CITY OF WILMINGTON

WILMINGTON WATER DIVISION

DETAIL STANDARDS AND SPECIFICATIONS

REVISED: NOVEMBER 2008

SECTION C-1 - WATER PIPING AND FITTINGS

C1.00 Work Included

The work under this Division of the Specifications shall include all labor, materials, and equipment necessary to furnish and install all piping, pipelines, connections and appurtenances, valves and accessories, restraint systems, and adaptors, all as specified under this Division and as shown on the Drawings.

C1.01 Schedule of Pipe and Jointing

Pipe and fitting materials, jointing and pipe linings shall be in accordance with the following schedule. This schedule is set forth as a guide to illustrate requirements. The lack of specific mention of any certain pipe line does not relieve the Contractor from the responsibility for furnishing, installing, painting, and testing same as required for a complete job.

Service	Pipe Material	Jointing	Lining
Water Main Piping Underground	Ductile Iron Class 350 Retainer Gland as indicated on Drawings	Push-on Joint or Mechanical Joint	Cement Lined
Water Main Piping Above Ground	Ductile Iron Class 350	Groove Type Coupling	Cement Lined
Pipe Fittings Underground	Cast or Ductile Iron	Mechanical Joint with Retainer Glands	Cement Lined
Service Connection 1/2" to 2"	Copper Type K	Compression Connection	None

C1.02 Ductile Iron Pipe

a) General

Ductile iron pipe shall be centrifugally cast cement-lined and shall conform to AWWA C151 (ANSI A21.51), Ductile Iron Pipe Centrifugally Cast in Metal Molds or Sand-Lined Molds for Water or Other Liquids. Cement lining shall conform to AWWA C104 (ANSI A21.4), Cement Mortar Lining for Cast Iron and Ductile-Iron Pipe and Fittings for Water and shall include a bituminous seal coat. Pipe exterior shall receive a standard foundry coal tar dip coating in accordance with AWWA C151; product shall meet with EPA approval. Pipe may be furnished in 18 or 20-foot nominal laying lengths.

Where restrained joints are not required, joints shall be of the push-on type with a rubber gasket conforming to ANSI A21.11 (AWWA C-111), Rubber Gasket Joints for Cast-Iron

and Ductile Iron Pressure Pipe and Fittings, latest revision thereof. Pipe plain ends shall be suitable beveled to permit easy entry into the bell. Pipe joints shall be "Tyton" as manufactured by United States Pipe Company, "Fastite" as manufactured by American Cast Iron Pipe Company, "Super Bell-Tite" as manufactured by Clow Cast Iron Pipe and Foundry Company, "Tyton Joint" as manufactured by Griffin Pipe Products Company, or approved equal.

In areas where the contract plans call for restrained joints, joints shall be ductile iron mechanical joints utilizing mechanical joint "retainer glands" as manufactured by EBAA Iron, Inc., or approved equal. Additional restraint will be provided if thrust conditions are created due to horizontal and/or vertical adjustment to the pipeline due to field conditions. Mechanical joints shall conform to AWWA C111.

b) Pipe Thickness

Pipe thickness classes for 24" diameter and smaller pipe shall be Class 350 psi unless otherwise noted on the drawings or instructed by the City Engineer.

c) Marking Pipe

Each pipe delivered to the job shall have clearly marked the weight, class designation and sampling period. In addition, each pipe shall have cast on the face of the bell the manufacturer's mark and the year the pipe was produced.

C1.03 Ductile Iron Fittings

Ductile iron fittings shall be cement lined, mechanical joint, meeting the American Standard Specifications for Gray Iron and Ductile Iron Fittings 3-inch through 48-inch, for Water and Other Liquids ANSI/AWWA C110 latest revision thereof. Mechanical joints shall conform to ANSI/AWWA C111/A21.11 for Rubber Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings. Hydrant tees shall be mechanical joint tees. Cement lining shall conform to AWWA C104 Cement Mortar Lining for Cast Iron and Ductile Iron Pipe and Fittings for Water and shall include a bituminous seal coat. The exterior surface of fittings shall receive a standard foundry coal tar dip coating, product to meet with EPA approval. Fittings up to and including 24-inch size shall be 350 psi pressure rating and fittings over 24-inch shall be cast iron or ductile iron with a pressure rating class of 250 psi. All mechanical joint fittings shall be supplied with ductile iron retainer glands, as manufactured by EBAA Iron, Inc., or approved equal.

C1.04 Mechanical Joint Solid Sleeves

Mechanical joint solid sleeves shall be as manufactured by U.S. Pipe, Clow, or equivalent. Solid sleeves shall be installed with ductile iron retainer glands and shall be installed in accordance with manufacturer's recommendations. Solid sleeves shall be installed where shown on the drawings and where necessary to prevent movement of cut out lengths of pipe which are to be rejoined.

C1.05 Flexible Couplings

Flexible couplings shall be Style 38 couplings as manufactured by Dresser Industries, Smith--Blair, Inc., or equal. Couplings shall be installed in accordance with the recommendations of the manufacturer. All flexible couplings are to be adequately harnessed to withstand the test pressures in the lines unless other means are provided to take the thrust.

C1.06 Transition Couplings

Transition couplings shall be Style 162 couplings as manufactured by Dresser Industries, Smith-Blair, Inc., or equal. Couplings shall be installed in accordance with the recommendations of the manufacturer. All transition couplings are to be adequately harnessed to withstand the test pressures in the lines unless other means are provided to take the thrust.

Transition couplings shall be used where new ductile iron mains are to be joined to existing pit cast pipe.

C1.07Water Service Lines

All service materials required including corporation stops, service pipe, curb valve, curb box and adaptors shall be furnished by the Contractor.

A standard service "kit" will consist of the following materials:

a) Type K copper tubing as manufactured by Mueller or equal.

b) Mueller Mark II Ori-Seal Curb Valve Catalog #H15192 or Ford

c) Mueller Cast Iron Curb Box – Improved Extension Type or equal

e) Mueller Curb Valve Rod, 39 inches long or equal.

f) Corporation valve Mueller Ori-Seal suitable for compression connection, Ford or equal.

Mueller adapters shall also be provided by the Contractor to adapt new Mueller curb valve outlets to existing copper, galvanized or plastic service piping, etc.

When the service line has been installed, prior to backfilling and connecting the customer service, the curb valve shall be closed and the corporation opened. After all air is expelled, a visual leakage test will be conducted. The customer service shall then be connected and the curb valve shall be opened. An additional leakage test shall then be conducted under "system pressure". The City Engineer or his representative shall be present for this testing, and no backfilling will be permitted until the pressure testing is satisfactorily completed.

Tapping of the water mains and all necessary connection work shall be carried out only by personnel experienced in this work using equipment designed for use and the corporation

stops specified above. Service saddles shall be provided for all taps larger than 1-inch diameter.

The Contractor shall warranty against defective workmanship for a twelve-month period following the date of tap and corporation stop installation.

C1.08 Inspection of Pipe

All pipe and fittings used in the work may be factory inspected by a recognized inspection agency engaged by the Owner. The Contractor shall inform the Owner and the inspection agency of the name and address of the foundry or other sources of materials to be used in the work and shall coordinate with the manufacturer to assure that the inspection agency has access at the manufacturer's plant and adequate assistance and notice so that each item may be examined. All reports will be made to the Owner and the cost of the services of the inspection agency will be borne by the Owner.

C1.09 Excavation and Backfill in Connection with Pipe Laying Operations

The Contractor shall trim the bottom of all trenches to receive pipe and shall provide finish grade by hand methods. The trench bottom shall be carefully graded to the proper elevation, and the maximum practical solid bearing areas shall be provided throughout its entire length, prior to swinging the pipe into place. No blocking under the pipe will be permitted. Additional excavation shall be made under joints to allow for proper jointing.

The Contractor shall provide a bed of DelDOT No. 8 quarry process stone to be installed across the full trench width, from a depth of 6" below the bottom of the pipe to the spring line of the pipe.

In pipe trenches, after the pipes have been tested and approved, trenches shall be backfilled with suitable material, carefully deposited and compacted in layers not to exceed eight inches (8") in thickness.

Wherever the existing material is unsuitable in the opinion of the City Engineer, the Contractor shall excavate and remove all unsuitable material and shall backfill and compact the trench to grade using quarry processed stone or bank run sand and gravel, as directed by the City Engineer. All pipe trenches in paved roadways shall be backfilled with bank run sand and gravel or quarry processed stone compacted in eight-inch (8") layers. Refer to the contract drawings for select fill requirements at various locations.

All material unsuitable for backfill and excess excavation shall be disposed of at an off-site location at the Contractor's expense.

C1.10 Pipe Laying

All pipes shall be carefully examined for defects, and no pipe known to be defective shall be laid. If any pipe is found to be broken or defective after being laid, it shall be removed and replaced by sound pipe without any further payment than is included in the prices bid.

Joint surfaces shall be protected from damage, and shall be carefully examined before jointing. No damaged joints shall be used in the work.

Pipe shall be thoroughly cleaned and ample precautions shall be taken to prevent entrance of dirt and debris into the pipe after installation. Exposed ends of all uncompleted lines shall be provided with plugs or covers at all times when pipe laying is not actually in progress.

All pipes shall be carefully laid to true alignment and grade with bell ends upgrade.

The trench bottom shall be carefully graded to the proper elevation, and the maximum practical solid bearing areas shall be provided throughout its entire length, prior to swinging the pipe into place. Unless otherwise specified, pipe shall be laid on six inches (6") of compacted thickness DelDOT No. 8 process stone beneath pipe and up to the spring line of pipe so that pipe will have a firm bearing for its full length.

Care shall be taken not to excavate below grade. Material excavated below adopted grade shall be replaced by material which will meet with the approval of the City Engineer, without any further payment.

Immediately after the pipe is brought to final position, it shall be thoroughly secured and properly bedded, and ample support shall be provided to prevent settlement or disturbances.

Pipe shall be protected during construction against possible flotation due to pouring of concrete or in case the trench becomes flooded prior to placing the backfill, either with water, or a wet mud mixture.

Jointing and installation shall be in strict accordance with recommendations of pipe manufacturer.

C1.11 Jointing of Pipes and Fittings

Jointing shall be done in strict conformance with manufacturer's recommendations. Pipe shall be handled with care to avoid damage to the lining and coating.

Cutting of pipe where required shall be done in a neat and workmanlike manner using an abrasive cutting wheel or other means which will produce a smooth end normal to the pipe axis with the cement lining undamaged. Cut ends shall be beveled to avoid damage to the gasket. Pipe ends shall be thoroughly cleaned prior to jointing and only approved lubricants shall be used.

Jointing of valves and fittings shall be with mechanical joints with ductile iron retainer glands. Materials and methods for jointing valves and fittings shall conform to the following:

The last 8 inches of the outside of the spigot piece and inside of the bell of mechanical joint pipe shall be thoroughly cleaned to remove all oil, grit, tar (other than the standard coating) and other foreign materials from the joint, and then painted with a soap solution. The rubber

gasket shall be painted with the soap solution and placed on the spigot end with the thick edge toward the glands.

The entire section of the pipe shall be pushed forward to seat the spigot end into the bell. The gasket shall then be pressed into place within the bell being careful to have the gasket evenly located around the entire joint. The ductile iron gland shall be mounted along the pipe into position for bolting, all of the bolts inserted and the nuts screwed up "fingertight." All nuts and set screws shall be tightened with a suitable torque limiting wrench. The torque for various sizes of bolts shall be in accordance with Appendix A of AWWA C111 which is as follows:

Bolt Size (Inches)	Range of Torque (Ft.-Lb.)
5/8	45 - 60
3/4	75 - 90
1	100 - 120
1-1/4	120 - 150
Set Screws 5/8	70

Nuts spaced 180^{o} apart shall be tightened alternately in order to produce an equal pressure on all parts of the gland. Suitable torque gauges shall be used for checking the job.

If effective sealing is not attained at the maximum torque indicated above, the joint shall be disassembled and reassembled after thorough cleaning. Overstressing of bolts to compensate for poor installation practice will not be permitted.

C1.12 Anchorage of Fittings

All fittings shall be securely anchored by suitable blocking and/or by an approved bolted metal harness and/or approved restrained joints. Refer to plans for specific anchorage requirements.

Reaction or thrust blocking shall be Class C (2500 lbs.) concrete. Blocking shall be placed between solid ground and the fittings with adequate bearing area on the pipe and the ground. Blocking, clamps, and methods of anchorage shall be such as to permit accessibility for joint repair. Metal harnesses of tie rods and metal clamps of adequate strength to prevent movement or other approved means may be used where concrete blocks cannot be used. Rods and clamps shall be painted with a corrosion resistant asphaltum. Reaction or thrust blocking metal harnesses of tie rods and clamps shall not be used without written authorization from the City Engineer.

Where fittings are anchored by the use of restrained joints, the type of joint must be as specified or approved by the City Engineer and a sufficient number of straight pipe lengths both sides of the fittings must be furnished with restrained joints designed to withstand the thrust due to the internal test pressure. Deflection of the joints shall be in accordance with the manufacturer's recommendations. All mechanical joint fittings shall be supplied with ductile iron retainer glands unless otherwise directed by the City Engineer.

