Pressure Class 250 (14-16"). a. Fittings: Either mechanical joint or push on joint, AWWA C153, and shall be coated with a 6-8 mil nominal thickness fusion bonded epoxy conforming to the requirements of AWWA C550 and C116, or cement mortar lined in accordance with AWWA C104.

b. Elastomeric gaskets and lubricant: ASTM F477.

2. Polyvinyl Chloride (PVC) Water Pipe: Pipe, AWWA C900, rated DR 18 (Class 150), continually marked as required. a. Elastomeric gaskets and lubricant: ASTM F477 for smaller

b. Pipe joints: Integrally molded bell ends, ASTM D3139.

2.2 VALVES

A. Ball Valves, 2-Inches and Smaller:

. Manufacturer and Model: Mueller Oriseal or approved equal. 2. Brass body, teflon coated brass ball, rubber seats and stem seals, Tee stem pre drilled for control rod, AWWA compression inlet end, compression outlet with electrical ground connector, with control rod, extension box and valve key.

2.3 FIRE HYDRANTS

A. Fire Hydrants: Type as required by utility company/Local Fire Department and as shown on Construction Drawings.

B. Hydrant Extensions: Fabricate in multiples of 6-inches with rod and oupling to increase barrel length.

C. Hose and Steamer Connections: Match sizes with utility company, with two hose nozzles, one pumper nozzle.

D. Finish: Apply primer and 2 coats of enamel or special coating to color as

2.4 ACCESSORIES

A. Thrust Blocking: Place 2500 psi concrete to provide sufficient bearing area to transmit unbalanced thrust from bends, tees, caps, or plugs to undisturbed soil without loading undisturbed soil in excess of 2.500 pounds per square foot when water main pressure is 100 psi.

MINIMUM THRUST BLOCKING BEARING AREAS (in square feet)

Pipe Diameter	Tee's	90 Bend	45 Bend	22.5 Bend	Cap or Plug
3"	1	1	1	1	1.5
4"	1	1	1	1	2
6"	1.5	2	1	1	3
8"	2.5	3.5	1.8	1	4
10"	4	5.5	2.8	1.5	6
12"	6	8	4	2	8.5
14"	8	11	5.5	3	12
16"	10	14.2	7	4	15
18"	21	21	12	6	24

B. Locked mechanical joint fittings shall be installed where vertical changes in direction are required and, if approved by Owner and governing authority, can be installed in lieu of above thrust blocking requirements.

Polyethylene Encasement: Single layer of two ply cross-laminated high density polyethylene encasement per AWWA C105, Section 4.1.2, Type III, Class C (Black), Grade 33, tensile strength 5,000 psi minimum. elongation 100 percent, thickness nominal 0.004 inch (4 mil).

D. Trace Wire: Magnetic detectable conductor, (#12 Copper) brightly colored plastic covering imprinted with "Water Service" in large letters.

PART 3 - EXECUTION

3.1 EXAMINATION

. Verify that building service connection and municipal utility water main size, location, and depth are as indicated on Construction Drawings.

3.2 INSTALLATION - GENERAL

Perform installation in accordance with utility company or municipality requirements which shall take precedence over requirements stated herein when difference exists.

3.3 INSTALLATION - PIPE AND FITTINGS

A. Connections with Existing Pipelines: Where connections are made petween new work and existing piping, make connection using suitable fittings for conditions encountered. Make each connection with existing pipe at time and under conditions with least interference with operation of xisting pipeline and in compliance with local utility company

B. Form and place concrete for thrust blocks or other specified methods of retainage at each change of direction or end of pipe main.

Install trace wire continuous over top of non-metal pipe. Bury a minimum

of 6 inches below finish grade, and above pipeline. 3.4 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Perform disinfection of potable lines in accordance with AWWA C651.

B. Disinfect distribution system with chlorine before acceptance for domestic operation. Chlorine dosage shall be not less than 50 parts per million. Flush lines before introduction of chlorinating materials and after contact period of not less than 24 hours. Flush with clean water after contact eriod until residual chlorine content is not greater than 1.0 part per million. Flush water discharged from water supply lines or hydrants shall not be allowed to discharge directly onto exposed soil or turf which could result in erosion of soil. If potential for erosion exists at discharge point, measures shall be taken to prevent erosion. Open and close valves in lines being disinfected several times during contact period. After disinfection, take water sample and bacteriological test in accordance with AWWA C651 Do not place distribution system in service until approval is obtained from ocal governing authorities.

