

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

SECTION A

MATERIALS

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 be uniformly coated with bituminous coating. Joints will be rubber gasket. Rubber gaskets 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 a 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 sound, 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 for the first 200 cubic yards of each class placed. For the next 300 cubic yards 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 a minimum 28-day compressive strength of 4,500 pounds per square inch and a slump not to exceed 3-1/2 inches.

Class A concrete will have a 28-day compressive strength of 3,000 pounds per square inch and a slump not to exceed 3-1/2 inches.

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

Class C concrete will have a 28-day compressive strength of 2,000 pounds per square inch and a slump not to exceed 2-1/2 inches.

Determination of the slump will be made in accordance with ASTM C143.

Reinforced concrete will normally be Class A. Concrete for special cases will be as specified under the specific structures.

Materials of the proportions determined for the concrete specified will be mixed in a batch mixer of approved type for not less than one and one-half minutes after the materials, including the water, are in the mixer. Unless the requirement is waived by the Engineer, the Contractor will install a batch meter on the mixer to time each mix for the guidance of the operator. No materials will be placed in the drum until all of the previous batch has been discharged. Water will be added at the time the other materials are being run into the mixer and the mixer will be provided with a satisfactory device for accurately measuring the water for each batch.

The equipment used for making concrete as herein specified will be adequate for the particular work in hand and of such character as to insure at all times rigid control of the quantities of all concrete under ASTM C94 may be used with approval of the Engineer. Cement, aggregates, water and design and testing will be as above specified.

Concrete will be poured continuously in layers not exceeding 12 inches. Concrete will not be thrown or dropped from a height sufficient to cause jarring of concrete already in place. After being placed, the concrete shall be worked sufficiently by vibration, spading, rodding or forking to fill all voids and hold any steel reinforcement.

No concrete will be poured when the air temperature is below 40 degrees Fahrenheit unless the Engineer's approval has been first obtained for the specific pour.

Each construction joint will be thoroughly cleaned with steel brushes, roughened and all loose materials removed by washing with a hose before concrete is fully set. The concrete should be dry enough to prevent injuring the concrete when the joint is cleaned.

In connecting new concrete with concrete already set, the surface will be again thoroughly washed to remove dust and debris and the surface covered with a thin layer of mortar of the same proportions of sand and cement as is used in making the concrete.

Formwork will be of standard form plywood. All forms will be clean, smooth and tight with all angles, interior and exterior, chamfered to prevent leaving any sharp edges in the finished concrete. Forms will be constructed true to line and grade and braced so as to maintain such line and grade when concrete is placed. Twisted wires will not be used to tie forms together. All concrete edges at the top of the forms (unless chamfered) will be rounded with a suitable edging tool. Necessary precautions should be taken to prevent loss of moisture from concrete after it has been poured. The method and period of curing shall be determined by the Engineer. Formwork for columns, walls and other parts not supporting the weight of the concrete may be removed as soon as the concrete has hardened sufficiently to resist damage from form removal operations. All other formwork shall be removed as permitted by the Engineer. All exposed concrete surfaces shall be smooth and free of any form marks.

No waterproofing material or admixture will be used in the concrete without the Engineer's approval.

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:

3/4", 1", 1 1/2" 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 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 furnishing 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), furnishing 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 1/2", 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 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 1/2" or 5 1/4" unless otherwise specified. Each hydrant will have two hose nozzles and one steamer nozzle. The 2 1/2" hose nozzles and the 4 1/4" 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 base 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 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 will have a minimum pressure rating of 250 psi unless otherwise specified by the Engineer. 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 weight 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 cold 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:

- (1) Sumter Machinery Company, Inc. (Ring - Part No. 669;
Cover - Part No. KL)
- (2) U.S. Foundry & Manufacturing Corp. (Ring - Part No. 669;
Cover - Part No. KL)
- (3) Vulcan Foundry, Inc. (Part 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:

- (1) Vulcan Foundry, Inc. (Ring - Part No. V-2384;
Cover - Part No. V-1385)
- (2) 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:

- (1) Vulcan Foundry, Inc. (Ring - Part No. V-2484-3;
Cover - Part No. V-2384)
- (2) 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 and the Engineer.

DAVIDSON WATER, INC.
TYPICALLY

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 shall be rejected. The cast iron cover shall be thoroughly coated 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: All meter yokes and accessories shall conform to the specifications and requirements of the governing authority.

MORTAR: Lime and cement mortar will be composed of one part cement to 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 the 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 1/2 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 saddle by Romac Industries, Inc.

STEEL ENCASUREMENT PIPE: Steel encasement pipe shall be smooth wall pipe with welded joints. The pipe shall have a 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>ENCASUREMENT 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 as 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 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 formwork 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, valves, 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 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) - 3/4" high-strength, low-alloy steel tie bolts. High-strength, low-alloy steel washers and tie nuts shall be used with all tie bolts.

VALVES (AIR RELEASE): All air release valves shall conform to ANSI/AWWA C512. The unit price for an air release valve will include furnishing 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 mils of fusion bonded epoxy or liquid epoxy in accordance with ANSI/AWWA 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 valves 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 a 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 shall 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 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. Valves used for buried service will have a

non-rising stem, mechanical joint end connections and a 2" square operating nut. The word "OPEN" and an arrow to indicate the direction of opening the valve shall be cast on the flanged base of the operating nut. Above ground valves, unless otherwise specified, will have an outside screw and yoke rising stem or a non-rising stem, flanged end connections and a hand wheel to operate the valve. The word "OPEN" and an arrow to indicate the direction of opening the valve shall be cast on the rim of the hand wheel. All valves will open by turning the nut or hand wheel counter clock-wise. Valves installed in manholes will normally be considered to be buried service valves and valves installed in vaults will normally be considered to be above ground valves.

Resilient-seated gate valves shall be designed for a minimum working pressure of 200 psi. Each valve shall be seat tested at 200 psi and shell tested at 400 psi in accordance with ANSI/AWWA C509 - Section 6. All valves shall be warranted for 10 years from date of purchase against defective materials and workmanship. Gate valves furnished under these specifications must be manufactured by one of the following:

- (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 (A-2360)

Gate valves shall be paid for at the unit price named under the proper item. This shall include the cost of furnishing and installing gate valves and cast iron valve boxes (or manholes if specified).

VALVES (SWING CHECK): All swing check valves shall meet the specifications of AWWA C508. The valves shall have an iron body, be of the clear waterway type and have bronze to bronze or rubber to bronze seat construction. End connections can be flanged or mechanical joint. Check valves shall be designed for a working pressure of 175 psi for 2-12 inch valves and 150 psi for 16-24 inch valves. Assembled check valves shall be subjected to the following hydrostatic tests in accordance with AWWA C508 - Section 5:

- (1) Shell Test - 350 psi for 2-12 inch valves
300 psi for 16-24 inch valves
- (2) Seat Test - 175 psi for 2-12 inch valves
150 psi for 16-24 inch valves

Check valves normally will be lever and weight or lever and spring operated only if used for above ground service, but may be used at any time if so specified by the Engineer. All valves shall have two coats of asphaltic varnish applied to the outside ferrous metal surfaces. All interior iron surfaces (including the disc, clapper and clapper arm) shall be coated with a minimum of 8 mils of fusion bonded epoxy or liquid epoxy in accordance with ANSI/AWWA C550. Check valves furnished under these specifications must be manufactured by one of the following:

- (1) Mueller Company
- (2) American Flow Control
- (3) M & H Valve Company

VALVES (TAPPING): Tapping sleeves and valves shall be used for "wet" taps into existing water mains as indicated on the Engineer's drawings. The Contractor shall verify the type of material, size, etc., of the existing main prior to ordering the sleeve. The sleeve shall be a split sleeve with mechanical joint end connections and a flanged outlet. For taps on larger mains (24" and above), a saddle may be used in lieu of a sleeve, but only if the tap is less than or equal to half the size of the line to be tapped. The tapping valve shall meet all specifications for "gate valves" except that the valve shall have an inlet flange (with centering ring) for connection to the flanged sleeve outlet. The unit price named shall include installation also.

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) Russell 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 BSM 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 a 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 shall be in accordance with specifications for installation of sanitary sewer pipe contained hereinafter.

SECTION B

METHODS OF CONSTRUCTION

1. GENERAL

THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING, READING, AND BECOMING FAMILIAR WITH THE SPECIFICATIONS, DETAIL DRAWINGS, BULLITENS, AND NOTICES OF THE LOCAL GOVERNING AUTHORITY AND THE NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES FOR DETAIL SPECIFICATIONS PERTAINING TO THIS CONTRACT.

SEWER DESIGN REQUIREMENTS:

- (a) Ductile iron pipe will be required when three feet of cover cannot be maintained.
- (b) Ductile iron pipe will be required for sewers that are subject to traffic bearing loads. Class of pipe shall be as shown on the Engineer's drawings.
- (c) Ductile iron pipe will be required for all creek crossings. For crossings below water level, the top of the pipe shall be located at or below the bottom of the streambed. For crossings located above water level, the bottom of the pipe shall be located above the 25-year flood elevation as provided in the engineering drawings or as otherwise directed by the engineer. All ductile iron pipe used for creek crossings shall be manufactured to public water supply standards and hydrostatically tested at 150 psi to assure water tightness. The pipe and creek bank shall be protected by rip-rap as shown on the Engineer's drawings.
- (d) Sanitary sewer lines shall not be located less than 25 feet from a private well or 50 feet from a public water supply well. Sewer lines less than 100 feet from a well shall be constructed of ductile iron pipe manufactured to public water supply standards, and shall be hydrostatically tested at 150 psi to assure water tightness.
- (e) Maximum separation between manholes shall be 350 feet unless authorized by the Engineer in writing or as shown on the construction drawings.
- (f) Odor and corrosion control shall be controlled as indicated on the Engineer's drawings, detail drawings and in the Technical Specifications.
- (g) Minimum Separations:

- 1. Storm sewers (vertical) ~~12~~ inches
- 2. Water mains (vertical-water over sewer) ~~18~~ inches
or (horizontal) ~~10~~ feet
- 3. In benched trenches (vertical) ~~18~~ inches
- 4. Any private or public water supply source, including WS-I waters or Class I or Class II impounded reservoirs used as a source of drinking water ~~100~~ feet
- 5. Waters classified WS-II, WS-III, B, SA, ORW, HQW, or SB [from normal high water (or tide elevation)] ~~50~~ feet
- 6. Any other stream, lake or impoundment ~~10~~ feet
- 7. Any building foundation ~~5~~ feet
- 8. Any basement ~~10~~ feet
- 9. Top slope of embankment or cuts of 2 feet or more vertical height ~~10~~ feet

24" DGR MIN. DESIGN CRITERIA

- 10. Drainage systems
 - (I) Interceptor drains 5 feet
 - (II) Ground water lowering and surface drainage ditches 10 feet
- 11. Any swimming pool 10 feet
- 12. **FINAL EARTH GRADE** 36 INCHES

*PER NCDOT
MIN. DESIGN
CRITERIA*

Ductile iron pipe with joints equivalent to water main standards shall be used where these minimum separations cannot be maintained. Pipe shall be hydrostatically tested at 150 psi to assure water tightness.

(h) Sanitary sewer mains on 20 percent slopes or greater shall have concrete anchors spaced as follows:

1. Not greater than 36 feet center to center on grades 21% to 35%;
2. Not greater than 24 feet center to center on grades 35% to 50%; and
3. Not greater than 16 feet center to center on grades 50% and over.

Concrete anchors are to be constructed the same as anti-seepage collars. Sewer mains on 20 percent slopes or greater shall be constructed with ductile iron pipe.

PRIORITIES: The Engineer reserves the right to establish priorities as he seems fit. However, the Contractor will be consulted and every effort will be made to cooperate with the Contractor as not to impose any undue hardship upon his own scheduling.

LUMP SUM BIDS: The limits for all lump sum bids will be shown on the Engineer's drawings. The lump sum bid will include all work as indicated.

EXTRA WORK ORDER APPROVAL: The Contractor's attention is called to the section of the "General Conditions" relating to extra work orders. No payment for extra work will be authorized by the Engineer unless the extra work is specifically agreed upon by the Engineer prior to the work being done by the Contractor. The Contractor will plan his work and make necessary checks and investigations in order to avoid extra work. The Engineer will not authorize payment for any extra work that arises due to a lack of planning, checking and investigating by the Contractor.

EASEMENTS: The necessary easements for construction of the project and all easements essential for access to the project, for all pipe lines not on street right-of-way will be secured by the County. Easements will normally be as follows: permanent easements - 30 feet and construction easements - 50 feet. The Contractor shall stay within the construction easement. If the Contractor desires an additional easement for easier access, storage or any other purpose, it will be his/her responsibility to obtain the easement from the individual property owner. If the Contractor desires such additional easement he shall acquire same from the property owner and present a signed easement agreement satisfactory to the County prior to entering upon such additional easement to perform the work of the project. Such work will begin only after the Contractor receives written approval from the County. Failure to comply with these terms relating to easements by the Contractor shall constitute breach of this contract. The County will not be responsible for, and the Contractor shall hold the County harmless from, any damages or claims from property owners resulting from the Contractor working outside the easements obtained by the County. The Contractor shall not receive any additional compensation for any delays due to acquisition of easements by the County.

All trees, buildings, etc., within the 30' permanent easement will be removed unless otherwise directed by the Engineer. If necessary for construction of the pipeline, any trees, buildings, etc., within the construction easement may be removed by the Contractor. Any trees, buildings, etc. that are to be saved shall be designated on the Engineer's drawings and/or marked by the Engineer's survey party. If property owners desire to keep wood from trees, they are requested by the County to remove trees prior

to the Contractor commencing clearing and grubbing activities. After beginning such activities, trees, buildings, etc., are to become the property of the Contractor.

INGRESS AND EGRESS TO BUSINESS ESTABLISHMENTS: The Contractor will be required to conduct his construction work so that ingress and egress to business establishments will be maintained at all times. No direct payment will be made for providing ingress and egress, as the cost of this work will be considered incidental to the work.

XEROSION CONTROL PROVISIONS: All construction should be carefully staged in a sequence that is most effective in preventing erosion and sedimentation damage. Erosion control devices (matting for erosion control, catch basin protection, storm drain protection, silt fence, rock check dam, temporary stream crossing, temporary diversion ditch, etc.) are to be constructed at locations shown on the Engineer's drawings or as directed by the Engineer and/or the governmental erosion control officer. These devices shall be constructed as shown on the Erosion Control Standards Detail Sheet prior to any construction. Erosion control devices will be paid for on a unit price basis as set forth in the proposal. This price shall include removal of all devices. All erosion control devices shall be removed prior to final payment being made to the Contractor, unless directed otherwise by the Engineer. Any existing erosion control devices that may be altered, destroyed, or damaged during construction of this project must be repaired/replaced by the Contractor to the satisfaction of the governing authority.

EXISTING UTILITIES:

*NOTE: IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO CALL U.L.O.C.O. AT 1-800-632-4949 TO VERIFY THE LOCATION OF EXISTING UNDERGROUND UTILITIES PRIOR TO MOVING ON SITE.

The Contractor shall be responsible for making a field inspection of existing utilities prior to the bid opening. The Contractor shall be responsible for any damage to existing utilities resulting from his work. Approximate locations, based on the information available, are shown on the plan view of each sheet. The County does not guarantee the accuracy or completeness of underground utility location shown on the plans. **The Contractor shall be responsible for contacting the appropriate utility locating companies to locate any and all underground utilities before construction.** The Contractor shall excavate and expose all existing underground lines in advance of trenching operations to assure that there will be no conflicts with the proposed grade and alignment. All water and sewer connections damaged during construction shall be repaired by the Contractor at his/her cost.

Any mailboxes, fences, water meter boxes, valve boxes, existing storm sewer pipes or other pipes that may need to be removed during construction will be reinstalled and the cost included in the various contract items. Should existing pipe be damaged while being handled, it will be replaced with new pipe of the same class at no extra charge. Any defective pipe encountered by the Contractor shall be replaced by the Contractor. In case of defective pipe the Contractor shall be reimbursed for the cost of the pipe only.

