

Town of Mead Design Standards and Construction Specifications

SECTION 33 33 00 SANITARY SEWERAGE UTILITIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Polyvinyl chloride (PVC) non-pressure pipe for gravity sanitary sewer with all jointing materials, fittings, and other appurtenances required for a complete installation
- B. Polyvinyl chloride (PVC) pressure pipe for sanitary sewer force main with all jointing materials, fittings, and other appurtenances required for a complete installation
- C. All precast manholes complete with steps, ring and cover as required

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. A48 – Standard Specification for Gray Iron Castings
 - 2. A126 – Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
 - 3. A185 – Standard Specification for Welded Steel Wire Fabric for Concrete Reinforcement
 - 4. A307 – Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength
 - 5. A615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
 - 6. C33 – Standard Specification for Concrete Aggregates
 - 7. C150 – Standard Specification for Portland Cement
 - 8. C443 – Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
 - 9. C478 – Standard Specification for Circular Precast Reinforced Concrete Manhole Sections
 - 10. C497 – Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile
 - 11. C913 – Standard Specification for Precast Concrete Water and Wastewater Structures
 - 12. C923 – Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals
 - 13. C1227 – Standard Specification for Precast Concrete Septic Tanks
 - 14. C1619 – Standard Specification for Elastomeric Seals for Joining Concrete
 - 15. C1821 – Standard Practice for Installation of Underground Circular Precast Manhole Structures
 - 16. D698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³))
 - 17. D1248 – Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable
 - 18. D1330 – Standard Specification for Rubber Sheet Gaskets
 - 19. D1351 – Standard Specification for Thermoplastic Polyethylene Insulation for Electrical Wire and Cable
 - 20. D1784 – Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC)

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21. D1785 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
 22. D2122 – Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings
 23. D2240 – Standard Test Method for Rubber Property – Durometer Hardness
 24. D2321 – Standard Specification for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
 25. D2466 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
 26. D2774 – Standard Specification for Underground Installation of Thermoplastic Pressure Piping
 27. D2837 – Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products
 28. D3034 – Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
 29. D3035 – Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter
 30. D3139 – Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
 31. D3212 – Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
 32. D3261 – Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
 33. D3350 – Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
 34. F412 – Standard Terminology Relating to Plastic Piping Systems
 35. F477 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
 36. F714 – Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter
 37. F679 – Standard Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
 38. F1055 – Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene and Crosslinked Polyethylene (PEX) Pipe and Tubing
 39. F2164 – Standard Specification for Field Leak Testing of Polyethylene (PE) and Crosslinked Polyethylene (PEX) Pressure Piping Systems Using Hydrostatic Pressure
- B. American Water Works Association (AWWA):
1. C104 – Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings
 2. C105 – Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems
 3. C111 – Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
 4. C115 – Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Grey-Iron Threaded Flanges
 5. C150 – Standard for Thickness Design of Ductile-Iron Pipe
 6. C151 – Standard for Ductile-Iron Pipe, Centrifugally Cast

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7. C504 – Standard for Rubber-Seated Butterfly Valves
 8. C512 – Standard for Air Release, Air/Vacuum, and Combination Air Valves for Water and Wastewater Service
 9. C600 – Standard for Installation of Ductile Iron Mains and Their Appurtenances
 10. C900 – Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution
 11. C905 – Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In. (350 mm Through 1,200 mm), for Water Transmission and Distribution
 12. M23 – PVC Pipe: Design and Installation
- C. Colorado Department of Transportation (CDOT)
- D. Occupational Safety and Health Administration (OSHA)
- E. National Association of Corrosion Engineers (NACE):
1. SP0169 – Control of External Corrosion on Underground or Submerged Metallic Piping Systems
 2. SP0286 – Electrical Isolation of Cathodically Protected Pipelines
- F. Plastics Pipe Institute (PPI):
1. TR-4 – HDB / HDS / SDB / PDB / MRS Ratings for Thermoplastic Piping Materials or Pipe
 2. TR-33 – Generic Butt Fusion Joining Procedure for Field Joining of Polyethylene Pipe
 3. Handbook of Polyethylene Pipe
 4. Polyethylene Piping Systems Field Manual for Municipal Water Applications
 5. Material Handling Guide

1.3 SUBMITTALS

- A. Product Data: Submit on all products or materials supplied herein.
- B. Shop Drawings: Provide piping layout and assembly drawings with fitting dimensions. Provide sufficient information to verify compliance with specifications.
- C. Shop Drawings and Product Data: Provide manufacturer's catalog information with dimensions, material and assembled weight.
1. Pipe materials
 2. Special, fitting, and coupling details
 3. Gasket materials
 4. Valves
 5. Laying and installation schedule
 6. For sewer rehabilitation work
 - a. Manufacturer
 - b. Sufficient data to verify compliance with the specifications and to illustrate construction and assembly of the products
 - c. Detailed specifications and data describing materials used
 - d. Indicate liner dimensions for each pipe size to be relined
 - e. Complete description of proposed wet-out procedures
 7. Specifications and data sheets

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- 8. Affidavits of compliance for protective shop coatings and linings
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements and applicable standards. Provide prior to shipment.
- E. Test Reports: Submit reports of field exfiltration/infiltration, mandrel and lamp tests.
- F. TV Inspection Files:
 - 1. Submit videos and reports
 - 2. For rehabilitation work, show cured liner, connections to mains, and reestablished service connections after relining work is complete

