



**SPECIAL PROVISIONS
FOR
SANITARY SEWERS**

**Linn County
HDP-100-1(73)--71-57**

**Effective Date
November 21, 2017**

THE STANDARD SPECIFICATIONS, SERIES 2015, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

PART 1 GENERAL

1.1 – Section Includes

- A. Sanitary Sewer Gravity Mains.
- B. Sanitary Sewer Services.
- C. Sanitary Sewer Manholes.
- D. Sanitary Sewer Force Mains.
- E. Sanitary Sewer Point Repair.

1.2 – Description of Work

- A. Sanitary Sewer Gravity Mains – This item includes furnishing and installing pipe in accordance with the contract documents for sanitary sewers with gravity flow.
- B. Sanitary Sewer Services – This item includes furnishing and installing pipe for sanitary sewer services with gravity flow, and furnishing and installing a sanitary sewer service tap on an existing sanitary sewer main which does not have an existing connection in the required location, all in accordance with the contract documents.
- C. Sanitary Sewer Manholes – This item includes furnishing and installing sanitary sewer manholes, and making new pipe connections to existing sanitary sewer manholes, all in accordance with the contract documents.
- D. Sanitary Sewer Force Mains – This item includes furnishing and installing pipe in accordance with the contract documents for sanitary sewers with pressure flow.
- E. Sanitary Sewer Point Repair – This item includes repair of pipe for sanitary sewers with gravity flow in accordance with the contract documents.

1.3 – Submittals

- A. Submit test results as set forth in the contract documents.
- B. Submit certificate of compliance indicating the materials incorporated into the project comply with the contract documents.
- C. Submit certificates of compliance from the manufacturer that steel and iron materials utilized on this project comply with Article 1107.06 of the Standard Specifications and FHWA 23 USC 313 – Buy America 23 CFR 635.410.

- D. Submit shop drawings of pipe, manholes, castings, fittings, and other Products to be incorporated into the project.

1.4 Delivery, Storage and Handling

- A. Store material in accordance with the manufacturers' recommendations and in locations which will minimize the interference with operations, minimize environmental damage and protect adjacent areas from flooding, runoff and sediment disposition.
- B. Damaged or otherwise unacceptable castings shall be replaced by Contractor at Contractor's expense.

1.5 – Scheduling and Conflicts

- A. Schedule Work to minimize disruption of public streets and facilities.

1.6 – Special Requirements

- A. FHWA 23 USC 313 – Buy America 23 CFR 635.410 policies apply to all steel and iron items. Due to the continual manufacturing outsourcing, manufacturers and products listed within this specification may not comply with FHWA Buy America policies; as a result, it is the Contractor's responsibility to identify manufacturers, verify FHWA Buy America compliance and submit certificates of compliance from manufacturers for all steel and iron products. Certificates of compliance shall state compliance with FHWA 23 USC 313 – Buy America 23 CFR 635.410.
- B. The use of explosives is not permitted unless provided for in the contract documents.
- C. Only ductile iron pipe is allowed for installations of depth equal to or greater than 20 feet.
- D. Temporary sanitary sewer connections should be made with solid wall pipe and watertight fittings, as approved by the Engineer. No leakage shall be allowed.
- E. Polyvinyl Chloride Pipe (PVC) with solid wall or A-2000 corrugated exterior shall not be used in the City of Marion unless set forth in the contract documents.

PART 2 PRODUCTS

2.1 – Sanitary Sewer Gravity Mains

- A. PVC Composite Pipe (PVC Truss).
 - 1. Pipe shall conform to ASTM D2680, minimum pipe stiffness of 200 psi (ASTM D2412).
 - 2. Pipe shall be homogeneous throughout and free from visible cracks, holes, foreign inclusions or other injurious defects.
 - 3. Plastic material for pipe and fittings shall be a rigid PVC plastic and shall meet or exceed the requirements of ASTM D1784 for a minimum cell classification of 12454.
 - 4. The other component for the pipe shall be Portland cement, Mearlcrete concrete or other inert filler material that essentially fills the truss annulus to form a composite pipe.
 - 5. All joints shall be made with gasketed bell coupling connections. No leakage when gasketed pipe joints are tested in accordance with ASTM D 2680, Section 10.4.2 and ASTM D3212. Elastomeric seals (gaskets) shall meet the requirements of ASTM F477.
 - 6. Pipe fittings and cleanouts conform to ASTM D2680 Section 7.1 and Tables 5 and 6.
 - 7. PVC cell classification shall be clearly marked on pipe at intervals not to exceed 5 feet.
- B. PVC Pipe with A-2000 corrugated exterior, 8 inch to 36 inch diameter.
 - 1. Pipe shall conform to current ASTM F949 with a minimum pipe stiffness of 46 psi (ASTM D2412) at 5 percent deflection.
 - 2. There shall be no evidence of splitting, cracking, or breaking when pipe is tested in accordance with ASTM D2412 at 60% flattening.