Provide a means of neutralizing the super-chlorinated water before releasing into the environment. This may be accomplished by either a method of dechlorinization, direct release into a detention area approved by Owner, or any method acceptable to federal, state, and local codes. Direct release to open ground shall not be allowed, unless contained within an onsite detention facility with 6" permanent storage. In this case, the Contractor shall time the release to assure that no rainstorms are imminent. The intent of this condition is to allow the majority of the chlorine to evaporate into the atmosphere before a rainstorm has the opportunity to wash the residual downstream. Contractor shall not release super-chlorinated water directly into the sanitary sewer system, private or public, nor any storm drain system not directly discharging into the detention facility.

3.5 SERVICE CONNECTIONS

Provide water service connection in compliance with utility company requirements including reduced pressure backflow preventer (if required) and water meter with by-pass valves and sand strainer.

3.6 FIELD QUALITY CONTROL

A. Test water distribution system pipe installed below grade and outside building in accordance with the following procedures:

 Perform testing of pipe materials, joints, and other materials incorporated into construction of water mains and force mains to determine leakage and water tightness. In the event state or local code requires more stringent test, more stringent test shall take

2. Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water. Test at not less than one-and-one-half times working pressure for two hours. Increase pressure in 50-psic increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig. Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage shall be 2 quarts per hour per 100 joints Remake leaking joints with new materials and repeat test until

B. Prepare reports of testing activities.

leakage is within allowed limits.

C. END SECTION

SECTION 02535 - SANITARY SEWAGE SYSTEMS PART 1 - GENERAL

A. Section Includes

1.1 SUMMARY

1. Sanitary sewer drainage piping, fittings, accessories, cleanouts,

sewer systems. B. Related Requirements:

2. Connection of site sanitary sewer system to municipal sanitary 1. Section 02300 - Earthwork: Trenching, backfill, and compaction

13

2. Section 02536 - Sewer Manholes, Frames, and Covers REFERENCES A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic

designation only B. ASTM International (ASTM):

1. ASTM A74 - Cast Iron Soil Pipe and Fittings 2. ASTM A746 - Ductile Iron Gravity Sewer Pipe 3. ASTM C425 - Compression Joints for Vitrified Clay Pipe and

4. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings 5. ASTM C700 - Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated 6. ASTM D2241 - Poly (vinyl Chloride) (PVC) Pressure-Rated Pipe

(SDR Series) 7. ASTM D2657 - Heat-Joining Polyolefin pipe and Fittings 8. ASTM D3034 - Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe

Elastomeric Seals 10. ASTM D3139 - Joints for Plastic Pressure Pipe Using Flexible Elastomeric Seals 11. ASTM D3261 - Butt Heat Fussion Polyethylene (PE) Plastic Fittings For Polyethylene Plastic Pipe And Tubing

9. ASTM D3035 - Polyethylene (PE) Plastic Pipe Using Flexible

12. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe 13. ASTM F1417 - Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure C. American Water Works Association (AWWA):

2. AWWA C600 - Ductile-Iron Water Mains And Their Appurtenances 3. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In, For Water Distribution 4. AWWA C901 - Polyethylene (PE) Pressure Pipe, Tubing And Fittings 1/2 Inch Through 3 Inches, For Water Distribution 5. AWWA C906 - Polyethylene (PE) Pressure Pipe And Fittings, 4

1. AWWA C111 - Rubber_Gasket Joints for Ductile Iron Pressure

Inch Through 63 Inch, For Water Distribution 1.3 SUBMITTALS A. Project Record Documents

Pipe and Fittings

1. Accurately record actual locations of pipe runs, connections, cleanouts, and invert elevations 2. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities. 1.4 PROJECT CONDITIONS

Coordinate work with termination of sanitary sewer connection outside building and connection to municipal sewer utility service. PART 2 - PRODUCTS 2.1 SEWER PIPE, FITTINGS, AND JOINTS Polyvinyl Chloride Pipe (PVC): ASTM D 3034, rated SDR 35 unless

otherwise specified by the utility company. Pipe shall be continually

marked with manufacturer's name, pipe size, cell classification, SDR

rating, and ASTM D 3034 classification Pipe joints: Integrally molded bell ends, ASTM D 3034, Table 2, with factory supplied elastomeric gaskets and lubricant.

