

COPY

SECTION 02600

WATER MAINS AND APPURTENANCES

PART 1 GENERAL

1.01 SCOPE

- A. The work of this section includes the furnishing of all labor, tools, equipment and materials and performing all operations necessary for the construction of water mains including fittings, valves, hydrants, hydrant branches, couplings, and other related items required to complete the work as shown on the drawings and as specified.

1.02 MEASUREMENT AND PAYMENT

- A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025 - MEASUREMENT AND PAYMENT.

1.03 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. All pipe when shipped shall be packed and separated by wood separators such that pipe to pipe contact is prevented during transit and/or storage.
- B. The loading, trucking, unloading, and handling of pipe and appurtenant materials shall be done by the Contractor. Care shall be taken so as not to damage the pipe, appurtenant materials or the street surface. Dropping pipe, special castings, valves, hydrants, etc. directly from the trucks upon the ground will not be permitted. Suitable effective buffers or runners shall be provided. Metal chain shall not be used for lifting pipe materials. The Contractor shall be responsible for any damage done to the pipe or appurtenant materials until they are accepted in the completed work.
- C. Distribution of pipeline materials along the line of work will not be permitted, unless approved by the Engineer. The Contractor shall not obstruct driveways, sidewalks, walkways, etc., nor shall pipeline materials be placed on private property without the express written approval of the property owner.

PART 2 MATERIALS

2.01 DUCTILE IRON PIPE

- A. All ductile iron pipe shall have push-on joints, except as may be otherwise noted. Pipe shall be designed for the rated working pressure in pounds per square inch shown below and for laying condition type 2 (Flat bottom trench, backfill consolidated to centerline of pipe) and for eight feet of earth cover. Wall thickness and tolerances shall be as specified in ANSI Specification A21.50 (AWWA C150). The grade of iron from which the pipe is made shall be 60-42-10; having 60,000 psi minimum tensile strength, 42,000 psi minimum yield strength and 10 percent minimum elongation.

Pipe Size	Thickness (inches)	Thickness Class	Rated Working Pressure
6"	0.31	52	350
8"	0.33	52	350
10"	0.35	52	350
12"	0.37	52	350
16"	0.37	51	350

- B. The interior of the pipe shall be cement lined to twice the thickness specified in ANSI A21.4 (AWWA C104) and asphalt seal coated twice. Asphalt seal-coat shall not impart taste or odor, or toxic or carcinogenic compounds to the water contained therein. Asphalt seal coat shall be a product acceptable to the National Sanitation Foundation (NSF) for use in potable water and shall be so listed in the most current NSF summary of approved products. The asphalt seal coat shall be applied and cured in strict conformance with the coating manufacturer's cautions and instructions. The seal coat shall be applied by the pipe manufacturer under controlled factory conditions and field application is strictly prohibited. Outside of pipe shall be bituminous coated.

2.02 FITTINGS

- A. Fittings shall be mechanical joint ductile iron. Branch of tees for hydrants or stubs shall be mechanical joint anchoring tees. All fittings shall be cement lined, and coated as specified hereinbefore for ductile iron pipe. Fittings shall conform to ANSI Specifications A21.53 (AWWA C153) and ANSI Specification A21.11 (AWWA C111). All fittings shall be "USA" made.
- B. All fittings shall conform with the weights and dimensions shown in the latest edition of the DIPRA Handbook of Ductile Iron Pipe and be provided complete with all joint accessories.
- C. Plugs, caps and blank flanges shall be ductile iron and shall conform with the weights and dimensions shown in the latest edition of the DIPRA Handbook of Ductile Iron Pipe and be provided complete with all joint accessories.

2.03 SOLID SLEEVES, FLEXIBLE AND TRANSITION COUPLINGS

- A. Solids sleeves shall be long body type, ductile iron with mechanical joints. All sleeves shall conform with the weights and dimensions shown in the latest edition of the DIPRA Handbook of Ductile Iron Pipe and come complete with all joint accessories.
- B. Flexible couplings and/or transition couplings shall be furnished and installed where shown on the drawings or wherever the intent for their use is indicated or may be required by the Engineer. Flexible couplings shall be cast iron with rubber gaskets. Bolts shall be properly spaced to insure uniform gasket compression. Flexible couplings shall be as manufactured by Dresser Industries, Smith Blair, or equal and shall be cement lined and seal coated as specified hereinbefore for ductile iron pipe.

2.04 RESILIENT SEAT GATE VALVES

- A. Valves shall be manufactured in full compliance with the content and intent of this specification. Valve shall be iron body, resilient seat, with two inch operating nut, mechanical joint and shall conform in every respect to AWWA C509. Valves shall be designed for 200 psi working pressure and 400 psi test pressure. Gate valves shall open left and shall be Mueller or Clow, now standardized by the Owner.
- B. Valves shall conform to the specifications of the AWWA as to size of stem, pitch of thread, etc. When mechanical joint ends are specified for use, the gasket seating areas shall be fully machined to fixed dimensions and tolerances as per AWWA specifications. All valves shall be provided with "O" rings. The design of the valve shall be such that the seal plate can be fitted with new "O" rings while the valve is under pressure in a fully open position.

2.05 BUTTERFLY VALVES

- A. Butterfly valves shall conform to the requirements of AWWA C504 with the specific requirements and exceptions to the AWWA C504 which follows;

- B. Manual operation shall be submersible worm gear type (Philadelphia Gear, or equal) or rack and pinion type. Valve operators shall be rated for 450 ft. lbs. of torque at the full open or closed position without damage to the valve or valve operator. All operations shall have positive adjustable stops to prevent over traveling of the disc in the open and closed positions. Operators shall be equipped with a two-inch square operating nut fully gasketed and greased for buried service. Gearing shall be totally enclosed, oil tight and permanent sealed.
- C. Butterfly valves shall have a rated working pressure of 150 psi. Valve body shall be cast iron conform to ASTM A126, Class B. Butterfly valves shall be Mueller, now standardized by the Owner.
- D. Valves shall have mechanical joint ends and shall open left. All valves shall be coated with either a minimum of three applications of an approved bitumastic or a fusion bonded epoxy protective coating over a rust free casting, prior to shipment. Valve interiors shall have 100 percent solids thermostat or fusion bonded epoxy protective coating holiday-free in the waterway, which shall meet all requirements of AWWA C550. The epoxy coating shall not impart taste or odor to the water. The coating shall be a product acceptable to the NSF for use in potable water and shall be so listed in the most current NSF summary of approved products. The coating shall be applied and cured in strict conformance with the coating manufacturer's cautions and instructions. The coating shall be applied by the valve manufacturer or supplier, under controlled factory conditions and field application is strictly prohibited.

2.06 TAPPING SLEEVES AND VALVES

- A. Tapping sleeves and valves shall conform to the most current AWWA specifications for tapping sleeves and valves.
- B. Tapping sleeves shall be mechanical joint, two part castings, flanged on the vertical centerline and come complete with all joint accessories. The surface area of each flange shall be thoroughly machined, and the sleeve flanges shall be fitted with gaskets recommended by the manufacturer. Each gasket shall cover the entire surface of each joint for the full length of the sleeve. Bolts used to assemble the sleeves shall pass directly through each flange and through each gasket. Bolts shall be properly spaced to insure uniform gasket pressure and compression.
- C. Sleeve outlets shall have counterboard flanges to insure proper centering of the tapping valve.
- D. All tapping valves shall be flanged by mechanical joint and open left. Tapping valves shall conform with aforementioned specifications for gate valves.
- E. Prior to ordering the sleeve, the Contractor shall check the dimensions of the pipe on which the tapping sleeves are to be installed.

2.07 VALVE BOXES AND COVERS

- A. Valve boxes shall be cast iron, tar coated, adjustable sliding type which include cast iron covers. Bell end of the lower sections shall in all cases be sufficiently large enough to fit over the stuffing boxes of the valves. The smallest inside dimension of the shaft shall not be less than 5-1/4 inches. Upper section shall have a flange sufficiently strong enough to furnish the bearing for that section so that all weight or jolting from street traffic or the like shall not be transmitted to the valve. Valve box sections shall have a minimum of 6-inches of overlap. Each valve box including cover shall weight at least 100 pounds. Valve box lid shall be drop type with "WATER" cast into the lid. Valve boxes and covers shall be American made.

2.08 HYDRANTS

- A. Hydrants shall be of the following type and manufacturer only.

Make and Model - Mueller Centurion
Type of Thread - National Standard
No. of Outlets - 2 2-1/2" hose connection
 1 4-1/2" steamer connection
Diameter Valve Opening - 5-1/4 inches
Diameter of Barrel - 7 inches
Hub - mechanical joint
Direction of Opening - open right *LEFT*
Depth of bury - 5'-6"
Color - to match existing hydrants of the Owner

- B. Hydrants shall be designed for 150 pounds per square inch working pressure and shall conform in every respect to the specifications adopted for hydrants by the AWWA. Hydrants shall be given two coats of quality paint after installation.
- C. Hydrant barrel extension shall be as manufactured by the hydrant manufacturer and shall include all couplings, pins, flanges, gaskets, nuts and bolts, etc. to provide a complete installation.

2.09 SAMPLING STATION

- A. Sampling station shall be Eclipse Model No. 88. The sampling station shall be installed at the location shown on the plans.
- B. At Tank #2 and at the Marstons Lane/Country Club Drive Pressure Reducing Valve Vault, the Contractor shall remove the existing sampling stations and reinstall them at the locations shown on the plans.

2.10 POLYETHYLENE WATER MAINS (2")

- A. Polyethylene water main shall be manufactured from PE-3408 high density polyethylene resin, shall be rated for 200 psi and shall meet ASTM D-2737 and NSF standards for use in drinking water. The pipe shall be American made and of a manufacturer approved by the Owner.
- B. Polyethylene water mains shall be joined together with brass compression fittings as manufactured by Mueller.

2.11 SAMPLE LINES, WATER SERVICES, TAPS AND BLOWOFFS

- A. Sample Lines. The sample lines shall be 1-inch Polyethylene #3408, SDR rated for 200 psi and meet the requirements of ASTM D2737-81 (CTS). The pipe shall be American made. Copper tubing shall be Type K and shall be American made.
- B. Water Services. The water services to be relocated at the Marstons Lane/Country Club Drive and Stonehedge Pressure Reducing Valve Vaults shall be 1-inch Polyethylene #3408, SDR rated for 200 psi and meet the requirements of ASTM D2737-81 (CTS). The pipe shall be American made.
- C. Curb Boxes. Curb boxes shall be tar coated, cast iron, sliding type with inlaid covers. Covers shall be held in place with bronze bolts. Shaft shall be 2-1/2 inches inside diameter and be the extension type extending from four (4) feet to five foot six inches (5'-6"). Service boxes shall be Erie type.

