



DAVIDSON COUNTY SEWER DEPARTMENT

GENERAL SPECIFICATIONS

All references to specifications by the following institutes, associations and societies shall be made to the latest revision of each specification:

ANSI – American National Standards Institute

ASTM – American Society for Testing Materials

AWWA – American Water Works Association

AASHTO – American Association of State Highway
and Transportation Officials

All materials shall be new and are subject to approval by the Engineer. Only materials meeting specifications and/or the Engineer's approval will be used.

- **BRICK:** All brick used on the work will be hard, tough, sound clay or shale brick, of first-class quality, thoroughly vitrified and especially suitable to the class of work for which it is to be used. All brick will meet ASTM C32, Grade MS or higher. All brick will be laid in class "A" cement mortar.
- **CAST IRON SOIL PIPE AND FITTINGS:** All cast iron soil pipe and fittings will conform to ASTM A74 and be classified as SV (service weight). Single or double hub is acceptable. No-hub pipe shall not be used. All pipe and fittings shall conform to ASTM C564. 4" x 4" combination wye and eighth bends shall be short pattern – Fig. No. SV-32 by Charlotte Pipe and Foundry (or approved equal). 4" cleanouts shall consist of a 4" service weight cast iron ferrule (with 3" iron pipe size tap) and 3" brass plug. The plug shall have a low raised square head (Southern Code). Cleanouts shall be Part Number 184 by Jumbo Manufacturing Company (or approved equal).
- **CEMENT:** All cement used on the work will meet ASTM C150. Brand will be subject to the approval of the Engineer upon submission of typical test reports. Type I or II may be used in all work. Where high early strength concrete may be required, Type III cement may be used with permission of the Engineer.
- **COARSE AGGREGATE:** Coarse aggregate shall consist of mud, hard and tough broken stone and will conform to the specifications for coarse aggregate given in ASTM C33.
- **CONCRETE:** All concrete will be made of cement, water and aggregate as herein specified and will further be in accordance with the following definite requirements for the various classes.

A design of the mix made by an independent laboratory for each class of concrete will be submitted to the Engineer for approval before concreting is started. During the progress of work, standard compressive strength test specimens will be made, cured in accordance with ASTM C31 and tested by an independent testing laboratory in accordance with ASTM C39. At least three cylinders will be made for each test. Tests will be submitted for each

50 cubic yards or fraction thereof for each class of concrete used, one test will be furnished for each 100 cubic yards and for all over 500 cubic yards, one test for each 500 cubic yards. Should there be any evidence that concrete is not up to standard, a strength test may be required at any time.

Class AA concrete will have minimum 28-day compressive strength of 4,500 pounds per square inch and a slump not to exceed 3-1/2 inches.

- **COPPER PIPE:** All copper pipe will conform to ASTM B88. All copper shall be Type K, soft copper and all joints shall be compression.
- **CORPORATION COCKS:** All corporation cocks shall be made of red brass in accordance with ASTM B62 and AWWA C800. Red brass shall consist of 85% copper, 5% lead, 5% zinc and 5% tin. All corporation cocks shall be of the ball valve type with AWWA inlet threads.

The following materials are acceptable:

¾", 1", 1 ½" and 2" – FB1000-G by Ford or 4701BT by McDonald

- **DUCTILE IRON PIPE:** Ductile iron pipe shall be designed to conform to ANSI A21.50 (AWWA C150) and shall be manufactured to conform to ANSI A21.51 (AWWA C151). The interior of the pipe will be cement lined in accordance with ANSI A21.4 (AWWA C104) unless otherwise specified for specific applications such as sewer outfalls and force mains that may be subject to corrosive effluents. The exterior of the pipe shall be coated with a bituminous coating. Pipe joints will be single rubber gasket push-on type or mechanical joint type unless otherwise specified or otherwise shown on the Engineer's drawings. Rubber gasket joints shall conform to ANSI A21.11 (AWWA C111). Pipe design laying condition will be type 2, flat-bottom trench with backfill lightly consolidated to centerline of pipe. Pipe for gravity sanitary sewer shall be thickness Class 50 or greater. In cases where gravity sewer must be hydrostatically pressure tested, sewer shall be constructed of ductile iron pipe which is manufactured to public water supply standards and a minimum pressure class 250. Pipe for water and sewer force mains shall be pressure class 350 for 3"-20" and pressure Class 250 for 24" and above. Any deviations in class shall be otherwise specified or otherwise shown on the Engineer's drawings. The unit price for ductile iron pipe in the contract shall include the furnishings of necessary ductile iron pipe, labor, supervision, equipment and tools necessary for installing the pipe as shown on the Engineer's drawings or as may be directed by the Engineer. The unit price shall also include all excavation (except rock excavation), furnishings and placing suitable backfill, hauling and unloading of all pipe and removal and disposal of all rigid and flexible pavement. If for any reason the Engineer finds any or all ductile iron pipe unacceptable, the Contractor shall be responsible for obtaining acceptable pipe. The Engineer's acceptance or rejection of all pipe will be final.
- **DUCTILE IRON RESTRAINED JOINT PIPE FOR PRESSURE MAINS:** Ductile iron restrained joint pipe shall be installed at the locations shown on the Engineer's drawings. All restrained joint pipe shall have flexible push-on joints designed to deflect a minimum of 3 degrees per joint. At locations where field cutting of restrained joint pipe is required, a special field cut kit shall be used by the Contractor. Field welding will not be

allowed. Field cut kits shall provide restraint equivalent to factory manufactured restrained joint pipe. Field kits shall be provided by the pipe manufacturer. Restrained Joint pipe with a gripping gasket as the only means of providing restraint will not be allowed.

- **FENCE GATES:** At the unit price named, 14 foot wide 48" high gates will be furnished and installed in farm fences at locations as directed by the Engineer or as indicated on the Engineer's drawings. Gates will be installed as per the detail drawing.

Gates will be five panel type, fabricated using 4 ½", 24 gauge galvanized, steel forms. Gates will be mounted on 6" diameter, 8 foot long, pressure treated posts at the hinged ends. Hinges will utilize 5/8" pins screwed into posts, turned up at the bottom and turned down at the top. Female receivers mounted on gate frames will rotate on pins. All hinges, pins, etc. shall be hot-dip galvanized.

Slide latches will be provided to slide into receivers attached to a 6" diameter, 8 foot long, pressure treated posts. Minimum retention for treated posts shall be .4 lbs. of chromated copper arsenate per cubic foot of wood.

For locking purposes, a 5/16" link chain 28" long, will be furnished and attached to the latch posts. Furnished with each gate will be a master padlock, master keyed as directed by Engineer.

- **FENCING (OUTFALLS):** At the unit price named per linear foot, 48" high fencing shall be furnished and installed at locations as directed by the Engineer or as shown on the Engineer's drawings. Fencing will be installed as per the detail drawing.

Fencing shall be 2" x 4" galvanized woven wire fabric. Posts shall be 4" x 4" pressure treated lumber (6 feet long). Minimum retention for treated posts shall be .4 lbs. of chromated copper arsenate per cubic foot of wood.

FIRE HYDRANTS: All fire hydrants shall be dry-barrel fire hydrants, which comply with ANSI/AWWA C502. All hydrants will have a dry top with O-ring seals, which permanently seal off the stem operating threads from water and keep the lubricant in. Turning the operating nut on top of the hydrant counterclockwise shall open all hydrants. The main valve shall be a compression type valve with a valve opening of 4 ½" or 5 ¼" unless otherwise specified. Each hydrant will have two nozzles and one steamer nozzle. The 2 ½" hose nozzles and the 4 ¼" steamer nozzle shall have national standard threads unless applicable water system has its own specific threads. The nozzle shall be fastened into the hydrant barrel by mechanical means, but shall not be leaded into the barrel. Nozzle caps shall be chained to the barrel. All hydrants will be furnished with a breakable traffic feature that will break upon impact. The feature shall consist of a breakable safety flange on the barrel and a breakable safety coupling in the main valve stem. Hydrants must have a bronze main valve seat ring that threads into a bronze drain ring. Each hydrant shall have at least two bronze drain outlets. All hydrants will have 6" mechanical joint bass connections unless otherwise specified by the Engineer. Hydrants shall be designed for a working pressure of 200 psi. Assembled hydrants shall be subjected to two hydrostatic tests of 400 psi in accordance with ANSI/AWWA C502 - Section 5. All exterior iron surfaces below ground level shall be covered with two coats of asphaltic varnish. The first coat shall be

allowed to dry thoroughly before the second is applied. All exterior iron surfaces above ground level shall be painted yellow to the satisfaction of the Engineer. Yellow paint shall be Rust-Oleum 7446 or 2148. All interior iron surfaces of the hydrant shoe which are in contact with water (including the lower valve plate and nut) shall be coated with a minimum of 8 mils of fusion bonded epoxy or liquid epoxy in accordance with ANSI/AWWA C550. All hydrants shall have a thrust or anti-friction washer in the operating area of the hydrant bonnet. A weather cap around the operating nut on top of the hydrant is required. It is the Contractor's responsibility to determine specific brands of hydrants that are accepted by the governing authority and the Engineer for this project. Hydrants will normally be three and one-half feet from the ground to the bottom of the hydrant (42" bury). However, when plans indicate a deeper bury is required, such hydrants will be furnished and conforming to the depth of bury as shown on the plans. Hydrant extensions will be installed only if necessary.

- **FITTINGS (DUCTILE IRON):** Ductile iron fittings shall meet all requirements of ANSI A21.10 (AWWA C110) and will be of the mechanical joint type unless otherwise specified. All glands shall be ductile iron, not gray iron. The interior of all fittings will be cement lined in accordance with ANSI A21.4 (AWWA C104). The exterior of all fittings shall be coated with a bituminous coating. Fittings are subject to approval by the Engineer and his acceptance or rejection shall be final. Rubber gasket joints shall conform to ANSI A21.11 (AWWA C111). Ductile iron compact fittings (3"-24") conforming to ANSI A21.53 (AWWA C153) are acceptable. "DI" or "Ductile" shall be cast on each fitting. Fittings shall be paid for at the unit price per pound for fittings in the contract. This price shall include the cost of furnishing and installing the fittings and accessories. Payment will be made based on weights for ductile iron fittings as listed in AWWA C110. The weights to be used for payment include fitting weights only. No payment will be made for glands, bolts and gaskets. Fittings not listed in AWWA C110 will be paid based on actual fitting weight as shown on the foundry invoice. In case of discrepancy, the Engineer's decision shall prevail over AWWA C110.
- **IRON AND STEEL (MISCELLANEOUS):** All miscellaneous iron and steel such as angle iron, checkered plate covers, valve stem guides and supports, etc. will be galvanized.

Galvanizing will be by the hot-dip process after the materials have been cut, assembled and all holes punched. Any field welds or bolts which may be used to fasten iron or steel together will be painted immediately after installation with two coats of galvanizing compound.

