

**CITY OF KALAMAZOO  
DEPARTMENT OF  
PUBLIC SERVICES**

**ENGINEERING DIVISION**



**PUBLIC SERVICES DEPARTMENT**

ENGINEERING DIVISION  
415 STOCKBRIDGE AVE.  
KALAMAZOO, MICHIGAN 49001-2898  
PHONE 269-353-8769  
FAX 269-353-8533

**Standard Specifications for  
Wastewater Sewer Installation  
2013**

## SANITARY SEWERS AND LATERALS

### PART 1 GENERAL

#### 1.01 SCOPE

- A. This Section includes furnishing and installing sanitary sewer systems.
- B. Reconstruction of existing sewers and house connections shall be in conformance with requirements of this Section.
- C. This Section shall include furnishing and installing all required pipe, bends or beveled pipe, tees, wyes, tee manhole base pipes, bulkheads and stoppers, jointing material, granular material for pipe bedding, concrete used for encasement or bedding, making watertight connections to existing and new sewers and existing manholes, cleaning, testing, and videotaping sewers, removing temporary bulkheads, and other work incidental to the sewer installation unless specifically included under other Items.

#### 1.02 SUBMITTALS

- A. Submittals shall be the responsibility of the Contractor :
  - 1. Shop Drawings for Review:
    - a. Manufacturer's Shop Drawings indicating physical dimensions, and joint details for each size, type, and class of pipe, fittings and specials furnished for the project.
  - 2. Information for the Record:
    - a. Manufacturer's certification indicating that the pipe and joints meet specifications for each production run for each size, type, and class of pipe furnished. The Engineer may request test results to verify certification. Certification documents shall be according to the Source Quality Control of this Section.
    - b. Manufacturer's installation instructions.
    - c. The laboratory shall submit test certifications of pipe ordered tested under "Field Quality Control," of this Section.
  - 3. Engineer may request additional Shop Drawings or Information for the Record as required.

#### 1.03 AS CONSTRUCTED RECORD

- A. During construction the contractor shall be required to keep current a set of "as constructed" drawings. Before final payment shall be made, the contractor shall submit for approval to the City of Kalamazoo the complete set of as constructed drawings. Each set of "as constructed" drawings shall be labeled "As Constructed", dated, and contain at a minimum the following information (additional information may be required by the City of Kalamazoo):

Structures:	Pipes:	Laterals:
1. Rim Elevations	1. Diameter	1. Address
2. Diameter	2. Length	2. Wye Station
3. Adjustment Ring Height	3. Material	3. Property Line Station
4. Cone/Top Material	4. Slope	4. Wye Elevation
5. Cone/Top Shape		5. Property Line Elevation
6. # of IN pipes		6. Wye Depth
7. # of Out pipes		7. Cleanout Depth
8. # of IN drops		8. Diameter

- 9. # of Out drops
- 10. Invert Elevations
- 11. Depth of Structure

- 9. Material
- 10. Lead Length
- 11. Riser Height
- 12. Distance from DS MH
- 13. Tie downs of CO and horizontal bends
- 14. Distance and direction from edge of house

## PART 2 PRODUCTS

### 2.01 PIPES

#### A. Polyvinyl Chloride (PVC) Sewer Pipe Specifications:

1. For pipe 15-inch diameter and smaller: Pipe, fittings, and jointing systems shall conform to ASTM D-3034, except that the standard dimension ratio of the outside diameter of the pipe to wall thickness shall be 35.
2. For pipe 18-inch thru 24-inch diameter: Pipe, fittings, and jointing systems shall conform to ASTM D-3034 except that the standard dimension ratio of the outside diameter of the pipe to wall thickness shall be 26.
3. For pipe 27-inch thru 54-inch. Pipe, fittings, and jointing systems shall conform to ASTM F-1803 and UNI-B-9 (Vylon Pipe) and shall comply with the requirements for a minimum cell classification of 12364 as defined by ASTM D-1784. Impact resistance shall be 220 ft-lbs for 27-inch and 440 ft-lbs for 30-inch and larger. Test shall be per ASTM D 2444 and ASTM F 1803.
4. Joint systems shall be elastomeric seal (gasket) type. Seals shall conform to ASTM F-477 requirements. Joint materials and testing shall conform to ASTM D-3212 requirements.
5. All service connections shall be made using a wye and a bend. Tees shall be used only as directed by the Engineer. Tees and wyes shall be die cast or factory fabricated. All service pipes shall be SDR 35.

### 2.02 ACCESSORIES

#### A. Flexible Pipe Repair Couplings:

1. Flexible repair couplings shall be made of elastomeric polyvinyl chloride boot with series 300 stainless steel shield and clamps. Couplings shall be Strong Back RC series as manufactured by Fernco Joint Sealer Co., Ferndale, Michigan; Logan Clay Pipe Co., Logan, Ohio; Mission Clay Products Corp., or equal.

#### B. Flexible Watertight Joints:

1. Flexible watertight joints used in connecting to existing sewers or manholes shall be a "boot" type rubber gasket meeting ASTM F477 with a PVC SDR 35 hub adaptor meeting ASTM D3034 sealed to the pipe wall and around the hub adaptor with an external adjustable series 301 stainless steel band and housing and series 305 stainless steel screws. Other types of applicable flexible joints may be submitted for approval.

#### C. Granular Pipe Bedding Material:

1. Granular pipe bedding material shall be Class IIIa as specified in table 902-3 of the 2012 Michigan Department of Transportation Standard Specifications for Construction. .

## 2.03 REPLACEMENT LATERALS, SEWERS, AND APPURTENANCES

- A. All existing sanitary sewer pipe removed shall be replaced using pipe and joints as specified in this section. Connections to existing sewers shall be as specified in this section.

## 2.04 SOURCE QUALITY CONTROL

### A. Pipe Manufacturer's Certification:

1. The pipe manufacturer's certificate shall state that the materials have been sampled and tested in accordance with the provision for and meet the requirements of the designated specification and shall be signed by an authorized agent of the seller or the manufacturer.
2. A test results report shall accompany that manufacturer's certificate. The report shall compare test results to Specification requirements. Test specimens shall be selected in conformance with the designated specification, except that no less than two tests shall be made for each production run of each size, type, and class of pipe furnished, and further, that in case tests are unsatisfactory, additional tests shall be made to the maximum number in the referenced ASTM Specification.

### B. Profile Wall Basis of Design:

1. In addition to the above certifications, and if required by the Engineer, for pipe 18-inch and larger or greater than 20 feet in depth, the manufacturers of plastic profile wall pipes shall provide a certification that shows the basis of design for each pipe class furnished and that they are satisfactory for use as shown on the Drawings. Basis of design limits provided shall include but are not limited to; crushing resistance of pipe wall, pipe deflection, and constrained buckling resistance.

2. The following constraints shall be used as minimum conditions for the basis of design:

Safety Factor = 2

Bedding Class = ASTM D-2321 Class 1A

Loads = Soil weight (120 lb/cft)+H20

Depth of burial as shown of Drawings

Depth of submergence as indicated on soil borings or 4-feet minimum.

## PART 3 EXECUTION

### 3.01 PREPARATION OF TRENCH

- A. The trench shall be excavated so the pipe can be laid to the alignment and grade required. Removed material (regardless of nature encountered) shall be stockpiled if approved to be reused or removed from site and disposed of according to all applicable laws and regulations.
- B. For pipes the width of trench at the top of pipe 18-inch in diameter or less shall be 36 inches. For pipe having a diameter greater than 18-inch, the width of trenches at the top of the pipe shall be two (2) times the inside diameter of the pipe. .
- C. Trenches shall be of such extra width as to permit the placing of sheeting and bracing where required. The contractor shall furnish and put in place all bracing, shoring or sheeting as may be required for the protection of the work and public or adjacent property. The bracing, shoring or sheeting shall be removed as the work progresses in such a manner as to prevent the caving in of the excavations or any damage to the sewer or structure. Any voids left by removal of said materials must be filled in with granular material as specified and compacted. This work shall be included in the pay item and will not be paid for separately.

- D. Unless otherwise indicated all sewer trenches shall be excavated below the proposed pipe invert as required to accommodate the depths of pipe bedding material as shown on Michigan Department of Transportation (MDOT) R-83 Series Standard Plans
- E. The Contractor shall at all times during construction provide and maintain ample means and devices with which to remove promptly and dispose of properly all water entering the excavations or other parts of the work and shall keep said excavations dry until the structures to be built or pipelines to be placed therein are completed. In waterbearing sand, well points and/or sheeting shall be supplied, together with pumps and other appurtenances of ample capacity to keep the excavation free of water and in compliance with government regulations.
- F. The Contractor shall dispose of water from the Work in a suitable manner without damage to adjacent property or structures and in compliance with all regulations.

### 3.02 PIPE INSTALLATION

- A. All loose dirt shall be removed from the bottom of the trench and the trench backfilled with specified bedding material to pipe laying grade, as detailed on the Drawings. Pipe trenches shall be excavated to the depth indicated on MDOT R-83-Series Standard Plans to provide adequate depth of pipe bedding and the pipe shall be placed and supported on bedding material the full length of the barrel. Bedding material shall then be placed 4-inch maximum depth along both sides of the pipe and tamped firmly under the pipe haunches. Hand tampers shall be used for installing bedding material around pipes smaller than 36-inch diameter and mechanical hand tampers shall be used around pipes 36-inch diameter and larger unless otherwise directed by the Engineer. The remainder of the trench shall be backfilled as specified in the R-83-series standard with a maximum size of 1.5 inches within two feet of the pipe.
- B. Concrete bedding and encasement in lieu of bedding material shall be installed as shown on the Drawings or specified.
- C. The laying of pipe in finished trenches shall be commenced at the lowest point, with the bell end or groove end laid upgrade. All pipe shall be laid with ends abutting and true to line and grade. They shall be carefully centered to form a sewer with a uniform invert of line and grade shown on the Drawings.
- D. All pipe shall be laid to lines and grades by use of a laser beam and checked for conformance. Pipes installed more than 0.04 feet above or below specified elevation shall be removed and reinstalled to grade.