- D. Required Brass Goods shall include Corporation Cocks, Curb Stops, Misc. Couplings and Fittings. Castings shall be sufficiently heavy to meet all service conditions without springing or leaking and be clean and free from roughness both inside and out. Waterways shall be smooth, full size and free from obstruction. All threads shall be cut sharp, clean and true.
- E. All brass goods shall be individually wrapped to protect threads during shipment. Corporation cocks and curb cocks shall open left, and shall be of the compression type. Corporation cocks shall be Mueller H15008, and curb stops shall be Mueller H 15219. Stainless steel inserts shall be used at each compression connection.
- F. Saddles shall be installed on the water main for 2-inch taps.
- G. Temporary blow-offs shall be provided by the Contractor for chlorination and flushing purposes for the new water mains.
- H. Permanent blow-offs shall be comprised of a corporation cock, a gooseneck, a curb cock (Mueller Oriseal with waste), a 4-1/2 foot length of Type K copper pipe, hose bibb, a threaded cap and a cast iron valve box and cover. Erie type service box shall be placed over the curb stop. Permanent blow-offs shall be of the size shown on the plan or as directed by the Engineer.

2.12 RETAINER GLANDS WITH THRUST RESTRAINT WEDGES

- A. Retainer glands shall be ductile iron conforming to ASTM A53.80. Restraining devices shall be ductile iron heat treated to a minimum hardness of 370 BHN. Glands shall conform to dimension/requirements for mechanical joint ball and teehead bolts for standard ANSI/AWWA A21.11 or ANSI/AWWA C153/A21.53. Twistoff nuts shall be used to ensure proper actuation of the restraining device. The restraining device shall be Ebba Iron Inc. Series 1100 or equal.
- B. Retainer glands with thrust restraint wedges shall be furnished and installed from the piping in the inlet-outlet pipe chamber of Tank #2 to the altitude valve vault.

2.13 POLYETHYLENE ENCASEMENT

- A. Polyethylene encasement or wrap shall be eight (8) mil thick tubes or sheets manufactured in accordance with AWWA C105 (ANSI A21.5).

2.14 OTHER MATERIALS

- A. Furnish all necessary materials for a complete installation, and materials required by the Engineer for the proper completion of the work as specified.

PART 3 EXECUTION

3.01 INSTALLATION OF WATER MAINS, FITTINGS AND APPURTENANCES

- A. Pipes shall be thoroughly cleaned before being installed. Particular attention shall be paid to the proper positioning of the rubber gaskets. Under no conditions will the Contractor be allowed to "pop" the pipe home. Methods such as driving the pipe home with a bar and block or by using the bucket of the backhoe to push the pipe home (utilizing a block in front of the bell to push against) will be allowed unless otherwise approved by the Engineer. Special care shall be used in following the Manufacturer's instructions for pipe joint systems.

- B. Temporary watertight plugs shall be utilized at the end of each working day to prevent the intrusion of silt, debris and water into the pipes. When working in areas with a high potential for flooding the pipe from groundwater, streams, storm drains, sewers or other water pipes, the temporary plug shall be provided on each pipe length.
 - 1. In the event of flooding of the pipe all pipe laying shall cease until the pipes have been thoroughly cleaned as determined by the Engineer.
- C. When joined together, pipes shall form a smooth continuous line and grade on straight sections and on curved sections (both vertical and horizontal) shall have uniform deflections within the required limits and conforming in general to the line and profile of adjacent roadways or easements. Location of rubber rings shall be determined with a checking gauge before backfilling the pipe.
 - 1. Pipe shall be joined and laid in accordance with the manufacturer's latest published instructions.
 - 2. Pipe shall not be laid with deflection of more than one-half the maximum deflection as recommended by the manufacturer.
- D. Backfill shall be placed on both sides of the pipe and compacted simultaneously with approved tamping bars for the full length of pipe.
 - 1. Bell holes shall be excavated as necessary to ensure that the pipes and not the pipe bells are bearing the weight of backfill and the traffic load.
 - 2. Bells or other joints shall not be installed directly under existing utilities or structures. Use short or random lengths to avoid such conditions.
- E. Pipe shall not be installed in areas where excavations have been carried below trench grade, or where water conditions create unstable bottoms, until such time as the trench is excavated, refilled and compacted as specified.

3.02 POLYETHYLENE ENCASEMENT

- A. Polyethylene encasement shall be installed where required to prevent contact between the water main and appurtenances and the surrounding backfill and bedding material, where shown on the drawings or directed by the Engineer. Application of the polyethylene encasement shall be in accordance with AWWA C105. In general, the encasement shall be used where the water main or appurtenances are installed within four (4) feet of existing gas mains. The encasement shall be continuous through and including a full length of pipe beyond the areas described above.
- B. Polyethylene tubes shall be two (2) feet longer than pipe sections and centered on the pipe prior to installation. After assembling the pipe, the polyethylene shall be lapped one (1) foot at the pipe joints and secured with tape. Shallow bell holes shall be provided at joints to facilitate the lapping of the polyethylene tube. The branched polyethylene shall be pulled forward from the proceeding length of pipe and slipped over the new length and secured in place. The wrap from the new pipe shall then be slipped over the first wrap and secured in place. Bends, reducers, offsets, tees, valves, etc. shall be wrapped in the same manner. Where polyethylene joins an unwrapped pipe, extend the polyethylene two (2) feet onto the unwrapped pipe and secure with circumferential turns of the tape. The same backfill shall be used for polyethylene wrapped pipe as specified for unwrapped pipe, with care being taken to prevent damage to the polyethylene wrap.

- C. The Contractor shall install the polyethylene encasement in accordance with Method A of AWWA C105, and manufacturer's instructions. Where sheet polyethylene is used, Contractor shall install the wrap in accordance with Method C - AWWA C105.

3.03 MECHANICAL JOINTS

- A. Mechanical joints shall be installed with all required joint accessories, including gaskets, cast iron follower glands with drilled bolt holes, cast iron teehead bolts, hexagonal nuts, etc.
 - 1. Torque wrenches shall be used to take up such joints. Wrenches shall be equipped with adjusting breakable tension gauge, set to break the tension at the tension loading recommended by the manufacturer. Mechanical joints shall be made so as to secure tight joints, every means being taken to secure this result.
 - 2. Joints shall have a deflection where required of not more than one-half the recommended maximum deflection allowed by the standards of DIPRA.

3.04 FLANGED JOINTS

- A. Flanged joints shall be Class 125 drilled in accordance with ANSI Specification B16.1, with the required joint accessories, gaskets, bolts, hexagonal nuts, etc. Torque wrenches shall be used to take up such joints. Wrenches shall be equipped with adjusting breakable tension gauge, set to break the tension at the tension loading recommended by the manufacturer.
- B. Flanged joints shall be made to secure light tight joints. Every means shall be taken to secure this result.

3.05 CUTTING OF PIPE

- A. All cuts of ductile iron pipe shall be made with either an electric, pneumatic, or gasoline driven power saw. Blades shall be carbide tipped for cutting cement lined ductile iron pipe.
 - 1. When lengths of pipe are field cut to provide for short lengths, the outside of the cut ends shall be tapered back about 1/8 inch at an angle of 30 degrees with the centerline of the pipe and as recommended by the manufacturer before field cut pieces are used.

3.06 PROCEDURE FOR INSTALLING TAPPING SLEEVES AND VALVES

- A. Pipe upon which a tapping sleeve is to be installed shall be thoroughly cleaned of all foreign matter with scraping tools and wire brushes, a minimum of six (6) inches each side of the sleeve. The interior surface of the sleeve shall be lightly dusted with calcium hypochlorite powder at the rate of approximately 150 mg per square foot of surface area.
- B. Clean the flanged surface of the sleeve with a wire brush to remove any excess bituminous coating or burrs. The two sections of the sleeve shall be lined up, with great care being taken to ensure that they are positioned in the same manner as received from the manufacturer.
- C. Sufficient blocking and wedges shall be used to secure the sleeve once it has been leveled and positioned.
- D. Sleeve bolts shall be alternately tightened from the extreme end on one side to the extreme of the opposite side with approved torque wrenches until all are securely tightened.
- E. Flange bolts shall be tightened in a similar manner, with care being taken not to disturb the gasket.

- F. Take care to ensure that the tapping machine is kept in leveled horizontal position and securely supported so as not to transmit any additional weight to the tapping valve.
- G. Blocking shall be left in place after completing the tap.

3.07 HYDRANT BRANCHES

- A. Furnish and install hydrants on hydrant branches where shown on the drawings or as approved by the Engineer. Each branch shall consist of a valve anchoring tee, 6-inch gate valve (mechanical joint) and one 6-inch ductile iron, mechanical joint nipple of the required length. The base of the hydrant shall be set on a concrete pad. Hydrants shall be restrained with thrust rods. All tie rods shall be coated twice with asphaltum after installation. Hydrant riser shall be installed where necessary to provided a hydrant elevation acceptable to the Engineer. Construct hydrant drainage wells of 1/2 cubic yard capacity of 2-inch stone placed in the excavation below and around the hydrant bottom. Barrel blocks shall be placed between the hydrant and the soil for thrust restraints. Hydrants shall be given two coats of quality paint after installation of the same type and color of the existing hydrants of the Owner.

3.08 CONNECTIONS TO EXISTING MAINS

- A. Eight (8) hours prior to connecting to any existing water main, the Contractor shall notify the water utility. At no time shall the Contractor operate any existing line valves. All such operations shall be performed by water utility personnel.
- B. Make all taps, whether wet or dry, into the various water pipes, and install the required sleeves, tees, couplings, adaptors, reducers, pipe nipples, jointing materials, and other fittings which may be required and make all joints watertight, as specified, where shown on the contract drawings and/or as approved by the Engineer. All materials removed under this contract with the exception of hydrants shall remain the property of the Contractor. The Contractor shall legally dispose of the removed materials at his own expense.
- C. The cutting, removal, plugging and bracing of parts of the existing water mains made necessary by this work, and the shutdown of the existing water system, and subsequent pumping, hand excavating and whatever time that may be required by the Owner to notify water takers of discontinuation of water service, time required to effect tight closures of existing valves, and any reasonable changes that may be required by the Engineer or any other work done hereunder shall be considered as an obligation of the Contractor to complete the work.
- D. The work shall be coordinated with the Owner and such connections that may be required shall be made at such times and in such a manner as to cause as little interference in water service within the existing system as is practicable.