1.4 PROJECT RECORD DOCUMENTS

- A. Accurately record actual locations of piping mains, valves, connections, invert elevations, and any mapped or unmapped utilities.
- B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.
- C. Sewer Rehabilitation Work: Accurately record actual locations of piping mains, laterals, and services that include CIPP liner. Indicate pipe inverts and top of pipe elevations.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with the Town of Mead and CDPHE Stormwater and/or Groundwater Discharge Permit, notes on the drawings and as specified herein.
- B. Manufacturers shall be experienced in the design and manufacturing of materials specified herein for a minimum period of 5 years.
- C. All PVC pipe, regardless of diameter, shall be supplied by a single manufacturer. Fittings may be provided by another manufacturer.
- D. Perform Work in accordance with the Colorado Department of Public Health and Environment (CDPHE) and Weld County.
- E. Contractor shall conduct visual inspection before installation.
- F. Manufacturer's name and pressure rating shall be marked on piping and valves.
- G. Provide piping complete with all fittings, jointing materials, supports, joint restraint system, and necessary appurtenances for watertight, fully operational sewer lines.

1.6 REGULATORY REQUIREMENTS

- A. Conform to all municipal codes and ordinances, laws and regulations of Weld County, Town of Mead, CDPHE, the notes and details on the drawings and as specified herein, and CDPHE Stormwater Management and/or Construction Dewatering Permit.
- B. In case of apparent conflict, CDPHE requirements govern over these specifications.
- C. Contractor shall prepare, submit, pay, and otherwise obtain all necessary permits from all appropriate entities.

1.7 DELIVERY, STORAGE AND HANDLING

- A. During loading, transporting and unloading, exercise care to prevent damage to material
 - 1. Use nylon slings only
 - 2. Do not drop pipe or fittings
 - 3. Do not roll or skid against pipe already on ground
 - 4. Repair any damage done to coating or lining
 - 5. Handle per manufacturer's recommendations

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6. Store rubber gaskets in cool dark location
7. Store all material on wood pallets or timbers
- B. Shop coated materials shall be handled, transported, stored and shipped in a manner that will prevent damage to the coating and lining. Coating or lining damaged in handling or other operations shall be repaired to the approval of the Town.
- C. Any damage to the pipe or the protective coating from any cause during the installation of the pipeline shall be repaired in accordance with these Specifications.
- D. Pipe
 1. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
 2. PVC pipe has reduced flexibility and impact resistance as temperatures approach and drop below freezing. Extra care should be used in handling PVC pipe during cold weather.
 3. Do not store PVC pipe uncovered in direct UV light.
 4. Pipe stored along the trench side shall be suitably supported off the ground to avoid damage to the coating.
- E. Valves
 1. Prepare valves for shipping as follows:
 - a. Ensure that valves are dry and internally protected against rust and corrosion
 - b. Protect valves against damage to threaded ends, flange faces, and weld ends
 - c. Seal valve ends to prevent entry of foreign materials into valve body
 - d. Set valves in best position for handling
 - e. Set valves closed to prevent damage
 2. Deliver and store valves and accessories in shipping containers with labeling in place.
 3. Storage: Use the following precautions for valves during storage:
 - a. Do not remove end protectors unless necessary for inspection; then reinstall for storage
 - b. Protect valves from weather by storing indoors or support valves off ground or pavement in watertight enclosures when outdoor storage is necessary
- F. Precast Concrete Structures
 1. Transport and handle precast concrete units with equipment to protect from dirt and damage.
 2. Do not place precast concrete units in position which will cause damage.
 3. Handle precast concrete structures by means of lifting inserts. Do not move from manufacturer's yard until curing is complete.

1.8 JOB CONDITIONS

- A. All work which requires the interruption of active sanitary sewer service lines must be completed as quickly as possible in order to minimize inconvenience to customers and risk to the Town.
- B. Underground Obstructions
 1. Underground Obstructions known to Engineer are shown on approved drawings
 - a. Contractor shall field locate and verify all obstructions where or not shown on the Drawings.

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2. Notify each Utility Provider and request utility be field located by surface reference at least 48 hours prior to trenching or excavation.
3. Expose and verify size, location and elevation of underground utilities and other obstructions where conflicts might exist sufficiently in advance to permit changes in the event of a conflict.
 - a. Notify project's Engineer and the Town in case of a conflict.
 - b. In case of a conflict, the proposed work may be changed by Engineer and will require Town approval to modify approved drawings.
4. Maintain, protect, and support by shoring, bracing or other means existing utilities and appurtenances.

PART 2 PRODUCTS

2.1 PIPE, MANHOLES AND ACCESSORIES

- A. Comply with the Town of Mead Design Standards and Construction Specifications and standard details.
- B. Provide products in sizes and materials specified in approved drawings.

2.2 PVC GRAVITY SANITARY SEWER PIPE (NON-PRESSURE)

- A. The PVC piping shall be non-pressure PVC pipe for gravity sanitary sewer application of sizes indicated in the approved drawings.
- B. Pipe and fittings:
 1. ASTM D3034, T-1 wall, SDR 35, non-pressure pipe
 2. Cell classification: ASTM D1784
 3. Pipe length: 12-20 feet standard manufactured length for construction
- C. Joints: ASTM D3212 and F477 - Rubber gasket with one compression gasket ring, integral bell and spigot type
 1. Designed to hold pipe in alignment, provide flexibility, separate the ends of pipe lengths, resist applied earth pressures, and provide fluid tightness
 2. Rubber rings: ASTM F477

2.3 SOURCE QUALITY CONTROL

- A. Identification Marks: Clearly and permanently marked at not greater than 5-foot intervals with pipe diameter, PVC cell classification (if applicable), manufacturer, plant, shift, ASTM, date designations and service designation.
- B. Testing per ASTM D3034
 1. Test products not manufactured in the U.S. at an acceptable laboratory in the U.S.