### 3.03 PIPE JOINTS

- A. Pipe jointing surfaces shall be clean and dry when preparing surfaces for joining. Lubricants, primers, adhesives, etc., shall be used as recommended by the pipe or joint manufacturer's specifications. The jointing materials or factory fabricated joints shall then be placed, fitted, joined, and adjusted in such a manner as to obtain a watertight joint. Trenches shall be kept water-free and as dry as possible during bedding, laying, and jointing. As soon as possible after the joint is made, sufficient backfill material shall be placed along each side of the pipe to prevent movement of the pipe from any cause.
- B. Flexible Plastic Gasket Joints - Materials used for gaskets shall be as specified in this Section. Cross section size of gaskets and method of installation shall conform to the manufacturer's recommendations.

### 3.04 SANITARY SEWER AND MANHOLE TAPS

- A. Unless indicated otherwise connections to existing sewers shall be connected in conformance with the manufacturer's recommendations as approved by the Engineer.

### 3.05 BACKFILLING AND COMPACTING

- A. Backfilling Under Existing Conduits - Where it is necessary to undercut or replace existing utility conduits and/or service lines, the excavation beneath such lines shall be backfilled the entire length with granular bedding material tamped in place in 6-inch layers to the required density. The granular bedding shall extend outward from the spring line of the conduit a distance of 2-feet on either side and thence downward at its natural slope.
- B. Backfilling With Excavated Material - Unless otherwise specified or directed, material excavated in connection with the work shall be used for backfilling and other filling purposes, if it meets all requirements given elsewhere in this specification. No material shall be used for backfilling that contains stones, rock, or pieces of masonry greater than 12-inch, frozen earth, debris, earth with an exceptionally high void content, organic material, or marl. No large pieces of rock or masonry greater than 1.5 inches shall be deposited closer than 24-inch from the completed outside surface of any structure or pipe.
- C. Backfill Immediately - All trenches and excavations shall be backfilled immediately after pipe is laid therein, unless otherwise directed by the Engineer. Under no circumstances shall water be permitted to rise in unbackfilled trenches after pipe has been placed.
- D. House Leads shall not be backfilled until the pipe ends are referenced and the Engineer has measured the pipe for payment.
- E. Backfilling around and over structures and pipes shall be carefully done by hand and tamped with suitable tools of approved weight to a point 1-foot above the top of pipe. Selected material or, where specified or ordered by the Engineer, special backfill material shall be used in this area. The material shall be placed in uniform layers not exceeding 6-inch in depth up each side. Each layer shall be placed, then carefully and uniformly tamped to the specified density so as to eliminate the possibility of lateral displacement of pipe or structure.
- F. Backfilling by Machinery - After the backfill has been placed and compacted around the structures and conduits to a height of 1-foot above the top. The remainder of the trench may be backfilled by machine. The backfill material shall be deposited in horizontal layers and each layer shall be thoroughly compacted to the specified density by approved methods before a succeeding layer is placed. In no case will backfill material from a bucket be allowed to fall directly on a structure or pipe and in all cases the bucket must be lowered so that the shock of the falling material will not cause damage.

### 3.06 COMPACTION REQUIREMENTS

- A. Compact each layer to 95% maximum density as tested by the Michigan Department of Transportation Density Testing and Inspection Manual.

### 3.07 COMPACTION TESTS

- A. Trenches and excavation around structures shall be backfilled and consolidated in layers, as specified, to the existing ground surface. Compaction tests shall be performed on each layer immediately after compaction.
- B. Initial test series for each type of backfill material shall be continued until the method of consolidation employed has proven to attain the required compaction. Any change in the proven method of consolidations will require additional testing and field verification of compaction.
- C. Subgrade below pavements, curbs, sidewalks, and structures shall be consolidated as specified. Compaction tests shall be performed to verify specified consolidation.
- D. Subsequent tests or series of tests shall be in locations and at depths ordered by the Engineer.

### 3.08 FIELD QUALITY CONTROL

- A. The Engineer may select one sample of pipe on the job site of each production run of each size and type of pipe to be tested by the Contractor's laboratory. The Contractor shall furnish the first test piece or pipe core and any additional samples required because of failures. The Contractor shall pay for tests on the first sample. Should the sample fail to meet specifications, retests shall be conducted by the Contractor's laboratory in conformance with the specifications and shall be at no additional expense to Owner.
- B. Deflection of PVC Pipe:
  - 1. Vertical Ring Deflection - Before final acceptance of sewer lines, all sections of sewer pipe 8-inch and larger specified diameter shall be measured for vertical ring deflection by the Contractor and witnessed by the Engineer. Maximum deflection under full load shall not exceed 5 percent of the ASTM designated average inside diameter as determined by the laboratory for the specified piping.
  - 2. Failures - Should a pipe exceed the allowable deflection, the Contractor shall replace those pipes and retest the section.
  - 3. Equipment used in testing shall be go-no-go pull through gauges of a type approved by the Engineer. A metal or plastic gauging ring of diameter equal to 95 percent of the specified average inside pipe diameter shall be furnished with each gauge.
  - 4. The Contractor shall furnish testing equipment and personnel and perform the required tests. Tests shall be witnessed by the Engineer.
  - 5. Use of mechanical pulling devices is not permitted.
  - 6. Deflection testing shall not be performed until the completed and accepted trench backfill has been in place for at least 30 days.
- C. Field Inspection:
  - 1. Individual sections of pipe may be rejected at any time because of defective joints, dimension variations, fractures, cracks, chips, or blisters exceeding the permissible tolerances.
  - 2. Rejected pipe shall be so marked with a lumber crayon or paint and shall be removed from the job site before the end of the following work day.

### 3.09 LOW PRESSURE AIR ACCEPTANCE TESTS

- A. The Contractor will perform low pressure air acceptance tests in lieu of infiltration or exfiltration tests. Test shall be made in accordance with ASTM F-1417-Plastic Gravity Sewer Lines.
  - 1. If the air pressure required for the test is greater than 5.0 psig, the low pressure air acceptance test shall not be used.
- B. The Contractor shall furnish all equipment, materials, and labor, and conduct the tests under observation of the Engineer.
- C. Safety:
  - 1. The air test may be dangerous if the line is improperly prepared. All plugs shall be installed and braced in such a manner to prevent blowouts. No one shall be allowed in manholes during testing.
  - 2. Pressurizing equipment shall include a regulator set at the maximum pressure.

D. Line Preparation:

1. Sewers to be air tested shall be prepared and inspected as specified herein for infiltration and exfiltration tests.
2. Where porous pipe materials are used, the pipe walls may be wetted to temporarily reduce the porosity of the material.
3. All pipe outlets shall be plugged, braced, and the joints restrained adequately to prevent blowouts.

E. Test Procedure:

1. Low pressure air shall be slowly introduced into the sealed line until the internal air pressure reaches 4.0 psig greater than the average back pressure of any ground water above the invert of the pipe.
2. When a constant pressure of 4.0 psig greater than the average back pressure of any ground water above the pipe is reached, the air supply shall be throttled to maintain that internal pressure for at least 2 minutes to permit temperature equalization.
3. When temperatures have been equalized and the pressure stabilized at 4.0 psig greater than the average back pressure of any ground water above the pipe, the air supply shall be shut off or disconnected.
4. Decrease the pressure in the sealed line until the continuous monitoring pressure gauge reads 3.5 psig greater than the average back pressure of any ground water above the pipe. When this pressure is reached, timing shall commence with a stop watch.
5. Determine the time, as shown on the stop watch, required for the pressure in the sealed line to drop 1.0 psig.

F. Test Method ASTM F-1417-Plastic Gravity Sewer Line:

1. Low pressure air test method shall be the Time-Pressure Drop Method.
2. The pressure used in the test shall be the stated pressure plus the average back pressure of any groundwater above the pipe.
3. The time required for the pressure in the test section to drop 1.0 psig shall be measured using a stop watch. If the time is less than the time determined from ASTM F-1417, the section fails. The table below has been reprinted from ASTM F-1417 for Contractor's information.

Pipe Diameter, Inches	Minimum Time, Min.: Sec.	Length for Minimum Time, Feet	Time for Longer Length, Sec. (L=Ft)
6	5:40	398	0.854 L
8	7:34	298	1.520 L
10	9:26	239	2.374 L
12	11:20	199	3.418 L
15	14:10	159	5.342 L
18	17:00	133	7.692 L
21	19:50	114	10.470L
24	22:40	99	13.674L

Note: Minimum time applied to all lengths less than or equal to the length shown. For more information, see ASTM F-1417, Table 1.



G. Air Pressure Adjustment For Groundwater:

1. In areas where groundwater is known to exist, the Contractor shall install a one-half inch diameter capped pipe nipple, approximately, 10-inch long, through the manhole wall on top of one of the sewer lines entering the manhole. This shall be done at the time the sewer line is installed. Immediately prior to the performance of the line acceptance test, the groundwater level shall be determined by removing the pipe cap, blowing air through the pipe nipple into the ground to clear it, and then connecting a clear plastic tube to the pipe nipple. The hose shall be held vertically and a measurement of the height in feet of water shall be taken after the water stops rising in this plastic tube.
2. The air pressure correction, for the average back pressure of the groundwater above the pipe, shall be calculated by subtracting the average invert elevation from the measured groundwater elevation and dividing the difference by 2.31 psi/ft.. This correction must be added to the test pressures stated in the test procedure.

3.10 CLOSED CIRCUIT TELEVISION INSPECTIONS (CCTV)

- A. Perform CCTV television inspections on sanitary mains and laterals per the City of Kalamazoo Standard Specifications for Closed Circuit Television Inspections of Sewer Mains, Manholes, and Laterals

PART 4 MEASUREMENT AND PAYMENT

<b>Pay Item</b>	<b>Pay Unit</b>
Sanitary Sewer, PVC, _ inch, TR Det _.....	Foot
Sanitary Service, PVC, _ inch, TR Det _.....	Foot
Sanitary Cleanout, PVC, _ inch, TR Det _.....	Each
Sanitary Sewer Tap, _ inch.....	Each
Sanitary Manhole Tap, _ inch.....	Each

Sanitary sewer shall be measured in place per foot as measured from center of manhole to center of manhole.

Sanitary service shall be measured in place per foot as measured from the wye connection to the center of each bend, tees, wyes, or plugs until the pipe terminates or is connected to the existing service. Connection to the existing service shall be considered incidental to construction and will not be paid for separately

Sanitary cleanouts shall be measured per unit installed and include the riser pipe, plug/cap, and any additional items as detailed on the drawings. Connection to the existing service shall be considered incidental to construction and will not be paid for separately

Sanitary Sewer Tap and Sanitary Manhole Tap, \_inch shall be measured per unit installed based on the size of the connecting sewer pipe.