PIPE ACCESSORIES Pipe Joints: Mechanical clamp ring type, stainless steel expanding and contracting sleeve, neoprene-ribbed gasket for positive seal. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps,

2.3 CLEANOUTS AND MANHOLES

A. Manholes shall conform to Section 02536. B. Lid and Frame: Provide in accordance with Section 02536. Provide traffic grade and rated covers and frames where cleanouts and manholes are within pavement, with the letters "SSCO" or "SANITARY SEWER" respectively cast into the cover. Shaft Construction: Cast iron shaft of internal diameter as specified

on Construction Drawings with 2500 psi concrete collar for cleanouts. APPURTENANCES A. Trace Wire: Magnetic detectable conductor (#12 copper), brightly colored plastic covering, imprinted with "Sanitary Sewer Service" in large letters. PART 3 - FXECUTION

3.1 EXAMINATION Verify that trench cut and excavation is ready to receive work and excavations dimensions and elevations are as indicated on Construction

3.2 PREPARATION A. Hand trim excavations to required elevations. Correct over excavation B. Remove large stones or other hard matter that could damage pipe or impede consistent backfilling or compaction.

3.3 BEDDING A. Excavate trench and place bedding material in accordance with Section 3.4 INSTALLATION PIPE

A. Install type and class of pipe as shown on the drawings. Pipes shall be laid and maintained to the required line and grade with necessary fittings bends, manhole risers, cleanouts and other appurtenances placed at the required locations. The pipe shall be installed with uniform bearing unde the full length of the barrel of the pipe. The pipe shall be inspected for defects and cracks before being lowered into the trench. Defective, damaged or unsound pipe, or pipe that has had its grade disturbed after

laying shall be taken up and replaced. Commence installation at lowest point with the bell end upgrade. B. No pipe shall be laid in water or when trench conditions are unsuitable for

C. Pipe connecting to manholes or other structures shall terminate flush inside of the structure wall.

D. Joints for PVC and CISP shall be thoroughly lubricated with an approved lubricant before pipe sections are slipped together. Open ends shall be fully protected with a stopper to prevent earth or other material from entering the pipe during construction. Carefully free interior of the pipe from dirt, cement and other deleterious material as the work progresses.

E. Maintain separation of potable water main from sewer piping at crossings a minimum of 10 feet horizontal and 18 inches vertical. F. Install HDPE piping and fittings to AWWA C901 and C906. Butt fusion welded per ASTM D3261.

G. Route pipe in straight line parallel to roads, buildings and adjacent utilities and as shown on the drawings. H. Establish elevations of buried piping with sufficient cover as recommended

by pipe manufacturer to ensure not less than 3 feet of cover, except as noted on drawings. I. Form and place concrete for thrust blocks at each elbow of pipe force main. See construction drawing for details of construction.

J. Backfill trench in accordance with Section 02300. K. Install trace wire continuous over top of non-metal pipe. Bury 6 inches

minimum below finish grade, above pipeline. L. Make connections to existing piping and underground manholes. 1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch (150-mm) overlap, with not less than 6 inches (150 mm) of

concrete with 28-day compressive strength of 3000 psi (20.7 2. Make branch connections from side into existing piping, NPS 4 to NPS 20 (DN 100 to DN 500). Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches (150 mm) of concrete with 28-day

compressive strength of 3000 psi (20.7 MPa). 3. Make branch connections from side into existing piping, NPS 21 (DN 525) or larger, or to underground manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches (76 mm) of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, manhole, or structure wall, encase entering connection in 6 inches (150 mm) of concrete for minimum length of 12 inches (300 mm) to provide additional support of collar from connection to undisturbed ground

 Use concrete that will attain a minimum 28-day compressive strength of 3000 psi (20.7 MPa) unless otherwise indicated. b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials. 4. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections

Remove debris or other extraneous material that may accumulate. INSTALLATION - CLEANOUTS AND MANHOLES A. Form bottom of excavation clean and smooth to correct elevation B. For cleanouts, form and place cast_in_place concrete base pad with provision for sanitary sewer pipe to be installed to proper elevations.

and lean concrete

C. For manholes, construct inverts according to the following guidelines: 1. Invert channel shall be smooth and accurately shaped to a semicircular bottom to match with the inside of the adjacent sewer 2. Invert channels and structure bottoms shall be shaped with mortar

3. Changes in size and grade of invert shall be made gradually and 4. Changes in the direction of the sewer entering branch or branches shall have a true curve of as large a radius as the manhole will D. For manholes, provide manhole rings, frame, and cover as shown on the construction drawings

3.6 FIELD QUALITY CONTROL A. Field quality control shall be conducted by the Contractor. B. Pipes and joints shall not be completely backfilled until after inspection, testing, and approval by the Owner and local jurisdiction.