2.4 PIPE ACCESSORIES

- A. Underground Type Plastic Line Marker
 1. Manufacturer's standard permanent, continuous-printed plastic tape with metallic core, intended for direct-burial service; not less than 6-inch wide x 4 mils thick. Provide green tape with black printing reading "CAUTION SANITARY SEWAGE LINE BURIED BELOW." Provide identification markers of one of the following:
 - a. Allen Systems, Inc.
 - b. Emed Co., Inc.
 - c. Seton Name Plate Corp.

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- d. Or accepted substitution
- B. Tracer Wire for Buried Pipe
 - 1. Provide tracer wire for all HDPE pipe and PVC pipe.
 - 2. All tracer wire shall be 12 AWG solid copper wire coated with 45 mil Type HMW - PE blue insulation compliant with ASTM D1351 specifically designed for direct burial in corrosive soil or water.
 - 3. UL listed
- C. Tracer Wire for Horizontal Directional Drilling
 - 1. Non-UL listed tracer wire specifically developed for Horizontal Directional Drilling application.
 - 2. 1/4-inch 304 Stainless Steel tracer wire
 - a. Performance Wire & Cable Inc.: "Tracer wire, Stranded SS /45 mil HMW-HDPE, 30 Volt, HDD direct bury use only"
 - 3. #12 AWG Solid Carbon Clad Steel Extra High Strength tracer wire
 - a. Copperhead Industries, LLC: "Direct Burial #12 AWG Solid (.0808" diameter), 21% conductivity copper-clad hard drawn high carbon steel extra high strength horizontal directional drill tracer wire, 1150# average tensile break load, 45 mil. high molecular weight-high density polyethylene jacket complying with ASTM D1248, 30 volt rating"
 - b. Pro-Line Safety Products Co.: "Pro-Trace HDD-CCS PE45"
- D. Tracer Wire Test Stations
 - 1. 4-inch with locking lid
 - 2. Manufacturers:
 - a. CP Test Services
 - b. Glenn Series "Glenn-4"
 - c. Or accepted substitution
- E. Corrosion Control
 - 1. Rust inhibitive primer:
 - a. Tnemec "Series 77H Chem-Prime"
 - b. Or accepted substitution
 - 2. Rust preventative compound:
 - a. Houghton "Rust Veto 344"
 - b. Rust-Oleum "R-9"
 - c. Or accepted substitution

2.5 AIR RELEASE AND VACUUM BREAKER COMBINATION VALVES

- A. Manufacturers:
 - 1. Val-Matic "Model 801A"
 - 2. Dezurik/APCO "Series 440 SCAV"
 - 3. Or accepted substitution
- B. Provide combination air release and vacuum breaker valves as indicated on Drawings.
 - 1. Provide single body type that functions as both an air release and a vacuum breaker valve.
 - 2. Valves shall be manufactured and tested in accordance with AWWA C512.

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3. Provide a shutoff valve and transition piece from HDPE to NPT threaded connection on valve.
 - a. Ball valve: compatible with butt fusion, HDPE fitting
- C. General
 1. Usage: Recommended for service up to a pressure rating indicated by approved drawings
 2. Bodies and covers:
 - a. Gray iron meeting requirements of ASTM A126 Class B
 - b. Globe style of 1-inch valves to increase float clearance and reduce clogging
 3. Exterior coating: universal alkyd primer
 4. Valve cleanout: 2" NPT
 5. Valve drain connection: 1" NPT
 6. Inlet and Outlet:
 - a. Inlet: NPT, 2-inch on 1-inch valves
 - b. Outlet: NPT equal to valve size, 1-inch
 7. Internals:
 - a. Metal internal parts only
 - b. Float sensitive skirt provided
 - c. Float, plug, guide shafts, and bushings: Type 316 stainless steel
 - d. Resilient seats: Buna-N

2.6 ECCENTRIC PLUG VALVES

- A. Manufacturers:
 1. DeZurik
 2. Henry Pratt Company
 3. Milliken
 4. Val-Matic Valve and Manufacturing Corporation
 5. Or accepted substitution
- B. Provide plug valves as indicated on approved drawings.
- C. General
 1. Quarter-turn non-lubricated eccentric plug valves
 2. Resilient faced plug
 3. Valves with vane type seat rings are not acceptable
 4. Valve ends to match connecting piping
 - a. Buried: Mechanical joint, ANSI A21.11/AWWA C111
 - b. Flanged: 125 lb, ANSI B16.1
 - c. Screwed valve ends shall be to the NPT standard
 5. Minimum Working Pressure Rating:
 - a. 175 psi
 6. Opening motion eccentric, lifting plug away from body seat
 7. Valve alignment