3. Pipe dimensions shall meet the requirements given in ASTM F949 when measured in accordance with ASTM D2122.
 4. Pipe shall be homogeneous throughout and free from visible cracks, holes, foreign inclusions or other injurious defects
 5. Plastic material for pipe and fittings shall be a rigid PVC plastic and shall meet or exceed the requirements of ASTM D1784 for a minimum cell classification of 12454B.
 6. All joints shall be made with gasketed bell coupling connections. No leakage shall occur when gasketed pipe joints are tested in accordance with ASTM D3212. Elastomeric seals (gaskets) shall meet the requirements of ASTM F477.
 7. Pipe fittings shall conform to ASTM F949, Section 5.2.3.
- C. PVC Pipe, Solid Wall.
1. Pipe, fittings, and joint shall meet AWWA C900 and C905 Specifications for DR18 pipe.
 2. The bell shall consist of an integral wall section with a factory installed, solid cross section elastomeric ring in accordance with ASTM F-477.
 3. The minimum pipe stiffness shall be 364 psi.
 4. In accordance with ASTM D1599, a minimum burst pressure of 755 psi shall be withstood without failure.
 5. The pipe must be able to withstand an impact of 100 foot-pounds without visible evidence of shattering or splitting as specified in ASTM D2444.
 6. Plastic material for pipe and fittings shall be a rigid PVC plastic and shall meet or exceed the requirements of ASTM D1784 for a minimum cell classification of 12454B.
 7. All joints shall be made with gasketed bell coupling connections. No leakage shall occur when gasketed pipe joints are tested in accordance with ASTM D3212. Elastomeric seals (gaskets) shall meet the requirements of ASTM F477.
- D. Reinforced Concrete Pipe (RCP).
1. Pipe shall conform to ASTM C76, with a strength of Class III, unless otherwise on the contract documents, and a C wall, unless indicated otherwise in the contract documents.
 2. Cement used in the manufacture of the pipe shall be Type II with the following material properties:
 - a. Tricalcium Aluminate: <8%
 - b. Air Entrainment: 6% \pm 1%
 - c. Minimum Cement Content: 564 pounds per cubic yard
 - d. Maximum Water Cement Ratio: 0.40
 - e. Flyash: 10% maximum
 3. Pipe to be installed in a boring and jacking operation shall meet the strength and wall thickness requirements set forth herein unless indicated otherwise in the contract documents.
 4. Joints shall be bell-and-spigot type with rubber O-ring flexible gasket conforming to ASTM C443.
 5. Lifting holes shall not be allowed.
- E. Ductile Iron Pipe (DIP)
1. Ductile iron pipe shall conform to ANSI A21.50 and A21.51.
 2. DIP required to comply with reduced separation from water supply lines shall be as follows:
 - a. Conform to AWWA C151/ANSI A21.4, minimum pressure Class 52.
 - b. Interior lining shall be cement-mortar lined with bituminous seal coat inside and outside conforming to AWWA C151/ANSIA21.4.
 - c. Push on joint conforming to AWWA C111/ANSIA21.11.
 - d. Mechanical joint fittings and cleanouts conforming to AWWA C110/ANSI A21.10.
- F. Extra Strength Vitrified Clay Pipe (ESVCP)

1. Extra strength vitrified clay pipe shall meet the requirements of ASTM C700 and shall be bell and spigot construction.
 2. Pipe shall be provided with factory-fabricated joints and gaskets meeting requirements of ASTM C425.
- G. Polyethylene Wrap: Conform to ANSI/AWWA C105/A21.5; minimum thickness is 8 mil.

2.2 – Sanitary Sewer Services

- A. PVC Pipe.
1. Pipe and fittings shall be SDR 23.5 and shall conform to ASTM D3034 with a minimum pipe stiffness of 153 psi (ASTM D2412).
 2. Pipe shall be homogeneous throughout and free from visible cracks, holes, foreign inclusions or other injurious defects.
 3. The thermoplastic material for pipe and fittings shall be a rigid PVC plastic and shall meet or exceed the requirements of ASTM D1784 for a minimum cell classification of 12454.
 4. All joints shall be made with gasketed bell coupling connections. No leakage shall occur when gasketed pipe joints are tested in accordance with ASTM D3312 and ASTM D3212. Elastomeric seals (gaskets) shall meet the requirements of ASTM F477.
 5. Pipe fittings including cleanout risers shall conform to ASTM D3034.
- B. Cast Iron Soil Pipe (CISP).
1. The pipe shall meet the requirements of ASTM A74 (Specification for Cast Iron Soil Pipe and Fittings, Hub and Spigot (Service and Extra Heavy)) for the specified wall thickness.
 2. The fittings including cleanouts shall meet the requirements of ASTM A74.
 3. Gaskets for cast iron soil pipe shall conform to ASTM C564.
 4. Use of no-hub joints is not permitted.
- C. Extra Strength Vitrified Clay Pipe (ESVCP), 4 inch to 6 inch diameter
1. The pipe shall meet the requirements of ASTM C700.
 2. The fittings including cleanouts shall meet the requirements of ASTM C425.
- D. Ductile Iron Pipe (DIP).
1. Ductile iron pipe shall conform to ANSI A21.50 and A21.51.
 2. DIP required to comply with reduced separation from water supply lines shall be as follows:
 - a. Conform to AWWA C151/ANSI A21.4, minimum pressure Class 52.
 - b. Interior lining shall be cement-mortar lined with bituminous seal coat inside and outside conforming to AWWA C151/ANSI A21.4.
 - c. Push on joint conforming to AWWA C111/ANSI A21.11
 - d. Mechanical joint fittings and cleanouts conforming to AWWA C110/ANSI A21.10.
- E. Sanitary Sewer Service Tap
1. Use wyes, not tees.
 2. PVC Pipe Main
 - a. Preformed wye service fitting with gasket joints conforming to ASTM D 3034 and ASTM F949.
 - b. Preformed saddle wye for service tap conforming to ASTM D 3034 and ASTM F949.
 3. PVC Composite Pipe (PVC Truss) Main
 - a. Preformed wye service fitting with gasket joints conforming to ASTM D 2680.
 - b. Preformed saddle wye for service tap conforming to ASTM D 2680
 4. Reinforced Concrete Pipe (RCP) Main
 - a. Precast reinforced concrete wye or tee service fitting conforming to ASTM C76.
 - b. Preformed connector designed for use with reinforced concrete pipe, conforming to ASTM C923 and A167.
 5. DIP: Preformed wye service fitting with gasket joints conforming to AWWA