Payment for each item includes all excavation, trenching, backfilling, compacting, shoring/bracing cleaning and CCTV inspection, labor and equipment to complete pay item.

END OF SECTION

## PRECAST SEWER MANHOLES

### PART 1 GENERAL

#### 1.04 SCOPE

- A. This Section includes furnishing and installing precast sewer manholes, including drops and manhole stacks of types and at locations shown on the Drawings and scheduled.
- B. This Section includes removing existing structures, additional excavation to widen and deepen trenches for manhole construction, furnishing and installing concrete of classes called for, Portland cement mortar, reinforcing steel, precast concrete pipe integral base sections, bottom riser sections, transition sections, and riser sections, eccentric cones, flat slab tops and grade rings, flexible manhole connections, pipe for drop connections, manhole steps, manhole frames and covers, plugging lifting holes, pointing joints, forming channels through manhole bottoms, making watertight connections to new and existing sewers, and other work incidental to manhole construction and testing.

#### 1.05 SUBMITTALS

- A. Submittals shall be the responsibility of the Contractor :
  - 1. Shop Drawings for Review:
    - a. Manufacturer's Shop Drawings indicating physical dimensions, joint details, and reinforcing steel layout for each size and type of manhole components furnished for the project.
    - b. Manufacturer's certification indicating that the manhole components and joints meet specifications for each production run for each size and type furnished.
  - 2. Information for the Record:
    - a. The Engineer may request test results to verify certification. Certification documents shall be according to the Source Quality Control of this Section.
  - 3. Engineer may request additional Shop Drawings or Information for the Record as required.

### PART 2 PRODUCTS

#### 2.01 MATERIALS

- A. Type of Manhole Sections:
  - 1. Manhole Stacks - Manhole stacks shall mean 4-foot diameter manholes used for access to reinforced concrete manhole chambers and precast manhole riser tee sections.
  - 2. Type I Manholes - Type I manholes shall mean 4-foot diameter manholes with precast integral base sections for sanitary sewers. All connections to manholes shall be made with flexible water tight joints. Type I manholes are intended for installation on sewers 18-inch diameter and smaller.
  - 3. Type II Manholes - Type II manholes shall mean manholes with 5-foot diameter precast integral base sections. All connections to manholes shall be made with flexible water tight joints. Type II manholes are intended for installation on 21-inch through 30-inch diameter sewers.

4. Type III Manholes – Type III manholes shall mean manholes with precast integral base sections or precast bottoms that are larger than 5-foot diameter. The diameter of the bottom riser sections shall be as shown on the Drawings. All connections to manholes shall be made with flexible water tight joints. Type III manholes are intended for installation on pipes where the additional wall area is needed for installation of flexible joints and on 36-inch through 48-inch diameter sewers.
  5. Type IV Manholes - Type IV manholes shall mean manholes with cut-outs in the bottom riser sections installed on cast-in-place concrete bases. The diameter of the bottom riser sections shall be as shown on the Drawings. All connections to manholes shall be made with flexible water tight joints. Type IV manholes are intended for installation on sewers 48-inch diameter and larger and on existing sewers where identified on Drawings.
  6. Type S Manholes - S following manhole type shall mean the designated type manhole constructed with a precast flat slab top in lieu of a precast cone.
- B. Precast manhole sections, integral base sections, transition sections, eccentric cones, flat slab tops, and adjusting rings shall conform to ASTM C-478. Reinforcing in transition sections shall be equal to that specified for wall sections of the larger diameter.
  - C. Joints shall be manhole gaskets conforming to ASTM C-923.
  - D. The standard length of riser sections shall be 48-inch. Lengths of 32-inch or 16-inch shall be used to meet required dimensions and as specified.
  - E. Openings for connecting pipes in riser sections, bottom riser sections, and integral base sections, and for access in flat slabs shall be preformed or cored by the manufacturer, except “cut-out” openings may be made in bottom riser sections for Type IV manholes. Cut-out openings shall be made immediately after the pipe is removed from the casting form. All cored openings for sewer pipe connections shall have flexible joints.
  - F. Precast integral base sections shall be of monolithic construction. Base flat slab floors or integral floors shall have a minimum thickness of 6-inch for risers up to and including 48-inch in diameter and 8-inch for larger diameters. A layer of reinforcement shall be placed above the midpoint, and shall have a minimum area of 0.12 square inch/linear feet in both directions.

## 2.02 ACCESSORIES

- A. Manhole Steps - Manhole steps shall be of polypropylene plastic reinforced with a 1/2-inch No. 60 grade reinforcing rod. Steps shall be M. A. Industries Model PS-1, or equal.
  1. Specified manhole steps shall be factory installed to provide a continuous ladder of 14-inch Center-to-Center rung spacing. Steps shall be placed in the forms and cast in pipe wall or placed immediately after the pipe is removed from casting and carefully mortared in place with nonshrink mortar to insure a watertight joint. Manhole step installation shall be in compliance with OSHA regulations. If the outer surface of the pipe wall is pierced the patch shall be completely covered with a bituminous sealer.
- B. Manhole frames and covers shall be City of Kalamazoo Standard.
  1. Where pressure tight manhole frames and covers are called for, threaded inserts shall be cast in eccentric cones or flat slab tops and holes formed or cored in adjusting rings to match bolt size and spacing specified for manhole casting.

- C. Mortar:
  - 1. Mortar used for the structures herein specified shall conform to ASTM C-270 Type S, containing no masonry cement. The mortar shall be composed of one part portland cement to two parts sand by volume.
  - 2. Non-shrinking Mortar - Materials for nonshrinking mortar shall be Sauereisen F-100, Five-Star, or equal.
- D. Cast-in-Place Concrete:
  - 1. All cast-in-place concrete used for concrete bases and for forming channels in manhole bottoms shall be Class A as shown in table 1
  - 2. All concrete used for supporting precast concrete manhole bases shall be Class B as shown in table 1

**Table 1: Concrete Requirements**

Concrete Class	Min 28-Day Compressive Strength (psi)	Maximum Water - Cement Ratio	Minimum Cement Content Sacks/CY	Slump Min.	Inches Max
A	4000	.45 (5.1*)	6.5	1	4
AA	3000	.53 (6*)	6	2	4
B	1750	.71 (8*)	4	1	6

\* - Water in U.S. gallons per 94 -lb. sack of cement

- E. Reinforcing Steel - Reinforcing steel used in cast-in-place concrete shall meet the requirements of the City of Kalamazoo pre-cast concrete manhole drawings.
- F. Pipe for Manhole Drops - Pipe for manhole drops shall conform to specifications of Sanitary Sewer for the required size and type shown on the Drawings.

**PART 3 EXECUTION**

**3.01 COORDINATION**

- A. Location and type of manholes installed shall be as shown on the Drawings or directed.
- B. Construction shall be in conformance with details shown on the Drawings and as specified.
- C. Excavation for manhole construction shall be prepared as directed in applicable paragraphs of the Sanitary Sewer Specification.

**3.02 INSTALLATION OF INTEGRAL BASE SECTIONS**

- A. Class B concrete shall be poured as to provide a minimum 4-inch thick pad under the entire area of the manhole base. Place the manhole base on the pad before the concrete is completely set so that final leveling adjustment can be made. Alternatively, the manhole base may be placed on 4-inch compacted granular bedding material. Bottom sections placed on bedding shall be a minimum of 6-inch thick.

**3.03 INSTALLATION OF BOTTOM RISER SECTIONS (WITHOUT INTEGRAL BASE)**

- A. Unless otherwise called for on the Drawings or directed, precast bottom riser sections shall be placed with cast-in-place reinforced concrete bases.
- B. The base shall be of Class A concrete 12-inch thick minimum placed on undisturbed earth. Reinforcing shall be as shown on the Drawings.

- C. The cut-out riser section shall be blocked in place above the pipe and the concrete base poured in place. Concrete shall be extended above the lower rim of the riser wall as required to provide a watertight seal around the entire circumference of the riser section. The sewer pipe shall be bedded in concrete monolithic with the base to the first joint each way from the manholes.

#### 3.04 CHANNELING MANHOLE BOTTOMS

- A. The bottoms of all manholes shall be channeled to conduct flow in the planned direction. The channel walls shall be formed or shaped to the full height of the crown of the outlet sewer in such a manner to not obstruct maintenance of flow in the sewers and shall match inverts of connection pipe at the manhole wall.
- B. In integral base sections (only) channels may be constructed using brick and Portland cement mortar. Mortar shall be 3/4-inch thick minimum between bricks and between bricks and concrete and 1-inch thick minimum on all exposed surfaces.

#### 3.05 PRECAST CONCRETE RISER SECTIONS

- A. The shortest length of riser section to be incorporated into the manhole shall be installed immediately below the eccentric cone section or the flat slab top.
- B. Pipe section joints shall be pointed and lifting holes filled with nonshrinking mortar.

#### 3.06 INSTALLATION OF MANHOLE FRAMES

- A. Manhole frames and covers shall be installed to grades shown on the Drawings or as directed.
- B. Adjustment of manhole castings shall be made using specified precast grade rings and Portland cement mortar joints or preferred bitumen seals.
- C. Each pressure tight manhole casting shall be anchored in place using four 5/8-inch stainless steel bolts with nuts as detailed on the Drawings or directed.
- D. The maximum depth of adjustment below any manhole casting shall be 12-inch and the minimum depth of adjustment shall be 4-inch
- E. In concrete pavement, separate frame from pavement with 1/2-inch thick premolded mastic joint material extending from the base of the frame to the top of the frame.

#### 3.07 MANHOLE TESTING

- A. Each manhole shall be tested after assembly and after all lift holes have been plugged with an approved non-shrink grout, after backfilling is complete and prior to installation of any specified chimney seals.
- B. Testing shall be by drawing a vacuum on the manhole using equipment specifically designed for such testing. All pipes entering the manhole shall be plugged and braced to prevent being drawing into the manhole. A test head with necessary gauges and connections shall be placed at the inside of the top of the cone section and sealed in accordance with the manufacturer's instructions. A vacuum of 10 inches of mercury shall then be drawn and the vacuum pump shut off. With valves closed, the time shall be measured for the vacuum to drop to 9 inches. The test shall be successful if the time measured is greater than 60 seconds. If the test is unsuccessful, necessary repairs shall be made and retesting shall proceed until a satisfactory test is obtained.