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- a. Valve shall be installed so that the plug is horizontal and rotates upward as the valve opens.
 - b. Valve shall be installed with seat on low pressure side of valve.
 8. Provided with fully adjustable plug position stops.
 9. Plugs shall be eccentric type with no backing ring or frame.
 10. Valve body cavity shall be smooth without protrusions or baffles.
 11. Valve body plainly marked to indicate seat end
 12. Valve packing adjustment accessible without removing actuator from valve
- D. Valve Materials
1. Plug and body: Cast iron, ASTM A126, Class B
 2. Resilient plug facing or replaceable style body seats shall be synthetic rubber, neoprene, or Buna N compound suitable for use with water and wastewater applications
 3. Seat rings shall be threaded, or welded of corrosion-resistant stainless steel (18-8), nickel, or Monel conforming to AWWA C504
 4. Sprayed or plated mating seat surfaces are not acceptable.
 5. Bearings shall be replaceable. Sleeve type and thrust bearings in the upper and lower journals shall be corrosion-resistant stainless steel or bronze.
 6. Shaft seals shall be multiple O-ring, self-adjusting U-cup or chevron type packing conforming to AWWA C504
 7. Pull-down packing is not acceptable.
 8. Shaft seals shall be field adjustable or replaceable without valve disassembly.
 9. Plug seat: Chloroprene (Neoprene)
 10. Packing: Acrylonitrile Butadiene V-Type Cup
 - a. Dual U-cup
 11. Upper thrust bearing: TFE
 12. Body seat: Welded-in overlay seat of no less than 90% nickel
 13. Upper and lower trunnion bearings: Sleeve type, 18-8 stainless steel
 14. Valves complete with epoxy coating on the interior and exterior, manufacturer's standard corrosion resistant coating shall be acceptable
- E. Testing
1. Valves shall be capable of drip-tight shut-off up to the full leak test rating.
 - a. Test and certify pressure capacity in the reverse direction.

2.7 MANHOLES

- A. Precast Concrete Units:
1. Manufacturers:
 - a. Rinker Materials
 - b. Old Castle Precast
 - c. Or accepted substitution
 2. Specification: ASTM C478
 3. Minimum wall thickness: greater of 6 inches or 1/12 of internal diameter

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4. Reinforced
5. Grade rings as required
- B. Precast Units or Cast-in-place: Use concrete that will attain a 28-day compressive strength of not less than 4,000 psi with a cement content of not less than 6 sacks per cu. yd. Openings to be precast per plan. Sawcut in field only if no other option.
- C. Manhole Steps:
 1. Steel bar, ½-inch Grade 60, drop-front type, with polypropylene coating applied by manufacturer, Type MA Industries, Inc. "PS2-PF," or,
 2. Aluminum, drop-front type with polypropylene coating applied by manufacturer, Type MA Industries Inc. "PS2-PF" or approved substitution or approved substitution

2.8 FABRICATION

- A. Vault/Manhole Sections
 1. Precast concrete dimensions as shown on plans
 2. Minimum manhole inside diameter: 48 inches
 3. Precast lid and Cones: Same or greater reinforcement and wall thickness as vault or manhole section with capability for H20 loading
 4. Vault Joints: Shiplap or tongue and groove with double mastic gaskets, each joint to set equally and tightly
 5. Manhole Joints: Keylock type with double mastic gaskets, each joint to set equally and tightly
 6. Access opening: Minimum 24 clear or as indicated
 7. Pipe connection: As indicated on Drawings
 8. Pipe knockout: As indicated on Drawings
 9. Cast-in-place base
 10. Manhole steps: 12 inches on center, vertical alignment above largest bench or open area
- B. Grating and Metal Frame: As specified on drawings

2.9 ACCESSORIES

- A. Plugs and Caps: Use pipe plugs or caps provided by the pipe manufacturer and approved by the Town Engineer/Inspector for pipe stub-outs.
- B. Cleanouts: Provide as indicated, pipe extension to grade with ferrule and countersink cleanout plug. Provide round cast-iron access frame over cleanout, with heavy duty secured scoriated cover with lifting device cast with the word "SANITARY".
- C. Reinforcement:
 1. Reinforcing Steel: ASTM A615 Grade 60
 2. Welded Wire Fabric: ASTM A185
- D. Concrete:
 1. Minimum compressive strength: 4,500 psi at 28 days
 2. Cement: ASTM C150, Portland Cement, Type II
 3. Aggregates: ASTM C33, free of deleterious substances
- E. Gaskets and Plastic Sealing Compound:

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1. Mastic:
 - a. Approved sealant manufacturers:
 - i. "Rub'r-Nek", K.T. Snyder Co.
 - ii. "Kent Seal", Hamilton-Kent Manufacturing Co.
 - iii. GS #79, 44, or 4, General Sealants
 - iv. ConSeal, CS202
 - v. Or accepted substitution
 - vi. "Ram-Nek" is not acceptable
 2. Rubber: Neoprene, 40±5 hardness when measured by ASTM D2240, Type A durometer
 3. Compression Gaskets: ASTM C443
 4. Boot Connectors: ASTM C923
 - a. Flexible rubber boots shall provide a watertight seal between the pipe and concrete structure.
 - b. Z-LOK connector by A-LOK Products, Inc. or approved substitution
- F. Frames and Castings: ASTM A48 with asphalt varnish coating hot dip applied at foundry, 6 mils thick Class 30b
- G. Manhole Rings and Covers
 1. Cast iron, heavy duty traffic type, ASTM A48, Class 35B. Grind bearing surfaces to ensure flat, true surfaces
 2. Covers to seat at all points on ring
 3. Lids
 - a. All sanitary sewer lids shall be forged with the following: "Town of Mead Sanitary Sewer". Sewer manhole lids must be Denver Pick slot style model #1156 manufactured by Deeter Foundry or A-1480 by D&L Foundry.
 - b. Rings and covers shall be cast-iron. Manhole rings and covers shall be twenty-six (26) inch diameter manholes.
 - c. Surface patterns in the lids shall be drivable and per detail. Checker patterns or other textured patterns are not allowed.
 4. Provide type as indicated on the drawings
- H. Manhole Height Adjustment: Use precast concrete grade rings
- I. Rock Subbase: 1-1/2 -inch minus, well-graded gravel over compacted subgrade
- J. Water: Clean and free of deleterious substances