- C155/ANSI A21.53.
6. VCP (clay pipe): Preformed wye service fitting with gasket joints conforming to ASTM C700 and ASTM C425. Use "short-body" type fittings.
 7. All saddle wye fittings must provide positive protection against service pipe insertion beyond inside of sewer main pipe wall, and shall form an airtight seal with the sewer main pipe. Bond clamps shall be stainless steel.
- F. Mechanical plugs shall be provided for each service and shall form an airtight seal with the end of the service.

2.3 – Sanitary Sewer Manholes

- A. Sanitary sewer manholes shall be of a size and depth as set forth in the contract documents. Manholes shall be 48 inches in diameter, unless noted otherwise.
- B. Sanitary sewer manholes shall be precast and conform to ASTM C478.
- C. Sanitary sewer manholes shall include precast integral base sections with preformed inverts, flexible pipe connectors which are water tight, and precast riser, eccentric reducer, and/or flat top sections and grade rings. All flat tops must be able to support the AASHTO H-20 loading. Top of eccentric cone section shall have a 2 inch minimum vertical face.
- D. Channels
 1. Preformed inverts shall be sloped to drain.
 2. Field constructed channels shall be formed of the same size and shape as the pipes to which they connect, shall form a smooth curve through the manhole of longest possible radius and shall receive a smooth, steel trowel finish. The manhole floor, or bench, outside the channels shall be finished smooth and shall slope toward the channel at not less than 1 inch per foot. Field constructed channels for "straight-through" manholes may be constructed by laying the pipe continuously through the manhole and breaking out the top half after the surrounding concrete has hardened and neatly dressing the edges.
- E. Flexible pipe connectors shall meet all material and performance requirements of ASTM C923.
- F. All joints between precast sections shall be fitted with a confined, watertight O-ring or profile gasket between the bell and spigot ends in conformance with ASTM C478, ASTM C361, and AWWA C302.
- G. Manhole steps shall be required in all precast manholes, and junction boxes with a height from the lowest flow line to the top of rim in excess of 6 feet. They are not required between precast adjusting rings. Steps shall be an approved plastic-coated 10 inch steel step securely anchored into the riser section. The steel step shall be a 1/2 inch bar, Grade 60, in accordance with ASTM A615. Steps where provided shall be manufactured of polypropylene encased steel, and comply with ASTM C478.
- H. The manhole frame and lid shall be of uniform quality and free from defects. Metal used in the manufacture of gray iron castings shall conform to ASTM A48, Class 35, or ASTM A536, Grade 65-45-12 for ductile iron. Minimum weight shall be 300 pounds. If casting is to be anchored to the manhole structure per contract documents, provide a minimum of four bolts. Bolt diameter shall be as recommended by manhole structure manufacturer. Refer to Appendix A, this section for list of approved castings.
- I. The lid shall fit in the frame such that it does not rock. The frame and lid shall be watertight and self-sealing with a compression gasket and a concealed pick hole.
- J. External Manhole Chimney Seals, a flexible watertight sleeve connected to the casting frame and to the precast adjusting rings, or to the cone section, shall be subject to approval in advance by the Engineer. The flexible rubber sleeve shall be in conformance with ASTM C923, with a durometer hardness of approximately 45. The unexpanded vertical height of the sleeve shall be a minimum of 9 inches, and minimum thickness of the sleeve shall be 3/16 inch. After installation in the unexpanded position, the sleeve shall be capable of repeated vertical expansions and contractions of at least 2 inches.
 1. The top of the rubber sleeve shall be mechanically locked onto the casting with a compression band to form a watertight seal that cannot be broken through repeated expansion and contraction cycles. The bottom of the sleeve shall be

fastened securely to the precast concrete adjusting rings, or to the top of the cone section if applicable, with a compression band, to form a watertight seal which cannot be broken or shifted during vertical expansion or contraction of the casting. The sleeve shall be capable of withstanding at least 1 inch lateral movement of the casting without breaking the watertight seal.