3.09 CEMENT CONCRETE (THRUST BLOCKS) AND FRICTION CLAMPS

- A. Furnish and place cement concrete for thrust restraint in such locations and quantities specified and as approved by the Engineer.
- B. Concrete shall be of proportions, 1 part cement to 2 parts sand and 4 parts coarse aggregate.
- C. Care shall be taken to ensure that all concrete thrust blocks bear against undisturbed trench walls, and not to encase flanges and bolts on mechanical joint fittings. Where unsuitable bearing material is encountered, excavate and place sufficient concrete ballast, with the approval of the Engineer, to offset the anticipated thrusts.

- D. Thrust block bearing areas and volumes shall conform to the minimum dimensions found in the "Thrust Block Sizing" table, at the end of this section, for the various soil and fitting types noted. Where unsuitable bearing material is encountered, the Contractor shall excavate and place sufficient concrete ballast, with the approval of the Engineer, to offset the anticipated thrusts.
- E. Friction clamps, thrust rods and retainer glands shall be installed in accordance with the manufacturer's instructions, as directed by the Engineer. All exposed rods shall be coated twice with asphaltum after installation.

3.10 PIPE BLOCKING

- A. Furnish and install wood blocking where required. Blocking shall be used as directed by the Engineer.
 - 1. Blocking shall be new spruce plank 1-inch and 2-inches in thickness. Blocks shall be bedded firmly and level across the bottom of the trench and when any block has been sunk too deeply additional blocking of suitable thickness shall be placed to bring the pipe to the required grade. Blocks shall be placed at a point 1/5th of the span from each joint. Each block shall be 2 inch x 4 inch with a length of four (4) inches larger than the diameter of the pipe. A sufficient quantity of wedges 12-inches long of 4 inch x 4 inch fir shall be furnished to properly hold valves and special castings in place.

3.11 VALVE BOXES

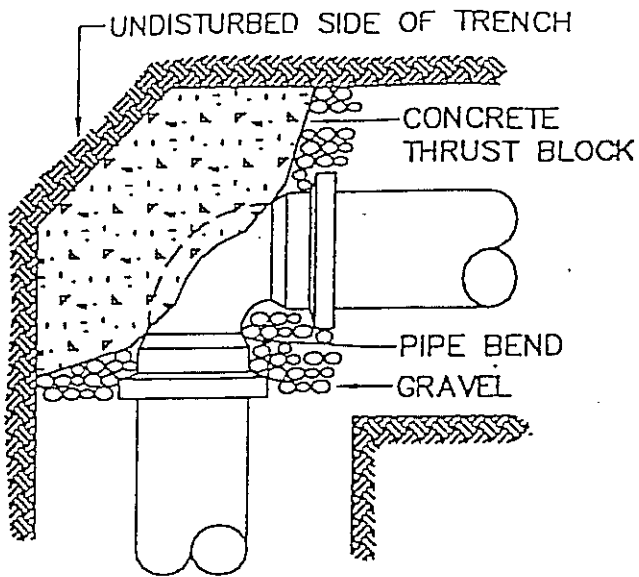
- A. Furnish and install valve boxes over each valve.
 - 1. Valve boxes shall be cut with a wheel cutter if necessary, to adjust them for height, where approved by the Engineer.
 - 2. Valve boxes shall be properly adjusted over the operating nuts of valves and adjusted to the proper height to correspond to the street or ground surface. Operating nuts shall be centered in the valve boxes.
- B. Upon completion of all work and testing and chlorinating of the proposed mains, the Contractor shall, with the assistance of the water department personnel, close all existing valves on mains which have been cut and capped and/or are no longer in service. After closure, the valve box shall be removed or filled with gravel and capped with grout prior to repaving.

3.12 SAMPLE LINES, WATER SERVICES AND BLOW-OFFS

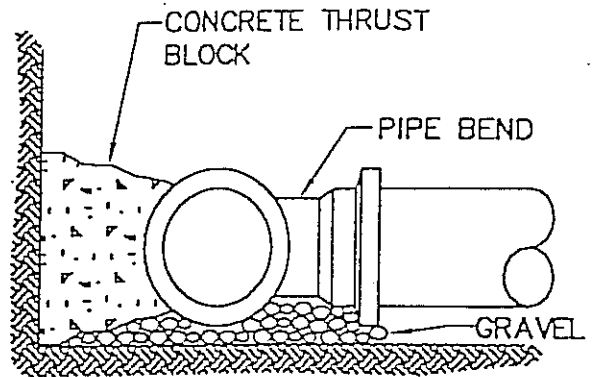
- A. Connect sample lines, water services and blow-offs to the new main as directed by the Owner, the Engineer and as specified herein. Sample lines, water services and blow-offs shall be connected after the new main has been tested, chlorinated and approved for service and the work shall result in a minimum disruption of service to the consumer.
- B. Make only "wet taps" into the new mains and install corporation cocks, goosenecks, copper tubing, curb stops, service boxes, fittings, service pipe, etc., and make all joints water tight. Sample lines, water services and blow-offs shall be installed to the limits and at such locations, as directed by the Engineer.

- C. Water mains shall be tapped in accordance with the manufacturer's latest published recommendations, i.e., depth of tap, number of threads exposed, allowable sizes, etc., and the Contractor shall adhere strictly to these recommendations. The Contractor shall be held responsible for all subsequent leaks or failure of the taps for one year from the date of final acceptance of the project and he shall make all necessary repairs that may be required during this period.
- D. Drills and/or taps shall be inspected frequently for signs of wear and in general, the Contractor shall not exceed the number of taps specified by the manufacturer before reconditioning or replacement. Sample line shall be cut only with approved wheel cutters.
- E. Sample line and water service pipe shall be laid to a minimum depth of five feet, zero inches (5'-0") and laid in a straight line wherever practicable to the structures or the point of termination of service.
- F. Where required, the Contractor shall flush all new services before connecting to the existing water service. The Contractor will assist Water Department personnel when flushing service lines if sediment or debris from existing mains plugs piping or meters, as a result of the work under this contract.
- G. It is the intent of this contract that all service pipe be installed with methods other than open cut trench.

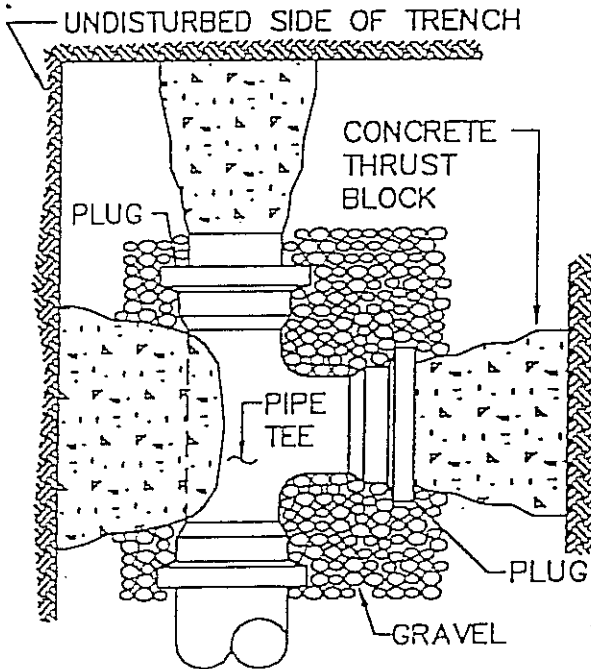
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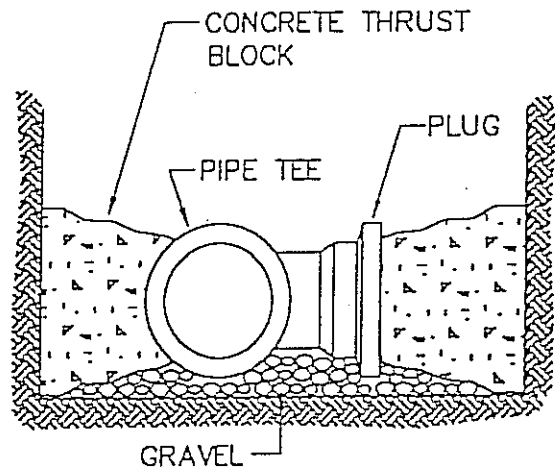
PLAN



SECTION



PLAN



SECTION

NOTE: ALL FITTINGS TO BE PLACED ON
WELL CONSOLIDATED GRAVEL

• TYPICAL
THRUST BLOCK PLACEMENT
ON BENDS, TEES AND PLUGS

W-TBP-1

Whitman & Howard, Inc.