INSPECTION AND CONSTRUCTION STAKE OUT: Construction stake out and obtaining final as-built measurements will be done by the Engineer's survey crews. The Contractor shall cooperate with these surveyors in every respect and to make every available effort to protect hubs and grade stakes. Line and grade stakes will be provided and, if in the judgment of the Engineer these stakes are destroyed through carelessness or neglect on the Contractor's part, it will be the Contractor's responsibility to see that the destroyed points are re-established by the surveyors. Any charges for re-establishing such stakes must be paid for by the Contractor.

Construction inspection will be handled by the Engineer's inspectors. The Contractor shall cooperate with the inspector and adhere to his or her instructions. The inspector must be notified 10 days prior to the Contractor beginning any work.

SUPERVISION: The Engineer reserves the right to request the removal of any person employed on any part of the work who is considered by the Engineer to be incompetent or

disorderly. A request from the Engineer for the removal of such a person will be immediately observed. The Contractor is responsible for furnishing qualified personnel for all phases of the work. Proper supervision of the work shall be maintained at all times. Each crew shall consist of a foreman, equipment operators and sufficient laborers.

STREET CLOSINGS: If a street closing is required it shall be the Contractor's responsibility to arrange and coordinate the closing with the North Carolina Department of Transportation.

SAFETY PROVISIONS AND TRAFFIC CONTROL: The Contractor shall provide adequate barricades, construction signs, warning lights, guards and traffic flagmen as required by the North Carolina Department of Transportation. Such protection shall be maintained during the progress of the construction work and until it is safe for traffic to use the highway. All material piles, equipment and pipe which may serve as obstructions to traffic shall be enclosed by barricades and shall be protected by proper lights. The rules and regulations of the local authorities and the North Carolina Department of Transportation regarding safety provisions and traffic control shall be observed at all times.

The Contractor shall carry on the work in a manner, which will cause the least interruption to traffic and may close a street only with the permission of the Engineer and/or the North Carolina Department of Transportation. Should it become necessary to allow only one-way traffic, the Contractor shall provide one flagman with a stop-slow paddle for each end of the one-way strip for proper direction of traffic.

The standard procedures for construction signing of the North Carolina Department of Transportation and the Manual on Uniform Traffic Control Devices shall be followed.

The Contractor will not be directly compensated for any traffic control measures necessary, as this work will be considered incidental to the work covered by the various contract items.

RESTRICTION OF LOAD LIMITS: Equipment of such weight or so loaded as to cause damage to drainage structures, existing pavement, subgrade, base course, or to any type of construction, either being constructed or previously constructed, shall not be operated in any location where damage would be caused. It shall be the responsibility of the Contractor to correct any damage to any type of construction incurred as a result of exceeding a safe load limit. Repair of such damage shall be at the Contractor's expense.

PAVEMENT REMOVAL: All rigid or flexible pavement, sidewalk, driveways, etc., to be removed under this contract shall be completed as specified herein. All such removal (including hauling and disposal) shall be included in the price bid for furnishing and installing pipe unless specified otherwise.

The Contractor shall cut the pavement with a saw or other approved means. Under no circumstances will the Contractor be allowed to pull up pavement without prior cutting. All cutting will be neat and straight. The width of pavement cuts shall not exceed the diameter of the pipe plus 40 inches.

The Contractor shall repair all pavement cuts in accordance with the requirements of the North Carolina Department of Transportation.

CLEARING AND GRUBBING: The work of clearing shall consist of the cutting, removal and satisfactory disposal of all vegetation and debris in wooded areas.

The work of grubbing shall consist of the removal and satisfactory disposal of all vegetation and surface debris. Where the material being removed is high in organic matter content, such as root mat and other vegetative matter, it shall be considered vegetation and removed as part of the work of grubbing.

The work of clearing and grubbing shall also include the removal and satisfactory disposal of stumps, crops, weeds and other annual growth; the removal and satisfactory disposal of fences, steps, walls, chimneys, column footings, signs, junked vehicles and other rubble and debris; and the filling of holes and depressions.

Removed trees, stumps, buildings, debris, vegetation, and other materials shall be disposed of off site at a location secured by the contractor at his/her cost, unless otherwise approved by the engineer. Holes and depressions shall be filled with suitable backfill material as directed by the engineer. If sufficient on-site backfill material is not available, acceptable material from an off-site borrow area shall be secured.

Clearing and grubbing operations shall be completed sufficiently in advance of trenching operations as may be necessary to prevent any of the debris from the clearing and grubbing operations from interfering with the trenching operations.

All work under this section shall be performed in a manner, which will cause a minimum of soil erosion. The Contractor shall perform such erosion control work, temporary or permanent, as may be directed by the Engineer and as shown on the plans in order to satisfactorily minimize erosion resulting from clearing and grubbing operations.

Failure on the part of the Contractor to perform the required erosion control measures will be just cause for the Engineer to direct the suspension of clearing and grubbing operations. The suspension will be in effect until such time as the Contractor has satisfactorily performed the required erosion control work.

All clearing, grubbing and disposition of timber, stumps and debris shall be included in the price bid for furnishing and installing pipe unless specified otherwise.

(a) Clearing

The work of clearing shall be performed within the limits required by the plans, or as established by the Engineer.

The Engineer will designate all areas of growth or individual trees, which are to be preserved due to their desirability for landscape or erosion control purposes. When the trees to be preserved are located within the construction limits, they will be so shown on the plans or designated by the Engineer.

The Contractor shall conduct his operations in a manner to prevent limb, bark or root injuries to trees, shrubs or other types of vegetation that are to remain growing and also to prevent damage to adjacent property. When any such injuries unavoidably occur, all rough edges of scarred areas shall first be made reasonably smooth in accordance with generally accepted horticultural practice and the scars then thoroughly covered with an asphaltum base tree paint. Any such plants that are damaged by any construction operations to such an extent as to destroy their value for shade or other landscape purposes, shall be cut and disposed of by the Contractor, without extra compensation, when so directed by the Engineer.

(b) Grubbing

Within the areas between construction limits and the limits of clearing and grubbing, all holes and other depressions shall be filled, and the area brought to sufficiently uniform contour that subsequent mowing operations will not be hindered by irregularity of terrain. This work shall be done regardless of whether the irregularities were the result of the Contractor's operations or were originally existing.

(c) Disposition of Timber, Stumps and Debris

The property owner will have no right to use or reserve for his use any timber on the project after the Contractor commences his clearing and grubbing activities. All timber cut during the clearing operations is to become the property of the Contractor and shall be removed from the project by him.

The Contractor shall not cut any timber beyond the clearing limits established by the Engineer nor shall he cut any timber, which is to be preserved for landscape or erosion control purposes except at the direction of the Engineer.

When the timber, stumps and debris are to be disposed of in locations off of the right-of-way and out of sight of the project, the Contractor shall furnish the Engineer before final acceptance of the project a written release from the property owner, or his authorized agent, granting the servitude of his lands.

EXCAVATING AND BACKFILLING TRENCHES FOR ALL PIPE LINES: All excavation will be of one classification regardless of the nature of the material encountered, except for solid rock formation in trenches. This will be paid for by the cubic yard at the unit price given for "Rock Excavation". This will include the cost of furnishing all labor, equipment and material required for the removal and disposal of the rock and the cost of providing suitable material for bedding of the pipe and backfilling the excavation. The width of the trench allowed in rock excavation will be three feet (3') greater than the nominal diameter of the pipe to be laid. here rock may be encountered in excavating for manholes, rock will be figured for the outside diameter of the structure plus three feet (3').

Rock excavation will include the excavation of all solid ledge rock, which cannot be removed by machinery without blasting and of all boulders of one cubic yard in size not previously excavated.

Should rock be encountered in trenches, it will be uncovered in sections not less than fifty feet (50') in length and the Engineer immediately notified in order to enable him to obtain a record of it. Rock removed without such record having been made shall not be paid for. Rock excavation shall be carried six inches (6") below the bottom of the pipe and shall be so paid for. Rock excavation for manholes shall be carried six inches (6") below the bottom of the manhole and shall be so paid for. The trenches will be brought back to grade by the pipe laying crew with suitable material, properly compacted and no extra compensation shall be paid for such refilling.

All blasting operations will be conducted in strict conformance with the existing ordinances of any other governing authority and accepted safe practices relative to the storage and use of explosives. Blasting will be done only by experienced personnel. Extreme care and precaution will be used to prevent injury to workmen and to existing pipe, buildings or other structures either below or above the surface of the ground. Sufficient warning will be given to all persons in the area prior to blasting. The Contractor will be responsible for all damage due to blasting operations.

Trenches for pressure lines (water or sanitary sewer) will, wherever possible, have continuous grades between air valves and blow-offs or hydrants so as to avoid air pockets and will be of sufficient width to give room for properly making the joints. Trenches will be of such depth as to provide a minimum of 36 inches of cover above the top of all pressure lines. The price for excavating and backfilling trenches (except for rock excavation) will in all cases be included in the unit price for pipe.

Backfilling along the sides of the pipe and immediately above the pipe will be done by hand with extreme care. On large pipe lines (12" and above), backhoes or other equipment may be used upon approval by the Engineer. In order to insure proper grade and alignment and to insure that backfill material is distributed under the pipe properly, each joint of pipe shall be backfilled to the center of the pipe and hand tamped as each joint is laid.

All trench backfill under paved areas (or proposed paved areas), parking areas, sidewalks and shoulders shall be compacted to a density of at least 95 percent of maximum dry density as determined by AASHTO T99. The final 12" of subgrade shall be compacted to 100 percent density. Cross-country water lines or sanitary sewer outfalls shall have backfilled compaction of 90 percent density unless otherwise directed by the Engineer. Backfill material shall have a moisture content in the range of 5 percent above to 3 percent below optimum moisture content at the time it is placed.

From two (2) feet above the top of the pipe to the subgrade, material containing rocks or stones up to six (6) inches in their greatest dimension may be used. Otherwise, rock shall not be used as backfill.

Suitable backfill shall be defined as loam, clay, sand, gravel or other materials satisfactory to the Engineer.

Under no circumstances shall pipe be laid in water. The Contractor shall not have open in excess of two hundred (200) feet of water and/or sewer main trench at one time. Backfilling shall be completed at the end of each day's work.

TRENCH AND EXCAVATION SAFETY: The Contractor shall follow the guidelines set up by the N.C. Department of Labor, Division of Occupational Safety and Health for safe trenching, excavation and confined spaces. All trenching over five feet deep will be sloped, shored, sheeted, braced or otherwise supported. When soil conditions are unstable, excavations shallower than five feet also must be sloped, supported or shored. Shoring or sheeting below the top of the pipe should be left cut off above the pipe. Cost for the above shall be included in the various contract items.

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. Spacers 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 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.

2. SANITARY SEWER

INSTALLATION OF GRAVITY SANITARY SEWER PIPE: All materials for laying and jointing the pipe in the trench will conform to the specifications for such material herein given and will be furnished by the Contractor. Grade lines for aligning and grading the pipe in the trench will be established by the Engineer and all labor and material required will be furnished by the Contractor. Pipe laying in general will conform to ASTM C12. Pipe shall be paid for according to the depth from the original ground elevation of the centerline of the trench to the invert of the pipe. Pipe laid deeper than proposed (due to Contractor error) shall be paid for at proposed depth. Pipe laid shallower than proposed shall be paid for at shallower depth. Quantities shall be determined based on the as-built horizontal distance from center of manhole cover to center of manhole cover.

Construction on new sanitary sewers will begin one joint upstream from the existing sewer main or existing manhole. Tie-ins will be made after the new sewer has been built, inspected and approved for service by the Engineer. (Exception - Effluent pipe of first upstream manhole on the new sewer may be plugged if approved by the Engineer.) Tie-ins (including connections) to all concrete manholes will be made by coring a hole in the manhole wall and installing a flexible sleeve. Coring will only be required for 16" diameter holes or smaller.

Prior to being lowered into the trench, each pipe will be inspected by the crew foreman. Faulty pipe shall be rejected and removed from the work site.

Polyvinyl Chloride (PVC) Sewer pipe and fittings should be installed in accordance with ASTM D2321, "Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications".

The method for calculating loads and determining embedment requirements for PVC sewer pipe shall be in accordance with the latest published edition of ASCE Manual No. 60 / WPCF Manual FD-5, "Gravity Sanitary Sewer Pipe Design and Construction".

No pipe will be laid within ten (10) feet of excavation operations or within thirty (30) feet of rock, which must be blasted for removal. The open end of all pipes will be plugged when pipe laying is not in progress and all pipe will be protected against injury from falling rock when blasting.

Pipe will be laid with the bell ends facing the direction of laying. ^{Bell Hole} A bell hole will be dug for each bell, but only of sufficient size to insure that the pipe will bear evenly throughout its length on the bottom of the trench.

Bedding Bedding for pipe on stable subgrade shall be in accordance with the detail drawing. When unstable subgrade is encountered, pipes shall be bedded on stabilization stone. The bedding shall have a minimum thickness beneath the pipe of four inches (4") or one-eighth of the outside diameter of the pipe, whichever is greater. The required thickness shall be determined by the Engineer. All stone will be paid for at the price named for "Stabilization Stone".

The pipe and fittings will be laid in the trench so that after the sewer is completed the invert of the pipe will conform accurately to the line and grade given by the Engineer. Batter boards and grade rods or a laser beam shall be used to obtain horizontal and vertical alignment.

SHAPE BOTTOM BEDDING OR USE CONE

Whenever the Engineer's drawings show, or for other reasons it may be necessary to substitute ductile iron pipe for PVC, the Contractor will furnish all necessary labor, equipment and material to install the pipe at the unit price for ductile iron at that specific depth. When changing from PVC to ductile iron, a donut manufactured by Fernco Joint Sealer Company or approved equal or a flexible coupling with two stainless steel clamps, manufactured by Fernco or approved equal, may be used to make the joint. When changing from ductile iron to PVC, the flexible coupling will be used. A concrete collar will be constructed around all joints where couplings or donuts are used. All ductile iron shall meet the specification for "Ductile Iron Pipe" and shall be installed in accordance with water line specifications.

Backfilling of trenches will be carefully done with selected material thoroughly tamped to a point above the top of the pipe as specified under "Excavating and Backfilling Trenches for All Pipe Lines".

Upon completion of the entire work all lines will present a clean and unbroken barrel. All lines will be thoroughly cleaned and inspected by the Contractor before asking for final inspection by the Engineer. Any defective lines will be repaired and any deposits removed by the Contractor at his own expense. Any materials left along the line of the trench after work on the sewer is completed will be removed by the Contractor, and if not owned by the Contractor, stored as directed by the Engineer.

SANITARY SEWER MANHOLES: Manholes shall be built at the locations shown on the Engineer's drawings. Manholes shall be constructed of precast reinforced concrete. Construction will conform to detail drawings. Depth of manholes shall be as shown on the Engineer's drawings.

Standard manholes shall have a depth of eight feet (8') from the top of the manhole cover to the invert at the center of the manhole. Depths in excess of 8' shall be paid for separately at the price named for "Extra Depth Manholes".

Manhole shelves and channels can be constructed of brick and mortar, Class AA concrete or be of the precast type. Channels shall be built to a depth of three-quarters of the diameter of the pipe and shall conform to the inside diameter of the influent and effluent pipes. The channel shall be constructed from the invert of the influent pipe to the invert of the effluent pipe. The channel shall be smooth in order to ^{avoid} any turbulence in the manhole. Manhole shelves shall slope from the manhole wall to the channel. The shelf at the wall shall be a minimum of three inches (3") higher than the shelf at the channel. A maximum of two inches (2") shall be allowed for the protrusion of the influent and effluent pipes beyond the inside wall of the manhole.

Manholes on outfalls shall be built 24" above finished grade unless a Type "B" manhole is used or the manhole is in a yard.

Precast reinforced concrete manholes used on right-of-way maintained by the North Carolina Department of Transportation must be approved by the North Carolina Department of Transportation before being installed.

When unstable subgrade is encountered, manholes shall be bedded on stabilization stone. All stone will be paid for at the price named for "Stabilization Stone".

The Contractor shall be responsible for adjusting the manhole ring and cover to street grade. All points on the top edge of the ring cover shall be within plus or minus one-half of an inch of street grade before the Contractor is relieved of any further adjustments. Final adjustment is generally determined at the time of the street cut repair.