2. When the vertical height of precast concrete adjusting rings is such that the bottom of the sleeve cannot form a watertight seal on the cone section, an extension skirt shall be used to cover any exterior portion of the manhole chimney from the bottom of the rubber sleeve down onto the top of the cone section. The extension skirt shall be securely fastened with compression bands at the bottom of the sleeve and on the cone section.
 3. The compression band used to fasten the top of the sleeve to the casting, and the compression bands used to fasten the bottom of the sleeve and the skirt to the manhole, shall be a minimum 1 inch width, 16 gauge stainless steel band conforming to ASTM A240, Type 304. Screws, nuts, and bolts used on the band shall be stainless steel conforming to ASTM F593 and F594, Type 304. Fastening methods shall be subject to approval in advance by the Engineer.
 4. The extension skirt shall be a minimum 12 ounces per square foot fiberglass-reinforced PVC impervious fabric that is resistant to tears and punctures. Extension skirt material shall be subject to approval in advance by the Engineer. Overlapped skirt sections shall be solvent cement welded and watertight, in a manner provided by the supplier.
 5. A bead of butyl rubber caulk, conforming to AASHTO M198, Type B, shall be applied to the concrete manhole surface to help form a watertight seal under the compression bands.
 6. Alternative types of seals require approval of the Engineer.
- K. Manhole Adjustment Rings (Grade rings)
1. Rings shall be tested to assure compliance with impact and loading requirements per AASHTO Standard Specification for Highway Bridges.
 2. High Density Polyethylene Adjustment Rings
 - a. Comply with ASTM D1248 for recycled plastic.
 - b. Test and certify material properties by methods in the following table:

PROPERTY	TEST METHOD	ACCEPTABLE VALUE
Melt Flow Index	ASTM D1238	0.3 to 30 g/10 min
Density	ASTM D792	0.94 to 0.98 g/cm ³
Tensile Strength	ASTM D638	2,000 to 5,000 lb/in ²

- c. Do not use polyethylene grade adjustment rings if exposure to HMA pavement is possible or expected.
 - d. When a single ring is used, provide tapered adjustment ring that may vary from 1/2 inch to 3 inch thickness.
 - e. Install adjustment rings on clean, flat surface according to the manufacturer's recommendations and using an approved butyl rubber sealant/adhesive. Apply sealant to manhole, between adjustment rings, and to casting flange.
 - f. Manufacturer: Ladtech, Inc. or approved equal.
3. Expanded Polypropylene Adjustment Rings
 - a. Test and certify compliance with the following:
 - 1) ASTM D3575 for expanded polypropylene (EPP)
 - 2) AASHTO H25 and HS25
 - 3) Minimum finished density of 7.5 PCF
 - 4) UV stability
 - 5) Minimum 50 year design life

- b. Adhesive/sealant shall be M-1 Structural adhesive/sealing meeting the following:
 - 1) ASTM C920, Type S, Grade NS, Class 25, uses NT, T, M, G, A and O
 - 2) Federal Specification TT-S-00230-C, Type II, Class A
 - 3) US Army Corps of Engineers CRD-C-541, Type II, Class A
- c. Adjustment rings may be fabricated with one or more of the following:
 - 1) Upper and/or lower keyway (tongue-and-groove) for vertical alignment between rings
 - 2) Uniform or variable thicknesses to allow matching flat or sloping surfaces to within 1/4 inch to 1/2 inch of specified final elevation
 - 3) Flat top surface to allow casting to bear uniformly
 - 4) Trench or slot for adhesive on the underside
- d. Manufacturer: CRETEX Specialty Projects (PRO-RING) or approved equal
- 4. Rubber adjustment risers shall be rubber composite with the following properties:
 - a. Density 1.098 grams per cubic centimeter, tested in accordance with ASTM C642.90.
 - b. Durometer hardness 75A+/- 10 points (molded surface) and 73A+/- 10 points (interior surface), testing based on ASTM D2240.
 - c. Tensile strength: 232 psi, tested in accordance with ASTM D412-87.
 - d. Compression deformation: under 145 psi, 6% \pm 2%, testing based on ASTM D575.
 - e. Freeze and thaw when exposed to deicing chemicals: no loss after 50 cycles, tested in accordance with ASTM C672-91.
 - f. Weathering: Hardness, compressive strength, tensile strength, elongation retained to 100% \pm 5%, tested in accordance with ASTM D573-88.
 - g. Risers to be made in flat or tapered configurations and resistant to rotting, chipping, or breaking.
 - h. Do not use rubber adjustment risers if manhole casting will be in the wheel path of a paved travel lane. Use is permitted outside paved areas.
 - i. Manufacturer: Infra Riser by GNR Technologies or approved equal.
- 5. Inside dimension not less than the bottom inside diameter of the ring casting.
- 6. Minimum inside diameter of 24 inches.
- 7. The outside diameter of the rings shall match the outside diameter of the top of the eccentric reducer, or opening in flattop, whichever is applicable.
- L. Internal manhole chimney seals used for sealing the joint between the manhole frame and chimney or corbel/cone section, shall consists of the following components:
 - 1. The flexible rubber sleeve shall be extruded from a high grade rubber compound conforming to the applicable requirements of ASTM C-923, with hardness (durometer) of 45 \pm 5. The sleeve shall be double pleated with a minimum unexpanded vertical height of 8 inches, a minimum thickness of 3/16 inches and shall be capable of a vertical expansion when installed of not less than 2 inches. The top and bottom section of the sleeve shall contain an integrally formed expansion band recess and multiple sealing fins. Any splice used to fabricate the sleeve shall be hot vulcanized and have a strength such that the sleeve shall withstand a 180 degree bend with no visible separation.
 - 2. The expansion bands used to compress the sleeve against the manhole shall be 16 gauge stainless steel conforming to ASTM A-240, Type 304, with a minimum 1 3/4 inch width. The expansion mechanism shall have the capacity to develop the pressures necessary to make a watertight seal and shall have a minimum adjustment range of 2 diameter inches. Studs and nuts used for this mechanism shall be stainless steel conforming to ASTM F-593 and 594, Type 304.
 - 3. Use only if specified in contact documents or if approved by the Engineer.
- M. Molded Shield for Manhole Infiltration Barrier
 - 1. Single molded piece consisting of a flat flange that seats on the top of manhole cone sections or flattops and a cylindrical portion that fits inside adjustment rings

(grade rings). Flange inside and outside diameters shall match manhole cone section. Cylinder diameter shall match inside diameter of casting.