02600-11

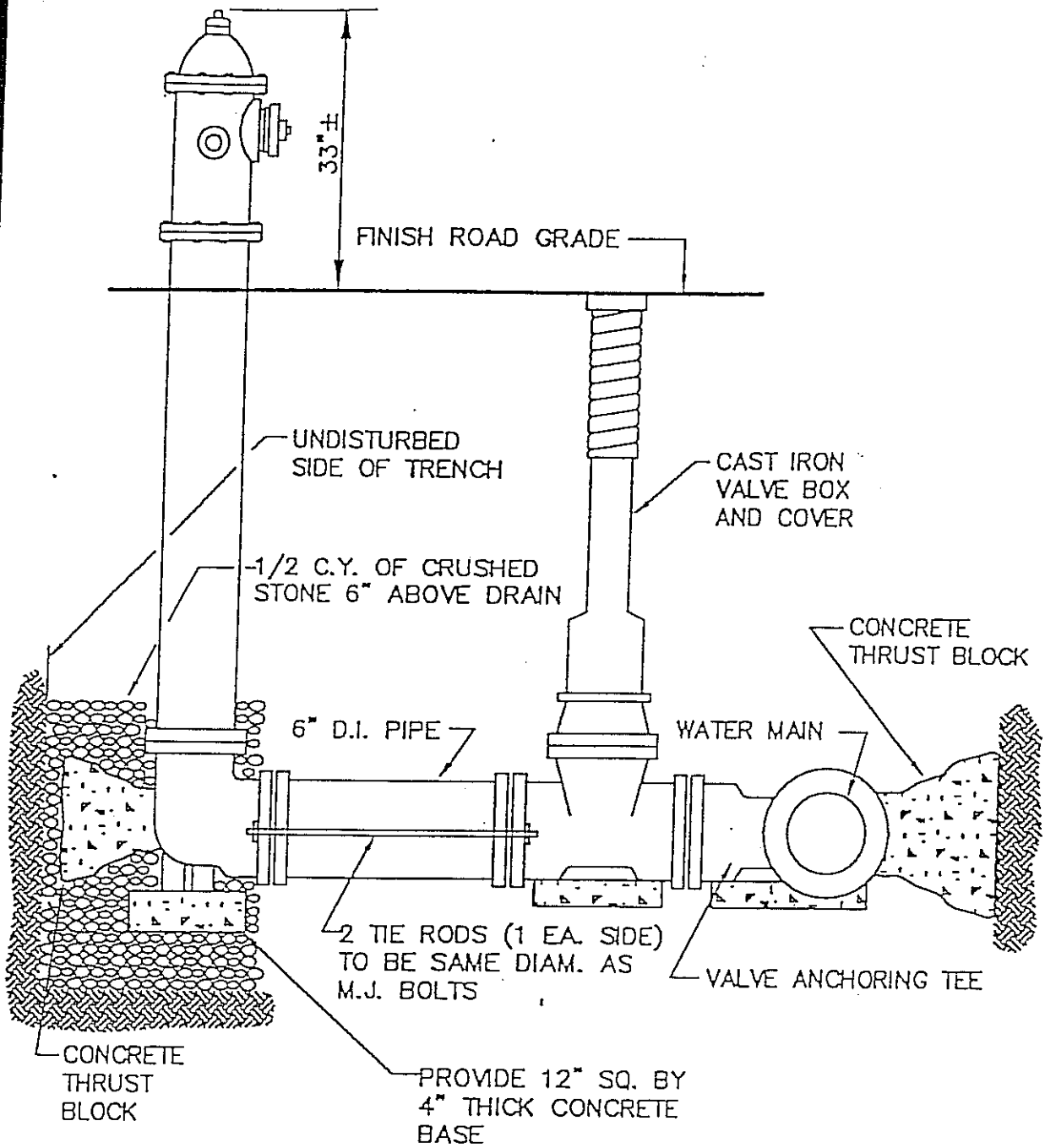
MINIMUM BEARING AREA — FT.²

PIPE DIAMETER (INCHES)	TEES, DEAD ENDS VALVES	90° BENDS	45° BENDS	22 ¹ / ₂ BENDS	11 ¹ / ₄ BENDS
4	2.0	2.0	2.0	2.0	2.0
6	2.5	3.6	2.0	2.0	2.0
8	4.4	6.2	3.3	2.0	2.0
10	6.5	9.2	5.0	2.6	2.0
12	8.9	12.6	6.8	3.4	2.0
14	12.0	16.9	9.2	4.6	2.3
16	14.8	—	11.4	5.8	2.9
18	—	—	12.8	7.3	3.7
20	—	—	16.8	8.6	4.2
24	—	—	—	12.0	6.0
30	—	—	—	—	9.1
36	—	—	—	—	12.7
42	—	—	—	—	16.8

NOTE

1. BEARING AREAS, BASED ON SOIL BEARING CAPACITY OF 4,000 PSF. MINIMUM BEARING AREA IS 2.0 SQUARE FEET.
2. IF SOIL HAS DIFFERENT BEARING CAPACITY THAN NOTED, NEW BEARING CAN BE CALCULATED BY RATIO I.E., IF SOIL HAS BEARING OF 2,000 PSF, MULTIPLY TABULATED VALVE BY 4/2.
3. TABLE IS FOR HORIZONTAL RESTRAINT ONLY.
4. VALUES SHOWN ARE FOR TEST PRESSURE OF 150 PSI WITH A 100 PSI SURGE ALLOWANCE.
5. THRUST BLOCKS SHALL NOT BE PLACED AGAINST THE FOLLOWING SOILS:
A) PEAT, ORGANIC SILT AND ORGANIC SOILS; B) SOFT CLAY; C) RUBBISH FILL AND OTHER UNSUITABLE ARTIFICIAL FILL; D) SHATTERED SHALE;
E) INORGANIC SILT AND VERY FINE SANDS.
6. WHERE POSSIBLE, POUR CONCRETE ANCHOR BLOCKS AGAINST UNDISTURBED EARTH. OTHERWISE, PLACE COMPACTED BACKFILL USING GRAVEL AND WELL GRADED SAND AFTER REMOVING FORMS.
7. BACKFILL SHOULD BE COMPACTED TO AT LEAST 90 PERCENT OF MAXIMUM DRY UNIT WEIGHT DETERMINED BY ASTM TEST DESIGNATION D-1557.

● MINIMUM THRUST BLOCK SIZING

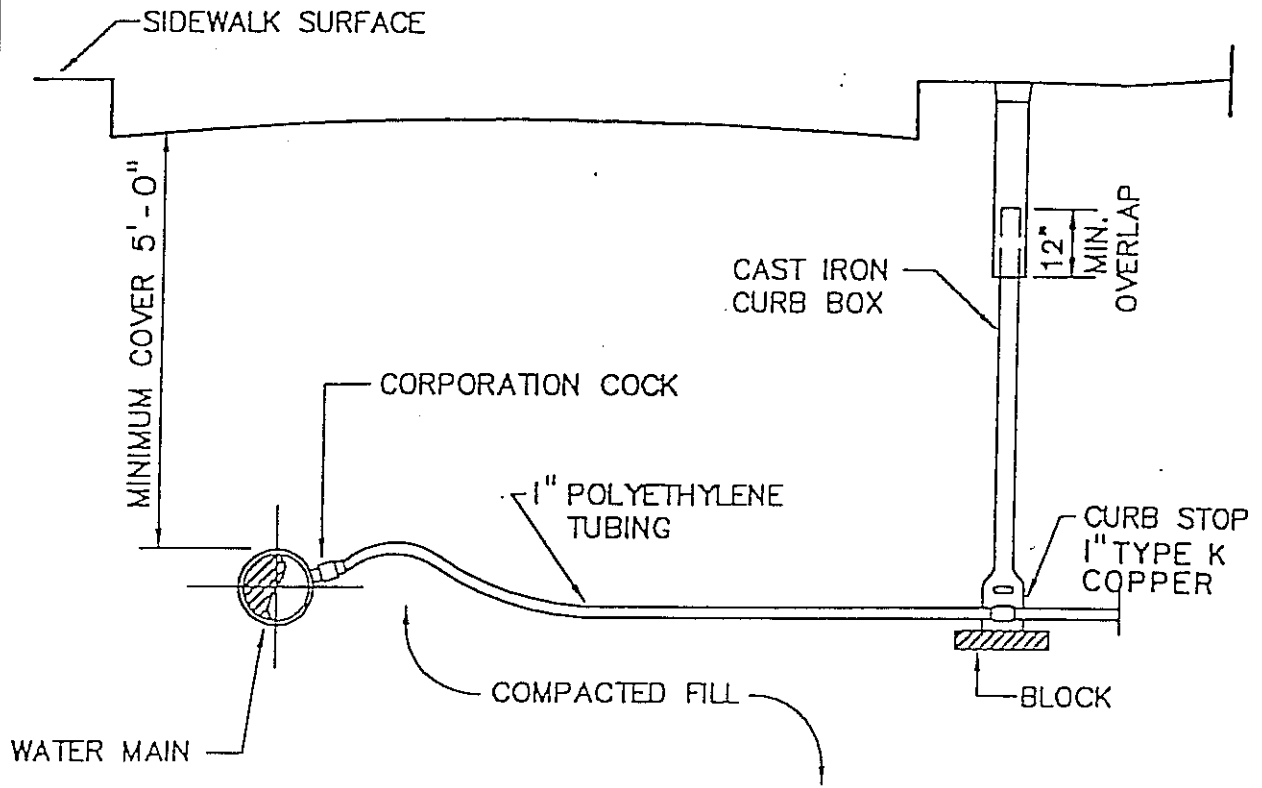


● HYDRANT INSTALLATION

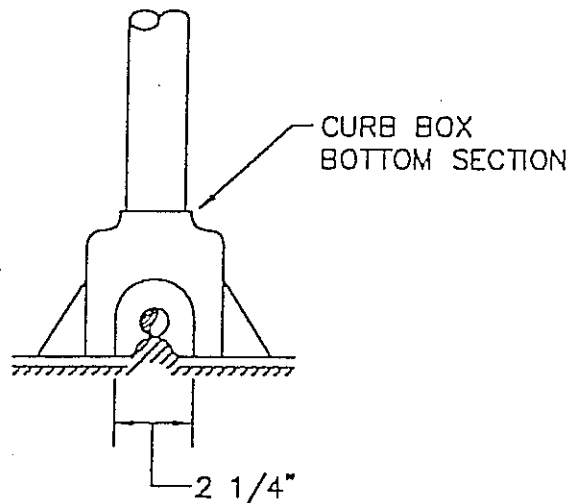
W-HYD-4

Whitman & Howard, Inc.

02600-13



NOTE: PLACE 10# SOLID TRACER WIRE ABOVE POLYETHYLENE LINE.



SAMPLING LINE DETAIL

NOT TO SCALE

SECTION 02673

HYDROSTATIC TESTING AND CHLORINATION OF WATER MAINS

PART 1 GENERAL

1.01 SCOPE

- A. The work of this section includes the furnishing of all labor, tools, equipment and materials and performing all operations necessary for the flushing, pressure testing, leakage testing and chlorination of water mains as specified herein and as required to complete the work.

1.02 MEASUREMENT AND PAYMENT

- A. Measurement and payment for work described in this Section will be made in accordance with the provisions of SECTION 01025 - MEASUREMENT AND PAYMENT and as follows:
 - 1. If sufficient manpower and equipment are not provided to prosecute this phase of the work, the Owner reserves the right to engage an independent Contractor to perform the flushing, testing, and chlorinating work. The cost for this work will be deducted from payments due the Contractor, and he shall not place any claims against the Owner, Engineer or said independent contractor, for any leaks, damages to public or private property, production loss and/or profits, incurred by this work.
 - 2. If the leakage test is declared a failure by the Engineer, the Contractor shall at his own expense locate and make repairs as necessary, until the leakage is within the specified allowance.

1.03 JOB CONDITIONS

- A. The work of this section shall be coordinated with the Owner. Use of water will only be as approved by the Owner. All work shall be in accordance with this specification and AWWA C651. Where conflicts appear between these specifications and AWWA C651 the more stringent requirement shall apply. All flushing, pressure and leakage testing and chlorinating shall be done by the Contractor in the presence of the Engineer.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Each temporary blow-off shall consist of a corporation cock, type K copper tubing and a curb stop, each of not less than 1-inch diameter.
- B. A pumping unit or proportionate feeder suitable for delivering a hypochlorite solution to the isolated main shall be provided. The unit used shall prevent chlorine solution from flowing back into the existing system.
- C. Chlorine solution for disinfecting water mains and appurtenances shall be made from either liquid sodium hypochlorite, or solid calcium hypochlorite, which shall conform to the latest AWWA B300 Standard for Hypochlorites.