2.10 GROUT MANUFACTURERS

- A. Non-Shrink, Non-Metallic Grout
 1. Master Builders: Masterflow 928
 2. Burke: Non-Ferrous Non-Shrink
 3. M.R. Meadows: Sealtight 588
 4. Sonneborn: Sonogrout G.P.
 5. Tamms: Tammsgrout 621
 6. Sika: SikaGrout 212
 7. Or accepted substitution

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- B. Epoxy Grout
 - 1. Burke: BurkEpoxy Anchoring Grout
 - 2. L&M Inc.: EpogROUT
 - 3. Sika: Sikadur 42, Grout Pack
 - 4. Or accepted substitution

2.11 SOIL MATERIALS

- A. Furnish pipe bedding and cover as specified in Section 31 00 00 – Earthwork

2.12 TAP SADDLE MANUFACTURERS

- A. Fernco, Inc., Flexible Tab Saddle
- B. T-FLEX, Sewer Saddle
- C. Indiana Seal, Flexible Service Saddle
- D. Or accepted substitution

PART 3 EXECUTION

3.1 INSPECTION

- A. Examine pipe and fittings and do not use individual sections containing cracks, dents, abrasions, and other defects

3.2 INSTALLATION OF PVC GRAVITY SANITARY SEWER PIPE (NON-PRESSURE)

- A. Trenching, Pipe Embedment, Backfill, and Compaction: See Section 31 00 00 - Earthwork
- B. Install pipe in accordance with ASTM D2321 as modified herein or on the drawings.
- C. Cutting
 - 1. Cut and bevel ends in accordance with manufacturer's standard recommendations.
 - 2. Machine cut ends smooth and square to proper dimensions.
 - 3. Do not cut with a cold chisel, iron pipe cutter, flame or any other method that may fracture the pipe or leave ragged, uneven edges.
 - 4. Remove burrs and wipe off all dust and dirt from jointing surfaces.
- D. Pipe Laying
 - 1. Inspect pipe and accessories for cracks and other defects before lowering into trench.
 - 2. Replace any defective, damaged or unsound pipe.
 - 3. Remove all dirt and foreign material from the inside of pipe before laying.
 - 4. Check bedding for firmness and uniformity of surface immediately before laying each section of pipe.
 - 5. Carefully lower pipe, fittings, valves, and accessories into the trench with derricks, ropes, and other suitable equipment to prevent damage.
 - 6. Do not dump or drop pipe or accessories into trench.
 - 7. Lay to lines and grades indicated on drawings or as specified.
 - a. Lay piping beginning at a low point of system, true to line and grade with unbroken continuity of invert.
 - b. Closely joint to form a smooth flow line.
 - c. Place bell end or groove ends of piping facing upstream.

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- d. Maximum length of pipe that can be used without exceeding the allowable deflection at a coupling shall be determined.
 8. Utilize implements, tools, and facilities as recommended by the manufacturer.
 9. Keep pipe clean during and after laying.
 10. Close all open ends with watertight expandable type sewer plugs or test plugs.
 11. Remove and relay any pipe which has floated.
 12. Do not lay pipe when:
 - a. There is water in the trench
 - b. Trench conditions are unsuitable
 - c. Weather conditions are unsuitable
 13. Use acceptable adaptors at manhole and structure connections to provide a watertight seal.
 14. Protect from lateral displacement by placing and compacting bedding material under provisions of Section 31 00 00 – Earthwork.
- E. Jointing
1. Assemble in accordance with the manufacturer's instructions.
 2. Wipe clean pipe ends, gasket and gasket groove before inserting gasket.
 3. Apply lubricant furnished by the pipe manufacturer to the gasket and the outside of the spigot end.
 4. Insert the spigot end to the reference mark.
- F. Fittings
1. Install utilizing standard methods.
 2. Lower into trench with rope or other means to prevent damage.
 3. Attach rope around the exterior.
 4. Do not attach rope through the interior.
 5. Carefully connect to pipe or other facility.
 6. Check joint to insure a sound and proper joint.
- G. Water Line and Sanitary Sewer Crossings
1. Whenever possible lay water mains over sanitary sewers to provide vertical separation of at least 18-inches between invert of water main and crown of sewer.
 2. If above separation cannot be met, provide one continuous length of watertight sewer pipe 20 feet long centered on water main with joints between different pipes encased in 6-inch minimum of concrete and extending 6-inches either side of joint or encase sewer pipe in 6-inches of concrete completely around pipe, for not less than 10 feet either side of water main.
 3. Water Mains Passing Under Sewers: If vertical separation less than 18-inches provide structural support for sewer.