2. Molded shields shall be fabricated from medium density polyethylene (MDPE) meeting the following requirements:

PROPERTY	TEST METHOD	VALUE
Material	ASTM D1248	MDPE
Melt Index	ASTM D1238	4.5
Density	ASTM D792	0.938
Tensile strength at yield, PSI	ASTM D638	2800
Elongation at break, %	ASTM D638	400
Flexural Modulus, tangent, PSI	ASTM D790	115,000
ESCR	ASTM D1693	1,000
UL-94 @ 0.060 AND 0.120 thickness	UL-94	HB
Deflection Temp., 88 PSI, degrees C	D648	83
Deflection Temp., 264 PSI, degrees C	D648	42
Low Temp. Impact, -40 degrees C, Ft-LB	ARM	68
Proof load test	AASHTO M306	40,000

3. Butyl sealant for attaching molded shields to manhole cone sections shall conform to AASHTO M198.

N. Heat Shrinkable Sleeve for Manhole Infiltration Barrier

1. Heat shrinkable sleeves shall be an irradiated and cross-linked polyethylene impermeable backing, coated with a protective heat-activated adhesive and capable of bonding to primed concrete, metal, or fiberglass surfaces.
2. Properties of Heat-Shrinkable Sleeve

PROPERTY	TEST METHOD	VALUE
Peel Strength	ASTM D1000	8.6 LBS/LINEAL INCH
Lap Shear	ASTM D1002	1.5 LBS/SQ. INCH
Water Absorption	ASTM D570	0.05% MAXIMUM
Low Temperature Flexibility	ASTM D2671	- 40 DEGREES F
Supplied Thickness		101 MILS
Fully Recovered Thickness		125 MILS
Shrink Factor		40% MAXIMUM

3. Sleeve adhesive shall have a softening point of 212° F as determined by ASTM E28.
4. Properties of Sleeve Backing

PROPERTY	TEST METHOD	VALUE
Tensile Strength	ASTM D638	2900 LBS/SQ. INCH
Elongation	ASTM D638	600%
Hardness	ASTM D2240	SHORE D = 46
Abrasion Resistance	ASTM D1044	35 MG

5. Primers shall conform to manufacturer's recommendations and be compatible with concrete, steel, and fiberglass substrates and with sleeve adhesive.

O. Seals for New Pipe Openings in Existing Structures

1. Purpose and Description

- a. Purpose: Seal annular space around new pipe installed in opening cored in existing manhole wall.
- b. Description: Modular mechanical seal consisting of rubber links or rings shaped to continuously fill annular space secured by pressure plates and stainless steel hardware.

2. Material Specifications

- a. Modular Seal (Nitrile rubber, oil resistant)

Property	ASTM Method	Value (minimum)
Hardness (Shore A)	D2240	50 ± 5
Tensile Strength	D412	1300 PSI
Elongation	D412	300%
Compression Set	S395	45% based on 22 hours @ 212° F (100° C)
Specific gravity	D297	1.15
Color	---	Green

- b. Pressure Plates (Molded Glass Reinforced Nylon)

Property	ASTM Method	Value (minimum)
IZOD Impact-Notched	D256	2.05 ft-lb/in
Tensile strength @ yield	D638	20,000 PSI
Tensile strength @ break	D638	20,250 PSI
Flexural Strength @ yield	D790	30,750 PSI
Flexural Modulus	D790	1,124,000 PSI
Elongation, break	D638	11.07%
Specific gravity	D791	1.38
Moisture content	---	0.18%
Color	---	green

- c. Hardware (Bolts and Nuts)

1) Material: ANSI Type 316 Stainless Steel, per ASTM F593. 2) Tensile strength: 85,000 PSI average

3. Approved Products

- a. Model OS-316 PSI-Thunderline/Link Seal Modular Seal as manufactured by Pipeline Seal and Insulator, Inc.
- b. Pre-approved equal to above

b. - Sanitary Sewer Force Mains

P. Ductile Iron Pipe (DIP)

- 1. Conform to AWWA C151/ANSI A21.4, minimum pressure Class 52
- 2. Interior lining shall be cement-mortar lined with bituminous seal coat inside and outside conforming to AWWA C151/ANSI A21.4.
- 3. Push on joint and/or mechanical joint conforming to AWWA C11/ANSI A21.11

Q. PVC Pipe

- 1. Pipe and joint shall meet AWWA C900 Specifications for DR 18 pipe.