- **LIME:** Lime for cement mortar will meet ASTM C207, Type N
- **MANHOLE RINGS AND COVERS (TYPE 1):** Manhole rings and covers will be made of cast iron and will conform to ASTM A48, Class 30B. In addition, all manhole rings and covers shall be designed to support an H-20 wheel load. All castings will conform to the shape and dimensions shown on the detail drawings and will be free from holes, cracks or any other defects. Rings and covers will have machined seats so that the cover will not rattle. Rings will weigh a minimum of 190 pounds and covers a minimum of 120 pounds. The name of the foundry and the part number shall be cast permanently on the ring and the

cover. Castings that do not meet specifications shall be rejected. Rings and covers furnished under these specifications shall be manufactured by one of the following:

- Sumter Machinery Company, Inc. (Ring – Part No. 669;
- Cover – Part No. KL)
- U.S. Foundry & Manufacturing Corp. (Ring – Part No. 669;
- Cover – Part No. KL)
- Vulcan Foundry, Inc. (Parts No. V-1384)
- **MANHOLE RINGS AND COVERS (TYPE 2):** Rings and covers shall meet all specifications for Type 1 rings and covers and shall conform to the detail drawing for Type 2. Rings and covers shall be manufactured by one of the following:
 - Vulcan Foundry, Inc. (Ring – Part No. V-2384)
 - Cover – Part No. V-1385)
 - U.S. Foundry & Manufacturing Corp. (Ring – Part No. 669-2;
 - Cover – Part No. KL-2)
- **MANHOLE RINGS AND COVERS (TYPE 3):** Rings and covers shall meet all specifications for type 1 rings and covers, except that rings will weigh a minimum of 136 pounds and covers a minimum of 120 pounds. All rings and covers shall conform to the detail drawing for type 3. Rings and covers shall be manufactured by one of the following:
 - Vulcan Foundry, Inc. (Ring – Part No. V-2484-3;
 - Cover – Part No. V-2384)
 - U.S. Foundry & Manufacturing Corp. (Ring – Part No. 571;
 - Cover – Part No. KK)
- **MANHOLE STEPS:** All manhole steps shall conform to current OSHA standards and ASTM C478. The approved step is shown on a detail drawing. All other steps must be approved by the Engineer prior to being installed.
- **METERS:** All 5/8” – 2” meters will be installed by the governing authority. The unit price for water connections shall include everything shown on detail drawings except for the meter and the expansion connection.
- **METER BOXES (CAST IRON):** Cast iron meter boxes will conform to ASTM A48, Class 30B. All boxes will conform to the shape, dimensions and weights shown on the detail drawing and will be free from holes, cracks, or any other defects. All boxes shall be thoroughly coated with an asphaltic varnish. Meter boxes that do not meet specifications shall be rejected. It shall be the Contractor’s responsibility to determine specific manufacturers that are acceptable to the governing authority (typically Davidson Water, Inc.) and the Engineer.
- **METER BOXES (PLASTIC WITH CAST IRON COVERS – 5/8” AND 1” METERS):** All plastic meter boxes will conform to the shape and dimensions shown on the detail drawing. Meter boxes that do not meet specifications will be rejected. The cast iron cover shall covered with an asphaltic varnish. Plastic meter boxes may be supplied by the following:
 - Carson-Brooks #1419-12 box with solid cast iron Meter box lid (15 lb. Min.)
- **METER YOKES AND ACCESSORIES:** Lime and cement mortar will be composed of one part cement and two parts well-aged lime paste or hydrated lime to four parts sand, the

proportions to be by measure in boxes. Commercial mortar compounds with the approval of the Engineer may be substituted for the lime and cement.

- Unless otherwise provided, cement mortar will be of two classes known as Class A and Class B.
- **MORTAR:** Lime and cement mortar will be composed of one part cement and two parts well-aged lime paste or hydrated lime to four parts sand, the proportions to be by measure in boxes. Commercial mortar compounds with the approval of the Engineer may be substituted for the lime and cement.

Unless otherwise provided, cement mortar will be of two classes known as Class A and Class B. Class A mortar will consist of cement and sand mixed in proportions of one part cement to two parts sand with not more than 6.3 gallons of water per bag of cement. Class B mortar will consist of cement and sand mixed in the proportion of one part cement to three parts sand with not more than 6.3 gallons water per bag of cement.

All mixtures may be varied to increase workability only by reducing the amount of sand or blending one or more sands.

Mortar in which cement has been placed for more than an hour will not be used.

When air temperature is below 40 degrees Fahrenheit, no mortar will be used without special permission of the Engineer.

- **POLYVINYL CHLORIDE (PVC) PRESSURE PIPE WATER MAINS AND SANITARY SEWER FORCE MAINS:** PVC pipe 12" and under shall conform to AWWA C900, minimum pressure rating 200 psi and the dimension ratio (DR) shall be 14. All pipe shall have an integral bell and gasketed joint. The gasketed joint shall meet the requirements of ASTM D-3139 and the joint gasket shall conform to ASTM F-477. The outside diameters shall conform to ductile iron standard dimensions. All pipe shall meet ASTM-D1784 and ASTM-D2241.

PVC Pipe 14" and 16" shall conform to AWWA C905, minimum pressure rating 200 psi and the dimension ratio (DR) shall be 18. All pipe shall have an integral bell and gasketed joint. The gasketed joint shall meet the requirements of ASTM D-3139 and the joint gasket shall conform to ASTM F-477. The outside diameters shall conform to ductile iron standard dimensions.

PVC pipe shall not be stored uncovered in direct sunlight. Conductive copper tracer wire shall be buried above all PVC pipe, not more than 18 inches below the ground surface.

Installation (including pressure testing) shall conform to Methods of Construction for water pipe contained hereafter or manufacturer's installation requirements, whichever is greater. Disinfection will not be required on sewer force mains. PVC pipe will be handled with care and shall not be dumped, dragged, dropped or thrown. Heavy materials must not be top loaded on PVC pipe. Trenches will be carefully graded to insure continuous and equal bearing the full length of all joints. Backfilling of trenches will be carefully done with

selected material removing all sharp rocks. Air release valves shall be located at all high points on sewer force mains as shown on the Engineer's drawings.

- **RIP-RAP:** Rip Rap shall include Class 1 and 2 Rip Rap and Class A and B Erosion Control Stone. All materials shall conform to Section 1042 of the N.C. Department of Transportation Standard Specifications for Roads and Structures. Rip Rap thickness shall be 1.5 times the maximum stone diameter or as shown on the Engineer's drawings.

At creek crossings, Rip Rap shall be placed a minimum of 15 feet on each side of the centerline of the pipe. Rip Rap shall be placed to the satisfaction of the Engineer. Rip Rap from the quarry will be paid for on a unit price basis as set forth in the proposal. No payment will be made for field stone or broken concrete used as Rip Rap. Filter fabric shall be placed under all Rip Rap. The filter fabric cost shall be included in the unit price for Rip Rap.

- **SAND:** All sand used in mortar or as fine aggregate in concrete will be clean, sharp, practically free from loam, clay or vegetable matter and so graded as to insure workability and water tightness when mixed with other ingredients. Sand will conform to ASTM C33 and when made into mortar will have a compressive strength at 7 and 28 days of not less than 100 percent of mortar made with standard sand. Independent laboratory tests will be submitted for approval of the Engineer.
- **SCREENINGS:** Screenings shall be placed on all paved roadways prior to beginning any trenching activities. Screenings shall be placed on the affected pavement area at a depth of ½ inch. All screenings shall be removed once backfilling has been completed.
- **SERVICE SADDLES (SEWER):** Service saddles for 4" sewer connections may be used in lieu of wyes. Saddles shall be style "CB" sewer saddles by Romac Industries, Inc.
- **STEEL ENCASEMENT PIPE:** Steel encasement pipe shall be smooth wall pipe with welded joints. The pipe shall have minimum yield strength of 35,000 psi. The encasement pipe must be capable of withstanding highway loadings and must have an inside diameter which will allow the carrier pipe to be removed subsequently without disturbing the encasement pipe.

Minimum wall thicknesses for steel encasement pipe are as follows:

<u>ENCASEMENT PIPE OUTSIDE DIAMETER</u>	<u>WALL THICKNESS</u>
4" - 12 3/4"	.188"
16"	.250"
18"	.250"
20"	.250"
24"	.250"
30"	.312"
36"	.375"
48"	.500"

Encasement pipe installed on railway rights-of-way shall be subject to specifications by the American Railway Engineering Association.

Pipe diameter shall be shown on the Engineer's drawings.

- **STEEL FOR REINFORCEMENT:** All reinforcement steel bars will conform to ASTM A615 (Grade 60) and all reinforcement welded steel wire fabric will conform to ASTM A185. All steel will be free from rust or other coatings, which would destroy the bond between the steel and the concrete. Bars shall be tied together and supported to prevent damage by construction loads or by pouring of concrete. On the ground and where necessary, concrete blocks cast of the same concrete as is to be poured will be used for the purpose of supporting the steel. On formwork, bar chairs and spacers approved by the Engineer shall be used for support. Where the concrete surface will be exposed, the portions of all accessories in contact with the framework will be galvanized or coated with plastic.
- **STONE (MISCELLANEOUS):** Miscellaneous stone shall be ABC stone. This stone shall be used for driveways, streets, parking lots, etc.
- **STONE (STABILIZATION):** Stabilization stone shall be #5 or #57 stone. This stone shall be used in unstable soil, under or around pipe, under manholes, etc.
- **T-HEAD BOLTS AND HEXAGONAL NUTS:** All T-head bolts and nuts used for mechanical joint pipe, vales, hydrants or fittings shall be high-strength, low-alloy steel in accordance with ANSI A21.11 (AWWA C111). Cast iron bolts will not be accepted.
- **THREADED RODS:** Threaded rods used for thrust restraint shall be $\frac{3}{4}$ ", high-strength, low-alloy steel rods which conform to ASTM A242. The minimum yield strength shall be 36,000 psi and the tensile strength shall be at least 60,000 psi.
- **TIE BOLTS:** Tie bolts used for thrust restraint shall be Star Figure No. SST 7 (or SST 756) – $\frac{3}{4}$ " high-strength, low-alloy steel tie bolts. High-strength, low-alloy steel washers and tie nuts shall be used with all the bolts. High-strength, low-alloy steel washers and tie nuts shall be used with all tie bolts.
- **VALVES (AIR RELEASE):** All air release valves should conform to ANSI/AWWA C512. The unit price for an air release valve will include furnishings and installing a corporation cock on the main, two bronze ball valve curb stops, brass pipe, brass fittings and an air release valve, all enclosed in a manhole as indicated on the detail drawings. The air release valve shall be a pressure air valve (operating pressure 0-200 psi) manufactured by GA Industries or an approved equal. All interior iron surfaces of the air valve shall be coated with a minimum of 8 mills of fusion bonded epoxy or liquid epoxy in accordance with ANSI/AWW C550. The bronze ball valve curb stops shall have a minimum working pressure of 200 psi.
- **VALVES (BUTTERFLY) (24" AND LARGER ONLY):** All rubber-seated butterfly vales will meet the specifications of ANSI/AWWA C504. All valves shall have an iron body with a gray iron or ductile iron disc. The disc shall have a rubber seat which is fastened to the disc with a stainless steel retaining ring and stainless steel screws. The disc shall seat against a stainless steel seat ring, which is fastened to the valve body. Valve shafts shall be stainless steel. Valves will have totally enclosed oil or grease lubricated gear or traveling nut type manual operator. Valves used for buried service will have a 2" square operating nut and mechanical joint end connections. Valves for above ground service will be short bodied with flanged end connections and will have a hand

wheel operator. Valves installed in manholes will normally be considered to be buried service valves. All valves will open by turning the nut or hand wheel counterclockwise.

Butterfly valves will be designed for a minimum working pressure of 150 psi (Class 150B). The required working pressure design shall be shown on the Engineer's drawings. The valve body will be hydrostatically tested to twice the working pressure and the seat will be air tested to the working pressure. Both tests shall be made in accordance with ANSI/AWWA C504 – Section 5. All valves shall have two coats of asphaltic varnish applied to all exterior iron surfaces. All interior iron surfaces, which are in contact with water (including the disc) shall be coated with a minimum of 8 mils of liquid epoxy in accordance with ANSI/AWWA C550. Butterfly valves furnished under these specifications must be manufactured by one of the following:

(1) Mueller Company

(2) M&H Valve company

Butterfly valves shall be installed in manholes and shall be jointed to the water main with a sleeve in accordance with detail drawings for butterfly valve installation. Payment for furnishing and installing sleeves shall be included in the price bid for furnishing and installing butterfly valves.