DROP MANHOLES: Whenever the vertical distance between the influent and effluent pipes is 30" or more, the Engineer will require a special drop pipe to be built into the manhole. This drop will consist of a tee in the main sewer where it enters the manhole, a vertical drop pipe down the side of the manhole and a 90-degree bend at the bottom of the drop pipe. Ductile iron pipe will be used along the main line as the last joint of

pipe into the drop portion of a drop manhole. See detail drawings for further specifications on drop manholes. Payment for the drop pipe (manhole will be paid for separately at the price for "Standard Manholes") will be at the unit price per vertical foot for "Drop Manholes". The distance paid for shall be measured from the invert at the top of the drop pipe to the invert at the bottom of the drop pipe.

SEWER CONNECTIONS: Sewer connections shall be installed as shown on detail drawings. Wyes will not be allowed within 10 feet of a manhole. Only one bend will be allowed for connecting the sewer connection to the sewer main. 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	8:30	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

3. 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 material 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 rehandling. 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. 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. The spigot shall then be centered in the bell and the gasket carefully pushed

evenly into the bell. The gland shall be pushed up to the gasket with the gland being parallel to the face of the bell. Bolts shall be inserted and the nuts tightened uniformly by hand until snug. At this point the joint may be deflected if so desired. Final tightening of the bolts shall be done with a ratchet torque wrench, unless the Engineer decides that a non-torque wrench is acceptable. It is essential that the gland be brought toward the pipe bell evenly, maintaining approximately the same distance between the gland and the face of the bell at all points. This may be done by partially tightening the bottom bolt; then the top bolt; next, the bolts on either side; and finally the remaining bolts, alternately tightening bolts 180 degrees apart. This cycle is then to be repeated until all bolts are tightened to a torque as listed below:

<u>PIPE SIZE</u>	<u>BOLT SIZE</u>	<u>TORQUE (FOOT-POUNDS)</u>	<u>LENGTH OF NON-TORQUE WRENCH</u>
3"	5/8"	45 - 60	8"
4" - 24"	3/4"	75 - 90	10"
30" - 36"	1"	100 - 120	14"

If effective sealing is not obtained at the maximum torque specified for the size of bolt used, the joint shall be disassembled, thoroughly cleaned and reassembled. Overstressing of bolts to compensate for poor installation practice will not be permitted.

Push on joints shall be installed as follows:

All interior bell and exterior spigot surfaces shall be cleaned, the gasket installed in the bell and all joint surfaces lubricated with the pipe manufacturer's lubricant. Lubricant shall be applied according to each manufacturer's recommendations. Gaskets from different pipe companies are not interchangeable. The spigot end must be beveled. The spigot shall then be pushed straight into the full depth of the bell. The spigot end of the pipe shall not be allowed to touch the ground or trench wall after lubrication. The joint may be deflected only after the joint is assembled. All instructions and recommendations of the pipe manufacturer relative to gasket installation and jointing operations shall be observed and followed by the Contractor. It is essential that each gasket is in proper position when the pipe is "shoved home". A leaking joint will result from an improperly made joint. Each defective joint, if any, discovered after pipe has been laid, shall be repaired by and at the expense of the Contractor by a method acceptable to and approved by the Engineer.

Joint deflection for mechanical and push-on joints shall in no case be greater than 80 percent of the maximum recommended by the pipe manufacturer and/or ANSI/AWWA C600.

Standard corporation cocks will be installed at any location as directed by the Engineer for filling, flushing or disinfecting the line. No extra payment will be made for corporation cocks so installed. They shall be left tightly closed after the line is completed.

All existing valves larger than 12" that must be operated during the course of the contract shall be operated by the maintenance personnel of the governing authority. The Engineer must be present if existing valves are operated by the Contractor.

All butterfly valves will be protected by valve manholes. Valve manholes shall be precast reinforced concrete manholes constructed as shown on detail drawings unless otherwise stated on the plans or approved by the Engineer. All manholes on State maintained right-of-way must be approved by the North Carolina Department of Transportation. Cast iron manhole rings and covers will be furnished and set in mortar. Covers will have the word "Water" or "Sanitary Sewer" as applicable cast thereon. Gate valves shall require cast iron valve boxes. Eight-inch PVC or ductile iron pipe shall be centered over the valve nut and the valve box placed over the 8" pipe.

All valves, hydrants and fittings will be placed in the line as indicated on the Engineer's drawings and in accordance with instructions from the Engineer. Eighteen-

inch (18") extensions of pipe shall be the connection between all valves and fittings unless detail drawings indicate otherwise. For DIP where a valve is placed within two joints (36') or less of the end of a dead end line, the Contractor shall be required to use Series 1100 Megalugs on the valve and on all fittings.

All water main taps shall be made after the water main has pressure. No "dry" taps will be allowed. On dead end mains, taps for permanent water connections shall not be made beyond the last hydrant or blowoff. Direct tapping (without a saddle) will be allowed in accordance with the following:

<u>Pipe Size</u>	<u>Maximum Size Tap Without Saddle</u>
4"	3/4"
6"	1"
8"	1"
12"	1-1/2"

Sleeves used for tying to existing mains shall be either 12" or 15" in length. If after all pipe is homed up, the gap between the two plain ends is more than 1", a filler shall be cut to go between the two plain ends. The filler shall be at least 3" wide but not more than 5" wide. The filler shall be 1/2" wider than the depth of the mechanical joint bell for that size of pipe.

All concrete and asphalt driveways less than 30 feet in width shall be bored (no encasement) for installation of DI pipe up to and including 8" pipe. The auger bit shall be just large enough to allow passage of the pipe bell through the bored hole. The Contractor shall be paid for the measured width of each driveway.

CUTTING OF GRAY IRON AND DUCTILE IRON PIPE: Gray iron pipe will be cut with one of the following devices: Hydraulic cutters, wheel-type cutters or saw. Ductile iron pipe will be cut with a saw only. Any variations in the above described must have prior approval of the Engineer. Pipe ends must be beveled if used for push-on joint.

CUTTING AND BEVELING PVC PIPE: For shorter than standard pipe lengths, field cuts may be made with plastic pipe cutters. Ends shall be cut square and perpendicular to the pipe axis. Spigots shall have burrs removed and ends smoothly beveled by a mechanical beveller or by hand with a rasp or file. Field spigots shall be stop-marked with felt tip marker or wax crayon for the proper length of assembly insertion. The angle and depth of field bevels and length to stop-mark shall be comparable to factory pipe spigots.

CONCRETE THRUST BLOCKS: Concrete thrust blocks shall be constructed as directed by the Engineer at all bends, tees, tapping sleeves, tapping saddles, reducers and plugs to provide restraint against thrust resulting from internal pressure. Any exceptions to this such as restrained joints or mechanical joints with Megalugs will be noted on the Engineer's drawings or otherwise specified. Thrust blocks will not be required for restrained joint pipe (exception - blocking will be required when connecting restrained pipe to existing pipe). All thrust blocks will be constructed of a minimum of Class C concrete.

~~Polyethylene~~ shall be placed over all fittings before the concrete is poured. All nuts and bolts shall be clear of concrete so that the joint will be accessible. Plywood shall be used as forms for blocking. Concrete is to be poured only against undisturbed soil and should be allowed to set prior to any backfilling. Thrust blocks should be allowed to cure two days prior to pressure testing the water main. Higher strength concrete may be required when it is necessary to pressure test prior to the end of the two-day curing time.

No direct payment will be made for thrust blocks where the size of the pipe is 16 inches in diameter or smaller; payment shall be included in the unit price for the pipe. For pipe larger than 16 inches, thrust blocks will be paid for as Class C concrete. The Contractor shall be responsible for presenting concrete delivery tickets to the Engineer

at the time of delivery. Payment shall be based upon the quantity of concrete required by the Engineer.

PRESSURE TESTING: After construction of the water main is completed, it is to be tested between main line valves in accordance with AWWA C600 - Section 4. The test shall be performed with all hydrant valves (4 1/2" or 5 1/4") closed, but all hydrant leg valves (6") open. All corporation cocks shall be open and angle valves inside meter boxes will be closed. The number of sections to be tested at one time shall be determined by the Engineer. Testing shall not be performed within 24 hours after the new main is filled or within two days after the thrust blocks have been poured. Test pressure at the high point in the new main shall be ~~twice the working pressure (up to 200 psi) or 150 psi, whichever is greater, and this pressure shall be maintained for no less than three hours.~~ Test pressures above 200 psi must be approved by the Engineer. If after the three-hour period the pressure has dropped more than five psi, a quantity of water must be used to bring the pressure back up to test pressure. This quantity of water must be metered and shall not exceed the following allowable leakage figures:

*ALLOWABLE LEAKAGE IN GALLONS PER 1000 FEET OF MAIN

MAIN SIZE (Inches)	4	6	8	12	16	20	24	30
	1.11	1.65	2.22	3.30	4.41	5.52	6.63	8.28

*This table is figured for 150 psi. Engineer will provide allowable leakages for higher test pressures.

If the allowable leakage is exceeded, the Contractor shall repair the defective portion of the main until leakage is within the specified allowance. All leaks shall be repaired regardless of whether or not the allowable leakage is exceeded. The Engineer must be present during the entire pressure testing process. Any work done without his supervision will not be accepted.

TESTING OF PVC AND DIP FORCE MAINS:

1. A hydrostatic pressure test shall be performed on each segment of installed force main.
2. The test shall be performed after the force main has been backfilled and at least seven days following the pouring of the last thrust block.
3. The following procedures shall be followed in performing hydrostatic pressure tests on force mains:
 - a. The force main segment shall be carefully filled with water at a velocity of approximately one foot per second. Water may be introduced from either the pump station or a temporary connection made in the force main. Appropriate measures necessary to eliminate all air from the force main shall be taken during this process.
 - b. Once full of water, the force main segment shall be pressurized and allowed to stabilize at a minimum test pressure of 1.5 times the maximum design pressure of the force main.
 - c. This pressure shall be maintained for at least two consecutive hours.
 - d. If the stated pressure cannot be maintained, the contractor is responsible for assuring that the cause of test failure is determined, all necessary repairs are made, and repeating the hydrostatic pressure test until the force main segment passes.

The pressure test may be performed concurrently or separately with the leakage test as required in the Leakage Testing below.

LEAKAGE TESTING:

1. A leakage test shall be performed on each segment of installed force main at the hydrostatic pressure test stipulated above.
2. Leakage shall be defined as the quantity of water required to maintain a pressure within five pounds per square inch of the specified test pressure after the pipe has been filled with water and all air has been expelled.
3. Leakage shall be measured with a calibrated test meter and shall not exceed the amount given by the following formula:

L = allowable leakage (gallons per hour)
N = number of joints in length of pipe segment tested
D = nominal diameter of pipe segment tested (inches)
P = test pressure (pounds per square inch)

$$L = \frac{ND\sqrt{P}}{7,400}$$

All visible leaks shall be repaired regardless of the amount of leakage. If leakage exceeds this rate, the contractor is responsible for assuring that the cause of test failure is determined, all necessary repairs are made, and repeating the test until the force main segment passes.

DISINFECTION: All water mains shall be disinfected by the Contractor in accordance with AWWA C651. Disinfection will not be required on sewer force mains. The Contractor shall furnish qualified men to do the work who are experienced with chlorine and disinfecting agents. The Contractor shall see that the pipe is thoroughly clean when installed and should give the new mains a high velocity flushing (minimum of 2.5 feet/second) through fire hydrants or other approved blow-offs. The flushing shall continue until the Engineer determines that the lines are free from all foreign matter and are ready to be disinfected. The following openings are required to obtain flushing velocity:

<u>Pipe Size</u>	<u>Minimum Opening</u>
4"	1"
6"	1-1/2"
8"	2"
12"	3"
16"	4"
20"	6"
24"	6"
30"	8"

Disinfection shall be accomplished by the continuous feed method using liquid chlorine or a hypochlorite solution. If liquid chlorine (100 percent available chlorine) is used, a chlorine-gas water mixture shall be injected into the new main through a solution feed chlorinator and a booster pump. If hypochlorite is used, the hypochlorite solution shall be applied to the new main with a gasoline or electrically powered chemical feed pump designed for feeding chlorine solutions. In addition, a rate setter must be used in order that the flow in gallons per minutes may be determined. Hypochlorites shall either be calcium hypochlorite (70 percent available chlorine in granular or tabular form) or sodium hypochlorite (5.25 - 16 percent available chlorine in liquid form). A backflow preventer (approved by the Engineer) will be used in order to prevent the chlorine solution from flowing back into the existing water system.

Water from the existing distribution system or other approved source and the chlorine solution must both be made to flow at rates which will guarantee a chlorine concentration of 100 parts per million throughout the new main. This high concentration chlorine solution shall not be pumped into copper service connections (this could cause the copper to corrode). Concentrations above 100 parts per million must be approved by the Engineer. Pumping of the chlorine solution shall be continued until tests conducted at the extremities of the new main indicate a concentration of the required 100 parts per million. The chlorinated water shall then be retained in the new main for 24 hours, during which time all valves and hydrants in the new main shall be operated in order to

disinfect all parts of the system. After the 24-hour period there should be at least 10 parts per million concentration of chlorine throughout the main. The chlorinated water shall then be flushed from the main until the chlorine concentration in the water leaving the main is no higher than the concentration in the existing distribution system. The chlorinated water must be disposed of in a manner that will not damage the environment. While the main is being flushed, all service connections shall be thoroughly flushed in order to disinfect each connection.

After final flushing and before the main is placed in service, a sample or samples shall be collected by the Engineer from the line and tested for bacteriological quality using the membrane filter method. The number of samples to be taken and the location of the samples shall be determined by the Engineer. No hose or fire hydrant shall be used in collection of samples. If the initial disinfection fails to produce satisfactory samples, disinfection shall be repeated by the Contractor until satisfactory samples have been obtained. The Engineer, upon 48 hours advance notice, will furnish the personnel and laboratory facilities to conduct the required bacteriological tests. No samples will be taken on Friday, the day before a holiday or on a holiday.

The Engineer must be present during the entire disinfection process. Any work done without his supervision will not be accepted.

POUNDS OF CALCIUM HYPOCHLORITE REQUIRED TO DISINFECT
WATER MAINS WITH 100 PARTS PER MILLION OF CHLORINE

SIZE MAIN	POUNDS PER 1000 FEET OF PIPE
4"	0.8
6"	1.8
8"	3.1
12"	7.0
16"	12.4
20"	19.4
24"	28.0
30"	43.9

4. FINAL PREPARATIONS

CONCRETE AROUND STRUCTURES: All manhole rings and covers and valve-boxes located within any pavement area (including gravel and dirt streets) shall have placed around them a concrete collar constructed of Class A (3000 psi) concrete, 6" thick, extending a minimum of 12" from the outside circumference of the structure. For paved streets, the elevation of the top of the concrete collar shall be at the same elevation as the bottom of the surface course of pavement. For gravel or dirt streets, the elevation of the top of the collar shall be the same as the street elevation. No direct payment will be made for the construction of these concrete collars but the cost of same shall be included in the unit prices bid on the various items in the contract.

RESTORATION OF STREETS, CURB & GUTTER, DRIVEWAYS, SIDEWALKS, ETC.: Asphalt or concrete pavement repair performed by the Contractor shall be done in accordance with North Carolina Department of Transportation Standard Specifications. The Contractor shall be responsible for maintaining the cut until a final inspection is conducted and approved by the Engineer and the North Carolina Department of Transportation. Pavement cuts of NCDOT Roads are by NCDOT Permit Only.

Gravel or dirt streets will be maintained in a passable condition with three inches (3") of miscellaneous stone spread over the traveled area. If agreed upon by the Contractor and the Engineer, the entire street or surface will be stoned after the final inspection.

Replacement of curb and gutter, driveways and sidewalks shall be in accordance with North Carolina Department of Transportation Standard Specifications and the cost of same shall be included in the unit prices bid on the various items in the contract.