Retainer glands shall be ductile iron and be Underwriters Laboratory approved, as manufactured by EBAA Iron, Inc., or approved equal.

C1.13 Testing

When a section of pipe of a length deemed adequate by the City Engineer is ready for testing, the pipeline shall be pressure and leak tested in accordance with AWWA Standard C600, latest version except as described herein. The work shall include furnishing all labor, materials, and equipment for carrying out these tests.

Unless otherwise required to meet working conditions, all new potable water pipelines shall be tested under a hydrostatic pressure of 150 pounds per square inch on the highest part of the section under test. The duration of each pressure test shall be at least two hours. The City Engineer or his representative shall be present for all hydrostatic pressure and leakage tests.

Under the foregoing conditions the leakage shall not exceed the following:

Push-on Joints or Standard Mechanical Joints	0.828 gallons per hour per inch of pipe diameter per 1,000 ft length

Joints that leak shall be repaired and retested under the same conditions and under the same period of operation. If joints are found to be defective, they shall be replaced until the line passes the required test.

Any cracked or broken pipe, fittings, or valves shall be removed and replaced with sound pieces.

Wherever conditions will permit, in the opinion of the City Engineer, the pipes shall be tested before the trench is backfilled. All joints shall be examined during the open trench test and all visible leaks entirely stopped.

The Contractor shall be required to provide all pipe taps, gauges, and corporation stops, as well as any other materials and equipment necessary to expel all air and test the lines.

C1.14 Disinfection

All new water lines shall be flushed and disinfected upon completion of pressure testing in accordance with the recommendation of Standard for Disinfecting Water Mains (AWWA C651) of the American Water Works Association, except as may be modified herein.
The Contractor shall furnish sodium hypochlorite, which shall conform to AWWA B300, and injection equipment as needed to complete the disinfection of all pipelines.

As a result of both the pressure and leakage testing and the pipeline flushing operations, the pipeline will be filled with potable water with a free chlorine residual of less that 0.5 mg/l. The disinfection of the pipeline shall proceed by filling the pipeline with the heavily chlorinated water at one end while the low chlorine residual (<0.5 mg/l) potable water in the

pipeline is expelled at the other end. Chlorine residual shall be monitored at regular intervals until the pipeline is filled with chlorinated water not less than 20 mg/L free chlorine.

Sodium hypochlorite shall be fed at constant rate at a point not more than 10 feet downstream from the beginning of the new main such that the water flowing into the pipeline will have not less than 20 mg/l free chlorine. A feed pump designed for feeding chlorine solution shall be used for injecting sodium hypochlorite into the pipeline. Sodium hypochlorite is available in liquid form, and contains approximately 12 1/2 to 16% available chlorine. Table 1 provides sodium hypochlorite required to produce 20 mg/L of free chlorine in 100 ft of pipeline which does not have a chlorine demand.

Table 1: Sodium Hypochlorite Required to Produce 20 mg/l
Free Chlorine in 100 feet of Pipe by Diameter

Pipe Diameter (inches)	16% Available Chlorine (Gal. NaOCL)	15% Available Chlorine (Gal. NaOCL)	12.5% Available Chlorine (Gal. NaOCL)
8	.032	.035	.04
12	.07	.08	.09
16	.13	.14	.17
20	.20	.22	.26
24	.29	.31	.37
30	.46	.49	.59
36	.66	.70	.84
48	1.18	1.25	1.51

The chlorinated water shall be retained in the pipeline for at least 24 hours, during which time shall all valves and hydrants in the section treated shall be operated in order to disinfect the appurtenances. At the end of this 24 hour period, the treated water in all portions of the main shall have not less than 20 mg/l free chlorine.

The heavily chlorinated water should not remain in the pipeline for more than 48 hours in order to prevent damage to the pipe lining and valve components. The heavily chlorinated water shall be flushed thoroughly from the pipeline, until the replacement water throughout its length will be equal in quality to permanent source of supply. The chlorinated water shall be neutralized by treating with sodium bisulfite, sodium sulfite, sodium thiosulfate or equal approved chemical before disposal to a sewer system. The proposed disposal site shall be approved by the City Engineer.

C1.15 Bacteriological Testing

After water has stood in the pipeline at least 24 hours following final flushing before the water main is placed in service, water samples will be collected from points along the line by the Department of Public Works Water Quality Laboratory personnel and tested for bacteriological quality in accordance with Standard Methods for the Examination of Water and Wastewater. The Water Quality Laboratory will collect samples for bacteriological tests

during normal working hours on Monday to Wednesday. The Contractor shall provide at least 24 hours prior notice to the City Engineer or to the Water Quality Laboratory Manager for arranging water sampling and testing. The Contractor shall assist the Water Quality Laboratory personnel in obtaining water samples for bacteriological testing. The cost of the laboratory testing shall be borne by the City.

Bacteriological tests must show complete absence of coliforms. If tests show presence of coliform, Contractor shall perform additional flushing and disinfection of the pipeline until such time acceptable tests are obtained.

No newly laid water main shall be placed into service until approval is given by the City Engineer.

SECTION C-2 - VALVES

C2.00 Work Included

The Contractor shall furnish gate valves, butterfly valves and valve boxes complete where required by the City. The valves shall conform to the following specifications:

C2.01 Gate Valves

Gate valves shall be iron body, inside screw, fully bronze mounted, conforming with the requirements of A.W.W.A. C509 for Resilient Seated Gate Valves. The gate shall be of cast/ ductile iron completely encapsulated with resilient material. The resilient sealing material shall be permanently bonded to the cast iron gate with a rubber tearing bond to meet ASTM D 429. All internal parts shall be accessible without removing the body from the line. The water way in the seat area shall be smooth, unobstructed and free of cavities.

The valve body and bonnet shall be coated externally and internally with fusion bonded thermosetting plastic conforming to AWWA C550: Protective Interior Coating for Valves and Hydrants.

Non-rising type stem shall be cast bronze with internal collars in compliance with two O ring seals above the thrust collar and one O ring seal below the thrust collar. Stuffing box shall be attached to the bonnet and bonnet to the body with bolts and nuts.The operation nut shall be a 2-inch square wrench nut. An arrow showing the direction of opening and the word “OPEN” shall be cast on the flange of the operating nut. Valves in sizes 3-inch to 12-inch shall be suitable for water working pressures to 250 psi (Valves shall open right - clockwise).

Each valve shall be hydrostatically tested in the factory at 500 psi.

Valves in sizes 3-inch to 16-inch shall be vertical and shall be provided with mechanical joint ends and retainer glands. All bolts, nuts and studs shall be Type 304 stainless steel.

Retainer glands shall be ductile iron and Underwriters Laboratory approved, as manufactured by EBAA Iron, Inc.

Lubrication instructions and parts lists shall be furnished in triplicate for each type and manufacture.

Valves shall be Ken-Seal Resilient Wedge Valves as manufactured by the Kennedy Valve Co. or approved equal.

C2.02 Butterfly Valves

All butterfly valves shall be manufactured in accordance with the latest revision of AWWA C504 for Class 150B service.

Butterfly valves shall be of the rubber seated, tight closing type suitable for two way flow. Valve designs that seat at an angle to the axis of the pipeline other than 90 degrees will not be acceptable. Butterfly valves shall be provided with cast-iron body, cast or ductile-iron disc, stainless steel shaft, self-lubricating sleeve type bearings and replaceable rubber seats.

All valves shall open right (clockwise). An arrow showing the opening and the word "OPEN" shall be cast on the flange of the operating nut.

All butterfly valves shall be suitable for 150 psi working pressure and shall be subjected to factory hydrostatic, factory leakage and performance tests as specified in Section 5 of AWWA Standard C504.

Butterfly valve shall be manufactured by Henry Pratt Company, or equal.

Buried butterfly valves shall be Groundhog type(mechanical joints with retainer glands unless otherwise noted on the Drawings.

Valve bodies shall be high strength cast iron ASTM A126 Class B. Valve disc shall be high-strength cast iron ASTM A 48 Class 40 in sizes 24" and smaller. Sizes 30" and larger shall be built from ductile iron in conformance to ASTM A-536. Disc shall be furnished with 316 Stainless Steel seating edge. Suitable rubber seats shall be provided on the body.

Valve shafts shall be constructed of 18-8 Type 304 stainless steel. Shaft diameters must meet minimum requirements established by AWWA Standard C504 for Class 150B.

Valve operator shall be of the traveling-nut type, sealed, gasketed, and lubricated for underground service. Operators shall be designed to hold the valve in any intermediate position between fully open and fully closed without creeping or fluttering. Operators shall be equipped with mechanical stop limiting devices to prevent over travel of the disc in the open and closed position. Operators shall be equipped with a 2-inch square operating nut and shall be fully gasketed and grease packed for buried service. Operator components shall withstand an input torque of 450 ft. lbs. at the extreme operator positions without damage.

Valve shall be capable of easy closure by one man using standard valve key, even under emergency break conditions as severe as those that would cause a valve maximum opening torque requirements of as much as two times AWWA Class 150B.

Butterfly valve internal waterway surfaces shall have a heat-cured epoxy coating holiday-free in the waterway. Vale vane shall have a 100% holiday-free epoxy coating. Coatings shall be in accordance with AWWA C550. The external surfaces of valves to be buried shall be shop coated with two coats of asphalt varnish.

All valves shall be factory tested for leakage at rated pressure, and tested hydrostatically at two times rated pressure-all in conformance with AWWA Standard C-504, latest revision, unless otherwise noted. Certified test results shall be furnished.

C2.03 Valve Boxes

Each buried valve shall be provided with a cast iron, two piece, slide type valve box. Valve boxes shall be 5-1/4 inch shaft with a round base and shall be provided with extra deep covers with the word "WATER" cast on and an arrow indicating direction of opening.
Length of valve boxes and size of base shall be to suit each particular installation and shall have about eight inches of adjustment up and down available after setting to grade.

Valve boxes shall be as manufactured by Bingham & Taylor, Tyler Company or approved equal.

C2.04 Installation

Valves shall be set truly plumb with valve boxes directly over the valves. After being correctly positioned for line and grade, earth fill shall be carefully tamped around the valve box. Top of box shall be flush with pavement surface in paved areas and shall be one inch above ground surface in grassed or earth areas.

C2.05 Testing

Upon completion of the installation and restraint of the new underground gate valve, the line shall be completely filled with water at a controlled slow rate.

No visible leakage shall be permitted. In the event that the section of reconstructed main and valve has visible leaks, the Contractor shall make all necessary repairs and repeat the test. The test shall be repeated as many times as necessary until there is no visible leakage.

C2.06 Disinfection

All new valves and appurtenants installed on existing water mains shall be flushed and sterilized in accordance with the recommendation of Standard for Disinfecting Water Mains, Section 10: Disinfection Procedures When Cutting Into or Repairing Existing Mains (AWWA C651 92).

All work of flushing and sterilizing shall be the responsibility of the Contractor. Following completion of sterilization and flushing, the Owner may obtain samples and have them analyzed and reported upon by a recognized testing laboratory. The cost of the services of the testing laboratory will be borne by the Owner.

C2.07 Corporation Stops

Corporation Stops shall be Mueller No. H-15020 or accepted equal.

C2.08 Curb Stops and Boxes

Curb Stops size shall be Mueller No. H-15210 or accepted equal. Curb boxes for¾-inch and 1-inch supply lines shall be 4.5 feet, Mueller No. H-10314 complete with stationary rod and No. 87081 lid or accepted equal.

For 1½-inch and 2 inch supply lines, the curb box shall be Bingham & Taylor or Mueller H-10360 Valve Box, 2 pc Buffalo screw type, size 664-S with lid H-10361 and extension piece or accepted equal.

Stationary Rods shall be Mueller 82863 or 82864 or accepted equal.

C2.09 Tapping Sleeves and Valves

Tapping sleeves shall be caulk type or mechanical joint type, depending on the pipe material being tapped, suitable for 200 psi working pressure. The Contractor shall have on hand spare gaskets to suit Class A, B, C, or D pipe.

Valves shall comply with the pertinent provisions of Section C2.01 with the exception that tapping valves shall be provided with flanged inlet-mechanical joint outlet ends. Mechanical joint outlet shall be provided with Ductile Iron Retainer Glands, as manufactured by EBAA Iron Company.

Tapping valves and sleeves shall be as manufactured by the Mueller Company or approved equal.

Work shall be carried out by personnel thoroughly experienced in the construction of wet taps, using approved methods and equipment. The tapping sleeves and valves shall be securely supported and restrained.

Before ordering tapping sleeves, the Contractor shall excavate by test pit and determine the exact location and outside diameter of the existing pipe.

SECTION C-3 - FIRE HYDRANTS

C3.01 Description of Hydrants

Hydrants shall conform to the standards of the American Water Works Association, AWWA Standard for Dry-Barrel Fire Hydrants for Ordinary Water Works Service, AWWA C502, latest revision, relating to fire hydrants and conforming with the City of Wilmington standards.

Hydrants shall be Guardian as manufactured by Kennedy Valve Company. Hydrants shall be of a two piece design with a breaking ring located approximately 3-inches above the ground line. Hydrants shall be provided with a standpipe with an 8-inch ID, and 6-inch diameter mechanical joint connection and shall be for a typical trench depth of 4 feet. Extension collars should be provided as required for proper setting of hydrants.