PART 3 EXECUTION

3.01 GENERAL

- A. Flushing, testing and chlorinating of the pipeline shall closely follow pipe laying work. As the pipeline is installed, it shall be tested approximately every 1000 feet, or between line valves, whichever is less, as directed by the Engineer. Should the pipelines fail to be flushed, tested, and chlorinated as specified, the pipe laying work shall be suspended until the flushing, testing and chlorinating is done.
- B. All flushing, testing and chlorination shall be done in the presence of the Engineer. The method of chlorination shall be the Continuous Feed Method as described hereinafter. The Contractor shall consult with the Owner and Engineer to identify acceptable location(s) for discharging the heavily chlorinated water, which will result from the chlorination procedures. Final acceptance of the water main(s) shall be based on successful (negative) results of bacteriological tests, which shall be done on samples taken from the main(s) following chlorination and final flushing. Locations of samples shall be as directed by the Engineer.
- C. The Contractor, with the assistance of the Owner, shall fill mains as slowly as practicable so as not to cause dirty water and serious pressure drops within the existing system.
 - 1. Vent air from the mains during the filling process and supply adequate manpower and make taps on the mains where directed.

3.02 FLUSHING

- A. All new water mains, and existing water mains that have been drained and cut-into for making connections, shall be thoroughly flushed prior to pressure or leakage testing or final chlorination. Flushing shall be accomplished by partially opening and closing valves, hydrants, and blowoffs, several times, under expected line pressure, with flow velocities of not less than 2.5 feet per second, in the main(s). The size and number of hydrant outlets or main taps to provide the required flow (at 40 psi residual pressure) is as follows:

1. MINIMUM REQUIRED FLOW AND OPENINGS TO FLUSH PIPELINES
(40 psi Residual Pressure in Water Mains)

Pipe Diameter (in.)	Flow Required to produce 2.5 fps Velocity in Main (gpm)	Minimum Size of Taps on Main (in.)	Hydrant Outlet	
			Number	Size (in.)
4	100	15/16	1	2-1/2
6	220	1-3/8	1	2-1/2
8	390	1-7/8	1	2-1/2
10	610	2-5/16	1	2-1/2
12	880	2-13/16	1	2-1/2
16	1565	3-5/8	2	2-1/2

2. If less than a 40 psi residual is available in the main, with the size tap shown above then a larger, or more tap(s) or hydrant outlets will be required, as directed by the Engineer.
3. The length of time for flushing, at or above the minimum allowable velocity, shall be computed to allow a minimum of 3 times the total volume of water stored in the main(s) to be flushed to waste. Flushing shall be done in the presence of the Engineer.

3.03 PRESSURE TESTING

A. All new water mains, or any valved sections thereof shall be subjected to a hydrostatic pressure of at least 1.5 times the working pressure that will exist at the point of testing, or 150 psi, whichever is greater. Test pressures shall meet the following requirements.

1. Be of at least 2.5-hour duration.
2. Be not less than 1.25 times the expected system working pressure at the highest point along the test section.
3. Not exceed pipe or thrust-restraint design pressures.
4. Not vary by more than ± 5 psi for the duration of the test.
5. Not exceed 2-times the rated pressure of the valves or hydrants when the pressure boundary includes closed gate valves or hydrants. Valves shall not be operated in either direction at differential pressure greater than the rated pressure.
6. Not exceed 1-times the rated pressure of the valves when the pressure boundary of the test section includes closed butterfly valves or resilient seated gate valves.

B. Air Removal

1. Following flushing, and before applying the specified test pressure, air shall be completely expelled from the pipes, valves, and hydrants. After all air has been expelled, the air blowoffs can be closed, and the test pressure applied.

C. Pressure Test

1. Each valved section of pipe shall be slowly raised to the specified test pressure for two separate periods. The first period shall be for 15-minutes, after which the pressure in the test section shall be allowed to drop slowly back to system pressure. The pressure shall then be slowly raised again to the specified test pressure and maintained for 2.5 hours. The test pressure shall be based on the elevation of the lowest point of the pipe, in the test section and shall be corrected to the elevation of the test gauge, as directed by the Engineer. The test pressure shall be applied by means of a pump connected to the pipe, in a manner satisfactory to the Engineer, and which will prevent any backflow into the existing system. Valves shall not be operated in either the closing or opening direction, at differential pressure greater than the rated pressure.

D. Examination

1. Any exposed pipe, fittings, valves, hydrants and joints shall be carefully examined during the test. Any damaged or defective pipe, fittings, hydrants, or valves discovered following, or as a result of the pressure test shall be repaired or replaced with sound material. If faulty materials are removed and replaced, the pressure testing procedure shall be repeated until satisfactory to the Engineer.

3.04 LEAKAGE TEST

A. Leakage testing shall be conducted concurrently with the pressure test.

B. Leakage Defined

1. Leakage shall be defined as the quantity of water that must be pumped into the new main, or any valved section thereof, to maintain pressure within ± 5 psi of the specified test pressure, after the main(s) have been filled with water and all air has been expelled. Leakage shall be recorded to the nearest one-tenth of a gallon, by means of a calibrated test meter. If allowed by the Engineer, drawdown may be measured in a calibrated barrel. All records and charts shall become the property of the Engineer. The Contractor shall employ qualified personnel throughout the testing. Leakage shall not be measured by a drop in pressure over a period of time.

C. Allowable Leakage

1. No pipe installation will be accepted if the leakage is greater than that determined by the following formula:

$$L = \frac{SD(P^{0.5})}{133200}$$

where

L = allowable gallons of leakage per hour

S = the length of pipe tested, in feet

D = the nominal pipe diameter in inches

P = the average test pressure during the test, in psi

- D. The leakage formula is based on the allowable leakage of 11.65 gallons per day, per mile of pipe, per inch, (nominal) of pipe diameter, at a pressure of 150 psi. Allowable leakage at various pressures, for various pipe diameters are shown below.

1. ALLOWABLE LEAKAGE PER 1000 FEET OF PIPELINE
NOMINAL PIPE DIAMETER - (INCHES)

Average Test Pressure	6	8	10	12	16	20	24
250	0.71	0.95	1.19	1.42	1.90	2.37	2.85
225	0.68	0.90	1.13	1.35	1.80	2.25	2.70
200	0.64	0.85	1.06	1.28	1.70	2.12	2.55
175	0.59	0.80	0.99	1.19	1.59	1.98	2.38
150	0.55	0.74	0.92	1.10	1.47	1.84	2.21
125	0.50	0.67	0.84	1.01	1.34	1.68	2.01
100	0.45	0.60	0.75	0.90	1.20	1.50	1.80

2. If the pipeline under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size.

3. When testing against closed metal seated valves, an additional leakage shall be allowed per closed valve, of 0.0078 gallons per hour, per inch of nominal valve diameter.
 4. When hydrants are in the test section, the test shall be made against the closed hydrant(s).
 5. Zero leakage will be allowed on all welded steel and flanges pipe sections.
- E. Acceptance shall be determined on the basis of allowable leakage. If any test of pipe discloses leakage greater than that specified, the Contractor shall locate and make repairs as necessary until the leakage is within the specified allowance.
1. All visible leaks are to be repaired regardless of the amount of leakage.
 2. All water mains shall be pressure and leakage tested in the presence of the Engineer, in order to qualify for acceptance.

3.05 CHLORINATION

- A. The method of chlorination shall be the Continuous Feed Method as described hereinafter, and as approved by the Owner and Engineer.
- B. Continuous Feed Method of Chlorination
1. The continuous feed method consists of the following steps:
 - a. Upon completion of construction, fill mains with potable water, and remove all air from high spots and/or pockets.
 - b. Flush the completed main(s) to remove particulates. Following the filling and flushing of the main(s), and before chlorination, complete all hydrostatic testing to the satisfaction of the Engineer.
 - c. Fill the main(s) with chlorinated potable water, having an initial concentration of 25 mg/l free chlorine residual. After a 24-hour period, there shall be a minimum of 10 mg/l free chlorine residual in the main(s).
 - aa. Water from the existing distribution system or other approved source of supply shall be made to flow at a constant measured rate, into the new main(s). In the absence of a meter, the rate may be approximated by methods such as placing a pitot gauge in the discharge or measuring the time to fill a container of known volume.
 - d. At a point not more than 10 feet downstream from the beginning of the new main(s), water entering the new main shall receive a dose of hypochlorite solution fed at a constant rate such that the water in the main(s) will have not less than 25 mg/l free available chlorine. To assure that this concentration is achieved, the Contractor shall measure chlorine concentration at regular intervals along the main(s), using appropriate chlorine test kits, or as otherwise described in the current edition of AWWA M12 - Simplified Procedures for Water Examination.
- C. The amount of chlorine required to obtain a concentration of 25 mg/l per 100 feet of various diameter pipes is as follows.

1. CHLORINE REQUIRED TO OBTAIN A CONCENTRATION OF 25 MG/L PER 100 FEET OF PIPE.

SODIUM HYPOCHLORITE - GALLONS

Pipe Dia. (Ins.)	5% Avail. Chlorine	10% Avail. Chlorine	12 1/2% Avail. Chlorine	15% Avail. Chlorine	CALCIUM HYPOCHLORITE OUNCES 65% Avail. Chlorine
4	0.03	0.02	0.02	0.01	0.32 Ounces
6	0.08	0.04	0.03	0.03	0.75 Ounces
8	0.13	0.07	0.06	0.05	1.30 Ounces
10	0.20	0.10	0.09	0.07	2.10 Ounces
12	0.28	0.15	0.12	0.10	2.95 Ounces
16	0.50	0.25	0.22	0.17	5.30 Ounces
20	0.80	0.40	0.34	0.28	8.40 Ounces
24	1.5	0.60	0.50	0.40	12.00 Ounces

2. The above quantities are to be added to a sufficient quantity of water, dissolved, and mixed. The entire solution shall be injected into the main as specified.
 3. The quantities shown are based on concentrations of available chlorine by volume. Extended or improper storage may have caused a loss of available chlorine.
 4. For concentrations of 50 ppm, double the quantities listed.
- D. During the application of chlorine, valves shall be closed to prevent strong chlorine solution in the new main(s) from flowing into the existing system. Chlorine application shall continue until the entire main(s) is filled with water having 25 mg/l of free available chlorine. The chlorinated water shall be retained in the main(s) for at least 24 hours, during which time all valves and hydrants in the section(s) being treated shall be operated, in order to disinfect the appurtenances. At the end of this 24 hour period, all portions of the main(s) and appurtenances being tested shall have a free available chlorine residual of at least 10 mg/l. If less than 10 mg/l free available chlorine residual is measured, the main shall be refushed and the entire disinfection procedure repeated.
- E. Hypochlorite solutions shall be applied to the water main(s) with a gasoline or electrically powered chemical feed pump designed for feeding chlorine solutions. Feed lines shall be of such material and strengths as to safely withstand corrosion caused by the concentrated chlorine solutions, and also the maximum pressures that may be created by the pumps. All connections shall be checked for tightness before the solution is applied to the main.