Prior to testing for leakage, the pipe trench shall be backfilled to at least the spring line of the pipe. If required to prevent pipe movement during testing, additional backfill shall be added leaving the pipe joints incovered to permit inspection. D. Exfiltration Test

final rim elevation. Maximum limit, 4 courses. 1. Each section of sewer line between successive manholes shall

be tested by closing the lower end of the sewer to be tested and the inlet sewer of the upper manhole, using stoppers. 2. Fill the manhole and pipe with water to a point which produces a maximum of 3 feet of head above the invert of the sewer at the center of the upper manhole; or if groundwater is present, 3 feet of

head above the average adjacent groundwater level. 3. The allowable leakage shall be 200 gal/inch of pipe diameter/mile/day Infiltration Test

1. If excessive ground water is encountered in the construction of a section of the sewer, the exfiltration test shall not be used. 2. The upper and lower ends of the sewer to be tested shall be closed sufficiently to prevent the entrance of water. 3. Pumping of ground water shall be discontinued for at least 3 days; then infiltration shall be tested

4. Infiltration into each section of sewer between adjoining manholes shall not exceed that allowed for the exfiltration test, except that head conditions shall be a maximum of 6 feet. The Exfiltration Test may be limited to the manholes only when the authority having jurisdiction does not require the test and the construction manager waives the test. The Infiltration Test will always be required when excessive ground water is encountered in addition to the air test.

for 5 minutes per ASTM F1417 for plastic pipes. H. Deflection Test: 1. Deflection tests shall be conducted on all plastic pipe using a mandrel with a diameter equal to 95 percent of the inside diameter of the pipe. The test shall be performed without mechanical pulling devices

. Air Test: Gravity systems shall be air tested between manholes at 3.5 psi

exceed 5 percent of nominal inside diameter. 3. Mandrel: Mandrel, go/no-go, device shall be cylindrical in shape and constructed with either 9 or 16 evenly spaced arms or prongs. Mandrels with fewer arms will be rejected as not sufficiently accurate. Contact length of mandrel's arms shall equal or exceed nominal inside diameter of sewer to be inspected. Critical mandrel dimensions shall carry tolerance of 0.01-inch maximum. Contractor shall provide mandrel and necessary equipment for

2. Allowable Deflection: Maximum allowable pipe deflection shall not

4. Procedure: Mandrel shall be hand-pulled through flexible pipe sewer lines no earlier than 30 days after trench has been completely backfilled. Sections of sewer not passing mandrel shall be uncovered and rebedded, rerounded, or replaced to satisfaction of Owner or governing agency. Repaired section shall

Hydrostatic Test: Force main piping shall be hydrostatically tested at 150 psi in accordance with AWWA C 600 J. Provide measuring devices, meters, water, materials, and labor for making the required tests. Tests shall be conducted in the presence of the Construction

Manager or their designee. Test data shall be submitted to the Engineer for review and approval. END OF SECTION

SECTION 02536 - SEWER MANHOLES, FRAMES, AND COVERS

1.1 Section Includes: Monolithic concrete, modular precast concrete and precast polyethylene manhole assemblies.

PART 2 - PRODUCTS

2.1 MANHOLES

PART 1 - GENERAL

A. Cast-In-Place Concrete: Nonreinforced cast in place concrete barrel.

1. Concrete: 3500 psi concrete conforming to ASTM C94. 2. Forms: Steel sheet accurately shaped and fabricated of sufficient strength to form dense watertight walls to true dimensions.

B. Precast Concrete: Reinforced precast concrete barrel.

. Manhole Sections: ASTM C478.

2. Joints and Joint Sealant: Joint between manhole barrel sections shall conform to ASTM C990 using preformed flexible joint Pipe Connection Sealant: Joint material between manhole barre

and adjoining pipe shall be as shown on the drawings. 4. Construct manholes of precast concrete sections as required by Construction Drawings to size, shape, and depth indicated.

C. Concrete Brick: ASTM C55, Grade N Type I_moisture controlled, normal weight, of same grade, type and weight as block units, nominal modular size of 3 5/8-inches x 7 5/8-inches x 2 1/4-inches.