Hydrants shall be of the safety flange type with a 6-inch mechanical joint connection, compression type valve 5-1/4-inch diameter opening, two (2) 2-1/2 inch hose connections (with thread size 3.06-inch O.D. and 7 threads per inch), and one (1) 4-1/2 inch steamer nozzle (with thread size 5.251 inch O.D and 5 threads per inch). Hydrants shall have O-Ring seals and the main valve shall open clockwise with a 19/16-inch to 3/4 inch pentagon nut.

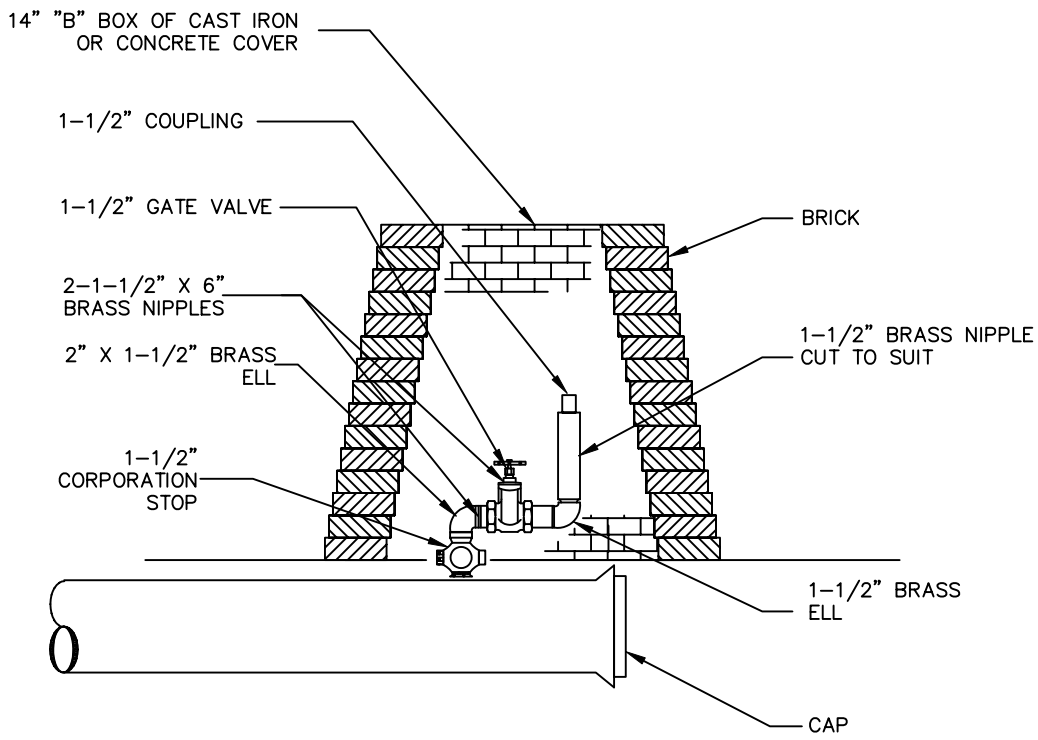
Painting and all details shall be in accordance with the City of Wilmington standards

All parts of hydrants shall be interchangeable with similar parts of hydrants of the same size and type. All bolt holes shall be accurately drilled from templates. All joints shall be faced smooth, so as to make a perfectly watertight joint.

Hydrants shall be provided with "breakable ring" traffic flange and breakable coupling stem. The traffic flange shall have 360 deg. adjustment facilities.

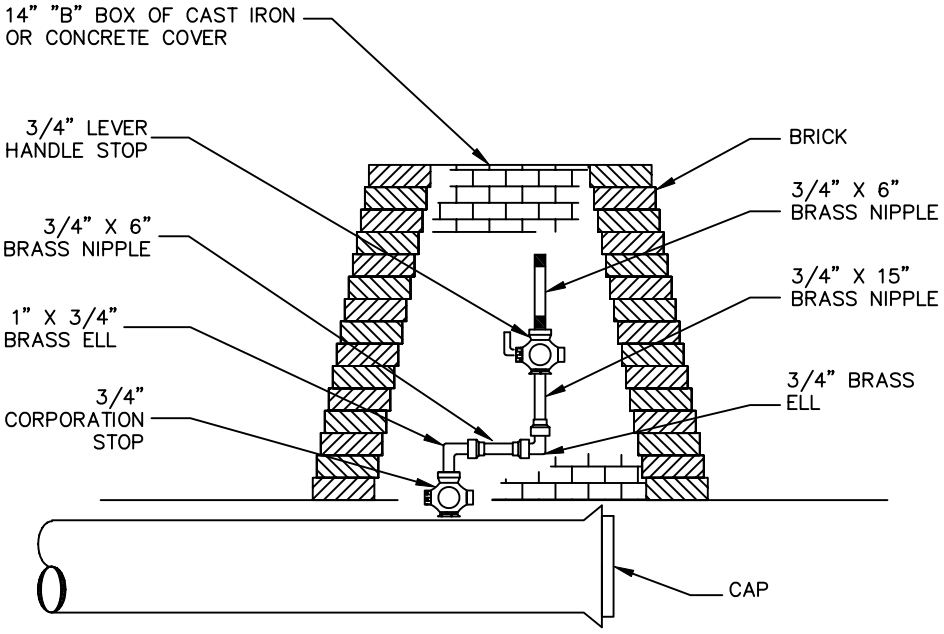
Each hydrant shall be shop tested under 300 psi applied above and below the compression valve. Any hydrant showing sweating of metal or leaking or other defect shall be rejected. All tests shall be made at the expense of the supplier.

Hydrants manufactured by Kennedy Valve Company or equal as detailed in the Standard Detail Drawings.



1–1/2" BLOW OFF

(NOT TO SCALE)



(NOT TO SCALE)

Hatch Mott MacDonald
Certificate No. 24GA28075000

27 Bleeker Street
Millburn, New Jersey 07041

CITY OF WILMINGTON
WILMINGTON, DELAWARE

STANDARD DETAIL
3/4" AND 1 1/2" BLOW OFF

Designed	Drawn	Checked	Approved	Date
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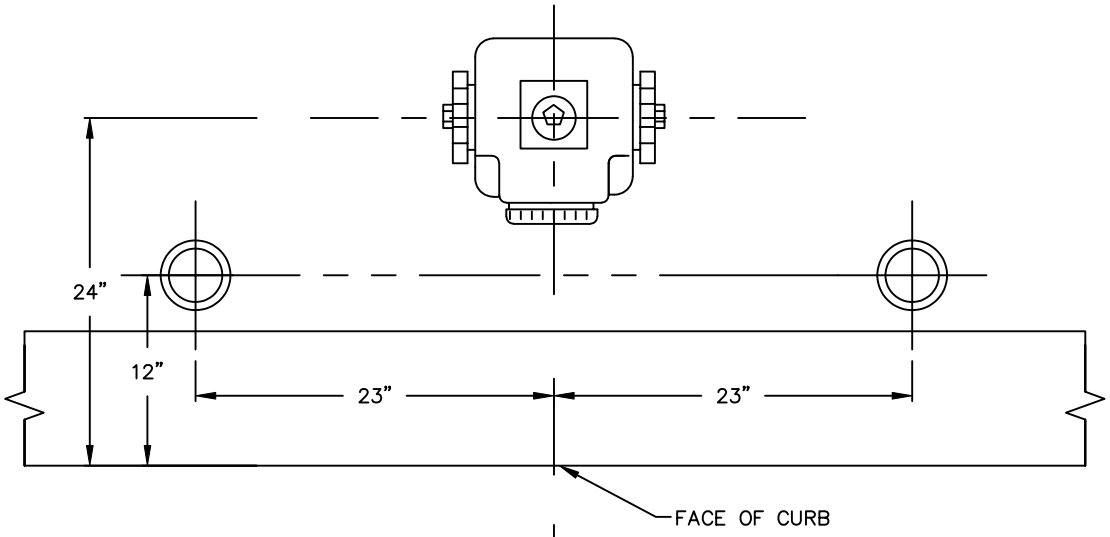

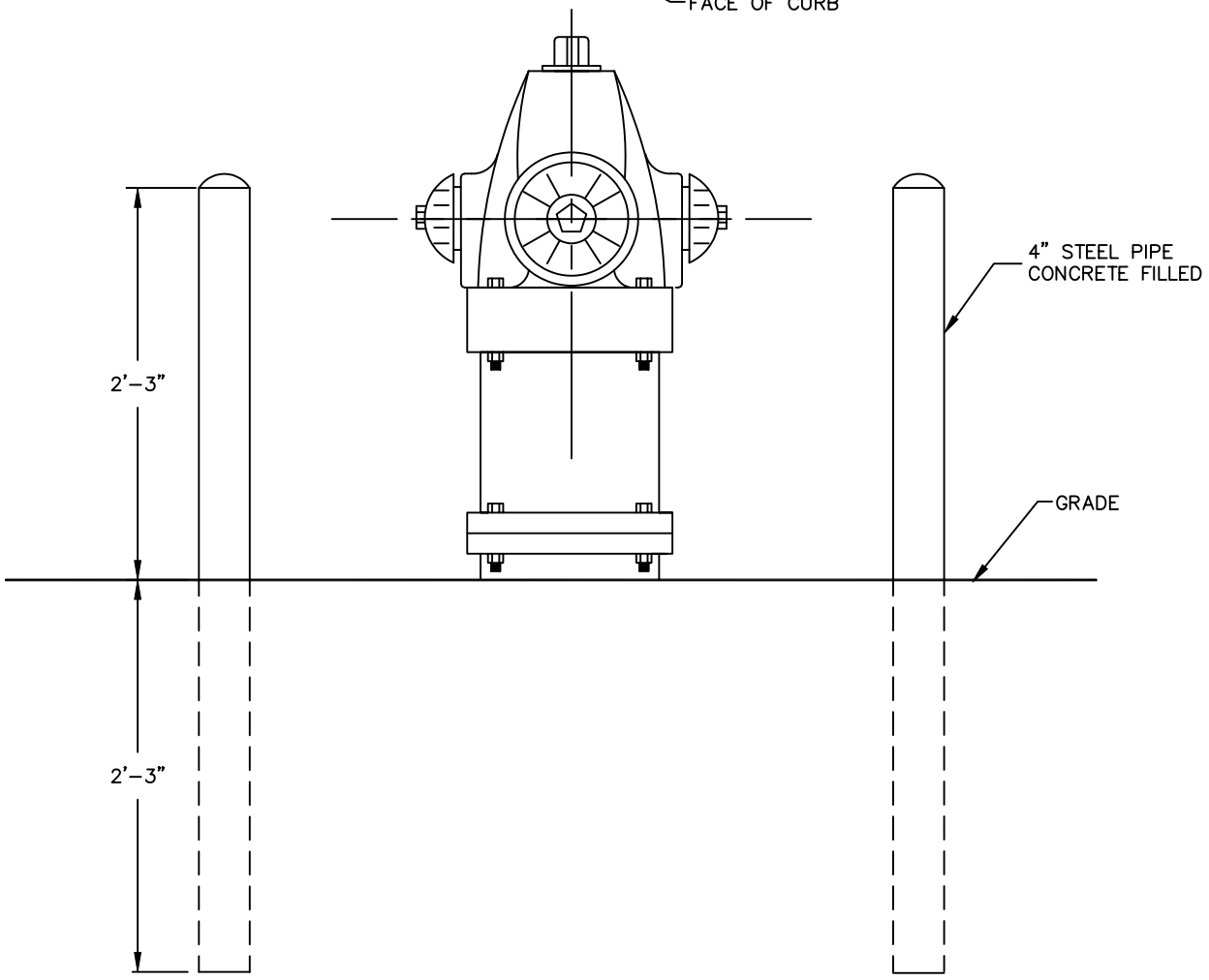

(NOT TO SCALE)

