

SECTION 02630
STORM DRAINAGE

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Work for each system includes design and placement of systems, connections to existing work, required components, related earthwork, structures, concrete work and testing necessary to provide complete, functioning systems.

- B. Related Work Specified In Other Sections:
 - 1. Site Demolition - Division 2.
 - 2. Earthwork other than that specified in this Section – Division 2.
 - 3. Utility Services - Division 2.
 - 4. Cast-In-Place Concrete other than that specified in this Section – Division 3
 - 5. Miscellaneous Metal Fabrications - Division 5.
 - 6. Riprap. Refer to Division 2, Soils and Aggregates.

- C. Related Work Performed Under Other Contracts

1.2 SYSTEM DESCRIPTION

- A. Storm Drainage (ST)
 - 1. Type CISP, Cast Iron Soil Pipe where shown. Type PVC-PSM, Polyvinyl Chloride Sewer Pipe from 5 feet outside building perimeter for piping under 12 inches except as shown. Type RCP, Reinforced Concrete Pipe from 5 feet outside building perimeter for piping 12 inches and larger except as shown. type CSP, Corrugated Steel Pipe or type CSP-SD Corrugated Steel Slotted Drain Pipe where shown.

- B. Underdrain
 - 1. Type CSPU, Corrugated (Perforated) Steel Pipe.
 - 2. Type CPEU, Corrugated (Perforated) Polyethylene Pipe.
 - 3. Provide where shown.

1.3 SUBMITTALS

- A. Furnish submittals for items that are identified in this Section by different typeface and bracketed code (e.g., *Item [L]*). Refer to Division 1 General Requirements for definition of codes for types of submittals and administrative requirements governing submittal procedure. Additional submittal requirements pertaining to this Section are specified under this Article.

- B. *Product [P]*: Include materials and equipment classification and identification, required supports, and special installation requirements.

- C. Submittals: Submit typical precast components for underground structures; do not submit specific configurations of each structure.
- D. *Test Reports [T]*: Test reports: Submit structural integrity, leakage and performance test data.
- E. Record: Submit progress prints and as-built drawings per Division 1 General Requirements.
- F. Record: Pipe camera inspection video: Inspect 20 percent of pipe runs (rounded up) but no less than 2.

1.4 QUALITY ASSURANCE

- A. Reference Specifications:
 - 1. Geotechnical Data.
 - 2. Submittals – Division 1 General Requirements.
 - 3. Soils and Aggregates – Division 2.
 - 4. Earthwork – Division 2.
- B. Requirements Of Regulatory Agencies

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store and protect plastic pipe to prevent ultraviolet deterioration and to minimize bowing.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Ells, tees, reducing tees, wyes, couplings, increasers, crosses, transitions and end caps shall be of same Type and Class of materials as pipe, or of material having equal strength and chemical resistance properties.
- B. Type CISP, Cast Iron Soil Pipe
 - 1. Hub and spigot: Per ASTM A 74, “Standard Specification for Cast Iron Soil Pipe and Fittings”, coated inside and outside with coal tar enamel. Pipe with eccentrically cast, thin walls will not be accepted.
 - 2. Elastomer gaskets. Single pipe weight use, per ASTM C 564, “Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings”.
- C. Type RCP, Reinforced Concrete Pipe
 - 1. Pipe and fittings: Include precast end sections, modified tongue and groove joints, per ASTM C 76, “Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe”, Class III or as shown. Stencil class identification inside bore of pipe and fittings. Elliptical reinforcement in circular pipe is not acceptable.