- **VALVES (GATE) (3" THROUGH 16"):** All gate valves should be resilient-seated gate valves, which meet the specifications of ANSI/AWWA C509. The valve body, bonnet and seal plate shall be coated on all exterior and interior surfaces with a minimum of 8-10 mils of fusion-bonded epoxy in accordance with ANSI/AWWA C550. The valve shall incorporate a new guide system with guide lugs on the wedge or on the body. The wedge shall be gray or ductile iron, fully encapsulated with rubber (including guide lugs and stem nut holder). Non-rising stem valves shall have two O-ring seals above the stem thrust collar that can be replaced with the valve under pressure. Non-rising stem valves shall also have a thrust washer on the stem thrust collar.

All tapping sleeves and valves shall be air or water tested before the tap is made. During the test, the gates on the valve shall be open. All tapping sleeves and valves shall be installed level.

Approved tapping sleeves are as follows:

(1) Mueller Company

(2) American Flow Control

(3) M & H Valve Company

(4) Clow Valve Company

Approved tapping saddles are as follows:

- (1) American Flow Control
- (2) U.S. Pipe and Foundry Company

Approved tapping valves are as follows:

- (1) Clow Valve Company
- (2) M & H Valve Company
- (3) American Flow Control (Series 500)
- (4) U.S. Pipe and Foundry Company
- (5) Mueller Company (T-2360)

- **VALVE BOXES (ROUND TOP):** Cast iron valve boxes will conform to ASTM A48, Class 30B. All boxes will conform to the shape and dimensions shown on the detail drawings and will be free from holes, cracks or any other defects.

All castings will be thoroughly coated with an asphaltic varnish. Valve boxes that do not meet specifications shall be rejected. Cast iron valve boxes furnished under these specifications shall be manufactured by one of the following:

- (1) Sumter Machinery Company, Inc.
- (2) Russel Pipe & Foundry Co., Inc.
- (3) Fastener Technology, Inc. (FASTECH) – Made in India
- (4) Vulcan Foundry, Inc. (Part No. V-8463) – Made in India

- **WATER:** Water shall be clean and free from oil, acid alkali, organic matter or other deleterious material. Water from doubtful sources shall not be used unless approved by the Engineer.
- **POLYVINYL CHLORIDE (PVC) SANITARY SEWER PIPE AND FITTINGS:** PVC sewer pipe in sizes 4" – 15" shall meet the requirements of ASTM D3034 "Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings". The standard dimension ratio (SDR) shall not exceed 26 unless specifically authorized by Engineer.

The pipe shall be made and joined with an integral bell, bell-and-spigot rubber gasketed joint. Each integral bell joint shall consist of formed bell complete with a single rubber gasket. Gaskets shall conform to ASTM F477 and shall meet ASTM D3212 "Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seal". No solvent cement joints will be permitted in field construction except as may specifically be authorized by Engineer. Fittings for gravity PVC sewer pipe shall be fabricated from pipe meeting the respective ASTM/PVC pipe standard or molded PVC. The wall thickness of the waterway and bell of molded fittings shall be no less than the

respective minimum thickness for the equivalent pipe. All fittings shall be compatible with the pipe to which they are attached.

All PVC sewer pipe shall have a minimum pipe stiffness that equals or exceeds 46 lbs./in-in and shall be furnished in laying lengths of 13' minimum with markings in accordance with the applicable ASTM standard specification marking. Intervals shall not exceed 5 feet.

- **INSTALLATION OF STEEL ENCASEMENT PIPE:** Encasement pipe shall be installed by dry boring and jacking. The boring auger shall be mounted inside the encasement pipe. The installation of the pipe and the boring of the hole shall be done simultaneously. As the boring operation progresses each new section of encasement pipe shall be butt-welded to the previously installed section. Voids are to be filled with a Portland cement grout consisting of one (1) part Portland cement grout to three (3) parts sand at sufficient pressure to insure there will be no settlement of the highway or railroad. Encasement pipe shall be sealed at the ends with brick and mortar to prevent flowing water or debris from entering the space between the encasement pipe and the carrier pipe. Spaces will be required if shown on the Engineer's drawings. Encasement pipe shall be installed prior to laying the carrier pipe within 50 feet of either the end of the encasement.

In the event that an obstruction is encountered during the dry boring operation, the auger is to be withdrawn, the excess pipe cut off and capped and the void completely filled with Portland cement grout as described above before moving to another boring site. The Contractor will be paid for actual footage installed in the event an obstruction is encountered. Open cutting will not be allowed unless approved by the North Carolina Department of Transportation. When encasement pipe is installed on railway rights-of-way, the Contractor must obtain all insurance required by the railway. The cost of insurance shall be included in the unit price for encasement pipe.

- **RELATION OF WATER MAINS TO SANITARY SEWER MAINS:**
 - (a) Lateral Separation of Sanitary Sewer Mains and Water Mains – Water mains shall be laid at least 10 feet laterally from existing or proposed sanitary sewers, unless local conditions or barriers prevent a 10 foot lateral separation – in which case:
 - (1) The water main is laid in a separate trench, with the elevation of the bottom of the water main at least 18 inches above the top of the sewer; or
 - (2) The water main is laid in the same trench as the sewer with the water main located at one side on a bench of undisturbed earth and with the elevation of the bottom of the water main at least 18 inches above the top of the sewer.
 - (b) Crossing a Water Main over a Sanitary Sewer Main – Whenever it is necessary for a water main to cross over a sanitary sewer, the water main shall be laid at such an

elevation that the bottom of the water main is at least 18 inches above the top of the sewer, unless local conditions or barriers prevent an 18 inch vertical separation-in which case both the water main and sewer shall be constructed of ductile iron pipe and with joints that are equivalent to water main standards for a distance of 10 feet on each side of the point of crossing. Both lines shall be hydrostatically tested to 150 psi to assure water tightness.

- (c) Crossing a Water Main under a Sanitary Sewer Main – Whenever it is necessary for a water main to cross under a sanitary sewer, both the water main and the sewer main shall be constructed of ductile iron pipe and with joints equivalent to water main standards for a distance of 10 feet on each side of the point of crossing. A section of water main pipe shall be centered at the point of crossing. Both lines shall be hydrostatically tested to 150 psi to assure water tightness.
- **SEWER CONNECTIONS:** Sewer connections shall be installed as shown on detail drawings. Wyes will not be allowed within 10 feet of a manhole. If more than one bend is needed (Ex: bored sewer connection), the road shall be open cut and the connection installed properly. Connections into manholes will require a flexible sleeve at the manhole. Connections into manholes must be at least 6” from the nearest manhole step. Sewer connections shall be a maximum of 75 feet from the sewer main to the cleanout.
- **SEWER PIPE DEFLECTION:** The Engineer shall require deflection testing to be performed no sooner than 30 days after the backfilling of each section to be tested. If the test section fails the test for excessive deflection, the Contractor shall repair or replace all defective materials and/or workmanship at no additional cost to the governing authority. Deflection tests should be conducted using a go/no-go mandrel. The mandrels outside dimension shall be sized to permit no more than 5.0 percent deflection. The percent deflection shall be established from the base inside diameter of the pipe as measured in compliance with ASTM D 2122 “Standard Test Method of Determining Dimensions of Thermoplastic Pipe and Fittings. The mandrel shall be approved by the Engineer prior to use.
- **VACUUM TESTING OF MANHOLES:** Each manhole constructed by the Contractor shall be vacuum tested by the Contractor after assembly of the manhole. The test shall be conducted in accordance with ASTM C-1244. The test shall be performed after all grade rings and rings and covers have been installed. After the testing equipment is in place, a vacuum of 10 inches of mercury shall be drawn on the manhole. The time for the vacuum to drop to 9 inches of mercury must be greater than the minimum time listed below:

MINIMUM VACUUM TEST TIME (Seconds)

<u>Manhole Depth</u>	<u>Diameter of Manhole</u>		
	<u>48”</u>	<u>60”</u>	<u>72”</u>
0 – 10’	60 sec.	75 sec.	90 sec.
10-15’	75 sec.	90 sec.	150 sec.
15-25’	90 sec.	105 sec.	120 sec.
25-30’	105 sec.	120 sec.	135 sec.

The Engineer shall be present during the entire testing process. Any repairs to manholes, which fail the vacuum test, must be made on the inside and outside of each manhole.

- **ACCEPTANCE TESTING:** After the pipeline is completely backfilled and before being placed into service, a low-pressure air test will be conducted by the Contractor in accordance with ASTM F-1417-92 as modified herein. Each section of pipeline (including connections) between manholes will be tested by plugging the upstream manhole and the downstream manhole. Air is added to the line until the pressure is 4.0 psi. If the pressure drops more than 0.5 psi during the time shown in the chart below, the line has failed the test. If the top of the pipe to be tested is below the ground water table, an infiltration test may be required. Infiltration shall not exceed 50 gallons per inch diameter per mile of pipe per 24 hours. An obvious leak in any section will be corrected even if the section passes testing. The Engineer must be present during the entire testing process. Any work done without his supervision will not be accepted. Air testing will only be required for pipelines 24" and smaller. Larger pipelines will require infiltration and/or exfiltration testing. Exfiltration limits shall be the same as infiltration. Air test time shall be as follows:

Minimum Air Test Time

Pipe Diameter Inches	Minimum Time Minutes	Specification Time for Length (L) Shown, Minutes							
		100 ft.	150 ft.	200 ft.	250 ft.	300 ft.	350 ft.	400 ft.	450 ft.
4	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	2:50	2:50	2:50	2:50	2:50	2:50	2:50	3:12
8	4:00	4:00	4:00	4:00	4:00	4:00	4:26	5:04	5:42
10	4:43	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	5:40	5:40	5:40	7:08	8:33	9:58	11:24	12:50
15	7:05	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:00
18	8:30	8:39	9:37	12:49	16:00	19:14	22:26	25:38	28:50
21	9:55	9:55	13:05	17:27	21:49	26:11	30:30	34:54	39:15
24	11:20	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:15

WATER

- **INSTALLATION OF PVC AND DIP FORCE MAINS:** The bid price for water mains and force mains will include the pipe and the installation of the pipe to a depth as shown on plans at all locations required by the Engineer. Minimum cover will be 36 inches or as indicated on plans. Pipe laying in general will conform to ANSI/AWWA C600. Pipe shall be paid for based on the total horizontal centerline distance along the water main. No deduction will be made for valves, fittings, manholes, etc.

All materials for the laying and jointing pipe in the trench will conform to the specifications for such material as hereinbefore given and will be furnished by the Contractor. Pipe, fittings, valves and other pipeline accessories shall be loaded, transported, unloaded, stored, handled and installed by methods that will insure final installation in a sound and undamaged condition. Under no circumstances shall pipe, fittings or valves be dropped to the ground onto or against hard or solid objects or materials, or otherwise subjected to possible damage from impact or shock. In distributing pipeline materials at the site of the work, each piece shall be unloaded opposite or as close as possible to the installation in order to avoid unnecessary re-handling. All gaskets shall be stored out of direct sunlight.

Pipe and fittings shall be handled in such a manner that neither the lining nor the coating will be damaged. Hooks used for insertion in the ends of pipe shall have well-padded surfaces. Pipe and fittings in which any linings are broken or loosened in unloading or subsequent handling shall be rejected by the Engineer.

All pipe will be thoroughly cleaned of all earth and rubbish before being placed in the trench. Pipe will be laid on true lines and grades as directed by the Engineer. Pipe shall be laid with the bell ends facing the direction of laying. Bell holes will be dug at each joint to assure the pipe barrel will lie flat on the trench bottom. Every open end of the pipe will be securely plugged when pipe laying is not in progress. Every open end of the pipe will be securely plugged when pipe laying is not in progress. Pipe will be placed on firm foundation so as to prevent subsequent settlement and the trenches will be carefully excavated to the proper grade so that it will not be necessary to fill-in under the pipe. Under no circumstances shall pipe be laid in water and no pipe shall be laid under unsuitable weather or trench conditions. A maximum of 200 feet of open trench shall be allowed in the process of excavation.

Installation of PVC pipe shall be in conformance with ASTM D-2321 except where modified herein.