Hatch Mott MacDonald
Certificate No. 24GA28075000

27 Bleeker Street
Millburn, New Jersey 07041

CITY OF WILMINGTON
WILMINGTON, DELAWARE

STANDARD GUARD PIPE (FRONT)
FOR FIRE HYDRANTS

Designed	Drawn	Checked	Approved	Date
CITY	BRK	MAP	MD	NOV. 04

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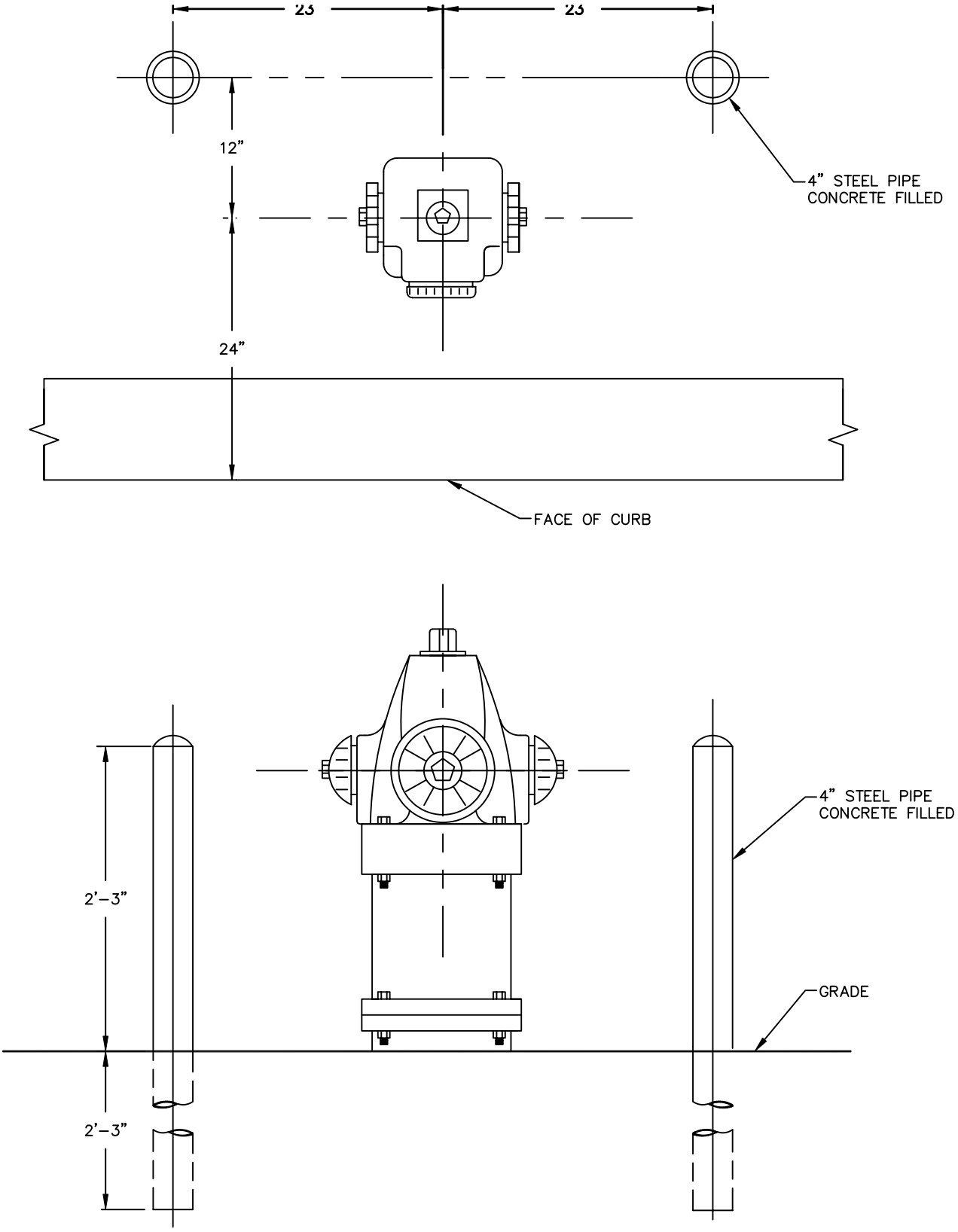

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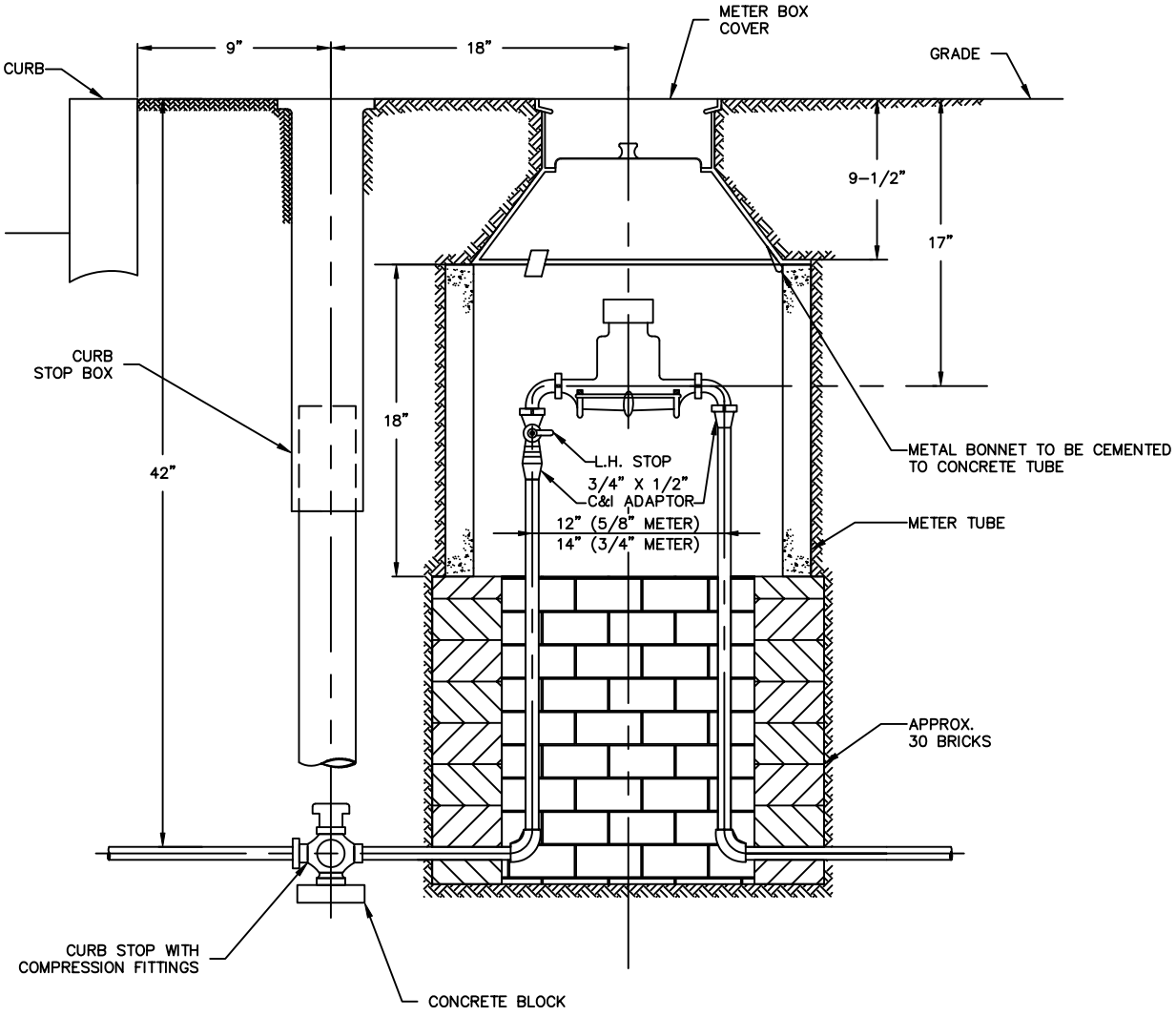
Hatch Mott MacDonald
Certificate No. 24GA28075000

27 Bleeker Street
Millburn, New Jersey 07041

CITY OF WILMINGTON
WILMINGTON, DELAWARE

STANDARD GUARD PIPE (REAR)
FOR FIRE HYDRANTS

Designed	Drawn	Checked	Approved	Date
CITY	BRK	MAP	MD	NOV. 04



(NOT TO SCALE)

Hatch Mott MacDonald
Certificate No. 24GA28075000

27 Bleeker Street
Millburn, New Jersey 07041

CITY OF WILMINGTON
WILMINGTON, DELAWARE

STANDARD CURB SETTING
5/8" & 3/4" METER

Designed	Drawn	Checked	Approved	Date
CITY	BRK	MAP	MD	NOV. 04

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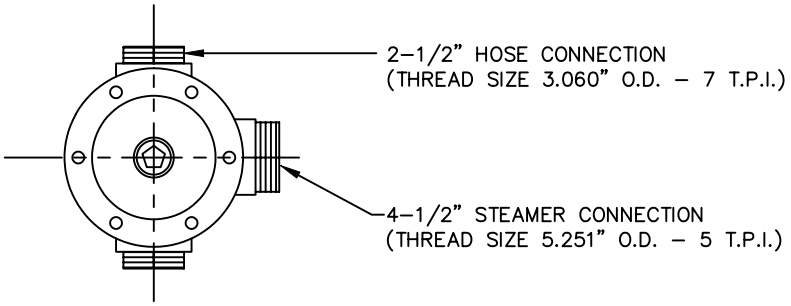
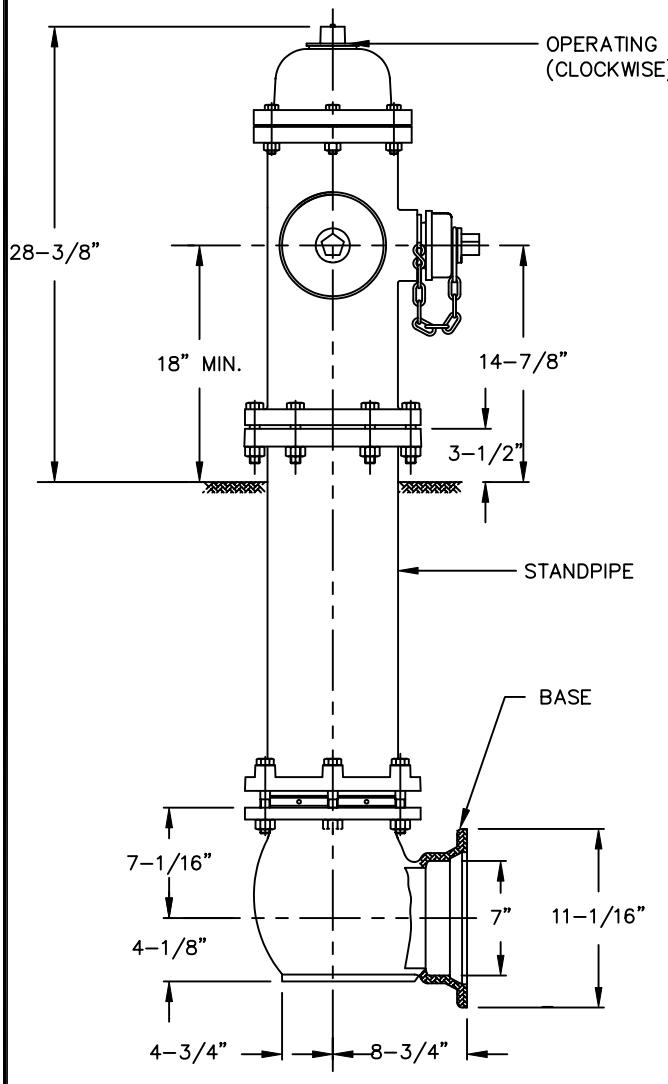
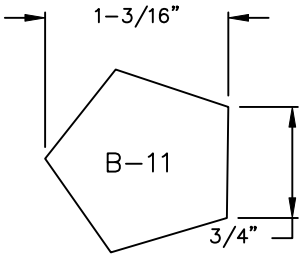
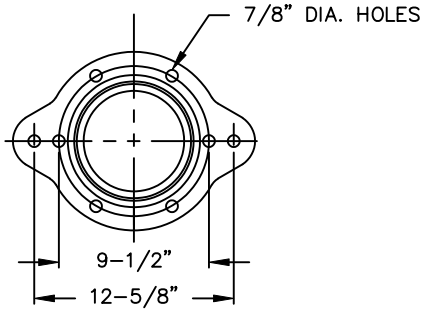






OPERATING NUT DETAIL

*NOTE:
PAINT YELLOW



(NOT TO SCALE)

Hatch Mott MacDonald
Certificate No. 24GA28075000

27 Bleeker Street
Millburn, New Jersey 07041

CITY OF WILMINGTON
WILMINGTON, DELAWARE

STANDARD FIRE HYDRANT
AMERICAN-DARLING MODEL B62B
5 1/4" VALVE OPENING
(EXISTING)