D. Precast Polyethylene:

1. Manufacturer: Advanced Drainage Systems (ADS) or approved

2. Precast polyethylene in accordance with ASTM D1248. Nominal

cylinder internal diameter shall be 48-inches and shall be designed to accept concrete filled polyethylene manhole lids and standard cast iron frames with lid or grate. 3. Manholes shall have compressive strength that meets ASTM D2412 standards

E. Mortar and Grout: Mortar for finishing and sealing shall be Class "C" Honeycombing less than 2-inches deep shall be repaired using Class "D"

F. Brick Transition Reinforcement: Formed steel 8-gauge wire with

galvanized finish

G. Configuration:

 Barrel Construction: Concentric with eccentric cone top section. Shape: Cylindrical. 3. Clear Inside Dimensions: 48-inches diameter minimum or as

indicated on Construction Drawings 4. Design Depth: As indicated on Construction Drawings. 5. Clear Lid Opening: 22-inches minimum. 6. Pipe Entry: Provide openings as indicated on Construction

7. Main and Lateral Pipes: Neatly cut off main and lateral pipes flush with inside of manhole or inlet where they enter structure walls. Point up irregularities and rough edges with nonshrinking grout.

H. Inverts: Shape inverts for smooth flow across structure floor as indicated on Construction Drawings. Use concrete and mortar to obtain proper grade and contour. Finish surface with fine textured wood float.

2.2 COMPONENTS

A. Lid and Frame: 1. Manufacturer: One of the following or approved equal:

> a. Bass & Hays Foundry. b. Deeter Foundry, Inc c. East Jordan Iron Works.

 d. Neenah Foundry. e. U.S. Foundry & Manufacturing 2. ASTM A48, Class 30B minimum, heavy duty cast iron

construction, machined flat bearing surface. 3. Removable lid, closed or open as indicated on Construction Drawings, with sealing gasket.

PART 3 - EXECUTION

3.1 PRECAST MANHOLE CONSTRUCTION

A. Place base pad to proper elevation and location and trowel top surface level for placement of manhole barrel. B. Place manhole barrel plumb and level to correct elevations and anchor to

1. After completion of slab foundation, lower first joint of manhole barrel into position, grooved end first, and set level and plumb on concrete base. Align and adjust to proper grade prior to placing and forming invert. Pour invert immediately after setting of first section of manhole barrel.

2. Prior to setting subsequent manhole barrel sections, apply primer to tongue and groove ends and allow to set in accordance with manufacturer's recommendations. Place joint sealant on tongue

end. Lower next section into position, and remove excess material from interior of structure. Add additional material on exterior of joint, if necessary, for completely watertight joint.

3. Set cover frames and lids level without tipping, to correct elevations. Utilize pre-cast rings or brick and mortar to achieve

3.2 CAST-IN-PLACE MANHOLE CONSTRUCTION

A. Cast-in-place concrete shall conform to the applicable requirements of concrete. Utilize steel forms.

B. Place base pad to proper elevation and location and pour monolithically with invert. Base shall support pipe to first joint. Deposit concrete in evenly distributed layers of about 18 inches, with each layer vibrated to bond to preceding layer

Place gasket between all joints and paint exterior of manhole within 5 inches of the joint with mastic waterproofing Place precast concrete cone Set section cover frames and lids level without tipping, to correct elevations. Utilize pre-cast rings or brick and mortar to achieve final rim elevation. Maximum limit, 4 courses.

END OF SECTION 02536

SECTION 02555 - NATURAL AND PROPANE GAS DISTRIBUTION

PART 1 - GENERAL

1.1 SUMMARY

 A. Section Includes 1. Pipe and fittings for site utility natural or propane gas distribution. 2. Propane storage tanks and appurtenances.

3. Connection of site natural gas system and private utility company

REFERENCES

The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic

designation only. 1.3 SUBMITTALS

A. Project Record Documents: 1. Accurately record actual locations of pipe mains, valves,

connections, and top of pipe elevations.

1.4 DELIVERY, STORAGE, AND HANDLING A. Deliver, store, protect, and handle products to be included

B. Deliver and store valves in shipping containers with labeling in place. PART 2 - PRODUCTS

2.1 PIPE

A. Steel Pipe:

1. Below Ground: ASTM A53, Schedule 40, type E or S, grade B,

a. Fittings: ASME B16.11, forged steel, or ASTM A234 forged steel welding type. Joints: Welded and seamless. Jackets: AWWA C105 polyethylene jacket, double layer,

half lapped, 10-mil polyethylene tape.

2. Above Ground: ASTM A53, Schedule 40, type E or S, grade B, a. Fittings: ASME B16.3, malleable iron, ASME B16.11, forged steel, or ASTM A234, forged steel welding type.

b. Joints: Threaded. B. Copper Tubing (Propane Piping):

1. Below ground: ASTM B88, Type K, internally tinned: a. Fittings: ASME B16.18, cast copper, or ASME B16.22, wrought copper; internally tinned. b. Joint: AWS A5.8 BCuP silver brazed.