2. The bell shall consist of an integral wall section with a factory installed, solid cross section elastomeric ring in accordance with ASTM F-477.
 3. The minimum pipe stiffness shall be 364 psi.
 4. In accordance with ASTM D1599, a minimum burst pressure of 755 psi shall be withstood without failure.
 5. The pipe must be able to withstand an impact of 100 foot-pounds without visible evidence of shattering or splitting as specified in ASTM D2444.
- R. Sewage Air Release Valve
1. General: Consists of an elongated tapered or conical body with outward-slanting walls and a float to operate (open and close) under pressure without spillage. Use a float with a flexible connection to the seal plug assembly to prevent irregular air release and protect the connecting rod. Ensure the bottom of the valve is sloped or funnel-shaped to encourage the accumulated sewage and solids to drain from the valve. Preserve a volume of air at all times between the liquid sewage and the seal plug assembly.
 2. Materials:
 - a. Body and Cover: Stainless steel, fiberglass-reinforced nylon, or other corrosion-resistant materials.
 - b. Internal Metal Components: Stainless steel.
 - c. Float: Stainless steel, ASTM A240, Type 304, or foamed polypropylene.
 - d. Seal Plug Assembly: Stainless steel, foamed polypropylene, EPDM rubber, and reinforced nylon.
 3. Tapping Saddle: Stainless steel or nylon.
 4. Pit: Construct according to contract documents.
- S. Tracer Wire: Comply with Special Provisions for Water Main. Tracer wire will be required on all force mains.
- T. Tracer Wire Station:
1. Two internal terminals with shunt
 2. 5 to 6 foot plastic post (color as specified by the Jurisdiction)
 3. Removable top cap with lock
 4. Decals indicating "Sewer Force Main" or similar language

2.4 – Sanitary Sewer Point Repair

- A. The following pipe materials and fittings are approved for point repairs
 1. Ductile Iron Pipe, Class 52
 2. Extra strength vitrified clay pipe
 3. PVC Pipe, Solid Wall, C-900 and C-905, DR-18
 4. PVC Truss Pipe not allowed for point repairs
- B. Connect repair pipe to existing sanitary sewers with couplers meeting the following
 1. Flexible PVC gasket with smooth inside surface
 2. Stainless steel shear ring, minimum 0.012 inch thickness full length of coupling
 3. Stainless steel bands and hardware to secure coupler in place
 4. Meets requirements of ASTM C1173 and D5926

PART 3 EXECUTION

3.1 – Sanitary Sewers – General

- A. Sanitary sewer materials shall not be installed until trench excavation and bedding has been completed.
- B. The Contractor shall furnish and install sanitary sewer materials according to the contract documents.
- C. The Contractor shall inspect sanitary sewer materials for defects. Do not install damaged or defective materials.
- D. The pipe interior, and pipe and manhole joints shall be kept clean during installation and between periods of installations.
- E. If bottom of excavation is wet, dewater.

- F. The Contractor shall provide uniform bearing for the full pipe barrel length when installed. This shall be accomplished by excavating holes in the bedding for pipe bells. The pipe shall be supported above the bedding material only if the pipe is being incased in concrete.
- G. Manhole section and pipe joints shall be assembled according to the Manufacturer's instructions and verified by the Contractor.
- H. The Contractor is responsible to block or anchor pipe as necessary to prevent joint displacement when using movable trench boxes or shields.
- I. Junctions of dissimilar pipe materials require an adapter with stainless steel sleeve over adapter and installation recommended by the pipe manufacturer.
- J. The Contractor shall backfill the pipe or structure according to the contract documents.
- K. The Contractor shall test the sanitary sewer installation according to Special Provisions for Testing and Quality Control.

3.2 – Sanitary Sewer Gravity Mains

- A. Pipe installation shall begin at the lowest point of the reach unless approved by the Engineer.
- B. The Contractor shall install waterstops in the trench at the locations set forth in the Standard Details. They shall be constructed of clayey excavated material compacted to 95% of optimum density (ASTM D698).
- C. Contractor shall cut the pipe at structures and when preformed wye service fittings are to be incorporated into the Work. PVC truss pipe shall be sealed at cut edges as recommended by the manufacturer. This shall not apply to the construction of new service wyes on new mains.
- D. Line and Grade
 - 1. Install pipe to line and grade shown on plans. Set field grades to invert of pipes.
 - 2. Notify Engineer immediately if discrepancies or irregularities are discovered in line or grade shown by grade stakes.
 - 3. Make detailed measurements as required to construct Work to line and grade established by line and grade hubs.
 - 4. Laser Beam
 - a. Set laser equipment to proper line and grade from line and grade hubs. Provide adequate forced air ventilation in pipes to improve laser accuracy.
 - b. Use a level to check line and grade of laser at 25 foot intervals for first 100 feet and then at 50 foot intervals for each setup.
 - c. Check line and grade of each pipe length.
 - 5. Check alignment of sewer by flashing light between manholes or between last pipe laid and opening at downstream manhole.
 - 6. Correct misalignment, displacement or otherwise defective pipe by removing, relaying or replacing pipe at Contractor's expense.
- E. Cutting Pipe
 - 1. Pipe shall be cut in a neat and workmanlike manner to provide an even surface, perpendicular to the pipe centerline.
 - 2. All burrs and irregularities shall be removed prior to pipe fitting.
 - 3. Bevel ends of push-on type pipe
- F. Jointing
 - 1. The gasket position shall be verified prior to compressing the pipe joint together.
 - 2. Only those solvents, adhesives, and lubricants furnished by the pipe manufacturer shall be permitted.
 - 3. Perform push-on joint installation per manufacturer's instructions.
- G. Tolerances
 - 1. Horizontal and vertical alignment of each pipe length shall not vary from design line and grade by more than 1% of the inside diameter of the pipe, as established by the Engineer. This tolerance in grade will be allowed only if the sewer is designed at a slope sufficient to prevent backfall when its limits are reached. All sewer laid

incorrectly, as determined by the Engineer, must be re-laid at the Contractor's expense. Under no condition will a sewer be accepted when one or more pipe lengths have been installed without "fall".