Designed	Drawn	Checked	Approved	Date
CITY	BRK	MAP	MD	NOV. 04

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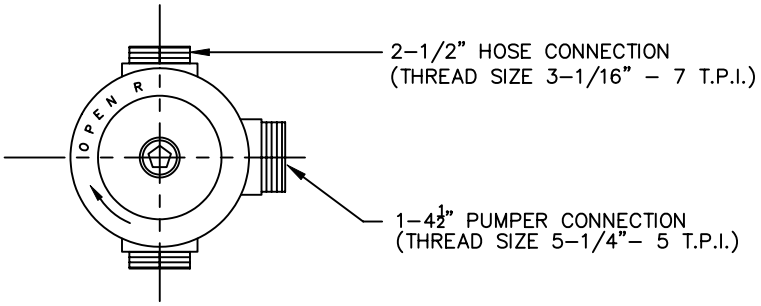
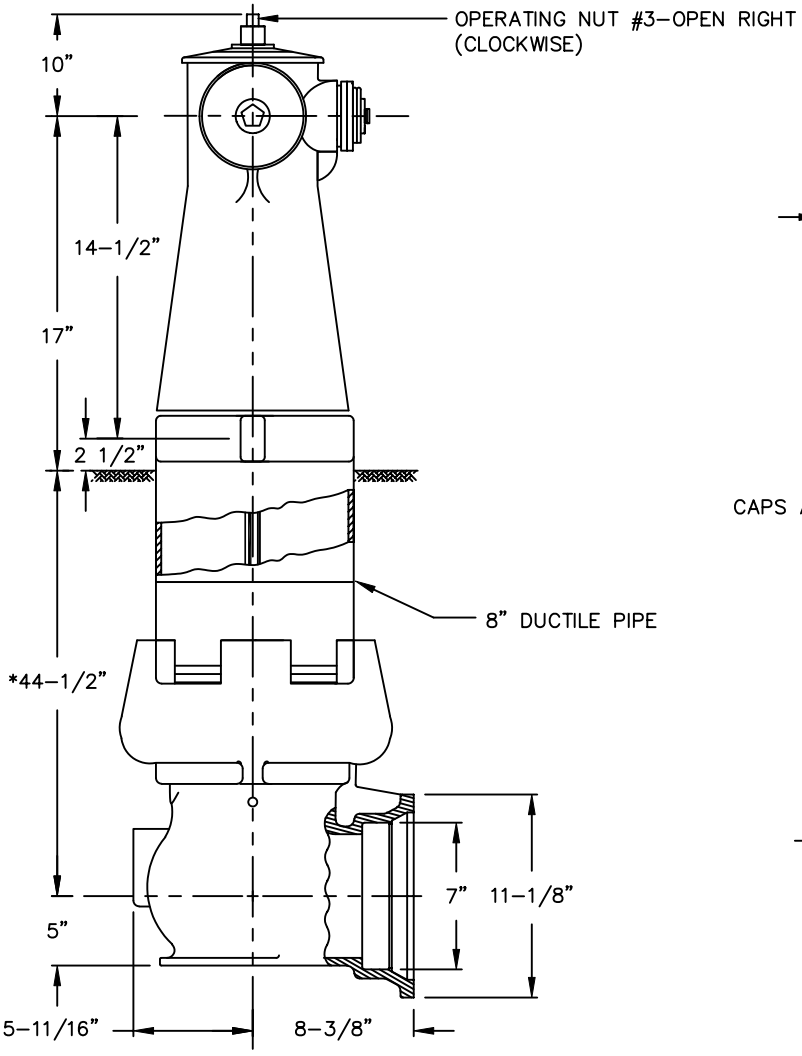
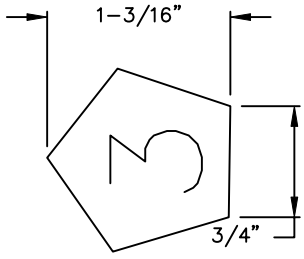
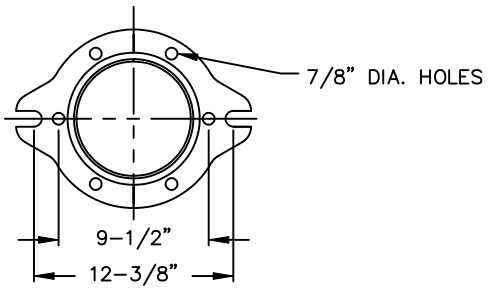






CAPS AND OPERATING NUT DETAIL



(NOT TO SCALE)

*NOTE:
1. PAINT YELLOW
2. DIMENSIONS ARE FOR 4'–0 COVER

Hatch Mott MacDonald
Certificate No. 24GA28075000

27 Bleeker Street
Millburn, New Jersey 07041

CITY OF WILMINGTON
WILMINGTON, DELAWARE

STANDARD FIRE HYDRANT
USP SENTINEL
5 1/4 VALVE OPENING
(EXISTING)

Designed	Drawn	Checked	Approved	Date
CITY	BRK	MAP	MD	NOV. 04

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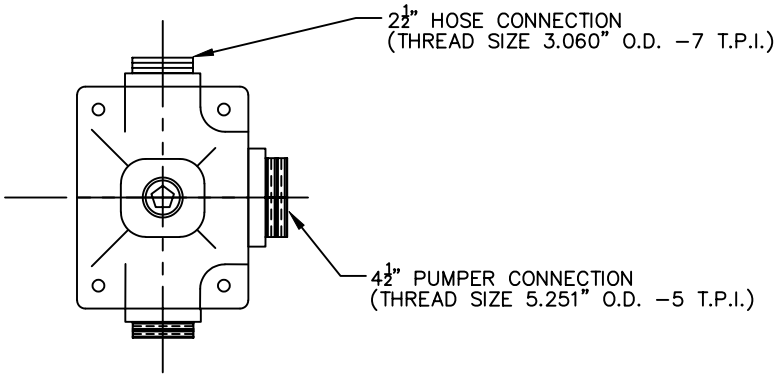
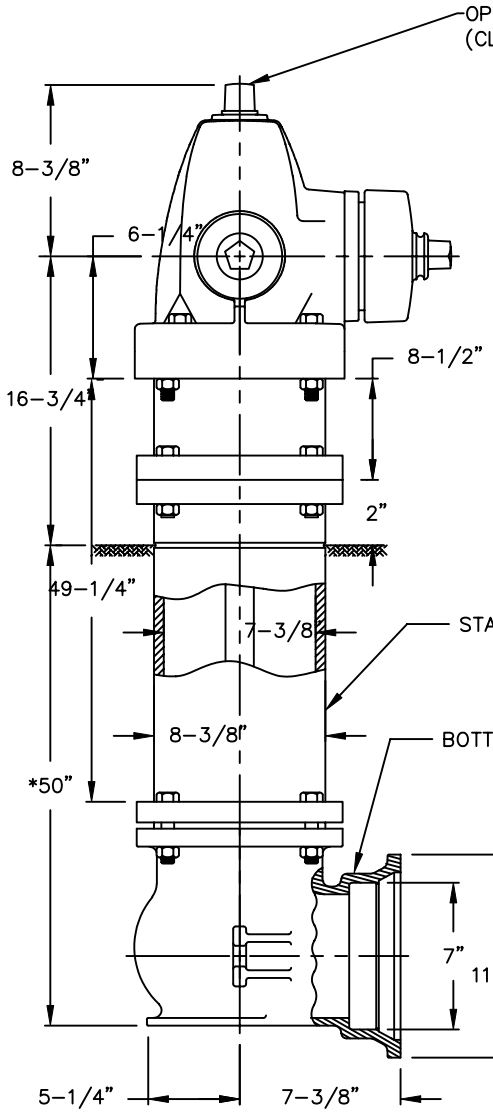
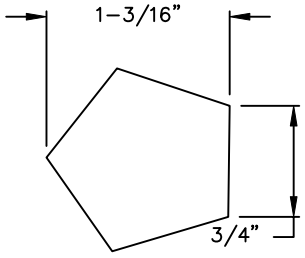
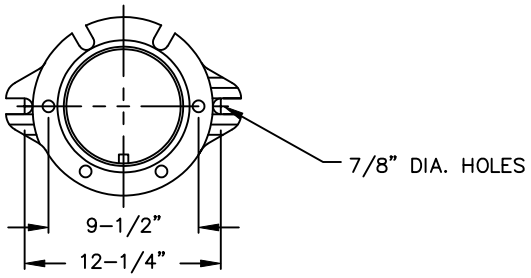






OPERATING NUT DETAIL



(NOT TO SCALE)

*NOTES:
1. PAINT YELLOW
2. DIMENSIONS ARE FOR 3–1/2' COVER

Hatch Mott MacDonald
Certificate No. 24GA28075000
27 Bleeker Street
Millburn, New Jersey 07041

CITY OF WILMINGTON
WILMINGTON, DELAWARE
STANDARD FIRE HYDRANT
WATEROUS PACER WB-67-DDP
5" VALVE OPENING
(EXISTING)

Designed	Drawn	Checked	Approved	Date
CITY	BRK	MAP	MD	NOV. 04

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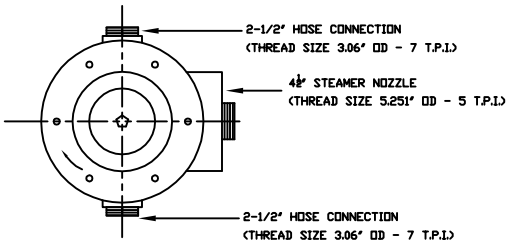
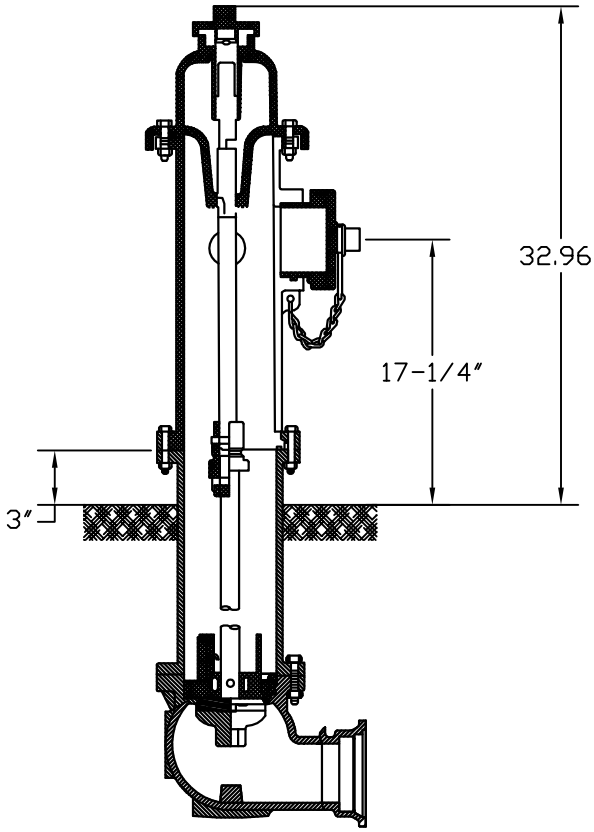
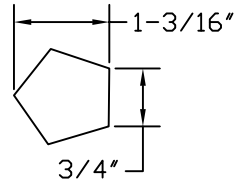
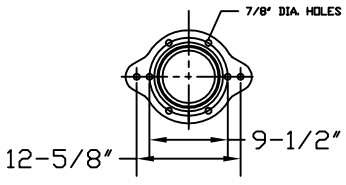






OPERATING NUT DETAIL

NOT TO SCALE



P:\228877 - Wilmington\Data to Wilmington\Kennedy autocad drawing.dwg 10/30/08 3:57 pm

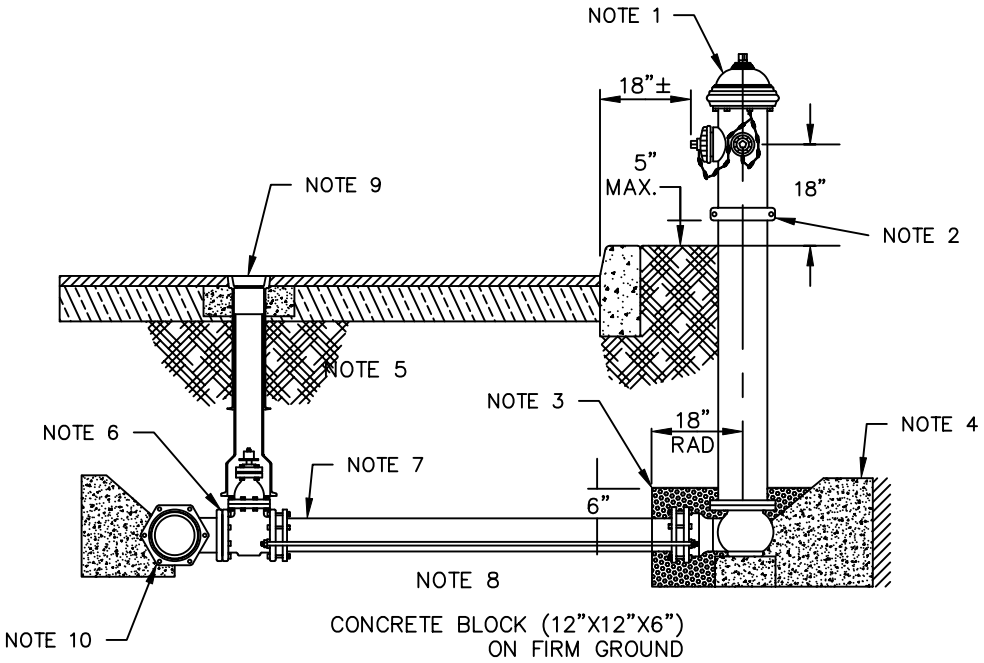
Hatch Mott MacDonald
Certificate No. 24GA28016600

27 Bleeker Street
Millburn, New Jersey 07041

CITY OF WILMINGTON
WILMINGTON, DELAWARE

STANDARD FIRE HYDRANT
KENNEDY GUARDIAN
5 1/4 VALVE OPENING

Designed	Drawn	Checked	Approved	Date
KV	MCW	SBN	SBN	DEC 26 2007



FIRE HYDRANT INSTALLATION DETAIL

N.T.S.