PART 4 MEASUREMENT AND PAYMENT

<b>Pay Item</b>	<b>Pay Unit</b>
Sanitary Manhole, _ inch .....	Each
Sanitary Manhole, _ inch, Add Depth, 8 foot to 15 foot.....	Foot
Sanitary Manhole, _ inch, Add Depth, more than 15 foot .....	Foot
Sanitary Manhole Cover .....	Each

Payment for each item includes all excavation, trenching, backfilling, compacting, shoring/bracing cleaning and videotaping, labor and equipment to complete pay item.

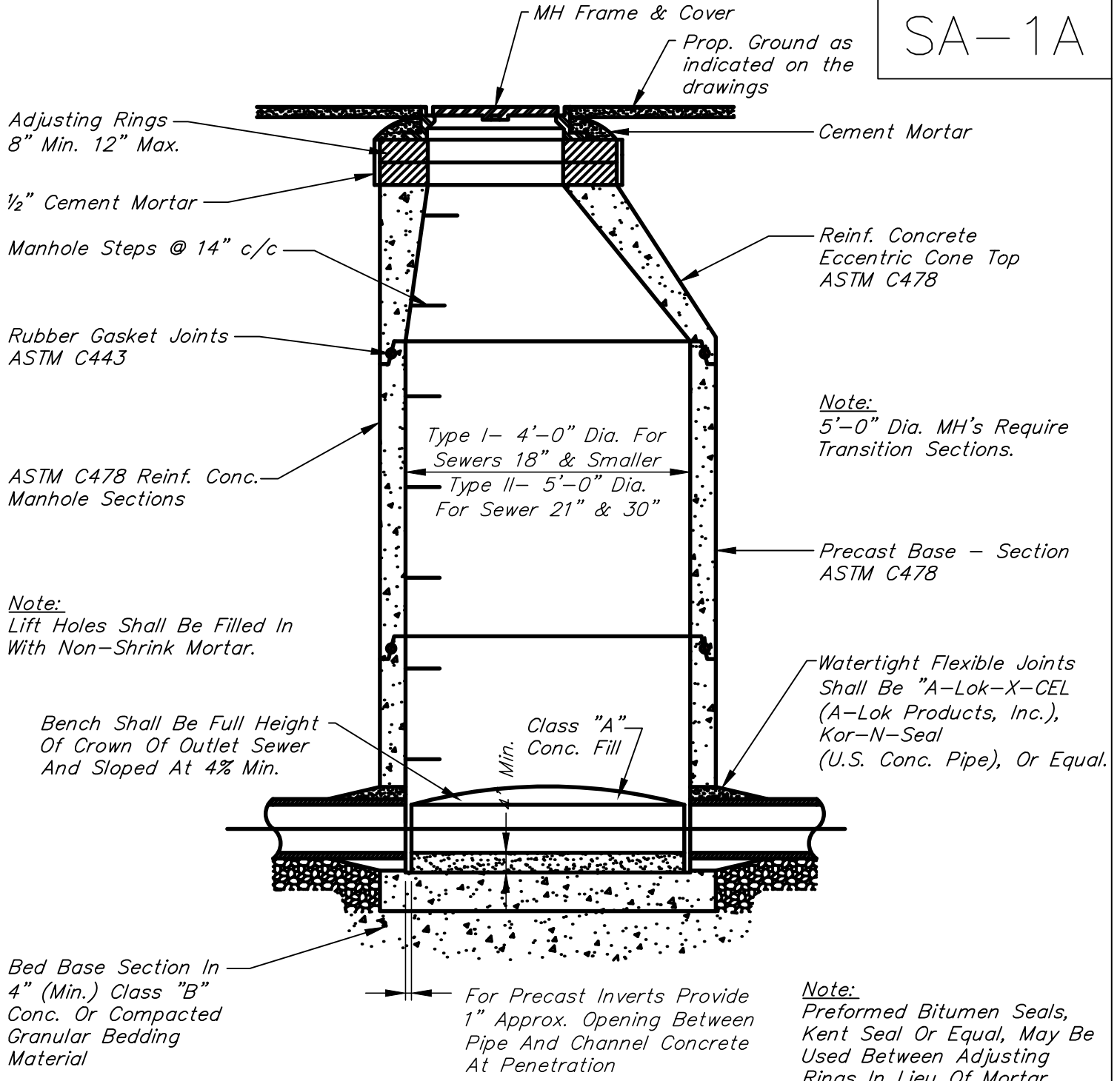
Payment for Sanitary Manhole, \_inch shall include the concrete footing and no greater than 8 feet of concrete structure depth measured from the flow line to the bottom of the chimney or adjustment rings. The price also includes the cost of temporary and/or final adjustments of structure.

Payment for Sanitary Sewer, \_ inch, Add Depth, \_\_\_\_\_ shall be the cost of the structure portions which are greater than 8 feet but less than 15 feet and more than 15 feet.

END OF SECTION

This page was intentionally left blank.

SA-1A



TYPE I & II MANHOLES

1/4" = 1'-0"