2. Compression elastomer joints. Per ASTM C 443, "Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets". Provide neoprene elastomer for services related to building drainage.
- D. Type PVCU, Perforated Polyvinyl Chloride Pipe
1. Perforated, polyvinyl chloride pipe: Manufacturer's standard construction, per ASTM F-758, "Standard Specification for Smooth-Wall Poly(Vinyl Chloride) (PVC) Plastic Underdrain Systems for Highway, Airport, and Similar Drainage".
- E. Type PVC-PSM, Polyvinyl Chloride Sewer Pipe
1. Pipe, fittings and jointing materials: Per ASTM D 3034, "Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings", SDR 35 with elastomer gasket joint.
- F. Piping Transitions
1. Transitions. Provide for joining different types of pipe materials for joining different pipe sizes, and for joining cut pipe, where approved. Fabricate transitions with materials capable of resisting normal corrosion.
 - a. Can-Tex Industries Division of Harsco Corp. "CT-Adapters".
 - b. Fernco Joint Sealer Co. "PVC Donut".
 - c. Joints, Inc. "Caulder".

2.2 MANUFACTURED UNITS

- A. CASTINGS
- B. Shop coat ferrous metal surfaces with "Bituminous Coating", except where other equivalent types of protective coatings are manufacturer's standard. Provide each manhole cover with lettering identifying respective service: "Storm".
- C. Storm manhole frame and cover:
1. Neenah R-1642 with Type B solid cover.
 2. East Jordan Iron Works No. 1040 with Type A solid cover.
- D. Catch basin and inlet frame and grate:
1. Neenah R-3448-B with Type S grate.
 2. East Jordan Iron Works No. 5000 with Type M1 grate.
- E. Catch basin, inlet and storm manhole frame and grate:
1. East Jordan Iron Works No. 1040 with Type M1 grate.
 2. Neenah No. R-2501 with Type G grate.
- F. Manhole steps:
1. Ductile iron, 16 inches wide.
 - a. Neenah R-1980-M.
 2. Stainless steel per local code and OSHA requirements.

3. Formed steel with plastic jacketed exposed surfaces per local code and OSHA requirements.
4. Fiberglass reinforced plastic per local code and OSHA requirements.

G. Wall Pipes

1. Cast iron. Class D, bell and flange or flange and plain end.
 - a. Clow F-1424 or F-1426.
 - b. American Cast Iron Pipe.
 - c. United States Pipe & Foundry Co.

H. UNDERGROUND PRECAST STRUCTURES

1. General. Use HS-20 live load for design purposes.
2. Precast:
 - a. Riser Sections. ASTM C 478, "Standard Specification for Precast Reinforced Concrete Manhole Sections", with factory formed openings and installed steps.
 - b. Compression Elastomer Joints. ASTM C 443, "Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets".
 - c. Base. ASTM C 478, "Standard Specification for Precast Reinforced Concrete Manhole Sections".
 - d. Flat Slab. ASTM C 478, "Standard Specification for Precast Reinforced Concrete Manhole Sections".
 - e. Manhole Tee Section. ASTM C 76, "Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe", Class IV minimum (Class V if required to match adjacent pipe) with joints to match adjacent pipe.

2.3 COMPONENTS

A. Masonry:

1. Brick. Type MB per ASTM C 32, "Standard Specification for Sewer and Manhole Brick (Made From Clay or Shale)", Grade MS.
2. Block. Type CMU per ASTM C 139, "Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes", formed units to structure diameter with cones battered vertically and curved horizontally if circular.

B. Leveling Course:

1. 1:10 ratio cement/sand dry mixture.

C. Plaster Coating:

1. Cement plaster coating 1/2 inch thick.

D. Pipe:

E. Flexible joint material for use at joint between pipe and manhole.

1. Res-Seal
2. Link-Seal
3. Press Wedge II

- F. Trench drain system:
1. Provide precast polymer concrete pre-sloped trench drainage system complete with heavy duty slotted cast iron gratings, grating locking device, catch basins with trash bucket and outlets as shown on Drawings. Components to be product of one manufacturer.
 - a. Aco Drain Incorporated.
 - b. Polymer Concrete Research, Inc.
 2. Channel section with end caps:
 - a. Aco NW100.
 - b. Polycart 600 Series.
 3. Catch basins:
 - a. Aco Model No. 620.
 - b. Polycart Model No. 651.
 4. Design system for H-20 loading.