SEEDING AND MULCHING: Seeding and mulching shall consist of preparing seedbeds; furnishing and thoroughly incorporating into the soil lime and fertilizer; furnishing and covering seed; furnishing, placing and securing a mulch covering and other operations incidental to proper control of erosion and beautification on shoulders, slopes or other right-of-way areas shown on the plans or as directed by the Engineer.

(a) Seedbed Preparation

Grass and weeds, if any, shall first be cut or otherwise disposed of satisfactorily. Areas to be seeded shall be brought to the proper line, grade and cross-section as shown on the plans or as required by the Engineer. Minor shaping and smoothing of uneven and rough areas outside of the graded section shall be done as directed by the Engineer in order to provide for more effective erosion control and for ease of subsequent mowing operations. All rocks shall be removed for Type I seeding and all rocks over 2" in diameter shall be removed for Type II seeding.

The soil shall be scarified or otherwise loosened to a depth of not less than five (5) inches. After initial scarification, dolomitic limestone and fertilizer shall be applied to the soil and worked in throughout the scarified zone. The top two or three inches of soil shall be worked into a satisfactory seedbed, free of clods, by discing, using drags, harrows or other appropriate means. The preparation of the seedbed shall not be done when the soil is frozen, extremely wet or otherwise in an unfavorable working condition.

The Contractor shall get the Engineer's approval of the finish grading and seedbed preparation prior to reseeding. Failure to comply may result in the Contractor reworking the unapproved areas at his cost.

(b) Seed Application

In all cases the seed used must be certified by the North Carolina Department of Agriculture. The date of certification of all seed must be within eight (8) months of the date of sowing. Certification tags from all seed shall be given to the Engineer for inspection and approval prior to seeding.

Seed shall be distributed uniformly over the seedbed at the specified rate of application. The seedbed shall be lightly raked or dragged to insure soil to seed contact. The seed shall not be covered as light is needed for proper germination.

Type I Seeding, Application Rate Per 1000 Square Feet (Lawns or other focal areas):

100 lbs. of lime
20 lbs. of 10-20-20 or 20 lbs. of 10-10-10 in combination with
4 lbs. of 0-46-0
5 lbs. of tall fescue, containing a blend of 2 or more tall fescues
1 lb. of Kenblue or Kentucky Bluegrass
1 lb. of annual rye (November 1 to March 1)

Type II Seeding, Application Rate Per 1000 Square Feet (General or low maintenance areas):

100 lbs. of lime
15 lbs. of 10-20-20 or 15 lbs. of 10-10-10 in combination with
3 lbs. of 0-46-0
4 lbs. of tall fescue, containing a blend of 2 or more tall fescues
1 lb. of sericea lespedeza (use unscarified seed August 15 to February 1)
1/4 lb. of German millet (May 1 to August 15)

1 lb. of rye grain (prior to May 1 or after August 15)

Seeding mixtures other than those listed above shall be approved by the Engineer prior to seeding.

(c) Applying Mulch

Mulch shall consist of grain straw or other equally satisfactory material approved by the Engineer. Mulch shall be spread uniformly over the area by hand or by mechanical spreader at the rate of 2 bales per 1000 square feet minimum. The mulch shall be applied uniformly to allow some sunlight to penetrate and air to circulate, while serving to partially shade the ground, reduce erosion and conserve soil moisture.

As determined necessary by the Engineer, mulch shall be held in place by means of stakes and twine, spraying of an asphalt emulsion or other means approved by the Engineer.

The rate of application of an asphalt emulsion will be sufficient to bond together the mulch particles without giving a heavy coating of the asphalt material. Adequate precautions shall be taken to prevent spraying asphalt emulsion on cars, fire hydrants or other structures. The Contractor shall clean any structures that are sprayed.

RESEEDING: When seeding and mulching has been damaged or grass fails to grow and the Contractor has fully complied with the specifications, the Contractor shall be paid at the unit price for "Seeding and Mulching" to repair the areas of damage or failure. This shall also apply to areas beside drives or other paved areas needing reseeding once the pavement has been repaired. As an exception to the above, the Contractor shall repair, at his cost, any damage or failure, which is due to his carelessness or neglect.

CLEANING UP: All surplus or spoil material and all tools and temporary structures shall be removed from the site by the Contractor. All dirt, rubbish and excess earth from the excavation shall be hauled to a dump provided by the Contractor and the construction site left clean to the satisfaction of the Engineer.

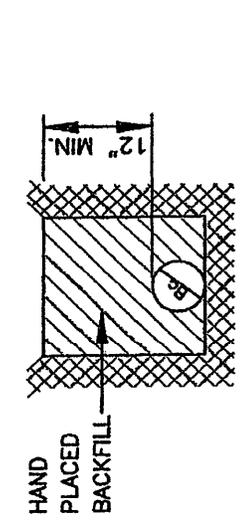
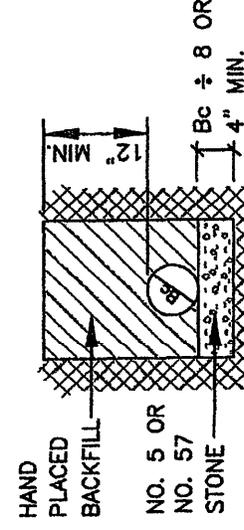
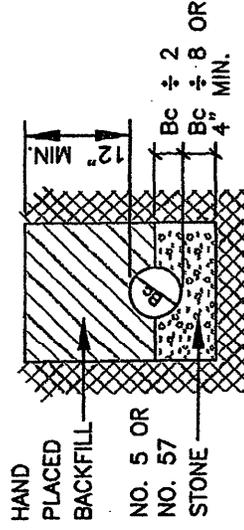
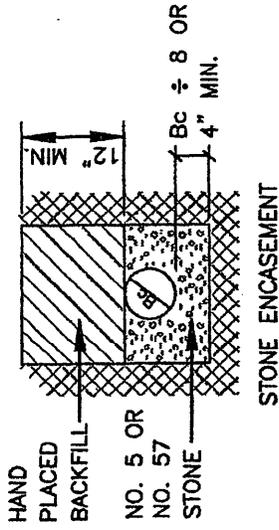
In every instance, the Contractor shall be responsible for leaving the site in as good or better shape than before the construction was begun. It shall be up to the Engineer to determine when the clean up operation is finished and acceptable to the governing authority.

Any excavation from trenches which has been placed on roadway surfaces and driveways will be completely removed from such surfaces as soon as practical, but in no case will excavation material be left on pavement at the end of a work day. Necessary equipment for removal of such material will be available at all times to preclude the development of traffic hazards from dust and/or slick areas caused by rainfall on clay material. The Contractor shall maintain personnel on the site until all clean up activities are satisfactorily completed. All final clean up activities including grassing will be completed within 30 days after completion of the main line in that area (i.e., no area will remain without grassing longer than 30 days).

All salvageable materials from the water or system belong to the Owner and must be turned over to the construction and maintenance personnel.

FINAL INSPECTION: The Contractor is instructed to request a final inspection only after the work has been checked by the Contractor or his appointed agent. All defects observed by the Engineer during the final inspection shall be repaired by the Contractor at his expense. Final inspection for sanitary sewer lines may include using T.V. equipment on all lines accessible to a mobile unit. After the Contractor satisfactorily corrects all defects and the project is deemed acceptable by the Engineer, written notice will be given to the Contractor stating that the governing authority has accepted the new facilities for maintenance. Said notice will also include the date of expiration of the one-year warranty.

PIPE SIZE		8"	10"	12"	15"	18"	21"	24"	27"	30"	36"
SAFE COVER	0'										
	2'										
	4'	CLASS "D"	CLASS "D"	CLASS "D"	CLASS "D"	CLASS "D"	CLASS "D"	CLASS "D"	CLASS "D"	CLASS "D"	CLASS "D"
	6'										
	8'		XI-2								
	10'		CLASS "C"								
	12'		CLASS "B"								
	14'		STONE ENC.								
	16'										
	18'										
	20'										
	22'										



NOTE: *SDR-24*
 SEE TECHNICAL SPECIFICATIONS FOR BEDDING
 REQUIREMENTS FOR UNSTABLE SUBGRADE AND
 ROCK FORMATIONS.
 Bc = Outside Diameter of Pipe

BEDDING REQUIREMENTS AND SAFE COVER
 FOR
V.C. & P.V.C. PIPE ON STABLE SUBGRADE

GUPTON & ASSOCIATES, P.A.
 Engineers - Planners - Surveyors
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 Winston-Salem, N.C. 27103

Class B

MANHOLE RING & COVER

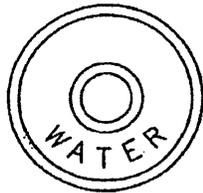
TYPE 1



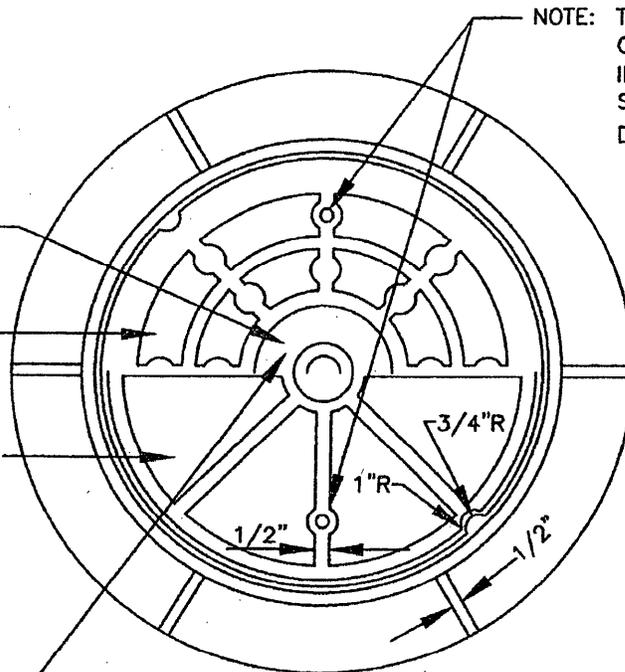
DETAIL "C C"

TOP OF COVER

BOTTOM OF COVER



DETAIL "B B"



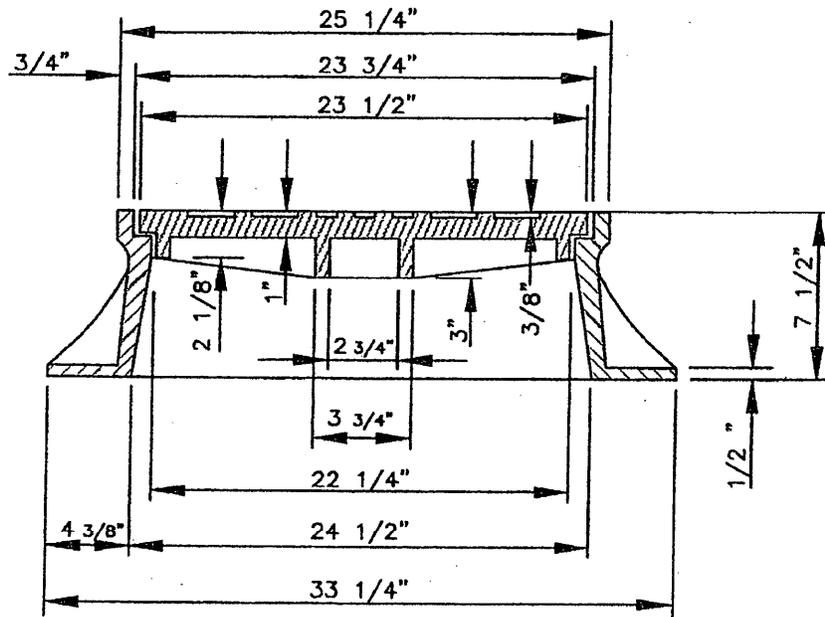
PLAN

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.

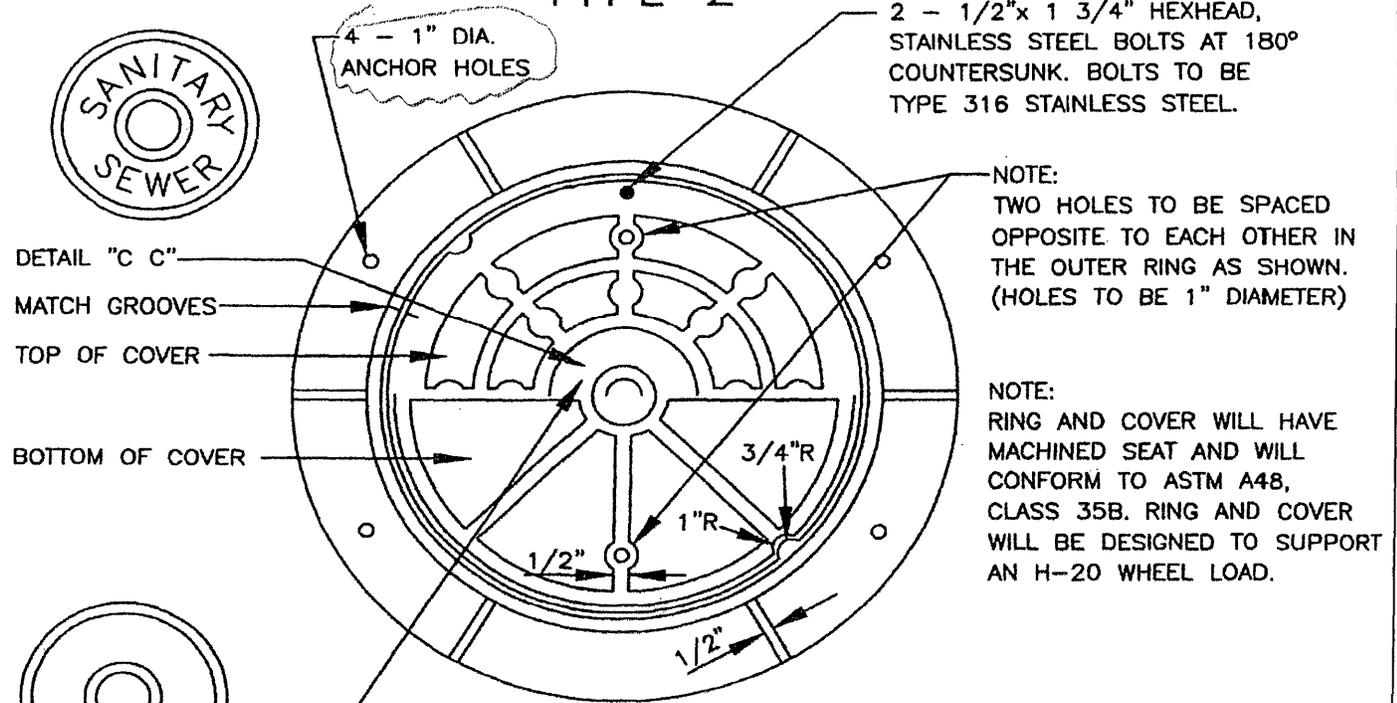
MINIMUM AVERAGE WEIGHTS

RING	190 LBS.
COVER	120 LBS.
	<u>310 LBS.</u>



SECTION

MANHOLE RING & COVER TYPE 2



PLAN

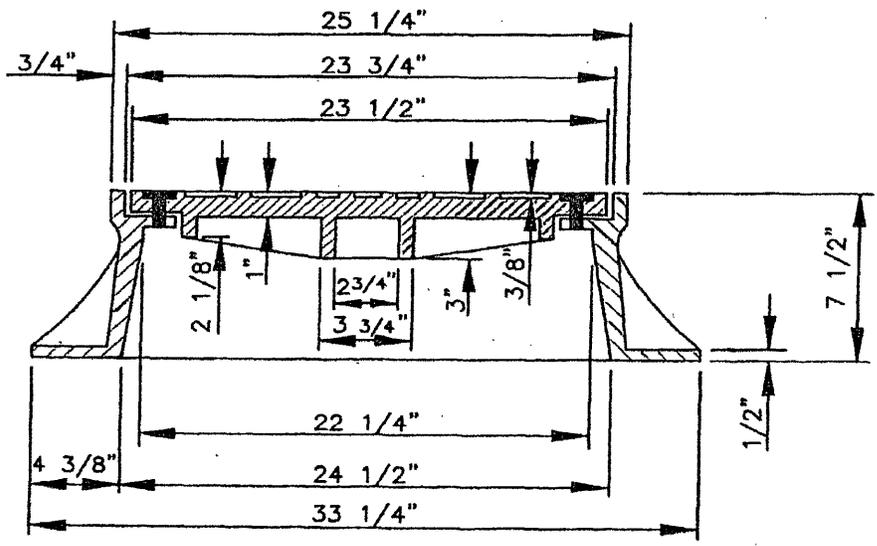
2 - 1/2"x 1 3/4" HEXHEAD, STAINLESS STEEL BOLTS AT 180° COUNTERSUNK. BOLTS TO BE TYPE 316 STAINLESS STEEL.