Mechanical joints shall be installed as follows:

The bell, spigot, gland and gasket shall be wiped clean (and wire brushed if necessary) of all dirt, sand, etc. The bell, spigot and gasket shall then be coated with soapy water or approved pipe lubricant and the gland and gasket slipped over the spigot end of the pipe.

MANHOLE RING & COVER TYPE 1



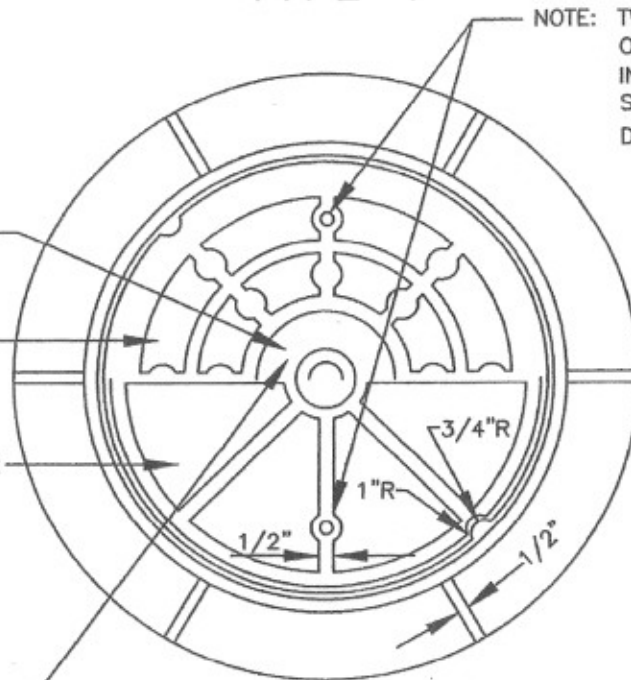
DETAIL "C C"

TOP OF COVER

BOTTOM OF COVER



DETAIL "B B"



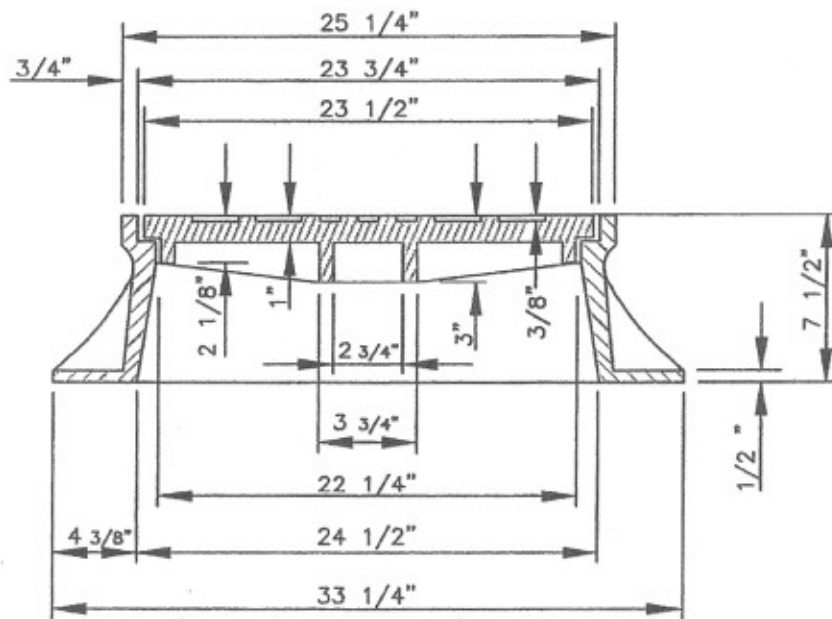
PLAN

NOTE: TWO HOLES TO BE SPACED OPPOSITE TO EACH OTHER IN THE OUTER RING AS SHOWN. (HOLES TO BE 1" DIAMETER)

NOTE:
RING AND COVER WILL HAVE MACHINED SEAT AND WILL CONFORM TO ASTM A48, CLASS 35B. RING AND COVER WILL BE DESIGNED TO SUPPORT AN H-20 WHEEL LOAD.

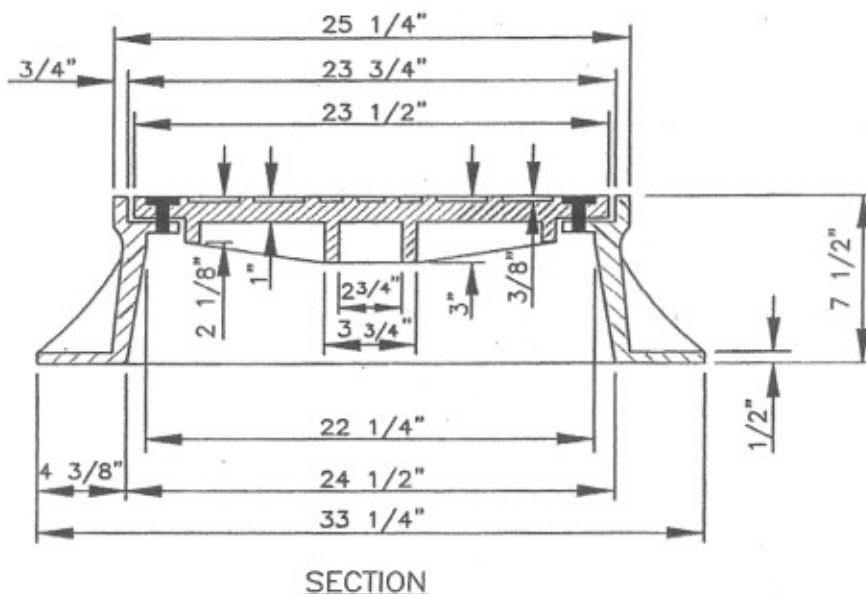
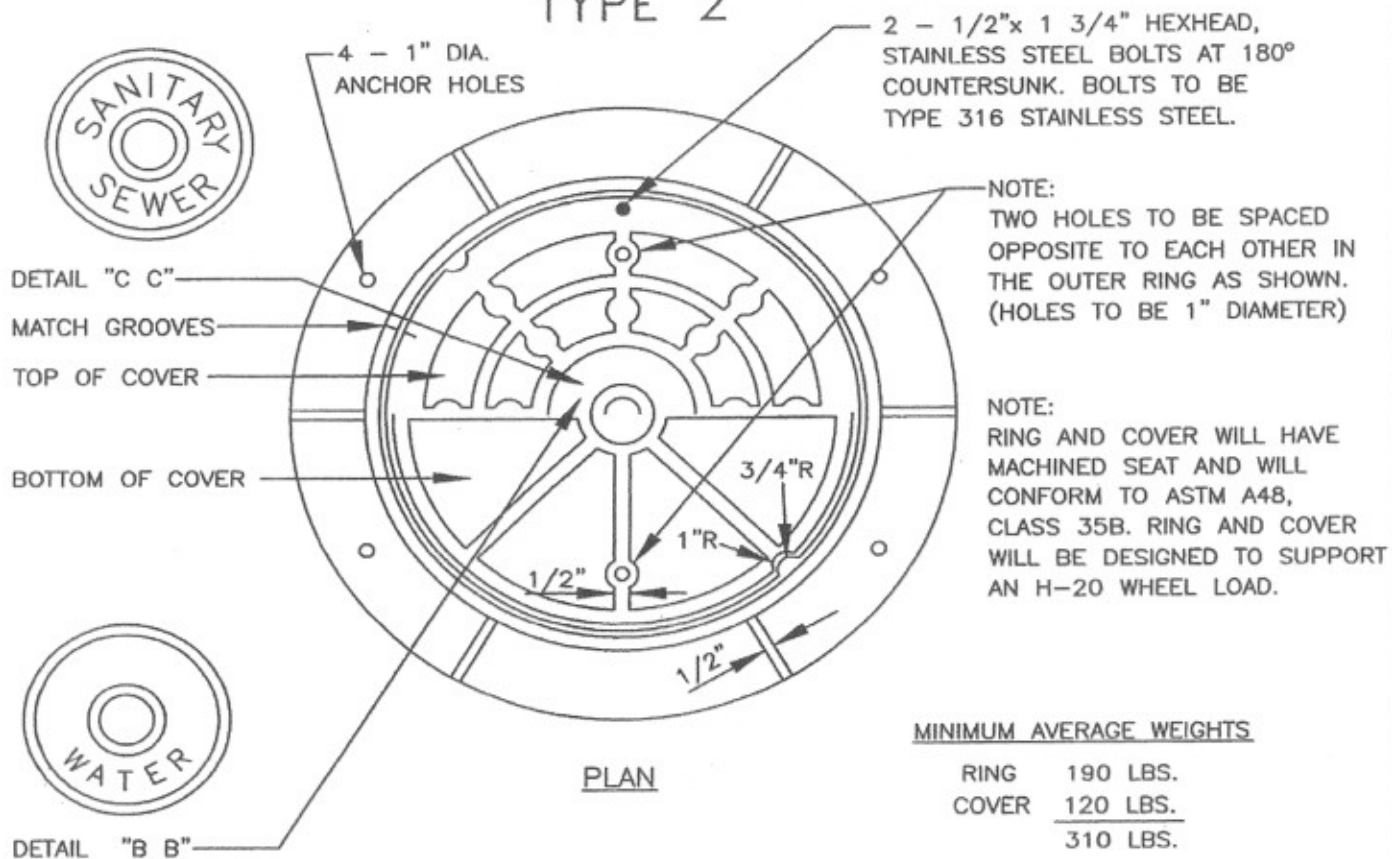
MINIMUM AVERAGE WEIGHTS

RING	190 LBS.
COVER	120 LBS.
	310 LBS.