NOTES:

1. HYDRANT SHALL BE KENNEDY GUARDIAN DRY–BARREL TRAFFIC MODEL DESIGN WITH 5–1/4" VALVE OPENING.
   A. TWO 2 1/2" HOSE NOZZLES WITH 7 THREADS PER INCH.
   B. ONE 4 1/2" STEAMER NOZZLE WITH 5 THREADS PER INCH.
2. STANDPIPE (BREAK–AWAY) COUPLING SHALL NOT EXCEED A MAXIMUM OF 5 INCHES FROM THE TOP OF THE CURB TO THE BOTTOM OF THE COUPLING.
3. THE DRAIN VALVE SHALL BE CLEAR OF ANY OBSTRUCTIONS. A MINIMUM OF 1/3 YARD OF 3/4" CLEAN STONE SHALL BE INSTALLED AND COVERED WITH AN 8 MIL POLYETHYELENE SHEET.
4. THRUST BLOCKS SHALL BE MADE OF 3000 PSI CONCRETE.
5. BACKFILL MATERIAL SHALL BE IN ACCORDANCE WITH THE SPECIFICATION.
6. 6" KENNEDY KENSEAL II (RESILIENT SEATED) MECHANICAL JOINT END GATE VALVE (RIGHT HAND).
7. 6" DUCTILE IRON CEMENT LINED CLASS 52 PIPE.
8. 3/4" DIAMETER TIE ROD WITH EYE BOLTS–2 REQUIRED (SIDE VIEW SHOWN).
9. SEE SURFACE BOX INSTALLATION DETAIL.
10. MECHANICAL JOINT TEE W/ RETAINER GLANDS AND TIE RODS.

Hatch Mott MacDonald
Certificate No. 24GA28075000
27 Bleeker Street
Millburn, New Jersey 07041

CITY OF WILMINGTON
WILMINGTON, DELAWARE

FIRE HYDRANT INSTALLATION DETAIL

Designed	Drawn	Checked	Approved	Date
CITY	BRK	MAP	MD	NOV. 04

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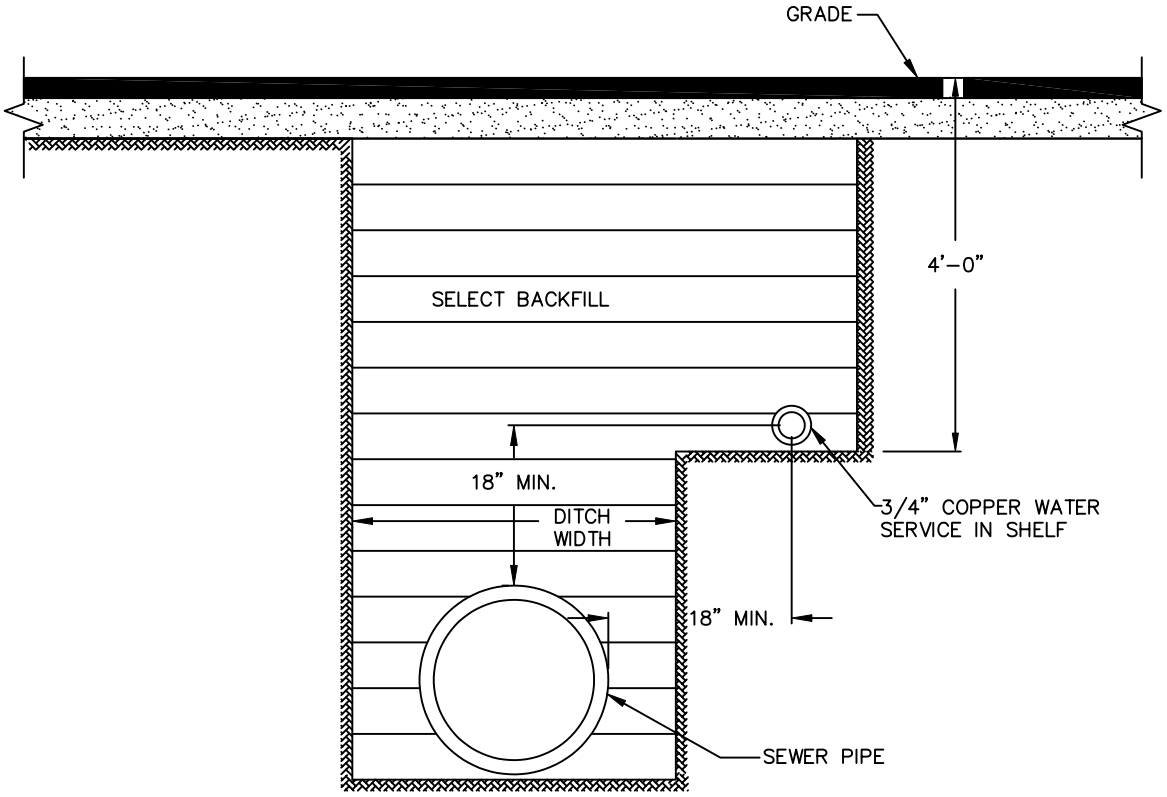

CROSS SECTION

(NOT TO SCALE)

Hatch Mott MacDonald
Certificate No. 24GA28075000

27 Bleeker Street
Millburn, New Jersey 07041

CITY OF WILMINGTON
WILMINGTON, DELAWARE

STANDARD DETAIL - SEWER TRENCH
WITH 3/4" WATER PIPE SHELF DETAIL

Designed	Drawn	Checked	Approved	Date
CITY	BRK	MAP	MD	NOV. 04

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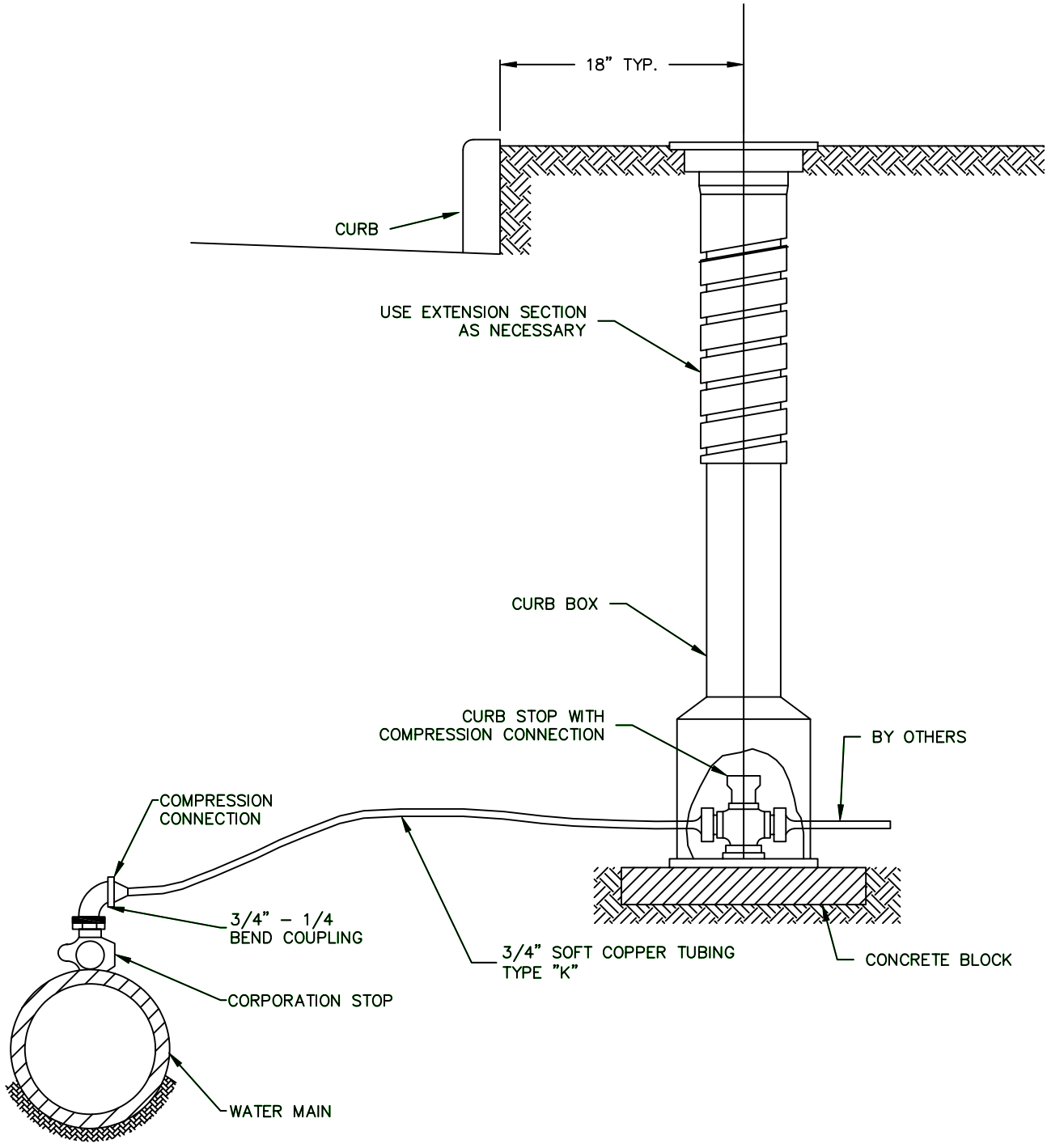

(NOT TO SCALE)

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Hatch Mott MacDonald
Certificate No. 24GA28075000

27 Bleeker Street
Millburn, New Jersey 07041

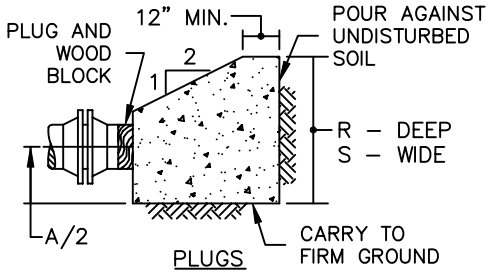
CITY OF WILMINGTON
WILMINGTON, DELAWARE

STANDARD INSTALLATION OF
WATER SERVICE

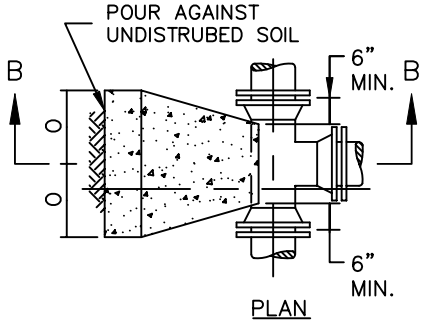
Designed	Drawn	Checked	Approved	Date
CITY	BRK	MAP	MD	NOV. 04

THRUST BLOCKS FOR TEES, HORIZ. & VERTICAL BENDS AND PLUGS THRUST BLOCKS DESIGNED FOR 150 LB. PER SQ. IN. TEST PRESSURE AND 2000 LB. PER SQ. FT. SOIL PRESSURE										
	DESC.	DIM.	4"ø	6"ø	8"ø	10"ø	12"ø	14"ø	16"ø	20"ø	24"ø
	TEES	N	0'–7"	1'–0"	1'–3"	1'–5"	1'–6"	1'–11"	2'–0"	2'–0"	3'–2"
		O	0'–7"	1'–4"	1'–10"	1'–5"	3'–3"	1'–11"	4'–3"	6'–6"	3'–2"
UPWARD HORIZ. & VERT. BENDS	90°	P	0'–9"	1'–0"	1'–3"	1'–8"	1'–6"	2'–3"	2'–0"	2'–0"	3'–9"
		Q	0'–9"	1'–4"	1'–10"	1'–8"	3'–3"	2'–3"	4'–3"	6'–6"	3'–9"
	45°	P	0'–7"	0'–9"	1'–0"	1'–3"	1'–3"	1'–8"	1'–9"	1'–9"	2'–9"
		Q	0'–7"	1'–0"	1'–3"	1'–3"	2'–2"	1'–8"	2'–8"	4'–1"	2'–9"
	22 1/2°	P	0'–5"	0'–6"	0'–9"	0'–11"	1'–0"	1'–2"	1'–6"	1'–9"	2'–0"
		Q	0'–5"	0'–9"	0'–11"	0'–11"	1'–4"	1'–2"	1'–7"	2'–1"	2'–0"
	11 1/4°	P	0'–4"	0'–5"	0'–6"	0'–9"	0'–8"	1'–10"	1'–0"	1'–3"	1'–5"
		Q	0'–4"	0'–6"	0'–8"	0'–9"	1'–1"	1'–10"	1'–3"	1'–6"	1'–5"
	5 5/8°	P									
		Q									
VERTICAL DOWNWARD BENDS	45°	*	0.6 CY	1.4 CY	2.5 CY	2.8 CY	5.2 CY	5.2 CY	9.0 CY	13.9 CY	14.9 CY
	22 1/2°	*	0.3 CY	0.7 CY	1.3 CY	1.4 CY	2.7 CY	2.7 CY	4.6 CY	7.1 CY	7.6 CY
	11 1/4°	*	0.2 CY	0.4 CY	0.7 CY	0.7 CY	1.4 CY	1.4 CY	2.3 CY	3.6 CY	3.8 CY
	5 5/8°	*									
	PLUGS	R	1'–2"	2'–0"	2'–6"	2'–10"	3'–0"	3'–10"	4'–0"	4'–0"	6'–4"
		S	1'–2"	2'–8"	3'–8"	2'–10"	6'–6"	3'–10"	8'–6"	13'–0"	6'–4"

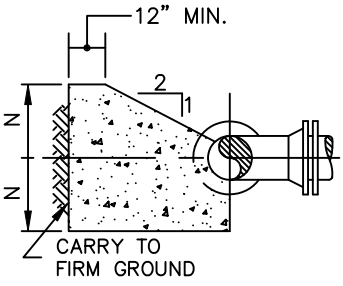
* MIN. CONC. ANCHORAGE WITHOUT BACKFILL AND NO GROUND WATER CONDITION.