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	<u>120 LBS.</u>
	310 LBS.

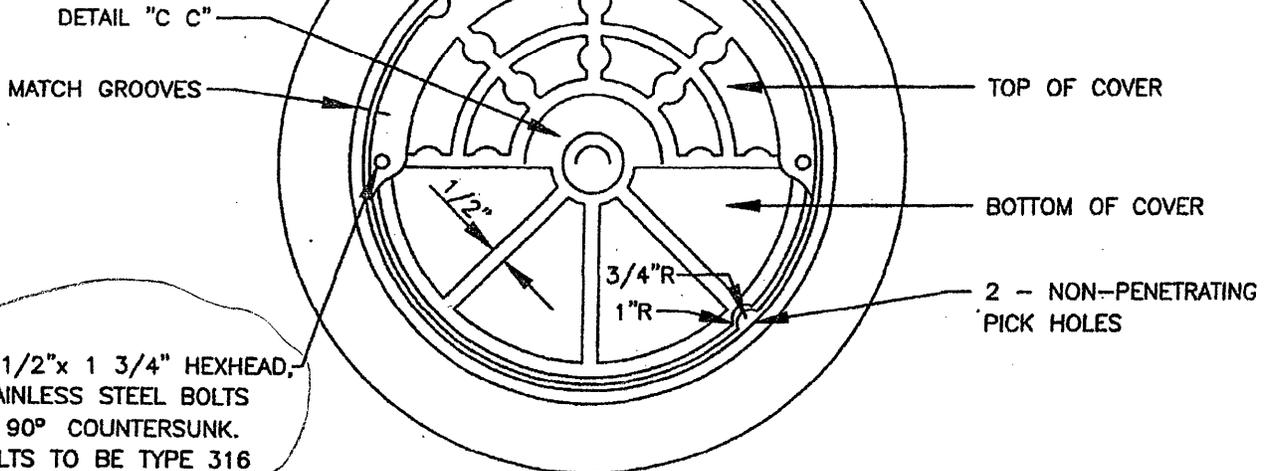


SECTION

MANHOLE RING & COVER TYPE 3



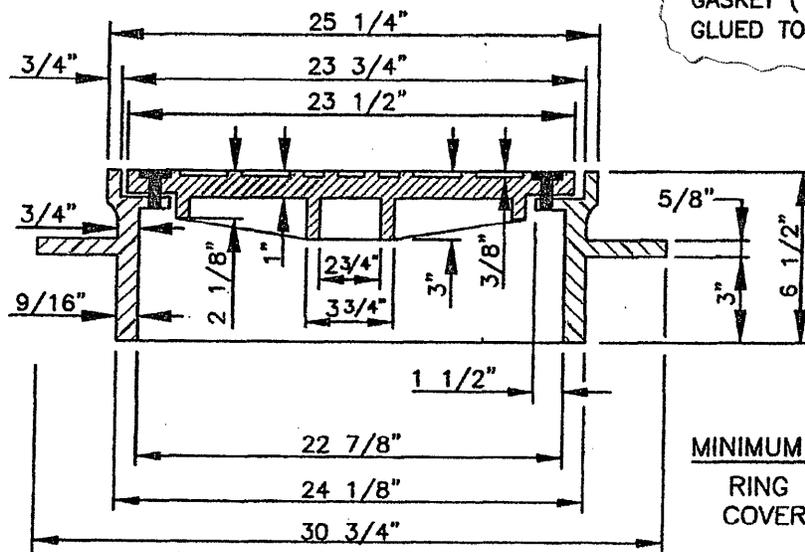
NOTE:
RING AND COVER WILL HAVE
MACHINED SEAT AND WILL CONFORM
TO ASTM A48, CLASS 35B.



4-1/2"x 1 3/4" HEXHEAD,
STAINLESS STEEL BOLTS
AT 90° COUNTERSUNK.
BOLTS TO BE TYPE 316
STAINLESS STEEL.

PLAN

CONTINUOUS RUBBER
GASKET (1/8" THICK)
GLUED TO RING SEAT.



SECTION

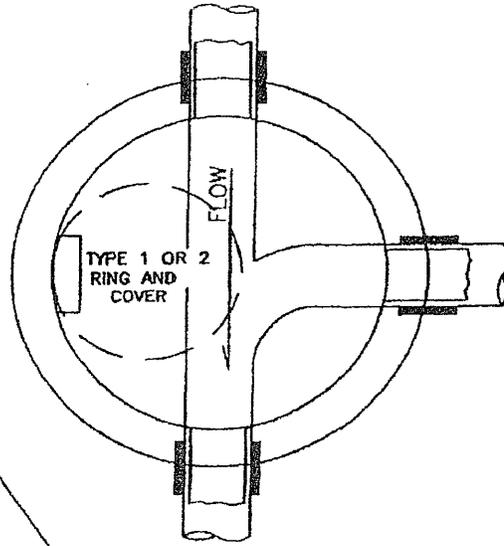
MINIMUM AVERAGE WEIGHTS

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

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)

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.

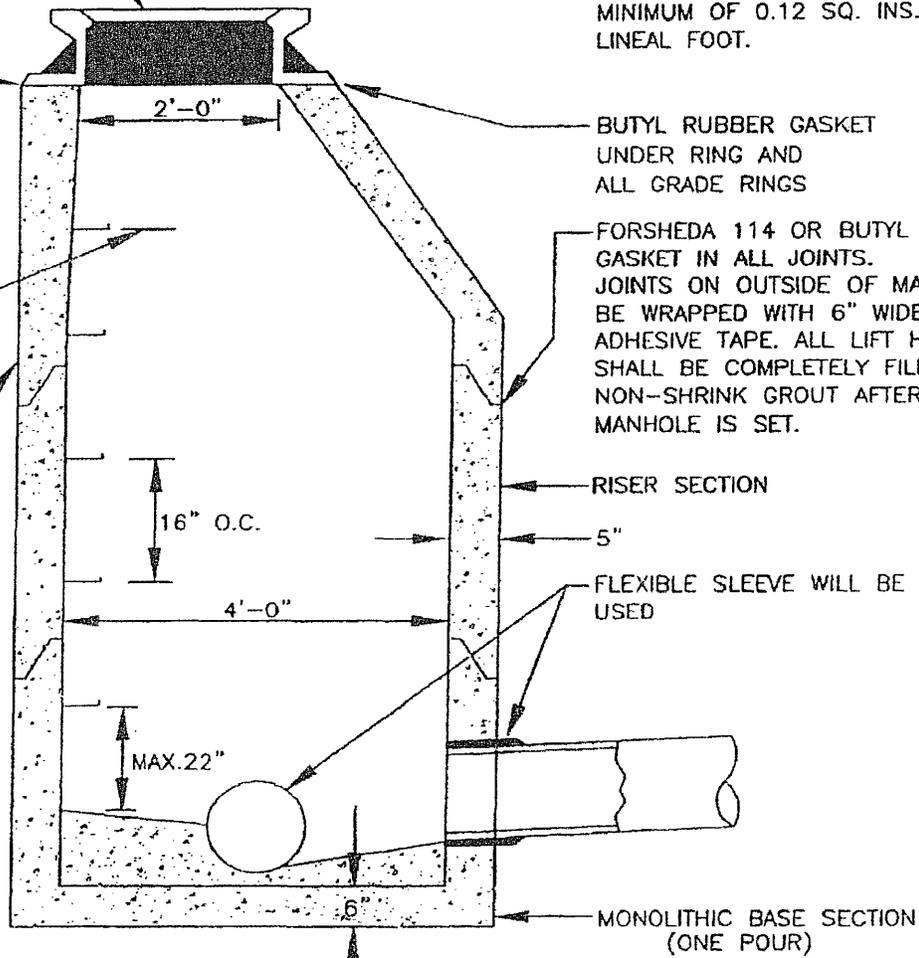
MAX. 3 COURSES OF BRICK (8 IN.) OR 2-5" GRADE RINGS MAY BE ADDED VERTICALLY. (NOT ALLOWED WITH TYPE 2 RING & COVER)

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.)



BUTYL RUBBER GASKET UNDER RING AND ALL GRADE RINGS

FORSHEDA 114 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

5"

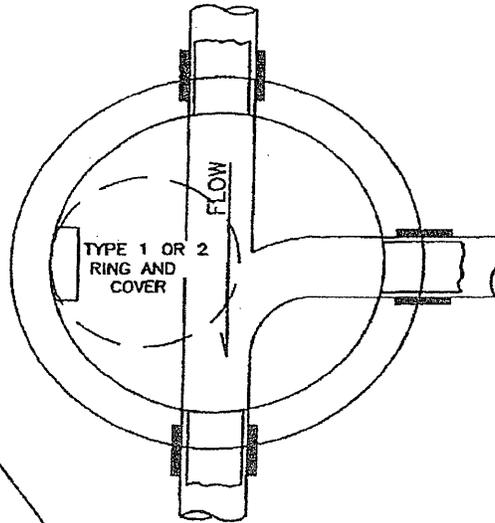
FLEXIBLE SLEEVE WILL BE USED

MONOLITHIC BASE SECTION (ONE POUR)

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.

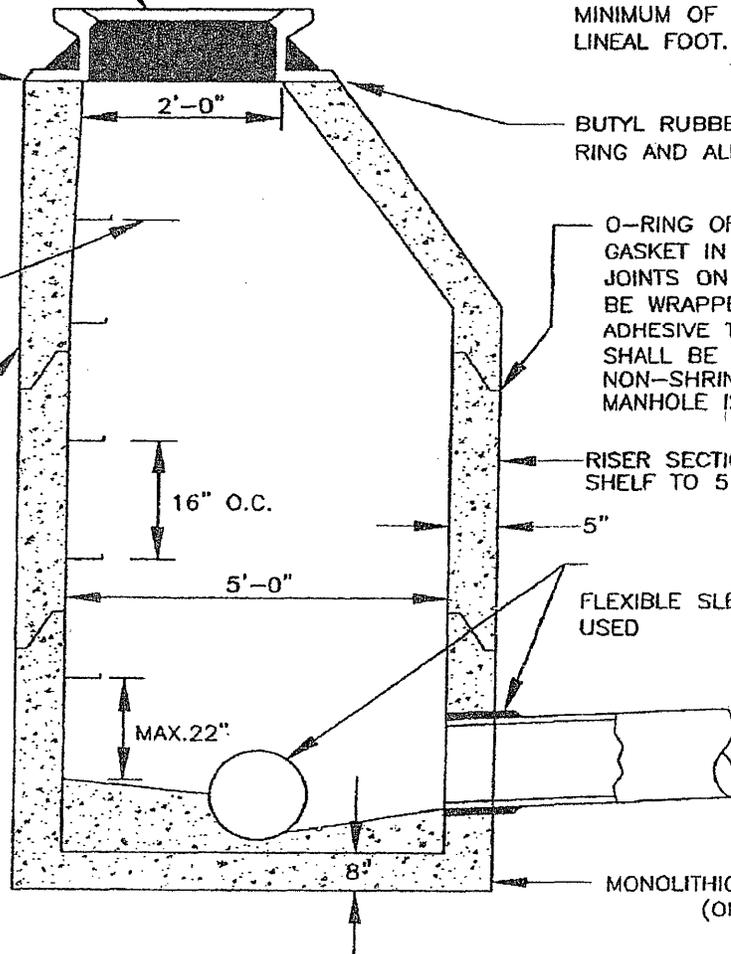
MAX. 3 COURSES OF BRICK (8 IN.) OR 2-5" GRADE RINGS MAY BE ADDED VERTICALLY. (NOT ALLOWED W/TYPE 2 RING AND COVER)

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

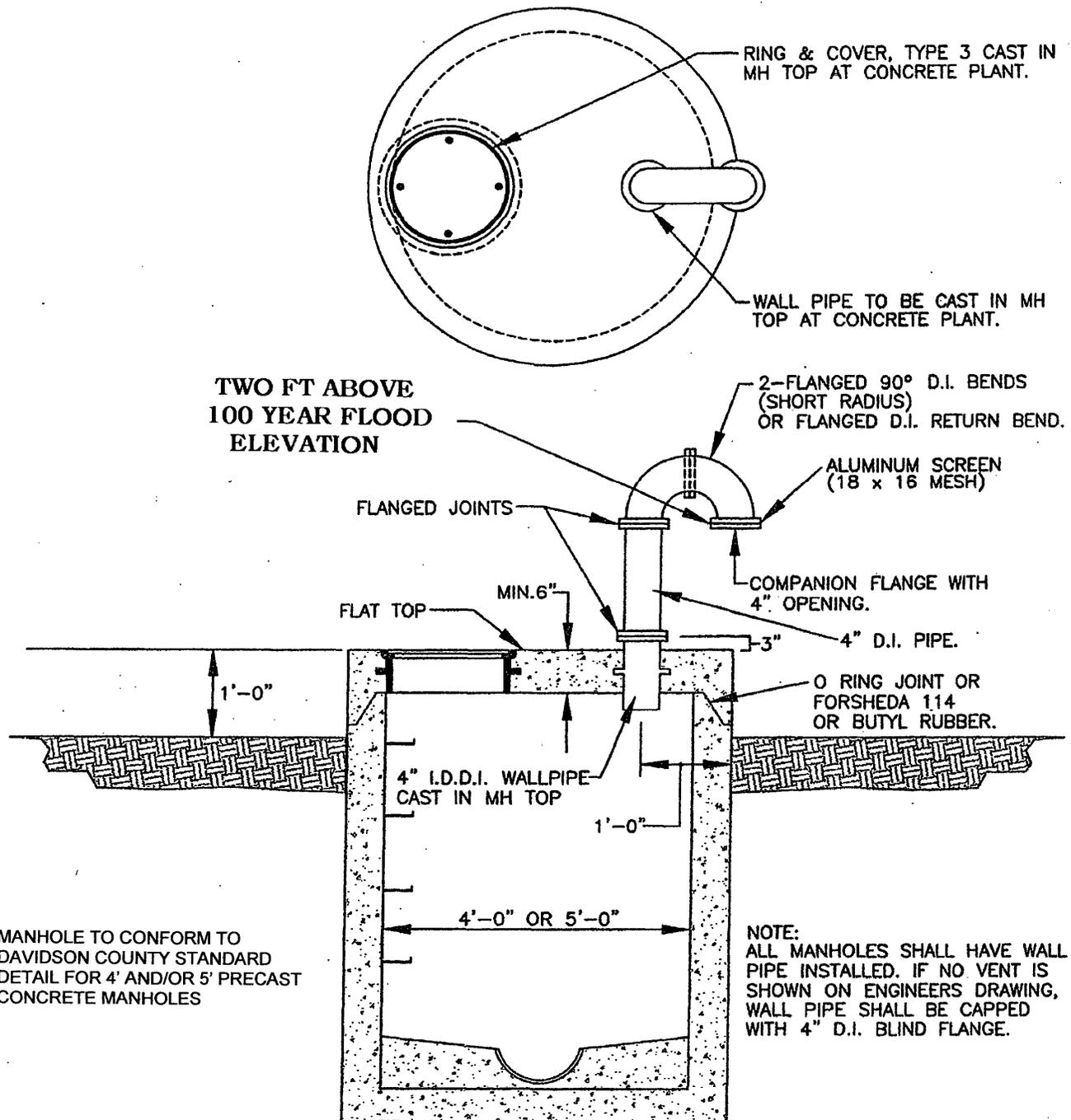
O-RING OR BUTYL RUBBER GASKET IN ALL JOINTS. JOINTS ON OUTSIDE OF MANHOLE TO BE WRAPPED WITH 6" WIDE BUTYL ADHESIVE TAPE. ALL LIFT HOLES SHALL BE COMPLETELY FILLED WITH NON-SHRINK GROUT AFTER MANHOLE IS SET.