2. The completed sewer must be laid so nearly in a perfect line that an ordinary electric lantern held at the center of the sewer at a manhole may be wholly visible to the eye at the level of the sewer center at the next manhole.
3. Pipe invert elevations at manholes shall not deviate by more than 0.04 feet from design elevations.

3.3 – Sanitary Sewer Services

A. Installation of new services

1. The pipe installation shall begin at a wye fitting unless approved otherwise by the Engineer.
2. Line and Grade
 - a. Horizontal Alignment: Service lines shall be constructed at right angles to the sewer.
 - b. Grade: Service lines shall be laid at a minimum uniform grade of 1/8 inch per foot unless otherwise noted on the plans.
 - c. Depth: The elevation of the service at the property line or easement line shall be sufficiently deep to provide a minimum grade of 1/8 inch per foot from the existing building sewer, where it exits the building, to the end of the service lead. If a service is to be provided for a vacant lot, the service shall be kept at the lowest possible elevation.
3. Connection Fittings
 - a. Location of the connection fitting shall be as shown on the plans to match an existing service or as required by the Engineer.
 - b. 45 degree or 60 degree wyes shall be utilized for connection of the service leads to the sanitary sewer.
4. Main Risers: Where the cover is greater than 12 feet at the main, a riser may be placed to bring the service to a reasonable depth to match an existing service.
5. No vertical bends greater than 45 degrees will be permitted for service lines.
6. Horizontal directional changes of greater than 45 degrees will be permitted in service lines, provided a cleanout is provided immediately upstream of the bend.
7. Mechanical plugs, when specified, shall not be installed with a lubricant. Plugs shall be inserted loosely until the back washer seats against the bell hub transition. This shall be held in place and the wingnut tightened until the plug is firmly seated.
8. Pipe "caps", when specified, shall be solvent welded to the pipe on dead end lines, which shall be cut off at a later date when the line is extended.
9. Service connections in excess of 100 feet in length shall have cleanouts installed at 100 foot intervals, including riser pipe lengths. Cleanouts installed at the ends of a long pipe run shall allow one-way cleaning, and cleanouts at intermediate points along a long run shall allow cleaning in both directions of the pipe run.
10. Notify Engineer about services that are possibly live (transporting sewage). Confirm service status with dye testing, sewage testing, tracer and/or video inspection prior to reconnection or abandonment.

B. Sanitary Sewer Service Tap

1. No new connection, repair, replacement, or cutoff work shall be made on any service line at the sanitary sewer main, in the local jurisdiction right-of-way, or in a local jurisdiction easement, without notifying the local jurisdiction for approval, inspection, and recording purposes.
2. No service connection shall be made to a manhole unless approved in writing by the Engineer.
3. If it is necessary to tap a new connection to the sewer main, the following criteria shall be met:

- a. All taps shall be made with an approved pipe-drilling machine or hole saw to make a clean hole.
- b. A prefabricated saddle with stainless steel clamps shall be set over the hole with a rubber gasket or cemented to form a watertight seal.
- c. Saddles shall be attached to PVC with solvent cement and two stainless steel band clamps.
- d. Tap shall not protrude into sewer main.
4. A new tap shall not be made less than 12 inches from a joint, and never directly on top of the main. Care should be taken neither to make the tap larger than necessary nor to damage the main. The Contractor shall be solely liable for repairing the sewer main damaged by construction operations.
5. Service line connections will normally be 4 or 6 inch lines. A 6 inch service line shall only be connected to an 8 inch or larger main with a prefabricated fitting or a manhole. A service line of 8 inch diameter or larger shall require a manhole at the connection.
6. All service lines shall be connected with precast compression gasket joints or approved adapters.
7. The fitting interior and joints shall be clean prior to lowering into trench and kept clean during installation and between periods of installation, (e.g. downtime).
8. The pipe installation for the service line shall begin at the lowest point of the reach unless approved by the Engineer.
9. Sanitary sewer service line cutoffs shall be cut off at the sanitary main and shall be tightly and permanently sealed with a plug of mortar.
10. No connections, replacements, or cutoffs shall be covered or backfilled until inspection and approval have been completed. The Contractor shall notify the Engineer for inspection prior to any backfilling. Work shall be uncovered for inspection at the order of the Engineer, and shall be in full view from above the ditch, prior to backfilling.