PLUGS

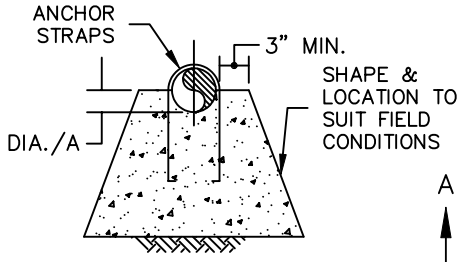


PLAN

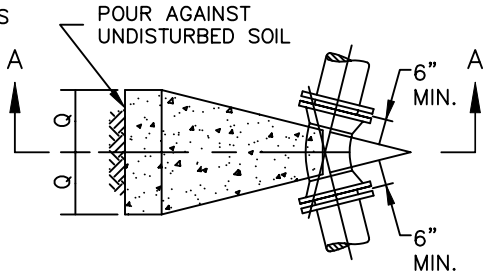


SECTION B–B

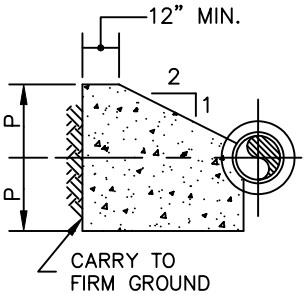
TEES



SECTION C–C

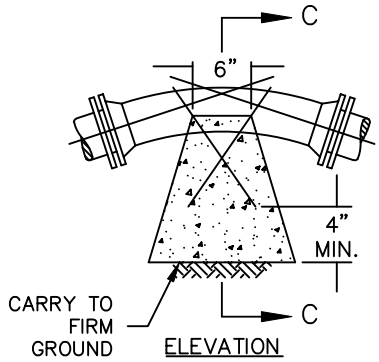


PLAN



SECTION A–A

HORIZONTAL AND VERTICAL UPWARD BENDS



ELEVATION

VERTICAL DOWNWARD BENDS

(NOT TO SCALE)

Hatch Mott MacDonald
Certificate No. 24GA28075000
27 Bleeker Street
Millburn, New Jersey 07041

CITY OF WILMINGTON
WILMINGTON, DELAWARE

THRUST BLOCKS

(150 LB. TEST)

Designed	Drawn	Checked	Approved	Date
CITY	BRK	MAP	MD	NOV. 04

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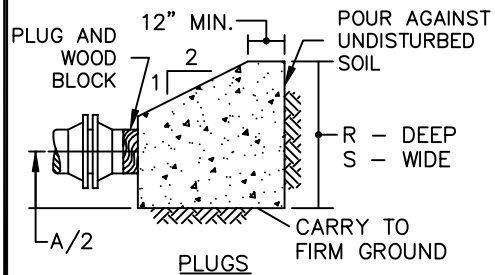
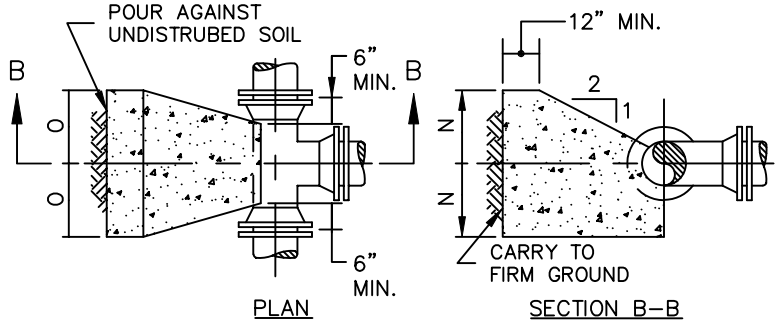
THRUST BLOCKS FOR TEES, HORIZ. & VERTICAL BENDS AND PLUGS THRUST BLOCKS DESIGNED FOR 200 LB. PER SQ. IN. TEST PRESSURE AND 2000 LB. PER SQ. FT. SOIL PRESSURE

	DESC.	DIM.	6"ø	8"ø	12"ø	16"ø	20"ø	36"ø	42"ø	48"ø	54"ø
	TEES	N	1'–0"	1'–3"	1'–6"	2'–0"	2'–0"	3'–0"	3'–9"	4'–0"	4'–3"
		O	1'–4"	1'–10"	3'–3"	4'–3"	6'–6"	13'–7"	14'–9"	17'–11"	21'–4"
UPWARD HORIZ. & VERT. BENDS	90°	P	1'–0"	1'–3"	1'–6"	2'–0"	2'–0"	3'–0"	3'–9"	4'–0"	4'–3"
		Q	1'–4"	1'–10"	3'–3"	4'–3"	6'–6"	13'–7"	14'–9"	17'–11"	21'–4"
	45°	P	0'–9"	1'–0"	1'–3"	1'–9"	1'–9"	3'–0"	3'–6"	3'–9"	4'–3"
		Q	2'–0"	1'–3"	2'–2"	2'–8"	4'–2"	7'–5"	8'–7"	10'–5"	11'–7"
	22 1/2°	P	0'–6"	0'–9"	1'–0"	1'–6"	1'–9"	2'–6"	3'–0"	3'–6"	3'–6"
		Q	0'–9"	0'–11"	1'–4"	1'–7"	2'–1"	4'–7"	5'–1"	5'–8"	7'–2"
	11 1/4°	P	0'–5"	0'–6"	0'–8"	1'–0"	1'–3"	2'–0"	2'–6"	3'–0"	3'–0"
		Q	0'–6"	0'–8"	1'–1"	1'–3"	1'–6"	2'–10"	3'–1"	3'–4"	4'–3"
	5 5/8°	P	0'–3"	0'–5"	0'–6"	0'–9"	0'–11"	1'–6"	1'–9"	2'–0"	2'–6"
		Q	0'–5"	0'–5"	0'–8"	0'–10"	1'–1"	1'–11"	2'–3"	2'–6"	2'–7"
VERTICAL DOWNWARD BENDS	45°	*	1.4 CY	2.4 CY	5.2 CY	9.0 CY	13.8 CY	43.5 CY	58.8 CY	76.6 CY	96.8 CY
	22 1/2°	*	0.7 CY	1.2 CY	2.6 CY	4.6 CY	7.1 CY	22.2 CY	30.0 CY	39.1 CY	49.3 CY
	11 1/4°	*	0.4 CY	0.6 CY	1.3 CY	2.3 CY	3.5 CY	11.2 CY	15.1 CY	19.6 CY	24.8 CY
	5 5/8°	*	0.2 CY	0.3 CY	0.7 CY	1.2 CY	1.8 CY	5.6 CY	7.5 CY	9.8 CY	12.4 CY
	PLUGS	R	1'–0"	1'–3"	1'–6"	2'–0"	2'–0"	3'–0"	3'–9"	4'–0"	4'–3"
		S	1'–4"	1'–10"	3'–3"	4'–3"	6'–6"	13'–7"	14'–9"	17'–11"	21'–4"

* MIN. CONC. ANCHORAGE WITHOUT BACKFILL AND NO GROUND WATER CONDITION.

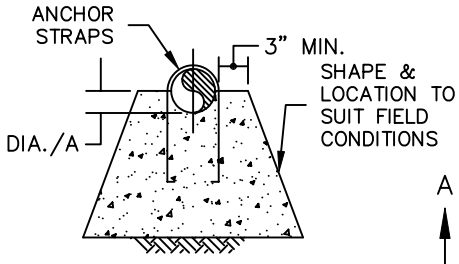


PLUGS

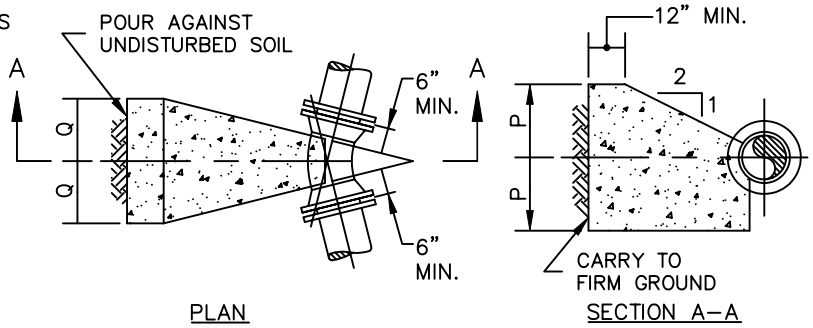


PLAN SECTION B–B

TEES

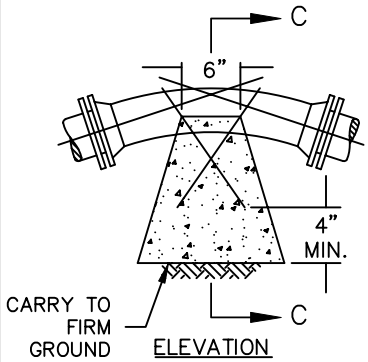


SECTION C–C



PLAN SECTION A–A

HORIZONTAL AND VERTICAL UPWARD BENDS



VERTICAL DOWNWARD BENDS

Hatch Mott MacDonald
Certificate No. 24GA28075000
27 Bleeker Street
Millburn, New Jersey 07041

CITY OF WILMINGTON
WILMINGTON, DELAWARE

THRUST BLOCKS

(200 LB. TEST)

Designed	Drawn	Checked	Approved	Date
CITY	BRK	MAP	MD	NOV. 04

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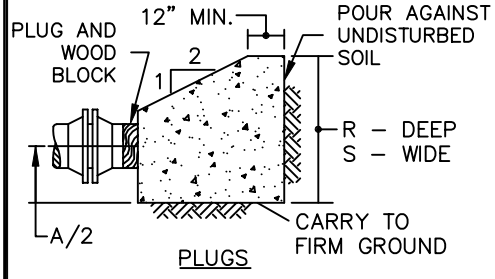
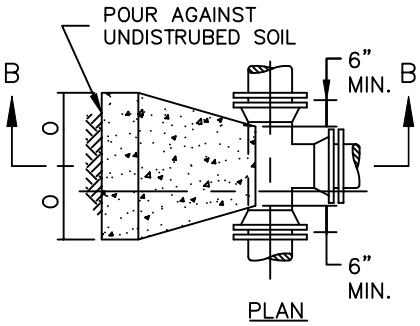
THRUST BLOCKS FOR TEES, HORIZ. & VERTICAL BENDS AND PLUGS
THRUST BLOCKS DESIGNED FOR 220 LB. PER SQ. IN. TEST PRESSURE AND 2000 LB. PER SQ. FT. SOIL PRESSURE

	DESC.	DIM.	6"ø	8"ø	12"ø	16"ø	20"ø	36"ø	42"ø	48"ø	54"ø
	TEES	N	1'–0"	1'–3"	1'–6"	2'–0"	2'–3"	3'–6"	3'–9"	4'–0"	4'–3"
		O	1'–6"	2'–0"	3'–7"	4'–8"	6'–5"	12'–10"	16'–2"	19'–9"	23'–6"
UPWARD HORIZ. & VERT. BENDS	90°	P	1'–0"	1'–3"	1'–6"	2'–0"	2'–3"	3'–6"	3'–9"	4'–0"	4'–3"
		Q	1'–6"	2'–0"	3'–7"	4'–8"	6'–5"	12'–10"	16'–2"	19'–9"	23'–6"
	45°	P	0'–9"	1'–0"	1'–3"	1'–9"	2'–0"	3'–0"	3'–6"	4'–0"	4'–3"
		Q	1'–1"	1'–5"	2'–4"	2'–11"	3'–11"	8'–2"	9'–5"	10'–8"	12'–9"
	22 1/2°	P	0'–6"	0'–8"	1'–0"	1'–3"	1'–6"	3'–0"	3'–0"	3'–6"	3'–6"
		Q	0'–10"	1'–2"	1'–6"	2'–2"	2'–8"	4'–2"	5'–7"	6'–9"	7'–11"
	11 1/4°	P	0'–5"	0'–6"	0'–9"	1'–0"	1'–0"	2'–0"	2'–6"	3'–0"	3'–0"
		Q	0'–7"	0'–9"	1'–0"	1'–4"	2'–0"	3'–2"	3'–5"	3'–8"	4'–8"
	5 5/8°	P	0'–3"	0'–5"	0'–6"	0'–9"	0'–11"	1'–6"	2'–0"	2'–0"	2'–6"
		Q	0'–5"	0'–6"	0'–10"	0'–11"	1'–2"	2'–1"	2'–2"	2'–9"	2'–10"
VERTICAL DOWNWARD BENDS	45°	*	1.6 CY	2.7 CY	5.7 CY	9.9 CY	15.2 CY	47.9 CY	64.7 CY	84.3 CY	106.5 CY
	22 1/2°	*	0.8 CY	1.4 CY	2.9 CY	5.0 CY	7.8 CY	24.4 CY	33.0 CY	43.0 CY	54.3 CY
	11 1/4°	*	0.4 CY	0.7 CY	1.5 CY	2.5 CY	3.9 CY	12.3 CY	16.6 CY	21.6 CY	27.3 CY
	5 5/8°	*	0.2 CY	0.3 CY	0.7 CY	1.3 CY	2.0 CY	6.1 CY	8.3 CY	10.8 CY	13.7 CY
	PLUGS	R	1'–0"	1'–3"	1'–6"	2'–0"	2'–3"	3'–6"	3'–9"	4'–0"	4'–3"
		S	1'–6"	2'–0"	3'–7"	4'–8"	6'–5"	12'–10"	16'–2"	19'–9"	23'–6"

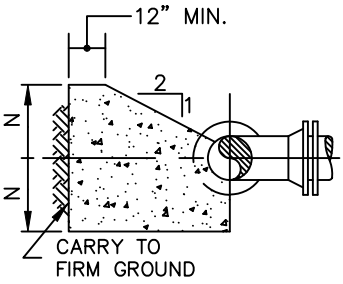
* MIN. CONC. ANCHORAGE WITHOUT BACKFILL AND NO GROUND WATER CONDITION.