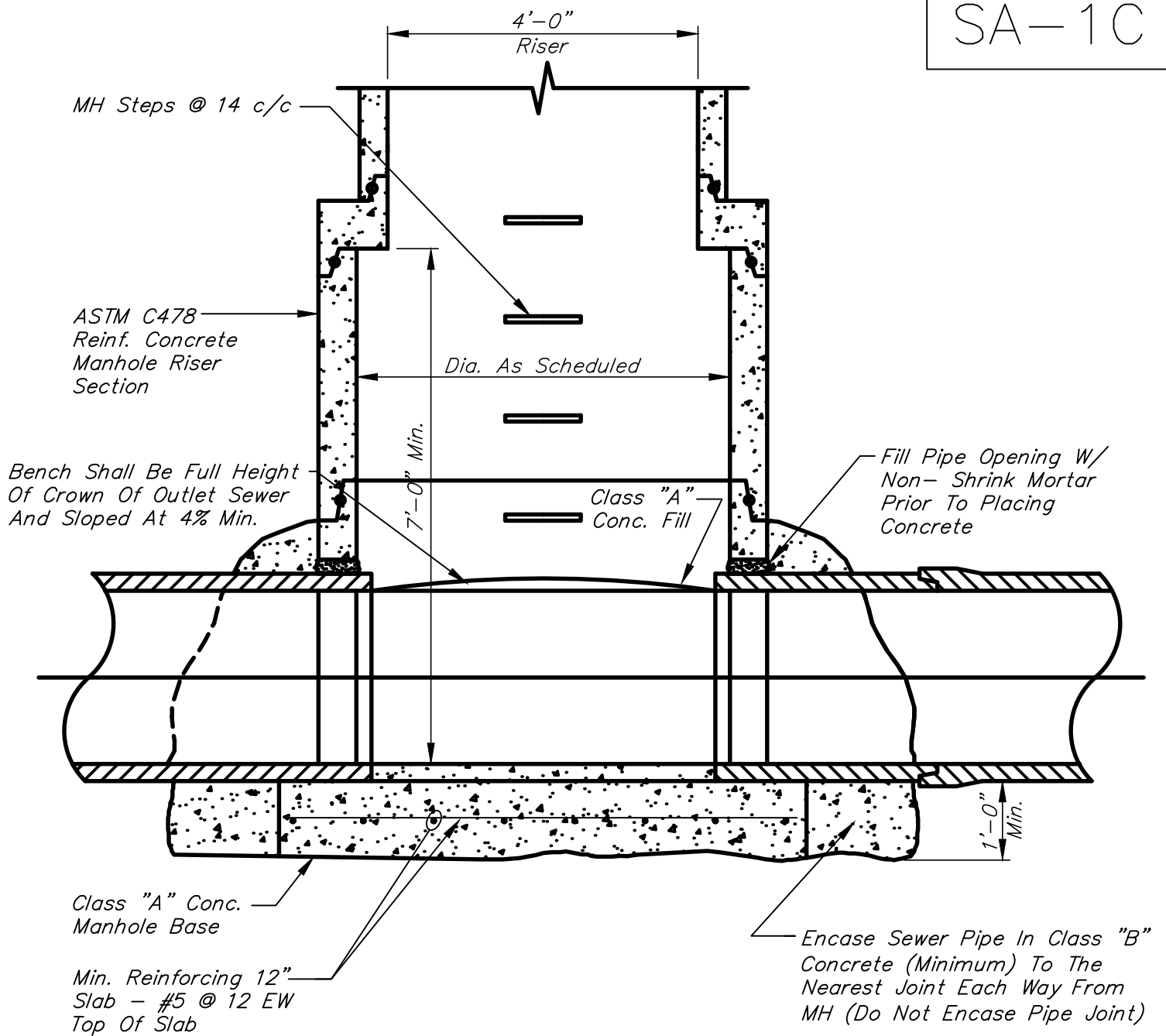


CITY OF KALAMAZOO  
DEPT. OF PUBLIC SERVICES  
STD. MANHOLES  
TYPE-I & II  
MARCH 2012





SA-1C

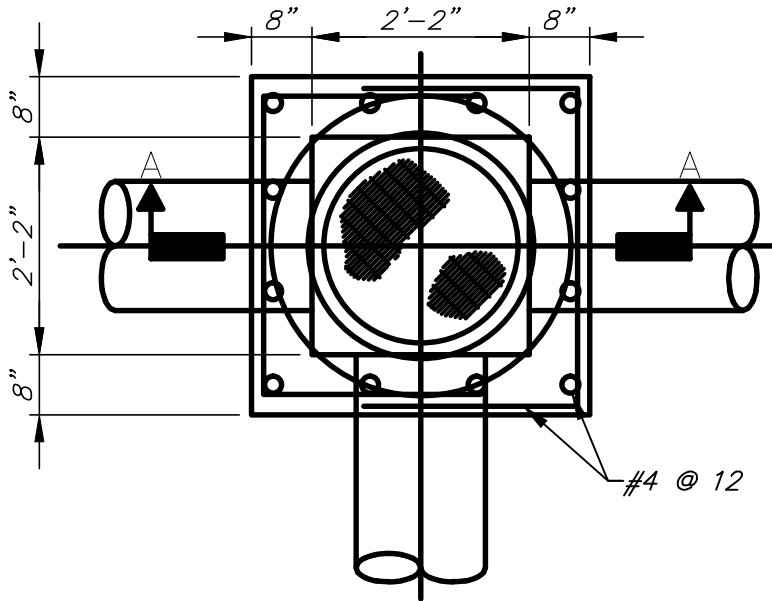


TYPE IV MANHOLE  
 $\frac{1}{2}'' = 1'-0''$

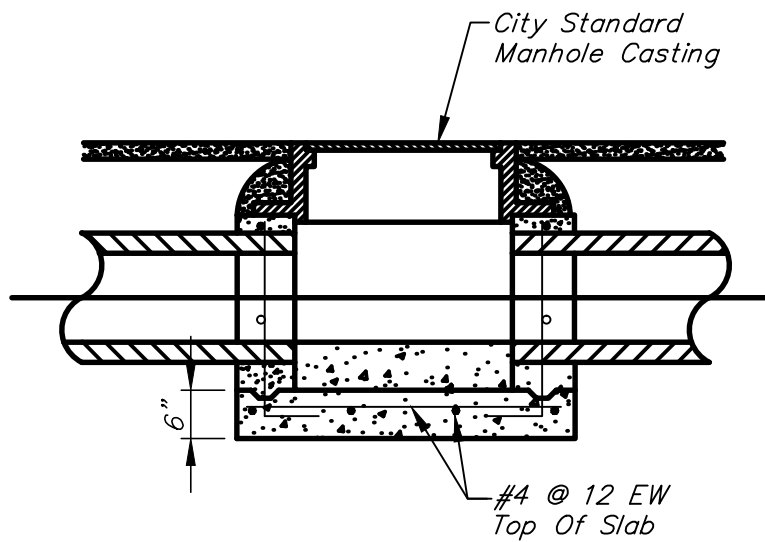


CITY OF KALAMAZOO  
DEPT. OF PUBLIC SERVICES  
STD. MANHOLES  
TYPE-IV  
MARCH 2012

SA-1D



PLAN

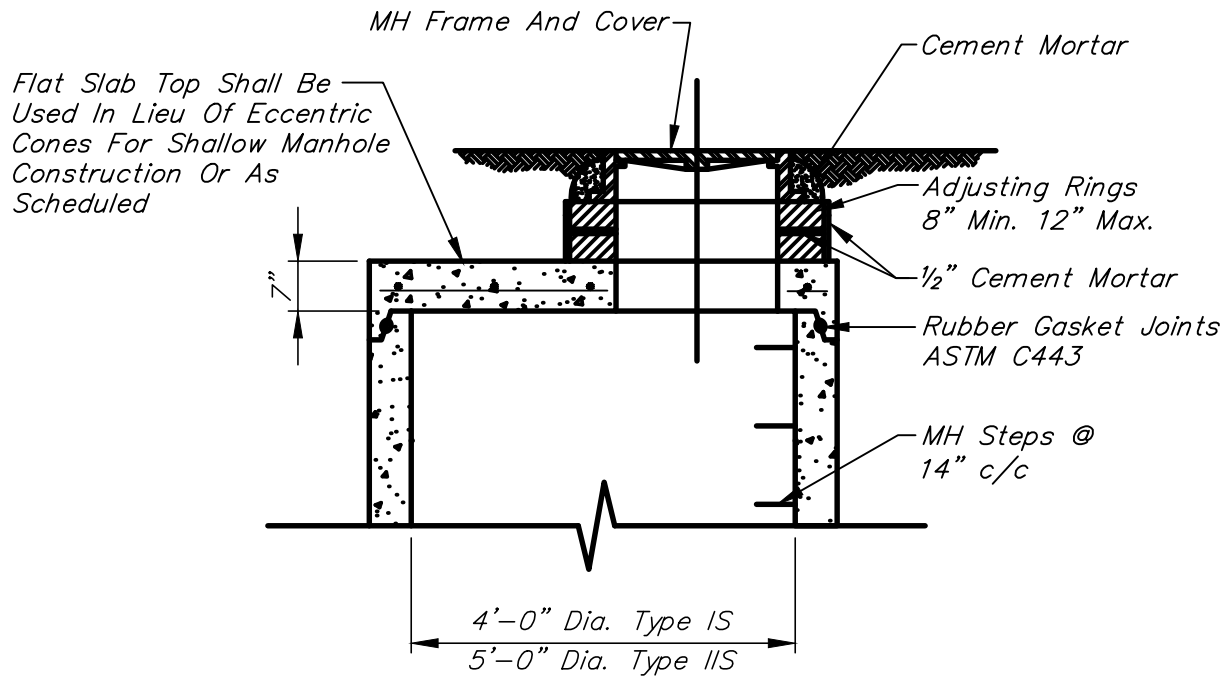


SECTION A-A

TYPE V MANHOLE  
 $\frac{1}{4}'' = 1'-0''$



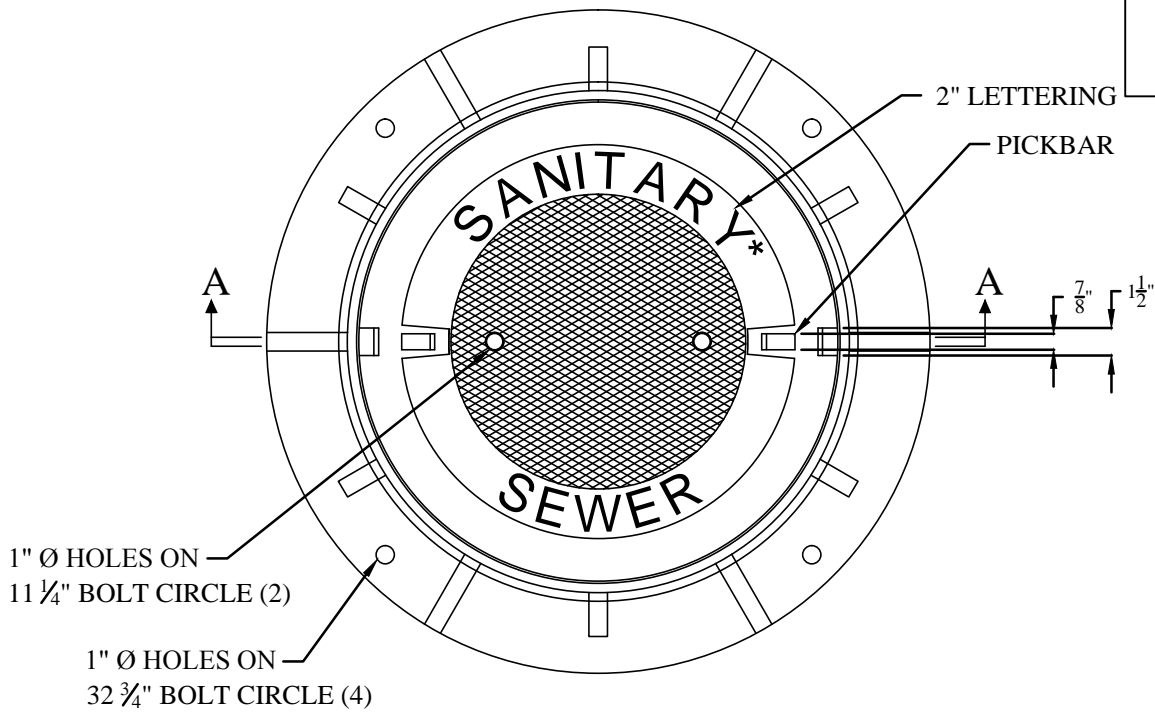
CITY OF KALAMAZOO  
DEPT. OF PUBLIC SERVICES  
STD. MANHOLES  
TYPE-V  
MARCH 2012



TYPE IS, IIS & IIIS MANHOLES

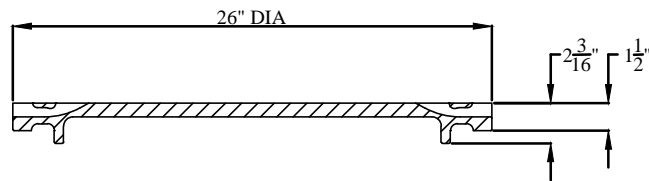
1/2" = 1'-0"

SA-2A

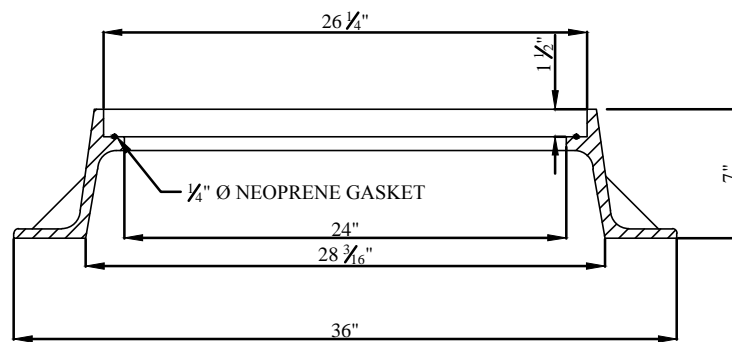


### FRAME AND COVER

\*WHEN USED ON STORM SEWER, THE COVER SHALL READ 'STORM SEWER'