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

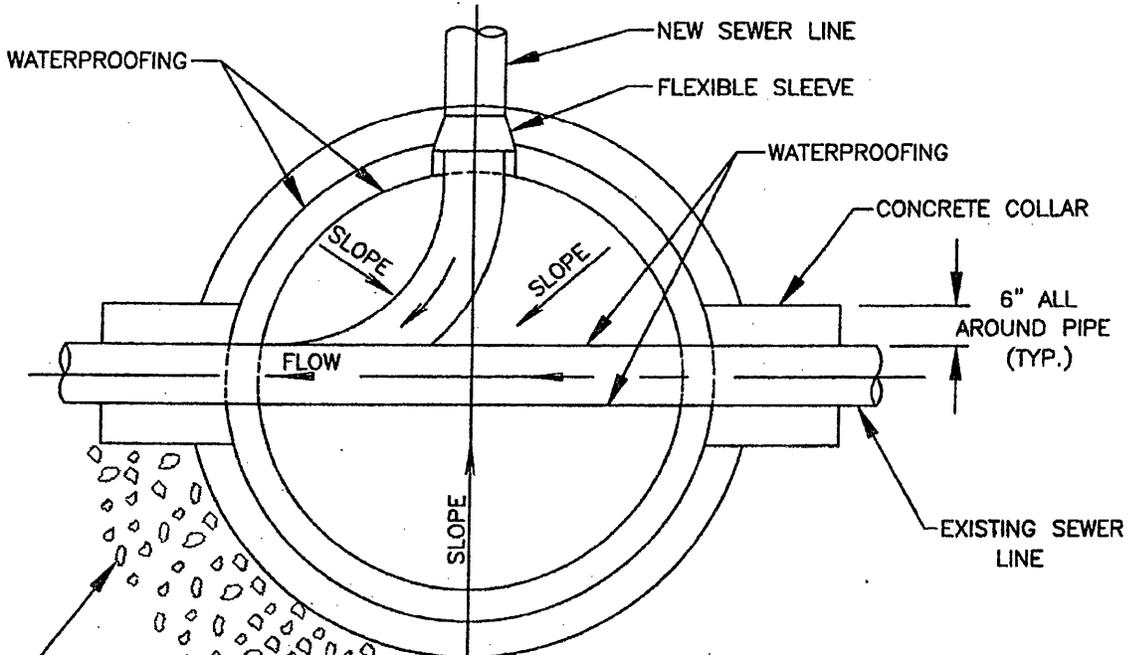
FLEXIBLE SLEEVE WILL BE USED

MONOLITHIC BASE SECTION (ONE POUR)

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



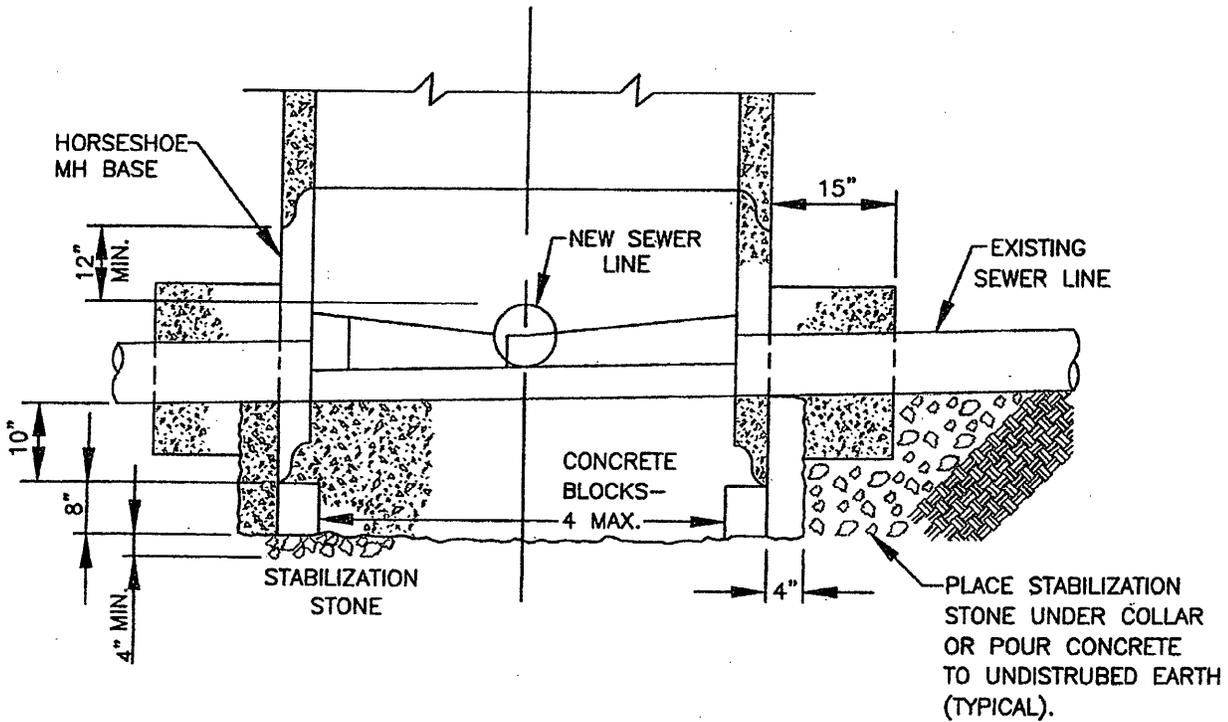
MANHOLE BUILT OVER EXISTING LINE



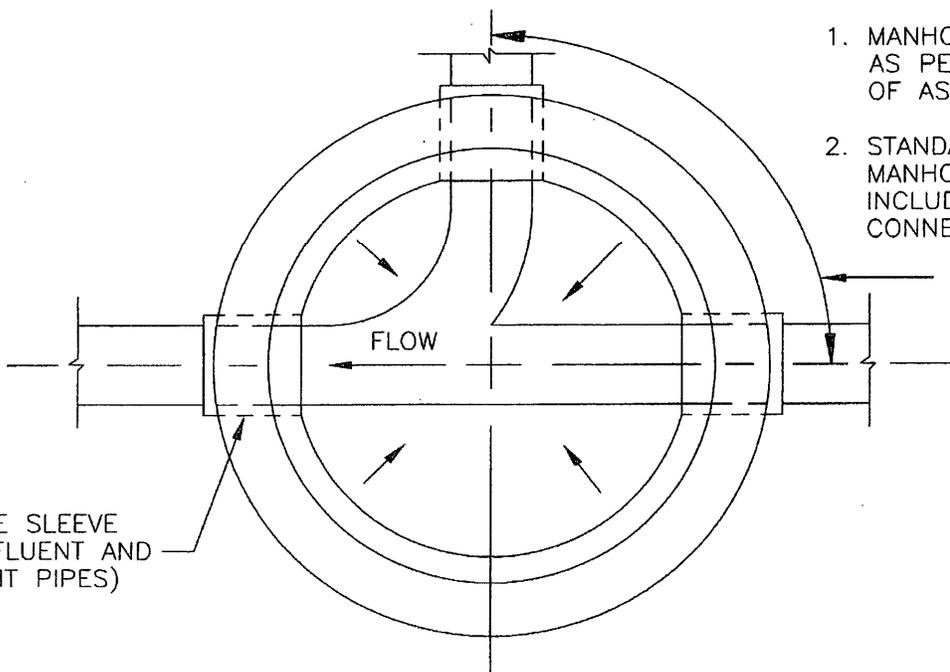
1. PLACE HORSESHOE MH BASE IN WET CONCRETE (4000 PSI).
2. AFTER CONCRETE SETS CORE HOLE & SET NEW SEWER LINE.
3. CUT OUT TOP HALF OF EXISTING PIPE. FINISH INVERTS & WATERPROOF ALL COLD JOINTS & AROUND ALL PIPE.
4. POUR CONCRETE COLLARS.

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

PLAN



PRECAST REINFORCED CONCRETE MANHOLE WITH PRECAST INVERT

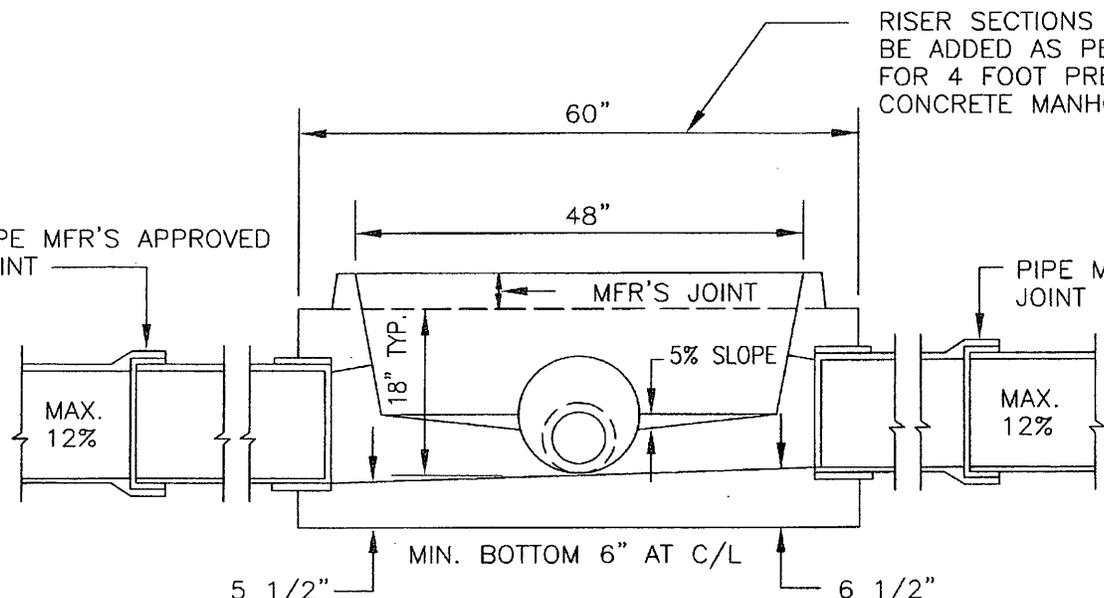


1. MANHOLE SHALL BE MANUF. AS PER THE REQUIREMENTS OF ASTM C-478.
2. STANDARD FALL THROUGH MANHOLE IS 1" (.08') INCLUDING 4" AND 6" CONNECTIONS INTO MANHOLE.

35° MIN. ANGLE

FLEXIBLE SLEEVE
(ALL INFLUENT AND
EFFLUENT PIPES)

PLAN



RISER SECTIONS AND CONE TO BE ADDED AS PER DETAIL DRAWING FOR 4 FOOT PRECAST REINFORCED CONCRETE MANHOLE.

PIPE MFR'S APPROVED JOINT

PIPE MFR'S APPROVED JOINT

MAX. 12%

MAX. 12%

5 1/2"

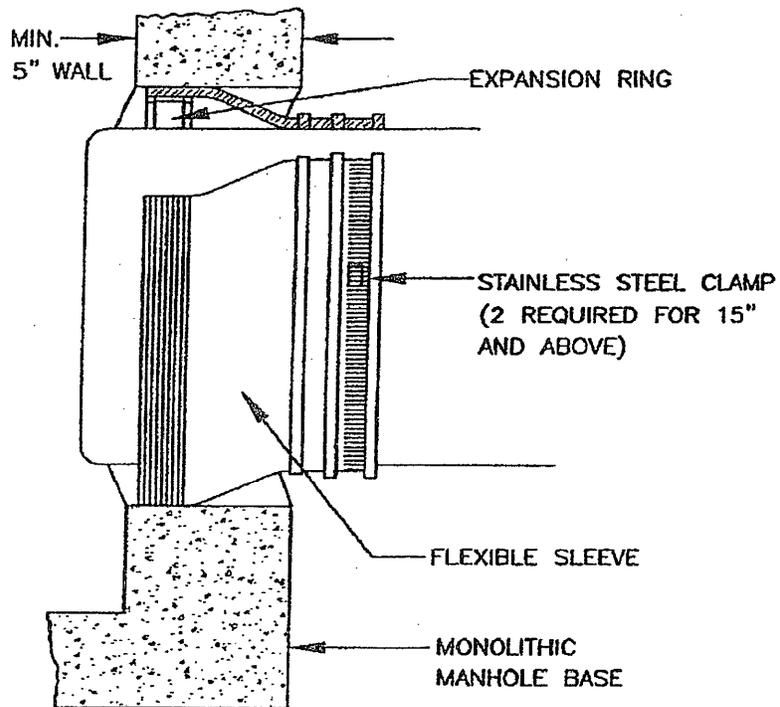
6 1/2"

MIN. BOTTOM 6" AT C/L

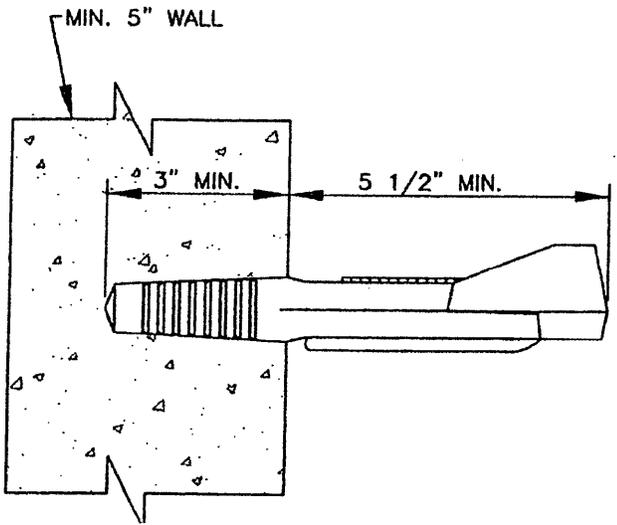
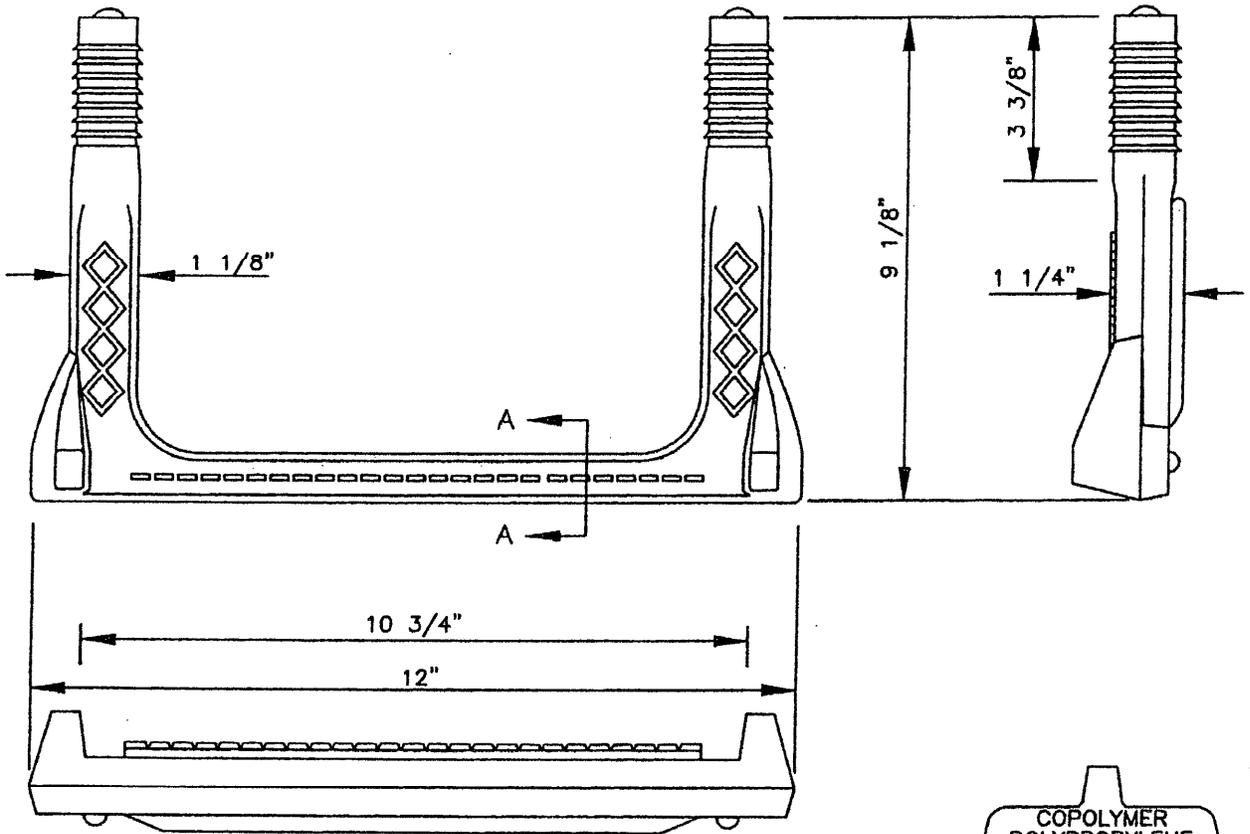
SECTION

FLEXIBLE MANHOLE SLEEVE

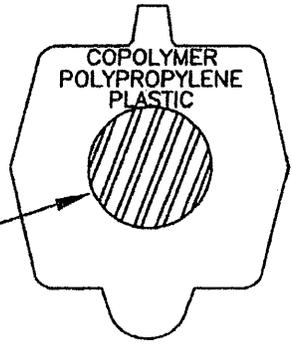
NOTE: FLEXIBLE MANHOLE SLEEVES SHALL CONFORM TO ASTM C923. SLEEVES BY PRESS-SEAL GASKET CORPORATION, EPCO INC. OR NPC INC. ARE ACCEPTABLE. MAXIMUM DEFLECTION FOR SLEEVE IS 7° (12%). SLOPES GREATER THAN 12% MUST HAVE SLEEVES DESIGNED FOR HIGHER DEFLECTION.