2. Above ground: ASTM B88, Type K, L or ASTM B75, Type GP; internally tinned: a. Fittings: ASME B16.18 cast copper, ASME B 16.22, wrought copper, or ANSI B16.26, cast copper, internally

b. Joint: ASTM B32, Solder, Grade 95TA or AWS A5.8, Bcup

C. Polyethylene Pipe (below ground only): 1. ASTM D-2513, SDR 11.5.

2. PE Fittings: ASTM D 2683, socket type or ASTM D 3261, butt type with dimensions matching ASTM D 2513, SDR 11, PE pipe. 3. Joints: Mechanical or Compression fit.

Reinforced Epoxy Resin Piping: ASTM D2517. 1. Fittings: ASTM D2517. Joints: Bell and spigot with epoxy resin.

2 Inches and Smaller: 150 psig WOG, bronze body, bronze tapered plug, non_lubricated, Teflon packing, threaded ends with cast iron curb box,

B. Larger than 2 inches: 125 psig WOG, Steel or Cast iron body and tapered plug, non_lubricated, Teflon packing, threaded ends, with cast iron curb box, cover, and key.

C. For Applications with Line Pressure Greater than 60 psig: Over 2 Inches: Cast iron body and plug, pressure lubricated, Teflon packing, flanged ends, with cast iron curb box, cover, and key.

2.3 Mark manufacturer's name and pressure rating on valve body

2.4 PRESSURE REGULATING VALVES

Single stage, malleable iron body, corrosion resistant, pressure regulato with atmospheric vent, elevation compensator; with threaded ends for 2 inches and smaller or flanged ends for larger than 2 inches. Install earthquake actuated automatic shutoff valve, if required by local code or

B. Capacity: For inlet and outlet gas pressures, specific gravity, and flow rate

2.5 PROPANE STORAGE TANKS

A. Construction: Closed, welded steel, tested and stamped in accordance with ASME S00081, Sec VIII; minimum 250 psig rating; cleaned, prime coated, and painted with 2 coats of silver anti_rust paint, and supplied with steel support saddles, pressure gage, tapping for installation of piping and

insulation and covered by flexible stainless steel plate, with thermostat in

weatherproof box set to turn on at _13 degrees Fahrenheit with manual C. Capacity: Diameter and length as shown on Construction Drawings.

B. Vaporizer: 1,000 watts, heating cable bedded in 1-inch of glass fiber

A. Magnetic detectable conductor, brightly colored plastic covering, imprinted with "Natural Gas Service" in large letters

PART 3 - EXECUTION 3.1 PREPARATION

A. Ream pipe ends and remove burrs. Bevel plain end ferrous pipe over 2-inches diameter or thread ferrous pipe 2-inches diameter and under

B. Remove scale and dirt, on inside and outside, before assembly

C. Prepare piping connections with flanges or threading and unions. D. Comply with NFPA 54 on installation of gas lines.

A. Excavate pipe trench and place bedding material in accordance with

3.3 INSTALLATION - GENERAL

A. Perform installation in accordance with local utility company requirements in conjunction with requirements herein. Utility requirements shall take precedence when differences occur.

3.4 INSTALLATION PIPING

A. Maintain a minimum of 12 inches separation of gas line from sewer, water,

25

or storm water piping in accordance with state or local code. B. Install piping to conserve space and not interfere with use of site space.

C. Install piping to allow for expansion and contraction without stressing pipe

Install cocks and other fittings as required.

E. Establish elevations of buried piping in accordance with Section 02300. F. Wrap couplings and fittings of steel pipe with polyethylene tape and heat

shrink over pipe in accordance with AWWA C105 G. Install trace wire continuous over top of pipe for nonmetallic pipe.

H. Backfill trench in accordance with Section 02300.

I. Center and plumb valve box over valve. Set box cover flush with finished ground surface. Prevent shock or stress from being transmitted through

J. Wrap valve and valve box with polyethylene tape and heat shrink or paint valves and valve boxes with red anti_rust primer and 1 coat of epoxy paint.

A. Provide sleeve in foundation wall for gas service main. Caulk enlarged

SERVICE CONNECTIONS

3.6 PROPANE TANK INSTALLATION

B. Anchor service main to interior surface of foundation wall.

C. Install service regulator adjacent to building wall in specified location. D. Install service regulator and riser pipe to prevent undue stress on service pipe. For plastic service pipe, use steel pipe riser from below ground to

E. Provide regulator vent with rain and insect proof opening, terminating not less than 5 feet away from building openings.

