, conducted by the manufacture of the pipe installed under this contract. The training shall be a minimum of 8 hours and cover as a minimum the items set forth in the AGA plastic pipe manual. Equipment used for training shall be of the same manufacture as that to be utilized on this project.
  2. The Contractor Quality Control representative shall attend the same training as that required for the personnel performing the joining procedure.
  3. Testing: Instruments which must be available at the project site:
    - a. Thermometer
    - b. Anemometer
    - c. Pyrometer (or temperature crayons)
  4. Verification of Joining Procedure: Each morning, prior to commencing work, a joint of each size and type to be installed during that day shall be made.
    - a. Three coupons from each joint shall be taken at 120 degrees apart.
    - b. Each coupon shall be checked for alignment and subjected to a bend test.
    - c. Coupons shall be identified and retained.
    - d. Should the ambient temperature change by more than 20 degrees F or wind velocity increases by more than 10 MPH when ambient temperature is below 50 degrees F, the joining procedures to be used for the remainder of the day will be retested.
  5. Recording Test Data: The following items where applicable, shall be recorded each day of installing pipe. (Complete the attached sheet titled "TEST DATA RECORD FOR P-E PIPE.")
    - a. Manufacture of Equipment
    - b. Operating pressures
    - c. Heating iron temperatures
    - d. Ambient conditions
    - e. Coupon Data
    - f. Installer and CQC signature block
- C. Connections Between Metallic and Plastic Piping: Connections shall be made only outside, underground, and with approved transition fittings.

### 3.08 VALVE BOXES

- A. Valve boxes of cast iron not less than 3/16-inch thick shall be installed at each ve. Valve boxes shall be provided with locking covers that require a special wrench for removal. Wrench shall be furnished for each box. The word "gas" shall be cast in the box cover. When the valve is located in a roadway, the valve box shall be protected against movement by a suitable concrete slab at least 3 square feet. When in a sidewalk, the top of the box shall be in a concrete slab 2 feet square and set flush with the sidewalk. Boxes shall be adjustable extension type with screw or slide-type adjustments. Valve boxes shall be separately supported, not resting on the pipe, so that no traffic loads can be transmitted to the pipe.

### 3.09 CONNECTIONS TO EXISTING LINES

- A. Connections between new work and existing gas lines, where required, shall be made in accordance with ASME B31.8 using proper fittings to suit the actual conditions. When connections are made by tapping into a gas main, the connecting fittings shall

be the same size as the pipe being connected. The Contractor shall provide all materials for the connections to the existing gas lines, and shall make final connections in accordance with approved procedures. The Contractor's Connection and Abandonment Plan shall be submitted and approved prior to making any connections to existing gas lines. The Contractor shall notify, in writing, the Engineer 10 days before connections to existing lines are to be made. All above-grade valves, risers, and vault and valve box covers shall be removed. Vault and valve box voids shall be filled with suitable compacted backfill material. Deactivation of any portion of the existing system shall only be done as directed by the Engineer. Reactivation of any existing gas lines will only be done by the Government.

### 3.10 PRESSURE AND LEAK TESTS

- A. The system of gas mains and service lines shall be tested after construction and before being placed in service using air as the test medium. The test pressure shall be 150 percent of the maximum operating pressure or 50 psig, whichever is greater. However, the maximum test pressure shall not be more than three times the design pressure of the pipe. Prior to testing the system, the interior shall be blown out, cleaned and cleared of all foreign materials. All meters, regulators, and controls shall be removed before blowing out and cleaning and reinstalled after clearing of all foreign materials. All testing of gas mains and service lines shall be done with due regard for the safety of employees and the public during the test. Suitable steps shall be taken to keep persons not working on the test operations out of the testing area while testing is proceeding. The test shall be made on the system as a whole or on sections that can be isolated. Joints in sections shall be tested prior to backfilling, when trenches containing the sections must be backfilled before the completion of other pipeline sections. The test shall continue for at least 24 hours from the time of the initial readings to the final readings of pressure and temperature. The initial test readings of the instrument shall not be made for at least 1 hour after the pipe has been subjected to the full test pressure, and neither the initial nor final readings shall be made at times of rapid changes in atmospheric conditions. The temperatures shall be representative of the actual trench conditions. There shall be no indication of reduction of pressure during the test after corrections have been made for changes in atmospheric conditions in conformity with the relationship  $T(1)P(2)=T(2)P(1)$ , in which T and P denote absolute temperature and pressure, respectively, and the numbers denote initial and final readings. During the test, the entire system shall be completely isolated from all compressors and other sources of air pressure. Each joint shall be tested by means of soap and water or an equivalent nonflammable solution prior to backfilling or concealing any work. The testing instruments shall be approved by the Engineer. All labor, materials and equipment for conducting the tests shall be furnished by the Contractor and shall be subject to inspection at all times during the tests. The Contractor shall maintain safety precautions for air pressure testing at all times during the tests.

### 3.11 TEST DATA RECORD FOR P-E PIPE

Project Name: \_\_\_\_\_

Address: \_\_\_\_\_

City, State, Zip: \_\_\_\_\_

1. DATE                      TIME
2. FUSION EQUIPMENT

Manufacturer                      Model  
Design Pressure                  Design Iron Temp  
Actual Pressure (a)              Actual Iron Temp (b)

(a) Pressure gauge calibrated date:

(b) Method of determining iron temperature:

3.        WEATHER CONDITIONS

Ambient Temperature

Wind Velocity

Weather Condition (ie - clear, dry, etc)

4.        TEST COUPON DATA (mark and return coupons)

Bend Test    Alignment    Bead Size

      |        |

      |        |

      |        |

5.        TEST AUTHENTICATION (signature)

Equipment Operator

CQC Representative

QA Representative

END OF SECTION