POLYPROPYLENE MANHOLE STEP



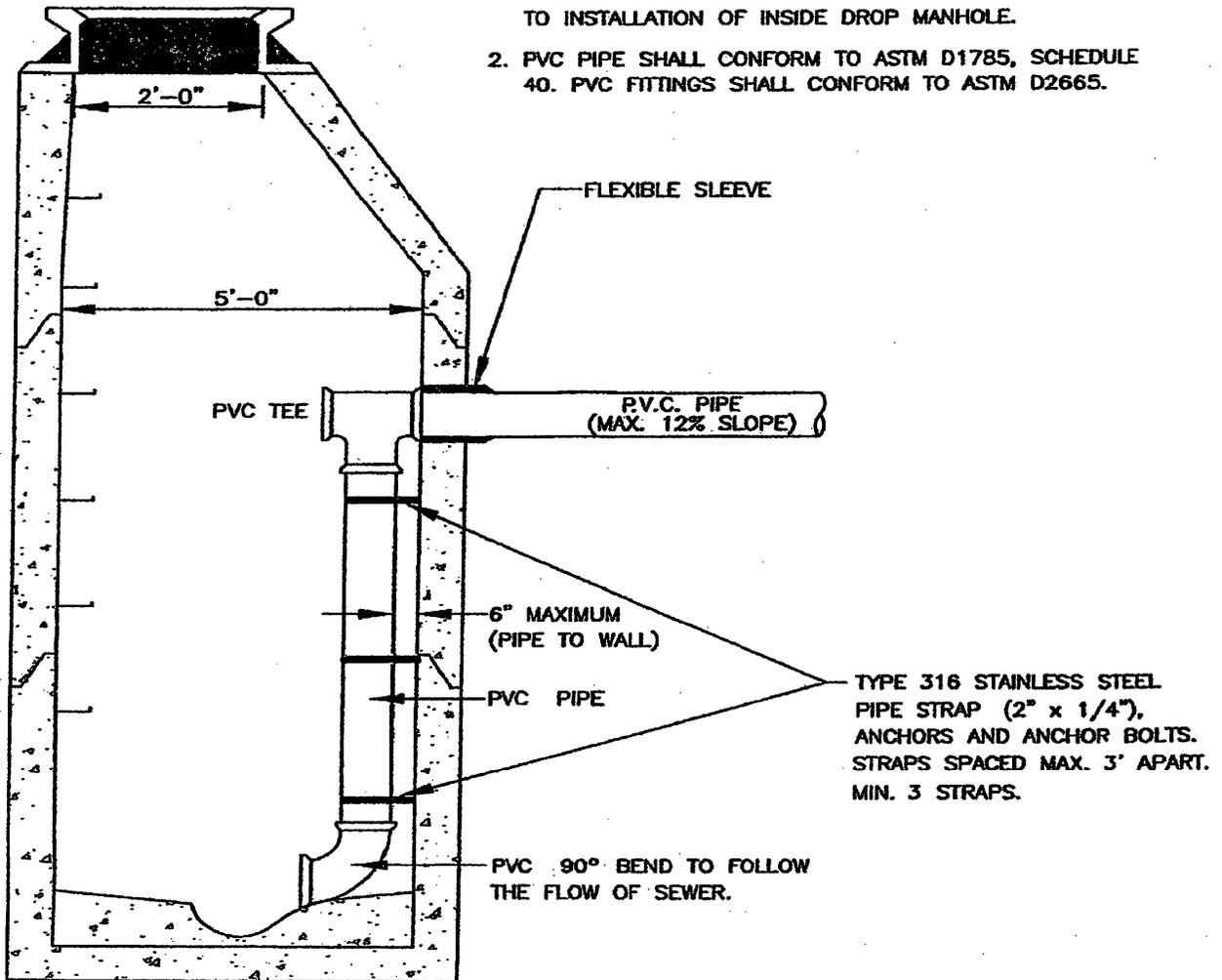
$\frac{1}{2}$ " GRADE 60 STEEL REINFORCEMENT



INSIDE DROP MANHOLE

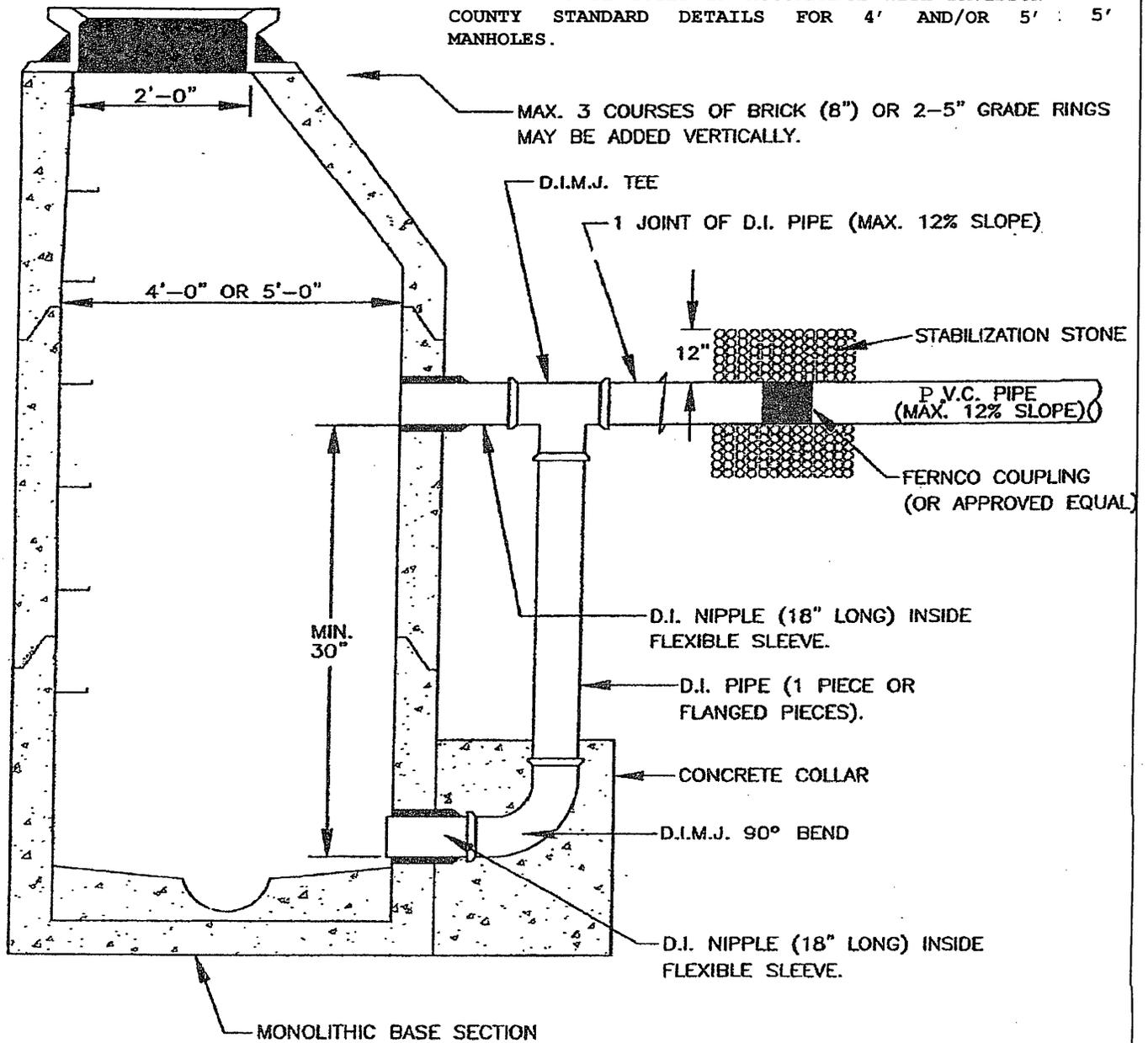
NOTES:

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.

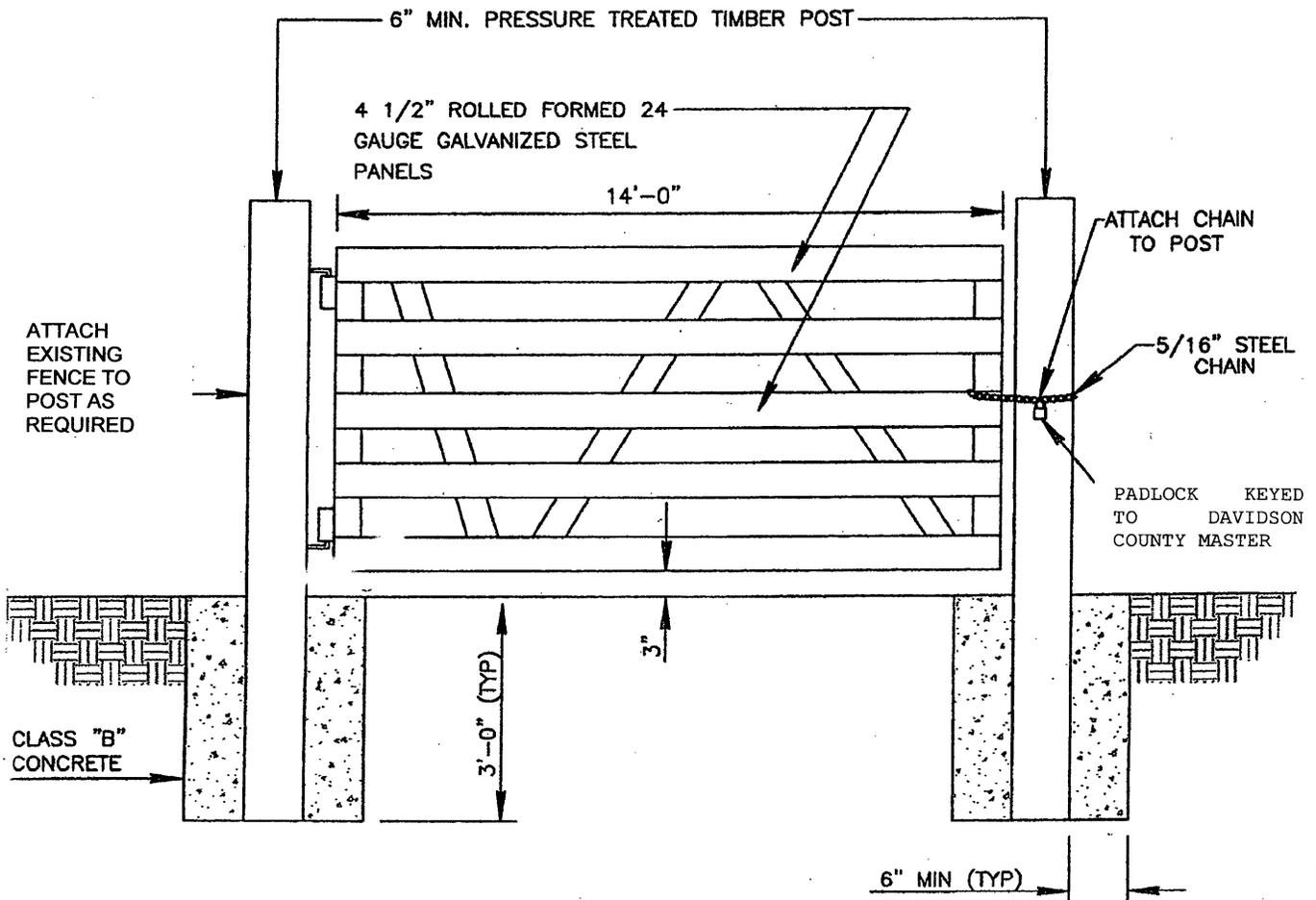


OUTSIDE DROP MANHOLE

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

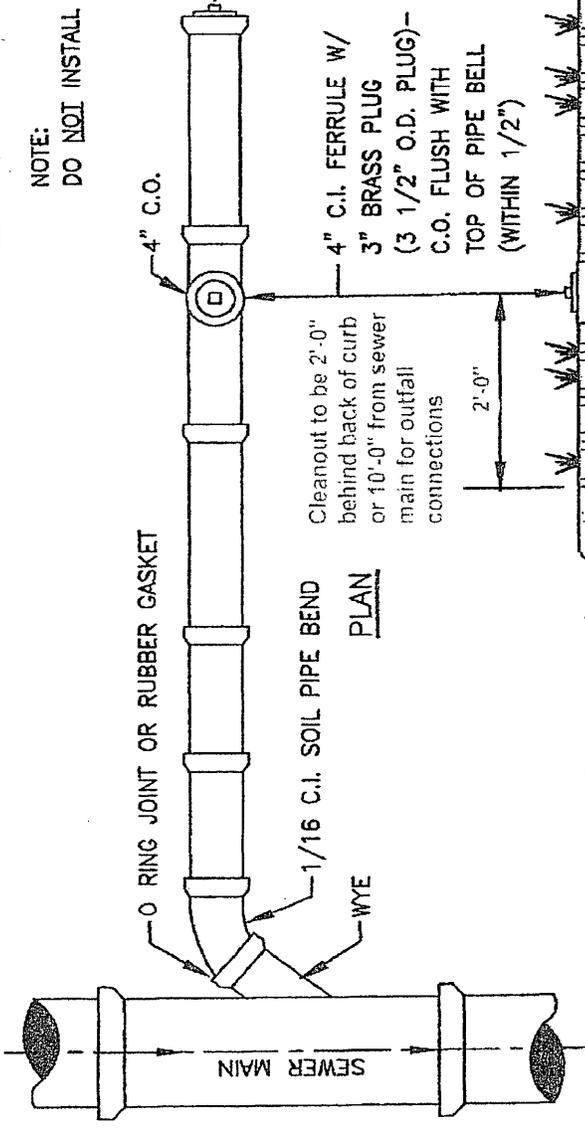


FENCE GATE



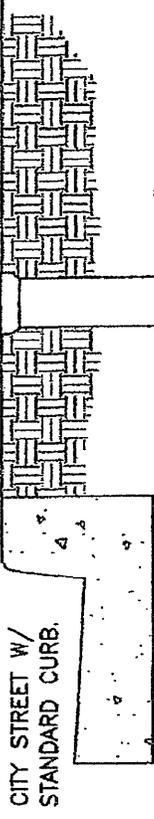
NOTE:
DO NOT INSTALL C.O. INSIDE A FENCE.