3.06 FINAL FLUSHING

- A. After the specified retention period, the heavily chlorinated water shall be flushed from the main until chlorine measurements show the concentration in water leaving the main is no higher than that generally prevailing in the system.
- B. Arrangements shall be made with the Owner to flush the mains of chlorinated water. Great care shall be exercised in the selection of the rate of flow and the discharge points, in order to minimize complaints, and damage to public or private property.
- C. The environment to which the chlorinated water is to be discharged shall be inspected. If it appears possible that the chlorinated discharge will cause damage to the environment, a reducing agent shall be applied to the water to thoroughly neutralize the chlorine residual remaining in the water. If necessary state, federal, and local regulatory agencies should be contacted to determine special provisions for the disposal of heavily chlorinated water.

3.07 BACTERIOLOGICAL TESTS

A. Standard Conditions

- 1. After final flushing and before the water main is placed in service, water samples shall be collected twice (24-hours apart) at each sampling point designated by the Engineer and tested for bacteriological quality in accordance with Standard Methods. Water samples shall show the absence of coliform organisms and background bacteria. A standard plate count may be required at the option of the Engineer. Water samples shall be taken at the locations directed by the Owner.

B. Special Conditions

- 1. If, during construction, trench water has entered the main, or if in the opinion of the Engineer excessive quantities of dirt or debris have entered the main, bacteriological samples shall be taken at intervals of approximately 200 ft. and shall be identified as to location. Samples shall be taken of water that has stood in the main for at least 24 hours after final flushing has been completed.

C. Sampling Procedure

- 1. Samples for bacteriological analysis shall be collected, in the presence of the Engineer and the Owner, in sterile bottles treated with sodium thiosulfate. No hose or fire hydrant shall be used in collection of samples. A corporation cock shall be installed in the main with a copper tube gooseneck assembly. After samples have been collected, the gooseneck assembly shall be removed. The Contractor shall sample twice (24 hours apart) at each location designated by the Owner.

- D. The Contractor shall deliver samples to a laboratory approved by the Department of Environmental Protection (DEP) for bacterial analysis. Only after each consecutive sample is approved shall the mains be incorporated into the water system. In the event, that positive reports of contamination are received, the mains shall be flushed and chlorinated as many times as may be necessary to obtain approved (negative) results.

3.08 RECHLORINATION

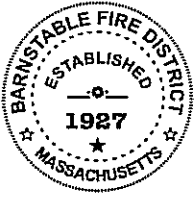
- A. If the initial chlorination fails to produce satisfactory bacteriological samples, the main(s) shall be reflushed and resampled. If check samples show the presence of coliform organisms, then the main shall be rechlorinated by the continuous feed

method of chlorination, until satisfactory results are obtained. High velocities in the existing system, resulting from flushing the new main, may disturb sediment that has accumulated in the existing mains. When check samples are taken, the Contractor shall sample water entering the new main.

3.09 CHLORINATION PROCEDURES WHEN CUTTING INTO OR REPAIRING EXISTING MAINS

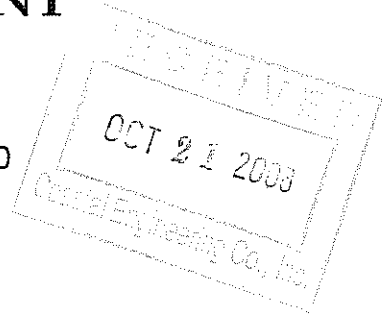
- A. The following procedures apply when mains are wholly or partially dewatered. After the appropriate procedures have been completed, the main may be returned to service prior to completion of bacteriological testing, in order to minimize the time customers are out of water. Leaks or breaks that are repaired with clamping devices while the mains are full of water under pressure present little danger of contamination and require no disinfection.
1. Trench Treatment
 - a. When an old main is opened, either by accident or on purpose, the excavation will likely be wet and may be contaminated from nearby sources of sewage or other pollutions. Liberal quantities of hypochlorite tablets shall be applied to open trench areas to lessen the danger from pollution.
 2. Swabbing with Hypochlorite Solution
 - a. The interior of all pipe and fittings used in making a repair (particularly couplings and sleeves) shall be swabbed or sprayed with a 1 percent hypochlorite solution before they are installed.
 3. Flushing
 - a. If valve and hydrant locations permit thorough flushing toward the work location from both directions, it shall be done. Flushing shall be started as soon as the repairs are completed and shall be continued until discolored water is eliminated.
 4. Slug Chlorination
 - a. Where practical in addition to the procedures above, a section of main in which the break is located shall be isolated. All service connections shall be shut off, and the section flushed and chlorinated by the slug method and the dose may be increased to as much as 300 mg/l, and the contact time reduced to as little as 1-hour. After chlorination, flushing shall be resumed and continued until discolored water is eliminated and the water is free of noticeable chlorine odor.
 5. Bacteriological samples shall be taken after repairs. If the direction of flow is unknown, samples shall be taken on each side of the main break. If positive samples are recorded, daily sampling shall be continued until two consecutive negative samples are recorded. Positive samples shall be evaluated by the Engineer for corrective action.

END OF SECTION



BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

1841 Phinney's Lane
P.O. Box 546
Barnstable, Massachusetts 02630
Phone: 508-362-6498
Fax: 508-362-9616



LETTER OF TRANSMITTAL

DATE: October 20, 2008

TO: John K. Lavelle
Coastal Engineering Company, Inc.
260 Cranberry Highway
Orleans, MA 02653

RE: BFD Water Main Specifications

We are sending you: Enclosed ___ Under separate cover the following:

___ Reports ___ Prints ___ Plans ___ Shop Drawings

Specifications ___ Calculations ___ Proposal ___ Contract Documents

NOTES:

THESE ARE TRANSMITTED as checked below:

For Review ___ Resubmit ___ Copies for Approval

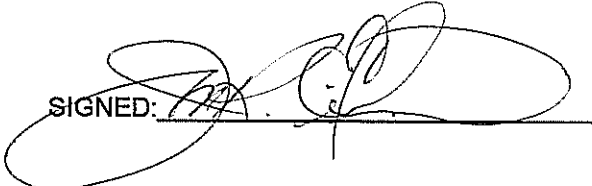
For Your Use ___ Approved as Noted ___ Copies for Distribution

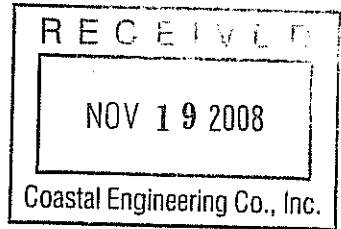
___ As requested ___ Returned ___ Approved as Submitted

___ Submit ___ For Revision ___ For Your Information

REMARKS:

COPY TO:

SIGNED: 



BARNSTABLE FIRE DISTRICT

DATE: NOVEMBER 19, 2008

Send to: Coastal Engineering Co., Inc.

Attention: John Lavelle

Office Location: Orleans, MA

Fax Number: 508-255-6700

From: Jon R. Erickson

Office Location: Barnstable Village

Phone Number: 508.362.6498

Number of Pages, Including Cover: 1

URGENT

REPLY/CONFIRM

PLEASE COMMENT

PLEASE REVIEW

FOR YOUR INFORMATION

RE: COUNTY COMPLEX – BARNSTABLE VILLAGE

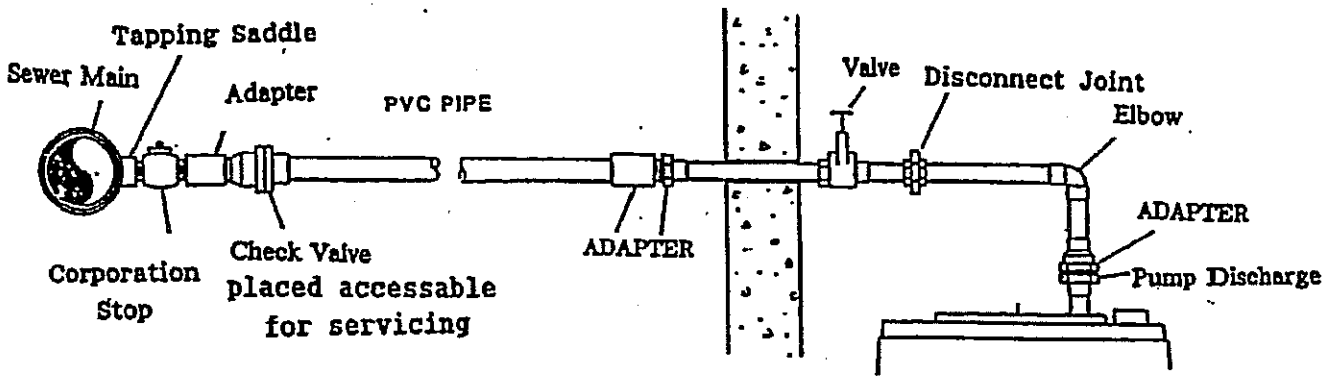
THE BOARD OF WATER COMMISSIONERS WILL BE DISCUSSING THE SYSTEM IMPROVEMENT FEES AT THEIR REGULARLY SCHEDULED MEETING ON DECEMBER 2, 2008 @ 4:30PM.

ANY QUESTIONS PLEASE CALL.