2.4 ACCESSORIES

- A. Gasket Joint Lubricant. Pipe manufacturer's recommended gasket lubricant.
- B. Epoxy Bonding Compound. 2-component system suitable for bonding wet or dry concrete to each other and to other materials.
 1. Copolymer Chemicals, Inc., Detroit, MI. "Crete-Tac".
 2. H. B. Fuller Co., St. Paul, Minn. "BC-013-14".
 3. W. R. Grace Co., A. C. Horn Products, Chicago, IL., "Thiopoxy-63".
- C. Underdrain Fabric. Nonwoven filtration (drainage) geotextile. Furnish in protective wrapper to resist abrasion and ultraviolet radiation.
 1. Site Type. For use in exterior areas more than 5 ft. outside of building wall lines, where underdrains are 10 ft. or less deep. Not for use within building wall lines.
 - a. Phillips Fibers Corp. "Supac 4NP"
 - b. Hoechst Celanese Corp. "Trevira 1114"
 - c. Amoco Fabrics Co. "Style 4545"
 2. Building Type. For use in interior areas including exterior areas to 5 ft. outside of building wall lines; and for underdrains 10 ft. or more deep in both interior and exterior areas.
 - a. Phillips Fibers Corp. "Supac 8NP"
 - b. Hoechst Celanese Corp. "Trevira 1125"
 - c. Amoco Fabrics Co. "Style 4553"
- D. Concrete: Compressive strength of 3000 PSI at 28-days, per ASTM C 94, "Standard Specification for Ready-Mixed Concrete", with 5-7 percent entrained air.
- E. Marking tape. Service identified 3 inch wide, green color foil-backed polyethylene tape, or non-foil tape.
 1. Reef Industries, Inc., "Terra Tape", Houston, Texas.
 2. Seton Co., New Haven, Connecticut.
 3. Thor Enterprises, Sun Prairie, Wisconsin.

- F. Prefabricated Drainage System. Polypropylene and polyethylene drain core panels, with polypropylene fabric bonded to 1 side.
 - 1. American Enka Co. “Enkadrain”.
 - 2. America Wich Drain Corp. “Amerdrain, 480”.
 - 3. Mirafi, Inc. “Miradrain 6000”.

2.5 FINISHES

- A. Bituminous coating:
 - 1. Koppers “Bitumastic 50”.
 - 2. Porter Coatings Division of Porter Paint Co. “Tarmastic 101”.
- B. Manhole coating system. 3-coat, 24-mil thick system of coal tar epoxy and fibrous glass cloth.
 - 1. Ameron “Amercoat No. 78 HD”.
 - 2. Carboline “Carbomastic No. 15”.
 - 3. Pitt Chem “Tar Set”.

PART 3 EXECUTION

3.1 PREPARATION

- A. Demolition
 - 1. Refer to Division 2, Site Demolition.
- B. Excavation And Backfill
 - 1. Do excavating and backfilling required for Work, per procedures specified in Division 2, Soils and Aggregates, and Earthwork and following requirements.
 - 2. Trim to lines and elevations in manner specified under Embedment. Embedment starts at final trimmed trench elevation and ends at 12 inches above top of pipe or component; “Backfill” starts 12 inches above pipe or component. Use manual methods in areas adjacent to buried construction and utilities to avoid damage or unscheduled service interruption. Limit trench width or embankment conditions to preclude excessive earth loads on installed piping system.
- C. New Connections
 - 1. Make complete connections to new or existing structures. Repair damage caused by Work to comply with Contract Documents at no increase in Contract sum.
- D. Embedment (Bedding And Initial Backfill)
 - 1. Trim rough trench to subgrade and provide embedment as defined in Soils and Aggregates – Division 2, and as shown. Provide stable, uniform support consisting of minimum compacted thickness below bottom of exterior surface of pipe, including bell, as shown but not less than 4 inches. Shape bedding to provide full length barrel support and to prevent point loading at pipe joints. Place and compact per Soils and Aggregates – Division 2.
 - 2. When bottom of excavation cannot support pipe, excavate to further depth and width and refill to pipe laying grade with bedding material per Soils and Aggregates – Division 2.