A. Place tank legs on concrete pad, level within tolerance of 2 inches

minimum. Compact in accordance with Section 02300. C. Provide tank with relief valve, shutoff valve, pressure regulator, pressure gauge, and removable protection cover. Install piping, shutoff valve, and

feet. Grade, place, and compact gravel fill to compacted depth of 3 inches

B. Prepare and grade an area outside the tank perimeter, for distance of 6

D. Set tank regulator to outlet pressure as indicated on Construction

pressure gauge to underground piping.

tray and two stainless steel straps. F. Install weatherproof control box for vaporizer 40-inches above ground surface. Install on 4-inch x 4-inch cedar post, driven into ground 40

Install control wire from vaporizer to control box 20 inches below ground

E. Install vaporizer to underside of tank and secure to tank with aluminum

surface. Install service wiring 24 inches below ground from control box to building

END OF SECTION

SECTION 02630 - STORM DRAINAGE

Storm drainage structures.

1.1 SUMMARY

A. Section Includes:

PART 2 - PRODUCTS 2.1 PIPE AND FITTINGS

1. Storm sewer drainage piping, fittings, and accessories.

A. Pipe and joint materials specified below for storm drainage shall be strictly

limited to the extent shown or allowed on the drawings or as specified in

1. Joint Material: Provide joints to the extent allowable in Part 3

Part 3 hereinafter B. Reinforced Concrete Pipe (RCP): ASTM C 76, Class III unless noted otherwise on Drawings.

a. Rubber O-ring Gasket: AASHTO M 198, Type B or ASTM 2. Flared End Sections: ASTM C 76 or, for sections with toe wall, AASHTO M 170

M330 or ASTM F 2736 smooth interior/annular exterior. Use only where specifically indicated on Drawings. Joint Material:

C. High Density Polyethylene Pipe - Water Tight (HDPE-WT): AASHTO

D. Polyvinyl Chloride (PVC) Pipe: ASTM D 3034, rated SDR 35, or ASTM F 949 for Profile Pipe, continually marked with manufacturer's name, pipe size, cell classification, SDR rating, and ASTM D3034 classification. Only permitted when specifically indicated on Drawings.

Rubber Gasket

1. Pipe joints conforming to ASTM D 3212. 2. Joint Material: Restrained Gasket, ASTM F 477. E. Subdrains: Perforated, PVC or flexible corrugated plastic pipe as specified herein of the size indicated on the drawings.

1) ADS HP WT by Advanced Drainage Systems, Inc.

A. Manholes: Conform to Section 02536. Grates and Frames: Provide in accordance with details shown on Drawings or equivalent by one of the acceptable manufacturers.

Acceptable Manufacturers:

slot width of 1-1/8".

2.2 DRAINAGE STRUCTURES

 East Jordan Iron Works. b. Neenah Foundry. c. U.S. Foundry & Manufacturing.

2. Standard Grates and Frames: Heavy duty grates, with maximum

2. Reinforcement: ASTM A 615, grade 60 deformed reinforcing bars,

C. Cast-In-Place concrete for drainage structures including manholes, inlets, catch basins, collars, support blocks, headwalls and paved ditches shall

PART 3 - EXECUTION 3.1 INSTALLATION - PIPE

1. Compressive Strength: 3500 psi at 28 days.

and ASTM A 185 for wire fabric.

Lay RCP with the groove or bell end upstream.

A. Install pipe in accordance with manufacturer's written recommendations B. HDPE-WT Pipe: Install pipe in accordance with pipe manufacturer's installation Guidelines for Culvert Storm Drainage Applications and as

C. Commence installation at the lowest point for each segment of the route.

Construct joints as described herein and in accordance with manufacturer's installation instructions. Provide pipe joint type for only watertight joint performance in accordance with the following table. The table applies only to the extent as applicable to the pipe and joint type and the joint performance as shown or

Pipe and Joint Type	Joint Performance			
	Watertight	Silt-tight	Soiltight	
RCP				
Rubber O-Ring Gasket	х	X	х	
HDPE-WT				
Rubber Gasket	X	X	х	
ADS HP WT	X	X	X	
PVC				
Restrained Gasket	х	X	х	

3.2 INSTALLATION - MANHOLES, CATCH BASINS, INLETS, AND JUNCTION BOXES

A. Construct drainage structures in accordance with details shown on

Drawings and in accordance with Section 02536 as applicable 3.3 SUBDRAINS

A. Install subdrains in accordance with the details and at the locations shown

END OF SECTION 02630 SECTION 02715 - BASE COURSE

PART 1 - GENERAL 1.1 SUMMARY

A. Section Includes: Aggregate base for asphaltic concrete including sand/shell base and hot-mix sand asphalt base

1.2 REFERENCES A. State Highway Department Standard Specifications.

1.3 WEATHER LIMITATIONS Do not place aggregate when base surface temperature is less than 40

weather conditions are unfavorable otherwise.