SECTION

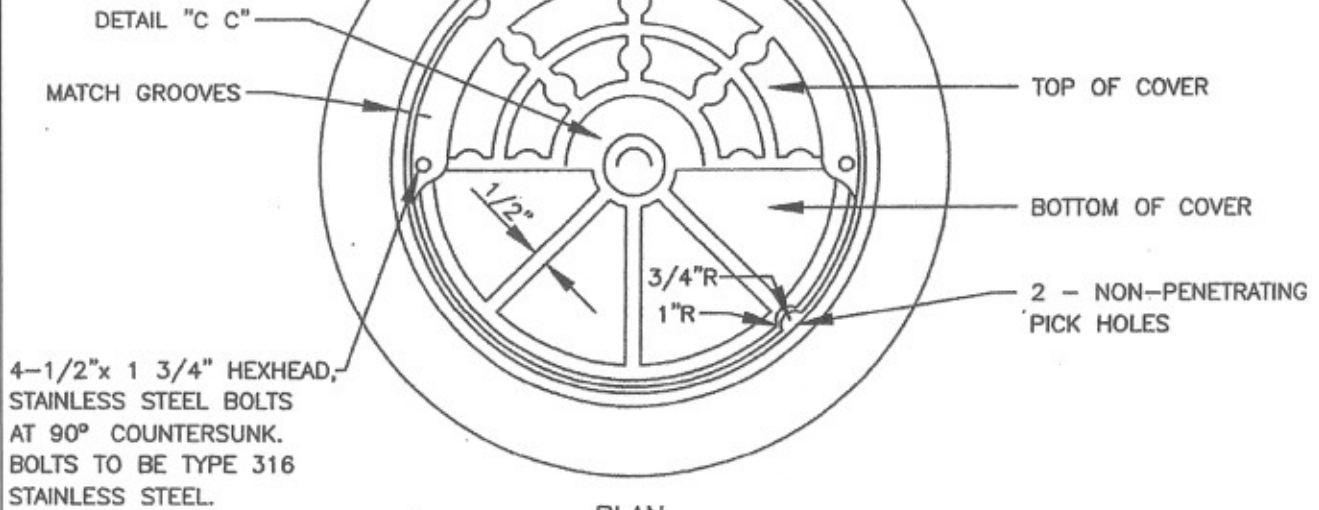
MANHOLE RING & COVER TYPE 2



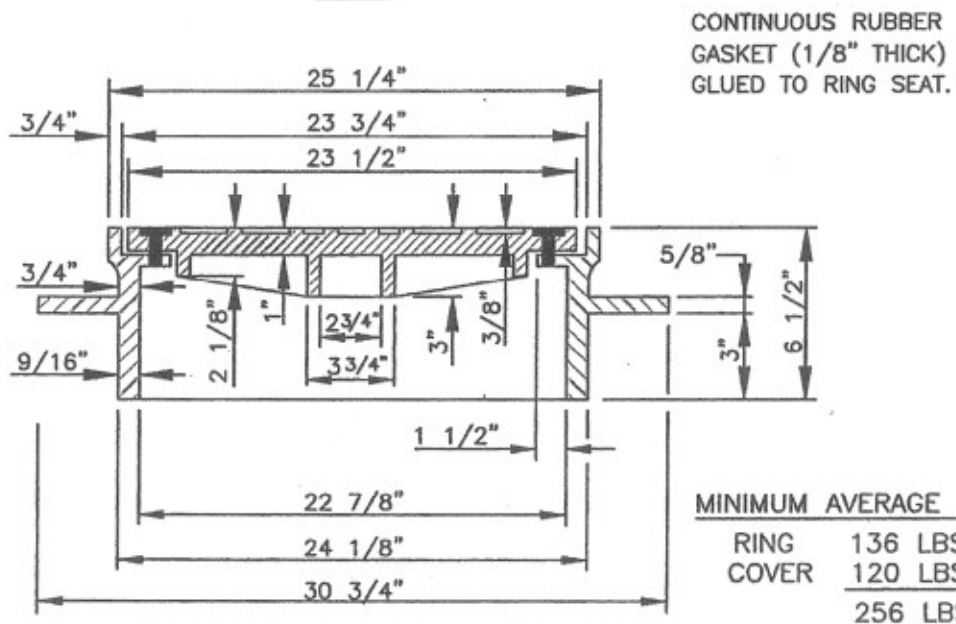
MANHOLE RING & COVER TYPE 3



NOTE:
RING AND COVER WILL HAVE
MACHINED SEAT AND WILL CONFORM
TO ASTM A48, CLASS 35B.



PLAN



MINIMUM AVERAGE WEIGHTS

RING	136 LBS.
COVER	120 LBS.
	<u>256 LBS.</u>

SECTION

4 FT. PRECAST REINFORCED CONCRETE MANHOLE

FLAT TOP SECTIONS USED SHALL BE DESIGNED TO SUPPORT AN H-20 WHEEL LOAD. USE OF A FLAT TOP MUST BE APPROVED BY THE ENGINEER.

FOUR FOOT MANHOLE TO BE USED FOR PIPE WITH A DIAMETER OF LESS THAN 18" UNLESS OTHERWISE SPECIFIED BY THE ENGINEER.

TYPE 1 OR 2 RING AND COVER
TYPE 2 TO BE BOLTED TO CONE W/ 4-TYPE 304 STAINLESS STEEL EXPANSION ANCHORS (3/4" HILTI KWIK BOLT II OR APPROVED EQUAL)

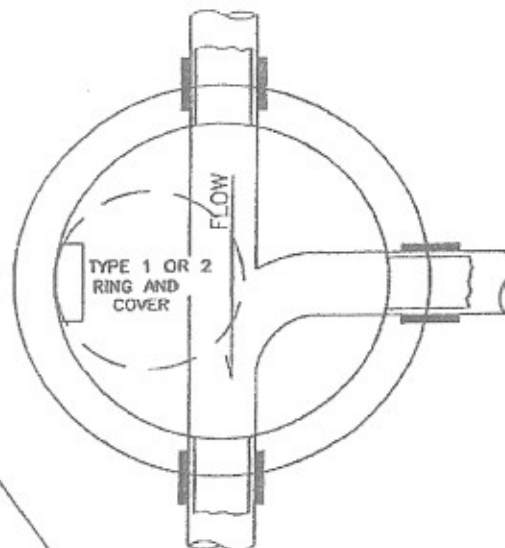
MAX. 3 COURSES OF BRICK (8 IN.) OR 2-5" GRADE RINGS MAY BE ADDED VERTICALLY.
(NOT ALLOWED WITH TYPE 2 RING & COVER)

MAX 24" FROM TOP OF RING & COVER TO TOP STEP- TOP STEP MUST BE IN CONE SECTION

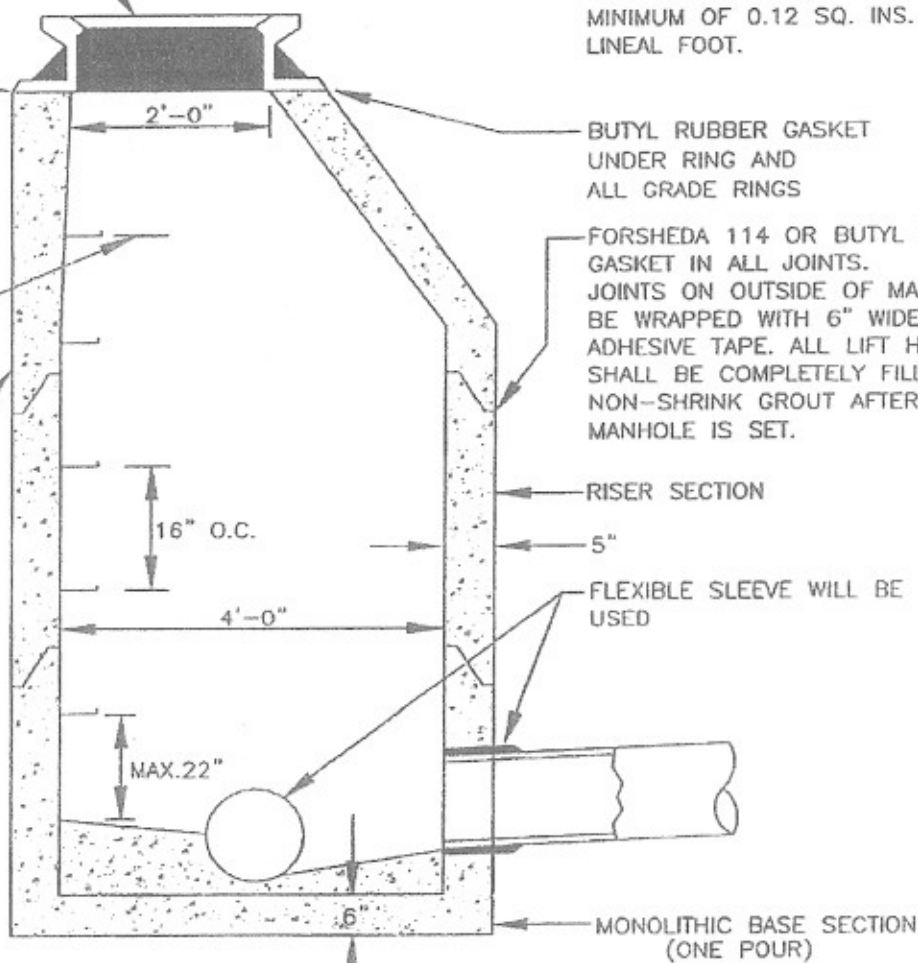
ECCENTRIC CONE SECTION

STEPS NOT TO BE PLACED OVER INFLUENT OR EFFLUENT PIPES. STEPS TO BE ALONG VERTICAL WALL SURFACE FROM SHELF TO TOP OF CONE.

NOTE: DO NOT BOLT RING TO CONE IF DIRT OR CONCRETE SURROUNDS THE RING (EX: YARD, SHOULDER, ETC.)



PRECAST CONCRETE MANHOLES SHALL CONFORM TO ASTM C-478. MANHOLES MUST BE ALLOWED TO CURE A MINIMUM OF 3 DAYS PRIOR TO SHIPMENT. THE DATE OF MANUFACTURE AND NAME OF MANUFACTURER SHALL BE ON ALL MANHOLE SECTIONS. CONCRETE SHALL BE 4,000 PSI. CIRCUMFERENTIAL REINFORCEMENT WILL BE PLACED AT A MINIMUM OF 0.12 SQ. INS. PER LINEAL FOOT.

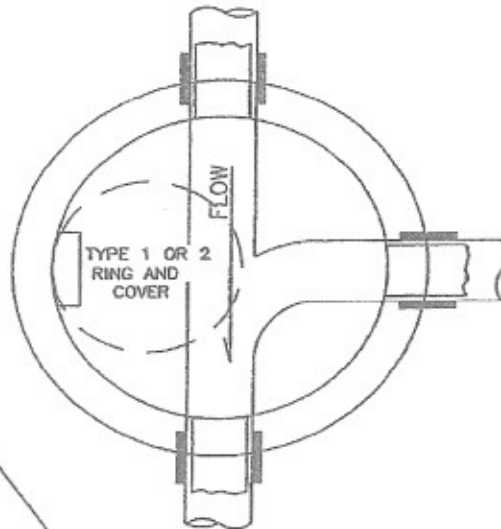


5 FT. PRECAST REINFORCED CONCRETE MANHOLE

FLAT TOP SECTIONS USED SHALL BE DESIGNED TO SUPPORT AN H-20 WHEEL LOAD. USE OF A FLAT TOP MUST BE APPROVED BY THE ENGINEER.

FIVE FOOT MANHOLE TO BE USED FOR PIPE WITH A DIAMETER OF 18" OR GREATER, UNLESS OTHERWISE SPECIFIED BY THE ENGINEER.

TYPE 1 OR 2 RING AND COVER
TYPE 2 TO BE BOLTED TO CONE W/4-TYPE 304 STAINLESS STEEL EXPANSION ANCHORS (3/4" HILTI KWIK BOLT II OR APPROVED EQUAL)



PRECAST CONCRETE MANHOLES SHALL CONFORM TO ASTM C-478. MANHOLES MUST BE ALLOWED TO CURE A MINIMUM OF 3 DAYS PRIOR TO SHIPMENT. THE DATE OF MANUFACTURE AND NAME OF MANUFACTURER SHALL BE ON ALL MANHOLE SECTIONS. CONCRETE SHALL BE 4,000 PSI. CIRCUMFERENTIAL REINFORCEMENT WILL BE PLACED AT A MINIMUM OF 0.15 SQ. INS. PER LINEAL FOOT.

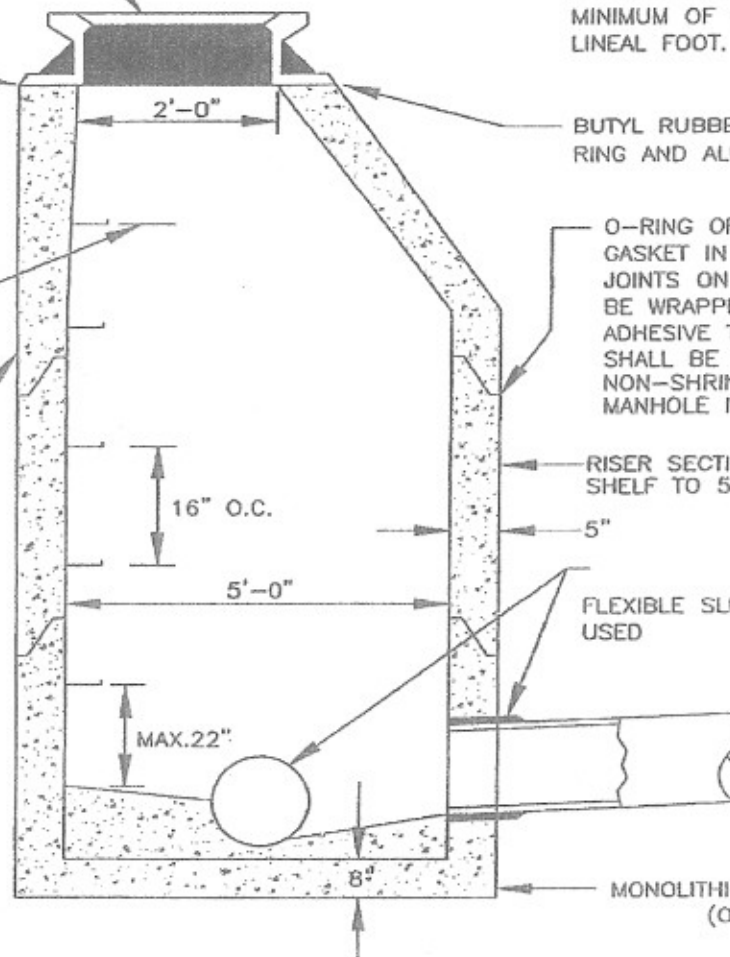
MAX. 3 COURSES OF BRICK (8 IN.) OR 2-5" GRADE RINGS MAY BE ADDED VERTICALLY. (NOT ALLOWED W/TYPE 2 RING AND COVER)

MAX 24" FROM TOP OF RING & COVER TO TOP STEP- TOP STEP MUST BE IN CONE SECTION

ECCENTRIC CONE SECTION

STEPS NOT TO BE PLACED OVER INFLUENT OR EFFLUENT PIPES. STEPS TO BE ALONG VERTICAL WALL SURFACE FROM SHELF TO TOP OF CONE.