3.2 INSTALLATION

A. General

1. The following construction methods are not intended to be completely detailed. Provide properly functioning systems per applicable codes, manufacturer's instructions and standards and best accepted safe practice of Trades.
2. Before lowering pipe into trench, clean and visually inspect for apparent defects. Remove defective pipe from site promptly. Before and during laying of pipe, maintain excavations dry and clear of water and extraneous materials. Provide minimum 4 inches of clearance for pipes passing under or through building grade beams or provide surface penetrations as shown.
3. Where pipe is embedded in an underground concrete structure, provide joints within 12 inches of exterior surface of structure, capable of absorbing movement without leakage.
4. Where connections between different piping materials are made, use manufactured "specials" and "transitions" to produce permanently tight joints.
5. Clean and lubricate elastomer joints before assembly. Check recessed gaskets with feeler gages.
6. During progress of construction, protect open ends of 18 inch and smaller pipe, fittings to prevent admission of foreign matter. Place plugs or end boards in ends of installed work whenever work stops. Plugs shall be commercially manufactured products.

B. Type CISP, Cast Iron Soil Pipe

1. Install per CISPI Cast Iron Soil Pipe and Fittings Handbook except as modified by Contract Documents.
2. Provide lead and oakum joints in vertical piping or where rigid joint alignment is required or where floor drains are caulked. Make joints with 1 pouring of molten lead, calked to produce liquid-tight joints without stressing hub or spigot. Where lead is driven 1/4 inch or more below face of hub, remove lead and remake joint.

C. Type RCP, Reinforced Concrete Pipe

1. Install per ACPA Concrete Pipe Installation Manual except as modified by Contract Documents.
2. Method of field tapping for branch connections is subject to approval by Registered Design Professional. Utilize "Epoxy Bonding Compound" to join cleaned piping and wet or dry cement.
3. Do not install pipe with chipped or otherwise damaged joint areas.

D. Type PVC-PSM, Polyvinyl Chloride Sewer Pipe

1. Install per ASTM D 2321, "Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications", except as modified by Contract Documents.
2. At no point shall completed installation have out-of-round pipe deflections greater than 7-1/2 percent. Registered Design Professional may require deflectometer or go/no-go gauging tests run on pipeline acceptance. Remove and install new pipe in sections that has deflected more than 7-1/2 percent per ASTM D 3034, "Standard Specification for Type

PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings". Test pipe for deflection not less than 30 days following completion of installation.

E. Underdrain Installation

1. Place Underdrain Fabric in prepared trench, overlapping ends at least 2 feet and spread material without wrinkles.
2. Lay pipe with perforations down, with firm embedment, and with each section having full bearing throughout its length to grade shown. Use fittings for changes in direction.
3. Place specified materials and compact as specified in Division 2.
4. Wrap Underdrain Fabric over filter materials and pipe, overlapping at least 12 inches. Cover fabric within 10 days of removing protective wrapper.

F. Epoxy Bonding To Existing Materials

1. Use Epoxy Bonding Compound to set sleeves or pipes in existing concrete or to bond dissimilar materials.
2. The compound, when applied per manufacturer's instructions, shall be capable of initial curing within 48 hours at temperatures as low as 40 degF and shall be capable of bonding any combination of the following properly prepared materials. Wet or dry, cured or uncured concrete or mortar; vitrified clay; cast iron, and carbon steel.