1. BRASS CLEANOUT.
2. C.I. PLUG WITH NO-HUB COUPLING.
3. QUICK SEAL PLUG (BY FERSCO).
4. 1" CONE EXPANDABLE STOPPER (S-401 BY ETCO).
5. C.I. PLUG WITH RUBBER GASKET.



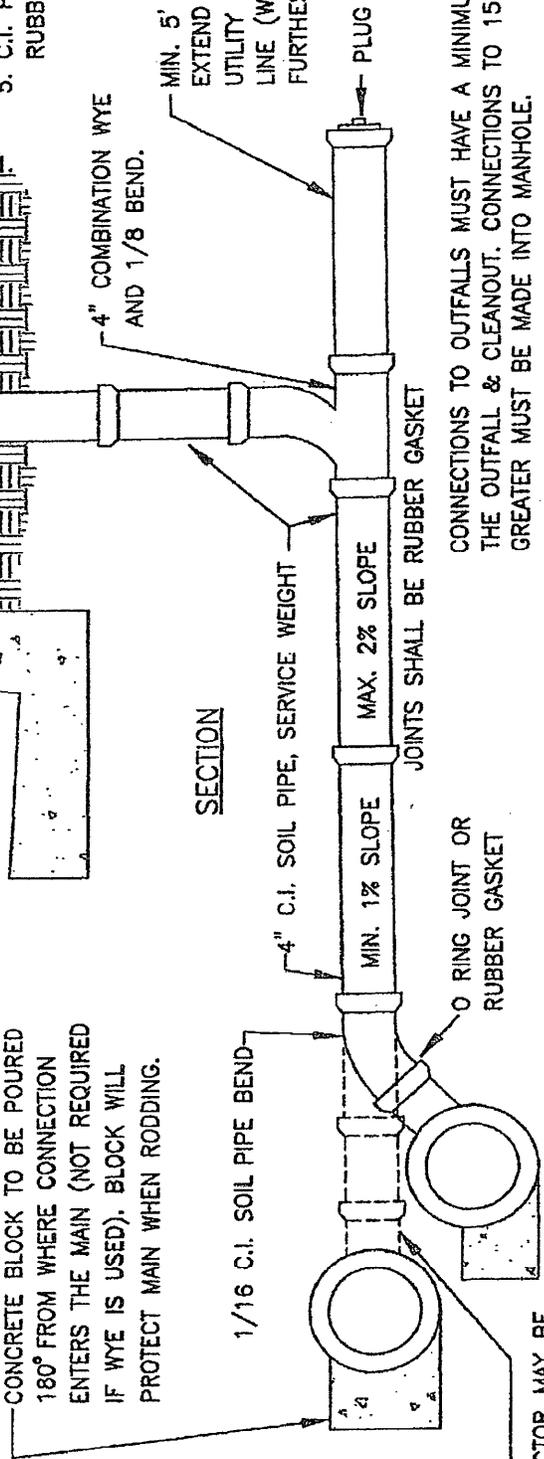
Cleanout to be 2'-0" behind back of curb or 10'-0" from sewer main for outfall connections

PLAN



SECTION

CONCRETE BLOCK TO BE POURED 180° FROM WHERE CONNECTION ENTERS THE MAIN (NOT REQUIRED IF WYE IS USED). BLOCK WILL PROTECT MAIN WHEN RODDING.

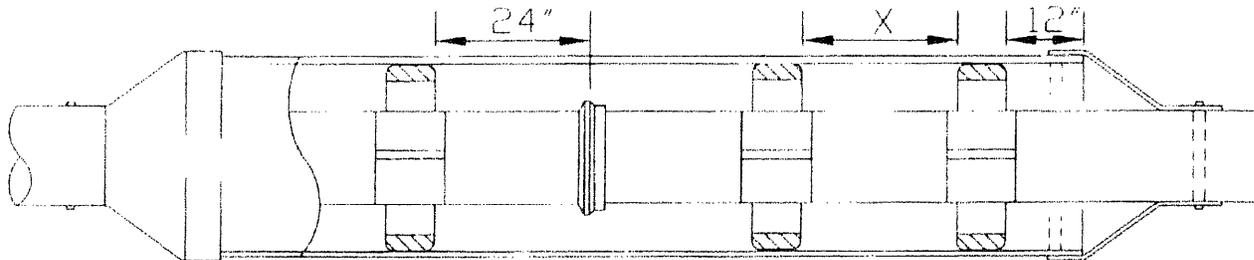


NOTE:
CONTRACTOR MAY BE REQUIRED TO LAY CONNECTION AS SHOWN BY DASHED LINES IF ELEVATION IS CRITICAL.

CONNECTIONS TO OUTFALLS MUST HAVE A MINIMUM OF 5' BETWEEN THE OUTFALL & CLEANOUT. CONNECTIONS TO 15" OUTFALLS & GREATER MUST BE MADE INTO MANHOLE.

TYPICAL 4" SEWER CONNECTION

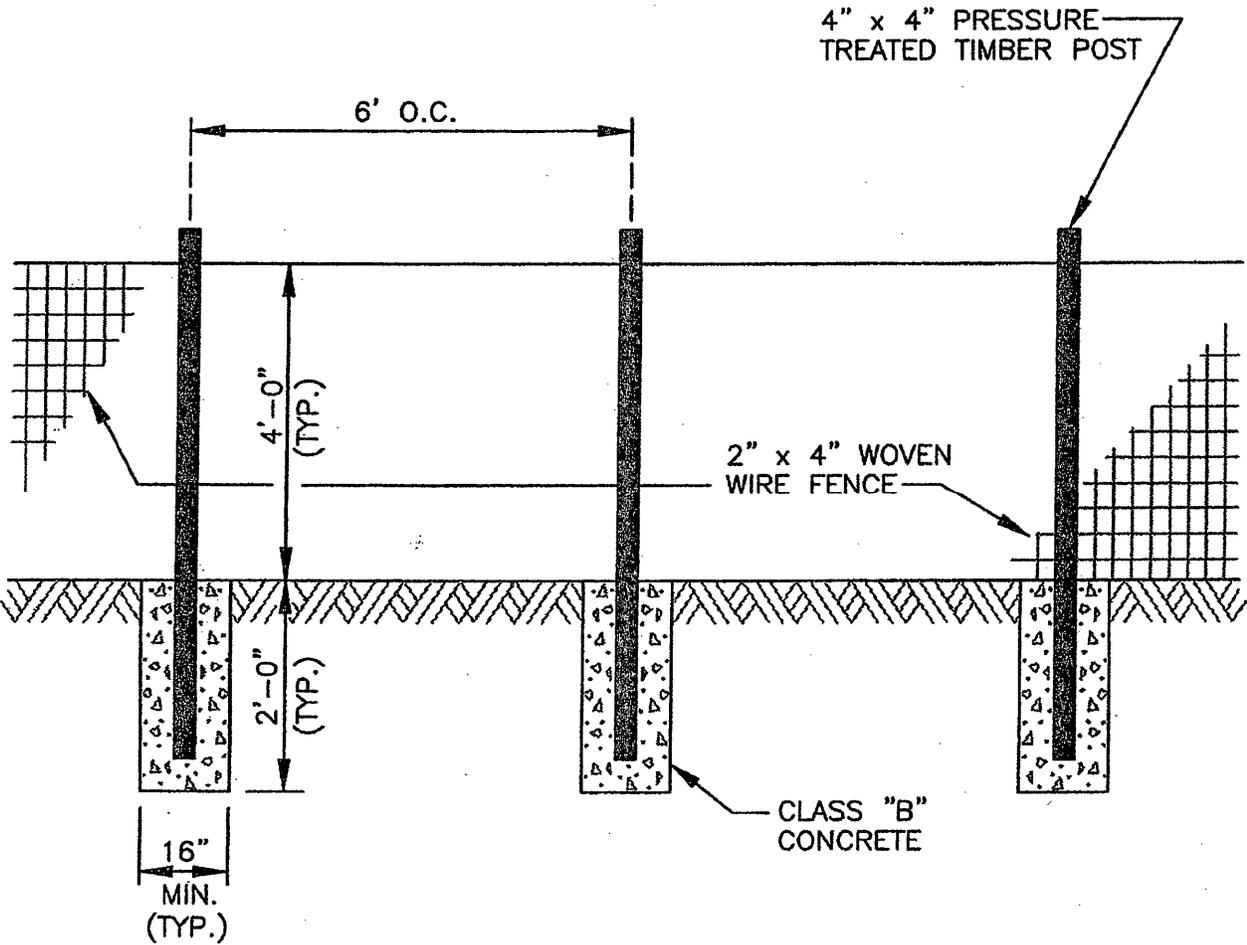
CASING DETAIL FOR WATER LINES & SEWER FORCE MAINS



CASING DETAIL NOTES:

1. CARRIER PIPE SHALL BE CENTERED WITHIN CASING BY AN APPROVED STAINLESS STEEL CASING SPACER.
2. CASING PIPE SHALL BE SEALED BY USE OF WRAPAROUND END SEALS OR WRAP ENDS OF CARRIER PIPE WITH TAR PAPER AND INSTALL 4" THICK BRICK AND MORTAR PLUG IN THE ANNULAR SPACE A 1" WEEP HOLE.
3. THREE CASING SPACERS SHALL BE ATTACHED TO EACH JOINT OF CARRIER PIPE WITH ONE AT THE CENTER AND ONE NOT MORE THAN 24" FROM EACH END. ONLY THE RUNNERS OF THE CASING SPACERS SHALL BE IN CONTACT WITH THE ENCASEMENT. THE BELL OF THE CARRIER PIPE WILL NOT BE ALLOWED TO BE IN CONTACT WITH THE ENCASEMENT.
4. ONE CASING SPACER SHALL BE LOCATED NOT MORE THAN 12" FROM EACH END OF CASING PIPE.
5. VALVES OR OTHER CONTROL/MAINTENANCE EQUIPMENT ATTACHED TO WATERLINE/SEWER FORCE MAINS SHALL BE LOCATED A MINIMUM OF FOUR PIPE LENGTHS FROM THE END OF THE CASING, OR AS APPROVED BY THE ENGINEER.
6. STEEL CASING SHALL HAVE A MINIMUM YIELD STRENGTH OF 35,000 PSI AND SUFFICIENT CORROSION PROTECTION,
7. LINES TO BE ENCASED UNDER STATE ROADS WILL COMPLY WITH NCDOT SPECIFICATIONS AND LINES TO BE ENCASED UNDER RAILROADS SHALL COMPLY WITH THE AMERICAN RAILWAY ENGINEERING ASSOCIATION SPECIFICATIONS.
8. WHEN INSTALLING CARRIER PIPE, CONTRACTOR SHALL PUSH SO THAT PIPE JOINTS ARE ALWAYS BEING COMPRESSED.
9. CLASS III STEEL CASING PIPE SHALL BE ASTM-139, GRADE B.
10. ALL PIPE IN CASING SHALL BE DUCTILE IRON PIPE AND BE FLEXIBLE RESTRAINED JOINT PIPE AS NOTED ELSEWHERE IN THESE SPECIFICATIONS. A MINIMUM OF 3 JOINTS OUTSIDE EACH END OF CASING SHALL BE DUCTILE IRON WITH FLEXIBLE RESTRAINED JOINTS.

FENCING (OUTFALLS)





SANITARY SEWER:

- Clearing & Grubbing- The work of clearing shall consist of the cutting, removal and satisfactory disposal off site of all vegetation and debris from wooded areas. The work of grubbing shall consist of the removal and satisfactory disposal of all vegetation and surface debris. Where material being removed is high in organic content, such as root mat and other vegetative matter, it shall be considered vegetation and removed as part of the work of grubbing. The work of clearing and grubbing shall also include the removal and satisfactory disposal of stumps, crops, weeds and other annual growth; the removal and satisfactory disposal of fences, steps, walls, chimneys, column footings, signs, junked vehicles and other rubble and debris; and the filling of holes and depressions with suitable clean fill material. The full extent of the permanent easement shall be properly cleared and grubbed.
- Excavating and Backfilling Trenches- Should rock be encountered in trenches, it will be uncovered in sections not less than fifty feet (50') in length. Rock excavation shall be carried six inches (6") below the bottom of the pipe. Rock excavation for manholes shall be carried six inches (6") below the bottom of the manhole. The trenches will be brought back to grade by the pipe laying crew with suitable material, properly compacted. All blasting operations shall be conducted in strict conformance with existing ordinances and applicable regulations, as well as accepted safe practices relative to the storage and use of explosives. Blasting shall be conducted only by experienced personnel. Extreme care and precaution shall be used to prevent injury to workmen and to existing pipe, buildings, or other structures below and/or above the surface of the ground. Sufficient warning shall be provided to all persons in the area prior to blasting. Backfilling along the sides of the pipe and immediately above the pipe shall be done by hand with extreme care. To ensure proper grade and alignment and to ensure that backfill material is distributed under the pipe properly, each joint of pipe shall be backfilled to the center of the pipe and hand tamped as each joint is laid. All trench backfill under existing & proposed paved areas, parking areas, sidewalks, and shoulders shall be compacted to a density of at least 95% of maximum dry density as determined by AASHTO T99. The final 12 inches (12") of subgrade shall be compacted to 100% density. Sanitary sewer outfalls shall have compaction of 90% density unless directed by the engineer to comply with an increased density. Backfill material shall have a moisture content in the range of 5% above to 3% below optimum moisture content at the time it is placed. From two feet (2') above the top of pipe to the subgrade, material containing rocks or stones up to six inches (6") in their greatest dimension may be used. Otherwise, rock shall not be used as backfill.

Under no circumstances shall pipe be laid in water. The contractor shall not have open in excess of two hundred feet (200') of sewer main trench at one time. Backfilling shall be completed at the end of each day's work.

- Trench Excavation & Safety- The contractor shall follow guidelines set up by the NC Department of Labor, Division of Occupational Safety and Health for safe trenching, excavation and confined space entry.
- Installation of Gravity Sewer Pipe- Tie-ins to all concrete manholes will be made by coring a hole into the manhole wall and installing a flexible sleeve. A pipe plug shall be installed and maintained at the first installed manhole to prevent mud and debris from entering the existing public sewer system.

Prior to being lowered into the trench, each pipe shall be inspected. Faulty pipe shall be rejected and removed from the work site.

No pipe shall be laid within ten feet (10') of excavation operations or within thirty feet (30') of rock, which must be blasted for removal. The open ends of all pipe shall be plugged when pipe laying is not in progress and all pipe shall be protected against injury from falling rock when blasting.

Pipe shall be laid with the bell ends facing the direction of pipe laying. A bell hole shall be dug for each bell, but only of sufficient size to ensure that the pipe will bear evenly throughout its length on the bottom of the trench.

When saturated soil or unstable subgrade are encountered, pipes shall be bedded on stabilization stone. The bedding shall have minimum thickness beneath the pipe of four inches (4") or one-eighth of the outside diameter of the pipe, whichever is greater.

The pipe and fittings shall be laid in the trench so that after the sewer is installed the invert of the pipe will conform accurately to the line and grade given by the engineer. A laser beam and target shall be used to obtain proper horizontal and vertical alignment.

- Sanitary Sewer Manholes- Manholes shall be built at the locations shown on the engineer's drawings. Manholes shall be constructed of precast reinforced concrete. Construction shall conform to detail drawings.

Manhole shelves and channels may be constructed of brick and mortar, Class AA concrete or be of the precast type. Channels shall be constructed to a depth of three-quarters of the diameter of the pipe and shall conform to the inside diameter of the influent and effluent pipes. The channel shall be constructed from the invert of the influent pipe to the invert of the effluent pipe. The channel shall be smooth in order to prevent any turbulence in the manhole. Manhole shelves shall slope from the manhole wall to the channel. The shelf at the wall shall be a minimum of three inches (3") higher than the shelf at the channel. A maximum of two inches (2") shall be allowed for the protrusion of the influent and effluent pipes beyond the inside wall of the manhole.

When unstable subgrade is encountered, manholes shall be bedded on stabilization stone. The contractor shall be responsible for adjusting the manhole ring and cover to street grade. All points on the top edge of the ring and cover shall be within plus or minus one half inch (1/2") of the street grade.