### COVER SECTION



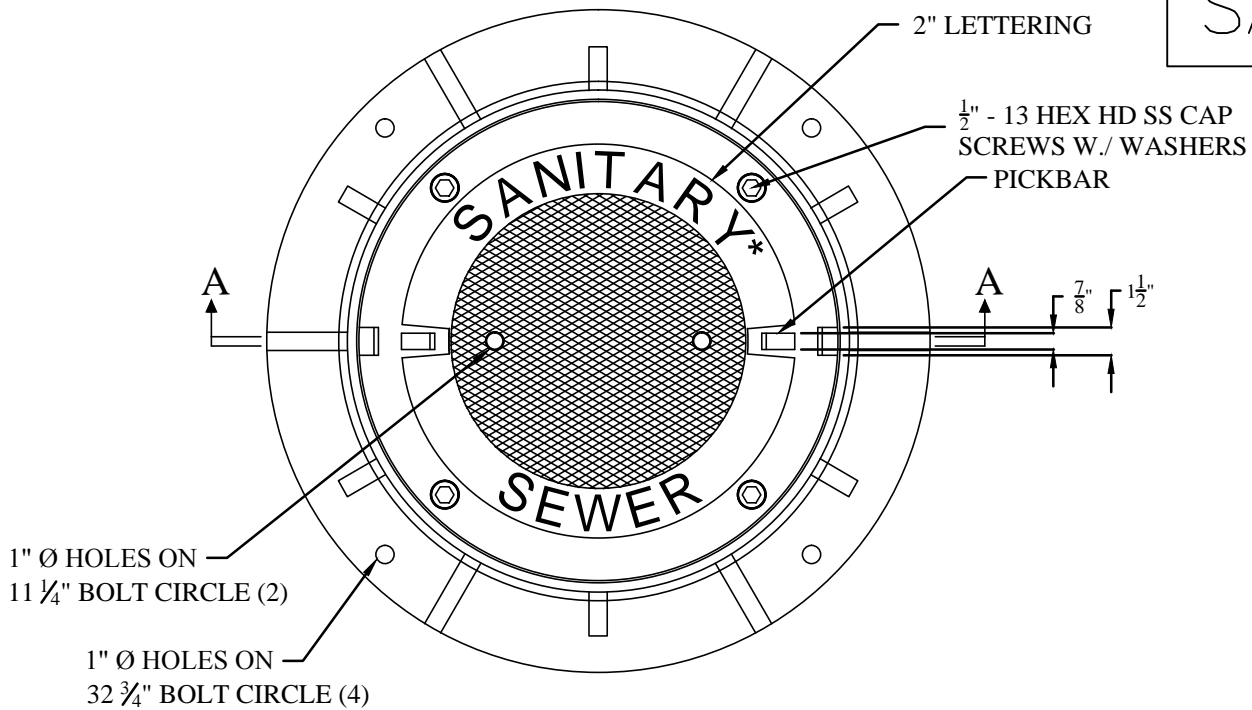
### SECTION A-A

NOMINAL WEIGHT - 320 LBS



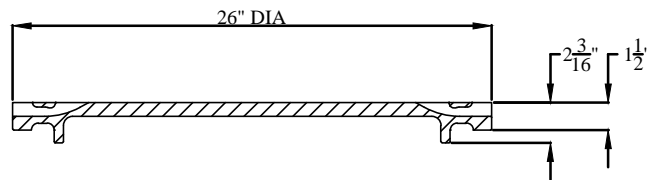
CITY OF KALAMAZOO  
DEPT. OF PUBLIC SERVICES  
SANITARY SEWER  
CASTING  
NOVEMBER 2012

SA-2B

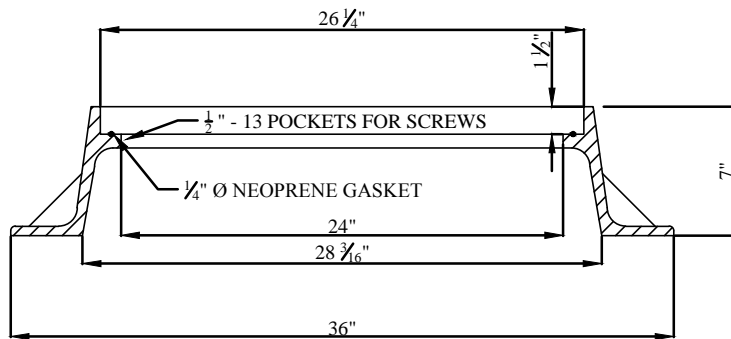


### FRAME AND COVER

\*WHEN USED ON STORM SEWER, THE COVER SHALL READ 'STORM SEWER'



### COVER SECTION



### SECTION A-A

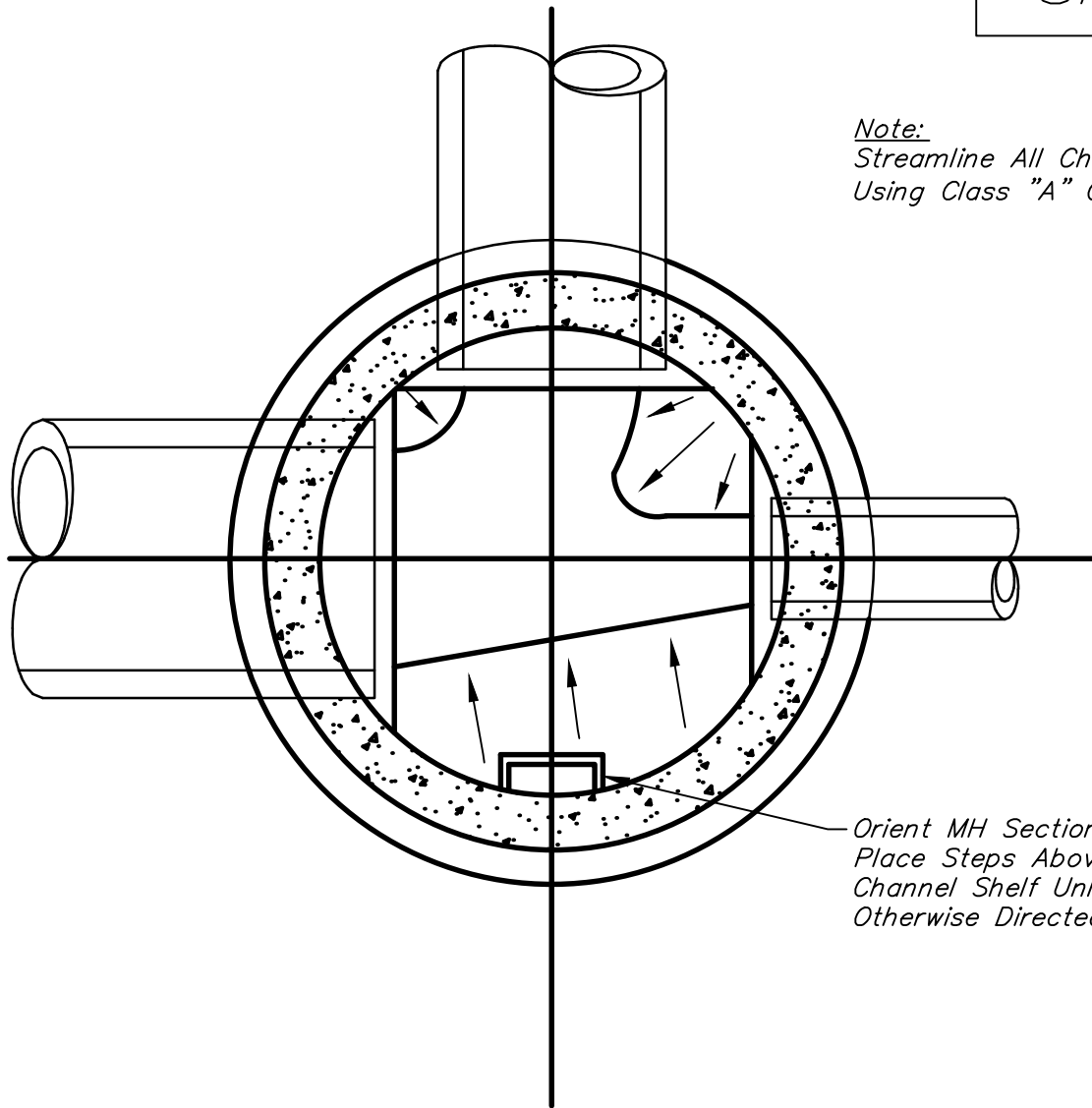
NOMINAL WEIGHT - 320 LBS



CITY OF KALAMAZOO  
DEPT. OF PUBLIC SERVICES  
SANITARY SEWER  
CASTING (LOCKING)  
NOVEMBER 2012

SA-3

*Note:  
Streamline All Channels  
Using Class "A" Conc.*



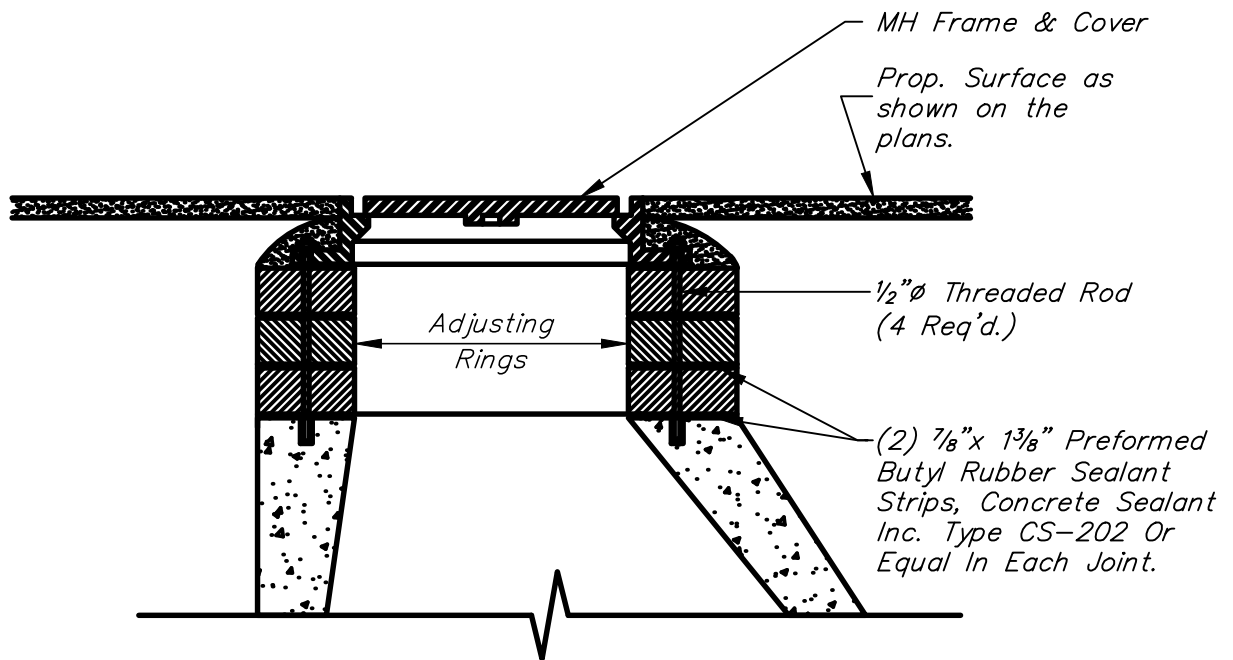
*Orient MH Sections To  
Place Steps Above  
Channel Shelf Unless  
Otherwise Directed*