PART 2 - PRODUCTS 2.1 BASE COURSE MATERIAL

> A. Aggregate Base Course: Aggregate base course shall consist of a well graded, durable aggregate uniformly moistened and mechanically stabilized by compaction. Base course may consist of a granular base (crushed slag, stone, or gravel, etc), sand/shell base material, or a hot-mix sand asphalt base.

Aggregate base material requirements from State or other local highway

agency specifications may be used for aggregate base course for roads,

1. Percentage of material by weight passing the No. 200 sieve will

completed base course. The aggregates shall have a maximum size of 2

inches and shall be continuously well graded within the following limits:

streets, or similar use pavements if the following conditions are met:

degrees F, nor when air temperature is below 45 degrees F. Do not place

aggregate when surface is wet or frozen. Do not place aggregate when

not exceed 10. 2. Portion of the material passing the No. 40 sieve must have a liquid limit not greater than 25 and a plasticity index not greater than 5.

C. Gradation: The specified gradation requirements shall apply to the

GRADATION OF AGGREGATES Percentage by Weight Passing Square-Mesh Sieve

weight P	assing Square	-IVIESTI SIE	ve	
	Sieve			
	Designation	No.1	No. 2	No.3
	2 inch	100		
	1-1/2 inch	70-100	100	
	1 inch	45-80	60-100	100
	1/2 inch	30-60	30-65	40-70
	No. 4	20-50	20-50	20-50
	No. 10	15-40	15-40	15-40

2.2 EXAMINATION

A. Contractor shall verify to the Owner in writing that the subgrade has been inspected, tested, and gradients and elevations are correct, dry, and properly prepared in accordance with Section 02300. 2.3 CONSTRUCTION

course construction. B. Compact base material to not less than 98 percent of optimum density as etermined by ASTM D698 or 95 percent of optimum density, as

Construct to thickness indicated on Construction Drawings. The minimum pase thickness as shown on drawings shall be achieved throughout all pavement areas 1. Granular Base: Apply in lifts or layers not exceeding 8-inches,

determined by ASTM D1557 unless otherwise indicated on the Drawings.

measured loose. 3. Hot-mix Sand Asphalt Bases: Apply in lifts or layers not exceeding 3-inches, measured loose.

2.4 FIELD QUALITY CONTROL Field quality control shall be the responsibility of the Contractor. Except for specified mandatory testing, field quality control testing and inspection shall be at the discretion of the Contractor as necessary to assure

similar routine, necessary, and customary testing and inspection of the

accordance with Contract Document requirements prior to

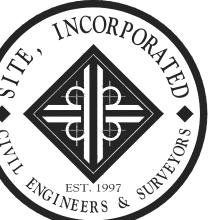
1. Measure base course tolerances no more than 25 ft. on center with a rod and level or stringline.

2.5 OWNER TESTING AND INSPECTION (T&I) A. The Owner will perform testing and inspection (T & I) but only as a means

END OF SECTION

1.1 SUMMARY

B. Submit approved mix designs and laboratory test results to CTL signed by the materials producer and Contractor certifying materials and mix ratios



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A. Perform base course construction in a manner that will drain the surface properly and prevent runoff from adjacent areas from draining onto base

measured loose 2. Sand/Shell Base: Apply in lifts or layers not exceeding 4-inches,

compliance with Contract requirements. Owner T&I shall not be considered a substitute for the Contractor's responsibility to perform

methods and frequency suitable for the type of work involved.

2. Certify in writing to the Owner that base course placement is in

subsequent work thereon.

B. Mandatory Testing and Inspection:

of verification to the Owner of Contractor quality control performance. B. Owner T&I will be performed by the Owner's Construction Testing

Laboratory (CTL) as specified in Section 01458

SECTION 02740 - ASPHALT CONCRETE PAVING GENERAL

A. Section Includes: 1. Asphalt concrete binder and surface course.

conform to the requirements specified herein. C. Submit certification of asphalt placement as specified in Field Quality

ORIGINAL ISSUE: 01/16/2023 SITE PROJECT#: 2062 SHEET: 15 OF: 19