G. Jacking Of Pipe

1. Do not jack pipe in place except upon prior approval of proposed materials and complete details of methods.

H. Marking Tape

1. Install approximately 6 to 8 inches below grade per manufacturer's instructions.

I. Drainage Structures

1. Install as shown.

J. Manhole Coating

1. Provide drainage pit with Manhole Coating System applied as follows:
 - a. Brush blast surfaces before application of coal tar epoxy.
 - b. Reinforce pit corners with layers of 12, 8, and 4 inch wide strips of closely woven, oil-free glass cloth embedded in successive layers of coal tar epoxy.
 - c. Each coat of coal tar shall be 8 mils thick. Apply each successive phase of work involving coal tar epoxy within 24 hours.

K. Adjusting Existing Structure Top Elevation

1. Adjust top elevations of manholes and catch basins where shown. If elevation is raised 12 inches or less, add brick courses below castings. If elevation is raised more than 12 inches, remove structure to bottom of cone or corbelling and rebuild structure. Where elevation is lowered, remove brick courses from under castings if cone is not enlarged. If cone is enlarged, remove sufficient structure and maintain cone profile. Do not batter brick masonry steeper than 2.5:1.

L. Concrete Work

1. Perform concrete work per details shown, including reinforcing.

M. Riprap

1. Lay riprap to extent shown, starting at low points and working up slopes. Place riprap individually, firmly embedding each piece into substrate and against adjacent pieces. Use small pieces to fill voids between larger pieces. Finished surface shall not deviate from elevations or slopes shown, in any direction, within tolerances of plus or minus 1 inch when measured with 10-foot straightedge. Grout joints with mixture of 1 part portland cement and 3 parts sand, using clean water.

3.3 FIELD QUALITY CONTROL

A. Site Tests

1. At discretion of Owner and at Owner's expense crushing strength of VCP and RCP may be tested per ASTM C 301, "Standard Test Methods for Soluble Cellulose Nitrate", and ASTM C 497, "Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile".
2. One half of 1 percent of number of pipe sections of each pipe size and type to be installed may be selected by Owner for testing; in no case shall less than 2 pipes in each size and type be tested. Failure to meet tests may be cause for rejection of entire lot of pipe.
3. Test Underdrain per requirements of governing codes.

B. Inspection

1. Maximum deviation from design elevation at any point along sewer shall not exceed 0.04 feet.
2. Maximum deviation from line at any point along sewer (normally at straight line between points of change in direction) shall not exceed 0.20 feet for pipes 15 inches in diameter and smaller and 0.40 feet for pipes larger than 15 inches in diameter. Corrections for deviation from line within preceding tolerances shall be made at correction rates not to exceed 0.10 feet for any 1 length of pipe.
3. After backfilling is completed, flash light between manholes. Remedy any displaced pipe, misalignment or poor joints revealed by this test.

C. Sewer Testing

1. General
 - a. Test per local codes.
2. Hydrostatic Leakage Test
 - a. Test system in sections not exceeding 500 feet in length.
 - b. Tests shall be made by bulkheading sewer at lower end of test section and filling pipe with water to an elevation 2 feet above top of upstream end of pipe or 2 feet above highest ground water elevation along section under test, whichever is highest. Leakage is measured quantity of water added to maintain water at this elevation. Test shall be run for at least 4 hours.
 - c. Leakage from manholes, plugs, or cleanouts shall not be included in the allowable leakage quantity.

- d. Allowable Leakage Quantities.
 - 1) Sanitary sewers. 0.2 gph/inch dia./100 feet of pipe.
 - 2) Process waste sewers. 0.2 gph/inch dia./100 feet of pipe.
 - 3) Storm sewers. 0.4 gph/inch dia./100 feet of pipe.
- 3. Camera Test
 - a. Pipe camera inspection video: Inspect 20 percent of pipe runs (rounded up) but no less than 2.

3.4 CLEANING

- A. Upon completion of work in each respective area, clean and protect work. Just before final acceptance, do additional necessary cleaning to provide clean equipment and areas to Owner.

END OF SECTION

Revision History	
Date	Rev. No.
A	0
B	0
C	0
D	0
E	0
F	0
02-19-09	0

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