3.3 MANHOLE PREPARATION

- A. Verify items provided by other section of Work are properly sized and located.
- B. Verify that built-in items are in proper location, ready for roughing into Work.
- C. Verify excavation for manholes is correct

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- D. Excavation, Backfill, Subgrade Compaction: Refer to Section 31 00 00 – Earthwork for requirements
- E. Rock Subbase
 - 1. Remove water and place to a 6-inch minimum depth.
 - 2. Vibrate for compaction.
 - 3. Level top to accept precast sections with uniform bearing all around.
 - 4. If material below vault is unsuitable, excavate as directed by the project's Engineer or Geotechnical Engineer and backfill to grade with 1-1/2 inch minus rock and compact.

3.4 PLACING MANHOLE

- A. Place manhole sections plumb and level. If not level, remove and re-level the grade.
- B. Clean ends of sections and place double mastic gasket.
- C. Set cover rings and covers level without tipping, to correct elevations or set cover rings and covers with slight tip to match cross slope of finished surface.
- D. Completed manholes shall be rigid and watertight.
- E. Coordinate with other sections of work to provide correct size, shape, and location.
- F. For cast-in-place:
 - 1. Place base pad, trowel top surface level to accept manhole section with uniform bearing all around
 - 2. Place sufficient non-shrink grout on base to ensure watertight fit between first manhole section and base of place first manhole section directly in wet concrete

3.5 PREFORMED GASKETS

- A. Remove and replace manhole sections which have chipped or cracked joints.
- B. Thoroughly clean section joints.
- C. Install gasket type in conformance with precast structure manufacturer's recommendation.
- D. Install gasket in conformance with manufacturer's recommendations.
- E. Only use primer furnished by gasket manufacturer.

3.6 MANHOLE INVERT

- A. Place concrete in bottom of manhole and form smooth transition. Trowel smooth and brush for non-skid finish. Slope bench ½-inch per foot for drainage to invert.
- B. Invert shape to conform to radius of pipe it connects.
- C. Remove all rough sections or sharp edges which tend to obstruct flow or cause material to snag. Remove all grout droplets from invert.
- D. Construct in conformance with standard drawings.

3.7 MANHOLE RINGS AND COVERS

- A. Place rings in bed of non-shrink grout on top of manholes.
- B. Ensure no infiltration will enter manhole at this location.
- C. Carry non-shrink grout over flange of ring.
- D. Set top of ring flush with all surfaces subject to foot and vehicular traffic or as required by approved drawings.
- E. Set manhole ring and cover 1/4-inch to 1/2-inch below roadway surface.

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- F. Use precast grade rings for height adjustment of manhole ring and cover.

3.8 CONNECTION TO EXISTING MANHOLES

- A. Maintain flow at all times.
- B. Prior approval of proposed method for maintaining flow must be obtained from the Town.
- C. Cover area around new pipe with non-shrink grout and or waterstop gasket to ensure a watertight structure.
- D. Make connection during low flow periods.
- E. The contractor shall core drill the existing manhole as necessary to insert a "Kor-N-Seal or approved gasket and new sewer pipe.
- F. The existing concrete foundation bench shall be ground to the cross-section of the new pipe in order to form a smooth, continuous invert similar to what would be formed in a new concrete base. Portland cement grout shall be used as necessary to smoothly finish the new invert.

3.9 NEW MANHOLE CONNECTIONS TO ACTIVE SEWER LINES

- A. When connecting to an active line, the connecting manhole shall be poured in place, Class "B" 4,500 psi concrete with a minimum thickness of eight inches (8) below the flow line of the pipe and four inches (4) above the crown is required.
- B. Manhole inverts shall be formed to the full diameter of the pipe to insure full and unobstructed flow. Each pipe must extend no more than four (4) inches into the manhole wall to a formed concrete invert.
- C. Pre-cast bases may be used when specifically authorized by the Town. Pipes extended through manholes and cut to form an invert are not acceptable without prior written permission from the Town.

3.10 FIELD QUALITY CONTROL – GENERAL TESTING REQUIREMENTS

- A. Testing shall be accomplished through a combination of visual inspections, deflection tests, low-pressure air tests, and leakage test methods.
- B. Sanitary sewer pipe and appurtenances shall be cleaned and tested after backfill operations have been completed and acceptable compaction test results have been submitted to the Town Engineer. All testing shall be completed and approved by the Town prior to placement of permanent resurfacing.
- C. All testing shall be witnessed by the Town Engineer. The Contractor shall provide a minimum of 48 hours' notice to Town Engineer prior to testing. Tests performed in the absence of the Town's representative shall be considered invalid and shall be repeated at the Contractor's expense.
- D. The Contractor shall provide the Town a final report of all testing completed.
- E. New sanitary sewer installations shall be televised and as-built shots taken to verify design slope requirements by the Contractor after backfill operations have been completed. The results of the inspection and video shall be submitted to the Town Engineer for approval. Digital video files to be provided with reach noted, footage, inverts, and manhole number at each end, and pipe size and type. Water line installation may not begin until acceptable televised testing video and as-built shots have been submitted and reviewed by the Town.
- F. The Contractor shall have sewers jet washed on new installation prior to the initial television inspection. Debris resulting from the cleaning shall be removed before entering the Town's existing sewer, by either some type of plug or elbow to catch debris. Material shall be removed from the site and disposed of by the Contractor. If on the initial television inspection, the cleaning is unsatisfactory and prevents the television inspection from being completed, the Contractor shall reclean the sewer and shall be responsible for costs incurred by a second television inspection.