SECTIONAL PLAN  
 $\frac{1}{2}'' = 1'-0''$



CITY OF KALAMAZOO  
DEPT. OF PUBLIC SERVICES  
FLOW CHANNEL  
SECTIONAL PLAN  
MARCH 2012

SA-4

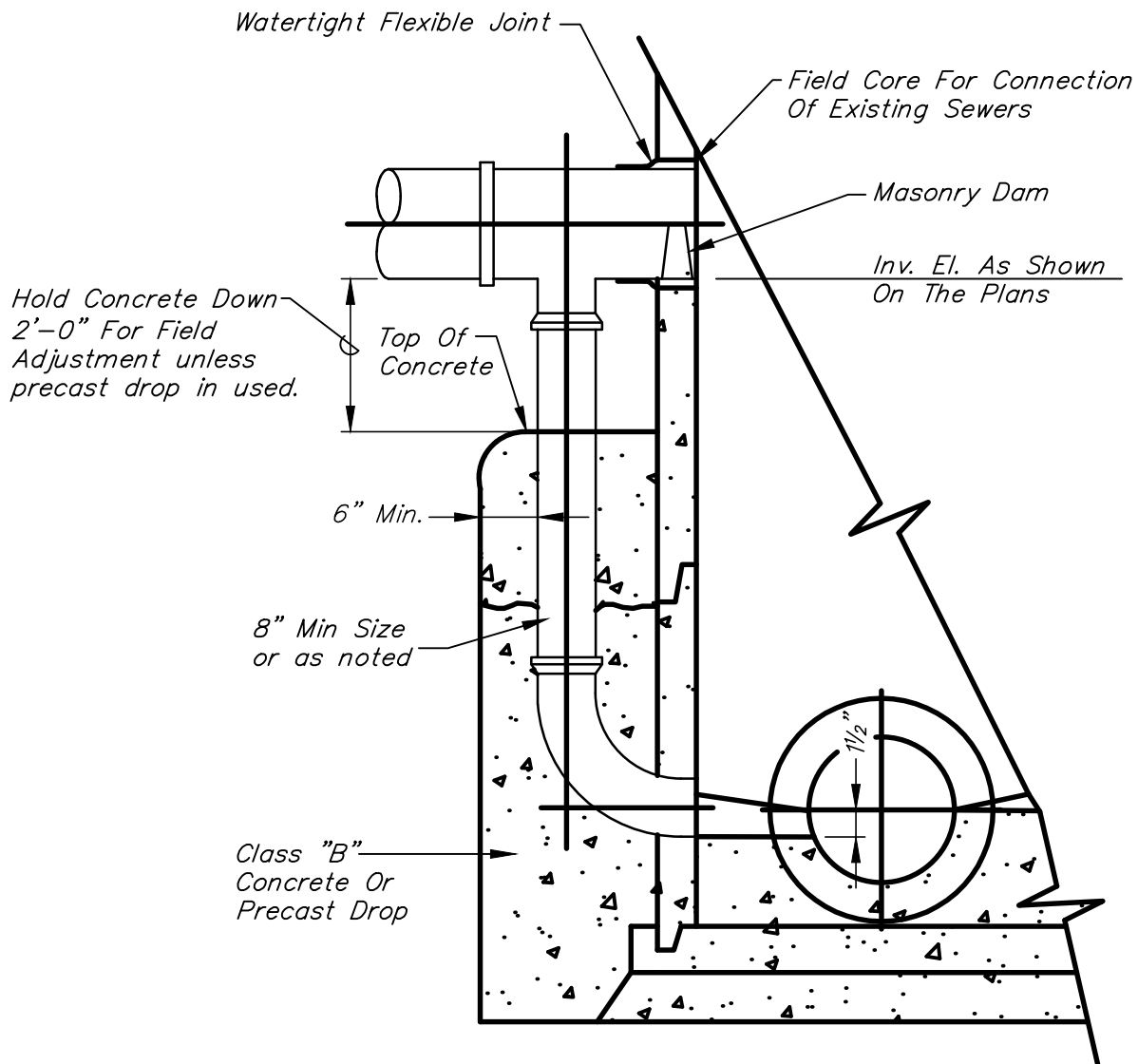


BUTYL RUBBER SEALANT DETAIL  
NTS



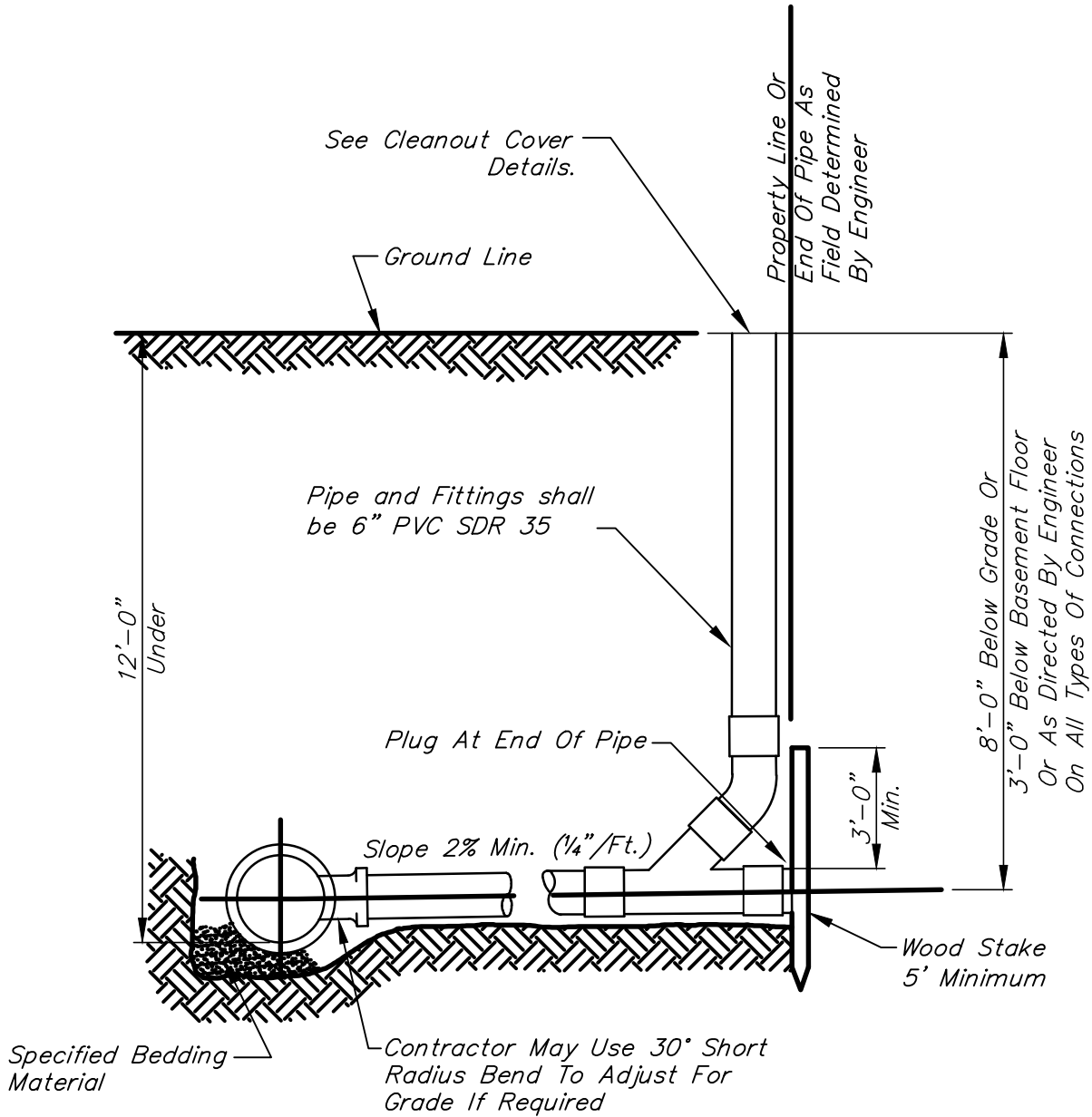
CITY OF KALAMAZOO  
DEPT. OF PUBLIC SERVICES  
BUTYL RUBBER  
SEALANT DETAIL  
MARCH 2012