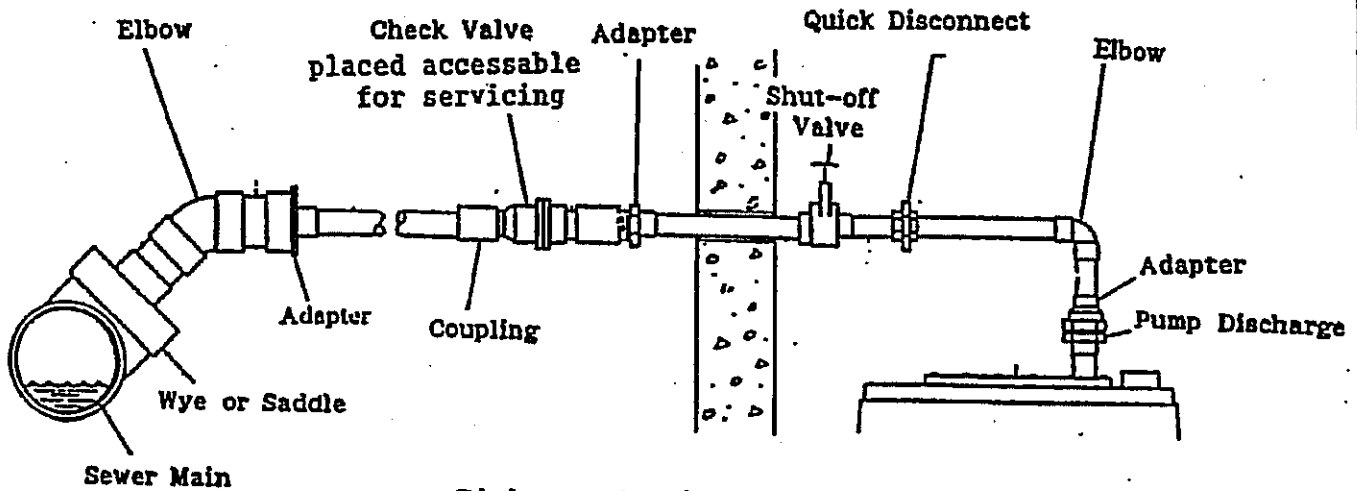
THANK YOU.

JON R. ERICKSON, SUPERINTENDENT

BARNSTABLE FIRE DISTRICT WATER DEPARTMENT
 1841 Phinney's Lane
 Barnstable, Massachusetts 02630
 508.362.6498 Fax 508.362.9616
 BFDWaterSupt@comcast.net



Piping to Low Pressure Sewer Main



Piping to Gravity Sewer Main

Town of Barnstable

Standard Detail of:

LOW PRESSURE SEWER
DISCHARGE PIPING

Department of Public Works

DIS-pipe Scale: None

FINISHED GRADE (PAVED AREA)
PER ROAD OPENING REQ
FINISH GRADE (UNPAVED AREAS)
AS APPROVED BY ENGINEER

ADJUST TO GRADE WITH
2 BRICK COURSE MAX &
WITH 3/8" MORTAR JOINTS
OR WITH FRAME RISER RING.
BED FRAME IN FULL 3/8" MIN.
MORTAR BED.

MANHOLE JOINT SHALL
BE SEALED WITH
BITUMASTIC SEALANT

COMPLETELY FILL ANNULAR
SURFACE WITH NON SHRINK
GROUT ON INSIDE OF MANHOLE

PIPE TO MANHOLE JOINT
TO BE FLEXIBLE SLEEVE
AND STAINLESS STEEL
STRAP OR APPROVED EQUAL

HEAVY WEIGHT, H-20 LOADING
FRAME AND COVER, REFER
TO SEWER SPECS FOR
ADDITIONAL COMMENTS

POINT UP BRICKWORK
ON THE INSIDE

4' DIA (NOM) PRECAST
REINFORCED CONCRETE MANHOLE
BASE, RISER(S) & ECCENTRIC CONE
2', 3', OR 4' HT. (TYP.)

STEEL REINFORCED POLYPROPYLENE
STEP, 12" O.C. (TYP)

1' 0" MIN.

5' DIA (NOM.)

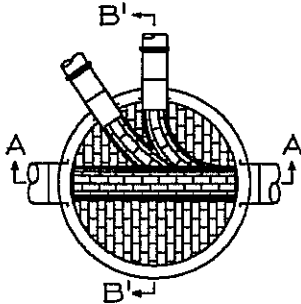
6" OF 3/4" STONE BEDDING

ELEVATION VIEW

SEWER MANHOLE (TYP)

(NOT TO SCALE)

6" HOUSE SERVICE OR
MAIN LINE SEWER LOCATION
TO BE DETERMINED IN FIELD

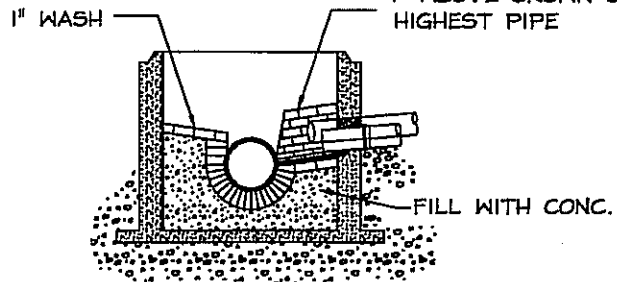


SECTION VIEW A - A

(NOT TO SCALE)

USE 4'-0" LENGTHS
AT MANHOLES MAX.
(TYP.)

NOTE: CARE SHALL BE TAKEN
TO INSURE THAT THE
BRICK INVERT IS A
SMOOTH CONTINUATION
OF THE SEWER INVERT.
INVERT TO BE INVERTED
ARCH WITH BRICKS LAID
AS STRETCHERS AND
ON EDGE.



SECTION VIEW B' - B'

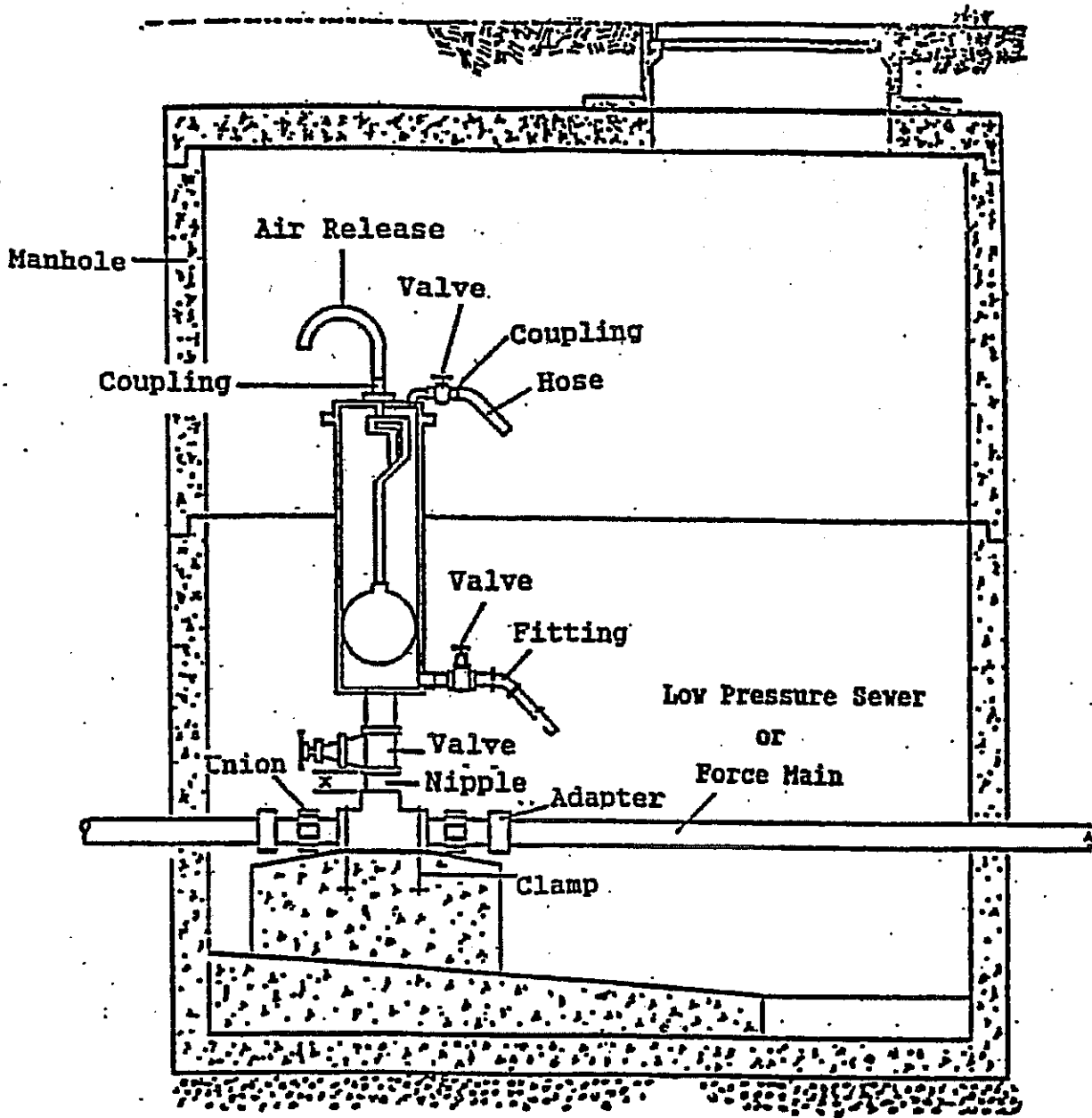
TYPICAL DETAIL OF BRICK INVERT

(NOT TO SCALE)

TOWN OF BARNSTABLE, MASS
DEPARTMENT OF PUBLIC WORKS

Building Sewer Connections
Standard Details for Manholes

Scale : As Noted	Drawn By : JHC
Date : Feb , 2001	Designed By : DJA



Town of Barnstable

Standard Detail of:

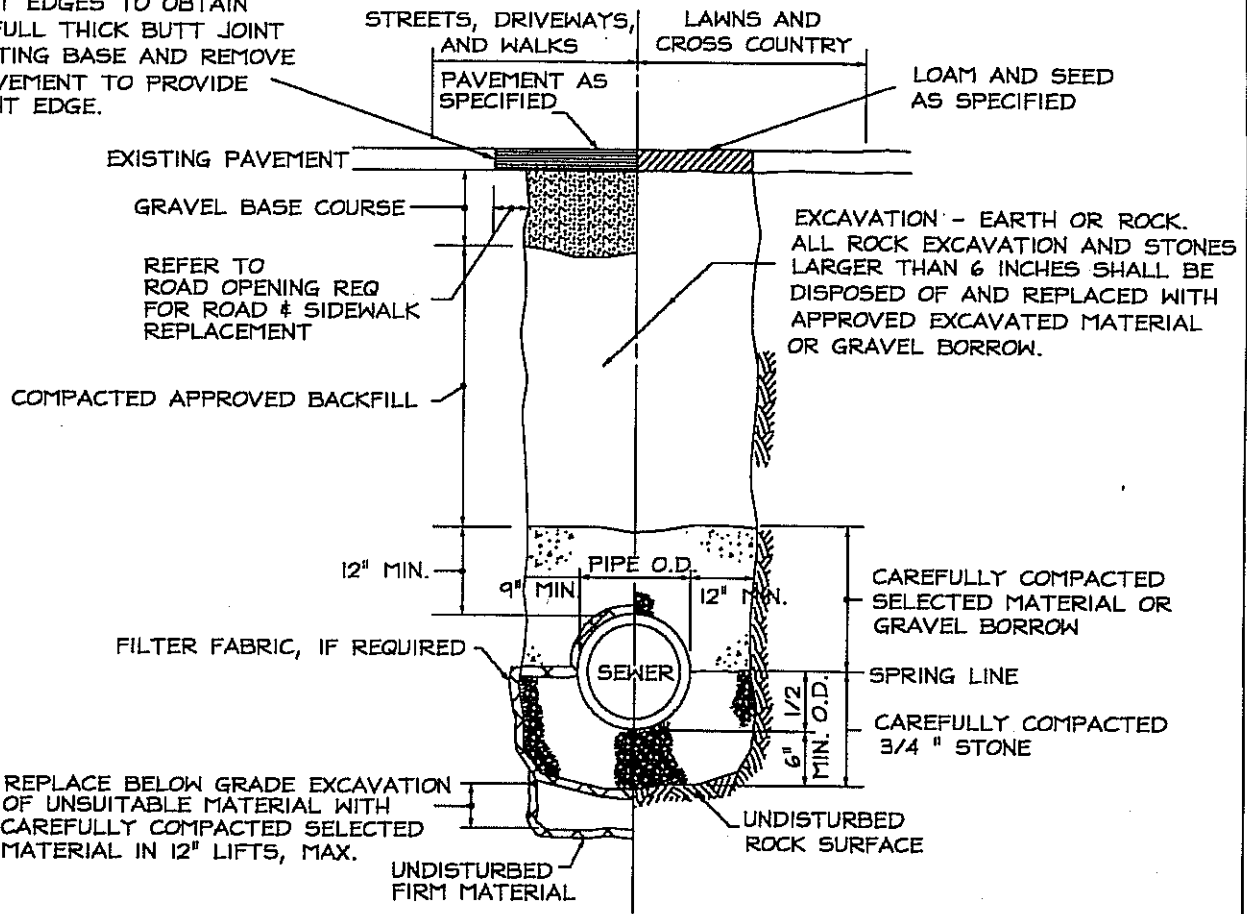
Low Pressure Sewer
/ Force Main

Air Release Valve

Department of Public Works

Low-pres-sew Scale: None

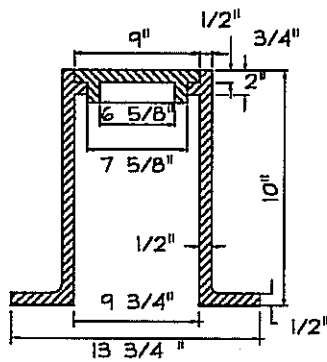
SAW CUT EDGES TO OBTAIN CLEAN FULL THICK BUTT JOINT ON EXISTING BASE AND REMOVE OLD PAVEMENT TO PROVIDE STRAIGHT EDGE.



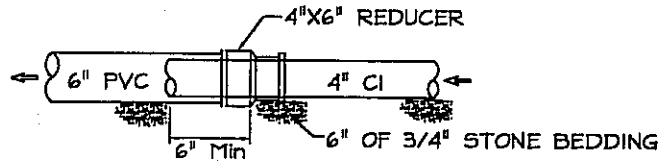
EARTH TRENCH
SEWER TRENCH - EARTH AND ROCK
(NOT TO SCALE)

TOWN OF BARNSTABLE, MASS
DEPARTMENT OF PUBLIC WORKS
Building Sewer Connections
Standard Details for Trenches

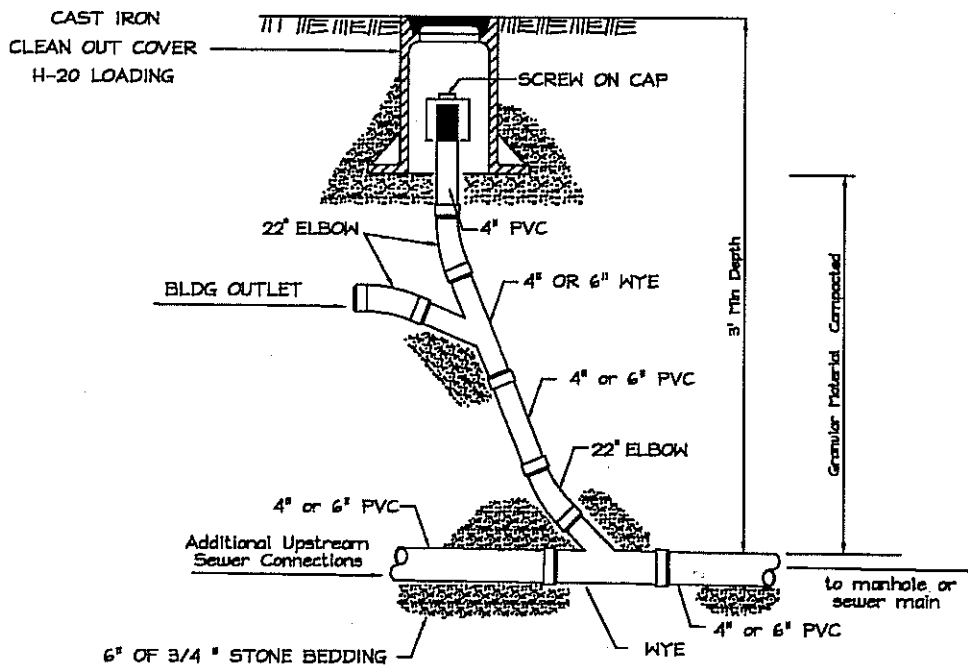
Scale : As Noted	Drawn By : JHC
Date : Feb , 2001	Designed By : DJA



SEWER CLEANOUT RING AND COVER
(NOT TO SCALE)



4"X6" PVC REDUCER
(NOT TO SCALE)

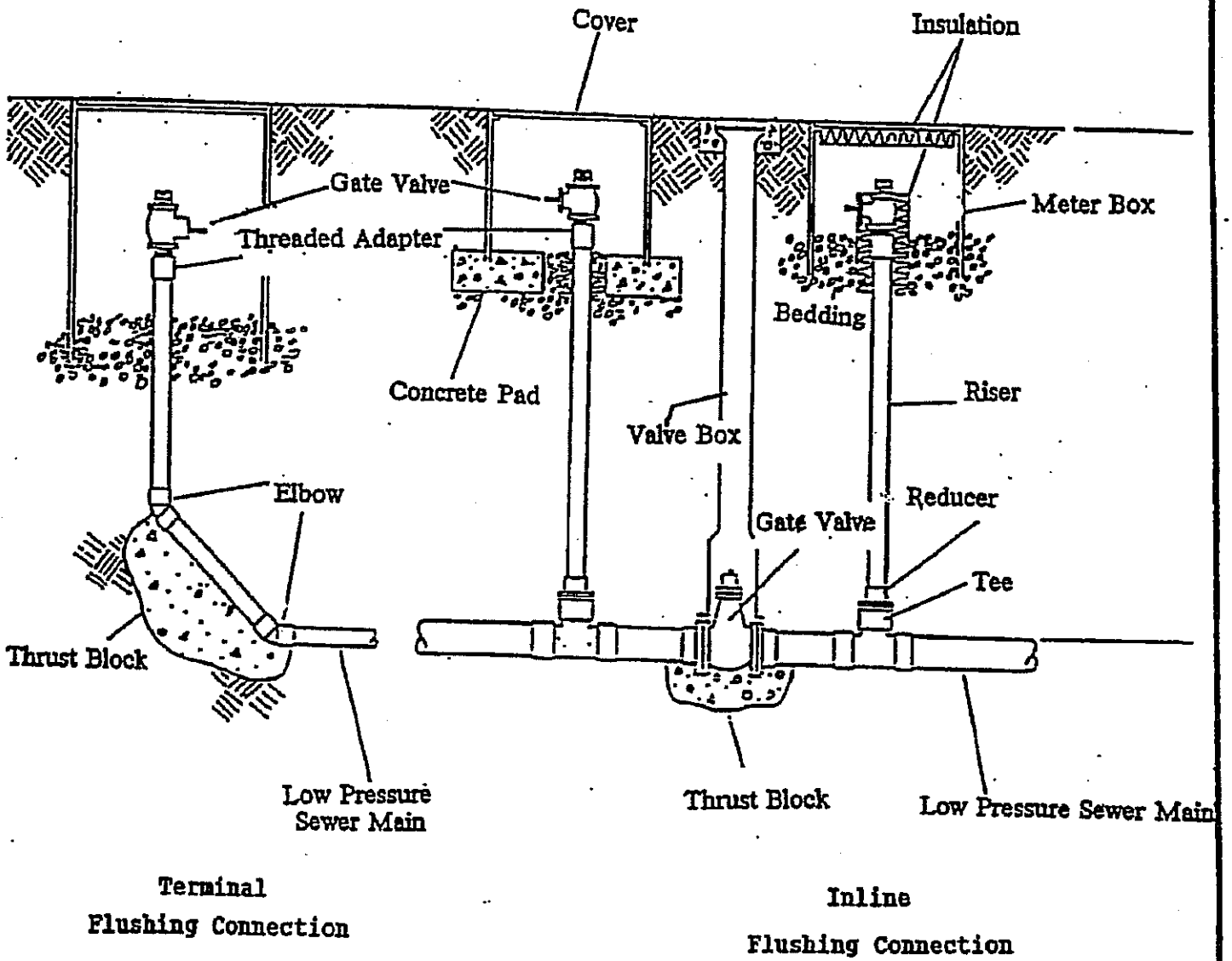


SEWER CLEAN OUT
NOT TO SCALE

TOWN OF BARNSTABLE, MASS
DEPARTMENT OF PUBLIC WORKS

Building Sewer Connections
Standard Details for Clean-outs

Scale : As Noted	Drawn By : JHC
Date : Sept , 2002	Designed By : DJA



Town of Barnstable

Standard Detail of:

Flushing Connection
FLUSH - CON

Department of Public Works

Scale: None