PLUGS

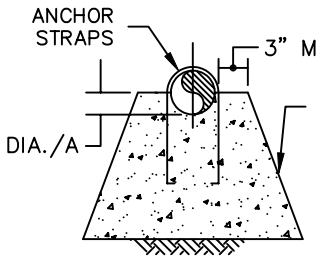


PLAN

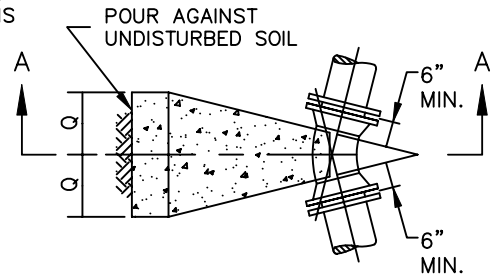


SECTION B–B

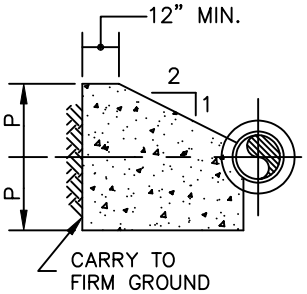
TEES



SECTION C–C

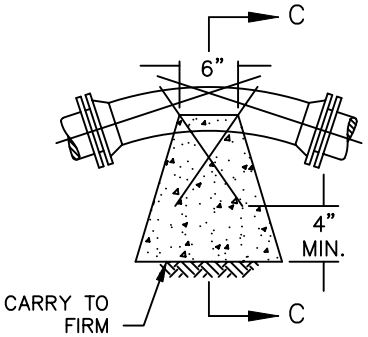


PLAN



SECTION A–A

HORIZONTAL AND VERTICAL UPWARD BENDS



ELEVATION

VERTICAL DOWNWARD BENDS

Hatch Mott MacDonald
Certificate No. 24GA28075000
27 Bleeker Street
Millburn, New Jersey 07041

CITY OF WILMINGTON
WILMINGTON, DELAWARE

THRUST BLOCKS

(220 LB. TEST)

Designed	Drawn	Checked	Approved	Date
CITY	BRK	MAP	MD	NOV. 04

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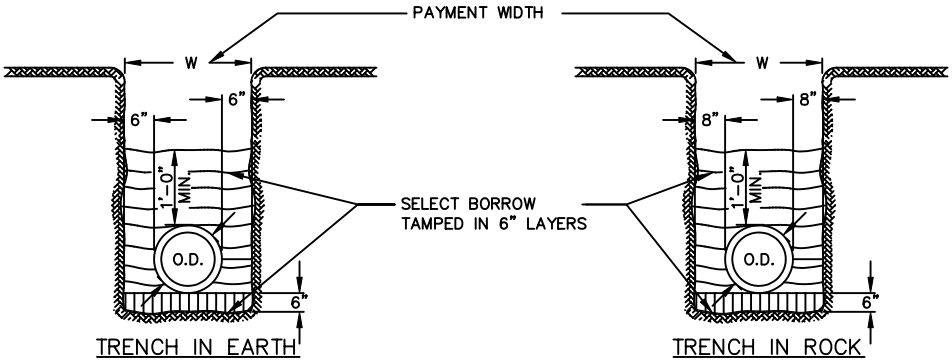
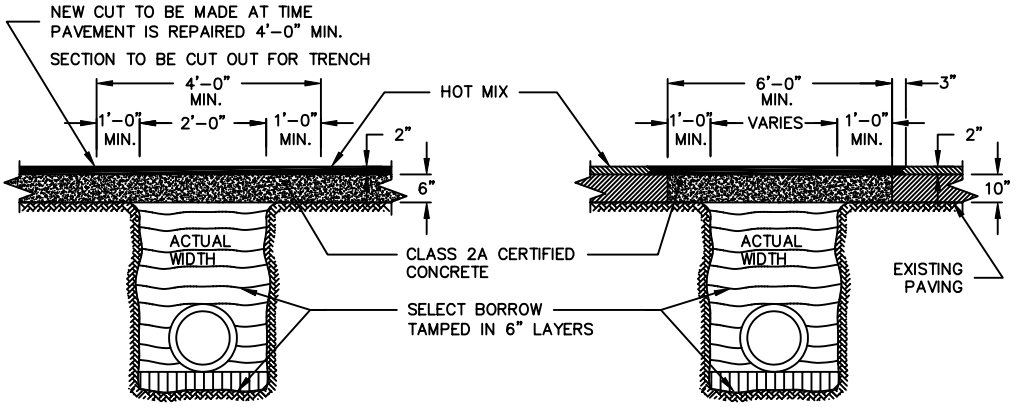


TRENCH IN EARTH

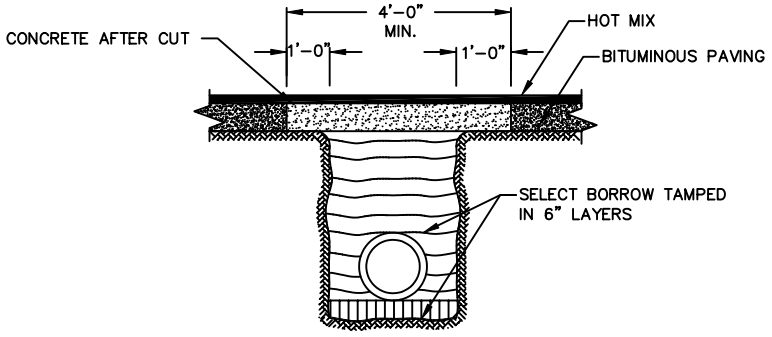
TRENCH IN ROCK



TRENCHING OTHER THAN STATE MAINTAINED ROADS

TRENCHING STATE MAINTAINED ROADS

CUTTING & REPLACING ROADWAY PAVING



CUT THRU BITUMINOUS PAVING–REPLACING WITH CLASS 2A CERTIFIED CONCRETE

(NOT TO SCALE)

Hatch Mott MacDonald
Certificate No. 24GA28075000
27 Bleeker Street
Millburn, New Jersey 07041

CITY OF WILIMINGTON
WILMINGTON, DELAWARE

STANDARD DETAIL - TRENCHING AND ROADWAY CUTTING

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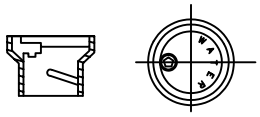
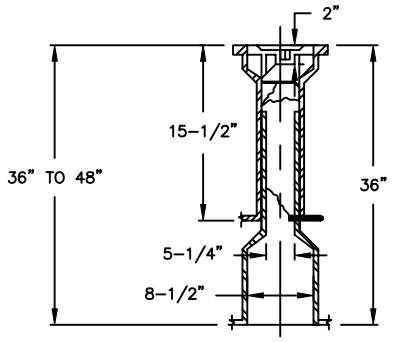
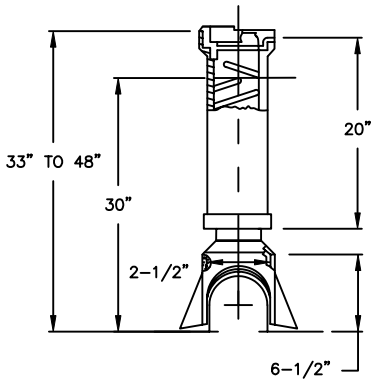


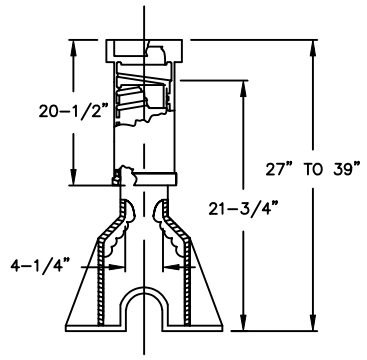
2–1/2" NEW STYLE FLUSH FIT COVER
ONLY COVER IS DIFFERENT STYLE
(NOT TO SCALE)



5–1/4" – 2 PIECE SLIDING TYPE
ADJUSTABLE VALVE BOX
TYPE B
(NOT TO SCALE)



2–1/2"–2 PIECE ADJUSTABLE CURB STOP BOX
TYPE A
(NOT TO SCALE)



4–1/2"–2 PIECE ADJUSTABLE CURB STOP BOX
TYPE C
(NOT TO SCALE)

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Hatch Mott MacDonald
Certificate No. 24GA28075000
27 Bleeker Street
Millburn, New Jersey 07041

CITY OF WILMINGTON
WILMINGTON, DELAWARE

STANDARD DETAIL
VALVE BOX AND COVER

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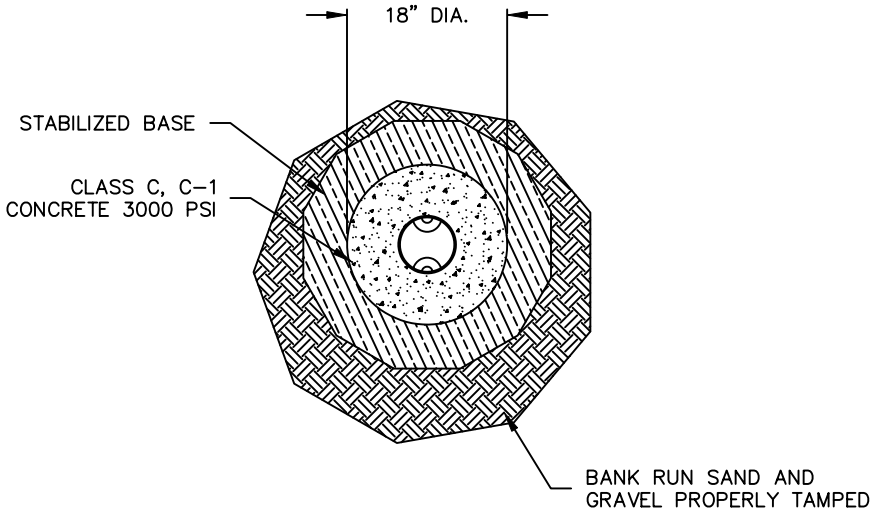

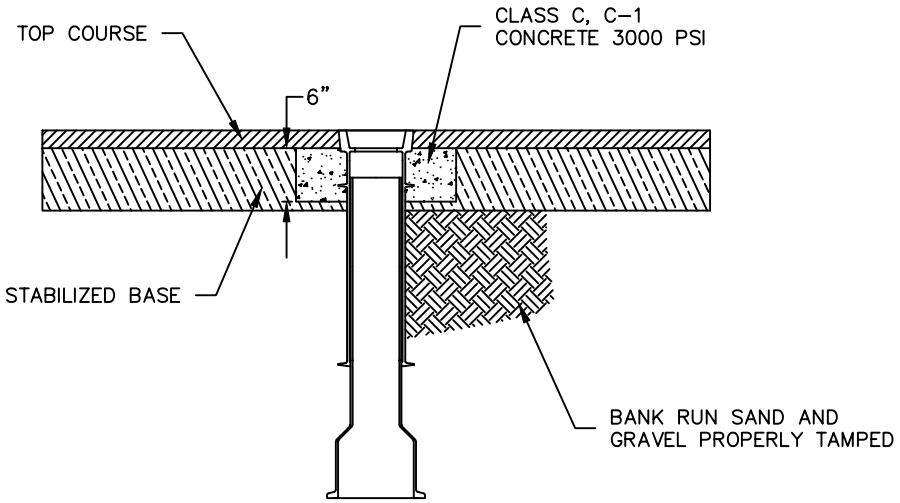

(NOT TO SCALE)

Hatch Mott MacDonald
Certificate No. 24GA28075000

27 Bleeker Street
Millburn, New Jersey 07041

CITY OF WILMINGTON
WILMINGTON, DELAWARE

VALVE BOX INSTALLATION DETAIL

Designed	Drawn	Checked	Approved	Date
CITY	BRK	MAP	MD	NOV. 04

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