MANHOLE WITH DROP  
NTS

SA-6A



SECTION

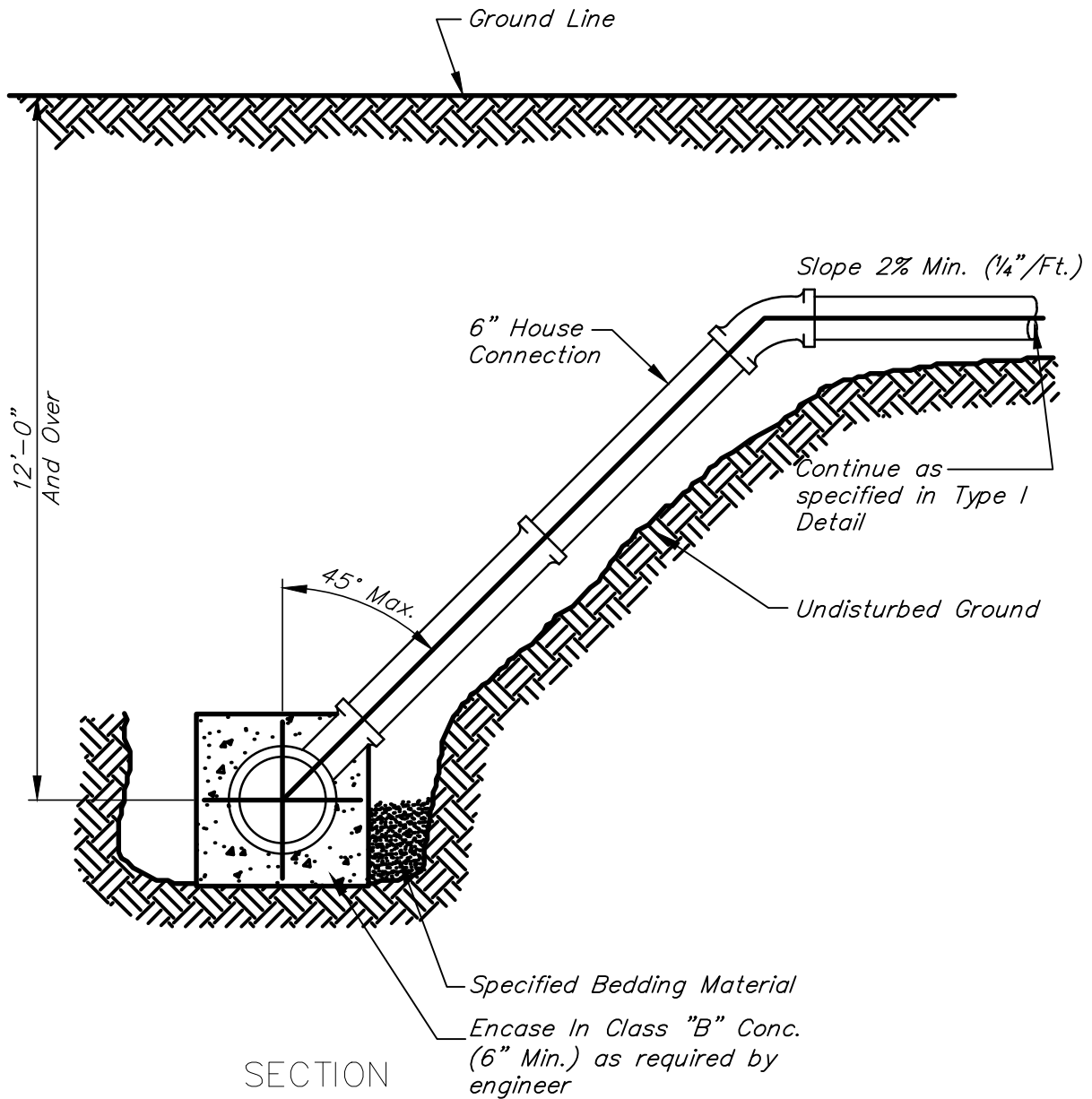
TYPE - 1

(To Be Used Where Main Sewer Is Less Than 12' In Depth)



CITY OF KALAMAZOO  
DEPT. OF PUBLIC SERVICES  
SANITARY SERVICE  
TYPE - 1  
MARCH 2012

SA-6B



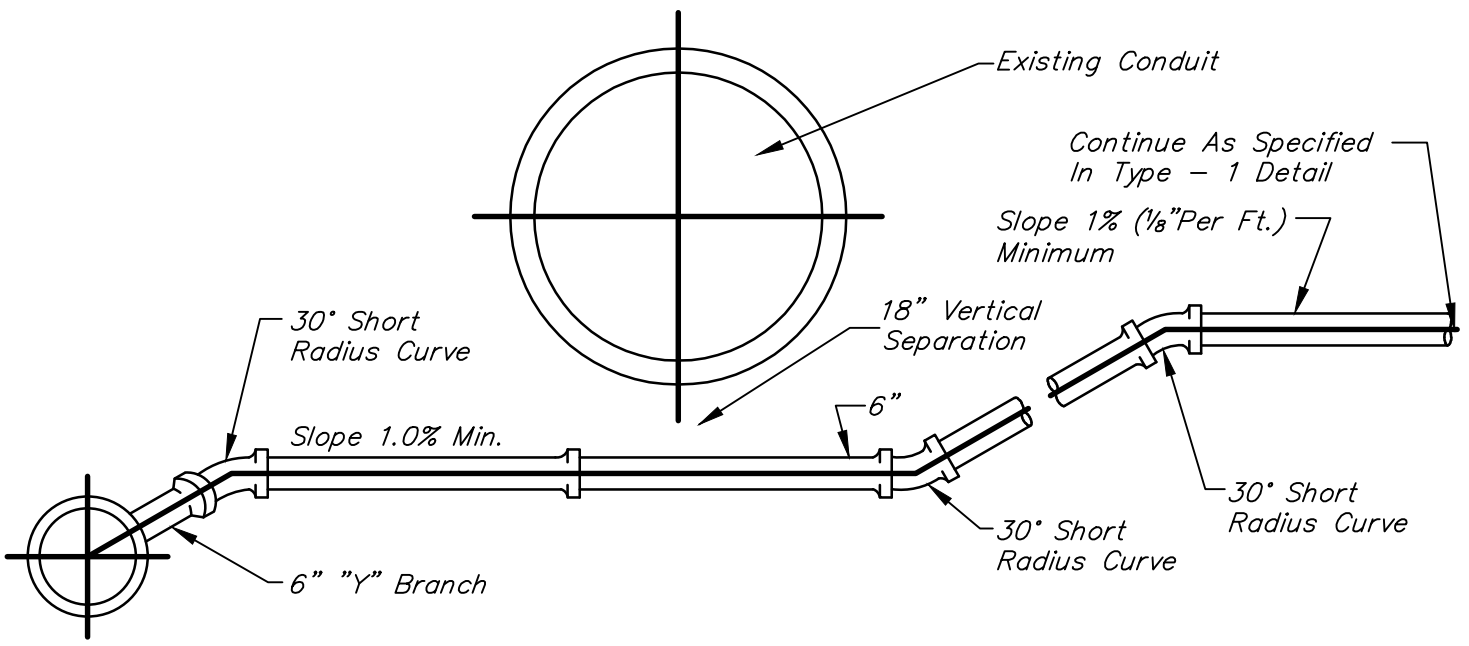
TYPE - 2

(To Be Used Where Main Sewer Is More Than 12' In Depth)



CITY OF KALAMAZOO  
DEPT. OF PUBLIC SERVICES  
SANITARY SERVICE  
TYPE - 2  
MARCH 2012

SA-6C



UNDER EXISTING CONDUITS

SERVICE CONNECTION DETAILS

NTS



CITY OF KALAMAZOO  
DEPT. OF PUBLIC SERVICES  
SANITARY SERVICE  
UNDER EXISTING  
CONDUIT  
MARCH 2012

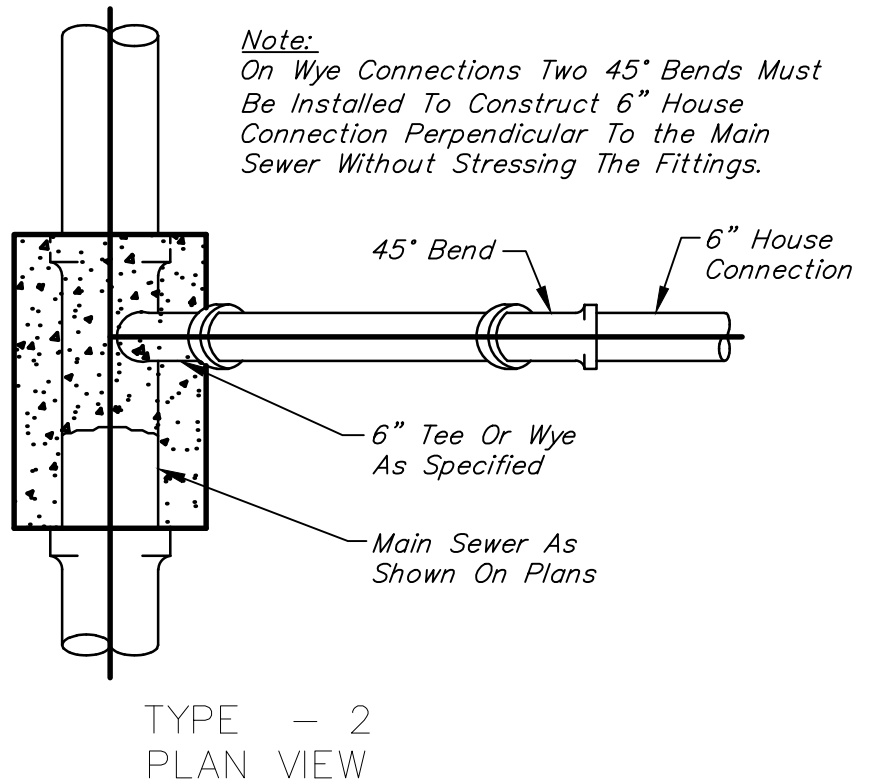
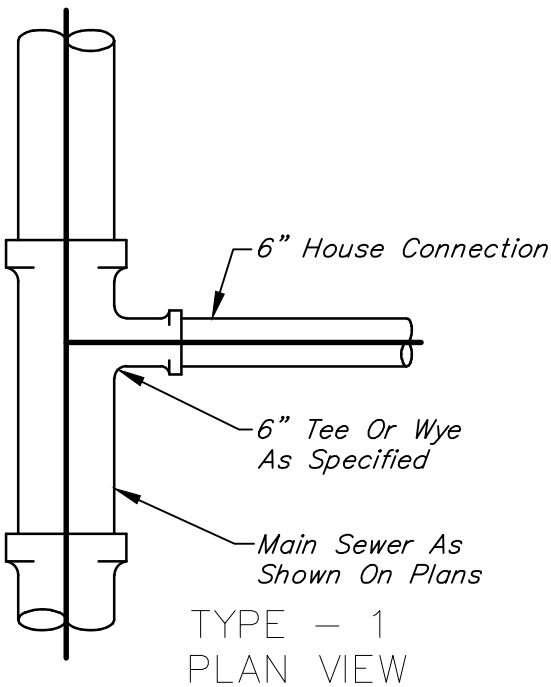
SA-6D

Service Connection Notes

- A. Contractor Shall Not Backfill Service Connection Until The Engineer Has Inspected And Taken Measurements, Elevations & Other Information Required For Purpose Of Record.
- B. All Tee And Wye Branches In The Main Sewer Line, Rotated More Than, 30° From Horiz. Shall Be Encased In 6" Min. Of Class "B" Concrete.
- C. Wye Branches Shall Be Used In all Connections For Sewers 18" and Smaller. Tee Branches May Be Used In Lieu Of Wye Branches For Connections To Main Sewers 18" And Larger.

Note:

On Wye Connections Two 45° Bends Must Be Installed To Construct 6" House Connection Perpendicular To the Main Sewer Without Stressing The Fittings.



CITY OF KALAMAZOO  
DEPT. OF PUBLIC SERVICES  
SANITARY SERVICE  
PLAN VIEW & NOTES  
MARCH 2012

SA-6E