NOTE: DO NOT BOLT RING TO CONE IF DIRT OR CONCRETE SURROUNDS THE RING (EX: YARD, SHOULDER, ETC.)



BUTYL RUBBER GASKET UNDER RING AND ALL GRADE RINGS

O-RING OR BUTYL RUBBER GASKET IN ALL JOINTS. JOINTS ON OUTSIDE OF MANHOLE TO BE WRAPPED WITH 6" WIDE BUTYL ADHESIVE TAPE. ALL LIFT HOLES SHALL BE COMPLETELY FILLED WITH NON-SHRINK GROUT AFTER MANHOLE IS SET.

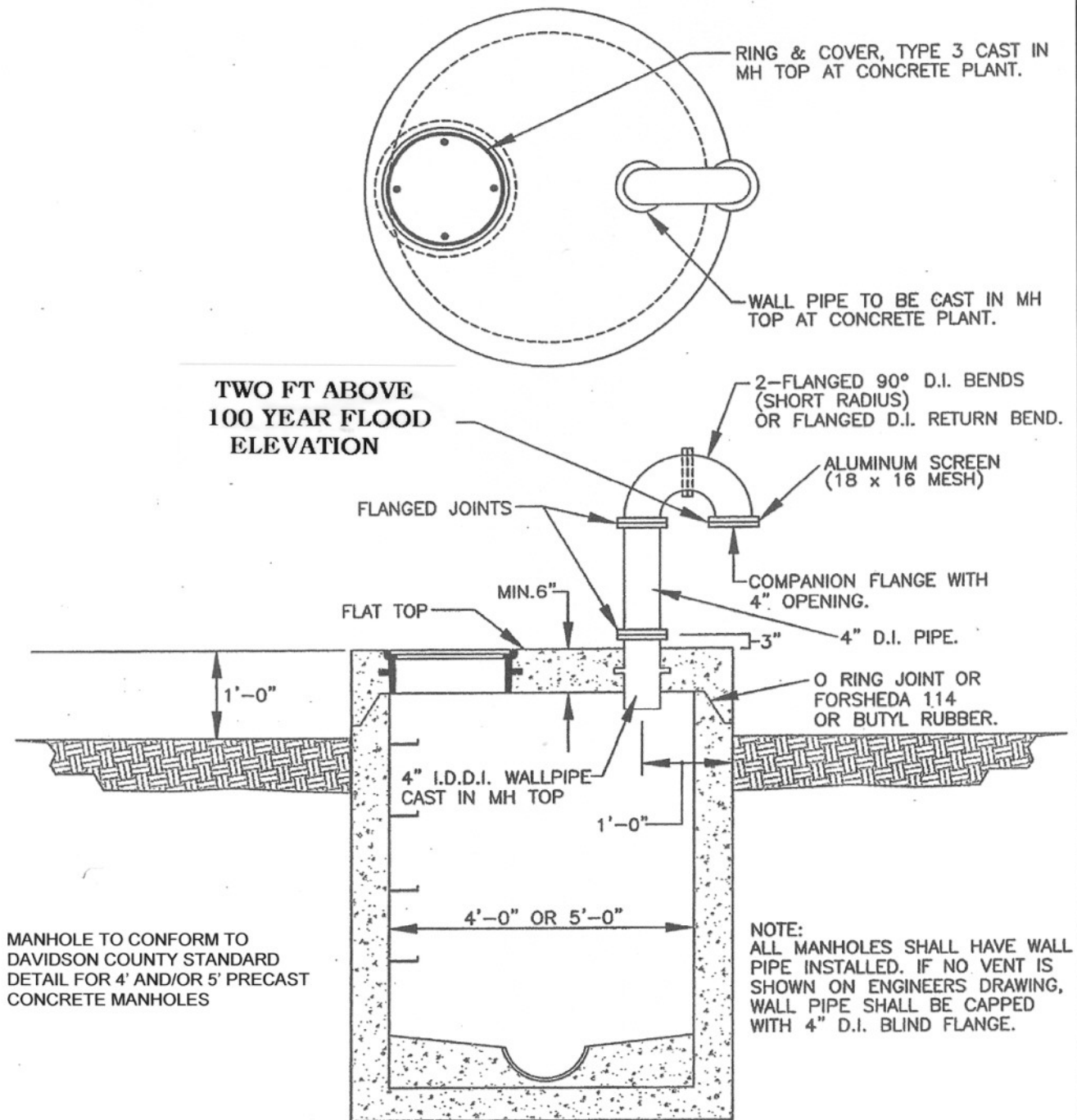
RISER SECTION-MIN. 6" FROM SHELF TO 5' X 4' TRANSITION CONE.

5"

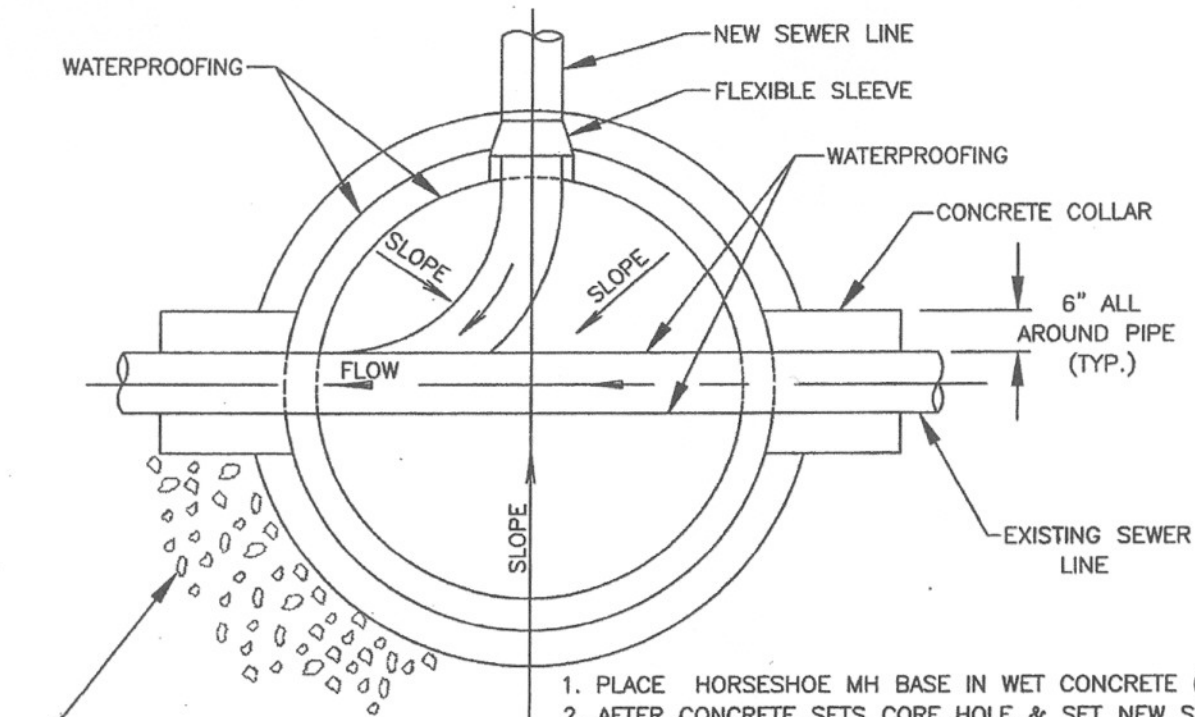
FLEXIBLE SLEEVE WILL BE USED

MONOLITHIC BASE SECTION (ONE POUR)