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- G. Any damages to the pipe caused by cleaning or testing operations shall be repaired or replaced by the Contractor at their own expense. Should the pipe fail to meet the requirements of the low-pressure air test or infiltration of ground water is noted, the Contractor shall determine the source or sources of the leakage and shall replace defective materials or workmanship. Replacement of defective materials or workmanship as above noted shall be the financial responsibility of the Contractor. Pipe which fails to meet these requirements shall be repaired or replaced and retested in accordance with these requirements.
- H. New sanitary sewer installations may also be televised by the Town for initial acceptance after the installation, cleaning, testing, and final lift of asphalt are complete. Inspection reports and videos shall be available for review by the Responsible Party. The Responsible Party shall be responsible for any repairs or replacement of any portions of the pipeline that are determined defective by the television inspections.
- I. Prior to the final acceptance there may be another television inspection performed by the Town. If there are any discrepancies, a punch list shall be formulated and sent to the Responsible Party. Any discrepancies must be repaired prior to final acceptance being granted.

3.11 PIPE TESTING

A. Low Pressure Air Test

1. The Contractor shall perform a low-pressure air test on each reach of sanitary sewer pipe between manholes. The low-pressure air test shall be required on the entire length of pipe installations. The test shall conform to the recommended practice and calculations established by the ASTM C-828.
2. Pipe outlets shall be plugged with suitable test plugs. Pipe may be tested without pre-wetting. If the pipeline to be tested is submerged in groundwater, the Responsible Party shall determine the groundwater elevation at the test location and provide it to the Town Engineer. The backpressure on the pipe due to groundwater shall be determined and the internal pipeline test pressure shall be established at 4.0 psi (gauge) in excess thereof. Add air slowly to the portions of the pipe being tested. After the pipe has been filled to the required pressure, allow at least two (2) minutes for the air-temperature to stabilize, adding only the amount of air necessary to maintain the test pressure. After the two (2) minute period, disconnect the air supply and allow the initial pressure to drop to 3.5 psi (gauge) in excess of the groundwater back pressure.
3. The time interval required for the sewer internal pressure to drop from 3.5 psi (gauge) to 2.5 psi (gauge) above the excess of ground water backpressure shall be measured and recorded.
4. The basis for acceptance of the air test shall be the minimum time required for the internal pressure to drop 1.0 psi (gauge). The calculations generated by ASTM C-828 shall then be used to check the adequacy of the pipe installation. The minimum allowable time in seconds shall be in accordance with the following tables. The minimum allowable pressure drop time is computed based upon an allowable leakage rate not to exceed 0.003 cfm per square foot of internal pipe surface. Sewers 15 inches in diameter and smaller shall be tested from manhole to manhole. Sewers 18 inches in diameter and larger shall be tested in lengths such that the total loss is no less than two (2) cfm when computed using an allowable rate of 0.003 cfm per square foot of internal surface.
5. Minimum allowable pressure drop times for pipe 15 inches in diameter and smaller (in seconds) per table below:

Pipe Diameter (Inches)	Length of Pipe Being Tested (Feet)			
	100'	200'	300'	400'
8"	38	76	114	152
10"	47	94	141	188

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12"	56	113	170	226
15"	71	141	212	283

6. Minimum allowable pressure drop times for pipe 18 inches in diameter and larger (in seconds) per table below:

Pipe Diameter (inches)	Length of Pipe Being Tested (feet)					Maximum Testing Length (feet)
	25'	50'	75'	100'	126'	
18"	21	42	64	85	106	140
21"	25	50	74	99		120
24"	28	56	85	113		106
27"	32	64	95			94
30"	35	71	106			84
36"	42	85				70

The minimum allowable pressure drop time when using the maximum testing length is 120 seconds.

7. Sewers 36 inches in diameter shall be tested one (1) joint at a time.
8. The Responsible Party shall follow precautions necessary to perform a safe and successful test. Plugs used to isolate the line for the air test must be securely braced to avoid the unintentional release of the plug. Gauges, air piping manifolds, and control valves shall be located above ground. No one shall be permitted to enter a manhole when a plugged pipe is under pressure. Air testing apparatus shall be equipped with a pressure relief device designed to relieve the pressure when in excess of six (6) psi (gauge).

B. Exfiltration Test

1. Contractor shall perform an exfiltration test on each reach of sanitary service and sanitary sewer pipe between manholes or discharge.
 - a. Test the first reach prior to backfilling and before installing any of the remaining pipe.
2. Procedure
 - a. Block off all manhole openings except those connecting with the reach under test.
 - b. Fill the line:
 - i. Average depth: 10 feet above invert except as required by manhole depth
 - ii. Maximum depth at lower end: 25 feet above crown
 - iii. Minimum depth at upper end: 5 feet above crown
 - c. Add and measure water as required to maintain a constant level
 - i. Air pocket entrapment shall be avoided when filling the line with water. Once filled with water, the system shall be allowed to stabilize for a period of one or two hours before starting the test.
 - ii. Maximum exfiltration/infiltration: 0.039 gallons per inch of nominal diameter per hour per 100 feet of pipe.
 - iii. For the purposes of exfiltration leakage, manholes shall be considered to be concrete pipe of the same diameter as the manhole i.e. 48, 60 or 72-inch diameter.
 - iv. Maintain test for a minimum of 2 hours or as long as necessary, to locate all leaks.
3. Repair and retest any reach which exceeds the allowable exfiltration/infiltration