3.4 – Sanitary Sewer Manholes

- A. Top of manhole structure shall be no more than 18 inches below finished grade.
- B. The Contractor shall complete each manhole as the Work progresses, including seals and covers. The contract documents shall identify where watertight castings are required.
- C. Where inverts are provided and no pipe is placed as a part of this Project, the Contractor shall furnish and install a plug to seal the manhole invert. Plug shall be subject to approval by Engineer before installation.
- D. When using PVC pipe, manhole-pipe adapters shall be furnished and installed by the Contractor according to the manufacturer's instructions.
- E. Sanitary manhole bases shall include a concrete fillet, sloped at 1 inch per foot minimum to the gutter, with gutters connecting the flow lines of inlet pipes to the flow line of the outlet pipe. Gutters shall be smooth, with no abrupt bends, and shall be rounded to meet the lower hemispheric radius of the inlet and outlet pipes across the manhole base.
- F. Contractor shall install shims as needed to provide a tight fit between the manhole cover and receiving frame. The space between the manhole cover and frame shall be no greater than 1/8 inch without shims and manhole cover shall not rock under the weight of traffic.
- G. Manhole adjusting ring (grade ring) installation:
 1. For polyethylene grade rings, bed each ring in a 3/16 to 1/4 inch bead of butyl sealant (use a double bead if surface irregularities are present).
 2. For rubber adjusting risers, bed each riser in a urethane-based mastic, in accordance with manufacturer's directions.
 3. Do not install more than two rings, or a total ring stack height more than 12 inches. For greater adjustment, modify barrel riser section(s).
- H. Sanitary sewer services may only be connected to manholes if a precast invert is included in the base section, or as otherwise directed by the Engineer.
- I. Infiltration barriers shall be installed according to the manufacturer's instructions.

3.5 – Sanitary Sewer Force Mains

Appurtenances shall be furnished and installed as set forth in the contract documents.

3.6 – Sanitary Sewer Point Repair

- A. The pipe repair shall begin at the lowest point of the reach unless approved otherwise by the Engineer.
- B. The Contractor shall provide bypass pumping of the area to be repaired unless the Engineer approves the plugging of the existing line at the upstream manhole and storing the sewage in the main until the repair is complete.
- C. The Contractor shall remove existing pipe to a usable joint and provide a banded coupler to connect existing pipe to the repaired section. Coupler shall be subject to prior approval by the Engineer.
- D. After completing assembly of the repair couplings, all voids under the exposed sewer line shall be completely filled with compacted bedding material.
- E. A prefabricated wye or tee fitting shall be installed as necessary to reconnect service lines within the repair area.
- F. The Contractor shall sawcut the pipe at structures and when preformed wye service fittings are to be incorporated into the Work. PVC truss pipe shall be sealed at cut edges as recommended by the manufacturer.
- G. All pipe cutting shall be accomplished with a saw intended for the Work to provide a neat cut.

3.7 – Connection to Existing Sanitary Sewer Manhole

- A. The Contractor shall use a core drill to make round, smooth opening in wall of existing manhole in order to make connection in accordance with the contract documents.
- B. Place new pipe through cored opening and install modular mechanical seal as specified in accordance with manufacturer's requirements.
- C. During extension of a new sewer line from any part of the existing sanitary sewer system, the new sewer shall be plugged with a mechanical plug until acceptance by the Engineer, to prevent inflow of stormwater and debris to the sanitary sewer system.
- D. The Contractor shall then shape a flume in the base of the existing manhole using non-shrink grout.
- E. The connection shall be allowed to cure for 24 hours before the pipe installation may occur, unless approved otherwise by the Engineer.

3.8 - Conflicts

- A. Provide temporary support for existing water, gas, telephone, power or other utilities or service that cross the trench.
- B. Compact backfill under existing utility crossing as specified in Section 2552 of the Standard Specifications or construct utility line supports where indicated in the contract documents or as directed by Engineer.
- C. Separate gravity sewers from water mains by horizontal distance of at least 10 feet unless:
 1. Top of sewer is at least 18 inches below bottom of water main.
 2. Sewer is placed in separate trench or in same trench on bench of undisturbed earth with at least 3 feet separation from water main.
- D. Use ductile iron pipe or DR-18 PVC pipe as specified for gravity sewers with less than 10 feet horizontal distance and top of sewer less than 18 inches below bottom of water main; maintain at least 2 feet separation.
- E. Where gravity sewer crosses over water main or service or where top of sewer is less than 18 inches below bottom of water main or service, the following requirements apply:
 1. The sewer may not be placed closer than 6 inches below a water main or 18 inches above a water main. The separation distance shall be the maximum feasible in all cases.
 2. Use 20 foot length of ductile iron pipe or DR-18 PVC as specified for gravity sewer centered on water main.

3. The sewer and water main must be adequately supported and have watertight joints.
 4. Backfill trench with low permeability soil for 20 foot length centered on crossing.
- F. Separate sanitary sewer force mains from water mains by horizontal distance of at least 10 feet unless:
1. Force main is constructed of water main materials meeting minimum pressure rating of 200 psi, and
 2. Force main is laid at least 4 linear feet from the water main.

APPENDIX A

**APPROVED SANITARY SEWER
CASTINGS**

Type of Installation	Manufacturer	Manufacturer's No.
Standard Manhole (Heavy Duty)	Neenah Foundries	1642
	East Jordan Iron Works	1045
	Deeter Foundry	1268
Watertight (Bolt Down Lid)	Neenah Foundries	1916-F
	East Jordan Iron Works	1045ZPT
	Deeter Foundry	1247-B
Note: Minimum clear opening for manholes shall be 24 inches.		