TYPE "B" 4' & 5' PRECAST REINFORCED CONCRETE MANHOLE



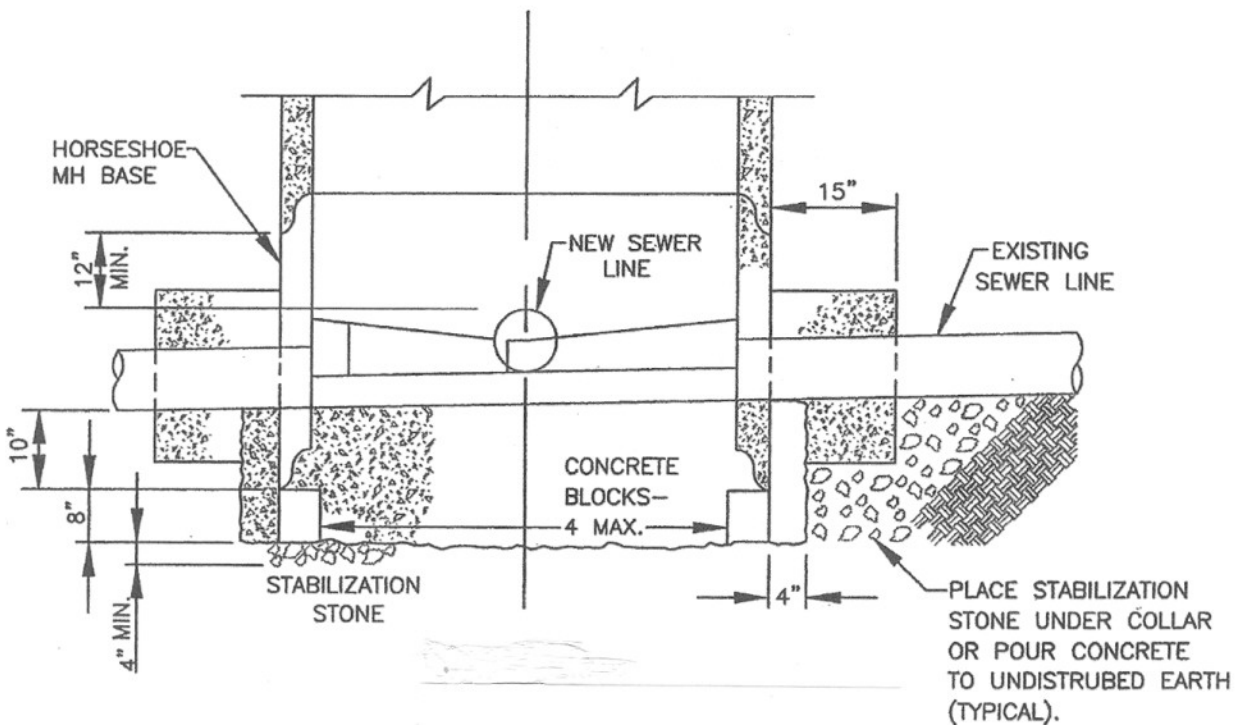
MANHOLE BUILT OVER EXISTING LINE



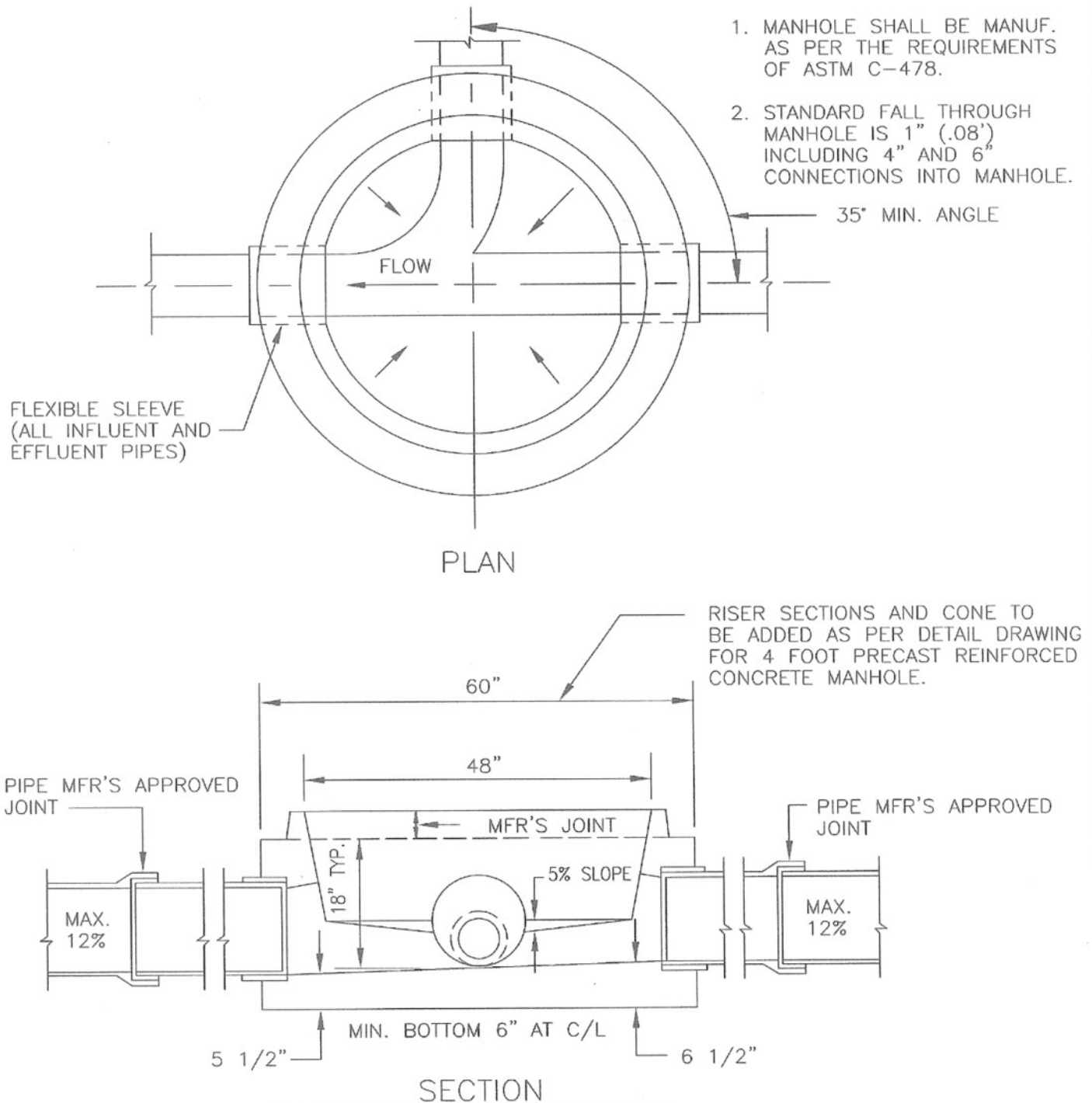
1. PLACE HORSESHOE MH BASE IN WET CONCRETE (4000 PSI).
2. AFTER CONCRETE SETS CORE HOLE & SET NEW SEWER LINE.
3. CUT OUT TOP HALF OF EXISTING PIPE. FINISH INVERTS & WATERPROOF ALL COLD JOINTS & AROUND ALL PIPE.
4. POUR CONCRETE COLLARS.

STABILIZATION STONE EXTENDED 12" PAST CONCRETE BASE OR TO THE UNDISTURBED EARTH.

PLAN

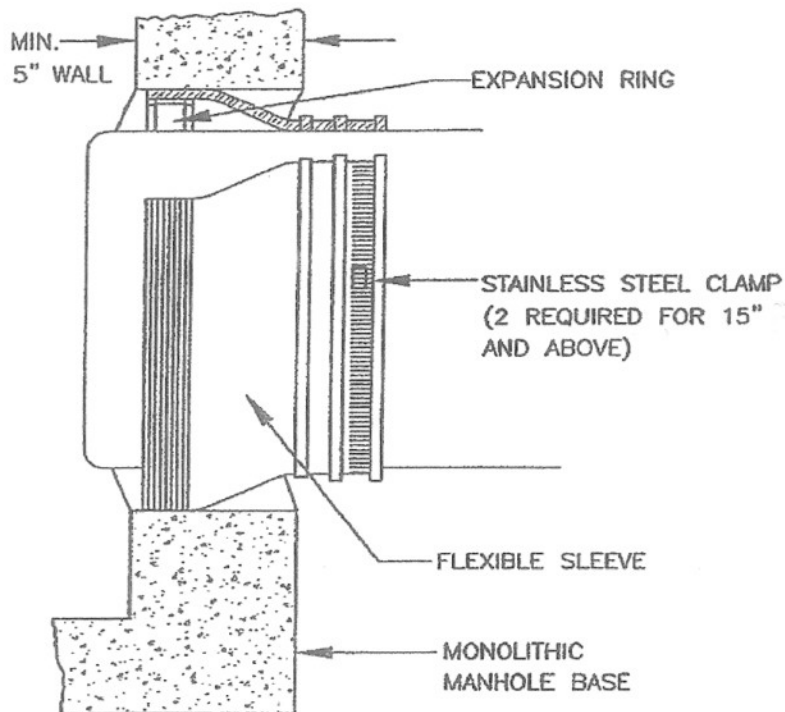


PRECAST REINFORCED CONCRETE MANHOLE WITH PRECAST INVERT

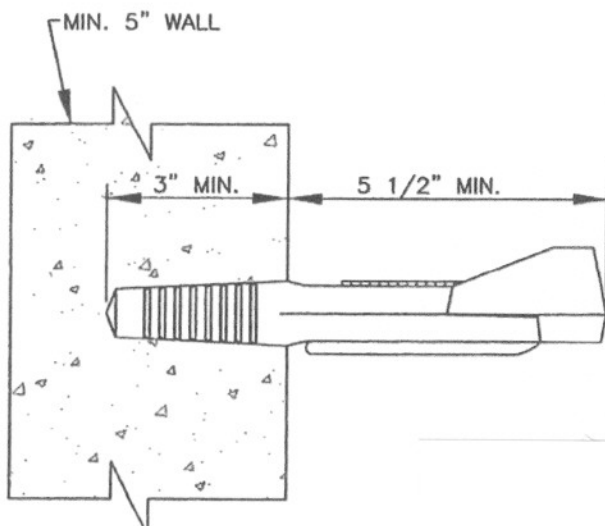
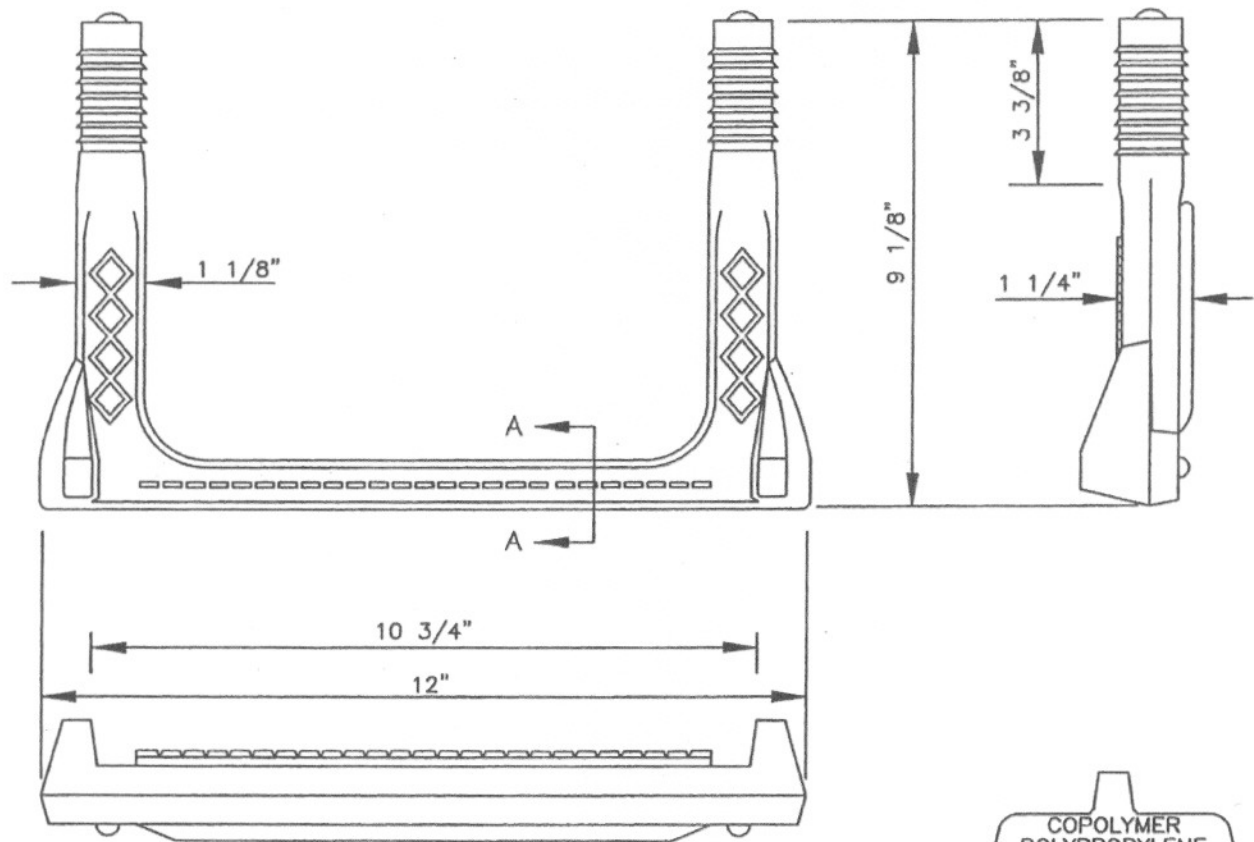


FLEXIBLE MANHOLE SLEEVE

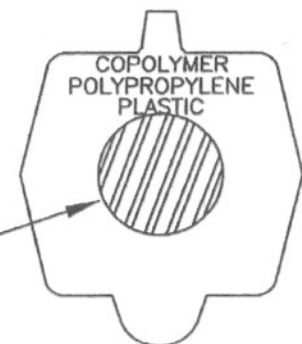
NOTE: FLEXIBLE MANHOLE SLEEVES SHALL CONFORM TO ASTM C923. SLEEVES BY PRESS-SEAL GASKET CORPORATION, EPCO INC. OR NPC INC. ARE ACCEPTABLE. MAXIMUM DEFLECTION FOR SLEEVE IS 7° (12%). SLOPES GREATER THAN 12% MUST HAVE SLEEVES DESIGNED FOR HIGHER DEFLECTION.