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- a. If excessive ground water is encountered during construction of a sanitary sewer section or as requested by the Town Engineer, the infiltration test for leakage shall be used.
 - b. Maximum infiltration: 0.039 gallons per inch of nominal diameter per hour per 100 feet of pipe.
4. Repair and retest any reach which exceeds the allowable infiltration.
- C. Infiltration
1. If excessive ground water is encountered during construction of a sanitary sewer section or as requested by the Town Engineer, the infiltration test for leakage shall be used.
 2. Maximum infiltration: 0.039 gallons per inch of nominal diameter per hour per 100 feet of pipe.
 3. Repair and retest any reach which exceeds the allowable infiltration
- D. Pipe Deflection Test
1. Pipe deflection test shall be completed if video inspection shows defects or as required by the Town Engineer.
 2. No sooner than 30 days after placement and compaction of backfill, but prior to placement of permanent surface materials, clean and mandrel each line to detect obstructions (deflections, joint offsets, lateral pipe intrusions, etc.).
 3. Use a rigid mandrel with diameter of at least 95 percent of the pipes specified average inside diameter and a length of the mandrel circular portion at least equal to the nominal pipe diameter.
 4. Maximum allowable deflection is 5 percent of the base internal diameter. Mandrel outside diameters in inches are as follows:
- | Pipe Size | Base I.D. | Mandrel O.D. |
|-----------|-----------|--------------|
| 6 | 5.792 | 5.50 |
| 8 | 7.764 | 7.38 |
| 10 | 9.711 | 9.23 |
| 12 | 11.558 | 10.98 |
5. Pull the mandrel through the pipe by hand.
 6. Relay or replace all pipe exceeding the 5 percent deflection.
 7. Retest repaired sections.
 8. Maximum allowable deflection at end of one year correction period, 7-1/2 percent of the base internal diameter tested in the same manner. Uncover and repair sections exceeding the allowable deflection.
- E. TV Inspection shall be provided as requested by the Town. Digital video files to be provided with reach noted, footage, inverts, and manhole number at each end, and pipe size and type.
- F. All sewer lines shall be inspected visually to verify accuracy of alignment and freedom from debris and obstructions. The full diameter of the pipe should be visible when viewed between consecutive manholes. The method of test can be photography, closed circuit television or visually lamping with mirrors and lights.
- G. Lamp Test
1. Each section between manholes will be lamped by Contractor in the presence of the Town Engineer if requested.

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2. A true circle will be required in the lamp tests to indicate a properly constructed sewer line.
3. Repair any sections not passing the lamp test at Contractor's expense.

3.12 MANHOLE TESTING

A. Test all manholes:

1. Vacuum test:
 - a. Plug all inlets and outlets in such a manner as to prevent displacement of plugs.
 - b. Install and operate vacuum tester head assembly in accordance with equipment specifications and manufacturer instructions.
 - c. Attach the vacuum pump assembly to the proper connection on the test head assembly. Ensure that vacuum inlet/outlet valve is closed.
 - d. Inflate sealing element to twice the pressure test to be used. Do not over inflate.
 - e. Start vacuum pump assembly engine and allow preset RPM to stabilize.
 - f. Open vacuum inlet/outlet valve and evacuate manhole to 5-inches Hg (mercury).
 - g. Close vacuum inlet/outlet valve, disconnect vacuum pump and monitor vacuum.
 - h. Record time for vacuum to drop from initial 5 inches Hg to 4 inches Hg.
 - i. Acceptance for manholes when the time to drop from 5 inches Hg to 4 inches Hg meets or exceeds requirements as defined below:

Maximum Allowable Vacuum Drop			
Manhole Depth - Rim to Invert	Manhole Diameter (in)		
	48"	60"	72"
	Vacuum Testing Durations (s)		
8"	20	26	33
10"	25	33	41
12"	30	39	49
14"	35	46	57
16"	40	52	67
18"	45	59	73
20"	50	65	81
22"	55	72	89
24"	59	78	97
26"	64	85	105
28"	69	91	113
30"	74	98	121

- j. Repair all manholes that fail leakage test and retest until manhole passes test.
 - k. If joint mastic or gasket is displaced during vacuum test, disassemble manhole and replace seal.
 - l. If the manhole fails the initial test, necessary repairs should be made with a non-shrink grout. Repairs and retesting shall proceed until a satisfactory test is obtained.
2. All testing shall be witnessed by the Town Engineer or Town Inspector. Contractor shall provide a minimum of 48-hour notice prior to testing.

3.13 TRACER WIRE TESTING

The Contractor shall provide test report for tracer wire continuity.

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3.14 CLEANUP AND RESTORATION

- A. Restore pavements, curbs and gutters, utilities, and other improvements to condition equal to or better than before work began and to satisfaction of the Town.
- B. Deposit waste material in designated waste areas and disposal site graded and shaped.

3.15 FINAL ACCEPTANCE

- A. The inside of all pipe, valves, and fittings shall be smooth, clean, and free from blisters, loose mill scale, sand, and dirt when connected.
 - 1. Wire brush, if necessary, wipe clean and keep joint contact surfaces clean until connection is complete.
- B. Provide record drawings with manhole number, inverts, and location (x, y, z) for each service connection.
- C. Provide test report for tracer wire continuity.
- D. Provide pipe and manhole tests and results.
- E. Provide video files of TV inspection on a DVD.

END OF SECTION 33 33 00