POLYPROPYLENE MANHOLE STEP



1/2" GRADE 60 STEEL
REINFORCEMENT

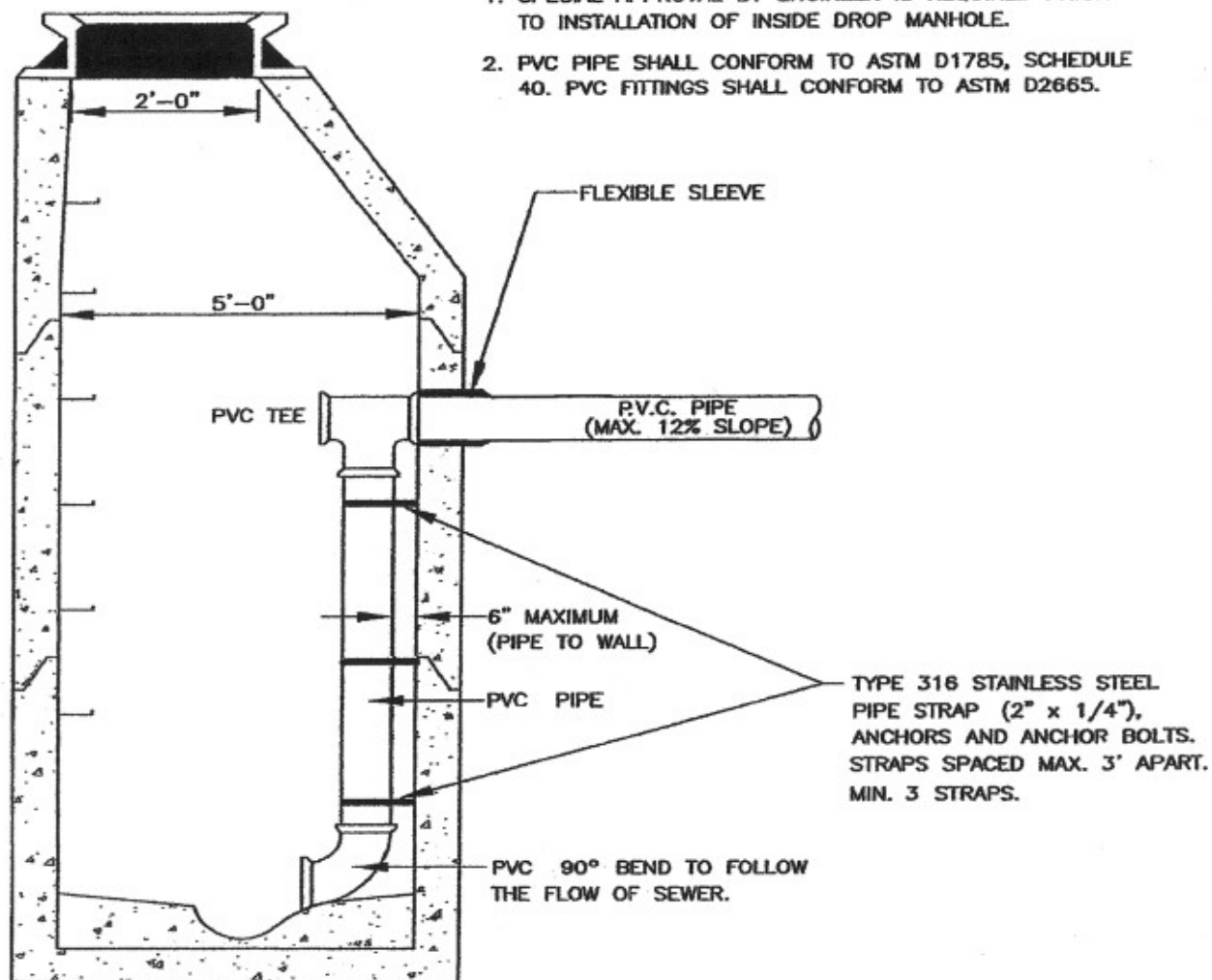


SECTION A-A

INSIDE DROP MANHOLE

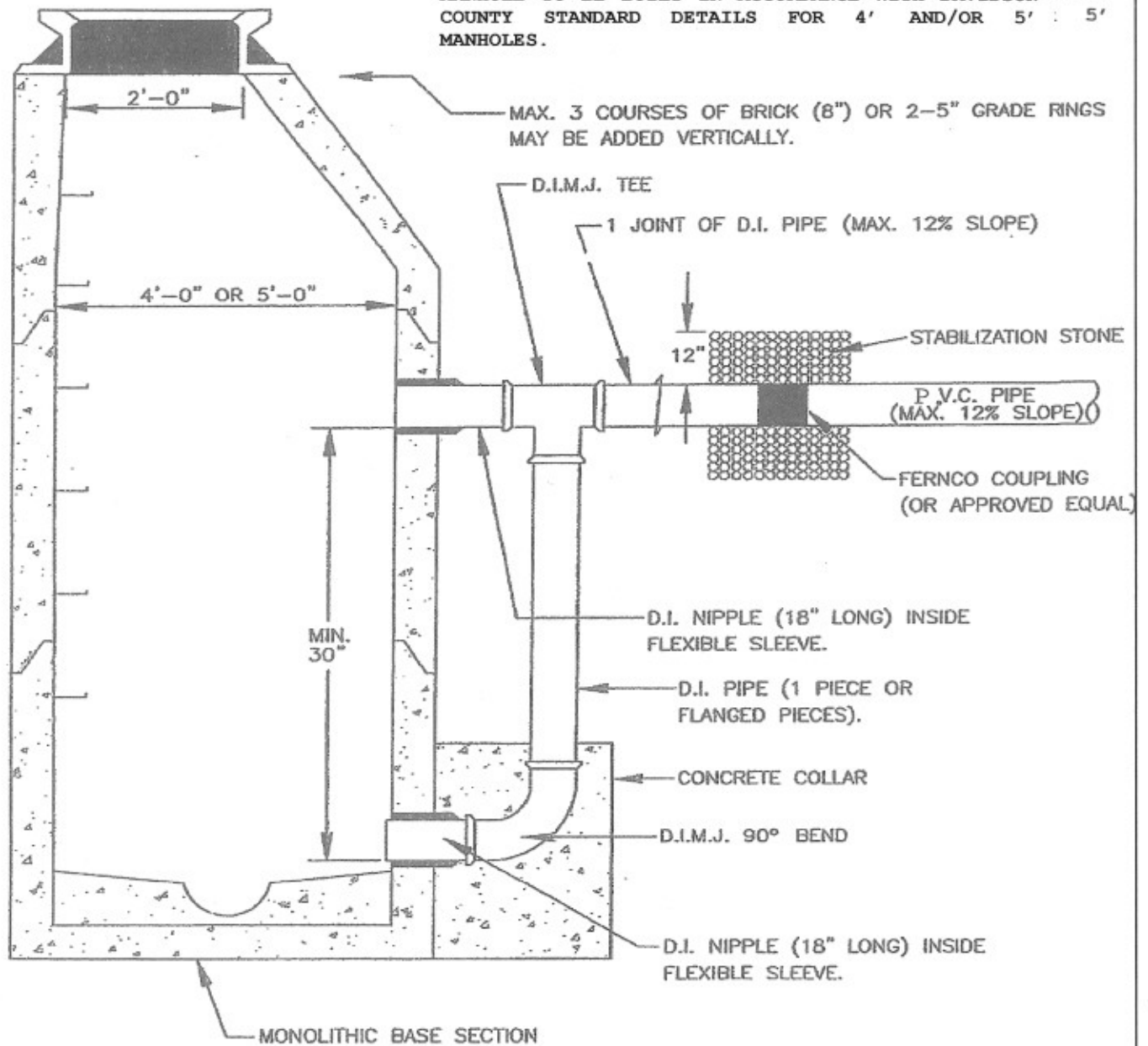
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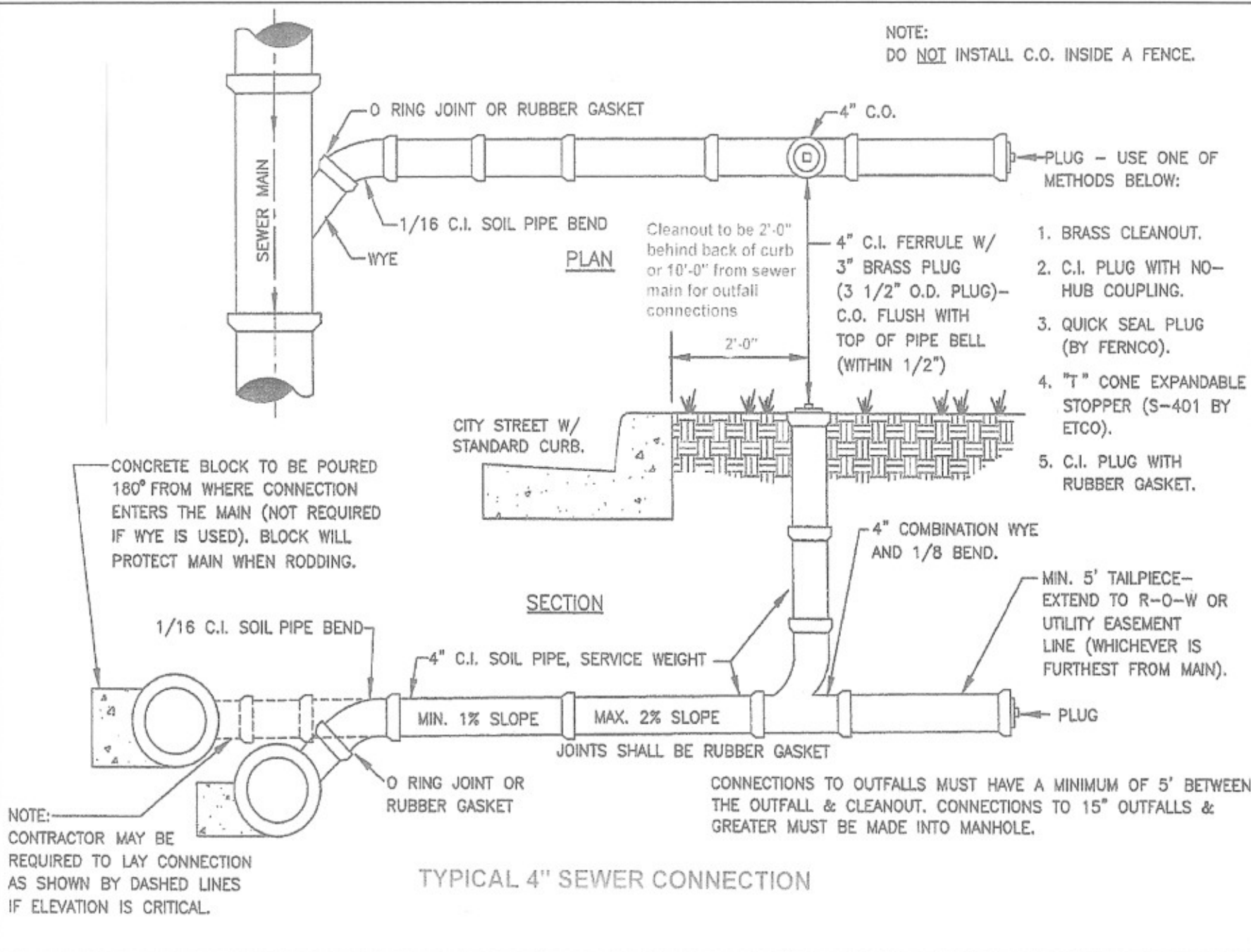
1. SPECIAL APPROVAL BY ENGINEER IS REQUIRED PRIOR TO INSTALLATION OF INSIDE DROP MANHOLE.
2. PVC PIPE SHALL CONFORM TO ASTM D1785, SCHEDULE 40. PVC FITTINGS SHALL CONFORM TO ASTM D2665.



OUTSIDE DROP MANHOLE

MANHOLE TO BE BUILT IN ACCORDANCE WITH DAVIDSON COUNTY STANDARD DETAILS FOR 4' AND/OR 5' : 5' MANHOLES.





FENCE GATE

